

entitle the Contractor to an extension of time for the completion of works, JICA and the Contractor shall hold mutual negotiation to determine the duration of such extension.

Article 5. Penalties

In case that the Contractor is in default as mentioned in Article 4, the Contractor agrees to be responsible to JICA as follows :-

5.1 In case of termination by default of commencement of the work, the Contractor shall pay a penalty of twenty thousand Baht (20,000.00 Baht) per day counting from the commencement date until a new Contract has been fully executed with a new Contractor for this work, the period of which includes the time spent finding a new Contractor and executing the new Contract, etc.

5.2 In case that JICA judges the Contractor will not be able to complete the work within the completion time and thereby terminates the Contract, the Contractor shall pay a penalty of twenty thousand Baht (20,000.00 Baht) per day counting the number of days in the same manner as prescribed in 5.1 above. However, JICA may reduce the number of days according to the ratio between the completed work and the total work as may be decided by the Supervisor.

5.3 In case that the Contractor fails to complete the work by the completion date or to meet any contract requirement, the Contractor shall pay a penalty of twenty thousand Baht (20,000.00 Baht) per day counting from the date following the completion date until the work is satisfactorily completed and accepted by the Supervisor.

Article 6. Compensation

If JICA sustains any loss through direct or indirect damages caused by the Contractor's failure, the Contractor shall compensate JICA for such losses. Both parties agree that time is essential for completion of the work.

Article 7. JICA's right for Default

JICA has the sole and absolute right to decide whether to terminate the Contract, to impose a penalty on the contractor or to claim compensation for damage as stated in Article 5 and Article 6. The money due to JICA exercising its right under this article shall be deducted from any money due to the Contractor but yet unpaid. If the total amount of the loss is larger than the money above-mentioned, the Contractor agrees that JICA has the right to retain the construction equipment, materials and supplies etc. and demand payment of the balance from such equipment, etc. or proceeds of sale thereof.

Article 8. Contractor's Responsibility on Termination of the Contract

After the Contract has been terminated in accordance with the foregoing Article 4, JICA shall have the right to employ another Contractor (hereinafter called the "New Contractor") to carry out the remaining work, and payment to the Contractor that has failed to complete the work shall be made out of the necessary Contract Price for the remaining work. Should the remaining amount after payment of the advance and interim payment from the Contract price insufficient to effect payment to the New Contractor, the difference between such remaining amount and the actual cost estimated by JICA for the satisfactory completion work carried out by the New Contractor shall be deemed as direct loss sustained by JICA, and the Contractor shall pay such difference to JICA within ten (10) days from the date of request by JICA, failing which interest at the rate of eighteen (18) percent per annum shall be charged thereon.

Article 9. Supervisor

The Supervisor, authorized to act on behalf of JICA, will be appointed by JICA and the Supervisor is entitled to do all things that JICA may do. The Supervisor shall control and supervise the work when necessary whether the work is in the preparation or implementation stage and the Contractor shall promptly furnish all necessary facilities for proper inspection of the work in accordance with the Supervisor's request. At any time the Supervisor can request the Contractor to stop the work, if necessary, and the Contractor shall have no claim on JICA for extension of the completion time due to such suspension of the work under this Article.

The supervision will not be deemed as the acceptance of the work, and the Contractor shall not be relieved from his responsibility to meet the Contract requirements by the fact that the Supervisor exercised its duties. Should it be found that the work has not been satisfactorily performed, the Contractor shall correct any part of the work indicated by the Supervisor within the period specified by the Supervisor.

Article 10. Prohibition of Equipment Removal

Should the Contractor fail to complete the work during the completion time or the Supervisor judges that the Contractor will not be able to satisfactorily complete the work, any equipment and materials brought to the site for use on the work shall not be removed without the prior approval of the Supervisor in writing.

Article 11. Rectification of Defective Construction Work

For a further period of one (1) year after satisfactory completion and final acceptance of the work by JICA, whether completed by the Contractor or by a new Contractor in case of termination of the Contract under Article 4, any damage to the work which is caused by the Contractor, either because of defective workmanship or the use of inferior materials, shall be made good as necessary by the Contractor to the satisfaction of JICA at no extra cost.

In case of the termination of the Contract, JICA may request the Contractor to make good the damaged work as the Contractor's responsibility. Should the Contractor fail to do so within the period specified after receipt of the written request from JICA, JICA shall have the right to employ another Contractor to carry out such work and the Contractor agrees to pay all expensed incurred.

Article 12. Discrepancies among the Contract Documents

If, prior to or during the course of the work, any discrepancies are found in the Drawings and / or the Technical Specification etc. attached to the Contract, the Contractor shall follow the ruling given by the Supervisor at no additional cost to JICA.

Article 13. Construction Method and Temporary Work

The construction method including implementation schedule and plan of the temporary work such as installation of temporary facilities, offices, warehouses, etc. shall be submitted by the Contractor and approved by the Supervisor within 14 (fourteen) days after signing of Contract.

Should the cost of the above temporary work be included in the cost of each work item in the Bill of Quantities in this Contract, the Contractor shall not entitle to claim any amount of charges for the temporary work.

Article 14. Modifications of Plans

If the Supervisor finds it necessary to make modifications of construction design, quantities and / or materials and so forth during the course of construction, JICA has the right to order the modification of the work, to the Contractor, and such orders shall be made in writing from the Supervisor to the Contractor.

JICA agrees to adjust upwards or downwards the necessary expense for such modification to the Contractor, which will be estimated by the unit price plus indirect costs in the Bill of Quantities of the Contract in case of modification of quantities of construction work. In the case of additional work which is not quoted by unit price in the Bill of Quantities of the Contract, the Supervisor will make estimation thereof and JICA will pay the Contractor for such additional work accordingly. But if the Contractor does not agree to such an estimation, the Contractor is then entitled to negotiate with JICA. Also the extension of the completion time due to any modification shall be given by JICA who shall negotiate with the Contractor to decide the number of days of such an extension for additional modifications.

Article 15. Acceptance of the Work

When the entire work has been completed, the Contractor shall submit an invoice in written form indicating the work actually completed to the Supervisor. If the work is in compliance with the Drawings and Technical Specifications, JICA shall accept the work as the final acceptance of satisfactory completion of the work within fourteen (14) days after the receipt of

the written form and it shall be deemed that the final acceptance has been made on such date of the receipt of the written form.

On the other hand, should there be noncompliance with the Drawings or Technical Specifications, or defects be found in the work executed by the Contractor, the Supervisor will have the right not to accept the work and to order rectification of the work. If the required period for the rectification of the defects is beyond the completion date, the Contractor shall not be relieved from its responsibility to pay the penalty as stipulated under Clause 5.3, and after the completion of rectification of the work, then the final acceptance will be made in the same manner as described in the first paragraph of this Article.

During the course of construction, whether in the completion time or extended time specified in the third paragraph of Article 4, JICA has the right to accept a part of the work already completed in written form which shall be considered as a part of final acceptance. However, both parties shall negotiate with each other for the maintenance and usage of the accepted part of the work.

Article 16. Site Engineer

The Contractor shall appoint a site engineer at its own expense for the supervision of the work performance, who shall be authorized to act on behalf of the Contractor, and the instructions given to him shall be deemed as given to the Contractor. The site engineer shall stay at the job site during the construction work and he shall not be transferred without obtaining the prior approval of the Supervisor. If the Contractor replaces the site engineer, the Contractor shall obtain prior approval from the Supervisor in writing.

Article 17. Replacement of Labour, Engineers and Foremen

The Supervisor may request the Contractor to remove any of the Contractor's laborers, foremen or engineers if it appears to the Supervisor that such laborers, foremen or engineers are incompetent in their work or are not suitable or are not capable of handling their workmen or staff, and the Contractor shall promptly replace any such laborers, foremen or engineers. No extra cost or claim for extension of time will be allowed because of such replacements.

Article 18. Sub-Contractor

The Contractor shall not sub-contract or assign any portion of the work under the Contract without obtaining the prior approval of JICA who has the sole right to decide which parts of the work may be sub-contracted or assigned to a Sub-Contractor. However, the Contractor shall be fully responsible for the work done by the Sub-Contractor.

Article 19. Notice

All notices required by the Contract shall be effective only at the time of receipt thereof, and only when received by the parties concerned at the following address :-

JICA Thailand Office.
1674/1 New Petchburi Road, Bangkok

The Contractor
.....
.....
.....

All notices required by the terms of the Contract shall be made in writing in English and delivered by registered mail or hand.

Article 20. Disagreements

In the event of any disagreements arising from the interpretation and performance of the terms of the Contract, both parties agree to make a sincere attempt in good faith to negotiate and amicably settle any such dispute, failing which the parties agree to refer such dispute to arbitration under Thai Commercial Arbitration Rules and Regulations, Bangkok, by two (2) arbitrators, one of each to be appointed by each party. If either party fails to appoint its arbitrator within seven (7) days or should the arbitrator fail, within fifteen (15) days after their appointment, to come to a decision resolving the dispute or no decision is reached on the appointment of an arbitrator, then the dispute shall be brought before the Court of Thailand and a decision reached under the laws and procedures of the Kingdom of Thailand.

Article 21. Force Majeure

In case where serious damage occurs to the completed part of the work, or the materials, tools, etc., that are already carried into the site of the construction, the Contractor shall promptly inform JICA of the circumstances. If such damage is caused by force majeure such as natural calamity, a civil war, a war, an epidemic or general trade strike, rioting or other unavoidable reason, the occurrence of which no responsibility can be attributed to either JICA and the Contractor.

The Conclusion of the Contract

This Contract is executed in duplicate of the same tenor, one of the original copies, to be kept by JICA and the other to be kept by the Contractor. Both JICA and the Contractor have set their signatures and affixed the seals thereto in the presence of a witness.

Bangkok : _____

JICA

THE CONTRACTOR

Mr. Nobuji ABE
Resident Representative,
JICA, THAILAND OFFICE

WITNESS

TECHNICAL SPECIFICATION

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SECTION I

GENERAL DESCRIPTION

101. General

These Specifications shall be read in conjunction with the Contract and the Contract Drawings; and the Contractor shall comply with all the provisions contained in the Contract Documents and the Supervisor's instructions and/or directions.

The Contractor shall fully understand the site conditions and the extent of the Works and carry out the Works in accordance with these Specifications and Drawings as well as the instruction of the Supervisor.

These Specifications describe the minimum required standards or criteria to be applied to the Works.

The Contractor shall fulfill all the requirements and obligations of all descriptions of the Contract and the Specifications.

102. As-Built Drawings

- (a) As Built-Drawings shall be prepared and submitted by the Contractor to the Supervisor with two(2) weeks after issuance of Certificate of Completion.

As-Built Drawings shall precisely show the final dimensions including all the changes, revisions and corrections of structure under the Contract. The size and title of As-Built Drawings shall be instructed by the Supervisor.

- (b) Prior to the submission of the As-Built Drawings, the Contractor shall obtain the Supervisor's approval. Each As-Built Drawing to be submitted shall contain one(1) original and three(3) blue prints.

103. Boundary of the Works

The RID will be responsible for making available the land upon which the Works are to be constructed.

The Contractor shall not exceed the limits of the Site as directed by the JICA and/or the Supervisor except in exceptional circumstances with prior approval of the Supervisor. The RID will pay compensation to land owners, tenants, or occupiers of land only for damage to or loss of trees, shops and property necessarily incurred for the purpose of the Works within the limits of the Site. Prior notification shall however be given by the Contractor both to the Supervisor and to the land owners before any such damage is done so that an assessment of the amount of compensation involved may be made and agreed with the RID.

The Contractor shall be responsible for obtaining the consent of the land owner, tenant, or occupier of private land to the use of such land or private roads for temporary access or for other temporary purposes outside the limits of the Site. Before entering upon such private land for the purpose of commencing construction, the Contractor shall confirm in writing to the Supervisor that he has obtained this consent.

The Contractor shall pay all costs, expenses, rentals, compensation or other disbursements which may be incurred by him in negotiations with the land owner, tenant or occupier and during the subsequent use by him of such private land or roads for these purposes. No reimbursement will be made to the Contractor in this respect.

The Contractor shall be responsible for all damages which he may do to land or property lying outside the Site as defined above.

104. Trespass

In carrying out the Works due regard shall be paid to the amenities of adjacent property and to the interests of land owners, tenants, and occupiers. The Contractor shall take adequate steps to prevent trespass by his employees and the employees of his sub-contractors and shall be wholly responsible for making good any loss or damage caused by such trespass.

105. Construction Programme

Within two weeks from the signing of the Contract, the Contractor shall submit for the Supervisor's approval a detailed programme of work with particulars of his proposed method of working and such other details as may be required by the Supervisor.

Within two weeks of approval of the programme, the Contractor shall forward four copies of the approved programme to the Supervisor.

If during the course of the work a programme revision becomes necessary, the Contractor shall submit details of such revision to the Supervisor for approval within one week of the event which causes the need for revision, and submit four copies of the revised programme to the Supervisor within one week of approval being given.

106. Lighting, Watching, and Traffic Control

The Contractor shall be responsible for watching and lighting the Works and for the control of traffic and he shall comply with the requirements of the Supervisor and Police and the competent authority in these matters.

107. Contractor's Office

The Contractor shall provide and maintain the Contractor's Site Offices throughout the duration of the Contract to which written instructions by the Supervisor can be delivered. Any instructions delivered to such office shall be deemed to have been delivered to the Contractor.

108. Contractor's Yards, Stores, etc.

The Contractor shall make his own arrangements for all yards, stores, workshops, offices, etc. and for all services in connection therewith.

The location of all yards, stores, workshops, offices, etc. shall be within the area directed by the Supervisor and shall be agreed beforehand with the Supervisor and shall be such as to avoid obstruction and nuisance to public.

109. Site to be Kept Tidy

Throughout the progress of the Works, the Contractor shall keep the Site and all working areas in a tidy and workmanlike condition and free from rubbish and waste materials. Any temporary works, constructional plant, materials or other things which for the time being are not required for use by the Contractor may, with the consent of the Supervisor, be removed from the Site but otherwise shall be dispersed about the Site in an orderly fashion and shall be properly and securely stored thereon. The Contractor shall make safe and reinstate all areas affected by Temporary Works.

110. Safety Measures, Instructions and Services

The Contractor shall be responsible for the safety of all workmen and other persons entering or on the Works and shall take all measures necessary to ensure their safety. Such safety measures shall include:

- (a) Provision of safety and emergency regulations and apparatus including stretchers and first-aid outfits for dealing with casualties due to accidents, fire, gas and electric shock and skilled personnel in the use of the apparatus.
- (b) Safe supporting of all excavations.
- (c) Regular maintenance of construction plant and temporary works.
- (d) Provision of proper and safe access to all parts of the Site and the Works.
- (e) Display of warning notices and safety instructions.

111. Demolition of Temporary Facilities

The Contractor shall demolish the temporary facilities provided for the execution of the Contract in accordance with written instruction and/or direction issued by the Supervisor.

Unless the Supervisor issue the instruction and/or direction of the demolition of temporary facilities to the Contractor before the date of issue of the Certificate of Completion of the works provided under the Contract, the Supervisor may exempt the demolition of temporary facilities provided for the execution of the Contract.

112. Precautions Against Contamination of the Works

The Contractor shall satisfy the Supervisor that all his personnel working on the Site are medically suitable to be in contact with a public water supply and his personnel shall undergo any necessary medical test, to show that they are free from any infectious diseases and are not carriers of any such diseases.

The Contractor shall at all times take every possible precaution against contamination of the Works. The Contractor shall give strict instructions to all persons employed by him to use the sanitary accommodations provided.

Throughout the Contract the Site and all permanent and temporary Works shall be kept in a clean, tidy and sanitary condition.

The Contractor shall at all times measures to avoid contamination of existing water courses and drains by petrol oil or other harmful materials.

The Contractor shall be responsible for making all arrangements for the disposal of waste water including the disposal of water from the water testing of pipes and water retaining structures.

113. Standards

Materials and workmanship shall comply with the latest revision of the authoritative standard approved by the Supervisor, unless otherwise provided in these Specifications. The Contractor may use the standard under the approval of the Supervisor against the standard provided in these Specifications. The Contractor shall satisfy the Supervisor to submit necessary documents for his approval as may be required.

114. Quality of Materials and Workmanship

The materials and workmanship shall be of the best of their respective kinds and to the approval of the Supervisor. In the reading of these Specifications the words "to the approval of the Supervisor" shall be deemed to be included in the description of all materials incorporated in the Works whether manufactured or natural and in the description of all operations for the due execution of the Works.

115. Rejected Materials

Should any materials or manufactured articles be brought on to Site of the Works which are in the judgment of the Supervisor unsound or of inferior quality or in any way unsuited for the work in which it is proposed to employ them, such materials or manufactured articles shall not be used upon the Works but shall be branded if in the opinion of the Supervisor this is necessary and shall forthwith be removed from the Site of the Works.

116. Quality Control

The Contractor shall be responsible for his own quality control and shall provide sufficient competent personnel on the Site for taking and preparing samples and for carrying out the necessary tests.

117. Existing Services

The Contractor shall take every precaution to ensure that all existing services, pipes, culverts, cables, retaining walls, drainage and irrigation ditches and the like are located, supported and safeguarded from damage even though they may not be in the line of excavation but near to it. Any damage caused to any such services, pipes, culverts, cables, irrigation and drainage ditches and the like attributable to the Contractor's operations his constructional traffic or to his negligence shall be made good by or for the Contractor at his own expense to the satisfaction of the Consultant and responsible Authority.

In the event of the RID or responsible Authority electing to repair such damage the Contractor shall pay the cost of his or their so doing the work.

118. Temporary Removal of Existing Services

If it should become necessary for the proper execution of the work temporarily to remove or divert any existing pipe sewer field-drain cable drainage or irrigation ditch or other service, the Contractor shall obtain permission from the responsible Authority or RID and shall carry out the work at his own expense in a manner and at times to be approved by such Authority or owner and shall subsequently reinstate the work to the satisfaction of such Authority or RID.

In the event of the owner or responsible Authority electing to arrange for the temporary removal of an existing service, the Contractor shall pay the cost of his or their doing the work.

119. Claims for Damage to Persons or Property

Any claim received by the Supervisor in respect of matters in which the Contractor is required under the Contract to indemnify the JICA will be passed to the Contractor who shall likewise inform the Supervisor of any such claim which is submitted directly to him by a claimant. The Contractor shall do everything necessary, including notifying the insurers of claims received, to ensure that all claims are settled properly and expeditiously and shall keep the Supervisor informed as to the progress made towards settlement, failing which the RID shall be entitled to make direct payment to claimants of all outstanding amounts due to them in the JICA's opinion and without prejudice to any other method of recovery to deduct by way of set-off the amounts so paid from any sums due or which shall become due from the JICA to the Contractor.

If the Contractor receives a claim which he considers to be in respect of matters in which he is indemnified by the JICA under the Contract he shall immediately pass such claim to the JICA.

