CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

2-1-1 The Objectives of comprehensive Agrarian Reform Program (CARP) and Outline of the Project

The objective of CARP are the alleviation of poverty and raising rural living standard by means of distributing farm lands to poor farmers and rural workers without lands. DAR adopts an approach to support the agrarian reform beneficiaries living on the distributed land by providing rural infrastructure, strengthening of farmers' organization, rendering agricultural extension services and others in the setting up of the Agrarian Reform Communities (ARCs).

Number of ARCs in the marginal land cover at least 30 % of the total ARC. The ARCs in the marginal areas has poor access and sloping land, where poverty incidence is high. The Project needs to pay special attention to make sustainability from the aspect of the operation and maintenance capability of the project facilities in project planning. This project aims to contribute to promote the ARC development in Mindanao and Visaya areas, where the poverty incidence is most severe through implementing in the two of representative ARC to the ARCs in these areas.

2-1-2 Outline of the Project

The Project will be implemented to achieve the objectives in the above through development of basic infrastructure in the marginal areas, two out of four model areas that were identified from twelve representative areas with taking into account the sustainability in term of operation a management of project facilities. The direct objectives of the Project are the following four items.

- To develop roads and bridges for the improvement of access to the marginal areas,
- To use the distributed lands efficiently with construction of farm roads and multi-purpose drying pavement,
- To satisfy BHN and activate village communities through the development of village water supply system and the construction of multi-purpose Barangay halls,
- To strengthen farmers' organization to operate and maintain the above-mentioned

facilities.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Design Concept

The contents of the requested projects included a variety of items as shown below. However, the following items have been selected as basic infrastructure in line with this basic design study policy, taking into account the community's capacity to operate and maintain the facilities based on the results of field survey and discussion with the organizations concerned.

Basic Infrastructure in Basic Design Policy

Facilities	Originally Requested		Basic Infrastructure
	Marangog Area	Silae-Dalacutan Area	
1. Nursery	One	one	
2. Demonstration Farm	One	one	
3. Cattle Mating Facility	One		
4. Chicken Hatching	One	one	
5. Irrigation Facility	one system	two systems	○
6. Drainage Facility	-	1,480m	○
7. Access road	9.6 km	-	○
8. Farm Road	3.3 km	2.7 km	○
9. Rural Water Supply System	One	one	○
10. Multi-purpose Meeting Hall	One	one	○
11. Rural Electrification	One	one	
12. Warehouse for Farm Machinery	One	one	
13. Post-Harvest Facility	Two	one	○
14. Equipment & Materials			
- Carabao for Dispersal	15 heads	15 heads	
- Farm Machinery	one set	one set	

Through the field investigation and discussions with the concerned local agencies as well as central levels, the requested contents of the project were modified as follows;

Marangog area :

Construction of (1) two access roads, (2) three farm roads, (3) three multi-purpose

drying pavements, (4) warehouse for grain, (5) rural water supply systems to cover each Sitio (three of level 2 systems), and (6) a multipurpose Barangay hall.

Silae-Dalacutan area :

Construction of (1) access road (7 spots), (2) five farm roads, (3) two multi-purpose drying pavements, (4) warehouse for grain, (5) rural water supply systems to cover each Sitio (one level 1 system with a deep tube well and two of level 2 systems), and (6) a multipurpose Barangay hall.

After coming back to Japan, the contents requested had been investigated thoroughly and concluded as follows. All of requested access roads will be developed as passable roads with vehicles. However, out of two access roads in Marangog area, a portion of Sat. Margarita road, the crossing point of the Salug River and the nearby route is excluded from the project due to the little traffic. Also the development plan of farm road from Maragog Proper to Caimito is excluded because of the little traffic.

Regarding to the two small irrigation system developments in Silae-Dalacutan area, the estimated construction costs would be too high to maintain the new system with diversion dam, hence it is proposed to maintain the existing systems without construction of diversion dam. Based on the field survey on the improvement of drainage condition in Silae-Dalacutan area, the area has neither infestation of Schistosomiasis nor significant flood damages. Therefore the drainage component has not been included. All requested rural water supply components are included in the proposed development plan because most people in the areas do not have access to safe water, and 30 liter /sec (Level I) and 40 liter / sec (Level II) are used for the design capacity of water supply system.

The demonstration farms, which were not designated as the basic infrastructure in the minute of discussion, would be established by the concerned agricultural offices of the Hilongos municipality in Marangog and Malaybalay city in Silae-Dalacutan respectively. The local government of Marangog municipality has a budget to construct the demonstration farm in September 2000, while the Malaybalay city government plans to have three-year budget for the establishment of demonstration farms.

Department of Agriculture - one of the implementation agencies for the CARP - has nominated the Bureau of Soils and Water Management (BSWM) as the representative agency of the department for the Project. The BSWM is now carrying out the nationwide

project of “Environment and Productivity Management of Marginal Soils (EPMMA)” from 2000 with the five-year technical cooperation of JICA. The EPMMA aims to increase agricultural production in the marginal soils - major typical mountainous soils of “Ultisol” and “Alfisol”.

Most soils in the Project area are “Ultisol” and “Alfisol and the BSWM has professed to assist the Project in raising the agricultural productivity in the marginal soil area. For the time being, the BSWM is in the position to extend technical assistance to the concerned LGUs for the establishment of the demonstration farms in Marangog and Silae-Dalacutan areas. For that purpose, DAR is preparing the coordination between BSWM and LGUs for the promotion of soil survey and land classification activities in the Project area.

Basic design shall be conducted according to the following design concepts considering the characteristics of marginal ARC in the Philippines and the project implementation under Japanese Grant Aid.

(2) Concepts for Natural Conditions

Progress of construction works depends on weather conditions. There is 2,300-2,500 mm annual rainfall in Marangog ARC and Silae-Dalacutan ARC. Both regions have no distinct wet and dry seasons. It is supposed that rainfall exceeding 30 mm will disturb construction works seriously. On the average rainfall exceeding 30 mm occurs at the rate of 14.3 days per year in Marangog and 22 days in Silae-Dalacutan area respectively. Maximum temperature is recorded at 32.3℃ and 31.0℃ respectively, which means that it is possible to have construction works throughout the year.

Rainy Days Exceeding 30 mm (Unit：days)

ARC	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Marangog	1.9	1.3	0.8	0.3	0.2	0.9	1.0	1.3	2.1	1.8	1.1	1.6	14.3
Silae-Dalacutan	0.8	0.6	0.8	0.7	1.9	0.6	3.6	2.7	2.7	3.8	1.4	0.7	20.3

Note: Marangog---ten years (1990-1999) average at Maasin Meteorological Station
Silae---------nine years (1990-1998) average at Malaybalay Meteorological Station

(3) Concepts for Social Conditions

Electric power is available in Marangog Proper and Silae but there is no power

supply in Dalacutan area. Telecommunication networks are unavailable in both ARC areas. Water is supplied by Level 2 water systems utilizing springs in a part of the Project areas. However, it is difficult to utilize the electric power or water supplies for the construction works because of their location and volume. Therefore, the contractor shall supply water and power for the constructions and accommodations. On the other hand, land acquisition for rehabilitation of road and other facilities shall be made by the Philippine side prior to the commencement of the Project. There is no need for removal of houses, however compensation for removed/cleared farm crops, trees (mainly they are fruit trees) and power line posts shall be done by the Philippine sides.

