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MINISTRY OF AGRICULTURE, DEPARTMENT OF MINISTERS - DEPARTMENT

GENERAL CONTRACT

ASSIGNMENT TO THE
GENERAL CONTRACT
BY THE AGRI. DEPT.
FOR THE FISCAL YEAR
GENERAL CONTRACT
FOR THE FISCAL YEAR
AGREEMENT NUMBER

1969

GENERAL CONTRACT OF THE YEAR 1969

1969



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THA NGON PROJECT

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SECTION 1

INSTRUCTIONS TO TENDERERS

1.1 General

Tenders are invited for the construction of the following works for the Tha Ngon Agricultural Development Project (hereinafter designed as "Tha Ngon Project") in the Kingdom of Laos.

- (a) Construction of the irrigation system including the civil engineering works for the Tha Ngon pumping station.
- (b) Construction of the drainage system including the civil engineering works for the flood gate.
- (c) Construction of the farm road system and flood protective embankment.
- (d) Land preparation works.
- (e) Construction of an office, a residential quarter and the services complete for the Purchaser.

The attention of tenderers is especially drawn to Section 5 "General Specifications" in which the extent of Contract is defined.

1.2 Submission of Tender

Sealed Tenders clearly marked as follows shall be submitted to the following address:

"Tender for General Contract,
Tha Ngon Project"

and delivered there before _____ on _____ 19 ____ at the latest.

Bids received after this time shall be returned unopened.

1.3 Completeness of Tender

The tender must be prepared according to the Forms annexed to the specification with all blanks therein and in all schedules duly filled up and signed.

Any tender which is incomplete or does not include the whole of the works covered by the specification will not be considered.

1.4 Price

Prices quoted for each item in the Form of Tender shall be reasonable for each item in the judgment of the Engineer and/or Purchaser. Under no circumstances will a manifestly unbalanced tender be considered. Prices shall be in U.S. dollars.

1.5 Bid Bond

The tender shall be accompanied by a bid bond or certified cheque (payable to the order of the Purchaser) for an amount not less than five (5) per cent of the tender price to guarantee the fulfilment of the terms of the tender. The bid bond or certified cheque of the Contractor will be returned when the contract is signed, and the Performance Bond referred to in Clause 2.7 of the General Conditions is received by the Purchaser. If the successful Tenderer to whom the contract is presented for signature refuses or neglects to sign, or fails to furnish the required Performance Bond, his bid bond or certified cheque shall be forfeited.

The bid bonds or certified cheques of the unsuccessful tenderers will be returned after the signing of the contract.

1.6 Validity of Tender

The tender is to be held open for acceptance or rejection for a period of six (6) months from the date of delivery of tenders.

1.7 Acceptance and Rejection of Tenders

The Purchaser does not bind himself to accept the lowest or any tender, nor to assign any reason for the rejection of any tender.

1.8 Correspondence

All correspondence in connection with the tender and contract and all matters accompanying the tender which are relevant to its examination are to be in English language and expressed in units of the metric system.

1.9 Expenses in Preparation of Tender

Tenderers will not be reimbursed for any expenses they may incur in preparing their tenders.

1.10 Standards

Unless otherwise specified, all equipment and materials which form part of the work shall be new and shall conform to JIS (Japan Industrial Standard) specifications or to other specifications approved by the Engineer.

If the Tenderers offer materials or equipment which conform to standards other than those stipulated in the specifications, full details including copies in English language of such standards shall be submitted with the tender. If approved, the alternative standards shall be incorporated in the contract, otherwise the specified standards shall apply.

1.11 Departures from Specification

The Tenderer shall submit with his tender, in order of the relevant clauses, a statement of any proposed departures from the specifications. Notwithstanding any discription, drawings or literature which may be submitted, all details other than those in such statement of departures shall be deemed to be in accordance with the specifications. Such departures shall not be binding on the Purchaser unless incorporated in the contract, and prices bid in the tender shall

not take into account any such proposed departures. The Tenderers shall, however, indicate in the statement of departures, the amount of increase or decrease in the tender prices for each proposed departure if such departure is incorporated in the contract.

1.12 Alterations in Tender

No alteration is to be made in the Form of Tender or the Schedules thereto except in filling up the blanks as directed. If any such alterations are made or if these instructions are not fully complied with, the tender may be rejected.

1.13 Site Conditions

The Tenderers shall have personal knowledge of the location of the proposed works and access thereto and shall acquaint himself with the actual conditions thereof and labor conditions and rates, and shall not claim at any time after the submission of the tender or the subsequent execution of the contract that there was any misunderstanding with regard to the conditions imposed by the contract, or prevailing at the site or in the country of Laos.

The Tenderers shall form his own opinion of the foundation materials, put his own interpretation upon the sounding and investigations made by or on behalf of the Purchaser and make such other investigations as he may consider proper.

If, as a result of the Tenderers' inspection of the site, or of their site investigations, any facts or conditions are brought to light which appear in any way to conflict with the letter of intent of the specifications, they shall apply to the Engineer for information and explanation before submitting his tender.

1.14 Transportation

The Tenderers' attention is directed to Clause 5.7 of the General Specifications and in particular to the fact that there will be charge for the use of the Mekong Ferry. The Tenderers are therefore

directed not to include Mekong Ferry charges in their tender rates and prices.

The Tenderers shall assume that the shipment of goods, construction machinery, equipment, materials, etc., through Thailand for the purpose of the Tha Ngon Project will be restricted to the Express Transport Organization (E.T.O.), as far as Tha Naleng Customs Station, Laos.

Transportation from Tha Naleng to the site shall be arranged by the Contractor with due regard for existing regulations and practice.

1.15 Additional Information in Tender

The Tenderers shall submit the following additional information as an appendix to his tender:

- (a) - Proposed detailed construction schedule to meet the governing dates stipulated in Clause 5.8 of the General Specifications.
- (b) - Schedule of proposed subcontractors;
- (c) - Proposed layout of construction facilities and camp facilities;
- (d) - Proposed construction methods including those for excavation, earthfilling, unwatering, aggregate production, concrete production and placing for the pumping station, flood gate, and main canals including related structures.

SECTION 2 GENERAL CONDITIONS

2.1 Definitions of Terms

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

"Purchaser" means the Royal Government of Laos, or any persons duly assigned by the Royal Government.

"Chief-Engineer" means the Chief-Engineer duly appointed by the Purchaser to act as the Chief of the site.

"Engineer" means the Consulting Engineers Messrs. _____ , or other person or persons appointed from time to time by the Purchaser and notified in writing to the Contractor to supervise the works, to test and examine any materials to be used materials and equipment to be furnished, or workmanship employed in connection with the works.

"Tenderers" mean the person or persons, firm or company tendering on the works covered by the those contract documents.

"Contractor" means the person or persons, firm or company whose Tender has been accepted by the Purchaser and includes the Contractor's personal representatives, successors and permitted assigns.

"Subcontractor" means any party or parties having a direct contract with the Contractor for the performance of any part or parts of the works to be performed under the contract.

"Other Contractor" means any party or parties having a direct contract with the Purchaser for work outside the scope of this contract and includes any subcontractor of this other Contractor.

"Contract" means the agreement between the Purchaser and the Contractor, and all appendixes and schedules thereto, including without limitation the Instructions to Tenderers, the Tender, the General Conditions, the Specifications and Schedules thereto annexed, the Drawings thereto annexed or to be provided or approved by the Engineer and any samples to be provided under the provisions of the Contract.

"Contractor's equipment" means all machinery, tackle, tools and store brought upon the site by the Contractor otherwise than for incorporation in the works.

"Public works equipment" means and includes all machinery, tools and store leased to the Contractor by the Purchaser for the performance of the works covered by this Contract other than those for incorporation in the works.

"Equipment" means and includes machinery, apparatus, materials, articles and things of all kinds to be installed under the Contract other than the Contractor's equipment.

"Works" mean and include all equipment to be provided and works to be done by the Contractor under the Contract.

"Contract Price" means the sum named in the Contract as the Contract Price.

"Site" means the actual place or places to which the equipment is to be delivered or where the works are to be done by the Contractor together with so much of the area surrounding the said place or places as the Contractor shall, with the consent of the Engineer, actually use in connection with the works otherwise than merely for the purpose of access to the said place or places.

"Approved", or "approval" shall mean approved or approval in writing by the Engineer or other authority herein specified.

"Tests on Completion" means such tests to be made by the Contractor before the works are taken over by the Purchaser as are provided for in the Contract and such other tests as may be agreed between the Purchaser and the Contractor.

"Writing" includes any manuscript, type-written or printed statement under seal or hand.

Words importing persons include firms and corporations.
Words importing the singular only include also the plural and vice versa.

Contract Documents mean and consist of:

- Instructions to Tenderers;
- General Conditions;
- Form of Agreement (herein and in the Contract documents sometimes referred to as the "Agreement" or "Contract");
- Form of Performance Bond;
- General Specifications;
- Detailed Specifications;
- Form of Tender;
- Drawings.

2.2 Intent

The intent and spirit of the contract is to provide for the work herein specified to be fully completed within the contract time, in every detail for the purpose designed and it is hereby understood that the Contractor, in accepting the contract, agrees to furnish any and everything necessary for such purpose notwithstanding any omission in the drawings or specifications. All matters omitted from the Contract Documents which may reasonably be inferred to be obviously necessary for the efficiency, stability and completion of the works shall be deemed to be included for in the Contract Price.

The Contractor shall apply to the Purchaser for any explanation which he may require with reference to the meaning and intent of any part of the contract and shall be held responsible for any errors or losses he may make in consequence of failure to obtain such explanation.

2.3 Letter of Intent

Following the opening and assessment of the tenders, the Purchaser will issue by registered post or by otherwise depositing at the registered office of the Successful Tenderer a letter of intent to enter into a contract with the Successful Tenderer for the execution of the works in accordance with the Contract Documents and such exceptions to the said documents which are acceptable to the Purchaser. Upon issue of such letter of intent by the Purchaser, the contract shall be deemed to have been fully and sufficiently made and the Purchaser and the successful Tenderer shall become bound by all the terms and conditions of the contract until the signing of the Agreement in accordance with Clause 2.4 herein.

2.4 Agreement

As soon as possible after the date of issue of the letter of intent as provided for in Clause 2.3 herein, the Successful Tenderer shall enter into a contract with the Purchaser for the execution of the work in the form of Agreement attached herein.

2.5 Alterations, Additions, Omissions and Extra Works

The Chief-Engineer shall make any variation of the form, quality or quantity of the works or any part thereof that may be necessary and for that purpose, or if for any other reason it shall in his opinion be desirable, shall have power to order the Contractor to do and the Contractor shall do any of the following:

- (a) increase or decrease the quantity of any works included in the Contract;

- (b) omit any such works;
- (c) change the character or quality or kind of any such works;
- (d) change the levels, lines, positions and dimensions of any part of the works, and
- (e) execute additional works of any kind necessary for the completion of the works;

and no such variation shall in any way vitiate or invalidate the Contract, but the value (if any) of all such variations shall be taken into account in ascertaining the amount of the Contract Price.

The Chief-Engineer shall determine the amount (if any) to be added to or deducted from the sum stated in the tender in respect of any extra or additional works done or works omitted by his order. All such works shall be valued at the unit prices specified in the Price Schedule submitted by the Contractor and duly accepted by the Purchaser, so far as the same may be applicable. If the Price Schedule shall not contain any unit prices applicable to the extra or additional works, then the prices shall be mutually agreed between the Purchaser and the Contractor.

2.6 Equipment and Materials

The Contractor shall, at his own expense, furnish all equipment, materials and Contractor's equipment, both for temporary and for permanent works, transport to or from the site and in and about the works and do other thing of every kind required for the construction, completion and maintenance of the works, unless otherwise provided wholly or in part, under the terms of the contract.

All the Contractor's equipment shall be capable of the highest performance and be in good working order, and shall be provided with any extra peice for which there is special need in carrying out the works under this Contract.

The public works equipment, if any, will be leased to the Contractor without charges by the Purchaser and be delivered to the Contractor at the garage of the Purchaser in Vientiane.

The Contractor undertakes to transport the rented public works equipment to the site, adjust it for use, maintain and replace any part worn and damaged and also the lost of such rented public works equipment, keep it and return it to the Purchaser, at his own responsibility and expense, at the Completion of the work in the same working order and in good repairs as the rented public works equipment was when delivered to the Contractor, except for reasonable wear.

Accordingly, the Contractor shall accept the rented public works equipment with full knowledge of its performance, capacity and operation.

All materials and workmanship shall be of the respective kinds described in the Contract and in accordance with the Engineer's instruction and shall be subject from time to time to such tests as the Engineer may direct at the place of fabrication or on the site or at all or any of such places.

The Contractor shall provide such assistance, instruments, machines, labor and materials as are normally required for examining, measuring and testing any works and the quality, weight or quantity of any material used, and shall supply samples of materials before incorporation in the works for testing as may be selected and required by the Engineer.

2.7 Performance Bond

Within fifteen (15) days after the receipt of notification of acceptance of his tender, the successful Tenderer undertakes to enter into a bond for the due and proper performance of the Contract and observance of all provisions, covenants, conditions and stipulations therein contained with good and sufficient sureties for an amount equal to () per cent of the total tender sum until twelve (12) months after the date of the Completion Certificated from the date of signing of the Contract.

The bond shall be prepared in the form attached hereto and the terms of the bond shall be such as shall be approved by the Purchaser and such that the bond will be enforceable in Laos. The sureties shall be subject to the approval of the Purchaser (which approval shall not unreasonably be withheld).

If the successful Tenderer offers as surety a Bank or Insurance Company so approved by the Purchaser, the Purchaser will accept such bank or insurance company.

2.8 Authority of the Chief-Engineer

The Chief-Engineer has been charged by the Purchaser with the management and supervision, in close cooperation with the Purchaser, of the execution of the Tha Ngon Project of which the works are part, and has the authority to exercise, on behalf of the Purchaser, all powers and rights of the Purchaser under the Contract.

2.9 Engineer's Authority

The Engineer's decision shall govern the interpretation of the Contract and he shall be the sole judge of methods used and the quality and quantity of labor, workmanship, materials, apparatus, appliances, equipment and machinery used or supplied by the Contractor pursuant to the Contract. The Engineer's decision on all such matters shall be final, being subject only to the terms of Clause 2.26 "Settlement of Disputes".

The Engineer shall have the authority to stop the progress of the works whenever, in his opinion, such stoppage may be necessary to ensure the proper execution of the works. In an emergency affecting or liable to affect the safety of life or property, the Engineer shall have the authority to stop the works and order such changes therein, or in the methods, apparatus, equipment and machinery used by the Contractor.

2.10 Contractor's Superintendence

The Contractor shall give or provide all necessary superintendence during the execution of the works and as long thereafter as the Engineer may consider necessary for the proper fulfilling of the Contractor's obligation under the Contract.

The Contractor or a competent and authorized agent or representative approved in writing by the Engineer (which approval may at any time be withdrawn) is to be constantly on the works and shall give his whole time to the superintendence of the same.

Such authorized agent or representative shall receive on behalf of the Contractor directions and instructions from the Engineer or the Engineer's representative.

2.11 Methods of Procedure

As far as is consistent with the interest of the works and the results to be attained, the order and methods of prosecuting the said works will be left to the discretion of the Contractor, with whom ordinarily the responsibility of such order and methods shall rest; provided, however, that the Engineer shall at any time have the right to prescribe and control such order and methods with a view to the safety, rapidity and economy of construction of said works, and to ensure harmony and cooperation with other contractors.

If required by the Engineer, before commencing the works or any portion thereof, the Contractor shall furnish the Engineer with full information as to his plans and methods for carrying out the works or any portion of the works.

2.12 Cooperation

During the progress of the works covered by the contract, it will be necessary for other contractors or persons to perform works on or about the site. The Contractor shall co-operate with and allow

such other contractors or persons the use of such facilities as required and as the Engineer may specify. Any differences or conflicts which may arise between the Contractor and other contractors or persons in regard to their respective works will be arbitrated by the Engineer, whose decision will be final and binding on all parties concerned.

2.13 Language and Unit of Measurement

Tender schedules, specifications, notices, site instructions, correspondence, operating and maintenance instructions, drawings or any other writing must be written in the English Language.

The metric system of measurement shall be used exclusively on this contract.

2.14 Assignment and sub-letting

The Contractor shall not assign the Contract or any part thereof or any benefit or interest therein or thereunder (other than a charge in favour of the Contractor's bankers of any monies due or become due under this Contract) without the prior written consent of the Purchaser.

The Contractor shall not sublet any part of the works except with the prior written approval of the Engineer. The Contractor shall state, in writing to the Engineer, the name of the subcontractor to whom he proposes to sublet a portion of the works and shall give full details of the nature and extent of such works and the terms of the proposed subcontract. Any and all subcontractors will be regarded as employees of the Contractor and shall be subject to all the applicable terms and conditions of this contract.

Should any subcontractor fail to carry out any portion of the works in a manner satisfactory to the Engineer, such subcontract shall be cancelled by the Contractor upon written notice from the Engineer and the Contractor or another approved subcontractor shall proceed with and complete the works forthwith.

2.15 Contractor's Liability

The Contractor shall be responsible for observance of all laws by his employees, as they may affect operations under the Contract. The Contractor shall give all notices and comply with all applicable laws, ordinances, rules and regulations under which he is operating and bearing on the conduct of the works.

The Contractor shall conform with all applicable safety and sanitary laws, regulations and ordinances and with the regulations of all governmental bodies having jurisdiction over the works and the manner in which it is performed. The Contractor shall assume all responsibility for the works and take all reasonable precautions to prevent injuries to persons and property on or adjacent to the site of the works.

The Contractor shall be solely responsible for the safety of the works and of all equipment and materials to be used in connection therewith until final completion and acceptance thereof and shall promptly repair any damage thereto, however caused, except as provided for under Clause 2.22 "Liability for Special Risks".

2.16 Drawings and Specifications

Drawings and specifications are intended to complement each other, so that if anything is shown on the drawings, but not mentioned in the specifications, or vice versa, it is to be furnished and built as though specifically set forth in both. If any discrepancies occur in the drawings, or specifications, the same shall be referred to the Engineer before proceeding with the works, and the Engineer's decision on resolving such discrepancies shall be final.

In the event of discrepancies or conflicts between the drawings and specifications, the specifications shall govern. Large scale drawings shall have preference over smaller scale drawings and figured dimensions shall have preference over scaled dimensions.

The Contractor shall at all times keep a copy of the drawings and specifications on the site. Such drawings and specifications must be the latest revised issue received and must bear the Engineer's stamp of approval.

In addition to the drawings and specifications attached thereto, the Engineer will, during the progress of the work, furnish additional drawings specifications, and instructions as may be necessary, in the opinion of the Engineer for the purpose of the proper and adequate execution and maintenance of the works, and the Contractor shall make his works conform to all such drawings, specifications, and instructions. Such drawings, specifications and instructions shall be deemed to be part of the contract documents.

2.17 Drawings to be Furnished by the Contractor

When requested to do so by the Engineer, or stated in the contract documents, the Contractor shall submit drawings of temporary and permanent works to be constructed by or supplied and installed by the Contractor or his subcontractors.

The drawings shall be of uniform size, except for brochures and typical drawings which may be allowed.

The Contractor shall be expected to check thoroughly all shop drawings provided by his subcontractors, including measurements, size of members, materials, and details to satisfy himself that they conform to the intent of the Engineer's specifications and drawings. Drawings found to be inaccurate or otherwise in error are to be returned to the subcontractors for correction before submitting them to the Engineer.

All drawings submitted to the Engineer for approval shall bear the Contractor's stamp of approval and the date of approval. The Engineer's approval of drawings, schedules and calculations submitted by the Contractor shall not relieve the Contractor from the responsibility for errors or omissions they may contain. The Contractor shall

verify all dimensions at the site prior to commencing the work. Where errors or omissions are discovered later, they must be made good by the Contractor at the Contractor's expense.

2.18 Commencement of Works

The Contractor shall commence the works on site within the period stated in the Contract after the receipt by him of an order in writing to this effect from the Chief-Engineer and shall proceed with the same with due expedition and without delay, except as may be expressly sanctioned or ordered by the Chief-Engineer or be wholly beyond the Contractor's control.

2.19 Suspension of Work

The Contractor shall on the written order of the Chief-Engineer suspend the progress of the works or any part thereof for such time or times and in such manner as the Chief-Engineer may consider necessary and shall, during such suspension, properly protect and secure the work so far as is necessary in the opinion of the Chief-Engineer.

The extra cost (if any) incurred by the Contractor in giving effect to the Chief-Engineer's instruction under this Clause will be borne and paid by the Purchaser unless such suspension is:

- (a) otherwise provided for in the Contract, or
- (b) necessary for the proper execution of the work or by reason of weather conditions affecting the safety or quality of the works or by some default on the part of the Contractor, or
- (c) necessary for the safety of the works or any part thereof.

Provided that the Contractor shall not be entitled to recover such extra cost unless he gives notice in writing of his intention to claim to the Chief-Engineer within a reasonable time from the receipt thereof. The Chief-Engineer shall settle and determine the extra

payment to be made to the Contractor in respect of such claim as the Chief-Engineer shall consider fair and reasonable.

If the progress of the works or any part thereof is suspended on the written order of the Chief-Engineer for more than sixty (60) days, the Contractor may serve a written notice on the Chief-Engineer requiring permission within a reasonable time from the receipt thereof to proceed with the works or that part thereof in regard to which progress is suspended and, if such permission is not granted within that time, the Contractor by a further written notice so served may elect to treat the suspension where it affects part only of the works as an omission of such part under Clause 2.5 hereof or where it affects the whole works as an abandonment of the Contract by the Purchaser.

2.20 Time for Completion

Subject to any requirement in the Specifications as to completion of any portion of the works before completion of the whole of the works, the whole of the works shall be completed within the time specified in the Contract, calculated from the date of the order served for the Commencement of works, or such extended time as may be allowed under Clause 2.21 hereof.

2.21 Extension of Time

Should the amount of extra or additional works of any kind, or other special circumstances of any kind whatsoever which may occur, be such as fairly to entitle the Contractor to an extension of time for the completion of the works, the Purchaser will determine the amount of such extension. Provided that the Purchaser is not bound to take into account any extra or additional works or other special circumstances, unless the Contractor has within 14 calendar days after such works have been commenced or such circumstances have arisen or as soon thereafter as is practicable delivered to the Chief-Engineer full and detailed particulars of any extension of time to which he may consider himself to be entitled, in order that such claim may be investigated at the time.

2.22 Liability for Special Risks

The Purchaser shall hold the Contractor harmless from all liability for damages or destruction of the work or property in Laos whether owned by the Purchaser or third parties and for injury or loss of life, caused directly or indirectly by act of God, declared or undeclared war, invasion, insurrection, usurped power or riot, commotion or disorder in Laos, hereinafter referred to as special risks. The Purchaser shall further compensate the Contractor for all reasonable claims in respect of costs and expenses and loss or damage to property of the Contractor at the work site and in transit in Laos, occasioned directly or indirectly by the said special risks.

2.23 Purchaser's Right to do Works

In the event of the Contractor failing to meet the requirements of the Engineer in the matter of labor, Contractor's equipment and materials, the Purchaser is hereby empowered to employ such additional labor, obtain such materials and additional equipment as may be necessary for the successful prosecution of the work and the cost of so doing shall be paid to the Purchaser by the Contractor or shall be deducted from payments due to the Contractor. In the execution of the work under this clause until its completion, the Purchaser may use all the Contractor's equipment and materials hitherto provided by the Contractor. The Purchaser shall not be liable to the Contractor for wear or tear thereto, nor for the loss, damage or destruction thereof, other than as may be provided for under the Contract.

2.24 Purchaser's Right of Use

Until all defective or faulty works have been made good or altered as provided elsewhere, the Purchaser shall have the right to use any such faulty or defective works at the Contractor's sole risk, and without thereby in any way affecting the Purchaser's rights requiring correction of faulty works by the Contractor unless the Contractor shall have notified the Purchaser in writing that, in the opinion of the Contractor, the faulty or defective works cannot be so used without undue risk to the works or to persons in the vicinity of the works.