120. Contractor's Day Staff

At least one responsible senior representative of the Contractor shall be immediately available at all times and he shall be on the Site during normal working hours. The representative shall be reasonably proficient in English as

required in relevant clauses of the Contract. To such representative shall be delegated full authority to confer with the Supervisor or his deputy and to take all steps and to issue all those instructions which may be required in an emergency to ensure the safety of all personnel of the Works and of all the JICA's and other property on the Site and in the immediate vicinity thereof. The Supervisor may from time to time at his discretion after taking into consideration all the prevailing conditions allow some relaxation of this clause but such relaxation shall be made only with his written permission and subject to any special conditions which he may then required.

SECTION II

EXCAVATION

201. Scope

The work shall consist of excavating all classes of materials and including the trimming, removal, placing and disposal to designated disposal areas, all in accordance with the Drawings and Specifications or as directed by the Supervisor. It shall also include excavation for temporary water diversion, drains, sumps, protection works, and also the removal and disposal of mud, muck and other unsuitable materials.

202. Sections and Slopes

Excavation shall be carried out true and straight in conformity with the lines and grades as shown on the Drawings.

203. Excavation for Structures

(a) Scope

Excavation for structure shall include removal of material where structure is to be constructed, transportation of excavated materials to stock pile or to disposal area in accordance with the Drawings and the Specification and/or the Supervisor's instruction.

(b) Foundation Surfaces

When concrete foundation is to be placed on rock, only light charges of explosives shall be used for the final lift of excavation, and the final excavation or clean up shall be by means of pneumatic tools, barring and wedging or the like means. All rock foundation surfaces shall be cleaned thoroughly of all loose rock fragments, dirt, and similar objectionable matters. Sides of rock excavation shall be prepared in the same manner as specified above when concrete is to be placed in contract therewith.

The bottom and side slopes of excavation in soil against which concrete is to be placed shall be finished carefully to the elevations and dimensions shown on the Drawings. If foundation material is loosened or disturbed, it shall be compacted to not less than 90 percent compaction for a depth of 30 cms., or if directed it shall be removed and replaced with compacted backfill or concrete.

Materials which will not provide a suitable foundation shall be removed and replaced with compacted backfill or concrete as directed.

The elevation of the bottom of spread footings shown on the Drawings shall be considered as approximate only and the Supervisor may order, in writing, such changes in dimensions or elevations as may be necessary to obtain a satisfactory foundation.

SECTION III

EMBANKMENT AND BACKFILL

301. Scope

This section shall cover all embankment and backfill Works under this Contract. The work on embankment and backfill shall consist of clearing and grubbing, hauling and placing of embankment materials, compacting to the desired degree of compaction of the said materials after placement and finishing the embankment all in accordance with the Drawings and Specifications.

302. Compaction and Watering Equipment

The type of equipment and method employed in moisture conditioning and compacting of embankment shall be at the option of the Contractor as approved by the Supervisor. The approval of the equipment and method used shall not relieve the Contractor from the responsibility in obtaining the specified result.

303. Common Borrow

When suitable material from excavation is not sufficient, additional material shall be obtained from sources as approved by the Supervisor. The materials shall be of quality satisfactory for the purpose and shall conform to the materials for embankment. The work under this clause shall consist of clearing, grubbing and if necessary stripping of the top soil of the borrow pit, excavating, stockpiling, loading and dumping of the excavated materials to the place of embankment, spreading and compaction.

The Supervisor will secure the designated borrow pits and borrow areas for side borrow, common borrow or borrow haul materials with the necessary right-of-way for access thereto. Haul roads to the borrow pits or borrow areas shall be constructed and maintained by the Contractor.

304. Embankment and Compaction

(a) General

Placing and embankment works shall be carried out to the lines, grades and dimensions shown on the Drawings or as approved by the Supervisor, on properly prepared and approved foundation.

(b) Material

Materials for embankment may be taken from excavation or common borrow area, and shall be subject to the approval of the Supervisor.

Materials shall be conditioned to have a moisture content at the time of compaction such that the specified compaction may be obtained with the use of compaction equipment. It shall be the responsibility of the Contractor at all times to employ such means as may be necessary to secure a uniform moisture content throughout the material being compacted.

(c) Construction and Compaction

Embankments shall be constructed in horizontal layers which extend the full width of the embankment. Thickness of the layers shall not exceed 30 cm after compaction. When a layer of material is dissimilar from the preceding layers, the materials shall be blended by mixing, scarifying, or a combination of these methods.

Should the Supervisor determine that any portion of the surface of the embankment has become so dry or glazed during construction that bond with the succeeding layer to be placed thereon cannot be obtained, or should ruts develop on the embankment, such surfaces shall be scarified to a minimum depth of 15 cm, relieved, moisture conditioned and re-compacted to the specified density just prior to placing of the succeeding layer of the embankment.

SECTION IV

STEEL REINFORCING BARS

401. General

All steel reinforcing bars and welded wire fabric required for the works as detailed in the construction drawings or as directed by the Supervisor shall be furnished by the Contractor. The Contractor shall furnish, transport to site, store, cut, bend and properly place all the reinforcing steel bars required for the works. All bar sizes to be used in the works shall be in accordance with the code of standard practice of the Concrete Reinforcing Steel Institute or equivalent approved. All bars shall be of the deformed type unless otherwise specified on the Drawings.

402. Workmanship

Workmanship shall be of the highest grade and shall be in accordance with the latest standard practice of the industry.

(a) Cutting and Bending

Cutting and bending of reinforcing bars may be done in a shop or at the job site. All bending works shall be in accordance with latest standard practice and by approved machine methods. Radii for bends and hooks will be specified on the approved detailed reinforcement Drawings in accordance with sound design procedures.

(b) Placing

Reinforcement shall be laid, anchored and embedded in the concrete as shown on the Drawings or as directed by the Supervisor. Unless otherwise directed the spacing of reinforcement bars shall be measured along the center line of the bars. Reinforcement shall be inspected for compliance with requirements as to size, shape, length, splicing, position and number after placement based on the approved reinforcement Drawings.

Before reinforcements are placed, the surfaces of the bars and the surfaces of any metal bar support shall be cleaned of heavy flaky rust, loose scales, dirt, grease or other foreign substance which in the opinion of the Supervisor are objectionable. Heavy flaky rust that can be removed by firm rubbing with burlap or equivalent treatment is considered objectionable. After being placed, the reinforcing bars shall be maintained in a clean condition until completely embedded in concrete.

Reinforcing bars shall be accurately placed and secured in a position so as to avoid displacement during the pouring of concrete. Special care shall be exercised to prevent any disturbance of the embedded reinforcement during the setting of concrete. Metal chairs, hangers, spacers or other approved support may be used by the Contractor for supporting reinforcing bars. Metal supports shall be galvanized when they are to be exposed to view on completed concrete surfaces or where its use will contribute in any way to the discoloration or deterioration of the concrete.

(c) Relation of Bars to Concrete Surfaces

The minimum cover for all main reinforcements shall conform to the dimensions shown on the detailed reinforcement Drawings.

(d) Splicing

All splices in reinforcement shall be as shown on the Drawings or as directed by the Supervisor. The lapped ends of bars shall be either supported sufficiently to permit the embedment of the entire surface of each bar in concrete or shall be securely wired.

(e) Protection

Reinforcement to remain exposed and intended for future concrete embedment shall be protected from corrosion or other damages in an approved manner where directed. The reinforcement protection shall be of such nature that it can be thoroughly cleaned without difficulty prior to encasement in concrete.

403. Reinforcement Drawings

The Contractor shall submit for the approval of the Supervisor detailed reinforcement drawings. These drawings shall include bar and other reinforcement as may be required to facilitate fabrication, placement and checking of reinforcement bars. No work shall be done by the Contractor until such approval has been given.

The reinforcement Drawings submitted shall show the name of the structure, location by stationing where the reinforcement drawings is intended and all the necessary information required by the Supervisor. It shall likewise bear the stamp or seal of the Contractor as evidenced that the Drawings have been checked by the Contractor.

The Contractor shall be held responsible for any delay in the progress of the work occasioned by his failure to observe the requirements and the time for the completion of the contract will not be extended on account of his failure to promptly submit the said drawings in strict adherence herewith.

SECTION V

CONCRETE WORKS

501. General

The Contractor shall perform concrete work in strict conformance with the Specifications and Drawings and as directed by the Supervisor.

Prior to the erection and installation of equipment for obtaining and processing raw materials for aggregates, handling and storing cement and aggregates, weighing and mixing concrete ingredients, and for transporting and placing concrete, the Contractor shall submit to the Supervisor for approval, Drawings and work plan showing the capacities and accuracy of the equipment which he proposes to use.

502. Composition

(a) General

Concrete shall be composed of cement, fine aggregate, coarse aggregate, water and admixtures, all well mixed and brought to the proper consistency.

(b) Maximum Size of Aggregates and Mix Proportions

The maximum size of aggregates and minimum compressive strength at 28 days shall be satisfied with the Specifications shown in Table 5-1 in principle. Practical specifications should be, however, determined at site by the Supervisor based on the test results conducted by the Contractor.

Mix proportions, such as the amount of cement, water-cement ratio, coarse aggregate, fine aggregate and admixtures per unit volume of concrete, shall be determined on the basis of those which produce the most economic concrete having suitable workability, density, impermeability, durability and strength required for the various types of concrete structures.

Mix proportions of concrete and cement content shall be determined from tests performed by the Contractor and shall satisfy the conditions specified in Table 5-1. The results of such tests shall be approved by the Supervisor.

The amount of water to be used in concrete shall be regulated as required to produce concrete of the proper consistency and shall be adjusted for any variation in the moisture content or grading of the aggregates. Addition of water to compensate of the concrete before placing will not be permitted. Uniformity in concrete from batch to batch will be required.

TABLE 5-1. STANDARD MIX PROPORTION FOR CONCRETE

Type of Mix	Max. Aggregate Size (mm)	Min. Comp Max.		Application
		Strength @28 days (kg/cm ²)	Slump	
AA	20	240		Reinforced concrete
C	20	180		Plain concrete
D	20 to 80	90		Leveling concrete, back fill concrete

(c) Disposal of Concrete Having Unsatisfactory Properties

Should the Supervisor deem that the mixed concrete does not meet the provisions stipulated in these Specifications, the Contractor shall dispose the said concrete in a place designated by the Supervisor.

5-3. Cement

(a) Quality

The Contractor shall furnish normal Portland cement in bulk or in sacks from a cement factory approved by the Supervisor. The cement shall conform to the requirements of Portland cement, type 1 designated in ASTM C150.

(b) Storage

The cement shall be stored in a suitable weather-tight storage bin or warehouse that will protect the cement from absorbing moisture.

All storage facilities shall be built in such a manner as to permit easy access for proper inspection. The bin for the bulk cement shall be so constructed that there will be no dead storage and shall be emptied and cleared by the Contractor when so directed by the Supervisor. Sacked cement shall not be piled more than 13 sacks high.

(c) Usage

Stored cement, which may have absorbed moisture, shall not be used unless approved by the Supervisor. Cement shall be used in the chronological order in which it was delivered to the project site.

504. Admixture

The Contractor may use an air-entraining agent conforming to the requirements of ASTM C260 and water-reducing and set-retarding agent conforming to the requirement of ASTM C494, in order to improve the quality, workability and finishability of concrete or mortar.

Admixtures will be accepted on manufacturer's certification of conformance with the Specifications but permission to ship on certification shall in no way relieve the Contractor of responsibility for furnishing an admixture meeting Specifications requirements. Where the Supervisor has reason to believe that testing is necessary to prove compliance with the requirements of these Specifications, he may order these admixtures to be sampled and tested at any time. The Contractor shall provide facilities satisfactory to the Supervisor for the ready procurement of adequate test samples.

(a) Air-entraining Agent

Concrete produced with water reducing agents shall contain four to six percent of entrained air by volume.

Concrete produced without dispersing agents shall have an air-entraining agent added. The agent shall conform to the requirements of ASTM C260.

The agent in solution shall be maintained at uniform strength and shall be added to the batch as a portion of the mixing water. This solution shall be batched by means of a mechanical batcher capable of accurate measurement. When a retarder or dispersing agent is used in the concrete, the portion of the mixing water containing the air-entraining agent shall be introduced separately into the mixer.

505. Water

Mixing water for concrete and mortar shall be free from objectionable quantities of silt, organic matter, oil, alkali, acid, salt or other impurities. A turbidity of more than 2,000 ppm shall be considered objectionable.

506. Coarse Aggregate

(a) Quality

Coarse aggregate shall be either natural gravel or manufactured coarse aggregate. Coarse aggregate shall consist of well-shaped, clean, hard, dense, durable rock fragments and shall not contain wood chips or other impurities.

The percentage of deleterious substances in any size of coarse aggregate, as delivered to the mixer, shall not exceed the following values:

	<u>Percentage by Weight</u>
Material passing No. 200 (75 micron) sieve, determined in accordance with ASTM C117	1.0
Clay lumps determined in accordance with Designation 13 of the U.S. Bureau of Reclamation, Concrete Manual	0.25

(b) Grading

The coarse aggregate shall be separated into two classifications as follows:

<u>Designation of Size</u>	<u>Nominal Size Range</u>	<u>Sieve Opening Range</u>
40 mm	39 to 20 mm	38.1 to 19.0 (1 1/2 to 3/4 inch)
20 mm	20 to 5 mm	19.0 to 4.76 mm (3/4 inch to No.4)

Separation of the coarse aggregate into the specified sizes, after screening, shall be such that when the aggregate as batched is tested by screening on the screenings designated in the following tabulation, the material passing the undersize test screen shall not exceed 2 percent by weight, and all materials shall pass the oversize test screen.

<u>Designation of Size</u>	<u>Test Sieve</u>	
	<u>For Oversize Test</u>	<u>For Undersize Test</u>
40 mm	44.5 mm (1 3/4 inch)	31.8 mm (1 1/4 inch)
20 mm	22.2 mm (7/8 inch)	15.9 mm (5/8 inch)

Screens used in making the test for undersize and oversize shall conform to the requirements of ASTM E11.

Coarse aggregate shall be graded for each maximum size within the standard limits specified in Table 5-2.

TABLE 5-2 COARSE AGGREGATE GRADATION

Nominal Size Range	Percentage by Weight Passing Sieve Size								
	64.0	50.8	38.1	25.4	19.0	12.7	9.5		
	(2 1/2 inch)	(2 inch)	(1 1/2 inch)	(1 inch)	(3/4 inch)	(1/2 inch)	(3/8 inch)	(No. 4)	(No. 8)
40 mm (1 1/2 to No.4)		100	95 to 100		35 to 70		10 to 30	0 to 50	
20 mm (3/4 inch to No.4)				100	90 to 100		20 to 55	to 10	0 to 5

(c) Storage

Coarse aggregate storage pile shall be built in such a manner as to avoid the inclusion of any foreign material and to prevent segregation and

excessive breakage. Water shall be sprayed on that portion of the stockpile which is intended for immediate use in concrete.

507. Fine Aggregate

(a) Quality

Fine aggregate shall be either natural sand or manufactured sand. It shall consist of clean, hard, dense and durable rock particles, free from injurious amounts of dust, silt, stone powder, pieces of thin stone, alkali, organic matter and other impurities.

(b) Grading

The fine aggregate as batched shall be well graded, and when tested shall conform to the following limits:

<u>Sieve Size</u>	<u>Percentage Passing by Weight</u>
9.51 mm (3/8 inch)	100
4.75 mm (No.40)	95 to 100
2.38 mm (No. 8)	80 to 100
1.19 mm (No.16)	50 to 85
595 micron (No. 30)	25 to 60
297 micron (No. 50)	10 to 30
149 micron (No. 100)	2 to 10

(c) Storage

Fine aggregate shall be stored in such a manner as to avoid the inclusion of any foreign materials in the concrete and to protect against exposure to the sun for at least 24 hours immediately prior to use. For this purpose, the Contractor shall stockpile the fine aggregate so as to drain excessive water and to stabilize the moisture content.

508. Batching and Mixing

The Contractor shall provide equipment, and shall maintain and operate the equipment as required, to determine and control accurately by weighing equipment the amount of each ingredient entering the concrete.

The amount of each ingredient shall be batched correctly with sufficient accuracy to obtain concrete of the quality specified in the Specifications.

The Contractor shall control delivery of materials from the batching equipment within the following limits of accuracy.

<u>Materials</u>	<u>Allowance in Percentage by Weight</u>
Cement	2
Water	1.5
Aggregates	3
Admixtures	2

The amount of cement, fine aggregate and each individual size of coarse aggregates entering each batch of concrete shall be determined by separate weighing, and the amount of water and admixture shall be determined by weighing or volumetric measurement in accordance with the mix proportion of concrete approved by the Supervisor. The batching equipment shall include an accurate recorder of digital type for making a continuous visible combined record on a single chart of the separate measurement of each concrete ingredient, including all mixing water, air-entraining admixture, and water-reducing and set-retarding admixture. The recording equipment shall also indicate and record the type of mix proportion, and date and time of each mix as delivered to the batching plant.

The Contractor shall check the accuracy of the operating performance of each scale and other measuring devices once a month. When and as required by the Supervisor, the Contractor shall check them in the presence of the Supervisor. The Contractor shall make such adjustments, repairs or replacement as may be necessary.

The concrete ingredients shall be mixed thoroughly in batch mixers of approved type and size and designed so as to positively insure uniform distribution of all the ingredients throughout the mass at the end of the mixing period. The volume of concrete mixed in one batch shall not exceed the rated capacity of the mixer.

When volumetric proportioning and measurement is needed and/or if concrete is to be mixed by hand, it shall be subject to approval by the Supervisor.

509. Placing of Concrete

(a) General

Prior to placing concrete, the Contractor shall submit to the Supervisor for approval the concrete placing schedule, setting forth his placing equipment, and method of execution of the Work. No concrete shall be placed until all form work, treatment of surface, placing of reinforcement and other parts to be embedded have been inspected and approved by the Supervisor.

Placing of concrete shall not be permitted under the following conditions, unless specifically approved by the Consultant.

- 1) When it rains
- 2) When illumination is inadequate for night work
- 3) Whenever ordered to stop by the Supervisor

(b) Preparation for Placing

1) Treatment of Foundation Surfaces

All surfaces of foundations upon or against which the concrete is to be placed shall be cleaned and moistened thoroughly before the placing. When concrete is placed upon or against earth foundations, the Contractor shall, in accordance with the direction of the Supervisor, remove all objectionable substances such as standing water, flowing water, and fragment of wood.

2) Treatment of Surfaces of Construction Joints

Prior to placing the concrete upon or against hardened concrete, the surface of the construction joints shall be cleaned, moistened and

removed of all laitance, defective or loose concrete, and unsound foreign materials.

(c) Transporting and Conveying

Prior to the commencement of concrete work, the Contractor shall submit to the Supervisor for approval the details of the method and equipment to be used for transporting and conveying concrete. The method and the equipment used for transporting and conveying fresh concrete shall be such as not to cause appreciable segregation of materials or loss of consistency.