(4) Concepts for Conditions of Construction

There are several small-scale contractors in Hilongos, Leyte and Malaybalay, Mindanao. However, they do not have adequate equipments, construction machines, staffs and experiences. The construction and rehabilitation works of national roads and bridges near Hilongos or Malaybalay have been undertaken by the contractors in Manila or Cebu, who are making contracts with DPWH. These companies are registered to DPWH and they have not only the experiences of working in Foreign Loan Projects and Grant Aid Projects but also enough equipment, staff and technology in general.

Within the project areas and the surrounding area, it is difficult to find office and accommodations. It is desirable to settle campsites nearby the construction sites. These campsites shall be settled at Conception in Leyte and Silae in Mindanao, considering the conditions of accessibility, accommodation and social infrastructure. In addition, for the base camps, which will be settled in Hilongos and Malaibalay, it is necessary to procure construction machines, concrete plants, stockyard for construction materials, generators, water supply system (well) and laboratories of concrete compressive strength and rolled embankment tests. The base camps will have project offices, which have administration room, meeting room and washroom.

Hotels or private houses in Hilongos and Malaybalay will be utilized to accommodate engineers and staffs of the contractor. For operators of heavy machines, foreman and so on, private houses will be hired in Conception, Leyte and Silae and Cabanglasan, Mindanao. In the Philippines, it is general to take a rest for two days in every weekend. In case of the construction firms, it is general to work even on Saturday. However, the construction schedule will be studied on the assumption of non-working on Saturday.

(5) Concepts for Application of Local Contractors and Construction Materials

There are many construction firms that have adequate capability to execute the Project construction in the Philippines. These firms shall be positively contracted for the Project. As for the construction materials such as heavy machinery, cement, steel bar, casing pipe, tools and sand, almost all materials are locally available in the Philippines. Therefore materials shall be procured at the site so far as there is no problem in quality and specification. Since ready-mixed concrete is not available at each site, the concrete will be produced at the site. Gravel for concrete and pavement will be taken from riverbed near to the site in consideration of environmental conservation such as preventing riverbed destruction.

Agriculture is a major means for livelihood in the Study area and there is virtually no other means. Other industries and local markets do not have important roles in local economy due to various reasons - limitation of seasonal employment, severe competition of labor and subsequent wage cuts. Villagers are supposed to operate and maintain the constructed facilities in the future and it is desirable for them to be skillful for O/M of the facilities. Therefore villagers will be employed as labors in the Project to level up standard of life and skill. During the field survey, the Study Team has confirmed that villagers would participate in the Project. Furthermore, on detailed design stage, it is necessary to reconfirm the villagers' willingness to participate in the Project and to collect a part of wages for capacity building-up regarding to the operation and maintenance of project facilities.

(6) Concepts to Capability of O/M by Implementation Agency

DAR is the implementation agency of this Project. Provincial Agrarian Reform Offices will actually implement the Project in cooperation with DPWH, DA, DOH, other GUs and LGUs. After the completion of construction, organized beneficiaries will need to maintain road and other rural infrastructures. However, poor farmers are main beneficiaries of this project, so it is supposed for the community to operate and maintain the facilities with collecting charge. The assistance from Japanese side may be required to establish O/M organizations and collect charges for O/M.

(7) Concepts for Project Components and Design Level

Project components consist of access roads, farm roads, solar drying pavements with warehouse, rural water supply facilities and multi-purpose Barangay halls. All components are common so that most construction materials are available in the Philippines. DAR has no section for construction and DPWH has responsibility for construction of road, rural water supply and Barangay hall. NIA is responsible to construct post-harvest facilities. These implementation agencies usually have design criteria, operation manuals and adequate experiences of planning, designing and implementation. In the design of each facility, these design criteria will be modified in consideration with the conditions in the marginal areas. Since the farmers in marginal areas will use these facilities, the design level has to consider the aspects of easy operation and low cost for maintenance.

(8) Concepts for Construction Period

Although each project component is rather small, project components cover various facilities and project sites are located in two islands - Leyte and Mindanao. In case of one by one construction, 15-month will take to complete the Project. Based on the working volume in Marangog area that is larger than that in Silae, it is possible to complete all the construction works within 12 months with efficient arrangement of equipment, materials. Detailed implementation schedule shall be studied to complete construction works within 12-month in this project. Cabinet council will be held in May 2001 and E/N will be signed in June. After July, it takes 6 months to complete contracts, detailed design and tender. It is supposed to be able to have a construction contract in January, 2002, and construction works will be completed in March, 2003.

2-2-2 Basic Plan (Construction Plan / Equipment Plan)

(1) Road

(a) Evaluation on Priority/Appropriateness of the Requested Roads

Among the requested roads, the following roads were excluded from the components:

- Improvement of the road is not urgently necessary.
- Socio-economic effect by the road improvement is little.
- Cost of the road improvement versus its socio-economic effect is high.
- Maintenance of the road after improvement is not secured.

However, the roads located in the ARC areas and regarded as beneficial to agrarian development should be given priority since they are the main objectives of the Project.

Evaluations on requested road are presented in the Table 2-1. The results of the evaluation on priority/appropriateness are summarized as follows:

Roads in Marangog ARC Area

① Marangog-Conception Road : Highest priority is given to this road due to its necessity and effects of the improvement.

② Marangog-Sta. Margarita Road : Priority is low because of few traffic volume and high construction cost. After the improvement of Marangog-Conception road, the traffic volume will decrease. The high cost comes from construction of a 75m long bridge and about 700m long approach roads. However the road section from junction with Marangog-Concepcion road to Sitio Caimito is ranked to medium priority as the same conditions as other farm roads such as ③ and ④.

③ Marangog Proper-Banban Road and ④Marangog Proper-Guintulian Road : Priority is medium due to low construction cost and low traffic volume which is composed of only few motorbikes, animal-drawn carts and pedestrians after improvement.

⑤ Marangog Proper-Caimito Road : Priority is low due to smaller population living along the road.

Roads in Silae-Dalactan ARC Area

①～④Farm Roads in the ARC and ⑤Silae-Tuluan Road : Priory is medium. These roads will directly promote the development of agricultural activities in the area after the Project. Since farming activities are relatively high in this area, appropriateness and priority justify the farm roads construction under this Project and will be effectively utilized and maintained by farmers.

⑥ Rehabilitation/Additional Construction of seven culverts along Silae-Dalacutan Road in the ARC : Priority is medium because the access road from the town to the ARC and Barangay Dalacutan is the basic requirement of the Project to support development of the area. It is also necessary to provide a passable road for the transportation of

construction materials.