2.25 Forfeiture of Contract

If the works, or any part of them, be not completed at the expiry of the respective periods specified in the Contract, or if the Contractor assigns or sublets his Contract, or any part of it, without the written consent of the Purchaser, or if he commits any act of insolvency whatsoever, or if he permits any execution to be levied on his property, or any portion of the works covered by the Contract, then the Purchaser may forthwith declare the contract forfeit. In which case, the Purchaser shall enter into possession of all the works, equipment and materials pertaining to the Contract and may complete the works in the Contractor's place and stead.

The Contractor shall be liable for all loss or damage which the Purchaser may suffer on account of the non-completion of the works by the Contractor, and he shall have no claim for payment in respect of works thereafter performed. Any monies due or becoming due to the Contractor up to the date of forfeiture of the Contract, shall be retained by the Purchaser until the completion of the works and may be applied by the Purchaser to satisfy the whole or any part of the loss or damage suffered in completing the Contract.

2.26 Settlement of Disputes

If any dispute or difference shall arise between the Purchaser or the Engineer and the Contractor concerning the interpretation or application of the Contract, it shall be referred, at the written request of either party, to the Engineer who shall within 90 calendar days after the receipt of such request, decide such dispute or difference.

If, in the opinion of the Purchaser or the Contractor, any decision of the Engineer pursuant to this Clause 2.26 is improper or unreasonable or if the Engineer shall not have rendered its decision within 90 calendar days after the written request under this Clause has been submitted to him, the matter shall be referred to arbitration upon written notice of either party and shall be settled in accordance

with the Rules of Conciliation and Arbitration of the International Chamber of Commerce by three arbitrators appointed in accordance with such Rules.

The arbitrators shall decide ex aequo et bono in accordance with the provisions of the Contract and their award shall be final and binding on the parties.

Arbitration proceedings shall take place in Laos, unless the Court of Arbitration of the International Chamber of Commerce or the arbitrators decide otherwise.

Pending the final award of the arbitrators, the parties shall comply with the decision of the Engineer.

2.27 Construction Program

As soon as practicable after the award of the contract, the Contractor shall submit to the Engineer for his approval a construction program in chart form or otherwise, as may be required by the Engineer showing in detail his proposed program or operations and providing for the orderly completion of the works by the dates specified in the contract. This detailed construction program shall contain similar items to those in the basic construction schedule prepared by the Purchaser, included in the Contract documents, shall show the anticipated starting and completion dates for each item and shall be in such form as to allow the progress of each item to be shown and shall be acceptable to the Engineer in every way.

Upon acceptance by the Engineer of the Contractor's construction program, it shall be referred to as the "Approved Construction Program" and shall become a part of the contract.

The works and each portion of the works shall be performed in accordance with the Approved Construction Program.

The Engineer shall have the right to review with the Contractor during the progress of the works, the manner in which the several parts

of the works shall be performed, and to require the Contractor to adopt such methods and time limits for the performance of the various parts of the works as in the opinion of the Engineer are necessary to ensure the safety, accuracy and satisfactory rate of progress of the works.

2.28 Setting-out

The Contractor shall do all setting-out of the works from bench marks and points of reference provided by the Engineer. The setting-out by the Contractor shall include, but shall not be limited to, the preparation of grade sheets, the installation of centreline stakes, grade stakes, offsets, sight rails and screeds.

The Contractor shall be responsible for the true and proper setting-out of the works and for the correctness of the position, levels, dimensions and alignment of all parts of the works and for the provision of all necessary instruments, appliances and labor in connection therewith and for the preservation of his own setting out work as well as the bench marks and points of reference provided by the Engineer. If at any time during the progress of the works, any error shall appear or arise in the position, levels, dimensions or alignment of any part of the works, the Contractor shall rectify such error to the satisfaction of the Engineer.

The Engineer may, at any time, check the lines and levels set by the Contractor. The checking by the Engineer of any lines or levels shall not in any way relieve the Contractor of his responsibility for the correctness thereof.

2.29 Inspection and Testing

All works to be performed and equipment to be supplied under the Contract shall at all times be subject to inspection by the Purchaser, the Engineer or his authorized representatives or his appointed inspectors. The Contractor shall provide every facility as required by the Engineer, or any one of the said inspectors for examining,

inspecting and testing the said works and equipment. The Contractor shall notify the Engineer before beginning or resuming any operation so as to enable him to arrange for the necessary inspection. The Engineer will specify the amount of advance notice required to provide for the proper inspection of any works or equipment.

If any such works should be covered up or put out of view, without the approval of the Engineer, the Contractor shall uncover any such works or make openings or through the same if required by the Engineer for examination and measuring of such works; the reinstatement and making good as required of such works shall be made to the satisfaction of the Engineer.

All works and equipment condemned by the Engineer or inspectors shall be made good or replaced to the satisfaction of the Engineer. The Contractor shall be liable for the replacement or repair of defective works or equipment, as required by the Engineer, up to the time of the final acceptance by the Purchaser of all works performed under the Contract. All works and other property, which are disturebed, injured, damaged or destroyed in the course of removal of the condemned works, shall be promptly repaired and made good to the Engineer's satisfaction. The re-examination of questioned works may be ordered by the Engineer.

Where required, the Contractor shall furnish a complete written statement of the origin, composition and manufacture of all materials to be supplied by him and shall furnish samples thereof, for testing, examination and approval purposes. The materials actually used in the works shall be in accordance with approved samples. The Contractor shall not be permitted to change the source of supply of materials without the written authorization of the Engineer.

(a) Inspection and Tests at Factory

All works shall be subject to inspection and testing at the Contractor's factory and shall conform to the requirments of the Contract.

Unless otherwise agreed, all equipment shall be given the usual factory commercial test.

At least 14 day's notice of the date, time and place of all tests shall be given to the Engineer so that arrangements can be made to have the tests witnessed.

(b) Inspection and Tests at Site

All works shall be subject to inspection and testing on site and shall conform to the requirements of the Contract.

After installation or erection of the works on site, the Contractor shall carry out such designated tests as are required by the Engineer to prove compliance with the Contract, notwithstanding any tests which may have been carried out earlier at the Contractor's factory; however such testing will not relieve the Contractor from liability for defects.

(c) Inspection and Tests on Completion

Within one month after the completion of the whole works or within one month after completion of any unit or section of the works, the Contractor shall give the Engineer at least 14 day's notice of the day from which he will be ready to carry out any final test required by the Contract.

If, in the opinion of the Engineer, the tests are being unduly delayed, he may by notice in writing call upon the Contractor to make such tests within 14 days from the receipt of the said notice and the Contractor shall make the said tests on such day within the said 14 days as the Contractor may fix and of which he shall give notice to the Engineer. If the Contractor fails to make such tests within the aforesaid time, the Engineer may himself proceed to make the tests. All tests so made by the Engineer shall be at the risk and expense of the Contractor, unless the Contractor shall establish that the tests were not being duly delayed in which case, the tests so made will be at the risk and expense of the Purchaser.

If any portion of the works fails to pass the tests, the tests of the said portion shall, if required by the Engineer or by the Contractor, be repeated upon the same terms and conditions.

2.30 Completion Certificate

As soon as the permanent works shall have been completed and shall have satisfactorily passed any final test that may be prescribed by the Contract, the Chief-Engineer will, on receiving a written undertaking by the Contractor to finish any outstanding work during the Period of Guaranty, so notify the Purchaser who will take over the works and issue a Completion Certificate in respect of the works with the following reserves, and the Period of Guaranty of the works shall commence from the date of such certificate:

- (a) That the Chief-Engineer may give such certificate with respect to any part of the works before the completion of the whole of the works.
- (b) That the Chief-Engineer shall upon the written application of the Contractor give such certificate with respect to any substantial part of the works which has been both completed to the satisfaction of the Chief-Engineer and occupied or used by the Purchaser.
- (c) That when any such certificate is given in respect of a part of the works, such part shall be considered as completed and the Period of Guaranty of such part shall commence from the date of such certificate.
- (d) That the "Completion Certificate" given in accordance with the foregoing provisions of any part of the works occupied and/or used as aforesaid shall not be deemed to certify completion of any ground or surfaces requiring reinstatement unless such certificate shall expressly so state.

2.31 Period of Guaranty

The Period of Guaranty shall commence from the date of completion of the works certified by the Chief-Engineer in accordance with Clause 2.30 hereof or, in the event of more than one certificate having been issued by the Chief-Engineer under the said clause, from the respective dates so certified and will remain in full effect and force for a period of one (1) year.

To the intent that the works shall at or as soon as practicable after the completion of the works be delivered up to the Purchaser in a good and perfect condition, the Contractor shall execute all such works of repair, amendment, reconstruction, rectification and making good of defects, imperfections, shrinkages or other faults as may be required of the Contractor in writing by the Chief-Engineer during the Period of Guaranty, or within fourteen (14) days after its expiration as a result of an inspection made by or on behalf of the Chief-Engineer prior to its expiration.

All such works shall be carried out by the Contractor, at his own expense, if the necessity thereof shall in opinion of the Chief-Engineer be due to the use of materials or workmanship not in accordance with the Contract or to neglect or failure on the part of the Contractor to comply with any obligation expressed or implied on the Contractor's part under the Contract. If in the opinion of the Chief Engineer, such necessity shall be due to any other cause, the value of such works shall be ascertained and paid for as if they were additional works.

If the Contractor shall fail to do any such works as aforesaid required by the Chief-Engineer, the Purchaser shall be entitled to carry out such works by his own workmen or by other contractors and, if such works are works which the Contractor should have carried out at the Contractor's own cost, the Purchaser shall be entitled to recover from the Contractor the cost thereof or may deduct the same from any monies due or to become due to the Contractor.

The Contractor shall, if required by the Chief-Engineer in writing, search for the cause of any defect, imperfection or fault under the directions of the Chief-Engineer. Unless such defect, imperfection or fault shall be one for which the Contractor is liable under the Contract, the cost of the works carried out by the Contractor in searching as aforesaid shall be borne by the Purchaser. But, if such defect, imperfection or fault shall be one for which the Contractor is liable as aforesaid, the cost of the works carried out in searching as aforesaid shall be borne by the Contractor and he shall, in such case, repair, rectify and make good such defect, imperfection or fault, at his own expense, in accordance with the provisions of this Clause 2.31.

2.32 Certificates and Payment

Payments for the works under this Contract will be made in United States Dollars at a bank designated by the Contractor. The unit prices and/or lump sum prices, specified in the Price Schedule submitted by the Contractor and duly accepted by the Purchaser, shall include the provisional sum specified by the Purchaser for providing Contractor's equipment for the works of other contractors and shall form the basis for the payments which will be effected as follows:

Within thirty (30) days of written notice to proceed with the works, the Contractor will receive an advance payment of US dollars (US\$) to apply toward the cost of establishing his employees in the site as well as the cost of mobilizing Contractor's equipment and supplies needed in the performance of the Contract.

This advance payment will be equivalent to per cent of the Contract Price and will be deducted in all subsequent monthly statements to be submitted as follows by the Contractor.

The Contractor shall submit to the Engineer at the end of each month a statement showing the contract value of the permanent works executed from the 21st of the previous month to the 20th of the said month and the Contractor will be paid monthly on the certificate issued

by the Engineer and duly approved by the Chief-Engineer the amount due to the Contractor on account of the estimated contract value of the permanent works executed up to the 21st of the month, subject to a retention of the percentage fixed by the Purchaser (hereinafter called the guaranty money).

This monthly payment will be computed according to the following formula:

$$P' = \frac{P (E - A)}{E} - G$$

- where: P' = the net monthly payment to be made to the Contractor;
- P = the contract value of the permanent works executed from the 21st of the previous month to the 20th of the said month;
- A = the avance payment received by the Contractor from the Purchaser;
- G = the Guarantee maney equivalent to () per cent of the monthly payment (P), but not exceeding ten (10) per cent of the Contract Price (E), to be retained by the Purchaser.
- E = Contract Price.

2.33 Payment of Guarantee Money

Subject to the production by the Contractor of a Certificate from the Labor Department stating that all wages due on the Contract have been paid and a Certificate from the Treasury of Laos that all contributions of the Employer Provident Fund have been made in full, one-half of the Guarantee Money in respect of works or part of works for which a Completion Certificate has been issued by the Chief-Engineer will become due and payable to the Contractor. The second half of the Guarantee Money will become due and payable at the expiration of the Period of Guaranty; provided that if at such time there shall remain to be executed by the Contractor any works ordered during such period pursuant to Clause 2.31 hereof, the Purchaser shall be entitled to withhold payment until completion of such works of so much of the second half of the Guarantee Maney as shall in the opinion

of the Chief-Engineer represent the cost of the works so remaining to be executed and provided further that in the event of different periods of guaranty having become applicable to different parts of the works pursuant to Clause 2.30 hereof, the expression "expiration of the Period of Guaranty" shall for the purposes of this Clause 2.33 be deemed to mean the "expiration of the latest of such periods".

2.34 Employees

All necessary arrangements shall be made by the Contractor for the provision of his own workmen and staff for the execution, completion and maintenance of the works. The Contractor shall give preference to the employment of Laotian National personnel subject to competency, efficiency and skill in the various occupations and trades. However, the Contractor shall have the right to employ non-Laotian personnel and tradesmen, where necessary to carry out the works efficiently, and he shall not be required to employ persons against whom he has reasonable objections.

Any workman, mechanic, or other employee employed upon the work, who shall be deemed by the Purchaser or the Engineer to be incompetent, disorderly, insubordinate, dangerous or otherwise unsatisfactory, shall, on the written request by the Engineer, be removed from the work by the Contractor and shall not at any time thereafter be employed upon the same.

The Contractor shall not permit gambling or the use of alcoholic beverages upon or about the works included under this Contract.

The Contractor shall comply with the laws and regulations of the Royal Government of Laos relating to employment, working conditions, compensation or insurance. He shall accept full and exclusive liability for payment of any and all contributions as required under the laws and regulations referred to above. The Contractor shall submit proof of complying with the above requirements upon the request of the Engineer.

The Contractor shall have due regard, during the progress of the works, to local customs, festivals and religions.

The Contractor shall pay, or cause to be paid to all persons employed by him or any of his subcontractors in the execution of this Contract, the prevailing rates of wages for such works as they may be engaged upon.

In the event that the Contractor or his subcontractor fail to pay any person or persons employed by them in the execution of this project at the rates of wages prevailing in Laos for the class of works upon which they are engaged, the Purchaser may pay any balance necessary and charge the cost of so doing to the Contractor or deduct the cost of so doing from payment due to the Contractor.

The decision of the Engineer in case of dispute as to the rates of wages to be paid to persons employed in the execution of this contract shall be final and binding on all parties.

The Contractor shall be responsible for the medical and surgical needs of his employees, including the provision of first aid facilities in the working areas. In the event of any outbreak of illness of an endemic or epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the local Administration or the local medical or sanitary authorities for the interest of public health.

2.35 Right of Way to and Possession of Site

Right of way to, and possession of the site shall be afforded to the Contractor by the Purchaser subject to the provision that such right of way and possession shall not be exclusive to the Contractor but only such as shall enable him to execute the works. The Contractor shall afford to the Purchaser and to other contractors whose names shall have been previously communicated in writing to the Contractor by the Engineer every reasonable facility for the Execution of their works concurrently with his own.

The Engineer and any person authorized by him shall at all times have access to the works and to the site and to all workshops and places where works are being prepared or whence materials, manufactured articles or machinery are being obtained for the works and the Contractor shall afford every facility for and every assistance in or in obtaining the right to such access.

2.36 Clearance of Site

The Contractor shall, at all times during the execution of the works, keep the site affected by his operations clean and free from obstruction, except where this is unavoidable for the construction of the works. The Contractor shall at any time, if directed by the Engineer, clear away and remove from the site any redundant facilities and plant, surplus materials, rubbish and Temporary Works no longer required and leave the part of the site affected clean and tidy to the satisfaction of the Engineer.

On the completion of the works, the Contractor shall clear away and remove from the site surplus material, rubbish and Temporary Works of every kind and leave the whole of the site and works clean and in a workmanlike condition to the satisfaction of the Engineer.

2.37 Safety

The Contractor shall take all necessary precautions against risks of loss of life or of injury to any person employed on the works, to employees of the Purchaser or of the Engineer or of others, to visitors or to persons having good and sufficient reasons to be about the works and to this end shall properly safeguard the works to the satisfaction of the Purchaser and the Engineer. The Contractor shall furthermore take all necessary precautions against damage to the property of the Purchaser or of others located at or adjacent to the site.

The Contractor shall at all times comply with any accident prevention regulations and any safety regulations peculiar to the

various trades employed on the works and any safety regulations published by the Purchaser or the Engineer.

The Contractor shall report promptly to the Engineer all accidents involving the death of or serious injury to any person, on the site or resulting from the Contractor's operations.

2.38 Notices

Any notice to be given to the Contractor under the terms of the Contract shall be served by sending the same by post to the address of the Contractor's registered office given in his tender for the works or leaving the same at the Contractor's site office.

Any notice to be given to the Purchaser under the terms of the Contract shall be served by sending the same by post or leaving the same at the Purchaser's principal office in the Kingdom of Laos.

SECTION 3

FORM OF AGREEMENT

THIS AGREEMENT made this _____ day of _____ 19____
BETWEEN

THE ROYAL GOVERNMENT OF LAOS
(hereinafter referred to as the "Purchaser")

OF THE FIRST PART

and

a _____ with head office in the
_____ of _____ in _____
(hereinafter referred to as the "Contractor")

OF THE SECOND PART

WITNESSETH that the parties covenant, promise, and agree each
with the other as follows:

(1) - The Contractor Agrees:

(a) - To do all the works and furnish all the labor, materials, equipment, and Contractor's equipment, appliances, and transportation necessary of proper for performing and completing the works in accordance with the terms, conditions, and requirements of the documents and papers set forth below, which are included in, attached to, and form part of this agreement, and which have been signed in duplicate for identification by both parties.

(i) - Contract Documents prepared by _____
entitled _____
dated _____ 19 _____ which Documents shall be
deemed to include:

Instructions to Tenderers

General Conditions

Form of Agreement

Form of Performance Bond

General Specifications

Detailed Specifications

Form of Tender

All drawings and documents referred to in the Specifications.

All additional drawings, agreements, detail specifications and written instructions when issued or approved in writing by the Engineer, and which alter, modify, detail or explain the works.

(ii) - Tender of the Contractor dated _____ 19 _____.

(iii) - The letter of intent dated _____ 19 _____ from the Purchaser; it being agreed that the terms, conditions and requirements of the Contract Documents shall prevail except to the extent that they are expressly modified or altered by this Agreement.

The said Contract Documents are intended to cover and provide for first class completed works in all respects, and everything necessary to carry out this intent which may be reasonably implied from the Contract Documents shall be done by the Contractor, even if not particularly referred to in the Contract Documents.

(b) - To complete the works set forth, on the dates indicated on drawing No. 11003 "Construction Schedule" forming part of the Contract Documents.

(c) - That the Contractor has examined the site of the works and has satisfied himself as to the working conditions, the nature and kind of works to be done, the special risks associated therewith, and to any and all matters which may be necessary in order to form a proper conception of the conditions under which the works will be performed.

(2) - The Purchaser Agrees:

(a) - To provide the Contractor with access to, and use of, its lands and premises to whatever extent may be necessary for the continuous and unrestricted prosecution of the Contractor's operation.

(b) - To make to the Contractor, the Payments as set forth in Clause 2.32 "Certificates and Payments", of Section 2 "General Conditions" of the Contract Documents.

(3) - It is Mutually Agreed:

(a) - (Herein insert particulars of any modifications or alterations of the Contract Documents contained in the tender or otherwise).

- (b) - (Herein insert any other matter of mutual agreement).
- (c) - That the works as hereinbefore set forth shall be performed and completed to the approval of the Engineer.
- (d) - That the date from which this Contract is to be in force is the _____ day of _____ 19__.
- (e) - That this Agreement shall extend to, be binding upon, and ensure to the benefits of the successors and assigns of the parties hereto.

IN WITNESS WHEREOF the Contractors and the Purchaser have respectively affixed their seals and the hands of their proper officers on the day and year first above written.

SIGNED SEALED AND DELIVERED
in the presence of

THE ROYAL GOVERNMENT OF LAOS
by _____

by _____

SECTION 4

FORM OF PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we, _____

(Name of Contractor)

(hereinafter called "Principal"), as Principal, and the _____

(Name of Surety, Bank or Insurance Company)

(hereinafter called "Surety"), are jointly and severally held and firmly bound unto The Royal Government of Laos, its successors and assigns, (hereinafter called the "Purchaser") in the penal sum of \$ _____ of lawful money of the United States of America for the payment whereof we, the Principal and the Surety, bind ourselves and our successors and assigns and each of us jointly and severally, firmly by these presents.

SEALED with out seals and dated this _____ day of _____ 19__.

WHEREAS the Principal has, by means of a written Agreement dated the _____ day of _____ 19__, entered into a Contract with the Purchaser for the Construction of civil engineering works, reclamation works for the Tha Ngon Agricultural Development Project, including the maintenance thereof for a period of 12 months after the issue of a Completion Certificate for the works shown and described in the said Contract, which Agreement is by reference made a part hereof and a copy is attached hereto.

AND WHEREAS, the Surety has agreed to execute these presents to secure the due performance on the part of the said Principal of the

said Contract as in the said Agreement set forth or as the same may be changed, altered or varied as hereinafter provided.

NOW the condition of this bond is such that if the Principal, its successors or assigns shall henceforth and at all times faithfully perform and observe the said Contract as in the said Agreement set forth or as the same be changed, altered or varied as hereinafter provided and shall fully indemnify and save harmless the Purchaser from all loss, damage and costs which he may suffer by reason of or incidental to the failure so to do and shall fully reimburse and repay Purchaser for all outlay and expense which he may incur in making good any such default, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

Provided further and it is hereby agreed and declared that the Principal and Surety, their successors and assigns, or any of them, shall not be discharged or released from any liability hereunder or such liability be in any way affected by any such changes, alterations, or variations, taking or receiving of security, or extension of time as aforesaid, or by any dealing or transaction or forbearance which may take place between the Principal and Purchaser, and the Purchaser shall not be required to give the Surety notice of any such or of any default of the Principal, such notice being hereby waived; but upon request from the Surety, the Purchaser shall furnish any information which it may have at the time of such request.

SIGNED, SEALED AND DELIVERED
in the presence of:

(
(
(

(Principal)
(

(Surety)

SECTION 5

GENERAL SPECIFICATIONS

5.1 Location

The Site of the Works is located approximately 25 kilometers due north of Vientiane near Ban Tha Ngon, Laos, and some 530 kilometers northeast of Bangkok, Thailand, which is the nearest available seaport. The location is shown on the drawings.

5.2 Purpose

The purpose of the Tha Ngon Agricultural Development Project is to develop the 800 hectares of cultivable area to be reclaimed by supplying irrigation water, draining excess water and preventing inflow from the Nam Ngum into the project area for the production of two crops a year by improved farming.

