

(4) Equipment

The requested equipment specified in the Minutes between the Cambodian side and the field survey team of the Basic Study, are classified into five (5) categories, as follows:

- i) Farming machines for cultivation
- ii) Thresher and seed processing machines
- iii) Laboratory equipment for seed testing
- iv) Workshop machines and equipment
- v) Other equipment
 - Office equipment
 - Equipment for dissemination
 - Vehicles

Considering the aforementioned equipment for dissemination, this equipment has been excluded from the equipment plan. However, the supporting equipment such as a conveyer belt, a monocyce, agricultural technical books and so on, as well as the necessary furniture have been additionally requested by the Center. These are the equipment necessary for the operation and maintenance of the Center. These modified equipment plans have been made based on the following conditions.

- The type of equipment shall meet with the seed quality which is urgently required.
- The running cost of the equipment should be commensurate to the financial capacity of the Center.
- The technical standard of the equipment should not be extremely high.

3.3 Project Description

3.3.1 Plan of Operation

(1) Seed Production

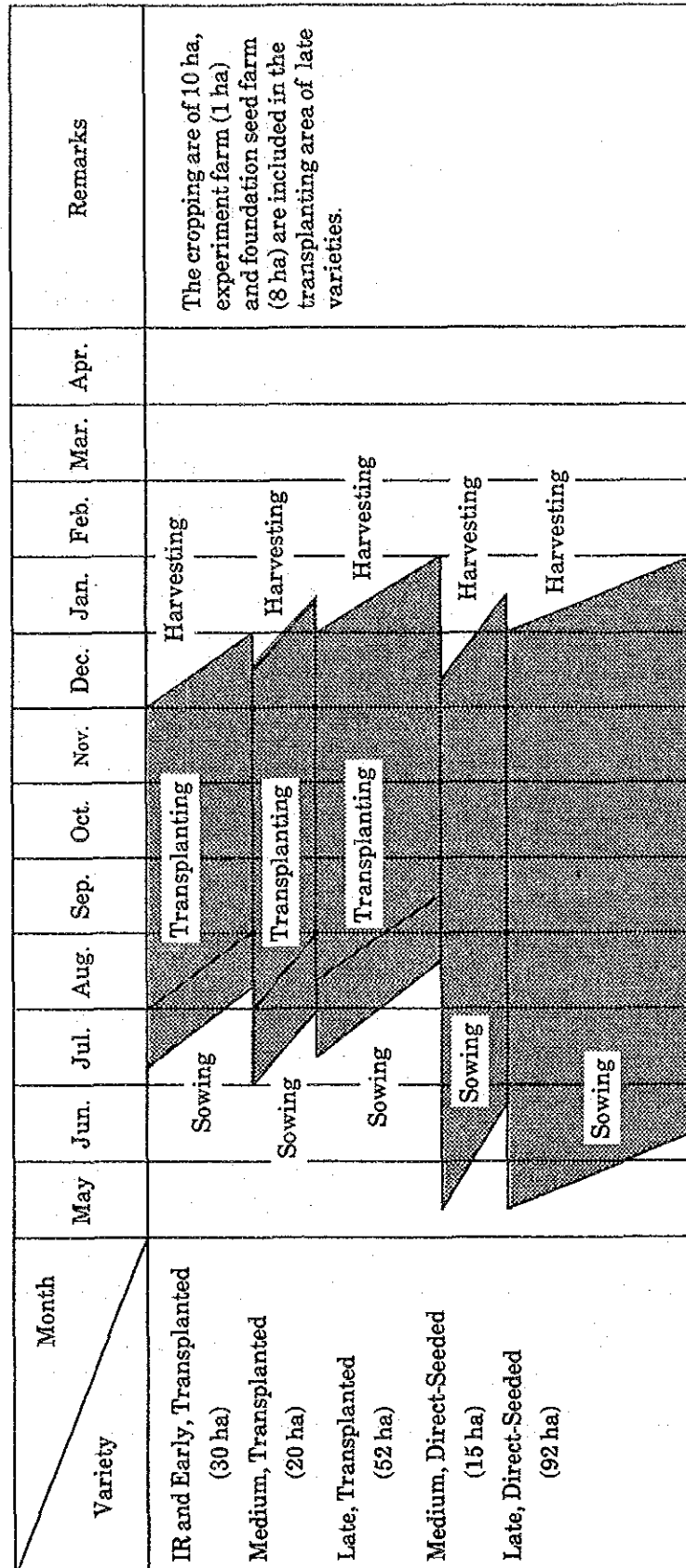
The seed production of the Center will be made, according to the seed production plan which will be formulated based on the estimate of seed demand for the northwest region and other regions. The Center will carry out seed production of respective varieties for three kinds of seeds, namely the breeder's stock, the foundation seeds, and the seeds to be distributed for the region and other regions.

The cropping plan for seed production of the Center is determined based on following trend of rice production in Cambodia as shown below (Refer to Figure 3-3 and Table 5-10 in Appendix).

- The cropped area of IRs, early maturing, and medium maturing varieties will be possibly increased along with development of rice production conditions implementing such agro-infrastructural projects for irrigation and drainage facilities etc.
- Not only late maturing varieties (Toul Samrong II and other promising varieties of newly bred varieties up to Toul Samrong VI) and some early and medium maturing varieties have been bred by the Agronomy Department. Some new IR varieties have been introduced through nationwide yield tests by the Cambodia-IRRI Rice Project. The cropped area of IRs and medium-maturing varieties cover 22 percent of the cropped area in the Center by transplanting farming which accounts for 8 ha out of 44 ha.
- There is a limit to the amount of increase in the area of transplanting farming because it is necessary to select suitable fields for transplanting farming and to supply much more labor and expenditure for farm inputs however, the Center intends to increase the transplanting farming area by about half.

To apply the above cropping plan, it is necessary to improve the irrigation and drainage facilities of the Center's farm and to introduce farm machines for the replacement of existing ones and the other kinds of farm machines for transplanting farming. Transplanting farming will be applied

FIGURE 3-3 CROPPING PATTERN OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER



to IR varieties and early-maturing varieties as well as medium-maturing varieties and late maturing varieties to the considerable extent. This accounts for about 50 percent of the total cropping area. The farm for transplanting farming needs independent setting of irrigation and drainage canals up to on-farm level, reshaping of farm plots to smaller sizes to a maximum size of 1 ha and prevention of inundation from water. The maximum water depth should be 30 cm. Based on the cropping plan, half of the Center's farm is planned to be improved for purposes of introducing transplanting farming and the other half will be cropped with direct-sowing late-maturing varieties without applying the aforementioned improvements for transplanting farming. Moreover, in order to raise a workability of farm machines, the farm road interval shall be reduced to 250 m.

The improvement of paddy cultivation for seed production can be attained mainly by increasing the area for transplanting cultivation in the improved seed farm, raising the quantity as well as quality of seeds. The total seed production by the Center will be increased to 567 tons from 319 tons at present, increasing the unit yield per hectare from 1.5 tons to 2.7 tons.

(2) Seed Testing and Seed Quality Control

The seed testing of each category of seeds shall be conducted at the Seed Quality Laboratory of Laboratory Division. Followings shows the items of testing and field checking.

- Seed tests (germination percentage, 1 ℓ-weight, whole grain percentage, moisture, exotic varieties, foreign matters and damaged grains)
- Seed characteristic test (thickness, width and grain transparency)
- Grain damages in operation of combine harvester and thresher as well as drying of paddy.
- Field checking on varietal performance and pest occurrence.

(3) Seed Processing

Seed processing machines of seed precleaner and seed processing shall be required for the processing of foundation seeds as well as the seeds to be distributed to farmers. However, it is necessary to introduce seed processing devices for the precise processing of breeder's stock and sample seeds from various experiments.

3.3.2 Outline of Facilities and Equipment

The outlines of facilities and equipment are as follows;

(1) Building and Related Facilities of the Buildings.

a) Buildings

i) Rehabilitation of the main building	1,496 sq.m
ii) Workshop construction	250 sq.m
iii) Seed processing house construction	220 sq.m
iv) Warehouse construction	525 sq.m
v) Meeting room construction	195 sq.m
vi) Dormitory construction	355 sq.m

b) Architectural Related Facilities Related to the Buildings

i) Elevated water tank and pump	1 lot
ii) Water distribution system	1 lot
iii) Generator and distribution lines	1 lot
iv) Sewerage and sanitation facilities	1 lot

c) Consolidation of Building Lots

i) Consolidation of roads in building lots	7,000 sq.m
ii) Drainage ditches	900 m
iii) Construction of seed drying yard	3,600 sq.m
iv) Rehabilitation of seed drying yard	3,600 sq.m

d) Rehabilitation of the Farm

i) Feeder canal rehabilitation	4,122 m
ii) Irrigation canal rehabilitation and construction	16,598 m

iii) Drainage canal rehabilitation and construction	16,058 m
iv) Farm road rehabilitation and construction	20,665 m
v) Arrangement of farm plot shape	103 ha

e) Equipment and Materials

i) Farm machinery	1 lot
ii) Thresher and seed processing machinery	1 lot
iii) Laboratory equipment for seed testing	1 lot
iv) Workshop machinery and equipment	1 lot
v) Office equipment	1 lot
vi) Vehicles	1 lot
vii) Supporting equipment for use in the center	1 lot
viii) Cabinet Articles	1 lot

3.3.3 Operation and Maintenance

(1) Organization for Operation and Maintenance (O & M)

As to operation and maintenance of facilities and equipments after the execution of the Project, the Administration Division shall manage all these properties and equipments under the direction of the Director of the Center. For their daily operation and maintenance, the respective users shall nominate a person to be in charge of the administration.

(2) Demarcation for Operation and Maintenance

a) Buildings

The Administration Division shall perform operation and maintenance works for buildings. In order to minimize O & M cost for buildings, in the design for buildings, they are to be mainly steel structures. Consequently, main works for O & M will be limited mainly to roof repair, re-painting the outer walls of buildings, generators, and electric generation for lighting apparatus. Cabinet articles shall be used which will be easily repaired at the Center.

b) Architectural Facilities Related to the Building

The operation and maintenance plan of the facilities related to the building are as follows;

- Water Supply Facilities

The sedimentation tank is divided into two parts. When filtering capacity decreases in one part, the dirty sand will be washed and fresh water will be diverted to the other part of the tank. The elevated tank shall be cleaned regularly.

- Generator

Fuel supply and periodical lubrication is necessary.

- Sewerage

Sewerage sedimentation should be cleaned periodically and the organic sediment deposit will be disposed on the farm land.

c) Farm Facilities

i) Feeder Canal

The feeder canal is one of the properties of the Center, therefore, its operation and maintenance work should be shouldered by the Center. All intake gates on the canal shall be operated by the Center in order to limit the water intake. For this purpose, a full time gate operator should be employed during the irrigation period.

ii) Farm Roads

Road surface conditions of the O & M road along the feeder canal and of the farm roads in the Farm should be checked and inspected, and the maintenance works of these roads shall be immediately carried out, if necessary.

iii) Canals

A full-time water management expert(s) shall be selected for proper water distribution in accordance with crop growth. The expert(s) should have sufficient understanding of water requirements and fertilization according to crop growing stage, and enough hydraulic

and structural knowledge of irrigation and drainage canals and these structures. Maintaining canal banks and dredging canal beds shall be carried out before the beginning of irrigation.

He should also, be in charge of the operation and maintenance works of the drainage pump station. The drainage pump station is proposed at close range from the building area due to the easy approach and operation of pump equipment in case of an emergency. A diesel engine type prime mover is chosen because pump operations will only take place during the flooding period to save operation cost. The hourly fuel consumption is 29.6 lit/hr per unit. In the case of full operation of two sets of pump equipment and three days operation, the total fuel consumption will reach at about 3,336 lit (equivalent to about 1,474 US\$ in 1992 prices, including lubrication oil) as shown in Table 5-14 of Appendix.

The use of fish traps in the proposed canals shall be prohibited during the irrigation period, because these equipment interrupts smooth flow of water in the canals.

iv) Fields

The repair work of paddy dikes, such as plugging of small holes made by rats etc., should be done before planting in order to protect water trickling through such holes.

d) Equipment and Materials

The Machinery and Repair Division of the Center shall be responsible for the operation and maintenance of the equipment such as farm machinery, thresher and seed processing machinery, workshop machinery and equipment, vehicles and supporting equipment. Also, the Laboratory Division and the Administrative Division shall take charge of laboratory equipment of seed testing and office equipment, respectively. Furthermore, the Machinery and Repair Division shall provide maintenance services for the various Center facilities in order to reduce the repair costs of the Center. The running costs for engine-driven equipment was estimated at about US\$ 14,900.

The increase of budget for the operation and maintenance of the Center will be given high priority by the Cambodian side, but not for purchasing spare parts. At present, it is difficult to fabricate spare parts as well as obtaining after-sales service in the country. Therefore, the spare parts under the equipment plan should be increased accordingly.

3.3.4 Basic Policy Line for Cooperation

This rehabilitation project is composed of quality control and production increase of paddy seeds. So the operation and management of the Center for seed production can be carried out by the staff of the Agronomy Department.

CHAPTER 4. BASIC DESIGN

CHAPTER 4. BASIC DESIGN

4.1 Design Policy

The scope of work of the basic design study include the rehabilitation and construction of buildings, related architectural facilities, and seed farm as well as procurement of equipment required for the Center. The design policy for these facilities is as follows:

- (1) In designing the building, natural conditions such as climatic, topographic, and geological conditions should be taken into account. Easy operation and maintenance should also considered in designing the facilities. And lightning roof shall be adopted considering the local electrification conditions in the areas.
- (2) The related architectural facilities such as water, electricity, etc. should be constructed with minimum operation and maintenance costs.
- (3) The farm facilities should be improved to produce good and qualified seed. From this point of view, improvement of drainage facilities to reduce the flood damages due to long period of inundation, and introduction of independent setting of irrigation and drainage systems should be taken into consideration.
- (4) The procurement of equipment for seed selection, quality examination, and quality control should be made taking into consideration the quality level of seeds required at present and, technical level of staff in the newly established organization, and easy operation and maintenance. A diesel-engine prime mover shall be adopted in the Center taking into account the low cost of fuel.
- (5) Construction method adopted by local skilled technician shall be introduced as much as possible.

- (6) If a foreign contractor will be required in the execution of work and materials will be procured from other countries, the method of implementation of such work should be studied.
- (7) The construction of the project should be implemented under the framework of Japanese grant-aid system. Therefore, the dimension and scheduling of the construction works should be examined carefully by analyzing; viz., the climatological and hydrological conditions of the area.

4.2 Basic Design

The basic design and cost estimate of the Project are examined based on the following conditions and criteria as follows:

4.2.1 Topographic Conditions

The scales of topographic map which will be used for the Basic Design are as follows:

- Topographic map S = 1/50,000 (for estimation of catchment area)
- Topographic map S = 1/50,000 (for building, general layout of farm facilities)
- Canal profile and sections S = 1/5,000 (for canal designing)
 (JICA surveyed) S = 1/100

4. 2. 2 General Layouts of Building and Building Lot

(1) Layout of the Building

The main building, workshop, meeting room and dormitory shall be built in the same or adjacent area where the facilities are presently located. The seed processing house and warehouse shall be constructed near the field (refer to Basic Design Drawing No. 1).

(2) Rehabilitation of Building Lot

Rehabilitation of the building lot shall be carried out. Road from the junction of the national road No. 5 to the end of the central road, access road to the main building and the road in front of the meeting room shall be paved with gravel along the side ditch. Rain water and daily waste water from buildings shall be collected by collecting facilities and emptied into the reservoirs. The overtopping water from these reservoirs shall be drained from the building lot.

Ditches along the existing seed drying yard with a scale 3,600 sq.m shall be constructed. An additional seed drying yard with the same scale shall also be constructed.

4. 2. 3 Architectural Design

(1) Design Conditions

For the design works of the buildings, since there are no standard criteria available in Cambodia, the following laws and criteria governing the design works in Japan shall be principally used.

- The Building Standards Act
- The Structural Standards
- The Electrical Standards
- The Design Criteria for Grain Storage
- The Fire Services Act

- The Standards for Construction Materials and Other Standards and Criteria

(2) Schemes and Functions of the Building

The following four schemes and functions were identified in design of the building:

- i) Testing for the production of quality seeds as well as seed quality control.
- ii) Seed processing and storing of paddy seed.
- iii) Repairing and maintenance of agricultural machineries for cultivation and various kinds of equipment.
- iv) Dissemination of quality seeds and management and operation of the Center.

(3) Number of Building

As mentioned above, the main building will be rehabilitated while the other five facilities such as workshop, seed processing house, warehouse, meeting room and dormitory will be newly constructed. Six buildings shall be rehabilitated and/or newly constructed. There are at present existing buildings in the proposed workshop and dormitory of the Center.

(4) Number of Staff

The number of personnel and equipment to be distributed for the buildings are as shown in the following tables:

TABLE 4-1 DISTRIBUTION OF PERSONNEL AND EQUIPMENT

Building/Room	Staff	person	Equipment
1. Main Building			
(1) Office Room	Director	1	
	Deputy Director	1	
	Chief of Administration		Office equipment
	Division and Staff	8	
	Chief of Laboratory Division	1	
	Chief of Seed Production		
	Division and Staffs	2	
(2) Laboratory	Chief of Extension Division	1	
- Seed Quality			
- Laboratory	Staff of Laboratory Division	2	Testing equipment, etc.
- Varietal			
- Performance			
- Laboratory	Staff of Laboratory Division	2	Analytical balances, etc.
- Seed Protection			
- Laboratory	Staff of Laboratory Division	1	Microscopes, etc
	Sub total	19	
(3) Multipurpose Room			
2. Workshop	Chief of Repair and Machinery Division and Staffs	5	
3. Seed Processing House			Seed processing machines,
4. Warehouse			600 ton of paddy seeds
5. Meeting Room	Participants in the meeting	10	
6. Dormitory	Participants for long-term job-training	8	8 rooms × 2 persons

(Refer to See Table 5-11 in Appendix for the details of buildings and staffs.)

(5) General Layout

Each room shall be designed in conformity with the Building Standards Act of Japan as well as the personnel and equipment to be distributed. The space per person shall be larger than that stipulated in the standards considering the high humidity in the region. Long canopies shall be planned above the corridors outside the buildings.

a) Main Building

The main existing two-storey building shall be rehabilitated without changing the main structures of the existing building. Partitioning of the rehabilitated building shall be based on the distributed personnel and equipment as well as the proposed organization. The second floor of the main building shall be divided into three rooms as follows:

i) Office Room

This room shall be designed for 12 personnel; namely, Chief of Administration Divisions, five staffs of the General Affairs Section, two staffs of Planning and Accounting Section, Chief of Laboratory Division, Chief and a staff of Seed Production Division and Chief of Extension Division.

ii) Laboratory

Three laboratories in the Center are proposed; viz, one each for seed quality control, varietal performance, and seed protection studies, respectively, (Table 5-11 of the Appendix refers.)

In the Seed Quality Laboratory, two personnel including the head of the Laboratory will perform their duties with regard to testing seeds quality. The equipment to be furnished are also included in the planning. Also, a storage for seeds of original variety of foundation stock seeds (up to three years' storage) shall be provided.

While in the Varietal Performance Laboratory, two personnel including the head of the laboratory will perform their duties on the field checking of varietal performance for new varieties obtained. This laboratory shall be furnished with laboratory equipment for analysis of yield, etc.

In the Seed Protection Laboratory, the head of the laboratory will perform his duties on field checking for insect and disease occurrence.

iii) Multi Purpose Room

This room will be mainly used for meeting by the staff of the Center. The meeting room shall be designed for nineteen staffs in total consisting only of major staff of the Center (refer to Table 3-1). The meeting room will also be used for the job training and other purposes such as of the exhibition, etc.

The first floor consisting of crop preparation room, test seed storage, and car parking will be rehabilitated. In particular, this floor will be equipped with shutter, doors, walls and wire fences.

b) Workshop

The workshop building will consist of desk work space, repairing rooms and a storage for spare parts. Five staffs of the Repair and Machinery Division are to be stationed in the Workshop. They will also be engaged in the operation and maintenance of vehicles.

The proposed floor area of the workshop is 250 sq.m {10m (frontage) × 25m (depth)} as calculated below:

- Space of desk work	
5(person) × 3sq.m (from an example for an area per person):	15sq.m
- Storage for spare parts with five shelves racks	: 15sq.m
- Repairing Room	: 220sq.m
30 sq.m (space for equipment and tools for repairing	
+ 190 m (working space)	
<u>Total</u>	<u>250sq.m</u>

c) Seed Processing House

Size of the seed processing house shall be determined based on size of processing machines to be applied, amount of seed material for temporary storage and amount of processing seeds.

The seed processing room shall be built in one-storey house with a floor area of 220 m² including space for seeds processing machines and for temporary storage for both paddy seeds and processed seeds, as calculated below:

- Space for seed processing : 132 sq.m : {11 m (frontage) × 12 m (depth)}
 - Space for Temporary : 55 sq.m : {11 m (frontage) × 5 m (depth)}
 - Storage of harvested seeds : 33 sq.m : {11 m (frontage) × 3 m (depth)}
 - Space for temporary : 33 sq.m : {11 m (frontage) × 3 m (depth)}
 - Storage for processed seeds : 33 sq.m : {11 m (frontage) × 3 m (depth)}
- Total 220 sq.m

d) Warehouse

Designed volume of stored seeds is 600 tons. In accordance with the design criteria for grain storage in Japan, a storage with a floor area of 525 sq.m will to be established for the above designed volume of stored seeds, as computed below:

- Volume of the seeds storage
 $600 \text{ ton} \div 0.55 \text{ (volume ratio of paddy seeds)} \div 0.4 \text{ (actual storage ratio)} = 2,727 \text{ cu.m}$
- Planning
 $2,727 \text{ cu.m} = 5 \text{ m (height)} \times 15 \text{ m (frontage)} \times 35 \text{ (depth)}$

e) Meeting Room (Building)

The participants in the meeting will hold various matters pertaining to seed production at the meeting room. This room will accommodate, ten members, including eight visiting member-

officials of concerned, a Director and a Deputy Director of the Center. Therefore, the Meeting Room should be built for 10 participants.