(b) Selection of the Project Roads

Based on the results of the evaluation on priority/appropriateness of the requested roads, the following roads were excluded from the Project:

Marangog ARC

②-2 The Section from Sitio Caimito to Sta. Margarita of the Sta. Margarita-Marangog Road (The remaining section of the road is named Jct. Marangog-Caimito Road in the following chapters)

⑤ Marangog Proper-Caimito Road

The selected roads for the Project are indicated below:

Marangog ARC (9.98km)

①-1 Marangog-Concepcion Road (Marangog-Tagnate Section)(2.92km)

①-2 Marangog-Concepcion Road (Tagnate Conception Section)(3.84km)

②-1 Jct. Marangog-Caimito Road (1.52km)

③ Marangog Proper-Caimito Road (0.72km)

④ Marngog Proper-Guintulian Road (0.98km)

Silae-Dalactan ARC (2.28km)

①～④ Farm Roads in the ARC (0.84km)

⑤ Silae-Tuluan Road (1.44km)

⑥ Rehabilitation/Additional Construction of culverts along Silae-Dalacutan Road in the ARC (7 spots)

Table 2-1 EVALUATION ON PRIORITY/APPROPRIATENESS OF THE REQUESTED ROADS

ARC	Road	Section	Road Length (km)	Road Class	Present				After Improvement					Maintenance		Necessity	Cost/ Benefit	Priority
					Condition	ADT (veh./day)	Population	Problem	Condition	Forecasted ADT (veh./day)	Beneficiery	Population	Effect	Required maintenance	Responsible Office			
Marangog	① Marangog-Concepcion Road	Concepcion Bridge	0,2	Access Road (Barangay Road)	No bridge	Motorbike(90) Pedestrian(960) Animal-drawin(25)	1,846	Vehicle impassable	Concrete Bridge	Vehicle(52) Motorbike(162) Pedestrian(902)	Tambis, Tagnate, Sto. Nino, Imelda Marcos, Marangog	2,729	To improve transport and living condition at very wide area	Repaire of riverbank protection and spillway after floods	Municipality & Barangay	Large	Medium	Large
		①-1 Marangog-Tagnate	3.6		Impassable for vehicles	Motorbike(0) Pedestrian(105) Animal-drawin(8)	225	Road Impassable	Gravel surfacing road	Vehicle(22) Motorbike(67) Pedestrian(371)	Most of Marangog residents	900	To provide safe and efficient traffic measures	Cleaning ditches and culverts every year, gravel re-surfacing every 5 year	Municipality & Barangay	Large/ Medium	Medium	Large
		①-2 Tagnate-Concepcion	2.9		Unpaved	Motorbike(90) Pedestrian(960) Animal-drawin(25)	1,846	Vehicle impassable	Gravel surfacing road	Vehicle(52) Motorbike(162) Pedestrian(902)	Tambis, Tagnate, Sto. Nino, Imelda Marcos, Marangog	2,729	To improve transport and living condition at very wide area	Cleaning ditches and culverts every year, gravel re-surfacing every 5 year	Municipality & Barangay	Large	little	Large
	②Marangog-Sta. Margarita Road	Sta. Margarita Bridge	-	Access Road (Local Road)	No bridge	Motorbike(32) Pedestrian(215) Animal-drawin(60)	1,126	Vehicle impassable	Concrete Bridge	Vehicle(4) Motorbike(13) Pedestrian(74)	Part of Marangog residents and 2ndry students	225	To provide safe and efficient traffic measures	Repaire of riverbank protection and spillway after floods	Municipality & Barangay	Medium	Large	little
		Marangog-Sta. Margarita	3.0		Impassable for vehicles	Motorbike(32) Pedestrian(215) Animal-drawin(60)	1,126	Vehicle impassable	Gravel surfacing road	Vehicle(4) Motorbike(13) Pedestrian(74)	Part of Marangog residents and 2ndry students	225	To provide safe and efficient traffic measures	Cleaning ditches and culverts every year, gravel re-surfacing every 5 year	Municipality & Barangay	Medium	Large/ Medium	Medium
	③Marangog Proper-Banban Road		0.7	Farm Road	Trail	Pedestrian(64)*	194	No road	Gravel surfacing road	Motorbike(21) Pedestrian(78) Animal Drawn(41)	Sitio Banban residents	194	To provide road to access social facilities and markets	do	Barangay & Sitio	Medium	Medium	Medium
	④Marngog Proper-Guintulian Road		1.0	Farm Road	Trail	Pedestrian(54)*	167	No road	Gravel surfacing road	Motorbike(18) Pedestrian(67) Animal Drawn(35)	Sitio Guintulian residents	167	To provide road to access social facilities and markets	do	Barangay & Sitio	Medium	Medium	Medium
	⑤Marangog Proper-Caimito Road		1.2	Farm Road	Trail	Pedestrian(20)*	60	No road	Gravel surfacing road	Motorbike(7) Pedestrian(24) Animal Drawn(13)	Sitio Caimito residents	60	To provide road to access social facilities and markets	do	Barangay & Sitio	little	Large	little
Silae	①-④Farm Roads in the ARC		0.9	Farm Road	Trail	Pedestrian and Animal-drawin only	-	No road	Gravel surfacing road	Passable for Vehicles & tractors	Farmers	-	To lessen transport cost	do	Farmers	Medium	-	Medium
	⑤Silae-Tuluan Road		1.5	Farm Road	Trail	Pedestrian and Animal-drawin only	150	No road	Gravel surfacing road	Passable for Vehicles & tractors	Residents of Tuluan and farmers	150	To provide road to access social facilities and markets	do	Barangay & Sitio	Medium	Medium	Medium
	⑥Rehabilitation/Additional Construction of culverts along Silae-Dalactan Road in the ARC		7 Spots	Access Road (Barangay Road)	Lack of culverts	Pedestrian, Animal-drawin, Motorbike, vehicles	281	Muddy when raining	Gravel surfacing road	Passable for Vehicles & tractors	ARC farmers and Barangay Dalactan residents	281	To provide safe and efficient traffic meas	do	Municipality & Barangay	Medium	little	Medium

Note : Vehicle traffic volumes include motor-tricycle traffic (conversion ratio is 0.5).

(c) Road Planning Concept

Concepts in Road Planning

For planning of the Project roads, the following design concepts were developed:

1) Structure will be durable and required minimal maintenance
   - Bridge type will be concrete,
   - Drainage structures will be protected from erosion by grouted riprap or concrete,
   - Side ditches and culverts will be planned with sizes that do not need frequent cleaning,
   - Frequent failure patterns on rural roads in the area will be analyzed and countermeasures will be taken in the design (refer to Table 2-2).
2) Utilization of local materials and labors
   - Stone masonry will be used instead of concrete where possible.
   - Natural boulders or gabions will be used for protection works.
3) Consideration on environmental protection
   - Embankment slope will be protected from erosion by sodding.
   - Road alignment will be planned to minimize house demolition, slope cutting, embankment, and others.
4) Optimum structures for the Project roads
   - Longitudinal grade will be limited to be ease for vehicles to climb the slope sections. However, the grade steeper than the standard specifications (10%) will be allowed in steep mountainous sections to avoid high construction cost. According to the survey, 15% slope along secondary national road and 18% slope along barangay road were observed near the Project area. It was farther observed that jeep and motor-tricycle can climb 15% grade and motorbike can climb 20% grade with full loading condition.
   - Roads that have Average Daily Traffic Volume (ADT) of less than 50 vehicles per day will be single lane. Waiting areas will be provided at least every 300m. The carriageway width will be minimum and passable by the largest vehicles in that class of roads.
   - Pipe culverts or spillways will be planned for every creek crossings. Low cost bridge will be studied for the 250m-width river crossing at Concepcion.
5) Consideration of standards applied in the previous similar projects (ARISP, CARP)
   - Pavement will be surfaced with gravel except steep sections (steeper than 8%) that will be paved with concrete to prevent from surface erosion by rainwater. The

concrete pavement will be 15cm thick - same as multi-purpose pavements

- constructed in many rural village centers and are performing well. The concrete pavement for roads without vehicular traffic will be 10cm thick.
- Side ditch will be earthen for gentle slope sections (steeper than 4%). Ditches at steep sections will be protected from erosion by grouted riprap except for rock ground parts.