5.3 Principal Features of the Project

The principal features of the Project and the structures to be built under these specifications are as follows:

1/-	Irrigation area	800 ha
2/-	Pumping Station	
	a) Number of pumps	2 sets
	b) Type	ø450 mm, Submersible pump
	c) Head	actual-head 16.30 m
		total-head 20.00 m
	d) Capacity (each)	29 m ³ /min.
	e) Rating (each)	145 kw
	f) Diameter of discharge pipeline	700 mm
	g) Length of discharge pipeline	54.5 m
	h) Control house	about 80 m ²

- i) Regulating pond
 - Dimension
 - Width 160 m
 - Length 80 - 160 m
 - Depth 1.6 m
 - Effective storage capacity 18,000 m³
 - Related structure
 - Regulator 2
 - Spillway 1
- j) Earthworks about 32,000 m³
- k) Concrete works about 380 m³

3/- Irrigation Canal System

A Main canals and lateral

- a) Type Trapezoidal open canal
- b) Design discharge 0.74 to 0.10 m³/sec
- c) Length
 - North canal 5,903 m
 - South canal 2,174 m
 - Lateral 962 m
- d) Earthworks in total about 60,000 m³
- e) Concrete work about 290 m³
- f) Related structures (number)
 - Turnout 20
 - Box culvert 13
 - Side spillway 8
 - Drainage crossing 4
 - Check structures
 - with gate and box culvert 6
 - with stop log 3

B Sub-laterals and farm laterals

- a) Type Trapezoidal open canal
- b) Design discharge
 - Sub-lateral 96 l/sec
 - Farm lateral 48 l/sec
- c) Length
 - Sub-lateral 3,710 m
 - Farm lateral 36,380 m
- d) Earthworks about 106,000 m³
- e) Concrete work about 600 m³
(including pipe works)

4/-	Drainage Canal	
a)	Type	Trapezoidal open canal
b)	Length	34,640 m
c)	Earthworks	about 70,000 m ³
d)	Related structures	188 nos
5/-	Farm Road	
a)	Effective width	
	- Main farm road	5.00 m
	- Secondary farm road	3.00 m
b)	Length	
	- Main farm roads	9,530 m
	- Secondary farm roads	40,040 m
c)	Earthworks in total	about 198,000 m ³
d)	Laterite for surfacing in main roads	about 7,100 m ³
e)	Concrete work	about 120 m ³
f)	Related structures	Bridge 7 Culvert 6
6/-	Flood Protective Embankment	
a)	Type	Trapezoidal earth embankment
b)	Length	8,260 m
c)	Crest width	4.00 m
d)	Crest elevation	Upstream 167.00 m Downstream 166.50 m
e)	Side slope	1:2.0
f)	Earthworks	about 90,000 m ³
7/-	Flood Gate	
a)	Culvert	two-barrel box culvert 2.0m high x 2.4m wide each
b)	Gate	1-steel gate 2.0m high x 5.0m wide
c)	Embankment	Crest length 150 m Crest elevation EL. 167.50 m Maximum height 11.0 m
d)	Earthworks	about 15,000 m ³

- | | | |
|--|---|------------------------------|
| e) | Soil cement protection | about 4,000 m ³ |
| f) | Concrete work
(including piling works) | about 490 m ³ |
| 8/- Land Preparation | | |
| a) | Land clearing | forest 200 ha |
| | (including area equiped by
irrigation and drainage
systems) | shrub 170 ha |
| | | grass land 600 ha |
| | | total 970 ha |
| b) | Earth moving | about 494,000 m ³ |
| 9/- Purchaser's Office and Quarter | | |
| a) | Office | 114 m ² |
| b) | Residences | 105 m ² |
| 10/- Power distribution line
(only for the project 2 nos) | | |
| a) | Total length | 10 km |
| b) | Voltage | 22 kv |

5.4 Extent of Contract

The works covered by these specifications comprise the following for the purpose of the Tha Ngon Agricultural Development Project:

- (a) An irrigation pumping station, known as "the Tha Ngon pumping station", the civil engineering works required for the intake, motor sump, substructure and the regulating pond located nearby, and the civil engineering and miscellaneous works for the control house sited near the Tha Ngon pumping station.
- (b) An irrigation system, the civil engineering works required for two main canals of a total length of 8.1 kilometers, a lateral of about 1.0 kilometer in length, three sub-laterals of a total length of 3.71 kilometers, and 66 farm laterals of a total length of 36.38 kilometers, and for related structures.

- (c) A drainage system, the civil engineering works required for 66 drainage canals of a total length of 34.64 kilometers, and for 188 related structures.
- (d) A flood protective embankment and a flood gate, the civil engineering works required for both of them.
- (e) A farm road system, the civil engineering works required for two main farm roads of a total length of 9.53 kilometers and 47 secondary farm roads of a total length of about 40 kilometers.
- (f) An office, a residential quarter and the service complete for the Purchaser.
- (g) The compounds, buildings and services complete for the Contractor's employees.

5.5 Works by Other Contractors

The Purchaser will arrange under other contracts for the supply and erection of pumping equipment, discharge pipe, electrical equipment, and gates as listed hereinafter.

The Contractor shall cooperate with other contractors engaged in the supply and erection of above-mentioned equipments to achieve the successful completion of the Project. He shall, when so directed by the Engineer, provide construction machinery and labor for the use of such other contractors.

The works covered by other contracts will include the provision and installations of the followings:

i/- Pumping station:

- a) Pumping equipment consisting of water pumps, check valves, and their accessories.
- b) Fixed trash racks
- c) Intake gate

- d) Discharge pipe
- e) Electrical equipment
- f) Equipment and tools for repair shop

ii/- Flood gate

- a) Fixed roller gate
- b) Gate guides, hoist, hoist deck, etc.
- c) Electrical equipment

iii/- Power distribution system

- a) Steel poles and line
- b) Transformers

5.6 Construction Machinery and Materials

5.6.1 General

All Contractor's equipment required for the construction and completion of the works, except those listed in Clause 5.6.2 hereof, shall be furnished by the Contractor. The Contractor's equipment shall have such sufficient performance capacity and durability as to secure the execution of the works within the construction period stipulated under the Contract.

5.6.2 Construction Machinery Lent to the Contractor

5.6.2.1 General

The following public works equipment will be lent to the Contractor without charges by the Purchaser.

<u>No.</u>	<u>Machinery</u>	<u>Description</u>	<u>Number</u>
------------	------------------	--------------------	---------------

All expenses entailed by the use of the above listed public works equipment during the period of borrowing shall be borne by the Contractor.

5.6.2.2 Delivery and return

The above listed public works equipment will be delivered to the Contractor at the garage of the Purchaser in Vientiane.

The Contractor shall accept these machinery with full knowledge of the performance capacity and treatment of them, and he shall transport them from the delivered point to the site and ensure the setting-up and installation of these machinery on his responsibility and at his expense.

On returning the public works equipment to the Purchaser, the Contractor shall be obligated to repair and/or replace any parts which are deemed unfit for further operation and neatly paint in order to bring these machinery into good operational condition satisfactory to the Purchaser.

5.6.2.3 Operation

The Contractor shall be responsible for the operation of the public works equipment and he shall provide at his own cost operators, fuel, lubricant, spare parts and other necessary consumption articles for the period of borrowing.

The operators shall have broad experiences and superior ability in their trades and shall be authorized by the Engineer, provided that the Contractor shall inform in the writing those operator's names and operation careers to the Engineer for his approval.

Before starting the operation, the Contractor shall make thorough inspection and trial operation of the machinery at his own expenses at the presense of the Engineer.

5.6.2.4 Administration, inspection and maintenance

The public works equipment shall be administrated by the Contractor with due care of good manager through the period of borrowing at his own responsibility and expense.

The Contractor shall perform all the necessary inspection and maintenance of the construction machinery of both public works equipment and Contractor's equipment at his expense in order to keep them in a good operational condition; he shall prepare a monthly schedule of inspection and maintenance and shall submit beforehand for the approval of the Engineer.

For repairing and maintaining the construction machinery, the Contractor shall establish repair shop completely equipped with necessary machines and tools at the site.

The Engineer will execute periodical inspections on the public works equipment, and the Contractor shall arrange for the inspection even if the machinery to be inspected are under operation.

When the public works equipment is damaged or lost by the Contractor's negligence, as determined by the Purchaser, the Contractor shall repair the damaged machinery or substitute an equivalent machinery for the lost one, provided that when monetary compensation is admitted or requested by the Purchaser, the Contractor shall pay to the Purchaser such amount of money as determined by the Purchaser.

In case the damage or loss of the machinery is caused by force majeure or causes beyond the control of the Contractor, the question of indemnity for the damage or loss shall be settled by an agreement between the Purchaser and Contractor.

The Contractor shall not use the public works equipment for the purpose other than those prescribed under these Specifications, without approval of the Purchaser.

The Contractor shall submit the daily working report and periodical maintenance report approved by the Engineer on the public works equipment each month to the Purchaser, the forms and content of which will be determined by the Engineer.

5.6.3 Construction Materials

5.6.3.1 General

Unless otherwise specified for particular parts of the works, the provision of this Clause shall apply to materials and workmanship employed on any part of the works. All materials used in the works, other than natural or pretreated materials, shall be new and of the kinds and qualities specified herein or on the drawings, and shall be equal to approved samples. Delivery shall be made sufficiently in advance to enable further samples to be taken and tested, if required.

No material shall be used until approved, and materials which are not approved, or have deteriorated or been damaged or contaminated, shall be immediately removed from the site at no extra cost to the Purchaser.

The Contractor shall inform the Engineer of the names of the persons or firms from whom he desires to obtain any materials, ironworks, pipes, manufactured articles or other things which are specified to be supplied by him for use in the works, and, except as regards, trifling and unimportant matters, no order shall be

placed except with the approval of the Engineer. The Contractor shall keep the Engineer fully advised of the orders and delivery dates of materials.

5.6.3.2 Standards

The Japanese Industrial Standard (JIS) have been used throughout these specifications. Other national or international standards may be accepted, provided that the requirements therein are, in the opinion of the Engineer, not less exacting than the corresponding standard quoted herein. If such other standards are used, the Contractor shall supply them in English to the approval of the Engineer.

5.6.3.3 Cement

Cement for concrete, mortar, soil cement and for grout (if the latter is required) shall be a slow-setting portland cement conforming to the standard prescribed by the Purchaser. The Contractor may use high-early-strength cement, but at no extra cost to the Purchaser.

Consignments of cement shall be taken into use in the order of delivery to the site and the use of cement of more than 6 months of age after production shall not be permitted unless otherwise approved by the Engineer after quality test.

The Contractor's method of handling and storing cement shall be subject to the approval of the Engineer, and the Contractor shall make arrangement at the site for the storage of cement in dry, water-tight, draught-free and properly ventilated structures.

Not more than thirteen (13) bags of cement shall be permitted to be piled up and this number shall be limited to seven (7) bags, when the storage is expected to be longer than sixty (60) days. These bags of cement shall be piled up or stored so as to permit easy access for identification, inspection and testing.

The Contractor shall make a weekly report to the Engineer of the consignments of cement then in stock, showing on a daily basis what quantity has been received and issued during the week, and in what portions of the works the cement has been used.

The Contractor shall submit a complete test report for each consignment of cement. Samples for the test shall be selected in such a manner to be approved by the Engineer as to represent the average quality of the consignment. The Engineer shall have the right to order further tests to be carried out as he may consider it necessary so that the material supplied is in accordance with these specifications.

The cement to be furnished shall be packed in waterproofed bags on which trademark, type of cement and date of manufacture shall be clearly marked.

5.6.3.4 Timber

Timber species both for temporary and permanent works shall be the most suitable for each particular purpose, and shall in all cases be thoroughly seasoned, sound, dry, straight, and free from sap, shakes, deadknots or defects of any kind. Tapping of resinous trees to dam resin from such timber shall not be allowed.

Timber shall be cut down before the rise of sap in spring. Timber for piles, sheet piles and underwater structures shall be used as soon as possible after it has been cut down. However, timber for centering or false work, temporary bridges, coffer dams, etc., may not be new, but shall be of suitable quality for each particular purpose. Timber for other purposes shall be at least one year of age after the cutting down.

Timber shall be properly stacked and protected from the weather. Timber shall be wrought and prepared for painting unless otherwise specified.

The cost of complying with the requirements of this Clause shall be included in the unit prices or lump sum prices for the various items of timber.

5.6.3.5 Substitute material

The Contractor shall make diligent efforts to procure the specified materials from any and all sources, but when the materials specified are unavailable for reasons beyond the control of the Contractor, substitute materials may be used; provided that no substitute materials shall be used without prior written approval of the Engineer.

No payment in excess of the price bid in the Price Schedule will be made because of substitution of one material for another, or because of the use of one alternative material in place of another.

5.6.3.6 Use of domestic materials

In performance of the works, the Contractor and his subcontractors shall, as far as is practicable, use articles, materials and supplies originating in Laos.

5.6.3.7 Inspection of equipment and materials

Equipment and materials furnished by the Contractor, shall be subject to inspection in accordance with the provisions of the Contract at any one or more of the following locations as determined by the Purchaser:

- a) - the place of production or manufacture;
- b) - the shipping point;
- c) - the site.

The Contractor shall submit to the Purchaser any information covering equipment and materials required by the Purchaser for the purpose of inspection.

The Inspection of equipment and materials or the waiving of the inspection thereof shall in no way relieve the Contractor of the responsibility for furnishing equipment and materials complying with these specifications.

5.7 Access and Transportation

5.7.1 Access

The Contractor shall make all arrangements and pay all the necessary costs, duties and taxes required in respect of the transportation of the materials, equipment, Contractor's equipment and personnel to Laos.

Access from Bangkok to Vientiane is available by:

- a) air from Bangkok to Vientiane;
- b) combined route of railway and public road to Nongkhai, by Mekong ferry from Nongkhai to Tha Deua or Tha Naleng, and by road from Tha Deua or Tha Naleng to Vientiane.

Access to the site from Vientiane is available over the Route National No.13 from Vientiane to B. Don Noun for a distance of 15 kilometers and then over a branch public road for a distance of 10 kilometers to the site. More detailed information on the access road from Vientiane to the site is given later in this Clause.

Transit goods through Thailand to Laos are required to be transported by road or railway from Bangkok to Nongkhai, then ferried to the Laotian Customs Station at Tha Naleng, all under the control of the Express Transportation Organization (ETO) an organization authorized by the Thai Government.

5.7.2 Mekong Ferry

A ferry service is maintained throughout the year across the Mekong river between Nongkhai (Thai side) and Tha Naleng (Laos side).

The river at the ferry site is about 700 meters wide; the one-way trip by ferry boat takes 20 minutes. At present two ferry boats each having a capacity of 90 tons are operated during working hours 8:30 - 12:00 and 13:00 - 16:00.

The Laotian Government has agreed to the free use of the Mekong Ferry.

5.7.3. Tha Naleng - Vientiane - Tha Ngon

The road from Tha Naleng to Vientiane and the Route National No.13 from Vientiane to B. Don Noun for a distance of 15 kilometers, making a total distance of about 34 kilometers, have an effective width of 8.0 meters or more and is asphalt paved. The public road to Tha Ngon branched off from the Route National No.13 at B. Don Noun, a distance of about 10 kilometers, is paved with laterite and has an effective width of 6.0 meters to 8.0 meters.

The existing bridges and culverts in these route have enough capacity to pass the heavy loads anticipated for this project.

5.7.4 Tha Ngon to the Site

The section of access from Tha Ngon to the site, a distance of 1.0 kilometer, has an effective width of 2.0 meters to 5.0 meters, and is not paved. This road shall be enlarged and paved with laterite as a main farm road under this Contract.

Other access roads in addition to the above, if needed, shall be constructed and maintained by the Contractor at his own expense. Within the Project Area, the Contractor shall construct the main and secondary farm road in accordance with Clause 6.2 of these Specifications.

The Contractor shall satisfy himself as to further detailed information on access to the site.

5.8 Program and Progress

A construction schedule for the whole works of the project has been prepared by the Purchaser and is included in the drawings. This construction schedule is shown to assist tenderers and the Contractor in preparing their own detailed construction schedules.

Within thirty (30) days after the issue of the letter of intent, the Contractor shall prepare in chart form, or otherwise as may be required by the Engineer, a construction program covering the order in which the works are to be carried to ensure that the underlying conditions on which the design is based shall be maintained in their entirety and without undue interference with the expeditions and economical operation of the Contractor's projected scheme of procedure, the manufacture, erection, testing and commissioning of the works in sufficient details to define the various sections of the works.

The program prepared by the Contractor shall be so arranged as to take into account the following specific conditions and limitations:

- a) Purchaser's office and quarter to be completed by _____.
- b) Construction of the pumping station including operation house to be sufficiently complete to allow installation of the pumping equipment and its accessories by other contractors to be completed by _____.
- c) Construction of the flood gate to be sufficiently complete to allow erection of the gate and its accessories by others contractors to be completed by _____.
- d) All works to be completed by _____.

This program shall be submitted for approval by the Engineer and, upon such approval, it should thereafter be referred to as the "Approved Construction Program" and shall become a part of the Contract.

Subsequently, the Contractor shall submit to the Engineer at the beginning of each month during the course of construction a construction schedule presenting in detail his program of works for the ensuing two months.

5.9 Monthly Reports

The Contractor shall submit monthly reports in detail in such form as the Engineer may prescribe indicating:

- (a) the actual state of progress of all items of the construction works;
- (b) the numbers of the several class of labor, including foreign technicians employed by the Contractor on the site;
- (c) such information respecting rented public works equipment as specified in Clause 5.6.2.4 hereof;
- (d) such information respecting Contractor's equipment and construction materials furnished by the Contractor;
- (e) such information on other matters as designated by the Engineer or Purchaser.

5.10 Meteorological and Hydrological Records

Average monthly temperature, rainfall, evaporation, humidity and number of rainy days in Vientiane are shown on the drawings. Hydrographs and water stage discharge curve of the Nam Ngum at the Tha Ngon Gauging Station are also shown on the drawings. The Purchaser assumes no responsibility for any deductions, conclusions or interpretations which may be made therefrom.

5.11 Temporary Works

5.11.1 General

The Contractor shall submit to the Engineer for approval the drawings and full particulars of all Temporary Works, which he intends to construct, prior to commencement of constructing such works.

The submission to or approval by the Engineer of any such proposals by the Contractor shall not relieve the Contractor of any of his responsibility for the sufficiency of the Temporary Works for their intended purpose.

5.11.2 Construction Camp and Facilities

The Contractor shall at his own expense provide, maintain and subsequently remove such temporary accommodation and living facilities as are necessary for his employees and workmen, office, adequately fenced store compounds and workshops, including such repair shop as is necessary for the repair and proper maintenance of both rented public works equipment and Contractor's equipment, all necessary services for lighting, water supply, drainage, and any other facilities which are necessary for the execution of the works.

The Contractor shall submit a plan and details of the proposed buildings and services to the Engineer for approval, and he shall also obtain any necessary approval from the local, statutory or other authority before beginning such works.

The Contractor shall also ensure that the site is at all time in a clean and sanitary condition, and shall provide and maintain sanitary conveniences for the use of persons employed on the works to the extent, in the manner and at such places as shall be approved by the Engineer. All persons connected with the works shall be obliged to use them.

All costs incurred by the Contractor in complying with the requirements of this Clause shall be included in the item of construction facilities cost in the Price Schedule.

5.11.3 Electric Power for Construction Purpose

The construction of the 22-Kv power distribution line under other contracts by the Purchaser is scheduled from the Vientiane substation to B. Tha Ngon near the site. For the power supply for

construction use, the Contractor will be provided with power free of charge and he shall make connection with the supply terminals on the said power distribution line, if the power distribution line is completed before the beginning of these construction works.

The Contractor shall provide his power generator taking into account that the power supply may not be available for the construction works, and shall provide such further distribution systems as are required for his own purposes and for the Purchaser.

The Contractor shall be responsible for providing all the electric power demanded during the construction period by all users within the site complex, free of charge, both before and after power is available from the power distribution line.

The Contractor, in determining the power which he will have to supply, shall make allowance for and include the 200 kW load required for the Purchaser's office and quarter and other contractors' use.

The cost for electric facilities to be provided by the Contractor shall be included in the item of construction facilities cost in the Price Schedule.

5.12 Surveys

The control stakes or bench marks of the works will be established by the Purchaser and delivered to the Contractor at the site.

The staking of the structures from the control stakes shall be performed by the Contractor at his own expense and responsibility.

Whenever necessary as determined by the Engineer, he will request the Contractor to submit his final result table of survey or will perform the check survey in order to check the staking executed by the Contractor.

The control stakes or bench marks set by the Purchaser shall be carefully preserved by the Contractor until they have served their purposes. In case of destruction by the Contractor or his employees, control stakes or bench marks will be replaced by the Purchaser at the Contractor's expense. Works shall be suspended at such reasonable time as may be required to transfer lines and to mark points for lines and levels.

5.13 Earthworks

5.13.1 Clearing and Stripping of Site

5.13.1.1 Clearing of site

The area to be occupied by the works and Temporary Works shall be cleared of all trees, brush, rubbish and other objectionable materials, and cleared materials shall be burned or otherwise disposed of, so as to give satisfaction to the Engineer.

Such clearing shall include the removal of tree stumps and roots, the removal and disposal of structures that obstruct, encroach upon the works and carried out all over the area of the grounds to be excavated or refilled.

The whole cost of carrying out the site clearance as ordered above shall be paid at the unit price per hectare for site clearance in the Price Schedule.

5.13.1.2 Stockpiles and waste material

Spoil shall be tipped in such areas as directed by the Engineer. Unless otherwise directed by the Engineer, the spoil tip areas shall be cleared as specified in Clause 5.13.1.1.

Waste material shall be formed in spoil tip areas and shall be kept separate from stockpiles.

Any waste material or stockpile shall be formed in such a manner that the area is at all times properly drained and, where directed by the Engineer, drainage works shall be constructed. No separate payment shall be made for such works.

Waste material and stockpiles shall be formed as approved by the Engineer and shall be stable.

The Purchaser may order the Contractor to change the spoil tip areas, if necessary, but the Contractor shall not be entitled to any claim for additional payment on account of such changes.

Change of location or addition of spoil tip areas for the Contractor's convenience in the execution of the works shall be made at the Contractor's expense, but subject to the prior approval of the Engineer.

Compensation of all kinds due to the owners or to the third parties for use of such spoil tip areas shall be borne by the Contractor.

5.13.1.3 Stripping of topsoil

Topsoil is defined as all material which is being or can be used for the cultivation of agricultural crops.

Before commencing any excavation (including excavation in borrow areas), the Contractor shall strip or excavate topsoil to the depths ordered by the Engineer and dispose it in accordance with Clause 5.13.1.2.

Stripping of topsoil shall be paid for at the unit price stipulated in the Price Schedule, and the unit price for stripping of topsoil shall include for stripping, hauling and disposal of the stripped topsoil in spoil tip areas place approved by the Engineer.

5.13.2 Excavation

5.13.2.1 General

For the purpose of this Clause, common excavation shall be deemed to mean the open-cut excavation of all material other than rock, such as earth, gravel, and soft or disintegrated rock which can be treated efficiently either by hand tools or by such excavating machines as bulldozer, power shovel or scraper, as well as the excavation of boulders or detached pieces of soiled rock not exceeding one (1) cubic meter.

Furthermore, common excavation has been divided into five (5) types for the measurement and payment in the Price Schedule:

- (a) Type A: Common excavation by bulldozers.
- (b) Type B-1: Common excavation by dragshovel (0.6 m^3) together with hand tools or motor grader for final finishing-up of the side slopes.
- (c) Type B-2: Common excavation for farm laterals by hand tools.
- (d) Type C: Common excavation by dragline (0.6 m^3).
- (e) Type D: Common excavation for foundation by hand tools.

Before excavation is started, the Contractor and the Engineer shall together survey and take levels over the entire area in which the excavation is to be carried out and shall agree upon the surface levels of the material to be excavated. The levels shall be taken from a bench mark near to the area of excavation and measurement of excavation shall be based upon the bench mark from which the levels of the original ground surface were determined.

Unless shown on the drawings or definitely directed by the Engineer, the open-cut excavation will be measured to slopes of 1 to 0.5 and, in case of excavation for structures which do not reach the excavated slopes, the lines of slope for measurement shall be drawn from 0.3 meter outside of the structure foundations; provided that

for any required excavation where, in the opinion of the Engineer, the condition warrants, the Engineer may direct to the Contractor to vary the slopes or dimensions from those specified herein to such slopes or dimensions as will be more practicable.

Where no concrete covering is to be performed, excavation shall be executed so that the excavated area is sufficient for serving its purposes and shall be finished to the lines and slopes specified on the Drawings. If exposed surfaces by excavation shall present such projections as stones, the latter may be left intact so far as they do not protrude more than 0.2 meter above the lines and they do not hinder the execution of the work.

