



**Project Office
Khairpur Special Economic Zone (KSEZ)
District Khairpur
Government of Sindh**

Infrastructure Development Works at Khairpur Special Economic Zone (KSEZ)



BIDDING DOCUMENTS

**Construction of
Brick Masonry Retaining Wall along
MC-02, MC-03 Periphery and Exit Gate along
with Gate Office**

- Conditions of Contract**
- Technical Specifications**
- Bill of Quantities**
- Drawings**



EA Consulting Pvt Ltd

(Formerly Engineering Associates)

Engineering, Architecture & Project Management

**Head Office: AL-9, 15th Lane, Khayaban-e-Hilal,
Phase VII, D.H.A., Karachi-75500.,**

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

June 2016

CONDITION OF CONTRACT

**Project Office
Khairpur Special Economic Zone (KSEZ)
District Khairpur, Government of Sindh**

**Infrastructure Development Works
At
Khairpur Special Economic Zone (KSEZ)**

**Construction of Brick Masonry Retaining Wall
along MC-02, MC-03 Periphery and Exit Gate
along with Gate Office
At KSEZ**

VOLUME-I



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BIDDING DOCUMENTS

1. CONDITIONS OF CONTRACT	(Volume - I)
(I) INVITATION FOR BIDS	03
(II) INSTRUCTIONS TO BIDDERS & BIDDING DATA	05
(III) FORM OF BID & SCHEDULES TO BID	24
(IV) CONDITIONS OF CONTRACT & CONTRACT DATA	38
(V) STANDARD FORMS	59
2. SPECIFICATIONS	(Volume - II)
3. APPENDIX D - BILL OF QUANTITIES	(Volume III)
4. DRAWINGS	(Volume IV)

Notice Inviting Tender

“Construction of Brick Masonry Retaining Wall along MC-02, MC-03 Periphery and Exit Gate along with Gate Office”

Project Office Khairpur Special Economic Zone (KSEZ), District Khairpur, Government of Sindh (the “Employer”) invites, sealed Bids on item rate basis from interested contractors/firms for their Project “Construction of Brick Masonry Retaining Wall along MC-02, MC-03 Periphery and Exit Gate along with Gate Office” complete as specified in the bid documents.

S. No	Name of Work	Bid Security	Tender Fee	Time for Completion
1	Construction of Brick Masonry Retaining Wall along MC-02, MC-03 Periphery and Exit Gate along with Gate Office	2 % of Tender Cost/	Pak Rs. 3000/-	6 Months

1. **Eligibility:** The interested bidders must have the following qualifications (documentary evidences to be submitted with the application for issuance of Bid documents):
 - a. Valid Pakistan Engineering Council (PEC) registration in Category C5 & above.
 - b. Valid NTN Certificate from Income Tax Authorities.
 - c. Valid Sales Tax registration certificate.
 - d. Valid Professional Tax Certificate.
 - e. Should be in construction business for last 5 years or more.
 - f. Should not be Blacklisted or engaged in any Litigation on any project.
 - g. Should have completed two contracts of similar nature and value of Pak Rs.30 million each in last 5 years.
 - h. Annual Construction Turnover for last three year of Pak Rs. 7.5 millions.
2. **Method of Procurement.** *Single Stage – Single Envelope*
3. **Bidding/Tender Documents:**
 - (i) **Issuance:** Documents will be issued from date of publication on payment of tender fee (*Non-refundable*) from NIP head office.
 - (ii) **Submission:** Last date will be _____(As per NIT).
 - (iii) **Opening:** will be opened on _____(As per NIT).

4. Terms & Conditions.

- (a) Under following conditions bid will be rejected:-
- (i) Bid not meeting eligibility criteria as stated above
 - (ii) Conditional and telegraphic bids/tenders;
 - (iii) Bids not accompanied by bid security of required amount and form;
 - (iv) Bids received after specified date and time.
 - (v) Black listed firms.
 - (vi) Bid not meeting minimum post qualification requirements as stated in the Bidding Document.
- (b) **Bid validity Period:** - (90) days
- (c) Procuring Agency reserves the right to reject all or any bids subject to the relevant provisions of Sindh Public Procurement Rules 2010.
- (d) **Responsive Bidder is required to submit following documents with bid: (Minimum requirement is stated in the Bidding Document)**
- (i) List of Similar nature works completed projects and in hand with cost under-taken in the past (05) years;
 - (ii) *Details of equipments, machineries and transport deployed at site by firm/contractor;*
 - (iii) List of technical and administrative staff on their permanent strength with CV mentioning qualification, general and relevant experience with mention of staff proposed for the Project
 - (iii) Financial Statement (summary) and income tax return for the last three- years;
 - (iv) Affidavit that firm has never been black listed;

The Bidding and Contract Documents with Drawings will be collected and returned as per said dates to the following address:

Chief Executive Officer, NIP

National Industrial Parks Development and Management Company, 2nd Floor, Block C, FTC Building, Shah rah-e-Faisal Karachi-74400, Pakistan,

Tel: 99205035-9

**INSTRUCTIONS
TO BIDDERS
&
BIDDING DATA**

TABLE OF CONTENTS

INSTRUCTIONS TO BIDDERS

Clause No.	Description	Page No.
A. GENERAL		
IB.1	Scope of Bid & Source of Funds	7
IB.2	Eligible Bidders.....	7
IB.3	Cost of Bidding.....	8
B. BIDDING DOCUMENTS		
IB.4	Contents of Bidding Documents	9
IB.5	Clarification of Bidding Documents.....	9
IB.6	Amendment of Bidding Documents.....	10
C-PREPARATION OF BID		
IB.7	Language of Bid.....	11
IB.8	Documents Comprising the Bid	11
IB.9	Sufficiency of Bid	11
IB.10	Bid Prices, Currency of Bid & Payment	11
IB.11	Documents Establishing Bidder's	12
	Eligibility and Qualifications	
IB.12	Documents Establishing Works	12
	Conformity to Bidding Documents	
IB.13	Bidding Security.....	12
IB.14	Validity of Bids, Format, Signing and.....	13
	Submission of Bid	
D-SUBMISSION OF BID		
IB.15	Deadline for Submission, Modification	14
	& Withdrawal of Bids	
E. BID OPENING AND EVALUATION		
IB.16	Bid Opening, Clarification and Evaluation	15
IB.17	Process to be Confidential	17
F. AWARD OF CONTRACT		
IB.18	Qualification	19
IB.19	Award Criteria & Procuring Agency's Right	19
IB.20	Notification of Award & Signing of	19
	Contract Agreement	
IB.21	Performance Security.....	20
IB.22	Integrity Pact.....	20

INSTRUCTIONS TO BIDDERS

A. GENERAL

IB.1 Scope of Bid & Source of Funds

1.1 Scope of Bid

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

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

1.2 Source of Funds

The Procuring Agency has arranged funds from its own sources or Federal/ Provincial /Donor agency or any other source, which may be indicated accordingly in bidding data towards the cost of the project/scheme.

IB.2 Eligible Bidders

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

- (i) Valid Pakistan Engineering Council (PEC) registration in Category C5 & above, and in discipline CE09 & CE10.
- (ii) Valid NTN Certificate from Income Tax Authorities.
- (iii) Valid Sales Tax Registration Certificate.
- (iv) Valid Professional Tax Certificate.
- (v) List of similar assignments completed projects and in hand with cost under-taken in the past five (05) years;
- (ii) *Details of equipments, machineries and transport Deployed at site by firm/contractor;*
- (iii) List of technical and administrative staff on their permanent strength with CV mentioning qualification, general and relevant experience with mention of staff proposed for the Project
- (iii) Financial Statement (summary) and income tax return for the last three- years;
- (v) Affidavit that firm has never been black listed;

IB.3 Cost of Bidding

- 3.1 The bidder shall bear all costs associated with the preparation and submission of its bid 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 (SPP Rules 24 & 25).

B. BIDDING DOCUMENTS

IB.4 Contents of Bidding Documents

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

- 1 Instructions to Bidders & Bidding Data
2. Form of Bid, Qualification Information & Schedules to Bid.

Schedules to Bid comprise the following:

- (i) Schedule A: Schedule of Prices/ Bill of Quantities (BOQ).
- (ii) Schedule B: Specific Works Data
- (iii) Schedule C: Works to be performed by Subcontractors
- (iv) Schedule D: Proposed Programme of Works
- (v) Schedule E: Method of Performing Works
- (vi) Schedule F: Integrity Pact (works costing Rs 10 million and above)

- 3 Conditions of Contract & Contract Data

4. Standard Forms:

- (i) Form of Bid Security,
- (ii) Form of Performance Security;
- (iii) Form of Contract Agreement;
- (iv) Form of Bank Guarantee for Advance Payment.

- 5 Specifications

- 6 Drawings, if any

IB.5 Clarification of Bidding Documents

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

5.2 An interested bidder, who has obtained bidding documents, may request for clarification of contents of bidding documents in writing and procuring agency shall respond to such queries in writing within three calendar days, provided they are received at least five calendar days prior to the date of opening of bid (SPP Rule 23-1).

IB.6 Amendment of Bidding Documents (SPP Rules 22(2) & 22).

- 6.1 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.
- 6.2 Any addendum thus issued shall be part of the Bidding Documents pursuant to Sub-Clause 6.1 hereof, and shall be communicated in writing to all purchasers of the Bidding Documents. Prospective bidders shall acknowledge receipt of each addendum in writing to the Procuring Agency.
- 6.3 To afford interested bidders reasonable time in which to take an addendum into account in preparing their Bids, the Procuring Agency may at its discretion extend the deadline for submission of Bids.

C. PREPARATION OF BIDS

IB.7 Language of Bid

- 7.1 All documents relating to the Bid shall be in the language specified in the Contract Data.

IB.8 Documents Comprising the Bid

- 8.1 The Bid submitted by the bidder shall comprise the following:
- (a) Offer /Covering Letter
 - (b) Form of Bid duly filled, signed and sealed, in accordance with IB.14.3.
 - (c) Schedules (A to F) to Bid duly filled and initialed, in accordance with the instructions contained therein & in accordance with IB.14.3.
 - (d) Bid Security furnished in accordance with IB.13.
 - (e) Power of Attorney in accordance with IB 14.5.
 - (f) Documentary evidence in accordance with IB.2(c) & IB.11
 - (g) Documentary evidence in accordance with IB.12.

IB.9 Sufficiency of Bid

- 9.1 Each bidder shall satisfy himself before Bidding as to the correctness and sufficiency of his Bid and of the premium on the rates of CSR / rates and prices quoted/entered in the Schedule of Prices, which rates and prices shall except in so far as it is otherwise expressly provided in the Contract, cover all his obligations under the Contract and all matters and things necessary for the proper completion of the works.
- 9.2 The bidder is advised to obtain for himself at his own cost and responsibility all information that may be necessary for preparing the bid and entering into a Contract for execution of the Works.

IB.10 Bid Prices, Currency of Bid and Payment

- 10.1 The bidder shall fill up the Schedule of Prices (Schedule A to Bid) indicating the percentage above or below the Composite Schedule of Rates/unit rates and prices of the Works to be performed under the Contract. Prices in the Schedule of Prices/Bill of Quantities shall be quoted entirely in Pak Rupees keeping in view the instructions contained in the Preamble to Schedule of Prices.
- 10.2 Unless otherwise stipulated in the Conditions of Contract, prices quoted by the bidder shall remain fixed during the bidder's performance of the Contract and not subject to variation on any account.

- 10.3 The unit rates and prices in the Schedule of Prices or percentage above or below on the composite schedule of rates shall be quoted by the bidder in the currency as stipulated in Bidding Data.
- 10.4 Items for which no rate or price is entered by the Bidder will not be paid for by the Procuring Agency when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities.

IB.11 Documents Establishing Bidder's Eligibility and Qualifications

- 11.1 Pursuant to Clause IB.8, the bidder shall furnish, as part of its bid, documents establishing the bidder's eligibility to bid and its qualifications to perform the Contract if its bid is accepted.
- 11.2 Bidder must possess and provide evidence of its capability and the experience as stipulated in Bidding Data and the Qualification Criteria mentioned in the Bidding Documents.

IB.12 Documents Establishing Works' Conformity to Bidding Documents

- 12.1 The documentary evidence of the Works' conformity to the Bidding Documents may be in the form of literature, drawings and data and the bidder shall furnish documentation as set out in Bidding Data.
- 12.2 The bidder shall note that standards for workmanship, material and equipment, and references to brand names or catalogue numbers, if any, designated by the Procuring Agency in the Technical Provisions are intended to be descriptive only and not restrictive.

IB.13 Bid Security

- 13.1 Each bidder shall furnish, as part of his bid, at the option of the bidder, a Bid Security as percentage of bid price/estimated cost or in the amount stipulated in Bidding Data in Pak. Rupees in the form of Deposit at Call/ Payee's Order or a Bank Guarantee issued by a Scheduled Bank in Pakistan in favour of the Procuring Agency valid for a period up to twenty eight (28) days beyond the bid validity date (Bid security should not be below 1% and not exceeding 5% of bid price/estimated cost SPP Rule 37).
- 13.2 Any bid not accompanied by an acceptable Bid Security shall be rejected by the Procuring Agency as non-responsive.
- 13.3 The bid securities of unsuccessful bidders will be returned upon award of contract to the successful bidder or on the expiry of validity of Bid Security whichever is earlier.
- 13.4 The Bid Security of the successful bidder will be returned when the bidder has furnished the required Performance Security, and signed the Contract Agreement (SPP Rule 37).

- 13.5 The Bid Security may be forfeited:
- (a) if a bidder withdraws his bid during the period of bid validity; or
 - (b) if a bidder does not accept the correction of his Bid Price, pursuant to Sub-Clause 16.4 (b) hereof; or
 - (c) in the case of a successful bidder, if he fails within the specified time limit to:
 - (i) Furnish the required Performance Security or
 - (ii) Sign the Contract Agreement.

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

- 14.1 Bids shall remain valid for the period stipulated in the Bidding Data after the date of bid opening.
- 14.2 In exceptional circumstances, Procuring Agency may request the bidders to extend the period of validity for an additional period but not exceeding 1/3 of the original period. The request and the bidders' responses shall be made in writing or by cable. A Bidder may refuse the request without forfeiting the Bid Security. A Bidder agreeing to the request will not be required or permitted to otherwise modify the Bid, but will be required to extend the validity of Bid Security for the period of the extension, and in compliance with IB.13 in all respects (SPP Rule 38).
- 14.3 All Schedules to Bid are to be properly completed and signed.
- 14.4 No alteration is to be made in the Form of Bid except in filling up the blanks as directed. If any alteration be made or if these instructions be not fully complied with, the bid may be rejected.
- 14.5 Each bidder shall prepare Original and number of copies specified in the Bidding Data of the documents comprising the bid as described in IB.8 and clearly mark them "ORIGINAL" and "COPY" as appropriate. In the event of discrepancy between them, the original shall prevail.
- 14.6 The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign (in the case of copies, Photostats are also acceptable). This shall be indicated by submitting a written Power of Attorney authorising the signatory of the bidder to act for and on behalf of the bidder. All pages of the bid shall be initialed and official seal be affixed by the person or persons signing the bid.
- 14.7 The Bid shall be delivered in person or sent by registered mail at the address to Procuring Agency as given in Bidding Data.

D. SUBMISSION OF BID**IB.15 Deadline for Submission, Modification & Withdrawal of Bids**

- 15.1 Bids must be received by the Procuring Agency at the address/provided in Bidding Data not later than the time and date stipulated therein.
- 15.2 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 and Contract Data; and
 - (c) provide a warning not to open before the specified time and date for Bid opening as defined in the Bidding Data.
 - (d) in addition to the identification required in 15.2, the inner envelopes shall indicate the name and address of the Bidder to enable the Bid to be returned unopened in case it is declared late.
 - (e) 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.
- 15.3 Bids submitted through telegraph, telex, fax or e-mail shall not be considered.
- 15.4 Any bid received by the Procuring Agency after the deadline for submission prescribed in Bidding Data will be returned unopened to such bidder.
- 15.5 Any bidder may modify or withdraw his bid after bid submission provided that the modification or written notice of withdrawal is received by the Procuring Agency prior to the deadline for submission of bids.
- 15.6 Withdrawal of a bid during the interval between the deadline for submission of bids and the expiration of the period of bid validity specified in the Form of Bid may result in forfeiture of the Bid Security pursuant to IB.13.5 (a).

E. BID OPENING AND EVALUATION

IB.16 Bid Opening, Clarification and Evaluation (SPP Rules 41, 42 & 43)

16.1 The Procuring Agency will open the bids, in the presence of bidders' representatives who choose to attend, at the time, date and in the place specified in the Bidding Data.

16.2 The bidder's name, Bid Prices, any discount, the presence or absence of Bid Security, and such other details as the Procuring Agency at its discretion may consider appropriate, will be announced by the Procuring Agency at the bid opening. The Procuring Agency will record the minutes of the bid opening. Representatives of the bidders who choose to attend shall sign the attendance sheet.

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

16.3 To assist in the examination, evaluation and comparison of Bids the Engineer/Procuring Agency may, at its discretion, ask the bidder for a clarification of its Bid. The request for clarification and the response shall be in writing and no change in the price or substance of the Bid shall be sought, offered or permitted (SPP Rule 43).

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

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

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

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

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

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

(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.

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

Technical Evaluation: It will be examined in detail whether the works offered by the bidder complies with the Technical Provisions of the Bidding Documents. For this purpose, the bidder's data submitted with the bid in

Schedule B to Bid will be compared with technical features/criteria of the works detailed in the Technical Provisions. Other technical information submitted with the bid regarding the Scope of Work will also be reviewed.

16.8 Evaluated Bid Price

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

- (i) making any correction for arithmetic errors pursuant to IB.16.4 hereof.
- (ii) discount, if any, offered by the bidders as also read out and recorded at the time of bid opening.
- (iii) excluding provisional sums and the provisions for contingencies in the Bill of Quantities if any, but including Day work, where priced competitively.

IB.17 Process to be Confidential

17.1 Subject to IB.16.3 heretofore, no bidder shall contact Engineer/Procuring Agency on any matter relating to its Bid from the time of the Bid opening to the time the bid evaluation result is announced by the Procuring Agency. The evaluation result shall be announced at least seven (07) days prior to award of Contract (SPP Rule 45). The announcement to all bidders will include table(s) comprising read out prices, discounted prices, price adjustments made, final evaluated prices and recommendations against all the bids evaluated.

17.2 Any effort by a bidder to influence Engineer/Procuring Agency in the Bid evaluation, Bid comparison or Contract Award decisions may result in the rejection of his Bid. Whereas any bidder feeling aggrieved, may lodge a written complaint to Complaint Redressal Committee as per terms and conditions mentioned in SPP Rules 31 & 32. However, mere fact of lodging a complaint shall not warrant suspension of procurement process.

17.3 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, noncompetitive 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.

F. AWARD OF CONTRACT

IB.18. Post Qualification

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

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

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

IB.19 Award Criteria & Procuring Agency's Right

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

- 19.2 Notwithstanding IB.19.1, the Procuring Agency reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without thereby incurring any liability to the affected bidders or any obligation to inform the affected bidders of the grounds for the Procuring Agency's action except that the grounds for its rejection of all bids shall upon request be communicated, to any bidder who submitted a bid, without justification of the grounds. Notice of the rejection of all the bids shall be given promptly to all the bidders (SPP Rule 25).

IB.20 Notification of Award & Signing of Contract Agreement

- 20.1 Prior to expiration of the period of bid validity prescribed by the Procuring Agency, the Procuring Agency will notify the successful bidder in writing ("Letter of Acceptance") that his bid has been accepted (SPP Rule 49).
- 20.2 Within seven (07) days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Procuring Agency will send the successful bidder the Form of Contract Agreement provided in the Bidding Documents, incorporating all agreements between the parties.

- 20.3 The formal Agreement between the Procuring Agency and the successful bidder duly stamped at rate of 0.03 % of bid price (updated from time to time) stated in Letter of Acceptance shall be executed within seven (07) days of the receipt of Form of Contract Agreement by the successful bidder from the Procuring Agency.

IB.21 Performance Security

- 21.1 The successful bidder shall furnish to the Procuring Agency a Performance Security in the form and the amount stipulated in the Conditions of Contract within a period of fourteen (14) days after the receipt of Letter of Acceptance (SPP 39).
- 21.2 Failure of the successful bidder to comply with the requirements of Sub-Clauses IB.20.2 & 20.3 or 21.1 or Clause IB.22 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.
- 21.3 Publication of Award of Contract: within seven days of the award of contract, the procuring shall publish on the website of the authority and on its own website, if such a website exists, the results of the bidding process, identifying the bid through procurement identifying Number if any and the following information:
- (1) Evaluation Report;
 - (2) Form of Contract and letter of Award;
 - (3) Bill of Quantities or Schedule of Requirements. (SPP Rule 50)

IB.22 Integrity Pact

The Bidder shall sign and stamp the Form of Integrity Pact provided at Schedule-F to Bid in the Bidding Document for all Sindh Government procurement contracts exceeding Rupees ten (10) million. Failure to provide such Integrity Pact shall make the bid non-responsive (SPP Rule 89).

BIDDING DATA

Instructions to Bidders

Clause Reference

1.1 Name of Procuring Agency

Project Office, KSEZ

Khairpur Special Economic Zone
 Khairpur District Council Office,
 Near Radio Pakistan Office old National Highway, District Khaipur
 Phone: 0243-9280398-400, 554449
 Fax: 0234-9280396

Brief Description of Works

Construction of Brick Masonry Retaining Wall along MC-02, MC03 periphery and Exit Gate along with Gate Office at Khairpur Special Economic Zone (KSEZ), District Khairpur.

2.1 PEC category C5 and above.

5.1 (a) Procuring Agency's address:

Khairpur Special Economic Zone
 Khairpur District Council Office,
 Near Radio Pakistan Office old National Highway, District Khaipur
 Phone: 0243-9280398-400, 554449
 Fax: 0234-9280396

(b) Engineer's address:

EA Consulting Pvt Limited
 AL-9, 15th Lane, off Khayaban-e-Hilal, Phase VII, DHA,
 Karachi.

7.1 Bid language: English

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

11.2 The bidder must furnish and provide followings:

- I. Valid PEC Category C5 and Above In Discipline CE-10 & EE05.
- II. NTN Certificate Of The Firm
- III. Registration Certificate from SBR.
- IV. Professional Tax Certificate
- V. Company Profile (information about construction equipment's & key personals, who will be deputed on this particular project along with their CV's and documentary evidence of their educational certificates.
- VI. Certify Copy Of Annual Construction Turnover Of Last Three Years

- VII. Completion Certificate Of Two Contracts Of Similar Nature In Last 5 Years.
- VIII. Qualified Engineer (B.E) 1.No. and Diploma Engineer (DAE) 2No.
- IX. Surveying Equipment (Including Total Station) [02 Set]
- X. Concrete Mixer Machine (2 No.)
- XI. Water Bowser (02 No.)
- XII. Wooden shuttering (6000 Sft)

12.1 (a) A detailed description of the Works, essential technical and performance characteristics.

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

13.1 **Amount of Bid Security**

2% of the Bid Price in the form of Deposit at Call/ Payee's Order or a Bank Guarantee issued by a Scheduled Bank in Pakistan in favor of Procuring Agency (Project Office, KSEZ)

14.1 **Period of Bid Validity**

90 days

14.4 **Number of Copies of the Bid to be submitted:**

One original and one copy only

14.6 **Procuring Agency's Address for the Purpose of Bid Submission**

As per Notice Inviting Bids

15.1 **Deadline for Submission of Bids**

As per Notice Inviting Bids

15.2 **Name and Identification Number**

Construction of Brick Masonry Retaining Wall along MC-02, MC03 periphery and Exit Gate along with Gate Office at Khairpur Special Economic Zone (KSEZ), District Khairpur.

16.1 Venue, Time, and Date of Bid Opening

Venue: as stated in IB 14.6(a) above
As per Notice Inviting Bids

16.4 Responsiveness of Bids

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

FORM OF BID AND SCHEDULES TO BID

FORM OF BID (LETTER OF OFFER)

Bid Reference No. _____

(Name of Works)

To:

Gentlemen,

- 1 Having examined the Bidding Documents including Instructions to Bidders, Bidding Data, Conditions of Contract, Contract Data, Specifications, Drawings, if any, Schedule of Prices and Addenda Nos. _____ for the execution of the above-named works, we, the undersigned, being a company doing business under the name of and address _____ and being duly incorporated under the laws of Pakistan hereby offer to execute and complete such works and remedy any defects therein in conformity with the said Documents including Addenda thereto for the Total Bid Price of Rs _____ (Rupees _____) or such other sum as may be ascertained in accordance with the said Documents.
- 2 We understand that all the Schedules attached hereto form part of this Bid.
- 3 As security for due performance of the undertakings and obligations of this Bid, we submit herewith a Bid Security in the amount of _____ drawn in your favour or made payable to you and valid for a period of twenty eight (28) days beyond the period of validity of Bid.
- 4 We undertake, if our Bid is accepted, to commence the Works and to deliver and complete the Works comprised in the Contract within the time(s) stated in Contract Data.
- 5 We agree to abide by this Bid for the period of _____ days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

- 6 Unless and until a formal Agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.
- 7 We undertake, if our Bid is accepted, to execute the Performance Security referred to in Conditions of Contract for the due performance of the Contract.
- 8 We understand that you are not bound to accept the lowest or any bid you may receive.
- 9 We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other person or persons making a bid for the Works.

Dated this _____ day of _____, 20

Signature _____

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

(Seal)

Address

Witness:

(Signature) _____

Name:

Address:

SCHEDULES TO BID INCLUDE THE FOLLOWING:

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

SCHEDULE – A TO BID

SCHEDULE OF PRICES

- 1 Preamble to Schedule of Prices
- 2 Schedule of Prices

SEPERATELY BOUNDED

SCHEDULE -A TO BID**PREAMBLE TO SCHEDULE OF PRICES****1. General**

- 1.1 The Schedule of Prices shall be read in conjunction with the Conditions of Contract, Contract Data together with the Specifications and Drawings, if any.
- 1.2 The Contract shall be for the whole of the works as described in these Bidding Documents. Bids must be for the complete scope of works.

2. Description

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

3 Units & Abbreviations

- 3.1 Units of measurement, symbols and abbreviations expressed in the Bidding Documents shall comply with the System International Unites (SI Units).

4. Rates and Prices

- 4.1 Except as otherwise expressly provided under the Conditions of Contract, the rates and amounts entered in the Schedule of Prices shall be the rates at which the Contractor shall be paid and shall be the full inclusive value of the works set forth or implied in the Contract; except for the amounts reimbursable, if any to the Contractor under the Contract.
- 4.2 Unless otherwise stipulated in the Contract Data, rates and prices entered by the bidder shall not be subject to adjustment during the performance of the Contract.
- 4.3 All duties, taxes and other levies payable by the Contractor shall be included in the rates and prices.
- 4.4 The whole cost of complying with the provisions of the Contract shall be included in the items provided in the Schedule of Prices, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related

items of the Works and no separate payment will be made for those items.

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

- 4.5 (a) The bidder shall be deemed to have obtained all information as to and all requirements related thereto which may affect the bid price.
- (b) The Contractor shall be responsible to make complete arrangements for the transportation of the Plant to the Site.
- 4.6 The Contractor shall provide for all parts of the Works to be completed in every respect. Notwithstanding that any details, accessories, etc. required for the complete installation and satisfactory operation of the Works, are not specifically mentioned in the Specifications, such details shall be considered as included in the Contract Price.

5. Bid Prices

5.1 Break-up of Bid Prices

The various elements of Bid Prices shall be quoted as detailed by the Procuring Agency in the format of Schedule of Prices. The bidder shall recognize such elements of the costs which he expects to incur the performance of the Works and shall include all such costs in the rates and amounts entered in the Schedule of Prices.

5.2 Total Bid Price

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

VOLUME-III
BILL OF QUANTITIES

SEPERATELY BOUNDED

SCHEDULE -B TO BID

SPECIFIC WORKS DATA

Construction of Brick Masonry Retaining Wall along MC-02 and Exit Gate along with Gate Office at Khairpur Special Economic Zone (KSEZ), District Khairpur Contract No.

SCHEDULE – C TO BID

WORKS TO BE PERFORMED BY SUBCONTRACTORS

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

Items of Works To be Sub-Contracted	Name and address of Sub-Contractors	Statement of similar works previously executed. (<i>attach evidence</i>)
---	--	--

Note:

- 1 No change of Sub-Contractors shall be made by the bidder without prior approval of the Procuring Agency.
- 2 The truthfulness and accuracy of the statement as to the experience of Sub-Contractors is guaranteed by the bidder. The Procuring Agency's judgment shall be final as to the evaluation of the experience of Sub-Contractors submitted by the bidder.
- 3 Statement of similar works shall include description, location & value of works, year completed and name & address of the clients.

SCHEDULE – D TO BID

PROPOSED PROGRAMME OF WORKS

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

SCHEDULE – E TO BID

METHOD OF PERFORMING WORKS

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

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

SCHEDULE – F TO BID

**(INTEGRITY PACT)
DECLARATION OF FEES, COMMISSION AND BROKERAGE ETC
PAYABLE BY 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]

CONDITIONS OF CONTRACT

TABLE OF CONTENTS**CONDITIONS OF CONTRACT**

Clause No	Description	Page No
1	General Provisions.....	40
2	The Procuring Agency.....	42
3	Engineer's/Procuring Agency's Representatives.....	43
4	The Contractor	43
5	Design by Contractor.....	44
6	Procuring Agency's Risks.....	44
7	Time for Completion	45
8	Taking Over	46
9	Remedying Defects.....	46
10	Variations and Claims	47
11	Contract Price And Payment.....	48
12	Default	50
13	Risks and Responsibilities	51
14	Insurance	52
15	Resolution of Disputes.....	52
16	Integrity Pact.....	53

CONDITIONS OF CONTRACT

1. GENERAL PROVISIONS

1.1 Definitions

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

The Contract

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

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

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

Persons

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

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

1.1.6 "Party" means either the Procuring Agency or the Contractor.

Dates, Times and Periods

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

1.1.8 "Day" means a calendar day

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

Money and Payments

1.1.10 "Cost" means all expenditure properly incurred (or to be incurred) by the

Contractor, whether on or off the Site, including overheads and similar charges but does not include any allowance for profit.

Other Definitions

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

1.1.12 "Country" means the Islamic Republic of Pakistan.

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

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

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

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

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

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

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

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

1.2 Interpretation

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

1.3 Priority of Documents

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

with the order as listed in the Contract Data.

1.4 **Law**

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

1.5 **Communications**

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

1.6 **Statutory Obligations**

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

2. THE PROCURING AGENCY

2.1 **Provision of Site**

The Procuring Agency shall provide the Site and right of access thereto at the times stated in the Contract Data. Site Investigation Reports are those that were included in the bidding documents and are factual and interpretative reports about the surface and subsurface conditions at the Site.

2.2 **Permits etc.**

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

2.3 **Engineer's/Procuring Agency's Instructions**

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

2.4 **Approvals**

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

3. ENGINEER'S/PROCURING AGENCY'S REPRESENTATIVES

3.1 Authorised Person

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

3.2 Engineer's/Procuring Agency's Representative

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

4. THE CONTRACTOR

4.1 General Obligations

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

4.2 Contractor's Representative

The Contractor shall appoint a representative at site on full time basis to supervise the execution of work and to receive instructions on behalf of the Contractor but only after obtaining the consent of the Procuring Agency for such appointment which consent shall not be withheld without plausible reason(s) by the Procuring Agency. Such authorized representative may be substituted/ replaced by the Contractor at any time during the Contract Period but only after obtaining the consent of the Procuring Agency as aforesaid.

4.3 Subcontracting

The Contractor shall not subcontract the whole of the works. The Contractor shall not subcontract any part of the works without the consent of the Procuring Agency.

4.4 Performance Security

The Contractor shall furnish to the Procuring Agency within fourteen (14) days after receipt of Letter of Acceptance a Performance Security at the option of the bidder, in the form of Payee's order /Bank Draft or Bank Guarantee from scheduled bank for the amount and validity specified in Contract Data.

5. DESIGN BY CONTRACTOR

5.1 Contractor's Design

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

5.2 Responsibility for Design

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

6. PROCURING AGENCY'S RISKS

6.1 The Procuring Agency's Risks

The Procuring Agency's Risks are:-

- a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies, within the Country;
- b) Rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war, within the Country;
- c) riot, commotion or disorder by persons other than the Contractor's personnel and other employees including the personnel and employees of Sub-Contractors, affecting the Site and/or the Works;
- d) ionising radiations, or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive, or other hazardous properties of any explosive nuclear assembly or nuclear component of such an assembly, except to the extent to which the Contractor/Sub-Contractors may be responsible for the use of any radio-active material;

- e) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds;
- f) use or occupation by the Procuring Agency of any part of the Works, except as may be specified in the Contract;
- g) late handing over of sites, anomalies in drawings, late delivery of designs and drawings of any part of the Works by the Procuring Agency's personnel or by others for whom the Procuring Agency is responsible;
- h) a suspension under Sub-Clause 2.3 unless it is attributable to the Contractor's failure; and
- i) physical obstructions or physical conditions other than climatic conditions, encountered on the Site during the performance of the Works, for which the Contractor immediately notified to the Procuring Agency and accepted by the Procuring Agency.

7. TIME FOR COMPLETION

7.1 Execution of the Works

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

7.2 Programme

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

7.3 Extension of Time

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

7.4 Late Completion

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

8. TAKING-OVER

8.1 Completion

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

8.2 Taking-Over Notice

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

9. REMEDYING DEFECTS

9.1 Remedying Defects

The Contractor shall for a period stated in the Contract Data from the date of issue of the Certificate of Completion carry out, at no cost to the Procuring Agency, repair and rectification work which is necessitated by the earlier execution of poor quality of work or use of below specifications material in the execution of Works and which is so identified by the Procuring Agency/Engineer in writing within the said period. Upon expiry of the said period, and subject to the Contractor's faithfully performing his aforesaid obligations, the Procuring Agency/Engineer shall issue a Maintenance Certificate whereupon all obligations of the Contractor under this Contract shall come to an end.

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

9.2 Uncovering and Testing

The Engineer/Procuring Agency may give instruction as to the uncovering and/or testing of any work. Unless as a result of an uncovering and/or testing it is established that the Contractor's design, materials, plant or workmanship are not in accordance with the Contract, the Contractor shall be paid for such uncovering and/or testing as a Variation in

accordance with Sub-Clause 10.2.

10. VARIATIONS AND CLAIMS

10.1 Right to Vary

The Procuring Agency/Engineer may issue Variation Order(s) in writing. Where for any reason it has not been possible for the Procuring Agency/Engineer to issue such Variations Order(s), the Contractor may confirm any verbal orders given by the Procuring Agency/Engineer in writing and if the same are not refuted/denied by the Procuring Agency/Engineer within ten (10) days of the receipt of such confirmation the same shall be deemed to be a Variation Orders for the purposes of this Sub-Clause.

10.2 Valuation of Variations

Variations shall be valued as follows:

- a) at a lump sum price agreed between the Parties, or
- b) where appropriate, at rates in the Contract, or
- c) in the absence of appropriate rates, the rates in the Contract shall be used as the basis for valuation, or failing which
- d) at appropriate new rates, as may be agreed or which the Engineer/Procuring Agency considers appropriate, or
- e) if the Engineer/Procuring Agency so instructs, at day work rates set out in the Contract Data for which the Contractor shall keep records of hours of labour and Contractor's Equipment, and of Materials, used.

10.3 Changes in the Quantities.

- a) If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25 percent, provided the change exceeds 1 percent of the Initial Contract Price, the Procuring Agency/Engineer shall adjust the rate to allow for the change and will be valued as per sub clause 10.2.
- b) The Engineer shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 15 percent, except with the prior approval of the Procuring Agency.
- c) If requested by the Engineer, the contractor shall provide the Engineer with a detailed cost breakdown of any rate in the Bill of Quantities.

10.4 Early Warning

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

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

10.5 **Valuation of Claims**

If the Contractor incurs Cost as a result of any of the Procuring Agency's Risks, the Contractor shall be entitled to the amount of such Cost. If as a result of any Procuring Agency's Risk, it is necessary to change the Works, this shall be dealt with as a Variation subject to Contractor's notification for intention of claim to the

Engineer/Procuring Agency within fourteen (14) days of the occurrence of cause.

10.6 **Variation and Claim Procedure**

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

11. **CONTRACT PRICE AND PAYMENT**

11.1 (a) **Terms of Payments**

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other terms of the Contract, shall , subject to Clause 11.3, be paid by the Procuring Agency to the Contractor within 30 days after such Interim Payment Certificate has been jointly verified by Procuring Agency and Contractor, or, in the case of the Final Certificate referred to in Sub Clause 11.5, within 60days after such Final Payment Certificate has been jointly verified by Procuring Agency and Contractor;

Provided that the Interim Payment shall be caused in thirty (30) days and Final Payment in 60 days in case of foreign funded project. In the event of the failure of the Procuring Agency to make payment within 90 days then Procuring Agency shall pay to the Contractor compensation at the 28 days rate of KIBOR+2% per annum in local currency and LIBOR+1% for foreign currency, upon all sums unpaid from the date by which the same should have been paid.

(b) **Valuation of the Works**

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

11.2 Monthly Statements

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

- a) the value of the Works executed less to the cumulative amount paid previously; and
- b) value of secured advance on the materials and valuation of variations (if any).

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

11.3 Interim Payments

Within a period not exceeding seven (07) days from the date of submission of a statement for interim payment by the Contractor, the Engineer shall verify the same and within a period not exceeding thirty (30/60) days from the said date of submission by the Contractor, the Procuring Agency shall pay to the Contractor the sum subject to adjustment for deduction of the advance payments and retention money.

11.4 Retention

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

11.5 Final Payment

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

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

11.6 Currency

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

12. DEFAULT

12.1 Defaults by Contractor

If the Contractor abandons the Works, refuses or fails to comply with a valid instruction of the Engineer/Procuring Agency or fails to proceed expeditiously and without delay, or is, despite a written complaint, in breach of the Contract, the Procuring Agency may give notice referring to this Sub-Clause and stating the default. If the Contractor has not taken all practicable steps to remedy the default within fourteen (14) days after receipt of the Procuring Agency's notice, the Procuring Agency may by a second notice given within a further twenty one (21) days, terminate the Contract. The Contractor shall then demobilize from the Site leaving behind any Contractor's Equipment which the Procuring Agency instructs, in the second notice, to be used for the completion of the Works at the risk and cost of the Contractor.

12.2 Defaults by Procuring Agency

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

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

12.3 Insolvency

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

12.4 Payment upon Termination

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

- a) any sums to which the Contractor is entitled under Sub-Clause 10.4,
- b) any sums to which the Procuring Agency is entitled,
- c) if the Procuring Agency has terminated under Sub-Clause 12.1 or

12.3, the Procuring Agency shall be entitled to a sum equivalent to twenty percent (20%) of the value of parts of the Works not executed at the date of the termination, and

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

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

13. RISKS AND RESPONSIBILITIES

13.1 Contractor's Care of the Works

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

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

13.2 Force Majeure

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

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

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

- a) any sums to which the Contractor is entitled under Sub-Clause 10.4,
- b) the cost of his demobilization, and
- c) less any sums to which the Procuring Agency is entitled.

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

14. INSURANCE

14.1 Arrangements

The Contractor shall, prior to commencing the Works, effect insurances of the types, in the amounts and naming as insured the persons stipulated in the Contract Data except for items (a) to (e) and (i) of the Procuring Agency's Risks under Sub-Clause 6.1. The policies shall be issued by insurers and in terms approved by the Procuring Agency. The Contractor shall provide the Engineer/Procuring Agency with evidence that any required policy is in force and that the premiums have been paid.

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

15. RESOLUTION OF DISPUTES

15.1 Engineer's Decision

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

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

15.2 Notice of Dissatisfaction

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

If a contractor is dissatisfied with the decision of the Engineer of the department or decision is not given in time then he can approach Superintending Engineer within 14 days, in case of dissatisfaction with decision of Superintending Engineer or not decided within 28 days, then arbitration process would be adopted as per clause 15.3.

15.3 **Arbitration**

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

16 **INTEGRITY PACT**

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

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

CONTRACT DATA

Sub-Clauses of Conditions of Contract

1.1.3 Procuring Agency's Drawings,
(Attached with this document)

1.1.4 **The Procuring Agency means**

Project Office, KSEZ
Khairpur Special Economic Zone, Khairpur District Council Office,
Near Radio Pakistan Office old National Highway, District Khairpur
Phone: 0243-9280398-400, 554449
Fax: 0234-9280396

1.1.5 **The Contractor means**

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

1.1.9 **Time for Completion** 180 days (6 months)

1.1.20 **Engineer:** EA Consulting Pvt. Limited.

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

- (a) The Contract Agreement (if completed)
- (b) Letter of Acceptance
- (c) The completed Form of Bid
- (d) Contract Data
- (e) Conditions of Contract
- (f) The completed Schedules to Bid including Schedule of Prices
- (g) The Drawings, if any
- (h) The Specifications
- (i) Any other document forming part of the contract

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

3.1 **Authorized person:** Chief Executive Officer, Nip

3.2 **Name and address of Engineer's/Procuring Agency's representative**

Engineer's Representatives: To be notified

Procuring Agency's Representative:

Project Manager,
National Industrial Parks
Development and
Management
Company

Add following Clause 3.3

3.3 Engineer's/Employer's Facilities Not Applicable

a) Vehicles

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

- i. Suzuki Cultus ---1 no (Maximum Fuel = 450 lit/month)

The vehicle shall be air-conditioned and fitted with 3-point inertia-reel seat belts for all occupants.

The vehicle shall be provided for the Engineer's use within 14 days from the Commencement Date.

If the Contractor fails to provide the vehicles within the time specified the cost incurred by the Engineer/Employer in renting / purchase respectively of similar vehicles plus a 20% (twenty percent) overhead charge shall be payable by the Contractor.

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

The Contractor shall provide safe, experienced and competent driver for the vehicle (if required by the Employer), to the approval of the Engineer. The driver shall be responsible for the vehicle allocated for the duration of the Contract. The Contractor shall promptly replace the driver who, in the Engineer's opinion, is not working satisfactorily.

4.3 **Subcontracting:** Not allowed.

4.4 **Performance Security:**

Amount: 5% of the Contract Price named in the Letter of Acceptance

Validity: The performance security shall be valid until a date 90 days from the date of issue of the Maintenance Certificate

5.1 **Requirements for Contractor's design (if any):** Not applicable

7.2 **Programme:**

Time for submission: Within seven (07) days of the Commencement Date.

Form of programme: Bar Chart

7.4 Amount payable due to failure to complete shall be 0.1% per day up to a maximum of (10%) of sum stated in the Letter of Acceptance. In addition to the Liquidated 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.

Completion of Works:

Completion period as per NIT.

7.5 Early Completion

Not Applicable

9.1 Period for remedying defects: 365 days

10.2 (e) Variation Procedures:

The Contractor shall submit with his bid, the Day work rates of Plant & Equipment and manpower

10.6 Variation and Claim Procedures:

Add following at the end of Clause 10.6

The Contractor shall not be entitled for any payment in respect of the claim(s) if the Contractor fails to comply with the requirements of time period stipulated in this Clause 10.6 and or fails in keeping and producing necessary records of claim whenever demanded by the Engineer.

11.1 Terms of Payments

a) Mobilization Advance

- (1) Mobilization Advance up to 10 % of the Contract Price stated in the Letter of Acceptance shall be paid by the Procuring Agency to the Contractor on the works costing Rs.2.5 million or above on following conditions:
 - (i) On submission by the Contractor of a Mobilization Advance Guarantee for the full amount of the Advance in the specified form from a Scheduled Bank in Pakistan to the Procuring Agency;
 - (ii) Contractor will pay interest on the mobilization advance at the rate of 10% per annum on the advance; and
 - (iii) This Advance including the interest shall be recovered in 5 equal installments from the five (05) R.A bills and in case the number of bills is less than five (05) then 1/5 of the advance inclusive of the interest thereon shall be recovered from each bill and the balance together with

interest be recovered from the final bill. It may be insured that there is sufficient amount in the final bill to enable recovery of the Mobilization Advance.

OR

2) **Secured Advance on Materials**

- (a) The Contractor shall be entitled to receive from the Procuring Agency Secured Advance against an INDENTURE BOND in P W Account Form No. 31(Fin. R. Form No. 2 acceptable to the Procuring Agency of such sum as the Engineer may consider proper in respect of non-perishable materials **(only in steel reinforcement bars)** 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 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 should not be allowed unless & until the previous advance, if any, fully recovered;
 - (viii) Detailed account of advances must be kept in part II of running account bill; 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 definitely not for full quantities of materials for the entire work/contract

(b) Recovery of Secured Advance:

- (i) Secured Advance paid to the Contractor under the above provisions shall be effected from the monthly payments on actual consumption basis, but not later than period specified in the rules not more than three months (even if unutilized); other conditions.
- (ii) As recoveries are made the outstanding accounts of the items concerned in Part II should be reduced by making deduction entries in the column; "deduct quantity utilized in work measured since previous bill," equivalent to the quantities of materials used by the contractor on items of work shown as executed in part I of the bill.

(c) Interim payments: The Contractor shall submit to the Engineer monthly statements of the estimated value of the work completed less the cumulative amount certified previously.

- (i) The value of work completed comprises the value of the quantities of the items in the Bill of Quantities completed.
- (ii) Value of secured advance on the materials and valuation of variations (if any).
- (iii) Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.
- (v) Retention money and other advances are to be recovered from the bill submitted by contractor.

(b) Valuation of the Works:

- i) Re-measurement with estimated/bid quantities in the Schedule of Prices

11.4 **Percentage of retention:** 10% of the amount of Interim Certificate but to a maximum of 5% of Contract Price

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

14.1 **Insurances:**

from Jubilee Insurance, Adamjee Insurance or EFU Insurance Company.

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). All Insurance policies shall be valid till issuance of Completion Certificate

14.2 Amount to be recovered

Premium plus twenty percent (20%).

14.2 Arbitration

Place of Arbitration: Karachi

STANDARD FORMS

FORM OF BID SECURITY
(Bank Guarantee)

Guarantee No. _____
Executed on _____

(Letter by the Guarantor to the Procuring Agency)

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

Name of Principal (Bidder) with
Address: _____

Sum of Security (express in words and
Figures): _____

Bid Reference No. _____ Date of Bid _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bid and at the request of the said Principal, we the Guarantor above-named are held and firmly bound unto the _____, (hereinafter called The "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 Principal has submitted the accompanying Bid numbered and dated as above for _____ (Particulars of Bid) to the said Procuring Agency; and

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

- (1) That the Bid Security shall remain valid for a period of twenty eight (28) days beyond
The period of validity of the bid;
- (2) That in the event of:
 - (a) The Principal withdraws his Bid during the period of validity of Bid, or
 - (b) The Principal does not accept the correction of his Bid Price, pursuant to Sub-Clause 16.4 (b) of Instructions to Bidders, or
 - (c) Failure of the successful bidder to
 - (i) Furnish the required Performance Security, in accordance with Sub-Clause IB-21.1 of Instructions to Bidders, or

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

The entire sum be paid immediately to the said Procuring Agency for delayed completion and not as penalty for the successful bidder's failure to perform.