When 60 minutes have elapsed after concrete has been discharged from the mixer and/or in which slump loss exceeds 3.0 cm as it is delivered to the site for placing, the concrete shall be disposed of at a place designated by the Supervisor. Concrete shall be placed with a vertical drop not greater than 1.5 meters, except where suitable equipment is provided to prevent segregation or where specifically authorized.

Concrete which has segregated, during transportation shall be remixed. Retempering of concrete shall not be permitted.

(d) Placing

After the surface of rock foundation or the surface of unformed construction joints have been cleaned and the placing of concrete has been approved by the Supervisor in accordance with the provisions of the preceding sub-clauses. For the structure as instructed by the Supervisor, the surface of rock shall be covered with a layer of mortar approximately 1 cm thick. The Contractor shall place concrete upon the fresh mortar before it begins to set. The mortar shall be of a richer cement content than concrete without coarse aggregate. The mix proportion of mortar shall be subject to approval of the Supervisor.

Concrete shall be deposited in all cases, as nearly as practicable, directly in its final position and shall not be caused to flow such that lateral movement will permit or cause segregation of the coarse aggregate, mortar, and water from the concrete mass. The Contractor shall not be

permitted to add water to compensate for hardening of the concrete resulting from overmixing or drying before placing.

Concrete shall be placed according to a predetermined schedule in order to prevent the development of cold joints during placing. In the event of equipment breakdown, or if for any other reason continuous placing is interrupted, the Contractor shall thoroughly consolidate the concrete at such joint to a reasonably uniform and stable slope while concrete is plastic. Cold joints shall be treated, prior to placing concrete thereon, in accordance with the provisions of Clause (b) above and Clause (e) below.

If placing of concrete in water is unavoidable, it shall be subject to approval of the Supervisor, and the method of depositing the concrete shall be approved by the Supervisor.

(e) Construction Joints

At least seven (7) days before placing concrete, the Contractor shall submit to the Supervisor for approval a plan indicating the locations of all construction joints to be constructed in the concrete work.

As a rule, the construction joints shall be located at places where shearing stresses or tensile stresses are the least, and shall be located so that the effects of the construction joints on the appearance of the finished surface and/or the function of the structure will be minimized. The construction joints shall be made horizontally or vertically.

Where directed by the Supervisor, polyvinyl chloride waterstops shall be placed in the construction joints.

(f) Consolidation

Immediately after placing, every layer of concrete shall be consolidated to the maximum practicable density so as to obtain maximum bond against all surface of reinforcement bars and embedded fixtures and against all corners of the forms. Consolidation of concrete shall be electric or pneumatic power-driven, immersion-type vibrators. Concrete vibrators shall be operated at speeds of at least 7,000 rpm when immersed in the concrete. When the use of immersion-type vibration is

not practicable, the Contractor will be permitted to use form vibrators or consolidate the concrete by hand tamping.

510. Curing

Prior to placing concrete, the Contractor shall obtain the Supervisor's approval of the method to protect and cure concrete and the facilities he proposes to use. After concrete has been placed, it shall be protected and cured strictly in accordance with the method approved by the Supervisor.

The Contractor shall protect the placed concrete from injurious actions, rapid change of temperature, drying, loads, shock and vibration, while the concrete has not hardened sufficiently.

511. Forms

(a) General

Forms shall be used, wherever necessary, to confine and shape the concrete to the required lines, and as directed by the Supervisor. Forms shall have sufficient strength to withstand the pressure resulting from placing and vibrating of the concrete, and shall be maintained rigidly in position. Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Chamfering shall always be employed in corners of forms so as to produce beveled edge with a face of 3 cm unless otherwise indicated on the Drawings. Each form shall be so prepared that each section may be removed individually without injuring the concrete. Prior to fabrication of the forms, the Contractor shall submit to the Consultant for approval the Drawings of forms and form support details.

(b) Form Sheathing

The Contractor will be permitted to employ wood sheathing, plywood sheathing and steel sheathing.

Wood sheathing used shall be of such kind any quality or shall be so treated or coated that there will be no chemical deterioration of the formed concrete surfaces. Plywood used for sheathing shall have a

minimum thickness of 20 mm and shall be high density overlaid plywood specially manufactured for use in constructing concrete forms.

(c) Supporting Metals for Forms

Steel bars to be embedded in concrete for holding forms shall be systematically installed. These steel bars shall be so installed that they may be removed from points deeper than 5 cm from the surface of concrete. The holes caused by the removal shall be cleaned, and kept damp for more than 4 hours and then the holes filled with mortar.

(d) Cleaning and Oiling Forms

Prior to assembling forms, the form surfaces coming into contact with concrete shall be thoroughly cleaned. Oil to be applied on the inner surface of form sheathing shall be mineral oil or other kind of oil, which will not stain the concrete surface. Oiling of forms shall as a rule be accomplished before erection of the forms, but when permitted by the Supervisor, the oiling may be performed after the forms are assembled and put in place. Oil sticking to reinforcement bars shall be completely removed by effective means.

(e) Removal of Forms

To facilitate satisfactory progress with the specified curing and permit the earliest practicable repair of surface imperfections, forms shall be removed as soon as concrete has hardened sufficiently to prevent damage by careful form removal.

Forms shall not be removed without the approval of the Supervisor. As a rule, the forms shall be kept in place at least for the periods indicated below after concrete has been placed.

Beam and slab	6 days
Column and wall	3 days

(f) **Forms for Warped Surface**

Forms for warped surface shall be constructed so as to conform accurately to the required curvatures. The Contractor shall interpolate and/or compute the intermediate sections on the basis of the several main sections given on the Drawings, and shall construct the forms so that curvature will be continuous through the whole section. In such case, the forms shall be so constructed that the joint marks on the concrete surface resulting from the form sheathing, in general, follow the line of water flow. Nail heads shall not protrude form surfaces.

In areas where forming of warped surfaces is impractical, the Contractor shall use templates or other approved means to insure the accuracy of warped surfaces formed by hand methods.

SECTION VI

RUBBLE MASONRY

601. General

The work under this Section shall consist of furnishing all materials, supplies, tools, equipment, labor, furnishing and construction of all necessary form work, furnishing and placing rubble stones and concrete binder on an approved foundation and form work, the removal of forms and curing of the masonry, all in accordance with the Drawings and Specifications of as directed by the Supervisor.

602. Materials

Rubble stones shall consist of field stones that are clean, sound, resistant to the action of water, and must have a specific gravity of at least two and four tenths (2.4). Stones shall have the prior approval of the Supervisor before its use. Such stones shall weight from twenty (20) to fifty (50) kilograms a piece.

603. Construction Method

Preparation and handling of the Concrete Binder shall be governed by the specifications for "Concrete", except the proportioning of the ingredients which is as specified above. The stones shall be thoroughly wet before they are installed in place. The entire surface of every stone shall be thoroughly covered with the concrete binder. The stone shall be well set such that no stone will project beyond the lines indicated on the Drawings. The concrete binder shall be thoroughly worked into the spaces between stones so that no void is left within the rubble masonry. In case reinforcements are placed, no rubber stone shall be closer than ten sentiments to the nearest reinforcing bars. The masonry shall be cured by water curing for seven (7) days.

SECTION VII

PIPE WORKS

701. General

This Section covers all pipes, fittings and other incidental appurtenances to be furnished under this Contract. The Contractor shall furnish all labor, materials, equipment and incidentals required to install the piping, fittings and appurtenances as shown on the Drawings. The completed installation shall be fully functional as shown on the Drawings. The fittings are shown as a convenience to the Contractor. It may be necessary to supply and install additional fittings other than those shown on the Drawings or to install fittings in different locations.

Also this Works shall include the furnishing and installing of certain miscellaneous items and appurtenances as hereinafter specified. Work to be done shall include hauling, laying installing, jointing, wrapping, testing and all other work necessary to produce a completed facility. The Contractor shall furnish and install couplings fittings, gaskets, nuts, wall sleeves, wall pipes, harnesses and all other materials necessary to properly install the works shown on the Drawings and as specified by the Supervisor.

Certain piping systems are shown diagrammatically as an indication of the works to be installed. The Contractor shall coordinate the works so that all works may be installed in the most direct and workmanlike manner, and so that interference between piping, ducts, equipment, architectural and structural features and appurtenances and other work will be avoided.

The works of installing pipe in earth excavations, earth fills and earth trenches is specified in Section II "Excavation".

702. Construction Drawings

The Contractor shall submit detailed working and Construction Drawings and schedules of all pipes, fittings and appurtenances.

Drawings shall include but not be limited to the followings:

- a) Lists and schedules of material
- b) Schedules of pipe lengths and thicknesses
- c) Details of proposed joints, harnesses and installation details
- d) Name of suppliers and identification of equipment to be supplied

Drawings shall show the locations of unions, bolted or flanged connections or other appurtenances to permit ready dismantling of piping systems.

The Contractor shall submit samples of materials to be supplied and exact details of various joints that are proposed for use on the works.

703. Pipes and Fittings

Each pipe, fitting and casting shall bear clear and permanent markings showing the nominal diameter class or schedule, type, year of manufacture and the manufacturer's name or trade mark. Markings on pipe length shall always be at the same end. *Painting of data will be acceptable for all pipe and fittings.*

Pipes and fittings shall be compatible and have equal or higher pressure ratings as specified.

Pipes, fittings and appurtenances shall be installed in full conformance with the manufacturer's recommendations.

Bedding, hanger details, supports and wall and floor penetrations shall be as shown on the Drawings.

When cutting of pipe is required, the cutting shall be done by machine in a neat and workmanlike manner without damage to the pipe. Pipe ends to be used with rubber joints shall be beveled and filed or ground smoothly to conform to the manufactured spigot end.

The Contractor shall furnish and install transition pieces at all locations when one type of pipe joins a second.

704. Handling

Care shall be taken during loading, transporting, and unloading to prevent injury to the pipes, fittings, or coatings. Under no circumstances shall pipes or fittings be dropped or rolled against one another. All pipes or fittings shall be examined and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Supervisor.

If any defective pipe or fitting is discovered after it has been installed, it shall be removed and replaced with a sound pipe or fitting in a satisfactory manner by the Supervisor. All pipes and fittings shall be thoroughly cleaned before installation.

Special handling of pipes and fittings shall be in accordance with the manufacturer's instructions.

705. Inspection

The quality of all materials the process of manufacturing, and the finished piping shall be subject to inspection and approval by the Supervisor. Such inspection may be made at the place of manufacturing, or at the working site after delivery, or at both places, and the pipe shall be subject to rejection at any time on.

SECTION VIII

BUILDING WORKS

801. General

This Section covers the Specification for the building works. The Contractor shall supply materials, equipment and labors to complete the building works as shown on the drawing or as specified herein.

The Contractor shall submit to the Supervisor for his approval catalogs, data, samples, and operation manual of the materials and equipment to be used for the building works prior to commencement of the works.

Building works shall include various works such as earthworks, concrete works, pipeworks, structural steel works, etc., which shall be carried out in accordance with the requirements described in each equipment clause of the Section.

802. Concrete Works

All concrete works and steel reinforcing works for Building works specified in this Section shall be referred to the Section IV & V.

The class of concrete of building works shall be as follows:

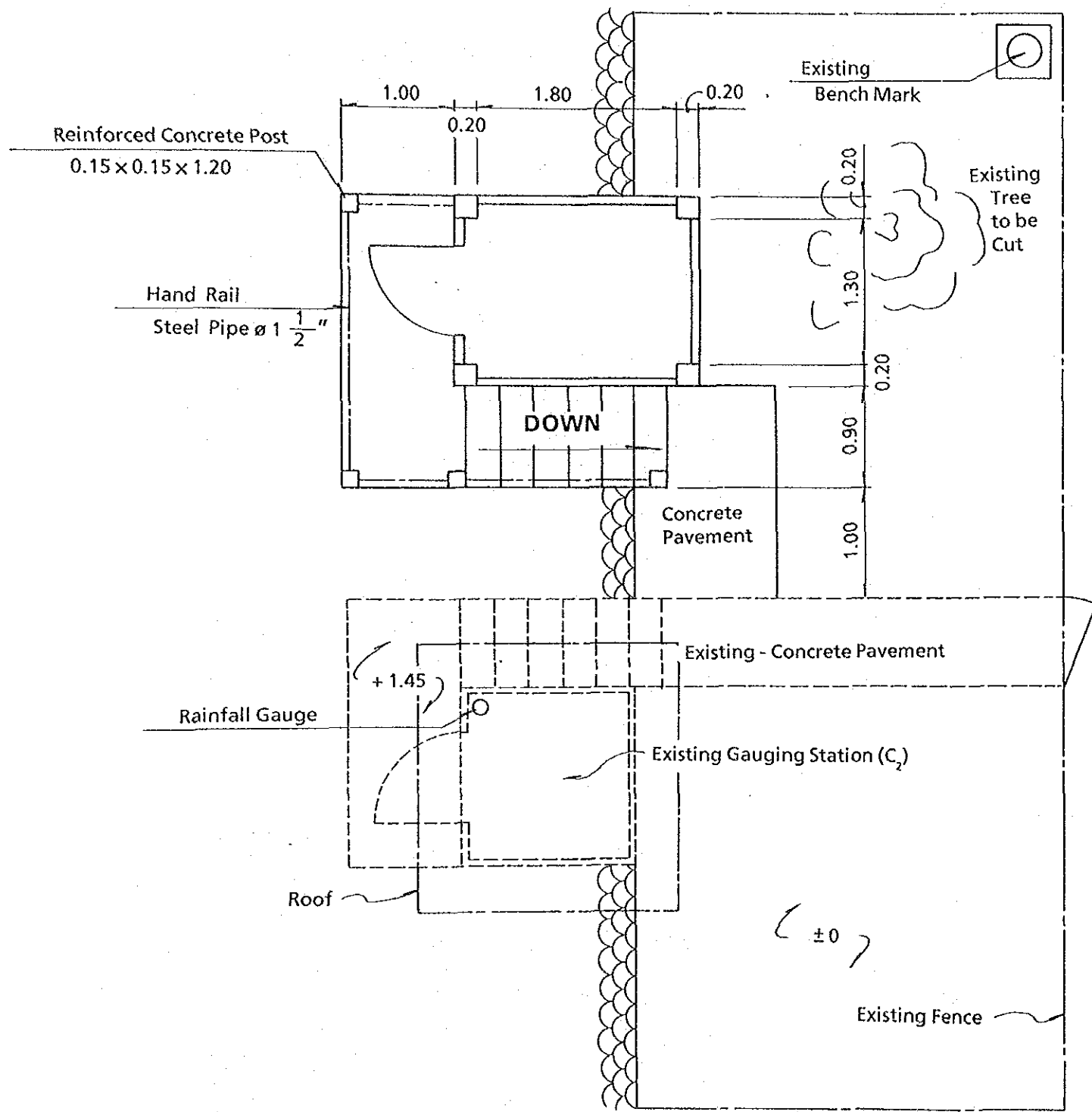
- Structural Concrete of Building A-Concrete
- Foundation Concrete A-Concrete
- Wall Stick up Concrete Block

803. Shop Drawing

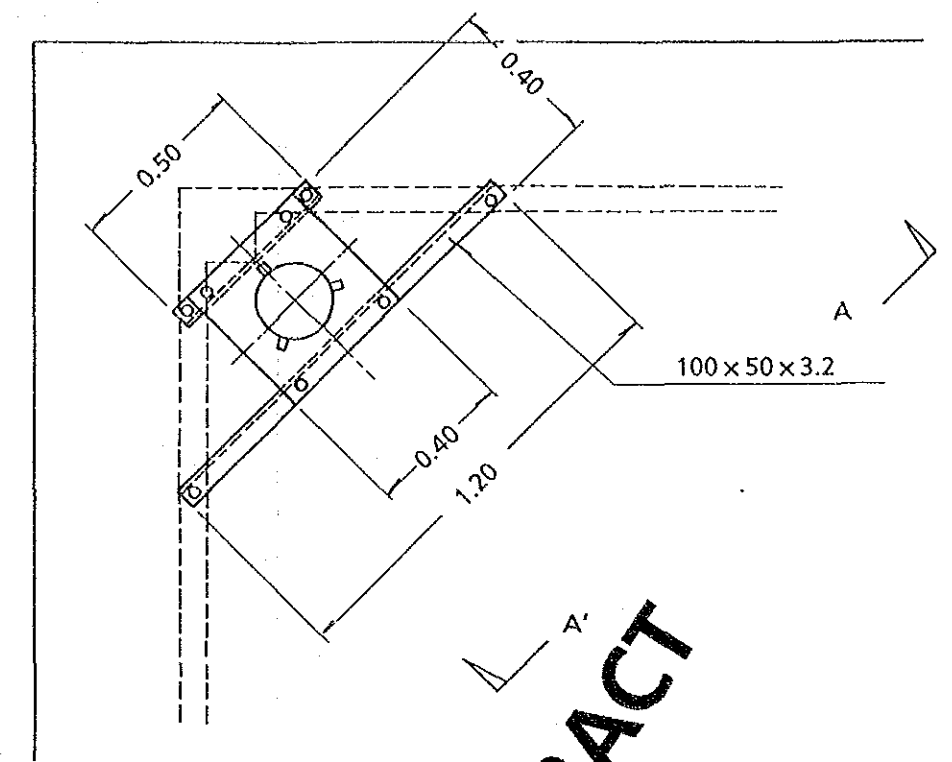
The Contractor shall provided and submit the Shop Drawings and detail specification for all structure, for the Supervisor's approval in accordance with this Specifications and drawings. Shop Drawings shall bear the signature of the Contractor and data checked and shall be accompanied by the Statement

that the shop drawings have been examined for conformity to Specification and Drawings.

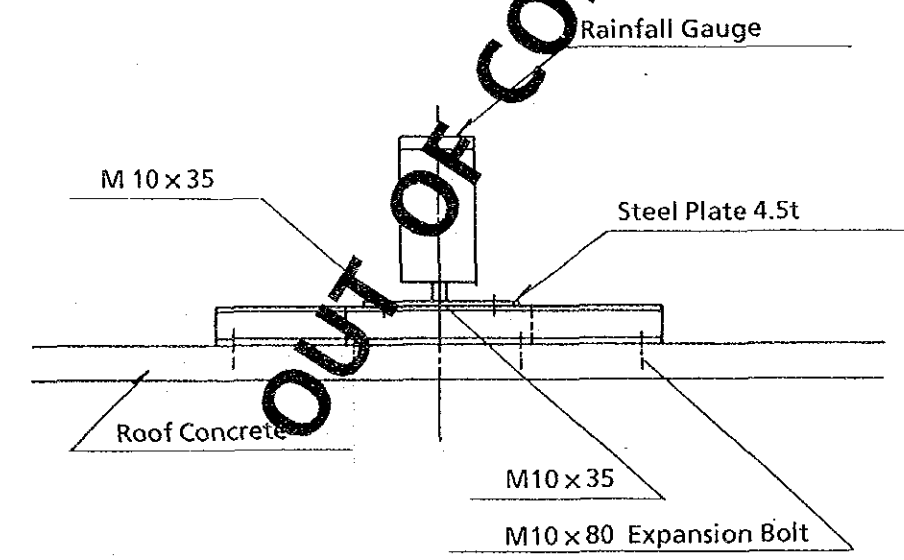
No material shall be ordered or shop work started until the Supervisor's approval of Shop Drawings has been given.