- Participants	: Agronomy Department	2
	: CARRDI	1
	: Officials from 5 provinces	5
	: Center	2
	<u>Total</u>	<u>10</u>

The Meeting Room (Building) shall consist of a meeting room, four guest rooms, a kitchen, a servant room, and a shower room. The required floor area of each room is as follows:

- Meeting room		
Ten persons x 6 sq.m/person	:	60 sq.m
- Guest room		
Two persons room x 4 rooms x 10 sq.m/person:		80 sq.m
- Kitchen	:	20 sq.m
- Servant rooms	:	15 sq.m
- Shower room		
10 sq.m(Shower room) + 10 sq.m(Lavatory)	:	20 sq.m
	<u>Total</u>	<u>195 sq.m</u>

f) Dormitory

The capacity of the dormitory will consist of the following 18 members:

- Participants	: Two national seeds farms	4
	: Provincial seed farms	12
	: CARRDI	2
	<u>Total</u>	<u>18</u>

Each room of the eight dormitories shall be furnished with two bedrooms, a living room and a shower room. The required floor area for each dormitory room is as follows:

- Bedrooms (two bed rooms)		
One person × 10.5 sq.m/person × 2 rooms	:	21.0 sq.m
- Living room	:	21.0 sq.m
- Shower room	:	2.4 sq.m
<u>Total</u>	:	<u>44.4 sq.m</u>

(6) Floor Area of each Building

Floor area of each building is summarized below:

TABLE 4-2 FLOOR AREA OF EACH BUILDING

Name of Building/Room		Floor Area (sq.m)
1.	Main Building	
	<u>Second floor</u>	
	- Office Room (Director's room, Deputy Director's room, and Large office room)	200
	- Seed Quality Laboratory	
	- Varietal Performance Laboratory	120
	- Seed Protection Laboratory	120
	- Multipurposed Room	80
	- Corridors	120
	<u>Sub-total</u>	40
	<u>First floor</u>	<u>680</u>
	- Crop Preparation Room	
	- Temporary Storage	218
	- Garage	20
	- Lavatory	280
	- A hall and corridors	58
	<u>Sub-total</u>	242
	<u>Total</u>	<u>816</u>
		<u>1,496</u>
2.	Workshop	
3.	Seed Processing House	250
4.	Warehouse	220
5.	Meeting Room	525
6.	Dormitory	195
		355
<u>Grand Total</u>		<u>3,041</u>

(7) Elevation and Height of Building

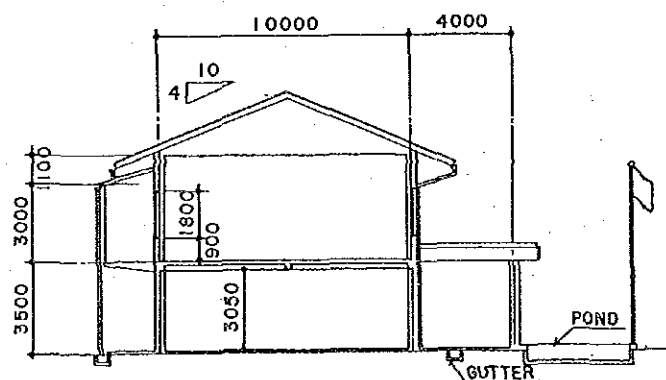
The height and slope of roof for Seed Processing House shall be determined considering the smooth operation of seed processing machines.

For other buildings, designs of existing buildings, e.g. large opening and high ceiling effective for ventilation will be introduced. The height of the floor of the warehouse shall be high enough to maintain good quality of seeds.

(8) Cross-section

The height of the main building will be 4.10 m. No obstacles should be placed along the north-south axis of each building in order to get a full ventilation. Slate shall be used of roofing to improve the insulation performance. The standard cross-section of the buildings is as shown below.

FIGURE 4-1 TYPICAL SECTION OF MAIN BUILDING



(9) Structural Planning

The foundation of the building lot of the Center is soft sub-soil, therefore, steel frame structure shall be applied in the buildings to reduce the weight and hence produce a good structural capacity. Moreover, friction piles shall be used for the foundation to support the structural weights. The structural planning shall be applied in conformity with the Structural Standards of Japan. Rigid structure made of RC, which is prevailing in general, shall be applied and earthquake resisting wall shall be introduced.

(10) Material for Building

Materials to be used for flooring, wall interior finishing, etc., are as follows.

- Floors for buildings except the main building shall be finished with concrete/cement mortar work. The floor of the main building shall be finished with tile work.
- Walls for the main building and the meeting room shall be finished with concrete/cement mortar while walls for other building shall be finished with short pitch corrugated slate.
- Interior finishing for the main building and the meeting room shall be made by concrete/cement mortar while finishing at for other buildings shall be made by steel frame washing.
- Exterior finishing for the main building and the meeting room shall be made by stucco finishing while interior painting by EP and OP painting.

4. 2. 4 Architectural Related Facilities Plan

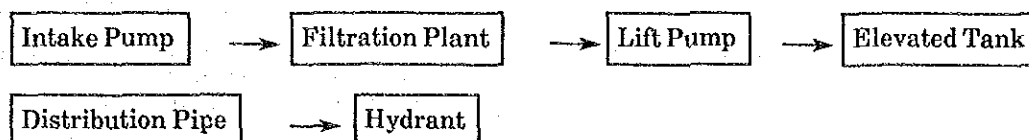
(1) Water Supply Facilities

Water source shall come from reservoirs in the site. Filtration plants shall be installed and water shall be sterilized by chlorine. The amount of daily water supply is calculated as follows:

- Portable water and water for miscellaneous
{150 person (staffs) + 50 person(technicians)} × 80 lit./day : 16.0 cu.m
- Water for disaster prevention
210 ha × 30 lit./10 a/30 days : 21.0 cu.m
- Total : 37.0 cu.m

In addition to the above and taking into consideration the considering water for washing agricultural machineries and water for laboratory use, maximum daily water supply shall be determined at 40 cu.m. The capacity

of an elevated tank shall be 10 percent of the maximum daily water supply. The following water supply system shall be applied in the Center.



The facilities and dimensions of water supply system are outlined below:

TABLE 4-3 THE OUTLINE OF THE FACILITIES AND DIMENSIONS OF WATER SUPPLY SYSTEM

Facilities	Dimensions
Intake Pump	Engine pump, Q=180ℓ/min. H=20 m
Filtration Tank	Reinforced concrete 5 m × 5 m 4 m(H)
Lift Pump	Engine pump, Q=200ℓ/min. H=24
Elevated Tank	Steel 2 m × 2 m × 1.5 m(H) H=15 m
Distribution Pipe	PVCφ=25 mm~80 mm ℓ=648 m

(2) Electrical Facilities

Diesel generators with 220 V, 50 Hz power shall be introduced as source of electricity in the Center. Each building shall be provided with diesel generator and its operation shall not be more than 24 hours (usually from sunset to 9:00 o'clock p.m). The capacity of the generator to be installed shall be determined based on the capacity of each equipment introduced, lighting apparatus, etc. as shown below.

TABLE 4-4 CAPACITY OF GENERATORS

Name of Building	Capacity (KVA)	Remarks
1. Main Building	45.0	25 KVA × 1 set, 20 KVA × 1 set
2. Workshop	10.0	10 KVA × 1 set
3. Seed Processing House	-	
4. Warehouse	15.0	15 KVA × 1 set
5. Meeting Room	7.5	7.5 KVA × 1 set
Total	77.5	77.5

(3) Drainage and Sanitation

Drainage of buildings shall be divided into two-line system: (1) rain water will be collected by chute into rain-pond and used for various purposes and, (2) other water will be directly discharged to outside area. The water for miscellaneous uses will be stored into sedimentation pond, and then discharged to the drainage canal. A simple sanitation system will be adopted in the Center by using a tank.

4.2.5 Plan of Farm Improvement

For the design of the experimental farm of the Center, the design criteria of the Food and Agriculture Organization (FAO) and Ministry of Agriculture, Forestry and Fishery (MAFF) of Japan will be applied since there is no design criteria available in Cambodia.

(1) Feeder Canal

The feeder canal serves the irrigation area, project area and other surrounding irrigation service areas. The design of water conveyance capacity of irrigation is calculated based on the water requirement data available at Bek Chan Meteorological Station, while the design of drainage capacity of the feeder canal is calculated based on the dual-purpose canal.

a) Water Requirement

Necessary Water for Land Preparation

The necessary amount of water for land puddling work will include water to saturate soil layers. The soil in the Center comprises (1) top soil layer with heavy clay, 15 cm thickness and porous ratio of 30 percent, and (2) subsoil layer with heavy clay, 35 cm thickness and porous ratio of 10 percent.

The proposed land preparation period is from August to September. Evapotranspiration rate of 4.5 mm/day during this period is

estimated by using the Modified Penman's method. The crop factor of 0.35 for non-vegetation land is applied based on the FAO Irrigation and Drainage Paper #24. The land preparation period of 30 days based on the proposed cropping pattern and the percolation rate of 1.0 mm/day are applied. The standing water depth of 50 mm is assumed. The water requirement for land preparation is calculated as follows:

-	Water depth to be saturated the top soil layer	
	$150 \text{ mm} \times 0.3 =$	45 mm
-	Water depth to be saturated the subsoil layer	
	$350 \text{ mm} \times 0.1 =$	35 mm
-	Evapotranspiration for 30 days	
	$4.5 \text{ mm/day} \times 30 \text{ days} \times 0.35 =$	47 mm
-	Percolation	
	$1.0 \text{ mm/day} \times 30 \text{ days} =$	30 mm
-	Standing water depth	50 mm
	<u>Total</u>	<u>207 mm</u>

The land preparation water is applied in three times; firstly, 30 days before transplanting (106 mm); secondly, 20 days before transplanting (51 mm); and thirdly, 1 day before transplanting (50 mm).

b) Overall Irrigation Efficiency

The overall irrigation efficiency is estimated based on the FAO Irrigation and Drainage Paper #24. By applying the conveyance efficiency of 0.9 in the feeder canal, conveyance efficiency of 0.7 in on-farm canal, and application efficiency of 0.8, the overall irrigation efficiency is calculated at 0.504.

c) Peak Water Requirement at Land Preparation Period (Q_i)

The peak water requirement (q) at land preparation period is calculated in the following equation:

$$q = (A/30 \times 207 \text{ mm} + (A - 102.6) \times 3.5 \text{ mm/day} \times 10/86,400/0.504) \\ = A \times 2.39 - 82.5 \text{ lit/sec}$$

where,

$$\text{ET crop} = 4.5 \text{ mm/day} \times 0.55 = 2.5 \text{ mm/day}$$

$$k_c \text{ value} = 0.55 \text{ (Paddy, Transplanting)}$$

Water duty at land preparation

$$= 3.5 \text{ mm/day} (= 2.5 \text{ mm/day} + 1.0 \text{ mm/day of percolation})$$

Service area and land preparation period

$$= A \text{ and } 30 \text{ days, respectively}$$

The total service area of the feeder canal is 818.2 ha including the proposed farm area of 208.9 ha and other surrounding service areas of 609.3 ha. The total water requirement at land preparation period is calculated below:

$$Q_i = 818.2 \times 2.39 - 82.5 \\ = 1,872 \text{ lit/sec (1.872 cu.m/sec)}$$

(2) Design Discharge (Q_f)

The design discharge of the feeder canal of 4,166 cu.m/sec (refer to computation below.) was computed by adding the drainage discharge of 2.294 m³/sec with the irrigation water of 1.872 cu.m/sec that will be conveyed to the feeder canal.

$$Q_f = Q_d + Q_i = 2.294 + 1.872 = 4.166 \text{ cu.m/sec}$$

a) Typical Cross-section

The total length of the feeder canal is 4,122 m. The design canal bed width of 2.5 m is determined in order not to acquire new land for the rehabilitation of the canal. The proposed side slope is determined at 1:1 taking into the texture of the soil. The hydraulic gradient is set at the scale of 1/2,000 (=0.05%), which is the same scale as the

present one. The roughness coefficient of 0.03 is applied because of the linear unpaved canal.

The typical cross-section of the feeder canal is designed by using the Manning's equation. Thus, the maximum flow capacity of the feeder canal is calculated at 4.671 cu.m/sec by considering the water depth of 1.6 mm and the flow velocity of 0.712 m/sec.

b) Design of Appurtenant Structures

The appurtenant structures of the feeder canal consist of a check structure on the Branch Canal No. 4, intake structure of the feeder canal, three outlets for farm lands at the surrounding irrigation service areas, ten (10) road crossings, a spillway to drain drainage water from the farm lands at the surrounding irrigation service areas to the existing drainage canal at the end of the canal, and two (2) intake structures for irrigation canals No. 1 and No. 2. of the center farm.

(3) Farm Road

The proposed farm roads are classified into two (2) types; namely, the main road and farm road. The size of main road and farm roads are determined by considering the number of times vehicles (including farm machines) pass the road. The road-widths are also determined based on the width of the vehicle and machines when crossing the road.

a) Alignment

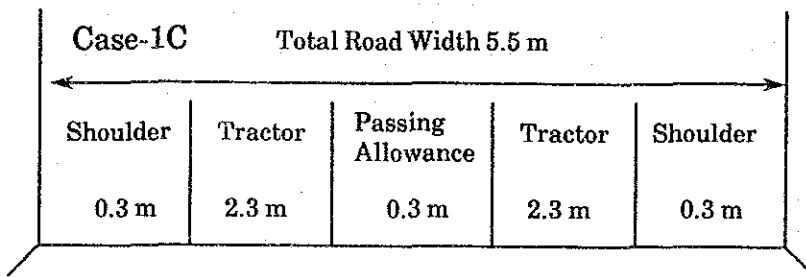
For the rehabilitation of the existing road, the existing alignment will not be changed, and two (2) farm roads are proposed to be constructed at a longer (vertical) section of the Center in order to have a road interval at 250 m at the maximum.

b) Main Road

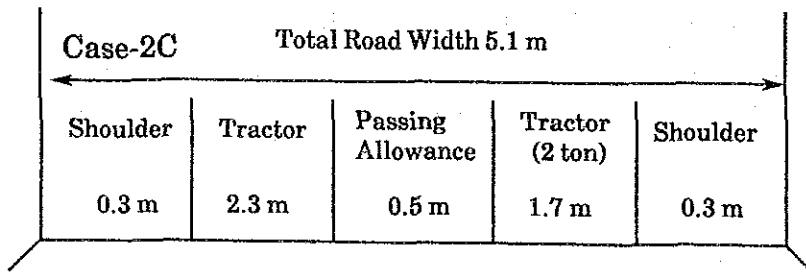
- Road Width

The proposed road width is determined by considering the number of times the vehicles (including the farm machines) pass the road, e.g. Case-1: two tractors will cross the road and Case 2: a tractor and a pickup truck will cross the road.

In Case-1, the total road width of 5.5 m includes the vehicle occupancy width of two tractors (4.6 m), passing allowance of 0.3 m (for low speed vehicles), shoulder (0.6 m). (the following figure refers.)



In Case-2, a vehicle occupancy width of vehicles of 4.0 (=2.3 + 1.7 m), passing allowance of 0.5 m (for middle and or high speed vehicles) are applied to determine the road way width of 4.5 m, and the total road width of 5.1 determined the road way width of 4.5 m, and the total road width of 5.1 m including both shoulders of 0.3 m each. (refer to the following Figure)



Consequently, Case-1 with a road width of 5.5 is selected.

- Structure

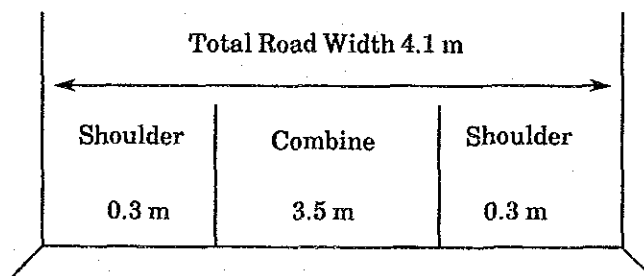
The overtopping floodwater of a 20 to 30 cm depth annually flows into the Center and its standing water damages the paddy. To minimize this damage, the 50 cm-embankment on the existing main farm road is planned. The embankment materials for a lower layer with about 30 cm is placed from side borrow 9 pits, and for an upper layer with 20 cm hauled from the outside borrow pits. The road surface is paved by gravel material with a thickness of 15 cm. The cross-sectional slope of 5% is designed to easily drain the excess water from the road surface.

c) Farm Road to be Rehabilitated

- Road Width

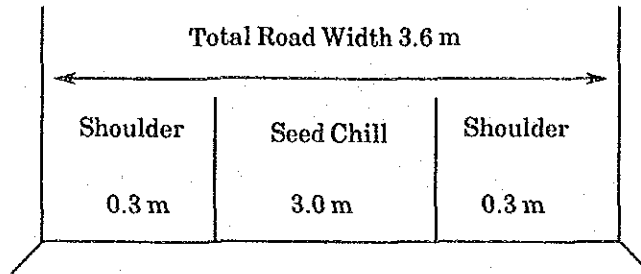
The proposed road width is determined based on the required distance of the proposed farm machine such a combine and/or a seed drill.

In Case-1, the vehicle occupancy width of 3.5 m of a combine is applied in determining the road width of 3.5 m and the total road width of 4.1 m including both shoulders of 0.3 m each, as shown in the following figure:



In Case-2, the vehicle occupancy width of 3.0 m of a seed drill is applied in designing the road width of 3.0 m and the total road

width of 3.6 m including both shoulders of 0.3 m each. (refer to the following Figure)



Consequently, the Case-1 with 4.1 m is applied.

- Structure

The existing road width and height are about 5.0 m and about 50 cm, respectively. The existing road surface becomes flat to drain poorly excess water due to inadequate maintenance work, therefore, rehabilitation of the road surface is proposed. The cross-sectional slope of 5% and 10 cm thickness of gravel pavement are proposed.

d) Farm Road to be Constructed

- Road Width

The proposed road width is as the same as the farm road to be rehabilitated as mentioned above.

- Structure

The proposed road height is 50 cm, while other scales are the same as the farm road that will be rehabilitated.

(3) Plan of Irrigation Canal

The design discharge in determining the canal size is calculated based on the water requirement at land preparation time on transplanting paddy cultivation. The irrigation and drainage canals are separately proposed to produce better quantity and quality of paddy seed. Considering the direct

intake of irrigation water from the canal to the fields, the irrigation and drainage canals are aligned. (refer to Figure 4-2)

a) Calculation of Design Discharge

Assuming that the land preparation work in the farm is carried out by the proposed farm machines, the design discharge will be determined by considering the land preparation period of 30 days and the total area of 102.6 ha on the transplanting cultivation. The daily land preparation area is, therefore, calculated at 3.42 ha (=102.6 ha/30). In the case of the service area (A) of an irrigation canal is less than 3.42 ha, the first land preparation water of 106 mm shall, be supplied by the canal. Therefore, the following equation is applied.

$$q = 106 \text{ mm} \times 10 \times A/86,400/0.504$$

$$= 24.3 A \text{ lit/sec}$$

In case the service area (A) is more than 3.42 ha, the equations will be as follows:

- Irrigation area less than 3.42 ha

$$q = 106 \text{ mm} \times 3.42 \times 10/86,400/0.504 = 83.3 \text{ lit/sec}$$

- Irrigation area less than 99.2 ha

$$q = (106 \text{ mm} + 51 \text{ mm}) \times 10 \times 3.42/86,400/0.504$$

$$= 123.3 \text{ lit/sec}$$

- Irrigation area less than 102.6 ha

$$q = (106 \text{ mm} + 51 \text{ mm} + 50 \text{ mm}) \times 10 \times 3.42/86,400/0.504$$

$$= 162.6 \text{ lit/sec}$$

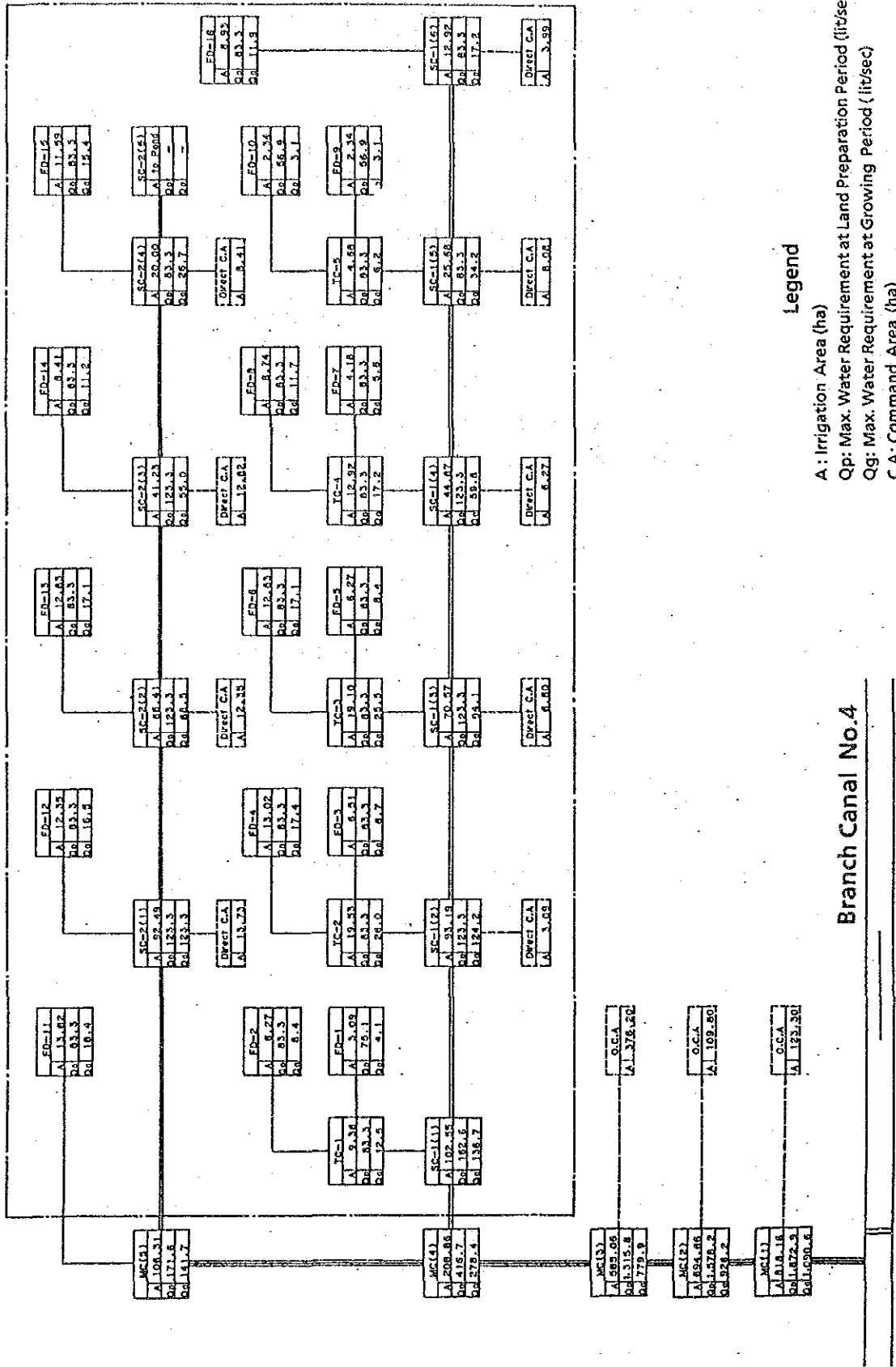
- Irrigation area more than 102.6 ha

$$q = (A/30 \times 207 \text{ mm} + (A - 102.6) \times 3.5 \text{ mm}) \times$$

$$10/86,400/0.504$$

$$= 2.39 A - 82.5 \text{ lit/sec}$$

FIGURE 4-2 IRRIGATION DIAGRAM OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER



Legend

- A : Irrigation Area (ha)
- Qp: Max. Water Requirement at Land Preparation Period (lit/sec)
- Qg: Max. Water Requirement at Growing Period (lit/sec)
- CA: Command Area (ha)
- O.C.A: Command Area Out of the Center (ha)

Branch Canal No.4

Check No.5

b) Alignment of Irrigation Canal (Farm Ditch)

The proposed alignment of the main farm ditch is drawn at the existing canal line and the plot-to-plot irrigation system is changed. The proposed farm ditches are aligned in order to directly take irrigation water from farm ditch to the field. The intake points of the main farm ditches from the feeder canal will not be changed. The main farm ditch No. 2 is newly proposed along the central main farm road and the dual-purpose existing canal along the road will be changed for drainage purpose only. The maximum length of a farm ditch as on-farm facilities will be limited to 300 to 500 m from viewpoint of easy water management. The end point of the main farm ditch No. 2 will be connected to the ponds to store water for domestic water supply.

c) Design of Canal Section

The size of an irrigation canal is designed based on the design discharge and hydraulic gradient as well as topographic conditions. From the viewpoint of protecting water leakage from the canal, the irrigation canal shall be paved by concrete. The costly pavement of the canal will, however, be carried out in the future when dry season irrigation is possible. The maximum water level of the farm ditch is 45 cm above the field surface. The free board of 5 cm and the side slope of 1:1 will be applied due to the heavy clay soil texture. The canal bed width of 30 to 50 cm and the canal depth of 50 cm of the farm ditch is determined according to the discharge.

d) Canals and Protective Structures

The proposed total length of the canals such as main farm ditches and farm ditches, are measured at 16,598 m based on the topographic scale of 1/5,000. The apparatus structures, road culvert at 34 places and the access roads to field at 61 places are proposed.

(4) Plan of Drainage Canal

a) Standard Application

- Design Rainfall

The probable daily rainfall of 151 mm with a return-period of 10-year rainfall data from 1981 to 1991 at the Bek Chan observatory as the design daily rainfall is calculated and applied for the drainage planning.

- Drainage Area

The drainage area is estimated at 285.08 ha, which consists of paddy fields of 199.93 ha, upland fields of 7.38 ha, housing areas of 22.95 ha and other areas such as roads and canals of 54.82 ha. (refer to Figure 4-3, Drainage Diagram)

- Discharge Coefficient

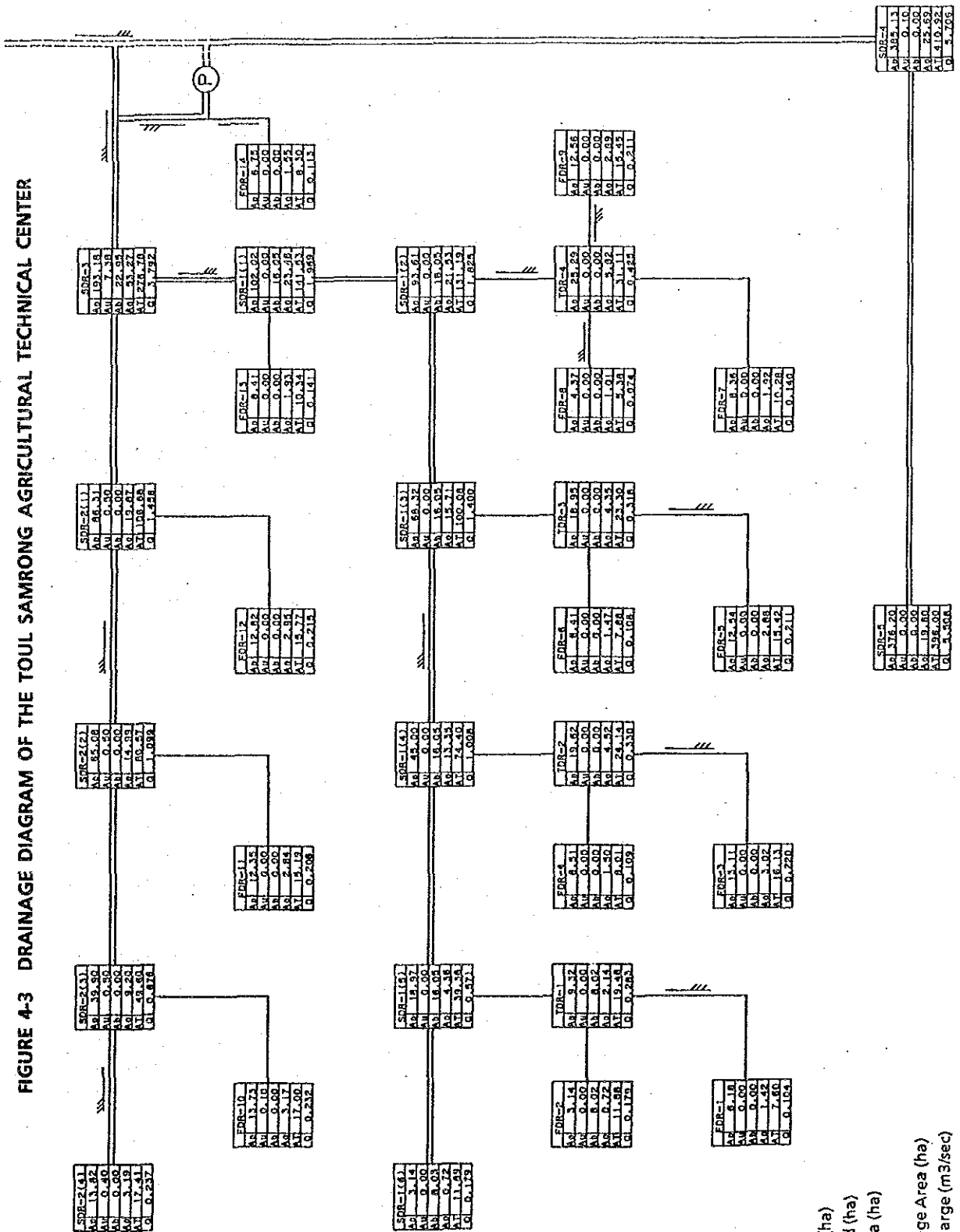
The discharge coefficient of 0.8 in paddy fields, 0.6 for upland fields, 0.9 for housing areas and 0.7 for other areas are applied.

b) Plan of Drainage Pump Station

i) Outer Water Level and Inundation Period

Since there is no record on the outer water level, the survey results of the flood mark elevation and farmers' interview data are used in estimating the outer water level and its duration day. The high outer water level usually continued up to more than 15 days. Later, the water level gradually goes down. According to the survey results, the elevations of the flood and the lowest fields are registered at 11.62 and 10.75, respectively.

FIGURE 4-3 DRAINAGE DIAGRAM OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER



- Legend**
- Ap : Paddy Field (ha)
 - Au : Upland Field (ha)
 - Ab : Building Area (ha)
 - Ao : Others (ha)
 - AT : Total Drainage Area (ha)
 - Q : Design Drainage (m³/sec)
 - P : Pump Station (Proposed)

ii) Calculation of Design Drainage Discharge

The rainfall type in the area is classified as tropical heavy rain type, therefore, it is unusual that the same rainfall intensity and duration period of rainfall in the drainage basin is observed. When tropical heavy rain occurred in the Center, the outside water level is high; hence, the water cannot be drained without using pump.

The floodwater in the main road from outside of the Center can be protected by the proposed farm roads. The drainage discharge, therefore, is caused only by rainfall in the Center area. Its amount shall be drained out by the proposed pump, because the outer water level is higher than that of the Center.

According to the above drainage condition, the pump shall drain excess water caused by the design daily rainfall. Based on the growth of paddy, the standing water within four (4) days on the paddy fields does not severely damage the paddy, therefore, the total design capacity of pump equipment is determined at a total flood discharge of 337,337 cu.m for four (4) days, which is equivalent to 84,334 cu.m/day (0.967 cu.m/sec).

iii) Design of Pump Equipment

To save the operation cost in ordinary flood time and to have easy maintenance works, two (2) sets of pump equipment with the same capacity is proposed. The pump capacity of 0,484 cu.m/sec (=29.3 cu.m/min) and the total lifting head of 5.0 m are determined based on the water level of 12.0 m from outside area, total loss head in the pump station of 2.0 m, and the lowest water level at the suction pit of 9.0 m. A diesel-engine prime mover is recommended during the flooding time only. A stand-by pump set is to proposed since there is enough time to maintain the equipment before rainy season. The specification of pump equipment is as follows:

- Pump Type : Horizontal shaft type, Axial flow Pump
- Pump Capacity : 29.3 m³/min (=0.484 m³/min)

- Pump Diameter : 500 mm
- Pump Number : 2 sets
- Total Head : 5.0 m
- Required Power of Engine : 60 HP

c) Design of Drainage Canal

i) Drainage Area

The drainage area of the canal is calculated based on the topographic map of 1/50,000 scale.

ii) Alignment of Drainage Canal

Farm drains are aligned in order to directly drain excess water from the fields. Taking into account the easy water management, the maximum length of the drainage canal shall be limited at 300 to 500 m. The end point of drainage canals will not be connected to the ponds which store water for domestic water supply to the Center to avoid water pollution by fertilization and pesticide at the farm lands.

iii) Design of Cross-section

The drainage canal of inside slope of 1:1 is proposed due to its heavy clay soil texture. The minimum dimensions of canal depth of 0.9 m bed width of 0.6 m are proposed in order to reduce the groundwater drawdown and make the construction by machines easy. (refer to Typical Cross-section)

iv) Canal and Structures

The total length of the drainage canals proposed of 16,085 m, which consists of 5,495 m to be rehabilitated and 10,590 m to be constructed. As the protective structures of the canals, drainage crossings at 42 places and access roads to filed at 25 places and a drainage pump station are planned.

(5) Land Preparation and Leveling

The farm plots to introduce transplanting method of paddy are planned to locate the eastern half part of the proposed farm land. These farm plots will have land leveling work to meet adequate water management for rice transplanting. However the land leveling work in the remaining half part will not be conducted, because of rice direct sowing area.

a) Land Leveling

Because of the undulated field surface of the existing paddy fields, the standing water depth is in inequality. Those fields are not suitable for a transplanting of paddy. It is necessary to make land leveling on the fields of 102.6 ha. On the other fields, the broadcasting fields, land leveling works will not be carried out on this plan. When the transplanting manner, however, will be introduced in the fields in the future the land leveling works shall be necessary.

b) Paddy Dike

Some paddy field are too large to perform favorably puddling works for transplanting. The maximum size of the paddy field shall be limited at about 1.0 ha. The new plot will be bounded by a farm road, a farm ditch and a farm drain. The necessary length of proposed paddy dikes with a height of 30 cm, a berm width of 30 cm and a side slope of 1:1, amounts at 3,690 m as proposed plan.

4. 2. 6 Plan of Equipment

In accordance with the design policy, the equipment shall consist of the following eight (8) categories:

- Farm machinery
- Thresher and seed processing machinery
- Laboratory equipment for seed testing
- Machinery and equipment in Workshop

- Office equipment
- Vehicles
- Supporting equipment
- Furniture

(1) Selection of Equipment

Based on the objectives and functions of the Center, selection of the equipment according to its type, quantity and standard will be done taking into consideration of the technical level, maintenance and operation cost, procurement problem of spare part, etc.. The basic guidelines of equipment selection shall be as follows:

- The scope of equipment selection shall be limited to the equipments for seed production, processing, storage and testing including the equipment for operation and maintenance in the Center.
- The equipment shall be as much as possible a manual-type in order to reduce the cost of electricity.
- The engine-driven equipment shall be a diesel-type in order to minimize the fuel cost.
- The technical standard of the equipment should be appropriate to the personnel, technicians, repairmen and the workers of the Center.
- The quantity of equipment and its scale shall be minimized.
- The equipment which requires after-sale services frequently shall be excluded.

(2) Farm Machinery

The Center has a farmland of 209 ha. Out of this one (1) ha is planned for maintenance of breeder's stock seeds and variety testing field. The remaining 208 ha is planned for the field of foundation seed as well as extension seed production. According to the cropping plan, transplanting and direct-sowing in 102 ha and 107 ha respectively, will be in operation. To cope with this cropping pattern, the type, standard and quality of farm machinery shall be proposed as follows:

a) 4-Wheel Tractor

The operation by tractors shall cover tilling, leveling, puddling seeding, pest control and transportation. A tractor shall be equipped with 4-wheel drive system and 80 horsepower class engine in order to improve the rate of work under the large farm with the heavy clay soil condition. Toward this, utilization of large scale farm machinery is presently experienced by the Center. Two (2) sets of the tractor shall be required for taking the design conditions of the area, operation period and cropping pattern. (Refer to Table 5 - 10 in Appendix)

The tractor attachments of bottom plow and disc plow for tilling, disc harrow for leveling and rotary harrow for puddling in the transplanting fields shall be required. Moreover, the attachments of grain-drill, power sprayer and trailer shall be required in the direct-sowing, pest control and transportation respectively.

b) Hand Tractor

In the breeder's stock field (1 ha) which is divided into small plots, the large scale machinery will not be suitable for operation. In this way, the hand tractor shall be required for tilling.

c) Sprayer

The manual sprayer shall be used in the breeder's stock field since tractor-mounted power sprayer is not economical. The engine-driven sprayer shall be used for spraying liquid, solid and powder typed fertilizers or pesticide in the testing field.

d) Combine Harvester

Since harvesting and drying are done simultaneously, a lot of manpower is required during the season. Most of the workers should engage in drying and handling operation to obtain quality seeds. Therefore, mechanization in harvesting is unavoidable.

Taking into consideration the soil condition and farm scale, the harvester shall be equipped with crawler type and 80 horsepower class engine.

Since, the working efficiency of combine harvesters are low in the small sized plots, it is required to introduce reapers for these plots.

e) Engine Pump

In order to control water in the plots of the testing field, the pump equipped with 15 horsepower engine class is required.

(2) *Thresher and Seed Processing Machinery*

The machinery for threshing and processing operation of seeds shall be determined on the type, specifications and quantity as follows:

a) Thresher

The engine-driven thresher shall be required in order not to intermix with other varieties in the testing field. The remaining paddy of which are harvested by combine harvester will be harvested by hand and threshed by this thresher.

b) Seed Processing machinery

The seed processing machinery (or mini-plant) shall consist mainly of precleaner, cleaner, and platform, but excluding width/length graders, gravity separator, and tempering dryer, taking into account the required currently in the country and the running cost.

As for precleaner, it shall be equipped with aspirator to remove straw stone and other impurities. The cleaner shall be equipped with air-screen to remove immature seed. The air-screen type is selected because it is widely used for indica variety and has easy exchangeability with other screens (mesh), while the indent cylinder type is used for Japonica varieties.

According to the plan, 567 tons of harvested un-dried seed will be processed within 30 days. Thus the mini-plant should perform 2 tons per hour with 10 hours operation per day. To make the mini-plant cope with fluctuation of input, the processing machinery shall have plural lines. Thus, mini-plant is required two (2) lines with the capacity of 1 ton/hr/per line.

(3) Laboratory Equipment for Seed Testing

The laboratory equipment shall cover seed quality and seed protection as shown in Table 4-5 and fundamental type shall be selected.

a) Laboratory Equipment for Seed Quality Test

For the seed testing, the equipment shown in Table 4-6 shall be selected. Only one (1) of the equipment shall be used in the laboratory. The expendable items such as glassware shall be provided to treat the seed volume for testing, approximately one (1) ton breeder's stock (1 ton) and one (1) ton of sample seeds from foundation seed (20 ton).

For the storage of breeder's seeds and other testing variety seeds, the desiccators with silica gel are proper to maintain high quality of seed at low cost. At least eighty (80) units of desiccators or equivalent shall be required to store more than 100 varieties (about 200 liter seeds) to plant in 1 ha of breeder's stock field. These units were calculated based on the volume of 10 liters desiccator, storing seed of 200 liters, 3 years storage and volume rate of 75 percent ($80 \text{ units} = 200 \text{ liters} \times 3 \text{ year} / 10 \text{ liters} / 75\%$).

TABLE 4-5 ITEMS FOR TESTING AND FIELD CHECK

Item for Testing	Seeds			Remarks
	Breeder's Stock	Foundation Seeds	Seeds for Distribution	
1. Testing of Seeds				
(1) Testing of Seed Quality				
- 1ℓ weight	<input type="radio"/>	<input type="radio"/>		
- Germination Percentage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
- Whole Grain Percentage	<input type="radio"/>	<input type="radio"/>		
- Moisture	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
- Exotic Variety	<input type="radio"/>	<input type="radio"/>		
- Foreign Matters	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
- Damaged Grain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
(2) Seed Characteristic By Variety				
- Thickness	<input type="radio"/>			
- Width	<input type="radio"/>			
- Grain Transparency	<input type="radio"/>			
2. Varietal Performance Check				
- Growth Habit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Measurement of plant height, number of tillers, and leaf number
- Yield Component	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Number of ears, number of grains per panicles, percentage of ripened grains, and weight of 1,000 grains
- Simple Soil Test	<input type="radio"/>			
- Field Survey of Standing crops	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Percentage of exotic varieties/heterogeneous plants
3. Seed Protection Survey				
- Insect Injury	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
- Disease Injury	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

TABLE 4-6 LABORATORY EQUIPMENT AND ITS PURPOSES

Equipment	Q'ty	Purpose
1. Laboratory Equipment for Seed Quality Test		
(1) Seed Moisture Meter	2 units	Measurement of seed moisture contents
(2) Trier	5 pcs	Sampling
(3) Magnifier	10 pcs	Inspection of different varieties and/or damaged seeds
(4) Weight-to-Volume Meter	1 unit	Measurement of 1-liter-weight
(5) Grain Divider	1 unit	Examination of paddy growth
(6) Drain Test Tray	30 pcs	Inspection general
(7) Top-pan Balance	1 unit	Measurement of weight
(8) Double Beam Balance	1 unit	Measurement of weight
(9) Table Balance	1 unit	Measurement of weight
(10) Thermometer	10 pcs	General usage
(11) Sampling Bottle	500 pcs	General usage
(12) Glassware		
- Desiccator	80 pcs	Storage of foundation seed
- Petri Dish	500 pcs	Examination of germination
- Beaker	1 set	General usage
- Conical Flask	1 set	General usage
- Cylinder	1 set	General usage
- Test tube	500 pcs	General usage
- Pipet	1 set	General usage
(13) Bunsen Burner	3 set	General usage
2. Laboratory Equipment for Varietal Performance Check and Pest Occurrence Check		
(1) Test Winnow	1 unit	Elimination of impurities, immature, etc
(2) Test Width/Thickness Grader	1 unit	Inspection of seed size deviation, Selecting of air-screen
(3) Infrared Moisture Meter	1 unit	Detailed measurement of seed moisture contents
(4) Compound Micrometer	1 unit	Examination of seed disease
(5) Drying Oven	1 unit	Storage, Preparation of tests
(6) Weighing Can	500 pcs	General usage
(7) Grain Crack Meter	1 lot	Inspection of different size of seed
(8) Grain Crack Meter	2 units	Analysis of seed feature
(9) pH Meter	1 unit	Analysis of soil
(10) Meteorological Equipment	1 lot	Meteorological observation relating paddy growth
(11) Soil Test Kit	1 set	Analysis of soil

b) Laboratory Equipment for Varietal Performance and Pest Occurrence Check

The laboratory equipment shall be used not only for seed quality test but also varietal performance check as well as pest occurrence check, as shown in Table 4-6 only one(1) unit of equipment will be used.

