SPPRA BIDDING DOCUMENT

SINDH PUBLIC PROCUREMENT REGULATORY AUTHORITY (SPPRA)

STANDARD FORM OF BIDDING DOCUMENT

(Civil Works – Large Works)

IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

This SBD shall be used for large works costing more than Rs.50 Million

Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

PROJECT ID: P-161402

BIDDING DOCUMENT FOR COMPETITIVE & LIVABLE CITY OF KARACHI PACKAGE A: IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03 . DMC KORANGI

December 2021

Superintending Engineer,
1st Floor, D.C Korangi Office
Near Total Petrol Pump
Korangi #2 1/2, Karachi

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INVITATION
FOR BIDS

NOTICE INVITING TENDERS

Refer Notice published in News papers

INSTRUCTIONS
TO
BIDDERS

INSTRUCTIONS TO BIDDERS

A. GENERAL

IB.1 Scope of Bid

1.1 Procuring agency as defined in the bidding data hereinafter called "the procuring agency" 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 will be expected to complete the works within the time specified in Appendix-A to Bid.

IB.2 Source of Funds

2.1 Procuring agency has received/allocated/ applied for loan/grant/Federal/ Provincial/Local Government funds from the source(s) indicated in the bidding data in various currencies towards the cost of the project /scheme specified in the bidding data, and it is intended that part of the proceeds of this loan/grant/funds 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 interested bidders who are eligible under provisions of Sindh Public Procurement Rules as mentioned below and the criteria given in the Notice Inviting Tender (NIT)/ Bidding Document.

Firms and individuals, national or international, may be allowed to bid for any project where international competitive bidding is feasible. Any conditions for participation shall be limited to those that are essential to ensure the bidder's capability to fulfill the contract in question.

(a) Bidders may be excluded if;

(i) as a matter of law or official regulations, commercial relations are prohibited with the bidder's country by the federal government in case of ICB, or

(ii) a firm is blacklisted/ debarred by the procuring agency and the matter has been reported to the Authority, subject to Rule 30 of Sindh Public Procurement Rules 2010.

(b) Government-owned enterprises or institutions may participate only if they can establish that they are;

(i) legally and financially autonomous, and
(ii) operate under commercial law.

Provided that where government-owned universities or research centers in the country are of a unique and exceptional nature, and their participation is critical to project implementation, they may be allowed to participate; and

Bidders shall include all those contractors who are registered or incorporated in Pakistan, irrespective of the nationality of their owners and professional staff, or

(c) Bidders are: -

(i) pre-qualified with procuring agency for particular project/scheme;

(ii) registered with Pakistan Engineering Council in particular category and discipline,

(iii) registered with relevant tax authorities (income/sales tax, wherever applicable)

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 procuring agency 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 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 procuring agency 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 procuring agency, 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.

B. BIDDING DOCUMENTS

IB.7 Contents of Bidding Documents (SSP RULE 21)

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.

a. Instructions to Bidders.
b. Bidding Data.
c. General Conditions of Contract, Part-I (GCC).
d. Special Conditions of Contract, Part-II (SCC)
e. Specifications.
f. Form of Bid and Appendices to Bid.
g. Bill of Quantities (Appendix-D to Bid).
h. Form of Bid Security.
i. Form of Contract Agreement.

j. Forms of Performance Security, Mobilization Advance Guarantee, Integrity Pact and Indenture bond for secured advance.
k. Drawings.

7.2 The bidders are expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of bid 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 BD will be rejected.

IB.8 Clarification of Bidding Documents (SSP RULE 23(1)):

Any interested bidder requiring any clarification(s) in respect of the bidding documents may notify the procuring agency in writing at the procuring agency's address indicated in the Invitation for Bids/NIT. Procuring agency will respond to any request for clarification provided they are received at least five calendar days prior to the date of opening of bid.

Provided that any clarification in response to query by any bidder; shall be communicated to all parties who have obtained bidding documents.

IB.9 Addendum/Modification of Bidding Documents:

9.1 At any time prior to the deadline for submission of bids, the procuring agency may, for any reason, whether at his own initiative or in response to a clarification requested by a interested 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 IB 7.1 hereof and shall be communicated in writing to all bidders. Interested bidders shall acknowledge receipt of each addendum in writing to the procuring agency.

9.3 To afford bidders reasonable time in which to take an addendum into account in preparing their bids, the procuring agency may extend the deadline for submission of bids in accordance with IB.20

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 procuring agency shall be in the language stipulated in the bidding data and Special Conditions of the 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 bid language, in which case, for purposes of evaluation of the bid, the translation in bid language shall prevail.

IB.11 Documents Accompanying the Bid

11.1 Each bidder shall:

(a) submit a written authorization on the letterhead of the bidding firm, 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 continue 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 following two years, including the effect of known commitments;

(iii) Work commitments since prequalification;

(iv) Current litigation information; and

(v) Availability of critical equipment.

And

(c) furnish a technical proposal taking into account the various Appendices to Bid 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;

11.2 Bids submitted by a joint venture of two (2) or more firms shall comply with the following requirements:

(a) 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;

(b) the bid, and in case of a successful bid, the Form of Contract Agreement shall be signed by the authorized partner so as to be legally binding on all partners;

(c) the partner-in-charge shall always be duly authorized to deal with the procuring agency 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 (a) above as well as in the Form of Bid and in the Form of Contract Agreement (in case of a successful bid);

(e) a copy of the agreement entered into by the joint venture partners shall be submitted with the bid 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 procuring agency;

(f) submission of an alternative Letter of Intent to execute a Joint Venture Agreement shall be mandatory.

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 sub- clause IB 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 IB 1.1 hereof, based on the unit rates or prices submitted by the bidder or percentage quoted above or below on the rates of Composite Schedule of Rates (CSR), as the case may be.

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 procuring agency when executed and shall be deemed to be covered by rates and prices for other items in the Bill of Quantities. In case of Composite Schedule of Rates, if the bidder fails to mention the percentage above or below, it shall be deemed to be at par with the rates of Composite Schedule of Rates.

12.3 The bid price submitted by the contractor shall include all rates and prices including
the taxes. All duties, taxes and other levies payable by the contractor under the contract, or for any other cause during the currency of the execution of the work or otherwise specified in the contract as on the date seven days prior to the deadline for submission of bids.

Additional / reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed / deducted as per Sub-Clause 13.7 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 13.7of GCC. The bidders shall furnish the prescribed information for the price adjustment formulae in Appendix-C to Bid, and shall submit with their bids such other supporting information as required under the said Clause. Adjustment in prices quoted by bidders shall be allowed as per Sub-Para 4(ii) of Section C of Instructions to bidders and bidding data.

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 procuring agency's country (referred to as the

"Foreign Currency Requirements") shall indicate the same in Appendix-B to Bid. The proportion of the bid 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 the bid.

13.2 The rates of exchange to be used by the bidder for currency conversion shall be the selling rates published and authorized by the State Bank of Pakistan prevailing on the date, 07 (seven) days prior to the deadline for submission of bids. For the purpose of payments, the exchange rates used in bid preparation shall apply for the duration of the contract.

IB.14 Bid Validity

14.1 Bids shall remain valid for the period stipulated in the bidding data from the date of opening of bid specified in clause IB.23.

14.2 In exceptional circumstances, prior to expiry of the original, the procuring agency may request the bidders to extend the period of validity for a specified additional period, which shall not be for more than one third of the original period of bid validity. The request and the responses thereto, shall be made in writing. A bidder may refuse the request without the forfeiture of the bid security. In case, a bidder agreed to the request, shall not be required or permitted to modify the bid, but will be required to extend the validity of the bid 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 the 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, Pay order 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 favour of the procuring agency, which should commensurate with the bid validity period. The bank guarantee for bid security shall be acceptable in the manner as provided at Annexure BS-1

15.3 Any bid not accompanied by an acceptable bid security shall be rejected by the procuring agency as non-responsive.

15.4 Bid security shall be released to the unsuccessful bidders once the contract has been signed with the successful bidder or the validity period has expired.

15.5 The bid security of the successful bidder shall 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 bid except as provided in sub- clause IB 22.1;

(b) if the bidder does not accept the correction of his bid price pursuant to sub-clause IB 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/Bids

16.1 Each bidder shall submit only one bid either by himself, or as a member of a joint venture, until and unless they have been requested or permitted for alternative bid, then he has to purchase separate bidding documents and alternate bid shall be treated as separate bid.

16.2 Alternate proposals are allowed only for procurement of works where technical complexity is involved and more than one designs or technical solutions are being offered. Two stage two envelope bidding procedure will be appropriate when alternate proposal is required.

16.3 Alternate bid(s) shall contain (a) relevant design calculations; (b) technical specifications; (c) proposed construction methodology; and (d) any other relevant details / conditions, provided that the total sum entered on the Form of Bid shall be that which represents complete compliance with the bidding documents.

IB.17 Pre-Bid Meeting

17.1 Procuring agency may, on his own motion or at the request of any bidder, hold a pre-bid 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, shall be communicated to all bidders. All bidders or their authorized representatives shall be invited to attend such a pre-bid meeting at their own expense.

17.2 The bidders are requested to submit questions, if any, in writing so as to reach the Procuring agency not later than seven (7) days before the proposed pre-bid meeting.

17.3 Minutes of the pre-bid meeting, including the text of the questions raised and the replies given, will be transmitted without delay to all bidders. Any modification of the bidding documents listed in sub- clause IB 7.1 hereof, which may become necessary as a result of the pre-bid meeting shall be made by the procuring agency exclusively through the issue of an Addendum pursuant to Clause IB.9 and not through the minutes of the pre-bid meeting.

17.4 Absence at the pre-bid 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 Alteration is not to be made neither 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 without alterations and shall provide an original copy along with photocopies as per the requirement of the procuring agency specified in the bidding data. The original as well as copies of the document shall be clearly marked as "ORIGINAL" and „COPY", as the case may be. If there is any discrepancy between original and copy(ies) then the original shall prevail.

18.5 The original 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(s) duly authorized to sign on behalf of the bidder pursuant to sub- clause IB 11.1(a) hereof. All pages of the bid shall be initialled and stamped by the person(s) signing the bid.

18.6 The bid shall contain no alterations, omissions or additions, except to comply with instructions issued by the procuring agency, or as are necessary to correct errors made by the bidder. Such corrections shall be initialled by the person(s) signing the bid.

18.7 Bidders shall indicate in the space provided in the Form of Bid their full and proper
postal 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.

D. SUBMISSION OF BIDS

IB.19 Sealing and Marking of Bids

19.1 Each bidder shall submit his bid as under:

(a) ORIGINAL and_____COPIES of the bid shall be separately sealed and put in separate envelopes and marked as such.

(b) The envelopes containing the ORIGINAL and COPIES shall be put in one sealed envelope and addressed as given in sub – clause IB 19.2 hereof.

19.2 The inner and outer envelopes shall:

(a) be addressed to the procuring agency 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 bid opening, as specified in the bidding data.

19.3 In addition to the identification required in sub-clause IB 19.2 hereof, the inner envelope shall indicate the name and postal 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 procuring agency will assume no responsibility for the misplacement or premature opening of the Bid.

IB.20 Deadline for Submission of Bids

20.1 (a) Bids must be received by the procuring agency at the address specified not 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 shall 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 bid package,

(d) Upon request, acknowledgment of receipt of bids will be provided to those making delivery in person or by messenger.

20.2 The Procuring Agency may, at its discretion, extend the deadline for submission of bids by issuing an amendment in accordance with IB 09. In such case, all rights and obligations of the procuring agency and the bidders shall remain the same as mentioned in the original deadline.

IB.21 Late Bids

(a) any bid received by the procuring agency after the deadline for submission of bids prescribed in to clause IB 20 shall be returned unopened to such bidder.

(b) delays in the mail, 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 submit the bid intime.

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 procuring agency 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 to sub - clauses IB 22.1 and IB 27.2.

22.4 Withdrawal of a bid during the interval between the deadlines for submission of bids and the expiration of the period of bid validity specified in the Form of Bid may result in forfeiture of the bid security in pursuance to clause IB 15.

E. BID OPENING AND EVALUATION.

IB.23 Bid Opening

23.1 Procuring agency 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 or their representatives who are in attendance shall sign an attendance sheet.

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 Procuring agency shall read aloud the name of the bidder, total bid price and price of any Alternate Proposal(s), if any, discounts, bid modifications, substitution and withdrawals, the presence or absence of bid security, and such other details as the procuring agency may consider appropriate, and total amount of each bid, and of any alternative bids if they have been requested or permitted, shall be read aloud and recorded when opened.

23.4 Procuring Agency shall prepare minutes of the bid opening, including the information disclosed to those present in accordance with the sub-clause IB.23.3.

IB.24 Process to be Confidential. (SPP Rule 53)

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 in accordance with the requirements of Rule 45, which states that Procuring agencies shall announce the results of bid evaluation in the form of a report giving reasons for acceptance or rejection of bids. The report shall be hoisted on website of authority and that of procuring agency if it website exists and intimated to all bidders at least seven (7) days prior to the award of contract The announcement to all bidders will include table(s) comprising read out prices, discounted prices, price adjustments made, final evaluated prices and recommendations against all the bids evaluated. Any effort by a bidder to influence the procuring agency'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 as per Rule 31; however mere fact of lodging a complaint shall not warrant suspension of the procurement process.

IB.25 Clarification of Bid (SPP Rule 43)

25.1 To assist in the examination, evaluation and comparison of bids, the procuring agency may, at its discretion, ask any bidder for clarification of the 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 procuring agency 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 procuring agency will determine whether the bidder fulfils all codal requirements of eligibility criteria given in the tender notice such as registration with tax authorities, registration with PEC (where applicable), turnover statement, experience statement, and any other condition mentioned in the NIT and bidding document. If the bidder does not fulfill any of these conditions, it shall not be evaluated further.

26.2 Once found to be fulfilling the eligibility criteria, as mentioned in sub- clause 26.1, the bids of eligible bidders will be evaluated for technical responsiveness as per specification and criteria given in the bidding documents. Technical and financial evaluations may be carried out in accordance with single stage-single one envelope, single stage-two envelopes, two stage or two stage-two envelopes bidding procedures, depending on the selection procedure adopted by the procuring agency.

26.3 A bid will be considered technically responsive if it (i) has been properly signed; (ii) is accompanied by the required bid security; and (iii) 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 affect 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 procuring agency'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.

26.4 If a bid has major deviations to the commercial requirements and technical specifications will be considered technically non responsive. As a general rule, major deviations are those that if accepted, would not fulfil the purposes for which the bid is requested, or would prevent a fair comparison or affect the ranking of the bids that are compliant with the bidding documents.

(A). Major (material) Deviations include: -

(i) has been not properly signed;
(ii) is not accompanied by the bid security of required amount and manner;
(iii) stipulating price adjustment when fixed price bids were called for;
(iv) failing to respond to specifications;
(v) failing to comply with Mile-stones/Critical dates provided in Bidding Documents;
(vi) sub-contracting contrary to the Conditions of Contract specified in Bidding Documents;
(vii) refusing to bear important responsibilities and liabilities allocated in the Bidding Documents, such as performance guarantees and insurance coverage;
(viii) taking exception to critical provisions such as applicable law, taxes and duties and dispute resolution procedures;
(ix) a material deviation or reservation is one :

(a) which affect in any substantial way the scope, quality or performance of the works;

(b) adoption/rectification whereof would affect unfairly the competitive position of other bidders presenting substantially responsive bids.

(B) Minor Deviations

Bids that offer deviations acceptable to the Procuring Agency and which can be assigned a monetary value may be considered substantially responsive at least as to the issue of fairness. This value would however be added as an adjustment for evaluation purposes only during the detailed evaluation process.

26.5 If a bid is not substantially responsive, it will be rejected by the procuring agency, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

IB.27 Correction of Errors before Financial Evaluation

27.1 Bids determined to be substantially responsive will be checked by the procuring agency for any arithmetic errors. Errors will be corrected by the procuring agency 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 procuring agency 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 procuring agency in accordance with the above procedure for the correction of errors and with the concurrence of the bidders. The amount thus corrected 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 IB 15.6(b) hereof.

IB.28 Financial Evaluation and Comparison of Bids

28.1 The procuring agency 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 procuring agency will determine for each bid the evaluated bid price by adjusting the bid price as follows:

(a) making any correction for errors pursuant to clause IB 27;

(b) excluding provisional sums (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 procuring agency's estimate of the cost of work to be performed under the contract, the procuring agency 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 procuring agency 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 procuring agency against financial loss in the event of default of the successful bidder under the contract.

28.5 Bidders may be excluded if involved in **"Corrupt and Fraudulent Practices"** means either one or any combination of the practices given below SPP Rule2(q);

(i) "**Coercive Practice**" means any impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence the actions of a party to achieve a wrongful gain or to cause a wrongful loss to another party;

(ii) "Collusive Practice" means any arrangement between two or more parties to the procurement process or contract execution, designed to achieve with or without the knowledge of the procuring agency to establish prices at artificial, non competitive levels for any wrongful gain;

(iii) "Corrupt Practice" means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence the acts of another party for wrongful gain;

(iv) "Fraudulent Practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(v) "Obstructive Practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in a procurement process, or affect the execution of a contract or deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements before investigators in order to materially impede an investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or acts intended to materially impede the exercise of inspection and audit rights provided for under the Rules.

28.6 Evaluation Report (SPP Rule 45)

After the completion of evaluation process, as described in clauses IB 27 and IB 28, the procuring agency shall announce the results of bid evaluation in the form of report (available on the website of the authority) giving reasons for acceptance and rejection of bid. The report shall be hoisted on website of the authority and that of procuring agencies if its website exists and intimated to all bidders at least seven (7) days prior to the award of contract.

F. AWARD OF CONTRACT

IB.29 Award (SPP Rule 49)

29.1 Subject to clauses IB 30 and IB 34 and provision of the rule: The procuring agency shall award the contract to the bidder whose bid has been determined to be substantially responsive to the bidding documents, and who has offered the lowest evaluated bid, but not necessarily the lowest submitted price, within the original or extended period of bid validity. Provided that such bidder has been determined to be eligible in accordance with the provisions of clause IB 03 and qualify pursuant to sub-clause IB 29.2.

29.2 Procuring agency, at any stage of the bid evaluation, having credible reasons for or having prima facie evidence of any deficiency(ies) in contractor's capacities, may require the contractor to provide information concerning their professional, technical, financial, legal or managerial competence whether already pre-qualified or not for the said project.

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

IB.30 Procuring Agency's Right to reject all Bids or Annul/Cancellation the Bidding Process (SPP Rule 25)

Notwithstanding clause IB 29 and provision of the rule: (1) A procuring agency reserves may cancel the bidding process at any time prior to the acceptance of a bid or proposal; (2) The procuring agency shall incur no liability towards bidders solely by virtue of its invoking sub–rule (1); (3) Intimation of the cancellation of bidding process shall be given promptly to all bidders and bid security shall be returned along with such intimation; (4) The procuring agency shall, upon request by any of the bidders, communicate to such bidder, grounds for cancellation of the bidding process, but is not required to justify such grounds.

IB.31 Notification/Publication of the Award of Contract (SPP Rule 25)

31.1 Prior to expiry of the period of bid validity, including extension, prescribed by the procuring agency, the procuring agency shall notify the successful bidder in writing ("Letter of Acceptance") that his bid has been accepted. This letter shall mention the sum which the procuring agency will pay to 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 be permitted, however, procuring agency may hold meetings to clarify any item in the bid evaluation report.

31.3 The notification of award and its acceptance by the bidder will constitute the formation of the contract, binding the procuring agency and the bidder till signing of the formal Contract Agreement.

31.4 Upon furnishing by the successful bidder of a Performance Security and signing of the contract, the procuring agency will promptly notify the name of the successful bidder to all bidders and return their bid securities accordingly.

31.5 Within seven days of the award of contract, procuring agency shall publish on the website of the Authority and on its own website, if such a website exists, the results of the bidding process, identify the bid through procurement identifying numbers, and the following information:

(1) Evaluation Report;
(2) Form of Contract and letter of Award;
(3) Bill of Quantities or Schedule of Requirement.

31.6 Debriefing (SPP Rule 51).

(a) A bidder may ask the procuring agency for reasons for non acceptance of his bid and may request for a debriefing meeting and procuring agency shall give him the reasons for such non acceptance, either in writing or by holding a debriefing meeting with such a bidder.

(b) The requesting bidder shall bear all the costs of attending such a debriefing.

IB.32 Performance Security (SPP Rule 39)

32.1 The successful bidder shall furnish to the procuring agency a Performance Security in the form of pay order or demand draft or bank guarantee, 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 bid security.

32.3 Validity of performance security shall extend at least ninety days beyond the date of completion of contract, or as mentioned in the bidding data to cover defects liability period or maintenance period subject to final acceptance by the procuring agency.

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IB.33 Signing of Contract Agreement (SPP Rule 39)

33.1 Within 14 days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the procuring agency 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 procuring agency and the successful bidder shall be executed within 14 days of the receipt of the Contract Agreement by the successful bidder from the procuring agency.

33.3 A procurement contract shall come into force when the procuring agency requires signs contract, the date on which the signatures of both the procuring agency and the successful bidder are affixed to the written contract. Such affixing of signatures shall take place within the time prescribed in the bidding documents.

Provided that the procuring agency may reduce the maximum time limit for signing of contract, as and when required, and shall be mentioned in the bidding documents.

33.4 Stamp Duty

The formal Agreement between the Procuring Agency and the successful bidder shall be duly stamped at rate of ----% of bid price (updated from time to time) stated in Letter of Acceptance.

IB.34 General Performance of the Bidders

Procuring agency may in case of consistent poor performance of the contractor and his failure to remedy the underperforming contract may take such action as may be deemed appropriate under the circumstances of the case including the rescinding the contract and/or black listing of such contractor and debarring him from participation in future bidding process.

IB.35 Integrity Pact (SPP Rule 89)

The bidder shall sign and stamp the Integrity Pact provided at Appendix-L to the bidding documents for all Provincial/Local 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.

IB.37 Arbitration (SPP Rule 34)

Any dispute that is not amicably resolved shall be finally settled, unless otherwise specified in the Contract, under the Arbitration Act 1940 updated from time to time and would be held anywhere in the Province of Sindh at the discretion of procuring agency.

BIDDING DATA

Bidding Data

Instructions to Bidders

Clause Reference

1.1 Name and address of the procuring agency:
Superintendant Engineer,
1st Floor, D.C Korangi Office
Near Total Petrol Pump
Korangi #21/2, Karachi
Tel: 021-99333842
E-mail: ayazkhan.d.information@gmail.com

1.2 Name of the Project and Summary of the works:

Name of Project:

Competitive & Livable City of Karachi

Name of Work:

Competitive & Livable City of Karachi. Comprised of following scheme falling under the jurisdiction of DMC Korangi:

Improvement/ Rehabilitation of EID GAH ground / Football Ground - Korangi 03 . DMC Korangi

The identification number of the Contract is:

CLICK/DMC Korangi/Phase-I/Package-A

1.2 The successful bidder will be expected to complete the works within the time specified in Special Stipulations (Appendix-A).

2.1 Name of the Funding Source;
The World Bank,
Borrwer is Government of Sindh

2.1 Amount and Type of Financing/Scheme Cost and Allocated Funds.

Loan from the World Bank, US $ 230 million

3.1 Eligible Bidders:

This bidding is open to all constructing firms of Islamic Republico of Pakistan meeting the following eligibility criteria:

a) **Valid Registration with Pakistan Engineering Council in Category C4 and discipline, CE-10, EE-04 and EE-06 (submit valid PEC Certificate)**

b) **Registered with FBR for Income Tax (submit NTN Certificate and 3 years income tax returns)**

c) **Registered with Sindh Revenew Board for Sales Tax (submit Sales Tax registration certificate)**

d) **Not having been declared ineligible by any client/entity**

e) **No conflicts of interest**

f) **Non-performance of a contract1 did not occur as a result of contractor default for last five (05) years**

g) **Not under suspension based on execution of a Bid Securing Declaration**

h) **No consistent history of court/arbitral award decisions against the Bidder for last five (05) years**

i) **Declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for breach of environmental or social (including Sexual Exploitation and Abuse)) contractual obligations in the past five (05) years**

j) **Cashflow Requiement is Rs. 40 million (submit details of line of credit through Form 13 of this document. Use of Form 13 is mandatory)**

k) **Valid Professional Tax Certificate/Receipt of Payment.**

l) **Electrical Licence from the Government of Sindh.**

8.1 Time limit for clarification:

The written clarification should reach the addressee of the NIT on any working day but not later than 7 working days prior to last date of bid submission.

10.1 Bid language:

Bid language is English

11.1(b) Delete whole text and replace with following:

The bidder is required to meet the minimum criteria set out hereunder:

a. **Average Annual Construction Turnover of PKR 375 Million (submit three years Audit reports and financial statemnts)**

b) **General Construction Experience is 10 years (submit company registration documents)**

c) **Specific Construction Experience (two projects of Building and Stadiums, each of minimum value PKR 100 Million) completed in last five (05) years (submit completion certificates)**

d) Must have following key staff

Position	Qualification & Experience
Project Manager	BE (Civil) with 20 years' experience (10 years relevant experience)
Planning Engineer	BE (Civil) with 10 years' experience
Contracts Engineer	BE (Civil) with 15 years' experience
Structures Engineer (Buildings)	BE (Civil) with 15 years' experience with 10 years relevant experience of buildings
Horticulture Expert	Msc in Botany or Agriculture with 10 or more years relevant experience
Material Engineer	Msc (Geology) with 15 years' experience
MEP Engineer	BE (Elec/Mech), with 10 years' experience
Environmental Expert	BE (Civil), with 10 years' experience
Social Development Specialist	Msc (Social Science) with 10 years' experience
Health & Safety Expert	Minimum Qualification as Bachelor's in Civil/Environmental Engineering or Environmental Sciences in addition, OHS personnel must be having qualification NEBOSH IGC and / or IOSH Certification, ISO 45001; Must be familiar with Tool Box Talk, Safety induction process, Accident's investigations and reporting; At least 5-7 years post qualification experience.

Submit detailed CVs

e) Must have following key Plant & Equipment

Plant & Equipment

Sr. No.	Description of Equipment	Capacity & Horsepower	Minimum Number
1	Concrete Batching Plant	30 Cum	1
2	Concrete Transit Mixer	6 Cum	4
3	Concrete Pump		2
4	Crane	25 Ton	2
6	Excavator	105 HP	4
7	Welding Plant		
8	Generator	5KVa	2
9	Cable Pulling/Laying Winch		4
10	Lineman Bucket Truck		2

Submit ownership documents/rental agrrement/lease documents

11.1(c) furnish a technical proposal taking into account the various Appendices to Bid 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-H to Bid: Construction Camp and Housing Facilities

Appendix-I to Bid: List of Subcontractors

Appendix-K to Bid: Organization Chart for Supervisory Staff

Appendix -L to Bid: ES Management Strategies and Implementation Plans

Appendix-M to Bid: Code of Conduct for Contractor's Personnel (ES) Form

Appendix-N to Bid: Integrity Pact

Appendix-O to Bid: Forms of eligibility

and other pertinent information such as mobilization programme etc;

11.1(d) The Bidder shall submit the following additional documents in its Bid:

Code of Conduct for Contractor's Personnel (ES)

The Bidder shall submit its Code of Conduct that will apply to Contractor's Personnel to ensure compliance with the Contractor's Environmental and Social (ES) obligations under the Contract. The Bidder shall use for this purpose the Code of Conduct form provided in Appendix M. No substantial modifications shall be made to this form, except that the Bidder may introduce additional requirements, including as necessary to take into account specific Contract issues/risks.

Management Strategies and Implementation Plans (MSIP) to manage the (ES) risks

The Bidder shall submit Management Strategies and Implementation Plans (MSIPs) to manage the following key Environmental and Social (ES) risks:

- Sexual Exploitation, and Abuse (SEA) prevention and response action plan;
- Outbreak of Epidemic, prevention and response;
- Prevention and response for Health & Safety of staff;
- Prevention and response against national disaster;
- Prevention and response against dust pollution;
- Traffic Management Plan to ensure safety of local communities from construction traffic

13.1 Bidders to quote entirely in Pak. Rupee

The currency of Bid is Pakistan Rupee (PKR). All payment will be made in PKR only

14.1 Period of Bid Validity:

Period of Bid Validity shall be 90 days

15.1 Amount of Bid Security:

The amount of the bid security shall be 2% (Two Percent) of Bid Price in PKR

The Bid Security shall be in shape of Pay Order or irrevocable Bank Guarantee issued by a Scheduled Bank in Pakistan in favour of the Employer named DMC Korangi.

16.1 Alternate Proposals/Bid

Alternative bids is not permitted

Alternative times for completion is not permitted.

Alternative technical solutions is not permitted for any part of the Works

17.1 Venue, time, and date of the pre-Bid Meeting:

A Pre-bid Meeting is scheduled to be held on 11-01-2022 at 1100 hours. Venue of the pre-bid meeting is the same as provided below

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

Original + Two Copies

19.2 (a) Procuring Agency's address for the purpose of bid submission:
1st Floor D.C. Korangi Office Near Total Petrol Pump Korangi # 2 ½ Karachi

(b) Name and Identification Number of the Contract:

Competitive & Livable City of Karachi. Comprised of following scheme falling under the jurisdiction of KMC:

Improvement/ Rehabilitation of EID GAH ground / Football Ground - Korangi 03. DMC Korangi

The identification number of the Contract is:

CLICK/DMC Korangi/Phase-I/Package-A

20.1 (a) Deadline for submission of bids:

18-01-2022 up to 1.00 pm

(b) Venue, time, and date of bid opening:
18-01-2022 up to 2.00 pm Address: **Committee Room District Municipal Corporation Korangi Karachi, 1st Floor D.C. Korangi Office Near Total Petrol Pump Korangi # 2 ½ Karachi**

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

The performance security will be in the form of a "unconditional, irrevocable and acceptable bank guarantee" in the amount of 5% (Five percent) of the Accepted Contract Amount acceptable to the Procuring Agency in the attached format

32.3 Validity of performance security

The Performance Security shall be valid for a period 90 days after the date of issue of defects liability certificate

33.4 Stamp duty

The Contract will be executed on a non-judicial stamp paper of the value @ 0.35% of the contract value. The cost of the stamp duty shall be borne by the successful bidder.

FORM OF BID
AND
APPENDICES TO BID

FORM OF BID

Bid Reference No. _____

(Name of Contract/Work)

To:

_____

_____

_____

1. Having examined the bidding documents including Instructions to Bidders, Bidding Data, and Conditions of Contract, Specifications, Drawings and Bill of Quantities and Addenda Nos._____for the execution of the above-named work, we/I, the undersigned, offer to execute and complete the work 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/I 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/I submit herewith a bid security in the amount of Rupees _____ (Rs._____) drawn in your favour or made payable to procuring agency and valid for a period of_____days beginning from the date, bid is opened.

4. We/I 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/I agree to abide by this bid for the period of_____days from the date fixed for opening the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

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

7. We 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.

9. We undertake, if our/my bid is accepted, to execute the Performance Security referred to in Clause 10 of Conditions of Contract for the due performance of the Contract.

10. We confirm, if our bid is accepted, that all partners of the joint venture shall be liable jointly and severally for the execution of the Contract and the composition or the constitution of the joint venture shall not be altered without the prior consent of the procuring agency. (Please delete this in case of Bid form a single bidder)

in the capacity of_____duly authorized to sign Bids for and on behalf of _____Dated this _____day of_____20_____

Signature: _____

_____
(Name of Bidder in Block Capitals)
(Seal)

Address:_____
_____
_____

Witness:

Signature:_____
Name: _____

Address: _____
_____
Occupation: _____

SPECIAL STIPULATIONS
Particular Conditions of Contract- Part A

	Description	General Conditions Clauses	Stipulations
1	Employer's name and address	1.1.2.2 & 1.3	**Superintendant Engineer,** 1st Floor, D.C Korangi Office Near Total Petrol Pump Korangi #21/2, Karachi Tel: 021-99333842 E-mail: dmckorangi@hotmail.com **Employer's Representative,** To be notified
2	Engineer's name and address	1.1.2.4 & 1.3	To be notified
3	Sections	1.1.5.6	Not Applicable
4	Electronic transmission systems	1.3	Scanned copy via e-mail and facsimile are acceptable, if the original is received within three days.
5	Governing Law	1.4	The Laws of Islamic Republic of Pakistan.
6	Ruling language	1.4	English
7	Language for communications	1.4	English
8	Time for access to the Site	2.1	Within seven (07) days after Commencement Date
9	Engineer representing Consulting Firm hired by the procuring agency to issue variation in case of emergency	3.1	Up to 1% of the contract price stated in the Letter of Acceptance.
10	Amount of Performance Security	4.2	The performance security will be in the form of a "unconditional, irrevocable and acceptable bank guarantee" in the amount of 5% (Five percent) of the contract price stated in the Letter of Acceptance.
11	Subcontract	4.4	The aggregate amount of the Works subcontracted shall not exceed 20% of the Contract Price.
12	Normal working hours	6.5	8 hrs a day and 6 days a week.
13	Time for Commencement	8.1	Within 07 days from the date of receipt of Engineer's Notice to Commence, this shall be issued within fourteen (14) days after signing of Contract Agreement.
14	Time for Completion	8.2	90 days/03 months from the date of receipt of

			Engineer's Notice to Commence.
15	Time for Furnishing Programme	8.3	Within 14 days from the date of receipt of Letter of Acceptance.
16	Revised Programme	8.3	Revised Programme to be submitted within 07 days of the Engineer's notice.
17	Delay damages for the Works	8.7 & 14.15(b)	0.1% of the Contract Price per day
18	Maximum amount of delay damages	8.7& 14.15(b)	10% of the final Contract Price & Also, other charges mentioned in Part B, Particular Conditions of Contract
19	Defects Liability Period	11.1	365 days from the effective date of Taking Over Certificate.
20	Provisional Sums	13.5.(b)(ii)	5% + Tax
21	Adjustments for Changes in Cost	13.8	Not Applicable
22	Advance payment	14.2	10% Percentage of the Accepted Contract Amount excluding Provisional Sum and Day work) payable payable in PKR: First Instalment: 50% of total Advance Payment shall be made after fulfilling all the requirements provided in Conditions of the Contract. Second Instalment: Remaining 50%, on mobilization of Plant, equipment and other resources at site by the Contractor to the satisfaction of the Engineer.
23	Repayment amortization rate of advance payment	14.2(b)	From three consequtive monthly statement starting from first month in equal instalments.
24	Percentage of Retention	14.3	10 % of the amount of Interim/ Running Payment Certificate.
25	Limit of Retention Money	14.3	5 % of Contract Price stated in the Letter of Acceptance.
26	Plant and Materials	14.5	Not Applicable
27	Minimum Amount of Interim Payment Certificates	14.6	10 % of the Accepted Contract Amount.
28	Payment	14.7	For IPC, 28 days. For FPC, 56 days
29	Maximum total liability of the Contractor to the Employer	17.6	The product of two (02) times the Accepted Contract Amount
30	Periods for submission of insurance: a. evidence of	18.1	14 days

	insurance. b. relevant policies.		28 days
31	Maximum amount of deductibles for insurance of the Employer's risks	18.2(d)	10% of the Accepted Contract Amount
32	Minimum amount of Insurance Cover	18.1, 18.2, 18.3 and 18.4	**Type of cover** The Works **Amount of cover** The sum stated in the Letter of Acceptance plus fifteen percent (15%) **Type of cover** Contractor's Equipment: **Amount of cover** Full replacement cost plus fifteen percent (15%) **Type of cover** Third Party-injury to persons and damage to property The Third-Party Compensation Policy must contain following conditions of indemnification per occurrence with the number of occurrence unlimited: i) in case of death, Pak Rs. 1,000,000/= per person ii) in case of major injury, Pak Rs. 500,000/= per person iii) in case of minor injury, Pak Rs. 100,000/= per person iv) in case of damage to property, full amount of repair/replacement as the case may be. **Workers:** i) in case of death, Pak Rs. 1,000,000/= per person ii) in case of major injury, Pak Rs. 500,000/= per person iii) in case of minor injury, Pak Rs. 100,000/= per person **Other cover:** Contractor's All Risk Policy (In each case name of insured is Contractor and Procuring Agency)
33	Date by which the Dispute Board (DB) shall be	20.2	28 days after the Commencement date

	appointed		
34	The DB shall be comprised of	20.2	Three Members The Adjudicator with name, address, hourly fee and biographical data will be provided in the Letter of Acceptance
35	List of potential DB sole members	20.2	None
36	Appointment (if not agreed) to be made by	20.3	Pakistan Engineering Council
37	Rules of arbitration	20.6(a)	Rules and Provisions of Arbitration Act 1940 of Islamic Republic of Pakistan enforced for the time being. The Place of Arbitration shall be Karachi.

Appendix-B to Bid

FOREIGN CURRENCY REQUIREMENTS

1. The bidder may indicate herein below his requirements of foreign currency (if any), with reference to various inputs to the works.

2. Foreign Currency Requirement as percentage of the bid price excluding Provisional Sums_____%.

3. Table of Exchange Rates

"Not Applicable"

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

PRICE ADJUSTMENT UNDER CLAUSE 13.8 OF CONDITIONS OF CONTRACT

A. Weight ages or coefficients are used for price adjustment.

The source of indices and the weightages or coefficients for use in the adjustment formula under Clause 13.8 shall be as follows:

Cost Element	Description	Weight ages	Applicable index
1	2	3	4
(i)	Fixed Portion	0.350	
(ii)	Local Labour		Government of Pakistan (GoP) Federal Bureau of Statistics (FBS) Monthly Statistical Bulletin.
(iii)	High Speed Diesel (HSD)		-do-
(iv)	Cement – in bags		-do-
(v)	Reinforcing Steel		-do-
(vi)	Pre-Stressing Strands		-do-
(vii)	Bitumen		-do-
(viii)			
	Total	1.000	

"Not Applicable"

B **When Escalation is allowed on the materials only.**

Price adjustment on following items shall be allowed:

Cost Element	Description	Base price	Applicable index
1	2	3	4
(i)	Cement – in bags (50kg bag)		GoP, Federal Bureau of Statistics, Monthly Bulletin
(ii)	Reinforcing Steel Steel Billet (150x150mm)		Pakistan Steel Mill
(iii)	Bitumen 60/70 in new drums 180 kg drums		National Refinery
(iv)	Brick		GoP, Federal Bureau of Statistics, Monthly Bulletin
	Total four items.		

"Not Applicable"

BILL OF QUANTITIES

A Preamble

1. The Bill of Quantities shall be read in conjunction with the Conditions of Contract, Specifications and Drawings.

2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work executed and measured by the Contractor and verified by the Engineer and valued at the rates and prices entered in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix as per the Contract (in case of item not mentioned in Bill of Quantities).

3. The rates and prices entered in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the contract include all costs of contractor's plant, labour, supervision, materials, execution, insurance, profit, taxes and duties, together with all general risks, liabilities and obligations set out or implied in the contract. Furthermore all duties, taxes and other levies payable by the contractor under the contract, or for any other cause, as on the date 14 days prior to deadline for submission of Bids shall be included in the rates and prices and the total bid price submitted by the bidder.

4. A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of items against which the contractor will have failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities and shall not be paid separately.

5. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Bill of Quantities, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related items of the works.

6. General directions and description of work and materials are not necessarily repeated nor summarised in the Bill of Quantities. References to the relevant sections of the bidding documents shall be made before entering prices against each item in the priced Bill of Quantities.

7. Provisional sums included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Engineer in accordance with sub-clause 13.5 of Part I, General Conditions of Contract.

8. The following abbreviations for the units or units of measurement have been used in the bidding documents including BOQ.

Unit	Abbreviations
• Linear Meter	LM or lm or M or m
• Square Meter	Sq.m. or SM or sm
• Cubic Meter	Cu.m. or CM or cm or Cum or cum
• Ton	Ton
• Kilogram	Kg or kg
• Per Number	No or Each
• Job	Job
• Linear Feet	LF or lf
• Square Feet	Sq.f. or SF or sf
• Cubic Feet	Cu.f. or CF or cf or Cuf or cuf
• Pounds	Lb or lb

IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

SUMMARY

Bill No	DESCRIPTION	AMOUNT (Rs)	AMOUNT IN WORDS
1	STRUCTURE WORKS		
2	ARCHITUCTURE WORKS		
3	ELECTRICAL WORKS		
4	PLUMBING WORKS		
5	EMPLOYER'S/ENGINEER'S FACILITIES		
	TOTAL CONSTRUCTION COST		

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES
STRUCTURE WORKS

IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

SUMMARY

Bill No	DESCRIPTION	AMOUNT	AMOUNT IN WORDS
1	**BILL NO. 01: STRUCTURE WORKS**		
1	STRUCTURE WORKS		
2	PROPOSED UGWT & PUMP ROOM FOR INTERNAL WATER SUPPLY		
	TOTAL AMOUNT BILL NO. 1 : STRUCTURE WORKS		

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

BILL NO. 1: STRUCTURE WORKS

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
A	**EARTH WORKS**					
	NOTE: INSTRUCTION FOR BIDDERS					
	The Bidders are instructed to perform a mandatory 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 / cost of this work.					
	CONFIRMATORY GEOTECHNICAL STUDIES					
1	Providing and applying the Exploratory / Confirmatory boring 10 meter deep and Testing in Dry / Wet Area including Geotechnical Report 4 No copies to be submitted to local authorities / Engineer / Client at any height in any floor etc. complete in all respects as per standard, specifications and as directed by the Engineer contractor to ensure providing all safety measure for the existing Structure to be retained.	Each	3			
	DISMANTLING AND DEMOLISHING WORKS					
2	Dismantling, demolishing, chiseling, cutting and removing of existing rooms / walls / floors, foundations, columns, beams, slab, tanks, pits, manhole, trenches or any other etc.) all works consisting of RCC/CC concrete of structural members with finishes of above on ground and below and where required for the Construction of New Work including removal of all debris at appropriate place to dispose off at locations approved by the local authorities / Engineer / Client at any height in any floor etc. complete in all respects as per standard, specifications and as directed by the Engineer contractor to ensure providing all safety measure for the existing Structure to be retained.	Cum	1,990			

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

BILL NO. 1: STRUCTURE WORKS

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
3	Cutting & removing of existing doors, windows & ventilators with MS grill, glass & framing of any size or where required at any floor / height including removal of all broken /damaged doors, windows & ventilator at appropriate suitable place to dispose off at locations approved by the local authorities / The Engineer with all lead & lifts etc. complete in all respects as per standard, specifications and as directed by the Engineer.					
i)	Doors	Nos	3			
ii]	Fence	Rm	170			
4	Excavation from EGL/NGL/RL/FFL up to the required level and dewatering for foundation, trenches and tanks etc. in all kind of soil & rocks (hard, medium, soft, silty, clayey slit, sandy, gravel, lime stone etc. including site clearing, dressing, leveling, shoring, compacting & back filling the excavated earth including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229mm) in depth to full compaction. Excavated earth stacking at appropriate suitable place , carting away surplus earth to dispose off at locations approved by the local authorities / The Engineer etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.					
i)	From EGL/NGL ± 0.00 meter to - 1.5 meter depth	Cum	1,435			
ii]	From - 1.5 meter to - 3.0 meter depth	Cum	265			

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

BILL NO. 1: STRUCTURE WORKS

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
5	Supplying and filling earth / engineered fill material from approved outside sources including breaking clods, leveling, dressing, watering, compacting and consolidating in 9 inches (229mm) layers with compaction test at each layer etc. and to obtain required density (at any floor) with all lead & lifts etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.	Cum	425			
6	Providing and laying stone soling from approved quarry including hand packing & filling voids with stone material over a consolidated & compacted layer of moist earth including ramming & compacting with power or hand roller etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.	Cum	240			
B	**SUB-STRUCTURE WORKS**					
7	Providing and laying cement concrete using OPC cement and crushed stone 1 inch (25 mm) and down gauge with approved sand having preliminary cylindrical crushing strength as per drawings / specification, including form work and its removal, leveling, compacting and curing etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.					
i)	Below foundation, Plinth beams, situ under sub floor or where required (1000 Psi)	Cum	93			
ii)	For Cast in situ / Mass / Level concrete (1500 Psi)	Cum	85			

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

BILL NO. 1: STRUCTURE WORKS

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
8	Providing and laying RCC cement concrete with approved concrete admixture / retarder mix according to supplier instruction] having preliminary cylindrical crushing strength as per drawings / specification at 28 days, using OPC cement and approved quality of 1 inch (25 mm] and down gauge size graded crush stone aggregate with approved quality sand including fixing & removing approved quality of fair face formwork and its removal, all operations of mechanically vibrating, leveling, consolidating and curing but excluding the cost of steel reinforcement etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.					
i)	Foundation (of any type) (3000 Psi)	Cum	280			
ii]	Plinth beams i/c nibs /projection (3000 Psi]	Cum	100			
iii)	Columns / Pedestal below plinth (3000 Psi)	Cum	88			
iv)	RCC Wall /Retaining Wall below plinth (3000 Psi)	Cum	10			
9	Providing, supplying, straightening, cutting, bending, fabricating, placing and installing / binding in position etc., straight or curved deformed steel bar reinforcement having minimum yield strength 414 Mpa (60,000 Psi], including cost of G.I binding wire 18SWG, chairs, wastages, precast c.c. spacers and welding where required to be followed ASTM A615 standard. Only those overlaps shall be paid which are according to the approved Bar Bending Schedule / shown on drawings or instructed by the Engineer, all kind of R.C.C. work etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer. (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].	M. Ton	60			

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

BILL NO. 1: STRUCTURE WORKS

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
10	Providing and applying industrial bitumen paint (Coverage 7 Kg / 10 Sqm) mixed with water component 2 coats on all RCC / CC structural member surfaces contact with earth up to plinth level etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.	Sqm.	3,405			
11	Providing and applying Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURSBIN or TENEKIL PLUS or MIRAGE ALI AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard, specifications and as directed by the Engineer. (Note: Plinth Area will be measured one time for payment where is the number of applications will be three times on all horizontal & vertical surfaces of the excavation for termite proofing)	Sqm.	795			

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

BILL NO. 1: STRUCTURE WORKS

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
C	**SUPER-STRUCTURE WORKS**					
12	Providing and laying RCC cement concrete with approved concrete admixture / retarder mix according to supplier instruction) having preliminary cylindrical crushing strength as per drawings / specification at 28 days, using OPC cement and approved quality of 1 inch (25 mm) and down gauge size graded crush stone aggregate with approved quality sand including fixing & removing approved quality of fair face formwork and its removal, all operations of mechanically vibrating, leveling, consolidating and curing but excluding the cost of steel reinforcement etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.					
i)	Columns / Pedestal (3000 Psi)	Cum	125			
ii)	Beams, coping beams, Parapet wall, lintels, nibs & projection (3000 Psi)	Cum	78			
iii)	Slab incl. projection (3000 Psi)	Cum	45			
iv)	Staircase, Steps & Seats (3000 Psi)	Cum	150			
13	Providing, supplying, straightening, cutting, bending, fabricating, placing and installing / binding in position etc., straight or curved deformed steel bar reinforcement having minimum yield strength 414 Mpa (60,000 Psi), including cost of G.I binding wire 18SWG, chairs, wastages, precast c.c. spacers and welding where required to be followed ASTM A615 standard. Only those overlaps shall be paid which are according to the approved Bar Bending Schedule / shown on drawings or instructed by the Engineer, all kind of R.C.C. work etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer. (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).	M. Ton	71			

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

BILL NO. 1: STRUCTURE WORKS

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
14	Design and built Canopy shed over stadium pavilion structure existing & proposed location as per drawings with supplying 03 Nos or required sets of all complete engineering design, method statement, shop drawings, design calculations to be submitted to the engineer and local authority for the approval (without any additional cost) as per it's requirements, including providing, cutting, fabricating, erecting, placing, installing, and fixing in position works. All structural steel members having vertical / horizontal / inclined minimum yield strength of 36 ksi & 46 Ksi consisting of (MS tubes, pipes base plate, MS sheets, stiffener plate, MS beams, pipes / MS framing, columns, braces, trusses, purlin, MS post, MS bar, anchors bolts, rawal bolts, nuts, washer, fiber sheet with if required insulation material on roof & wall cladding i/c curves, gutters & spouts, skylight and grouting material & mortar leveling grout waterproofing etc.) or where required and confirming to ASTM A36 (36 Ksi) & A500 (46 Ksi) jointing, welding confirming to AWS (American welding society) specification and bolts confirming to A307 & A325. in any floor / height, including the cost of scaffolding, platforms & winches, all structural elements / members shall be 03 coats of enamel paint over red oxide / primer coat. The contractor shall submit coordinated and checked shop drawings (without any additional cost) for approval prior to the start of the work etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.	Sqm	240			
					TOTAL AMOUNT BILL NO. 1 : STRUCTURE WORKS	

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BILL OF QUANTITIES

PROPOSED UGWT & PUMP ROOM FOR INTERNAL WATER SUPPLY

S.No	DESCRIPTION	UNIT	QTY	RATES (Rs.)	RATE IN WORDS	AMOUNT
1	**EXCAVATION**					
1.1	Excavation from EGL/NGL/RL/FFL up to the required level and dewatering for drain, culverts, foundation, trenches and tanks etc. in all kind of soil & rocks (hard, medium, soft, silty, clayey slit, sandy, gravel, lime stone etc. including site clearing, dressing, leveling, shoring, compacting & back filling the excavated earth including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229mm) in depth to full compaction. Excavated earth stacking at appropriate suitable place , carting away surplus earth to dispose off at locations approved by the local authorities / The Engineer etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.					
	± 0.00 m to -1.5 m depth	Cu.m	130			
	± 1.5 m to -3 m depth	Cu.m	120			
	± 3 m to -4.5 m depth	Cu.m	60			
1.2	Supplying and filling earth / engineered fill material from approved outside sources including breaking clods, leveling, dressing, watering, compacting and consolidating in 9 inches (229mm) layers with compaction test at each layer etc. and to obtain required density (at any floor) with all lead & lifts etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.	Cum	7			
1.3	Providing and laying stone soling from approved quarry including hand packing & filling voids with stone material over a consolidated & compacted layer of moist earth including ramming & compacting with power or hand roller etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.	Cum	26			

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BILL OF QUANTITIES

PROPOSED UGWT & PUMP ROOM FOR INTERNAL WATER SUPPLY

S.No	DESCRIPTION	UNIT	QTY	RATES (Rs.)	RATE IN WORDS	AMOUNT
2	**PLAIN CEMENT CONCRETE**					
2.1	Providing and laying cement concrete using SRC or OPC cement and crushed stone 1 inch (25 mm) and down gauge with approved sand having preliminary cylindrical crushing strength as per drawings / specification, including form work and its removal, leveling, compacting and curing etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.					
	Below drain, culverts or where required 1:4:8 Concrete	Cu.m	7			
	For Cast in situ / Mass / Level concrete (1500 Psi)	Cu.m	1			
3	**REINFORCED CEMENT CONCRETE**					
3.1	Providing and laying RCC cement concrete with approved concrete admixture / retarder mix according to supplier instruction) having 4000 Psi cylindrical crushing strength as per drawings / specification at 28 days, using SRC or OPC cement and approved quality of 1 inch (25 mm) and down gauge size graded crush stone aggregate with approved quality sand including fixing & removing approved quality of fair face formwork and its removal, all operations of mechanically vibrating, leveling, consolidating and curing but excluding the cost of steel reinforcement etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.					
i)	Foundation (of any type) (3000 Psi)	Cum	33			
ii)	Plinth beams i/c nibs /projection (3000 Psi)	Cum	1			
iii)	Columns / Pedestal below plinth (3000 Psi)	Cum	1			
iv)	Base Slab, Walls, Top Slab	Cum	38			

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BILL OF QUANTITIES

PROPOSED UGWT & PUMP ROOM FOR INTERNAL WATER SUPPLY

S.No	DESCRIPTION	UNIT	QTY	RATES (Rs.)	RATE IN WORDS	AMOUNT
3.2	Providing, making and fixing RCC Pre-Cast slab / cover concrete including reinforcement bars, lifting hook having 2400 Psi cylindrical crushing strength as per drawings / specification (with water-tight Fair faced form work), fixing on specified location, maintaining proper line & level etc., at any height & floor where required, as per drawing maintaining proper level etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.					
	Acess cover	Cu.m	1			
4	**STEEL REINFORCEMENT**					
4.1	Providing, supplying, straightening, cutting, bending, fabricating, placing and installing / binding in position etc., straight or curved deformed steel bar reinforcement having minimum yield strength 414 Mpa (60,000 Psi), including cost of G.I binding wire 18SWG, chairs, wastages, precast c.c. spacers and welding where required to be followed ASTM A615 standard. Only those overlaps shall be paid which are according to the approved Bar Bending Schedule / shown on drawings or instructed by the Engineer, all kind of R.C.C. work etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer. (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).					
	Base Slab, Walls, Top Slab & Acess cover	Ton	8			
5	**BITUMEN COATING**					
5.1	Providing and applying industrial bitumen paint mixed according to supplier instruction with water component 2 coats on all RCC / CC structural member surfaces contact with earth up to plinth level etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.	Sq.m	204			

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BILL OF QUANTITIES

PROPOSED UGWT & PUMP ROOM FOR INTERNAL WATER SUPPLY

S.No	DESCRIPTION	UNIT	QTY	RATES (Rs.)	RATE IN WORDS	AMOUNT
5.2	Providing and applying Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURSBIN or TENEKIL PLUS or MIRAGE ALI AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	Sq.m	90			
6	**WATER STOPPER**					
6.1	Providing " expansion joint" in concrete work of 9" wide corugated PVC water Stoper (with Bulb) cost of material and labour etc. complete in all respect as shown on the drawings.	Rm	34			
7	**MS LADDER RUNG**					
7.1	Providing, laying & fixing 3/4" Dia. M.s. Galvanised Ladder Rungs Including Fixing and Fixing Accessories Complete in all Respect As Shown on the Drawings.	Each	5			
8	**SUPER STRUCTURE WORKS**					
8.1	Providing and laying RCC cement concrete with approved concrete admixture / retarder mix according to supplier instruction) having preliminary cylindrical crushing strength as per drawings / specification at 28 days, using OPC cement and approved quality of 1 inch (25 mm) and down gauge size graded crush stone aggregate with approved quality sand including fixing & removing approved quality of fair face formwork and its removal, all operations of mechanically vibrating, leveling, consolidating and curing but excluding the cost of steel reinforcement etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer.					
i)	Columns / Pedestal (3000 Psi)	Cum	2			
ii)	Beams, coping beams, Parapet wall, lintels, nibs & projection (3000 Psi)	Cum	1			
iii)	Slab incl. projection (3000 Psi)	Cum	2			

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BILL OF QUANTITIES

PROPOSED UGWT & PUMP ROOM FOR INTERNAL WATER SUPPLY

S.No	DESCRIPTION	UNIT	QTY	RATES (Rs.)	RATE IN WORDS	AMOUNT
8.2	Providing, supplying, straightening, cutting, bending, fabricating, placing and installing / binding in position etc., straight or curved deformed steel bar reinforcement having minimum yield strength 414 Mpa (60,000 Psi), including cost of G.I binding wire 18SWG, chairs, wastages, precast c.c. spacers and welding where required to be followed ASTM A615 standard. Only those overlaps shall be paid which are according to the approved Bar Bending Schedule / shown on drawings or instructed by the Engineer, all kind of R.C.C. work etc. complete in all respects as per the drawing, standard, specifications and as directed by the Engineer. (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).	M. Ton	1			
				Total Amount.		

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES
ARCHITUCTURE WORKS

IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

SUMMARY

Bill No	DESCRIPTION	AMOUNT	AMOUNT IN WORDS
2	**BILL NO. 02: ARCHITUCTURE WORKS**		
A	CLUB HOUSE, WASHROOMS & GUARD ROOMS		
B	BOUNDARY WALL		
C	FOOTBALL GROUND		
D	HOTICULTURE		
	GRAND TOTAL		

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
A	**CLUB HOUSE, PUMP ROOM, WASHROOM & GUARD ROOM**					
1	**DPC & BLOCK MASONRY**					
	DPC (50mm Thick)					
1.1	Providing and laying (50mm) thick DPC damp proof course with cement concrete 1:2:4 cast in situ including 2 coats of asphaltic mixture with leveling, curing, finishing, form work & its remover etc,. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	Sqm.	140			
	Block Masonry					
1.2	Providing and laying 1:3:6 cement concrete solid block masonry of approved quality (1000 PSi) straight or curved walls of approved quality, setting the blocks in 1:4 cement sand mortar, raked joints including curing, 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, etc. complete in all respect as per specifications and drawings and as directed by the Engineer. (at any hight in any floor).	Cum.	725			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
	Block Masonry for Steps					
1.3	Providing and laying 1:3:6 cement concrete solid block masonry of approved quality (800 PSi) for steps (seats for spectators) of approved quality, setting the blocks in 1:6 cement sand mortar, raked joints including curing, wedges, hacking of existing surface for bonding where necessary, etc. complete in all respects as per specifications and drawings and as directed by the Engineer.	Cum.	25			
2	**METAL WORKS**					
2.1	**G.I Moulded Steel Door Frame**					
	Providing and fixing G.I. molded steel door frame of 150mm wide manufactured from galvanized iron steel sheet of 16 gauge having single/double rebate size 38mm x 12mm, with holes and threads. including 3 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 surfacespecial 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.	Rm.	75			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
	Aluminum Windows & Ventilators					
2.2	Providing and fixing fully glazed Bronze anodized or powder coated aluminum Sliding / fixed & openable /Top hung /Pivot 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.	Sqm.	35			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
	Aluminum Fixed Glazing with Door					
2.3	Providing and fixing fully glazed Bronz anodized or powder coated aluminium Fixed Partition with swing door comprising of 5 mm thick distortion free local clear glass, 2mm thick deluxe model premium quality aluminum sections by Pakistan Cable, Lucky & Knudsen or approved equivalent manufacturers, fixed on Rcc & masonry surface, fitted in Neoprene Gaskets including all required hardware (stainless steel/aluminum) such as hinges, handles, locks, stays, weather strip etc., silicon sealant to all external junction between structure and door to give water / wind proof seal & others, complete in all respects as per drawing, standard, specifications and direction of the Engineer.	Sqm.	15			
	Aluminium Waterproof Door					
2.4	Providing, fabricating and fixing Aluminum Frame door comprising of 12mm thick water proof Laminated Board/Ply of approve make & shade, premium quality aluminum sections (Frame) of Pakistan Cable/ Knudsen or equivalent approved manufacturers fixed on Rcc & masonry surface, fitted in Neoprene Gaskets including all required hardware (all hardware should be in stain less steel), hinges, handles, locks, stays etc, complete in all respect as per drawing, standard, specifications and direction of the Engineer.	Sqm.	35			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
3	**DOORS AND WINDOWS**					
	Door Shutter					
3.1	Providing, Making & fixing in position 38mm 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 of Ironmongery such as Tower bolts, Locks, Handles, kick & push plate etc. paid in Separate item.)	Sqm.	30			
3.2	Providing and fixing in position as per drawings & joinery schedule all ironmongery / hardware of approved make as per relevant drawings, (at any height / floor) complete in all respect as per specifications and approval of the Engineer.					
a)	Tower bolts	Nos.	22			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
b)	Single Cylinder 600mm with knob Sat. Nickle Finish (with Type-2 knob)	Nos.	16			
c)	Overhead Hydraulic Door Closer, Max.65 Kg. Door Weight.	Nos.	6			
d)	Pull Handle (C-Type)	Nos.	24			
4	**INTERNAL FLOOR FINISHES**					
	C.C Floor					
4.1	Providing and laying floors of 3 inches (76 mm) thick 1:2:4 cement concrete floor using approved crushed graded aggregate 3/4" inch (20 mm) and down gauge, with sand laid in panels including consolidation, leveling, finishing and curing (overall thickness as shown in the drawings) etc. complete in all respects as per drawing, standard, specifications and direction of the Engineer.	Sqm.	700			
	Porcelain Tile Flooring					
4.2	Providing and laying approved Pakistani made unglazed/ Matt porcelain 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).	Sqm.	200			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
	Ceramic Tile Flooring					
4.3	Providing and laying approved Pakistani made unglazed/ Matt Ceramic tiles 8" x 8" x1/4" thick in floor with approved 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).	Sqm.	95			
5	**INTERNAL WALL FINISHES**					
5.1	Providing and applying 12mm thick 1:6 cement sand plaster on internal walls, columns, beams, lintels etc. using expanded metal mesh on joints, electrical conduits, corner beads, chamfered edges, rounding off corner etc. including scaffolding, including MS Plaster stop as per drawings on edges and corners etc. complete in all respects as per specification, relevant drawings and as directed by Engineer.	Sqm.	850			
	Steps Plaster					
5.2	Providing and applying 12mm thick 1:4 cement sand plaster on Steps (Trade & Riser) etc. using expanded metal mesh on joints, chamfered edges, rounding off corner etc. including scaffolding, as per drawings, complete in all respects as per specification, relevant drawings and as directed by Engineer.	Sqm.	500			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
	Porcelain Tile Dado/Skirting					
5.3	Providing and laying approved Pakistani made unglazed/ Matt porcelain 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).	Sqm.	30			
	Ceramic Tile Flooring					
5.4	Providing and laying approved Pakistani made unglazed/ Matt Ceramic tiles 8" x 8" x1/4" thick on dado/skirting with approved colour and pattern in any floor & any height including & over 3/4" (20mm) 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).	Sqm.	250			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
	Matt Enamel Paint					
5.5	Providing and applying painting on all internal wall surface with Matt Enamel Paint of approved shade three coats over and including a coat of primer over plastered surface at any height in any floor including preparation of surface, filling depression with putty, rubbing, sand papering and cleaning etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	Sqm.	850			
6	**INTERNAL CEILING FINISHES**					
	Ceiling Plaster					
6.1	Providing and applying 12mm thick 1:6 cement sand plaster on ceiling (Steped ceiling), slab, landings) etc. using expanded metal mesh on joints, electrical conduits, chamfered edges, rounding off corner etc. as per drawings, scaffolding, curing etc. complete in all respects, as per specification, relevant drawings and as directed by Engineer.	Sqm.	310			
6.2	Providing and applying painting on all internal ceiling surface with Berger Robbialac or equivalent Oil Bound Distemper of approved shade three coats over and including a coat of primer over plastered surface at any height in any floor including preparation of surface, filling depression with putty, rubbing, sand papering and cleaning etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	Sqm.	310			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
7	**EXTERNAL FINISHES (BUILDING)**					
	Rough Cast Plaster					
7.1	Providing and applying 10mm thick Rough cast Plaster of cement mortar 1:4 on external works including grooves, jambs, bends, corners, recessed, including hacking the concrete surfaces scaffolding and making the masonry joints and providing approved quality G.I. Wire Mesh at all junctions of concrete and masonry, corner beads, chamfered edges, rounding off corner, true line & level/plumb. All plaster properly cured etc. Complete in all respect as per drawings, specifications and to the entire satisfaction of the Engineer. (at any hight in any floor)	Sqm.	850			
7.2	Providing and applying 10 mm thick Tyrolean plaster over roug cast plaster consisting of 1:2 (one part of white cement cement and two mixed graded bajri 3/8" or 9.5 mm and down gauge) in plinth and ground floor including finishing etc. all plaster properly cured etc. Complete in all respect as per drawings, specifications and to the entire satisfaction of the Engineer. (at any hight in any floor)	Sqm.	850			
7.3	Providing and applying painting on all external surface with Burger, ICI & Nippon or equivalent weather shield of approved shade 3 coats over and including a coat of primer over plastered surface including preparation of surface, cleaning etc, complete in all respect as per specifications & relevant drawings and all works to be carried out the satisfaction of the Engineer. (at any height in any floor)	Sqm.	200			
	TOTAL CARRIED TO SUMMARY.					

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
	EXTERNAL FINISHES OTHER THAN BUILDING					
B	**BOUNDARY WALL**					
1	Providing and laying (50mm) thick DPC damp proof course with cement concrete 1:2:4 cast in situ including 2 coats of asphaltic mixture with leveling, curing, finishing, form work & its remover etc.,. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	Sqm.	100			
2	Providing and laying 1:3:6 cement concrete solid block (1000 psi) masonry wall using graded screened bajri 1/2 inch (13 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc, complete in all respects as per specifications and drawings and as directed by the Engineer.	Cum.	120			
3	Providing and laying 1:3:6 cement concrete pigmented hollow block masonry screen wall using graded screened bajri 1/2 inch (13 mm) and down gauge (Envecrete or approved equivalent) set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc., in boundary wall superstructure. Complete in all respect as per specifications and drawings and as directed by the Engineer.	Cum.	55			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
4	Providing and applying 10mm thick Rough cast Plaster of cement mortar 1:4 on external works including grooves, jambs, bends, corners, recessed, including hacking the concrete surfaces scaffolding and making the masonry joints and providing approved quality G.I. Wire Mesh at all junctions of concrete and masonry, corner beads, chamfered edges, rounding off corner, true line & level/plumb. All plaster properly cured etc. Complete in all respect as per drawings, specifications and to the entire satisfaction of the Engineer. (at any hight in any floor)	Sqm.	2500			
5	Providing and applying 10mm thick Tyrolean plaster over roug cast plaster consisting of 1:2 (one part of white cement cement and two mixed graded bajri 3/8" or 9.5mm and down gauge) in plinth and ground floor including finishing etc. all plaster properly cured etc. Complete in all respect as per drawings, specifications and to the entire satisfaction of the Engineer.	Sqm.	2500			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
6	Providing, fabricating, welding & fixing in position MS tube gate comprising of 50mm x 50mm x 2.7mm thick tube outer frame, 38mm x 38mm x 2mm thick vertical member, 18mm dia solid bar top & bottom (2+2) including solid bar, L-drop, heavey duty wheel with track and 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.	Sqm.	42			
7	Providing & fixing four rows barbed wire including M.S angle, comprising of G.I coated double twist (2ply) barbed wire with four points (Bards).12 Swg line wire and 14 Swg bards with four points @ 4" Apart, 50mm x 50mm x 12 swg thick, 1.5m high MS equal angle with four points required size of cut/hole, 150mm x 150mm x 5mm thick M.S plate at the base with four holes for fixing it on 150 x 150 x 200mm deep 1:2:4 concrete pad by anchor bolts at the distance of 3m. C/C and other required activities, including 2 coats of enamel painting over a coat of red oxide etc., making good with required materials, complete in all respects as per specification & relevant approved drawing and direction of the Engineer.	Rm	515			
	TOTAL CARRIED TO SUMMARY.					

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
C	**FOOTBALL GROUND**					
	Ball Stop Net and Surround Netting					
1	Providing & fixing Football stop net consisting of MS structural steel frame & nylon netting comprising of G.I hollow pipe 75mm dia up 3m high from top of boundary wall @ 1.5m C/C horizontal & vertical, square profile nylon fence 80 x 80 mm x 3 mm thick including all required hardwares and fixing arrangement etc., complete in all respects as per specifications and drawings and as directed by the Engineer.	Sqm.				
2	Providing & laying football ground comprising of the following activities.					
	i] Site clearance including Levelling & dressing existing ground level by Cutting & filling (Zero code level) and compaction of standard required level.	Sqm.	17500			
	ii) Brown red or approved colour Murum on foot ball ground & jogging area.	Cum.	375			
	Goal Posts					
3	Providing, fabricating & fixing complete G.I Goal posts of approved dia & thickness with holdfast, 2 coat of enamel paint, naloon net, all required accessories, and making concrete foundation as shown in drawing etc., complete in all respects as per specifications and drawings and as directed by the Engineer.	Nos	2			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
	Pavers					
4	Providing & fixing 60mm thick Pre-cast concrete pavers strength not less than 7000 psi M/s ENVICRETE or equivalent approved quality pattern, size. design and colors in internal/ external floor including 50mm thick sand bed, levelling & grading earth work etc., compacted with plate compactor. pointing with sand etc., complete in all respect as per drawings and as directed by the Engineer.	Sq.m	7700			
5	Providing and laying following kerb stone strength not less than 5000 psi M/s ENVICRETE or equivalent, laid in cement mortar 1:4, ruled pointing in cement mortar 1:3 including cost of excavation and back filling of excavated stuff and its disposal within one chain lead as desired etc., complete in all respect as per drawings and as directed by the Engineer.					
	i) 300mm x 300mm x 150mm	R.m	2000			
	TOTAL CARRIED TO SUMMARY.					

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
D	**HOTICULTURE**					
	Providing, fixing and maintain at place following plants, shrubs bed, including excavation upto required depth & backfill as per drawing including prepration of soil, upto 450mm amended soil, tree root ball crown, corded rubber tyre for tie up, stake tree to prevailing wind, wooden stake 50mm dia 2m long and infiltration basin etc, complete to make it proper and as per drawing, standared and instruction of the Engineer.Detail of plants are as under.					
	i) ZIZYPHUS JUJUBA - Common name BER	Each	8			
	ii) NEEM TREE	Each	16			
	iii) GROUNDCOVER LIRIOPE	Each	12			
	iv) ORNAMENTAL RIBBON GRASS.	Each	12			
	v) ORNAMENTAL FESCUE GRASS.	Each	12			
	Providing & Spreading approved garden soil (sweet earth) in uniform thickness (not less than 300mm thick) including levelling & dressing existing ground level by Cutting & filling and breaking clods and dressing for grassing including disposal of rubbish etc complete in all respect as per drawings and as directed by the Engineer.	Cum.	1200			

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BILL OF QUANTITIES

BILL NO. 2 (ARCHITUCTURE WORKS)

S.NO	DESCRIPTION	UNIT	QUANTITY	RATE	RATE IN WORDS	AMOUNT
	All items under this head (Architectural) 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.					
	Providing & Spreading cowdung manure and mixing the same upto a depth of 100mm in the prepared bed including breaking clods, dressing for grassing complete in all respect as per drawings and as directed by the Engineer.	Sq.m	4000			
	Providng and fixing of Grassing by dibbing live Dhakka grass roots 75 mm apart including watering, weeding till such time the grass is set and becomes green and is fit for mowing complete in all respect as per drawings and as directed by the Engineer.	Sq.m	4000			
	TOTAL CARRIED TO SUMMARY.					

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES
ELECTRICAL WORKS

IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

SUMMARY

BILL NO	DESCRIPTION	AMOUNT	AMOUNT IN WORDS
3	**BILL NO. 03: ELECTRICAL WORKS**		
1	STADIUM LIGHTING & GUARD ROOMS ELECTRIFICATION		
	GRAND TOTAL		

SEAL OF THE COMPANY

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BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	**All Items are Including all Lead & Lift Complete in all Respect**					
	BILL NO. 03: ELECTRICAL WORKS (STADIUM LIGHTING & GUARD ROOMS ELECTRIFICATION)					
A	**STADIUM LIGHTING**					
1	Supply, installation, testing and commissioning of following Octagonal Street lighting pole, hot dipped galvanized (Zinc coating not less then 100 micron) from inside and outside with 4mm wall thickness including base plate anchor bolt, nuts and washer, self inspection door with special keys, cable connection box, all required materials and accessories etc., (detail shown on the drawings). Complete in all respects as per specification and drawings.					
a)	12 Meter High Octagonal Pole	No.	4			
2	Construction and installation of Pole foundation in concrete class "A", reinforcement as per AASHTO M31, lean concrete etc. Excavation and backfilling for the Pole foundation shall be included in this job. Foundation constructed above the drain or any location in project. Complete in all respects as per specifications and drawings.	Job	4			
3	Supply, installation, testing and commissioning of 6x150W LED Flood light fixture, including frame, Slot 25mm x 18mm with Grommet for Cable acess etc. (light to be installed on already installed Lighting Poles), min. Luminous Flux / watt 150, Color temperature shall be 6000K, Surge Protection with module min. 15kV, IP-66 Rated, Power factor 0.9, must be Painted Almunium Injection housing material, complete in all respects, as per specification and drawing. Lighting fixture samples must be submitted to Consultant for approval.	No.	4			
4	Supply, laying, termination, tagging, testing and commissioning of 4 Core 4 Sq.mm Cu.PVC/PVC + 1 Core 4 Sq.mm Cu.PVC as ECC, 300/500 volts grade cable in hollow poles from TP Box to flood light, complete in all respect.	Rm.	65			
5	Supply, installation, testing and commissioning of following Pole mounted outdoor type, Weatherproof IP65 rated, TP Breaker Box, made with 14/16 SWG sheet metal, dust protected, vermin proof housing, confirming to protection class (IP-65), epoxy powder coated paint with approved color, having all the required installation materials, mounting accessories and protections etc. as per specifications and drawings, complete in all respect with providing shop drawings, manual and warranty documents to owners representative / Consultant.					
a)	TP BOX (with 20A TP MCB)	No.	4			

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BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	**All Items are Including all Lead & Lift Complete in all Respect**					
	BILL NO. 03: ELECTRICAL WORKS (STADIUM LIGHTING & GUARD ROOMS ELECTRIFICATION)					
6	Supply, installation, testing and commissioning of following Pad mounted, outdoor type, Weatherproof IP65 rated, Feeder Pillar made with 14 SWG sheet metal, dust protected, vermin proof housing, confirming to protection class (IP-65), epoxy powder coated paint with approved color, having all the required installation materials, mounting accessories and protections etc. as per specifications and drawings, complete in all respect with providing shop drawings, manual and warranty documents to owners representative / Consultant.					
a]	FP-01	No.	1			
b]	FP-02	No.	1			
7	Supply and Construction of RCC foundation (PAD), including excavation and backfilling for Feeder Pillar. Construction with class "C" concrete used water resistance chemical, water proofing material applied on structure surfaces are concealed below FGL / FFL, Pad size as per Panel base, drawings, Specification and as directed by the consultant, complete in all respect.	Job	2			
8	Supply, laying, termination, tagging, testing and commissioning of following size of 600/1000 volts grade Copper conductor cables as incoming supply from nearest existing PMTs to Feeder Pillar in already installed uPVC burried conduit, including cable glands, cable ID marker etc. Complete in all respects, as per drawing and specification and the entire satisfaction of the engineer and employer. Contractor is advised to confirm the cable running lengths and termination as per site conditions before commencement of work. Note: Contractor is advised to confirm the cable running lengths & termination as per site conditions before commencement of work.					
a]	4C, 35 Sq.mm Cu/PVC/PVC Cable	Rm.	50			

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S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	**All Items are Including all Lead & Lift Complete in all Respect**					
	BILL NO. 03: ELECTRICAL WORKS (STADIUM LIGHTING & GUARD ROOMS ELECTRIFICATION)					
9	Supply, laying, termination, tagging, testing and commissioning of following sizes of 600/1000 volts grade Copper conductor cables from Feeder Pillar to Feeder Pillar and Feeder Pillar to Lighting Pole, in already installed uPVC burried pipe including cable glands, cable ID marker etc. Complete in all respects, as per drawing and specification and the entire satisfaction of the engineer and employer. Note: Contractor is advised to confirm the cable running lengths & termination as per site conditions before commencement of work.					
a]	4C, 25 Sq.mm Cu.PVC/PVC + 1C, 16 Sq.mm Cu.PVC as ECC	Rm.	180			
b]	4C, 10 Sq.mm Cu.PVC/PVC + 1C, 6 Sq.mm Cu.PVC as ECC	Rm.	350			
10	Supply and laying of following sizes of uPVC Class-D/E Pipes / uPVC Class--D Road Crossing Sleeves for LV Cables, burried in ground including excavation of trenches in hard / soft soil for laying of pipe, cost including providing fresh sand (6" under and 6" above pipe), laying protection A class bricks on sand, warning tape and backfilling with new and fresh sand, compaction, plugging of conduits ends etc., as per detail shown on the drawings and specifications, complete in all respect and the entire satisfaction of the engineer and employer.					
a]	2 x 50mm dia uPVC Pipe (Class-D)	Rm.	570			
b]	50mm dia uPVC Pipe (Class-D]	Rm.	30			
c]	38mm dia uPVC Pipe (Class-D]	Rm.	10			
d]	25mm dia uPVC Pipe (Class-E]	Rm.	35			

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S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	**All Items are Including all Lead & Lift Complete in all Respect**					
	BILL NO. 03: ELECTRICAL WORKS (STADIUM LIGHTING & GUARD ROOMS ELECTRIFICATION)					
11	Supply, installation, testing and commissioning of Earth pit for Feeder Pillars with Rod type earth electrode, 3/4" dia and 9 Ft. long copper Clad rod for earthing system, including cost 4" dia boring up to water level or as directed by the engineer in charge, with Bentonite chemical, filling mixture material etc. as per specification to achieve earthing resistance not more than 1 ohm, connection with earth leads of 2x35 sq.mm up to earth testing point, Inspection pit 15" x 15" x 18" deep (min) with heavy duty C.I cover, appropriate size of uPVC pipe for leads, complete as per detail drawing and instruction of consultant, providing as built drawings, test reports documents to Employer / Consultant representative. Complete in all respect.	No.	2			
12	Supply, laying, termination, tagging, testing and commissioning of following size PVC insulated (yellow/green) earth continuity copper conductor (ECC) from earth pit to Feeder Pillar, in already installed conduit / directly burried, including all accessories lugs, cable gland etc. as per drawings and specification, complete in all respect. Contractor is advised to confirm the cable running lengths and termination as per site conditions before commencement of work.					
a)	1C, 16 Sq.mm Cu.PVC as ECC	Rm.	25			
B	**STADIUM & GUARD ROOMS ELECTRIFICATION**					
	CONDUITS & PIPES					
1	Supply and installation of following size internal diameter PVC / uPVC Class-D pipe / Flexible PVC Conduit as race ways with all accessories, recessed / surface on wall / column / under floor, as per drawings and specifications, complete in all respect.					
a)	25 mm dia PVC Conduit	Rm.	5			
b)	38 mm dia PVC Conduit	Rm.	5			

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S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	**All Items are Including all Lead & Lift Complete in all Respect**					
	BILL NO. 03: ELECTRICAL WORKS (STADIUM LIGHTING & GUARD ROOMS ELECTRIFICATION)					
	DISTRIBUTION BOARDS					
2	Supply, installation, testing and commissioning of following wall mounting / floor standing surface type Distribution Boards (DB's) made with 16 SWG sheet metal, dust protected, vermin proof housing coated with approved color having all the necessary switching, energy analyzer etc., protections, as per drawing and specification, complete in all respect.					
a]	DB-GF	No.	1			
	LOW VOLTAGE CABLES AND WIRES					
3	Supply, laying, termination, tagging, testing and commissioning of following sizes of 600/1000 volts grade Copper conductor multi core / single core, Cu/PVC, Cu/PVC/PVC, unarmoured, 0.6 kV/1 kV, 450/750V or 300/500V voltage grade copper cable from Feeder Pillar to DB and Feeder Pillar to Guard rooms, in already laid uPVC burried pipe including cable glands, cable ID marker etc. Complete in all respects, as per drawing and specification and the entire satisfaction of the engineer and employer.					
a]	4C, 10 Sq.mm Cu.PVC/PVC + 1C, 10 Sq.mm Cu.PVC as ECC	Rm.	85			
b]	2C, 4 Sq.mm Cu.PVC/PVC + 1C, 4 Sq.mm Cu.PVC as ECC	Rm.	350			
	WIRING ACCESSORIES					
4	Supply, installation, testing and commissioning of following 10/13/15/20A, gang type switches, Dimmer Switches, Sockets including 16 SWG Sheet Steel powder coated back boxes with earth terminal, recessed in wall / column, with all accessories as per specification, complete in all respects.					
a]	One Gang Switch 10A	No.	7			
b]	Two Gang Switch 10A	No.	2			

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SIGNATURE

BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	**All Items are Including all Lead & Lift Complete in all Respect**					
	BILL NO. 03: ELECTRICAL WORKS (STADIUM LIGHTING & GUARD ROOMS ELECTRIFICATION)					
c)	Three Gang Switch 10A	No.	10			
d)	Four Gang Switch 10A	No.	4			
e)	One Gang Fan Dimmer Switch 10A	No.	4			
f)	Two Gang Fan Dimmer Switch 10A	No.	6			
g)	13A, International Switch Socket Outlet	No.	24			
h)	Hand Dryer Outlet	No.	5			
j)	32A, SPN Weatherproof type Isolator	No.	1			
	LIGHT FIXTURES & FANS					
5	Supply, installation, testing and commissioning of following Light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per drawings and specifications, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.					
a)	Surface mounted LED Downlight Fixture (IP-20) with Aluminum Profile housing and 1x20W LED lamp	No.	76			
b)	Surface mounted LED Downlight Fixture (IP-44) with Aluminum Profile housing and 1x12W LED lamp	No.	41			
c)	Surface mounted LED Batten Light Fixture (IP-20) with Polycarbonate Painted Steel housing and 1x40W LED lamp	No.	6			
d)	Wall / Surface mounted LED Wall Light Fixture (IP-54) with Polycarbonate housing and 1x10W LED lamp	No.	4			

Continue

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BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	**All Items are Including all Lead & Lift Complete in all Respect**					
	BILL NO. 03: ELECTRICAL WORKS (STADIUM LIGHTING & GUARD ROOMS ELECTRIFICATION)					
6	Supply, installation, testing and commissioning of following types of fan, including all connecting accessories, flexible wire etc. as per drawings and specifications, complete in all respects.					
a]	56" dia Sweep Ceiling Fan complete with hook	No.	16			
b]	8" dia Exhaust Fan	No.	6			
7	WIRING FOR LIGHTS, FANS & SOCKETS					
a]	Supply, laying, tagging, testing and commissioning of Circuit wiring from DB to Switchboard including wiring between switch on the same circuit with 2x2.5 sq.mm + 1x2.5 sq.mm as ECC single core copper conductor PVC insulated wires in 3/4" dia PVC conduit, surface / recessed in wall, column, ceiling etc., including with all conduit accessories, as per drawing and specification, complete in all respect.	No.	6			
b]	Supply, laying, tagging, testing and commissioning of Point wiring from Switch Board to Light/fan Point with 3x1.5 sq.mm. single core copper conductor PVC insulated wires in 3/4" dia PVC conduit, surface / recessed in wall, column, ceiling etc., including with all conduit accessories, as per drawing and specification, complete in all respect.	No.	73			
c]	Supply, laying, tagging, testing and commissioning of Point wiring from Light point to Light point with 3x1.5 sq.mm. single core copper conductor PVC insulated wires in 3/4" dia PVC conduit, surface / recessed in wall, column, ceiling etc., including with all conduit accessories, as per drawing and specification, complete in all respect.	No.	76			
d]	Supply, laying, tagging, testing and commissioning of wiring for 13A Switch Socket outlet with 2x2.5 sq.mm + 1x2.5 sq.mm as ECC single core copper conductor PVC insulated wires in 25mm dia PVC conduit, surface / recessed in wall, column, ceiling, under floor etc., including with all conduit accessories, as per drawing and specification, complete in all respect.					
i	DB to Socket outlet	No.	4			
ii	Socket outlet to Socket outlet	No.	20			

Continue

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BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	**All Items are Including all Lead & Lift Complete in all Respect**					
	BILL NO. 03: ELECTRICAL WORKS (STADIUM LIGHTING & GUARD ROOMS ELECTRIFICATION)					
e)	Supply, laying, tagging, testing and commissioning of wiring for Hand Dryer outlet with 2x4 sq.mm + 1x4 sq.mm as ECC single core copper conductor PVC insulated wires in 25mm dia PVC conduit, surface / recessed in wall, column, ceiling, under floor etc., including with all conduit accessories, as per drawing and specification, complete in all respect.					
i	DB to Hand Dryer outlet	No.	5			
f)	Supply, laying, tagging, testing and commissioning of wiring for 32A SFN Isolator (for Pump) with 2x6 sq.mm + 1x6 sq.mm as ECC single core copper conductor PVC insulated wires in 25mm dia PVC conduit, surface / recessed in wall, column, ceiling, under floor etc., including with all conduit accessories, as per drawing and specification, complete in all respect.					
i	DB to 32A SFN Isolator	No.	1			
C)	**SHOP DRAWINGS**					
13	Preparation of scaled Shop drawings of complete works after approval from the consultant/client. Job also includes any relocation works. Preparation of shop drawings is compulsory before execution of work as per requirement of consultant's design and site during project execution with coordination of all other services.	Job	1			
	TOTAL AMOUNT					

SEAL OF THE COMPANY

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES
PLUMBING WORKS

BILL OF QUANTITIES

SUMMARY

BILL NO	DESCRIPTION	AMOUNT	AMOUNT IN WORDS
4	**BILL NO. 04: PLUMBING WORKS**		
1	PLUMBING WORKS		
	GRAND TOTAL		

SEAL OF THE COMPANY

INITIAL

SIGNATURE

BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	All Items are Including all Lead & Lift Complete in all Respect					
	BILL NO. 04: PLUMBING WORKS					
1	Cold and Hot Water Supply Piping					
	Supply, installation, testing and Commissioning 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, cutting, filling, testing/commissioning and all accessories as indicated on the drawing, as per specifications and Engineers approval.					
i	20mm dia	RM	130			
ii	25mm dia	RM	55			
iii	32mm dia	RM	40			
iv	40mm dia	RM	52			
v	50mm dia	RM	170			
vi	65mm dia	RM	26			
vii	75mm dia	RM	-			
2	Isolation Valves					
	Providing and fixing of PPR Coated PN-20 Gate valves of bronze material for diameter 2" and smaller and Cast Iron material for Diameter greater than 2" as per specifications and Engineers approval.					
i	20mm dia	Nos.	4			
ii	25mm dia	Nos.	3			
iii	32mm dia	Nos.	2			
iv	40mm dia	Nos.	4			
v	50mm dia	Nos.	4			

Continue

SEAL OF THE COMPANY

INITIAL

SIGNATURE

BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	All Items are Including all Lead & Lift Complete in all Respect					
	BILL NO. 04: PLUMBING WORKS					
3	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	1/2" dia. Bib Tap	Nos.	4			
ii	1" Air Relief Valve	Nos.	6			
	Connection to water tank including with valves, supports, excavation and Backfill, complete all in accordance with the drawing and specifications.					
i	50 mm dia Connection to UG water tanks	Nos.	1			
ii	Connection to overhead water tanks	Nos.	2			
5	GRP Tank					
	Supply, installation and Insulation of GRP Water tanks of below mentioned capacities including Drain valve, Air Relief Valve, vent pipes, Access/Manhole Covers, accessories, valves, supports, ladders, low and high level float switches, etc., complete all in accordance with the drawing and specifications.					
i	1500 Gallons GRP overhead water tank	Nos.	2			
ii	200 Gallons GRP overhead water tank	Nos.	0			
6	Electric Water Heaters					
	Supply and installation of Electric water geyser / Heater of below mentioned capcity including all accessories like Valves, Relief Valves, interconnecting piping, Gas connection, Drain tray and drain connections as indicated in the drawings, as per specifications and engineers approval.					
i	EWH -(Capacity 50 Litres)	Nos.	0			
ii	EWH -(Capacity 80 Litres)	Nos.	1			
iii	EWH -(Capacity 100 Litres)	Nos.	1			
iv	EWH -(Capacity 150 Litres)	Nos.	1			

Continue

SEAL OF THE COMPANY

INITIAL

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BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	All Items are Including all Lead & Lift Complete in all Respect					
	BILL NO. 04: PLUMBING WORKS					
7	Soil, Waste and Vent Pipes					
a	Providing and fixing, uPVC pipes and fittings as per BS EN 1329 for above ground installations for Soil, Waste, Vent & Rw 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	50mm dia	RM	58			
ii	75mm dia	RM	160			
iii	100mm dia	RM	51			
b	Providing and fixing, uPVC pipes and fittings as per BS EN 1401 for below ground installations for Soil pipes including excavation, backfill, fittings (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.					
i	150mm dia	RM	120			
8	Drainage Specialties					
a	Providing and fixing of Multi floor trap with multiple dia inlet and Single outlet and cleanout plug of the approved self cleaning design with S.Steel grating as specified by the architect, as indicated on the drawing, as per specifications, architectural finishing schedule and Engineers approval.	Nos.	25			
b	Providing and fixing UPVC cowl for vent pipe of the following dia including all accessories complete in all respects.					
i	3" dia	Nos.	3			
ii	4" dia	Nos.	3			
9	Manholes and Gully traps					
a	Construction of 600 x 600mm Sanitary sewage manhole with 600 x 600mm Medium duty Cover (Min Weight = 90 kg) cover as specified and shown on the drawing, as per specifications and Engineers approval.	Nos.	8			
b	Construction of 300 x 300mm gully trap with 250mm P- trap and 300 x 300mm cover (min Weight = 65 kg) as specified and shown on the drawing, as per specifications and Engineers approval.	Nos.	4			

Continue

SEAL OF THE COMPANY

INITIAL

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BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	All Items are Including all Lead & Lift Complete in all Respect					
	BILL NO. 04: PLUMBING WORKS					
10	External Network 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.	Nos.	1			
11	PLUMBING FIXTURES:					
a	Providing and fixing European type water closet with (one piece) dual flush Tank with 6.0 liters main flush tank and 3 liters secondary flush tank, build in S/P-Trap , Stop cock with flexible pipe as specified by architect in Fixture schedule, per drawings, specifications and Engineers Approval.	Nos.	8			
b	Providing and fixing Eastern water closet with 6 liters main flush tank, build in S-Trap, Stop cock with Drain pipe till flush tank as per drawings, specifications and Engineers Approval.	Nos.	6			
c	Providing and fixing wash basin with mixer having flow of 6.0 lpm or less with two (2) nos. Stop cocks, Flexible Connection , flexible drain pipe to floor drain as specified by architect in Fixture schedule, per drawings, specifications and Engineers Approval.	Nos.	19			
d	Providing and fixing of kitchen/Pantry Sink with mixer, waste trap, Stop cocks with flexible pipes, Flexible drain pipe as per drawings , specifications and engineers approval.	Nos.	1			
e	Providing and fixing of Shower head with shower mixer having maximum flow of 9.5 lpm, as specified by architect in Fixture schedule, per drawings, specifications and Engineers Approval.	Nos.	3			
f	Providing and fixing bath toilet accessories:					
i	Toilet Paper Holder	Nos.	14			
ii	Double Bib tap with Muslim shower	Nos.	14			
iii	Liquid Soap Dispenser/ Soap dish	Nos.	11			
iv	WC Cleaning Brush	Nos.	14			
v	Robe Hooks	Nos.	28			
vi	Towel Railing	Nos.	8			
vii	Bathroom Mirror	Nos.	8			

Continue

SEAL OF THE COMPANY

INITIAL

SIGNATURE

BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	All Items are Including all Lead & Lift Complete in all Respect					
	BILL NO. 04: PLUMBING WORKS					
12	PVC PIPING:					
	Supply and Installation of PVC Class D pipe as per BS 4660, or Conforming to ASTM D2241 with Solvent Joints including the cost of excavation, backfill and other fittings, All connections to be sealed properly with water proof material. Warning tape to be laid over the buried pipes, as per drawings , specifications and engineers approval					
i	20mm dia	RM	110			
ii	25mm dia	RM	100			
iii	32mm dia	RM	120			
iv	40mm dia	RM	180			
v	50mm dia	RM	155			
vi	65mm dia	RM	5			
13	PVC Ball Valve					
i	20mm dia	Nos	15			
ii	25mm dia	Nos	4			
14	Specialties					
i	65mm dia strainer	Nos	4			
i	65mm dia Non Return Valve	Nos	4			
15	PE Valve Boxes					
	Supply and Installation of 12"x12"x12" Polyethylene Standard Valve Box with cover by Hunter or Rainbird for 25mm gate Valves, including the cost of Excavation and Backfill as indicated on the drawing, as per specifications and engineers approval.	No.	15			

Continue

SEAL OF THE COMPANY

INITIAL

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BILL OF QUANTITIES

S.NO.	DESCRIPTION OF WORKS	UNIT	QTY.	RATE (Rs.)	RATES IN WORDS	AMOUNT (Rs.)
Note:	All Items are Including all Lead & Lift Complete in all Respect					
	BILL NO. 04: PLUMBING WORKS					
16	TRANSFER PUMPS					
	Supply and installation of below mentioned pumps including pump foundation, control panel, wiring from panel to pumps, valves, piping, accessories, etc. and pressure switch as indicated on the drawing, as per specifications and Engineers approval.					
	Transfer Pump (1 Duty +1 standy),					
	Flow = 100 GPM @ 25m head	Set.	1			
17	Booster Pump					
	Supply and installation of below mentioned Packaged VFD Driven pump sets including pump foundation, control panel, Pressure Tank, wiring from panel to pumps, valves, piping, accessories, etc. from Suction header to Discharge header, as indicated on the drawing, as per specifications and Engineers approval.					
	Booster Water Pump set (2 Duty), Flow = 150 GPM @ 32m head (75gpm each)	Set.	1			
	TOTAL AMOUNT					

SEAL OF THE COMPANY

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IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES
EMPLOYER'S/ENGINEER'S FACILITIES

IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03, DMC KORANGI

BILL OF QUANTITIES

SUMMARY

Bill No	DESCRIPTION	AMOUNT	AMOUNT IN WORDS
5	**BILL NO. 05: EMPLOYER'S/ENGINEER'S FACILITIES**		
1	EMPLOYER'S/ENGINEER'S FACILITIES		
	TOTAL AMOUNT EMPLOYER'S/ENGINEER'S FACILITIES		

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BILL OF QUANTITIES

BILL NO. 05: EMPLOYER'S/ENGINEER'S FACILITIES

Pay Item No.	Item Description	Unit	Qty	Rate (Rs.)	Rates in Words	Amount (Rs.)
SP-3	**Provide Engineer'sOffice**					
(a)	Provide Engineer's Office, (8'x20' Porta Cabin or Rental, 1 no)	LS	LS			
(b)	Equip and Furnish Enginner's Cenral Office	LS	LS			
SP-4	**Testing of Material through private laboratory**	NOT PAYABLE				
SP-5	**Maintain Engineer's Office**	Per Month	3			
SP-6						
(a)	Provide New Survey Equipment	LS	LS			
(b)	Maintain Survey Equipment	Per Month	3			
SP-7						
(a)	Providing Engineer's Vehicles (Rental) including maintenance					
	i) Suzuki Bolan (1No.)	Per Month	3			
	ii) Honda CD-70 Motorcycle (2No.)	Per Month	3			
	Implemention of ESR	LS	LS			
	TOTAL AMOUNT EMPLOYER'S/ENGINEER'S FACILITIES					

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(SUMMARYOF BILL OF QUANTITIES)

I/We hereby quoted as follows:		***In Figure***	***In Words***
1	Bill No. 1 to 5 Total	Rs.	
	Total	Rs.	

The Total amount is Rs._____ In Words_____

_____ for

the complete job for all schedule of rate & offer rates(whichever is included in the BOQ).

I/We have attached a Bid Security amounting to Rs._____/- as per NIT is shape of pay order bearing No._____ dated _____ issued from _____.
(Bank)

Time Limit : 90 Calendar Days

NOTE:

- Tender must be quoted in figure & in words both otherwise liable to be cancelled.
- All over writing & correction if any must be initialed & stamped by the bidder.
- We/I read the standard bidding Documents and available DMC Korangi and agreed to abide all of them and also provide all these documents with our signatures as & when directed.

For Office Use of DMC Korangi

Verified BOQ by:

S.E Korangi
Signature with Stamp

Signature of the contractor with stamp

Address: _____

_____

Appendix-E to Bid

PROPOSED CONSTRUCTION SCHEDULE

Pursuant to Sub-Clause 8.2 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 may meet procuring agency'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):

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 at site, 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.

Safety Plan

The Bidder is required to submit an outline Construction Safety and Health Plan for this particular Project. The outline Safety and Health Plan shall be in accordance with the requirements of relevant decrees and/or bye laws governing Occupational Safety and Health Programme in the construction industry being implemented in the Islamic Republic of Pakistan including Sindh Occupational Safety and Health Act, 2017 and shall cover the following topics:

1. Organizational structure for handling all Safety and Health Matters
2. Composition of the Contractor's Construction Safety and Health Committee
3. Specific Safety Policies which the Contractor will undertake to observe and maintain
4. Provision of Protective Equipment
5. Safety Personnel
6. Emergency Occupational Health Personnel and Facilities
7. Worker's Welfare Facilities
8. Emergency Procedures
9. Accident Prevention and Reporting Procedures

(For further details and requirements, refer to Clause 4.8 of the Conditions of Contract, SP-11 and ESRs)

Award of the Contract to the Bidder shall not be deemed to mean that the outline Construction Safety and Health Plan is considered acceptable, and the Engineer shall be at liberty to instruct the Contractor to implement such safety and health procedures as he may deem necessary. Sindh Occupational Safety and Health Act, 2017 will be the main benchmark and overreaching document guiding/setting the OHS regime.

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 mobilize at site 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.]

Sr. No.	Description of Equipment	Capacity & Horsepower	Minimum Number Required
1	Concrete Batching Plant	30 Cum	1
2	Concrete Transit Mixer	6 Cum	4
3	Concrete Pump		2
4	Crane	25 Ton	2
6	Excavator	105 HP	4
7	Welding Plant		
8	Generator	5KVa	2
9	Cable Pulling/Laying Winch		4
10	Lineman Bucket Truck		2

Appendix-G to Bid

LIST OF MAJOR EQUIPMENT (SAMPLE)

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						

CONSTRUCTION CAMP AND HOUSING FACILITIES

The Contractor in accordance with Clause 6 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.).

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**

ESTIMATED PROGRESS PAYMENTS (SAMPLE)

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 Pakistani Rupees:

Quarter/ Year/ Period	**Amounts (in million)**
1	**2**
Ist Quarter	
2nd Quarter	
3rd Quarter	
Bid Price	

Appendix-K to Bid

ORGANIZATION CHART
FOR THE
SUPERVISORY STAFF AND LABOUR

(To be filled in by the bidder)

PROPOSED STAFF

(Detailed CVs of following Key staff shall be provided, it is mandatory. PEC registration Certificate and qualification certificates/degrees etc. shall also be provided. It will be mandatory for successful bidder to mobilize same staff as proposed below after the approval of the Engineer. The proposed staff must be employee of the bidder)

Position	Qualification & Experience
Project Manager	BE (Civil) with 20 years' experience (10 years relevant experience)
Planning Engineer	BE (Civil) with 10 years' experience
Contracts Engineer	BE (Civil) with 15 years' experience
Structures Engineer (Buildings)	BE (Civil) with 15 years' experience with 10 years relevant experience of buildings
Horticulture Expert	Msc in Botany or Agriculture with 10 or more years relevant experience
Material Engineer	Msc (Geology) with 15 years' experience
MEP Engineer	BE (Elec/Mech), with 10 years' experience
Environmental Expert	BE (Civil), with 10 years' experience
Social Development Specialist	Msc (Social Science) with 10 years' experience
Health & Safety Expert	Minimum Qualification as Bachelor's in Civil/Environmental Engineering or Environmental Sciences in addition, OHS personnel must be having qualification NEBOSH IGC and / or IOSH Certification, ISO 45001; Must be familiar with Tool Box Talk, Safety induction process, Accident's investigations and reporting; At least 5-7 years post qualification experience.

ES Management Strategies and Implementation Plans

(ES-MSIP)

The Bidder shall submit comprehensive and concise Environmental and Social Management Strategies and Implementation Plans (ES-MSIP) as required by ITB 11.1 (d) of the Bidding Data. These strategies and plans shall describe in detail the actions, materials, equipment, management processes etc. that will be implemented by the Contractor, and its subcontractors.

In developing these strategies and plans, the Bidder shall have regard to the ES provisions of the contract including the World Bank Environmental, Health, and Safety General Guidelines, ISO 45001 and those as may be more fully described here under:

Environmental, Social, Health and Safety Requirements

The Works' policy goal, as a minimum, should be stated to integrate environmental protection, occupational and community health and safety, gender, equality, child protection, vulnerable people (including those with disabilities), Sexual Exploitation and Abuse/ Sexual Harrasment (SEA/SH), HIV/AIDS/COVID-19 awareness and prevention and wide stakeholder engagement in the planning processes, programs, and activities of the parties involved in the execution of the Works. The Employer is advised to consult with the World Bank to agree the issues to be included which may also address: climate adaptation, land acquisition and resettlement, indigenous people, etc. The policy should set the frame for monitoring, continuously improving processes and activities and for reporting on the compliance with the policy.

The policy shall include a statement that, for the purpose of the policy and/or code of conduct, the term "child" / "children" means any person(s) under the age of 18 years.

The policy should, as far as possible, be brief but specific and explicit, and measurable, to enable reporting of compliance with the policy in accordance with the Conditions of Contract.

As a minimum, the policy is set out to the commitments to:

a) apply good international industry practice to protect and conserve the natural environment and to minimize unavoidable impacts;

b) provide and maintain a healthy and safe work environment and safe systems of work;

c) protect the health and safety of local communities and users, with particular concern for those who are disabled, elderly, or otherwise vulnerable;

d) be intolerant of, and enforce disciplinary measures for illegal activities. To be intolerant of, and enforce disciplinary measures for gender-based violence, inhumane treatment, sexual exploitation, rape, sexual abuse, sexual activity with children, and sexual harassment;

e) incorporate a gender perspective and provide an enabling environment where

women and men have equal opportunity to participate in, and benefit from, planning and development of the Works;

f) work co-operatively, including with end users of the Works, relevant authorities, contractors and local communities;

g) engage with and listen to affected persons and organizations and be responsive to their concerns, with special regard for vulnerable, disabled, and elderly people;

h) provide an environment that fosters the exchange of information, views, and ideas that is free of any fear of retaliation, and protects whistleblowers;

i) minimize the risk of communicable diseases and to mitigate the effects of communicable diseases associated with the execution of the Works;

The policy should be signed by the senior manager of the Employer. This is to signal the intent that it will be applied rigorously.

MINIMUM CONTENT OF ES REQUIREMENTS

In preparing detailed specifications for ES requirements, the specialists should refer to and consider:

- *project reports e.g. ESIA/ESMP/ESRs*
- *consent/permit conditions*
- *required standards including World Bank Group EHS Guidelines*
- *relevant international conventions or treaties etc., national legal and/or regulatory requirements and standards (where these represent higher standards than the WBG EHS Guidelines)*
- *relevant international standards e.g. WHO Guidelines for Safe Use of Pesticides*
- *relevant sector standards e.g. EU Council Directive 91/271/EEC Concerning Urban Waste Water Treatment*
- *grievance redress mechanism including types of grievances to be recorded and how to protect confidentiality e.g. of those reporting allegations of SEA.*
- *SEA prevention and management.*

The detail specification for ES should, to the extent possible, describe the intended outcome rather than the method of working.The ES requirements should be prepared in manner that does not conflict with the relevant General Conditions of Contract and Particular Conditions of Contract.

PAYMENT FOR ES REQUIREMENTS

The payment for the delivery of ES requirements shall be a subsidiary obligation of the Contractor covered under the prices quoted for other Bill of Quantity items or activities. For example, normally the cost of implementing work place safe systems of work, including the measures necessary for ensuring traffic safety, shall be covered by the Bidder's rates for the relevant works.

Environmental, Social, Health and Safety (ESHS) Metrics for Progress Reports

Metrics for regular reporting:

a. environmental incidents or non-compliances with contract requirements, including contamination, pollution or damage to ground or water supplies;

b. health and safety incidents, accidents, injuries that require treatment and all fatalities;

c. interactions with regulators: identify agency, dates, subjects, outcomes (report the negative if none);

d. status of all permits and agreements:

   i. work permits: number required, number received, actions taken for those not received;

   ii. status of permits and consents:

   - *list areas/facilities with permits required (quarries, asphalt & batch plants), dates of application, dates issued (actions to follow up if not issued), dates submitted to resident engineer (or equivalent), status of area (waiting for permits, working, abandoned without reclamation, decommissioning plan being implemented, etc.);*
   - *list areas with landowner agreements required (borrow and spoil areas, camp sites), dates of agreements, dates submitted to resident engineer (or equivalent);*
   - *identify major activities undertaken in each area in the reporting period and highlights of environmental and social protection (land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation);*
   - *for quarries: status of relocation and compensation (completed, or details of activities and current status in the reporting period).*

e. health and safety supervision:

safety officer: number days worked, number of full inspections & partial inspections, reports to construction/project management;

number of workers, work hours, metric of PPE use (percentage of workers with full personal protection equipment (PPE), partial, etc.), worker violations observed (by type of violation, PPE or otherwise), warnings given, repeat warnings given, follow-up actions taken (if any);

f. worker accommodations:

   i. number of expats housed in accommodations, number of locals;

   ii. date of last inspection, and highlights of inspection including status of accommodations' compliance with national and local law and good practice, including sanitation, space, etc.;

actions taken to recommend/require improved conditions, or to improve conditions.

g. Health services: provider of health services, information and/or training, location of clinic, number of non-safety disease or illness treatments and diagnoses (no names to be provided);

h. gender (for expats and locals separately): number of female workers, percentage of workforce, gender issues raised and dealt with (cross-reference grievances or other sections as needed);

i. training:

   i. number of new workers, number receiving induction training, dates of induction training;

   ii. number and dates of toolbox talks, number of workers receiving Occupational Health and Safety (OHS), environmental and social training;

   iii. number and dates of communicable diseases (including STDs) sensitization and/or training, no. workers receiving training (in the reporting period and in the past); same questions for gender sensitization, flag person training.

   iv. number and date of SEA and SH prevention sensitization and/or training events, including number of workers receiving training on Code of Conduct for Contractor's Personnel (in the reporting period and in the past), etc.

j. environmental and social supervision:

   i. environmentalist: days worked, areas inspected and numbers of inspections of each (road section, work camp, accommodations, quarries, borrow areas, spoil areas, swamps, forest crossings, etc.), highlights of activities/findings (including violations of environmental and/or social best practices, actions taken), reports to environmental and/or social specialist/construction/site management;

   ii. sociologist: days worked, number of partial and full site inspections (by area: road section, work camp, accommodations, quarries, borrow areas, spoil areas, clinic, HIV/AIDS center, community centers, etc.), highlights of activities (including violations of environmental and/or social requirements observed, actions taken), reports to environmental and/or social specialist/construction/site management; and

   iii. community liaison person(s): days worked (hours community center open), number of people met, highlights of activities (issues raised, etc.), reports to environmental and/or social specialist /construction/site management.

k. *Grievances:* list new grievances (e.g. number of allegations of SEA and SH) received in the reporting period and number of unresolved past grievances by date received, complainant's age and sex, how received, to whom referred to for action, resolution and date (if completed), data resolution reported to complainant, any required follow-up (Cross-reference other sections as needed.

   i. Worker grievances;

   ii. Community grievances

l. Traffic, road safety and vehicles/equipment:

   i. traffic and road safety incidents and accidents involving project vehicles & equipment: provide date, location, damage, cause, follow-up;

ii. traffic and road safety incidents and accidents involving non-project vehicles or property (also reported under immediate metrics): provide date, location, damage, cause, follow-up;

iii. overall condition of vehicles/equipment (subjective judgment by environmentalist); non-routine repairs and maintenance needed to improve safety and/or environmental performance (to control smoke, etc.).

m. Environmental mitigations and issues (what has been done):

i. dust: number of working bowsers, number of waterings/day, number of complaints, warnings given by environmentalist, actions taken to resolve; highlights of quarry dust control (covers, sprays, operational status); % of rock/spoil lorries with covers, actions taken for uncovered vehicles;

ii. erosion control: controls implemented by location, status of water crossings, environmentalist inspections and results, actions taken to resolve issues, emergency repairs needed to control erosion/sedimentation;

iii. quarries, borrow areas, spoil areas, asphalt plants, batch plants: identify major activities undertaken in the reporting period at each, and highlights of environmental and social protection: land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation;

iv. blasting: number of blasts (and locations), status of implementation of blasting plan (including notices, evacuations, etc.), incidents of off-site damage or complaints (cross-reference other sections as needed);

v. spill cleanups, if any: material spilled, location, amount, actions taken, material disposal (report all spills that result in water or soil contamination;

vi. waste management: types and quantities generated and managed, including amount taken offsite (and by whom) or reused/recycled/disposed on-site;

vii. details of tree plantings and other mitigations required undertaken in the reporting period;

viii. details of water and swamp protection mitigations required undertaken in the reporting period.

n. compliance:

i. compliance status for conditions of all relevant consents/permits, for the Work, including quarries, etc.): statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance;

ii. compliance status of C-ESMP/ESIP requirements: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance

iii. compliance status of SEA and SH prevention and response action plan: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance

iv. compliance status of Health and Safety Management Plan re: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance

other unresolved issues from previous reporting periods related to environmental and social: continued violations, continued failure of equipment, continued lack of vehicle covers, spills not dealt with, continued compensation or blasting issues, etc. Cross-reference other sections as needed.

Code of Conduct for Contractor's Personnel (ES) Form

Note to the Bidder:

The minimum content of the Code of Conduct form as set out by the Employer shall not be substantially modified. However, the Bidder may add requirements as appropriate, including to take into account Contract-specific issues/risks.

The Bidder shall initial and submit the Code of Conduct form as part of its bid.

CODE OF CONDUCT FOR CONTRACTOR'S PERSONNEL

We are the Contractor, [*enter name of Contractor*]. We have signed a contract with [*enter name of Employer*] for [*enter description of the Works*]. These Works will be carried out at [*enter the Site and other locations where the Works will be carried out*]. Our contract requires us to implement measures to address environmental and social risks related to the Works, including the risks of sexual exploitation, sexual abuse and sexual harassment.

This Code of Conduct is part of our measures to deal with environmental and social risks related to the Works. It applies to all our staff, laborers and other employees at the Works Site or other places where the Works are being carried out. It also applies to the personnel of each subcontractor and any other personnel assisting us in the execution of the Works. All such persons are referred to as "**Contractor's Personnel"** and are subject to this Code of Conduct.

This Code of Conduct identifies the behavior that we require from all Contractor's Personnel.

Our workplace is an environment where unsafe, offensive, abusive or violent behavior will not be tolerated and where all persons should feel comfortable raising issues or concerns without fear of retaliation.

REQUIRED CONDUCT

Contractor's Personnel shall:

1. carry out his/her duties competently and diligently;
2. comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety and well-being of other Contractor's Personnel and any other person;
3. maintain a safe working environment including by:
   a. ensuring that workplaces, machinery, equipment and processes under each person's control are safe and without risk to health;
   b. wearing required personal protective equipment;
   c. using appropriate measures relating to chemical, physical and biological substances and agents; and

d. following applicable emergency operating procedures.

e. modifying work methodology to remove/mitigate work hazards.

4. report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and serious danger to his/her life or health;

5. treat other people with respect, and not discriminate against specific groups such as women, people with disabilities, migrant workers or children;

6. not engage in Sexual Harassment, which means unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;

7. not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another;

8. not engage in Sexual Abuse, which means the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;

9. not engage in any form of sexual activity with individuals under the age of 18, except in case of pre-existing marriage;

10. complete relevant training courses that will be provided related to the environmental and social aspects of the Contract, including on health and safety matters, and Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH);

11. report violations of this Code of Conduct; and

12. not retaliate against any person who reports violations of this Code of Conduct, whether to us or the Employer, or who makes use of the grievance mechanism for Contractor's Personnel or the project's Grievance Redress Mechanism.

RAISING CONCERNS

If any person observes behavior that he/she believes may represent a violation of this Code of Conduct, or that otherwise concerns him/her, he/she should raise the issue promptly. This can be done in either of the following ways:

1. Contact [*enter name of the Contractor's Social Expert with relevant experience in handling gender-based violence, or if such person is not required under the Contract, another individual designated by the Contractor to handle these matters*] in writing at this address [ ] or by telephone at [ ] or in person at [ ]; or

2. Call [ ] to reach the Contractor's hotline *(if any)* and leave a message.

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be submitted and will be given all due and appropriate consideration. We take seriously all reports of possible misconduct and will investigate and take appropriate action. We will provide warm referrals to service providers that may help support the person who experienced the alleged incident, as appropriate.

There will be no retaliation against any person who raises a concern in good faith about any behavior prohibited by this Code of Conduct. Such retaliation would be a violation of this Code of Conduct.

CONSEQUENCES OF VIOLATING THE CODE OF CONDUCT

Any violation of this Code of Conduct by Contractor's Personnel may result in serious consequences, up to and including termination and possible referral to legal authorities.

FOR CONTRACTOR'S PERSONNEL:

I have received a copy of this Code of Conduct written in a language that I comprehend. I understand that if I have any questions about this Code of Conduct, I can contact [*enter name of Contractor's contact person with relevant experience*] requesting an explanation.

Name of Contractor's Personnel: [insert name]

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Contractor:

Signature:_____

Date: (day month year): _____

ATTACHMENT 1: Behaviors constituting Sexual Exploitation and Abuse (SEA) and behaviors constituting Sexual Harassment (SH)

ATTACHMENT 1 TO THE CODE OF CONDUCT FORM

BEHAVIORS CONSTITUTING SEXUAL EXPLOITATION AND ABUSE (SEA) AND BEHAVIORS CONSTITUTING SEXUAL HARASSMENT (SH)

The following non-exhaustive list is intended to illustrate types of prohibited behaviors:

(1) **Examples of sexual exploitation and abuse** include, but are not limited to:

- A Contractor's Personnel tells a member of the community that he/she can get them jobs related to the work site (e.g. cooking and cleaning) in exchange for sex.
- A Contractor's Personnel that is connecting electricity input to households says that he can connect women headed households to the grid in exchange for sex.
- A Contractor's Personnel rapes, or otherwise sexually assaults a member of the community.
- A Contractor's Personnel denies a person access to the Site unless he/she performs a sexual favor.
- A Contractor's Personnel tells a person applying for employment under the Contract that he/she will only hire him/her if he/she has sex with him/her.

(2) Examples of sexual harassment in a work context

- Contractor's Personnel comment on the appearance of another Contractor's Personnel (either positive or negative) and sexual desirability.
- When a Contractor's Personnel complains about comments made by another Contractor's Personnel on his/her appearance, the other Contractor's Personnel comment that he/she is "asking for it" because of how he/she dresses.
- Unwelcome touching of a Contractor's or Employer's Personnel by another Contractor's Personnel.
- A Contractor's Personnel tells another Contractor's Personnel that he/she will get him/her a salary raise, or promotion if he/she sends him/her naked photographs of himself/herself.

Appendix-N to Bid

(INTEGRITY PACT)

DECLARATION OF FEES, COMMISSION AND BROKERAGE ETC; PAYABLE BY CONTRACTORS.

(FOR CONTRACTS WORTH RS. 10.00 MILLION OR MORE)

Contract No._____Dated_____
Contract Value: _____
Contract Title: _____

…… [name of Contractor] 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 Sindh (GoS) or any administrative subdivision or agency thereof or any other entity owned or controlled by it (GoS) through any corrupt business practice.

Without limiting the generality of the foregoing, [name of Contractor] 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, from Procuring Agency (PA) except that which has been expressly declared pursuant hereto.

[name of Contractor] accepts full responsibility and strict liability 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 PA and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.

[name of Contractor] 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 PA under any law, contract or other instrument, be voidable at the option of PA.

Notwithstanding any rights and remedies exercised by PA in this regard, [name of Supplier/Contractor/Consultant] agrees to indemnify PA for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to PA in an amount equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or kickback given by [name of Contractor] 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 PA.

……
[Procuring Agency]

……
[Contractor]

FORMS OF ELIGIBILITY

(All forms should be filled and submitted on Company letter head in original by each Bidder or each member of a JV)

Form 1: Bidder Information Form

Company Profile

All individual firms and each partner of a joint venture submitting bid are requested to complete the information in this form.

1.	Name of firm (legal): (In case of Joint Venture (JV), legal name of each member	
2.	Nature of Business: (Whether the firm is a Corporation, Partnership, Trust etc.) (In case of Consortium; whether the Lead Consortium Member is a Corporation, Partnership, Trust etc.)	
3.	Head Office address:	
4.	Telephone : Fax Number: E-mail address:	
5.	Place of Incorporation/Registration: Year of Incorporation/Registration:	
6.	Applicant's authorized representative: Telephone Fax numbers: E-mail address:	
7.	NATIONALITY OF OWNERS	
	Name:	Country:

Form 2: Not Declared Ineligible by any Client/Entity

Ineligibility
❑ **Bidder shall not be declared ineligible by any Client/Entity**

Form 3: No Conflict of Interest

Conflict of Interest
❑ **Bidder shall not have conflict of interest**

Form 4: Historical Contract Non-Performance

Non-Performing Contracts

❑ **Contract non-performance did not occur** within the last **ten (10)** years prior to the deadline for bid submission based on all information on fully settled disputes or litigation

❑ **Contract non-performance during the stipulated period,**

Year	**Outcome as Percent of Total Assets**	**Contract Identification**	**Total Contract Amount (current value, PKR)**
		Contract Identification: Name of Employer: Address of Employer: Matter in dispute:	

Form 5: Bid Security Declaration

Bid Security Declaration
❑ **Bidder shall not be under execution of a Bid–Securing Declaration**

Form 6: History of Court/Arbitral Award

History of Court/Arbitral Award
❑ **Bidder shall not have the consistent history of court/arbitral award decision again bidder**

Form 7: History of Suspension/Termination

Declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for breach of environmental or social (including Sexual Exploitation and Abuse)) contractual obligations
❑ **Previous Contracts of the Bidder shall not be suspended or terminated and/or performance security called by an employer for breach of environmental or social (including Sexual Exploitation and Abuse)**

Form 8: Blacklisting

Blacklisting
❑ **Bidder shall not be blacklisted by government/semi government/autonomous/private organizations**

Form 9: Litigation History

Pending Litigation			
❑ **No pending litigation** (A fully settled dispute or litigation is one that has been resolved in accordance with the Dispute Resolution Mechanism under the respective contract and where all appeal instances available to the Bidder have been exhausted) ❑ **Pending litigation** (All pending litigation shall in total not represent more than **50%** of the Bidder's net worth and shall be treated as resolved against the Bidder)			
Year	**Outcome as Percent of Total Assets**	**Outcome as Percent of Total Assets**	**Total Contract Amount (PKR)**
		Contract Identification: Name of Employer: Address of Employer: Matter in dispute:	

Form 10: Financial Situation

Each Bidder or each member of a JV must fill in this form

Financial Data for Previous 3 Years

Information from Balance Sheet

	Year 2019-20	Year 2018-19	Year 2017-18
Total Assets			
Total Liabilities			
Current Assets			
Current Liabilities			

Information from Income Statement

Total Revenues of Construction			
Profits Before Taxes			
Profits After Taxes			

❑ Attached are copies of financial statements (balance sheets including all related notes, and income statements) for the last three years, as indicated above, complying with the following conditions.

- All such documents reflect the financial situation of the Bidder or partner to a JV, and not sister or parent companies.
- Historic financial statements must be audited by a certified accountant.
- Historic financial statements must be complete, including all notes to the financial statements.
- Historic financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).
- NTN certificate must be attached
- Foreign firms if participating in the bidding process should submit NTN Certificate of their country duly attested by Consulate of their country

Form 11: Average Annual Construction Turnover

Each Bidder or each member of a JV must fill in this form

Annual Turnover Data for the Last 3 Years (Construction only)	
Year	**Amount (PKR)**
2019-20	
2018-19	
2017-18	
Average Annual Construction Turnover	

The information supplied should be the Annual Turnover (Construction only) of the Bidder or each member of a JV in terms of the amounts billed to clients for each year for work in progress or completed.

Form 12: Financial Resources

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract as indicated in the Qualification Criteria

Financial Resources		
No.	**Source of financing**	**Amount (PKR)**
1		
2		
3		

Form 13: Credit Line Certificate

CREDIT LINE CERTIFICATE

Date: _____

Superintendant Engineer
1st Floor, D.C Korangi Office
Near Total Petrol Pump
Korangi #2(1/2), Karachi
Tel: 021-99333842
E-mail: ayazkhan.d.information@gmail.com

CONTRAT/PROJECT : **Improvement/ Rehabilitation of EID GAH ground/ Football Ground - Korangi 03. DMC Korangi**

CONTRACTOR : _____

ADDRESS : _____
_____

BANK : _____

ADDRESS : _____
_____

AMOUNT : _____

This is to certify that the above ---------- (*Name of Bank*) with business address indicated above, commits to provide to the Contractor, if awarded the above mentioned Contract, a credit line in the amount specified above which shall be exclusively used to finance the performance of the above mentioned contract subject to our terms, conditions and requirements.
The credit line shall be available within fifteen (15) calendar days after receipt by the *Contractor* of the Letter of Acceptance and such line of credit shall be maintained until the project is completed by the Contractor.
This Certification is being issued in favor of said Contractor in connection with the bidding requirement of **Superintendant Engineer,** 1st Floor, D.C Korangi Office, Near Total Petrol Pump, Korangi #2(1/2), Karachi for the above mentioned Contract. We are aware that any false statements issued by us make us liable for perjury.

Name and Signature of Authorized

Bank Officer : _____

Official Designation :_____

Concurred By:

Name and Signature of the Contractor

Authorized Representative : _____

Official Designation : _____

Note: The amount committed should be machine validated.

ACKNOWLEDGMENT

SUBSCRIBED AND SWORN to before me this_____day of_____, 21_____, and affiant exhibited to me his/her NTN_____issued on_____at _____, Pakistan.

Attested BY

First Class Magistrate

Form 14: Current Contract Commitments / Works in Progress

Bidders and each member to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Current Contract Commitments					
No.	**Name of Contract**	**Employer's Contact Address, Tel, Fax**	**Value of Outstanding Work [PKR]**	**Estimated Completion Date**	**Average Monthly Invoicing Over Last Six Months [PKR/month)]**
1					
2					
3					
4					
5					

Form 15: Details of Contracts of Similar Nature and Complexity completed over the last 5 years

Sr. No.	**1**	**2**	**3**	**4**	**5**
Name of Contractor:					
Country:					
Name of Procuring Agency with Address, Tele, Fax.					
Nature of works and special features relevant to the contract for which applied:					
Contract Role (Mention: Sole, Sub Contactor or Partner in a Joint Venture).					
Value of the total contract in Pak/Rs:					
Date of Award:					
Date of Completion:					
Cost per day Index					

Form 16: Personnel Capabilities

Bidder should provide the names of suitably qualified personnel to meet the specified requirements stated in Evaluation and Qualification Criteria

Sr. No.	Title of Position	Name
1		
2		
3		
4		
5		

Form 17: Curriculum Vitae (CV) for Proposed Experts

1. Proposed Position:

_____

2. Name of Expert & PEC Registration No:_____

3. Name of Firm:

_____

4. Current Residential address:

_____

Telephone No:_____**Fax No:** _____

E-Mail Address: _____

5. Date of Birth:_____**Citizenship:** _____

6. Qualification:_____

7. Work Experience: Summarize professional experience in reverse chronological order.

Indicate particular technical and managerial experience relevant to the project.

From	To	Company/Project/Position/Relevant technical and management experience

Form 18: Plant & Equipment

Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment whether owned/ leased/ rented listed Evaluation and Qualification Criteria.

A. Equipment Capabilities (owned by the contractor/firm)

Sr. No	Name of Equipment	Name of Manufacturer	Model and power rating	Capacity	Year of Manufacture	Current Location

Note: Provide copies of ownership of equipment.

B. Equipment Capabilities (leased/rented by the contractor/firm)

Sr. No	Name of Equipment	Mention whether leased or rented	Name of Owner	Address of owner	Contact name and title with Telephone Fax & Email of the owner	Agreements Details of rental/ lease/ manufacture agreements specific to the project

Note: Provide copies of Lease Agreement/ Rent Agreement

FORMS

BID SECURITY
PERFORMANCE SECURITY
CONTRACT AGREEMENT
MOBILIZATION ADVANCE GUARANTEE
INDENTURE BOND FOR SECURED ADVANCE

BID SECURITY
(Bank Guarantee)

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. _____)

Bid Reference No. _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the bid and at the request of the said Principal (Bidder) we, the Surety above named, are held and firmly bound unto _____
(hereinafter called the 'Procuring Agency') 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 bid dated _____ for Bid No. _____ for_____(Particulars of Bid) to the said Procuring Agency; and

WHEREAS, the Procuring Agency has required as a condition for considering said bid that the **bidder** furnishes a bid 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 procuring agency, conditioned as under:

(1) that the bid 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 procuring agency, notice of which extension(s) to the Surety is hereby waived;

(2) that the bid security of unsuccessful bidders will be returned by the procuring agency 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 procuring agency 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 procuring agency in accordance with his bid 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 procuring agency for the faithful performance and proper fulfilment of the said Contract or in the

event of non-withdrawal of the said bid within the time specified 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 procuring agency, the said sum upon first written demand of the procuring agency (without cavil or argument) and without requiring the procuring agency to prove or to show grounds or reasons for such demand, notice of which shall be sent by the procuring agency by registered post duly addressed to the Surety at its address given above.

PROVIDED ALSO THAT the procuring agency 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 procuring agency 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

FORM OF PERFORMANCE SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____
Expiry date _____

[Letter by the Guarantor to the Procuring Agency]

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 procuring agency) in the penal sum of the amount stated above for the payment of which sum well and truly to be made to the said procuring agency, 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 procuring agency'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 procuring agency, 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 11, 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 defences under the Contract, do hereby irrevocably and independently guarantee to pay to the procuring agency without delay upon the procuring agency's first written demand without cavil or arguments and without requiring the procuring agency to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the procuring agency'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 Procuring Agency's designated Bank & Account Number.

PROVIDED ALSO THAT the procuring agency 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 procuring agency 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)

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the _____day of_____(month),20_____ between_____(hereafter called the "Procuring Agency") of the one part and _____(hereafter called the "Contractor") of the other part.

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

NOW this Agreement witnesseth-- as follows:

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

2. The following documents after incorporating addenda, if any, except those parts relating to Instructions to bidders shall be deemed to form and be read and construed as part of this Agreement, viz:

   (a) The 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 completed Appendices to Bid (B, C and E to O);
   (h) The Drawings;
   (i) Special provisions
   (j) Specifications
   (k) The priced Bill of Quantities (Appendix-D to Bid);
   (l) _____(any other)

3. In consideration of the payments to be made by the procuring agency to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the procuring agency to execute and complete the works and remedy defects therein in conformity and in all respects with the provisions of the contract.

4. Procuring agency 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	Signature of Procuring Agency
_____	_____
(Seal)	(Seal)

Signed, Sealed and Delivered in the presence of:

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

MOBILIZATION ADVANCE GUARANTEE

Bank Guarantee No._____ Date _____

WHEREAS_____(hereinafter called the 'Procuring Agency') has entered into a Contract for _____
(Particulars of Contract)
with_____(hereinafter called the "Contractor').

AND WHEREAS, the Procuring Agency 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 Procuring Agency 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)
(hereinafter called the "Guarantor") at the request of the Contractor and in consideration of the **procuring agency** 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 procuring agency for payment not exceeding the aforementioned amount.

Notice in writing of any default, of which the procuring agency shall be the sole and final judge, on the part of the Contractor, shall be given by the procuring agency 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 _____

WITNESS

1. _____

_____
Corporate Secretary (Seal)

2. _____

_____
(Name Title & Address)

Corporate Guarantor (Seal)

INDENTURE FOR SECURED ADVANCES

.

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

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

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

(Here enter (the description of the works).

AND WHEREAS the contractor has applied to the ……..…… ……..……..for an advance to him of Rupees ……..……

(Rs. .....) on the security of materials absolutely belonging to him and brought by him to the site of the said works the subject of the said agreement for use in the construction of such of the said works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charge) AND WHEREAS the Government has agreed to advance to the Contractor the sum of Rupees, (Rs. .....) on the security of materials the quantities and other particulars of which are detailed in Part II of Running Account Bill (B). the said works signed by the contractor

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On ……..…… and on such covenants and conditions as are hereinafter contained and the Government has reserved to itself the option of marking any further advance or advances on the security of other materials brought by the Contractor to the site of the said works.

NOW THIS INDENTURE WTTNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees... ……..……..

(Rs. ……..……..) on or before the execution of these presents paid to the Contractor by the Government (the receipt whereof the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as aforesaid (all of which advances are hereinafter collectively referred to as the said amount) the Contractor doth hereby assign unto the Government the said materials by way of security for the said amount

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

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

(2) That the materials detailed in the said Running Account Bill (B) which have been offered to and accepted by (he Government as security for the said amount are absolutely by the Contractors own property free from encumbrances of any kind and the Contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the contractor hereby agrees, at all times, to indemnify and save harmless the Government against all claims whatsoever to any materials in respect of which an advance has been made to him as aforesaid.