LAYOUT OF NAKHON SAWAN GAUGING STATION



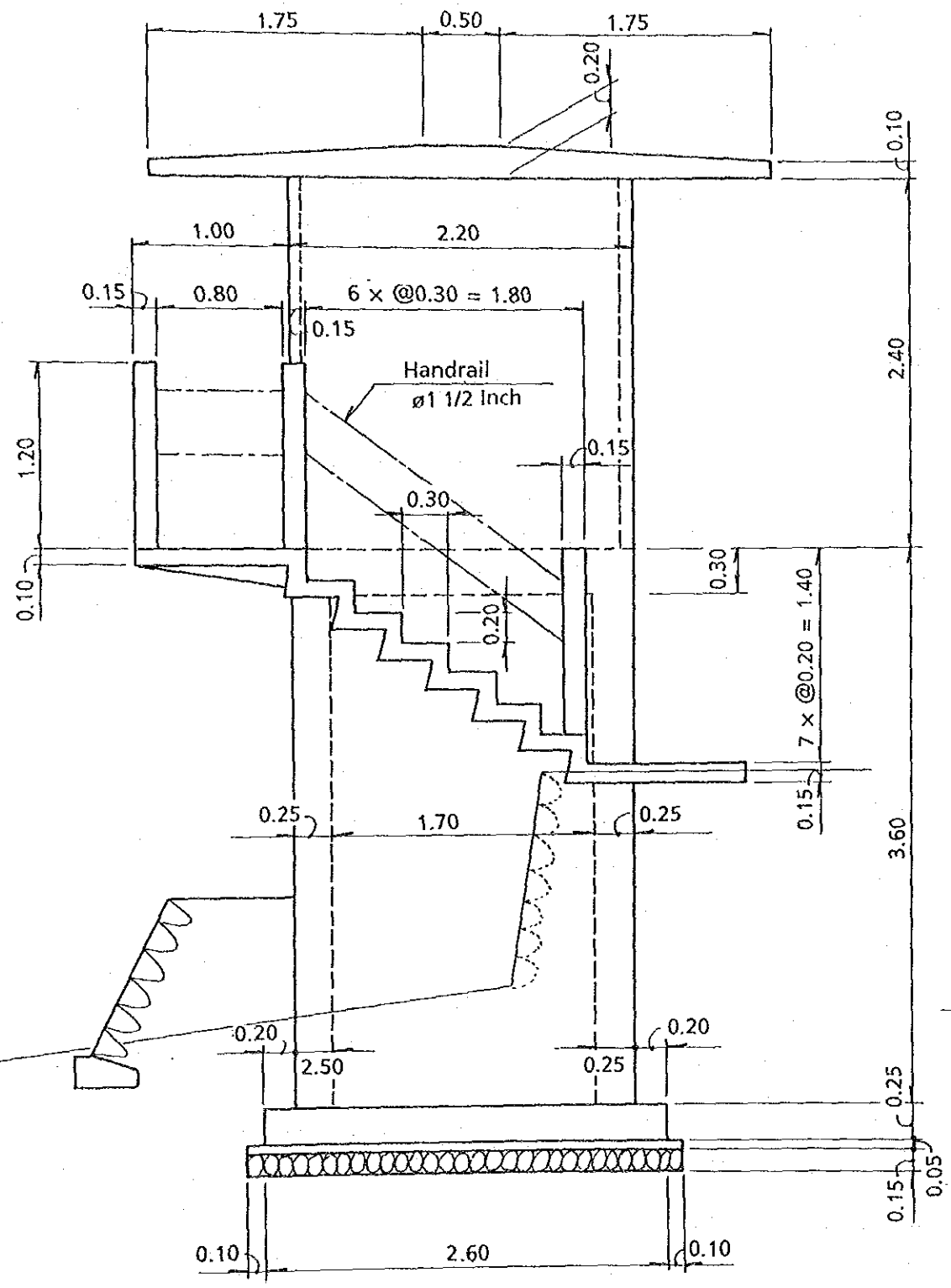
DETAIL OF RAINFALL GAUGE



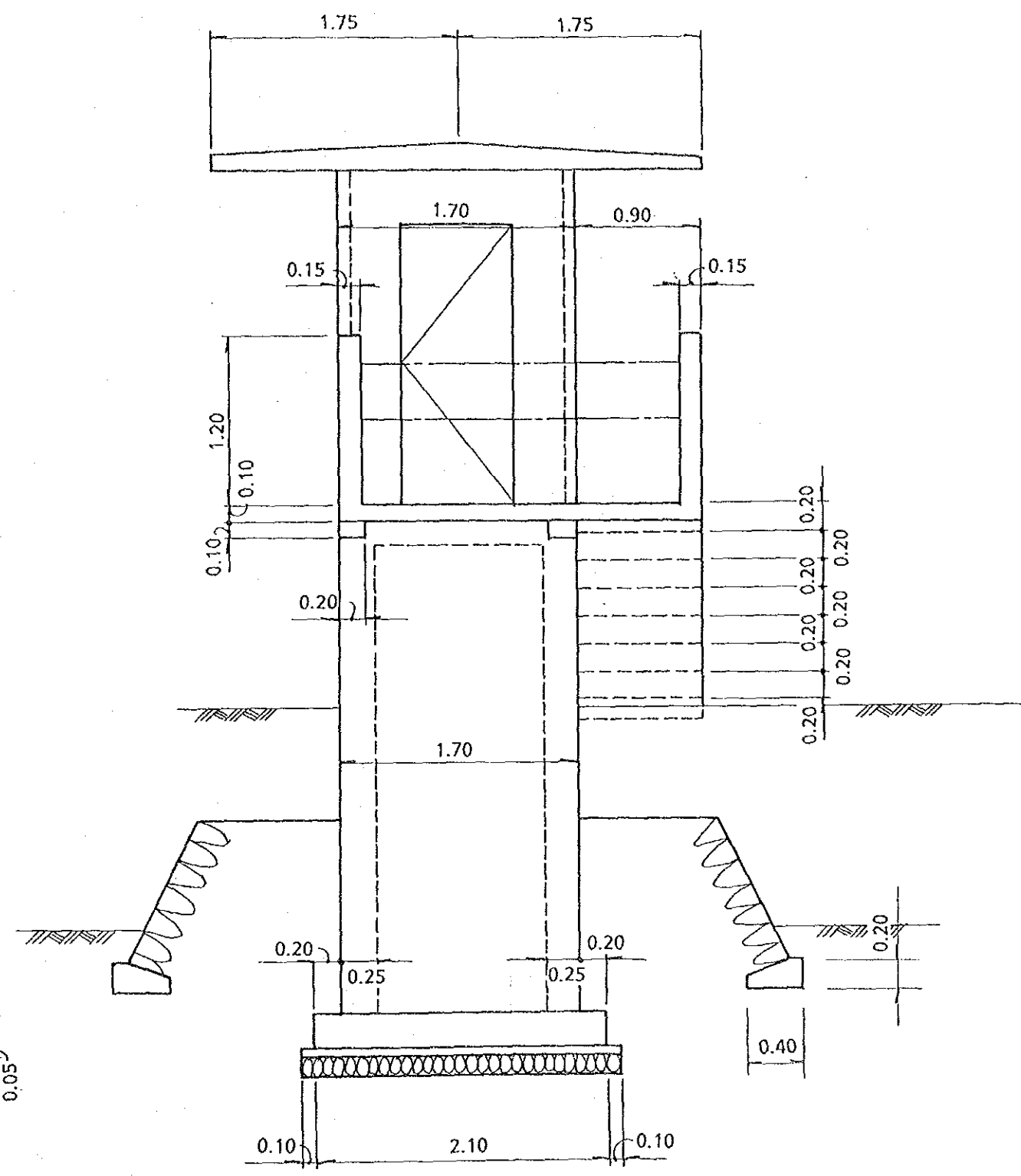
ELEVATION OF RAINFALL GAUGE

OUT OF CONTRACT

DWG - IEC - 21	UNIT	METER
	SCALE	1/50, 1/20
PLAN AND RAINFALL GAUGE OF NAKHON SAWAN GAUGING STATION		
JAPAN INTERNATIONAL COOPERATION AGENCY		

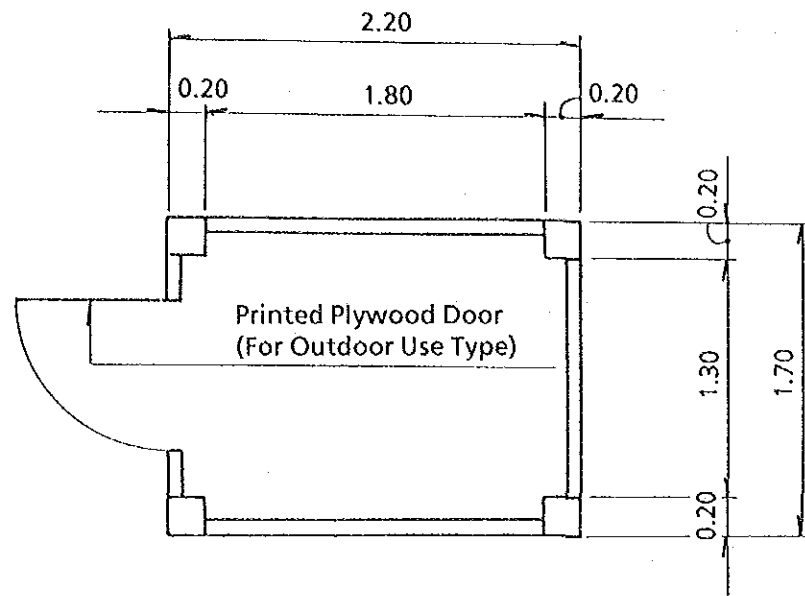


ELEVATION A

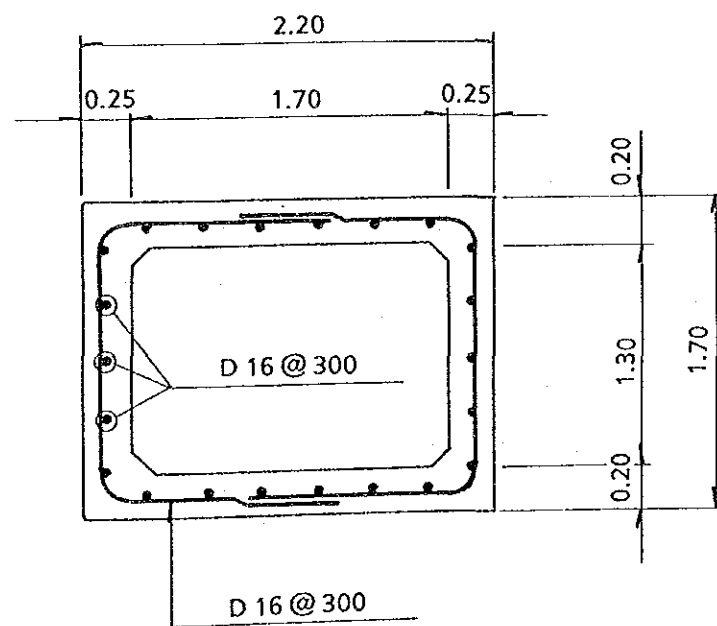


ELEVATION B

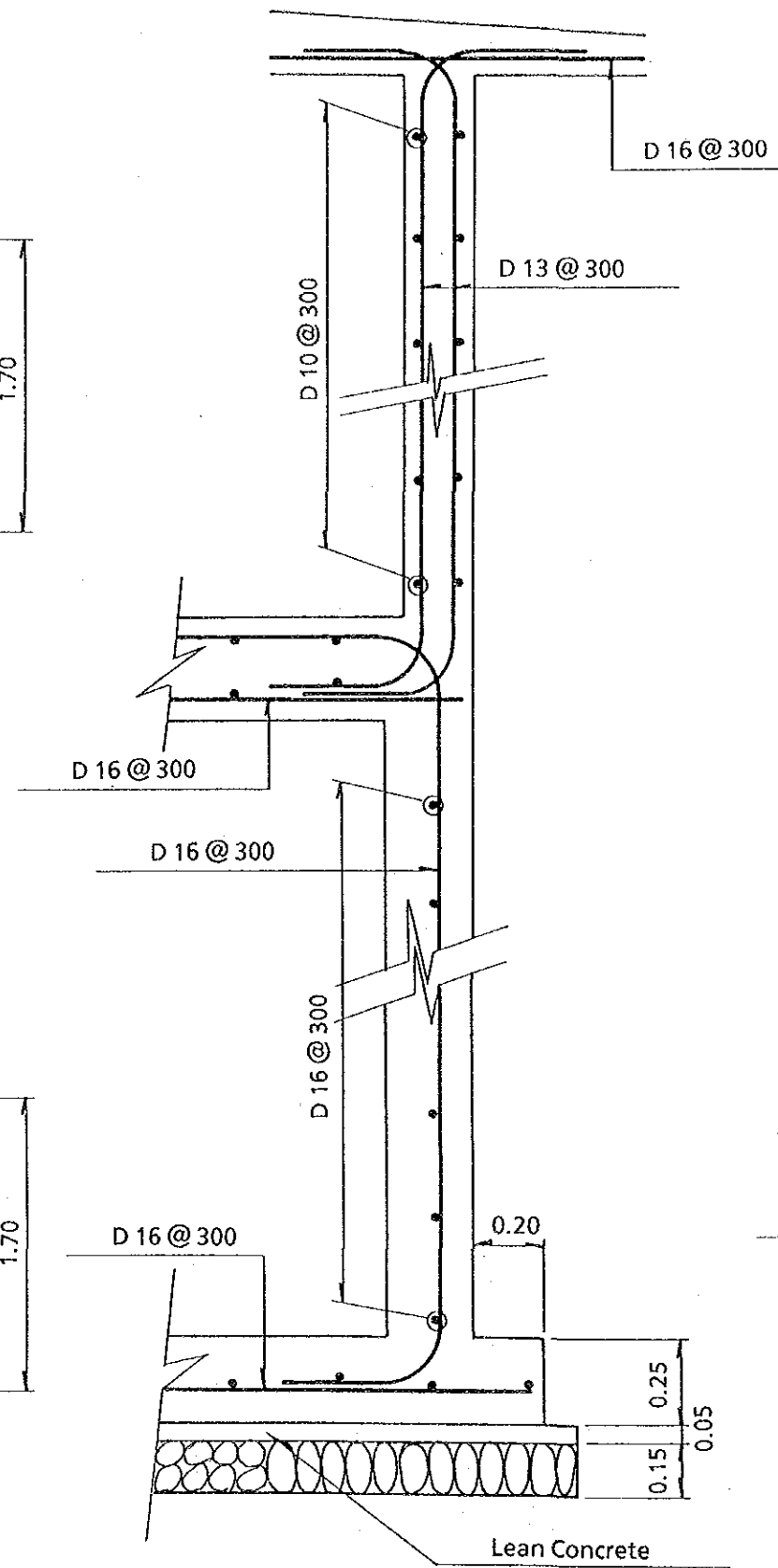
DWG - IEC - 22	UNIT	METER
	SCALE	1/40
STRUCTURE(1) OF NAKHON SAWAN GAUGING STATION		
JAPAN INTERNATIONAL COOPERATION AGENCY		