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

PROVIDED THAT the Guarantor shall forthwith pay to the Procuring Agency the said sum stated above 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 Guarantor at its address given above.

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

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

Guarantor (Bank)

Witness:

1. _____

Corporate Secretary (Seal)

2. _____

(Name, Title & Address)

1. Signature _____

2. Name _____

3. Title _____

Corporate Guarantor (Seal)

**FORM OF PERFORMANCE SECURITY
(Bank Guarantee)**

Guarantee No. _____

Executed on _____

Expiry Date _____

(Letter by the Guarantor to the Procuring Agency)

Name of Guarantor (Scheduled Bank in Pakistan) with

Address: _____

Name of Principal (Contractor) with

Address: _____

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

Letter of Acceptance No. _____ Dated _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bidding Documents and above said Letter of Acceptance (hereinafter called the Documents) and at the request of the said Principal we, the Guarantor above named, are held and firmly bound unto the _____ (hereinafter called the 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 the said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till all requirements of Clause 9, Remedying Defects, of Conditions of

Contract are fulfilled.

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

We, _____ (the Guarantor), waiving all objections and defenses 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, for 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 bounded Guarantor has executed this Instrument under its seal on the date indicated above, the name and corporate seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

 Guarantor (Bank)

Witness:

1. _____

 Corporate Secretary (Seal)

2. _____

 (Name, Title & Address)

1. Signature _____

2. Name _____

3. Title _____

 Corporate Guarantor (Seal)

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the ____ day of _____ 2015 ____ between _____ (hereinafter called the "Procuring Agency") of the one part and _____ (hereinafter 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

2. The following documents after incorporating addenda, if any except those parts relating to Instructions to Bidders, shall be deemed to form and be read and construed as part of this Agreement, viz:
 - (a) The Letter of Acceptance;
 - (b) The completed Form of Bid along with Schedules to Bid;
 - (c) Conditions of Contract & Contract Data;
 - (d) The priced Schedule of Prices/Bill of quantities (BOQ);
 - (e) The Specifications; and
 - (f) The Drawings

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 within the provisions of the Contract.

4 The 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 Contract Agreement to be executed on the day, month and year first before written in accordance with their respective laws.

Signature of the Contactor

Signature of the 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

Guarantee o. _____
Executed on _____

(Letter by the Guarantor to the Procuring Agency)

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

AND WHEREAS _____ (Scheduled Bank) (hereinafter called the Guarantor) at the request of the Contractor and in consideration of the 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 fulfillment 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, as aforesaid, 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 come into force as soon as the advance payment has been credited to the account of the Contractor.

This Guarantee shall expire not later than _____ by which date we must have received any claims by registered letter, telegram, telex or telefax.

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

Guarantor (Scheduled Bank)

Witness: 1. Signature _____

1. _____ 2. Name _____

_____ 3. Title _____

Corporate Secretary (Seal)

2. _____

(Name, Title & Address) Corporate Guarantor (Seal)

Not Applicable

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 of197--"-
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 thefor 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 (E). The said works signed by the contractor

Fin R.Form.17.A

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

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

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

- (2) That the materials detailed in the said Running Account Bill (B) which have been

Fin R Form No. 17-A

Offered to and accepted by (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

Fin. R. Form No. 17-A

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.

- (4) 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 quality 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.

- (5) '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) That if the Contractor shall at any time make any default in the performance or observation in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing to the Government shall immediately on the happening of such default be repayable by the Contractor to the Government together with interest thereon at twelve percent per annum from the date or respective dates of such advance or advances to the date or repayment and with all costs, charges, damages and expenses incurred by the Government in or for the recovery thereof or the enforcement of this security or otherwise by reason of (he default of the Contractor and any 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 notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whether the covenant for payment and repayment hereinbefore contained shall become enforceable and the money owing shall not be paid to accordingly.

Once therewith 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 aid 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..... Circle whose..... decision shall be final and the provisions of the Indian Arbitration Act for the time being in force so far as they are applicable shall apply to any such reference.

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

Signed, sealed and delivered by in
The presence of

Seal
1st witness 2nd witness

Signed, sealed and delivered by in the presence of

Seal
1st Witness 2nd witness

TECHNICAL SPECIFICATIONS

CIVIL WORKS

INFRASTRUCTURE DEVELOPMENT WORKS AT KHAIRPUR SPECIAL ECONOMIC ZONE (KSEZ)

TENDER DOCUMENTS

(VOLUME – II)

SPECIFICATIONS FOR CIVIL WORKS

Table of Contents

1.	Section-1	General	SP-C-1 to 2
2.	Section-2	Site Clearing	SP-C-3 to 4
3.	Section-3	Excavation, Backfill	SP-C-5 to 7
4.	Section-4	Termite Control	SP-C-8 to 9
5.	Section-5	Water	SP-C-10 to 10
6.	Section-6	Concrete	SP-C-11 to 28
7.	Section-7	Steel Reinforcement	SP-C-29 to 31
8.	Section-8	Flooring	SP-C-32 to 38
9.	Section-9	Stone Soling / Paving	SP-C-39 to 45
10.	Section-10	Dewatering	SP-C-46 to 49
11.	Section-11	Moisture Protection & Waterproofing	SP-C-50 to 58
12.	Section-12	Piling Works (<i>NOT APPLICABLE</i>)	SP-C-59 to 80
13.	Section-13	Metal Works	SP-C-81 to 88
14.	Section-14	Brick Masonry	SP-C-89 to 95
15.	Section-15	Plastering	SP-C-96 to 99
16.	Section-16	Doors and Windows	SP-C-100 to 103
17.	Section-17	Timber, Joinery and Hardware	SP-C-104 to 108
18.	Section-18	Aluminum Anodized Doors, Windows, and Ventilators	SP-C-109 to 112
19.	Section-19	Roof Treatment	SP-C-113 to 113
20.	Section-20	Painting, Distempering and White / Color Washing etc	SP-C-114 to 117
21.	Section-21	Color Creating	SP-C-118 to 119
22.	Section-22	Random and Dressed Un-coursed Stone Masonry	SP-C-120 to 121

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 specially of cement, sand, aggregates, steel, water, tiles, hard-core and all fittings. Whenever practicable, samples shall be submitted at least three weeks before it is proposed to use the materials. Until and unless specified otherwise and whenever materials are ordered to be forwarded to a testing laboratory other than site laboratory for check/ testing, the Contractor will be reimbursed the cost of fees for such tests if proved satisfactory, by the Employer. The Contractor, however, will be required to bear the cost of the fees for tests, which proved unsatisfactory.
- 1.05 The Contractor must take all steps necessary to prevent damage or interference with all supply lines such as water, electric power, fuel, telephones, drains, buried cables and any construction designed for the use of the public, government or semi government authorities or the Employer. The Contractor shall be responsible for any damage caused to such services or constructions and settle all claims in respect of such damage.
- 1.06 The Contractor shall protect from injury by covering all work, internally and externally needing protection including new concrete, brickwork, surface renderings, floors, etc., to the satisfaction of the Engineer, including the work of his sub-contractors at his own cost.
- 1.07 The whole work shall be carried out in the best manner in accordance with the instructions contained in these documents and those given by the Engineer from time to time during the progress of the work. The work shall be carried out in conformity with the best of the standard construction practices preferably the British Codes of Practices.
- 1.08 The Contractor shall submit to the Engineer for his approval before beginning the work, a

complete plan of the proposed sequence and methods of operations for the execution of the works. Detailed drawings showing the location and construction of dumping and working platforms, gantries, building and all other structures in connection with the Contractor's plant and material storage sheds shall also be submitted to the Engineer for his approval before construction.

- 1.09 Orders and directions may be given orally by the Engineer or his Representative, and shall be received and promptly obeyed by the Contractor or his Representative or any superintendent or foreman or any supervisor of the Contractor whosoever may have charge of the particular part or section of work in relation to which the orders or directions are given, and a confirmation in writing of such order or directions will be given to the Contractor by the Engineer, if so requested. The Contractor shall provide and maintain at his own expense during the performance of the work an office in the vicinity of work. Orders or directions, written or oral, from the Engineer or his Representative delivered at such office shall be considered as delivered to the Contractor. The Contractor's office shall be fitted with a telephone connected to the local Telephone Exchange.
- 1.10 The Contractor shall not use the site for any other purpose than that of carrying out this Contract work. The operations of the Contractor shall be confined to the area immediately adjoining the buildings and the works included in this Contract but site clearance shall be kept to the satisfaction of the Engineer to permit carrying out of other works by other Contractors. The Contractor shall not affix advertisements; neither shall he permit advertisements to be displayed without the written consent of the Engineer.
- 1.11 The contract drawings are the working drawings to guide the Contractor generally about the shape and size of all the structures and fittings. Before proceeding to make preparations, fabrication, execution, erection of any such fittings and other details of any temporary works, scaffolds, railings, shutterings, details of doors, windows, partitions, iron mongery works, etc; the Contractor shall be under obligation to prepare and submit all detailed shop drawings to the satisfaction and the approval of the Engineer, before doing any or all of that described above or as directed. Approval of the contractor's drawings shall not relieve the Contractor for any part of his obligation to meet all the requirements of the specifications or correctness of his drawings.
- 1.12 No cement work shall be permitted during extreme cold weather when unless otherwise authorized by the engineer.
- 1.13 **PAYMENT**
Contractor shall not be entitled to any separate or additional payment on account of all these general requirements and any other arrangement or action Contractor has to undertake under the direction of the Engineer for a proper carrying out of the works and meeting all obligations of the Contract.

SECTION - 2

2.0 SITE CLEARING, GRUBBING AND SETTING OUT OF WORKS

2.01 SCOPE OF WORK

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

2.02 CLEARING

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

2.03 GRUBBING

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

2.04 DISPOSAL OF DEBRIS

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

2.05 SETTING OUT OF WORKS

The Contractor shall set out the works and shall be responsible for true and perfect setting out of the same and for correctness of the direction, levels, dimension and alignment of all parts thereof. If at any time any error in this respect shall appear during the progress of the works, the Contractor shall, at his own expense, rectify the error to the satisfaction of the Engineer. The Contractor shall construct accurate benchmarks so that the lines and levels can easily be checked by the Engineer.

2.06 DRAINAGE DITCHES

The Contractor shall construct and maintain such ditches, in addition to those shown on drawings or as may be ordered by the Engineer to adequately drain and areas under construction.

2.07 PAYMENT

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

SECTION - 3

3.0 EXCAVATION, FILLING, BACKFILLING AND DISPOSAL

3.01 SCOPE OF WORK

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

3.02 BORING LOG DATA

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

3.03 EXCAVATION

(a) Classification

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

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

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

(d) Shoring and Bracing:

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

(e) Dewatering and Drainage:

The Contractor shall control the grading in the vicinity of site of work in order to prevent any water from running into the excavated areas. He shall at his own cost keep dry all pits and trenches during construction and all de- watering and pumping out whether due to ground water seepage or otherwise, shall be included in the rates as quoted by the Contractor. The method employed in all cases shall be approved and

agreed by the Engineer or his Representative.

(f) Protection of utility lines:

When any existing utility lines whether to be retained or be removed are encountered within the area of operations, the 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 of granular materials/backfilling shall be thoroughly compacted and measured net and no allowance shall be made for any increase in bulk after excavation. Excavation, filling and Disposal shall include all leads and lifts as specified elsewhere in these specifications. Payment for all the items under this section shall be made at the rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

SECTION - 4

4.0 TERMITE CONTROL

4.01 SCOPE OF WORK:

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

4.02 MATERIALS:

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

4.03 METHOD OF APPLICATION:

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

4.04 EXTENT OF APPLICATION:

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

4.05 LOCATION AND SCHEDULING:

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

4.06 **STANDARD:**

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

4.07 **GUARANTEE:**

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

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

4.08 **TESTING:**

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

4.09 **PAYMENT:**

No separate payment will be made for wood work etc. covered under this section of the specifications, and all costs in connection therewith shall be deemed to have been included in the unit rates of the various items of wood works requiring treatment, except only building site which will be paid separately on the basis of plinth area covered by this treatment including all ditches, pits, excavation, fills etc. complete as per rate quoted in the Bill of Quantities.

SECTION - 5

5.0 WATER

5.01 SCOPE:

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

5.02 QUALITY OF WATER:

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

5.03 TESTING:

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

5.04 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 with concrete work complete in strict accordance with the applicable Drawings and the Specifications herein and subject to the terms and conditions of the Contract.

6.02 GENERAL:

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

6.03 MATERIALS:

6.03.1 CEMENT

- i) Grey/ white Portland Cement shall be normal setting cement of the specific gravity, fineness and chemical composition fully conforming to Pakistan Standard Specifications P.S. No.232:1967 and shall be capable of satisfying all tests such as the tensile strength tests contained therein. Standard test briquettes prepared with 1:3 cement sand mortar shall give the following tensile strengths:
At 3 days not less than 300 Lbs/Sq.in(2.1N/Sq.mm).
At 7 days not less than 400 Lbs/Sq.in(2.8N/Sq.mm).
- ii) The OPC cement with appropriate proportion of GGBS and or Blast furnace slag cement where required a fully confirming to Pakistan standards specification (PS) and satisfying the requirements for fineness, chemical composition strength, setting time and soundness.etc.
- iii) 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) (ii) and (iii) 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 on Standard test cylinders, water/cement ratio and minimum quantity of cement required per m³ or 100 cft. of finished concrete for various mixes and under various conditions.

Class of Concrete	Min. Qty. of Cement		Cylindrical Compressive Strength at 28 days		Water/Cement Ratios
	Lbs. per 100 cft.	Kg /cu.m			
			Lbs./Sq.in	N/Sq.mm	
A.	3024	485	5000	35	0.4
B.	2520	404	4000	28	0.45
C.	2016	323	3000	21	0.5
D.	1344	216	1500	10.5	0.5
E.	1008	161	1000	7	0.5

6.05 PROPORTIONING OF CONCRETE MIXES:

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

6.05.2 MAXIMUM ALLOWABLE WATER CONTENT:

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

indicate that the quality of the concrete is satisfactory.

6.05.3 SLUMP TEST:

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

6.06 BATCHING AND MIXING:

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

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

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

** Nominal mixes and Quantities of Cement, Sand and aggregates as shown above are indicative only and Contractor need to submit concrete mix design to arrive at appropriate mix ratios.*

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

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

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

Fine Aggregate	1
Coarse Aggregate	2

6.06.3 MIXING UNIT:

- i) Operations:
Mixers shall not be charged in excess of noted capacity nor be operated in excess of noted speed. Excessive mixing requiring addition of water to preserve required consistency shall not be permitted. The entire batch shall be discharged before re-charging.

- ii) Mixing time shall be measured from the instant water is introduced into the mixer drum containing all solids. All mixing water shall be introduced before one-fourth of the mixing time has elapsed. Mixing time for mixers of one cubic meter or less shall be 2 minutes; for larger than one cubic meter capacity mixers time shall be increased 15 seconds for each additional half cubic meter or fraction thereof. If an air-entraining agent is used, additional mixing time shall be allowed such as to provide the specified air-content.

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

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

6.07 SAMPLES AND TESTING:

6.07.1 GENERAL:

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

6.07.2 CEMENT:

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

6.07.3 AGGREGATES:

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

6.07.4 REINFORCEMENT:

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

6.07.5 TESTING OF CONCRETE

- i) The Contractor shall provide for test purposes one set of six cubes taken for each class of concrete poured on each day. The Engineer or his Representative may, however, order for more cube tests if any irregularity is found in the concrete.
- ii) All test cubes shall be 150 x 150 x 150 mm (6"x6"x6") size.
- iii) All test cubes of the same set shall be made from the same batch of concrete.
- iv) Three cubes of the set shall be tested at 7-days and three shall be tested at 28 days or at such ages as directed by the Engineer or his Representative.
- v) All test specimens shall be made and cured in accordance with Pakistan Standard PS 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 occurring, shall be removed without any extra charges by the Contractor. All un-plastered concrete works is to be fair face, smooth, pleasing and to the entire satisfaction of the Engineer or his Representative.
- r. A float or screed is to be worked over the exposed surfaces of all concrete work on the flat or curve, so as to render the surfaces perfectly smooth, clear, and to the necessary slopes or falls or as required to receive the floor or roof finishes, according to the drawings, and as directed by the Engineer or his Representative without any extra charges by the Contractor.

6.09 PROTECTION AND CURING:

All exposed concrete shall be cured. Curing shall be accomplished by preventing loss of moisture, rapid temperature change and mechanical injury or injury from rain or flowing water for a period of at least ten (10) days. Curing shall be started as soon as the concrete has hardened sufficiently for the surface not to be marked. Curing shall be done either by continuous sprinkling of water on the surface or by covering with sand, hessian, canvas or other approved fabric mats, which shall be kept continually wet. If required and so directed by the Engineer or his Representative, formed surfaces with forms in position shall also be cured by keeping all forms continually wet. As an alternative, curing of concrete, on all

exposed surfaces which could not be kept covered, such as sides of the beams, under side of the slabs, may also be done by sealing concrete surfaces with curing compounds like "Paccacure" or equal so as to arrest loss of moisture from concrete, with approval of Engineer or his Representative. The Contractor shall take special care that curing of concrete is satisfactorily carried out and in accordance with methods specified herein and / or as instructed by the Engineer or his Representative. Any negligence in this regard may result in total rejection of such concrete works, which in the opinion of the Engineer or his Representative have not been adequately cured.

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

6.10 **FORMWORK:**

6.10.1 **General**

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

6.10.2 **Making Forms**

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

6.10.3 **Rigid with Allowance for Camber and Bulges**

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

6.10.4 **Exposed Surfaces Left Unplastered**

For concrete work covered in this contract where concrete Surface is to be exposed in the finished work and left unplastered, the form-work shall be smoothly faced by using plywood sheets or lining the shuttering with smooth steel sheet or non-absorbent material like formica sheets or in any manner as approved by the Engineer or his Representative, so as to make a

perfectly smooth surface of the finished concrete. Where any surface defects on the exposed concrete surfaces occur and which do not impair the structural performance, being in excess of the designed surfaces, and the architectural appearance of the work in the opinion of Engineer or his Representative, such defects may be removed by guniting and grinding with corborandum stone or in any other approved manner, at the cost of the Contractor, otherwise the whole or part of the work may have to be removed and remade good by the Contractor at his own cost. For precast concrete members the forms shall be rigid, exact, smooth and made of steel.

6.10.5 Materials and Labour

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

6.10.6 Form Work not to Interfere or Injure Work

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

6.10.7 Opening in Form-work

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

6.10.8 Openings and other details

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

6.10.9 Joints in Form-work

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

6.10.10 Treatment and Inspection of Forms

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

6.10.11 Striking Shuttering

No struts or timbering which serve the purpose of supporting the shuttering or centering shall be struck and removed without direct permission from the Engineer or his Authorized Representative in writing and the work of striking and removal after the receipt of such permission shall be conducted under the personal supervision of the competent foreman in the employment of the Contractor and the Contractor shall hold himself fully responsible for any consequences whatsoever. In all cases the Engineer or his Authorized Representative will direct and control the minimum period of time for which the forms, shuttering or centering shall remain in place before being struck; but, for the general guidance of the contractor, when normal Portland Cement has been used in the work, the following are to be considered as the minimum periods in days for the main classes of work:

Removal of Shuttering	10 °C (50°F)	20 °C (70°F)
Beams sides, walls & Columns (unloaded)	3	2
Slabs soffits (props left under)	9	6
Removal of props to slabs	18	14
Beams soffits (props left under)	18	12
Removal of props to beams, and shuttering under shells.	24	18

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

6.10.12 Injury or Damage.

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

6.10.13 Treatment after Removal of Forms.

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

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

6.11 FINISHING OF FORMED SURFACES

6.11.1 SPECIAL ARCHITECTURAL FINISHES

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

6.11.2 RUBBED FINISHES

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

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

- iii) Cork floated finish - Remove from at an early stage, within 2 to 3 days of placement where possible. Remove ties . Remove all burrs and fins. Mix one part Portland cement and one part fine sand with sufficient water to produce a stiff mortar. Dampen wall surface. Apply mortar with firm rubber float or with trowel filling all surface voids. Compress mortar into voids using a slow - speed grinder or stone. if the mortar surface dries too rapidly to permit proper compaction and finishing, apply a small texture with a cork float using a swirling motion.

6.11.3 UNSPECIFIED FINISH

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

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

6.11.4 RELATED UNFORMED SURFACE

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

6.12 CONSTRUCTION JOINTS:

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

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

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

6.13 CONCRETE FLOOR SLAB FINISHING:

6.13.1 GENERAL

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

6.13.2 MONOLITHIC FINISH

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

6.13.3 CONCRETE TOPPING

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

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

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

6.15 WATERPROOF CONCRETE:

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

6.16 CLEANING AND REMOVAL OF RUBBISH:

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

6.17 COORDINATION:

The Contractor shall provide chases and openings required for other sections of the work and

will co-operate and coordinate with other trades in placing their pipes, ducts, reglets and other built-in-items as the work proceeds.

6.18 EXTERNAL EXPOSED CONCRETE SURFACE:

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

6.19 PARTICULAR SPECIFICATIONS FOR CONCRETE

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

Concrete Mix:	1:1:2	-	4500 p.s.i. (Class 'A')
	1:1 1/2:3	-	3750 p.s.i. (Class 'B')
	1:2:4	-	3000 p.s.i. (Class 'C')
	1:3:6	-	1500 p.s.i. (Class 'D')
	1:4:8	-	1000 p.s.i. (Class 'E')

- e) All R.C.C. work shall be in 1:2:4 concrete mix unless otherwise indicated for a richer mix on the drawing or specified.
- f) All concrete is to be thoroughly vibrated mechanically:
 - i. Any concrete failing to meet the specified strength or not formed as shown on drawings, concrete out of alignment, concrete with surfaces beyond require tolerances or with defective surfaces which cannot be properly repaired or patched in the opinion of Engineer=s Representative shall be removed and replaced at Contractor=s expense. The Engineer=s Representative may reject any defective concrete and order it to be cut out in part or in whole and replaced at the Contractors expense. Only in case of minor surface defects the Engineer=s Representative may approve a surface treatment immediately after from removal.

- ii. All ties and bolt holes and all repairable defective area shall be patched immediately after removal.
 - iii. All honeycombed and other defective concrete shall be 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.
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- g) For heavy concrete members the form work is to be properly designed and approved by the Engineer.
 - h) Shuttering should not be struck earlier than the time specified unless otherwise approved by the Engineer.
 - i) 18 gauge G.I. binding wire to be used for securely binding the reinforcing bars to avoid dislocation or displacement during concreting.
 - j) Clear cover to main reinforcement in concrete members be as follows:-
 - i) For slabs, projections chajjas, fins, walls, staircases precast slabs. 3/4"
 - ii) For beams, Columns, all members of water tank on the side in contact with water. 1 1/2"
 - iii) For foundations, retaining walls and foundation beams. 2"
 - k) All the reinforcing bars are to be properly placed as shown on the working drawings. Steel chairs and concrete spacer blocks are to be used without any extra cost. Concrete spacer blocks are to be properly cured to avoid their damage during

concreting, thereby causing displacement of bars. Holes made by bolts etc. introduced for keeping the shuttering in tact should be properly treated after striking the shuttering. No such holes shall be allowed in walls of water retaining structures and earth retaining walls.

- l) All bent up bars in slabs are to be properly secured in position. Workers or trollies shall not be allowed in any case over the reinforcement mesh.
- m) Special care is to be taken to see that all expansion joints shown on the drawings are made in perfect straight line and treated as specified.
- n) Construction joints in beams and slabs shall be located at the centre of the span (such that a proper seat is formed for the next part to be cast); unless otherwise indicated on drawings or approved by the Engineer.
- o) DPC

The Concrete mix of DPC will be CC 1:2:4 as specified in this chapter.

To protect the dampness water proofing agent APudlo@ or any other water proofing agent as approved by the Engineer will be mixed in CC 1:2:4 @ the ratio of 5 lbs per bg of cement. The DPC will be cured for at least 10 days.

6.20 MEASUREMENT AND PAYMENT

All the concrete work shall be measured net as per execution at site in square or cubic meter 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 exclusive of all type of formwork, unless otherwise specified its erection and removal, all scaffolding and inclusive the all cost of mixing and batching plants, all T&P required for executing and placing the concrete work in position. Defective and honey-combed work will not be measured & paid and will be liable to be rejected and redone at contracts' cost.

SECTION - 7

7.0 STEEL REINFORCEMENT

7.01 SCOPE OF WORK:

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

7.02 MATERIALS:

A. Reinforcing steel to be new billet stock of mild steel (plain bar), hard grade (deformed bar) and Ribbed Tor steel as specified on the drawings and shall conform to British Standard Specifications or equivalent ASTM or Pakistan Standard.

B. The Contractor shall furnish to the Engineer's Representative Manufacturers' mills certificate to guarantee that steel meets the standard, specifications requirements and minimum certified yield stresses as follows:-

i) Mild Steel plain bars conforming to B.S.S. 15 or B.S.S. 4449 or PS-231-1962

- a) Tensile Strength - 438 to 517 N/Sq.mm (28 to 33 tons/Sq.in).
- b) Yield Strength - 250 N/Sq.mm (16 Tons/Sq.in)
- c) Elongation - 16% to 24% (av. 20%).

ii) Hard grade deformed bars conforming to ASTM, A-15-85 T. or PS-605-1962

- a) Tensile Strength - 560N/Sq.mm (35.7 Tons/Sq.in).
- b) Yield Strength - 350 N/Sq.mm(22.3 Tons/Sq.in).
- c) Elongation - 1100 000 x %

Tensile Strength

iii) Ribbed Tor steel conforming to B.S. 4461

- a) Tensile Strength - 490 N/Sq.mm(70,000 lbs/Sq.in).
- b) Yield Strength - 420 N/Sq.mm(60,000 lbs/Sq.in).
- c) Elongation - 14.5%

C. All steel to be true to the Standard Specifications with regard to bend ability specially the hard grade deformed bars under 19 mm (3/4") dia. shall be capable of being bent cold through 90 degree round a bar of four times its own diameter without fractures or injury of any kind. In case of deformed bars over 19 mm (3/4") dia. and under 28 mm (1-1/8")dia. round a bar of 6 times its own diameter.

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

7.03 TESTING:

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

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

7.04 **STORAGE**

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

7.05 **REINFORCEMENT CUTTING AND PLACING**

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

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

7.06 **LAPS AND SPLICES**

A. No splicing of bars shall be allowed at position other than shown on the drawings. All lap lengths shall be of the minimum sizes as indicated on the drawings and in no case shall lap length be less than 40 times the diameter of the bigger lapping bars for nominal M.S. bars. Hard grade bars and 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	2.045
1/2	0.668	1	2.670
5/8	1.043	1 1/8	3.380

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

SECTION - 8

8.0 FLOORING

8.01 Scope of Work:

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

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

8.03 Sub-Grade

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

8.04 Material:

i) Water

As specified in the relevant Section of the Specifications.

ii) Cement

a) The grey cement shall be ordinary normal setting cement of any brand complying in all respects with B.S. No.12.

b) White cement shall be complying in all respects with British Standard.

iii) Concreting:

All classes of concreting, "B", "C", "D" or "E" shall conform to their respective specifications as laid down in Section on "Concrete".

iv) Terrazzo Cast-in-Situ:

a) The Contractor shall lay 1/2" thick terrazzo topping with white cement or grey as specified and use marble chips No.1 to 4 of approved colour and quality and shall have an abrasive hardness of not less than 16 as determined by the test of wear resistance in national bureau of Standard Report BMS-98. The various sizes of chips shall conform to following:

Hips size no. -----	Passing through Screen inches -----	Retained in Screen inches -----
1	1/4	1/8
2	3/8	1/4
3	2	3/8
4	5/8	1/2

Chips shall be crushed so that all the dimensions are close to the limits of the

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

b) **Division Strips**

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

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

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

8.05 **Method of Application:**

i) Terrazzo Cast-in-Situ:

The terrazzo shall be machine grinded to a true even surface using a No.24 grit followed by a No.80 grit or finer abrasive stone. After the first grinding, the floors shall be thoroughly grouted with the same cement and colour composition as specified for the matrix of the terrazzo mix. The grout shall be of the consistency of thick cream, and shall be brushed over the floor to eliminate all cavities and thoroughly fill the surface for final grinding.

Not less than 72 hours after application, the grouting coat shall be removed by grinding. In the later stages of grinding the grit stones or other abrasive used in the grinding machine shall be of a grain or fineness that will give the surface a honed finish. Small areas, inaccessible portions and corners, which cannot be reached by the grinding machine, shall be ground and rubbed manually. After all grinding is completed the surface shall be polished to the entire satisfaction of Engineer or his Representative.

8.06 **Terrazzo Tile Flooring:**

a. General:

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

Tiles shall be cured for a minimum of seven days after casting Terrazzo tiles shall be made of grey cement, white cement or a combination of two and to match sample for

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

b) Chequerred Tiles:

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

c) Polishing & Finishing:

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

d) Curing:

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

e) Defects in Tiles and Tile laying:

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

f) Wall Bases: (Skirting)

Wall bases where specified in all areas with Terrazzo shall be as shown on drawings. All wall bases shall be made with cast-in-situ Terrazzo and the colour and size of marble chips used shall be such as to match with the terrazzo tile floors in each room or area. The minimum thickness of Terrazzo Matrix shall not be less than 1/2" thick. The height of wall bases shall be as shown on the finish schedule and the relevant

drawings. The surface shall be perfectly smooth and polished to a high degree of finish. The top edge of wall base shall be perfectly straight. Sample of each type of wall bases shall have to be approved by the Engineer or his Representative before commencement of work of wall bases by the Contractor. All applicable Specifications pertaining to Terrazzo cast-in-situ as laid in this Section shall be applicable for cast-in-situ wall bases. All tiles shall be laid before the work of wall bases is started and no cast-in-situ Terrazzo of wall bases shall be allowed on the flooring to overcome defect in tile laying.

8.07 Glazed Ceramic Tiles:

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

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

8.08 Marble Tiles in Flooring, Skirting, Dado and Steps

a. Material

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

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

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

Coloured marble shall be other than dark Green onyx marble.

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

b. Samples:

Samples of all types of marble for various areas shall be got approved by the Engineer or his Representative. Contractor shall have to match the marble brought to site as close to the approved samples as possible. The Engineer or his Representative has the right to reject marble pieces, which have unduly dark patches, or large unsightly veins which do not conform to the overall pattern and effect on the marble wall. Contractor shall also construct a Panel for each of the marble areas for the approval of the Engineer or his Representative before commencement of work. Engineer's discretion with regard to quality of marble shall be final and binding on the contractor.

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

Before cutting the marble pieces for each space the Contractor shall take actual physical measurements of the constructed portion so that even sized marble panels can be fitted at all places. Unequal panel sizes shall not be acceptable and shall be replaced at the cost of the Contractor. Joints between marble panels shall not be more than 1/16" and shall be filled in with white cement slurry as specified.
- g. Kitchen Cabinet Tops:
Specially selected marble slab shall be used for counter tops as specified and directed. These marble slabs shall first be approved by the Engineer or his Representative before actual cutting and installation of marble slabs is undertaken. Counter tops upto 3'- 0" length shall be one piece marble slabs and for over 3'-0" long counters two marble pieces shall be used to obtain the required length of the counter.

The cutting of holes in slab for sink and water taps where required shall be accurately done according to the actual size of sink and piping. The Contractor shall coordinate this work with the sanitary contractor. Marble slabs wherever indicated to be installed shall be mirror polished and finished before installation duly cut to the required size.

h. Finishing and Polishing:

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

8.09 **Cement Concrete Flooring:**

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

a. Composition of Concrete

Concrete shall be composed of Portland cement, sand, coarse aggregate and water, all well mixed and brought to the proper consistency. The Contractor shall mix the ingredients as shown on the drawings or as specified. The proportions of the various ingredients shall be determined from time to time during the progress of the work and tests shall be made of samples of the aggregates and the resulting concrete. The mix proportions and appropriate water cement ratio shall be determined on the basis of the production of concrete having required workability, density, impermeability, durability and required strength.

b. Mixing Concrete

The concrete ingredients shall be mixed in batch mixer for not less than 1 1/2 minutes after all ingredients, except the full amount of water, are in the mixer. The Engineer reserves the right to increase the mixing time when the charging and mixing operations fail to produce a concrete batch in which the ingredients are not uniformly distributed and the consistency is not uniform. The concrete shall be uniform in composition or consistency from batch to batch except when changes in composition or consistency are required. Water shall be added prior to, during and following the mixer charging operations. Excessive over-mixing requiring the addition of water to preserve the required concrete consistency shall not be permitted. The concrete ingredients shall be mixed by volume in boxes made for this purpose and approved by the Engineer.

c. Construction

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

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

After the C.C. bed has been cured, as directed by the Engineer, it shall be roughened and well watered before floor finishing is laid. The floor finish shall comprise of cement concrete 1:2:4 nominal mix or of such proportion as specified or directed by the Engineer and of the required thickness shall be laid in alternate panels with butt joints to the required thickness as shown on the drawings and/or as directed by the Engineer. The concrete after laying will be thoroughly rammed and mortar worked up to the top and smoothed with a steel trowel. The edge of each section into which the floor is divided should be defined by wooden screeds of the approved width and of a depth equal to the depth of floor concrete.

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

8.10 Measurement and Payment:

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

SECTION-9

9.0 STONE SOLING/PAVING

9.1 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.

9.2 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 to comply 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.

- O. 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.

Latex-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.

9.3 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.

9.4 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 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 -10

10.0 DEWATERING

PART 1 - GENERAL

10.1 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.

10.2 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 "Subdrainage" for permanent foundation wall, underfloor, and footing drainage.

10.3 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.

10.4 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.

10.5 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."

10.6 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

10.3.1 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.

10.3.2 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 piezometric 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.

10.4.2 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 piezometric 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.

10.4.3 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-11

11.0 MOISTURE PROTECTION & WATERPROOFING

PART 1 GENERAL

11.1 SUMMARY

11.1.1 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.

11.1.2 Appendix A forms part of this Specification.

11.1.3 Related Sections:

11.1.4 In addition to the general conditions of contract, the Contractor shall also refer to the following specifications:

Section 03300 : Cast-in-Place Concrete

11.2 REFERENCES

11.2.1 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.

11.2.2 Any differences between their requirements and this Specification shall be submitted to the Consultant for his ruling.

11.2.3 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

11.3 SUBMITTALS

11.3.1. 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.

11.3.2. 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.

11.3.3. 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.

- 11.3.4. 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.
- 11.3.5. 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.

11.4 QUALITY ASSURANCE

- 11.4.1 All substructure waterproofing systems shall be manufactured and supplied by a company certified to conform to the requirements of the quality standard ISO 9002.
- 11.4.2 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.
- 11.4.3 The Contractor shall operate a quality system for all stages of the work and all work shall be in accordance with that system.
- 11.4.4 The labor force shall be adequately trained and supervised to ensure that the quality system is adhered to during all stages of the work.
- 11.4.5 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.
- 11.4.6 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.
- 11.4.7 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.
- 11.4.8 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.

11.5 DELIVERY, STORAGE & HANDLING

- 11.5.1 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:

- 11.5.1.1. Name of Manufacturer and product (M)
- 11.5.1.2. Batch reference (M)
- 11.5.1.3. Date of manufacture (M)
- 11.5.1.4. Shelf-life and conditions of storage (M)
- 11.5.1.5. 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.

11.6 WARRANTY

- 11.6.1. 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.
- 11.6.2. 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.
- 11.6.3. 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

11.2.1 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.

Waterstops – Re-injectable hoses

Waterstops 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 waterstops are to be re-injectable hoses in accordance with the appendix to this specification. Waterbars are not permitted.

11.3.0 PART 3 EXECUTION

11.3.1 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.

11.3.2 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/mm² 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

Waterstops 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 waterstop 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 warranted 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 – Plasticised 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

11.4 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-12

12.0 PILING

12.1 DESCRIPTION

This work shall consist of performing all operations in connection with furnishing, driving, cutting off and load testing of piles to obtain the specified bearing value complete in place and strictly in accordance with these Specifications and as shown on the Drawings.

The Contractor shall furnish the precast piles in accordance with an itemized list, which will be provided by the Engineer, showing the number and lengths of all piles.

When cast-in-place concrete piles are specified on the Drawings, the Engineer will not furnish the Contractor, an itemized list showing the number and length of piles. When test piles and load tests are required in conformance with sub-items 7.3.8 and 7.3.9 respectively, the data obtained from such test loads will be used in conjunction with other available subsoil information to determine the number and lengths of piles to be furnished. The Engineer will not prepare the itemized list of piles for any portion of the foundation area until all loading tests representative of that portion have been completed.

The contractor shall provide an outline of his proposed method for constructing large diameter pile when submitting his tender; the proposed method of boring being stated.

Not less than two weeks before the contractor proposes to commence piling, detailed proposal for the piling shall be delivered to the Engineer. These proposals shall include full details of materials, equipment and method to be used in the construction of piles.

If it is proposed to use bentonite slurry, this shall also be described.

Work on piling shall not commence until the contractor's proposals have been approved by the Engineer and communicated to the contractor.

The requirements herein are minimum. Strict compliance with these requirements will not relieve the Contractor of the responsibility for adopting whatever additional provisions may be necessary to ensure the successful completion of the work.

The kind and type of piles shall be as shown on the Drawings and / or as specified. No alternate types or kinds of piling shall be used, except with the written approval of the Engineer each time.

12.2 MATERIAL REQUIREMENTS

12.2.1 Types of Piles

a) Untreated Timber Piles

Untreated timber piles shall conform to the requirements of AASHTO M 168.

b) Treated Timber Piles

Treated timber piles shall conform to the requirements of AASHTO M 133 and M 168. Unless otherwise called for on the drawings, the timber piles shall be treated with creosote according to the Standard AWPA PI of the American Wood-Preservers Association.

c) Reinforced Concrete Cylindrical Piles

Diameter of reinforced concrete piles shall be as shown on the and may or may not have permanent lining, as shown on the drawing. Reinforcing Steel shall conform to the

requirements under Item 404 –Steel Reinforcement. Concrete shall meet all the requirements for specified Class as provided under Item 401 and shall be of Class-D unless otherwise specified.

d) Structural Steel Piles

Structural steel piles shall be rolled steel sections of the type, weight and shape called for on the Drawings. The piles shall be structural steel conforming to the requirements of ASTM A 7 and ASTM A 36, except that steel produced by the Acid-Bessemer's process shall not be used. The steel piles shall be coated with red lead paint conforming to AASHTO M 72 as instructed by the Engineer, unless otherwise specified.

e) Precast Concrete Piles

Concrete for piles shall meet all the requirements for the specified class as provided under Item 401 - Concrete. The concrete shall be of Class-D1 unless otherwise specified.

Reinforcing Steel shall conform to the requirements under Item 404 –Steel Reinforcement.

Prestressed concrete piles shall conform to Item 405 – Prestressed Concrete Structures.

Precast piles shall be made in accordance with the Drawings, and reinforcement shall be placed accurately and secured rigidly in such manner as to ensure its proper location in the completed pile. The concrete cover as measured to the outside face of ties or spirals shall not be less than five (5) cm.

The piles shall be cast separately or, if alternate piles are cast in, a tier, and the intermediate piles shall not be cast until four (4) days after the adjacent piles have been poured. Piles cast in tiers shall be separated by tar paper or other suitable separating materials. The concrete in each pile shall be placed continuously. The completed piles shall be free from stone pockets, porous spots, or other defects, and shall be straight and true to the form specified. The forms shall be true to line and built of metal, plywood, or dressed lumber. A two and half (2.5) cm chamfer strip shall be formed on all edges. Forms shall be watertight and shall not be removed within twenty four (24) hours after the concrete is placed. Piles shall be given a surface finish according to Item 401.3.7 - Concrete Surface Finishing.

Piles shall be cured in accordance with the requirements of Item 401.3.8 (e) - Curing Precast Concrete Piles.

Piles shall not be moved until the tests indicate a compressive strength of eighty (80) percent of the design twenty eight (28) days compressive strength and they shall not be transported or driven until the tests indicate a compressive strength equal to the design twenty eight (28) days compressive strength.

When concrete piles are lifted or moved, they shall be supported at the points shown on the Drawings or, if not so shown, as instructed by the Engineer,

12.2.2 Pile Shoes

Pile shoes when required shall be of the design as called for on the Drawings or by the Engineer.

12.2.3 Pile Splices

Materials for pile splices, when splicing is allowed, shall be of the same quality and characteristics as the materials used for the pile itself and shall follow the requirements given on the Drawings unless otherwise directed by the Engineer.

12.3 CONSTRUCTION REQUIREMENTS

12.3.1 Driven Piles

a. Location and Site Preparation

Piles shall be used where indicated on the Drawings or as directed by the Engineer. All excavations for the foundation in which the piles are to be driven shall be completed before the driving is begun, unless otherwise specified or approved by the Engineer. After driving is completed, all loose and displaced materials shall be removed from around the piles by hand excavation, leaving clean solid surfaces to receive the concrete for foundations.

b. Determination of Pile Length

The criteria for pile length and bearing capacity will be determined by the Engineer according to the results from test piles and load tests. The piles shall be driven to such depths, that the bearing loads indicated on the Drawings are obtained.

The criterion for pile length may be one of the following:

- 1) Piles in sand and gravel shall be driven to a bearing value determined by use for the pile driving formula or as decided by the Engineer.
- 2) Piles in clay shall be driven to the depth ordered by the Engineer. However, the bearing value shall be controlled by the appropriate pile driving formula if called for by the Engineer.
- 3) Piles shall be driven to refusal on rock or hard layer when so ordered by the Engineer.

The contractor shall be responsible for correct pile lengths and bearing capacities according to the criteria given by the Engineer.

c. Pile Driving

All piles shall be driven accurately to the vertical or the batter as shown on the drawings. Each pile shall, after driving, be within fifteen (15) cm from the theoretical location underneath the pile cap or underneath the superstructure in the case of pile bents. All piles pushed up by the driving of adjacent piles or by any other cause shall be driven down again.

Piles shall be used only in places where a minimum penetration of three (3) meters in firm materials, or five (5) meters in soft materials, can be obtained. Where a soft stratum overlies a hard stratum, the piles shall penetrate to hard material up to a sufficient distance to fix the ends rigidly.

All pile driving equipment is subject to the Engineer's approval. The Contractor is responsible for sufficient weight and efficiency of the hammers to drive the piles down to the required depth and bearing capacity. Hammers shall be gravity hammers, single acting steam or pneumatic hammers or diesel hammers. Gravity hammers shall not weigh less than sixty (60) percent of the combined weight of the pile and driving head and not less than 2,000 Kg. The fall shall be adjusted so as to avoid injury to the pile and shall in no case exceed one (1) m for timber and steel piles and one half (0.5) M for concrete piles unless otherwise specified or approved by the Engineer. The plant and equipment furnished for steam hammers shall have sufficient capacity to maintain, under working conditions, the pressure at the hammer specified by the manufacturer. The boiler or pressure tank shall be equipped with an accurate pressure gauge and another gauge shall be supplied at the hammer intake to determine the drop in pressure between the gauge and the hammer. When diesel hammers are used, they shall be calibrated with test piling and / or test loads in accordance with Item 7.3.9.

Water jets shall be used only when permitted in writing by the Engineer. When water jets are used, the number of jets and the nozzle volume and pressure shall be sufficient to erode the material adjacent to the pile freely. The jets shall be shut off at a depth not less than three (3) M before final tip elevation is reached, and the piles driven solely by hammer to final penetration as required by the Engineer.

Piles shall be supported in line and position with leads while being driven. Pile driving leads shall be constructed in such a manner as to afford freedom of movement of the hammer, and shall be held in position by guys or steel braces to ensure rigid lateral support to the pile during driving. The leads shall be of sufficient length to make the use of a follower unnecessary, and shall be so designed as to permit proper placing of batter piles. The driving of piles with followers shall be avoided if practicable and shall be done only under written permission from the Engineer.

The method used in driving piles shall not subject them to excessive and undue abuse producing crushing and spilling of the concrete, injurious splitting and brooming of the wood, or deformation of the steel. Manipulation of piles to force them into proper position, if considered by the Engineer to be excessive, will not be permitted.

The pile tops shall be protected by driving heads, caps or cushions in accordance with the recommendations from the manufacturer of the pile hammer and to the satisfaction of the Engineer. The driving head shall be provided to maintain the axis of the pile in line with the axis of the hammer and provide a driving surface normal to the pile.

Full-length piles shall be used where practicable. Splicing of piles when permitted shall be in accordance with the provisions of Item 7.3.5. All piles shall be continuously driven unless otherwise allowed by the Engineer.

d. Pile Driving Formulae

Pile driving formulas may be used to determine the number of blows of hammer per unit of pile penetration needed to obtain the specified bearing capacity for piles driven in the sub-soils at the site. Piles shall be driven to a final resistance as indicated on the plans determined by the following formula:

For drop hammer

$$Q_{all} = WH / [6(S+2.5)]$$

For single-acting steam or air hammers and for diesel Hammers having unrestricted rebound of rams.

$$Q_{all} = WH / [6(S+0.25)]$$

(Use when driven weights are smaller than striking weights)

$$Q_{all} = WH / [6\{S+0.25(WD/WS)\}]$$

(Use when driven weights are larger than striking weights)

For double-acting steam or air hammers and diesel hammers having enclosed rams

$$Q_{all} = E / [6(S+2.5)]$$

(Use when driven weights are smaller than striking weights)

$$Q_{all} = E / [6\{S+0.25(WD/WS)\}]$$

(Use when driven weights are larger than striking weights)

In the above formulas:

Q_{all} = Allowable pile load in Kilograms.

W = Weight of striking parts of hammer in Kilograms.

H = The height of fall in centimetres for steam, and air hammers, and the observed average height of fall in centimetres, of blows used to determine penetration for diesel hammers with unrestricted rebound of hammer.

S = Average net penetration per blow in centimetres for the last 10 to 20 blows of steam, air, or diesel hammer; or for the last 15 centimetres of driving for a drop hammer.

E = The actual energy delivered by hammer per blow in Kilogram - centimetre.

WD = Driven weights in Kilograms

Note: Ratio of driven weights to striking weights should not exceed three.

WS = Weight of striking parts in Kilograms.

