SERICULTURAL DEVELOPMENT PROJECT IN INDONESIA

FINAL STUDY REPORT NO. 2

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JAPAN INTERNATIONAL COOPERATION AGENCY

ADT

CONTENTS

Chapter 6 Construction Plan

6-1 Construction Plan

6-1-1 Mulberry Field Reclamation

a) Outline

The following farms will be created in the proposed site of Sericulture Centre at .

	Mulberry Field	Grassland	Total
Farm No.1	2.96	0.98	3.94
Farm No.2	2.02	0.25	2.27
Total	4.98	1.23	6.21

Of the total farm area shown above, 3 ha mulberry field for silkworm egg production should be reclamined at an early stage. The reclamation work can be carried out in the wet season because the soil in the proposed farm site promises good drainage. However, for full coverage of the whole reclamation area which calls for compacting, it should preferably by conducted in the dry season.

The following new field will be created in the Sub-Centre site.

	Mulberry Fiedl	Glassland	Total
New Field	17.8	0	17.8

In the Sub-Centre area, too, reclamation of 3.5 ha mulberry field area should be completed at an early state. The reclamation work in this area should be planned with account taken of the following conditions.

(1) Use of large machinery is difficult because of the absence of a suitable transport road.

(2) The 1.5 km long connecting road between the national highway and New Field is in a poor condition. Passage of vehicles on this road is rejected even by a small rainfall. Further, there are no cross-rive bridges constructed on this road. The reclamation work should therefore be preceded by the improvement of the connecting road and the construction of temporary bridges.

(3) The Sub-Centre site is poorly conditioned for drainage because it is covered with heavy clay soil which makes the groundwater level very high even in the dry season (June ∿ September). Hence, the whole site is swampy throughout the year.

(4) Virtually now earthwork is required because the site is flat and not dispersed.

On account of these reasons, reclamation work in the wet season should be avoided as far as practicable. Further, it is necessary to make prior arrangements and consultation with the pertinent administrative authority to secure its cooperation in the execution of the reclamation work.

b) Sequence and Method of Reclamation Work

Sericulture Centre Area:

(1) Trees and weedes should be removed.

(2) Reference piles for farm reclamation and road construction should be driven on lines shown in the drawings according to the base lines and bench marks.

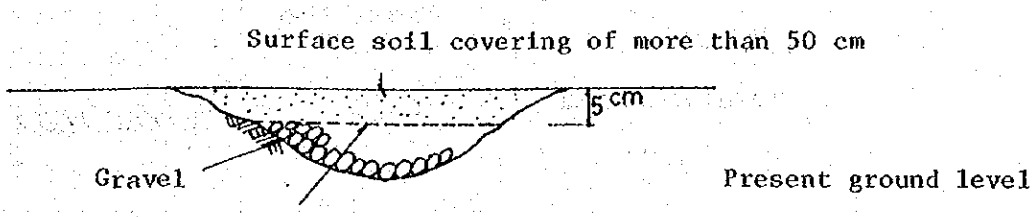
(3) Finishing stakes should be provided from the reference piles. The initial year reclamation work should cover mulberry fields A and B of Farm No.2 and mulberry field A of Farm No.2.

(4) An 11-ton class bulldozer should be introduced for uprooting and removal of gravels with the rake.

(5) Excavated gravels should be transported to the site shown in the drawing since they will be used for masonry of the sheathing work of the farm and road. The gravels should be transported chiefly by manual labour without planning secondary transportation. However, consideration should be given to the use of the bulldozer or a horse carriage because the volume of gravels will be considerably large. The gravels are expected to have a maximum diameter of 100 mm but are soft, so that they should be crushed before transportation.

(6) Gravels with a diameter of less than 5 cm will be used for road pavement, and those with a diameter of 10 ∿ 20 cm for building foundation work. Gravels with these two diameter ranges should therefore be carried to the previously designated places.

(7) Banking of the planned places in the farms should be performed as illustrated below.



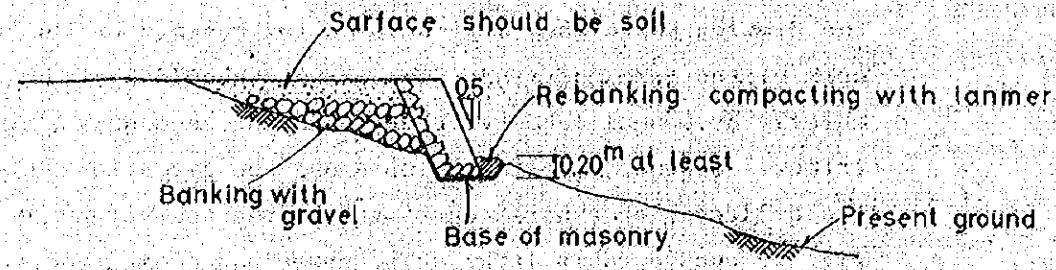
Gravels to be laid out on the bottom and compacted

(8) Masonry of embankment should be conducted in parallel with the farm reclamation work.

(9) The following cautions should be observed in the masonry work.

a. Mortar should be used for masonry, but it should not fill more than 50% of voids for the purpose of satisfactory drainage.

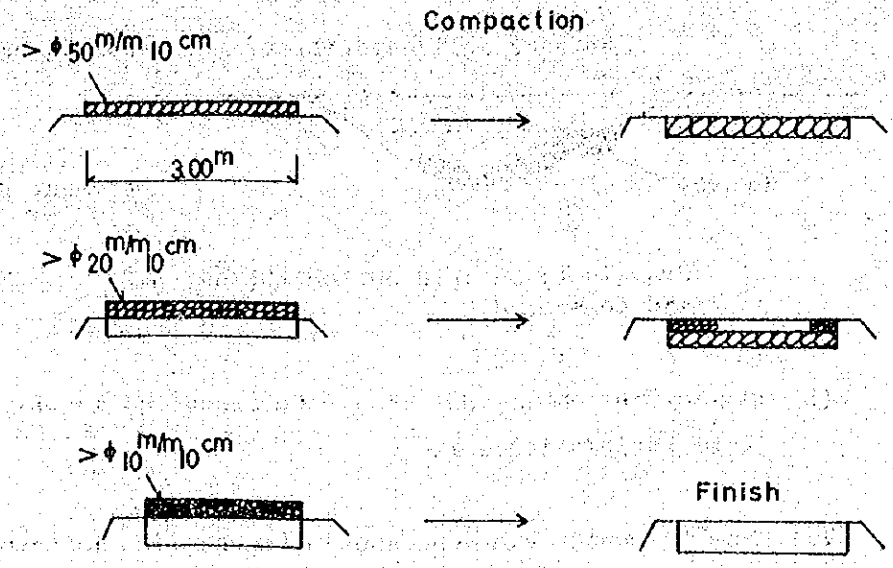
b. The masonry should not be provided on the existing natural ground.



(10) Farm road construction should be started after removing gravels from the farm area.

(11) Gravel paving of the farm road should be carried out as instructed below.

a. Gravels with a diameter of less than 50 mm should be used with each spreading depth set at 10 cm, using bulldozer or road-roller for compacting.



(12) Construction of the side ditch along the farm road should preferable be conducted after completion of the pavement work if this does not cause any particular impediment to drainage.

(13) Finish levelling of the farms should be carried out by means of the bulldozer on fine days in order to prevent compaction.

Subcenter

(1) Same as the above center construction procedure (1) - (3).

(2) Main farm road shall be constructed.

(3) As described in the outline, this area is characterized with a heavy clay soil with much underground water, and the drainage is very poor.
It is necessary to control the moisture content of the soil so that the construction is effected when the moisture content is optimum to enable best compaction.
Accordingly, construction in a rainy season or on a rainy day in a dry season must be completely avoided.

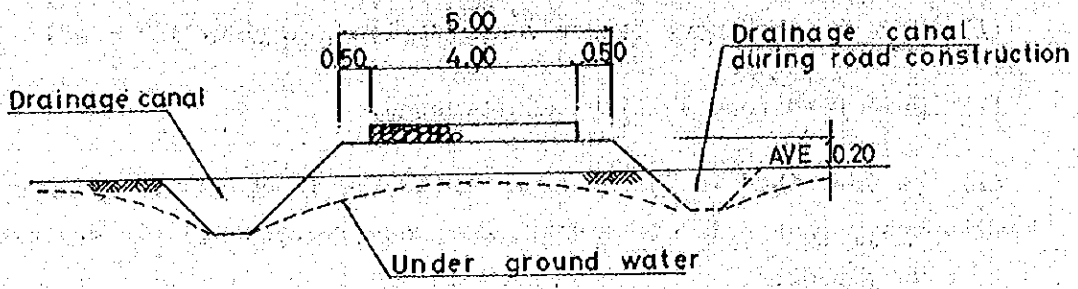
(4) Construction is processed in the following order:

a. Provide a drainage ditch. - Manual labor.

b. Soft subgrade in the road filling shall be replaced with the sand. The range shall be determined upon consultation with the site supervisor.

c. Spreading depth of the soil should be kept within 5 cm each time, and the spread soil shall be rammed after dried up by sunshine.

d. After completion of the filling, pave with gravel. Spreadding and rolling are performed in the similar manner as in the case of the center, but we recommend to spread clay up to 2 - 3 cm upon a spread gravel layer of 10 cm deep before finishing. The addition of clay prevents the rain water from entering the subbase course.



e. A bulldozer is used for the filling work in principle, but manual labor may be adopted if the bulldozer delivery is delayed.

(5) Lateral farm load in the field is constructed like the main farm load.

(6) Subcenter field reclamation involves non-land adjustment. Disposed roots line shall be provided along the main farm road and the branch farm road.

Non-land adjustment is mainly for the rain water drainaze, and is performed by a bulldozer. When the top soil is cut more than 50 cm, the place will be treated as the surface soil.

(7) The downstream drainage canal in the field shall be excavated by manual labor.

6-1-2 Building site construction plan

Build ng site area

Location		Area
Centre		1.12HA
Sub-Centre	New Field	0.60HA
	Station	0.50HA
Total		2.22HA

(1) Center

Reclamation includes 1% entire gradient.
Dug out stones during the field reclamation are used for building foundation works.

The expected building site is reclamated by bulldozers, but no rake dozer is used.

Stones in other places than the cleaved portion will not be dug out.

(2) Subcenter New Field

As the underground water level is high, filling shall be performed up to the same level as the main farm road.

Since the settlement due to consolidation is expected because of the clay subsurface, soil exploration is necessary.

If boring is impossible, carry out the filling exceeding 10 cm, foundation pili-g must be considered upon consultation with the supervisor.

(3) Subcenter-Soppong Sericulture Station

This area also has a soft subsurface, and the settlement due to consolidation is expected. Whole building site shall be filled up to the current road level. Mountain sand is recommended for the filling material. The filling not only improves the drainage but also prevents unequal settlement after the building construction. Spreading depth of the filling soil shall be 20 ∿ 30 cm. After levelling and rolling by a bulldozer, compact the ground using compactors.

6-1-3 Engineering plan for source facilities

The water source for the center and sub-center are both natural rivers. Water is drawn by the underground flow system; porous pipes are buried by excavating the rivers. The pumping stations are of steel-reinforced concrete rahmen construction for durability and vibration resistance.

List of Water-drawing Structures

	Center	Subcenter
Water-drawing intake	Porous C.P. (diameter: 300 mm) L=31 M	Porous C.P. (diameter: 600 mm) L=18 m
Water-drawing pit	Reinforced concrete BxLxH=1x3x7 m	HP diameter: 1200 mm H=5 m
Pump station	RC construction BxLxH=3.6x9.2x3.5m A=331 m	Same
Site area	A=30x30=900 m	Same

1. Center

The bed of the Berang River is covered with pebbles. A bulldozer will be used. The gut will be changed in advance and sandbags used to temporarily coffer the river. The water flow in this river is large even during the dry season so construction during the rainy season must be avoided.

