



GOVERNMENT OF SINDH



BIDDING DOCUMENT FOR

Work - (a)-1

(Reference No. SSWMB-Re-NIT 18-a-1)

SINGLE STAGE - ONE ENVELOPE PROCEDURE

**“Construction of Garbage Transfer Station (GTS)”
at Mewa Shah Near Graveyard, District West, Karachi**

(Civil, Electrical, Water Supply, Sanitary and allied Mechanical Works)

Note:SSWMB reserves the right to change the location / site of GTS

Procuring Agency:

**Sindh Solid Waste Management Board
D-47, Block-2 Clifton, Karachi
Ph. #+92 2135863026 / 5372982-4
Fax # +92 2135863029
E-mail: info@sswmb.gos.pk**

RFP is issued on _____

REQUEST FOR PROPOSAL FOR

Work - a-1
(Reference No. SSWMB-Re-NIT 18-a-1)

**“Construction of Garbage Transfer Station (GTS)”
at Mewa Shah Near Graveyard, District West, Karachi
(Civil, Electrical, Water Supply, Sanitary and allied Mechanical Works)**

Note: SSWMB reserves the right to change the location / site of GTS

BID PRICE:

TENDER DOCUMENT (CIVIL, ELECTRICAL, WATER SUPPLY, SANITARY AND MECHANICAL)

Date of opening:	18 th March 2016 at 03:30 PM
Place of opening:	Committee Room, Sindh Solid Waste Management Board, D-47, Block 2, Clifton – Karachi
Date of issue:	
Name of Contractor:	
Contractor's Representative	
Name & Signature of Tender Issuing Officer:	
Bid Price:	
Amount in Numbers [Pak Rs. _____.]	
Amount in Figures [Pak Rs. _____.]	

SEAL AND SIGNATURE OF THE CONTRACTOR

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INVITATION FOR BIDS

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INSTRUCTIONS TO BIDDERS

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

A. GENERAL

IB.1 Scope of Bid & Source of Funds

1.1 Scope of Bid

The Executive Director (Operations-I), Sindh Solid Waste Management Board (SSWMB) 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

This project is approved by Government of Sindh and is reflected in ADP 2015-16.

IB.2 Eligible Bidders

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

- a) Duly licensed by the Pakistan Director (GTS) / Engineering Council (PEC) in the appropriate category for value of works i.e. C-3 or above having codes (CE10, BC01, EE05).
- b) The Procuring Agency i.e. Sindh Solid Waste Management Board may ask information and documents not limited to following (in addition to information provided in Technical Proposal):-
 - (i) company profile;
 - (ii) works of similar nature and size for each performed in last 3/5 years;
 - (iii) construction equipments;
 - (iv) qualification and experience of technical personnel and key site management;
 - (v) financial statement of last 3 years;
 - (vi) information regarding litigations and abandoned works if any.

IB.3 Cost of Bidding

3.1 The bidder shall bear all costs associated with the preparation and submission of

its bid and Executive Director (Operations-I), Sindh Solid Waste Management Board 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 (if 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 Executive Director (Operations-I), Sindh Solid Waste Management Board at the Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board.
- 6.3 To afford interested bidders reasonable time in which to take an addendum into account in preparing their Bids, the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 English language 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. For items not covered under Schedule Rates, the prices shall be quoted on Item Rate Basis.
- 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.
- 10.5 Rates for the items not covered in Schedule Rates may be quoted as Item rates.

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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 2% percentage of the offered bid price 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 Executive Director (Operations-I), Sindh Solid Waste Management Board valid for a period up to twenty eight (28) days beyond the bid validity date.

- 13.2 Any bid not accompanied by an acceptable Bid Security shall be rejected by the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 of 120 days after the date of bid opening.
- 14.2 In exceptional circumstances, Executive Director (Operations-I), Sindh Solid Waste Management Board may request the bidders to extend the period of validity for a 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 authorizing 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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, Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 for future 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 Procurement Committee constituted by Sindh Solid Waste Management Board will open the bids, in the presence of bidders representatives who choose to attend, on 18th March 2016 at 03:30 PM in the Committee Room of SSWMB.

16.2 The bidder's name, Bid Prices, any discount, the presence or absence of Bid Security, and such other details as the Procurement Committee, Sindh Solid Waste Management Board at its discretion may consider appropriate, will be announced by the Procurement Committee at the bid opening. Secretary, Procurement Committee, Sindh Solid Waste Management Board 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 Procurement Committee 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 Procurement Committee 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Sindh Solid Waste Management Board 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 Procurement Committee constituted by Sindh Solid Waste Management Board 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 Director (GTS) / Engineer / Executive Director (Operations-I), Sindh Solid Waste Management Board shall 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 discount, if any, offered by the bidders as also read out and recorded at the time of bid opening.
- (ii) 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 any officer / official of Sindh Solid Waste Management Board 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 Procurement Committee, Sindh Solid Waste Management Board. 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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Sindh Solid Waste Management Board authorities 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 & Executive Director (Operations-I), Sindh Solid Waste Management Board Right

19.1 Subject to IB.19.2, the Procuring Agency i.e. Sindh Solid Waste Management Board shall award the Contract to the bidder whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the lowest evaluated Bid 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 i.e. Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board, the Executive Director (Operations-I), Sindh Solid Waste Management Board 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, Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board and the successful bidder duly stamped at rate of 0.3% 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 Executive Director (Operations-I), Sindh Solid Waste Management Board.

IB.21 Performance Security

- 21.1 The successful bidder shall furnish to the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Rule 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

(The following specific data for the works to be tendered shall complement, amend, or supplement the provisions in the Instructions to Bidders. Wherever there is a conflict, the provisions herein shall prevail over those in the Instructions to Bidders).

Instruction to Bidders

Clause Reference

1.1 Name of Procuring Agency

Sindh Solid Waste Management Board

Brief Description of Works

Construction of Garbage Transfer Station with Material Recovery (MR) and Refuse Derived Fuel (RDF) Facilities at Mewa Shah Near Graveyard District West, Karachi

5.1 (a) Procuring Agency address:

Executive Director (Operations-I), Sindh Solid Waste Management Board
D 47, Block 2, Clifton, Karachi
Ph: +92 21 35863026-28
Fax: +92 21 35863029
Email: info@sswmb.gos.pk
Website: www.sswmb.gos.pk

(b) Director (GTS) / Engineer's address:

Director (GTS), Sindh Solid Waste Management Board
D 47, Block 2, Clifton, Karachi
Ph: +92 21 35863026-28
Fax: +92 21 35863029
Email: info@sswmb.gos.pk

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

11.2 The bidder has the financial, technical and constructional capability necessary to perform the Contract as follows:

i. Financial capacity:

(must have turnover of Rs. 400 Million or above);

ii. Technical capacity:

PEC Category C-3 or above having codes (CE10, BC01, EE05).

One B.E Civil with 15 years experience.

One DAE Civil with 10 years experience.

One DAE Civil with 5 years experience.

iii. Construction Capacity:

1 Mixer, 1 Tractor, 1 Dumper, 1 Compactor & three pair of each basic equipment.

- 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 amount

14.1 Period of Bid Validity

90 days

14.4 Number of Copies of the Bid to be submitted:

One original plus One Copy

14.6 (a) Procuring Agency Address for the Purpose of Bid Submission

Executive Director (Operations-I), Sindh Solid Waste Management Board
D 47, Block 2, Clifton, Karachi

15.1 Deadline for Submission of Bids

18th March 2016 at 02:30 PM

16.1 Venue, Time, and Date of Bid Opening

18th March 2016 at 03:30 PM

Venue: Committee Room, Sindh Solid Waste Management Board,
D 47, Block 2, Clifton, Karachi

Responsiveness of Bids

- (i) Bid is valid till required period,
- *(ii) This is a Fixed Price Contract, Bid prices are firm during currency of contract/Price adjustment and no escalation of price shall be allowed;
- (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. SSWMB – Re-NIT -18.a.1

Construction of Garbage Transfer Station at Mewa Shah, Near Graveyard, District West –
Karachi
(Civil, Electrical, Water Supply and allied Mechanical Works)

To:

The Executive Director (Operation-I),
Sindh Solid Waste Management Board,
Karachi

Dear Sir,

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 Rs. _____ (Rupees _____) 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 120 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

<u>Sr. No.</u>		<u>Page No.</u>
1.	Preamble to Schedule of Prices.....	25
2.	Schedule of Prices.....	26
	* (a) Summary of Bid Prices	
	* (b) Detailed Schedule of Prices /Bill of Quantities (BOQ)	

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 d'Unites (SI Units).

As per Government of Sindh

4. Rates and Prices

- 4.1 Except as otherwise expressly provided under the Conditions of Contract, the rates and amounts entered in the Schedule of Prices shall be the rates at which the Contractor shall be paid and shall be the full inclusive value of the works set forth or implied in the Contract; except for the amounts reimbursable, if any to the Contractor under the Contract.
- 4.2 Unless otherwise stipulated in the Contract Data, the premium, 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 Sindh Solid Waste Management Board 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.

6. Provisional Sums and Day work

- 6.1 Provisional Sums included and so designated in the Schedule of Prices if any, shall be expended in whole or in part at the direction and discretion of the Director (GTS) / Engineer / Executive Director (Operations-I), Sindh Solid Waste Management Board. The Contractor will only receive payment in respect of Provisional Sums, if he has been instructed by the Director (GTS) / Engineer / Executive Director (Operations-I), Sindh Solid Waste Management Board to utilize such sums.

- 6.2 Day work rates in the contractor's bid are to be used for small additional amounts of work and only when the Director (GTS) / Engineer have given written instructions in advance for additional work to be paid for in that way.

***SPECIFIC WORKS DATA**

Work will be itemized work based on Sindh Schedule and each item whether linked to other item or not for execution will be considered as one work.

1. Organization Chart indicating head office and field office personnel involved in management and supervision, engineering, equipment maintenance and purchasing.
2. Mobilization in Pakistan, the type of facilities including personnel accommodation, office accommodation, provision for maintenance and for storage, communications, security and other services to be used.
3. The method of executing the Works, the procedures for installation of equipment and machinery and transportation of equipment and materials to the site.

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>
--	--	--

The work shall not be sublet to subcontractor

1. No change of Sub-Contractors shall be made by the bidder without prior approval of the Executive Director (Operations-I), Sindh Solid Waste Management Board.
2. The truthfulness and accuracy of the statement as to the experience of Sub-Contractors is guaranteed by the bidder. The Executive Director (Operations-I), Sindh Solid Waste Management Board’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.

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.

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.
- ☐ Organization chart indicating head office & field office personnel involved in management, supervision and engineering of the Works to be done under the Contract.

(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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 times 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.

.....
Executive Director (Operations-I),
Sindh Solid Waste Management Board

.....
[Contractor]

CONDITIONS OF CONTRACT

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CONDITIONS OF CONTRACT

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CONDITIONS OF CONTRACT

1. GENERAL PROVISIONS

1.1 Definitions

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

The Contract

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

1.1.2 “Specifications” means the document as listed in the Contract Data, including Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board drawings of the Works as listed in the Contract Data, and any Variation to such drawings.

Persons

1.1.4 “Executive Director (Operations-I)”, Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board) any assignee.

1.1.6 “Party” means the Executive Director (Operations-I), Sindh Solid Waste Management Board 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.

1.2 Interpretation

Words importing persons or parties shall include firms and organizations. 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.

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 “Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board 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 “Director (GTS) / Engineer” means the person notified by the Executive Director (Operations-I), Sindh Solid Waste Management Board to act as Director (GTS) / Engineer for the purpose of the Contract and named as such in 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 EXECUTIVE DIRECTOR (Operations-I), SINDH SOLID WASTAGE MANAGEMENT BOARD**

2.1 **Provision of Site**

The Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board shall, if requested by the Contractor, assist him in applying for permits, licenses or approvals which are required for the Works.

2.3 **Director (GTS) / Engineer's/ Executive Director (Operations-I), Sindh Solid Waste Management Board's Instructions**

The Contractor shall comply with all instructions given by the Executive Director (Operations-I), Sindh Solid Waste Management Board or the Director (GTS) / Engineer, if notified by the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board shall affect the Contractor's obligations.

3. DIRECTOR (GTS) / ENGINEER'S/ EXECUTIVE DIRECTOR (Operations-I), SINDH SOLID WASTAGE MANAGEMENT BOARD 'S REPRESENTATIVES

3.1 Authorized Person

The Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board shall notify the Contractor, in writing, the precise scope of the authority of such authorized person at the time of his appointment.

3.2 Director (GTS) / Engineer's/ Executive Director (Operations-I), Sindh Solid Waste Management Board Representative

The name and address of Director (GTS) / Engineer's/ Executive Director (Operations-I), Sindh Solid Waste Management Board's Representative is given in Contract Data. However the Contractor shall be notified by the Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board for such appointment which consent shall not be withheld without plausible reason(s) by the Executive Director (Operations-I), Sindh Solid Waste Management Board. 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board.

4.4 **Performance Security**

The Contractor shall furnish to the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 **Not Applicable**

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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board shall be responsible for the Specifications and Drawings.

6. **EXECUTIVE DIRECTOR (Operations-I), SINDH SOLID WASTAGE MANAGEMENT BOARD'S RISKS**

6.1 The Executive Director (Operations-I), Sindh Solid Waste Management Board The Executive Director (Operations-I), Sindh Solid Waste Management Board'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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board's personnel or by others for whom the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board and accepted by the Executive Director (Operations-I), Sindh Solid Waste Management Board.

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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board /Director (GTS) / 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 Director (GTS) / Engineer for a reasonable extension in the time for the completion of works. Subject to the aforesaid, the Director (GTS) / 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 Director (GTS) / Engineer within such period as may be prescribed by the Director (GTS) / Engineer for the same; and the Director (GTS) / Engineer 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / 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 Director (GTS) / Engineer may identify any outstanding items of work which the Contractor shall undertake during the Maintenance Period.

9. REMEDYING DEFECTS

9.1 Remediating 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 Executive Director (Operations-I), Sindh Solid Waste Management Board, 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 Executive Director (Operations-I), Sindh Solid Waste Management Board /Director (GTS) / 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 Executive Director (Operations-I), Sindh Solid Waste Management Board /Director (GTS) / 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board may issue Variation Order(s) in writing. Where for any reason it has not been possible for the Executive Director (Operations-I), Sindh Solid Waste Management Board /Director (GTS) / Engineer to issue such Variations Order(s), the Contractor may confirm any verbal orders given by the Executive Director (Operations-I), Sindh Solid Waste Management Board /Director (GTS) / Engineer in writing and if the same are not refuted/denied by the Executive Director (Operations-I), Sindh Solid Waste Management Board /Director (GTS) / 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) Preferably contractor should submit a rate and its rate analysis for approval if demanded by the Director (GTS) / Engineer, and the Director (GTS) / Engineer will be final authority of approval.
- b) at a lump sum price agreed between the Parties, or
- c) where appropriate, at rates in the Contract, or
- d) in the absence of appropriate rates, the rates in the Contract shall be used as the basis for valuation, or failing which
- e) at appropriate new rates, as may be agreed or which the Director (GTS) / Engineer considers appropriate, or
- f) if the Director (GTS) / Engineer 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 45% percent (weather increase or decrease), provided the change exceeds 1 percent of the Initial Contract Price, the Director (GTS) / Engineer shall adjust the rate to allow for the change and will be valued as per sub clause 10.2.
- b) The Director (GTS) / 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 Executive Director (Operations-I), Sindh Solid Waste Management Board.
- c) If requested by the Director (GTS) / Engineer, the contractor shall provide the Director (GTS) / Engineer with a detailed cost breakdown of any rate in the Bill of Quantities. Change in drawings the construction drawings can be different from tender drawings, hence

advised to visit site and consultant Director (GTS) / Engineer before quoting rates.

10.4 **Early Warning**

The Contractor shall notify the Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board being unable to keep all relevant records or not taking steps to minimize 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 Executive Director (Operations-I), Sindh Solid Waste Management Board s Risks, the Contractor shall be entitled to the amount of such Cost. If as a result of and Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / Engineer within fourteen (14) days of the occurrence of cause.

10.6 **Variation and Claim Procedure**

The Contractor shall submit to the Director (GTS) / Engineer an itemized 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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board shall check and if possible agree the value. In the absence of agreement, the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / Engineer pursuant to this Clause, or to any other terms of the Contract, shall , subject to Clause 11.3, be paid by the Executive Director (Operations-I), Sindh Solid Waste Management Board certificate has been jointly verified by Executive Director (Operations-I), Sindh Solid Waste Management Board and Contractor, or, in the case of the Final Certificate referred to in Sub Clause 11.5, within 60 days after such Final Payment Certificate has been jointly verified by Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board to make payment within 90 days then Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / Engineer to verify and the Director (GTS) / Engineer shall verify the same within fourteen (14) days from the date of submission and forward the same to the Executive Director (Operations-I), Sindh Solid Waste Management Board together with any documentation reasonably required to enable the Executive Director (Operations-I), Sindh Solid Waste

Management Board to ascertain the final contract value.

Within sixty (60) days from the date of receipt of the verified final account from the Director (GTS) / Engineer, the Executive Director (Operations-I), Sindh Solid Waste Management Board shall pay to the Contractor any amount due to the Contractor. While making such payment the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board or fails to proceed expeditiously and without delay, or is, despite a written complaint, in breach of the Contract, the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board notice, the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board**

If the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board is entitled,
- c) if the Executive Director (Operations-I), Sindh Solid Waste Management Board has terminated under Sub-Clause 12.1 or 12.3, the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 demobilization 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 Executive Director (Operations-I), Sindh Solid Waste Management Board /Director (GTS) / Engineer's issuance of Certificate of Completion under Sub-Clause 8.2. Responsibility shall then pass to the Executive Director (Operations-I), Sindh Solid Waste Management Board. 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 Executive Director (Operations-I), Sindh Solid Waste Management Board d Risks, the Contractor shall indemnify the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board immediately. If necessary, the Contractor may suspend the execution of the Works and, to the extent agreed with the Executive Director (Operations-I), Sindh Solid Waste Management Board. 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 's Risks under Sub-Clause 6.1. The policies shall be issued by insurers and in terms approved by the Executive Director (Operations-I), Sindh Solid Waste Management Board. The Contractor shall provide the Director (GTS) / Engineer/ Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 **Director (GTS) / Engineer's Decision**

If a dispute of any kind whatsoever arises between the Executive Director

(Operations-I), Sindh Solid Waste Management Board and the Contractor in connection with the works, the matter in dispute shall, in the first place, be referred in writing to the Director (GTS) / 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 Director (GTS) / Engineer shall give notice of his decision to the Executive Director (Operations-I), Sindh Solid Waste Management Board (Director (GTS) / 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 Executive Director (Operations-I), Sindh Solid Waste Management Board (Director (GTS) / Engineer) shall give effect forthwith to every such decision of the Director (GTS) / 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 Director (GTS) / 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 Director (GTS) / Engineer is revised by an arbitrator.

If a contractor is dissatisfied with the decision of the Director (GTS) / Engineer of the department or decision is not given in time then he can approach Executive Director (Operations-I), Sindh Solid Waste Management Board within 14 days, in case of dissatisfaction with decision of Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh solid wastage management board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board under Sub-Para (a) and (c) of this Sub-Clause.

CONTRACT DATA

Sub-Clauses of Conditions of Contract

1.1.3 Procuring Agency Drawings, if any *attached*

1.1.4 **The Procuring Agency** means

Executive Director (Operations-I), Sindh Solid Waste Management Board

1.1.5 **The Contractor** means

1.1.7 **Commencement Date** means the date of issue of Director (GTS) / 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** 24 months

1.1.20 **Director (GTS) / Engineer (mention the name along with the designation including whether he belongs to department or consultant) and other details**

Executive Director (Operations-I), Sindh Solid Waste Management Board

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

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

- 2.1 **Provision of Site:** On the Commencement Date
- 3.1 **Authorized person:**
Executive Director (Operations-I), Sindh Solid Waste Management Board
- 3.2 **Name and address of Executive Director (Operations-I), Sindh Solid Waste management representative:**
Director (GTS) / Engineer
- 4.4 **Performance Security:**
5%
- 5.1 **Requirements for Contractor's design (if any):**
Specification Clause No's N/A
- 7.2 **Programme:**
Time for submission: Within fourteen (14) days* of the Commencement Date.
Form of programme: _____ (*Bar Chart/CPM/PERT or other*)
- 7.4 Amount payable due to failure to complete shall be 05% per day up to a maximum of (10%) of sum stated in the Letter of Acceptance
(Usually the liquidated damages are set between 0.05 percent and 0.10 percent per day.)
- 7.5 **Early Completion**
In case of earlier completion of the Work, the Contractor is entitled to be paid bonus up-to limit and at a rate equivalent to 50% of the relevant limit and rate of liquidated damages stated in the contract data.
- 9.1 **Period for remedying defects**
as per bidding documents
- 10.2 (e) **Variation procedures:**
Day work rates as per bidding documents
- 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board.

- (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 1/5th of the advance **inclusive of the interest** thereon shall be recovered from each bill and the balance together with interest be recovered from the final bill. It may be insured that there is sufficient amount in the final bill to enable recovery of the Mobilization Advance. OR The contractor will have the right not to obtain any mobilization advance to start work however he has the right to obtain secure advance on materials under the terms given below.

2) **Secured Advance on Materials**

- (a) The Contractor shall be entitled to receive from the Executive Director (Operations-I), Sindh Solid Waste Management Board Secured Advance against an INDENTURE BOND in P W Account Form No. 31(Fin. R. Form No. 2 acceptable to the Executive Director (Operations-I), Sindh Solid Waste Management Board of such sum as the Director (GTS) / Engineer may consider proper in respect of non-perishable materials brought at the Site but not yet incorporated in the Permanent Works provided that:
 - (i) The materials are in accordance with the Specifications for the Permanent Works;
 - (ii) Such materials have been delivered to the Site and are properly stored and protected against loss or damage or deterioration to the satisfaction and verification of the Director (GTS) / 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 Director (GTS) / Engineer, and such records shall be available for inspection by the Director (GTS) / 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 Director (GTS) / 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 Executive Director (Operations-I), Sindh Solid Waste Management Board and these materials shall not be removed from the Site or otherwise disposed of without written permission of the Executive Director (Operations-I), Sindh Solid Waste Management Board

- (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 Director (GTS) / 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) Director (GTS) / 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.
 - (iv) Retention money and other advances are to be recovered from the bill submitted by contractor.

11.2 ***(a)Valuation of the Works:**

- i) Lump sum price_____ (details), or
- ii) Lump sum price with schedules of rates _____ (details), or
- iii) Lump sum price with bill of quantities_____ (details), or
- iv) Re-measurement with estimated/bid quantities in the Schedule of Prices or on premium above or below quoted on the rates mentioned in CSR _____ (details), or/and
- v) Cost reimbursable_____ (details)

11.3 **Percentage of retention*:** (10%)

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

14.1 **Insurances:** -NA-

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

Type of cover

Third Party-injury to persons and damage to property

(The minimum amount of third party insurance should be assessed by the Executive Director (Operations-I), Sindh Solid Waste Management Board and entered).

Workers:

Other cover*:

(In each case name of insured is Contractor and Executive Director (Operations-I), Sindh Solid Waste Management Board)

14.2 **Amount to be recovered**

Premium plus _____ percent (___%).

15.3 **Arbitration****

Place of Arbitration:_____



STANDARD FORMS

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

FORM OF BID SECURITY
(Bank Guarantee)

Guarantee No. _____

Executed on _____

(Letter by the Guarantor to the Executive Director (Operations-I), Sindh Solid Waste Management Board)

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 Executive Director (Operations-I), Sindh Solid Waste Management Board) 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 Executive Director (Operations-I), Sindh Solid Waste Management Board; and

WHEREAS, the Executive Director (Operations-I), Sindh Solid Waste Management Board has required as a condition for considering the said Bid that the Principal furnishes a Bid Security in the above said sum to the Executive Director (Operations-I), Sindh Solid Waste Management Board, 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board for the faithful performance and proper fulfillment 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 Executive Director (Operations-I), Sindh Solid Waste Management Board the said sum stated above upon first written demand of the Executive Director (Operations-I), Sindh Solid Waste Management Board without cavil or argument and without requiring the Executive Director (Operations-I), Sindh Solid Waste Management Board to prove or to show grounds or reasons for such demand, notice of which shall be sent by the Executive Director (Operations-I), Sindh Solid Waste Management Board

PROVIDED ALSO THAT the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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. Signature _____

1. _____

2. Name _____

Corporate Secretary
(Seal)

3. Title _____

2. _____

(Name, Title & Address)

Corporate Guarantor (Seal)

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

Guarantee No. _____
Executed on _____
Expiry Date _____

(Letter by the Guarantor to the Executive Director (Operations-I), Sindh Solid Waste Management Board)

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 Executive Director (Operations-I), Sindh Solid Waste Management Board) in the penal sum of the amount stated above, for the payment of which sum well and truly to be made to the said Executive Director (Operations-I), Sindh Solid Waste Management Board, 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 Executive Director (Operations-I), Sindh Solid Waste Management Board'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 Executive Director (Operations-I), Sindh Solid Waste Management Board all 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 Executive Director (Operations-I), Sindh Solid Waste Management Board without delay upon the Executive Director (Operations-I), Sindh Solid Waste Management Board first written demand without cavil or arguments and without requiring the Executive Director (Operations-I), Sindh Solid Waste Management Board to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the Executive Director (Operations-I), Sindh Solid Waste Management Board'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 Executive Director (Operations-I), Sindh Solid Waste Management Board designated Bank & Account Number.

PROVIDED ALSO THAT the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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.

<p>Witness:</p> <p>1. _____</p> <p>_____</p> <p>Corporate Secretary (Seal)</p> <p>2. _____</p> <p>_____</p> <p>(Name, Title & Address)</p>	<p>_____</p> <p>Guarantor (Bank)</p> <p>1. Signature _____</p> <p>2. Name _____</p> <p>3. Title _____</p> <p>_____</p> <p>Corporate Guarantor (Seal)</p>
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FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the -Agreement[]) made on the ____ day of _____ 200 ____ between _____(hereinafter called the - Executive Director (Operations-I), Sindh Solid Waste Management Board []) of the one part and _____ (hereinafter called the -Contractor[]) of the other part.

WHEREAS the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 witnessed as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents after incorporating addenda, if any except those parts relating to Instructions to Bidders, shall be deemed to form and be read and construed as part of this Agreement, viz:
 - (a) The Letter of Acceptance;
 - (b) The completed Form of Bid 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 Executive Director (Operations-I), Sindh Solid Waste Management Board to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Executive Director (Operations-I), Sindh Solid Waste Management Board to execute and complete the Works and remedy defects therein in conformity and in all respects within the provisions of the Contract.
4. The Executive Director (Operations-I), Sindh Solid Waste Management Board 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
_____ (Seal)

Signature of the Executive Director
(Operations-I), Sindh Solid Waste
Management Board _____
(Seal)

Signed, Sealed and Delivered in the presence of:

Witness:

(Name, Title and Address)

Witness:

(Name, Title and Address)

MOBILIZATION ADVANCE GUARANTEE

Guarantee No. _____

Executed on _____

(Letter by the Guarantor to the Executive Director (Operations-I), Sindh Solid Waste Management Board)

WHEREAS the _____ (hereinafter

Called the Procuring Agency) has entered into a Contract for _____

_____ (Particulars of Contract), with
_____ (hereinafter called the Contractor).

AND WHEREAS the Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board 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 Executive Director (Operations-I), Sindh Solid Waste Management Board for payment not exceeding the aforementioned amount.

Notice in writing of any default, of which the Executive Director (Operations-I), Sindh Solid Waste Management Board shall be the sole and final judge, as aforesaid, on the part of the Contractor, shall be given by the Executive Director (Operations-I), Sindh Solid Waste Management Board to the Guarantor, and on such first written demand payment shall be made by the Guarantor of all sums then due under this Guarantee without any reference to the Contractor and without any objection.

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

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

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

Guarantor (Scheduled Bank)

Witness:

1. _____

Corporate Secretary (Seal)

2. _____

(Name, Title & Address)

1. Signature _____

2. Name _____

3. Title _____

Corporate Guarantor (Seal)

INDENTURE FOR SECURED ADVANCES

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

This INDENTURE made the _____ day of _____ 197_____” 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 GOVERNMENT 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).¹

AND WHEREAS the contractor has applied to the _____ for an advance to him of Rupees _____. (Rs. _____) on the security of materials absolutely belonging to him and brought by him to the site of the said works the subject of the said agreement for use in the construction of such of the said works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charge) AND WHEREAS the Government has agreed to advance to the Contractor the sum of Rupees, (Rs. _____) on the security of materials the quantities and other particulars of which are detailed in Part II of Running Account Bill (E) of 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 WTTNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees _____ (Rs. _____) on or before the execution of these presents paid to the Contractor by the Government (the receipt whereof the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as aforesaid (all of which advances are hereinafter collectively referred to as the said amount) the Contractor doth hereby assign unto the Government the said materials by way of security for the said amount

And both hereby covenant and agree with the Government and declare as follow :-

(1) That the said sum of Rupees _____ (Rs. _____) so advanced by the Government to the Contractor as aforesaid and all or any further sum or sums which may be advanced 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 grater degree than is due to reasonable use and wear thereof Contractor will forthwith replace the same with other materials of like qualify or repair and make good the same as required by the Divisional Officer and the materials so brought to replace the said materials so repaired and made good shall also be considered as security for the said amount.

(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 not with standing 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 Director (GTS) / 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 Government 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

SPECIFICATIONS

[Note for Preparing the Specifications]

A set of precise and clear specifications is a prerequisite for bidders to respond realistically and competitively to the requirements of the user without qualifying their Bids. The specifications must be drafted to permit the widest possible competition and, at the same time, present a clear statement of the required standards of workmanship, materials, performance of the works. Only if this is done objectives of economy, efficiency, and fairness in procurement will be realized and responsiveness of Bids can be ensured, and the subsequent task of bid evaluation can be facilitated. The specifications should require that materials to be incorporated in the works be new, unused, and of the most recent or current models, and incorporated all recent improvements in design and materials unless provided for otherwise in the contract.

Samples of specifications from similar to previous procurements are useful in this respect. The use of metric units is encouraged. Depending on the complexity of the works and the repetitiveness of the type of procurement, it may be advantageous to standardize the Technical Specifications that should cover all classes of workmanship, materials and equipment although not necessarily to be used in a particular procurement.

Care must be taken in drafting specifications to ensure that they are not restrictive. In the specification of standards for equipment, materials, and workmanship, recognized international standards should be used as much as possible. The specifications shall consider all conditions but not limited to seismic conditions, weather conditions and environmental impact. The specifications should state that equipment, materials, and workmanship that meet other authoritative standards, and which ensure at least a substantially equal quality than the standards mentioned, will also be acceptable. The following clause may be inserted in the Specifications.

Sample Clause: Equivalency of Standards and Codes

Wherever reference is made in the Specifications to specific standards and codes to be met by Works to be furnished and tested, the provisions of the latest current edition or revision of the relevant shall apply, unless otherwise expressly stated in the Contract. Other authoritative standards that ensure equivalence to the standards and codes specified will be acceptable.]

***BILL OF QUANTIITES**

**Summary For "Construction of Garbage Transfer Station (GTS)"
at Mewa Shah Near Graveyard, District West, Karachi**

Bill of Quantities

S.No.	Description	Cost of Scheduled Items	Cost of Non Scheduled Items	Percentage Above on schedule rates	Percentage Below on schedule rates	Total Cost
		Items (Rs.)	Items (Rs.)	Items (Rs.)	Items (Rs.)	(Rs.)
1	Civil Works	76,486,097				
2	Public Heath Works	381,145				
3	Electrification Works	1,250,480				
	Cost Rs.					
4	Supplying detailed construction drawings of civil, electrical and mechanical works based on concept drawing attached with this tender from PEC approved consulting Director (GTS) / Engineers complete along with soil investigation of minimum 3 bore holes of 30 m each and a proper report of licensed geotechnical Director (GTS) / Engineer.				1% of the Total Cost	-----

TOTAL COST IN FIGURES =

TOTAL COST IN WORDS _____

**“Construction of Garbage Transfer Station (GTS)”
at Mewa Shah Near Graveyard, District West, Karachi**

Bill of Quantities (Civil)

N.B: These items and their rates given are based on Schedule Rate 2012 of Govt. of Sindh. However Rates of Non-Schedule Items and Premium are to be filled by the Contractor.

1) SCHEDULE OF ITEM (A), CIVIL WORKS

S.No	Description of Item	Unit	Qty	Rate	Amount
				(Rs.)	
1	Excavation in foundation of building bridges and other structures including dagbelling dressing refilling around structure with excavated earth watering and ramming lead up to 10 Km (S.I. No. 18 (b)/P-4) (for foundation)				
	(a) In All Kinds of Soil	%oCft	736320	3176.25	2,338,736
2	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing of stone aggregate without shuttering) (with under foundation & plinth protection).				
	(a) Ratio 1:4:8 (S.I. No. 5(i)/P-15).	%Cft	25781	11288.75	2,910,353
3	Providing and fabrication of tor steel reinforcement for cement concrete including cutting, bending, laying in position, making joints and fastenings including cost of binding wire (also including removal of rust from bars). S.I. No. 8(b) P-16).	P.Cwt	7454	5001.70	37,282,672
4	Reinforced cement concrete work including all labour and material except the cost of steel reinforcement and its labour for bending and binding which will be paid separately. This rate also includes all kinds of forms moulds lifting shuttering curing rendering and finishing the exposed surface. (S.No 6 ii / P-G 16)				
	a) R.C work in roof slab, beams columns rafts,lintels and other structural members laid in situ or precast laid in position complete in all respects.				
	(I) Mix designed for cylinder strength 40 Mpa (6,000 psi)	P.Cft	76383	349.00	26,657,667
	a) Foundation - 19,450 Cft				
	b) Column Upto Plinth - 4,000 Cft				
	c) Column Above Grade - 4,745 Cft				
	d) Wall Beam - 18,750 Cft				

	e) Beams - 7,139 Cft				
	f) Walls for Bin, Pits & Weigh Bridge & Ramp, Plinth Protect - 11,299 Cft				
	g) Str Screed at Top of Double Tee - 6,075 Cft				
	h) U.G Tank - 4,125 Cft				
	i) Drain - 400 Cft				
	j) Sum Pits - 400 Cft				
	Total - 76,383				
5	Providing & laying 1:3:6 cement concrete solid block masonry wall 6" and below in thickness set in 1:6 cement mortar in ground floor superstructure including raking out joints, rule pointing & curing etc complete (S.I. No. 24/P-18).	%Cft	2640	15771.01	416,355
6	Steel gate (S.No 24/P-91)	Sft	440	726.72	319,757
7	Steel window & ventilators (S.No 1/P-91)	Cwt	88	6420.61	565,014
8	Providing and laying floor of approved coloured glazed tiles 1/4" thick laid in white cement and pigment on bed of 3/4" thick cement mortar 1:2, complete in all respect as per drawing and specification or as directed by the Director (GTS) / Engineer in office & toilet areas. Floors (S.I. No. 25/P-42).	%Sft	1650	27747.06	457,826
9	Providing and fixing 3/8" thick marble tiles of approved quality and colour shade size 8" x 4/6" x 4" in dado skirting and facing removal / tucking of existing plaster surface etc over 1/2" thick base of cement mortar 1:3 setting mortar base including fillings the joints and washing the tiles with white cement, slurry current , finishing cleaning and polishing etc complete . (a) for new work (S.I No. 68(I)/P-48).	P.Sft	1221	186.04	227,155
10	Supply & fixing inposition aluminium channels framing for hinged doors or alcop made with 5 mm thick tinted glass glazing (Belgium) and Alpha (Japan) locks including handles stoppers etc (b) Deluxe Model (Bronze) (S.I. No. 83(b)/P-107).	P.Sft	484	1507.66	729,707
11	Supply and fixing in position aluminum channels framing for slidding windows and ventilators of Alcop made with 5mm thick tinted glass galzing (Belgium) & aluminium fly screen i/c handles stopper & locking arrangement etc complete (S.I. No. 84b/P-107). b. Deluxe model (Bronze)	P.Sft	242	1647.69	398,741

12	Providing and laying cement sand plaster in walls and ceiling including applying nero. Mixing and applying mortar to perfect line & level as per drawings, specifications (S.I. No. 11 & 13/P-51).				
	c. In walls and ceiling 1/2" inches thick (1:4)	%Sft	50600	2283.93	1,155,669
13	Preparing the surface and painting with matt finish i/c rubbing the surface with bathy (Silicon carbide rubbing brick) filling the voids with zink/chalk/plaster of paris mixture, applying first coat premix making the surface smooth and then painting 3 coats with matt finish of approved make etc: complete (S.I. No. 36(a) / P-54).	%Sft	11000	1989.62	218,858
14	Preparing the surface and painting with weather coat including rubbing the surface with rubbing brick / sand paper filling the voids with chalk / plaster of paris and then painting with weather coat of approved make (S.I No. (A) 38/P-55).	%Sft	19800	1328.25	262,994
	2nd & subsequent coat (S.I No. (B) 38/P-55).	%Sft	19800	619.85	122,730
15	Preparing surface and enamel painting (S.I No. 5c/P-68-69).	%Sft	12100	1489.65	180,248
16	Two coats of bitumen laid hot using 34 lbs for %sft over roof and blinded with sand at one Cft. Per %Sft (S.I. No. 13)/P-34.	%Sft	34100	1887.40	643,603
17	Installation of 400 ft deep tube well with submersible pump complete for 5000 gpm for washing of floor.				
17a.	Boring of tube well in all water bearing soil from ground level upto 100 ft or 30.50 meter depth including sinking and with drawing of casing pipe (PHSI No. 1 P/41).				
	12" dia 1 x 100 = 100 Rft	Rft	100	743	74,300
17b.	Boring of tube well in all water bearing soil from 100-200 ft or 30.51 to 61 meter below ground level including sinking and with drawing of casing pipe (PHSI No. 1 P/41).				
	1 x 100 = 100 Rft	Rft	100	849	84,900
17c.	Boring of tube well in all water bearing soil from 200-1 to 300 ft or 61.0 to 91.50 meter below ground level including sinking and with drawing of casing pipe (PHSI No. 1 P/41).				
	1 x 100 = 100 Rft	Rft	100	989	98,900
17d.	Boring of tube well in all water bearing soil from depth of 300-1" to 400 ft or 91.50 to 122 meter below ground level including sinking and with drawing of casing pipe (PHSI No. 1 P/41).				
	1 x 100 = 100 Rft	Rft	100	1073	107,300

17e.	Taking and preserving in box 2 lbs (1 Kg) samples of start from bore holes (PHSI No. 6 P/43).				
	1 x 500 / 10 = 50 Nos	Each	50	101	5,050
17f.	Taking sample of water from bore holes and placing in two separate bottles (PHSI No. 7 P/43).				
	1 x 500 / 10 = 50 Nos	Each	50	131	6,550
17g.	Supplying and installing PVC strainers (B Class) of approved design quality and make including necessary sockets etc complete (PHSI No. 12 P/44).				
	8" dia 1 x 110 = 110 Rft	Rft	110	554.05	60,946
17h.	Supplying and installing blind pipe Class "B" of best and approved design quality and make necessary sockets etc complete (PHSI No. 9 P/43).				
	8" dia 1 x 290 = 290 Rft	Rft	290	516.80	149,872
17i.	Sounding with gravel bajri (A" to 1/4") OR (a to 3mm) in between bore and blind pipe for 8" c or strainers (PHSI No. 13 P/45).				
	1 x 400 = 400 Rft	Rft	400	193.00	77,200
17j.	Plugging of joint casing and pipe with cement concrete (1:1 1/2:3) (PHSI No. 14 P/38).				
	1 x 3.14 x 0.83 x 0.17 x 8.0 = 3.52 Rft	Rft	3.52	347.00	1,221
17k.	M.S bail plug of approved quality (PHSI No. 8(B) P/43).				
	8" dia 1 x 1 = 1 No	Each	1	2607.00	2,607
17l.	Providing & fixing suspension clamps market rate approved by S.E.P.H.E Hyderabad (PHSI No. 13C P/26).				
	1 x 1 = 1 No	Each	1	350.00	350
17m.	Developing & testing charges of tube well (Market Rate).				
	1 x 24 = 24 hours	Per Hour	24	500.00	12,000
18	Aggregate base course (NHA 202).	Cft	16669	55	916,817
Total					76,486,097

_____ %Premium (Above or Below) on Sindh Schedule 2012 Cost
Therefore Cost After Premium _____

1) NON- SCHEDULE OF ITEM, CIVIL WORKS					
1	Heavy duty power float finish reinforced floor made with concrete designed for (70 Mpa) (10,000 psi)	Cft	50119.3		
2	Glazing	P.Sft	1980		
3	Providing and laying pre-stressed double tee roofing system for 45 ft to 60 ft span designed for 50 psf of live load loading and 2 inches thick screed on top of it and self weight including launching, placing in position, welding joint metallic insertions etc complete as per specification, design & drawing	%Sft	35200		
4	Installation of R.O Plant for getting potable water about 3000 gallons per day complete with power arrangement accessories and R.O membrane complete.	No	1		
a.	Feed Pump make Grandfos	No	1		
b.	Sand filtration Vessel	No	1		
c.	Jambo Filter with cartage	No	2		
d.	High Pressure vertical pump	No	1		
e.	Code line vessel 8" dia	No	2		
f.	Membranes film Tec	No	2		
g.	Online TDS Meter	No	1		
h.	Control Panel with pressure gauges TDS Meter, Flow Meters	No	1		
i.	Skid Moated frame	No	1		
j.	Complete Fitting P.V.C. S.S 316 grade	No	L.S		
k.	Installation Charges	No	L.S		
5	Designing complete ventilation system and installing ducts, vents with complete machines, motors , pumps etc complete.	%Sft	35200		
6	Supplying and installing of submersible pump HMA complete stainless steel submersible Pumping Set 20 BHP type (3 x 400v x 50Hz x 200 Rpm Cable transmission kit x 1 No top set 2 1/2" consist of Bend Sluice valve & bore plate and nipple 2 1/2" dia 1 No drop cable 3 x 16mm x 270 meter 20 BHP motors control unit of metallic box circuit breaker am - meter voltmeter, electronic over current relay, magnetic contractor under / over voltage relay (EUR) dry running protection relay indication pump sand on / off switch Riser pipe 2 1/2 35 Nos. motor jacket 7" dia 1 No against the head of 390 ft given discharge 100 gallon.	Set	1		
7	Test of Pumping Set (72 hours) 4 days pump driver / operator.	P.Day	4		
8	Skilled labour 1 No for 4 days (72 hours).	P.Day	4		
Total					

**“Construction of Garbage Transfer Station (GTS)
at Mewa Shah Near Graveyard, District West, Karachi**

Bill of Quantities (Plumbing)

2 (B) SCHEDULE OF ITEM (B), PLUMBING WORKS

S.No	Description of Item	Unit	Quantity	Rate (Rs.)	Amount (Rs.)
1	Providing & fixing 1/2" dia, lead connection complete with a 1/2" dia brass stop cock, two brass nuts & lining jointed to lead pipe with plumber wiped solder joints 1/2" inches lead pipe to be of not less than 4lbs per lineal yard (S.I. No. 22/P-6).	Each	16	689.70	11,035
2	Providing & fixing M.S clamps of the approved design to 4" i/c the cost of cutting and making good to wall or M.S bolts and nuts, 4" into wall including pipe distance pieces extra painting to match the colour of the building (S.I. No. 2/P-9).	Each	10	72.16	722
3	Providing & fixing M.S clamps of the approved design to 3" i/c the cost of cutting and making good to wall or M.S bolts and nuts, 3" into wall including pipe distance pieces extra painting to match the colour of the building (S.I. No. 14/P-10).	Each	20	264.00	5,280
4	(b) S/Fixing long bib-cock of superior quality with c.p head 1/2" dia (S.I. No. 13(a)/P-19).	Each	28	1109.46	31,065
5	Supplying & fixing 6" x 4" earthen gully trap with 4" outlet complete with 4" thick 1:2:4 C.C for bed & 1/2 thick cement plaster (1:3) to the karb C.I grating 6" x 6" and C.I. cover and frame 12"x12" (inside) etc Complete (b) earthen ware glazed gully trap(a) (i) 6'x6"x4" (i) With C.I Cover and Frame(S.I. No. 1(i)/P-23.	Each	1	1220.67	1,221
6	Providing and fixing squatting type white glazed earthen were w.c pan with including the cost of flushing cistern with internal fitting and flush pipe with bend and making requisite number of holes in walls plinth & floor for pipe connections and making good in cement concrete 1:2:4 (S.No 1/ P-1)	Each	8	5044.60	40,357
7	Supply & fix European type white glaze earthen ware wash down w.c pan complete with the cost of white/black plastic seat (best qty) and lid with c.p brass hinges best quality and buffers 3 gallons plastic flushing cistern with internal fitting with fitting and clamp 3/4" dia. and cutting and making requisite number of holes in walls , plinth and floor for pipe connection and making good in cement concrete 1:2:4 (S.No 1/ P-1)	Each	4	5339.40	21,358