Modifications of basic pile driving formula:

- a) For piles driven to and seated in rock as high capacity. End-bearing piles: Drive to refusal (approximately four (4) to five (5) blows for the last 0.625 centimetres of

driving). Re-drive open end pipe piles repeatedly until resistance for refusal is reached within two and half (2.5) centimetres of additional penetration.

- b) For piles driven through stiff compressible materials unsuitable for pile bearing to an underlying bearing stratum:

Add blows attained before reaching bearing stratum to required blows attained in bearing stratum.

- c) For piles into limited thin bearing stratum:
Drive to predetermined tip elevation, and determine allowable load by load test.

The bearing power as determined by the appropriate formula in the foregoing list will be considered effective only when it is less than the crushing strength of the pile. Other recognized formula for determining pile-bearing power may be used when given in special specification. However, it shall be understood that the relative merits and reliability of any of the pile formula can be judged only on the basis of comparisons with the results of load tests.

12.3.2 Cast-in-Place Piles

Piles, cast-in-place, shall consist of one of the types either shown on the drawing and / or as specified. The term shaft wherever used in this section, shall mean either piles or shafts.

a. Working Drawings

At least 4 weeks before work on shafts is to begin, the Contractor shall submit to the Engineer for review and approval, an installation plan for the construction of drilled shafts. The submittal shall include the following:

- i. List of proposed equipment to be used including cranes, drills augers, bailing buckets, final cleaning equipment, descending equipment, slurry pumps, sampling equipment, tremies or concrete pumps, casing etc.
- ii. Details of overall construction operation sequence and the sequence of shaft construction in bents or groups.
- iii. Details of shaft excavation methods.
- iv. When slurry is required, details of the method proposed to mix, circulate and descend slurry.
- v. Details of methods to clean the shaft excavation.
- vi. Details of reinforcement placement including support and centralization methods.
- vii. Details of concrete placement, curing and protection.
- viii. Details of any required load tests.
- ix. Other information shown on the plans or requested by the Engineer.

The Contractor shall not start the construction of drilled shafts for which working drawings are required until such drawings have been approved by the Engineer. Such approval will not relieve the Contractor of responsibility for results obtained by use of these drawings or any of his other responsibilities under the contract.

b. Fabrication of Permanent Lining

If shown on the drawings, the contractor shall provide a permanent lining suitable formed of ten (10) mm minimum thickness mild steel plate complying with B.S. 4360. The plates shall be cut and rolled to the inner diameter not less than the nominal diameter of the pile or such larger diameter as to allow the requisite pile diameter hole in the unlined length of pile. The rolled plates shall be connected by full penetration butt welds generally complying with B.S. 5133. No more than three (3) longitudinal seam welds shall be employed in any one cross-section and such welds shall be staggered in position in the cross-section between one length and the next. The dimensional accuracy of the lining shall be as stated on the drawings.

In the case of steel shells or pipes, after being driven and prior to placing reinforcing steel and concrete therein, the steel shells or pipes shall be examined for collapse or reduced diameter at any point. Any shell or pipe, which is improperly driven or broken or shows partial collapse to such an extent as to materially decrease its bearing value, will be rejected. Rejected shells or pipes shall be removed and replaced, or a new shell or pipe shall be driven adjacent to the rejected one. Rejected shells or pipes, which cannot be removed, shall be filled with lean concrete by the Contractor at his expense.

c. Piles Cast in Drill-Borehole

i) Boring Procedure

The method and equipment of boring generally either the dry method, wet method, temporary casing method or permanent casing method shall be one, which maintains stability, verticality or batter (as shown on the Drawing) of the wall and base of borehole by the use of temporary casing and / or bentonite slurry.

All holes shall be drilled to the tip elevation shown on the Drawings, unless otherwise specified or approved by the Engineer. Rejected boreholes shall be filled with lean concrete by contractor at his expense.

The method shall be such that allows soil samples to be taken and in site soil test, (if required) to be carried out during or ahead of boring operations. The method / procedure used in execution of borehole and other operations shall not be such as to cause vibrations resulting in damage to completed or partially completed piles or to adjacent structures, services or other property. The procedure shall not be such as to cause harmful loosening or softening of soil outside the pile that has to be filled with concrete. The equipment used for execution of borehole shall be adequate to ensure that each pile penetrates to the required founding level.

Use of Casing

Suitable casings shall be furnished and placed when required to prevent caving of the hole before concrete is poured. Casing, if used in drilling operations shall be removed from the hole as concrete is poured unless otherwise specified. The bottom of the casing shall be maintained not less than fifty (50) cm below the top of the concrete during withdrawal and pouring operations unless otherwise permitted by the Engineer. Separation of the concrete during withdrawal operations shall be avoided.

Reinforcement

Reinforcement if called for shall conform to the requirements under item 404. The steel shells/pipes shall be of sufficient strength and rigidity to permit driving to the required bearing value or depth without injury. The steel may be either cylindrical or tapered, step tapered or a combination, plain, circular or fluted. All types shall conform to the corresponding ASTM standards. The minimum average tensile strength of steel shall be 3500 Kg/sq.cm (50,000 psi).

When called for on the Drawings or by the Engineer, the steel shells/pipes shall be factory coated on both interior or exterior surfaces by red lead paint conforming to AASHTO M-72 or as stated in the special specifications. The coating shall not cause any hindrance while assembling the pile section during welding operations.

ii) Temporary Casing Method

The temporary casing of appropriate diameter for locating the pile and piloting the borehole shall be pitched at the exact locations as given on the drawings to ensure that the casing when sunk is within the specified tolerances. The casing shall be sunk to sufficient depth by approved methods. The depth shall be at least sufficient to prevent the ingress of alluvium or other loose materials into the bore when executed below the bottom level of the casing. In addition, the depth shall be such as the contractor considers necessary for the stability of the casing and / or temporary works system during construction in general and for the following conditions and operations in particular during ail conditions of river current which may occur during the period of works:

- a) Open temporary casing to ensure against blow-in of soil.
- b) Concreting of the pile, until temporary casing is extracted.

Safety of Casing

The contractor shall take all such measures and provide such strengthening and bracing as is necessary and to the approval of the engineer to ensure that the temporary casing is not disturbed, overturned, over-stressed or under-eroded in any condition of temporary casing shall be such that it will not disturb the freshly cast concrete and / or permanent lining and / or

reinforcement.

Where the use of temporary casing is approved for the purpose of maintaining the stability and over-rapid withdrawal of the boring tools which could lead to excessive removal of soil and water and disturbance of the surrounding ground and when boring through any permeable stratum (including silt) the water level in the boring shall be maintained between one (1) meter and two (2) meters above the external water level, unless the engineer directs' otherwise.

The temporary casings shall be free from significant distortion and of uniform cross sections throughout each continuous length. During concreting they shall be free from encrusted concrete or any internal projections, which might prevent the proper formation of the piles.

Permanent Casing Method

The permanent casing construction method shall be used when required by the plans. This method consists of driving or drilling a casing to a prescribed depth before excavation begins. If full penetration cannot be attained, the Engineer may require either excavation of material within the embedded portion of the casing or excavation of a pilot hole ahead of the casing until the casing reaches the desired penetration. In some cases, over-reaming to the outside diameter of the casing may be required in order to advance the casing.

The casing shall be continuous between the elevations shown on the plans. Unless shown on the plans, the use of temporary casing in lieu of or in addition to the permanent casing shall not be used except when authorized by the Engineer in writing.

After the installation of the casing and the excavation of the shaft are complete, the casing shall be cut-off at the prescribed elevation and the reinforcing steel and shaft concrete placed within the portion of the casing left in place.

iii) Bentonite Slurry

Where the use of bentonite slurry is approved for the purpose of maintaining the stability of the walls and base of bore, the contractor's proposals in accordance with (sub clause vi) hereof shall include details of the slurry.

These shall include inter-alia:

- a) The source of the bentonite
- b) The constitution of the slurry
- c) Specific gravity, viscosity, sheer strength and PH value of slurry.
- d) The methods of mixing, storing, placing, removal and re-circulating the slurry, and
- e) The provision of stand-by equipment.

Tests shall be carried out to ensure that the proposed constitution of the slurry

is compatible with the ground water. Proposals for the constitution and physical properties of the slurry shall include average, minimum and maximum values. The specific gravity of the slurry shall not be less than one and three hundredth (1.03) in any case at any time. The contractor shall use additives where necessary to ensure the satisfactory functioning of the slurry.

Manufacturers Certificate

A manufacturer's certificate showing the properties of the bentonite powder shall be delivered to the Engineer for each consignment delivered to site. Independent tests shall be carried out at laboratory approved by the Engineer on samples of bentonite frequently.

Tests on Bentonite Slurry

The Contractor shall carry out tests during the course of the piling to check the physical properties of the bentonite slurry in the works. These tests shall include inter-alia, density, viscosity, shear strength and PH tests. The test apparatus and test methods shall be those given in "Recommended Practice" Standard by American Petroleum Institute, New York City, 1957, reference API RP29, Section- 1, 11 and V1.

The frequency of tests shall be that which the Contractor considers necessary to ensure that the bentonite slurry is in accordance with his proposals and as such other times as the Engineer may direct.

Should the physical properties of any bentonite slurry deviate outside the agreed limits, such slurry shall be replaced, irrespective of the number of time it has been used by new bentonite slurry of correct physical properties.

Adequate time shall be allowed for proper hydration to take place, consistent with the method of mixing, before using slurry in the works.

Precautions

The Contractor shall control the bentonite slurry so that it does not cause a nuisance either on the site or adjacent waterways or other areas. After use it shall be disposed in a manner to the approval of the Engineer.

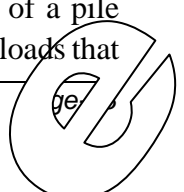
The level of the slurry in the bentonite shall be maintained so that the internal fluid pressure always exceeds the external water pressure.

If chiselling is used when boring through hard strata or to overcome obstructions, the stability of the excavation shall be maintained by methods acceptable to the Engineer.

iv) Excavation from Boreholes

The soil and debris from inside the pile boreholes shall be removed by bucket, augur or circulating bentonite slurry provided that no jetting at the foot of the borehole shall be permitted. Methods of excavation, which in the opinion of the Engineer may damage the permanent lining of the pile, shall not be employed.

Should the excavation reveal any soil stratum below the bottom of a pile which, in the opinion of the Engineer, unsuitable for supporting the loads that



will be imposed on it, the Contractor shall remove all such sub soil stratum to the satisfaction of the Engineer and shall lengthen the pile if necessary and cost of any such lengthening shall be paid as per this contract.

Excavation shall be carried out as rapidly as possible in order to reduce to a minimum the time in which any strata are exposed to the atmosphere, bentonite slurry or water. In any case, a pile shall not remain unfilled with concrete for period exceeding eighteen (18) hours after completion of borehole. 407-10 The materials from pile excavation shall be disposed so that the same does not interfere with any part of the permanent works of this project, in neat and workmanlike manner.

v) Samples and Tests

The Contractor shall take soil samples as given below or as directed by the Engineer to the designed tip elevation of the pile and shall carry out insitu Standard Penetration tests within, and ahead of borehole on the line of vertical axis of the pile at these locations after one and half (1.5) meter interval. The costs of tests and collection of samples shall be deemed to be included in the unit rates quoted by the Contractor. Each disturbed sample shall, as far as possible, be truly representative of the grading of insitu soil at the point from which it is taken, without contamination by other material. It shall be approximately five (5) Kg in weight and shall be placed in a strong airtight container immediately after its removal from the sampler. The container shall be sealed as soon as the sample has been placed in and shall be taken to the site laboratory for grading, moisture content and Atterberg Limits tests.

The apparatus and procedure for the Standard Penetration Test shall be in accordance with the provisions of ASTM D 1586 Penetration Test and split-barrel sampling of soils and / or ASTM D 1587 thin-walled sampling of soils, (except insofar as any such provisions may conflict with other requirements of the contract).

vi) Limitations of Boring Sequence

Piles shall be constructed in such a manner and sequence as to ensure that no damage is sustained by piles already constructed in adjacent positions. The Contractor shall submit to the Engineer for his approval a programme showing sequence of construction of various piles.

vii) Tolerances

Following construction tolerances shall maintained

- a) The drilled shaft shall be within 3 inches of the plan position in the horizontal plane at the plan elevation for the top of the shaft.
- b) The vertical alignment of the shaft excavation shall not vary from the plan alignment by more than 1/4 inch per foot of depth.
- c) After all the shaft concrete is placed, the top of the reinforcing steel cage shall be no more than 6 inches above and no more than 3 inches below plan position.
- d) When casing is used, its outside diameter shall not be less than the shaft diameter shown on the plans. When casing is not used, the minimum diameter of the drilled shaft shall be the diameter shown on the plans for diameters 24 inches or less, and not more than 1 inch less than the diameter shown on the plans for diameters greater than 24 inches.
- e) The bearing area of bells shall be excavated to the plan bearing area as a minimum. All other plan dimensions shown for the bells may be varied, when approved, to accommodate the equipment used.
- f) The top elevation of the shaft shall be within 1 inch of the plan top of shaft elevation.
- g) The bottom of the shaft excavation shall be normal to the axis of the shaft within 3/4 inch per foot of shaft diameter.

viii) Inspection

After the borehole has reached its final stipulated positions, after the samples have been taken out, as required by the Engineer and the borehole has been completely cleaned of all loose matter and otherwise made ready to receive the reinforcement and thereafter the concrete, the contractor shall so inform the Engineer.

The Engineer shall inspect the soil samples and test results thereon, check the elevation of the bottom of the borehole and the amount and direction, if any, by which the top of the casing is out of position, or out-of-plumb having satisfied himself on these and on any other points which he may consider relevant shall sign permission authorizing the Contractor to proceed with the placing of the reinforcement. The Contractor shall under no circumstances proceed with the placing of reinforcement or with the subsequent concreting without having first obtained the authority signed separately for each and every borehole by the Engineer.

ix) Pile Reinforcement

The reinforcement for each pile shall be assembled and securely tied by means of binding wire and by welded reinforcement rings of twenty five (25) mm diameter bar as shown on the drawings, in such a manner as to form a rigid cage.

The required concrete cover to the reinforcement shall be maintained by suitable spacers securely attached to the reinforcement and of sufficient strength to resist damage during handling of the reinforcement cage into the pile. The distance between the spacers shall be such that the required cover is maintained throughout and that there is no displacement of the reinforcement cage in the course of the concreting operation.

Should the Contractor prefer to lower the reinforcement cage assembly into the borehole in sections, he may do so provided the same lapping requirements as for assembly on the ground are followed, namely, the longitudinal reinforcement shall be lapped as shown on the drawings and the spiral reinforcement shall be doubled over the lap zones. Spacers maintaining concrete cover shall be located immediately below and above the laps at 4 points spaced around the cage.

12.3.3 Concreting, of Piles

In general, item 401 of the General Specifications shall be followed, however, the following particular requirements shall be observed.

i) **Materials**

Compressive strength of concrete in piles shall be of class A3 as prescribed in Item 401, except if otherwise indicated.

Suitable retarder, plasticiser may be added as approved by the Engineer.

The Contractor shall submit the detailed proposed additive for approval, which shall be approved after laboratory trial mix results. The dosing of retarders shall ensure initial setting time of not less than five (5) hours corresponding to the ambient temperature at which the concreting is proposed to be carried out.

ii) **Commencement of Concreting**

Prior to placing any concrete:

- a. Any heavy contaminated bentonite slurry, which could impair the free flow of concrete from the tremies pipe, shall be removed.
- b. Any loose or soft material/water soil shall be removed from the bottom of the bore by methods acceptable to the Engineer.

The Contractor shall not proceed with the concreting of the pile until the Engineer gives specific permit to do so after satisfying himself of the:

- Adequacy of the Contractors equipment and arrangement.
- Proficiency of his personnel.
- Cleanliness of the borehole.

Contractor shall have a suitable lighting arrangements at all times for inspecting the entire length of the shells, pipe or hole before placing the reinforcing steel or concrete.

Prior to the concreting a pile, sample of slurry shall be taken from the base of the borehole using an approved sampling device and its specific gravity shall be determined.

iii) Placing of Concrete

The tremies shall be of not less than two hundred and fifty (250) mm diameter made of water-tight construction. The means of supporting the tremies shall be such as to permit the free movement of the discharge end in the concrete in the pile. The tremies pipe shall be fitted with travelling plug, which shall be placed at the top of the pipe before charging the tremies pipe with concrete as barrier between the concrete and water or bentonite slurry, so as to prevent water or bentonite slurry entering the tube and mixing with the concrete. The tremies shall be carefully lowered into the borehole so that the end of the tube shall rest at about one hundred and fifty (150) mm above the bottom of the borehole, with reinforcement in the borehole, and the hopper end of the tremies tube shall be filled with concrete as aforesaid. It shall be slightly raised so that when the concrete reaches the bottom it flows out of the lower end of the tube, and fills the bottom of the borehole. Thereafter, the rate of withdrawal of the tremies shall be gradual so as to ensure the end of the tremies pipe is always one and half (1.5) meters below the top of the concrete in the borehole. An allowance shall be made for the top five hundred (500) mm of concrete in borehole during concreting being unsatisfactory. When the next batch is placed in the hopper the tremies shall be slightly raised but not out of the concrete at the bottom, until the batch discharges to the bottom of the upper. This operation shall be controlled by calculating the volume of concrete required to fill one linear meter of pile and then by measuring the rate of withdrawal of the tube corresponding to the volume of the batch in the hopper. The flow shall then be retarded by lowering the tube. The depth of the concrete in borehole shall be measured at intervals to keep a constant check that the tremies pipe bottom is immersed in concrete.

Concreting in each pile shall be carried out in a continuous operation without stoppages until the pile has been completed.

If the bottom of the tremies pipe ceases to be immersed in the body of the concrete in the pile and the seal is broken, concreting shall cease immediately and such remedial measures as the Engineer may accept or direct shall be carried out. The Contractor shall take precautions to ensure that the concrete is free of voids and shall prevent the entry of water and/or collapse of soil into concrete. If any soil or other deleterious or extraneous materials fall into any pile excavation prior to or during concreting, it shall be removed immediately.

Concreting shall continue until the concrete has reached an elevation five hundred (500) mm higher than the designated pile cut off level shown on the drawings, or as otherwise directed by the Engineer.

The concrete shall be placed in one continuous operation from tip of cut-off elevation and shall be carried out in such a manner as to avoid segregation. The method of placing the concrete and the consistency (slump) shall conform to the requirements of Item 401 or to the satisfaction of the Engineer.

No shell or pipe shall be filled with concrete until all adjacent shells, pipes or piles within a radius of three (3) M or five (5) times the pile diameter, whichever is greater, have been driven to the required resistance.

After a shell or pipe has been filled with concrete, no pile shall be driven within seven (7) meters thereof until at least seven (7) days have elapsed.

12.3.4 Withdrawal of Temporary Casing

If the method of construction involves partial withdrawal of temporary casing as concreting proceeds, a sufficient head of concrete shall be maintained above the bottom of the temporary casing to ensure that no voids are formed within the pile and to prevent the entry of ground water and to prevent the collapse of soil into the concrete.

If such entry or collapse should occur, the temporary casing shall be re-driven before the concrete has set and all defective concrete shall be removed or the construction of the pile shall be abandoned, in which case the provision of the clause herein which refers to "Defective Piles" shall apply.

The withdrawal of the temporary casing shall be carried out before the adjacent concrete has taken its initial set.

The method and timing of withdrawal must be such as to ensure that the space between the pile and the surrounding ground shall be filled with concrete.

12.3.5 Splicing of Piles

Splicing of piles, when permitted by the Engineer, shall be made as shown on the Drawings or as specified with materials having same quality and characteristic as for materials used for the pile itself.

i) Precast Concrete Piles

For precast concrete piles, the splicing shall be done according to one of the following methods unless otherwise specified.

- 1) Using prefabricated joints mounted in the forms and cast together with the pile sections and joined together as specified by the manufacturer and approved by the Engineer. The joints shall be of the design and type as shown on the Drawings.
- 2) By cutting away the concrete at the end of the pile, leaving the reinforcement steel exposed for a length of forty (40) times steel bar diameters. The final cut of the concrete shall be perpendicular to the axis of the pile. Reinforcement of the same size as that used in the pile shall be welded to the projecting steel and the necessary formwork shall be placed, care being taken to prevent leakage along the pile. The concrete shall be of the same quality as that used

in the pile. Just prior to placing concrete, the top of the pile shall be wetted thoroughly and covered with a thin coating of neat cement. or other suitable bonding material to the satisfaction of the Engineer. The forms shall remain in place not less than seven (7) days. The pile shall not be driven until the 28-days design strength is reached.

- 3) Any other method shown on the Drawings or approved by the Engineer.

ii) Steel Piles, Shells or Pipes

For steel piles shells and pipe, the splicing shall be as under:

If the ordered length of the steel pile, pipe, or shell is insufficient to obtain the specified bearing value, an extension of same cross-section shall be spliced to it. Unless otherwise shown on the Drawings, splices shall be made by butt-welding the entire cross-section to form an integral pile using the electric arc method. The sections connected shall be properly aligned so that the axis of the pile will be straight. Piles bent or otherwise injured shall be rejected.

12.3.6 Cutting of Piles

Tops of piles shall be embedded in the concrete footing as shown on the drawings.

Concrete piles shall, when approved by the Engineer, be cut off at such a level that at least five (5) cm of undamaged pile can be embedded in the structure above. If a pile is damaged below this level, the Contractor shall repair the pile to the satisfaction of the Engineer. The longitudinal reinforcement of the piles shall be embedded in the structure above to a length equal to at least (40) times the diameter of the main reinforcing bars. The distance from the side of any pile to the nearest edge of the footing shall not be less than twenty (20) cm.

When the cut-off elevation for a precast concrete pile, steel shell, pipe or for a cast-in-place concrete pile is below the elevation of the bottom of the pile cap, the pile may be built up from the butt of the pile to the elevation of the bottom of the cap by means of a reinforced concrete construction according to Item 401, if approved by the Engineer.

Cut-offs of structural steel piles shall be made at right angles to the axis of the pile. The cuts shall be made in clean, straight lines and any irregularity due to cutting or burning shall be levelled off with deposits of weld metal prior to placing bearing caps.

12.3.7 Defective Piles

Any pile delivered with defects such as damaged during driving or cast insitu, placed out of its proper location, incapable or partially capable of permanently carrying the load which it is intended to carry, driven below the elevation fixed by the Drawing or by the Engineer, due to the immature setting of the concrete in the pile or due to caving collapse of the borehole fully or partially, or due to any cause of which Engineer shall be sole judge to determine shall be corrected at the contractor's expense by one of the following methods approved by the Engineer:-

- a) The pile shall be withdrawn and replaced by a new and when necessary, by longer pile.
- b) A second pile shall be driven or cast adjacent to the defective pile.

- c) The pile shall be spliced or built up as otherwise provided herein or the underside of the footing lowered to properly imbed the pile.

The contractor shall undertake such additional tests/works as the Engineer may specify to provide additional foundations to supplement the defective piles and so modify the structure to be supported as to ensure that load will be transferred safely to the additional foundations of existing pile. The contractor shall be responsible for the cost of such additional functions and tests and / or of the extra work carried out in such modification to the structure.

A concrete pile shall be considered defective if it has a visible crack or cracks, extending around the four sides of the pile, or any defect, which, in the opinion of the Engineer affects the strength, or life of the pile.

When a new pile is driven or cast to replace a rejected one, the Contractor, at his expense, shall enlarge the footing as deemed necessary by the Engineer.

12.3.8 Test Piles

Test piles which are shown on the Drawings or ordered by the Engineer shall conform to the requirements for piling as specified and shall be so located that they may be cut-off and become a part of the completed structure.

Test piles to be load tested in accordance with Item 7.3.9 shall be driven in locations determined by the Engineer. These piles shall not be utilized in the structure unless otherwise directed.

Test piles driven by the Contractor for his own use in determining the lengths of piles to be furnished may be so located and they may be cut-off and become a part of the completed structure provided that such test piles conform to the requirement for piling in these specifications.

Any pile, which after serving its purpose as a test pile is found unsatisfactory for utilization in the structure, shall be removed if so ordered by the Engineer, or if approved by the Engineer it shall be cut-off below the ground line and footings, but such approval does not in any way relieve the Contractor of his responsibilities.

Test piles shall generally be driven with the same equipment that is to be used for driving foundation piles. When required, the ground shall be excavated to the elevation of the bottom of the footing before the test pile is driven.

When diesel hammers are to be used for driving end bearing piles, or friction piles where the bearing capacity shall be checked by pile driving formulas, the Contractor shall in advance carry out test piling or load tests to determine the energy developed by the hammer. The Contractor may elect one of the following methods for the calibration:

- a) By test driving the same type of piles successively with diesel hammer and gravity or single acting hammer, or by driving two different piles with diesel hammer and gravity or single acting hammer respectively.

- b) By driving test piles to a depth determined by the Engineer and load testing the same piles in accordance with Item 7.3.9.
- c) Calibration tests shall be made at least at two different sites until the results are satisfactory to the Engineer.

Calibration of diesel hammers may not be required if the hammer has been previously calibrated under soil conditions and for the same size and type of pile, provided that the calibration data is accepted by the Engineer.

12.3.9 Load Tests

A load test shall consist of the application of a load equal to a minimum of 2 times the specified bearing capacity or as otherwise provided for herein or as directed by the Engineer. Load tests shall be made where specified and / or where called for by the Engineer. Unless otherwise permitted by the Engineer, the load tests shall be completed before the remaining piles in the same structure are driven or cast.

Load tests shall be made by methods approved by the Engineer. The Contractor shall submit to the Engineer detailed plans of the loading system and apparatus he intends to use at least three (3) weeks in advance. The apparatus shall be so constructed as to allow the various increments of the load to be placed gradually without causing vibration to the test piles. Tension anchor piles if used, shall be of a design and driven to a depth satisfactory to the Engineer. Steel shells or piles whose walls are not of adequate strength to withstand the test loading when empty, shall have the required reinforcement and concrete placed before loading. The load test shall not be started until the concrete has attained a minimum compressive strength of ninety five (95) percent of the design twenty eight (28) days compressive strength. If he so elects, the Contractor may use high early strength cement in the concrete of the load test pile and the tension piles.

Suitable approved apparatus for determining accurately the load on the pile and the settlement of the pile under each increment of load shall be supplied by the Contractor. The apparatus shall have a working capacity of three times the design load for the pile being tested. Reference points for measurement of pile. Settlement shall be sufficiently away from the test pile to preclude all possibility of disturbance.

All pile load settlements shall be measured by adequate devices, such as gauges, and shall be checked by means of an Engineer's level. Increment of deflection shall be read just after each load increment is applied and at 15minute intervals thereafter. The safe allowable load shall be considered as 50 percent of the load which, continuous application, has caused not more than 6 mm of permanent settlement, measured at the top of the pile.

The first load to be applied to the test pile shall be 50%, of the pile design load and the first increment shall be up to the pile design load by applying additional loads in three equal increments. A minimum period of 2 hours shall intervene between the applications of each increment; except that no increment shall be added until a settlement of less than one tenth (0.1) mm is observed for a 157minute interval under the previously applied increment. If there is a question as to whether the test pile will support the test load, the load increments shall be reduced by fifty (50) percent, at the direction of the Engineer, in order that a more

closely controlled failure curve may be plotted. The full test load shall remain on the test pile not less than forty eight (48) hours. The full test load shall then be removed and the permanent settlement read.

When directed by the Engineer load tests shall then be continued beyond the double design load in 10-ton increments to failure or a maximum of three (3) times the design load.

The pile may be considered to have failed when the total permanent settlement exceeds (6) mm.

12.3.10 Backfilling Empty Boring

When each pile has been cast, the empty bores remaining shall not be back-filled unless required by the construction procedures and activities following the completion of piling work.

12.3.11 Pile Records

The Contractor shall keep records of the piles driven or installed. A copy of the record shall be given to the Engineer within two (2) days after each pile is driven. The record form to be used shall be approved by the Engineer. The pile records shall give full information on the following:-

Driven Piles	Cast-in-Place Piles
Pile type and dimension	Pile type and nominal dimensions
Driving equipment, type, weight, reach-and efficiency of hammer etc.	Date of boring commenced, level reached each day and date of casting.
Date of casting (for concrete piles) and driving	Soil samples taken from pile boring operation and soil test results.
Details of Reinforcement	Strata and ground water encountered with levels, description shall be in accordance with BSCP 2001.
Test results on concrete	Length of finished pile and tip elevation.
Depth driven & trip elevation	Dia of borehole
For gravity and single-acting hammers : the height of drop	Elevation of the bottom of borehole.
For double acting hammers : the frequency of blows	Date of placing concrete; theoretical and actual quantities of concrete used in pile.
Final set for last 20 blows for every 10 piles and when the Engineer so requires the penetration along the whole driven depth shall be recorded.	Length and diameter of temporary casing and permanent lining and the elevation of the tip of temporary casing and of permanent lining.
Details of any interruption in driving.	Details of Reinforcement.
Level of pile top immediately after driving, and the level when all piles in the group area driven	Details of penetration during boring operation or driving of steel shell (driving records as for driven piles),
Details of re-driving	Quality, consistency and other test results on concrete.
Any other relevant information	Time interval between boring or driving and concreting. Any other relevant information.

12.3.12 Confirmatory Boring

The contractor shall carry out confirmatory boring at bridge site at locations indicated by the Engineer.

Boring shall be carried out with ASTM D 1586 Penetration Test and Split barrel sampling of soil. Additionally, when undisturbed sampling is required, the procedure shall conform to ASTM D 1587, Thin Walled sampling of soil.

Diameter of boreholes shall be twenty (20) centimetres cased throughout its length and shall be down to the designated elevation. In-situ standard penetration test shall be carried out at one and half (1.5) meters interval from designated top elevation to the bottom of the hole. Undisturbed samples shall be taken from substratum. If clay is encountered, undisturbed samples will be taken at interval of three (3) meters.

At least two borings are required at each bridge site. The boring shall extend to a depth of at least three (3) meters below the pile tip elevation as indicated in the drawings.

12.4 MEASUREMENT AND PAYMENT

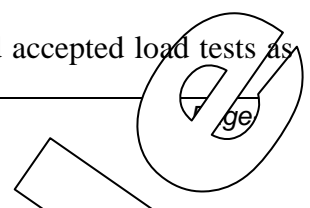
12.4.1 Measurement

The quantities to be paid for shall be the number of linear meters of piles, completed and accepted, measured from the pile tip elevation to the bottom of pile caps, footings or bottom of concrete superstructure in the case of pile bents. In case the bottom of pile caps or footing or bottom of pile bent is above N.S.L and method of fabrication is such that the work above N.S.L is done as that of column, the same shall be measured as concrete and steel for column. No allowance shall be made for cut-offs or the required length of concrete or reinforcement steel placed into the concrete structure as called for on the drawings. Any additional pile lengths that may be necessary to suit the Contractor's method of operation or for any other reason shall not be included in the measurements.

For-cast-in-situ piles, helical and vertical steel will be measured in Tons. Pile casing where ever provided will be measured in linear meters. Measurement shall be made for permanently placed pile casing s shown on drawings. If the Contractor likes to use temporary casing for the convenience of preparing of boreholes, the same shall not be measured whether left at site or withdrawn after completing the boreholes.

Test piles when ordered by the Engineer, whether or not utilized as service piles in the structure shall not be included in the above measurements. Accepted test piles will be measured separately as the number of linear meters.

- Pile shoes when called for on the Drawings or by the Engineer shall be measured by the number accepted in place.
- Splicing of piles if not shown on the drawings will not be allowed except that the length of reinforcement is to exceed 12 meter in which case the splicing will not be measured or paid directly but the cost thereof shall be considered as included in the unit price for piling.
- Load tests shall be counted as the number of complete and accepted load tests as



described in Item 7.3.9.

- Concrete footings or pile caps shall be measured and paid for as provided under Item 400 "Structures". Additional quantities of concrete, reinforcement and formwork caused by incorrect location of piles or additional piles necessary to replace defective piles shall be to the Contractor's expense.

12.4.2 Payment

- The quantities of piling left in place in the accepted structure measured as provided above shall be paid for at the contract unit price per linear meter of piles of the different types listed below and shown in the Bill of Quantities.
- For cost-in-situ piles, rate per linear meter will include all items except for helical and vertical reinforcement, which will be paid as per steel reinforcement
- For pre cast piles, the cast of steel shall be included in the rate per linear meter.

Pile casing will be paid at the contract unit price per linear meter for pile casing.

Test piles whether or not used in the completed structure or constructed adjacent to structure as per requirements of the contract document shall be paid for at the contract unit price for pile installation.

Load tests shall be paid for at the contract unit price for pile load Tests, either one or half (1.5) times or two (2) times the design load. The unit price for test loading to three (3) times the design load shall include the total load test with all load increments as described.

Payment for tubular steel piles left in place shall include the cost of the concrete core of the specified class of concrete and the steel reinforcement of the said concrete core.

The quantity to be paid for confirmatory boring shall be the number of linear meters of the boring completed and accepted.

Such prices and payment shall be considered full compensation for furnishing all materials, performing standard penetration and all other relevant laboratory tests, labour, equipment, tools, fuel, welding, if needed and other incidental expenses including splicing, caging providing covers etc. necessary to complete the item as directed by the Engineer.

Pay Item No.	Description	Unit of Measurement
7a	Untreated Timber Piles	m
7b	Treated Timber Piles	m
7c	Precast Concrete Piles type	m
7d	Cast-in-place Concrete Piles, type	m
7e	Structural Steel Piles, type	m
7f	Pile Shoes, type	Each
7g	Test Piles, type	m
7h	Pile Load Tests to 1.5 times the design load	Each
7i	Pile Load Tests to 2 times the design load	Each
7j	Pile Load Tests to 3 times the design load	Each
7k	Confirmatory Boring	m
7l	Permanent Pile Casing, type	m
7m	Temporary Pile Casing type	m

SECTION – 13

13.0 METAL WORKS

13.1 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.

13.2 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.

13.3 DRAWINGS

13.3.1 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.

13.3.2 Workshop Drawings

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

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

- Standards and quality of steel used.
- Parts List.
- Instruction for painting, primer and finish coats with derusting process.
- Recommended scale for assembly drawings are preferably 1:10 or 1:20 and for joints and details 1:1, 1:2 or 1:5.
- Notes for assembly drawings shall be as follows:
 - i) List of symbols for bolts and holes used.
 - ii) List of symbols for welds used.
 - iii) Edge distance (general).
 - iv) Welding thickness (general).
 - v) Material quality of steel used.
 - vi) Type and quality of electrodes to be used.
 - vii) Test for welding if any.
 - viii) Reference to related erection scheme drawings.
 - ix) Reference to design and working drawings.

13.4 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.

13.5 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.

13.6 FABRICATION

- a) Straightening Material
Rolled material, before being worked upon, must be straightened within tolerances by ASTM specifications A6. Straightening, necessarily shall be done by mechanical means or by the application of limited amount of localised heat. The temperature of heated areas, as measured by approved methods, shall not exceed 1100 F for A514 steel or 1200 F for other steels. All material, before and after fabrication shall be straight or curvilinear form as required free from twists.
- b) Cutting
As far as possible cutting must be done by shearing. Oxygen cutting shall be done where shear cutting is not possible and shall preferably be done by machine. All edges shall be free from gauges, notches or burs. If necessary the same shall be removed by grinding.
- c) Holes punching drilling
Holes shall be punched where thickness of the material is not greater than the diameter of bolt or rivet + 3mm. Where the thickness of the material is greater, the holes shall be drilled or sub-punched and the drill of all subdrilled holes shall be at

least 2mm smaller than the nominal diameter of the rivet or bolt. Holes for A514-77 steel plates over 1/2" thick shall be drilled. Holes shall not be allowed to formed gas cutting process.

d) Welding

1. Maximum Thickness of fillet welds

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

2. Minimum thickness of fillet welds.

Least thickness for calculation and designing requirements:

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

3. Design length of a fillet weld shall not be less the 40 mm or 10 times thickness of fillet weld and not more than 60 times thickness of fillet weld.

- or
4. Surfaces to be welded shall be free from loose scale, slag, rust, grease, paint 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.

13.7 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.

13.8 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.

13.9 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.

13.10 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.

13.11 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 metal 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 – 14

14.0 BRICK MASONRY

14.1.1 GENERAL

- a) **Scope**
This section of the Specification covers solid brickwork.
- b) **Related sections of the specification**
Section 6.1 for Cement Plaster
- c) **Exclusions**
The scope of work does not include supply of embedded items, other than those specified herein.
- d) **Classification of bricks and brickworks**
 - i) "Fair face bricks" --- bricks selected from first class bricks, having better surface and more uniform size and colour.
 - ii) "Fair face brickwork" --- using fair face bricks in brickwork required to be pointed and exposed to view.
 - iii) "First class bricks" m conforming to the requirements of Clause 3.1.2(b) specified hereinafter.
 - iv) "First class brickwork" --. using first class bricks, in brickwork required to be plastered.
- e) **Submittals**
 - i) Specimen samples of all materials and bricks intended to be used in the Works. Specimens of bricks shall be representative of a complete range of colors, textures and sizes.
 - ii) Results of all the tests performed on the materials and bricks as may be considered necessary by the Engineer to establish compliance to specification.
 - iii) Reference panel and sample panel of brickwork as per BS 3921: 1985, if required by the Engineer.
- f) **Quality control and testing**
 - i) **General**
Carryout regular quality control of the works and ensure that materials, construction and workmanship are in compliance with the plans and specification. Maintain quality control and test records and make available to the Engineer as a routine, as may be required by him.
 - ii) **Quality control**
Quality control shall include, but is not limited to, the following:
 - that all materials meet the requirements of specification,

- that they are properly stored and prepared for use,
- that mortar and grout are properly mixed using specified proportions of ingredients, and
- that the method of measuring materials for mortar and grout are such that the proportions of the constituents are entirely controlled .

Brick shall pass a visual inspection for soundness, compact structure, reasonably uniform texture and shape; freedom from cracks, warpage, large pebbles, balls of clay or particles of lime that would affect the serviceability or strength of the brick.

- iii) All brickwork shall be erected plumb and true to line and level with maximum variation in any storey height or any length of wall being one mm in one metre.

14.1.2 MATERIALS

- a) Mortar
i) Cement

Comply with requirements of BS 12: 1989. Use ordinary Portland cement (grey) unless specified otherwise.

- ii) 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.

- iii) 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.
- iv) Mortar composition
Cement to dry sand ratio by volume as specified.
- v) 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 retamper mortar. Thoroughly clean and wash mixing troughs and pans at the end of each day's work.

- b) Bricks
Bricks shall be made from carefully selected earth which shall be good loam or clay. The earth shall be free from objectionable quantities of lime, gravel, coarse sand and roots and other organic matter. Brick shall be manufactured from clay which has been carefully weathered, worked, pugged and tampered, hand molded.

The bricks shall be thoroughly burnt but without being vitrified, uniform in shape, size, homogeneous texture, colour and shall produce a ringing sound when struck. The bricks shall be free from flaws, cracks, chips, stone, nodules of lime or kankar or other blemishes. Bricks shall have sharp edges, square corners and parallel faces.

Brick shall usually measure **9" x 4-3/8" x 2-11/16"** (nominal size) so that every four courses laid shall measure one foot in height.

Tolerance in dimensions shall be as under:

- Over 2" and upto 3" + 1/16"
- Over 3" and up to 4" + 1/8"
- Over 4" and up to 6" + 3/16"
- Over 6" and up to 10" ±1/4"

Although bricks may have been approved at site of kiln or at Site of Work they shall be liable to rejection thereafter at any stage even after they have been built into the Work, if they are found not to comply in all respects with the specification.

- c) 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 brickwork - 6mm dia x 300mm long, MS galvanized.

14.1.3 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.

STACKING, SAMPLING AND TESTING

Sort out and arrange the bricks in stacks of one or two thousands or as directed by the Engineer. Each stack shall be 10 courses high and two bricks thick so that at least 0.6 metre space between the stacks shall be left for the purpose of inspection. Stack each size or class of brick separately. For purposes of inspection and tests, the sample bricks shall be selected by the Engineer.

Bricks shall be sampled and tested for compressive strength and water absorption as per BS 392: 1985. Average compressive strength shall not be less than 2000 psi and that of individual brick not less than 1600 psi. Water absorption shall not be more than one - sixth of the dry mass of brick.

14.1.4 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.

14.1.5 EXECUTION OF WORK OF FIRST CLASS BRICKWORK

- a) Compliance with Standard
Comply with the relevant applicable requirements of section - 4 of BS 5628 : Part 3 1985 with amendment No.1.
- b) Soaking and washing bricks
Before use, soak bricks in clean water for at least 4 hours. If bricks contain soluble salts liable to cause efflorescence, wash bricks thoroughly to satisfaction of the Engineer.
- c) Laying
Do not lay brickwork during rain sufficiently heavy or prolonged to wash the mortar from the bricks. Remove and replace already laid mortar which becomes diluted by rain.

Lay bricks in English bond with frogs (manufacturer's marks) upwards. Set each brick with both bed and vertical joints filled with mortar and bed-in bricks by tamping with the handle of the trowel. Do not simply cover brickwork with mortar at edges. Lay bricks with all horizontal joints parallel and truly level, and vertical joints in alternate courses directly over one another. Thickness of horizontal joints unless approved otherwise shall not be less than 6mm and not more than 10mm such that the height of 4 courses and 3 joints as laid shall not exceed by more than 25mm the height of 4 bricks piled dry one upon the other. Thickness of vertical joints shall be approximately 10mm. Lay all brickwork truly plumb and check each set of four brick courses with plumb bob and straight edge. Do not use bats except where absolutely

necessary for obtaining the specified bond. At all corners lay alternate course~ of bricks as headers and stretchers so as to bond the two walls together. Where fresh brickwork is to join brickwork that has partially or fully set, clean roughen and wet the exposed jointing surface of the set brickwork so as to effect the best possible bond with the new work. At intersections, interlock brickwork so as not to leave a straight vertical joint.

Where neither plastering nor pointing is to be provided, as in foundations and plinth, fill the joints flush with the same mortar as used for laying brickwork as the work progresses and strike the joints. Where plastering or pointing is to be applied, rake out joints with a hook to a depth of 12mm before the mortar sets, each day.

Cut, dress or groove bricks as required for shaping jambs, fitting frames and for architectural features of the building. Make corners with cut-bricks. Build in brickwork all frames and inserts required to be installed as the work progresses, maintain them in their proper position and do not remove until they are firmly held in brick work. Fill the spaces around all built-in work with concrete of approved mix. Leave openings for ducts and other uses where required. Make and install formwork for arches to conform to the required shape.

Carry up brickwork regularly and leave no portion of work more than one metre lower than another. Rake back temporary stops left during constrllclio11. Mark course marks with saw cuts on straight edges supplied to brick-layers and check height of courses all over the brickwork from time to time so as to keep the courses level. Clean each day's work before finishing day's work. Leave out only headers to allow put log to be inserted and do not leave more than one brick for each put log.

Any space between brickwork and slabs/beams above shall be filled with PCC 1:2:4.

- d) **Jointing concrete and brickwork**
Where vertical faces of concrete and brickwork abut, roughen about 40% of the concrete surface by hacking or other approved means; clean the surface thoroughly and moist it for 24 hours before laying brickwork. Drill holes in concrete at 600mm centres vertically and install ties with Fisher plug unless shown otherwise in drawings. Embed wall ties in mortar bed joint of brickwork.

- e) **Uniting leaves of cavity walls**
Unite leaves of cavity walls by wall ties embedded in the mortar, at the time the course is laid, to a minimum depth of 50mm. In non-load bearing brickwork, use ties at intervals of not more than 900mm horizontally and not more than 450 mm ventrally. In load bearing brickwork, the spacing shall be as tabulated below:

Least leaf thickness (one or both) (mm)	Cavity Width (mm)	Spacing of ties	
		Horizontally (mm)	Vertically (mm)
75 or more	50 – 150	450	450
90 or more	50 – 150	900	450

Ties shall be staggered and evenly distributed. Clean any mortar droppings on the ties

or cover the ties with polythene in the cavity portion.

- f) Removal of efflorescence
Remove efflorescence as specified in section 6.1 - of this Specification.

14.1.6 PROTECTION AND CURING

Protect all brickwork during construction from the effects of sun, rain and frost, by suitable covering if necessary in the opinion of the Engineer, and keep brickwork moist for a period of ten days.

14.1.7 EXECUTION OF WORK OF FAIR FACE BRICK WORK

Comply with the requirements of 3.1.6 and 3.1.7 except that use fair face bricks selected from first class bricks and lay the brickwork with extra care.

14.1.8 MEASUREMENT

- a) No deductions shall be made for the following:
- Voids (openings) not exceeding 0.10 m² (1 Sft) area in elevation.
 - Fire place flues.
 - Chases, pipes and embedded items.
- b) Deductions for string courses, sills, lintels, plates and the like shall be made as regards height to the extent only of full brick courses displaced.
- c) No deduction or addition shall be made on any account for ends of dissimilar materials like joists, beams, girders, rafters, purlins, trusses, corbels, steps etc, not exceeding 450 sq. cm (0.5 sq.ft) in section.
- d) In cavity walls, the width of the cavity shall not be included in the thickness of the wall.
- e) Pay Items
Payment shall be made only for the pay items applicable to this Contract as listed in the Bill of Quantities. Thicknesses of walls for payment shall be as stated in the pay items irrespective of the actual size of bricks approved. Pay item numbers and units for rates shall be as designated in the Bill of Quantities.

Pay Items	Description	Unit for Rate
-	Provide and lay first class brickwork in foundations and plinth in cement sand mortar of indicated ratio: (a) 228mm (9") and over thick (b) 114mm (4.5") thick	m3/Cft. m3/Cft.
-	Provide and lay first class brickwork in superstructure: (a) 228mm (9") and over thick in cement sand mortar of indicated ratio. (b) 114mm (4.5") thick in cement sand mortar of indicated ratio (c) 75mm (3") thick in cement sand mortar	m3/Cft. m3/Cft. m3/Cft.

	of indicated ratio	
-	Provide and lay fair face brickwork, any thickness, in cement sand mortar of indicated ratio; (a) In plinth (b) In superstructure	m3/Cft. m3/Cft.

14.1.9 Payment

All the items of work covered by this Section of the Specifications shall be paid for at the unit rates entered in the Bill of Quantities and in accordance with the applicable terms and conditions of the Contract.

SECTION - 15

15.0 PLASTERING

15.01 Scope of Work:

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

15.02 General

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

15.03 Materials:

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

be taken to maintain the heat and prevent premature cooling during the process of hydration. The slaked quicklime shall be passed through a No.10 sieve and stored for at least 72 hours before using. When the use of lump quicklime, slaked on the job, in lieu of pulverized quicklime, is specifically approved for plastering, the cooling and aging period shall be not less than 14 days.

- ii. Hydrated lime shall be machine-mixed with water to form a putty and shall be allowed to stand for at least 15 minutes before using.