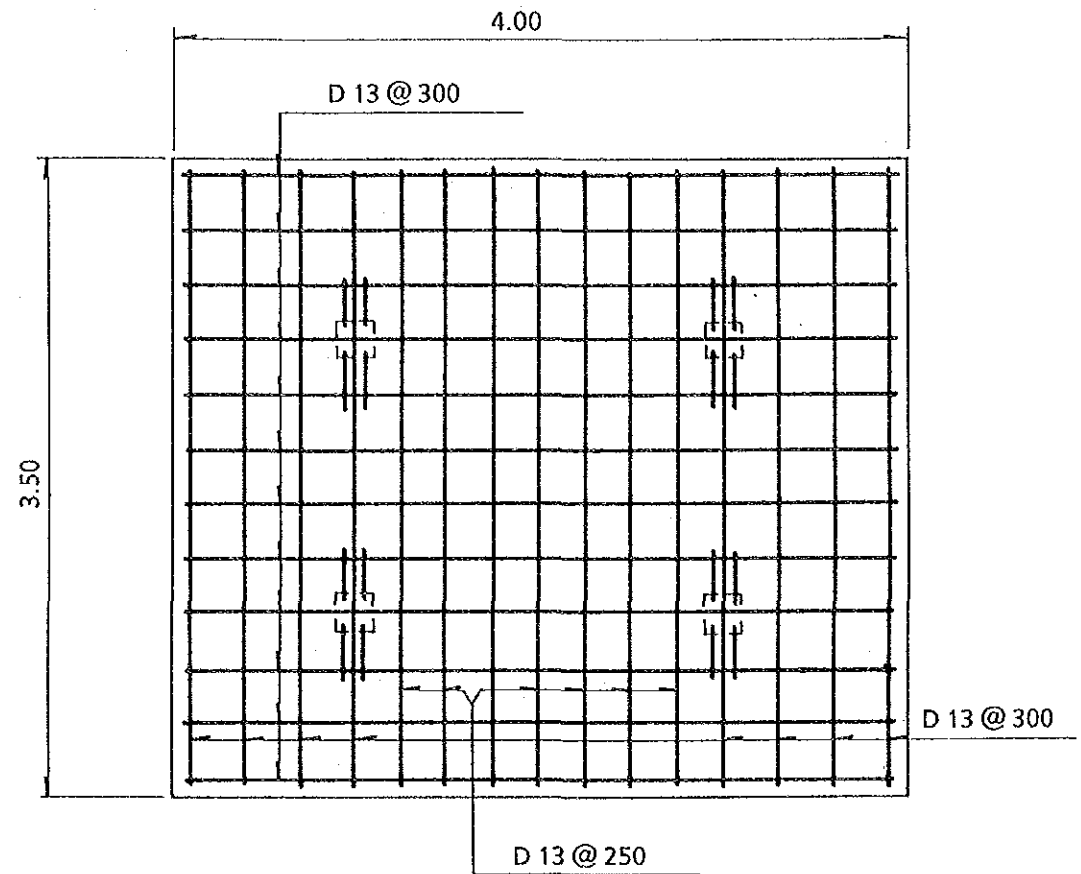
SECTION OF UPPER STRUCTURE



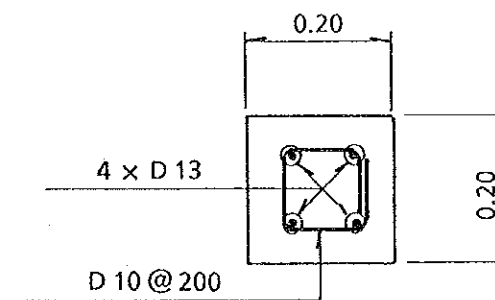
SECTION OF LOWER STRUCTURE



DETAIL OF FOOTING

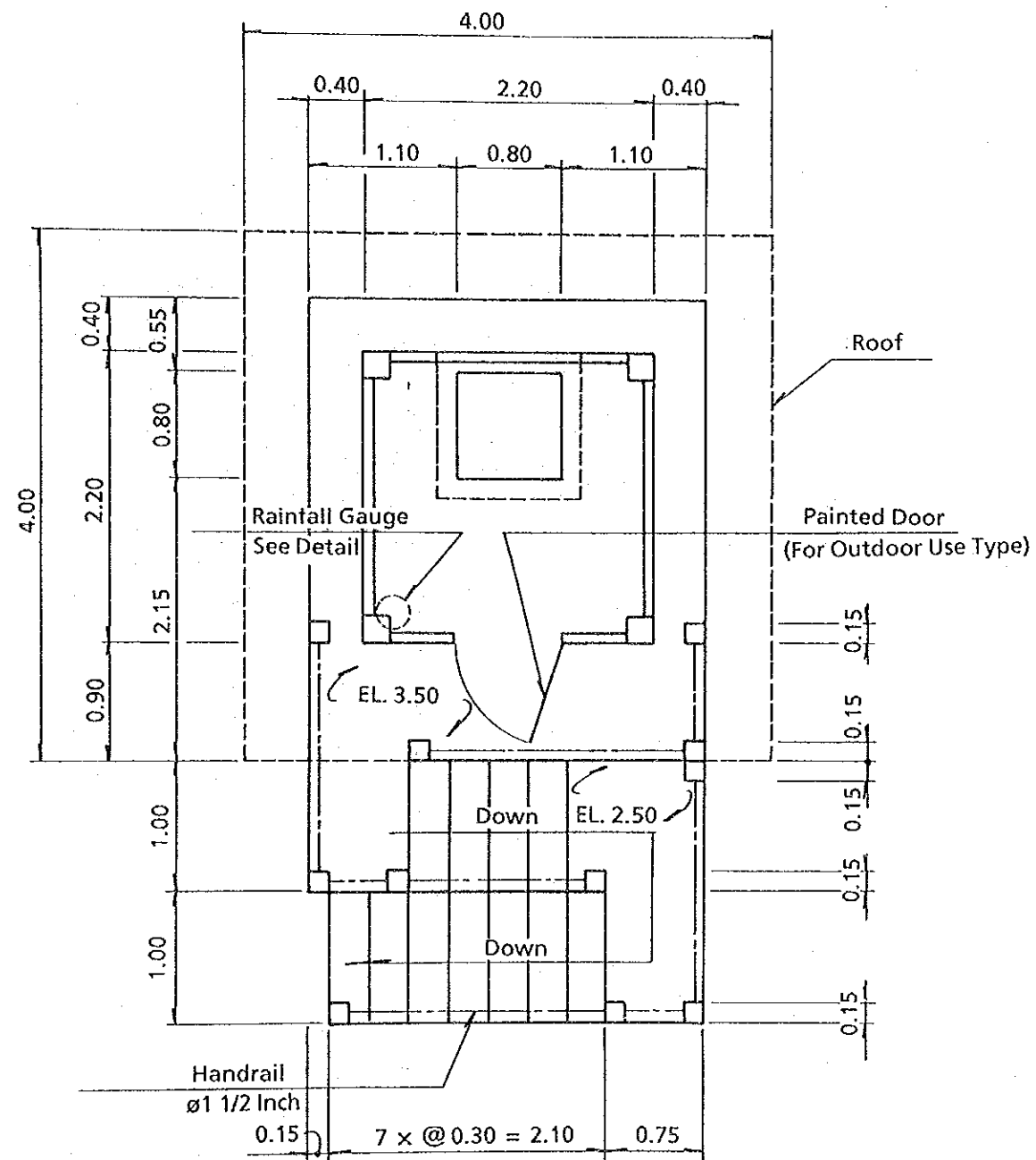


PLAN OF ROOF

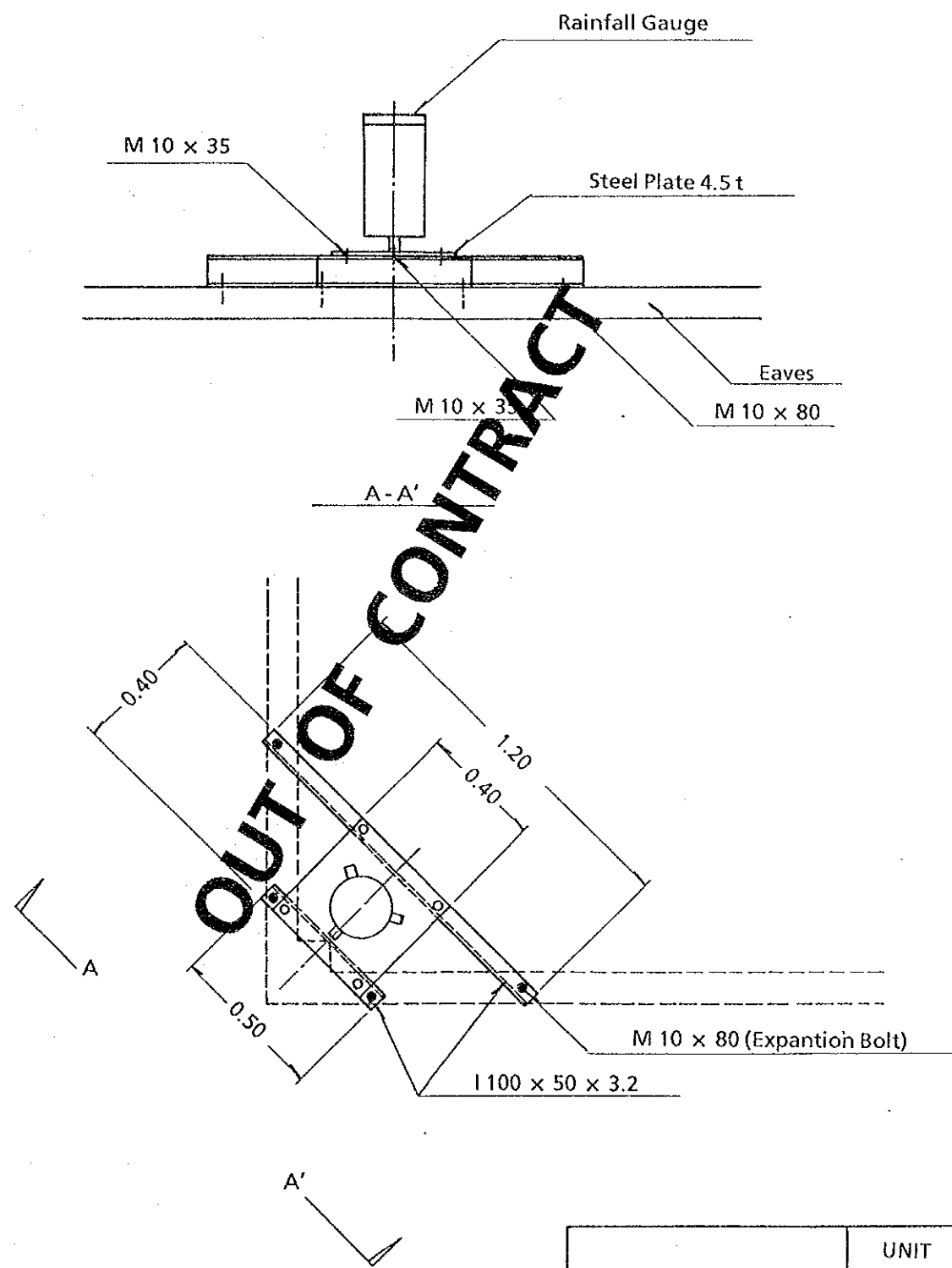


SECTION A-A

DWG - IEC - 23	UNIT	METER
	SCALE	1/40, 1/20, 1/10
STRUCTURE (2) OF NAKHON SAWAN GAUGING STATION		
JAPAN INTERNATIONAL COOPERATION AGENCY		

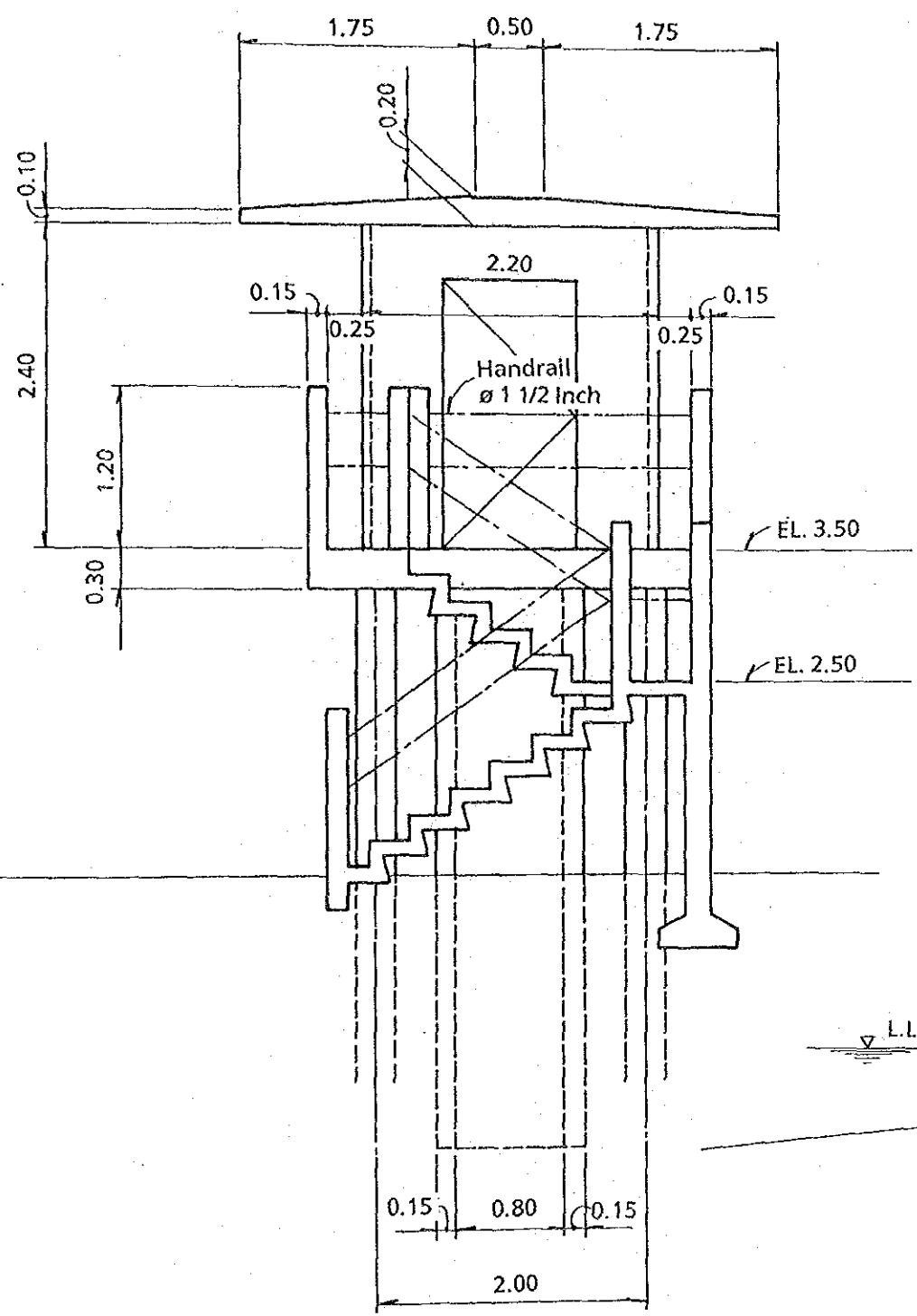


PLAN



OUT OF CONTRACT

DWG - IEC - 31	UNIT	METER
	SCALE	1/50, 1/20
PLAN AND RAINFALL GAUGE OF BANG SAI GAUGING STATION JAPAN INTERNATIONAL COOPERATION AGENCY		

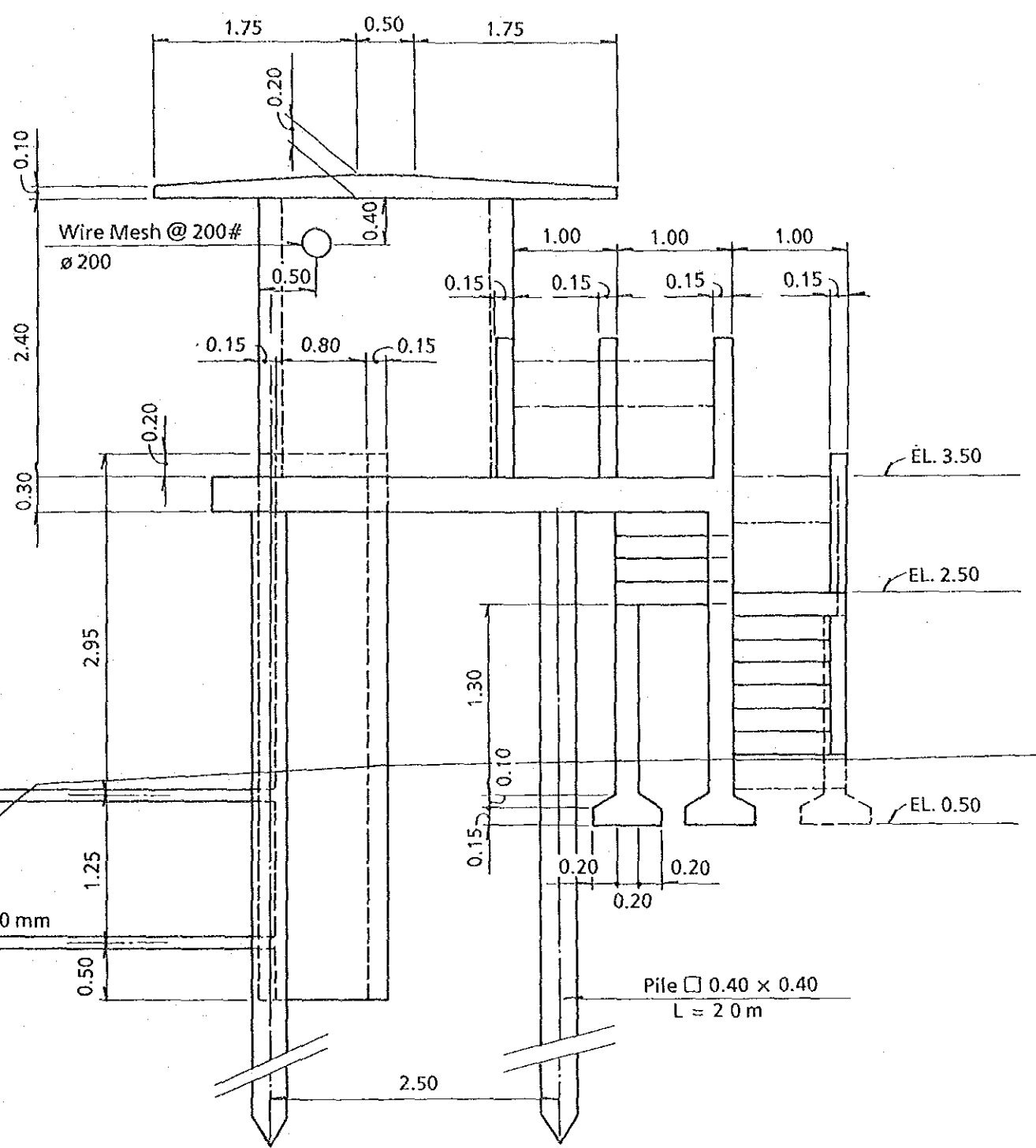


ELEVATION A

H.H.W.L 3.23
(1983)

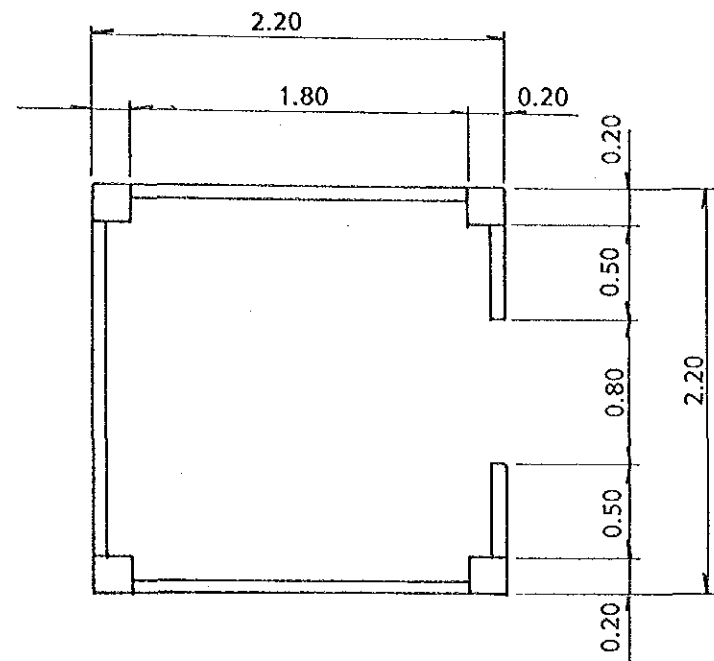
L.L.W.L - 0.27
(1991)