Where the excavation is to be covered subsequently by permanent construction, the Contractor shall, immediately after exposing the specified satisfactory foundation, proceed with the construction on that foundation. If the Contractor allows any portion of such foundation to deteriorate due to exposure, he shall make good the foundation at no extra cost to the Purchaser and to the satisfaction of the Engineer.

Prior to placing concrete on excavated surface or on open-cut excavation, all foundations shall be inspected by the Engineer after the excavation has been performed up to the required levels or dimensions by the Contractor, who should also obtain the Engineer's approval before the laying of fill materials.

Where the excavated surface has to be concreted or the open-cut excavation has to be filled with concrete, the measurement for payment shall be limited to the prescribed dimensions of the excavation required for the concrete structures.

The bottom and side slopes of common excavation to be filled with concrete shall be moistened and compacted to form a firm foundation finished accurately to the prescribed dimensions.

If, at any point in common excavation, the surface required to receive the structure is excavated beyond the neat measured lines, the over-excavation shall be filled with selected materials in layers not more than 0.15 meter thick, and shall be moistened and thoroughly compacted by tamping or rolling.

If the natural foundation material is disturbed or loosened during the excavation process or otherwise, such material shall be removed and the foundation shall be refilled with selected materials in the same manner as mentioned above.

There is every probability that slide may occur by excavating to the prescribed lines and by excavating the prescribed slopes and, by such occurrence, that slopes will not remain stable, the Contractor shall immediately inform the Engineer who will witness them, and a report confirming such fact will be made and will be notified to the Contractor through official channel.

This notwithstanding, the Contractor shall perform the excavation to the additional lines and excavation of additional slopes as staked out or otherwise directed by the Engineer. In compensation for damages caused by the slide not within the control of the Contractor, and which, even by the exercise of due diligence, the Contractor is unable to overcome, as acknowledged above, all the costs incurred by the Contractor -- including the costs for any additional excavations performed under the direction of the Engineer -- will be paid to the Contractor by the Purchaser according to the unit price bid for common excavation in the Price Schedule.

5.13.2.2 Unit price bid for open-cut excavation

The unit price bid for open-cut excavation in the Price Schedule shall include for excavation, dewatering, slide prevention; for laying out, constructing and maintaining catchwater drains in good order during the works.

In addition to the above, the unit price bid for open-cut excavation shall include for hauling and disposal of the excavated material in spoil tip areas, and in the case of the excavated material being approved for incorporation in the works for hauling over any distance to the point of incorporation in the works.

The unit price bid for open-cut excavation shall include also for the cost of minor backfilling as may be naturally required by the Engineer, except if such costs are already covered in other items of the Price Schedule.

5.13.2.3 Disposal of excavated materials

Where approved by the Engineer, the excavated material may be incorporated in the works as designated by the Engineer.

Such suitable material of different grading shall be hauled and selectively laid down by loads at the places designated by the Engineer during the excavation directed by the Engineer.

Besides the material obtained from the above-mentioned open-cut excavation, the Engineer will designate the best fitted material for incorporation in the works to be obtained from the depths of cut which, in the opinion of the Engineer, are suitable for excavation of material for such purpose. If the excavated material is too wet for immediate incorporation in the works, it shall be placed temporarily in stock piles until the moisture content is within the appropriate limits.

Where excavated material is unsuitable for the above-mentioned purpose, it shall be deemed as waste material and be deposited as specified in Clause 5.13.1.2 hereof.

When any excavation carried out is subsequently abandoned and is no longer necessary, it shall be filled with unsuitable materials deposited in spoil tip areas to the Engineer's satisfaction. Payment for filling back with unsuitable excavated material as

specified above shall be included in the unit price bid for excavation.

5.13.3 Earthfill

5.13.3.1 General

Earthfill shall mean all earthfill for the canal embankment, road embankment, protective embankment and for other parts of the works, built entirely with material obtained both from excavation as specified in Clause 5.13.2.3 hereof and from borrow pits as specified in Clause 5.13.3.3 and hauled to the fill site, and compacted.

For the purpose of this clause, earthfill has been divided into five (5) types for the measurement and payment in the Price Schedule:

- a) Type Ao -- Earthfill for the irrigation canal embankment below the water surface designed in the canal, in the section specially specified, including Type A excavation in borrow pits and hauling to the fill site by bulldozers.
- b) Type A --- Earthfill for the irrigation canal embankment below the water surface designed in the canal, for road embankment, protective embankment and for other parts of the works built with material obtained from Type A excavation both in borrow pits and in working sites, and hauling to the fill site by bulldozers.
- c) Type B --- Earthfill for the canal embankment other than above;
 - Type B-1 - Earthfill built with material obtained from Type B-1 excavation including hauling to the fill site by power shovel and hand tools.
 - Type B-2 - Earthfill built with material obtained from Type B-2 and Type D excavations including hauling to the fill site by hand tools.

- d) Type C --- Earthfill for the flood gate embankment including Type A excavation in borrow pits and hauling to the fill site by bulldozers.

5.13.3.2 Foundation preparation

The whole of the base area of earthfill or embankment upon which any kind of material will be placed, shall be cleared as specified in Clause 5.13.1.1 hereof, and stripping of topsoil and excavation shall be carried out to a depth determined on the site by the Engineer. The level at which this excavation is finished is hereafter referred to as the "level of acceptable foundation".

Such ground preparation shall be completed only eight (8) days at most prior to placing the bottom layer of fills. Should the Contractor fail to comply with the provisions of this clause, he shall, if the Engineer orders him so to do, remove all grasses which have grown on the surface to be filled, at no extra cost to the Purchaser.

If earthfill is to be built on sloping or nearly level ground, the surface of the ground shall be deeply plowed or stepped.

Before the first layer of filling is compacted, its foundation shall be thoroughly raked or plowed over the whole surface to the depth of over 0.15 meter, and if necessary, such measures as moistening with water shall be taken so that the filling to be compacted will join firmly and neatly with the foundation materials.

5.13.3.3 Borrow pits

All fill material for incorporation in the works which is not available in the excavation site, shall be taken from the designated borrow pits along the canal or other designated borrow pits shown on the Drawings.

The Contractor will, however, be permitted to obtain fill material from such other areas as contain suitable material and which are not specifically excluded from use as borrow pits or which are, in the opinion of the Engineer, too close or liable to endanger the stability or performance of the permanent works or other properties.

If the Contractor chooses to borrow fill material from any area which is not a designated borrow pit, he shall, before commencing site clearance, stripping the topsoil and excavation in the area, check the quantities and suitability by digging trial pits as directed by the Engineer. The Contractor shall take and pass to the Engineer for testing, samples of material from the trial pits; The actual depths and types of samples shall be as ordered by the Engineer. The cost of digging and sampling from such trial pits shall be covered by the unit price bid for earthfill.

Minor changes of the location of borrow pits may be made by the Engineer due to constructional circumstances, but the Contractor shall not be entitled to additional payments on account of such change.

The Contractor shall not start any site clearance, stripping of topsoil and excavation at an area from which he intends to borrow fill material without obtaining specific permission in writing from the Engineer.

Before commencing to extract fill material from any part of a borrow pit, the Contractor shall clear, strip and excavate from the surface of that part all material, which is in the opinion of the Engineer unsuitable for fill. Such material and any other unsatisfactory material, at whatever depth it occurs, shall be removed immediately from the working area and deposited separately in approved spoil tip areas or such other areas as may be specified.

All costs incurred by the Contractor in complying with the provisions of this Clause shall be paid at the unit prices bid specified in Clause 5.13.1 hereof for clearing and stripping of site, except where a separate item for such work in borrow pits appears in the Price Schedule. However, compensation of all kinds due to the owners or to the theird parties for use of such borrow pits shall be borne by the Contractor.

5.13.3.4 Placing fill material

Before starting any earthfill, the foundation preparation executed on the areas where earthfill is to be made, by the Contractor as specified in Clause 5.13.3.2 hereof, shall be checked and accepted by the Engineer as being carried out to his satisfaction.

All earthfill shall be made according to the measured lines and slopes shown on the drawings or specified.

Fill material shall not contain any clod, turf, stump, animal or vegetable debris, or any other objectionable material. Material for filling shall be suitable and free draining mixture of soil, sand, gravel or rock waste extracted from excavation as specified in Clause 5.13.2.3 or from borrow pits as prescribed in Clause 5.13.3.3.

The layer of earthfill, when placed, shall be horizontal of uniform thickness as specified in Clause 5.13.3.5, and shall extend to the full width of filling. The rate of settlement shall be observed and the placing of the following layer shall be started only after the approval of the Engineer is obtained. No cobbles or rocks of more than 0.2 meter in size shall be placed in the 0.5 meter thick upper layer of the fill.

Unless otherwise specified, the following extra filling or available material for settlement allowance shall be added according to the condition of original ground:

<u>Height of embankment</u> (meter)	<u>Extra filling percentage to embankment height</u> Soil (%)
0 - 3	9 - 7
3 - 6	8 - 6
6 - 9	7 - 5

Measurement of fill material, for payment, will be made to the lines of placed and compacted earthfill shown on the drawings or specified by the Engineer.

The Contractor shall route the hauling equipment over the layers already in place and shall distribute the traffic evenly over them so as to obtain the maximum practicable compacting effect of the equipment.

5.13.3.5 Compaction of fill material

Prior to the commencement of embanking works, the Contractor shall carry out under the direct supervision and to the specification of the Engineer, a series of field tests to determine the optimum conditions of compaction and the minimum number of passes of each type of rolling compaction equipment required to compact each type of fill material to the densities specified. The cost of executing such tests shall be included in the appropriate unit price bid for earthfill.

The Contractor shall provide facilities for spraying fill material with water or allowing it to dry out, if necessary, in order to maintain or achieve the requisite moisture content. The cost of such watering or drying out shall be covered by the appropriate unit price bid specified in the foregoing clauses.

Watering shall be carried out by means of sprays approved by the Engineer. The use of hoses without sprays will not be permitted. Sufficient watering points shall be provided to permit watering by hoses of all areas of the surface of the earthfill. Water carts may be used, but their use will not relieve the Contractor to provide watering points as specified above.

The compaction equipment shall be capable of achieving the specified densities in all parts of the earthfill, The Engineer will not approve the compaction equipment for compaction of placed material unless it complies with the following requirements:

- (1) Tamping rollers are capable of producing ground pressures in excess of ten (10) kgs per square centimeter, measured on a rigid surface.
- (2) Road rollers of a rolling capacity equivalent to that of smooth-wheeled rollers weighing not less than ten (10) tons.
- (3) Vibratory compaction equipment of a compacting capacity which is equivalent to the rolling capacity of smooth-wheeled rollers weighing not less than ten (10) tons.

The speed of the above-mentioned rolling compaction equipment shall be below five (5) kilometers per hour, and the compaction shall be overlapping on successive passes by at least half the width of the rolling compaction equipment.

Each layer of material placed as specified below shall be compacted to a dry density not less than 90% of the maximum dry density at optimum moisture contents of J.I.S. by the rolling compaction equipment:

<u>Type of earthfill</u>	<u>Thickness of each layer</u>	<u>Rolling times</u>	<u>Remarks</u>
Type Ao	0.20 m	more than 7 times	excavation for canal section shall not be executed until at least 3 months have elapsed since embanking work has been completed and without Engineer's approval.
Type A	0.30 m	more than 5 times	
Type B-1 and Type B-2	0.30 m	more than 2 times	
Type C	0.20 m	more than 5 times	

In addition to the equipment specified above, the Contractor shall provide sufficient vibrating and mechanical rammers weighing more than 75 kg to compact to the specified densities any parts of the earthfill inaccessible to the rolling compaction equipment specified above. In such parts of the earthfill, the layers of material shall be placed in a continuous horizontal layer not exceeding 0.1 meter thick and shall be compacted at least three (3) times by such rammers.

At the end of each day or whenever embanking at any particular point is interrupted, the surface of the fill shall be rolled to give a slightly cambered surface to facilitate drainage. At all times during dry period, whether embanking is taking place or not, the surfaces of the earthfill shall be watered as directed by the Engineer to prevent the fill from drying out.

When the weather is such that it would adversely affect the properties of the fill material placed, all embanking shall be stopped. Embanking will not be resumed until the upper layers of fill have dried to their correct moisture contents. The Contractor shall allow in his unit prices for such interruptions to embanking.

5.13.3.6 Deterioration of fill material

No fill material shall be placed on a previous layer of fill that has dried out, become saturated or in any way deteriorated by exposure, by spilling of other material, or by disturbance by mechanical transport or by any other means. Before fresh fill material is placed, all such deteriorated fill or objectionable material shall be removed to a depth at which fill material of an acceptable standard is exposed. The Contractor shall ensure that a good bond is achieved between layers of fill, and unless otherwise directed, previously compacted layers shall be harrowed or otherwise roughened and made suitable for covering with a further layer of fill.

Following a period of rain, the Contractor shall not work on or run transport of any kind over fill material until the approval of the Engineer has been obtained, nor shall the Contractor be permitted to start the placing of fill material after a period of rain until all fill material, that is unsuitable or has deteriorated, has been removed and the fresh fill material to be placed is within the appropriate limits of moisture content.

All costs incurred by the Contractor in complying with the provisions of this clause shall be deemed to be covered by the appropriate unit price bid for earthfills.

5.13.3.7 Payment for earthfill

Payment for fill material placed and compacted shall be made at the unit prices specified in the Price Schedule as follows for the net volume of fill in place, measured after compaction to the lines shown on the Drawings or specified by the Engineer:

- (a) Unit price for earthfill of types Ao and A, which shall include the cost for Type A excavation in the borrow pits, and for handling and hauling of excavated material to the fill site within a maximum radius of 50 meters from the point of excavation or from the places where the excavated material has been deposited. The Contractor will be paid on a cubic meter based on handling and hauling beyond average distance of 30 meters.
- (b) Unit price for earthfill of types B-1 and B-2, which shall include for handling and hauling of the excavated material over any distance to the point of incorporation in the works.
- (c) Unit price for earthfill of type C, which shall include the cost for Type A excavation in the borrow pits, and for handling and hauling of excavated material to the fill site within a maximum radius of 100 meters from the point of excavation. The Contractor will be paid on a cubic meter based on handling and hauling beyond average distance of 50 meters.

The unit prices for any earthfill described above shall also include for sorting and strewing of fill material, for final finishing-up of side slopes together with motor grader or hand tools, and for all other works connected therewith.

5.13.4 Backfilling

Backfilling shall be carried out with such approved material on the front and the side of outlying structures and elsewhere as shown on the Drawings or as directed. Unless otherwise specified by the Engineer, the maximum size of any rock contained in the backfilling material shall be 0.2 meter. Topsoil, vegetation or other organic material shall be excluded from backfilling material extracted from required excavation for structures.

Prior to the commencement of placing fill material, the places to be backfilled shall be cleared of all remaining concrete form and other Temporary Works and shall be subject to the approval of the Engineer.

Backfilling material shall be placed in a continuous horizontal layer of not more than 0.2 meter thick, measured after compaction, and each layer placed shall be compacted by at least 4 passes of rolling compaction equipment or at least 5 times with a mechanical tamper weighing more than 75 kilograms.

The surface of the backfilling material shall be compacted so as to give a slightly cambered surface to facilitate drainage. At all times, the backfilling material shall be watered or allowed to dry, if necessary, in order to maintain or achieve the requisite moisture content for compaction as determined by the Engineer. The cost of such watering or drying out shall be covered by the unit prices for backfill.

Backfilling material adjacent to structures shall be placed in such a manner as will ensure that it can be satisfactorily compacted without damage to the structures, and compaction adjacent to all structures shall be carried out by approved hand tools.

Compaction of backfilling material above buried concrete, however nature, shall not be permitted to be carried out with vibrating rollers within 0.5 meter vertically of the surface of the concrete, except with the prior approval of the Engineer.

Unless otherwise specified by the Engineer, no backfilling material shall be placed and no compaction shall be permitted adjacent to concrete for fourteen (14) days following the placing of the concrete.

5.13.4.1 Payment for backfilling

Payment for backfilling shall be made at the unit prices for backfill specified in the Price Schedule for the net volume of fill material in place, measured after compaction to the lined to which open-cut excavation was measured, as prescribed in Clause 5.13.2 hereof and according to the prescribed levels shown on the Drawings or directed by the Engineer.

The unit price for backfill shall include for the cost of supplying suitable material as specified, placing in the structures by hand tools or machines, mixing, harrowing (if required), spreading, trimming, watering and compacting, and for the cost of all other works connected therewith.

5.14 Concrete Works

5.14.1 General

All concrete works shall be performed as established on the drawings or directed by the Engineer. Unless specifically provided in these specifications, concrete shall be produced, placed, cured, finished and tested in accordance with the provisions of JIS or equivalent.

5.14.2 Cement

Cement used in the works shall be furnished by the Contractor

as prescribed in Clause 5.6.3.3.

The Contractor shall submit the supply and transportation program of cement to the Engineer for approval.

5.14.3 Aggregates

5.14.3.1 General

The Contractor shall furnish sand for concrete, mortar and for grout (if the latter is required), and also coarse aggregates for concrete from any approved source as specified in these specification or directed by the Engineer. Such aggregates shall consist of natural sand, gravel, broken stones, or a mixture of natural sand, gravel and/or broken stones, and, as delivered to the batching plant, shall have a reasonably uniform and stable moisture content.

Sand for concrete, mortar and grout (if the latter is required) shall be free of earthy or marly material.

Stones, broken stones and gravel for concrete shall be selected among the hardest materials obtained from excavation.

5.14.3.2 Sources of aggregates

The Contractor will be permitted to obtain aggregates to be furnished by him from any deposit. The Contractor shall submit, for preliminary test and approval, a representative 50 kilogram samples of sand and coarse aggregates proposed for use in the works at least 30 days prior to its use, to the Engineer.

Natural sand may be obtained from the deposit at Vientiane on the Mekong river, and coarse aggregates may be obtained from the quarry sites at Khouei Dong at a distance of about 34 kilometers east from Vientiane.

Aggregates may be also obtained from the deposit near the Tha Ngon Ferry site, but its quantity is not so great to be useful for all works.

5.14.3.3 Storage of aggregates

Provision shall be made on the site for the separate storage of each size of coarse aggregates in such a manner as to avoid the inclusion of any foreign material in the concrete and to prevent segregation and excessive breakage. Stockpiles shall be provided with suitable drainage facilities to ensure as far as practicable that the aggregates delivered to the batching plant shall have such a uniform and suitable moisture as directed by the Engineer.

5.14.3.4 Grading of sand

Sand delivered to the batching plant shall be well graded so that the percentage by weight passing the screen with mesh mean opening shall conform with the standard percentage given below:

<u>Mesh mean opening of the screen</u> (mm)	<u>Standard percentage by weight passing the screen</u> (%)
10	100
5	90 to 100
2.5	80 to 100
1.2	50 to 85
0.6	25 to 60
0.3	10 to 30
0.15	2 to 10

Where the fineness modules of sand varies by more than 0.20 from the fineness modules used for determining the concrete mix proportions, the sand shall not be used without changing the concrete mix proportions utilized.

All sand shall be washed free of all organic matter or other impurities which may impair the cement and eventually reinforcing steel. Tests to check the efficiency of the washing of

the sand shall be made at regular and frequent intervals, and any sand found to be unsatisfactory shall be rejected or, if permitted by the Engineer, subjected to further washing.

5.14.3.5 Grading of coarse aggregates

The maximum size of coarse aggregates shall be 80 millimeters in mass concrete, 40 millimeters in other structural concrete, and 20 millimeters in concrete piles and other thin structures. The maximum sizes of coarse aggregates to be applied for the various types of mix are given in Clause 5.14.9 hereof.

Coarse aggregates delivered to the batching plant shall be separated into nominal sizes and shall be well graded so that the percentage by weight passing the screen with specified mesh openings shall conform with the standard percentage given below:

Nominal size Size range	Screen designation	Standard percentage by weight passing the screen		
		80 mm aggregate 40 to 80 mm	40 mm aggregate 20 to 40 mm	20 mm aggregate 5 to 20 mm
	100	100	-	-
	80	90 to 100	-	-
	60	45 to 70	-	-
	50	-	100	-
	40	0 to 15	90 to 100	-
	25	0 to 5	20 to 55	100
	20	-	0 to 15	90 to 100
	10	-	0 to 5	20 to 55
	5	-	-	0 to 10
	2.5	-	-	0 to 5

Coarse aggregates shall be washed free of earth, screened and be washed again, if the Engineer deems it necessary. Unless otherwise directed, all crushing shall be carried out outside of the place of its utilization.

5.14.4 Mixing Water

Water for mixing concrete, mortar, rendering and grout (if the latter are required) shall be clean, fresh and free from organic or inorganic matter in solution or suspension in such amounts that may impair their strength, appearance or durability.

5.14.5 Concrete Admixtures

No admixtures shall be mixed with concrete without the direction or approval of the Engineer. However, if the use of admixtures is approved, such approval shall cover the type of admixture and the amount to be used, and also the location of its use.

Calcium chloride shall not be used in excess of two (2) per cent by weight of cement. Accelerators shall be measured accurately and introduced with mixing water into the mixer in such a manner as to obtain a suitable solution.

5.14.6 Reinforcing Steel

The Contractor shall supply the Engineer with a certificate for each consignment from the steel manufacturers showing that the steel meets the requirements of these specifications.

Steel reinforcing bars shall be kept clean and shall be free from pitting, loose rust, mill scabs, oil, grease, earth or paint, or any material which may impair the bond between the concrete and the reinforcement.

The Contractor shall satisfy himself that the bar schedules are accurate, and any bars wrongly dimensioned and built into the works shall be replaced at no extra cost to the Purchaser.

Bends, cranks and other shapes of reinforcement shall be to the dimensions specified, otherwise all bars shall be truly straight. Bending and cutting shall be done by such method as not to injure the

bar qualities and as approved by the Engineer; unless otherwise shown on the drawings, all bending is to be done cold round a former having a diameter of more than five (5) times the diameter of the bar.

The weight of reinforcement shall be determined by multiplying the length in meters given in the bending schedule by 0.785 kilogram per square centimeter of nominal cross-sectional area, no allowance being made for laps, waste in cutting or for the weight of binding wires used.

5.14.7 Preparing Foundations for Concrete

Before placing concrete on foundations, the Contractor shall remove from all such surfaces oil, objectionable coatings, loose or unsound fragments of rock (if any), earth, mud, debris, and standing water to the satisfaction of the Engineer and shall keep such surfaces clean and free from standing water during concreting operations. No concrete shall be placed until the Engineer shall have inspected and approved the foundations.

Where concrete abuts against earth or any other material liable to become loose or to slip, care shall be taken to avoid falls of material on to the surface of the wet concrete either by leaving timbering in place, where permitted, or by cutting away or removing timbering in small lengths or depths at a time. If any such falls occur, all contaminated concrete shall be removed and replaced at no extra cost to the Purchaser.

A layer of blinding concrete shall be placed as ordered by the Engineer in preparation for the foundation concrete. Blinding concrete shall be of thickness prescribed by the Engineer or shown on the drawings, and shall be Type D.

Unless otherwise directed by the Engineer, before placing any concrete on surfaces made of earth, gravel, etc., a layer of stiff cement mortar shall be worked into the cleaned surface with a stiff broom. The mortar shall have the same sand/cement ratio and shall

include the same quantity of admixtures per cubic meter as used in the concrete. No mortar shall be required on foundations where a concrete blinding layer or other foundation protection is specified.

All costs incurred in preparing foundations for concrete shall be covered by the appropriate unit prices for concrete for structures in the Price Schedule.

5.14.8 Placing Reinforcement

The approved disposition of the steel shall on no account be interfered with. The greatest care shall be taken that the steel is laid out correctly, that the bars are tightly and securely fixed by means of iron binding wire in position to prevent any displacement before or during concreting and so that the concrete may be consolidated firmly around the steel and against the forms. Metal chairs, metal hangers, metal spacers, mortar blocks or other satisfactory supports may be used by the Contractor for supporting the steel; however, steel blocks or wooden wedges to keep the steel away from the forms will not be allowed.