8	Supply & fixing 24" x 18" wash basin in white glazed earthen ware complete with including the cost of W.I or C.I cantilever brackets 6 inches built into wall, painted white in two coat after a primary coat of red lead paint, a pair of 1/2" rubber plug and chrome plate brass chain 1-1/4" malleable iron or brass trap malleable iron or brass unions and making requisite number of holes in walls , plinth and floor for pipe connection and making good in cement concrete 1:2:4 and add extra labour for providing and fixing of earthen ware pedestal white or coloured glazed (S.No 8 & 9/ P-3)	Each	8	5192.37	41,539
9	Construction manhole for the required dia of circular sewer and 7'-9" depth with walls of B.B in cement mortar 1:3 cement plaster 1:3, 1/2" thick inside of wall and 1" (25mm) thick over benching and channel including fixing C.I manhole cover with frame of clear opening 2'x2' (610 x 610mm) of 4.5 cwt embedded in plain C.C 1:2:4 and two way reinforcement 6" thick including fixing 1" (25mm) dia dia M.S steps 6" (150mm) wide projecting 4" (102mm) from the face of wall at 12" (305mm) c/c duly painted etc complete as per specification and drawing (a) 4" to 9" dia 4" x 3'x7'-9" (S.I.No. 2/P-47) ,(if the depth of main hole is less than 7'-9" deduct from the cost @rate 2143/each).	Each	3	42745.00	128,235
10	Providing and fixing chrome plated brass towel rail complete with brackets fixing on wooden cleats with 1" long C.P brass Screws.(I) Towel rail 36" long (a) 3/4" dia round or square (standard pattern) (S.I. No.1(i)(a)/P-7).	Each	16	1269.95	20,319.20
11	Providing and fixing 24"x18" beveled edge mirror of belgium glass complete with 1/8" thick hard board and C.P screws fixed to wooden pleat (b) superior quality (S.I. No.3(b)/P-7).	Each	8	2376.00	19,008.00
12	Supplying & fixing soap tray of made of plastic of superior quality and design with fine finishing with c.p screws etc complete (S.I. No.6/P-8).	Each	24	169.40	4,065.60
13	Supplying & fixing jet shower with rod of superior quality single c.p head 1/2" dia (S.No 15 / P-19)	Each	16	1142.24	18,275.84
14	Providing & fixing full way gun metal valves with wheels threaded or flanged ends with rubber washing (S.I. No.6(A)/P-17)				
	(vii) 2-1/2" dia	Each	2	1226.00	2,452.00
	(viii) 3" dia	Each	2	1390.84	2,781.68
	(ix) 4"	Each	2	2435.84	4,871.68
15	Constructing small wheel value chamber clear inside size 12" x 12" x 12" with walls of 9" thick of B.B cement mortar 1:3 over 4" thick cement concrete 1:3:6 cement plastered 1/2" thick 1:3 inside including supplying & fixing C.I light weight manhole cover with frame and locking arrangement of 12" x 12" clear opening etc complete (S.I. No.8/P-52).	Each	1	3128.00	3,128.00

16	Supplying & fixing wash basen mixture of superior quality with c.p head 1/2" dia (S.I. No.14 b /P-19)	Each	8	3179.00	25,432.00
Total					381,145

_____ %Premium (Above or Below) on Sindh Schedule 2012 Cost
Therefore Cost After Premium _____

**“Construction of Garbage Transfer Station (GTS)”
at Mewa Shah Near Graveyard, District West, Karachi**
Bill of Quantities (Electrical)

2 (C) SCHEDULE OF ITEM (C), ELECTRICAL WORKS

S.No	Description of Item	Unit	Quantity	Rate	Amount
				(Rs.)	(Rs.)
1	Wiring for light or fan point with (3/.029) PVC insulated wire in 20mm (3/4") PVC conduit recessed in the wall or column as required including 1mm ² wire as ECC (S.No.124, Pg-15).	Point	105	1130	118,650
2	Wiring for plug point with (3/.029) PVC insulated wire in 20mm (3/4") PVC conduit recessed required in the wall or column as required including 1mm ² PVC insulated wire as ECC as required (S.No.126, Pg-15).	Point	32	985	31,520
3	Providing & laying (Main or Sub Main) PVC insulated with size 2-7/.029 copper conductor in 3/4" dia PVC conduit on surface recessed in wall or column including 1.5mm ² wire as ECC (For Power Plug and Chandelier) (S.No-3, Pg-1).	Meter	30	294	8,820
4	Providing & fixing one way SP 5 amp switch flush type on metal board & covered with plastic sheet (S.No-219, Pg-33).	No	133	54	7,182
5	Providing & fixing two pin 5 amp plug & socket switch flush type on metal board & covered with plastic sheet (S.No-225, Pg-33).	No	26	83	2,158
6	Providing & fixing three pin 5 amp plug & socket switch flush type on metal board & covered with plastic sheet (S.No-226, Pg-33).	No	6	151	906
7	Providing & fixing three pin 10/15 amp plug & socket flush type on metal board & covered with plastic sheet (S.No-227, Pg-33).	No	2	162	324
8	Providing & fixing bakelite / plastic ceiling rose with two terminals (S.No-228, Pg-33).	No	10	72	720
9	Providing & fixing ceiling fan 56" good quality (S.No-235 Pg-34).	No	8	3185	25,480
10	Providing and fixing Earthing set with 2"x2"x1/4" copper plate burried in the ground at a depth of 12" or less if water comes out from the ground level with salt and charcoal etc in/c.making the pit 12" deep by excavation of all type of soil Earth plate to be connected with No. 8S.W.G. bare copper wire run in 1/2" G.I pipe straight from the earth plate upto the metallic Eletrical assesary i/e providing necessary tee (40 for lower one for light DBs) (S.No-(A)2, Pg-26).	No	5	25000	125,000

11	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with 4 core armoured copper conductor 600/1000 volts size 35mm ² (From MDB Power to DB1 Power) (S.No-115, Pg-13).	Meter	30	3008	90,240
12	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with 4 core armoured copper conductor 600/1000 volts size 95mm ² (From MDB Power to DB2 Power) (S.No-118, Pg-14).	Meter	40	7520	300,800
13	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with 4 core armoured copper conductor 600/1000 volts size 25mm ² (From MDB Power to DB3 Power) (S.No-114, Pg-13).	Meter	50	2435	121,750
14	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with 4 core armoured copper conductor 600/1000 volts size 16mm ² (From MDB Low to MDB Light) (S.No-113, Pg-13).	Meter	100	1679	167,900
15	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with 4 core armoured copper conductor 600/1000 volts size 10mm ² (From MDB Light to DB1 Light) (S.No-112, Pg-13).	Meter	30	1230	36,900
16	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with single core copper conductor 300/500 volts size 2-7/.044 (From MDB Light to DB2 Light) (S.No-55, Pg-7).	Meter	50	213	10,650
17	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with 4 core armoured copper conductor 600/1000 volts size 16mm ² (From MDB Power to Metallic Box 30 HP Motor) (S.No-113, Pg-13).	Meter	120	1679	201,480
Total					1,250,480

_____ %Premium (Above or Below) on Sindh Schedule 2012 Cost

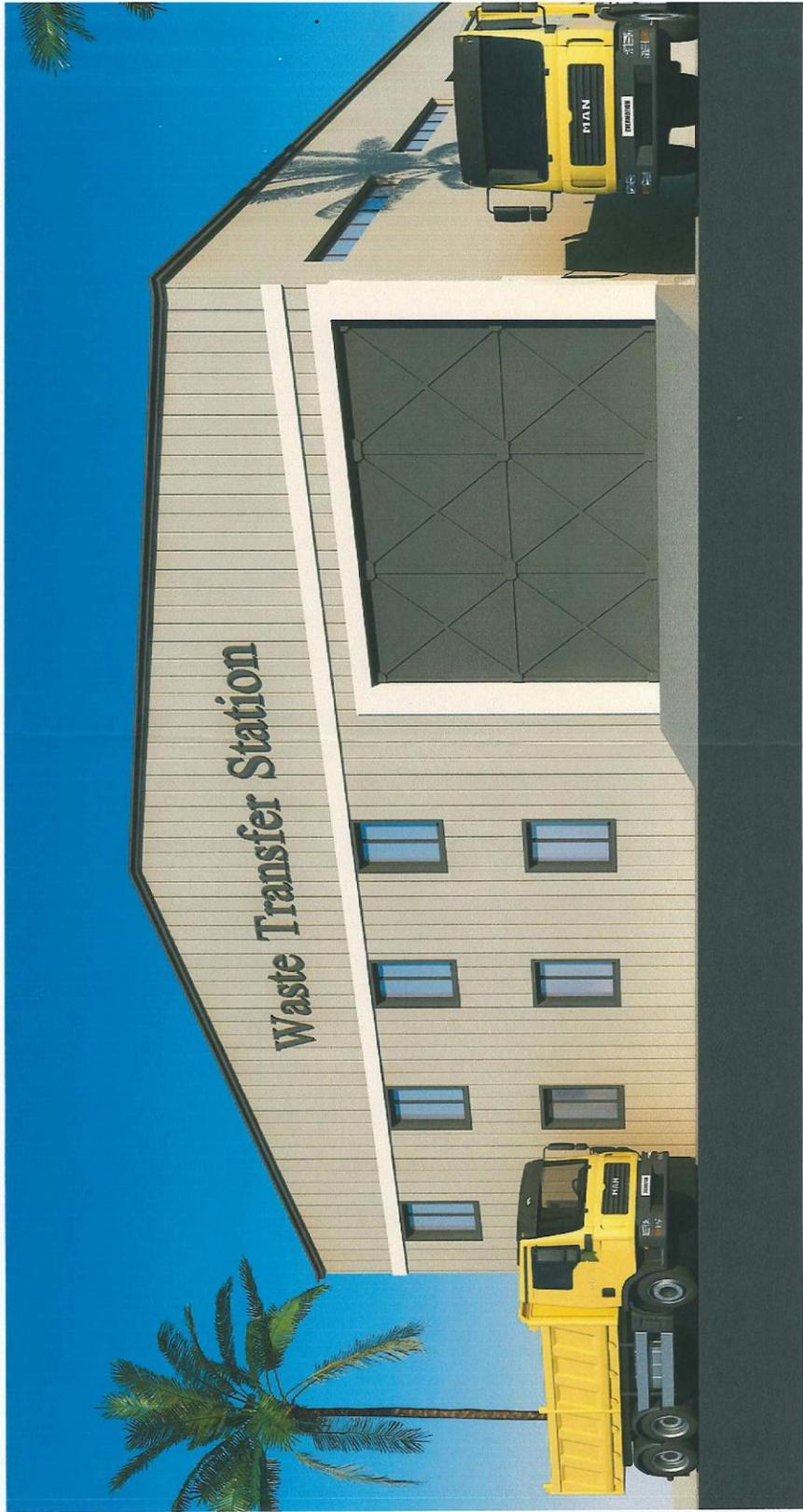
Therefore Cost After Premium _____

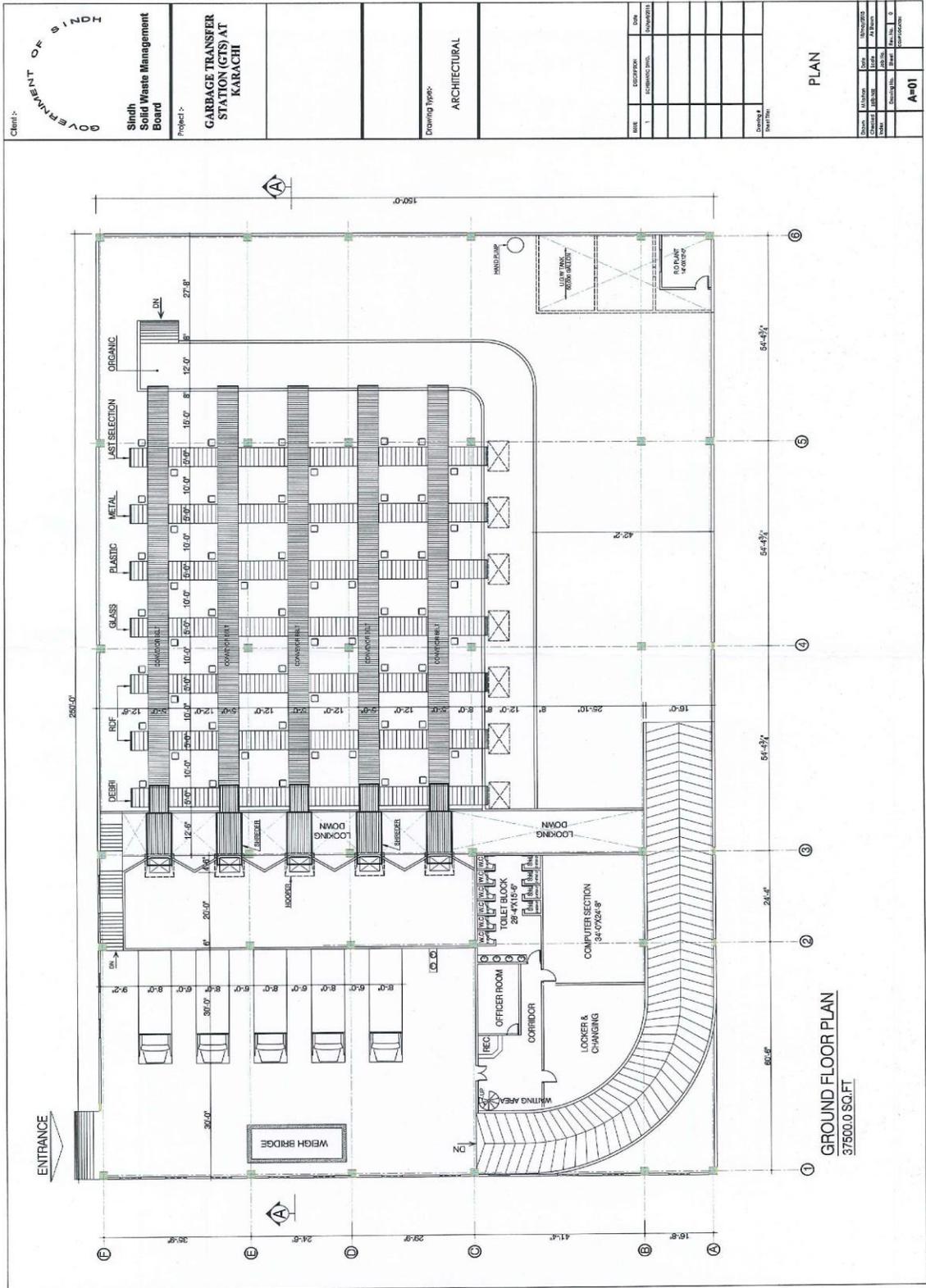
4C) NON SCHEDULE OF ITEM (C), ELECTRICAL WORKS				
1	Providing and fixing 4 1/2" x 4 1/2" MS dia casted powder coated recessed type fan clamp box with 1/2" dia MS bar fan clamp fixed on roof at casting time as required.	No	8	
2	Providing and fixing 6 Amps Piano fan dimmer fixed on plastic or fiber top cover sheet on 14 SWG metal board recessed in the wall and column including connection as required.	No	8	
3	Providing and fixing 30cm (12") sweep metallic body exhaust fan complete with blades, motor etc fitted in existing hole including connection with 14.0076 flexible wire complete as required Millat / Pak / Asia / Climax / Younas / Royal.	No	2	
4	Making hole in the wall for 12" sweep exhaust fan and fixing of hole fast duly plastard and making good the damages as required.	No	2	
5	Providing & laying (Main or Sub Main) PVC insulated with size 2-7/.044 (6mm ²) copper conductor in 1" dia PVC conduit on surface recessed including 2.5mm ² as ECC as required (For AC).	Meter	30	
6	Providing & fixing 20/25 A Plug socket switch flush type on metal board (For AC).	No	2	
7	Providing & fixing LCD Light 22 watt earthing type 6" dia round shape philips make as per Cat PL No 33365 22 W.	No	105	
8	<p>Main DB Power (Floor Type)</p> <p>Providing and fixing testing, commissioning cubical type metal sheet distribution board type with locking arrangement duly powder quoted paint including all fastening material including wiring with suitable gauge PVC x PVC wire complete in all respect (Seimens, Pel, Libra, RCO, Karimi, Electromech System, In Power Tech).</p> <p>Incoming:</p> <p>1) 500 A TP MCCB 1 No Terasaki/Similar 2) Volt Meter W/Selector 1 No 3) Ampere Meter W/Selector 1 No 4) C.T 500/5A 3 No 5) Pilot Lamp 1 Set</p> <p>Outgoing:</p> <p>1) 30 A TP MCCB 5 No Terasaki/Similar</p>	No	1	

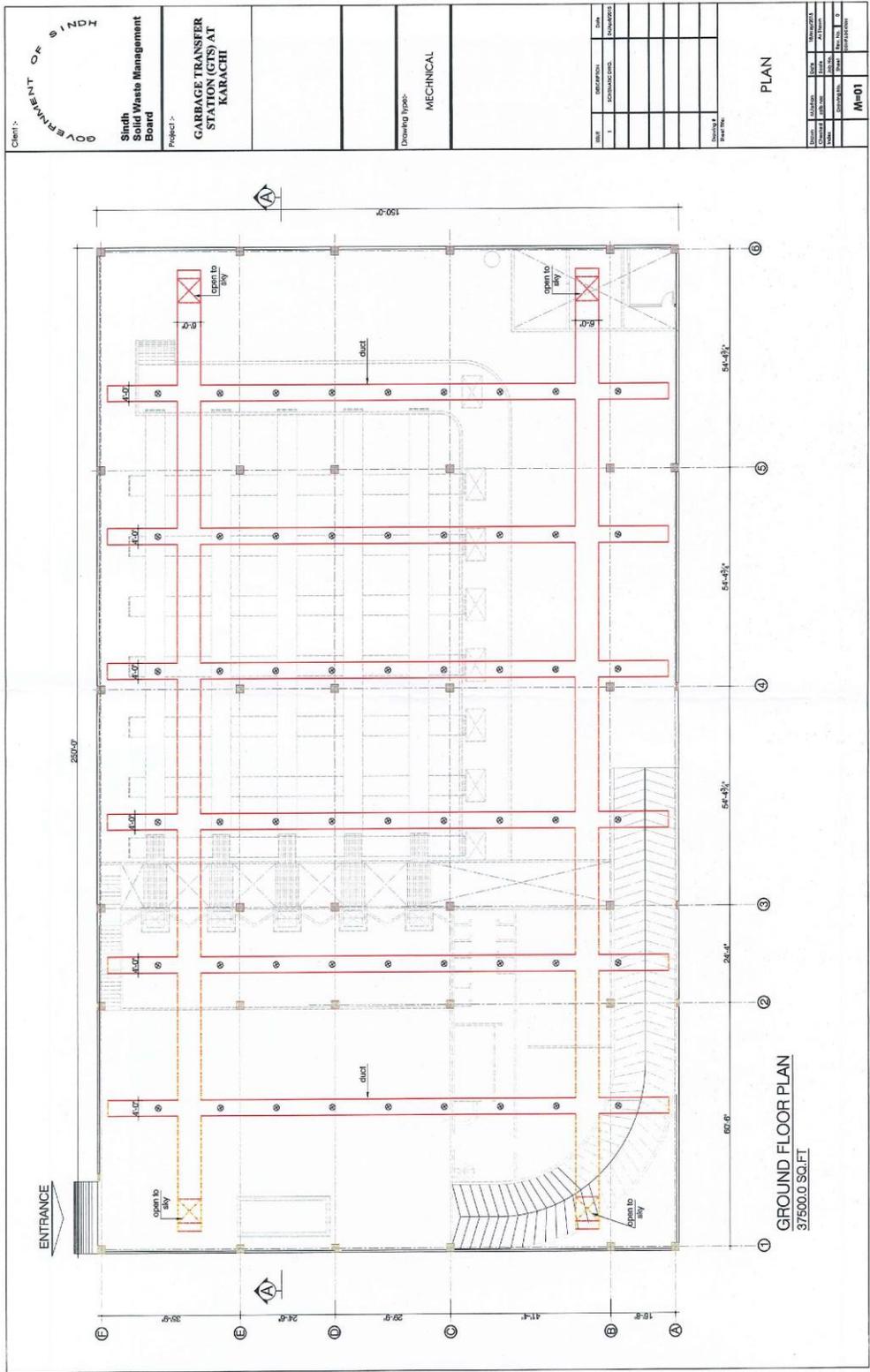
	<p>Incoming:</p> <p>1) 100 A TP MCCB Terasaki/Similar 1 No</p> <p>2) Pilot Lamp 1 Set</p> <p>Outgoing:</p> <p>1) 15 A TP MCCB Terasaki/Similar 7 No</p> <p>2) 10 A TP MCCB (Spare) 1 No</p>				
12	<p>Main DB (Light)</p> <p>Providing and fixing testing, commissioning cubical type metal sheet distribution board type with locking arrangement duly powder quoted paint including all fastening material including wiring with suitable gauge PVC x PVC wire complete in all respect (Seimens, Pel, Libra, RCO, Karimi, Electromech System, In Power Tech).</p> <p>Incoming:</p> <p>1) 50 A TP MCCB 1 No Terasaki/Similar</p> <p>2) Volt Meter W/Selector 1 No</p> <p>3) Ampere Meter W/Selector 1 No</p> <p>4) C.T 50/5A 3 No</p> <p>5) Pilot Lamp 1 Set</p> <p>Outgoing:</p> <p>1) 10 A SP MCB Terasaki/Similar 18 No</p> <p>2) 15 A SP (P.P) 3 No</p> <p>4) 20/25 A SP MCB (AC) 2 No</p>	No	1		
13	<p>DB1 (Light)</p> <p>Providing and fixing testing, commissioning cubical type metal sheet distribution board surface / flush type with locking arrangement duly powder quoted paint including all fastening material including wiring with suitable gauge PVC x PVC wire complete in all respect (Seimens, Pel, Libra, RCO, Karimi, Electromech System, In Power Tech).</p> <p>Incoming:</p> <p>1) 30 A TP MCCB 1 No Terasaki/Similar</p> <p>2) Pilot Lamp 1 Set</p> <p>Outgoing:</p> <p>1) 10 A SP MCB 7 No Terasaki/Similar</p> <p>2) 15 A SP MCB 3 No</p>	No	1		

	2) 20/25 A SP MCB	2 No				
14	DB2 (Light) Providing and fixing testing, commissioning cubical type metal sheet distribution board surface / flush type with locking arrangement duly powder coated paint including all fastening material including wiring with suitable gauge PVC x PVC wire complete in all respect (Seimens, Pel, Libra, RCO, Karimi, Electromech System, In Power Tech). Incoming: 1) 15 A DP MCB 1 No Terasaki/Similar 2) Pilot Lamp 2 Set Outgoing: 1) 10 A SP MCB 9 No		No	1		
15	Cable Work Providing and laying main or submain PVC insulated PVC sheathed with 4 core armoured copper conductor 600/1000 volts grade size 300mm ² laying in ground (From Supply Point to MDB).		Meter	500		
16	Providing and fixing 50 A TP MCCB in suitable size metallic box for 30 HP Motor.		No	1		
17	Supplying transformer for 750 KVA.		Each	1		
18	Generators 500 KVA.		Each	2		
19	Complete automatic transfer switch, battery etc.		Each	1		
20	KE - Payments (Lump Sum for each GTS).		Each	L.S		
21	Cable - of various sizes & electric work from KE Mains.		L.S	1		
Total						

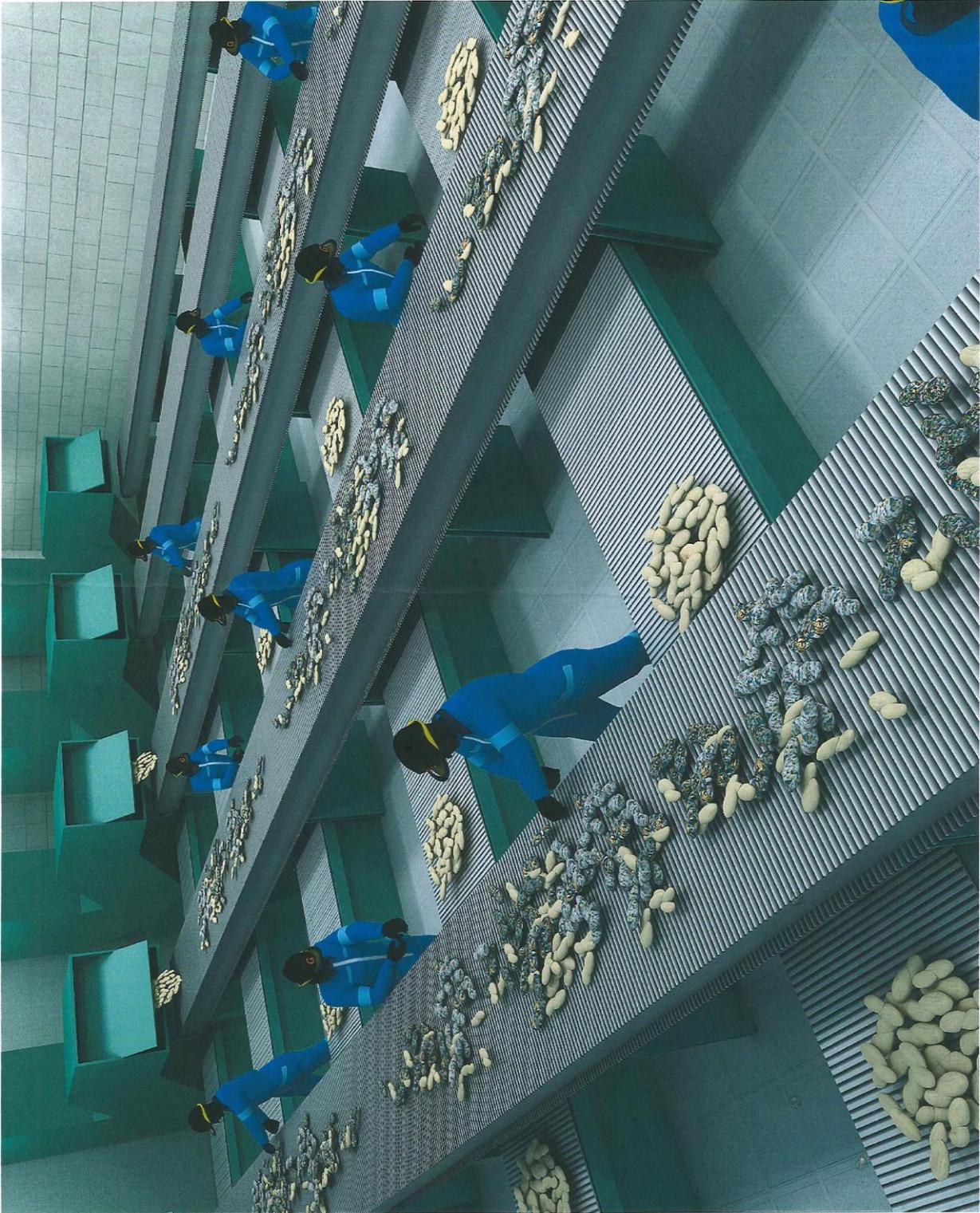
***DRAWINGS**







W-1
K&I



Technical Specification

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STAKE-OUT SURVEY

1. SCOPE

Under this item the Contractor shall make the stakeout survey for construction purposes with competently qualified men, consistent with the current practices. The work shall proceed immediately upon the award of the contract and shall be expeditiously progressed to completion in a manner and at a rate satisfactory to the Director (GTS) / Engineer. The Contractor shall keep the Director (GTS) / Engineer fully informed as to the progress of the stake-out survey. The scope of this section of specifications is covered by detailed specifications as laid down herein.

2. MATERIAL AND EQUIPMENT

All instruments, equipment, stakes and other material necessary to perform all work shall be provided by the Contractor. These instruments and equipment shall be available to Director (GTS) / Engineer at all times for the purpose of checking the work of the Contract.

All stakes used shall be of a type approved by the Director (GTS) / Engineer, clearly and permanently marked so as to be legible at all times. It shall be the Contractor's responsibility to maintain these stakes in their proper position and location at all times. Any existing stakes or markers defining property lines and survey monuments which may be disturbed during construction shall be properly tied into fixed reference point before being disturbed and accurately reset in their proper position upon completion of the work.

3. CONSTRUCTION

The contractor shall trim trees, bushes and other interfering objects, not consistent with the plan, from survey lines in advance of all survey work to permit accurate and unimpeded work by his stake-out survey crews and the Director (GTS) / Engineers survey crews. The exact position of all work shall be established from control points which are shown on the plans or modified by the Director (GTS) / Engineers. Any error, apparent discrepancy in or absence of data shown or required for accurately accomplishing the stake-out survey shall be referred to the Director (GTS) / Engineer for interpretation or furnishing when such is observed or required.

The contractor shall be responsible for the accuracy of his work and shall maintained all reference points, stakes, etc. through out the life of the contract. Damaged, destroyed or inaccessible reference point, bench point or Stakes shall be replaced by the Contractor. Existing or new control points that will be or are destroyed during construction shall be re-established and all reference ties recorded thereon shall be furnished to the Director (GTS) / Engineer. All stakeout survey work shall be referenced to the centerlines shown on the Plans. All computations necessary to establish the exact position of the work from control points shall be made and preserved by the Contractor, All computations, survey notes and other records necessary to accomplish the work shall be kept neatly and made available to the Director (GTS) / Engineer upon request and furnished to the Employer upon Contract completion.

The Director (GTS) / Engineer may check all or any portion of the stakeout survey work or notes made by the Contractor and any necessary correction to the work shall be immediately made. Such checking by the Director (GTS) / Engineer shall not relieve the Contractor of any of his responsibilities for the accuracy or completeness of his work.

Reference points, base lines, stakes and benchmarks for borrow pits shall be established by the Contractor.

All required right-of-way and easement limits shall be established, staked and referenced by the Contractor concurrent with the construction stakeout survey.

The Contractor shall place at least two offset stakes or references at each center lines station and at such intermediate stations as the Director (GTS) / Engineer may direct. From computations and measurements made by the Contractor, these stakes shall be clearly marked with the correct center line, station number, offset and cut or fill so as to permit the establishment of the true center line location during construction. He shall locate and place all cut, fill, slope, line grade or other stakes and points as the Director (GTS) / Engineer may direct to be necessary for the proper progress of the work.

4. PAYMENT OF WORK

No payment shall be made for the Works involved within the scope of this Section of Specifications unless otherwise specifically stated in the Bills of Quantities or herein. The cost thereof shall be deemed to have been included in the quoted unit rate of other items of the Bills of Quantities.

***** END OF SECTION*****

CLEARING AND GRUBBING

1. SCOPE

The clearing and grubbing shall consist of clearing the designated area of all trees, down timber, snags, bush, other vegetation, rubbish and all other objectionable material, and shall include grubbing stumps, roots, and matted roots, and approved disposal area of all spoil material resulting from the clearing and grubbing. It shall also include the removal and disposal of structures that protrude, encroach upon, or otherwise obstruct the work, except when otherwise provided for on the plans or directed by the Director (GTS) / Engineer to be saved. The scope of this section of specifications is covered with detailed specifications laid down herein.

2. LIMIT OF AREA

2.1 Location of Works

The Director (GTS) / Engineer will define the limit of areas where clearing and grubbing is to be done. Normally it will include all land within the right of way and all other construction area including ditches, detours, minor road crossings and other areas shown on the plans or as specified or as directed by the Director (GTS) / Engineer. The Director (GTS) / Engineer will designate the fences, structures and debris and trees and bushes to be cleared where grubbing is not required. It shall not include clearing and grubbing of borrow or other pit areas from which material is secured. It shall include the levelling or removal of all bunds or mounds within the right of way unless otherwise directed by the Director (GTS) / Engineer.

2.2 Grubbing and Cutting

No tree shall be cut without the written approval of the Director (GTS) / Engineer, All roots and stumps within the limits of the site shall be grubbed and excavated unless otherwise specified or approved by the Director (GTS) / Engineer.

2.3 Disposal

All wood and bush shall be burned or otherwise disposed off within fifteen (15) days after cutting or filling unless otherwise approved. No tree trunks, stumps or other debris shall be left within Site unless approved in writing by the Director (GTS) / Engineer. The location of disposal areas shall be within or outside the limits of the project or as approved in writing by the Director (GTS) / Engineer and shall be acquired by the Contractor at his own expense. Any useable material including trees/wood recovered in the above activity will be stacked and shall remain the property of the Employer.

2.4 Protection and Restoration

Prior to starting construction activities at site, contractor shall locate all existing utilities and submit to the Director (GTS) / Engineer for approval.

The Contractor shall prevent all damage to pipes, conduits, wires, cables or structures above or below ground. No land monuments, property markers, or official datum points shall be damaged or removed until the Director (GTS) / Engineer has witnessed or otherwise referred their location and approved their removal. The Contractor shall so control his operations as to prevent damage to trees and shrubs which are to be preserved. Protection may include fences and boards lashed to trees to prevent damage from machine operations. The existing covered or open bench marks should be relocated as directed by the Director (GTS) / Engineer. In the event that anything specified herein to be saved and protected is damaged by the Contractor; such damages shall immediately be repaired or replaced by the Contractor at his own cost to the satisfaction of the Director (GTS) / Engineer. All areas cleared and grubbed must be approved by the Director (GTS) / Engineer or Director (GTS) / Engineer's Representative before the start of cleaning operations.

3. PAYMENT OF WORK

No payment shall be made for the Works involved within the scope of this Section of Specifications unless otherwise specifically stated in the Bills of Quantities or herein. The cost thereof shall be deemed to have been included in the quoted unit rate of other items of the Bills of Quantities.

***** END OF SECTION*****

EXCAVATION

a. General

The areas to be occupied by the permanent construction required under these specifications and the surfaces of all borrow pits (and stockpile and waste pile and sites) shall be cleared of all trees, stumps, (exposed) roots, brush, rubbish, and other objectionable matter as determined by the contracting authority.

(The reservoir area below Elevationas shown on Drawing No.shall be cleared of all trees, stumps and brush 5 feet or more in height, regardless of diameter, and 2 inches or more in diameter, regardless of height. Trees and stumps in the reservoir area shall either be uprooted or cut off so that the maximum allowable stumps height shall be 6 inches as measured on the uphill side of the stump). (Brush in the reservoir area shall be cut off approximately flush with the ground level).

(All down timber, braches, and other floatable and combustible material 5 feet or more in length, regardless of diameter, and 2 inches or more in diameter, regardless of length, shall be cleared).

No trees shall be cut outside of areas mentioned above without specific approval, and all trees designated by the contracting authority shall be protected from damage by the contractor's construction operations.

Clearing will consist primarily of the removal of(insert description of major items).

The bidders and the contractor shall, by their own investigation, determine the extent of clearing required in accordance with this section.

The contractor may, at no cost, retain any materials of value from clearing operations for his own use or disposal by sale. Such material shall be removed from the construction area before the date of completion of the work under the specifications. Every reasonable effort shall be made by the contractor to channel materials of value resulting from clearing operations into beneficial use. The contracting authority assumes no responsibility for the protection or safekeeping of any materials so retained by the contractor.

b. Disposal of Materials.

Materials from clearing operations shall become the property of the contractor and shall be, at the contractor's option, buried, *(buried), *(chipped or trimmed and cut to lengths), removed from the site of the work before the date of completion, or otherwise disposal of as approved. *(Burning of materials required to be cleared will not be permitted).

Materials disposal of by burying shall be buried at locations approved by the contracting authority and shall be covered with not less than 2 feet of earth material. Approved locations will be natural or excavated depressions in the reservoir area which are not subject to erosion from stream flow or wave action.

(Burning will be permitted only at times when conditions are considered favorable for burning and at locations approved by proper State or local authorities). *(The contractor will be required to obtain a burning permit from.....). Materials to be burned shall be piled neatly and, when in a suitable condition, shall be burned completely. Piling for burning shall be done in such a manner and in such locations as to cause the least fire risk. All burning shall be so thorough that the materials are reduced to ashes. No logs, braches, or charred pieces shall be permitted to remain. The contractor shall at all times take special precautions to prevent fire from spreading to areas beyond the limits of the cleared areas and shall have available at all times suitable equipment and supplies for use in preventing and suppressing fires).

*(Cut timber, down timber, dead timber, braches, and brush inches and less in diameter, to be disposed of by chipping, shall be reduced to chips of one-half-inch maximum thickness. The chips may be sold by the contractor as provided in subsection G-6 (a), or shall be disposed of by distributing uniformly on the ground surface in approved areas and the chips shall be mixed with the underlying earth so that they will not float or support combustion).

Cut timber, down timber, dead timber, braches, and other floatable and combustible materials over Inches in diameter, to be disposed of by cutting to lengths, shall be trimmed and cut into approximate 5-foot lengths. Such cut material may be sold by the contractor as provided in subsection (a), or shall be hauled to stockpiles above Elevation, and at locations as approved by the contracting authority. Cut material shall be neatly stacked in piles.

c. Payment

(Payment for clearing the areas to be occupied by the permanent construction and the surfaces of borrow pits *(and stockpile and waste pile sites)* (and the reservoir area below Elevation.....) will be made at the lump-sum price bid in the schedule for clearing.

***** END OF SECTION*****

LEVELLING AND GRADING

1. SCOPE

- 1.1 The work to be done under this section of the specifications consists of performing all earth work required for leveling & grading in accordance with required levels, elevations and grades shown on the Drawing/Plans or as established by the Director (GTS) / Engineer. The work to be done by the Contractor shall include performing the required excavation to line, levels, grade and filling the area to the desired levels and grades; providing and transporting labor, excavating, grading, leveling, watering and compacting equipment and all incidental operations required in performing the earthwork as specified herein.
- 1.2 Leveling and grading work shall be performed after completing the clearing and grubbing of the site. The work shall consist of removing earth and other materials from above the required finish levels, transporting, placing and compacting the same in the areas requiring filling. It shall also include compaction of excavated areas to the required densities and levels as shown on the Drawings. The scope also covers haulage of unsuitable/surplus excavated material to places designated by the Director (GTS) / Engineer within the specified haulage lead.

During the progress of the works, if by reason of delay, effects of bad weather, rainfall, or from any cause whatsoever, any levels, grades or profiles of the area are changed, the Contractor shall, at his own cost, be liable to bring the area to the required levels and profiles as shown on the Drawings or as directed by the Director (GTS) / Engineer.

2. EXCAVATION AND EXCAVATED MATERIAL

2.1 Excavation to be done by Machines

All excavation shall be made to the lines, levels and grades as shown on the Drawings/plans or established by the Director (GTS) / Engineer. During progress of the work it may be found necessary or desirable by the Director (GTS) / Engineer to vary the levels, elevations and grades of the excavations from those shown on the Drawings/Plans and the Contractor shall perform the excavation to the revised levels, elevations, and grades as established by the Director (GTS) / Engineer.

2.2 Classifications of Excavated Materials

No classification shall be made of any material excavated as to its class, nature, origin or conditions.

2.3 Compaction of Excavated Surface

Compaction and testing of the suitability of soil shall be done as given in sub-section 3,6 of this section. The excavated surfaces shall be compacted to 95% modified AASHTO density.

2.4 Disposal of Excavated Material

Suitable materials derived from excavations may be used for filling the depressions or low lying areas, any surplus or unsuitable material shall be disposed off by the Contractor, in spoil banks, waste area as designated and directed by the Director (GTS) / Engineer.

Disposal of surplus/unsuitable-excavated material shall include loading, unloading, transporting, stacking, leveling and sloping the material in disposal area as directed by the Director (GTS) / Engineer.

Disposal lead shall be measured from the leveling and grading limits shown on the Drawings by following shortest route to be determined by the Director (GTS) / Engineer.

2.5 Leveling and Grading of Area

Leveling and grading of the excavated area shall be done by means of leveling equipment and grading machines. The Contractor shall be responsible for the required construction and

stability of the grades and slopes of the area in conformity with the Drawings/Plans or as determined by the Director (GTS) / Engineer.

2.6 Extra Excavation

In the event the Contractor excavates any area to a level lower than the required, he shall re-instate such areas to the required densities levels and grades. No extra payment will be made to the Contractor on this account.

2.7 Contractor to bear Damages

The Contractor shall conduct all excavation operations in a safe and prudent manner in order to avoid and prevent damage to any surrounding property and to vegetation (outside the project area). All damages caused by the Contractor's operations shall be repaired by the Contractor at his cost and to the satisfaction of the Director (GTS) / Engineer.

3. FILL

3.1 Fill Materials

Areas requiring filling shall be filled with material consisting of selected material obtained from the required excavations or from the out side sources as designated by the Director (GTS) / Engineer for the purpose and all filling material shall be free from debris, tree roots and such other objectionable substances and to the satisfaction of the Director (GTS) / Engineer. All filling shall be deposited in layers of 6 to 8 inches. The material shall have maximum plastic index of 6 and maximum liquid limit of 25.

3.2 Scarifying of the Surfaces

Prior to placing first layer of filling the existing and stripped surfaces shall, if so required by the Director (GTS) / Engineer, be scarified to a depth of not less than 6 inches and compacted to the required density. The cost thereof shall be deemed to have been included in the rates for the items of leveling and grading.

3.3 Variation in Filling Requirements

All filling shall be done as specified herein above. During progress of work it may be found necessary or desirable by the Director (GTS) / Engineer to vary the levels, elevations and grades of filling from those shown on the Drawings/Plans and the Contractor shall perform filling to the revised levels, elevations and grades as established by the Director (GTS) / Engineer.

3.4 Excess Filling

If the Contractor fills any area to the levels and grades greater than the required, he shall excavate and re-instate the surfaces and dispose off excess material as directed by the Director (GTS) / Engineer, at his cost.

3.5 Placement

Fill to be placed shall be clay, silt, sand, gravel and various combinations thereof obtained from the required excavations and shall be placed to achieve as much as possible a homogeneous fill to the satisfaction of the Director (GTS) / Engineer.

The fill material shall be spread parallel to the existing ground surfaces in layers of uniform thickness not exceeding 20 cm before compaction.

The water content of the fill, prior to and during compaction, shall be uniform throughout in each layer of material. Contractor shall control the water content of fill between three percent points below and two percent points above the laboratory optimum water content as determined by the compaction test designated ASTM D 1557.

If the water content of the fill is less than that specified, water shall be added to the fill and the

fill worked with a harrow, scarifier, or other approved equipment until the water is uniformly distributed throughout the layer and the water content of the fill satisfies the requirements of these specifications.

3.6 Compaction

All fills shall be compacted to 95% modified AASHTO density. The in-place density shall be determined by the sand cone method in accordance with ASTM Designation D-1556. The Maximum Density is defined as the maximum dry weight in kilogram per cubic meter as determined by the ASTM D-1557.

Equipment, suitable and adequate for uniform compaction to the specified densities, must be on hand and approved by the Director (GTS) / Engineer before any fill operations are started by the Contractor. All compaction equipment must be in good working order and any defective equipment shall immediately be replaced or repaired to the satisfaction of the Director (GTS) / Engineer, Earth moving and other equipment not specifically manufactured for compaction purposes will not be considered as compaction equipment.

When the moisture content of the layer is within the limits as determined by the Director (GTS) / Engineer for proper compaction, the entire surface shall be compacted with the appropriate type of roller or compactor until the specified density has been obtained. In no case, shall the number of passes of the roller over each portion of the fill area be less than the number specified or as required by the Director (GTS) / Engineer for achieving the specified density.

A pass of a piece of compaction equipment over any area is defined as a direct vertical contact of the compactor wheel, tire, drum or plated load upon all elements of that area in such a manner as to assure complete coverage of the area- No successive layers shall be placed until the layer under construction has been brought to the required density and has been approved by the Director (GTS) / Engineer. In areas inaccessible to the equipment designated in the foregoing sections, other types of compaction equipment shall be used, as approved by the Director (GTS) / Engineer. For other types of compaction equipment used in areas of limited space, the minimum number of passes required on all portions of each successive layer shall be determined by the Director (GTS) / Engineer after appropriate field tests to evaluate the efficiency of the equipment. The use of hand tamps will not be permitted.