(4) Workshop Machinery and Equipment

The workshop machinery and equipment shall be classified into seven (7) groups, namely: engine tools, chassis tools, electric tools, measuring tools, general maintenance tools, fabricating tools for periodical check and repair including the engine-overhaul, and simple parts fabrication shall be included.

Fabricating machines which needed technology transfer for a long term shall be excluded. But machines that required only short-term technology transfer on simple parts-making like drilling, grinding, and welding machines shall be included.

Furthermore, the workshop machinery and equipment which could be operated and maintained in the technical level by the repairmen of the Center, shall be selected.

(5) Office Equipment

The office equipment shall include English manual typewriter, Khmer manual typewriter and mimeograph machine. The one (1) English and two (2) Khmer typewriters shall be respectively used in Laboratory Division and Administration Division. The mimeograph machine which could be operated by both manual and electric is required for a the publication of the Center.

It is expected that no public tele-communication service will be available in the project area in near future. Thus, a set of wireless communication equipment shall be introduced for the operation of the Center. The wireless communication equipment should include of three (3)

items: (1) sets of base station equipment for the communication between the headquarter of the Ministry of Agriculture / Agronomy Department and the Center through the Agricultural Service Office of Battambang province, (2) six (6) units handy transceiver for the divisional chief staffs, and (3) one unit of transceiver for a station wagon.

(6) Vehicles

The vehicles shall include station wagon, motorcycle and pickup truck. Following are the details:

a) Stations Wagon

The station wagon shall be required for observation and maintenance of seven (7)km feeder canal. Considering the conditions of the road and number of workers, the station wagon shall be equipped with 4-wheel-drive system and rear bench seat.

b) Motorcycle

The motorcycles shall be required for management of farm. The Seed Production Division shall be responsible for the management and operation of the farm. The motorcycle shall have 100 to 125 cc class engine to avoid the frequent engine-troubles.

c) Pick-up Truck

The pick-up truck shall be required for transporting farm inputs to the farm and materials to the canal and the upper stream.

(7) Supporting Equipment

The Center will also need the following equipment:

a) Portable Conveyor

The handling works of seeds should be carried out efficiently to maintain seed quality. Therefore the conveyor shall be required in carrying, piling and loading of seed sacks.

b) Monocycle, Ladder and Step Ladder

The monocycle shall be used for seed-drying in the concrete yard, while the ladder and step ladder will be used for piling in the seed into the warehouse.

c) Plastic Sheet

In order to avoid reverting of seed moisture content during the night, plastic sheet is required.

d) Agricultural Technical Book

At least twenty (20) books are required to enhance the new graduates who will be engaged in seed production works.

(8) Cabinet Articles

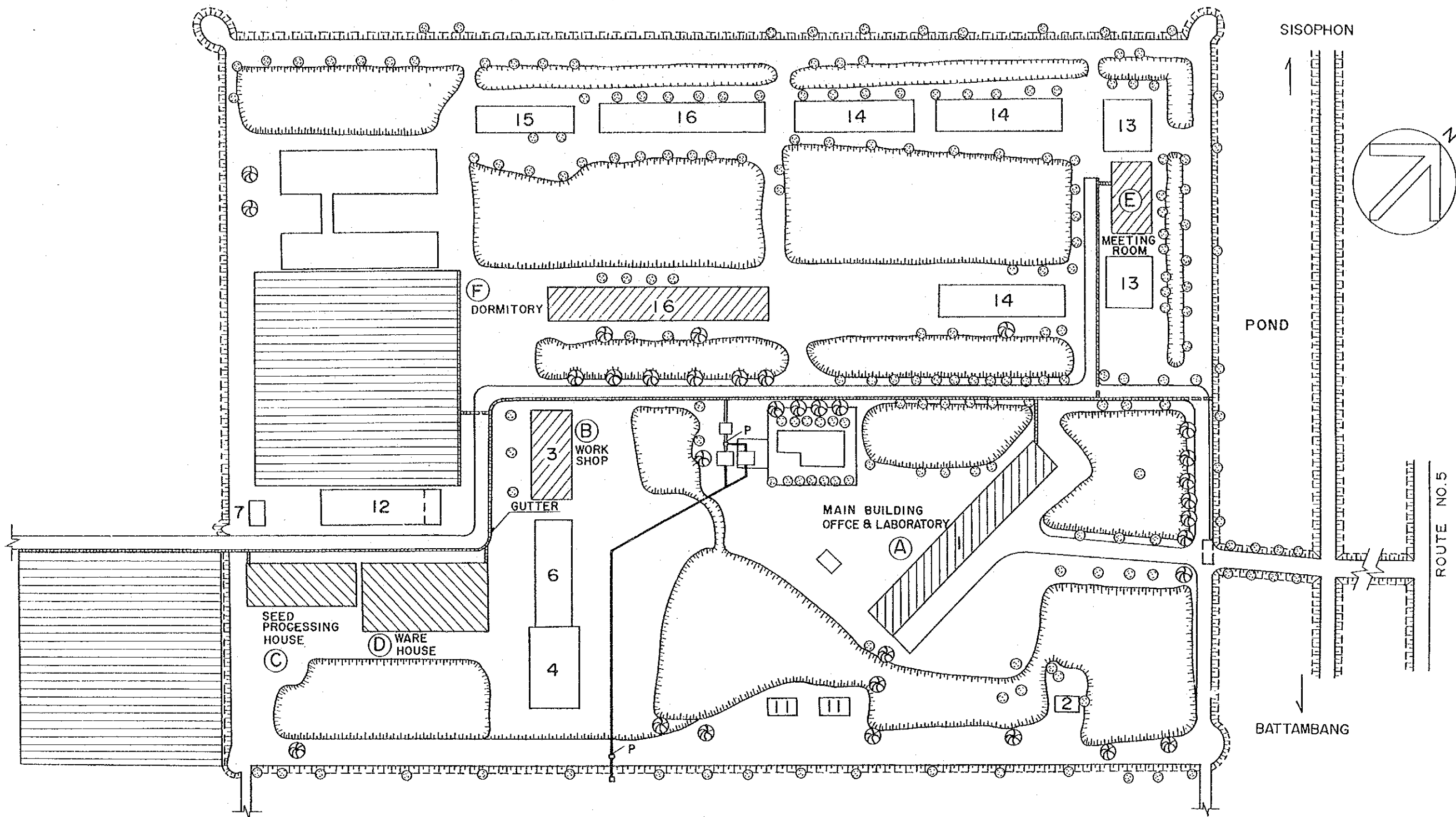
The cabinet articles are required in administration room, laboratory, preparation room, workshop, guest house, etc. The furnitures shall include laboratory center tables, desks, chairs, lockers, working tables, shelves, etc. The type and quantity is determined by personnel and equipment layout in each room. (Refer to Table 5-12 in Appendix)

4.2.7 Basic Design Drawings

The list of basic design drawings is given as follows:

No. of Drawing	Title
DWG No. 1	General Layout of Building
DWG No. 2	Finishing of Building
DWG No. 3	Elevation of Main Building
DWG No. 4	Plan of Main Building
DWG No. 5	Elevation and Plan of Workshop
DWG No. 6	Elevation and Plan of Seed Processing House
DWG No. 7	Elevation and Plan of Warehouse
DWG No. 8	Elevation and Plan of Meeting Room
DWG No. 9	Elevation and Plan of Dormitory
DWG No.10	General Plan of Center Farm Facilities
DWG No.11	Typical Cross Section of Center Farm Facilities
DWG No.12	Plan and Profile of Feeder Canal (1/2)
DWG No.13	Plan and Profile of Feeder Canal (2/2)
DWG No.14	Turnout and Drainage Pump Station

Note: Drawing are given in the following pages.



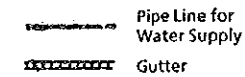
LEGEND

EXISTING BUILDINGS

1. Office & Laboratory	1,496 m ²	7. Observatory	12 m ²
2. Fuel Storage	30	8. Generator House	120
3. Farming Tool Repair Factory	240	9. Livestock House	120
4. Farming Tool Exhibition House	240	10. Compost House	100
5. Farmer's Station	120	11. Green House	48.6
6. Lecture Room & Storage	785.7	12. Workshop	200

PROPOSED BUILDINGS

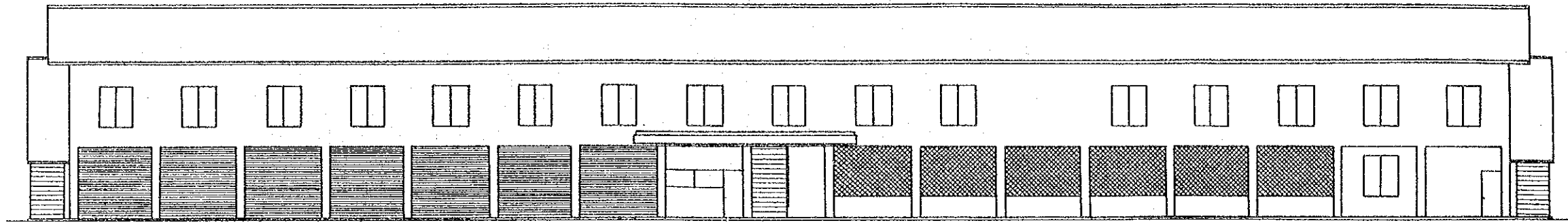
Ⓐ Main Building	1,496 m ²
Ⓑ Workshop	250 m ²
Ⓒ Seed Processing House	220 m ²
Ⓓ Warehouse	525 m ²
Ⓔ Meeting Room	195 m ²
Ⓕ Dormitory	355 m ²



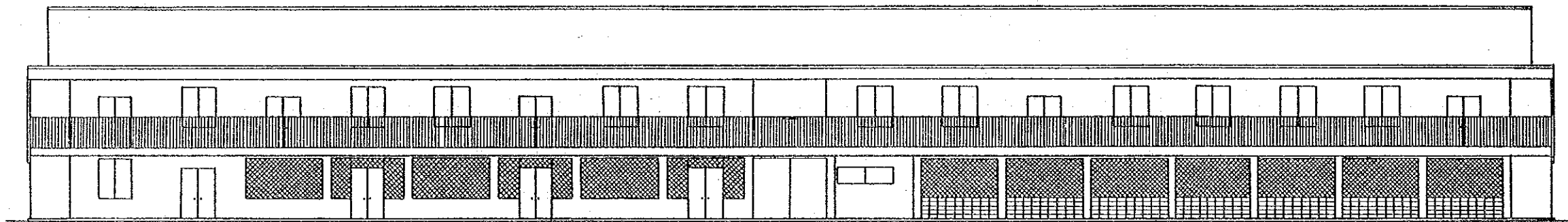
CAMBODIA	
THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
GENERAL LAYOUT OF BUILDINGS	DWGS No. 1
JAPAN INTERNATIONAL COOPERATION AGENCY	

	STRUCTURE & ROOF	EXTERNAL WALL	ROOM NAME	AREA	FLOOR	SKIRTING	INTERNAL WALL	CEILING	
Ⓐ MAIN BUILDING OFFICE & LABORATORY 1360 M ²	STEEL TRUSS REMAIN EXISTING STRUCTURE BUT RENEW 1ST FLOOR CONCRETE SLAB & STEEL TRUSS & LARGE CORRUGATE ASBESTOS SHEET	CEMENT BORD W/ LGS. FRAM AND PAINTED EMULSION PAINT & NETFENCE	VERIETAL PERFORMANCE LAB	120 M ²	LOCAL VINYL TILES 12"x12" T=2.0	MORTAR	CEMENT BOAD W/LGS FRAM & PAINTED	T-BAR PB 12mm VEP	
			SEED PROTECTION LAB	80 M ²	LOCAL VINYL TILES	MORTAR	CEMENT BOAD W/LGS FRAM & PAINTED	T-BAR PB 12mm VEP	
			SEED STORAGE	20 M ²	MORTAR STEEL TROWEL FINISH t=25	MORTAR	CEMENT BOAD W/LGS FRAM & PAINTED	PAINTED	
			SEED QUARITY LAB	100 M ²	MORTAR STEEL TROWEL FINISH t=25	MORTAR	CEMENT BOAD W/LGS FRAM & PAINTED	PAINTED	
			ADMINISTRATION	120 M ²		LOCAL VINYL TILES	LOCAL VINYL TILES H=100	CEMENT BOAD W/LGS FRAM & PAINTED	T-BAR PB 12mm VEP
			DIRECTOR & VICEDIRECTOR	80 M ²		LOCAL VINYL TILES	LOCAL VINYL TILES H=100	CEMENT BOAD W/LGS FRAM & PAINTED	T-BAR PB 12mm VEP
			CONFERENCE ROOM	120 M ²		LOCAL VINYL TILES	LOCAL VINYL TILES H=100	CEMENT BOAD W/LGS FRAM & PAINTED	T-BAR PB 12mm VEP
			TEST SEED STORAGE	72 M ²		MORTAR STEEL TROWEL FINISH t=25	MORTAR	CEMENT BOAD W/LGS FRAM & PAINTED	T-BAR PB 12mm VEP
			RESERCH ROOM	216 M ²		MORTAR STEEL TROWEL FINISH t=25	MORTAR	CEMENT BOAD W/LGS FRAM & PAINTED	T-BAR PB 12mm VEP
			ENTRANCE HALL	40 M ²		LOCAL VINYL TILES	LOCAL VINYL TILES H=100	CEMENT BOAD W/LGS FRAM & PAINTED	T-BAR PB 12mm VEP
			CAR PARKING	280 M ²		MORTAR STEEL TROWEL FINISH t=25		CEMENT BOAD W/LGS FRAM & PAINTED	PAINTED
			TOILET	58 M ²		MOSAIC TILE		CERAMIC TILE H=1800 MORTAR & PAINTED	CEMENT BOAD 6mm VEP
Ⓑ WORK SHOP 250 M ²	FOUNDATION RC COLUMN & BEAM STEEL LARGE CORRUGATE ASBESTOS SHEET	SKIRTING H=1000 BRICK SMALL CORRUGATE ASBESTOS SHEET	WORK SHOP	220 M ²	MORTAR STEEL TROWEL FINISH t=25		STEEL PAINTED	STEEL PAINTED	
			STAFF ROOM	15 M ²	MORTAR STEEL TROWEL FINISH t=25		STEEL PAINTED	STEEL PAINTED	
			SPEAR PARTS ROOM	15 M ²	MORTAR STEEL TROWEL FINISH t=25		STEEL PAINTED	STEEL PAINTED	
Ⓒ SEED PROCESSING HOUSE 220 M ²	FOUNDATION RC COLUMN & BEAM STEEL LARGE CORRUGATE ASBESTOS SHEET	SKIRTING H=1000 BRICK SMALL CORRUGATE ASBESTOS SHEET	SEED PROCESSING		MORTAR STEEL TROWEL FINISH t=25 DUST PROTECTION PAINTED		STEEL PAINTED	STEEL PAINTED	
			CONTROL ROOM		LOCAL VINYL TILES	LOCAL VINYL TILES H=100	SKIRTING H=1000 BRICK VEP ALUM WINDOW 2000x1200	T-BAR PB 12mm VEP H=2400	
Ⓓ WARE HOUSE 525 M ²	FOUNDATION RC COLUMN & BEAM STEEL LARGE CORRUGATE ASBESTOS SHEET W/ INSULATION GLASS WOOL T=25 & WIRE MESH	SKIRTING H=1000 BRICK SMALL CORRUGATE ASBESTOS SHEET W/ INSULATION GLASS WOOL T=25 & WIRE MESH			MORTAR STEEL TROWEL FINISH t=25		STEEL PAINTED	STEEL PAINTED	
Ⓔ MEETING ROOM 195 M ²	FOUNDATION & COLUMN&BEAM RC ROOF STEEL TRUSS LARGE CORRUGATE ASBESTOS SHEET	BRICK CEMENT PLASTER FINISH, AND PAINTED EMULSION PAINT	GUEST ROOM	80	LOCAL VINYL TILES	LOCAL VINYL TILES H=100	MORTAR & PAINTED	T-BAR PB 12mm VEP	
			KITCHIN	20 M ²	MORTAR STEEL TROWEL FINISH t=25	MORTAR H=100	MORTAR & PAINTED	CEMENT BOAD 6mm VEP	
			LIVING DININGROOM	60 M ²	LOCAL VINYL TILES	LOCAL VINYL TILES H=100	MORTAR & PAINTED	T-BAR PB 12mm VEP	
			BATH & SHOWER ROOM	10 M ²	MOSAIC TILE		CERAMIC TILE H=1800 MORTAR & PAINTED	CEMENT BOAD 6mm VEP	
			TOILET	10 M ²	MOSAIC TILE		CERAMIC TILE H=1800 MORTAR & PAINTED	CEMENT BOAD 6mm VEP	
			SERVANT ROOM	15 M ²	MORTAR STEEL TROWEL FINISH t=25	MORTAR H=100	MORTAR & PAINTED	T-BAR PB 12mm VEP	
Ⓕ DORMITORY 355.2 M ²	FOUNDATION & COLUMN&BEAM RC ROOF STEEL TRUSS LARGE CORRUGATE ASBESTOS SHEET	BRICK CEMENT PLASTER FINISH, AND PAINTED EMULSION PAINT	LIVING DININGROOM		LOCAL VINYL TILES	LOCAL VINYL TILES H=100	MORTAR & PAINTED LGS.FRAME W/PB12 VEP	T-BAR PB 12mm VEP	
			BED ROOM		LOCAL VINYL TILES	LOCAL VINYL TILES H=100	MORTAR & PAINTED LGS.FRAME W/PB12 VEP	T-BAR PB 12mm VEP	
			TOILET		MOSAIC TILE		CERAMIC TILE H=1800 MORTAR & PAINTED	CEMENT BOAD 6mm VEP	
			KITCHIN		MORTAR STEEL TROWEL FINISH t=25		MORTAR & PAINTED		

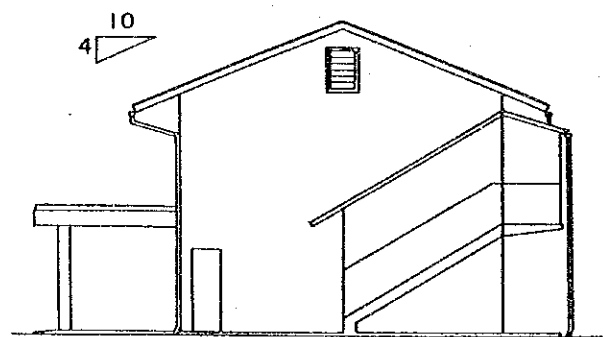
CAMBODIA THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
FINISHING OF BUILDINGS	DWGS No. 2
JAPAN INTERNATIONAL COOPERATION AGENCY	