6) Classification of Project roads by function and traffic volume and propose optimum design standards

- Road classification and standards by class were described in the following sections

Table 2-2 Frequent Failure Pattern on Rural Roads and Proposed Countermeasures.

Frequent Failure Patterns on Rural Roads	Cause	Countermeasures in this Project
- Rain water streams down and erodes the gravel surface. Eroded surfaces are impassable by vehicles.	No treatment/ counter-measures at steep sections was made.	To pave road surface at steep section (steeper than 8%) with Concrete pavement.
- Side ditches are buried with mud and soil and rain water overflowing onto road surface. Muddy road surface are impassable by vehicles.	Side ditches were not constructed or/neither maintained.	To install side ditches at all sections except embankment sections. To design ditches with enough discharge capacity and to be durable.
- Slope failures close roads and side ditches.	Slope was constructed with too steep grade. Slope surface without protection treatment were eroded by rain water.	To design with stable grade for cut and embankment slopes. Grade 1:0.6 is proposed for soft rock cut based on survey at the site. To design Soddig slope protection for embankment.
- Ruts occurred on road surface. Deep ruts cause impassable by vehicles	Gravel surfacing was constructed with insufficient thickness. Unsuitable materials were used for embankment or subgrade.	To design 15cm thick gravel surfacing and 10cm subbase course. Not to use clayey soil including soft rocks in Marangog area.
- Rain water collected from the mountain overflows on road surface. Road surfaces are eroded and become muddy.	Culverts were not constructed at creek crossings and longitudinal sags or absence of maintenance caused pipes clogged. Headwalls at inlet/outlet were not constructed.	To design culverts at every creek crossing and longitudinal sags. To provide cross drain for every less than 200m along side ditches.
- Spillways washed-out.	Lack of protections against scouring and erosion at riverbed and riverbank.	To design protections made of concrete, stone masonry, gabions or boulders to be installed at riverbed and riverbank. To design stone masonry or concrete headwalls for inlet/outlet of all culverts.

(d) Road Planning

Road Classification Criteria

Access Road-A : Road connecting more than two Barangays and has large traffic volume

Access Road-B : Roads connecting one Barangay and has little traffic volume

Farm Road-A : Roads connecting farms and Barangays/Sitios with vehicle traffic

Farm Road-B : Roads connecting farms and Barangays/Sitios with very few vehicle traffic

Classification of the Project Roads

Classification of the Project Roads

Project Roads	Road Class	Design Vehicle
Marangog ARC		
①-1 Marangog-Concepcion Road (Marangog-Tagnate Section)	Access Road-A (ADT56)	Large Truck（15 ton）
①-2 Marangog-Concepcion Road (Tagnate Conception Section)	Access Road-B (ADT 22)	Large Truck（15 ton）
②-1 Jct. Marangog-Caimito Road	Farm Road-B	Motorbike, Animal drawn
③ Marangog Proper-Caimito Road	Farm Road-B	Motorbike, Animal drawn
④ Marngog Proper-Guintulian Road	Farm Road-B	Motorbike, Animal drawn
Silae-Dalacutan ARC		
①～④ Farm Roads in the ARC	Farm Road-A	Med Truck (7ton)、Tractor
⑤ Silae-Tuluan Road	Farm Road-A	Med Truck (7ton)、Tractor
⑥ Rehabilitation/Additional Construction of culverts along Silae-Dalacutan Road in the ARC (7 spots)	Access Road-B	Large Truck（15 ton）

Note: ADT includes motor-tricycle traffic (conversion ratio is 0.5).

Geometric Standards

Geometric Standards

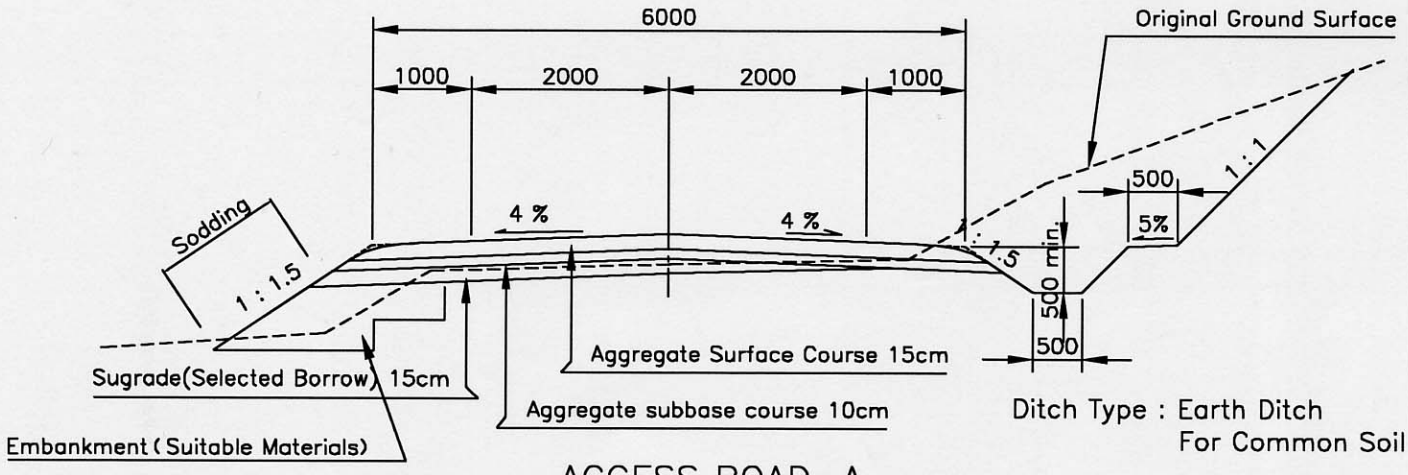
	Access Road-A	Access Road-B	Farm Road-A	Farm Road-B
Road Width (m)	1+4+1	1(0.5)+3+1(0.5)	0.5+3+0.5	0.5+2+0.5
Max. Grade (%)	10%(14%)	10%(15%)	14%(15%)	15%(18%)
Design Speed (km/h)	20 km/h	-	-	-
Super-elevation	Normal Crown for all sections			
Sight Distance	No requirement			
Widening at Curve	No widening			

Note:1) Road widths in the table are composed of Shoulder + Carriageway + Shoulder.