15.04 MIXING OF MORTAR

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

15.05 PROPORTIONING OF PLASTER

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

15.06 APPLICATION OF PLASTER:

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

- iii) The walls shall be washed with fresh water and shall be kept damp for 2 hours before the plaster is applied. All masonry joints and concrete surfaces shall be properly roughened before plaster work is commenced. The proportion of cement plaster shall be as per drawings or as specified. The ingredient shall be properly mixed. The sand used for mix shall be only sufficient for one bag of cement. The mixtures shall be turned over and over till the ingredients are thoroughly mixed. Cement slurry shall be applied to the surface to be plastered and allowed to dry before plaster work is commenced.

- iv) The plaster shall be from 1/2" to 3/4" thick and shall not be less than 1/2" thick at any surface. If the plaster is 3/4" or more than 3/4" thick it shall be done in two coats, the first coat shall be made rough. The plaster on all surfaces shall be perfectly in plumb. The edges and corners shall represent a straight line. The plaster shall be kept wet for at least 10 days. No extra payment shall be allowed for jambs, junctions, corners, edges, round surfaces, cement slurry base and for thicker plaster required due to any un-evenness in the work done by the Contractor. At edge of every horizontal projection on external faces of the building if directed by Engineer a drip course of 3/4" is to be provided for trickling of water without any extra cost. Plaster on lath shall be done in three coats. Finish coat shall have a reasonably uniform thickness of approximately 3 mm (1/8"), and the minimum thickness at any point shall not be less than 1.5 mm (1/16") and shall be applied in one continuous operation without staging breaks.
 - a) **The Scratch Coat** shall be full and thick and shall be applied with sufficient force to form good keys. The scratch coat shall be cross-scratched upon attaining its initial set and shall be kept damp with a fog spray.

 - b) **Brown Coat** shall be applied after the scratch coat has set, but not earlier than 24 hours after the application of the scratch coat. When applied directly to masonry, the brown coat similar to the scratch coat shall be applied with sufficient pressure to fill the raked-out joints in brickwork to prevent air pockets and secure a good bond. The brown coat shall be lightly scratched and broomed after attaining its initial set and shall be kept moist with a fog spray for 2 days and then be allowed to dry out.

 - c) **Finish Coat** shall not be applied until the brown coat has seasoned for 7 days. Just before the application of the finish coat, the brown coat shall be wetted evenly with a fog spray. All plaster shall be given a sand float finish of a uniform texture as approved or directed otherwise by the Engineer or his Representative. The finish coat shall be kept moist with a fog spray for at least 7 days and thereafter shall be protected against rapid drying until properly and thoroughly cured and dried.

15.07 SAMPLING OF PLASTER

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

contractor.

15.08 DRIPS AND GROOVES:

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

15.09 ALIGNMENT AND SMOOTHNESS

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

15.10 CLEANING AND PROTECTION

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

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

Protect finished plaster from injury by any source.

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

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

15.11 PAYMENT

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

SECTION - 16

16.0 DOORS AND WINDOWS

16.01 Scope:

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

16.02 Materials:

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

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

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

16.03 Grounds, Blocking and Nailing Strips:

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

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

16.04 Metal Door Frames (Other Than Aluminium Doors):

16.4.1 Specifications & Standards

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

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

16.4.2 Samples

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

16.4.3 **Manufacturers**

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

16.4.4 **Hollow Metal Steel Door Frames**

- A. Door shall be of 16 gauge mild steel sheet and frame made of suitable sections as specified, to exact profiles with prime coat of grey colour and 3 coats of enamel paint.

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

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

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

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

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

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

16.4.5 **Installation**

- A. All work shall be accurately set to established lines and rigidly fastened to the constructions. Frames shall be erected plumb and true and shall be braced during construction and until there is no danger of movement.
- B. In masonry walls, anchors shall be built-in during progress of brick masonry work. Space between backs of frames and masonry shall be grouted full of c.c. mortar (1:4) with anchors securely bedded in mortar joint.
- C. Frames shall be accurately fabricated, assembled and fitted and shall be free from defects affecting appearance and proper operation. Steel reinforcing channels where

required shall be provided in each frame.

- D. Two PVC stoppers 1/4" dia to prevent door shutter striking metal frame shall be provided in each frame.
- E. Three hinges 5" long in each frame shall be provided.

16.05 **Wooden Door Frames**

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

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

16.06 **Teak Ply Wood Doors:**

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

Panelled doors shall be constructed in accordance with the requirements part 1 of British Standard Specification No. 459, with the additional requirements that panels in exterior openings shall be assembled with waterproof glue. Loose beads shall be provided in glazed wooden doors for holding glass panes of thickness and size as specified and shown in drawings or directed by the Engineer. Flush doors shall be constructed in accordance with the requirements of British Standard 459.

16.07 **Closet Doors:**

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

16.08 **Doors Shutters:**

The shutters will be fixed to the frames with approved quality brass fittings.

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

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

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

16.09 Fitting, Hanging, and Trimming:

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

16.10 Hardware:

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

16.11 Measurement and Payment:

All the wooden doors shall be measured between outer edges of the jambs of frames horizontally and between the finished floor level and top of frame vertically and paid for at the rates entered in the Bill of Quantities appended to the contract and in accordance with the conditions of the contract. All the rates for doors shall be exclusive of the door frames, finishing and hardware as specified hereinbefore as well as painting/ polishing etc.

SECTION - 17**17.0 TIMBER JOINERY AND HARDWARE****17.01 Scope of Work:**

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

17.02 Materials, Fittings and Samples:**i) Timber etc:**

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

- a) **Soft Wood:** The timber of trees belonging to the botanical group Gymnosperms, commercial timber deodar of this group, with best of its kind available in Pakistan shall be used.
- b) **Hard Wood:** The timber of trees belonging to botanical group Angiosperms, commercial timber teak of the group shall be used.
- c) **Plywood:** Shall comply in all respects with BSS 1455:1948. The plywood shall only be obtained for doors, paneling and the like shall be of the thickness as specified. The grade shall be first quality. The face and back shall be free from end joints, dead knots, overlaps, patches and other defects. Edge joints in Veneers shall be well made. Isolated pin-worm holes shall be permitted provided they do not run along the plane of the veneer. The face and back shall be finished smooth for painting or polishing.
- d) **Formica and Chip-board:** shall be first class quality of its kind in Pakistan from manufacturer approved by the Engineer.
- e) **Veneers:** of selected quality shall be used. The veneers shall be carefully selected so that the grains shall be matching and running in the same direction. The cross banding shall not be less than 1/16 inch and the combined thickness of cross banding and face veneer on each door shall not be less than 1/8 inch. The cross banding and face veneer shall be teak wood or as indicated. The face veneers shall be uniform texture and glued to core as

specified hereinafter.

ii) **Hardware and Fittings:**

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

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

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

17.03 Flush Doors:

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

17.04 Handrails Wooden:

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

17.05 Cupboards/Ward Robes

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

17.06 Kitchen Cabinets

a) **Low Level Cabinets**

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

b) **High Level Cabinets**

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

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

17.07 Reception Counter

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

17.08 Fabrication:

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

authorized representative.

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

17.09 Measurement and Payment:

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

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

SECTION - 18

18.0 ALUMINIUM ANODIZED DOORS, WINDOWS AND VENTILATORS

18.1 SCOPE:

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

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

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

18.4 DEFINITION:

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

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

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

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

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

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

Panel: Movable or fixed glazed frame.

Stile: Vertical member of a panel or shutter.

Weather Stripping: A PVC or synthetic rubber material to improve resistance of the closed window, door and ventilator to air infiltration and water penetration.

18.5 **MATERIAL:**

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

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

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

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

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

18.6 **CONSTRUCTION:**

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

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

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

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

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

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

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

Joints in frames shall be made either by welding or by mechanical means (example are cleating and screwing). Where necessary, joints shall be sealed with material that does not react with aluminium. Joints may have flush, stepped or lapped surfaces. Flush joints, formed by mechanical means may deviate from the same plane only within the limits set by the use of extrusion tolerance given in BS-1474. Welded joints shall be cleaned off smooth on surfaces visible when the doors windows and ventilators are open or closed and where they might interfere with glazing.

18.7 HARDWARE:

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

18.8 FASTENING AND FIXINGS:

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

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

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

18.10 GLAZING:

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

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

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

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

18.11 SECURITY:

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

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

Where directed by the Engineer locks may be key operated from the outside or inside and supplied with removable keys.

18.12 PERFORMANCE:

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

18.13 SHOP DRAWINGS:

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

18.14 SAMPLES:

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

18.15 MEASUREMENT AND PAYMENT:

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

SECTION - 19

19.0 ROOF TREATMENT

19.01 SCOPE:

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

19.02 MATERIALS:

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

19.03 APPLICATION

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

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

19.04 ALTERNATE ROOFING SYSTEM:

1.5 inch thick brick tiles grouted with cement sand mortar over 3 inch mud filling / plaster with husk over two layers of polythene sheet 004" - 005" thick over bitumen flood coat 10/20 grades @ 35 lbs per 100 sft over bitumen sticking coat grade 70/90 @ 5 lbs per 100 sft over smooth finish R.C.C slab.

19.05 MEASUREMENT AND PAYMENT:

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

Unit rate for the Roof treatment work shall be deemed to be inclusive of all preparatory works, like scrapping, scratching, cleaning, etc. complete as per drawings, specifications and direction the Engineer.

SECTION - 20

20.0 PAINTING, DISTEMPERING AND WHITE/COLOUR WASHING ETC.

20.01 SCOPE OF WORK:

The work covered by this section of the specifications consists of furnishing all materials, plant, labour, equipment, appliances and performing all operations in connection with surface preparation, mixing, painting concrete works, gates, frames steel works, steel and wooden doors, windows, ventilators, walls ceilings and all such surfaces as shown on the Drawings and/or as directed by the Engineer. The scope of this section of specifications is covered with detailed specifications as laid down herein.

20.02 GENERAL:

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

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

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

20.03 MATERIALS:

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

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

All enamel paints and primers for wood and metal work will be the best available of its type and shall be approved by the Engineer prior to its procurement. All plastic enamel paint and primers for CC and RCC works will be the best available of its type and shall be approved by the Engineer prior to its procurement. The weather shield paint manufactured by ICI or any equivalent approved by the Engineer shall be used for painting on the surface specified.

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

All materials shall be delivered to site in their original unbroken containers or packages and bear the manufacturer's name, label, brand and formula and shall be mixed and applied in accordance with his directions.

20.04 SURFACE PREPARATION:

All oil, grease, dirt, dust, loose mill, scale and any other foreign substance shall be removed from the surface to be painted, polished and white washed by the use of a solvent and clean wiping material. Following the solvent cleaning, the surfaces shall be cleaned by scraping, chipping, blasting, wire brushing or other effective means as approved by the Engineer.

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

Surfaces of stainless steel, aluminium, bronze and machined surfaces adjacent to metal work being cleaned or painted shall be protected by effective masking or other suitable means, during the cleaning and painting operations.

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

20.05 APPLICATION:

All paint and coating materials shall be in a thoroughly mixed condition at the time of application. All work shall be done in a workmanlike manner, leaving the finished surface free from drips, ridges, waves, laps and brush marks. All paints shall be applied under dry and dust free conditions. Unless approved by the Engineer paint shall not be applied when the temperature of the surrounding air is below 10 Deg.C. Surfaces shall be free from moisture at the time of painting.

All primary paint shall be applied by brushing. The first coat of paint shall be applied immediately after cleaning. When paint is applied by spraying, suitable measures shall be taken to prevent segregation of the paint in the container during painting operations.

Effective means shall be adopted for removing all free oil and moisture from the air supply lines of the spraying equipment.

Each coat of paint shall be allowed to dry or harden thoroughly before the succeeding coat is applied. Surfaces to be painted that will be inaccessible after installation shall be completely painted prior to installation shall be completely painted prior to installation.

Only as much material should be mixed as can be used up in one hour. Over-thinning will not be permitted. After the first coat, the surfaces will be soaked evenly four or five times and the second coat shall be applied after leaving for at least overnight.

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

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

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

20.06 WHITE AND COLOUR WASHING:

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

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

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

20.07 DISTEMPERING:

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

20.08 EXECUTIONS:

20.09 SUBMITTALS

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

20.10 PRODUCT DELIVERY

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

20.11 JOB CONDITION

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

Place drop cloths to adequately protect all finished work.

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

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

20.12 MEASUREMENT AND PAYMENT:

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

SECTION - 21

21.0 COLOUR CREATING

21.01 MATERIAL

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

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

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

21.04 PREPARATION OF SURFACE

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

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

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

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

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

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

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

21.08 PAYMENT

All the items of work covered by this Section of the Specifications shall be paid for at the unit rates entered in the Bill of Quantities and in accordance with the applicable terms and conditions of the Contract.

SECTION – 22

22.0 RANDOM AND DRESSED UNCROUSED STONE MASONRY

22.1 DESCRIPTION

The item shall consist of Random and Dressed uncoursed Stone Masonry with or without mortar. Dimensions of such masonry may vary as per drawings or as directed by the Engineer.

22.2 MATERIAL REQUIREMENTS

22.2.1 Stone

Random or dressed stone shall be of approved quality, sound and durable, free from segregation's, seams, cracks and other structural defects or imperfection tending to reduce its resistance to weather. It shall be free from rounded or weathered surfaces.

22.2.2 Mortar

Mortar for laying stone and pointing shall be composed of one part of Portland cement and ' four parts of sand unless otherwise shown on the drawings. Portland cement shall meet the requirements of AASHTO M-85 and sand shall meet the requirements of AASHTO M-45. Water used in preparation of mortar shall conform to the requirement set forth under item.

22.3 CONSTRUCTION REQUIREMENTS

22.3.1 Stone Size and Shape

Individual stones shall have a thickness of not less than twenty (20) cms and a width of at least one and a half (1.112) times the thickness and length of atleast one and a half (1. 112) times their width

Shape of stones may be irregular in random masonry, however for dressed uncoursed masonry, stones shall be cut in such a way that a well locked masonry can be laid. The size and shape of ring stones for arches shall be as shown on the drawings.

22.3.2 Dressing of Stones

For "A-Class" Masonry, Stones shall be dressed to exact sizes and shapes and cut to lay on beds with top and bottom truly parallel. Hollow beds shall not be permitted. Beds of face stone shall be fine finished for a depth of not less than thirty (30) centimeters. Vertical joints of face stone shall be fine finished and full to the square for a depth of not less than twenty five (25) centimeters.

Exposed surfaces of face stone shall be according to the plans, with edges pitched to

true lines and exact batter, chisel drafts four (4) centimeters wide shall be cut at all exterior corners.

Stones for B-Class Stone Masonry shall be roughly squared on joints, beds and faces. Selected stones, roughly squared pitch to line shall be used at all angles and ends of wall.

22.3.3 **Stretchers**

Stretcher shall have a width of bed not less than one and a half (1.112) times their thickness, and length of bed not less than twice nor more than three and half (3.112) times their thickness but in no case less than ninety centimeters. Stone masonry in cement mortar shall be cured for at least seven (7) days.

22.3.4 **Headers**

Header, placed in each course, shall have width not less than one and a half (1.112) times their thickness. In walls having thickness of 1.2 meters or less, the headers shall extend entirely through the wall. In walls of greater thickness, the length of headers shall be not less than two and a half (2.112) times their thickness when the course is forty five ~45) centimeters or less in height, and not less than 1.2 meters in courses of greater height. Header shall bond with the core or backing not less than thirty (30) centimeters. Header shall hold in the heart of the wall spaced not further a part than 2.5 meters center to center. There shall be atleast one header to every two stretchers.

22.3.5 **Cores and Backing**

Core and backing shall consist either of roughly bedded and jointed headers and stretchers, as specified above or concrete as may be specified. When stone is used for cores of backing, at least one-half (1.112) of the stone shall be of the same size and character as the face stone and with parallel ends. No course shall be less than twenty (20) centimetres thick. Concrete used for cores and backing shall conform to the requirements specified in Item 401. The headers and stretchers in walls, having a thickness of one meter or less shall have a width or length equal to the full thickness of the wall. No backing will be allowed.

22.4 **PAYMENT**

All the items of work covered by this Section of the Specifications shall be paid for at the unit rates entered in the Bill of Quantities and in accordance with the applicable terms and conditions of the Contract.

ELECTRICAL WORKS

INFRASTRUCTURE DEVELOPMENT WORKS AT
KHAIRPUR SPECIAL ECONOMIC ZONE (KSEZ)

TENDER DOCUMENTS

(VOLUME – II)

SPECIFICATIONS FOR ELECTRICAL WORKS

Table of Contents

1. General
2. Low Voltage Switch Boards / Distribution Boards
3. Low Voltage Cable and Wires
4. Conduits and Pipes
5. Wiring Accessories
6. Interior Lighting Fixtures
7. Earthing System
8. Cable Tray, Ladder and Trunking
9. Telecommunication Cabling Systems

**SECTION – E - 1
GENERAL SPECIFICATIONS**

FOREWORD

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

1. SCOPE OF WORK

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

- | | |
|--|-------------------|
| 1. Low Voltage Switch Boards / Distribution Boards | (Section - E - 2) |
| 2. Low Voltage Cable and Wires | (Section – E - 3) |
| 3. Conduits and Pipes | (Section – E - 4) |
| 4. Wiring Accessories | (Section – E - 5) |
| 5. Interior Lighting Fixtures | (Section – E - 6) |
| 6. Earthing System | (Section – E - 7) |
| 7. Cable Tray, Ladder and Trunking | (Section – E - 8) |
| 8. Telecommunication Cabling Systems | (Section – E - 9) |

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

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

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

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

2. RULES AND REGULATIONS

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

All works shall be carried out in accordance with the latest edition of the Regulations

of the Electrical Equipment of Buildings issued by the Institute of Electrical Engineers - London, the Contract documents, the Electricity Rules 1937 and bye-laws that are in force from time to time. Any discrepancy between these specifications and any other rules and regulations shall be brought to the notice of Owner or his representative, and his decision shall be final and conclusive.

The Contractor shall be responsible for completing all formalities and submitting the test certificates as per prevailing rules and regulations and shall have the installation passed by the Government Electric Inspector of that region.

3. STANDARDS

All works, equipment and materials shall conform to:

On the one hand:

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

International Electro-technical Commission (IEC)

British Standards (BS)

National Electric Code (NEC)

National Standards

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

Whenever the electrical equipment to be installed, does not hold national standards, the Contractor shall take into account the specific standards chosen by the Owner and make sure that the equipment he has to install, meets these standards.

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

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

4. INSTALLATION AND SERVICE CONDITIONS

4.1 Site Conditions

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following ambient conditions unless specifically stated otherwise for any material / equipment:

a.	Maximum outdoor ambient temperature	:	45 degree C
b.	Minimum Indoor ambient temperature	:	15 degree C
c.	Maximum relative humidity	:	75 %
d.	Minimum relative humidity	:	40 %

4.2 Service Conditions

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

5. MAIN ELECTRICAL CHARACTERISTICS

5.1 Power Supply System

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate and function satisfactorily with the following minimum requirements without any de-rating:

- Voltage 380 \pm 10%
- Phase 3, 4 wire system
- Frequency 50 Hz. \pm 2 Hz.

5.2 Degree of Protection of Enclosures

For indoors, IP31 minimum degree of ingress protection of the enclosures against contact with line or moving parts and against ingress of solid foreign bodies or liquids, shall be selected, in accordance with IEC 60529.

6. GUARANTEE

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

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

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

7. EXCEPTIONS TO SPECIFICATION

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

8. AVAILABILITY OF SPECIFICATIONS, DRAWINGS AT SITE

The Contractor shall assume at his own cost the permanent availability of this specification and drawings on site where applicable.

9. DISCREPANCIES IN TENDER DOCUMENTS AND DRAWINGS

The Contractor shall carefully examine the documents and drawings and if he finds any discrepancies or omissions from the specifications, bill of quantities or drawings, or is in doubt as to the meaning, he shall at once notify the Owner or his representative for receiving his instructions before proceeding with the works. If such defective or modified work is carried out by the Contractor on his own, he shall rectify the same at his own cost.

10. MEASUREMENT OF WORKS

The quantities set out in the bill of quantities are the estimated quantities and they shall not be taken as actual and correct quantities of work to be executed by the Contractor. The Contractor shall carry out actual measurement of works at the site.

11. INSTALLATIONS DETAILS

The locations, routings, installation heights, detail etc. for electrical equipment are indicated on the drawings. If any information is not stated on the drawings or wherever modifications are required the Contractor shall obtain prior instructions from the Owner or his representative.

12. DRAWINGS AND DATA

The Contractor shall provide dimensional outline drawings, arrangement drawings and technical data for the equipment offered, for the approval of Owner or his representative.

13. PRIOR APPROVAL OF SHOP DRAWINGS, MATERIALS AND EQUIPMENT

The Contractor shall provide shop drawings for the electrical installations showing the exact routes of all underground cables and ducts, the exact run of all conduits and trunking, draw-in and junction boxes, the number and size of wires in each conduit, the final connection arrangements at distribution boards and the details of ducts for the approval of consultant / Owner's representative before commencing any portion of the works. All such working drawings shall be submitted in suitable number of copies as indicated in the particular conditions and within the periods stipulated below:

a. **Cable entry ducts into buildings:**

Working drawings shall be submitted within two weeks of handing over the site.

b. All other working drawings shall be submitted to the Engineer against signed receipt and dated within two months of signing the Contract. Should however the Contractor be obliged to install electrical conduits prior to this period then he shall submit the relevant working drawings at least two weeks prior to the proposed date of commencement of the work. The Contractor shall submit the program indicating the dates on which coordination in different sections will take place, together with the submission of the working drawings. The Engineer shall arrange to return to the Contractor at least one week prior to the commencement of concreting of the section, his comments or approval of the working drawings.

The Contractor shall supply detailed specifications, dimensional drawings, etc., of equipment that he proposes to supply and install.

Where this Contract requires the approval of Engineer to material and goods, the Contractor must seek to obtain this approval within eight weeks after signing of the Contract. No extension of time will be granted for non-availability of material or goods if this clause is not complied with. Approval of the Engineer does not relieve the Contractor of placing his orders in due time for the materials he needs to complete the Contract on time. The approved samples shall be retained on site for comparison with commodities used in works and removed when no longer required.

14. MATERIAL ORIGIN AND QUALITY

The material and equipment shall be purchased from Consultant / Owner's agreed suppliers.

The consultant / owner shall retain the right to at any time demand the indication of origin of the materials, and to eventually refuse products, the origin of manufacturing of which have not been previously agreed to without consideration of quality.

On specific agreement of the Owner, the materials may be delivered progressively to the field, but in such a manner as to allow sufficient time for their reception.

When choice of manufacturer is allowed for any particular commodity the Contractor shall obtain the whole quality required to complete the work from one manufacturer or obtain approval of any change in source of supply. He shall produce written evidence of sources of supply when requested to do so by the Engineer.

15. IDENTIFICATION OF EQUIPMENT

For each piece of equipment, identification label shall be fitted in front of the casing. The label shall have block letter 7mm high, black on white back ground of trifoliate and fixed with screws.

16. MARKINGS

The contractor shall provide “Danger Boards “and” Shock Charts “wherever required to comply with the requirements of local Electricity Rules and according to normal practice.

17. FACTORY TESTS

All equipment supplied by and installed as part of the Contract such as distribution boards and like shall be fully tested at the manufacturer's works to the requirements of appropriate standards called for later in the particular specification.

The Contractor shall inform the Engineer in writing about the date and time of test of each equipment at least two weeks in advance. The witnessing of test by the Owner or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment and for furnishing the guarantees referred to in Clause 6.0. All test results in the form of certificate of test / test record certificates, signed by all the witnesses, for each item in the scope of Contractor's supply shall be supplied to the Engineer within seven days of the test date, and in any event before delivery to the site.

All expenses for carrying out the tests and witness by the Owner or his representative shall be borne by the Contractor and deemed to have been included in the tender bid.

18. STORAGE

The Contractor shall store the equipment in such conditions that it can not be damaged, i.e., in a dry warehouse. As particular concerns; fragile components, these shall be stored on shelves in their original packing, fitted with identification labels so as to avoid unnecessary manipulation or handling.

The Contractor shall handle, store and fix each commodity in accordance with the manufacturer's recommendations. He shall inform the Engineer if these conflicts with any other specified requirement and submit copies of manufacturer's recommendations to the Engineer when requested to do so.

19. LABOUR AND STAFF OF CONTRACTOR

The Contractor shall provide / furnish and arrange for:

- Skilled and unskilled labor required for performing the works in accordance

- with the technical specifications and drawings within the agreed time schedule.
- Supervisory technical staff with appropriate experience and requisite expertise to ensure quality of work performed.
- Supervisory administration and clerical staff to ensure smooth functioning of the activities at site.
- Construction equipment, meggers, tools, etc.

The Contractor shall supply all labor, materials and equipment necessary for the installation of low voltage distribution boards, cables, lighting and power equipment, together with all other apparatus shown on the drawings and as detailed in the Particular specification.

20. SMALL INSTALLATION MATERIAL

The Contractor shall supply all small installation and consumable materials such as nuts, bolts, washers, shims, angles, leveling materials, insulation tape, solder, PVC strap-on or heat shrinkable type cable tags, cable ties, bushes, sealing compound, Avometer, electrical testing and measuring instruments, etc., and all such other material not listed in BOQ, required for complete installation as intended by the specification and scope of works.

21. INSTALLATION INSTRUCTIONS - GENERAL

The Contractor shall set out the works himself as per specifications and drawings and shall properly position the equipment on specified foundation / location. In general, the manufacturer's instructions for installation shall be followed. Any defect or faulty operation of equipment due to Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost.

22. ASSOCIATED CIVIL WORKS

The expression 'Associated Civil Works' shall mean civil work to be carried out by the Contractor under the direction of the Engineer in connection with the Electrical Service.

The Contractor shall prepare accurate drawings giving details of all holes, fixings, bases and other civil work requirements and shall be responsible for their accuracy. The cost of preparing shop drawings shall be considered to have been so specified in the tender price.

The following is a summary of the work to be carried out by the Contractor:

- a. The cutting and forming of holes for conduits or pipes, or conduit or pipe fixings through walls, floors, ceilings, partitions, roofs, etc., and making good after the work is sufficiently advanced.
- b. The building of concrete and / or brick ducts in floors, walls, etc.
- c. The formation of concrete bases, etc., for equipment
- d. Excavation forming for underground services of ducts and courses and then covers it.
- e. The cutting or forming of chases, recesses, etc., in floors, walls, etc., for conduits and fittings in and making good.
- f. Excavation for and lying of cable carrying pipes.
- g. The building in of brackets and supporting bars or other form of conduit or

pipe suspensions.

- h. The painting of all pipes, tube and conduits etc. after fixing unless specified to the contrary.
- i. The providing and building in of sleeves through slabs and walls.

In general all required holes through walls, floors and beams for pipes and ducts will be left out by the Contractor during the process of building.

Where conduits, pipes or fittings are fixed to concrete or woodwork by means of saddles or clips, the Contractor shall himself execute the work necessary and the cost of such work shall be considered to have been so specified in the price.

Cutting, fitting, repairing, patching or plastering and finishing of carpentry work shall be done by craftsmen skilled in their respective trades, when cutting is required it shall be done in such a manner as not to weaken structure, partitions or floors. The holes required to be cut must be directed without breaking out around the holes. Where patching is necessary in finished areas of building, the Engineer shall determine the extent of such patching or refinishing.

23. TESTING - GENERAL

Upon completion of installation, at least seven days notice is to be given of intention to perform any test. The Contractor shall perform all static, semi-dynamic (by simulation), and dynamic field testing on all the equipment and systems.

All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment or system compliance with specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the test procedure, test observations and expected results.

The Contractor shall furnish all tools, instruments, test equipment, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all electrical equipment and material including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of Contractor. The Contractor shall record all test values of the tests made by him on all equipment. Four copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc.

The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship, or as any obligations of Contract.

In addition to installation testing, the Contractor is to carry out operation testing of all sections and is to clean, set, calibrate and fully commission, demonstrate and hand over to the Owner the entire Contract works in a thoroughly complete and operational state to the satisfaction of the Engineer.

The acceptance - provisional or final- shall be made by the Owner. This reserves him the right to be represented or assisted by a representative or an organization (whether

official or not) of his choice, which may decide on his behalf any repairs deemed necessary resulting from lack of observations of this specification, or of the rules and standards. In addition, he may judge the quality of the works and the materials supplied.

This remains in force in case of sub-contracting.

The Contractor shall formally engage his direct responsibilities to the Owner or his representative, and likewise, shall assume all responsibility for work performed by sub-contractors and materials he has supplied and installed.

23.1 Insulation Resistance Test

Insulation resistance test shall be made on electrical equipment by using a megger of 1000 volts for circuits between 250 and 500 volts. The insulation resistance of distribution boards, cables, etc., shall be as per IEC, IEEE, BSS and Pakistan Electricity Rules.

The distribution boards shall be given an insulation resistance measurement test after installation, but before any wiring is connected. Insulation tests shall be made between open contacts of circuit breakers, switches and between each phase and earth.

If the insulation resistance of the circuit under test is less than specified value, the cause of the low reading shall be determined and removed. Corrective measures shall include dry-out procedure by means of heaters, if equipment is found to contain moisture. Where corrective measures are carried out, the insulation resistance readings shall be taken after the correction has been made and repeated twice at 12 hours interval. The maximum range for each reading in the three successive tests shall not exceed 20% of the average value. After all tests have been made, the equipment shall be reconnected as required.

23.2 Earth Resistance Test

Earth resistance tests shall be made by contractor on the earthing system, separating and reconnecting each earth connection as may be required by the Engineer. If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The electrical resistance of the E.C.C. together with the resistance of the earthing lead measured from the connection with earth electrode to any other position in the completed installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earthing sets are installed, the earth resistance test between two sets shall be measured by means of Resistance Bridge Instrument. The earth resistance between two sets shall not exceed one ohm.

23.3 Switchgear

Each circuit breaker shall be operated electrically and mechanically. All interlocks and control circuits shall be checked for proper connections in

accordance with the wiring diagrams given by the manufacturer.

The Contractor shall properly identify the phases of all switchgear and cables for connections to give proper phase sequence.

Trip circuits shall be checked for correct operation and rating of equipment served. The correct size and function of fuses disconnect switches, number of interlocks, indicating lights and alarms shall be in accordance with approved manufacturer drawings. Nameplates shall be checked for proper designation of equipment served. Protective relays shall be tested and set at site prior to commissioning of the equipment.

23.4 Special Systems Tests

The special systems such as telephone, intercom, etc., shall be tested according to the procedures laid down in the respective sections of the technical specifications. However, any specific tests recommended by the manufacturer shall also be carried out as approved by the Engineer.

23.5 Complete Tests

After any equipment has been tested, checked for operation, etc., and is accepted by the Engineer, the Contractor shall be responsible for the proper protection of that equipment so that subsequent testing of other equipment do not cause any damage to the already tested equipment.

24. ELECTRICAL CONNECTION

Electrical connection for building shall be supplied by other but necessary arrangement coordination to be done by this Contractor.

25. AS BUILT DRAWINGS AND SERVICE MANUALS

A record shall be kept as the work proceeds of any work not in accordance with the working drawings, and upon completion of the work, the Contractor shall prepare the following drawings and forward them to the Engineer for approval:

- a. Duplicate prints of as built single line diagram of the main and sub main distribution network, indicating all cables, their size and type, and the rating of all protection devices such as circuit breakers, fuses, etc.
- b. Duplicate prints of as built drawings of Lighting, Power, and Telephone as applicable.
- c. Duplicate prints of as fixed control and wiring diagrams for the equipment installed as part of the Electrical Contractor works.

After these drawings have been approved, the Contractor shall supply two prints on paper of each and insert these in the operating and maintenance manual specified below.

The Contractor shall submit to Engineer for approval a sample of manufacturer instructions for installation, testing, commissioning, operation and maintenance manuals including manuals of spare parts and tools of the equipment. Upon acceptance, the Contractor shall supply three copies to the Engineer for forwarding to the Owner. These manuals should be in properly bound form. At least two copies of the documents shall be submitted in original. The installation instruction shall be

submitted two weeks prior to commencement of installation of each equipment, and operation and maintenance instruction at the time of commissioning. If the Contractor fails to provide the documents, the Engineer shall withhold issuance of requisite certificates and deduct suitable amount from the payments to the Contractor.

26. WORK COMPLETION

The Contractor shall further make good, repair, replace all defective works and clear away on completion and leave all installations in perfect working order and to the satisfaction of the Owner or his representative.

27. PAYMENT

No separate payment shall be made for work involved within the scope of this section unless specifically stated in the Bill of Quantities or herein.

SECTION - E - 2
LOW VOLTAGE SWITCHBOARDS / DISTRIBUTION BOARDS

1.0 GENERAL

1.1 Purpose

This section together with its appending document covers the minimum requirement for the design, construction and performance of factory built assemblies of LV switchboard.

1.2 Scope of Work

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of the complete switchboard as specified herein and/ or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

1.3 Standards

Switchboards shall comply with Section - E - 1, Clause 3.

Particular reference shall be made to :

IEC 60027	Letter symbols to be used in Electrical technology.
IEC 60051	Direct setting electrical measuring instruments.
IEC 60073	Colour for indicator lights and push bottoms
IEC 60158	LV Switch gear and control gear.
IEC 60185	Current Transformers.
IEC 60186	Voltage Transformers.
IEC 60269	LV fuses.
IEC 60439	Factory built assemblies of LV switch gear and control gear.
IEC 60529	Degree of protection provided by enclosures.
IEC 60617	Graphic symbols for diagrams.
IEC 60947-2	LV Switch gear and Control gear.
BS 951	Earthing Clamps
BS 1433	Hard drawn bare copper conductor for earthing.
BS 2874	Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346	PVC Insulated Cables.
CP 1013	Earthing

Any other standard referred to in above standards or these specifications.

1.4 Installation and Service Conditions

For general site conditions refer to Section - E- 1, Clause 4.

Switchboard shall be installed indoor. The equipment shall be capable of operation under the prevailing ambient conditions without any deleterious effect of any kind. Switchboard shall be suitable for continuous operation at full load rating under combined variation of both voltage and frequency as stated in Section - E-1, Clause 5.1.

Transient voltage depression down to 80% of rated voltage shall not affect the performance of the equipment and dip voltage must be within permissible limit.

2.0 MAIN ELECTRICAL CHARACTERISTICS

2.1 Power Supply System

Main characteristics of power supply system applicable to all switchboards are:

- Voltage 380 V \pm 10%
- Phase 3 ϕ , 4 Wire.
- Frequency 50 Hz. \pm 2 Hz.
- Neutral system Solidly grounded.
- Peak asymmetrical SCC To be specified by the bidders.
- RMS symmetrical SCC To be specified by the bidders.

2.2 Ratings

The equipment shall be capable of carrying the specified current on a continuous basis of 24 hours / day, without exceeding the permitted temperature.

The current ratings of all equipment must be guaranteed at the specified design temperature. Equipment shall be fully rated and constructed for withstanding, making and breaking the specified short circuit duty.

3.0 GENERAL REQUIREMENTS

3.1 Concept

The Switchboard shall be of standard, prefabricated metal clad cubicle(s), floor mounting type, totally enclosed, dead front, dust tight and vermin proof requiring front access only. It shall complete in all respects with material and accessories, factory assembled, tested and finished all according to the specifications and to normal requirements. For indoor installations the international classification shall be IP42.

The Switchboard with all components and accessories shall be suitable for front operation only and shall:

- have a rated service short service breaking capacity, Ics at 400 VAC, conforming to IEC 60947-2 unless otherwise stated on the drawings.
- be provided with adequate clearance from live parts so that flash over cannot be caused by switching, vermin, pests, etc.
- have all components rated for insulation class 600-volt minimum.
- be designed for flush mounting of all instruments on the front side.
- have all incoming or outgoing connections from the top or bottom as required. Have the components mounted so as to facilitate ease of maintenance from the front. Have common lamp test facility for all lamps.
- have wiring diagram on the inside of door of the switchboard. Be labeled with nameplate on the front side of door.
- have arrangements for extension of switchboard in future.

3.2 Accessibility

Switchboard shall preferably be arranged for bottom cable entries. Adequate space must be provided for cable entries and termination. It shall be possible to work easily and safely on cable of a main or control outgoing circuit in OFF position with the remainder of the board alive.

Adequate system shall be provided for installation and clamping of cables inside the cable compartment. Position of terminals and cables shall allow use of clamp ammeter.

Power and Control cable termination shall avoid obstruction to other cable termination and provide easy access for terminating cables. Cable supports shall be provided to avoid undue strain on cable termination. Easily accessible locations shall be reserved in the compartment for measuring transformers.

3.3 Name plates

On the front side, a name plate shall be provided at the top to indicate the name of manufacturer, system voltage and frequency and the current carrying capacity of switchboard.

Each breaker shall have a circuit identification label fitted below the breaker aperture or as suitable.

Drawing indicating the branch circuit names, breaker elements, cable sizes and connecting services shall be placed in a clear plastic pocket provided at the back of the front access.

Labels described shall have block letters 7 mm high on a white back ground, to be made from traffolite and be fixed with screws.

Each incoming and outgoing circuit shall also be labeled with name plate 75 mm x 15 mm, as described above on the front side of door.

4.0 MECHANICAL DESIGN

4.1 General Construction

The switchboard shall be fabricated, welded; grinded, finished with angle iron framework and cladded with 14 SWG MS sheet, to form a rigid, free standing, surface mounting fronted assembly.

It shall be suitably divided into panels and compartments for accommodating the required number of circuit components, instruments and accessories. Each compartment shall be fully partitioned from its neighbor both horizontally and vertically, allowing safe cable routing / termination without shutting the switchboard down.

All live parts within cubicles, compartments or modules, which have to be accessible during normal maintenance operations, shall be adequately protected and / or barred to ensure protection of works and to avoid accidental contact. Barriers may be rigid, transparent, insulating material fitted with warning labels.

The doors shall be provided with hinges on the left-hand side and locking handles on the right hand side for fastening the door. The front assembly shall be fastened to the enclosure by means of self locating fasteners for quick and easy fixing.

All holes, cutouts shall be tool or jib manufactured and free from burrs and rough edges. All structural components shall be of standardized design to provide complete uniformity and inter change ability of common parts. Removable gland plated shall be provided at top and / or bottom as required.

The switchboard shall be supplied complete with foundation bolts and other installation materials as recommended by the manufacturer. Proper size cable clamping channels with galvanized steel clamps and brass cable clamps respectively for unarmoured and armoured cables shall be provided.

The cabling inside the Switchboard shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the switchboard shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

4.2 Bus Bars

Bus bars and droppers supported on non - hygroscopic material are to be high conductivity electrolytic tinned copper, completely isolated and mechanically braced and rated to withstand the specified short circuit currents for one second duration.

Bus bars and droppers shall be housed in a separate compartment and shall be clearly marked with their respective colors. Bus bars shall be provided for three phases, neutral and multi - terminal earth. The temperature rise shall not exceed 50 degree centigrade at rated current. Neutral bus assembly shall consist of outgoing screw terminals with one terminal for every MCCB / MCB. Neutral Bus bar should be of same ampere rating as phase bar.

Removable metal covers on the bus bar chamber shall be provided with suitably sized labels at regular intervals, fixed with self tapping screws and warning of live metal work.

All bus connectors shall be tinned plated connections and joints. Horizontal bus bars shall be of the same current rating throughout their length.

4.3 Earthing

A copper earth bar of suitable section for the specified fault level shall extend the entire length of the Switchboard. Provisions shall be made for possible future extensions at both ends.

Earthing facilities shall be provided on each incoming and outgoing unit to permit earthing of the connections.

All metallic non-current carrying parts of the Switchboard shall be bonded together and connected to the Switchboard's earth bar.

Each circuit wiring shall be green / yellow colour. Earthing mass continuity between withdrawable parts and fixed frame shall be correctly ensured whatever the withdrawable part position.

Provision shall be made adjacent to cable termination for earthing cable armour to the earth bus bar.

Earthing switch shall be provided wherever mandatory as per rules and regulations / codes and standards and shall be manually operated. An interlocking system shall provide the following locking and safety functions:

- Impossibility of closing the earth switch if the switching device is closed.
- Visual check of earthing switch positions to be possible.
- Possibility of locking the earthing switch operating handle in open and closed position.
- The earthing of the bus bar shall be done manually by the operator without provision of general earthing system.

5.0 DISTRIBUTION BOARDS

The enclosure of the LV Distribution Board shall be fabricated from electro-galvanized / zinc coated sheet steel.

The LV Distribution Board shall be fabricated with 16 SWG sheet steel recess mounting. All components shall be installed on a common component mounting plate made of 14 SWG sheet steel inside the enclosure and protected from the front with screwed sheet steel front plate. The door and dead front covers shall be made of 14 SWG sheet steel. The door shall be fully gasket with hinges on the left hand side and locking handle on the right hand side for fastening the door. The locking handle should be detachable. The dead / front assembly shall be fastened to the enclosure by means of self - locating fasteners for quick and easy fixing.

The distribution board shall be supplied complete with all installation materials as recommended by the manufacturer. The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box for accommodating the cables and conduits may be provided. The box shall be of the same material and finish as the Distribution Boards.

An earth bar or terminal strips shall be provided for connection of incoming and outgoing earth conductors. The earth bar or terminals shall be permanently connected to the body of Distribution Boards at two points. Flexible copper strip shall be provided for earthing of the door of Distribution Board.

Neutral bus assembly shall consist of out going screw terminals with one terminal for each MCB. All holes, cutouts, etc., shall be tool or jib manufactured and free from burrs and rough edges. Removable gland plates shall be provided at both the top and /

or bottom, as required.

The cabling inside the distribution board shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the distribution board shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

6.0 COMPONENTS

The switchboards shall be provided with all components as specified or shown on the Drawings and as necessary for the satisfactory operation of the Switchboard and of the electrical system. All components should comply with IEC 60947-2. Typical specifications are given hereunder:

6.1 Air Circuit Breaker (ACB)

Air circuit breaker should be three poles / four poles as mentioned in drawing suitable for making and breaking a fault condition. Operating mechanism shall be manually or motor operated charged spring with front drive grip handle. These shall be locally operative. Mechanically operative ON-OFF-OFF indicators positively driven in both directions shall be provided to indicate the position of the unit.

Overload and over current features / relays shall be of an adjustable, manually resettable type, according to manufacturer's standard range.

Each ACB shall have built in tester with the selection of Trip or Non-Trip Functions. Also with the facility of testing the ACB in field from single phase (220VAC) supply only. Each of the above function shall have separate LED Indicators and Alarm switches for trip monitoring of Overload, Short circuit, Pre trip alarm and Ground Fault. ACB shall be having Trip Memory.

The Breaking Capacity of ACB shall be 65KA. ACB breaking capacity shall be; $I_{cu}=I_{cs}=I_{cw}$.

The circuit breaker shall have two normally open and two normally closed auxiliary contacts rated for 10 Amps. 230 VAC. The circuit breaker shall also provide for ON-TRIP-OFF indicating lamps. The circuit breaker shall have specified reclosing capacity without the use of back-up fuses. Auxiliary release and trip coils shall be provided for desired operation and / or interlocking as shown and / or stated on the Drawings.

6.2 Moulded Case Circuit Breaker

These shall be three pole 400 / 500 volts rating shown on the drawings. The

breakers shall have both time delay over current and instantaneous short circuit protection.

The MCCBs shall be installed such that their switching levers are accessible through the dead front plate for operation. Circuit numbers / designation on all circuits shall be conspicuously marked to facilitate connection and maintenance.

The breaker shall have quick make - quick break toggle mechanism with positive 'ON', 'OFF' and intermediate 'Tripped' positions.

Trip mechanism shall be trip free on overload or short circuit ensuring that the breaker will not close / remain close even if the close command is given while the circuit breaker has tripped due to short circuit or continuing overload.

6.3 Miniature Circuit Breaker (MCB)

The MCBs with current rating from 3 to 80 amperes shall be conforming to BS EN 60-898 or IEC 60947-2. The circuit breakers shall be suitable for DIN-rail mounting, maintenance-free and fully tropicalised.

The MCBs shall be designed for horizontal or vertical mounting, or reverse feeding, without any adverse effect on electrical performance.

The operating mechanism shall be quick make, quick break type, trip free, with all poles opening and closing simultaneously (except for the neutral pole, which if required shall be of the advance-closing and late-opening type). The operating toggle shall clearly indicate the ON and OFF/TRIP positions.

The individual operating mechanism of each pole of a multiple MCB shall be directly linked within the MCB casing and not by the operating handle.

Each pole of the MCBs shall be provided with bimetallic thermal element for overload protection and a magnetic element for short circuit protection.

6.4 Load Break Switches

Load Break Switches and contractors shall be of AC3 type for motor loads. Air circuit breakers above 630A shall be housed in separate cubicles. Aluminium plate shall be provided for cable entry to ACBs / MCCBs cubicles of 630A and above rating.

7.0 PARTICULAR COMPONENT REQUIREMENTS

7.1 Current Transformers

Current transformers shall comply with the requirements of IEC 60185 (or equivalent).

Current Transformers shall be polyester resin insulated, ring type, air cooled having transformation ratio as indicated on the drawings. The current Transformers shall be of suitable burden having accuracy class 1.0. The Current Transformers shall have rated secondary current 5A / IA as required.

Current Transformers shall mechanically and thermally withstand the specified

short circuit capacity. Test terminal blocks shall be provided for current Transformer secondary circuits having short circuiting provisions to allow portable apparatus to be connected.

7.2 Voltage Transformers

Voltage transformers shall comply with the requirements of IEC 60186 (or equivalent) and shall be of the same accuracy class as Current Transformers.

Voltage Transformers shall be equipped with primary fuses with an interrupting capacity of the incoming circuit breakers. Test terminal block shall be provided for each Voltage Transformer system.

7.3 Ammeters and Voltmeters

Indicating instruments shall be semi-flush Switchboard type, moving Iron, spring controlled with standard scale having white background and black graduations and markings. The front dimensions shall be 144 x 144 mm for instruments on incoming side and 96 x 96 mm on all outgoing circuits.

Indicating instruments shall be 1.0 class percent of full scale basic accuracy class in accordance with IEC 60051.

The ammeter shall be suitable for connection to 5 Amp. Secondary of Current Transformer or directly through shunt as shown on the drawings. The instruments shall have measuring range indicated on the drawings. A red mark shall be provided at the working voltage on the scale of all voltmeters.

7.4 Selector Switches

Ammeter and voltmeter selector switches shall be complete with front plate, grip handle, R-Y-B and OFF position for ammeter and RY-YB-BR-RN and OFF positions for voltmeters.

The selector switches for controls shall be rotary cam type and shall be provided complete with knob and front plate, showing all positions as required.