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

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

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

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

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

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

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

(a) Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractor in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion the amount due in respect of advances under these presents and crediting the Contractor with the value of work done as he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor he is to pay the same to the Government on demand.

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

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

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

(10) That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been hereinbefore expressly provided for the same shall be referred to the Superintending Engineer/Executive District Officer/Officer one grade higher to officer signed the agreement Circle whose..... decision shall be final and the provisions of the Arbitration Act 1940 for the time being in force so far as they are applicable shall apply to any such reference.

Singed, sealed and delivered by*
In the presence of

SEAL
1st witness

2nd witness

SEAL
1st witness

2nd witness

Condition of Contract

Federation International des Ingenieurs-Conseils, or FIDIC)

(a)	Part I	-	General Conditions of Contract
(b)	Part II	-	Special Conditions of Contract

Notes on the Conditions of Contract

The Conditions of Contract comprise two parts:

(a) Part I - General Conditions of Contract
(b) Part II - Special Conditions of Contract

Over the years, a number of "model" General Conditions of Contract have evolved. The one used in these Standard Bidding Documents was prepared by the International Federation of Consulting Engineers (Federation International des Ingenieurs-Conseils, or FIDIC), and is commonly known as the FIDIC Conditions of Contract. (The used version is the harmonized Edition March 2006).

The FIDIC Conditions of Contract have been prepared for an ad measurement (unit price or unit rate) type of contract, and cannot be used without major modifications for other types of contract, such as lump sum, turnkey, or target cost contracts.

The standard text of the General Conditions of Contract chosen must be retained intact to facilitate its reading and interpretation by bidders and its review by the procuring agency. Any amendments and additions to the General Conditions, specific to the contract in hand, should be introduced in the Particular Conditions of Contract.

The use of standard conditions of contract for all civil works will ensure comprehensiveness of coverage, better balance of rights or obligations between procuring agency and Contractor, general acceptability of its provisions, and savings in time and cost for bid preparation and review, leading to more economic prices.

The FIDIC Conditions of Contract are copyrighted and may not be copied, faxed, or reproduced. Without taking any responsibility of its being accurate, Pakistan Engineering Council with prior consent of FIDIC Secretariat, has reproduced herein the FIDIC General Conditions of Contract for reference purpose only which cannot be used by the users for preparing their bidding documents. The bidding document may include a purchased copy, the cost of which can be retrieved as part of the selling price of the bidding document. Alternatively, the FIDIC Conditions of Contract can be referred to in the bidding documents, and the bidders are advised to obtain copies directly from FIDIC

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

FIDIC CASE POSTALE, CH-1215 Switzerland;

Tel. +41 22 799 49 00;
Fax; +41 22 799 49 01
E-mail: fidic@fidic.org.

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PART B - PARTICULAR CONDITIONS OF CONTRACT

1.1	**Definitions**
1.1.1.4	"Form of Bid" is synonymous with "Letter of Tender".
1.1.1.5	"Bid" is synonymous with "Tender".
1.1.1.8	"The word 'Tender' is synonymous with 'Bid', and the words 'Bidding' with 'Tendering' and the words 'Appendix to Tender' with 'Appendix to Bid' and words 'Tender Documents' with 'Bid Documents'".
1.1.1.11	Insert this Sub Clause "Programme" means the programme to be submitted by the contractor in accordance with Sub-Clause 8.3 and any approved revisions thereto.
1.1.2.2	"Employer" is synonymous with "Procuring Agency" **Superintendant Engineer,** 1st Floor, D.C Korangi Office Near Total Petrol Pump Korangi #21/2, Karachi Tel: 021-99333842 E-mail: ayazkhan.d.information@gmail.com **Employer's Representative**, To be notified
1.1.2.4	**The Engineer is:** To be notified
1.1.2.9	"DB" is synonymous with "Committee"
1.1.2.11	"Bank" means the World Bank
1.1.2.12	Borrwer
1.1.3.1	"Replace 28 days with 7 days"
1.1.3.7	"Defects Notification Period is synonymous with Defects Liability Period"
	Add following definations
1.1.6.10	**"ES"** means Environmental and Social (including Sexual Exploitation and Abuse (SEA) and Sexual Harassment (SH)
1.1.6.11	**"Sexual Exploitation and Abuse" "(SEA)"** means the following **"Sexual Exploitation"** is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another; **"Sexual Abuse"** is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions
1.1.6.12	**"Sexual Harassment" "(SH)"** is defined as unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature by the Contractor's Personnel with other Contractor's or Employer's Personnel

Sub-Clause 1.5 Priority of Documents	*Replace sequence of priority of documents with the following:* (a) the Contract Agreement (if completed), (b) the Letter of Acceptance, (c) the completed Letter of Bid (d) the Particular Conditions – Part A, (Appendix A) (e) the Particular Conditions – Part B (f) the General Conditions (g) The completed Appendices to Bid (E to O); (g) the Drawings, (h) Special Provisions (i) Specification, (j) the Appendix D, Bill of Quantities and (k) the Schedules and any other documents forming part of the Contract.
Sub-Clause 1.6 Contract Agreement	*Replace the word "Employer" with "Contractor" in last line*
Sub-Clause 2.4 Employer's Financial Arrangements	This Sub-Clause is deleted entirely.
Sub-Clause 3.1 Engineer's Duties and Authority	*The following paragraph is added after duties:* Procuring agency shall ensure that the Engineer's Representative/Staff is a professional engineer as defined in the Pakistan Engineering Council Act 1975 (V of 1976) *Replace part of Clause after the sentence "The following provisions shall apply" with following:* The Engineer shall obtain the specific approval of the Employer before taking action under the following Sub Clauses of these conditions: a) Sub-Clauses 1.9, 2.1, 4.7, 4.12, 4.24, 7.4, 8.4, 8.5, 8.9, 10.3, 13.7, and 19.4: Agreeing or determining an extension of time and / or additional cost. b) Approving subletting of any part of the Works under Clause 4.4. c) Sub-Clause 8.8: Instructing suspension of Works; d) Sub-Clause 10.1: Issuing Taking Over Certificate e) Sub-Clause 10.2: Issuing Taking Over Certificates f) Sub-Clause 11.9: Issuing Performance Certificate(s) g) Sub Clause 13.1: Instructing a Variation, except; i) in an emergency situation as determined by the Engineer, or ii) if such Variation would increase the Accepted Contract Amount not more than 1% cumulatively of such Amount. h) Sub-Clause 13.3: Approving a proposal for Variation submitted by the Contractor in accordance with Sub Clause 13.1 or 13.2. i) Sub Clause 13.4: Specifying the amount payable in each of

	the applicable currencies j) Sub-Clause 13.7: Before Adjustment for Changes in Legislation k) Sub-Clause 13.8: Before Adjustment for Changes in Cost l) Sub-Clause 20.1: Approving Claims of the Contractor (Time / Financial) under Clause 20.1 and accepting principles of the Claims Notwithstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of Works or adjoining property, he may, without relieving the Contractor of any of his duties and responsibility 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, despite the absence of approval of the Employer, 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 13 and shall notify the Contractor accordingly, with a copy to the Employer.
Sub-Clause 3.6 Management Meetings	*Insert this Sub Clause at the end of Clause 3* "The Engineer or the Contractor's Representative may require the other to attend a management meeting in order to review the progress with reference to the agreed program and arrangements for future works. The Engineer shall record the business of management meetings and supply copies of the record to those attending the meeting and to the Employer. In the record, responsibilities for any actions to be taken shall be in accordance with the Contract".
Sub-Clause 4.1. Contractor's General Obligation	*Add following at the end of Sub-Clause 4.1*: The Contractor shall prepare and submit one complete set of "As-Built" Documents on one master CD and two complete sets of print copies of "As-Built" Documents together with the back-up of the quantity calculation to the Engineer after completion of work. These "As-Built" Documents shall indicate all approved changes made during construction, superimposed on the original plans / "As-Staked Documents". The final measured quantities for all pay items shall be included on all "As-Built" Documents. These "As-Built" Documents shall be prepared continuously as execution of the Works progresses and shall be submitted to the Engineer for review as sections or parts of the Project are completed. No Taking-Over Certificate for a section/part or the whole of Works shall be issued to the Contractor by the Engineer without the approved "As-Built" Documents. The preparation of the "As-Built" Documents shall be at the expense of the Contractor, payment for which is subsidiary to the pay items of the Contract. The review and approval by the Engineer or by the Employer of the "As-Built" Documents does not relieved the Contractor of

	any responsibility for and/or liabilities arising out of inaccurate, false or otherwise incorrect "As-Built" Documents prepared and submitted by the Contractor. The approved "As-Built Documents" shall be reproduced by the Contractor in four (4) hard copies and one (1) soft copy and return the same to the Employer. **Shop Drawings**. The Contractor shall furnish to the Engineer all Contractor's, and Subcontractor's Shop Drawings. Shop Drawings shall be deemed to include design drawings, fabrication drawings, catalogue cuts, brochures, illustrations, material lists, design calculations, reference standards and performance data which may be required by the specification necessary for the proper execution of the Work, or as otherwise required by the Engineer for assurance that there is intent to meet the requirements of the specifications. All Shop Drawings shall be in English. The Contractor shall submit all Shop Drawings to the Engineer in the manner hereinafter described, in sufficient time to prevent delays in the delivery of materials or in the progress or completion of the work. Regardless of the source of Shop Drawings, all submissions shall be deemed to be submissions by the Contractor under the Contract. All Subcontractors' Shop Drawings shall first be sent directly to the Contractor. The Contractor shall thoroughly check all such Shop Drawings for measurements, sizes of members, materials and all other details, to assure him that the Shop Drawings conform to the intent of the Drawings and Specifications. The Contractor shall return to the Subcontractors for correction, such Shop Drawings that are found inaccurate or otherwise in error. After the Contractor has checked and approved such Shop Drawings he shall place thereon the date of such approval and the legible signature of the checker, and shall then submit them to the Engineer for review. The Engineer may refuse to check or review any Shop Drawings that are not submitted in compliance with the foregoing requirements. The Contractor shall submit five (5) copies of Shop Drawings plus the number that the Contractor wishes to return for his own and his Subcontractor's use. For all Equipment, Shop Drawings shall be completed in all respects and shall show clear compliance with the Specifications. Where applicable, performance figures of equipment, finishes and reference to other relevant drawings must be noted on the Shop Drawings. Details of ancillary items being supplied with the particular equipment must be submitted. Piecemeal submissions will not be considered. Descriptive brochures that are applicable shall be included for information. Any notation on the Shop Drawings which is on the prints and not on the original from which the prints were made shall be in GREEN INK. The Engineer will review submitted Shop Drawings within a

	reasonable time and will return them stamped with "NO COMMENT", "SEE COMMENTS" or "RESUBMIT". The Engineer may, at his discretion, require an immediate re-submission of Shop Drawings noted "SEE COMMENTS" so that he can make a further review or amendments. Drawings requiring re-submission shall be either amended and re-submitted or shall be superseded by another Shop Drawings. Comments on Shop Drawings are not orders for Extra Work. Shop Drawings re-submitted for further review will be reviewed for response to previous notations only and the Contractor, by such re-submission shall be held to have represented that such Shop Drawings contain no other alterations, additions or deletions, unless the Contractor (in writing) directs the Engineer specific attention to the same. Should the Contractor question, or dissent, from such notations or comments, he shall direct the Engineer's attention to the same for further clarification before re-submitting. *By reviewing Shop Drawings, the Engineer does not assume responsibility for errors or omissions and non-compliance with the Contract requirements. Such errors and omissions must be made good by the Contractor, irrespective, of the receipt, checking, or review of the Shop Drawings by the Engineer and even though the Work is done in accordance with such Shop Drawings.* **Quality of Plans ("As-Built" and other Drawings for Variation).** All sheets of the "As-Built" and other drawings for Variations should be of uniform size and one (1) standard size (A1) using Mylar or other quality tracing paper. The sheets must be neat and clean and without any crossed-out or voided portion. The title block should be made an integral part of the sheet plans and not merely patched-up. **Supplementary Drawings and Instructions.** The Engineer shall have the authority to issue to the Contractor from time to time such supplementary drawings and instructions to the proper and adequate execution of the Works and the remedying of any defects therein. The Contractor shall carry out and be bound by the same. The Contractor shall designate an additional set of drawings as "Record Drawings" and keep them to the site. The Contractor shall clearly and neatly mark the Record Drawing in ink to indicate all authorized changes in the work, and also as actually constructed. These additional plans will not change the work of the Contract but will elucidate or explain it.
Sub-Clause 4.3 Contractor's Representative	*Insert additional paragraph at the end of Sub-Clause 4.3* The Contractor's authorized representative and his other professional engineers working at site shall register themselves with the Pakistan Engineering Council.
Sub-Clause 4.4 Subcontractors	*Replace first line with the following*

	The Contractor may subcontract the Works for the maximum value equal to 20% of the Accepted Contract Amount.
Sub-Clause 4.8 Safety Procedures	*Insert additional paragraphs at the end of Sub-Clause 4.8* 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. The Contractor shall have on his staff at the site an officer dealing only with questions regarding the safety and protection against accidents of all staff and labour. This officer shall be qualified for this work and shall have the authority to issue instructions and shall take protective measures to prevent accidents. Adequate number of Site Safety Inspectors shall be deployed by Contractor to assist Accident Prevention Officer and ensure safety of workers in the hazardous work areas. The Contractor shall within 24 hours of the occurrence of any accident at or about the site or in connection with the execution of the Works report such accident to the Engineer with copy to the Employer. In case of any fatality or serious accident the Contractor shall in addition notify the Engineer immediately by the quickest available means. In case of fatal accident, the Engineer may suspend the Work till the Contractor enhances proper safety arrangements. Such suspension shall be at the Cost of the Contractor and no time extension shall be considered for such suspension. 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.
Sub-Clause 4.18 Protection of the Environment	*Final paragraph to be added to after second paragraph* The Contractor shall exercise care to protect the natural landscape and shall conduct his construction operation 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 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 scarring damage or defacing may occur as a result of the Contractor's operations, it shall be repaired, replanted or otherwise corrected as directed by the Engineer at Contractor's expense. Borrow areas shall be located and operated so as not to detract from the future usefulness or value of the sites. Upon completion of operations, borrow areas shall be left in a safe and sightly conditions. No borrow areas shall be located within 500 meters from the right of way. During the performance of the work required under the Contract, the Contractor shall carryout proper and efficient measures as often as necessary to reduce the dust nuisance, and to prevent dust originating from his operations. For wastewater disposal, the provision of septic tank alone for worker's camp etc. will not be sufficient and may have to be supplemented with secondary treatment in form of gravel drains / constructed wetland depending on the laboratory results of effluent from the septic tank. The Contractor shall take all necessary measures to prevent water from the Site causing a nuisance on or, in any neighbouring land or property either by causing flooding or by depositing sediment on the surface of the ground or in drains or watercourses. Wherever necessary to prevent this, the Contractor shall construct temporary drainage channels, layer sumps and traps (in addition to those shown on the Contract) discharging into existing drain, ditches or watercourses. The Contractor snail removes over 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 works including those below sub-soil 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 works therein and for the collection and disposal of water shall be to the Engineer's Approval. Such arrangements may include interalia temporary cofferdams, well-point systems, pumps; drains trenches, flumes and other recognized means. All Costs and charges in dealing with water in any way whatsoever and the effects thereof will be deemed to be included in the Contract Price and in the unit rates or prices of the Contractor for excavations. 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 sands shall generally be clear of the Permanent Works unless approved otherwise by the Engineer. If, with the said Approval of the Engineer trenches drains or sumps are excavated under or immediately adjacent the Permanent Works, these shall comprise open-jointed pipes with gravel mounds. When no longer required and when approved by

	the Engineer they shall be filled with a cement /sand grout injected under pressure so as to fill the pipe and all voids completely. 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 Works in any other way. Notwithstanding the Approval by the Engineer 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. The Contractor shall throughout the execution and completion of the Works and the remedying of any defects therein, comply with all applicable Environment Protection Laws and Regulations of the Country. For other details regarding Environment, Helath and Safety refer to Appendix L and M, SP-10 and SP-11, which are the integral part of the Contract Documents.
Sub-Clause 4.21 **Progress Reports**	*Add following paragraphs after paragraph (h)* (i) An updated construction schedule indicating the progress in percentage; and (j) Description of all works carried out since the last report; and (k) An updated Progress Curve/Projected Cash flow indicating the planned and actual progress; and (l) An updated Critical Resource Usage Chart showing comparison of planned and actual values; and (m) An updated material procurement plan showing comparison of planned and actual values; and (n) An updated schedule of shop drawings comparison of planned and actual values; and (o) Description of the Works planned for the next 28 days sufficiently detailed to enable the Engineer to determine his programme of inspection and testing; and (p) Summary of all submission; and (q) Information about problems and areas of concern and proposal to overcome the same.
Sub-Clause 6.5 Working Hours	*Add the following paragraph at the end of Sub-Clause 6.5*: The Contractor shall pay overtime payment to the Engineer's Support Staff/Personnel who were required by the Contractor to perform their respective work assignment beyond the normal working hours stated in Part A – Particular Conditions (Appendix A).
Sub-Clause 6.10 **Records of Contractor's Personnel and Equipment**	*The following paragraphs added:* The Contractor shall, upon request by the Engineer at any time in relation to any time 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.
Sub-Clause 6.20 Prohibition of Forced or Compulsary Labor	*Delete Text of Sub-Clause 6.20 and replace with following:* The Contractor, including its Subcontractors, shall not employ or engage forced labor. Forced labor consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements. No persons shall be employed or engaged who have been subject to trafficking. Trafficking in persons is defined as the recruitment, transportation, transfer, harboring or receipt of persons by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purposes of exploitation
Sub-Clause 6.21 Prohibition of Harmful Chield Labor	*Delete Text of Sub-Clause 6.21 and replace with following:* The Contractor, including its Subcontractors, shall not employ or engage a child under the age of 14 unless the national law specifies a higher age (the minimum age). The Contractor, including its Subcontractors, shall not employ or engage a child between the minimum age and the age of 18 in a manner that is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. The Contractor including its Subcontractors, shall only employ or engage children between the minimum age and the age of 18 after an appropriate risk assessment has been conducted by the Contractor with the Project Manager's approval. The Contractor shall be subject to regular monitoring by the Project Manager that includes monitoring of health, working conditions and hours of work. Work considered hazardous for children is work that, by its nature or the circumstances in which it is carried out, is likely to jeopardize the health, safety, or morals of children. Such work activities prohibited for children include work: (a) with exposure to physical, psychological or sexual abuse; (b) underground, underwater, working at heights or in confined spaces; (c) with dangerous machinery, equipment or tools, or involving handling or (d) transport of heavy loads; (e) in unhealthy environments exposing children to hazardous substances, agents, or processes, or to temperatures, noise

	or vibration damaging to health; or (f) under difficult conditions such as work for long hours, during the night or in confinement on the premises of the employer
Sub-Clause 6.23 **Workers' Organizations**	*Insert sub-clause after Sub-Clause 6.22:* In countries where the relevant labor laws recognize workers' rights to form and to join workers' organizations of their choosing and to bargain collectively without interference, the Contractor shall comply with such laws. In such circumstances, the role of legally established workers' organizations and legitimate workers' representatives will be respected, and they will be provided with information needed for meaningful negotiation in a timely manner. Where the relevant labor laws substantially restrict workers' organizations, the Contractor shall enable alternative means for the Contractor's Personnel to express their grievances and protect their rights regarding working conditions and terms of employment. The Contractor shall not seek to influence or control these alternative means. The Contractor shall not discriminate or retaliate against the Contractor's Personnel who participate, or seek to participate, in such organizations and collective bargaining or alternative mechanisms. Workers' organizations are expected to fairly represent the workers in the workforce
Sub-Clause 6.24 **Non-Discrimination and Equal Opportunity**	*Insert sub-clause after Sub-Clause 6.23:* The Contractor shall not make decisions relating to the employment or treatment of Contractor's Personnel on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment of Contractor's Personnel on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination. The Contractor shall provide protection and assistance as necessary to ensure non-discrimination and equal opportunity, including for specific groups such as women, people with disabilities, migrant workers and children (of working age in accordance with Sub-Clause 6.24)
Sub-Clause 6.25 **Epidemics**	*Insert sub-clauses after Sub-Clause 6.24:* 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 the purpose of dealing with and overcoming the same.

Sub-Clause 7.9 **Use of Pakistani Materials and Services**	*Insert additional sub-clauses after Sub-Clause 7.8* 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.
Sub-Clause 8.1 **Commencement of Works**	*Delete paragraph (b) entirely 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
Sub-Clause 8.3 **Programme**	*Insert following additional paragraphs at the end of Sub Clause 8.3;* The programme shall be submitted within 07 days from the date of receipt of Notic to Commence. The Contractor shall incorporate and mention activities with allotted time and resources for activities of different stages. Also, the Programme of work should also clearly identify the activities with time and resources for parts of work as stated in Appendix A. The Contractor shall pay a penalty of Rs. 200,000/- (Rupees Two Hundred Thousand only) for each day of delay in the submission of said Programme of works. The Employer shall recover such amount from any payment due to the Contractor under the Contract, on the Engineer's recommendations. a. The Contractor shall submit the Programme of Works on Primavera for the agreement of the Engineer and approval of the Employer. All items of works and activities including mobilization should be included in the Programme of Works. The programme shall identify and highlight those activities, which are on the Critical Path. This programme of works as scheduled shall form basis of Liquidated Damages pursuant to clauses 8.7 of the Conditions of Contract. In addition, cash flow estimates shall be supported with inputs of over drafts organized with financial institutions at various stages of the projects to meet the funding requirements of the project. The Contractor shall supply and maintain at his site office for his and Engineer's use a licensed copy of the project management computer software package namely Prima Vera or equivalent as used by the Contractor for programming, to monitor the progress. It shall be supplied complete with manuals and technical training and support for the duration of the Contract as per requirements assessed by the Engineer. b. In order to assist the Engineer, the Contractor shall be required to submit at 2 weeks intervals data to the Engineer on the cost and quantities and other data relevant to the monitoring of progress according to a particular format suitable for computer processing.

	c. The programme should identify all items of work including temporary work. Progress reporting by the Contractor should be supported on a monthly basis with an up-to-date analysis of the progress including a statement on items, which are or are about to become critical to the progress of the work along with the proposals on how the Contractor intends to alleviate the situation. d. The programme should be resource based and must provide the critical resource. The programme must be drawn up on CPM. **General Requirements:** a. Programme should be submitted (both hard and soft copy) strictly following the guidelines and format specified in this Clause. b. The Engineer at any time during the execution of the Works; direct the Contractor to change/modify the Programme / Schedule based on the Priority of Works. c. No payment shall be released to the Contractor prior to approval of the Base Line Programme by the Engineer. d. Submittal of Programme consists of: 1. Construction Schedule (CPM); 2. Progress Curve/Project Cash Flow; 3. Critical Resources Usage Chart; 4. Detailed Method Statement; 5. Material Procurement Plan; 6. Schedule of Submittals and Shop-Drawings; 7. Any other details as required by the Engineer; **Construction Schedule: F** a. Construction Schedule shall be developed on the basis of Work Breakdown Structure provided or approved by the Engineer. b. Construction Schedule shall be detailed up to level 4 or as required by the Engineer. c. Durations of construction activity should be calculated practically in relation to quantity of work done and allocated resources. Any activity that demands duration greater than seven (07) calendar days should be split into number of activities to monitor the same accordingly. d. Construction activities of the schedule should be logically linked with preceding and succeeding activities and showed in submitted construction schedule. e. Critical Activities and Critical Path of the project should be highlighted with red colour in bar chart and precedence diagram. Total Float for non-critical activities should also be shown in the schedule. f. Appropriate quantity of direct resources (material, labour, equipment and non-consumable material) should be allocated to all

activities and showed in submitted construction schedule. Labour resource should be divided according to related trades (e.g. Mason, Operator, helper etc.) Contractor should make sure that no resource is being over allocated. Indirect resources should be allocated to supervision / summary activity.

g. BOQ amount should be loaded to each construction activity. Accrual basis should be indicated to construction activity.

h. Construction Schedule should show Activity ID, Activity Description, BOQ Quantity, Duration, Start Date, Finish Date, Total Float, Predecessors, Resource names with quantity, BOQ Amount and timescale where the bars show start and finish dates.

Progress Curve / Projected Cash Flow:

a. Progress Curve / Projected Cash Flow should be developed and presented on Project Management Software – Primavera Project Planner as stated above.

b. S-Curve should be plotted between time (in weeks) and progress of work done (in % of work). The progress should be shown in cumulative percent of work done. Percent of work done should be calculated with the BOQ amount and payment terms.

Critical Resources Usage Chart:

a. Critical Usage Chart should be developed.

b. List of Critical Resources included Labourers, equipments, consumable/non-consumable materials and/or identified by the Engineer.

c. Resource usage chart should show Resource Name and weekly utilization (numbers) of resources on each activity.

Detailed Method Statement:

Detailed method statement should be presented in descriptive format explaining the method of carrying out works, logistics, site layout, flow of work, quality and safety measures for each activity and any other details as required by the Engineer.

Material Procurement Plan:

Material Procurement Plan for major items of purchase should be presented in a Tabular Format to be submitted to the Engineer for pre-approval. The Plan must as a minimum show the list of local & imported materials to be used, their specification reference, and planned dates for submittal to Consultant, approval process, placing of order, vendor contact, required delivery on site, status of Line of Credit (LOC) if applicable, and usage of material.

Schedule of Shop Drawings and Submittals:

Schedule of Shop Drawings and other Submittals should be presented in a Tabular Format to be submitted to the Engineer for pre-approval. Plan must as a minimum show the list of shop drawings required and their specification reference, planned dates for submittal to consultant, approval process, and usage of

	shop drawing. **Cash Flow Estimates:** The Contractor shall, within 07 days from the receipt of the Notice to Commene, provide to the Engineer for his information a detailed cash flow estimate in quarterly periods, of all payments to which the Contractor will be entitled under the Contract and the Contractor shall subsequently supply revised cash flow estimates at quarterly intervals, if required to do so by the Engineer. **Revised Programme of work** If at any time it should appear to the Engineer that the actual progress of the Works does not conform to the programme to which consent has been given under Sub-Clause 8.3, the Contractor shall produce, at the request of the Engineer, a revised programme showing the modifications to such programme necessary to ensure completion of the Works within the Time for Completion. The revised programme, in accordance with the Contract, shall be submitted within seven (07) days of the request received from the Engineer. The Contractor shall pay a penalty of Rs.100,000/- (Rupees Hundred Thousand only) for each day of delay in the submission of said revised programme. The Employer shall recover such amount from any payment due to the Contractor under the Contract, on the Engineer's recommendations. Notwithstanding General Conditions of the Contract Sub Clause 8.3, the program to be submitted for the execution of the works shall, in addition to the program of pure construction activities, include an alleviation program for site staff and labour and their families (if allowed to stay at camp) in respect of Sexually Transmitted Infections (STI), Sexually Transmitted Diseases (STD) including HIV/AIDS. The STID and HIV/AIDS alleviation program shall indicate when, how and at what cost the Contractor plans to satisfy the requirements of Sub Clause 6.7 herein and the related Appendices and Special Provisions.
Sub-Clause 8.7 **Delay Damages**	*Insert following additional paragraphs at the end of Sub-Clause 8.7* Notwithstanding the provision of above stated conditions following shall prevail: The rate of Delay Damages shall be 0.1% per day of the Contract Price for every day of delay in which whole or part of the work(s) remained unfurnished subject to a maximum of 10% of the Final Contract Price. In addition to the Delay Damages, the Contractor shall borne all the cost/expenses related to the supervision of the works by the Engineer and his staff covering salaries of the Engineer and all of his Site Supervision staff including all the benefits, providing, running and maintenance of all the Engineer's Facilities up to the issuance of the Taking Over Certificate by the Employer. All the above cost/expanses will not be reimbursed / paid to the

	Contractor beyond the approved completion period of the works. If, before the Time for Completion of the whole of the Works or, if applicable, any Section, a Taking-Over Certificate has been issued for any part of the Works or of a Section, the delay damages for delay in completion of the remainder of the Works or of that Section shall, for any period of delay after the date stated in such Taking-Over Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The provisions of this Sub-Clause shall only apply to the rate of delay damages and shall not affect the limit thereof.
Sub-Clause 10.1 **Taking Over of the Works and Sections**	*Insert following as 3rd paragraph after 2nd paragraph* Within 07 days of the date of receipt of Contractor's notice for issuance of Taking Over Certificate the Employer shall on the written request of the Engineer constitute a committee comprising of Engineer/Engineer's Representative, Employer's and Contractor's Representatives. The Committee shall conduct a detailed inspection of the works completed by the Contractor to ascertain the completion or the extent of completion to decide about the issuance of Taking Over Certificate. The Engineer shall take further action on the Contractor's application in pursuance to the recommendations of the committee.
Sub-Clause 11.9 **Performance Certificate**	*Insert following as 2rd paragraph after 1st paragraph* At the completion of the Defects Notification Period the Employer shall constitute a committee comprising of Engineer / Engineer's Representative, Employer's and Contractor's Representatives. The Committee shall conduct a detailed inspection of the works to ascertain the issuance of Performance Certificate or otherwise.
Sub-Clause 13.1 **Right to Vary**	In the last line of Para, after the word "Variation", the word "in writing" is added.
Sub-Clause 13.3 **Variation Procedure**	In the tenth line, after the words "as soon as practicable" following is added: "and within a period not exceeding one-eighth of the completion time"
Sub-Clause 13.8 **Adjustment for Changes in cost**	*Deleted*
Sub-Clause 14.1 **The Contract Price**	*Renumber subparagraphs (c) and (d) as (f) and (g) and delete subparagraph (e).* *Insert following paragraphs (c), (d) and (e):* (c) The Contract Price shall include all taxes, duties and other charges imposed outside the Country on the production, manufacture, sale and transport of the Contractor's Equipment. Plant, Materials and supplies to be used on or furnished under the Contract, and on the services to be performed under the Contract. (d) The Contractor's staff and labour will be liable to pay

	personal income taxes in the Country in respect of such of their salaries and wages as are chargeable under the Laws for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such laws. (e) Notwithstanding the provisions of subparagraph (b), Contractor's Equipment, including essential spare parts therefore, imported by the Contractor for the sole purpose of executing the Contract shall be temporarily exempt from the payment of import duties and taxes upon initial importation, provided the Contractor shall post with the customs authorities at the port of entry an approved export bond or bank guarantee, valid until the Time for Completion plus six months, in an amount equal to the full import duties and taxes which would be payable on the assessed imported value of such Contractor's Equipment and spare parts, and callable in the event the Contractor's Equipment is not exported from the Country on completion of the Contract. A copy of the bond or bank guarantee endorsed by the customs authorities shall be provided by the Contractor to the Employer upon the importation of individual items of Contractor's Equipment and spare parts. Upon export of individual items of Contractor's Equipment or spare parts, or upon the completion of the Contract, the Contractor shall prepare, for approval by the customs authorities, an assessment of the residual value of the Contractor's Equipment and spare part to be exported, based on the depreciation scale(s and other criteria used by the customs authorities for such purposes under the provisions of the applicable Laws. Import duties and taxes shall be due and payable to the customs authorities by the Contractor on (a) the difference between the initial imported value and the residual value of the Contractor's Equipment and spare parts to exported; and (b) on the initial imported value that Contractor's Equipment and spare parts remaining in the Country after completion of the Contract. Upon payment of such dues within 28 days of being invoiced, the bond or bank guarantee shall be reduced or released accordingly; otherwise the security shall be called in the full amount remaining.
Sub-Clause 14.2 Advance Payment	*Delete the Clause in entirety and replace with following* The Employer if requested by the Contractor shall make an advance payment for mobilisation and cash flow support, when the Contractor submits a guarantee in accordance with this Sub-Clause. The total advance payment, the number and timing of instalments (if more than one) shall be as stated in the Appendix A. The Advance Payment (if required) shall be paid in two equal instalments after the following conditions have been fulfilled. Installment-1: 50% of the total amount of the Advance Payment • That the Contract Agreement has been signed by the

	Parties. • The Contractor has submitted bank guarantee for the full amount of the advance payment in the form of irrevocable without recourse bank guarantee. • The Contractor has submitted the Performance Security in the form as prescribed in Sub-Clause 4.2. Installmentt-2: Remaining 50% of the total amount of the Advance Payment shall be paid on mobilization of Plant, Equipment and other resources at site by the Contractor to the satisfaction of the Engineer. Unless and until the Employer receives this guarantee, or if the total advance payment is not stated in the Appendix A, this Sub-Clause shall not apply. The Engineer shall deliver to the Employer and to the Contractor an Interim Payment Certificate for the advance payment or its first instalment after receiving a Statement (under Sub-Clause 14.3 [Application for Interim Payment Certificates]) and after the Employer receives (i) the Performance Security in accordance with Sub-Clause 4.2 [Performance Security] and (ii) a guarantee in amount equal to the advance payment. This guarantee shall be issued by an entity and from within a country (or other jurisdiction) approved by the Employer and shall be in the form annexed to the Particular Conditions or in another form approved by the Employer. The Contractor shall ensure that the guarantee is valid and enforceable until the advance payment has been repaid, but its amount shall be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates. If the terms of the guarantee specify its expiry date, and the advance payment has not been repaid by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been repaid. At any time, the bank guarantee shall be valid for an amount not less than the amount of the original Advance Payment less any partial repayment of that Advance Payment which may have been affected. The Contractor shall inform the guaranteeing bank, by letter, counter signed by the Employer, of the required amount of the guarantee from time to time. Reduction of the amount shall not be made without such authorizing letter. Unless stated otherwise in the Appendix A, the advance payment including interest shall be recovered in 5 equal instalments starting from first IPC and in case the number of bills is less than 5 then 1/5 of the advance inclusive of the interest thereon shall be recovered from each bill and the balance be recovered from the final bill. It may be insured that there is sufficient amount in the final bill to enable recovery of the Mobilization Advance. If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior to termination under Clause 15 [Termination by Employer], Clause 16 [Suspension and Termination by Contractor] or Clause 19 [Force Majeure] (as the case may be), the whole of the balance

	then outstanding shall immediately become due and in case of termination under Clause 15 [Termination by Employer] and Sub-Clause 19.6 [Optional Termination, Payment and Release], payable by the Contractor to the Employer. In the event that the amount of money certified and due to the Contractor under the contract at any time is less than the total of due repayments of Advance Payment, the balance of the due repayments shall be paid to the Employer by the Contractor within seven days of demand by the Employer. If the balance is not so paid, the Employer shall be empowered to call in sufficient of the Advance payment bank guarantee to cover the said balance. The Employer shall be empowered to call in the guarantee in whole or in part(s) if the Contractor defaults in the repayment(s) for any reason(s).
Sub-Clause 14.5 **Plant and Materials intended for the Works**	*Add the following paragraph as sub-clause 14.5 (d) for Secured Advance on non – perishable materials and sub-clauses (a), (b) and (c) will be applicable for plants only :-* **I.** The Contractor shall be entitled to receive from the procuring agency Secured Advance against an INDENTURE BOND in Public Works Account Form No.31 (Fin. R. Form No. 2) acceptable to the procuring agency of such sum as the Engineer may consider proper in respect of non-perishable materials brought at the site but not yet incorporated in the Permanent Works provided that: i. The materials are in accordance with the specifications for the permanent works; ii. Such materials have been delivered to the site and are properly stored and protected against loss or damage or deterioration to the satisfaction and verification of the Engineer/Assistant Engineer but at the risk and cost of the Contractor; iii. 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; iv. The Contractor shall submit with his monthly statement the estimated value of the materials on site together with such documents as may be required by the Engineer for the purpose of valuation of materials and providing evidence of ownership and payment therefore; v. Ownership of such materials shall be deemed to vest in the procuring agency and these materials shall not be removed from the site or otherwise disposed of without written permission of the procuring agency; vi. The sum payable for such materials on site shall not exceed 75 % of the (i) landed cost of imported materials, or (ii) ex-factory /ex-warehouse price of locally manufactured or produced materials, or (iii) market price

	of stands other materials; vii. Secured Advance shall not be allowed unless and until the previous advance, if any, is fully recovered; viii. Detailed account of advances must be kept in part II of running account bill or a separate statement; and ix. Secured Advance may be permitted only against materials/quantities anticipated to be consumed / utilized on the work within a period of 3 months from the date of issue of secured advance and in no case for full quantities of materials for the entire work/contract. **II. Recovery of Secured Advance:** Secured Advance paid on non-perishable materials to the Contractor under the above provisions shall be affected from the monthly payments on actual consumption basis, but not later than period specified in the rules not more than three months (even if unutilized);
Sub-Clause 14.8 Delayed Payment	*Second Para is replaced with following text:* In the event of the failure of the Procuring Agency to make the payment within the time stated, the procuring agency shall pay to the contractor the compensation at rate of KIBOR+2% per annum in local currency, upon all sums to be paid from the date of which the same would have been paid.
Sub-Cause 14.15 Currencies of Payment	Currency of Payment is Pakistan Rupee (PKR).
Sub-Clause 15.2 Termination by Employer	*Insert following as paragraph (g) after paragraph (f)* (g) If the progress of works with respect to the Programme of Works is observed to be behind the approved program of works pursuant to Sub Clause 8.7 for three consecutive months. *The following Para is added at the end of the sub-clause:* Provided further, that in addition to the action taken by the procuring agency against the Contractor under this Clause, the procuring agency 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.
Sub-Clause 15.6 Corrupt and Fraudulent Practices	*The following text is to be added as 3rd paragraph:* *Successful Contractor has to provide Integrity Pact (for contracts worth Rs.10.0 million and above).* 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 procuring agency 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 procuring agency 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 **15.2** & 15.5 and the payment under Sub-Clause 15.4 shall be made after having deducted the amounts due to the procuring agency under Sub-Para (a) and (c) of this Sub-Clause.
Sub-Clause 16.1 Contractor's Entitlement to Suspend Work	*Delete words "... Sub-Clause 2.4 [Employer's Financial Arrangements] or ... " from first paragraph* Delete paragraph 2 *in entirety* (i.e. from words "Notwithstanding" to "notification from the bank".
Sub-Clause 16.2 Termination by Contractor	*Delete paragraph (a) in entirety.*
Sub-Clause 17.3 Employer's Risks	Delete paragraph (a) in entirety.
Sub-Clause 18.1 General Requirements for Insurance	*Add following text* The contractor shall be obliged to place all insurances relating to the contract (including, but not limited to, the insurances referred to in Clauses 18.1,18.2,18.3,18.4) with Insurance Company having at least AA rating from PACRA/JCR in favour of the Employer valid for a period 28 days after the expiry of Defects Liability Period. Costs of such insurances shall be borne by the contractor.
Sub-Clause 19.6 Optional Termination, Payment and release by the Employer	Delete paragraph (c), (d) and (e) in entirety.
Sub-Clause 20.1 Contractor's Claims	*Insert following at the end of Sub-Clause 20.1* The Contractor shall not be entitled for any extension of Time for Completion and/or additional payment in respect of the claim(s) if the Contractor fails to comply with the requirements or any of the requirement of Sub-Clause 20.1 within the time period stipulated there in the Clause above mentioned and or fails in keeping and producing necessary records whenever demanded by the Engineer.
Sub-Clause 20.6 Arbitration	*Delete the Clause in entirety and replace with following* Any dispute in respect of which: *a. the decision of the Dispute Board has not become final and binding pursuant to sub-clause 20.2, and* *b. amicable settlement has not been reached within the period stated in sub-clause 20.5, shall be finally settled,* under the provisions of the Arbitration Act, 1940 as amended or any statutory modification/Rules of Conciliation and Arbitration PEC Islamabad or re-enactment thereof for the time being in force. The place of arbitration shall be Karachi, in Sindh Province.

	The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, and any decision of the DB, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Engineer from being called as a witness and giving evidence before the arbitrators on any matter whatsoever relevant to the dispute. Neither Party shall be limited in the proceedings before the arbitrators to the evidence or arguments previously put before the DB to obtain its decision, or to the reasons for dissatisfaction given in its notice of dissatisfaction. Any decision of the DB shall be admissible in evidence in the arbitration. Arbitration shall be commenced after completion of the Works. The obligations of the Parties, the Engineer and the DB shall not be altered by reason of any arbitration.

General Conditions of Dispute Board Agreement

1. Definitions

Each "Dispute Board Agreement" is a tripartite agreement by and between:

(a) the "Employer";

(b) the "Contractor"; and

(c) the "Member" who is defined in the Dispute Board Agreement as being:

(i) the sole member of the "DB" and, where this is the case, all references to the "Other Members" do not apply, or

(ii) one of the three persons who are jointly called the "DB" (or "Dispute Board") and, where this is the case, the other two persons are called the "Other Members."

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the "Contract" and is defined in the Dispute Board Agreement, which incorporates this Appendix. In the Dispute Board Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract.

2. General Provisions

Unless otherwise stated in the Dispute Board Agreement, it shall take effect on the latest of the following dates:

(a) the Commencement Date defined in the Contract,

(b) when the Employer, the Contractor and the Member have each signed the Dispute Board Agreement, or

(c) when the Employer, the Contractor and each of the Other Members (if any) have respectively each signed a dispute board agreement.

This employment of the Member is a personal appointment. At any time, the Member may give not less than 70 days' notice of resignation to the Employer and to the Contractor, and the Dispute Agreement shall terminate upon the expiry of this period.

3. Warranties

The Member warrants and agrees that he/she is and shall be impartial and independent of the Employer, the Contractor and the Engineer. The Member shall promptly disclose, to each of them and to the Other Members (if any), any fact or circumstance which might appear inconsistent with his/her warranty and agreement of impartiality and independence.

When appointing the Member, the Employer and the Contractor relied upon the Member's representations that he/she is:

(a) experienced in the work which the Contractor is to carry out under the Contract,

(b) experienced in the interpretation of contract documentation, and

(c) fluent in the language for communications defined in the Contract.

4. General Obligations of the Member

The Member shall:

(a) have no interest financial or otherwise in the Employer, the Contractor or Engineer, nor any financial interest in the Contract except for payment under the Dispute Board Agreement;

(b) not previously have been employed as a consultant or otherwise by the Employer, the Contractor or the Engineer, except in such circumstances as were disclosed in writing to the Employer and the Contractor before they signed the Dispute Board Agreement;

(c) have disclosed in writing to the Employer, the Contractor and the Other Members (if any), before entering into the Dispute Board Agreement and to his/her best knowledge and recollection, any professional or personal relationships with any director, officer or employee of the Employer, the Contractor or the Engineer, and any previous involvement in the overall project of which the Contract forms part;

(d) not, for the duration of the Dispute Board Agreement, be employed as a consultant or otherwise by the Employer, the Contractor or the Engineer, except as may be agreed in writing by the Employer, the Contractor and the Other Members (if any);

(e) comply with the annexed procedural rules and with Sub-Clause 20.4 of the Conditions of Contract;

(f) not give advice to the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel concerning the conduct of the Contract, other than in accordance with the annexed procedural rules;

(g) not while a Member enter into discussions or make any agreement with the Employer, the Contractor or the Engineer regarding employment by any of them, whether as a consultant or otherwise, after ceasing to act under the Dispute Board Agreement;

(h) ensure his/her availability for all site visits and hearings as

are necessary;

(i) become conversant with the Contract and with the progress of the Works (and of any other parts of the project of which the Contract forms part) by studying all documents received which shall be maintained in a current working file;

(j) treat the details of the Contract and all the DB's activities and hearings as private and confidential, and not publish or disclose them without the prior written consent of the Employer, the Contractor and the Other Members (if any); and

(k) be available to give advice and opinions, on any matter relevant to the Contract when requested by both the Employer and the Contractor, subject to the agreement of the Other Members (if any).

5. General Obligations of the Employer and the Contractor

The Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the Member regarding the Contract, otherwise than in the normal course of the DB's activities under the Contract and the Dispute Board Agreement. The Employer and the Contractor shall be responsible for compliance with this provision, by the Employer's Personnel and the Contractor's Personnel respectively.

The Employer and the Contractor undertake to each other and to the Member that the Member shall not, except as otherwise agreed in writing by the Employer, the Contractor, the Member and the Other Members (if any):

(a) be appointed as an arbitrator in any arbitration under the Contract;

(b) be called as a witness to give evidence concerning any dispute before arbitrator(s) appointed for any arbitration under the Contract; or

(c) be liable for any claims for anything done or omitted in the discharge or purported discharge of the Member's functions, unless the act or omission is shown to have been in bad faith.

The Employer and the Contractor hereby jointly and severally indemnify and hold the Member harmless against and from claims from which he is relieved from liability under the preceding paragraph.

Whenever the Employer or the Contractor refers a dispute to the DB under Sub-Clause 20.4 of the Conditions of Contract, which will require the Member to make a site visit and attend a hearing, the Employer or the Contractor shall provide appropriate security for a sum equivalent to the reasonable expenses to be incurred by the Member. No account shall be taken of any other

payments due or paid to the Member.

6. Payment

The Member shall be paid as follows, in the currency named in the Dispute Board Agreement:

(a) a retainer fee per calendar month, which shall be considered as payment in full for:

(i) being available on 28 days' notice for all site visits and hearings;

(ii) becoming and remaining conversant with all project developments and maintaining relevant files;

(iii) all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and

(iv) all services performed hereunder except those referred to in sub-paragraphs (b) and (c) of this Clause.

The retainer fee shall be paid with effect from the last day of the calendar month in which the Dispute Board Agreement becomes effective; until the last day of the calendar month in which the Taking-Over Certificate is issued for the whole of the Works.

With effect from the first day of the calendar month following the month in which the Taking-Over Certificate is issued for the whole of the Works, the retainer fee shall be reduced by one third. This reduced fee shall be paid until the first day of the calendar month in which the Member resigns or the Dispute Board Agreement is otherwise terminated.

(b) a daily fee which shall be considered as payment in full for:

(i) each day or part of a day up to a maximum of two days' travel time in each direction for the journey between the Member's home and the site, or another location of a meeting with the Other Members (if any);

(ii) each working day on Site visits, hearings or preparing decisions; and

(iii) each day spent reading submissions in preparation for a hearing.

(c) all reasonable expenses including necessary travel expenses (air fare in less than first class, hotel and subsistence and other direct travel expenses) incurred in connection with the Member's duties, as well as the cost of telephone calls, courier charges, faxes and telexes: a receipt shall be required for each item in excess of five percent of the daily fee referred to in sub-paragraph (b) of this Clause;

(d) any taxes properly levied in the Country on payments made to the Member (unless a national or permanent resident of the Country) under this Clause 6.

The retainer and daily fees shall be as specified in the Dispute Board Agreement. Unless it specifies otherwise, these fees shall remain fixed for the first 24 calendar months, and shall thereafter be adjusted by agreement between the Employer, the Contractor and the Member, at each anniversary of the date on which the Dispute Board Agreement became effective.

If the parties fail to agree on the retainer fee or the daily fee, the appointing entity or official named in the Contract Data shall determine the amount of the fees to be used.

The Member shall submit invoices for payment of the monthly retainer and air fares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a site visit or hearing. All invoices shall be accompanied by a brief description of activities performed during the relevant period and shall be addressed to the Contractor.

The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the DB; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of all sums paid in excess of one-half of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in Sub-Clause 14.8 of the Conditions of Contract.

If the Member does not receive payment of the amount due within 70 days after submitting a valid invoice, the Member may (i) suspend his/her services (without notice) until the payment is received, and/or (ii) resign his/her appointment by giving notice under Clause 7.

7. Termination

At any time: (i) the Employer and the Contractor may jointly terminate the Dispute Board Agreement by giving 42 days' notice to the Member; or (ii) the Member may resign as provided for in Clause 2.

If the Member fails to comply with the Dispute Board Agreement, the Employer and the Contractor may, without prejudice to their other rights, terminate it by notice to the Member. The notice shall take effect when received by the Member.

If the Employer or the Contractor fails to comply with the Dispute Board Agreement, the Member may, without prejudice to his other rights, terminate it by notice to the Employer and the Contractor. The notice shall take effect when received by them both.

Any such notice, resignation and termination shall be final and binding on the Employer, the Contractor and the Member. However, a notice by the Employer or the Contractor, but not by both, shall be of no effect.

8. Default of the Member

If the Member fails to comply with any of his obligations under Clause 4 (a) - (d) above, he shall not be entitled to any fees or expenses hereunder and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses received by the Member and the Other Members (if any), for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

If the Member fails to comply with any of his obligations under Clause 4 (e) - (k) above, he shall not be entitled to any fees or expenses hereunder from the date and to the extent of the non-compliance and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses already received by the Member, for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

9. Disputes

Any dispute or claim arising out of or in connection with this Dispute Board Agreement, or the breach, termination or invalidity thereof, shall be finally settled by institutional arbitration. If no other arbitration institute is agreed, the arbitration shall be conducted under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with these Rules of Arbitration.

Annex: Procedural Rules

Unless otherwise agreed by the Employer and the Contractor, the DB shall visit the site at intervals of not more than 140 days, including times of critical construction events, at the request of either the Employer or the Contractor. Unless otherwise agreed by the Employer, the Contractor and the DB, the period between consecutive visits shall not be less than 70 days, except as required to convene a hearing as described below.

The timing of and agenda for each site visit shall be as agreed jointly by the DB, the Employer and the Contractor, or in the absence of agreement, shall be decided by the DB. The purpose of site visits is to enable the DB to become and remain acquainted with the progress of the Works and of any actual or potential problems or claims, and, as far as reasonable, to endeavour to prevent potential problems or claims from becoming disputes.

Site visits shall be attended by the Employer, the Contractor and the Engineer and shall be co-ordinated by the Employer in co-operation with the Contractor. The Employer shall ensure the provision of appropriate conference facilities and secretarial and copying services. At the conclusion of each site visit and before leaving the site, the DB shall prepare a report on its activities during the visit and shall send copies to the Employer and the Contractor.

The Employer and the Contractor shall furnish to the DB one copy of all documents which the DB may request, including Contract documents, progress reports, variation instructions, certificates and other documents pertinent to the performance of the Contract. All communications between the DB and the Employer or the Contractor shall be copied to the other Party. If the DB comprises three persons, the Employer and the Contractor shall send copies of these requested documents and these communications to each of these persons.

If any dispute is referred to the DB in accordance with Sub-Clause 20.4 of the Conditions of Contract, the DB shall proceed in accordance with Sub-Clause 20.4 and these Rules. Subject to the time allowed to give notice of a decision and other relevant factors, the DB shall:

(a) act fairly and impartially as between the Employer and the Contractor, giving each of them a reasonable opportunity of putting his case and responding to the other's case, and

(b) adopt procedures suitable to the dispute, avoiding unnecessary delay or expense.

The DB may conduct a hearing on the dispute, in which event it will decide on the date and place for the hearing and may request that written documentation and arguments from the Employer and the Contractor be presented to it prior to or at the hearing.

Except as otherwise agreed in writing by the Employer and the Contractor, the DB shall have power to adopt an inquisitorial procedure, to refuse admission to hearings or audience at hearings to any persons other than representatives of the Employer, the Contractor and the Engineer, and to proceed in the absence of any party who the DB is satisfied received notice of the hearing; but shall have discretion to decide whether and to what extent this power may be exercised.

The Employer and the Contractor empower the DB, among other things, to:

(a) establish the procedure to be applied in deciding a dispute,

(b) decide upon the DB's own jurisdiction, and as to the scope of any dispute referred to it,

(c) conduct any hearing as it thinks fit, not being bound by any rules or procedures other than those contained in the Contract and these Rules,

(d) take the initiative in ascertaining the facts and matters required for a decision,

(e) make use of its own specialist knowledge, if any,

(f) decide upon the payment of financing charges in accordance with the Contract,

(g) decide upon any provisional relief such as interim or conservatory measures, and

(h) open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of the Engineer, relevant to the dispute.

The DB shall not express any opinions during any hearing concerning the merits of any arguments advanced by the Parties. Thereafter, the DB shall make and give its decision in accordance with Sub-Clause 20.4, or as otherwise agreed by the Employer and the Contractor in writing. If the DB comprises three persons:

(a) it shall convene in private after a hearing, in order to have discussions and prepare its decision;

(b) it shall endeavour to reach a unanimous decision: if this proves impossible the applicable decision shall be made by a majority of the Members, who may require the minority Member to prepare a written report for submission to the Employer and the Contractor; and

(c) if a Member fails to attend a meeting or hearing, or to fulfil any required function, the other two Members may nevertheless proceed to make a decision, unless:

  (i) either the Employer or the Contractor does not agree that they do so, or

  (ii) the absent Member is the chairman and he/she instructs the other Members not to make a decision.

SPECIAL PROVISION

SPECIAL PROVISIONS

SP-1 NOT USED

SP-2 THE ENGINEER'S FACILITIES

2.1 SCOPE

a) The Contractor shall provide, properly maintained and serviced, facilities for the Engineer (the "Engineer's Facilities") comprising of an office, (the Engineer's Office"), Survey Equipment (the Engineer's Survey Equipment") and Vehicles (the "Engineer's Vehicles") as specified hereinafter for the exclusive use of the Engineer during the whole Contract period.

b) The Contractor shall provide and pay for all consumables, the consumption of electricity, gas and water, and provide and pay for all other incidental and running costs related to the Engineer's Facilities.

c) The Engineer's Facilities shall be available and ready for use within 15 (Fifteen) days of the Commencement Date during this period of 15 days the contractor shall make an interim arrangement at his own cost by hiring suitable and acceptable office/vehicles etc to serve the purpose to the satisfaction of the Engineer.

d) The Contractor shall be responsible for and take all necessary measures to ensure the security of the Engineer Office and its contents at all times and shall employ watchmen for this purpose.

e) The Engineer's facilities shall be provided as per the requirements set forth in relevant SPs, under the pay item on the respective BOQ.

f) All facilities shall be provided by the Contractor for entire contract period. After expiry of the contract period, all facilities shall become the property of the Contractor except.

2.2 SITE LOCATION/LAYOUT

a) The location/layouts of the sites for the Engineer's Office is to be agreed by the Engineer and should take into account the following general requirements:

b) Safe access from the public road.

c) Paved areas for vehicle movement.

d) Covered areas for vehicle parking.

e) Dust suppression in unpaved areas.

f) Grading of the site to provide drainage.

g) Separate foul and surface water drainage system, with outfall and treatment as appropriate. Septic tanks being suitably distanced from and down-wind of occupied buildings.

h) Standby electrical generating capacity located and protected to avoid noise nuisance.

i) Suitable and convenient covered areas for storage of materials samples.

j) Ducts, cables, pipes and sewers for services and drainage.

k) A car washing area with a water source and proper drainage.

l) Areas of visual amenity having trees, flower beds, shrubs and so forth, with a water source nearby.

m) Security measures comprising perimeter fencing or walls, gates and guardhouses.

2.3 UTILITIES

a) Back-up electrical power supply by diesel generator (with Canopy) shall be provided. The generator shall have an automatic cut-in in case of failure of the main supply. The power circuit shall be equipped with voltage regulation to protect electrical equipment from overload and to ensure proper operation of computers and the like.

b) A continuous water supply shall be available for normal use. All kitchens shall be provided with potable water and the source shall be tested and certified by the Contractor at least monthly or at shorter intervals as directed by the Engineer.

c) Continuous supplies of water, gas, electricity and fuel for the stand-by generator shall be provided by the Contractor who shall be responsible for and pay all costs of installation, connection, maintenance and use. Fuel stored at site shall be protected against fire.

d) The Contractor shall take appropriate measures to discourage the presence or entry of termites, cockroaches, vermin and the like. Such measures may include chemical treatment of foundations, sealing of joints in construction and periodic fumigation.

e) Contractor shall be responsible to do all the formalities in acquiring and installing the Gas, Telephone, Water and Electricity connection for the respective building required under this SP.

2.4 COMMUNICATIONS

1. The Contractor will be required to pay for the cost of telephone calls (Mobile Telephones) made by the Engineer and his staff up to a total cost of Rs.10,000 per calendar month.

2.5 ESTABLISHMENT

1. Within 7 (Seven) days of the Commencement Date the Contractor shall submit to the Engineer the details of furniture and equipment for the Engineer's Office. The rental or office or Porta Cabins shall also be arranged within this period.

2. Within 7 (Seven) days of receiving the Contractor's proposal the Engineer will approve them with any necessary modifications and will instruct the Contractor to proceed with the procurement of the furnishings and equipment.

The Engineer's all Facilities (Offices, Vehicles, Survey Equipment, other equipment, furniture, fixtures, fittings etc) provided as per relevant SPs shall become the property of the Contractor three (03) months after the date of issue of the Completion/Taking-Over Certificate(s).

SP-3 ENGINEER'S OFFICE

3.1 SCOPE

The contractor shall provide the Engineer's office (1 no 8'x20') Porta Cabins or at-least four rooms rental building for each scheme (i.e total 4 nos).

a) The Contractor's Office will be situated adjacent to but at a reasonable distance from the Engineer's Office.

b) The Contractor shall maintain the Engineer's Office in good condition to the satisfaction of the Engineer for as long as required for the purposes of the Contract.

c) The Contractor shall provide the Engineerr with at-least two office messengers and pay for the same.

d) The office shall be provided with underground and overhead water reservoirs of adequate capacity.

e) The office shall be provided with all facilities in accordance with SP-2.

f) The Engineer's office along with fittings, equipment and furnishings will be handed over to the Contractor three six months after the date of issue of the Completion/Taking Over Certificate(s).

3.2 FURNITURE AND EQUIPMENT

In addition to normal stationery requirements, the Contractor shall provide for the Engineer's Office, furnishings and equipment complying at least to the following list, all to the approval of the Engineer and all for the exclusive use of the Engineer.

No.	ITEM
OFFICE FURNITURE	
8	Standard office desks with lockable drawers and glass top
4	Small tables
10	Swivel type padded desk chairs with arms and castors
1	Executive desk with lockable drawers and glass top with computer table
1	Executive type upholstered desk chair
1	Secretary's desk with chair and matching computer table
10	Standard office chairs
4	Lockable metal filing cabinets for drawings (1.0 x 0.80 x 0.75) m with 4 No. Drawers
3	Metal cabinets with two lockable doors and five shelves 0.95m x 0.50m x 1.85m high
3	Metal filing cabinets with four lockable drawers
5	Book cases with two shelves
3	Display boards
4	Metal waste baskets
4	Office clock, battery powered
4	Plastic trash containers, 500 mm diameter minimum by 750 mm high.

1 Electric water coolers

1 Desk lamps, fluorescent, 20 watts

4 Split type Air conditioners or as required

8 Standard size staplers

1 Heavy duty staplers

4 Paper cutters

1 Paper hole punches, heavy duty

10 Paper hole punches, light duty

1 Pairs of scissors, heavy duty

2 Pencil sharpeners, desk mounted

4 Calculators Scientific

1 Digital Camera, 35 mm single lens reflex Canon/Nikkon or similar, 35-150 mm zoom lens, electronic flash gun, carrying case, filters

4 Fire extinguishers (carbon dioxide), wall-hung

COMPUTER EQUIPMENT

2 Desktop PC latest with all accessories

1 Laser Printer (A3 + A4 paper size)

1 Colour Laser Printer A3 paper size

2 Uninterruptible Power supplies, 1 KVA.

1 Copies of the latest versions of the following PC software

Windows 7 and latest MS Office

- Autocad (latest version)

MISCELLANEOUS

2 Oxford Shorter English Dictionary (Soft/Hard copy)

2 English – Urdu and Urdu – English dictionaries

20 Construction hard hats, Safety Shoos, Jackets etc

Consumables including camera film, batteries for clocks and calculators, paper, cartages and all other office supplies as required.

Venetian blinds and cotton curtains on all windows

KITCHEN

1 Double stainless-steel sink with drain board

1 Electric refrigerator, 0.50 cu.m capacity with separate freezer compartment, self-defrost type

1 Gas stove with oven, four burners, and gas bottles as required.

1 Set of kitchen cabinets, lockable, with Formica top

1 Electric kettle

1 Electric coffee maker

1 Water heater, 60 liters per minutes

6 Tea towels

2 Towel racks

1 Exhaust fan

Tea pot, coffee pot, cups, saucers, glasses, spoons and serving trays for 24 persons

LAVATORIES

4 Hot water heaters, 6 liters per minute

4 Water closets, pedestal style

4 Wash basins with hot and cold water

4 Stainless steel lavatory paper holders

4 Paper towel dispensers

4 Mirrors, 400 mm x 500 mm

4 Ceramic urinals

4 Exhaust fan, ½ HP, 220 Volt

3.3 MEASUREMENT & PAYMENT

The cost of providing, furnishing and equipping the Engineer's Office shall be measured and paid for at the contract unit price quoted in the Bill of Quantities, which price and payment shall be full compensation for all costs of providing building, painting furnishing and providing all services, equipment, utilities, installations and access/service roads and for all materials, labour, equipment and incidentals for the proper completion of the work prescribed in these Specifications or as directed by the Engineer.

PAY ITEM NO	DESCRIPTION	UNIT OF MEASUREMENT
SP-3a	Engineer's Office (/Porta Cabins)	Lump Sum (L.S)
SP-3b	Equip and Furnish Engineer's Office	Lump Sum (L.S)

SP-4 TESTING OF MATERIAL THROUGH PRIVATE LABORATORY

The Contractor for the duration of the Contract shall arrange all quality tests required for the satisfactory execution of work through private laboratories.

The purpose of testing material and other construction activities as per the requirement of the Engineer, specifications and drawings, the Contractor shall propose three private laboratories to the Engineer for approval.

The cost of testing of material through private laboratory(ies) shall not be paid separately.

The work under this SP-4 shall neither be measured nor be paid separately. The cost incurred in this respect shall be deemed to have been included in other items of work.

In case of failure of the contractor to comply with all or any provision(s) of this SP-4, the damage(s) caused shall be attributable towards the Contractor, and the Engineer shall assess the amount of such damage(s) which shall be deducted from the monies due or to become due to the Contractor.

SP-5 MAINTENANCE OF ENGINEER'S OFFICE

5.1 SCOPE

1. The Contractor shall maintain the Engineer's Office in all respects, including all repairs and replacements of any item and the supply of all consumables.
2. The Contractor shall provide all necessary janitorial services and supplies for the Engineer's Office. The services shall include normal domestic servicing and cleaning, including lavatories and bathrooms, washing windows and so forth. Janitorial services shall be performed on a daily basis with personnel and to a programme of work approved by the Engineer.
3. The Contractor shall maintain the Engineer's Office in a neat, hygienic and attractive manner and provide daily garbage collection and disposal services.
4. The Contractor shall maintain fire extinguishers and air-conditioners as recommended by their manufacturers and shall clean and replace air-conditioner air filters at regular intervals of one month, or more frequently if required by service conditions or as otherwise directed by the Engineer.
5. The Contractor shall provide guard services for the Engineer's Office on a twenty-four-hour basis. The suitability, number and work schedule of all guard personnel shall be approved by the Engineer.
6. The maintenance of Engineer's Office shall also include payment of all utilities bills such as Gas, Mobile Telephone, Electricity and water etc. by the Contractor which shall not be paid separately and shall be deemed to be included in maintenance per month cost under the respective BOQ items of SP-5.
7. The Contractor shall provide these services from the date of acceptance of the individual facilities by the Engineer till three months after the issuance of the Completion/Taking-Over Certificate(s).

5.2 MEASUREMENT AND PAYMENT

The maintenance and servicing of the Engineer's Office shall be measured and paid for at the contract unit price quoted in the Bill of Quantities for the respective Pay Items listed below, commencing from the date of occupancy of the premises by the Engineer. In case of a Contract Extension, maintenance and servicing will be paid for on the same monthly basis, provided that it has been approved by the Engineer in accordance with the conditions of contract.

PAY ITEM NO	DESCRIPTION	UNIT OF MEASUREMENT
SP-5	Maintain Engineer's Office	Per Month

SP-6 ENGINEER'S SURVEY EQUIPMENT

6.1 SCOPE

1. The Contractor shall provide and maintain survey equipment for the use of the Engineer. All the survey equipment shall be new and shall be maintained throughout the Contract and replaced by the Contractor free of charge in case of damage or loss due to any caused. The Contractor shall also arrange calibration of all surveying equipment after every two months.
2. The Contractor shall provide and pay for experienced survey helpers for the Engineer as required by the Engineer.
3. The survey equipment after the completion of the project shall become the property of the Contractor.

6.2 EQUIPMENT

The Contractor shall provide and maintain the following survey equipment:

NO.	DESCRIPTION
1	Total Station survey units complete
1	Total Station accessories complete as under:
-	Interface Cable
-	Comms Plus Unit
-	Precision Wooden Tripod
1	Single Tilting Range Pole Prism complete as under:
-	Prism
-	Single Tilting Mount with Coaxial Target
-	Range Pole Telescopic Tripod with Soft Case
-	2 m Telescopic Range Pole
-	Range Pole Level
-	Soft Case
1	Single Tilting Prism with Coaxial Target complete as under:
-	Prism
-	Single Tilting Mount with Coaxial Target
-	Simple Carrier
-	Tribrach with Optical Plummet
-	Soft
1	Triple Tilting Prism with Coaxial Target complete as under:
-	Prism
-	Triple Tilting Mount with Coaxial Target
-	Simple Carrier
-	Tribrach with optical plummet

-	Soft case
2	Aluminium Telescopic Tripod
2	1 m Range Pole for Extension
1	Automatic Level complete
1	Aluminium Telescopic Tripod
3	Leveling Staff (local manufacture)
2	Range Pole Level
6	Steel measuring tape, 50 m long
6	Steel measuring tape, 20 m long
25	Steel measuring tape, 3 m long
12	Measuring rod (4 m)
18	Ranging rod with tripod

6.3 CONSUMABLES

The Contractor shall provide adequate supplies of expendable materials, such as pencils, rubbers, inks, notebooks, drawing paper, survey pegs, brushes, paints etc. as required by the Engineer.

6.4 MEASUREMENT AND PAYMENT

The cost of providing and maintenance of surveying equipment for the exclusive use of the Engineer, including survey helpers for the duration of the contract, shall be paid for at the contract unit price quoted in the Bill of Quantities for the respective Pay Items listed below, which price and payment shall be full compensation for all costs of providing survey equipment, survey helpers, materials and its maintenance and incidentals for the proper completion of the work prescribed in these Specifications or as directed by the Engineer.

PAY ITEM NO	DESCRIPTION	UNIT OF MEASUREMENT
SP-6a	Provide New Survey Equipment	Lump Sum
SP-6b	Maintain Survey Equipment	Per Month

SP-7 ENGINEER'S VEHICLES

7.1 SCOPE

1. The Contractor shall provide, maintain and make available at all times for the exclusive use of the Engineer the following vehicles on rental basis, the number and type of each being as specified below:

   i. Suzuki Cultus A/C and CNG ---------- 2 nos

   ii. Suzuki Bolan A/C and CNG----------2 nos

   iii. Honda CD-70 Motorcycles ---------- 4 nos

   All vehicles except motorcycles shall be air-conditioned.

2. All vehicles shall be fitted with 3-point inertia-reel seat belts for all occupants.

3. All the vehicles shall be provided for the Engineer's use within 15 days from the Start Date.

4. If the Contractor fails to provide the vehicles within the time specified, the cost incurred by the Employer in renting similar replacement vehicles plus a 20% (twenty percent) overhead charge shall be payable by the Contractor.

5. The vehicles shall be registered, taxed, comprehensively insured, fueled, repaired, serviced, cleaned and maintained by the Contractor for the duration of the Contract plus three months and temporarily replaced if, in the Engineer's opinion, any vehicle is not in a roadworthy condition.

6. The Contractor shall provide safe, experienced and competent drivers for all the vehicles except motorcycles, for the approval of the Engineer. Each driver shall be responsible for the vehicle allocated to him for the duration of the Contract. The Contractor shall promptly replace any driver who, in the Engineer's opinion, is not satisfactory.

7. The Engineer's vehicles shall become the property of the Contractor three months after the issuance of Completion/Taking Over Certificate(s).

PAY ITEM NO	DESCRIPTION	UNIT OF MEASUREMENT
SP-7	Provide Engineer's Vehicle (Rental) including maintenance of vehicles	Per Month

SP-8 NOT USED

SP-9 NOT USED

SP-10 PROTECTION OF THE ENVIRONMENT

10.1 GENERAL

The Contractor shall take all necessary measures and precautions and otherwise ensure that the execution of the works and all associated operations on-site are carried out in conformity with statutory and regulatory environmental requirements of Federal & Provincial Environmental Protection Agencies (EPA's) including those prescribed elsewhere in this document.

The Contractor shall take all the measures and precautions to avoid any nuisance or disturbance arising from the execution of the works. This shall wherever possible be achieved by suppression of the nuisance at source rather than abatement of the nuisance once generated. The provision of this SP shall, however, be disregarded in respect of emergency work required for saving life or the safety of the works. However, after completing such works of emergent nature, suitable environmental mitigation measures will be adopted by the contractor with the approval of Engineer.

In the event of any spoil or debris or silt from the sites being deposited on adjacent land, the Contractor shall immediately remove such spoils, debris or silt and restore the affected areas to its original state to the satisfaction of both the Engineer and the landowner.

Surplus excavation materials and topsoil shall, wherever possible, be used to reinstate quarries or borrow pits or other areas as may be approved by the Engineer. Such materials should be spread in such a manner as to limit subsequent erosion and the site shall be re-vegetated as existing ground cover dictates.

10.2 Borrow-Pits for Embankment Construction

Borrow-pits shall not be dug in the right of way of the road. However, even outside the ROW, depending upon type of soil strata, depth of water table, ground topography and prevalent vegetation state etc, a minimum distance for such borrow areas will be pre-specified by the Engineer. The main ruling factors for determining such distances will be the highway safety from capillary action where pore pressure may damage the pavement and the water stagnation, becoming a source of disease vector.

10.3 Quarry Operations

The Contractor shall obtain materials from licensed and government approved quarries only. The quarry operation shall be undertaken within the purview of the rules and regulations in force.

10.4 Soil Erosion and Sedimentation Control

The Contractor shall carry out the works in such a manner that soil erosion is fully controlled, and sedimentation and pollution of natural watercourses, ponds, tanks and reservoirs is avoided. At suitable places sedimentation basin with impervious linings will be constructed for containing, stopping and trapping any silt run off for premature siltation of downstream watercourses and reservoirs.

10.5 Conservation of Fauna and Flora

The Contractor shall adopt all measures and take necessary precautions to avoid disturbance to fauna and flora, as far as possible. Felling of trees and removal of vegetation for fuel or other uses will not be practiced.

10.6 Fuel and Chemical Storage

All fuel and chemical storage shall be sited on an impervious base within an embanked area and secured by fencing. The storage area shall be located away from any watercourse or wetland. The base and walls of the embankment shall be impermeable and of sufficient capacity to contain 110% of the volume of tanks.

Filling and refueling shall be strictly controlled and subjected to formal procedures. All valves and trigger guns shall be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use. The contents of any tank or drum shall be clearly marked. Measures shall be taken to ensure that no contamination happens, or discharges enter any drain or water courses.

10.7 Water Quality

The Contractor shall prevent any interference with the supply to or abstraction from polluted water sources (including underground percolating water) as a result of execution of the works.

Areas where water is regularly or repetitively used for dust suppression purposes shall be laid to fall to specially constructed settlement tanks to permit sedimentation of particulate matter. After resettlement, the water may be re-used for dust suppression.

All water and liquid waste products arising on the sites shall be collected and disposed of at location outside or off site and in a manner that shall not cause nuisance or pollution.

The Contractor shall not discharge or deposit any matter arising from the execution of the works into any place except with the permission of the Engineer and the regulatory authorities concerned.

The Contractor shall protect all watercourses, water ways, ditches, canals, drains, lakes and the like from pollution, silting flooding or erosion as a result of the execution of the works.

The Contractor shall submit the details of his temporary drainage works system (including all surface channels, sediment traps, washing basins and discharge-pits) to the Engineer for approval prior to commencing work on its construction.

10.8 Air Quality

The Contractor shall devise and arrange methods of working to minimize dust, gaseous or other air borne emissions and carry out the works in such a manner as to minimize adverse impacts on air quality.

Bituminous hot-mix plants and concrete batching plants shall be located sufficiently away from habitation, agricultural operations or industrial establishments.

The Contractor shall utilize effective after sprays during the delivery and handling of materials when dust is generated and dampen stored material during dry weather.

Stockpiles of materials should be sited in sheltered areas or within hoarding, away from sensitive areas. Stockpiles of friable materials shall be covered with clean tarpaulins with application of sprayed water during dry and windy weather. Stockpiles of debris shall be dampened prior to their movement, except where this is contrary to the specifications.

Any vehicle with an open load carrying area used for transport of potentially dust producing materials shall have properly fitting side and tailboards. Materials having potential to produce dust shall not be loaded to a level higher than the side and tail boards and shall be covered with clean tarpaulin in good condition. The tarpaulin should be properly secured and extended to at least 300 mm over the edges of the sideboard and tailboard.

During high wind, no dust generating operations shall be permitted within 200 m of residential areas having regard to the prevailing direction of the wind.

Construction vehicles and machinery shall be kept in good working order and engine turned off when not in use. Appropriate measures shall be taken to limit exhaust emissions from construction vehicles, machinery and plant and the Contractor shall include details of such proposed measures in the mitigation and monitoring plan to be submitted to the Engineer.

In residential areas or other sensitive areas, such as nurseries, schools, hospitals, etc. advance warning shall be given to potentially affected persons so that some measures can be taken by them before commencement of the works.

Any open vehicle carrying a load of freshly mixed asphalt concrete for transportation and laying the pavement must have a full cover of tarpaulin sheet. In this manner its toxic fumes will be reduced against any atmospheric contamination.

10.9 Noise

The Contractor shall consider noise as an environmental concern in his planning and during execution of the works.

The Contractor shall use plant and equipment conforming to international standards and directives on noise, vibrations and emissions shall include the details of measures for abating noise at source in the mitigation and the monitoring plan to be submitted to the Engineer.

10.10 TRANSMISSION OF DISEASES

Contractor shall take all necessary measures to prevent transmission of diseases between inhabitants and the labourers engaged for the works, especially with regard to sexually transmitted diseases. The Contractor shall install the necessary medical facilities for this purpose.

The Contractor shall verify that checkup for detecting the occurrence of sexually transmitted diseases amongst the labourers engaged for the works are actually being carried out and submit a certificate to that effect to the Engineer.

10.11 PRESERVATION OF ARCHAEOLOGICAL, CULTURAL, RELIGIOUS ASSETS/HERITAGE VALUE AND ANTIQUITIES

The Contractor shall take all necessary measures to protect any archaeological finds or antiquities as required.

Where antiquities are shown on the drawing or otherwise identified during the course of the works, these shall be protected by means of suitable fencing and barriers to the satisfaction of the Engineer. The Contractor shall provide and maintain access at all time for persons wishing to stop and pay their respects.

10.12 ENVIRONMENT ENHANCEMENT

All existing highways and roads used by vehicle of the Contractor or any of his sub-contractors or suppliers of materials or plant, and similarly any new roads which are part of the works and which are being used by traffic, shall be kept clean and clear of all dust/mud or other extraneous materials dropped by the said vehicles or their tyres. Similarly, all dust/mud or other extraneous materials from the works spreading on these highways shall be immediately cleared by the Contractor.

Clearance shall be affected immediately by manual sweeping and removal of debris, or, if so, directed by the Engineer, by mechanical sweeping and clearing equipment, and all dust, mud and other debris shall be removed entirely from the road surface. Additionally, if so, directed by the Engineer, the road surface shall be hosed or watered using suitable equipment.

Any structural damage caused to the existing roads by the Contractor's construction equipment shall be made good without any extra cost.

On completion of the works, the Contractor shall reinstate all areas with proper vegetation to the satisfaction of the Engineer.

The Contractor shall remove all old tyres and internal rubes from within the limits of right of way and subject to the agreement of adjacent landowners for additional areas of 75 m on either side of the road centerline. The Contractor shall dispose of all materials in a manner approved by the Engineer.

Where directed by the Engineer, the Contractor shall improve and reinstate the land on which informal roadside service area has been established, by removing all debris and contaminated soils, regarding to natural ground levels and reestablishing the original vegetation where appropriate. All debris and contaminated materials shall be disposed of on site as approved by the Engineer.

10.13 MEASUREMENT AND PAYMENT

The work under clause SP-10 (Protection of the Environment) shall neither be measured nor be paid separately. The cost incurred in this respect shall be deemed to have been included in other items of work.

In case of failure of the contractor to comply with all or any provision(s) of this clause the damage(s) caused shall be attributable towards the Contractor, and the Engineer shall assess the amount of such damage(s) which shall be deducted from the monies due or to become due to the Contractor. However, the said amount may be reimbursed to the Contractor on rectification of all damage caused and subsequent certification by the Engineer that the said damage has been rectified by the Contractor at his own cost as per the requirements specified herein above.

Where directed by the Engineer, the Contractor shall improve and reinstate the land on which informal roadside service area has been established, by removing all debris and contaminated soils, regarding to natural ground levels and reestablishing the original vegetation where appropriate. All debris and contaminated materials shall be disposed of on site as approved by the Engineer.

However, for third party monitoring of protection of environment and Environment Mitigation Measures, the Employer is planning to hire the services of third party whose fees will be paid through the Contractor for which Provisional Sum will be provided in the BOQ.

SP-11 HEALTH, SAFETY & ENVIRONMENTAL (HSE)

11.1 GENERAL HSE REQUIREMENTS

11.1.1 Compliance to Laws/Regulations/Company Requirements

The Contractor shall comply with all applicable Health, Safety and Environmental (HSE) laws and regulations including fire and security, which are applicable to the location where the works are being carried out.

The Contractor shall indemnify the Employer against all legal costs, fines and compounds imposed and claims and damages incurred as a result of breach or non-compliance with relevant laws and regulations. Contractor shall comply at all times with the requirements as set forth by the Employer in this contract. These requirements are intended to supplement any known or ought to be known laws and regulations applicable at the location where the works are being carried out.

The Contractor shall take all necessary HSE precautions related to or arising out of the performance of the Contract in order to protect the work, the personnel and property of the Employer, the Engineer, the Contractor, Subcontractor, all third parties and public from the hazards associated with the work.

The Contractor shall implement permits/permission based system for all hazardous activities.

11.1.2 Contractor Written Policy/Organization

The Contractor shall acknowledge the Employer's strong commitment to HSE and affirm that it has a written HSE policy which is a standard comparable to international standards and which has been signed and is actively supported and endorsed by the Contractor's management.

The Contractor shall further affirm that its HSE policy is widely disseminated and understood among the Contractor and Subcontractor's employees.

The work's policy should allow workers to refuse work for non safe work practices or if they feel that their safety is being jeopardized.

11.1.3 Protection of Employees, Public, Assets and Environment

The Contractor shall protect the safety and health of workers and people living or working near the construction activity from potential hazards created by that activity. The Contractor, without cost to the Employer, must take all necessary precautions to protect the public and minimise disturbance and inconvenience to the public resulting from performance of the work.

Throughout performance of the work, the Contractor shall conduct all operations in such a way as to minimize any impact upon the natural environment including compliance with all laws, regulations and rules applicable to the site. The Contractor agrees to indemnify the Employer and the Engineer and their staff for all claims, damage costs and penalties relating to any environmental damage or loss or non-compliance with any laws or regulations arising out of the Contractor and / or Subcontractor performance of works.

11.1.4 Right to Stop Work

The Engineer or his designated representatives shall have the right to prohibit commencement of works or to stop any works in progress if the equipment, machinery, personnel or work conditions are considered to be unsafe or not to be in compliance with any applicable rules, regulations and procedures.

Stoppage of the work shall be at the Contractor's expense until the Contractor has satisfactorily rectified such unsafe acts and condition. In the event of serious or repeated infringements, the Employer may terminate the contract without compensation.

11.1.5 Maintain Equipment and Machinery in a Safe Condition

The Contractor shall ensure that all Contractor's machinery, plant & equipment, facilities and other items in any way associated with or utilised in the work are fit for use and maintained in a safe and good working condition.

11.1.6 Risk Management and Hazards Identification

The Contractor shall make an initial assessment of the HSE risks involved in the execution of the works. The focus of the assessment should be to evaluate the inherent hazards in conducting the work and the potential adverse consequence of an accident to the workforce, the public and the environment, company assets and reputation.

The Contractor shall take appropriate measures to prevent incidents from occurring and to minimise the consequence of an event should it occur.

The Contractor shall conduct HSE inspections and audits to ensure that such preventive measures are carried out. The Contractor shall promptly conform to all recommendations made pursuant to the said inspections and audits.

11.1.7 Competent Personnel

The Contractor shall ensure that competent personnel are fully trained and certified to carry out the task of operating all machinery, equipment, and tools. The Contractor shall provide an adequate level of technical and HSE related training conducted by a recognized training institution for all relevant personnel in connection with the work. All Contractor's supervisory personnel shall attend relevant HSE training and be competent in hazard identification.

The Contractor shall ensure that all Contractor and Subcontractors personnel engaged in the works are healthy and fit, and possess the experience and skill required to perform the works.

11.1.8 HSE Awareness

The Contractor shall be responsible for maintaining and enhancing the HSE awareness among its personnel and subcontractor's personnel, including arranging safety induction, toolbox, regular HSE meetings and emergency drills.

Findings of hazard identification including Job Safety Analysis shall be communicated to the Contractor's personnel. Copies of minutes of the Contractor's safety meetings shall be submitted to the Engineer.

11.1.9. Incident Reporting

The Contractor shall report to the Engineer immediately of the occurrence of any incident or accident including near misses. The Contractor shall also alert

fire brigade, police and /or other authorities relevant to the incidents or accidents. The Contractor shall be responsible for reporting accidents and incidents to relevant Government Agencies.

All incidents or accidents that result in or have the potential to cause serious injury or property damage must be suitably investigated by the Contractor and reported to the Engineer.

The Contractor shall maintain accurate incident and injury reports and shall comply with the Engineer's requests for information relating to accidents, injury or illnesses.

11.1.10. Housekeeping

The Contractor shall ensure that good housekeeping is maintained continuously throughout the duration of the work. Due regard being paid to proper disposal of scrap material, tidiness, and clear access ways and emergency exits.

Access and egress of all exits, fire and safety equipment, and work areas must be kept clear of obstructions at all times. Special attention must be given to maintaining clear walkways, removal of slippery and tripping hazards, securing or removing of loose materials at height, and proper storage of materials. Oily or chemical soaked rags must be disposed of in a proper manner. All housekeeping shall be at The Contractor's cost.

11.2. SPECIFIC HSE REQUIREMENTS

11.2.1. Site SHO/Safety Supervisor

The Contractor shall, at Contractor's cost, provide such numbers of qualified Safety and Health Officers (SHO) or supervisors who will be responsible to provide guidance and advice pertaining to Health, Safety and Environment (HSE) requirements of works. He shall guide Contractor's management on hazard assessment and measures, with equal diligence being paid to fulfillment of the contractual technical specifications.

In addition to the ongoing monitoring of the site, the Contractor's SHO or supervisors shall also perform a formal inspection of the site at least once every week to identify and correct any hazardous conditions noted. A written record of all inspections and their status of action follow-ups shall be given to the Engineer.

Prior to start of works, the Contractor shall submit the CV of the proposed SHO or supervisors for the Engineer's approval.

11.2.2. Project HSE Plan

One week, prior to mobilization, the Contractor shall prepare and submit a project specific HSE plan to the Engineer which, as a minimum, describes the followings:

- Prevailing laws and regulations
- Contractor's HSE policy
- Contractor's organization including position for HSE manager
- HSE responsibilities of key personnel
- Hazards review including control and mitigating measures
- Description and schedule of HSE activities

- Accident/incident reporting
- Emergency response plan
- Internal Audit mechanism for improving HSE plans.

The Engineer's review or comments on such plan shall not relieve nor shall such review and comments to be construed as limiting in any manner the Contractor's obligations to undertake any action which may be necessary to establish and maintain safe working conditions at the location where the works are being carried out.

11.2.3. Equipment Safety Inspections

Prior to start of works, the Contractor is required to inspect the equipment and machinery required in connection with the works including but not limited to cranes, bulldozers, trucks, tractors, rigs, dumpers, etc., to ensure that works will be performed under safe condition.

In addition, the Contractor shall maintain and perform continuous safety inspection throughout the works and shall promptly implement all recommendations made pursuant to the said inspection.

The Engineer shall have the right to conduct its own safety audit or inspection at worksite. The Contractor shall comply with all recommendations arising from such audit or inspection.

The Contractor shall ensure that all fuel powered and electrical equipment working in the vicinity of flammable vapors is equipped with proper ignition protective devices. The Contractor shall ensure that only permitted personnel by way of previous technical training and familiarization are allowed to operate and/or maintain equipment and machinery.

11.2.4. Personal Protective Equipment (PPE)

The Contractor shall at its own cost, supply its personnel and subcontractor's personnel required in connection with the works with adequate PPE and maintain enforcement on the use of such PPE.

The Contractor shall purchase PPE in accordance with the following specification - PPE STANDARDS & TECHNICAL SPECIFICATIONS.

1	Safety Glasses	Frame: Wide vision, clear plastic eye shield with side protection which can be worn over spectacles Lenses: Clear polycarbonate affording BS2092 Grade 2 impact protection Marking: all eye shields shall be appropriately and distinctly stamped with the authentic trademarks of the Manufacturer's monogram and standards. Accessories: Neck strap only Certificate: Manufacture's Certificate of compliance to standards. ANSI Z 87.1-1979 ANSI ZZ 87.1-1979 AS 1337-1981 BS 2092, BS1542, BS679, DIN 4646/58211

2	Safety Shoes	
	for general use	Hazard control: Crush from heavy objects (steel toe), Cuts and Puncture, Slip (oil resistant sole), Trip & Fall and Electrocution. ANSI Z 41.1-1967 AS 2210 EN 345
	For chemical use	Hazard control: Crush from heavy objects(steel toe), Slip(oil resistant sole), Trip & Fall and Chemical contact BS 1870/3 , DIN 4843
3.	Coverall	One-piece coverall, Long Sleeve. Flame/fire retardant material Nomex III A (DuPont Product) Weight : min 150 gm/m^2 Colour : Dark Green
4	Hand Protection	All types of gloves, cotton, leather or PVC conforming to BS 1651 are acceptable.
	Cotton Glove	Knitted Cuffs, palm, thumb and forefinger with anti-slip, PVC Dots. Overall length 250mm
	Leather Cotton Glove	Cotton drill knitted cuffs with chrome leather palm. Overall length 250mm
	PVC Glove	PVC over knit cotton interlock standard weight and smooth surface. Length 400 mm.
5	Hearing Protection	
	Ear muff	Adjustable all-purpose headbands BS 6344, ANSI S 3.19
	Ear muff on helmet	Adjustable BS 6344, ANSI S 3.19
	Ear plug/insert	Expandable Foam, Non -toxic and Nonirritant ANSI Z 24.22 ANSI s 3.19-74 BS 5108, ISO 4869
6	Head Protection	Peak type, Chemical resistance complete with hot press branding adjustable headband, Clip and Elastic chin straps Material: ABS (Acrylic Butadiene Styrene Added with Nitrile) ANSI Z 89.2-71, ANSI Z 89.1-86 class B, AS 1808-81, BS 5240, DIN 4840
7	Eye/face Protection	
	Chemical splash goggle	Goggles with hooded ventilation - 2 (face shield (9) in combination with safety glasses - 4, 5) ANSI Z87.1-68
	Face shield	Goggles or Safety glasses - 1,3, 4, 5 (for severe exposure face shield – 9) ANSI Z 89.1

	Welding goggles	Welding goggles with tinted lenses 6, 7, 8 (for severe exposure face shield - 9) ANSI Z 87.1-68, ANSI Z 87.1-79

8	Safety Harness/lifebelt	The harnesses shall be constructed of shock-absorbing material e.g. Webbing manufactured from synthetic fiber. Similar, safety lanyards shall also be of synthetic fibers e.g. Polyamide, nylon or polyester. To reduce possible injuries to the users from decelerating forces, safety harnesses, the leg and shoulder load-carrying straps at least 38mm (1.5 inches) wide. Each safety harness must be provided with one or more D-rings suitably positioned for attachment to a safety lanyard. They shall withstand a 5000 lb (2300 kg) force without breaking or cracking. Buckles should be of a universal-friction type. Harnesses with load-bearing single-insertion type buckles are not permitted. Snap hooks for safety lanyards shall be of the self-closing type and shall be designed so that disengagement of each of the latches requires a deliberate action. All harnesses and safety lanyards shall carry test certificates or certificates of compliance to the standards to which they are manufactured. Two types of safety harnesses are recommended, and they are classified according to their intended use:- Chest Harness - Class II Body Harness - Class III AS1891, BS1397, MS707, LS 954-lanyard
9	Personal floatation Devices(PFD's) Life Jacket Work Vest	It is intended as an aid to turn an unconscious person in the water from a face down position to a vertical and slightly backward position which greatly increases the chance of survival. Type 1 PFD USGC(US Coast Guard) It is intended as an aid to floatation should the wearer fall into the water. Type V PFD USGC(US Coast Guard)
10	Breathing Apparatus	BS 4667, NIOSH
11	Self-contain Breathing Apparatus	NIOSH, ANSI, AS, BS
12	Other Respirator for protection from dust, vapors, etc.	BS 2091, NIOSH, EN 149

13	Fire Fighting Suits	NFPA 1971, NBSIR 75, US OSHA CFR 1010 VOL 45

11.2.5. Mechanical Equipment Operation

The Contractor shall upon arrival at the worksite, inspect all mechanical construction equipment that is to be utilized in the work.

The equipment will include but may not be limited to the following:

- Cranes
- Dozers
- Graders
- Rollers
- Excavators
- Forklifts
- Dumpers
- Semi-Trailers and Prime Movers
- Compressors
- Temporary Electrical Distribution Boards
- Scaffolding equipment
- Rigging equipment
- Man-cages/Personal Baskets
- Aerial Work Platforms
- Etc

All equipment inspected that requires remedial work (or replacement) shall be carried out at the Contractor's cost.

All equipment inspected and accepted for use on the work shall be clearly identified by a tagging system.

11.2.6. Occupational Health

The Contractor shall ensure that all its employees and subcontractor employees engaged in the work are medically fit and healthy. Any medical diseases or disabilities which the Contractor may consider will not adversely influence the employee's ability to perform his role in the work, should be reported to the Engineer prior to start of the work.

The Contractor shall at no cost to the Employer be responsible for the medical welfare of its own and subcontractor employees and shall take care of arrangements for medical attendance, treatment or hospitalization if and when necessary and will arrange suitable insurance coverage for such contingencies.

The Contractor shall at its own expense have a fully equipped first aid station on site and make arrangement for availability of an ambulance. This station will be manned during all working hours.

The Contractor shall ensure that its personnel and subcontractor's personnel shall maintain a high standard of hygiene in connection with the performance of the work.

The Contractor shall provide where necessary sufficient hygienic drinking fluids and toilet facilities to meet health regulations and all other legislated requirements.

11.2.7. Confined Space

The Contractor shall take precautions which include gas/oxygen tests, PPE requirement, respiratory equipment, isolation of connections to confined space, provide ventilation and making confine space free from fumes, place person on standby, ensure availability of rescue equipment and team.

The Contractor's SHO or supervisor shall ensure that all necessary precautions and protective measures are implemented.

The person(s) shall be certified medically fit before they are allowed to work in confined space.

11.2.8. Emergency Response Preparedness

The Contractor, at its own cost, shall ensure adequate provision for emergency response at site for all hazardous and risky works, which as a minimum, includes the following;

- fire fighting
- fire prevention
- accidents or incidents
- epidemic spread
- first aid medical facilities
- any other hazardous/risky activity identified during execution

The Contractor personnel shall be trained and competent in the use of firefighting equipment effectively.

The Contractor shall also ensure its first aiders are trained and competent to render such services effectively.

11.2.9. Tools and Equipment

The Contractor shall ensure that all Contractor's machinery, tools and equipment, facilities, and other items associated with the works whether purchased or rented are maintained in a safe condition and to be operated by competent operators. Tools shall only be used for the job they were designed to perform. All guards must be fitted and shall be in good condition at all times. All grinding discs must be checked for correct size and speed prior to fitting. Electrically powered tools shall meet the hazardous zones requirement where applicable. All electric cables shall be industrial type. Use of domestic electric cables is prohibited. The Contractor shall repair or replace defective tools and equipment at its own cost. Appropriate personal protective equipment must be worn at all times when using any tool or equipment.

11.2.10. Compressed Gas Cylinders

The Contractor shall ensure that:

- ✓ Mineral and Industrial Gases Safety Rules, 2010 should be followed.
- ✓ Compressed gas cylinders are stored, transported or used shall be in an upright position and secured to some substantial object or structure by a

chain or other suitable means capable of supporting the weight of the cylinder. This applies to all cylinders, whether empty or full.

- ✓ Cylinder valves shall be closed, and hoses depressurized when cylinders are not in use.
- ✓ Cylinders shall have protective valve caps in place while they are being transported/stored.
- ✓ Cylinders shall be returned promptly to a suitable storage area after use. They shall not be left at any worksite. Cylinder storage areas should be kept away from general traffic paths and must not be adjacent to vehicle paths.
- ✓ Flammable gases and oxygen cylinders must not be stored in close proximity unless separated by a non-combustible wall.
- ✓ Cylinders may only be hoisted when enclosed in an approved box or cradle within which they are securely fastened.
- ✓ Cylinders must be identified by a colour code in accordance with Malaysian or respective national standards.
- ✓ Gas welding cylinders shall have hose check valve (non-return valves), which allow gases to the blowpipe, but not back from it. Flashback arrestors shall be installed to quench flashback flames and cut off the gas flow automatically, in both oxygen and fuel gas outlet lines.

11.2.11. Welding and Cutting

The Contractor shall ensure only competent, authorized workers be allowed to use welding equipment. Hard hats are not required to be worn by welders during actual process of welding if there is no immediate potential for head injury.

The Contractor shall ensure suitable precautions against exposure of welding hazards such as excessive ultraviolet radiation, fire, or dusts.

Welding, and/or flame cutting in the vicinity of flammable or combustible items shall only done under the control of qualified persons.

The Contractor shall provide adequate number of suitable fire extinguishers at a welding site. Welders must be competent in the use of these extinguishers.

The Contractor shall carried out all welding and cutting works following WB EHS General Guidelines, OHSA regulations, AWS/ASME/BS/CEN/ISO relevant standards.

11.2.12. Grit Blasting

The Contractor shall take permit prior to grit blasting. The Contractor shall provide the blaster with an approved air mask and oil free air supply. Associated workers and any other personnel within the blasting area must wear approved respiratory protection. The blasting gun must have a 'dead man' safety device operated by the blaster. Under no circumstances the device be tied back.

The Contractor shall made efforts to minimize the exposure of the blasting grit to the surrounding environment. Protective shield shall be erected, and notice board shall be posted in order to prevent exposure of the blasting grit.

11.2.13. Chemicals

The Contractor shall ensure all requirements for storage, handling and personal protection outlined in the material safety data sheet are followed.

Solvents, cleaners and cleaning agents must not be stored or used in unventilated areas or in immediate proximity to any sources of ignition. Quantities of such materials greater than needed for one day's work must be stored outside the work area in a proper storage facility. Smoking is not permitted while using or in the vicinity of any such chemical.

11.2.14. Driving/Vehicle Safety

The Contractor's personnel travelling to and from worksite shall use proper means of transport. Such transport shall comply with the Pakistan Statutory Rules made under the Road Traffic. Transportation of personnel in open trucks is prohibited unless fitted with seats and certified to carry passengers. The Contractor shall be responsible to provide safe access and egress to the worksite. The Contractor shall set allowable speed limit and place suitable road signs at the worksite.

The Contractor shall maintain and enhance the awareness of safe driving among its employees and its subcontractors. This includes wearing of seat belt, observing speed limit, maintain good vehicle condition, driving defensively and possess valid driving license.

11.2.15. Electrical Safety/Power Source

No part of any lifting device or any equipment operated around power lines is closer than below:

150-750 V	2.0 m
750- 50k V	3.0m
50k-250k V	4.5m
250kV	6.0m

For High Tension Lines 9.0m

The above clearance applies in all directions. All overhead lines shall be identified with a highly visible sign placed 7m from both sides of the lines, 1.8m above ground. A restriction guard pole connected with ropes shall be installed to restrict clearance close to power lines.

It is mandatory to follow NEPRA Power Safety Code 2014 for all electrical works

11.2.16. Excavation

The Contractor shall ensure that all excavation works shall meet the following requirements as a minimum:

- ✓ Prior to embarking excavation work, proper design and plan shall be drawn up taking into account the soil type and the weather conditions and proximity to facilities.
- ✓ Walkways between trenches should be kept clear of obstruction.
- ✓ A competent person must inspect all excavations, shafts, tunnels and earthworks of any description each day when persons are working.

- ✓ A standby person shall be made available at all times equipped with all necessary safety equipment.
- ✓ All excavation exceeding 1.5 meters shall be shored. For excavation exceeding 2 meters deep, a confined space permit shall be secured.
- ✓ No mechanical excavation within 1 meter of the existing service is allowed. All underground services must be hand exposed and identified.
- ✓ All excavation operations should be carried out following WB EHS General Guidelines., ISO 93.02, ILO standrads, OHSA standards.

11.2.17. Barricade, Platforms and Guardrails.

The Contractor shall provide adequate barricades, covers, guardrails, signal flag persons or other appropriate warning devices to protect personnel near any hazardous operations or overhead work. Temporary covers for floor openings shall be firmly fastened and clearly identified by warning signs.

All elevated work areas, walkways, platforms etc. whether permanent or temporary, shall be protected by an approved guardrail (consisting of an upper and intermediate rail and toe board) and shall provide a sturdy working space. The Contractor shall provide all the necessary signs, barriers, flag persons, etc. to protect the general public from exposure to injury from the work.

11.2.18. Scaffold

A safe means of access must be provided for any work to be carried out at a height greater than 2 meters above ground. If a suitable permanent access is not available, a well-designed, erected, inspected and maintained scaffold will provide a safe means of access and safe working areas. Additionally, safe access to scaffold work platforms by ladder must be provided. All scaffoldings shall be constructed in accordance with B.S 5973 Code of Practice for Access and Working Scaffolds and Special Scaffold Structures in Steel or its equivalent.

All scaffolding materials and components shall be as follows:

a. Scaffold tubes

All tubes must be galvanized steel 48.3mm OD and wall thickness 4mm comply to BS 1139 Part 1, 1982 and free from cracks, splits or excessive corrosion and straight. Black steel or aluminum scaffold not allowed in offshore.

b. Coupling and fittings

They must be of sound construction, comply with BS 1139, Part 2. Do not mix tubular and fittings of different standards.

c. Board or decking

All timber scaffold boards shall meet the international standards.

d. Ladders (If Applicable)

Ladders shall meet BS 1129:1982.

e. Frame or tubular scaffold

Only proprietary steel frame or tubular scaffold of sound design and construction are allowed as per manufacturer specification.

f. Inspection (If Applicable)

A scaffold inspector shall inspect all scaffold material. Any scaffold above 40 meters must be designed and endorsed by a professional structural and forward to DOSH.

g. Erection

Scaffolds must only be erected, altered or dismantled by competent scaffolder under supervision of a chargeh and scaffolder. All inspection of any scaffold shall be done by a scaffold inspector.

11.2.19. Camp Site

The Contractor shall construct and operate the camp in accordance to the following requirements:

- Air-condition rooms
- Electrical equipment and wiring to safety standard
- Smoking in bedrooms prohibited
- All fuel lines are properly connected
- Smoke detectors in rooms
- Fire extinguishers at strategic locations
- Evacuation procedures posted

11.2.20. Office

The Contractor shall maintain comfortable working condition in office as follows:

- Temp 20-26 deg C
- Humidity 40-60%
- Adequate ventilation
- No smoking policy
- Photocopy placed away from personnel workstations
- Adequate lighting comfortable to the eyes at 400 lux
- Recommend white ceiling
- Colorful posters/picture on walls
- Office space at 6.25 sq. m per workstation
- Welfare facilities e.g. toilet, eating area
- Cleaning daily
- Clear passageways, remove tripping hazards
- Emergency plans for evacuation
- Ensure car park well-lit and control of vehicle movement
- Office chairs with 5 wheels and adjustable seat height and back rest
- Reduce VDU screen glare
- Frequent breaks for key board operator
- Gentle stretching exercise before work and after lunch
- Keep first aid box

11.2.21. Storage/Warehouse

The Contractor shall ensure an acceptable means for storing of material, chemical and fuel on sites. The requirements for storing of materials shall also include the following:

- Construction material shall be stored at the designated on site location
- Written procedures on handling and disposal for all material must be made available
- Good housekeeping must be practiced at all storage sites
- Storage areas must be located away from vehicular traffic at areas
- Storage floors and bins shall be labeled and constructed to safely support the loads that are to be imposed upon them with a posted appropriate maximum safe load limits provided
- Storage buildings and warehouses must be provided with an approved lighting, well ventilated and constructed with a fire resistance or explosion proof facilities where appropriate for the chemicals or fuel stored.
- Welding, cutting or any other operations that create sparks must be prohibited inside a warehouse or near the flammable/combustible material storage yards
- Adequate number of fire extinguishers of appropriate type shall be made available at all storage areas and warehouses.
- All personnel shall wear approved hard hats while in storage areas.
- Flammable and combustible liquids shall be stored separately preferably in storage buildings.
- Storage rooms shall be constructed to meet the required fire-resistant rating for their use
- Approved safety cans/cabinets shall be used to store and transfer flammable and combustible liquids, with the name of the material clearly stamped
- "No Smoking" signs shall be posted at storage areas involving flammable and combustible liquids

11.2.22. Explosives

The Contractor shall ensure that every reasonable precaution will be taken to ensure that Contractor's personnel dealing with the explosives observe recognized industry regulations in the correct transportation, storage and usage of explosives. Similar precautions must be exercised when dealing with other potentially hazardous sources e.g. flammable substances.

The Contractor shall obtain all relevant permits and comply with the regulatory requirements for the use of explosives.

11.2.23. Transportation

Whether by land, sea or air, the Contractor is obliged to follow recognized industry guidelines for the safe transport of personnel and equipment.

11.2.24. Lifting

All cranes supplied by the Contractor shall be tested before going into service and witnessed by the Engineer and a competent person. All associated lifting equipment shall be inspected.

The Contractor shall maintain cranes in a safe condition and make repair or replace unsafe crane for works. Should there be any doubt to the safety of the crane, the Contractor may be required to perform load test at the Contractor's cost.

A colour coding shall be used to identify inspected lifting appliance. The Contractor shall seek approval from the Engineer on any heavy lifting of 15 tons and above. The Contractor is responsible for ensuring that a competent, authorised worker operates any lifting device and that a signaler is designated to signal the operator as necessary to properly place and control the loads.

Prior to performing any lift, the operator shall determine the weight of the object being lifted and ensure that cables, lifting device and any slings, wire rope, chains etc used in the lift are of a sufficient strength to support the weight of the load.

No worker shall be allowed under the load. Tag lines must be used to guide and control the load where excessive movement is possible.

A competent worker shall inspect all wire rope, chains, and slings prior to performing any lift. Record of inspection shall be kept for the Engineer's review. During winch or tow, all personnel must be clear of the 'whip area' of cable under tension.

All lifting operations must be carried out using OHSA, ISO and other international standards and regulations.

11.2.25. Heavy Machinery

All Contractor's vehicles on any worksite must have proper insurance, be in safe operating condition.

They must be operated by a competent, properly licensed operator. It shall be operated in a safe manner and a speed suited to the terrain and weather condition.

All cranes, stringing trucks, heavy and tracked equipment and machinery, welding rigs and all vehicles except passenger vehicles must be fitted with reverse alarms. Any vehicle with restricted vision shall not operate in the vicinity of workers, except under the direction of a designated worker who is in a position to see that the way is clear and safe.

11.2.26. Security

The Contractor shall provide adequate number of security personnel and security measures to safeguard the worksite from any threat, damage or theft of properties. The Contractor' security personnel shall be equipped with communication equipment and able to contact police and other emergency units as required.

The Contractor shall provide shelter, facilities and amenities to enable such functions or duties to be performed properly and to the satisfaction of safety officer.

11.2.27. Drugs and Alcohol

The use, sale, dispensing or possession of drugs, narcotics and alcoholic beverages is prohibited on the location and at any place where the work is performed.

The Contractor shall ensure that its personnel do not at any time, during the performance of the work, partake, brought onto the worksite, or be under the influence of any alcoholic liquor, drug or other intoxicating substance. This prohibition also covers all legal or prescription drug which may impair an employee's ability to perform his job safely. Employees who are caught using or in possession of drugs, on the job site shall be discharged. The Employer reserves the right to randomly require the Contractor's employee, to undergo drug test at any time. Drugs test may be used in the event of accident investigation. The Contractor undertakes that each and every person engaged by it or on its behalf to perform any element of the work (including Sub-Contractor) shall be advised of the local laws relating to the importation and/ or possession of drugs.

11.2.28. Statistics Board

The Contractor is required to install a Loss Production Scoreboard to highlight achievement/milestone for safe working hours of employees.

The Contractor shall install the above at each site office. The Loss Production Scoreboard shall be of acceptable material and shall contain the following information as a minimum (in English and Urdu):

Name of CONTRACTOR_____

Date Start of Work.

Safety Target without LTA (Manhours, Year)____

Best Record Achieved (Manhours, Year)_____

Current Manhours Achieved (Manhours, Year)___

Date of Last Loss Time Accident _____

Total Number of Loss Time Accidents_____

All lettering in the Safety Scoreboard shall be of suitable sizes and shall be visible from at least 10 meters distance.

11.2.29. Safety Induction

The Contractor shall implement a safety induction for the site. The Contractor shall identify its employees who will be required to attend the safety induction program. The induction briefing shall be applicable to all employees and sub-contractor's employees. The participation of all staff is mandatory.

Briefing shall be done at site prior to the commencing of the construction activities.

Each worker who has attended and completed the safety induction program shall be issued with a sticker to indicate that he has completed the safety induction course. The sticker shall be displayed on the safety hat and worn at site.

11.2.30. Toolbox HSE Meeting

The Contractor shall ensure that his appointed works supervisor hold 'toolbox' safety meeting for about 5-10 minutes daily or prior to each shift. Specific

topics shall include hazards relevant to current work, review of accidents and near misses and deficiencies and any new equipment or machinery. The Contractor shall maintain records of attendance and submit to the Engineer as and when required.

11.2.31. HSE Meetings

The Contractor shall form a Safety Committee at work site and shall hold regular meetings, minimum monthly to create and maintain an active interest in safety. The meeting shall be attended by the Contractor management and workers representatives and chaired by the Engineer or his representative. Minutes of meeting shall be distributed to all attendees.

11.2.32. Working at Height

When working at height more than 7.5 meters, the Contractor shall provide suitable safety nets, which extends 2.5 meters beyond the edge of work level. The nets shall be sufficiently anchored using steel hooks or shackle. The net shall be inspected daily.

If nets are impractical, the Contractor shall provide to the workers fall protection devices such as belts, harness etc. Fall protection is required when working above 3 meters. Personnel using fall protection shall be instructed on its use.

All works carried out at height should comply with European Directives/BS/OHSA/ILO/ISO standards, regulations and directives

11.2.33. Air hose

Air hose should not be used to clean any part of the body or clothing or use to blow off dirt on the floor.

11.2.34. Safety Inspection/Audits

Prior to commencement of works, the Contractor is required to inspect the worksite and equipment involved to ensure that works will be performed under safe conditions. In addition, the Contractor shall maintain and perform continuous safety inspection throughout the works and shall promptly implement all recommendations made pursuant to the said inspection. The Employer/ Engineer shall have the right to conduct its own safety audit/Inspection at the worksite. The Contractor shall comply with all recommendations arising from such audit/Inspection.

11.2.35. Safety Performance Target

The Contractor shall implement and establish a safety management award program to recognize the achievement and milestone for safe working performance for its employees.

11.2.36. Abrasive Wheels

The Contractor shall ensure that safety protection in the form of goggles and /or shields are provided and utilized by the personnel working with grinding machines and abrasive wheels. When changing discs on a portable grinder it is imperative that a suitable replacement disc is fitted and placed in the correct manner. The Contractor shall ensure only trained and competent personnel are permitted to carry out this task.

11.2.37. Contractor HSE Performance Reports

The Contractor shall compile and maintain HSE performance records pertaining to its work. These records shall be updated and submitted to the Engineer's representative monthly or as and when required.

11.2.38. Contractor Training Records

The Contractor shall provide adequate training to all its personnel to ensure that they have sufficient knowledge and skill to undertake assigned tasks. The Contractor's training records shall be maintained and controlled.

11.2.39. Job Safety Analysis (JSA)

Prior to performance of works, the Contractor shall implement JSA as a safety precaution to eliminate or guard against hazards on a specified job. The JSA methodology shall include the following:

- Study the job and develop basic job steps
- Identify the hazards on each job step
- Identify the safety precautions to be taken against each job step
- Record the JSA and inform all workers of the hazards and precautions to be taken.

11.2.40. Incident Notifications and Investigation

The Contractor shall develop an accident/incident reporting system. Any hazardous incident involving the Employer, the Engineer, the Contractor's or any third-party personnel, plant or equipment, shall be immediately reported to the Engineer, irrespective of whether there is injury to personnel or damage to plant or equipment.

All incidents that result in or have the potential to cause serious injuries or property damage must be suitably investigated by the Contractor and reported to the Engineer. The Contractor shall keep a copy of the report at site. The Contractor is required to investigate and report major accident to the concerned government department in accordance with the regulatory requirements. The investigation and report shall not preclude any similar investigations and reports required by the governmental authority in accordance with any relevant laws and regulations and maybe handled concurrently with them.

Upon completion of the work under the contract and/or on an annual basis, whichever is more frequent, the Contractor shall prepare a summary report of its HSE performance together with an accident statistic.

The Employer and the Engineer should be notified by the Contractor of any incident/accident as per Clause 4.8 of the Conditios of Contract.

11.2.41. Use of Public Road

The Contractor shall keep public roads free from its debris due to vehicle movement to and from site. The Contractor shall provide washing facilities at site to clean vehicle tyres. In the event of spillage onto the road, the Contractor shall undertake the cleaning at its own cost.

11.3. MEASUREMENT AND PAYMENT

The work under this SP-11 (Health & Safety) shall neither be measured nor be paid separately. The cost incurred in this respect shall be deemed to have been included in other items of work.

In case of failure of the contractor to comply with all or any provision(s) of this SP-11, the damage(s) caused shall be attributable towards the Contractor, and the Engineer shall assess the amount of such damage(s) which shall be deducted from the monies due or to become due to the Contractor.

ESR for each scheme prepared by the Employer are attached in Technical Specifications.

Competitive and Livable City of Karachi

Local Government Department, Government of Sindh

PROJECT

COMPETITIVE AND LIVABLE CITY OF KARACHI
SCHEMES UNDER DMC MALIR

SCHEME

IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03 . DMC KORANGI

TENDER DRAWINGS

DECEMBER 2021

CONSULTANT

EA Consulting Pvt Ltd
Engineering, Architecture & Project Managment
Head Off: AL-9, 15th Lane, Kh-Hilal, Ph.VII, DHA,
Karachi. Postal Code 75500. UAN: 111-111-584
Fax: +92-21-35841825. Web: www.eaworld.com

Architecture

S.#	DRAWING NO.	DRAWING TITLE
	A0 - GENERAL DRAWINGS	
1	EA-01062-EGFS-A0-0001	LIST OF DRAWINGS
2	EA-01062-EGFS-A0-0002	SURVEY PLAN
3	EA-01062-EGFS-A0-0003	MASTER PLAN
4	EA-01062-EGFS-A0-0004	DEMOLITION PLAN
	A1 - ARCHITECTURAL PLANS	
5	EA-01062-EGFS-A1-0100	PP-01 (PART PLANS)
6	EA-01062-EGFS-A1-0200	PP-01 & PP-02 (PART PLANS)
	A2 - SECTIONS & ELEVATIONS	
7	EA-01062-EGFS-A2-0010	SECTIONS & ELEVATION
	A5-ANICILLARY WORK DETAILS	
8	EA-01062-EGFS-A5-0010	TL-01 DETAIL OF TOILET (PLAN & ELEVATIONS)
9	EA-01062-EGFS-A5-0011	TL-01 DETAIL OF TOILET (ELEVATIONS)
10	EA-01062-EGFS-A2-0020	TL-02 DETAIL OF TOILET (PLAN & ELEVATIONS)
11	EA-01062-EGFS-A2-0021	TL-02 DETAIL OF TOILET (ELEVATIONS)
12	EA-01062-EGFS-A2-0030	LD-01 DETAIL OF LOCKERS ROOM (PLANS & ELEVATIONS)
13	EA-01062-EGFS-A2-0040	PD-01 DETAIL OF PANTRY (PLANS & ELEVATIONS)
	A6 - SCHEDULE	
14	EA-01062-EGFS-A6-0010	SCHEDULE OF FINISHING
15	EA-01062-EGFS-A6-0020	SCHEDULE OF DOOR, WINDOWS & VENTILATORS
16	EA-01062-EGFS-A6-0030	DOORS , WINDOWS PLAN & ELEVATIONS
A7 - FLOORING PLANS		
17	EA-01062-EGFS-A7-0100	PP-01 & PP-02 (FLOORING PLANS)
	A10-MISCELLANEOUS DETAILS	
18	EA-01062-EGFS-A10-0010	BOUNDARY WALL LAYOUT & DETAIL
19	EA-01062-EGFS-A10-0020	GD-01 (FOOTBALL FIELD DETAIL)
20	EA-01062-EGFS-A10-0030	GD-02 (CRICKET FIELD DETAIL)

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt.Ltd
Head Office:No.9 15th Lane, Khayaban-e-Hilal,Phase 7
Defence Housing Authority, Karachi. 75600 – Pakistan
Phone No 111-113-664, Fax No 8961828
Email : info@eaward.com | www.eaward.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

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 Meter (M) unless otherwise specified.
- All Structural And MEP drawings to be read in conjunct on with Architecture drawings.
- The Architect / Engineer shall be notified of any discrepancy immediately.

Rev.	Date	Description
REVISIONS		

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

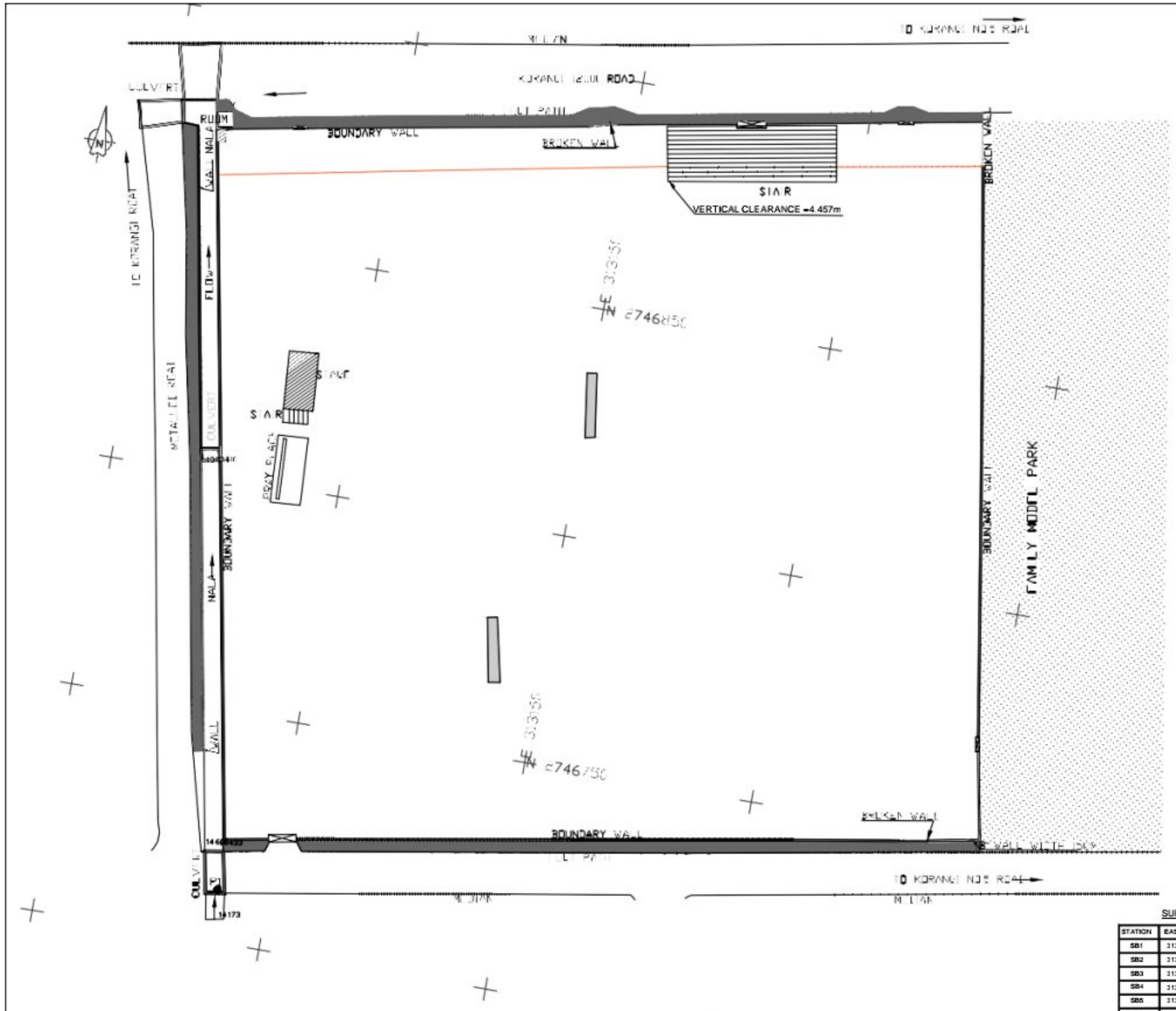
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Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
LIST OF DRAWINGS

Designed:	Checked:	Approved:
SAH	SAH	AAA
Drawn:	Date:	Scale / Sheet:
USA	November, 2021	N.T.S
Project Code: 01062		Rev.: 0

Drawing No.: EA-01062-EGFS- A0-0001



SURVEY CONTROL POINTS

STATION	EASTING(m)	NORTHING(m)	ELEVATION(m)
SB1	313222.766	2746905.569	16.022
SB2	313141.000	2746901.000	16.000
SB3	313056.476	2746886.804	15.561
SB4	313150.736	2746836.140	15.592
SB5	313243.656	2746746.607	19.032
SB6	313105.861	2746722.128	17.105

Client :

CLICK

Consultant :

EA Consulting Pvt Ltd

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan

Note:
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3 All dimensions are in Meter (SI) unless stated otherwise.
4 All Structural / MEP drawings to be read in conjunction with Architecture drawings.
5 The Architect to be informed shall be notified of any discrepancy immediately.

North:

Rev.	Date	Description
REVISIONS		

Date of Issue	16 November 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

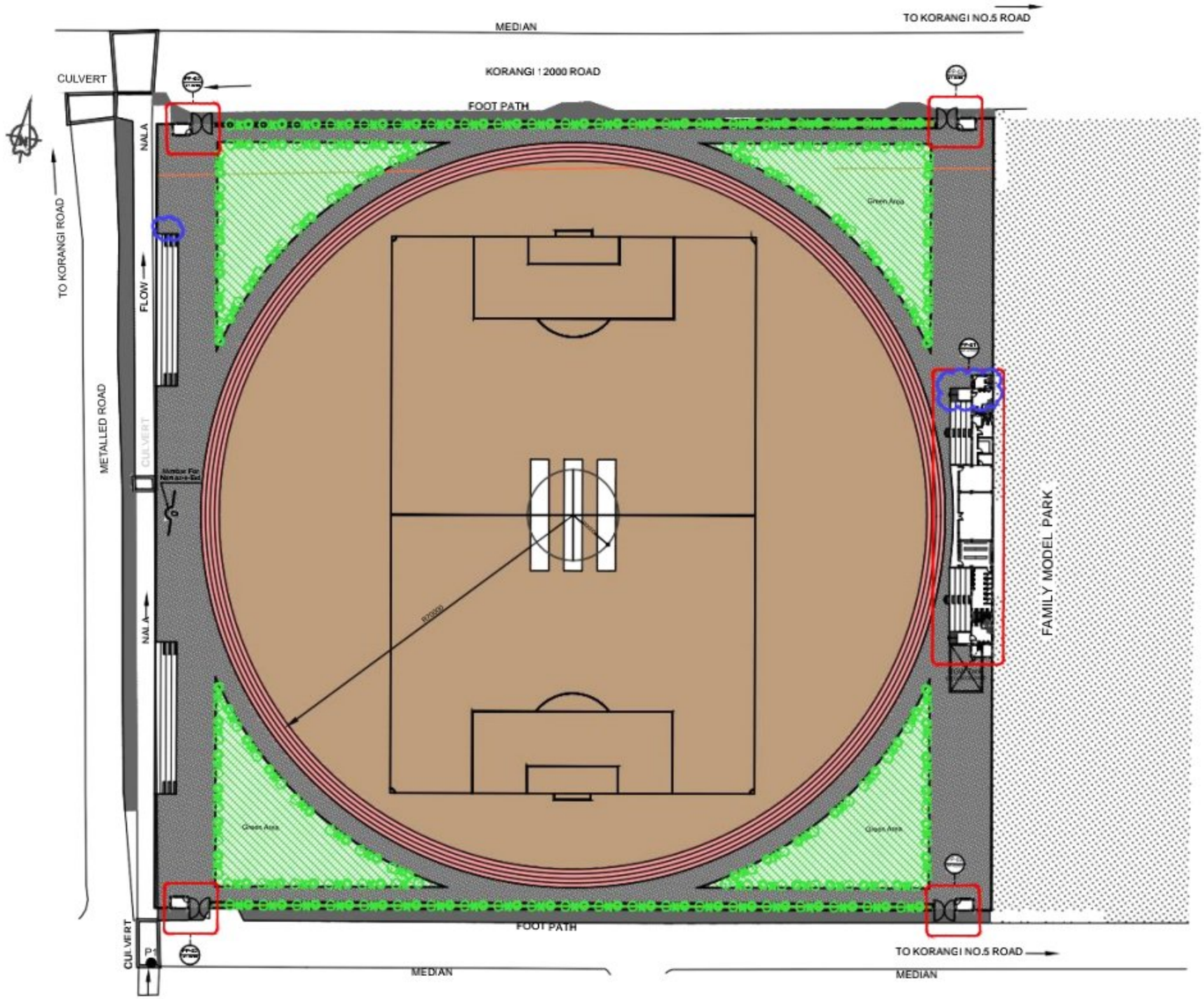
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Drawing Title:
SURVEY PLAN

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SAH	SAH	ARK
Drawn:	Date:	Scale / plotted:
WA	November 2021	1:500@A3 1:250@A1
Project Code: 01062		Rev.:

Drawing No:
EA-01062-EGFS- A0-0002



Client :

CLICK

Consultant :

EA Consulting Pvt Ltd

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

Note:
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- The Architect is to be informed of any discrepancy immediately.

Rev.	Date	Description
REVISIONS		

Date of Issue	16 November 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

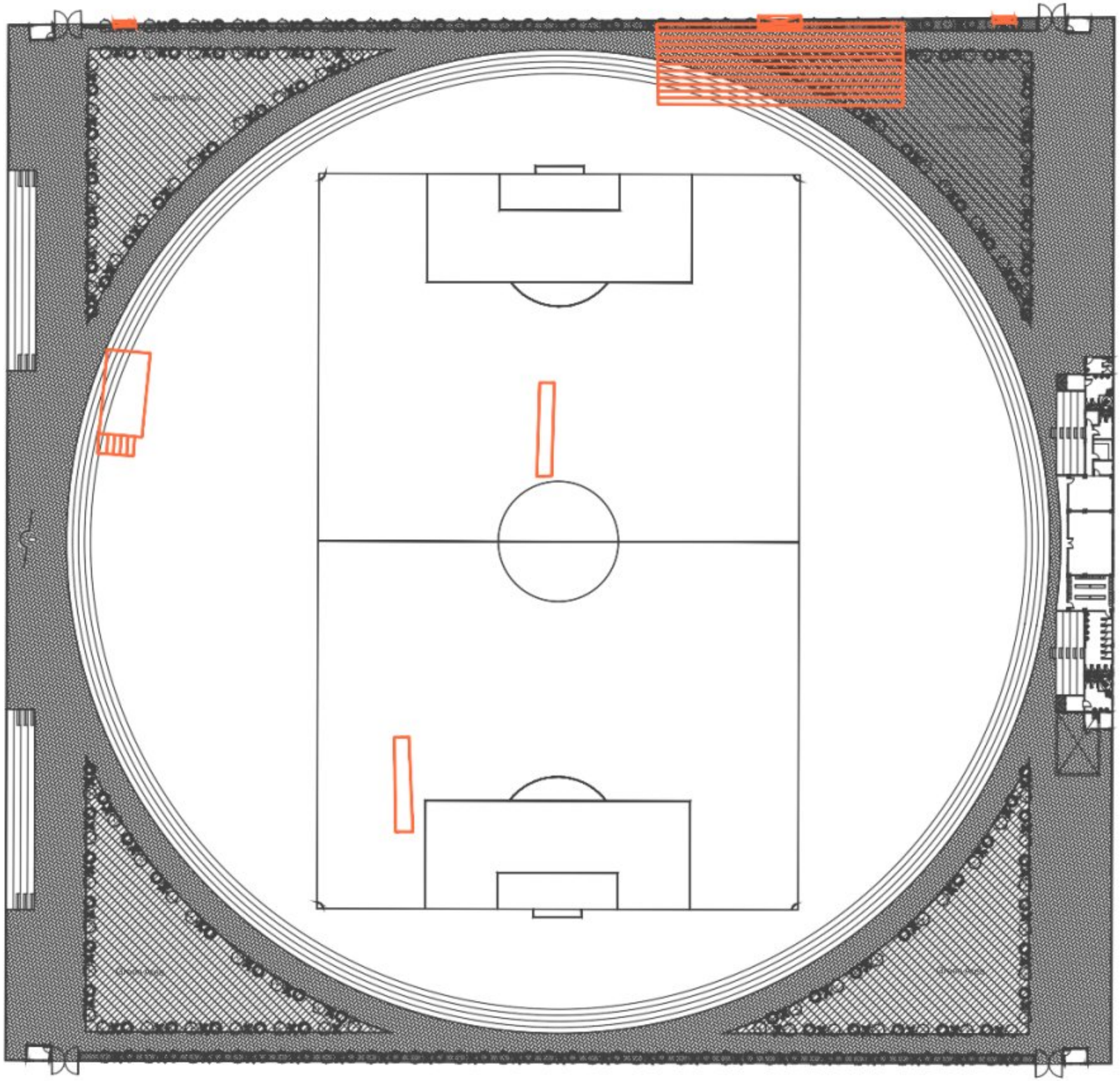
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EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
MASTER PLAN

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MAA	MAA	AHK
Drawn:	Date:	Scale:
MAA	November 2021	1:400@A1
Project Code: 01062		Rev.:

Drawing No.:
EA-01062-EGFS- A0-0003



DEMOLISH AREA

PROPOSED AREA

Client :

Consultant :

EA Consulting Pvt Ltd

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan

Note:
1. All dimensions to be checked and verified on Site.
2. Only written dimensions to be followed. Do not scale any drawing.
3. All dimensions are in Meter (Mtr) unless noted otherwise.
4. All Structural / MEP/FP drawings to be read in conjunction with Architecture drawings.
5. The Architect's representative shall be notified of any discrepancy immediately.