The level of excovation of the water absorption pit is high; therefore, care must be taken in normal plane protection to avoid accidents.

Due to the sandstone layer, construction on rainy days must be changed upon consulting with the field supervisor if concrete laying is difficult due to excessive leakage.
The foundation of the pump station is very important. Construction work must be started only after checking the bearing power of the ground. Concrete laying must be performed in conformity with the General Technical Specifications.

2. Sub-center

The riverbed of the branch of the Taweleng River is clay. It is possible to excavate this riverbed by manual labor; however, introduction of a backhoe recommended. Since the amount of water flow in the dry season is approximately 10 e/s, construction may be carried out without difficulty.
A 1200 ϕ HP(hydraulic pump) is installed at the water intake pit. Since this may not be performed by manual power a crane is necessary. The pump station is the same as that for the center.

6.1.4 Engineering Plan of Water Pipe

1. Specifications of Pipes

	Total Length	Kind of Pipe	Pipe Diameter	Maximum internal water pressure
Center	1368.4 m	Tactile cast iron pipe	100 mm	180 m
Sub-center	88.0 m	Vinyl chloride pipe	150 mm	17 m

2. Engineering Sequence

(1) Water pipe engineering starts from the source to upward.

(2) In storing on the engineering site, pipes are protected by sleefers or wheels layed beneath and piled up with their hubs and spigots alternately. However, ductile cast iron pipes are not permitted to be piled up begond 25 layers.

(3) Pipes stored are carried by manpower to the piping site along the microwave road.

(4) At the piping site, pipes are lined with their hubs in the same direction and in parallel with the planned route. Skids must be surely provided.

(5) In the case of underground piping works, the excavation must be large enough so that refilling of soil and sand reaches the pipes bottom. Excavation for joints is made deep enough to make joints connection works easy and to allow powerful con-

nection works. Especially, cares are fully taken for the joint connection works, because a fairly larger hydraulic pressure acts upon the water pipes of the centes.

(6) Refilling up to the upper end of a pipe is performed in a manner so that earth and sand may be packed throughly to its bottom and surrounding. Cares should be taken in refilling works to avoid any affect, relief or lateral deflection.

(7) Refilling earth should be free from either pebbles or rocks mined with and applied water binding.

(8) In performing a main road crossing work, refilling and rolling compaction should be made after the completion of pipe laying on one side of the car route at first, followed by excavation of pipe laying works on the other side to avoid making route crossing and excavating works simultaneously. However, this does not apply to any places where a rundabout path may be easily established. Road restoration and maintenance works (pavement, etc.) should be made after the pipe laying.

3. Other matters to be attended

(1) For both the fore and back parts which are fastened with thrusts and blocks, be careful of the their boundary which tends to cause such dangers as non-uniform settlement. Expecially, it is necessary in any refilling works to hang a pipe with two wire ropes, because the settlement becomes the largest during and immediately after a refilling.

(2) In order to prevent irregular settlement of the pipe route, no tools nor equipments must be placed on the route after refilling.

(3) The water pipe route must be constructed by skilled laborers because of the possible danger of water hammer.

6-1-5 A. Construction Schedule of the Sericultural-Centre

Items	1st Year	2nd Year	3rd Year	Remarks
1 Land Preparation				
Muberry field	3.0HA	4.0HA		1st year bulloozer is rentaled
Glassland			1.0HA	
Building site		1.0HA		After 2nd year bul. will be provided from Japan
2 Pump Staion				
Intaice work		L=31M ϕ300		ry season only
Pump house (2 places)		1,000M^2		included installation of pumps
3 Pipe laying				
Foundation				Aqueouct 5 places support 82 places
Pipe laying		L=1,390M		buried 989M surface 326M
4 Buildings				1st : Mulberry field maintenance room
				2nd : Silkworm egg refrigerator room

Note 1st year 76' 10 ∿ 77' 3 2nd year 77' 4 ∿ 78' 3 3rd year 78' 4 ∿ 79' 3

Buildings of centre will be disgned and constructed by indonesian side therfore, the schedule of buildings is not clear.

B. Construction Schedule of the Sub Centre

Items	1st Year	2nd Year	3rd Year	Remarks
NEW FIELD				
1 Land Preparation				
Mulberry field	3.5HA	6.0HA	5.0HA	Expected dry season only
Glassland				After the 4th year
Building site		——		Dry season only
2 Pump Station				
Intaice work		L=18M ϕ600		Dry season only
Pump house		1,000M^2		Included installation of pumps and pipe laying
3 Buildings		----	----	
SOPPENG SERICULTURAL STATION				
1 Building site preparation		——		Dry season only
2 Buildings		----------		

Note The above schedule will be affected with the condition of the road from national road to the new field.

6-2 Specification

6-2-1 General Technical Specification

1. Earthworks

- 1-1 Site Clearing
- 1-2 Excavation-General
- 1-3 Excavation for structure
- 1-4 Excavation of rock foundation
- 1-5 Backfilling
- 1-6 Foundation preparation of embankment
- 1-7 Finish to embankment

2. Concreteworks

- 2-1 Cement
- 2-2 Concrete aggregates
- 2-3 Mixing water
- 2-4 Concrete mixes
- 2-5 Mixing concrete by machine
- 2-6 Mixing concrete by hand
- 2-7 No concrete during unsuitable weather
- 2-8 No partially set material
- 2-9 Depositing concrete
- 2-10 Vibration of concrete
- 2-11 Curing and protection
- 2-12 Formwork-General
- 2-13 Removal of forms
- 2-14 Reinforcement
- 2-15 Placing reinforcement steel

3. Pipe Line

- 3-1 Earth foundation and sand foundation
- 3-2 Concrete foundation
- 3-3 Laying and connection of pipes
- 3-4 Steel pipes and Ductile iron pipe
- 3-5 Vinyl pipes

4. Farm Road

4-1 Setting out

4-2 Tolerance in earthwork dimensions

4-3 Site Clearing and Preparation of Foundation

4-4 Placing and Compaction of Material

4-5 General Pavement

5. Metalwork

6. Welding

7. Timberwork

8. Panting

9. Water Stop

1. EARTHWORKS

1-1 Site Clearing

The works under this Clause shall include the supply of all labour, materials and Constructional Plant and the performance of all works necessary for clearing the area to be occupied by the Works and Temporary Works.

Such clearing shall include the cutting down and uprooting of all trees, bushes and vegetation, grubbing and removal of the tree roots and stumps, removal of vegetations, structures and other obstructions to the extent requied by the Engineer, but not otherwise.

1-2 Excavation-General

All excavation shall be carried out to the lines and levels shown on the Drawings or to such lines and levels as the Engineer may direct. The Contractor shall trim all permanent excavations to the levels and dimensions shown on the Drawings.

Before commencing excavation, the Contractor shall survey and take levels over the entire area in which excavation is to be carried out. The Contractor shall use bench marks approved by the Engineer for such survey works. The surface levels so determined shall be subject to the Engineer's approval, and measurement of excavation shall be based upon the approved surface levels.

When any excavation has been taken out and trimmed, the Engineer shall be informed accordingly so that he may inspect the completed excavation, and no excavation shall be filled in or covered with concrete until it has been inspected and the Contractor has been authorized to preceed with the work.

1-3 Excavation for Structures

Excavation for foundation work shall be carried out in a safe manner and to the lines and levels shown on the Drawings or to such lines and levels as may be approved by the Engineer. Firm foundation are to be achieved by moistening and tamping if necessary.

Excavation for cut-offs and wing-wall footings serving a cut-off purpose shall be so executed that, below the level of the bankseat, concrete shall be placed against the sides of the excavation without the use of intervening formwork. In the event of over excavation for cut-offs or wall footings, below the level of the bankseat, extra concrete to fill the extra excavation shall be provided at the Contractor's expense.

1-4 Excavation of Rock Foundations

Where structures are to be founded on rock the bottom of the excavation is to have all loose rock removed. Immediately before concreting the surface shall be thoroughly cleaned of all loose material and dirt by means of water jets, all to the satisfaction of the Engineer.

1-5 Backfilling

Backfilling shall, unless otherwise specified, be carried out with approved materials and shall be well compacted in 15 centimeter layers to the satisfaction of the Engineer. Topsoil, vegetation or other organic material shall be excluded from backfilling material.

Payment for backfilling shall be made for the net volume of fill in place, measured after compaction to the lines to which the excavation was measured. Free draining material incorporated in backfilling behind retaining walls shall be measured and paid for separately.

The Contract Rate for backfilling shall include for the cost of supplying suitable material, placing by hand tools or machines, mixing, harrowing (if required), spreading, trimming, watering and compacting, and the cost of all other works connected therewith. The Contract

Rates shall apply whatever the source of the material.

1-6 Foundation Preparation for Embankment

The foundation where embankments are to be built shall be prepared by ploughing or ripping to an appropriate depth. If the foundation in any area is not suitable in the opinion of the Engineer for placing the fill, the Contractor shall excavate this area to such a depth, and dispose of the excavated material, as directed by the Engineer.

1-7 Finish to Embankments

The side slopes of all embankments are to be in accordance with those shown on the Drawings or such other slope as may be approved or ordered by the Engineer.

The finished surfaces of the top and sides of the embankments shall present an even and neat appearance. The alignment, bank heights and regularity of surface shall be to the satisfaction of the Engineer and shall be trimmed as necessary.

2. CONCRETEWORKS

2-1 Cement

The cement to be used throughout the Works shall be obtained from manufactures approved in writing by the Engineer.

The cement shall be ordinary Portland cement conforming to the requirements for the Portland cement.

The name and brand of manufacturer, the type of cement, the year and month produced and the weight contained shall be clearly marked on each bag.

2-2 Concrete Aggregates

All concrete aggregates are to be obtained from sources approved by the Engineer.
They shall be free from eath, clay, chalk, lime, peat, loam, soft clayey shaly or decomposed stone, vegetable and organic matter and other impurities. The stone shall be hard and dense.

2-3 Mixing Water

Water for mixing concrete, mortar, rendering and grout (if required), shall be subject to the approval of the Engineer, it shall be clean, fresh and free from oil, acid, alkali, sugar and vegetable substances, and it shall, anyhow, be free of organic or inorganic matter in solution or suspension in such amounts that it may impair their strength, appearance or durability.

If required by the Engineer, samples shall be taken from the proposed sources of supply and tested by comparison with distilled water. Comparison shall be made by means of standard cement test for soundness, time of setting and mortar strength. Indication of unsoundness, change in time of setting plus or minus 30 minutes or more, or decrease of mortar strength more than ten (10) per cent compared with distilled water shall be sufficient cause for rejection of the water being tested.

2-4 Concrete Mixes

The table below gives the different types of concrete mixes contemplated by the Engineer to be used in principle in the various structures, and, for each minimum compressive strength at a 28 days age, the maximum sizes 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:

Types of concrete mixes	Minimum compressive strength at a 28 days age	Maximum size of aggregates	Maximum water/ cement ratio	Cement content
	(kg/cm^2)	(mm)		(kg)
AA	240	20	57.5	350
A	210	40	60	300
BB	180	80	70	250
B	180	40	70	250
C	130	40	80	180

The actual proportions of the various gradings of coarse and fine aggregates will be determined from analysis and tests by the Engineer, and he 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 aggregates during mixing to ensure proper hydration of the cement and to produce a mixture of workability such that is can be well consolidated, worked into the corners of the forms and around the reinforcement, give a satisfactory finish and achieve the specified strength specified in the above table.