To minimize the effect of precipitation on placed fill, the surface shall be rolled smooth prior to any suspension of operations. During spreading and compacting, the fill surface shall be provided with a grade of not less than 3 percent to ensure drainage of surface water.

If the surface of any compacted layer of fill is too dry or, in the opinion of the Director (GTS) / Engineer, too smooth to bond properly with the layer of material to be placed thereon, the layer shall be wetted and worked with a harrow, scarifier, or other approved equipment, to a sufficient depth to provide a satisfactory bonding surface, before the succeeding lift is placed,

If the surface of any compacted layer of fill is too wet or lump to allow proper compaction of the fill to be placed thereon, it shall be reworked with harrow, disc, or other approved equipment or mixed with drier fill material to reduce the water content until it satisfies the requirements of these specifications. The reworked fill shall be re-compacted to the requirement of these specifications at his own cost, before any succeeding layer of fill is placed thereon and at no additional cost to the Employer.

Any compacted layers of fill which have suffered a reduction in density due to the action of precipitation, or for any other reason, shall be worked and re-compacted to the requirements of these specifications before spreading and compacting operations are resumed.

Construction traffic shall be routed such that ruts are not formed on the surface of any layer. If ruts are formed, they shall be graded level and recompact to the requirements of these specifications.

Any and all materials which do not meet the requirements as specified for fill and accumulated on the surface of any layer or prepared foundation, shall be removed by the Contractor at his own cost before any material is placed in the succeeding layer.

Special care shall be exercised in placing and compacting fill material immediately adjacent to pipe to avoid damage either to the pipe or its alignment. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced at Contractor's expense.

3.7 Inspection

Field inspection and testing will be carried out jointly by the Contractor and the Director (GTS) / Engineer. Contractor shall facilitate the inspection and the performance of these tests and bear all costs thereof.

3.8 Tolerances

Finished surface shall be smooth and even and shall not vary more than 50 mm in 3 meters from true profile and cross section or more than 25 mm at any individual point

4. WATERING

4.1 Description

Under this item the Contractor shall furnish all equipment, labor, materials and make all necessary arrangements for storing, supplying, transporting, distributing and applying water required in the compaction of excavated areas & fills and all other incidental operations and purposes of construction and completion of the works. The equipment shall consist of pumps, pipe lines, hoses, pressure sprinklers and all other necessary items. Suitable pressure regulating devices shall be applied so that the water pressure may be adjusted to any specific application.

4.2 Application and use of Water

Water may be applied by equipment or by labor at the locations in the amount and during the hours (including nights) as directed by the Director (GTS) / Engineer. The supply of the water shall be adequate to cater all the requirements specified here in or directed by the Director (GTS) / Engineer. The distributor used for watering shall be equipped with a spray bar and shall be of ample capacity and of such design as to ensure uniform application of water in the amounts directed by the Director (GTS) / Engineer. Water supplied through employment of labor shall also be in accordance with the direction of Director (GTS) / Engineer.

4.3 Quality of Water

The sources of water shall be approved by the Director (GTS) / Engineer. Water shall be free from silt, organic matter, alkali, salts and other impurities and shall conform to AASHTO 26.

The Contractor shall not use water from shallow, muddy or marshy surfaces. The quality of water shall be subject to the approval of the Director (GTS) / Engineer.

***** END OF SECTION*****

EARTHWORKS

1. SCOPE

The work under this section of the specifications consists of furnishing all plant, labor, equipment, appliances and materials and in performing all operations in connection with earthworks of all foundation for structure & services line trenches including stock piling of suitable excavated material, disposal of unsuitable and surplus excavated material in accordance with this section of specifications, the applicable drawings and subject to terms and conditions of the Contract.

2. GENERAL

2.1 The Contractor shall acquaint himself with the nature of the ground, existing structures, foundations and subsoil, which might be encountered during excavation or earthworks. The Employer does not guarantee or warrant in any way that the materials to be found in the excavation will be similar in nature to that of any samples which may have been exhibited or indicated in the Report, Drawings or in any other Contract Documents or to material obtained from boring or trial holes. The Contractor shall be deemed to have made local and independent inquiries as to, and shall take the whole risk of, the nature of the ground subsoil or material to be excavated or penetrated and the Contractor shall not be entitled to receive an extra or additional payment nor to be relieved from any of his obligations by reasons of the nature of such ground subsoil or material.

2.2 All excavations, cut and fills shall be constructed to the lines, levels and gradients specified with necessary allowance for consolidation, settlement and drainage so that at the end of the Period of Maintenance the ground shall be at the required lines, levels and gradients. During the course of the Contract and during the Period of Maintenance any damage or defects in cuts and fills, in structures and other works, caused by slips, falls of wash-ins or any other ground movement due to the Contractor's negligence shall be made good by the contractor at his own cost.

3. SITE PREPARATION

3.1 The Contractor shall set out the works and shall be responsible for true and perfect setting out of the same and for correctness of the positions, levels, dimensions and alignments of all parts thereof. If at any time any error in this respect shall appear during the progress of the works, the Contractor shall at his own expense rectify such error.

3.2 The Contractor shall construct and maintain accurate bench marks so that the lines and levels can be easily checked by the Director (GTS) / Engineer.

3.3 The Contractor shall construct and maintain such ditches, in addition to those shown on the plans, as will adequately drain areas under construction.

3.4 The Contractor shall perform a joint survey with the Director (GTS) / Engineer's Representative, of the area where earthwork is required, plot the ground levels on the drawings and obtain approval from the Director (GTS) / Engineer before starting the earthwork.

4. FOUNDATION FOR STRUCTURE

4.1. Excavations

4.1.1 Excavation shall include the removal of all material of every name and nature. Excavations shall be carried out in accordance with excavation plans and sections shown on the Drawings.

4.1.2 The major portion of excavations shall be carried out by mechanical excavators and excavated materials disposed off to stock on spoil as per Drawings or as directed by the Director (GTS) / Engineer. The excavation which cannot be done by mechanical means shall be done by manual tools Unless otherwise specified by the Director (GTS) / Engineer, leveling, trimming and finishing to the required levels and dimensions shall be done manually. The material suitable for fill and backfill if approved by the Director (GTS) / Engineer shall be stockpiled within the free haulage limit of the project boundary of the works.

- 4.1.3 The Contractor shall give reasonable notice that he intends to commence any excavation and he shall submit to the Director (GTS) / Engineer full details of his proposals. The Director (GTS) / Engineer may require modifications to be made if he considers the Contractor's proposals to be unsatisfactory and the contractor shall give effect to such modifications but shall not be relieved of his responsibility with respect to such work.
- 4.1.4 For major excavations, the Contractor shall submit for the prior approval of the Director (GTS) / Engineer full details and drawings showing the proposed method or procedure, supporting and strutting, etc. The design, provision, construction, maintenance and removal of such temporary works shall be the responsibility of the Contractor and all cost in these respects shall be included in the quoted unit rate for the permanent work.
- 4.1.5 The Contractor's attention is drawn particularly to his obligations under the General Conditions of Contract in respect of those works which are in close proximity to existing buildings,
- 4.1.6 The Contractor shall preserve the completed excavation from damage due to slips and earth movements, ingress of water from any source whatsoever and deterioration by exposure to the sun and the effects of the weather.
- 4.1.7 All excavation of every description, in whatever material encountered shall be performed to the elevations and dimensions shown on the Drawings in such a manner as to avoid interruption to work in other parts of the site. The Contractor shall be responsible for injury to the other works caused during excavation period
- 4.1.8 Excavation shall extend to adequate distance from walls and footings to allow for placing and removal of forms, installations of services and for inspection, except where the concrete for walls and footings is authorized to be deposited directly against excavated surfaces. Undercutting will not be permitted.
- 4.1.9 AH excavations in foundations shall be taken to 150mm above the final excavation elevations shown on the drawings and the last 150mm shall be trimmed carefully to a smooth and level surface. Immediately after trimming to the final elevation, a layer of blinding concrete shall be placed to the thickness shown on the drawings. All excavations for foundations which have been trimmed and disturbed shall be compacted and covered by lean concrete by the end of the day. It is specifically brought to the notice of the Contractor that any excavation taken down to the trimmed elevation overnight or for any length of time thereafter uncovered by the blinding concrete, shall be required to be trimmed to such lower elevation as directed by the Director (GTS) / Engineer and any extra work or any consequent increase in the quantities caused thereby shall not be paid to the Contractor.
- 4.1.10 No excavation shall be covered nor any permanent work commenced until the foundation has been inspected by the Director (GTS) / Engineer and his permission to proceed is given,
- 4.1.11 If excavations for sub-structures are carried below the required level, as shown on the Drawings or as directed by the Director (GTS) / Engineer, the surplus depth shall be filled in with concrete of same grade as of blinding concrete at the sole cost of the Contractor.
- 4.1.12 All excavation shall be performed in the dry. The placing of blinding concrete, placing of reinforcement and casting of the permanent works in the excavation shall be carried out in the dry and the Contractor shall have sufficient dewatering equipment for this purpose. Adequate precautions shall be taken to prevent any erosion due to undercutting from underneath the previously constructed adjoining foundations.
- 4.1.13 Shoring, where required during excavation, shall be installed to protect workmen and the bank, adjacent paving, structures and utilities. The term shoring shall also be deemed to cover whatever methods the Contractor elects to adopt, with prior approval of the Director (GTS) / Engineer, for upholding the sides of excavation and also for planking and strutting to excavation against the side of roadways and adjoining properties In

existing hardcore of any other material. The Contractor will be held responsible for upholding the sides of all excavations and no claim for additional excavation, concrete or other material will be considered in this respect.

The Contractor shall locate all the existing utilities prior to starting excavation and submit to the Director (GTS) / Engineer for approval. He should coordinate with various government or other agencies in this regard.

- 4.1.14 Existing utility lines that are shown on the drawings or the locations of which are made known to the Contractor prior to excavation and that are to be retained, as well as utility lines constructed during excavation and backfilling, and if damaged, shall be repaired by the Contractor, in coordination with relevant agency, at his own expense. Lines which are not known to the Contractor in sufficient time to avoid damage, if inadvertently damaged during excavation, shall be repaired by the Contractor and adjustment in payment will be made as approved by the Director (GTS) / Engineer. When utility lines which are to be removed, are encountered within the area of operations the Contractor shall notify the Director (GTS) / Engineer in ample time for the necessary measures to be taken to prevent interruption of the service.
- 4.1.15 Excavated material suitable for use as fill and backfill shall be stockpiled within free haulage limit of the project boundary as directed by the Director (GTS) / Engineer. This stockpiled material shall be transported back to places requiring fill or backfill.
- 4.1.16 Excavated material unsuitable for use as fill and backfill shall be disposed off, by the Contractor at locations approved by the Director (GTS) / Engineer within specified free haulage limit.
- 4.1.17 The excavation work shall include the excavation in above water table and excavation below water table. The Contractor shall submit the proposal for dewatering from the areas of excavation for the approval of the Director (GTS) / Engineer and shall provide all plant, equipment, pumps, sheeting, well points as required to keep the water table 1 meter below the deepest foundation as shown on the drawings till the completion of foundation works, all in accordance with the specification section 1200.
- 4.1.18 The Contractor shall make independent enquiries and perform and make independent observations to ascertain the water table in the areas of excavations during the period when the construction works are in progress. The Contractor shall take whole risk of any nature for fluctuation of the water table from his own findings. The Employer does not bind himself in any way and shall not be responsible for any information given by him or any information, observations or values obtained from his reports, Drawings, and Documents or anywhere in this Document.
- 4.1.19 Excavation shall be performed within the tolerances for excavation limits indicated on the drawings. Where no tolerance limits are indicated excavation shall be performed to tolerances established by the Director (GTS) / Engineer as acceptable for the design and type of work involved.

4.2. Fill and Backfill

- 4.2.1. After completion of foundation footing, foundation, walls and other construction below the elevation of the final grades and prior to start filling forms shall be removed and the excavation shall be cleaned of trash and debris.
- 4.2.2. The fill/backfill shall include filling under the floors and around the foundations.
- 4.2.3. The fill/backfill shall include loading, unloading, transporting, placing, stacking, spreading of earth, watering, rolling, Ramming and compacting, etc., complete as specified herein.
- 4.2.4. Filling under floor shall do with approved selected material obtained from required excavation or outside sources. It shall be predominantly granular material and free from slurry mud, organic or other unsuitable matter and capable of compaction by ordinary means
- 4.2.5. The Contractor shall provide the approved quality backfill and fill material required to

complete the specified fill and backfill from the places designated by the Director (GTS) / Engineer. The material shall have maximum plastic index of 6 and maximum liquid limit of 25

- 4.2.6. Filling in foundations shall be placed in 150mm layers and compacted at optimum moisture content by mechanical means or other means as approved by the Director (GTS) / Engineer.
- 4.2.7. Material for fill/backfill shall be as approved by the Director (GTS) / Engineer and shall be placed in layers not exceeding 150mm measured as compacted material and saturated with sufficient water and compacted to produce In-situ density not less than 95% of the maximum dry density at optimum moisture content, achieved in Test No. 15 of RS 1377 : 1975.
- 4.2.8. All fill areas shall be left neat, smooth and well compacted, the top surface consisting of the normal site surface soil, unless otherwise directed.
- 4.2.9. Depending on the capacity of the compacting equipment the Director (GTS) / Engineer may instruct increased thickness of successive layers to be placed.
- 4.2.10. Fill shall not be placed against foundation walls prior to approval by the Director (GTS) / Engineer. Fill shall be brought up evenly on each side of the walls as far as practicable. Heavy equipment for spreading and compacting the fill shall not be operated closer to the wall than a distance equal to the height of the fill above the top of footing or as directed by the Director (GTS) / Engineer.
- 4.2.11. In case the Contractor has to arrange the till material from outside sources the quality of the till material will be subject to the approval of the Director (GTS) / Engineer. The Director (GTS) / Engineer shall require the Contractor to carry out various tests of the fill material. All such tests shall be made at an approved laboratory at the cost of the Contractor.
- 4.2.12. FIII/Backfill of foundations shall be carried out only after the structural works within the excavations have been inspected, tested and approved by the Director (GTS) / Engineer.
- 4.2.13. Before the start of fill & backfill the Contractor shall satisfy himself as to the levels and slopes of the fills and backfills shown on the Drawings, the requirements of compaction, the possibility of settlement and all other particulars what so ever in connection of the filling works.
- 4.2.14. If it is found necessary to alter the moisture content of the fill material in any way being bumpy or otherwise, then, very strict control shall be exercised over the wetting and/or the drying process and frequent moisture content tests shall be carried out,
- 4.2.15. The upper 300mm thick layer of natural soil shall be scarified and compacted to 95% of modified AASHTO T-180 before tilling the area upto plinth level of the building/structures.
- 4.2.16. Tolerances the surface of compacted backfill/fill shall be smooth and even and gradual irregularity shall not vary more than 2 inches in 10 feet length and abrupt irregularity shall not be more than one inch.

5. SERVICE LINE TRENCHES

5.1 Excavation

- 5.1.1 All excavation shall be made to the lines, levels and grades shown on the drawings or established by the Director (GTS) / Engineer.

The sides of trench shall be as nearly vertical as practical. If found necessary by the Director (GTS) / Engineer a side slope on either side of the trench may be permitted for a trench equal to or greater than 6 feet depth so that the average width of the trench

does not exceed 5 feet. Bell holes and depressions for joints shall be dug after the bottom of trench has been graded. Bell holes and depressions shall only be of such length, depth and width as required for properly making the particular type of joints as shown on the drawings or as directed by the Director (GTS) / Engineer. The bottom of trench shall be properly graded and compacted with approved compacting equipment. Stones, protruding edges etc. shall be removed. When unsuitable material is encountered in the bottom of the trench, such material shall be removed to the required depth and the trench backfilled to proper grade and required level with coarse sand or other approved material.

If the Contractor excavates beyond the required depth it shall be backfilled with approved material and thoroughly compacted at the expense of the Contractor.

- 5.1.2 Before starting the excavation, the Contractor shall ensure the correct alignment of the pipeline on the ground the depth and width of excavation of the trench, all in accordance with the drawings and instructions of the Director (GTS) / Engineer. The Contractor shall make profile with cement concrete pillars.
- 5.1.3 Excavation shall be carried out true to lines, levels, grades and widths as shown on the drawings or as directed by the Director (GTS) / Engineer ensuring proper laying of the pipe line, the bedding fill, construction of chambers for appurtenances and any other structures. The trench bottom shall be graded to provide even and substantial bearing over the specified bedding and of the structure.
- 5.1.4 The Contractor, at his cost shall provide to the satisfaction of the Director (GTS) / Engineer all timbering, approved supports, shores and bracing to the sides of the excavated trench and foundations in such a manner so as to secure the sides of the trench and excavations from falling or adverse movement All responsibility connected with such shoring shall rest with the Contractor.
- 5.1.5 Without the written permission of the Director (GTS) / Engineer, not more than 100m of the trench shall be opened in advance of the completed pipeline,
- 5.1.6 The bottoms of all excavations shall be carefully leveled. Any pockets of soft or loose material in the bottoms of the trenches shall be removed and the cavities so formed filled with lean concrete at the Contractor's expense.
- 5.1.7 During excavation, material suitable for back filling shall be stockpiled in an orderly manner at sufficient distance from the excavated trenches for reuse in backfill,
- 5.1.8 All necessary precautions shall be taken to properly maintain the excavation while it is open and exposed. If necessary, grading shall be done to prevent surface water from flowing into trenches and any water accumulated therein shall be removed by pumping or other approved methods. If ordinary open cut excavation is not possible or advisable, sheeting and bracing shall be furnished and installed in such excavations to prevent damage and delay of work and to provide safe working conditions. Shheeting and bracing shall be removed as the work progresses.
- 5.1.9 If for any reason, the levels, grades or profiles of the excavations are changed adversely, the Contractor shall, at his own cost, be liable to bring the excavations to the required levels and profiles as shown on the drawings or as directed by the Director (GTS) / Engineer.

5.2 Backfill and Compaction

- 5.2.1 Backfilling and compaction of trench bottoms shall be done in the following three stages.
 - I Prior to lowering the pipe into the trench, 150mm thick compacted layer of approved sand will be placed over properly graded and compacted bottom of the trench wherever required.
 - II Coarse sand shall be placed and compacted around and over the pipe after it has been properly laid and tested as directed by the Director (GTS) / Engineer.

III Backfilling of the remaining trench will be done in layers with the approved material as specified herein.

- 5.2.2 The material for Backfilling required herein above will be sand as specified in the section "Concrete". The material for backfilling in stage III will be the same as that for stages I and II, if it is under paved areas. In all other cases, stage III material shall be in accordance with the following specifications.

All the material shall be clean excavated earth or quarry spoil from trenches or from other approved borrow areas shall not contain stones, organic matters, cinders and refuse that would prevent proper compaction or cause subsequent settlement.

- 5.2.3 The backfill material shall be placed evenly and carefully around and over the pipes in layers not exceeding 150mm. When the material has been conditioned and placed as specified, each layer shall be thoroughly and carefully rammed with tamper of adequate size and weight and watered if necessary for proper compaction. Backfill shall be done by hand until a thickness of 300mm has been compacted over the pipe. The remaining backfill may be done with machine. The degree of compaction desired will be at least 95 percent of maximum dry density.

The Contractor shall be responsible for any damage to installations caused by his operations in compacting of backfills and any damage to the pipe and fitting shall be repaired by the Contractor at his own expense.

- 5.2.4 Backfill designated to be compacted shall be compacted to 95% in-situ density with respect to maximum density to the lines, levels and grades as shown on the drawings or established by the Director (GTS) / Engineer, The Contractor's operations in the placing of backfill designated to be compacted shall be such as will result in an acceptable gradation of material when placed for use in backfill.

- 5.2.5 Prior to and during placement operations, the material shall have the optimum moisture content required for the purpose of compaction, as determined by the Director (GTS) / Engineer, and the moisture content shall be uniform throughout each layer. If the moisture content is less than optimum for compaction, or if the soil is lumpy, the moisture content shall be supplemented by sprinkling and reworking the material at the site of compaction. If the moisture content is greater than optimum for compaction the material shall be dried by reworking, mixing of the dry material or other approved means.

- 5.2.6 The material obtained from excavation shall be reused for backfilling brought from the stockpile with approval of the Director (GTS) / Engineer.

6. DISPOSAL OF SURPLUS EXCAVATED MATERIAL

- 6.1 The rejected unsuitable material and surplus excavated material shall be disposed off out of boundary limits from any lead as directed by the Director (GTS) / Engineer.
- 6.2 The disposal of surplus/unsuitable-excavated material shall include loading, unloading, transporting, stacking, spreading and leveling as directed by the Director (GTS) / Engineer.

***** END OF SECTION*****

DEWATERING

1. SCOPE OF WORK

The work to be performed under this item shall consist of supplying all labor, materials and plant and the performance of all work necessary for lowering and continuously Controlling the piezometric levels of the groundwater in the subsurface material as well as the control and handling of surface water, in such a manner as to maintain the bottom and slopes of the excavations for the structures in a stable condition, and to permit the structures excavation and construction to be performed in the dry, and as shown on the excavation and dewatering drawings. Dewatering drawings to be prepared by the Contractor for foundations as specified herein and as required by the Director (GTS) / Engineer.

The Contractor shall build, maintain and operate all berms, channels, flumes, sumps and other temporary diversion and protective works needed to divert the surface water through or around the required excavations.

All excavations shall be de-watered and kept free of standing water, water seeping from the sides and bottom of the excavations above the free level or excessively muddy conditions as needed for proper execution of the excavation operations. The contractor shall furnish, install, operate and maintain all drains, sumps, pumps and other equipment needed to de-water the excavation areas. Dewatering methods that cause a loss of fines from the bottom and slopes of the excavations will not be permitted.

The work shall include designing, supplying, installing, operating and maintaining a system of wells complete with pumps and associated equipment, standby power arrangements, piezometers and all other equipment necessary to achieve the required control of the ground water and surface water in the areas as shown on the drawings, as specified herein and as required by the Director (GTS) / Engineer. The work shall also include the construction and maintenance of ditches and sumps as required to achieve the specified results.

2. DEFINITIONS

Prior to commencement of the work, the Contractor shall furnish the Director (GTS) / Engineer for review and comments with complete plans and sketches for diverting surface water and dewatering of the required excavation Contractor shall submit detailed design calculations where required to provide safe and stable excavations is the sole responsibility of the Contractor. Submission for review and comments of the required plans and sketches and any approval from Director (GTS) / Engineer shall not relieve the Contractor of any of his duties under the Contract.

The Dewatering System shall consist of the Basic De-watering System, the Standby Dewatering System, Standby Power System, monitoring devices, ditches, sumps, pumps and all associated equipment as specified herein.

The basic Dewatering System shall be the minimum dewatering system required to achieve the specified results.

The Standby Dewatering System shall be that system which may be required to achieve the specified results should part or all of the Basic Dewatering System becomes ineffective for maintenance or any reason other than a failure of the power supply.

The Standby Power System shall be that independent generating system which may be required to keep the dewatering system fully operational in the event of a power failure.

3. DESIGN OF DEWATERING SYSTEM

The Contractor shall arrange to have the entire Dewatering system designed in detail, installed, maintained and operated by qualified and experienced personnel throughout the course of the work.

Two weeks prior to commencement of installation of the Dewatering System, Contractor shall submit to the Director (GTS) / Engineer for his review & comments, complete final plans, details and description of the Dewatering System.

The Contractor shall be responsible for the arrangements and location of the various Dewatering System components necessary to accomplish the specified work.

The Director (GTS) / Engineer's approval of the installed Dewatering System will be based on the demonstrated performance of the system and the effectiveness with which it satisfies the requirements for dewatering the foundation areas during the entire period upto required elevation.

Approval of the Dewatering System by the Director (GTS) / Engineer shall in no way relieve the Contractor from the responsibility for satisfying the entire dewatering requirements as specified herein and to the satisfaction of the Director (GTS) / Engineer.

4. **DEWATERING THE EXCAVATIONS**

The Contractor shall install, maintain and operate a system of bells, trenches and pumps as required to perform the excavations for the areas and subsequent construction of the structures and placement of backfill, in the dry.

The dewatering of the excavations shall be accomplished in a manner that will prevent seepage, boils, loss of fines, erosion, softening of the strata, and that will maintain the stability of the bottom and slopes of excavation. Should any damage to the work, in the opinion of the Director (GTS) / Engineer, be due to the inadequacy or failure of the Dewatering System, in part or in whole, then the supply of all labor, materials and plant, and the performance of all work necessary to carry out additional or remedial work resulting from such damage shall be undertaken by the Contractor at no additional compensation, the cost of any damage caused to the structures or the permanent works like structures and machinery and other equipment due to the failure of the dewatering system shall be borne by the Contractor and shall be covered by proper insurance to be provided by the Contractor and in accordance with insurance clauses of the "General Conditions of Contract".

The Dewatering System shall be designed to operate on a continuous basis in such a manner that during excavation, the water level as observed in all piezometers installed near the periphery of the excavation with their tips located below the prevailing excavation level, is at-least one meter below the prevailing excavation level. If the water level observed in any or all of the piezometers is higher than that specified, the excavation shall be halted until remedial measures to the Dewatering System have been effected and the specified water levels in the piezometers attained or until the Contractor demonstrates to the satisfaction of the Director (GTS) / Engineer that it is safe to proceed with the excavation. Piezometers tips shall be installed near the bottom of the hole drilled for that purpose.

During construction of structures and subsequent backfill placement and associated work operations, the Dewatering System shall operate on a continuous basis in such a manner that the water level, as observed in the piezometers located below the level of construction and backfill placement is atleast one meter below the lowest point of construction and backfill placement and the water level in the piezometers is maintained at such level till the concrete if any, has sufficiently hardened and until in the opinion of the Director (GTS) / Engineer, it is safe to allow the water level to rise upto a predetermined level.

The Dewatering System shall be maintained in operating condition so as to achieve the specified results until the construction of the structures and the backfill placement at all points, and installation of machinery and other associated equipment and embedded parts has reached a stage when, in the opinion of the Director (GTS) / Engineer Dewatering is no longer required. Thereafter, the Dewatering system shall shut off in stages as directed by the Director (GTS) / Engineer. The Contractor shall not permit the accumulation of surface water within the confines of the excavation areas, the Contractor shall control, remove and divert surface water runoff, and water discharging from the Dewatering System away from the excavations, to a point outside the working area as required by the Director (GTS) / Engineer.

The Contractor shall perform all work including, but not limited to, the construction and maintenance of ditches and sumps and provide, install, maintain and operate pumps and pipelines of adequate capacity as are necessary for the effective control of surface runoff and groundwater, not required to be intercepted by the Dewatering System.

The Contractor shall supply, install, maintain and operate as required, the generators for power supply which shall be of sufficient capacity to maintain all pumps and equipment for both the Basic and Standby Systems, operating on a continuous basis.

The Contractor shall supply, install and maintain an alarm system which will alert responsible personnel at the time of power failure and at the same time will automatically activate the standby power units.

The Dewatering System shall be designed in such a manner that all or parts of the Standby System may be directly connected to the Basic System. If during construction, it becomes necessary to make this connection, the Contractor shall expeditiously perform all work necessary to resolve the Standby Dewatering System to the requirements as hereto fore specified.

The Standby Dewatering System shall be operated for a period of atleast 3 hours duration each week to demonstrate its complete effectiveness. For such demonstration no payment or compensation shall be paid to the Contractor.

5. **OBSERVATIONS**

Contractor's Dewatering System shall include the supply, installation, data recording and maintenance of piezometers as may be required to demonstrate the satisfactory performance of the Dewatering System.

In order to ascertain the continuous effectiveness of the Dewatering System, Contractor shall supply all equipment and perform all work necessary to obtain and correlate records of the water elevation in each of the piezometric observation wells as well as records of the discharges from the Dewatering System. These data shall be obtained on a continuous basis and shall be properly compiled and copies of the compiled data shall be submitted to the Director (GTS) / Engineer daily, or as required. The contractor shall also keep the Director (GTS) / Engineer advised on a daily or as required basis on the equipment being utilized to effect the required results during the entire period when the Dewatering System is in operation.

6. **MEASUREMENT**

The measurement for the item of dewatering shall be made as a complete job. This will include but not limited to all works performed in connection with provision, installation, operation and maintenance etc. of the complete Dewatering System consisting of basic Dewatering System, Standby Dewatering System together with Standby Power arrangements. The item also includes transportation of all plant, equipment, supply and personnel to the site and making ail the necessary arrangements for satisfactory performance of the Dewatering System as specified and directed by the Director (GTS) / Engineer. The provision of safety measure required for excavation of the work and any insurance to cover the life and property shall also be considered as part of this item for the purpose of measurement. All the works involved for designing of the Dewatering System will be deemed included under this item for measurement.

7. **PAYMENT OF WORK**

No payment shall be made for the Works involved within the scope of this Section of Specifications unless otherwise specifically stated in the Bills of Quantities or herein. The cost thereof shall be deemed to have been included in the quoted unit rate of other items of the Bills of Quantities.

***** END OF SECTION*****

SOLING

1. SCOPE OF WORK

The work to be done under this section of specifications consists of furnishing all plant, labour, equipment, appliances, materials and performance of all operations required in connection with the construction of stone or brick bottoming in strict accordance with the specifications and Drawings and/or as directed by the Director (GTS) / Engineer. The scope of this section of specifications is covered with detailed specifications as laid down herein.

2. MATERIAL

2.1 Stone

Stone to be used shall comprise of strong, hard, durable stone of the specified/approved size, free from impurities, quarry sap, dust, dirt and solubility characteristics. The stone shall be obtained from approved quarries and shall be sound, free from laminations and weak cleavages.

2.2 Clay Bricks

First class burnt bricks with minimum compressive strength of 1400 psi. Bricks should not be over or under burnt and should produce ringing sound.

3. CONSTRUCTION

3.1 Preparation of Sub-grade

Sub-grade shall be formed of suitable materials free of clods, roots, stumps, bush or other objectionable material.

Sub-grade material shall be placed in successive layers not exceeding 6 inch. (150mm) in thickness loose measure, and each layer shall be thoroughly compacted to give the specified density.

The sub-grade will be compacted at optimum moisture content and loose pockets, if any, cut-out and refilled with selected materials in layers not more than 6 inch. (150mm) thick and formed to levels and grades shown on the Drawings.

Compaction shall be done by approved methods consistent with the soil/material to be compacted.

The maximum dry weight density of the sub-grade shall not be less than 95% of Modified AASHTO requirements.

Maximum density is defined as the maximum dry weight density as determined by ASTM Designation D-1557 (MOD-AASHTO).

3.2 Stone or Brick Ballast Soling

The stone/brick ballast shall be well graded having a maximum size or 2 inch (50mm). It should be graded down to 3/4 inch (20mm).

3.3 The soling material shall be laid and packed to even grades and well rolled to a consolidated thickness as shown on the Drawings.

The whole of the surface of the compacted stone bottoming will be blinded with or any other approved gritty material, after the interstices have been filled with smaller size stones, so as to effectively fill in the voids and crevices, watered, if necessary and again thoroughly rolled with the same roller to produce a smooth and even surface free from irregularities, true to line and level.

Care is to be taken to avoid any damage to existing structures, mains or pipes while rolling operation is in progress. In places inaccessible for a roller, compaction shall be done by hand tampers weighing not less than 9 kg or power rammers as directed by the Director (GTS) / Engineer.

***** END OF SECTION*****

TERMITE CONTROL TREATMENT

1. SCOPE

The scope of work for anti termite treatment includes injection of insecticide in sides and bottom of foundation trenches, spraying on stockpiled backfill material and injections of the insecticide in floor sub-grade of the building. The scope also covers treatment of all wood works with insecticides before installation in position.

2. MATERIAL

- 2.1 An approved emulsible concentrate insecticide shall be used for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a diluent.
- 2.2 All mixing shall be done at site and mixing proportion of insecticide with water shall be in accordance with the approved manufacturer's recommendations and shall be verified by the Director (GTS) / Engineer.
- 2.3 Pure turpentine shall be used for dilution of insecticide, in approved proportion for application to woodwork.

3. QUALITY ASSURANCE

- 3.1 In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for the work, including preparation of substrata and application.
- 3.2 A professional operator shall be engaged who shall have license in accordance with regulations of governing authorities for application of soil treatment solution.

4. EXTENT OF APPLICATION

- 4.1 Contractor to ensure a continuity of treatment under and around the footings and upto the slab on grade in the form of an envelop.
- 4.2 Insecticide solution shall be applied with approved pressure spraying equipment maintaining a pressure of 150 psi to all applications to, on or in earth.
- 4.3 Soil treatment shall begin after all work of preparation of earth prior to installation of concrete has been done. After application, no additional earth moving or work upon sub grade should be done. No covering of earth or concrete should be applied over soil treatment until at least 24 hours after treatment has been made.
- 4.4 Insecticide solution should not be applied during wet weather, or when the earth surface is excessively wet. Application should be made to all areas beneath concrete slabs-on-grade, including sidewalks and paving abutting buildings for distance of at least 6 feet beyond building line. Rate of application of the solution shall be as per the recommendations of the manufacturer. Insecticide shall penetrate to a depth of 1 inch. (25mm) minimum in porous earth at bottom and atleast 50mm at the sides of excavations.
- 4.5 Sides of foundation excavations, grade beam, and similar areas shall be treated with solution at a rate of 0.5 lit per square feet upon inner sides of such excavations, and at all locations where concrete slabs for platforms and similar work abut the building. Similar treatment shall be made at all locations where expansion Joints, control joints, column bases and similar work occur at or below grade slabs.

- 4.6 In the areas of application signs shall be fixed to show that soil treatment has been applied. Such signs shall be removed when areas are covered by other construction.

Care shall be exercised to insure that no marks or damage occurs to the finished structure as a result of the work under this section.

All woodwork for the entire project is to be insecticide treated (before application of solignum). Insecticide shall be sprayed on all surfaces of all the wooden work viz., door frames, blocking, furring, planks, boards etc. before installation. Spraying is to be done at the site, after delivery and before installation. No spraying shall be necessary after field sawing, jointing or installation of such material.

5. STANDARDS

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

SAMPLES AND TESTS

The Contractor shall supply samples of all the materials to be used for insecticide control for approval of the Director (GTS) / Engineer and testing in accordance with the specified standards. Rejected materials shall be removed from the site immediately.

6. GUARANTEE

The Contractor is to guarantee that the building shall be free from termites (white ants), wood bores and other pests, which cause damage to wood or other organic material for 7 years from the date of acceptance of the building.

In the event of any damage caused within the guaranteed 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.

***** END OF SECTION*****

FORMWORK

1. SCOPE

The work under this section of the Specifications consists of furnishing all plant, labor, equipment, appliances and materials and in performing all operations in connection with the supply and installation of formwork for the purpose of shuttering in concreting work, complete in strict accordance with this section of the specifications and the applicable drawings and subject to the terms and conditions of the Contract.

2. GENERAL

It shall be the responsibility of the Contractor to perform the work by engaging well-trained and experienced staff or by the sub contractor who shall have enough number of well-trained and experienced staff to coordinate his activities with the other operations. However the Contractor shall be responsible for the quality of work performed by the sub-contractor as per the requirements of these specifications.

3. MATERIALS

The Contractor shall use the following formwork materials for different purposes as stated below:

3.1 Timber

Form framing, sheathing and shoring.

3.2 Plywood

Form sheathing and panels.

3.3 Steel

- Heavy forms and false work
- Column and joint forms

3.4 Form Ties Anchors and Hangers

For securing form work against placing loads and pressures

3.5 Coatings

Facilitate form removal.

3.6 Steel Joints

For formwork support.

3.7 Steel Frame Support

For formwork support.

4 DELIVERY AND STORAGE

4.1 Delivery

The delivery of formwork materials shall be done in such a manner that damage can be prevented.

4.2 Storage

Formwork should be stored, after cleaning and preparing for re-use if used before in such a manner that access to all different materials is available.

Material, which can be affected by weathering, shall be stored in appropriate building or under covers and shade.

5. WORKMANSHIP

- 5.1 Forms shall be used, wherever necessary, to confine the concrete and shape it to the required dimensions. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete and shall have sufficient rigidity to maintain specified tolerances.

The main architectural theme is to retain the concrete as the finished facade material. The Contractor therefore shall realize a special and perfect formwork. The drawings set out details and locations of these special formwork. The Director (GTS) / Engineer shall refuse any formwork and any part of the building, which has been constructed with a non-approved formwork. The Director (GTS) / Engineer shall refuse any concreting which will not be perfect or may not conform to the approved model.

- 5.2 Earth cuts shall not be used as forms for vertical surfaces of reinforced concrete work unless required as such or permitted by the Director (GTS) / Engineer.
- 5.3 Mud centering shall not be permitted without the prior approval of the Director (GTS) / Engineer.
- 5.4 Formwork shall be of wrought timber, steel, plywood, proprietary building boards and such special materials, as may be shown on the drawings or approved by the Director (GTS) / Engineer, which give the required finish to the surface of concrete. Wooden formwork shall be free from loose knots and shall be well seasoned.
- 5.5 The formwork shall conform to the shape, lines and dimensions as shown on the plans, and be so constructed as to remain sufficiently rigid during the placing and compacting of the concrete, and shall be sufficiently tight to prevent loss of liquid from the concrete.

The design and Director (GTS) / Engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor. Where necessary, to maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads.

The Contractor shall establish and maintain in an undisturbed condition and until final completion and acceptance of the project, sufficient control points and benchmarks to be used as references for checking upon tolerances.

- 5.6 Requirements for 'facing materials' are given in the Section relevant to 'Finishing of Formed Surfaces'. The maximum deflection effacing material reflected in concrete surfaces exposed to view shall be $1/240$ of the span between structural members.
- 5.7 Where natural plywood-form-finish, grout-cleaned-finish, smooth-rubbed-finish, scrubbed-finish, or sand-floated-finish is required, forms shall be smooth (faced with plywood, liner sheets, or prefabricated panels) and true to line, in order that the surfaces produced will require little dressing to arrive at true surfaces. Where any as-cast finish is required, no dressing shall be permitted in the finishing operation.
- 5.8 Where as-cast surfaces, including natural plywood-form-finish are specified, the panels of material against which concrete is cast shall be orderly in arrangement, with joints between approved relation to openings, building corners and other architectural features.
- 5.9 Where panels for as-cast surfaces are separated by recessed or otherwise emphasized Joints, the structural design of the forms shall provide for locating form ties, where possible, within the joints so that patches of tie holes will not fall within the panel areas,
- 5.10 Forms shall not be re-used if there is any evidence of surface wear and tear or defect, which would impair the quality of the surface finish. Forms shall be thoroughly cleaned and properly coated before re-use.
The formwork shall be designed so that the soffits of slabs and sides of beams, columns, and walls may be removed first, leaving the forms to the soffits of beams and their supports in position.
- 5.11 Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Unless otherwise specified in the Contract Documents chamfer strips shall be placed in the corners of forms to produce beveled edges on permanently exposed surfaces. Interior corners on such surfaces and the edges of formed joints will not require beveling unless required by the Contract Documents.
- 5.12 Positive means such as wedges or jacks for accurate adjustment and for proper removal of shores and struts shall be provided and all settlement shall be monitored during concrete placing operation. Forms shall be securely braced against lateral deflections.
- 5.13 Where concreting of thin members is required to be carried out within formwork of considerable depth, temporary openings in the sides of the formwork shall be provided where necessary to facilitate the placing and consolidation of concrete. Small temporary openings shall also be provided at the bottom of the formwork for columns, walls and deep beams to permit the cleaning

out of debris and observation immediately before concrete is deposited,

- 5.14 Form ties shall be constructed so that the ends or end fasteners can be removed without causing appreciable spalling at the faces of the concrete. After the ends or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 2 diameter or twice the minimum dimension of the tie from the formed faces of concrete to be permanently exposed to view and in no case shall this distance be less than 3[^] inch. (20 mm). When the formed face of the concrete is not to be permanently exposed to view, form ties may be cut off flush with the formed surfaces.

Through bolts may be permitted provided that they are greased to allow for easy withdrawal and the holes subsequently made good. Through bolts are not to be used on water retaining structures.

- 5.15 At construction joints contact surface of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by no less than 1 inch (25 mm). The forms shall be held against the hardened concrete to prevent offsets or loss of mortar at the construction joint so as to maintain a true surface.
- 5.16 Wood forms for wall opening shall be constructed to facilitate loosening, if necessary to counteract swelling of the forms.
- 5.17 Wedges used for final adjustment of the forms prior to concrete placement shall be fastened in position after the final check.
- 5.18 Formwork shall be so anchored to shores or to other supporting surfaces or members that upward or lateral movement of any part of the formwork system during concrete placement will not occur.
- 5.19 Runways or planks for moving labor and equipment shall be provided with struts or legs and shall be supported directly on the formwork or upon the structural member without resting on the reinforcing steel.
- 5.20 All surfaces of forms and embedded materials shall be cleaned of any accumulated mortar or grout from previous concreting and of all other foreign material before placing fresh concrete.
- 5.21 Forms shall be sufficiently tight to prevent leakage of grout or cement paste. Board forms having joints opened by shrinkage of the wood shall be removed and replaced. Plywood and other wood surfaces not subject to shrinkage shall be sealed against absorption of moisture from the concrete by either (1) a field applied, approved form oil or sealer, or (2) a factory applied non-absorptive liner. When forms are coated to prevent bond with concrete, it shall be done prior to placing of the reinforcing steel. Excess coating material shall not be allowed to stand in puddles in the forms nor allowed to come in contact with the concrete against which fresh concrete will be placed. Care shall be taken that such approved composition is kept out of contact with the reinforcement. Where as-cast finishes are required, materials, which will impart a stain to the concrete shall not be applied to the form surfaces. Where the finished surface is required to be painted, the material applied to form surfaces shall be compatible with the type of paint to be used.
- 5.22 For reinforced concrete, in no circumstances shall form until the concrete attains strength of at least twice the stress to which the concrete may be exposed at the time of striking

The strength referred to shall be that of concrete using the same cement and aggregates, with the same proportions, and cured under conditions of temperature and moisture similar to those obtaining in the work. Where possible, the formwork should be left for longer time, as it would assist the curing.

In normal circumstances (generally where temperatures are above 20 degree C/(168°F) and where ordinary cement is used, forms may be struck after expiry of the following periods.

Walls, columns and vertical sides of beams.	48 hours or as may be decided by the Director (GTS) / Engineer.
Side of slabs (shores of props left under).	2 Days.
- Beams soffits (shores or props left under).	
- Removal of shores or props to slabs	12 Days.
1. Spanning upto 13 ft. (4 meter)	12 Days
2. Spanning over 13 ft. (4 meter)	
- Removal of shores or props to beams.	16 Days

- Spanning upto 20 ft. (6 meter)	
2. Spanning over 20 ft. (6 meter)	18 Days 28 Days

For rapid hardening cement 3/7 of the above period will be sufficient in all cases except vertical sides of slabs, beams and columns which should be retained for a minimum of 24 hours.

The number of shores or props, their sizes and disposition shall be such as to be able to safely carry the full dead load of the slab and beams, as the case may be.

Proper allowance shall be made for the decrease in rate of hardening of concrete in cold weather and the above minimum duration must be increased when the mean daily temperature is below 20 degree C.

- 5.23 When repair of surface defects or finishing is required at an early age forms shall be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations.
- 5.24 Top forms on sloping surfaces of concrete shall be removed as soon as the concrete has attained sufficient stiffness to prevent sagging. Any needed repairs or treatment required on such sloping surfaces shall be performed at once and be followed by the specified curing.
- 5.25 Wood forms for wall openings shall be loosened as soon as this can be accomplished without damage to the concrete.
- 5.26 All formwork shall be removed without such shock or vibration as would damage the reinforced concrete. Before the top plank and struts are removed, the concrete surface shall be exposed where necessary in order to ascertain that the concrete has sufficiently hardened. Proper precautions shall be taken to allow for the decrease in the rate of hardening that occurs with all cement in the cold weather.
- 5.27 When reshoring or repropping is permitted or required, the operations shall be planned in advance and shall be subject to approval. While reshoring is underway no live load shall be permitted on the new construction.

In no case during reshoring shall concrete in beam, slab, columns or any other structural member be subjected to combined dead and construction loads in excess of the load permitted by the Director (GTS) / Engineer for the developed concrete strength at the time of reshoring.

Reshores shall be placed as soon as practicable after stripping operations are complete but in no case later than the end of working day on which stripping occurs.