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Rev.	Date	Description
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Date of Issue	16 November 2021
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Issued For	Tender

ARCHITECTURE

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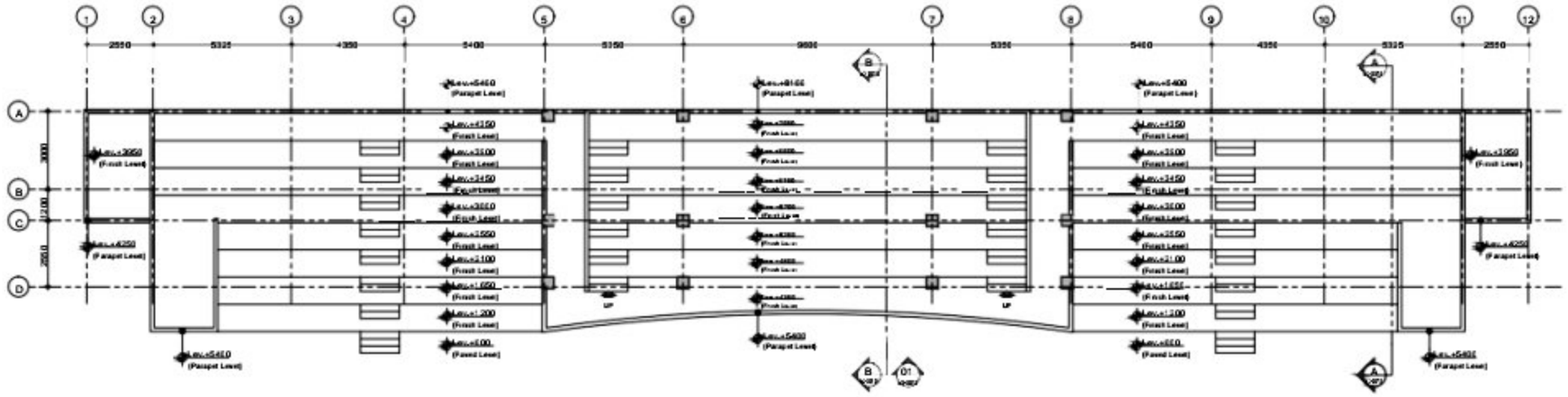
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Drawing Title:
DEMOLITION PLAN

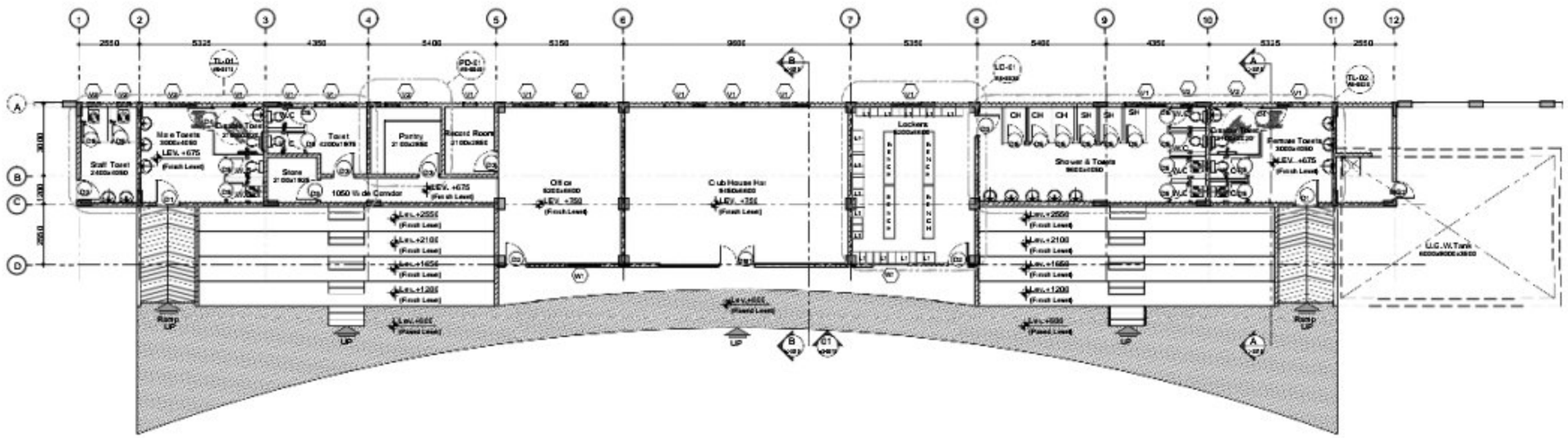
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Project Code: 01062 Rev.: 0

Drawing No.: EA-01062-EGFS- A0-0004



PP-01 (FIRST FLOOR PLAN)



PP-01 (GROUND FLOOR PLAN)

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:NL-9 18th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi 75500 - Pakistan
Phone No : 111-113-892 Fax No : 9501-926
E-mail : info@eaworld.com www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

Note:
- All dimensions to be checked and verified on Site.
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- All dimensions are in Meter (M) Meter unless otherwise specified.
- All Structural, Architectural drawings to be read in conjunct on with Architectural drawings.
- The Architect / Engineer shall be notified of any discrepancy immediately.

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		REVISIONS

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ARCHITECTURE

Status:
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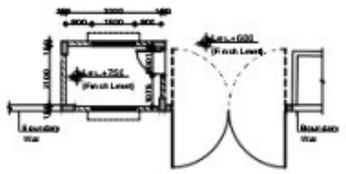
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Drawing Title:
PP-01
(PART PLANS)

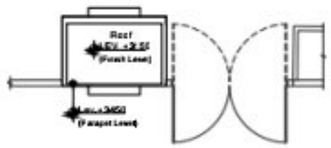
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Project Code: 01062 Rev.:

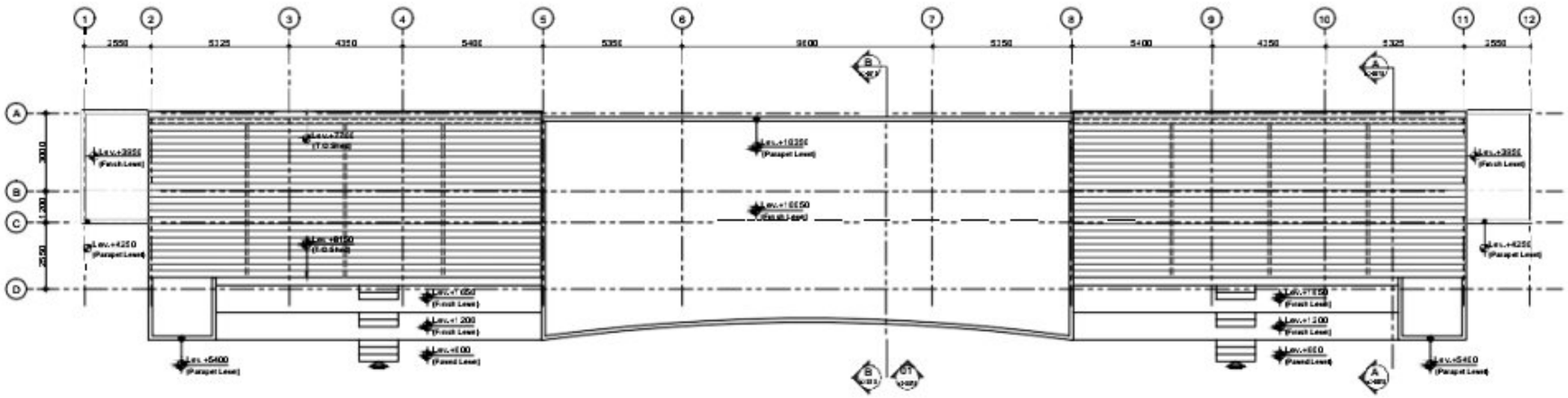
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PP- 02 (GROUND FLOOR PLAN)



PP- 02 (ROOF PLAN)



PP-01 (ROOF PLAN)

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:NS-9 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi, 75500 - Pakistan
Phone No : 111-111-864 Fax No : 9561-1528
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

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 Meter if Mr.Meter unless otherwise specified.
- All Structural And MEP drawings to be read in conjunct on with Architecture drawings.
- The Architect & engineer shall be notified of any discrepancy immediately.

Rev.	Date	Description
		REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

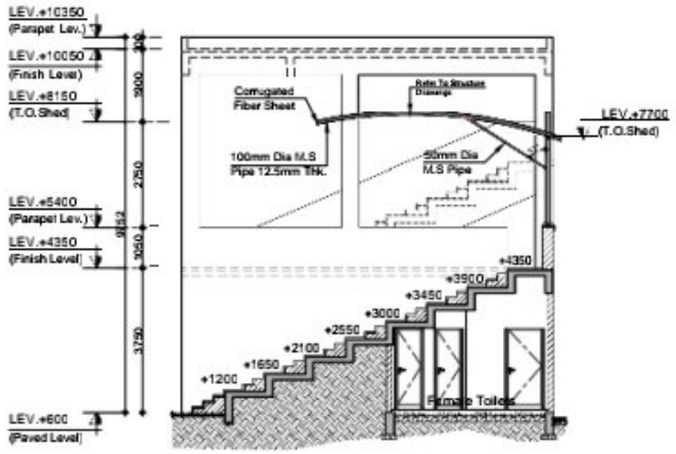
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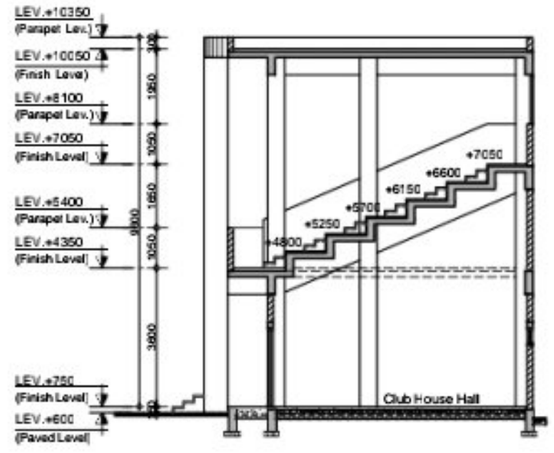
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PP-01 & PP-02
(PART PLANS)

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SHH	SHH	AAK
Drawn:	Date:	Scale / Sheet:
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Project Code: 01062		Rev.:

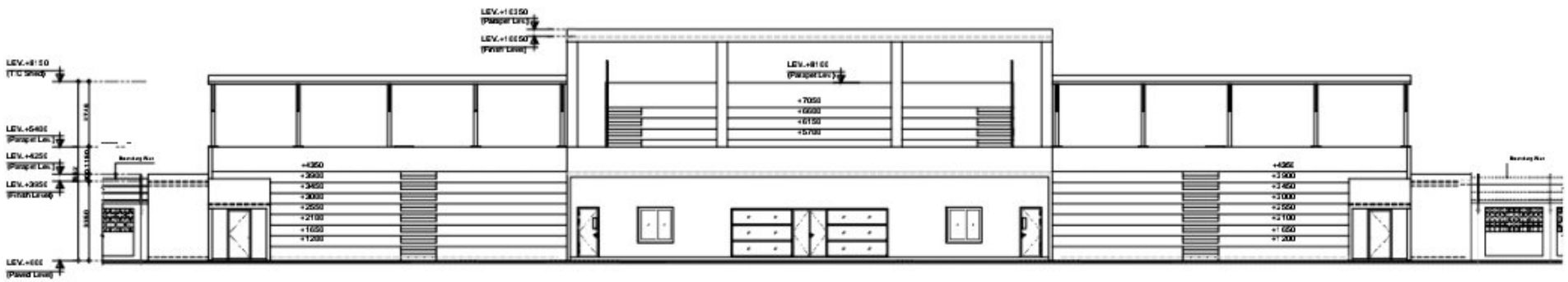
Drawing No.:
EA-01062-EGFS- A1-0200



SECTION - A A



SECTION - B B



ELEVATION - 01

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:A/5-B 15th Lane, Khayaban-e-Hilal,Phase V
Defence Housing Authority, Karachi. 75500 – Pakistan
Phone No 111-113-564, Fax No 9561-626
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

NOTE:
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Rev.	Date	Description
		REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

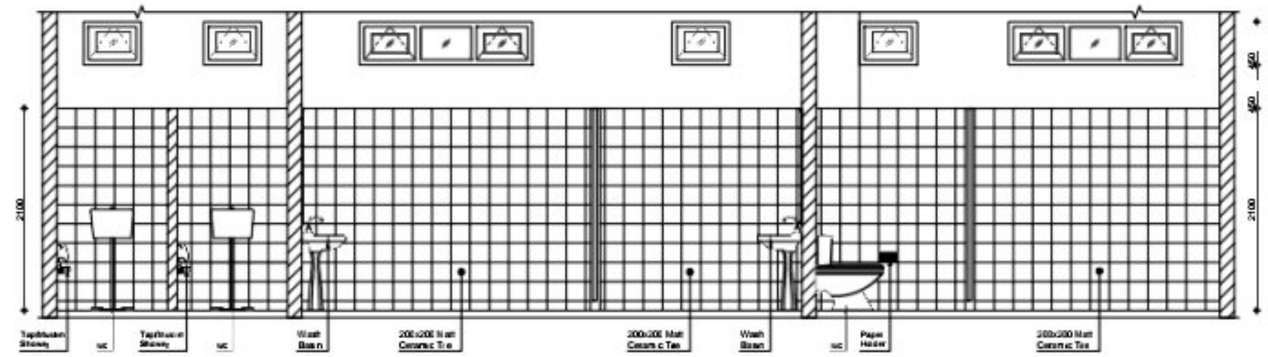
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Name:
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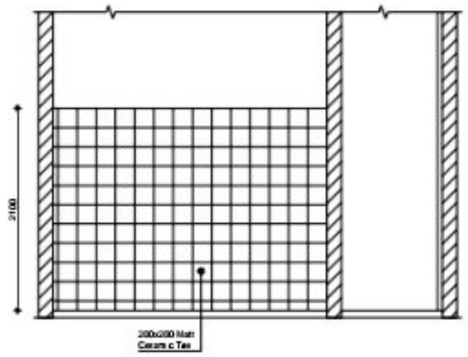
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SECTIONS & ELEVATION

Designed:	Checked:	Approved:
SKM	SKM	AK
Drawn:	Date:	Scale / Sheet:
WA	November 2021	1:75@A1
Project Code: 01062		Rev.:

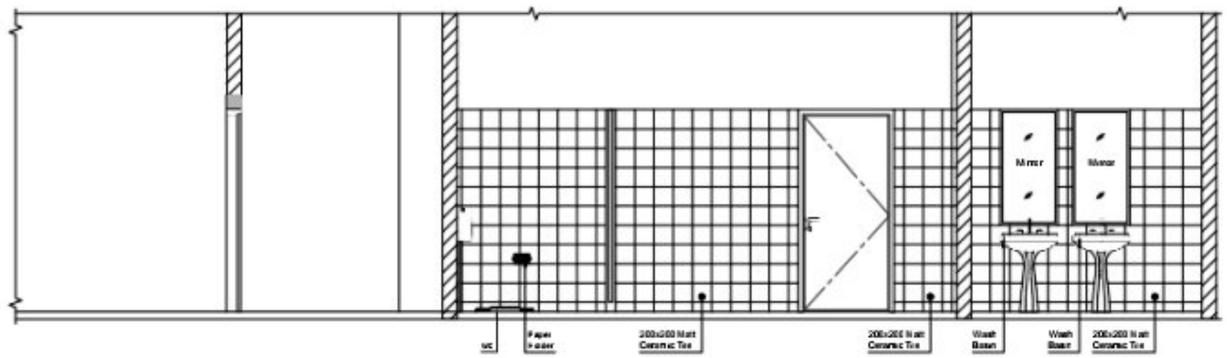
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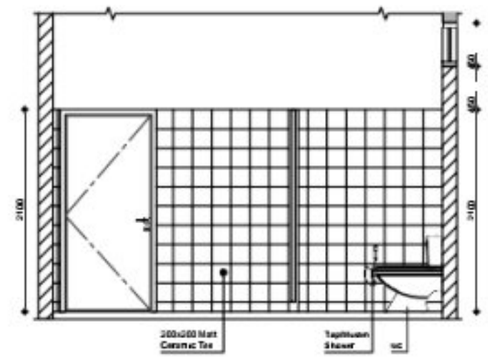
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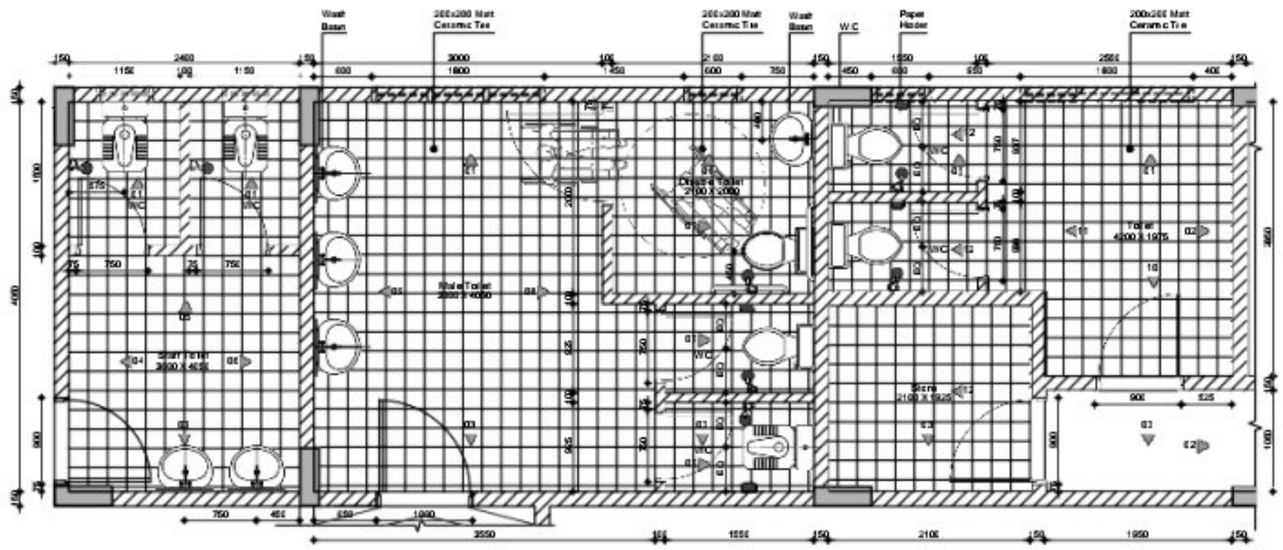
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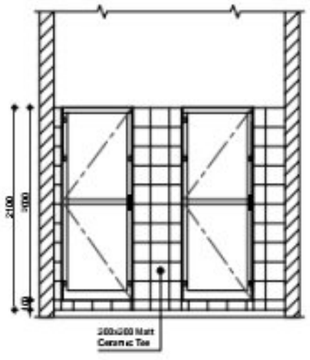
ELEVATION-03 (TL-01)



ELEVATION-04 (TL-01)



BLOCK PLAN (TL-01)



ELEVATION-05 (TL-01)

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:A1-B 18th Lane, Khayaban-e-Hilal,Phase 7 Defence Housing Authority, Karachi, 75600 – Pakistan
Phone No 111-113-864 Fax No 880-1826
Email : info@eaconsult.com | www.eaconsult.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan:

Notes:
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Rev.	Date	Description
REVISIONS		

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

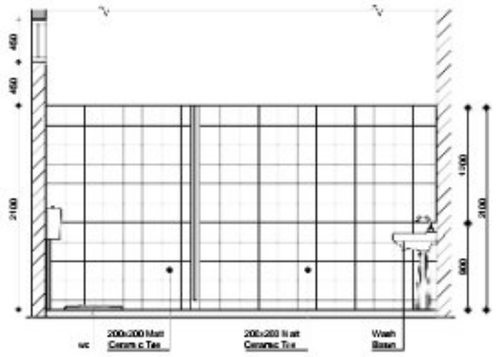
Status:
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EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

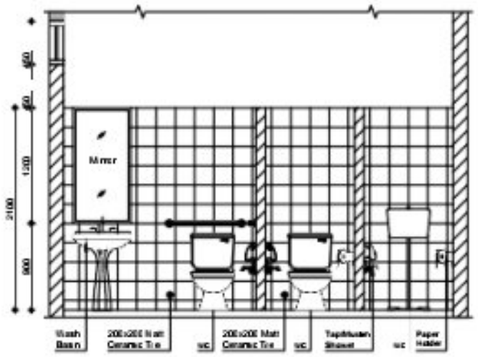
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DETAIL OF TOILET
(PLAN & ELEVATIONS)

Designed:	Checked:	Approved:
SHH	SHH	AAK
Drawn:	Date:	Scale / Sheet:
S A A	November 2021	1:20 @ A
Project Code: 01062		Rev.:

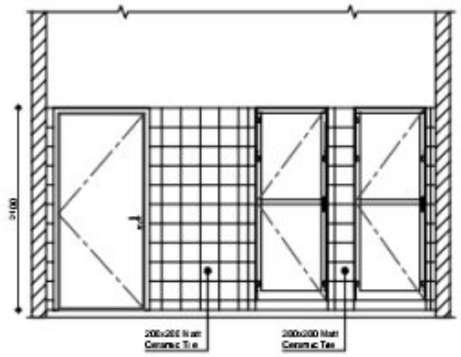
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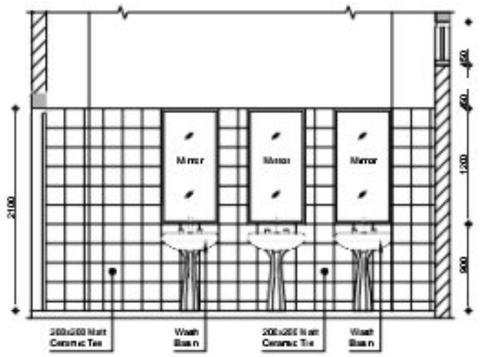
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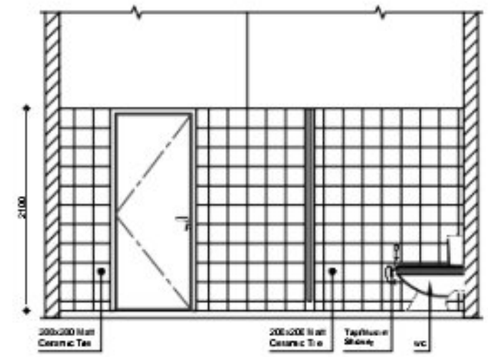
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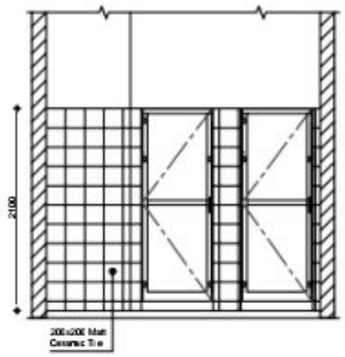
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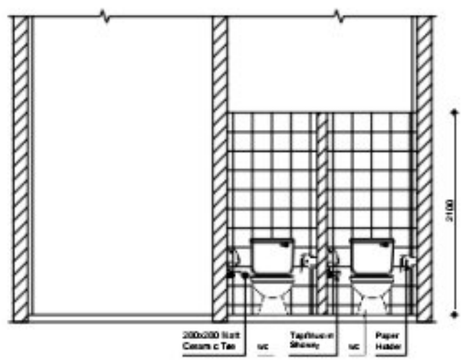
ELEVATION-09 (TL-01)



ELEVATION-10 (TL-01)



ELEVATION-11 (TL-01)



ELEVATION-11 (TL-01)

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:No.9, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi, 75600 – Pakistan
Phone No: 111-113-564, Fax No: 8961826
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan:

Note:
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Rev.	Date	Description

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

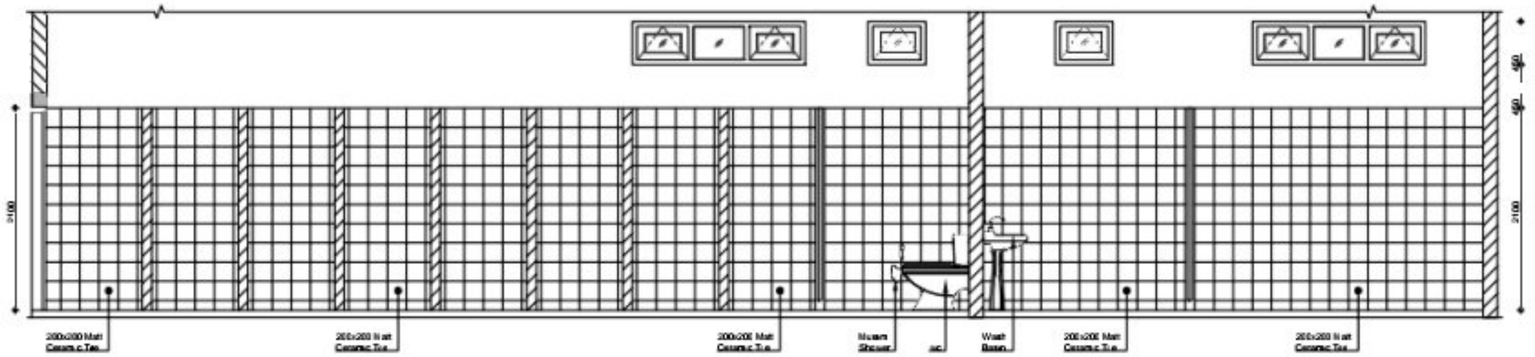
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Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

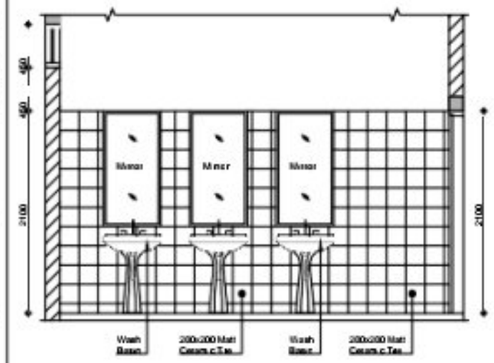
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TL-01
DETAIL OF TOILET
(ELEVATIONS)

Designed:	Checked:	Approved:
SHH	SHH	AAK
Drawn:	Date:	Scale / Sheet:
S A A	November 2021	1:20 @ A
Project Code: 01062		Rev.:

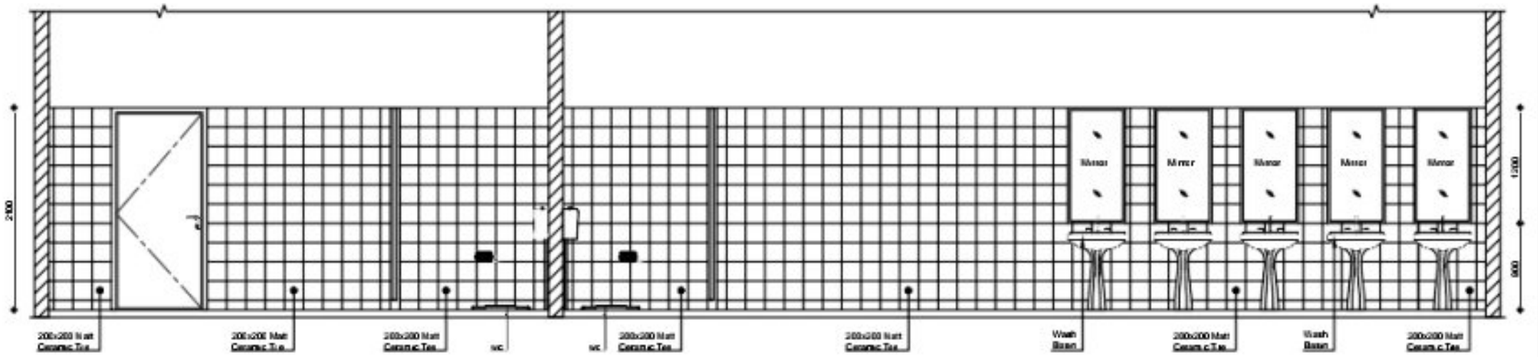
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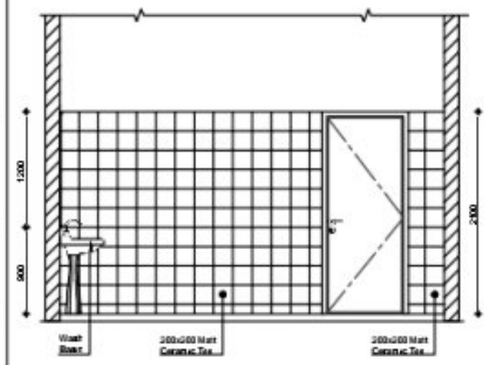
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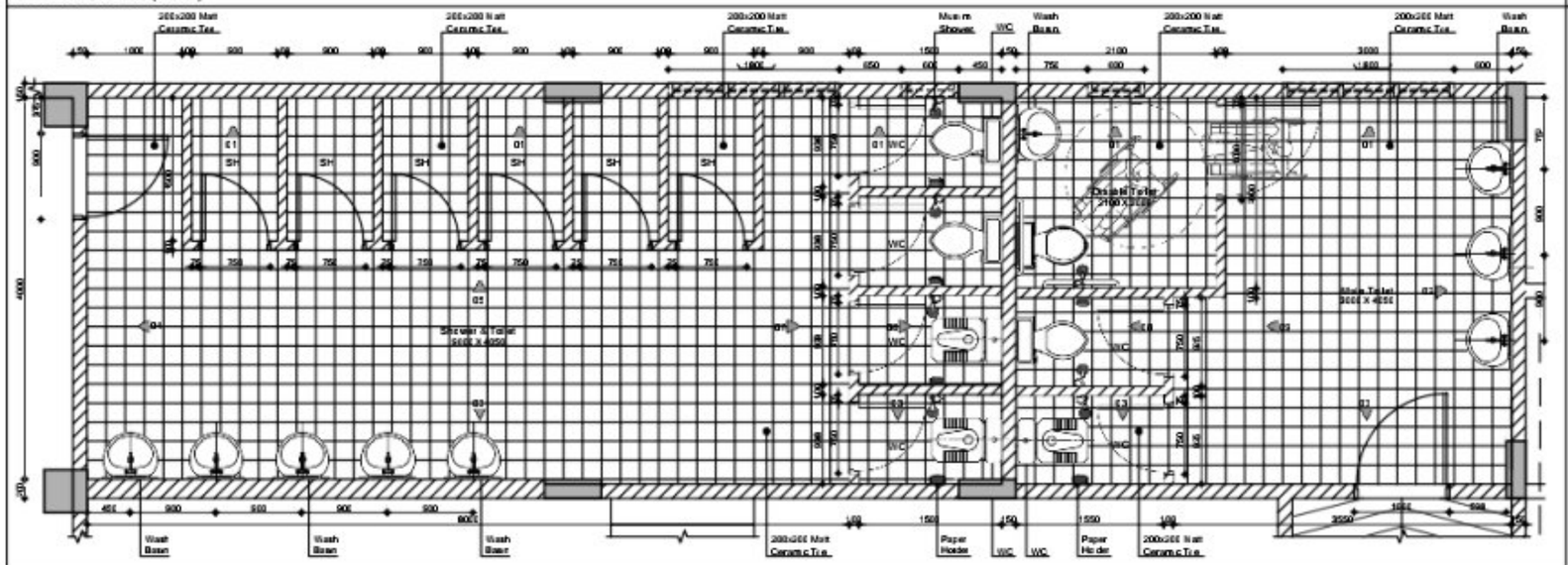
ELEVATION - 02 (TL-02)



ELEVATION - 03 (TL-02)



ELEVATION - 04 (TL-02)



BLOCK PLAN (TL-02)

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:NL-9 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi 75500 - Pakistan
Phone No : 111-113-664 Fax No : 9531-535
E-mail : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan:

Notes:
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Rev.	Date	Description
		REVISIONS

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Issued To	Client
Issued For	Tender

ARCHITECTURE

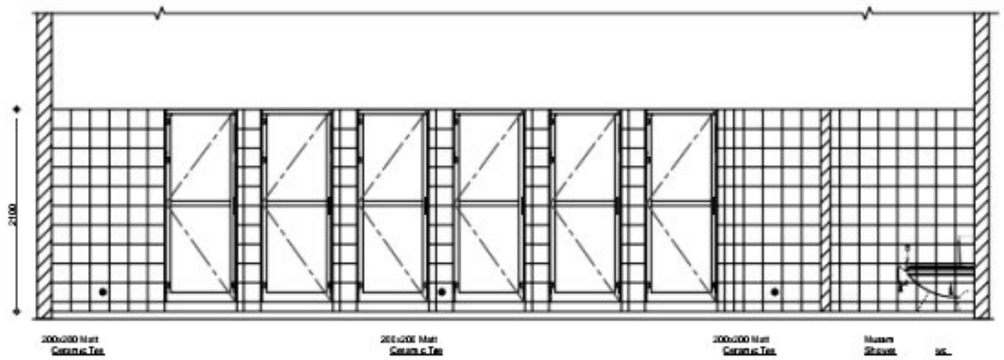
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EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

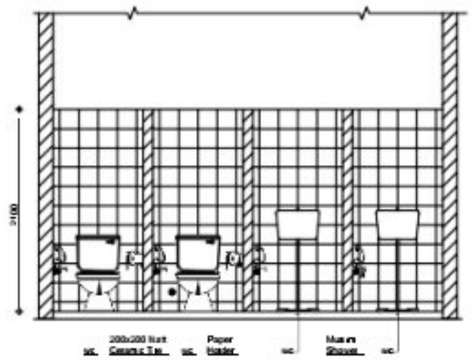
Drawing Title:
TL-02
DETAIL OF TOILET
(PLAN & ELEVATIONS)

Designed:	Checked:	Approved:
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Project Code: 01062		Rev.:

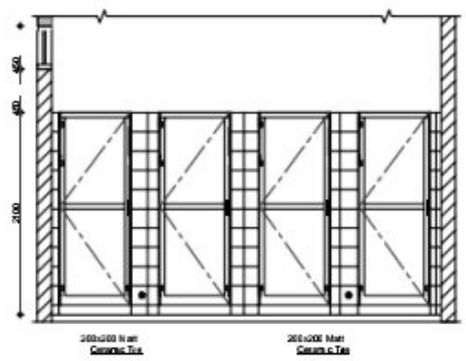
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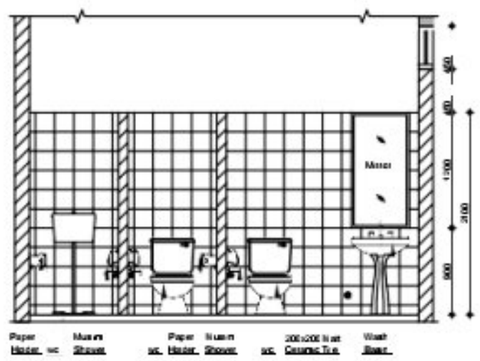
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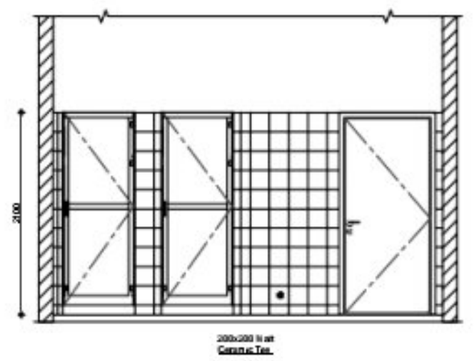
ELEVATION - 06 (TL-02)



ELEVATION - 07 (TL-02)



ELEVATION - 08 (TL-02)



ELEVATION - 09 (TL-02)

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office Al-6, 16th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi, 75500 - Pakistan
Phone no 111-111-EACL Fax no 9340-1828
Email : info@eaconsult.com | www.eaconsult.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan:

Note:
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Rev.	Date	Description

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

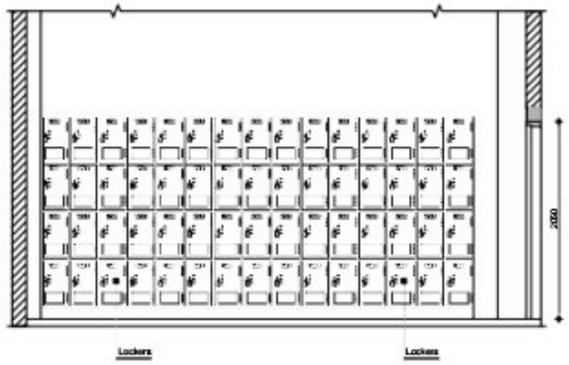
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EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

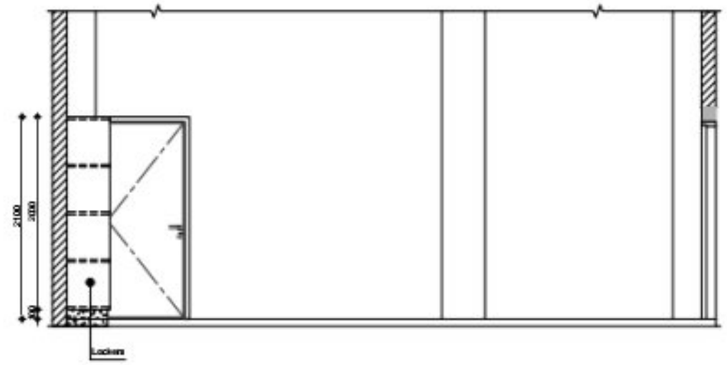
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TL-02
DETAIL OF TOILET
(ELEVATIONS)

Designed:	Checked:	Approved:
SAH	SAH	AKH
Drawn:	Date:	Scale / Sheet:
S A H	November, 2021	1:30 @ A
Project Code:		Rev.:
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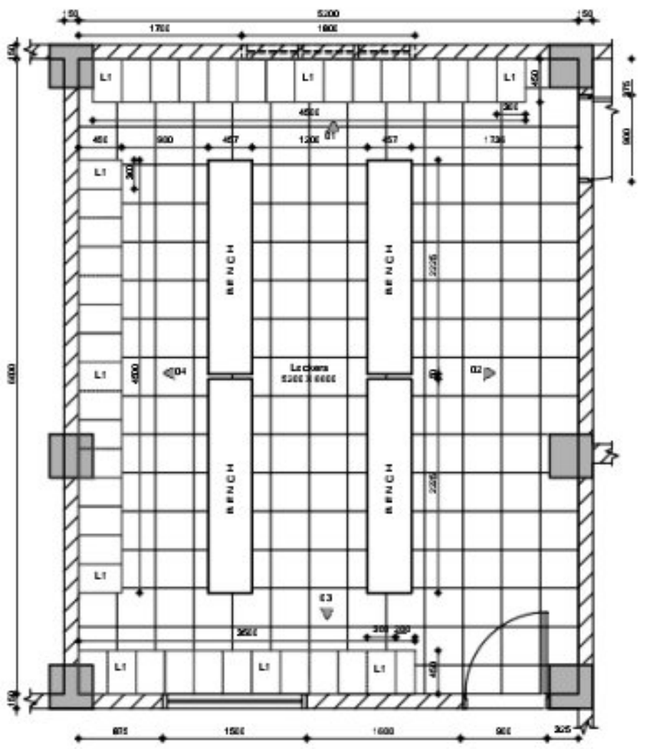
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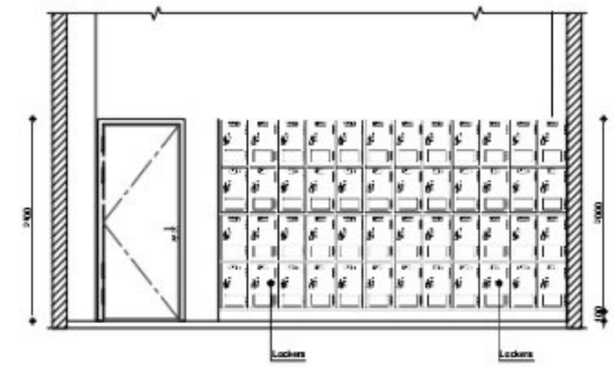
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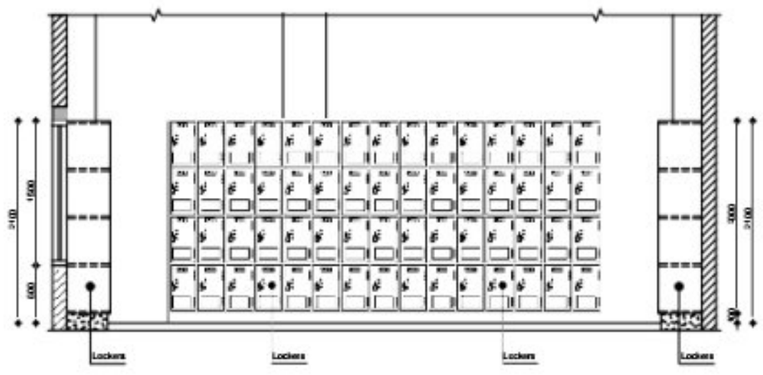
ELEVATION-02 (LD-01)



BLOCK PLAN (LD-01)



ELEVATION-03 (LD-01)



ELEVATION-04 (LD-01)

Client :

CLICK

Consultant :

EA Consulting Pvt Ltd

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan:

Title to:
- All dimensions to be checked and verified on Site
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ARCHITECTURE

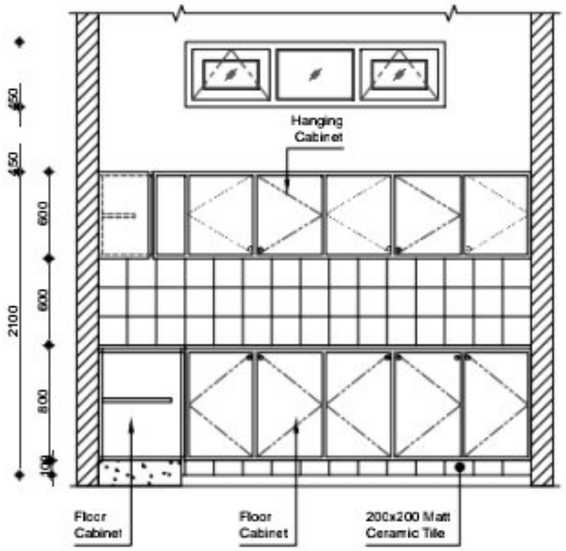
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Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

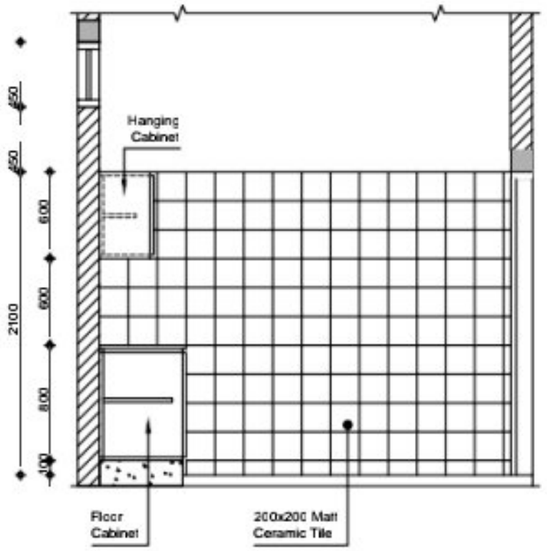
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LD-01
DETAIL OF LOCKERS ROOM (PLAN & ELEVATIONS)

Designed:	Checked	Approved
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Drawn:	Date:	Scale / Sheet:
S A A	November, 2021	1:30 @ A1
Project Code:		Rev.:
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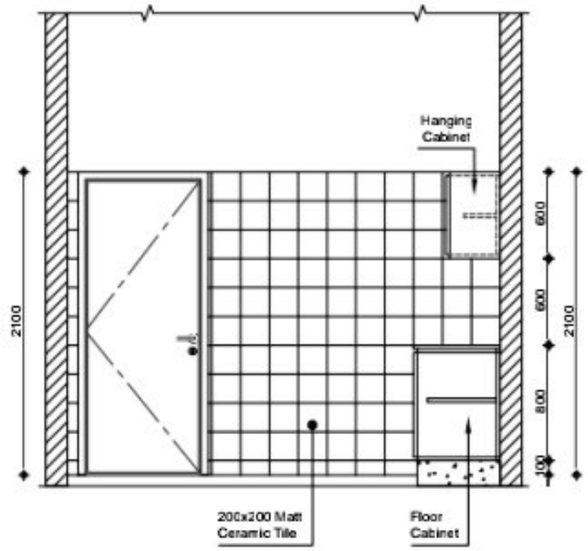
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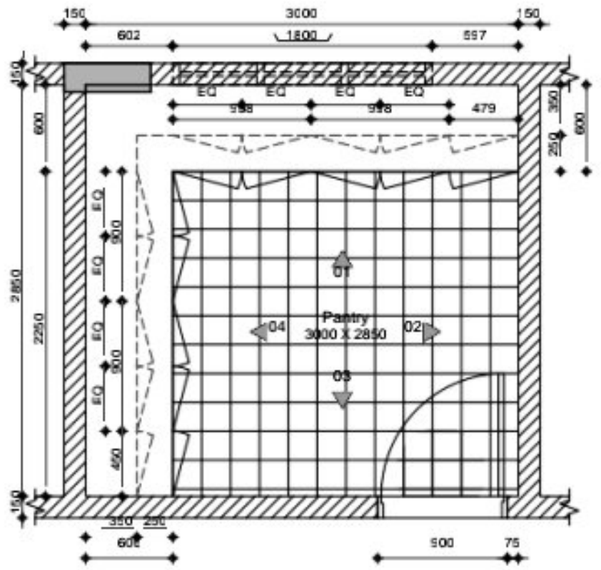
ELEVATION - 01 (PD-01)



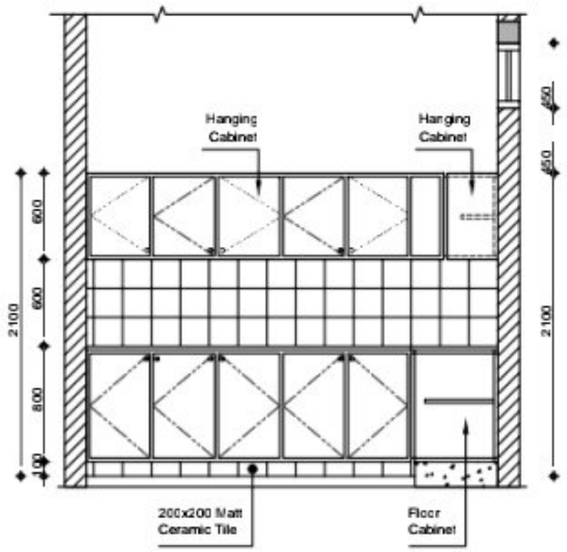
ELEVATION - 02 (PD-01)



ELEVATION - 03 (PD-01)



BLOCK PLAN (PD-01)



ELEVATION - 04 (PD-01)

Client :

CLICK
Construction and Living City of Koranji

Consultant :

EA Consulting Pvt Ltd
Head Office:A-9 16th Lane Khayaban-e-Iqbal,Phase 7
Defence Housing Authority, Karachi- 75600 – Pakistan
Phone No 111-113-564 Fax to 586-1626
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan:

Note:
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- Drawing copies of revisions to be followed. Do not scale any drawing
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- The Architect & engineer shall be notified of any discrepancy immediately.

Rev.	Date	Description

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
PD-01
DETAIL OF PANTRY
(PLAN & ELEVATIONS)

Designed:	Checked:	Approved:
SAH	SAH	AAA
Drawn:	Date:	Scale / Sheet:
S A A	November, 2021	1:20 @ A1
Project Code:	01062	Rev.: 0

Drawing No:
EA-01062-EGFS- A5-0040

SCHEDULE OF FINISHES

S#	TITLE	FLOOR	SKIRTING / DADO	WALL	CEILING	REMARKS
01	Male Toilet	Matt Ceramic Tile	Ceramic Tile Dado	Matt Enamel Paint	Distemper Paint	Upto 2100mm High
02	Store	Porcelain Tile	Porcelain Tile Skirting	Matt Enamel Paint	Distemper Paint	--
03	Corridor	Porcelain Tile	Porcelain Tile Skirting	Matt Enamel Paint	Distemper Paint	--
04	Pantry	Porcelain Tile	Porcelain Tile Skirting	Matt Enamel Paint	Distemper Paint	--
05	Record Room	Porcelain Tile	Porcelain Tile Skirting	Matt Enamel Paint	Distemper Paint	--
06	Office	Porcelain Tile	Porcelain Tile Skirting	Matt Enamel Paint	Distemper Paint	--
07	Club House Hall	Porcelain Tile	Porcelain Tile Skirting	Matt Enamel Paint	Distemper Paint	--
08	Locker	Porcelain Tile	Porcelain Tile Skirting	Matt Enamel Paint	Distemper Paint	--
09	Shower	Matt Ceramic Tile	Ceramic Tile Dado	Matt Enamel Paint	Distemper Paint	Upto 2100mm High
10	Guard Room	Porcelain Tile	Porcelain Tile Skirting	Matt Enamel Paint	Distemper Paint	--
11	Steps	Cement Tile	--	--	--	Non Skid Groove At Nosing
12	Ramp	Cement Tile	--	--	--	--
13	Roof Screeding	C.C 1:2:4	--	--	--	--

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office A-6, 16th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority Karachi 75500 - Pakistan
Phone No : 111-11-1804, Fax No : 9861828
Email : info@eaconsult.com | www.eaconsult.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan:

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Rev.	Date	Description

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
SCHEDULE OF FINISHES

Designed:	Checked:	Approved:
SAA	SAA	AAA
Drawn:	Date:	Scale / Sheet:
S A A	November, 2021	1:20@A
Project Code:	01062	Rev.:

Drawing No.:
EA-01062-EGFS- A6-0010

SCHEDULE OF DOORS , WINDOWS & VENTILATOR

SCHEDULE OF DOORS

S.#	TYPE / MARK	SIZE		GROUND FLOOR	ROOF	TOTAL NOS	TYPE	FRAME	PANEL	HARDWARE
		WIDTH	HEIGHT							
01	MG1	4000	2400	04	-	04	Double	MS Frame	As Per Existing	-
02	MG2	750	2400	01	-	01	Double	MS Frame	As Per Existing	-
03	D1	1000	2100	02	-	02	Single	GJ Frame	Solid Core Laminated	Deadlock, Handle 12 Inch, Tower Bolt, Hinge & Door Closer, Kick Plate, All Items Ir Stainless Steel - As Per Approved Sample
04	D2	900	2100	02	-	02	Single	GJ Frame	Solid Core Laminated	Deadlock, Handle 12 Inch, Tower Bolt & Double Action Hinge All Items In Stainless Steel - As Per Approved Sample
05	D3	900	2100	10	-	10	Single	GJ Frame	Solid Core Laminated	Deadlock, Handle 12 Inch, Tower Bolt & Double Action Hinge All Items In Stainless Steel - As Per Approved Sample
06	D4	1000	2100	02	-	02	Single	Aluminum Frame	16mm Thick Water Proof Laminated Board	Hard Lock, Tower Bolt, Hinge & Door Stopper All Items In Stainless Steel - As Per Approved Sample
07	D5	750	2100	10	-	10	Single	Aluminum Frame	16mm Thick Water Proof Laminated Board	Hard Lock, Tower Bolt, Hinge & Door Stopper All Items In Stainless Steel - As Per Approved Sample
08	DW1	6000	2100	01	-	01	Double	Aluminum Frame	8mm Thick Tinted Tempered Glass	Indicator Door Lock, Hinge, Corner Fasteners & Door Nob As Per Approved Sample

SCHEDULE OF WINDOWS & VENTILATOR

S.#	TYPE / MARK	SIZE		GROUND FLOOR	ROOF	TOTAL NOS	TYPE	FRAME	PANEL	HARDWARE	REMARKS
		WIDTH	HEIGHT								
01	W1	1500	1500	10	-	10	Sliding Window	Aluminum Frame	5mm Thick Double Glazed Tinted Glass , Operable Panel	-	As Per Design & Detail
02	V1	1800	450	11	-	11	Top Hung Window With Fixed Glass	Aluminum Frame	5mm Thick Double Glazed Tinted Glass , Operable Panel	-	As Per Design & Detail
03	V2	600	450	07	-	07	Top Hung Window With Fixed Glass	Aluminum Frame	5mm Thick Double Glazed Tinted Glass , Operable Panel	-	As Per Design & Detail

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office A-6 16th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority Karachi 75500 - Pakistan
Phone No : 111-11-1804, Fax No : 9861828
Email : info@eaconsult.com | www.eaconsult.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan:

Note:
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Rev.	Date	Description

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

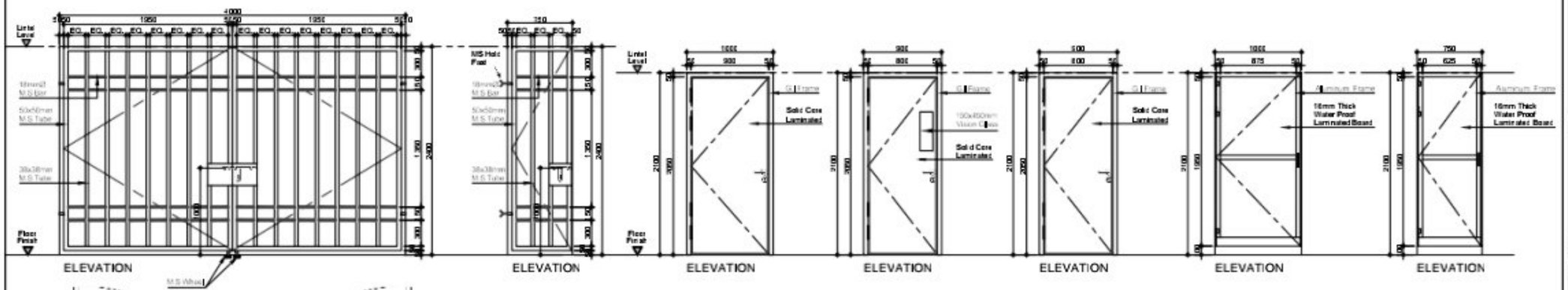
Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
SCHEDULE OF DOOR, WINDOWS & VENTILATORS

Designed:	Checked:	Approved:
SAM	SAM	AAA
Drawn:	Date:	Scale / Sheet:
S A A	1 November, 2021	NTS
Project Code: 01062		Rev.:

Drawing No.:
EA-01062-EGFS- A6-0020



MG1 PLAN 4000 x 2400

MG2 PLAN (PUMP ROOM 750 x 2400

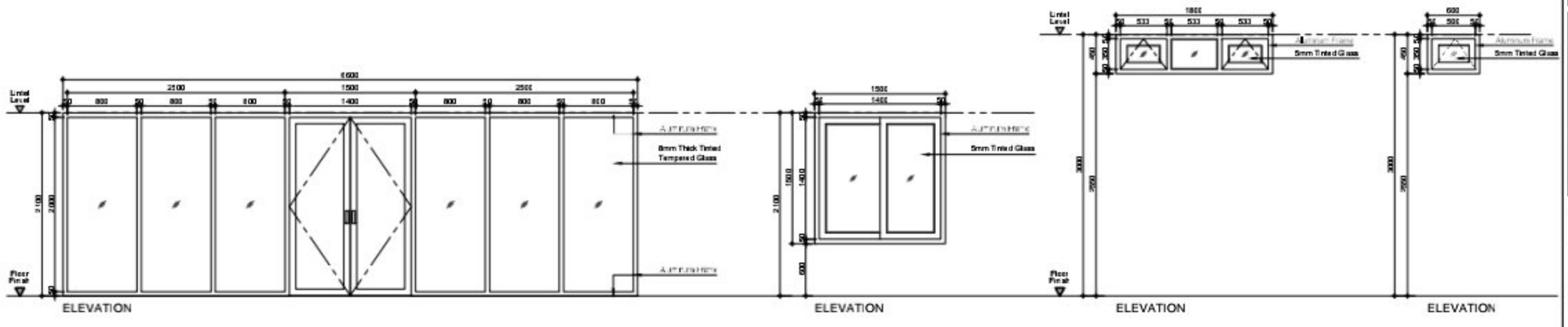
D1 PLAN 1000 x 2100

D2 PLAN 900 x 2100

D3 PLAN 900 x 2100

D4 PLAN 1000 x 2100

D5 PLAN 750 x 2100



DW1 PLAN 6600 x 2100

W1 PLAN 1500 x 1500

V1 PLAN 1800 x 450

V2 PLAN 600 x 450

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:A1-B 18th Lane, Khayaban-e-Hilal,Phase 7 Defence Housing Authority, Karachi- 75600 – Pakistan
Phone No 111-113-564, Fax No 880-1826
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

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Issued To	Client
Issued For	Tender

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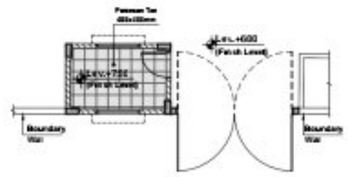
Status:
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Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

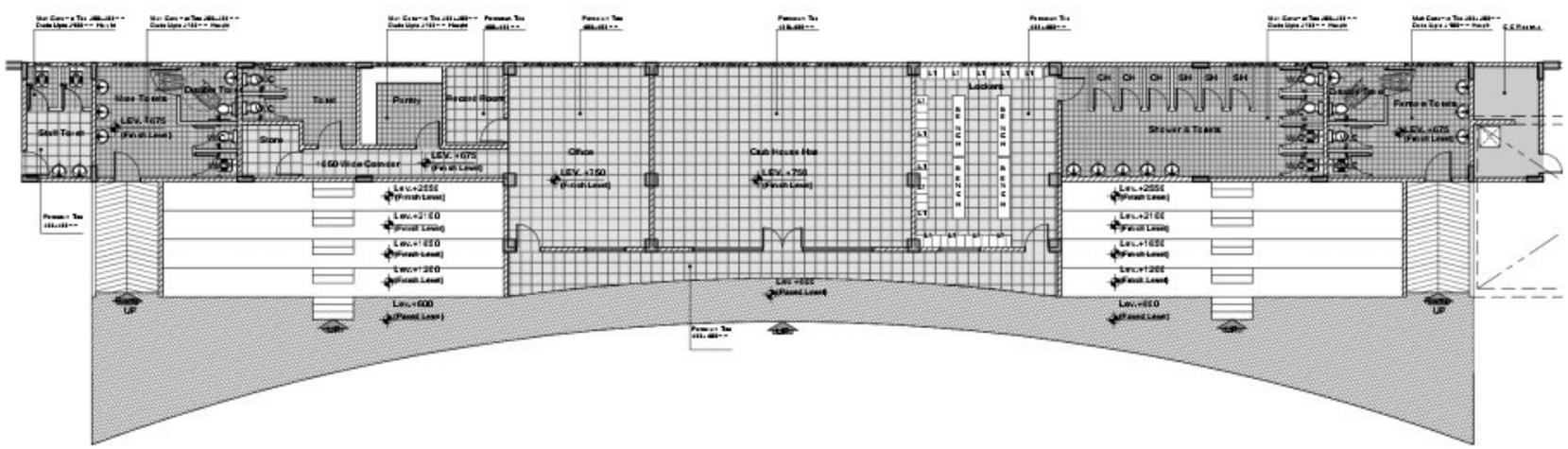
Drawing Title:
DOORS , WINDOWS PLAN & ELEVATIONS

Designed:	Checked:	Approved:
SHH	SHH	FAK
Drawn:	Date:	Scale / Sheet:
S A A	November 2021	1:25@A
Project Code: 01062		Rev.:

Drawing No.: EA-01062-EGFS- A6-0030



PP-02 (GROUND FLOOR PLAN)



PP-01 (GROUND FLOOR PLAN)

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:No.9, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi, 75600 – Pakistan
Phone No: 111-113-864, Fax No: 8961826
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

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Rev.	Date	Description
REVISIONS		

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

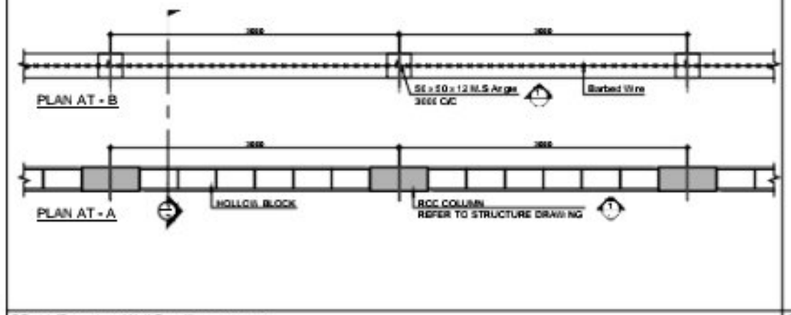
Status:
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Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

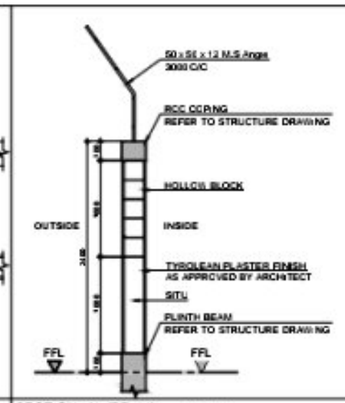
Drawing Title:
PP-01 & PP-02
FLOORING PLANS

Designed:	Checked:	Approved:
SHH	SHH	AK
Drawn:	Date:	Scale / Sheet:
WA	November 2021	1:100@A1
Project Code: 01062		Rev.:

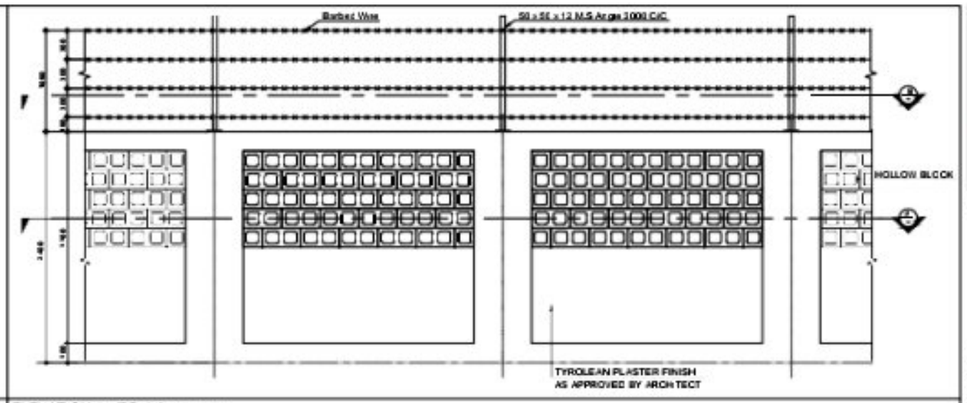
Drawing No.: EA-01062-EGFS- A7-0100



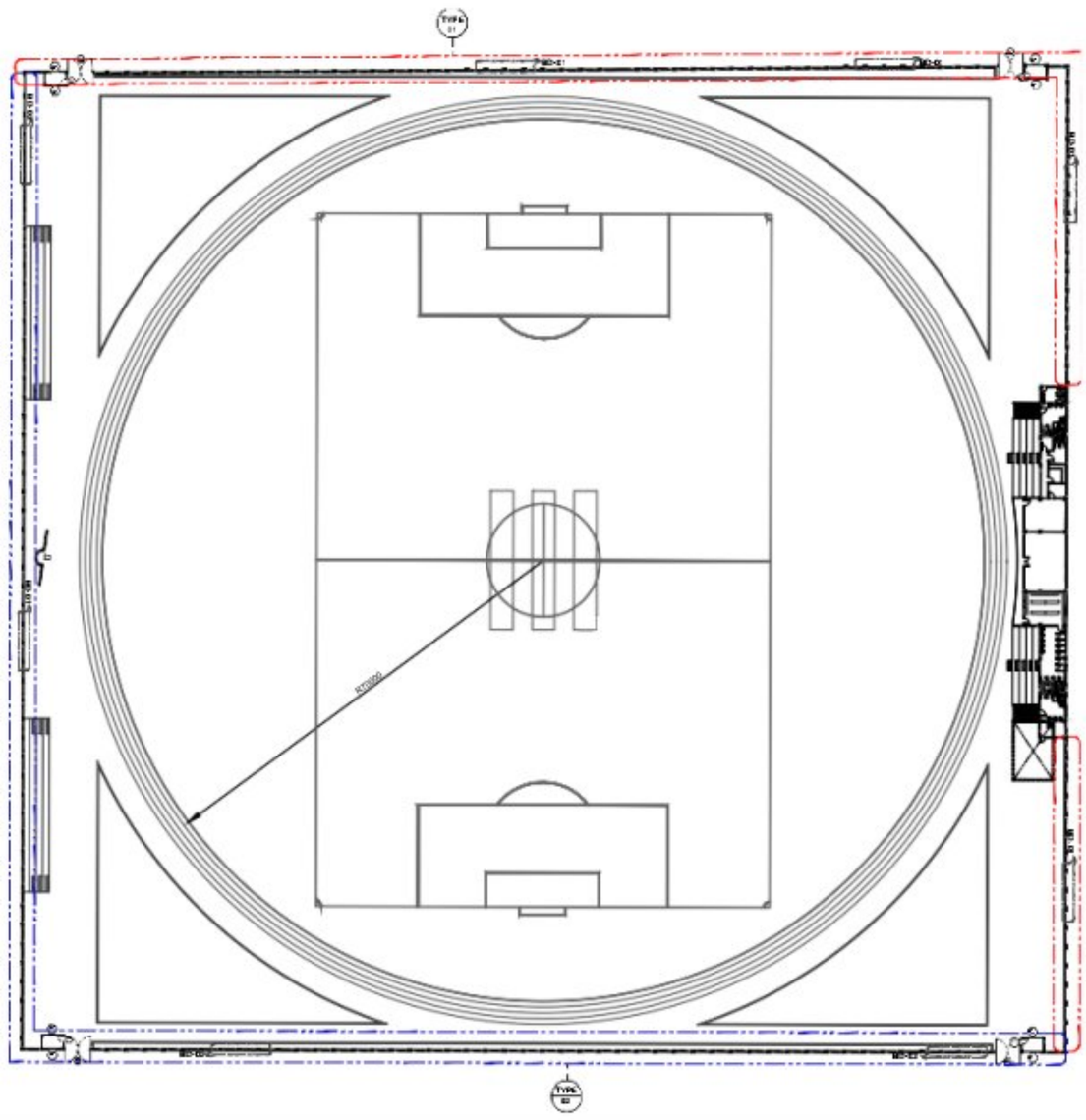
BD-01 (Boundary Wall Detail) Scale = 1:30



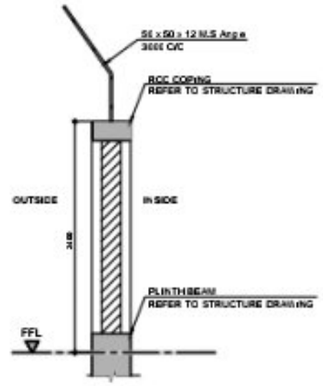
SECTION - Y (BD-01) Scale = 1:30



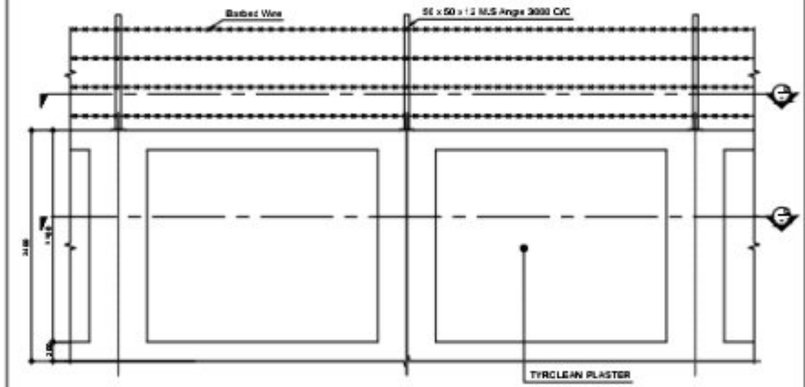
ELEVATION-01 (BD-01) Scale = 1:30



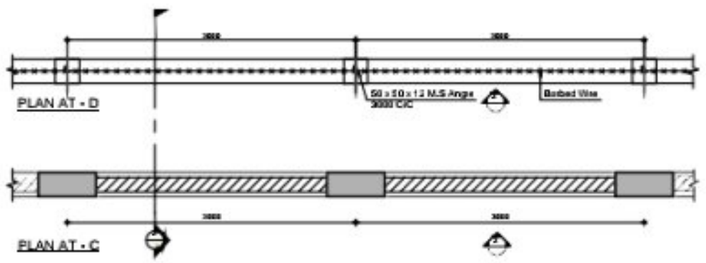
BOUNDARY WALL LAYOUT Scale = 1:450



SECTION - Z (BD-02) Scale = 1:30



ELEVATION-02 (BD-02) Scale = 1:30



BD-02 (Boundary Wall Detail) Scale = 1:30

Client :

CLICK
Construction and Facilities City of Karachi

Consultant :

EA Consulting Pvt Ltd

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan:

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Rev.	Date	Description
REVISIONS		

Date of Issue	18 November 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

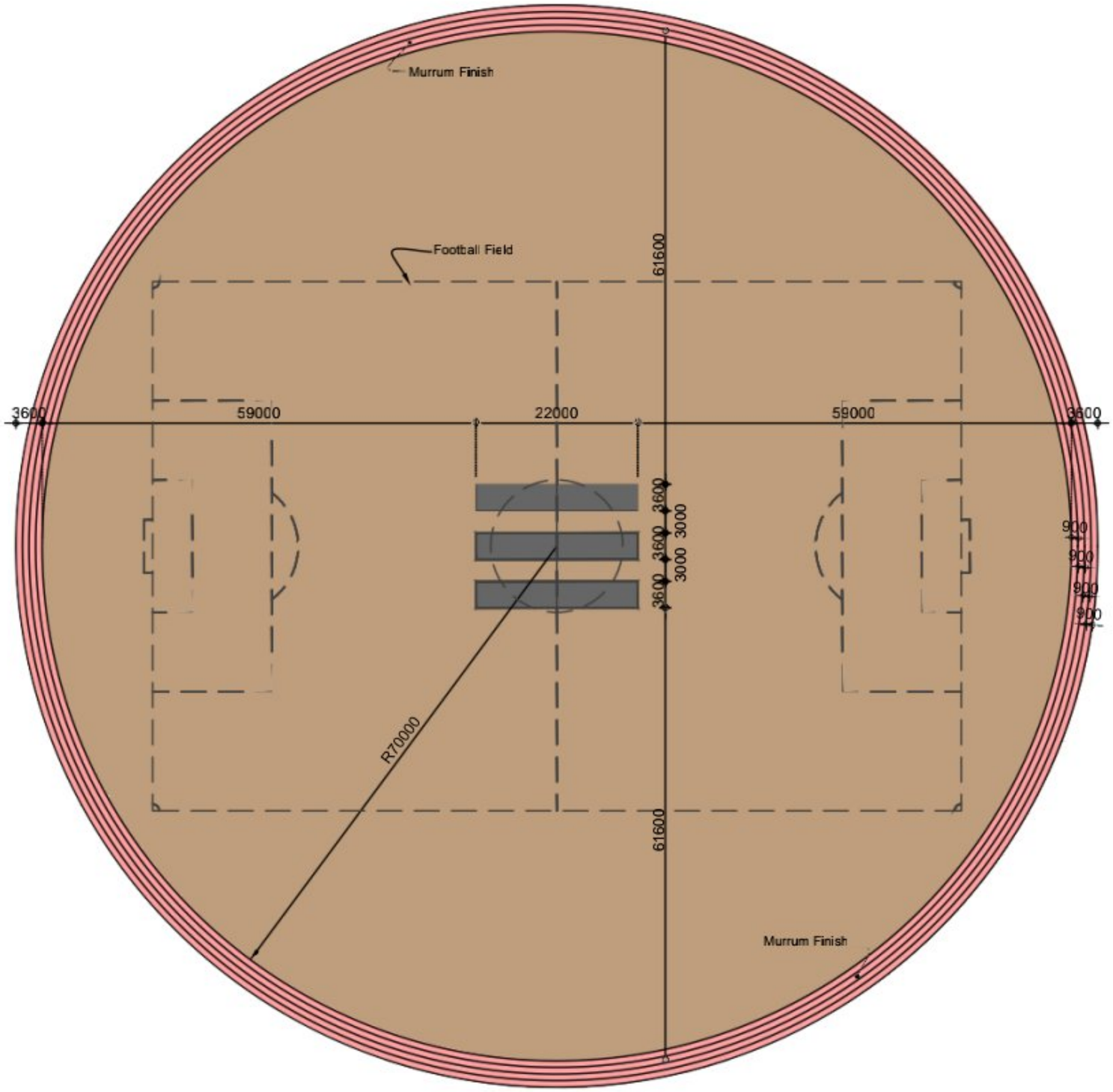
Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
BOUNDARY WALL LAYOUT & DETAIL

Designed:	Checked:	Approved:
SAH	SAH	AFK
Drawn:	Date	Scale / Sheet:
N AA	November 2021	As Shown @ A1
Project Code: 01062		Rev.:

Drawing No:
EA-01062-EGFS-A10-0010



Client:

CLICK

Consultant:

EA Consulting Pvt Ltd

Project:

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

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Rev:	Date	Description
		REVISIONS

Date of Issue	16 November 2021
Issued To	Client
Issued For	Tender

ARCHITECTURE

Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
GD-02
CRICKET FIELD DETAIL

Designed:	Checked:	Approved:
SHM	SHM	AHK
Drawn:	Date:	Scale / Sheet:
MM	November 2021	N.T.S
Project Code: 01062		Rev.: 0

Drawing No:
EA-01062-EGFS-A10-0030

Structures

LIST OF DRAWING

EID GAH FOOTBALL STADIUM KORANGI

S.NO	DRAWING NO	TITLE OF DRAWINGS
0	EA- 062-EGFS-S-0001	LIST OF DRAWINGS
02	EA- 062-EGFS-S-001	GENERAL NOTES
03	EA-1062-EGFS-S-002	GENERAL NOTES
0	EA- 062-EGFS-S-010	COLUMNS AND FOUNDATION LAYOUT PLAN
05	EA-1062-EGFS-S-0102	FOUNDATION AND COLUMNS DETAILS
06	EA-1062-EGFS-S-0103	GROUND FLOOR PLAN
0	EA-1062-EGFS-S-010	FIRST FLOOR PLAN AND SECTION
08	EA-1062-EGFS-S-0105	ROOF PLAN
09	EA- 062-EGFS-S-0201	DETAILS OF GUARD ROO
0	EA- 062-EGFS-S-0301	UNDER GROUND WATER TANK AND PUMP ROO
	EA- 062-EGFS-S-0401	BOUNDARY WALL FOUNDATION AND COLUMN DETAILS
2	EA-1062-EGFS-S-0402	BOUNDARY WALL FOUNDATION AND COLUMN DETAILS
3	EA-1062-EGFS-S-0403	BOUNDARY WALL PLINTH LEVE
	EA-1062-EGFS-S-0404	BOUNDARY WALL LAYOUT PLAN
5	EA-1062-EGFS-S-0405	BOUNDARY WALL SECTIONS

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting PvtLtd
Head Office:AL-1, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi, 75500 - Pakistan
Phone No. 111-111-58, Fax No. 58-1825
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

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North: N

Rev.	Date	Description
0	DEC,2021	ISSUED FOR TENDER

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

STRUCTURE

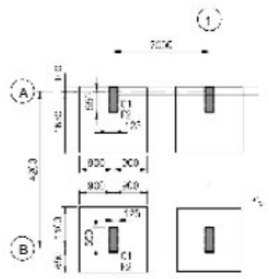
Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
LIST OF DRAWINGS

Designed:	Checked:	Approved:
F.A	A.J	M.B
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	1:75@A1
Project Code: 01062		Rev.: 0

Drawing No.: EA-01062-EGFS-S-0001

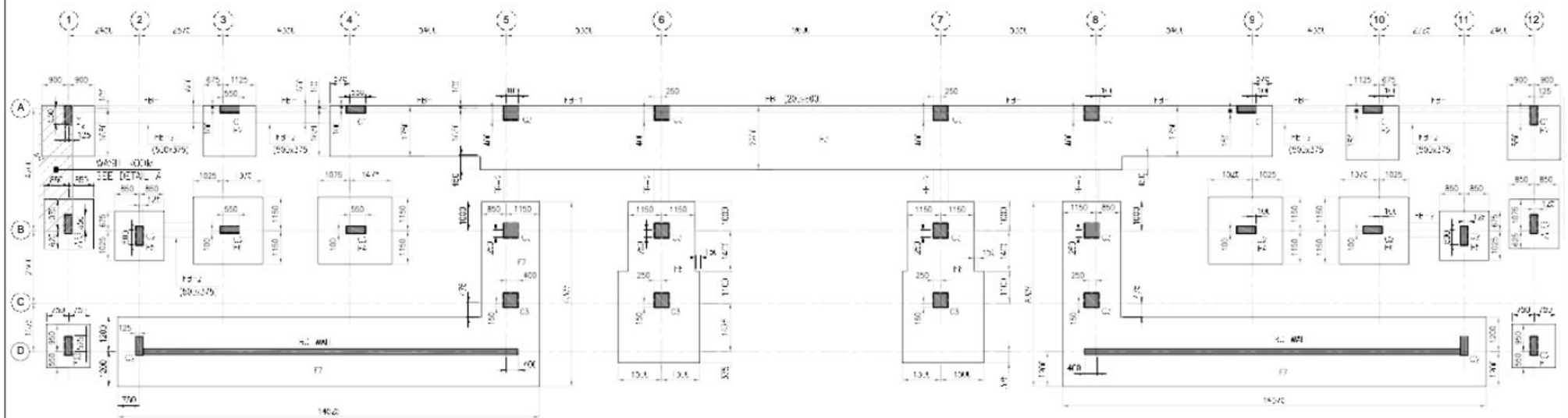


B WASH ROOM DETAIL-A

SCHEDULE OF FOOTING				
S.NO.	FOOTING	FOOTING SIZE		FOOTING THICK
		A	B	C
1	F1	150	150	375
2	F4	1875	1500	375
3	F3	SEE PLAN		375
4	F4	2250	2250	375
5	F5	1725	1725	375
6	F6	2400	2250	375
7	F7	SEE PLAN		375
8	F8	SEE PLAN		375

NOTE:-

1. FOR GENERAL NOTES REFER DRG. NO. EA-062-CLICK-EGFS-S-001 & S-002
2. ALL LEVELS ARE WRT PROJECT DATUM
3. ALL DIMENSIONS TO BE READ IN CONJUNCTION WITH ARCHITECTURAL DRAWINGS AND OTHER RELEVANT DRAWINGS
4. FOUNDATION IS DESIGNED ON SBC OF 125 psf (1250kPa) ASSUMED NET ALLOWABLE BEARING CAPACITY OF SOIL CONTRACTOR SHALL ACHIEVE REQUIRED BEARING CAPACITY OF SOIL PRIOR CASTING FOOTINGS



A COLUMNS AND FOUNDATION LAYOUT PLAN

Client:
CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant:
EA Consulting Pvt Ltd
Head Office:AL-1, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaconsult.com | www.eaconsult.com

Project:
EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

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North: N

Rev.	Date	Description
0	DEC,2021	ISSUED FOR TENDER

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

STRUCTURE

Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
COLUMNS AND FOUNDATION LAYOUT PLAN

Designed:	Checked:	Approved:
F.A	A.J	M.S
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	AS SHOWN
Project Code: 01062		Rev.: 0

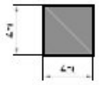
Drawing No.: EA-01062-EGFS- -0101



TYP. SECTION OF COLUMN C1
SCALE = 1:25 (ABOVE GROUND)



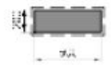
TYP. SECTION OF COLUMN C2
SCALE = 1:25 (ABOVE GROUND)



TYP. SECTION OF COLUMN C3
SCALE = 1:25 (ABOVE GROUND)



TYP. SECTION OF COLUMN C1
SCALE = 1:25 (GROUND LEVEL)



TYP. SECTION OF COLUMN C2
SCALE = 1:25 (GROUND LEVEL)



TYP. SECTION OF COLUMN C3
SCALE = 1:25 (GROUND LEVEL)



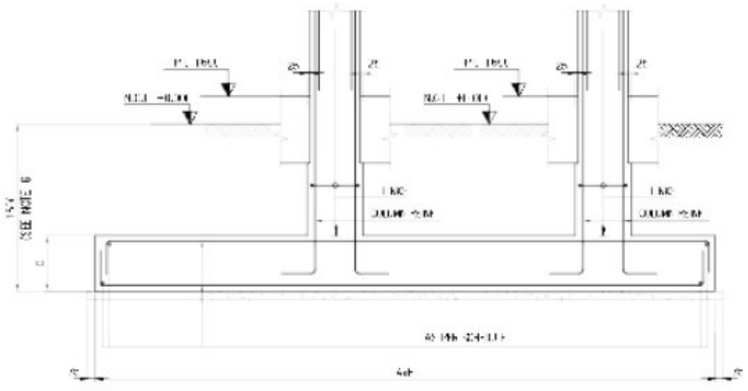
TYP. SECTION OF COLUMN C1
SCALE = 1:25 (BELOW GROUND)



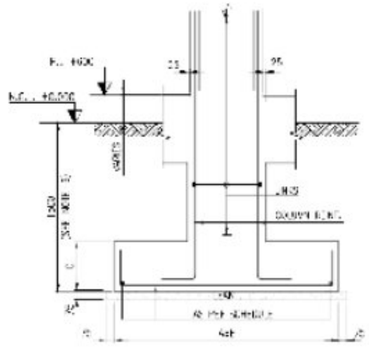
TYP. SECTION OF COLUMN C2
SCALE = 1:25 (BELOW GROUND)



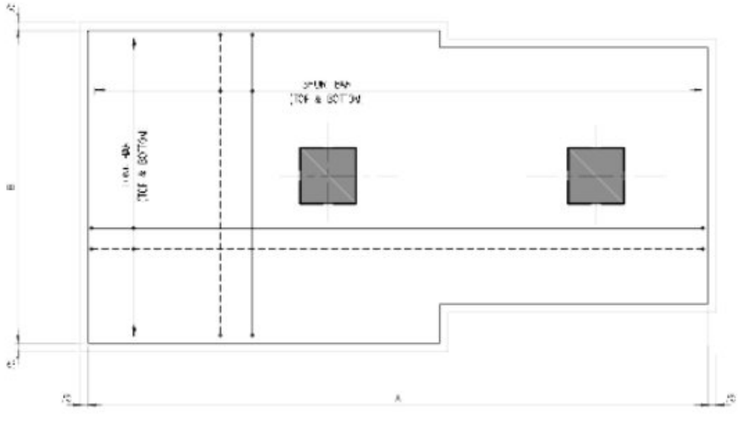
TYP. SECTION OF COLUMN C3
SCALE = 1:25 (BELOW GROUND)



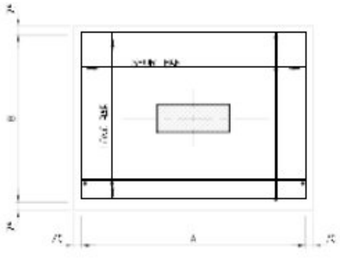
TYP. SECTION OF COMBINED FOOTING
SCALE = 1:25



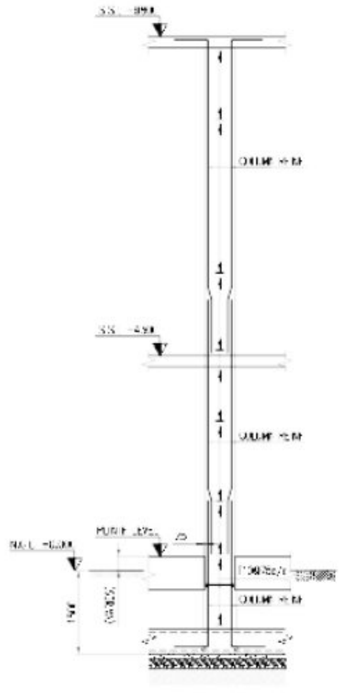
TYP. SECTION OF ISOLATED FOOTING
SCALE = 1:25



TYP. PLAN OF COMBINED FOOTING
SCALE = 1:25



TYP. PLAN OF ISOLATED FOOTING
SCALE = 1:25



TYP. ELEVATION OF COLUMN
SCALE = 1:25

NOTE:-

1. FOR GENERAL NOTES PLEASE REFER DRAWING NO. EA-062-CLICK-EGFS-S-001 & S-002
2. ALL LEVELS ARE IN METERS.
3. ALL DRAWINGS TO BE READ IN CONJUNCTION OF ARCHITECTURAL DRAWING AND OTHER RELEVANT SERVICES DRAWINGS.
4. COLUMN GRID IS UNIFORM ON 7.20m (125'-0") SQUARE NET ALLOWABLE SOIL CAPACITY OF SOIL UNDER PLUM STONE ALLOWABLE SOIL CAPACITY OF SOIL UNDER PLUM STONE IS 2TON/SQ.FT.

Client:

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant:

EA Consulting Pvt Ltd
Head Office:A-1, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaconsult.com | www.eaconsult.com

Project:

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

Note:
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Rev.	Date	Description
0	DEC,2021	ISSUED FOR TENDER

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

STRUCTURE

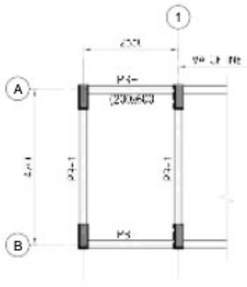
Status: TENDER

Name: EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

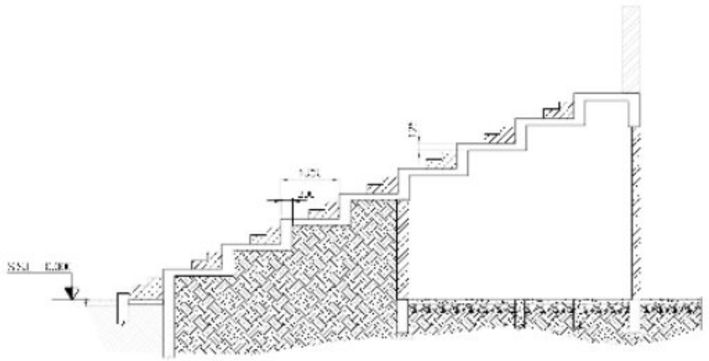
Drawing Title: FOUNDATION AND COLUMNS DETAILS

Designed:	Checked:	Approved:
F.A	A.J	M.S
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	AS SHOWN
Project Code: 01062		Rev.: 0

Drawing No.: EA-01062-EGFS-S-0102



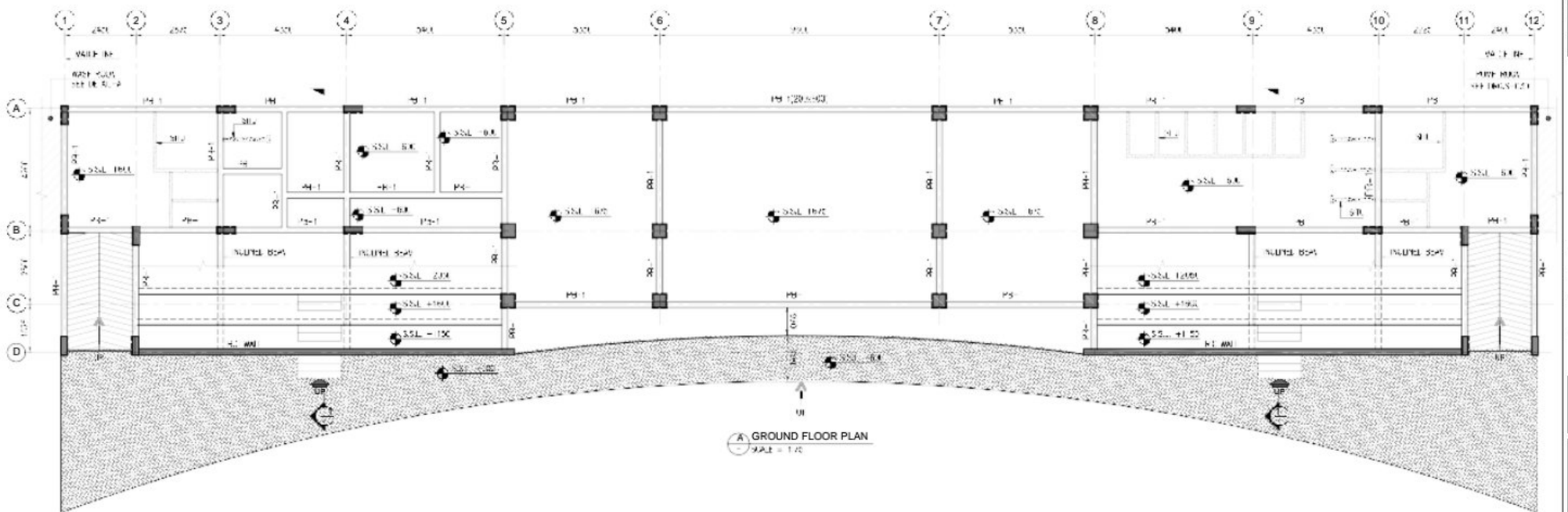
A WASH ROOM DETAIL-A



SECTION 1

NOTE:-

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]



A GROUND FLOOR PLAN

Client:

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant:

EA Consulting Pvt Ltd
Head Office:AL-1, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaconsult.com | www.eaconsult.com

Project:

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

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Rev.	Date	Description
0	DEC,2021	ISSUED FOR TENDER

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

STRUCTURE

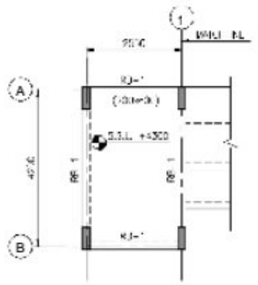
Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

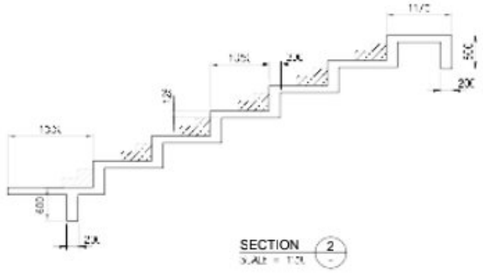
Drawing Title:
GROUND FLOOR PLAN

Designed:	Checked:	Approved:
F.A	A.J	M.S
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	AS SHOWN
Project Code: 01062		Rev.: 0

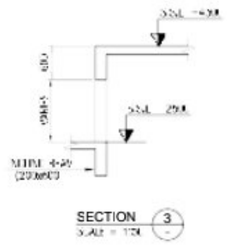
Drawing No.:
EA-01062-EGFS--S-0103



A WASH ROOM DETAIL-A
SCALE = 1:25



SECTION 2
SCALE = 1:25

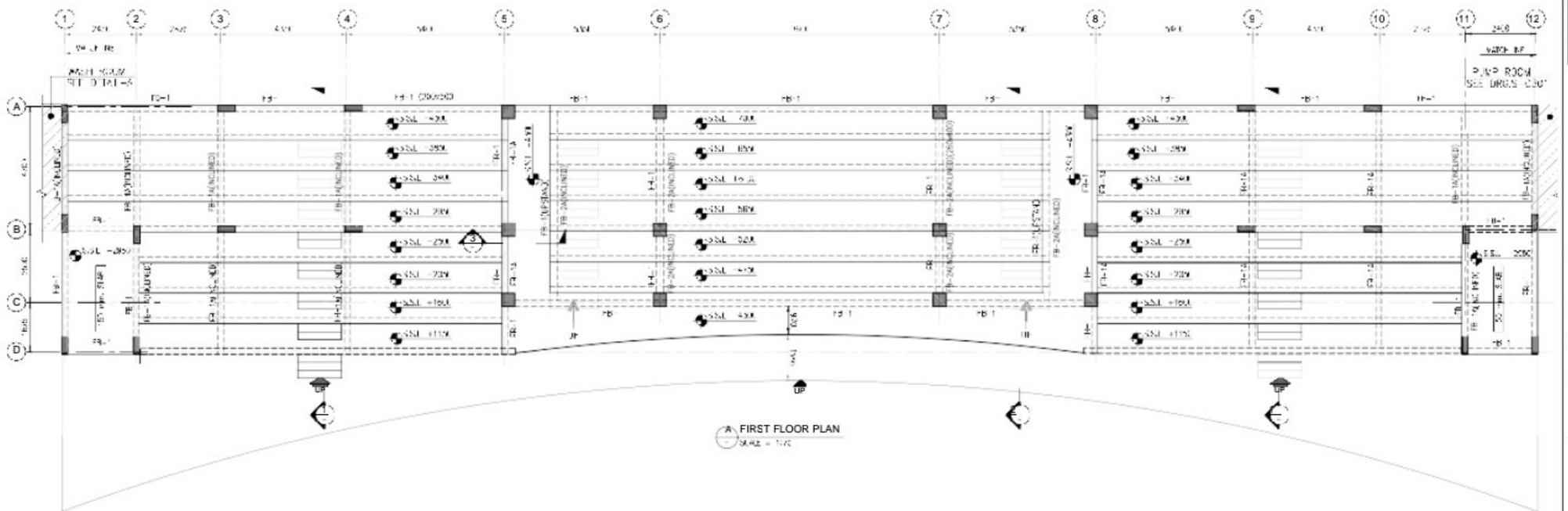


SECTION 3
SCALE = 1:25

NOTE:-

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]

SCHEDULE OF BEAMS		
S.NO.	BEAMS	BEAM SIZE
1	FB-1	230mmX[illegible]
2	FB-1A (INCLINED)	230mmX[illegible]
3	FB-2A (INCLINED)	230mmX[illegible]



A FIRST FLOOR PLAN
SCALE = 1:75

Client:
CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant:
EA Consulting Pvt Ltd
Head Office:AL-1, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaward.com | www.eaward.com

Project:
EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

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North: N

Rev.	Date	Description
0	DEC,2021	ISSUED FOR TENDER
REVISIONS		

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

STRUCTURE

Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

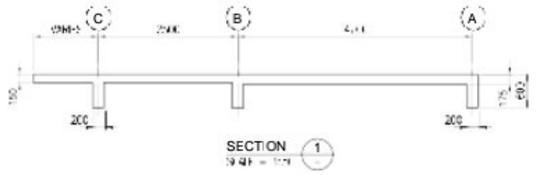
Drawing Title:
FIRST FLOOR PLAN AND SECTION

Designed:	Checked:	Approved:
F.A	A.J	M.S
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	AS SHOWN
Project Code: 01062		Rev.: 0

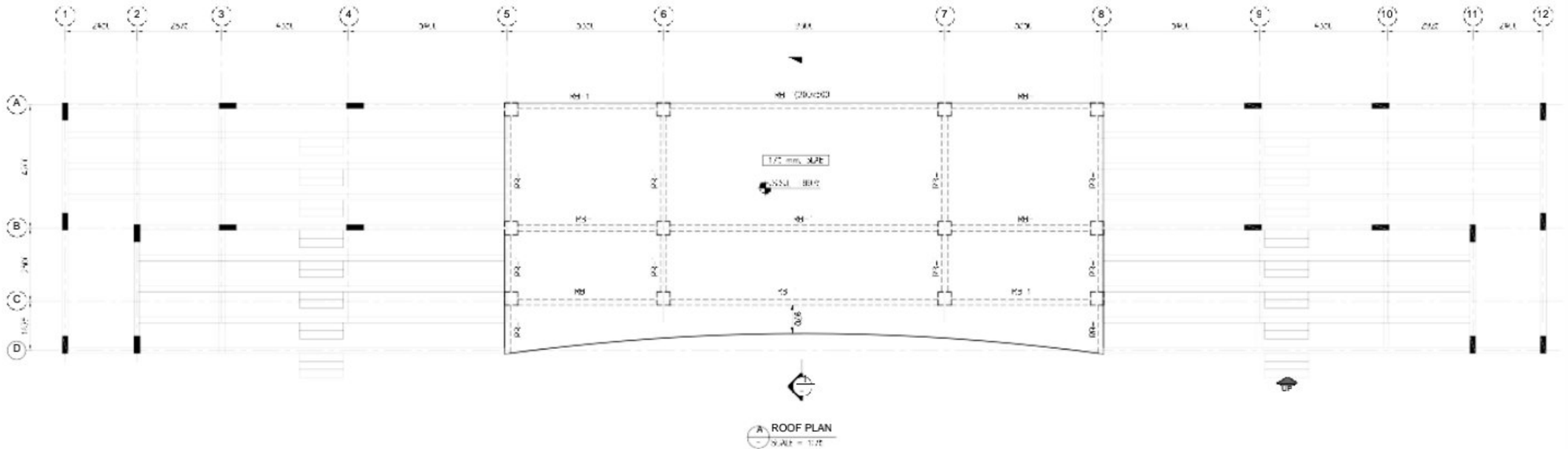
Drawing No.: EA-01062-EGFS-S-0104

NOTE:-

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]



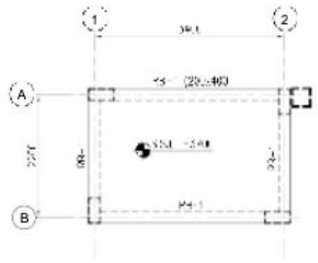
SECTION 1



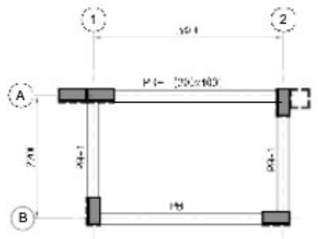
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1. [illegible]
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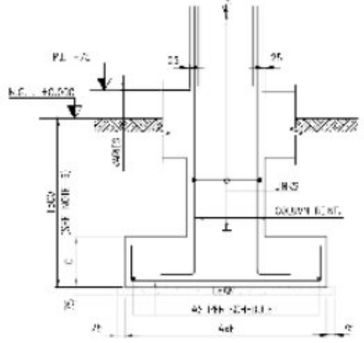
SCHEDULE OF FOOTING				
S.NO.	FOOTING	FOOTING SIZE		FOOTING THICK
		A	B	C
1	F1	2500	1800	375
2	F2	1450	1800	375



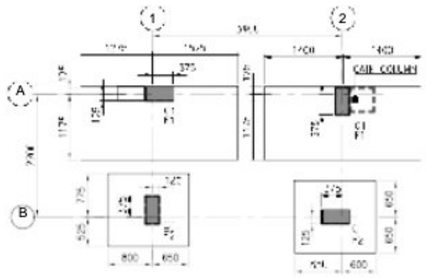
A ROOF PLAN
SCALE : 1:25



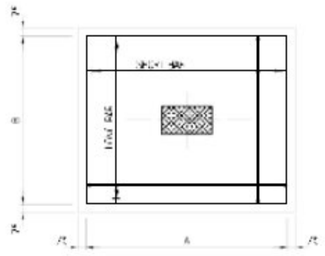
A GROUND FLOOR PLAN
SCALE : 1:25



TYP. SECTION OF ISOLATED FOOTING
SCALE : 1:25



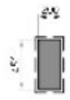
A FOUNDATION AND COLUMNS LAYOUT PLAN
SCALE : 1:25



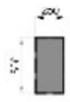
TYP. PLAN OF ISOLATED FOOTING
SCALE : 1:25



TYP. SECTION OF COLUMN C1
SCALE : 1:25 (ABOVE GROUND)



TYP. SECTION OF COLUMN C1
SCALE : 1:25 (GROUND LEVEL)



TYP. SECTION OF COLUMN C1
SCALE : 1:25 (BELOW GROUND)



TYP. ELEVATION OF COLUMN
SCALE : 1:25

Client:

CLICK
Competitive and Liveable City of Karachi
Local Government Department, Government of Sindh

Consultant:

EA Consulting Pvt Ltd
Head Office:AL-1, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi, 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaward.com | www.eaward.com

Project:

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

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Date of Issue	16 November, 2021
Issued To	Client
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STRUCTURE

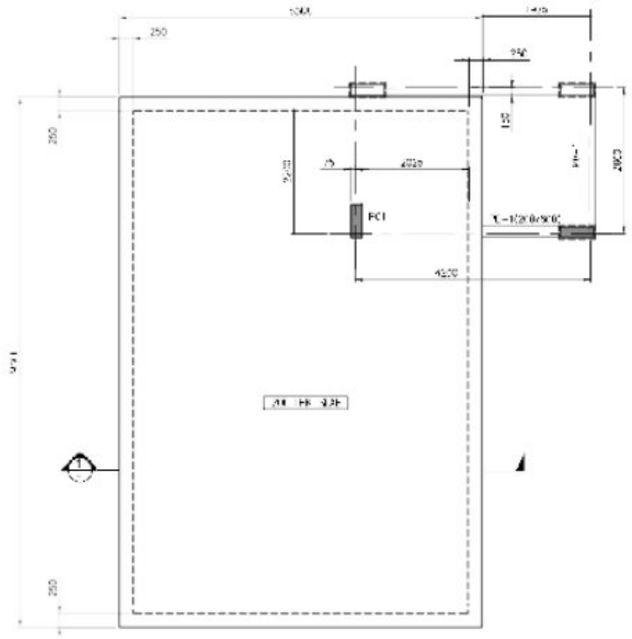
Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

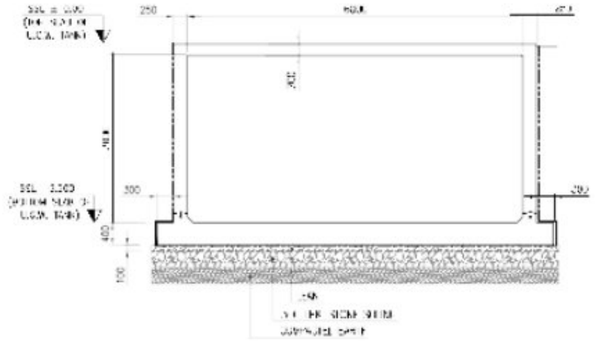
Drawing Title:
DETAILS OF GUARD ROOM

Designed:	Checked:	Approved:
F.A	A.J	M.S
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	AS SHOWN
Project Code: 01062		Rev.: 0

Drawing No.:
EA-01062-EGFS--S-0201



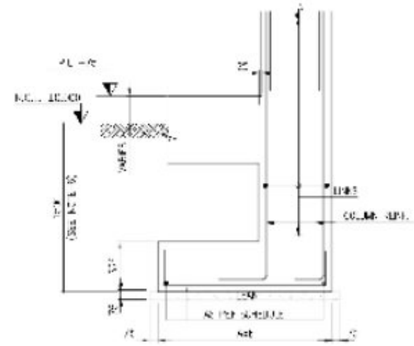
B TOP SLAB PLAN



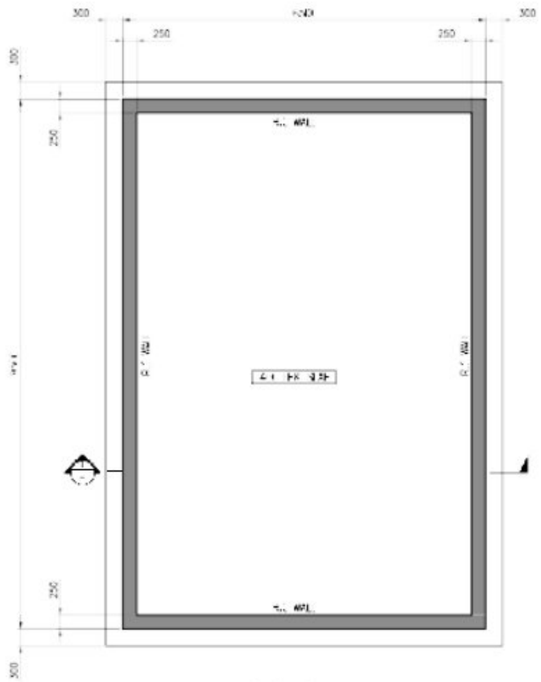
SECTION

NOTE:-

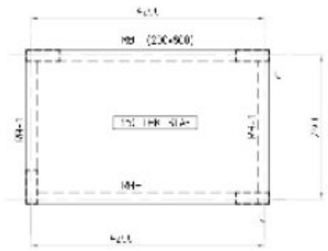
1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]



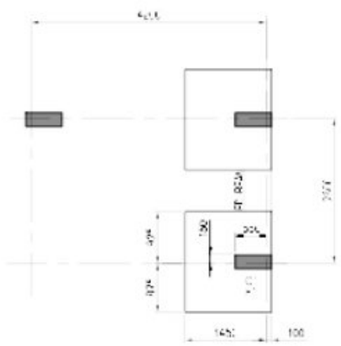
TYP. SECTION OF ISOLATED FOOTING



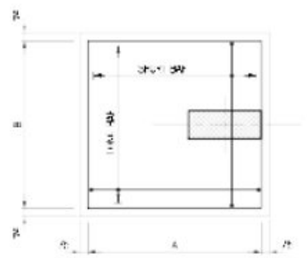
A BOTTOM SLAB PLAN



D PUMP ROOM ROOF



C PUMP ROOM FOUNDATION



TYP. PLAN OF ISOLATED FOOTING

Client:

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Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

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Project:

EID GAH FOOTBALL STADIUM
D M C KORANGI

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REVISIONS

Date of Issue	16 November, 2021
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Issued For	Tender

STRUCTURE

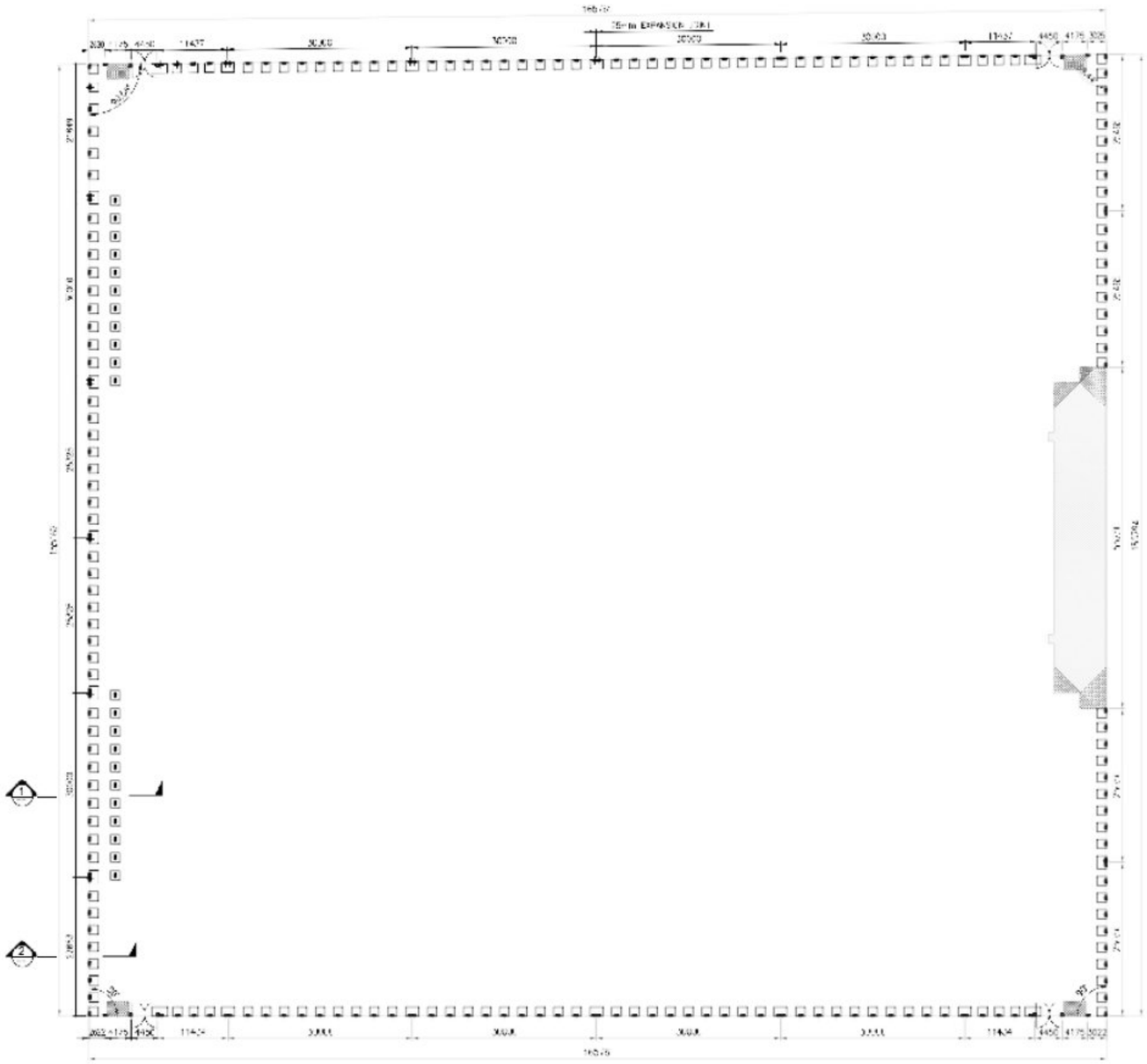
Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
UNDER GROUND WATER TANK AND PUMP ROOM

Designed: F.A	Checked: A.J	Approved: M.S
Drawn: A.B	Date: December, 2021	Scale / Sheet: AS SHOWN
Project Code: 01062		Rev.: 0

Drawing No.:
EA-01062-EGFS- -0301



A FOUNDATION AND COLUMN LAYOUT PLAN

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

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Head Office:AL-5, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi, 75500 - Pakistan
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Email : info@eaward.com | www.eaward.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

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Issued For	Tender

STRUCTURE

Status:
TENDER

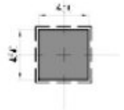
Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
BOUNDARY WALL FOUNDATION AND COLUMN LAYOUT PLAN

Designed: F.A	Checked: A.J	Approved: M.S
Drawn: A.B	Date: December, 2021	Scale / Sheet: AS SHOWN
Project Code: 01062		Rev.: 0
Drawing No.: EA-01062-EGFS-S-401		



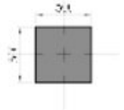
TYP. SECTION OF COLUMN C1
SCALE = 1:25 (GROUND LEVEL)



TYP. SECTION OF COLUMN C2
SCALE = 1:25 (GROUND LEVEL)

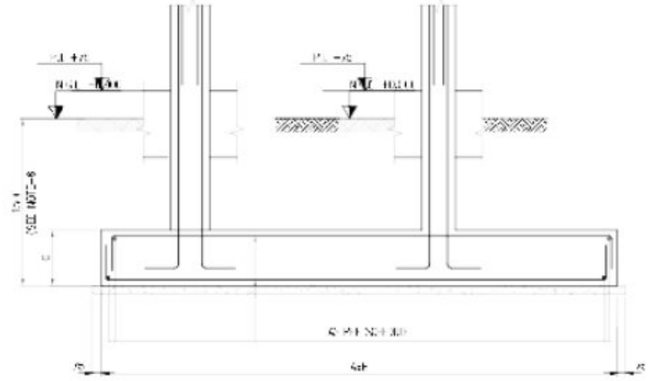


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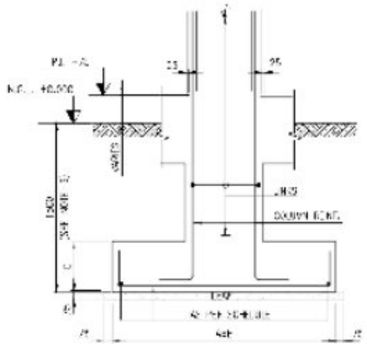


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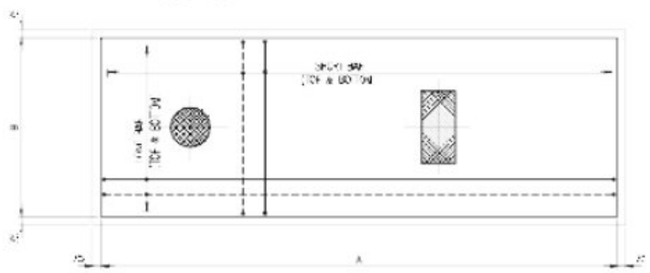
SCHEDULE OF FOOTING				
S.NO.	FOOTING	FOOTING SIZE		FOOTING THICK
		A	B	C
1	F	15'0"	15'0"	4'0"
2	F1A	15'0"	15'0"	4'0"
3	F2	2'-0"	15'0"	4'0"
4	F2A	2'-0"	15'0"	4'0"
5	F3	25'0"	15'0"	4'0"



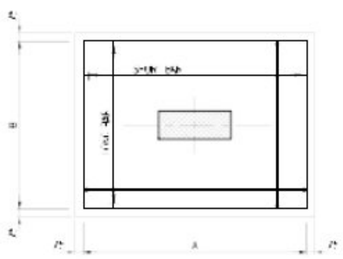
TYP. SECTION OF COMBINED FOOTING
SCALE = 1:25



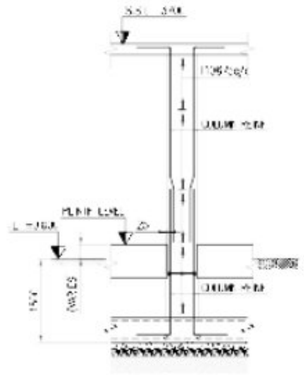
TYP. SECTION OF ISOLATED FOOTING
SCALE = 1:25



TYP. PLAN OF COMBINED FOOTING
SCALE = 1:25



TYP. PLAN OF ISOLATED FOOTING
SCALE = 1:25



TYP. ELEVATION OF COLUMN
SCALE = 1:25

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:AL-1, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaward.com | www.eaward.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

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 Meter / Millimeter 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.	Date	Description
0	DEC,2021	ISSUED FOR TENDER

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

STRUCTURE

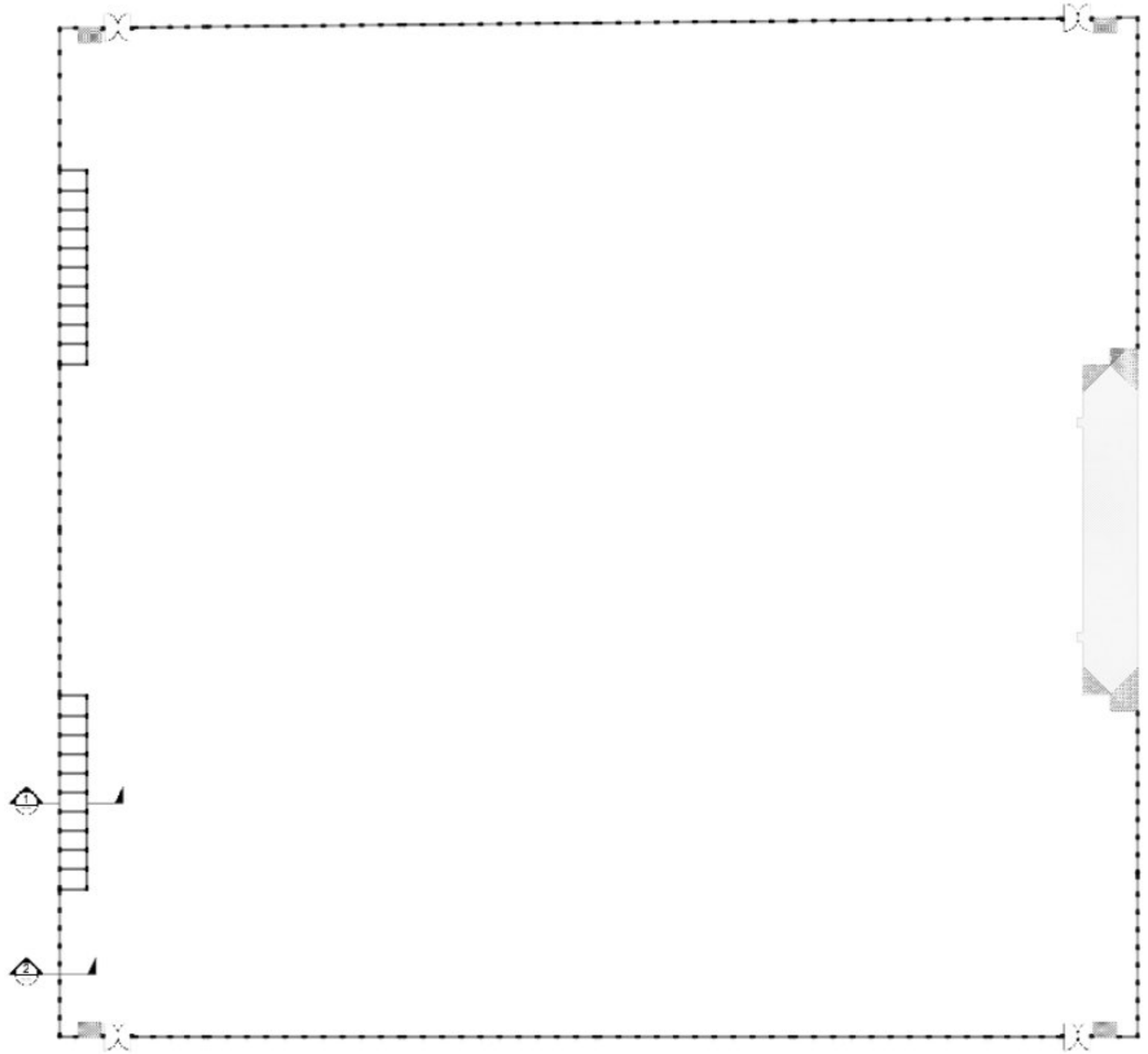
Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
BOUNDARY WALL FOUNDATION AND COLUMN DETAILS

Designed:	Checked:	Approved:
F.A	A.J	M.S
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	AS SHOWN
Project Code: 01062		Rev.: 0

Drawing No.:
EA-01062-EGFS-S-402



A BOUNDRY WALL PLINTH LEVEL PLAN
SCALE - 1:100 (AL SIZE PAPER) AND 1:200 (A3 SIZE)

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:AL-5, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-594, Fax No. 584-1825
Email : info@eaward.com | www.eaward.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

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North: N

Rev.	Date	Description
0	DEC,2021	ISSUED FOR TENDER

REVISIONS

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

STRUCTURE

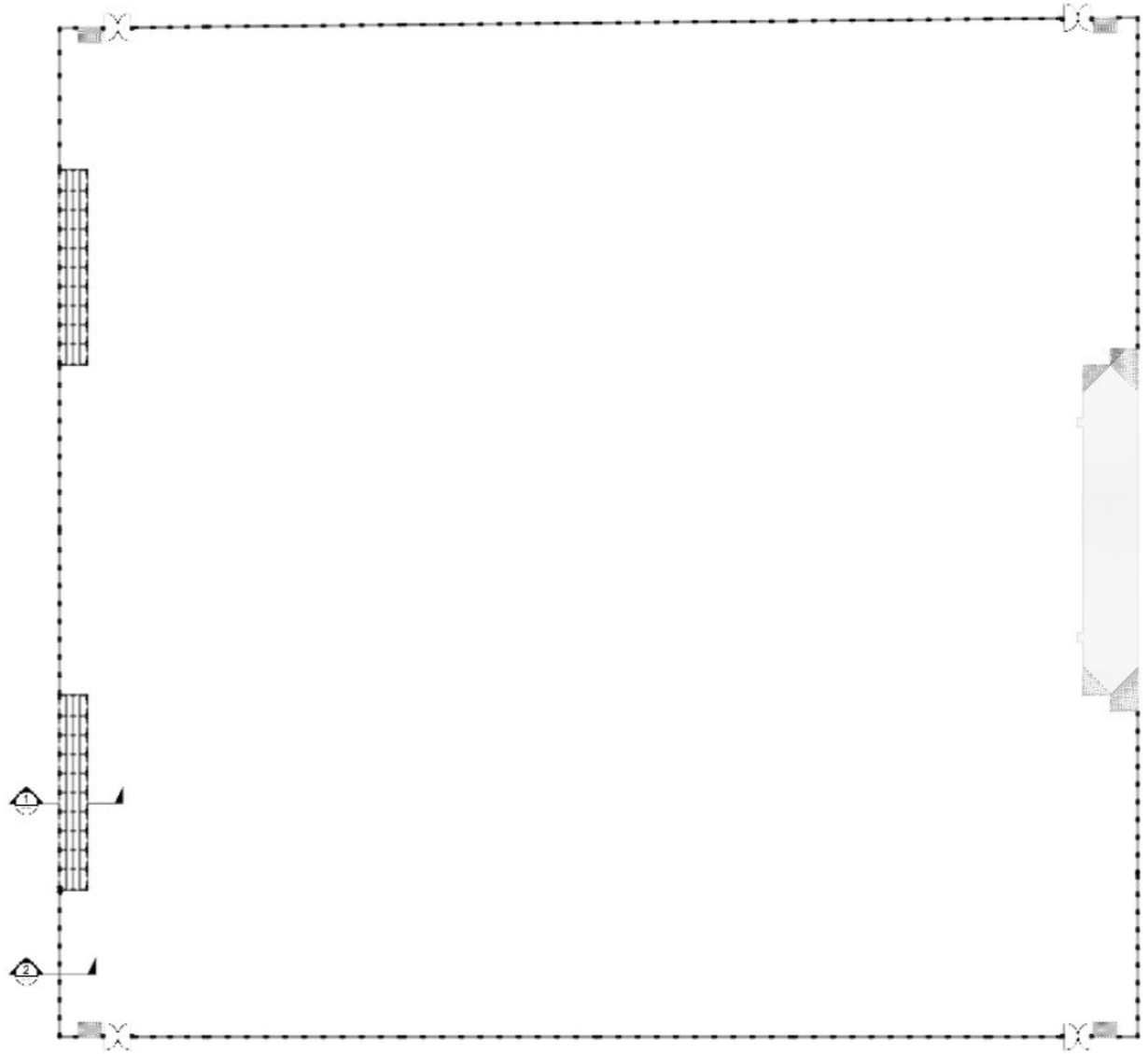
Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
BOUNDARY WALL PLINTH LEVEL PLAN

Designed:	Checked:	Approved:
F.A	A.J	M.S
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	AS SHOWN
Project Code: 01062		Rev.: 0

Drawing No.:
EA-01062-EGFS-S-403



A BOUNDRY WALL PLINTH LEVEL PLAN

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:AL-5, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
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Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

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North: N

Rev.	Date	Description
0	DEC,2021	ISSUED FOR TENDER

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STRUCTURE

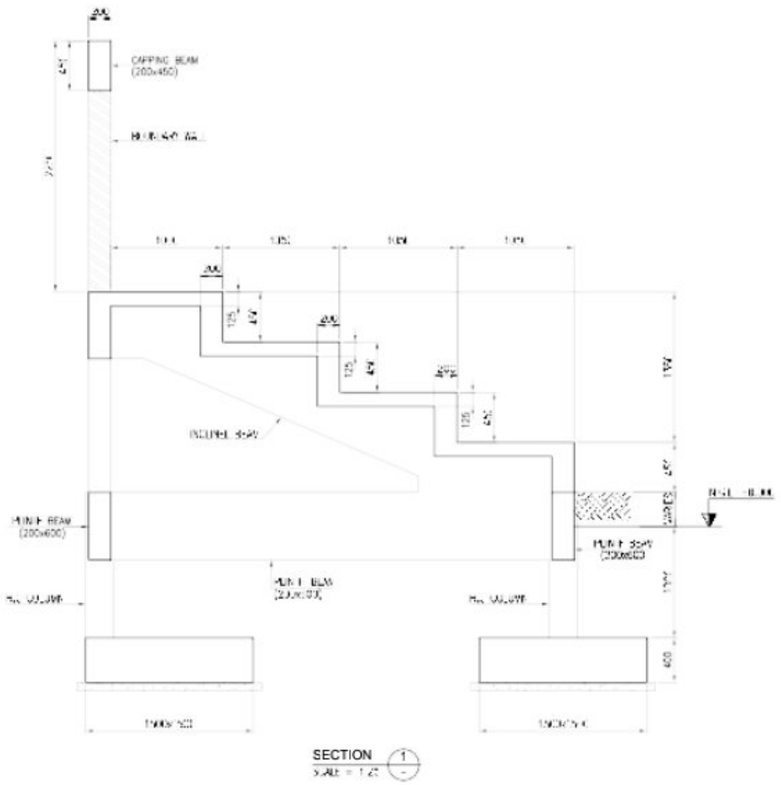
Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

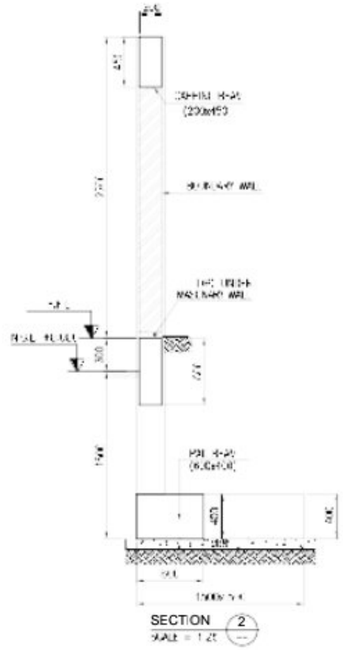
Drawing Title:
BOUNDARY WALL LAYOUT PLAN

Designed:	Checked:	Approved:
F.A	A.J	M.S
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	AS SHOWN
Project Code: 01062		Rev.: 0

Drawing No.:
EA-01062-EGFS-S-404



SECTION 1
SCALE : 1:25



SECTION 2
SCALE : 1:25

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:AL-5, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
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Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

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0	DEC,2021	ISSUED FOR TENDER

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Date of Issue	16 November, 2021
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Issued For	Tender

STRUCTURE

Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
BOUNDARY WALL SECTIONS

Designed:	Checked:	Approved:
F.A	A.J	M.S
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	AS SHOWN
Project Code: 01062		Rev.: 0

Drawing No.:
EA-01062-EGFS-S-405

GENERAL

S1 STRUCTURAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DISCIPLINE DRAWINGS, DOCUMENTS, SPECIFICATIONS ETC. AS PART OF THE CONTRACT DOCUMENT OR, MAY BE ISSUED DURING THE COURSE OF THE CONTRACT.

S2 ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE, DIMENSIONS SHALL NOT BE OBTAINED BY SCALING DRAWINGS.

S3 FOR MAIN SETTING OUT LINES AND LEVELS REFER TO ARCHITECTURAL DRAWINGS.

S4 THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THE SAFETY OF CONSTRUCTION AT ALL TIMES AND SHALL ENSURE THAT NO PART OF INTERMEDIATE COMPLETED CONSTRUCTION IS HAZARDOUS (EXAMPLE: SIDES OF EXCAVATION, STARTER BARS ETC.)

S5 THE STRUCTURE IN WHOLE AND ALL IMPORTANT MEMBERS SHALL BE DESIGNED TO RESIST MOMENT LATERAL FORCES AND ALL COMBINATION LOADS THROUGHOUT THE CONSTRUCTION PROCESS.

S6 ALL ELEMENTS OF THE STRUCTURE DESIGNED BY THE CONTRACTOR SHALL BE SUBMITTED TO DESIGN CONSULTANT FOR REVIEW.

S7 THE DESIGN CONSULTANT'S REVIEW PROCESS FOR ALL SUBMITTALS, DRAWINGS, METHOD STATEMENTS AND DOCUMENTS IS ONLY COMPLETE ONCE A STATUS OF "NO OBJECTION" IS REACHED, THE SUBMITTAL SHALL BE REVIEWED BY THE DESIGN CONSULTANT FOR COMPLIANCE WITH THE DESIGN INTENT THIS DOES NOT RELIEVE THE CONTRACTOR FROM HIS CONTRACTUAL RESPONSIBILITIES.

S8 FOR ALL BUILDERS WORK INFORMATION (OPENINGS IN STRUCTURAL ELEMENTS)- LIGHTING POINTS, DUCTS, CAST-IN PIPES, SLEEVES, ELECTRICAL TRENCHES, WAREHOUSES ETC), REFER TO M&P DRAWINGS FOR LOCATION, THE CONTRACTOR SHALL PREPARE COORDINATED SERVICES DRAWINGS IDENTIFYING STRUCTURAL, M&P AND ARCHITECTURAL ELEMENTS/DETAILS FOR CONSULTANT'S REVIEW BEFORE COMMENCEMENT OF CONSTRUCTION IN THE AREA CONCERNED.

S9 ALL DESIGN, WORKMANSHIP AND MATERIAL SHALL BE IN ACCORDANCE WITH THE CURRENT ACI, UBC, BIS, ASCE AND LOCAL AUTHORITY STANDARDS AND PROJECT DESIGN CRITERIA UNLESS NOTED OTHERWISE.

GENERAL CONSTRUCTION CONDITION

GC1 ALL EXCAVATION SHALL BE BASED ON ENGINEERING SHOP DRAWINGS PREPARED BY THE CONTRACTOR, INCLUDING PLANS AND SECTIONS OF EXCAVATION SEQUENCES, THE EXCAVATION SEQUENCES SHALL BE CONTROLLED TO MATCH THE REQUIREMENTS OF THE DESIGN OF THE SOIL RETENTION SYSTEM AND SHALL INCLUDE MONITORING OF WALL AND GROUND MOVEMENTS.

GC2 [illegible] DRAWINGS [illegible] FOOTINGS [illegible] FOUNDATION OF [illegible] SUBGRADE.