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

	Description	Mix types
1.	Reinforced concrete for main body in structures	A
2.	Such ancillary works as concrete pipes, piles, etc.	AA
3.	Unreinforced concrete for canal lining, flooring, etc.	B
4.	Unreinforced concrete for weir body, aprons, bridge pier etc.	BB
5.	Foundation concrete	C

The slump of the concrete shall not exceed 7.5 centimeters for concrete in slabs that are horizontal or nearly horizontal and 10 centimeters for all other concrete.

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.

2-5 Mixing Concrete by Machine

(1) Mixing by mechanical mixer

The materials for concrete shall be mixed in an approved mechanical mixer. The mixing time for each batch shall not be less than the minimum mixing time, shall not exceed three (3) times the minimum time, and shall be constant for a series of batches of concrete for a particular structure. The mixing time shall start when all the ingredients are in the mixer and shall, unless otherwise directed by the Engineer, be longer than one and half ($1\frac{1}{2}$) minutes.

The mixers shall not be loaded beyond their rated capacity, nor shall they be operated at a speed in excess of that recommended by the manufacturer. They shall produce a concrete of uniform consistency and appearance, at a continuous rate approved by the Engineer.

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. Pick-up and throw-over blades inside the mixers shall be replaced, when worn down two (2) centimeters.

(2) Truck mixing

The materials for concrete may also be mixed in an approved truck mixer (agitator truck). The drums on truck mixer shall revolve at the speed recommended by the manufacturer.

When the materials are mixed in a truck mixer, the mixing operation shall start within thirty (30) minutes after the cement and aggregates are in the mixer, and the concrete shall be delivered to the site of the works and its discharge be completed within one (1) hour after the introduction of the mixing water into cement and aggregates.
In hot weather, or under conditions contributing to quick stiffening of the concrete, a mixing time less than one (1) hour may be ordered by the Engineer.

2-6 Mixing Concrete by Hand

Where it is not possible to employ machine mixing and approval has been obtained from the Engineer, concrete shall be mixed by hand as near as practicable to the site where it is to be deposited. Clean mixing bankers or platforms of sufficient areas for the proper execution of the work shall be provided. These platforms if constructed of timber shall consist of planks closely jointed so as to avoid the loss of any grout or liquid from the wet concrete. The whole of the aggregate and cement shall be turned over on the banker in a dry state at least twice. The water shall then be added gradually through a rose head, after which the materials shall again be entirely turned over in a wet state at least three times before leaving the banker.

2-7 No Concreting during Unsuitable Weather

No concreting will be allowed in the open during storms or heavy rains. All concreting materials and plant are to be adequately protected against the effect of heavy storms and strong winds.

2-8 No Partially Set Material to be Used

All concrete and mortar must be placed and compacted within 30 minutes of its being mixed; and no partially set material shall be used in the work.

2-9 Depositing Concrete

The arrangements for placing concrete are to be such that in all cases the material may be conveniently handled and placed in the required position without re-handling or segregation. Wherever possible the concrete is to be deposited from bottom opening skips and in all cases shall be deposited in layers of such depth that each layer can be easily incorporated with the layer below with the use of internal vibrators or by spading, slicing, and ramming. In no case is any layer to slope except where specified and all temporary joints are to be formed square to the work. Concrete shall not be delivered by shute or dropped from barrows or otherwise through a greater height than 1.5 meters except with the approval of the Engineer who may order the concrete to be dropped on to a banker and it shall be turned over by hand before being placed. The height of any lift shall not exceed 1.5 meters unless otherwise permitted by the Engineer.

The area on which any concrete is to be deposited must be made and maintained free from standing water during concreting operations unless otherwise approved. Running water crossing or entering such areas must be brought under control before concreting proceeds.

Before depositing any concrete resting or abutting on work previously executed the surface and ends are to be thoroughly roughened with a chisel-pointed pick to such an extent that no smooth skin of concrete that may be left from the previous work is visible.

These roughened surfaces must be thoroughly cleaned by compressed air and water jets or other approved means, brushed and watered immediately before depositing concrete and if so instructed by the Engineer are to be covered with cement motar 1.0 centimeter thick immediately beofre proceeding with the next layer of concrete. The cost of all roughening of surfaces shall be deemed to be included in the Contract Rates for concrete in the Bill of Quantities.

Where new concrete is to be deposited on or against rock or old concrete, the surface of the rock or old work must be toothed to form an adequate bond, roughened if necessary, cleaned, washed and all loose material removed from it. The faces shall then be mortared as specified for joints in new concrete.

Concrete in reinforced concrete work shall be deposited in small quantities in a plastic state with a water-cement ratio such as to give the specified strength. The depositing of concrete in individual members shall be continued without stoppage up to an approved pre-arranged construction joint or until the member is completed and shall be finished off in such manner that the junction of members shall be monolithic unless otherwise specified.

Mass concreting shall be carried out in sections previously ordered or approved by the Engineer and shall proceed continuously in each section until completed and no interval shall be allowed to lapse while the work is in hand. As it may be necessary to work beyond the ordinary hours to enable this condition to be fulfilled the Contractor must allow for this in the Contract Rates in the Bill of Quantities.

2-10 Vibration of Concrete

Except where otherwise permitted by the Engineer concrete shall, during placing, be compacted by approved pattern internal vibrators. The vibrators shall be of the rotary out-of-balance type or the electro-magnetic type and shall operate at a frequency of not less than 6,000 cycles per minute. The vibrators shall be designed for continuous operation. The vibrators shall be disposed in such a

manner that the whole of the mass under treatment shall be adequately compacted at a speed commensurate with the supply of concrete from the mixers. Vibration shall continue until the concrete being placed shall be judged to be compacted by the appearance of a blistening and even surface except for slight irregularities where the coarse aggregate breaks through. All air shall be this time have been expelled.

Vibration is not to be applied directly or through the reinforcement to sections or masses of concrete which have hardened or after the initial set has taken place. Vibration must not be used to make the concrete flow in the formwork so as to cause segregation.

2-11 Curing and Protection

The Contractor shall take adequate measures to ensure that the concrete is cured. These shall include covering the concrete with burlap matting or other effective means which shall be kept damp continuously for a minimum period of three days after casting or for such other time as the Engineer may direct. After removal of this covering, the concrete shall then be sprayed with water for a minimum period of a further seven days. Other methods of preventing the water of hydration in the concrete from evaporating may be used with the approval of the Engineer.

All concrete liable to be affected by running water or wave action shall be adequately protected from damage during the setting period and all temporary protective works shall be to the satisfaction of the Engineer.

2-12 Formwork - General

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

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

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. Shuttering boards shall be carefully jointed and so arranged as to be able to swell under the influence of humidity of the concrete, without causing any deformation to the forms, interstices shall be properly filled with glazier's putty and the waterproofing of the forms shall be sufficient to prevent escape of cement resulting from excess of water in the concrete. However, the use of paper tamping shall be strictly forbidden.

Openings (if required) for inspection of the inside of the forms and for 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 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. The use of wire ties for supporting the forms shall not be permitted in concrete walls which are to be subject to water, 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. In case embedded metal rods are used for holding forms, the rods shall terminate not less than 3 centimeters from the formed surface of the concrete in which the maximum size of aggregate is 40 millimeters and not less than 5 centimeters from the same concrete surface in which the maximum size of aggregate is 80 millimeters.

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 the reinforcement, but if this should inadvertently occur, the reinforcement must be cleaned.

When forms have been built and have bee- 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.

2-13 Removal of Forms

The Contractor shall take 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 in any case at least three (3) days shall elapse before forms are struck.

Connections shall be so formed as to permit the easy removal of the forms without hammering, etc., and without the necessity of levering against the surface of the concrete.

2-14 Reinforcement Steel

Reinforcement steel shall consist of round deformed bars rolled from new billet stock, and shall conform to the requirements of the appropriate standards referred to Clause 2.21 hereof. Steel shall have a tensile strength of 39 to 53 kg/mm^2 and a minimum yield point of 24 kg/mm^2 and a minimum yield point of 24 kg/mm^2. A cross section of any bar to be delivered shall be exact shape and have the specified diameter at any point of the bar. The average diameter of 20 bars which are to be selected at random from each shipment of the same size, shall not be bigger or smaller by 2 percent than the specified diameter. Bars shall be free of scale, oil, dirt and structural defects.

When required by the Engineer the Contractor shall submit three copies of mill sheets of steel bars issued by the iron and steel works for the approval of the Engineer before each shipment, and inspection at site will be made by the Engineer in accordance with the Specification and the above mill sheets.

2-15 Placing Reinforcement Steel

The number, size, form and position of all reinforcement steel bars, fabric, ties, links, stirrups and other parts of the reinforcement are to be placed in exact accordance with the Drawings and kept in the correct position in the forms without displacement during the process of vibrating, tamping and ramming the concrete in place. The Contractor shall provide all necessary distance pieces and space bars at his own cost to maintain the reinforcement in the correct position.

Any ties, links or stirrups connecting the bars shall be taunt so that the bars are properly braced, the inside of their curved parts shall be in actual contact with the bars around which they are intended to fit. Bars shall be bound together with best black annealed mild steel wire which is subject to the Engineer's approval, and the binding shall be twisted tight with proper pliers. The free ends of the binding wire shall be bent inwards.

The Contractor shall provide at his own cost and to the approval of the Engineer working drawings of all reinforcement accompanied by bending schedules and copies of the orders placed for bars.

Before any steel reinforcement is embedded in the concrete any scale, loose rust, oil, grease or other deleterious matter shall be removed. Partially set concrete which may be adhering to the exposed bars during concreting operations shall likewise be removed.

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 improved by him. The Contractor shall inform the Engineer at least 24 hours in advance of his intention to have the reinforcement ready for inspection.

3. PIPE LINE

3-1 Earth Foundation and Sand Foundation

3-1-1 Things like rock shall not be out cropped on the section contacting with pipes on the foundation and be trimmed so as to contact equally through the whole length of pipes. Specially, a condition of bearing one point shall not be allowed to raise at the collar and socket of the joint of pipes.

3-1-2 The foundation of pipe canal shall be sand foundation in accordance with the provision of design drawings.

3-1-3 In case of being a change of ground water flowing along sand foundation, the flowing shall be stopped with impervious earth and likes to conform with the instruction of engineer.

3-2 Concrete Foundation

The placement of concrete shall be made so that concrete may completely spread over the surface of perimeter of pipes.

3-3 Laying and Connection of Pipes

3-3-1 Laying of pipes shall be consulted with the engineer in regard to methods of transport and connection of pipes.

3-3-2 The sequence of laying and connecting pipes shall be, as a rule, made to direct from low position to high position.

3-3-3 The connection of pipes shall be inspected in regard with the position of rubber rings for joints and the space of connecting parts to use gauge on the whole circular of each pipe, and the results shall be submitted to the engineer.

3-3-4 In connecting pipes, an attention shall be paid for so that foreign matter as sand may not enter into the inside and connecting part of pipes.

3-4 Steel Pipe and Ductile iron pipe

The durability of steel pipes ductile pipe shall be more than design internal pressure and thickness of pipes.

3-5 Vinyl Chloride Pipe

The durability of vinyl chloride pipes shall be more than design internal pressure.

4. FARM ROADS

4-1 Setting Out

The Contractor is entirely responsible for the accurate setting out of the works from the information supplied on the Drawings and the instructions given by the Engineer.

4-2 Tolerance in Earthwork Dimensions

Unless otherwise specified, no point on the surface of the completed earthworks shall be less than -0.10 meter and more than 0.10 meter in distance from the designated surface. However, it is understood that height of road embankments shall always be subject to Clause 3D.01 hereof, and the dimensions of farm road which form canal embankments shall be within the tolerances set out in Clause 3C.03 hereof.