G.S.P. ϕ 50 mm

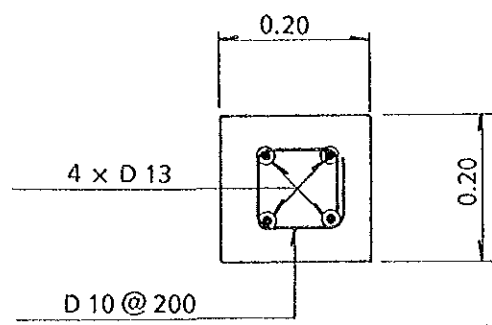


ELEVATION B

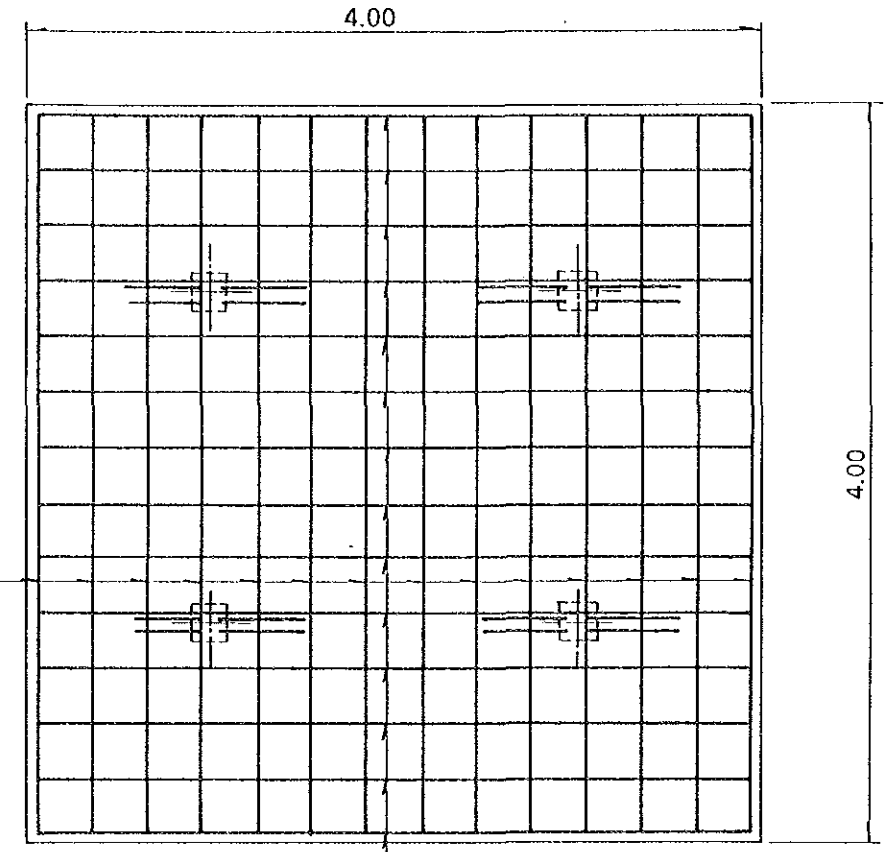
DWG - IEC - 32	UNIT	METER
	SCALE	1/50
STRUCTURE (1) OF BANG SAI GAUGING STATION		
JAPAN INTERNATIONAL COOPERATION AGENCY		



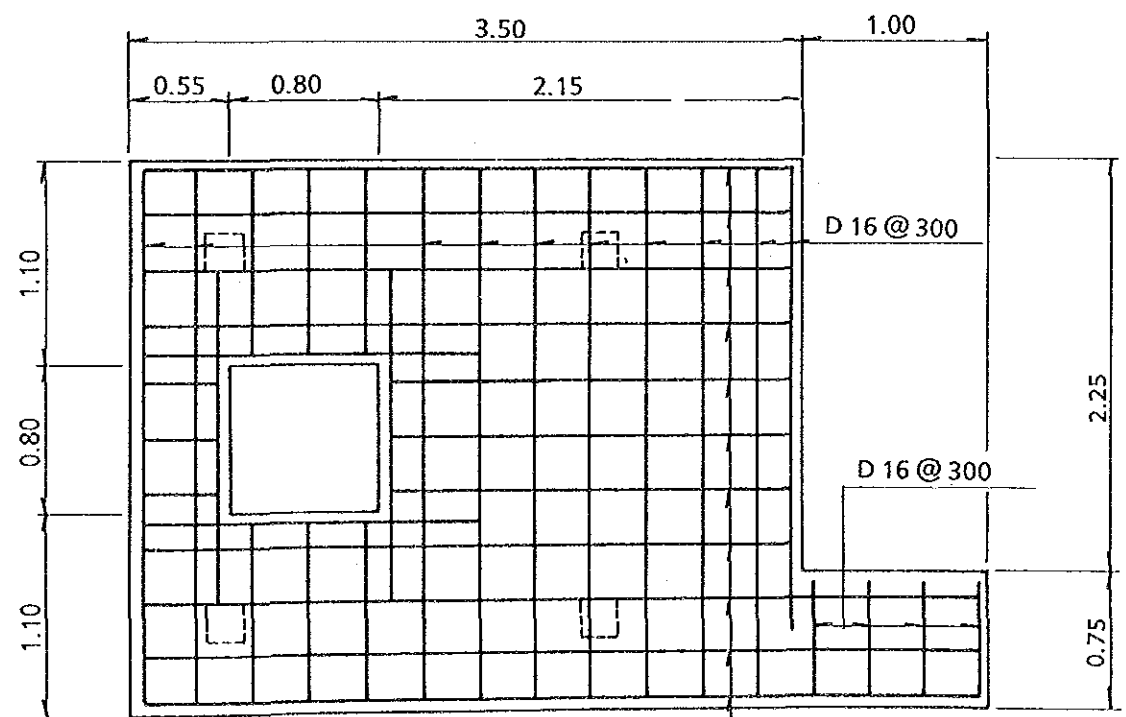
PLAN OF UPPER STRUCTURE



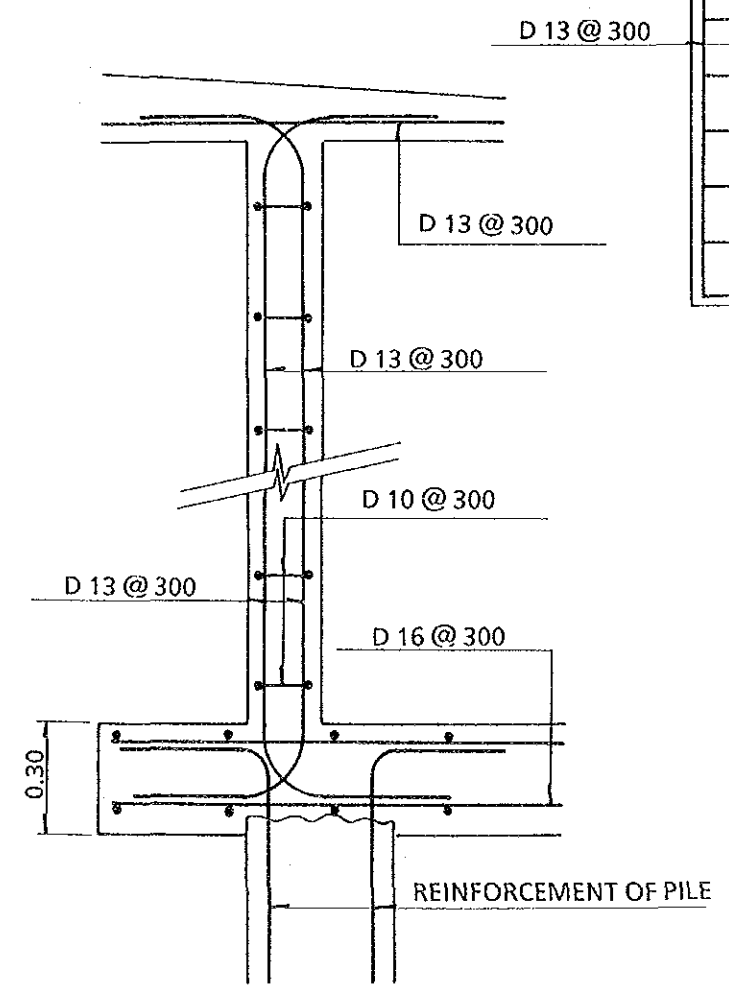
SECTION A - A



PLAN OF ROOF



REINFORCEMENT OF FLOOR

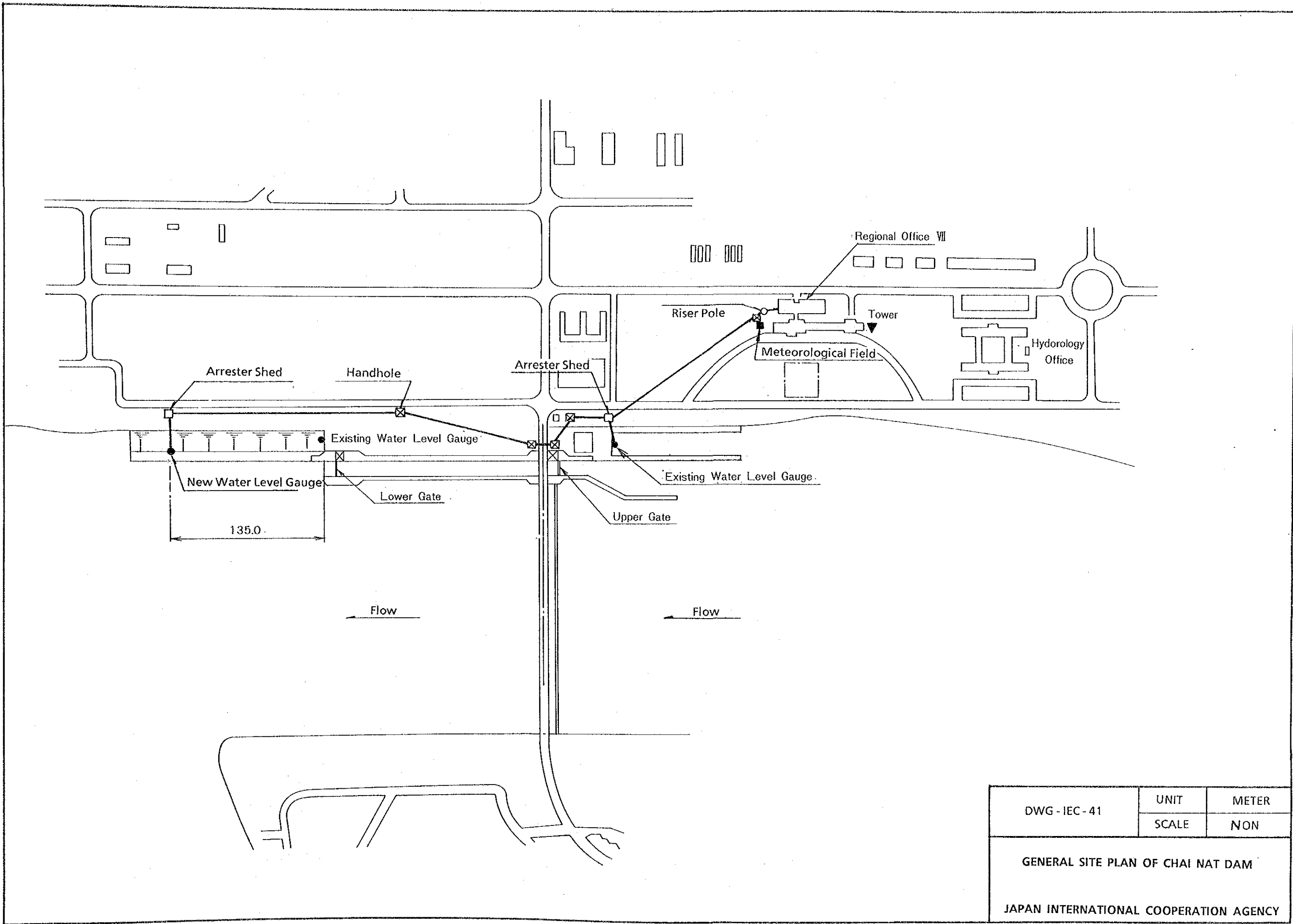


REINFORCEMENT OF PILE

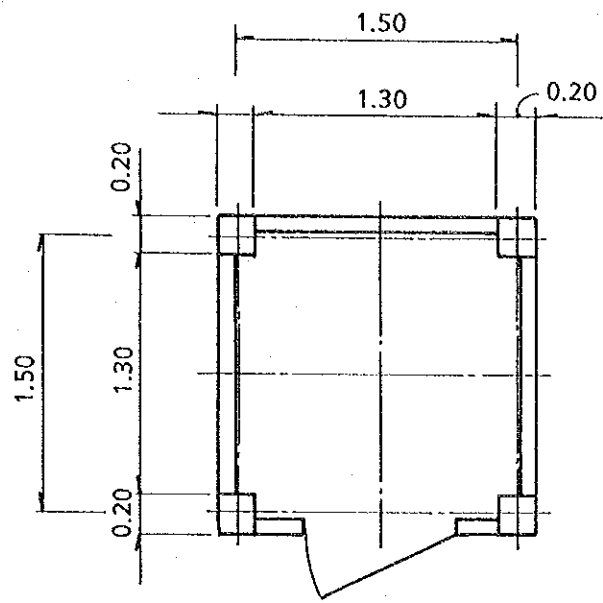
DWG - IEC - 33	UNIT	METER
	SCALE	1/40, 1/20, 1/10

STRUCTURE (2) OF
BANG SAI GAUGING STATION

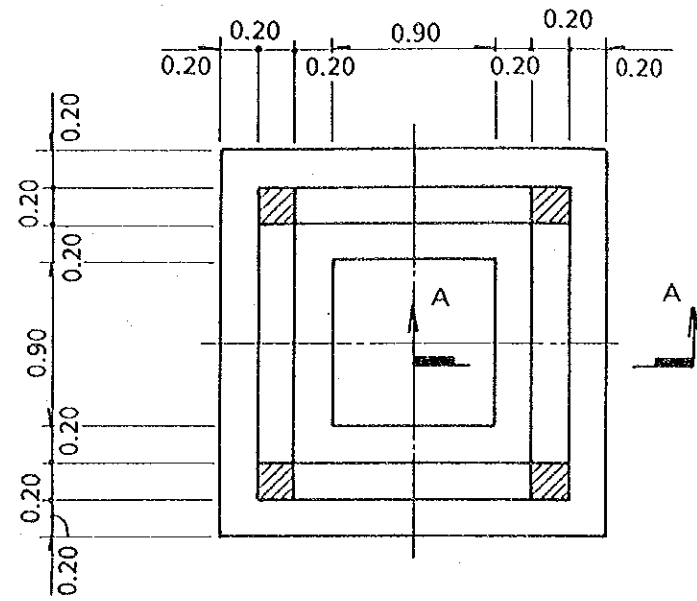
JAPAN INTERNATIONAL COOPERATION AGENCY



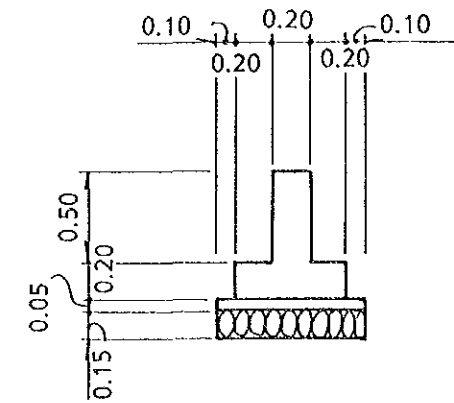
DWG - IEC - 41	UNIT	METER
	SCALE	NON
GENERAL SITE PLAN OF CHAI NAT DAM		
JAPAN INTERNATIONAL COOPERATION AGENCY		