Reshores shall be tightened to carry their required loads without overstressing the construction. Reshores shall remain in place at least until tests representative of the concrete being supported has reached the strength specified in sub- clause 5.23 hereof.
- 5.28 Floors supporting props or shores under newly placed concrete shall have their original supporting props or shores left in place or shall be reshored. The reshoring system shall have a capacity sufficient to resist the anticipated loads and in all cases shall have a capacity equal to at least one half the capacity of the shoring system above. The reshores shall be located directly under a shore position above unless other locations re permitted.
- 5.29 The reshoring or re-propping shall extend over a sufficient number of stories to distribute the weight of newly place construction live loads in such a manner that the design superimposed loads of the floors supporting shores or props are not exceeded.
- 5.30 It is generally desirable to give forms for reinforced concrete an upward camber to ensure that the beams or slabs (specially cantilever slabs) do not have a sag when they have taken up their deflection, but this should not be done unless permitted by the Director (GTS) / Engineer.
- 5.31 No loads, other than man and light plant required in connection with the actual work in hand, shall be allowed on suspended floors until 28 days after concreting where ordinary Portland Cement is used and 14 days when rapid hardening Portland Cement is used.

***** END OF SECTION*****

REINFORCEMENT

1. SCOPE

The work under this section of specifications consists of furnishing, cutting, fabricating, bending and placing steel reinforcement as shown on the drawings or as directed by the Director (GTS) / Engineer. The scope of this section of specification is covered with detailed specifications as laid down herein.

2. APPLICABLE STANDARDS

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

Pakistan Standard

PS 241 Tensile Testing of Steel.

PS244 Bend test for Steel

PS 580 Rolled deformed Steel bars (intermediate grade) for concrete reinforcement.

PS605 Rolled deformed steel bars (hard grade) for concrete reinforcement.

PS 606 Rolled deformed Steel bars (structural grade) for concrete reinforcement.

PS607 General technical delivery requirement for steel.

British Standard

BS 693 General requirements for Oxy-acetylene welding of mild steel.

BS 785 Hot rolled bars and hard drawn wire for the reinforcement of concrete.

BS 1856 General requirement for the metal arc welding of mild steel.

BS 4449 Hot rolled steel bars for reinforcement of concrete

BS 4461 Cold worked steel bars for reinforcement of concrete.

BS 4466 Bending dimensions and scheduling of bars for the reinforcement of concrete.

ASTM Standard

A 305 Minimum requirement for the deformations bars for concrete reinforcement.

A 615 Deformed billet steel bars for concrete reinforcement.

ACI315 Manual of standard practice for detailing reinforced concrete structure.

ACI 318 Building code requirements for reinforced concrete.

In addition to the above, the latest editions of other Pakistan Standards, British standards, American Concrete Institute Standards, American Society for Testing and Materials Standards and other standard as may be specified by the Director (GTS) / Engineer for Special Material and construction are also relevant.

3. MATERIAL AND SIZE OF BARS

- 3.1 Reinforcement for concrete shall conform to the respective Pakistan, British, ASTM, or other Standards as specified in the Drawings and in the Contract Documents or as may be specified by the Director (GTS) / Engineer.
- 3.2 Unless otherwise specified, all plain reinforcing bars shall comply with the requirements of BS 4449 for plain mild steel bars and shall have a minimum characteristic strength of 40,000 psi.
- 3.3 Unless otherwise specified, all deformed reinforcing bars shall comply with the requirements of BS 4461 for deformed cold worked new stock billet steel bars and shall have a minimum characteristic strength of 60,000 psi.
- 3.4 Reinforcement of all types is to be stored on Site in an approved manner so as to avoid damage.
- 3.5 Steel wire mesh reinforcement shall conform to requirements of ASTM Designation A 185-64 or BS 4483, 1969: Standard Specifications for Welded Steel Wire Fabric for concrete reinforcement. It shall be used where shown on the Drawings.
- 3.6 Reinforcement shall be free from all loose or flaky rust and mill scale, or coating, including ice, and any other substance that would reduce or destroy the bend. Reduced section steel reinforcement shall not be used.

4. DELIVERY & STORAGE

4.1 Delivery

Steel reinforcement bars shall be kept in bundles firmly secured and tagged.

4.2 Storage

The method of storage shall be approved by the Director (GTS) / Engineer. Reinforcing bars shall be stored in racks or platforms above the surface of ground and shall be protected free from scaling, rusting, oiling, coatings, damage, contamination and structural defects prior to placement in works. Bars of different diameters and grades of steel reinforcement shall be kept separately,

5. BAR BENDING SCHEDULES

The Contractor shall prepare bar bending schedules of all the reinforcing steel bars and these bar bending schedules shall be submitted to the Director (GTS) / Engineer for his approval. The Contractor shall obtain approval of the bar bending schedules before starting actual bar bending works.

6. FABRICATING, BENDING & PLACING

- 6.1 All metal for reinforcement shall be free from loose mill scale, loose rust, mud, oil, grease, or other harmful matter immediately before the concrete is placed.
- 6.2 Reinforcement is to be accurately placed as shown in the drawings, and secured against displacement by using 16 gauge G.I wire ties or suitable slips at intersections and supported from the formwork by using concrete, metal or plastic chairs and spacers or hangers of an approved pattern- Where concrete blocks are used for ensuring the cover, they shall be made of mortar not leaner than 1 part of cement to 2 parts of sand.

Where the concrete surface will be exposed to the weather in the finished structure, the portions of all accessories in contact with the form work shall be galvanized or shall be made of plastic.
- 6.3 Bars used for concrete reinforcement shall be fabricated in accordance with the dimensions shown in the bar bending schedule approved by the Director (GTS) / Engineer.
- 6.4 The cutting tolerance for all bars shall be ± 1 inch. (± 25 mm).

6.5 Where an overall or an internal dimension of a bent bar is specified in the schedule, the bending tolerance, unless otherwise stated, shall be as in Table 1.

Table 1 : Bending Tolerances

Dimensions of bent bars		Tolerances	
Over	Up to & including	Plus	Minus
Inches	Inches	Inches	inches
„	40	¼	1/4
40	80	¼	3/8
80	-	¼	1

6.6 Bars shall be placed to the following tolerances:

1. Concrete cover to formed surfaces	± 1/4"	(±6mm)
2. Minimum spacing between bars	± 1/4"	(±6mm)
3. Top bars in slabs and beams.		
a. Members 8 inch deep or less	± 1/4"	(±6mm)
b. Members more than 8 inch but not over 24 inch deep	± 3/8"	(±10mm)
c. Members more than 24 inch deep	± 1"	(±25mm)
4. Cross wise members: speed evenly with in:	2"	(50 mm)
5. Length wise members:	± 2"	(±50mm)

6.7 Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to approval of Director (GTS) / Engineer.

6.8 Vertical bars in columns shall be offset at least one bar diameter at lapped splices. To ensure proper placement, templates shall be furnished for all column dowels.

6.9 Reinforcement shall not be bent or straightened in manner that will injure the material.

No bars shall be bent twice in the same place, nor shall they be straightened after bending.

Unless permitted, by Director (GTS) / Engineer, reinforcement shall not be bent after being partially embedded in hardened concrete.

6.10 No splice of reinforcement shall be made except as shown on the working drawings.

6.11 Welding shall be permitted for bars only under suitable conditions and with suitable safeguards in accordance with BS 693, BS 1856, or AWS D12.1, provided the type of reinforcement bar has the required welding properties. Tack welding may be used to fix in position bars that cross each other, only with prior approval of the Director (GTS) / Engineer.

6.12 Exposed reinforcement intended for bonding with future extensions is to be effectively protected from corrosion. Protection is also to be provided to reinforcement partly built into concrete where the exposed part is to be built into later concrete.

6.13 No concreting is to be carried out until the reinforcement has been checked and approved by the Director (GTS) / Engineer.

6.14 Welding shall be done as in section 'Structural Steel Works'.

6.15 All detailing shall be done as per ACI standards ACI-315 and ACI-318.

7 Concrete clear cover for reinforcing steel shall be as follows:

8	Structural Members	Minimum Cover, inch	
a)	Concrete cast against and permanently exposed to earth	3inch	(75 mm)
b)	Concrete exposed to earth or weather:		
	Bar Dia > 3/4" (20mm)	2 inch.	(50 mm)
	Bar Dia < 5/6" (16mm)	1-5/6inch.	(40 mm)
c)	Concrete not exposed to weather or in contact with ground:		
	Slabs, Walls	3/4 inch	(20 mm)
	Beams, Columns: (Primary Reinforcement)	1-5/6 inch	(40 mm)

All reinforcing steel shall be held firmly in place before and during the placing of concrete by means of wires and supports adequate to prevent displacement during the course of construction.

***** END OF SECTION *****

PLAIN AND REINFORCED CONCRETE

1. SCOPE

The work under this section of the specification consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with the supply, manufacturers, transporting, placing, consolidating and curing of plain & reinforced concrete and its constituents. Reinforcing steel does not form part of this section and is described in section "2200".

2. GENERAL

- 2.1 Trades like electrical, mechanical, plumbing etc. shall be well coordinated. Contractor shall take approval of coordinated shop drawings prior to concrete pouring.
- 2.2 Suitable templates or instructions or both shall be provided for setting out of items not placed in the forms. Embedded items and other materials for mechanical and electrical operations shall have been completed, inspected, tested and approved before concrete is placed.
- 2.3 For special concrete finish and for special methods of construction, formwork shop drawings shall be designed and prepared by the Contractor, at his own cost. Approval of shop drawings as well as that of actual samples of concrete finish shall be obtained before work is commenced.

3. APPLICABLE STANDARDS

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

3.1 Pakistan Standards

PS233	Portland Cement (ordinary & rapid hardening)
PS243	Natural aggregates for concrete
PS279	Abrasion of coarse aggregates by the use of Los Angeles machine.
PS280	Determination of aggregates crushing value
PS281	Organic impurities in sand for concrete aggregate.
PS282	Material finer than No. 200 BS test sieve in aggregates, method of test for
PS283	Soundness test for aggregates by the use of sodium sulphate or magnesium sulphate.
PS284	Sampling aggregates for concrete
PS285	Sieve or screen analysis of fine and coarse
PS286	Description and classification of mineral aggregates
PS421	Sampling fresh concrete
PS422	Slump test for concrete
PS560	Making and curing concrete compression test specimen in the field. Sulphate-resistant Portland cement type 'A' and sampling fresh concrete in the laboratory.
PS612	Mixing
PS716	Compacting factor test for concrete
PS717	Defi(ions and terminology of cements
PS746	Making and curing concrete compression test cubes.
PS849	

3.2 ASTM (American Society for Testing and Materials)

3.3

C33	Concrete Aggregates.
C40	Organic impurities in sand for concrete.
C87	Effect of organic impurities in fine aggregates on strength of mortar.
C88	Soundness of aggregates.
C94	Ready mixed Concrete.
C 109	
C 117	Compressive strength of hydraulic cement mortars

C 123	Material finer than No. 200 (0.075mm) sieve
C 125	Light weight pieces in aggregates.
C 127	Concrete and concrete aggregates.
C 128	Specific gravity and absorption of coarse aggregate.
C 131	Specific gravity and absorption of fine aggregate.
C 136	Resistance to abrasion of small size coarse aggregate.
C 142	Sieve or screen analysis of fine and coarse aggregate.
C 143	Clay lumps and friable particles in aggregates.
C150	Slump of Portland Cement Concrete
C156	Portland Cement
C171	Water retention by concrete curing material
C185	Sheet material for curing concrete.
C188	Air content or hydraulic cement mortar.
C191	Density of hydraulic cement.
C260	Time of setting of hydraulic cement by vicat needle
C289	Air entraining admixture for concrete.
C309	Potential reactivity of aggregate.
C494	Liquid membrane forming compounds for curing concrete.
C535	Chemical admixtures for concrete.
C75	Resistance to abrasion of large size coarse aggregates.
C994	Aggregate sampling.
C1190	Preformed expansion joint filler for concrete.
C1715	Concrete joint sealer (hot poured elastic type). Preformed expansion joint filler for concrete paving and structural concrete.
D1850	Concrete joint sealer (cold application type).
E11	Wire cloth sleeves for testing purposes.
E96	Water vapour transmission of materials in sheet form.
E154	Materials for use as vapour barrier under concrete slabs.
E337	Relative humidity by wet and dry bulk psychrometer.

3.3 **ACI (American Concrete Institute)**

211	Recommended practice for selecting proportions for normal and heavy weight concrete.
214	Quality control charts
301	Specifications for structural concrete for building.
304	Recommended practice for measuring, mixing, transporting and placing concrete. Hot weather concreting.
305	Recommended practice for curing concrete.
308	Recommended practice for consolidation of concrete
309	Manual of standard practice of detailing reinforcement concrete structure.
315	Building code requirement of reinforced concrete. Recommended practice for concrete formwork.
318	
347	

3.4 **British Standards**

BS 12	Portland cement, ordinary and rapid hardening
BS 410	Test Sieve
BS 812	Methods for the sampling and testing of mineral aggregates, fine sand filters Concrete aggregate from natural sources
BS 822 & 1210	Method of testing concrete
BS 1881	Test for water making concrete
BS 1348	Expanded polystyrene borads
BS 3837	Rigid expanded polyvinyl chloride for thermal insulation.
BS 3869	Sulphate-resisting Portland cement
BS 4027	Structural use of concrete
CP 8110	Structural use of reinforced concrete in buildings
CP 114	

In addition, the latest editions of other Pakistan and British Standards, American Concrete Institute Standards, American Society for Testing and Materials Standards and other Standards as may be specified by the Director (GTS) / Engineer for special Materials and Construction are also relevant.

4. MATERIALS

4.1 Aggregates

Contractor shall run requisite physical and chemical tests of coarse and fine aggregates and submit to the Director (GTS) / Engineer for approval.

- 4.1.1 The sources of supply of all fine and coarse aggregates shall be as specified or approved by the Director (GTS) / Engineer.
- 4.1.2 All fine and coarse aggregates shall be clean and free from clay, loam, silt and other deleterious matter. If required, the Director (GTS) / Engineer reserves the right to have them washed by the Contractor at no additional expense. Coarse and fine aggregates shall be delivered and stored separately at site. Aggregates shall not be stored on muddy ground or where they are likely to become dirty or contaminated. They shall be placed on sloped hard strata to ensure well drained at all times.
- 4.1.3 Fine aggregate shall be hard coarse sand, crushed stone or gravel screenings and shall conform to requirements of PS 243 and/or BS 882 and/or ASTM C-33. Only fine aggregate of grading zones 1 to 3 (BS882) shall be used.
- 4.1.4 Coarse aggregate shall be crush stone of hard, durable material free from laminated structure and conforming to PS 243 and/or BS 882 and/or ASTM C-33, graded as follows for use in mass concrete as in foundations:

Total Passing SB Sieve	Percent by Weight
76.20 mm (3 inch)	100
38.10 mm (1 - ½ inch)	95-100
19.05 mm (¾ inch)	30-70
9.52 mm (⅜ inch)	10-35
4.76 mm (⅜ inch)	0-5

Coarse aggregate for all cast-in-place concrete other than mass concrete as for foundations shall be graded with the following limits:

Total Passing SB Sieve	Percent by Weight
38.10 mm (1-1/2 inch)	100
19.05 mm (¾ inch)	95-100
9.52 mm (⅜ inch)	25-55
4.76 mm (⅜ inch)	0-10

- 4.1.5 Wherever feasible, the nominal maximum size of aggregate for cast-in-place reinforced concrete slabs and other members shall be ¾ inch. If there are difficulties in placing such a concrete the maximum size may be restricted to 1/2. Inch. Provided the requirements for strength are satisfied, as approved by the Director (GTS) / Engineer.
- 4.1.6 Except where it can be shown to the satisfaction of the Director (GTS) / Engineer that a supply of properly graded aggregate of uniform quality can be maintained over the period of the work, the grading of the aggregates shall be controlled by obtaining the ¾ inch maximum nominal size, the different sizes being stocked in separate stock piles and recombined in the correct proportion for each batch at the batching plant. The materials shall be stockpiled for a period before use so as to drain nearly to constant moisture content (as long as site and other conditions permit, preferably for at least a day). The grading of the coarse and fine aggregates shall be tested at least once for every 100 tons. supplied, to ensure that the grading is uniform and same as that of the samples used in the preliminary tests.

4.2 **Cement**

- 4.2.1 The cement shall be fresh and of approved origin and manufacture. It shall be one of the following as may be specified by the Director (GTS) / Engineer.
- Ordinary or rapid hardening portland cement complying with the requirements of P.S.232 or ASTM C-150.
 - Sulphate Resisting Portland/Cement complying with the requirements of P.S.612 or BS 4027 or ASTM C-150.
- 4.2.2 Unless otherwise specified, Ordinary Portland Cement complying with the requirements of BS.12 shall be used.
- 4.2.3 For all fair faced concrete it will be necessary to use an approved cement with a view to obtain a light shade concrete as approved by the Director (GTS) / Engineer.
- 4.2.4 The Contractor shall supply to the Director (GTS) / Engineer at fortnightly intervals, test certificates with the appropriate standard in respect of the samples of cement from the work site. These tests shall be carried out in a laboratory approved by the Director (GTS) / Engineer.
- 4.2.5 Only one brand of each type of cement shall be used for concrete in any individual member of the structure. Cement shall be used in the sequence of receipt of shipment, unless otherwise directed.
- 4.2.6 There shall be sufficient cement at site to ensure that each section of work is completed without interruption. If the cement is supplied by the Employer, the Contractor should inform the Employer, of his requirements sufficiently in advance of its use in construction.
- 4.2.7 Cement reclaimed from cleaning of bags or from leaky containers shall not be used.
- 4.2.8 The contractor shall provide and erect (at his cost) a suitable plain, dry, well-ventilated, weather- proof and water-proof shed of sufficient capacity to store the cement.
- 4.2.9 The cement shall be used as soon as possible after delivery and cement which the Director (GTS) / Engineer considers has become stale or unsuitable through absorption of moisture from the atmosphere or otherwise shall be rejected and removed immediately from the site at the Contractor's expense. Any cement in containers damaged so as to allow the contents to spill or permitting access of the atmosphere prior to opening of the container at the time of concrete mixing shall be rejected and removed immediately from the site at the Contractor's expense.
- 4.2.10 The mixing together of different types of cement will not be permitted.

4.3 **Water**

Water shall be tested in accordance with BS 3148 and shall be used only from an approved source.

The Contractor shall supply sufficient water for all purposes, including mixing the concrete, curing and cleaning plant and tools. Where water can be shown to contain any sugar or an excess of acid, alkali or salt, the Director (GTS) / Engineer may refuse to permit its use.

4.4 **Additive**

All additives such as foaming and water proofing agents shall be from a manufacturer approved by the Director (GTS) / Engineer.

Air Entraining Admixtures conforming to ASTM C260. and other Admixtures conforming to ASTM C494 shall be used subject to approval of the Director (GTS) / Engineer.

5. **NOMINAL CONCRETE MIXES**

5.1 **Proportions of Mix**

5.1.1 **Cement and aggregates:**

The cement, fine aggregate and the coarse aggregate shall be weighed separately. The proportions of cement to fine aggregate and coarse aggregate shall be adjusted so as to provide the concrete of the required crushing strength when tested as set out in Table 1

5.1.2 The Contractor shall prepare mix design of various grades of concrete for the approval or Director (GTS) / Engineer prior to starting concrete works. He shall regulate and arrange mixing of the ingredients of the concrete by weigh batching. The cost of designing the mix shall be borne by the Contractor.

5.1.3 **Water Cement Ratio:**

The quantity of water used shall be Just sufficient to produce a dense concrete of adequate strength and workability for its purpose. For all external work and foundations the water/cement ratio should not exceed 0.55.

5.1.4 **Workability:**

The workability shall be controlled by direct measurement of the water content, allowance being made for any water in the fine and coarse aggregates. The concrete shall be sufficiently workable to be placed and compacted, without difficulty, by the available means.

Workability shall be determined by either the slump or compaction factor tests as directed by the Director (GTS) / Engineer and these shall be performed in accordance with the methods given in PS 422 and P.S. 177 or ASTM C-143, The slump or compaction factor for each class of concrete shall be determined during the preliminary test mixes and the value obtained shall not be modified without the written consent of the Director (GTS) / Engineer, Unless otherwise permitted or specified, the concrete shall be proportioned and produced to have a slump of 3 inch or less if consolidation is to be by vibration. A tolerance of upto 1 inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, which ever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

5.2 Strength requirements for concrete

5.2.1 Concrete made with Portland cement shall comply with the strength requirements of Table 1. (Works Test).

Table: Strength requirements for Portland cement concrete with aggregate complying with BS 882.

Class of concrete (psi)	Cube strength at 28 days (psi)
A	4500
B	3750
C	3000
D	1500
E	1000

5.2.2 All structural concrete shall conform to BS 5328-81.

5.2.3 Unless otherwise stated, the types of concrete shall be classified on the basis of compressive strength

5.2.4 The Contractor shall provide Mix Design by weight for each class of concrete. Manufacture 12 Nos. test cubes 6" x 6" x 6" in accordance with the Mix design batching by weight and test 3 cubes each at 3,7,14 & 28 days intervals in the presence of Director (GTS) / Engineer's Representative and submit all relevant data and results of tests for approval of the Director (GTS) / Engineer. The Contractor shall obtain approval from the Director (GTS) / Engineer in writing for each Mix design before producing the actual concrete for the Works,

No payments for producing the Mix design, manufacture of test cubes and testing shall be made. The Contractor shall include this cost in the relevant item of concrete.

5.3 Batching

- 5.3.1 All cement, including cement supplied in bulk, shall be batched by weight. A bag of cement may be taken as 110 lbs. With the prior approval of the Director (GTS) / Engineer.
- 5.3.2 Aggregates shall be batched by weight, due allowance being made for moisture content. The apparatus for weigh batching may be an integral part of the mixer or a separate unit of a type approved by the Director (GTS) / Engineer. It shall be accurate within 2% and shall be checked for accuracy at least once a month.
- 5.3.3 The quantity of additives i.e. foaming and water proofing agents etc. shall be as prescribed by the manufacturer or as directed by the Director (GTS) / Engineer.
- 5.3.4 Where the batching plant is of the type in which cement and aggregates are weighed in the same compartment, the cement shall be introduced into the compartment between two sizes of aggregates.
- 5.3.5 Each batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue to flow for a period, which may extend to the end of the first 25 percent of the specified mixing time. Controls shall be provided to prevent batched ingredients from entering the mixer before the previous batch has been completely discharged.

5.4 Mixing

- 5.4.1 The concrete shall be mixed in an conforming to the requirements of BS 1305. It shall be fitted with the manufacturer's plate stating the rates, capacity and the recommended number of revolutions per minute and shall be operated in accordance therewith. It shall be equipped with a suitable charging mechanism and an accurate water-measuring device.
- 5.4.2 Mixing shall continue for the period recommended by the mixer manufacturer or until there is apparently a uniform distribution of the materials and the mass is uniform in colour, whichever period is longer. If it is desired to use a mixing period of less than 1-1/2 minute, the Director (GTS) / Engineer's approval shall be obtained in writing.
- 5.4.3 Controls shall be provided to ensure that the batch cannot be discharged until the required mixing time has elapsed. At least three quarters of the required mixing time shall take place after the last of the mixing water has been added.
- 5.4.4 The interior of the mixer shall be free of accumulations that will interfere with mixing action. Mixing blades shall be replaced when they have lost 10 percent of their original height.
- 5.4.5 Concrete shall be mixed only in quantities for immediate use. Concrete, which has set shall not be retempered, but shall be discarded.

5.5 Transporting

- 5.5.1 The concrete shall be transported from the place of mixing to the place of final deposit as rapidly as practicable by means which will prevent segregation or loss of or addition to ingredients. It shall be deposited as nearly as practicable in its final position so as to avoid rehandling or flowing. All skips vehicles, or containers used for transporting the concrete shall be thoroughly clean.
- 5.5.2 During hot or cold weather, concrete shall be transported in deep containers, on account of their lower ratios of surface area to mass, which reduces the rate of loss of water by evaporation during hot weather and loss of heat during cold weather.

5.6 Placing

- 5.6.1 Before placing of concrete, formwork completed; water shall have been completed; water shall have been removed reinforcement shall have been secured in place; expansion joint material, and other embedded items shall have been kept in position; and the entire preparation shall have been approved.

No concrete is to be placed into the foundation trenches until the ground to receive the same has been examined and approved by the Director (GTS) / Engineer for this purpose.
- 5.6.2 Concrete shall be deposited continuously, or in layer of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located as shown in the Contract Documents or as approved by the Director (GTS) / Engineer. Placing shall be carried out at such a rate that the concrete

which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened shall not be deposited. Temporary spreaders in forms shall be removed when the concrete placing has reached an elevation rendering their services unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior approval has been obtained.

- 5.6.3 The actual sequence of construction proposed by the Contractor shall be subject to the Director (GTS) / Engineer's approval before construction starts on any part of the structure, and this sequence shall not be varied without the Director (GTS) / Engineer's approval.
- 5.6.4 The concrete shall be placed as soon after it has been mixed as is practicable. Once the concrete has left the mixer, no more water shall be added, although the concrete may be mixed or agitated to help maintain workability. The concrete shall not be used if, through any cause, the workability of the mix at the time of placing is too low for it to be compacted fully and to an acceptable finish by whatever means available.
- The time between mixing and placing should be reduced if the mix is richer or the initial workability of the mix is lower than normal, if a rapid hardening cement or an accelerator is used, or if the work is carried out at a high temperature or exposed to a drying atmosphere.
- The Contractor shall ensure that the delay between mixing and placing does not exceed 45 minutes under any circumstances. Any concrete, which does not satisfy this requirement shall not be used.
- 5.6.5 The concrete shall be deposited as nearly as possible in its final position to avoid rehandling. In no circumstances may concrete be railed or made to flow along the forms by the use of vibrators. Concreting shall be carried on as a continuous operation using methods, which shall prevent segregation or loss of ingredients.
- 5.6.6 The free fall of concrete shall not be allowed to exceed 5 ft. (1.5m) and where it is necessary for the concrete to be lowered more than this depth, it is not to be dropped into its final position, but shall be placed through pipes fed by a hopper. When a pipe is used for placing concrete the lower end shall be kept inside, or close to the freshly deposited concrete. The size of the pipe shall be not less than 9 inches (225mm) diameter.
- 5.6.7 The workmen carrying concrete to the site, and all other workmen moving about on the reinforcement before the concrete is placed, shall move only along runways or planks placed for the purpose and no person shall be allowed to walk on the reinforcement itself.
- 5.6.8 Prior to the laying of concrete on load bearing masonry walls, bearing plates and at other points, as may be directed by the Director (GTS) / Engineer, the surface will be brought to a true, hard, smooth, level surface using cement sand mortar in the ratio of 1 part of cement to 3 parts of sand. Two layers of building paper will then be laid flat to separate the concrete from the surface on which it is to be laid.

5.7 Construction Joints

- 5.7.1 Concreting shall be carried out continuously up to construction Joints, the position and arrangement of which shall be predetermined by the Director (GTS) / Engineer.
- 5.7.2 Joints not shown on the drawings shall be so made and located as to least impair the strength of the structure and shall need prior approval of the Director (GTS) / Engineer. In general, they shall be located near the middle of the spans of slabs and beams unless a secondary beam intersects a main beam at this point, in which case the joint in the main beam shall be offset a distance equal to twice the width of the secondary beam. Joints in walls and columns shall not be at the underside of floor slabs or beams, and at the top of footings or floor slabs. Beams, brackets, columns, capitals, haunches and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.
- 5.7.3 All reinforcing steel shall be continued across joints. Key and inclined dowels shall be provided as directed by the Director (GTS) / Engineer. Longitudinal keys at least 1 -1/2 inch. (40mm) deep shall be provided in all joints in walls and between walls and slabs or footings.
- 5.7.4 When the work has to be resumed on a surface which has hardened, such surface shall be roughened in an approved manner which will expose the aggregate uniformly and will not leave laitance, loosened particles of aggregate or damaged concrete at the surface. Feather edges will be avoided.
- 5.7.5 The hardened concrete of construction joints and of joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in unexposed

walls and all others not mentioned herein shall be dampened (but not saturated) immediately prior to placing of fresh concrete,

- 5.7.6 The hardened concrete of joints in exposed work, joints in the middle of beams and slabs; and joints in work designed to contain liquids shall be dampened (but not saturated) and then thoroughly covered with a coat of cement grout similar in proportions to the mortar in the concrete. The grout shall be as thick as possible on vertical surfaces and at least 150mm thick on horizontal surfaces. The fresh concrete shall be placed before the grout has attained initial set.
- 5.7.7 Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle, and brushed, care being taken to avoid dislodgment of particles of aggregate. The surface shall then be coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 6 inches (150 mm) in thickness, and shall be well rammed against old work, particular attention being paid to corners and closed spots.

5.8 Expansion Joints

Expansion joints shall be provided wherever indicated on the Drawings. In no case shall the reinforcement, corner protection angles, or other embedded items be run continuous expansion joint.

All expansion joints shall be carefully placed so as not to be displaced during concreting. The method of placing the expansion joints shall be strictly in accordance with the Drawings and as approved by the Director (GTS) / Engineer. All materials for use in the expansion joints shall have, prior approval of the Director (GTS) / Engineer before placing order for supply.

5.9 Embedded Items

- 5.9.1 The material, design and location of waterstops in joints shall be as indicated in the Contract Documents. Each piece of premolded water stop shall be of maximum practicable length in order that the number of end joints will be held to a minimum.

Joints at intersections and at ends of pieces shall be made in the manner most appropriate to the material being used. Joints shall develop effective water-tightness fully equal to that of the continuous waterstop material, shall permanently develop not less than 50 percent of the mechanical strength of the parent section, and shall permanently retain their flexibility.

- 5.9.2 Electric conduits and other pipes which are planned to be embedded shall not, with their fittings, displace more than four percent of the area of the cross section of a column on which stress is calculated or which is required for fire protection. Sleeves, conduits, or other pipes passing through floors, walls, or beams shall be of such size or in such location as not to impair unduly the strength of the construction: such sleeves, conduits, or pipes may be considered as replacing structurally in compression the displaced concrete, provided that they are not exposed to rusting or other deterioration, are of uncoated or galvanized iron or steel not thinner than standard steel pipe, have a nominal inside diameter not over 50mm and are spaced not less than three diameters on centres, Except when plans of conduits and pipes are approved by the Director (GTS) / Engineer embedded pipes and conduits other than those merely passing through, shall not be larger in out side diameter than one third the thickness of the slab, wall, or beams in which they are embedded nor so located as to impair unduly the strength of the construction. Sleeve pipes, or conduits of any material not harmful to concrete and within the limitations of this section may be embedded in concrete with the approval of the Director (GTS) / Engineer provided they are not considered to replace the displaced concrete
- 5.9.3 All sleeves, inserts, anchors, and embedded items required for adjoining work or for its support shall be placed prior to concreting.
- All Contractors whose work is related to the concrete or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.
- 5.9.4 Expansion joint material, waterstops and other embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

5.10 Precast Concrete/Precast Jali

Precast concrete units shall be fair faced, cast to the sizes and dimensions as indicated on the Drawings. The concrete used for precast units shall conform to the specifications laid down for cast in situ reinforced cement concrete unless otherwise required and directed by the Director (GTS) / Engineer.

The Contractor shall be required to submit a sample of precast unit for the approval of the Director (GTS) / Engineer all precast units shall strictly conform to the approved sample.

Precasting platform of the size and at the location approved by the Director (GTS) / Engineer shall be constructed. The concrete in one pre- cast unit shall be placed in one operation, in accordance with the details shown on the Drawings.

The material and design of formwork and the method of pre- casting the units shall be approved by the Director (GTS) / Engineer.

The erection/installation and removal of the precast units from the precasting platform shall not be permitted until and unless they are properly cured to the satisfaction of the Director (GTS) / Engineer.

All precast units shall be smoothly finished to the required lines, grades, angles etc. Holes, grooves, pockets, hooks shall be provided as shown and/or as directed by the Director (GTS) / Engineer. The units shall be properly stacked on a platform without causing any cracks and damages. Curing of all the precast units shall be done in accordance with the relevant BSS/approval of the Director (GTS) / Engineer.

5.10.1 Erecting Precast Units

All the precast units shall be transported and erected into position in a manner as approved by the Director (GTS) / Engineer.

The Contractor shall submit his proposal in this regard and obtain approval from the Director (GTS) / Engineer in advance.

The units shall be embedded or otherwise installed in their permanent positions as shown on the Drawings or as directed by the Director (GTS) / Engineer.

5.10.2 Lifting Beams

The Contractor shall use lifting beams at his own cost, for erecting pre-cast members where the Director (GTS) / Engineer so directs. Lifting beams shall be supplied and erected by the Contractor, at his own cost, at all points where lifting is necessary for maintaining the plant but is inaccessible to mobile cranes or, alternatively, covered by overhead travelling cranes. The Contractor, however, is to supply the trolleys and erect them on the lifting beams, and to test operation of installed equipment.

5.11 Cement Concrete Pavements

For all concrete work relevant specifications of this section shall apply.

5.11.1 Side Forms and Construction

Side forms shall be of steel or any other suitable material and of a design as approved by the Director (GTS) / Engineer.

In general, only materials and methods that have proved their acceptability by past performance will be considered. All form shall be constructed so that they can be removed without hammering or prying against the concrete.

Horizontal joints in the forms will not be permitted. Forms shall be thoroughly cleaned and oiled with linseed/mineral oil or shall be given two coats of nitro-cellulose lacquer each time they are used.

The forms shall be set on a thoroughly compacted base true to lying and level and firmly secured in position by appropriate methods. Conformity with the alignment and levels shown on the Drawings shall be checked as and when required by the Director (GTS) / Engineer. Where necessary corrections shall be made immediately before placing the concrete; where any form has been disturbed it shall be reset and rechecked.

Pavements shall be constructed in panels of sizes as shown on the Drawings. The panels shall be laid alternately, the adjoining panels being concreted when the side forms are struck and the jointing materials placed, inspected and approved by the Director (GTS) / Engineer. Each panel is to be concreted in one operation and no interruptions shall be

permitted during the operation. The concrete shall be tipped from the trolley slightly in advance of the working place and then shoveled into position. The spreading shall be carried out very carefully. Compaction shall be done by means of vibro-compactors or approved surface vibrators. If a vibro-compactor is used, it shall be operated on the concrete and will not be allowed to strike or displace the forms. The spreading and compacting of the successive layers shall proceed without interruptions and as quickly as practicable so as to ensure that the slab is monolithic throughout its depth.

The wearing surface shall be laid while the base concrete is still wet and screeded to line and level. When the initial set takes place the surface shall be troweled smooth with a steel trowel to provide a dense closed surface.

All the joints shall be carefully formed as shown on the Drawings or as directed by the Director (GTS) / Engineer. The joint filler together with preformed groove shall provide complete separation of adjacent slabs. The joints shall all be sealed with bitumen as shown on the Drawings and as directed by the Director (GTS) / Engineer.

5.11.2 **Protection and Curing**

- **General Requirements :**

Concrete shall be protected adequately from injurious action by sun, rain, flowing water and mechanical injury, and shall not be allowed to dry from the time it is placed until the expiry of the minimum curing periods specified hereinafter. Water curing shall be accomplished by keeping the surface of the concrete continuously covering with water or with approved covering. Where wood forms are left in place for curing they shall be kept sufficiently damp at all times to prevent openings at the joints and drying out of the concrete. All portions of the structure shall be kept moist for the full curing periods, specified hereinafter.

When liquid membrane curing compound is used the surface of the concrete shall be protected from traffic or other abrasive action, that may break the membrane, for the full period of curing. The membrane curing compound shall be white colored and shall be approved by the Director (GTS) / Engineer and shall comply with ASTM Designation: C 309, type 2.

- **Curing Periods:**

The curing period shall be at least 10 days, or as directed by the Director (GTS) / Engineer.

- **Removal of Forms:**

The Contractor shall exercise great care in avoiding damage to joints, arises, dowel bars etc, while removing the forms. Under no circumstances will the use of pry bars between the forms and pavement be permitted. Side forms shall not be removed until at least 40 hours have elapsed from the time of completing the concreting of the slab which they contain, in no case shall forms be removed until the concrete has hardened sufficiently to permit removal without damage to the concrete. Concrete work shall be protected from damage during the removal of formwork and from injury resulting from the storage or movement of material during construction.

5.11.3 **Finishing**

All unformed surfaces shall be finished with a wood float except as otherwise specified. Visible vertical surfaces shall have all projections and irregularities removed. The entire surface shall be rubbed if required by the Director (GTS) / Engineer, with a No. 16 carborundum brick, or other abrasive until even, smooth and of uniform appearance, and shall be washed clean. Plastering of surface, application of cement or other coating will not be permitted.

All exposed corners shall be chamfered 1 inch x 1 inch. (25x25mm) Unless otherwise mentioned or show on the plans or directed by the Director (GTS) / Engineer will be covered with other materials shall be screeded without floating.

5.11.4 **Spreading, finishing and floating of concrete in pavements:**

- **General Requirements:** The striking off, compacting and floating of concrete shall be done by mechanical methods, if approved by the Director (GTS) / Engineer. Where the Director (GTS) / Engineer determines that it is impracticable to use mechanical methods, manual methods of spreading, finishing and floating may be used on pavement lines as indicated on the Drawings.

- **Mechanical Methods:**

The concrete shall be spread uniformly between the forms, immediately after it is placed, by means of an approved spreading machine. The spreader shall be followed by an approved finishing machine equipped with two oscillating or reciprocating screeds. The spreading machine or the finishing machine shall be equipped with vibrating equipment that will vibrate the concrete for the full paving width. Internal vibrators shall be used adjacent to the longitudinal edge of the pavement. These vibrators shall be attached to the rear of the spreading machine or to the finishing machine. Vibrators shall not rest on new pavements or side forms or in contact with any dowel bars, and the arrangement of power supply to the vibrators shall be such that when the motion of machine is stopped, vibration shall cease. The rate of vibration shall be not less than 8000 vibrations per minute. The concrete shall be spread to full width before being struck off and compacted so that the surface will conform to the finished grade and cross-section as shown on the plans and at the same time leave sufficient material for the floating operation. The spreading & finishing machine shall move over the pavement as many times and at such intervals as may be required by the Director (GTS) / Engineer to ensure thorough compaction.

Except as otherwise specified, after the pavement has been struck off and compacted, it shall be finished with an approved longitudinal float. The Contractor may use a longitudinal float composed of one or more cutting and smoothing floats, suspended from & guided by rigid frame. The frame shall be carried by four or more visible wheels riding on and constantly in contact with the forms.

The Contractor may use a longitudinal float which works with a sawing motion, while held in a floating position parallel to the road centre line and passing gradually from one side of the pavement to the other. Movements ahead, along the centre line of the road, shall be in successive advances of not more than half the length of the float.

Instead of using other type of longitudinal float a single machine which will affect satisfactory compaction, finishing and floating may be used. This machine may be towed by a spreading machine. This combination, finishing- floating machine shall be equipped with screeds and vibrators as hereinafter specified for spreading and finishing machine. Floating shall be accomplished by means of a non-oscillating float held in a suspended position from the frame.

If any spreading, finishing and floating equipment is not maintained in full working order or if the equipment as used by the Contractor proves inadequate to obtain the results prescribed, such equipment shall be improved or satisfactory equipment substituted or added at the direction of the Director (GTS) / Engineer.

- **General Requirement;**

The concrete shall be spread uniformly immediately after it is placed and shall be levelled and then struck-off to such an elevation that, when properly compacted, the surface will conform to the required grade and cross-section. The strike board shall be moved forward with a combined longitudinal and transverse motion, the manipulation being such that neither end is raised from the side forms during the process. While striking off, a slight excess of concrete shall be kept in front of the cutting edge at all times. Prior to tamping, the concrete along the forms shall be thoroughly spaded or vibrated. The entire area of pavement shall be tamped or vibrated in a manner that will ensure maximum compaction. The concrete shall be brought to the required grade and shape by the use of a tamper consisting of a heavy plank whose length exceeds the width of the pavement by 300mm or by the use of a mechanical vibrating unit spanning the full width of the spread. The tamper shall be constructed with properly trussed rods to stiffen it and prevent sag and shall be shod with a heavy strip of metal for a tamping surface. The tamper shall be moved with a combined tamping and longitudinal motion, raising it from side form and dropping it so that the concrete will be thoroughly compacted and rammed into place. A small surplus material is compacted and rammed into front of the tamper or vibrating unit and tamping or vibrating shall continue until the true cross-section is obtained and the mortar flushes slightly to the surface.

5.11.5 **Expansion and Construction Joints**

- i All the expansion and construction joints shall be carefully formed as shown on the Drawings or as directed by the Director (GTS) / Engineer. The joint filler together with the preformed groove shall provide complete separation of adjacent slabs or building. The preformed chase shall be thoroughly cleaned of all dust, debris, stones or other hard material.

- ii All joints are to be filled with flexcell expansion joint filler, or an approved elastic, compressible, durable, and rot-proof equivalent of sufficient rigidity to enable it to be satisfactorily installed in the joint and resist deformation during the passage of the concreting equipment. The filler is to be of the same thickness as the joint width.
- iii Construction joints shall be provided as shown on the Drawings, The assembly and method of constructing the expansion joints/construction joints shall be subject to the approval of the Director (GTS) / Engineer.

5.12 Consolidation

- 5.12.1 All concrete shall be consolidated by vibration, spading, rodding or forking so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall have a minimum frequency of 8000 vibrations per minute and sufficient amplitude to consolidate the concrete effectively. They shall be operated by competent workmen. Use of vibrators to transport within forms shall not be allowed, vibrators shall be inserted and withdrawn at points approximately 1 1/2 ft. (1/2 meter) apart. At each insertion, the duration shall be sufficient to consolidate the concrete but not excessive so as to cause segregation, generally from 5 to 15 sec. A spare Vibrator shall be kept on the job site during all concrete placing operations. Where the concrete is to have an as-cast finish, a full surface of mortar shall be brought against the form by the vibration process, supplemented, if necessary, by spading to work the coarse aggregate back from the formed surface.
- 5.12.2 If there is any tendency for the mix to segregate during consolidation, particularly if this produces excessive laitance, the mix proportions shall be modified to effect an improvement in the quality of the concrete to the satisfaction of the Director (GTS) / Engineer and in conformity with the provisions of Clause 5.
- 5.12.3 Vibrators shall not be allowed to touch the formwork or the reinforcing bars during consolidation operation.
- 5.12.4 Mechanical vibrators shall be of a type suited in the opinion of the Director (GTS) / Engineer to the particular conditions.
- 5.12.5 Over-vibration or vibration of very wet mixes is harmful and should be avoided.

5.13 Curing and Protection

- 5.13.1 Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures and mechanical injury, and shall be maintained with minimum moisture loss at a relative constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval of the Director (GTS) / Engineer
- 5.13.2 For concrete surfaces not in contact with forms, one of the following procedures shall be applied immediately after completion of placement and finishing:
 - 2 Ponding or continuous sprinkling.
 - 2 Application of absorptive mats or fabric kept continuously wet.
 - 2 Application of waterproof sheet materials approved by the Director (GTS) / Engineer
 - 2 Application of other moisture-retaining covering as approved.
 - 2 Application of a curing compound conforming to ASTM C 309 type 2. The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any water sheet which may develop after finishing has disappeared from the concrete surface. It shall not be used on any surface against which additional concrete or other material is to be bonded unless it is proved that the curing compound will not prevent bond, or unless positive measures are taken to remove it completely from areas to receive bonded applications.
- 5.13.3 Moisture loss from surface placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal, the vertical faces of concrete shall be cured until the end of the time prescribed in sub-clause 5.13.4 by one of the methods of sub-clause.

- 5.13.4 Curing in accordance with sub-clause 5.13.1 & 5.13.2 above shall be continued for at least 14 days in the case of all concrete except concrete with rapid- hardening Portland Cement for which the period shall be at least 3 days. Alternatively, if tests are made of cubes kept adjacent to the structure and cured by the same methods, moisture retention measures may be terminated when the average compressive strength has reached 70 percent of the minimum specified works cube strength. If one of the first four curing procedures of sub-clause 5.13,2 is used initially, it may be replaced by one of the other procedures of that sub-clause any time after the concrete is one day old provided the concrete is not permitted to become surface dry during the transition.
- 5.13.5 When the mean daily outdoor temperature is less than 41°F then temperature of the concrete shall be maintained between 50°F - 68°F for the required curing period of sub-clause 5.13.4. When necessary, arrangements for heating, covering insulation or housing the concrete work shall be made in advance of placement and shall be adequate required temperature without injury to Combustion heaters shall not be used during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gasses which contain carbon dioxide.
- 5.13.6 When necessary, provision for wind-brakes, shading for spraying, sprinkling, ponding or wet covering with a light coloured material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operation will allow.
- 5.13.7 Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 37°F in any one hour or 50°F in any 24 hour period.
- 5.13.8 During the curing period, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock and excessive vibrations. All finished concrete surfaces shall be protected from damage by construction equipment, materials or methods by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete. No traffic should be allowed on pavement for atleast 7 days after casting.