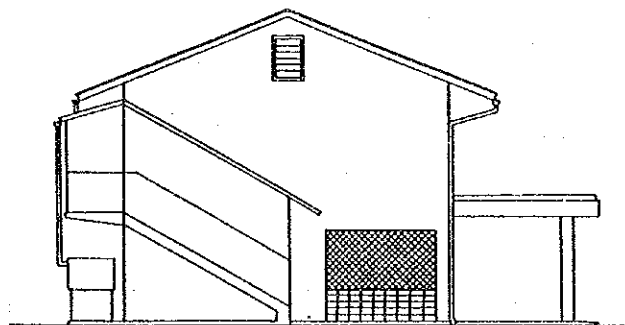
SOUTH ELEVATION



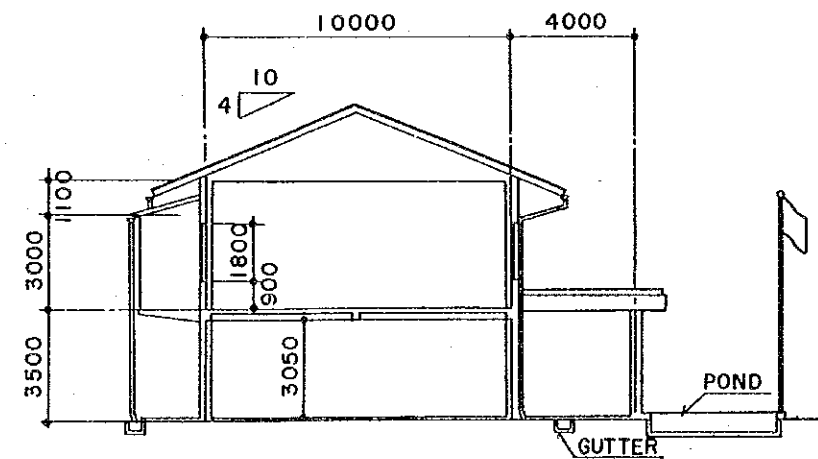
NOUTH ELEVATION



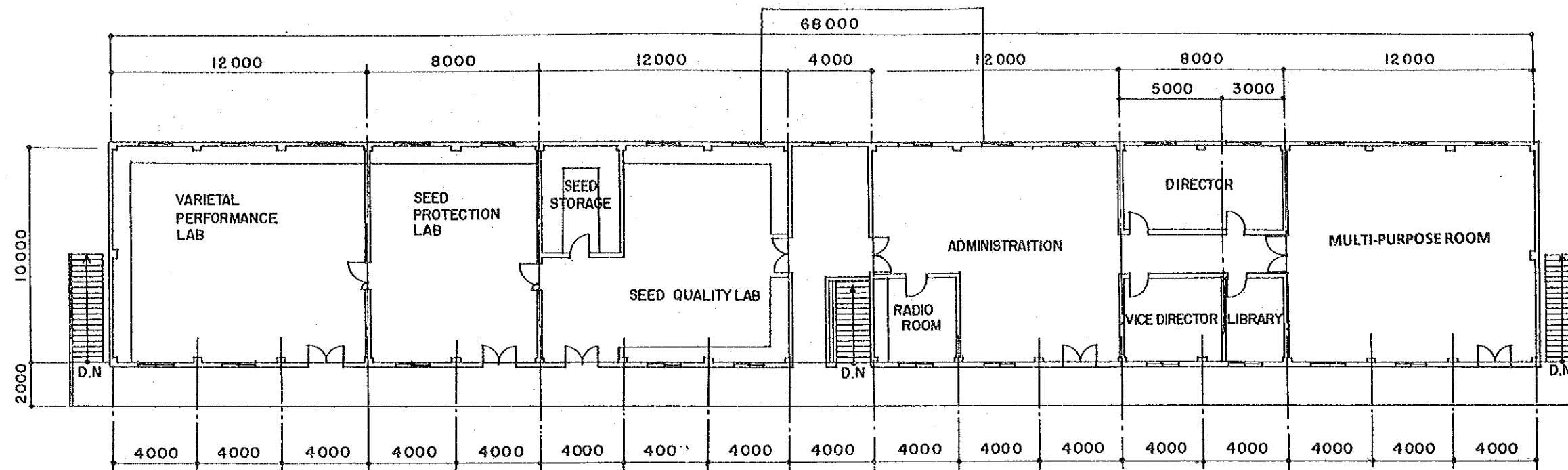
EAST ELEVATION



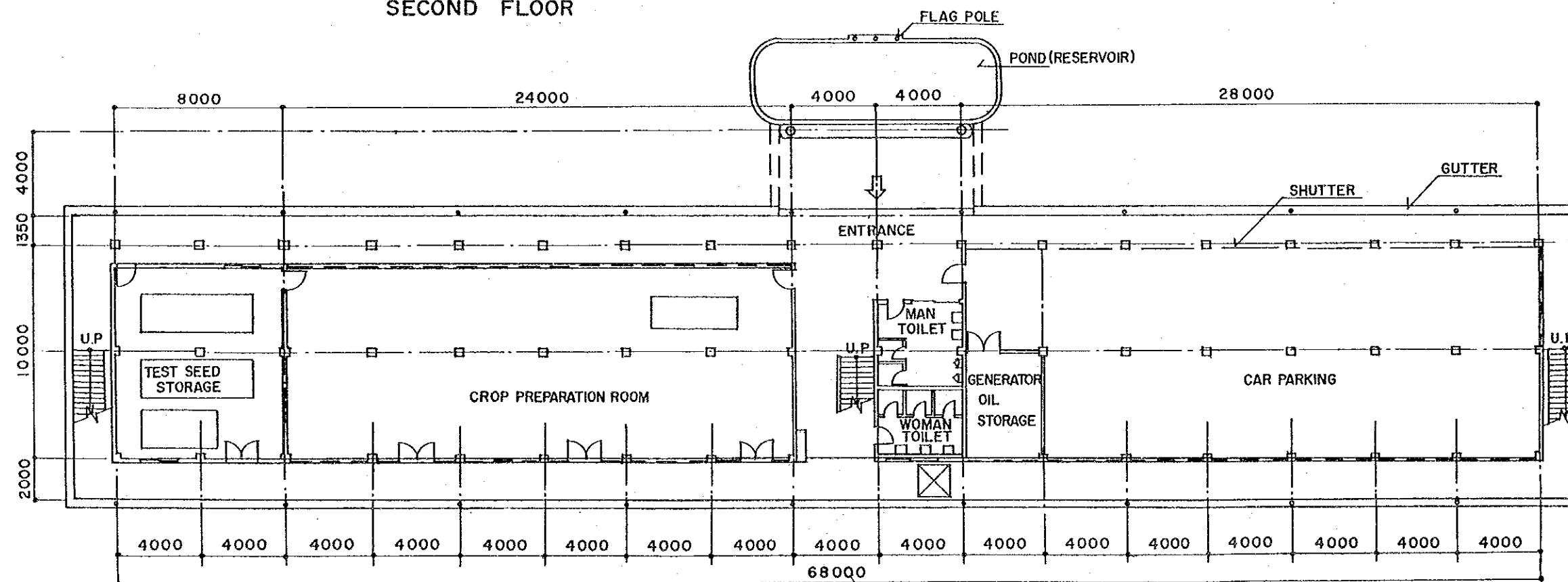
WEST ELEVATION



CAMBODIA THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
ELEVATION OF MAIN BUILDING	DWGS No. 3
JAPAN INTERNATIONAL COOPERATION AGENCY	

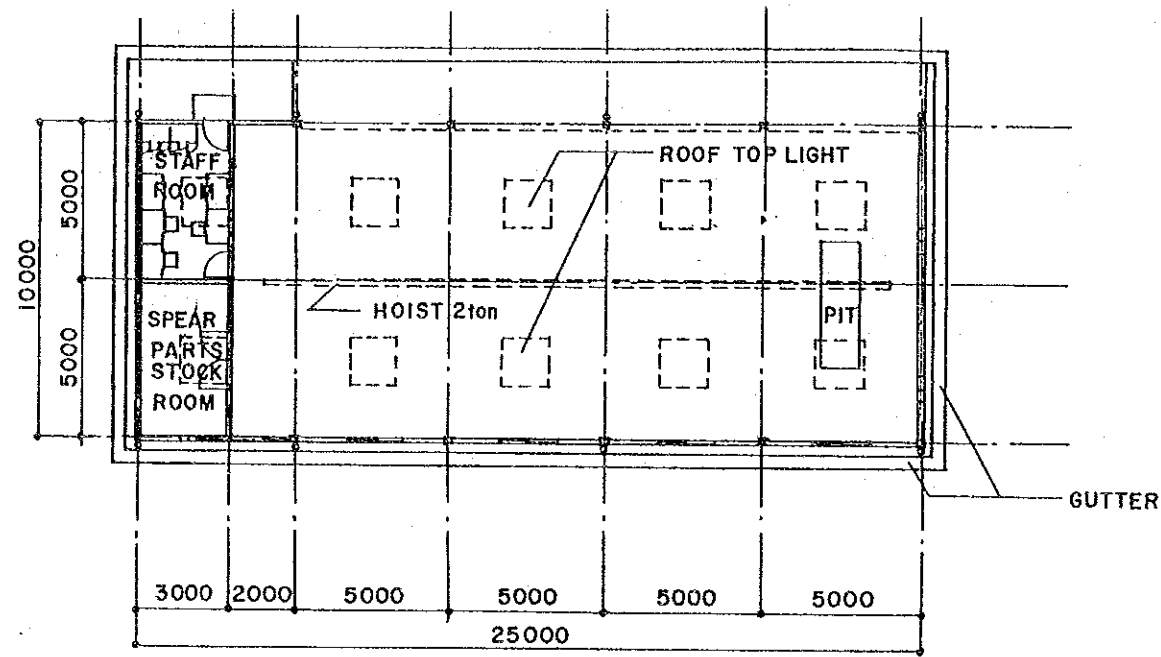


SECOND FLOOR

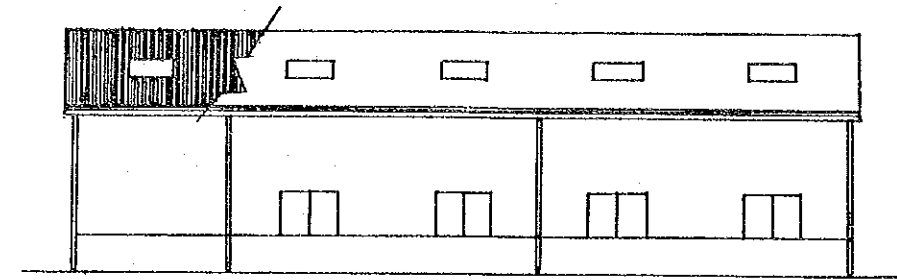


FIRST FLOOR

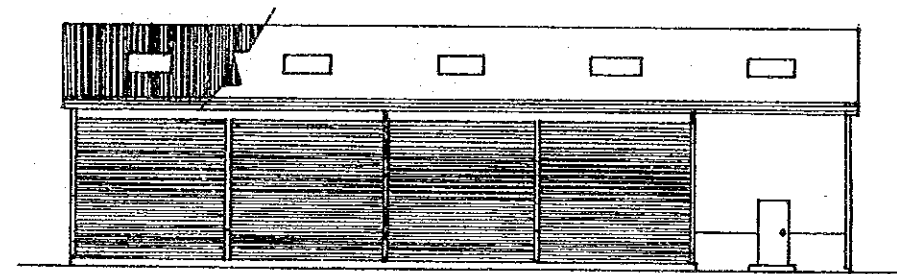
CAMBODIA	
THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
PLAN OF MAIN BUILDING	DWGS
	No. 4
JAPAN INTERNATIONAL COOPERATION AGENCY	



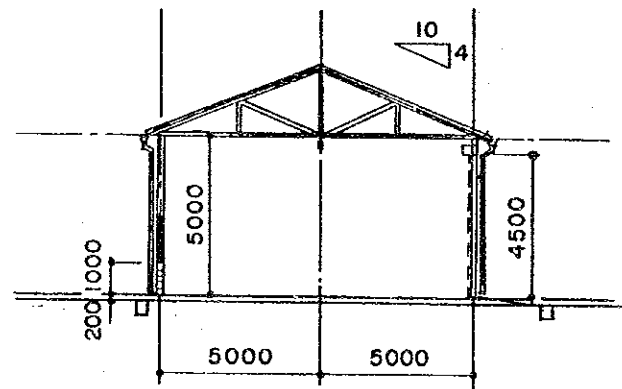
PLAN



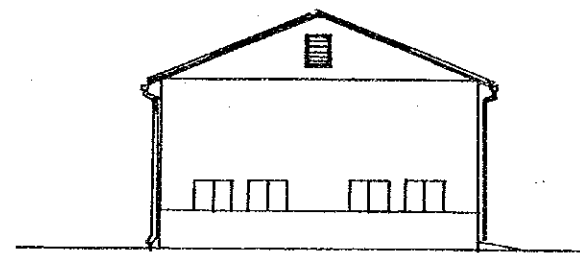
EAST ELEVATION



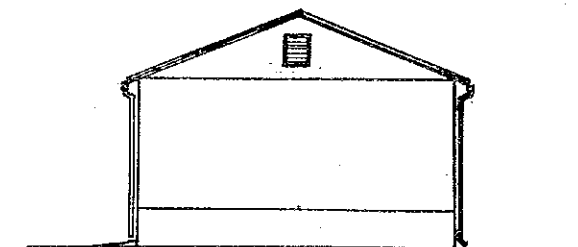
WEST ELEVATION



SECTION

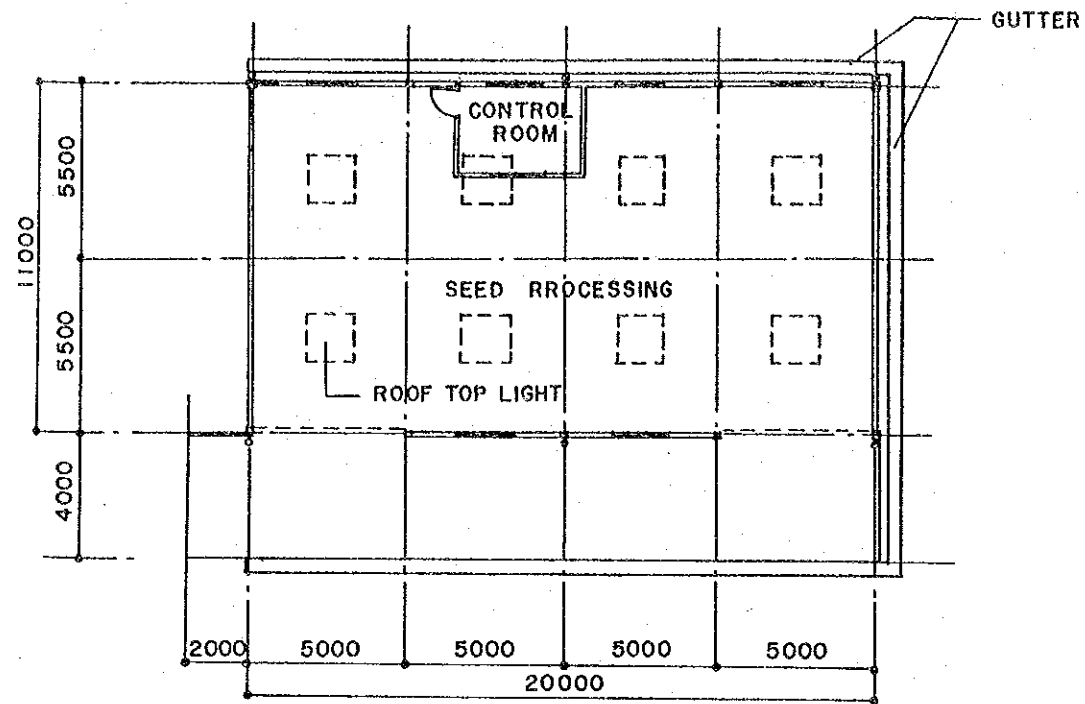


NORTH ELEVATION

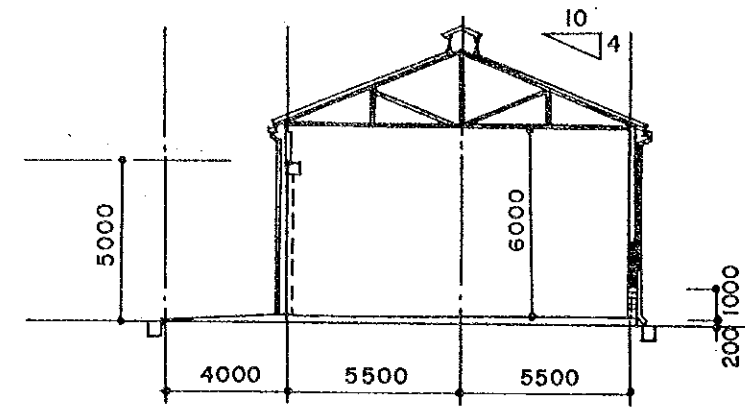


SOUTH ELEVATION

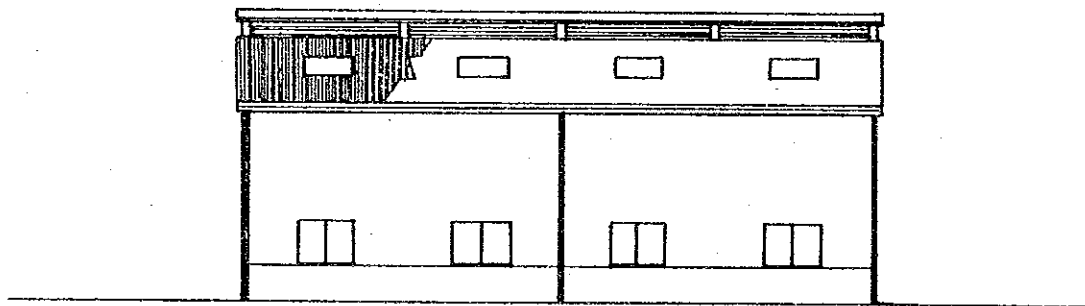
CAMBODIA THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
ELEVATION AND PLAN OF WORKSHOP	DWGS No. 5
JAPAN INTERNATIONAL COOPERATION AGENCY	



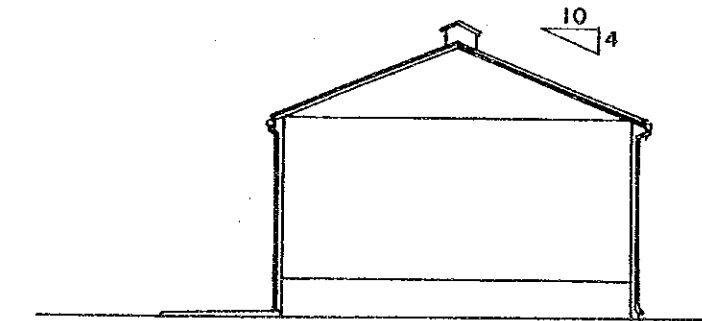
PLAN



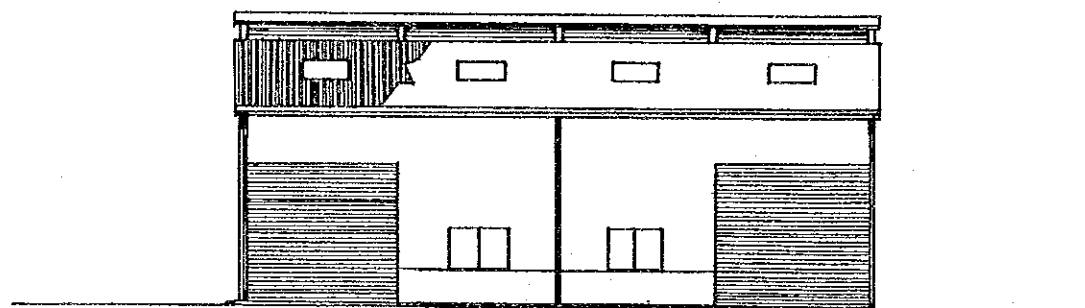
SECTION



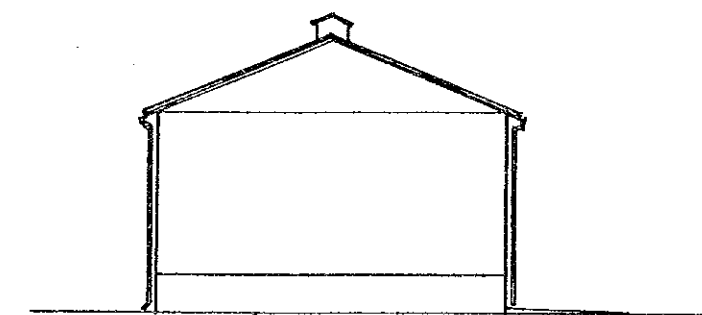
SOUTH ELEVATION



EAST ELEVATION

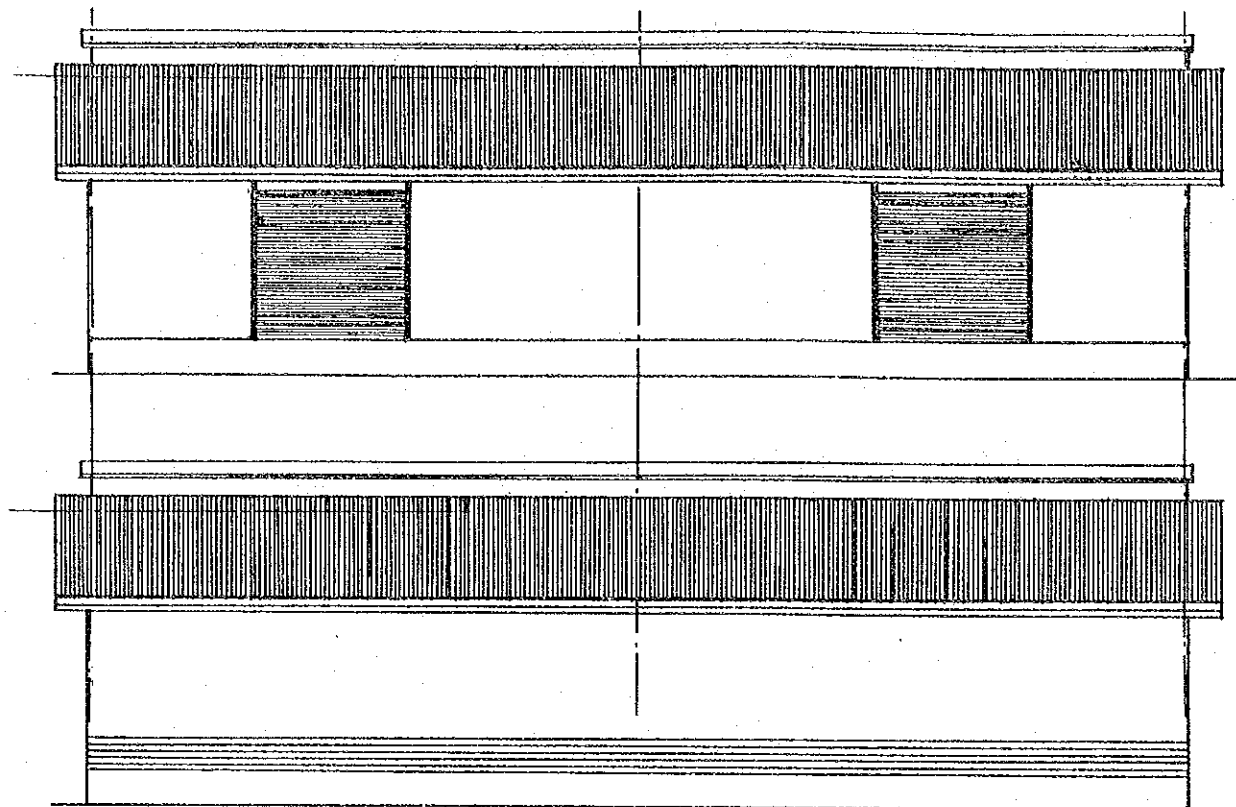


NORTH ELEVATION



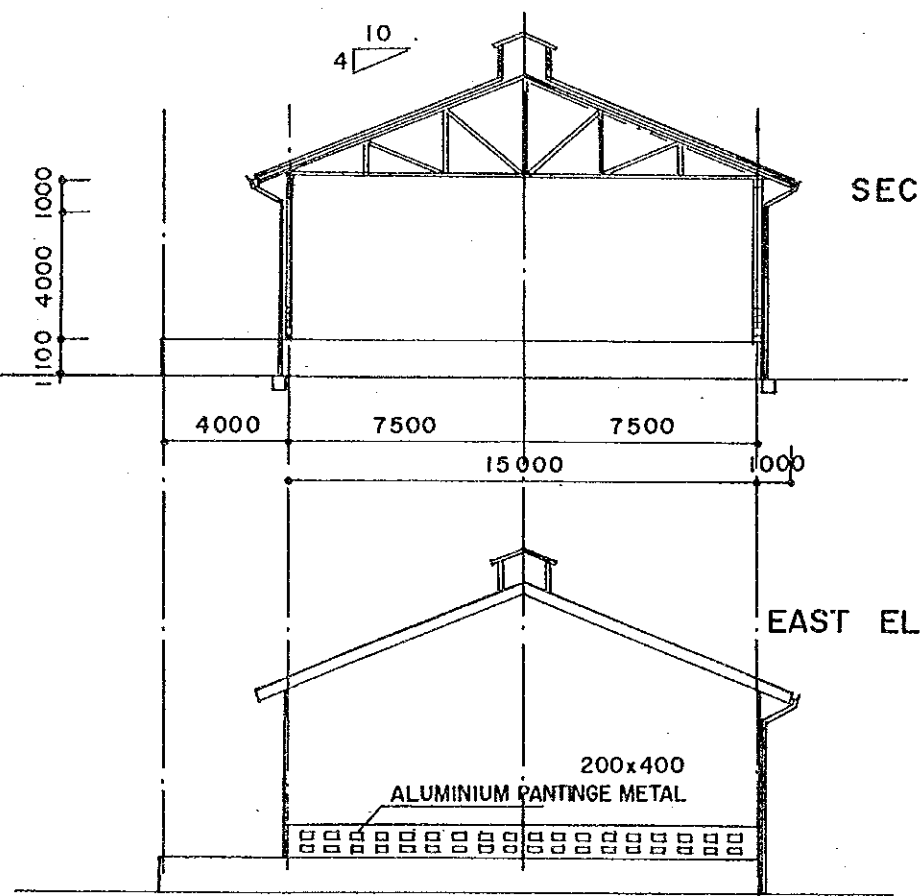
WEST ELEVATION

CAMBODIA THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
ELEVATION AND PLAN OF SEED PROCESSING HOUSE	DWGS No. 6
JAPAN INTERNATIONAL COOPERATION AGENCY	