GC3 THE CONTRACTOR SHALL PROVIDE POSITIVE PROTECTION (MAT/SHOT COVERING) FOR ALL EXCAVATED SLOPES TO PROTECT SLOPES FROM INSTABILITY AND DETERIORATION DUE TO ENVIRONMENTAL CONDITIONS.

GC4 THE EXCAVATION RETENTION SYSTEM SHALL BE DESIGNED AND INSTALLED BY THE CONTRACTOR, UNLESS NOTED OTHERWISE, IN ACCORDANCE WITH THE GEOTECHNICAL DESIGN PARAMETERS AND SOIL PRESSURES AS INDICATED IN THE GEOTECHNICAL INVESTIGATION REPORT.

GC5 THE CONTRACTOR SHALL INSTALL AND CONTINUOUSLY SURVEY VERTICAL AND HORIZONTAL MOVEMENTS OF THE TOP OF THE SOIL RETENTION SYSTEM (IF INSTALLED), BENCH MARKS ADJACENT TO AND AWAY FROM THE SITE PERIMETER FOR VERTICAL AND HORIZONTAL MOVEMENTS AND OBSERVATION WELLS FOR MONITORING WATER LEVELS BELOW GROUND SURFACE.

GC6 AFTER COMPLETION OF THE PERIMETER SOIL RETENTION SYSTEM, THE SITE SHALL BE DE-WATERED, AS NECESSARY, BEFORE OR AS THE EXCAVATION PROCEEDS. THE CONTRACTOR SHALL PROVIDE ALL CONSTRUCTION AND EQUIPMENT FOR THE DE-WATERING SYSTEM INCLUDING, BUT NOT LIMITED TO, TRENCHES, SUMPS, DE-WATERING WELLS, WELL POINTS, OBSERVATION WELLS, PUMPING SYSTEM, DISPOSAL LOCATION, SETTLING BASINS, MAINTENANCE AND EMERGENCY BACK-UP EQUIPMENT, ETC.

GC7 THE DE-WATERING SYSTEM SHALL MAINTAIN THE WATER LEVEL A MINIMUM OF [illegible] BELOW THE DEEPEST FOUNDATION SUBGRADE AT ALL TIMES.

GC8 THE DE-WATERING SYSTEM SHALL BE MAINTAINED UNTIL THE CASTING OF FOUNDATION / GROUND SLAB.

FOUNDATIONS

F1 THE CONTRACTOR SHALL READ AND FAMILIARIZE HIMSELF WITH THE GEOTECHNICAL INVESTIGATION REPORT AS WELL AS VISIT THE SITE AND BECOME THOROUGHLY FAMILIAR WITH THE SURFACE AND SUBSURFACE CONDITIONS.

F2 LOOSE POCKETS OF SOIL WHICH ARE ENCOUNTERED SHALL BE REMOVED AND REPLACED WITH GOOD SOIL COMPACTED TO ACHIEVE THE DESIRED BEARING PRESSURE.

F3 ANY ADJACENT FOOTING IN THE VICINITY OF THE WORK SHALL BE PROPERLY PROTECTED BEFORE EXECUTION OF WORK.

F4 FOUNDATION SHALL BE PLACED ON FIRM AND VIRGIN GROUND HAVING NET ALLOWABLE BEARING CAPACITY OF 1.25 TSF AT 1.5M FROM EXISTING ROAD LEVEL.

F5 THE BOTTOM OF NEW FOUNDATION SHALL BE PLACED NO DEEPER THAN DEPTH OF ADJACENT FOOTING PLUS THE OF THE MINIMUM DISTANCE BETWEEN THE FOOTINGS.

DESIGN LOADS

[illegible] BUILDING IS DESIGNED IN ACCORDANCE WITH THE APPLICABLE BUILDING CODE AND THE FOLLOWING LOADS [illegible]

SEISMIC ZONE	2B
SEISMIC ZONE FACTOR	= 0.15
SOIL PROFILE	AS PER SOILS INVESTIGATION REPORT
IMPORTANCE FACTOR, I	= 1.0
STRUCTURE CATEGORY	[illegible]
NUMERICAL COEFFICIENT, R	= 8.5 AS PER TABLE 6.10
Cv	= 0.14
Ca	= 0.10

REINFORCED CONCRETE

C1 THE CONTRACTOR SHALL SUBMIT DETAILED RC SHOP DRAWINGS AND BAR BENDING SCHEDULES SHOWING BAR SIZES, SPACING, PLACEMENT AND SUPPORT DETAILS, DOWELS AT EXPANSION JOINTS AND LAPS ETC. FOR REVIEW AND ACCEPTANCE OF THE DESIGN CONSULTANT, WORK SHALL NOT COMMENCE UNTIL THE SHOP DRAWINGS ARE REVIEWED AND ACCEPTED REVIEW OF SHOP DRAWINGS DOES NOT ALLEVIATE THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE THE INPUT DETAIL TRADES ON THE SHOP DRAWINGS.

C2 REFER TO SPECIFICATIONS FOR QUALITY AND PERFORMANCE REQUIREMENTS OF CONCRETE.

C3 NORMAL CONCRETE MIX TO COMPLY WITH THE GRADES

LOCATION	MINIMUM 28 DAYS CYLINDER STRENGTH (fc')
	GRADE (fc')
MIN. CEMENT CONTENT	24 BAG/CUM (340 KG/M³)
MAX. W/C RATIO	0.50

C3 ALL CAST-IN-SITU CONCRETE SHALL HAVE A MINIMUM 28 DAYS CYLINDRICAL STRENGTH OF 21.0 Mpa EXCEPT BLINDING CONCRETE WHICH SHALL HAVE A MINIMUM STRENGTH OF 10 Mpa.

C4 WATER CEMENT RATIO SHALL NOT EXCEED 0.45.

C5 MAXIMUM POSSIBLE WATER-SOLUBLE CHLORIDE ION (CL) CONTENT IN CONCRETE SHALL NOT EXCEED 0.150% BY WEIGHT OF CEMENT.

C6 MAXIMUM SIZE OF COURSE AGGREGATE SHALL BE 25MM UNLESS NOTED OTHERWISE.

C7 CONTRACTOR SHALL GET APPROVAL FROM DESIGN CONSULTANT OF A CONCRETE MIX DESIGN.

C8 THE CONTRACTOR SHALL PERFORM AND SUBMIT FOR REVIEW INSTRUMENT SURVEYS OF FINISHED CONCRETE SLAB SURFACES, BOTH BEFORE AND AFTER REMOVAL OF FORM WORK AND/OR SHORING SYSTEM TO VERIFY AS-BUILT TOLERANCES.

C9 REFER TO SPECIFICATIONS FOR REQUIREMENTS OF CONCRETE SURFACE FINISH AND CASTING TOLERANCE.

C10 PROVIDE CHAMFER CHAMFER TO SLABS AND BEAMS AS NOTED ON STRUCTURAL DRAWINGS. MAJOR SPECIFICATIONS UNDER WHICH CONCRETE SHALL TOP OF CONCRETE TO MONITOR THE TOP AND BEAM DEPTH SHOWN ON THE DRAWINGS. UNLESS STATED OTHERWISE.

C11 BEAMS, SLABS, COLUMNS, WALLS AND FOUNDATION ELEMENTS SHALL NOT BE SLEEVED OR BOXED-OUT OR HAVE THE REINFORCEMENT INTERRUPTED EXCEPT AS INDICATED ON THE STRUCTURAL DRAWINGS.

C12 ALL CONCRETE SHALL CONTAIN AN APPROVED WATER REDUCING, PLASTICIZING ADMIXTURE, APPROVED HIGH RANGE WATER REDUCING ADMIXTURE MAY BE UTILIZED AT THE CONTRACTOR'S OPTION, ALL CONCRETE PERMANENTLY EXPOSED TO WEATHER SHALL ALSO CONTAIN AN APPROVED AIR-ENTRAINING ADMIXTURE TO PROVIDE PERCENTAGE OF AIR REQUIRED FOR SEVERE EXPOSURE AS PER ACI 318.

C13 ADMIXTURES/ADMIXTURES CONTAINING CHLORIDE (CaCl) SHALL NOT BE USED IN ANY CONCRETE.

C14 THE RC SLAB/BEAM CONCRETE IS TO BE CAST TO ACHIEVE SATISFACTORILY SHALL BE PROVIDED, UNLESS LARGER COVER IS SHOWN ON THE STRUCTURAL DRAWINGS.

ELEMENT	CONCRETE CLEAR COVER (mm)	
	EXPOSED TO EARTH OR WEATHER (EXTERNAL)	NOT EXPOSED TO WEATHER (INTERNAL)
COLUMNS, VERTICAL BEAMS	40	50
STRAPS, LONGITUDINAL BEAMS	40	50
WALLS	25	35
GRADE SLAB	25	35
SUSPENDED SLAB	25	35
EQUIPMENT PAD	25	35
WATER TANK	50	50

NOTE: - CLEAR COVER SHALL NOT BE LESS THAN ONE BAR DIA.
- CONCRETE COVER FOR SURFACE CAST AGAINST SOIL SHALL BE 75 AND FOR SURFACE INCONTACT WITH SOIL SHALL BE 50.

C15 AGGREGATE FOR CONCRETE SHALL BE FROM APPROVED SOURCE AND SHALL COMPLY WITH THE SPECIFICATION REQUIREMENTS.

C16 [illegible] SHALL BE CURED IN ACCORDANCE WITH THE SPECIFICATIONS.

C17 ALL CONCRETE SHALL BE COMPACTED USING ONLY MECHANICAL VIBRATION PROCESS.

C18 ALL CONCRETE SHALL BE CURED IN ACCORDANCE WITH THE SPECIFICATIONS.

REINFORCEMENT

R1 ALL REINFORCING BARS SHALL BE DEFORMED BARS WITH YIELD STRENGTH OF 414MPa CONFORMING TO ASTM A615.

R2 EPOXY COATED REINFORCING BARS SHALL NOT BE PERMITTED.

R3 ALL REINFORCING BARS SHALL BE DETAILED, FABRICATED, LABELED, SUPPORTED, SPACED IN FORMS AND SECURED IN PLACE IN ACCORDANCE WITH THE PROCEDURES AND REQUIREMENTS OUTLINED IN THE CURRENT ACI 315 AND ACI 315 UNLESS NOTED OTHERWISE ON THE STRUCTURAL DRAWINGS.

R4 ALL STARTER BARS SHALL BE SURVEYED AND LOCATION CONFIRMED IN AS-BUILT CONDITION PRIOR TO PLACING WALL/COLUMN REINFORCEMENT AND ANY DISCREPANCIES SHALL BE REPORTED TO THE DESIGN CONSULTANT FOR INSTRUCTIONS.

R5 FROM ALL SLAB/BEAM EDGES, OF WALLS AND COLUMNS EXPOSED TO EARTH OR WEATHER SHALL BE TIED AND SPACED TO THE [illegible] BARS UNLESS NOTED OTHERWISE.

R6 WELDING AND/OR SITE CUTTING OF THE REINFORCING BARS SHALL NOT BE PERMITTED UNLESS REVIEWED AND ACCEPTED BY THE DESIGN CONSULTANT.

R7 ALL PROPRIETARY FIXING SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

R8 ALL REINFORCING SPLICES SHALL BE CLASS B TENSION SPLICES IN ACCORDANCE WITH THE CURRENT ACI 318 UNLESS NOTED OTHERWISE. REFER TO SCHEDULE BELOW FOR SPLICE LENGTHS.

TENSION SPLICE LENGTH	
CLASS A	1.0X DEVELOPMENT LENGTH
CLASS B	1.3X DEVELOPMENT LENGTH

CLASS A - [illegible] REQUIRED AND NUMBER OF SPLICE < 50

CLASS B - ALL OTHER CASES

R9 ALL WIRE MESH REINFORCEMENT SHALL BE LAPPED AT LEAST 2 MESH PANELS AND SECURELY TIED. ALL REINFORCING DEVELOPMENT LENGTHS SHALL BE TENSION DEVELOPMENT LENGTHS IN ACCORDANCE WITH THE CURRENT ACI 318 UNLESS NOTED OTHERWISE, REFER TO SCHEDULE BELOW.

	TENSION DEVELOPMENT LENGTHS FOR f'c= 21 Mpa					
	10	12	16	20	25	32
CLEAR SPACING OF BARS BEING DEVELOPED OR SPLICED NOT LESS THAN DIA OF BAR, AND BEAM STIRRUP/TIE COLUMNS TIES THROUGHOUT SPACE LENGTH NOT LESS THAN THE CODE MINIMUM OR CLEAR SPACING OF BARS BEING DEVELOPED OR SPLICED NOT LESS THAN TWICE THE DIA OF BAR, AND CLEAR COVER NOT LESS THAN DIA OF BAR	420	525	700	875	1350	1725
OTHER CASES	655	790	1050	1315	2050	2665

ABOVE DEVELOPMENT LENGTH SHALL BE MULTIPLIED BY 1.3 WHERE HORIZONTAL REINFORCEMENT IS PLACED SUCH THAT MORE THEN 300mm OF FRESH CONCRETE IS CAST BELOW.

R10 MECHANICAL SPLICING OF LARGE DIAMETER BARS MAY BE ACCEPTABLE SUBJECT TO REVIEW BY THE DESIGN CONSULTANT

R11 [illegible] IS ASSUMED WITH THE CURRENT ACI 318 UNLESS NOTED OTHERWISE ON THE STRUCTURAL DRAWINGS.

R12 COUPLERS TO BE PROVIDED IF COLUMN REINFORCEMENT EXCEEDS 32Ø.

ANCHORAGE OF BARS BY HOOKS:

* THE DIMENSIONS AND BENDING RADII FOR HOOKS TO BE USE AS STANDARDIZED IN THE ACI CODES:

1.- A 180° BEND PLUS AN EXTENSION OF AT LEAST 4 BAR DIAMETERS, BUT NOT LESS THAN 2.5 IN AT THE FREE END OF BAR OR

2.- A 90° BEND PLUS AN EXTENSION OF AT LEAST 12 BAR DIAMETERS AT THE FREE END OF THE BAR, OR

3.- [illegible] FOR NO. 3 THRU NO. 8 BARS, A 90° BEND PLUS AN EXTENSION OF AT LEAST 12 BAR DIAMETERS AT THE FREE END OF THE BAR, OR

4.- FOR NO. 9 THRU NO. 11 BARS, A 90° BEND PLUS AN EXTENSION OF AT LEAST 18 BAR DIAMETERS AT THE FREE END OF THE BAR

THE MINIMUM DIAMETER OF BEND, MEASURED ON THE INSIDE OF THE BAR, FOR STANDARD HOOKS OTHER THAN FOR STIRRUPS OR TIES IN SIZES NO. 3 THROUGH 5, SHOULD NOT BE LESS THAN 6 BAR DIAMETER, FOR STIRRUP AND TIE HOOKS, FOR BAR SIZES NO.5 AND SMALLER, THE INSIDE DIAMETER OF BEND SHOULD NOT BE LESS THAN 4 BAR DIAMETERS, ACCORDING TO ACI CODE:



(a). MAIN REINFORCEMENT (b). STIRRUPS AND TIES

r = 4db FOR db <T25
r = 5db FOR db >T25

STRUCTURAL STEEL

S1 THE STRUCTURAL STEEL SYSTEMS HAVE BEEN DESIGNED AS PER AISC LRFD 1.2CR AND RESISTANCE FACTOR 1.15(SBH THIRD EDITION (2338) AND AWS D1.1 (2338) REQUIREMENTS. ALL CONTRACTOR ALTERNATIVE DESIGNS SHALL MEET THESE RESPECTIVE DESIGN CRITERIA.

S2 ALL STRUCTURAL STEEL DETAILING, FABRICATION, AND ERECTION SHALL CONFORM TO AISC 360 (ASTM 2005 SPECIFICATIONS AND CODES OR EQUIVALENT BRITISH STANDARDS.

S3 ALL WELDING WORK SHALL CONFORM TO THE AWS D1.1 "STRUCTURAL WELDING CODE - STEEL, 2338 AND SHALL BE PERFORMED BY AWS CERTIFIED WELDERS OR EQUIVALENT BRITISH STANDARDS.

S4 THERE SHALL BE NO FIELD CUTTING OF STRUCTURAL STEEL MEMBERS FOR THE WORK OF OTHER TRADES WITHOUT PRIOR REVIEW BY THE CONSULTANT.

S5 STRUCTURAL STEEL GRADES SHALL BE ASTM A36 OR EQUIVALENT BRITISH STANDARD.

S6 ALL BOLTS, NUTS, AND WASHERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A325 OR EQUIVALENT BRITISH STANDARD.

S7 ALL WELDING ELECTRODES SHALL BE E70XX (LOW HYDROGEN) AWS [illegible].

S8 THE MINIMUM NUMBER OF BOLTS PER CONNECTION SHALL BE TWO (2) 19MM DIAMETER A325 BOLTS.

S9 MINIMUM FILLET WELD SIZES SHALL COMPLY WITH THE AISC SPECIFICATION REQUIREMENTS, BUT SHALL NOT BE LESS THAN 1/4 UNLESS NOTED OTHERWISE.

S10 THE CONTRACTOR SHALL SUBMIT DETAILED, ENGINEERED, COORDINATED, AND CHECKED SHOP DRAWINGS FOR ALL STRUCTURAL STEEL TO THE CONSULTANT FOR REVIEW PRIOR TO THE START OF FABRICATION AND / OR ERECTION.

S11 THE CONTRACTOR SHALL ENGAGE A QUALIFIED STRUCTURAL STEEL MATERIALS TESTING AGENCY, ACCEPTABLE TO THE OWNER TO CONTINUOUSLY PERFORM ALL REQUIRED SHOP FABRICATION AND FIELD ERECTION, TESTING [illegible] MAGNETIC PARTICLE AND U.T.MASONRY AND INSPECTIONS. TESTING REGIME SHALL BE AS APPROVED BY THE CONSULTANT.

S12 [illegible] ASSEMBLIES SHALL BE TIGHTENED FOR A MINIMUM OF 10% OF BOLT PILES ON A RANDOM BASIS.

S13 100% OF ALL BOLTED CONNECTIONS SHALL BE VISUALLY INSPECTED, AND THEN TESTED WITH A CALIBRATED TORQUE WRENCH TO VERIFY A MINIMUM OF 25% OF BOLTS IN EACH CONNECTION (2 BOLTS PER CONNECTION MINIMUM).

S14 THE STRUCTURAL STEEL FABRICATOR AND ERECTOR SHALL SCHEDULE ALL WORK TO ALLOW THE ABOVE INSPECTION AND TESTING REQUIREMENTS TO BE COMPLETED.

S15 COUPLERS TO BE PROVIDED IF COLUMN REINFORCEMENT EXCEEDS 32Ø.

MASONRY WORKS

M1 ALL MASONRY UNITS SHALL CONFORM TO [illegible] AND ALL [illegible] AUTHORITY REQUIREMENTS AND SHALL CARRY ALL [illegible] SUBMITTALS MAY BE OCCASIONALLY REQUIRED BY THE DESIGN CONSULTANT/CONSTRUCTION.

M2 THE CONTRACTOR IS TO [illegible] WORK THAT WILL BE PROVIDED ETC. AND PROPERLY FILLED WITH MORTAR.

M3 ALL CONTROL JOINTS SHALL BE FILLED WITH COMPRESSIBLE EXPANDABLE FILLER, REFER TO SPECIFICATIONS FOR FIRE RATED WALLS.

M4 FIRE RATING, SOUND AND THERMAL INSULATION PROPERTIES SHALL BE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

M5 PROVIDE LINTELS OVER ALL OPENING OR RECESSES IN MASONRY WALLS INCLUDING THOSE FOR MECHANICAL OR ELECTRICAL SERVICES OR EQUIPMENT. SEE STANDARD DETAIL DRAWINGS FOR LINTEL SIZES AND DETAILS.

M6 PROVIDE RESTRAINT TO ALL MASONRY WALLS AT SLAB SOFFIT AND SIDES AS SHOWN IN STANDARD DETAIL DRAWINGS.

M7 ALL MASONRY UNITS SHALL BE NORMAL WEIGHT CONCRETE UNLESS NOTED OTHERWISE.

M8 ALL MASONRY [illegible] ADJACENT TO ALL EMBEDDED ITEMS SHALL BE HOT DIP GALVANIZED.

M9 PROVIDE [illegible] REINFORCEMENT IN ACCORDANCE WITH STANDARD DETAIL DRAWINGS AND SPECIFICATIONS.

CONSTRUCTION INSPECTION PROGRAM FOOTNOTES:

1. [illegible] TESTING, REPORTING AND COMPLIANCE PROCEDURES ACCORDING TO CHAPTER 17 OF THE 1997 UNIFORM BUILDING CODE.
2. [illegible] WITH THE ARCHITECT, ENGINEER, AND AGENCIES HAVING JURISDICTIONS.
3. DUTIES OF THE CONSTRUCTION INSPECTION INCLUDE, BUT ARE NOT LIMITED TO:
   A. OBSERVE THE WORK FOR CONFORMANCE WITH THE APPROVED DRAWINGS AND SPECIFICATIONS. BRING DISCREPANCIES TO THE IMMEDIATE ATTENTION OF THE GENERAL CONTRACTOR FOR CORRECTION, THEN, IF UNCORRECTED, TO THE ENGINEER AND TO THE BUILDING OFFICIAL.
   B. FURNISH INSPECTION REPORTS FOR EACH INSPECTION TO THE BUILDING OFFICIAL, ARCHITECT, STRUCTURAL ENGINEER, GENERAL CONTRACTOR AND OWNER IN A TIMELY MANNER.
   C. SUBMIT A FINAL REPORT STATING WHETHER THE WORK REQUIRING CONSTRUCTION INSPECTION WAS INSPECTED, AND WHETHER THE WORKS IN CONFORMANCE WITH THE APPROVED DRAWINGS AND SPECIFICATIONS.
4. DUTIES TO THE GENERAL CONTRACTOR INCLUDE, BUT ARE NOT LIMITED TO:
   A. [illegible] FOR INSPECTION AT LEAST 24 HOURS BEFORE INSPECTION IS REQUIRED.
   B. MAINTAIN ACCESS TO WORK UNTIL FINAL INSPECTION HAS IT HAS BEEN OBSERVED AND INDICATED TO BE IN CONFORMANCE BY THE CONSTRUCTION INSPECTOR AND APPROVED.
   C. PROVIDE THE APPROVED PLAN INSPECTOR WITH ACCESS TO APPROVED PLANS SITE AND FABRICATORS AT THE JOB SITE.
   D. MAINTAIN JOB-SITE COPIES OF ALL APPROVED SUBMITTED BY THE CONSTRUCTION INSPECTOR.

A1. GENERAL ABBREVIATIONS

APPROX.	APPROXIMATELY	LG	LONG
BP	BASE POINT	M	METRE
CHAM	CHAMFERED	MAX	MAXIMUM
CJ	CONSTRUCTION JOINT	MIN	MINIMUM
CONC	CONCRETE	MJ	MOVEMENT JOINT
DEG	DEGREES	MM	MILLIMETRES
DIA	DIAMETER	NO	NUMBER
D	DEPTH	NOM	NOMINAL
DWG	DRAWING	NTS	NOT TO SCALE
EGL	EXISTING GROUND LEVEL	P/T	PERMANENT OPENING
EJ	EXPANSION JOINT	RAD	RADIUS
EXTG	EXISTING	RC	REINFORCED CONCRETE
FFL	FINISHED FLOOR LEVEL	RET	RETOR
FGL	FINISHED GROUND LEVEL	REQD	REQUIRED
GA	GENERAL ARRANGEMENT	REV	REVISION
GL	GROUND LEVEL	SOW	SETTING OUT POINT
GWT	GROUND WATER TABLE	SQ	SQUARE
IJ	ISOLATION JOINT		
SLSL	STRUCTURAL SLAB LEVEL		
STD	STANDARD		
TBC	TO BE CONFIRMED		
THK	THICKNESS		
TJ	TRANSVERSE JOINT		
TW	THICKNESS OF WALL		
TYP	TYPICAL		
UNO	UNLESS NOTED OTHERWISE		
W	WIDE		
PL	PLINTH LEVEL		
BOF	BOTTOM OF FOOTING		
SOG	SLAB ON GRADE		

A2. REINFORCEMENT ABBREVIATIONS

ARR	ALT. BARS REVERSED
ABS	ALT. BARS STAGGERED
ALT	ALTERNATE
B	BOTTOM
CRS	CENTRES
EF	EACH FACE
EW	EACH WAY
EXTF	EXTERNAL FACE
FF	FAR FACE
H	HORIZONTAL
INT	INTERNAL FACE
NF	NEAR FACE
PRS	PAIRS
REINF	REINFORCEMENT
STG	STAGGERED
T	TOP
T/C	TEMPORARY OPENING
TB	TENSION ANCHORAGE
TOC	TOP OF CONCRETE
V	VERTICAL
ADDL	ADDITIONAL
-	DIAMETER

Client:

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant:

EA Consulting Pvt Ltd
Head Office:A-1, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaward.com | www.eaward.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

Notes:
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North: N

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STRUCTURE

Status: TENDER

Name: EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title: GENERAL NOTES

Designed:	Checked:	Approved:
F.A	A.J	M.S
Drawn:	Date:	Scale / Sheet:
A.B	December, 2021	AS SHOWN
Project Code: 01062		Rev.: 0

Drawing No.: EA-01062-EGFS--S-001

GENERAL NOTES FOR REPAIR / REHABILITATION WORK

1.0 WORK PREPARATION

1.1 THE CONTRACTOR SHALL DEPLOY SUFFICIENTLY EXPERIENCED LABOR FOR CARRYING OUT THE WORK OUTLINED HEREIN. TOWARDS THIS END, THE CONTRACTOR SHALL PROPOSE THE NAMES OF PERSONS, IN SUPERVISORY POSITIONS, HE PROPOSES TO DEPLOY FOR THIS WORK ALONG WITH THEIR EXPERIENCE SUMMARIES FOR THE ENGINEER'S APPROVAL. THE CONTRACTOR SHALL DEPLOY ONLY PERSONS APPROVED BY THE ENGINEER FOR THIS WORK DURING EXECUTION.

1.2 EQUIPMENT TO BE USED FOR THE WORKS OUTLINED HEREIN SHALL BE SUITABLE FOR INTENDED USE AND IN GOOD WORKING ORDER. TOWARDS THIS END, THE CONTRACTOR SHALL MAKE AVAILABLE FOR THE ENGINEER'S INSPECTION AND APPROVAL ANY EQUIPMENT HE PROPOSES TO USE FOR THE WORKS – SUFFICIENTLY BEFORE TIME SO THAT THE INSPECTION AND APPROVAL PROCESS MAY BE SATISFACTORILY CARRIED OUT.

1.3 ALTHOUGH THE CONTRACTOR MAY USE ANY MECHANIZED MEANS OF REMOVING EXISTING CONCRETE, USE OF SMALL CHISELS WITH LIGHT TO MEDIUM HAMMER BLOWS SHALL BE ENCOURAGED. ANY METHOD OF REMOVAL OF CONCRETE PROPOSED BY THE CONTRACTOR SHALL ENSURE THAT THE CHANCES OF ANY POSSIBLE DAMAGE TO THE EMBEDDED REINFORCEMENT AND SURROUNDING SOUND CONCRETE REMAIN MINIMIZED. USE OF JACKHAMMERS AND SIMILAR VIBRATORY EQUIPMENT SHALL NOT BE ALLOWED.

1.4 THE ENGINEER MAY INSTRUCT PRACTICAL DEMONSTRATION OF SOME OR ALL OF THE EQUIPMENT PROPOSED TO BE USED BY THE CONTRACTOR TO SATISFY HIMSELF OF THE ADEQUACY/SUITABILITY OF THE SAME. UPON RECEIVING SUCH INSTRUCTIONS FROM THE ENGINEER, THE CONTRACTOR SHALL ARRANGE TRIALS OF HIS PROPOSED EQUIPMENT IN MOCK CONDITIONS DUPLICATING THE ACTUAL WORKING CONDITIONS AS FAR AS REASONABLY POSSIBLE. ONLY EQUIPMENT APPROVED BY THE CONSULTANTS SHALL BE USED FOR THE WORKS.

1.5 SINCE THE REPAIR/REHABILITATION WORK SHALL INVOLVE HINDRANCE TO FREE TRAFFIC MOVEMENT ON THE BRIDGES DURING THE COURSE OF THE WORK INCLUDING COMPLETE STOPPAGE FOR BRIEF PERIODS FOR CONCRETING, THE CONTRACTOR SHALL ENSURE THAT HE HAS ALL NECESSARY EQUIPMENT AND SKILL AVAILABLE AT SITE TO COVER ANY EVENTUALITY, BEFORE COMMENCING THE WORK. THIS SHALL ALSO INCLUDE AVAILABILITY OF BACKUP EQUIPMENT AND MATERIAL IN SUFFICIENT QUANTITIES. THE CONTRACTOR SHALL SATISFY THE ENGINEER OF HIS PREPARATIONS AND GET THE ENGINEER'S APPROVAL FOR COMMENCEMENT OF WORKS. THIS SHALL BE TO CARRY OUT THE WORKS IN THE MOST PLANNED AND EXPEDITIOUS MANNER.

2.0 REMOVAL OF EXISTING CONCRETE

2.1 EACH PORTION OF CONCRETE TO BE REMOVED SHALL BE CLEARLY IDENTIFIED, OUTLINED AND CATALOGUED. THE AREA MARKED SHALL BE SUCH THAT THE POLYGON DEFINING THE BOUNDARY DOES NOT HAVE ANY INTERNAL ANGLE LESS THAN 135 . THE ENGINEER SHALL APPROVE THE EXTENTS AND LOCATIONS OF THESE POCKETS TO BE REMOVED PRIOR TO COMMENCEMENT OF WORKS BY THE CONTRACTOR.

2.2 THE CONTRACTOR SHALL APPLY SHALLOW CUTS OF 20 MM DEPTH AT THE DEFINED PERIPHERY OF THE AREA MARKED FOR REMOVAL BEFORE COMMENCING WITH THE REQUIRED REMOVAL OF CONCRETE. THE CONTRACTOR SHALL USE APPROVED MEANS TO REMOVE CONCRETE UP TO LIMITS DEFINED ABOVE. CARE SHALL BE EXERCISED THAT SOUND CONCRETE TO BE LEFT INTACT AT THE BOUNDARY IS NOT DAMAGED OR COMPROMISED. IN THE EVENT SUCH DAMAGE IS INADVERTENTLY CAUSED, THE DAMAGE SHALL BE IMMEDIATELY NOTIFIED TO THE ENGINEER AND THE EXTENT OF CONCRETE REMOVAL AREA SHALL BE ENHANCED TO INCLUDE THE NEWLY DAMAGED CONCRETE IN CONSULTATION WITH THE ENGINEER.

2.3 UTMOST CARE SHALL ALSO BE EXERCISED TO PREVENT ANY DAMAGE TO THE EXISTING REINFORCEMENT WITHIN PORTIONS OF THE CONCRETE TO BE REMOVED. ANY DAMAGE CAUSED TO THE EXISTING REINFORCEMENT SHALL BE RECORDED AND REPORTED TO THE ENGINEER IMMEDIATELY.

2.4 PRIOR TO POURING FRESH CONCRETE, THE SURROUNDING EDGES OF EXISTING CONCRETE SHALL BE COATED WITH AN APPROVED EPOXY MIX AS PER THE SUPPLIER'S RECOMMENDATIONS.

3.0 CLEANING REINFORCEMENT

3.1 THE INTENDED CONCRETE HAVING BEEN REMOVED TO THE EXTENTS DESIRED INSTRUCTED BY THE ENGINEER, THE EXPOSED REINFORCEMENT SHALL NOW BE CLEANED OF ALL DEBRIS ETC STILL ADHERING TO THE SURFACE OF THE BARS. THIS DEBRIS SHALL BE REMOVED USING WIRE BRUSHES AND SMALL CHISELS WHERE REQUIRED. UTMOST CARE SHALL BE EXERCISED THAT THE EXISTING REINFORCEMENT IS NOT DAMAGED DURING THIS OPERATION. UNDUE FLEXING, BENDING OR HAMMERING OF THE REINFORCEMENT SHALL NOT BE ALLOWED. THE USE OF CHEMICALS TO REMOVE OR OTHERWISE DISSOLVE MATERIAL STICKING THE EXPOSED REINFORCEMENT SHALL NOT BE ALLOWED. THE CLEANED UP REINFORCEMENT SHALL BE INSPECTED AND APPROVED BY THE ENGINEER BEFORE PROCEEDING FURTHER WITH THE WORK AT EACH LOCATION.

3.2 THE REINFORCEMENT HAVING BEEN CLEANED, THE EDGES OF SOUND CONCRETE DEFINING THE EXTENTS OF REMOVED PORTIONS SHALL BE CLEANED WITH WIRE BRUSHES AND WATER/AIR JETS. THE OBJECTIVE SHALL BE TO DISLODGE AND REMOVE ANY LOOSE MATERIAL FROM THESE EDGES.

3.3 AREAS SO WORKED AND PREPARED SHALL BE CORDONED OFF TO PREVENT CONTAMINATION OR FURTHER DAMAGE DUE TO ANY REASON.

4.0 DRILLING OF DOWEL HOLES

4.1 AFTER LOCATIONS OF ALL DOWELS HAVE BEEN MARKED AND IDENTIFIED, WORK SHALL PROCEED TO DRILLING OF DOWEL HOLES. APPROVED DRILLING EQUIPMENT SHALL BE USED TO DRILL HOLES OF THE REQUIRED DEPTH AND DIAMETER. THE DRILL BITS SHALL BE MARKED SO THAT DRILL HOLE DEPTHS ACHIEVED CAN BE EASILY ESTABLISHED DURING THE DRILLING OPERATIONS. CARE SHALL BE EXERCISED THAT CONCRETE SURROUNDING THE DRILL HOLE IS NOT SHATTERED OR DAMAGED IN ANY WAY.

4.2 IN CASE SUCH DAMAGE DOES OCCUR, THE DAMAGED PORTIONS SHALL BE IMMEDIATELY REMOVED USING SMALL CHISELS AND LIGHT HAMMER BLOWS. AFTER REMOVING SUCH DAMAGED CONCRETE, THE WORKED SURFACES SHALL BE CLEANED USING WIRE BRUSHES AND AIR JETS TO DISLODGE AND REMOVE ANY LOOSE PARTICLES AT THE SURFACE.

4.3 WHILE DRILLING IN THE VICINITY OF REINFORCEMENT COMPONENTS EMBEDDED WITHIN THE GIRDER, EXTREME CARE SHALL BE EXERCISED TO ENSURE THAT NONE OF THE REINFORCEMENT COMPONENTS ARE DAMAGED IN ANY WAY DUE TO THE DRILLING OPERATION. EACH DRILL HOLE IN SUCH AREAS SHALL BE ADVANCED 5 M M AT A TIME. AFTER EACH ADVANCE, THE DRILL SHALL BE REMOVED AND THE HOLE SHALL BE CAREFULLY EXAMINED TO ENSURE THAT ANY REINFORCEMENT ELEMENT HAS NOT BEEN ENCOUNTERED INADVERTENTLY. IN THE EVENT THAT A REINFORCEMENT ELEMENT HAS BEEN ENCOUNTERED, THE HOLE SHALL BE IMMEDIATELY ABANDONED AND FILLED UP WITH EPOXY AS OUTLINED IN THE DRAWINGS. AN ALTERNATE LOCATION, IN LIEU OF THE ABANDONED HOLE SHALL BE DECIDED AND APPROVAL FOR THE SAME SOUGHT FROM THE DESIGNER BEFORE DRILLING AT THE NEW LOCATION.

4.4 IMMEDIATELY AFTER EACH HOLE IS DRILLED, IT SHALL BE CLEANED USING AIR JETS AND THE DRILLED DEPTH RECORDED. THE MOUTH OF THE DRILL HOLE SHALL THEN BE PLUGGED TO PREVENT ANY DEBRIS OR CONTAMINATION FROM ENTERING THE HOLE.

4.5 THE ENGINEER SHALL INSPECT WORKS FOR QUALITY AND ACCURACY BEFORE GIVING APPROVAL FOR THE DRILLING OPERATION. WORK SHALL PROCEED TO THE NEXT STAGE AFTER THE ENGINEER'S APPROVAL FOR THIS STAGE OF WORK. THE CONCERNED WORK AREAS SHALL BE KEPT CLEAN AND FREE OF CONTAMINATION AT ALL TIMES.

5.0 INSTALLING DOWELS

5.1 THE DRILL HOLES MADE AND APPROVED, WORK SHALL PROCEED TO INSTALLATION OF DOWELS. EACH DRILL HOLE SHALL BE UNPLUGGED JUST PRIOR TO INSTALLATION OF THE DOWEL WITHIN. THE HOLE SHALL BE RE-CLEANED USING AIR JETS AND PREPARED AS PER RECOMMENDATIONS OF THE EPOXY SUPPLIERS. USUALLY EPOXY APPLICATIONS REQUIRE THE INTENDED SURFACES TO BE SATURATED BUT WITHOUT ANY FREE SURFACE MOISTURE. TO ACHIEVE THIS, WATER JETS FOLLOWED BY AIR JETS MAY BE USED TO GET THE DESIRED RESULTS. THE SUPPLIER'S RECOMMENDATIONS FOR PREPARING THE INTENDED CONCRETE SURFACES SHALL HOWEVER BE FOLLOWED IN ALL DETAIL. A GROUP OF DRILL HOLES HAVING BEEN SO PRIMED; THE CONCERNED AREA SHALL BE CLEANED AGAIN TO REMOVE ANY DEBRIS OR LOOSE PARTICLES.

5.2 EPOXY, PREMIXED AS PER THE SUPPLIER'S RECOMMENDATIONS, SHALL BE INTRODUCED INTO THE DRILL HOLES–FOLLOWED BY THE STEEL DOWELS OF THE REQUIRED LENGTH, GRADE AND DIAMETER. WHILE INTRODUCING EPOXY INTO THE DRILL HOLES, CARE SHALL BE EXERCISED THAT AIR POCKETS OR BUBBLES ARE NOT FORMED WITHIN THE DRILL HOLE. TOWARDS THIS END IT IS RECOMMENDED THAT AN EPOXY GUN WITH AN EXTENDED NOZZLE BE USED FOR INTRODUCING EPOXY INTO THE DRILL HOLE–FILLING THE HOLE FROM THE BOTTOM TOWARDS THE TOP. POURING THE EPOXY USING FUNNELS IS NOT ADVISED.

5.3 DOWELS SHALL BE INSERTED INTO THE HOLES IMMEDIATELY AFTER THE EPOXY HAS BEEN INTRODUCED. ANY EPOXY THAT OVERFLOWS THE HOLES UPON INTRODUCTION OF DOWELS SHALL BE REMOVED IMMEDIATELY USING SUITABLE BLADED INSTRUMENTS AND DISPOSED OFF. SUCH OVERFLOW EPOXY SHALL NOT BE REUSED IN ANY OF THE OTHER DRILL HOLES.

5.4 AFTER INTRODUCTION OF DOWELS INTO THE HOLES, THE CONCERNED AREA SHALL BE CORDONED OFF SO AS TO PREVENT ANY DISTURBANCE TO THE DOWELS UNTIL THE EPOXY HAS SET AND GAINED STRENGTH. SIMILARLY , ANY DRILLING OPERATIONS OR SIMILAR WORKS THAT MAY CAUSE VIBRATIONS IN AREAS WHERE FRESH EPOXY HAS BEEN APPLIED SHALL BE SUSPENDED FOR SUFFICIENT AMOUNT OF TIME.

5.5 THE EPOXY SHALL BE GIVEN SUFFICIENT TIME TO SET AND GAIN STRENGTH AS PER THE SUPPLIERS RECOMMENDATIONS BEFORE SUBSEQUENT OPERATIONS ARE PERFORMED IN THE AREA. DURING THE CURING PERIOD FOR THE EPOXY COMPOUND, THE AREA SHALL BE PROTECTED FORM EXTREME VARIATIONS OF TEMPERATURE AND MOISTURE AS PER THE SUPPLIER'S RECOMMENDATIONS.

6.0 CONCRETE PATCH REPAIR

6.1 THE CONTRACTOR SHALL APPLY SHALLOW CUTS OF 20 MM DEPTH AT THE DEFINED PERIPHERY OF THE AREA MARKED FOR REMOVAL BEFORE COMMENCING WITH THE REQUIRED REMOVAL OF DEFECTIVE CONCRETE. THE CONTRACTOR SHALL USE SMALL CHISELS AND LIGHT HAMMER BLOWS TO REMOVE DEFECTIVE CONCRETE UP TO LIMITS DEFINED AND/OR UP TO A MINIMUM OF 25 MM BEHIND THE SURFACE REINFORCEMENT. CARE SHALL BE EXERCISED THAT SOUND CONCRETE TO BE LEFT INTACT AT THE BOUNDARIES IS NOT DAMAGED OR COMPROMISED. IN THE EVENT SUCH DAMAGE IS INADVERTENTLY CAUSED, THE DAMAGE SHALL BE IMMEDIATELY NOTIFIED TO THE ENGINEER AND THE EXTENT OF CONCRETE REMOVAL AREA SHALL BE ENHANCED TO INCLUDE THE NEWLY DAMAGED CONCRETE IN CONSULTATION WITH THE ENGINEER.

6.2 UTMOST CARE SHALL ALSO BE EXERCISED TO PREVENT ANY DAMAGE TO THE EXISTING REINFORCEMENT WITHIN PORTIONS OF THE CONCRETE TO BE REMOVED. ANY DAMAGE CAUSED TO THE EXISTING REINFORCEMENT SHALL BE RECORDED AND REPORTED TO THE ENGINEER IMMEDIATELY.

6.3 THE DEFECTIVE CONCRETE HAVING BEEN REMOVED TO THE EXTENTS DESIRED/INSTRUCTED BY THE ENGINEER, THE EXPOSED REINFORCEMENT SHALL NOW BE CLEANED OF ALL DEBRIS, RUST ETC STILL ADHERING TO THE SURFACE OF THE BARS AS SPECIFIED IN THE DRAWINGS.

6.4 THE REINFORCEMENT HAVING BEEN CLEANED, THE EDGES OF SOUND CONCRETE DEFINING THE EXTENTS OF REMOVED PORTIONS SHALL BE CLEANED WITH WIRE BRUSHES AND WATER/AIR JETS. THE OBJECTIVE SHALL BE TO DISLODGE AND REMOVE ANY LOOSE MATERIAL FROM THESE EDGES.

6.5 PRIOR TO POURING FRESH CONCRETE, THE SURROUNDING EDGES OF EXISTING CONCRETE SHALL BE COATED WITH AN APPROVED EPOXY MIX AS PER THE SUPPLIER'S RECOMMENDATIONS. IN CASE THE EXISTING REINFORCEMENT WAS DISCOVERED TO BE CORRODED, IT SHALL BE COATED WITH AN APPROVED EPOXY PROTECTION.

6.6 DEPENDING UPON THE SITUATION, THE CONTRACTOR MAY, AFTER PREVIOUS DECLARATION AND APPROVAL, USE BGUNITING, SHOTCRETING, DRY PACKING OR SIMPLE CONCRETE TO REPLACE THE DAMAGED CONCRETE REMOVED. IN THE CASE OF CONCRETING, A MIX CONTAINING 20 MM AND DOWN AGGREGATE WITH A SLUMP OF 150 MM MINIMUM IS ADVISABLE. THE MIX SHALL BE SO PROPORTIONED THAT SHRINKAGE TENDENCIES ARE MINIMIZED. IN ALL INSTANCES THE MATERIAL USED BY THE CONTRACTOR SHALL BE PRE-APPROVED BY THE ENGINEER.

6.7 THE OUTER/EXPOSED SURFACE OF THE NEW CONCRETE SHALL BE WORKED TO A SMOOTH AND UNIFORM FINISH IN LINE WITH THE ORIGINAL PROFILES TO COMPLETE THE JOB.

7.0 CONCRETE MIX DESIGN FOR SLAB

7.1 CONCRETE USED FOR SLAB SHALL BE CLASS "A". SINCE EARLY STRENGTH IS REQUIRED, AN ACCELERATOR LIKE CORNPLAST 430 OR EQUIVALENT SHALL BE USED. RECOMMENDED DOSAGE FOR CORNPLAST 430 IS BETWEEN 0.5 LITERS AND 1.0 LITERS FOR EACH BAG OF CONCRETE USED. RECOMMEND WATER/CEMENT RATIO IS 0.32.

7.2 CONTRACTOR SHALL PREPARE A MINIMUM OF 4 TRIAL MIXES. 12 TEST CYLINDERS SHALL BE PREPARED FROM EACH TRIAL MIX. THESE CYLINDERS SHALL BE CRUSHED AT 8 HRS, 24 HRS, 72 HRS AND 7 DAYS. MINIMUM CYLINDRICAL STRENGTH TO BE ACHIEVED SHALL BE 1500 PSI AT 8 HRS AND 3000 PSI AT 24 HRS. AT LEAST 3 CYLINDERS SHALL BE CRUSHED AT EACH TESTING STAGE.

7.3 CONCRETE MIX SHALL BE FINALIZED ON THE BASIS OF TRIAL MIX RESULTS. IF A NEW VARIANT IS DEEMED NECESSARY, THE SAME SHALL BE TESTED AS IN THE CASE OF TRIAL MIXES. IN ANY EVENT 3 CYLINDERS OF THE FINAL MIX SHALL ALSO BE TESTED AT 28 DAYS.

7.4 AT THE TIME OF ACTUAL CONCRETING, A MINIMUM OF 12 TEST CYLINDERS SHALL BE PREPARED FROM EACH BATCH. THESE CYLINDERS SHALL THEN BE TESTED AT 8 HRS, 24 HRS, 7 DAYS AND 28 DAYS FOR CRUSHING STRENGTH.

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting PvtLtd
Head Office:AL-1, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan:

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Competitive and Livable City of Karachi

Local Government Department, Government of Sindh

MEP

Electrical

S.#	DRAWING NO.	DRAWING TITLE
1	EA-01062-EGFS-EL-0001	LIST OF DRAWINGS
2	EA-01062-EGFS-EL-0002	LIGHTING POLE INSTALLATION & MISCELLANEOUS ELECTRICAL DETAILS
3	EA-01062-EGFS-EL-0003	ELECTRICAL DISTRIBUTION SINGLE LINE DIAGRAM
4	EA-01062-EGFS-EL-0004	MASTER PLAN EXTERNAL LIGHTING LAYOUT
5	EA-01062-EGFS-EL-0005	PP-01 LIGHTING & POWER LAYOUT PLAN
6	EA-01062-EGFS-EL-0006	PP-02 & PP-03 GUARD ROOM ELECTRICAL LAYOUT

Client :

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Consultant :

EA Consulting Pvt Ltd
Head Office:#L-9, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
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REVISIONS

Date of Issue	December, 2021
Issued To	Client
Issued For	Tender

ELECTRICAL

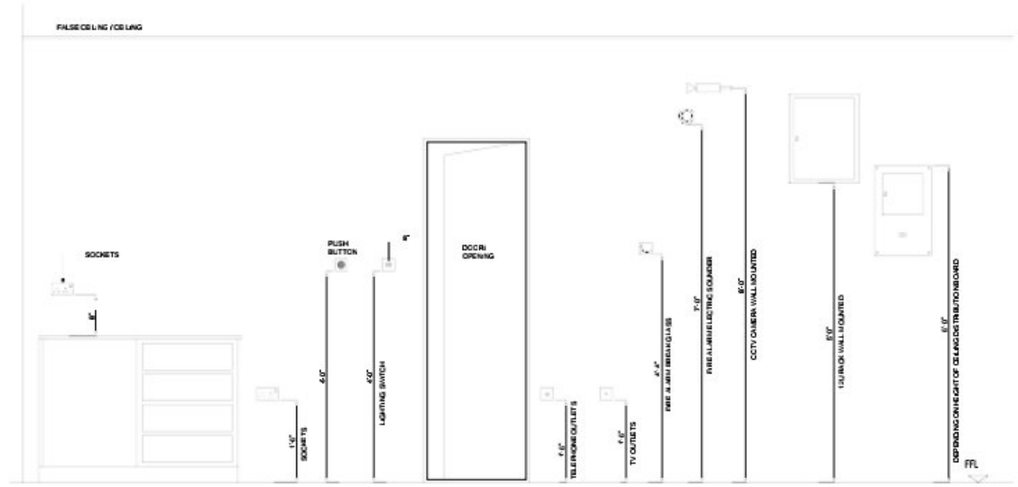
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TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

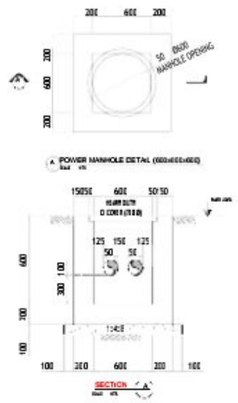
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LIST OF DRAWINGS

Designed:	Checked:	Approved:
SA	SA	AUJ
Drawn:	Date:	Scale / Sheet:
ZA	November,2021	NTS @ A3 NTS @A1
Project Code: 01062		Rev.:

Drawing No.: EA-01062-EGFS- EL-0001



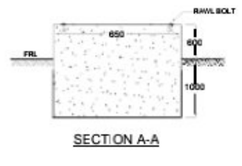
STANDARD MOUNTING HEIGHTS OF ELECTRICAL ACCESSORIES



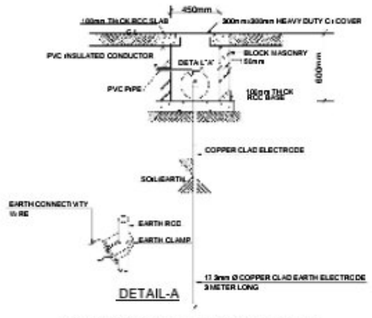
POWER MANHOLE DETAIL

NOTES:

1. POLE DESIGN DIMENSION IS FOR REFERENCE ONLY. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO CONSULTANT / THE ENGINEER FOR APPROVAL.
2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
3. LIGHTING CONTROL PANEL (LCP) & POLE DIMENSIONS ARE TENTATIVE / APPROXIMATE ONLY. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS WITH ALL RELEVANT DETAILS TO THE CONSULTANT / ENGINEER FOR APPROVAL.
4. WALL THICKNESS OF POLE SHALL BE 4 mm MINIMUM .
5. FOR FOUNDATION DETAILS OF POLES; REFER TO STRUCTURAL DRAWINGS.
6. LCP SHALL BE OUTDOOR WEATHER PROOF (IP-65) RATED.

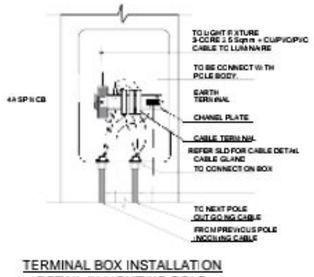


SECTION A-A

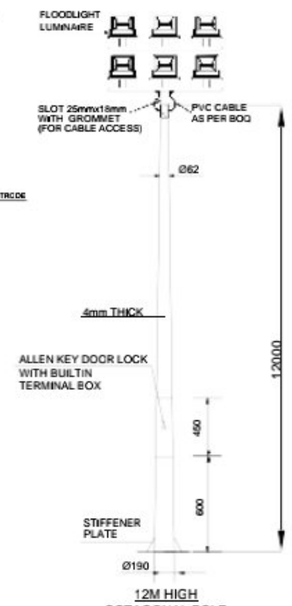


DETAIL-A

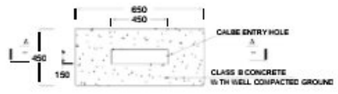
EARTHING PIT WITH EARTH ROD DETAIL



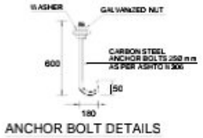
TERMINAL BOX INSTALLATION DETAIL IN LIGHTING POLE



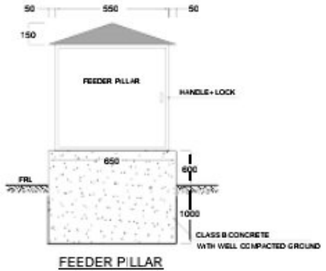
12M HIGH OCTAGONAL POLE



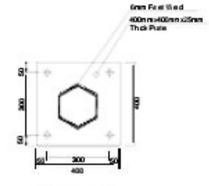
FEEDER PILLAR FOUNDATION DETAIL (TOP VIEW)



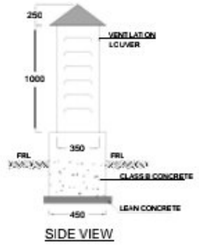
ANCHOR BOLT DETAILS



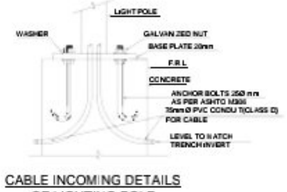
FEEDER PILLAR FRONT VIEW (AS PER MANUFACTURER RECOMMENDATION)



BASE PLATE



SIDE VIEW



CABLE INCOMING DETAILS OF LIGHTING POLE

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

EA Consulting Pvt Ltd
Head Office:AL-9, 15th Lane, Khyaban-e-Firdaus,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan :

Note:
- All dimensions to be checked and verified on Site.
- Only written dimensions to be followed. Do not scale any drawing.
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North:

Rev.	Date	Description
REVISIONS		

Date of Issue	December, 2021
Issued To	Client
Issued For	Tender

ELECTRICAL

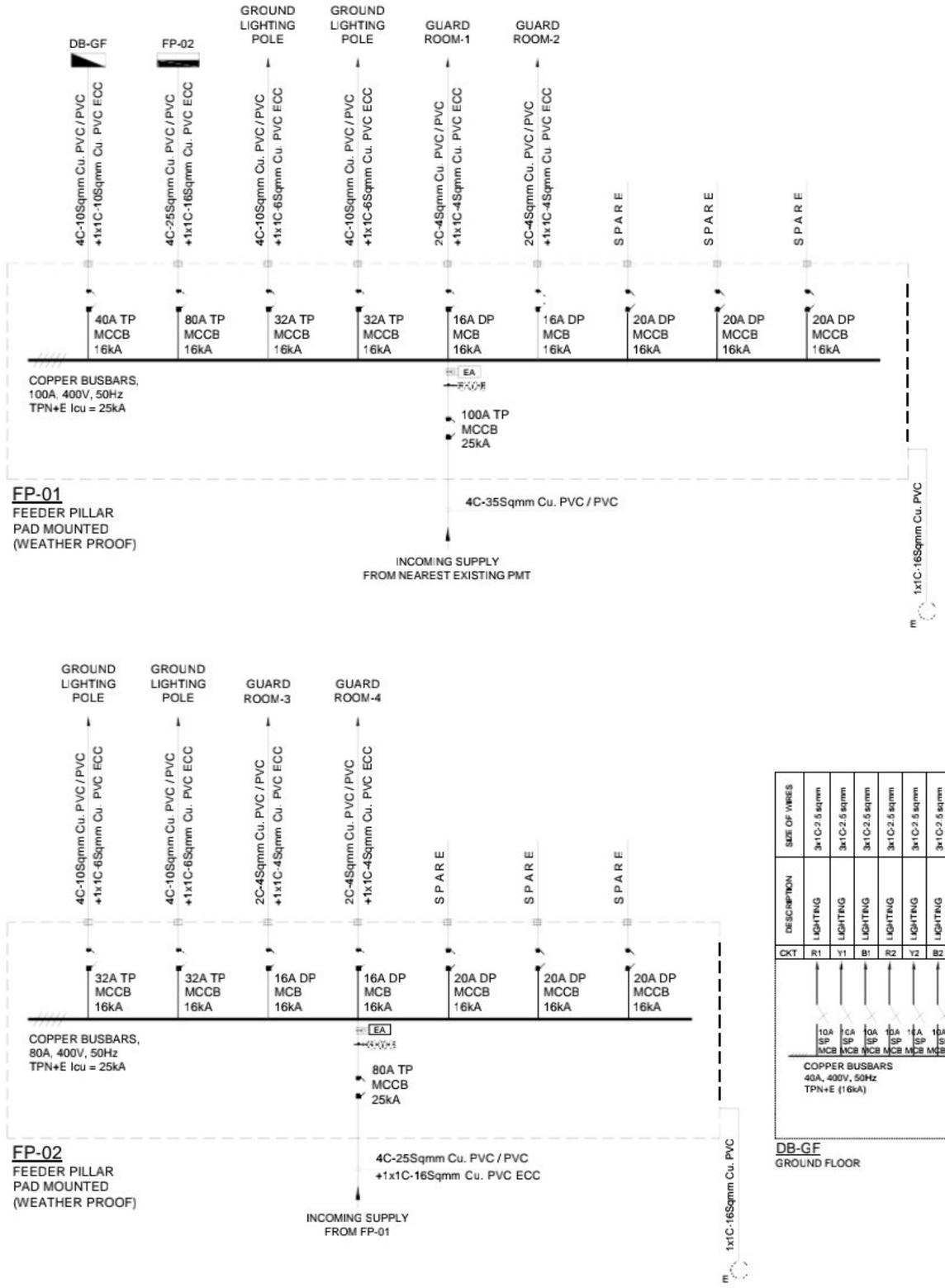
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TENDER

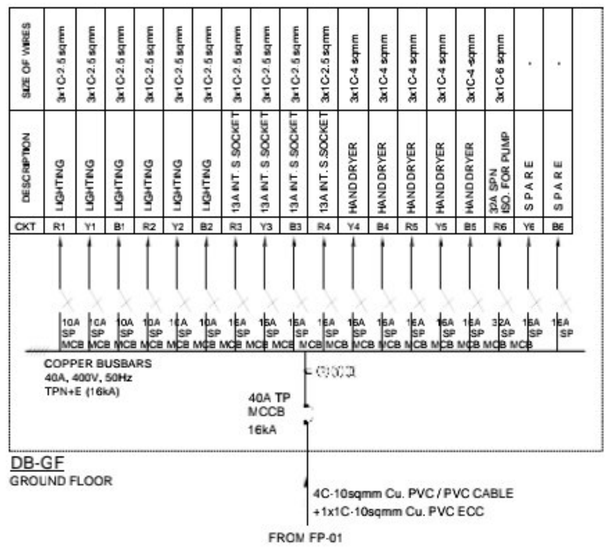
Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
LIGHTING POLE INSTALLATION & MISCELLANEOUS ELECTRICAL DETAILS

Designed:	Checked:	Approved:
SA	SA	ALU
Drawn:	Date:	Scale (Sheet: NTS @ A3
ZA	November,2021	NTS @ A1
Project Code: 01062		Rev :

Drawing No.:
EA-01062-EGFS- EL-0002





SINGLE LINE SYMBOLS FOR DEVICES

SYMBOL	DESCRIPTION
EA	ENERGY ANALYZER
	PHASE INDICATION LAMPS (R,Y,B)
	FUSE
	CURRENT TRANSFORMER
	SINGLE POLE MINIATURE CIRCUIT BREAKER (MCB)
	DOUBLE POLE MINIATURE CIRCUIT BREAKER (MCB)
	TRIPLE POLE MINIATURE CIRCUIT BREAKER (MCB)
	MOULDED CASE CIRCUIT BREAKER (MCCB)
	TRANSFORMER
	EARTH PIT

ABBREVIATIONS

LCP	LIGHTING CONTROL PANEL
FP	FEEDER PILLAR
HV	HIGH VOLTAGE
MV	MEDIUM VOLTAGE
LV	LOW VOLTAGE
1C	ONE CORE
2C	TWO CORE
3C	THREE CORE
4C	FOUR CORE
Sqmm	SQUARE MILLIMETER
Cu.	COPPER
Al.	ALUMINUM
PVC	POLY VINYL CHLORIDE
XLPE	CROSS LINKED POLYETHELENE
SWA	STEEL WIRE ARMOURED
ECC	EARTH CONTINUITY CONDUCTOR
SP	SINGLE POLE
DP	DOUBLE POLE
TP	TRIPLE POLE
4P	FOUR POLE
TPN+E	TRIPLE POLE NEUTRAL + EARTH
MCB	MINIATURE CIRCUIT BREAKER
MCCB	MOULDED CASE CIRCUIT BREAKER
kA	KILO AMPERE
kW	KILO WATT
Hz	HERTZ
WP	WEATHER PROOF
CL	CONNECTED LOAD
TCL	TOTAL CONNECTED LOAD
MD	MAXIMUM DEMAND
DDL	DIVERSIFIED DEMAND LOAD
TDDL	TOTAL DIVERSIFIED DEMAND LOAD
CKT	CIRCUIT
CT	CURRENT TRANSFORMER
ABC	AERIAL BUNDLED CONDUCTOR

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

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. 584-1825
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

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		REVISIONS

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Issued To	Client
Issued For	Tender

ELECTRICAL

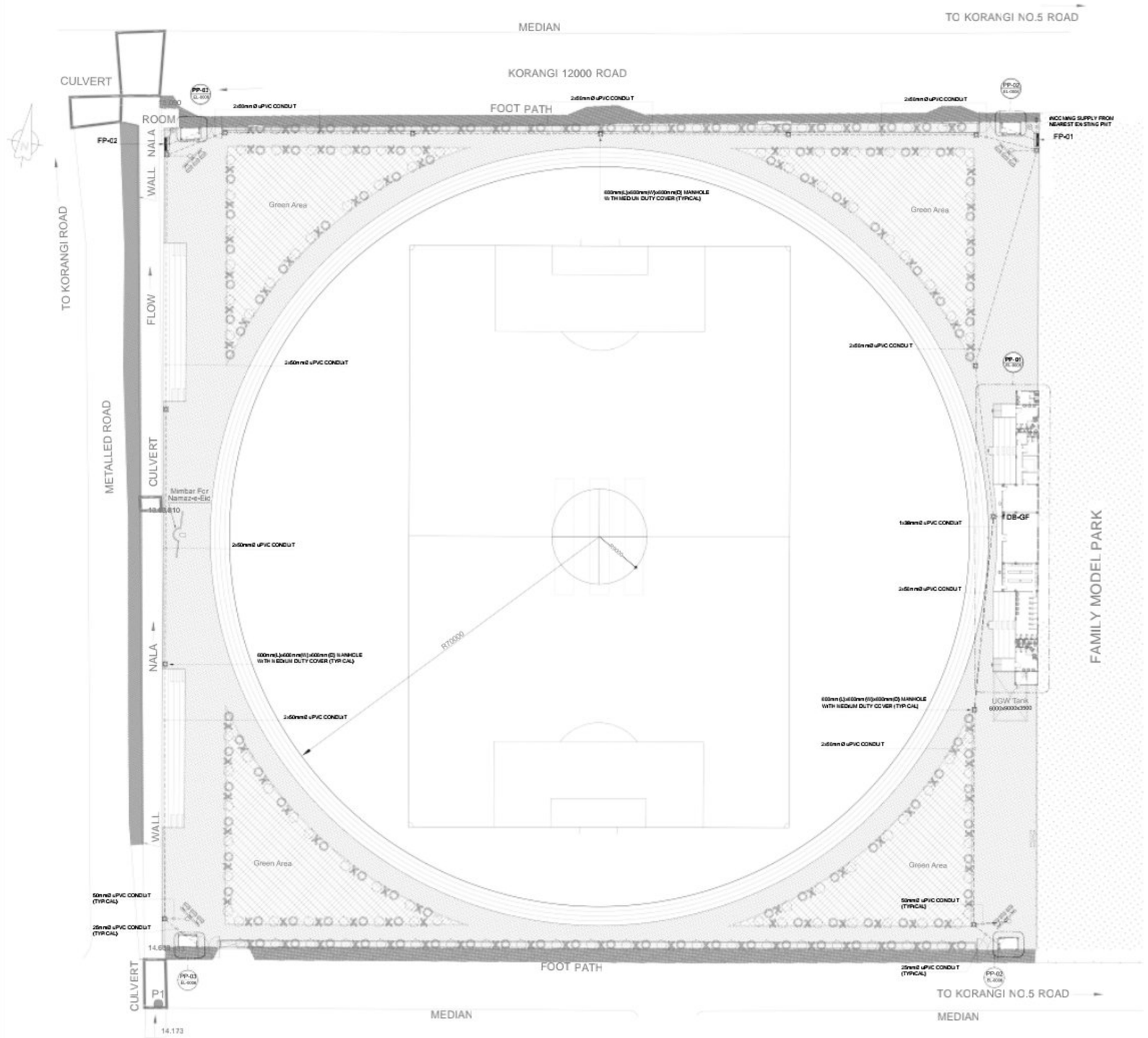
Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
ELECTRICAL DISTRIBUTION SINGLE LINE DIAGRAM

Designed:	Checked:	Approved:
SA	SA	AUJ
Drawn:	Date:	Scale / Sheet:
ZA	November,2021	NTS @ A3 NTS @ A1
Project Code: 01062		Rev.:

Drawing No.:
EA-01062-EGFS- EL-0003



LEGEND

S.No.	SYMBOL	DESCRIPTION
1		FLOOD LIGHT FIXTURE WITH 6x150W LED (IP66) INSTALLED ON 12M HIGH POLE
2		FEEDER PILLAR (FP) (WEATHER PROOF)
3		600mm(L)x600mm(W)x600mm(D) MANHOLE WITH MEDIUM DUTY COVER
4		COPPER EARTH ROD

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

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Head Office:AL-9, 15th Lane, Khayaban-e-Hilal,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

Key Plan :

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North:

Rev.	Date	Description

REVISIONS

Date of Issue	December, 2021
Issued To	Client
Issued For	Tender

ELECTRICAL

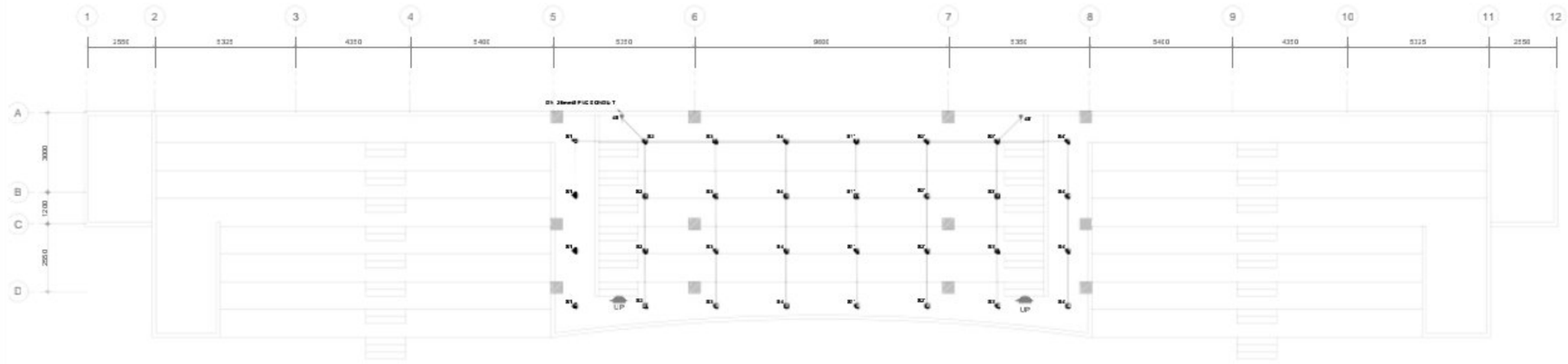
Status:
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Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
MASTER PLAN
EXTERNAL
LIGHTING LAYOUT

Designed:	Checked:	Approved:
SA	SA	AIU
Drawn:	Date:	Scale / Sheet:
ZA	November,2021	1:800@A3 1:400@A1
Project Code: 01062		Rev.:

Drawing No.:
EA-01062-EGFS-EL-0004



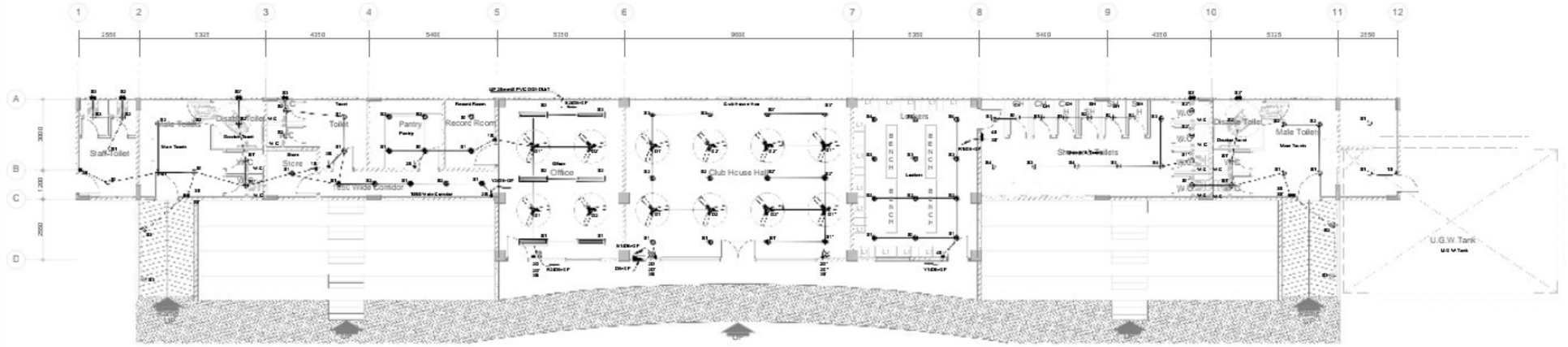
LEGEND FOR LIGHTING

SYMBOL	DESCRIPTION	LAMP	MOUNTING
	DOWN LIGHT FIXTURE , ALUMINUM PROFILE HOUSING (IP-20)	1x20 W LED	SURFACE
	DOWN LIGHT FIXTURE , ALUMINUM HOUSING (IP-44)	1x12 W LED	SURFACE
	BATTEN LIGHT FIXTURE , POLYCARBONATE PAINTED STEEL HOUSING (IP-20)	1x40 W LED	SURFACE
	WALL LIGHT, POLYCARBONATE HOUSING (IP-64)	1x 8W LED	WALL / SURFACE
	CEILING FAN 56"		CEILING SURFACE
	EXHAUST FAN		WALL
SW1 / SW2	LIGHTING CONTROL SWITCH (1 GANG) / FAN DIMMER (1 DIMMER)		WALL

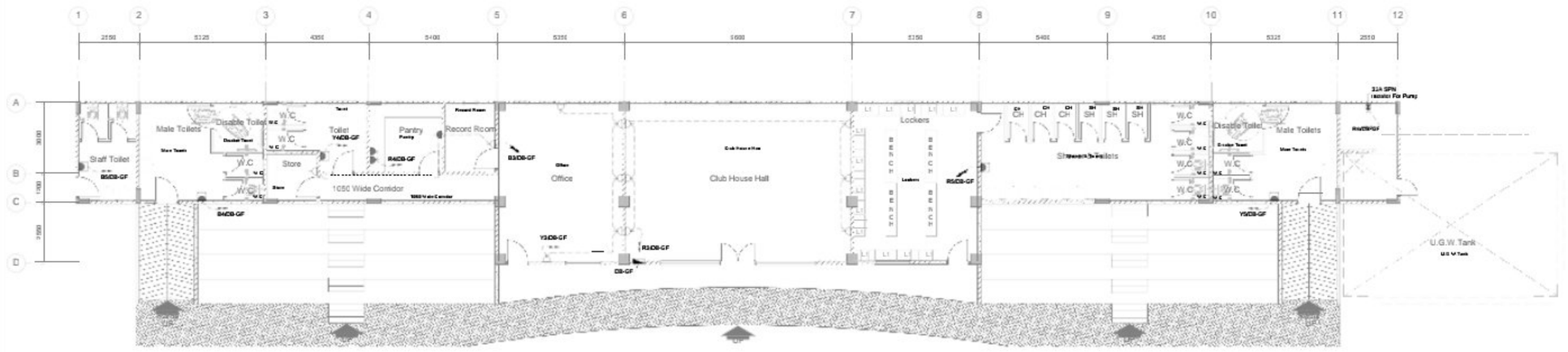
LEGEND FOR POWER SYSTEM

SYMBOL	DESCRIPTION
	13A UNIVERSAL SWITCHED SOCKET OUTLET (LOW LEVEL)
	13A UNIVERSAL SWITCHED SOCKET OUTLET (HIGH LEVEL)
	HAND DRYER
	SPN ISOLATOR
	DISTRIBUTION BOARD (DB)

LIGHTING LAYOUT PLAN - FIRST FLOOR



LIGHTING LAYOUT PLAN - GROUND FLOOR



POWER LAYOUT PLAN - GROUND FLOOR

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant :

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Head Office:RL-9, 15th Lane, Khayaban-e-Firdaus,Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email : info@eaworld.com | www.eaworld.com

Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan :

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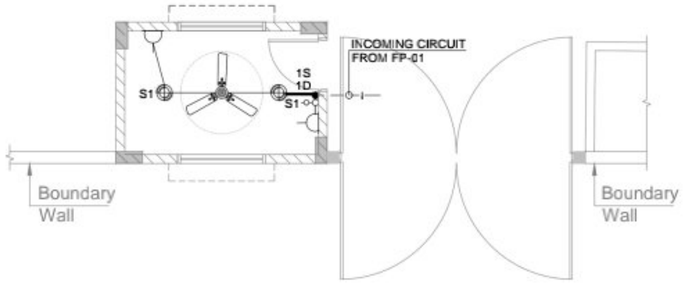
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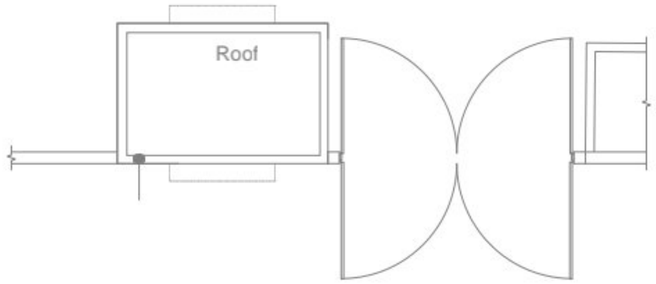
Status: TENDER

Name: EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title: PP-01 LIGHTING & POWER LAYOUT PLAN

Designed:	Checked:	Approved:
SA	SA	AUJ
Drawn:	Date:	Scale / Sheet:
ZA	November,2021	1:200@A3 1:100@A1
Project Code: 01062		Rev.:
Drawing No.: EA-01062-EGFS-EL-0005		





ELECTRICAL LAYOUT PLAN GUARD ROOM (PP-02)

ELECTRICAL LAYOUT PLAN GUARD ROOM (PP-03)

LEGEND FOR ELECTRICAL

S.No.	SYMBOL	DESCRIPTION	LAMP	MOUNTING
1		DOWN LIGHT FIXTURE , ALUMINUM PROFILE HOUSING (IP-20)	1x20 W LED	SURFACE
2		CEILING FAN 56"		CEILING SURFACE
3	NS ND	LIGHTING CONTROL SWITCH (N GANG) / FAN DIMMER (N DIMMER)		WALL
4		13A UNIVERSAL SWITCHED SOCKET OUTLET (LOW LEVEL)		

Client :

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Project :

EID GAH FOOTBALL STADIUM
D M C K O R A N G I

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ELECTRICAL

Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
PP-02 & PP-03
GUARD ROOM
ELECTRICAL LAYOUT

Designed:	Checked:	Approved:
SA	SA	AIJ
Drawn:	Date:	Scale / Sheet:
ZA	November,2021	1:100@A3 1:50@A1
Project Code: 01062		Rev.:

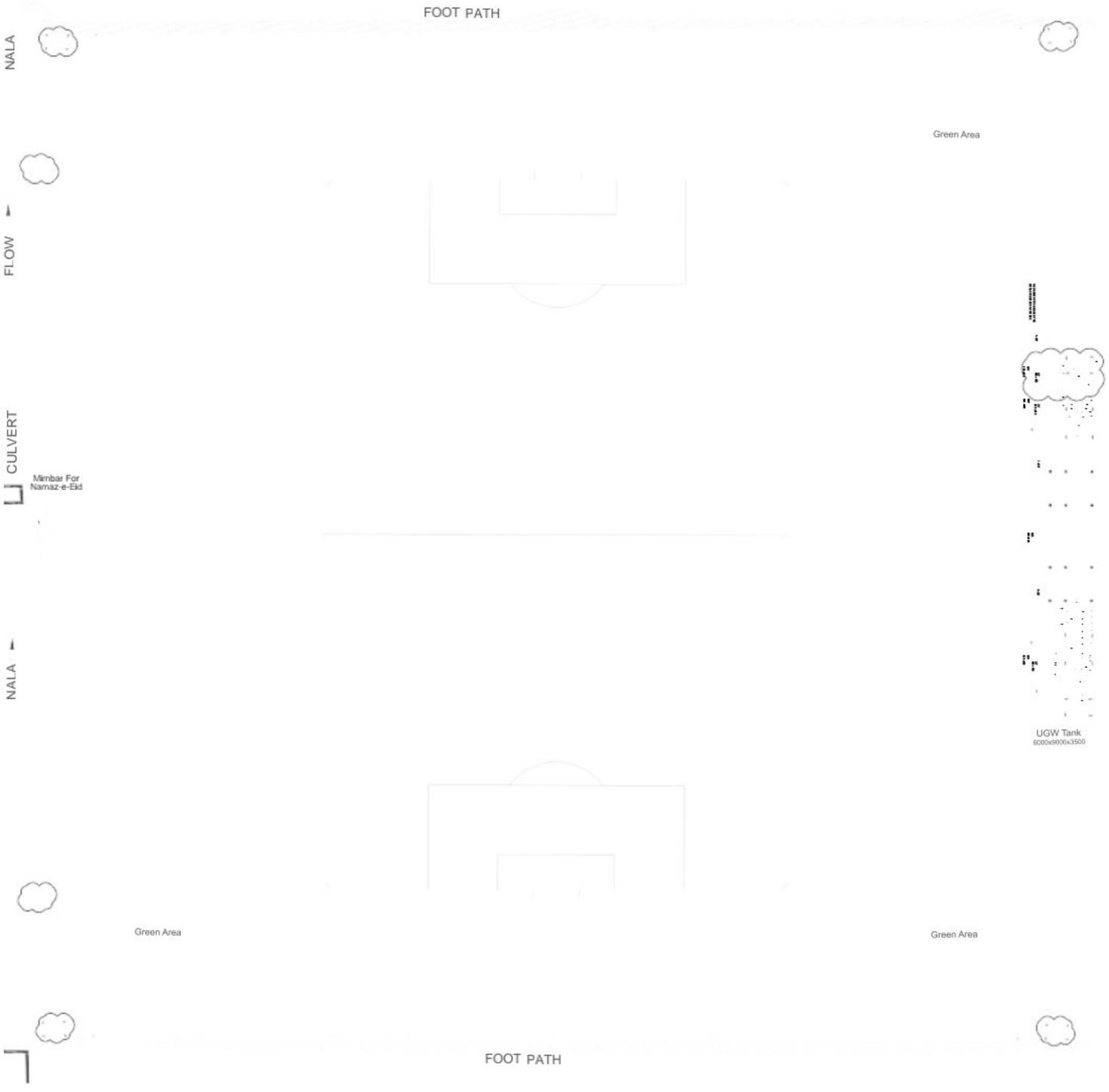
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EA-01062-EGFS-EL-0006

Competitive and Livable City of Karachi

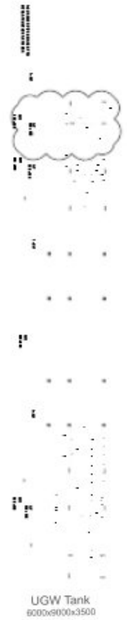
Local Government Department, Government of Sindh

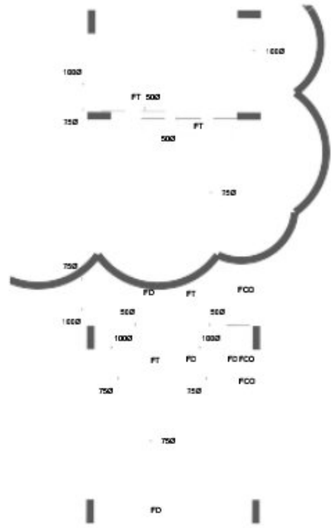
MEP

Plumbing



MAIN PLAN





ENLARGE DETAIL-A



UGW Tank
000x9000x3500

ENLARGE DETAIL-B

Client :

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

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Project :

EID GAH FOOTBALL STADIUM
D M C KORANGI

Key Plan :

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North :

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REVISIONS		

Date of Issue	16 November, 2021
Issued To	Client
Issued For	Tender

PLUMBING

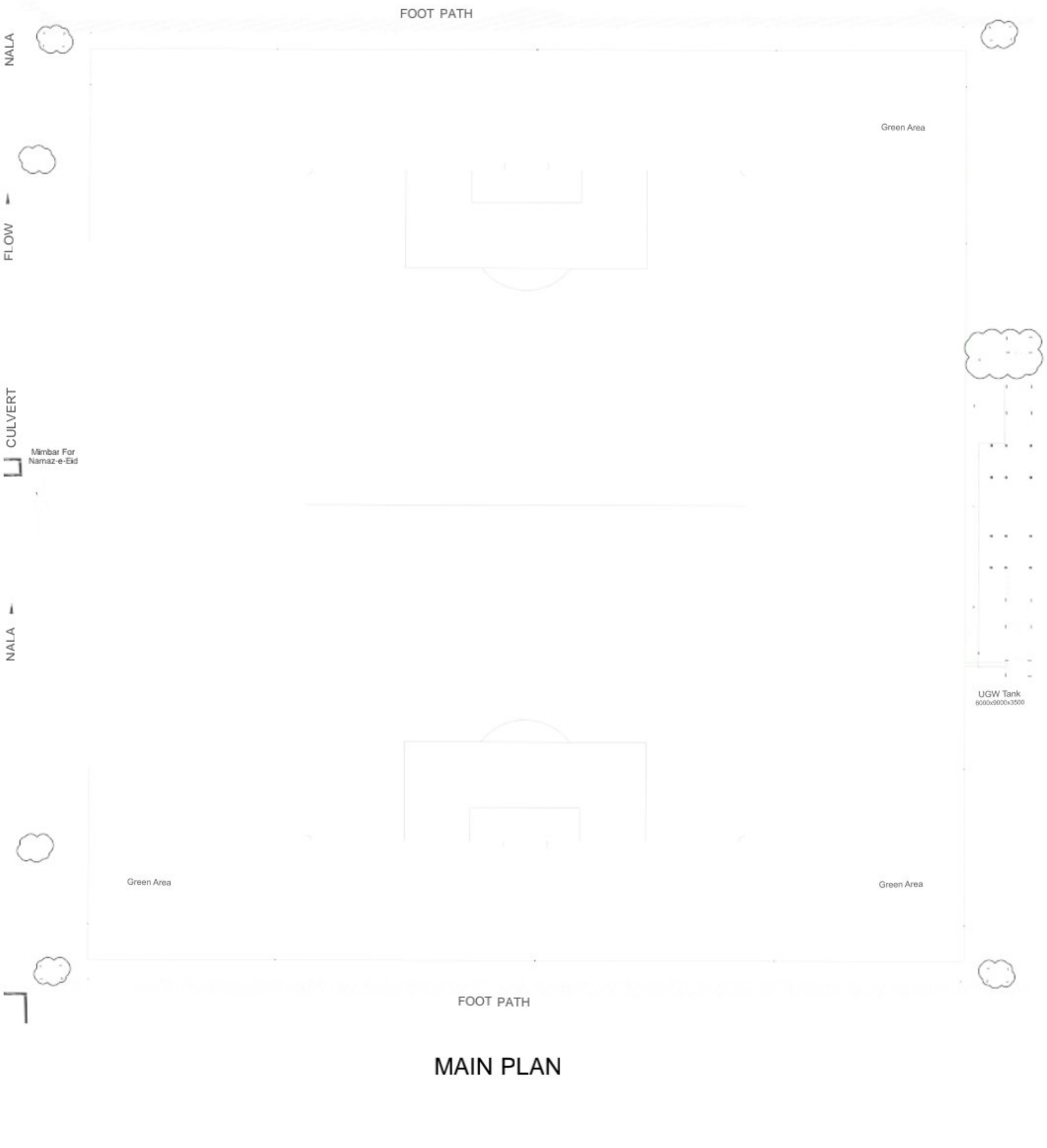
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EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

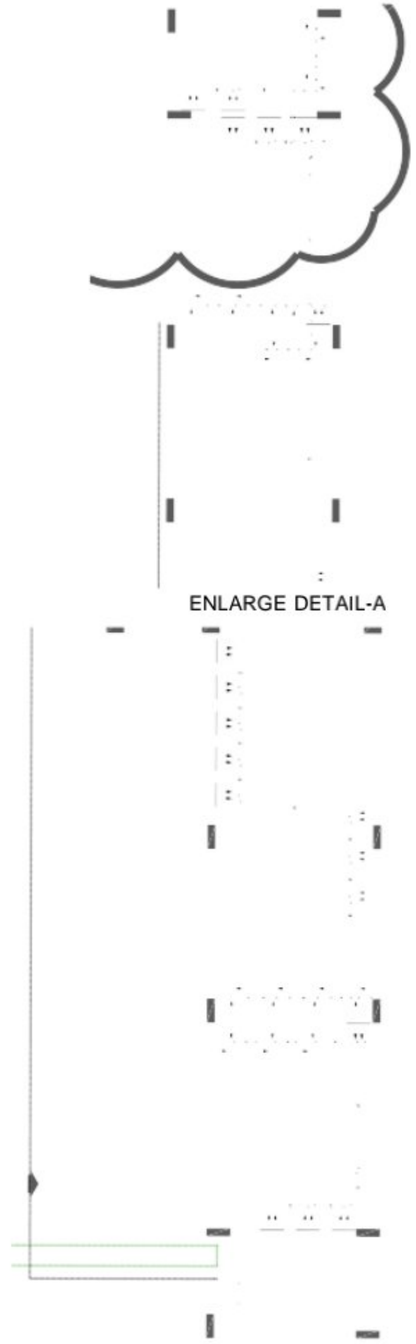
Drawing Title:
MASTER PLAN
DRAINAGE LAYOUT

Designed:	Checked:	Approved:
MT	MT	ZA
Drawn:	Date:	Scale / Sheet:
IB	November, 2021	1:700 @A3 1:350 @A1
Project Code:		Rev.:
01062		

Drawing No.:
EA-01062-EGFS-W1-0010



MAIN PLAN



ENLARGE DETAIL-B

Client:

CLICK
Competitive and Livable City of Karachi
Local Government Department, Government of Sindh

Consultant:

EA Consulting Pvt Ltd
Head Office:AL-9, 15th Lane, Khayaban-e-Hilal, Phase 7, Defence Housing Authority, Karachi. 75500 - Pakistan
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Project :

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D M C KORANGI

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Issued To	Client
Issued For	Tender

PLUMBING

Status:
TENDER

Name:
EID GAH FOOTBALL STADIUM, KORANGI No.3 (Package-1)

Drawing Title:
MASTER PLAN
WATER SUPPLY LAYOUT

Designed:	Checked:	Approved:
MT	MT	ZA
Drawn:	Date:	Scale / Sheet:
MD	November, 2021	1:700@A3 1:350@A1
Project Code: 01062		Rev.:

Drawing No.:
EA-01062-EGFS-W1-0010

Competitive and Livable City of Karachi
Local Government Department, Government of Sindh.

COMPETITIVE & LIVABLE CITY OF KARACHI
PACKAGE A:
IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03 . DMC KORANGI

TECHNICAL SPECIFICATIONS

(PART – A)

December, 2021

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. 584-1825
Email : info@eaworld.com | www.eaworld.com

Competitive and Livable City of Karachi
Local Government Department, Government of Sindh.

TECHNICAL SPECIFICATION - ARCHITECTURE

TENDER

December, 2021

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Email : info@eaworld.com | www.eaworld.com

TECHNICAL SPECIFICATION (Architecture)

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1 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 Contractor must provide shop drawings of all construction activities for approval of consultant. No execution is allowed without approved shop drawings.

1.04 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 or his 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.

1.05 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.

1.06 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.

1.07 The Contractor shall protect from injury by covering all work, internally and externally needing protection including new concrete, Formwork, surface

renderings, floors, etc., to the satisfaction of the Engineer, including the work of his sub-contractors at his own cost.

1.08 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.

1.09 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, cranes, 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.

1.10 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.

1.11 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.

1.12 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, shuttering, details of doors, windows, partitions, iron mongers work, 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. On site Mock-up and sample must be prepared and informed to engineer and client two weeks prior for visit.

1.13 No cement work shall be permitted during extreme cold weather when unless otherwise authorized by the engineer.

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.

END OF SECTION

2 UNIT MASONRY ASSEMBLIES

2.1 BLOCK MASONRY

2.1.1 SCOPE OF WORK

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

2.2 MATERIALS

2.2.1 CEMENT

Cement shall be Portland cement meeting the requirements specified under clause of section of "Concrete".

2.2.2 Aggregates

Aggregates used shall meet the requirements specified under clause of section of "Concrete".

2.2.3 Water

Water shall be as specified under clauses of the section of "Water".

2.2.4 Concrete Masonry Units

2.2.4.1 General: Provide shapes indicated and as follows:

i) Provide special shapes for corners, jambs, sash, control joints, headers, bonding, and other special conditions.

ii) Provide square-edged units for outside corners, unless indicated as bullnose.

2.2.4.2 CMU units designations: Currently, six ASTM standards apply to units intended primarily for construction of concrete masonry walls, beams, columns, or specialty applications:
Type of Unit is Non-load bearing Concrete Masonry Units and ASTM Designation is C 129

2.2.4.3 Concrete Masonry Units: ASTM C 129 and as follows:

i) Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 13.1 MPa [7.5 MPa on gross area].
   a) Normal-weight units: more than 125 lb/cu. ft. (2002 kg/cu. m)

ii) 2. Weight Classification: Normal weight, unless otherwise indicated.

2.2.4.4 Concrete masonry units shall be made on the project site and shall be of the sizes required by the drawings and / or as directed by the **Engineer.**

2.2.4.5 The blocks shall be solid or hollow as required and shall be carefully made so that they are true in line and face with square corners and free from all defects.

2.2.4.6 The concrete for the blocks shall be mixed in the proportions of one (1) part of cement, three (3) parts of sand and six (6) parts of well graded course aggregate not exceeding ½" in size.

2.2.4.7 Concrete blocks shall be machine moulded. The concrete shall be well worked in the moulds, vibrated tamped and pressed to ensure that the blocks are dense and free from voids.

2.2.4.8 The blocks shall be cured by keep moist continuously for a period of at least ten (10) days and then shall be allowed to dry in a shady location for at least eight (8) days before being used in masonry.

2.2.4.9 Where blocks are to be exposed to view they shall have clean, cut straight and true, edges, smooth dense faces of uniform appearance without voids, honeycombs, projections or variation in texture and shall be free from cracks, spells, chips, ragged edges or other defects detrimental of their appearance.

2.2.4.10 Where blocks are to be plastered the exposed surfaces shall have a coarse texture suitable for bonding the plaster as approved by the Engineer.

2.2.4.11 The average compressive strength of any five blocks picked at random shall be not less than the strength as specified for Class 'D' concrete under clause of the section of "Concrete".

2.2.4.12 The average moisture content of all concrete masonry units shall not exceed 30% of the total absorption of the units.

2.3 HANDLING AND STORAGE

Concrete masonry unit shall be stacked on platforms and covered or stored in any other manner approved by the Consultants to protect from contact with the soil and exposure to weather. Care shall be taken in handling to avoid chipping and breakage. Storage piles stacks, or bins shall be so located as to avoid being disturbed or shall be barricaded to protect the blocks from damages by construction operations.

2.4 MORTAR FOR MASONRY

2.4.1. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1) Do not use calcium chloride in mortar or grout.
2) 2. Use mortar cement mortar unless otherwise indicated.
3) 3. For exterior masonry, use mortar cement mortar.

2.4.2. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a pre blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients be- fore delivering to Project site. Comply with ASTM C 270 Property Specification:

1) Wet mix life: <1.5 hours
2) 2. Initial adhesion at 28 days: > 0.3N/mm2
3) 3. Bending strength: around 1N/ mm2
4) 4. Compressive strength : not less than 5 ±1 N/ mm2
5) 5. Min. cement sand mix: 1:3-4
6) 6. Testing: ASTM C 780

2.4.3. Mortar for Unit Masonry: Comply with ASTM C 270 Property Specification. For job mixed mortars, minimum properties shall be as follows:

1) Compressive strength : not less than 5 ±1 N/ mm2
2) 2. Min. cement sand mix: 1:3-4
3) 3. Bending strength: around 1N/ mm2
4) 4. Testing: ASTM C 780

2.4.4. Property specification ASTM C 270:

Mortar	Type	Average Compressive Strength at 28 days, min, psi (MPa)	Air Content Max %
	S	1800 (12.4)	12
	N	750 (5.2)	14
	O	350 (2.4	14

Aggregate Ratio (Measured in Damp, Loose Conditions): Not less than 2 1/4 and not more than 3 1/2 the sum of the separate volumes of cementitious materials Minimum water retention 75 %

1) For masonry below grade or in contact with earth, use Type M.
2) For reinforced masonry, use Type S.
3) For mortar parge coats, use Type S or Type N.
4) For exterior, above-grade, non-load-bearing walls and parapet walls; for interior non-load- bearing partitions; and for other applications where another type is not indicated, use Type N.

2.4.5. Grout for Unit Masonry: Comply with ASTM C 476.

1) Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2) Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified
3) 28-day compressive strength indicated, but not less than 14 MPa.
4) Provide grout with a slump of 203 to 279 mm as measured according to ASTM C 143/C 143M. PART

2.4.6. Cement shall be Portland as specified under Clause of the Section of "Concrete".

2.4.7. Fine aggregate shall be clean, hard, durable particles free from laminated material well graded from No. 4 to 100 sieve.

2.4.8. Water shall be clean and free from injurious acids, alkali and organic impurities.

2.4.9. All mortar for masonry shall be proportion of one (1) part of cement and four (4) parts of sand (fine aggregate) and the ingredients shall be mixed by volume.

2.4.10. Mortar shall be mixed thoroughly in a drum type batch mixer for a period of not less than three minutes, using the quantity of water required to obtain the desired workability. Hand mixing shall be subject to approval by the Engineer and if he allows the mortar materials shall be mixed in a light mortar mixing box. In no case the mixing of mortar shall be done on open platform.

2.4.11. The mortar shall be subject to compressive strength test and the average compressive strength of three numbers 50 mm (2") cylinders of mortar shall be not less than 1,800 lbs per sq. inch at 28 days.

2.4.12. Mortar shall be used in the masonry within half an hour from addition of water into the mortar. The mortar which has already set shall not be used in the masonry.

2.5 MASONRY AND JOINTING

a) All masonry shall be laid plumb, true to the line and level and accurately spaced coursed and with each course breaking joints with the course below. Bond shall be keeping plumb; corners and reveals shall be plumb and true. Chases, grooves, reglet blocks and raked out joints shall be kept free from mortar and other debris.

b) The thickness and length of various walls shall be as indicated on the drawings.

c) Unless otherwise shown on the drawings or specified the spaces around forms and other built in items shall be solidly filled with mortar except that joints that are to be caulked shall be raked out 20 mm (3/4").

d) Work required to be built in with masonry including anchor, wall plugs and accessories shall be built in as the work progresses. Wood plugs and blocking shall not be built into masonry.

e) All horizontal and vertical joints shall be completely and solidly filled with mortar when and as the blocks are laid.

f) (1/2") deep when the mortar is still fresh so as to give proper bond to the plaster.

g) Where masonry abuts RCC columns or walls it shall be anchored thereto by means of wire anchors of galvanized metal not less than 10 gauge or 25 mm (1") wide G.I. strip 22 gauge located at every fourth horizontal joint.

h) The top course of partitions under slabs beams shall not be laid until the forms have been removed and the roofing placed.

i) Masonry walls shall be cured for at least ten days from the day it is erected.

2.6 MATERIALS

a. Mortar

b. Cement
Comply with requirements of BS 12: 1989. Use ordinary Portland cement (grey) unless specified otherwise.

c. Sand
Comply with requirements of BS 1200: 1976 with Amendments 1, 2 & 3, for "Building sands from natural sources". Grading S of table below is preferred.

BS Sieve	Percentage by mass passing BS sieves	
	Type S	Type G
mm		
6.30	100	100
5.00	98 – 100	98 – 100
2.36	90 – 100	90 – 100
1.18	70 – 100	70 – 100
microns		
600	40 – 100	40 – 100
300	5 – 70	20 – 90
150	0 – 15	0 – 25
75	0 -5*	0 – 8**

* 0-10% for crushed stone sands

** 0-1 2 % for crushed stone sands

Store sand at the Site in such a manner that it is not mixed with foreign matter. Methods employed by the Contractor for unloading, loading, handling and storage shall be subject to the approval of the Engineer. Maintain sufficient quantity at the Site at all times to ensure continuous work.

i) Water
Do not use seawater or brackish water containing more than 100 ppm chloride ion or 2000 ppm sulphate ion for mixing or curing concrete. Water shall be clean and free from harmful matter and shall comply with the requirements of appendix A of BS 3148: 1980. Avoid contamination during storage.

ii) Mortar composition
Cement to dry sand ratio by volume as specified.

iii) Mortar batching and mixing
Employ methods and equipment for mixing mortar so as to accurately determine and control the amount of each separate ingredient entering into the mortar, subject to the approval of the Engineer. Unless mixing by hand is allowed by the Engineer, mix mortar in a mixer which shall be of approved design and the mixing time after all the ingredients are in the mixer, except for the full amount of water, shall not be less than two minutes. Mix mortar only in quantities just sufficient for immediate use and waste all mortar not used within 30 minutes after addition of water to the mix. Do not re-tamper mortar. Thoroughly clean and wash mixing troughs and pans at the end of each day's work.

d. Metal ties
Unless approved otherwise by the Engineer or shown on drawings:

i) Cavity wall ties - comply with the requirements of BS 1243: 1978 as approved by the Engineer.
ii) Ties for jointing concrete and blockwork - 6mm dia x 300mm long, MS galvanized.

2.7 TIES AND ANCHORS

2.7.1. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
i) Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/ A 153M, Class B-2 coating.
ii) Stainless-Steel Wire: ASTM A 580/A 580M, Type 316.
iii) Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
iv) Stainless-Steel Sheet: ASTM A 666, Type 316.
v) Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.7.2. Corrugated Metal Ties: Metal strips not less than 22 mm wide with corrugations having a wavelength of 7.6 to 12.7 mm and an amplitude of 1.5 to 2.5 mm made from 1.52-mm- thick, steel sheet, galvanized after fabrication.

2.7.3. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 16-mm cover on outside face. Outer ends of wires are bent 90 degrees and extend 50 mm parallel to face of veneer.

2.7.4. Individual Wire Ties: Rectangular units with closed ends and not less than 100 mm wide.

i) Z-shaped ties with ends bent 90 degrees to provide hooks not less than 50 mm long may be used for masonry constructed from solid units.

ii) Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 32 mm.

iii) Wire: Fabricate from 6.35-mm- diameter, hot-dip galvanized steel wire.

2.7.5. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

i) Anchor Section for Welding to Steel Frame: Crimped 6.35-mm- diameter, hot-dip galvanized steel wire.

ii) Tie Section: Triangular-shaped wire tie, sized to extend within 25 mm of masonry face, made from 6.35-mm- diameter, hot-dip galvanized steel wire.

2.7.6. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

i) Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 2.66-mm- thick, steel sheet, galvanized after fabrication.

ii) Tie Section: Triangular-shaped wire tie, sized to extend within 25 mm of masonry face, made from 6.35-mm- diameter, hot-dip galvanized steel wire.

iii) Corrugated Metal Ties: Metal strips not less than 22 mm wide with corrugations having a wavelength of 7.6 to 12.7 mm and an amplitude of 1.5 to 2.5 mm made from 2.66-mmthick, steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 25 mm of masonry face.

2.7.7. Provide Adjustable Anchors for Connecting to Structural Steel Framing or Concrete made of stain- less steel sheet or wire where required for location and directed by Engineer.

2.7.8. Partition Top anchors: 2.66-mm- thick metal plate with 9.5-mm- diameter metal rod 152 mm long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication. I. Rigid Anchors: Fabricate from steel bars 38 mm wide by 6.35 mm thick by 610 mm long, with ends turned up 51 mm or with cross pins unless otherwise indicated.

i) Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

2.8.1. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

2.8.2. Preformed Control-Joint Gaskets: Material as indicated below, Made from styrenebutadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

2.8.3. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.8.4. Weep/Vent Products: Use one of the following unless otherwise indicated:

i) Wicking Material: Absorbent rope, made from UV-resistant synthetic fiber, 6 to 10 mm in diameter, in length required to produce 50-mm exposure on exterior and 450 mm in cavity. Use only for weeps.

ii) Plastic Weep Hole/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, designed to fill head joint with outside face held back 3 mm from exterior face of masonry, in color selected from manufacturer's standard.

2.9 DELIVERY AND STORAGE

The methods and equipment used for transporting the bricks and mortar shall be such as will not damage the bricks nor delay the use of mixed mortar.

Masonry materials shall be so stored that at the time of use the materials are clean and structurally suitable for use.

2.10 SCAFFOLDING

Provide and erect safe scaffolding of adequate strength for use of workmen at all levels and heights. Do not use scaffolding which in the opinion of the Engineer is unsafe, until it has been strengthened and made safe for use of workmen.

2.11 MEASUREMENT AND PAYMENT

All the items of work covered by this section of the specifications shall be measured by the standard method of measurements and paid in accordance with unit rates entered in the Bill of Quantities. No separate payment will be made for masonry anchors etc. required.

END OF SECTION

2.2 DIMENSION STONE CLADDING

PART 1 – GENERAL

2.2.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions of Contract and Division 1 Specification Sections, apply to this Section.

2.2.2 SUMMARY

A. This Section includes dimension stone panels set with individual anchors.
B. Related Sections include the following:
1. Division 3 Section "Cast-in-Place Concrete" for installing inserts in concrete for anchoring dimension stone cladding.
2. Division 7 Section "Joint Sealants" for sealing joints in dimension stone cladding system with elastomeric sealants.
3. Division 9 Section "Stone Paving and Flooring" for dimension stone used as paving and flooring.
C. Stone Types: Descriptions of stone types required for other Sections are included in Part 2 of this Section.
D. Inspection and Testing Allowance: Furnish quality-control testing under the Inspection and Testing Allowance as specified in Division 1 Section "Allowances."

2.2.3 DEFINITIONS

A. Definitions contained in ASTM C 119 apply to this Section.
B. Dimension Stone Cladding System: An exterior wall covering system consisting of dimension stone panels together with the anchors, fasteners, and sealants used to secure the stone to the building structure and to produce a weather-resistant covering.

2.2.4 PERFORMANCE REQUIREMENTS

A. General: Design stone anchors and anchoring systems according to ASTM C 1242.

2.2.5 SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and other manufactured products indicated.
B. Shop Drawings: Show details of fabrication and installation of dimension stone cladding system, including dimensions and profiles of stone units.
1. Show locations and details of joints both within dimension stone cladding system and between dimension stone cladding system and other construction.
2. Include details of mortar joints, with sealant.
3. Show locations and details of anchors and backup structure.
4. Include large-scale shaded elevations and details of decorative surfaces and inscriptions.
5. For installed dimension stone cladding systems indicated to comply with certain design loads and deflection limits, include structural analysis data signed and sealed by the qualified structural engineer responsible for their preparation.

C. Stone Samples for Verification: Sets for each color, grade, finish, and variety of stone required; not less than 300 mm square. Include two or more Samples in each set showing the full range of variations in appearance characteristics expected in the completed Work.
D. Colored Pointing Mortar Samples for Verification: For each color required, showing the full range of exposed color and texture expected in the completed Work.
E. Sealant Samples for Verification: For each type and color of joint sealant required.
F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/engineers and owners, and other information specified.
G. Material Test Reports: From a qualified independent testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
1. Stone Test Reports: For each stone variety proposed for use on Project, provide test data indicating compliance with required physical properties including those specified by reference to ASTM standards. Include test data for flexural strength based on testing according to ASTM C 880, performed on specimen representative of minimum thickness and finish of installed stone, in both wet and dry conditions. Base reports on testing done within previous 5 years.
2. Anchorage Test Reports: For each stone variety, and anchor type, based on testing according to ASTM C 1354, performed on specimens representative of minimum thickness and finish of installed stone.
3. For metal components, indicate chemical and physical properties of metal.
4. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer complying with requirements in Division 7 Section "Joint Sealants." Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.
5. Preconstruction Sealant Field Test Report: From the Installer, complying with requirements in Division 7 Section "Joint Sealants."

2.2.6 QUALITY ASSURANCE

A. Quality System: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.
B. Installer Qualifications: An experienced installer who has completed dimension stone cladding systems similar in material, design, and extent to those indicated for this
Project and whose work has resulted in construction with a record of successful in service performance.
1. Installer's responsibilities include engineering, fabricating, and installing dimension stone cladding system.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified [professional] [structural] engineer.
C. Structural Engineer Qualifications: A structural engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of dimension stone cladding systems that are similar to those indicated for this Project in material, design, and extent.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
E. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.
1. Obtain each variety of stone from a single quarry, whether specified in this Section or in another Section of the Specification.
F. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from a single manufacturer and each aggregate from one source or producer.
G. Source Limitations for Other Materials: Obtain each type of stone accessory, sealant, and other material from a single manufacturer for each product.
H. Preconstruction Stone Testing: The Employer will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made from the Inspection and Testing Allowance, as authorized by Change
Orders. Retesting of materials that fail to meet specified requirements shall be done at the Contractor's expense.
1. Furnish test specimens selected by testing agency from blocks representative of actual materials proposed for incorporation into the Work.
2. One set of test specimens will be required for each stone variety, of number and size indicated in referenced standards.
3. Stone will be tested for compliance with physical property requirements according to referenced ASTM standards.
4. Flexural Strength Tests: ASTM C 880, performed on specimens representative of minimum thickness and finish of installed stone. One set will be tested in both wet and dry conditions.
5. Anchorage Tests: ASTM C 1354, performed on specimens representative of minimum thickness and finish of installed stone. One set will be tested for each combination of stone variety, finish, and anchor type.
I. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint sealant manufacturers samples of materials that will contact or affect joint sealants, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Division 7 Section "Joint Sealants."
J. Preconstruction Field Testing of Sealants: Before installing joint sealants, field test their adhesion to joint substrates per requirements specified in Division 7 Section "Joint
Sealants."
K. Mockups: Before installing dimension stone cladding systems, build mockups to verify selections made under Sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Locate mockups where indicated or, if not indicated, as directed by the Engineer.
2. Build mockup of typical wall area as shown on Drawings.
3. Build mockups of typical exterior wall with dimension stone cladding.
a. Show typical components, attachments to building structure, and methods of installation.
b. Include sealant-filled joint complying with requirements in Division 7 Section "Joint Sealants."

4. Notify the Engineer 7 days in advance of dates and times when mockups will be constructed.
5. Obtain the Engineer's approval of mockups before starting installation.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
a. Approval of mockups does not constitute approval of deviations from the Contract
Documents contained in mockups unless such deviations are specifically approved by the Engineer in writing.
7. Demolish and remove mockups when directed.
8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

2.2.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealants to Project site in original unopened containers labeled with manufacturer' name, product name and designation, color, expiration period, pot life, curing time, and mixing instructions for multicomponent materials.
B. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.
1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
2. Store stone on wood skids or pallets with nonstaining, waterproof covers. Arrange distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.
C. Store cementitious materials on elevated platforms, under cover, and in a dry location.
Do not use cementitious materials that have become damp.
D. Store aggregates in locations where grading and other required characteristics can be maintained and where contamination can be avoided.

2.2.8 PROJECT CONDITIONS

A. Environmental Limitations for Sealants: Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or below
4.4 deg. C (40 deg. F) or when joint substrates are wet.

PART 2 - PRODUCTS

2.2.9 STONE, GENERAL

A. Available Varieties and Sources: Subject to compliance with requirements, stone varieties that may be incorporated into the Work include, but are not limited to, those indicated.
B. Match the Engineer's samples for color, finish, and other stone characteristics relating to aesthetic effects.
C. For each stone variety, provide matched blocks extracted from a single bed of quarry stratum unless the Engineer approves stone from blocks randomly selected for aesthetic effect.
D. Quarry stone in a manner to ensure that as-quarried block orientations yield finished stone with required characteristics.
E. Make quarried blocks available for examination by the Engineer for appearance characteristics.

2.2.10 STONE TYPES

A. Flag stone copping 40 mm thick for separating wall as shown on drawings.
B. Sand stone cladding 40 mm thick as indicated on drawings.
C. Flag stone skirting 40 mm thick as indicated on drawings.
D. Flag stone 60 mm thick rough finish for stairs.
E. Flag stone 30 mm thick rough finish for stairs.
F. Marble stone cladding 200x200x20 mm thick, light blue color for fountains.
G. Marble stone copping 40mm thick set on 20mm thick of mortar bed for exterior finishes as indicated in drawings.
H. Marble stone cladding 20mm thick set on 20mm thick of mortar bed for exterior finishes as indicated on drawings. Preferred stone is Swat Stone (Grey color)

2.2.11 BACKUP STRUCTURE

A. Masonry Walls: Masonry walls supporting natural stone cladding are to be constructed from solid concrete blocks to ASTM C 90. Properties shall be as follows:
1. Type: Moisture controlled units.
2. Classification: normal weight.
3. Compressive Strength: Minimum average net-area compressive strength 10 Mpa.

2.2.12 ANCHORS

A. Anchors shall be of appropriate types and sizes as recommended and certified for the particular purpose, function, location, and background by the manufacturer, and to approval. Fixings are to consist of two parts and are to be sufficiently adjustable vertically and horizontally to meet the specified requirements for accuracy. They are to be fixed, wherever practicable, to backing wall by expanding bolts.
B. Fabricate anchors, including shelf angles, from stainless-steel, ASTM A 666, Type [304] [316], temper as required to support loads imposed without exceeding allowable design stresses.
1. Fasteners for Stainless-Steel Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 738M for bolts and ASTM F 836M for nuts, Alloy Group [A1] [A4].

C. Fabricate anchors, including shelf angles, from hot-dip galvanized steel, ASTM A 36/A
36M for materials and ASTM A 123/A 123M for galvanizing.
1. Fasteners for Hot-Dip Galvanized Steel Anchors: ASTM F 568M, Property Class 4.6, for bolts; ASTM A 563M, Grade A, for nuts; and ASTM F 436M for washers; all either hot-dip or mechanically zinc coated.
D. Cast-in-Place and Postinstalled Fasteners for Concrete and Masonry: Type indicated below, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing, per ASTM E 488, conducted by a qualified independent testing agency.
1. Adjustable Inserts Embedded in Concrete: Steel, cast iron, or malleable iron, with bolts, nuts, washers, and shims; all hot-dip galvanized.
2. Postinstalled Fasteners for Concrete and Masonry: [Chemical anchors,] expansion anchors,] made from stainless-steel components complying with ASTM F 738M and ASTM F 836M, Alloy Group A1 or A4 for bolts and nuts; ASTM A 666 or ASTM A 276, Type [304] [316], for anchors.

2.2.13 STONE FABRICATION

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.
B. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.

2.2.14 MORTAR MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.
1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not use calcium chloride.
2. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Discard mortar when it has reached initial set.

2.2.15 SOURCE QUALITY CONTROL

A. Source Quality-Control Testing Service: The Employer will employ an independent testing agency to perform source quality control testing. Payment for these services will be made from the Inspection and Testing Allowance, as authorized by Change Orders.
Retesting of materials that fail to meet specified requirements shall be done at the Contractor's expense.
B. Tests for compliance with requirements will be performed as follows. Furnish test specimens selected by testing agency from blocks representative of actual material proposed for incorporation into the Work.

1. Flexural Strength Tests: ASTM C 880, performed on specimens representative of minimum thickness and finish of installed stone. One set of test specimens will be required for every [500 sq. m] but not fewer than 2 sets for each stone variety.
2. Anchorage Tests: ASTM C 1354, performed on specimens representative of minimum thickness and finish of installed stone. One set of test specimens will be required for each combination of stone variety, finish, and anchor type.
C. Testing agency will report test results promptly and in writing to the Engineer and the
Contractor.

PART 3 – EXECUTION

2.2.16 EXAMINATION

A. Examine surfaces to receive dimension stone cladding and conditions under which dimension stone cladding will be installed, with the Installer present, for compliance wit requirements for installation tolerances and other conditions affecting performance.
1. For the record, prepare a written report, endorsed by the Installer, listing condition detrimental to performance of dimension stone cladding.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2.17 PREPARATION

A. Advise installers of other work about specific requirements for placement of inserts, flashing reglets, and similar items to be used by the dimension stone cladding Installer for anchoring, supporting, and flashing of dimension stone cladding system. Furnish installers of other work with Drawings or templates showing locations of these items.
B. Protect dimension stone cladding during erection as follows:
1. Cover tops of dimension stone cladding installation with non-staining, waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 600 mm down both sides and hold securely in place.
2. Prevent staining of stone from mortar, grout, sealants, and other sources Immediately remove such materials without damaging stone.
3. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
4. Protect sills, ledges, and projections from mortar and sealant droppings.
C. Clean stone surfaces that are dirty or stained by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

2.2.18 SETTING DIMENSION STONE CLADDING, GENERAL

A. Execute dimension stone cladding installation by skilled mechanics and employ skilled stone fitters at Project site to carry out necessary field cutting as stone is set.
1. Use power saws with diamond blades to cut stone. Produce lines cut straight and true, with edges eased slightly to prevent snipping.

B. Contiguous Work: Provide reveals, reglets, and openings as required to accommodate contiguous work.
C. Set stone to comply with requirements indicated on Drawings and Shop Drawings. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure dimension stone cladding in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.
D. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.
1. Sealing expansion and other joints is specified in Division 7 Section "Joint Sealants."
2. Keep expansion joints free of mortar and other rigid materials.

2.2.19 INSTALLATION TOLERANCES

A. Variation from Level: For lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 6 mm in 6 m maximum.
B. Variation of Linear Building Line: For positions shown in plan and related portions of walls and partitions, do not exceed 6 mm in 6 m or 12 mm in 12 m or more.
C. Variation in Joint Width: Do not vary joint thickness more than 3 mm in 900 mm or a quarter of nominal joint width, whichever is less.

2.2.20 SETTING MECHANICALLY ANCHORED DIMENSION STONE CLADDING

A. Attach anchors securely to stone and to backup surfaces. Comply with recommendations in ASTM C 1242.
B. Attach framing for stone support system to structural frame of building, at connection points indicated, by welding or bolting to comply with the following:
1. Weld connections to comply with AWS D1.1, "Structural Welding Code--Steel."
2. Fabricate joints to exclude water or to permit its escape to building exterior, at locations where water could accumulate because of condensation or other causes.
3. For galvanized surfaces, clean welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
4. For shop-painted surfaces, clean field welds, bolted connections, and abraded areas immediately after erection. Apply paint to exposed areas using same material as used for shop painting.
C. Fill anchor holes with sealant.
1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.
D. Set stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of stone a distance at least equal to width of joint.

2.2.21 JOINT SEALANT INSTALLATION

A. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Division 7 Section "Joint Sealants."

2.2.22 FIELD QUALITY CONTROL

A. Field Quality-Control Testing Service: The Employer will engage a qualified independent testing agency to perform field quality-control testing. Payment for these services will be made [by the Employer] [from the Inspection and Testing Allowance, as authorized by Change Orders]. Retesting of materials that fail to meet specified requirements shall be done at the Contractor's expense.
B. Water Leakage: Dimension stone cladding system will be tested according to AAMA
501.2.
C. Testing agency will report test results promptly and in writing to the Engineer and the Contractor.

2.2.23 ADJUSTING AND CLEANING

A. Remove and replace broken, chipped, stained, or otherwise damaged stone, defective joints, and dimension stone cladding that does not match approved samples and mockups. Damaged stone may be repaired if the Engineer approves methods and results.
B. Replace in a manner that results in dimension stone cladding's matching approved samples, complying with other requirements, and showing no evidence of replacement.
C. In-Progress Cleaning: Clean dimension stone cladding as work progresses. Remove mortar fins and smears before tooling joints.
D. Clean dimension stone cladding no fewer than six days after completion of pointing and sealing, using clean water and stiff-bristle fiber brushes. Do not use wire brushes, acid type cleaning agents, cleaning agents containing caustic compounds or abrasives, or other materials or methods that could damage stone.

END OF SECTION

3 METAL

3.1- METAL FABRICATION

PART 1 - GENERAL

3.1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

3.1.2 SUMMARY

A. This Section covers items fabricated from steel, stainless steel or aluminum and are not covered under other Specification Sections, including, but not limited to, the following:

1. Miscellaneous framing and supports.
    a. Concealed applications where framing and supports are required.
    b. Countertop support.
    c. Vanity supports
    d. Steel framing and supports for mechanical and electrical equipment.
    e. Steel framing and supports for Architectural applications.
2. Elevator machine beams, hoist beams, and divider beams.
3. Support angles for elevator door sills.
4. Shelf angles.
5. Loose bearing and leveling plates.
6. Steel welded plates and angles for casting into concrete not specified in other Sections.
7. Miscellaneous steel trim including steel angle corner guards, steel edgings and loading-dock edge angles.

This Section includes the following metal fabrications:

8. Ladders.
9. Floor plate and supports.
10. Cast nosings, treads, and thresholds.
11. Pipe guards.
12. Pipe bollards.
13. Column protection guard.

Products furnished, but not installed, under this Section include the following:

14. Loose steel lintels.
15. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

Related Sections include the following:

16. 3.0 Section "Cast-In-Situ Concrete" for corner guards to be placed in forms of reinforced concrete columns and for concrete footings required for metal fabrications.
17. 4.0 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
18. 9.0 Section "Painting" for field applied paint finishes.

3.1.3 DESIGN REQUIREMENTS

A. Design Requirements: Design, engineer, fabricate, and install work in compliance with specified standards, performance requirements, material selections, and requirements of this Section and related sections.

1. Provide work to withstand thermal movement, wind pressure, gravity loads, seismic loads and movement of building structure without failure. Work to remain free from defects.
   a. **Seismic Load**: Uniform Building Code, 1997 Edition, zone 2A.
   b. **Wind Loads**: Provide exterior metal fabrications that withstand design wind pressure calculated according to Uniform Building Code (UBC), 1997 Edition, Exposure C, Basic Wind Speed 130 Km/hr.
   c. **Thermal Movements**: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
      1) Temperature Change (Range): 35 deg C, ambient; 65 deg C, material surfaces.

B. The design shall ensure that all components including anchors and connections shall comply with the allowable stresses as per relevant ASTM Standards. Load combinations shall be chosen to ensure that no element shall exceed the allowable stresses under any case of loading.

3.1.4 SUBMITTALS

a. **Product Data**: for non-slip aggregates and non-slip aggregate surface finishes, cast nosings, treads and thresholds, steel floor plate, paint products, and grout.

b. **Shop Drawings**: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

   i. Provide templates for anchors and bolts specified for installation under other Sections.

c. Samples representative of materials and finished products as may be requested by Engineer.

d. **Mill Certificates**: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

e. Welding Certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

f. **Qualification Data**: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/engineers and owners, and other information specified.

3.1.5 QUALITY ASSURANCE

a. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

b. **Fabricator Qualifications**: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units, without delaying the work.

c. **Engineering Responsibility**: Engage a fabricator who utilizes a qualified and experienced structural engineer to prepare design calculations, shop drawings, and other structural data.

d. **Welding**: Qualify procedures and personnel according to the following:

   i. AWS D1.1, "Structural Welding Code--Steel."

   ii. AWS D1.2, "Structural Welding Code--Aluminum."

   iii. AWS D1.3, "Structural Welding Code--Sheet Steel."

   iv. AWS D1.6, "Structural Welding Code--Stainless Steel."

   v. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

   vi. Qualification tests according to the Structural Steel Code of Practice Prevailing in the country or other international Code or standard may also be accepted by the Engineer.

3.1.6 PROJECT CONDITIONS

a. **Field Measurements**: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

   i. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

3.1.7 COORDINATION

a. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including

sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART2 - PRODUCTS

3.1.8 METALS, GENERAL

A. **Metal Surfaces, General**: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

3.1.9 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36M, Tensile strength 400 Pa and minimum yield point 250 MPa.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless Steel:

1. Grade and type designated below for each form required:

   a) Tubing: ASTM A 554, Grade MT 316

   b) Pipe: ASTM A 312M, Grade TP 316.

   c) Castings: ASTM A 743M, Grade CF 8M.

   d) Plate: ASTM A 167, Type 316.

   e) Bar Stock: ASTM A 276.

2. Finish: Bright, directional polish; match AISI No. 4 finish.

D. Rolled-Steel Floor Plate: ASTM A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

F. Steel Tubing: Product type (manufacturing method) and as follows:

1. Cold-Formed Steel Tubing: ASTM A 500.

   a) Provide tubing with hot-dip galvanized coating per ASTM A 53.

G. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

1. Provide galvanized finish for all steel pipes.

H. Malleable-Iron Castings: ASTM A 47M, Grade 22010.

I. Gray-Iron Castings: ASTM A 48M, Class 200, unless another class is indicated or required by structural loads.

J. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

K. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

3.1.10 ALUMINUM

a. Aluminum Extrusions: ASTM B 221M, alloy 6063-T6.

b. Aluminum-Alloy Rolled Tread Plate: ASTM B 632M, alloy 6061-T6.

3.1.11 PAINT

a. **Shop Primers**: Provide primers that comply with 9.00 Section "Painting."

b. **Shop Primer for Ferrous Metal**: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

c. **Shop Primer for Ferrous Metal**: Organic zinc-rich primer, complying with SSPC-Paint 20 and compatible with topcoat.

d. **Galvanizing Repair Paint**: High-zinc-dust-content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

e. **Bituminous Paint**: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

3.1.12 FASTNERS

a. **General**: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn , where built into exterior walls. Select fasteners for type, grade, and class required.

b. **Bolts and Nuts**: Regular hexagon-head bolts, ASTM F 568M, Property Class 4.6; with hex nuts, ASTM A 563M; and, where indicated, flat washers.

c. **Anchor Bolts**: ASTM F 1554, Grade 36.

d. **Machine Screws**: ASME B18.6.7M.

e. **Lag Bolts**: ASME B18.2.3.8M.

f. **Wood Screws**: Flat head, carbon steel, ASME B18.6.1.

g. **Plain Washers**: Round, carbon steel, ASME B18.22M.

h. **Lock Washers**: Helical, spring type, carbon steel, ASME B18.21.2M.

i. **Expansion Anchors**: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

i) Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

ii) Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 738M and nuts complying with ASTM F 836M.

j. **Toggle Bolts**: FS FF-B-588, tumble-wing type, class and style as needed.

3.1.13 GROUT

a. **General**: Grout shall meet the requirements of 3.0 section, "Cast-in-Place Concrete".

b. **Non-shrink, Metallic Grout**: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

c. **Non-shrink, Nonmetallic Grout**: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

3.1.14 CONCRETE FILL

Concrete Materials and Properties: Comply with requirements in 3.0 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 20 MPa, unless otherwise indicated.

3.1.15 FABRICATION, GENERAL

a. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

b. Shear and punch metals cleanly and accurately. Remove burrs.

c. Ease exposed edges to a radius of approximately 1 mm, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

d. Weld corners and seams continuously to comply with the following:

i) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

ii) Obtain fusion without undercut or overlap.

iii) Remove welding flux immediately.

iv) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

e. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

f. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

g. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

h. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

i. Remove sharp or rough areas on exposed traffic surfaces.

j. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

k. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

3.1.16 MISCELLANEOUS FRAMING AND SUPPORTS

a. General: Provide steel framing and supports indicated or not indicated that are not a part of structural-steel framework as necessary to complete the Work.

b. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

   i) Fabricate units from slotted channel framing where indicated.

   ii) Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 32 mm (1.25") wide by 6 mm (1/4") thick by 200 mm (8") long at 600 mm (24") o.c., unless otherwise indicated.

   iii) Furnish inserts if units must be installed after concrete is placed.

c. FINISH:

   i) Interior: Prime painted, unless indicated as galvanized.

d. Prime miscellaneous framing and supports with zinc-rich primer.

3.1.17 RECEIVING STEEL CAGES

Receiving steel cages are to be included in the steelwork package. Cages are to be designed to incorporate the following:

a. Total 7 cages size shown on drawings and 10'-0" high.

b. Cage are to be constructed from steel frames with wire mesh wall and roof cladding. Wire mesh is to be ¼" bars @ maximum 2" centres both ways

c. All cages to have 2 roller shutter doors as indicated on the architectural plans. Doors to type 1 cage to have aluminum doors in accordance with the architectural specifications. Roller shutter door controls to incorporate facility that only one door per cage may be open or partly open at any one time.

d. Design, supply, and insulation to including all fixings, claddings, and flashings required to construct the cages.

e. All materials to be painted in accordance with specifications.

3.1.18 SHELF ANGLES

a. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 19-mm 3/4" bolts, spaced not more than 150 mm 6" from ends and 600 mm 24" o.c., unless otherwise indicated.

   i) Provide mitered and welded units at corners.

   ii) Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 50 mm 2" larger than expansion or control joint.

b. Galvanize shelf angles located in exterior walls.

c. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

3.1.19 LOOSE BEARING AND LEVELING PLATES

a. Column base plates are not included in this category.

b. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

3.1.20 STEEL WELD PLATES AND ANGLES

Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

3.1.21 MISCELLANEOUS STEEL TRIM

a. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and

smooth exposed edges. Miter corners and use concealed field splices where possible.

b. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 150 mm 6" from each end, 150 mm 6" from corners, and 600 mm 24" o.c., unless otherwise indicated.

c. Galvanize miscellaneous steel trim in the following locations:

i) Exterior.

ii) Interior, where indicated.

3.1.22 LOOSE STEEL LINTELS

a. Unless otherwise indicated on Drawings, provide steel lintels as follows.

b. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

c. Weld adjoining members together to form a single unit where indicated.

d. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 200 mm 8", unless otherwise indicated.

e. Galvanize loose steel lintels located in exterior walls.

3.1.23 STEEL LADDERS

a. **General**: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.
i) Comply with ANSI A14.3, unless otherwise indicated on Drawings.
b. **Side rails**: Continuous, 500 x 10 mm (20" x ½") steel flat bars, with eased edges, spaced 460 mm (19") apart.
c. **Bar Rungs**: 20-mm (3/4") - diameter steel bars, spaced 300 mm (12") o.c maximum.
d. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
e. Support each ladder at top and bottom and not more than 1500 mm (5'-0") o.c. with welded or bolted steel brackets.
i) Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 150 mm (6").
ii) Extend side rails using 30-mm (1.25) diameter galvanized steel pipes to a height of 0.90 m above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the

top rung, goose-neck the extended rails back to the structure to provide secure ladder access

f. Provide non-slip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
g. Galvanize ladders, including brackets and fasteners.
h. Finish is to be field-applied alkyd paint system of color and gloss as selected by the Engineer.

3.1.24 METAL FLOOR PLATE

a. Fabricate raised-pattern floor plates from rolled-steel floor plate of thickness indicated below:
    i) Thickness: As indicated.
    ii) Pattern: As selected from manufacturer's standard patterns.
b. Fabricate raised-pattern floor plates from rolled-aluminum-alloy tread plate of thickness indicated below:
    i) Thickness: 6.00 mm (1/8"), unless otherwise higher thickness is indicated.
c. Include steel angle stiffeners, and fixed and removable sections as indicated.
    i) Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

3.1.25 CAST NOSINGS, TREADS AND THRESHOLDS

a. Fabricate units of material, sizes, and configurations indicated. If not indicated, provide cast-iron units with an integral abrasive finish. Furnish in lengths as required to accurately fit each opening or conditions.
    i) Cast units with an integral abrasive grit consisting of aluminum oxide, silicon carbide, or a combination of both.
b. Drill for mechanical anchors with countersunk holes located not more than 100 mm from ends and not more than 300 mm (12") o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by the manufacturer.
    i) Provide 2 rows of holes for units over 125 mm (5") wide, with 2 holes aligned at ends and intermediate holes staggered.
c. Apply black asphaltic coating to concealed bottoms, sides, and edges of cast-iron units set into concrete.
d. Provide a plain surface texture, except where fluted or cross-hatched surfaces are indicated.