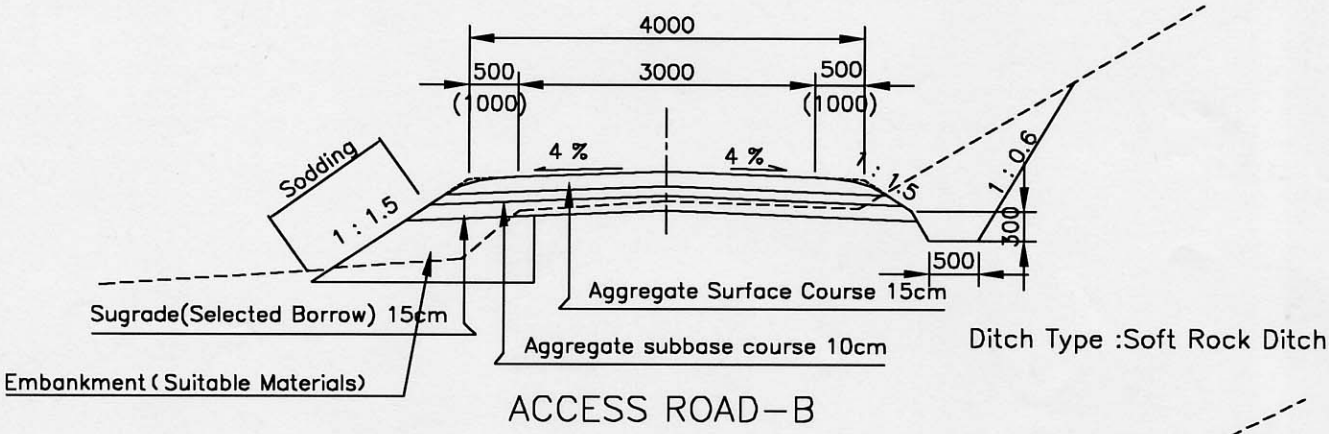
2) Figures in ( ) are allowed to be applied where the standards are difficult to be applied due to geographical reason.

Typical Cross Sections

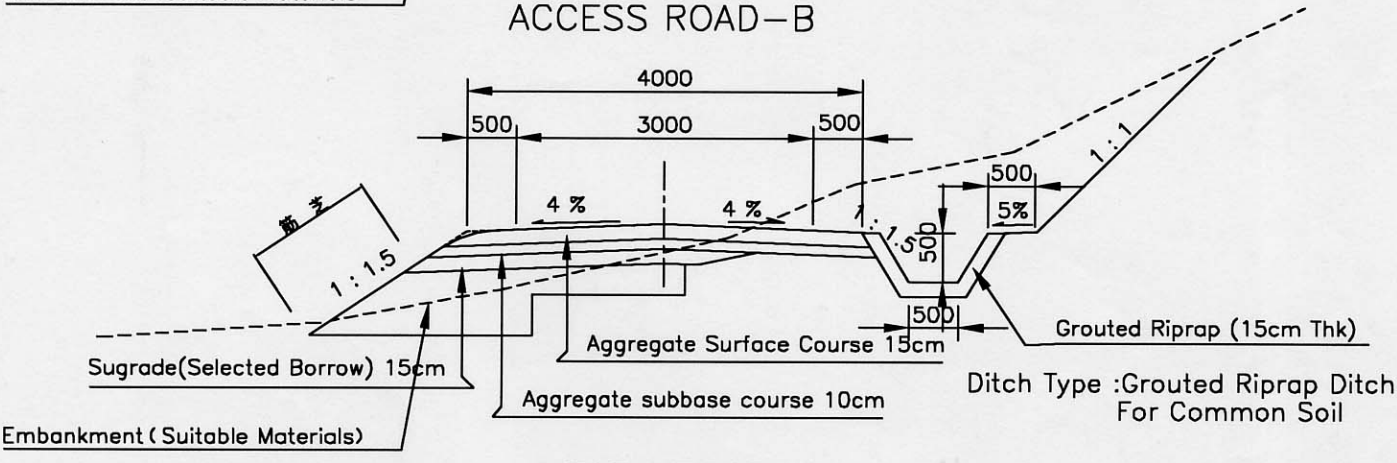
Typical cross sections for the Project roads are shown in Figure 2-1.



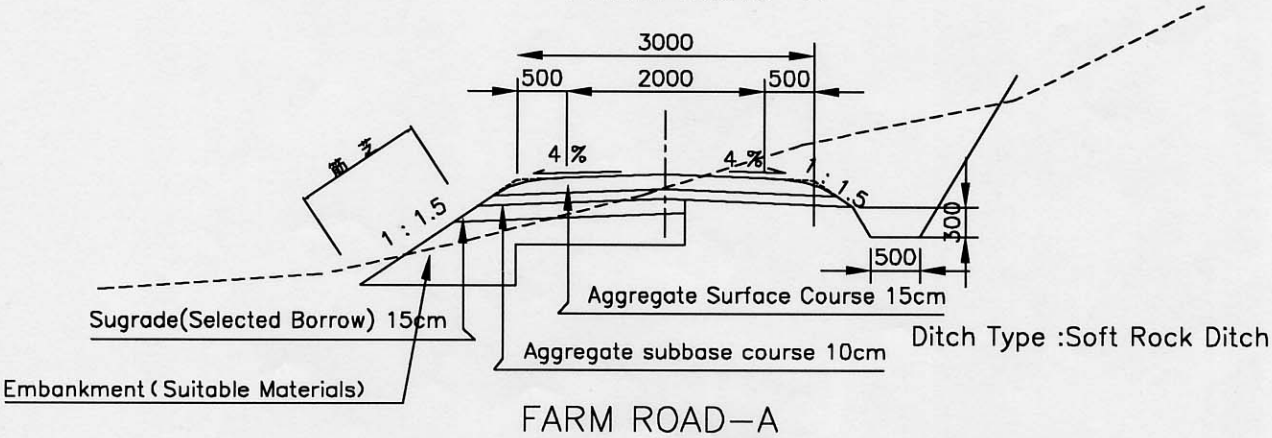
ACCESS ROAD—A



ACCESS ROAD—B



FARM ROAD—A



FARM ROAD—A

Figure 2-1 Typical Cross Sections of the Project Roads

Length of Project Roads by Type (unit:km)

Type	Marangog Area	Silae-Dalacutan Area	Total
Access Road A	3.84	—	3.84
Access Road B	2.92	—	2.92
Farm Road	3.22	2.28	5.50
Total	9.98	2.28	12.26

Note) the length of Access Road A includes 0.20 km of concepcion bridge with the approach road.

(e) Planning of Conception Bridge

Concepcion Bridge is located in the vicinity of Barangay Concepcion along the Marangog-Concepcion Road. At the moment there is no river crossing facility there. A new bridge is proposed as follows:

Selection of River Crossing Route

River and ground conditions were surveyed at up- and down-stream of the river and no route was found better than existing river crossing route. The bridge is planned to connect with the existing roads at the both riversides.

Riverbank Protection and Bridge Length

Although the river land (upper-riverbed) is approximately 250m wide, ordinal stream width is about 10m wide and lower-riverbed width (which is equal to yearly flood width) is about 100m wide. Since the traffic of the bridge is light and little (ADT 56 veh./day), low-cost structure type bridge is proposed. To minimize bridge length, abutments are planned at just behind the riverbank protections at lower-riverbed banks and the length of the bridge will be 100m long. Riverbank protection is planned to extend 15m from abutments to the up- and down-stream at the both sides of the river.

Selection of Bridge Structure Type

The following low-cost bridge structure types were compared as shown in Table 2-3.