Where iron binding wires are used for suspension of the bars in position, the number of binding wires to be used shall be as great as necessary for hanging each bar in position as prescribed in the Drawings, except for an allowance which shall be equal to one half (1/2) of the diameter or thickness of the bars but which should in no case exceed six (6) millimeters.

Reinforcement in place shall be cleaned of all set or partially set concrete which has been deposited on it during previous concreting operations.

When reinforcement has been placed and is ready for concreting, it will be inspected by the Engineer and no concrete shall be placed until the reinforcement has been approved by him. The Contractor shall inform the Engineer at least 24 hours in advance, of his intention to have the reinforcement ready for inspection.

Reinforcing bars in structures shall be so placed that the reinforcement, any anchor bolts or other embedded metal works, and the surface of form will be at least two centimeters (0.02 meter) apart from each other. Intersection point of the reinforcing bars placed shall be securely tied with an annealed iron wire of not less than 0.9 millimeter in diameter.

Jointing of the reinforcing bars shall be made in the type of overlap joint or welded joint.

The length of overlapping shall not be less than twenty five (25) times the diameter of the bars, and the overlapping joint shall be tied at several points by annealed iron wire of diameter as specified above. Welding of the joint to be welded shall be performed by a reliable method and by experienced welding operators which shall be subjected to approval by the Engineer.

The unit price or the contract price for reinforcement bar in structures shall be deemed to cover the cost of providing, loading, transporting to site, unloading, storing, placing and, except where otherwise specified and if required, jointing, testing all steel bars, including the cost of all labor, materials, and use of plant and tools.

5.14.9 Concrete Mix Proportions

The table below gives the different types of mix contemplated by the Purchaser to be used in principle in the various structures, and for each minimum compressive strength at 28 days the maximum size of aggregates and the cement content per cubic meter of concrete placed, it being understood that the cement content shown herein is not final but is indicated tentatively for enabling the Contractor to prepare his bid estimate:

<u>Mix Type</u>	<u>Minimum compressive strength at 28 days</u> (kg/cm ²)	<u>Maximum size of aggregates</u> (mm)	<u>Slump</u> (cm)	<u>Maximum water/cement ratio</u> (%)	<u>Cement content</u> (kg/m ³)
A	230	20	12-16	57.5	350
B	200	40	8-10	60	300
C	180	80	8-10	70	250
D	130	80	8-10	80	180

The actual proportions of the various gradings of coarse aggregate and sand will be determined from analysis and tests by the Engineer, who may vary these proportions from time to time, should the materials appear to render this advisable in order to obtain a concrete of maximum density, workability, consistency and strength with the minimum water-cement ratio.

Only sufficient water shall be added to the cement and aggregate during mixing to ensure proper hydration of the cement and to produce a mixture of workability such that it can be well consolidated, worked into the corners of the forms and around the reinforcement, give a satisfactory finish and achieve the specified strength given in the above table.

The following types of mix shall in principle be used in the various structures specified below, but the Engineer reserves the right to change the mix proportions from time to time in order to achieve a workable mix in accordance with the actual site requirements:

<u>Description</u>	<u>Mix Type</u>
1. Reinforced concrete for main body in structures	B
2. Such ancillary works as concrete pipes, concrete piles, etc.	A
3. Plain concrete for foundation bed, footing, etc.	C
4. Blinding concrete	D

The water-cement ratio of the concrete (inclusive of the moisture contents of the aggregates) shall not exceed 0.80 in weight for concrete to be used in any structure.

The amount of water added at the mixer shall take into account the moisture contents of the aggregates at the time of mixing and shall be changed as required to secure concrete of proper consistency. Uniformity in concrete consistency from batch to batch will be required, and no addition of water shall be permitted to compensate for stiffening of the concrete resulting from excessive over-mixing or objectionable drying before placing of the concrete.

The slump of the concrete shall not exceed 10 centimeters for blinding concrete and all plain concrete and 18 centimeters for all other concrete. The Engineer may order the Contractor to waste any batch having inappropriate slump, and the Contractor shall be entitled to no claim on account of such orders.

5.14.10 Batching of Concrete

The Contractor shall provide such means and equipment as required for the accurate measurement and control of each of the materials comprising the concrete.

The batching equipment shall be capable of combining the aggregates, cement, admixtures and water into a uniform mixture within the limits specified and be capable of ready adjustment to compensate for the varying moisture content of the aggregate and to change the weights of the materials being batched. The combined accuracy of the batching equipment in feeding and measuring shall not exceed the following limit:

Water and cement	1.5 per cent
Admixtures	1 per cent
Aggregates	3 per cent

The Contractor shall also provide standard test weights and any other auxiliary equipment required for checking the operation

of each scale or other measuring devices, and shall make periodic tests over the ranges of measurements involved in the batching operation.

Each ingredient that goes to the making of the concrete shall be determined by weighing, except water which may be measured by volume. However, if it is customary to utilize the later measurement for cement and aggregates, such practice may be permitted if approved by the Engineer.

The Contractor shall provide a mechanical tilting concrete mixer for mixing the materials for concrete, to the approval of the Engineer.

Unless otherwise directed by the Engineer, the mixing time for each batch shall not be less than the minimum mixing time specified as follows:

<u>Capacity of mixer</u>	<u>Minimum mixing time</u>
2 cubic meters to 1.5 cubic meters	2.0 minutes.
1.5 cubic meters or less	1.5 minutes.

The mixing time shall start when all the ingredients are in the mixer. The main charge of water shall be added prior to, during and after the charging operation in the mixer for a moment, and admixtures shall be added only if required and as directed by the Engineer.

The mixer shall not be loaded beyond its rated capacity unless specifically authorized by the Engineer, nor shall they be operated at a speed in excess of that recommended by the manufacturer. The mixer shall produce a concrete of uniform consistency and appearance.

All mixing equipment shall be clean before commencing mixing and shall be kept free from set concrete. The first mix after each cleaning of the mixing equipment shall not be used in the works.

A daily statement shall be rendered to the Engineer of the number of batches mixed, the volume and type of concrete poured and the weight of the cement used.

Where approved by the Engineer, concrete and mortar may be mixed by hand. Such concrete and mortar shall be mixed as close as is practicable to the site where it is to be deposited. Ingredients shall be thoroughly mixed at least four (4) times, while dry, on a clean watertight iron mixing sheet with mixing scoops, until the cement colour can no longer be distinguished from the sand in any part of the mass. The mixture shall then be wetted gradually and uniformly while undergoing further mixing until it is thoroughly uniform and homogeneous.

5.14.11 Trial Mixes

The Contractor shall, if directed by the Engineer, undertake a programme of trial mixes before the start of concrete operations, in order to establish the quantities of aggregate, cement and water to be used in the concrete for the works.

Trial mixes shall be made under the direction of the Engineer and shall be made as far as possible under conditions representative of those obtaining in the various parts of the works.

5.14.12 Transporting and Placing Concrete

Concrete and mortar shall be conveyed from the mixer to its place in the works as rapidly as possible by methods which will prevent segregation, consolidation or drying out.

Concrete shall be placed and compacted before initial set has occurred and in no case later than 45 minutes after the addition of water to the mix.

The use of belt-conveyor for transporting concrete shall, in general, not be permitted unless approved by the Engineer.

A sufficient number of men shall always be available to ensure complete compaction when concrete is deposited into the place it is to occupy in the works. Such local distribution as may be necessary shall be made by shovel and not by vibrator.

Concrete shall be deposited to the spot by vertical dropping so as to prevent segregation, but shall not be dropped freely through a vertical height greater than 1.5 meters nor allowed to strike hard reinforcing bars or forms assembled.

No concrete shall be deposited under water without the prior written approval of the Engineer.

Chutes, if used, must have a section with round corner and a proper slope so that there is no segregation, loss of mortar or reduction in slump, and shall be provided with a drop chute not less than 0.6 meter long to prevent segregation at transfer points and to ensure that the concrete is discharged vertically into place.

The Contractor shall submit to the Engineer for his approval, details of his proposed general plant arrangement, the equipment and the experience of the operators, and also samples of the aggregate, cement, water and of any admixture sufficiently in advance of the processing, handling and transporting of concrete ingredients, and the mixing, transporting and placing of the concrete to be given proper consideration, including tests where applicable.

The Contractor shall, after completion of the installation, execute the overall operation test of all equipment and plants in the presence of the Engineer. Trial parts, approved by the Engineer and included in the permanent work, will be measured and paid for at the appropriate unit prices. However, if the quality of concrete produced by such plants and equipment fails to comply with the requirements prescribed herein, the Contractor shall correct the defect of such equipment and plants to the satisfaction of the Engineer.

Unless intercepted by joints, all concrete to be placed in the forms shall be continuously placed in approximately horizontal layer not exceeding 0.3 meter thick. No partly set or retempered concrete shall be used in the works.

The height of lift shall be as designated on the Drawings or as specified by the Engineer.

While the concrete is in flow, whether during transportation by the use of truck or during placing by the use of chutes, it shall always be protected against extreme temperature rise by providing sun shade or such other means of protection as approved by the Engineer. All costs incurred by the Contractor in taking all necessary measures to comply with this requirement shall be deemed to be included in the unit prices for concrete.

Concrete shall be placed at such rate that no concrete surface shall have reached its initial set before additional concrete is placed thereon. No concreting in the open shall be allowed if, in the opinion of the Engineer, storms or heavy rain render it inadvisable.

5.14.13 Compaction and Curing

5.14.13.1 Compaction of concrete

All concrete placed in-situ shall be consolidated with suitable appliances. In general, electric or penumatic power driven internal type vibrators operating at a speed of at least 5,000 revolutions per minute when immersed in the concrete shall be used.

The duration of vibration shall be limited to that required to produce satisfactory consolidation without causing segregation. Vibration shall on no account be continued after water or excess grout (if any) has appeared on the surface.

In consolidating each layer of concrete, vibrators shall be employed in a systematic manner and concrete in one layer shall be compacted snugly in all surfaces of the forms and embedded materials

before placing the next. The vibrating head shall be withdrawn slowly to ensure complete closure of the hole in the concrete which it has formed and care shall be exercised to avoid contact of the vibrating head with the surface of the forms and to avoid excessive local vibration.

Where the use of internal vibrator is difficult, the concrete may be compacted with external type vibrators or by rodding or tamping as directed by the Engineer. However, the use of external type vibrators shall be held to the minimum.

5.14.13.2 Curing concrete

The exposed faces of all newly placed concrete shall be kept moist continuously by covering with water saturated material or other approved methods for the minimum period of days as follows:

High-early-strength cement	3 days
Ordinary Portland cement	7 days

The Contractor shall have available and ready to install before concrete placing begins all equipment necessary for the adequate curing and protection of the concrete.

All costs involved in curing concrete shall be deemed to be included in the unit prices for concrete.

5.14.14 Finishing

5.14.14.1 Formed surfaces

The Contractor shall clean all exposed surfaces of unsightly encrustations and stains. Immediately after the forms have been removed from the surfaces that are exposed permanently to view, the surface of the concrete shall be brushed down with a hard broom and all unsightly ridges, fins and other projections shall be removed, water being sprinkled on during the process and care being exercised not to spall the general surfaces. Conspicuous local bulging shall be remedied by tooling or grinding to produce a finished surface that is neat and uniform in appearance.

All holes left by the removal of fasteners from the end of tie rods and of grouting system nipples, and all voids shall be filled neatly with mortar consisting of 750 kilograms of cement per cubic meter of sand, after such holes and voids have been kept moist at least for 4 hours. All porous and fractured or defective concrete surfaces shall be removed by chipping an opening with dimensions directed by the Engineer, shall be filled up with fresh concrete or mortar (by dry-method, if required by the Engineer). The surface of repairs to defects in the concrete after filling shall be ground smooth.

When concrete is used for filling of the surface of repairs to defects, the chipped opening shall not be less than 8 centimeters deep.

All costs incurred in finishing formed surfaces shall be included in the unit prices for concrete for structures.

5.14.14.2 Unformed surfaces

Unformed surfaces that are exposed shall be worked with suitable tools to produce an even and unformed surfaces. Surface irregularities shall be such as not to impair the structural properties of the work and surplus concrete shall removed by striking off with a template. Floating shall be started as soon as the worked surface has stiffened sufficiently and shall be the minimum necessary to produce a reasonable float finished surface that is uniform in texture.

The Contractor shall exercise such particular care in finishing unformed surfaces that will be subjected to the action of flowing water as to produce a surface conforming accurately with the specified shape and alignment.

Broader surfaces, which are to be exposed to atmospheric precipitation and are normally horizontal, shall be sloped for drainage purpose. Unless otherwise shown on the Drawings or specified by the Engineer, such slopes shall be approximately 1 to 100.

Excessive trowelling on the unformed surfaces, while the concrete is plastic, shall not be permitted.

5.14.15 Defects and Holes in Concrete

Concrete that is damaged or honeycombed shall be cut away until sound concrete is exposed and the space filled with mortar or concrete as specified or directed by the Engineer.

Narrow slots cut for repair of cracks, grout insert holes (if any) and temporary holes left by the removal of forms shall be filled neatly with mortar consisting of 750 kilograms of cement per cubic meter of sand or with fresh concrete (by dry-method, if required and) as directed by the Engineer.

All defects and holes shall be kept moist for 24 hours before filling, except if other wise directed by the Engineer, and shall be cured after repair.

All fillings shall be tightly bonded to the surfaces of the hole, shall be sound and free from shrinkage cracks and shall match the adjacent concrete in colour and texture after the filling has been cured and has dried.

The cost of filling holes in concrete not called for in the Specifications, or filling other holes for which there is no separate unit prices, and for repairing defects occurring in the concrete as a result of failure by the Contractor to comply with the Specifications shall be deemed to be included in the unit prices for concrete.

5.14.16 Embedded Items

Before placing concrete, care shall be taken to determine that all embedded items are securely fastened in place as shown on the Drawings or otherwise directed. All embedded items shall be thoroughly clean and free from oil and other foreign matter, such as

loose coatings of rust, paint, scale, mortar, etc. The embedding of wood in concrete shall be prohibited unless specifically authorized.

5.14.17 Cement Mortar

Cement mortar shall consist of 400 kilograms of cement per 0.95 cubic meter of sand, unless otherwise specified. All cement mortar is to be freshly mixed and no softening or retempering will be allowed.

5.14.18 Surfaces of Construction Joints

The surfaces of construction joints against which concrete or mortar is to be placed shall be cleaned of all laitance, loose or defective concrete, coatings or other objectionable material, and shall be damped by a method approved by the Engineer.

The surfaces of construction joints in the structures shall be wet sandblasted. When the surface skin has been removed and the aggregate exposed, the surface shall be thoroughly cleaned with air-water jet.

The long-aged concrete surfaces of construction joints against which new concrete is to be placed shall be kept moist for at least 48 hours prior to placing the new concrete, after the surfaces of the joints have been subjected to the above-mentioned treatment.

When fresh concrete is to be placed on the construction joints, the surfaces of the joints shall be clean, damp and free from standing or running water and all construction joints shall be covered with an about 1.5 centimeter thick layer of mortar immediately before concreting. The mortar shall have the same sand/cement ratio as used in the concrete or shall have a richer mix proportion than the concrete.

The whole cost of forming and treating the surfaces of construction joints shall be included in the unit prices for concrete.

5.14.19 Concrete Blockouts

Concrete blockouts shall be formed where specified to enable metal works and manufactured equipment supplied to the Contractor to be installed.

Where concrete blockouts are to be formed, the concrete surfaces shall be chipped and roughened. After the roughened surfaces have been cleaned, kept moist for at least 4 hours and been approved by the Engineer, they shall be filled with cement mortar composed of more than 500 kilograms of cement or with concrete of the same mix designation as specified for the surrounding concrete.

When the blockouts are to be filled with concrete after the installation of metal works and manufactured equipment is completed, care shall be taken that the newly placed concrete is tightly bonded to the previously placed concrete and that complete adhesion between the concrete and all metalworks and manufactured equipment installed in the blockouts is obtained.

The cost of forming concrete blockouts for which there is no separate unit price in the Price Schedule shall be deemed to be covered by the appropriate unit prices for concrete, and the cost of filling blockouts with mortar or concrete for which no particular item appears also in the Price Schedule will be paid at the same unit price per cubic meter stipulated for concrete work.

5.14.20 Precast Concrete Units

Precast concrete units to be constructed by the Contractor shall be:

- (a) Concrete piles.
- (b) Concrete pipes.

as shown on the drawings or directed by the Engineer.

Precast units shall be built to the size and shape shown on the drawings and shall be reinforced. The mix designation of

concrete shall be of Type A as specified in Clause 5.14.9 hereof. Only sufficient water shall be added to the cement and aggregate during mixing to ensure proper hydration of the cement and to produce a homogeneous mixture.

Precast units shall remain in their moulds for three (3) days before being stripped and after removal from the moulds, precast units shall be kept moist continuously for a minimum period of eleven (11) days.

5.14.21 Measurement and Payment for Concrete

Unless otherwise specifically provided herein for payment of concreting work, concrete will be measured net to the lines of the structures shown on the Drawings or specified by the Engineer, or to such revised lines as the Engineer may order during the progress of the work.

Where the excavated surface has to be concreted or the open-cut excavation has to be filled with concrete, measurement of concrete shall be limited to the prescribed dimensions of the excavation required for the concrete structures. Where material has been excavated beyond the neat measured lines prescribed for the structures, the space between the actual limit of excavation and the lines prescribed for the structures shall, except where the Engineer orders otherwise, be filled with concrete of the same type as the concrete specified, and the concrete shall be placed so as to form an integral mass with it. No payment shall be made or be due for such additional concrete placed outside the prescribed lines of the structures.

No deduction will be made for space occupied by metalwork.

The unit price bid for concrete for structures shall be deemed to cover the cost of providing, loading, transportation to site, unloading, providing storage for cement and storing it,

including the cost of all labor, materials, use of plant and tools. The unit prices shall, except where otherwise specified, further cover all costs incurred by the Contractor from all contractual obligations related to such works as providing storage for aggregates and drainage facilities and also all other related works, except for supplying and placing reinforcement and forms which shall be paid for separately.

5.14.22 Formwork

5.14.22.1 Preparation and placing

Forms shall be simple; they shall be rigidly constructed of approved materials to withstand the pressure resulting from placing and vibrating the concrete, constructional loads, wind and other forces without appreciable deformation, and shall conform to the shapes, lines and dimensions of the structure as indicated on the Drawings.

Shuttering boards shall be carefully jointed and interstices shall be properly filled with glazier's putty. However, the use of paper tamping shall be strictly forbidden.

Surfaces of the forms to be in contact with concrete shall be free from adhering foreign matter, projecting nails and the like, grooves, splits or other defects. The waterproofing of the forms shall be sufficient to prevent the escape of cement resulting from excess of water in the concrete. Boards shall be so arranged as to be able to swell under the influence of humidity of the concrete, without causing any deformation to the forms.

The Contractor shall submit to the Engineer for approval, before commencing construction of forms, a set of formwork complying with the above requirements, but such submission or approval by the Engineer shall not relieve the Contractor of any of his responsibilities.

Openings (if required) for inspection of the inside of the forms and for the removal of water used for washing down shall be provided and so formed as to be easily closed before placing the concrete.

Before placing any concrete, all bolts and the like (if they are required and) which are to be built in shall be fixed in their correct positions, and cores and other devices for forming holes, openings, etc., shall be fixed to the forms. No holes shall be cut in any concrete unless approved by the Engineer.

In case embedded metal rods are used for holding forms, the rods shall remain embedded and shall terminate not less than 3 centimeters from the formed surface of the concrete in which the maximum size of aggregates is 40 millimeters, and shall terminate not less than 5 centimeters from the same surface of the concrete in which the maximum size of aggregates is 80 millimeters.

The use of wire ties for supporting the forms shall not be permitted in concrete walls, which are to be subject to water pressure or when the finished surface -- required as determined by the Engineer -- is to be permanently exposed. Wire ties used for other concrete works shall be cut off flush with the concrete surface after the forms are removed.

A non-staining commercial mineral oil or other approved material shall be applied to the faces of the forms before concreting to prevent adherence to the concrete. Care must be exercised to prevent the material applied to the faces of the forms from coming in contact with reinforcement, but if this should inadvertently occur, the reinforcement must be cleaned.

When forms have been built and have been prepared ready for concreting, they will be inspected by the Engineer and no concrete shall be placed until the forms have been approved by him. In order to avoid delays in obtaining approval, the Contractor shall

inform the Engineer, at least 24 hours in advance of his intention to have the forms ready for inspection.

5.14.22.2 Removal of forms

The Contractor shall take the full responsibility that the time has elapsed for the concrete to attain sufficient strength before forms are removed. Nevertheless, the forms shall not be struck without the prior approval of the Engineer, and at least three (3) days shall elapse before forms are struck.

In any case, removal of forms shall begin when the concrete is hardened enough to withstand the stresses to which the concrete will be immediately subjected to after the removal, without excessive straining and under sufficiently safe condition, and to permit the easy removal by purely statical force and without hammering.

All holes left by the removal of fasteners from the ends of tierods and of grouting system nipples shall be reamed with suitable tools so as to leave a clean and rough surface of holes before filling the mortar.

5.14.22.3 Payment for concrete forms

Payment for concrete forms will be made at the unit price per square meter specified in the Price Schedule.

The unit price bid for concrete forms shall be deemed to cover the cost of labor, supply of material and of all other works connected therewith.

5.15 Metal Works

5.15.1 Steel Works

The Engineer will design and the Contractor shall detail structural steel work, such as steel steps, ladders and handrails, etc. Such materials for structural steel work shall be furnished by the Contractor.

Welding of structural steel work shall be performed only by competent welders approved by the Engineer.

Structural steel work shall be fabricated, stored, handled and erected in accordance with the Drawings or the instructions given by the Engineer.

Measurement of structural steel work will be made by weighing the steel materials in the presence of the Engineer and the Contractor before their use.

The unit price bid per kilogram specified for metal works in the Price Schedule shall include for all wastes, for the cost of transporting and labor, temporary and final erections, installation, painting and tarring whenever, required, and testing, and also for the cost of all bracing, bolts, cleats, washers, nuts and welding electrodes as may be necessary.

5.15.2 Dissimilar Metals

The Contractor shall not use fixtures and fittings for metal works (including pipe work) in which dissimilar metals likely to lead to galvanic action are placed in permanent contact with each other.

5.15.3 Welding

All welding shall be done by electrical welding method, except where otherwise specifically permitted by the Engineer. All welding rods required shall be furnished by the Contractor.

The welding rods shall be of the heavily coats type designed for all position welding, and the size, type, and manufacture of the rods shall be subject to the approval of the Engineer. Welds shall be made as specified on the drawings or as directed by the Engineer.

All beveling of the materials shall be done as shown on the drawings and shall be finished to a smooth and true finish with an

automatic gas cutters or grinders. The use of manual gas cutters shall be subject to the prior approval of the Engineer.

The surface of the working materials shall be free from slag, moisture, soil, rust, oil, paints and other impurities. Mill scale, which can not be removed with a stiff wire brush and thin linseed oil, will be allowed to remain.

The face of welds shall be smooth and free from an uniform beads, and the size of bead shall not be less than the designed dimensions or as directed by the Engineer. A slight excess over the designed dimensions is permissible. However, there shall not be excessive built up or marked irregularities in the surface appearance.

Blow hole, slags, overlap, undercut and unsatisfactory melting of welded joints shall be removed with grinders or gas cutters with due care to protect the surrounding part from any injuries or damage and then shall be rewelded.

Deformation of the members resulting from welding shall be repaired in a mechanical method approved by the Engineer. Heating temperature for correcting deformations shall be less than about 650°C.

5.16 Pipe Works

5.16.1 Pipes

Pipes and specials used in the works shall be precast reinforced concrete pipes built as specified in Clause 5.14.20 hereto, and corrugated metal pipes as specified hereinafter.

Corrugated metal pipes shall be weldless, lapwelded or helical welded as specified.

Welded pipes shall be made from not more than two (2) plates with two longitudinal welds. Each pipe barrel, when welded up, shall be truly cylindrical and circular in cross sections.

Corrugated metal pipe fittings including channels, traps, gullies and the like shall be to the dimensions shown on the Drawings or specified by the Engineer.