5.14 Works in Extreme Weather

- 5.14.1 Unless adequate protection is provided and approval is obtained, concrete shall not be placed during rain.

Rainwater shall not be allowed to increase the mixing water nor to damage the surface finish.
- 5.14.2 When the temperature of the surrounding air is expected to be below 41 degree F during placing or within 24 hours thereafter, the temperature of the plastic concrete, as placed, shall be no lower than 55 degree F for sections less than 300mm in any dimension nor 50 degree F for any other sections.
- 5.14.3 During hot weather, the temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints and should not exceed 90°F. When the temperature of the concrete exceeds 90°F precautionary measures approved by the Director (GTS) / Engineer shall be put into effect. When the temperature of the steel is greater than 122°F steel forms and reinforcement shall be sprayed with water just prior to placing the concrete ingredients shall be cooled before mixing, or flaked ice or well crushed ice of a size that will melt completely during mixing may be substituted for all part of the mixing water if, due to high temperature, low slump, flash set or cold joints are encountered.

Other precautions recommended by ACI 305 shall also be adopted.

6. TEST OF CONCRETE QUALITY

- 6.1 The Contractor shall provide samples of concrete for testing at the Director (GTS) / Engineer's direction. Proper facilities shall be provided for making and curing the test specimens in accordance with PS 560 and PS 849. A competent person shall be employed by the Contractor whose first duty shall be to supervise all stages in the preparation and placing of the concrete. All test specimens shall be made and site tests carried out under his direct supervision.
- 6.2 Test sample shall be taken at the mixer or as directed by the Director (GTS) / Engineer. The test specimens shall be cured in accordance with PS 560, PS 849 and BS 1881. The strength shall comply with the standard of quality specified in table 1.

- 6.3 The five test cubes are to be tested for compressive strength as specified in BS 1881. These tests shall be carried out at site or in a laboratory approved by the Director (GTS) / Engineer. Two cubes shall be tested at the age of seven days and three at 28 days and the strengths determined are to comply with the standard of quality specified. The laboratory tests shall be carried out by an independent organization, such as Government Testing Laboratory or such other undertakings approved by the Director (GTS) / Engineer. The original test reports received from the above authorities should be submitted to the Director (GTS) / Engineer.
- 6.4 For all grades of concrete, the appropriate strength requirement shall be considered to be satisfied if none of the strengths of the cubes is below the specified cube strength or if the average strength of the three cubes is not less than the specified cube strength and the difference between the greatest and the least strength is not more than 20% of the average.
- 6.5 When the results of works cube tests show that the strength of any concrete is below the minimum specified the Director (GTS) / Engineer may give instructions for the whole or part of the work concerned to be removed and replaced at the expense of the Contractor. The Contractor shall bear the cost of any other part of his, or any other contractor's work, which has to be removed and replaced as a result of the defective concrete. If any concrete is held to have failed, the Director (GTS) / Engineer may order the proportions of that class of concrete to be changed in order to provide the specified strength.

7 FINISHING OF FORMED SURFACES

7.1 General

- 7.1.1 After removal of forms, the surfaces of concrete shall be given one or more of the finishes specified below in locations designated by the Contract Documents.
- 7.1.2 When finishing is required to match a small sample furnished to the Contractor, the sample finish shall be reproduced on an area at least 100sq.ft. in an inconspicuous location designated by the Director (GTS) / Engineer before proceeding with the finish in the specified location.
- 7.1.3 Allowable deviations from plumb or level and from the alignment, profile grades, and dimensions are specified in clause 9. Tolerances for concrete construction are defined as tolerances to be distinguished from irregularities in finish as described herein. The finish requirements for concrete surfaces shall be as generally specified in this clause and as indicated on the Drawings. Finishing of concrete surfaces shall be performed only by workmen who are skilled in concrete finishes. The Contractor shall keep the Director (GTS) / Engineer advised as to when finishing of concrete will be performed. Unless inspection is waived in each specific case, finishing of concrete shall be performed only in the presence of the Director (GTS) / Engineer. Concrete surfaces will be tested by the Director (GTS) / Engineer where necessary to determine whether surface irregularities are within the limits herein after specified. Surface irregularities are classified as abrupt or gradual. Offsets caused by displaced or misplaced form sheating or lining or sections, or otherwise defective form lumber will be considered as abrupt irregularities, and will be tested by direct measurements. All other irregularities will be considered as gradual irregularities, and will be tested by use of a template, consisting of a straight edge or the equivalent thereof for curved surfaces. The length of the template will be 2 meter for testing of formed surfaces and 3 meters for testing unformed surfaces.

7.2 **As-cast Finishes**

Unless otherwise specified or indicated on the Drawings the classes of finish shall apply as follows:

7.2.1 **Rough form finish:**

No selected form facing materials shall be specified for rough form finish surfaces. The holes and defects shall be patched. Otherwise, surfaces shall be left with the texture imparted by the forms.

7.2.2 **Fair face finish:**

Fair face finish applies to concrete formed surfaces, the appearance of which is considered by the Director (GTS) / Engineer to be of special importance, such as surfaces of structures prominently exposed to public inspection. Surfaces of concrete structures requiring fair face finish as shown in the Drawings. Surface irregularities, measured as described in sub-clause 7.2.1, 'Rough form finish', shall not exceed 4mm for gradual irregularities and 6mm for abrupt

irregularities, except that abrupt irregularities will not be permitted at construction joints. Abrupt irregularities at construction joints and elsewhere in excess of 6mm and gradual irregularities in excess of 1/8 inch. (3mm) shall be reduced by grinding so as to conform to the specified limits. Abrupt irregularities at construction Joints shall be ground on level of 1 to 20 ratio of height to length.

Unless otherwise approved, repair of imperfections in formed concrete shall be completed within 24 hours after removal of forms. The form facing material shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, tempered concrete-form-grade hardboard, metal, plastic paper, or other approved material capable of producing the desired fair face finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edge, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. The holes and defects shall be patched. All fins shall be completely

7.2.3

Architectural Finish Concrete:

Architectural finish to concrete formed surfaces as shown on the Drawings is required by the Director (GTS) / Engineer where the architectural appearance of surfaces of structures exposed to public view is of special consideration and importance. The Contractor shall use approved special material for formwork and design the forms in conformity with the specified architectural patterns, textures and finishes in order to obtain first class architectural finish on formed concrete surface without any defect, irregularities, blemishes, imperfections and encrustations.

Sample approvals of precast & in-situ concrete:

These samples will be reviewed and approved on the basis of colour, dimensional accuracy, and finish of surfaces and general appearance. The same requirements for sample approval will be required for both precast and in-situ concrete exposed surfaces.

Forms

The contractor must maintain the forms unusually tight and braces to prevent movement, mal-alignment and bleeding that will result in sand streaks, honeycomb, fins, stain or unsightly appearance.

If wood forms are chosen to be used by the Contractor they shall be constructed of 3[⁄] inch. (20mm) minimum thickness plywood constructed in a fashion to allow many re-uses with all surfaces sealed with a polyurethane varnish.

Edges, surfaces and corners of forms shall be sealed to prevent loss of any matrix or unequal absorption of water. Corners of wood forms shall be filled with suitable compound and all contact surfaces sealed with a polyurethane varnish.

Re-use of forms shall be subject to approval of the Director (GTS) / Engineer.

Curing:

Curing shall be done in shade (out of direct sunlight) and shall be for a minimum period of 4 days.

Finishing procedures:

"Finishing procedures for filling air void in smooth finished concrete developed by a formed surface".

While the concrete surface is still damp (not more than three days after removal of forms), apply a thin coat of medium consistency neat cement slurry by means of bristle brushes to provide a bonding coat within any pit or blemishes in the parent concrete, avoid coating large areas of the finished surface. Before slurry has dried or changed colour, apply a dry (almost crumbly) grout comprised of one part cement, of the type and brand of cement used in the original concrete, to one and one-half parts clean masonry sand with a fineness modulus of approximately 2.25 and complying with the gradation requirements of the ASTM Specifications C144. Mix proper amounts of white cement and colouring with the parent mortar to produce a satisfactory colour match with the parent concrete after hardening. Use samples previously prepared.

Apply the finishing grout uniformly with damp (neither dripping wet nor dry) pads of coarse burlap approximately 6 inch square used as a float. Scrub the grout well into the pits to provide a dense mortar in all the imperfections to be filled. Allow the mortar to partially harden, from one to two hours, depending upon the weather. Avoid direct hot sunlight. If the air is hot and dry, keep the concrete surface damp during this period using a fine fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the edge of a steel trowel without damaging the grout from the small pits of holes, cut off all that can be removed with a trowel without delay: next allow the surface to dry thoroughly and rub it vigorously with clean, dry burlap to completely remove any dried grout. No visible film of grout shall remain after this rubbing. Complete the entire cleaning and grouting operation for the grout to dry after it has been cut with the trowel, so it can be wiped off clean with the burlap.

On the day after the repair work, the concrete surfaces should again be wiped off clean with dry burlap to remove any inadvertent dust; leave no built-up surfaces on the parent surfaces. Employ, if possible, a used piece of burlap containing old hardened mortar to act as a mild abrasive. Use of fine abrasive stone if needed to remove any remaining built-up film without breaking through the surface of the original concrete. Such scrubbing should be light and sufficient only to remove excess material without working up a lather of mortar or changing the texture of concrete. Following the final bagging or stoning operation, provide a thorough washdown with stiff bristle brushes to remove all extraneous materials and spray the concrete surface with a fine fog spray periodically to maintain a continually damp condition for at least three days after application of the pit repair grout.

Rust Stains:

All rust stains are to be removed employing the following procedure:

The rust stain shall be soaked for 10 minutes with a solution of (0.055 lb.) 25gm of sodium citrate in (0.33lb) 150gms water (brushing the solution at short intervals is satisfactory). Then the surface is sprinkled with crystals of sodium hydrosulfite and covered with a paste of Fuller's Earth and water. On a vertical surface, the paste is applied with a trowel, with the crystals first sprinkled on the paste so they will be in direct contact with the stain. The paste is allowed to dry for 10 minutes then scraped off and the treatment repeated if necessary.

Repairing of Formed Surfaces:

It is the intention of Specification to require forms, mixture of concrete and workmanship so that concrete surfaces, when exposed, will require no patching. Any concrete which is not formed as required and conforming to approve samples or for any reason is out of alignment or level or shows a defective surface, shall be removed from the job by the Contractor at his expense unless the Director (GTS) / Engineer grants permission to repair the defective area. Permission to patch any such area shall not be considered a waiver of the Director (GTS) / Engineer's right to require a complete removal of defective work if the repair does not, in his opinion, satisfactorily restore the quality and appearance of the surface. The Director (GTS) / Engineer shall be the sole judge of acceptability of appearance.

REPAIR OF SURFACE DEFECTS

8.1 General

Any concrete failing to meet the specified strength or not formed as shown on drawings, concrete out of alignment, concrete with surfaces beyond required tolerances or with defective surfaces which can not be properly repaired or attached in the opinion of the Director (GTS) / Engineer shall be removed at contractor's cost.

The Director (GTS) / Engineer may reject any defective concrete and order it to be cut out in part or in whole and replaced at the Contractor's expense.

8.1.1 All ties and boltholes and all repairable defective areas shall be patched immediately after form removal.

8.2 Repair of Defective Areas

8.2.1 All honeycombed and other defective concrete shall be removed down to sound concrete. The area to be patched and an area at least 6 inch. (150mm) 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 BS

Sieve and shall then be well brushed into the surface.

- 8.2.2 The patching mixture shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2-1/2 parts sand by damp loose volume. White Portland cement shall be substituted for a part of the grey Portland cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch.
- 8.2.3 The quantity of mixing water shall be no 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 it has reached the stiffest consistency that will permit placing.
- 8.2.4 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 leave the patch slightly higher than the surrounding surface to permit initial shrinkage, it shall be left undisturbed for at least 1 hour before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed
- 8.2.5 Where as-cast finishes are specified, the quantity of patched area shall be strictly limited. The combined total of patched areas in as-cast surfaces shall not exceed 6 sq.ft. in each 100sq.ft of as-cast surface. This is in addition to form tie patches, if the project design permits ties to fall within as-cast areas.
- 8.2.6 Any patches in as-cast architectural concrete shall be indistinguishable from surrounding surfaces. The mix formula for patching mortar shall be determined by trial to obtain a good colour match with the concrete when both patch and concrete are cured and dry. After initial set, surfaces of patches shall be dressed manually to obtain the same texture as surrounding surfaces.
- 8.2.7 Patches in architectural concrete surfaces shall be cured for 7 days. Patches shall be protected from premature drying to the same extent as the body of the concrete.

8.3 Tie and Bolt Holes

After being cleaned and thoroughly dampened, the tie and bolt holes shall be filled solid with patching mortar.

8.4 Proprietary Materials

If permitted or required by the Director (GTS) / Engineer, proprietary compounds for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching procedures. Such compounds shall be used in accordance with the manufacturer's recommendations with prior approval of the Director (GTS) / Engineer.

8 CONCRETE CONSTRUCTION TOLERANCES

Where tolerances are not stated in the specifications or drawings for any individual structure or feature thereof, maximum permissible deviations from established lines, grades and dimensions shall conform to the following. The Contractor is expected to set and maintain concrete limits. These allowable tolerances shall not relieve the Contractor of this responsibility for correct fitting of indicated materials. Those tolerances are not cumulative.

9.1 Variation from the plumb (or the specified batter for inclined walls)

9.1.1	In the lines and surfaces of columns, piers, and walls and in arises	
	- In any 10 ft. (3 meter) of length or height:	1/4" (6mm)
	- In any storey or 20 ft. (6 meter) maximum:	3/8" (10mm)
	- Maximum for the entire length or height:	1" (25mm)
9.1.2	For exposed corner columns, control joint grooves and other conspicuous lines.	
	- In any bay or 20 ft. (6 meter) maximum	1/4" (6mm)
	- Maximum for the entire length or height	1/2" (13mm)

<p>9.2 Variation from the level or from the grades indicated on the drawings.</p> <p>9.2.1 In floors, ceilings, beams soffits and in arises.</p> <ul style="list-style-type: none"> - In any 10 ft. (3 meter) of length - In any bay or 20 ft. (6 meter) maximum - Maximum for the entire length <p>9.2.2 For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines.</p> <ul style="list-style-type: none"> - In any bay or 20 ft. (6 meter) maximum - Maximum for the entire length 	<p>$\frac{1}{4}$" (6mm) $\frac{3}{8}$" (10mm) $\frac{3}{4}$" (20mm)</p> <p>$\frac{1}{4}$" (6mm) $\frac{3}{8}$" (10mm)</p>
<p>9.3 Variation of the linear building lines from established position in plan and related position of columns, walls and partitions.</p> <ul style="list-style-type: none"> - In any bay or 10 ft. (3 meter) maximum - Maximum for the entire length 	<p>$\frac{1}{2}$" (13mm) 1" (25mm)</p>
<p>9.4 Variation in the sizes and locations of sleeves, floor openings, and wall openings.</p>	<p>$\pm 1/4$" (6mm)</p>
<p>9.5 Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls.</p> <ul style="list-style-type: none"> - Minus - Plus 	<p>$\frac{1}{4}$" (6mm) $\frac{1}{2}$" (13mm)</p>
<p>9.6 <u>Footings</u></p>	
<p>9.6.1 Variation in dimensions in plan</p> <ul style="list-style-type: none"> - Minus - Plus (plus variation applied to concrete only, not to reinforcing bars or dowels). 	<p>$\frac{1}{2}$" (13mm) $\frac{1}{2}$" (13mm)</p>
<p>9.6.2 Misplacement or eccentricity: 2 percent of the footing width in the direction of misplacement but not more than (applies to concrete only, not to reinforcing bars or dowels).</p>	<p>2" (50mm)</p>
<p>9.6.3 Reduction in thickness Minus 5 percent of specified thickness</p>	
<p>9.7 <u>Variation in Steps</u></p>	
<p>9.7.1 Rise</p>	<p>$\frac{1}{8}$" (3mm) $\frac{1}{4}$" (6mm)</p>
<p>Tread</p>	
<p>9.7.2 In consecutive steps: Rise Tread</p>	<p>$\frac{1}{16}$" (1.5mm) $\frac{1}{8}$" (3mm)</p>
<p>9.8 <u>Tolerances for Pavements</u></p>	
<p>9.8.1 Departure from established alignment</p>	<p>$\pm 1/2$" ($\pm 6mm$)</p>
<p>9.8.2 Departure from established longitudinal grade on any time.</p>	
<p>9.8.3 Departure from transverse template contour at transverse joints except at transverse joints.</p>	<p>$\pm 1/4$" ($\pm 6mm$)</p>
<p>9.8.4 Departure from transverse template contour at transverse joints</p>	<p>$\pm 1/8$" ($\pm 3mm$)</p>
	<p>$\pm 1/8$" ($\pm 3mm$) width of one traffic lane</p>

9.9 Pavements for parking areas

The tolerances are twice the values listed for pavements.

9 ACCEPTANCE OF STRUCTURE

10.1 General

- 10.1.1 Completed concrete work which meets all applicable requirements will be accepted subject to the other terms of the Contract Documents.
- 10.1.2 Completed concrete work which fails to meet one or more of the requirements and which has been repaired to bring it into compliance will be accepted subject to the other terms of the Contract Documents.
- 10.1.3 Completed concrete work which fails to meet one or more of the requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Specifications or in the Contract Documents. In this event, modifications may be required to assure that remaining work complies with the requirements.

10.1 Dimensional Tolerances

- 10.2.1 Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of clause 9 shall be considered potentially deficient in strength and subject to the provisions of sub clause 9.4
- 10.2.2 Formed surfaces resulting in concrete outlines larger than permitted by the tolerances of clause 9 may be rejected and the excess material shall be subject to removal. If removal of the excess material is permitted, it shall be accomplished in such a manner as to maintain the strength of the section and to meet all other applicable requirements of function and appearance. Permission is required if excess material is to be removed in accordance with this clause.
- 10.2.3 Concrete members cast in the wrong location may be rejected if the strength, appearance or function of the structure is adversely affected or if misplaced items interfere with other construction.
- 10.2.4 Inaccurately formed concrete surfaces exceeding the limits of Clause 9 or of Clause 5.1 of Section 'Formwork' shall be removed and replaced and those that are exposed to view, may be rejected and shall be repaired or removed and replaced if required.

10.3 Appearance

- 10.3.1 Architectural concrete with surface defects exceeding the limitations of Sub-clause 5.1 of Clause 5 of the Section, 'Formwork' shall be removed and replaced.
- 10.3.2 Other concrete exposed to view with defects which adversely affect the appearance of the specified finish may be repaired only by approved methods.
- 10.3.3 Concrete not exposed to view is not subject to rejection for defective appearance.

10.4 Strength of Structure

- 10.4.1 The strength of the structure in place will be considered potentially deficient if it fails to comply with any requirements which control the strength of the structure, including but not necessarily limited to the following conditions.
- Concrete strength requirements not considered to be satisfied in accordance with Clause 6 hereof.
 - Reinforcing steel size, quantity, strength, position or arrangement at variance with the requirements as listed under specification of 'Reinforcement' or in the Contract Documents.
 - Concrete which differs from the required dimensions or location in such a manner as to reduce the strength.
 - Curing less than that specified.
 - Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
 - Mechanical injury, construction fires, accidents of premature removal of formwork likely to result in deficient strength.
 - Poor workmanship likely to result in deficient strength.
- 10.4.2 Structural analysis and/or additional testing may be required when the strength of the structure is considered potentially deficient.
- 10.4.3 Core tests may be required when the strength of the concrete in place is considered potentially deficient.
- 10.4.4 If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be required and their result evaluated in accordance with British Standard, CP 110 or ACI 318.
- 10.4.5 Concrete work judged inadequate by structural analysis or by results of a load test shall be reinforced with additional construction if so directed by the Director (GTS) / Engineer or shall be replaced, at the Contractor's expense.
- 10.4.6 The Contractor shall pay all costs incurred in providing the additional testing and/or analysis required by this section.
- 10.4.7 All costs of additional testing and/or analysis which is made at the Employer request and which is not required by these Specifications, or by the Contract Documents shall be borne by the Contractor

11 VAPOUR BARRIER

Vapour barrier shall be polyethylene building film. The film shall be 200 micron thick.

The quality of material shall be approved by the Director (GTS) / Engineer prior to use in the works.

Vapour barrier shall be laid in position wherever shown on the Drawings or as directed by the Director (GTS) / Engineer.

The material shall be supplied in roils and laid by rolling over the prepared surface at the levels and position in the areas shown on the Drawings. Where Joint is necessary at the side or end of a sheet, this shall be a double weld folded joint made by placing the edges together

and folding over twice continuously taking the top edge prior to concreting. The Contractor shall protect the film sheets from damages during laying and subsequent operations and shall replace at his cost all damaged film sheets to the satisfaction of the Director (GTS) / Engineer.

Manufacturer's recommendations and instructions along with the sample of material shall be submitted to the Director (GTS) / Engineer for his approval.

12 **PVC WATER STOP/HYDROFOIL**

12.1 **Material**

All PVC water stops/hydrofoil shall be central bulb type from a manufacturer approved by the Director (GTS) / Engineer, The specific gravity of PVC water stop/hydrofoil shall not be less than 1.37 & Full stretch Break cut intensity when tested at normal temperature shall not be less than 1878 Psi.

The material shall have a modulus of rigidity of 853 Psi at 50° F & 10544 Psi at 68° F.

12.2 **Placing & Connections**

In general all PVC water stops/hydrofoil shall be placed in the centre of the structural member. Each piece of the water stop-hydrofoil shall be of maximum practicable length. An ordinary sharp knife, saw or any other sharp tool can be used to cut the water stop. Joints at inter sections and at ends of pieces shall be made in the manner most appropriate to the material being used. Joints shall develop effective water tightness fully equal to that of the continuous water stop material and shall permanently retain their flexibility. For straight line connection melting method of connection can be used by pressing two water stops intended for connection against a heated iron or copper sheet. When they are melted, the two are combined.

After joining, the water stop should be allowed to cool.

For all other connections such as T-type or L-type, the welding method of joining should be used. Welding rod of same material as the water stop shall be used. The

Welding rod & the water stop shall be heated & melt at the same time, by means of heated air Jetting from the hot jet gun.

*****END OF SECTION*****

CEMENT CONCRETE BLOCK MASONRY

1. SCOPE

The work under this section of the Specifications consists of furnishing all plant, labor, equipment, appliances and materials and in performing all operations in connection with the supply and installation of ordinary cement concrete solid and hollow block masonry work including wall ties, anchors, damp-proof courses, complete in strict accordance with this section of the Specifications and applicable drawings, and subject to the terms and conditions of the Contract.

2. APPLICABLE STANDARDS

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

2.1 Pakistan Standards

232	Ordinary Portland Cement.
419	Properties & Specifications of blocks

2.2 ISO (International Standardization Organization)

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

2.3 ASTM (American Society for Testing and Material)

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

2.4 BSI British Standards Institution

743	Materials for Damp-proof Courses.
1243	Specification for Metal Ties for Cavity wall Construction
4887	Mortar Plasticizer
121 Pt1	Brick and Block Masonry
122 Pt2	Walls and Partitions of Blocks and Slabs.

3. MATERIALS

3.1 For Block

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

3.2 For Mortar

3.2.1 Sand

Sand for mortar shall comply with the requirements for BS-1200. It shall be graded in accordance with the following table and the various sizes of particles shall be uniformly distributed. Sand that has been in contact with seawater shall not be used unless it has been thoroughly washed to the satisfaction of the Director (GTS) / Engineer.

Sieve Size No	Percent Passing By Weight	
	Maximum	Minimum
#4	100	-
#8	95	-
#16	70	100
#30	40	75
#50	10	35
#100	2	15
#200	0	0

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

3.2.2 Cement:

Cement shall be Ordinary Portland Cement conforming to BS 12.

3.2.3 Water:

Water shall be clean and free from any harmful impurity. Quality of the water shall be tested in accordance with BS3148.

3.2.4 Additives:

Additives where used, shall be proprietary products used in the proportions and manner recommended by the manufacturer. The additives shall in no way adversely affect the mortar strength or contain chemicals, which may be harmful to other building materials. To add gypsum to cement is strictly forbidden.

3.2.5 Mortars and Grout:

Materials for mortar, sand binding agent and water, shall be mixed by volume or by weight for at least 3 minutes with the minimum amount of water to produce a correctly mixed mortar or grout of workable consistency in a mechanical batch mixer. For small jobs, hand mixing may be permitted, the ingredients being mixed with sufficient water to produce a correctly mixed workable mortar.

Mortar shall be as strong, but no stronger than the materials it bonds together: Mortars shall be mixed in batches, which can be used within a period before the setting process commences. Once a mix begins drying off, it shall be rejected. No ingredients shall be added to it once the setting process has begun.

3.2.6 Reinforcement:

For reinforcement refer specification section no. 2200.

4. CONCRETE BLOCK MAKING

4.1 The Solid and Hollow blocks shall be machine molded. The block making machines shall be of the standards approved by the Director (GTS) / Engineer. They shall be operated according to the instructions laid down by the manufacturers.

4.2 The blocks shall be continuously water cured by sprinkling water for a minimum of 10 days and covered between sprinkling operations with 4 mils thick polyethylene sheeting. After 10 days water curing period the blocks shall be air-dried. Under no circumstances will blocks be used in the work until they are completely dry. During curing period no surfaces of the block will be allowed to dry.

- 4.3 Cured concrete blocks shall be stored off the ground, stacked on level platforms, which allow air circulation under stacked units. Units shall be covered and protected against wetting.
- 4.4 Care shall be exercised in the handling of the concrete blocks. No damaged blocks shall be used in the work.
- 4.5 The hollow blocks shall be manufactured as per pattern shown on the drawing. These block units shall be provided by the Contractor for use where required in building structures from approved type of materials. Units shall have uniformly fine smooth surfaces of uniform color. These shall be free of any honey combing or other imperfections or deformations, all edges true and straight, and at right angles with each other and without any chipped or otherwise broken edges.
- 4.6 The blocks cast on different dates shall be stacked separately and must be labeled showing the date on which they were cast.
- 4.7 Reinforced cement concrete hollow block masonry shall be provided where shown on the drawings. Hollow block manufactured by molding machine shall have well formed cavities, sharp and well-defined edges and corners, smooth surfaces without any imperfections or deformations.

5. PROPERTIES OF BLOCKS

- 5.1 All blocks shall be of the size and shape required to complete the work shown in the Drawings or as instructed by the Director (GTS) / Engineer.
- 5.2 The cement, sand and coarse aggregate shall be volume batched and their proportion may be adjusted so as to provide the concrete of the required strength when tested and shall be mixed in a concrete mixer in accordance with clause 5.4 of the section 'Plain and Reinforced Concrete.
- 5.3 All blocks shall comply with ASTM 1988 edition. The compressive strength of various solid and hollow block, shall be as follows:

S. No.	Type of Concrete Masonry ASTM 1988 Edition	Compressive Strength Psi		Location
		Average of 3 Units	Individual Units (Mpa)	
1	Solid load bearing Masonry units (ASTM-C-145-85)	1800 (12.4) 1200 (8.30)	1500 (10.4) 1000 (6.90)	Exposed to frost action
2	Solid/Hollow non load bearing Masonry units	600 (1.4)	500 (3.45)	Not exposed to moisture & weather
3	Hollow non load bearing Masonry	1000 (6.90)	800 (5.50)	Exposed to moisture & weather
	ASTM-C-90-85	700 (4.80)	600 (4.10)	Not exposed to moisture & weather

- 5.4 The Contractor shall provide test certificates providing the average minimum crushing strength of the blocks prior to the commencement of the construction. Further test certificates shall be provided as required by the Director (GTS) / Engineer, to ensure that all batches of blocks have the minimum specified crushing strength.

- 5.5 The test shall be carried out by a laboratory approved by the Director (GTS) / Engineer. Evidence shall be produced that the block manufacturer has an efficient method of quality control. The Director (GTS) / Engineer will require to test samples of blocks periodically and the Contractor shall make necessary arrangements accordingly. The method of sampling for all tests shall be in accordance with.
- 5.6 All properties or specifications of blocks, not explained in these Specifications shall comply with the requirements of ASTM 1988 edition as directed by the Director (GTS) / Engineer.

6. SUCTION RATE

The Contractor shall, at his own cost, satisfy the Director (GTS) / Engineer that the suction rate of the block when determined in accordance with Appendix "A" of BS 3921 does not exceed 20 g/dm²/min. or that the Contractor is able to adjust it so that it does not exceed this value on site.

7. SOLUBLE SALT CONTENT

For exposed block work, the contents by weight percent of soluble sulphate, calcium, magnesium, potassium and sodium radicals, shall not exceed 0.30, 0.10, 0.30, 0.03 and 0.03, percent respectively when ascertained in accordance with BS 3921, at the cost of the Contractor.

8. REINFORCING AND ANCHORS OF BLOCK MASONRY

Unless otherwise stated reinforcing and anchors shall conform to under mentioned sizes:

- 8.1 Joint reinforcing shall be 1.32mm (0.05-inch) diameter mild steel wire mesh design, galvanized after fabrication. Steel wire woven into 12mm mesh 75mm wide. Reinforcing bar anchors shall be 250mm dia. deformed bar minimum 10 inch long.
- 8.2 Dovetail anchors and slots (if used as an alternate anchorage) shall be not less than 18 gauge galvanized steel.

9. ERECTION

9.1 Blocks shall be laid true to line, level and laid in accurately spaced courses in stretcher bond with vertical joints of each course located at center of units in alternate courses below. Vertical joints shall be buttered in the entire height of blocks. Each course shall be bonded at corners and at intersections of walls and shall be properly bonded. Courses of block shall be kept plumb throughout and corner reveals shall be true and in plumb.

Standard width of mortar joints for both horizontal and vertical joints shall be 10mm (maximum). Mortar joints in walls shall have full mortar coverage on vertical and horizontal faces between the blocks. Mortar joints on wall including struck joints, shall be thoroughly compacted and pressed tight against the edges of the blocks with proper tools. Blocks terminating against soffits of beam or slab construction shall be wedged tight with wedge and the joints shall be packed solidly with mortar between the top of the block and the bottom of slab or beam. Control expansion joints shall be kept free from mortar or other debris.

Unless otherwise shown on the drawings or specified by the Director (GTS) / Engineer, the spaces around doorframes and other material or built in items shall be solidly filled with mortar. Spaces around the door and window hold fasts shall be filled in with Class 'C' concrete. Work required to be built in with masonry including

doorframe anchors, wall plugs, and dovetail anchors and accessories shall be built in as the erection progresses.

- 9.2 The block work shall be carried up in a uniform manner and no portion shall be carried more than one meter above the adjoining one at any time. All masonry shall be kept strictly true and square and the whole properly bonded together and leveled round each floor.
- 9.3 Sleeves, Chases, holes, sinking and mortices for other trades shall be correctly located and formed to the sizes as required by the relevant trades. Chiseling of completed walls or the formation of holes shall only be carried out with the approval of the Director (GTS) / Engineer.
- 9.4 Walls of blocks indicated as being non-load bearing shall be constructed on the insitu concrete floor slab unit after the floor formwork is struck and the concrete has obtained sufficient strength to support their weight. Tooting into load-bearing walls shall not be permitted.
- 9.5 All bolts, anchors, ties, pipe sleeves, flushing metal attachments, lintels and the like required to be built into the work shall be correctly inserted and executed as the work proceeds.

Walls or partitions abutting concrete columns or walls shall be securely anchored and tied with metal anchors or ties at not more than 450mm vertical centers. Wall ties cast in with concrete shall be bent down after the removal of formwork and shall be securely jointed into the mortar beds of walling.

10. SCAFFOLDING

Contractor shall provide safe scaffolding of adequate strength for use of workmen at all levels and heights at his own expense. Scaffolding which is unsafe in the opinion of the Director (GTS) / Engineer shall not be used until it has been strengthened and made safe for use of workmen. Cost of scaffolding etc., shall be included by the Contractor in the unit rate for masonry items.

Damage to masonry from scaffolding or from any other object shall be repaired by the Contractor at his own cost.

11. JOINTING

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

- 11.1 Exterior exposed joints shall be tightly formed to weather Joint with the point of the trowel.
- 11.2 Interior exposed joints shall be tightly formed to a concave Joint.
- 11.3 Joints, which are subsequently covered with plaster or other finish materials, shall be struck flush.

12. TOLERANCES

All block work shall be erected plumb and true to line and level with the maximum variation in any story height or any length of wall being one mm in one meter. The maximum tolerance in the length, height or width of any single masonry unit shall be ± 3 mm.

13. DAMP PROOF COURSE

Damp-proof course shall be laid on an even mortar bed, free from projections, which may puncture the material. Where the damp-proof course is to be stepped, only flexible membrane shall be used. All damp proof course, unless otherwise specified, shall consist of class 'C' cement concrete 50mm thick, mixed with 2.5 kg of pudlo per bag of cement or other approved quality water proofing compound as per manufacturer's specifications and shall be laid at required levels as per drawings and instructions of the Director (GTS) / Engineer. The DPC shall be tamped consolidated, leveled, edges and corners made to the requirements of concerned drawings including finishing and curing complete.

14. SOLID BLOCK WORK AROUND OPENING OF HOLLOW MASONRY

Around all openings in hollow block masonry, the Contractor shall provide solid block work of same thickness as that of hollow block masonry wall and of width as indicated on the Drawings. Solid block shall be laid around openings in such a manner that these are bonded integrally with hollow block masonry.

15. REINFORCED HOLLOW BLOCK MASONRY

Where specified on the Drawings, reinforced hollow block masonry shall be provided. Horizontal and vertical reinforcement shall be cold worked deformed bar. Two bars of No. 8 (8mm) diameter shall be provided at every third horizontal course at 600mm centers, while the vertical reinforcement shall be two bars of No. 12 (12 mm) diameter at 800mm centers. Bars shall be anchored and held firmly vertical in respective beams and columns in the manner shown in shop Drawings. The reinforced hollow part of the block wall shall be solidly filled with Class 'D' concrete at intervals of one meter maximum height as the laying of block masonry work proceeds. The filled concrete shall be consolidated thoroughly by rodding to avoid formation of voids. Contractor shall submit shop drawings of anchoring and placing of reinforcement in hollow block masonry for approval of the Director (GTS) / Engineer.

16. CURING AND REPAIRS

16.1 All block masonry shall be water cured and shall be kept wet for at least seven days, by an approved method, which will keep all surfaces to be cured continuously wet. Water used for curing shall meet the requirements of the specifications for water used in the manufacture of blocks.

16.2 If after the completion of any block masonry, the work is not in alignment or level, or does not, conform to the lines and grades shown on the Drawings or shows a defective surface, it shall be removed and replaced by the Contractor at his expense unless the Director (GTS) / Engineer grants permission, in writing, to patch or replace the defective area.

17. MASONRY SHORT OF HEIGHT

In case of different thickness of slab in different areas or rooms or for any other reasons, whatsoever if chiseling of masonry is required, the Contractor shall do so at his own cost. Where for any reason whatsoever, the height of the wall is short of ceiling height, the actual height shall be made good with Class 'C' nominal mix concrete. This concrete shall neither be measured nor be paid under item of concrete but will be paid for under the item of wall masonry. Similarly where the lintel heights are such that the Contractor has to chisel the masonry or provide cast-in-place concrete to make up the height of the course, no payment will be made for chiseling or cast-in-place concrete.

*** END OF SECTION***

CARPENTRY AND JOINERY

1. SCOPE

The work covered under this section of Specifications consists of providing all material, labor, plant, equipment, appliances and performing all operations connected with the fabrication and erection of all woodwork, mill work, construction assembly, surface finish treatment and building in of all cabinet type items, supports etc. of wood or metal and incidentals, associated woodwork appurtenances, procuring and applying preservatives, installation of "Finish Hard Ware" in connection with finish woodwork as per details shown on the Drawings or as directed by the Director (GTS) / Engineer. The scope of this section is covered with detailed specifications as laid down herein.

2. APPLICABLE STANDARDS

Latest editions of following British and ISO Standards are relevant to these specifications wherever applicable.

2.1 ISO (International Organization for Standardization)

1891 Bolts, screens, nuts and accessories-Terminology and nomenclature.

1097 Plywood - Measurement of dimensions of panels.

1098 Veneer ply wood for general use-General requirements.

2427 Veneer ply wood with rotary cut veneer for general use-Classification by appearance of panels with outer veneer of beech.

2429 Ply wood - Veneer ply wood with rotary cut veneer for general use-Classification by appearance of panels with outer veneers of brand leaved species of tropical Africa.

3804 Ply wood-Determination of dimension of test pieces

3805 Ply wood-Determination of density,

3806 Ply wood-Determination of moisture content

6442 Door leaves-Measurement of defects

6443 Door leaves-Measurement of dimensions and of defects of squareness.

6444 Door leaves-Test of behavior under humidity variations

2.2 BSI (British Standards Institution)

459 Wooden doors.

1186 Quality of timber and workmanship in joinery.

1127 Hinges

1331 Builder's hardware for housing.

1567 Wood door frames and linings nails.

1202 Nails

1203 Specifications for synthetic resin adhesive for plywood.

1204 Synthetic resin adhesives for wood.

1282 Guide to choice, use and application of wood preservatives

1494 Fixing accessories for building purposes.

1579 Connectors for timber.

3842 Treatment of ply wood with preservatives.

3. **MATERIALS**

3.1 **Timber**

- All wood shall consist of cedrous deodar (referred in the document as deodar) having density of 500-600 kg/m³.
- Wood locally known as 'Partal' to be used in framing where specified.

3.1.1 **General Characteristics**

All the timber shall be in accordance with the requirements of BSI No: 1186, 'Quality and Workmanship in Joinery'.

The whole of the timber shall be from the heart of sound and fully grown tree, uniform in substance, straight in fibber, first class quality properly seasoned, free from large or loose deadknots, open shakes and excessive sapwood. The scantlings of all timbers shall be bright, sound and square edged. The moisture content of timber shall not be more than ten (10) percent.

3.1.2 **Preservation of Wood**

Prior to installation of all finish wood works in their respective positions, preservatives shall be applied to safeguard the woodwork against fungus, termite and bores.

The preservatives shall be of the best available quality of solignam oil (clear) as approved by the Director (GTS) / Engineer. The method of application shall be strictly in accordance with the manufacturer's instructions. The treatment and application of all the preservatives shall comply with the requirements of BS-CP 98:1964.

3.1.3 **Adhesive:**

The adhesives shall conform to the requirements of BSI No. 745 "Animal Glues for Wood" or as directed and approved by the Director (GTS) / Engineer.

3.1.4 **Nails and Screws:**

All nails and screws shall comply with requirements of BSI NO. 1202 and BSI NO. 1210 respectively.

3.2 **Ply Wood**

- 3.2.1 The plywood shall comply in all respects with BSI No. 1455:1963. All the plywood shall only be obtained from manufacturers approved by the Director (GTS) / Engineer.

Plywood used for doors, paneling and other similar works shall be to the thickness and size as shown on the Drawings or as directed by the Director (GTS) / Engineer. The grade shall be first quality and the face and back shall be free from end joints, dead knots, overlaps, patches and other surfaces shall be free, smooth for painting or polishing.

- 3.2.2 The veneer shall be of the required thickness and quality including base veneer and shall be impregnated with an approved adhesive and machine compressed. Such machine pressed veneered wood shall be fixed on all sides of the inner core wood (softwood of approved quality) after it has been treated with water resistant hot setting glue.

4. **SAMPLES**

All samples of the material used for the work under this Section of Specification shall be approved by the Director (GTS) / Engineer and same type of material shall be used throughout the work. If the Director (GTS) / Engineer desires to get the material tested, this will be done by the Contractor at his own cost from a laboratory approved by the Director (GTS) / Engineer.

5. **FABRICATIONS**

5.1 **General**

Unwrought' timber shall be used. Sawing shall be done true to the size and dimensions to finally meet the requirements of specified sizes and dimensions of the finished work.

All framing shall be joined as shown on the Drawings or as directed by the Director (GTS) / Engineer. All joints shall be secured with sufficient number of nails. The Contractor shall perform all necessary mortising, tenoning, grooving, matching, tonguing, housing, rebating and all operations required for the correct jointing. The Contractor shall also provide all metal plates, screws, nails and other fixing material that may be ordered by the Director (GTS) / Engineer for the proper execution of the joinery work. Fabrication that develop defects due to bad workmanship or unsound materials not conforming to these specifications and the directions of the Director (GTS) / Engineer, shall be cut out and replaced at Contractor's own expense before the expiry of the maintenance period.

5.2 **Doors**

5.2.1 Verify design and size of doors required for each opening. Door thickness shall be 40 mm (1 1/2 inch.) unless otherwise indicated.

5.2.2 Fabricate flush wood doors in accordance with the following requirements.

Cores

Edging of doors and shutters shall be of wood as shown on the drawings and cores shall be Partial wood (solid core) planed to a smooth uniform thickness. All doors and shutters shall have Deodar wood lapping on all edges as per details shown on the drawing.

Face Panels

- Door facing on each side of door shall consist of plywood have total minimum thickness of 1/8 inch. before sanding.
- Door plywood shall be bonded to each other, and to core unit with approved adhesive and machine compressed.

6. **PROTECTION OF MATERIALS**

All materials and assembled units shall be protected from weather and stored in such a way as to prevent decay and attack by fungus and termites.

7. **WOODEN DOORS & DOOR FRAMES**

7.1 **Materials**

7.1.1 First class Deodar wood as approved by the Director (GTS) / Engineer shall be used for the doorframes and full/half glazed and paneled shutters.

7.1.2 The plywood and veneering shall be of selected best quality as approved by the Director (GTS) / Engineer.

7.2 **Exterior and Interior Door Frames**

All exterior and interior door frames shall be constructed 18 SWG MS sheet or of wood as shown on the drawings.

The door frames shall be secured in place by means of mild steel anchors welded/screwed in place and built into the masonry as it is being constructed. There shall be one such anchor near the top and bottom of each jamb but not over 900mm intervals between the top and bottom anchors.

7.3 Exterior and Interior Wooden Doors

The Director (GTS) / Engineer shall unless otherwise shown or specified, of the paneled type, flush and type as shown on the Drawings or as direct the exterior and interior wooden door.

All the door shall conform to the following requirements:

Paneled doors shall be constructed in accordance with the requirements of Part I of British Standard Specification No. 459 with the additional requirements that panels in exterior openings shall be assembled with waterproof glue, glued tacked in place. Flush door shall comply with BSI 459 Part-2 and shall consist of solid core 40mm (1 1/2 inch.) thick shutters as shown on drawings.

7.4 Door Shutters

The shutters will be fixed to the frames with approved quality hardware schedule.

- 7.4.1 All doors, shutters shall be fabricated in a workman- manner strictly to the correct sizes and shapes as shown on the Drawings or as directed by the Director (GTS) / Engineer.
- 7.4.2 The door shutters shall have solid core as shown on the Drawings. It shall be built in sections, properly jointed and glued together, both sides being covered with plywood of the required thickness and approved quality. The surfaces shall be prepared for painting or polishing.
- 7.4.3 The arrangements of inner core for solid shutters shall be approved by the Director (GTS) / Engineer. It shall be so adjusted that circulation of air is free and uninterrupted. Minute holes shall be provided in edges at suitable places to admit and exit air.
- 7.4.4 Each door shall be constructed so as to permit the installation of hinges, knobs and locks in the position shown on the Drawings.
- 7.4.5 Completed doors shall be sound, rigid and free from defects and warp. All edges shall have Deodar wood lipping and shall be aligned and smooth, joints shall be close fitting, hard wood doweled or mortised framed and of a strength to maintain frame and of strength to maintain the structural properties of the member connected. All adjoining edges and faces shall be flush and smooth. Edges shall be rectangular and solid

7.5 Fitting, Hanging and trimming

All the doors shall be fitted, hung and trimmed as hereinafter specified and as indicated on the Drawings.

Doors shall have a clearance of 4 mm at sides and top unless otherwise directed by the Director (GTS) / Engineer and shall have 5 mm clearance at bottom. Doors shall be hung and trimmed with hardware as specified. All the locks shall be installed at the same height and shall be located at height as directed by the Director (GTS) / Engineer.