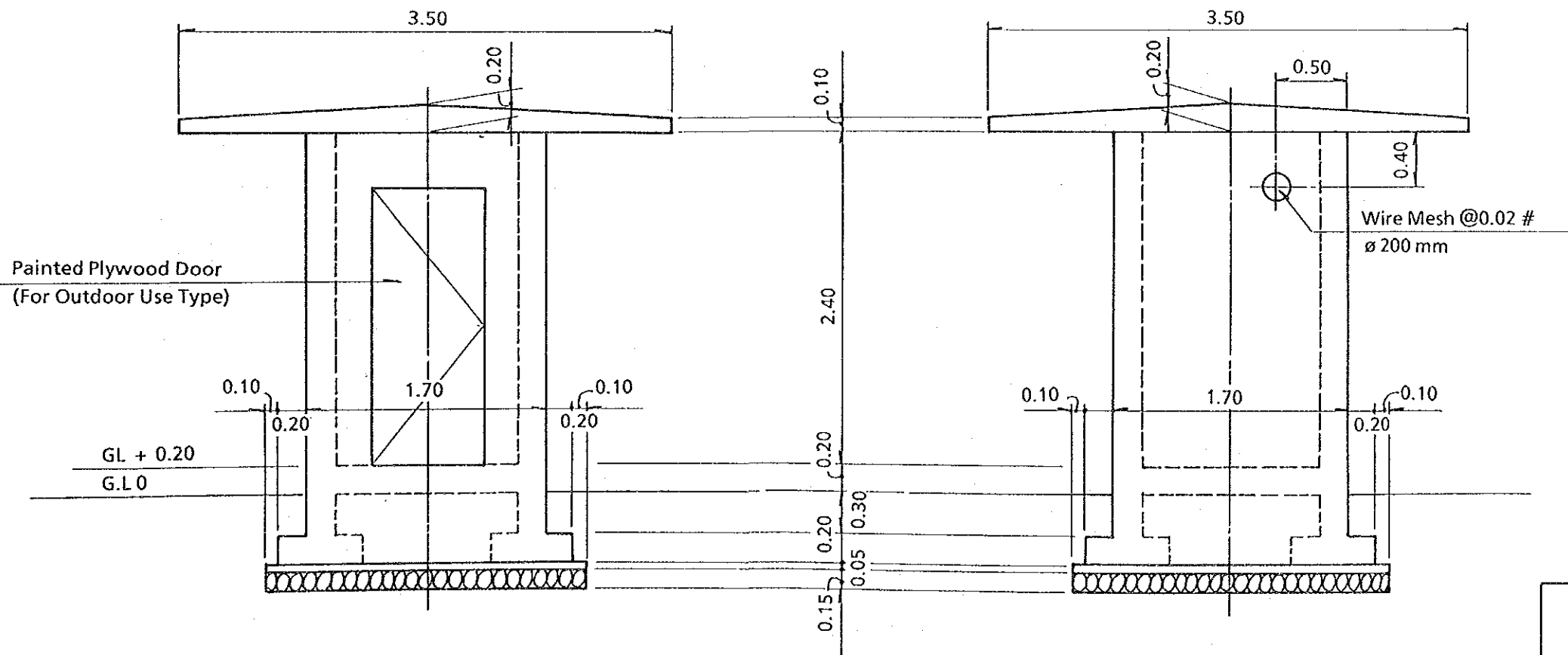
PLAN



PLAN OF FOUNDATION



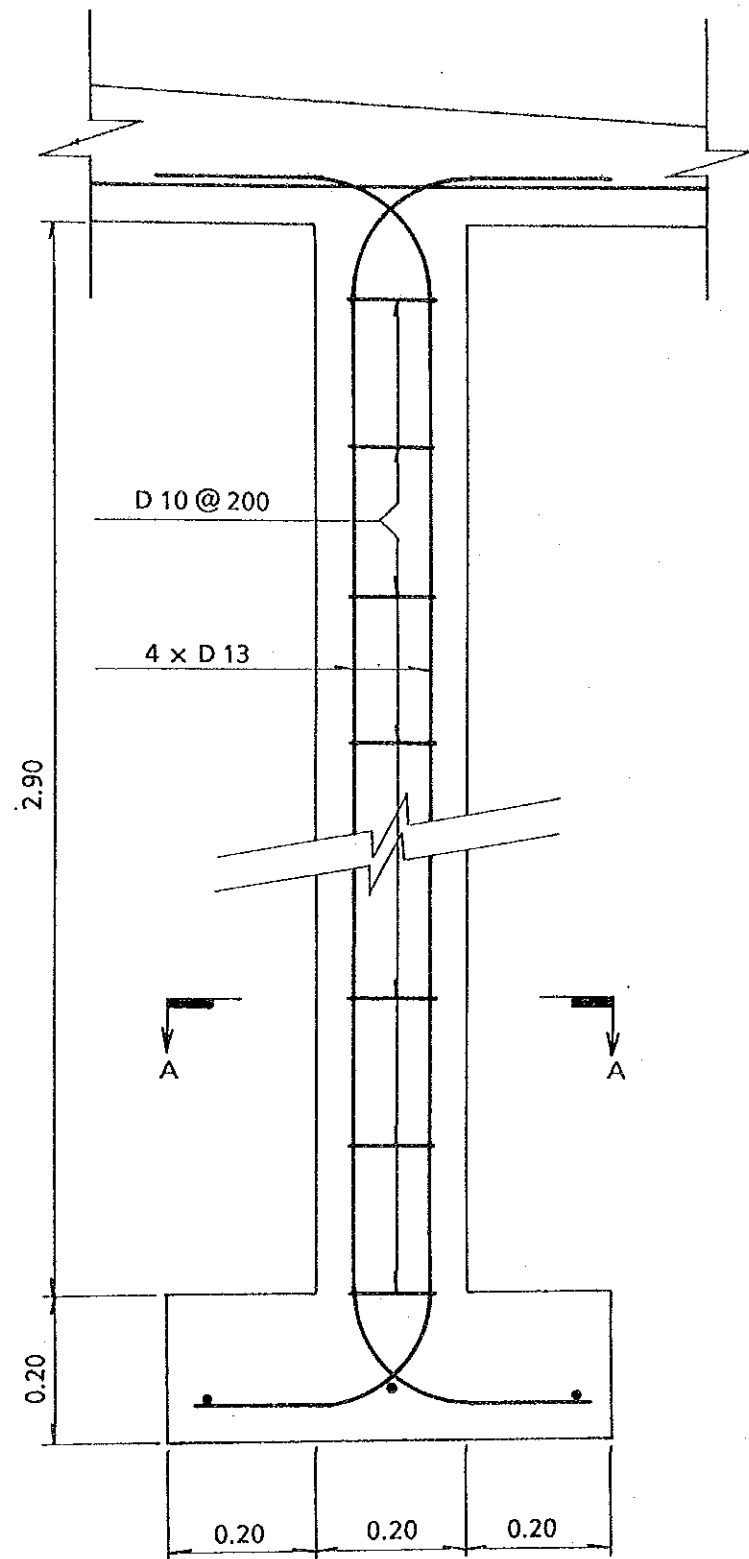
SECTION A-A



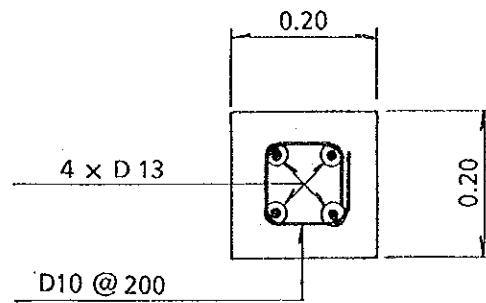
ELEVATION (A)

ELEVATION (B)

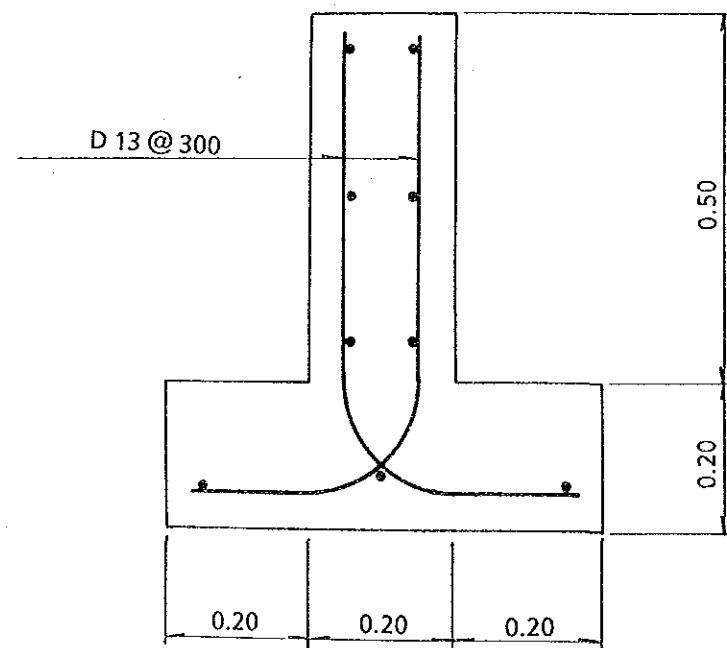
DWG - IEC - 42	UNIT	METER
	SCALE	1/40
STRUCTURE (1) OF ARRESTER SHED IN CHAI NAT		
JAPAN INTERNATIONAL COOPERATION AGENCY		



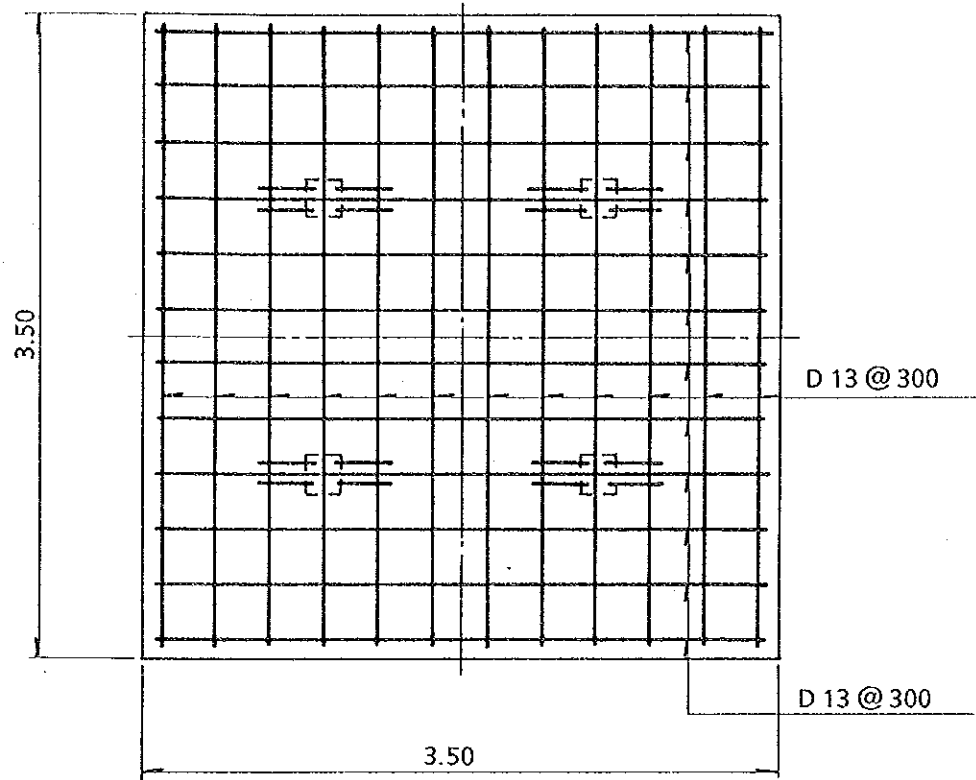
PILLAR



SECTION A-A



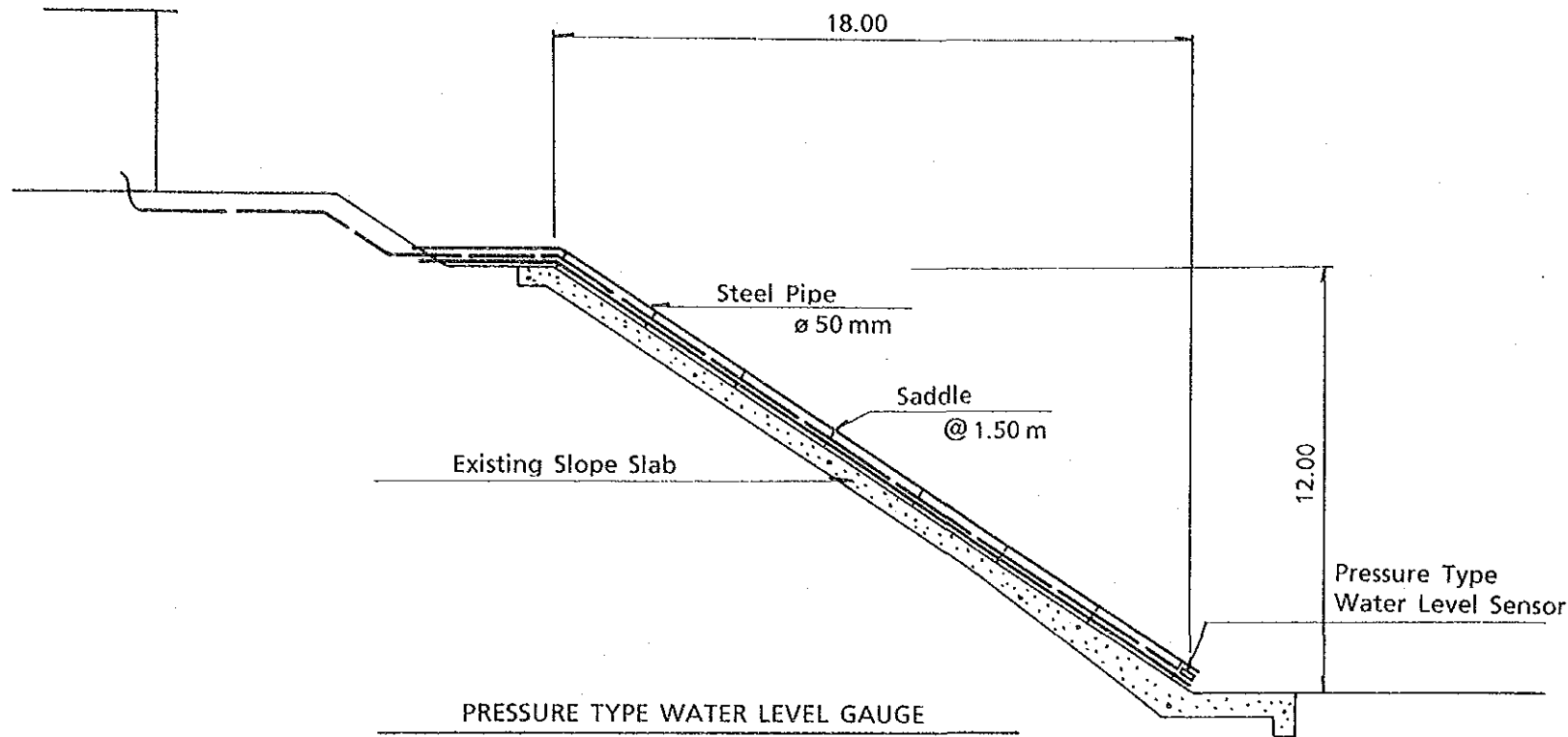
FOUNDATION



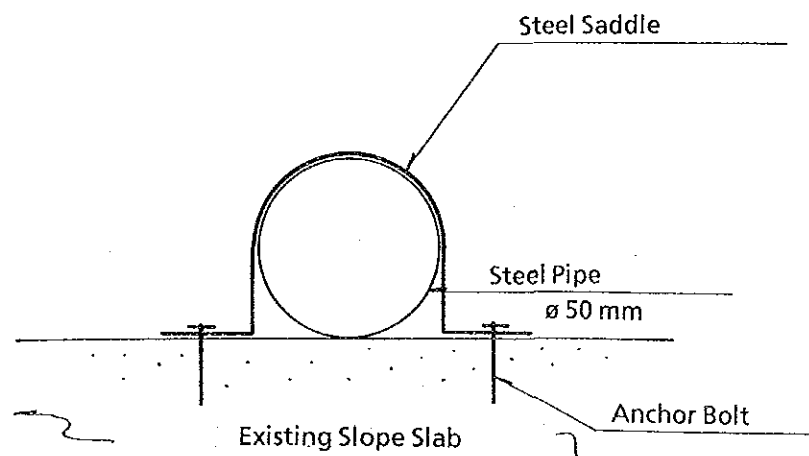
PLAN OF ROOF

S = 1 : 40

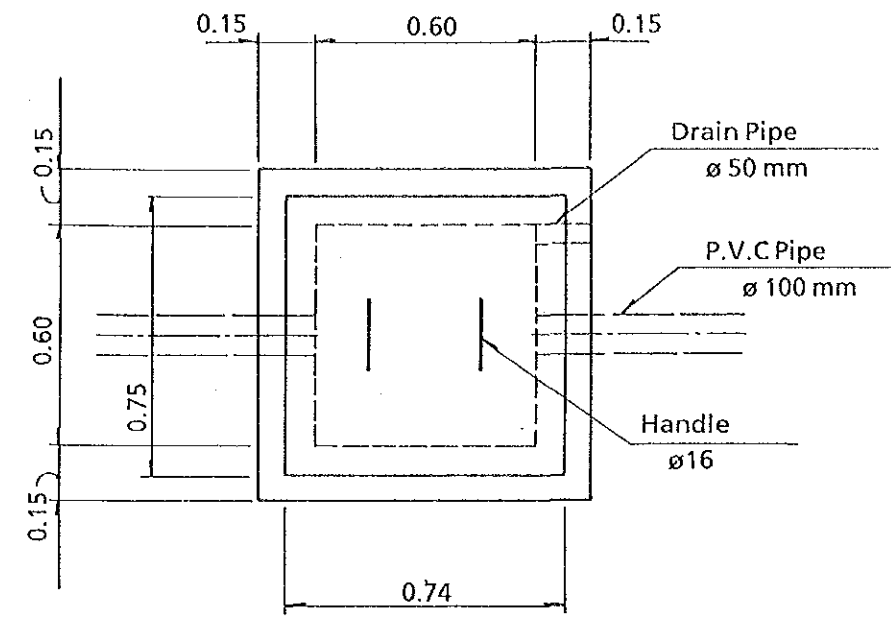
DWG - IEC-43	UNIT	METER
	SCALE	1/40, 1/20
STRUCTURE (2) OF ARRESTER SHED IN CHAI NAT		
JAPAN INTERNATIONAL COOPERATION AGENCY		



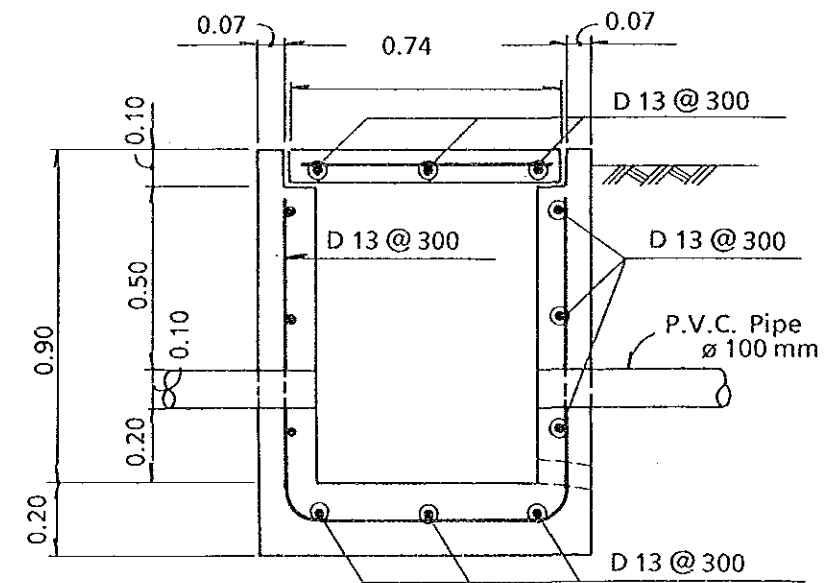
PRESSURE TYPE WATER LEVEL GAUGE
S = 1 : 200