Corrugated metal pipes, pipe fittings and specials shall be of similar metals such that galvanic action is not likely to occur between them.

Type, typical sections and structures of each of the precast reinforced concrete pipes and corrugated metal pipes are shown on the Drawings.

5.16.2 Preparation of Bedding

The trench bottom where both corrugated metal and concrete pipes are to be laid shall be carefully excavated according to the required lines and levels. If the trench bottom is soft or unstable, its loose or unstable soil shall be removed; then the trench shall be backfilled and thoroughly compacted to grade with suitable soil, gravel or sand in accordance with the direction by the Engineer. Any stump, rock fragment, objectionable materials, and free water encountered in the trench shall be removed before the pipe is laid.

5.16.3 Laying and Jointing

Both corrugated metal and concrete pipes shall be carefully laid on the previously specified lines and levels with the joints fitted together tightly. As for the concrete pipe, the joints shall be caulked with mortar consisting of 400 kilograms of cement per 0.95 cubic meter of sand as shown on the Drawing.

After pipes are laid, the backfilling work shall be carefully continued by use of excavated materials and thoroughly tamped to hold it rigidly in position until the joints are completely fitted together as directed by the Engineer.

5.16.4 Payment for Pipe Works

Pipe trench excavation shall be measured in accordance with the lines cut actually as shown on the Drawings and shall be paid at the unit price bid per cubic meter in the Price Schedule as stipulated in Clause 5.13.2 hereto. Payment for backfilling shall be also made at the unit price bid per cubic meter as specified in Clause 5.13.4 hereto.

Measurement of both pipes shall be made of the net length of pipes installed, no allowance being made for joints, specials, cutting to waste, brackets and clips, seals, glands, bolts and the like.

The unit price bid per meter of both pipes shall cover all the costs involved in supplying, loading, transporting, providing storage, storings and shall include for laying and jointing the pipes in accordance with the Drawings or with the instructions given by the Engineer, and for the cost of supporting brackets, unions, couplings and the like, and for painting where appropriate.

The unit price bid for corrugated metal pipes shall also include for the cost of all materials, instruments and tools used, forming or drilling bolt holes wherever required and the unit price bid for precast reinforced concrete pipes shall be deemed to cover also all the costs involved in complying with the requirements specified in Clause 5.14.2.1 for reinforced concrete works.

5.16.5 Testing Jointed Pipes

All these pipes, which do not normally operate under pressure, shall be filled with water and inspected. Any defects shall be made good at no extra cost to the Purchaser.

5.17 File Works

5.17.1 General

File works specified in this Clause shall mean manufacturing precast reinforced concrete piles as specified in Clause 5.14.20 hereto and driving them where shown on the Drawings.

Piles shall be cast to the lengths shown on the Drawings or to such other lengths as the Engineer may order. When removed from the forms, piles shall present a true, smooth and even surface free from honeycomb, voids and other defects; piles shall be so straight that a line stretched from the butt to the tapered tip shall not show a distance of more than 1.5 centimeters between the said line and any faces of the piles at any point.

Piles shall not be handled or driven at least 28 days have elapsed since casting without the approval of the Engineer.

5.17.2 Driving

The type and weight of pile hammer to be used shall be subject to the approval of the Engineer. The depth of pile penetration shall be decided by the Engineer on the basis of achieving a minimum pile set for a given number of blows of the piling hammer. The Contractor shall provide such facilities as the Engineer may require to enable him to measure the penetration in order to control the driving of piles to the desired set.

All piles driven incorrectly or injured during the pile driving to such an extent as to be unsuitable, as determined by the Engineer, shall be pulled off and replaced, but no payment will be made to the Contractor for casting, driving and pulling off such piles.

After driving, piles shall be carefully cut clean and square to the required length and stripped to expose the reinforcement. The exposed reinforcement shall be suitably fixed to the cross head or abutment reinforcement so that, when the cross heads or abutments are cast, they form an integral structure with the supporting piles.

5.17.3 Payment for Pile Works

Payment for pile works shall be made on the basis of the numbers of piles of each size cast and driven properly in accordance with the specifications, no deduction being made for the cut off length.

The unit price bid per number of piles cast and driven shall be deemed to include for all the costs specified in Clause 5.14.21 and for the cost of cutting and stripping the heads of piles and integrating the reinforcement with the abutment and cross head reinforcement in accordance with the specifications whenever required.

5.18 Soil Cement Protection

5.18.1 General

The works under the term "Soil Cement Protection" in these specifications shall consist of building earthfills as specified in Clause 5.13.3 with a mixture of cement and fill material.

Soil cement protection shall be constructed to the lines, levels, thickness, and with slopes as shown on the Drawings.

5.18.2 Placing and Mixing Fill Material

After the foundations for such works have been prepared as specified in Clause 5.13.3.2, filling in earthfills, shall be carried out with approved material specified in Clause 5.13.3.4.

Each layer of the fill material so placed shall be horizontal, of uniform thickness not exceeding 0.2 meter, and shall extend the full width of the earthfills, then, one bag (of 50 kg) of cement shall be spread over on an area of four (4) square meters of each layer. Before compacting each layer of fill, it shall be thoroughly raked or plowed in such manner over the whole surface that the mixing of cement with fill material is achieved.

Unless otherwise directed by the Engineer, the extra filling shall applied for earthfills as stipulated in Clause 5.13.3.4.

The Engineer may order water to be sprayed on the material to improve its compaction characteristics, and in such case the Engineer shall determine the quantity of water to be used. Water shall be added to the fill materials in such a manner that the material is uniformly moistened. No separate payment will be made for the addition of water.

5.18.3 Compaction

Prior to the commencement of filling work, the Contractor shall carry out a series of field tests to determine the optimum conditions of compaction as stipulated in Clause 5.13.3.5.

Each layer of material shall be compacted by rolling at least 5 passes with the tamping rollers, or by tamping at least 6 times with a mechanical tamper weighing more than 75 kilograms, and the compacted layer shall be a continuous horizontal layer of not more than 0.15 meter thick measured after compaction.

5.18.4 Payment

Payment for soil cement protection shall be made at the unit price bid in the Price Schedule for the net volume of fill in place, measured after compaction to the lines shown on the Drawings or specified by the Engineer.

The unit price for soil cement protection shall include for excavating in the borrow pits, handling and hauling of excavated material to the fill point, furnishing and mixing cement with fill material, and controlling moisture in fill material, and shall also include for sorting and strewing of fill material, for final finishing up of side slopes and for all other works connected therewith.

5.19 Miscellaneous Works

5.19.1 Sod Facing

For the purpose of this Clause sod facing, shall consist of soiling and grassing the slopes of earthfills as shown on the Drawings or directed by the Engineer.

Slopes to be sown with grass-seeds shall be carefully cleared of stones, roots and all other objectionable matters to the satisfaction of the Engineer. The soil surface thereof shall be loosened to a depth of 10 centimeters and furrowed at right angles to the line of the larger slope by means of five-teeth-rake, then be levelled by means of the back of the rake after seeds have been spread over and tamped.

Proportions of seeds to be used in sod facing shall be as determined by the Engineer and the mix proportions of seeds shall be scattered regularly and in such sufficient quantity as to obtain a luxuriant and thick vegetation.

The Contractor shall sow again as aforesaid wherever the grass has not grown thickly.

Measurement for sod facing will be made on the basis of the actual area in square meters of slopes to be soiled with topsoil and to be grassed.

The unit price bid per square meter for sod facing shall be deemed to include for all the costs involved in furnishing grass-seeds, provide storage and storing.

The unit price bid for sod facing shall further include for the costs of all accessory supplies and labor, particularly for preparation of the lawn, raking after the scattering of seeds, sowing again wherever grass has not grown up well, and for repair work (if any) which shall be deemed to be included in the maintenance service to be provided during the Guaranty Period until the final acceptance by the Purchaser.

5.19.2 Stoplog

The stoplogs required for turnouts, division boxes, check gates, spillway, etc. shall be designed, manufactured and painted by the Contractor as shown on the Drawings, or as directed by the Engineer.

Timber to be used for the stoplogs shall be of first class material and be as specified in Clause 5.6.3.4.

The cutting, smoothing with plane and finishing of the wood-work shall be performed by the Contractor as directed by the Engineer.

The Contractor shall erect the stoplogs in position to ensure that all clearances are correct.

Payment for stoplogs will be made to the Contractor for timber at the unit price bid per cubic meter.

The unit price bid for stoplogs shall include for the cost of transporting to the site, providing, storing timber, manufacturing, painting, fabricating and placing stoplogs, and erection for testing, including all other related costs.

5.19.3 Painting

All paints and materials for painting shall be approved by the Engineer and shall be used in accordance with the manufacture's recommendation for the particular location when the paints are to be applied.

Except as otherwise provided, paints shall be applied only to surfaces that are thoroughly clean and dry and only under such combination of humidity and temperature of the atmosphere and of the surfaces to be painted as will cause evaporation of moisture rather than condensation.

Surfaces which have been cleaned, pretreated and/or otherwise prepared for painting shall be primed as soon as practicable after such preparation has been completed but, in any event, prior to

deterioration of the prepared surface.

Woodwork to be painted shall be rubbed down with glass paper, knotted and primed. Any holes, cracks and joints shall then be neatly stopped with putty. After stopping, undercoat and finishing coat shall be given on the wood work as specified.

Steel and ironwork shall receive the following painting treatment according to its intended location in the works:

- (a) For items liable to be immersed in water --- Blast cleaning shall be performed so as to produce a white metal finish completely free from mill scale, rust and foreign matter to the satisfaction of the Engineer. The first coat of specified paint shall be applied to cleaned areas not more than 4 hours after blasting.
- (b) For items not liable to be immersed in water --- The surface of steel and ironwork, other than steel reinforcement, which is to be encased in concrete or other work shall have a coat of approved primer applied at the place of manufacture and shall be thoroughly wire brushed to remove any rust immediately before it is built into the works.

The cost of painting woodwork and/or steel and ironwork shall be included in the unit price bid for the various items of woodwork and/or steel and ironwork. If the cost of painting is paid separately, payment will be made per square meter of surface effectively painted. The unit price bid for painting shall be deemed to cover especially all the costs involved in labor for complying with the requirements of this Clause, including supply of paint and materials, and the costs for scaffoldings wherever required.

SECTION 6

DETAILED SPECIFICATIONS

6.1 Irrigation and Drainage Canal Systems

6.1.1 General

The works comprise the site clearing of the areas to be occupied by 2 main canals, 1 lateral including 54 related structures; 3 sub-laterals and 66 farm laterals including 633 related structures; 66 drainage canals including 188 related structures; the stripping of topsoil on canal alignment; the excavation for canals, including forming of canal banks; the supply and laying of precast concrete pipes and corrugated metal pipes in related structures.

6.1.2 Site Clearing and Excavation

Site clearing and topsoil stripping for the canal systems shall be carried out in accordance with Clauses 5.13.1.

Excavation for canals, foundations for canal embankments and canal structures shall be carried out to the required depths and with slopes as shown on the Drawings or as may be directed by the Engineer. Unless otherwise directed, excavation shall start with removal of earth materials beginning at the lower end and working upstream of any canals to provide drainage from the face of cut.

Spoil from the excavation for the canal excavation shall be deposited in such area as directed by the Engineer and the stockpiles shall not be sodded.

Excavation in earth material for the canals, the foundations for canal embankments and the canal structures will be measured for payment in accordance with Item No. I.B.a, I.B.b, I.B.c and I.C of the Price Schedule.

6.1.3 Placing Fill and Embankment

Canal embankments shall be performed in accordance with the lines and slopes shown on the Drawings or as they may be established by the Engineer, provided that the division lines of the embankment materials may be subject to variation at any time during the construction period. However, the Contractor shall not be entitled to any additional allowance above the unit price bid in the Price Schedule on ground of such change.

The foundation for the embankments shall be scarified or plowed before placing fill material to provide a bond with the foundation.

Material obtained from excavation as specified in Clause 6.1.2 shall be used as much as possible as fill material for canal works.

Unless otherwise directed by the Engineer, the extra filling of the embankment shall be carried out as specified in Clause 5.13.3.4.

Any approved material that is lost after being placed in the embankment and before the final acceptance, due either to floods, weather actions or other causes that - in the opinion of the Purchaser - are avoidable or under the control of the Contractor, shall be replaced by the Contractor at his own expense in a manner satisfactory to the Engineer.

All portion of the required embankment, whether made of materials excavated for other parts of the works or excavated from the borrow pits, will be measured for payment under the item of earthfill in the Price Schedule after being compacted.

The cost for compaction of the side slopes of canals and elsewhere as may be directed by the Engineer, shall also be deemed to be covered by the unit price bid for earthfill as prescribed in Clause 5.13.3.7.

6.1.4 Concrete in Canals

The item for concrete of mix types B, C and D (as specified in Clause 5.14.9) shall include all concrete required for the related structures such as turnouts, check structures, box and pipe culverts, spillway, drop structures, drainage crossing, etc.

The Contractor shall provide blockout in concrete for installation of gate equipment which will be furnished and installed by other contractors, for the turnouts and check structures, as shown on the drawings under the direction of the Engineer.

The Contractor shall supply and install precast concrete pipes for the construction of pipe culverts and turnouts, and corrugated metal pipes for the construction of drainage crossings and pipe culverts, as shown on the drawings. After laying both precast concrete and corrugated metal pipes, the Contractor shall backfill the trenches as shown on the drawings. Suitable material excavated from the trenches shall be used for backfilling.

Cut-off collares shall be constructed on the turnouts and drainage crossings as shown on the drawings.

The item in the Price Schedule for concrete shall include preparation of bedding and other necessary works.

The unit price per linear meter for furnishing and laying both precast concrete pipes and corrugated metal pipes shall include all costs stipulated in Clause 5.16.4.

6.2 Road Works

6.2.1 General

The Contractor shall construct and maintain the farm road system consisting of two main farm roads and 47 secondary farm roads including 7 bridges and 6 culverts on the Project Area. The location, typical cross section and level are as shown on the drawings or direction of the Engineer.

The main farm roads shall be paved with laterite material obtained from borrow pits as directed by the Engineer, as shown on the Drawings.

6.2.2 Definitions

For the purpose of this Clause, the following definitions shall be applied:

- (a) "Sub-base" shall mean the ground or embankment on which the road is to be built.
- (b) "Wearing course" shall mean the layer laid on the sub-base, consisting of laterite.
- (c) "Foundation" shall mean the stripped or excavated ground surface on which an embankment is to be placed, prepared and shaped beneath the roadway.
- (d) "Roadway" shall mean the ground between the outside limits of the drainage or interception ditches or the top edges of cuttings, or between one such limit and another whichever measurement is the greatest.

6.2.3 Wearing Course in Main Farm Road

6.2.3.1 General

Wearing course shall be made of the laterite obtained from sources approved by the Engineer. The binder shall be mixed into the wearing course during placing operation.

6.2.3.2 Preparation of sub-base

Sub-base shall be prepared so as to conform to the grade and cross sections shown on the Drawings by use of motor graders. The compaction shall be effected in such a satisfactory manner as to prevent the mixing of the wearing course material, when placed, with the sub-base material.

Where the spraying of water is directed by the Engineer to improve the sub-base material compaction characteristics, the Contractor shall, without extra payment, spray water on to the sub-base which shall be brought to a firm, unyielding surface by rolling.

6.2.3.3 Spreading

Depositing and spreading of wearing course material on the sub-base shall be effected so as to commence at the point farthest from the point of loading of material from the excavation and progress continuously and without break towards the loading point, except if otherwise directed by the Engineer.

The wearing course material brought in by vehicle shall be spread by hand. Dumping, in piles on the sub-base shall not be permitted. The depositing and spreading of wearing course material shall be carried out in such a manner as to obtain a layer of uniform thickness and in such a depth as a layer of required thickness is obtained after compaction.

After the material has been spread, it shall be mixed thoroughly by blading with heavy grader. Wetting shall be effected as directed by the Engineer for obtainment of proper mixing.

6.2.3.4 Compacting

Immediately after the material has been placed on the sub-base, the wearing course material shall be rolled with a roller until there is no further significant movement, to give the total finished specific thickness. If the material is too dry to be compacted under rolling, the Contractor shall, without extra payment and when ordered by the Engineer, apply water on it during the rolling operation. The rolling operation shall be carried out so as to commence from the outer edges of the wearing course and progress towards the center.

6.2.3.5 Payment

Payment will be made on the basis of the unit price bid per cubic meter for laterite for the main roads in the Price Schedule. The cost of required excavation, removal of unsuitable material, application of water, hauling the laterite from the quarry sites,

spreading and compacting it, and all other related costs shall be deemed to be covered by the unit price bid per cubic meter for laterite for surfacing.

6.2.4 Excavation for Foundation

The common excavation specified in Clause 5.13.2 shall apply to excavation for farm roads, however, if unsuitable materials are found in the common excavation, they shall be removed by the Contractor to the depth beyond the prescribed foundation lines in the Drawings.

Payment for roadway excavation will be made on the basis of the unit price bid per cubic meter for common excavation Type A as stipulated in Clause 5.13.2.

6.2.5 Earthfill in Foundation

The earthfill for farm roads shall be carried out with fill materials obtained from borrow pits as directed by the Engineer or from excavation required for other works as approved by the Engineer, and shall conform with Type A earthfill as prescribed in Clause 5.13.3.

All portion of the required earthfill will be measured and paid for under the item of earthfill after being compacted.

Payment for earthfill will be made on the basis of unit price per cubic meter as specified in Clause 5.13.3.7.

6.3 Land Preparation

6.3.1 Land Clearing

The whole land designated for the irrigated agriculture in the Project Area of 970 hectares shall be cleared as stipulated in Clause 5.13.1.1.

6.3.2 Payment for Land Clearing

Notwithstanding the provisions of Clause 5.13.1.1 of General Specifications, payment for land clearing will be made on the basis of the assessment made by the Engineer and on the basis of the unit price bid per hectare in the Price Schedule for land clearing.

6.3.3 Land Grading

The amount of soil that must be removed and added to make the original ground surface conform to the prescribed grade is referred to as soil excavation and filling respectively for land grading operations.

The excavation involved in grading operation will consist of excavation of all materials other than rocks, such as earth, gravel, soft or disintegrated rocks, all of which can be treated efficiently either by hand tools or excavating equipment.

Soils excavated for grading purpose shall be deposited by the Contractor at the place specified by the Engineer where soil dumps shall be formed, kept separate from other waste soils deposited in waste area and shall be maintained at optimum moisture condition.

Excavation for grading work shall be accurately done true to lines and level as shown in the Drawings. Excavated materials shall be hauled and spread over the fill site according to the measured lines and grades shown on the Drawings or established by the Engineer. However, the Contractor's attention is drawn upon the fact of avoiding cloddy fill material as much as possible by cheseling either prior to or subsequently to scraping operation as directed by the Engineer.

When the weather is such that it would adversely affect the properties of the soil filled or when the surface soils are so wet that they might be damaged if graded, the grading work shall be stopped; the grading operation shall not be resumed until the soil surface has dried to its correct moisture contents.

The Contractor shall allow in his unit price bid for earth moving in the Price Schedule for such interruptions to land grading.

The soil filling shall be performed by the Contractor so as to make an allowance for possible settlement of about two per cent.

6.3.4 Payment for Land Grading

Payment for grading works will be made on the basis of the unit price bid per cubic meter for earth moving in the Price Schedule. The unit price bid for earth moving shall cover the cost for Type A excavation as specified in Clause 5.13.2, except for clearing which will be paid for as prescribed in Clause 6.3.2, and shall be deemed to include for hauling within a radius of 110 meters in average from the point of excavation, forming of soil dumps, if any, breaking up and spreading excavated material to filling site, levelling of soils, and other related works necessary for preparation of the farmlands, including all other related expenses in consideration of the above-specified provisions.

6.4 Pumping Station

6.4.1 General

The provisions in this Section shall apply to the works in connection with civil and architectural works, excluding installation of pumps, motors, discharge pipeline and related equipment which will be made under separate contract.

6.4.2 Civil and Architectural Works

6.4.2.1 Preparation of foundation

The entire area to be occupied by the pumping station as may be directed by the Engineer shall be stripped and excavated to the required depth and grades as directed by the Engineer.

Unsuitable materials to be removed shall include topsoil, rubbish, vegetation of every kind, roots, and other objectionable materials that might interfere with the bonding of embankment material.

6.4.2.2 Stripping

The Contractor shall carefully strip the area for the pumping station or as much area thereof as may be required, of topsoil,

clay and other objectional materials as provided in Clause 5.13.1.3.

The disposal of all stripped materials wasted by stripping shall be subjected to the approval of the Engineer.

Payment for stripping and disposal of stripped materials will be made at the unit price bid per cubic meter in the Price Schedule for stripping of topsoil.

6.4.2.3 Excavation

The Engineer will direct sequence and depth of cut of every excavation operation in the area for the pumping station so as to obtain the acceptable grading of the materials to be utilized as the earthfill materials.

The captioned item of the Price Schedule includes all the open-cut excavation required for discharge pipeline, intake, sump, the foundation of anchor blocks and saddles of pipeline below the excavated surface of the discharge pipeline, and for the foundation of footings of the control house.

The excavation for the anchor blocks, saddles and footings shall be made to sufficient depth to secure the sound foundation of adequate bearing capacity as determined by the bearing test in site by the Engineer.

Payment for excavation for all these works will be made according to the provisions stipulated in Clause 5.13.2.

6.4.2.4 Earthfill

The works under the term "earthfill" in these Specifications comprise placing and compaction of free draining material in foundation for control house, embankment for regulating pond and access road.

The earthfill shall be constructed to the lines and grades as shown on the Drawing or as may be directed by the Engineer.

The foundation of earthfill shall be prepared by levelling

and rolling so that the surface materials of foundation will be compacted and well-bonded with the foundation soil.

No direct payment for preparation of foundation will be made to the Contractor and the cost thereof shall be included in the unit price bid for earthfill.

The side slopes of the earthfill in regulating pond shall be sod faced as specified in Clause 5.19.1, and the payment for sod facing will be made in accordance with Item I.A.d.7 of the Price Schedule.

6.4.2.5 Concrete work

Unless otherwise specified or directed by the Engineer, and except for the description of the work site, the specifications as provided in Clause 5.14 Concrete Works shall be applied.

The Contractor shall provide blockouts for installation by other contractors of trash racks and gate in the intake structure, pumps including motors and discharge pipes and pipeline, and gates for regulators, as shown on the drawings under the direction of the Engineer.

Measurement for payment of concrete work shall be on the basis of the volume per cubic meter filled as shown on the Drawings and as specified. The item in the Price Schedule shall cover all costs for concrete including in the operation house, anchor blocks and saddles of pipeline, and all other related works.

6.4.2.6 Plastering work

6.4.2.6.1 Cement mortar plastering

Unless otherwise specified or directed by the Engineer, and except for the description of the work site, the same specifications as provided in Clause 5.14.17 together with the specifications as provided below shall be applied to this work.

The surfaces which are to receive cement mortar shall be cleaned free from all deleterious materials, roughened and scratched.

Concrete surfaces shall be kept wet for 24 hours prior to application of mortar. Cement mortar shall be used within 30 minutes from the time of mixing and retempering shall not be permitted.

In case of cement mortar finish, cement mortar shall be applied in one coat for floor and two coats - one rendering and one finish coat - for other areas. Rendered mortar surfaces shall be left to dry at least 10 days to ensure cracking and to fill up the cracks.

The total thickness of rendering plus finishing coat shall be 30 millimeters for floors, and 18 millimeters for other areas.

When finishing coat is applied, the entire surface of wall or ceiling shall be finished in one operation in order to avoid joint marks.

Method of plastering-brushing, wooden float, metal float and spraying shall be as directed by the Engineer.

6.4.2.6.2 Waterproof cement mortar

Waterproof cement mortar shall be applied to the roof finishing as shown on the Drawings or as directed by the Engineer. Cement mortar shall comply with the specifications as provided in Clause 5.14.17. Waterproof admixture shall be added to the above cement mortar by an adequate amount recommended by the manufacturer to attain effective waterproofing. Samples and specification sheets of waterproof admixture shall be submitted for the approval of the Engineer.