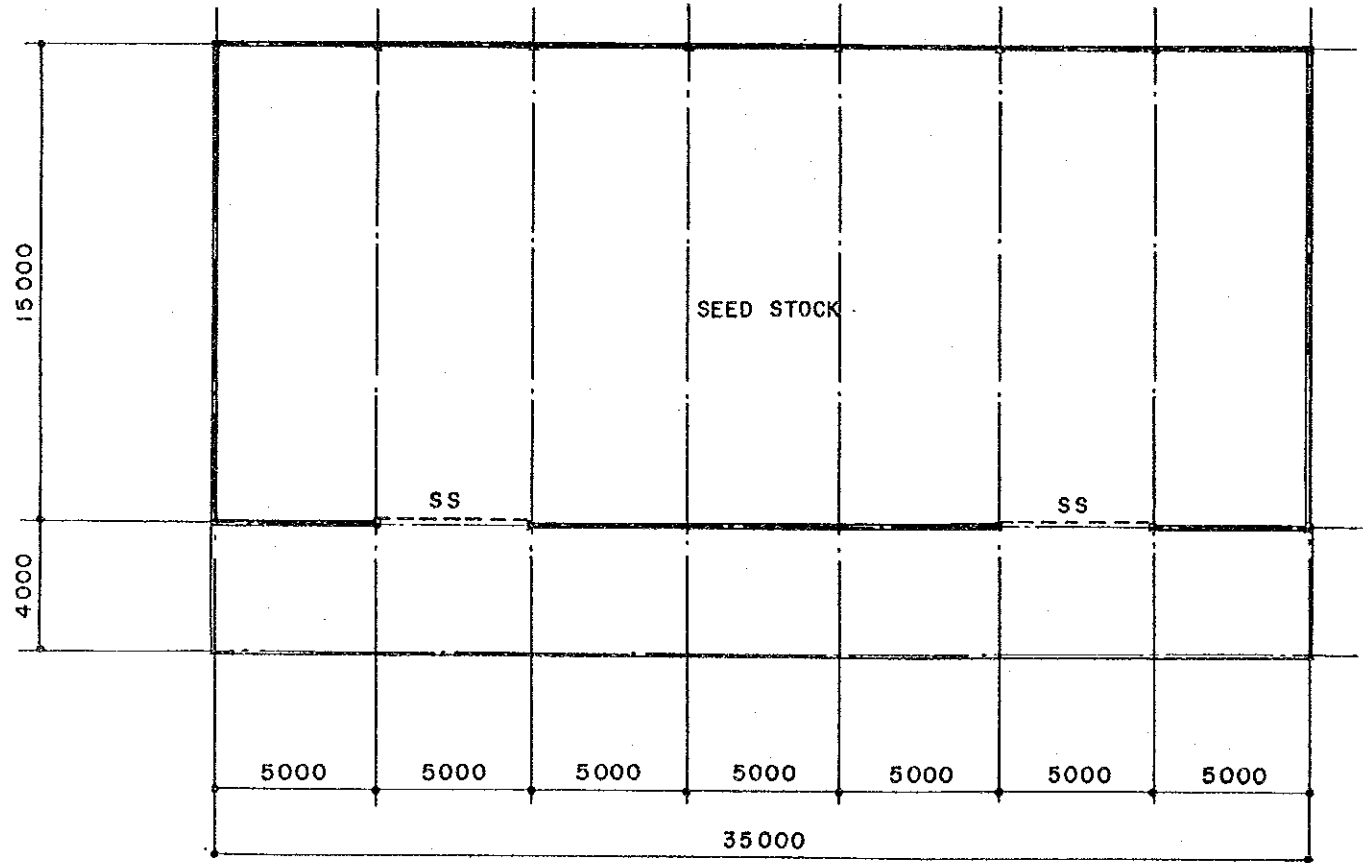
NORTH ELEVATION

SOUTH ELEVATION

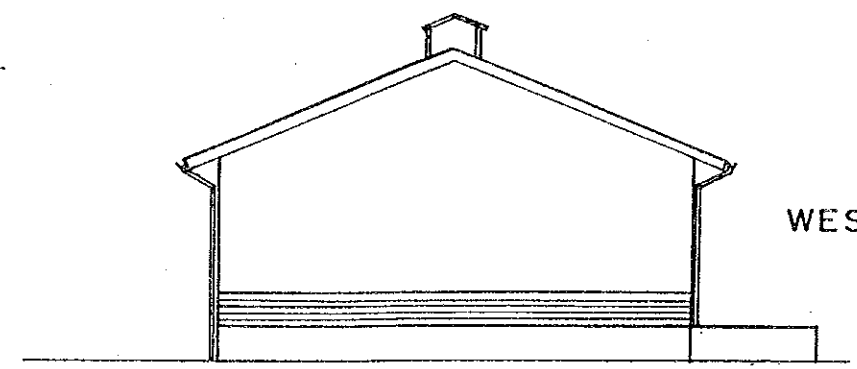


SECTION

EAST ELEVATION

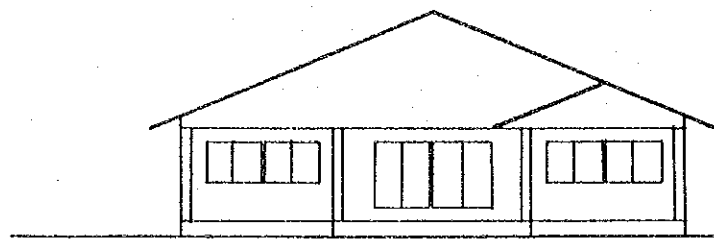


PLAN

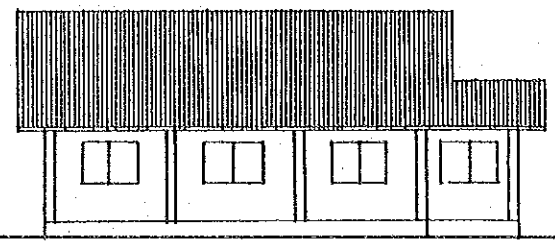


WEST ELEVATION

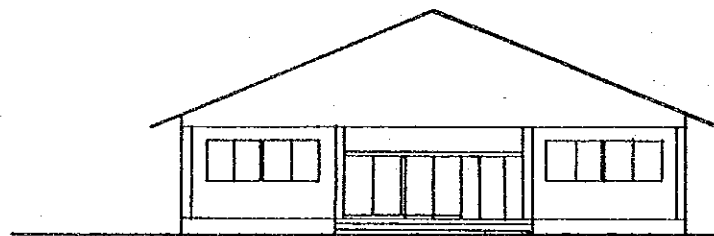
CAMBODIA THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
ELEVATION AND PLAN OF WARE HOUSE	DWGS
	No. 7
JAPAN INTERNATIONAL COOPERATION AGENCY	



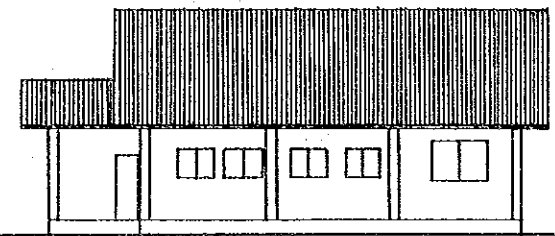
EAST ELEVATION



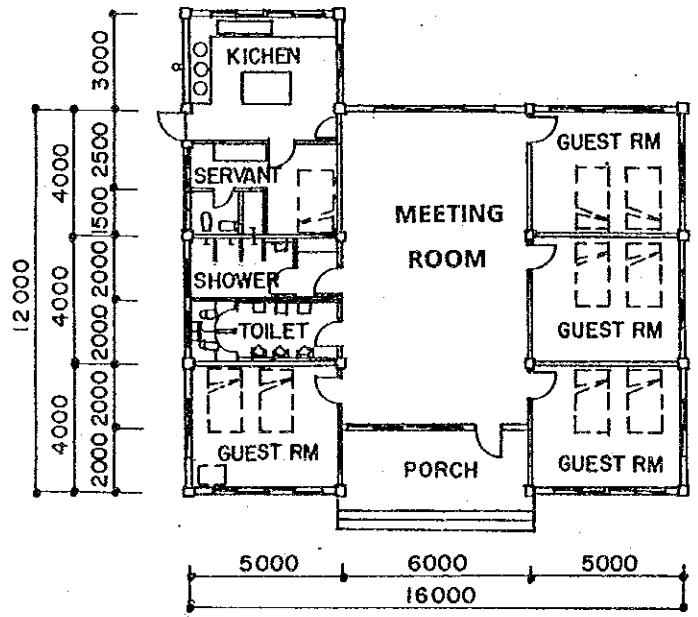
SOUTH ELEVATION



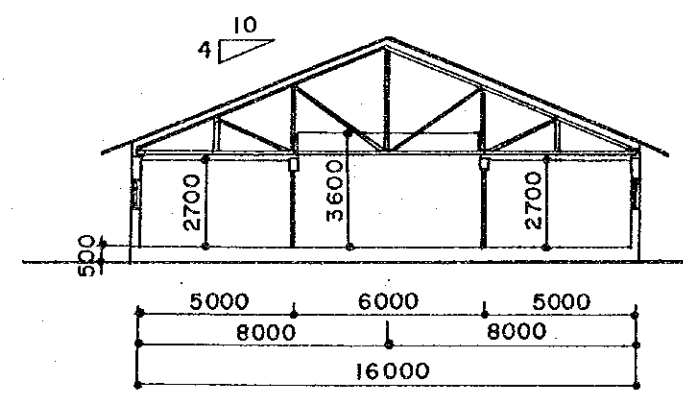
WEST ELEVATION



NORTH ELEVATION

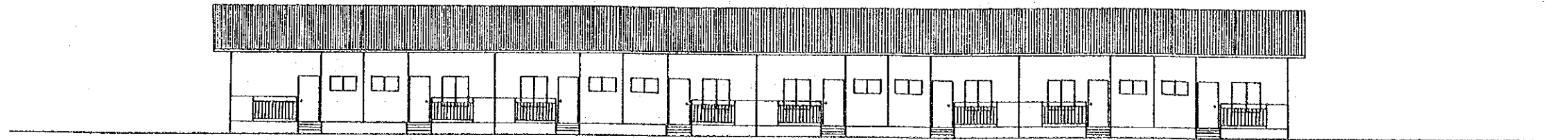


PLAN

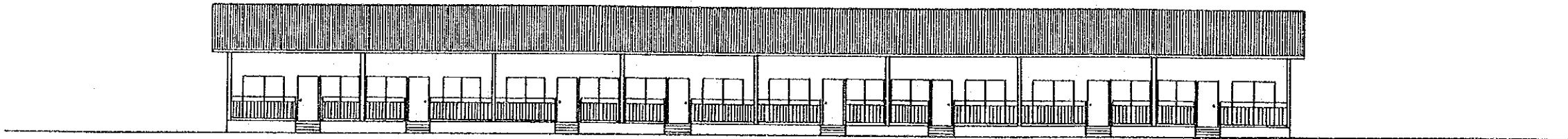


SECTION

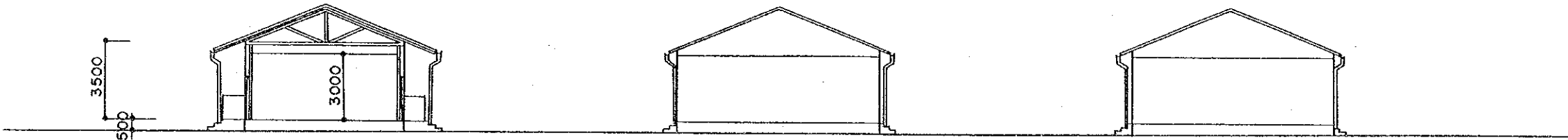
CAMBODIA THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
ELEVATION AND PLAN OF MEETING ROOM	DWGS
	No. 8
JAPAN INTERNATIONAL COOPERATION AGENCY	



NORTH ELEVATION



SOUTH ELEVATION

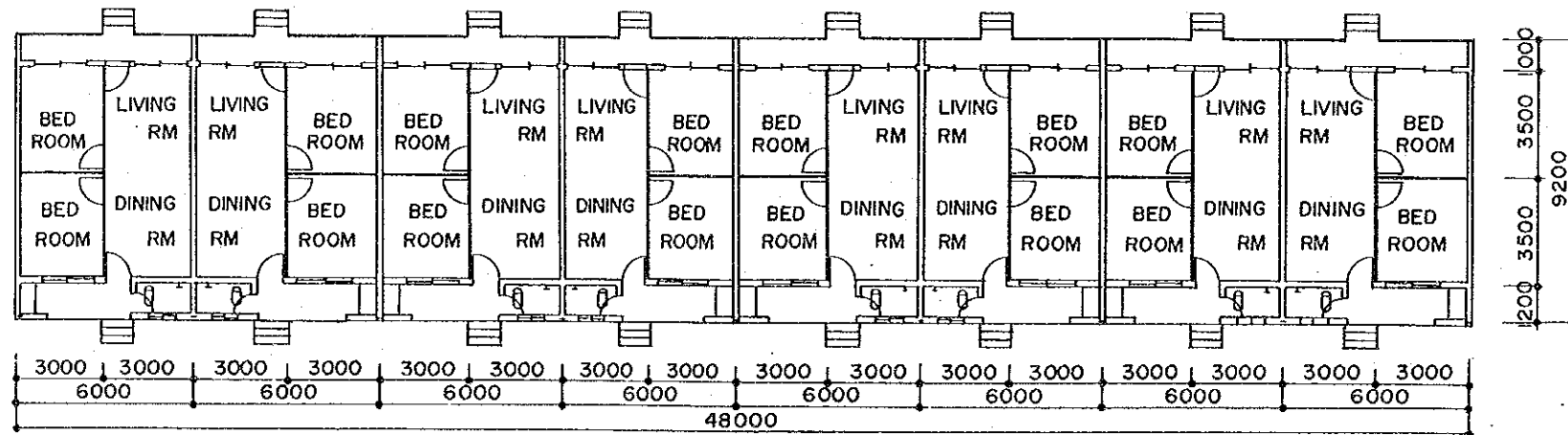


1200 3500 3500 1000
9200

SECTION

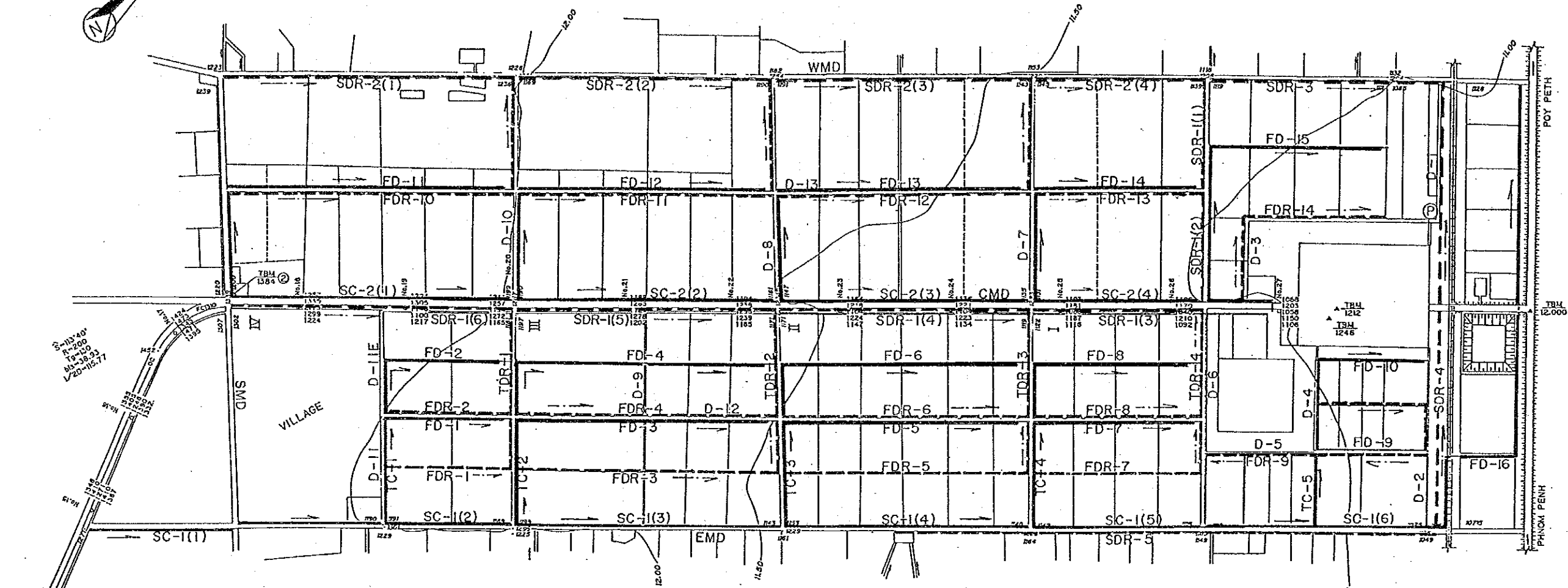
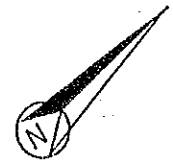
EAST ELEVATION

WEST ELEVATION



PLAN

CAMBODIA THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
ELEVATION AND PLAN OF DORMITORY	DWGS
	No. 9
JAPAN INTERNATIONAL COOPERATION AGENCY	

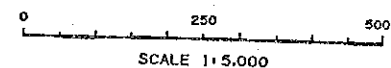


LEGEND	
	Main Farm Road (EMD, SMD, WMD, CMD)
	Farm Road (D)
	Main Farm Ditch (SC)
	Farm Ditch (TC and FD)
	Main Farm Drain (SDR)
	Farm Drain (TDR and FDR)
	Drainage Pump Station

LEGEND	
	RICE FIELD
	RAIL WAY
	NATIONAL ROAD
	POND
	TBM

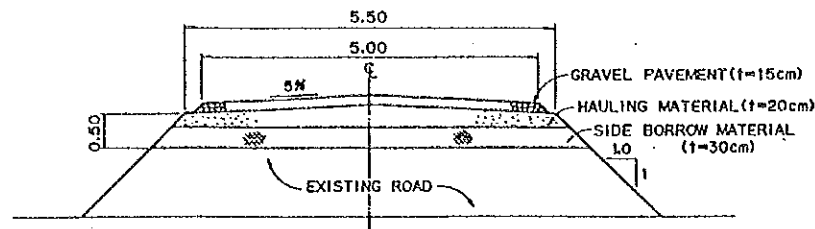
NOTE

NO DATA AVAILABLE OF THE BENCH MARK
THE TEMPORARY ELEVATION OF 12.0M AT
THE ENTRANCE OF THE CENTER ON THE
NATIONAL ROAD IS USED.