7.6 Hardware

Hardware shall be of approved quality and first class finished material. The Contractor shall obtain prior approval from the Director (GTS) / Engineer for quality; shape and pattern of ail the hardware materials by providing samples and shall provide and fix only the approved hardware materials.

Hardware shall be carefully and securely fitted. Upon handing over the work, hardware shall be demonstrated to operate freely. Keys shall be placed into respective locks and upon acceptance of the work keys shall be tagged and delivered to the Employer.

7.7 **Quality Assurance**

7.7.1 **Tolerances: Doors shall be fabricated to following tolerance**

- Size: Plus or minus 1.6 mm overall dimensions
- Maximum Wrap: 3mm
- Squareness: Maximum diagonal difference 3mm (between length of diagonal measured on face of door from upper right corner to lower left corner and length of diagonal measured from upper left corner to lower right corner).

7.8 **Submittals**

- 7.8.1 Provide shop drawings showing door types, details and locations, referred to the door type and hardware group shown on door and hardware schedules.
- 7.8.2 Provide certificates stating that doors were constructed timbers of the species specified having moisture content and meeting equilibrium and relative humidity requirements
- 7.8.3 Submit samples of face veneers for selection of color and pattern.

7.9 **Product Delivery, Storage and Handling**

- 7.9.1. Keep products dry, stack products off ground on level platforms, fully protected from weather, including direct sunlight.
- 7.9.2. Identify type, size and location of each door in order to permit installation at correct location.

7.10 **Installation**

- 7.10.1 Install doors at correct openings and assure smooth swing and proper closer with frames.
- 7.10.2 Install finishes hardware in accordance with manufacturer directions.

8. **KITCHEN CABINETS/WOODEN**

CABINETS/WARDROBES/DRESSERS/SHELVES/SEATS

All cabinet/wardrobes/dressers/shelves/seat including fittings, fixtures and hardwares shall be supplied of approved manufacturer and shall be of best quality fabricated by using materials and details as shown on the drawings.

8.1 **Installation**

All cabinets, wardrobes and shelves/seat shall be installed in position by the skilled workmen specialized in the job. Works shall be executed in accordance with drawings and the Director (GTS) / Engineer's instructions.

The Contractor shall inspect delivered cabinets, wardrobes seats and shelves and related parts for indication or location, size required by field measurements, finishing hardware and similar preliminary works. Verify locations for installation, required floor and wall finishes, painting and all other related work. Cabinets/wardrobe, shelves and seats shall exactly flush the floor and wall surfaces. Cut and fit accurately scribe strips at wall surfaces and bases. Secure wall cabinet to blocking. Concealed

fasteners all joints surfaces shall be smooth and even. Doors and other moving parts shall exactly fit in the frame. Refit, as necessary, to ensure proper and easy operation. Refit, if necessary, all cabinet, wardrobes and shelves hardware, test for proper operation, remove for painting and other finishing and properly replace in position with all fittings and accessories.

All work shall be thoroughly protected from damage at all times by suitable methods approved by the Director (GTS) / Engineer. Adjacent works shall similarly be protected from damage. Any damage or disfigurement shall immediately made good at Contractor's expense.

8.2 Cabinet work will be coordinated with Employer supplied items (if any) such as cooking range etc.

8.3 Kitchen cabinet work, generally all framing will be in treated Deodor wood with portions' etc., in best quality commercial plywood. All exposed surfaces will be covered by approved laminates. Exposed edges, if any, will be covered by polished Deodor wood lipping. Where approved counter tops for kitchen will be specified thick selected marble on painted M.S. framing.

Best quality hinges, metallic drawer guides (with bearing) and handles will be used. Samples and shop drawings to be approved by Director (GTS) / Engineer.

8.4 **Wardrobes**

Wardrobes (and similar works) will be made of deodar wood. Internal partitions will be as shown on the drawings. Shutters will have a (deodar wood) louvered front backed by laminated plywood. All louvers and exposed deodar wood edges/faces will be polished. Best quality hinges metallic drawer guiders (with bearing) handles locks catches etc., will be used. Shoe rack (inside wardrobe) will consist of 13mm dia (hollow) chrome plated M.S. rods. Samples and shop draw to be approved by the Director (GTS) / Engineer.

9. **DEFECTIVE WORK**

In the event of non-conformance to specification and drawings, the wood works shall be rejected by the Director (GTS) / Engineer and the Contractor shall remove and replace the rejected work by new work of same specifications.

10. **SURFACE PREPARATION**

The surfaces of all wood works shall be prepared in the manner as directed by the Director (GTS) / Engineer for polishing and painting.

11. **MOCK-UP SAMPLE**

After approval of shop drawings and tests etc., the contractor shall submit at his own cost one mock-up sample of each type of wood works complete with all fittings/fixtures accessories prior to the actual fabrication of the bulk.

The samples shall be returned to the Contractor for incorporation in the works after installation of at least 80% of the works.

***** END OF SECTION *****

CEMENT PLASTER

1. SCOPE

The work under this section of the Specifications consists of furnishing all plant, labor, equipment, appliances, and materials and in performing all operations in connection with providing and installation of cement plaster, and specified external rendering complete in strict accordance with this section of the Specifications and the applicable drawings and subject to the terms and conditions of the Contract. The scope of this section of Specification is covered with detailed Specifications as laid down herein.

2. APPLICABLE STANDARDS

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

2.1 Pakistan Standard

PS 232 Ordinary Portland Cement

2.2 ISO (International Organization for Standardization)

R 597 Definitions and terminology of cement.

R 679 Method of testing strength of cements, compressive and flexural strength of plastic mortar (Rilem - (embureau method).

R 680 Chemical analysis of cement & main constituents of Portland Cement.

R 681 Chemical analysis of cements-mixer Constituents of Portland cement.

R 682 Chemical analysis of cements - determination of sulphur as sulphide.

2.3 ASTM (American Society for Testing and Material)

C 144 Aggregate for Masonry mortar

C 631 Bonding compounds for interior plastering

2.4 BSI (British Standards Institution)

812 Methods for sampling and testing of mineral aggregates, sands and fillers.

1199 Sands for external renderings Internal plastering with lime and Portland cement and floor screeds.

1369 Metal lathing (steel) for plastering.

5262 External rendered finishes.

5492 Internal plastering.

3. GENERAL

3.1 Except as may be otherwise shown on surfaces specified, all plaster work, both internal and external shall be Ordinary Portland Cement plaster of the required thickness as shown on the drawings.

3.2 Plastering shall not commence until all electric conduits, drainage and sanitary pipes, inlets to tanks, brackets, clamps, doors and window frames and all sorts of inserts and

embedded items are fixed in position. It shall be the responsibility of the Contractor to make sure that other contractors carry out all such work before starting of plasterwork. Chiseling and repairing of cement plaster shall not be permitted without the approval of the Director (GTS) / Engineer.

- 3.3 Sample of materials shall be submitted to the Director (GTS) / Engineer for his approval prior to use in the works.

4. MATERIAL

- 4.1 Cement for plaster shall be Ordinary Portland Cement (BS 12 or PS 232) or Sulphate Resisting Cement (BS 4027 or P.S. 612) as specified and shall conform to requirements specified in the section "Plain and Reinforced Concrete".
- 4.2 Sand for plaster shall comply with the requirements of BS 1199, BS 1200 or the Pakistan Standard "Sand for Plaster" as directed by the Director (GTS) / Engineer.
- 4.3 Water for plaster shall conform to requirement section for "Plain and Reinforced Concrete"
- 4.4 All materials and workmanship for plaster not explained in these Specifications, shall comply with the requirements of relevant BS CP 211 and CP 221 as directed by the Director (GTS) / Engineer.
- 4.5 External rendered finishes should comply with appropriate clauses of BS 882.

5. PROPORTIONING AND MIXING

- 5.1 Measurement of materials by volume shall be by containers of known capacity to maintain consistent proportions. No lumpy or caked material shall be used. Mixing equipment boxes and tools shall be clean. Materials shall be proportioned as specified on the Drawings or as directed by the Director (GTS) / Engineer. Mixing shall be continuous until all ingredients are evenly distributed and thoroughly mixed.
- 5.2 Only limited water shall be added for proper workability and such quantity of mortar shall be prepared which can be consumed in thirty minutes after preparation. Preparation of mortar in bulk quantity for use during the entire day or for any other time more than that stipulated above is expressly prohibited. Retempering shall not be permitted and all mortar, which has begun to stiffen, shall be discarded.
- 5.3 Plaster ingredients shall be thoroughly mixed either by hand on a clean cement concrete platform or by a mechanical mixer, as directed by the Director (GTS) / Engineer.
- 5.4 Water Proofing Plaster 3/4 inch. (20mm) thick 1:4 cement sand plaster mixed with approved water proofing agent.

6. PREPARATION OF SURFACE TO BE PLASTERED

- 6.1 Concrete surface to be plastered shall be cleaned to remove all grease, form oil and other surface impurities, which will otherwise adversely affect the adhesion of plaster to the surface concerned. The surface of all concrete ceilings, beams and columns shall be lightly hacked by approved means **to give** the required key for plastering.
- 6.2 All masonry surface to be plastered shall be cleaned to remove all matter which will otherwise adversely affect the adhesion of plaster to the surface concerned. The

surface shall be washed with clean water and kept damp for 24 hours before further surface thus prepared shall be treated uniformly cement and sand slurry. The slurry to be used shall be one part cement to one sand by volume with water added to make a stiff creamy mix.

Spatter dash of slurry shall be applied on surface to receive plaster and be left to cure for three days.

7. APPLICATION OF PLASTER

7.1 The plaster shall not have wavy surface and shall be perfectly in plumb. The edges and corners shall represent a straight line. The plaster shall be kept wet continuously for at least ten (10) days. No extra payment shall be allowed for jambs, junctions, corners, edges, round surfaces or plaster required due to any unevenness in the work done by the Contractor. The plaster work is to cover all conduits, pipes etc fixed in the walls and ceiling. Wherever specified, metal lath shall be nailed firmly before plastering is commenced. The plaster surface shall be tested frequently with a 10 ft. (3 meter) straight edge and plumb bob.

7.2 Plaster containing cracks, blisters, pits, discoloration or any defects shall not be acceptable. Any plaster giving hollow sound or loose plaster shall be removed and replaced with plaster in conformity with these specifications and as additionally directed by the Director (GTS) / Engineer.

Contractor shall cut out and patch all defective work at his own cost. All damaged plaster shall be patched as directed by the Director (GTS) / Engineer. Patching plaster shall match appearance of and shall be finished level with adjoining plaster.

8. CLEANING AND PROTECTION

8.1 Rubbish and debris shall be removed as necessary to make way for work of other trades and as directed by the Director (GTS) / Engineer. As each room or space is completed all rubbish, debris, scaffolding and tools should be removed to leave the room clean.

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

8.3 Protect finished plaster from injury by any source. Contractor shall also protect walls, floors and work of other trades from plaster materials.

9. TOLERANCES

Surfaces of plaster work shall be finished with a true plane to correct line and level unless otherwise specified and with walls and reveals plum and square

Maximum permitted tolerances shall not exceed 1/8 inch. (3mm) in 6ft. (2 meter) variation from plumb or level in any exposed line or surface and 1/16 inch. (1.5 mm) variation between planes of abutting edges or ends.

***** END OF SECTION *****

FLOOR AND WALL FINISHES

1. SCOPE

The work under this section of the Specification consists of furnishing all plant, labor, equipment, appliances and materials and performing all operations in connection with the installation of cement concrete floors and floor finishes including bases, skirting and Dado, complete in strict accordance with this section of the specifications and the applicable drawings.

2. APPLICABLE STANDARDS

Latest editions of following Pakistan, ISO, British & ASTM standards are relevant to these specifications wherever applicable.

2.1 Pakistan Standard

P.S. 232 Ordinary Portland Cement

2.2 ISO (International Organization for Standardization)

R 680 Chemical analysis of cements Main constituents of Portland Cement.

R 681 Chemical analysis of cements Minor constituents of Portland cement.

2.3 ASTM (American Society for Testing and Materials)

C 482 Bond strength of ceramic tile to Portland cement.

C 648 Breaking strength of ceramic tile.

C 650 Resistance of ceramic tile to chemical substances.

C 798 Color permanency of glazed ceramic tile.

E 84 Surface burning characteristics of building materials

2.4 BSI (British Standards Institutions)

882 Pt.2 Course and fine aggregates from natural sources.

1199 Sands for external renderings, internal plastering with lime and Portland cement and floor screeds.

1201 Pt.2 Aggregates for granulithic concrete floor finishes.

1281 Glazed ceramic tiles and tile fittings for internal walls.

5442 Classification of adhesives for use in Construction pt-1 Adhesives for use.

203 Tile flooring

204 In-situ Floor Finishes.

209 Pt.1 Care and Maintenance of floor surface, wooden flooring.

3. MATERIAL

3.1 Cement

Cement shall be ordinary Portland cement conforming to BS 12 or PS232.

3.2 Sand

All fine sand shall be as specified or approved by the Director (GTS) / Engineer and stored on properly constructed paving or as directed by the Director (GTS) / Engineer. The grading shall conform to BS 882 Grading Zone 1 and 2 of which the gradation limits are as follows:

Percentage (by weight) passing		
BS Sieve	Grading Zone 1	Grading Zone 2
3/8" (9.53mm)	100	100
3/16" (4.765mm)	90-100	90-100
No. 7	75-100	60-95
No. 14	55-90	30-70
No. 25	35-59	15-34
No. 52	8-30	5-20
No. 100	0-10	0-10

3.3 Coarse Aggregate:

Coarse aggregate shall be obtained from approved source crushed, angular in shape and shall have granular, crystalline or smooth surface free from friable, flaky and laminated pieces, mica and shale. It shall not contain matters injurious to concrete. All coarse aggregate shall conform to BSS NO.882 and shall be graded as follows:

BS Sieve	<u>% Passing by weight</u>
1" (25.40mm)	100
3/4" (19.05mm)	90-100
3/8" (9.53mm)	20-55
3/16" (4.765mm)	0-10

The aggregate shall be stored on properly constructed paving or as directed by the Director (GTS) / Engineer.

There shall be a physical partition between the stockpiles of coarse and fine aggregate. If required aggregates shall be washed and screened to the satisfaction of the Director (GTS) / Engineer. Sieve analysis of all the aggregates to be used in the works shall be carried out as and when required by the Director (GTS) / Engineer.

Any aggregates not found to be of the specified/approved standard shall be rejected by the Director (GTS) / Engineer and all such rejected material shall be removed from site without delay.

Floors, sub-base or base constructed with rejected aggregates shall be dismantled and rebuilt at the expense of the Contractor.

3.4 Not Used

3.5 Water

Water used for mixing concrete, curing or any other operation of the works specified herein shall be fresh, clean and free from organic or inorganic matters in solutions or in suspension. Only water of the approved quality shall be used for all constructional purposes:

3.6 Ceramic tiles

Ceramic tiles shall be local, best quality white or any other color. The size of tiles shall be as specified and shall conform to BS 1281 as per samples. The Director (GTS) / Engineer can select different color and designs of the approved tiles for use in different locations, if not specified.

3.7 Terrazzo Tiles

Terrazzo tiles shall be first grade mechanically compressed types conforming to PS-531. Tiles shall be of specified sizes with a topping of 10mm thickness composed of 1:2 cement marble chips, the base being 1:2 cement mortar. The color quality and size of chips shall be as per Director (GTS) / Engineer's approval.

3.8 Cleaning Compound

The compound used for all cleaning of terrazzo shall be an approved neutral chemical cleaner free from acid and alkali or any other material that will affect the color or otherwise damage the terrazzo and shall not affect the conductivity of terrazzo floors.

3.9 Vitrified Clay Tile

Vitrified clay tiles of specified size shall be first quality of local manufacture approved by the Director (GTS) / Engineer.

4. CEMENT CONCRETE FLOORING

The materials for C.C flooring shall be same as already specified under Clause 3, "Materials".

4.1 Composition of Concrete

Concrete shall be composed of Portland Cement, sand, coarse, aggregate and water, all well mixed and brought to the proper consistency. The Contractor shall mix the ingredients as 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 will be determined on the basis of the production of concrete having required workability, density, impermeability, durability and required strength.

4.2 Mixing Concrete

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

4.3 Construction

The base course of the floor shall comprise of brick ballast of 2 inches (approx. 50 mm) mesh size. The base course shall be thoroughly compacted by suitable power rammers to the total consolidated thickness as shown on the Drawings. The interstices shall be filled with smaller size brick. The base course shall be blinded with sand and the whole surface watered- Over the well compacted base course, a layer of concrete of the required grade and thickness shall be laid, in panels of the sizes as indicated on the Drawing or as approved by the Director (GTS) / Engineer.

After the C.C bed has been cured, as directed by the Director (GTS) / Engineer, it shall be roughened and well watered before floor finishing is laid. The floor finish shall comprise of cement concrete of required grade and shall be laid in panels to the required thickness as shown on the Drawings or as directed by the Director (GTS) / Engineer. The concrete after laying will be thoroughly rammed and mortar worked up to the top and smoothed with a steel trowel. The edge of each section into which the floor is divided should be defined by wooden screeds of the approved width and of a depth equal to the depth of the floor concrete.

Freshly placed concrete floor and completed floor portions as finished shall be protected to prevent loss of water by covering with damp hessian, damp sand or other approved material, and shall be kept constantly damp for a period of four days. The concrete shall be allowed to dry out slowly over a period of three days after wet curing is completed.

5. INSTALLATION OF TILE FLOORING

The contractor should note that all tiles before installation should be sorted out in a proper way acceptable to the Director (GTS) / Engineer, no under/ over sized and damaged tile should be used.

When setting out the tiles, care shall be taken to establish the correct elevation for the floor. A gauge rod shall be used, indicating the overall measurement of a given number of tiles with specified joint width to reduce cutting.

After the floor has been machine finished, it should be covered with white, non-staining sand or rags to protect it while other work is being done. After removal, the floor shall be thoroughly scrubbed.

5.1. General

The base shall be prepared by laying cement concrete of specified grade and of thickness as specified or as shown on the drawings.

The curing period of the setting bed shall be as directed by the Director (GTS) / Engineer. As large an area of setting bed shall be spread at one time as can be covered with tiles before the mortar has set. Surplus mortar shall be removed. The thickness of setting bed in any space shall not be less than 1/2" (12.5 mm).

Floor and wall surfaces to receive the tiles shall be thoroughly cleaned of all dirt, dust, oil and other objectionable matters. Tiles shall be laid out from the center line of each space in an outward direction and the pattern should be made symmetrical with a minimum number of cut tiles.

Joints between the tiles shall be of uniform width. Tiles shall be cut with a suitable cutting tool and rough edges shall be rubbed smooth. Tiles shall be laid to the straight edges.

5.2. Terrazzo Tiles

The terrazzo tiles will be laid to the required lines, levels and grades over a setting bed of cement sand mortar comprising of 1 part of cement and 4 parts of sand by volume.

After seven days, the terrazzo tile floors shall be Machine grounds to a true even surface using various grades of abrasive stores, as required and directed by the Director (GTS) / Engineer. After the first grinding the floor shall be grouted with the same color composition as used for its manufacture. The grout shall be of the consistency of thick cream and shall be brushed over the floor to fill in the joints and after 72 hours the grouting coat shall be removed by grinding till a smooth and even surface is obtained. Areas and portion of the floor inaccessible for the grinding machine shall be ground and rubbed by hand. The final gloss shall be given by polishing the surface to the satisfaction of the Director (GTS) / Engineer.

5.3. Ceramic Tiles

The ceramic tiles shall be laid to the required lines, levels and grades over a setting bed of cement sand mortar comprising of one part of cement and 4 parts of sand by volume and the Joints filled with neat white or grey cement including vertical and horizontal covers. The tile floor shall be kept wet for at least 72 hours and no traffic should be allowed on the tiles during curing period.

5.4. Cement Concrete/Vitrified Tiles

The cement concrete and vitrified clay tile shall be laid to the required, lines, levels and grades over a setting bed of cement sand mortar comprising of 1 part of cement and 4 parts of sand by volume.

6. TERRAZZO FLOORING CAST IN SITU

6.1 Mix The terrazzo mixes shall be composed by weight as follows:

Plain terrazzo for all floors and bases indicated as terrazzo and not otherwise specified, shall be composed of one part cement, white or grey, and 2 parts of marble chips of the sizes and colors hereinafter specified.

6.2 Preparation for Terrazzo

The grade and thickness of concrete as shown on the Drawings shall be laid as underbed to receive terrazzo. The surface of the bed shall be roughened for bonding with the terrazzo finish. If the surface is too smooth it shall be roughened with a toothed chisel and, prior to laying the terrazzo the bed shall be cleaned of all dirt, oil grease and extra loose material.

6.3 Division Strips

Terrazzo floors and bases shall be divided by glass/marble strips. The division strips between fieldwork and borders shall have exposed tops in full width of the strips. The division strips shall be set immediately after the spreading of the underbed, the strips being partially embedded therein, securely anchored to the sub-floor and grouted solid.

All division strips shall be set, straight to lines and to the proper level to ensure that the tops of the strips will show uniformly after grinding and smoothing operations are completed and joints and intersections shall be fitted tight. Strips shall be braced to prevent bulging during the placing of terrazzo.

Unless otherwise shown on the drawings, the divisions in field work of large areas shall not exceed 3 feet x 3 feet and in small areas shall not exceed 2 feet x 2 feet.

Edging strips shall be placed at door ways between terrazzo and types of flooring and along the edges of all terrazzo bases or borders and adjoining other types of floor finishes or floor covering. The edging strips at door ways shall be placed in line with the step face of doors. All edging strips shall be anchored and grouted solid in the underbed or to the concrete sub-floor and braced to prevent bulging as specified for division strip.

6.4 Laying Terrazzo

6.4.1 The sub-surface shall be swept clean, thoroughly moistened, but not saturated, and slushed with a coating of neat cement grout. The underbed consisting of specified cement concrete screed shall be spread and brought to a level not less than 1/2" inch. (12mm) below the finished floor level. The dividing strips shall be installed in the green underbed. The terrazzo mix shall be spread, tamped and rolled into a compact mass not less than specified thickness. After rolling additional aggregate mix shall be sprinkled over the surface to fill up all depressions, to take up excess moisture and to permit the terrazzo to be trowelled to a level, dense and even surface, slightly above the finish line of floor. This level shall allow for surface grinding necessary to expose the specified areas of aggregate, and to produce smooth, levels, floors free of waves and depressions.

6.4.2 Seasoning

The completed terrazzo shall be allowed to season for 6 days during which time it shall be kept moist and free of traffic. The curing shall be accompanied by (1) covering with approximately 1 inch (25 mm) thickness of sand; or (2) sprinkling with water at every 10 hour interval.

6.4.3 Surface

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

6.4.4 Finishing

Not less than 72 hours after application, the grouting coat shall be removed by grinding. In the later stages of grinding, the grit stones or other abrasive used in the grinding machine shall be of a grain or fineness that will give the surface smooth finishes. Small areas, inaccessible portions and corners, which cannot be reached by the grinding machine, shall be ground and rubbed by hand.

6.4.5 Protection

The walls and all surfaces of the finished work of other trades shall be properly protected from damage and spoiling during the process of grinding and washing of the terrazzo. After the finish grinding has been completed and the surface treatment applied, the terrazzo work shall be covered and protected with material approved by the Director (GTS) / Engineer until completion of the work of all other trades.

6.4.6 Cleaning and Coating

Prior to placing the protective covering, the terrazzo floor shall be approved by the Director (GTS) / Engineer. After the work all other trades has been completed and the protective covering removed, all terrazzo work shall be washed with cleaning where necessary to remove any stains or cement smears. The terrazzo shall be allowed to dry thoroughly and shall be given a sealing application of preservative material. The sealing material shall be applied in accordance with the manufacturer's directions, leaving all terrazzo work in clean condition as approved by the Director (GTS) / Engineer.

6.4.7 Dado/Skirting

The ingredients of Dado/skirting shall be one part of cement and two parts of marble chips varying from Nos. zero to 2. Skirting shall be laid over a base of plaster of specified thickness. The thickness of dado/skirting layer shall be as specified. The surface shall be ground and polished to the satisfaction of the Director (GTS) / Engineer.

***** END OF SECTION *****

VALVE CHAMBERS

1. SCOPE OF WORK

The work to be done under this section of specifications includes all plant, labor, equipment, appliances, materials and in performing all operations required in connection with construction of valve chambers including providing and fixing R.C.C/C.I. cover and frame, ladder rungs, etc. complete as specified herein as shown on the drawings, or as directed by the Director (GTS) / Engineer,

2. APPLICABLE SECTIONS OF SPECIFICATION

The following specification sections shall be followed for carrying- out civil works associated with this section:-

<u>S. No.</u>	<u>Description</u>	<u>Section No.</u>
1.	Earthwork	1100
2.	Form Work	2100
3.	Reinforcement	2200
4.	Plain and Reinforced concrete	2300
5.	Cast Iron Covers with frames & ladder rungs	5233

3. CONSTRUCTION

Chambers shall be of ordinary/Sulphate resistant cement, plain/reinforced cement concrete of the sizes, thicknesses, and class of concrete as shown on the drawings. Where soil is alkaline Sulphate resistant cement shall be used for concrete work. The work of excavation, backfilling, disposal of surplus/rejected earth, block masonry, plain and reinforced cement concrete, formwork, reinforcement, R.C.C / C.I. cover and frame, ladder rungs etc. are to be done under this section and shall be executed in accordance with the specifications as stated above. The steel frame and ladder rungs shall be well set in place at the time of pouring concrete.

*****END OF SECTION *****

GLAZING

1. SCOPE

The work under this section of the Specifications consists of furnishing all labor, equipment, tools, appliances, scaffoldings and providing glass gaskets, sealants, compound and other materials required for performing all operations in connection with the installation and setting of all types of glass, glazing and glass blocks complete in every respect in accordance with the Drawings or as directed by the Director (GTS) / Engineer. The scope of this section of Specifications is covered with detailed Specifications as laid down herein.

2. APPLICABLE STANDARDS

Latest editions of following British Standards are relevant to these specifications wherever applicable.

2.1 BSI (British Standards Institution)

952	Glass for glazing
5051	Security glazing Part I & I)
CP.152	Glazing

3. GENERAL

- 3.1 Glazing sealant shall be as recommended by the manufacturer for the particular application.
- 3.2 Spacer shims (distance pieces) shall be elasticized polyvinyl chloride (PVC). Thickness shall be equal to space shown on drawings between glass and rebates, bead or cleat. Depth shall give not less than 1/4 inch cover of glazing sealant.
- 3.3 Contractor shall submit samples for each type of glass, minimum 4 ft. x 4 ft. in size with protective edges. Samples of glazing sealant minimum 0.1 liter of specified types shall be submitted. Samples of minimum of three glass blocks shall also be submitted.
- 3.4 Contractor shall submit 1 foot long sample of each type of glazing gasket.
- 3.5 Contractor shall also submit printed materials manufacturer's installation instructions for specified glazing gaskets, compounds sealants and accessories including description of required equipment and procedures and precautions to be observed.

4. DELIVERY STORAGE AND HANDLING

- 4.1 Contractor shall deliver materials in manufacturer's original, unopened containers clearly labeled with manufacturer's name and address, material, brand, type, class and rating as applicable.
- 4.2 Contractor shall store the materials in original unopened containers with labels intact/protected from ground contact and from elements which may damage glass.
- 4.3 Contractor shall handle the materials in a manner to prevent breakage of glass and damage to surfaces.

5. **MATERIALS**

5.1 **General**

Glass shall be free from all blemishes, bubbles, distortions and other flaws of any kind and shall be properly cut to fit the rebates so as to have a uniform clearance of 1.6 mm round the panes between the edges of glass and the rebates. All glass shall be best quality from reputable manufacturer (USA/Sweden) as approved by the Director (GTS) / Engineer.

5.2 **Glass**

5.2.1 **Tinted/Plain Glass (Local)**

Glass for windows, and ventilators and louvers shall be of specified thickness of approved quality.

5.3 **Glazing Sealants and Compounds**

Contractor shall provide material colored to match frame in which glass is installed. Provide only compounds known to be fully compatible with surfaces, which they will contact as follows:

5.3.1 Two component polysulfide glazing sealant.

5.3.2 One component acrylic glazing

5.3.3 Acrylic-latex glazing sealant consisting of modified latex rubber and acrylic emulsion, non-hardening, non-staining and non-bleeding.

5.3.4 Cleaners, Primers and sealer as recommended by the sealant manufacturer.

5.4 **Accessories**

5.4.1 **Glazing Sealant**

It shall be tape or ribbon of polymerized butyl or mixture of butyl 1 and polyisobutylene compounded with inert fillers and pigments, solvent based, 95 percent solids thread or fabric reinforced, paintable, non-staining.

5.4.2 **Setting Blocks**

It shall be chloroprene (Neoprene) 70 to 90 durometer hardness, compatible with sealant used, channel shaped and of the necessary height for proper perimeter clearance.

5.4.3 **Channels, Gaskets, and spacer's**

It shall be chloroprene (Neoprene), 40 to 50 durometer hardness compatible with sealant used.

6. **INSTALLATION OF GLAZING**

6.1 Glazing shall comply with the recommendations of glass and glazing materials manufacturers.

6.2 Examine each piece of glass and discard and replace glass with edge damage or face imperfection. All glazing shall be wind tight and fully water tight on completion.

6.3 Clean glazing channels and other framing members indicated to receive glass.

Remove coatings, which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are to be used. Apply primer and sealer to joint surfaces wherever recommended by the sealant manufacturer and as shown on the drawings.

- 6.4 Trim and clean excess glazing materials from surrounding surfaces immediately after installation and eliminate stains and discolorations.
- 6.5 Cure glazing sealants and compounds in compliance with manufacturer's instructions to obtain high early bond strength internal cohesive strength and surface durability.
- 6.6 While glazing operation is in progress care shall be taken to avoid breakage or damage to the glass and adjoining glazing. The Contractor shall make good at his own cost, all glass broken by his workmen while cleaning or carrying out other operations. On the completion of the glazing work, all glass that has been set by the Contractor shall, if it becomes loose, within the maintenance period, be refixed at Contractor's expense.
- 6.7 No glazing shall be considered complete until and unless paint and other stains have been removed from the surface of the glass and checked by the Director (GTS) / Engineer for water tightness.

7. PROTECTION AND CLEANING OF GLAZING

- 7.1 Remove all smears, labels and excess glazing sealant, leave clean inside and outside free from scratches. The Contractor shall be responsible for the protection of installed glass. Before final acceptance, damaged or broken glass shall be removed and replaced with new glass at no additional expense to the Employer.
- 7.2 All glass surfaces shall be washed clean both inside and outside within two weeks prior to final acceptance by the Employer.

*****END OF SECTION *****

WATER PROOFING & BUILT-UP ROOFING

1. SCOPE

The works under this section of the Specifications consists of furnishing all plant, labor, equipment, appliances and materials and in performing all operations in any floor and at any height in connection with installation of insulation, water-proofing and built-up roofing, including water proof treatment to foundations and basement structures complete in strict accordance with this section of the specifications and the applicable drawings and subject to the terms and conditions of the Contract.

2. SUBMITTAL

- 2.1 Shop Drawings: Shop drawings showing layout and all the details for construction.
- 2.2 Samples of all materials proposed for use under this section shall be submitted to the Director (GTS) / Engineer for approval.

3. MATERIALS

- 3.1 Bitumen 10/20 grades.
- 3.2 Polyethylene buildings film visqueen standard or approved equal. The film shall be 0.008 inches thick.
- 3.3 Cement and aggregates shall be in accordance with specifications Section 2300 for "plain and reinforced concrete".
- 3.4 Mud mortar composed of stiff clay mixed with an equal bulk of chopped rice husk/bhoosa.
- 3.5 Brick ties conforming to specifications section 4200.

4. DELIVERY STORAGE AND HANDLING

Materials shall be protected from damage during loading shipment delivery and storage non-staining materials shall be used for blocking and packing.

5. PREPARATORY WORK

- 5.1 All scuppers and roof drains shall be placed and metal flashing, cant strips flanges etc. shall be provided in time to be installed along with the roofing assembly.
- 5.2 All surfaces, to be treated shall be dust free and dry. Application of roof finishes shall not start unless the preparatory work has been inspected and approved by the Director (GTS) / Engineer.

6. APPLICATION OF ROOFING

- 6.1.1 Roofing shall not be applied during rain or while surfaces are damp, it shall be applied only to surfaces that are clean and dry.
- 6.1.2 Mopping of surface with bitumen shall be performed so that the surface shall be completely covered. Coats of bitumen shall be as specified in drawings. All bitumen shall be applied with mops except that the hot surfacing application shall be poured from a dipper.

- 6.1.3 Polyethylene sheet shall be laid in position wherever shown in drawings. Where joint is necessary at the side or end of the sheet, this shall be a double weld folded joint made by placing the edges together and folding over twice continuously taking the top edge prior to plastering or screeding. The contractor shall protect the sheets from damages during laying and subsequent operation and shall replace at his own cost all damaged sheets to the satisfaction of the Director (GTS) / Engineer.
- 6.1.4 Mud mortar/concrete screed of specified thickness as indicated on drawing shall be laid in slope.
- 6.1.5 Brick tiles of specified size laid over prepared base to be grouted and flush pointed with cement sand mortar.

7 WATER PROOFING & BUILT UP ROOFING

The water proofing treatment to reinforced cement concrete roof slabs shall be done as specified and as indicated on the drawings.

*****END OF SECTION *****

MARBLE WORK

1. SCOPE

The work under this section of specifications, consists of providing all material, labour, plant, equipment, appliances and performing all operations required for providing and installing marble natural stone slab and tile finishes in floor and special aglow marble stone in floor & skirting, where shown on the drawings, complete in strict accordance with this section of the specification and the applicable Drawings.

2. SUBMITTALS

Submit three range samples 12"x12" in size of each type of marble showing colour, grade, finishing and texture for approval.

3. DELIVERY, STORAGE AND HANDLING

Materials shall be protected from damage during loading, shipment, delivery and storage. Non-staining materials for blocking and packing shall be used. Stack marble units at site in accordance with manufacturer's recommendations and as required to prevent staining, scratching, etching or breakage.

4. MATERIALS

4.1 General

The marble/stone work of all types should be consistent in type, colour range and texture.

Provide slabs or tiles of specified sizes in floor and wall areas as shown on drawings.

Provide marble/stone of specified thickness. Saw-cut the back surfaces that are meant to be concealed in finished work.

Provide irregular shaped units, staircase units and skirting base units to the profiles of required, with arises sharp true and matched at joints, polish exposed edges.

4.2 Marble/Stone Type

All marble/stone types are to be selected and approved by the Director (GTS) / Engineer for quality, colour and texture as:

a. Marble of local origin, first class quality and high class finish acceptable to the Director (GTS) / Engineer.

b. Stone: As approved by the Director (GTS) / Engineer.

4.3 Beds and Backings

Where applicable, standard cementitious screed and mortar beds and backings, mixed and proportioned by volume shati be as follows:

Grey ordinary Portland Cement: 1 part

Sand: 4 parts

Water: Clean, fresh and free from deleterious substances.

4.4 Adhesives, Grouts and Sealants

Proprietary adhesives, joint grouts and sealants of approved type as required and recommended by the manufacturer for specific application shall be used. The colour of the joint grout and the sealants shall match with the colour of stone/marble.

5. **EXECUTION**

5.1 **Flooring, Skirting and Stair**

Apply cement slurry coat over surfaces of concrete substrate immediately prior to placing setting bed. Limit area of application to avoid premature drying out. Install setting bed of required thickness and set marble/stone units before initial set occurs. Apply a thin layer of cement paste to bottom of each unit. Set, tamp and level units immediately. Set units in required pattern with uniform joint widths.

Joints as soon as possible after initial set. Force grout into Joints, strike flush and tool slightly concave.

Remove mortar and grout from surfaces while still moist and as the work progresses. Do not permit traffic on finished surface during setting and for a minimum of 24 hours after final pointing of joints

5.2 **Repair and Cleaning**

Remove and replace marble/stone units, which are broken, chipped, stained or otherwise damaged. Where directed, remove and replace units, which do not match adjoining stonework or are not in line and level as shown on Drawings. Provide new matching units, install and point joints to eliminate evidence of replacement. Repoint defective and unsatisfactory joints to provide neat, uniform appearance.

Clean stonework not less than 6 days after completion of work, using clean water and bristle brushes. Do not use wire brushes, acid or caustic type cleaning agents or other cleaning compounds which may be detrimental to the marble/stone finish or joint grout.

5.3 **Protection**

Provide covers, boards, supports and all other necessary materials to protect finished work from collapse, deterioration, discolouration or damage during installation and until contract completion.

5.4 **Polishing**

The finished surface shall be provided with two applications of approved wax polish or as approved by Director (GTS) / Engineer.

*****END OF SECTION *****

PAINTING

1. SCOPE

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

2. APPLICABLE STANDARDS

Latest editions of following British Standards are relevant to these specifications wherever applicable.

2.1 BSI (British Standards Institution)

- 245 Specification for mineral solvents (white spirits and related hydrocarbon solvents) for paints and other purposes.
- 2521 Lead-based priming paint for woodwork.
- 2522 Lead based priming paint for iron and steel.
- 2569 Sprayed metal coatings.

Paint colours for building purposes

- CP231 Painting of building.
- CP.3012 Cleaning and preparation of metal surfaces.

3. GENERAL

- 3.1 Except as otherwise specified, all painting shall be applied in conformity with BS CP 231 "Painting of Building" as applicable to the work.
- 3.2 The Contractor shall repair at his own/expense all damaged or defective areas of shop-painted metal work and structural steelwork. Metal surfaces against which concrete is to be placed will be furnished shop-painted and shall be cleaned to being embedded in concrete
- 3.3 Except as otherwise specified, all concrete and plastered surfaces are to be painted.
- 3.4 The Director (GTS) / Engineer will furnish a schedule of colours for each area and surface. All colours shall be mixed in accordance with the manufacturer's instructions
- 3.5 Colours of priming coat (and body coat where specified, shall be lighter than those of finish coat. The Director (GTS) / Engineer shall have unlimited choice of colours.
- 3.6 Samples of all colours, and finishes shall be prepared in advance of requirement so as not to delay work and shall be submitted to the Director (GTS) / Engineer for approval before any work is commenced. Any work done without such approval shall be redone to the Director (GTS) / Engineer's satisfaction, without additional expense to the Employer Samples of each type of paint shall be on separate 1 ft. x 1 ft. x 1/8 inch tempered hard board panels. Manufacturer's colour chart shall be submitted for colour specifications and selection.

4. **MATERIALS**

- 4.1 All materials shall be acceptable, proven, first grade products and shall meet or exceed the minimum standards of approved manufacturers.
- 4.2 Colours shall be pure, non-fading pigments, mildew-proof sun-proof, finely ground in approved medium. Colours used on plaster and concrete surfaces shall be lime-proof. All materials shall be subject to the Director (GTS) / Engineer's approval.
- 4.3 Approved quality Distemper paint shall be used for painting where specified on the drawings as directed by the Director (GTS) / Engineer,
- 4.4 The plastic emulsion/weather shield paint or similar as approved by the Director (GTS) / Engineer shall be used where specified on the drawing as directed by the Director (GTS) / Engineer,

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

5. **DELIVERY STORAGE AND CONTAINER SIZES**

Paints shall be delivered to the site in sealed containers which plainly show the type of paint, colour (formula or specifications number) batch number, quantity, date of manufacture, name of manufacturer and instructions for use. Pigmented paints shall be supplied in containers not larger than 20 liters. All materials shall be stored under cover in a clean storage space which should be accessible at all times to the Director (GTS) / Engineer. If storage is allowed inside the building, floors shall be kept clean and free from paint spillage.

6. **SURFACE PREPARATION**

- 6.1 All oil, grease, dirt, dust, loose mill scale and any other foreign substance shall be removed from the surface to be painted, polished and white washed by the use of a solvent and clean wiping material. Following the solvent cleaning, the surfaces shall be cleaned by scrapping, chipping, blasting, wire brushing or other effective means as approved by the Director (GTS) / Engineer.
- 6.2 In the event the surfaces become otherwise contaminated in the interval between cleaning and painting, recleaning will be done by the Contractor at no additional cost.
- 6.3 All the surfaces to be painted shall be free from dust, dirt, fungus, lichen, algae etc. Ud paint, varnish and lime wash should always be removed by scraping and washing.

No work in this section shall be allowed until all surfaces or conditions have been inspected and approved by the Director (GTS) / Engineer.

7. **APPLICATION**

- 7.1 All paint and coating materials shall be in a thoroughly mixed condition at the time of application. All work shall be done in a workman like manner, leaving the finished surface free from drips, ridges, waves, laps, and brush marks. All paints shall be applied under dry and dust free conditions, Unless approved by the Director (GTS) / Engineer paint shall not be applied when the temperature of the metal or of the surrounding air is below 7 degrees centigrade, Surfaces shall be free from moisture at the time of painting,

All primary paint (Alkali Resistance) shall be applied by brushing. The first coat of paint shall be applied immediately after cleaning. When paint is applied by spraying,

suitable measures shall be taken to prevent segregation of the paint in the container during painting operation,

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

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

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

7.2 Where shown on Drawings all exterior finishes shall be painted with weather resistant paint in approved colours as per manufacturer's specifications.

7.3 Plastic emulsion paint of the approved make and shade shall be applied to surfaces as shown on Drawings or as specified by the Director (GTS) / Engineer.

7.4 Polyvinyl Destemper of the approved make and shade shall be applied to surfaces as specified.

7.5 Polishing

After fine sanding by a skilled operator, one coat of clear polish should be rubbed in by hand using a cloth or pad, be allowed to dry and huffed up with worn fine sand paper or atcol wool to remove lased grain. A second coat of clear polish should then be applied.

8. **JOB CONDITIONS**

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

8.2 Adequately protect all finished work.

8.3 Remove and replace all items of finish hardware, device plates, accessories, lighting fixtures or other removable items

8.4 In no case shall any finish hardware or other finished item that is already fitted into place be painted, unless otherwise specified

9. **QUALITY ASSURANCE**

All paint for any one surface shall be top quality, of one manufacturer of the specified. Deep tone accent colours shall be used and the unavailability of final coat colours may be the basis for rejecting materials for any one surface.

*****END OF SECTION *****

STRUCTURAL STEEL WORKS

1. SCOPE

The work covered by this section, consists of supply of all material, labour, plant, equipment and appliances including welding, bolts, nuts, washers, anchor bolts, embedded **parts** etc. fabrication, erection **and** painting in accordance with the specifications and as per drawings and as directed by the Director (GTS) / Engineer.

2. DRAWINGS

Design drawings shall be prepared by the Director (GTS) / Engineer and supplied to the Contractor. These shall contain main dimensions, sizes of members, typical details of joints.

Workshop drawings shall then be prepared by the Contractor from the design drawings supplied and submitted to the Director (GTS) / Engineer for approval. Fabrication shall not be commenced until approval of workshop drawings has been **obtained** from the Director (GTS) / Engineer.

3. MATERIAL

Except otherwise stated in the drawings, the material specifications **shall** conform to the following. Wherever necessary the Contractor may use equivalent alternative material subject to approval of the Director (GTS) / Engineer.

3.1 Structural Steel

Structural steel for structures shall conform to the requirements of ASTM A-36 or equivalent

3.2 Steel Forging

Steel forging shall **conform to** the requirements of ASTM A235.

3.3 Steel Casting

Steel casting shall **conform to** the requirements of ASTM A27.

3.4 Welding

Welding Electrodes for manual shielded metal arc welding shall conform to AWS A 5.1 latest edition or the A 5.5 latest edition. Equivalent locally manufactured electrodes may be used subject to the approval of the Director (GTS) / Engineer.

3.5 Common Bolts, Anchor Bolts, Nuts and Washers Bolts and Nuts shall conform to the requirements of ASTM A 307.

3.6 High Strength Bolts

High strength carbon steel bolts including nuts and washers shall conform to the requirements of ASTM A325 latest editions and of A1S1B18.2

3.7 Washers

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 of bolts used.

3.8 Cast Iron

Shall conform to the requirements of latest edition of ASTM A 48.

4. FABRICATION

4.1 Straightening of 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 a 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.

4.2 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

4.3 Holes Punching Drilling.

Holes shall be punched where thickness of the material is not greater than the diameter of bolt (+3 mm) where the thickness of the material is greater the holes shall either be drilled or sub-punched and reamed to size. The die for all sub-punched holes and the drill **to ail** sub-drilled holes shall be at least 1.58 mm smaller than the nominal diameter of the rivet or bolt. Holes for A514 steel plates over 13 mm thick shall be drilled.