3.1.26 PIPE BOLLARDS

a. Fabricate pipe bollards from Schedule 40 steel pipe.
   i) Cap bollards with 6-mm (1/8") - minimum steel plate.
b. Fabricate bollards with 10-mm (1/2") - thick steel base plates for bolting to concrete slab. Drill base plates at all four corners for 19-mm (3/4") anchor bolts.
   i) Where bollards are to be anchored to sloping concrete slabs, angle base plates for plumb alignment of bollards.
c. Finish is to be factory-applied manufacturer's standard thermo setting coating including rust inhibition coat and of minimum dry film thickness of 60 microns.

3.1.27 COLUMN PROTECTION GUARDS

a. **Metal Protection**: Formed steel plates with welded lugs for building into concrete filling. Galvanize protection after fabrication to be not less than 300 gm/m2 (28 gm/sft zinc coating intensity.
b. **Pads**: Prefabricated from ASTM D2000, extruded synthetic rubber with type A shore durometer Hardness of 75, plus or minus 5 when tested according to ASTM D2240. Furnish in thickness as recommended by manufacturer for traffic type, but not less than thickness indicated on Drawings.
c. **Filling Concrete**: As specified in this Section.
d. **Finish**: Is to be field-applied epoxy paint system to exposed surfaces of steel and concrete as specified in 9.0 Section "Painting".

3.1.28 FINISHES, GENERAL

a. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
b. Finish metal fabrications after assembly.

3.1.29 STEEL AND IRON FINISHES

a. **Galvanizing**: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:
   i) ASTM A 153 for galvanizing iron and steel hardware.
   ii) ASTM A 123 for galvanizing both fabricated and un-fabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.76 mm thick or thicker.
b. **Preparation for Shop Priming**: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
   i) Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

ii) Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

c. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

i) Stripe paint corners, crevices, bolts, welds, and sharp edges.

3.1.30 STAINLESS-STEEL FINISHES

a. Remove tool and die marks and stretch lines or blend into finish.

b. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

c. Bright, Directional Polish: No. 4 finish.

d. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

3.1.31 ALUMINUM FINISHES

a. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

b. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

c. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: no specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating but with no less 0.025 mm or thicker) complying with AAMA 611.

d. For powder coat finishes, AAMA 2605 is the high-performance exterior specification. Depending on the manufacturer, a 2605 powder coat may or may not utilize a fluoropolymer resin (PVDF). These finishes are resistant to moisture, weathering, ozone and UV radiation. An application for this finish would include architectural projects that require long term cosmetic and functional protection.

PART3 - EXECUTION

3.1.32 PREPERATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.
B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.
C. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.1.33 INSTALLATION, GENERAL

A. **Fastening to In-Place Construction**: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
B. **Cutting, Fitting, and Placement**: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
E. **Field Welding**: Comply with the following requirements:
    1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    2. Obtain fusion without undercut or overlap.
    3. Remove welding flux immediately.
    4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
F. **Corrosion Protection**: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.1.34 SETTING, BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

    1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations, unless otherwise indicated.

    2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.1.35 INSTALLING NOSING, TREADS AND THRESHOLDS

A. Install with anchorage system indicated to comply with manufacturer's written instructions.

B. Center nosings on tread widths.

C. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

D. Seal thresholds exposed to exterior with elastomeric sealant complying with 7.0 Section "Joint Sealants" to provide a watertight installation.

3.1.36 INSTALLING PIPE BOLLARDS

A. Anchor bollards in place with concrete footings. Support and brace bollards in position in footing excavations until concrete has been placed and cured.

B. Fill bollards solidly with concrete, mounding top surface.

3.1.37 ADJUSTING AND CLEANING

A. **Touchup Painting**: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 0.05-mm (1/32") dry film thickness.

B. **Touchup Painting**: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in 9.0 Section "Painting."

C. **Galvanized Surfaces**: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.2- ORNAMENTAL HANDRAILS AND RAILINGS

3.2.1 GENERAL
3.2.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

3.2.3 SUMMARY

A. This Section includes the following:

i) Stainless steel ornamental handrails and railings.

B. Related Sections include the following:

i) 5.0 Section "Pipe and Tube Railings" for handrails and railings fabricated from pipe and tube components.

ii) 5.0 Section "Custom Steel Door".

3.2.4 PERFORMANCE REQUIREMENTS

A. **General**: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:

i) Stainless Steel: ASCE 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."

B. **Structural Performance of Handrails and Railings**: Provide handrails and railings capable of withstanding structural loads required by ASCE 7 without

exceeding allowable design working stress of materials for handrails, railings, anchors, and connections.

C. **Structural Performance of Handrails and Railings**: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections:

1. Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:

   a. Concentrated load of 890 N applied at any point and in any direction.

   b. Uniform load of 730 N/m applied in any direction.

   c. Concentrated and uniform loads above need not be assumed to act concurrently.

2. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 82.71 N applied to 0.96 Sft. m at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.

   a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

3. Demonstrate capability of proposed handrail systems by:

   a. Submission of structural calculations.

   b. Submission of laboratory test report conducted on the proposed product during the last three years.

D. **Thermal Movements**: Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 35 deg. C, ambient; 65 deg. C, material surfaces.

E. **Control of Corrosion**: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

3.2.5 SUBMITTALS

A. **Product Data**: For manufacturer's product lines of handrails and railings assembled from standard components.

1. Include Product Data for grout, anchoring cement, and paint products.

B. **Shop Drawings**: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other Work.

1. For installed handrails and railings indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. **Samples for Initial Selection**: Short sections of railing or flat sheet metal Samples showing available mechanical finishes.

D. **Samples for Verification**: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. 150 mm (6") long sections of each different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Welded connections.
4. Assembled Samples of railings, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

E. Samples of exposed fasteners, where exposed fasteners are indicated.

F. **Qualification Data**: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/engineers and owners, and other information specified.

G. **Product Test Reports**: Indicating products comply with requirements, based on comprehensive testing of current products.

3.2.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

B. **Structural/Consulting Engineer Qualifications**: A structural consulting engineer who is legally qualified to practice, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

C. **Testing Agency Qualifications**: To qualify for acceptance, an independent testing agency shall demonstrate to the Engineer's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated.

D. **Source Limitations**: Obtain each type of railing through one source from a single manufacturer.

E. **Mockups**: Before installing handrails and railings, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in the location as directed by the Engineer.

2. Build mockups for each form and finish of railing consisting of three posts, top rail, infill area, and anchorage system components that are full height and are not less than 600 mm (24") in length.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Notify the Engineer seven days in advance of dates and times when mockups will be constructed.
5. Obtain the Engineer's approval of mockups before fabricating ornamental handrails and railings.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.
8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

3.2.7 STORAGE

A. Store handrails and railings in a dry, well-ventilated, weathertight place.

3.2.8 PROJECT CONDITIONS

A. **Field Measurements:** Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

3.2.9 COORDINATION

A. Coordinate installation of anchorages for handrails and railings. Furnish Setting Drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

3.2.10 SCHEDULING

A. Schedule installation so that handrails and railings are mounted only on completed walls. Do not support temporarily by any means that do not satisfy structural performance requirements.

PRODUCTS

3.2.11 METALS

A. **General**: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.
B. **Stainless Steel**: Grade or type designated below for each form required.
   1. Tubing: ASTM A 554, Grade MT 304.
   2. Pipe: ASTM A 312/A 312M, Grade TP 304.
   3. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

4. Plate: ASTM A 666, Type 304.

C. **Brackets, Flanges, and Anchors:** Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
   1. Provide formed steel brackets with predrilled hole for bolted anchorage and with Snap-on cover that matches rail finish and conceals bracket base and bolt head.

3.2.12 MISCELLANEOUS MATERIALS

A. **Filler Metal and Electrodes**: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as required for color match, strength, corrosion resistance, and compatibility in fabricated items.

3.2.13 FASTNERS

A. **Fasteners for Anchoring Handrails and Railings to Other Construction**: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.
   1. For stainless-steel handrails and railings, use fasteners fabricated from Type 304 stainless steel.

B. **Fasteners for Interconnecting Handrail and Railing Components**: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless exposed fasteners are unavoidable or are standard fastening method for handrail and railing indicated.

C. **Cast-in-Place and Postinstalled Anchors:** Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
   1. Chemical anchors.
   2. Expansion anchors.

3.2.14 PAINT

A. **Bituminous Paint**: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

3.2.15 GROUT AND ANCHORING CEMENT

A. **Non-shrink, Nonmetallic Grout**: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

3.2.16 FABRICATION

A. **General**: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than that required to support structural loads.

B. Assemble handrails and railings in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Form changes in direction of railing members as follows:
   1. By bending.
   2. By flush radius bends.
   3. By radius bends of radius indicated.
   4. By mitering at elbow bends.
   5. By inserting prefabricated flush elbow fittings.
   6. By any method indicated above, applicable to change in direction involved.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

E. **Welded Connections**: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

F. **Mechanical Connections**: Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   1. Fabricate splice joints for field connection using epoxy structural adhesive where this is manufacturer's standard splicing method.

G. **Brackets, Flanges, Fittings, and Anchors**: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

H. Provide inserts and other anchorage devices to connect handrails and railings to concrete or masonry. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

I. For railing posts set in concrete, provide preset sleeves of steel not less than 150 mm (6") long with inside dimensions not less than 13 mm (½")

larger than outside dimensions of post, and steel plate forming bottom closure.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

J. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

K. Ease exposed edges to a radius of approximately 1 mm (1/32"), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

L. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

M. Close exposed ends of railing members with prefabricated end fittings.

N. **Toe Boards:** Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

O. **Fillers**: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

P. Provide sleeves, inserts, and other anchorage devices to connect handrails and railing systems to concrete, masonry, embedded steel plates, and structural steel work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.

3.2.17 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. **Appearance of Finished Work**: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

3.2.18 STAINLESS-STEEL FINISHES

A. Remove or blend tool and die marks and stretch lines into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Mirrorlike Reflective, Nondirectional Polish: No. 8 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

EXECUTION

3.2.19 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.
B. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete, masonry, and terrazzo construction. Coordinate delivery of such items to Project site.

3.2.20 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.
B. **Cutting, Fitting, and Placement**: Perform cutting, drilling, and fitting required for installing handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
    1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
    2. Set posts plumb within a tolerance of 2 mm (1/32") in 1 m (3'-3").
    3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 5 mm (1/4") in 3 m (3'-3").
C. Adjust handrails and railings before anchoring to ensure alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.
D. **Fastening to In-Place Construction**: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.
E. **Field Welding**:
    1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    2. Obtain fusion without undercut or overlap.
    3. Remove welding flux immediately.
    4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness or discoloration shows after finishing and welded surface matches contours and finish of adjoining surfaces.
F. **Non-welded Connections**: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.
G. **Welded Connections**: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in shop or in field.

H. **Expansion Joints**: Install expansion joints at locations indicated but not further apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 50 mm beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 150 mm (6") of post.

3.2.21 ANCHORING POSTS

A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's written instructions.
   1. Non-shrink nonmetallic grout.
B. Form or core-drill holes not less than 125 mm (5") deep and 20 mm (3/4") greater than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's written instructions:
   1. Non-shrink, nonmetallic grout.
C. Cover anchorage joint with a flange of same metal as post, attached to post as follows:
   1. Welded to post after placing anchoring material.
   2. By set screws.
   3. Set flange in clear silicone sealant / adhesive flow surface.
D. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 3 mm build-up, sloped away from post.
E. Anchor posts to metal surfaces with flanges, angle or floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For stainless-steel railings, weld flanges to post and bolt to metal supporting members.
F. Where shown on Drawings, fasten posts to face of spandrel construction as indicated and in accordance with manufacturer's instructions.

3.2.22 ANCHORING RAIL ENDS

A. Anchor rail ends to concrete and masonry with flanges connected to rail ends and anchored with postinstalled anchors and bolts.

3.2.23 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.2.24 PROTECTION

A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by

railing manufacturer. Remove protective coverings at the time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

3.3- CUSTOM STEEL DOOR AND FRAMES - GENERAL

3.3..1 RELATED DOCUMENTS

A. Drawing and provision of the contract, including general and supplementary Conditions.

3.3..2 SUMMARY

A. This Section includes the following:
   1. Steel doors.
   2. Steel door frames.
   3. Fire-rated door and frame assemblies.
   4. Fire-rated window assemblies.
   5. Louvers in doors. Steel louvered door.

B. Related Sections include the following:
   1. Section "Unit Block Masonry Assemblies" for building anchors into and grouting frames in masonry construction.
   2. 8.0 Section "Door Hardware" for door hardware and weather stripping.
   3. 8.0 Section "Glazing" for glass in doors.

3.3..3 PERFORMANCE REQUIREMENTS

A. **Fire-Rated Door Assemblies**: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to the Consultant, for fire ratings indicated, based on testing according to NFPA 252.
   1. Test Pressure: Test at atmospheric pressure.
   2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
   3. Temperature-Rise Rating: If indicated, provide doors that have a temperature-rise rating of 250 deg C maximum in 30 minutes of fire exposure.

B. **Fire Resisting Door Components**: All components of fire resisting doors and assemblies, including but not limited to: door leaves, frames, ironmongery, hardware and glazing, shall carry identifying labels of an approved independent testing and inspection agency or laboratory, confirming their individual fire resistance rating. The rating of all door components shall be equal to the rating of the door assembly.

C. **Fire Resisting Door Closers**: All fire resisting doors shall be fitted with door closers that automatically close and positively latch the door. In case of double-leaf doors, the closing system shall ensure that the inactive

door leaf (door leaf with strike) closes first prior to active door leaf (door leaf with lock).

D. Fire rated door assemblies that are tested and certified according to British Standard Specifications (BS) shall also be accepted.
E. Weather Stripping: provide weather seals to all external doors.
F. Smoke-Control Door Assemblies: Comply with NFPA 105.

3.3..4 **SUBMITTALS**

A. **Product Data**: Include construction details, material descriptions, core descriptions, label compliance, sound and fire-resistance ratings, and finishes for each type of door and frame specified.
B. **Shop Drawings**: Show fabrication and installation of doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, dimensions of profiles and hardware preparation, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessories.
C. **Door Schedule**: Submit schedule of doors and frames using same reference numbers for details and openings as those on Drawings.
    1. Coordinate glazing frames and stops with glass and glazing requirements.
D. **Samples for Initial Selection**: Manufacturer's color charts showing the full range of finishes or colors available for units with factory-applied color finishes.
E. **Samples for Verification**: For each type of exposed finish required, prepared on Samples not less than 75 by 125 mm (3" x 5") and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
F. **Construction Samples**: Approximately 300 by 300 mm, (12" x 12") representing the required construction of doors and frames for Project.
    1. Doors: Show vertical-edge, top, and bottom construction; insulation; face stiffeners; and hinge and other applied hardware reinforcement. Include louver section and glazing stops if applicable.
    2. Frames: Show profile, welded corner joint, welded hinge reinforcement, dust-cover boxes, floor and wall anchors, stops, and silencers. Include panel and louver sections and glazing stops if applicable.
G. **Product Certificates**: Signed by manufacturers of doors certifying that products furnished comply with or exceed the acceptance criteria of ANSI A250.4 for Level A doors.
H. **Oversize Construction Certification**: For door assemblies required to be fire rated and exceeding limitations of labeled assemblies, submit certification of a testing agency acceptable to authorities having jurisdiction that each door and frame assembly has been constructed to comply with design, materials, and construction equivalent to requirements for labeled construction.

3.3..5 **QUALITY ASSURANCE**

A. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
B. **Manufacturer Qualifications:** A firm experienced in manufacturing custom steel doors and frames similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
C. **Mockups**: Before installing custom steel doors and frames, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
    1. Build mockups in the location indicated or, if not indicated, as directed by Consultant.
    2. Build mockups for each custom steel doors and frames, and anchorage system components.
    3. Notify Consultant seven days in advance of dates and times when mockups will be constructed.
    4. Obtain Consultant's approval of mockups before fabricating custom steel doors and frames.
    5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
    6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

3.3..6 **WARRANTY**

A. **Door Manufacturer's Warranty**: Provide written Warranty, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that do not fulfill quality and performance requirements or do not comply with tolerances in referenced quality standard such as, but not limited to:
    1. Structural failures.
    2. Faulty operation of movable parts and hardware.
    3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
B. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
    1. Warranty Period: Three years from date of Substantial Completion.

3.3..7 **DELIVERY, STORAGE AND HANDLING**

A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.
B. Inspect doors and frames, on delivery, for damage. Minor damage may be repaired provided refinished items match new work and are approved by Consultant; otherwise, remove and replace damaged items as directed.
C. Store doors and frames under cover at building site. Place units on minimum 100-mm- high wood blocking. Avoid using nonvented plastic

or canvas shelters that could create a humidity chamber. If wrappers on doors become wet, remove cartons immediately. Provide minimum 6-mm spaces between stacked doors to permit air circulation.

PRODUCTS

3.3..8 **MATERIALS**

A. **Metallic-Coated Steel Sheets**: ASTM A 653/A 653M, CS (commercial steel), Type B; with Z180 zinc (galvanized) or ZF180 zinc-iron-alloy (galvannealed) coating.
B. **Inserts, Bolts, and Fasteners**: Manufacturer's standard units. Where items are to be built into exterior walls, zinc coat according to ASTM A 153/A 153M, Class C or D as applicable.

3.3..9 **DOORS**

A. **General**: Provide flush-design doors, minimum 44 mm thick, (1¾") of seamless construction, unless otherwise indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges.
    1. Visible joints or seams around glazed or louvered panel inserts are permitted.
    2. For single-acting swing doors, bevel both vertical edges 3 mm (2/16") in 50 mm (2").
    3. For double-acting swing doors, round vertical edges with 54-mm (2¼") radius.
B. **Metallic Core Construction**: Provide the following core construction welded to both door faces:
    1. Steel-Stiffened Core: Galvanized steel vertical stiffeners extending full-door height, spaced not more than 150 mm apart and spot welded to face sheets a maximum of 150 mm (16") o.c. Fill spaces between stiffeners with rockwool insulation of minimum 96.00 kg/cu. m (2.72 kg/cft) density applied to inside surfaces of face sheets.
    2. Use for all doors internal and external.
    3. Thickness of vertical stiffeners shall be equal to or more than thickness of door skins
C. **Fire Door Cores**: As required to provide fire-protection and temperature-rise ratings indicated.
D. **Astragals**: As required by NFPA 80 to provide fire ratings indicated. Comply with requirements specified in 8.0 section "Hardware"
E. **Top and Bottom Channels**: Spot weld metal channel not less than thickness of face sheet to face sheets not more than 150 mm o.c.(6")
    1. Reinforce tops and bottoms of doors with inverted horizontal channels of same material as face sheet so flanges of channels are even with bottom and top edges of face sheets.
    2. For exterior doors, close bottom edge with metallic-coated steel closing channel and top edge with filler channel of same

material, so webs of channels are flush with bottom and top door edges.

F. **Hardware Reinforcement**: Fabricate reinforcing plates from the same material as door to comply with the following:
   1. Hinges and Pivots: 4.2 mm (1'8") thick by 38 mm (1.5") wide by 150 mm (6") longer than hinge, secured by not less than 6 spot welds.
   2. Lock Face, Flush Bolts, Closers, and Concealed Holders: 2.3 mm (1/16") thick.
   3. All Other Surface-Mounted Hardware: 1.3 mm (1/16") thick.

G. **Interior Doors**: Fabricate face sheets of doors from two 1.30-mm-(2/32") thick metallic-coated, cold-rolled, stretcher-leveled steel sheets and other metal components from hot- or cold-rolled steel sheets.

H. Thickness of face sheets for fire rated interior doors shall be as recommended by manufacturer to obtain fire rating indicated, but not less than 1.30 mm (2/32").

I. Thickness of face sheets for interior steel doors to receive armor plates shall be 1.60 mm.

J. **Exterior Steel Doors**: Fabricate face sheets of doors from two 1.6-mm-(3/32") thick, stretcher-leveled, metallic-coated steel sheets. Provide weep-hole openings in bottom of doors to permit entrapped moisture to escape. Seal joints in top edges of doors against water penetration.

3.3..10 **FRAMES**

A. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, and continuously welded full depth and width of frame. Knockdown frames are not acceptable.
   1. For exterior use, form frames from 2.00-mm- (4'-0") thick, metallic-coated cold-rolled steel sheets.
   2. For interior use, form frames from metallic-coated cold-rolled steel sheet of the following thicknesses:
      a) Openings up to and including 1200 mm (48") Wide: 1.60 mm (3/32").
      b) Openings More Than 1200 mm (48") Wide: 1.7 mm (3/32").

B. **Hardware Reinforcement**: Fabricate from same material as frame. Minimum thickness of steel reinforcing plates for the following hardware:
   1. Hinges and Pivots: 4.2 mm 1/8") thick by 38 mm (1.5") wide by 150 mm (6") longer than hinge, secured by not less than 6 spot welds.
   2. Strikes, Flush Bolts, and Closers: 2.3 mm (2/8").
   3. Surface-Mounted Hold-Open Arms and Panic Devices: 2.3 mm (2/8").

C. **Mullions and Transom Bars**: Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame.
   1. Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.

D. **Head Reinforcement:** Where installed in masonry, leave vertical mullions in frames open at top for grouting.
E. **Jamb Anchors**: Weld jamb anchors to frames near hinges and directly opposite on strike jamb as required to secure frames to adjacent construction.
    1. In-Place Concrete or Masonry: Anchor frame jambs with minimum 9-mm- (6/16") diameter concealed bolts into expansion shields or inserts 150 mm from top and bottom and 650 mm (26") o.c., unless otherwise indicated. Reinforce frames at anchor locations. Except for fire-rated openings, apply removable stop to cover anchor bolts, unless otherwise indicated.
F. **Floor Anchors:** Provide floor anchors for each jamb and mullion that extends to floor, formed of same material as frame, 1.7 mm (3/32") thick, as follows:
    1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions.
    2. Cement-Based Screeds: Adjustable type with extension clips, allowing not less than 50-mm height adjustment. Terminate bottom of frames at finish floor surface.
G. **Head Anchors**: Provide 2 head anchors for frames more than 1066 mm (43") wide and mounted in steel-stud walls.
H. **Head Strut Supports**: Provide 9-by-50-mm (6/16" x 12") vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
I. **Structural Reinforcing Members**: Provide as part of frame assembly, where indicated at mullions, transoms, or other locations to be built into frame.
J. **Head Reinforcement**: For frames more than 1200 mm (48") wide in masonry wall openings, provide continuous steel channel or angle stiffener, 2.3 mm (2/8") thick for full width of opening, welded to back of frame at head.
K. **Spreader Bars**: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
L. **Rubber Door Silencers**: Except on weather-stripped doors, drill stop in strike jamb to receive three silencers on single-door frames and drill head jamb stop to receive two silencers on double-door frames. Install plastic plugs to keep holes clear during construction. Silencers shall be neoprene, UL-rated for fire doors.
M. **Plaster Guards**: Provide 0.4-mm- thick plaster guards or dust-cover boxes of same material as frame, welded to frame at back of hardware cutouts to close off interior of openings and prevent mortar or other materials from obstructing hardware operation.
N. External frames shall have continuous grooves along perimeter to house weather stripping.

3.3..11 **LOUVERS**

A. **Door Louvers:** Fabricate louvers and mount flush into doors without overlapping moldings on surface of door face sheets. Provide internal

support as recommended by louver manufacturer. Prime paint steel louvers after fabrication.

1. Interior Louvers: Sightproof, stationary type, constructed of inverted Y-shaped blades formed of same material as door.

a) Steel: 1.00 mm (2/32") thick.

B. **Fire-Rated Automatic Louvers**: Sight proof louver inserts fabricated from 1.3-mm- thick (2/32") steel, spring operated, and released by 57 deg C fusible links listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by the same testing and inspecting agency that established fire-resistance rating of door assembly.

3.3..12 **STOPS AND MOLDINGS**

A. Provide stops and moldings around solid, glazed, and louvered panels where indicated.
B. Form fixed stops and moldings integral with frame, unless otherwise indicated.
C. Provide removable stops and moldings where indicated or required, formed of 0.8-mm- thick steel sheets matching steel frames. Secure with countersunk flat or oval head machine screws spaced uniformly not more than 300 mm (12") o.c. Form corners with butted hairline joints.
D. Coordinate rabbet width between fixed and removable stops with type of glass or panel and type of installation indicated.

3.3..13 **FABRICATION**

A. Fabricate doors and frames rigid, neat in appearance, and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

1. Fabricate doors to comply with acceptance criteria of ANSI A250.4 for a Level A door.

B. For doors with metallic core construction, weld cores to both door face sheets.
C. For doors with nonmetallic core construction, laminate core material to both door face sheets with waterproof adhesive.
D. **Exposed Fasteners**: Provide countersunk flat or oval heads for exposed screws and bolts, unless otherwise indicated.
E. **Thermal-Rated (Insulating) Assemblies**: At exterior locations and elsewhere as shown or scheduled, provide doors and frames fabricated as thermal-insulating assemblies and tested according to ASTM C 236 or ASTM C 976.

1. Provide thermal-rated assemblies with U-factor matching that of the assembly involving door.

F. **Hardware Preparation**: Prepare doors and frames to receive hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final hardware schedule and templates provided by

hardware supplier. Comply with applicable requirements of ANSI A115 Series specifications for door and frame preparation for hardware.

1. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
2. Locate hardware as indicated or, if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

G. **Electrical Closets Doors**: Are to comply with the following requirements:

1. Doors are to be proprietary, labeled as one (1) hour fire resistance rated and complying with requirements specified in this Section.
2. Frames are to be integral with sill to be anchored to underlying sill construction.

3.3..14 STEEL LOUVERED DOOR

A. General: Are to heavy-duty construction, stile-and-rail door leaves with prefabricated framed steel louver panels mechanically fixed flush with stiles and rail of the door leaves.

1. Stiles and rails are to of tubular construction with sound deadening core material. Stiles and top rail are to be 75 mm (3") wide, bottom rail 250 mm (10") high, unless otherwise indicated on Drawings.
2. Stiles and rails are to be from galvanized sheet steel as specified, 1.30 mm (2/32") thick minimum. Reinforcement for hinge installation is to be minimum 4.00 (3/16") thick galvanized steel plates. Drilling and tapping for surface applied ironmongery may be done on Project Site.
3. Louver panels are to be pre-fabricated panels from galvanized steel sheets as specified in this Section comprising tubular frame and fixed Z-shaped, blades, 1.60 mm (3/32") thick minimum, in welded construction. Free area shall not be less than 43%.
4. Furnish doors with louver panels pre-assembled and finished with factory applied baked enamel system including corrosion inhibiting protective coating and baked-on polyester topcoat of minimum dry film thickness of 60 microns. Color is to be selected by the Consultant.
5. Louver panel fasteners are to be galvanized steel of matching finish.

3.3..15 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for cleaning, treating, priming, and when specified, finishing.
B. Finish products specified in this Section after fabrication.

3.3..16 METALLIC COATED STEEL FINISHES

A. **Surface Preparation**: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and

apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

B. **Factory-Applied Finish**: Immediately after cleaning and pre-treating, apply manufacturer's standard two-coat, air-dried-enamel, baked-enamel, or polyester finish consisting of prime coat and topcoat that complies with ANSI A250.3 acceptance criteria. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 0.03 mm for topcoat.

1. Color and Gloss: As selected by Consultant from manufacturer's full range.

EXECUTION

3.3..17 **INSTALLATION**

A. **General**: Install doors and frames according to DHI A115.IG and manufacturer's written instructions.

B. **Frames**: Install steel frames for doors, transoms, sidelights, borrowed lights, and other openings, of size and profile indicated.

1. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
2. Install frames with removable glazing stops located on secure side of opening.
3. Install door silencers in frames before grouting.
4. Remove temporary braces necessary for installation only after frames have been properly set and secured.
5. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
6. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing anti-freezing agents.
7. Set masonry anchorage devices where required for securing frames to in-place concrete or masonry construction.

   a) Set anchorage devices opposite each anchor location according to details on Shop Drawings and anchorage device manufacturer's written instructions. Leave drilled holes rough, not reamed, and free of dust and debris.
8. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on Shop Drawings.
9. Placing Frames: Set frames accurately in position; plumb; align, and brace securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

   a) At existing concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.

b) At fire-rated openings, install frames according to NFPA 80.
c) Field splice only at approved locations. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
d) Remove spreader bars from each frame only after frame is properly set and secured.

10. Hollow core of frames shall be fully filled with cement sand grout.
11. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
12. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in 4.0 Section "Unit Masonry Assemblies."
13. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
14. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
15. In-Place Gypsum Board Partitions: Secure frames in place with post installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
16. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

C. **Doors**: Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
   1. Jambs and Head: 2 mm (3/32").
   2. Meeting Edges, Pairs of Doors: 3 mm (3/32").
   3. Bottom: 9 mm (6/16"), if no threshold or carpet.
   4. Bottom: 3 mm (3/32"), at threshold or carpet.
D. **Fire-Rated Doors**: Install with clearances as specified in NFPA 80.
E. **Smoke Control Doors**: Install according to NFPA 105.

3.3..18 **ADJUSTING AND CLEANING**

A. **Final Adjustments**: Check and readjust operating hardware items just before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise unacceptable.

B. **Factory-Finish Touchup**: Immediately after erection, sand to feather-edge minor scratched, chipped, or damaged areas and apply touchup of compatible air-drying paint. Minor finish imperfections may be repaired provided finish matches new work finish and is approved by Consultant; otherwise, remove and replace.

END OF SECTION

4 WOOD, PLASTIC AND COMPOSITE

4.1- WOODEN DOORS

GENERAL SECTION

4.1.1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including general and supplementary Conditions.

4.1.1.2 SUMMARY

A. This Section includes the following:
   1. Non-fire-rated flush wood doors of semi-solid core.
   2. Shop priming flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.
   4. Louvers for flush wood doors.

B. Related Sections include the following:
   8.0 Section "Steel Doors and Frames" for steel frames to receive flush wood doors.
   1. Section "Door Hardware" hardware for flush wood doors.
   2. 8.0 Section "Glazing" for glass view panels in flush wood doors.
   3. 9.0 Section "Painting".

4.1.1.3 SUBMITTALS

Product Data: For each type of door. Include details of core and edge construction, trim for openings, and louvers.

1. Include factory-finishing specifications.

A. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
   1. Indicate dimensions and locations of mortises and holes for hardware.
   2. Indicate dimensions and locations of cutouts.
   3. Indicate doors to be factory finished and finish requirements.

B. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
   1. Faces of factory-finished doors with opaque finish. Show the full range of colors available.

C. Samples for Verification: As follows:
   1. Corner sections of doors approximately 200 by 250 mm (8" x 10") with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
   2. Louver blade and frame sections, 150 mm (6") long, for each material and finish specified.
   3. Frames for light openings, 150 mm (6") long, for each material, type, and finish required.

4.1.1.4 QUALITY ASSURANCE

Quality System: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

4.1.1.5 DELIVERY, STORAGE, AND HANDLING

Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.

1. Individually package doors in plastic bags or cardboard cartons.
2. Individually package doors in cardboard cartons and wrap bundles of doors in plastic sheeting.

A. Mark each door with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

4.1.1.6 PROJECT CONDITIONS

Environmental Limitations: Do not deliver or install doors until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

4.1.1.7 WARRANTY

Door Manufacturer's Warranty: Provide written Warranty, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 6.5 mm (4/16") in a 1100-by-2100-mm (44" x 84") section or that show telegraphing of core construction in face veneers exceeding 0.25 mm in a 75-mm (3") span, or do not comply with tolerances in referenced quality standard.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time after the date of Substantial Completion:
   a) Semi-solid-core Interior Doors: Two years.

PRODUCTS

4.1.2.1 WOODS, GENERAL

A. Woods shall be marked-on as Class-1 stocks which shall be properly treated, adequately seasoned and free from roy or insect attack, splits, shakes or checks, warping, twisting, chipping, loose knots and waming. Provide woods

of wane-free edges. Woods shall conform to the requirements of BS EN No. 942; plywood to BS EN No. 636.

B. **Preservative Treatment**: All woods and plywood used shall be preservative treated. Application is to be carried out after cutting and machining, but before assembly, by a processor licensed by the treatment solution manufacturer. Solution strengths and treatment by pressure, vacuum or immersion process are to be selected to achieve service life and to suit wood treatability. Moisture content of wood at time of treatment is to be as specified for use in the work. After treatment, allow wood to dry before use. For each batch of wood, provide certificate of assurance that treatment has been carried out as specified.

C. Softwoods

1. Douglas Fir: Yellowish Brown wood of average intensity not less than 570 kg/m3 (16.5 kg/cft) at 12% moisture content.
2. Whitewood: White/pale Yellowish Brown wood of average intensity of 470 kg/m3 (13.32 kg/cft).
3. Or as directed by the Architect.

D. Hardwoods

1. White Oak Wood: Yellowish Brown, fine-grained wood of strong, compact, homogenous fibers and uniform texture. Average intensity shall not be less than 720 kg/m3 (20.40 kg/cft) at 12% moisture content. Or as directed by the Architect.

E. Plywood

1. General: Shall be highest grade to BS EN 636, designated as veneer, with minimal imperfections as peeled. Moisture content shall not exceed 12%. Thickness shall be as specified. Employ plywood glued with INT glues to BS 1203.
2. Softwood Plywood: All layers shall be of softwood.
3. Hardwood Plywood: White Oak plywood; White-Oak veneer 0.90 mm thick minimum shall be factory hot-applied at exposed face of door, cut and match of veneer shall be selected by the Consultant.

4.1.2.2 ACCESSORY MATERIALS

Preservative treatment: Type listed in BS 1282 (except coal tar creosote) obtained from approved manufacturer to provide protection against termites and other destroying organisms.

A. Adhesives: Close contact type to BS EN 301 or BS EN 302, suitable for the purpose and compatible with preservative treatment.

4.1.2.3 NON-FIRE RATED SEMI-SOLID-CORE FLUSH WOOD DOORS

General: Non-fire-rated flush wood doors shall be swinging-type side-hinged to jambs of frames with hand of doors as indicated on Drawings, fabricated to the general tolerances of BS No. 4787 and shall consist of a frame (door leaf frame) consisting of stiles and rails constructed of Douglas fir and a core constructed of a lower-density softwood (Whitewood). Core strips shall cover, at least, 67% of door leaf area (Semi-solid core).

A. **Door Leaf Frame**: Stiles and rails shall be of dimensions as indicated on Drawings but in no case shall the width be less than 140 mm (5.50") for mortise stile or less than 100 mm for other stile and rails, before lipping. Door-leaf-frame components shall be continuously lipped at outer edges with 20 mm (3/4") thick lipping constructed of White Oak wood. Oak lipping shall be fixed to stiles and rails in continuous glued tongue-and-groove joints. Stiles, rails and lipping of door leaf frame shall be constructed in one piece, no jointing or splicing shall be permissible. Joints between stiles and rails shall be glued mortise-and-tenon.
B. **Semi-Solid Cores:** Shall be horizontal rails of White wood, of uniform width. Ratio of solid to vacant shall be 2:1. Horizontal core rails shall be in one piece. Throughout door leaf height, at least, two horizontal core rails shall be mortise-and-tenon jointed and glued to stiles.
C. **Facing**: Facing material shall be 6 mm (1/4") thick plywood glued with waterproof glue under pressure to both sides of core. Facing material shall extend flush and uniform, in both directions, between inner edges of lipping. Extend facing in one piece; no jointing or splicing shall be permissible. Type of facing material shall be as follows:
    1. Doors of Opaque Finish: Softwood plywood
D. **Thickness of Doors**: Unless otherwise indicated on Drawings, finish thickness of flush non-fire-rated wood doors shall be 45 mm; (1¾") thickness of stiles, rails and core strips shall be 33 mm (1.5") and 45 mm (1¾") wood lipping.

4.1.2.4 LOUVERS AND LIGHT FRAMES

Metal Louvers: As follows:

1. Blade Type: Vision proof, inverted V.
2. Metal and Finish: Extruded aluminum with clear anodic finish, 25micron thick minimum.

4.1.2.5 HARDWARE

Hardware shall be as indicated in Hardware Sets and Door Schedule and as specified in 8.0, Section "Door Hardware".

4.1.2.6 FABRICATION, GENERALLY

Flush wood doors shall be fabricated in accordance with details shown on Drawings, requirements of this Section, general tolerances of BS No. 4787 and other in-contradicting requirements of BS No. 1186: Part 2.

A. Carefully plan and layout the work to erect wood doors and to accommodate the work of other trades.
B. Finish wood shall be smoothly dressed and sanded prior to assembly of door inner frames and shall be free from open joints, hammer and machine marks and other defects or surface blemishes.
C. Re-treat all treated wood which is sawn along the length, ploughed, thickness, planed or otherwise extensively processed. Treat wood surfaces exposed by minor cutting and drilling with two flood coats of solution recommended for the purpose by the treatment solution manufacturer.
D. Finish and cut wood at exact dimensions as required. Stile and rails shall be connected only in glued mortise-and tenon joints with horizontal core strips

assembled and jointed at their locations between rails, along stiles. The resulting frame shall be robust, firm and square.

E. Facing material shall be glued to core and frame. No nail-fixing exposed or concealed, for facing material shall be permissible. The assembly shall be glued under pressure with waterproof casein glue and be thoroughly dried and seasoned.
F. Join lipping at outer perimeter of frame in continuous tongue-and-groove joints with glue.
G. Factory machine doors for hardware that is not surface applied. Locate hardware as indicated on approved shop drawings. Comply with final hardware schedules, door frame shop drawings, and hardware templates.
   1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
H. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Louvers: Factory install louvers in prepared openings.

4.1.2.7 SHOP PRIMING

Doors for Opaque Finish: Shop seal faces and edge of doors including cutouts with one coat of wood primer specified in 9.0 Section "Painting."

PART 2 - EXECUTION

4.1.3.1 EXAMINATION

A. Examine installed door frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
   2. Reject doors/ frames with defects.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

4.1.3.2 INSTALLATION

Hardware: For installation, see 8.0 Section "Door Hardware."

A. Manufacturer's Written Instructions: Install wood doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
B. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer. Machine doors for hardware. Seal cut surfaces after fitting and machining.
   1. Clearances: Provide 3.2 mm (4/32") at heads, jambs, and between pairs of doors. Provide 3.2 mm (4/32") from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 6.4 mm (4/16") from bottom of door to top of threshold.
   2. Bevel non-fire-rated doors 3-1/2 degrees at lock and hinge edges.
C. Field-Finished Doors: Refer to the following for finishing requirements:
   1. 9.0 Section "Painting."

4.1.3.3ADJUSTING AND PROTECTING

Operation: Re-hang or replace doors that do not swing or operate freely.

A. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion by the Employer.

4.2- ACCESS DOORS AND FRAMES

GENERAL

4.2.1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contracts, including general and supplementary Condition.

4.2.1.2 SUMMARY

A. This Section includes the following:
   1. Wall access doors and frames.
   2. Recessed panels for ceramic tiles.
   3. Access panels for suspended gypsum board ceilings.
   4. Wood shaft access doors.

B. Related Sections include the following:

   1. 4.0 Section "Unit Masonry Assemblies" for anchoring and grouting access door frames set in masonry construction.

   2. 6.0 Section "Rough Carpentry" for materials and workmanship requirements for wooden shaft access doors.

   3. 9.0 Section "Gypsum Board Assemblies" for access panels to be installed in suspended gypsum board ceilings.

   4. 9.0 Section "Ceramic Tiles" for ceramic tiles and adhesives.

   5. 9.0 Section "Painting".

4.2.1.3 SUBMITTALS

A. **Product Data**: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

B. **Shop Drawings**: Show fabrication and installation details of doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

C. **Samples**: For each door face material, at least 75 by 125 mm (3" x 5") in size, in specified finish.

4.2.1.4 QUALITY ASSUARANCE

A. **Source Limitations**: Obtain each type of doors and frames through one source from a single manufacturer.

B. **Fire-Rated Access Doors and Frames**: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. NFPA 252 for vertical access doors.

C. **Size Variations**: Obtain Engineer's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

4.2.1.5COORDINATION

A. **Verification:** Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PRODUCTS

4.2.2.1MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with ZF180 zinc-iron-alloy (galvannealed) coating or Z180 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
C. **Plaster Bead**: Casing bead formed from 0.75-mm (1/32") zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

4.2.2.2PAINT

A. **Shop Primers**: Provide primers that comply with 9.0 Section "Painting."
B. **Shop Primer for Metallic-Coated Steel**: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.
C. **Galvanizing Repair Paint**: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.
D. **Epoxy paint**: Provide primers that comply with 9.0 Section "Painting."

4.2.2.3ACCESS DOORS AND FRAMES

A. Flush, Insulated, Fire-Rated Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.
    1. Locations: wall surfaces.
    2. Fire-Resistance Rating: As indicated on Drawings.
    3. Temperature Rise Rating: 139 deg C at the end of 30 minutes.
    4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 1.5 mm (2/32").
    5. Frame: Minimum 1.5-mm (2/32") thick sheet metal with plaster bead.
    6. Hinges: Concealed pin type.
    7. Lock: Key-operated cylinder lock, specified in 8.0 Section "Door Hardware".
B. **Recessed Panels for Ceramic tiles:** Units consisting of frame with expansion casing bead, door, hardware and complying with the following requirements:
    1. Frame: Zinc-coated steel sections and shapes.
    2. Plaster casing Bead: 0.76 mm (1/32") zinc coated steel casing bead with flange formed out of expanded metal lath.
    3. Panel: 2 mm (2/32") zinc coated steel sheet.
    4. Finish: Ceramic wall tiles matching adjacent walls adhered with water cleanable epoxy-based adhesive.
    5. Hardware: Nickel-plated steel hinges, exposed type and self-latching bolt operated with knurled knob.
C. **Heavy Duty Gypsum Board Ceiling Panels:** Heavy duty ceiling flush access panel with fully concealed steel frame and gypsum board inlay fastened to door.

1. Material: Removable spring-loaded door, integrated safety catches, patented concealed nylon hinge mechanism, rounded or square corners as directed, formed galvanized frames, stainless steel springs, zinc-plated fasteners, self-adhesive rubber gasket and accessories. Frame shall be two-part type fixed to opening edges and recessed door gypsum board inlay.
2. Latch: Tamper-resistant cam latch.

Sizes: As indicated on Drawings.

4.2.2.4 SHAFT ACCESS DOOR

A. **Doors**: Solid core from approved softwood. 3 mm (2/16") thick plywood facing and hardwood lipping.
B. **Frame:** Fabricate from preservative treated hardwood. Joints between stile and rail shall be single dove tail joints. Protect frame surfaces in contact with masonry with approved bitumen-based cold-applied protection coating.
C. **Anchors**: Type suitable for fixing into concrete or hollow concrete masonry with metal components fabricated from corrosion-resistant material. Use minimum two anchors per each frame jamb or sill.
D. **General**: Comply with requirements of Sections "Rough Carpentry" and "Flush Wood Doors" for preservative treatment and general workmanship requirements
E. **Finishing**: Field-applied approved paint type of color selected by Engineer.

4.2.2.5 FABRICATION

A. **General**: Provide access door assemblies manufactured as integral units ready for installation.
B. **Metal Surfaces:** For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
C. **Steel Doors and Frames**: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
    1. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
D. **Latching Mechanisms**: Furnish number required to hold doors in flush, smooth plane when closed.
    1. For cylinder lock, furnish two keys per lock and key all locks alike.
    2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

4.2.2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Finish metal fabrications after assembly.

4.2.2.7 METALLIC-COATED STEEL FINISHES

A. **Galvanizing of Steel Shapes and Plates**: Hot-dip galvanize items indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. **Surface Preparation**: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   1. **Galvanizing Repair Paint**: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

C. Factory Priming for Field-Painted Finish: Apply shop primer immediately after cleaning and pre-treating.

EXECUTION

4.2.3.1 PREPARATION

A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

4.2.3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.
B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
C. Install access doors with trim less frames flush with adjacent finish surfaces or recessed to receive finish material.
D. Installation of fire-rated access doors and panels shall maintain same applicable requirements of Standards referenced for installation of fire-rated steel frames in 8.0 Section "Custom Steel Doors and Frames".

4.2.3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.
B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

4.3- RIOUGH CARPENTARY

GENERAL - RELATED WORK

1. Architectural Wood Work
2. Gypsum Board System

4.3.1.1 THIS SECTION INCLUDES

This Section specifies incidental rough carpentry required for support or attachment of other construction and not specified in other sections and includes, but is not limited to, the following items:

a. Wood grounds, blockings, nailers.

b. Temporary and permanent grounds, blockings and supports required by other trades.

4.3.1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

1. Wood grounds, nailers, and blocking.
2. Wood furring.
3. Wood sub-frames.

PRESERVATIVE TREATMENT

a. Application is to be carried out after cutting and machining, but before assembly, by processor licensed by the treatment solution manufacturer.

b. Solution strengths and treatment by pressure, vacuum or immersion process are to be selected to achieve service life and to suit wood treatability.

c. Moisture content of wood at time of treatment is to be as specified for use in the work.

d. After treatment, allow wood to dry before use.

e. For each batch of wood, provide certificate of assurance that treatment has been carried out as specified.

f. Re-treat all treated wood which is sawn along the length, plouged, thicknessed, planed or otherwise extensively processed.

g. Treat wood surfaces exposed by minor cutting and drilling with two flood coats of solution recommended for the purpose by the treatment solution manufacturer.

4.3.1.3 SUBMITTALS

a. Samples of all materials used in the work of this Section.

b. Shop drawings for furring including details, sizes of wood sections, panel, spacings and method of attachment.

4.3.1.4 QUALITY ASSURANCE

A. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

4.3.1.5 DELIVERY, STORAGE AND HANDLING

Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

PRODUCTS

TIMBER

a. Timber shall be well seasoned and free from decay, insect attack except pinhole borers,

and knots wider than half of the width of the section.

b. Timber shall be kiln dried to a maximum moisture content of 12% by weight.

c. Timber required to be treated with preservatives or fire retardant shall be seasoned and kiln dried before treatment, and re-dried after treatment.

d. Softwood shall be free from decay and insect attack, except pinhole borers, with

no knots wider than half the width of the section. Softwood shall comply with BS EN 942 softwood spices to be used in external locations are to be recommended for the purpose.

e. Hardwood shall comply with BS EN 942. Hard wood to be used in internal locations are to be recommended for the purpose.

1. Wood used for exterior applications or for interior applications in wet areas shall be factory treated to prevent moisture absorption.

SOFTWOOD

To be either:

a. Douglas Fir (Standard Grade)

b. European Redwood

c. Or as suggested by the Architect.

HARDWOOD

a. Teakwood

b. White American Oakwood

c. Or as suggested by the Architect.

RIGID SHEETS

4.3.2.1 MDF (Fire Resistance)

a. Medium density fiberboard's for fabric panels, 8-10mm thick.

b. Strips of MDF around fabric panels edging.

c. All MDF components to be fire resistant.

4.3.2.2 PLYWOOD

a. Plywood: BS EN 636: Part 1, face grade for general use. Bonding is to be to BS 1203, type WBP for external use and type MR or INT for internal use.
b. Marine Quality Plywood: to BS 1088 and BS 4079, excluding plywood made from gaboon.

4.3.2.3 CORK BOARD

Are to be pre-formed sheets that have been formed from clean granulated cork particles securely bound together by a synthetic resin of an insoluble nature. Minimum thickness of sheets is to be 25 mm (1"), width and length are to be as indicated on Drawings.

4.3.2.4 FASTNERS

a. Nails: to BS 1202, Part 1, 2 or 3 generally, but non-ferrous types to Parts 2 or 3 for external use.
b. Wood Screws: to BS 1210 generally, but non-ferrous types for external use.
c. Self-Tapping Screws: to BS 4174.
d. Dowels: mild steel, 10 mm (1/2") diameter, 100 mm (4") long, galvanized to BS EN ISO 1461 after fabrication.
e. Cramps: mild steel, 25 x 3 x 250 mm (1" x 2/16" x 10") girth, turned up at one end and twice drilled for 3 mm (2/16") screws, fish-tailed at other end for building in and galvanized to BS 729 after fabrication.
f. Plugs: either traditional hardwood plugs, shaped to twist and grip when driven, or proprietary fibre or plastics plugs, or other approved type.

4.3.2.5 TREATMENTS, ADHESIVE AND FINISHES

a. Preservative Treatment: shall be type listed in BS 1282 (except coal tar creosote), obtained from an approved manufacturer, to give suitable protection against termites and other wood destroying organisms.
b. Adhesive for Joinery: shall be close contact type to BS EN 301 or BS EN 302 suitable for the purpose. Obtain manufacturer's confirmation that adhesive is compatible with preservative treatment.

EXECUTION

4.3.3.1 INSTALLATION, GENERAL

a. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
b. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

c. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
d. Apply field treatment to cut surfaces of preservative-treated lumber and plywood.
e. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.
f. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

g. Use hot-dip galvanized nails.
h. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

4.3.3.2 WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS

a. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
b. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
c. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-38 mm wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

4.3.3.3 WOOD FURRING

a. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

b. Firestop furred spaces of walls at each floor level and at ceiling with wood blocking or noncombustible materials, accurately fitted to close furred spaces.

c. Furring to Receive Wood or Plastic Sheets or Boards: Install 19-by-63-mm actual-size furring at 600 mm o.c., horizontally and vertically. Select furring with no knots capable of producing bent-over nails and damage to paneling.

d. Furring to Receive Gypsum Board: Install 19 (3/4")-by-38-mm (1½") actual-size furring at 400 mm (16") o.c., vertically.

e. Furring to Receive Plaster Lath: Install 19 (3/4")-by-38-mm (1½") actual-size furring at 400 mm (16") o.c., vertically.

4.4- INTERIOR ARCHITECTURAL WOODWORK

GENERAL

4.4.1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

4.4.1.2 SUMMARY

A. This Section includes the following:
   1. Pantry cupboard.
   2. Laboratory bench.
   3. Vanities constructed from solid surfacing.
   4. Wood base.

B. Related Sections include the following:
   1. 6.0 Section "Rough Carpentry".
   2. 9.0 Section "Painting" for field finishing of interior architectural wood works components that need finishing.

4.4.1.3 SUBMITTALS

A. **Product Data**: For each type of product indicated, including finishing materials and processes.
   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. **Shop Drawings**: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for items installed in architectural woodwork.

C. **Samples for Initial Selection**: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
   1. Shop-applied transparent finishes.
   2. Solid-surfacing materials.

D. Samples for Verification: For the following:
   1. Solid-surfacing materials, 150 mm (6") square.
   2. Pantry hardware.
   3. Plastic-laminate-clad panel products, 200 by 250 mm, (8" x 10") for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.

E. **Product Certificates**: Signed by suppliers of used woods and rigid sheets certifying that products comply with requirements specified.

4.4.1.4 QUALITY ASSURANCE

A. **Installer Qualifications**: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
B. **Fabricator Qualifications**: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
C. **Source Limitations**: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.

4.4.1.5 PROJECT CONDITIONS

A. **Field Measurements**: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

4.4.1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PRODUCTS

4.4.2.1 WOOD

A. Softwood shall be free from decay and insect attack, except pinhole borers, with no knots wider than half the width of the section. Softwood shall comply with BS EN 942 softwood spieces to be used in external locations are to be recommended for the purpose.
B. Hardwood shall comply with BS EN 942. Hardwood to be used in the works are to be recommended for the purpose.
C. Wood shall be treated to prevent absorption of moisture.
D. Plastic Laminate: to BS EN 438, color and pattern as follows:
   1. Color and Pattern: Shall be selected by Engineer from manufacturer's full range of colors and patterns.
   2. Minimum Thickness: 1.20 mm (1/16").
   3. Where indicated, select plastic laminate type suitable for post forming application.

4.4.2.2 RIGID SHEETS

A. Plywood: BS EN 636: Part 1, face grade for general use. Bonding is to be to BS 1203, type WBP for external use and type MR or INT for internal use.

4.4.2.3 FASTENERS

A. **Nails**: to BS 1202, Part 1, galvanized steel.
B. **Wood Screws**: to BS 1210 generally, galvanized steel.
C. **Self-Tapping Screws**: to BS 4174.
D. **Dowels**: mild steel, 10 mm (1/2") diameter, 100 mm (4") long, galvanized to BS EN ISO 1461 after fabrication.
E. **Cramps**: mild steel, 25 x 3 x 250 mm (1" x 1/32" x 10") girth, turned up at one end and twice drilled for 3 mm (1/32") screws, fish-tailed at other end for building in and galvanized to BS EN ISO 1461 after fabrication.
F. **Plugs**: either traditional hardwood plugs, shaped to twist and grip when driven, or proprietary fiber or plastics plugs, or other approved type.

4.4.2.4 FIRE-RETARDANT-TREATED MATERIALS

A. **General**: Where indicated, use materials impregnated with fire-retardant chemical formulations indicated by a pressure process or other means acceptable to Engineer to produce products with fire-test-response characteristics specified.
   1. Do not use treated material that does not comply with requirements of referenced woodworking standard or that is warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

B. **Fire-Retardant-Treated Lumber and Plywood by Pressure Process**: Comply with BS 5589. Use the following treatment type:
   1. Type: Organic-resin-based formulation thermally set in wood by kiln-drying.
   2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
   3. Kiln-dry material before and after treatment to levels required for untreated material.
C. All lumber, wood, fir, plywood or boards used in the works of this Section are to be preservative and fire-retardant treated.

4.4.2.5 SOLID SURFACE MATERIAL

A. **Solid-Surfacing Material for Counter Top**: Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a pre-coated finish.

4.4.2.6 INSTALLATION MATERIALS, GENERAL

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

4.4.2.7 5FABRICATION, GENERAL

A. **General**: Comply with requirements of BS 1186-2.
B. **Wood Moisture Content**: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
D. Fabricate woodwork to dimensions, profiles, and details indicated.
E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Engineer seven days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
F. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
G. Fabricated; cabinets and similar items are to be of robust firm neat construction with:
   1. Shutters, sashes, drawers and other opening or moving parts working smooth without bound conditions.
   2. Clearance between sashes and between jambs and sashes uniform.
   3. Level horizontal surfaces and plumb vertical surfaces when installed.

4.4.2.8 SHOP PRIMING

A. **General**: Priming of interior architectural woodwork required to be performed at fabrication shop are specified in this Section. Refer to 9.0 Section "Painting" for final finishing of installed architectural woodwork and for priming materials to be used.
B. **Preparations for Priming**: Comply with 9.0 Section "Painting" for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for priming woodwork, as applicable to each unit of work.
   a. **Back-priming**: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to end-grain surfaces.

4.4.2.9 PANTRY CUPBOARD AND BENCHES

A. Base counters and upper cabinets units shall be pre-fabricated units constructed to dimensions and details indicated on Drawings.
B. Construct units from the following materials so as to have all exposed or semi-exposed surfaces of plastic laminate finish:
   1. 19 mm (3/4") thick plywood with post-formed plastic laminate finish at both faces for front doors, bottoms and top of upper cabinet and shelves.
   2. 19 mm (3/4") thick solid surfacing material with integral factory formed back splash top of base counter with integral back splash.
   3. 6 mm (2/8") thick plywood of plastic laminate finish at one face for units backs and drawer base.

4. 19 mm (3/4") thick plywood with post-formed plastic laminate finish for drawers front, sides and back

C. Plastic laminate sheet veneers shall be as specified in Clause 2.1 of this Section, color and pattern to the selection of the Engineer. Units are to be assembled in manufacturer's standard system to provide neat and robust construction.
D. Construct sole of base counter, consisting of perimeter sides and intermediate struts, from hardwood solid blocks and finish exposed fronts to match finish of surrounding floors.
E. Provide metal pre-slotted shelf holders of baked enamel finish complete with removable brackets for shelf supporting. Color is to be to the selection of the Engineer.
F. Provide manufacturer's standard hardware including hinges, drawer slides, latches and knobs of finish to the selection of the Engineer. All hardware shall be manufactured from stainless steel, alloy 304, of satin finish.
G. Blocking wood shall be from approved hardwood type.
H. Construct top of base cabinet units integral with coved back splash from solid surfacing material as specified. Color or colors shall be selected by the Engineer from manufacturer's full range. To the maximum possible extent provide seamless construction. Where seams are unavoidable, align adjacent solid surfacing-material units and factory form seams. Joints are to be dressed smooth with surface scratches removed and entire surface cleaned.

4.4.2.10 WOOD BASES

A. Are to be constructed from White Oak hardwood.
B. Fabricate to dimensions and details indicated.
C. Furnish in length as long as practice.
D. Corners are to be mitered at 45 degrees.
E. Finish of bases shall be transparent stained varnish as specified in section "Painting".

4.4.2.11 VANITIES

A. Furnish vanities pre-fabricated in the workshop from solid surfacing material. Color(s) shall be selected by the Engineer.
B. Fabricate vanities to dimensions indicated on Drawings and details indicated on approved shop drawings. Comply with the following sheet thickness:
   - Vanity: 20.0 mm (3/4")
   - Aprons and backsplash: 13.0 mm (1/2").
C. Provide seamless vanity construction with pre-opened holes for assembly of lavatories. Use approved samples of lavatories for fixing size of holes. Comply with manufacturer's printed instructions for fabrication of vanities.

EXECUTION

4.4.3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

4.4.3.2 INSTALLATION

A. **Quality Standard**: Install woodwork to comply with BS 1186-2 and details indicated on Drawings and approved shop drawings.
B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops).
C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.
E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
F. Fix wood bases with pre-drilled, expansion-type wall plugs fabricated from hard nylon and galvanized-steel wood screws of suitable length and diameter at maximum intervals of 750 mm (30"). Counter sink heads of screws in wood and overfill with approved wood filler of matching color as adjacent finished stained wood.
G. Refer to 9.0 Section "Painting" for final finishing of installed architectural woodwork components that need finishing.

4.4.3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
B. Clean woodwork on exposed and semi exposed surfaces.

END OF SECTION

4.5 - POLYCARBONATE RESIN PANELS

PART 1 GENERAL

4.5.1. SECTION INCLUDES

A. Polycarbonate plastic glazing.
B. Abrasion-resistant polycarbonate plastic glazing.
C. Enhanced UV-resistant polycarbonate plastic glazing.
D. Flame inhibiting polycarbonate plastic glazing.
E. Laminated polycarbonate plastic glazing for security applications.
F. Multiwall Enhanced UV-resistant polycarbonate plastic glazing.

4.5.2. REFERENCES

A. ANSI Z 97.1 - American National Standard for Glazing Materials Used in Buildings -- Safety Performance Specifications and Methods of Test.
B. ASTM C 297 - Standard Test Method for Tensile. Strength on Flat Sandwich Constructions in. Flatwise Plane.
C. ASTM D 256 - Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
D. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
E. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
F. ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
G. ASTM D1003 Standard Test Method for Haze and Luminous transmittance of Transparent Plastics.
H. ASTM D 1929 - Standard Test Method for Ignition Properties of Plastics.
I. ASTM F 1233 - Standard Test Method for Security Glazing Materials and Systems.
J. ASTM F 1915 - Standard Test Method for Glazing for Detention Facilities.
K. UL 752 Standard for Bullet-Resisting Equipment.

4.5.3. SUBMITTALS

A. Submit under provisions of Section 01300.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Physical properties including data on material weight, wind load capacity, light transmission, shading coefficient, and thermal expansion
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods and glazing procedures, including edge engagement guidelines.
C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
D. Verification Samples: Submit samples for each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product and framed on two adjacent sides to show glazing system.
E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

4.5.4. DELIVERY, STORAGE, AND HANDLING

A. Deliver polycarbonate sheets on enclosed pallets.
B. Store products in manufacturer's unopened packaging until ready for installation.
C. Store in dry, well-ventilated and covered areas at temperatures below 80 degrees F
(27 degrees C).
D. Handle polycarbonate sheets carefully to prevent damage; do not drop, slide, or drag.

4.5.5. PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

4.5.6. WARRANTY

A. Provide manufacturer's written warranty covering breakage.
B. Provide manufacturer's written warranty covering breakage, loss of light transmission, and yellowing.
C. Provide manufacturer's written warranty covering breakage, abrasion resistance, coating failure, loss of light transmission, and yellowing.
D. Provide manufacturer's written 15 year warranty covering breakage, abrasion resistance, coating failure, loss of light transmission, and yellowing.

PART 2 PRODUCTS

4.5.7. POLYCARBONATE SHEET GLAZING

A. Polycarbonate Sheet: Comply with ANSI Z 97.1 and with properties as follows:
1. Specific gravity: 1.2, per ASTM D 792.
2. Tensile strength, yield: 9,000 psi (62 MPa), per ASTM D 638.
3. Tensile strength, ultimate: 9,500 psi (65 MPa), per ASTM D 638.
4. Tensile modulus: 345,000 psi (2378 MPa), per ASTM D 638.
5. Flexural strength at 5 percent strain: 13,500 psi (93 MPa), per ASTM D 790.
6. Flexural modulus: 345,000 psi (2378 MPa), per ASTM D 790.
7. Izod impact strength (0.125 inch (3.2 mm) notched): 12-16 ft lb/in/in (641 - 854 J/m) of notch, per ASTM D 256.
8. Self-ignition temperature: 1070 degrees F (577 degrees C), per ASTM D 1929.
9. Flash ignition temperature: 870 degrees F (466 degrees C), per ASTM D 1929.
10. Thickness and colour : as indicated on drawing.
B. Enhanced UV Resistant Type: plastic glazing sheet
C. UV and Abrasion Resistant Type: hard-coated plastic glazing sheet.
D. UV and Abrasion Resistant Type: hard-coated plastic glazing sheet.
E. Flame Inhibiting Plastic Glazing: solid flame inhibiting polycarbonate sheet. Meets requirements of UL 94 V-0 test criteria.
1. Heat deflection temperature at 264 psi, 270 degrees F (132 degrees C), per ASTM D 648.
2. Heat deflection temperature at 66 psi, 280 degrees F (138 degrees C), per ASTM D 648.

4.5.8. LAMINATED POLYCARONATE SHEET GLAZING

A. Polycarbonate Laminated Sheet: Comply with ANSI Z 97.1 and with properties as follows:
1. Specific gravity: 1.2, per ASTM D 792.
2. Tensile strength, yield: 9,000 psi (62 MPa), per ASTM D 638.
3. Tensile strength, ultimate: 9,500 psi (65 MPa), per ASTM D 638.
4. Tensile modulus: 340,000 psi (2343 MPa), per ASTM D 638.
5. Flexural strength at 5 percent strain: 13,500 psi (93 MPa), per ASTM D 790.
6. Flexural modulus: 345,000 psi (2378 MPa), per ASTM D 790.
7. Izod impact strength (0.125 inch (3.2 mm) notched): 12-16 ft lb/in/in (641 - 854 J/m) of notch, per ASTM D 256.
8. Self-ignition temperature: 1077 degrees F (581 degrees C), per ASTM D 1929.
9. Flash ignition temperature: 872 degrees F (467 degrees C), per ASTM D 1929.

B. Containment Glazing:

1. Provide two-ply polycarbonate laminate with the following properties:
a. Overall Thickness: 0.375 inches (9.5 mm).
b. Conforms to ASTM F 1915, Grade 3.
c. Forced entry ratings: ASTM F1233 Class III Sequence 12; H.P. White TP- 0500.02 Level II Step 11.
d. Ballistic Rating: H.P. White TP-0500.02 Level A (.38 Special).
e. Gage: 0.380 inch, plus/minus 5 percent tolerance.
f. Weight: 2.5 pounds per sq ft.
g. Shading coefficient: 0.92.
h. Light transmittance (clear): 86 percent.
j. Color: Custom color to match Architect's sample.

2. Provide three-ply polycarbonate laminate with the following properties:
a. Overall Thickness: 0.5 inches (12.7 mm).
b. Conforms to ASTM F 1915, Grade 2.
c. Forced entry ratings: ASTM F1233 Class III Sequence 15; H.P. White TP-0500.02 Level II Step 12.
d. Ballistic Rating: H.P. White TP-0500.02 Level A (.38 Special).
e. Gage: 0.525 inch, plus/minus 5 percent tolerance.
f. Weight: 3.3 pounds per sq ft.
g. Shading coefficient: 0.90.
h. Light transmittance (clear): 83 percent.
j. Color: Custom color to match Architect's sample.

3. Provide three-ply polycarbonate laminate with the following properties:
a. Overall Thickness: 0.75 inches (19 mm).
b. Conforms to ASTM F 1915, Grade 1.
c. Forced entry ratings: ASTM F1233 Class IV Sequence 26; H.P. White TP-0500.02 Level IV Step 31
d. Ballistic Rating: H.P. White TP-0500.02 Level B (9 mm).
e. Gage: 0.775 inch, plus/minus 5 percent tolerance.
f. Weight: 4.9 pounds per sq ft.
g. Shading coefficient: 0.87.
h. Light transmittance (clear): 77 percent.
j. Color: Custom color to match Architect's sample.

4.5.9. MULTI WALL POLYCARONATE SHEET GLAZING

A. Polycarbonate Sheet: Comply with ANSI Z 97.1 and with properties as follows:

1. Specific gravity: 1.2, per ASTM D 792.
2. Tensile strength, yield: 9,000 psi (62 MPa), per ASTM D 638.
3. Tensile strength, ultimate: 9,500 psi (65 MPa), per ASTM D 638.
4. Tensile modulus: 345,000 psi (2378 MPa), per ASTM D 638.
5. Flexural strength at 5 percent strain: 13,500 psi (93 MPa), per ASTM D 790.
6. Flexural modulus: 345,000 psi (2378 MPa), per ASTM D 790.
7. Izod impact strength (0.125 inch (3.2 mm) notched): 12-16 ft lb/in/in (641 - 854 J/m) of notch, per ASTM D 256.
8. Self-ignition temperature: 1070 degrees F (577 degrees C), per ASTM D 1929.
9. Flash ignition temperature: 870 degrees F (466 degrees C), per ASTM D 1929.

B. Multi Wall Glazing:

I. Provide twin wall polycarbonate sheet with the following properties:

a. Overall Thickness: 4 mm.
b. Rib distance: 6 mm.
c. Color/Light Transmittance:
1) Clear 1099 / 79 percent.
2) White 1146 / 77 percent.
3) Bronze 1850 / 59 percent.
4) White 1125 / 21 percent.
5) Blue 1545 / 42 percent.
6) Green 1650 / 55 percent.
d. Heat Transfer Coefficient: 4.1 w/m2 K per ASTM C 976.
e. Coefficient of Thermal Expansion: 0.065 mm/m degrees C.
f. Possible expansion due to heat and moisture: 3 mm/m.
g. Maximum service temperature without load. 120 degrees C. h. Coextruded UV protective layer on exterior face.

II. Twin wall polycarbonate sheet with the following properties:

a. Overall Thickness: 6 mm.
b. Rib distance: 6 mm.
c. Color/Light Transmittance:
1) Clear 1099 / 81 percent.
2) White 1146 / 78 percent.
3) Bronze 1850 / 61 percent.
4) White 1125 / 21 percent.
5) Blue 1545 / 44 percent.
6) Green 1650 / 58 percent.
7) Clear 4099 No drop.
d. Heat Transfer Coefficient: 3.7 w/m2 K per ASTM C 976.
e. Coefficient of Thermal Expansion: 0.065 mm/m degrees C.
f. Possible expansion due to heat and moisture: 3 mm/m.
g. Maximum service temperature without load. 120 degrees C.
h. Weighted sound reduction index: 10 db.
i. Coextruded UV protective layer on exterior face.

III. Twin wall polycarbonate sheet with the following properties:

a. Overall Thickness: 8 mm.
b. Rib distance: 10.5 mm.
c. Color/Light Transmittance:
1) Clear 1099 / 81 percent.
2) White 1146 / 78 percent.
3) Bronze 1850 / 61 percent.
4) White 1125 / 21 percent.
5) Blue 1545 / 44 percent.
6) Green 1650 / 58 percent.
7) Clear 4099 No drop.
d. Heat Transfer Coefficient: 3.3 w/m2 K per ASTM C 976.
e. Coefficient of Thermal Expansion: 0.065 mm/m degrees C.. f. Possible expansion due to heat and moisture: 3 mm/m.
g. Maximum service temperature without load. 120 degrees C.
h. Coextruded UV protective layer on exterior face.

IV. Twin wall polycarbonate sheet with the following properties:

a. Overall Thickness: 10 mm.
b. Rib distance: 10.5 mm.
c. Color/Light Transmittance:
1) Clear 1099 / 80 percent.
2) White 1146 / 70 percent.
3) White 1140 IQ-Relax (Heat Reflecting) 70 percent.
4) White 1125 / 19 percent.
5) Blue 1545 / 42 percent.
6) Green 1650 / 54 percent.
7) Bronze 1850 / 56 percent.
8) Clear 4099 No drop.
d. Heat Transfer Coefficient: 3.1 w/m2 K per ASTM C 976.
e. Coefficient of Thermal Expansion: 0.065 mm/m degrees C..
f. Possible expansion due to heat and moisture: 3 mm/m.
g. Maximum service temperature without load. 120 degrees C.
h. Coextruded UV protective layer on exterior face.

V. Wall polycarbonate sheet with the following properties:

a. Overall Thickness: 8mm.
b. Rib distance: 6mm.
c. Color/Light Transmittance:
1) Clear 1099 / 68 percent.
2) White 1146 / 61 percent.
3) White 1140 IQ-Relax (Heat Reflecting) 52 percent.
4) Clear 4099 No drop.
d. Heat Transfer Coefficient: 2.76 w/m2 K per ASTM C 976.
e. Coefficient of Thermal Expansion: 0.065 mm/m degrees C..
f. Possible expansion due to heat and moisture: 3 mm/m.
g. Maximum service temperature without load. 120 degrees C.

h. Coextruded UV protective layer on exterior face.
6. Provide wall polycarbonate sheet with the following properties:
a. Overall Thickness: 25 mm.
b. Rib distance: 25 mm X structure. c. Color/Light
Transmittance:
1) Clear 1099 / 54 percent.
2) White 1146 / 40 percent.
3) White 1140 IQ-Relax (Heat Reflecting) 37 percent. d. Heat
Transfer Coefficient: 1.6 w/m2 K per ASTM C 976.
e. Coefficient of Thermal Expansion: 0.065 mm/m degrees C.
f. Possible expansion due to heat and moisture: 3 mm/m.
g. Maximum service temperature without load. 120 degrees C.
h. Weighted sound reduction index: 19 dB.
i. Coextruded UV protective layer on exterior face.

4.5.10. ACCESSORIES

A. Glazing Accessories: As recommended by manufacturer of plastic glazing sheet for wet or dry glazing installations.
B. Glazing Accessories: In accordance with Section 08850 - Glazing Accessories.
C. Sealants: In accordance with Section 07900 - Joint Sealants

PART 3 EXECUTION

4.5.11. EXAMINATION

A. Do not begin installation until openings have been properly prepared.
B. Inspect and verify that frame openings are correct size and conform to recommendations of the plastic glazing sheet manufacturer.
C. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

4.5.12. PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
B. Clean frame contact surfaces with compatible solvent and wipe dry. Do not allow solvent to pool in glazing channels.
C. Immediately prior to installation, expose glazing edges of plastic sheet by peeling back factory-applied protective masking to a dimension sufficient for edge engagement.

4.5.13. INSTALLATION

A. Install plastic glazing in accordance with manufacturer's recommendations for edge engagement and expansion allowance.
B. Sawing:
1. Cut using triple chip design saw blades at steady feed rate. Do not force material through saw.
2. Sand or scrape cut edges smooth after sawing.
C. Mechanical Attachment:
1. Drill slightly oversized holes through plastic glazing and frames.

2. Install nuts, bolts and washers according to manufacturer's recommendations.
3. Use material backer strips with same strength and ballistic characteristics as glazing material.
4. Ensure bolts are not overtightened.
D. Non-mechanical Installation:
1. Use wet or dry gaskets compatible with plastic glazing material.
2. b. Insert glazing tape between metal frame and plastic glazing and ensure there is no contact between frame and glazing material.
E. Employ only sealants and glazing accessories that have been approved by manufacturer of plastic glazing sheet. F. Remove protective masking immediately after all glazing operations are completed.

4.5.14. PROTECTION

A. Protect installed products until completion of project.
B. Affix polyethylene film or other covering approved by plastic glazing sheet manufacturer to framing members, as required to protect plastic glazing from other construction operations.
C. Repair or replace damaged products before Substantial Completion.

4.5.15. MAINTENANCE

A. Wash plastic glazing sheets regularly using soft cloth or sponge and mild soap and water solution.
B. Dry using chamois or sponge
C. Do not use abrasive cleaners or sharp instruments such as razor blades or scrapers that may gouge plastic glazing sheet surfaces.

5- THERMAL AND MOISTURE PROTECTION

5.1- LIQUID APPLIED WATERPROOFING

GENERAL

5.1.1.1 RELATED WORK

A. Section 3.00 - Concrete.

5.1.1.2 WORK INCLUDED

A. Fluid applied cold applied one or two component polyurethane membrane waterproofing. For internal application.
B. Protective covering.

5.1.1.3 REFERENCE

A. ANSI/ASTM D412 - Rubber Properties in Tension.
B. ANSI/ASTM D746 - Test for Brittleness Temperature of Plastics and Elastomeric by Impact.
C. ASTM C836 - High Solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use With Separate Wearing Course.
D. ASTM D624 - Rubber Property - Tear Resistance.
E. ASTM D2240 - Rubber Property - Durometer Hardness.
F. ASTM E96 - Water Vapour Transmission of Materials.

5.1.1.4 QUALITY ASSURANCE

A. **Membrane Manufacturer**: Company specializing in liquid waterproofing membrane systems with eight years minimum experience.
B. **Applicator**: Company specializing in application of specified waterproofing with five years minimum experience and approved by manufacturer.

5.1.1.5 FIELD SAMPLE

A. Provide field sample of installed membrane.
B. Field sample to represent conditions of finished work including internal and external corners, seam jointing, attachment method, sealing and counter flashing cover, and control and expansion joints.
C. Approved sample may be incorporated as part of the Work.

5.1.1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of General Requirements.
B. Submit shop drawings detailing special joint or termination conditions and conditions of interface with other materials.
C. Submit product data for liquid membrane compound, flexible flashing, joint cover sheet, and joint and crack sealants, with temperature range for application of waterproofing membrane.
D. Submit manufacturer's installation instructions under provisions Contract Documents.

5.1.1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply waterproofing during inclement weather or when air substrate temperature is below 5 degrees C.
B. Liquid water proofing should be non-toxic.

5.1.1.8 WARRANTY

A. Provide (10) ten years warranty under provisions of General Conditions of Contract.

B. Warranty includes coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

C. Warranty includes coverage of waterproofing failure to resist penetration of water except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered as structural failure.

PRODUCTS

5.1.2.1 ACCEPTABLE MANUFACTURERS

A. Carisle Corporation System Liquiseal

B. Chevron USA (Asphalt Div) System C.I.M.

C. Floorlite - Andek System Rooftex

D. Tremco Ltd System Tremproof 60

E. Fosroc Nitoproof 10

Note: The products and manufacturer specified herein are specified for the purpose of establishing minimum quality standards. Products equal to or better than those specified will be considered acceptable. The decision of acceptability shall rest with Engineer/Engineer Representative.

5.1.2.2 MATERIAL

A. **General**: Provide liquid applied waterproofing, and other required materials produced by one manufacturer.

B. **Waterproofing Membrane**: Pitch Modified, High Polymer one part Polyurethane Elastomeric Membrane Type. Trowel apply membrane at areas indicated on Drawings to receive "Waterproofing", consisting of a high polymer and polyurethane applied in multiple layers forming a seamless waterproofing membrane to a minimum thickness of 1.5mm.

C. The Physical properties of the membrane must satisfy the following criteria:

1. Specific Gravity : 1.2
2. Solid Contents : 92% minimum
3. Application Temperature : 5 degrees C to 45 degrees C
4. Cure Time : 4 – 6 Hour
5. Store "A" Hardness : 30 degrees C
6. Tensile Strength : 20N/mm^2
7. Ultimate Elongation : 680%
8. Accelerated Weathering: 12000 Hours. No appreciable deterioration.

D. Sealer (For Substrate): As recommended by manufacturer.

E. Cant Strips: As recommended by manufacturer.

5.1.2.3 ACCESSORIES

A. Surface Conditioner: as recommended by membrane manufacturer.

B. Elastic Flashings: 1.2 as recommended by membrane manufacturer.

C. Joint and Crack Sealant: As recommended by membrane manufacturer.

D. Cant: as detailed on drawings.

5.1.2.4 PROTECTIVE MATERIALS

A. Protection Board: 3mm thick, (2/32") asphalt impregnated board manufactured by W.R. Meadows.

B. Tack-free Surfacer: Normal Portland Cement.

C. Separation Sheet: Sheet polyethylene, 0.15 mm thick (1/32").

EXECUTION

5.1.3.1 EXAMINATION

A. Verify surfaces are solid, free of frozen matter, loose particles, cracks, pits, rough projections, and foreign matter detrimental to adhesion and application of waterproofing.

B. Do not apply waterproofing to damp, frozen, dirty, dusty, or deck surfaces unacceptable to manufacturer and applicator.

C. Verify items, which penetrate surfaces to receive waterproofing, are securely installed.

D. Beginning of installation means acceptance of substrate.

5.1.3.2 PREPARATION

A. Clean and prepare surfaces to receive waterproofing, in accordance with manufacturer's instructions.

B. Apply mastic to seal penetrations, small cracks, and honeycomb in substrate.

C. Protect adjacent surfaces not designated to receive waterproofing.

D. Apply surface conditioner at a rate recommended by membrane manufacturer.

5.1.3.3 APPLICATION

A. Apply membrane in accordance with manufacturer's instructions.

B. Apply and spread membrane to minimum 2mm thickness, averaging 2.5mm in thickness.

C. Continue membrane up vertical surfaces minimum 150mm (6") or as indicated on drawings.

D. Seal items projecting through membrane.

E. Install membrane flashing and seal into membrane.

F. Reinforce membrane over static or moving joints.

5.1.3.4 FIELD QUALITY CONTROL

A. On completion of horizontal membrane installation, dam installation in preparation for flood testing.

B. Flood to minimum depth of 30mm (1.25"). with clean water. After 48 hours, check for leaks.

C. If leaking is found, patch using new waterproofing materials; repeat flood-test. Repair damage to building.

D. When area is proved watertight, drain water and remove dam.

5.1.3.5 PROTECTION

A. Immediately after cooling, dust membrane with Portland Cement at rate of approximately 4 kg/10 sq m (4kg / 108 Sft).

B. Apply protection boards over cured membrane surface. Scribe boards around pipes and projections.

C. Close off area to prevent un-authorized traffic or work over membrane until final concrete topping is applied.

PART 3 - LOCATION OF THE WORKS

A. In toilets, pantries and preparation areas, below tiling 2 – Below screed at delivery yard area 3 – Below cold rooms flooring in structurally recessed areas.

5.2- ROOF WATERPROOFING

GENERAL

5.2.1- RELATED DOCUMENT

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and 1.0 Specification Sections, apply to this Section.

5.2.2- SUMMARY

A. This Section includes Roof waterproofing.
B. Related Sections include the following:

1. Section "Cast-in-Place Concrete" for formwork, water stops, and finishing concrete walls and slabs to receive waterproofing.

2. 4.0 Section "Unit Masonry Assemblies" for preparing concrete unit masonry walls to receive waterproofing.

3. 9.0 Section "Portland Cement Plaster" for plaster finishes to be applied over waterproofing.

5.2.3- SUBMITTALS

A. Product Data: Include construction details, and material descriptions and installation instructions for waterproofing.
B. Product Certificates: For waterproofing, signed by product manufacturer.
C. Qualification Data: For Installer and manufacturer.
D. Material Test Reports: For waterproofing.
E. Manufacturer's inspection reports of completed installation.
F. Warranty: Special warranty specified in this Section.

5.2.4- QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
B. Mockups: Provide mockups of waterproofing to verify selections made under sample submittals and to demonstrate aesthetic effects.
   1. Engineer will select locations of mockups that represent typical surfaces and conditions for applications of waterproofing.
      a. Vertical and Horizontal Surfaces: Provide samples of at least one sq.m.
   2. Apply waterproofing according to requirements for the completed Work after permanent lighting and other environmental services have been activated.
C. Pre-installation Conference: Conduct conference at Project site to comply with requirements. Review methods and procedures related to waterproofing including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review required certifying procedures.

5.2.5- PROJECT CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit waterproofing to be performed according to manufacturer's written instructions and warranty requirements.
B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete and masonry substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 4.4 deg C or above during work and cure period and space is well ventilated and kept free of water.

5.2.6- WARRANTY

A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of waterproofing that fail in materials or workmanship within specified warranty period.
    1. Failures include, but are not limited to, the following:
        a. Failure to maintain watertight conditions within specified warranty period.
    2. Warranty Period: Ten years from date of Substantial Completion.

PRODUCTS

5.2.7- MATERIALS

A. Waterproofing: A prepackaged, white-colored proprietary blend of Portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates by capillary action into concrete or masonry and reacts chemically with free lime in the presence of water to develop growth within concrete or masonry capillaries to produce an impervious, dense, waterproof concrete or masonry with properties meeting or exceeding the following criteria:
    1. Permeability: 0 for water at 10 m when tested according to CE CRD-C 48.
    2. Compressive Strength: 28 MPa when tested according to ASTM C 109M.
B. Patching Compound: Cementations waterproofing and repair mortar for filling and patching tie holes, honeycombs, reveals, and other imperfections; with properties meeting or exceeding the following criteria:
    1. Compressive Strength: 52.44 MPa at 28 days when tested according to ASTM C 109M.
    2. Flexural Strength: 4.8 MPa at 28 days when tested according to ASTM C 348.
    3. Shrinkage: Minus 0.093 percent at 28 days and plus 0.073 percent at 90 days when tested according to ASTM C 596.
C. Plugging Compound: Cementations compound with hydrophobic properties; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead and horizontal surfaces not exposed to vehicular traffic); with properties meeting or exceeding the following criteria:
    1. Permeability: 9 m when tested according to CE CRD-C 48.

2. Compressive Strength: 41.4 MPa at 28 days when tested according to ASTM C 109M.
3. Flexural Strength: 6.9 MPa at 28 days when tested according to ASTM C 348.
4. Bond Strength: 2.1 MPa at 14 days when tested according to ASTM C 321.

D. Water: Potable

5.2.8- PROPORTION AND DESIGN OF PROTECTIVE TOPPING MIX

A. Protective Topping: Measure, batch, and mix Portland cement and sand in the proportion of 1:3 and water. Blend together with mechanical mixer to required consistency.

EXECUTION

5.2.9- EXAMINATION

A. Acceptance of Conditions: Examine substrates, with Applicator present, where waterproofing is to be applied.
   1. Proceed with application only after unsatisfactory conditions have been corrected.
   2. Notify Engineer in writing of active leaks or structural defects that would affect system performance.

5.2.10-PREPARATION

A. Protect other work from damage from cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.
B. Stop active water leaks according to waterproofing manufacturer's written instructions.
C. Repair damaged or unsatisfactory concrete or masonry according to manufacturer's written instructions.
D. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, curing compounds, and form-release agents to ensure that waterproofing bonds to concrete or masonry surfaces.
   1. Clean concrete surfaces according to ASTM D 4258.
      a) Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
      b) Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
   2. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

5.2.11-APPLICATION

A. General: Comply with waterproofing manufacturer's written instructions for application.
   1. Dampen surface for several hours prior to application with water and maintain damp condition until applying waterproofing.
   2. Apply waterproofing to positive-side surfaces.
   3. Number of Coats: Two for spray application.
   4. Dampen surface between coats.
B. Final Coat Finish: Smooth.

C. Moist-cure waterproofing for three days immediately after application has set, followed by two days of air drying as recommended in writing by manufacturer.
D. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:
    1. Onto columns integral with treated walls.
    2. Onto interior non-treated walls intersecting exterior treated walls, for a distance of 600 mm (24") for cast-in-place concrete.
    3. Onto exterior walls and onto both exterior and interior columns, for a height of 300 mm, (12") where floors, but not walls, are treated.
    4. Onto every substrate in areas indicated for treatment, including pipe trenches, pipe chases, pits, sumps, and similar offsets and features.
E. Protective Floor Topping: Apply 40-mm- (11/2") thick, protective topping over floor surfaces.

5.2.12-PROTECTION

A. Protect applied waterproofing from rapid drying, severe weather exposure, and water accumulation. Maintain completed Work in moist condition for not less than three days by procedures recommended in writing by waterproofing manufacturer. Protect waterproofing from temperatures below 2 deg C.

5.2.13-FIELD QUALITY CONTROL

A. Inspection: Manufacturer's representative to inspect completed application and to provide a written report that application complies with manufacturer's written instructions.

5.3 - WATERPROOFING

GENERAL

5.3.1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions of Contract and 1.0 Section Specification Sections, apply to this Section.

5.3.1.2 SUMMARY

A. This Section includes the following:
   1. Two-ply modified bituminous sheet waterproofing.
B. Related Sections: include the following::
   2. Section "Cast-in-Place Concrete" for concrete curing and finishing.

5.3.1.3 PERFORMANCE REQUIREMENTS

A. Provide waterproofing that prevents the passage of water.

5.3.1.4 SUBMITTALS

A. **Product Data**: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
B. **Shop Drawings**: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
C. **Samples**: For the following products:
   1. 300 by 300 mm (12") square of waterproofing.
D. **Installer Certificate**: Signed by sheet waterproofing manufacturer certifying that the Installer complies with specified requirements.
E. **Product Test Reports**: From a qualified independent testing agency acceptable to the Engineer, indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.
F. **Sample Warranty**: Before starting waterproofing, copy of waterproofing manufacturer's and Installer's warranty, stating obligations, remedies, limitations, and exclusions.

5.3.1.5 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.
B. **Installer Qualifications**: A qualified Installer who is authorized, approved, or licensed by sheet waterproofing manufacturer to install manufacturer's products; and who is eligible to receive waterproofing warranty specified.
C. **Source Limitations**: Obtain waterproofing materials through one source from a single manufacturer.
D. **Mockup**: Apply waterproofing to at least 15 sq. m (161 Sft) of deck and/or wall to demonstrate surface preparation, crack and joint treatment, corner treatment, and execution quality.

1. Construct mockup in the location and of the size indicated or, if not indicated, as directed by the Engineer.
2. Notify the Engineer 7 days in advance of dates and times when mockup will be constructed.
3. Obtain the Engineer's approval of mockup before starting sheet waterproofing.
4. If the Engineer determines mockup does not comply with requirements, reapply waterproofing until mockup is approved.
5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. **Pre-Installation Conference**: Conduct conference at Project site to comply with requirements in 1.0 Section "Project Management and Coordination." Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

5.3.1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

5.3.1.7 PROJECT CONDITIONS

A. **Environmental Limitations**: Apply waterproofing within range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

a) Do not apply waterproofing in rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

5.3.1.8 WARRANTY

A. **Manufacturer's Warranty**: Provide written warranty, signed by waterproofing manufacturer and Installer, and countersigned by the Contractor, agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight within specified warranty period. Warranty includes responsibility for removing and replacing construction and other work that conceals modified bituminous sheet waterproofing.

1. Warranty Period: 10 years after date of Substantial Completion.

PRODUCTS

5.3.2.1 SHEET WATERPROOFING

A. **APP-Modified Bituminous Sheet, Smooth Surfaced**: ASTM D 6222, Grade S, Type I or II, polyester reinforced, atactic-polypropylene-modified bituminous sheet, smooth surfaced; suitable for application indicated and installation method specified; for use as follows:
   1. Use: Base and top plies of two-ply, modified bituminous sheet waterproofing.

B. **Physical Properties**: Provide APP-modified bituminous sheet materials with the following properties when tested according to ASTM D 5147:
   1. Thickness: 4.5 mm.
   2. Tensile Strength: 15.75 kN/m at minus 18 deg. C (minus 0.4 deg. F) in each direction.
   3. Elongation at Maximum Load: 20 percent minimum at minus 18 deg. C (minus 0.4 deg. F) in each direction.
   4. Tear Strength: 378 N minimum.
   5. Low-Temperature Flexibility: Pass at minus 10 deg. C (14 deg. F).

5.3.2.2 AUXILIARY MATERIALS

A. **General**: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

B. **Asphalt Primer**: ASTM D 41.

C. **Asphalt**: ASTM D 312, Type III or Type IV, as recommended by sheet waterproofing manufacturer.
   1. Label each container or provide certification with each load of bulk asphalt identifying type of asphalt and indicating softening point, minimum flash point, equiviscous temperature, and finished blowing temperature.

D. **Cants and Miscellaneous Accessories**: Provide cants and miscellaneous accessories recommended by sheet waterproofing manufacturer for intended use.

E. **Waterproofing and Sheet Flashing Accessories**: Provide sealants, pourable sealers, cone and vent flashings, inside and outside corner flashings, termination reglets and bars, and other accessories recommended by waterproofing manufacturer for intended use.

F. **Protection Course**: The following or, at the Contractor's option, alternative means of protection as recommended by waterproofing manufacturer for intended use, and acceptable to the Engineer.
   1. Sand – cement scred layer.
   2. Semi rigid sheet of fiberglass or mineral – reinforced asphaltic care, pressure laminated between two asphalt – saturated fibrous liners and as follows:
      a. Thickness : 3 mm.
      b. adhesive: Rubber based solvent type recommended by water proofing manufacturer for type of protection course.

EXECUTION

5.3.3.1 EXAMINATION

A. Examine substrates, areas, and conditions, for compliance with requirements and other conditions affecting performance.
    1. Do not proceed with installation until after the minimum concrete curing period recommended by waterproofing manufacturer.
    2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
    3. Notify the Engineer in writing of anticipated problems using waterproofing over substrate.
    4. Proceed with installation only after unsatisfactory conditions have been corrected.

5.3.3.2SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.
B. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
D. Prepare, fill, prime, and treat joints and cracks in substrate. Remove dust and dirt from joints and cracks according to ASTM D 4258.
E. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
F. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to manufacturer's written instructions.
G. Install and secure cants, reinforcement strips, flashings and miscellaneous accessories to comply with manufacturer's written instructions and requirements for treatments at construction joints, horizontal to vertical surface intersections, inside and outside corners, perimeters, and edges.

5.3.3.3MODIFIED BITUMINOUS SHEET INSTALLATION

A. Install modified bituminous sheet over areas to receive waterproofing, according to manufacturer's written instructions and applicable recommendations.
    1. Unroll sheet and allow to relax for the minimum time period required by manufacturer.
B. **Two-Ply, Modified Bituminous Membrane**: Install 2 plies of modified bituminous sheet waterproofing, consisting of a base ply and a finish ply.
    1. Base- and Finish-Ply Application: Torch apply each ply to substrate.
C. **Horizontal Application**: Apply sheets from low point to high point to ensure that side laps shed water.
D. **Laps**: Accurately align sheets, without stretching, and maintain uniform side and end laps of minimum dimensions required. Stagger end laps. Heat-weld side and end laps and completely seal by rolling, leaving no voids.
    1. Repair tears and voids in laps and lapped seams not completely sealed.

E. Repair tears and voids in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 150 mm beyond repaired areas in all directions.
F. Correct deficiencies to satisfaction of the Engineer, or remove sheet waterproofing that does not comply with requirements, repair and prepare substrates, re-apply waterproofing and repair flashings.

5.3.3.4 PROTECTION COURSE INSTALLATION

A. Install protection course over waterproofing membrane according to manufacturer's written instructions and before beginning subsequent construction operations. Minimize exposure of membrane.

5.3.3.5 PROTECTION AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected horizontal membrane.
B. Protect installed waterproofing and protection course from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where installation may be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

5.4 - SHEET METAL FLASHING AND TRIM

GENERAL

5.4.1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Section 1 Specification Sections, apply to this Section.

5.4.1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim.
    1. Formed roof flashing and trim.
B. Related Sections include the following:
    1. Section "Cast-in-Place Concrete" for installing reglets.
    2. 4.0 Section "Unit Block Masonry Assemblies" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
    3. 6.0 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
    4. 7.0 Section "Metal Roof Panels" for factory-formed metal roof panels and flashing and trim not part of sheet metal flashing and trim.
    5. 7.0 Section "Metal Wall Panels" for factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
    6. 7.0 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

5.4.1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to:
    1. **Wind Loading**: Design fascia panels to withstand wind forces calculated in accordance with the UBC for a basic wind speed of 130 km/h, Importance Factor 1.00, and Exposure Category "C".
C. **Thermal Movements:** Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
    1. Temperature Change (Range): 35 deg. C, ambient; 65 deg. C, material surfaces.
D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

5.4.1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop and field assembled work. Include the following:
    1. Identify material, thickness, weight, and finish for each item and location in Project.
    2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
    3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
    4. Details of expansion-joint covers, including showing direction of expansion and contraction.
C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
    1. Include similar Samples of trim and accessories involving color selection.
D. **Samples for Verification:** For each type of exposed finish required, prepared on Samples of size indicated below:
    1. Sheet Metal Flashing: 300 mm long. Include fasteners, cleats, clips, closures, and other attachments.
    2. Trim: 300 mm long. Include fasteners and other exposed accessories.
    3. Accessories: Full-size Sample.
E. **Qualification Data:** For firms and persons specified in Article 1.4, "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of the Engineers and Employers, and other information specified.

5.4.1.5 QUALITY ASSURANCE

A. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.
B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
    1. **Copper Standard:** Comply with CDA's "Copper in Architecture Handbook."
C. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
    1. Mockup of roof level, including built-in gutter fascia trim apron flashing, approximately 1200 mm long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
    2. Approval of mockups is for other material and construction qualities specifically approved by the Engineer in writing.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by the Engineer in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. **Pre-installation Conference:** Conduct conference at Project site to comply with requirements in 1 Section "Project Management and Coordination."
1. Meet with the Employer, Engineer, Employer's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

5.4.1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
C. Stack materials on platforms or pallets, covered with suitable weather tight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

5.4.1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak proof, secure, and noncorrosive installation.

PRODUCTS

5.4.2.1 SHEET METALS

A. Aluminum Sheet: ASTM B 209M, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
1. Anodized Finish: Apply the following coil-anodized finish:
a. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as-fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating but 0.025 mm or thicker) complying with AAMA 611.

5.4.2.2 UNDERLAYMENT MATERIALS

A. Slip Sheet: Rosin-sized paper, minimum 0.16 kg/sq. m.

5.4.2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
B. **Fasteners:** Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
    1. Fasteners: Stainless steel.
    2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
    3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
    4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
C. **Sealing Tape:** Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.
D. **Elastomeric Sealant:** ASTM C 920, elastomeric polyurethane, polysulfide or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
E. **Butyl Sealant:** ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 0.4 mm dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

5.4.2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Flashing: Fabricate from aluminum sheets to details indicated on Drawings and approved shop drawings. Thickness shall not be less than 1.00 mm.

5.4.2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
    1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
    2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 25 mm deep, filled with elastomeric sealant concealed within joints.
F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
    1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

H. Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

5.4.2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Aluminum finish is specified in Clause 2.1 of this Section.

EXECUTION

5.4.3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
    1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
    2. Proceed with installation only after unsatisfactory conditions have been corrected.

5.4.3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
    1. Torch cutting of sheet metal flashing and trim is not permitted.

B. **Metal Protection:** Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementations construction.
2. Underlayment: Where installing metal flashing directly on cementations or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
    1. Space cleats not more than 300 mm apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 3 m with no joints allowed within 600 mm of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 25 mm deep, filled with elastomeric sealant concealed within joints.
G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 32 mm for nails and not less than 20 mm for wood screws.
    1. Aluminum: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.
    1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 25 mm into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 4 and 21 deg. C, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 4 deg. C.
    2. Prepare joints and apply sealants to comply with requirements in 7.0 Section "Joint Sealants."

I. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

5.4.3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and

SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. **Counter flashing:** Coordinate installation of counter flashing with installation of base flashing. Insert counter flashing in reglets or receivers and fit tightly to base flashing. Extend counter flashing 100 mm over base flashing. Lap counter flashing joints a minimum of 100 mm and bed with elastomeric sealant.
    1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
    1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
    2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

5.4.3.4CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
B. Clean and neutralize flux materials. Clean off excess solder and sealants.
C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

5.5 - JOINT SEALANTS

GENERAL

5.5.1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

5.5.1.2 SUMMARY

A. This Section includes sealants for the applications indicated on Drawings and applications specified by reference to this Section.
B. Related Sections include the following:
   1. Section "Unit Block Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
   2. 7.0, "Sheet Metal Flashing and Trim" for sealing joints related to flashing and sheet metal for roofing.
   3. 8.0 Section "Glazing" for glazing sealants.
   4. 9.0 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board assemblies to reduce sound transmission.
   5. 9.0 "Ceramic Tile" for sealing joints in ceramic tile.
   6. 9.0 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

5.5.1.3 DEFINITIONS

A. **TRAFFICABLE SEALANT**: To qualify for traffic use under ASTM C 920 requirements, elastomeric sealants must demonstrate a shore A hardness of not less than 25 nor more than 50
B. **LOW MODULUS**: Tensile strength of 310 kPa or less.
C. **MEDIUM MODULUS**: Tensile strength of not less than 310 kPa or more than 517 kPa. Movement capabilities of ±50%
D. **HIGH MODULUS**: Tensile strength of more 517 kPa. Joint movement is limited to ±25% or less

5.5.1.4 PERFORMANCE REQUIREMENTS

A. Provide joint sealants that have been produced and installed to establish and maintain airtight continuous seals, that are water resistant and cause no staining or deterioration of joint substrates.
B. Sealant shall be compatible for adhesion with specified aluminum finishes, resin base paint, glass, stone, metal, ceramic tiles, anodized aluminum, galvanized steel and plastics such as polycarbonate and pvc etc.
C. Sealant shall be capable of withstanding dynamic movement of ± 50 %.
D. Bond width of the sealant shall be minimum 10 mm.
E. All exterior joints shall be filled with self-expanding "Compriband"
F. Where required, use acoustical foam tape in conjunction with sealant.
G. Sealant shall be non-chalking and non-cracking. Based on performance, the sealant shall be non-fire hazard.
H. Sealants for joints that may be exposed to direct sun rays shall be UV-resistant.
I. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or

exceeding the fire-resistance rating of the construction in which the joint occurs.

5.5.1.5 SUBMITTALS

A. **Product Data**: For each joint-sealant product indicated.
B. **Samples for Initial Selection**: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
C. **Samples for Verification**: For each type and color of joint sealant required. Install joint sealants in 13-mm- (1/2") wide joints formed between two 150-mm- (6") long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
D. **Product Certificates**: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.
E. **Installer Certificates**: Signed by product manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install his products.
F. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product endorsed by the manufacturer's representative.
G. **Qualification Data**: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/Consultants and owners, and other information specified.
H. **Preconstruction Field Test Reports**: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
I. **Field Test Report Log**: For each elastomeric sealant application. Include information specified in "Field Quality Control" Article.
J. **Product Test Reports**: From a qualified testing agency indicating sealants comply with requirements and are compatible with joint substrates, shims, joints sealant backings, secondary seals and miscellaneous materials, based on comprehensive testing of current product formulations.
K. **Warranties**: Special warranties specified in this Section.

5.5.1.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
B. **Installer Qualifications**: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
C. **Source Limitations**: Obtain each type of joint sealant through one source from a single manufacturer.
D. **Product Testing**: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
5. Include test results performed on joint sealants after they have cured for 1 year.

E. **Preconstruction Field-Adhesion Testing**: Before installing elastomeric sealants, field test their adhesion to joint substrates as follows:
1. Locate test joints where indicated or, if not indicated, as directed by Consultant.
2. Conduct field tests for each application indicated below:
   a. Each type of elastomeric sealant and joint substrate indicated.
   b. Each type of non-elastomeric sealant and joint substrate indicated.
3. Notify Consultant seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
5. Test Method: Test joint sealants by hand-pull method described below:
   a. Install joint sealants in 1500-mm- long joints using same materials and methods for joint preparation and joint-sealant installation required for the completed Work. Allow sealants to cure fully before testing.
   b. Make knife cuts from one side of joint to the other, followed by two cuts approximately 50 mm long at sides of joint and meeting cross cut at one end. Place a mark 25 mm from cross-cut end of 50-mm piece.
   c. Use fingers to grasp 50-mm piece of sealant between cross-cut end and 25-mm mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
   d. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.
6. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

F. **Mockups**: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution:
   1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

5.5.1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi component materials.
B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

5.5.1.8 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
   2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 deg C.
   3. When joint substrates are wet.

B. **Joint-Width Conditions**: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. **Joint-Substrate Conditions**: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

5.5.1.9 SEQUENCE AND SCHEDULING

A. Sequence installation of joint sealants to occur not less than 21 or more than 30 days after completion of waterproofing, unless otherwise indicated.

WARRANTY

A. **General Warranty**: Special warranties specified in this Article shall not deprive Employer of other rights Employer may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
B. **Special Installer's Warranty**: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

C. **Special Manufacturer's Warranty**: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

D. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PRODUCTS

5.5.2.1 MATERIALS, GENERAL

A. **Compatibility**: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. **Colors of Exposed Joint Sealants**: As selected by Consultant from manufacturer's full ranges for this characteristic.

5.5.2.2 SOLVENT-RELEASE-CURING JOINT SEALANTS

A. **Acrylic Sealant**: Manufacturer's standard one-part, nonsag, solvent-release-curing acrylic terpolymer sealant complying with AAMA 808.3 or FS TT-S-00230 or both, with capability when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage change in joint width existing at time of application and remain adhered to joint substrates indicated for Project without failing cohesively:
   1. 12-1/2 percent movement in both extension and compression for a total of 25 percent.

5.5.2.3 ELASTOMERIC JOINT SEALANTS

A. **Elastomeric Sealant Standard**: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

B. **Additional Movement Capability**: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in

the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

C. **Stain-Test-Response Characteristics**: Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
D. **Suitability for Contact with Food**: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
E. **Suitability for Immersion in Liquids**. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

5.5.2.4ACOUSTICAL JOINT SEALANTS

A. **Acoustical Sealant for Exposed and Concealed Joints**: For each product of this description indicated in the Acoustical Joint-Sealant Schedule at the end of Part 3, provide manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and the following:
    1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

5.5.2.5LATEX JOINT SEALANTS

A. **Latex Sealant Standard**: Comply with ASTM C 834

5.5.2.6JOINT-SEALANT BACKING

A. **General**: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
B. **Cylindrical Sealant Backings**: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
    1. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 40 kg/cu. m and tensile strength of 241 kPa in accordance with ASTM D 1623, and with water absorption less than 0.02 g/cc in accordance with ASTM C 1083.
C. **Bond-Breaker Tape**: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
D. **Elastomeric Tubing Joint Backings**: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -32 deg C. Provide products with low compression set and of size and shape to provide a secondary seal, to

control sealant depth, and otherwise contribute to optimum sealant performance.

5.5.2.7 MISCELLANEOUS MATERIALS

A. **Primer**: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
B. **Cleaners for Nonporous Surfaces**: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
C. **Masking Tape**: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

EXECUTION

5.5.3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

5.5.3.2 PREPARATION

A. **Surface Cleaning of Joints**: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
    1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
    2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
    a) Concrete.
    b) Masonry.
    c) Unglazed surfaces of ceramic tile.
    3. Remove laitance and form-release agents from concrete.
    4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
    a) Metal.
    b) Glass.
    c) Porcelain enamel.

d) Glazed surfaces of ceramic tile.

B. **Joint Priming**: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
C. **Masking Tape**: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

5.5.3.3 INSTALLATION OF JOINT SEALANTS

A. **General**: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
B. **Sealant Installation Standard**: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
C. **Acoustical Sealant Application Standard**: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
    1. Do not leave gaps between ends of sealant backings.
    2. Do not stretch, twist, puncture, or tear sealant backings.
    3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
F. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
    1. Place sealants so they directly contact and fully wet joint substrates.
    2. Completely fill recesses provided for each joint configuration.
    3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
G. **Tooling of Non-sag Sealants**: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
    1. Remove excess sealants from surfaces adjacent to joint.
    2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
    3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
    4. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.

5. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
   a) Use masking tape to protect adjacent surfaces of recessed tooled joints.

5.5.3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed elastomeric sealant joints as follows:
      a) Perform 10 tests for the first 300 m of joint length for each type of elastomeric sealant and joint substrate.
      b) Perform one test for each 300 m of joint length thereafter or one test per each floor per elevation.
   2. **Test Method**: Test joint sealants by hand-pull method described below:
      a) Make knife cuts from one side of joint to the other, followed by two cuts approximately 50 mm long at sides of joint and meeting cross cut at one end. Place a mark 25 mm from cross-cut end of 50-mm piece.
      b) Use fingers to grasp 50-mm piece of sealant between cross-cut end and 25-mm mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
      c) For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.
   3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
   4. Inspect tested joints and report on the following:
      a) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field- adhesion hand-pull test criteria.
      b) Whether sealants filled joint cavities and are free from voids.
      c) Whether sealant dimensions and configurations comply with specified requirements.
   5. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
   6. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that

original sealant surfaces are clean and new sealant contacts original sealant.

B. **Evaluation of Field-Test Results**: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

5.5.3.5 SEALANT INSTALLATION SCHEDULE

A. **General**: Unless otherwise indicated, install sealants at the following locations. For locations and applications not specified, install sealants of types recommended by the joint sealant manufacturer.

B. **Exterior Joints**:
   1. Non-Traffic Joints: One-part non-sag urethane sealant.
   2. Joints Subject to Traffic: Multi-part pourable urethane sealant.

C. Interior Joints:
   1. Joints Subject to Traffic: Multi-part pourable urethane sealant.
   2. Non-Traffic Joints:
      a) Joints Subject to Movement of 10 to 25 Percent: One-part non-sag urethane sealant.
      b) Joints Subject to Movement Under 10 Percent: Acrylic sealant.
   3. Tiled Areas and Areas Subject to Attack by Mildew: One-part mildew-resistant silicone sealant.
   4. Acoustical Rated Assemblies: Use acoustical sealant for sealing joints through and around acoustical rated assemblies.
   5. Paintable Wall Joints: Acrylic sealant.
   6. Sealants Subject to Contact with Food: Comply with requirements in Clause 2.3/D of this Section.
   7. Sealants Subject to Water Immersion: Comply with requirements in Clause 2.3/E of this Section.

5.5.3.6 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

2. Doors and Windows

6.1- ALUMINIUM FRAMED ENTRANCES AND STORESFRONTS

GENERAL

6.1.1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contracts, including general and supplementary Conditions.

6.1.1.2 SUMMARY

A. This Section includes the following:
   1. Exterior manual-swing aluminum doors.
B. Related Sections include the following:
   1. 8.0 Section "Door Hardware" for lock cylinders and closers.
   2. 8.0 Section "Glazing" for glazing requirements to the extent not specified in this Section.

6.1.1.3 PERFORMANCE REQUIREMENTS

A. **General**: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
   1. Structural loads.
   2. Thermal movements.
   3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   4. Dimensional tolerances of building frame and other adjacent construction.
   5. Failure includes the following:
      a) Deflection exceeding specified limits.
      b) Thermal stresses transferred to building structure.
      c) Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
      d) Glazing-to-glazing contact.
      e) Noise or vibration created by wind and thermal and structural movements.
      f) Loosening or weakening of fasteners, attachments, and other components.
      g) Sealant failure.
      h) Failure of operating units to function properly.

B. Structural Loads:
   1. Wind Loads: Uniform Building Code (UBC) 1997 Edition, Exposure C, Basic Wind Speed 130 km/hr.
   2. Seismic Loads: Provide aluminum systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of Uniform Building Code (UBC), 1997 Edition, Zone 2A.

C. Deflection of Framing Members:
   1. **Deflection Normal to Wall Plane**: Limited to 1/175 of clear span for spans up to 4.1 m and to 1/240 of clear span plus 6.35 mm (4/16") for spans greater than 4.1 m (3/16").
   2. **Deflection Parallel to Glazing Plane**: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 3.2 mm (2/16")

and clearance between members and operable units directly below to less than 1.5 mm (1/16").

D. **Structural-Test Performance**: Provide aluminum systems tested according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity but not less than 10 seconds.

E. **Thermal Movements**: Provide exterior aluminum systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base Consultanting calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. **Temperature Change (Range)**: 35 deg C, ambient; 65 deg C, material surfaces.
   2. **Test Performance**: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a) Test Ambient Temperature Range: plus 15 to 55 deg. C.

F. **Air Infiltration**: Provide exterior aluminum systems with maximum air leakage through fixed glazing and framing areas of 0.03 L/s per sq. m of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 300 Pa.

G. **Water Penetration Under Static Pressure**: Provide exterior aluminum systems that do not evidence water penetration through fixed glazing and framing areas when

tested according to ASTM E 331 at a minimum static-air-pressure difference of 20

percent of positive wind-load design pressure, but not less than 300 Pa.

F. **Water Penetration Under Dynamic Pressure**: Provide exterior aluminum systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 300 Pa.

G. **Sound Transmission**: Provide exterior aluminum-framed systems with fixed glazing and framing areas having minimum STC 30 according to ASTM E 413 and an OITC 26 according to ASTM E 1332, as determined by testing according to ASTM E 90.

6.1.1.4 SUBMITTALS

A. **Product Data**: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. **Shop Drawings**: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Include structural analysis data signed and sealed by the qualified professional Consultant responsible for their preparation.
   2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
   3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. **Samples for Initial Selection**: For units with factory-applied color finishes.
D. **Samples for Verification**: For each type of exposed finish required, in manufacturer's standard sizes.
E. **Fabrication Sample**: Of each vertical-to-horizontal intersection of systems, made from 300-mm (12") lengths of full-size components and showing details of the following:
   1. Joinery
   2. Anchorage
   3. Expansion provisions
   4. Glazing
   5. Flashing and drainage
F. Welding certificates.
G. **Qualification Data**: For Installer and testing agency.
H. **Preconstruction Sealant Test Reports**: For structural-sealant-glazed systems, compatibility and adhesion test reports from sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants. Include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
I. **Product Test Reports**: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.
J. Field quality-control test and inspection reports.
K. **Maintenance Data**: For aluminum-framed systems to include in maintenance manuals.
L. **Warranties**: Special warranties specified in this Section.

6.1.1.5 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
B. **Installer Qualifications**: Capable of assuming Consultant responsibility and performing work of this Section and who is acceptable to manufacturer.
   1. Consultant Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and Consultant analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.
C. **Testing Agency Qualifications**: An independent agency qualified according to ASTM E 699 for testing indicated.
D. **Product Options**: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics.

Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Consultant, except with Consultant's approval. If modifications are proposed, submit comprehensive explanatory data to Consultant for review.

E. **Welding**: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code-Aluminum."

F. **Mockups**: Prior to installing aluminum entrances, construct one mockup for an exterior aluminum entrances to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for Work. Include class, glazing materials and spandrel panels.

1. Locate mockups on-site in the location and of the size indicated on Drawings.
2. Notify Consultant 7 days in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Consultant's approval of mockups before start of Work.
5. Retain and maintain mockups during construction in an undisturbed conditions as a standard for judging the completed Work.
    a) Approved mockups in an undisturbed condition at the time of Substantial Completion as judged solely by the Consultant may become part of the completed Work, otherwise dismantle mockup and install permanent works.

6.1.1.6 PROJECT CONDITIONS

A. **Field Measurements**: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

6.1.1.7 WARRANTY

A. **Special Assembly Warranty**: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:
    a) Structural failures including, but not limited to, excessive deflection.
    b) Noise or vibration caused by thermal movements.
    c) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    d) Water leakage through fixed glazing and framing areas.
    e) Failure of operating components to function properly.
    f) Warranty Period: Five years from date of Substantial Completion.

B. **Special Finish Warranty**: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   1. Warranty Period: 20 years from date of Substantial Completion.

PRODUCTS

6.1.2.1 MATERIALS

A. **Aluminum**: Alloy and temper recommended by manufacturer for type of use and finish indicated, but not less than alloy and temper 6063 T5. Minimum wall thickness of extrusions for main ribs shall be 2.00 mm.
   1. Sheet and Plate: ASTM B 209M.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221M.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308/B 308M.
   5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

6.1.2.2 FRAMING SYSTEMS

A. **Framing Members**: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
B. **Brackets and Reinforcements**: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
C. **Fasteners and Accessories**: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
   1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

6.1.2.3 Weather-stripping

A. **Compression Weather stripping**: Cellular elastomeric preformed gasket and sealing material of vulcanized rubber, EPDM or neoprene, to ASTM D 2000

6.1.2.4 GLAZING SYSTEMS

A. **Glass Type**: As indicated on Drawings and specified in 8.0, Section "Glazing".
B. **Glazing Material**: As specified in 8.0 Section "Glazing."
C. **Bond-Breaker Tape**: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

6.1.2.5 DOORS

A. **Doors**: Manufacturer's standard glazed doors, for manual swing operation.
   1. Door Construction: 44-mm (2") overall thickness unless otherwise indicated on Drawings, with minimum 5-mm (3/16"), extruded-aluminum tubular rail and stile members. Mechanically fasten corners

with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
2. Door Design: Wide stile; 127-mm (5") nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
4. Provide non removable glazing stops on outside of door.

6.1.2.6 HARDWARE

A. **General**: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for swing doors indicated and fabricated from cast, wrought or extruded aluminum. Finish exposed parts to match door finish, unless otherwise indicated.
B. **Pivot Hinges**:
   1. Standard: BHMA A156.4, Grade 1.
   2. Offset-Pivot Hinges: Provide top, bottom and intermediated offset pivots at each door leave.
C. **Closers, General**: Comply with requirements of 8.0 Section "Door Hardware" and manufacturer's recommendations for closer size, depending on door size, exposure to weather, and anticipated frequency of use.
   1. Closing Cycle: Comply with requirements of authorities having jurisdiction.
   2. Opening Force: Comply with the following maximum opening-force requirements for locations indicated:
      a) Exterior Doors: 15 lbf (67 N).
D. **Hardware for Swing Doors**:
   1. Hinges: As specified.
   2. Door Pulls: Provide manufacturer's standard aluminum pull grips.
   3. Door Stops: Floor-or-wall-mounted door stop as appropriate, with integral rubber bumper complying with ANSI A 156.16, Grade 1.
   4. Keyed Cylinders: Mortise-type, 5-pin tumbler, stainless steel, inside cylinder units with cast aluminum face complying with ANSI A 156.5, Grade 1. Furnish 4 keys for each cylinder. Include cylinders in the master keying system.
   5. Locks: Roller type, for installation in aluminum styles of width indicated, aluminum casing.
   6. Closers: As specified in this Section and in 8.0, Section "Door Hardware".

6.1.2.7 ACCESSORY MATERIALS

A. **Joint Sealants**: For installation at perimeter of aluminum-framed systems, as specified in 7.0 Section "Joint Sealants."
B. **Bituminous Paint**: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 0.75-mm (1/32") thickness per coat.

6.1.2.8 FABRICATION

A. **General**: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs

and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

1. Form aluminum shapes before finishing.
2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. **Framing Members, General**: Fabricate components that, when assembled, have the following characteristics:
   a) Profiles that are sharp, straight, and free of defects or deformations.
   b) Accurately fitted joints with ends coped or mitered.
   c) Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
   d) Physical and thermal isolation of glazing from framing members.
   e) Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   f) Provisions for field replacement of glazing from exterior or interior.
   g) Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. **Mechanically Glazed Framing Members**: Fabricate for flush glazing (without projecting stops).

C. **Door Frames**: Reinforce as required to support loads imposed by door operation and for installing hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.
   2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

D. **Doors**: Reinforce doors as required for installing hardware.
   1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

E. **Hardware Installation**: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.
   1. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

F. **Forming**: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
   1. Prepare components to receive concealed fasteners and anchor and connection devices.
   2. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

G. **Welding**: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

H. **Glazing Channels**: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

I. **Metal Protection**: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
J. **Entrances**: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
K. **Exterior Doors**: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.

6.1.2.9 ALUMINUM FINISHES

A. **General**: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
C. **High-Performance Organic Finish (3-Coat Fluoropolymer)**: AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
    1. Color and Gloss: As selected by Consultant from manufacturer's full range.

EXECUTION

6.1.3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
    1. Proceed with installation only after unsatisfactory conditions have been corrected.

6.1.3.2 INSTALLATION

A. Install aluminum swing doors in accordance with manufacturer's recommendations and approved shop drawings.
B. Install units plumb, level, and square, true to line or curvature as required, in alignment with work of other trades, free from waves, buckles, sags or other defects. Provide secure anchorage for all parts of work. Coordinate with related trades to ensure proper mating and connecting of the work.
C. Isolate aluminum from contact with dissimilar metals and materials by applying on contact surfaces a heavy coat of approved alkali-resistant bituminous paint; or by separating surfaces with a non-absorptive tape or gasket.

D. Install work in prepared openings. Conform with applicable requirements for assuring use of proper materials and procedures to prevent electrolytic deterioration.
E. Comply with manufacturer's instructions and recommendations for installation of work. Shim and allow for movement resulting from changes in thermal conditions.
F. Set frames level, plumb and in true alignment in accordance with approved shop drawings. Construct completely tight and waterproof assemblies. Provide proper support and anchor securely in place.
G. Provide sealing as necessary to make work watertight and properly finished including joints between frames and adjoining construction.
H. **Moving Parts:** There shall be no aluminum to aluminum contact between hardware parts or swing doors members which move relative to each other and remain in contact.
I. **Hardware:** Install hardware to hardware manufacturer's instructions and installation templates.

6.1.3.3 FIELD QUALITY CONTROL

A. **Testing Agency:** Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
B. **Test Services:** Test aluminum swing doors as part of the assembly including them as specified in relevant Specifications Sections.

6.1.3.4 Adjusting

A. Adjust operating swing doors and hardware to provide a tight fit at contact points and weather-stripping for smooth operation and weathertight closure.

6.1.3.5 Cleaning

A. Clean aluminum surfaces promptly after installing units. Avoid damaging protective coatings and finishes. Remove excess glazing and sealing compounds, dirt and other substances.
B. Lubricate hardware and the moving parts. Clean glass of pre-glazed units promptly after installing sliding glass door units.
C. Wash and polish glass on both faces not more than 4 days prior to the date scheduled for final inspection. Comply with manufacturer's recommendations for final cleaning and maintenance.
D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during the construction period, including by natural causes, accidents and vandalism at no additional cost to the Employer.

6.1.3.6 Protection

A. Institute and maintain protective and other precautions required through remainder of construction period to ensure that except for normal weathering aluminum.
B. Aluminum swing doors units will be clean, neat and without damage or deterioration at time of Substantial Completion.

6.2 - ALUMINUM WINDOWS

GENERAL

2.11.2.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including general and supplementary Conditions.

2.11.2.2 SUMMARY

A. This Section includes aluminum-framed windows
B. Related Sections include the following:
    1. 8.0 Section "Aluminum Framed Entrances and Storefronts."
    2. 8.0 Section "Glazing" for glazing requirements for aluminum windows, including those specified to be factory glazed.

2.11.2.3 DEFINITIONS

A. Structural test pressure, for uniform load structural test, is equivalent to 150 percent of design pressure.

2.11.2.4 PERFORMANCE REQUIREMENTS

A. **General**: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:
    1. Size indicated on Drawings.
B. **Structural Performance**: Provide aluminum windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated:
    2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length 19 mm, whichever is less, at design pressure based on structural computations.
    3. Basic Wind Speed: Determine wind loads and resulting design pressures applicable to Project according to the following, based on mean roof heights above grade as indicated on Drawings:
        a) Uniform Building Code, 1997 Edition, Exposure C, Basic Wind Speed 130 km/hr
C. **Air Infiltration**: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.
    1. Maximum Rate: 2 cu. m/h x sq. m of area at an inward test pressure of 300 Pa.
D. **Water Resistance**: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.
    1. Test Pressure: 20 percent of positive design pressure, but not more than 580 Pa.
E. **Thermal Transmittance**: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503 and ASTM E 1423.

1. U-Value: shall not exceed U-value specified for glass insulating units specified in 8.0 Section "Glazing".

F. **Sound Transmission Class**: Provide glazed windows rated for not less than 26 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

G. **Thermal Movements**: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base Consultant calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 35 deg C, ambient; 65 deg C material surfaces.

H. **Life-Cycle Testing**: Test according to AAMA 910 and comply with AAMA/ WDMA 101/I.S.2.

2.11.2.5 SUBMITTALS

A. **Product Data**: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. **Shop Drawings**: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:
   1. Mullion details, including reinforcement and stiffeners.
   2. Joinery details.
   3. Expansion provisions.
   4. Flashing and drainage details.
   5. Weather-stripping details.
   6. Thermal-break details.
   7. Glazing details.
   8. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional Consultant responsible for their preparation and used to determine the following:
      a) Structural test pressures and design pressures from basic wind speeds indicated.
      b) Deflection limitations of glass framing systems.

C. **Samples for Initial Selection**: For units with factory-applied color finishes.

D. **Samples for Verification**: For aluminum window components required, prepared on Samples of size indicated below.
   1. Main Framing Member: 300-mm- (12") long, full-size sections of extrusions with factory-applied color finish.
   2. Hardware: Full-size units with factory-applied finish.
   3. Weather Stripping: 300-mm- (12") long sections.
   4. Consultant reserves the right to require additional samples that show fabrication techniques, workmanship, and design of hardware and accessories.

E. **Qualification Data**: For manufacturer, Installer, and testing agency.

1. Installer Experience: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product endorsed by the manufacturer's representative.
2. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

F. **Product Test Reports**: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of down-sized test units will not be accepted.
G. **Maintenance Data**: For operable window sash, operating hardware, weather stripping and finishes to include in maintenance manuals.

2.11.2.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
B. **Manufacturer Qualifications**: A firm experienced in manufacturing items specified in this section similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to manufacture required units.
C. **Installer Qualifications**: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
    1. A qualified firm specializing in performing the work of this Section with minimum three years documented experience and that is approved, authorized, or licensed by the product manufacturer to install his product and that is eligible to receive manufacturer's warranty. Include project names and addresses, names and addresses of Consultants and Employers, and other information specified
D. **Testing Agency Qualifications**: An independent testing agency, acceptable to Consultant, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
E. **Source Limitations**: Obtain aluminum windows through one source from a single manufacturer.
F. **Fenestration Standard**: Comply with AAMA/WDMA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
G. **Mockups**: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
    1. Build mockup in building envelope wall in locations selected by Consultant.
    2. Build one mockup of each type of windows indicated on Drawings.
    3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion as judged solely by the Consultant, otherwise dismantle mockups, remove site and install permanent works.
H. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements in 1.0 Section "Project Management and Coordination."

2.11.2.7 PROJECT CONDITIONS

A. **Field Measurements**: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

2.11.2.8 WARRANTY

A. **Special Warranty**: Provide written warranty signed by Manufacturer and Contractor in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Failure to meet performance requirements.
   2. Structural failures including excessive deflection.
   3. Water leakage, air infiltration, or condensation.
   4. Faulty operation of movable sash and hardware.
   5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   6. Insulting glass failure.
   7. Warranty Period: 5 years from date of Substantial Completion.
   8. Warranty Period for Metal Finishes: 20 years from date of Substantial Completion.

PRODUCTS

6.2.2.1 MATERIALS, GENERAL

A. **Aluminum Extrusions**: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 150-MPa ultimate tensile strength, not less than 110-MPa minimum yield strength, and not less than 2.00 mm (3/32") thickness at any location for the main frame and sash members.

B. **Fasteners**: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components
   1. Reinforcement: Where fasteners screw-anchor into aluminum less than 3.2 mm (2/16") thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, non-corrosive, pressed-in, splined grommet nuts.
   2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. **Anchors, Clips, and Accessories**: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. **Reinforcing Members**: Aluminum or nonmagnetic stainless steel, complying with ASTM B 456 for Type SC 3 severe service conditions, provide sufficient strength to withstand design pressure indicated.

E. **Sliding-Type Weather Stripping**: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
   1. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon--fabric or aluminum-strip backing complying with AAMA 701/702 requirements.

F. **Compression-Type Weather Stripping**: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when aluminum window is closed.
    1. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864 fabricated from EPDM.
G. **Replaceable Weather Seals**: Comply with AAMA 701/702.
H. **Sealant**: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

6.2.2.2 GLAZING

A. **Glass and Glazing Materials**: Refer to 8.0 Section "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.
B. **Glazing System**: Manufacturer's standard factory-glazing system that produces weather tight seal or as indicated in 8.0 Section "Glazing".

6.2.2.3 HARDWARE

A. **General**: Provide manufacturer's standard hardware fabricated from aluminum, designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Cadmium-plated hardware is not permitted. Do not use aluminum in frictional contact with other metals. Where exposed, provide extruded, cast, or wrought aluminum with clear anodized satin finish.
B. **Hardware, General**: Comply with AAMA 902.
C. **Sill Cap/Track**: Extruded-aluminum with finish matching that of window track of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
D. **Locks and Latches**: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
E. **Roller Assemblies**: Low-friction design.
F. **Four- or Six-Bar Friction Hinges**: Comply with AAMA 904.
    1. Locking mechanism and handles for manual operation.
    2. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, non-staining, non-corrosive, durable material.
G. **Limit Devices**: Provide limit devices designed to restrict sash or ventilator opening.
    1. Safety Devices: Limit clear opening to 150 mm (6") for ventilation; with custodial key release.
H. **Horizontal-Sliding Windows**: Provide the following operating hardware:
    1. Sash Rollers: Stainless-steel, lubricated ball-bearing rollers with nylon tires.
    2. Sash Lock: Spring-loaded, snap-type lock at jambs; two per sash.
I. **Projected Windows**: Provide the following operating hardware:
    1. Hinge: Five-knuckle butt hinge.
    2. Lock: Combination lever handle and cam-action lock with concealed pawl and keeper.
    3. Limit Device: Concealed friction adjustor, adjustable stay bar limit device; located on jamb of each ventilator.

6.2.2.4 FABRICATION

A. **General**: Fabricate aluminum windows, in sizes indicated, that comply with AAMA/WDMA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.
B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
C. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
    1. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.
    2. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
    3. Provide hardware with low conductivity for hardware bridging thermal breaks at frame or vent sash.
D. **Weather Stripping**: Provide full-perimeter weather stripping for each operable sash and ventilator.
E. **Weep Holes**: Provide weep holes and internal passages to conduct infiltrating water to exterior.
F. **Mullions**: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
G. **Sub-frames**: Provide sub-frames with anchors for window units as shown, of profile and dimensions indicated but not less than 1.6-mm- (2/32") thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide subframes capable of withstanding design loads of window units.
H. **Factory-Glazed Fabrication**: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in 8.0 Section "Glazing" and with AAMA/WDMA 101/I.S.2.
I. **Glazing Stops**: Provide snap-on glazing stops coordinated with 8.0 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

6.2.2.5 FINISHES

A. **General**: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
C. **High-Performance Organic Finish (3-Coat Fluoropolymer)**: AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer,

fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

D. Color and Gloss: As selected by Consultant from manufacturer's full range.

EXECUTION

6.2.3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances and other conditions affecting performance of work.
    1. Masonry and Concrete Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

6.2.3.2 INSTALLATION

A. **General**: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.
B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
E. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/WDMA 101/I.S.2.

6.2.3.3 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather-tight closure. Lubricate hardware and moving parts.

6.2.3.4 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

6.3 - DOOR HARDWARE

PART 4 - GENERAL

6.3.1.1 RELATED DOCUMENTS

A. Drawing and provisions of the contract, including General and supplementary Conditions.

6.3.1.2 SUMMARY

A. This Section includes the following:
   1. Commercial door hardware for the following steel and wood doors:
      a) Swinging doors.
      b) Cylinders for doors specified in other Sections.
      c) Electrified door hardware.

B. Related Sections include the following:
   2. 8.0 Section "Custom Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the time.
   3. 8.0 Section "Flush Wood Doors" for astragals provided as part of a fire-rated labeled assembly.
   4. 6.0 Section "Access Doors and Frames".
   5. 8.0 Section "Aluminum Framed Entrances and Storefronts".
   6. 8.4 Section "Sliding Automatic Entrance Doors" for entrance door hardware, except cylinders.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
   1. Cylinders for locks on aluminum and glass entrance doors.

6.3.1.3 SUBMITTALS

A. **Product Data**: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. **Shop Drawings**: Details of electrified door hardware, indicating the following:
   1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following:
      a) System schematic.
      b) Point-to-point wiring diagram.
      c) Riser diagram.
      d) Elevation of each door.
      e) Detail interface between electrified door hardware and fire other building systems.