Scheme-1 : Half lane of standard bridge
Scheme-2 : Bailey temporary bridge
Scheme-3 : Submersible type bridge (low and short type bridge)

Scheme-4 : Spillway
Scheme-5 : Box culvert
Scheme-6 : Concrete riverbed

As the result of the comparative study, the Scheme-3: submergible type bridge (110m) is proposed over the lower-riverbed and concreting upper-riverbed (125m length for Concepcion side and 40m length for Marangog side) is proposed at the bridge approaches. (Refer to Figure 2-2)

Design Riverbed

Since an irrigation dam is located at about 2km downstream, large change of riverbed elevation will not occur. However change of stream alignment will cause 1m-riverbed elevation change. Considering the possibility of riverbed up-and-down and scouring around pile-bent piers, the design riverbed is assumed at EL.277m (2m lower than present deepest riverbed).

Bridge Elevation

About 50cm freeboard is secured between yearly flood level and the elevation of the bridge bottom. Once in several years, the bridge approach roads and the bridge will be submerged every around 10 years.

Bridge Structure and Spans

To minimize disturbance to floods by the bridge, flat slab without handrail and pile-bent pier are proposed. The longest span of 12.3m is planned for the flat slab to let drifts including coconut trees stream down beneath the bridge easily.

Design Criteria

i) Specifications

AASHTO 1996

Design Method:

Reinforce concrete member : Strength design method

Pile capacity and spring constant : Japan Road Association

Seismic design : AASHTO

ii) Design Load

Live load : H15 (13.5 ton truck)

Impact : 0.3 (span=12.3m)

Dead load（Specific gravity）:

Concrete/RC=2.4 tf/m^3

Sand/Gravel=1.9 tf/m^3

Soil =1.6 tf/m^3

Temperature change=+/-15℃

River current pressure=0.052K*V2*A　K=1.4(quadrilateral)、K=0.67(round)

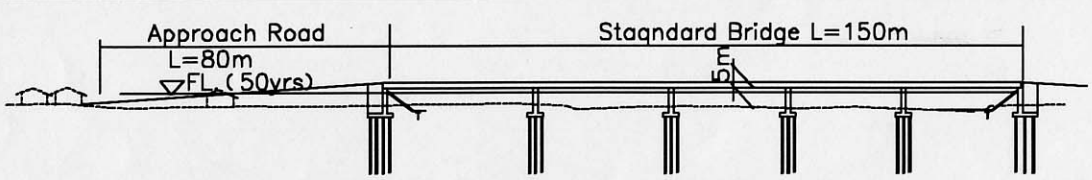
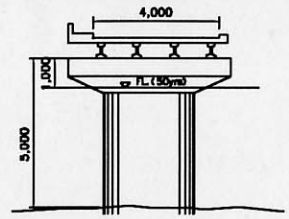
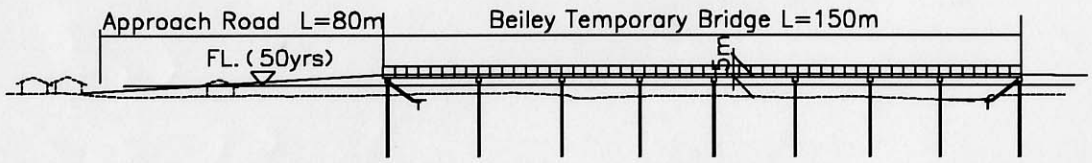
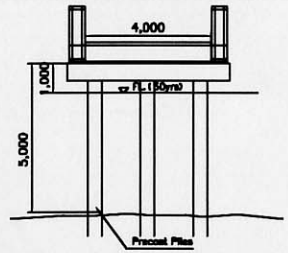
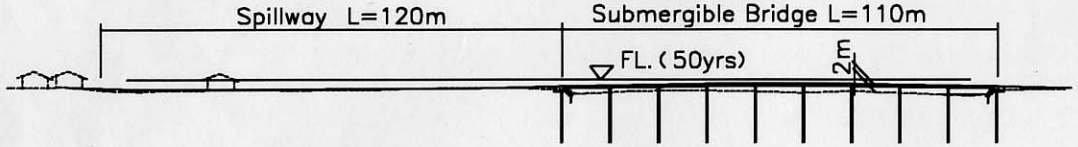
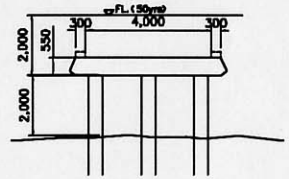
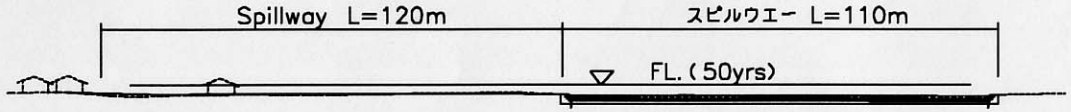
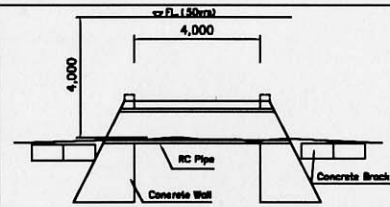
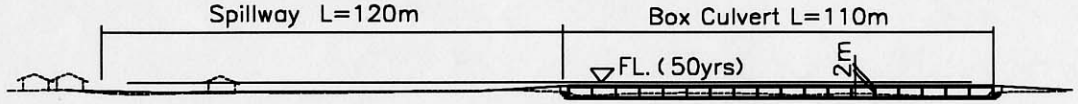
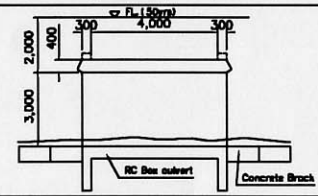
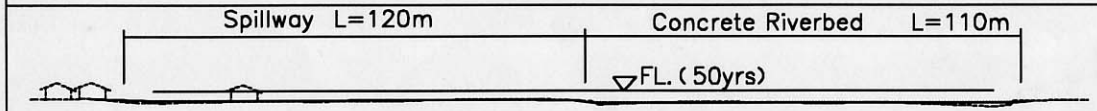
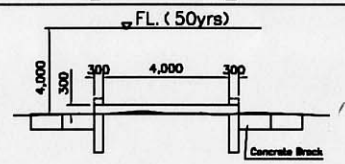
iii) Material

Concrete (RC member)：Design strength =210kgf/cm^2

Bridge Length and Width

The bridge has 110m of total length for nine spans with 4.6m of full width and the total length of approach roads is 130m.

Table 2-3 Comparison of Low-Cost Bridge Type for Conception Bridge

ELEVATION	CROSS SECTION	FEATURES	Const. Cost	Evalu-ation
 Scheme−1 Half of Standard Bridge		− Construction cost is hight due to bridge is long and substructure is large − Approach roads is heigh and long. − Structure is durable	2.0	△
 Scheme−2 Beyley Temporary Bridge		− Bridge is long and approach roads are large. − Temporary bridge require yearly repair of slab	1.7	×
 Scheme−3 Submergible Bridge		− Impassable during floods. − Construction cost is inexpensive. − Pile foundation is durable.	1.0	○
 Scheme−4 Spillway		− Impassable during floods − Inexpensive Construction Cost − Riverbed will rise at upstream side and drop at down streamside. − Drop of riverbed loose stability of the structure − Drifts will deposit upstreamside.	0.6	×
 Scheme−5 Box Culverts		− Impassable during floods − Inexpensive Construction Cost − Drop of riverbed loose stability of the structure − Drifts will deposit upstreamside.	1.0	×
 Scheme−6 Concrete Riverbed		− Impassable during floods − Inexpensive Construction Cost − Drop of riverbed loose stability of the structure − Rise of riverbed bury the path	0.3	×

Note : Construction costs show ratio against Scheme−3.