4-3 Site Clearing and Preparation of Foundation

The area to be occupied by the roads shall be cleared in accordance with Clause 3A.03 hereof.

Foundation on which embankments are to be placed shall be prepared in accordance with Clause 3A.11 hereof, and no materials shall be placed on any portion of the foundations until such foundation has been approved by the Engineer for placing fill. Test pits, trenches and cavities made for the removal of unsound foundation materials or for the inspection of subsurface foundations shall be filled with selected material and properly compacted.

4-4 Placing and Compaction of Material

Fill material shall be compacted to at least 95% of the maximum dry density and in addition have a C.B.R. (the California Bearing Ratio) of not less than 10% or such lower value that the Engineer may decide. Compaction of all filling material shall be carried out at moisture contents as directed by the Engineer from time to time as the work proceeds in order to reduce as far as possible any subsequent consolidation or swelling. Water shall be added as and where necessary by a water cart fitted with an approved sprinkler.

Compaction shall be carried out by means of approved by the Engineer. All construction equipment must operate over the whole area to ensure uniform compaction. All filling shall be compacted in layers of not greater than 15 centimeters compacted thickness, or such other thickness as may be approved by the Engineer. Longitudinal and transverse joints in any two successive layers shall be staggered by a minimum distance of 3.0 meters.

4-5 Gravel Pavement

Unless otherwise specified, material for road pavement shall be gravel or broken stone extracted from the quarries shown on the Drawings or other sources approved by the Engineer. The material shall be free from earth, clay loam, soft clayey shaley stone, vegetable and organic matters. The stone shall be hard and dense.

The material shall be free from flat and elongated particles, and generally, particles of the material shall be spherical or cubical in shape. Unless otherwise specified, the maximum size of the material shall be 80 millimeters, and the material shall be well graded. The quality and grading of the material shall be subject to the approval of the Engineer.

The material shall be spread in such quantity that, when levelled and finished, the surface shall be free from irregularities or loose material, true to cross-section, line and level shown on the Drawings or established by the Engineer.

5. Metalwork

If required the Contractor shall prepare dimensioned drawings showing all details of such metalworks as the intake bridge, steel handrails, ladders, steps etc. and the materials to be used for such purposes in accordance with the drawings or the instructions given by the Engineer. Such dimensioned drawings shall be submitted to the Engineer for his approval prior to the commencement of such metalworks.

All the metalwork supplied by the Contractor for permanent works shall conform to the applicable standards showed by the Engineer, unless otherwise specified.

The Contractor shall furnish all pipes, pipe fittings and pipe specials, bolts, ragbolts (if required), nuts, washers and the like for assembling any other steel pipe handrails and steelwork if required; each bolt shall be provided with two washers and bolts shall be long enough to show a full thread through the nut after fixing.

Galvanizing of the galvanized items provided by the Contractor is to be of the first quality and finish. Rough edges and burrs are to be neatly filed off before the works go into place, but in filing off, the parent metal must not be exposed.

The Contractor shall not use fixture and fittings for metalwork (including pipework) in which dissimilar metals likely to lead galvanic action, are placed in permanent contact with each other.

6. Welding

Details of weld preparation and the proposed welding procedure shall be subject to the approval of the Engineer, before welding operation commences. Sample welds shall be prepared by each welder, before he commences work on the construction and during construction as required by the Engineer. No constructional welds will be permitted until the Engineer is satisfied with welding procedure, with workmanship of the welders and with the system of weld testing.

7. Timberwork

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 saps, shakes, dead knots, dogmarks or other defects. Timber shall be sawn into scantlings not less than one (1) month before use, such that the scantlings will be of the specified dimensions after planning and preparing.

Timber for piles and carpentry work shall, except as specified otherwise, be of the best quality available within the locality, sound, round or sawn square as shown on the drawings, straight and well seasoned, free from rot, worm, beetle, decayed knot or other defects.

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

8. Painting

All paints and materials for painting shall be furnished by the Contractor and used in accordance with the manufacturer's recommendation for the particular location where the paints are to be applied. The quality of such paints and materials shall be subject to the Engineer's approval.

Undercoats shall be of distinctive tints and finishing colours are to be approved by the Engineer. Except as required for certain water thinned paints, paints shall be applied only to surfaces that are thoroughly clean and dry, and only under such combination of humidity and temperatures 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.

Paint shall not be applied to any surface, which is excessively hot for the type of paint being used, and freshly painted surfaces shall be shaded and protected from overheating, until sufficiently hardened, to prevent the occurrence of cracking or blistering.

Painted timberwork and metalwork shall be lightly rubbed down with glass paper between cots and dusted down. At least 24 hours shall elapse between the application of successive coats, unless otherwise specified by the manufacturers. On completion of painting, the Contractor shall remove all paint spots and shall touch up or re-paint imperfect work. Painted exterior surfaces shall be protected from the weather, until the paint is thoroughly dry and hard.

Timberwork to be painted shall be rubb-d down with glass paper, knotted and primed. Any holes, cracks and joints shall then be neatly stopped with putty. Joinery shall be primed before assembly. After stopping, all timber-work shall be given undercoat and finishing coat as directed by the Engineer.

9. Waterstop

Waterstop shall be placed in joins shown on the Drawings and directed by the Engineer. The waterstop shall be 150 mm or 230 mm in width and 10 mm in web thickness and be made of rubber or plastics conforming to the following requirements.

	Rubber	Plastics
Specific weight	1.15 or more	1.35 or more
Tensile strength, kg/cm^2	200 or more	120 or more
Elongation, %	400 or more	300 or more
Hardness	60 - 70	60 - 70
Shape (of both types);	Center hallow bulb type with solid bulbs at both ends	

All waterstops shall be stored in as cool a place as practicable and in no case rubber be stored in the place open or exposed to the rays of the sun. All rubber shall be stored so as to permit free circulation of air about the rubber.

All field splices and intersections of waterstops shall be made so as to provide watertight connection with such means as specified by manufacturer of the waterstops. The Contractor shall provide suitable support and protection during the progress of the work to protect the waterstops from damage, deterioration, or warping.

The waterstops shall be installed with equal widths of the material embedded in the concrete on each side of the joint. The concrete shall be carefully placed and vibrated around the waterstops to secure a complete bond between the concrete and all embedded areas of the waterstops.

Measurement for payment for furnishing and placing waterstops will be made only of the length of the waterstops placed at the joints in accordance with the Drawings or as directed by the Engineer. No allowance will be made for lap at splice. Payment for furnishing and placing waterstops will be made at the Contract Rate per linear meter in the Bill of Quantities, which Contract Rate shall include the cost of furnishing waterstops, and of delivering, unloading, handling, storing, cutting, cleaning, placing and maintaining in position all waterstops as shown on the Drawings or as directed by the Engineer.

6-2-2 Specifications of Machinery

1) Bulldozer

Type	: D50A CRAWLER
Engine	: Water-cooled, 4-cycle, overhead valve distribution type diesel engine
Starting method	: Motor-driven
Output and rated speed	: 90 HP, 1750 RPM
Maximum tractive force	: 10,340 kg
Earth-moving deivces	
Weight during operation	: 11,000 kg
Overall length	: 4,700 mm
Overall width	: 3,350 mm
Overall height	: 2,690 mm
Contact pressure	: 0.66 kg/cm^2
Bowl	
Operation method	: Hydraulic operation
Width	: 3,350 mm
Height	: 855 mm
Lifting limit	: 1,050 mm
Lowering limit	: 380 mm

2) Drawing Pump at Sericulture Centre

-1 Pump Specification

Type	: Multistage volute pump
Suction Bore	: 80 mm
Delivery Bore	: 65 mm
Capacity	: 0.5 m^3/m
Total Head	: 172 m
Speed	: 3200 R.P.M
Efficiency of pump	: 52%
Generating power	: 50 PS
Method of Coupling	: flexible
Quantity	: 2 sets
Method of operation	: hand-operate

-2 Material of Pump Main Parts

Suction cover	: Cast iron
Casing	: "
Impeller	: Bronze
Main Shaft	: Carbon steel
Sleeve	: Bronze
Liner Ring	: "
Side plate	: Cast iron
Bracket	: "
Packing	: Graphate cotton

-3 Accessories for Pump Set

Common Bed	1	Pressure Gauge	1
Foundation Bolts Nuts	1	Vacuum Gauge	1
Coupling	1	Compound gauge	1
Funnel with cock	1	Foot valve (100 mm)	1
Air vent cock	1	Sluice valve (65 mm)	1
Drain cock	1	Check valve (65 mm)	1
Companion flange	1	Flywheel	1

II Diesel Engine Specification

Cooling system	: Radiator
Continuous output	: 50 HP
No. of cylinder	: 4
Speed	: 1800 R.P.M
Accessories	: Gear units 1800 R.P.M/3200 R.P.M
"	: Tmyblex coupling
Quantity	: 2 sets

3) Drawing Pump at Sericulture Sub-Centre

-1 Pump Specification

Type	: Multistage volute pump
Suction Bore	: 100 mm
Delivery Bore	: 85 mm
Capacity	: 1.18 m^3/min
Total head	: 14 m
Speed	: 1800 R.P.M
Efficiency of pump	: 73%
Generating power	: 8 PS
Method of Coupling	: Flexible
Quantity	: 2 sets
Method of operation	: Hand-operate

-2 Material of Pump Main Parts

Suction cover	: Cast iron
Casing	: "
Impeller	: Bronze
Main shaft	: Carbon steel
Sleeve	: Bronze
Liner ring	: "
Side plate	: Cast iron
Bracket	: "
Packing	: Graphate cotton

-3 Accessories per Pump Set

Common bed	1	Pressure gauge	1
Foundation bolts nuts	1	Vacuum gauge	1
Automatic centrifugal crutch	1	Foot valve (100 mm)	1
Funnel with cock	1	Sluice valve (100 mm)	1
Air vent cock	1	Check valve (100 mm)	1

II Gasoline Engine Specification

Type	: 4 cycle air-cooled engine	
Cooling system	: Radiator	
Continuous output	: 8 HP	
No. of cylinder	: 1	
Cylinder bore	: 90 mm	
Speed	: 1800 R.P.M	
Starting system	: Cell-motor	
Accessories	: Fuel tank	1
	Fuel filter	1
	Lubrication oil filter	1
	Muffler	1
	Battery	1

4) Pump for Irrigation at Sericulture Centre

-1 Pump Specification

Type	: Multistage volute pump
Suction bore	: 80 mm
Delivery bore	: 80 mm
Capacity	: 0.74 m^3/m
Total head	: 51 m
Speed	: 1750 R.P.M
Efficiency of pump	: 75%
Generating power	: 11 KW
Method of coupling	: Flexible
Quantity	: 2 sets
Method of operation	: Hand operate

-2 Accessories per Pump Set

Common bed	1	Pressure gauge
Foundation bolts nuts	1	Vacuum gauge
Coupling	1	Foot valve (80 mm)
Funnel with cock	1	Sluice valve (80 mm)
Air vent cock	1	Check valve (80 mm)
Drain cock	1	Companion flange

-3 Motor

Power	: 11 kW
Voltage	: 220V
Cycle	: 60 Hz

5) Pump for Irrigation at Sericultre Sub-Centre

-1 Pump Specification

Type	: Multistage volute pump
Suction bore	: 125 mm
Delivery bore	: 125 mm
Capacity	: 1.79 m^3/min
Total head	: 61 m
Speed	: 1750 R.P.M
Efficiency of pump	: 75%
Generating power	: 30 kW
Method of coupling	: Flexible
Quantity	: 2 sets
Method of operation	: Hand-operate