C. **Samples for Initial Selection**: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of door hardware indicated.

D. **Samples**: For exposed door hardware of each type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.
   1. Door Hardware: Each piece of hardware indicated in hardware schedule or on Drawings.
   2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field

comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

E. **Door Hardware Schedule:** Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
      a) Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.
   3. Content: Include the following information:
      a) Type, style, function, size, label, hand, and finish of each door hardware item.
      b) Manufacturer of each item.
      c) Fastenings and other pertinent information.
      d) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      e) Explanation of abbreviations, symbols, and codes contained in schedule.
      f) Mounting locations for door hardware.
      g) Door and frame sizes and materials.
      h) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
      i) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

F. **Submittal Sequence:**
   1. Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
   2. Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in the Project construction schedule. Submit the final Door Hardware Schedule after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

G. **Keying Schedule**: Prepared by or under the supervision of supplier, detailing Employer's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
H. **Product Certificates:** Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements.
    1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
I. **Qualification Data**: For firms and persons specified in "Quality Assurance" Article.
    1. Include lists of completed projects with project names and addresses of architects/Consultants and owners, and other information specified.
J. **Product Test Reports**: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating current products comply with requirements.
K. **Maintenance Data:** For each type of door hardware to include in maintenance manuals specified in 1.0 section.
L. **Warranties**: Special warranties specified in this Section.

6.3.1.4 QUALITY ASSURANCE

A. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Installer Qualifications**: A qualified firm specializing in performing the work of this Section and who has completed door hardware similar in material, design, and extent to that indicated for this Project with minimum three years documented experience and that is approved, authorized, or licensed by the product manufacturer to install his product and that is eligible to receive manufacturer's warranty. Include project names and addresses, names and addresses of Consultants and Employers, and other information specified

C. **Supplier Qualifications**: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying conventional and security door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Employer, Consultant, and Contractor, at reasonable times during the course of the Work, for consultation. The supplier shall have access to adequate inventory of all hardware items to meet Project construction schedules and shall have the ability to submit samples, hardware data, templates, and hardware schedules in accordance with Project construction schedules.
    1. Require supplier to meet with Employer to finalize keying
    2. Electrified Door Hardware Supplier Qualifications: An experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.

a) Consultant Responsibility: Prepare data for electrified door hardware, including Shop Drawings, based on testing and Consultant analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

b) Scheduling Responsibility: Preparation of door hardware and keying schedules.

D. **Architectural Hardware Consultant Qualifications:** A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1. Electrified Door Hardware Qualifications: Experienced in providing consulting services for electrified door hardware installations.

E. **Source Limitations**: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.

F. **Regulatory Requirements**: Comply with provisions of the following:

1. NFPA 101: Comply with the following for means of egress doors:

a) Latches, Locks, and Exit Devices: Not more than 67 N to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

b) Delayed-Egress Locks: Lock releases within 15 seconds after applying a force not more than 67 N for not more than 3 seconds.

c) Door Closers: Not more than 133 N to set door in motion and not more than 67 N to open door to minimum required width.

d) Thresholds: Not more than 13 mm (1/2") high.

e) Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. **Fire-Rated Door Assemblies**: Provide door hardware for assemblies complying with NFPA 80, or any approved equal international standard, that are listed and labeled by a testing and inspecting agency acceptable to Consultant, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure.

2. **Labels**: All hardware components of fire resisting doors assemblies including, but not limited hinges, locks, bolts, door closers shall carry the identifying labels of an approved independent testing and inspection agency or laboratory, confirming their fire resistance rating. The rating of all door components shall be equal to the rating of the door assembly.

H. **Door Closers on Fire Rated Doors**: Comply with requirements with specified in Clause 2.10 of this Section.

I. **Keying Conference**: Conduct conference at Project site to comply with requirements in "Project Meetings." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.

J. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements in 1.0 Section "Project Meetings." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.

6.3.1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to manufacturer of key control system.

D. Deliver keys to Employer by registered mail or overnight package service.

6.3.1.6 COORDINATION

A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in 3.0 Section "Cast-in-Place Concrete."

B. **Templates**: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. **Electrical System Roughing-in**: Coordinate layout and installation of electrified door hardware with connections to power supplies and fire alarm system and detection devices and any other building system as indicated on Drawings.

6.3.1.7WARRANTY

A. **General Warranty**: Special warranties specified in this Article shall not deprive Employer of other rights Employer may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. **Special Warranty**: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of operators and door hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

A. **Warranty Period**: Three years from date of Substantial Completion, unless otherwise indicated.

B. **Warranty Period for Electromagnetic and delayed-Egress Locks**: Five years from date of Substantial Completion.

C. **Warranty Period for Manual Closers**: 10 years from date of Substantial Completion.

D. **Warranty Period for Concealed Floor Closers**: Five years from date of Substantial Completion.

6.3.1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Employer's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies as used in the manufacture and installation of original products.

PRODUCTS

6.3.2.1 SCHEDULED DOOR HARDWARE

A. **General:** Provide door hardware for each door to comply with requirements in this Section, and the Door and Hardware sets Schedule annexed at the end of Part 3.

1. **Door Hardware Sets:** Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.

2. **Sequence of Operation:** Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. **Designations:** Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door and Hardware sets Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. International hardware manufactures have to establish their compliance with these specifications and with international fire codes for fire rated hardware.

2. **References to BHMA Standards:** Provide products complying with these standards and requirements for description, quality, and function.

6.3.2.2 HINGES AND PIVOTS

A. **Standards:** Comply with the following:

1. **Butts and Hinges:** BHMA A156.1.

2. **Template Hinge Dimensions:** BHMA A156.7.

3. **Self-Closing Hinges and Pivots:** BHMA A156.17.

4. **Pivots:** BHMA A156.4.

B. **Size:** Provide the following minimum sizes, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

Maximum Door Size (mm)	Hinge Height (mm)	Metal Thickness (mm)	
		Standard Weight Kg	Heavy Weight Kg
800 by 2125 by 35	88 (3½")	3.1	-
900 by 2125 by 35	100 (4")	3.3	-
900 by 2285 by 38	113 (4½")	3.4	4.6
1050 by 2285 by 38	113 (4½")	3.4	4.6
1200 by 3050 by 38	125 (5")	3.7	4.8

C. **Template Requirements**: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

D. **Hinge Weight**: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Standard-weight hinges.

E. **Hinge Base Metal**: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel alloy 316, with stainless-steel pin
2. Interior Hinges: Stainless steel alloy 304, with stainless-steel pin.
3. Hinges for Fire-Rated Assemblies: Stainless steel alloy 304, with stainless-steel pin.

F. **Hinge Options**: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:

1. Maximum Security Pin: Fix pin in hinge barrel after it is inserted.
2. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

a) Out-swinging exterior doors.

3. Corners: 4-mm (5/32") radius.

G. **Hinges, General**: Shall be full mortise, template, of concealed ball bearing, 5 knuckles, suitable for high frequency applications and of life time warranty.

6.3.2.3 LOCKS AND LATCHES

A. **Standards**: Comply with the following:

1. Mortise Locks and Latches: BHMA A156.13.
2. Interconnected Locks and Latches: BHMA A156.12.
3. Auxiliary Locks: BHMA A156.5.
4. Push-Button Combination Locks: BHMA A156.2.
5. Electromagnetic Locks: BHMA A156.23.
6. Delayed-Egress Locks: BHMA A156.24.
7. Exit Locks: BHMA A156.5.

B. **Mortise Locks**: Stamped steel case with stainless steel parts; BHMA Grade 1; Series 1000. Provide mortise locks for exterior doors, throughout the job, except for toilets. All lock shall be ADA compliant Marine grade mortise locks shall be provided in the exterior and in non air conditioned areas. Provide ten years product warranty for performance and finish.

C. **Mortise Lock**: Shall be types produced for extra-heavy-duty applications. Lock lever shall be of anti-vandalism design.

D. Where threaded bars are used to assemble the two pieces of lock spindle, minimum inner diameter of threading bar shall be 6 mm (1/4").

E. **Interconnected Locks**: BHMA Grade 1; Series 5000.

F. **Auxiliary Locks**: BHMA Grade 1.

G. **Push-Button Combination Locks**: BHMA Grade 1 for cylindrical locks and Grade 2 for mortise locks.

H. **Certified Products**: Provide door hardware listed in the following BHMA directories:

1. Mechanical Locks and Latches: BHMA's "Directory of Certified Locks & Latches."

I. **Lock Trim**: Comply with the following: All trims to have returns. Trims shall be ADA compliant. Trim shall be stainless steel BHMA-630

1. Lever: Wrought, forged, or cast.

2. Escutcheon (Rose): Wrought, forged, or cast.
3. Dummy Trim: Match lock trim and escutcheons.
4. Lockset Designs: Provide the lockset design designated below or, if sets are provided by another manufacturer, provide designs that match those designated:

J. **Lock Functions**: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:

1. Mortise Locks: BHMA A156.13.
2. Interconnected Locks: BHMA A156.12.

K. **Lock Features**: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Mortise Locks: Minimum 19-mm (3/4") latchbolt throw.
2. Deadbolts: Minimum 25-mm (1") bolt throw.
3. Pairs of Doors: 16-mm (3/4") minimum throw of latch.
4. Fire-Rated Doors: Comply with UL requirements for throw of bolts and latches on rated fire openings.
5. Heavy duty anti friction tongue.
6. Non handed auxiliary guard latch.
7. Adjustable stainless steel armor front.
8. Seven pin interchangeable core cylinder.
9. Corrosion protected steel case.

L. **Rabbeted Doors**: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.

M. **Backset**: 70 mm, (3") unless otherwise indicated.

N. **Lock Function**: Provide lock functions as described below, but not limited to

1. F-04 Office lock, with faceplate button depressed function.
2. Classroom function for stores
3. F-13 Corridor lock.
4. Provide classroom dead bolts for main doors of toilets and janitors rooms

Additional lock function will be required as per function of various rooms.

O. Locks shall have double buttons in face plate. For Office Locks the handle will rotate only when bottom button is depressed or turning key for outside cylinder. For other locks, the bottom button in face plate shall also retract the latch.

P. These requirements for mortise locks shall remain applicable in all respects for wood doors, steel doors and minimum doors.

6.3.2.4 DOOR BOLTS

A. **Standards**: Comply with the following:

1. Surface Bolts: BHMA A156.16.
2. Manual Flush Bolts: BHMA A156.16.

B. **Surface Bolts**: BHMA Grade 1.

1. Flush Bolt Heads: Minimum of 13-mm- (1/2") diameter rods of brass, bronze, or stainless steel with minimum 300-mm- (24") long rod for doors up to 2100 mm in height. Provide longer rods as necessary for doors exceeding 2100 mm (7'-0").

C. **Flush Bolts**: BHMA Grade 1, designed for mortising into door edge.

D. **Bolt Throw**: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Half-Round Surface Bolts: Minimum 22-mm (1") throw.
2. Interlocking Surface Bolts: Minimum 24-mm (1") throw.
3. Fire-Rated Surface Bolts: Minimum 25-mm (1") throw; listed and labeled for fire-rated doors.
4. Dutch-Door Bolts: Minimum 19-mm (3/4") throw.
5. Mortise Flush Bolts: Minimum 19-mm (3/4") throw.

6.3.2.5 EXIT DEVICES

A. **Standard**: BHMA A156.3.

1. BHMA Grade: Grade 1.

B. **Certified Products**: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."

C. **Panic Exit Devices**: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

D. **Panic Exit Devices**: For non-fire rated doors are to be as specified in Sub-Clause but with facility to hold latchbolts in retracted position so that the doors may be used as push/pull. Dogging is to be accomplished by a hex key cylinder installed on the body of touch bar devices or a hexagonal key in the hinge and lock cases of cross bar devices

E. **Fire Exit Devices**: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. **Dummy Push Bar**: Nonfunctioning push bar matching functional push bar.

1. Operation: Rigid.

G. **Outside Trim**: Lever with cylinder or Pull with cylinder; unless otherwise indicated material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

H. **Through Bolts**: For exit devices and trim on metal doors and non-fire-rated wood doors.

I. Fire and panic exit devices shall be of concealed latches. No exposed latches shall be accepted.

6.3.2.6 CYLINDERS AND KEYING

A. **Standards**: Comply with the following:

1. Cylinders: BHMA A156.5.
2. Key Control System: BHMA A156.5.

B. **Cylinder Grade**: BHMA Grade 1 or Grade 1A.

C. **Cylinders**: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Seven.
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

D. **Permanent Cores**: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key, and usable with other manufacturers' cylinders.
2. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

E. **Construction Keying**: Comply with the following:

1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 4 constructions master keys for Employer/Consultant use.

a) Replace construction cores with permanent cores, as directed by Employer.

b) Furnish permanent cores to Employer for installation.

F. **Keying System**: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:

1. Master Key System: Cylinders are operated by a change key and a master key.

G. **Keys**: Provide stainless steel keys complying with the following:

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
   a) Notation: Information to be furnished by Employer.
2. Quantity: In addition to one extra blank key for each lock, provide the following:
   a) Cylinder Change Keys: Three.
   b) Master Keys: Five.

H. **Key Control System**: BHMA Grade 1 system, including key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers. Contain system in metal cabinet with baked-enamel finish.

1. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
2. Capacity: Able to hold keys for 150 percent of the number of locks.
3. Cross-Index System: Set up by key control manufacturer, complying with the following:
   a) Card Index: Furnish four sets of index cards for recording key information. Include three receipt forms for each key-holding hook.

6.3.2.7 STRIKES

A. **Standards**: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Interconnected Locks and Latches: BHMA A156.12.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.

B. **Strikes**: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.

5. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non recessed strike for bolt.

C. **Dustproof Strikes**: BHMA Grade 1.

6.3.2.8 CARD READER

A. Proximity Reader with Keypad:

1. Technology: Wiengand proximity system compatible with building security system.
2. Housing: Weather resistant ABS plastic housing. Color as selected by Consultant from manufacturer's full line.
3. Key Pad: 12 button key pad for entry of Personal Identification Number (PIN) in addition to proximity card.
4. Display Status: 3 LED status display and controllable beeper to indicate reader operation and status.
5. Tamper Detection: Mechanical tamper switch to send signal to security room if reader is completely removed from wall in addition to detecting when reader has been separated from its back plate.
6. Provide all mounting plates, cables, programs and other items required to make card reader work with building security system.

6.3.2.9 OPERATING TRIM

A. **Standard**: Comply with BHMA A156.6.

B. Door handles shall have returns in direction of door, straight handles shall not be accepted.

C. Handles shall be with round (rose) cover plates.

D. **Materials**: Fabricate from stainless steel, unless otherwise indicated.

E. **Push-Pull Design**: As indicated on Drawings.

6.3.2.10 ACCESSORIES FOR PAIRS OF DOORS

A. **Standards**: Comply with the following:

1. Coordinators: BHMA A156.3.

B. **Carry-Open Bars**: Provide carry-open bars for inactive leaves of pairs of doors, unless automatic or self-latching bolts are used.

C. Do not use security astragals. Use split adjustable astragals or concealed side mounted.

6.3.2.11 CLOSERS

A. Closers, General-unless otherwise indicated, provide closers on all fire-rated doors, exterior doors, toilet and locker room doors, sound-retardant doors, corridor doors, doors between heated/cooled and unheated / uncooled areas, elevator equipment room doors, and other door as required. Closer shall be tested for 10 million cycles and will withstand 57 degree ambient temperature and will be provided with all weather hydraulic fluid. Closer will be equipped with the function of variable back check and delayed action. Closer will be provided with ten years warranty and warranty against leaks.

Closer will be non banded. Closer will be provided with adjustable with speed and hold open facility. Concealed door closer will be completely and components will minimize tempering and vandalism.

1. Size of Units: Unless otherwise indicated, comply with the manufacturer's recommendation for size of door control unit depending on size of door, exposure to weather and drafts, and anticipated frequency of use.
2. Arms: Provide parallel arms for all overhead closers, unless otherwise indicated. Provide closer unit one size larger than recommended for use with standard arms.
3. Closing Cycle: Comply with requirements of authorities having jurisdiction or the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)", whichever are most stringent
4. Opening Force: Comply with the following maximum opening-force requirements for locations indicated:
    a) Exterior Doors: 67 N.
    b) Interior Doors: 22.2N.
5. Construction: Provide marine-grade construction for closers in non-air conditioned areas and in door swimming pool areas, consisting of nonferrous and stainless steel components.

B. **Aluminum Entrance Doors**: Provide concealed door closer. Standards: Comply with the following:
    1. Closers: BHMA A156.4.
    2. Closer Holder Release Devices: BHMA A156.15.

C. **Surface Closers**: BHMA Grade 1.

D. **Concealed Closers**: BHMA Grade 1.

E. **Certified Products**: Provide door closers listed in BHMA's "Directory of Certified Door Closers".

F. **Door Closers on Fire Rated Doors**: Shall be type that closes the door and positively latch the door.

G. **Hold-Open Closers/Detectors**: Coordinate and interface integral smoke detector and closer device with fire alarm system. Fire rated doors with closers of hold open facility shall release automatically in case of fire based on signal from the fire alarm system (electric release door closer). System of release device for double leaf fire rated doors shall be adjustable so as the inactive leaf shall close prior to the active leaf and that active leave shall positively latch to the inactive leaf at final closing position (electric release door closers and door coordinator).

H. **Flush Floor Plates**: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.

I. **Recessed Floor Plates**: Provide recessed floor plates with insert of floor finish material for floor closers, unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.

J. Weather Comply with manufacturer's written recommendation of exposure to weather. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

K. **Grade**: Door closers shall be from types tested for 10 millions cycles of operation and sized for door leafs of minimum weight of 200 kilogram per leaf for both steel doors and external doors.

6.3.2.12 PROTECTIVE TRIM UNITS

A. **Standard**: Comply with BHMA A156.6.

B. **Materials**: Fabricate protection plates from the following to match requirement indicate:

1. Stainless Steel: beveled top and 2 sides.

C. **Protection Plates, General**:

1. Fabricate edge trim of stainless steel to fit door thickness in standard lengths or to match height of protection plates.

D. **Kick Plates**: beveled top and two side edges (B3E). Provide two kick plates for toilet doors. Kick plate will ensure that the door bottom is protected.

1. Metal Plates: Stainless steel, 3.00 mm (2/16") thick

E. **Armor Plates**: 3 mm (2/16") thick, 914 mm (36") high by full width of door less clearance for stops on door frame.

F. **Fasteners**: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

G. Furnish protection plates sized 38 mm (1.5") less than door width on push side and 13 mm (1/2") less than door width on pull side, by height specified in Door Hardware Schedule.

6.3.2.13 STOPS AND HOLDERS

A. **Standards**: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.

2. Mechanical Door Holders: BHMA A156.16.

3. Electromagnetic Door Holders: BHMA A156.15.

4. Combination Overhead Holders and Stops: BHMA A156.8.

5. Door Silencers: BHMA A156.16.

B. **Stops and Bumpers**: BHMA Grade 1.

C. **Mechanical Door Holders**: BHMA Grade 1.

D. **Combination Floor and Wall Stops and Holders**: BHMA Grade 1.

E. **Combination Overhead Stops and Holders**: BHMA Grade 1.

F. **Electromagnetic Door Holders for Labeled Fire Door Assemblies**: Coordinate with fire detectors and interface with fire alarm system.

G. **Floor Stops**: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.

    a) Where floor or wall stops are not appropriate, provide overhead holders.

H. **Silencers for Wood Door Frames**: BHMA Grade 1; neoprene or rubber, minimum 16 by 19 mm; (½" ~ ¾") fabricated for drilled-in application to frame.

I. **Silencers for Metal Door Frames**: BHMA Grade 1; neoprene or rubber, minimum diameter 13 mm; (1/2") fabricated for drilled-in application to frame.

6.3.2.14 DOOR GASKETING

A. **Standard**: Comply with BHMA A156.22.

B. **General**: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide non-corrosive fasteners for exterior applications and elsewhere as indicated.

    1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

    2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

    3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. **Air Leakage**: Not to exceed 0.000774 cu. m/s per m (0.0000209 cft / s per 3'-0") of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

D. **Smoke-Labeled Gasketing**: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

    1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

E. **Fire-Labeled Gasketing**: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252.

F. **Sound-Rated Gasketing**: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

G. **Replaceable Seal Strips**: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

H. **Gasketing Materials**: Comply with ASTM D 2000 and AAMA 701/702.

I. **Weather-stripping and Seal Types**: Unless otherwise indicated, provide the following, or approved equal:

1. Door Shoes: Extruded aluminum, with vinyl seal and integral rain drip.

2. Rain Drips: Extruded aluminum. Unless noted otherwise, provide rain drips for all exterior doors.

3. Automatic Door Bottoms: Extruded aluminum with neoprene insert for doors to achieve STC of 47 or better, as indicated in the hardware schedule.

4. Meeting Stile Seals (Astragal Seals): Extruded anodized aluminum, with silicon seal.

5. Weather-stripping, Smoke Seals, and Sound Retarding Gaskets: Compression-type self-adhesive silicone gasket applied to door stops, white color.

6. Security Astragals: Cam operated automatic security astragal.

6.3.2.15 THRESHOLDS

A. **General**: Unless otherwise indicated, provide standard metal threshold units of type, size, and profile as shown or scheduled. Comply with ANSI/BHMA A156.21.

1. Material: Extruded aluminum, non-slip finish, except as otherwise specified.

2. Exterior Hinged Doors: Provide units not less than 100 mm (4") wide, and not more than 12-mm- (1/2") high, with beveled edges providing a floor level change with a slope of not more than 1:2, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames, and as follows:

a) For in-swinging doors provide units with interlocking lip and interior drain channel; include hook on bottom edge of door and drain pan.

b) For out-swinging doors provide rabbeted type units with replaceable weather-strip insert in stop. Provide threshold with thermal break when mentioned in the hardware schedule

B. **Exterior Thresholds**: ANSI/BHMA A156.21, extruded aluminum. Provide flat saddle type or interlocking type with resilient insert as shown.

C. **Threshold for Aluminum Entrance Doors**: Manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than 12-mm-(1/2") high, with beveled edges providing a floor level change with a slope of not more than 1:2, formed to accommodate change in floor elevation where indicated.

D. **Threshold for Doors with Exit Devices**: Extruded aluminum latching type, with replaceable vinyl inserts.

E. **Interior Thresholds**: Extruded aluminum flat saddle type with smooth surface.

6.3.2.16 MISCELLANEOUS DOOR HARDWARE

A. **Standard**: Comply with the following:

1. Auxiliary Hardware: BHMA A156.16.

2. Exit Alarms: BHMA A156.5.

B. **Auxiliary Hardware**: BHMA Grade 1, unless otherwise indicated.

C. **Boxed Power Supplies**: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.

6.3.2.17 FABRICATION

A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Consultant.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. **Base Metals**: Produce door hardware units of base metal specified, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. **Fasteners**: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for

application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Steel Machine or Wood Screws: For the following fire-rated applications:

   a) Mortise hinges to doors.

   b) Strike plates to frames.

   c) Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:

   a) Surface hinges to doors.

   b) Closers to doors and frames.

   c) Surface-mounted exit devices.

4. Spacers: For through bolting of hollow metal doors.

5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

6.3.2.18 Base Metal

A. Base Metal for hardware and door furniture shall be as follows:

1. Exterior Units: Stainless Steel alloy 316

2. Interior Units: Stainless Steel alloy 304

6.3.2.19 FINISHES

A. **Standard**: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. **Appearance of Finished Work**: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are

acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. **BHMA Designations**: Comply with base material and finish requirements indicated by the following:

1. BHMA 630: Satin stainless steel, over stainless-steel base metal.

EXECUTION

6.3.2.20 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

6.3.2.21 PREPARATION

A. **Steel Doors and Frames**: Comply with DHI A115 series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. **Wood Doors**: Comply with DHI A115-W series.

6.3.2.22 INSTALLATION

A. **Mounting Heights**: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in 9.0 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. **Key Control System:** Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. **Thresholds**: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in 7.0 Section "Joint Sealants."

6.3.2.23 Adjusting

A. **Initial Adjustment**: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 75 mm (3") from the latch, measured to the leading edge of the door.

B. **Six-Month Adjustment**: Approximately six months after date of Substantial Completion, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

2. Consult with and instruct Employer's personnel on recommended maintenance procedures.

3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

6.3.2.24 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

6.3.2.25 DEMONSTRATION

Engage a factory-authorized service representative to train Employer's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

6.4 – GLAZED ALUMINUM CURTAIN WALL

6.4.1. Section Includes:

A. Aluminum framing system.
B. Glass Panels
C. Other accessories including integral fire stops at floor slabs and Perimeter sealant.

6.4.2. REFERENCES

A. AAMA - American Architectural Manufacturer Association

AAMA Metal Curtain Wall, Window, Store Front and Entrance -Guide Specifications Manual
AAMA Aluminum Curtain Wall Design Guide Manual
AAMA Curtain Wall Manual #10 - Care and Handling of Architectural Aluminum from Shop to Site
AAMA Series No. 11 - Design Wind loads for Buildings and Boundary Layer Wind Tunnel Testing
AAMA 501 Methods of Test for Metal Curtain Walls
AAMA 603.8 Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum
AAMA 605.2 Specification for High Performance Organic Coatings on Architectural Extrusions and Panels
AAMA 606.1 Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum
AAMA 607.1 Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum
AAMA 608.1 Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum
AAMA T1R A1 Sound Control for Aluminum Curtain Walls and Windows
AAMA FC-1 Field Check of Metal Curtain Walls for Water Leakage

B. ASTM - American Society of Testing and Materials
ANSI/ASTM A36 Structural Steel
ANSI/ASTM A386 Zinc Coating (Hot Dip) on Assembled Steel Products
ANSI/ASTM A446 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
ANSI/ASTM B209 Aluminum and Aluminum-Alloy Sheet and Plate
ANSI/ASTM B221 Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube
ANSI/ASTM E283 Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors
ANSI/ASTM E330 Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ANSI/ASTM E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ASTM E413 Classification for Determination of Sound Transmission Class
B. SSPC - Steel Structures Painting Council
SP-10 Near-White Blast Cleaning
PS-12.00 Guide for Selecting Zinc-Rich Painting Systems

6.4.3. SYSTEM DESCRIPTION

A. Glazed aluminum curtain wall system includes PVDF3 coated aluminum sections with self-supporting framing, shop fabricated, factory pre-finished, vision double glazing glass, glass spandrel infill; related flashings, anchorage and attachment devices.

6.4.4. 1.04 PERFORMANCE REQUIREMENTS

A. General: Provide glazed aluminum curtain wall system that has the following capabilities based on pre-construction testing:
1. Withstand loads and thermal and structural movement requirements indicated without failure. Failure includes the following:
a. Air infiltration and water penetration not exceeding the specified limits.
b. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.
B. Glazing: Glazing shall be physically and thermally isolated from framing members.
C. System is reglazable from interior, except spandrel glazing are reglazable from exterior.
D. Wind Loads: Provide glazed aluminum curtain wall system, including anchorage, capable of withstanding wind-load inward and outward design pressures calculated according to requirements of the Saudi Code for loading and Saudi Code of Structural Steel works.
E. Design and size components to withstand seismic loads and sway displacement when wind loads effect maximum overturning moment.
F. Limit deflection of framing members in a direction normal to wall plane to 1/175 of clear span or 19 mm whichever is smaller; with full recovery of glazing materials. Where system affects gypsum board or plaster surfaces, limit deflection of framing members in a direction normal to wall plane to 1/360 of clear span or 19 mm maximum, whichever is smaller.
G. System to accommodate, without damage to system, components or deterioration of seals; movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; deflection of structural support framing, shortening of building concrete structural columns, creep of concrete structural members and a mid-span slab edge deflection of 1/175 of clear span, 19 mm maximum.
H. Test Performance: Provide glazed aluminum curtain wall system that does not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E330 and achieving the following:
1. Test Pressure: 150 percent of inward and outward wind-load design pressure.
2. Duration: As required by design wind velocity; fastest 1 mile of wind for relevant exposure category.
I. Average Thermal Conductance: Provide double glazed aluminum curtain wall system with average U-value 2 W/m2C.
J. Sound Attenuation Through Wall system (Exterior to Interior): > STC 37, measured according to ASTM E413.
K. Air infiltration through Assembly: Limit air infiltration to 0.3 L/s/sq. m of fixed wall area when tested according to ANSI/ASTM E283 at a static-air-pressure difference of 299 Pa.
L. Water Leakage: None, when measured in accordance with ASTM E331.

M. System to provide for expansion and contraction within system components caused by a cycling temperature range of 95 degrees C over a 12 hour period without causing detrimental effect to system components.
N. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
O. Maintain system components from dust and moisture during assembly, after transport to site, during and after installation.
P. Reinforce curtain wall system to accommodate window washing guide rails. Provide anchors sufficiently rigid to resist loads caused by equipment platform, without damage to wall system.
Q. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

6.4.5. SUBMITTALS

A. Design calculations by professional engineer
B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.
C. Product Data:
1. Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and water flow diagrams.
2. Product Data: Provide framing member structural and physical characteristics, dimensional limitations, and special installation requirements.
3. Type and properties of glass and method of fixation.
D. Submit 2 samples 300 x 300 mm in size illustrating prefinished aluminum surface, specified glass units, insulated infill panels, glazing materials illustrating edge and corner.
E. Test Reports: Submit substantiating engineering data, test results of previous tests which purport to meet performance criteria, and other supportive data.
F. Manufacturer's Installation Instructions: Indicate special installation procedures, instruction and other recommendations.
G. Properties of PVDF3 finish, indicating durability of coating considering the project site weather.

6.4.6. QUALITY ASSURANCE

A. Drawings and Specifications: Plans, elevations and details as shown on Drawings and the requirements specified in this section, indicate design concept. The approved manufacturer shall be responsible for complete curtain wall system design based on the system performance requirements specified in this section.
B. Applicable Standards: Perform Work in accordance with the following:
1. AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
2. AAMA - Aluminum Curtain Wall Design Guide Manual.

6.4.7. MANUFACTURER AND INSTALLER QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing aluminum curtain wall systems with minimum 10 years documented experience.
B. Installer for Total System: Company authorized by system manufacturer and approved by The Engineer.
C. Design structural support framing components under direct supervision of a Professional Engineer experienced in design of this work.

6.4.8. MOCKUP

A. Provide a floor-to-floor mock-up including intermediate mullion, corner mullion, sill, vision glass light, and infill panel. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.
B. Mockup may not remain as part of the Work.

6.4.9. DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site in strict accordance with manufacturer's instructions.
B. Protect prefinished aluminum surfaces. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

6.4.10.WARRANTY

A. Provide five year for the glazed curtain wall system. Warranty shall include coverage for complete system for failure to meet specified requirements.

PRODUCTS

6.4.11. MATERIALS AND ACCESSORIES

A. Aluminum: Alloy and temper shall be as recommended by manufacturer for type of use and finish indicated and complying with the following requirements:
1. Sheet and Plate: ASTM B209
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221
3. Extruded Structural Pipe and Tube: ASTM B429
4. Welding Rods and Bare Electrodes: AWS A5.10
5. Aluminum Coating PVDF 3.

B. Steel Reinforcement:
1. ASTM A36 for structural shapes, plates and bars.
2. ASTM A611 for cold-rolled sheet and strip.
3. ASTM A570 for hot-rolled sheet and strip.

C. Glazing: Double glazing as specified in item 2.03
D. Glazing Gasket: Manufacturer standard sealed-corner pressure-glazing system of resilient elastomeric glazing gaskets, setting blocks, and shims or spacers; in hardness as recommended by manufacturer.
E. Glazing Sealant: As recommended by manufacturer for the intended application.
F. Fasteners: Stainless steel.

G. Touch-Up Primer for Galvanized Steel Surfaces: Zinc rich type.

6.4.12.COMPONENTS

A. Mullion Profile: Manufacturer standard aluminum extrusions, matching stops and pressure plate of sufficient size and strength to provide bite on glass and infill panels; drainage holes; deflector plates and internal flashings to accommodate internal weep drainage system; internal mullion baffles to eliminate "stack effect" air movement within internal spaces.

B. Reinforced Mullion: Where required, provide profile of extruded or sheet aluminum cladding with internal reinforcement of shaped steel structural section.

C. Operable Windows: Heavy Commercial grade, complying with the requirements specified in of AAMA 101 as well as Section 08520 - ALUMINUM WINDOWS.

D. Infill Panel: Internally reinforced, glazing units, color to match vision glass, structurally sufficient to support wall fin radiation saddles with glass fiber insulation core and aluminum backing.

E. Column Covers: Aluminum with backing, thickness as recommended by manufacturer to ensure flat surface, finish as selected to match curtain wall mullion sections.

F. Flashings: Aluminum, thickness as recommended by manufacturer to ensure flat surface, finish as selected to match curtain wall mullion sections where exposed, secured with concealed fastening method.

G. Louver Screening: Provide bird screen at exhaust and insect screen at intake air louver inside surface.

6.4.13.GLASS AND GLAZING MATERIALS

A. Refer to the requirements in the following table:

Single Glazing :- 6mm

Colour	mm	Blue
Thickness	mm	6
Light Factors		
LT	%	57
LRe	%	6
LRi	%	6
Energy Factors		
T	%	44
Re	%	5
Ri	%	5
A	%	51
Solar factor g		0.57
Shading Coefficient SC		0.65
U-Value	W/(m2.K)	5.7

Double Glazing : 6 (12) 6 mm

External Pane		Blue
Low E coating	Face	3
Light factors		
LT	%	49
LRe	%	8
LRi	%	10
Energy Factors		
T	%	30
Re	%	9
Ri	%	18
A1		56
A2	%	8
Solar factor g		0.40
Shading coefficient SC		0.46
U-value (Air gap)	W/(m2.K)	1.8
STC		≥37

The thickness and gap of glass mentioned above is minimum only. It may vary as indicated in drawings or as directed by Engineer.

6.4.14.SEALANT MATERIALS

A. Sealant and Backing Materials: Comply with the requirements of Section SEALANTS for perimeter sealants.

B. Structural Glazing Sealant: Silicone-based, high performance sealant, type and grade as recommended by manufacturer for the intended application.

6.4.15.FABRICATION

A. Fabricate curtain wall components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors in factory.

D. Arrange fasteners and attachments to ensure concealment from view.

E. Where required, reinforce interior horizontal head rail to receive drapery track brackets and attachments.

F. Reinforce framing members for external imposed loads.

6.4.16.2.06 FINISHES

A. Exposed aluminum surfaces shall have PVDF3 finish.
B. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A386 to 610 gm/sq m).
C. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

EXECUTION

6.4.17.3.01 EXAMINATION

A. Verify site opening conditions.
B. Verify dimensions, tolerances, and method of attachment with other work.
C. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

6.4.18.3.02 INSTALLATION

A. Install curtain wall system in strict accordance with manufacturer's instructions as well as the following standard:
1. AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
2. AAMA - Aluminum Curtain Wall Design Guide Manual.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Provide thermal isolation where components penetrate or disrupt building insulation.
F. Where required, install sill flashings.
G. Coordinate installation of fire and air stop insulation at each floor slab edge.
H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
J. Install operating sash in accordance with Drawings.
K. Install louvers, associated flashings, blank-off plates and screening. Fit blank-off plates tight to ductwork.
L. Install glass and infill panels in accordance with Section 08800 - GLAZING.
M. Install perimeter sealant to method required to achieve performance criteria, backing materials, and installation criteria in accordance with Section 07900 - SEALANTS.

6.4.19.3.03 TOLERANCES

A. Maximum Variation from Plumb: 1.5 mm/m non-cumulative or 12 mm/30 m), whichever is less.
B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 0.8 mm.

6.4.20.3.04 FIELD QUALITY CONTROL

A. Inspection will monitor quality of installation and glazing.
B. Air Infiltration: Test areas of installed system for compliance with system performance requirements according to ASTM E783.
C. Repair or remove defected and damaged work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

6.4.21.3.05 ADJUSTING AND CLEANING

A. Adjust operating sash for smooth operation.
B. Remove protective material from prefinished aluminum surfaces and system components.
C. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
D. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

6.4.22.PROTECTION OF FINISHED WORK

A. After work completion provide final protection and maintain conditions, in a manner acceptable to Manufacturer, Installer and the Engineer, that ensure glazed aluminum curtain wall system is without damage or deterioration at time of Substantial Completion.

END OF SECTION

6.6 - MIRRORS

GENERAL

6.6.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

6.6.2. SUMMARY

A. Section includes the following types of silvered flat glass mirrors:
1. Annealed monolithic glass mirrors.
B. Related Sections include the following:
1. Division 1 Section "Architectural Products Submittals and Substitutions" for requirements regarding submittals and substitutions of architectural products.
2. Division 1 Sections for contractual requirements.
3. Division 10 Section "Toilet and Bath Accessories".

6.6.3. SUBMITTALS

A. Product Data: For each type of product indicated.
1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.
C. Samples: For each type of the following products:
1. Mirrors: 300 mm square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
D. Qualification Data: For qualified Installer.
E. Product Certificates: For each type of mirror and mirror mastic, from manufacturer.
F. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing paint and substrates on which mirrors are installed.
G. Maintenance Data: For mirrors to include in maintenance manuals.
H. Warranty: Sample copy of manufacturer's proposed warranty complying with specified requirements, and stating obligations, remedies, limitations, and exclusions of warranty.

6.6.4. QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.
D. Glazing Publications: Comply with the following published recommendations:

1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
E. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing paint and substrates on which mirrors are installed.

6.6.5. DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

6.6.6. PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

6.6.7. WARRANTY

A. Mirrors Warranty: Provide complete warranty in which Manufacturer, Contractor and
Installer are jointly and severally responsible and agree to repair or replace without limitations, all or any part of the mirrors specified in this section which fails or becomes defective in materials or workmanship within specified warranty period.
1. Defects: Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
1. Warranty Period: Five years from date of Substantial Completion.

PRODUCTS

6.6.8. SILVERED FLAT GLASS MIRRORS

A. Glass Mirrors, General: ASTM C 1503.
Clear Glass: Mirror Glazing Quality.
Nominal Thickness: 6.0 mm.

6.6.9. MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

6.6.10. MIRROR HARDWARE

A. Mirror Bottom Clips: One Piece continuous fixed type 25 mm high brass nickel plated, as shown on detail.
B. Mirror Top Clips: One Piece adjustable type, 30 mm high brass nickel plated with 16 mm counter sunk screw and slot, as shown on detail.
C. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
D. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

6.6.11. FABRICATION

A. Mirror Sizes: To suit Project conditions, cut mirrors to final sizes and shapes.
B. Cutouts: Fabricate cutouts for notches and holes in mirrors without marring visible surfaces.
Locate and size cutouts so they fit closely around penetrations in mirrors.
C. Mirror Edge Treatment: Beveled polished edge of width shown.
1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

EXECUTION

6.6.12. EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

6.6.13. PREPARATION

Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

6.6.14. INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
B. Provide a minimum air space of 3 mm between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
C. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
1. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips where indicated.
2. Install mastic as follows:
a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 3 mm between back of mirrors and mounting surface.

6.6.15. CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
B. Do not permit edges of mirrors to be exposed to standing water.
C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION

6.7 - GLASS AND GLAZING

GENERAL

6.7.1. DESCRIPTION

A. Furnish labor, materials and equipment to supply and install glass in different types of windows and doors.

6.7.2. SUBMITTALS

A. Samples:
1. 300 x 300 mm (12 x 12 IN), of each specified type, class and thickness.
2. Sample of translucent ceramic fit pattern.
B. Project close-out information
1. Guarantee

6.7.3. JOB CONDITIONS

Do not proceed with installation under adverse weather conditions, or when temperature are below or above manufacturer's recommended limitations.

6.7.4. STORAGE AND HANDLING:

A. Store glazing in cases within building in a dry, well-ventilated area to avoid cyclic wetting and drying and damage from moisture.
B. Store glazing out of case vertically with interweaving or pacing between the individual lights
C. Protect glazing from welding operation, wind-blown objects, and run-off over alkaline materials.
D. Handle glazing carefully to prevent edge damage.

6.7.5. GUARANTEE

Written 5 year guarantee singed by installer to cover weather tightness of installation including air and water integrity. Guarantee structural adequacy of units and hardware, sealants and caulking within and around perimeter of installation.

PRODUCTS

6.7.6. MATERIALS

A. Glass materials.
1. Comply with specified standards
2. Manufacturer or fabricator is responsible for determining if any of these materials should be heat strengthened or fully tempered and provide accordingly.

B. Tinted glass for aluminum windows & doors
1. Tinted tempered float glass 6 or 8, 10 or 12 mm thick as produced by Pilkington or similar.
2. The following performance:

a- Visible light transmittance 71%
b- Outdoor reflectance (%) 7%
c- Total solar energy transmittance 33%
d- Shading Coefficient 0.58%

C. Clear glass for windows and doors
1. Clear tempered float glass, 6 mm, 8 mm or 10 mm thick ASTM C1048.
D. Glazing compounds:
1. Non-sag, non-stain type.
2. Pigmented to match frame units not requiring painting.
3. Compatible with adjacent surfaces.
4. For use in setting glass: One part polyurethane or silicone sealant, F.S. TTS-00230C (2), Type II, class A or two-part polyurethane sealant, F.S. TT-S- 00227E, Type II, class A.
5. Sealant tape: Performed butyl 1 rubber sealant tape or ribbon having a continues neoprene rubber shim.
6. Gaskets: Polyvinyl chloride or neoprene, extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.

D. Setting blocks and spacers: Neoprene, compatible with sealants used.
1. Setting blocks: 70 - 90 udometer
2. Spacers: 40-50 udometer
3. Compressible filler stock: closed-cell jacketed rod stock of synthetic rubber or plastic foam.

E. Shims clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.

EXECUTION

6.7.7. INSPECTION

Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be performed.

6.7.8. INSTALLATION

A. Do not install glass with edge damage.
B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.
C. Comply with combined recommendation of material manufacturers, except where more stringent requirements are shown or specified.
D. Install sealants as recommended by sealant manufacturer.
A. E. Install setting blocks in adhesive.
F. Provide spacers inside and out, of proper size and spacing, for all glass sizes larger than 1270 united mm, expect where gaskets are used for glazing. Provide 3.175 mm minimum bite of spacers on glass. Use thickness equal to sealant width. Use preshimmed tape, if tape is used.
G. Miter cut and bond gasket ends together at corner. Do not stretch gaskets.
H. Immediately after installation, attach crossed streamers to framing held away from glass. Do not apply anything to surfaces to glass.
I. Remove, and replace damaged glass and provide new acceptable materials.

6.7.9. CLEANING AND PROTECTION

A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.
B. Wash and polish, glass on both faces not more than 7 days prior to Engineers acceptance of work in each area. Comply with glass manufacturer's recommendation.

END OF SECTION

3. FINISHES

7.1. UNIT PAVERS

GENERAL

7.1.1 RELATED DOCUMENTS

A. Drawing and general provision of the contract, including condition of Contract and other Details.

7.1.2 SUMMARY

A. This Section includes the following:
   1. Concrete pavers set in aggregate setting bed.
B. Related Sections include the following:
   1. 2.0 Section "Earthwork" for compacted sub grade and sub base course, if any, under unit pavers.

7.1.2.1 SUBMITTALS

A. **Product Data**: For the following:
   1. Concrete pavers.
B. **Samples for Initial Selection**: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of unit paver indicated.
   1. Include similar samples of material for joints and accessories involving color selection.
C. **Samples for Verification**: Full-size units of each type of unit paver indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
   1. Provide samples with joints grouted and cured, showing the full range of colors to be expected in the completed Work.
D. **Qualification Data**: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/Consultants and owners, and other information specified.

7.1.2.2 QUALITY ASSURANCE

A. **Installer Qualifications**: An experienced installer who has completed unit paver installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
B. **Source Limitations**: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
C. **Mockups**: Before installing unit pavers, build mockups for each form and pattern of unit pavers required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, special features for expansion joints, and contiguous work as indicated:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by the Consultant.
2. Notify the Consultant 7 days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain the Consultant's approval of mockups before starting unit paver installation.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed.
7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

7.1.2.3 DELIVERY, STORAGE, AND HANDLING

A. Protect unit pavers and aggregate during storage and construction against soiling or contamination from earth and other materials.
    1. Cover pavers with plastic or use other packaging materials that will prevent rust marks from steel strapping.

PRODUCTS

7.1.2.1 COLORS AND TEXTURES

A. **Colors and Textures**: As shown on drawings and as selected by the Consultant from the manufacturer's full range.

7.1.2.2 UNIT PAVERS

A. **Concrete Pavers**: Solid, interlocking paving units, ASTM C 936, made from normal-weight aggregates in sizes and shapes indicated. Interlocking Paving should be installed on 30-50 mm thick sand setting bed over 250 mm thick sub-base. The minimum thickness of concrete pavers shall be 60mm. Concrete pavers shall be tested for compressive strength, abrasion resistance, absorption and dimensional tolerance. The test results shall comply with the requirements specified in ASTM C 936.

7.1.2.3 ACCESSORIES

A. **Precast Concrete Edge Restraints**: Precast concrete curbing, made from normal-weight aggregate, in shapes and sizes indicated.

7.1.2.4 AGGREGATE SETTING-BED MATERIALS

A. **Graded Aggregate for Sub base**: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 57.
B. **Graded Aggregate for Sub base**: ASTM D 2940, sub base material.
C. **Graded Aggregate for Base**: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.
D. **Graded Aggregate for Base**: ASTM D 2940, base material.
E. **Geotextile**: Woven or nonwoven geotextile manufactured from polyester or polypropylene fibers, with a permeability rating 10 times greater than that of

soil on which paving is founded and an apparent opening size small enough to prevent passage of fines from leveling course into graded aggregate of base course below.

F. **Sand for Leveling Course**: Sound, sharp, washed natural sand or crushed stone complying with gradation requirements of ASTM C 33 for fine aggregate.
G. **Stone Screenings for Leveling Course**: Sound stone screenings complying with ASTM D 448 for Size No. 10.
H. **Sand for Joints**: Fine, sharp, washed natural sand or crushed stone with 100 percent passing 1.18 mm sieve and no more than 10 percent passing 0.075 mm sieve.
    1. Provide sand of color needed to produce required joint color.

EXECUTION

7.1.3.1 EXAMINATION

A. Examine areas indicated to receive paving, with the Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
    1. Where pavers are to be installed over waterproofing, examine waterproofing installation, with the waterproofing Installer present, for protection from paving operations. Examine areas where waterproofing system is turned up or flashed against vertical surfaces and horizontal waterproofing. Proceed with installation only after protection is in place.

7.1.3.2 PREPARATION

A. Vacuum clean concrete substrates to remove dirt, dust, debris, and loose particles.
B. Remove substances, from concrete substrates, that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
C. Proof-roll prepared sub grade surface to check for unstable areas and areas requiring additional compaction. Proceed with unit paver installation only after deficient sub grades have been corrected and are ready to receive sub base for unit pavers.

7.1.3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.
B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
    1. For concrete pavers, a block splitter may be used.
D. **Joint Pattern**: Herringbone.
E. **Pavers over Waterproofing**: Exercise care in placing pavers and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Carefully replace

protection materials that become displaced and arrange for repair of damaged waterproofing before covering with paving.

1. Provide joint filler, at waterproofing that is turned up on vertical surfaces; or, if not indicated, provide temporary filler or protection until paver installation is complete.

F. Tolerances: Do not exceed 0.8 mm unit-to-unit offset from flush (lippage) nor 3 mm in 3 m from level, or indicated slope, for finished surface of paving.

7.1.3.4 AGGREGATE SETTING-BED PAVER APPLICATIONS

A. Compact soil sub grade uniformly to at least 95 percent of ASTM D 1557 laboratory density.
B. Place geotextile over prepared sub grade, overlapping ends and edges at least 300 mm.
C. Place aggregate sub base in thickness indicated. Compact by tamping with plate vibrator and screed to depth required to allow setting of pavers.
D. Place aggregate sub base over compacted sub grade. Provide compacted thickness indicated. Compact sub base to 100 percent of ASTM D 1557 maximum laboratory density and screed to depth required to allow setting of pavers.
E. Place geotextile over compacted base course, overlapping ends and edges at least 300 mm.
F. Place leveling course and screed to a thickness of 25 to 38 mm, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.
G. Treat leveling base with soil sterilizer to inhibit growth of grass and weeds.
H. Set pavers with a minimum joint width of 1.6 mm and a maximum of 3 mm, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 10 mm with pieces cut to fit from full-size unit pavers.
    1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
I. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 16- to 22 kN compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
    1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
    2. Before ending each day's work, fully compact installed concrete pavers to within 900 mm of the laying face. Cover open layers with non-staining plastic sheets overlapped 1200 mm on each side of the laying face to protect it from rain.
J. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
K. Do not allow traffic on installed pavers until sand has been vibrated into joints.
L. Repeat joint-filling process 30 days later.

7.1.3.5 REPAIR

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

7.2. GYPSUM BOARD ASSEMBLIES

GENERAL

7.2.1. RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including general and supplementary Conditions.

7.2.2. SUMMARY

A. This Section includes the following:
   1. Suspended gypsum board ceilings.
   2. Gypsum board walls and partitions.
   3. Recessed Lighting enclosure.
   4. Partition Closers.
   5. Framed steelwork encasement.

B. **Related Sections**: The following Sections contain requirements that relate to this Section:
   1. 5.0 Section" Metal Fabrication".
   2. 6.0 Section "Rough Carpentry" for wood framing and furring, and gypsum sheathing applied over wood framing.
   3. 5.0 Section "Custom Steel Doors and Frames" for steel door to be installed in gypsum board walls or partitions.

7.2.3. DEFINITIONS

A. **Gypsum Board Construction Terminology**: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

7.2.4. ASSEMBLY PERFORMANCE REQUIREMENTS

A. **Fire Resistance Characteristics**: Provide interior gypsum board assemblies with fire-resistance ratings indicated.

7.2.5. SUBMITTALS

A. **Product Data**: For each type of product specified.
B. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of Consultants and Employers, and other any information required by the Consultant.
C. **Shop Drawings**: Showing locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
D. **Samples**: For the following products:
   1. Trim Accessories: Full-size sample in 300-mm-(12") long length for each trim accessory indicated.
   2. Access panel framing and hardware

E. **Product Certificates**: Signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.
F. **Installer Certificates**: Signed by the product manufacturer certifying that the Installer is approved, authorized, or licensed by the manufacturer to install his products.
G. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product endorsed by the manufacturer's representative.

7.2.6. QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
B. **Installer Qualifications**: A qualified firm specializing in performing the work of this Section with minimum three years documented experience and that is approved, authorized, or licensed by the product manufacturer to install his product and that is eligible to receive manufacturer's warranty. Include project names and addresses, names and addresses of Consultants and Employers, and other information specified
C. **Single-Source Responsibility for Gypsum Boards and Steel Framing**: Obtain each type of gypsum board and other panel products and steel framing from a single manufacturer.
D. **Single-Source Responsibility for Finishing Materials**: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable t the gypsum board manufacturer.
E. **Fire-Test-Response Characteristics**: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:
    1. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E 119 or BS 476 Part 20-24by an independent testing and inspecting agency acceptable to the Consultant.
    2. Deflection and Firestop Track: Top runner provided in fire-resistance-rated assemblies indicated is labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to the Consultant.
F. **Mockups**: Prior to finishing gypsum board assemblies, construct mockups of at least 9 sq. m in surface area to demonstrate aesthetic effects of finishes as well as qualities of materials and execution. Simulate finished lighting conditions for review of in-place unit of Work.
        1. Construct mockups for each of the following applications:
            a) Ceiling surfaces indicated to receive emulsion paint finishes.
        2. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
            a) Locate mockups on site in the location and of the size indicated or, if not indicated, as directed by the Consultant.
            b) Notify the Consultant one week in advance of the dates and times when mockups will be constructed.
            c) Demonstrate the proposed range of aesthetic effects and workmanship.
            d) Obtain the Consultant's approval of mockups before start of final unit of Work.

e) Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
f) Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

7.2.7. Delivery, storage and handling

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.
C. Handle steel framing materials in a manner not to cause bending or denting of sections.

7.2.8. PROJECT CONDITIONS

A. **Environmental Conditions, General**: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.
B. **Room Temperatures**: Maintain room temperature at not less than 4 deg. C.
C. **Ventilation**: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PRODUCTS

7.2.9. STEEL FRAMING COMPONENTS FOR SUSPENDED CEILINGS

A. **General**: Provide components complying with ASTM C 754 for conditions indicated.
B. **Post-installed Anchors in Concrete**: Anchors of type indicated below, fabricated from corrosion-resistant materials, with holes or loops for attaching hanger wires, and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing according to ASTM E 488 conducted by a qualified independent testing agency.
    1. Expansion anchor.
C. **Wire Ties**: ASTM A 641M, Class 1 zinc coating, soft temper, 1.6 mm thick.
D. **Hanger Rods**: Mild steel and zinc coated or protected with rust-inhibitive paint.
E. **Flat Hangers**: Mild steel and zinc coated or protected with rust-inhibitive paint.
F. **Angle-Type Hangers**: Angles with legs not less than 22.2 mm (3/4") wide, formed from 1.6-mm- (2/32") thick galvanized steel sheet complying with ASTM A 653M, Z 180 coating designation, with bolted connections and 8 mm (1/2") diameter bolts.
G. **Channels**: Cold-rolled steel, 1.5 mm (2/32") minimum thickness of base (uncoated) metal and 11.1 mm wide flanges, and as follows:
    1. Carrying Channels: 38 mm (1.5") deep, 70 kg/100 m (70 kg/328 Rft), unless otherwise indicated.
    2. Furring Channels: 19 mm (3/4") deep, 45 kg/100 m (45 kg/328 Rft), unless otherwise indicated.

3. Finish: ASTM A 653M, Z 180 hot-dip galvanized coating.

7.2.10. STEEL FRAMING FOR WALLS AND PARTITIONS

A. **General**: Provide steel framing members complying with the following requirements:
   1. Protective Coating: ASTM A 653M, Z180 hot-dip galvanized corrosion resistant coating.

B. **Steel Studs and Runners**: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 5 mm (1/4") wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
   1. Thickness: 0.84 mm (1/32") as follows:
      a) For head runner, sill runner, jamb, and cripple studs at door and other openings.
      b) Where indicated.
   2. Depth: As required to obtain thickness indicated on Drawings.

C. **Deflection Track**: Manufacturer's standard top runner designed to prevent cracking of gypsum board applied to interior partitions resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A 653M or ASTM A 568M. Thickness as indicated for studs, and width to accommodated depth of studs, and of the following configuration:
   1. Top Runner with Compressible Flanges: 64 mm (2.5") deep flanges with V-shaped offsets that compress when pressure is applied from construction above.
   2. Top Runner with Slotted Flanges: 64 mm (2.5") deep flanges with slots 25 mm (1") o.c.
   3. Top runner with 64 mm (2.5") deep flanges that either have V-shaped offsets that compress when pressure is applied from construction above or have slots 25 mm (1") o.c. that allow fasteners attached to studs through the slots to accommodate structural movement by slipping.

D. **Deflection and Firestop Track for Fire Rated Assemblies**: Top runner designed to allow partition heads to expand and contract with movement of structure above while maintaining continuity of the assembly. Comply with requirements of ASTM C 645 except configuration, of thickness indicated for studs and width to accommodate depth of studs indicated with flanges offset at midpoint to accommodate gypsum board thickness.
   1. Offset Configuration: Shadow-line design with offset projecting out from depth of stud.
   2. Offset Configuration: Reveal design with offset recessing in from depth of stud.

E. **Steel Rigid Furring Channels**: ASTM C 645, hat shaped, depth and minimum thickness of base (uncoated) metal as follows:
   1. Thickness: 0.84 mm (1/32") , unless otherwise indicated.
   2. Depth: 22.2 mm (1").

F. **Furring Brackets**: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, minimum thickness of base (uncoated) metal of 0.84 mm (1/32"), designed for screw attachment to steel studs and steel rigid furring channels used for furring.

G. **Steel Resilient Furring Channels**: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet complying with ASTM A 653M or ASTM A 568M to form 13 mm (1/2") deep channel of the following configuration:
   1. Single-Leg Configuration: Asymmetric-shaped channel with face connected to a single flange by a single-slotted leg (web).
   2. Double-Leg Configuration: Hat-shaped channel with 38 mm (1.5") wide face connected to flanges by double-slotted or expanded-metal legs (webs).

H. **Z-Furring Members**: Manufacturer's standard Z-shaped furring members with slotted or nonslotted web, fabricated from steel sheet complying with ASTM A 653M or ASTM A 568M; with a minimum base metal (uncoated) thickness of 0.45 mm, face flange of 31.8 mm, wall-attachment flange of 22.2 mm, (1") and of depth required to fit insulation thickness indicated.

I. **Steel Channel Bridging**: Cold-rolled steel, 1.5 mm (1/16") minimum thickness of base (uncoated) metal and 11.1 mm wide flanges, 38 mm (1.5") deep, 45 kg/100 m, (45 kg / 328 Rft.) unless otherwise indicated.

J. **Steel Flat Strap and Backing Plate**: Steel sheet for blocking and bracing complying with ASTM A 653M or ASTM A 568M, length and width as indicated, and with a minimum base metal (uncoated) thickness as follows:
   1. Thickness: 1.5 mm (1/16") where indicated.

7.2.2.1 **Fasteners for Metal Framing**: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

7.2.11. GYPSUM BOARD PRODUCTS

A. **General**: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.
   1. Widths: Provide gypsum board in widths of 1200 mm (48").
   2. Composition: The mix for manufacture of gypsum boards shall incorporate reinforcing noncombustible glass fibers.

B. **Gypsum Wallboard**: ASTM C 36 and as follows:
   1. Type: Regular, unless otherwise indicated for lining.
   2. Type: Type X where required for fire-resistance-rated assemblies.
   3. Type: Sag-resistant type for ceiling surfaces.
   4. Edges: Tapered.
   5. Thickness: 13 mm, (1/2") unless otherwise indicated and unless higher thickness is recommended by manufacturer to obtain fire performance rating specified.

C. **Water-Resistant Gypsum Backing Board**: ASTM C 630 and as follows:
   1. Type: Regular, unless otherwise indicated.
   2. Type: Type X where required for fire-resistance-rated assemblies and where indicated.
   3. Type: Sag-resistant type for ceiling surfaces.

4. Thickness: 13 mm, (1/2") unless otherwise indicated and unless higher thickness is recommended by manufacturer to obtain fire performance rating specified.
5. Use for application in wet areas and where indicated on Drawings or specified.

7.2.12. TRIM ACCESSORIES

A. **Accessories for Interior Installation**: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:
   1. Material: Formed metal or plastic, with metal complying with the following requirement:
      a) Steel sheet zinc coated by hot-dip, G60 (Z180) coating intensity.
   2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:
      a) Cornerbead on outside corners, unless otherwise indicated.
      b) LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.
      c) L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
      d) U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
      e) One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

7.2.13. JOINT TREATMENT MATERIALS

A. **General**: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
B. **Joint Tape for Gypsum Board**: Use open-weave, glass-fiber reinforcing tape, 50 mm (2") wide with compatible joint compound where recommended by the manufacturer of gypsum board and joint treatment materials for application indicated.
C. **Drying-Type Joint Compounds for Gypsum Board**: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
   1. Ready-Mixed Formulation: Factory-mixed product.
      a) All-purpose compound formulated for both taping and topping compounds.

7.2.14. ACOUSTICAL SEALANT

A. **Acoustical Sealant for Exposed and Concealed Joints**: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:
   1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

B. **Acoustical Sealant for Concealed Joints**: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

7.2.15. MISCELLANEOUS MATERIALS

A. **General**: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

B. Steel drill screws complying with ASTM C 1002 for the following applications:
   1. Fastening gypsum board to steel members less than 0.84 mm thick.

C. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.84 to 2.84 mm (1/32" to 4/32") thick.

D. Steel drill screws of size and type recommended by unit manufacturer for fastening cementations boards.

E. **Foam Gaskets**: Closed-cell vinyl foam adhesive-backed strips that allow fastener penetration without foam displacement, 3.2 mm (2/16") thick, in width to suit metal stud size indicated.

F. **Sound-Attenuation Blankets**: Un-faced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).
   1. Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
   2. Blanket is to be 40 mm (1.5") thick, 60 kg/m3 (60 kg/35.28 cft) intensity, minimum.
   3. Where ceiling plenum is used for air condition return, use sound blanket with foil scrim facing and set with facing at upper side in the as-installed position.

G. **Core Material**: Material indicated below, of thickness and width to fill inner cavity of gypsum board wall or partition.
   1. Un-faced Mineral-Fiber Blanket Insulation: Un-faced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).
      a) Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
      b) Intensity: As recommended by manufacturer to attain performance specified.
   2. Manufacturer's standard pre-packed mineral fiber insulation quilts to be snugly fitted in vertical studs.
      a) Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
      b) Intensity: As recommended by manufacturer to attain performance specified.

H. **Vapor Retarder Tape**: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder. Use at warm side of open-to-air assemblies.

7.2.16. RECESSED LIGHTING ENCLOSURE

A. Shall be constructed from 13.00 mm (1/2") thick plasterboards, moisture-resistant type, fixed to galvanized steel furring channels not less than 0.84 mm (1/32") thick with galvanized steel plasterboard screws

B. Lighting Enclosure shall also comprise stainless steel, alloy 304, grille of polished mirror finish loosely laid on stainless steel T-section supports of material and finish matching that of the adjoining suspended ceiling. Comply with applicable requirements of 5.0 Section "Metal Fabrications" for manufacture of grilles.
C. Inner surfaces of plasterboards are to receive smooth acrylic emulsion paint finish of White color, as specified in 9.0, Section "Painting".

7.2.17. PARTITIONS CLOSERS

A. **Partition Closers**: Are nonload-bearing gypsum boards short solid partitions used to close the gabs between masonry walls and partitions and aluminum used in building elevations.
B. **Fire Rating**: Partition closer is to be of the same fire resisting rating as of the masonry wall or partition to which it is fixed.

7.2.18. FRAMED STEELWORK ENCASEMENT

A. **System**:

1. Fire rated gypsum boards as specified fixed to lightweight framework connected to structural steel work with manufacturer's standard clips.

2. Manufacturer's standard patent system that is tested and list for fire protection ratings indicated on Drawings and recommended by manufacturers for steel sections and applications indicated.
3. **Framework**: Fabricated from galvanized steel sheets, not less than 180 gm/m2 zinc coating intensity. Clips and fasteners or anchors are to be from galvanized steel of same minimum zinc coating intensity.
4. **Joints**: Tape and finish using manufacture's jointing compounds used in laboratory fire testing of the system.
5. Where necessary, use moisture resistant fire rated gypsum boards.
6. **Fire Protections Rating**: As indicated on Fire Drawings.
7. Use of Frameless steelwork encasement is not acceptable.

EXECUTION

7.2.19. EXAMINATION

Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with the Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

7.2.20. PREPARATION

A. **Ceiling Anchorages**: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.
B. Before sprayed-on fireproofing is applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fireproofing.

Where offset anchor plates are required, provide continuous units fastened to building structure not more than 600 mm (24") o.c.

C. After sprayed-on fireproofing has been applied, remove only as much fireproofing as needed to complete installation of gypsum board assemblies without reducing thickness of fireproofing below that is required to obtain fire-resistance rating indicated. Protect remaining fireproofing from damage.

7.2.21. INSTALLING STEEL FRAMING, GENERAL

A. **Steel Framing Installation Standard**: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co.'s "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
   1. Where building structure abuts ceiling perimeter or penetrates ceiling.
   2. Where lining abut structure, except at floor.
      a) Provide cushioned-type joints as detailed to attain lateral support and avoid axial loading.
   3. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

7.2.22. INSTALLING STEEL FRAMING FOR SUSPENDED CEILINGS

A. Suspend ceiling hangers from building structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacing's that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
   3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
   4. Secure flat, angle, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye-screws, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or otherwise fail.

5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Sway-brace suspended steel framing with hangers used for support.
C. Install suspended steel framing components in sizes and at spacing's recommended by manufacturer, but not less than that required by the referenced steel framing installation standard.
   1. Wire Hangers: 1200 mm (48") o.c.
   2. Carrying Channels (Main Runners): 1200 mm (48") o.c.
   3. Furring Channels (Furring Members): 400 mm (16") o.c.
D. **Installation Tolerances**: Install steel framing components for suspended ceilings so that cross-furring or grid suspension members are level to within 3 mm (2/16") in 3.6 m (12'-0") as measured both lengthwise on each member and transversely between parallel members.
E. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

7.2.23. INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
   1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.
   2. Additional Runners and Furring: Where fittings, equipment or accessories are to be hung to gypsum board walls or partitions, provide additional runners or furring of suitable section and wall thickness installed at locations so as to receive fasteners of fittings, equipment or accessories. Coordinate with Drawings or shop drawings indicating work items to be hung to gypsum board walls or partitions.
B. **Installation Tolerances**: Install each steel framing and furring member so that fastening surfaces do not vary more than 3 mm (2/16") from the plane formed by the faces of adjacent framing.
C. Extend partition framing full height from structural floors to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
   1. Cut studs 13 mm (2/16") short of full height to provide perimeter relief.
   2. For fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.
D. Install steel studs and furring in sizes and at spacing's indicated.
   1. Single-Layer Construction: Space studs 400 mm (16") o.c., unless otherwise indicated.
   2. Multilayer Construction: Space studs 600 mm (24") o.c., unless otherwise indicated.

E. Install steel studs so that flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.
F. Frame door openings to comply with GA-219, and with applicable published recommendations of the gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    1. Install 2 studs at each jamb, unless otherwise indicated.
    2. Install cripple studs at head adjacent to each jamb stud, with a minimum 13 mm (1/2") clearance from jamb stud to allow for installation of control joint.
    3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
G. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.
H. Install insulation to manufacturer's standard details approved by the Consultant.
I. Install polyethylene vapor retarder where indicated to comply with the following requirements:
    1. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with mechanical fasteners or adhesives. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose mineral-fiber insulation.
    2. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end, and bottom edges, at perimeter of wall openings, and at lap joints; space fasteners 400 mm (16") o.c.
    3. Seal joints in vapor retarders caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor retarder tape.
    4. Repair any tears or punctures in vapor retarder immediately before concealing it with the installation of gypsum board or other construction.

7.2.24. APPLYING AND FINISHING GYPSUM BOARD, GENERAL

A. **Gypsum Board Application and Finishing Standards**: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

B. Install sound-attenuation blankets, where indicated, prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panel's not less than one framing member.

D. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1.5 mm of open space between panels. Do not force into place.

E. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Avoid joints other than control joints at corners of framed openings where possible.

F. Attach gypsum panels to steel studs so that leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Form control and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.

I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases that are braced internally.

   1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 0.7 sq. m (7.50 Sft) in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 6.5 to 9.5 mm wide joints to install sealant.

J. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 6.5 to 13 mm (1/4" ~ ½") wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

   1. Space screws a maximum of 300 mm (12") o.c. for vertical applications.
   2. Space screws a maximum of 200 mm (8") o.c. for ceilings.

L. Space fasteners in panels that are tile substrates a maximum of 200 mm (8") o.c.

7.2.25. GYPSUM BOARD APPLICATION METHODS

A. **Single-Layer Application**: Install gypsum wallboard panels as follows:

   1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, unless otherwise indicated, and provide panel lengths that will minimize end joints.

3. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless parallel application is required for fire-resistance-rated assemblies. Use maximum-length panels to minimize end joints.
    a) Stagger abutting end joints not less than one framing member in alternate courses of board.
    b) At stairwells and other high walls, install panels horizontally.

B. **Multilayer Application on Partitions/Walls**: Apply gypsum board indicated for base layers and gypsum wallboard face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints. Stagger joints on opposite sides of partitions.
    1. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

C. **Single-Layer Fastening Methods**: Apply gypsum panels to supports as follows:
    1. Fasten with screws.

7.2.26. INSTALLING TRIM ACCESSORIES

A. **General**: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install corner-bead at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
    1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
    2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
    3. Install U-bead where indicated.
    4. Install aluminum trim and other accessories where indicated.

D. Install control joints at locations indicated.

E. Install control joints according to ASTM C 840 and manufacturer's recommendations and in specific locations approved by the Consultant for visual effect.

7.2.27. FINISHING GYPSUM BOARD ASSEMBLIES

A. **General**: Treat gypsum board joints, interior angles, and flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

B. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.

C. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by the trim accessory manufacturer.

D. **Levels of Gypsum Board Finish**: Provide the following levels of gypsum board finish per GA-214.

1. Level 5.

E. Use one of the following joint compound combinations as applicable to the finish levels specified.

F. Where Level 5 gypsum board finish is indicated, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories; and apply a thin, uniform skim coat of joint compound over entire surface. For skim coat, use joint compound specified for third coat, or a product specially formulated for this purpose and acceptable to the gypsum board manufacturer. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects, tool marks, and ridges and ready for decoration.

7.2.3.1 FIELD QUALITY CONTROL

A. **Above-Ceiling Observation**: The Consultant will conduct an above-ceiling observation prior to installation of gypsum board ceilings and report any deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify the Consultant one week in advance of the date and the time when the Project, or part of the Project, will be ready for an above-ceiling observation.
2. Prior to notifying the Consultant, complete the following in areas to receive gypsum board ceilings:
   a) Installation of 80 percent of lighting fixtures, powered for operation.
   b) Installation, insulation, and leak and pressure testing of water piping systems.
   c) Installation of air duct systems.
   d) Installation of air devices.
   e) Installation of mechanical system control air tubing.
   f) Installation of ceiling support framing.

7.2.3.2 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to the Installer, that ensure that gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

SECTION 3

7.3 PORTLAND CEMENT PLASTER

PART 5 - GENERAL

7.3.1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including general and supplementary conditions.

7.3.1.2 SUMMARY

A. This Section includes the following:
   1. Portland cement plaster.
   2. Metal Lath suspended ceiling.
B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. 6.0 Section "Rough Carpentry".
   2. 9.0 Section "Ceramic Tiles" for plaster base coat to be applied to receive ceramic wall tiles.

7.3.1.3 SUBMITTALS

A. **Product Data**: For each product specified.
B. **Samples for Initial Selection**: manufacturer's color charts consisting of actual units or sections of units at least 300 mm (12") square showing the full range of colors, textures, and patterns available for each type of finish indicated.
   1. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.
   2. Include similar Samples of material for joints and accessories involving color selection.
C. **Shop Drawings:** Submit shop drawings for suspended metal lath ceilings including layout and details of ceilings installation
D. **Material Certificates**: certificate signed by manufacturer for each kind of plaster aggregate certifying that materials comply with requirements.

7.3.1.4 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
B. **Mockups**: Prior to installing plaster work, construct panels for each type of finish and application required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
   1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Consultant.
   2. Erect mockups 1200 by 1200 mm (48" x 48") by full thickness in presence of Consultant using materials, including lath, support system, and control joints, indicated for final Work.

3. Notify Consultant 7 days in advance of the dates and times when mockups will be constructed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Consultant's approval of mockups before start of plaster Work.
6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Portland cement plaster Work.
7. When directed demolish mockups, remove rubbles from site and replace with permanent works.

7.3.1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver cementations materials to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.
B. Store materials indoor, under cover, and dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

7.3.1.6 PROJECT CONDITIONS

A. **Environmental Requirements, General**: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.
B. **Warm-Weather Requirements**: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.
C. **Exterior Plaster Work**: Do not apply plaster when ambient temperature is below 4 deg C.
D. **Interior Plaster Work**: Maintain at least 10 deg C temperatures in areas to be plastered for at least 48 hours before, during, and after application.
E. **Ventilation**: Provide natural or mechanical means of ventilation to properly dry interior spaces after Portland cement plaster has cured.
F. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and other provisions necessary to minimize harmful spattering of plaster on other work.

PART 6 - PRODUCTS

7.3.2.1 METAL SUPPORTS FOR SUSPENDED CEILINGS

A. **General**: Size metal ceiling supports to comply with ASTM C 1063, unless otherwise indicated.
B. **Post installed Anchors in Concrete**: Anchors of type indicated below, fabricated from corrosion-resistant materials, with holes or loops for attaching hanger wires; and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing according to ASTM E 488 conducted by a qualified independent testing agency.
   1. Chemical anchor.
C. **Wire for Hangers and Ties**: ASTM A 641M, Class 1 zinc coating, soft temper.

D. **Rod Hangers**: Mild steel, zinc coated.
E. **Flat Hangers**: Mild steel, zinc coated or protected with rust-inhibitive paint.
F. **Channels**: Cold-rolled steel, minimum 1.5-mm- (1/16") thick base (uncoated) metal and 11.1-mm- wide flanges, and as follows:
   1. Carrying Channels: Based on design calculations but not less than 38 mm (1.5") deep, 0.7 kg/m.
G. **Finish**: ASTM A 653M, Z180 hot-dip galvanized coating for framing where indicated.

7.3.2.2 LATH

A. **Expanded-Metal Lath**: Comply with ASTM C 847 for material, type, configuration, and other characteristics indicated below.
   1. Material: Fabricate expanded-metal lath from sheet metal conforming to the following:
      a) Galvanized Steel: Structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653M, Z275 minimum coating designation, unless otherwise indicated.
      b) Form: Coil.
      c) Special Pieces: For internal corners.
   2. Diamond-Mesh Lath for Plaster Background: Comply with the following requirements:

      a) Configuration: Flat.

         i) Weight: 1.1 kg/sq. m.
   3. Rib Lath for Suspended Ceilings: Comply with the following requirements:
      a) Configuration: Flat, rib depth of not over 3 mm (2/16").
         i) Weight: 1.8 kg/sq. m.

7.3.2.3 ACCESSORIES

A. **General**: Comply with material provisions of ASTM C 1063 and the requirements indicated below; coordinate depth of accessories with thicknesses and number of plaster coats required.
   1. Galvanized Steel Components (for internal plaster): Fabricated from zinc-coated (galvanized) steel sheet complying with ASTM A 653M, Z90 minimum coating designation.
B. **Metal Corner Reinforcement**: Expanded, large-mesh, diamond-metal lath fabricated from zinc-alloy or welded-wire mesh fabricated from 1.2-mm-diameter, zinc-coated (galvanized) wire and specially formed to reinforce external corners of Portland cement plaster on exterior exposures while allowing full plaster encasement.
C. **Cornerbeads**: Small nose cornerbeads fabricated from the following metal, with expanded flanges of large-mesh diamond-metal lath allowing full plaster encasement.
D. **Casing Beads**: Square-edged style, with expanded flanges.
E. **Curved Casing Beads**: Square-edged style, fabricated from aluminum coated with clear plastic, preformed into curve of radius indicated.
F. **Control Joints**: Prefabricated, of material and type indicated below:
   1. One-Piece Type: Folded pair of non-perforated screeds in M-shaped configuration, with expanded or perforated flanges.

2. Two-Piece Type: Pair of casing beads with back flanges formed to provide slip-joint action, adjustable for joint widths from 3 to 16 mm (2/16" to 3/4").

   a) Provide removable protective tape on plaster face of control joints.

G. **Foundation Sill (Weep) Screed**: Manufacturer's standard profile designed for use at sill plate line to form plaster stop and prevent plaster from contacting damp earth, fabricated from zinc-coated (galvanized) steel sheet.
H. **Lath Attachment Devices**: Material and type required by ASTM C 1063 for installations indicated.

7.3.2.4 PLASTER MATERIALS

A. **Base-Coat Cements**: Type as indicated below:
   1. Portland cement, ASTM C 150, Type I.
B. Job-Mixed Finish-Coat Cement: Material and color as indicated below:
   1. Portland cement: sand aerated mix
C. **Cement Color**: Gray.
D. Lime: do not use lime.
E. **Plasticizer**: ASTM C260.
F. **Sand Aggregate for Base Coats**: ASTM C 897.
G. **Aggregate for Finish Coats**: ASTM C 897 system and as indicated below:
   1. Manufactured or natural sand, White in color.

7.3.2.5 MISCELLANEOUS MATERIALS

A. **Fiber for Base Coat**: Alkaline-resistant glass or polypropylene fibers, 13 mm long, free of contaminates, manufactured for use in Portland cement plaster.
B. **Water for Mixing and Finishing Plaster**: Potable.
C. **Acid-Etching Solution**: Muriatic acid (10 percent solution of commercial hydrochloric acid) mixed 1 part to not less than 6 nor more than 10 parts water.
D. **Dash-Coat Material**: 2 parts Portland cement to 3 parts fine sand, mixed with water to a mushy-paste consistency.

7.3.2.6 PLASTER MIXES AND COMPOSITIONS

A. **General**: Comply with ASTM C 926 for base- and finish-coat mixes as applicable to plaster bases, materials, and other requirements indicated. Do not use lime in plaster mixes.
B. **Base-Coat Mixes and Compositions**: Proportion materials for respective base coats in parts by volume per sum of cementations materials for aggregates to comply with the following requirements for each method of application and plaster base indicated. Adjust mix proportions below within limits specified to attain workability.
C. **Fiber Content**: Add fiber to following mixes after ingredients have mixed at least 2 minutes. Comply with fiber manufacturer's written instructions but do not exceed 16 kg/cu. m (1/2 kg/cft) of cementations materials. Reduce aggregate quantities accordingly to maintain workability.
D. **Three-Coat Work over Metal Lath**: Base-coat proportions as indicated below:
   1. Scratch Coat: 1 part Portland cement, 2-1/2 to 4 parts aggregate.
   2. Brown Coat: 1 part Portland cement, 3 to 5 parts aggregate.
   3. Admixtures and workability aids, as per manufacturer's printed instructions

E. **Two-Coat Work over Concrete and Concrete Unit Masonry**: Base-coat proportions as indicated below:
   1. Base Coat: 1 part Portland cement, 5 parts aggregate, aerating plasticizer as per manufacturer's recommendation.

F. **Job-Mixed Finish Coats**: Proportion materials for finish coats in parts by volume for cementations materials and parts by volume per sum of cementations materials to comply with the following requirements:
   1. Proportions using sand aggregates as indicated below:
      a) 1 part Portland cement, 4 parts aggregate, aerating plasticizer as per manufacturer's recommendation.

7.3.2.7 MIXING

A. Mechanically mix cementations and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 7 - EXECUTION

7.3.3.1 INSTALLATION OF CEILING SUSPENSION SYSTEMS

A. **Preparation and Coordination**: Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure inserts and other structural anchorage provisions have been installed to receive ceiling hangers in a manner that will develop their full strength and at spacing's required to support ceiling.

B. **Hanger Installation**: Attach hangers to structure above ceiling to comply with ML/SFA 920, "Guide Specifications for Metal Lathing and Furring," and with referenced standards.

C. Install ceiling suspension system components of sizes and spacing's indicated, but not in smaller sizes or greater spacing's than those required by referenced lathing and furring installation standards.
   1. Wire Hangers: Space 4-mm- (3/16") diameter wire hanger's not over 1200 mm (48") o.c., parallel with and not over 900 mm (36") perpendicular to direction of carrying channels, unless otherwise indicated, and within 150 mm (6") of carrying channel ends.
   2. Carrying Channels: Space carrying channels not over 900 mm (36") o.c. with 1200-mm (48") o.c. hanger spacing.
   3. Furring Channels to Receive Metal Lath: Space furring channels not over 500 mm (20") o.c. for 1.8-kg/sq. m (16 kg / sft) flat rib lath.

7.3.3.2 PREPARATIONS FOR PLASTERING

A. Clean plaster bases and substrates for direct application of plaster, removing loose material and substances that may impair the Work.

B. Etch concrete and concrete unit masonry surfaces indicated for direct plaster application. Scrub with acid-etching solution on previously wetted surface and rinse thoroughly with clean water. Repeat application, if necessary, to obtain adequate suction and mechanical bond of plaster (where dash coat, bonding agent, or additive is not used).

C. **Dissimilar Backgrounds**: where rendering is to be continued without break across joints between dissimilar solid backgrounds which are in the same plane

and rigidly bonded or tied together, cover joints with 150mm (6") wide strip of building paper overlaid with 300mm (12") wide galvanized steel lathing fixed with corrosion resistant fasteners at not more than 600mm (24") centers along both edges.

D. Apply dash coat on concrete and concrete masonry surfaces indicated for direct plaster application. Moist-cure dash coat for at least 24 hours after application and before plastering.
E. Install temporary grounds and screeds to ensure accurate rodding of plaster to true surfaces; coordinate with scratch-coat work.
F. Refer to 6.0 Sections for installing permanent wood grounds, if any.
G. **Surface Conditioning**: Immediately before plastering, dampen concrete and concrete unit masonry surfaces that are indicated for direct plaster application. Determine and apply amount of moisture and degree of saturation that will result in optimum suction for plastering.

7.3.3.3 LATHING

A. Install metal lath for the following applications where plaster base coats are required. Provide appropriate type, configuration, and weight of metal lath selected from materials indicated that comply with referenced ML/SFA specifications and ASTM lathing installation standards.
   1. Dissimilar Backgrounds: where rendering is to be continued without break across joints between dissimilar solid backgrounds which are in the same plane and rigidly bonded or tied together, cover joints with 150 mm (6") wide strip of building paper overlaid with 300 mm (12") wide galvanized steel lathing fixed at not more than 600 mm (24") centers along both edges.

7.3.3.4 INSTALLATION OF PLASTERING ACCESSORIES

A. **General**: Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and in alignment during plastering. Install accessories of type indicated at following locations:
   1. External Corners: Install corner reinforcement at external corners.
   2. Terminations of Plaster: Install casing beads, unless otherwise indicated.
   3. Control Joints: Install at locations indicated or, if not indicated, at locations complying with the following criteria and approved by Consultant:
      a) Where an expansion or contraction joint occurs in surface of construction directly behind plaster membrane.
      b) Distance between Control Joints: Not to exceed 5.5 m (4/16") in either direction or a length-to-width ratio of 2-1/2 to 1.
      c) Wall Areas: Not more than 13 sq. m (140 Sft).
      d) Horizontal Surfaces: Not more than 9 sq. m (97 Sft) in area.
      e) Where plaster panel sizes or dimensions change, extend joints full width or height of plaster membrane.

7.3.3.5 PLASTER APPLICATION

A. **Plaster Application Standard**: Apply plaster materials, composition, and mixes to comply with ASTM C 926.
B. Do not use materials that are frozen, caked, lumpy, dirty, or contaminated by foreign materials.
C. Do not use excessive water in mixing and applying plaster materials.
D. **Flat Surface Tolerances**: Do not deviate more than plus or minus 3 mm (2/16") in 3 m (10'-0") from a true plane in finished plaster surfaces, as measured by a 3-m (10'-0") straightedge placed at any location on surface.
E. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, and before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 150 mm (6") at each jamb anchor.
F. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.
G. Plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where interior plaster is not terminated at metal frame by casing beads cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
H. **Corners**: Make internal corners and angles square; finish external corners flush with corner beads on interior work, square and true with plaster faces on exterior work.
I. **Finish Coats**: Apply finish coats to comply with the following requirements:
    1. Float Finish: Apply finish coat to a minimum thickness of 3 mm (2/16") to completely cover base coat, uniformly floated to a true even plane with fine-textured finish matching samples approved by the Consultant.
J. **Number of Coats and Thickness**: Excluding dash coats and dubbing out coats apply plaster of composition indicated, to comply with the following requirements:
    1. Two Coats: Base and finish coats over the following plaster bases:
        a) Concrete unit masonry.
        b) Concrete, cast-in-place or precast when surface condition complies with ASTM C 926 for plaster bonded to solid base.
    2. Three Coats: Scratch, base and finish coats over metal lath backgrounds and installations.
    3. Overall thickness is to be 15.00 mm (3/4") for internal plaster and 20.00 mm (3/4") for external plaster.
    4. One plaster base coat (15 mm (3/4") thick) for walls to be finished with ceramic tiles set with thin bed adhesive.
    5. One coat work (15 mm (3/4") thick) for plaster on concrete structural slabs uniformly floated to a true even plane.
K. Moist-cure plaster base and finish coats to comply with ASTM C 926, including written instructions for time between coats and curing in "Annex A2 Design Considerations."

7.3.3.6 CUTTING AND PATCHING

A. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking,

dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

7.3.3.7 CLEANING AND PROTECTING

A. Remove temporary covering and other provisions made to minimize spattering of plaster on other work. Promptly remove plaster from doorframes, windows, and other surfaces not to be plastered. Repair surfaces stained, marred or otherwise damaged during plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.
B. Provide final protection and maintain conditions, in a manner acceptable to Consultant, that ensure plaster work is without damage or deterioration at the time of Substantial Completion.

7.4 - CERAMIC TILE

PART 8 - GENERAL

7.4.1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including general and supplementary Conditions.

7.4.1.2 SUMMARY

A. This Section includes the following:
   1. PorcelinTiles.
B. Related Sections include the following:
   1. 7.0 Section "Liquid Applied Waterproofing" for waterproofing under thickset mortar beds.
   2. 9.0 Section "Portland Cement Plaster" for Portland cement scratch coat over metal lath on wall surfaces.

7.4.1.3 DEFINITIONS

A. **Module Size**: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
   1. **Facial Dimension**: Actual tile size (minor facial dimension as measured per ASTM C 499).
   2. **Facial Dimension**: Nominal tile size as defined in ANSI A137.1.

7.4.1.4 PERFORMANCE REQUIREMENTS

A. **Static Coefficient of Friction:** For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6 (1/32").
B. **Load-Bearing Performance**: Provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project:
   1. Heavy: Passes cycles 1 through 12. Use where indicated in Finishing Schedules.
   2. Moderate: Passes cycles 1 through 10. Use for other applications indicated on Schedule where heavy duty is not indicated.

7.4.1.5 SUBMITTALS

A. **Product Data**: For each type of tile, mortar, grout, and other products specified.
   1. **Shop Drawings**: For the following:
      a) Tile patterns and locations.
      b) Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
      c) Locate precisely each joint and crack in tile substrates, record measurements on shop drawings, and coordinate them with tile joint locations, as approved by Consultant.
B. **Tile Samples for Initial Selection**: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

C. **Grout Samples for Initial Selection**: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.
D. **Samples for Verification**: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
   1. Each type and composition of tile and for each color and texture required, at least 400 mm square, (1.76 Sft) mounted on braced cementations backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Consultant.
   2. Full-size units of each type of trim and accessory for each color required.
   3. Stone thresholds in 150-mm (6") lengths.
E. **Master Grade Certificates**: For each shipment, type, and composition of tile, signed by tile manufacturer and installer.
F. **Product Certificates**: Signed by manufacturers certifying that the products furnished comply with requirements.
G. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product.
H. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of Consultants and Employers, and other any information required by Consultant.
I. **Test Reports**: Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile and tile setting and grouting products with requirements indicated.
J. **Setting Material Test Reports**: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

7.4.1.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
   1. **Installer Qualifications**: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
   2. **Source Limitations for Tile**: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.
   3. **Source Limitations for Setting and Grouting Materials**: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
   4. **Source Limitations for Other Products**: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:

a) Stone thresholds.
b) Cementations backer units.
c) Joint sealants.
d) Waterproofing.

B. **Mockups**: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Consultant.
2. Notify Consultant 7 days in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Consultant's approval of mockups before proceeding with final unit of Work.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
a) Approved mockups in an undisturbed condition as judged solely by the Consultant at the time of Substantial Completion may become part of the completed Work, otherwise demolish mockups, remove rubbles from site and install permanent works.

7.4.1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
1. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
2. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

7.4.1.8 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

7.4.1.9 EXTRA MATERIALS

A. Deliver extra materials to Employer. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 9 - PRODUCTS

7.4.2.1 PRODUCTS, GENERAL

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
2. Retain below with appropriate definitions in referenced part 1 article.
3. For facial dimensions of tile, comply with requirements relating to tile sizes.
4. Tiles are to be highest grade of production in manufacturer's quality grading system.

A. **ANSI Standards for Tile Installation Materials**: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

B. **Colors, Textures, and Patterns**: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
   1. Provide Consultant's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.

C. **Factory Blending**: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

D. **Mounting**: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.

E. **Factory-Applied Temporary Protective Coating**: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

7.4.2.2 TILE PRODUCTS

A. **General Characteristics**: Tiles are to comply with the following general requirements:
   1. Floor Tiles:
      a) Abrasive Hardness: Minimum Index 253 to ASTM C 501 (unglazed tiles), unless otherwise specified.
      b) Bending Strength: Minimum 35 Kg/cm^2 to ASTM C 648
      c) Water Absorption: As specified.
      d) Chemical Resistance: Unaffected with moderate acids.
      e) Tile Rating: For heavy duty floor by a rating system acceptable to the Consultant.

   2. Wall Tiles:
      a) Water Absorption: Maximum 6% to ASTM C 373.

B. **Unglazed Paver Tile:** Provide flat tile complying with the following requirements:
   1. Composition: Porcelain mix.
   2. Constriction: Color-through.
   3. Water Absorption: Less than 0.5% to ASTM C 373.
   4. Surface Finish: Matt or Polished as indicated on Drawings.

5. Facial Dimensions: As indicated on Drawings.
6. Thickness: minimum 9.0 mm (1/2") for tiles and 8.50 mm (1/2") for fittings.
7. Face: Plain with Square or cushion edges.

C. **Wall Tile**: Provide flat tile complying with the following requirements:
   1. Module Size: As indicated on Drawings.
   2. Water Absorption: Less than 6% to ASTM C373.
   3. Thickness: minimum 20 mm (3/4").
   4. Face: Plain with modified square edges or cushion edges.

D. **Trim Units**: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:
   1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
   2. Shapes: As follows, selected from manufacturer's standard shapes:
      a) Base for Portland Cement Mortar Installations: Coved.
      b) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
      c) External Corners for Thin-Set Mortar Installations: Surface bullnose.
      d) Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

E. **Tiles Thickness of Tiles**: Specified thickness of tiles excludes thickness of keying patterns on back.

Background/Base: 15mm thick 1:4 cement/sand render on concrete or concrete block works

Bedding: Thin cement based adhesive to be approved

Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.

Movement joints: All internal corners; Width: 6mrn

Accessories: all exposed edges and corners to have preformed rounded edges

7.4.2.3 PORECALIN WALL TILING

- Background/Base: 15mrn (3/4") thick 1:4 cement/sand render on concrete or concrete block works.
- Bedding: Thin bed cement based adhesive. Adhesive: to be approved
- Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.
- Joint width: 3mm. (2/16") Movement joints: Location: All internal corners; Width: 6mm (2/8").
- Accessories: all exposed edges and corners to have preformed rounded edges In toilets, no tiles behind low level ducts or full height ducts. Complete tiling should be done behind mirrors. In pantry, tiles are to be fixed behind base and wall units but not behind service duct panels. Plaster only where no tiles.

7.4.2.4FLOOR TILING

- Background/Base: screed 1 in-situ concrete
- Screed: 11.5:3 cement/sand/aggregate semi-dry screed laid to falls and towards
- Floor drain outlets, overall thickness of flooring to be 75mm (3").
- Bedding: Waterproof adhesive on cement 1 sand bed
- Adhesive: to be approved
- Waterproofing: 2 coats Fosroc Nitoproof 10, or equal, to B.S. Standard. laid to
- manufacturer's recommendations, with necessary accessories
- Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved
- to be used in accordance with manufacturer recommendations. Colour to architects
- approval.
- Joint width: 2.5mm (3/32").
- Movement joints: location: At all perimeters including door thresholds; Width: 6mm
- (1/4").
- Accessories:
    - Skirting: Coved skirting tiles, 100mm (4") high to match ceramic floor tiles, set flush with render, to be fixed on plastered walls, grouted with epoxy grout Nitotile 489 as supplied by Fosroc or equal approved, applied in accordance with manufacturer's recommendations.

7.4.2.5CERAMIC FLOOR TILING TO HALL AREA

- Type/Size: Vitrified matt finish floor files 400mmx400mm (16" x 16") as manufactured by GRANITS or equivalent. Tiles to be beige colour as per approved sample and to Carrefour standard requirements. Tile size tolerance to be not greater than + or – 0.25mm (1/64") in any side.
- Background/Base: screed on in-situ concrete.
- Screed: Quick furing proprietary wet mix sand/cement screed, such as *Isocrete Heavy Duty KScreed' laid in panels (maximum area 90m2) (970 Sft) and as per manufacturer's recommendations.
- **Note:** semi-dry screed will not be permitted in these areas.
- Adhesive and grout: Adhesive shall be Laticrete 325 or equivalent. Application strictly in accordance with manufacturer's instruction. Grout shall be epoxy Laticrete or equivalent. Colour to Architect approval.
- Joint width: 3mm (2/16")

7.4.2.6GROUTING MATERIALS

A. **Sand-Portland Cement Grout**: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. **Chemical-Resistant Epoxy Grout**: ANSI A 118.3, color as indicated.
    1. Provide product capable of resisting continuous and intermittent exposure to temperatures of up to 60 deg C and 100 deg C, respectively, as certified by mortar manufacturer for intended use.

C. **Grout Colors**: Provide colors as selected by the Consultant from manufacturer's full range of standard and custom colors. Finish shall be smooth, unless otherwise specified or directed by the Consultant.

7.4.2.7 ELASTOMERIC SEALANTS

A. **General**: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of 7.0 Section "Joint Sealants."
B. **Colors**: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

7.4.2.8 MISCELLANEOUS MATERIALS

A. **Trowelable Underlayments and Patching Compounds**: Latex-modified, Portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
B. **Temporary Protective Coating**: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.
   2. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 49 to 60 deg C per ASTM D 87.
C. **Tile Cleaner**: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
   1. Add materials, water, and additives in accurate proportions.
   2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 10 - EXECUTION

7.4.3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.

7.5 - MARBLE AND GRANITE

PART 11 - GENERAL

7.5.1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including general and supplementary Conditions.

7.5.1.2 SUMMARY

A. This Section includes the following:
   1. Marble & Granite.

B. Related Sections include the following:
   1. 7.0 Section "Liquid Applied Waterproofing" for waterproofing under thickset mortar beds.
   2. 9.0 Section "Portland Cement Plaster" for Portland cement scratch coat over metal lath on wall surfaces.

7.5.1.3 DEFINITIONS

A. **Module Size**: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
   1. **Facial Dimension**: Actual tile size (minor facial dimension as measured per ASTM C 499).
   2. **Facial Dimension**: Nominal tile size as defined in ANSI A137.1.

7.5.1.4 PERFORMANCE REQUIREMENTS

A. **Static Coefficient of Friction:** For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6 (1/32").

B. **Load-Bearing Performance**: Provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project:
   1. Heavy: Passes cycles 1 through 12. Use where indicated in Finishing Schedules.
   2. Moderate: Passes cycles 1 through 10. Use for other applications indicated on Schedule where heavy duty is not indicated.

7.5.1.5 SUBMITTALS

A. **Product Data**: For each type of tile, mortar, grout, and other products specified.

B. **Shop Drawings**: For the following:
   1. Tile patterns and locations.
   2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
   3. Locate precisely each joint and crack in tile substrates, record measurements on shop drawings, and coordinate them with tile joint locations, as approved by Consultant.

C. **Tile Samples for Initial Selection**: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

D. **Grout Samples for Initial Selection**: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.
E. **Samples for Verification**: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
   1. Each type and composition of tile and for each color and texture required, at least 400 mm square, (1.80 Sft) mounted on braced cementations backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Consultant.
   2. Full-size units of each type of trim and accessory for each color required.
   3. Stone thresholds in 150-mm (6") lengths.

F. **Master Grade Certificates**: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
G. **Product Certificates**: Signed by manufacturers certifying that the products furnished comply with requirements.
H. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product.
I. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of Consultants and Employers, and other any information required by Consultant.
J. **Test Reports**: Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile and tile setting and grouting products with requirements indicated.
K. **Setting Material Test Reports**: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

7.5.1.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
B. **Installer Qualifications**: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
C. **Source Limitations for Marble & Granite**: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.
D. **Source Limitations for Setting and Grouting Materials**: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
E. **Source Limitations for Other Products**: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:
   1. Stone thresholds.

2. Cementations backer units.
3. Joint sealants.
4. Waterproofing.

F. **Mockups**: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
   1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Consultant.
   2. Notify Consultant 7 days in advance of the dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Consultant's approval of mockups before proceeding with final unit of Work.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      a) Approved mockups in an undisturbed condition as judged solely by the Consultant at the time of Substantial Completion may become part of the completed Work, otherwise demolish mockups, remove rubbles from site and install permanent works.

G. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements of 1.0 Section "Project Management and Coordination."

7.5.1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
   1. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
   2. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

7.5.1.8 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

7.5.1.9 EXTRA MATERIALS

A. Deliver extra materials to Employer. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PRODUCTS

7.5.2.1 PRODUCTS, GENERAL

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
2. Retain below with appropriate definitions in referenced part 1 article.
3. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
4. Marble & Granite are to be highest grade of production in manufacturer's quality grading system.

A. **ANSI Standards for Tile Installation Materials**: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

1. **Colors, Textures, and Patterns**: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
   a) Provide Consultant's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.
2. **Factory Blending**: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

7.5.2.2 PRODUCTS

A. **General Characteristics**: Materials are to comply with the following general requirements:

1. For Flooring:

a) Abrasive Hardness: Minimum Index 253 to ASTM C 501 (unglazed tiles), unless otherwise specified.
b) Water Absorption: As specified.
c) Chemical Resistance: Unaffected with moderate acids.
d) Tile Rating: For heavy duty floor by a rating system acceptable to the Consultant.

2. For Wall:

a) Water Absorption: Maximum 6% to ASTM C 373.

B. **Unglazed Paver Tile:** Provide flat tile complying with the following requirements:

1. Composition: Natural Stone.
2. Constrition: Color-through.
3. Water Absorption: Less than 0.5% to ASTM C 373.
4. Surface Finish: Matt or Polished as indicated on Drawings.
5. Facial Dimensions: As indicated on Drawings.
6. Thickness: minimum 9.0 mm (1/2") for tiles and 8.50 mm (3/4") for fittings.
7. Face: Plain with Square or cushion edges.

C. **Wall Tile**: Provide flat tile complying with the following requirements:

8. Module Size: As indicated on Drawings.

    a) Water Absorption: Less than 10% to ASTM C373.
    b) Thickness: minimum 20 mm (3/4").
    c) Face: Plain with modified square edges or cushion edges.

D. **Trim Units**: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:
    1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
    2. Shapes: As follows, selected from manufacturer's standard shapes:
        a) Base for Portland Cement Mortar Installations: Coved.
        b) Wainscot Cap for Thin-Set Mortar Installations: Surface bull-nose.
        c) External Corners for Thin-Set Mortar Installations: Surface bull-nose.
        d) Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

E. **Tiles Thickness of Marble**: Specified thickness of tiles exclude thickness of keying patterns on back.
    - Background/Base: 15mm (3/4") thick 1:4 cement/sand render on concrete or concrete block works
    - Bedding: Thin cement based adhesive to be approved
    - Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.
    - Movement joints: All internal corners; Width: 6mrn (2/8")
    - Accessories: all exposed edges and corners to have preformed rounded edges

7.5.2.3 MARBLE WALL TILING

- Background/Base: 15mrn (3/4") thick 1:4 cement/sand render on concrete or concrete block works.
- Bedding: Thin bed cement based adhesive. Adhesive: to be approved
- Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.
- Joint width: 3mm (2/16"). Movement joints: Location: All internal corners; Width: 6mm
- Accessories: all exposed edges and corners to have preformed rounded edges In toilets, no tiles behind low level ducts or full height ducts. Complete tiling should be done behind mirrors. In pantry, tiles are to be fixed behind base and wall units but not behind service duct panels. Plaster only where no tiles.

7.5.2.4 FLOOR

- Background/Base: screed 1 in-situ concrete

- Screed: 11.5:3 cement/sand/aggregate semi-dry screed laid to falls and towards floor drain outlets, overall thickness of flooring to be 75mm (3")
- Bedding: Waterproof adhesive on cement 1 sand bed
- Adhesive: to be approved

- Waterproofing: 2 coats Fosroc Nitoproof 10, or equal, to B.S. Standard. laid to manufacturer's recommendations, with necessary accessories.
- Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.
- Joint width: 2.5mm (3/32").
- Movement joints: location: At all perimeters including door thresholds; Width: 6mm(2/8")

Accessories:

Skirting: Coved skirting tiles, 100mm (4") high to match ceramic floor tiles, set flush with render, to be fixed on plastered walls, grouted with epoxy grout Nitotile 489 as supplied by Fosroc or equal approved, applied in accordance with manufacturer's recommendations.

Joint width: 3mm (2/16")

7.5.2.5 GROUTING MATERIALS

A. **Sand-Portland Cement Grout**: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
B. **Chemical-Resistant Epoxy Grout**: ANSI A 118.3, color as indicated.
   1. Provide product capable of resisting continuous and intermittent exposure to temperatures of up to 60 deg C and 100 deg C, respectively, as certified by mortar manufacturer for intended use.
C. **Grout Colors**: Provide colors as selected by the Consultant from manufacturer's full range of standard and custom colors. Finish shall be smooth, unless otherwise specified or directed by the Consultant.

7.5.2.6 ELASTOMERIC SEALANTS

A. **General**: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements.
B. **Colors:** Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

7.5.2.7 MISCELLANEOUS MATERIALS

A. **Trowel able Underlayment's and Patching Compounds:** Latex-modified, Portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
B. **Temporary Protective Coating**: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.
   1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 49 to 60 deg C per ASTM D 87.
C. **Marble Cleaner**: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

7.5.2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
   1. Add materials, water, and additives in accurate proportions.
   2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 12 - EXECUTION

7.5.3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.

END OF SECTION

7.6 - PORCELAIN TILES

PART 13 - GENERAL

7.6.1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including general and supplementary Conditions.

7.6.1.2 SUMMARY

A. This Section includes the following:
   1. Porcelain Tiles.
B. Related Sections include the following:
   1. 7.10 Section "Liquid Applied Waterproofing" for waterproofing under thickset mortar beds.
   2. D9.24 Section "Portland Cement Plaster" for Portland cement scratch coat over metal lath on wall surfaces.

7.6.1.3 DEFINITIONS

A. **Module Size**: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
   1. **Facial Dimension**: Actual tile size (minor facial dimension as measured per ASTM C 499).
   2. **Facial Dimension**: Nominal tile size as defined in ANSI A137.1.

7.6.1.4 PERFORMANCE REQUIREMENTS

A. **Static Coefficient of Friction:** For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6 (1/32").

A. **Load-Bearing Performance**: Provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project:
   1. Heavy: Passes cycles 1 through 12. Use where indicated in Finishing Schedules.
   2. Moderate: Passes cycles 1 through 10. Use for other applications indicated on Schedule where heavy duty is not indicated.

7.6.1.5 SUBMITTALS

A. **Product Data**: For each type of tile, mortar, grout, and other products specified.
B. **Shop Drawings**: For the following:
   1. Tile patterns and locations.
   2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
   3. Locate precisely each joint and crack in tile substrates, record measurements on shop drawings, and coordinate them with tile joint locations, as approved by Consultant.

C. **Tile Samples for Initial Selection**: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.
D. **Grout Samples for Initial Selection**: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.
E. **Samples for Verification**: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
   1. Each type and composition of tile and for each color and texture required, at least 400 mm square, (1.80 Sft) mounted on braced cementations backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Consultant.
   2. Full-size units of each type of trim and accessory for each color required.
   3. Stone thresholds in 150-mm (6") lengths.
F. **Master Grade Certificates**: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
G. **Product Certificates**: Signed by manufacturers certifying that the products furnished comply with requirements.
H. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product.
I. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of Consultants and Employers, and other any information required by Consultant.
J. **Test Reports**: Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile and tile setting and grouting products with requirements indicated.
K. **Setting Material Test Reports**: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

7.6.1.6 QUALITY ASSURANE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
B. **Installer Qualifications**: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
C. **Source Limitations for Tile**: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the

same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

D. **Source Limitations for Setting and Grouting Materials**: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

E. **Source Limitations for Other Products**: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:
   1. Stone thresholds.
   2. Cementations backer units.
   3. Joint sealants.
   4. Waterproofing.

F. **Mockups**: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
   1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Consultant.
   2. Notify Consultant 7 days in advance of the dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Consultant's approval of mockups before proceeding with final unit of Work.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      a) Approved mockups in an undisturbed condition as judged solely by the Consultant at the time of Substantial Completion may become part of the completed Work, otherwise demolish mockups, remove rubbles from site and install permanent works.

G. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements of 1.0 Section "Project Management and Coordination."

7.6.1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

7.6.1.8PROJECT CONDITIONS

A. **Environmental Limitations**: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

A. EXTRA MATERIALS

B. Deliver extra materials to Employer. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART2 – PRODUCTS

PRODUCTS, GENERAL

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
2. Retain below with appropriate definitions in referenced part 1 article.
3. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
4. Tiles are to be highest grade of production in manufacturer's quality grading system.

A. **ANSI Standards for Tile Installation Materials**: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

B. **Colors, Textures, and Patterns**: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Provide Consultant's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.

C. **Factory Blending**: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

D. **Mounting**: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.

E. **Factory-Applied Temporary Protective Coating**: Where indicated under tile type, protect exposd surfaces of tile against adherence of mortar and grout

by pre-oating them with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

7.6.2.1 TILE PRODUCET

A. **General Characteristics**: Tiles are to comply with the following general requirements:
   1. Floor Tiles:
      a) Abrasive Hardness: Minimum Index 253 to ASTM C 501 (unglazed tiles), unless otherwise specified.
      b) Bending Strength: Minimum 35 Kg/cm² (1 kg / cft) to ASTM C 648
      c) Water Absorption: As specified.
      d) Chemical Resistance: Unaffected with moderate acids.
      e) Tile Rating: For heavy duty floor by a rating system acceptable to the Consultant.
   2. Wall Tiles:
      a) Water Absorption: Maximum 6% to ASTM C 373.

B. **Unglazed Paver Tile:** Provide flat tile complying with the following requirements:
   1. Composition: Porcelain mix.
   2. Constriction: Color-through.
   3. Water Absorption: Less than 0.5% to ASTM C 373.
   4. Surface Finish: Matt or Polished as indicated on Drawings.
   5. Facial Dimensions: As indicated on Drawings.
   6. Thickness: minimum 9.0 mm (1/2") for tiles and 8.50 mm (1/2") for fittings.
   7. Face: Plain with Square or cushion edges.

C. **Wall Tile**: Provide flat tile complying with the following requirements:
   1. Module Size: As indicated on Drawings.
      a) Water Absorption: Less than 6% to ASTM C373.
      b) Thickness: minimum 8.0 mm (1/2").
      c) Face: Plain with modified square edges or cushion edges.

D. **Trim Units**: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:
   1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
   2. Shapes: As follows, selected from manufacturer's standard shapes:
      a) Base for Portland cement Mortar Installations: Coved.
      b) Wainscot Cap for Thin-Set Mortar Installations: Surface bull nose.
      c) External Corners for Thin-Set Mortar Installations: Surface bull nose.
      d) Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

E. **Thickness of Tiles**: Specified thickness of tiles excludes thickness of keying patterns on back.

- Background/Base: 12mm (1/2") thick 1:4 cement/sand render on concrete or concrete block works
- Bedding: Thin cement based adhesive to be approved

- Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.
- Movement joints: All internal corners; Width: 6mrn (2/8")
- Accessories: all exposed edges and corners to have preformed rounded edges.

7.6.2.2PORCELAIN WALL TIMING

- Background/Base: 15mrn (3/4") thick 1:4 cement/sand render on concrete or concrete block works.
- Bedding: Thin bed cement based adhesive. Adhesive: to be approved
- Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.
- Joint width: 3mm (2/16"). Movement joints: Location: All internal corners; Width: 6mm (2/8")
- Accessories: all exposed edges and corners to have preformed rounded edges in toilets, no tiles behind low level ducts or full height ducts. Complete tiling
- should be done behind mirrors. In pantry, tiles are to be fixed behind base and wall units but not behind service duct panels. Plaster only where no tiles.

7.6.2.3FLOOR TILING

- Background/Base: screed 1 in-situ concrete
- Screed: 11.5:3 cement/sand/aggregate semi-dry screed laid to falls and towards floor drain outlets, overall thickness of flooring to be 75mm (3")
- Bedding: Waterproof adhesive on cement 1 sand bed
- Adhesive: to be approved
- Waterproofing: 2 coats Fosroc Nitoproof 10, or equal, to B.S. Standard. laid to manufacturer's recommendations, with necessary accessories
- Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval

- Joint width: 2.5mm (3/32").
- Movement joints: location: At all perimeters including door thresholds; Width: 6mm- Accessories:
- Skirting: Coved skirting tiles, 100mm (4") high to match ceramic floor tiles, set flush with render, to be fixed on plastered walls, grouted with epoxy

grout Nitotile 489 as supplied by Fosroc or equal approved, applied in accordance with manufacturer's recommendations.

7.6.2.4CERAMIC FLOOR TILING TO HALL AREA

- Type/Size: Vitritied matt finish floor files 400mmx400mm (16" x 16") as manufactured by GRANITO or equivalent. Tiles to be beige colour as per
- approved sample and to Carrefour standard requirements. Tile size tolerance to be not greater than + or – 0.25mm (1/32") in any side.
- Background/Base: screed on in-situ concrete.
- Screed: Quick furing proprietary wet mix sand/cement screed, such as *Isocrete Heavy Duty KScreed' laid in panels (maximum area 90m2) (970
- Sft) and as per manufacturer's recommendations. **Note:** semi-dry screed will not be permitted in these areas.
- Adhesive and grout: Adhesive shall be Laticrete 325 or equivalent. Application strictly in accordance with manufacturer's instruction. Grout shall be epoxy Laticrete or equivalent. Colour to Architect approval.
- Joint width: 3mm (2/16")

7.6.2.5GROUTING MATERIALS

A. **Sand-Portland Cement Grout**: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
B. **Chemical-Resistant Epoxy Grout**: ANSI A 118.3, color as indicated.
   1. Provide product capable of resisting continuous and intermittent exposure to temperatures of up to 60 deg C and 100 deg C, respectively, as certified by mortar manufacturer for intended use.
C. **Grout Colors**: Provide colors as selected by the Consultant from manufacturer's full range of standard and custom colors. Finish shall be smooth, unless otherwise specified or directed by the Consultant.

7.6.2.6ELASTOMERIC SEALANTS

A. **General**: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of 7.0 Section "Joint Sealants."
B. **Colors**: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

7.6.2.7 MISCELLANEOUS MATERIALS

A. **Trowel able Underlayment's and Patching Compounds**: Latex-modified, Portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. **Temporary Protective Coating**: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.
   1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 49 to 60 deg C per ASTM D 87.

C. **Tile Cleaner**: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

7.6.2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
   1. Add materials, water, and additives in accurate proportions.
   2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 14 - EXECUTION

7.6.3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.

END OF SECTION

7.7 - PAINTING

PART 15 - GENERAL

7.7.1.1 RELATED DOCUMENTS

A. Drawing and general provision of the contract, including general and supplementary Conditions.

7.7.1.2 SUMMARY

A. This Section includes surface preparation and field painting of the following:
   1. Exposed exterior items and surfaces.
   2. Exposed interior items and surfaces.
   3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Consultant will select from standard colors and finishes available.

C. Do not paint pre-finished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

   1. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

   2. Operating parts include moving parts of operating equipment and the following:

   3. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
   1. 5.0 Section "Metal Fabrications" for shop priming ferrous metal.
   2. 6.0 Section "Flush Wooden Doors" for shop priming wood doors.

7.7.1.3 DEFINITIONS

A. **General**: the following coating terms apply to this Section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

   2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.

3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.

4. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

7.7.1.4 SUBMITTALS

A. **Product Data**: For each paint system specified. Include block fillers and primers.
   1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application Identify each material by manufacturer's catalog number and general classification.

   2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

B. **Samples for Initial Selection**: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

   1. After color selection, the Consultant will furnish color chips for surfaces to be coated.

C. **Samples for Verification**: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
   1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

   2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

   3. Submit Samples on the following substrates for the Consultant's review of color and texture only:

      a) Concrete: Provide two 100-mm- (4") square samples for each color and finish.

      b) Ferrous Metal: Provide two 100-mm- (4") square samples of flat metal and two 200-mm- long samples of solid metal for each color and finish.

D. **Qualification Data**: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

Include lists of completed projects with project names and addresses, names and addresses of Consultants and owners, and other information specified.

7.7.1.5 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Applicator Qualifications**: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

C. **Source Limitations**: Obtain fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

D. **Benchmark Samples (Mockups)**: Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project.
   1. The Consultant will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
      a) Wall Surfaces: Provide samples on at least 9 sq. m (97 Sft) of wall surface.
      b) Small Areas and Items: The Consultant will designate an item or area as required.
   2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.
      a) After finishes are accepted, the Consultant will use the room or surface to evaluate coating systems of a similar nature.
   3. Final approval of colors will be from job-applied samples.

E. **Manufacturers Qualifications**: Paint materials shall be the products of paint and coating manufacturers whose qualifications are as follows:
   1. Manufacturers shall be reputable of multi-national scale in production and distribution with capabilities to deliver paint materials quantities necessary for the project on due time.
   2. Manufacturers shall have evidence from scientific bodies that demonstrate their participation and share in the development of paint industry generally and production of new painting materials kinds.
   3. Manufacturers shall have their own proprietary brand names that are well known worldwide.
   4. Manufacturers shall have minimum 25 years of successful experience in producing painting materials for use in prestigious projects worldwide of same standard of quality as that intended for the Project.
   5. Manufacturers shall be registered in the associations, councils, boards, federations or other similar bodies of paint manufacturers in countries of origin and practice.

F. **Performance of Paints**: Paints shall be fit for purpose and manufactured specifically for the applications indicated and uses intended, taking into

account the type, nature, location, and aesthetic and utility requirements of the Project.

1. Opacity: Paint shall cover or hide the substrate to the Consultant's satisfaction.
2. Clean ability: Paint shall not absorb dirt and shall be capable of being washed or scrubbed periodically, to the Consultant's satisfaction, without adverse effect on its attributes or appearance.
3. Scrub resistance wet and dry: paint shall resist abrasion caused by scrubbing in accordance with ASTM D 2486.
4. Adhesion: Paint shall adhere firmly to the substrate without peeling.
5. Exposure resistance: Paint shall resist yellowing and weathering caused by UV rays and ozone.

G. **Standards**: Paints shall be manufactured to relevant US standards, or any other international standard approved by Authorities having jurisdiction.

7.7.1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 7 deg C. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

7.7.1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 10 and 32 deg C.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 7.2 and 35 deg C.

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 3 deg C above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature

limits specified by manufacturer during application and drying periods.

7.7.1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to the Employer.

1. Quantity: Furnish the Employer with an additional 5 percent, but not less than 3.8 L or 1 case, as appropriate, of each material and color applied.

PART 2 – PRODUCTS

7.7.2.1 PAINT MATERIALS, GENERAL

A. **General**: Employed paints and painting materials shall be the highest grade and top quality in manufacturer's range of products for the generic kind of paint or paint material.

B. **General**: Materials for paint works shall comply with requirements of BS 6150, as applicable.

C. **Material Compatibility**: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

D. **Material Quality**: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

E. **Colors**: Provide color selections made by the Consultant or by reference to manufacturer's color designations.

7.7.2.2 ANTI-CARBONATION PAINT MATERIALS, GENERAL

A. Paint for application on internal and external is to be anti-carbonation paint that is easy to clean, applicable on new or existing concrete, Portland cement plaster or masonry, water-based and non toxic, allows substrate to breath, Protects substrates form Carbonation, of elastic nature with crack bridging properties.

B. Anti-carbonation paint is to be self-cleaning by application of just sprayed water, highly durable, copolymer based coating which cures to form a tightly adherent, decorative weatherproof membrane guaranteed for up to 15 years. The formed coating membrane shall tolerate thermal movement in the substrate without splitting or cracking and will retain its elastomeric properties even after prolonged exposure to ultra-violet light. Coating shall have the advantage of being reinforced using glass fiber matting or tapes and shall be capable of bridging cracks or joints between different substrates. The finished

surface shall be chemical and pollution-resistant surface that has been specially manufactured to shed dirt, ensuring that it retains a bright, attractive appearance throughout its life. Coating shall be vapor permeable and allows entrapped substrate moisture to escape without causing blistering or delimitation and shall produce an effective barrier to carbon dioxide diffusion and provide reinforced concrete substrates with an excellent defense against the harmful effects of carbonation. Color and sheen shall be selected by the Consultant from manufacturer's full range of products.

C. Anti carbonation paint shall also comply with following properties;
   1. Carbon Dioxide Diffusion Resistance, Tay wood Method
      a) Equivalent Thickness of Air: More than 175 mm (7").
      b) Equivalent Thickness of 30N Concrete: More than 500 mm (20").

   2. Chloride Ion Diffusion Coefficient: No chloride ion diffusion after 60 days; Tay wood Method
   3. Static Crack Spanning Capability for 200-micron Dry Film Thickness at 23 ºC: Minimum 2.00 mm to ASTM C836.
   4. Tear Resistance: 15 N/mm to ASTM D1004.
   5. Tensile Strength: 5.00 N/mm2 to ASTM D412.
   6. Reduction in Water absorption: Not less than 82% to ASTM C642.
   7. Reduction in Chloride Ions Penetration: Not less than 92% to AASHTO M259.
   8. Adhesion: Not less than 1.00 N/mm2, BS 1881.

PART 3 – EXECUTION

7.7.3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
   1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. **Coordination of Work**: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify the Consultant about anticipated problems using the materials specified over substrates primed by others.

7.7.3.2 PREPARATION

A. **General**: Preparation of surfaces to receive paints is to be according with requirements of BS 6150 and recommendations of paints manufacturer.

B. **General**: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of

the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

C. **Cleaning**: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

D. **Surface Preparation**: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and re-prime.

2. Cementations Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   a) Use abrasive blast-cleaning methods if recommended by paint manufacturer.
   b) Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
   c) Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
   d) Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

Ferrous Metals: Clean un-galvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of referenced standards.

Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of referenced standards.

Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

a) Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

3. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

E. **Materials Preparation**: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

F. **Tinting**: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

7.7.3.3APPLICATION

A. **General**: Apply paint according to recommendations of BS 6150 and manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, non-specular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding enamel or varnish coat.

B. **Scheduling Painting**: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

   2. Omit primer on metal surfaces that have been shop primed and touchup painted.

   3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

   4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. **Application Procedures**: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
   1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
   2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
   3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. **Minimum Coating Thickness**: Apply paint materials no thinner than manufacturers recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. **Mechanical and Electrical Work**: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. **Prime Coats**: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted

or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed

G. areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

H. **Pigmented (Opaque) Finishes**: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

I. **Transparent (Clear) Finishes**: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
   1. Provide satin finish for final coats.

J. **Stipple Enamel Finish**: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

K. **Completed Work**: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

7.7.3.4 FIELD QUALITY CONTROL

A. The Employer reserves the right to invoke the following test procedure at any time and as often as the Employer deems necessary during the period when paint is being applied:
   1. The Employer will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
   2. The testing agency will perform appropriate tests for the following characteristics as required by the Employer:
      a) Quantitative material analysis.
      b) Abrasion resistance.
      c) Apparent reflectivity.
      d) Flexibility.
      e) Wash ability.
      f) Absorption.
      g) Accelerated weathering.
      h) Dry opacity.
      i) Accelerated yellowness.
      j) Recoating.
      k) Skinning.
      l) Color retention.
      m) Alkali and mildew resistance.

   3. The Employer may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove non-complying paint from the site, pay for testing,

and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

7.7.3.5 CLEANING

A. **Cleanup**: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
   1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

7.7.3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Consultant.
B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
   1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

7.7.3.7 EXTERIOR PAINT SCHEDULE

A. Coordinate the following paint coats with surface preparation steps as specified.
B. Concrete and Cement Sand Portland Plaster: Provide the following finish system over exterior concrete and Portland Cement Plaster.
   1. Light Textured Emulsion Paint
      a) 100% pure acrylic-based paint specially formulated for external application. The paint is to dry by evaporation of water and will produce a durable, flexible, excellent water and alkali resistant and is to provide long lasting protection for coated surfaces. The paint is to be UV-resistant, of high bond strength to substrates and distinguished color retention, and is to provide anti-carbonation shield for the substrate while allowing moisture of substrate to escape to the outside.
      b) Finished surface is to be of light texture.
C. **Ferrous Metal**: Provide the following finish system over exterior ferrous metal.
   1. Full-Gloss, Epoxy-Based Enamel: Two finish coat over primer.
      a) Primer: High-molecular-weight, epoxy-resin primer at spreading rate recommended by manufacturer.
      b) Finish Coat: High-molecular-weight, epoxy-resin topcoat at spreading rate recommended by the manufacturer.
      c) Protection Coating: Two Coats of clear polyurethane-based, UV resistant protection coating.

7.7.3.8 INTERIOR PAINT SCHEDULE

A. Coordinate the following paint coats with surface preparation steps as specified.
B. **Concrete**: Provide the following paint systems over interior concrete and masonry surfaces:

1. Flat Acrylic Finish: 2 finish coats over a primer.

    a. Primer: Alkali-resistant, acrylic-latex, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.025 mm.

2. First and Second Coats: Flat, acrylic latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.060 mm per coat.

C. **Plaster**: Provide the following finish systems over new, interior Portland
A. cement plaster surfaces:

1. Flat Acrylic Finish: 2 finish coats over a primer.

    a) Primer: Alkali-resistant, acrylic-latex, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.036 mm.
    b) Undercoat: same material for finish coats specified hereafter diluted to the manufacturer's recommendations.
    c) First and Second Finish Coats: Flat, acrylic-latex, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.064 mm per coat.

2. Semi gloss, Alkyd-Enamel Finish: One finish coat over an undercoat and a primer.

    a) Primer: Alkali-resistant, alkyd- or latex-based, interior primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
    b) First and Second Coats: Semi gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.066 mm.

D. **Woodwork and Hardboard**: Provide the following paint finish systems over new, interior wood surfaces:

1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a wood undercoated.

    a) Undercoat: Alkyd- or acrylic-latex-based, interior wood undercoated, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.
    b) First and Second Coats: Semi gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.066 mm.

2. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a wood undercoated.

    a) Undercoat: Alkyd, interior enamel undercoated applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.
    b) First and Second Coats: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.061 mm.

E. **Stained Woodwork**: Provide the following stained finishes over new, interior woodwork:

1. Alkyd-Based, Satin-Varnish Finish: 2 finish coats of an alkyd-based, clear-

satin varnish over a sealer coat and an alkyd-based, interior wood stain. Wipe wood filler before applying stain.

a) Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

b) Stain Coat: Alkyd-based, interior wood stain applied at spreading rate recommended by the manufacturer.

c) Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

d) First and Second Finish Coats: Alkyd-based or polyurethane varnish, as recommended by the manufacturer, applied at spreading rate recommended by the manufacturer.

F. **Zinc-Coated Metal**: Provide the following finish systems over zinc-coated metal:

1. Full-Gloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoat and a primer.

a) Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.

b) Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.

c) Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.

G. **Ferrous Metal**: Provide the following finish systems over ferrous metal:

1. Full-Gloss, Alkyd-Enamel Finish: two finish coat over a primer.

a) Primer: Interior ferrous-metal primer at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.

b) Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm per coat.

H. **Ferrous Metal**: Provide the following finish systems over ferrous metal:

1. Full-Gloss, Epoxy-Based Enamel: Two finish coat over primer.
   a) Primer: High-molecular-weight, epoxy-resin primer at spreading rate recommended by manufacturer.
   b) Finish Coat: High-molecular-weight, epoxy-resin topcoat at spreading rate recommended by the manufacturer.

End of Section

7.8 - ACOUSTICAL CEILING

PART 1 – GENERAL

7.9.1.1 RELATED DOCUMENTS

A. Drawing and general provision of the contract, including general and supplementary Conditions.

7.9.1.2 SUMMARY

A. This Section includes acoustical tiles for ceilings and the following:
   1. Concealed and Semi-concealed suspension systems.
   2. Glass fiber acoustical tiles.
B. Related Sections include the following:
   1. 9.0 Section "Acoustical Panel Ceilings" for ceilings consisting of glass-fiber-base acoustical panels and exposed suspension systems.
C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

7.9.1.3 DEFINITIONS

A. CAC: Ceiling Attenuation Class.
B. LR: Light Reflectance coefficient.
C. NRC: Noise Reduction Coefficient.

7.9.1.4 SUBMITTALS

A. **Product Data**: For each type of product indicated.
B. **Coordination Drawings**: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
      a) Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
1. Size and location of initial access modules for acoustical tile.
2. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
3. Minimum Drawing Scale: 1:50.

C. **Samples for Initial Selection**: For components with factory-applied color finishes.
D. **Samples for Verification**: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
   2. Concealed Suspension System Members: 300-mm (12") long Sample of each type.
   3. Exposed Moldings and Trim: Set of 300-mm (12") long Samples of each type and color.
E. **Qualification Data**: For testing agency.
F. **Product Test Reports**: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical tile ceiling.
G. **Research/Evaluation Reports**: For acoustical tile ceiling and components and anchor type.
H. **Maintenance Data**: For finishes to include in maintenance manuals.

7.9.1.5 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum.

Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Acoustical Testing Agency Qualifications**: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

C. **Source Limitations**:
   1. Acoustical Ceiling Tile: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.

D. **Source Limitations**: Obtain each type of acoustical ceiling tile and supporting suspension system through one source from a single manufacturer.

E. **Fire-Test-Response Characteristics**: Provide acoustical tile ceilings that comply with the following requirements:

F. **Surface-Burning Characteristics**: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
   1. Smoke-Developed Index: 450 or less.

G. **Seismic Standard**: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:
   1. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."

H. **Mockups**: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. **Preinstallation Conference**: Conduct conference at Project site to comply with requirements in 1.0 Section "Project Management and Coordination."

7.9.1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

7.9.1.7 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

7.9.1.8 COORDINATION

A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

7.9.1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

PART 2 – PRODUCTS

7.9.2.1 ACOUSTICAL TILES, GENERAL

A. **Acoustical Tile Standard**: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 400 mm (16") away from test surface per ASTM E 795.

B. **Acoustical Tile Colors and Patterns**: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

C. **Tile-Based Antimicrobial Treatment**: Provide acoustical tiles treated with manufacturer's standard antimicrobial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.

7.9.2.2 NODULAR, CAST OR MOLDED, MINERAL-BASE ACOUSTICAL PANELS

A. **Classification**: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
   1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular or Form 4, cast or molded according to manufacturer standard.

B. **Composition:**
   1. Core: 100% glass wool treated with water repellent.
   2. Backing: Glass tissue bonded to backing.
   3. Surface Coating: Manufacturer's standard latex.
   4. Thickness: 20.00 mm.

C. **Pattern and Color of Surface**: Smooth surface with microscopic holes, White color.

D. **Size**: 600 x 600 mm.
E. **Edge Condition**: Rabbeted to allow flush reveal ceiling to ASTM E 1264.
F. **Particle Emission**: Low emission classification to an international classification system acceptable to the Consultant.
G. **Fire burning Characteristics**: As specified in Clause 1.5 of the Section.
H. **Acoustical Performance**:
   1. Reverberation Time: less than 0.60 second between 250-4000 Hz.
   2. Sound Absorption (ap): Not less than 0.80 between 250 - 4000 Hz to ISO 354 and ISO 11654.
   3. Noise Reduction Coefficient - 0.85 to ASTM C 423.
   4. Sound Insulation (R_w) - Not less than 35 dB room to room air borne sound insulation to ISO 14019.
   5. Moisture Resistant withstand minimum 95% relative humidity at 30 C without sagging, warp.
   6. Light Reflectance Not less that 84%.

7.9.2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. **Metal Suspension System Standard**: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
B. **Finishes and Colors, General**: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
   1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
C. **Attachment Devices**: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      a) Type: Postinstalled expansion anchors.
      b) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
D. **Wire Hangers, Braces, and Ties**: Provide wires complying with the following requirements:
   1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 3.5-mm diameter wire.
E. **Hanger Rods and Flat Hangers**: Mild steel, zinc coated or protected with rust-inhibitive paint.
F. **Angle Hangers**: Angles with legs not less than 22 mm (1") wide; formed with 1-mm thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 8-mm (3/8")diameter

bolts.

G. **Seismic Struts**: Manufacturer's standard compression struts designed to accommodate lateral forces.
H. **Seismic Clips**: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

7.9.2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

A. **Direct-Hung, Single-Web Suspension System**: Main and cross runners roll formed from and capped with cold-rolled steel sheet, pre-painted, electrolytic zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, Z90 coating designation.
1. Structural Classification: Heavy duty system.
2. Access: Downward and end or side pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
3. Initial Access Opening: In each module as indicated on Drawings or approved shop drawings.