4.4 Welding

4.4.1 General:

The execution and inspection of welding will be done in accordance with the provisions of the American welding society code for welding in Building construction, D1.0. No welding for piping/electrical supports shall be made transversely to any tension flanges of trusses, beams or columns.

4.4.2 Automatic sub-merged Arc Welding:

For all built-up members, i.e. sections fabricated from plates and flat bars or compound rolled sections, plate and box girders, where long continuous, welding is to be done, should be executed by Automatic submerged Arc Welding process in accordance with relevant AWS specifications.

4.4.3 Maximum and minimum size and lengths of fillet welds shall be in accordance with AISC specifications.

Surface to be welded shall be free from loose scale, slag, rust, grease, paint or any other foreign matter except mill scale, which withstands vigorous wire brushing.

4.5 Tolerances

A variation of 1 mm is permissible in the over all length of members with both ends finished for Contact bearing. The bearing surfaces prepared to a common plane by milling.

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 (3 mm)

5. **SURFACE PREPARATION/PAINTING**

5.1 Surface Preparation

All structural steel material i.e. rolled steel sections, plates, pipes, flat bars, chequered plates shall be cleaned free from loose scale, rust, burrs slag, etc. by means of sand blasting.

5.2 Painting

- a) Immediately after surface preparation all material shall be given one prime coat of rust preventive paint.
- b) After fabrication one shop coat of prime paint and then one coat of enamel paint shall be applied.
- c) One final coat of enamel paint shall be applied after erection of all components.
- d) The type of primer and enamel paints to be applied shall be as specified on the drawings.
- c) All other requirements for the specified paint system shall be in accordance with the paint manufacturer's specification/ recommendations.
- d) The Contractor shall use the best quality of the type of paint specified and shall get the same approved by the Director (GTS) / Engineer.

- g) Steel work/Surfaces not to be painted
 - i) Steel work to be encased/embedded in concrete or surface in contact with concrete or grout shall not be painted, but shall be given a cement wash after sand blasting.
 - ii) Machined finished surfaces shall not be painted but shall be coated with rust preventive compound, (approved by the Director (GTS) / Engineer) immediately after finishing. Such surfaces shall also be protected with wooden pads or other suitable means for transportation. Unassembled pins, keys, and bolt thread shall be greased and wrapped with moisture resistant paper.

6. **INSPECTION AND TESTS**

- 6.1 Manufacturer's Work Test Certificate for all material used shall be furnished by the contractor for Director (GTS) / Engineer's scrutiny and approval.
- 6.2 Rolling tolerance of all shapes and profile according to AISC 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.
- 6.3 The Contractor shall arrange for analysis and test of all material rolled locally at a testing laboratory selected by the Director (GTS) / Engineer.
- 6.4 Inspection of Welding.
The inspection of welding shall be performed in accordance with the American Welding Society specifications, as directed by the Director (GTS) / Engineer.
- 6.5 Rejection
Materials or workmanship not in reasonable conformance with the provisions of these specifications shall be rejected at anytime during the progress of the work or the completion and erection at site.

7. **MISCELLANEOUS STEEL WORKS**

General

The work covered shall include furnishing, fabricating, installing and painting miscellaneous steel work including the following:

- Steel windows/ventilators Steel louvered doors
- Steel rollup shutter
- G.I. flashing
- Steel gate and steel fence Steel ladders/rungs
- Steel gratings
- Moulded steel sheet door frames Steel railing/fencing
- Steel grill Steel wire gauze

All steel fabricated items shall conform to the drawings, details and instructions of the Director (GTS) / Engineer. Contractor shall submit detailed shop/erection drawings of the above listed items to the Director (GTS) / Engineer for approval. Drawing, material, fabrication, surface preparation shall conform to the applicable requirements of relevant clauses of these specifications. Any proposed deviation due to field conditions and availability of local material shall be submitted to the Director (GTS) / Engineer for approval.

*****END OF SECTION *****

PREPARATION OF SUB-GRADE

1. SCOPE

The work under this section of specification includes furnishing all labour, plant, equipment, appliances and materials and performing all operations in connection with preparation of sub-grade as detailed below in accordance with this section of specifications, the applicable drawings and subject to terms and conditions of the Contract. The scope of work consists of:

- 1.1 Excavation of the existing ground to required levels, grades, and lines.
- 1.2 Removing unsuitable material from below the required grades & profiles and filling with approved material.
- 1.3 Transporting from approved areas, filling and compacting the fill material in depressions or in low lying areas to match with the required levels, profiles, grades, and lines.
- 1.4 Rolling and compacting the entire sub-grade area.
- 1.5 Disposal of surplus and unsuitable materials to areas upto any lead from the work site.

2. GENERAL

The subgrade shall be formed of suitable materials free of clods, sod, roots, stumps, bushes or other objectionable materials.

The maximum dry weight density of the sub grade shall be as determined by ASTM Designation D-1557. The compaction shall be done by approved methods consistent with the soil/materials to be compacted.

3. EXCAVATION AND EXCAVATED MATERIAL

- 3.1 All excavations shall be made to the lines, levels, profiles and grades as shown in the drawings or established by the Director (GTS) / Engineer. During progress of the work it may be found necessary or desirable by the Director (GTS) / Engineer to vary the levels, elevations and grades of the excavations from those shown in the drawings. The Contractor shall perform the excavation to the revised levels, elevations and grades as established by the Director (GTS) / Engineer,

3.2 Classifications of Excavated Materials

No classification will be made of any material excavated as to its class, nature, origin or conditions.

3.3 Disposal of Excavated Materials

Suitable non-plastic materials derived from excavations shall be used for filling the depressions on low lying areas. Any surplus or unsuitable material shall be disposed off by the Contractor, in spoil banks, waste area as directed by the Director (GTS) / Engineer, up to any lead from the site of work. The contractor may however, manipulate and use the unsuitable plastic soil to make it non plastic at no extra cost to the project. All work shall be executed to the entire satisfaction of the Director (GTS) / Engineer.

3.4 Grading of Area

Grading of the excavated area shall be done by means of levelling equipment and grading machines. The Contractor shall be responsible for the required construction and stability of the grades and slopes of the area in conformity with the drawings.

3.5 Extra Excavation

In the event that the Contractor excavates any area to a level lower than the required, he shall refill the area with suitable non-plastic material and compact it in accordance with the stipulated levels so as to bring the area to the required levels and grades. No extra payment will be made to the Contractor on this account.

3.6 Contractor to bear Damages

The Contractor shall conduct all excavation operation in a safe and prudent manner in order to avoid and prevent damage to any surrounding property and to the vegetation outside the project area. All damages caused by the Contractor's operations shall be made good and repaired by the Contractor at his own expense.

4. FILLS

4.1 Fill Material

The material suitable for fill shall be non-plastic materials as approved by the Director (GTS) / Engineer.

Areas requiring filling shall be filled with material consisting of selected material from excavations or selected materials obtained from outside sources as designated by the Director (GTS) / Engineer for the purpose and all fill materials shall be free from debries, tree roots and such other objectionable substances and to the satisfaction of the Director (GTS) / Engineer.

4.2 Scarifying of the Surfaces

Prior to placing first layer of filling the existing and stripped surfaces shall be scarified to a depth of not less than 8 inch. (200 mm) and compacted to specified density. The cost thereof shall be deemed to have been included in the rates for sub-grade item.

4.3 Variation in Fill Requirements

All fill shall be done in accordance with the approved drawings. During progress of work it may be found necessary or desirable by the Director (GTS) / Engineer to vary the levels, elevations and grades of filling from those shown in the drawings. The Contractor shall perform filling to the revised levels, elevations and grades at no extra cost to the Project.

4.4 Excess Filling

If the Contractor fills any area to the levels and grades greater than the required, he shall excavate the excess materials and dispose off as directed by the Director (GTS) / Engineer. No extra payment will be made to the Contractor on this account.

4.5 Placement

Filling shall be done only with approved non-plastic soil or with the materials obtained from the excavations provided it is non-plastic as approved by the Director (GTS) / Engineer.

Fill materials shall be placed in successive layers not exceeding 6 inch.(150 mm) compacted thickness and each layer shall be thoroughly compacted to give the specified density. The sub-grade will be compacted at optimum moisture content. Loose pockets if any shall be cut out and refilled with selected materials in layers **not** more than 4 inch. (100mm) thick and formed to levels and grades as shown on the Drawings.

The water content of the fill, prior to and during compaction shall be uniform throughout each lift of material. Contractor shall control the water content of fill between three percentage points below and two percentage points above the laboratory optimum water content as determined by the compaction test designated by ASTM D 1557-91.

If the water content of the fill is less than that specified, water shall be added to the fill, and if water exceeds the OMC, or if the surfaces becomes bumpy, the fill shall be scarified with approved equipment until the water is uniformly distributed throughout the fill, and the water content of the fill satisfies the requirements of these specifications.

5. ROLLING AND COMPACTION

The in-place density shall be determined by the sand cone method in accordance with AASHTO Designation T191-61, The laboratory Density is defined as the maximum dry weight in kilogram per cubic meter as determined by the ASTM D-1557.

The subgrade shall be compacted to achieve a minimum density equal to 95% of the maximum dry density.

Equipment, suitable and adequate for uniform compaction to the specified densities, must be on hand and approved by the Director (GTS) / Engineer before any fill operations are started by the Contractor. All compaction equipment must be in good working order and any worn or defective equipment shall immediately be replaced or repaired to the satisfaction of the Director (GTS) / Engineer. Earth moving and other equipment not specifically manufactured for compaction purposes will not be considered as compaction equipment,

When the moisture content of the layer is within the limits as determined by the Director (GTS) / Engineer for proper compaction, the entire surface shall be compacted with the appropriate type of roller or compactor until the specified density has been obtained. In no case, shall the number of passes of the roller over each portion of the fill area be less than the number specified or required by the Director (GTS) / Engineer for achieving the specified density.

A pass of compaction equipment over any area is defined as a direct vertical contact of the compactor wheel, tire, drum or plate load upon all elements of that area in such a manner as to assure complete coverage of the area. No successive layers shall be placed until the layer under construction has been brought to the required density and has been approved by the Director (GTS) / Engineer.

In areas inaccessible to the equipment designated in the, foregoing sections, other types of compaction equipment shall be used as approved by the Director (GTS) / Engineer. For other types of compaction , equipment used in areas of limited space, the minimum number of passes required on all portions of each successive layer shall be determined by the Director (GTS) / Engineer after appropriate field tests to evaluate the efficiency of the equipment. The use of hand tampers will not be permitted.

To minimise the effect of precipitation on placed fill, the surface shall be rolled smooth prior to any suspension of operations. During spreading and compacting, the fill surface shall be provided with a grade transverse to the axis of the fill, being not less than 3 percent, to ensure drainage of surface water from the fill at all times.

If the surface of any compacted layer of fill is too dry or, in the opinion of the Director (GTS) / Engineer, too smooth to bond properly with the layer of material to be placed thereon, the layer shall be wetted and worked with a harrow, scarifier, or other approved equipment, to a sufficient depth to provide a satisfactory bonding surface, before the succeeding lift is placed.

If the surface of any compacted layer of fill is too wet or bumpy to allow proper compaction of the fill to be placed thereon, it shall be reworked with harrow, disc, or other approved equipment and mixed with dried fill material to reduce the water content until it satisfies the requirements of these specifications. The reworked fill shall be recompacted to the requirement of these specifications before any succeeding lift of fill is placed thereon.

Any compacted lifts of fill which have suffered a reduction in density due to the action of precipitation, or for any other reason, shall be worked and recompacted to the requirements of these specifications by the Contractor at his own cost, before spreading and compacting operations are resumed. If ruts are formed, they shall be graded level and recompacted to the requirements of these specifications.

Any and all materials which do not meet the requirements as specified for fill and are accumulated on the surface of any lift or prepared subgrade, shall be removed by Contractor at his own cost before any material is placed in the succeeding lift.

Special care shall be exercised in placing and compacting fill material immediately adjacent to pipe to avoid damage either to the pipe or its alignment. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced at Contractor's expense.

Any portion of the subgrade which has, in the opinion of the Director (GTS) / Engineer, been damaged by the Contractor's equipment during his construction operations, shall be repaired and re compacted by the contractor to the satisfaction of the Director (GTS) / Engineer and no extra payment will be made thereof

The limits to which "Filling and backfilling at Structures" will apply shall be in accordance with the relevant section of the specifications or as required by the Director (GTS) / Engineer.

6. WATERING

Water may be applied by equipment or by labour at the locations in the amount and during the hours (including nights) as directed by the Director (GTS) / Engineer, The supply of water shall be adequate to cater for all the requirements specified herein or directed by the Director (GTS) / Engineer. The distributor used for watering shall be equipped with a spray bar and shall be of ample capacity and of such design as to ensure uniform application of water in the amounts directed by the Director (GTS) / Engineer. Water supplied through employment of labour shall also be in accordance with the directions of the Director (GTS) / Engineer.

The Contractor shall not use water from shallow, muddy or marshy surfaces. The quality of water shall be subject to the approval of the Director (GTS) / Engineer; the use of seawater shall not be permitted.

7. FINISH OF SUB-GRADE

7.1 When the sub-grade has been constructed to the required grade, line and cross-section and compacted to the required degree, the sub-grade shall present a finished surface acceptable as formation to the Director (GTS) / Engineer. The formation shall be properly shaped to a smooth uniform surface parallel to the finished surface of the road.

7.2 Sub-grade that does not conform to these specifications and the drawings shall be re-worked to the correct grade, line and cross-section as directed by the Director (GTS) / Engineer. Any work carried out in compliance with this clause shall be at the expense of the Contractor.

7.3 No material for the construction of sub-base-course shall be placed until the prepared sub-grade is upto the work and approved by the Director (GTS) / Engineer.

8. INSPECTION

Field inspection and density test shall be carried out jointly by the Contractor and the Director (GTS) / Engineer. Contractor shall facilitate the inspection and the performance of these tests and bear all costs. Subgrade that does not conform to these specifications and the Drawings shall be reworked and redone by the Contractor at his expense as directed by the Director (GTS) / Engineer.

9. TOLERANCES

The finished graded surface shall be smooth and even and tolerance from the required grades shall be ± 2 inch. (± 50 mm).

10. DISPOSAL OF SURPLUS/REJECTED EXCAVATED MATERIAL

Refer Clause 6 of Section 1100.

*****END OF SECTION *****

MANHOLES

1. SCOPE OF WORK

The work to be done under this section of the specifications includes furnishing all plant, labor, equipment, appliances, material and performing all operations required in connection with construction of manhole, including provision and installation of cast-iron cover and frame / ladder rungs, vent, inlet & outlet fittings etc., complete as specified herein, or as shown on the drawings, or as directed by the Director (GTS) / Engineer.

2. APPLICABLE SECTIONS OF SPECIFICATIONS

The following specification sections except for sub-sections regarding measurement and payment shall be followed for carrying-out civil works associated with this section.

<u>S.No.</u>	<u>Description</u>	<u>Section No.</u>
1.	Earthwork	1100
2.	Formwork	2100
3.	Reinforcement	2200
4.	Plain and reinforced concrete	2300
5.	Plumbing	5100
6.	Ladder rungs	5233
7.	Cast iron cover and frame	5233

3. CONSTRUCTION

Manholes shall be constructed using ordinary/sulphate resistant cement. The bottom slab and benching shall be of plain cement concrete cast in situ, the walls shall be of block/brick masonry or reinforced cement concrete with internal and external cement plaster and bitumen coating on the out side surface. The top slab shall have opening for cast-iron cover and frame. The work of excavation, backfilling, disposal of surplus/rejected earth, plain and reinforced cement concrete, formwork, reinforcement, benching, pipe connections and provision and installation of cast-iron cover with frame, ladder rungs, vent, inlet & outlet fittings etc., are to be done under this section and shall be executed in accordance with specifications.

*****END OF SECTION *****

CAST IRON COVERS WITH FRAMES & LADDER RUNGS

1. SCOPE OF WORK

The work to be done under this section of the specifications consist of furnishing all plant, labor, equipment, appliances, material and performing all operations required in connection with supply and proper installation of C.I. cover with frame, and ladder rungs, complete as specified herein, as shown on the drawings, or as directed by the Director (GTS) / Engineer.

2. CAST IRON COVER WITH FRAME

Cast iron cover and frame shall be of the size and duty as specified on the drawings. The specified size means the clear opening. The cover shall be complete with frame. Top of cover shall be roughened in an approved pattern with lifting arrangement provided. The frame shall be well set in place at the time of pouring of concrete. The cover shall tightly fit in the frame. It shall be airtight and watertight. The duty and weight for 18" x 18" square cover and frame shall be as follows:

<u>Class/Duty of Cover and Frame</u>	<u>Gross Weight</u>
Light	25 - 30 KG
Medium	45 - 50 KG

3. LADDER RUNGS

Galvanized mild steel ladder rungs shall be fabricated to the size specified on the drawings or as directed by the Director (GTS) / Engineer. The galvanized mild steel ladder rungs shall be fitted by approved fittings at locations shown on the drawings or as directed by the Director (GTS) / Engineer.

*****END OF SECTION *****

TESTING AND COMMISSIONING

1. SCOPE OF WORK

The work under this section of specifications includes visual inspection, furnishing all plant, labor, equipment, appliances and materials and performing all operations required in connection with testing and commissioning of all water line, drainage system and fixture etc. in parts and as a whole as specified herein or as shown in the Contract Documents or as directed by the Director (GTS) / Engineer.

2. GENERAL

The testing shall include a complete visual inspection of the whole plumbing and fire fighting system and verification of performance as stipulated in the material specification and of correct functioning of the electrical and control systems.

All supply documents, operating instructions, acceptance documentation and maintenance regulations shall be checked to ensure that they correspond with equipment described and also all certificates such as that of the inspection authorities, test certificates and data about quality, temperature and pressure shall be submitted.

3. FIXTURES AND FITTINGS

3.1 Test Program

The type and the catalogue number of the sanitary fixtures shall be checked.

All equipment in general including the accessories shall be checked for service ability, correct operation and freedom from damage.

The flow and water capacity shall be checked on the full connection of lavatories, showers, WC's, etc. and also the draining capacity shall be measured at the same time.

4. POTABLE WATER SUPPLY SYSTEMS HOT & COLD

4.1 Test Program

The method of laying and sealing the water connection lines to the buildings and through walls shall be checked.

Visual inspections shall be made of the entire network for the water systems with regard to laying, fixing, suspension of pipes and fixtures, particularly the arrangements of the fixed points and the separation of the individual connections in the various parts of the system.

The satisfactory function of all valves, air relief valve check-valves, pressure reducers, thermostats, pumps, etc., shall be checked. The test programme shall also cover.

- 2 Checking of type, thickness and professional laying of the piping insulation
- 2 Checking number, form and inscription of the equipment labeling.
- 2 Checking of all pipe and flanged connections to devices, water-heaters, drainage and vents for symmetry and lack of strain.
- 2 Performance of pressure test for the entire network, including fixtures.

4.2 Hydraulic Pressure Test

On completion of the pipe work installation, or sections thereof as required, pressure test shall be made before the application of insulation. The pressure tests shall be

taken by sectors. All equipment and accessories shall be provided and the Director (GTS) / Engineer shall be given notice that the work is ready for testing. Tests shall be made by pumping up the system to the required pressure then closing the valves between the pump and the section under test. The valve shall remain closed for the duration of the test and the pump shall be disconnected. Test pressure, as detailed below shall be applied as detailed for a period two hours or longer, at the discretion of the Director (GTS) / Engineer. If, at the end of period, there is no drop in pressure and no evidence of leak or other faults, the test will be considered satisfactory.

Should any fault be revealed by the test, leaks are to be recorded, Faults shall be made good and the pipe work retested as many times as necessary until satisfactory results are obtained.

After all the pipes and fixtures have been properly laid and tested, they shall be flushed clean with water and then disinfected with water solution of chlorine of at least 50 PPM strength for a contact period 6 hours. The system will be finally flushed with clean water,

4.3 Test Pressure and Procedure

Fill pipes slowly with potable water to exclude all air. Apply test pressure of 1.5 times the maximum working pressure. There must be no measurable loss of pressure for at least 30 minutes.

5. DRAINAGE SYSTEMS

5.1 Test Program

Check the piping by means of the separation system, In relation to the specified capacity.

Check each connection for dimension and draining capacity.

Check the drain line for laying, fixing, and compliance with specification.

Check the practical arrangement of the fixtures, fixing points, suspensions, cleaning openings, vents, pit covers and ground inlets,

Check all the covers and openings, paying special attention to the separation system for waste/sewage and the storm water.

Generally provide clean water and apparatus for testing

5.2 Test Methods

a. Water Testing

All the openings in the piping system shall be tightly closed by inserting testing plug. The highest point will be left open to supply water and may be raised if necessary by temporary jointing, develop a minimum static head of 05 bar for of water at each section of the system. Water is filled to the point of overflow and any drop in the level of water will indicate a leak that will be found by inspection. The water level will be checked for no drop for at least 15 to 30 minutes. Higher stacks will be tested in sections, starting from the top section and then connecting top section to next lower section.

b. Timing

Testing shall be carried out as soon as practicable after completion of each drainage stack. All concealed work shall be tested before being finally enclosed,

6. **FIRE FIGHTING SYSTEMS**

6.1. Stand Pipe System

Test Program

Visual inspections shall be made of the entire network for the standpipe' system with regard to laying, fixing, suspension of pipes, particularly the arrangements of the fixed points and the separation of the individual connections in the various parts of the system.

The satisfactory function of all valves, air relief valve check valves, pressure gauges shall be checked,

The test programme shall also cover:

- 2 Checking number, form and inscription of the labeling.
- 2 Performance of pressure test for the entire network

6.2. Hydraulic Pressure Test

As described for potable water supply system

6.3. Test Pressure and Procedure

As described for potable water supply system

*****END OF SECTION****

PUMPING MACHINERY

1. SCOPE

The work to be done under this section of the specifications includes furnishing all plant, labor, equipment, appliances and materials and in performing all operations required in connection with the installation of pumping machinery including all accessories as specified herein or shown on the Drawings or as directed by the Director (GTS) / Engineer.

2. MATERIALS AND PRODUCTS

Materials and machinery shall conform to the latest referenced specifications and other provisions specified herein and shall be new and unused. In case where manufacturers are specified, materials and equipment will be of the same manufacturers. In all other cases the Contractor shall submit the names and addresses of the Manufacturers and trade names of the materials and equipment that he intends to buy. Other information such as diagram, drawing and descriptive data will be supplied if so desired by the Director (GTS) / Engineer. Approval of materials and all the machinery under this provision shall not be construed as authorizing any deviations from the specifications. The approval of machinery of manufacturer other than that specified will be purely on the discretion of the Director (GTS) / Engineer. The Director (GTS) / Engineer will fully ascertain the facts and satisfy himself as to the performance of the machinery offered by the Contractor.

3. SPECIAL REQUIREMENTS OF PUMPS

The Contractor shall furnish with each pump properly identified characteristic curves prepared and certified by the manufacturer showing capacity, head, efficiency and brake horsepower throughout the entire range of the pump.

The pumps shall have stable throttling curves and be suitable for unrestricted parallel operation.

All pumps shall be electric driven.

The pumps and their drives shall not overload or trip when operating against zero pressure.

The design, construction and materials shall be such that damage as a result of cavitation is completely eliminated.

Pumps shall have bearings and be suitable for continuous as well as intermittent operation without external sealing or cooling water.

The pumps shall be such that they shall come into operation at once after a prolonged shutdown period without having to take special measures.

Pumps shall be capable of delivering specified quantity of water at the specified pressure.

Pumps shall be tested at site before their final acceptance.

Pumps shall be installed at positions shown on the Drawings and/or as directed by the Director (GTS) / Engineer.

Pumps and their drives shall be in perfect alignment when installed in position.

4. POTABLE WATER PUMP SET

4.1 The pump sets will consist of close coupled, horizontal, centrifugal pumps of specified capacity and head and duty and shall be horizontally mounted, totally enclosed, fan cooled, squirrel cage induction motors of specified power

- 4.2 Pump materials shall be as under:
- | | |
|--------------|-------------------------------|
| Body | : Fine grained grey cast iron |
| Impeller | : Bronze |
| Shaft | : Stainless steel |
| Shaft Sleeve | : Bronze or stainless steel |

Pumps shall have mechanical seal. The suction and discharge flanges shall be rated for a working pressure of 10 kg/cm² and 16 kg/cm for potable and fire pumps respectively The flanges shall be drilled to BS 10 (Table 'D' or 'E') or BS 4504,

- 4.3 Motors shall run on 3-phase, 400 volts \pm 10%, 50 c/s A/C power motors shall be protected from low voltage, overload, overheating and phase failure.
- 4.4 Pump set shall be provided with reducer/enlarger if necessary on pump discharge and suction pipe.

5. **MOTOR PROTECTION**

Motors of 3 kW or less power shall be started direct on line. Star-delta starter shall start larger motors.

Motor shall be protected against under voltage over voltage, overload, and overheating and phase failure.

Motor shall be rated for normal operation against a voltage fluctuation of 10% and frequency fluctuation of \pm 2 Hz.

6. **MAINTENANCE MANUALS AND TOOL**

- 6.1 A book of books containing the complete information in connection with the assembly, operation, lubrication, adjustment and repair of the pumping equipment, electric motor, together with detailed parts list with drawings or photographs shall be furnished in duplicate
- 6.2 For the pumping station, special tools necessary for maintenance and repair of the pumps and electric motors including tools kits, grease guns etc. with accessories shall be furnished,
- 6.3 The equipment to be supplied for the pumping station shall be provided with spare parts necessary for the operation and maintenance for 1 year.
- 6.4 The manufacturer's recommended list of spare parts to be stocked by the Authority shall be submitted by the Contractor to the Director (GTS) / Engineer for approval. Such spare parts will also be furnished by the Contractor.
- 6.5 All the maintenance manuals, tools, spare parts etc., shall be supplied by the Contractor at no cost of the Authority and all cost shall be deemed to be included by the Contractor in his bid against item of pumping set.

7. **MISCELLANEOUS**

7.1 **Scope**

The work under this section of specification consist of providing all material and labor, equipment, appliances etc. for proper installation of miscellaneous items of valve, pressure gauge, pressure switch, brass strainers as specified herein or as shown on drawing or as directed by the Director (GTS) / Engineer.

7.2 Material and Installation

7.2.1 Cast Iron Gate Valves

Gate valves shall be of cast iron body and shall conform to BS 5150 "Specifications for Double Flanged Cast Iron Wedge Gate Valves for general purposes", the service rating shall be 10 bars for potable water, Body of the valve shall be tested to 1-1/2 times service pressure and the seat shall be tested at maximum service pressure. No leakage shall be observed under the above tests. The material used shall be corrosion resisting, free from toxic substances and shall not foster microbiological growth or given rise to taste, odors, cloudiness or discoloration of water. The external surface of the valves shall be painted with a minimum of two coats of black bituminastic enamel paint.

Ends of the valves shall be flanged to join with the standard fittings. Flanges shall be appropriate class and material.

Valves shall be installed in pipelines or in valves chamber in ground depending upon the requirement.

7.2.2 Cast Iron Check Valves

Check valves shall conform to BS-5152 "Specifications for Cast Iron Check Valves for general purposes", the service rating shall be 10 bars for potable water. The direction of flow shall be permanently marked on the body of the valve, Body of the valve shall be tested to 1-1/2 times the service rating and seat shall be tested at the pressure of service rating. No leakage shall be permitted under the above tests.

Ends of the valves shall be flanged to join with the standard fittings. Flanges shall be of appropriate class and material.

Valves shall be installed at positions shown on the drawings. Wherever valve is installed vertically they shall be of lift type and installed horizontally they shall be of swing type. The interior shall be cleaned of all foreign matter before installation. They shall be inspected to ensure that all the components are sound and in working condition. Valves shall be adequately supported, wherever required.

7.2.3 Air Valves

Air valves shall be of cast iron of specified size for automatic discharge of airs and for automatic breaking of vacuum in a pressure main. They shall be rated for a working pressure of 10 bars for installation on potable water pipes, and test pressure of 1 1/2 times the working pressure. The material used shall be corrosion resisting, free from toxic substances and shall not foster microbiological growth or give rise to last, odor, cloudiness or discoloration of the water each valve shall be provided with an isolating plug gate valve,

7.2.4 Cast Iron Globe Valve

Cast iron globe valves shall conform to BS-5152. Valve stem shall be fitted

with wheel handle or top nut as specified. Valves shall close in clockwise direction when viewed from top. Valve ends shall be flanged. Flanges shall conform to BS-4504. Valves and flanges unless otherwise specified, shall be rated for working pressure of 10 bars for potable water. Valves shall be tested to 1 1/2 times the working pressure.

7.2.5 Pressure Switch

Pressure switch shall be electric actuating device which will close/open the circuit at present lower/higher pressure. The device shall be housed in diecast aluminum casing with enamel finish. The switch shall be adjustable between pressure of 3-12 bars. The pressure switch shall be rated for a working pressure of 10 bars. The switch shall be wired to control panel.

7.2.6 Pressure Gauge

Pressure gauge shall be of copper alloy, bourdon tube type with 100 mm diameter dial face. The dial shall be engraved in black or white background from zero to 6 bars or 1-1/2 times the working pressure whichever is larger. Gauge shall be installed to socket welded to the pipeline with an isolating plug/ball valve. Gauge shall be installed not higher than 1.0 m above the finished floor. If the pipeline elevation is such that the above requirement cannot be met pressure gauge of remote reading type shall be installed.

7.2.7 Brass Strainer

Brass strainers shall be of bucket type with flanged end. They shall be installed at the end of pump suction pipe. The wall thickness of the strainer shall not be width of the slots shall not be greater than 5 mm. The open areas of the strainer shall not be less than 1-1/2 times the cross sectional area of the suction pipe on which it is installed,

7.2.8 Foot Valve

Foot valve shall be installed on the suction line of the pumps where required or indicated in the drawing. Foot valve shall be of brass, and shall be provided with integral strainer. Foot valve shall be provided with a spring loaded vertical check disc with gasket for tight shut-off.

*****END OF SECTION *****

SERVICE CONNECTION

1. SCOPE OF WORK

The work to be done under this section of the specifications consists of furnishing all plant, labor, equipment, appliances, materials and in performing all operations required in connection with providing and Installing service connection to the pipe line at locations as shown in the Contract Documents or as directed by the Director (GTS) / Engineer.

2. GENERAL

Service connection of water shall consist of cast iron saddle clip, gasket, bolts, GI pipe upto plug stopcock, complete, inclusive of making connection with water main. The size of service connection shall be as shown on the layout plan. Service connection pipe shall cross the sewage pipe from above only. In case the distance between the two pipes is less than 1'-0", the water pipe will be enclosed. In concrete pipe sleeve of a suitable length. Service connection to water main shall be take from the top of pipe only.

*****END OF SECTION *****

TESTING AND DISINFECTION OF TANK

1. SCOPE

The works under this section of the specifications include furnishing all labour, plant, equipment, appliances, materials and performing all operations in connection with testing for imperviousness, and disinfection of under ground tank in strict accordance with this section of the specifications, the applicable drawings, and the terms and conditions of the contract.

2. GENERAL

- 2.1 The Contractor shall notify in writing to the Director (GTS) / Engineer/Director (GTS) / Engineer's Representative at least three days in advance of performing the tests for imperviousness and disinfection respectively, so that the latter may be present to witness the tests.
- 2.2 The Contractor shall furnish all devices, materials, supplies and labour required for testing and disinfection of the tank.
- 2.3 The Contractor shall arrange water required for testing and disinfection of tank.
- 2.4 The Contractor shall arrange sampling and testing of chlorine solution for residual.
- 2.5 The Contractor shall arrange disposal of water after testing and disinfection of tank. Any damage or claim arising from improper disposal of water shall be compensated by the Contractor.

3. TESTING

- 3.1 The imperviousness tests shall consist of exfiltration test in all cases and infiltration test when the surrounding water table is higher than the floor of the tank.
- 3.2 The earth around the tank shall not be filled until the tank has been tested and the tests have been passed by the Director (GTS) / Engineer for water tightness against exfiltration.
- 3.3 During and after the tests the outside surface of tank shall be inspected by the Director (GTS) / Engineer for any leakage and wet patches.
- 3.4 For exfiltration test the Contractor shall fill tank with water and keep it full for a period of seven days During this period, the Contractor shall record the water surface level in the tank at interval of 24 hours for seven days. The tank shall be considered to have passed the test if the egress of water from the tank does not exceed the permissible limit
- 3.5 For infiltration test the Contractor shall completely empty tank and leave it empty for a period of seven days. During this period, the Contractor shall record the water surface level in the tank at interval of 24 hours The test shall be carried out at least seven days after the completion of the construction work of the tank or discontinuation of dewatering operation whichever comes

later. The tank shall be considered to have passed the test if the ingress of water into the tank does not exceed the permissible limit.

- 3.6 The permissible limits for exfiltration and infiltration tests shall be determined by the Director (GTS) / Engineer but shall not exceed 15 litres per square metre of the internal surface area of the tank below the water surface in the tank and water table around the tank respectively.
- 3.7 If the tank does not pass any of the above mentioned tests the Contractor would suggest to the Director (GTS) / Engineer necessary remedial measures which after approval by the Director (GTS) / Engineer, shall be carried out by the Contractor at his own cost. Approval by the Director (GTS) / Engineer will not relieve the Contractor of his contractual obligation of making the tank water tight against exfiltration and infiltration.
- 3.8 After completion of remedial works the testing procedure shall be repeated until the tank has passed the tests,
- 3.9 After successful completion of exfiltration and/or infiltration tests the tank shall be emptied and water will be safely disposed off.

4. DISINFECTION

- 4.1 After successful completion of exfiltration and infiltration tests the tank shall be disinfected, if it is intended to be used for potable water.
- 4.2 Disinfection of tank shall be carried out by chlorine solution containing not less than 50 milligrams per litre of chlorine. The solution will be made with potable water. The tank shall be filled with chlorine solution and kept for 48 hours, At the end of this period the chlorine solution in the tank shall be tested for chlorine residual. If the residual is greater than one milligram per litre disinfection of tank shall be considered satisfactory,
- 4.3 If the chlorine residual is less than one milligram per litre disinfection process shall be repeated until the minimum chlorine residual of one milligram per litre has been obtained.
- 4.4 After successful disinfection the tank shall be emptied and water will be safely disposed off.

*****END OF SECTION *****

CONCRETE PIPES AND PIPE FITTINGS

1. SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all concrete pipes and pipe fittings, plant, labour, equipment. Appliances and materials and in performing all operations required for installing the Concrete Pipes in strict accordance with the specifications of this section and applicable drawings and subject to the terms and conditions of the contract.

2. MATERIALS

2.1 General

Materials shall conform to the latest referred standard specifications and other provisions stipulated herein and shall be new and unused. Prior to procurement of the materials, the Contractor shall be required to prepare and submit to the Director (GTS) / Engineer for his approval a complete schedule of materials to be used in the works together with a list of the names and addresses of the manufacturers and the trade names of the materials. The schedule shall include diagrams, drawings and such other technical data as may be required by the Director (GTS) / Engineer to satisfy himself as to the suitability, durability, quality and usefulness of the material intended to be purchased.

2.2 Concrete Pipes and Pipe Fittings

All concrete pipes and pipe fittings shall conform to ASTM designation C-14 Class 3. It must be clearly noted that all concrete pipes and pipe fittings shall be manufactured with sulphate resisting cement.

3. LAYING AND INSTALLATION

3.1 Transportation

Pipes shall be handled with special care during transportation to the site of work. Pipes shall be properly secured to minimise their movement. Cranes shall be preferably used for loading and unloading of pipes. Hooks shall be well padded to prevent pipe damage.

3.2 Storage

Pipes should be carefully stored to prevent damage, pipes should not rest directly on ground. Solid timbers base should be set on ground for pipe stacking. Pipes should not be stacked so high as to over load the bottom. The height of stack shall be further limited by the head room available for any fitting gear used on site. Pipe sockets should not normally rest on other pipes in the stack. The end pipes in the bottom row should be securely locked, wedges should be firmly anchored to prevent collapse of the stack.

3.3 Inspection of Pipe before Laying

Each pipe shall be carefully examined for soundness and cleanliness immediately before laying, any defective and damaged pipe should be rejected and removed from site.

3.4 Laying

Laying shall start from down stream. Each length of Concrete Pipe shall be in a straight line and to the true alignment, position, gradient, and the inverts as shown on the Drawings, unless otherwise directed in writing and set out by the Director (GTS) / Engineer. The Contractor shall check and satisfy himself as to the correctness of the final gradient, position, and slope of the complete Concrete Pipe before commencing the laying operation.

The Contractor shall maintain the inside of the pipe free from foreign materials and in a clean condition until the work is completed and approved by the Director (GTS) / Engineer.

Care shall be taken to avoid abrasion of the pipe. The full length of each section of pipe shall rest solidly up on the prepared bed. Pipes that have the alignment, grades or joints disturbed after laying, shall be removed and relaid by the Contractor at his own cost. Pipe shall not be laid in water. The pipes shall be encased in Reinforced Cement Concrete as shown on the drawings.

3.5 Collar Joint

The collar joint shall be made in the following manner:

The collar is slipped over, clear of the end of the pipe already laid. The next pipe is brought forward against the first pipe. The two ends when butted together concentrically shall leave a groove, in between this groove a jute or hemp gasket soaked in neat cement slurry or bitumen compound is caulked in place. The collar is then slipped back over the pipe ends. The remaining annular space between the collar and the outside of the pipe is filled with 1:1 cement sand mortar and pressed lightly. Every joint is finished off smooth inside and the interior cleared of all dirt, excess cement mortar and superfluous material.

*****END OF SECTION *****

CONDUITS AND PIPES

1. SCOPE OF WORK

The work under this section consists of supplying, installing and commissioning of all material and services of the complete Conduits and Pipes as specified herein and/or shown on Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Director (GTS) / Engineer and co-ordinate at Site with other services for exact route, location and position of the electrical lines.

The conduits and pipes with accessories shall also comply with the General Specifications for Electrical Works, Section-8001 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 conduits 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 Director (GTS) / 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 conduits 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. APPLICABLE STANDARD/CODES

The latest edition of the following standards and codes shall be applicable for the materials specified within the scope of this section:

BS 31 - Steel conduits and accessories.

BS 4607 - PVC conduits and accessories.

BS 3595 - PVC Pipes and accessories.

BS 1378 - Galvanized Iron pipes & accessories.

4. MATERIAL

4.1 PVC Conduits 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 Director (GTS) / 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 63 mm diameter and depth. The junction boxes for wall light points shall have minimum dimensions of 63 mm diameter and 38 mm deep. Round junction boxes shall be provided with one piece PVC cover plate fixed to the box by means of brass screws.

The PVC conduits and accessories shall be from approved manufacturers.

4.2 Inspection and Adaptable Boxes

Inspection/Pull boxes and 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 inspection/pull boxes or adaptable boxes. However, these shall meet the following requirements: -

Inspection/Pull Boxes

The rectangular inspection/pull boxes shall be made of 16 SWG heavy gauge sheet steel of

suitable design to receive conduits. 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 the box shall not be less than four times the cable manufacturer recommended bending radius of the cable. All concealed type boxes shall have a white plastic sheet of appropriate size fixed to the box by means of galvanized screws.

If the spacing between the end points of conduit run with respect to bends exceeds the following, an inspection/pull box of suitable size according to the number and size of cables and as approved by the Director (GTS) / Engineer shall be provided:

2	Straight run without bend	:	Max. spacing 30 metres
2	Run with one 90° bend	:	Max. spacing 20 metres
2	Run with two 90° bends	:	Max. spacing 15 metres

Adaptable Boxes:

Adaptable boxes shall also be made of 16 SWG sheet steel and painted and finished to the same quality as the Lighting distribution boards. The adaptable box shall preferably be fixed adjacent to the DB and have suitable dimensions to match the installation with DB. However, in any case, the depth of adaptable box shall be according to number & size of cables & conduits and shall not be less than the following:

2	Conduits upto 25 mm dia	:	Min. depth = 50 mm
2	Conduits upto 38 mm dia.	:	Min. depth = 65 mm
2	Conduits upto 50 mm dia.	:	Min. depth = 90 mm
2	Conduits more than 50 mm dia	:	Min. depth = 2 x dia.

4.3 Galvanized Iron (G.I.) Pipes and Accessories

The G.I. pipes shall be made of mild steel, galvanized inside and outside by hot-dip galvanizing process. The pipes shall be free from stains, burrs or any other defect. The accessories for G.I. Pipes such as sockets, bends, etc. shall be also galvanized inside and outside and of same quality and specifications as the pipes.

These pipes shall be installed for crossing of cables above nallas and culverts and at entry into building. The pipes and accessories shall be provided with one thick coat of bituminous paint on the outer surface prior to installation. All pipes shall be secured in position by means of galvanized clamps, supports, etc.

G.I. pipes and accessories shall be from the approved manufacturers.

4.4 PVC Pipes and Accessories

The PVC pipe shall be rigid. All pipes shall be minimum Class 'D' (Working pressure - 12 bar), unless otherwise stated on Drawings or Bill of Quantities. The buried PVC pipe should be able to withstand the external load acting upon it by continuous movement of heavy duty vehicles such as trucks, cranes, fork-lift, etc. Where pipe changes direction, manufactured smooth bends shall be used.

Bending of pipes by heating or otherwise will be allowed in special cases only. Bending by heating shall be carried out by first filling the pipe with sand inside and then immediately removing the sand. The use of sharp 90 degree bends and tees will not be allowed. The bends shall conform to same specifications as given for PVC conduits. For jointing of pipe all precautions and procedures recommended by manufacturer shall be followed.

The pipes and accessories shall be from the approved manufacturers.

5. INSTALLATION

5.1 Concealed Conduits

Where concealed conduit system is stated on drawings, the conduit shall be installed concealed in roof, wall, column, etc. Conduits shall be laid under floor only where specifically stated, The entire conduit system shall be installed and checked before wiring is carried out,

Any obstruction found shall be cleared before the installation of cable.

When concealed, the conduit shall have a minimum of 32 mm cover of concrete measured from the top of conduit to finished surface. 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 conduit shall be supported on top of bottom reinforcement of slab. All outlet boxes to be firmly supported and installed such that they finish flush with the soffit of slab or beam.

Where conduits have to be concealed in cement concrete (CC) work after concreting or in block masonry, chase shall be made with appropriate tools and shall not be made deeper than required. The conduit shall then be fixed firmly in the recess and covered with cement concrete mixture. The work of cutting in the cement concrete work or block masonry work shall be co-ordinated with the civil work. The Contractor shall obtain approval from the Director (GTS) / Engineer before starting chasing and cutting.

The termination of conduits at or near the equipment switchboard is shown diagrammatically on the drawings. The exact locations of the termination shall be co-ordinated with the equipment switchboard to be installed. Any extension of conduit 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 terminations of conduit, sharp edges of conduit ends shall be prevented to avoid the cutting or damaging of wires or cables during pulling through the conduits.

Underfloor conduit shall be installed at a minimum depth of 2 inch from the finished floor level or as shown on the drawings. The conduits shall be installed empty, before finishing of floor or in RCC work, with an 18 SWG steel wire drawn through the conduit for pulling cable. No conduits shall be laid under floor in bathroom.

Wherever the conduit lengths cross the expansion joint either along the columns or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed, the conduit shall not crack or break

5.2 Surface Conduits

The surface conduits shall be installed where shown on drawings only. The conduits shall be installed parallel or perpendicular to the surface of wall, structural members, ceiling, etc., by means of steel saddles and clamps of approved design. The conduits shall be kept at least 150 mm away from parallel runs of flues, steam pipes and hot water pipes.

The saddles shall be installed on surface by means of nylon or wooden plugs and galvanized screws. Appropriate size of holes in structure shall be made by drilling, the thickness of saddles shall not be less than 6mm and clamps shall be of 16 SWG sheet steel. The surface conduits shall be supported at a maximum of one metre spacing along horizontal and vertical runs. All accessories for complete installation of conduit system shall be provided by the Contractor.

The pull boxes, etc. as stated for concealed conduits shall also be applicable for surface conduit system. The entire steel conduit system alongwith the accessories shall be painted with one coat of black enamel paint after installation.

5.3 Steel Conduits and Accessories

The steel conduits and accessories are required to be installed on surface or concealed as shown on the drawings. Wherever possible the conduit(s) shall run on ceiling/beams on the appropriate routes as approved by the Director (GTS) / Engineer. The conduit(s) down to switches, socket outlets and other instruments shall be concealed in walls. The installation instructions for surface and concealed conduits given in this section are also applicable to the installation of steel conduits and accessories.