-2 Accessories per Pump Set

Common bed	1	Pressure gauge	1
Foundation bolts nuts	1	Vacuum gauge	1
Coupling	1	Foot valve (125 mm)	1
Funnel with cock	1	Sluice valve (125 mm)	1
Air vent cock	1	Check valve (125 mm)	1
Drain cock	1	Companion flange	1

-3 Motor

Power	: 30 kW
Voltage	: 220 V
Cycle	: 60 Hz

6) Pump for Supply Drinking Water

-1 Pump Specification

Type	: Volute pump with pressure tank
Suction bore	: 40 mm
Delivery bore	: 40 mm
Capacity	: 0.10 m^3/min.
Total head	: 10 m
Speed	: 1750 R.P.M
Efficiency of pump	: 90%
Generating power	: 0.75 kW
Method of coupling	: Flexible
Quantity	: Total 3 sets
	Center - 1 set, Sub-centre New field - 1 set Station - 1 set
Method of operation	: Hand operate

-2 Accessories per Pump Set

Common bed	1	
Foundation bolts nuts	1	
Sluice valve (40 mm)	1	
Check valve (40 mm)	1	
Companion flange	1	
Pressure tunk	1	with Pressure gauge
		with vacuum gauge
		with foundation bolt nuts
		with controller

7) Generator

-1 Generator specification (at centre)

Type	: Diesel engine
Generating power	: 40 K.V.A
Voltage	: 220 V
Cycle	: 60 Hz
Quantity	: 3 sets

Accessories per Generator Set

Tranformer (220V/100V)	: 1 set
Electric control panel	: 1
Oil Tank (8 m^3)	: 2 sets

-2 Generator Specification (for Refrigerator at centre)

Type	: Diesel engine
Generating power	: 60 kVA
Voltage	: 220 V
Cycle	: 60 Hz
Quantity	: 2 sets
Accessories	: Oil tank (4 m^3 - 2 sets)

-3 Generator Specification (New Field at Sub-Centre)

Type	: Diesel engine
Generating power	: 70 kVA & 10 kVA
Voltage	: 220 kVA
Cycle	: 60 Hz

Quantity	: 2 sets (for irrigation pump)	
	1 set (for supply water pump)	
Accessories	: Transformer (220V/100V)	1 set
	(for 70 kVA generator)	
	Oil tank 8 m^3	2 sets

-4 Generator Specification (Station at Sub-Centre)

Type	: Diesel engine	
Generating power	: 30 kVA	
Voltage	: 220V	
Cycle	: 60 Hz	
Quantity	: 2 sets	
Accessories	: Transformer (220V/100V)	1 set
	Oil tank 8 m^3	1 set

-5 Generator Specification (for Refrigerator at Sub-Centre)

Type	: Diesel engine	
Generating Power	: 65 kVA	
Voltage	: 220V	
Cycle	: 60 Hz	
Quantity	: 2 sets	
Accessories	: Transformer (220V/100V)	1 set
	Oil tank 4 m^3	2 sets

Chapter 7

Estimation of Project Cost

7-1 Amount of Material

Amount of material specification at Sericulture Centre

Reclamation

Item		Quantity	Unit	Remarks
Earthwork	excavation	3,706.12	m^3	farm-1
		8,763.47	"	farm-2
		2,718.33	"	building site
		15,187.92*	"	
	Bank	3,101.38	"	farm-1
		4,222.27	"	farm-2
		2,042.85	"	building site
		9,366.50	"	
Dry masonry	ℓ=504.5^m	1,009.00	"	farm-1
	ℓ=801.1	1,602.20	"	farm-2
	ℓ=323.5	647.00	"	building site
		Σ 3,258.20	"	
Mortar masonry for side ditch	ℓ=578.0^m	121.38	"	farm-1
	ℓ=377.0	79.17	"	farm-2
	ℓ=231.5	48.62	"	building site
		Σ 249.17	"	
Mortar for side ditch	ℓ=578.0^m	17.34	"	farm-1
	ℓ=377.0	11.31	"	farm-2
	ℓ=231.5	6.95	"	building site
		Σ 35.60	"	
Crusher stone for pavement	ℓ=900.79^m	810.71	"	farm-1
	ℓ=783.83	705.50	"	farm-2
	ℓ=378.30	435.05	"	asphalt pavement at building site
		Σ 1,951.26		
	ℓ=545.00	408.75	"	building site
		Σ 2,360.01	"	

Item			Quantity	Unit	Remarks
Campaction	ℓ=1094.39		3,283.17	m^2	farm-1
	ℓ=783.83		2,351.49	"	farm-2
	ℓ=378.30		1,740.18	"	asphalt pavement at building site
		Σ	7,374.84		
	ℓ=545.00		1,362.50	"	building site
		Σ	8,737.34		
Asphalt pavement	ℓ=378.30		1,740.18	"	building site
Concrete pipe	ϕ600		145.00	m	farm-1
			5.00	"	farm-2
		Σ	150.00	"	
Catch box			9	places	farm-1

Amount of material specification of Sub Centre

1. Reclamation at New-field

Item		Quantity	Unit	Remarks
Earthwork		1,380	m^3	main road
Crusher stone for pavement	ℓ=1150 m	1,411.2	"	blanch
	ℓ= 286 m	214.5	"	building site
		Σ 3,005.7	"	
Compaction	ℓ=1150 m	1,001.9	m^2	main
Mortar mainsonry	ℓ=1150 m	241.50	m^3	
Collecting conduit	ℓ=1162 m	1,045.80	m^3	(excavation)

2. Reclamation at Station

Item		Quantity	Unit	Remarks
Earthwork	Bank	2,520	m^3	
Crusher stone	ℓ= 160 m	120	m^3	
Compaction	ℓ= 160 m	400	m^2	

Amount and Material Specification of Pipeline

Material		Standard/Specification	Unit	Quantity	Remarks
Ductile cast iron pipe		Type K, class 1, ϕ100mm			
		Surface pipe	m	988.902	
		Underground pipe	"	325.777	Incl. stiffening work
Ductile bend, type A		ϕ100 x 90°	pce	3	
		x 45°	"	3	
		x $22°\frac{1}{2}$	"	17	
		x $11°\frac{1}{4}$	"	32	
Thrust block		Type A		3	
		Type B	"	1	
		Type D	"	2	
		Type E	"	6	
		Type F	"	10	
		Type G	"	25	
Sluice valve work		ϕ100 mm	"	3	Incl. stiffening work
Air valve work		ϕ100 x 25 mm	"	8	"
Earth-moving valve work		ϕ100	"	1	"
Aqueduct work	No.1	ϕ100	"	1	Incl.abutment work Σℓ=14.535m
	No.2	"	"	1	" Σℓ=12.172m
	No.3	"	"	1	" Σℓ=15.914
	No.4	"	"	1	" Σℓ=19.335
	No.5	"	"	1	" Σℓ=14.739

Amount and Material Specification of End Irrigation Facilities (Centre)

Material	Standard/ Specification	Unit	Quantity	Remarks
Dusctile cast iron pipe, type K, class 1, ϕ100	Surface pipe	m	185.34	Incl. stiffening work
Vinyl chloride pipe,ϕ100	Underground pipe	m	1,376.8	
Tee (UP)	ϕ100 x 100	pce	6	
	ϕ100 x 75	"	20	
Bend pipe (UP)	ϕ100 x 90°	"	5	
	x 45°	"	5	
	x 22° 1/2	"	6	
	x 11° 1/4	"	13	
Cap	ϕ100	"	7	
Sluice valve work(Farms)	ϕ100	place	8	
Air valve work (")	ϕ100 x 25	"	7	
Hydrant work (")	ϕ75	"	20	
Ductile bend, type A	ϕ100 x 45°	pce	3	
(Cast iron)	x 22° 1/2	"	3	
(")	x 11° 1/4	"	3	
Sluice valve work (")	ϕ100	place	1	
Air valve work (")	ϕ100	"	1	
Thrust block	Type B	place	1	
	Type D	"	2	
	Type F	"	2	
	Type G	"	3	
Sprinkler set		set	2	

Amount and Material Specification of End Irrigation Facilities (Sub-Centre)

Material	Standard/ Specification	Unit	Quantity	Remarks
Vinyl chloride pipe for surface installation	ϕ150	m	1273.0	
Tee	ϕ150 x 150	pce	1	
	ϕ150 x 100	"	22	
Bend	ϕ150 x 90°	"	7	
Cap	ϕ150	"	2	
Sluice valve work	ϕ150	place	4	
Air valve work	ϕ150 x 25	"	3	
Hydrant work	ϕ100	"	22	
Sprinkler		set	2	

7-2 Estimation of Project Cost

Total Cost

854,000,000 RP

	Item	Quantity	Unit	Amount
A.	Sericulture Centre	1	set	503,283,000 PR
B.	Sub-Centre	1	"	350,850,000
	Total			854,133,000
				≒ 854,000,000

A. Total Construction Cost of Sericulture Centre

	Item			
A1.	Direct construction cost	1	set	417,012,000 RP
	Overhead cost (A1 - A2) x 0.30			
	= (417,012,000 - 128,896,000) x 0.3 = 86,434,000			
	Total			503,446,000

B. Total Construction Cost of Sub-Centre

	Item			
B1.	Direct construction cost			293,283,000 RP
	Overhead cost (B1 - B2) x 0.30			
	= (293,283,000 - 101,393,000) x 0.30 = 57,567,000			
	Total			350,850,000

A1. Direct Construction Cost of Sericulture Centre

417,012,000 RP

Item	
Reclamation work	16,156,000
Intake and collecting work	4,674,000
Pump house	7,242,000
Pump	10,188,000
Pipeline	15,480,000
Farm pond	11,668,000
Irrigation facilities	9,521,000
Pump and generator house	13,776,000
Building for sericultural production	232,273,000
Appurtenant facilities	96,034,000
Total	417,012,000

A2 Main Facilities of Sericulture Centre

128,896,000 RP

Item			Yen
Pipeline		2 sets	7,120,000
Pressure pump		2 sets	790,000
Water supply pump		1 set	410,000
Purifying tank		1 set	6,210,000
Generator	65 KVA	2 sets	8,800,000
Generator	40 KVA	3 sets	13,500,000
Cold storage		1 set	20,500,000
Accessories to cold storage		1 set	27,234,000
Monorail		1 set	454,380
Ductile cast iron pipe		1500m	6,465,000

Vinyl chloride pipe	1,376 m	956,320
Sprinkler	20 units	291,660
Total		¥ 92,731,360 ≒ 128,896,000 RP

B1. Direct Construction Cost of Sub-Centre

293,283,000 RP

Item			
Reclamation work	1 set	14,442,000 1,488,000	at New Field at Station
Intake and collecting work	1 set	745,000	
pump house	1 set	7,242,000	same as Centre
Delivery pump	1 set	2,600,000	
Pipeline installation work	1 set	351,000	
Farm pond	1 set	13,971,000	
Irrigation facilities	1 set	9,159,000	at New Field, same
Pump and generator house	1 set 1 set	13,776,000 9,657,000	as Centre at Station
Building for sericultural production	1	80,588,000	
Appurtenant facilities	1	139,264,000	
Total		293,283,000	

B2. Main Facilities of Sub-Centre

101,393,000 RP

Item	Q'ty	Amount (Yen)	(RP)
Delivery pump	2 sets	866,000	
Pressure pump	2 sets	1,470,000	
Water supply pump	2 sets	220,000	
Purifying tank	2 sets	620,000	
Generator 65 KVA	1 set	9,000,000	
70 KVA	2 sets	10,000,000	
30 KVA	2 sets	8,440,000	
10 KVA	1 set	3,560,000	
Cold storage		4,320,000	
Accessories to cold storage		30,575,000	
Vinyl chloride pipe	1273 m	3,174,000	
Sprinkler	48 unit	699,984	
Total		¥ 72,944,984	
		≒ 101,393,000 RP	