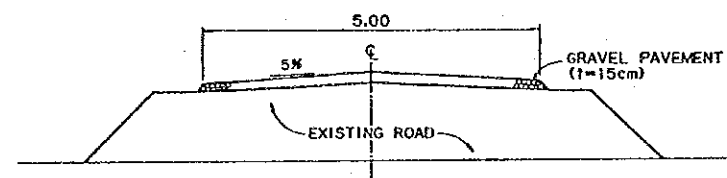


CAMBODIA	
THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
GENERAL PLAN OF CENTER FARM FACILITIES	DWGS No. 10
JAPAN INTERNATIONAL COOPERATION AGENCY	

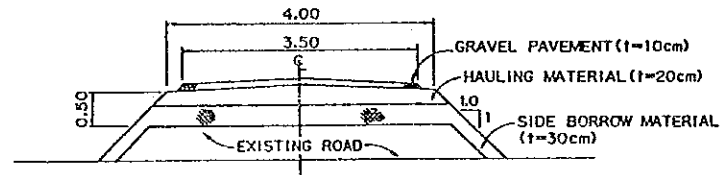
TYPICAL CROSS SECTION OF
MAIN FARM ROAD



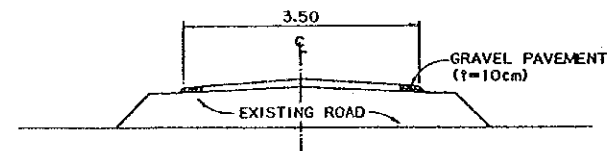
TYPE-A



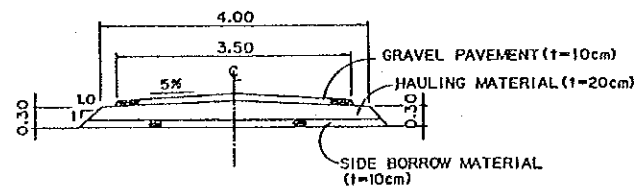
TYPE A-1



TYPE B

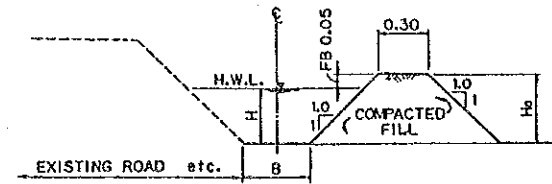


TYPE C

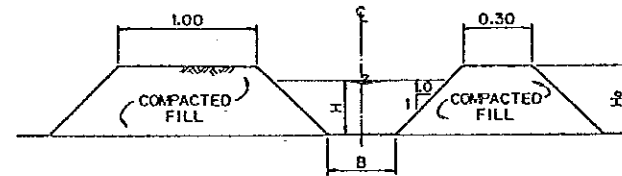


TYPE D

TYPICAL CROSS SECTION OF
IRRIGATION CANAL
(FARM DITCH)



TYPE-1

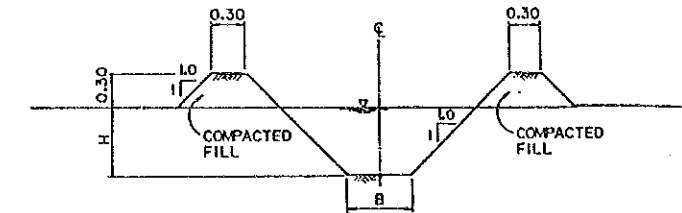


TYPE-2

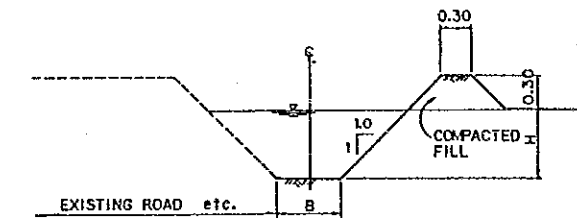
DIMENSION OF IRRI. CANAL

TYPE	B	H ₀	H
A-1 or A-2	0.30 m	0.50 m	0.45 m
B-1 or B-2	0.40	0.50	0.45
C-1 or C-2	0.50	0.50	0.45
D-1 or D-2	0.70	0.50	0.45
E-1 or E-2	1.00	0.70	0.65
F-1 or F-2	1.20	0.70	0.65
G-1 or G-2	1.20	0.85	0.80

TYPICAL CROSS SECTION OF
DRAINAGE CANAL
(FARM DRAIN)



TYPE-1

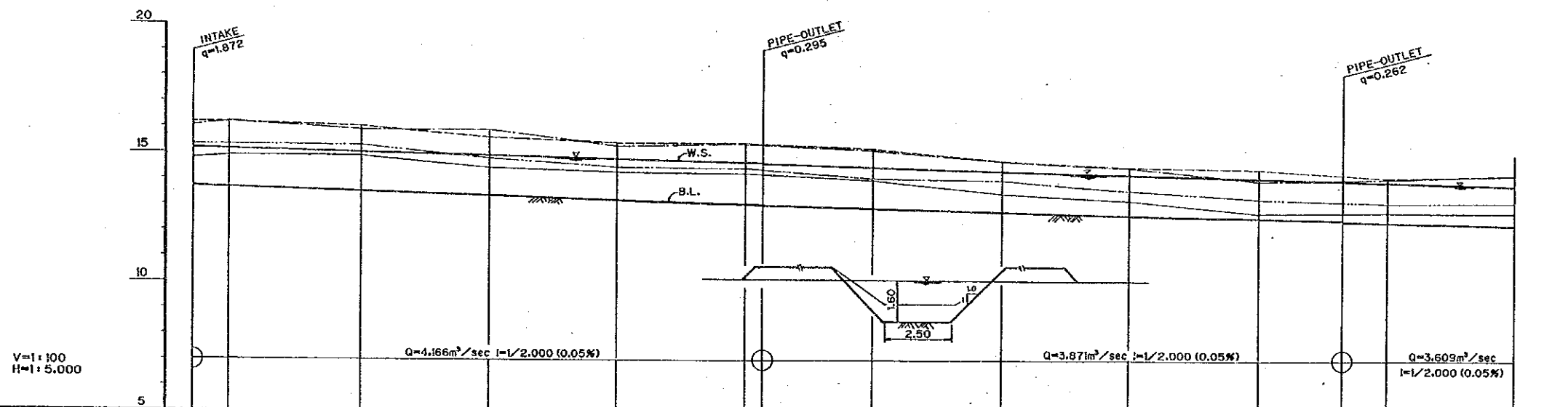
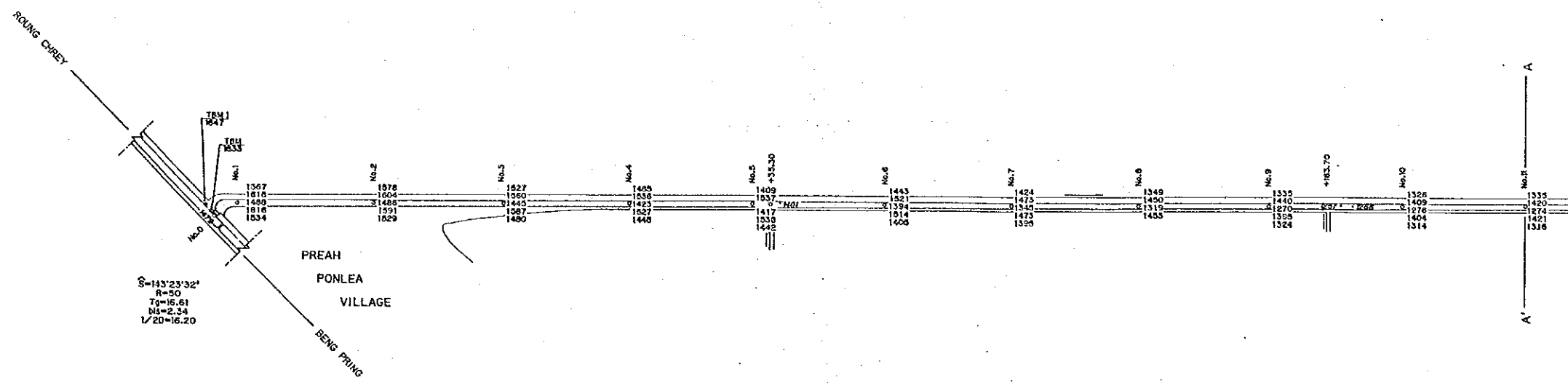


TYPE-2

DIMENSION OF DRAINAGE CANAL

TYPE	B	H
A-1 or A-2	0.60 m	0.90 m
B-1 or B-2	0.80	0.90
C-1 or C-2	1.00	0.90
D-1 or D-2	1.50	0.90
E-1 or E-2	1.30	1.20
F-1 or F-2	2.00	1.20
G-1 or G-2	2.50	1.50

CAMBODIA THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
TYPICAL CROSS SECTION OF CENTER FARM FACILITIES	DWGS No. 11
JAPAN INTERNATIONAL COOPERATION AGENCY	

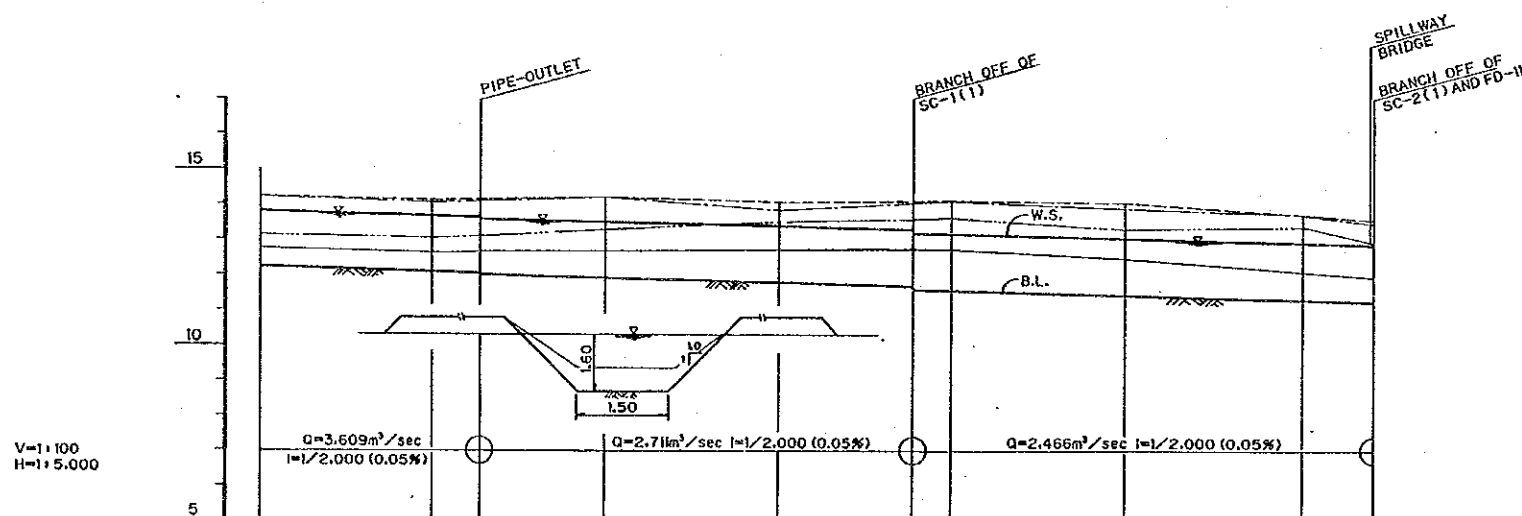
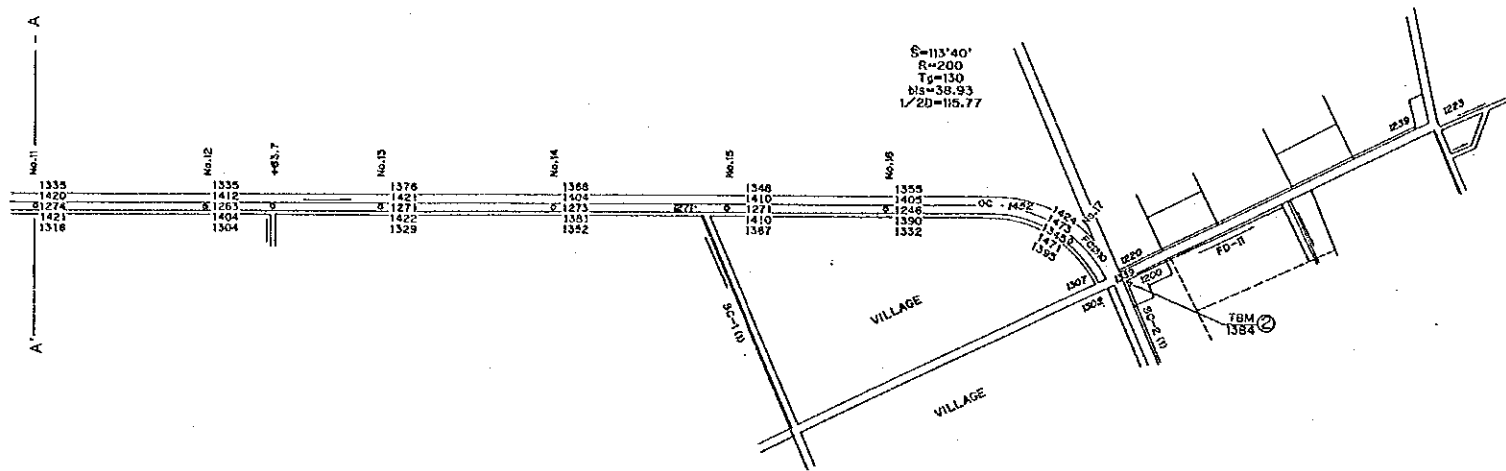


PLAN	STATION											
	0	1	2	3	4	5	6	7	8	9	10	11
WATER LEVEL (m)	15.19	15.16	15.03	14.91	14.76	14.65	14.53	14.41	14.28	14.16	14.03	13.81
BED LEVEL (m)	13.99	13.96	13.83	13.71	13.58	13.45	13.33	13.21	13.08	12.96	12.83	12.71
FIELD LEVEL (m)		15.34	15.29	15.20	15.14	15.04	14.96	14.87	14.79	14.71	14.62	14.54
RIGHT BANK EL (m)	16.08	16.17	15.91	15.81	15.71	15.61	15.51	15.41	15.31	15.21	15.11	15.01
LEFT BANK EL (m)	16.21	16.18	16.04	15.94	15.84	15.74	15.64	15.54	15.44	15.34	15.24	15.14
BED LEVEL (m)	14.79	14.68	14.67	14.45	14.23	14.18	14.15	14.13	14.11	14.09	14.07	14.05
CUMULATIVE DISTANCE (m)	0.00	69.92	319.92	569.92	819.92	1069.92	1319.92	1569.92	1819.92	2069.92	2319.92	2569.92
DISTANCE (m)	0.00	69.92	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00
STATION	0	1	2	3	4	5	6	7	8	9	10	11
CURVE	S=143°23'32"											

CAMBODIA
THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG
AGRICULTURAL TECHNICAL CENTER, BATTAMBANG

PLANE AND PROFILE OF FEEDER CANAL (1/2)	DWGS
	No. 12

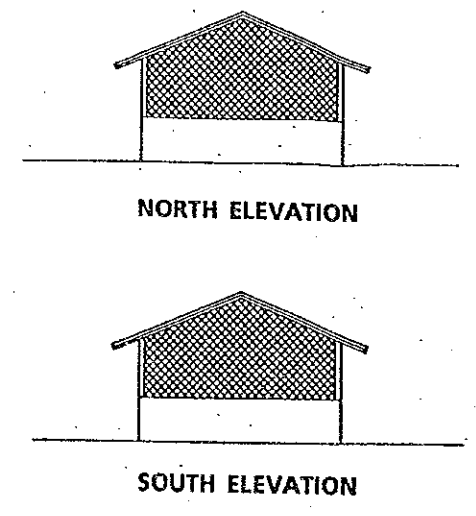
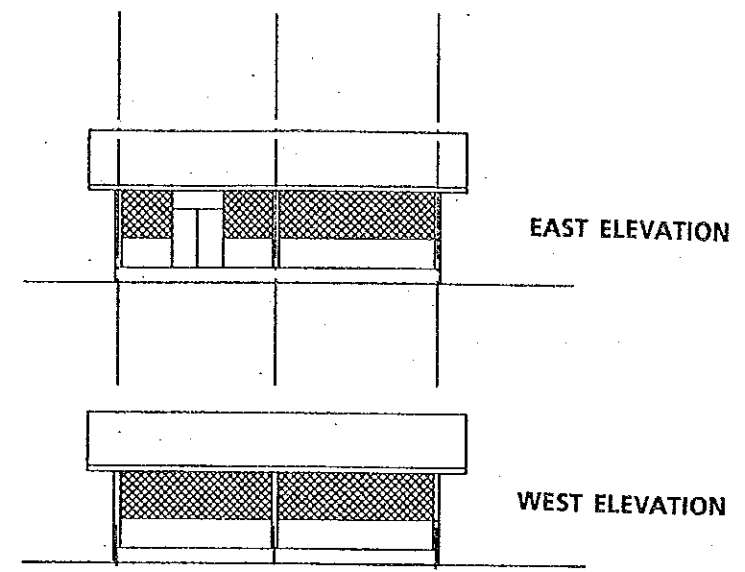
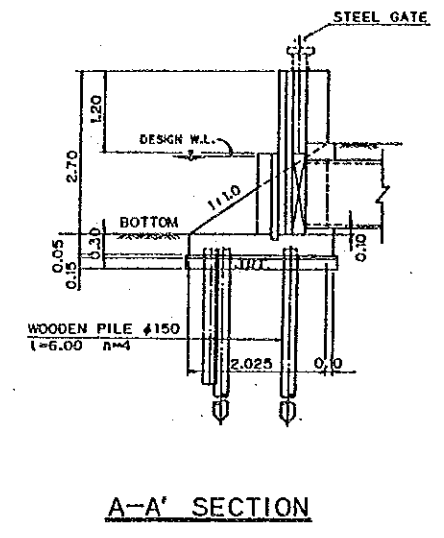
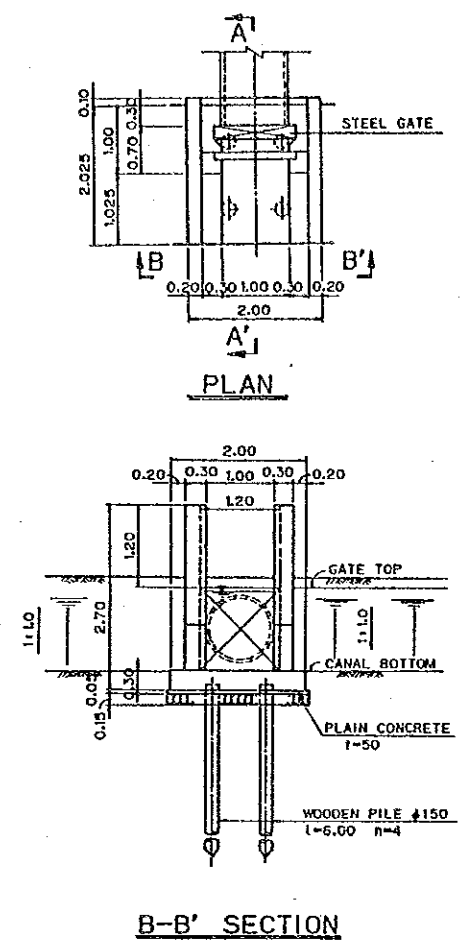
JAPAN INTERNATIONAL COOPERATION AGENCY



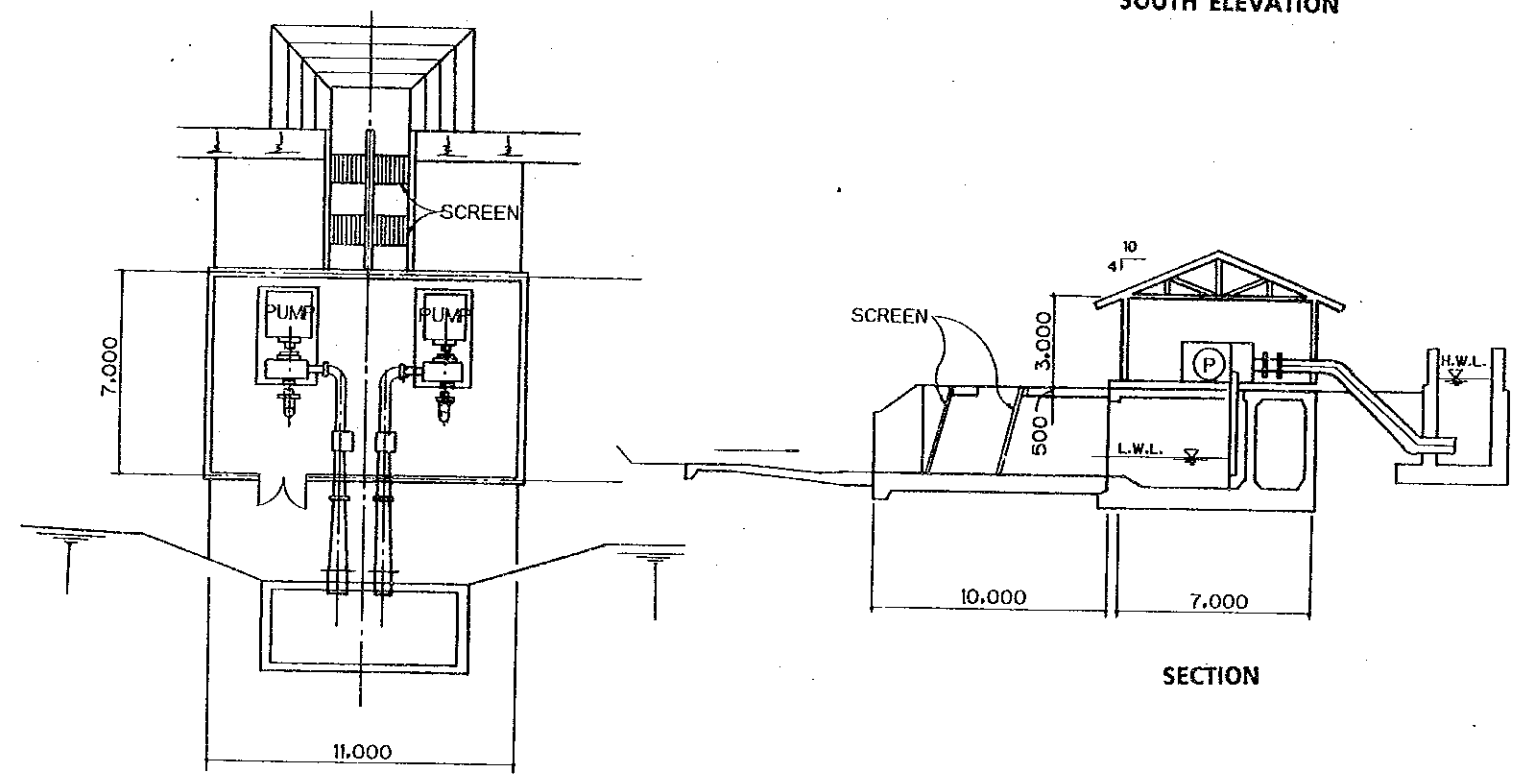
	PLAN	ELEVATION DATA (m)										
		11	12	13	14	15	16	17	17	17	17	
WATER LEVEL (m)		13.81	13.68	13.60	13.51	13.38	13.28	13.18	13.15	13.03	12.90	12.85
BED LEVEL (m)		12.21	12.08	12.03	11.91	11.78	11.68	11.58	11.55	11.43	11.30	11.25
FIELD LEVEL (m)		13.16	13.04	13.11	13.30	13.52	13.58	13.60	13.60	13.32	13.37	12.92
RIGHT BANK EL (m)		14.21	14.05	14.09	14.22	13.81	14.04	14.10	14.10	13.90	13.73	13.43
LEFT BANK EL (m)		14.20	14.12	14.14	14.21	14.04	14.09	14.10	14.10	14.05	13.69	13.55
BED LEVEL (m)		12.74	12.63	12.65	12.71	12.75	12.71	12.71	12.71	12.46	12.08	11.94
CUMULATIVE DISTANCE (m)		250.00	2819.92	2853.82	3089.92	3319.92	3515.22	3659.92	3819.92	4039.92	4169.92	4169.92
DISTANCE (m)		250.00	300.00	330.00	360.00	390.00	420.00	450.00	480.00	510.00	540.00	570.00
STATION		11	12	13	14	15	16	17	17	17	17	17
CURVE		S=113°40'00"										