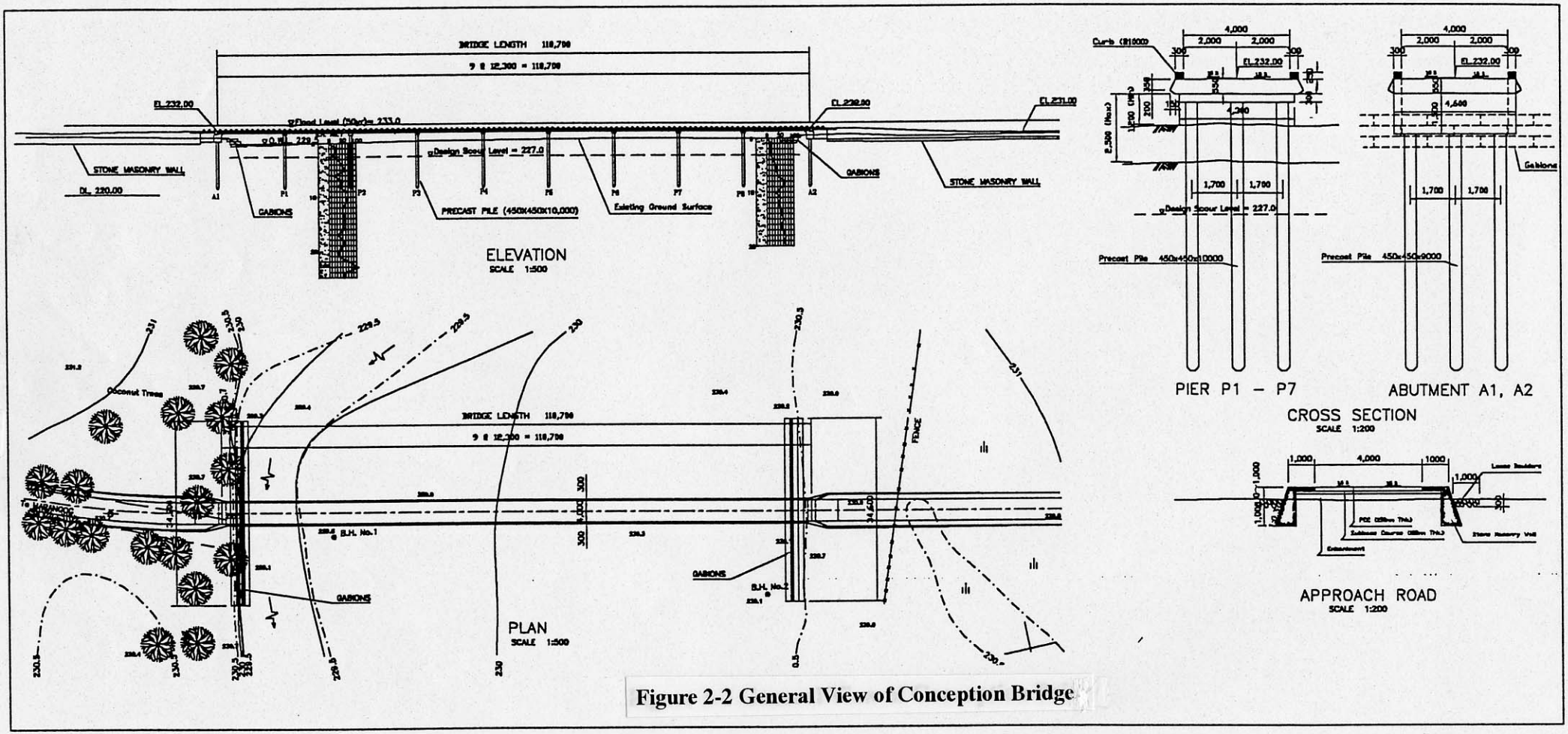


Figure 2-2 General View of Conception Bridge

(2) Post-Harvest Facilities

(a) General Concepts

Post-harvest facilities will be constructed for reduction of working time and labor force, decrement of harvesting loss and quality improvement. The post harvesting facilities to be constructed may be used not only for drying grains but also for multi purposes like temporary storing such products of root crops, copra and Abaca and maintenance of farm equipments, cleaning of communal items such as desk and chair. Development of post-harvest facilities in marginal areas will be conducted in line with following considerations.

- Facilities to be developed shall be designed in simple structure.
- Facilities shall be developed with the development of roads and other rural infrastructures, and designed in consideration of cost performance.
- Operation and maintenance shall be easy for farmers' organizations.

It might be desirable to construct dryer and storage facilities but firstly multi-purpose dryers will be constructed. There are presently few multi-purpose dryers in Marangog and Silae and many farmers are obliged to dry farm production using vinyl sheets on farmlands or roads. Since the volume to be dried is limited with this method, harvesting operations often delay. The delay of harvest brings both crop production decrease and low quality owing to rainfall and damages caused by birds and insects, which in turn oppresses the farm economy.

With this project, first priority is the improvement of farmers' living conditions as well as marketing. Therefore, the development of agriculture - raising productivity and improving products' quality - will be pursued in the next stage through irrigation and soil improvement. Although it is indispensable to develop storage facilities from the aspect of the improvement of products' quality and marketing system, rapid increase of crop production is not expected in this stage. Consequently, the investment for the related facilities may impose a burden on farmers for operation and maintenance. Because these storage facilities should be developed together with the improvement of irrigation and soil, multi-purpose solar dryer will be constructed in this Project. For drying rice by solar, it takes two to three days, so small-scale grain warehouse will be attached to the dryer for storing crops temporally.

(b) Facility Utilization Plan

To determine the scale or dimensions of facilities and their utilization plan, following factors are considered.

Crop Production and Cropping Pattern

Almost all farmers harvest rice and corn between September and October. Annual productions of rice and corn are summarized as follows.

Crop	Marangog		Silae-Dalacutan	
	Planted Area (ha)	Productions (ton)	Planted Area (ha)	Productions (ton)
Rice	38 (15)	38 (14)	14 (10)	32 (25)
Corn	39 (39)	33 (33)	133 (65)	504 (273)

Note: Figure in parenthesis is the value in September and October.

Cropping patterns in Marangog and Silae-Dalacutan are shown below.

Cropping Pattern in Marangog

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Rice	———	———	———	———	···	———	———	———	———	···		
Corn	———	———	———	———	·····		———	———	———	———	····		

Cropping Pattern in Silae-Dalacutan

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Rice	———	———	···			———	———	———	———	———	····		———
Corn	———	———	———	····		———	———	———	———	·····		———	———

Utilization Period

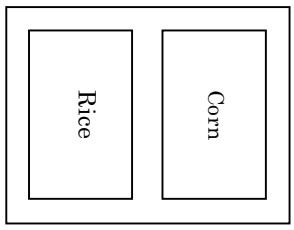
In general, suitable season for harvesting rice is 30 days after heading. In Marangog and Silae, September and October are the suitable period for harvesting. Based on the data observed from 1986 to 1999 of the Maasin Observatory Station, which is nearest to Marangog, number of non-rainy days during September and October is 16-day in each month on the average. In Silae, it is 8 days in each month based on the records from 1990 to 1998 at the Malaybalay Observatory Station. These data indicate that harvesting should be done within rather short period.