7.5 Push Buttons

The push buttons shall be momentary make / break contact type (normally open / normally close) and suitable for flush mounting. The push button for ON and OFF switching shall be red and green respectively.

7.6 HRC Fuses

HRC Fuses shall be provided complete with fuse bases, fuse, etc. The fuses shall have a fusing factor as specified for class Q1 in accordance with BS 88.

7.7 Pilot Lamps

Switchboard shall be provided with phase indicating pilot lamps. The lamps shall be rated for 250 volts supply and suitable for flush mounting. The front of the lamps shall have colored rosettes for identification of phases.

7.8 Secondary Wiring

All wiring shall be copper conductor, thermoplastic insulated, at least 1 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.

8. INSTALLATION

The LV Switchboard shall be installed at location shown on the drawing. The Contractor shall ensure coordination with civil works for providing any openings, holes, etc. to avoid any breakage to completed works. In case the provisions in civil works for the installation of electrical equipment are not made or made incorrect the same shall be rectified by the Contractor at his own cost and to the satisfaction of the Engineer. The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

All installation material for physically erecting the Switchboard, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. The Switchboard shall be installed upright and in level and shall be firmly and rigidly bolted to the floor and concrete supports.

The switchboard shall be completely erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking provided by the manufacturer for safe transportation shall be released only after the switchboard is erected in position.

The incoming and outgoing cables shall be connected as recommended by cable manufacturer. The cable armour shall be connected effectively to ground.

The Switchboard body shall be connected to earth as per instructions given in section "Earthing" of these specifications. The Switchboard shall be tested and commissioned in the presence of the Engineer. 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 E-1 of these specifications.

**SECTION - E - 3
LOW VOLTAGE CABLES AND WIRES**

1. SCOPE OF WORK

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of low voltage cables and wires and the accessories as specified herein or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The LV cables and wires with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

2. GENERAL

All multicore and single core wires for light circuits, socket outlets and circuits operating upto 250 volts shall be 450 / 750 volts grade. All single core sheathed cables shall be of 450 / 750 volt grade and upto 16sqmm and above shall be of 600/1000V. Power cables for main feeders, main to sub main feeders, power equipment, etc., armoured or unarmoured shall be of 600 / 1000 volts grade. Armouring of cables shall be done with appropriate size galvanized steel wire as per codes.

The conductors shall be stranded or solid, high conductivity, soft annealed copper. Conductor of single core cables shall be circular, whereas of multicore cables may be circular or shaped according to standard practices and codes. The PVC insulation shall be extruded with a PVC compound having good flexibility, resistance to aging and ability to withstand the ambient temperatures as given in General Specifications for Electrical Works, Section E-1 of these specifications. Cable should be capable of running 125% of full load current without any damage.

3. STANDARDS

LV Cables and Wires shall comply with Section – E -1, Clause 3.

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. MATERIAL

4.1 General

The power, lighting and control cables shall be furnished and installed in accordance with the routes and requirements shown on the drawings.

All cables shall have phase identification colours on insulation of each core.

The colour code for three phase circuits shall be red, yellow and blue for phase conductors and black for neutral conductor. Where insulated earth conductor is installed, it shall have green colour insulation.

Single phase circuits shall have insulation of red colour for phase / line, black colour for neutral and green colour for earth conductor.

All DC circuits shall have insulation of red colour for positive, black colour for negative and green for earth conductor.

The ends of each length of multicore armoured or unarmoured cables shall be properly marked for clock-wise and anti clock-wise sequence of core colors.

4.2 Cables for Conduit Wiring

All cables / wiring in concealed or surface mounted PVC or steel conduits shall be single core PVC insulated of specified grade and size, unless specifically shown on the drawings or given in BOQ.

4.3 Cables on Surface / Concrete Trenches

Cables for distribution system to be installed on surface, in cable ducts, in concrete trenches or on trays shall be single or multicore PVC insulated and PVC sheathed of specified voltage grade and size, unless specifically shown on the drawings or given in BOQ.

4.4 Underground Installation

Cables for laying directly underground shall be PVC insulated, PVC sheathed and armoured with galvanized steel wire. Cables fully installed in underground ducts / pipes and mechanically protected from end to end shall be PVC insulated and PVC sheathed unless specifically shown on the drawings or given in BOQ.

4.5 Cable Accessories

All cable accessories shall be provided for the complete cabling and wiring system without any additional cost unless specifically mentioned in BOQ. These shall include but not limited to the items such as saddles, clamps, fixing channels, connectors, cable joints (where necessary and approved by the Engineer), clips, lugs, tapes, solder, identification tags, bushes, glands, etc.

5. INSTALLATION

5.1 General

When the laying is effectuated by others, the contractor shall test the cable characteristics insulation and continuity, at all phases of these and communicate them in a report to the Engineer, as per recommendations of the standards according to which the cable is manufactured.

The cables shall be spaced by categories along their entire length as well as upon penetration into buildings and in their interiors, according to their following rated voltages:

- 30 cm at least between a cable carrying 1 KV - 30KV and other cables.

- 20 cm at least between a cable carrying voltages between 50V - 500V, and any power or control 10 cm at least between a cable carrying voltages lower than 50V and telephone or these possible being grouped.

All installation material, labour, tools and accessories for cable installation shall be furnished by the Contractor. The cable and accessories shall be installed as described in accordance with these specifications, drawings and manufacturer's instructions.

5.2 Conduit Wiring

The wiring through conduit shall be started only after the conduit system is completely installed and all outlet boxes, junction boxes, etc., are fixed in position. The filling rate inside the conduits shall not exceed 50 %. Cables directly embedded in the masonry are not accepted.

The wires shall be pulled in conduit with care, preferably without the use of any lubricant. Where necessary and if approved by the Engineer, the cable manufacturer's recommended lubricant may be used. Where several wires are to be installed in the same conduit, they shall be pulled together along with the earth conductor. All wires of same circuit shall be run in one conduit.

The wires shall not be bent to a radius less than 10 times the overall diameter of the wire, or more if otherwise recommended by the manufacturer.

The wiring shall be continuous between terminations and looping-in system shall be followed throughout. Any joint in wires shall not be allowed. The use of connectors shall only be allowed at locations where looping-in is rendered difficult. The consent of the Engineer shall be required for using connectors. The connector shall be of suitable rating having porcelain body with sunk-in screw terminals. The connector shall be wrapped with PVC insulation tape after its installation. A minimum of 150 mm extra length of cable / wire shall be provided at each termination to facilitate repairs in future.

5.3 Cables on Surface / Trenches

All cables for installation on surface of wall, column, ceiling, trenches, etc., shall be fixed to the surface by means of galvanized steel clips, secured to a steel channel using suitable stud plate, nuts and washers.

The erection of cables and position of support shall be agreed by the Engineer on site, having taken into consideration the accessibility of all such routes. These shall be so arranged that cable crossing one another be minimized if cannot be avoided.

Cables shall be fixed throughout their length by means of approved saddles, clips, etc., at every 600 mm vertically and 900 mm horizontally.

Cables and equipment fixed to a building fabric, i.e., brickwork, concrete, etc., shall be fixed by means of appropriate fixing devices, i.e., Raw bolts, Hilti fixing devices, etc., or alternatively by means of suitable fixing devices cast at site, e.g., concrete inserts.

Contractor shall be responsible for all drilling of steel work, brick work and masonry where necessary for fixing clamps and brackets for supports.

Cables shall not be pulled into conduit until the conduit system has been completed, cleared and free from obstruction and sharp edges.

It shall be ensured that conduit system is clear before cable is drawn in. cables shall be put into conduits in such a manner that there will be no cuts or abrasions in the cable insulation, protective braid and jackets. There shall be no link in the conductors.

Distance of saddles shall be used for installation of cables in defined condition of the surface of wall etc.

Grease or other injurious lubricants shall not be used in pulling cables. The use of talc or non injurious lubricants is permissible, if desirable.

The number of wires installed in any conduit shall be such that the resulting space factor does not exceed 50 %. Spliced wires shall not be pulled through conduits.

All conduit wiring shall be carried out in the loop - in principle from outlet box to outlet box and in no circumstances shall joints be used except in fixed base connection blocks housed in outlet boxes.

The vertical clearance between two adjacent cables at any point is 50 mm minimum. Common mounting, channels are to be furnished for cable along the same route. The Contractor can offer alternate cable fixing arrangement, which shall be approved by the Engineer before commencement of installation.

The wall crossings where the outdoor cables penetrate in the building shall be carefully obstructed by means of polyurethane foam. The Contractor shall be fully responsible for the perfect tightness of these cable penetrations.

5.4 Underground Cables

The Contractor shall plan and take special care to prevent any damage to existing under ground facilities such as under ground piping, cables, foundations, etc. The Contractor shall notify the Engineer of any obstruction encountered and shall provide protective support or removal of such obstructions as instructed by the Engineer. Excavation adjacent to existing facilities, such as foundations manholes, ducts, under ground pipelines and paving shall be braced and / or shored properly to protect those facilities during excavation and construction.

Sufficient slack shall be left in cables for this purpose that cut lengths of cables shall allow about 3% more in the measured lengths between terminations.

Cables, whether installed under ground or in concrete trenches, shall not be bent to a radius less than 10 times the diameter of the cable or as recommended by the cable manufacturer, whichever is higher.

All cables shall be marked at least at each end, switch gear and equipment

termination, where cable enter or leave under ground cable trenches or channels, where cable rises from one level to another, at 30M intervals with predetermined identification numbers, by means of proprietary non-deteriorating type, PVC, heat shrinkable, strap-on type or equivalent, for the identification of cable and circuit. These shall be indelibly marked with cable number and securely fixed to the cable. Where conductors are left to be terminated by another party or left to be connected later, they shall be identified. The earth continuity conductor shall be laid in the trench with the cables.

Cables entering the buildings shall also be laid in protective pipes. The protective pipe ends, after installation of cables, shall be plugged water tight by means of polyurethane foam / bituminized Hessian or equivalent method as approved by the Engineer.

5.5 Cable Termination and Joints

Cables shall be terminated in a safe, neat and approved manner at the associated equipment, included that erected by others.

Compression type connectors (lugs) shall be of the correct size and approved type for the conductors concerned. Compression tools shall be supplied for specific use and shall be maintained in good order. After compression the conductor and terminal shall form a solid mass ensuring good conducting properties and mechanical strength. The compression jointing system used throughout the installation must be approved by the Owner or his representative before use.

The Contractor shall be responsible for all drilling and if necessary, tapping entries where these have not been provided by others.

When preparing cables prior to fitting glands, the gland manufacturer's instructions for cable preparation shall be observed. In all cases where armoured cables are used, care shall be taken to ensure that the lay of the armour is maintained after the gland is completely fitted.

Termination and joints shall be suitably insulated for the voltage of the circuits in which they are used.

Every compression joint shall be of a type, which has been the subject of a test certificate as described in BS 4579.

Cable ends, which are not terminated immediately after cutting, shall be sealed effectively to prevent ingress of moisture and shall be protected from damage until termination.

For all cables above 6 sq. mm in section, if a substantial mechanical clamp is not provided a compression type lug or socket shall be provided. At all equipment, cable shall be installed and terminated so that no strain is imposed on the cable or gland and due allowance made to counter the effect of vibration. At all termination an ample length of 'tail' shall be left.

Where joints in cable conductors and bare conductors are required, they shall

be mechanically and electrically sound and they shall be accessible for inspection. Joints in non-flexible cables shall be made either by soldering or by means of mechanical clamps or compression type socket, which shall securely retain all the wires of the conductors.

Any joint in flexible cable shall be effected by means of cable coupler. Cable couplers and connectors shall be mechanically and electrically sound and shrouded in metal, which can be earthed. Where the apparatus to be connected require earthing every cable coupler shall have adequate provision for maintaining earth continuity.

Cables of AC circuits, installed in PVC or steel conduit shall always be so bunched that the cables of all phases and the neutral conductor (if any) are contained in the same circuit. The outdoor apparatus shall normally be connected by means of cables with conduit termination down to about 30 cm below ground level or concrete foundation. The conduit shall be firmly secured down to their penetration into the trench or channel.

**SECTION - E - 4
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 Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The Conduit and Pipes with accessories shall also comply with the General Specifications for Electrical Works, Section E- 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 D-Class (working pressure - 12 Kg / cm), unless otherwise stated on Drawings or Bill of Quantities. Where pipe changes direction, manufactured smooth bends shall be used. For jointing of pipe, all precautions and procedures recommended by manufacturer shall be followed.

4.2 Steel Conduit and Accessories

All conduits shall be of heavy gauge 16 SWG steel, manufactured and tested in accordance with latest relevant standards.

The conduit shall be protected by two base coats of red oxide anti-rust paint and finished in first quality black enamel paint. The coating shall be of heavy enamel, which shall not flake or crack during installation and handling. Each conduit length shall be furnished with threaded ends and a threaded coupling at one end. Soft metal bushes shall be provided at conduit termination to prevent damage to cable during pulling operation.

Junction boxes shall be 100 mm square, having minimum depths of 38 mm or 65 mm as required for accommodating the number of wires. The junction box shall be 16 SWG sheet steel provided with anti-rust paint and finished in heavy black enamel paint. The cast Iron outlet boxes for light points shall be round having 50 mm diameter and 63 mm depth. The above dimensions are given as minimum only, and the exact size shall be determined by the Contractor keeping in view the ease of Installation and maintenance. All outlet boxes and junction boxes shall be provided with one piece bakelite cover plate of suitable design.

4.3 Galvanized Iron Pipes and Accessories

The G.I. pipes shall be galvanized from inside and outside by hot dip galvanizing method. The pipes shall be free from stains, burrs or any other defect. The accessories for G.I. pipes shall be galvanized from inside and outside. The conduit shall be NPT threaded, with at least 5 complete threads and assembled with TEFLON tape.

4.4 Inspection Boxes / Pull Boxes

The rectangular inspection boxes or pull boxes shall be of 16 SWG heavy gauge, sheet steel having nipples welded to box at entry holes to receive PVC conduit with force fit. The box shall be painted inside and outside with black enamel paint over a base coat of red oxide primer paint. The minimum length of inspection box shall not be less than six times the cable manufacturer's recommended bending radius of the cable. All concealed type pull boxes shall have a white plastic sheet of appropriate size fixed to the box by means of galvanized screws.

4.5 Conduit / Pipe Accessories

Bushes, plugs, glands, etc., shall be of brass and all male bushes shall be of long thread pattern. Covers for boxes shall be screw fixed and finished as the

boxes. Gaskets shall be fitted only when finish is galvanized unless otherwise specified.

4.6 Cable Trunking

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m intervals with straps and hangers fabricated from minimum 6-mm dia HDGF bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking of fitting, and continuity shall not depend on contact through the screws, 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 covered before plastering. The work of curing in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from Engineer for the route, to suit the site conditions before starting chasing and cutting.

The termination of conduits at or near the Switchboard / Distribution Board is shown diagrammatically on the drawing. The exact final locations of the termination shall be coordinated with the Switchboard / Distribution Board to be installed. Any extension of conduit near the Switchboard / Distribution Board to suit the site condition shall be made without any extra cost. Conduit ends pointing upwards or downwards shall be properly plugged in order to prevent the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against filling with concrete. At all termination of concrete, soft bushes shall be fixed to prevent sharp edges of conduit ends from cutting or damaging the wires or cables to be pulled through them.

The entire conduit system shall be installed and tested before wiring is carried out. Any obstruction found shall be cleared by use of cutting mandrel or other approved device and the conduit shall be cleaned out before the installation of cable.

Pull boxes / Adaptable boxes shall be provided in conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of pull boxes or adaptable boxes. However, these shall meet the following requirements:

- Pull boxes.
 - For straight runs the spacing shall not be more than 30 meters.
 - For runs with one 90 degree bend, the spacing shall not be more than 15 meters.

Wherever the conduit lengths cross the expansion joint either along the column or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed, the conduit neither develops any cracks nor breaks down.

Bending, off setting 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 a 16 SWG steel wire drawn through the conduits for pulling of cables. Joints in underground conduits shall be avoided or reduced to the absolute minimum.

Where adjustable dies are used they shall be so adjusted that threads cut with them shall be the same depths as machine made threads.

The use of manufactured bends shall be avoided and instead smooth bends shall be provided by using approved type of bending tools.

Flexible steel conduits shall be installed at all points' locations where flexible connection is required, as directed by the Engineer. The flexible conduits when used shall be protected by external PVC sheath, resistant to oil damages.

G.I. pipes for under ground installation shall be given bituminous paint coating and wrapped with suitable paper or cloth before installation.

5.3 Fixing of Conduits and Fittings

Conduits in buildings shall be fixed with galvanized distance saddles. Where a number of conduits follow a single route they may be fixed to mild steel brackets.

Conduits shall be supported on both vertical and horizontal runs as follows:

- Conduits size 20 mm and 25 mm maximum spacing of fixing 1000 mm.
- Conduit sizes larger than 25 mm spacing of fixing 1500 mm.

All conduit boxes that support fittings shall be securely fixed. All conduits shall be fixed 150 mm before and after every right angle or off set. All conduit fittings and equipment shall be fixed true and line able.

All conduit bends shall be made with an approved conduit bending machine or hickory. The radius of curvature of the inner edge of any bend shall not be less than the following table:

Conduit size	Radius
20 mm (3/4")	Not less than 130 mm.
25 mm (1")	Not less than 150 mm.
32 mm (1-1/4")	Not less than 200 mm.
38 mm (1-1/2")	Not less than 255 mm.
50 mm (2")	Not less than 305 mm.
70 mm (2-1/2")	Not less than 380 mm.
82 mm (3")	Not less than 460 mm.
100 mm (4")	Not less than 610 mm.

Under ground 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. Under ground 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 - 5
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 switches, switch sockets, etc., and miscellaneous items as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The wiring accessories shall also comply with the General Specifications for Electrical Works, Section – E - I and with other relevant provisions of the Tender document.

2. GENERAL

The locations of the wiring accessories such as sockets, switches etc. are tentatively shown on the drawings. The Contractor shall ensure exact positions and locations of wiring accessories in coordination with other services drawings, as per site requirements and as directed by the Engineer. The Contractor shall be responsible for proper functioning of wiring accessories after installation and Commissioning.

3. STANDARDS

Wiring accessories and miscellaneous items shall comply with Section - E-1, Clause 3. Particular reference shall be made to:

- BS 67 Ceiling roses.
- BS 1363:1984 13A fused plugs and un-switched socket outlets
- BS 116 Two and three terminal ceiling roses.
- BS 2135 Capacitors for radio interference suppression
- BS 3676 Switch for domestic and similar purposes.
- BS 4934 Safety requirements for electric fans and regulators.
- BS 5060 Performance of circulating fans and their regulators.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 Switches

Switches for controlling light and fan points shall be single pole, rated for 10 Amp, 250 VAC. The body of switches shall be made of poly carbonate / urea with white face plate suitable for flush mounting on sheet steel outlet box. The switches shall be gang type having silver tipped contacts and operate with snap action.

For locations where switches and fan speed regulators are installed together, single switches shall be grouped and fixed on 3 mm thick plastic sheet screwed to a sheet steel box of appropriate dimensions. The fixing of plates on outlet boxes shall be means of flat head counter sunk galvanized screws with the head of the screw finish flush with the surface of the plate. Except for switches controlling light points, all single switches for fans, sockets, etc., shall have identification symbols on the operating levers.

4.2 Switched Socket Outlets

Switched socket units shall be of flat pin type and conform to BS 1363, 13A for fused plugs and socket outlets. 2 and 3 Pin rated for 10 Amps. Supply as specified in the bill of quantities.

2 Pin 10 Amps/13A 3 Pin sockets shall be molded type having white plastic face plate, suitable for mounting on a sheet steel box of appropriate dimensions. Switch sockets shall have shrouded live contacts such that the earth pin is engaged to socket earth before making with the live contacts. Where specified, the switch socket unit shall have spring loaded dust tight cover for mechanical protection.

4.3 Sheet Steel Boxes

The outlet boxes for installation of switches, fan speed regulators and socket outlets shall be 16 SWG sheet steel having appropriate dimensions. The boxes shall have suitable knockouts or welded nipples for receiving the conduits. An earth terminal shall be provided for connecting at least three earth wires of 4 sq. mm. The outlet boxes shall be given two coats of anti-rust red oxide and one coat of enamel before installation. The boxes shall be suitable for mounting flush with the surface of wall or on the surface of wall as may be required. The boxes shall not be less than 75 mm x 75 mm (3" x 3"). All boxes shall be water tight where installed in the vicinity of liquids.

4.4 Ceiling Rose

The ceiling rose shall be suitable for 10 Amps. 250V AC. It shall have white plastic moulded base plate, copper or brass terminals for connecting at least two wires of 2.5 sq. mm size. The ceiling rose shall have a cover with cable inlet hole for multicore PVC insulated and PVC sheathed cable.

4.5 Fans

4.5.1 Exhaust Fan

The exhaust fans shall be three blade types, mounted on the steel/plastic structure of its own, which will be fixed to the structure by means of suitable grouted foundation bolts. The fan shall be suitable for operation on 250 VAC with + 10 % tolerance.

The sweep of the fan shall be as given in Schedule of Quantities/drawings. Fans shall be direct driven and supplied complete with electric motor, back draft dampers and anti-vermin screen. The bearings shall be ball, roller or sleeve type of permanently lubricated and sealed type. Wheels shall be heavily and rigidly constructed and accurately balanced both statically and dynamically and free from objectionable vibration or noises.

The fans shall comply with BS 380 as far as constructional requirements, range of fan speed, speed regulator starting, radio interference silent operation and temperature rise is concerned. For testing BS 848 as amended 1 960 shall be complied with.

SECTION - E – 6
INTERIOR LIGHTING FIXTURES

1. 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.

The light fixtures with accessories shall also comply with the General Specifications for Electrical Works, Section - E-1 and with other relevant provisions of the Tender document.

2. GENERAL

The description of light fixtures in given Bill of Quantities, and stated on the drawings, and relevant material are described in this section. The determination of quality is based on certified photo-metric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.

The Contractor shall submit two samples of each and every light fixture specified and obtain approval of the Owner before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer. The accessories such as ballast, lamp / starter holders, starters, lamps, igniters, etc., for all type of light fixtures shall be of Philips make.

All fixtures shall be finished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the Specifications, Drawings or Bill of Quantities or directed by the Engineer.

3. STANDARDS

Lighting fixtures shall comply with Section E-1, Clause 3.

Particular reference shall be made to:

- IEC 81 Tubular fluorescent lamps.
- IEC 82 Ballast for tubular fluorescent lamps.
- IEC 155 Starters for fluorescent lamps.
- IEC 400 Lamp holders and starters holders for fluorescent lamps.
- IEC 566 Capacitors for use in TL, HP Mercury and LP sodium vapour.
- IEC 598 Luminaries.
- BS 3677 Discharge lamp circuits.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 Fluorescent Light Fixtures

The fluorescent light fixtures shall have lamps and ballast of proper rating as shown on the drawings. Each lamp shall be provided with independent ballast.

The fluorescent lamps shall be tubular, 1224 / 610 mm long, for TL 36 / 18 watts respectively as specified. The fluorescent colour shall be daylight white characteristics with an average output of 3350 lumens (+5%) for 36 watts and 1350 lumens (+5%) for 18 watts after 100 burning hours. The ballast shall be electronic type for 36 watts ballast. A wiring, diagram, wattage, voltage and current figures shall be printed on the body of the ballast.

The lamp holders shall be rotary lock-in type. The starters shall be glow type with radio interference suppressor / by-pass capacitor. The internal wiring of the fluorescent light fixtures shall be done with heat resistant wires at the manufacturer's factory. All light fixtures shall be provided with power factor improvement capacitor to give a minimum power factor of 0.90.

The body of the fluorescent light fixtures shall be minimum 22 SWG sheet steel, derusted, degreased, finished in heat resistant paint, stove enameled. Appropriate size bushed wire entry holes, fixing holes and earth terminals shall be provided. Connectors suitable for connecting 2.5 sq. mm cable connectors shall be provided for supply connections. An earth terminal for connection to 14 SWG copper conductors shall be provided.

The light fixtures shall be furnished with perspex diffusing panels " 040 opal acrylic" (minimum sheet thickness 3 mm), polystyrene louvers or metal grid louvers or mirror optic reflectors, etc. as specified on the drawings or in BOQ. The louvers shall be secured firmly and in level. The polystyrene louvers shall be white Egg Crate or as approved. The louvers shall be in one section and not in pieces.

The design of light fixture for recess mounting shall be coordinated with the design of false ceiling prior to commencement of manufacture. Shop drawings shall be submitted for approval of Engineer.

5. INSTALLATION

5.1 General

The mounting heights of light fixtures are indicated on the drawings, and position of fixtures according to the mentioned scale.

The Contractor must ensure that the light fixtures are installed uniformly with respect to the dimensions of the area. Any modifications due to site conditions may be made with the approval of Engineer. All fixtures shall be carefully aligned before fixing in position. All fixing accessories such as ceiling rose, flexible cord, lamp holder, suspension rod; pipe or chain with suitable canopy, etc., shall be provided and installed.

The wiring between terminal box and the fixture shall be carried out with 3

core 0.75 sq. mm and 1 sq. mm copper conductor, PVC / PVC cable respectively for circuits protected by 10 amps and 15 / 20 amps MCBs. The wiring inside light fixture body shall be done with heat resistant cables or PVC insulated cable in heat resistant sleeves as approved by the Engineer.

Glasses, shades, reflectors, diffuses, etc., must be in a clear condition after installation.

All light fixtures shall be earthed by an earth wire connected to the earth terminal in the fitting.

5.2 Fluorescent Light Fixtures

The fluorescent light fixtures on the surface of ceiling shall be installed with the back of the body flush with the ceiling surface, and in a manner so as to facilitate wiring. Nylon plugs and galvanized steel bolts or screws shall be used for fixing the light fixture to the ceiling. For light fixtures on installation on false ceiling, the installation method detail shall be coordinated with ceiling design and submitted for approval of Engineer. Care shall be taken to prevent the weight of the fixture from being transferred to the false ceiling.

Pendent light fixtures shall have two holes in the top of each casing by a 1/4" diameter galvanized pipe or any other standard method as approved by the Engineer. Wiring from ceiling rose to the fixture shall be installed through the pipe. Proper arrangements such as long threads with check nuts, etc. for minor adjustment in the mounting heights of the fixtures shall also be provided.

5.3 LED/CFL Light Fixtures

The LED and CFL light fixture shall be installed on the surface of ceiling or wall by means of nylon plugs and galvanized steel screws, such that their back finish flush with the surface for exposed conduits and flush with outlet box for concealed conduit system. Wherever convenient, screws for fixing light fixtures shall be screwed into the holes of the outlet box. The light on false ceiling shall be installed in accordance with manufacturer's recommendations and in coordination with ceiling installation.

5.4 Outdoor Lighting

For illumination around buildings during dark hours, light fittings in various arrangements shall be provided in accordance with these specifications. The items not shown on drawings or called for, but which are necessary for a complete working system as required, these shall also be provided and deemed to have been considered as such.

The Contractor shall essentially use the standard products of a manufacturer, regularly engaged in the manufacture of the product and shall meet the requirement of the specifications.

SECTION - E - 7 EARTHING SYSTEM

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete earthing system as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of the electrical lines and equipment.

The Earthing system with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

2. GENERAL

The earthing system consists of earth electrodes, earthing leads, earth connecting points, earth continuity conductors and all accessories necessary for the satisfactory operation of the associated electrical system.

3. STANDARDS

The latest editions of the following standards / codes shall be applicable for the materials covered within the scope of this specification:

BS 951	Earthing Clamps
BS 1433	Hard drawn bare copper conductor for earthing.
BS 2874	Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346	PVC Insulated Cables.
CP 1013	Earthing

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 Earth Rod Electrodes

Drive extensible rods of the same diameter into the ground, either manually or by power driven hammer, to a suitable depth to obtain low resistivity in the particular soil.

Weld earth connectors to the top of the rods, in sufficient number to take all incoming cables.

4.2 Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point or equipment in the building. It shall be round hard drawn bare electrolytic copper of size shown on the drawings. The cost of earthing leads deemed to have been included in the price of earth electrode & no separate pavement shall be made for it.

4.3 Earth Continuity Conductor

Earth continuity conductor (E.C.C) shall be hard drawn bare copper wire or single core PVC insulated copper conductor cable of sizes indicated on the drawings. All thimbles, lugs, sockets, nuts, washers and other accessories necessary for the complete installation of ECC shall be provided by the Contractor without any extra cost.

The specifications for single core PVC insulated cables used as E.C.C. shall be same as those given in section E - 3 of these specifications. PVC insulated cables when used as E.C.C. shall be green,

5. INSTALLATION

Complete earthing systems as shown on the drawing shall be installed by the Contractor. The earthing system shall give earth resistance, including resistance of soil, earth leads and E.C.C. equal to less than one ohm, this without ground pits water spraying.

The earthing system shall be loop connected with earthing cables at least 300 mm away from telephone cables. The concept of the main loops and the way they are connected shall be such that equipment / apparatus can be easily removed without requiring a complex disconnection operation nor risking interruption of / or damage to the loop itself. The fastening of the earthing conductors shall be made on a sufficient length so as to prevent crushing or cross section weakening. The parts on which they are connected shall be conveniently cleansed and surface.

Leads sheaths or steel tape armours are not permitted as grounding conductors. The earthing system shall be installed to ensure that when any part of the earthing system is disconnected for the purpose of carrying out periodic testing an alternative path to earth is available.

At all connections of earth continuity conductor to LV Switchboard, LV Distribution Board or any other metallic body, proper size or brass sockets, thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or termination shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall be in general run in cable trench or in conduits / pipes as shown on the drawings. For under floor runs, these shall be installed in pipe / conduit of appropriate sizes. Where laid along under ground cables, these shall be laid directly under ground in unpaved areas and in pipes under paved areas.

The electrode plate shall be installed at a minimum depth of 5 meters from finished ground level or 1 meter below permanent water level, whichever is less. The minimum horizontal distance between earth electrodes shall be 3 meters. Proper mixture of lime and charcoal in the ratio of 1: 3 shall be made and buried along with the copper plate in the ground to increase the soil conductivity. The electrode shall be installed as per details shown on the drawings. The inspection chambers shall be constructed at locations approved by the Engineer.

A 50 mm diameter G.I. shall be provided from inspection chamber to earth plate for

watering purposes. The pipe shall have 10 mm diameter holes at 500 mm center to center all along the length. At the ground level an inspection chamber with cast iron cover shall be constructed having dimensions as shown on the drawings. The inspection chamber shall have a copper supported on angle iron frame. The cover shall be hinged type, as approved by the Engineer and shall finish flush with the ground level.

The earth connecting point shall be installed at locations shown on the drawings. It shall be fixed on wall surface by means of brass screws with nuts, washers and other insulating material as instructed by the Engineer.

The earth continuity conductor of sizes shown on the drawing shall be installed all along the cable runs and connected to the earthing bar / terminals provided in the equipment. The body of all Switchboards shall be connected to earth by specified size of E.C.C. All metal work shall also be connected to earth by specified size of E.C.C.

At any joint or termination, the E.C.C. shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.

SECTION – E - 8
CABLE TRAY, LADDER AND TRUNKING

1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification 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 growth. Cables laid on cable trays shall be spaced twice their overall diameter (consider the largest cable as reference). In case of discrepancy with the contract documents this clause shall prevail, unless approved by the Engineer otherwise.

Shop drawings detailing fabrication and installation of cable tray, including plans, elevations, sections, details of components, and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice plate's connectors, expansion joint assemblies, straight lengths, and fittings.

Co-ordination drawings, including floor plans and sections drawn to accurate scale. Show accurately scaled cable tray layout and relationships between components and adjacent structural and mechanical elements.

3. 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.

4. SEQUENCING AND SCHEDULING

Co-ordination: Co-ordinate layout and installation of cable tray with other installations.

Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Engineer.

5. 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 gauges (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 KESC regulations.

6. CABLE TRUNKING

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m intervals with straps and hangers fabricated from minimum 6-mm dia HDGF bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking of fitting, and continuity shall not depend on contact through the screws, 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 unsatisfactory 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 cable ladder level and plumb according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.
- b. Remove burrs and sharp edges of cable trays.
- c. Make changes in direction and elevation using standard fittings.
- d. Make cable tray connections using standard fittings.
- e. Locate cable tray above piping except as required for tray accessibility and as otherwise indicated.
- f. Fire stop penetrations through fire and smoke barriers, including walls, partitions, floors, and ceilings, after cables are installed.
- g. Working Space: Install cable trays with sufficient space to permit access for installing cables.

10. 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.

SECTION – E - 9
TELECOMMUNICATION CABLING SYSTEM

1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

2. SYSTEM DESCRIPTION

The proposed cabling system (Passive Equipment only) for the UTP shall be an open system and application and vendor independent and shall be warranted by an International Vendor for a minimum of 20 years. The contractor Installers (labor) and engineers must be trained and certified by this vendor to design and install cabling system.

3. SCOPE

The contractor shall carefully examine all of the specifications to ensure that he is fully conversant therewith and has included for everything necessary therein, either expressly provided for or as would normally be expected to be provided for by a reputable contractor specializing in the type and nature of the Services described in the Contract.

The Contractor is advised that items or matters not specifically provided for, or partially described or otherwise missing from the specifications, but which are nevertheless necessary for the execution and completion of the Services, shall be deemed to have been included by the Contractor.

The Contractor shall ensure that all selected manufacturers of equipment and materials provide with appropriate warranties and guarantees for their products. Authorized and certified installers registered with their respective Manufacturers shall execute the installation of the Cabling system.

The Contractor shall also be required to submit, in their bid, a list of personnel along with their CV, certifying that the installers it intends to employ on the services have the necessary training and experience.

4. SUBMITTALS

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop Drawings: Submit layout drawings of computer cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for computer system, including rack and terminal connections.

5. QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacture of signal transmission media and accessories of types required, whose products have been in satisfactory use in similar service for not less than 10 years.

Installer's Qualifications: Firms with at least 10 years of successful installation experience with projects utilizing systems and equipment similar to that required for

this project.

Co-ordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of data system with other work.

Sequence installation of data system with other work to minimize possibility of damage and soiling during remainder of construction.

6. COPPER CABLE AND CONNECTORS

Unshielded twisted-pair copper cables shall be approved & recommended by component manufacturer. This is to enable the component manufacturer to give the necessary product and application warranties for the system.

Provide unshielded twisted-pair copper cable, fiber optic cable and connectors, in sizes and types as recommended by the active equipment manufacturer for indicated applications. Mate and match connector materials to factory installed equipment.

Computer cabling System Accessories: Provide computer accessories, including modular wall and floor jacks, junction boxes, connecting blocks and pre-wired boxes.

The selection and type of material required for the Services shall conform to the specifications given herein and items or matters not specified herein shall conform to ISO/IEC 11801, EN 50173 and TIA / EIA 568B Category 6 Standards as applicable. The Contractor shall also ensure that the materials utilized to complete the Cabling System installation are capable of supporting the minimum expected performance requirements. The complete system shall guarantee a minimum of 250 MHz & 100 MHz bandwidth performance and the products shall be from an internationally reputable manufacturer. The selection of materials shall be subject to approval by The Company.

The cables that are used to complete the installation shall be Category 6 UTP, capable of carrying high bit rate signals for extended distances in building distribution systems over frequency ranges up to and potentially beyond 250 MHz, designed to work on an ISO 11801 Class “E” link.

The cable shall be composed of 23 or 24 AWG bare, solid-copper conductors. The insulated conductors shall be twisted into individual pairs and four such pairs twisted together.

The cables shall be fully color coded as provided hereunder, color contrast being such that each pair in the cable is easily distinguishable from every other pair.

Conductor Identification	Colored Code	Abbreviation
Pair 1	White – Blue Blue – (White)	WT – BL BL
Pair 2	White – Orange Orange – (White)	WT – OR OR
Pair 3	White – Green Green – (White)	WT – GN GN

Pair 4	White – Brown Brown – (White)	WT – BR BR
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8. SPECIFICATIONS OF UTP CABLES:

Cable Type	Category 6 UTP
Conductor Size(mm)	23 or 24 AWG
Number of Pairs	4
Nominal Outer Diameter (mm)	6.0
Impedance(Ohm)	100+/-15
Velocity of propagation (% speed of light)	69
Frequency (MHz)	250
Max. Attenuation @ 250 MHz (dB)	32.1
Worst case NEXT @ 250 MHz (dB)	38.3

7. HORIZONTAL CABLING DISTANCES

The maximum horizontal portion of a cabling system from work area information outlet to a mechanical termination at the patch-panel in the wiring closets must not be more than 90 meters. The cable run must be free of bridges, taps and splices.

Both ends of the cable shall be labeled for identification, i.e., at the patch panel and work area information outlet according to EIA/TIA 606 administration standards for the Data cabling of commercial buildings.

The horizontal cabling system shall be correctly designed and the work area outlets in each shown or required location shall be correctly mapped to an appropriate wiring closet. The star topology shall be applicable to every individual unit of the transmission media.

8. VOICE CABLING SYSTEM

The telephone points are located as marked in drawings.

The telephone cabling System shall be designed using standard, proven equipment and materials with the latest Technology version or model. If there is any problem during warranty period related to the shortage of Materials, the Contractor shall supply them with no extra cost to the Project.

The design shall fully comply with TIA/ EIA 568B & ISO.

9. SCOPE

The contractor shall carefully examine all of the specifications to ensure that he is fully conversant therewith and has included for everything necessary therein, either expressly provided for or as would normally be expected to be provided for by a reputable contractor specializing in the type and nature of the Services described in the Contract.

The Contractor is advised that items or matters not specifically provided for, or partially described or otherwise missing from the specifications, but which are nevertheless necessary for the execution and completion of the Services, shall be deemed to have been included by the Contractor.

The Contractor shall ensure that all selected manufacturers of equipment and materials provide with appropriate warranties and guarantees for their products. Authorized and certified installers registered with their respective Manufacturers shall execute the installation of the Cabling system.

The Contractor shall also be required to submit, in their bid, a list of personnel along with their CV, certifying that the installers it intends to employ on the services have the necessary training and experience.

The Contractor shall carry out all the necessary surveys, design and engineering so as to provide for the Services, a whole and complete system to ensure full compatibility of the Services with any of the existing facilities pertinent to Cabling System applications & operations.

The scope of the Services include the provision of all material, labour, supervision, construction, equipment, tools, temporary, test equipment, spares, consumable and all other things and services required to engineer, design, supply, install, test and commission the Cabling System.

It is the responsibility of the Contractor to make sure that the system works at the company environment.

10. SUBMITTALS

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop Drawings: Submit layout drawings of telephone cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for telephone system, including Pull Box and terminal connections.

11. TELEPHONE CABLING

Horizontal runs from a PP to the telephone outlet using 4 Pair CAT 6 cables.

Wiring system used shall be star topology i.e. each telephone outlet is connected directly to the associated floor distributor (PP).

The voice backbone cabling system shall meet the TIA / EIA 568A/B-5 and ISO 11801 Category 5, Class D specifications.

The pair twist of the cables must be maintained as close to the termination at the patch panel IDC Modular outlet as possible. Cables shall not be untwisted for more than 12.7 mm. The cable conductor's entry shall be at the center of the IDC module and the module shall be wired from the center to the outside.

12. QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacture of signal transmission media and accessories of types required, whose products have been in satisfactory use in similar service for not less than 10 years.

Installer's Qualifications: Firms with at least 10 years of successful installation

experience with projects utilizing systems and equipment similar to that required for this project.

Co-ordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of data system with other work.

Sequence installation of data system with other work to minimize possibility of damage and soiling during remainder of construction.

LIST OF APPROVED MANUFACTURER

*** All Equipment shall be procured from Principal Authorized agents / distributors / resellers**

The Bidder shall fill name of only one manufacturer for each equipment/material on which the tender is based. He shall be bound to supply the equipment from the same manufacturer. In case, the Bidder gives names of more than one manufacturer against any equipment, the Engineer / Owner can ask the Bidder supply the equipment from any one of them.

At the evaluation stage if it is noted that any material offered by the bidder does not meet the specification requirements, the Engineer / Owner reserves the right to ask the bidder to replace his choice of equipment supplier meeting the required quality and specification requirement.

During the execution stage if the material from any supplier is found defective / substandard the Engineer / Owner reserves the right to ask the successful bidder to replace his choice of manufacturer / supplier for that particular equipment.

Any change in manufacturer / supplier shall only be entertained if there is sufficient reason that adhering to the original choice of manufacturer / supplier shall be detrimental to either the project quality or project timeline. Proper approval shall have to be sought for change in the choiced manufacturer / supplier at least 1 month before the equipment is to be procured.

Samples of all equipments shall have to be got approved prior to their procurement. The bidder has to sign and stamp all pages of Annexure-1. Any deviation from the BoQ / Specification shall be listed in a separate sheet to be labeled as Annexure-2 containing the details of the deviation including the deviating BoQ item number.

S.No.	Manufacturer / Supplier	Country Of Origin
-------	-------------------------	-------------------

(To be filled in by the Bidder)

LOW VOLTAGE (LV) PRODUCTS

Distribution Boards

- | | | |
|----|--------------------------------|----------|
| a. | Pak Electron Limited (PEL) | Pakistan |
| b. | Siemens | Pakistan |
| c. | Areva T&D (Schneider Electric) | Pakistan |
| d. | Hussain & Company | Pakistan |
| e. | Libra Engineering | Pakistan |
| f. | Taj Engineering Company | Pakistan |

Circuit Breakers

- | | | |
|----|---------------------------|---------------------------------|
| a. | M.G. (Schneider Electric) | France / Italy |
| b. | Terasaki | Japan / Malaysia /
Indonesia |
| c. | ABB | Germany / Italy |

- d. General Electric (GE) USA
- e. Siemens Germany

Load Break Switches, Changeover Switches

- a. Socomec France
- b. Kraus & Naimer Austria

Push Buttons, Switches, Etc.

- a. Schneider Electric France / Italy
- b. Maruyasa Japan / Malaysia / Indonesia

LV Cables & Wires

- a. Pakistan Cables Pakistan
- b. Pioneer Cables Pakistan
- c. Newage Cables Pakistan
- d. AGE Cables Pakistan

Cable Glands, Lugs, Terminals and Accessories

- a. Cembre UK
- b. Hubbell / Hawke UK

PVC Conduits and Accessories

- a. Galco Pakistan
- b. Dadex Pakistan
- c. Jeddah Polymer Pakistan

Back Boxes

- a. Hussain & Co. Pakistan
- b. Ezzi Engineering Pakistan
- c. Electroline Pakistan

Switch & Socket Outlets / Floor Boxes

- a. Clipsal (Schneider Electric) Australia / Hong Kong
- b. M.K. UK
- c. Legrand UK
- d. ABB Germany

Fans & Accessories

- a. Pak Fan Pakistan
- b. GFC Pakistan
- c. Millat Fan Pakistan

Lighting Fixtures

- | | | |
|----|----------|----------|
| a. | Philips | Pakistan |
| b. | Britlite | Pakistan |
| c. | Oslo | Pakistan |
| d. | Pierlite | Pakistan |

Lightning Protection System

- | | | |
|----|----------|-----------|
| a. | WJ Furse | UK |
| b. | Erico | UK |
| c. | LPI | Australia |

Cable Tray / Trunking

- | | | |
|----|---------------------|----------|
| a. | Ezzi Engineering | Pakistan |
| b. | Premier Engineering | Pakistan |
| c. | Electroline | Pakistan |

LOW CURRENT PRODUCTS

Telephone Cable

- | | | |
|----|------------------------------|-----------------------|
| a. | Clipsal (Schneider Electric) | Australia / Hong Kong |
| b. | 3M | UK |
| c. | Panduit | UK |

BILL OF QUANTITIES

PREAMBLE TO PRICING AND METHOD OF MEASUREMENTS

BILL OF QUANTITIES

PREAMBLE TO PRICING AND METHOD OF MEASUREMENTS

Table of Contents

<u>Description.</u>	<u>Page No.</u>
Generally	1
Method of Measurement	2
Pricing	2
Adjustment Item	3
General Requirements	3
Materials at Site	11
Shop Drawings, Working Drawings, Operations and Maintenance Instructions	12
Provisional Sums	12
Bill Item for Conditions of Contract	12
Abbreviations	13
Variations	14
Fix only	14
Supply Only	14
Sub-Contractors	15
Prime Cost Rates (PC Rates)	15
Site Work	16
Disposal of excess excavated material	17
Underground Drainage	17
Formwork	19
Precast Concrete	19
Reinforcement to Masonry	20
Masonry	20
Metal Work	21

**Preamble to Pricing and
Method of Measurements**

Woodwork	21
Thermal and Moisture Protection	23
Doors and Windows	23
Ironmongery	24
Finishes	24
Painting and Decoration	25
Mechanical Installations	26
Rates for Plumbing and HVAC	27
Electrical Installations	27
External Services	28
External Works	28
Proprietary Materials	28
Measurable Contract	28
Builder's Work	28
Profit	30

PREAMBLE TO PRICING AND METHOD OF MEASUREMENTS

Generally

The Bill of Quantities herein, including all notes and instructions, forms an integral part of the Bid/Contract Documents. However, the descriptions contained in the Bill of Quantities for each item are not necessarily complete. The Contractor is referred to the Conditions of the Contract and other Documents, Specifications and Drawings as well as relevant Standards and Codes of Practice for further information as no claim or variation will be considered on account of the Contractor's failure to do so.

The Contractor is cautioned to familiarize himself with the full content of other Contract Documents including the Instructions to Bidders, Bid Form, General Conditions, Particular Conditions, Bid / Contract Drawings and Specifications or any other information that can be easily inferred from any of them and all obligations contained in the documents shall be included in the item rates and / or contract price.

Drawings, Specifications and Bill of Quantities and all other documents are complementary and if description of any item is included in any of them, it shall be deemed included in all.

The Contractor's bid for the entire work shall provide for supervision of any or all trades that are intended to be performed with his own forces, his domestic sub-contractors and nominated sub-contractors. No extra compensation for services as a General Contractor will be paid.

The Contractor shall not use these Bills of Quantities as the basis for a construction program or for the purposes of ordering materials or arranging sub-contracts. The references for these activities shall be the drawings, specifications and instructions issued by the Engineer.

This is a Measurable type of Contract. The quantities contained within these Bills of Quantities may not accurately reflect the quantities of works as indicated in the drawings, Specification and Package Scope. The contractor is to satisfy himself for the accuracy of all quantities. No claim will be entertained for differences in quantities between the Tender Drawings, Specification and Bills of Quantities.

Items in the Preamble Section of these Bills of Quantities are deemed to qualify and to form part of description of measured work to which they refer including composite description.

All measurements are net and the rates shall include for all laps, waste, working space, etc. and trade or traditional allowances.

Amendments shall not be made to these Bills of Quantities without the authority, in writing of the Engineer.