A1-a. Cost Breakdown of Land Reclamation Works

Construction Cost: Rp 16,156,000

Items	Size	Quantity	Unit	Unit cost RP	Cost RP	Remarks
Earthwork	cut-1	8,105.22	m^3	738	5,981,652	
	Cut-2	7,082.70	"	30	212,481	
Dry masonry		3,258.20	"	945	3,078,999	
Mortar Masonry		249.17	"	7,945	1,979,655	for side ditch
Catch box		9	place	15,898	143,082	
Mortar		35.60	m^3	14,000	498,400	
Crusher stone		1,951.26	"	250	487,815	
Campaction of road		7,374.84	m^2	30	221,245	
Asphalt pavement		1,740.18	"	1,000	1,740,180	
Concrete pipe work ϕ600		150.00	m	11,135	1,670,250	
Intra-site road (Crusher stone)		408.75	m^3	250	102,187	ℓ=545 m
" (Compaction)		1,362.5	m^2	30	40,875	
Total					16,156,821	
				≒	16,156,000	

A1-b. Cost Breakdown of Water Intake Works

Construction Cost: 4,674,000 RP

Item	Size	Quantity	Unit	Unit cost	Cost	Remarks
Concrete	28=240	42.20	m^3	48,100	2,029,820	
Concrete	28=135	1.76	"	42,320	74,483	
Form		128.08	m^2	4,200	537,936	
Riprap		5.28	m^3	500	2,640	
Reinforcement	SD30	2.046	t	470,670	962,990	
Checkered plate	t=30mm	0.115	"	500,000	57,500	
. pipe	ϕ300	31.00	m	4,853	150,443	
Weep hole	VPϕ50	11.00	m	210	2,310	
Gravel		3.90	m^3	1,000	3,900	Transportation over 2 km distance at a rate of 1 m^3/person/day
Gravel excavation	man power	548.00	"	150	82,200	
Backfilling	"	486.62	"	250	72,993	
Surplus soil removal	"	61.40	"	150	9,210	
Dewatering		40	day	2,020	80,800	
Temporary scaffolding		48	m^3	7,523	361,104	
Sandbang piling		60	m	4,000	240,000	
Dredging	11t bull-dozer	220	m^3	30	6,600	B=5.0 H=1.0
Total					4,674,929	
					= 4,674,000	

A1-c. Cost Breakdown of Pump House Work

Construction Cost: 7,242,000 RP

Item	Size	Quantity	Unit	Unit Cost	Amount	Remarks
Reinforced concrete	28=240	31.78	m^3	48,100	1,528,618	
Concrete for flooring	28=135	1.10	"	42,320	46,552	
Form		283.67	m^2	4,200	1,191,414	
Crushed gravel		8.46	m^3	3,500	29,610	
Reinforcement	SD30	5.12	5	470,670	2,409,830	
Excavation	Manual labour	40.21	m^3	150	6,031	
Backfilling	"	22.32	"	250	5,580	
Waterproofing work						
Ashphalt waterproofing		56.00	m^2	2,800	156,800	
Expansion joint		40.00	m	140	5,600	
Recaulking of fittings		42.50	"	170	7,225	
Carpentry						
Ceiling bed		8.29	m^2	320	2,652	
Lauan baseboard		2.70	m	120	324	
Partition		2.70	"	100	270	
Fitting frame		10.50	"	760	7,980	
Architrave		31.40	"	760	23,864	
Lauan plywood		8.64	m^2	360	3,112	
Metal work						
Roof drain	Cast iron, ϕ75	2	place	1,100	2,200	
Curing pipe	White gas pipe, ϕ100	3.60	m	1,600	5,760	
Nails and other metal fixtures		1	set		8,000	

Item	Size	Quantity	Unit	Unit Cost	Amount	Remarks
Plaster work						
Mortar brushing	Wall	121.87	m^2	3,100	377,797	
Mortar trowelling	"	15.14	"	2,900	43.906	
"	Floor	57.30	"	2,240	128,352	
"	Baseboard	18.50	m	1,070	19.795	
Evening mortar		56.00	m^2	1,200	67,200	
Water proof mortar trowelling		29.00	"	1,200	34.800	
"	Baseboard	20.40	m^2	910	18,564	
Plaster	Wall	20.72	"	3,120	64,646	
Resin spraying		121.87	"	5,460	665,410	
Colour cement		22.16	"	2,400	53,184	
Concrete covering		3.50	"	1,500	5,250	
Waterproof mortar finish on fitting joint		45.2	m	1,200	54,240	
Mortar trowelling on window environs		31.4	"	580	18,212	
Fittings work						
Wooden door	1800 x 2100	1	place		4,100	
"	900 x 2100	1	"		2,200	
Window frame	1800 x 1100	1	"		9,590	
Wooden flush	900 x 2000	1	"		6,750	
Adjustment and transportation		1	set		2,264	10% of above amount
Painting work						
UP	Plaster board	8.29	m^2	2,400	19,896	
UP	Mortar	7.84	"	2,400	18,816	
OP	Metal	18.52	"	800	14,816	

Item	Size	Quantity	Unit	Unit cost	Amount	Remarks
Mortar finish on metal lathing		12.15	m^2	2,800	34,020	
Lathing board		2.16	"	210	453	
Plaster board		8.29	"	1,800	14,922	
Riser	VUφ75	6.8 m	m	1,100	7,480	
Fence		60	m	1,900	114,000	
Total					7,242,083	
					= 7,242,000	

A1-d. Cost Breakdown of Delivery Pump Work

Construction Cost: 10,188,000 RP

Item	Quantity	Amount	
Type MVHR-804AZ single suction multi-stage centrifugal pump ($0.5\ m^3$/min x 167m x 3200 rpm x 45 PS x 2 units)	1 set	6,460,000	
1 set of standard accessories of above incl. check valve, sluice valve, mating flange, foot valve, strainer, fly wheel, orifice, etc.			
50 PS diesel engine	2 units		
1 set of standard accessories including battery, battery charger, speed up gears, etc.			
Type NVS-201AZ vacuum pump ($0.27\ m^3$/min x 60 mmHg x 1800 rpm x 3 PS)	1 unit	360,000	
1 set of standard accessories including 3 PS diesel engine			
Indoor piping materials for cast iron pipe including bolts, nuts and packings	1 set	300,000	
		7,120,000.-	
Installation and transportation Fee		210,000	30% of above
		7,330,000 Yen	
		10,188,000 RP	1Yen=1.39RP

A1-e. Cost Breakdown of Pipeline Work

Cosntruction Cost: 15,480,000 RP

Item	Size	Quantity	Unit	Unit cost	Amount	Remarks
Ductile cast iron pipe, type K, class 1,ø100	Surface pipe	988.902	m	5,717	5,653,552	
"	Underground pipe	325.777	"	14,070	4,583,682	
Bend	ø100 x 900°	3	pce	10,555	31,665	
	x 45°	3	"	8,888	26,664	
	x $22°\frac{1}{2}$	17	"	8,888	151,096	
	x $11°\frac{1}{4}$	32	"	11,958	382,656	
Thrust block	Type A	3	place	47,898	143,694	
	Type B	1	"	40,196	40,196	
	" D	2	"	31,665	63,330	
	" E	6	"	21,663	129,978	
	" F	10	"	31,736	137,360	
	" G	25	"	11,662	291,550	
Sluice valve work		3	"	112,547	337,641	
Air valve work		8	"	233,213	1,865,704	
Earth-moving valve work		1	"	256,821	256,821	
Aqueduct work	No.1	1	place	330,750	330,750	Σℓ =14.535m
	No.2	1	"	283,354	283,354	Σℓ =12.172
	No.3	1	"	227,122	227,122	Σℓ =15.914
	No.4	1	"	316,161	316,161	Σℓ =19.331
	No.5	1	"	227,692	227,692	Σℓ =14.739
Total					15,480,668	
				≒	15,480,000	

A1-f. Farm pond

Construction cost: 11,668,000 RP

Item	Size	Q'ty	Unit	Price RP	Amount	Remarks
Ferroconcrete	σ28=210	113.00	m^3	48,100	¥5,435,300	
Concrete	σ28=135	17	"	42,320	719,440	
Form		441	m^2	4,200	1,852,200	
Crushed stone	20∿30 m/m	57	m^3	250	14,250	
Iron reinforcement	SD30	6.414	t	470,670	3,018,877	
Dowel bar	φ16	0.202	"	101,400	20,482	
PVC pipe	φ20	76.8	m	170	13,056	
Sheathing plate		119	m^2	2,000	238,000	
Sluice valve	φ125	1	unit		87,000	
Checkered plate		75.01	kg	500	37,505	
	50x50xR	19.46	"	84	1,634	
Handrail, stainless steel pipe	φ1"	210.5	m	200	42,100	
Earth-moving work						
Excavation	11-ton bullodozer	589.2	m^3	30	17,676	
Hand excavation		7.2	"	150	1,080	
Back filling	11-ton bulldozer	121.5	"	230	27,945	
Banking	"	163.9	"	230	37,559	
Mucking		311.0	"	30	9,330	
Sodding		720.33	"	132	95,083	
Total					11,668,517	
					≒ 11,668,000	

A1-g. End irrigation facilities (Bili-Bili sericulture center)

Construction cost: 9,521,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Ductile pipe, type K, class 1, 100 mm ϕ, surface laying		185.34	m	14,070	2,607,733	
PVC pipe, 100 mm ϕ, underground laying		1,376.8	m	2,175	2,994,540	
Tee	ϕ100x100 (VP)	6	unit	1,847	11,082	
	ϕ100x75 (")	20	"	1,472	29,440	
Bend	ϕ100x90° (")	5	"	1,097	5,485	
	x45° (")	5	"	1,097	5,485	
	x22°1/2(")	6	"	1,097	6,587	
	x11°1/4(")	13	"	1,097	14,261	
Cap	ϕ100	7	"	7 4	5,488	
Sluce valve installation (Farm)	ϕ100	8	pl'ce	87,757	702,056	
Air valve installation (Farm)	ϕ100x25	7	"	116,959	818,713	
Water service valve installation	ϕ75	20	"	61,462	1,229,240	
Bend, 100 mm ϕ x 45° (cast iron)		3	unit	10,555	31,665	
	x 22°1/2(")	3	"	8,888	26,664	
	x 11°1/4(")	3	"	11,958	35,874	
Sluice valve	ϕ100 (")	1	pl'ce	112,547	112,547	
Air valve	ϕ100 (")	1	"	233,213	233,213	
Thrust block, type B		1	"	40,196	40,196	
type D		2	"	31,665	63,330	
type F		2	"	13,736	27,472	
type G		3	"	11,662	34,986	
Subtotal					9,036,052	

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Sprinkler set		2	set	242,700	485,400	
Subtotal					485,400	
Total					9,521,452	
					≒ 9,521,000	

Al-h. Pump and radiator house (sericulture center)