6.4.2.7 Carpentry works

6.4.2.7.1 Timber

Timber to be used for carpentry works shall be locally available of first class, with the quality specified in Clause 5.6.3.4. All timber shall be well air-seasoned. Timber with loose, rotten or dead knots shall not be accepted.

Mill works shall be carefully cleaned and sanded free from machine marks. Sawn timber shall have correct shapes and sizes in the longest length attainable. All wood surface shall be planed wherever exposed to view. Timber, which is used in damp places or directly in contact with concrete or cement mortar, shall be preservative treated dipped in an approved preservative.

6.4.2.7.2 Measurement and payment

Measurement for payment of carpentry work in the Price Schedule shall be on the basis of the volume in cubic meters of wood including all necessary hardware and preservative.

6.4.2.8 Steel door and window

6.4.2.8.1 Steel flush door and glazed window

Steel materials to be used for steel door and window shall conform to the requirements of JIS or equivalent. The Contractor shall submit shop drawings showing details of various parts, method of anchoring and any other pertinent details in large scales for approval of the Engineer. The doors and windows shall be designed and constructed as to resist a wind load of 120 kilograms per square meter and to obtain maximum weather tight and smooth operation.

All members shall be cut accurately, straightened, free from strain and shall be cleaned of any dust. Welding shall be ground smooth where exposed to view. All steel surfaces shall be treated with bonderizing and anticorrosive and oil painted in accordance with the specifications in Clause 5.19.3.

The thickness of plates in various parts shall be as follows:

For window:

Stool, architrave trim	:	1.2 millimeters
Casing, stud, transom, flashing	:	1.6 "
Sash bar, sill, anchor	:	2.3 "

For door:

Architrave trim	:	1.2 millimeters
Casing, flashing, rail, stile, flushing plate	:	1.6 "
Sill, stiffening rib, anchor	:	2.3 "

All door leaves shall be flush type of 36 millimeters of thickness. The door leaves shall be adequately reinforced for stiffness of them as well as for fixing hardware. Where required, panes and grilles shall be provided. The door casing shall be reinforced, drilled and tapped to receive hinges, lockset strikes and closers and shall be provided with rubber bumpers. All members for window shall be fabricated in single unbroken length, accurately mortised and reinforced for fasteners and other necessary fixtures with metal battens. The window sashes shall be straight and smooth free from warps or curves to ensure proper fitting and functioning. Anchor metals for casing shall be welded to rods in concrete wall or in case of brick wall shall be placed in as the brick laying proceeds.

6.4.2.8.2 Measurement and payment

Measurement for payment for steel door and window shall be on the basis of the total areas occupied by the door and window leaves in square meters including casings and all necessary hardware but excluding glazing and paint-finishing.

6.4.2.9 Hardware for door and window

Hardware for doors and windows shall comply with the following requirements as well as the details as shown on the drawings.

The Contractor shall submit catalogues and samples of hardware for approval of the Engineer.

For steel door:

Hinge - Bronze lacquer finished, 13 centimeters wide,
3 pieces for each door leaf.

Knob - Stainless steel.

Lock - Bronze, cylinder lock with 3 pieces of keys for
each.

Door bolt, stop - Brass.

For steel windows:

Handle - Stainless steel.

Pastener - Stainless steel.

6.4.2.10 Glazing work

Materials to be used for door and window panes shall be of reputable manufacture and the best of its kind subject to approval of the Engineer. Glasses to be used in this section shall be of 3 millimeter thick sheet glass. All glasses shall be transparent unless otherwise directed.

All panes shall be cut accurately to fit in the frames with adequate clearance for glazing all around. Glazing shall be performed by the following method.

(a) Steel window - Metal clip and putty

(b) Steel door - Metal bead and putty

All panes shall be adequately protected from damage by signing paper and cleaned and polished when directed by the Engineer.

Measurement for payment for sheet glass shall be on the basis of the actual areas of panes in square meters including putty and glazing beads.

6.4.2.11 Painting

6.4.2.11.1 General

Unless otherwise specified or directed by the Engineer, and except for the description of work site, the same specifications as provided in Clause 5.19.3 together with the specifications provided below shall be applied to this work.

All paint to be used shall be of reputable manufacture and the best quality of its kind.

The Contractor shall submit painted sample boards and specification sheets of all paint for approval and color selection of the Engineer. Painting shall not be done during inclement weather or when such weather can be expected. All surfaces to receive paint shall be cleaned of all dirt, grease, dust or any other deleterious materials. The surface shall be thoroughly sanded, puttied and polished to a smooth and even surface. All surrounding works shall be adequately protected from smear in a suitable manner. All smeared and damaged surface shall be cleaned or repainted to satisfaction of the Engineer. Method of paint application - brushing, spraying and rubber rolling shall be as directed by the Engineer. Between the application of each new coat of paint, sufficient time shall be allowed for drying of them.

6.4.2.11.2 Oil paint

Oil paint shall be applied on metal surfaces and wood surfaces.

The Contractor may use galvanizing instead of anti-corrosive paint for surface treatment subject to approval of the Engineer.

6.4.2.11.3 Vinyl emulsion paint

Vinyl emulsion paint shall be applied on cement mortar surfaces as shown on the drawings.

The cement mortar surface shall be left to dry for at least 3 weeks after application of cement mortar.

Paint shall be applied in 3 coats as follows:

1. Priming clear emulsion paint
2. Polishing
3. Second coat of emulsion paint
4. Polishing
5. Finish emulsion paint

6.4.2.11.4 Measurement and payment

Measurement for payment for all painting work shall be on the basis of the areas in square meters actually painted. Item for painting in the Price Schedule shall include all necessary puttying and sanding.

6.4.2.12 Ceiling work

6.4.2.12.1 Plywood ceiling

Plywoods to be used for ceiling shall be 4 millimeters thick waterproof type of first grade.

Plywood shall be fixed to wood furring strips using brass or chrome plated nails to be made even and smooth surfaces. Open joints in plywood boards shall be 5 millimeters wide. The surfaces shall be finished with oil paint applied by rubber rolling to make the surface coarse texture.

6.4.2.12.2 Ceiling trim

Ceiling trim shall be made of polyvinyl chloride having a shape shown on the drawings. Samples shall be submitted for approval of the Engineer.

6.4.2.12.3 Measurement and payment

Measurement for payment of plywood ceiling shall be on the basis of the areas in square meters covered with them. Item for applying plywood in the Price Schedule shall include all necessary openings and reinforcing work for lighting fixtures, ceiling trim, excluding painting.

6.4.2.13 Metal work

6.4.2.13.1 Roof drain and downspout

Roof drains shall be made of cast iron heat coated with asphalt. The roof drains shall consist of drain body and removable high dome type sediment cup.

The roof drains shall have two flanges. The bottom flange shall be double flanged integral with the drain body and shall be set as the upper flange coincide with the top surface of the surrounding concrete. The top flange shall be integral with a stub of pipe and shall be adjustable to permit this flange to be set to the finished roof elevation. The two flanges shall be used to clamp the roof waterproof membrane. Weep hole shall be incorporated in the stub pipe to allow seepage to drain from beneath the top flange.

The roof drains shall be installed in blockouted space in concrete slab and gaps shall be grouted with waterproof cement mortar. Great care shall be exercised in fixing the surrounding waterproof membrane securely to the drain. Calking shall be applied as required. Catalogues of roof drain shall be submitted for approval of the Engineer.

Downspout shall have a 100 millimeters diameter, constructed of galvanized iron sheet #28. The pipe shall be formed with seam joints soldered and pipe pieces shall be connected together overlapping by 3 centimeters soldered all around to a required length. Supports for the pipe shall be provided at less than 1.2 meters interval.

Inside surfaces of pipe shall receive anti-corrosive paint prior to forming and outside surfaces shall receive 2 coats of oil paint. P.V.C. pipes of 3 meters length and of a diameter to suit the downspout shall be provided for protection at the foot of each downspout.

6.4.2.13.2 Fence

The fence shall be of barbed wire fence, installed as shown on the Drawings and as directed by the Engineer.

Concrete posts of 80 x 80 millimeters, 1.8 meter high above ground shall be installed at an interval of 1.8 meters, the foot fixed securely to the ground by using concrete, to which 10 rows of barbed wire shall be fixed to metal hooks anchored previously to the posts.

6.4.2.13.3 Steel handrail

All pipes to be used for steel handrails shall be steel pipe jointed by welding at factory. Ends of balusters in outdoor handrails shall be installed in the concrete foundation when concrete is placed and those in indoor handrails shall be welded to reinforcing rods in concrete making recesses for welding. Pipe surfaces shall be painted with oil paint.

6.4.2.13.4 Stair nosing

Stair nosing shall be brass made. Brass nosing shall be 65 millimeter wide and fixed to concrete by anchor metals.

The Contractor shall submit the samples of nosings to the Engineer for his approval.

6.4.2.13.5 Measurement and payment

Measurement for handrail, downspout, roof drain, stair nosings and P.V.C. protection pipe shall be on the basis of total weight in kilograms fixed including supports and coal tar painting.

Measurement for fence shall be on the basis of the length in meters of fence installed, including concrete posts and foundations.

6.4.2.14 Miscellaneous work

6.4.2.14.1 Cupboard unit

The cupboard shall be constructed of composite panels and boards and installed over the kitchen sink as directed by the Engineer.

Cupboard shall be fixed to wall with base blocks, synthetic adhesive and nails and suspended from ceiling joists using metal straps.

Guide roller shall be provided at the bottom of glass sliding door.

Outside wood surfaces shall be oil paint finished.

Hardware shall be brass made and chrome plated.

6.4.2.14.2 Kitchen sink unit

Kitchen sink unit shall be provided at the place as shown on the Drawings, having approximate size of 50 by 160 centimeters, height of 80 centimeters. The counter top shall be covered by stainless steel sheet. Lower part shall be provided with sliding wood door for the use of seasoning storage.

6.4.2.14.3 Measurement and payment

The unit price tendered for item in the Price Schedule for kitchen sink unit and cupboard unit shall cover the complete supply and installation in all respects as shown and specified herein, but oil paint finish shall not be included.

6.5 Protective Embankment

6.5.1 General

The foundations of the protective embankment shall be cleared as specified in Clause 5.13.1. Excavation shall be carried out to remove from the foundations all unsuitable materials as directed by the Engineer. It is expected that the depth of such excavation will generally be about 20 centimeters, and occasionally deeper in small areas.

The Contractor will be permitted to obtain fill material from the borrow pits along the contemplated site designated by the Engineer.

6.5.2 Earthfill

Earth filling shall be carried out as specified in Clause 5.13.3.4.

The Contractor shall make an allowance for settlement so that the final lines and levels of earthfill are as specified or as shown on the drawings.

The side slopes of the protective embankment shall, where shown on the drawings, be sod faced in accordance with Clause 5.19.1.

Payment for construction of protective embankment will be made in accordance with Item I.E of the Price Schedule.

6.6 Flood Gate

6.6.1 General

Provisions herein made and unit price bids in the Price Schedule shall be limited to the civil engineering works of the flood gate structure.

6.6.2 Preparation of Foundation

6.6.2.1 Excavation and stripping

The entire area to be occupied by the flood gate structure consisting of the embankment portion and culvert portion including chute and stilling basin, shall be stripped and excavated in accordance with required depth and slopes shown in the Drawings or directed by the Engineer.

Excavation shall be carried out to remove from the foundation all unsuitable materials including topsoil, rubbish, vegetation of every kind, roots and other objectionable materials that interfere with the bonding of embankment material.

The foundation of embankment portion in both abutments shall be excavated and finished in such a manner as to avoid sudden changes in slopes. The excavation for the culvert portion shall be taken down to an acceptable foundation, as shown on the drawings.

Payment for stripping and disposal of material will be made at the unit price bid per cubic meter in the Price Schedule for stripping of topsoil.

Payment for excavation for culvert portion will be made in accordance with Items I.F.2 and I.F.3 of the Price Schedule.

6.6.2.2 Unwatering for foundation

The stream channel of H. Nong Sam Kha shall be drained to the required extent practicable for excavating foundation, placing and compacting embankment material thereupon, and water shall be diverted to the downstream of the river.

The drainage shall be accomplished by providing drain ditches, temporary cofferdams, sumps with pumping equipment if required.

The cost for unwatering foundation will be included in the cost for minor works in the Price Schedule.

6.6.3 Backfill

Backfilling for culvert portion shall be carried out in the same manner as prescribed in Clause 5.13.4.

Payment for backfilling will be made at unit price bid per cubic meter measured after compaction.

6.6.4 Embankment

6.6.4.1 Earthfill

The works under the term "embankment" in these specifications comprise the earthfill in the embankment portion and in side bank for chute and stilling basin, and the soil cement protection on the surface of embankment portion.

Embankment shall be constructed to the lines, level and slopes as shown on the Drawings or as may be established by the Engineer. The Contractor's attention is drawn to Clause 5.8 concerning the time of completion of the flood gate structure.

The suitability of each part of the foundation for placing embankment materials thereon and of all materials for use in embankment construction will be determined by the Engineer.

All portions of the required embankment, whether constructed of materials excavated for other parts of the works or from borrow pits, will be measured and paid for in embankment after being compacted.

For preventing the placed or rolled surface of the fill material from being over-moistened by heavy rainfall, the Contractor shall cover the surface with a water proofing canvas during the time of heavy rainfall.

If the surface material of the layer becomes too moist due to rainfall to execute the practicable rolling or to bond properly with layer of material to be placed thereon, the Contractor may be required by the Engineer to remove such surface material to the thickness as directed by him prior to compacting the layer or placing the next succeeding layer of fill material.

Unless otherwise specified, Type C earthfill shall apply to earthfill for the embankment portion, and Type A earthfill for the chute and stilling basin in culvert portion.

Payment for construction of Type A and Type C earthfills will be made in accordance with Item I.F.4 and I.F.5 of the Price Schedule.

6.6.4.2 Soil cement protection

Surface of Type C earthfill in the embankment portion shall be protected with soil cement placed as specified in Clause 5.18.2 to the lines and slopes shown on the Drawings or established by the Engineer. Payment will be made in accordance with Item I.F.8 of the Price Schedule.

6.6.5 Concrete Piles for Foundation

After foundation preparation for the culvert portion has been completed, piles cast to the specified length shall be driven at intervals shown on the Drawings as specified in Clause 5.17.2.

After driving, they shall be carefully cut clean and square in such a manner to attain the required levels and stripped to expose the reinforcement. The exposed reinforcement shall be fixed to the cross head or abutment reinforcement as stipulated in the said Clause.

6.6.6 Concrete in Culvert Portion

Concrete to be placed in culvert portion, excluding for piles, shall be Types B and D.

Joints shall be provided in the culvert portion at positions shown on the drawing.

Cut-off collars shall be constructed on the culvert portion parallel to the embankment axis.

The Contractor shall provide blockouts for gate and hoist deck to be installed by other contractors.

Payment for concrete piles for foundation and concrete works will be made in accordance with Items I.F.9 to I.F.14 in the Price Schedule.

6.7 Purchaser's Office and Quarter

6.7.1 General

This section covers all the construction works of field office, quarter, toilet for the use of Purchaser's field staff in charge of the Project, including incident facilities.

The Contractor shall supply all the labor, materials and equipment necessary for the completion of the work together with water supply, sewerage, electrical services and any other fittings and equipment shown on the Drawings and specified herein, or as may be further directed by the Engineer.

Buildings to be constructed under this section shall be as follows:

	Bldg area	Number
Office	114 M ²	1
Quarter	105 M ²	1
Toilet	6 M ²	1

6.7.2 Maintenance

During the construction period and until the end of the last guaranty period provided for under the Conditions of Contract, the Contractor shall maintain all the works prescribed in this section in the condition to satisfy the Engineer.

By way of illustration, but without any limitation, the maintenance shall include keeping the structures, interior and exterior finishes in good condition, repainting if necessary, keeping the water supply, sewerage and electrical systems in good working order.

6.7.3 Clearing and Land Readjustment

Site clearing and land readjustment shall be required only surroundings of buildings and incident facilities. The Contractor shall clear from the building area vegetation, trees and other objectionable materials and perform land readjustment of site for a minimum of 5 meters from the exterior walls of the buildings.

The exact location and elevation of each of the buildings shall be as shown and as directed by the Engineer.

6.7.4 Foundations

The foundations of the buildings and other appurtenant works covered in this section shall be constructed as shown on the Drawings and to the dimensions shown therein, excluding the elevation of footings which shall be as directed by the Engineer because it is necessary to inspect the soil conditions.

The waste concrete and concrete to be used for the foundation work shall be of mix designation "D" and "C" respectively, as stipulated in Clause 5.14.9.

6.7.5 Floors

Floors shall be of concrete of thickness as shown on the Drawings and mixture shall be the same as for the foundation works. The floor shall be finished with mortar, mixture of 400 kilogram cement and 1,000 litre sand.

6.7.6 Structures

The wall and roof structures shall be made of wooden post and truss to the dimensions as shown on the Drawings. The timber to be used for such work shall be locally available "Maykhene" of the first class materials as stipulated in Clause 5.6.3.4.

6.7.7 Interior and Exterior Finish

- 1) Roof - The roof sheet shall be corrugated asbestos sheet, set to the wooden purlins with bolts, which shall be provided with felt and galvanized metal washers. The side of the sheet shall be overlapped more than twelve centimeters each.
- 2) Exterior wall - Wood siding shall be applied on the exterior wall. Siding boards shall be "Maykhene" of about 12 centimeter sidth, nailed onto the furring strips one by one with halving joint.

- 3) Interior wall and ceiling - Plywood shall be applied on the walls and gypsum board on the ceiling as shown on the Drawings. All boards shall be screwed or nailed on to the bed. Nails and screws shall be of an appropriate size and type so as to flush the surface.

6.7.8 Wood Doors and Windows

All wood doors and windows shall be made as shown on the Drawings and to the appearance shown therein. The timber to be used for such fittings shall be of quality acceptable to the Engineer. Samples of hardwares for wood doors and windows shall be submitted for the approval of the Engineer.

Glasses to be set in doors and windows shall be sheet glass of three millimeters thick.

6.7.9 Metal Work

6.7.9.1 Downspout

Downspouts shall be fabricated and installed as shown on the Drawings with galvanized iron sheet. The pipes shall be made with soldered seam joints.

6.7.9.2 Punching metal cover

Punching metal cover shall be installed at the opening of eaves provided for the ventilation of ceiling.

6.7.10 Painting

All wood and metal surfaces which are to be exposed shall be applied two coats of oil paint.

Surfaces to receive paint shall be treated to be in proper condition and to the satisfaction of the Engineer.

6.7.11 Miscellaneous

- 1) Kitchen sink unit - Kitchen sink unit shall be provided at the place as shown on the Drawings, having approximate size of 50 by 160 centimeters, height of 80 centimeters. The counter tops shall be covered by galvanized iron sheet, soldered at the joints. Lower part shall be provided with sliding wood door for the use of seasoning storage.
- 2) Cupboards unit - Cupboards units shall be made by wood and install over the kitchen sink as directed by the Engineer.

6.7.12 Sanitary Facilities

6.7.12.1 Sanitary fixtures

The Contractor shall provide all sanitary facilities in the Purchaser's office and quarter as shown on the Drawings and further as directed by the Engineer.

Sanitary fixtures may be what are available locally.

6.7.12.2 Drainage system

The waste water shall be drained in absorbing basin through cement pipe of 80 millimeter diameter. Absorbing basin shall be constructed by digging the earth, 80 centimeter diameter and about 2 meter depth, filled with a layer of crushed stone of 30 centimeters thick at the bottom. A concrete cover shall be provided and fitted such as to give an airtight seal to the pit, and if necessary, concrete casing shall be provided against the tumbling down of soil.

6.7.12.3 Sewage system

The sewage shall be leaded to the septic tank and drained in absorbing basin through cement pipe of 100 millimeter diameter septic-tank shall be constructed as shown on the Drawings and to the dimensions shown therein. Absorbing basin work shall be performed in accordance with the requirements of "Drainage System", provided that the basin diameter shall be 1.20 centimeters and depth shall be about 3.0 meters or as directed by the Engineer.

6.7.13 Water Supply Facilities

6.7.13.1 Water supply system

The water supply piping necessary for the domestic use of the Purchaser's office and quarter shall be performed as shown on the Drawings or as directed by the Engineer.

The Contractor shall ensure that the whole equipment together with all pipework and fittings supplied by him, is in proper working order to the satisfaction of the Engineer.

6.7.13.2 Water well and pressure water pump

A well shall be constructed at the location directed by the Engineer.

Details of well shall be as shown on the Drawings, provided that the final depth of well shall be determined by the Engineer in order to obtain required quantity and quality of water. Pressure water pump shall conform to the following characteristics:

32 millimeters dia. x 53 litres/min x 24 m x 0.75 kw, 3-phase, with pressure tank and automatic controls.

6.7.14 Payment for Purchaser's Office and Quarter

The lump sum bid for Purchaser's office and quarter in the Price Schedule shall include the cost of all works required in this section including site clearing, excavation, earthfilling, supply and erection of buildings, interior and exterior finish, works, fittings, metal works, electrical service stipulated in Clause 6.8, sanitary facilities, water supply and sewage system, and any other necessary works to complete the work.

The payment to the Contractor shall be made on the basis of the above mentioned lump sum bid at the completion of the work and after the test of equipment, has been completed to the satisfaction of the Engineer.

6.8 Lighting Facilities

6.8.1 General

The electric lighting works for the control house, outdoor switchyard and regulators at the pumping station, and for office and quarter, and low-tension overhead line work shall be carried out as shown on the drawings.

The Contractor shall supply and install the following apparatus and materials necessary to complete the above works.

- (1) All conduits and wiring works or cabling work for lighting fixtures, switches and outlets.
- (2) Fixing of all lighting fixtures, switches and outlets.
- (3) Overhead line work.
- (4) Necessary earthing works.

Electric power for the apparatus shall be supplied from main and station service cubicle, which will be provided by other contractors at the pumping station, and from each switch board at the office and quarter through the overhead line of about 120 m length as shown on the drawings. The electric power source will be A.C.50 HZ, 380-220V, three-phase, four-wire system, except 220V single-phase, two-wire system to the quarter.

6.8.2 Apparatus and Materials

6.8.2.1 General

All apparatus and materials shall be suitable for satisfactory use in tropical climate.

All similar materials and similar parts shall be interchangeable with one another. The Contractor shall submit the drawings and samples for approval, before procurement of the apparatus and materials.

Defective equipment damaged in the course of installation or

or test shall be replaced to the satisfaction of the Engineer.

6.8.2.2 Conductors and cables

The size of conductors and cables shall be as indicated on the drawings.

Insulated wire to be used on the conduit system shall be 600 V polyvinyl chloride (PVC) insulated, single core, tinned copper wire.

600 V rubber insulated and chloroprene sheathed cable shall be used where cable is buried directly in the ground or is laid down in the cable duct. Cable of 2-core, 2.0 square millimeters shall be used in the outdoor lighting post.

600 V PVC insulated PVC sheathed, 2-core or 3-core flat cable shall be used for cabling in the office and quarter.

Cable with cable ends between the secondary terminals of distribution transformer and overhead line conductors on the pole at the transformer yard shall be of 600 V rubber insulated and chloroprene sheathed cable of 4-core, 38 square millimeters and shall be supplied by the Contractor, but the transformer and the pole will be provided by other contractors.

Conductors to be used for overhead line from the transformer yard shall be of bare hard drawn copper conductor of 4.0 millimeter diameter. Outdoor weather proof, PVC insulated wires (called as OW wires) or PVC insulated drop wires (called as DV wires) of 2.6 millimeter diameter of conductor shall be applied to overhead service line.

Conductors larger than 5.5 square millimeters except for overhead line, shall be stranded conductor.

6.8.2.3 Conduit pipes

Rigid steel conduit shall be galvanized and enamelled inside and outside. It shall be of a minimum thickness of 2.3 millimeters

and have a minimum inside diameter of 16 millimeters.