CAMBODIA
THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG
AGRICULTURAL TECHNICAL CENTER, BATTAMBANG

PLANE AND PROFILE OF FEEDER CANAL (2/2)	DWGS
	No. 13
JAPAN INTERNATIONAL COOPERATION AGENCY	



TURN-OUT



DRAINAGE PUMP

CAMBODIA THE PROJECT FOR REHABILITATION OF THE TOUL SAMRONG AGRICULTURAL TECHNICAL CENTER, BATTAMBANG	
TURNOUT AND DRAINAGE PUMP STATION	DWGS No. 14
JAPAN INTERNATIONAL COOPERATION AGENCY	

4.3 Implementation Plan

4.3.1 Condition of Construction

The quantity of major works such as building, civil work and equipment supply for the project are calculated as follows:

a) Building Works (6 buildings)

Main Building	1,360 sq.m (repair)
Workshop	250 sq.m (newly construction)
Seed Processing House	220 sq.m (newly construction)
Warehouse	525 sq.m (new construction)
Meeting Room	195 sq.m (new construction)
Dormitory	355 sq.m (new construction)
<u>Total</u>	<u>3,041 sq.m</u>

b) Equipment

Electrical work, plumbing, water supply, drainage and other equipment supply works for the above six (6) buildings, are calculated as follows:

c) Outdoor Works

Water Supply	Elevated tank, Filtration tank, Pumping plant, pipeline
Road	Repair & Gravel paving of 7,000 sq.m
Drainage Ditch	
Seed Drying Yard	Embankment & Concrete paving of 7,200 sq.m
Electric Supply	1 Lot

d) Farm Works

Conveyance Canal	L=4,122 m (repair)
Farm Road	L= 20,665 m (repair)
Irrigation Canal	L= 18,598 m (repair)
Drainage Canal	L= 16,085 m (repair)
Farm Leveling	A= 103 ha (leveling)

The quantity of work of the above activities are as follows:

Earthwork	11,900	cu.m
Gravel Pavement	11,000	cu.m
Foundation Cobble	200	cu.m
Wooden Pile	1,618	pcs.
Sheet Pile	88	pcs.
Concrete	1,200	cu.m
Reinforcing Bar	69	ton
Concrete Pile	460	pcs.
Wet Masonry	290	cu.m
Land Leveling Works	103	pcs.

e) Other Works:

Drainage Pump	- Supply and Installation of two (2) pumps of @ 500 mm, 29.2 cu.m./min
Water Gate	- Supply and Installation of eleven (11) water gates (max. 2.7 m × 2.0 m)
Cabinet Articles	- Supply and Installation of furniture of the above 6 buildings.
Demolishing of Existing Building	- Roof & Floors (1,380 sq.m)

f) Supply of Equipment

Farm Machinery	- 1 Lot
----------------	---------

Thresher & Seed Processing Machinery	- 1 Lot
Laboratory Equipment for Seed Testing	- 1 Lot
Workshop Machinery & Equipment	- 1 Lot
Office Equipment	- 1 Lot
Vehicles	- 1 Lot
Supporting Equipment Supporting	- 1 Lot
Spare parts	- 1 Lot

(2) Conditions of Construction

a) Building Works

Only repair works shall be undertaken for the existing main building. The skeleton structure of the main building shall be maintained while the roof and floor shall be reconstructed. All the other five (5) buildings shall be newly constructed.

For the proper installation of equipment, the construction of the seed processing house, warehouse, and workshop shall be well coordinated. However, no high technology is required in the construction of the six (6) buildings.

All construction materials except concrete aggregate and brick, etc. are proposed to be imported; hence, supply and storage of the above materials shall be necessary in the planning stage. Concrete U-flume is not readily available in the local market and therefore, will be cast at site using pre-made steel form or imported from Thailand.

b) Farm Works

Land leveling in the field shall be performed within the months of January to March to avoid the period of paddy cultivation from April to December. The required earth work activities is approximately 130,000 cu.m including gravel pavement, hence, these activities should be undertaken before the coming of the rainy season. About 30,000 cu.m/month of earth works will be undertaken during the five (5) months period from December to

April, therefore, proper arrangement of earth moving equipment is necessary so as not to complicate use of equipment.

Soil at site is heavy clay and sandy. Embankment material for road repairs as well as cobble stone shall be transported from the quarry site located 7 km away from the site. The required concrete work is about 2,400 cu.m including concrete paving works for seed drying yard. These concrete works shall also be undertaken during the dry season, thus the need to at least finish about 500 cu.m of concreting works per month to complete the construction work.

c) Construction Materials

The following materials shall be procured locally:

- Concrete aggregate
- Brick
- Cobble
- Crashed stone
- Embankment material
- Plank
- Gasoline, and diesel oil

Concrete aggregate, cobble, crashed stone and sandy soil, etc. are available locally and can be procured at the quarry site located about 7 km, north of the center. There exist a number of brick factories near Battambang with acceptable quality of products. Goods and acceptable quality plywood are not locally available, but planks are available. Gasoline and diesel oil can be procured at Battambang but are not locally made and are imported from either China, Vietnam or Thailand. Structural steel and most of the interior materials are also not available and shall also be imported. All other construction materials for the project are to be procured in Thailand.

d) Labor

At present, there many on-going constructions in Cambodia resulting in the shortage of skilled workers. The construction booming in the country for UNTAC activities aggravated the shortage of labor and also cause the sudden rise of labor cost.

The workers for earthwork, concrete, brick, block and masonry works are available in Battambang while skilled workers for structural steel and equipment works and operators for heavy equipment and others are not available in Cambodia.

e) Construction Equipment and Plants

Though there are various construction equipment and plants in Cambodia, they are very limited in number and come from various countries hence with many manufacturing.

Most of these equipment and plants belong to UNTAC countries or contractors of Third World countries. There are no construction equipment and plant available for lease. Only Thailand has available construction equipment and supply for lease necessary for the Project.

Road distance to Battambang from major points where construction materials and equipment are expected to be imported are presented below:

From Poipet (boarder to Thailand)	120 km
Phnom Penh (port & airport)	290 km
Komongsom (port)	520 km

About 40 km of the National Road between Poipet and Sisophon which is part of the road between Poipet and Battambang are under repair by the Thailand belonging to UNTAC. The repair of the remaining 80 km of road between Sisophon and Battambang is also scheduled for immediate implementation. It takes about 2.5 to 3

hours to travel this road length. The road surface of National Road No. 5 between Phnom Penh and Battambang has been severely damaged. It now takes nine (9) hour to travel this road stretch, Moreover, this road is not passable during the rainy season.

Some parts of National Road No. 4 and 5 between Kompong Som and Phnom Penh have security problems. As a consequence, the railway system is more commonly used as means of transportation. The railway runs from Komponson to Piopet via Phnom Penh and Battambang.

The port of Phnom Penh is located at the Tonle Sap River. About 100 to 200 tons of materials per day, loaded and unloaded by some 25 to 30 ships (per month) transpire in this port. It has a fixed pier and a floating jetty and can accommodate four (4) ships simultaneously. The minimum depth of water at this port is approximately 4.2 m during the rainy season.

g) Construction and Temporary Works

There are no electricity in the Project area, hence power generating equipment are necessary during the construction period. Since it would be difficult to get sufficient water for construction during the dry season, arrangements for the supply of water such as construction of reservoir and/or preparation of water lorry to transport from the river water near the Center site shall be considered.

The site is muddy during the rainy season thus outdoor construction becomes difficult.

Lodging facilities like hotels and private homes are available in Battambang. Also, construction of temporary lodging homes shall be undertaken inside the compound of the Center.

h) Local Consultants and Contractors

There are no local consulting engineering firm with international capability in Cambodia. Most of the local civil and building contractors are government-owned. No big scale construction work occurred during the past years, thus the lack and/or unavailability of construction equipment within the area.

i) Dispatch of Engineers and Technicians

It is proposed that engineers in the field of buildings, equipment, machineries and civil works should be dispatched to the execution of the Project. In addition to the above, skilled workers for the field should be required of for structural steel, equipment and finishing works of buildings, operators of heavy equipment and installation of machineries and equipment.

4.3.2 Implementation Method

(1) Implementation Agency

The implementing agency of the Project shall be the Ministry of Agriculture, Government of Cambodia. The operational organization recommended are as follows:

a) Establishment of a Committee for Implementation

The Committee shall be organized by the Vice-Minister which shall also act as Chairman with the Department of Planning and the Agronomy Department as members.

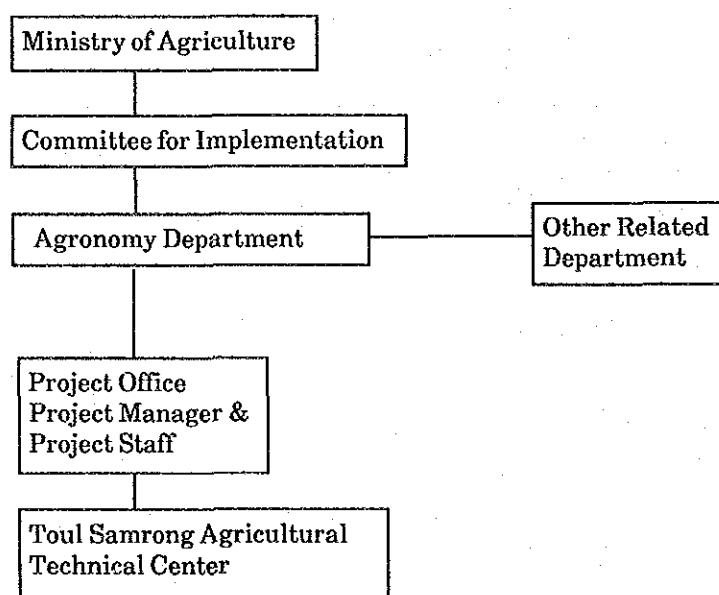
The Committee for the basic design phase has been organized and is now operating.

b) Direct Implementing Agency

The Agronomy Department shall be appointed as the direct implementing agency. It shall appoint the Project Manager and the staff that will comprise the Project Office.

The proposed organizational chart for the project implementation is presented below.

FIGURE 4-4 ORGANIZATION FOR IMPLEMENTATION



(2) Consultants

In accordance with JICA regulations, a Japanese consulting engineering firm shall be employed for the implementation of the Project. The consultants shall be responsible for preparation of detailed design and the construction supervision of the Project, the specific activity of the consultant which are as follows:

a) Preparation of Detailed Design

- detailed design for facilities and equipment to be prepared,

- preparation of tender documents for a selecting contractor to implementation work,
- consultation to the Ministry of Agriculture of Cambodia.

b) Tendering and Contract Assistance

- tendering for a selecting contractor and/or supplier on behalf of the Ministry of Agriculture of Cambodia,
- evaluation of tender and preparation of recommendation to the Ministry,
- assistance to the Ministry in the negotiation and preparation of contract with the highest evaluated tender.

c) Construction Supervision

- preparation of implementation plan,
- coordination with the Ministry and the contractor and/or supplier and the Japanese Government's agencies concerned,
- construction supervision,
- assistance to the Ministry for site hand-over and take-over of the works.

(3) Contractor

In accordance with JICA regulations, a Japanese contractor and supplier shall be selected for the construction and supply of equipment and materials as necessary for the Project.

The selected contractor and/or supplier, under the supervision of the consultants, shall perform the construction works in accordance with the terms and conditions of the contract document.

4.3.3 Plan of Construction Supervision

Construction supervision would require at least two resident engineers, a civil engineer and a building engineer. However, only one engineer shall be assigned as resident engineer. The other required engineers shall be given short-term assignment at the time required, taking into consideration budget limitation.

Topographic survey and geological investigations (SPT boring) for building and structure foundation shall be required to be completed before the commencement of the detailed design.

4.3.4 Plan of Procurement

(1) Consultants

A Japanese consulting engineering firm shall be employed for the implementation of the Project. The consultants shall be directly assigned by the JICA. The contract for engineering services shall be made between the Ministry of Agriculture of Cambodia and the consulting firm. The contract shall be subject to verification by the Government of Japan.

All procedures mentioned above shall be performed in accordance with the regulations of JICA under the verification of the Government of Japan.

(2) Contractors

A Japanese contractor and a Japanese supplier shall be hired for the Project implementation, including supply of equipment and materials. The contractor and supplier shall be selected through tender procedure.

The contract for the contractor's work shall be made between the Ministry and the Contractor witness of a consultant. The contract document shall also be subject to verification by the Government of Japan.

All above-mentioned programme shall be performed in accordance with the regulations of JICA and verified by the Government of Japan.

(3) Procurement of Equipment and Materials

Equipment and materials necessary for project implementation shall be basically procured in Japan and/or Cambodia, nevertheless, procurement from Third World countries such as Thailand or other countries can be accepted, if properly justified.

4.3.5 Implementation Schedule

(1) Overall Implementation Schedule

The contract of consulting engineer services will be made after the Exchange of Notes concludes between the Government of Japan and the Government of Cambodia.

The preparation of detailed design including of the contract document for implementation work is planned to be completed within 2.5 months. After said detailed design has been approved by the Government of Cambodia and concurred by the Government of Japan, tendering and contracting for a selection of legible contractor shall take place. Terms of the tendering and contract is tentatively proposed to be completed within two months. The period of implementation all work is proposed to be within twelve (12) months.

(2) Schedule of Detailed Design

Immediately after the contract for consulting service becomes effective, the consultants shall commence the detailed design based on the result of the Basic Design.

The survey and investigation works as well as initial consultation with the implementing agency of the Government of Cambodia are scheduled to be carried out within two (2) weeks. About 1.5 months of the detailed design terms shall be preformed at home office. The explanation and consultation for the finalization of the detailed design and contract documents to be made

in Cambodia are to be scheduled within two (2) weeks. The schedule for the preparation of detailed design is shown in Table 4-7.

(3) Schedule of Implementation Work

The schedule of construction and supply of equipment and materials are shown in Table 4-7. The entire works shall be completed within 12 months.

Preparatory works and temporary facility arrangement are scheduled to be completed within 1.5 months. All kinds of outdoor works including foundation and structure works of buildings and civil works are scheduled to be completed during the dry season to avoid the muddy site conditions. Such works are planned to be completed before the 7th month after commencement of works. Supply of equipment and finishing works shall follow and expected to be completed within the contract period.

Terms of manufacturing for procurement of equipment and materials are considered to be five (5) months and installation works including test operation will be undertaken during the last three (3) months.

4.3.6 Scope of Work

The following will be the undertakings by the Government of Cambodia and the Government of Japan:

By Government of Cambodia

- Exemption of tax, duty, levy, etc. for imported equipment and materials for the project
- Exemption of taxes for Japanese staff members and other businessmen engaged in the project
- Bearing of the necessary fees and charge for banking service for foreign exchange transaction for import works

TABLE 4-7 TENTATIVE CONSTRUCTION SCHEDULE

	1	2	3	4	5	6	7	8	9	10	11	12
Detail Design	(Site Survey)											
		(Works in Japan)	(Approval)									
Construction Works and Procurement	(Preparation)											
		(Temporary Arrangement)										
		(Foundation Works)				(Structural Works)			(Facilities Works)			
									(Finishing)		(Outdoor Finishing)	
											(Compound Works)	
												(Road Works)
												(Installation)

- Recruitment of staffs for O/M of the project facilities and budgetary support for their works.

By Government of Japan

- Rehabilitation or construction of a main building, a workshop, a seed processing house, a warehouse, a meeting room, and a dormitory
- Rehabilitation and consolidation of building lots and farm plots
- procurement of equipment and materials for the project
- Detailed design, tendering, and supervision for the above construction works, a and design and tendering for procurement of equipment and materials

CHAPTER 5. PROJECT EVALUATION

CHAPTER 5. PROJECT EVALUATION

5.1 Project Evaluation

The project aims to supply adequate foods and nutrients to the nation, increase farmers' income, and improve the living conditions of the rural people through strengthening of paddy rice seed production and maintenance of good quality seeds under the Socio-Economic Rehabilitation and Development Programme for 1991-1995.

After completion of the Project, it is expected that the paddy seed production of the Center would increase from 319 tons to 567 tons. The seeds that will be produced in the Center will have good quality, thus meeting the demand of the local farmers. Generally, the yield of paddy seeds with good quality marks an increase by about 10 percent, and the quality of rice is improved, according to the Agronomy Department. In other terms, the paddy rice with good quality would give a considerable benefit to the farmers. Even with relatively small amount of investment, a quick benefit can be attained by rice producers/farmers and rice millers through improvement of rice production.

The seeds to be produced in the Center will be distributed mainly to the Northwest region, consisting of five province including Battambang Province. In this region, traditional and deteriorated varieties of paddy are prevailing; thus, strengthening of seed multiplication is of great importance.

The Northwest region has about 479,000 ha of paddy fields, which is about 26 percent of the national paddy cropping areas. A major part of devastated area (about 630,000 ha) is located in this region. The northwest region is one of the largest growing regions in the country with comparatively low density of population. There are at present about 340,000 refugees temporarily living in the border areas between Thailand and Cambodia, and approximately seventy percent are expected to settle down in the region. Such settlement projects have already been commenced.

The Northwest region, being the objective area, has high development potential for rice production; thus, the demand of quality paddy seeds in the

rice production area as well as settlement project area for the refugees will increase to a considerable extent. Toward this, supply of adequate paddy quality seeds including expansion of rice cropping area which was devastated by civil war are indispensable.

Good quality paddy seeds should be produced largely at such well-qualified production farm as the Center in this region under the long term of production plan of the Center. The good quality seeds produced in the Center will be directly distributed to the local farmers and furthermore, indirectly to individual farmers after multiplication at provincial seed farms. Under such a system, about 1,500,000 persons could be benefited from the seeds distributed in the Northwest region.

As a target, the good quality seeds will be distributed to the areas of about 380,000 ha, which is about 80 percent of the total paddy cropping areas in the Northwest region. Upon completion of the rehabilitation, quality paddy seeds would replace the traditional varieties in the region. The impacts given by the project in its respective works are summarized in Table 5-1.

5.2 Conclusion

The project is expected to have considerable direct benefit in particular, by increasing unit yield and improvement of rice quality, and indirect benefit by uplifting the living standards of the rural people in the Northwest region as a whole. The project is viable and it is, therefore, recommended that the project be implemented under the grant aid programme by the government of Japan.

For the implementation of the Project under the Grant Aid Program by the government of Japan, security in the Project area should be maintained.

Cambodian side shall be fully responsible for providing the necessary staff particularly in the operation and maintenance period of the project. They should have a long-term and stable budgetary support not only for seed production but also for the related activities.

TABLE 5-1 PROJECT EVALUATION

Present Conditions and Problems	Countermeasures by the Project	Project Impact
<p>The unit yield of rice of Cambodia is very low and considered the world's lowest level. The country is suffering from shortage of rice, which is the staple food. Production and distribution of quality seed paddy is fundamentally required for effective improvement of rice cultivation in Cambodia. The seed production capability of the country has been remarkably low brought about by the civil war; consequently, production and distribution of quality seeds have been insufficient in both quantity and quality - the reason of its low yield. The present conditions of rice production in the Northwest region and seed production in the Center are as follows:</p> <ul style="list-style-type: none"> - Present rice yield : 1.3 tons/ha - Seed production by Ministry of Agriculture: 462 tons - Unit seed yield of national seed farm 1.5 ton/ha <p>(Toul Samrong Agricultural Technical Center)</p>	<p>The Toul Samrong Agricultural Technical Center shall be rehabilitated to strengthen the seed production and to meet the presently required seeds. Necessary facilities and equipment/materials shall be rehabilitated and consolidated. The details of major consolidation works are as follows:</p> <ol style="list-style-type: none"> ① Building, facilities and equipment <ul style="list-style-type: none"> - Rehabilitation of the Main Building - Construction of Building for Seed Processing House - Construction of Warehouse - Construction of Meeting Room - Construction of Dormitory ② Rehabilitation of facilities attached to the seed farms <ul style="list-style-type: none"> - Consolidation of building lots - Improvement of Seed Farm ③ Replacement and procurement of farming machines and other equipment/materials 	<p>By rehabilitation and consolidation of the seed farms and facilities, the seed production will be increased qualitatively and quantitatively. The seed quality shall be raised with facilities, equipment and/or materials for seed processing, storage, quality improvement, etc. As a result, the quantity of seeds distributed by Ministry of Agriculture can be increased; thus, resulting to increase in rice self-sufficiency rate and farmers' income.</p> <ol style="list-style-type: none"> ① Expected of paddy rice seed increase : 248 tons (Toul Samrong Agriculture Technical Center) ② Unit seed yield at the Center : 2.7 tons/ha ③ Expected distribution area : 7,090 ha/year