Construction cost: 13,776,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Temporary work		1	set		800,000	
Earth-moving work	Excavation	86.5	m^3	150	12,975	
	Back filling	58.5	"	250	14,625	
	Mocking	28	"	250	7,000	
	Boulder	14	"	500	7,000	
Concrete work	$\sigma 28=240$	83.1	"	48,100	3,997,110	
	$\sigma 28=135$	24.2	"	42,320	1,024,144	
Form		612.3	m^2	4,200	2,571,660	
Iron reinforcement		7.9	t	470,670	3,718,293	
Brick laying		10	m^2	248	2,480	
Water-proofing work	Asphalt coating	66.5	"	2,800	186,200	
	Expansion joint	41	m	2,670	109,470	
	Caulking	84.5	"	210	17,745	
Metal work	Roof drain	1	pc	1,100	1,100	
	Aluminum molding	35.36	m^2	8,200	289,952	
	Metal wrath	35.36	"	670	23,691	
Plastering	Finish mortar work	110	"	1,200	132,000	
	Roof mortar (troweling)	110	"	1,260	138,600	
	Siding mortar (brushing)	51.2	"	2,900	148,480	
	Wainscotting mortar	9.4	"	2,700	25,380	
	Floor ground mortar	17.4	"	2,240	38,976	

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Plastering	Interior mortar (brushing)	88	m^2	3,100	272,800	
	Mopboard mortar (troweling)	27.4	m	1,070	29,318	
	Floor water-proof mortar	56	"	1,200	67,200	
	Water-proof mortar grounting for furnishings	37.6	"	1,200	45,120	
Paning	Rough wire glass	8	m^2	2,800	22,400	
Painting	VP	27.4	m	2,400	65,760	
Gutter	VP ϕ75	6.6	"	1,100	7,260	
Total					13,776,739	
					≒ 13,776,000	

Al-1. Building for sericulture center

Cosntruction Cost: 232,273,000 RP

	Items	
1.	Main building	134,994,000 RP
2.	Cocoon testing room	7,816,000
3.	Rearing room for rearing method	11,855,000
4.	Rearing room, egg raising (1)	10,903,000
5.	" (2)	10,903,000
6.	Research room	3,194,000
7.	Pathological rearing room	6,828,000
8.	Pebring inspection building	11,281,000
9.	Silkworm egg refrigerator	6,566,000
10.	Artificial hatching room	1,127,000
11.	Chemicals warehouse	761,000
12.	Garage	5,314,000
13.	Mulberry field maintenance room	5,245,000
14.	Compost shed	6,738,000
15.	Agricultural machine & tools warehouse	6,207,000
16.	Pool (B)	1,790.000
17.	Bathing & shower room	751,000
	Total	232,273,000

Al-j. Appurtenances

Construction cost: 96,034,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
j-1)	Water supply and generator facilities	1	set		29,470,000	
j-2)	Male moth refrigerator	1	"		3,080,000	
j-3)	Temperature and humidity control equipments for incubation room and egg refrigerate room	1	"		52,986,000	
j-4)	Water service piping work	1	"		5,330,000	
j-5)	Electrical wiring work	1	"		4,424,000	
j-6)	Self-travelling monorail facilities	1	"		744,000	
Total					96,034,000	

j-1 Water supply and generator facilities

Construction cost: 29,470,000 RP

	Item	Size	Q'ty	Unit	Price	Amount	Remarks
1.	Pressurizing pump, 80 φ 4-stage single-suction centrifugal pump, 11 kW, 4P, 220 V, 60 Hz		2	set	395,000	¥790,000	
2.	Pressure tank type water supply pump, 40 φ single-suction single-stage centrifugal pump		1	set		410,000	
3.	Water treatment equipment	2 m^3/hr	1	set		6,210,000	
4.	Generator, 40 kVA, transformer, 220/110 V, switchboard		3	unit	4,500,000	13,500,000	
5.	Package and shipping		7	set	40,000	280,000	
6.	Setting: Worker		20	person	360	7,200	
		Foreman	10	person	480	4,800	
Total						¥21,202,000	

1 yen
29,470,000 ≒ 1.39 RP

j-2 Sericulture center: Male moth refrigerator

Construction cost: 3,080,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
1. Prefabricated and thermal insulated room	1	set		1,340,000		
	3000w x 3000ℓ x 2700h colour aluminium 0.8mm stainless steel 0.8mm polyurhetan form 40mm with Insulation door 1 set Drain board 1 set Room light, Thermometer.					
2. Cooling Unit	1	set		520,000		
	Wall insert type Refrigerate capacity 2,100kcal motor 3φ 200V 1.5kW with refrigerator, evaporator, refrigerant control parts, thermostat.					
3. Electric control panel	1	set		60,000		
4. Supporting metal	1	set		50,000		
5. Pre-installation & testing charges	1	set		80,000		
Sub-total				2,050,000		
Packing charges	200	cft.	500	100,000		
Carriage to Yokohama	1	set		30,000		
Sub-total				¥2,180,000.-		1 yen =1.39 RP
Labour for installation	100	person	500	50,000		
Total				3,080,000		

j-3 Sericulture centre: Temperature and humidity control equipments for incubation room and egg refrigerate room

Construction cost: 52,986,000 RP

	Item	Size	Q'ty	Unit	Price	Amount	Remarks
1.	Prefabricated and thermal insulated room		1	set		¥11,207,000	
2.	Machine & equipments		1	set		9,629,000	
3.	Electric control equipments		1	set		4,797,000	
4.	Generator		1	set		8,800,000	
5.	Spare parts & tools		1	set		1,601,000	
6.	Packing charges		3474	cft	500	1,737,000	
7.	Carriage		1	set		320,000	
	Sub-Total					¥38,091,000	
						52,946,000	RP 1 yen=1.39RP
8.	Labour for installation		40	person	500	70,000	
	Total					52,986,000	

j-4 Water service piping facilities

Construction cost: 5,330,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Water service piping work		2,107	m^2	2,530	5,330,710	Japanese standard
					≒ 5,330,000	

j-5 Electrical wiring

Construction cost: 4,424,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Wiring work		2,107	m^2	2,100	4,424,700	Japanese standard
					≒ 4,424,000	

j-6 Self-traveling monorail facilities

Construction cost: 744,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Monorail main body	H=600 700 x 400	1	set		¥178,500	
Car		2	unit	50,500	101,000	
Reinforcing stand		50	pl'ce	740	37,000	
Stopper		2	pc	190	380	
Fittings		50	set	2,750	137,500	
Transportation		1	set		40,000	
Installation		100	person	360	36,000	
Foreman		10	person	480	4,800	
Total					¥535,180	
					744,000	1 yen ≒ 1.39 RP

B1-a-1 Land development (subcenter - new field)

Construction cost: 14,442,000 RP

Item	Size	Q'ty	Unit	Price RP/10a	Amount	Remarks
Leveling		17.80	ha	2,933	522,074	
Catchment canal	Hand excavation	1,045.80	m^3	150	156,870	ℓ=1162m
Side ditch	Wet masonry	241.5	"	7,945	1,918,717	ℓ=1150m
Catch basin		6		15,898	95,388	
Ballasting		3,005.7	m^3	3,750	11,271,375	ℓ=1150m B=5 ℓ=1568 B=4 ℓ= 286 B=3
Consolidation by rolling		1,001.9	m^2	30	300,570	
Concrete and pipe work	φ600	15	m	11,135	167,025	
Sodding	1.5x160m	80	m^2	132	10,560	
Total					14,442,579	
					≒ 14,442,000	

B1-a-2 Land development (subcenter - station)

Construction cost: 1,488,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Banking	0.40x70x90	2,520	m^3	230	579,600	
Transportation					289,800	50% above amount
Road	Ballasting	120	m^3	3,750	450,000	ℓ=160m
	Consolidation by rolling	400	m^2	30	12,000	
Drain canal	Wet masonry	19.74	m^3	7,945	156,834	ℓ=94m
Total					1,488,234	
				≒	1,488,000	

B1-b. Water intake work (subcenter)

Construction cost: 745.000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
CP Hume pipe	φ1200	2			18,000	
Concrete	σ28=135	1.52	m^3	42,320	64,326	
Foundation boulder		4.56	"	4,800	21,888	
Checkered plate		0.115	"	500,000	57,500	
Concrete porous pipe		16.44	m	4,853	79,783	
Weep hole	VP φ50	5	m	210	1,050	
Gravel		3.61	m^3	3,750	13,537	
Excavation	Manual	273.70	"	150	41,055	
Back filling		232.72	"	250	58,180	
Mocking		40.98	"	150	6,147	
Drainage		30	month	2,020	60,600	
Temporary scaffolding		32	space m^3	7,523	240,736	
Sandbag		20	m	4,000	80,000	
Dredging	Manual	20	m^3	150	3,000	
Total					745,802	
				≒	¥745,000	

B1-d. Water supply pump

Construction cost: 2,600,000 RP

Item	Q'ty	Price	Amount	Remarks
(1) Water suction and delivery pump SV0102FZ single-suction centrifugal pump, 1.18 m^3/min., 14 m, 1,800 rpm, 8 PS; a complete set of accessories for the pump; check valve, sluice valve, mating flanges, foot valve, pressure gauge, vacuum gauge, automatic centrifugal clutch, cover, tools; 8PS gasoline engine (cell starter type), lead storage battery, fuel tank, tools.	2 sets	433,000	¥866,000	
(2) Indoor piping materials (cast iron pipes), including bolts, nuts and packings	1 set		520,000	
Sub-total			¥1,386,000	
Transportation and installation			485,100	
Total			¥1,871,100	
			2,600,829	1 yen ≒ 1.39RP
			≒ 2,600,000 RP	

B1-e, Water supply pipe installation work

Construction cost: 351,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
PVC pipe	ϕ150	88	m	3,989	351,032	
					≒ 351,000	

B1-f. Farm pond (subcentre)

Construction cost: 13,971,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Concrete	σ28=240	152.34	m^3	48,100	¥7,327,554	
Concrete	σ28=135	28.80	"	42,320	1,218,816	
Form		115.04	m^2	4,200	483,168	
Crushed stone		99.08	m^3	3,500	346,780	
Iron reinforcement		6.307	t	470,670	2,968,515	
Sheathing plate	$^{B}200x^{t}5$	179.20	m	2,000	358,400	
PVC pipe	φ20	57.60	"	170	9,792	
Spill pipe VP	φ150	96	"	3,600	345,600	
TS tee	φ150x150	1	unit		8,000	
TS elbow	φ150x90°	11	"	4,800	52,800	
VP	φ50	16.1	m	600	9,660	
TS tee	φ150x75	14	unit	2,200	30,800	
TS elbow	φ50x90°	14	"	350	4,900	
Reducer socket	φ25x50	14	"	200	2,800	
Sluice valve	φ200	1	unit		22,000	
Steel pipe	φ200	72.2	m	5,200	375,440	
Stainless steel pipe	φ1"	59.0	m	200	11,800	
Stainless pipe	φ1-1/2"	29.3	"	250	7,325	
2x50x200		5.28	kg	92	485	
4.5x50x235		6.64	"	92	610	
Hex bolt	W3/8x32	32	pc.	24	768	

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Anchor bolt	W5/8x210	32	pc.	90	2,880	
Hume pipe	ϕ500	0.5	m	6,223	3,111	
Manhole cover	for ϕ450	1	set		2,100	
Checkered plate	t=3.2	52.51	kg	500	26,255	
Angle		19.92	kg	84	1,673	
Earth-moving work						
Excavation	11-ton bulldozer	635.05	m^3	30	19,051	
Back filling	"	110.63	"	230	25,444	
Sodding		1,563.26	m^2	132	206,350	
Hand excavation		104.44	m^3	150	15,666	
Hand back filling		80.03	"	250	20,007	
Banking		223.76	"	230	51,464	
Mocking (by machine)	11-ton bulldozer	300.66	"	30	9,019	
Mocking (by hand)		10.86	"	250	2,715	
Total					13,971,748	
				$\fallingdotseq$	13,971,000	

B1-g. End irrigation facilities (Soppeng sericulture subcenter)