A price or rate is to be entered against each item in the Bills of Quantities. The cost of any item left un-priced will be deemed to be included for elsewhere in the Bills of Quantities, and the rate for the un-priced item will be taken as nil. Any item of the Day Works if not entered by the Bidder shall have to be carried out at the Rate as decided by the Engineer.

For the general guidance of the bidders the relevant CSI Section numbers have been mentioned in the beginning of each Bill/Division/Section. This does not absolve the Bidder's responsibility to confirm and price according to the appropriate BSI/ASTM/CSI code applicable to any item mentioned in the Bill of Quantities and drawings etc.

Method of Measurement

The quantities in the Bill of Quantities have been prepared generally in accordance with the **Principles of Measurement (International) for works of construction dated June 1979 / Standard Method of Measurement of Building Works (SMM 7) seventh edition year 1988, published by the Royal Institution of Chartered Surveyors, 12 Great George Street, Parliament Square, London SW1P 3AD, U.K. amended to suit the local practice and conditions.** The description of each item (which description shall imply references to any heading, sub-heading, preamble or other clause of item which shall apply) shall be held to include all claims, materials, workmanship, including all taxes, duties, charges, all Government levies, landing charges, transport, profit and overheads and all other incidental costs to complete the Works.

These preambles are to be read in conjunction with the item description in the Bill of Quantities.

“As described” means as directed in the Specifications and / or Drawings.

Unless otherwise described or measured separately, prices for all items shall include for all necessary straight, raking or circular cutting.

The Conditions of Contract applicable to this Contract is as specified in Volume 1 – Tender & Contract Conditions of the Tender and Contract Document.

Pricing

The prices shall be comprehensive and must include for complying in all respects with the instructions to Bidder, Conditions of Contract, Specifications, and Drawings and for all matters and things necessary for the proper construction and completion of the whole of the Works. No claim for additional payment will be allowed for any error or misunderstanding by the Contractor of the work involved.

The rates and sums inserted in the Bills of Quantities are deemed to include for the following:

- (i) Labor and all costs in connection therewith.
- (ii) Materials, goods and all costs in connection therewith (e.g. carriage, freight, delivery, unloading, storing, returning packing handling, Letters of Credit, Bank Guarantees, Bank charges and the like, Customs duties, port dues, import duties, taxes, charges, Insurances and other dues levied by any authority or imposed by the Government, hoisting or lowering, replacing work, goods or materials damaged, broken, lost or stolen until the issue of a Certificate of Completion.
- (iii) Fittings and fixing materials or goods in position.
- (iv) Plant.
- (v) Waste, bulking, shrinkage and overlaps.
- (vi) Land required for tips and stockpiles including all costs for obtaining any necessary licenses and approvals.
- (vii) Allowance for phasing requirements of works, effect on programming of the works of all traffic diversions and construction activity associated with diversion or installation of services.
- (viii) For taking measures for the support and full protection of pipes, cables and other apparatus required during the progress of the Works as required by Service Authority or the Engineer.
- (ix) For working alongside and liaising with other Contractors working on the same site.
- (x) Preparation and submission of shop drawings.
- (xi) Overhead charges and profit.
- (xii) Guarantees and warranties where necessary.
- (xiii) Temporary works, if any.

Lump sums shall not be given where unit rates are applicable.

Where the word “allow” is used, the cost of the item shall be the responsibility of the Contractor.

The amounts set against any items of overhead shall include for all costs in connection with letters of credit, bank charges, interest charges and insurance after the materials come under the control of the Contractor.

The rates inserted will be used to determine the amount of the Contractor's Interim Payments.

The Bidder shall submit the full and detailed rate breakdown of all the BOQ items including spare parts items in the format as per enclosed Annexure-1, together with their Bid submission. The breakdown is to show the actual calculations of the General Items, Labor, Plant and Materials costs for the Works, the build-up of measured rates with on-costs and site and Head Office overheads and any other allowances used to arrive at the Bid Price. In addition the Bidder will be required to provide the Engineer within 48 hours with a full and detailed breakdown/any other information if requested. The purpose of this Breakdown/Rate Analysis is to make sure that (i) the rates used in the analysis of the items of permanent works and those quoted in the Day Works are reciprocal to each other, (ii) the bid is not front loaded, and (iii) the markup of Overheads & profit is uniform throughout the bid.

Where "fix only" items are specified, the rate shall be deemed to include for taking delivery, storing and installation of goods or materials in works where appropriate.

The rates inserted in the Schedule of Day work shall be deemed to be the rates used by the Contractor in making up rates for works items in all Parts of the Bills of Quantities.

Adjustment Item

The adjustment item, if any, addition or deduction, shall apply to all Bill items, excluding provisional sum unless clearly indicated otherwise. The adjustment item shall not be a lump sum, but a percentage of the total Bid amount excluding provisional sum or a percentage of the total for the items indicated. The adjustment items shall be applied to all applicable item rates and sums entered in the Bills of Quantities (including any addenda). The adjusted rates and sums shall be applied for the valuation of Variations.

General Requirements

Standards

Where no reference is made to a code, standard or Specifications in Section "B" Specifications of the SUB-CONTRACT Documents, the Standard Specifications of the American Society of Testing Materials, (ASTM), British Standard Codes of Practice (BSCP) or any other relevant standard as approved by the EMPLOYER shall govern.

Drawings

The WORK shall agree in all particulars with the Drawings or any approved modifications of them or such other drawings as may be issued during the SUB-CONTRACT.

The EMPLOYER will supply two copies of each of the drawings to the CONTRACTOR free of charge.

The CONTRACTOR will make any further copies required by him at his own expense.

The CONTRACTOR will keep one set of all drawings duly mounted with muslin cloth and hanged on the wooden drawings stand when not in use.

CONTRACTOR'S (Drawings & Documents)

The CONTRACTOR shall submit three prints/copies of all drawings, documents and schedules to be prepared by him. These will be of a standard size and format acceptable to the EMPLOYER. All such submission by the CONTRACTOR shall be accompanied by a letter of submittal.

Record Drawings

The CONTRACTOR shall prepare during the progress of the SUB-CONTRACT, drawings showing the WORK "as built" including the positions of all services, plant and equipment. The drawings shall be prepared to a form & detail to the satisfaction of the EMPLOYER and prints shall be submitted to the EMPLOYER'S REPRESENTATIVE for his approval as the WORK proceeds. At the completion of the SUB-CONTRACT the CONTRACTOR shall supply to the EMPLOYER reproducible of each drawing.

Supply of Water and Electricity

The CONTRACTOR shall make his own arrangements for the provision of water & electricity whether for use in the execution and construction of the WORK or otherwise. In the event of the source of water being from any existing piped supply the CONTRACTOR shall comply with any regulations laid down by the Water Authority and shall pay for such supply, stand-pipe connections, meter rents and all other charges as required all at his own expense. Similarly he will be responsible for all costs in providing electricity. Where electricity is not available for 24 hours, diesel/petrol driven electricity generators in good and reliable condition and of sufficient capacity to meet the requirements of construction equipment and lighting and other facilities at Site will be used by the CONTRACTOR.

Disposal of Wastes

The CONTRACTOR shall make adequate arrangements to the satisfaction of the EMPLOYER'S REPRESENTATIVE for disposal of all sewage, rubbish and all other waste material arising from or connected with the execution of the WORK.

Other Services

The CONTRACTOR shall make his own arrangements for and shall provide any service (including telephone) which may require in addition to the foregoing.

Bench Marks and Control Points

All levels, lines, grades and measurements shown on the Drawings shall be measured from a Bench Mark and points to be established by the EMPLOYER within the Points Site of the WORK. The CONTRACTOR shall be responsible for ensuring the levels of all parts of the work are accurately related to this Bench Mark which shall be notified to the CONTRACTOR by the EMPLOYER immediately after commencement of the WORK.

Survey

The CONTRACTOR shall furnish and maintain at his own expense survey instruments stakes and other such materials and give such assistance, including qualified staff as may be required by the EMPLOYER who will establish Bench Marks base lines, grades and other principal control points. The CONTRACTOR shall, however, call the EMPLOYER'S attention to any inaccuracies and discrepancies of such controlling points etc., before proceeding with the work. The CONTRACTOR shall at his own expense, establish working or construction lines and grades as required, which shall be frequently checked by the EMPLOYER'S REPRESENTATIVE but the CONTRACTOR shall be solely responsible for the accuracy thereof.

Safeguarding Bench Marks & Control Points

The CONTRACTOR shall safeguard all points, stakes, grade marks and bench marks made or established on the work. If disturbed he shall bear the cost of re-establishing them and also the entire Points expense of rectifying the work rendered defective due to such disturbance.

Progress Photograph

The CONTRACTOR shall, throughout the construction of the WORK use digital camera for photography and provide the progress photographs in color to the EMPLOYER. He will also submit three prints each of size 5"x7" along with the recorded data at two week intervals. All such photographs will be taken under the direction of the EMPLOYER.

Materials and Workmanship

As soon as possible after the SUB-CONTRACT has been awarded, the CONTRACTOR shall submit to EMPLOYER list of suppliers from whom he proposes to purchase the materials necessary for the execution of the WORK. The information regarding the names of suppliers may be submitted at different times, as may be convenient, but no approved source of supply shall be changed without the prior permission of the EMPLOYER'S REPRESENTATIVE.

Preference shall be given to the use of materials and fittings manufactured in Pakistan which comply with the SUB-CONTRACT and are competitive in price. Foreign materials shall only be used with the consent of the EMPLOYER.

All materials incorporated in the WORK shall be new and of the best quality and description of their respective kinds and shall comply with all relevant specifications. Similarly the workmanship in every case shall be of the best character, and the whole shall be subject to the approval of the EMPLOYER.

Materials whose quality and construction are not covered by the Technical Specifications shall be of equal or better quality than the relevant sample accepted by the EMPLOYER'S REPRESENTATIVE.

Samples

In addition to any special provisions herein for the sampling and testing of materials, the CONTRACTOR shall submit to the EMPLOYER as he may require samples of all materials and goods which he proposes to use or employ in or for the WORK. Such samples, if approved, will be retained by the EMPLOYER'S REPRESENTATIVE, and no materials or goods of which samples have been submitted shall be used on the WORK unless and until such samples have been approved in writing by the EMPLOYER.

The EMPLOYER'S REPRESENTATIVE may reject any materials and goods which in his opinion are inferior to the samples thereof previously approved and the CONTRACTOR shall promptly remove such materials and goods from the Site.

The cost of supplying all such samples and of conveying same to such place of inspection or testing as the EMPLOYER may designate within the country of origin shall be deemed to be included in the tendered rates and prices.

Samples will be retained by the EMPLOYER and when directed by the EMPLOYER'S REPRESENTATIVE the CONTRACTOR shall dispose of the samples. Except for those which may be incorporated into the WORK after approval, such as plumbing and electric fixtures.

Tests Generally, Access to Premises

The EMPLOYER may examine and may require to be tested any materials or goods required in or for the WORK such as he may decide from time to time and shall have unrestricted access to the CONTRACTOR'S, CONTRACTOR'S and supplier's premises for such purpose at all times and the CONTRACTOR shall specify this requirement when placing all orders.

The EMPLOYER will notify the CONTRACTOR whether materials and goods will be inspected at the manufacturer's or supplier's premises or at the Site. No materials or goods shall be dispatched from such premises until such notification is given and, if appropriate, inspection is complete and a release certificate is given to this effect. In both cases the CONTRACTOR is to notify the EMPLOYER when materials and good will be ready for inspection and shall do so adequately in advance for him to make the necessary arrangement for inspection.

The CONTRACTOR shall afford the EMPLOYER all facilities, assistance, labor and appliances necessary for the convenient examination, testing weighing or analysis of all such materials or goods. The CONTRACTOR shall provide and prepare such test pieces of any such materials or goods as the EMPLOYER may require.

Notwithstanding any tests which may have been carried out off the Site the EMPLOYER shall be empowered to order further tests of any materials or goods to be made on the Site and to reject such materials or goods should they fail to pass such test on the Site.

The full cost of providing all facilities, labor, consumable stores and appliances required in connection with all testing on the Site shall be deemed to be included in the tendered rates and prices.

Test Certificates

Should the EMPLOYER not inspect any materials or goods at the place of manufacture, the CONTRACTOR shall, if required, obtain certificates of test from the suppliers of such materials or goods and shall send such certificates to the EMPLOYER. Such certificates shall certify that the materials or goods concerned have been tested in accordance with the requirements of the Technical Specifications and shall show the results of all the tests carried out. The CONTRACTOR shall provide adequate means of identifying the materials & goods delivered to the Site with the corresponding certificates.

Testing at an independent Laboratory

Where tests are specified or directed by the EMPLOYER to be carried out in an independent testing laboratory, the CONTRACTOR shall supply and deliver the samples and shall arrange for the relevant tests to be carried out. The independent testing laboratory shall be nominated by the CONTRACTOR and acceptable to the EMPLOYER. Unless otherwise specified the CONTRACTOR shall arrange for one copy each of the independent testing laboratory's test certificates to be delivered to the EMPLOYER and to the EMPLOYER not less than 3 working days before the materials covered by the relevant test certificates are to be incorporated in the WORK. Each test certificate shall be relatable to the materials from which the sample was taken.

Site Testing

The CONTRACTOR shall carry out such laboratory and field test (including tests to check the accuracy of testing equipment and methods but excluding tests specified to be carried out in an independent testing laboratory) as specified or as can reasonably be inferred from herein, as may be necessary to ensure and satisfy the EMPLOYER that the requirements of the Technical Specifications are met. The type and frequency of testing shall be in accordance with the relevant standards except as otherwise specified herein or directed by the EMPLOYER.

The CONTRACTOR'S attention is drawn to the fact that the frequencies of testing specified in the relevant clauses are intended to represent only a general guide. The EMPLOYER shall be empowered to vary the frequencies at which tests are conducted should he deem this necessary for the proper control of the quality of the WORK. Should the EMPLOYER'S REPRESENTATIVE vary the frequencies stated in the relevant clauses of the Technical Specifications, the CONTRACTOR shall not be entitled to extra payments thereof.

Unless otherwise agreed or directed by the EMPLOYER methods of sampling and test procedures shall be in accordance with the relevant Standard Methods of ASTM, British Standard Codes of Practice or any other relevant standard approved by the EMPLOYERS. Sample will be selected by the EMPLOYER'S REPRESENTATIVE.

The CONTRACTOR shall keep clear, accurate and up-to-date records of tests and immediately any test is completed shall supply two copies and summaries of the results thereof to the EMPLOYER'S REPRESENTATIVE in such form as he may require. Testing equipment operations and records shall be available for inspection by the EMPLOYER'S REPRESENTATIVE at all times.

Removal of Condemned Materials

The EMPLOYER'S REPRESENTATIVE may require the CONTRACTOR to remove and dispose of any materials employed of the EMPLOYER'S REPRESENTATIVE, are unsuitable or have been incorrectly deposited or have suffered damage by exposure to the weather or otherwise are not in accordance with the specified requirements for such materials. The CONTRACTOR shall be entitled to no payment whatsoever in respect of such materials.

Contractor and Engineer's Site Offices

- i- Contractor shall provide and maintain a temporary, weather tight site office for his own use and that for Engineer's use complete with facilities for filing, drawings, specifications correspondence, and other appurtenances necessary for the proper execution of the Work. The Contractor shall make provision for transportation and off-site living accommodation for his personnel and provide necessary power, water, sanitary facilities, necessary for his personnel, equipment cartage and materials operations. Facilities shall be as approved by the Engineer.
- ii- contractor at his own cost shall provide, erect and maintain an office facility at Site for the sole use of the Engineer's/Consultant's Staff. Facility shall be serviced with power, potable filtered water, lighting, air conditioning, telephone connection, sewerage and waste disposal facilities, during the entire construction phase and up to six months from the date of Substantial Completion, of the type as follows:

Office facility shall be temporary type weather-tight construction having a total floor area of not less than 500 sft. And shall be air-conditioned and have attached meeting room as well as a washroom containing W.C., urinal and washbasin. A mobile shipping container designed for the above purpose in accordance to the requirements of the Engineer, shall be acceptable.

Furniture, Equipment etc. for Site Office: All necessary office furniture, including filing facilities for two junior and one senior staff of Engineer/ Consultant should also be provided.

Computer & Printer: The contractor shall provide a latest PENTIUM IV computer with laser color printer with all peripherals as required by the Engineer, printer to be capable of printing A-3 size sheets, fax machine, photo copier capable of copying up to A-3 size sheet: (powder copies)

Furniture

One Table Approx. 5' x 3' , two tables of approx. size 4' x 2' 6"

One good quality revolving Chair, and six Nos. Good quality non-revolving chairs.

Drawings Stand for holding 30 drawings.

An Internet/E-mail account

As per the requirement of the Engineer for exclusive use of Engineer/consultant and their staff

Telephone & Fax

A separate telephone line for fax machine shall be provided by the Contractor. The maintenance and the stationary of the entire aforesaid facilities shall solely be the responsibility of the contractor

Transportation facility

The contractor shall provide a minimum 1000 cc brand new vehicle, along with driver and POL, (to be transferred to the employer after successful completion of the project) in connection with performance of official duties, exclusively for the Resident Engineer.

The contractor shall also provide adequate transportation facility in connection to performance of official duties, exclusively for the site staff of the Engineer/Consultant during the construction as well as the extended period (if any) as and when required by the Engineer/ Consultant.

For both the above items the Contractor shall furnish, supply and provide, as may be necessary without specific direction of the Engineer, all fuels, lubricants, tires and other supplies, all maintenance, repairs and running costs and suitably qualified drivers at all times.

Security

Contractor shall be responsible for the security of the site offices and its contents at all times

First Aid Box

First Aid Box suitably equipped for a site force of about 20 people.

The foregoing furniture, equipment and miscellaneous items shall be provided and installed by the CONTRACTOR within 15 days of the Letter of Intent from the EMPLOYER.

Sanitary Accommodation for Site

The CONTRACTOR shall also maintain and service a suitable sanitary accommodation facility and provide consumable stores including soap, etc.

Surveying Equipment

The CONTRACTOR shall provide & maintain in an accurate and serviceable condition the following new surveying equipment at Site at all times during the execution of the WORK:

- 1No. Theodolite to read to 20 seconds complete with tripod and accessories.
- 1No. Reversible level complete with tripod and accessories.
- 1No. 14 ft. telescopic leveling staff graduated in feet.
- 1No. 100 ft. steel tapes.
- 1No. 50 ft. steel tapes.
- 1No. 12 Ft. flexible steel tapes.
- 1No. Steel tape repair kit.
- 1No. Plumb bobs.

The foregoing equipment shall be inspected at the Site of WORK by the EMPLOYER'S REPRESENTATIVE within 15 days of the receipt by the CONTRACTOR of the Letter of Intent from the EMPLOYER.

In addition to the specified list of equipment, the CONTRACTOR shall also provide and renew from time to time such miscellaneous materials and equipment as might reasonably be required at the Site.

Traffic Routes to be Maintained

The CONTRACTOR shall not cause unnecessary obstruction of roads, footpaths or waterway at any time during the course of the WORK and in no circumstances shall closure, in whole or in part, of these or any other "right of way" be permitted except with the prior permission of the EMPLOYER'S REPRESENTATIVE in writing. All disturbances to be negotiated with the affected community in advance.

The CONTRACTOR shall maintain adequate, through safe traffic routes for vehicles and pedestrians on public highways within and adjacent to the Site of the WORK, including such diversions of highways as may be required, and make arrangement for watching, signaling, and control of traffic by day and night and for adequate lighting all to the satisfaction of the EMPLOYER'S REPRESENTATIVE.

All temporary diversions shall be constructed to adequate widths and maintained in good condition at all time by the CONTRACTOR to the satisfaction of the EMPLOYER'S REPRESENTATIVE and on completion of the CONTRACT all such road shall be left in a condition approved by the EMPLOYER. The temporary diversions shall be removed and reinstated to the satisfaction of the EMPLOYER/EMPLOYER when no longer required.

The CONTRACTOR shall make arrangements and co-operate with all other CONTRACTORS working in the area for directing, routing, marshalling, controlling and circulating the traffic connected with the WORK in accordance with the EMPLOYER'S REPRESENTATIVE requirements in order that the flow of all traffic may be facilitated, that all obstruction, inconvenience & delay may be minimized and that the interest of all concerned including the general public may be promoted.

The CONTRACTOR shall, before commencing work affect any public highway or right of way, submit to the EMPLOYER'S REPRESENTATIVE his proposals for the control of traffic, access for residents & diversions in respect of the area in which he proposes to work. The EMPLOYER'S REPRESENTATIVE will instruct the CONTRACTOR to make such amendments as are considered necessary.

The CONTRACTOR shall pay all cost and expenses attendant upon the employment of any Police, which the Local Magistrate/Government may appoint for the preservation of peace, or the prevention of trespass and theft, or for any other purpose on or near the site of the WORK.

Protection of Livestock

The CONTRACTOR shall be responsible for protection of livestock against damage or accidents because of the WORK, during day and night. All gaps made in fences and hedges etc. to be closed when WORK are not in progress and all trenches and excavations to be suitably protected.

Haulage Routes

The CONTRACTOR shall submit to the EMPLOYER'S REPRESENTATIVE as soon as possible after the acceptance of the Tender and from time to time thereafter as required, proposals for the routing of traffic in connection with the execution of WORK being the traffic of the CONTRACTOR, his suppliers in the movement or haulage of heavy loads, construction plant, materials and spoil (hereinafter referred to as "the construction traffic") including particulars of the public roads of the public roads which he, the CONTRACTOR, proposes to select as routes to be used by the construction traffic.

The EMPLOYER'S comment on all such proposal as may be submitted by the CONTRACTOR.

Support

The CONTRACTOR shall provide ample shoring to all poles, buildings, walls, roads, railings and structures etc., adjacent to the trenches and shall carry out the trench work in close-timbered lengths near such property at his own expense.

Protection Mains, Services & Apparatus

The information given on the Drawings relating to existing services is given for general guidance only and is not guaranteed and no responsibility & Apparatus whatsoever is accepted by the EMPLOYER for the accuracy thereof. The CONTRACTOR shall refer directly to the concerned authorities for more detailed information on any of the services within the working spaces of the site.

The CONTRACTOR shall not cause or permit interference with mains, services or apparatus whether indicated on the Drawings or not & shall be responsible for their protection. He shall give notice and provide reasonable facilities to the relevant authority and/or their servants to enable them to do alterations, repairs or maintenance WORK if so required.

If during the course of the WORK underground services are uncovered they shall be carefully protected and shall be immediately referred to the EMPLOYER'S REPRESENTATIVE.

Diversion of Mains, Services & Apparatus

The CONTRACTOR shall make arrangements with the appropriate owners/ authorities and pay all costs for any temporary diversions of mains, services and apparatus which may be required in carrying out the WORK.

Dealing with Water

The CONTRACTOR shall take all necessary measures to prevent water from the Site causing a nuisance on or in any neighboring land or property either by causing flooding or by depositing sediment on the surface of the ground or in drains or water-courses. Wherever necessary to prevent this, the CONTRACTOR shall construct temporary drainage channels, layers, sumps and traps in addition to those shown on the Drawings discharging into existing drains, ditches or water-courses. The CONTRACTOR shall remove all sediment which may accumulate on any land or in any drains, ditches or watercourses or in any other property as a result of his operations.

All WORK including those below subsoil standing water level shall be carried out in the dry unless specified otherwise. The CONTRACTOR'S arrangements for controlling the inflow of water into the parts of the excavation being worked and during the placing of concrete and other WORK therein and for the collection and disposal of water shall be to the EMPLOYER'S approval. All costs and charges in dealing with water in anyway whatsoever and effects thereof will be deemed to be included in the several rates in the Bills of Quantities.

Water flowing into excavations shall be carried by trenches, drainage layers or open jointed drains to sumps from which it shall be pumped. Such trenches, drains or sumps shall generally be clear of the WORK unless approved otherwise by the EMPLOYER'S REPRESENTATIVE.

The CONTRACTOR shall keep all surfaces upon or against which concrete is to be deposited free from running water and no concrete shall be placed until such surfaces are properly drained. Suitable precautions shall be taken to prevent running water from washing out cement or concrete while it is setting or from injuring the WORK in any other way.

Notwithstanding the approval by the EMPLOYER'S REPRESENTATIVE of the CONTRACTOR'S methods of dealing with water, the CONTRACTOR shall be responsible for and accept all the risks and liabilities of dealing with water from whatever source and of all effects thereof.

WORK to be Water-tight

All WORK, intended to retain or exclude water or through which water is to be passed shall be absolute water-tight, so as not only entirely to prevent loss of water from the WORK, but also so as entirely to prevent the percolation of water into any part or parts of the WORK.

Name Boards / Temporary Signage

The CONTRACTOR shall erect only such name boards as the EMPLOYER may approve. These must be of simple and becoming appearance. They shall display the name of the project, the CONTRACTOR, and such other information as the EMPLOYER may direct or approve.

Materials at Site

Payment for unfixed materials delivered on site shall be included in the Monthly valuations shall and shall be certified as provided for by the Conditions of Contract.

The valuation so certified by the Engineer shall be the invoiced cost of the materials, if the Engineer considers this cost to be realistic, plus any customs duty or other taxes paid together with an allowance for port dues and delivery to and unloading at the Site. The valuation for unfixed materials on site shall be the net reimbursement to the Contractor of the cost of the materials delivered and unloaded at the Site and as such shall be exclusive of any profit or Contractor's overheads mark-up.

Notwithstanding the foregoing, such net reimbursement to the Contractor for unfixed materials on Site shall be less than the total price included by the Contractor in the Bill of Quantities for both supplying fixing and sufficient value shall be retained for payment to the Contractor in subsequent monthly payment for permanently fixing the materials in the Works.

The Contractor shall make due allowance in pricing the Bill of Quantities to take account of these clauses.

Formwork materials including all struts, timber or sheet boarding, all other timber work, waffle moulds, proprietary shuttering and the like shall not be considered as "unfixed materials on site" for the purposes of monthly valuations.

Shop Drawings, Working Drawings, Operations and Maintenance Instructions.

The Contractor is to allow in his rates for the production of all shop drawings, working drawings, operations and maintenance instructions called for in the Specifications.

These shall include but not to be limited to the following:

- (i) The surveyed location of all existing services.
- (ii) A Combined Services Drawing including all surveyed existing and proposed services showing manholes, draw pits, joint boxes, inspection chambers, lighting column bases traffic signal bars, concrete surrounds, pipe diameters, etc. to scale, plus any other possible obstructions.
- (iii) Combined Services Working drawings original and new.
- (iv) Separate sets of working drawings for each individual service showing proposed locations for submission to the service authorities.
- (v) Existing ground levels.
- (vi) Earthworks cross sections.
- (vii) Temporary traffic sign design and fixing details.
- (viii) Proposed traffic sign design and fixing details.
- (ix) Mechanical, electrical and other services drawings, diagrams and instructions as required in the contract and directed by the Engineer.
- (x) Temporary work drawing where requested by the Engineer.

The rates in the appropriate section shall include for design of the civil works as specified in the Contract and for providing working drawings, shop drawings, schedules, specifications, calculations, etc. and for obtaining the Engineer's approval.

Provisional Sums

The Provisional Sums given in the Bill of Quantities may be used in whole or in part, or not at all, on the instruction of the Engineer.

Percentage of adjustment for Provisional Sums as provided in the Conditions of Contract shall not be applicable to any work carried out by other Contractors or Service Authorities employed directly by the Employer. Payments to such Contractors or Service Authorities shall be made directly by the Employer.

The Contractor shall co-ordinate with the Service Authorities and provides all necessary facilities as may be required and as foreseeable by an experienced Contractor. The cost of such co-ordination and facilities is deemed to have been included in the respective item given in Bill No. 1 of the Bill of Quantities.

Bill Item for Conditions of Contract

Payment for this item will be pro-rata to the value of work completed and approved by the Engineer and shall cover all costs and expenses including overhead and profits incurred by the Contractor in carrying out the requirements of the Conditions of Contract, not

otherwise, included in the Bills of Quantities. Breakdown of the same shall be submitted together with the Tender Documents.

Abbreviations

In the Specification and Bill of Quantities the following abbreviations have the meanings hereby assigned to them:

B.S.	Means the specification issued by the British Standards Institution (B.S.I.)
C.P.	Means the code of practice issued by the B.S.I.
AASHTO	means the specification issued by the American of State Highways & Transportation Officials.
ASTM	means the specification issued by the American Society for Testing & Materials.
AC	Asbestos Cement
B.S.	British Standards
Cont'd	Continued
DEPT, Dept.	Department
Dia	diameter
Drg.	Drawing
E.O.	Extra Over
F.C.	Fiber Cement
GRP	Glass Fiber Reinforced Plastics
HDPE	High Density Polyethylene
HP	Horse Power
ISO	International Standards Organization
Kg.	Kilograms
Kw/hr	Kilowatt per hour
L.R.B.	Local Regulatory Body
L.S.	Lump Sum
M	meter
mm	millimeter
m ³ ,cu.m.	Cubic meter
m ² , sq.m.	Square meter
MDPE	Medium Density Polyethylene
Mic	Micron
Min., min	Minimum
MDD	Maximum Dry Density
MH	MANHOLE
No.	Number
Nos.	Numbers
O.P.C.	Ordinary Portland cement
PE	Polyethylene
P.Q.	Provisional Quantity
PVC	Polyvinyl Chloride
Qty.	Quantity
RHS	Rectangular Hollow Section
Spec	Specifications
S.R.C.	Sulphate Resisting Cement
t, tons	tonne
uPVC	Unplasticised Polyvinyl Chloride
W	Width
P.C. Rate	prime cost rate
>	Greater than
≥	Equal to or Greater than
<	Less than
≤	Equal to or Less than
=	Equal to

Rates for various items throughout the Bills of Quantities shall include, unless otherwise stated or measured, for cutting of every description and the consequent waste, for work in girths, widths or heights of less than 300mm and for all short lengths.

Rates for all work shall include for protection, provision of samples and testing.

The pricing of materials shall take account of the following:

- (i) Pricing Preambles and Specifications shall apply reciprocally between sections of the works unless otherwise described.
- (ii) Materials shall be of the quantity specified unless otherwise directed by the Engineer.
- (iii) All materials shall be transported, handled, stored and fixed in accordance with the printed instructions or recommendations of their manufacturer's or suppliers.
- (iv) Protection of completed work, all casings and temporary coverings and making good, cleaning and polishing and clearing away upon completion.

Variations

The rates inserted in the Bills of Quantities with application of adjustment item will be used to value any variations to the work, whether omission or addition. The Contractor shall not be entitled to payment for profit and overheads on the value of work omitted.

Any claim or additional General Requirement costs, General and Special attendance's, Builders work and the like on variation Works, shall be considered only upon receipt of full supporting contemporary substantiation being presented by the Contractor to the Engineer.

Fix only

The expressions "fix only" used in these Bills of Quantities means that the contractor shall provide the following facilities:

- (i) Fixing as defined in Clause GP 7.2 of POM(I).
- (ii) Supplying full size templates.
- (iii) Giving and marking dimensions and taking responsibility for their accuracy.
- (iv) Getting in, protecting, handling, distribution and placing in position.
- (v) Assembling as required.
- (vi) Casing up and protection, including clearing away protection on completion of the works.
- (vii) Full cost of replacement of any items which are damaged, broken, lost or stolen after the acceptance of the items from the supplier or client and until handing over the complete works.
- (viii) Other necessary and usual facilities and documentation.

Supply Only

The expression "supply only" used in these Bills of Quantities means that the Contractor is to provide for everything as defined in Clause GP4.1 of POM(I) in connection with such items except fixing in position. All such items are to be delivered to Site and stored in accordance with the Engineer's instructions.

Sub-Contractors

Any sub-contractors which the Contractor proposes to use for the works are subject to the approval of the Engineer and the Employer.

The Contractor should ascertain from sub-contractors and suppliers before the works put in hand particulars of positions in which chases, holes, mortices and the like will be required to be formed or left. No claim for the extra costs of cutting away work already built due to the Contractor's failure to ascertain these particulars will be admitted.

Any sub-contractor who has not been approved by the Engineer and the Employer shall not be used in connection with the carrying out of the Works.

The Contractor shall allow for any additional costs incurred due to sub-contractors working different hours from and extended hours to those worked by the Contractor.

Prime Cost Rates (PC Rates)

Where Prime Cost (PC) Rates are included, the Contractor is to include in his rate the full amount shown. Such rate is for the material cost only of the particular item so described, delivered to the site. The Contractor is, in addition to those relevant items listed at Clause A, Page 9, to allow in his rates for all auxiliary materials required for fixing such as mortar for bedding and jointing, adhesive and all similar items of a like nature. The Prime Cost will be expended at the discretion of the Engineer and the adjustment to the Contractor's rate will be the net difference between the Prime Cost (PC) Rate stated in the description and the actual price paid (benefit of any discount passing to Employer).

The word "attendance" means the following:

Attendance to be provided by the Main Contractor

The Main Contractor shall be responsible for providing, including but not limited to, the following attendances:

- i) Use of Main Contractors administrative arrangements.
- ii) Use of Constructional Plant.
- iii) Use of Contractor's Mess Room, Sanitary and Welfare Facilities.
- iv) Co-ordination and scheduling of all works related to each sub-contract.
- v) Use of Standing Scaffolding.
- vi) Use of Temporary Works including water and Electricity.
- vii) Supplying full size setting out templates.
- viii) Giving and marking dimensions and taking responsibility for their accuracy.
- ix) Space for Sub-Contractors Office and Stores.
- x) Providing working space.
- xi) Offloading Sub-Contractors materials and placing in Stores.
- xii) Clearing away rubbish.
- xiii) Other necessary and usual facilities, documentation, general intergrades attendances, labor and assistance.

Attendance to be provided by the Sub-Contractor shall include but not be limited to the following

- i) All special scaffolding required by him in the execution of his works.

- ii) Taking from stores, distributing, hoisting and placing in position, all items of plant, equipment and materials required by him in the execution of his works.
- iii) All labor, plant, etc. (other than included in Attendances to be provided by Main Contractor).
- iv) Site offices and stores required by him for the execution of his works.
- v) Obtaining security passes for access of work people to the Site.

Site Work

All quantities for excavations have been measured net with no allowance for increase in bulk or working space.

The method of measurement and any measurement will be entirely at the discretion of the Engineer but generally will be as follows:

- (i) Where there is no reduced level excavation, other excavations will be measured from natural ground level.
- (ii) In instance where there is excavation to reduce levels, other excavations will be measured from the reduced level.

Should the Contractor be able to use any excavated material arising from the works as general filling then it shall be measured as material backfilling in making up levels with a deduction of items for filling and for material removed from Site.

In addition to the provisions of POM (I) Sections B8 rates for excavation shall include for the following -

- (i) Excavation by whatever means are necessary including hand excavation in any kind of ground material including running silt and running sand.
- (ii) Excavation to the Commencing Level to be measured separately.
- (iii) Commencing excavation at any depth.
- (iv) Excavation below the normal water table level.
- (v) Over break and soft spots including filling with mass concrete to the levels required by the Engineer.
- (vi) Forming temporary spoil heaps where required and multiple handling including any charges in connection therewith.
- (vii) Working space.
- (viii) Excavation around existing services and mains.
- (ix) Trimming or grading ground to produce level surfaces or surfaces to falls or slopes.
- (x) Ramming and compacting sides and bottom of excavations.
- (xi) Supporting the sides of excavations.
- (xii) Keeping excavations free from water by whatever means necessary

The rates for items of imported fillings, graded level filling etc, shall include, but not limited, for the following:

- (i) Grading to slopes and falls.

- (ii) Special compacting to form vertical or battering faces.
- (iii) Forming sinking's.
- (iv) Forming earth bunds and grading to gabions as required.
- (v) Leveling, and compacting to formation levels below roads, buildings, paved areas, etc.
- (vi) Compacting in layers.
- (vii) Any loss in volume due to compaction and for any additional materials required due to penetration of the filling materials into the ground or any settlement or compacting of the original ground levels under the weight of materials or due to methods of compaction or construction traffic.
- (viii) Temporary spoil heaps and multiple handling as required.
- (ix) All labors including handpacking and temporary retaining boards where required.
- (x) Blinding with sand or similar approved fine material where required to receive concrete or the like.
- (xi) (xi) Costs of testing.

Disposal of excess excavated material

Rates for disposal of excess excavated material shall include for any necessary double handling and the provision of a tip, if necessary, including any charges in connection therewith.

Underground Drainage

The rates for trenches for services pipes, drainage pipes, ducts, cables, etc. shall include for disposal and for bedding and backfilling as specified for each service.

The rate for trenches shall include for backfilling to trenches with approved excavated material. If the excavated material is not suitable imported fill shall be used.

The rates for drains, inspection chambers, etc. are to allow for testing.

Rates for drain pipes generally are to include for all short lengths, back stops, wooden plugs and retaining and alignment pegs required in laying and for the extra involved over normal trench excavating in hand packing and tamping selected fine material around the lower half of the pipes to buttress them against the side of the trench. Rates are to be include for leaving all pipes clean and clear.

Pipes are measured nett as laid and are to include for all cuttings, etc. for laying in trenches of any depth, and building in to sides of inspection chambers.

Rates for drain fittings on all types of drain pipes are to include for extra joints of all types and cutting and waste on all pipes.

Rates for drain accessories shall include for concrete surrounds and any additional excavation and disposal.

The rates for all concrete work shall include for the following:

- (i) Concrete testing and testing cost.
- (ii) All considerations arising from the specification.
- (iii) Mixing, hoisting to any height or lowering to any depth and placing and compacting on the surfaces of any material or on formwork by whatever means necessary.
- (iv) Pouring in hot weather conditions in accordance with the Specification.

- (v) Compacting by vibrators if required.
- (vi) Forming any control and construction joints, locations as agreed by the Engineer.
- (vii) Shuttering to upper surfaces not exceeding 15 degrees from horizontal.
- (viii) Curing, hacking surfaces for key and protecting concrete surfaces from harmful weather conditions.
- (ix) All surface treatment to unset concrete.
- (x) Finishing to floor slabs as Specification.
- (xi) Expanded metal lathing and angle beads.
- (xii) Joint sealing between concrete and plaster.
- (xiii) All costs in connection with the construction of "kickers".
- (xiv) Forming and grouting grooves and mortises and making good to holes and mortises.
- (xv) Water bars and the like.

The rates for plain concrete foundations and concrete blinding shall include for the following:

- (i) Any extra volume of concrete used in lieu of formwork.
- (ii) Forming sloping surfaces where required.

The rates for concrete work laid in trenches as bed or surround to all pipes and ducts shall include for all necessary formwork.

The rates for reinforced concrete shall include for working concrete around reinforcement.

The rates for bar reinforcement shall include for the following:

- (i) Extra material in hooks, laps and the like not required by the Specification.
- (ii) Positioning and protecting starter bars.
- (iii) Straightening (if required) cutting to length and bending reinforcement to required shapes and complying with the Specification.
- (iv) Fixing rods of any diameter in any position including any necessary hoisting.
- (v) All considerations arising from the Specification.
- (vi) Epoxy coating as required and all necessary preparation.
- (vii) Supporting in position during concreting, provision of supports, chairs, block spacers and steel binding wire and approved / proprietary distance pieces.
- (viii) Welding bars to form mesh reinforcement.
- (ix) Additional cutting and bonding in connection with holes, mortises, pockets, grooves, chases and the like.
- (x) Providing bar bending schedules to be checked and approved by the Engineer.

The rates for fabric reinforcement shall include for the following:

- (i) Straight, raking, curved and circular cutting and waste.
- (ii) Bending to profiles.
- (iii) Laps of once full square / rectangular module or as noted.
- (iv) All considerations arising from the Specification.
- (v) Supporting in position during concreting; provision of supports, chairs, block spacers, steel binding wire and approved / proprietary distance pieces.

- (vi) Cutting, bending and notching around all obstructions.

Formwork

The rates for formwork or moulds shall include for the following:

- (i) Small quantities.
- (ii) All cutting and waste including raking curved or circular cutting and notching around pipes, ducting and fittings.
- (iii) Grooves of any sectional areas, all stops, chamfers and splayed angles.
- (iv) Setting up, strutting and supporting at any height above the structure subject to any limitations imposed by the Engineer.
- (v) All considerations arising from the specification.
- (vi) Carefully coating with mould oil ensuring that no shutter oil is applied to surfaces of reinforcement.
- (vii) Easing, striking, removing and cleaning and preparing for re-use and removal when no longer required.
- (viii) The provision of all props, stays, struts, wedges and bolts.
- (ix) Overlaps and passing's at angles and labors at intersections.
- (x) Shortening struts or shapes and re-strutting or reshoring where required.
- (xi) Rubbing down, filling and making good the surface of concrete after removal of shuttering.
- (xii) Cutting or notching shutters or moulds to in-situ or precast concrete around projecting reinforcement.

The rates for wrought formwork to produce a special finish shall include for the following:

- (i) Any necessary rubbing down or filling allowed by the Specification to produce the finish demanded by the specification.
- (ii) Cutting out and re-casting unsatisfactory work or work not fulfilling the requirements of the specification.
- (iii) Carrying out remedial or any other work required by the Engineer as an alternative to cutting out substandard work.
- (iv) All consideration arising from the specification.

Precast Concrete

The rates for precast concrete shall include for the following:

- (i) Reinforcement.
- (ii) The provision of moulds.
- (iii) Forming a fair face in accordance with the specification to all exposed surfaces.
- (iv) Square, rounded and mitred angles.
- (v) Hacking or forming keys to all other surfaces.
- (vi) Holes or notching for pipes.
- (vii) All considerations arising from the specification.
- (viii) Hoisting to any height including the provision of lifting hooks or other devices approved by the Engineer.

- (ix) Setting and bedding in position and jointing in mortar as specified.
- (x) All necessary temporary struts or supports.
- (xi) Sills and copings etc. shall include for plain ends and mitred angles where necessary.

Reinforcement to Masonry

- A. The contents of this section equally apply to reinforcement included within the Masonry section of the Bills of Quantities, unless otherwise stated.

Masonry

The rates for blockwork shall include for the following:

- (i) Block testing at a recognized laboratory, provision of certificates.
- (ii) All considerations arising from the specification.
- (iii) Building at any level or height of slabs or beams.
- (iv) Small quantities and any extra labor in forming kerbs.
- (v) Straight, raking, curved and circular rough or fair cutting.
- (vi) Forming bull nose edges to quoins and the like.
- (vii) All labor and materials necessary for closing wall cavities.
- (viii) Plumbing at angles.
- (ix) Cutting and bonding at angles, openings and intersections.
- (x) Building into and / or against adjacent work.
- (xi) Providing solid course blockwork at still level at all openings and bearings of all in-situ concrete and at the top of all free standing walls.
- (xii) Wedging and pinning up to soffits and all insulation required between tops of concrete block partitions and underside of structure.
- (xiii) Special or concrete filled blocks at angles, openings and intersections, and soffit junction and heads of walls.
- (xiv) Providing any means necessary to prevent concrete cast on hollow blockwork or over cavities from falling into voids or cavities (subject to the approval of the Engineer).
- (xv) All necessary keys for in-situ finishing.
- (xvi) Grouting up at back of walls built against other construction.
- (xvii) All necessary starter bars and cast in wall ties at junctions between blockwork and in-situ concrete and all strap supports and lateral supports in accordance with the Specification and shown on the drawings.
- (xviii) All reinforcement to blockwork in accordance with the Specification and shown on the drawings.
- (xix) All necessary expansion joints, control joints, sealant and termination bars as required by the Specification and shown on the drawings.
- (xx) Fire stopping and smoke seals.
- (xxi) Insulation.

The rates for block walls shall include, for the following additional labors:

- (i) Cutting or forming chases or grooves for slabs, partitions, staircases, etc.
- (ii) Cutting grooves for water bars, flashings and the like and making good and pointing in similar mortar.

- (iii) Bedding and pointing frames, etc., building in door and window frames and the like.
- (iv) Building in or cutting and pinning in and making good ends of lintels, brackets, timbers, steelwork, holder bats and the like.
- (v) Building in or cutting for and making good around pipes, ducting, fittings and the like.

Metal Work

The rates for all steelwork and metalwork shall include for the following:

- (i) Ends, angles, intersection, ramps on frames, bearers, stays and the like.
- (ii) Assembling and jointing together components.
- (iii) Stanchions and rafter restraints, gussets and end places.
- (iv) Allowance for rolling margin.
- (v) The weight of weld metal in welded constructions.
- (vi) Members of any length.
- (vii) Cutting to size and shape and joints in the running length.
- (viii) Notches, holes, slots, miter / angle ends, and for all drilling and splay cut ends.
- (ix) Grinding welds to a smooth finish, unless otherwise required.
- (x) Fixing with appropriate non-corroding countersunk screws including holes unless otherwise described.
- (xi) Riveted and bolted work shall include rivets, bolts and holes and countersunk holes.
- (xii) Approved protection to cut ends or holes in galvanized work or other applied finish.
- (xiii) All considerations arising from the specification.
- (xiv) Metal door frames shall include for assembling, fixing with clamps, filling with mortar, temporary supports and removal of base ties.
- (xv) Floor plates, duct covers and the like shall include narrow widths, laying in position, frames, and for all holes, slots and the like and making good.
- (xvi) All preparation, protection coatings and final decoration with the items to which they relate.
- (xvii) All fittings and fixing required, including grouting in position.
- (xviii) Forming cambers in structural steel beams as indicated on the drawings.
- (xix) Shop drawings.

"Welding" is deemed to be in accordance with the specification and for the material to which it is to be used. Base plates, ends, caps, cleats, brackets, stiffeners, bolts, etc., shall be included in the weights of the associated steelwork in which they occur.

Woodwork

Sizes of sawn timber are basic.

Sizes of milled (wrote) timbers are finished.

Woodwork shall be deemed to be fixed with non-corroding nails unless otherwise described.

Screwed woodwork shall be described and shall be deemed to be fixed with non-corroding screws.

These preambles apply equally to all items measured as composite units.

The rates for woodwork shall include for the following:

- (i) Working to size and shape.
- (ii) Raking, curved or splay cutting.
- (iii) Short lengths, mitres, stops, ends and angles.
- (iv) Rebates, chamfers, grooves, scribed edges, rounded edges and the like.
- (vi) Cross grain and stopped work.
- (vii) All joints in the running length including structural joints.
- (viii) Cutting and fitting to steelwork.
- (ix) All considerations arising from the specification.
- (x) Trimming around openings.
- (xi) Extra timber in joints, horns, etc.
- (xii) Notching, boring and sinking have, rounded curves and splayed edges.
- (xiii) Holes for pipes, tubes, bars, cables, conduits, ducting, trunking and the like.
- (xiv) Treating backs of woodwork in contact with structure.

The rates for framed woodwork shall include for the following:

- (i) Proper framed joints.
- (ii) Glueing joints.
- (iii) Doweling cramps and / or screwing joints.