7.9.2.5 METAL EDGE MOLDINGS AND TRIM

A. **Roll-Formed Sheet-Metal Edge Moldings and Trim**: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical tile edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

B. **Extruded-Aluminum Edge Moldings and Trim**: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with the following requirements:
1. **Aluminum Alloy**: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for alloy and temper 6063-T5.
2. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
3. **Baked-Enamel Finish**: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
a) Organic Coating: Thermosetting, enamel primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

7.9.2.6 ACOUSTICAL SEALANT

A. **Acoustical Sealant for Exposed and Concealed Joints**: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

B. **Acoustical Sealant for Concealed Joints**: Manufacturer's standard nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 – EXECUTION

7.9.3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

7.9.3.2 PREPARATION

A. **Testing Substrates**: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

7.9.3.3 INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

A. **General**: Install acoustical tile ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counters playing, or other equally effective means.
   3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, counters playing, or other equally effective means.
   4. Where width of ducts and other construction within ceiling plenum produces hanger spacing's that interfere with location of hangers at spacing's required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

   5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 1200 mm (48") o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 200 mm from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post installed anchors.
D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 400 mm (16") o.c. and not more than 75 mm (3") from ends, leveling with ceiling suspension system to a tolerance of 3.2 mm in 3.66 m (10 ft). Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
F. Arrange directionally patterned acoustical tiles as follows:
   1. As indicated on reflected ceiling plans.
G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
   1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
   2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 300 mm (12") o.c.
   3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

7.9.3.4CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

End of Section

7.10 - PERFORATED METAL CEILING

A. Aluminum Clip-in tiles ceiling in white standard powder coated finish as produced by Thermec Engineering Co. or similar approved. Beveled edge linear ceiling system ideally suited for large halls where quick and complete access to the void above is required.

B. Design

Rectangular, modular aluminum units in size 300 x 1200 x 0.7 mm thick with long sides beveled and combined with the square unit ends to achieve the linear effect.

C. Suspension System

Galvanized steel metal suspension system consisting of spring tee runners, splices, edge trim and 8SWG wire hanger with adjustment clips etc. The suspenders shall be fixed to the soffit with nylon anchors and 1 ½ x No.12 round head steel screw.

D. Perforation

Perforation patterns in various hole sizes give a combination of perfect acoustic properties and aesthetic appearance. Tile shall be perforated with 1.8 mm holes.

E. Acoustic Felt

To achieve optimal acoustics, acoustic felt is bonded to the reverse side of the units. Acoustic felt also prevents any dust fall-out from perforated ceiling types. Acoustic felt is available in three colours. The units shall be provided with a factory applied Soundtex (Germany) high sound absorption acoustic felt in black colour.

F. Material

Ceiling panels are produced from steel coils on roll-forming plant. Uniformity must be assured.

G. Quality

Ceiling units must be produced to Quality Management System approved by Lloyd's Register in accordance with ISO 9002.

MEASUREMENT AND PAYMENT

A. Payment for all the items under this section shall be made at the Unit rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

End of Section

7.11 - RAISED ACCESS FLOOR SYSTEM

A raised floor or access floor system comprises of load bearing floor panels laid in a horizontal grid supported by adjustable vertical pedestals to provide an under floor space for the housing and distribution of services.

A. **ACCESSABILTY**

The floor panels are readily removable to allow quick access to the under floor services for installation and maintenance. Space allows for ever increasing volume of power, data and telecom services and is often used as a large duct for HVAC system.

1. **CEMENT CORE RAISED ACCESS FLOORING**

These are robust lightweight panels comprising of a hollow shell made of a flat top and profiled steel base welded together and filled with a foam cemented base core.

Cement core panels are available in 600x600 x35mm size module.

A. COVERING

Top surface can be Carpet Tile, Wooden Flooring or Vinyl Tiles as per requirement; however these can also be used without any cover.

B. PEDESTALS AND STRINGERS

Pedestals made of galvanized steel with levelling provision. Pedestals are connected through stringer made of Galvanized pipes and concealed screws for perfect fit. Heavy Duty European standard EN 12825 of Ultimate, Concentration & Rolling Loads Class 6 as manufactured and provided by The Protectors or similar approved.

C. TECHNICAL DATA

a) PANEL

- Floor panel without HPL finish - 600X600X35mm, steel plate and cementitious infill, top steel-SPCC, bottom steel-ST14

b) SUBSTRUCTURE

- Flat head pedestal – 600mm, top 75X75X3mm, base 95X95X2mm, tube 25X1.2mm, galvanized steel, base plate dowelled by expansion bolt
- Stringer - 570X21X32mm
- Construction height as per design.

c) LOAD VALUES

- Concealed load: 3560N
- Tested acc. To DIN EN 12825, class 6
- Impact load: ≥536N
- Unlimited load: ≥10680N
- Rolling load: 10 times 3560N & 10000 times 2670N
- Distribution load: 16100 N/m²

d) **FIRE RATING** 2 HRS

2. WOOD CORE HPL RAISED ACCESS FLOORING

This panel construction comprises of a high density particle board core that is encase by galvanized steel laminated to the particle board by a structural polyurethane or epoxy resin adhesive.

Wood core HPL panels are available in 600x600 x40mm size module.

A. COVERING

These panels are supplied with a factory appled HPL (high pressure laminate) finish in two standard colours, grey-white and wooden; however top surface can be Carpet Tile, Wooden Flooring or Vinyl Tiles as per requirement.

B. PEDESTALS AND STRINGERS

Pedestals made of galvanized steel with levelling provision. Pedestals are connected through stringer made of Galvanized pipes and concealed screws for perfect fit. Heavy Duty European standard EN 12825 of Ultimate, Concentration & Rolling Loads Class 6 as manufactured and provided by The Protectors or similar approved.

C. TECHNICAL DATA

a) PANEL

- Floor panel - 600X600X40mm, coated with HPL, under side: coated with 0.3mm galvanized steel sheet, panel material: 38mm Chipboard

b) SUBSTRUCTURE

- Flat head pedestal – 600mm, top 75X75X3mm, base 95X95X2mm, tube 25X1.2mm, galvanized steel, base plate dowelled by expansion bolt
- Stringer - 540X20X30mm
- Construction height as per design.

c) LOAD VALUES

- Concealed load: 3560N
- Tested acc. To DIN EN 12825, class 6
- Impact load: ≥536N
- Unlimited load: ≥10680N
- Rolling load: 10 times 3560N & 10000 times 2670N
- Distribution load: 16100 N/m²

d) **FIRE RATING** 1 HRS

3. MEASUREMENT AND PAYMENT

B. Payment for all the items under this section shall be made at the Unit rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

End of Section

7.12 - CARPET TILE

1.1 GENERAL

A. Submittals: Submit Product Data for each type of carpet tile material and the following:
   1. Shop Drawings showing carpet tile type, color, and dye lot; type of subfloor; pile direction; and type, color, and location of insets and borders.
   2. Samples of each type of carpet tile required.
   3. Schedule of carpet tile using same room designations indicated on Drawings.
   4. Maintenance data for carpet tile to include in the operation and maintenance manual.

B. Carpet Tile Surface Flammability: Passes CPSC 16 CFR, Part 1630.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.
   2. Critical Radiant Flux Classification: Class II, not less than 0.22 W/sq. cm per ASTM E 648.
   3. Flame Spread: 25 or less per ASTM E 84.
   4. Smoke Developed: 450 or less per ASTM E 84.

C. Project Conditions: Comply with CRI 104, Section 6: "Site Conditions."

D. Subfloor Moisture Conditions: Moisture emission rate of not more than 3 lb/1000 sq. ft./24 hours (14.6 kg/1000 sq. m/24 hours) when tested by calcium chloride moisture test in compliance with CRI 104, 6.2.1, with subfloor temperatures not less than 55 deg F (12.7 deg C).

E. Subfloor Alkalinity Conditions: A pH range of 5 to 9 when subfloor is wetted with potable water and pHydrion paper is applied.

F. Furnish full-size carpet tile units equal to 5 percent of amount installed, packaged with protective covering for storage, and identified with labels clearly describing contents, before installation begins.

1.2 PRODUCTS

A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the products specified in each carpet tile Product Data sheet at end of this Section.

B. Products: Subject to compliance with requirements, provide one of the products specified in each carpet tile Product Data sheet at end of this Section.

C. Concrete-Slab Primer: Nonstaining type as recommended by carpet tile manufacturer.

D. Trowelable Underlayments and Patching Compounds: As recommended by carpet tile manufacturer.

E. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated and to comply with flammability requirements for installed carpet tile as recommended by carpet tile manufacturer.

1.3 EXECUTION

A. Verify that subfloors and conditions are satisfactory for carpet tile installation and comply with requirements specified in this Section and those of carpet tile

manufacturer.

B. Level subfloor within 1/4 inch in 10 feet (6 mm in 3 m), noncumulative, in all directions.
   1. Use leveling and patching compounds to fill cracks, holes, and depressions in subfloor as recommended by carpet tile manufacturer.
C. Remove subfloor coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone.
D. Broom or vacuum clean subfloors to be covered with carpet tile. Following cleaning, examine subfloors for moisture, alkaline salts, carbonation, or dust.
E. Concrete-Subfloor Preparation: Apply concrete-slab primer, according to manufacturer's directions, where recommended by carpet tile manufacturer.
F. Wood-Subfloor Preparation: Apply wood-floor sealer, according to manufacturer's directions, where recommended by carpet tile manufacturer.
G. Resilient-Flooring Substrate Preparation: Replace missing pieces of existing resilient flooring or patch to level as recommended by carpet tile manufacturer.
H. Terrazzo-Subfloor Preparation: Patch grout lines and cracks to level with latex underpayment as recommended by carpet tile manufacturer.
I. Installation: Comply with CRI 104, Section 13: "Carpet Modules (Tiles)."
J. Install borders parallel to walls.
K. Protection: Comply with CRI 104, Section 15: "Protection of Indoor Installation."

1.4 MEASUREMENT AND PAYMENT

C. Payment for all the items under this section shall be made at the Unit rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

End of Section

7.13 - RESILIENT FLOOR TILE

PART **1 GENERAL**

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

1.2.1 This Section includes the following:

- Rubber floor tile

1.2.2 Related Sections include the following:

- Division 9 Section "Resilient Athletic Flooring" for resilient floor tile for use in athletic activity pr support areas.

- Division 9 Section "Static-Control Resilient Floor coverings" for resilient floor tile

  designed to control electrostatic discharge (ESD).

1.3 SUBMITTALS

Product Data : For each type of product indicated

Samples for Initial Selection :For each type of product indicated.

Samples for Verification : Full-size units of each color and pattern of resilient floor tile required.

Maintenance Data : For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

1.4.1 Fire-Test-Response Characteristics: Provide products identical to those tested for fire exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.4.2 Technical Data

Material	Recycled rubber particles molded with a custom formulated solvent free pure MDI polyurethane binder
Properties ".	Water permeable, resilient, durable, slip proof, insulating, flexible, frost proof, non-flammable, non-toxic, sound deadening
Thickness	15mm, 20mm, 25mm, 45mm, and 60mm
Sound Absorption	Approx. 5Db
Flammability	DIN 51960 Class 1
Slip Resistance	95 (dry) 65 (wet)
Abrasion Resistance	• after air aging 0.10 (gr.) • after water aging 0.36 (gr.) • after artificial weathering 0.20 (gr.)
Residual Indentation	0.64mm after recovery
Fatigue Resistance	No cracking or fracture
Resistance to Ozone	No cracking or fracture
Infiltration Rate	25mm - approx. 180mm / hr 45mm - approx. 285mm / hr

1.5 DELIVERY, STORAGE. AND HANDLING

1.5.1 Store resilient products and installation materials in dry spaces protected from the Weather, with ambient temperature maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store files on flat surfaces.

1.6 PROJECT CONDITIONS

1.6.1 Maintain temperatures within range recommended by manufacturer, but not less than

70'F, or more than 95'F, in spaces to receive floor tile during the following time periods.

- 48 hours before installation
- During installation
- 48 hours after installation

1.6.2 After post installation period, maintain temperatures within range recommended by manufacturer, but not less than 55' F, or more than 95'F.

1.6.3 Close spaces to traffic during floor covering installation.

1.6.4 Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIAL

1.7.1 Furnish extra materials described below that match products installed and that are

packaged with protective covering for storage and identified with labels describing contents.

- Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type,

color, and pattern of floor tile installed.

PART 2 PRODUCTS

2.1.1 MANUFACTURERS

2.1.1 Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products listed in other Part 2 articles.

2.1.2 Products: Subject to compliance with requirements, provide one of the products listed

in other part articles.

2.2 COLORS AND PATTERNS

2.2.1 Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 INSTALLATION MATERIALS

2.3.1 **Trowel able leveling and Patching Compounds:** Latex modified, Portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

2.3.2 **Adhesives**: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

2.3.3 **Metal Edge Strips**: Extruded aluminum with mill Finish of width shown, of

height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Examine substrates with Installer present, for compliance with requirements for installation tolerances, moisture control, and other conditions affecting performance.

3.1.1.1 Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

3.1.1.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

3.2.1 Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

3.2.2 **Concrete Substrates**: Prepare according to ASTM F 710.

3.2.2.1 Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

3.2.2.2 **Alkalinity and Adhesion Testing**: Perform tests recommended by manufacturer.

Proceed with installation only after substrates pass testing.

3.2.2.3 **Moisture Testing**:

- Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sq. ft. in 24-hours.
- Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2.3 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3.2.4 Access Flooring Panels: Remove film of oil or other coating using method recommended by access flooring manufacturer.

3.2.5 Use trowel able leveling and patching compound to fill cracks, holes, and depressions in substrates.

3.2.6 Move resilient products and installation materials into spaces where they will be installed at least 48-hours in advance of installation.

- Do not install resilient products until they are same temperature as space where they are to be installed.

3.2.7 Sweep and vacuum clean substrates to be covered by resilient products

immediately before installation. After cleaning, examine substrates for moisture, alkaline sales, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

3.3.1 Layout tiles from center marks established with principal walls, discounting minor offsets, so

tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

- Lay tiles in pattern indicated.

3.3.2 Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped or deformed tiles.

Lay tiles in pattern of colors and sizes indicated.

3.3.3 Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets edgings, door frames, thresholds, and nosing.

3.3.4 Extend tiles into toe spaces, door reveals, closets, and similar openings.

3.3.5 Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other non-permanent, constraining marking, device.

3.3.6 Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

3.3.7 Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open racks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

3.4.1 Perform the following operations immediately after completing resilient product installation:

3.4.1.1 Remove adhesive and other blemishes from exposed surfaces.

3.4.1.2 Sweep and vacuum surfaces thoroughly.

3.4.1.3 Damp-mop surfaces to remove marks and soil.

- Do not wash surfaces until after time period recommended by manufacturer.

3.4.2 Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

3.4.3 Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive and surface blemishes if recommended in writing by manufacturer.

3.4.3.1 Use commercially available product acceptable to manufacturer.

3.4.3.2 Coordinate selection of floor polish with Owner's maintenance service.

3.4.4 Cover products installed on horizontal surfaces with un-dyed, untreated building paper until Substantial Completion.

3.4.5 Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

PART 4 MEASUREMENTS AND PAYMENT

A. Payment for all the items under this section shall be made at the Unit rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

END OF SECTION

8 SPECIALITIES

8.1 - TOILET AND BATH ACCESSORIES

PART 1 – GENERAL

1.1.1.1 RELATED DOCUMENTS

Drawing and general provisions of the contract, including general and supplementary Conditions.

1.1.1.2 SUMMARY

- This Section includes the following:
- Toilet and bath accessories.
- Warm-air dryers.
- Related Sections include the following:
  - Section "Ceramic Tile" for ceramic toilet and bath accessories.

1.1.1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Samples: For each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in
2. the Work.
3. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.
4. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.
5. Maintenance Data: For accessories to include in maintenance manuals specified in 1.0 section. Provide lists of replacement parts and service recommendations.

1.1.1.4 QUALITY ASSURANCE

A. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

B. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Consultant, may be provided.

C. Other manufacturers' products with equal characteristics may be considered.

- See 1.0 Section "Substitutions."

D. Do not modify aesthetic effects, as judged solely by Consultant, except wit

E. Consultant's approval. Where modifications are proposed, submit comprehensive explanatory data to Consultant for review.

1.1.1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.1.1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Employer of other rights Employer may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.
C. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 – PRODUCTS

8.1.2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.8-mm minimum nominal thickness, unless otherwise indicated.
B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16M, rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.
C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.9-mm minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
D. Galvanized Steel Sheet: ASTM A 653/A 653M, Z180.
E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.
G. Mirror Glass: as per requirements of 8.0, section "Mirrored Glass".
H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

8.1.2.2 FABRICATION

A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.
D. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:
    1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
    2. Heavy-duty wall brackets of galvanized steel, equipped with concealed

locking devices requiring a special tool to remove.

3. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Employer's representative.

PART 3 – EXECUTION

8.1.3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

8.1.3.2 ADJUSTING AND CLEANING

A. Remove temporary labels and protective coatings.

B. Clean and polish exposed surfaces according to manufacturer's written recommendations.

8.1.3.3 TOILET AND BATH ACCESSORY SCHEDULE

A. Toilet Tissue Dispenser (Toilet Paper Holder): Provide toilet tissue dispenser complying with the following:
   1. Type Single-roll dispenser.
   2. Mounting: Surface mounted with concealed anchorage.
   3. Material: Stainless steel
   4. Operation: Noncontrol delivery with mfr's standard spindle.
   5. Capacity: Designed for standard diameter-core tissue rolls up to 140 mm (6") diameter (800 sheets)

B. Soap Dish: Stainless steel size and shape as selected by the Consultant from manufacturer's standard range.

C. Soap Dispenser: Provide soap dispensers complying with the following:
   1. Liquid Soap Dispenser, Vertical-Tank Type: Wall mounted type, minimum 1182.9 ml capacity tank with stainless steel piston, springs, and internal parts designed to dispenses soap in measured quantity by pump action, and stainless-steel cover with unbreakable window-type refill indicator.
      a) Mounting: Designed for wall mounting.
      b) Soap Valve: Designed for dispensing soap in liquid form.

D. Paper Towel Dispenser: 800 multi-hold towels capacity, stainless steel, surface mounted.

E. Robe Hook
   1. Stainless steel.
   2. Double-prong with rectangular wall bracket and back plate for concealed mounting.

F. Grab Bar
   1. Surface mounting, exposed.
   2. Stainless steel.
   3. 38 mm (1.5") outside diameter and 1.20 mm minimum wall thickness

and 38 mm (1.5") distance from inside of bar and face of wall.

4. Furnish complete with two end flanges, 3 mm (2/16") thick minimum and 76 mm (3") diameter, each of three countersunk screw holes for attachment to walls.

5. Use of flanges with snap covers is acceptable.

G. Warm-Air Dryer: Provide warm-air dryer complying with the following:
   1. Touch-Button-Activated Hand Dryer: Surface-mounted, warm-air hand dryer activated by touch button and with manufacturers' standard, white-painted metal cover and 30-second-timed power cut-off switch.

8.2 - TERMITE CONTROL

PART 1 – GENERAL

A. General provisions of the Contract, including Conditions of Contract apply to this Section.

8.9.3.1 SUMMARY

B. This Section includes the following for termite control:
   1. Termite prevention
   2. Soil treatment
   3. Wood protection

8.9.3.2 TERMITE PREVENTION

A. Avoid creation of conditions that invite termites wherever possible. Take the following measures:
   1. Remove stumps, roots, wood, and other cellulose materials from the building site before commencing construction.
   2. Remove cellulose materials from around the foundation before final backfill.
   3. Promptly remove form boards and grade stakes used in construction from site.
   4. Allow no contact between building woodwork and soil or fill material.
      a) Locate exterior woodwork a minimum of 15 cm above ground and beams in crawl spaces at least 45 cm above ground to provide ample space to make future inspections.
      b) Make foundation areas accessible for inspection if possible.
      c) If wood that contacts the soil, such as fence posts and foundation elements, use pressure treated wood.
   5. Design ventilation openings in foundations to prevent dead air pockets and to help keep the ground dry.
   6. Direct water away from the structure through proper grading.
   7. Assure that the roof drainage system directs all water away from the foundation.
   8. Avoid plantings near the foundation. Any tree that has the potential to grow to a height of 12 meters or taller shall not be planted within 15 meters of the foundation.

8.2.1.3 DEFINITIONS

A. EPA: United States Environmental Protection Agency.
B. PMP: Pest Management Professional

8.2.1.4 SUBMITTALS

A. Product Data: For termiticide and borate.
   1. Include the EPA-Registered Label for termiticide and borate products.
B. Product Certificates: For termite control products, signed by product manufacturer.
C. Qualification Data: For Installer of termite control products.
D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:
   1. Date and time of application.

2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

E. Wood Treatment Application Report: After application of borate is completed, submit report for Owner's record information, including the following:
1. Date and time of application.
2. Brand name and manufacturer of borate.
3. Quantity of undiluted borate used.
4. Dilutions, methods, volumes, and rates of application used.
5. Areas of application.

F. Warranty: Special warranty specified in this Section.

8.2.1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A PMP who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.
B. Regulatory Requirements: Formulate and apply termiticide, and label with a US EPA registration number, to comply with EPA regulations and authorities having jurisdiction.
C. Document any applicable local codes or authorities and ensure that all relevant work is in compliance.
D. Implement applicable provisions of the Quality Control program as established in:
- Section 01401, "Contractor Quality Control."

8.2.1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

8.2.1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

8.2.1.8 WARRANTY

A. Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, retreat soil and repair or replace damage caused by termite infestation.

B. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

8.2.2.1 TERMITICIDES

A. Soil Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or amusable, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation for review and acceptance by the COR.
   1. The Department of State currently authorizes Termidor and Premise as soil termiticide.
   2. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA Registered Label.

B. Wood Protection Termiticide:
   1. Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation for review and acceptance by COR.
   2. The Department of State currently authorizes Timber and Bora Care for preventive wood treatment.
   3. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA Registered Label.
   4. Protect vegetation from contact with Timber and Bora Care.

END OF SECTION

Proposed List Of Manufacturers

No	Product	Manufacturer / Supplier by Approved List
1	Cement	Falcon,Attock,Lucky,DG Khan,Cherat
2	Steel / structural steel	Amreli,Razzaq,Abbas,Frontier,Nawab / Saify Iron,Mughal Steel, ILL,Izhar, Banumukhtar
3	Ready Mix Concrete	Lucky Paragon, Atlas, Allied, D mix
4	Fiber / concrete admixture & retarders (for concrete & Mortar)	Matrixx, BASF, Fospak, Sika, Aquafin
5	Waterproofing membrane / Water Stopper bar / Swell Bar / Crack filler	Hy Grip, Roof line, Aquafin, BASF, Fospak, Bituthene & Resichem
6	Blocks	Bes Block, Concrete Concept, Prime crete, Izhar
7	Precast Items	Envicrete, Hubcrete, Finecrete, Izhar
8	Insulation	Knauf, Pakistan Insulation
9	Porcelain/Ceramic Tiles	Imperial, Granato, Benitoz, Cretesol
10	Aluminum	Pak. Cable, Krudsons, Lucky & Prime Aluminum
11	Paint, Varnishes	ICI, Berger, Juton, Nippon,Nelson
12	Glass	Emirates, Saint-Gobain, Ghani & Tariq Flot
13	Door lock, Iron mongery,	Yale (Italy), Bonoco, Newstar, Kale(Turky), Star, Dorma, Hager
14	Special floor finish/ coatings	Resichem, Fospak, BASF, Sika, Aquafin

Competitive and Livable City of Karachi
Local Government Department, Government of Sindh.

TECHNICAL SPECIFICATION - STRUCTURES

TENDER

December, 2021

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. 584-1825
Email : info@eaworld.com | www.eaworld.com

TECHNICAL SPECIFICATION

(Structure)

TECHNICAL SPECIFICATIONS FOR STRUCTURE WORKS

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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.

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 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 withought 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

Payment shall be made which will be paid separately as per the unit rate quoted in the Bill of Quantities. Appended to the contract and in accordance with applicable condition of the contract.

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 Contactor 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, unadulated 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, dewatering, 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 which will be paid separately as per the unit rate quoted in the Bill of Quantities. Appended to the contract and in accordance with applicable condition of the contract.
2. Stone soling item which will be paid separately as per the unit rate quoted in the Bill of Quantities. Appended to the contract and in accordance with applicable condition of the contract.
3. Shoring / Close timbering (if required) item which will be paid separately as per the unit rate quoted in the Bill of Quantities. Appended to the contract and in accordance with applicable condition of the contract.
4.

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 O.5% Dieldrin or O.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 IN/Sq.mm (150 lb/sq.in.) for all applications, to, on, or in earth. Spraying to wood shall be done by hand compassion sprayers with an approximate pressure of O.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'-O" 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'-O" 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 on the basis of plinth area covered by this treatment including all ditches, pits, excavation, fills etc. which will be paid separately as per the unit 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 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.

5.05 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.

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 wit 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 embeding 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, metalled 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 300 or 100 x200 mm test cylinder and minimum quantity of cement required per cum or 100 cft. Of finished concrete for various mixes and under various conditions.

Class of Concrete	Nominal Min. Ratio	Min. Qty. of Cement		Preliminary Cylinder strength			
				at 7 days		at 28 days	
		Lbs. per 100 cft.	Kg. / Cu.m.	Lbs./ Sq. in.	N/ Sq.mm	Lbs./ Sq. in.	N/ Sq.mm.
A.	1:1:2	3024	485	3350	23.10	4000	27.58
B.	1:11/2:3	2520	404	2800	19.31	3000	20.68
C.	1:2:4	2016	323	2250	15.51	2500	17.24
D.	1:3:6	1344	216	1100	7.58	1500	10.34
E.	1:4:8	1008	161	700	4.82	1000	6.89

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-1 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 proposition 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 atlease 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 Lbs.	Kg	Sand Cft.	Litre	Coarse Aggregate Cft.	Litre
A	1:1:2	110	50	1 3	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:-

MATERIAL	PERCENTAGE BY WEIGHT
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.560:1965, 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 cylinder shall be 100 x 200 or 150 x 300 mm size.

iii) All test cylinder 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 560:1965 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 occuring, 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 impart 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 flot 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 1O 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 toweled 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 cylindrical 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	- 4000 p.s.i. (Class 'A')
	1:1 1/2:3	- 3000 p.s.i. (Class 'B')
	1:2:4	- 2500 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 remove 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 preca st 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 Puddlo@ 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 bag 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 etc. Defective and honey-combed work will not be measured & paid and will be liable to be rejected and redone at contracts' cost.

NOTE:

1. Bitumen coating item which will be paid separately as per the unit rate quoted in the Bill of Quantities. Appended to the contract and in accordance with applicable condition of the contract.
2. PVC water stopper bar item which will be paid separately as per the unit rate quoted in the Bill of Quantities. Appended to the contract and in accordance with applicable condition of the contract.
3. DPC damp proof course item which will be paid separately as per the unit rate quoted in the Bill of Quantities. Appended to the contract and in accordance with applicable condition of the contract.
4. Earth / engineered fill from outside sources item which will be paid separately as per the unit rate quoted in the Bill of Quantities. Appended to the contract and in accordance with applicable condition of the contract.

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-615

a) Tensile Strength - 560N/Sq.mm (35.7 Tons/Sq.in).
b) Yield Strength - 420 N/Sq.mm (60,000 psi).
c) Elongation - 11 %

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 4O times the diameter of the bigger lapping bars for nominal M.S. bars. Hard grade bars and tor

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 Ibs per ft.	Size in.	Weight in Ibs per ft.
1/4	0.167	3/4	1.502
3/8	0.376	7/8	2.044
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 DISMANTLING AND DEMOLITIONING WORKS

8.1 SCOPE OF WORK

The scope of work of this section covers dismantling and demolishing of existing works.

8.2 EXECUTION

The existing work as may be required shall be dismantled. Where a portion of the RCC work is to be demolished, the reinforcing steel bars shall be cut carefully where required or cleaned straightened and restored in position. Dismantling shall be carried out with appropriate tools and in such a manner as to avoid unnecessary damage or injury to other adjoining work and to those parts of works which are to be retained and to render unserviceable as little of the material as possible. Any un-necessary damage shall be made good by the Contractor at his own expense.

Where insulation, roof coverings and waterproofing etc. are required to be removed from the roofs, roofs shall be thoroughly cleaned to bare concrete.

Where footings and foundations are required to be removed, the work shall also include excavation, backfill with excavated suitable material and compaction to 95% standard Proctor density.

The unserviceable material and debris shall be disposed off outside the Site limits to the satisfaction of the Engineer and the local authorities, or to a place within the Site, as may be designated in the Contract.

All serviceable materials shall be separated, cleaned and properly stacked within the Site.

All salvaged serviceable materials shall be handed over to the Employer unless provided otherwise in the Bill of Quantities.

8.3 MEASUREMENT

The unit of measurement shall be as indicated in Bill of Quantities. All quantities shall be measured net. In case of demolition of structure, plaster and paint shall not be measured for separate payment.

SECTION – 9

9.0 STRUCTURAL STEEL WORKS

9.1 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.

9.2 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.

9.3 DRAWINGS

9.3.1 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.

9.3.2 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, and 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.

9.4 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.

9.5 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.

9.6 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 sub drilled holes shall be at least 2mm smaller than the nominal diameter of the rivet of 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.

9.7 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.

9.8 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.

9.9 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.

9.10 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.

9.11 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.

c) 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.

SECTION-10

10.0 STONE SOLING/PAVING

10.1 GENERAL

A. Stone Abrasion Resistance: Minimum abrasive-hardness value of 12, as determined per ASTM C241.

B. Static Coefficient of Friction: ASTM C 1028, values as follows:
Level Surfaces: A minimum of 0.6.
Ramp Surfaces: A minimum of 0.8.

C. Submittals: Submit the following:
Product Data: For each variety of stone, stone accessory, and other manufactured products specified.

Shop Drawings: Show details of fabrication and installation of stone paving and flooring, including dimensions and profiles of stone units; arrangement and details of jointing; and details showing relationship with, attachment to, and reception of related work.

Stone Samples: Sets for each color, grade, finish, and variety of stone required; not less than 12 inches (300 mm) square.

D. Mockups: Before installing stone paving and flooring, construct mockups, in locations and of sizes indicated, to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.

10.2 PRODUCTS

A. Provide stone from a single quarry for each variety of stone required.

Match Architect's samples for variety, color, finish, and other stone characteristics relating to aesthetic effects.

Match existing stone for variety, color, and finish where stone is indicated to match existing.

Provide stone that is free of cracks, seams, and starts impairing structural integrity or function.

Provide matched blocks extracted from contiguous locations in a single bed of quarry stratum unless stone from blocks randomly selected for aesthetic effect is approved by Architect.

B. Granite: ASTM C 615 and the National Building Granite Quarries Association's (NBGQA) "Specifications for Architectural Granite."

C. Limestone: ASTM C 568.

D. Marble: ASTM C 503.

E. Quartz-Based Stone: ASTM C 616.

F. Slate: ASTM C 629 with a fine, even grain and with uniform, unfading color from clear, sound stock.

G. Pattern: As follows:
Rectangular-grid pattern of 18 by 18 inches (457 by 457 mm).
Rectilinear pattern of 12-by-24-inch (305-by-610-mm) units, laid in brickwork pattern.

Random, rectangular pattern composed of units not less than 6 inches (152 mm) nor more than 24 inches (610 mm) in nominal dimension.

Random, polygonal pattern composed of units not less than 1 sq. ft. (0.09 sq. m) nor more than 5 sq. ft. (0.46 sq. m) in area.

H. Mortar Materials: As follows:

1. Portland Cement: ASTM C 150, Type I or II; natural color, white, or a blend to produce mortar color indicated.

a. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

Hydrated Lime: ASTM C 207, Type S.

1. Aggregate: ASTM C 144 and as indicated below:

a. For joints narrower than 1/4 inch (6 mm), use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.

b. For pointing mortar, use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.

c. White-Mortar Aggregates: Natural, white sand or ground, white stone.

d. Colored-Mortar Aggregates: Natural, colored sand or ground marble, granite, or other sound stone, as required to match Architect's sample.

Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in stone mortars.

Latex-Portland Cement Mortar: ANSI A118.4, factory-packaged dry-mortar mix with water-emulsion latex additive added at Project site.

Water: Potable.

I. Grout Materials: As follows:
1. Grout Colors: Provide Architect's selection from manufacturer's full range of colors.

J. Sand-Portland cement Grout: ANSI A108.10.

K. Latex-Portland Cement Grout: ANSI A118.6 and as follows:

1. Factory-Prepared Dry-Grout Mixture: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to produce the following:

a. Un-sanded grout mixture for joints 1/8 inch (3 mm) and narrower.

b. Sanded grout mixture for joints 1/8 inch (3 mm) and wider.

2. Mixture of Dry-Grout Mix and Latex Additive: Mixture of factory-prepared dry-grout mix and latex additive to comply with the following requirements:

a. Un-sanded Dry-Grout Mix: Dry-set grout complying with ANSI A118.6, for joints 1/8 inch (3 mm) and narrower.

b. Sanded Dry-Grout Mix: Commercial Portland Cement grout complying with ANSI A118.6, for joints 1/8 inch (3 mm) and wider.

c. Latex Additive: Styrene butadiene rubber.

d. Latex Additive: Acrylic resin.

L. Accessories: As follows:
Cleavage Membrane: Polyethylene sheeting, ASTM D 4397, 4 mils (0.1 mm) thick.

Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch- (1.6-mm-) diameter wire, complying with ASTM A 185 and ASTM A 82, except for minimum wire size.

Divider Strips and Edging: Metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications consisting of the following:

a. Exposed-Edge Material: As follows:

1. Material: Half-hard brass. 2) Material: Stainless steel; ASTM A 666, Type 302.

b. Cross-Section Profile and Size: As indicated; height to match stone thickness.

1) Width: 0.063 inch (1.6 mm). 2) Width: 1/8 inch (3.2 mm).3) Width: 1/4 inch (6.4 mm).

c. Control-Joint Filler: Neoprene, in color selected by Architect from manufacturer's full range of colors.

Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.

Cleaner: Specifically formulated for stone types, finishes, and applications indicated. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

Floor Sealer: Colorless, slip- and stain-resistant sealer not affecting color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

M. Stone Fabrication: Fabricate stone paving and flooring in sizes and shapes required complying with requirements indicated, including details on Drawings and Shop Drawings. For granite, comply with recommendations of National Building Granite Quarries Association's (NBGQA) "Specifications for Architectural Granite."

For marble, comply with recommendations of Marble Institute of America's (MIA) "Dimensional Stone-Design Manual IV."
For limestone, comply with recommendations of Indiana Limestone Institute of America's (ILI) "Indiana Limestone Handbook."

N. Pattern Arrangement: Fabricate stone from one block or contiguous, matched blocks, and arrange units with veining and other natural markings to comply with the following requirements:

Arrange units with veining horizontal.
Arrange units with veining vertical.

Arrange units with veining as indicated on Drawings.

0. Mortar and Grout Mixes: Comply with referenced standards and with manufacturers' written instructions. Do not use admixtures.

Mortar: Comply with ASTM C 270, Proportion Specification, Type N for interior applications and Type S for exterior applications.

La&ex-Modified-Portland Cement Mortar: Proportion and mix Portland cement, aggregate, and latex additive to comply with latex additive manufacturer's written instructions.

1. Cement-Paste Slush Coat: Mix to consistency of thick cream and consisting of either cement and water or cement, sand, and water.

a. For latex-modified-portland cement mortar, substitute latex admixture for part or all of water according to latex additive manufacturer's written instructions.

b. Pigmented Pointing Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.

c. Colored-Aggregate Pointing Mortar: Produce color required by combining colored aggregates with Portland cement of selected color.

Joint Grout: Comply with mixing requirements of referenced ANSI standards and manufacturer's written instructions.

10.3 EXECUTION

A. Vacuum clean substrates to remove dirt, dust, debris, and loose particles.

B. Remove substances from substrates that could impair mortar bond.

C. Clean stone surfaces before setting by thoroughly scrubbing with fiber brushes and then drenching with clear water.

D. Execute stone paving and flooring installation by skilled mechanics and employ skilled stone fitters at the site to do necessary field cutting as stone is set.

1. Use power saws to cut stone.

E. Set stone to comply with Drawings and Shop Drawings. Match for color and pattern by using units numbered in sequence as indicated on Shop Drawings.

F. Scribe and field-cut stone as necessary to fit at obstructions. Produce tight and neat joints.

G. Stone Paving over Waterproofing: Carefully place stone and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged.

1. Provide cork joint filler, where indicated, at waterproofing that is turned up on vertical surfaces or, if not indicated, provide temporary filler or protection until stone paving installation is complete.

H. Expansion- and Control-Joint Installation: Locate and install according to Drawings and Shop Drawings. Joint-sealant materials and installation are specified in Division 7 Section "Joint Sealants."

Architectural Specifications

I. Installing Stone Directly over Concrete: Install as follows:
Saturate concrete with clean water before placing setting bed. Remove surface water before placing setting bed.

Apply cement-paste slush coat before placing setting bed. Limit area of slush coat to avoid its drying out. Do not exceed 1/16-inch (1.5-mm) thickness for cement-paste slush coat.

Apply mortar setting bed over cement-paste slush coat. Spread and screed setting bed to uniform thickness at elevations required for accurate setting of stone.

Mix and place only as much mortar as can be covered with stone before initial set. Cut back, bevel edge, and discard setting-bed material that has reached initial set before placing stone.

Place stone before initial set of cement occurs. Apply uniform 1/16-inch-(1.5-mm-) thick, slurry bond coat to bed or to back of each stone

unit.

Tamp and beat stone to obtain full contact with setting bed. Set each unit in a single operation before initial set of mortar; do not disturb stone for purposes of realigning.

Point joints after setting. Tool joints flat, uniform, and smooth, without visible voids.

J. Installing Stone over Cleavage Membrane or Waterproofing: Install as follows:
Place cleavage membrane over subfloor surfaces indicated to receive stone flooring, lapped at least 4 inches (100 mm) at joints.

Place reinforcing wire fabric, lapped at joints by at least one full mesh and supported so mesh becomes embedded in middle of setting bed. Do not butt edges against vertical surfaces.

Place mortar setting bed with reinforcing wire fabric fully embedded in middle of setting bed. Spread and screed setting bed to uniform thickness at elevations required for accurate setting of stone.

Mix and place only as much mortar as can be covered with stone before initial set. Cut back, bevel edge, and discard setting-bed material that has reached initial set before placing stone.

Place stone before initial set of cement occurs. Apply uniform 1/16-inch-(1.5-mm-) thick, slurry bond coat to bed or to back of each stone unit.

Tamp and beat stone to obtain full contact with setting bed. Set each unit in a single operation before initial set of mortar; do not disturb stone for purposes of realigning.

Point joints after setting. Tool joints flat, uniform, and smooth, without visible voids.

K. Grout stone joints to comply with ANSI A108.10 and manufacturer's written instructions. Do not use sanded grout for polished stone.

Grout joints as soon as possible after initial set of setting bed. After initial set of grout, finish joints by tooling to produce a slightly concave polished joint.

Cure grout by maintaining in a damp condition for 7 days, except as otherwise recommended by latex additive manufacturer.

L. Remove and replace damaged and defective stone paving and flooring in a manner that results in stone paving and flooring's matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

M. Clean stone paving and flooring after setting and grouting are complete. Use procedures recommended by stone fabricator for types of application.

N. Apply sealer to cleaned stone flooring according to sealer manufacturer's written instructions.
Architectural Specifications

O. Prohibit traffic from installed stone for a minimum of 72 hours.

P. Protect stone paving and flooring during construction. Where adjoining areas require construction work access, cover stone paving and flooring with a minimum of 3/4-inch (19-mm) untreated plywood over nonstaining kraft paper.

10.4 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 stone soling / paving will be ascertained by measuring length, breadth and depth of actual volume laid deducting any section of columns and other structures penetrating throughout the under 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 DEWATERING

PART 1 - GENERAL

11.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Particular Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

11.2 SUMMARY

B. This Section includes construction dewatering.

C. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
2. Division 2 Section "Excavation Support and Protection."
3. Division 2 Section "Earthwork" for excavating, backfilling, site grading and for site utilities.
4. Division 2 Section "Sub drainage" for permanent foundation wall, underfloor, and footing drainage.

11.3 PERFORMANCE REQUIREMENTS

D. Dewatering Performance: **[Design,]**furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.

1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Accomplish dewatering without damaging existing buildings adjacent to excavation.
4. Remove dewatering system if no longer needed.

11.4 SUBMITTALS

E. Shop Drawings for Information: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.

1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
2. Include a written report outlining control procedures to be adopted if dewatering problems arise.
3. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

F. Qualification Data: (To be submitted by the contractor for the approval)

G. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

H. Record drawings at Project closeout identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions performed during dewatering.

1. Note locations and capping depth of wells and well points.

I. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that dewatering system is capable of meeting performance requirements.

11.5 QUALITY ASSURANCE

J. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

K. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

11.6 PROJECT CONDITIONS

L. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

M. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
2. The geotechnical report is **[included]** **[referenced]** elsewhere in the Project Manual.

N. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

11.7 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

11.8 INSTALLATION

C. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

D. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

E. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
   1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

F. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
   1. Maintain piezo metric water level a minimum of **[24 inches (600 mm)]** **[60 inches (1500 mm)]** <**Insert depth**> below surface of excavation.

G. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

H. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
   1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

I. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

11.9 OBSERVATION WELLS

J. Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated and additional observation wells as may be required by authorities having jurisdiction.

K. Observe and record daily elevation of ground water and piezo metric water levels in observation wells.

L. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. Suspend construction activities in areas where observation wells are not functioning properly until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
   1. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

11.10 MEASUREMENTS AND PAYMENTS:

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-12

12.0 MOISTURE PROTECTION & WATERPROOFING

PART 1 GENERAL

12.1 SUMMARY

12.1.1 This Specification covers the materials, workmanship, testing, design life and guarantee requirements for substructure waterproofing, including membranes and waterstops, as necessary to keep water out of the building and substructure elements, as shown on the drawings.

12.1.2 Appendix A forms part of this Specification.

12.1.3 Related Sections:

12.1.4 In addition to the general conditions of contract, the Contractor shall also refer to the following specifications:

Section 06 : Cast-in-Place Concrete

12.2 REFERENCES

12.2.1 Except where otherwise specified, work shall be in accordance with the British Standards relevant to this Specification. The latest editions shall be used, including all current amendments and additions.

12.2.2 Any differences between their requirements and this Specification shall be submitted to the Consultant for his ruling.

12.2.3 Standards

BS 8000 1989 Part 4: Workmanship on building sites. Code of practice for waterproofing
BS 8102 1990 Code of practice for the protection of structures from water in the ground

12.3 SUBMITTALS

12.3.1. Prior to starting work on the contract the Contractor shall submit for approval, details of the proposed sources of all materials, and place of manufacture, together with full documentary evidence that the materials and manufacture will comply with the specification.

12.3.2. Details shall include, but not be limited to, manufacturer's printed specifications and membrane installation instruction, including procedures and materials for terminations,

penetrations, flashing, protection, compatibility and bonding.

12.3.3. Further submissions shall be made for any change of material, quality or source and the Consultant's approval obtained before the new materials or place of manufacture are used.

12.3.4. During installation, the waterproofing manufacturer's technical representative shall prepare and submit daily reports to the Consultant. The reports shall fully detail installation activities, observations, defects and corrective actions taken.

12.3.5. To certify the installation of the waterproofing system, the Contractor shall submit manufacturer's certification stating materials ordered and supplied are compatible with each other, suited for locations and purpose intended, and shipped in sufficient quantity to ensure proper and timely installation. A certificate signed by the manufacturer of the materials specified shall also be submitted, which states materials installed on the Works meet manufacturer's published performance standards, installation instructions and the requirements of this Specification.

12.4 QUALITY ASSURANCE

12.4.1 All substructure waterproofing systems shall be manufactured and supplied by a company certified to conform to the requirements of the quality standard ISO 9002.

12.4.2 The manufacturer shall supply specific instructions and a quality plan to the Contractor to form clear and unambiguous scope of works. The Contractor shall work in strict accordance with the manufacturer's instructions at all times.

12.4.3 The Contractor shall operate a quality system for all stages of the work and all work shall be in accordance with that system.

12.4.4 The labor force shall be adequately trained and supervised to ensure that the quality system is adhered to during all stages of the work.

12.4.5 Special consideration shall be given to prevent any damage of the waterproof system by plant, labour or other means. Particular attention should be paid to construction operations carried out in the vicinity of the waterproofing.

12.4.6 Where required, the Contractor shall ensure that the ground dewatering system is working sufficiently to ensure no hydrostatic pressure is exerted on the waterproof membranes and to ensure concrete substrates are sufficiently dry for lasting bond of the waterproof membrane.

12.4.7 The manufacturer is to have a technical representative present during the performance of the work as necessary to ensure the proper preparation and installation of waterproofing.

12.4.8 The representative of the manufacturer is to approve the conditions of the sub-strates prior to the application of the waterproofing. If necessary, the Contractor shall rectify conditions as necessary to obtain the manufacturer's representative's approval.

12.5 DELIVERY, STORAGE & HANDLING

12.5.1 Delivery to site, storage and handling of all materials shall be clearly controlled in strict compliance with the manufacturer's instructions and fully document by the Contractor. All documentation shall be open to inspection by the Consultant. The following information shall be shown for each delivery of each material:

12.5.1.1. Name of Manufacturer and product (M)

12.5.1.2. Batch reference (M)

12.5.1.3. Date of manufacture (M)

12.5.1.4. Shelf-life and conditions of storage (M)

12.5.1.5. Date of usage and location in the Works

Information shown (M) shall be clearly marked on the material itself when it is delivered and the Contractor shall impose this requirement upon the Manufacturer.

12.6 WARRANTY

12.6.1. The Contractor shall furnish a written warranty of all waterproof materials and workmanship for water tightness extended to include, but not limited to, seams, membranes and penetrations.

12.6.2. The warranty shall be signed by the product manufacturer agreeing to repair or replace defects in materials and workmanship, and failure of waterproofing to prevent water from entering into the building and building components for a period of fifteen years from date of the Taking-Over-Certificate. Under warranty, the membrane manufacturer shall be responsible for all costs of removal and replacement of overburden, such as floors and walls as necessary to obtain access to the waterproofing.

12.6.3. Warranty shall include the waterproofing of substructure components, including the raft foundations, to ensure that water ingress does not occur over the design life of the membrane. Special quality measures should be adopted

during construction to guarantee zero defects to the raft foundation membranes.

PART 2 PRODUCTS

12.7 MATERIALS

Specification

A range of waterproofing options is available to the Contractor. The materials shall be in accordance with Appendix A, Water proofing systems and with the British Standards mentioned in this specification.

All materials shall be approved in accordance with the Quality Assurance procedures in this specification in conjunction with the following requirements.

Requirements of all materials

The waterproof system provided, shall form a continuous waterproof barrier, installed without damage and protected against construction operations.

Waterproofing material shall be specially formulated to allow application in the hot climatic conditions encountered in the Middle East and it should not be adversely affected by temporary heat gain whilst exposed during construction.

Penetrations by services, etc. shall be sealed with a compatible waterproof system as recommended by the waterproofing manufacturer.

Under normal service conditions a factor of safety of at least two shall be provided against failure of any kind. Where necessary, materials shall be designed to resist:

a. pressures from solids, liquids or gases.
b. abrasion and other effects of traffic or flow of materials over joints.
c. chemical and biological attack.
d. fire.
e. degradation from ultraviolet light, thermal effects and other natural phenomena.
f. degradation by ageing (e.g. ultra-violet) or fatigue (e.g. vibration).
g. damage cause by chemicals in the ground.
h. damage during construction.
i. damage caused by cracking of the sub-strate, up to 0.5mm crack width.

Materials shall be compatible with other materials against which they abut.

Materials shall be properly formulated for their intended use and shall be within their movement and fatigue capability, taking account of construction tolerance.

Materials shall be physically and chemically stable at handover and not liable to subsequently release of toxic agents.

Materials to be mixed on site shall have adequate pot-life to allow proper installation by the operators, taking into account the size of container and the conditions under which the operators are working.

Materials which will be in contact with potable water shall be approved under the Water Research Centre's Testing Scheme.

Materials which will be exposed to food products or used in a food-preparation or food-handling or food-storage environment, shall be fully cured at handover and shall, after curing, be inert, non-toxic, odourless, non-tainting, mould resistant and waterproof.

Materials which will be in any way exposed when the work is completed shall be resistant to attack by vermin (rodents, insects, etc).

Materials which will normally be open to view once the works are completed shall present a neat appearance. Solvents shall not bleed and stain adjacent work.

Installation shall be strictly in accordance with the manufacturer's requirements, by experienced operators.

Initial meetings and approvals

At the start of the Contract the Contractor shall meet with the Consultant to review the requirements of the job. Where additional information is necessary for the design of the joints, it is the responsibility of the Contractor to request this information from the Consultant. The Contractor shall then submit to the Consultant, for approval, his proposals for the supply of materials and for their installation into the works. If required by the Consultant, technical representatives of the Manufacturers and of any proposed application subcontractors shall attend a meeting to review the proposals. If requested by the Consultant, site-trials shall be carried out using mock-ups to demonstrate the system proposed.

Approval of materials and their method of application

The Contractor shall submit samples and full technical details for approval by the Consultant. Samples shall include 300 x 300mm of membranes and 300mm of strip products, as appropriate. Technical details shall include:

a. Full material analysis and properties (both initial and long-term).
b. Shelf-life and pot-life.
c. Instructions for handling, mixing, installing, finishing, curing and protecting (including Health and Safety and COSSH).
d. Requirements for preparation and condition, backing, debonding and priming.
e. Behavior under imposed movements, cross-joint pressure and fatigue.
f. Special instructions for jointing, interfaces, etc.

Colours of materials which will be visible when the works are completed shall be to the Consultant's approval.

Manufacturer's Requirements and Expertise

The Contractor shall submit to the Consultant for each material two copies of the Manufacturer's specifications and recommendations and a letter from the Manufacturer certifying that the material complies with the requirements of this Specification and is suitable for the intended application.

The requirements of the material Manufacturer shall be met by the Contractor. A technical representative of each company supplying materials shall visit the site at the commencement of the relevant part of the works and shall advise on the use of the materials. Installation shall then proceed strictly in accordance with the Manufacturer's recommendations. If required by the Consultant, the same technical representative shall make further visits to the site during the execution of the works.

Operators' Expertise

The Contractor must demonstrate to the satisfaction of the Consultant that the operators are adequately experienced and that they fully understand the requirements of the particular job being undertaken. New operators shall at no time be employed on the work without being approved by the Consultant. If the work is subcontracted, copies of the Specification and the Manufacturer's recommendations for the materials to be applied shall be furnished by the Contractor to the subcontractor.

Primers

Where the membrane Manufacturer recommends the provision of a primer, it shall be provided fully in accordance with his requirements.
Water stops – Re-injectable hoses

Water stops shall be provided at all joints to prevent water seepage. Construction joints are to be provided only as shown on the construction drawings.

The Contractor shall inform the Lead Sector Consultant without delay if the need for any additional joints arises. All water stops are to be re-injectable hoses in accordance with the appendix to this specification. Water bars are not permitted.

12.8 PART 3 EXECUTION

12.8.1 WORKMANSHIP

Trials

At the start of the work the Contractor shall carry out trials which may at the discretion of the Consultant be incorporated in the final works. The quality of the work shall be to the approval of the Consultant. Once a satisfactory standard of work has been reached, the trials shall be used as a standard

for the approval of the work as a whole.

Preparation for application of membrane

Surfaces to receive waterproofing shall be prepared in strict compliance with the requirements of the manufacturer. All contaminants such as dust, loose particles, moisture, oils or greases shall be removed from the surface. If necessary, rough or other unsuitable surfaces shall be improved to satisfy the manufacturer's recommendations for the product to be applied.

A technical representative of the manufacturer shall be present on site, as defined in the Quality Assurance section of this specification section. The representative is to approve the conditions of the sub-strates prior to the application of the waterproofing. If necessary, the Contractor shall rectify conditions as necessary to obtain the manufacturer's representative's approval.

The waterproofing manufacturer's representative shall verify that the installation complies with the waterproofing manufacturer's requirements and shall prevent entry of water into the building and structural components so that the installation can be warrantied. The Contractor shall provide remedial work as necessary to obtain the waterproof manufacturer's technical representative's verification.

Installation

Membranes and tanking are to be installed in strict compliance with the manufacturer's requirements and as described in Appendix A of this specification.

All waterstops shall be installed in strict compliance with the manufacturer's installation instructions and as described in Appendix A of this report.

Substandard work, which is not in accordance with this Specification, shall be completely removed and remade.

12.8.2 INSPECTION AND TESTING

Testing

The Contractor shall be responsible for all testing required by the waterproofing manufacturer, to give the required warranties. The Consultant shall be permitted access to witness any tests. Two copies of all test results shall be submitted promptly to the Consultant.

Approval of the Consultant

Wherever the Contractor is required to obtain the approval of the Lead Consultant, this must be requested in writing and written approval obtained before the work concerned is put in hand.

Approval of materials
Full test data for all materials shall be given by the Manufacturer. If required by the Consultant, tests shall be repeated and further tests carried out.

Site Inspection
The Contractor shall provide full supervision of all operators and their work shall be thoroughly inspected on a regular basis to maintain standards.

Site testing
If required by the Consultant, samples of materials shall be removed from the works and tested at the expense of the Contractor.

Joints exposed to the weather shall be water-jet tested in the presence of the Consultant. The jet shall be from a 19mm hose under minimum 2 kN/mm^2 pressure held 600mm from the joint and moved along the joint at 600mm/minute. The joints shall be pass the test if they do not show any sign of water ingress.

Joints required to resist water or other pressure shall be tested for compliance with this Specification as directed by the Consultant.

Rectification
All work which fails to comply with this Specification either during construction or during the guarantee period shall be rectified promptly, by the Contractor at his own expense.

WATER PROOFING SYSTEMS
The systems noted below shall be obtained from a single manufacturer who shall supervise the installation on site, in accordance with this Specification.

The Contractor may propose alternative systems within the constraints of this specification.

WATERSTOPS – RE-INJECTABLE HOSES
Water stops are to be re-injectable hoses.

Re-injectable hoses shall be provided as a complete system for each structure, by one Manufacturer. The hose shall be of a re-injectable nature and be capable of re-injection several times over the life of the structure.

The re-injectable hose and re-injectable resin shall be fully compatible, supplied by one manufacturer.

All water stop products shall be manufactured by a company certified to conform to the requirements of the quality standard ISO 9002.

WATERPROOFING MEMBRANES:

General

The waterproof membrane is to perform as required by this specification. The membrane shall be installed in compliance with this specification and it shall be warrantied for a minimum period of 10 years .The membrane shall be free from defects. Stringent site quality control measures and supervision will be required to achieve this.

The waterproof membrane shall comply with one of the following specifications.

Type 1: Synthetic membrane – Plasticized PVC

A single layer, plasticized PVC membrane (minimum thickness 2.0mm with welded seams) installed with overlaps and corner detailing formed and fully sealed, all in strict compliance with the manufacturer's recommendations.

The substrate, joints and laps are to be in accordance with the manufacturer's requirements, to achieve the required warranty. The manufacturer's representative shall confirm in writing that the installation, including joints, is satisfactory.

Once installed, the inspected membrane shall be permanently protected by rot proof protection boards, thermal insulation or sand and cement blinding layer as appropriate.

Type 2: Bituminous membrane with fabric reinforcement

A single layer, bituminous membrane (minimum thickness 5.0mm with torched joints) installed with overlaps and corner detailing formed and fully sealed, all in accordance with the manufacturer's recommendations.

The substrate, joints and laps are to be in accordance with the manufacturer's requirements, to achieve the required warranty. The manufacturer's representative shall confirm in writing that the installation, including joints, is satisfactory.

Once installed, the inspected membrane shall be permanently protected by rot proof protection boards, thermal insulation or sand and cement blinding layer as appropriate.

Type 3: Liquid applied membranes

Two or three coats, as recommended by the manufacturer, of a high build rubber/ bitumen emulsion with a minimum 65% solids content and 10% rubber content in the dried film.

The use of liquid applied membranes shall be limited to direct application onto finished, prepared faces of structural elements. Application of liquid applied membranes onto blinding layers below foundations is not permitted.

BITUMEN COATING ON WALLS

Unless otherwise specified all concrete and masonry work in contact with earth upto plinth level shall be given an application of two coats of Industrial Bitumen paints at the rate of 15 lbs per 100 sq.ft ensuring that no pin holes / patches are left out. Bitumen will be applied after cleaning all dirt, dust and loose material from the surface and ensuring that the concrete or masonry has been cured and dried. Second coat will be applied after the first coat completely dried backfilling of each in foundation upto plinth will only be carried out after the application of bitumen coats and after the final coat completely dried as specified hereinabove or as directed by the Engineer. Bitumen coat shall be measured in sq.ft of area to

be coated and 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

12.9 MEASUREMENTS AND PAYMENTS:

Payment for all the items under this section shall be made at the individual rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

SECTION – 13

13.0 CONCRETE REPAIRS

13.1 General Description.

13.1.1 The Work shall consist of:

13.1.1 Removing the deteriorated concrete as shown and described on the Drawings and in this Specification

13.1.2 Preparing the surface of the concrete for the repair, including abrasive cleaning, cleaning of existing reinforcement, and applying bonding agent to the surface; and

13.1.3 Supplying materials and the mixing and placing of concrete repair mortar or concrete as shown and described on the Drawings and in this Specification including vibrating, finishing and curing; and

13.1.4 Supplying, fabricating, constructing, maintaining and removing temporary works, including false work and formwork; and

13.1.5 The quality control (QC) testing of all materials.

13.1.6 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.

13.2 References

All reference standards shall be current issue or the latest revision at the date of tender advertisement.

13.3 References.

13.3.1 ASTM - the published standards of the American Society for Testing and Materials, West Conshohocken, PA.

13.3.2 CSA A23.1, Concrete Materials and Methods of Concrete Construction

13.3.3 ASTM D4541 - Pull-off Strength of Coatings Using a Portable Adhesion Tester.

13.3.4 International Concrete Repair Institute (ICRI) Technical Guideline No. 310.1R, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.

13.3.5 D638 - Tensile Properties of Plastics.

13.3.6 ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics.

13.3.7 ASTM D695 - Compressive Properties of Rigid Plastics.

13.3.8 ASTM D2584 - Volatile Matter Content.

13.3.9 ASTM D2240 - Durometer Hardness, Type D.

13.3.10 Reinforcing steel (when required) shall conform to the requirements of ASTM A-615 (Fy = 60 ksi) deformed steel bars of Grade 60 U.N.O

13.3.11 ACI 117, Standard Tolerances for Concrete Construction and Materials

13.3.12 Structural steel to be used for falsework shall comply with the requirements of Standard Specifications for StructuralSteel ASTM.

13.3.13 Approved Products List

13.4 Submittals

The Contractor shall submit the following to the Engineer, in accordance with this Specification and the Special Provisions:

13.4.1 Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.

13.4.2 Product data sheets and installation procedures for proposed concrete repair mortar(s).

13.4.3 Project specific guidelines and recommendations

13.4.4 Detailed design notes, calculations and Shop Drawings for any temporary works, including formwork and false work shall be submitted to the Engineer prior to the Contractor proceeding with the work.

13.5 Materials

The Contractor shall supply all materials necessary for the repair and restoration of deteriorated concrete areas as follows:

13.5.1 Concrete repair mortar from the most recent Approved Products List most closely matching the exposure class and properties of the existing concrete and meeting the anticipated placement requirements.

13.5.2 Sacrificial galvanic anodes (when required) shall be puck-shaped, pre-manufactured, and consist of electrolytic high grade zinc in compliance with ASTM B418-95a Type 1 cast around a pair of steel electric lead wire in compliance with bright annealed ASTM A82-97a and encased in a highly alkaline cementitious shell with a pH of 14 or greater. The cementitious shell shall contain no chlorides or other corrosive constituents as per ACI Guideline No. 222.

13.5.3 Reinforcing steel (when required) shall conform to the requirements of ASTM A-615 (Fy = 60 ksi) deformed steel bars of grade 60 unless indicated otherwise on the Drawings.

13.6 Construction Methods

13.7 Surface Preparation

13.7.1 Each portion of concrete to be removed shall be clearly identified, outlined each portion of concrete to be removed shall be clearly identified, outlined and catalogued. The area marked shall be such that the polygon defining the boundary does not have any internal angle less than135. The engineer shall approve the extents and locations of these pockets to be removed prior to commencement of works by the contractor.

13.7.2 The contractor shall apply shallow cuts of 20 mm depth at the defined periphery of the area marked for removal before commencing with the required removal of concrete. The contractor shall use approved means to remove concrete up to limits defined above. Care shall be exercised that sound concrete to be left intact at the boundary is not damaged or compromised. In the event such damage is inadvertently caused, the damage shall be immediately notified to the engineer and the extent of concrete removal area shall be enhanced to include the newly damaged concrete in consultation with the engineer.

13.7.3 Although the contractor may use any mechanized means of removing existing concrete, use of small chisels with light to medium hammer blows shall be encouraged. Any method of removal of concrete proposed by the contractor shall ensure that the chances of any possible damage to the embedded reinforcement and surrounding sound concrete remain minimized. Use of jackhammers and similar vibratory equipment shall not be allowed.

13.7.4 The engineer may instruct practical demonstration of some or all of the equipment proposed to be used by the contractor to satisfy him of the adequacy/suitability of the same. Upon receiving such instructions from the engineer, the contractor shall arrange trials of his proposed equipment in mock conditions duplicating the actual working conditions as far as reasonably possible. Only equipment approved by the consultants shall be used for the works.

13.8 Removal of Existing Concrete

13.8.1 Each portion of concrete to be removed shall be clearly identified, outlined and catalogued. The area marked shall be such that the polygon defining the boundary does not have any internal angle less than 135. The engineer shall approve the extents and locations of these pockets to be removed prior to commencement of works by the contractor.

13.8.2 The contractor shall apply shallow cuts of 20 mm depth at the defined periphery of the area marked for removal before commencing with the required removal of concrete. The contractor shall use approved means to remove concrete up to limits defined above. Care shall be exercised that sound concrete to be left intact at the boundary is not damaged or compromised. In the event such damage is inadvertently caused, the damage shall be immediately notified to the engineer and the extent of concrete removal area shall be enhanced to include the newly damaged concrete in consultation with the engineer.

13.8.3 Utmost care shall also be exercised to prevent any damage to the existing reinforcement within portions of the concrete to be removed. Any damage caused to the existing reinforcement shall be recorded and reported to the engineer immediately.

13.8.4 Prior to pouring fresh concrete, the surrounding edges of existing concrete shall be coated with an approved epoxy mix as per the supplier's recommendations.

13.9 Cleaning of Reinforcement

13.9.1 The intended concrete having been removed to the extents desire d/instructed by the engineer, the exposed reinforcement shall now be cleaned of all debris etc. still adhering to the surface of the bars. This debris shall be removed using wire brushes and small chisels where required. Utmost care shall be exercised that the existing reinforcement is not damaged during this operation. Undue flexing, bending or hammering of the reinforcement shall not be allowed. The use of chemicals to remove or otherwise dissolve material sticking the exposed reinforcement shall not be allowed. The cleaned up reinforcement shall be inspected and approved by the engineer before proceeding further with the work at each location.

13.9.2 The reinforcement having been cleaned, the edges of sound concrete defining the extents of removed portions shall be cleaned with wire brushes and water/air jets. The objective shall be to dislodge and remove any loose material from these edges.

13.9.3 Areas so worked and prepared shall be cordoned off to prevent contamination or further damage due to any reason.

13.10 Drilling of Dowel Holes

13.10.1 After locations of all dowels have been marked and identified, work shall proceed to drilling of dowel holes. Approved drilling equipment shall be used to drill holes of the required depth and diameter. The drill bits shall be marked so that drill hole depths achieved can be easily established during the drilling operations. Care shall be exercised that concrete surrounding the drill hole is not shattered or damaged in any way.

13.10.2 In case such damage does occur, the damaged portions shall be immediately removed using small chisels and light hammer blows. After removing such damaged concrete, the worked surfaces shall be cleaned using wire brushes and air jets to dislodge and remove any loose particles at the surface.

13.10.3 While drilling in the vicinity of reinforcement components embedded within the girder, extreme care shall be exercised to ensure that none of the reinforcement components are damaged in any way due to the drilling operation. Each drill hole in such areas shall be advanced 5 mm at a time. After each advance, the drill shall be removed and the hole shall be carefully examined to ensure that any reinforcement element has not been encountered inadvertently. In the event that a reinforcement element has been encountered, the hole shall be immediately abandoned and filled up with epoxy as outlined in the drawings. An alternate location, in lieu of the abandoned hole shall be decided and approval for the same sought from the designers before drilling at the new location.

13.10.4 Immediately after each hole is drilled, it shall be cleaned using air jets and the drilled depth recorded. The mouth of the drill hole shall then be plugged to prevent any debris or contamination from entering the hole.

13.10.5 The engineer shall inspect works for quality and accuracy before giving approval for the drilling operation. Work shall proceed to the next stage after the engineer's approval for this stage of work. The concerned work areas shall be kept clean and free of contamination at all times.

13.11 Installing dowels.

13.11.1 The drill holes made and approved, work shall proceed to installation of dowels. Each drill hole shall be unplugged just prior to installation of the dowel within. The hole shall be re-cleaned using air jets and prepared as per recommendations of the epoxy suppliers. Usually epoxy applications require the

intended surfaces to be saturated but without any free surface moisture. To achieve this, water jets followed by air jets may be used to get the desired results. The supplier's recommendations for preparing the intended concrete surfaces shall however be followed in all detail. A group of drill holes having been so primed; the concerned area shall be cleaned again to remove any debris or loose particles.

13.11.2 Epoxy, premixed as per the supplier's recommendations, shall be introduced into the drill holes–followed by the steel dowels of the required length, grade and diameter. While introducing epoxy into the drill holes, care shall be exercised that air pockets or bubbles are not formed within the drill hole. Towards this end it is recommended that an epoxy gun with an extended nozzle be used for introducing epoxy into the drill hole–filling the hole from the bottom towards the top. Pouring the epoxy using funnels is not advised.

13.11.3 Dowels shall be inserted into the holes immediately after the epoxy has been introduced. Any epoxy that overflows the holes upon introduction of dowels shall be removed immediately using suitable bladed instruments and disposed-off. Such overflow epoxy shall not be reused in any of the other drill holes.

13.11.4 After introduction of dowels into the holes, the concerned area shall be cordoned-off so as to prevent any disturbance to the dowels until the epoxy has set and gained strength. Similarly, any drilling operations or similar works that may cause vibrations in areas where fresh epoxy has been applied shall be suspended for sufficient amount of time.

13.11.5 The epoxy shall be given sufficient time to set and gain strength as per the supplier's recommendations before subsequent operations are performed in the area. During the curing period for the epoxy compound, the area shall be protected from extreme variations of temperature and moisture as per the supplier's recommendations.

13.12 Concrete Patch Repair

13.12.1 The contractor shall apply shallow cuts of 20 mm depth at the defined periphery of the area marked for removal before commencing with the required removal of defective concrete. The contractor shall use small chisels and light hammer blows to remove defective concrete up to limits defined and/or up to a minimum of 25 mm behind the surface reinforcement. Care shall be exercised that sound concrete to be left intact at the boundaries is not damaged or compromised. In the event such

damage is inadvertently caused, the damage shall be immediately notified to the engineer and the extent of concrete removal area shall be enhanced to include the newly damaged concrete in consultation with the engineer.

13.12.2 Utmost care shall also be exercised to prevent any damage to the existing reinforcement within portions of theconcrete to be removed. Any damage caused to the existing reinforcement shall be recorded and reported to the engineer immediately.

13.12.3 The defective concrete having been removed to the extents desired/instructed by the engineer, the exposed reinforcement shall now be cleaned of all debris, rust etc still adhering to the surface of the bars as specified in the drawings.

13.12.4 The reinforcement having been cleaned, the edges ofsound concrete defining the extents of removed portions shall be cleaned with wire brushes and water/air jets. The objective shall be to dislodge and remove any loose material from these edges.

13.12.5 Prior to pouring fresh concrete, the surrounding edges of existing concrete shall be coated with an approved epoxy mix as per the supplier's recommendations. In case the existing reinforcement was discovered to be corroded, it shall be coated with an approved epoxy protection.

13.12.6 Depending upon the situation, the contractor may, after previous declaration and approval, use uniting, shotcreting, dry packing or simple concrete to replace the damaged concrete removed. In the case of concreting, a mix containing 20 mm and down aggregate with a slump of 150 mm minimum is advisable. The mix shall be so proportioned that shrinkage tendencies are minimized. In all instances the material used by the contractor shall be pre-approved by the engineer.

13.12.7 The outer/exposed surface of the new concrete shall be worked to a smooth and uniform finish in line with the original profiles to complete the job.

13.13 Concrete Mix Design

13.13.1 Concrete shall be class "A" (refer general notes drawing as given in appendix d for concrete classes). Since early strength is required, an accelerator like corn plast 430 or equivalent shall be used. Recommended dosage for corn plast 430 is between 0.5 liters and 1.0 liters for each bag of concrete used. Recommended water/cement ratio is 0.32.

13.14 Curing

13.14.1 Curing shall be in accordance with the manufacturer's instructions or as otherwise directed by the Engineer.

13.15 Quality Management

13.16 General.

13.16.1 Concrete repair mortar that is not stored, handled, prepared, placed, or cured in accordance with the manufacturer's instructions will be rejected by the Engineer and his/her decision shall be considered final. The Engineer reserves the right to require immediate removal of any concrete from rejected batches that may have already been placed in the structure.

13.16.2 Quality assurance testing will be carried out by the Engineer and all associated costs will be paid for by the Department. There shall be no charge to the Department for materials taken by the Engineer for testing purposes.

13.17 Delivery, Storage, and Handling

13.17.1 Materials are to be kept dry, protected from weather andstored under cover.

13.17.2 Materials such as protective coating are to be stored between 50 and 90 degree Fahrenheit. Do not store near flame, heat or strong oxidants.

13.17.3 Materials are to be handled according to their materialsafety data sheets.

13.18 Warranty

13.18.1 Applicator shall warrant all work against defects in materials and workmanship for a period of ten (10) years, unless otherwise noted, from the date of final acceptance of the project. Applicator shall, within a reasonable time after receipt of written notice thereof, make good defects in materials or workmanship which may develop during said ten (10) years period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner.

13.19 **Payment**.

The unit of measurement shall be as indicated in Bill of Quantities. 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.

Competitive and Livable City of Karachi
Local Government Department, Government of Sindh.

TECHNICAL SPECIFICATION - ELECTRICAL

TENDER

December,2021

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. 584-1825
Email : info@eaworld.com | www.eaworld.com

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SECTION – E – 1

SPECIFICATION FOR MATERIALS AND EQUIPMENT

GENERAL:

This Technical Specification refers to the Road Lighting and Medium Voltage distribution Electrical Services, to be supplied and installed on M.T Khan Road.

The Contract shall include the supply of equipment and materials installation, completion, testing and commissioning of the individual components of electrical system and finally the complete installation of electrical system in accordance with the conditions of contract, specifications, drawings, bill of quantities and as per applicable International Codes & Standards.

General Electrical Requirements

The Contractor shall carry out all the work in accordance with the specification and in conformity with the Electricity Act and Rules as adopted in PAKISTAN and the latest edition of the British Standard Specifications and Wiring Rules of the Institute of Electrical Engineers (London) hereinafter referred to as the (I.E.E. Wiring Rules). Where these specifications differ from the rules stated, these specifications shall be followed:

The entire electrical installation/work shall be carried out by the licensed contractor, authorized to undertake such work under the provisions of Electricity Act and The Electricity Rules as adopted and modified up to date by the Government of PAKISTAN. The licensed contractor must be registered with PAKISTAN Engineering Council (PEC).

Any special requirements of the Local Electrical Inspector shall be compiled with by the contractor, and all works shall be to the entire satisfaction of the Government Inspector/Engineer / Power Supply provided (KE).

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 and by Power supply authorities (KE).

If during preparation of the bid, the Contractor finds any error /discrepancies /omission / ambiguity/ uncertainty that need clarification, the same shall be referred to the consultant.

a. Any installation not complying with the specification shall be corrected/ replaced

b. It shall be the responsibility of the Contractor to protect equipment and materials (installed or stored) from damage till final taking over by the Employer.

c. The materials shall be purchased from approved supplier / manufacturer.

d. The Contractor shall produce comprehensive documentation of individual testing, calibration and installation together with an overall record of the state of completion to the client as per tender conditions.

e. It will be the responsibility of the Contractor to coordinate between other agencies and client shall accommodate other utilities/services.

f. The work shall be carried out in accordance with the B.S.S, I.E.C and I.E.E. Rules and Regulations as adopted in PAKISTAN, to satisfy the requirements of the client.

g. The Contractor shall ensure at his own cost the permanent availability of this specification, drawings and Contract agreement on site.

h. 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 work as per approved drawings.

ELECTRICAL EQUIPMENT AND MATERIALS

a. The Contractor shall supply all materials, tools, plants, equipment, scaffolding, hardware, supports and fixing as necessary to complete the installation satisfactorily.

b. 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, quality and function as here in specified and fully meet the quality level and requirements of the specifications and shall be purchased from approved sources.

c. The Contractor shall be solely responsible for ensuring proper functional requirements of various equipment.

d. Where any materials in the Contractor's supply are specified on the drawings or in Bill of Quantities, the same shall form part of the specification.

e. Where equipment, materials or articles are referred to in the specifications as "Equal to" any particular standard, the choice and approval of the same shall rest with the client.

f. 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.

g. The Contractor shall supply all small installation and consumable materials without any extra cost such as nuts, bolts, washers, shims, angles, levelling materials, insulation tape, PVC strap-on or heat shrinkable type cable tags, cable ties, bushes, sealing compound, AVO meter, 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.

CODES AND STANDARDS

a. The latest published rules British Standards (BS), International Electro Technical Commission (IEC), Institute of Electrical Engineers (IEE) and National Standards. Rules and Regulations of Provincial/Local Authorities shall be considered included as part of these specifications and all their requirements shall be fully met.

b. The entire installation shall be free from improper grounds, open and short circuit faults. Tests shall be made in accordance with Section "E" of IEE Regulations for the electrical equipment of building 17th Edition. Each panel shall be tested with mains connected to the riser, branches connected, switches off, all fixtures in place and permanently connected, and lamps removed or omitted, sockets and wall switches closed. Each individual power line shall be tested with the power equipment connected for proper and intended operation. In no case shall the insulation

resistance be less than that allowed by the Regulations for electrical equipment of buildings and manufacturer's recommendations based on British standards. Failure shall be corrected in a manner satisfactory to the client.

c. It shall be the responsibility of the Contractor to test all systems of the entire electrical installation as well as those installations where sequence in operation is required. The electrical contractor shall test for proper sequence and the consultant shall leave the entire electrical installation in satisfactory working condition.

d. The Contractor shall guarantee that the electrical systems including all components and accessories used therein are free of all grounds, shorts and open circuit faults, defective workmanship and materials.

ALTERATIONS

The location of various items indicated on the drawings are presumed to be approximately correct, but it is to be understood, however, that the small scale drawings are necessarily diagrammatic and that such locations as are shown, are subject to slight revision, the work is in progress or equipment is installed, which may be necessary to accommodate local construction condition or interference with other services. No major changes shall be made without the approval in writing of the client. On obtaining client approval, the position of any point may be altered without extra charge being made. The location of poles/LCP shown in the systematic plans should be considered as approximately correct.

PROTECTION

The Contractor shall effectively protect the work from damage during and as may be necessary, after installation and he shall likewise protect adjoining work of other trades from damage resulting from installation of electrical work.

OPERATION AND MAINTENANCE MANUALS

The contractor shall submit the operation & maintenance manual for all equipments, which were supplied by vendors. The completion of document and preparing a comprehensive manual shall be the responsibility of contractor.

DRAWING AND DATA TO BE FURNISHED BY THE CONTRACTOR

a) **Shop Drawings:** The location, routing and installation heights of the equipment etc., which are given on the detailed approved drawings, are approximate. These drawings depict only the position of various fixtures and outlets. All the detailed planning for electrical system including conduit routes etc. shall be carried out well in advance of the actual execution of work, by the Contractor to the satisfaction of the client. For this purpose the Contractor shall prepare three (3) sets of "Shop drawings" prior to installation duly coordinated with other services and submitted to the client for approval.

b) **As-built Drawings:** Clearly annotated As-Built electrical drawings and diagrams shall be maintained up to date on site on completion of the project. Contractor shall submit four (4) sets of **"As built"** drawings to the client after completion of works.

SECTION – E – 2

15 KV, MEDIUM VOLTAGE CABLE

1.0 SCOPE

The work under this section consists of supplying, installing, testing and commissioning of all material and services of Medium Voltage cable and accessories as specified herein or as stated on the drawings and in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at site with other services for exact route, location and position of the MV cables.

The Medium Voltage cable with accessories shall also comply with the General Specifications for Electrical Works Section- 1 and with other relevant provisions of the Tender Documents.

2.1 GENERAL

The 15kV MV cable shall be three core, Aluminium conductor, cross-linked polyethylene (XLPE) insulated, shielded, armoured as per requirements and overall sheathed. It shall be suitable for indoor and outdoor use in the transmission and distribution of electrical energy.

The cables shall be capable of operating continuously at a conductor temperature of not less than 90ºC and shall be suitable for 8.7/15 kV, 50 Hz in three phase grounded system in accordance with IEC 60502.

The cable shall be treated for vermin proofing and be protected against rodents during storage, laying.

2.2 APPLICABLE STANDARD / CODES

The following standards and codes shall be applicable for the materials within the scope of this Section:

IEC 60502 - Extruded solid electric insulated power cable for rated voltage from 1 kV to 30 kV.

IEC 60540 - Test methods for insulation and sheaths of electric cables and cords.

IEC 60228 - For resistance of conductors.

IEC 60332-1 - For flame retardant test.

IEC 60332-3 - For fire resistant test on fire resistant cables.

IEC 60227 - For core identification by colours.

2.3 MATERIAL

2.3.1 15kV Cable

The cable shall meet the following specifications:

Nominal/System Voltage	-	**11 kV**
Frequency	-	**50 Hz**
Conductor Size	-	**Sq.mm. As given in BOQ,**
Number of Cores	-	**3**
Rated Voltage	-	**8.7 / 15kV**
Continuous operating Temperature of conductor	-	**90 °C**
Conductor material	-	**Aluminium stranded**
Insulation	-	**Cross-linked polyethylene (XLPE)**
Shielding	-	**Aluminium tape**
Jacket	-	**PVC**
Armouring	-	**Galvanized steel wire**
Over sheathing	-	**Extruded PVC**
Phase identification	-	**Red, Yellow, Blue**

2.3.2 Conductor

The conductors shall be of high conductivity electrolytic Aluminium, stranded in accordance with specified standard.

2.3.3 Insulation

The insulation shall be cross-linked polyethylene extruded over the conductor. The insulation shall be laid to avoid any gap/air pockets between the conductor and insulation. The insulation colour red, yellow and blue for phase identification by providing tape.

The insulation shall be easy to strip from individual conductors and to separate for jointing/termination purposes.

2.3.4 Shielding

Each core shall be shielded by a layer of semi-conducting material applied directly over the insulation. The semi-conducting insulation shall be covered by a bare copper tape applied with suitable overlapping.

Phase identification tape of red, yellow and blue colours shall be wrapped over the copper shield.

2.3.5 Assembly

The three insulated conductors shall be assembled with PVC or any non-hydroscopic filler and bounded with tape. The tape binder shall then be covered with extruded PVC jacket. The PVC jacket shall be padded with a suitable material before application of armour.

2.3.6 Armour

Armouring shall be provided with single layer of galvanized steel wire to provide cable protection and also act as a low resistance earth return path. The armouring shall be covered with binder tape. The armour shall be of appropriate size to carry the system fault current.

2.3.7 Over sheath

The entire cable assembly shall be covered with a PVC jacket of thickness not less than 2.5 mm. The colour of the jacket shall be black.

Embossed marking on the over sheath at 3 meters intervals shall give the following information:

- **Name of Manufacturer**
- **Year of Manufacture**
- **Size of cable in sq.mm.**
- **Voltage grade**
- **Type of cable i.e. Al., XLPE/SWA/PVC**
- **Project/ Client name (if required)**

2.3.8 Factory Tests

Physical and electrical acceptance tests in accordance with applicable standard shall be carried out at the manufacturer works in the presence of Engineer. Three copies of test reports will be furnished to the Engineer, which shall include brief description of tests, test records and results.

The tests shall include, but not limited to, the followings:

- AC High Voltage Test
- Partial Discharge Test
- DC Resistance Test

2.3.9 Termination Kits

Cold shrink Termination kits for 15 kV cable shall be indoor/outdoor type as per requirement and recommended by cable manufacturer and as approved by Engineer. The termination kits shall be complete with all materials including boots etcs,.

2.3.10 Cable Accessories

All cable accessories shall be provided for the complete cabling 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, clips, lugs, tapes, solder identification tags, bushes, glands etc.

2.3.11 Cable Reels

The cable shall be supplied in non-returnable, mechanically strong, rail/ road worthy, wooden or metallic cable drums, protected against weather. The cable drum should bear the markings for cable type, cable size, voltage grade, year of manufacture, name of manufacturer, direction of unreeling, and any other additional marking normally provided by the manufacturer. Cable ends on cable reels shall be protected by means of suitable seal.

2.3.12 Cable Markers

Above ground cable markers made of Grade-25 reinforced concrete shall be erected at a maximum interval of 200 metres along the straight trench, at each bend and joint box for indicating the presence of underground cables. Where the trench changes its direction two number of markers shall be installed one in each direction to indicate the two directions of the trench. At the joint box, additionally a symbol shall be engraved just beneath the letters MV to indicate the presence of the joint box.

The cable markers shall be finished in grey paint. The letters and symbols for indication shall be engraved in concrete on both sides. Letters shall be MV for medium voltage or low voltage cable. The colour of the engraved letters and symbol shall be black. The dimensions of the markers shall be as shown on the drawing and shall be installed in the ground as shown.

2.4 INSTALLATION

2.4.1 General

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 these Specifications, drawings and in accordance with manufacturer's instructions.

Necessary precautions for safety of cables shall be taken during the laying of cables to avoid scratches/ cuts to the cable surface. Pulling force on cable at all times shall remain well within the manufacturer's recommended limits.

The exact cut lengths for cable shall be confirmed by the Contractor by actual measurements at site prior to the commencement of manufacturing. The cable lengths where shown on the drawing are tentative and only for general guidance. The Contractor shall be solely responsible for furnishing correct lengths of cable to avoid joints in cable length except where necessary, after obtaining approval of the Engineer.

Prior to installation of jointing and termination kits, the cable lengths shall be checked and tested to ensure that the cables are in sound condition, and no damage has been done during handling and installation. After the MV cable and jointing/termination kits are installed, it shall again be tested prior to commissioning and in accordance with recommendations of standard to which the cable is manufactured. All protective pipes/ sleeves shall be plugged to attain the same after installation.

SECTION – E – 3

LOW VOLTAGE CABLES AND WIRES

1.0 GENERAL

This item shall consists of supplying, laying, testing ,connecting and commissioning of all material and services of Low Voltage (LV) cables and wires and the accessories according to the specifications, bill of quantities, drawings and/or as directed by the Engineer. The Cables shall be supplied from the approved supplier, as specified in approved manufacture list for the LV cables.

The Contractor shall discuss the electrical layout with client and coordinate at site with others for exact route, location and positions of LV cables.

The LV Works shall comply with requirements of relevant IEC and British Standards, the LV cables and wires with accessories shall also comply with the requirements of BOQ Item.

All cables shall be certified by the manufacturer as suitable for installation in Pakistan.

All materials shall be procured from approved Vendor. Only products with a proven record of performance, efficiency and long life will be considered for approval.

All works, equipment and materials shall comply with statutory and other regulations, Codes of Practice and Standards current at the date of Tender.

2.0 MATERIAL REQUIREMENTS

All multicore and single core wires shall be as per Bill of Quantities. All single and three core sheathed cables shall be of 450 / 750 volt grade. 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, 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.

All the cables shall be suitable for operation in 400 / 220 Volts; 50 Hz three phase multiple neutral and Earthed Distribution System. The Electrical cable should be suitable for direct burial, for installation in air or running in the ducts/conduits. The maximum Ambient Temperature shall be 500C.

3.0 Standards

Particular reference shall be made to:

- BS 6004 / 6346 PVC insulated cables for lighting and power.
- BS 6746 PVC insulation for electrical cables.
- BS 6360 Copper conductors
- BS 6500 Insulated flexible cords.

Any other standard referred to in above standards or these specifications

4.0 CONSTRUCTION REQUIREMENTS

The lighting and control cables shall be furnished and installed in accordance with the routes and requirements shown on the drawings.

The Voltage grade of the multi core LV Power cables shall be of 600/1000 volts.

All multi core cables shall be provided with identifications color scheme, i.e. red, yellow, blue for phases and black for neutral. The insulated earth continuity conductors shall be having Green or green Yellow color.

The ends of each length of multicore armored or un-armored cables shall be properly marked for clockwise and anti-clock-wise sequence of core colors.

The armored cables shall comprise of shaped stranded copper conductor, PVC insulated taped bedding, galvanized steel wire armor and PVC over sheath.

The insulation resistances of the cables shall conform to the relevant British Standard and these specifications.

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, Cable glands, etc.

Embossed marking on the over sheath at 3 meters intervals shall give the following information:

- Name of Manufacturer
- Year of Manufacture
- Size of cable in sq.mm.
- Voltage grade
- Type of cable i.e. Cu., PVC/SWA/PVC
- Project/ Client name (if required

5.0 INSTALLATION OF LV CABLES

Cable shall be laid as shown on the drawing, if the laying is effected by others utility services, the contractor shall test the cable characteristics insulation and continuity, of all phases and these shall communicate in a report to the Engineer/Client.

If cable is crossing the road extra protection of bricks, uPVC pipe class "D' other than mentioned in underground cable laying detail shall be provided.

The cables shall be spaced by categories along their entire length as well as upon penetration into buildings and in their interiors, according to their following rated voltages:

- 30 cm at least between a cable carrying I kV – 30kV and other cables.
- 20 cm at least between a cable carrying voltages between 50V - 500V, and any power or control
- 10 cm at least between a cable carrying voltages lower than 50V and telephone or these possible being grouped.

All installation material, labor, tools and accessories for cable installation shall be furnished by the Contractor. The cable and accessories shall be installed as described in accordance with these specifications, drawings and manufacturer's instructions.

6.0 INSTALLATION OF LV CABLES LAID DIRECT IN THE GROUND / PIPE

All the cables shall be laid in the trenches/duct according to the drawings or as directed by the Engineer. For burial of cables in ground, the following instruction shall be followed:

a) 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 client of any obstruction encountered and shall provide protective support or removal of such obstructions as instructed by the client. 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 or elsewhere as designated, they shall be drawn into underground pipe ducts.

Where cables

- ❖ cross roads or other paved areas with vehicular access
- ❖ cross unpaved areas regularly used by vehicles
- ❖ Pass through corrosive soils.

A steel draw wire or nylon or polypropylene cord shall be inserted in each duct run immediately after its installation. A 2m surplus shall be left at each end of each run, neatly coiled and attached to a cross bar preventing the wire or cord from being drawn into the duct.

Underground pipe ducts shall be Heavy gauge un-plasticized PVC conduits with tapered sleeve or spigot and socket joints.

All ducts shall have a nominal internal diameter of 100 mm unless designated otherwise.

All dual systems shall be installed so that no undue strain is placed on cables when pulled in.

All underground cable ducts shall so far as possible, be run in straight lines.

Duct runs crossing roads shall be straight and, wherever possible, perpendicular to the axis of the road.

Except in the case of short isolated duct runs such as road crossings, underground cable duct runs shall terminate in draw pits.

Cable ducts passing under roads carrying heavy vehicles shall be completely surrounded with lean concrete to a minimum radial thickness of 150 mm.

Ducts shall be laid so as to drain naturally towards one or both ends, where adequate provision of drainage shall be made. Adequate precautions shall be taken to prevent the cable duct system acting as storm water or ground water drainage system. A minimum fall of 1 in 200 shall be provided for drainage purposes.

Any work carried out requiring the use of split ducts shall be carried out in such a manner as to preserve the withdraw ability of the cables concerned.

If two or more cables are to be installed in the same duct, the aggregate of their cross sectional areas shall not exceed 30% of the cross-sectional area of the duct.

All trenches excavated for the laying of cable ducts shall be completely backfilled and rammed before cable installation work begins.

Immediately following the installation of any duct run, the interior of the duct shall be thoroughly cleaned by twice drawing through the ducts a suitable brush once in each direction. Following this, the ends of each run shall be sealed with a suitable hardwood or plastic sealing plug which shall be left in position until cable laying is about to begin.

Before any cables are installed in the ducts, each duct shall be proved by drawing through it a polished hardwood mandrel 300 mm long having spherical ends and a diameter 6mm less than the nominal duct diameter.

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 12 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. When crossing road the cable must be drawn through pipes, which should extend up to the unpaved area..

b) Low voltage cables shall be laid in PVC conduit at a depth of not less than 900 mm or as shown on the drawings. For external cabling, trenches shall be excavated as per the details shown on the drawings or as directed by the Engineer.

c) The bottom of the trench shall be covered with clean sand or soft soil of minimum 100 mm thickness before laying the cables. After laying the cables they shall be covered with clean sand. The clean sand shall be placed well punned over and around the cables to a level of 100 mm above the uppermost cable. Mechanical punnets shall not be used. Protective cable tiles shall be carefully covered over each cable as per drawing. Polyethylene warning tapes with danger sign shall be laid below 300mm of finished ground level along the route of buried cables.

d) It is the responsibility of the Contractor to take actual measurements of cable length, required between two termination points, as per drawings and site conditions and install single length of cables without joints of any nature.

7.0 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 used for installation of Lugs. After compression, the conductor and terminal shall form a solid mass ensuring good conducting properties and

mechanical strength. The Engineer or his representative before use must approve the compression jointing system used throughout the installation.

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 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.

SECTION – E – 4

LOW VOLTAGE (LV) LIGHTING CONTROL PANEL (LCP)

1.0 GENERAL

The work under this section consists of design, manufacturing, fabricating, supplying, installing, connecting, testing and commissioning of all material and services of the complete indoor and outdoor type LV, Lighting Control Panel (LCP) as specified herein and shown on drawings and stated in Bill of Quantities.

2.0 APPLICABLE STANDARDS / CODES

The latest editions of the following standards and codes shall be applicable for the materials specified within the scope of this Section:

BS 4752-1	-	Triple Pole Molded Case Circuit Breaker
IEC 60947	-	Low Voltage Switchgear and Control Gear
IEC 60439	-	Factory Built Assemblies of LV Switchgear
IEC 60475-2	-	Switchgear & Control Gear for Voltages up to & including 1 kV
BS 88	-	HRC Fuses
IEC 60073	-	Colors for indicator lights and push buttons
IEC 60446	-	Identification of insulated / bare conductors

Any other standard referred to in above standards or these specifications.

3.0 INSTALLATION AND SERVICE CONDITIONS

Outdoor LCP for road lights shall be installed at grade level as per drawing. The equipment shall be capable of operation under the prevailing ambient conditions without any deleterious effect of any kind. Distribution board shall be suitable for continuous operation at full load rating under combined variation of both voltage and frequency.

Transient voltage depression down to 80% of rated voltage shall not affect the performance of the equipment.

4.0 ROAD LIGHTING CONTROL PANEL CONSTRUCTION

The outdoor Lighting Control Panel shall be sheet steel fabricated, suitable for floor mounted totally enclosed, dead front, dust tight and vermin proof requiring front access only. It shall be complete in all respects with material and accessories, factory assembled, tested and finished all according to the specifications and to normal requirements. For outdoor installations, the international classification shall be IP65.

The LCP with all components and accessories shall be suitable for front operation only and shall:

- Have a rated service short service-breaking capacity, as per BOQ, conforming to IEC 60157- 1, category P2 unless otherwise stated on the drawings.
- Be suitable for 400 / 230 Volts, 3 phase 4 wires, 50 Hz.
- Have incoming and outgoing cable termination arrangement, terminal block / line up terminals.

- Be provided with wiring diagram on inside of the door.
- Have all incoming and outgoing connections from top and / or bottom according to site requirements.

5.0 ACCESSIBILITY

Distribution Board shall preferably be arranged for bottom cable entries. Adequate space must be provided for cable entries and termination.

Adequate space shall be provided for installation and clamping of cables inside the Distribution Board. 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.

6.0 MECHANICAL DESIGN

6.1 General Construction

The enclosure of the LCP shall be fabricated from electro-galvanized / zinc coated sheet steel.

The LV outdoor LCP shall be fabricated with 15 SWG sheet steel. 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 gasketed 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 indoor Lighting Control Panel shall be fabricated with 16 SWG sheet steel surface mounting as approved by the Engineer. All the components shall be installed on a common component mounting plate inside the enclosure and protected from the front with screwed sheet steel front plate. The enclosure shall be provided with rubber gasketting and a lockable hinged door with cam fastener. The Control Panel should have adequate space and well design for installing lighting control relays as per drawing.

The LCP 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 LCP 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, cut outs, 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 LCP 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, phosphated and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of color RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

6.2 LABELING

On the front side, a nameplate 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 trifoliate and be fixed with screws.

Each incoming and outgoing circuit shall also be labeled with nameplate 75 mm x 15 mm, as described above on the front side of door.

The Distribution Board shall be supplied fitted with warning labels.

7.0 COMPONENT OF LV, LIGHTING CONTROL PANEL

The LV, LCP shall be provided with all components as specified or shown on the Drawings and as necessary for the satisfactory operation of the LCP and of the electrical system. Typical specifications are given hereunder:

7.1 BUS BARS

Bus bars shall be made of 99.9% high conductivity hard drawn electrolytic tinned copper, completely isolated and mechanically braced and rated to withstand the specified fault level.

Bus bars shall be clearly marked with their respective colors and these shall be red, yellow and blue for phases and white for neutral. The earth bus bar shall be green. Bus bars shall be provided for three phases, neutral and multi- terminal earth. The temperature rise shall not exceed 45 degree centigrade at rated current. Neutral bus assembly shall consist of outgoing screw terminals with one terminal for every MCCB / MCB.

Horizontal bus bars shall be of the same current rating throughout their length.

7.2 MOLDED CASE CIRCUIT BREAKER

These shall be triple pole 400/500 volts or single phase 250 volts of current 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 triple pole MCCBs shall have short circuit rupturing capacity suitable for distribution system as approved by the Engineer or as shown on the drawings. The MCCBs shall be suitable for lighting and power circuits.

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.

7.3 AIR BREAK CONTACTORS

The contactors shall be air break, triple pole, 400 VAC and suitable for the type of duty to be performed. The main contacts shall be silver tipped, butt type with double break per pole. Each contactor shall be provided with single phase 230 VAC operating coil, one 5 watt 230 Volt red color signaling lamp, control fuse and two normally open and two normally closed auxiliary contacts wired up to terminals for electrical interlocking.

7.4 CURRENT TRANSFORMERS

Current transformers shall comply with the requirements of IEC 60185 (or equivalent).

Current Transformers shall be polyester resin insulated, ring type, air-cooled having transformation ratio as indicated on the drawings. The Current Transformers shall be of suitable burden having accuracy class 1.0. The Current Transformers shall have rated secondary current 5A / IA as required.

Current Transformers shall mechanically and thermally withstand the specified short circuit capacity.

7.5 PILOT LAMPS

Distribution Board shall be provided with phase indicating pilot lamps. The lamps shall be rated for 230 volts supply and suitable for flush mounting. The front of the lamps shall have colored rosettes for identification of phases.

7.6 LINEUP TERMINALS

Line up terminals wherever provided for Control or Power circuits shall be suitable for voltage and size of conductors as indicated on drawings. The Line up terminals for controls shall be suitable for channel mounting. All necessary accessories such as end plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

7.7 AC VOLT METERS/AMPERE METERS

Shall be Digital type and shall be suitable for flush mounting on front door of the LV Switchboards. The front dimensions shall be as per standard. The voltmeters shall have 3-1/2 digit, 0.55 inch display.

7.8 VOLTMETER SELECTOR SWITCH:

The voltmeter reading shall be RY-YB-BR-OFF-RN-YN-BN positions.

7.9 SECONDARY WIRING

All wiring shall be copper conductor, thermoplastic insulated, at least 1.5 sq. mm flexible, neatly arranged and clipped in-groups.

Each conductor and its termination are to be identified and marked with numbered ferrules. All live terminals are to be shrouded.

Secondary wiring for Current Transformers shall be carried out with not less than 2.5-sq. mm. Terminals shall be specially marked to avoid opening of the circuit by accident.

7.10 TIMER SWITCH FOR STREET LIGHTING CONTROL

Timer Switch Operated shall be suitable for automatically switching street light ON & OFF. It should be possible to put it in service for any required time within 24 hours. The operating voltage shall be 220 volts between phase neutral, 50 cycle / Sec.

7.11 DAY LIGHT SWITCH FOR STREET LIGHTING CONTROL

The street lighting circuits shall be controlled by photo-electric daylight sensitive switches. The Day light Switch shall be suitable for automatically switching street light ON & OFF.

The operational level shall be factory preset for "ON" at a light level of approximately 54 lux and "OFF" at approximately 100 lux. Voltage variations shall not materially affect the operational levels.

A time delay of not less than 15 seconds shall be provided to prevent the unit from functioning due to short period changes in illumination.

The unit shall be effectively safeguarded against voltage surges by means of a suitable surge protector which shall preferably form an integral part of the unit.

8.0 INSTALLATION OF LCP

All installation material for installation on concrete pad of LCP, junction box such as bolts, nuts; galvanized, washers, supporting steel, etc., shall be provided and installed by the Contractor. The LCP shall be installed upright and in level and shall be firmly and rigidly installed on concrete pad.

The Lighting control Panel shall be completely installed on concrete pad 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 distribution board is erected in position.

The Lighting control Panel installation shall include all related civil works, termination of all incoming and outgoing cables. The cable armor shall be connected effectively to ground. All outgoing and incoming cable connections shall be made neatly and firmly to ensure good contact. Special care should be taken in fixing cable lugs and lead connections so as to have no danger of leakage during operation.

Appropriate entry holes for metal or PVC glands / bushes are provided in order to avoid danger to pulling cables.

The Lighting control Panel body shall be connected to earth as per instructions given in section "Earthing "of these specifications. The distribution board shall be tested and commissioned in the presence of the Engineer. The tests to be carried out shall be tested before energizing as per instructions contained in the article "Testing "of General Specifications of Electrical Works, section 1 of these specifications.

9.0 FOLLOWING PROTECTION SHALL BE PROVIDED

- Triple pole series connected adjustable bimetallic over current release.
- Triple pole magnetic short circuit release.

Before procurement and installation the detailed shop drawings with make and type of the components shall be submitted to the Engineer for approval.

The manufacturer's recommendations shall be followed while installing the Lighting Control Panel. The LV Lighting Control Panel shall be tested and commissioned in the presence of the Engineer.

10.0 TESTS AND INSPECTION

The following tests and inspections shall be performed in accordance with relevant engineering standards:

a) Visual inspection of appearance, construction, dimensions and workmanship, and
b) Electrical and Mechanical operation tests.

11.0 OPERATION AND MAINTENANCE MANUAL

1. Prior to delivery of the equipment the Vendor shall submit three (3) sets of manuals for all equipment supplied under the contract. The manual shall be A4 size bound in a loose leaf binder or booklets suitably enclosed and shall include the following:
   a) A complete set of all corrected drawings prepared by the supplier and approved, by the Engineer. All drawings included shall be folded to fit within the binders.
   b) Setting up, commissioning and operation instructions.
   c) Trouble shooting procedure.
   d] Maintenance instructions including schedules for preventive maintenance.
   e) Complete recommended spare parts list including manufacturer's name and catalogue number with all required ordering information.
2. Operation and maintenance manuals shall be prepared to allow the purchaser and operators to truly understand the product, its theory of operations, its application and performance.

SECTION – E – 5

LIGHTING POLES AND LIGHTING FIXTURES

1.0 GENERAL

The work under this section consists of supply, storage, installation, testing & commissioning of road lighting system read together with drawings & bill of quantity. The Contractor shall furnish all labour, materials, services, and skilled supervision necessary for the construction, erection, installation, and connection of all equipment. The extent of work specified herein and/or shown on the drawings represents the minimum requirements.

Electrical Work Generally is to be in accordance with the requirements of the Specification Road lighting including luminaries, columns, related power distribution and control, protective earthing and related works including column foundations and cables etc.

2.0 STANDARDS:

Luminaries generally are to comply with IEC 60598 standards and recommendations. Manufacturer is to verify compliance with these standards and the applicable local regulations and design standards.

3.0 TECHNICAL REQUIREMENTS:

Minor deviations from the Drawings may be considered for improvement in construction details, but no changes are to be made without the written approval of the client/Engineer.

4.0 AMBIENT CONDITIONS:

Unless otherwise specified, equipment is to be designed and derated for continuous and trouble-free service at 50 ^{0}C ambient temperature and 100% relative humidity, with temperature reaching 70 ^{0}C in direct sunlight and with high content of ultra-violet rays. Equipment is to withstand full load operation whilst exposed to sun.

5.0 EQUIPMENT DATA:

Contractor shall submit complete data for approval including, but not limited to, the following:

- Detailed literature, in English, for each type of luminaire or fixture, lamp and control gear including manufacturer's name, catalogue number, rating, material specification, overall dimensions, operating characteristics and principles, and any modification to a standard product if applicable

- Detailed specification and drawings for each column type including shape, base/mounting flanges, bolts, nuts etc, cross-sections, design criteria and calculations, brackets, finishes, provisions for cabling, cut- out or circuit-breaker etc.

- Photometric data for lighting calculations including polar curves, coefficients of utilization efficiency and depreciation factors.

6.0 SHOP AND CONSTRUCTION DRAWINGS:

Contractor shall submit drawings for approval including, but not limited to, the following:

a) Layout of equipment in exact positions.

b) Cabling and wiring diagrams, single line drawings, loads, phase distribution, protection and control, earthing.

7.0 SAMPLES:

Submit fully equipped sample of luminaire or other materials or components if required by the Engineer.

8.0 WARRANTY

The supplier shall provide the full warranty on all equipment supplied during the period specified below. The warranty shall cover all parts and all costs, which are directly attributable to the supplier. Warranty coverage shall begin on the date that the equipment is received. The warranty period shall be 3 years.

9.0 O & M DOCUMENTATION

An Operation, Instruction and Maintenance Manual, in English and in the local language, shall be provided by the Supplier/Contractor .The following minimum details must be provided in the Manual:

(a) About Photovoltaic

(b) About White LED lighting system - its components and expected performance

(c) About White LED Lights. The make, model number, country of origin and technical characteristics of LEDs should be stated in the product data sheet and furnished to the test centres.

(e) DO's and DONT's

(f) Name and address of the person or service centre to be contacted in case of failure or complaint.

10 PRODUCTS AND MATERIALS

10.1 LED STREET LIGHTING SYSTEM

The Road light operates from **Dusk to Dawn** i.e., the lamp automatically switches ON after the sunset and switches OFF after sunrise. The LED light should have programmable driver.

The light fixture shall be posted on single or double arm pole as shown in drawings. The luminaire shall be fixed on to the Pole and are interconnected through the cables. The street light operates in the stand alone mode.

The Street Lighting system components consist of:

a) LED Luminaire

b) Pole

c) Interconnecting cables

d) Terminal box & Circuit Breaker

10.4 LED LUMINAIRE

Luminaire with transparent acrylic cover, housing a high efficiency LED lamp shall be fitted with gasket and accessories for weather and insect proof operation. The light fixture shall be posted on single or double arm pole as shown in drawings. The light fixture should be fully comply with safety norms according to:

- IEC 62471 photo biological safety of lamps and lamp systems including luminaires.
- EN 61347-2-13:2006; Safety testing for LEDs.
- EN 60598-1 and EN 60598-2; Luminaries safety testing.

a. **BODY CONSTRUCTION:** The Road light LED Luminaire shall be as per international standard and made of non-corrosive high pressure molded die cast aluminum housing and Tempered Flat glass with minimal glare. The surface must be finished with powder coating paint. The body should be aerodynamic profiled to give least air resistance. The Luminaire shall be consist of Heat Sink, One-piece cast, low-copper (<0.4% Cu) aluminum alloy. Which shall be effectively spreads heat to ensure long component life of LEDs and electronic components and provides precise alignment of LEDs and lenses. The Lamp compartment must be IP 66 with lens replaceable possibility.

b. **SOURCE OF LIGHT OUTPUT:**

The light source shall be of white LED type. Single lamp or multiple lamps can be used. View angles of a minimum of 120 or above. The luminous performance of individual LED used should not be less than 120 lumen / watt, when measured luminaire as a whole. The colour temperature of white LEDs used in the system should be in the range of 40000K – 50000K. Use of LEDs which emit ultraviolet light will not permitted.

The light output from the white LED light source should be constant throughout the duty cycle. The Supplier shall ensure that LED working life shall be >50,000 Hrs. and Color Index (CRI) Ra >75.

The make, model number, country of origin and technical characteristics of white LEDs used in the lighting system must be furnished by the supplier/manufacturer.

In absence of these above data the Road lighting fixture will not be accepted by the Engineer.

c. **LED MODULES:** The LED modules utilize an aluminium metal-clad board for maximum heat transfer, leading to longer life. The product shall be enabling Pending Aimed Optics, which allows the direction and intensity of the light to be tightly controlled. This control of the LEDs allow fixtures to maintain light levels equal to or greater than that of MH and HPS fixtures at a much lower energy consumption levels.

d. **LENS:** The LED's Lens shall be High impact molded, UV-stabilized, Profile Acrylic lens, for maximum efficiency of light transmission.

e. **LED DRIVER:** The LED driver, with high output current accuracy of ± 1.5%, with a high power factor correction to maximize power utilization shall be required. The driver should be comply UL 1310 / UL48 Class 2 with a built-in over-temperature protection.

f. **FINISH/COLOR:** Thermally set polyester powder-coated for durability with 3 mils nominal paint thickness and corrosion resistant rated 500 hours salt spray endurance.

g. **FULL CUT OFF:** The Luminaire should meet IEC standards for full cut-off luminaires.

11 LIGHTING POLE

a. **CONSTRUCTION:** Columns are to have octagonal section, tapered, formed sheet steel, electrically welded, and of height specified in the drawing. Columns height are to be one piece section. Columns are to have minimum wall thickness of 4 mm at base. Sheet steel is to have minimum rupturing resistance of 490 to 610 N/mm² and minimum yield strength of 355 N/mm2. The Columns shall be hot dipped galvanized with min 80 microns. The manufacturer shall provide quality assurance certificate.
Contactor should submit the Shop drawing / design details of Poles.

b. **TOP OF COLUMN:** is to be designed to receive single or double arm brackets or other arrangement required, to support number of luminaires shown on the Drawings. Bracket arrangement is to be designed to ensure that failure, due to wind induced oscillations, does not occur and that rotation from desired alignment is not possible.

c. **COLUMN DESIGN:** Column cross-section, thickness of steel, joints, welds, bolts etc. are to be designed to withstand gust wind velocity of 160 km/hr blowing in the most unfavourable direction at a height 20 m above ground level, with column fully equipped. Fatigue of steel is in no case to exceed half elasticity limit, taking into account dynamic stresses due to vibrations. Steel flange plate, of adequate thickness, is to be solidly welded onto lower edge of column as shown on the drawings, and is to have specified number of holes for holding down bolts together with central cable access hole not less than 150 mm diameter.

d. **ACCESS DOOR:** of weatherproof construction is to be positioned hinged at column base and is to be suitably sized to insert and service the supply cable terminations and protective device. Door is to be flush fitting with retaining mechanism and positive locking arrangement with removable hexagonal key. Column is to be reinforced at door opening. Opposite each door, a non-hygroscopic baseboard of suitable size to accept appropriate equipment is to be fixed to inside of column by purpose-made brackets. Stainless steel earthing stud with washers and nuts is to be welded inside the column near the access door.

e. **LIGHT BRACKET:** The road light bracket shall be made of Galvanized M.S pipe bent to shape as shown on the drawing. The light fixture bracket shall be fixed on pole, by means of bolt. The dimensions of the bracket shall be as shown on the drawing.

f. **FINISH:** Welds are to be smooth with spatter removed, inside and outside surfaces of column are to be cleaned by pickling or blasting and are to be free of grease. Steel components of columns are to be hot-dip galvanized after fabrication. Minimum thickness of zinc coating is to be 500 g/m² on both inside and outside surfaces of column. Galvanizing is to be to NFA 91121 and NFA 91 122 (June 1958) or BS 729. Any damage to galvanizing is to be rectified during erection by wire brushing affected area and treating with approved rust converter to the satisfaction of the Engineer. Flange plate and inside and outside of column base are to be galvanized.

TECHNICAL DATA SHEET FOR ROAD LIGHTING	
DESCRIPTION :	**SPECIFICATION**
Road light :	
Light Source	LED light
lamp for LED light	As per BOQ
Heat dissipater	Air Convection radiator
LED luminous efficiency	>120 lm/w
LED Illumination flux	As per BOQ
Working Temperature	55 ° C
Lamp's Output Ratio/ Efficiency	>= 90%
P.F of LED Street/Flood Lighting	>= 0.99
Colour Temperature(CCT)	As per engineers / consultant approval
Surge Protection	Min surge protection 15kV
Colour Index(CRI)	As per consultant / engineer approval
Beam Angle	Vertical Axis:70°, Horizontal Axis: 140°
Lifespan	50,000hrs life, 3yrs warranty minimum
IP Rating	IP66
Illumination time	8~10 hours per day,

The Contractor shall provide following certificates with LED Light Fixture Sample for the approval from Consultant/Client.

- LM 80 certificate for Chips
- LM 79
- LM 82 -12
- ENEC Certificate @ 50 C

Following manufacturer declaration and submission should be provided with the Tender submission.

S. No.	Parameters.	Technical Specifications.	Documents to be provided.
1	System Voltage	220V to 240V 50 Hz	Laboratory Test Report
2	Power Factor	Not less than 0.90	Laboratory Test Report
3	Surge Protection.	15KV	Laboratory Test Report
4	LED Driver	Programmable for Dimming with 1-10V DC DALI On board standalone program	Manufacturer's Declaration
5	Lumen Maintenance	L70 at 50000hours or better	LM80 test report & TM21 Projection
6	Color Temperature	Neutral White ~ 4000K ±275K	Manufacturer's Declaration LM 79 Test report
7	Color Rendering index	70 + / - 10	Manufacturer's Declaration LM 79 Test report
8	Ambient Temperature	50 Degrees Celsius	Manufacturer's Declaration with Thermal report
9	IP Rating	≥ IP66 without glue	IEC 60596-1 Test report
10	IK Rating	≥ IK08	IEC 60598-1 or IEC 62262 Test report
11	Cover	Transparent & weather resistant grade polycarbonate optic cover	Manufacturer's Declaration Material Datasheet Material UL94 rating of V2 (Minimum).
12	Housing	High Pressure Die Cast Aluminum with heat management system	Manufacturer's Declaration
13	Maintenance	Tool less Driver Cavity opening Tool less Gear Tray Change	Manufacturer's Declaration
14	Tel. management Controls.	Integrated Antenna or communication equipment in to luminaire housing	Manufacturer's Declaration and Evidence to show capability.

S. No.	Parameters.	Technical Specifications.	Documents to be provided.
15	3rd Party Test Report	Laboratory facility must be accredited according to ISO 17025 & recognized by ILAC /APLAC for testing of LED products.	IEC60598 Report (IEC 60598-2-3) EMC Test Report (EN55015,EN61547,61000-3-2) Photo biological Safety Test Report (IEC62471) EMF Test Report (IEC 62493) SPD Test (IEC 61643-1-2005 & IEC 61347-2-11) Factory Certificates (ISO 14001, ISO9001,OHSAS18001) Certificates for Test Laboratory (ISO 17025)
16	3rd Party Driver Test Report	Laboratory facility must be accredited according to ISO 17025.	IEC 61347-1,-2-13 Test Report. IEC 62384 Test Report.
17	Additional Test Report	Manufacturer's Test Report or from accredited lab.	Salt Spray Test Report (Minimum 500Hours Natural Salt Spray) as per ISO 9227 & ISO 10289 Vibration Test Report. Road Lighting simulations based on given configurations.

INDOOR LIGHTING FIXTURES

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 stan dard color schemes as mentioned in the manufacturer's catalogue for respective fixt ures, unless specifically stated in the Specifications, Drawings or Bill of Qu antities 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 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.
- BSEN 1838 Emergency Lighting

Any other standard referred to in above standards or these specifications.

4.0 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 othe rwise 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.

5.0 INSTALLATION

5.1 General

The mounting heights of light fixtures are indicated on the drawings, and position of fixtures according to the mentioned scale.

The Contractor must ensure that the light fixtures are installed uniformly with respect to the dimensions of the area. Any modifications due to site conditions may be made with the approval of Engineer. All fixtures shall be carefully aligned before fixing in position. All fixing accessories such as ceiling rose, flexible cord, lamp holder, suspension rod; pipe or ch ain with suita ble 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 I sq. mm copper conduc tor, 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.

5.2 LED Light Fixtures

The LED 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.

5.3 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.

TECHNICAL DATA SHEET FOR HIGH BAY LIGHTING

DESCRIPTION :	SPECIFICATION
Road light :	
Light Source	LED light
lamp for LED light	As per BOQ
Heat dissipater	Air Convection radiator
LED luminous efficiency	>120 lm/w
LED Illumination flux	As per BOQ
Working Temperature	55 ° C

Lamp's Output Ratio/ Efficiency	>= 90%
P.F of LED Street/Flood Lighting	>= 0.99
Colour Temperature(CCT)	As per engineers / consultant approval
Surge Protection	Min surge protection 10kV
Colour Index(CRI)	As per consultant / engineer approval
Beam Angle	Vertical Axis:70°, Horizontal Axis: 140°
Lifespan	50,000hrs life, 3yrs warranty minimum
IP Rating	IP66
Illumination time	8~10 hours per day,

The Contractor shall provide following certificates with LED Light Fixture Sample for the approval from Consultant/Client.

- LM 80 certificate for Chips
- LM 79
- LM 82 -12
- ENEC Certificate @ 50 C

Following manufacturer declaration and submission should be provided with the Tender submission.

S. No.	Parameters.	Technical Specifications.	Documents to be provided.
1	System Voltage	220V to 240V 50 Hz	Laboratory Test Report
2	Power Factor	Not less than 0.90	Laboratory Test Report
3	Surge Protection.	11KV	Laboratory Test Report
4	LED Driver	Programmable for Dimming with 1-10V DC DALI On board standalone program	Manufacturer's Declaration
5	Lumen Maintenance	L70 at 50000hours or better	LM80 test report & TM21 Projection
6	Color Temperature	Neutral White – 4000K ±275K	Manufacturer's Declaration LM 79 Test report
7	Color Rendering index	70 + / - 10	Manufacturer's Declaration LM 79 Test report

8	Ambient Temperature	50 Degrees Celsius	Manufacturer's Declaration with Thermal report
9	IP Rating	≥ IP66 without glue	IEC 60596-1 Test report
10	IK Rating	≥ IK08	IEC 60598-1 or IEC 62262 Test report
11	Cover	Transparent & weather resistant grade polycarbonate optic cover	Manufacturer's Declaration Material Datasheet Material UL94 rating of V2 (Minimum).
12	Housing	High Pressure Die Cast Aluminum with heat management system	Manufacturer's Declaration
13	Maintenance	Tool less Driver Cavity opening Tool less Gear Tray Change	Manufacturer's Declaration
14	Tel. management Controls.	Integrated Antenna or communication equipment in to luminaire housing	Manufacturer's Declaration and Evidence to show capability.

S. No.	Parameters.	Technical Specifications.	Documents to be provided.
15	3rd Party Test Report	Laboratory facility must be accredited according to ISO 17025 & recognized by ILAC /APLAC for testing of LED products.	IEC60598 Report (IEC 60598-2-3) EMC Test Report (EN55015,EN61547,61000-3-2) Photo biological Safety Test Report (IEC62471) EMF Test Report (IEC 62493) SPD Test (IEC 61643-1-2005 & IEC 61347-2-11) Factory Certificates (ISO 14001, ISO9001,OHSAS18001) Certificates for Test Laboratory (ISO 17025)
16	3rd Party Driver Test Report	Laboratory facility must be accredited according to ISO 17025.	IEC 61347-1,-2-13 Test Report. IEC 62384 Test Report.
17	Additional Test Report	Manufacturer's Test Report or from accredited lab.	Salt Spray Test Report (Minimum 500Hours Natural Salt Spray) as per ISO 9227 & ISO 10289 Vibration Test Report. Road Lighting simulations based on given configurations.

SECTION - E - 6

WIRING ACCESSORIES

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete switch es, switch sockets, etc., and miscellaneous items as specified herein and / or shown on the Dra wings 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 an d positions of electrical lines and equipment.

The wiring accessories shall also comply with the General Specifications for Ele ctrical Works, Section – E – I and with other relevant provisions of the Tender document.

2. GENERAL

The locations of the wiring accessories such as sockets, switches etc. are tentatively shown on the drawings. The Contractor sha ll 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 af ter installation and Commissioning.

3. STANDARDS

Wiring accessories and miscellaneous items sh all comply with Section – E–1, Clause 3.

Particular reference shall be made to:

- BS 67 Ceiling roses.
- BS 1363:1984 13A fused plugs and unswitched socket outlets
- BS 116 Two and three terminal ceiling roses.
- BS 2135 Capacitors for radio interferenc e 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. MATERIAL

4.1 Switch Socket Outlets

Switch 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 15 Amps. or 2 Pin rated for 10 Amps. Supply as specified in the bill of quantities.

3 Pin 15 Amps. Sockets shall be moulded 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.

4.2 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.

4.3 Fans

4.3.1 Bracket Type

The bracket type fans shall be suitable for mounting on the wall and suitable for operation semi-horizontally. These shall operate satisfactorily on 250 volts, single phase, 50 Hz, A.C. supply with + 10 % tolerance.The sweep of the fan shall be as given in BOQ/drawings.

4.3.2 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 an d 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.

SECTION – E – 0 7

CABLE TRAY, LADDER AND TRUNKING

1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specificatio n Sections, apply to this Section.

2. SUBMITTALS

General: Submit the following according to the Division 1 Specification Sections.

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 grow th. 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, detai ls of components , and attachments to other construction elements. Designate components and accesso ries, 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. QUALITY ASSURANCE

Manufacturer Qualifications: Select a firm experienced in manufacturing cable trays which has a record of successful in-service performance.

Comply with the relevant standards of BS, NEMA and NEC.

Single-Source Responsibility: All cable tray components shall be the product of a single manufacturer. For

4. SEQUENCING AND SCHEDULING

Co-ordination: Co-ordinate layout and installa tion of cable tray with other installations.

Revise locations and elevations from those indi cated as required to suit field conditions and as approved by the Engineer.

5. 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 of K-Electric regulations.

6. CABLE TRUNKING

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trucking 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 an 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, nor on removal on site paint finish from ferrous metal.

7. 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 unsatisfacto ry conditions have been corrected.

8. 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. INSTALLATION

a. Install cable tray, cable trunking and ca ble 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. 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. 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.

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SECTION - E - 8

CONDUITS AND PIPES

1. 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 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- I and with other relevant provisions of the Tender document.

2. GENERAL

The extent of works shown on the drawing does not indicate the exact position of conduit and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services drawings, as per site requirements and as directed by the Engineer.

The quality and material for the accessories of conduits and pipes such as sockets, elbows, 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. STANDARDS

Pipes and Conduits shall comply with Section - E-1, 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. 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 B-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

For Surface run G.I. pipes shall be used and must 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 Adaptable Boxes

Adaptable boxes shall be made of 16 SWG sheet steel box, painted and finished to the same quality as the light Distribution Board. The boxes shall be 50 mm in depth for conduits up to 25 mm diameter, 63 mm in depth for conduits up to 40 mm diameter and 87 mm in depth for conduits up to

50 mm in diameter. For conduits more than 50 mm in diameter, the minimum depth shall be two times the diameter.

4.6 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.

4.7 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 HDGI 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 an 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, nor 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 cover before plastering. The work of curing in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from Engineer for the route, to suit the site conditions before starting 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.

- Adaptable boxes.

  For conduits up to 25 mm diameter, the boxes shall be 50 mm in depth.

  For conduits up to 40 mm diameter, the boxes shall be 63 mm in depth.

  For conduits up to 50 mm diameter, the boxes shall be 87 mm in depth.

Wherever the conduit lengths cross the expansion joint either along the column or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed, the conduit neither develops any cracks nor breaks down.

Bending, offsetting and similar operations shall be performed through the help of proper bending tool to give a perfect bend of required angle without Desha ping of conduit to the least.

5.2 Steel and G.I Conduit

The minimum size of conduit shall be 20 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 an 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 process units and on steel work with "U" bolt type fixings.

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.
75 mm (2-1/2")	Not less than 380 mm.
82 mm (3")	Not less than 460 mm.
100 mm (4")	Not less than 610 mm.
150 mm (6")	Not less than 750 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 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 – 9

EARTHING SYSTEM

1. GENERAL

The work covered under this section of the specifications consist of furnishing all labour, equipment, appliances and materials and in performing of all operations in connection with providing, installing, connecting, testing the earthing system complete in accordance with this section of specifications and drawings. The earth pits on the drawings are only indicative and these will be located as directed by the Engineer.

2. APPLICABLE STANDARDS AND CODES

- BS 951 - EARTHING CLAMPS
- BS 7430 - EARTHING
- BS 2874 - NUTS,BOLT,WASHER,SCREW & RIVETS FOR USE ON COPPER
- BS 1433 - HARD DRAWN BARE COPPER CONDUCTOR FOR EATHING.
- BS 6346 - PVC INSULATED CABLES.

The maximum values of resistance of equipment earthing systems to the body of earth shall be as follow:

- General Electrical Earthing 1Ω
- Earthing For Static Discharge 1000Ω
- Earthing For Lightning Protection 10Ω
- Instrument Clean Earth 1Ω

3. EARTHING ACCESSORIES

The Earthing system shall be consist of Earth electrodes, Earthing leads, Earth connecting point, Earth continuity conductor and all accessories necessary for the satisfactory operation of the associated electrical system.

a. Earthing by Earth Copper Plate

The earth electrode Copper plate shall consist of 600mm x 600mm x 3mm thick 99.9% high conductivity electrolytic tinned copper plate. The plate shall have four terminals for connecting the earthing leads as shown on the drawings.

b. Earthing by Earth Copper Rods

The earth copper rod shall be installed for lighting poles as indicated in drawings. The copper rods shall be of 3m length and 20mm dia with high conductivity electrolytic copper. This shall be driven into the ground to the full length as shown in drawing.

c. Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point or equipment. 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.

d. 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 or BOQ. 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. PVC insulated cables when used as E.C.C. shall be green or green yellow.

e. Earth Connecting Points

When copper plates or copper rods are used as earth electrodes, the earthing leads from the plate or rod shall terminate at the earth connecting points which shall be of tinned copper bar, rectangular in shape, having dimensional 500mm x 50mm x 10mm, installed in the wall of the inspection chamber at the ground level. Further connections to respective locations shall be made from this bar by earth conductors of various sizes as shown on the drawings.

f. Inspection Chamber

At the ground level an inspection chamber shall be provided size shown on the drawing. The inspection chamber shall have 50mm x 50mm angle iron frame at the top to accommodate an approved quality heavy duty cast iron or concrete cover with handle. The cover shall have "EARTH BELOW" inscribed on its top. The Contractor shall provide and install the cover flush with the ground level.

4. EARTH 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 MV/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.Where laid along underground cables these shall be laid directly under ground in unpaved areas and in pipes under paved areas.

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.

- **Installation of Earth Electrode (Copper Plate)**

The installation of earth electrode (copper plate), a pit of appropriate diameter and up to the depth of 4 m or (as directed at site) shall be first excavated in the bare ground. The earth electrode shall be installed upright in the pit and shall be surrounded by **mixture of lime and charcoal** around the electrode as shown on the drawings and packed hard. From the plate earthing leads of 2x70mm² bare Cu. Conductor shall be taken to the bus bar in the inspection chamber through 50mm G.I pipe for watering purpose.

- **Installation of Earth Electrode (Copper Rod)**

The earthing system by copper rod shall consist of 20mm dia and 3 meter long copper rods. These shall be of 99.9% purity copper. These shall have screw able head to accommodate other rods in series with the help of dowel as is shown in the drawings. The driven head shall consist of a hardened tip. These rods shall be connected to the earthing lead whose other end shall be connected to the earth connecting points to be provided in the inspection chamber. From the earth connecting point's earth connection shall be made to individual point as marked in drawing.

- **Installation of Earth Electrode where the condition not suitable for Earthing**

Where the rock lie just below the surface or water table are very deep then earth electrode shall be installed through drilling or digging method. Due to certain ground conditions make it difficult to obtain a reliable earth resistance, whilst particular installations may require a very low resistance. In such cases, **Marconite concrete** shall be used as backfill for a conventional earth rod achieve a lower earth electrode resistance.

5. Equipment Grounding

a. Non-current carrying metal parts:

Bond and ground non-current carrying metal parts of electrical apparatus and equipment provided under work of any section of specifications.

b. Grounding of Fence:

All metallic fences shall be grounded by driving earth rods at a distance of 50 meter.

6. Inspection and Test

Earth resistance test shall be made by the Contractor on the complete earthing system in the presence of the Engineer. The test result shall conform to BS 7430 (formerly CP 1013) and BS 6651 (Formerly CP 326). To obtain the desired result more earth rods shall be provided.

SECTION – E – 10

POLE MOUNTED TRANSFORMER

1. Type of transformers

The transformers shall be 3 phase, oil-immersed, self-cooled, core type, designed for distribution service. They will be used to supply LT distribution networks with lighting and power-loads. The transformers shall be required to be continuously in circuit. The transformers shall be generally in conformity with

i) IEC Publication 60076 (amended to date) Power Transformer (part 1-5)

ii). IEC Publication 60137 (amended to date) Bushing

ii) IEC Publication 60296 (amended to date) Transformer Oil

iii) IEC Publication 60060 (amended to date) High Voltage Testing Techniques

2. Systems Particulars

2.0 The system frequency is normally 50 complete cycles per second. The primary 11,000 volts, 3 phase networks supplying the transformers have solidly earthed neutrals and may be either overhead lines or underground cables.

2.1 The transformers will be required to supply 420 volts, 3 phases, 4 wire overhead and underground secondary networks with the neutrals solidly earthed.

3. Particulars of climatic atmospheric conditions at site

3.0 The transformers shall be designed and built to give efficient and reliable performance continuously at their full rate capacities in the climatic and atmospheric conditions prevailing at the sites, which are specified below: -

Peak ambient air temperature	50°C
Mean maximum temperature during 24 hours	45°C
Minimum temperature	0 °C
Maximum relative humidity	95% at dry bulb temperature of 43 °C
Altitude	Sea-level
Location	Sea-coast (interior in semi-desert).
Wind speed	136 KM/hr

4. Transformers ratio and vector group ref no

4.0 The no-load ratio of the transformers shall be 11,000/420 volts. The high voltage windings shall be delta connected, the low voltage windings shall be star connected.

4.1 The impedance of each transformer shall be approximately 5%. The vector group shall be DY 11 for all the transformers.

5. Winding

5.0 All windings shall be suitably insulated and shall have the end turn insulation specially reinforced at both ends of each phase to withstand the effects of abnormal transient pressure rises which may occur on the system either due to atmospheric lightning, switching or system faults.

6. Transformer terminals

6.0 The three line leads on the primary high voltage side and the three line leads and the neutral on the secondary 420 volt side shall terminate on glazed porcelain insulators bushings for having a silicone coating, for connection to external circuits.

6.1 The high voltage bushings shall conform to IEC-137: 1973 for rated voltage 20 KV and the surface leakage path outside the tank shall not be less than 508 mm. Terminal LT should conform to DIN 42530

6.2 The connection terminal for L.V. bushing shall be of palm type.

6.3 Arcing horns shall be fitted on the high voltage bushings and set to discharge at about 80% of the impulse withstand voltage of the transformer and shall serve to keep the arc from the surface of the insulator.