6.8.2.4 Outlets

Galvanized sheet steel boxes shall be used in concealed work.

6.8.2.5 Convenience outlets

Convenience outlets to be used in all places shall be 3-pins (one of them is earthing use), rated 15 amp. at 250 V, suitable for English pattern plug and provided with galvanized sheet steel box.

6.8.2.6 Tumbler switches

The switches shall be of the fully enclosed flush mounting, single pole, 250V, 10 amp. tumbler type.

6.8.2.7 Safety switch

The switch shall be of weather proof and quick break type with interlocked cover and enclosed fuses, and shall be enclosed in a surface mounted box and operated by an outside handle.

6.8.2.8 Lighting fixtures

Lighting fixtures shall be complete with lamp or lamps, and where required, shall be of weather proof design.

Fluorescent lighting fixtures shall be equipped with complete fittings for A.C. 220V, 50 Hz source and a ballast or ballasts of high power factor.

Incandescent reflector light shall be mounted on the top of lighting post as shown on the drawings and shall be equipped with a suitable guard.

Special care shall be exercised on selection of fixtures, so that the illumination of the lamps is not obstructed by accumulation of insects and dust.

6.8.2.9 Lighting posts

Lighting posts to be used for outdoor lighting shall be made of galvanized steel pipes. Typical design of the post with lighting fixtures is shown on the drawings. Cutout switch, terminals and other attachments necessary for wiring and fixing of lighting fixtures shall also be supplied.

The ground level shall be marked on the post for easy installation.

6.8.2.10 Overhead line

Supports shall be of galvanized steel tubular poles or steel reinforced concrete poles with low-tension shackle type insulators and galvanized steel fittings including step bolts, and shall be reinforced stay wires where necessary.

Shackle type insulators, fixing bands for cable and other necessary fittings on the pole at the transformer yard shall be supplied by the Contractor.

Overhead conductors of the line shall be arranged in vertical as shown on the drawings.

One 600 V, three pole, 100 AF 100 AT no-fuse circuit breaker with weather-proof, key locked, steel switch box shall also be supplied on secondary side of the distribution transformer.

6.8.2.11 Switch-boards

Switch-board shall be of flush mounting, dead-front, no-fuse circuit breaker type and shall be suitable for operation on 380-220 V, three-phase, four-wire, neutral earthed system. But switch-board at the quarter shall be 220 V single-phase, two-wire system.

Cabinet box shall be made of sheet steel coated with two coats of primer and finished with anticorrosive paint.

Ratings of no-fuse circuit breaker are shown on the drawings.

6.8.2.12 Miscellaneous materials

All apparatus, accessories and materials which have not been specifically mentioned herein but which are necessary for the efficient performance of the works shall be provided by the Contractor. There shall be complete in all respects and shall conform to the applicable requirements of the respective standard specification.

6.8.2.13 Spares

Spares as stated below shall be supplied by the Contractor.

- (a) Bulbs and tubes 100%
- (b) Fuses 100%

6.8.3 Installation

6.8.3.1 General

All installation work shall be carried out by the Contractor.

The indoor wiring at the pumping station shall be of concealed conduit system. At office and quarter, indoor wiring shall be of concealed cabling on ceiling or in wall, or exposed cabling system as shown on the drawings.

All apparatus shall be installed at the places and at a height as indicated on the drawings. The position and/or height of the apparatus and materials which have not been specifically mentioned herein will be directed by the Engineer.

The outdoor wiring shall be directly buried in ground or laid down in the cable duct.

Low-tension overhead line shall be supported by poles as shown on the drawings.

6.8.3.2 Lighting fixtures

The exact location and height of fixtures shall be determined

by the structural and mechanical limitations of the house, and the lighting fixtures shall be installed in such a manner as to avoid obstructions and to give the proper illuminating effect.

Electric bulbs and tubes shall be installed after completion of the work.

6.8.3.3 Conduit piping

Conduits shall be concealed in the ceiling, wall and floor where possible. Conduit shall be installed in such a manner as to ensure that the inside remains in a dry condition, and securely fastened to sheet steel outlets and junction boxes with galvanized lock-nuts and bushing.

Conduit which has been crushed or deformed shall not be used in the works.

6.8.3.4 Wiring and cabling

Conductors shall be continuous between outlets, and no junction shall be made, except within outlet or junction boxes. Conductors shall be drawn into conduits after they have been cleaned up. No oil or grease shall be used as a lubricant for drawing operation, except an approved compound.

Joints in wiring shall be made by sleeve, compression or other approved connector and insulated with PVC tapes. No soldering shall be permitted except where otherwise approved by the Engineer.

Cables to be directly buried in the ground shall be covered with sand and laid not less than 60 centimeters below the ground surface. Where the underground cable crosses road-way, it shall be properly protected against damage from a heavy traffic.

Flat cables shall be laid on ceiling or in wall without conduit pipe and shall be securely fastened along the structures with saddles, staples or other suitable supports a space not more than 1 meter a part. In case the cabling on ceiling or in wall is clogged

with concrete or other materials, or for the purpose of protecting flat cable from damages, the cable shall be used with conduit pipe having an inside diameter larger than 1.5 times against outside diameter of the cable.

Joints for overhead conductor tensioned shall be of sleeve type, and other connections shall be made by bolt type connectors.

6.8.3.5 Tumbler switches

The switches shall not be inserted on the neutral line.

6.8.3.6 Outlets

The Contractor shall study the general house plans in relation to the spaces surrounding each outlet to ensure that this work may fit in with the other works. Whenever necessary, the Contractor shall relocate outlets, under the instruction of the Engineer, so that when fixture or other fittings are installed, they will be sensibly located according to room layout and will not interfere with other equipment installations.

Switch and convenience outlet boxes on concealed system shall be set flush with metallic plate.

6.8.3.7 Switch-board and safety switch

Switch-board and safety switch shall be mounted so that the height from the floor to top of them will not exceed 200 centimeters and 140 centimeters respectively.

6.8.3.8 Overhead line

Poles are to be directly buried in the ground. Footing depth of poles shall be so selected as to have an ample strength against overturning load.

Where necessary, reinforced concrete logs shall be employed for increasing the stability of footing.

The lowest line conductor height from the ground surface shall be selected at 6 meters. The installation height of drop wires at service entrance shall be not less than 2.5 meters.

No-fuse circuit breaker with switch box shall be mounted on the pole at the transformer yard.

Watt-hour-meters which will be provided by the Purchaser shall be installed.

6.8.3.9 Lighting posts

Posts are to be directly buried in the ground.

6.8.3.10 Earthing

Conduit system, metallic fittings and neutral conductor of the electric system shall be earthed.

Earthing conductor at the pumping station shall be connected to the earthing network which will be furnished by other contractors. One conductor of flat cable at the office and quarter shall be used for earthing conductor, and shall be connected to earthing pipes (25 millimeter diameter 2 meter), which shall be supplied and installed by the Contractor.

Bond or clamps shall be used for connection in earthing system and no soldering shall be permitted.

6.8.4 Tests

The tests required by applicable standards shall be carried out by the Contractor at the manufacturer's premises and the test certificate shall be forwarded to the Purchaser before shipment, the Contractor will be required to conduct in the presence of the Engineer the following tests at the site after the completion of the work:

- (a) Insulation resistance measurement with 1,000 - volt megger.
- (b) Operation test.

(c) Intensity of illumination measurement.

6.8.5 Payment for Lighting Facilities

Payment for lighting facilities in pumping station will be made on the bases of the lump sum bid specified in Item I.A.b.17 of the Price Schedule at the completion of the work and after tests as prescribed above have been completed to the satisfaction of the Engineer.

SECTION 7
FORM OF TENDER

The Royal Government of Laos,
Vientiane, Laos

Gentlemen,

We hereby offer to supply, transport to the site, all the materials, equipment and labor, and to test and place in commercial operation all the works described in the Specifications in accordance with the Contract Documents and Schedules attached hereto and submitted herewith, and to execute the works in the manner specified and to perform all the obligations to be performed by the Contractor under the terms of the said Contract Documents for the sum of U.S.\$ _____ (_____).

And we hereby undertake to have the whole of the work completely erected and all Performance Tests required under the terms of the Contract Documents satisfactorily completed by _____

We undertake, in the event of the Tender being accepted, to execute if called upon to do so, a formal Contract for the due execution of the work in the terms of the annexed form of Agreement, furnishing hereby a bid bond, amounting at U.S.\$ _____ (_____), being not less than 5 per cent of the tender price.

And we further agree, in the event of our failure to execute such Contract within one month of being so called upon to do or failure to provide the Performance Bond referred to in Clause 2.7 of the General Conditions that any acceptance to this Tender may be revoked by the Purchaser without prejudice to any other rights or remedies which he may have in respect of such failure, and that the aforementioned bid bond may be forfeited to the Administrator.

Signed _____

Address _____

Date _____

TOTAL BIDDING PRICE

1. DIRECT CONSTRUCTION COST

U. S. \$

2. CONSTRUCTION MACHINERIES COST

U. S. \$

3. CONSTRUCTION FACILITIES COST

U. S. \$

TOTAL BIDDING PRICE

U. S. \$

Name of Bidder

Signed by

CONTENTS OF BIDDING PRICE

1. General

The total contract price shall be classified into three parts, that is, (1) Direct construction cost (2) Construction machineries cost (3) Construction facilities cost.

2. Direct construction cost

The direct construction cost shall be the total of the amount calculated on the basis of the unit price bids or the lump sum price bids offered in the Price Schedule, and construction quantities described in the Price Schedule.

Each unit price bid or lump sum price bid shall be composed of such items as

- (1) Cost of domestic labor
- (2) Cost of domestic and imported materials and equipments including marine and inland transportation cost
- (3) Cost of fuel, lubricant and consumption parts for operating construction machineries which include both the public works equipment and Contractor's equipment
- (4) Cost of foreign engineers, technicians and managing staffs, including salary, insurance (if any), living cost at the site and travelling expense
- (5) General expenses, direct and indirect at the main office in domestic country and branch offices in Laos.

3. Construction machineries cost

The construction machineries cost shall be composed of such items as

- (1) Cost of depreciation of construction machineries
- (2) Cost of repairing and maintaining construction machineries.

4. Construction facilities cost

The construction facilities cost shall be consist of such items as

- (1) Purchaser's office and quarter
- (2) Cost of constructing and maintaining temporary buildings for construction use
- (3) Cost of constructing, maintaining and repairing electrical power supply system for construction use.

I. PRICE SCHEDULE FOR THE DIRECT CONSTRUCTION COST

A. Pumping Station	US\$ _____
A-a. Intake, sump and substructure	US\$ _____
A-b. Control house	US\$ _____
A-c. Discharge pipe line	US\$ _____
A-d. Regulating pond	US\$ _____
B. Irrigation Canal System	US\$ _____
B-a. Main canals and lateral	US\$ _____
B-b. Sub-laterals	US\$ _____
B-c. Farm laterals	US\$ _____
C. Drainage Canals	US\$ _____
D. Farm Road System	US\$ _____
D-a. Main farm roads	US\$ _____
D-b. Secondary farm roads	US\$ _____
E. Protective Embankment	US\$ _____
F. Flood Gate	US\$ _____
G. Land Preparation	US\$ _____
T O T A L	US\$ _____

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
<u>I.A. Tha Ngon Pumping Station</u>						
<u>A-a Intake, Sump and Substructure</u>						
Aa.1	Stripping of topsoil	m ³	480			
Aa.2	Excavation, Type A	m ³	80			
Aa.3	Excavation, Type C	m ³	4,060			
Aa.4	Earthfill, Type A	m ³	2,040			
Aa.5	Backfill by machinery	m ³	3,500			
Aa.6	Soil cement protection	m ³	185			
Aa.7	Concrete, Type B	m ³	173			
Aa.8	Concrete, Type C	m ³	44			
Aa.9	Concrete, Type D	m ³	14			
Aa.10	Form for concrete	m ²	975			
Aa.11	Reinforcement bar	ton	13			
Aa.12	Metal work	kg	270			
Aa.13	Gravel for foundation	m ³	7			
Aa.14	Minor works (less than 5% of above total)	Lump sum				
	<u>Sub-total</u>					
<u>A-b Control House</u>						
Ab.1	Excavation, Type D	m ³	60			
Ab.2	Backfill by hand tools	m ³	10			

Cost in U.S. dollar

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
Ab.3	Gravel for foundation and floor slab	m ³	17			
Ab.4	Concrete, Type B	m ³	43			
Ab.5	Form for concrete	m ²	350			
Ab.6	Reinforcement bar	ton	5.8			
Ab.7	Plastering cement mortar to floors, walls and ceiling	m ³	360			
Ab.8	Plastering water-proof cement mortar to roof	m ²	120			
Ab.9	Carpentry works consist of posts, roof-trusses, purlins, ceilings, wall frames and any other wooden works	m ³	1.2			
Ab.10	Applying plywood for interior finishing	m ²	61			
Ab.11	Metal works including bandrail, rain leader, roof drain, etc.	kg	70			
Ab.12	Furnishing and installing steel doors and steel glazed windows including accessories	m ²	12.5			
Ab.13	Furnishing and installing sheet glass, to windows and door with putty	m ²	6.0			
Ab.14	Painting two coats of paint on metal and wooden surfaces	m ²	237			
Ab.15	Furnishing and installing kitchen sink	set	1			
Ab.16	Barbed wire fencing	m	90			
Ab.17	Lighting equipment	Lump sum				
Ab.18	Minor works (less than 5% of above total)	Lump sum				

Sub-total

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
<u>A-c Discharge Pipeline</u>						
Ac.1	Stripping of topsoil	m ³	90			
Ac.2	Excavation Type D	m ³	130			
Ac.3	Earthfill, Type A	m ³	220			
Ac.4	Backfill by hand tools	m ³	90			
Ac.5	Concrete, Type B	m ³	16			
Ac.6	Concrete, Type C	m ³	25			
Ac.7	Concrete, Type D	m ³	4			
Ac.8	Form for concrete	m ²	125			
Ac.9	Reinforcement bar	ton	0.4			
Ac.10	Minor works (less than 5% of above total)	Lump sum				
	<u>Sub-total</u>					
<u>A-d Regulating Pond</u>						
Ad.1	Stripping of topsoil	m ³	5,700			
Ad.2	Excavation, Type A	m ³	730			
Ad.3	Excavation, Type D	m ³	310			
Ad.4	Earthfill, Type A	m ³	13,910			
Ad.5	Earthfill, Type B-2	m ³	10			
Ad.6	Backfill by hand tools	m ³	200			
Ad.7	Sod facing	m ²	3,980			
Ad.8	Concrete, Type B	m ³	48			
Ad.9	Concrete, Type C	m ³	3			
Ad.10	Concrete, Type D	m ³	2			

Cost in U.S. dollar

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
Ad.11	Form for concrete	m ²	360			
Ad.12	Reinforcement bar	ton	3,5			
Ad.13	Corrugated metal pipe, ϕ 600 mm	m	20,0			
Ad.14	Minor works (less than 5% of above total)	Lump sum				
	<u>Sub-total</u>					
	<u>T o t a l</u>					
I.B. <u>Irrigation Canal System</u>						
B-a <u>Main Canals and Lateral</u>						
Ba.1	Stripping of topsoil	m ³	11,300			
Ba.2	Excavation, Type A	m ³	600			
Ba.3	Excavation, Type B-1	m ³	10,620			
Ba.4	Excavation, Type D	m ³	860			
Ba.5	Earthfill, Type Ao	m ³	3,500			
Ba.6	Earthfill, Type A	m ³	24,070			
Ba.7	Earthfill, Type B-1	m ³	7,660			
Ba.8	Earthfill, Type B-2	m ³	500			
Ba.9	Backfill by hand tools	m ³	380			
Ba.10	Concrete, Type B	m ³	253			
Ba.11	Concrete, Type C	m ³	31			

Cost in U.S. dollar

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
Ba.12	Concrete, Type D	m ³	1			
Ba.13	Form for concrete	m ²	2,110			
Ba.14	Reinforcement bar	ton	11.7			
Ba.15	Timber for stoplog	m ³	0.1			
Ba.16	Concrete pipe, ø200 mm	m	58			
Ba.17	Concrete pipe, ø300 mm	m	15			
Ba.18	Concrete pipe, ø600 mm	m	5			
Ba.19	Corrugated metal pipe, ø600 mm	m	45.5			
Ba.20	Minor works (less than 5% of above total)	Lump sum				
	<u>Sub-total</u>					
B-b	<u>Sub-laterals</u>					
Bb.1	Stripping of topsoil	m ³	5,490			
Bb.2	Excavation, Type B-2	m ³	1,760			
Bb.3	Excavation, Type D	m ³	110			
Bb.4	Earthfill, Type Ao	m ³	11,680			
Bb.5	Earthfill, Type A	m ³	790			
Bb.6	Earthfill, Type B-2	m ³	1,500			
Bb.7	Backfill by hand tools	m ³	60			
Bb.8	Concrete, Type B	m ³	12			
Bb.9	Concrete, Type C	m ³	1			
Bb.10	Concrete, Type D	m ³	3			

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
Bb.11	Form for concrete	m ²	200			
Bb.12	Reinforcement bar	ton	0.7			
Bb.13	Timber for stoplog	m ³	0.1			
Bb.14	Concrete pipe, ø300 mm	m	16			
Bb.15	Concrete pipe, ø600 mm	m	52			
Bb.16	Corrugated metal pipe, ø1,000 mm	m	13.0			
Bb.17	Minor works (less than 5% of above total)	Lump sum				
<u>Sub-total</u>						
B-c Farm Laterals						
Bc.1	Stripping of topsoil	m ³	20,920			
Bc.2	Excavation, Type B-2	m ³	8,940			
Bc.3	Excavation, Type D	m ³	3,220			
Bc.4	Earthfill, Type A	m ³	42,260			
Bc.5	Earthfill, Type B-2	m ³	8,240			
Bc.6	Backfill by hand tools	m ³	1,250			
Bc.7	Concrete, Type B	m ³	29			
Bc.8	Concrete, Type C	m ³	282			
Bc.9	Form for concrete	m ²	4,820			
Bc.10	Reinforcement bar	ton	0.3			
Bc.11	Timber for stoplog	m ³	5.9			
Bc.12	Concrete pipe, ø200 mm	m	1,310			
Bc.13	Concrete pipe, ø300 mm	m	1,634			

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
Bc.14	Corrugated metal pipe, ϕ 600 mm	m	9.0			
Bc.15	Minor works (less than 5% of above total)	Lump sum				
	<u>Sub-total</u>					
	<u>T o t a l</u>					
<u>I.C. Drainage Canals</u>						
C.1	Stripping of topsoil	m ³	28,850			
C.2	Excavation, Type B-1	m ³	23,920			
C.3	Excavation, Type D	m ³	1,640			
C.4	Earthfill, Type B-1	m ³	14,680			
C.5	Backfill by hand tools	m ³	880			
C.6	Concrete, Type B	m ³	8			
C.7	Concrete, Type C	m ³	1			
C.8	Form for concrete	m ²	75			
C.9	Reinforcement bar	ton	0.4			
C.10	Concrete pipe, ϕ 200 mm	m	375			
C.11	Corrugated metal pipe, ϕ 600 mm	m	1,200			
C.12	Corrugated metal pipe, ϕ 1,000 mm	m	172			
C.13	Minor works (less than 5% of above total)	Lump sum				
	<u>T o t a l</u>					

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
<u>I.D. Farm Road System</u>						
<u>D-a Main Farm Roads</u>						
Da.1	Stripping of topsoil	m ³	17,560			
Da.2	Excavation, Type A	m ³	8,830			
Da.3	Excavation, Type D	m ³	40			
Da.4	Earthfill, Type A	m ³	58,780			
Da.5	Backfill by hand tools	m ³	40			
Da.6	Laterite for surfacing	m ³	7,110			
Da.7	Concrete, Type B	m ³	69			
Da.8	Concrete, Type D	m ³	8			
Da.9	Form for concrete	m ²	550			
Da.10	Reinforcement bar	ton	12.0			
Da.11	Metal works	kg	960			
Da.12	Mortar for joint on bridges	m ³	0.3			
Da.13	Concrete pile, L = 3.00 m	nos	32			
Da.14	Concrete pile, L = 5.00 m	nos	4			
Da.15	Minor works (less than 5% of above total)	Lump sum				
	<u>Sub-total</u>					
<u>D-b Secondary Farm Roads</u>						
Db.1	Stripping of topsoil	m ³	43,540			
Db.2	Earthfill, Type A	m ³	112,400			

Cost in U.S. dollar

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
Db.3	Concrete, Type B	m ³	37			
Db.4	Concrete, Type D	m ³	3			
Db.5	Form for concrete	m ²	230			
Db.6	Reinforcement bar	ton	3.8			
Db.7	Metal works	kg	260			
Db.8	Mortar for joint on bridges	m ³	0.2			
Db.9	Concrete pile, L = 3.00 m	nos	24			
Db.10	Corrugated metal pipe, φ1,000 mm	m	92.5			
Db.11	Minor works (less than 5% of above total)	Lump sum				
	<u>Sub-total</u>					
	<u>T o t a l</u>					
I.E. <u>Protective Embankment</u>						
E.1	Stripping of topsoil	m ³	16,300			
E.2	Earthfill, Type A	m ³	73,790			
E.3	Sod facing	m ²	33,970			
E.4	Minor works (less than 5% of above total)	Lump sum				
	<u>T o t a l</u>					

Cost in U.S. dollar

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
<u>I.F. Flood Gate</u>						
F.1	Stripping of topsoil	m ³	2,120			
F.2	Excavation, Type B-1	m ³	2,740			
F.3	Excavation, Type D	m ³	130			
F.4	Earthfill, Type A	m ³	240			
F.5	Earthfill, Type C	m ³	8,610			
F.6	Backfill by machinery	m ³	1,120			
F.7	Backfill by hand tools	m ³	60			
F.8	Soil cement protection	m ³	3,570			
F.9	Concrete, Type B	m ³	409			
F.10	Concrete, Type D	m ³	32			
F.11	Form for concrete	m ²	1,340			
F.12	Reinforcement bar	ton	24.8			
F.13	Metal works	kg	80			
F.14	Concrete pile, L = 5.00 m	nos	81			
F.15	Minor works (less than 5% of above total)	Lump sum				

T o t a l

Cost in U.S. dollar

Item No.	Work	Unit	Quantity	Unit Price	Amount	Remarks
I.G.	<u>Land Preparation</u>					
G.1a	Land clearing for forest	ha	200			
G.1b	Land clearing for shrub	ha	170			
G.1c	Land clearing for grass land	ha	600			
G.2	Earth moving	m ³	493,680			
G.3	Minor works (less than 5% of above total)	Lump sum				

T o t a l

II. CONSTRUCTION MACHINERIES COST

Item	Section	Price ^{/1} (US\$)	Operating Hour	Depreciation Cost (US\$)	Maintenance and Repairing Cost (US\$)	Total Cost (US\$)
A. Public Works Equipment (List up)						
Sub total						
B. Contractor's Equipment (List up)						
Sub total						
C. Use of construction machineries for other contractor's works						4,000 ^{/2}
<u>T O T A L</u>						

^{/1}: Including marine and inland transportation cost.

^{/2}: Including cost of operator, fuel, lubricant and consumption parts for operating construction machineries.

III. CONSTRUCTION FACILITIES COST

Item	Unit	Quantity	Unit Price (US\$)	Amount (US\$)
A. Purchaser's Office and Quarter	Lump sum			
B. Temporary Building for Construction Use				
B-1. Constructing, maintaining and repairing Contractor's office and quarter including water supply, and access roads if needed	Lump sum			
B-2. Constructing, maintaining and repairing warehouse	Lump sum			
B-3. Constructing, maintaining and repairing motor-pool and repair shop	Lump sum			
<u>Sub-total</u>				
C. Electric Power Supply System for Construction Use				
C-1. Furnishing and installing electric power supply system	Lump sum			
C-2. Operating, maintaining and repairing electric power supply system	Lump sum			
<u>Sub-total</u>				
T O T A L				US\$