The rates for milled woodwork shall include for the following:

- (i) Punching, fixings below exposed surfaces and filling flush.
- (ii) Any necessary sanding to remove "rippling" caused by milling machines.
- (iii) Wreaths, ramps and the like.

The rates for wood work described as "selected" shall include for the following:

- (i) Keeping clean and clear finishes.
- (ii) Punching nails and pins below exposed surfaces and filling with an approved colored filler to match the woodwork.
- (iii) Where described also as "screwed" the woodwork shall be fixed with screws recessed and pelleted to match the woodwork.

The rates for doors shall include for fitting and hanging any type.

The rates for frames and linings shall include for bedding in specified mortar where required.

The rates for plywood, blackboard and the like shall include for straight raking curved and circular cutting and all consequent wastage.

The rates for plastic laminate faced manufactured boards shall include for providing plastic laminate edgings and balancing laminates and removal of protective coatings.

The rates for ironmongery shall include for the following:

- (i) Mortises, sinking's and the like.
- (ii) All considerations arising from the specifications.

- (iii) Removing before and replacing after decoration.
- (iv) Fixing to wood or metal doors.
- (v) Testing and easing and adjusting.
- (vi) Oiling and leaving in perfect working order.
- (vii) Adhering strictly to mastering and sub-mastering schemes.
- (viii) Supplying and labeling at least two keys for each and every lock and handing over to the Engineer.
- (ix) Master key if required by the specification or drawings.

The rates for ironmongery described as "fixed to hardwood" shall include for fixing to plywood, blackboard and the like.

Thermal and Moisture Protection

The rates for work in this section shall include for the following:

- (i) Preparation and priming of surfaces to receive membranes.
- (ii) Laps, seams and narrow widths.
- (iii) Straight, raking, curved and circular cutting, notching, bending and all consequent wastage.
- (iv) All considerations arising from this specification.
- (v) Cement sand triangular fillet to returns behind the waterproofing membrane.
- (vi) Holes for pipes, standards and the like.
- (vii) Angles, returned ends and dressed ends on flashings.
- (viii) Dressing up and cover up stands and around and into gargoyles, vent pipes and the like.
- (ix) Tropical grade mastic pointing to all flashings.
- (x) Forming outlets, skirting, aprons, gutters and channels and forming small openings.
- (xi) Flashings and the like to penetrations through waterproofing systems.
- (xii) Clearing rubbish and cleaning areas on completion.
- (xiii) Testing in accordance with the specification and to the approval of the Engineer.
- (xiv) Providing an appropriate warranty / guarantee as required by the specification.
- (xv) Cement sand cant and reinforcing strip at corners.

Applied finishes described in this section are deemed to be measured as the relevant preamble in which they occur.

The cost of the mastic sealant and backer rod to be included in the item for Aluminum flashing.

Doors and Windows

The rates for work in this section shall include for the following:

- (i) Frames.
- (ii) Sub-frames.
- (iii) Architraves.
- (iv) Transoms.

- (v) Stops.
- (vi) Sealant.
- (vii) Weather bars.
- (viii) Thresholds or sills.
- (ix) Glazing.
- (x) Insulation.
- (xi) Ironmongery (except in timber doors where it is measured separately).
- (xii) Decoration.

Sizes referred to are structural opening sizes.

Ironmongery

Matching screens, keys and framing mortises in glass and the like shall be understood to be included.

Finishes

All finishing, screeds and backings have been measured net.

Rates for finishes shall include for the following:

- (i) Well wetting solid surfaces to be plastered or screeded.
- (ii) Preparing surfaces for finishing on backings including raking out joints of blockwork partitions, hacking surfaces of concrete or applying bonding agent to form a key and any necessary dubbing out.
- (iii) All cutting and waste, arises, short lengths, angles, ends, etc., making good or cutting and fitting around pipes conduits trunking pipe brackets and the like and making good up to door and window frames, skirting etc., all temporary rules and working around buried pipes, cables, conduits, etc.
- (iv) Angle beads, plaster stops, control joints, expanded metal strips, furring and lath, glass fibre scrims, aluminum channels and the like to all plasterwork around doors, windows at vertical abutments etc., and securely fixing to backgrounds.
- (v) All narrow widths, small areas and all cuttings.
- (vi) Fair edges, rebated edged, splayed edges, rounded edges, arises, quirks, grooves, flutes and the like.
- (vii) All setting out, temporary rules, screeds, templates and supports.
- (viii) Curing and cleaning off / down upon completion.
- (ix) Dubbing out as necessary to take up tolerances in the structure and cambers in floors and the like.
- (x) Expansion joints and control joints.
- (xi) Expanded metal lathing wherever required.

Rates for screeds and backgrounds shall include for the following:

- (i) Finishing with a tampered floated or trowelled surface as required.
- (ii) Laying level or to falls or slopes as required.

- (iii) Laying in bays where required including formwork to all edges, reinforcement, joint filler and sealant as detailed and specified.

Rates for wall and floor tiles and the like shall include for the following:

- (i) Fixing with an approved adhesive.
- (ii) Pointing up joints with mortar and cleaning off as required.
- (iii) Rounded, beveled and fair edges as required.
- (iv) Metal edge strips, dividers etc.
- (v) Straight, raking and curved cutting.
- (vi) Provision of expansion joints and sealant as indicated on the drawings.
- (vii) Provision of slurry protections or the like including removing same in floor areas subjected to movement of labor and materials.
- (viii) General protection of finished work to the Engineer's approval.

Rates for ceiling finishes shall include for the following:

- (i) Finishing with trowelled surface or other as required.
- (ii) False ceiling to include for all hangers, ceiling grid, tiles and insulation layers, and drop of any height.
- (iii) Bulkheads as shown on drawings.
- (iv) Work to sloping, curved, level soffits as required.
- (v) Straight, raking and curved cutting.
- (vi) Cutting and fitting around light fittings, A/C. equipment, etc.
- (vii) Shop drawings.
- (viii) Supporting framework, angle trims and other accessories.
- (ix) Lining to ceilings, beams and up stands.
- (x) Metal plaster stops, angle beads, etc.

Painting and Decoration

Painting to Structural Steelwork and Metalwork may either be included in this section or within either section to which it occurs and has been measured either as M2 or kg of Steel/Metalwork.

The rates for painting and decorating shall include for the following:

- (i) Painting either internally or externally.
- (ii) All cleaning and preparatory work to the surface to be painted including rubbing down between coats.
- (iii) Priming shall include for using a primer appropriate to the surface to which it is being applied.
- (iv) Preparation of manufactured boards and wood products shall include for surface filling.
- (v) Work on "Woodwork" shall include both softwood and hardwood and for knotting.
- (vi) Extra preparation on metal trims and the like over that of general surfaces in which they are decorated.
- (vii) Unless of a differing specification, work shall be deemed to cover internal or external painting.

- (viii) Work in multi-colors.
- (ix) Work to curved surfaces.
- (x) All cutting into edges.
- (xi) Scaffolding as required and working to or at any height.
- (xii) All narrow widths, cutting to line, opening edges of doors.
- (xiii) Rates for sprayed paint shall include for all masking work.

Mechanical Installations

The rates and prices for plant, equipment and installations are to be all inclusive of supply, installation, testing, commissioning and all associated builders work required for the full operation of such plant, equipment and installations, to comply in all respects with the Specification, Bills of Quantities, Drawings and to the complete satisfaction of the Local Regulatory Body and the Engineer.

The rates for pipework and ductwork shall include for the following:

- (i) All cuttings, short lengths and small quantities.
- (ii) Made bends.
- (iii) Couplers and / or joins in the running length.
- (iv) Splay cut ends.
- (v) All considerations arising from the specification.
- (vi) Fixing with approved holder bats or pipe clips cut and pinned, built in or plugged and screwed.
- (vii) Sleeves through walls.
- (viii) Bends and fittings on pipes whatever the diameter.
- (ix) Fittings to ductwork of all shapes and sizes.
- (x) Rates for cable and duct trench excavation shall include for all excavation, bedding, backfill and disposal as required by the Statutory Authority standard specification.
- (xi) Backfilling to trenches with approved excavated material. If the excavated material is not suitable imported fill shall be used.

The rates for sanitary fittings and the like shall, unless otherwise described or implied, include for the following:

- (i) Assembling component parts including suitable bedding compounds.
- (ii) Flexible connections from the supply point.
- (iii) All necessary plugging and screwing.
- (iv) Joints to water services with straight or bent proprietary connectors.
- (v) Cleaning off all protective wrappers and leaving ready for use.
- (vi) Leaving taps and valves greased, clean and in full working order.

The Contractor shall include for the supply of manufacturers recommended spares as required by the Specification for all mechanical engineering installations and shall submit details of spares to be provided by him on the Schedule of Recommended Spares, including other relevant details.

Rates for Plumbing and HVAC Work

Rates for all pipe work shall include for assembling and joining, pipe supports, pipe sleeves and cover plates and the like.

Rates for pipework shall include for all fittings to small pipes (i.e. pipes into an internal dia. of 60mm or less) fittings (except joint in running lengths) to large pipes (i.e. pipes with internal dia exceeding 60mm) and to gutters shall be enumerated, grouped together for each size of pipe and gutter and described as fittings.

Rates for duct work are to be included all fittings, brackets, hangers and other support.

Rates for insulation are to be included for cutting, waste, joining lap and working around and our ancillaries, fittings, flanges and other obstructions.

Electrical Installations

The rates and prices for plant, equipment and installations are to be all inclusive of supply, installation, testing, commissioning and all associated builders work required for the full operation of such plant, equipment and installations, to comply in all respects with the Specification, Bills of Quantities, Drawings and to the complete satisfaction of the Local Regulatory Body and the Engineer.

The rates in general shall include for the following:

- (i) All cutting, short lengths and small quantities.
- (ii) All joints in the running length and all connections.
- (iii) All considerations arising from the specification.
- (iv) Fixing conduits / cable trays, etc., by approved methods.
- (v) Pipe sleeves through walls.
- (vi) Assembling component parts.
- (vii) Cleaning off all protective wrappers and leaving ready for use.
- (viii) Leaving all equipment etc., clean and in full working order.
- (ix) Draw wires in empty conduits.
- (x) Rates for cable and duct trench excavation shall include for all excavation, bedding, backfill and disposal as required by the Statutory Authority standard specification.
- (xi) Backfilling to trenches with approved excavated material. If the excavated material is not suitable imported fill shall be used.

The Contractor shall include for the supply of manufacturers recommended spares as required by the Specification for all electrical engineering installations and shall submit details of spares to be provided by him on the Schedule of Recommended Spares, including other relevant details.

The cable lengths / routes are measured from point to point on the drawing (horizontal plan distance on the drawing, any cable required for connections, loops, etc., at equipments, appliances, control gear or the like will be deemed to be included.

Multiple Ducts and Cables

The quantity stated in the Bills of Quantities for multiple ducts and cables is the length of a single duct or cable in the particular group of ducts or cables. The contractor will allow the cost of number of ducts or cables in the rate as appropriate. eg., a qty of 50m against a 3 way

200mm dia duct means that a total quantity of $50 \times 3 = 150\text{m}$ of 200mm duct is to be priced for, ditto for cables.

External Services

The rates for all manholes and the like are to be all inclusive of all costs for the complete construction, in accordance with the specifications, drawings and local authority requirements.

External Works

Where external works are analogous to other sections of the work e.g. excavation concrete etc., the clauses elsewhere shall apply equally to this section of the work.

Kerbing – Rates shall include for construction of concrete bed and lacking, supply and laying of precast concrete kerbs either straight or curved, finishing, curing and protecting building in gratings and frame.

Paved areas (footpaths and roadways) – Rates shall include bedding material, supply and laying of paving slabs including all cutting to fit around manhole covers and the like. Allow for forming patterns and designs in the paving stones all as detailed.

The rates for gates and fences in this section shall include for the following:

- (i) Frames including lugs.
- (ii) Sealant.
- (iii) Ironmongery.
- (iv) Decoration.
- (v) Civil works including earthworks, concrete, formwork, reinforcement, protections, etc.

Proprietary Materials

Where manufacturers names or proprietary material names are given against certain items in the Bills of Quantities, the rates and prices inserted shall be for those specified material or other similar and equally approved materials. All proprietary materials shall be installed strictly in accordance with the manufacturer's printed instructions and the Contractor shall be deemed to have allowed for such in his pricing.

Measurable Contract

This Contract is a Measurable type of Contract.

Builder's Work

Drilling, cutting or leaving of holes for pipes, ducts and the like through walls floors, partitions, roofs, etc., and subsequently making good.

Cutting and pinning ends of supports for pipes, equipment, appliances, fittings and the like to walls, floors, partitions, soffits, etc., and making good.

Cutting or leaving mortises, sinking's, etc. for holding down bolts, brackets, supports and the like and grouting in.

Cutting chases for pipes and the like in walls, floors, partitions, etc. and subsequent making good.

Cutting and fitting around, boring holes through and making good of finishing's up to pipes, supports, brackets and the like.

The formation of concrete bases, plinths, etc. for plant, tanks, and equipment, including anti-vibration pads incorporated within the plinth as necessary. The subcontractor shall supply all other vibration isolation.

The painting of exposed pipe work, fittings, equipment etc.

The supply and installation of sub-frames where required for grilles, diffusers, luminaries, sprinkler heads, loudspeakers and the like.

Cutting and making good openings in false ceilings, bulkheads, walls for grilles, diffusers, luminaries, sprinkler heads, loudspeakers and the like.

The Contractor shall be completely responsible for obtaining the requirements for holes, fixings, and any other builders work between trades and ensure that such information as is shown on the drawings is in accordance with his own and the Employer's requirements. Details of builders work which is not shown in the drawings but which are required by the Contractor / Subcontractors shall be forwarded to the Engineer for his written approval before the work is put in hand. Cost of such works shall be borne entirely by the Contractor.

the drilling, cutting or leaving of holes or aperture through structural floors, walls, beams etc., shall be avoided, but where this become a necessity the Contractor must obtain the written approval of the Engineer before such work is put in hand. Cost of such works shall be borne entirely by the Contractor.

Installation of all embeds to be cast to the concrete such as brackets, channels, bolts or plates required for fixing of cladding and curtain walling. Embeds to be provided by the subcontractor.

Coordination and provision of all necessary holes in the steel structure for fixing of cladding.

"Builders work" will include all the above, but it should be noted that this list is not intended to be exhaustive and everything necessary will be deemed to be included.

The Contractor is referred to the Architectural/Structural Drawings for further information. The Contractor shall allow for any plinths or bases required for MEP equipment installations.

"Builders work" shall include for all penetrations through concrete surfaces for MEP Equipment, including (but not limited to) stair pressurization fans, ventilation openings through skylight up stands, fire barrier seals as required and the like.

Items in respect of general attendance (assistance) to be provided by the Main Contractor to the Nominated Sub-Contractors shall include the following items, free of all charges:

Provision of all site hoardings, fencing, controlled access openings and the like.

Provision of temporary hard standings for vehicular traffic and the like.

Provision of un-hindered access to working areas.

Preparation of the site, including (but not limited to); removal of asphalt road surfacing, kerbs, pavers, lighting poles, bollard, shrubs, signage, telephone kiosks and the termination / relocation of all existing underground and exposed services.

Provision of grid lines / markers and levels, including checking and verification.

Use of Contractor's administrative arrangements including the necessary supervision, coordination and shop drawings as applicable / as required.

Opening and maintaining letters of credit, repayments, etc. as applicable/required.

Unloading, distributing, hoisting and lowering of materials.

Unloading the delivered items to site, checking for damage and processing of insurance claims, as applicable / required.

Use of personnel hoist, stairs, platforms and walkways.

Use of constructional plant.

Use of Contractor's facilities.

Use of Temporary Works.

Space for Sub-Contractor's offices and stores.

Scaffolding, including access scaffolding and mobile platform.

Unloading, distributing, hoisting, lowering and placing in position items of plant, machinery or the like.

Provision of water for the Works and that required for testing and commissioning.

Provision of power and lighting for the Works and power required for testing and commissioning, including fuel and consumption charges.

Lifting, hosting, crange etc.

Insurance of the Works.

Provision of safe and secure space for offices goods and materials.

Programming of the Work including progress reporting and co-ordination of the Works to comply with the Contractor's programme.

Co-ordination of the whole of the works including the work of Sub-Contractors and any relevant authorities etc.

Provision of protection to finished work.

Clearance of all rubbish and debris.

Cleaning the finished work as part of the final cleaning obligations as detailed in the Specification.

Provision of any specialist scaffolding, access scaffolding and mobile platforms.

Provision of all specialist lifting, hoisting, crange etc. For off-loading, positioning and installation of materials and services equipment.

Co-ordination of the whole of the Works including the work of other Nominated sub-contractors as Domestic Sub-Contractors and providing all special attendance as required for the works which are required by sub-contractors and not covered under General Attendance's.

Profit

Where the Contractor is required to add for 'Profit' a percentage figure shall be inserted as indicated. This percentage value shall include all profits for site office, head office and other overheads.

GRAND SUMMARY

BILL OF QUANTITIES
GRAND SUMMARY

S.No	DESCRIPTION	AMOUNT (Rs.)
A	PERMANENT WORKS	
B	Civil Works	
i	Brick Masonry Retaining Wall Along the Road MC-02	
ii	Gate Office	
C	Electrical Works (Gate Office)	
	TOTAL COST OF THE PROJECT	

CIVIL WORKS

**BRICK MASONRY RETAINING
WALL ALONG THE ROAD MC-02**

Brick Masonry Retaining Wall Along The Road MC-02 & MC-03

S.No	GOVT.OF SINDH CSR 2012 Item #/Page#/ Vol.sched ref.	DESCRIPTION	QTY	UNIT	RATE (To be Fill by bidder) (Rs.)	CSR SINDH SCHD. 2012 RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6	7	8 = (4 x 6)
PART-A (SCHEDULE ITEMS)							
1	Item # 18(b)+18(i.ii)/ P-4+75/ Vol. III,Part- II & III,(General & PHEW)	EXCAVATIONS, BACKFILLING AND DEWATERING Excavation in foundation and dewatering in all kind of soil of building, bridges and other structures including dagbelling dressing refilling around structure with (suitable) excavated earth watering, ramming complete and disposal of surplus excavated material to designated area i/c all lead & lift. etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	3432	M ³		303.92	
2	Item # 20 / P-10 /Vol-III,Part-II, (General)	DSMANTLING OF EXISTING COLUMN Dismantling cement concrete reinforced separating reinfor cement from concrete cleaning and staightening the same etc complete in all respect as per standard specification, drawing and entire satisfaction of the Engineer.	54	M ³		1,923.17	
3	Item # 5(h) / P- 16 /Vol-III,Part-II, (General)	PCC CONCRETE (1:3:6) Providing and laying cement concrete plain including placing compacting, finishing, leveling and curing (including screening and washing at stone aggregate without shuttering etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.					
a)		Below foundation, plinth beam and floor and where required etc.	154	M ³		4,448.55	
4	Item # 19b(i+ii/2) / P-18 /Vol-III,Part-II, (General)	WOODEN FORMWORKS/SHUTTERING Providing, fixing, erecting and removal of partial wood centering (shuttering / formwork) of approved quality for RCC or plain cement concrete works etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.					
i		Form work for 1:3:6 concrete	342	M ²		361.31	
5	Item # 6a(ii) / P- 16,17 /Vol-III,Part- II, (General)	RCC CONCRETE Providing and laying Reinforced cement concrete work including all labor and material except the cost of steel reinforcement and its labor for bending and binding which will be paid seperately.This rate also includes all kinds of forms moulds lifting fixing of shuttering and its removal and vibrating, curing, rendering and finishing the exposed surface (including screening and washing of shingle) etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.					
i)		RCC Concrete Cylindrical strength 21 Mpa (3000 Psi) Extention of Column (at required level.)	171	M ³		12,326.68	

Brick Masonry Retaining Wall Along The Road MC-02 & MC-03

S.No	GOVT.OF SINDH CSR 2012	DESCRIPTION	QTY	UNIT	RATE (To be Fill by bidder) (Rs.)	CSR SINDH SCHD. 2012 RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
6	Item # 8b / P-17 /Vol-III,Part-II, (General)	<p>STEEL REINFORCEMENT Providing, supplying, cutting, fabrication of Tor / deformed steel reinforcement for cement concrete including cutting,bending,laying in position making joints and fastening including cost of binding wire (also includes removal of) etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p>	14	Ton		100,034	
7	Item # 5(1b) / P-21 /Vol-III,Part-II, (General)	<p>BRICK MASONRY Providing and laying pacca brick masonry work (1st class quality) in ground floor super structure up to any height and at any floor etc. laid and jointed with 1:3 cement sand mortar using approved quality screened sand including racking out and cleaning of joints and pointing, masonry to be laid in course, true to line, level and plumb, properly cured, etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p>	1234	M ³		4,844.28	
8	Item # 11c / P-52 / Vol. III,Part-II,(General)	<p>PLASTER (EXTERNAL SURFACE) Providing and applying 20mm (3/4") thick cement plaster to external walls, columns, beams, etc. with cement mortar 1:4 ic all corners, recesses, jambs, raking out joints of masonry, scaffolding etc, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (up to any height). (S.R cement to be used)</p>	2077	M ²		324.50	
Total Amount of Schedule Items-A							

Brick Masonry Retaining Wall Along The Road MC-02 & MC-03

S.No	GOVT.OF SINDH CSR 2012	DESCRIPTION	QTY	UNIT	RATE (To be Fill by bidder) (Rs.)	CSR SINDH SCHD. 2012 RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
PART-B (NON-SCHEDULE ITEMS)							
9		<p>REMOVING & RE-FIXING OF FENCE removing of existing fence including Chiseling, cutting of existing column consisting of (G.I wire net, G.I pipe 10swg, nuts & bolt, flat, hold fast) etc, and where required as shown in the drawings cutting of fence with gas cutter including cleaning, debris stacking at appropriate place and dispose off at locations which approved by the the Engineer with all leads and lift etc. complete as per drawing and specifications and approval of the Engineer.</p>	1821	M ²		-	
10		<p>REMOVING & RE-FIXING OF FOOTPATH Removing of existing foot path paver and staking at site as per instruction of the engineer including re fixing of these after completion masonry work, refilling and compaction work complete as per (Case-1) drawing and specifications and approval of the Engineer.</p>	504	M ²		-	
11		<p>75mm Thick C.C Coping Providing and laying (1:3) plain cement sand mortar coping concrete over brick masonry or where required including all formwork, rodding, leveling, compacting curing and finishing etc. complete as per drawing and specifications and approval of the Engineer.</p>	29	M ³		-	
12		<p>BRICK MASONRY WORK (Bricks Supplied by the Client) Providing and laying pacca brick masonry work in ground floor super structure up to any height and at any floor etc. laid and jointed with 1:3 cement sand mortar using approved quality screened sand including racking out and cleaning of joints and pointing, masonry to be laid in course, true to line, level and plumb, properly cured, etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. <i>NOTE: Bricks are provided by the client at site, only laying rate is required with CS mortar)</i></p>	900	M ³			
13		<p>Providing and fixing new periphery fence made from 50x4mm wire net fixed to 50mm dia x 10 swg G.I pipe frame panels of 2400 x 1700 mm size fixed with each other with 50mm x 5mm holdfasts vertically at three points. The G.I pipe supports to be embedded into RCC 1:2:4 pedestals of size 600 x 250 x to required height over RCC 1:2:4 footings of size 1000 x 500 x 300 mm high. Top of pedestal to matched as per existing, including excavation, lean concrete, etc. Complete in all respect as per drawings, specifications and direction of the Engineer.</p>	125	Rm			
Total Amount of Non-Schedule Items-B							
TOTAL CARRIED TO GRAND SUMMARY (A + B)							

GATE OFFICE

Construction of Gate Office

S.No	GOVT.OF SINDH CSR 2012 Item #/Page#/ Vol.sched ref.	DESCRIPTION	QTY	UNIT	RATE (To be Fill by bidder) (Rs.)	CSR SINDH SCHD. 2012 RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6	7	8 = (4 x 6)
PART-A (SCHEDULE ITEMS)							
1	Item # 18(b)+18(i.ii)/ P-4+75/ Vol. III,Part II & III,(General & PHEW)	EXCAVATIONS, BACKFILLING AND DEWATERING Excavation in foundation and dewatering in all kind of soil of building, bridges and other structures including dagbelling dressing refilling around structure with (suitable) excavated earth watering, ramming complete and disposal of surplus excavated material to designated area i/c all lead & lift. etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	155	M ³		303.92	
2	Item # 22+13 (b+cii)/P-3 & 4/Vol-III,Part-II, (General)	IMPORTED EARTH FILLING FROM OUTSIDE SOURCES Supplying and filling watering and ramming earth under floor with new earth excavated from outside in 150mm layers leveling dressing and watering for compaction and to obtain 95% modified AASHTO density. Complete including all lead & lifts etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	27	M ³		167.42	
3	Item # 2 / P-15 /Vol-III,Part-II, (General)	STONE SOLING Providing and laying dry rammed brick or stone ballast / soling 1-1/2" to 2" gauge from approved quarry including hand packing & filling voids with sprawls & chips, consolidating & compacting with power or hand roller,etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	30	M ³		1,175.27	
4	Item # 5(l) / P-16 /Vol-III,Part-II, (General)	PCC CONCRETE (1:4:8) Providing and laying cement concrete plain including placing compacting, finishing, leveling and curing (including screening and washing at stone aggregate without shuttering etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.					
a)		Below foundation, plinth beam and floor and where required etc.	12	M ³		3,987.19	
5	Item # 5(h) / P-16 /Vol-III,Part-II, (General)	PCC CONCRETE (1:3:6) Providing and laying cement concrete plain including placing compacting, finishing, leveling and curing (including screening and washing at stone aggregate without shuttering etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	3	M ³		4,448.55	
6	Item # 19b(i+ii/2) / P-18 /Vol-III,Part-II, (General)	WOODEN FORMWORKS/SHUTTERING Providing, fixing, erecting and removal of partial wood centering (shuttering / formwork) of approved quality for RCC or plain cement concrete works etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.					
i		Form work for 1:4:8 concrete	22	M ²		361.31	
ii		Form work for 1:3:6 concrete	5	M ²		361.31	

Construction of Gate Office

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	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
7	Item # 6a(ii) / P-16,17 /Vol-III,Part-II, (General)	<p>RCC CONCRETE SUB-STRUCTURE-Providing and laying Reinforced cement concrete work including all labor and material except the cost of steel reinforcement and its labor for bending and binding which will be paid seperately.This rate also includes all kinds of forms moulds lifting fixing of shuttering and its removal and vibrating, curing, rendering and finishing the exposed surface (including screening and washing of shingle) etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p> <p>RCC Concrete Cylindrical strength 21 Mpa (3000 Psi)</p> <p>i) Footing and Concrete Pads</p> <p>ii) Plinth Beams</p> <p>iii) Column up to Plinth level</p>	25	M ³		12,326.68	
8	Item # 8b / P-17 /Vol-III,Part-II, (General)	<p>STEEL REINFORCEMENT Providing, supplying, cutting, fabrication of Tor / deformed steel reinforcement for cement concrete including cutting,bending,laying in position making joints and fastening including cost of binding wire (also includes removal of) etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p>	4	Ton		100,034	
9	Item # 9 / P-71 /Vol-III,Part-II, (General)	<p>BITUMEN COATING Providing and applying industrial bitumen paint/coating to plastered or cement concrete surface etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer</p>	270	M ²		83.72	
10	Item # 28b / P-19 / Vol-III,Part-II,(General)	<p>(D.P.C) DAMP PROOF COURSE Providing and laying DPC damp proof course with (cement sand and shingle concrete 1:2:4) including 2 coats of asphaltic mixture with leveling, curing, finishing etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p>	5	M ²		421.02	
11	Item # 92 / P-109 / Vol-III,Part-II,(General)	<p>TERMITE TREATMENT Providing Anti-Termite treatment by spraying / sprinkling / spreading Neptachlar 0.5% Emulsion as an overall pre-construction treatment in slab type construction under the slab and along attached perches or entrances etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. <i>(Plinth area will be measured one time for payment whereas the number of applications will be three times on all horizontal & vertical surfaces of the excavations for termite proofing).</i></p>	20	M ²		104.80	

Construction of Gate Office

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	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
12	Item # 6a(ii) / P-16,17 /Vol-III,Part-II, (General)	RCC CONCRETE SUPER-STRUCTURE -Providing and laying Reinforced cement concrete work including all labor and material except the cost of steel reinforcement and its labor for bending and binding which will be paid seperately.This rate also includes all kinds of forms moulds lifting fixing of shuttering and its removal and vibrating, curing, rendering and finishing the exposed surface (including screening and washing of shingle) etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.					
		RCC Concrete Cylindrical strength 21 Mpa (3000 Psi)					
		i) Column	9	M ³		12,326.68	
ii)	Beams. Lintels, Projections, Pads, brackets and Sills	4	M ³		12,326.68		
iii)	Slab i/c Projection	4	M ³		12,326.68		
13	Item # 8b / P-17 /Vol-III,Part-II, (General)	STEEL REINFORCEMENT Providing, supplying, cutting, fabrication of Tor / deformed steel reinforcement for cement concrete including cutting,bending,laying in position making joints and fastening including cost of binding wire (also includes removal of) etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	2	Ton		100,034	
14	Item # 5(1e) / P-21 /Vol-III,Part-II, (General)	BRICK MASONRY Providing and laying pacca brick masonry work (1st class quality) in ground floor super structure up to any height and at any floor etc. laid and jointed with 1:6 cement sand mortar using approved quality screened sand including racking out and cleaning of joints and pointing, masonry to be laid in course, true to line, level and plumb, properly cured, etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	14	M ³		4,476.58	
15	Item # 4(1c) / P-21 /Vol-III,Part-II, (General)	BRICK MASONRY STEPS Providing and laying pacca brick work (1st class quality) in foundation and plinth for entrance steps laid and jointed with 1:4 cement sand mortar using approved quality screened sand masonry to be laid in course, true to line, level and plumb, properly cured, etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. For Steps and where required	1	M ³		4,415.50	

Construction of Gate Office

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	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
16	Item # 84(a) / P-108 /Vol-III,Part-II, (General)	ALUMINIUM WINDOWS / VENTILATORS Supplying & fixing in position Aluminium channels framing for sliding windows & ventilators of Alcop made with 5mm thick tinted glass glazing (Belgium) & Aluminium fly screen l/c handles stoppers & locking arrangement etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	5	M ²		17,137	
17	Item # 13c / P-52 / Vol. III,Part-II,(General)	PLASTER (INTERNAL WALL SURFACE) Providing and applying 20mm (3/4") thick cement plaster to internal walls, columns, beams, etc. with cement mortar 1:6 ic all corners, recesses, jambs, raking out joints of masonry, scaffolding etc, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (up to any height). PAINT (INTERNAL WALL SURFACE) Providing and applying painting on all internal wall surface with 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.	42	M ²		278.74	
18	Item # 30a+b / P-73 / Vol.III,Part II, (General)	PLASTER (INTERNAL WALL SURFACE) Providing and applying 20mm (3/4") thick cement plaster to internal walls, columns, beams, etc. with cement mortar 1:6 ic all corners, recesses, jambs, raking out joints of masonry, scaffolding etc, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (up to any height). PAINT (INTERNAL WALL SURFACE) Providing and applying painting on all internal wall surface with 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.	42	M ²		152.98	
19	Item # 11b / P-52 / Vol. III,Part-II,(General)	PLASTER (INTERNAL CEILING SURFACE) Providing and applying 12mm (1/2") thick cement plaster to internal ceiling, soffits of beams and projections etc. with cement mortar 1:4 ic all corners, recesses, jambs, raking out joints of masonry, scaffolding etc, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (up to any height). PAINT (INTERNAL CEILING SURFACE) 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.	25	M ²		245.75	
20	Item # 23+24a+b+c / P-54 / Vol.III,Part II, (General)	PLASTER (INTERNAL CEILING SURFACE) Providing and applying 12mm (1/2") thick cement plaster to internal ceiling, soffits of beams and projections etc. with cement mortar 1:4 ic all corners, recesses, jambs, raking out joints of masonry, scaffolding etc, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (up to any height). PAINT (INTERNAL CEILING SURFACE) 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.	25	M ²		340.94	
21	Item # 13c / P-52 / Vol. III,Part-II,(General)	PLASTER (EXTERNAL SURFACE) Providing and applying 20mm (3/4") thick cement plaster to external walls, columns, beams, etc. with cement mortar 1:6 ic all corners, recesses, jambs, raking out joints of masonry, scaffolding etc, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (up to any height).	155	M ²		278.74	

Construction of Gate Office

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	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
22	Item # 38a+b+b / P-56 / Vol.III,Part II, (General)	PAINT (WEATHERSHIELD ON EXTERNAL SURFACE) Providing and applying preparing the surface and painting with weather coat i/c rubbing the surface with rubbing brick /sand paper, filling the voids with chalk/ plaster of Paris and then painting with weather coat of approved make (1st coat, 2nd & subsequent coat) etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (At any height)	155	M ²		276.31	
23	Item # 2+3 / P- 91/ Vol.III,Part II, (General)	MS WORKS Providing, fabrication, erecting and fitting in position of heavy steel works with (angles,tees,flat iron, round iron and sheet iron for making trusses, girders, tanks etc.including cutting tanks etc. including cutting, drilling, riveting, handling assembling and fixing in position etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. For Pre-Engineered Steel Structure For M.S Grill / Grill Gate	8605 3750	Kg Kg		103.99 103.99	
24	Item # 5d(i,ii)/ P 70 / Vol.III,Part II, (General)	PAINT (ON MS WORKS) Providing and applying preparing the surface and painting in all types of MS guard bars, gates of iron bars, grating, railings (including standard braces etc) and similar open work with priming coat / enamel coating of approved make (1st coat, 2nd & subsequent coat) etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (At any height)	262	M ²		136.74	
Total Amount of Schedule Items-A							

Construction of Gate Office

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	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
PART-B (NON-SCHEDULE ITEMS)							
25		<p>ROOF PROTECTION Provide and lay roof treatment as per specifications, and shown in drawings and details shown consisting of following items (For payment only Tile area will be measured) etc. complete in all respects and as directed by the Engineer.</p> <p>i) 1-1/2" thick tiles grouted with cement sand Mortar including making slope, curing, hacking and chipping of existing surface for bonding where necessary, etc. complete</p> <p>ii) 2 layers of water proofing 3" mud filling / plaster with husk with curing etc.</p> <p>iii) 2 layers of polythene sheets 004"-005" thick</p> <p>iv) Bitumen flood coat 10/20 grade 35 lbs / 100 sft</p> <p>v) Bitumen flood coat 70/90 grade 5 lbs / 100 sft</p>	26	M ²		-	
26		<p>DOOR SHUTTER Providing and fixing 38mm thick solid core soft wood filling flush door shutters with 1/8" thick commercial ply on either sides complete cross band of standard specification with 5/8" thick edge solid Red maranti wood lipping all around, as produced by standard manufacturers under power driven hydraulic press as approved by the Engineer-in charge including 11/ 2" x 1/2" Red maranti wood beading / Architraves, approved Local Lock, 9" Tower bolt, Door Stopper etc., painting 3 coats with approved enamel paint over a coat of primer (at any floor & height) as per drawing and specifications and to the entire satisfaction of the Engineer.</p>	3	M ²		-	
27		<p>FLOORING Providing and laying 9 mm thick floor of Porcelain tiles Matt size 300 x 300 in grey cement, bedding material with cement sand mortar (1:6) including setting the tiles with cement slurry over mortar, jointing and washing the tiles with cement slurry of matching color, grinding, rubbing, polishing and curing etc. complete as per drawings, specifications and approval of the Engineer.</p>	16	M ²		-	
28		<p>SKIRTING Providing and fixing Porcelain tiles Matt 12" x 12" x 1/4" (or equivalent in mm) on skirting in grey cement, with cement sand mortar base (1:6) including setting the tiles with cement slurry over mortar, jointing and matching color, and curing etc. complete as per drawings, specifications and approval of the Engineer.</p>	16	RM		-	

Construction of Gate Office

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	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
29		RAIN WATER DRAIN Providing and fixing 75 mm dia UPVC pipe for rain water drain of approved class and make complete with SS jali and all required necessary clamps, fittings, jointing material and mastic filling silicon etc. complete in all respects as per drawing, specifications and as directed by the Engineer. (up to any height).	5	RM		-	
30		G.I DOOR FRAME Providing, making and fixing G.I molded sheet 16 Swg door frame size 2"x5" including steel hinges 3 Nos. fixing with cements sand mortar (1:6) painting 3 coats with approved enamel paint over a coat of primer (at any floor & height) as per drawing and specifications and to the entire satisfaction of the Engineer. (Door frame)	6	RM		-	
Total Amount of Non-Schedule Items-B							
TOTAL CARRIED TO GRAND SUMMARY (A + B)							

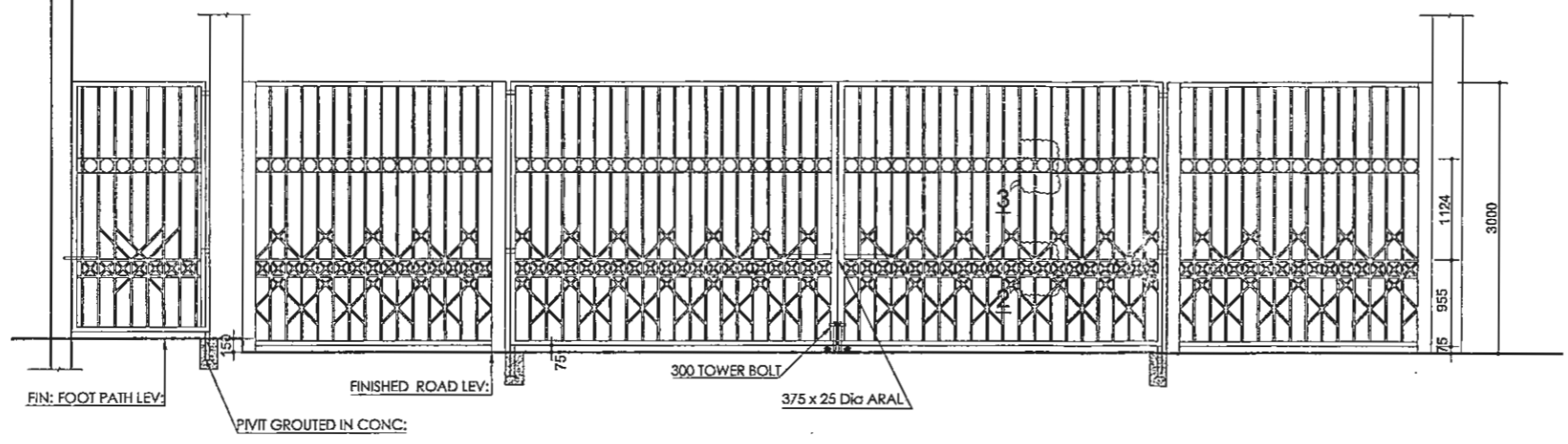
ELECTRICAL WORKS

Item Nos.	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
Non Schedule Items					
1	LIGHTING FIXTURES Supply, installation, testing and commissioning of following light fixtures complete with Electronic ballast (unless mention otherwise), lamps,lamps holder, mounting accessories etc. or as per specification,complete in all respects. Lighting fixtures Sample must be submitted to consultant for approval.				
	a) Wall mounted Fluorescent Light Fixture Philips TMS Type with 1 x 36W TLD. Color 84	Nos.	2		
	b) Wall mounted Flood Light Fixture Philips CON TEMPO RVP-250 Type weatherproof (IP 65) with 1 x 150W SON-T Lamp.	Nos.	4		
	c) Wall mounted Light Fixture Philips type weatherproof with 18W CFL Lamp (IP-54)	Nos.	3		
2	L.V DISTRIBUTION BOARDS Supply, installation, testing & commissioning of wall mounted LV Distribution Boards (DB's) as per single line diagram, dust protected, vermin proof housing coated with approved color including all mounting accessories as per specification & drawing complete in all respect.				
	i Distribution Board (DB-GR)	Job	1		
3	LOW VOLTAGE CABLES Supply, installation, testing and commissioning of following size of multi core PVC insulated, PVC sheathed unarmoured copper conductor 0.6 kV/1 kV voltage grade cable in already laid raceways or in trench including all accessories lugs,cable gland etc.as per drawings and specification.				
	i 1 x 4 Core - 16 Sq.mm PVC/PVC + 1 x 1-core 16 Sq.mm PVC as ECC	Rm	10		
4	WIRINGS				
a	Supply, installation, testing & commissioning of Circuit wiring from DB to switch board with 3x2.5 sq.mm single core, Cu. conductor PVC insulated wires including 20 mm dia. PVC conduit surface / recessed in wall, column, ceiling, etc., complete with all accessories as per specification,complete in all respect.	No.	1		
b	Supply, installation, testing & commissioning of Point wiring from switch board to light point with 3x1.5 sq.mm. wires in 20 mm dia PVC conduit, surface / recessed with all accessories,or as per specification, complete in all respect.	Nos.	5		
				SUB TOTAL	

Item Nos.	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
Non Schedule Items					
c	Supply, installation, testing & commissioning of Circuit wiring from DB to Flood Light point with 3x2.5 sq.mm single core, Cu. conductor PVC insulated wires including 20 mm dia. PVC conduit surface / recessed in wall, column, ceiling, etc., complete with all accessories as per specification and drawing,complete in all respect.	No.	1		
d	Supply, installation, testing & commissioning of Point wiring for flood light point to flood light point with 3x2.5 sq.mm. wires in 20 mm dia PVC conduit, surface / recessed with all accessories,or as per specification, complete in all respect.	Nos.	3		
5	LIGHTING CONTROL SWITCH Supply,installation,testing and commissioning of following 10 Amps switches, including 16 SWG sheet steel powder coated back boxes, recessed on wall with all accessories, as per drawing and specification,complete in all respects.				
	i Five gang switch	No.	1		
	ii One gang dimmer with switch 10A	No.	1		
6	SWITCH SOCKET OUTLET Supply,installation,testing and commissioning of following 3 pin,5 Amps, switch socket outlets including 16 SWG sheet steel powder coated back boxes, recessed on wall with all accessories, complete in all respects.				
	i 5A, 3 Pin Universal switched socket outlet	No.	1		
7	CONDUIT Supply & installation of following size (inner dia) PVC conduit as race ways with all accessories recessed/ surface on wall / column / under floor for Power. As per relevant specification, complete in all respect.				
	i 20 mm dia	Rm	10		
8	FAN				
a	Supply, installation, testing and commissioning of 56" Sweep ceiling fan with hook including all connecting accessories as per drawings, specifications, complete in all respects.	No	1		
				SUB TOTAL	

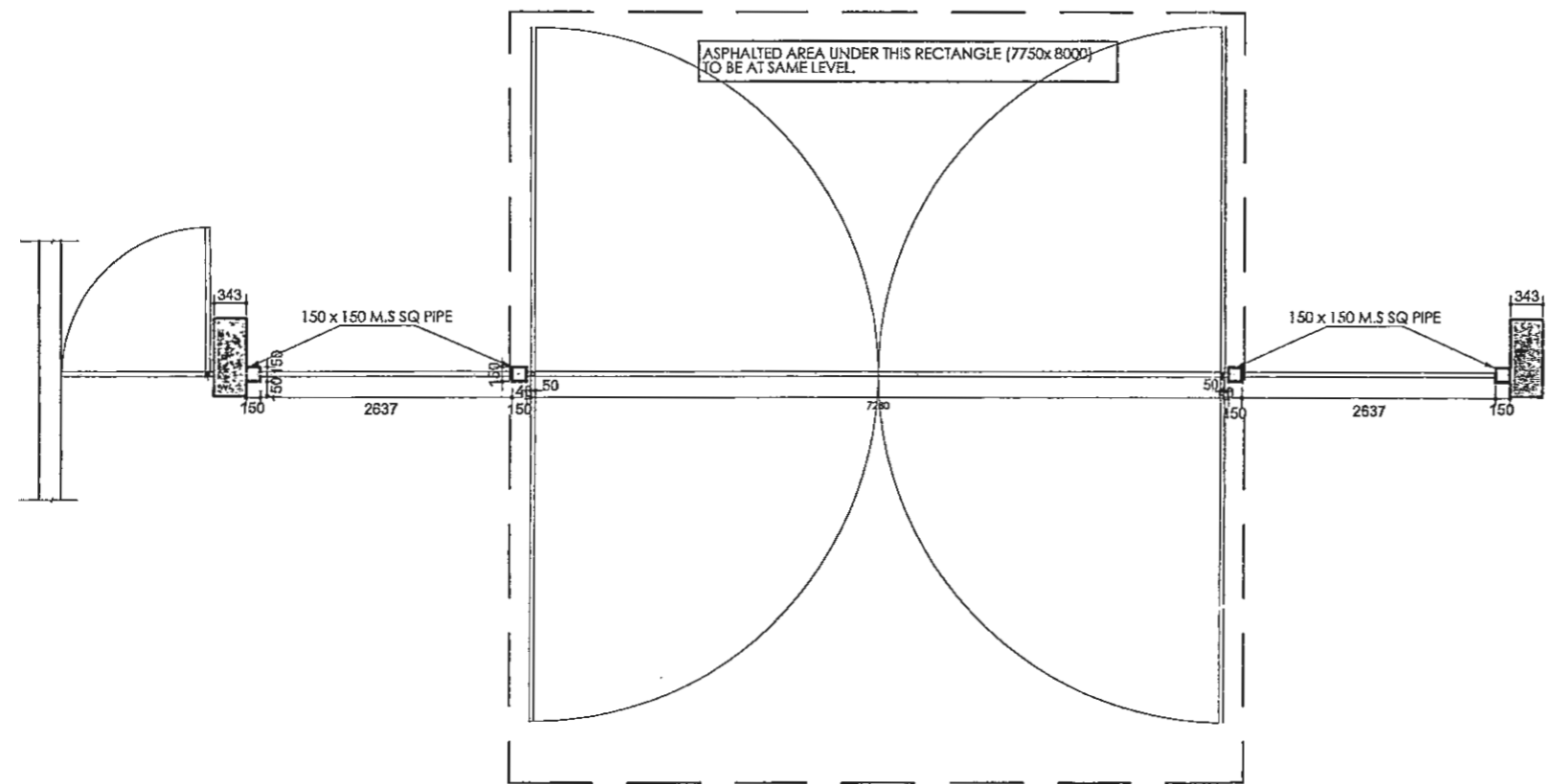
Item Nos.	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
Non Schedule Items					
9	EARTHING Supply, installation, testing and commissioning of following items for complete earthing system including all connecting accessories as per drawings & specifications complete in all respects.				
	i Earth pit with Rod type earth electrode, 20mm dia 3 meter long copper rod ,including earthing lead 2x70 sq.mm Bare copper conductor.	Job .	1		
	ii 1 x 1 Core - 16 Sq.mm as ECC	Rm	15		
10	uPVC Pipe Providing and laying of size of 50 mm internal dia uPVC class "D" pipe.Buried in ground as per drawing. Including excavation for laying of pipe and backfilling with clean sand (under and above pipe), compaction nylon rope 5mm and plugging of conduits ends etc. as shown on drawing complete in all respect.	Rm	20		
11	TELECOMMUNICATION SYSTEM				
a	Providing, fixing, testing & commissioning of RJ-11 Telephone outlet (simplex) Weatherpoof type with 16 SWG back box, complete in all respect.	No	1		
b	Providing, fixing, testing & commissioning of wiring 2 pair CAT-5 cable in 25mm dia PVC Conduit from TJB to Telephone outlet as per drawing or as per specification,complete in all respect.	Rm	20		
				SUB TOTAL	
				GRAND TOTAL FOR ONE UNIT	