Construction cost: 9,159,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
PVC pipe	φ150 Underground laying	1,273.0	m	3,989	5,077,997	
Tee						
Tee	φ150x150	1	unit	5,694	5,694	
	φ150x100	22	"	5,694	125,268	
Bend	φ150x90°	7	"	3,638	25,466	
Cap	φ150	2	"	1,777	3,554	
Sluice valve installation						
	φ150	4	pl'ce	128,632	514,528	
Air valve installation						
	φ150x25	3	"	118,629	355,887	
Sprinkler paiser		22	"	80,285	1,766,270	
Sub-total					7,874,664	
Sprinkler set		2	set	642,457	1,284,914	
Sub-total					1,284,914	
Total					9,159,578	
					≒ 9,159,000	

Bl-h. Pump and generator house (station)

Construction cost: 9,657,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Temporary work		1	set		450,000	
Excavation (by hand)		58.65	m^3	150	8,797	
Back filling (by hand)		38.80	"	250	9,700	
Mocking (by hand)		19.85	"	250	4,962	
Boulder		7.84	"	500	3,920	
Concrete	σ_{28}=240	63.00	"	48,100	3,030,300	
"	σ_{28}=135	2.70	"	42,320	114,264	
Form		364.1	m^2	4,200	1,529,220	
Iron reinforcement		5.28	t	470,670	2,485,137	
Iron reinforcement		7.5	m^2	248	1,860	
Waterproof work						
Asphalt coating		110	m^2	2,800	308,000	
Expansion joint		60	"	2,670	160,200	
Caulking		105	m	210	22,050	
Metal work						
Roof drain		2	pcs	1,100	2,200	
Grating		30	sheet	5,600	168,000	
Alminum molding		48.4	m^2	8,200	396,880	
(Metal wrath lining)		48.4	"	670	32,428	
Plastering						
Leveling mortar	Trowel	66.5	"	1,200	79,800	
Roof mortar	"	66.5	"	1,260	83,790	
Siding mortar	"	35.56	"	2,900	103,124	

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Wainscotting mortar	Trowel	4.66	m^2	2,700	12,582	
Floor mortar (ground)		17.21	"	2,240	34,070	
Interior wall mortar (brushing)		49.85	m^2	3,100	154,535	
Mopboard mortar (Troweling)		18.20	"	1,070	19,474	
		30.00	"	1,200	36,000	
Water-proof mortar grouting around furnishings		24.5	"	1,200	29,400	
Resin coating		56.68	"	5,460	309,472	
Glass (wrath wire glass)		7.22	"	2,800	20,216	
VP painting		18.2	m	2,400	43,680	
Gutter	VP ϕ75	3.3	"	1,100	3,630	
Total					9,657,691	
				≒	9,657,000	

Note Pump and Generator house in the New Field is same as Centre.

B1-1. Building for sericulture subcentre

Construction cost: 80,588,000 RP

	Item		
1.	Rearing house, grown silkworm (1)		12,201,215 RP
2.	" (2)		12,201,215
3.	Research house		3,541,481
4.	Rearing house, young silk worm		8,353,096
5.	Rearing house for egg production (1)		13,081,193
6.	" (2)		13,081,193
7.	Research house		3,676,449
8.	Pebrine inspection building		5,350,228
9.	Silkworm egg refrigerator		8,548,891
10.	Pool (A)		553,926
	Total		80,588,887
		≒	80,588,000

Bl-j. Appurtenances

Construction cost: 139,264,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
j-1.	Water supply and generator facilities	1	set		68,847,000	
j-2.	Male moth refrigerator	1	"		6,430,000	
j-3.	Temperature & humidity control equipments for incubation-room & egg refrigerate-room	1	"		58,219,000	
j-4.	Water service pipe installation work	1	"		3,152,000	
j-5.	Electrical wiring work	1	"		2,616,000	
	Total				139,264,000	

j-1. Water supply and generator facilities

Construction cost: 68,847,000 RP

	Item	Size	Q'ty	Unit	Price	Amount	Remarks
1.	Pressurizing pump, 125 ϕ, 1.79 m^3/min., 1,750 rpm, 30 kW		2	set	735,000	1,470,000	
2.	Pressure tank type water supply pump, 40 ϕ single-suction single-stage centrifugal pump		2	"	310,000	620,000	
3.	Water treatment equipment	1 m^3/hr	2	"	300,000	600,000	
4.	Generator	70 kVA	2	unit	5,000,000	10,000,000	
		30 kVA	2	unit	4,220,000	8,440,000	
		10 kVA	1	unit	3,560,000	3,560,000	
5.	Package and shipping		11	set	40,000	440,000	
6.	Setting		40	person	360	14,800	
			20	"	480	9,600	
	Total					49,530,000	
					≒	68,847,000	1 yen ≒ 1.39 RP

j-2. Subcentre: Male moth refrigerator

Construction cost: 6,430,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
1.	Prefabricated and thermal room; $2500^{W} \times 4500^{\ell} \times 2700^{h}$ colour aluminium 0.8mm polyurhetan form 40mm with Insulation door 1 set Drain board 1 set Room light, Thermometer.	2	sets	1,450,000	2,900,000	
2.	Cooling unit Wall insert type Refrigerate capacity 2,100 kcal Motor 3o 200V 1.5kW With Refrigerator, evaporator, refrigerant control parts, thermostat.	2	sets	520 000	1,040,000	
3.	Electric control panel	2	sets	60,000	120,000	
4.	Supporting metal	2	sets	50,000	100,000	
5.	Pre-installation & testing charges	2	sets	80,000	160,000	
	sub-total				4,320,000	
	Packing charges	420	cft.	500	210,000	
	Carriage to Yokohama	1	set		60,000	
	Total				4,590,000	1 yen ≒ 1.39 RP
					≒ 6,380,000 RP	
6.	Installation work	100	person	500	50,000	
	Total				6,430,000 RP	

j-3. Subcentre: Temperature and humidity control equipments for incubation room and egg refrigerate room

Construction cost: 58,219,000 RP

	Item	Size	Q'ty	Unit	Price	Amount	Remarks
1.	Prefabricated and thermal insulated room		1	set		¥13,364,000	
2.	Machine & equipments		1	set		10,437,000	
3.	Electric control equipments		1	set		5,173,000	
4.	Generator		1	set		9,000,000	
5.	Spare parts & Tools		1	set		1,601,000	
6.	Packing charges		3,870	cft	500	1,935,000	
7.	Carriage		1	set		360,000	
	Total					¥41,870,000	
						58,199,000	1 yen ≒ 1.39 RP
8.	Installation work		40	person	500	20,000	
	Total					¥58,219,000	

j-4. Water service piping work

Construction cost: 3,152,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Water service piping work		1,246	m^2	2,530	3,152,380	Japanese standard
					≒ 3,152,000	

j-5. Electrical wiring work

Construction cost: 2,616,000 RP

Item	Size	Q'ty	Unit	Price	Amount	Remarks
Wiring work		1,247	m^2	2,100	2,616,600	Japanese standard
					≒ 2,616,000	

Table of unit cost

No.	Items	Size	Unit	Unit cost
1.	Concrete	σ28=240 kg/cm	m^3	48,100 RP
2.	Concrete	σ28=135 "	"	42,320
3.	Mortar	1:1	"	14,000
4.	Boulder	at Bili-Bili	"	500
5.	"	at soppeng	"	4,800
6.	Grarrel	at Bili-Bili	"	250
7.	"	at soppeng	"	3,750
8.	Brik		m^2	248
9.	Hume pipe installation and jointing	ϕ600	m	11,135
10.	"	ϕ500	m	6,223
11.	Porous pipe	ϕ600	"	14,530
12.	"	ϕ300	"	4,853
13.	Form	wood	m^2	4,200
14.	Reinforcement		t	470,670
15.	Expansion joint		m^2	2,670
16.	Fence		m	1,900
17.	Dry masonry		m^3	945
18.	Mortar massonry		"	7,945
19.	Asphalt pavement		m^2	1,000
20.	Exacvation	by man power	m^3	150
21.	"	by 11t bulldozer case-1	"	738
22.	"	" case-2	"	30
23.	Bank (incl. ramming)	"	"	230
24.	Back filling (incl. ramming)	by man, power	"	250

No.	Items	Size	Unit	Unit cost
25.	Sodding		m^2	132 RP
26.	Leveling		10a	2,933
27.	Temporary scaffolding	Bamboo	Space m^3	7,523
28.	Drainage	7PS 10 mm ϕ centrifugal pump	day	2,020
29.	Sandbag		m	4,000
30.	Ductile cast iron pipe	Surface laying, 100mm ϕ	m	14,070
31.	"	Underground laying, 100 mm ϕ	"	5,717
32.	"	Surface laying, 150 mm ϕ	"	
33.	"	Underground laying, 150 mm ϕ	"	
34.	Surface-laid pipe protection		pl'ce	34,293
35.	Steel pipe laying		m	3,088
36.	Air valve installation,	100 mm ϕ x 50 (for delivery pipe)	pl'ce	233,213
37.	Sluice valve installation	150 mm ϕ (for farm)	"	128,632
38.	"	100 mm ϕ (")	"	87,757
39.	Air valve installation	150 mm ϕ x 25 (for farm)	"	110,629
40.	"	100 mm ϕ x 25 (for farm)	"	116,959
41.	Sluice valve installation	100 mm ϕ (for delivery pipe)	"	112,547
42.	Sludge valve installation	100 mm ϕ (for farm)	"	256,821
43.	Water supply valve installation	75 mm ϕ (for farm)	"	61,462
44.	"	100 mm ϕ (")	"	80,285

No.	Items	Size	Unit	Unit cost
45.	Sprinkler	at centre	set	242,700
46.	"	at sub centre	"	642,457
47.	Thrust block	A type	set	47,898
48.	"	"	"	40,196
49.	"	"	"	37,671
50.	"	B type	pl'ce	40,196
51.	"	C type	"	37,671
52.	"	D type	"	31,665
53.	"	E type	"	21,663
54.	"	F type	"	13,736
55.	"	G type	"	11,662
56.	PVC pipe laying	ϕ50 (surface laying)	m	557
57.	"	ϕ75 (")	"	1,027
58.	"	ϕ100 (")	"	1,603
59.	"	ϕ100 (underground laying)	"	2,175
60.	"	ϕ150 (surface laying)	"	3,357
61.	"	ϕ150 (underground laying)	"	3,989
62.	Aqueduct	No.1	"	330,750
63.	"	No.2	"	283,354
64.	"	No.3	"	227,122
65.	"	No.4	"	316,161
66.	"	No.5	"	227,692
67.	Catch box		unit	15,898

Calculation of bulldozer operation fee (excavation)

. Work Capacity of Bulldozer (m^3/H)

$V = v \times f \times w \times s$

$= 36 \times 1.0 \times 0.5 \times 1.0 = 18\ m^3/H$

Note, v: work capacity of 11t Bulldozer = 36 m^3/H

f: changing ratio of gravel soil = 1.0

w: efficiency of Bulldozer for scit condition at the site = 0.5

s: efficiency of Bulldozer for slope at the site = 1.0

Estimated by Japanese standard

1. Cost of excanation by Bulldozer

Rental Fee 13,000 RP/H

Including operater

Cost of fuel

items	consumption	unit price	total
light oil	6 ℓ/H	36 RP/ℓ	216 RP
other oil	30% of above coste		65
			281 RP

Bulldozer operation fee

1H = 13,000 + 281 = 13,281 RP/H

13,281 RP/H ÷ 18 m^3/H = 738 RP/m^3

2. In case of provided Bulldozer from Japan

items	amount	unit price	total
operater	0.17 person/H	675 RP/person	115
assistant	0.17 "	500 "	85
fuel fee	1 hr	281 RP/H	281
			481 RP

Per 1 m^3, 481/16 = 30 RP/m^3