7. Cores

7.0 The core material should be at least M-4 Grade. The cores shall have interleaved yokes which shall be securely clamped to reduce humming.

8. Tappings

8.0 Off load tappings shall be arranged on the primary side windings to give constant pressure of 420 volts at the secondary terminals when the primary line voltage varies + 2.5%, + 5%, -7.5%. These tapping shall be brought to a single radial (rotary) tapping switch arranged for external hand operation. A register plate with means for clearly indicating the tapping in use shall be provided. Switch position No. 1 shall correspond to + 5% tap.

8.1 The operating handle and the tapping indicator shall be located either on one side or on the top of the transformer.

8.2 Means shall be provided for securing and padlocking the tapping switch in any of the working position.

8.3 A rating plate showing the relative positions number of tap connections corresponding for different voltages.

9. Transformer Protection

9.0 The transformers will be protected by over-current and protective gear on the primary side and by fuses / LT circuit breaker on the secondary side.

10. Temperature Rise

10.0 When the transformer is tested in accordance with procedure laid down in IEC 60076-2 , the temperature rise above ambient for the windings core and oil, shall not exceed the limits as mentioned below.

- The maximum permissible temperature rise of the transformer oil (top oil)= 35°C
- Average temperature rise of the winding=45°C

10.1 All stipulated temperature rises shall not cause damage to the insulation of the windings or any part of the transformer or in any way adversely affecting the reliability and efficiency of the transformer.

11. Vector Group

11.0 Reference to vector diagram shall apply to diagram below. The vector group symbol being DY 11 belonging to group with phase displacement of minus 30°C.

11.1 The impedance shall be approximately 5%.

12. Tanks

12.0 The transformer tanks shall be constructed of welded boiler plates with external radiating tubes / corrugated and shall be sufficiently robust to withstand transit to site with the transformer enclosed.

13. Conservator with fittings

13.0 All transformers rated 250 KVA and above shall be fitted with conservators, which should be detachable from the transformer to facilitate transport and shall be overhung on one side and not placed between the two bushings.

13.1 The conservator shall be

fitted with: i). Oil gauge
ii). Drain valve
iii). Fitting hole with cover
iv). Dehydrating breather with filling of silica gel

14. Finish

14.0 The transformers shall be painted with special anticorrosive paint, steel gray in color to withstand the atmospheric conditions prevailing at site which tends to have storage corrosion inducing effect.

14.1 The paint shall be highly resistant to the effects of strong sunlight and high temperatures and shall have a long life under such conditions. As a minimum it shall consist of a priming coat and two finish coats, which shall be applied after Shot blasting of the tank. The thickness of paint coating shall not be less than 0.12 mm.

15. Transformer Oil

15.0 Low viscosity insulating transformer oil conforming to the requirement of IEC-60296 (Latest Applicable) shall be used.

15.1 Laboratory reports of transformer oil shall be submitted alongwith the bidding documents.

15.2 All necessary documents for the purchase of oil should also be submitted alongwith bidding documents.

Rating in KVA	Iron Losses in Watts.	Copper Losses in Watts	Total Losses in Watts
50	180	1000	1180
100	280	1750	2030
150	380	2000	2380
250	600	3500	4100
400	850	4900	5750
500	935	5715	6650
750	1250	7250	8500
1000	1500	10000	11500

SECTION – E – 11

TESTING OF ELECTRICAL EQUIPMENT

GENERAL

Upon completion of the installation the Contractor shall perform field tests on all equipment, material and systems all tests shall be conducted in the presence of the Consultant/client's Engineer for the purpose of demonstrating equipment or system compliance with specifications. The contractor shall submit test protocol for approval atleast two weeks before conducting the test.

The Contractor shall furnish, install and maintain all tools, instruments, test equipment, material, connections, etc and furnish all personnel including supervision and "Standby" labour required for the testing, setting and adjustment of all electrical facilities and their component parts, including putting the same into operation.

All tests shall be made with the proper regard for the protection of the equipment and the Contractor shall be responsible for adequate protection to all personnel during such tests.

The Contractor shall record all test values of the tests made by him on all equipment, giving both "as found" and "as left" conditions. Three (3) copies of all test result shall be given to the Engineer Incharge for record purposes.

The witnessing of any test by the Engineer In charge does not relieve the Contractor of his guarantees for materials, equipment and workmanship as specified in the Conditions of Contract.

INSULATION RESISTANCE TEST

Insulation resistance tests shall be made on all electrical equipment, using a self-contained instrument such as the direct indicating ohm-meter of the generator type Direct current potentials shall be used in these tests and shall be as follows:

Circuit under 230 volts – 500 volts test

Circuit 230 volts to 400 volts – 1000 volts test

The minimum acceptable insulation resistance value will be 5 Mega ohms.

The test equipment for insulation testing will be furnished by Contractor.

Before making connections at the ends of each cable run, the insulation resistance test of each cable shall be made. Each conductor of a multicore cable shall be tested individually to each other conductor of the group and also to earth. If insulation resistance test readings are found to be less than the specified minimum in any conductor, the entire cable shall be replaced and the new cable shall installed/laid.

All switch gear shall be given an insulation resistance measurement test to ground after installation but before any wiring is energized 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 that specified above the cause of the low reading shall be determined and removed. Corrective measures shall include dry out procedure by means of heaters of equipment is found to contained measure. Where corrective measures have been necessary and the insulation resistance reading taken after the correction has been made it should satisfy the requirements specified herein. Repeated insulation resistance test shall be made twice and at least 12 hours apart. The maximum range for each reading on the 3 successive tests shall not exceed 12 hours apart and 20% of the average value. After all tests have been made successfully, the equipment shall be reconnected.

EARTH RESISTANCE TESTS

Each resistance tests shall be made by the Contractor on the earthing system, separating and reconnecting each earth connection as may be required by the Engineer Incharge. If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer Incharge will determine the extent of such corrective measures.

The electrical resistance of the ECC 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.

OPERATING TESTS

Current load measurement shall be made on all electrical equipment.

The current reading shall be taken in each wire and in each neutral wire while the circuit or equipment is operating under actual load conditions Clip-on ammeters may be used to take current readings.

All light fittings shall be tested electrically and mechanically to check whether they comply with the standard of specifications. Light fittings shall be tested so that when functioning properly no flickering is observed or choke noise is heard.

After any equipment has been tested, checked for operation etc, and is accepted by the Project Engineer's representative the Contractor shall be responsible for the proper protection of such equipment for assurance that subsequent testing of other equipment of systems do not disturb the completed work.

VISUAL INPECTION

Visual Inspection to verify that the Electrical equipment has been correctly installed in accordance with the design with correctly rated protection devices and bonding that no visible damage exists.

SECTION – E – 12

DOCUMENTS TO BE SUBMITTED

The contractor shall submit following documents at the time of biding or as per Instruction of the Engineer.

1. Documents and certificate to be submitted for approval, including.
    - Information to be provided with the bid.
    - Document to be provided by the owner.
    - Documentation.
2. Warranty.
3. Packing and delivery.
4. Marking.
5. Testing, including :
    - Type tests.
    - Routine Tests.
    - Special test.
6. Technical data sheet
7. Maintenance and operation manual
8. Training Program

SECTION – E – 13

LIST OF APPROVED MANUFACTURERS/SOURCES OF ELECTRICAL EQUIPMENT

* All Equipment shall be procured from Principal Authorized agents / distributors / resellers

The Bidder shall fill the 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.

Bidder is required to mark the proposed Manufacturer / supplier and country of origin for each item below.

S.No	Equipment	Manufacturer/Supplier		✓	Country of Origin	✓
1	L.V Lighting Control Panel (LCP)	i	ABB.		Germany	
		ii	Schneider		Germany/France	
		iii	Hussain & Co		Pakistan	
		iv	Premier Engineering		Pakistan	

S.No	Equipment	Manufacturer/Supplier		✓	Country of Origin	✓
2	LV Circuit Breakers	i.	Schneider Electric		France	
		ii.	Terasaki		Japan	
		iii.	Siemens		Germany	
		iv.	ABB		France	
		v.	Legrand		France	
3	C.T, Relays & instruments	i.	Schneider Electric.		France	
		ii.	Siemens		Germany	
		iii.	Fico		Pakistan	
		iv.	Revalco		Italy	
4	LV Cables and Wires/ Earthing Cable	i.	Pakistan Cables		Pakistan	
		ii.	Pioneer Cables		Pakistan	
		iii.	Fast Cables		Pakistan	
5	UPVC Conduits / Pipes and Accessories	i.	Galco		Pakistan	
		ii.	Civic		Pakistan	
		iii.	Jeddah Polymer		Pakistan	
		iv.	Beta		Pakistan	
6	Cable Glands, Lugs, Terminals and Accessories	i.	Cembre		UK	
		ii.	Hubbell / Hawke		UK	
		iii.	Hensel		Germany	
7	LED Light Fixture	i.	Philips		Netherlands	
		ii.	Gewiss		Italy	
		iii.	Pierlite		Australia	
		iv.	Osram		Germany	

S.No	Equipment	Manufacturer/Supplier	✓	Country of Origin	✓
8	Earthing Equipments & Cu. Rod	i Erico		USA	
		ii. Furse		UK	
		iii Dehn		Germany	
		iv. Wallis		UK	

Competitive and Livable City of Karachi
Local Government Department, Government of Sindh.

TECHNICAL SPECIFICATION – PLUMBING

TENDER

December, 2021

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. 584-1825
Email : info@eaworld.com | www.eaworld.com

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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: Crosslinked 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 Gas Piping:

A. Natural Gas Piping Above Grade

1. LPG Liquid fill line (if Applicable) shall be seamless steel to ASTM A53/A106 schedule 80.

2. High Pressure (Above 5 Psi) Gas pipes shall be seamless black steel to ASTM A53/A106 schedule 40.

3. Natural Gas Low pressure Gas pipes shall be GI Medium as per as per BS EN 10255.

4. Pipe in Pipe Sleeve Pipe (if indicated on the drawings) should be seamless Pipe.

5. The Pipe selection should match the natural gas service in future.

B. Natural Gas Piping Below Grade

1. All buried Gas piping shall be Polyethylene PE-100 PN-16 as per DIN 8075, ASTM D2513, ISO 4437:1996, DIN 8075, ASTM D2513 with Fusion Weld fitting.

2.07 Fuel oil Piping:

1. Fuel Oil piping shall be in black mild steel to BS 1387 – heavy weight, with screwed malleable iron fittings for pipes up to 50 mm to BS 143 & 1256 and to BS EN 10242 and for pipe of 65 mm and above, Butt welded fittings to BS 1965 part 1.

2.08 VALVES

A. 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.

B. All valves 65 mm and larger shall be Cast iron type and shall be flanged (or grooved for grooved coupling joints).

C. For PPR piping use PPR Coated valves of the same piping material and manufacturer.

D. 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.

E. Arrows to indicate direction of flow on check, globe, angle, non-return, and eccentric plug valves.

2.09 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.

2.10 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.

2.11 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.

2.12 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.

2.13 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.

2.14 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.

2.15 Solenoid Valves

A. Electrically operated solenoid valves shall be single phase 220V and shall be rated for the system pressure

2.16 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.

2.17 Automatic Air Valves

A. Automatic air valves shall have a bronze body with bolted cover and a 9mm top outlet.

2.18 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 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

1.02 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

1.03 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.04 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 2 - PRODUCTS

2.01 BALANCING VALVES

A. Refer Section 15140

2.02 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. StrainersNPS 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.

2.03 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.

2.04 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.

2.05 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.

2.06 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.

2.07 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 3 - EXECUTION

3.01 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 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 the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.

1.03 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.

1.04 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.

1.05 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.

1.06 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Piping materials shall be as under. All drainage pipes and fittings shall be Kite Mark.

2.02 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.

2.03 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.

2.04 STORM WATER PIPE

A. Plastic pipes shall be extruded un-plasticized PVC (UPVC) conforming to the following British Standards:
1. uPVC pipe with solvent joints (as approved by consultant) as per DIN 8061/8062 and ISO 3633 Type B

2.05 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).

2.06 PRESSURE PIPING FROM PUMPS (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. Alternatively (Kite Mark) pipes are acceptable only if approved by consultant.

2.07 IRRIGATION PIPING

A. uPVC conforming to the following British Standards:
   1. Pipes 20mm and 300mm diameter: Upvc class 'D' pipe with solvent weld fitting as per BS 3505 (EN 1401).

2.08 SPECIAL PIPE FITTINGS

2.09 ENCASEMENT FOR UNDERGROUND PIPING CROSSING DRIVEWAYS

A. All Drainage pipes crossing driveways and subjected to heavy traffic shall be provided in concrete encasement.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Refer to "Earthwork" for excavating, trenching, and backfilling.

3.02 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.

3.03 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).

3.04 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.

3.05 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.

3.06 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 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 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.

1.03 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.

1.04 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.

1.05 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.06 COORDINATION

A. Coordinate size and location of concrete bases.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.01 CLEANOUTS

A. Plastic Floor Cleanouts:

1. Size: Same as connected branch.
2. Body: PVC.
3. Closure Plug: Stainless Steel.
4. Riser: Drainage pipe fitting and riser to clean out of same material as drainage piping.
5. Finish: Stainless steel cap

2.02 FLOOR DRAINS

A. Plastic Floor Drains:
1. Material: PVC as per piping material
2. Outlet: P-Trap (Side)
3. Sediment Bucket: Not required.
4. Top or Strainer Material: Stainless steel <Refer Architect finishes schedule>.
5. Top of Body and Strainer Finish: Stainless steel.
6. Top Shape: Square. <Refer Architect finishes schedule>.
7. Trap Material: Plastic drainage piping.
8. Trap Pattern: Standard Multi Floor Trap with Multiple inlets and one outlet.

B. Funnel floor drain where specified on drawings shall include a nickel bronze funnel secured to the grating

2.03 TRENCH DRAINS

A. Trench Drains :

1. Standard: ASME A112.6.3 for trench drains.
2. Outlet: Side.
3. Grate Material: Cast Iron as indicated on drawing and BOQ. <Also 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.

2.04 ROOF DRAINS

A. Plastic Roof Drains:

1. Standard: ASME A112.21.2M.
2. Pattern: Balcony/ Roof drain.
3. Body Material: PVC with 2" Side outlet for Balcony Drains.
4. Dimensions of Body: Refer Drawings
5. Outlet: Bottom.
6. Dome Material: Stainless Steel <<Refer Architect finishes schedule>.

2.05 Pre- Fabricated Area Drains/Catch Basins:

A. DUCO coated cast Iron body with 300mm x 300mm Dimensions and 200mm Depth with flashing flange and heavy duty hinged slotted grate.

2.06 Channel Gratings

A. Internal Channel grating shall be stainless steel 304 and the external channel grating shall be heavy duty Cast iron to dimensions as indicated on drawings.

B. External channel grating and catch basins shall be in heavy duty ductile iron material.

2.07 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

A. Vent Caps:

1. Description: PP 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 750 x 750 mm.

2. Manhole Cover sizes shall be as per as indicated in the drawing and Manhole schedule but shall NOT be less than 600mm x 600mm

3. All manholes and gully traps shall be vented as per drainage department requirements.

4. Gully trap covers shall have clear opening of 300 x 300 mm.

5. All manhole covers and frames shall comply with BS 497:1976 (BS EN 124:1994)

6. Covers in paved areas shall be medium duty type having weight as per Table 1
7. Covers in plinth protection shall be light duty having weight as per Table-1
8. Covers in Driveways shall be Heavy duty having weight as per Table-1

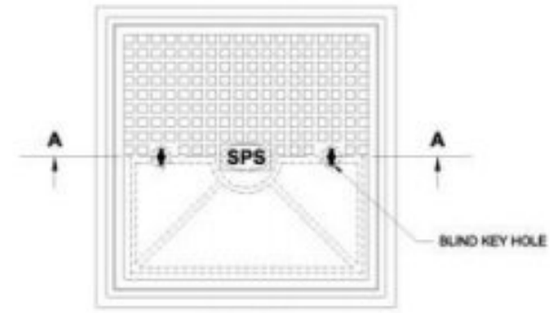
CAST IRON MULTI DUTY MANHOLE COVER & FRAME

Features :

Single Seal
Closed Key Holes
Coating Cold Applied

Option :

Ductile Iron
Epoxy Coated
Lockable



PLAN

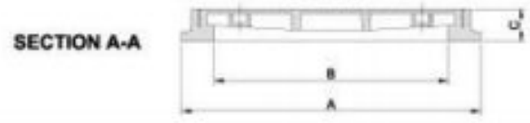


Table 1-1 (Manhole Covers Weights)

S.no	Cover material	Clean Opening	Type	Weight	Standard	Remarks
1	Cast Iron	750 x 750	Light duty	55 Kg	BS EN 124:1994	
2	Cast Iron	750 x 750	Medium duty	70 Kg	BS EN 124:1994	
3	Cast Iron	750 x 750	Heavy duty	95 Kg	BS EN 124:1994	

D. RCC Catch basins with Slot Grating

1. All cast iron covers shall be Slotted Cast Iron with black bitumen coating. Grating covers shall have clear opening of 600 x 600 mm.

E. Neutralization Tanks/ Dilution Tanks

Neutralization tanks shall be solid construction polyethylene body with inlet and outlet, optional vent connections, acid resistant epoxy coated bolted down gasketed lid, stainless steel hardware.

The tank is filled with neutralization medium, lump limestone 1" to 3" diameter size, water is then added to the tank to help dilution.

Capacity: Min 200 gallon capacity, having 6" inlet and outlet and 3" vent connections manufactured from high density polyethylene.

Refer Drawing for capacities but shall not be less than 200 Gallons

Function: Used in laboratories, industrial processes or other polluting sources to dilute and neutralize harmful wastes that may be discharged. Also used in chemical treatment plants or municipal water treatment facilities for diluting polluted effluent.

PART 3 - EXECUTION

3.01 INSTALLATION

A. 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.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. 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.

E. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

F. 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.

G. Install fixture air-admittance valves on fixture drain piping.

H. Install stack air-admittance valves at top of stack vent and vent stack piping.

I. Install air-admittance-valve wall boxes recessed in wall.

J. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

K. Install through-penetration firestop assemblies in plastic stacks at floor penetrations.

L. 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.

M. Install vent caps on each vent pipe passing through roof.

N. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

O. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

P. 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.

Q. 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.

R. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

S. 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.

T. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 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.

3.03 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.

3.04 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.

3.05 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

Sect.15410 - PLUMBING FIXTURES

1.01 QUALITY ASSURANCE

A. Quality Standard: NSF 61 for fixture materials in contact with potable water.

1.02 WARRANTY

A. Materials and Workmanship:

1. Commercial Applications: One year.

1.03 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.

1.04 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.

1.05 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.

1.06 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

1.07 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 – PLUMBING PUMPS

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 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.

1.03 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.

1.04 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.

1.05 COORDINATION

A. Coordinate size and location of concrete bases.

1.06 WITNESS TEST.

A. All pumps testing and compliance shall be witnessed by the consultant and client in the Country of Origin. All the cost of travel shall be supported by the Contractor including the Daily allowance.

PART 2 - PRODUCTS

2.01 BOOSTER AND TRANSFER PUMPS

A. Manufacturers:

1. Armstrong Pumps Inc.
2. Pantex Pumps - Italy
3. Grundfos Pumps Corp.
4. Wilo Pumps
5. Refer Approved list of manufacturers

B. Description: Factory-assembled and -tested, Multistage stage

1. Supply and install transfer and Booster water Set designed for a total system capacity as shown on Pump Schedule. The systems shall be tested and calibrated, and shipped to the job site as an integral unit ready to receive suction and discharge piping and incoming power supply.

2. 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.

3. Pumps shall be constant speed:

4. Pump shall be bronze fitted centrifugal, single stage, end suction type with Spacer coupling. The Pump and Motor shall be by same manufacturer

5. Pump shall be rated for a minimum of 175 PSIG working pressure.

6. Casings shall be cast iron with gauge ports, vent and drain ports at top and bottom of casing.

7. Shaft impeller shall be stainless steel 316.

8. The pumps shall be complete with gate valves, check valves, pressure gauges, suction and discharge Headers, thermal bleed circuits, wiring, conduit and interconnecting pipe work, mounted on anti-vibration mountings and neatly arranged and firmly supported by the framework of the unit. Suction connection shall be horizontal, as close to the base as possible to connect to inlet pipe from the water storage tank.

9. 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.

10. 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.

11. Motor shall have IE-3 rating as minimum.

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

2.02 CONTROLS

1. The pump set control panel shall be in a NEMA I enclosure which includes motor starters, time delays, protected control circuit, transformer, current relays, hand-off-automatic switches for each pump, minimum run timers, and low suction pressure cut out etc.

2. Transfer pump shall be controlled by float switch.

3. All Plumbing pumps shall be interlinked with BMS system.

4. All Pumps shall be compatible to interface with BMS System. Interfacing card, BACnet Compliant / compatible and software for interfacing and programming with BMS System shall be provided by pump manufacturer. Its pump manufacturer's responsibility to ensure the compatibility of equipment with BMS protocol.

5. Pump shall be provided with the following additional features .
   a. Phase Reversal and Phase Failure indication
   b. Dry Run protection
   c. Pump Cyclic Operation
   d. Microprocessor based controller.

2.03 SUMP PUMPS

1. Pump casing shall be Stainless steel.

2. Impeller shall be stainless steel wear resistant, semi shrouded, multi vane with adjustable diffusers. Minimum particle size shall be 20mm

3. Shaft shall be Stainless Steel 316SS.

4. Motor shall be squirrel cage induction type, class F insulation capable of a maximum of 15 starts/hour.

5. Motor casings shall be with integral cooling ribs for maximum heat dissipation.

6. Pumps shall be fitted with two mechanical seals with silicon carbide rotating & seat stainless steel spring, flexible bellows and gaskets. The chamber between the shaft seal to be oil filled.

7. Shaft shall be mounted on pregreased rolling element bearings.

8. Cable junction chamber shall be a sealed terminal chamber with separate gland assemblies incorporating strain relief clamps.

9. Pumps shall be suitable for a maximum depth of submersion with the flanged outlet directed vertical upwards.

10. Pumps shall be selected to match the duties indicated on drawings.

11. Pumps shall be supplied with control panel complete with integrated fuse elements, handoff automatic switch, motor contactor, duty pump selector switch, run/trip lamps for individual pumps etc. Pumps shall be controlled by a unit mounted float control. The pumps shall operate at high level and stop at low level of water in the sump pit.

2.04 Storm Water Pumps

1. Electric Dry Well Installation type – NON clog pumps shall be suitable for wet sump or dry pit installation and for intermittent or continuous operation.

2. Pump shall be suitable for a maximum depth of submersion with the outlet directed vertically upwards.

3. Motor shall be of the synchronous squirrel cage type, IP68 rating, hermetically enclosed within the stator housing. Stator shall be wound with double lacquered wire and subsequently triple dipped to provide insulation in accordance with IEC 85 temperature Class F (155 Deg. C). Stator winding over temperature shall be prevented by bimetallic thermal switches or thermistors embedded in each of the stator phase windings. Motor shall be designed for a maximum of 15 starts/hour. Motor casing shall be with integral ribs for maximum heat dissipation. Motor casing shall be of cast iron.

4. Cable entry glands shall be suitably designed to effectively seal the junction box from the surrounding liquid at depths upto 10 metres and to mechanically restrain the cable to avoid distortion of the gland rubbers and to prevent kinking of the cable adjacent to the cable entry.

5. Motor shaft shall be of stainless steel series 400 and mounted on robust pre-greased rolling element bearings rated for L10 duty life of at least 100,000 hours at the rated capacity. The shaft seal assembly shall comprise of two independent mechanical face seals mounted in tandem with an interposing oil chamber to cool the seals and to act as an additional leakage barrier. Seal combination shall be high wear resistant tungsten carbide/tungsten carbide.

6. Pump casing shall be constructed of fine grained grey cast iron, with fluid passages large enough to allow solids of any size which can pass through the impeller.

7. Pump casing shall be smooth profiled volute geometry for clog free operation fitted with replaceable inlet wear rings, fabricated from heat treated stainless steel.

8. Fabricate impeller of fine grained grey cast iron, Class 30 or better. Impeller shall be dynamically balanced single/multi channel type depending on the pump selection and duty specified.

9. The shredding system shall consist of spiral bottom plate with stationary cuter ring with cutting edges and a shredding motor located below the impeller for optimum blockage free running.

10. A mixing valve mounted directly on the pump casing shall be automatically activated to provide efficient mixing of the sump content prior to discharge.

11. The control panel shall be prewired, with IP65 enclosure and include the following:

    a) Panel mounted, door interlocked disconnect switch.

    b) Circuit breaker and earth leakage breaker for each pump.

    c) Magnetic starters with 3 leg overload protection.

    d) Selector switch Hand Off Auto (HOA) for each pump.

    e) 24 Volt control transformer.

    f) Float switch for high level alarm and pump operating.

    g) Pilot lights for power on, pump failure, high water level.

    h) Volt free contacts to interface with Building Management System for Power ON, HOA switches in auto position, Common fault, pump run/trip, high level and Hours run meter (One per pump).

12. Pump operation shall be automatic controlled through mercury type float switches installed in the sewage collection pit.

13. Pumps shall be supplied with all accessories including foot bends, stainless steel guide rails, stainless steel lifting chains, float switches, gate and check valves on each pump discharge.

14. All fasteners on the submersible pump and motor casing shall be type 316 stainless steel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.02 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.

3.03 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.

3.04 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.

3.05 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.
3. Clean strainers on suction piping.
4. 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.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.
8. Adjust timer settings.

3.06 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

SECTION 15480 - ELECTRIC HOT WATER STORAGE HEATERS

1.0 GENERAL

1.1 Reference

Conform to General Requirements for Mechanical Services of other sections in this specification.

1.2 Description of Work

a) This section describes the Electric Hot Water Storage Calorifiers, Domestic water Heaters and Electric Trace Heating systems as part of domestic water storage and distribution system.

b) The Contractor shall supply, install, test and commission all items to comply with the design. The Contractor shall ensure that the proposed locations of heaters are adequate and enough space is available for removal of elements and vessel itself for servicing and replacement.

c) All heaters shall be factory assembled and electrically prewired.

1.3 Quality Assurance:

1.3.1 Manufacturer's Qualifications: Firms regularly engaged in manufacture of water heaters of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.3.2 Codes and Standard:

a) BS 853, "Calorifiers and storage vessels for central heating and hot water supply".

1.4 Submittals:

1.4.1 Product Data: Submit manufacturer's technical product data including rated capacities and efficiencies of selected model clearly indicated; operating weights; furnished specialties and accessories; and installation and start up instructions.

1.5 Delivery, Storage and Handling:

1.5.1 Handle water heaters and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged water heaters or components; remove from site and replace with new.

1.5.2 Store water heaters and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

Comply with manufacturer's rigging and installation instructions for unloading water heaters, and moving units to final location for installation.

2.0 PRODUCTS

2.1 Materials

2.1.1 Electric Water Heater

a) Hot water heater shall be horizontal type. Vessel shall be glass lined steel. Heating element shall be copper sheathed electric immersion type.

b) Each heater shall be provided with a thermostat with adjustable setting in the range 32 to 82 deg. C and a safety thermal cut out operable at 90 deg. C with manual reset.

c) The vessel and electrical components shall be encased in a sheet metal enclosure suitable for a working pressure of 600 Kpa with baked enamel finish. Tank shall be insulated with polyurethane insulation. A temperature indicator mounted on the casing shall display the temperature of water. Each heater shall be supplied with drain cock and 20 dia safety valve, discharging to the building waste water drainage system via a floor trap and an automatic air vent.

d) Refer drawings for Capacities



3.0 EXECUTION

3.1.1 General: Install water heater in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

3.1.2 Support: Place units on concrete pads orient so controls and devices needing services and maintenance have adequate access.

3.1.3 Piping: Connect hot and cold water piping to units with shut off valves and unions, Connect recirculating water line to unit with shut off valve, check valve, and union. Extend relief valve discharge to closest floor drain.

3.1.4 Gages: Provide thermometers and pressure gauges on inlet and outlet piping of water heaters and recirculating pump, in accordance with Basic Mechanical

materials and methods section "Meters and gages"

3.1.5 Electrical wiring: Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.

Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 16 sections. Do not process with water heater start up until wiring installation is acceptable.

3.1.6 Start up: Start up, test and adjust electric water heaters in accordance with manufacturer's start up instructions. Check and calibrate controls.

END OF SECTION

LIST OF APPROVED MANUFACTURERS (PLUMBING):

S.NO.	EQUIPMENT / MATERIAL	RECOMMENDED MANUFACTURERS
1	PP-R PIPES	A) POPULAR PIPES B) TETRAPLAST C) EUROGULF D) PLASCO
2	PP-R COATED VALVES	A) POPULAR PIPES B) TETRAPLAST C) EUROGULF D) PLASCO
3	VALVES (100M AND ABOVE)	A) TOZEN - USA B) HATTERSLEY - UK C) KITZ-JAPAN
4	SPECIALITIES: I.E. NON RETURN VALVES, STRAINER, FLEXIBLE CONNECTOR	A) TOZEN - USA B) HATTERSLEY - UK C) KITZ-JAPAN
5	PRESSURE REDUCING VALVES	A) CLA VAL -USA B) WATTS - USA C) VAL MATIC -USA D) SINGER -CANADA
6	TRANSFER PUMP SETS	A) GRUNDFOS -DENMARK B) KSB - GERMANY C) WILO - GERMANY D) LOWARA-ITALY E) PANTEX-ITALY
7	WATER GEYSER	A) SINGER - LOCAL B) CANNON - LOCAL C) NAS GAS - LOCAL
8	MANHOLE COVERS	A) JAWS - LOCAL B) ADVANCE TECHNICAL SPARE - LOCAL C) SUPER ALPINE - LOCAL
9	UPVC PIPES FOR DRAINAGE	A) POPULAR PIPES B) TETRAPLAST C) AGM D) SMARTHOME-EGYPT
10	DRAIN SPECIALITIES	A) POPULAR PIPES B) TETRAPLAST C) AGM D) SMARTHOME-EGYPT

11	CHANNEL DRAINS, CATCH BASINS, PARKNG DRAINS AND GRATINGS	A) JAWS - LOCAL B) ADVANCE TECHNICAL SPARE - LOCAL C) SUPER ALPINE - LOCAL
12	PUMPS	A) GRUNDFOS -DENMARK B) WILO - GERMANY C) PANTEX - ITALY D) LOWARA - ITALY
13	SANITARY FITTINGS	A) CARMIN - OMAN B) ZILVER - CHINA C) PORTA - CHINA D) MASTER - LOCAL E) SONEX - LOCAL/CHINA
14	KITCHEN SINKS	A) CARMIN - OMAN B) ZILVER - CHINA C) PORTA - CHINA D) MASTER - LOCAL E) SONEX - LOCAL/CHINA
15	M.S.BLACK STEEL SCH.40 FIRE PIPE	A) HUFFAZ - UK B) MECH - CHINA C) LONTRIN - CHINA
16	FIRE HOSE REEL	A) NAFFCO - UAE B) SAFFECO - UAE C)BRISTAL-UAE D)FESCO-UAE
17	HANGERS & SUPPORTS	A) INKA, TURKEY B) LINK, TURKEY C) NORM, UAE
18	EXTINGUISHERS	A) NAFFCO B) SAFFECO D)FESCO-UAE
19	PVC PIPING FOR CONCENDATE (CLASS C,D,E)	A JEDDAH POLYMER B) PLASCO C) AGM - LOCAL D) POPULAR - LOCAL

Competitive and Livable City of Karachi
Local Government Department, Government of Sindh.

COMPETITIVE & LIVABLE CITY OF KARACHI
PACKAGE A:
IMPROVEMENT/ REHABILITATION OF EID GAH GROUND / FOOTBALL GROUND - KORANGI 03 . DMC KORANGI

TECHNICAL SPECIFICATIONS

(PART – B)

December, 2021

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. 584-1825
Email : info@eaworld.com | www.eaworld.com





Environmental and Social Screening Report
Rehabilitation of Improvement of Eid Gah / Football Ground at Korangi-03,

DMC Korangi, Karachi

October, 2021

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List of Acronyms

AED	:	Anti-Encroachment Drive
BP	:	Bank Procedure
CBC	:	Cantonment Board Clifton
GDP	:	Gross Domestic Product
GoS	:	Government of Sindh
DMCs	:	District Municipal Corporations
KMC	:	Karachi Metropolitan Corporation
CLICK	:	Competitive and Livable City of Karachi
PDOs	:	Project's Development Objectives
LCs	:	Local Councils
UIPT	:	Urban Immovable Property Tax
SSWMB	:	Sindh Solid Waste Management Board
ESR	:	Environmental and Social Screening Report
EA	:	Environmental Assessment
ESC	:	Environmental and Social Cell
EIA	:	Environmental Impact Assessment
IEE	:	Initial Environmental Examination
EC	:	Environmental Checklist
ESMP	:	Environmental and Social Management Plan
SEPA	:	Sindh Environmental Protection Agency
OP	:	Operational Policy
ESMF	:	Environmental and Social Management Framework
RoW	:	Right of Way
IEE	:	Initial Environmental Examination
PPEs	:	Personal Protective Equipment's
PAPs	:	Project Affected People
ESS	:	Environmental and social screening

Chapter 1: INTRODUCTION

1.1. Project Background

Karachi is Pakistan's largest city, its economic and financial hub and main seaport. However, despite its higher contribution to the national and regional economy, due to the heavy influx of population and a continued neglect in the development and upkeep of the urban infrastructure and related services over the last few decades, it is now considered among the world's least livable cities. The city ranks in the bottom five cities (out of 140), performing poorly in the dimensions of livability, health, environment, safety and education.

The Karachi City Diagnostic Study estimates an investment requirement of at least US$9-10 billion over the next 10 years to close the infrastructure and services gaps.

During the last few decades, Karachi has suffered infrastructure neglect and declining access and quality of urban services. The city's urban planning; management and service delivery has been unable to keep pace with the needs of the growing population. Karachi's infrastructure challenges are compounded by the city's high risk and vulnerability to climate-related disasters. Despite being a relatively dry city, Karachi faces heavy rainfall during the monsoon season and is highly vulnerable to recurrent and massive flooding. Increasing flooding events are mainly a result of the poor performance of the city's drainage system, which is largely blocked by uncollected solid waste and unplanned informal settlements along the drainage channels. The World Bank is assisting the Government of Sindh (GoS) for strengthening the institutional and financial capacity of the Karachi local councils (Karachi Metropolitan Corporation (KMC), six District Municipal Corporations (DMCs) and District Council Karachi) to deliver and maintain critical urban infrastructure and services through the project 'Competitive and Livable City of Karachi (CLICK).

1.2. CLICK Project Components

There are following four components of the project:

Component 1 – Performance-Based Grants to Local Governments and Capacity Building

This component will finance the provision of performance-based grants (PBGs) to Karachi local councils (LCs) upon achievement of specified institutional strengthening measures, to incentivize LCs to improve management capacity and enhance city competitiveness. LCs will use these grant funds to implement subprojects for infrastructure and services under their mandate, in line with the needs of citizens and businesses. To assist LCs in achieving the institutional strengthening measures, and to manage and implement the performance grants system, this component will also finance the provision of technical assistance (TA), and project implementation and management, by the Local Government Department (LGD) of GoS. Subprojects to be implemented by LCs and will be selected based on a comprehensive screening and risk reduction procedure. The sub project is proposed under the minimum condition grant 2020-2021 of component-1 of the project.

- **Sub-component 1.1:** Performance-based Grants to Local Councils; and
- **Sub-component 1.2:** Technical Assistance and performance grants implementation and management.

Component 2 – Technical Assistance for reforming urban Property Tax administration and system indicative financing.

Component 3 – Improving City's Competitiveness and Business Environment.

Component 4 – Technical Assistance for Solid Waste Management.

Chapter 2: LEGISLATIVE REQUIREMENTS

2.1. Legislative Requirements

This section of the screening report document gives an overview of the legislative requirements that apply to the proposed sub-project.

Relevant National and Provincial laws, policies and strategies for the proposed projects are mentioned below:

2.1.1 National and Provincial Requirements

- Pakistan Penal Code
- The Antiquities Act, 1975

2.1.1.2 Provincial Policies and Laws

- Sindh Environmental Protection Act, 2014 (SEPA 2014)
- The Sindh Local Government Act, 2013
- Sindh Strategy for Sustainable Development, 2007
- Sindh Drinking Water Policy 2017
- The Karachi Water and Sewerage Board Act, 1996 (KWSB Act)
- The Sindh Differently Able Persons (Employment, Rehabilitation and Welfare (Amendment) Act, 2017
- The Sindh Commission on the Status of Women Act, 2015
- Sindh Bonded Labour (Abolition) Act 2015
- Sindh Factories Act, 2015
- Sindh Minimum Wages Act, 2015
- Sindh Payment of Wages Act, 2015
- The Sindh Occupational Safety and Health Act, 2017
- The Sindh Occupational Safety and Health Rules, 2019
- Sindh Labour Policy, 2018
- The Sindh Prohibition of Employment of Children Act, 2017
- The Sindh Transparency and Right to Information, 2016
- Sindh Cultural Heritage (Preservation) Act, 1994
- Other relevant provincial labor laws

2.2.2 World Bank Safeguard Policies

Relevant World Bank safeguards policies triggered are as given in Table 2.1 below:

Table 2-1: Safeguard Policies Triggered and Compliance Status

#	Environmental Assessment	Policy Reference	Triggered	Remarks
1.	Environmental Assessment	OP/BP 4.01	√	CLICK is categorized as category B with partial assessment. The sub-project has been screened as per OP 4.01 and is envisaged to have low to minor environmental and social impacts. The sub-project involves only small-scale construction and rehabilitation within the existing ground, therefore it falls under Category-C.
2.	Physical Cultural Resources	OP/BP 4.11	√	Even though this OP has been triggered for this project, the requirements are not envisaged to be applicable for this activity. The sub-project activities will be carried out along the existing ground will small-scale rehabilitation and construction with no adverse impact on any cultural, archeological, historical, heritage, or religious significant site being observed.
3.	Involuntary Resettlement	OP/BP 4.12	√	This OP is triggered for the overall project of CLICK. For the subproject activity, screening has been carried out to ensure that there is no dispute and tenants or encroachment over the land used for the proposed sub-project, as well as not any Anti encroachment drive (AED) being carried out.
4.	Access to information	BP 17.50	√	This OP has been triggered for the overall project. It has been ensured that sub-project related information is put on the websites of DMC Korangi and CLICK and has been shared with the stakeholders to improve the design and implementation of the project.

Chapter 3: SUB-PROJECT DESCRIPTION

3.1 Details of the Sub-Project

The Sub-project is located in the District Korangi, Karachi. The sub-project location falls in a densely populated area surrounded by houses and commercial areas, providing a recreational facility to the local residents of the Korangi, Karachi. The playground has been used for many football tournaments in the past, which highlights its importance and significance for all players and users of this facility in the locality. The main use of the playground is as a recreational facility for football matches, where many children and other young adults regularly use this area for their sporting activities. As per the site visits, there is a sitting area that is directly exposed to the sunlight. On the other side of the ground, it was observed that water storage tank is located at sub-project site. Eid Gah is also located at the sub-project site. Existing ground is in bad condition. Ground level is not smooth. Existing washroom facility, water storage tank, ground gates and seating area are damaged. Existing Football ground facility is not up to mark for the players. Existing boundary wall is damaged.

DMC Korangi is planning to rehabilitate the existing ground to enhance this recreational facility for the locality.

3.2 Sub-Project Features

The playground is spread over an area of 64,911 square meters. The proposed sub-project includes the rehabilitation and maintenance of the existing football ground by laying the ground with grass, rehabilitating the ground lights, and providing shading for the seating area). The sub-project features can be seen in **Table 3.1.**

Table 3-1: Sub-project salient features

Sub-Project salient Features	Details
Eid Gah/Football Ground Rehabilitation (Area: 64,911 sq.m = 6.48 acre)	The sub-project includes the overall rehabilitation of the Football playground and Eid Gah as: • Rehabilitation of Football ground • Rehabilitation of Eid Gah – Minbar for Janamaz • Rehabilitation of two Main Gates • Rehabilitating the seating area for spectators • Rehabilitation of existing boundary wall of the ground • Rehabilitation the existing drainage system • Provision of an additional washroom for the players/audience • Provision of Cricket ground • Provision of shading for the seating area • Provision of Flood Lights • Provision of Grass for the ground • Filling of the ground (to level the existing surface of ground) • Provision of Dressing Room for both male and female • Provision of Restroom in the existing Park including for senior citizens and physically disabled persons. • Provision of walking track along the boundary wall

3.3. Sub-Project Location

The proposed sub-project is located in District Korangi, Karachi and it is spread over an area of 26,235 square meters (6.48 acres), which is easily accessible by Korangi 12000 road. The location map of the proposed sub-project can be seen in the following **Figure 3.1.**

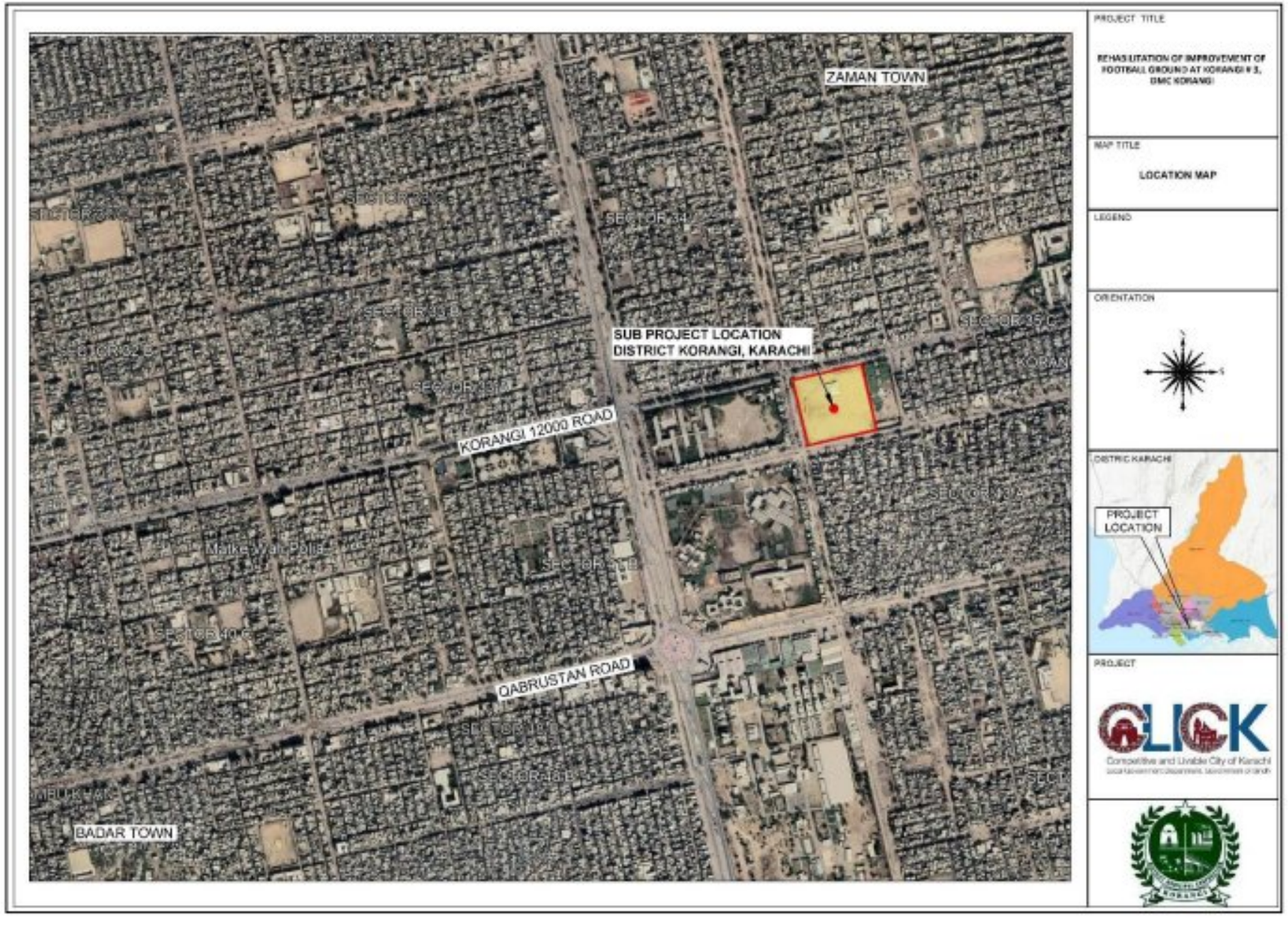


Figure 3-1: Location Map of the proposed Sub-Project

3.4. Sub-Project Significance

Eid Gah/ Football ground lies in the vicinity of DMC Korangi along the major road which carries around the main construction material shops and residential housing, the "Eid Gah/ Football Ground of Korangi" playground covers almost the main residents with the population of Korangi. The major lack that stand alone in this area is the recreational facilities availability in the locality, that's why the DMC Korangi pick up the "Eid Gah/Football Ground of Korangi" for the utmost need for youth of the area for better living environment.

3.5. Environmental Setting

The proposed sub-project site is located in the urban setting of Korangi, coming under the DMC Korangi jurisdiction, Karachi. Photographs of the surrounding of the proposed sub- project can be seen as **Annex-A**.

3.6. Sub-Project Commencement Details

The sub-project construction activities are expected to be initiated by January 2022 and will be finished till end of March 2022. The expected timeframe for the proposed sub-project can be seen in Table 3.2 below.

Table 3-2: The Tentative Schedule for the proposed sub-project

Details	Duration
Expected date for the start of Construction/Rehabilitation Activities	After receiving necessary approvals in FY 2020-21
Expected start and end year for completion	Start in January 2022 and will be finished till end of March 2022.

3.7. Sub-Project Activities

3.7.1. Design Phase

To design the sub-project consultancy services have been taken on-board for providing assistance in planning construction activities, preparing engineering design, cost estimation, preparation of bidding documents, contracts procurement, bid evaluation, construction supervision, quality assurance, and monitoring and evaluation of civil works (sub-projects) and contract management under CLICK. After the World Bank's approval, the consultant will assist in detailed engineering design and provision of construction drawings for the sub-project.

3.7.2. Construction Phase

The construction activity of the proposed Sub-Project will commence after getting approval from the World Bank. This phase will involve the works as following:

- Rehabilitation of Football ground
  The Rehabilitation of Eid Gah football ground involve the process of making field for both football and cricket playing field with in the same specific area with allied facilities.

- Rehabilitation of Main Gates
  Rehabilitation of existing entrance gates with making arrangement for separate entrance for special persons having any disabilities.

- Rehabilitating the seating area for spectators

As per the existing situation of ground some portion of spectator area is present on ground with deteriorating condition which cannot be rehab so it's going to be demolish and new spectator area will be construct on football ground.

- Rehabilitation of existing boundary wall of the ground
  Rehabilitation of existing boundary wall considered as there are some plinth level broken walls on each four side of boundary wall and as per the public consultation community asked for viewable boundary wall with security fence.

- Rehabilitation the existing drainage system
  As per the existing ground condition there is no drain system for draining out the storm water or the set out the ground levels as per the situation to out flow the storm water to the nala running on the periphery of ground, therefore we are proposing it to be that much level of ground level raising with existing ground earth sand material to maintain this condition or we are going to proposed channel drain line for draining out the storm water.

- Provision of an additional washroom for the players/audience
  For adding new spectator area on right and left side of football ground with allied facilities like washroom, rest rooms, changing rooms.

- Provision of Cricket ground
  The need for both cricket and football ground arises during the public consultation meeting and the players playing at the time of meeting shows interest for playing cricket in day time and football in night time in floodlights.

- Provision of shading for the seating area
  The community and kids playing around asked for spectator area having shades for sunlight for not disturbing their view during playtime.

- Provision of Flood Lights
  Most of the community representative asked for floodlights for giving the ground the look of night time playing field also for football players that why we have proposed flood light proper arrangement on ground in our design.

- Provision of Grass for the ground
  Grass arrangement have been proposed for the playing field.

- Provision of walking track
  Providing walking track along the boundary wall for the community persons asked for the walking area should be built in out design to cater for the service providing the healthy progressing the healthy activity.

3.7.3. Operation and Maintenance Phase

The overall responsibility of compliance of the operational phase will lie with DMC Korangi in line with the existing practices, ESMF of CLICK and ESR.

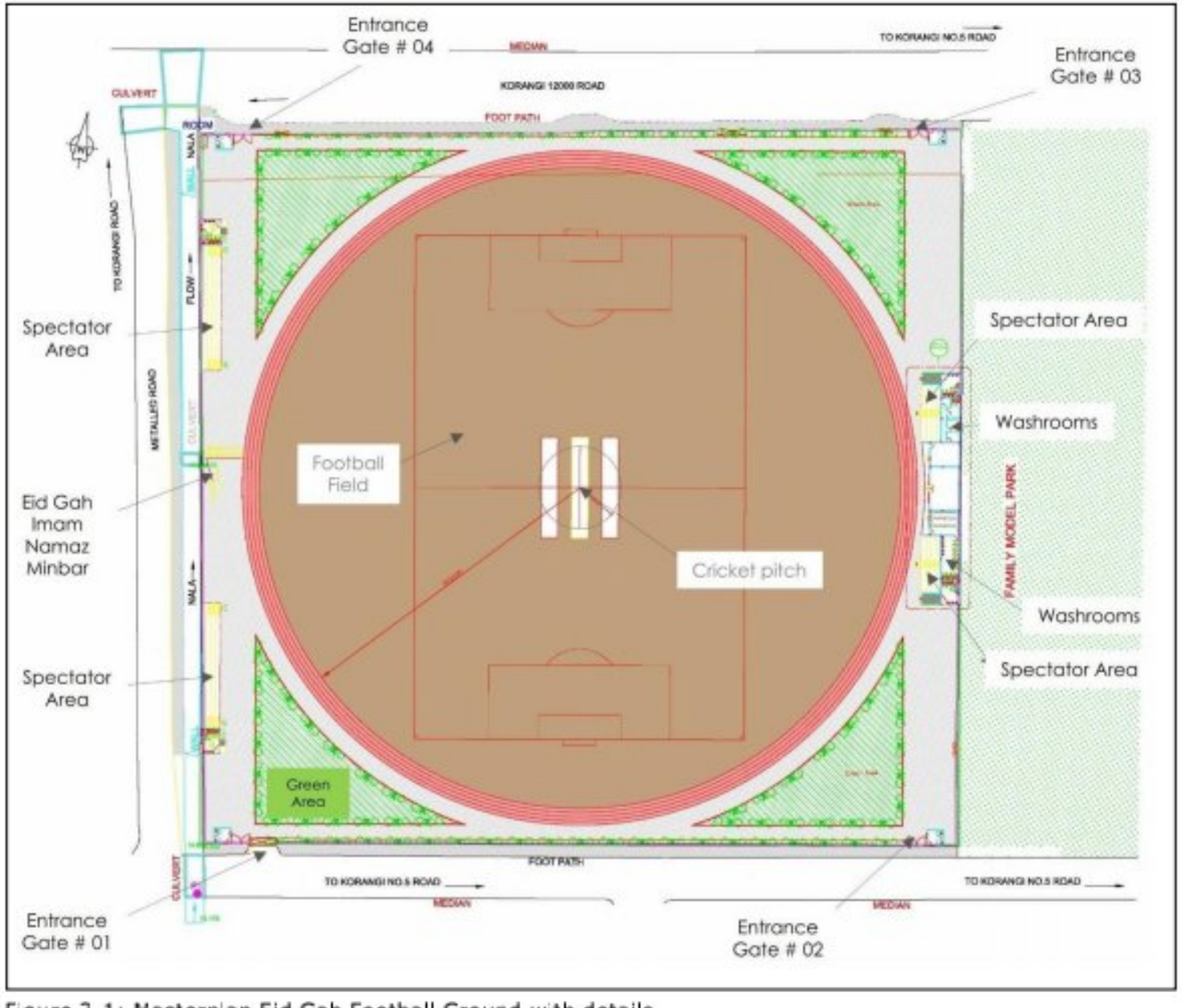


Figure 3-1: Masterplan Eid Gah Football Ground with details

Chapter 4: STAKEHOLDERS ENGAGEMENT

4.1. Stakeholders Consultation

The stakeholder's engagement and consultations has been carried out with the people of the proposed sub-project area at the pre-qualification phase, by following the methodological steps, guidelines and procedures for environmental and social screening defined in the Environmental and Social Management Framework (ESMF) of CLICK. The purpose and methodology for the social screening process is aimed to determine the activities of the proposed sub-project which are likely to result in significant positive or negative social effects, with a view at determining appropriate impact mitigation measures for those activities to ensure sustainability of the subproject. A Stakeholder consultative workshop was conducted adopting the COVID-19 Standard Operating Procedures, at the sub-project location on 28th October 2021, with people of the area as part of the environment and social screening study. The outcome of the consultation and determined social considerations are adhered in decision making and in carrying out the sub-project activities.

Information dissemination was ensured for the proposed project and complaint registration number has also been provided on website, social media and on banners at the project site. To address the grievances the consultation meeting progressed in the following manner:

- An overview of the Sub-project and screening process was provided to the community representatives in the local language.
- Participants were given the opportunity to raise queries or concerns regarding the Sub-project. Queries were responded to and concerns were documented.

The list of consultation participants is attached as **Annex B** and pictorial presentation of the activity as **Annex C** respectively.

4.2. Issues / information

The following information was shared with the people/Community:

- Sub-project salient features, proposed allocated budget and sources of assistance, implementation/execution methodology;
- Information on perceived benefits from the proposed sub-project;
- Construction activity whether causing any type of health hazard or not, and associated mitigation measures;
- Discussion among the public for sharing of information related to project, environment and social policy of World Bank, direct and indirect impacts of improvement/ construction work on the environment;
- Any loss of land/structure/ business or other community property due to construction activity;
- Any risk to historic or cultural monuments due to the project;
- Possible types of problems faced by the locals in their daily activities due to construction work; and
- The influx of labor during the construction stage of the project.

4.3. Feedback received

The main issues and concerns raised or feedback received from the community representatives of the area and the PIU/DMC Korangi Response is summarized in Table 4.1 hereunder;

Table 4-1: Key Community Stakeholder Concerns and PIU Response

S.No	Stakeholder Feedback	PIU/DMC Korangi Response
1	The residents had security concerns about the existing ground. They wanted the provision of an adequate boundary wall so that unwanted people are not able to get into the ground. The boundary wall will also restrict animals from entering the ground premises.	The DMC Korangi representative acknowledged this concern and ensured that the ground will be provided with this facility such that there is a boundary wall present. The goal of this project is also to make this recreational facility as safe as possible, so this concern will be addressed accordingly.
2	The participants at the stakeholder consultation asked to increase the capacity of the seating area of the existing ground.	DMC Korangi official stated that The seating area will be enhanced and increased so that it can accommodate for more spectators.
3	The participants at the stakeholder consultation asked for the provision of a parking lot for the recreational facility. When football matches take place in the ground, there isn't a proper space to park the cars for the spectators, which is an inconvenience.	The DMC Korangi official acknowledged this concern and validated the necessity for a parking space for the ground. The official stated how this matter would be looked into and assessed to accommodate for a parking space.
4	The participants expressed the need for a water tank supply for the football ground	The DMC Korangi official stated that the capacity of tank will be enhanced accordingly.
5	The stakeholders expressed their concerns regarding, provision of Football and cricket ground in the sub-project	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision.
6	The stakeholders expressed their concerns regarding, provision of Eid-Gah facility in the sub-project.	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision.
7	Flood Lights and electric lights (Currently- No lights facility available at ground.	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision of more ground lights.
8	The stakeholders expressed their concerns regarding, provision of Plantation in the sub-project.	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision.
9	The stakeholders expressed their concerns regarding, filling of the ground would be carried out to level the surface.	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision.
10	The stakeholders expressed their concerns regarding, provision of Sprinkler system for the ground.	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision.
11	The stakeholders expressed their concerns regarding, rehabilitation of the existing drainage system	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision.
12	The stakeholders expressed their concerns regarding, provision of Walking track.	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision.

13	The stakeholders expressed their concerns regarding provision of Ramp in the sub-project.	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision.
14	The stakeholders expressed their concerns regarding, provision of Dressing Room for both male and female in the sub-project.	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision.
15	The stakeholders expressed their concerns regarding, filling of the ground would be carried out to level the surface in the sub-project.	The DMC Korangi official acknowledged this concern and stated the sub-project would address the provision.
16	The stakeholders expressed their concerns regarding Health and Safety of the residents, especially in the duration of the construction phase of the sub-project.	The DMC Korangi representative ensured that all EHS measures would be noted in the contractors' document, and it will be implemented strictly. Since the rehabilitation of the football ground is a small-scale sub project, there would be minimal health and safety risks for the locals. Nevertheless, any disturbance to local residents will be avoided ensuring implementation all Health and Safety Protocols.
17	Local residents and sub-contractors should be given priority for jobs during the construction phase.	Even though the sub-project is not a labor-intensive project, priority will be given to the qualified local residents and sub-contractors fulfilling the criteria/ prompt reports for the sub-project.
18	The locals expressed that the rehabilitation and work on the playground should be completed in a timely manner so that locals are able to utilize it as soon as possible. They wanted an early finish to the rehabilitation so that the ground can be in use quickly.	After obtaining necessary approvals for the sub-project, the works will be started accordingly.
19	Several respondents were grateful that such a project was being undertaken because there is a need for recreational areas in the neighbourhood, especially for the youth.	DMC Korangi/PIU officials acknowledged their participation and appreciation.

During the consultation process about the proposed sub-project, people expressed keen interest in the proposed sub-project. People, in general, were very enthusiastic about the benefits of the sub-project for the residents and females in particular. People seemed willing to extend all types of support during the execution of the sub-project as their major difficulties would be addressed after completion of the sub-project.

Chapter 5: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

5.1 Methodology of Environmental and Social Screening

The environmental and social screening for the sub-project has been carried out by making use of the methodology provided in the approved Environmental and Social management framework (ESMF), the Environmental and Social Screening Checklist, the Screening Questions for Involuntary Resettlement/Indigenous People and Environmental and social monitoring checklist. (**Annex D and E, and F**). The environmental impacts are localized, low intensity, and temporary in nature which could be easily avoided or mitigated. There will be no involuntary land acquisition, and therefore there will be no physical displacement or impacts on livelihoods, nor restrictions on access to the local community. Team composition details for the study are attached as **Annex G**.

5.2. Overall Screening Outcome

The proposed sub-project will not have any significant environmental & social impact because the project will not involve any diversion of natural forest land, destruction of ecological resources, displacement of people, and acquisition of private land, demolition/removal of existing structures or any other major environmental threats/risks. There is no govt. led AED conducted at the project locations and its zone of impact.

There may be some short-term inconvenience to the local users due to construction/Rehabilitation of the playground, but it will be for a very short period if compared with its long-term benefits to the local citizens. Additional issues identified include as related Occupational, Health and Safety (OH&S) issues, generation of solid and liquid waste and air emissions which are expected to be short-term, localized and reversible in nature. The activity is expected to have long-term benefits for the local citizens. As such, no EC, IEE and EIA for SEPA and no separate ESMP (for World Bank) is required for the subproject site. However, the environmental and social screening checklist and mitigation measures proposed in this report would be implemented for the proposed sub-project site.

5.3. Statutory Clearances/ No Objection Certificate

Only Statutory clearance from the Karachi Commissioner's Office is required to be obtained by the DMC Korangi.

5.4. Implementation of ESR.

Bidding documents will include the ESR of the sub-project cleared by the World Bank and it will be a contractual binding for the successful Contractor to make arrangements for necessary compliance with the proposed mitigation measures. Regular site visits will also be arranged to monitor the compliance of the mitigation measures and their proper implementation during construction phase.

i. This environmental and social monitoring will be carried out with the help of the Environmental and Social Monitoring Checklist by the Focal Person of LC, ESC of PIU and Supervision Consultant.
ii. Safeguards Team-PIU will also arrange regular visits at sites and meetings with concerned officials to check the compliance as prescribed in Environmental and Social Screening checklist.
iii. Based on the prevailing scenario as mentioned in the Environmental and Social screening checklist, Environmental and Social monitoring checklist will be filled out accordingly.
iv. Summary of the findings of the monitoring for the compliance of environment and social aspects will be submitted to World Bank.

5.5. Environmental and Social Mitigation and Monitoring

Environmental and Social Management and Monitoring Plan is developed to address the environment and social issues that may arise during construction activities:

Table 5-1: Environmental and Social Management and Monitoring Plan

Proposed Mitigation Measures	Implementation Responsibility	Monitoring Parameter(s)	Frequency	Monitoring Responsibility
Site Selection				
• Selection of site that will result in a minimal loss of trees and soil erosion	E&S Team of Contractor / Sub-contractor	Visual inspection	Before initiation, During Construction	Focal Person of DMC Korangi, ESS and Supervision Consultant
Noise				
• The contractors would ensure keeping noise levels from construction vehicles and machinery is within safe limits. • Vehicular and machinery will not be allowed to operate at night time. • Noisy machines and vehicles will not be allowed at the sub-project site (noise level will not be more than 85 dBA at 7.5 m distance), properly tuned machines and vehicles will be allowed only. • Pressure horns will not be allowed to be used by the for the construction vehicles. • The contractor will adhere to the requirements of the EMF, SMF, and mitigation plan contained in the contract documents with true spirit. • No noisy work during night time or during sensitive times (e.g., prayer time) • Maintain all vehicles in order to keep them in good working order in accordance with manufactures maintenance procedures - Making sure all drivers will comply with the traffic codes concerning maximum speed limit	E&S Team of Contractor / Sub-contractor	• Use of machinery and equipment having less noise. • Provision for personal protective equipment (PPE's), ear muffs/ ear plugs to workers.	Pre and During Construction of the sub-project.	Focal Person of DMC Korangi, ESS and Supervision Consultant

and driving hours; • Providing construction workers with suitable hearing protection such as earmuffs and training them in their use. • Heavy machinery like percussion hammers and pneumatic drills should be used at a minimum level and should not be used at all during the night.		• Noise level testing will be carried throug h SEPA ***certi fied Lab.		
Air Emissions				•
• Regular water sprinkling at the dust generation points, during construction activities. Water will be also sprinkled at vehicular and machinery movement routes to avoid dust spreading to the nearby community as required. • The provision of dust masks and ensuring their use by the workers. • All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained to minimize exhaust emissions. • Stockpiled materials will be covered to avoid dust/particulate emission. • Air quality analysis will be carried out before and during construction by the contractor through engaging SEPA certified contractor, that will be shared with PIU Team to use well-maintained generators and vehicles/machines to keep ambient air quality within the desired level. • Provide fitness certificate/maintenance	E&S Team of Contractor / Sub-contractor /	Ambient Air Quality Analysis (SO_x, NO_x, CO, PM_{10}, $PM_{2.5}$, O_3,) by SEPA approved environmental laboratories	During Construction of the sub-project, once a month.	Focal Person of DMC Korangi, ESS and Supervision Consultant

records of the generators, vehicles and machines before deploying them at the construction sites.				
Solid Waste				
• Leftover material would not be dumped into storm water drains or watercourses • Non-toxic and biodegradable materials will be used whenever possible. • Hazardous materials will be properly collected transported and stored in appropriate containers with clearly visible labels. • Hazardous materials will be stored at least 100 feet from any down gradient drainage or within secondary containment capable of containing its entire volume (if any generated such as electric batteries). • Equipment and work areas will be regularly inspected for signs of leaks and spills. Spill containment and cleanup kits will be available wherever hazardous materials are being used or stored. Any incidental spills or leaks will be contained and cleaned up as soon as it is safe to do so. Any contaminated soil will be collected and disposed of in an appropriate landfill. • Equipment refueling and maintenance will be limited to designated areas • Solid Waste including construction debris will be safely disposed in demarcated waste disposal sites or dedicated garbage transfer stations (GTS) • A contract with SEPA Approved waste	E&S Team of Contractor / Sub-contractor	Visual inspection	During and Post execution of sub-project	Focal Person of DMC Korangi, ESS and Supervision Consultant

contractors should be made in case hazardous waste generates from the site, defining the schedule for hazardous waste management and its disposal. • Burning of waste oil will be strictly prohibited.				
Water Pollution				
• Proper disposal of solid waste in designated site to sustain the water and land quality for domestic requirements. Solid waste will not be thrown in Nullah or any water body present in the area.	- E&S Team of Contractor / Sub-contractor / -	- Visual inspection	- During and Post execution of sub-project	- Focal Person of DMC Korangi, ESS and Supervision Consultant
Vehicular Traffic				
• Only drivers with a valid license and car registration documents will be allowed to drive the vehicles. • The drivers will be trained to strictly adhere to local traffic laws. • At all times, the contractor will provide safe and convenient passage for vehicles, pedestrians and livestock, and will not cause any hurdle on the road for commuters. • Appropriate safety precautions will be taken when transporting large equipment on public roadways. • proper road signage during construction period, followed by provision of adequate and safe pedestrian crossings and walkways	E&S Team of Contractor / Sub-contractor /	Visual inspection	During and Post execution of sub-project	Focal Person of DMC Korangi, ESS and Supervision Consultant
Flora and fauna				
• Avoid unnecessary cutting of plant species during site clearance if needed; • Limiting vehicular transport to defined roads as to prevent unnecessary injury	E&S Team of Contractor / Sub-contractor /	Visual inspection	During and Post execution of sub-project	Focal Person of DMC Korangi, ESS and Supervision Consultant

and habitat destruction; •				
Occupational Health and Safety				
• The labor having transmittable diseases should not be allowed on the construction site; • The contractor will ensure and strictly implement the SOPs regarding COVID-19 (refer to **Annex H**), including daily body temperature check, daily disinfection, quarantine management, area access management, PPEs, emergency response, and drills; • Only skilled workers will be allowed to work at the construction site; • Provision of first aid facilities for workers at site for meeting the emergency needs of workers, and providing basic medical training to specified work staff and basic medical service and supplies to workers; • Observe and maintain standards of Health and Safety towards all employees in line with WB EHS Guidelines along with Sindh Occupational Health and Safety Law • The contractor will ensure that hazards associated with manual lifting are controlled by proper lifting techniques, Work rotation system will reduce the chances of being exposed to work-related stress associated with construction activities. • Unauthorized personnel will not be allowed to access the proposed project site without permission and safety permits.	E&S Team of Contractor / Sub-contractor /	Visual inspection	During and Post execution of sub-project	Focal Person of DMC Korangi, ESS and Supervision Consultant

• Workers should be facilitated by providing appropriate work specific personal protective equipment (PPE's); • Training and use of personal fall arrest systems, such as full-body harnesses and energy-absorbing lanyards as well as fall rescue procedures to deal with workers whose fall has been successfully arrested;				
Labor Living and Working Conditions				
• The worker's Grievance redressal mechanism must be developed and communicated among workers to lodge complains; • Workers should be provided with clean drinking water and hygienic food for free; • Avoiding Gender Based Violence. Contractor will prepare and implement robust measures to address the risk of gender-based violence that include (i) mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women; (ii) informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; (iii) Introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for noncompliance (e.g., termination), and (iv) contractors adopting a policy to cooperate with law enforcement	E&S Team of Contractor / Sub-contractor /	Visual inspection	During and Post execution of sub-project	Focal Person of DMC Korangi, SSS and Supervision Consultant

agencies in investigating complaints about gender based violence. • Use of child and forced labour will be strictly prohibited.				
Community Health and Safety				
• Maintain a complaint register on site and it must be communicated to the internal staff and the public. • Close consultation with local communities to identify optimal solutions where needed • Community grievances will be recorded and responded to on an urgent basis. • No Hazardous and non-hazardous waste will be dumped outside any community.	E&S Team of Contractor / Sub-contractor /	Visual inspection Monthly Grievance Report	During and Post execution of sub-project	Focal Person of DMC Korangi, SSS and Supervision Consultant
Socio-Culture and Cultural Heritage				
• Contractor will not cause any damage or harm to cultural heritage around the project area. In case of any finding Chance find Procedure will be followed (refer to **Annex I**) • Pollution such as noise and dust generation will be avoided while working close to religious and ancient site. Contractors would be trained to address privacy issues behave ethically. The contractor's staff must be trained enough to respect local norms.	E&S Team of Contractor / Sub-contractor /	Site Visit Public Consultation	During execution of sub-project	Focal Person of DMC Korangi, SSS and Supervision Consultant
• Site Restoration				
• Contractor will obtain approval for excavation and submit the plan of rehabilitating the site after construction. • Site restoration will be completed immediately after completion of the sub-project.	E&S Team of Contractor / Sub-contractor /	Visual inspection	During and Post execution of sub-project	Focal Person of DMC Korangi, ESS, SSS and Supervision Consultant

Recommendation for operation and maintenance: CLICK does not support operation and maintenance of the proposed sub-project. However, DMC Korangi is requested to follow the following measures to mitigate the environmental and social impacts during operation phase.

OPERATIONAL PHASE				
• Regular removal of dirt and substances • Regular maintenance of the football ground to achieve the best condition • Periodic maintenance of water supply resources and stadium lights • Regular maintenance of football ground markings for playing purposes • Ensure compliance with the labor laws and protection against harassment of women at the workplace Act.	Client / User Dept i.e., DMC Korangi	Visual inspection	During and Post execution of sub-project	Focal Person of DMC Korangi, ESS, SSS and Supervision Consultant

5.6. ESR Budget

The cost for the implementation of construction stage activities given in this ESR will be included within the civil works contract for this sub-project with total cost of **Rs. 1,062,000.00 PKR.**

Figure 5-1: ESR Implementation Cost.

Name of item	Total Quantity	Unit Rate	Total Amount in PKR
Masks Box	30	300	9,000
Safety Shoes	40	1,500	60,000
Safety Gloves	40	100	4,000
First Aid Box	10	600	6,000
Ear Plugs	40	100	4,000
Safety Helmets	40	500	20,000
Safety Jackets with reflectors	40	300	12,000
Sanitizer	40	500	20,000
Thermo-gun	5	5,000	25,000
Provision of Dust Bins	10	1,000	10,000
Reflective Tape	20	200	4,000
Safety cones	20	1000	20,000
Safety boards	5	1,000	5,000
		SUB TOTAL (01)	**199,000**
Environmental Analysis (By engaging Sindh EPA Certified Laboratory)			
Ambient Air Quality Analysis for 24hours (CO, SO_2, NO, NO_2, SPM, $PM_{2.5}$, PM_{10}, O_3 and Lead); once in a month	4	40,000	160,000
Noise Level Monitoring; once in a month	4	1,000	4,000
Drinking Water Quality Testing; once in a month	4	33,000	132,000
Wastewater Quality Testing; once in a month	4	33,000	132,000
Mobilization Charges; once in a month	4	5,000	20,000
		SUB TOTAL (02)	**448,000**
OTHERS			
Water sprinkling	20	10,000	200,000
Internal Training for sub-project construction staff comprises:	1	200,000	200,000
- Project overview			
- ESMP/ESR implementation, communication, documentation, logistics and reporting requirement			
- GBV/SH			
- Code of Conduct			
- Grievances Redress Mechanism			
Project dissemination materials such as banners, flayers,		15,000	15,000
		SUB TOTAL (03)	**415,000**
		GRAND TOTAL (1+2+3) PKR	**1,062,000**

Note:
Supervision of the ESR implementation is already included in the consultant's scope of work.

Chapter 6: RECOMMENDATIONS

Overall, the sub-project will have positive impacts. The proposed sub-project will achieve its objective of providing a healthier and livable, secure and safe residential environment to the local residents in an urban settlement. The proposed sub-project will also enhance the safe lifestyle of the area and it will also comply with all legislative requirements and standards listed under the ESMF, Contractual Documents and in this ESR report.

Recommendations made for the sub-project development on the basis of ESR are given below:

- The selected Contractor must implement the proposed mitigation measures mentioned in this ESR and Environmental and Social Management Framework (ESMF) and Social Management Framework (SMF) of CLICK.
- The selected Contractor must also ensure that all the safety and security (HSE) procedures are in place and implemented in true spirit which includes but is not limited to the use of safety nets/sheets, erection of safety warning signs, provision of the necessary Personal protective equipment (PPE) for the workers and warning signs for the road users and passersby.
- The selected Contractor must ensure that the building materials are sourced from genuine and certified suppliers.
- The selected Contractor should also take due care of the local community, construction activity related issues regarding women (e.g., preventing sexual exploitation and abuse /Sexual Harassment -SEA/SH), and its sensitivity towards local customs and traditions of local culture.

Annex A: Photographs of the Surrounding of Proposed Sub-Project

	
12000 Korangi road in the nearby vicinity of sub-project, where the existing Eid Gah/football ground is located at Korangi#3.	Road in the nearby vicinity of sub-project, where the existing Eid Gah/football ground is located at Korangi#3.
	
Existing condition of Football ground at Sub-project Site.	Existing condition of Main Entrance Gate at Sub-project Site.
	
Existing condition of Eid Gah at Sub-project Site.	Condition of Sanitation at Sub-project Site.



Existing condition of the seating area for spectators.



Existing condition of the seating area for spectators.



The existing condition of washroom in the playground.



The existing drain/ nullah along the boundary wall of Ground.

Annex B: List of Participants

Name	Designation	Department	Cell NO	Signature
1 Azhar Hussain Khan	Focal Person DMC (S)	XEN B&R DMC(S) Karachi	0345/3594518	
2 Mir Mohammad Sahrgan	AEE DMC-South	B&R DMC South	0334-2229295	
3 Mehdi Abbas	Sub - Eng	B&R D.M.C South	0300-2943541	
4 Kaseemullah Waqasi	Ex. Chairman UC-31. DMC Gizri		0300-8250388	
5 Syed Babar Ali	EA Consulting	CONSULTANT	0334-22 04323	
6 Waqas Iqbal	EA CONSULTING	CONSULTANT	0321-2276947	
7 Amir Ali	Sub Engineer DMC South	—	0333-3558013	
8 S. Gh. Muhammad Khan	Sub Engr:	B&R DMC South	03009592015	
9 Khalil Hanif	President PPP South		0302-4022300	
10 Hafiullah	PPP VS. Pres.		03007007100	
11 Ali Nawaz	PPP. J.N.P		03008248353	
12 Mutshif	PPP. P.S		0300-2436204	
13 Hafiz	PPP. U.C.9		0322-1250557	
14 Nok M	PPP. P.S.107 Sadaf		03218770771	
15 Asdar Ali	PPP. Sec. UC.7		0323-2703391	

DMC SOUTH [CAPTAIN SARFARAZ RAFIQUEE ROAD NEAR HAQQANI CHOWK KARACHI.]

Annex C: Photographs showing Stakeholders' Consultation

	
Stakeholder Consultation at Sub-project Site	Stakeholder Consultation at Sub-project Site
	
Stakeholder Consultation at Sub-project Site	Stakeholder Consultation at Sub-project Site

Annex D: Environmental and Social Screening Checklist

Country	PAKISTAN
Project Title	Competitive and Livable City of Karachi (CLICK), LGD, Sindh
Sub-project Title	**Rehabilitation of Eid Gah/Football Ground at Korangi #3, DMC Korangi, Karachi.**

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
Project Siting Is the project area							
• Densely populated?	√	□	□	√	□	□	The proposed football ground is located in a densely populated area, in a congested urban setting. Mitigations: As per the World Bank's Environmental Health and Safety Guidelines, the construction contractor will develop civil work construction and management plans for each civil works activity prior to the start of the work to avoid any disturbance to the local residents. The plans will be specifically targeted towards waste management, Emergency preparedness, and an overall environmental management plan.
• Heavy with development activities?	□	√	√	□	□	□	No development activity is going on in the surrounding area.
• Adjacent to or within any environmentally sensitive areas?	□	√	√	□	□	□	No sensitive area is around.
• Cultural heritage site	□	√	√	□	□	□	No cultural or heritage site is in the vicinity of this project. However, a Chance Finds Mechanism has been prepared and annexed as Annex I. The contractor will also ensure training of the workers in case a chance find is encountered. This training will be part of the overall training delivered by the contractor.

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
• Protected area	□	√	√	□	□	□	The area is well in the use of the residents as well as motorists and regular traffic and is not protected.
• Wetlands	□	√	√	□	□	□	No wetland or damage to flora and fauna
• Mangrove	□	√	√	□	□	□	No mangroves are present in the vicinity.
• Estuarine	□	√	√	□	□	□	No estuarine area is present around the project area.
• Buffer zone of protected area	□	√	√	□	□	□	No buffer zone viz. a river lake, open space, trees, shrubs in its immediate surroundings. However, mangroves are present at safe distance.
• Special area for protecting biodiversity	□	√	√	□	□	□	The area is in use of regular inhabitants and no special area for the protection of biodiversity exists.
• Forest	□	√	√	□	□	□	No forested area or a forestation is around.
• Bay	□	√	√	□	□	□	No bay is around this project.
B. Potential Environmental Impacts (Construction Phase)							
• Will construction camp site cause land clearing and tree cutting?	□	√	√	□	□	□	No construction camp will be constructed and will not cause any land clearing and tree cutting for it.
• Will construction camp site interfere with the community?	□	√	√	□	□	□	No interference to the community as the facility is enclosed and free from any interference. For the given activity no establishment of construction camp is required.
• Will construction camp site cause soil pollution?	□	√	√	□	□	□	No construction camp will be established; therefore, no soil pollution will be occurred.
• Will construction camp generate domestic solid waste?	□	√	√	□	□	□	No construction camp will be established; therefore, no domestic solid waste will be generated.
• Will construction camp generate hazardous solid	□	√	√	□	□	□	There will be no construction camp, therefore, no hazardous will be created.

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
waste?							
• Will construction camp generate sanitary wastewater?	□	√	√	□	□	□	There will be no construction camp, therefore, no sanitary wastewater will be created.
• Will fire be a potential safety hazard at construction camp?	□	√	√	□	□	□	No construction camp will be established; therefore, no fire risk is anticipated.
• Will construction camp activities cause air pollution?	□	√	√	□	□	□	No construction camp will be established; therefore, no air pollution from camp will be created.
• Will construction camp activities cause noise?	□	√	√	□	□	□	No construction camp will be established; therefore, no noise pollution from camp will be created.
• Will construction activities require tree cutting?	□	√	√	□	□	□	This is only rehabilitation and minor civil works for the improvement of the football ground, so there will be no requirement for tree cutting.
• Will construction activities result in damaging existing local roads, bridges or other infrastructure?	□	√	√	□	□	□	The Sub-project activities do not involve damage to any nearby and existing road, bridge and any other infrastructure.
• Will construction activities involve use of explosives and chemicals?	□	√	√	□	□	□	No explosives will be used during the rehabilitation activities.
• Will construction activities disturb natural habitats?	□	√	√	□	□	□	No natural habitats will be disturbed as the project is for the rehabilitation or construction in closed vicinity at the existing football ground.
• Will construction activities resulting impairment of historical/cultural monuments/areas and loss/damage to these sites?	□	√	√	□	□	□	The sub project site is located in the football ground, where no historical/cultural monument is present. Therefore, it will not cause any harm or damaged to such historical sites.

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
• Will construction activities generate noise?	√	□	□	√	□	□	Yes, noise will be generated from various sources such as construction machinery, generators, construction activities and vehicular movement. Mitigations: The contractors would ensure keeping noise levels from construction vehicles and machinery to be within safe limits. Vehicular traffic and machinery will not be allowed to operate at night time. Noisy machines and vehicles will not be allowed to be used at the sub project site (noise level will not be more than 85 dBA at 7.5 m distance), properly tuned machines and vehicles will be allowed only. Workers will use noise protection equipment when working in a noisy area; Notifying and coordinating with residents adjacent to project area prior to construction to inform them of the possibility of temporary noise disruption, and how to report noise complaints in accordance with the proposed GRM; The contractor will adhere to the requirements of the ESR mitigation plan contained in the contract documents with true spirit.
• Will construction activities generate dust?	√	□	□	√	□	□	There will be construction vehicles and machines which may generate dust emissions. Mitigations: Regular water sprinkling will be the responsibility of the contractor at the dust generation points, during construction activities. Water will be also sprinkled at vehicular and machinery movement routes to avoid dust spreading to the nearby community. In addition, the provision of dust masks and ensuring their use by the workers will also be the responsibility of the contractor. All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
							and be properly tuned and maintained to minimize exhaust emissions. Stockpiled materials will be covered to avoid dust/particulate emission.
• Will construction activities cause air pollution due to stack emissions from generators, construction machines and vehicles?	√	□	□	√	□	□	The civil work activities may cause air or dust impact a low to moderate level during the rehabilitation works, otherwise it will not import any air pollution. Mitigations: The stack emissions from generators, (if used) and vehicular/machinery movement at the site can affect the ambient air quality at sub project site. It will be the responsibility of the contractor to use well maintained generators and vehicles/machines to keep ambient air quality within the desired level. The contractor will be obliged to provide fitness certificate/maintenance records of the generators, vehicles and machines before deploying them at the construction sites.
• Will construction activities generate asphalt emissions?	√		√	□	□	□	Some asphalt activity is involved in this project; however, asphalt mitigation measures will be taken accordingly. **Mitigations:** The workers would use appropriate respiratory protection devices to avoid inhalation of the asphalt fumes. The workers, handling the asphalt, would also use safety gloves, apron and shoes to prevent dermal exposure to the workers. The application temperature of the heated asphalt should be kept as low as possible to avoid generation of fumes. The engineering controls and good work practices would be used at all work sites to minimize worker exposure to asphalt fumes.
• Will construction activities cause soil pollution?	√	□	□	√	□	□	Yes, the project construction/rehabilitation may cause minor soil pollution. **Mitigations:**

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
							-Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 6 inch thick, done on brick edge flooring lined with polyethylene sheet -Placement of fuel containers under containment and proper decantation arrangement to avoid its spillage and leakage on floor - Presence of spill kit to remove spills from the floor - Avoidance of washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags - Location of fuel storage and refilling areas at least 500 m from all cross-drainage structures and important water bodies
• Will construction activities generate construction debris?	√	□	□	√	□	□	Yes, as the sub-project will involve very civil works for the rehabilitation of the existing playground, which may generate a very small quantity of construction debris. Mitigation: The debris (rejected material) produced during construction would be disposed-off in government approved/allocated disposal sites. Leftover material would not be dumped into storm water drains or watercourses, because such practices can clog these man-made and natural drainage systems and cause many other problems for the residents/Local Commuters.
• Will construction activities generate hazardous solid waste?	√	□	□	√	□	□	Yes, during the construction activities different types of hazardous solid waste including empty containers of paint, lubricants, grease, fuel, etc. oil filters, and construction waste will be generated, though in very small quantity. Mitigation: The hazardous waste will be properly collected and temporarily stored at the impervious surface under shade. This waste will be handed over to the authorized waste collectors (SEPA Approved) so that it could be disposed of properly. The construction

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
							contractor will implement the mitigation measures provided in this screening report and elucidated in Table 5-1 above. In addition, following mitigations will be implemented in true spirit: Non-toxic and biodegradable products will be used whenever possible. Hazardous materials will be transported and stored in appropriate containers with clearly visible labels. Hazardous materials will be stored at least 100 feet from any down gradient drainage or within secondary containment capable of containing its entire volume. Equipment and work areas will be regularly inspected for signs of leaks and spills. Spill containment and cleanup kits will be available wherever hazardous materials are being used or stored. Any incidental spills or leaks will be contained and cleaned up as soon as it is safe to do so. Any contaminated soil will be collected and disposed of in an appropriate landfill. Equipment refueling and maintenance will be limited to designated areas at least 30 meters (100 feet) from any down gradient drainage.
• Will construction take place near to water bodies?	□	√	√	□	□	□	No surface water body is present around the proposed sub project site.
• Will construction activities cause contamination of the surface water resources?	□	√	√	□	□	□	It will not cause contamination of the surface water resources as it is the rehabilitation of the football ground.
• Will construction activities take place near wastewater/storm water drains?	√	□	□	√	□	□	Yes, wastewater/drain is present in the surroundings of the site along the boundary wall of Ground. Mitigations: Avoid dumping of construction materials within close proximity of the wastewater drain. Stockpiling will be barricaded to avoid runoff Any hazardous material runoff/leakage will be strictly monitored to avoid contamination of drain water

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
							Washing and change of oil/lubricants of vehicles will be strictly avoided onsite. Avoid siting of facilities near rivers, streams and nullahs (if exists) Proper disposal of solid waste in designated site to sustain the water and land quality for domestic requirements. Solid waste will not be thrown in Nullah or any water body present in the area.
• Will construction activities result in damaging the utilities at site?	□	√	√	□	□	□	The sub-project development will not cause any damage to the utilities at the site or utilities of the area.
• Will construction activities require utilities relocation?	□	√	√	□	□	□	No utilities relocation is required.
• Will construction activities involve excavation?	√	□	□	√	□	□	The excavation will be done for the foundation works, but it will be done carefully to avoid damages. Mitigations Appropriate availability and use of Personal Protective Equipment (PPEs) by the workers will be ensured.
• Will construction involve heavy machinery?	√	□	□	√	□	□	Yes, heavy machinery like excavator, field top maker, compaction wheel, turf roller and trencher will be used for the minor civil works; however, the contractor will ensure that all operators of heavy or dangerous machinery are properly trained/certified, and also insured and HSE procedures are followed.
• Will construction activities increase road traffic at site?	□	√	√	□	□	□	A small number of vehicles ~3-4 are required for construction activities which includes a truck for material supply, a bucket truck for material and a wagon for labor are anticipated, which may cause minimal traffic congestion. Mitigation measures to avoid any traffic disruption are as follows: 1. Only drivers with a valid license and car registration documents will be allowed to drive the vehicles. 2. The drivers will be trained to strictly adhere to local traffic laws.
• Will construction activities cause traffic congestion/diversion?	□	√	√	□	□	□	The work will be carried out within the boundary of the ground, therefore, no traffic congestion/jam will appear at the road.

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
• Will construction activities cause mobility and accessibility issue for the residents?	□	√	√	□	□	□	No such issue of mobility/accessibility will be caused during the sub-project development.
• Will construction activities/machines be the safety hazards for the workers?	□	√	√	□	□	□	The development of the proposed subproject doesn't involve any heavy machine and activities which can pose safety risks for workers. However, required safety gears will be used during the project activity and safety standards will be followed.
• Will construction activities be the safety hazards for the occupational?	√	□	□	□	√	□	Yes, occupational health and safety issues are anticipated from the proposed activities. Mitigations: • The laborers with any transmittable diseases will not be allowed on the construction site; • Ensure and strictly implement the SOPs regarding COVID-19, including daily body temperature check, daily disinfection, quarantine management, area access management, PPEs, emergency response, and drills; • Workers should be provided with good hygienic food; • Only skilled workers will be allowed to work at the construction site; • Assess the hazards associated with the required works and prepare and follow the safety procedures required for the specific works such as electrical works and works at height. • Provision of first aid facilities for workers at site for meeting the emergency needs of workers, and providing basic medical training to specified work staff and basic medical service and supplies to workers; • Observe and maintain standards of Health and Safety towards all employees in line with WB EHS Guidelines along with Sindh Occupational Health and Safety Law • Ensure that hazards associated with manual lifting are

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
							controlled by proper lifting techniques, work rotation system will reduce the chances of being exposed to work- related stress associated with construction activities. • Unauthorized personnel will not be allowed to access the proposed project site without permission and safety permits. • Workers should be facilitated by providing appropriate work specific PPE's;
• Will construction activities cause any damage to flora and Fauna of the area?	□	√	√	□	□	□	No, The proposed activities will not cause any harm to biodiversity of the area, but still strict mitigation measures are proposed to follow: • Avoid unnecessary cutting of plant species during site clearance if needed; • Limiting vehicular transport to defined roads as to prevent unnecessary injury and habitat destruction; • Hunting and trading of any wildlife species will be strictly prohibited.
C. Potential Social Impacts							
1. Will the construction cause any labor issues such as labor living and working conditions?	√	□	□	√	□	□	Labor condition or rights related issues will be complied such as working hours, leaves, benefits, wages, and other related facilities like provision of foods, clean water, transportation etc. However, no labor camps are anticipated as it involves small scale activities which doesn't involve any living conditions. Mitigations: The worker's Grievance redressal mechanism will be developed communicated among workers to lodge complains. Workers should be provided with clean drinking water for free.

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
2. Will construction activities cause community Health and Safety issues? Or any other such impacts	□	√	√	□	□	□	No such impacts are anticipated, though following will be applicable to the project activities. Mitigations: • GRM Mechanism must be communicated to the internal staff and the general public • Close consultation with local communities to identify optimal solutions where needed • Contractor shall give preference to local community members in the Project Area of Influence, to the extent feasible, with respect to the employment of unskilled labor • Community grievances will be recorded and responded to on an urgent basis • No Hazardous and non-hazardous waste will be dumped outside any community
3. Will the construction activities cause the socio-cultural issues and damage to any cultural heritage?	□	√	√	□	□	□	No, the construction activities will not cause such impacts. Mitigations: • Contractor will not cause any damage or harm to any cultural heritage around the project area. • Pollution such as noise and dust generation will be avoided while working close to religious and ancient site. Contractors would be trained to address privacy issues and behave ethically. The contractor's staff must be trained enough to respect the local norms.
C. Potential Environmental Impacts (Operational Phase)							
1. Leakages in the drains	□	√	√	□	□	□	The project is rehabilitation/improvement of the playground and will include some internal drain works. No damage to the drains is involved in the project.
2. Damaging of drains	□	√	√	□	□	□	The project is for the rehabilitation of the playground, therefore, no damage to the drains is involved in the project.

SCREENING QUESTIONS	Yes	No	Impact Severity Ranking				Remarks/Mitigation Measures
			NR	1	2	3	
3. Clogging and overflowing of wastewater from the drains	□	√	√	□	□	□	The project is for the rehabilitation of the playground; therefore, no overflowing of any gutter will be involved.
4. Chances of contamination water supply	□	√	√	□	□	□	The project is for the rehabilitation of the playground, therefore, no contamination of water supply coming in the area of project.
5. Flooding at roads	□	√	√	□	□	□	The project is for the rehabilitation of the football ground; therefore, no flooding will be caused on the roads.
6. Type of lightings in the infrastructure	□	√	√	□	□	□	During the construction or rehabilitation of the scheme all lighting and other electrical services will be replaced or changed within the project boundary.
7. Inadequate protection of intake works or wells, leading to pollution of water supply?	□	√	√	□	□	□	No such activity will be undertaken for sure, to avoid pollution of water supply to the community.

NR: Not Relevant
1. No or Minor Impact
2. Moderate, Short Term, Reversible Impact
3. Severe, Long Term, Irreversible Impact

Category	A	B	C
Environmental Management Required	NO	N/A	√
Type of Environmental Management Tool to be Used	YES Social + Environmental Monitoring checklist		
Prior review and "no-objection" of World Bank required.	YES		

Annex E: Screening Questions for Involuntary Resettlement/Indigenous People

Involuntary Resettlement Impact screening questionnaire.

Probable IR Impacts	Yes	No	Not Known	Remarks
Involuntary Acquisition of Land and Resettlement Impacts				
1. Will there be land acquisition?	□	√	□	No land acquisition will be required, the proposed sub-project land belongs to the DMC Korangi.
2. Is the site for land acquisition and ownership status and current usage of land to be acquired known?	□	√	□	The land acquisition is not acquired. The proposed sub-project land belongs to the DMC Korangi.
3. Will easement be utilized within an existing Right of Way (ROW)?	□	√	□	The Eid Gah/Football ground will be rehabilitated in the existing area.
4. Will there be loss of shelter and residential land due to land acquisition or due to clearance of existing right of way?	□	√	□	No shelter or residential land will be lost.
5. Will there be loss of agricultural and other productive assets due to land acquisition or due to clearance of existing right of way?	□	√	□	No agriculture or other productive assets exists.
6. Will there be losses of crops, trees, and fixed assets due to land acquisition or due to clearance of existing right of way?	□	√	□	No loss of trees, crops, trees and fixed assets are anticipated.
7. Will there be loss of businesses or enterprises due to land acquisition or due to clearance of existing right of way?	□	√	□	No loss of business enterprise is anticipated.
8. Will there be loss of income sources and means of livelihoods due to land acquisition or due to clearance of existing right of way?	□	√	□	No clearance of the existing ROW will be required.
9. Will people lose access to natural resources, communal facilities and services due to involuntary restriction of land use or on access to legally designate parks/protected areas?	□	√	□	The rehabilitation of the existing football ground will be undertaken in the existing facility/open space, therefore, temporary restriction is possible during the execution of the sub-project. The users of the existing football ground will lose access to this recreational facility during the construction

Probable IR Impacts	Yes	No	Not Known	Remarks
				period that will last for approximately six months. The rehabilitation works will not affect the livelihood of any individuals. Mitigation measures to address those individuals that will be affected during the construction period are as follows: • DMC Korangi will implement a Grievance Redress Mechanism to deal with any grievances/complaints related to the loss of the recreational facility. The access to the existing football ground will be lost during the rehabilitation activities period. Current users of the recreational facility will not be able to access this land for a during rehabilitation phase of sub-project. • A Grievance Redress Mechanism (GRM) will be put in place to deal with any complaints/grievances related to the loss of recreational facility. The loss of access to this space will only be temporary and the new facility will have an increased number of positive impacts as compared to the existing facility.
10. Will access to land and resources owned by communally or by the state be restricted?	□	√	□	The access will not be restricted.
Information on PAPs:				
Any estimate of the likely number of persons that will be affected by the Project? [NO] If yes, approximately how many? Not applicable				

Probable IR Impacts	Yes	No	Not Known	Remarks
Are any of them poor, female-heads of households, or vulnerable to poverty risks?			[NO]	

Note: The project team may attach additional information on the project, as necessary.

Annex F: Environmental and Social Monitoring Checklist

S.No	Environmental Aspect	Mitigation Measures Implemented			Reason for non-compliance (If status is " No")	Corrective Measures
		Details	Status (Yes/No)	Means of Monitoring (Documents/Pictorial Proof)		
1.	Site Selection	Selection of site that will not result in loss of trees and soil erosion will be considered for siting and construction activities.				
2.	Loss of Existing Facility	A Grievance Redress Mechanism (GRM) will be put in place to deal with any complaints/grievances related to the loss of recreational facility. The loss of access to this space will only be temporary and the new facility will have an increased number of positive impacts as compared to the existing facility.				
3.	Noise	The contractors would ensure keeping noise levels from construction vehicles and machinery is within safe limits. Vehicular and machinery will not be allowed to operate at night time. Noisy machines and vehicles will not be allowed to be used at the sub-project site (noise level will not be more than 85 dB(A) at 7.5 m distance), properly tuned machines and vehicles will be allowed only.				

		Workers will use noise protection equipment including ear plugs and/or ear muffs Pressure horns will not be allowed to be used by the for the construction vehicles. The contractor will adhere to the requirements of the EMF, SMF, and mitigation plan contained in the contract documents with true spirit. Confining excessively noisy work to normal working hours (8am-5pm) in the day. Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures - Make sure all drivers will comply with the traffic codes concerning maximum speed limit and driving hours. Providing construction workers with suitable hearing protection such as earmuffs and training them in their use. Heavy machinery like percussion hammers and pneumatic drills should be used at a minimum level and should not be used at all during the night.				
4.	Air Emissions	Regular water sprinkling will be the responsibility of the contractor at the dust generation points, during construction activities. Water will be also sprinkled at vehicular and machinery movement routes to avoid dust spreading to the nearby community as required. In addition, the provision of				

		dust masks and ensuring their use by the workers will also be the responsibility of the contractor. All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained to minimize exhaust emissions. Stockpiled materials will be covered to avoid dust/particulate emission. The stack emissions from generators, (if used), minor excavations and vehicular/machinery movement at the site can affect the ambient air quality at sub-project site. It will be the responsibility of the contractor to use well-maintained generators and vehicles/machines to keep ambient air quality within the desired level. The contractor will be obliged to provide fitness certificate/maintenance records of the generators, vehicles and machines before deploying them at the construction sites.				
5.	Solid Waste	The debris (rejected material) produced during construction would be disposed-off in government approved/allocated disposal sites. Leftover material would not be dumped into storm water drains or watercourses, because such practices can clog these man-made and natural drainage systems and cause many other problems for the residents/Local Commuters.				

		Non-toxic and biodegradable product will be used whenever possible. Hazardous materials will be collected and stored in appropriate containers with clearly visible labels. Hazardous materials will be stored at least 100 feet from any down gradient drainage or within secondary containment capable of containing its entire volume (if any generate such as electric batteries). Equipment and work areas will be regularly inspected for signs of leaks and spills. Spill containment and cleanup kits will be available wherever hazardous materials are being used or stored. Any incidental spills or leaks will be contained and cleaned up as soon as it is safe to do so. Any contaminated soil will be collected and disposed of in an appropriate landfill. Equipment refueling and maintenance will be limited to designated areas at least 30 meters (100 feet) from any down gradient drainage. Solid Waste will be safely disposed in demarcated waste disposal sites or dedicated garbage transfer stations (GTS); A contract with SEPA Approved waste contractor should be made in case hazardous waste generates from the site, defining the schedule for				

		hazardous waste management and its disposal. Burning of waste oil should be strictly prohibited.				
6.	Water Pollution	Avoid siting of facilities near rivers, streams and nullahs (if exists) Proper disposal of solid waste in designated site to sustain the water and land quality for domestic requirements. Solid waste will not be thrown in Nullah or any water body present in the area.				
7.	Vehicular Traffic	Only drivers with a valid license and car registration documents will be allowed to drive the vehicles. The drivers will be trained to strictly adhere to local traffic laws. At all times, the contractor will provide safe and convenient passage for vehicles, pedestrians and livestock, and will not cause any hurdle on the road for commuters. Appropriate safety precautions will be taken when transporting large equipment on public roadways. Proper road signage during construction period, followed by provision of adequate and safe pedestrian crossings and walkways.				

		- create a buffer area to separate workers and equipment from oncoming traffic - clearly mark the work zone so that drivers can know where they need to pay an extra attention - prepare traffic control plan to define all the mitigation measures for traffic safety to be implemented.				
8.	Flora and Fauna	• Avoid unnecessary cutting of plant species during site clearance if needed; • Limiting vehicular transport to defined roads as to prevent unnecessary injury and habitat destruction; • Hunting and trading of any wildlife species will be strictly prohibited;				
9.	Occupational Health and Safety	• The labor with any transmittable disease will not be allowed on the Construction site. • Ensure and strictly implement the SOPs regarding COVID-19, including daily body temperature check, daily disinfection, quarantine management, area access management, PPEs, emergency response, and drills; • Work related hazards should be assessed. • The safety procedures to address the identified				

		hazards associated with the specific works such as electrical works and works at height should be prepared and followed. • Workers should be provided with good hygienic food for free; • Only skilled workers will be allowed to work at the construction site; • Provision of first aid facilities for workers at site for meeting the emergency needs of workers, and providing basic medical training to specified work staff and basic medical service and supplies to workers; • Observe and maintain standards of Health and Safety towards all employees in line with WB EHS Guidelines along with Sindh Occupational Health and Safety Law • Ensure that hazards associated with manual lifting are controlled by proper lifting techniques, work rotation system will reduce the chances of being exposed				

		to work- related stress associated with construction activities. • Unauthorized personnel will not be allowed to access the proposed project site without permission and safety permits. • Workers should be facilitated by providing appropriate work specific PPE's; • Training and use of personal fall arrest systems, such as full-body harnesses and energy-absorbing lanyards as well as fall rescue procedures to deal with workers whose fall has been successfully arrested;				
10.	Labor Living and Working Conditions	• The worker's Grievance redressal mechanism must be developed communicated among workers to lodge complains; • Workers should be provided with clean drinking water for free; • Avoiding Gender Based Violence. Contractor will prepare and implement robust measures to address the risk of gender-based				

		violence that include (i) mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women; (ii) informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; (iii) introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for noncompliance (e.g., termination), and (iv) contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender based violence. • Use of child and forced labor will be strictly prohibited.				
11.	Community Health and Safety	• Maintain a complaint register on site and it must be communicated to the internal staff and the public • Close consultation with local communities to identify				

		optimal solutions where needed. • Contractor shall give preference to local community members in the Project Area of Influence, to the extent feasible, with respect to the employment of unskilled labor • Community grievances will be recorded and responded to on an urgent • No Hazardous and non-hazardous waste will be dumped outside any community.				
12.	Socio-Culture and Cultural Heritage	• Contractor will not cause any damage or harm to cultural heritage around the project area. • Pollution such as noise and dust generation will be avoided while working in close to religious and ancient site. Contractors would be trained to address privacy issues behave ethically. The contractors staff must be trained enough to –respect local norms.				
13.	Site Restoration	• Contractor should obtain approval for excavation and				

		submit the plan of rehabilitating the site after excavation. • Site restoration must be completed immediately after completion the sub-project.				
Operational and Maintenance Phase						
14.	Maintenance	• Regularly removal of dirt and substances. • Regularly cleaning of office building's floor for its shine maintenance. • Periodic maintenance of office building's facilities. • All other necessary items should have wheels to avoid the scratching of surfaces. • Regularly check the condition of lights, wires, poles, utilities, and ground facilities regularly. • Regularly check the conditions of associated facilities such as changing rooms and washrooms. • Regularly maintenance and landscaping of ground with grass. • Periodic rehabilitation of seating area of ground whenever required. • Regularly check the location's plumbing facilities and				

		structural integrity of utilities regularly. • Repairing of the damaged ground lights, wires, and other utilities will be done immediately.				

Contractor Details	**LC Focal Person Details**
Name: ----------	Name: ----------
Designation: ----------	Designation: ----------
Signature:	Signature:
Date:	Date:
Checklist filled by:	**Checklist reviewed by:**
Name: ----------	Name: ----------
Designation: ----------	Designation: ----------
Signature:	Signature:
Date:	Date:

Annex G: Screening Team Details

Focal Person of DMC Korangi	**Mr. Abdul Rehman Bugti** 0300-3253331

Annex H: COVID-19 Standards Operating Procedures (SOPs) for Construction in English and Urdu Languages for the Contractor

COVID-19 Pandemic and Health and Safety Measures

Given the unprecedented nature of the COVID-19 pandemic, contractors are bound to take all necessary precautions to maintain the health and safety related measures at site and to ensure suitable arrangements regarding hygiene requirements for the prevention of COVID-19 pandemic.

Scope:
These SOPs are intended to provide consistent measures on construction activities of all types and sizes in line with the ESR recommendations on social distancing and to ensure contractors, sub-contractors, and other individuals associated with the CLICK Project make every effort to comply.

Objectives:

Prioritize the health and safety of workers and of their surrounding individuals and communities;

- Apply recommendations and best practices from health authorities to construction site procedures;
- Implement COVID-19 Standard operating procedures in in true spirit across the construction activities or sites; and
- Foster open communication amongst stakeholders and ensure a respectful work environment.

Following are the measures that should be implemented at the construction site to avoid the spread of Covid-19:

Activities	Adaptive Measures
Pre- Execution Phase	
A. Profile preparation	• Detail profile of the workforce will be developed • Enlist the names, addresses and contact number • Breakdown of the workforce (workers from local community and those who will do house renting). Workers will be instructed to minimize contact with people near the site, and in certain cases be prohibited from leaving the site for the duration of their contract.
B. Initial Screening	• All enlisted workforce should go through initial screening (checking temperature using thermo gun) to confirm their fitness. • Ensuring the availability of Thermo-gun/s at site. • Checking temperature of all workers and maintaining record. If a worker shows symptoms of COVID-19 (e.g., fever, dry cough, fatigue), it is Site Supervisor's responsibility to immediately remove worker from the site and refer him to the nearest health facility. It's also his responsibility to prevent a worker who has been in contact with infected co-worker from returning to the site for 14 days.

During Execution Phase	
A. Restricted Movement/ Demobilization of staff	• Entry/exit to the work site should be controlled and documented for workers and other people. Possible measures should include: • Ensure that the social distancing is observed on site • All workers who reside in site labor camps (if any) should be provided separate accommodation keeping in view social distancing protocol. • Implementation of emergency preparedness and response plan covering the detail of a treatment facilities, procedure to inform health authorities, how to sanitize site, how to screen remaining workers, etc.
B. Special Arrangements regarding PPEs	• Ensure availability of PPEs at site including disposable masks, gloves etc. • Record keeping of PPE stock availability. If PPE items are unavailable due to world-wide shortages, alternatives such as dust masks, construction gloves and eye goggles should be arranged. While these items are not recommended, they should be used as a last resort if no medical PPE is available.
C. General Hygiene	• Encourage employees to wash their hands at least for 20 seconds with soap provided at key places throughout site. Where hand washing facilities do not exist or are not adequate, hand sanitizers should be placed. • Maintain a distance of at least one meter.
D. Training sessions	• Contractors E&S Team will arrange awareness sessions for Contractors and their labor force. • Sessions related to safety procedures, use of construction PPEs, occupational health and safety issues, and code of conduct specially privacy issues including social distancing • Post appropriate signage and pictorial displays at site about COVID-19 Health &Safety measures. • Site supervisor will arrange briefings from time to time with workforce, and encourage them to report to their supervisor or the COVID-19 focal person if they have symptoms. (TORs are attached at Annex H-II). • Training staff who will be monitoring entry to the site, providing them with the resources they need to document entry of workers, conducting temperature checks and recording details of any worker that is denied entry.
E. Operationalization of Grievance Redress Mechanism	• Contractor should ensure implementation of GRM developed by PIU for addressing specific COVID related grievances, which would allow community & workers to quickly report issues, such as a lack of PPE, lack of proper procedures, and allow the project to respond and take necessary action.
F. Role of PIU	• PIU is responsible for sharing the COVID-19 checklist with the contractors in the subproject procurement documents. • Arrange meetings with contractors for support and guidance where needed.

G. Role of supervision consultant	• The consultant must ensure the implementation of Environmental and Social Management Plans as per the ESRs along with afore mentioned COVID related activities / protocols. • Ensure that the necessary PPEs (as per contract) have been issued to the staff by the respective contractor.
Post Execution Phase	
A. Post Screening	• If a worker shows any symptoms of COVOD-19, he should be immediately reported to the concerned health department.
B. Cleaning and waste disposal	• All waste (PPEs and sanitation related) shall be disposed of properly following Sindh Hospital Waste Management Rules, 2014. • Providing cleaning staff with adequate protective gear, cleaning equipment, and disinfectants. • Where it is anticipated that cleaners will be required to clean areas that have been or are suspected to have been contaminated with COVID-19, providing them with appropriate PPEs. If appropriate PPE is not available, cleaners should be provided with best available alternatives.

Annex H-II

TORS for COVID-19 Focal Person from LCs

Responsibilities to include:

- Monitoring, supervising, and reporting on COVID-19 related issues
- Coordination and reporting arrangements with the contractors
- Raising awareness and training of workers in mitigating the spread of COVID-19
- Prepare a plan to handle COVID-19 cases in the light of WHO guidelines
- Implementing a communication strategy with the community, community leaders and local government.

کوویڈ۔۱۹ وبائی امراض اور صحت سے متعلق حفاظتی اقدامات

کورونا وائرس (COVID-19) وبائی مرض کے دوران کام کرنے والے تعمیراتی مقامات کو اس بات کا یقین کرنے کی ضرورت ہے کہ وہ انفیکشن کے خطرے اور پھیلاؤ کو کم سے کم کرنے کے اقدامات پر عمل کر کے اپنی افرادی قوت کی حفاظت کر رہے ہیں۔ تعمیراتی معیاری پروٹوکولز، تعمیراتی ٹھیکیداروں، سب ٹھیکیداروں اور دیگر کے لئے بہترین طریقوں کا خاکہ پیش کرتا ہے تاکہ COVID-19 بحران کے دوران فرائض انجام دینے کے لئے درکار تمام کارکنوں کی صحت اور حفاظت کو برقرار رکھا جاسکے۔ پروٹوکول، جس میں روک تھام، پتہ لگانے اور ردعمل کے اقدامات شامل ہیں، بحران کے اثرات کو کم سے کم کریں گے اور کلک کے تحت ذیلی منصوبوں پر آسانی سے عملدرآمد کو یقینی بنائیں گے۔

کوویڈ۔۱۹ وبائی بیماری کی غیر معمولی نوعیت کے پیش نظر، ٹھیکیدار سائٹ پر صحت اور حفاظت سے متعلق اقدامات کو برقرار رکھنے کے اور کوویڈ۔۱۹ وبائی بیماری کی روک تھام کے لیے حفاظات صحت کی ضروریات کے بارے میں مناسب انتظامیات کو یقینی بنانے کے لیے تمام ضروری احتیاتی تدابیر اپنانے کے پابند ہیں۔ کوویڈ۔۱۹ کے پھیلاؤ کے لیے تعمیراتی مقامات پر عمل درامد کرنا چاہیے۔

دائرہ کار:

ان رہنما خطوط کا مقصد معاشرتی دوری سے متعلق ESR / ESMP کی سفارشات کے مطابق تمام اقسام اور سائز کی تعمیراتی سرگرمیوں پر یکساں اقدامات کی فراہمی اور کلک پروجیکٹ سے وابستہ ٹھیکیداروں، ذیلی ٹھیکیداروں، اور دیگر افراد کی تعمیل کے لئے ہر ممکن کوشش کو یقینی بنانا ہے۔

کوویڈ۔۱۹ وبائی امراض اور صحت سے متعلق حفاظتی اقدامات

سرگرمیاں	احتیاطی تدابیر
	عمل درامد سے پہلے
پروفائل کی تیاری	ا۔ افرادی قوت کا تفصیلی پروفائل ۲۔ نام، پتے اور رابطہ نمبر کی فہرست تیار کرنا ۳۔ تمام افرادی قوت کی فہرست تیار کرنا بشمول مقامی آبادی سے تعلق رکھنے والے افراد اور وہ لوگ جو مکان کرایہ پر لیں گے کو ہدایت کی جائے کے وہ سائٹ کے قریب موجود لوگوں سے رابطہ کم سے کم رکھیں اور مخصوص حالات میں اپنے معاہدے کی مدت کے دوران سائٹ چھوڑنے سے بھی منع کیا جائے تاکہ مقامی آبادیوں سے رابطہ کم سے کم ہو۔
ابتدائی اوکریننگ	ا۔ تمام اندراج شدہ افرادی قوت کو ابتدائی کووڈ۔۱۹۔ اسکریننگ کے عمل سے گزارا جائے تاکہ ان کی اچھی صحت کی تصدیق ہو سکے۔ ۲۔ سائٹ پر تھرموگن کی دستیابی کو یقینی بنایا جائے۔ ۳۔ ملازمین کے درجہ حرارت کا ریکارڈ رکھا جائے ۴۔ اگر کسی ملازمین میں کووڈ۔۱۹ (جیسی بخار، خشک کھانسی، تھکاوٹ) کی علامات ظاہر ہوں تو سائٹ پر موجود نگران کی زمہ داری ہے کی وہ متعلقہ ملازمین کو فوری طور پر کام سے روک دے اور اسے قریبی مرکزی صحت بھجوائے۔ متاثرہ کارکن کے ساتھ رابطے میں رہنے والے کارکن کو ۱۴ دن تک سائٹ پر کام کرنے سے روکا جائے
	عمل درامد کے دوران
محدود نقل و حرکت	ا۔ کام کی جگہ پر داخلی خارجی راستوں پر کارکون اور دیگر افراد کی آمد و فروخت کو محدود اور ریکارڈ میں رکھا جائے۔ ممکنہ اقدامات میں یہ شامل ہونا چاہیے۔ ۲۔ سائٹ پر کام کرتے، آرام کرتے یا کھانا کھاتے ہوئے سماجی فاصلہ برقرار رکھیں۔ ۳۔ ہنگامی حالات سے نمٹنے کے لیے منصوبہ بندی کی جائے جس میں علاج کی سہولیات کی تفصیل، صحت سے متعلق حکام کو مطلع کرنے کا طریقہ کار، سائٹ کو صاف ستھرا رکھنے اور بقیہ ملازمین کی

ے کووڈ۔۱۹ وبائی امراض اور صحت سے متعلق حفاظتی اقدامات

	اسکریننگ شامل ہیں۔ ۴۔ ایسے کارکن جو سائٹ لیبر کیمپ یوٹر میں رہتے ہیں ان کے لیے (اگر کوئی ہے تو) سماجی فاصلہ کے پروٹوکول کو مد نظر رکھتے ہوئے ان کے لیے الگ رہائش کا بندوبست کیا جائے۔
ذاتی سوز و سامان کی حفاظتی اقدامات	۱۔ سائٹ پر ذاتی حفاظتی ساز و سامان بشمول ڈسپوزیبل ماسک اور دستانوں کی دستیابی کو یقینی بنایا جائے۔ ۲۔ سائٹ پر موجود حفاظتی ساز و سامان کا ریکارڈ رکھا جائے۔ ۳۔ اگر عالمی سطح پر ذاتی سامان کی قلت ہو جائے تو متبادل کے طور پر ڈسٹ ماسک، کنسٹرکشن والے دستانے اور حفاظتی عینک کی فراہمی کو یقینی بنایا جائے۔
عام حفاظات صحت	۱۔ ملازمین کی حوصلہ افزائی کی جایے تاکہ وہ سائٹ پر کم سے کم ۲۰ سیکنڈ تک ہاتھ دھوتے رہیں۔ سائٹ کے اہم مقامات پر صابن فراہم کیا جائے۔ جہاں صابن رکھنے کی جگہ نہیں یہ مناسب نہیں وہاں سینیٹائزر رکھے جائیں۔ ۲۔ کم سے کم ایک میٹر کی دوری برقرار رکھیں۔
ٹریننگ سیشن	۱۔ ٹھیکیدار کے ماحولیاتی و سماجی ماہرین ٹھیکیدار کے دیگر عملے کے لیے آگاہی سیشن کا اہتمام کرے گی۔ اس سیشن میں حفاظتی اقدامات ذاتی حفاظت کے ساز و سامان کا صحیح استعمال، کام کے دوران صحت کے مسائل اور ضابطہ اخلاق بالخصوص پراٹوبی اور سماجی فاصلے پر ٹریننگ دی جائے گی۔ ۲۔ کووڈ۔۱۹۔ ایس او پیز کو سائٹ پر واضح طور پر آوازیں کیا جائے۔ ۳۔ سائٹ سپروائزر افرادی قوت کے ساتھ وقتن بہ وقتن بریفینگ کا بندوبست کیا جائے۔ اور ملازمین کو اس کی ترغیب کی جائے۔ ۴۔ سائٹ کے داخلے راستے پر تعینات ورکرز کو ٹریننگ اور مسائل فراہم کیے جائیں تاکہ وہ ورکرز کا درجہ حرارت چیک کر سکیں اور رکارڈ رکھ سکیں۔
عوامی شکایات کے ازالے کا نظام	ٹھیکیدار پی ایم یو کے بنائے گئے شکایات کے ازالے کے نظام کو سائٹ پر موثر بنائے تاکہ کووڈ۔۱۹۔ کے ایس او پیز سے متعلقہ شکایات کا ازالہ ہو سکے۔
پی ایم یو کا کردار	۱۔ پی ایم یو ٹھیکیدارون کو کووڈ۔۱۹۔ چیک لسٹ فراہم کرے گا۔ رہنمائی اور مدد کے لیے ٹھیکیدار پی ایم یو کے ساتھ رابطے میں رہیں۔

۔ کووڈ۔۱۹ وبائی امراض اور صحت سے متعلق حفاظتی اقدامات

سپروژن کنسلٹنٹ کا کردار	۱۔ کووڈ۔۱۹۔ سے متعلق سرگرمیوں پر ٹوکول کے ساتھ ماحولیاتی اور حفاظتی منصوبے (ای ایس پی) کے نفاذ کو یقینی بنایا جائے۔ ۲۔ اس بات کو یقینی بنایا جائے کہ ٹھیکیدار کنٹریکٹ کے مطابق ورکرز کو ضروری حفاظتی ساماں مہیا کرے۔
عملدرآمد کے بعد	
اسکریننگ کے بعد	اگر کسی ملازمین میں کووڈ۔۱۹۔ کی علامات پائی جاتی ہے تو فوراً متعلقہ محکمہ صحت کو اطلاع دی جائے۔
صفائی اور کوڑا کرکٹ کو تلف کرنا	۱۔ استعمال شدہ حفاظتی ساماں اور دیگر فضلہ ہاسٹل ویسٹ مینجمنٹ رولز ۲۰۱۴ کے مطابق تلف کیا جائے۔ ۲۔ صفائی ستھرائی کے سازوساماں اور جراثیم کش ادویات فراہمی کو یقینی بنایا جائے۔ ۳۔ وہ عملہ جو کووڈ۔۱۹۔ سے متاثرہ جگہ یا ایسی جگہ جہاں بیماری کے پھیلنے کا خدشہ ہو انہیں مناسب سازوسامان مہیا کیا جائے۔ اگر کسی وجہ سے مناسب حفاظتی سامان دستیاب نہ ہو سکے تو اس کا بہترین متبادل مہیا کیا جائے۔

کووڈ۔۱۹۔ فوکل پرسن کی ذمہ داریاں

۱۔ کووڈ۔۱۹۔ سے متعلقہ مسائل کی مانیٹرنگ اور پورٹنگ کو یقینی بنایا جائے۔
۲۔ ٹھیکیداروں کے مابین رابطہ اور پورٹنگ کے انتظامات۔
۳۔ کووڈ۔۱۹۔ کے پھیلاو کو کم کرنے کے لیے ملازمین کی آگاہی اور تربیت کرنا۔
۴۔ ملازمین کے بیمار ہونے کی صورت (ڈبلیو۔ایچ۔او) کے رہنما اصولوں پر عمل کیا جائے۔
۵۔ سائٹ پر کووڈ۔۱۹۔ کے سلسلے میں مقامی آبادی، مقامی رہنمائوں اور لوکل گورنمنٹ کے ساتھ رابطہ کے لیے حکمت عمل مرتب کی جائے۔

۔ کووڈ۔۱۹ وبائی امراض اور صحت سے متعلق حفاظتی اقدامات

Annex I: Chance Find Procedure

Purpose of the chance finds procedure

The chance find procedure is a project-specific procedure that outlines actions required if previously unknown heritage resources, particularly archaeological resources, are encountered during project construction or operation. A Chance Find Procedure, as described in Guidance Note of World Bank and law on Cultural Antiquities of Sindh, is a process that prevents chance finds from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements are implemented.

Scope of the chance find procedure

This procedure is applicable to all activities conducted by the personnel, including contractors that have the potential to uncover a heritage item/site. The procedure details the actions to be taken when a previously unidentified and potential heritage item/site is found during construction activities. Procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority.

Induction/Training

All personnel, especially those working on earth movements and excavations, are to be inducted on the identification of potential heritage items/sites and the relevant actions for them with regards to this procedure during the Project induction and regular toolbox talks.

Chance find procedure

If any person discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:

1. Stop all works in the vicinity of the find, until a solution is found for the preservation of these artefacts, or advice from the relevant authorities is obtained;
2. Immediately notify a construction site in-charge. The in-charge will then notify the PIU-CLICK and the Supervision Consultant;
3. Record details in Incident Report and take photos of the find;
4. Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;
5. Preliminary evaluation of the findings by archaeologists. The archaeologist must make a rapid assessment of the site or find to determine its importance. Based on this assessment the appropriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;
6. Sites of minor significance (such as isolated or unclear features, and isolated finds) should be recorded immediately by the archaeologist, thus causing a minimum disruption to the work schedule of the Contractor. The results of all archaeological work must be reported to the Ministry/Agency, once completed.
7. In case of significant find the Agency/Ministry (Sindh Archaeology Department, hereinafter referred to as Heritage team) should be informed immediately and in writing within 7 days from the find).
8. The onsite archaeologist provides the Heritage team with photos, other information as relevant for identification and assessment of the significance of heritage items.
9. The Ministry must investigate the fact within 2 weeks from the date of notification and provide response in writing.
10. Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
11. Construction works could resume only after permission is granted from the responsible

authorities.

12. In case no response received within the 2 weeks period mentioned above, this is considered as authorization to proceed with suspended construction works.

One of the main requirements of the procedure is record keeping. All finds must be registered. Photo log, copies of communication with decision making authorities, conclusions and recommendations/guidance, implementation reports kept.

Additional information

Management options for archaeological site

- ***Site avoidance.*** If the boundaries of the site have been delineated attempt must be made to redesign the proposed development to avoid the site. (The fastest and most cost-effective management option)
- ***Mitigation.*** If it is not feasible to avoid the site through redesign, it will be necessary to sample it using data collection program prior to its loss. This could include surface collection and/or excavation. (The most expensive and time-consuming management option.)
- ***Site Protection.*** It may be possible to protect the site through the installation of barriers during the time of the development and/or possibly for a longer term. This could include the erection of high visibility fencing around the site or covering the site area with a geotextile and then capping it with fill. The exact prescription would be site-specific.

Management of replicable and non-replicable heritage

Different approaches for the finds apply to replicable and non-replicable heritage.

Replicable heritage

Where tangible cultural heritage that is replicable and not critical is encountered, mitigation measures will be applied. The mitigation hierarchy is as follows:

- Avoidance;
- Minimization of adverse impacts and implementation of restoration measures, in situ;
- Restoration of the functionality of the cultural heritage, in a different location;
- Permanent removal of historical and archaeological artefacts and structures ;
- Compensation of loss - where minimization of adverse impacts and restoration not feasible.

Non-replicable heritage

Most cultural heritage is best protected by in situ preservation, since removal is likely to result in irreparable damage or even destruction of the cultural heritage.

Nonreplicable cultural heritage must not be removed unless all of the following conditions are met:

- There are no technically or financially feasible alternatives to removal;
- The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and
- Any removal of cultural heritage must be conducted using the best available technique advised by relevant authority and supervised by archaeologist.

Human Remains Management Options

The handling of human remains believed to be archaeological in nature requires communication according to the same procedure described above. There are two possible courses of action:

- ***Avoid.*** The development project is redesigned to completely avoid the found remains. An assessment should be made as to whether the remains may be affected by residual or accumulative impacts associated with the development, and properly addressed by a comprehensive management plan.
- ***Exhumate.*** Exhumation of the remains in a manner considered appropriate by decision makers. This will involve the predetermination of a site suitable for the reburial of the remains. Certain ceremonies or procedures may need to be followed before development activities can recommence in the area of the discovery.

EMERGENCY CONTACTS

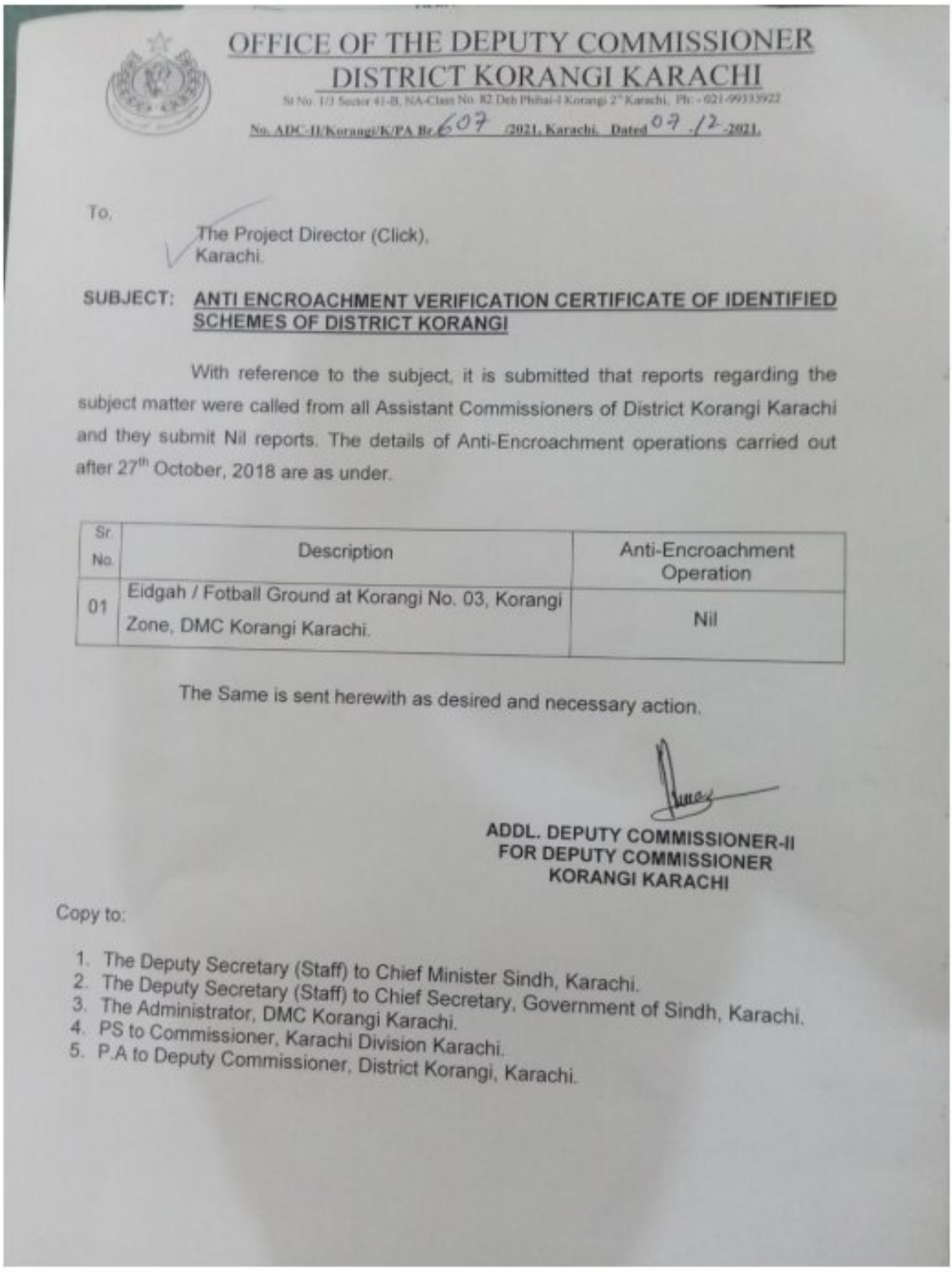
CLICK, Local Government Department, GoS

Address: 1st Floor, DMC South Office,
KRC Captain Road, Haqqani Chowk, Aaram Bagh
Karachi,
Landline# +92- 21- 99218874

Sindh Environmental Protection Agency
Address: Head Office, Plot No. ST-2/1, Sector-23,
Korangi Industrial Area, Karachi
Tel# 021-35065950 Fax: 021-35065940

Directorate General Antiquities & Archaeology
Address: C-82, Block 2 Clifton, Karachi
Tel: Phone: 021-99212126

Annex J: Anti-Encroachment Drive (AED) Certificate



OFFICE OF THE DEPUTY COMMISSIONER
DISTRICT KORANGI KARACHI
Sl No. 1/3 Sector 41-B, NA-Class No. 82 Deh Phitai-I Korangi 2 Karachi, Ph: - 021-99333922

No. ADC-II/Korangi/K/PA Br 607 /2021, Karachi. Dated 07 -12-2021.

To,

The Project Director (Click),
Karachi.

SUBJECT: **ANTI ENCROACHMENT VERIFICATION CERTIFICATE OF IDENTIFIED SCHEMES OF DISTRICT KORANGI**

With reference to the subject, it is submitted that reports regarding the subject matter were called from all Assistant Commissioners of District Korangi Karachi and they submit Nil reports. The details of Anti-Encroachment operations carried out after 27th October, 2018 are as under.

Sr. No.	Description	Anti-Encroachment Operation
01	Eidgah / Fotball Ground at Korangi No. 03, Korangi Zone, DMC Korangi Karachi.	Nil

The Same is sent herewith as desired and necessary action.

ADDL. DEPUTY COMMISSIONER-II
FOR DEPUTY COMMISSIONER
KORANGI KARACHI

Copy to:

1. The Deputy Secretary (Staff) to Chief Minister Sindh, Karachi.
2. The Deputy Secretary (Staff) to Chief Secretary, Government of Sindh, Karachi.
3. The Administrator, DMC Korangi Karachi.
4. PS to Commissioner, Karachi Division Karachi.
5. P.A to Deputy Commissioner, District Korangi, Karachi.