In addition, it is desirable to harvest as soon as possible in terms of farm labor efficiency. It takes about 10 days to harvest rice in Marangog and Silae. Since 2 days are necessary for the solar drying and the quality of rough rice starts to deteriorate in 48 hours after harvesting, it is recommendable that rice shall be harvested every other day. In consequence, it is assumed to take 5 days for whole harvesting operations.

As for corn, it takes about 15 days in Marangog and 45 days in Silae for harvesting. Planting of second crops will be followed about one month after harvesting and rainfall disturbs the harvesting operations in the same way as rice harvesting. Focused on the farm labor efficiency and the strengthening of cooperative shipment, corn shall be harvested as soon as possible within the present pattern. Because three days are necessary for drying corn, it is estimated that net harvesting will finish within five days in Marangog and 15 days in Silae.

Floor Efficiency of Solar Dryer

Farmers have to spread and stir their farm products repeatedly with wooden or steel rake in the process of drying. For the purpose of decreasing harvest losses, one meter of margin will be set around the edge of pavement, which is free from drying the produce. In case of drying rice and corn in the pavement, rice and corn will be separated with a distance of 1 meter. It is possible to install concrete blocks at the hedge to decrease the losses. However, the concrete blocks cause poor drainage and need much labor to keep pavement clean. Then concrete blocks shall not be installed.



(c) Study on Scale of Facilities

Dimensions of the drying facilities are studied by following formula according to the standard of ARISP.

Multipurpose Dryer

Demanded Area (m^2/day) = Drying Volume (m^3/day) / Thickness of Spreading (m) / Floor Efficiency

In this formula, Drying Volume (m^3/day) = Total Products (ton) / Harvesting Days (days) / Density (ton/m^3)

Warehouse

Demanded Floor (m^2/day) = Daily Storage Volume (Cavans) / Piling Nos. of Cavan (Cavans) x Occupied Area (m^2/Cavan) / Floor Efficiency

In this formula, Piling Nos. of Cavan = Piling Height (m) / 0.25 (m)

Occupied Area (m^2/Cavan) = 0.8 x 0.4 x 1.20

Results of the study on the dimensions of multi-purpose dryer and warehouse are shown below. Judging from the results, designed area for multi-purpose dryer is 1,312 m^2 in Marangog. Although there is one of existing drying pavement, this pavement is not usable due to the deterioration. Thus, it is necessary to construct multipurpose dryers with capacity of 1,312 m^2. It is also required to have warehouse with capacity of 28 m^2 for floor area. In Silae-Dalacutan area, it is necessary to have 3,133 m^2 of the multi purpose dryer for the whole area. Because the existing drying pavements have the capacity of 2,018 m^2, it is required to construct the drying pavement with capacity of 1,115 m^2 newly. Also it needs to construct new warehouse with 59-m^2 floor area.

Calculation of Demanded Area for Multi-purpose Dryer

Item	Marangog		Silae	
	Rice	Corn	Rice	Corn
Crop Production (ton)	14	31	24	260
Practical Harvesting Days (days)	5	5	5	15
Mixture Ratio of Other Substance	0.10	0.10	0.10	0.10
Bulk Density of Crops (g/lit.)	580	700	580	700
Thickness of Spreading (m)	0.03	0.05	0.03	0.05
Drying Periods (days)	2	3	2	3
Daily Drying Volume (m^3/day)	5.4	9.8	9.2	27.5
Net Demanded Area (m^2)	420.7	694.7	721.1	1,942.1
Floor Efficiency	0.85	0.85	0.85	0.85
Gross Demanded Area by Crop (m^2)	494.9	817.3	848.5	2,284.8
Total Demanded Area (m^2)	1,312		3,133	
Capacity of Existing Multi-purpose Dryer (m^2)	0		2,018	
Total Area for Proposed Multi-purpose Dryer (m^2)	1,312		1,115	

Calculation of Demanded Area for Warehouse

Item	Marangog		Silae	
	Rice	Corn	Rice	Corn
Crop Production (ton)	5.4	9.8	9.2	27.5
Total Numbers of Cavan (Cavans)	107.3	196.8	183.9	550.3
Piling Numbers of Cavan (Cavans)	6.0	6.0	6.0	6.0
Occupied Area per Cavan (m^2)	6.9	12.6	11.8	35.2
Floor Efficiency	0.70	0.70	0.80	0.80
Demanded Area (m^2)	9.8	18.0	14.7	44.0
Total Demanded Area (m^2)		27.8		58.7

Note: Dimension of one Cavan : Length 0.8 m x Width 0.4 m x Thickness 0.25 m, Weight 50 kg

(d) Site Selection

Sites are selected based on the following criteria.

- It is easy to access to market roads for collection and shipment of farm produce.
- Construction site is flat and spacious.
- Construction site is close to farmlands and village.
- Construction site belongs to LGUs and there are no buildings.

In Marangog area, Banban site is selected at the center of Banban sitio. Since there are rice and Abaca producing areas in the northern part of Banban area, the site is recognized as a collection point of rice and Abaca. In addition, farm roads will be extended from Barangay Proper to the site under this Project, which will make market access easier. As a consequence, multi-purpose dryer will be constructed at Banban site.

Iba site is located on the way to Conception from Barangay Proper. There are sizable paddy fields nearby the site. Access roads from Barangay Proper to Concepcion will be improved under this Project. Farmers have requested to construct multi-purpose dryer around Iba site for shipment of farm produce to markets.

There is one devastated multi-purpose drying pavement at the center of the Barangay Proper, which needs to rehabilitate. However, the rehabilitation of the pavement requires destruction and removal cost and causes environmental problems. Since the Marangog villagers find another site close to Barangay Proper, the multi-purpose dryer will be constructed on the new site.

In the Silae ARC, the development of farm roads is proposed. One farm road will be constructed at a distance of 1km east from the Dalacutan Proper and another will be located at a distance of 1km northwest from the Silae Proper. On these two sites,

multi-purpose dryer will be constructed to improve labor efficiency and marketing condition. There are no other suitable sites for dryer in these areas.

(e) Facility Plan

The dimensions of the facilities are calculated as shown below.
(Refer to Figure 2-3 and Figure2-4)

1) Dimension of Facility

Multi-purpose Dryer	Marangog	15 m x 30 m x 3 sites（1,350 m^2）
	Silae	20 m x 30 m x 2 sites（1,200 m^2）
Warehouse	Marangog	3 m x 5 m x 3 m x 3 sites（45 m^2）
	Silae	4 m x 8 m x 3 m x 2 sites（64 m^2）

2) Structural Plan

- Surface will be paved with 10 cm thick concrete and base will be set with 10 cm thick gravel.
- Meshed wire will be installed in surface concrete to protect cracking.
- Surface will be constructed with gradient of 1:100 from the center into short side direction in consideration of drainage
- Drainer will be set around concrete pavement.
- It is assumed that any vehicle does not enter the paved zone.