5.4 Galvanized Iron Pipes

The galvanized iron (G.I.) pipes shall be installed at a minimum depth of 900 mm measured from the top of pipes to finished ground level. The pipe shall be laid and checked for soundness before completion of civil works. The G.I. pipes at the entrance of the buildings shall be installed at locations as shown on the drawings.

At all joints the pipes shall be firmly screwed and cotton yarn with water-proof compound shall be used to make the joint water-proof.

At each termination, the pipe end shall have threads and socket screwed on thread for installing soft metal bush. The soft metal bush shall be of approved quality and shall be male type.

The installation of pipes shall be complete in all respects including its fixing at terminations before the work is started. All sharp edges and burrs shall be removed by using reamer or any approved device.

The pipe shall be checked before installation of cable for any obstruction. If found, it shall be cleared without damaging the installation. All pipe ends shall be plugged to prevent entry of water, rodents etc.

5.5 PVC Pipe & Accessories

Rigid PVC pipes shall be installed under roads paved areas, at crossing with other services and at cable entering building as shown on the drawings. The depth of the pipe shall vary according to the conditions at site, and approval of Director (GTS) / Engineer shall be obtained prior to installation, in general the pipes shall be installed underground at the following depths measured from the top of the pipe:

- | | | | |
|---|----------------------|---|--|
| 2 | Under roads/pavement | : | 900mm below finished surface. |
| 2 | When crossing outer | : | 250/500 mm vertical/horizontal services clearances with concrete cover |

The trench of required dimensions shall be excavated and the bottom of trench cleaned and levelled. A 75mm bed of fine sand shall be provided over which the PVC pipes installed after proper alignment. Where two or more pipes are installed in the same trench the clearance between pipes shall not less than 50mm. After laying of pipe the trench shall be backfilled with clean screened earth in layers of 75mm, each layer properly tamped and compacted.

Where underground cables enter connection terminal boxes the PVC pipe shall be installed on surface by means of galvanized steel clamps at a maximum interval of 450mm.

After installation, the ends of the pipe shall be plugged with material impervious to water and chemicals. All joints shall be sealed adequately to prevent entry of foreign elements.

The installation of pipes shall be completed in all respects including its fixing at terminations, before cabling work is started. All sharp edges and burrs shall be removed by using reamer or any approved device. The pipe shall be through cleaned of dirt and dust from inside; the pipes shall be installed in proper coordination with other works.

*****END OF SECTION *****

DISINFECTION

1. SCOPE OF WORK

The work under this section of specifications includes furnishing all plant, labor, equipment, appliances and materials and performing all operations required in connection with disinfecting of all potable water lines in parts and as a whole as specified herein or as shown in the Contract Documents or as directed by the Director (GTS) / Engineer.

2. DISINFECTION

After successful completion of pressure tests the entire potable water distribution system in the building shall be thoroughly flushed with water to remove all entrained dirt and mud before disinfecting of the system. The disinfecting chemical shall preferably be hypochlorite solution. However, bleaching powder may be used as alternate material with the approval of the Director (GTS) / Engineer. Use of gaseous chlorine shall not be allowed for disinfecting.

The chlorine solution shall be introduced into the system until the system is filled with the solution and all entrapped air is expelled from the system. The solution shall be retained in the system for at least 24 hours.

At the end of the period solution will be tested for chlorine residua, which shall not be less than 10 PPM of chlorine through out the system,

The disinfections process shall be repeated if chlorine required is less than 10 PPM at any location of the system.

After successful completion of disinfection the system shall be flushed with potable water until the residual chlorine is reduced to less than 1 PPM.

During disinfection period all the valves and faucets shall be opened and closed several times to ensure that all parts of the valves/fancets are also disinfected.

*****END OF SECTION *****

GENERAL SPECIFICATIONS FOR ELECTRICAL WORKS

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 Specifications and Bill of Quantities and explained in these specifications. The works shall broadly include but not limited to the following:

- LT Distribution Boards Internal Illumination (Electrification)
- Internal Power Distribution
- Earthing
- Provision of Telephone & TV outlets.

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 included in the scope of this Contract. The Contractor shall solely be responsible for ensuring proper functional requirements of various equipment and shall be responsible for furnishing any additional piece of equipment and for making modification in the equipment as desired and/or approved by the Director (GTS) / Engineer to achieve proper co-ordination with various equipments offered in the bid and also with those installed by others.

2. RULES & REGULATIONS

The entire electrical installation/work shall be carried out by licensed Contractor, authorized to undertake such work under the provisions of the Electricity Act 1910 and The Electricity Rules 1937 as adopted and modified upto 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 Director (GTS) / 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 Director (GTS) / Engineer for his instructions and decision of the Director (GTS) / Engineer shall be final and conclusive.

The Contractor on behalf of the Employer shall submit application for electrical connection and shall be responsible for completing all formalities and submitting the test certificates as per prevailing rules and regulations, and shall have the installation passed by the Government Electric Inspector of that region. All requirements of the Electric Inspector and the electric Supply Company (WAPDA or KESC) shall be complied with.

3. AMBIENT 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

Maximum indoor ambient temperature	50 Degree Celcius
Minimum indoor ambient temperature	Zero Degree Celcius
Maximum outdoor ambient temperature	50 Degree Celcius
Minimum outdoor ambient temperature	ZeroDegree Celcius
Maximum Relative humidity	90 Percent
Maximum Altitude of project	30 meters above the mean sea level.

4. STANDARDS

The latest standards and codes of reputable organizations shall be applicable for the material and equipment specified herein and for installation work. Such organizations to be BSS, VDE, etc. In case the Specifications laid down herein differ from those given in the standards, then the equivalent or

better specifications shall govern. Wherever applicable the equipment shall also conform to the requirements of Pakistan Standard Institution (PSI). Contractor shall maintain at the site office one copy of the standards/codes applicable to the works.

5. **SYSTEM DATA**

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate satisfactorily with the following minimum requirements without any derating.

- a) Voltage rating of equipment LT:400 V 3 phase & $\pm 10\%$ 230V 1 phase $\pm 10\%$
- b) Frequency 50Hz + 2HZ

6. **SHOP DRAWINGS AND DATA TO BE FURNISHED**

BY THE CONTRACTOR

The shop drawings and/or technical data to be furnished by the Contractor for each electrical equipment shall include, but not limited to the following;

- (a) Structural drawings showing foundations, RCC details, dimensional plans, elevation and sections on a suitable scale.
- (b) Electrical drawings showing:
 - 2 Line diagrams of switchboards, distribution boards, and motor control centers with detailed wiring diagrams, elevations/internal component layout and other standard details
 - 2 Complete tender drawings with necessary execution details such as no. of wires, size of conduit, etc.
- (c) Technical literature and manufacturer's characteristic data with the description of materials and weights of all equipment as instructed by the Director (GTS) / Engineer.

At least three (3) copies of the shop drawings and/or technical data of the equipment shall be submitted to the Director (GTS) / Engineer for checking and approval.

7. **MANUFACTURER'S INSTRUCTIONS**

The Contractor shall supply to the Director (GTS) / Engineer in properly bound form six (6) copies of manufacturer's instruction manuals for installation, testing, commissioning, operation and maintenance of the specified equipment including manuals of spare parts and tools of the equipment. At least two copies of the documents shall be submitted in original. The installation instructions shall be submitted 2 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 Director (GTS) / Engineer shall withhold issuance of requisite certificates and deduct suitable amount from the payments to the Contractor.

8. **GUARANTEE**

The Contractor shall furnish written guarantee of the manufacturer or supplier with respect to satisfactory performance of each equipment. Guarantee shall be given for replacement and repair of part or whole of the equipment, which may be found defective in material or workmanship. The guarantee shall cover the duration of Maintenance Period as defined in the Conditions of Contract. This guarantee shall not relieve the Contractor of his obligations and he will be fully 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.

9. **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.

10. **ASSOCIATED CIVIL WORKS**

Except where separately stated in the Bill of Quantities the cost of all civil works associated with any BOQ Item of electrical works, such as excavation and backfilling of earth, compaction of the earth, foundation pads, chiseling, making openings, etc. shall be included in the price quoted against respective items -No separate payment for such works will be made. Such works will also include repair of any damage to civil works caused by the Contractor during electrical installation.

11. **INSTALLATION INSTRUCTIONS - GENERAL**

The Contractor shall furnish all labor, materials, tools and equipment required to install, connect, test and commission all electrical equipment specified herein, whether or not such equipment is furnished by him or by others.

For all equipment to be installed by the Contractor, the Contractor shall supply and install all erection materials such as foundation bolts, washers, nuts, etc. as required and without any additional costs.

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 the Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost.

For any deviation from the working drawings that are deemed necessary by the Contractor due to site conditions, he shall submit the details and obtain the Director (GTS) / Engineer approval before starting such works.

12. **FACTORY TESTS**

All type and routine tests on transformer, switchgear and all other equipment shall be performed at the manufacturer's works in the presence of the Director (GTS) / Engineer or his Representative. Type tests may be waived off in case test certificates are submitted as certified by the Director (GTS) / Engineer approved standard laboratory of international repute; but merely producing the test type certificates will not relieve the manufacturer to carry out the required standard/routine tests.

The Contractor shall inform the Director (GTS) / Engineer about the date and time of test of each equipment at least two weeks in advance The witnessing of test by the Director (GTS) / Engineer 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 8.0. All test results shall be supplied in quadruplicate. All expenses for carrying out the tests and witness by the Director (GTS) / Engineer shall be borne by the Contractor and deemed to have been included in the tender bid.

13. **TESTING-GENERAL**

13.1 **Scope**

Upon completion of the installation, the Contractor shall perform field tests on all equipment, materials and systems. All tests shall be conducted in the presence of the Director (GTS) / Engineer for the purpose of demonstrating equipment or system compliance with Specifications. The Contractor shall submit for Director (GTS) / Engineer's approval complete details of tests to be performed describing the 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 (4) copies of all test data and results certified by the Director (GTS) / Engineer shall be given to the Director (GTS) / Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc.

The witnessing of any tests by the Director (GTS) / Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship, 'or as any other obligations of Contract.

13.2 **Insulation Resistance Test**

Insulation resistance test shall be made on all electrical equipment by using a meggar of 500 volts for circuits upto 250 volts and 1000 volt for circuits between 250 and 500 volts. For testing of 11 kV circuits, upto 5 kV megger shall be used; the exact voltage shall be as advised by the equipment manufacturer unless otherwise advised by the Director (GTS) / Engineer.

The insulation resistance values of cables, transformer, switchgears, etc., shall be as per BSS, IEEE, NEC, ICEA and Pakistan Electricity Rules.

Before making connections at the ends of each cable run or joint between cables, the insulation resistance test of each cable section shall be made. H.T. cables shall be subjected to high voltage test as per recommendations of standard to which the cable is manufactured. Each conductor of a multicore cable shall be tested individually with each of the other conductor of the group and also with earth. If insulation resistance test readings are found to be less than the specified minimum in any conductor, the entire cable shall be replaced and tests repeated on new cable. If cable joint is provided, then each cable section shall be tested, and joint made only after the tests have been made satisfactorily. Finally the completed cable length including the joints shall be tested.

The transformer and switchgear 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 the 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.

13.3 **Earth Resistance Test**

Earth resistance tests shall be made by the Contractor on the earthling system, separating and reconnecting each earth connection.

If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Director (GTS) / Engineer will determine the extent of such corrective measures.

The electrical resistance of the ECC together with the resistance of the earthling leads measured from the connection with earth electrode to any other position in the complete installation shall not exceed **one ohm**.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earth electrode is installed, the earth resistance test of each electrodes shall be measured by means of resistance bridge instrument.

The complete lightning protection system shall be tested for continuity and earth resistance. The combined earth resistance at any point in the lightning protection system shall not exceed **10 ohms**.

13.4 **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, alarms and remote control devices 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.

13.5 **Transformer Tests**

In addition to the insulation resistance test of the transformer, a polarity and phase rotation test shall also be made. Buchholz relay shall be tested for proper operation. Di- electric test shall be carried out on transformer oil prior to putting the same in operation.

13.6 **Special Systems' Tests**

The special systems such as Telephone, Intercom, public address, 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 Director (GTS) / Engineer.

13.7 **Completed Tests**

After any equipment has been tested, checked for operation., and is accepted by the Director (GTS) / 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.

13.8 **Expenses**

All expenses, I-e., traveling, boarding, and lodging for carrying out the tests and witnessing by the Director (GTS) / Engineer shall be borne by the contractor and are deemed to have included in the BOQ rates of the respective equipment (s) by the contractor.

*****END OF SECTION *****

LT DISTRIBUTION BOARDS

1. SCOPE OF WORK

The work under this section consists of manufacturing, fabricating, supplying, installing, testing, and commissioning of all material and services of the complete Low Tension (LT) Distribution Boards as specified herein, shown on the Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Director (GTS) / Engineer and coordinate at site with other services for exact location and position of the electrical lines and equipment.

The Low Tension Distribution Board with accessories shall also comply with the General Specifications for Electrical Works, Section - 8001 and with other relevant provisions of the Tender Document,

2. GENERAL

The Low Tension Distribution Board shall be sheet steel fabricated suitable for recessed mounting, totally enclosed, dust and damp proof. It shall be complete in all respect with material and accessories, factory assembled, tested and finished according to the Specifications and to the normal requirements-Trie Low Tension Distribution Board shall be dead front and front operation type and shall:

- have a rated service short circuit breaking capacity, Ics at 400 V AC as shown on drawing/BOQ.
- be suitable for 415/230 Volts, 3 phase 4 wire, 50 Hz system.
- be designed for flush mounting of all instruments on the front side.
- have incoming and outgoing cable termination arrangement, terminal, block/line up terminals.
- be provided with stainless steel name plate on the front side of door
- and wiring diagram on inside of door,
- have all incoming and outgoing connections from top or bottom according to site requirements.
- have door grounded by flexible copper strip/cable.
- Comply with requirements of IP40 for indoor and IP55 for outdoor units.

3. APPLICABLE STANDARDS/CODES

The latest editions of the following standards and codes shall be applicable for the materials specified within the scope of this section:

IEC 51	-	Direct setting electrical measuring instruments
IEC 73	-	Colours for indicator lights and push buttons.
IEC 157/158	-	Low voltage switchgear and control gear.
IEC 439	-	Low Voltage Switchgear and Controlgear Assemblies.
BS 4752	-	Circuit Breaker.
BS 88	-	HRC fuses.
BS 89/90	-	Ammeters and Voltmeters.
BS 3938	-	Low voltage current transformers-
BS 3245	-	Bus Bars.

4. **MATERIAL**

4.1 Sheet Metal Work

The Low Tension Distribution Board shall be fabricated from electro galvanized/zinc coated sheet steel. All the components shall be installed on a common component mounting plate inside the enclosure and protected from the front with screwed sheet steel dead front cover plate. The door and dead front cover shall be made of 14 SWG sheet steel. The door shall be fully gasketed with hinges on the left hand side and locking handle on the right hand side for fastening the door. The locking handle should be detectable. The dead front assembly shall be fastened to 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 DB.

The cabling inside the DB shall be suitably harnessed by means of straps or cords. 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 DB at two points. Flexible copper strip shall be provided for earthing of the door of DB.

Neutral bus assembly shall consist of outgoing screw terminals with one terminal for each MCB.

All holes, cutouts, etc., shall be tool or jib manufactured and free from burrs and rough edges. Removable glad plates shall be provided at both the top and bottom. All metal work of the DB shall be cleaned down to bare shining metal phosphated and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

Each breaker shall have a circuit identification label fitted below the breaker aperture of the protective cover.

A clean plastic pocket shall be provided at the back of the front access for placing wiring diagram.

Labels described shall have block letters (7 mm high) on a white background, to be made from trifoliate and be fixed with screws.

4.2 **Components**

The Low Tension Distribution Boards shall be provided with components as specified, as shown on the Tender Drawings and required for the satisfactory operation of the distribution board and of the electrical system.

Typical component specifications are given below: -

4.2.1 **Bus Bars**

The Bus bars shall be made of 99.9% pure high conductivity annealed electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The phase identification of bus bars shall be by colours applied on bus bars and these shall be red, yellow and blue for phases and white for neutral. The earth bus bar shall be green.

The bus bars shall be for three phase, neutral and earth and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 30°C at rated current.

4.2.2 **Moulded Case Circuit Breaker (MCCB)**

The MCCBs shall be moulded case triple pole 440 volts or single pole 250 volts of current ratings as shown on the drawings. These shall have fixed magnetic short circuit and adjustable/fixed thermal overload protection.

The MCCBs shall be installed such that their switching levers are accessible through the front plate for operation. Circuit numbers/designation on all circuits shall be conspicuously marked to facilitate connection and maintenance.

The single and triple pole MCCBs shall have short circuit rupturing capacity suitable for the distribution system as approved by the Director (GTS) / Engineer or as shown on the drawings. The MCCBs shall be suitable for working on lighting and power circuits.

The breaker shall have quick make, quick break toggle mechanism with positive 'ON', 'OFF' and 'Tripped' positions.

Trip mechanism shall be trip free on over load or short circuit, ensuring that the breaker will not remain close even when the operating handle is manually held closed or with circuit breaker handle locked in the 'ON' position during short circuit or continuous over load. Automatic tripping shall be indicated by a handle position between the manual 'ON' and 'OFF' positions,

4.2.3 **Load Break Switches (LBS)**

The load break switches shall be triple pole, moulded type and suitable for 400 V, 50 HZ., a.c. systems. The operating lever shall have a spring controlled toggle mechanism.

4.2.4 **Earth Leakage Circuit Breakers (ELCB)**

ELCBs shall be current operated type with tripping current as shown on drawings and tripping time not more than 0.1 seconds.

4.2.5 **Ammeters and Voltmeters**

All meters shall be flush mounting, moving iron, spring controlled. The front dimensions shall be 96 x 96 mm.

The meters shall be of accuracy class 1.5 according to BS-89 and 90 The ammeter shall be suitable for connection to 5 Amps secondary of current transformers or directly through shunt as shown on drawings. The ammeters and voltmeters shall have measuring range as indicated on the drawings. A red mark shall be provided at the working voltage on the scale of all voltmeters,

4.2.6 **Current Transformers**

Air-cooled, ring type current transformers shall be provided having transformation ratio as indicated on the drawings. The current transformers shall be of suitable burden having accuracy class 1.0 according to BS 3938. The current transformers shall have 5 amps secondary.

4.2.7 **Selector Switches**

Ammeter and voltmeter selector switches shall be complete with front plate and grip handle. R-Y-B and OFF position for ammeters and RY-YB-BR-RN and OFF position for voltmeters shall be marked on the respective selector switches.

The selector switches for controls shall be rotary cam type, having required number of positions. It shall be provided complete with knob and front plate showing all positions as required.

Air Break Contactors

The contactor shall be air break, triple pole, 400 volts. Each contactor shall be provided with a 230 volt operating coil, one 6 watt, 230 volt red coloured signaling lamp, control fuse and two normally open and two normally closed type auxiliary contacts wired upto terminals for electrical interlocking.

4.2.8 Push Buttons

Push Button shall be momentary contact type and suitable for flush mounting on the door of panel and on remote area. The push button for ON and OFF switching shall be spring loaded.

4.2.9 Indicating Lamps

Indicating lamps shall be suitable for flush mounting, complete with base and 230 volts incandescent lamp. It shall have rosettes of suitable colours as approved by the Director (GTS) / Engineer.

5. TESTS AND INSPECTION

The following tests and inspections shall be performed in accordance with relevant Director (GTS) / Engineering standards:

- (a) Visual inspection of appearance, construction, dimensions and workmanship.
- (b) Mechanical operating test.

6. INSTALLATION

The location of distribution boards are shown diagrammatically on the drawings. The actual location shall be determined at site, keeping in view the site conditions and other equipment, as approved by the Director (GTS) / Engineer.

Low tension distribution board for recessed mounting in wall shall be installed such that the door shall finish flush with the surface of wall. The recess mounted distribution board shall be installed before the plastering of walls. The DB shall be protected to avoid any damage due to the civil work.

All loose parts dispatched separately with the DB shall be installed as per manufacturer instructions and all adjustments or setting shall be made as required. All screws, nuts and bolts used for fixing the distribution board shall be galvanized.

The location of distribution boards are shown diagrammatically on the drawings. The actual location shall be determined at site, keeping in view the site conditions and in coordination with other equipment.

The distribution boards installation shall include connecting all incoming and outgoing cables. The cable entry in the boards shall be provided from top or bottom as required.

The distribution boards shall be tested as per instructions contained in article "Testing" of General Specifications for Electrical Works, Section-8001 of these Specifications.

*****END OF SECTION *****

LIGHT FIXTURES

1. SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and accessories of the complete Light fixtures as specified herein and/or shown on the drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Director (GTS) / Engineer and coordinate at Site with other services for exact locations and positions of the light fixtures, The lighting fixtures with accessories shall also comply with the General Specifications for Electrical Works, Section-8001 and with other relevant provisions of the Tender Document.

2. GENERAL

The description of light fixtures is given in the bill of quantities, and stated on the drawings, and all relevant material is 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 at least two samples of each and every light fixture specified and obtain approval of the Director (GTS) / Engineer before purchasing. The quality and finishes of the 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 or approved equivalent, Approved equivalent against those specified will be accepted if the specified one is/will not be available. For any substitution the Director (GTS) / Engineer's approval is necessary.

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 Director (GTS) / Engineer.

Normally the light fixtures are not part of this contract. However, only the bulb-holder shall be installed using the brass socket for the incandescent

3. APPLICABLE STANDARDS/CODES

The latest editions of the following standards/codes shall be applicable to the material specified within the scope of this section:

1EC 81& BS 1853	Tubular fluorescent lamps
IEC 82 &BS2818	Ballast for tubular fluorescent lamps
IEC 155 & RS 3772	
IEC 400	Starters for fluorescent lamps
IEC 566, BS 367,7 3767/4017	Lamp holders and starter holders for fluorescent lamps
IEC 598	Capacitors for use in TL, HP mercury and LP sodium vapour discharge lamp circuits Luminaries

4. MATERIAL

4.1 Fluorescent Light Fixtures

The fluorescent light fixtures shall have lamps and ballasts of proper rating as shown on the drawings. Each lamp shall be provided with an independent ballast.

The fluorescent lamps shall be tubular, 1224/610mm long, for 36/18 watts respectively as specified. The fluorescent colour shall be cool daylight characteristics with an average output of 2500 lumens ($\pm 5\%$) for 36 watts and 1030 lumens (5%) for 18 watts after 100 burning hours. The ballast shall be polyester filled type, totally

enclosed and suitable to operate upto 250 VAC. The power loss shall not be more than 9 watts for 40/36 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. Connectors suitable for connecting 2.5 sq.mm cable conductors shall be provided for supply connections.

The body of the fluorescent light fixtures shall be minimum 24 SWG sheet steel, derusted, degreased, finished in heat resistant paint, stove enamelled, Appropriate size bushed wire entry holes, fixing holes, and earth terminal shall be provided.

The light fixtures shall be furnished with perspex diffusing panels "040 opal acrylic" (minimum sheet thickness 3mm), 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 by the Director (GTS) / Engineer. The louvers shall be in one section and not in pieces. An earth terminal for connection to 2.5 sq.mm cable conductor shall be provided.

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 Director (GTS) / Engineer.

4.2 **Incandescent Light Fixtures**

The incandescent light fixtures shall be as stated on drawings and bill of quantities. The light fixture shall be finished in standard colours unless otherwise stated on drawings or directed by Engineer, All incandescent light fixtures shall be of International standard and quality, the type of fixtures with manufacturer catalogue reference are given on the fixture schedule and in bill of quantities. Equivalent fixture may be acceptable provided that the contractor submits for review all necessary data indicating photometric curves to show that the fixture proposed are of the same type, construction and quality.

The lamps for incandescent light fixtures shall be GLS lamps and shall be supplied and installed according to the wattage as indicated on drawings.

Weather proof bulkhead incandescent light fixture shall comprise of cast aluminium body and gasketed clear glass cover secured to the body by means of wing nuts/screws to give a weatherproof and water tight fit- The gasket shall be weather resistance type. A **G.I.** wire guard shall be provided on the glass cover. The lamp holder shall be of bi-pin brass having porcelain outer ring.

The glass shade of the light fixtures shall be opal white or clear and free from any air bubbles or voids. The shade may be spherical, cylindrical, flattened bottom or any other shape as specified in the drawings or BOQ. The glass shall be opal white or clear as furnished by the manufacturer with the light fixture unless specified.

5. **LIGHT FIXTURE INSTALLATION**

5.1 **General**

The mounting heights of light fixtures are indicated on the drawings, and position of fixtures are 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 Director (GTS) / Engineer. All fixtures shall be carefully aligned before fixing in position,

The wiring between ceiling rose or terminal box and the fixture shall be carried out with 3-core 0,75 sq.mm and 1 sq.mm flexible 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 Director (GTS) / Engineer.

Glasses, shades, reflectors, diffusers, 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 installation on false ceiling the installation method/detail shall be coordinated with ceiling design and submitted for approval of Director (GTS) / Engineer. Care shall be taken to prevent the weight of the fixture from being transferred to the false ceiling.

Pendant light fixtures shall have two holes in the top of each casing for supporting to the ceiling by a 3/4" dia. galvanized pipe or any other standard method as approved by the Director (GTS) / Engineer. Wiring from ceiling rose to the fixture shall be installed through the pipe. Proper arrangements such as long threads with check nuts, etc. for minor adjustment in the mounting heights of the fixtures shall also be provided.

5.3 Incandescent Light Fixtures

The incandescent light fixture shall be installed on the surface of ceiling or wall by means of nylon plugs and galvanized steel screws, such that their back finish flush with the surface for exposed conduits and flush with outlet box for concealed conduit system. Wherever convenient, screws for fixing light fixtures shall be screwed into the holes of the outlet box. The light on false ceiling shall be installed in a manner as described for fluorescent light fixture.

*****END OF SECTION *****

WIRING ACCESSORIES

1. SCOPE OF WORK

The work under this Section consists of supplying, installing, and commissioning of all material and services of the complete switches, switch sockets, etc., as specified herein, as shown on the Tender Drawings and explained in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Director (GTS) / Engineer and coordinate at Site with other services for exact location and position of all electrical equipment.

The wiring accessories shall also comply with the General Specifications for electrical works Sec. 8001 and with other relevant provisions of the Tender Documents.

2. GENERAL

The locations of the wiring accessories such as sockets, switches etc. are tentatively shown on the drawings. The Contractor shall ensure the exact positions and locations of wiring accessories in coordination with other services drawings, as per site requirements and as directed by the Director (GTS) / Engineer. The Contractor shall be responsible for proper functioning of wiring accessories after installation and commissioning.

3. APPLICABLE STANDARDS/CODES

The latest edition of following standards & codes shall be applicable for the materials specified within the scope of this section:

BS 3676	-	Switches for domestic and similar purposes.
BS 2135	-	Capacitors for radio interference suppression.
BS 67	-	Ceiling roses.
BS 115	-	3 pin plugs, socket outlets and socket outlet adapter.
PS 116	-	Two and three terminal ceiling roses,

4. MATERIAL

4.1 Switches - Indoor type

Switches for controlling light and fan points shall be single pole, rated for 10 Amps, 250 volts AC. The body of the switches shall be of Bakelite with white faceplate suitable for flush mounting on a sheet steel outlet box. The switches shall be piano type having silver tipped contacts and shall operate with snap action.

Unless otherwise specified wherever switches control only the light points, these shall be plate type gang switches installed on common outlet boxes.

Where specified metal front plates shall be used with single grid type switches. The plate shall be finished in specified color or as otherwise directed by the Director (GTS) / Engineer. The bell push switches shall be spring-loaded type with the identification symbol embossed on it. Two-way switches shall be used to control lights from two different locations as shown on the drawings.

The switches shall be manufactured by Switchekid, Busch or approved equivalent.

4.2 Switch-Socket Units

Switch socket units shall be combined 2 and 3 pin 5 Amp or 3 pin 15 Amp 250 volt AC, moulded type with switch and socket on white face plate conforming to the requirements stated above for switches Indoor type. The outlets shall be heavy duty type suitable for mounting on sheet steel outlet box. The 3 pin 15 amps sockets shall

have shrouded live contacts and designed such that the earth pin of plug is engaged to socket earth before making of live contacts.

Where metal plate switches are installed, the switch socket units shall also be provided with front plate of similar design.

4.3 Sheet Steel Box

The sheet steel boxes for installation of switches, fan regulators, dimmers and socket outlets shall be made of 16 SWG sheet steel having appropriate dimensions. The box shall have suitable arrangement for receiving the conduit(s). An earth terminal shall be provided for connecting atleast three earth wires of 4-sq.mm size.

The outlet box shall be given two coats of anti-rust red oxide paint before installation and one coat of enamel paint after installation.

4.4 Ceiling Rose

The ceiling rose shall be suitable for 5 amps 250 volts single phase ac. It shall have white plastic moulded base plate, copper or brass terminals for connecting atleast two wires of 2.5 sq.mm size. The ceiling rose shall have a cover with cable inlet hole suitable for multicore PVC insulated and PVC sheathed cable.

5. **INSTALLATION**

5.1 General

The mounting heights of all wiring accessories fixtures are stated on the drawings. In case the mounting height is not mentioned, the instructions of the Director (GTS) / Engineer shall be obtained before fixing.

5.2 Switches, and Switch Sockets

All wiring accessories shall be installed on 1.63 mm (16 SWG) thick sheet steel box recessed in wall. Sheet on sheet steel box shall be by means of flat head galvanized screws sunk in the plastic plate so as to finish flush with the surface. The edges of the plastic plate shall be chamfered.

Where switches and fan regulators are required to be installed together, these shall be grouped and suitably installed on common plastic sheet fixed on appropriate size sheet steel box.

***** END OF SECTION *****

EARTHING

1. SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and services of the complete Earthing system as specified herein, as shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Director (GTS) / Engineer and coordinate at Site with other services for exact route, location and position of the electrical lines and equipment.

The Earthing system shall also comply with the General Specifications for Electrical Works Section - 8001 and with other relevant provisions of the Tender Documents.

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. APPLICABLE STANDARDS/CODES

The latest editions of following standards / codes shall be applicable for the materials specified within the scope of this section:

BS 951	-	Earthing clamps
CP1013	-	Earthing
BS 2874	-	Nuts, bolts, washers, screws and rivets fixing for use on copper
BS 1433	-	Hard drawn bare copper conductor for earthing
BS 6346	-	PVC insulated cables.

4. MATERIAL

4.1 Earth Electrode

4.1.1 Plate Type

The plate type earth electrode shall comprise a 600 x 600 x 3mm electrolytic copper plate. The surface of the plate shall be tinned for protection. The plate shall have four terminals for connecting the earthing leads. Nuts bolts and washers, shall be either of brass or tinned copper. A 50mm dia, G.I. pipe shall be provided from inspection chamber to earth plate for watering purpose This pipe shall have 10mm dia, holes at 500mm 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 cover supported on angle iron frame. The cover shall be hinged type, as approved by the Director (GTS) / Engineer and shall finish flush with the ground level.

4.1.2 Rod Type

This type of earth electrode shall comprise a 10 ft. (3 meters) long, 5/8" (16 mm) dia. Copper rod having flat head at drive end and pointed conical tip at the driven end. The tip shall be hardened to facilitate driving. At the top of the pipe, a brass clamp for bolted connections shall be provided suitable for

connection to the down conductor or earthing lead as required.

The inspection chamber with C.I. cover shall be provided as specified for plate type earth electrode.

4.2 Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point or equipment in the building. It shall be of 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 and no separate payment shall be made for it.

4.3 Earth Continuity Conductor

Earth continuity conductor (ECC) 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 & 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 ECC shall be same as those given in section "LT. Cables" of the technical specifications, PVC insulated cables when used as ECC shall be green or green/yellow.

4.4 Earth Connecting Point

Earth connecting points shall comprise tinned copper bar, rectangular in shape, having dimensions of 300 x 50 x 6 mm. At least six terminals for connection shall be arranged on the bar, which can be increased or decreased as required by the Director (GTS) / Engineer.

The terminals shall have brass or tinned copper bolts, nuts and washers for protection against corrosion. Two holes shall be provided off center of the copper bar for fixing to the wall by means of 10 mm dia. nut and bolt and shall be insulated by means of rubber gaskets/washers,

5. INSTALLATION

5.1 General

Complete earthing systems as shown on the drawing shall be installed by the Contractor. The earthing system shall give earth resistance, including the resistance of soil, earth leads and ECC equal to or less than one ohm.

At all connections of earth continuity conductor to LT. switchboard, LT. distribution Board or any other metallic body, proper size copper 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 terminations 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 in general run in cable trench or in conduits/pipes as shown on the drawings. For under floor runs, these shall be installed in pipe/conduit of appropriate sizes. Where laid along underground cables, these shall be laid directly underground in unpaved areas and in pipes under paved areas.

5.2 Earth Electrode

5.2.1 Plate Type

The electrode plate shall be installed at a 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 shall be made and buried along with the copper plates 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 Director (GTS) / Engineer,

5.2.2 Rod Type

In case the soil conditions at site permit, this type of earth electrode may be installed by hammering the electrode in soil, until the top of the rod is about 300 mm below the proposed finished ground level. If hammering down of rod is not possible due to site conditions, a pit shall be first excavated in bare ground up to the required depth and electrode shall be installed upright in the pit. The excavated pit shall be backfilled in layers of 500 mm, each layer tamped and compacted.

5.3 Earth Continuity Conductor

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 equipment, The body of all switchboards shall also be connected to earth by specified size of ECC. All other metal work shall also be connected to earth by specified size of ECC.

At any joint or terminations, the ECC shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.

5.4 Earth Connecting Point

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 Director (GTS) / Engineer.

*****END OF SECTION *****

MISCELLANEOUS ITEMS

1. SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and accessories for Miscellaneous Items as specified herein and/or shown on the drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Director (GTS) / Engineer and co-ordinate at site with other sen/ices for exact locations and positions of the Miscellaneous Items.

The Miscellaneous Items with accessories shall also comply with the General Specifications for Electrical Works Section - 8001 and with other relevant provisions of the Tender Document.

2. GENERAL

The Miscellaneous Items as described in this section shall comply with other sections of these specifications as applicable. No specific reference to any manufacturer has been made and the Contractor shall ensure that all the miscellaneous items be supplied/fabricated from the reputable manufacturers, who have already supplied/fabricated similar items.

3. APPLICABLE STANDARDS/CODES

The latest editions of the following standards/codes shall be applicable to the material specified within the scope of this section:

BS 4752-1	Circuit Breakers.
BS 4934-	Safety requirements for electric fans and regulators.
BS 5060-	Performance of circulating fans and their regulators.

4. MATERIAL

4.1 Metal Enclosed Switch Fuse Unit & MCB Units

The single pole & neutral 250 volts and triple pole 500 volts switch fuse or MCB units are used for supplying single phase/three phase power control for the apartments/houses installed near supply company meter-boards or required for equipment as specified and as shown on the drawings.

The handle of the switch shall be so interlocked that it would be not be possible to open the cover without putting the handle in the "OFF" position.

The switch fuse unit shall be of FICO make or approved equivalent,

4.2 Ceiling Fan

Ceiling fan shall be capacitor type; suitable for 250V AC The air displacement shall be 12,000 cfm for 56" (1422 mm) sweep and 10,000 cfm for 48" (1219 mm) sweep at maximum speed. The fan motor shall be capacitor type and bearing shall be groove type to give noiseless operation. The complete fan with blades and canopy shall be finished in white color.

The fan hook shall be made of 16 mm diameter mild steel rod. It should be in the form of a loop about 75 mm long and about 50 mm wide. The rod should be bent to have atleast 200mm extension on both sides fur tying to reinforcement steel of slab.

Normally fans arc not part of this contract. However, for regulating the speed of the fan, tan dimmers shall be provided having electric circuit, Dimmer shall be so designed that it shall not interfere with electronic equipment or fluorescent light fixtures.

4.3 Exhaust Fans

Exhaust Fans shall be three-blade type of metal construction, mounted on steel mounting plate with Orifice ring.

Fans shall be direct driven and supplied complete with electric motor, backdraft 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 be free from objectionable vibration or noises,

4.4 Manholes with CI Cover & Frame

Manholes for electric power cables or telephone cables shall be constructed in accordance with the standard Specifications of Civil works. The work shall also include making of concrete chambers and concrete benching in manholes, complete as shown on the drawings. Top of the cover shall be roughened in an approved pattern. The cover shall tightly fit in the frame and shall be watertight. The manhole shall have appropriate identification code as instructed by Director (GTS) / Engineer.

CI covers complete with frame shall be of the size specified on the drawings. The specified size means the clear opening. The cover shall be of 100 kg weight or as approved by the Director (GTS) / Engineer. Suitable locking and lifting arrangement shall also be provided. The frame shall be set in place at the time of pouring of concrete so that the cover shall tightly fit in the frame.

5. INSTALLATION

5.1 General

The mounting heights, depths and other dimensions of all the Miscellaneous Items are stated on the drawings or in general notes. In case of any discrepancy, the instructions of the Director (GTS) / Engineer shall be obtained before fixing the item.

5.2 Metal Enclosed Switch Fuse Unit & MCB Units

The metal enclosed switch fuse or MCB unit shall be installed on wooden box with screws or some suitable arrangements as approved by Director (GTS) / Engineer.

5.3 Ceiling Fan

Fan hook shall be installed in the RCC ceiling and to the reinforcement before pouring of concrete.

The installation of fan shall include fixing of blades, down-rod, clamp, canopy, including testing and commissioning. The down rod shall be of required length having long threads and shall be provided with check nuts to secure it firmly with the clamp and the body of the fan. A split pin shall be provided both at the fan body end and at the clamp for safety. Any scratches on the body of the fan or fan rod appearing during installation shall be cleaned and painted properly with the same quality paint as provided by the manufacturer.

Wiring between the ceiling rose and the fan terminals shall be carried out with three core 0.75 sq.mm PVC insulated, PVC sheathed flexible copper conductor cable.

5.4 Exhaust Fan

The propeller exhaust fan shall be installed in the opening already made in the wall and shall be firmly fixed by means of flat head galvanized screws,

Wiring between the ceiling rose and the fan terminals shall be three core 1.0 sq.mm PVC insulated PVC sheathed flexible cables.

5.5 Manholes with CI Cover & Frame

The manholes shall be constructed according to the Specifications of the civil works and standard practice. Proper curing of the concrete shall be done for at least 15 days. Before constructing, the Contractor shall submit shop drawing of manhole showing steel reinforcement, embedded pipes, clearances, etc. for approval of the Director (GTS) / Engineer. Quality of cement used in the manhole shall be sulphate resistant.

*****END OF SECTION*****

TELEPHONE SYSTEM

1. SCOPE OF WORK

The work under this section consists of supplying, installing, testing, commissioning of material and services of telephone system as specified herein, as shown on the Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Director (GTS) / Engineer and co-ordinate at site with other services for exact route, location and position of the system.

The telephone system with accessories shall also comply with the General Specifications, Section 8001 and with other relevant provisions of the Tender Document,

The work shall be undertaken in accordance with applicable rules and regulations of Pak Telecom Corporation Limited. Any approval/NOC required from PTCL shall be contractors responsibility.

2. GENERAL

The telephone system comprises following:

- Conduits with galvanized steel pull wire.
- Pull boxes.
- Telephone outlet box and blank cover plate.
- Telephone distribution boxes.

3. APPLICABLE STANDARDS AND CODE

The latest editions of the following standards/codes shall be applicable for the materials covered within the scope of this section:

DIN 47615	Junction Boxes
DIN 47614	Terminal Strips
DIN 40040	Class and Reliability of units in Telecommunication
DIN 5800	Regulations for installation and operation of telecommunication
CCITT	Rrecommendations & Local PTCL regulations.

4. MATERIAL

4.1 Conduit and Conduit Accessories

The specifications for conduit and conduit accessories shall be same as given for electrical conduit in section "Conduits and Pipes" of these specifications. Conduits shall be provided with galvanized steel pull wire.

4.2 Telephone Outlet

The telephone outlet boxes shall have appropriate dimensions made of 16 SWG (1.63 mm) sheet steel and suitable arrangement for termination of conduits.

A 3.2 mm thick white plastic cover plate with grommet hole shall be fixed on the box having suitable arrangement for installation of telephone socket as and when required.

4.3 Distribution Box

Telephone distribution box shall be made of 16 SWG (1,63mm) sheet steel having required dimensions to accommodate the terminal strips with adequate space available for wiring. The terminal strips if mentioned in BOQ shall be of Krone make having provision for tag numbers for telephone extension and with suitable capacity for terminating all incoming and outgoing cables Including direct lines. The strip shall be installed on insulated material sheet inside the sheet steel boxes,

The steel box shall be provided with a lockable hinged door. The distribution box shall be suitable for recess mounting.

5. INSTALLATION

5.1 Conduit

The telephone conduit shall be installed in accordance with the instructions and details given in section "Conduit and Pipes" of these Specifications. Telephone conduit shall be laid 150mm away from the electrical conduits or cables, and wherever electrical conduits or cables, and telephone conduits cross each other, they shall do so at right angles.

Identification marking shall be given at the termination or free end of conduit so that it may not be confused with the electrical conduits. The marking shall be both by colour and by attaching an approved brass tag using brass or bronze tie wire. Each tag shall be clearly stamped with "T" for telephone conduit.

Full length of conduit shall be provided with galvanized steel pull wire for ease of pulling the telephone cable as and when required.

5.2 Telephone Distribution Box

Distribution boxes for telephone cables shall be fixed recessed. The box shall finish flush with the surface of wall.

All screws, nuts and bolts used for fixing the box shall be galvanized. Soft metal bushes shall be used at conduit entries in the box.

5.3 Telephone Outlet

These shall be installed flush with the surface of walls.

*****END OF SECTION*****

GAS PIPE LINES

1. SCOPE OF WORK

The Contractor shall furnish all plant, labour, materials, equipment, tools, appurtenances, services, temporary work and storage and perform all operations necessary for the supply and installation of the gas supply piping alongwith necessary fittings in perfect operating condition in accordance with these specifications and Drawings and/or as directed by the Director (GTS) / Engineer.

2. GENERAL

The Contractor shall provide and install gas piping to supply gas to areas as shown on drawing. Operating pressure in gas pipeline shall be 8 inches of water column.

3. CODES AND STANDARDS

The Codes and Standards applicable to only a portion of the specified works are referred in the relevant parts or clauses.

Codes and Standards which are generally applicable to the works and services of this section are listed herein after:

National Fire Protection Association Standard

NFPA 54

ASA Standard

ASAZ21-30

American National Standards Institutes

ANSI Z 223.1

Other authoritative codes and standards which ensure equal or higher quality than those referred above may also be acceptable subject to satisfaction and approval of the Director (GTS) / Engineer.

***** END OF SECTION*****

TV DISTRIBUTION SYSTEM

1. SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and services of complete Cable Antenna TV System as stated herein, as shown on Tender drawings and as given in the Bill of Quantities.

The Contractor will discuss the electrical layout with the Director (GTS) / Engineer and coordinate at site with other services for exact route, location and position of electrical lines and equipment.

TV distribution system with accessories shall also comply with the general Specifications for Electrical works Section 8001 and with other relevant provisions of the Tender documents.

2. GENERAL

The TV system shall comprise of the following:

- 2 Conduit with galvanized steel pull wire.
- 2 Pull boxes.
- 2 TV outlet box and blank cover platen.

3. APPLICABLE STANDARDS/CODES

IEC-728 and relevant DIN Standards shall be applicable for the material covered within the scope of this section.

4. MATERIAL

4.1 Outlet Wall Sockets

The outlet box for the TV socket shall have appropriate dimension made of 16 SWG sheet steel and suitable arrangement for termination of conduits and installation of TV socket.

A 3.2 mm thick white plastic plate with grommet hole shall be fixed on the box having suitable arrangement of TV socket as and when required.

4.2 PVC Pipe

Specifications of the PVC Pipe pipes are the same as given in the relevant section of these specifications.

5. INSTALLATION

5.1 Conduit

The television conduit shall be installed in accordance with the instructions and details given in section "Conduit and Pipes" of these specifications. Television conduit shall be laid 150mm away from the electrical conduits or cables, and wherever electrical conduits or cables, and TV conduits cross each other, they shall do so at right angles.

Identification marking shall be given at the termination or free end of conduit so that it may not be confused with the electrical conduits. The marking shall be both by color and by attaching an approved brass tag using brass or bronze tie wire. Each tag shall be clearly stamped with "TV" for television conduit.

Full length of conduit shall be provided with galvanized steel pull wire for ease of pulling the telephone cable as and when required.

5.2 TV Outlet

These shall be installed flush with the surface of wall.

***** END OF SECTION *****