DETAIL OF SADDLE

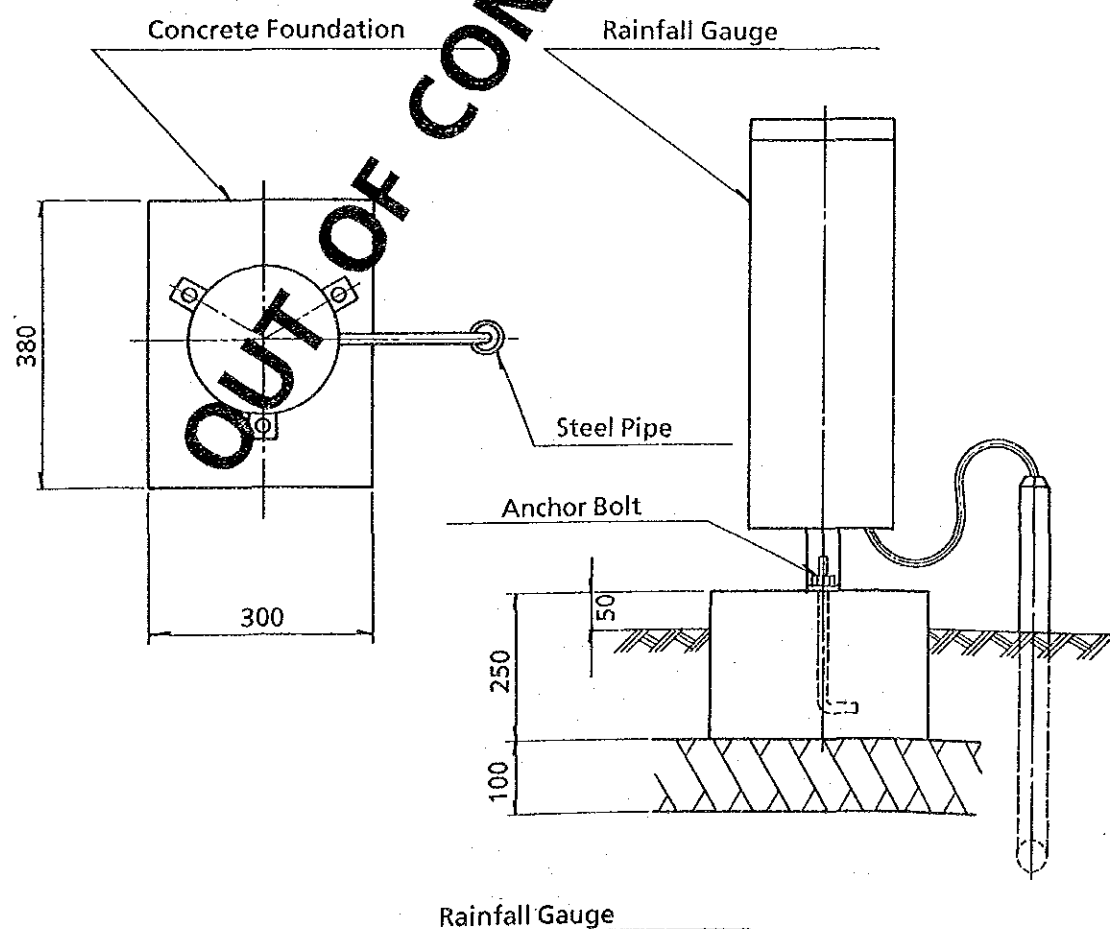
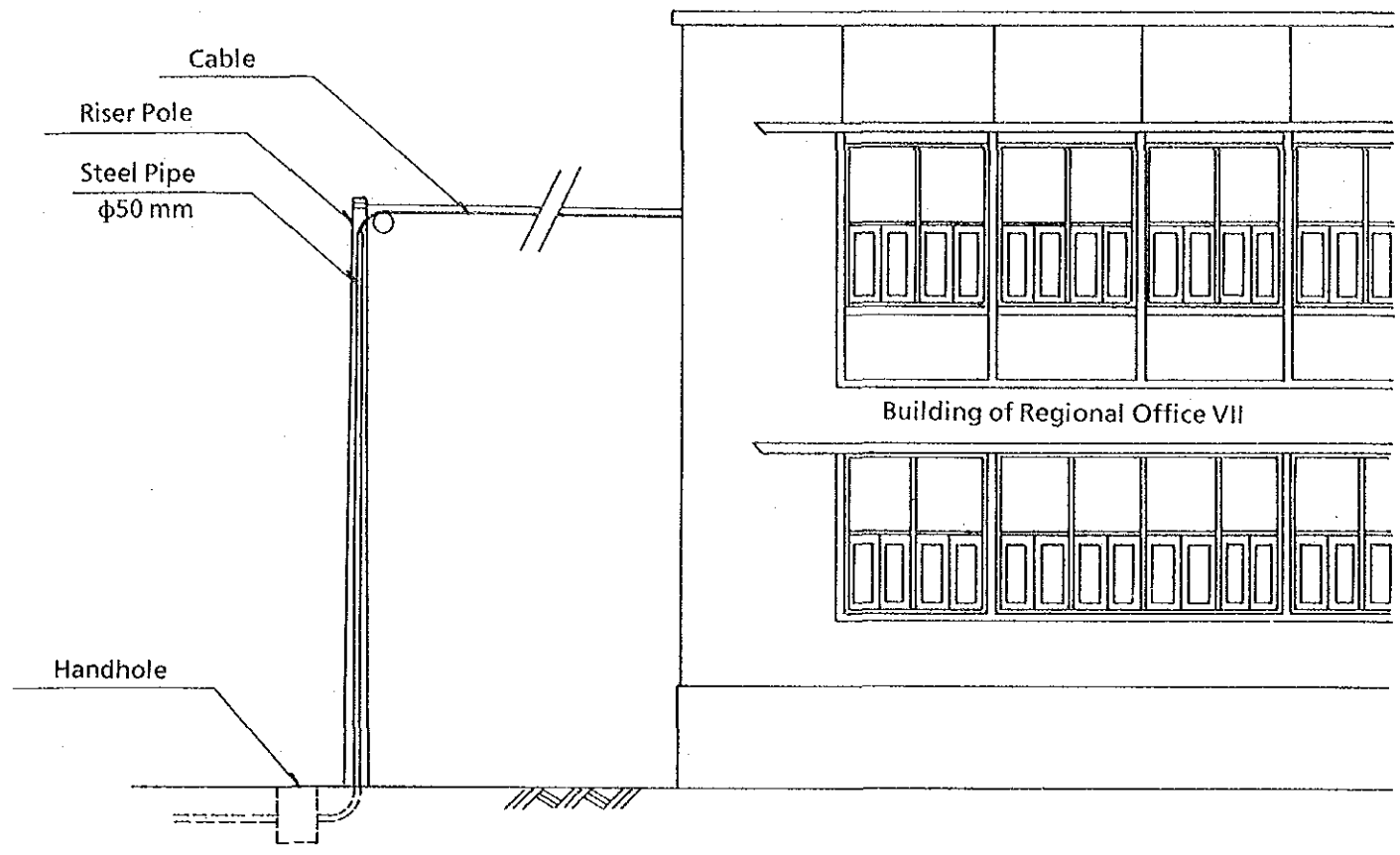
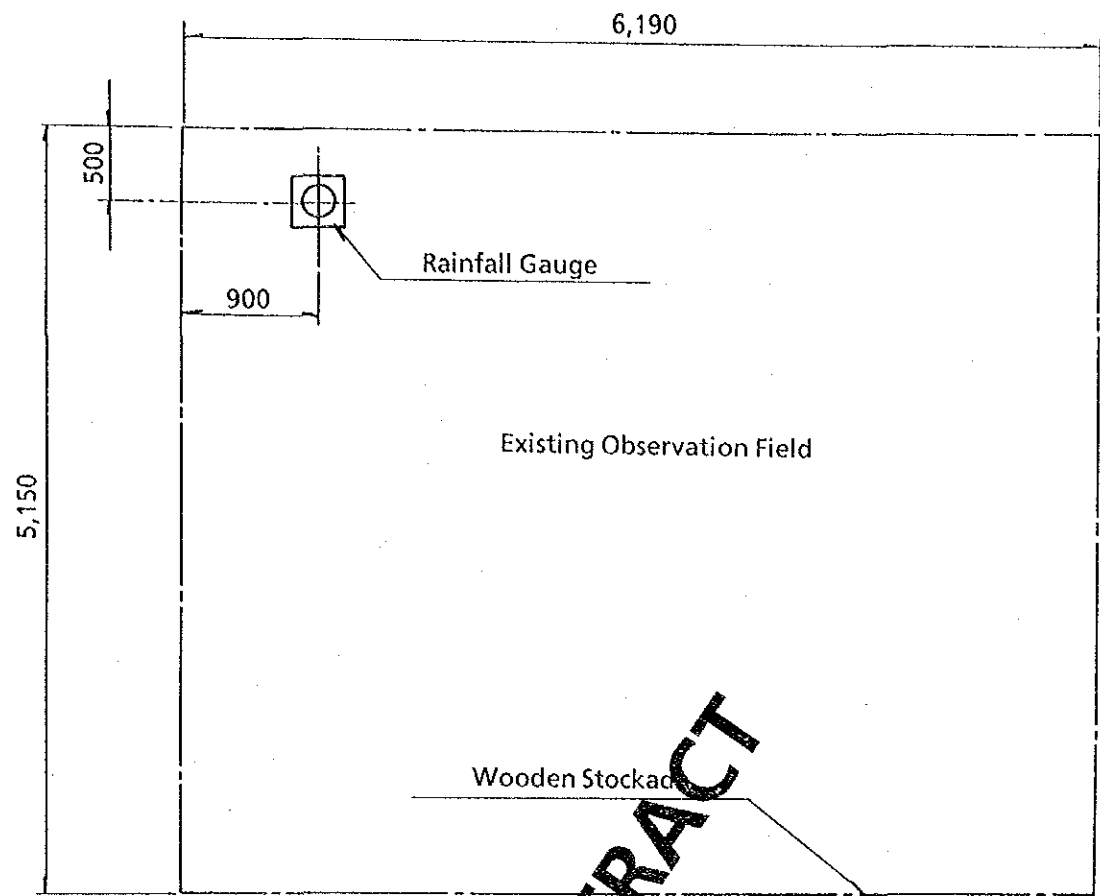


PLAN OF HANDHOLE



PROFILE OF HANDHOLE

DWG - IEC - 44	UNIT	METER
	SCALE	1/200, 1/20
PRESSURE TYPE WATER LEVEL GAUGE & HANDHOLE		
JAPAN INTERNATIONAL COOPERATION AGENCY		



Cable Installation

DWG - IEC-45	UNIT	mm
	SCALE	NO TO SCALE

RAINFALL GAUGE &
CABLE INSTALLATION PLAN IN CHAI NAT
JAPAN INTERNATIONAL COOPERATION AGENCY

OUT OF CONTRACT

BID DOCUMENTS 3

CONTRACT FOR SALE
OF
MATERIALS AND/OR EQUIPMENT
FOR
WATER MANAGEMENT SYSTEM IN IEC

This Contract is execute and delivered this () day of (month),
(year) in Bangkok, Thailand , by and between

JAPAN INTERNATIONAL COOPERATION AGENCY
Thailand Office
1674/1 New Petchburi Rd. Bangkok

represented by Mr. Nobuji ABE, hereinafter referred to as the
"Buyer" and

represented by Mr. (name) , hereinafter referred to as the
"Seller".

Both parties mutually agree as follows:-

1. AGREEMENT FOR SALES

The Buyer agrees to buy and the Seller agrees to sell the materi-
als and/or equipment (hereinafter referred to as the "Products")
in accordance with the terms and conditions of this Contract as
follows:-

Total Contract Value = Baht
(wording of total contract value, put Baht only in last)

Details as the attached herewith;

2. GUARANTEED DELIVERY TIME

The Seller guarantees to make and complete delivery of the
Products within (number of days) days from the date of this
Contract.

3. ACCIDENTS

In case of accidents occurred in transportation of the Products,
the Seller shall be fully responsible for them.

4. INSPECTION

The Buyer or the person whom the Buyer appointed shall inspect
the quantity and quality of the Products.

In case of failure on the parts of them, the Buyer shall claim
for the damages. The inspection shall be made as soon as the

Products arrive at the site mentioned above.

5. PAYMENT

Payment of all amounts due to the Seller under the terms of this Contract shall be made within one (1) week after the completion of the inspection at the Buyer's site mentioned above.

6. DELAY PENALTY

In case of failure on the part of the Seller to deliver the Products within the period of time specified in Article 2 of this Contract, the Seller agrees to pay the Buyer a penalty imposed on a daily basis at the rate of 0.10 % of the price of the Products remaining undelivered. A Maximum penalty shall not exceed 10 % of such price.

7. JURISDICTION

The proper law of this Contract shall;; be the law in force in the Kingdom of Thailand.

8. PERIOD OF GUARANTEE

One (1) year from acceptance date of the Buyer's authorized person and the Seller shall render all necessary after sales services for the Products during guarantee period on the Seller's account.

9. OTHERS

The Buyer shall take necessary measures except the Seller's custom duty, internal tax and other fiscal level which may be imposed to the Kingdom of Thailand with respect to the supply of Products, services and equipment necessary for the works.

10. COUNTERPARTS

This Contract is executed in two identical counterparts; one for Buyer, one for the Seller.

JAPAN INTERNATIONAL
COOPERATION AGENCY

(name of Seller)

By; _____
Mr. Nobuji ABE

By; _____
Mr.

Witness:

witness:

By; _____
Mr. Junji YOKOKURA

By; _____
Mr.

Item	: A-01
Description	: MICRO VAX 3100 Model 20e
Quantity	: 1 set

1. General

This CPU has duty as host processor for entire system of Water Management System including data communication. Therefore, it should be multi-task processor.

The data communication shall be established by TOT leased line. The system should have software to keep communication between remote stations.

2. Specifications

- a. Memory capacity : 16 MB
- b. Disk capacity : 209 MB × 3
- c. Magnetic tape unit : 95 MB cartridge tape
- d. ETHERNET controller : need
- e. Operating system : VMS 5.3
- f. Others : DEC net full function
VAX FORTRAN
VAX DSM
VAX FMS
VAXCLUSTER
VAX PCSA
- g. UPS : 1 KVA

Item	: A-02
Description	: VAX Station 3100 Model 48
Quantity	: 1 set

1. General

This CPU has duty as graphic processor for Supporting System of Water Management.

The CPU should be connected with Video Projector to display the figure on the screen and color printer to take hard copy.

2. Specifications

- a. Memory capacity : 16 MB
- b. Disk capacity : 644 MB
- c. Magnetic tape unit : 95 MB cartridge tape
- d. CD-ROM : 600 MB
- e. ETHERNET contoller : Need
- f. Monitor : 19 inch color monitor resolution
1,024 × 864 pixels
- g. Operating system : VMS 5.3
- h. Others : DEC Windows - Full document
DEC net - END Node
VAXCLUSTER
DEC/GKS - Full development
VAX FORTRAN - Right to copy
VAX FMS - Right to copy
VAX DSM - Right to copy
- g. UPS : 1 KV

<u>Item</u>	<u>: A-03</u>
<u>Description</u>	<u>: VT 382 Terminal</u>
<u>Quantity</u>	<u>: 2 sets</u>

1. General

These terminals are used for a console display and VT terminal individually.

2. Specifications

- a. CRT : 14 inch monochrome screen
- b. Character fonts : 11 × 26 (80 columns)
- c. Display format : 24 lines
- d. Communication : Host - RS232C
Printer - DEC423

Item	:	A-04
Description	:	Network Equipment
Quantity	:	1 L.S

1. General

This equipment has duty to establish the Local Area Network (LAN) in the IEC computer system.

To establish the LAN for the Water Management System, ETHERNET is installed.

2. Specifications

- a. CEC server 200/VMS
- b. Thick wire ETHERNET
- c. Thin wire ETHERNET
- d. Coaxial cable
- e. DEC ETHERWORKS

<u>Item</u>	<u>: A-05</u>
<u>Description</u>	<u>: Laser Printer (Host Processor)</u>
<u>Quantity</u>	<u>: 1 set</u>

1. General

After data processing on the host processor, result data processing are printed out through the printer. Generally, the volume of result are plenty, high speed printer is connected with host processor.

2. Specifications

- a. Printing process : Dry type laser electro-photography
- b. Printing speed : 8 pages per minutes
- c. Interface : RS-232C

<u>Item</u>	<u>:</u>	<u>A-06</u>
<u>Description</u>	<u>:</u>	<u>Image Printer (EWS)</u>
<u>Quantity</u>	<u>:</u>	<u>1 set</u>

1. General

Many number of figures and tables are processed on the EWS for Water Management System.

These figures and tables are printed out by image printer..

2. Specifications

- a. Printing Method : Thermal ink jet
- b. Printing Mechanism : 2 disposable ink cartridges
- c. Printing Speed : Black 167 cps
Color 55 cps
- d. Graphics Print Speed : 2 - 4 minutes per page
- e. Print Density : 180 × 180 dpi

Item	: A-07
Description	: Personal Computer
Quantity	: 4 sets

1. General

A Personal Computer (PC) out of 4 PCs is installed at Hydrology Division in IEC.

Three PCs are provided to the Chai Nat Region VII Office, Chai Nat Hydrology Office and Lop Buri Region VIII Office.

2. Specifications

- a. CPU : I 80386
- b. Coprocessor : I 80387 Mathematic Coprocessor
- c. Memory : 4 MB, up to 16 MB on board
- d. Hard disk : Approx. 100 MB
- e. Floppy disk : 3.5 inch FDD × 1
5 inch FDD × 1
- f. Display : 14 inch color display monitor
- g. Key board : 101 Keys AN
- h. UPS : 1 KVA

<u>Item</u>	<u>: A-08</u>
<u>Description</u>	<u>: Serial Printer</u>
<u>Quantity</u>	<u>: 4 sets</u>

1. General

To keep the result of analysis, entried data and source programs, the serial printers are prepared for the personal computer system.

2. Specifications

- a. Printing method : Impact dot matrix
- b. Number of pins in head : 24 pins
- c. Print Speed : Draft 10 cpi, more than 225 cps
Letter quality 10 cpi, more than 75cps
- d. Printable columns : 136 columns
- e. Ribbon cartridge : Color

Item	: A-09
Description	: Plotter
Quantity	: 1

1. General

Many kinds of graphs are processed at Hydrology Division at IEC by a personal computer system.

To make a copy of hydrological analysis, a small size plotter is installed for above mentioned requirement.

2. Specifications

- a. Type of plotter : Flat bed
- b. CPU : 16 - bit
- c. Driving system : Digital servo
- d. Max. plotting area : A3
- e. Max. pen speed : 640 cm/sec or more
- f. Number of pens : 8
- g. Mech. resolution : 0.005 mm or more
- h. Interface : RS-232C

Item	: A-10
Description	: Digitizer
Quantity	: 2 sets

1. General

To entry the observed data which are recorded on the chart papers, digitizer is used.

It can take a point of coordinate for a map or graphs before the data processing.

2. Specifications

- a. Digitizing method : Magnetic induction
- b. Effective digitizing Area : A3
- c. Effective digitizing Height : Within 5 mm
- d. Resolution : Up to 0.025 mm
- e. Point reading accuracy : ± 0.5 mm
- f. Maximum output rate : ASCII format - 60 points/sec
Binary format - 150
- g. Interface : RS-232C

Item	:	A-11
Description	:	MODEM
Quantity	:	3 sets

1. General

To keep the data communication between the master station in IEC and three remote stations, the MODEM are needed to modulate and demodulate the signals from digital to analog or reversal.

A MODEM is connected with a personal computer by the interface cable of RS-232C.

2. Specifications

- a. Transmission line : TOT leased line
- b. Standard of communication : CCITT V.26 bis
- c. Transmission method : Full-duplex
- d. Transmission speed : 2,400 bps
- e. Interface : RS-232C

<u>Item</u>	<u>: A-12</u>
<u>Description</u>	<u>: Desk 20 sets</u>
<u>Quantity</u>	<u>: Chair 9 sets</u>

1. General

The desks and chairs are provided to set the all of the computer equipments in the operation rooms.

2. Specifications

a. Dimension of desk : Apprx. 1,000 × 800 × 650
(W) (D) (H)

b. Type of Chair : Working chair with back-rest

Item	: B-01
Description	: Video Projector
Quantity	: 1 set

1. General

The video projector is installed to display the same figures and tables on the big screen as the monitor of EWS.

2. Specifications

- a. Projection System : 3 picture tube, 3 lenses, direct projection system
- b. Projected picture Size : 70 inch to 250 inch
- c. Color System : NTSC/PAL/SECAM/NTSC 4.43, automatically selected
- d. Resolution : 1,250 TV lines
1,110 × 970 pixels measured
- e. Scanning Frequency : Horizontal - 15 KHz - 75 KHz
Vertical - 28 Hz - 150 Hz
- f. Interface : Signal interface switcher
RGB 100 MHz

<u>Item</u>	<u>:</u>	<u>B-02</u>
<u>Description</u>	<u>:</u>	<u>Screen</u>
<u>Quantity</u>	<u>:</u>	<u>1 set</u>

1. General

The screen is provided to display the same figure and table as graphic display of EWS. The screen is fixed on the wall of Water Management Division in IEC.

2. Specifications

- a. Size of screen : 5 feet × 7 feet
- b. Operation method : Motor driven
- c. White board : 4 feet × 7 feet

Item	: B-03
Description	: Video Cassette Player
Quantity	: 1 set

1. General

The video cassette player is provided to show the audio source recorded cassette type.

The unit consists of video player and audio system.

2. Specifications

- a. Cassette Player : U-Matic cassette player
- b. Tape Speed : 9.53 cm/sec
- c. Horizontal Resolution : SP mode; 300 lines
High band mode; 260 lines
Low band mode ; 250 line
- d. Power Amplifier : 2 channels
- e. Speaker : Enclosure type of bass-reflex
Power handing of 100W