DRAWINGS



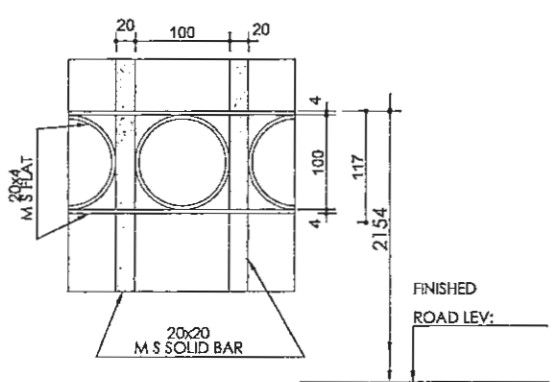
ELEVATION

SCALE:-1:75



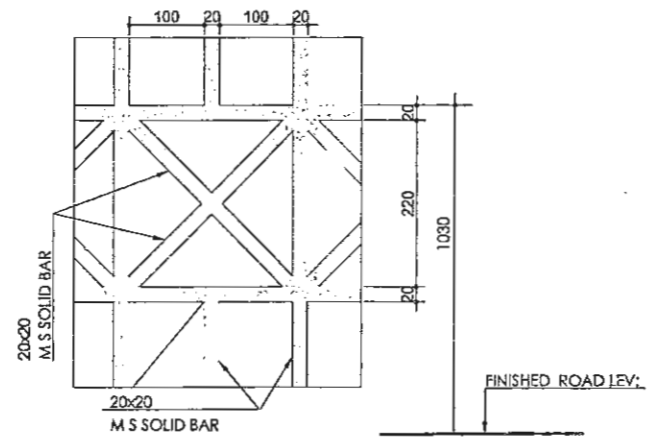
PLAN

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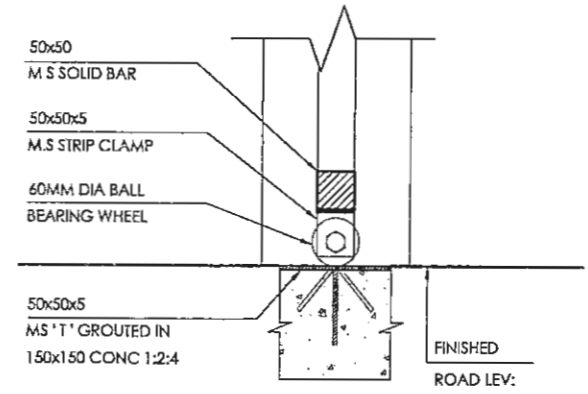
DETAIL-2

SCALE:-1:8



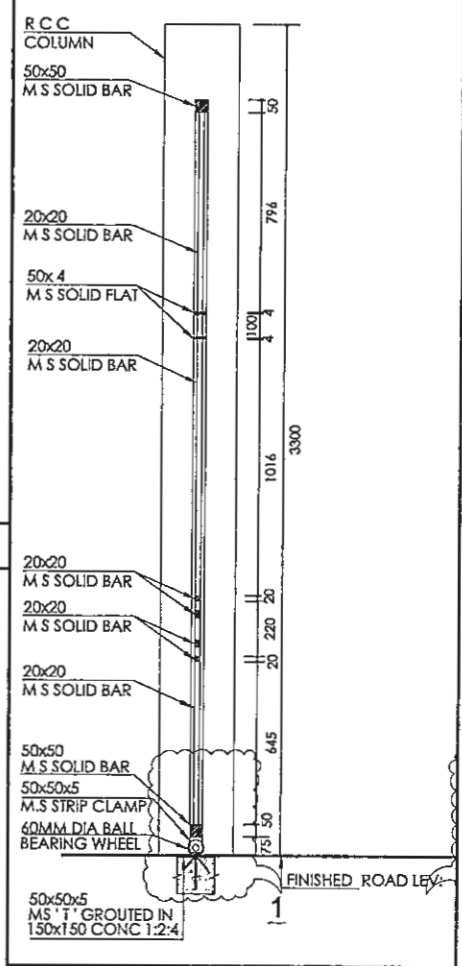
DETAIL-3

SCALE:-1:10



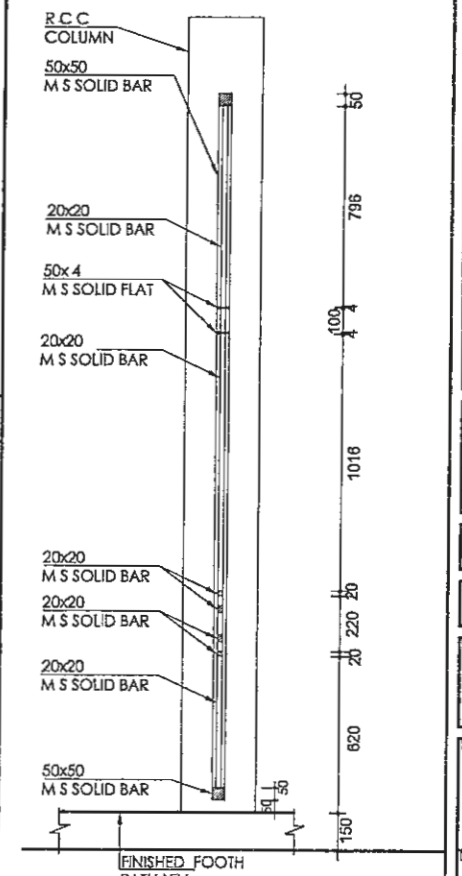
DETAIL-1

SCALE:-1:10



SECTION-XX

SCALE:-1:30



SECTION-ZZ

SCALE:-1:30

Project:
SPECIAL ECONOMIC ZONE KHAIRPUR

Client:
PROJECT OFFICE KHAIRPUR SPECIAL ECONOMIC ZONE KHAIRPUR

Consultant Architect:

EA Consulting (Pvt.) Limited
Head Office: AL-6, 15th Lane, Khayaban-e-Hind, Phase 7, Defence Housing Authority, Karachi. 75000 - Pakistan
Phone No. 111-11-884, Fax No. 854-1828
Email: info@ea-world.com | www.ea-world.com

Mark	Date	Description	Sig.
REVISIONS			

Date of Issue	
Issued To	
Issued For	

ARCHITECTURAL
Status: **APPROVAL**

Building Name:
GATE OFFICE (SMALL)

Drawing Title:
DETAIL OF GATE

Designed: Qazi Sharif	Checked: Naveed Iqbal	Approved:
Drawn: Jahangir	Date: Nov. 2014	Scale / Sheet: As shown/43
North:	Project Code: 660	Rev.: 0
Drawing No.:		EA-660-A-200D

Project
SPECIAL ECONOMIC ZONE (KSEZ) KHAIRPUR

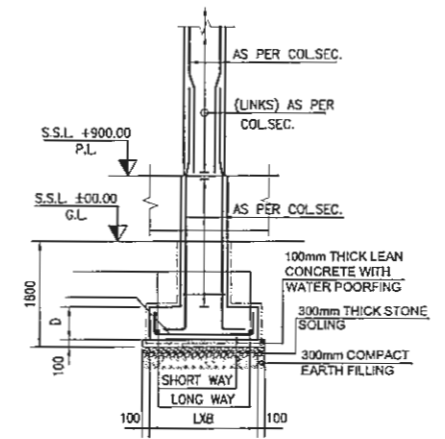
Client:
PROJECT OFFICE KHAIRPUR SPECIAL ECONOMIC ZONE (KSEZ) DISTRICT KHAIRPUR

Consultant Architect:

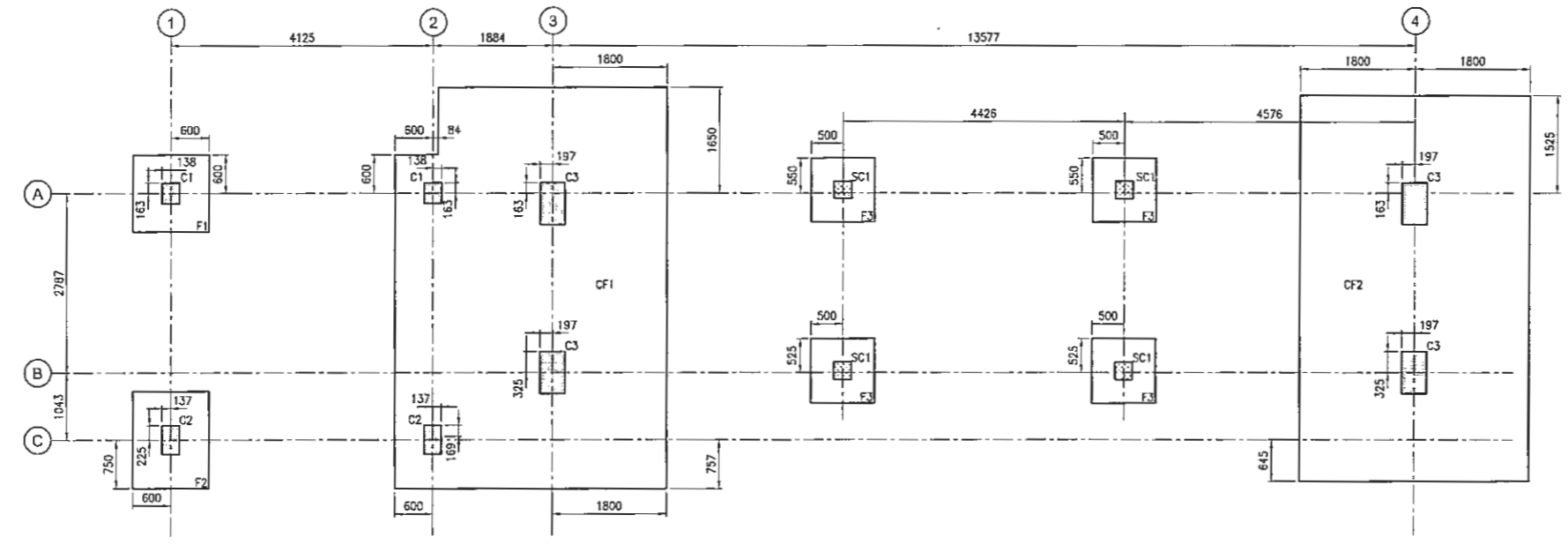
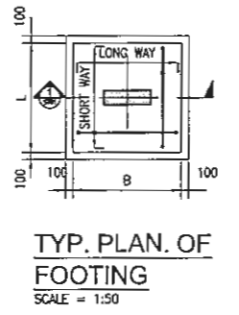
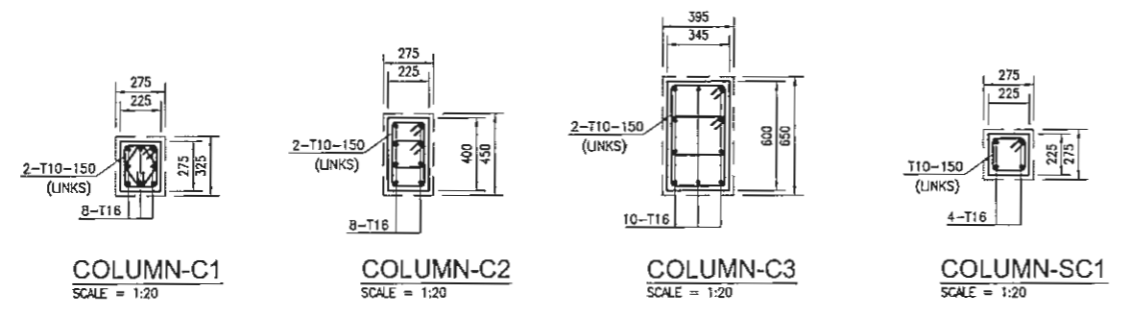
EA Consulting Pvt Ltd
Head Office: A.C. 15th Lane, Khayaban-e-Had Phase 7, Defence Housing Authority, Karachi, 75500 - Pakistan
Phone No. 111-111-564, Fax No. 584-1825
Email: info@ea-world.com, www.ea-world.com

NOTES:
1. ALL DIMENSIONS & LEVELS SHOWN ON THE DRAWING ARE IN MILLIMETERS U.N.D.
2. NO WORK ORDERING WILL BE PROVIDED WITHIN STRUCTURE MEMBER WITHOUT THE PERMISSION OF STRUCTURAL ENGINEER.
3. ALL STRUCTURAL DRAWINGS SHOULD BE READ IN CONJUNCTION WITH ARCHITECTURE DRAWINGS.

FOOTING MARKS	LENGTH (L)	BREADTH (B)	DEPTH (D)	REINFORCEMENT				REMARKS
				BOTTOM		TOP		
				LONG BAR	SHORT BAR	LONG BAR	SHORT BAR	
F1	1200	1200	300	T12-150	T12-150	-	-	-
F2	1200	1500	300	T12-100	T12-100	-	-	-
F3	1000	1000	300	T12-100	T12-100	-	-	-
CF1	AS PER PLAN		450	T12-100	T12-100	T12-200	T12-200	-
CF2	3600	6000	450	T12-100	T12-100	T12-200	T12-200	-



SECTION-1-1
SCALE = 1:50



FOUNDATION / COLUMN LAYOUT PLAN
SCALE = 1:50

Mark	Date	Description	Sig.
0	DEC.14	ISSUED FOR CONSTRUCTION	

REVISIONS

Date of Issue: DEC.2014
Issued To: Client
Issued For: CONSTRUCTION

STRUCTURE

Status: **CONSTRUCTION**

Building Name: **GATE OFFICE (SMALL)**

Drawing Title:
FOUNDATION LAYOUT PLAN AND FOOTING SCHEDULE & COLUMN DETAIL

Designed: A.R.K	Checked: M.F.A	Approved: M.S
Drawn: M.S.G	Date: DEC. 2014	Scale / Sheet: AS SHOWN @ A / 0
North:	Project Code: 660	Rev: 0
Drawing No: EA-660-GGS-S-1001		

Project: SPECIAL ECONOMIC ZONE (KSEZ) KHAIROPUR

Client: PROJECT OFFICE KHAIROPUR SPECIAL ECONOMIC ZONE (KSEZ) DISTRICT KHAIROPUR

Consultant Architect: EA Consulting Pvt Ltd

Head Office: 1501, T. Nagar, New Delhi - 110028
 Phone No. 111-111-554, Fax No. 554-1825
 Branch Office: 1501, T. Nagar, New Delhi - 110028
 Phone No. 111-111-554, Fax No. 554-1825

Drawn: M.S.G. Date: DEC. 2014
 Project Code: 660
 Drawing No.: EA-660-GGS-S-1002

Checked: M.F.A. Date: DEC. 2014
 Project Code: 660
 Drawing No.: EA-660-GGS-S-1002

Approved: M.S.G. Date: DEC. 2014
 Project Code: 660
 Drawing No.: EA-660-GGS-S-1002

Building Name: GATE OFFICE (SMALL)

Status: CONSTRUCTION

Structure: CONSTRUCTION

Issued For: CONSTRUCTION

Issued To: Client

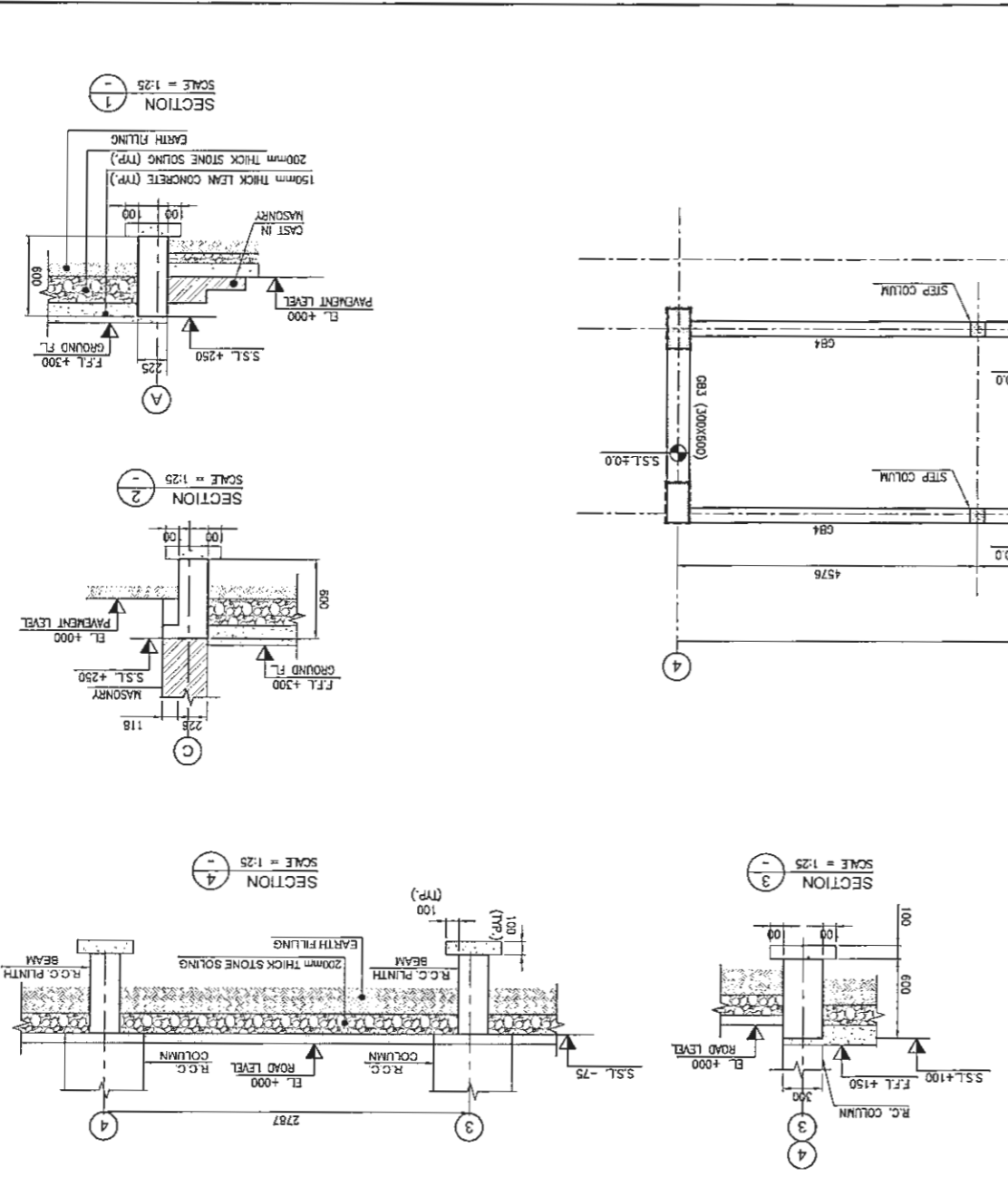
Date of Issue: DEC. 2014

Rev.	Date	Description	Sig.
0	DEC. 14	ISSUED FOR CONSTRUCTION	

REVISIONS

Notes:

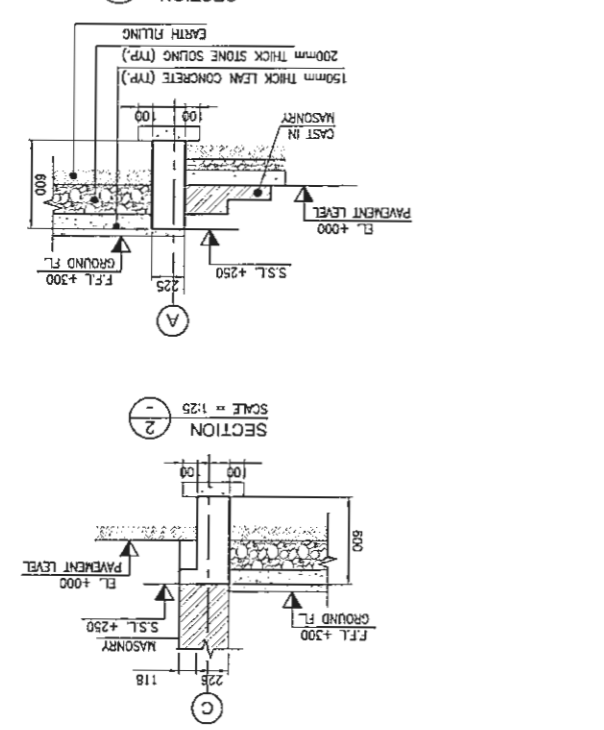
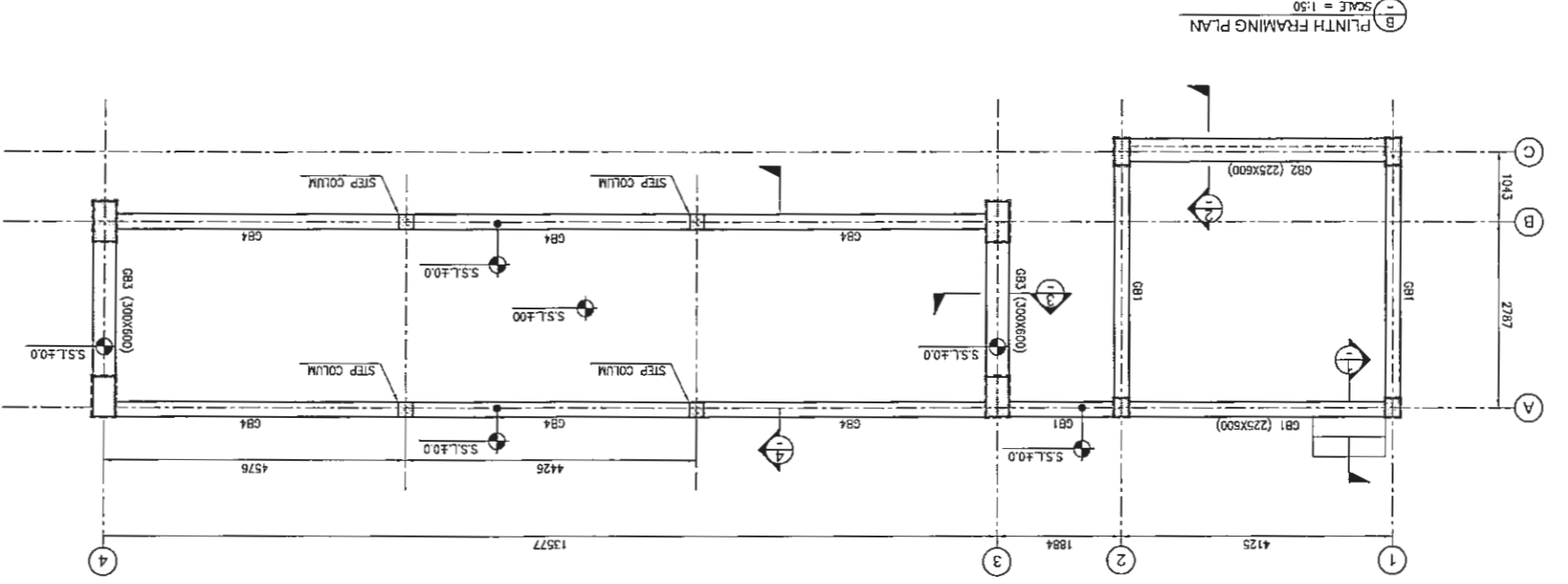
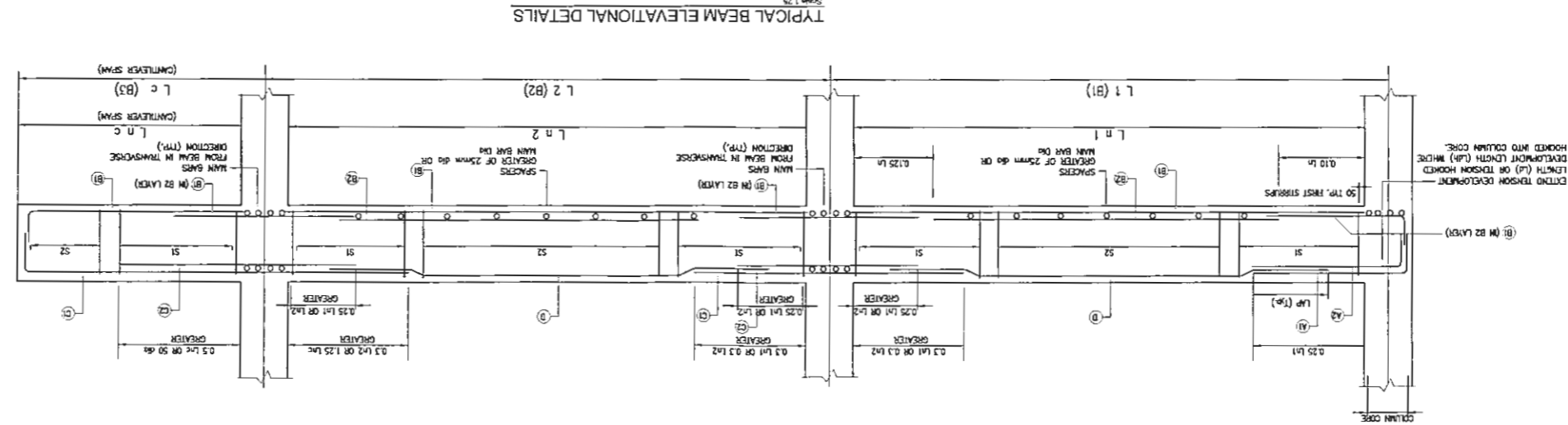
1. ALL DIMENSIONS & LEVELS SHOWN ON THE DRAWING ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. NO WORK SHALL BE PERMITTED WITHOUT THE PERMISSION OF STRUCTURAL ENGINEER.
3. ALL STRUCTURAL MEMBERS SHALL BE READ IN CONFORMANCE WITH ARCHITECTURAL DRAWINGS.



SCHEDULE OF REINFORCED CONCRETE BEAMS

REINFORCEMENT: $f_y = 460 \text{ N/mm}^2$

BEAM MARK	SIZE		TOP BARS				BOTTOM BARS				REMARKS	
	H (mm)	W (mm)	A1	A2	C1	C2	B1	B2	D	S1		S2
GB1	600	225	216	216	-	-	316	316	316	316	212	2LEGGED
GB2	600	225	316	316	316	316	316	316	316	316	316	2LEGGED
GB3	600	300	316	316	316	316	316	316	316	316	316	2LEGGED
GB4	600	225	312	312	-	-	312	312	312	312	312	2LEGGED



B PLINTH FRAMING PLAN SCALE = 1:50

SCHEDULE OF GROUND FLOOR BEAMS

TYPICAL BEAM ELEVATIONAL DETAILS

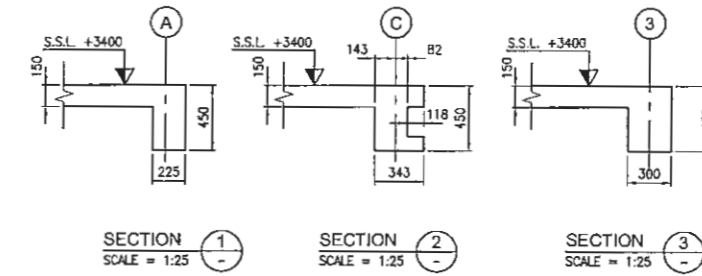
SCHEDULE ROOF BEAMS

SCHEDULE OF REINFORCED CONCRETE BEAMS														
BEAM MARK	SIZE		REINFORCEMENT						STIRRUPS		STIRRUPS ARRANGEMENTS	REMARKS		
	W (mm)	H (mm)	BOTTOM BARS		TOP BARS				S1	S2				
			B1	B2	A1	A2	C1	C2					D	
RB1	225	450	3T16	-	2T16	-	2T16	-	2T12	-	T10-100	T10-200	2-LEGGED	-
RB2	225	450	3T25	3T20	3T20	-	3T20	3T20	3T20	-	T10-100	T10-200	2-LEGGED	-
RB3	225	450	3T25	3T20	3T20	-	3T20	3T20	3T20	-	T10-100	T10-200	2-LEGGED	-
TB1	300	600	3T25	3T20	3T20	-	3T20	3T20	3T20	-	T10-100	T10-200	2-LEGGED	-

CONCRETE CUBE STRENGTH = 40 N/mm²
REINFORCEMENT, fy = 460 N/mm²

SCHEDULE OF ROOF SLABS

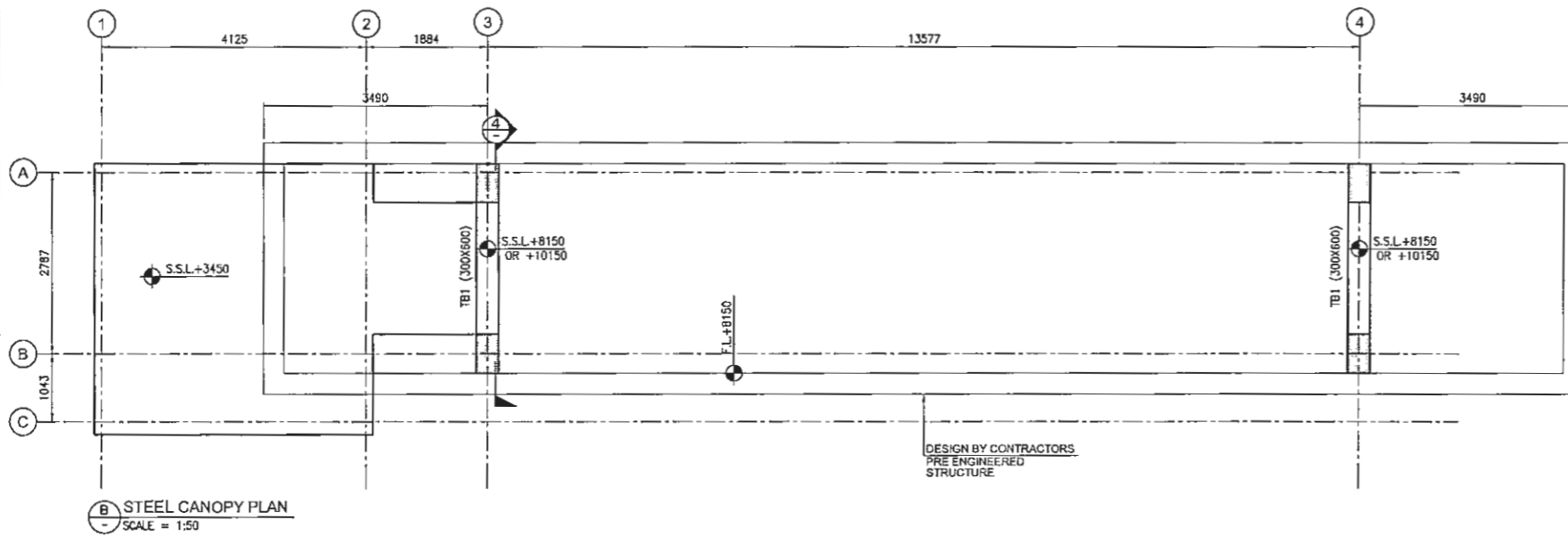
SLAB MARK	SLAB THICKNESS (mm)	BOTTOM		TOP			REMARKS
		SHORT WAY	LONG WAY	SHORT WAY	SHORT WAY	LONG WAY	
S1	150	T10-150	T10-200	T10-150	T10-150	T10-200	ONE WAY



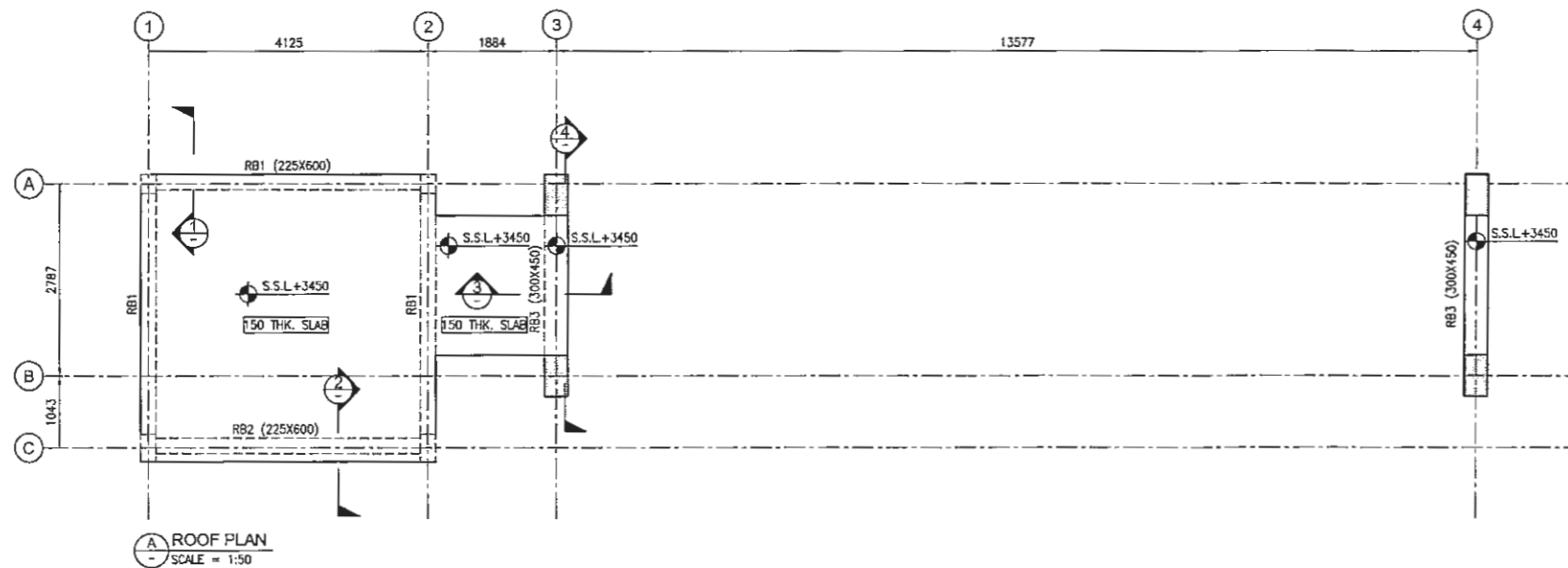
SECTION 1
SCALE = 1:25

SECTION 2
SCALE = 1:25

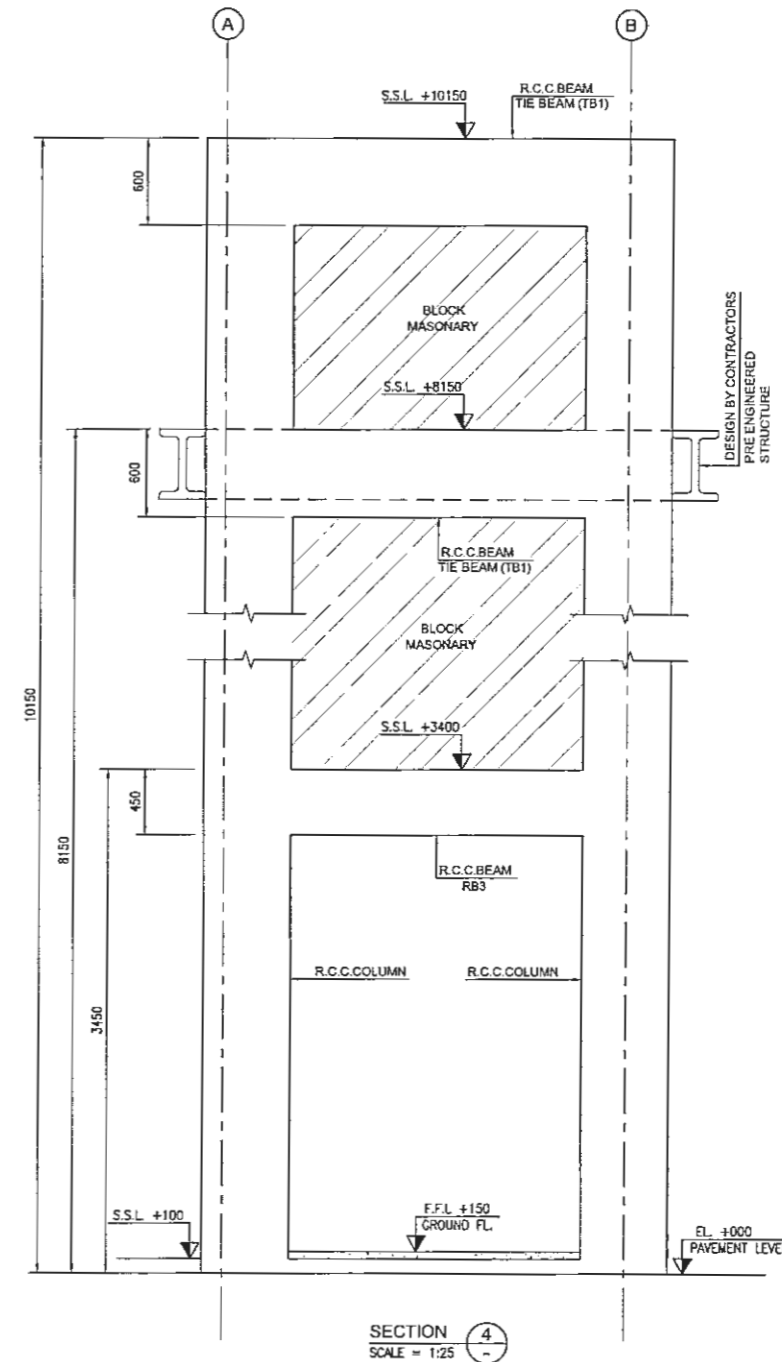
SECTION 3
SCALE = 1:25



STEEL CANOPY PLAN
SCALE = 1:50



ROOF PLAN
SCALE = 1:50



SECTION 4
SCALE = 1:25

SPECIAL ECONOMIC ZONE (KSEZ) KHAIRPUR

Client:
PROJECT OFFICE
KHAIRPUR SPECIAL ECONOMIC ZONE (KSEZ) DISTRICT KHAIRPUR

Consultant Architect:
EA Consulting Pvt Ltd
Head Office: AL-6, 15th Lane, Khayabani-Hilal Phase 7, Defence Housing Authority, Karachi-75500 - Pakistan
Phone No. 111-111-684, Fax No. 664-1825
E-mail: info@eaconsulting.com, www.eaconsulting.com

- NOTES:
- ALL DIMENSIONS & LEVELS SHOWN ON THE DRAWING ARE IN MILLIMETERS U.N.D.
 - NO WORK BEING DONE WITHOUT THE PERMISSION OF STRUCTURAL ENGINEER.
 - ALL STRUCTURAL DRAWINGS SHOULD BE READ IN CONJUNCTION WITH ARCHITECTURE DRAWINGS.

Mark	Date	Description	Sig.
1	DEC,14	ISSUED FOR CONSTRUCTION	

Date of Issue	DEC,2014
Issued To	Client
Issued For	CONSTRUCTION

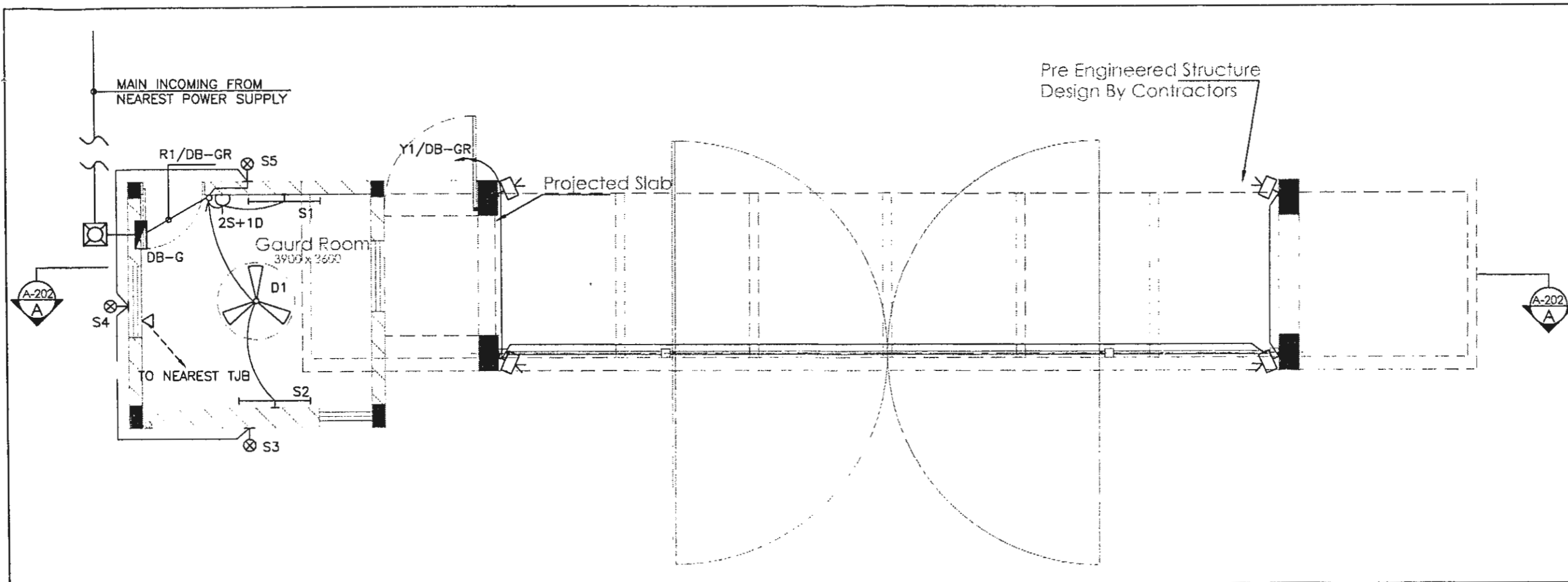
STRUCTURE

Status: CONSTRUCTION

Building Name: GATE OFFICE (SMALL)

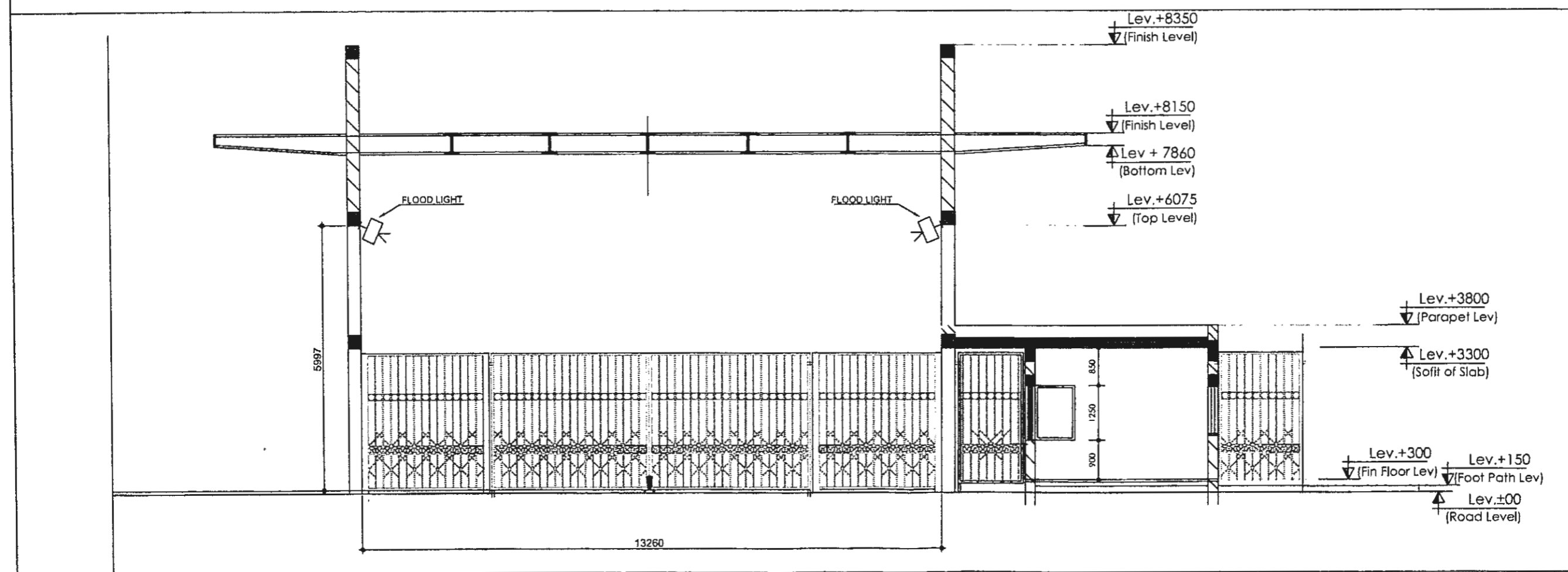
Drawing Title: ROOF FRAMING PLAN AND SECTIONS & BEAM SCHEDULE

Designed:	Checked:	Approved:
Drawn: A.R.K	Date: M.F.A	Scale / Sheet: M.S
M.S.G	DEC, 2014	AS SHOWN @ A1
Project Code:	660	Rev.: 0
Drawing No.:	EA-660-GGS-S-1003	



LIGHTING & POWER LAYOUT PLAN

SCALE=1:75



SECTION-AA

SCALE=1:100

Project:
SPECIAL ECONOMIC ZONE KHAIRPUR

Consultant Architect:
EA Consulting (Pvt.) Limited
Formerly Engineering Associates
Head Office: AL-8, 15th Lane, Khayaban-e-Hilal, Phase 7, Defence Housing Authority, Karachi, 75600 - Pakistan
Phone No. 111-111-504, Fax No. 504-1825
Email: info@eaconsult.com | www.eaconsult.com

Client:
CITY DISTRICT GOVERNMENT KHAIRPUR

Mark	Date	Description
0	FEB.2014	ISSUED FOR TENDER
REVISIONS		

Date of Issue	
Issued To	
Issued For	

ELECTRICAL

Status: **TENDER**

Building Name: **GATE OFFICE (SMALL)**

Drawing Title: **LIGHTING, POWER & SECTION LAYOUT PLAN**

Designed: M.R.	Checked: M.R.	Approved: J.I.S.
Drawn: M.W.	Date: FEB.2015	Scale / Sheet: AS SHOWN
Project Code: 650	Rev.: 0	

Drawing No.: **EA-660-EL-02**