INFRASTRUCTURAL SURVEY REPORT FOR THE DEVELOPMENT OF THE DOLOMITE RESOURCES IN CEBU ISLAND, REPUBLIC OF THE PHILIPPINES

JANUARY 1978

JAPAN INTERNATIONAL COOPERATION AGENCY

INFRASTRUCTURAL SURVEY REPORT FOR THE DEVELOPMENT OF THE DOLOMITE RESOURCES IN CEBU ISLAND, REPUBLIC OF THE PHILIPPINES

JANUARY 1978

JAPAN INTERNATIONAL COOPERATION AGENCY

FOREWORD

The Government of Japan decided to conduct feasibility surveys on the potential improvement of various infrastructures related to the exploitation of dolomite on the Island of Cebu, the Republic of the Philippines. In parallel with the Government decision, the Japan International Cooperation Agency organized a 12-man survey team headed by Hiromichi Kohno and delegated the mission during September 1 through October 15, 1977 for field survey.

In the Island, the survey team made efficient investigations with the favorable cooperation of the Philippine Government agencies and, after return to Japan, studied and drew up plans for the infrastructures improvement project on the basis of the results of field survey, data and data information collected on the Island. After a series of these works, the Survey Report has been completed.

The present investigation is primarily a feasibility survey designed to improve overall infrastructures including port facilities, power supply, road, bridge and water supply facilities and the report presents the details of economic and technical studies and assessment of the effect of development and improvement. It is therefore our heartfelt pleasure that our works will be a help to the promotion of the future mineral exploitation project on the Island.

In conclusion, we wish to express our sincere thanks to the Government agencies of the Republic of the Philippines, the Embassy of the Republic of the Philippines in Japan, Japanese Foreign Ministry and the Ministry of International Trade & Industry.

The Japan International Cooperation Agency
President

Shinsaku Hogan

Messrs. Japan International Cooperation Agency

Attn: Mr. Shinsaku Hogan, President

This report relates to a feasibility survey on the potential improvement of infrastructures including port, power supply, roads, bridges and water supply facilities required for the successful implementation of the mineral exploitation (dolomite) project on the Cebu of the Republic of the Philippines.

Staffed with 5 officers from Mitsui Consultants Co., Ltd., one from Mitsui Consultants Co., Ltd., one from I.P.L. Co., Ltd., 5 from Toyo Construction Co., Ltd. and one from Sanyo Hydrographic Survey Co., Ltd. at the request Japan International Cooperation Agency, the Survey Team conducted field surveys and observation (geology, topography and oceanography) in Alcoy an and Dalaquete municipalities in the neighborhood of the projected mineral exploitation area and compilation of data and information in Manila and Cebu cities during September 1 through October 15, 1977 through the kind cooperation of the Government agencies concerned.

This project survey is primarily designed to conduct technical and economic survey of infrastructures, i.e., port, power supply, roads, bridges, water service facilities and clinic, etc., related to the mineral exploitation project for the purpose of ensuring proper improvement of these facilities, carrying out the development of dolomite successfully and improving public welfare and economy in local communities, and to provide pertinent advices in connection therewith.

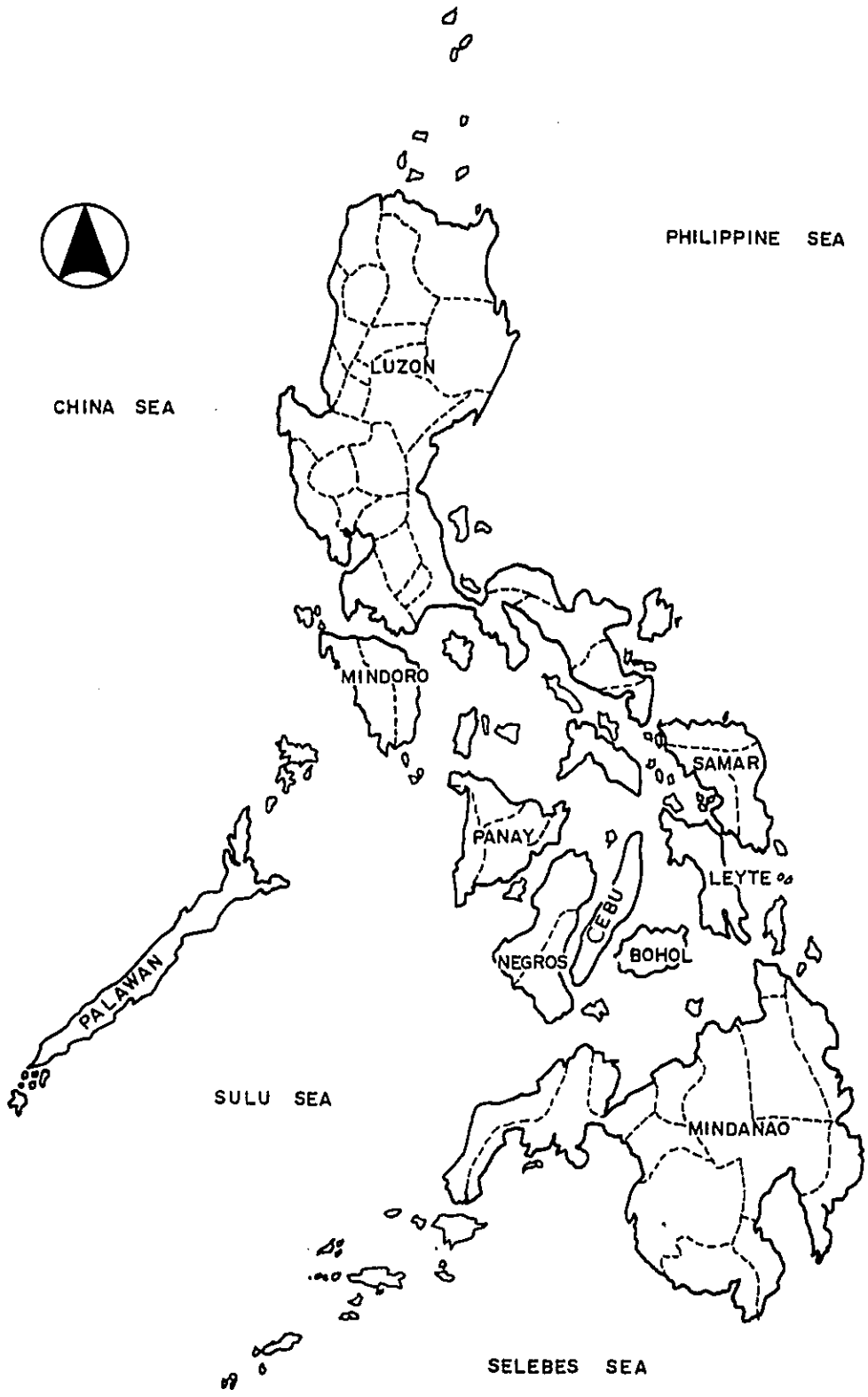
At present, Alcoy and Dalaquete municipalities adjacent to the projected mineral exploitation site remains economically undeveloped more than any other districts in Cebu Province, with nominal industrial activities in agriculture, fishery, mining (coal), high jobless rate and massive expatriation of workers to Cebu and other cities as casual or seasonal workers.

It is therefore expected that projects on mineral exploitation and construction of related infrastructures will exert favorable effect on the local economy in Alcoy and Dalaquete through improved job opportunities and public welfare.

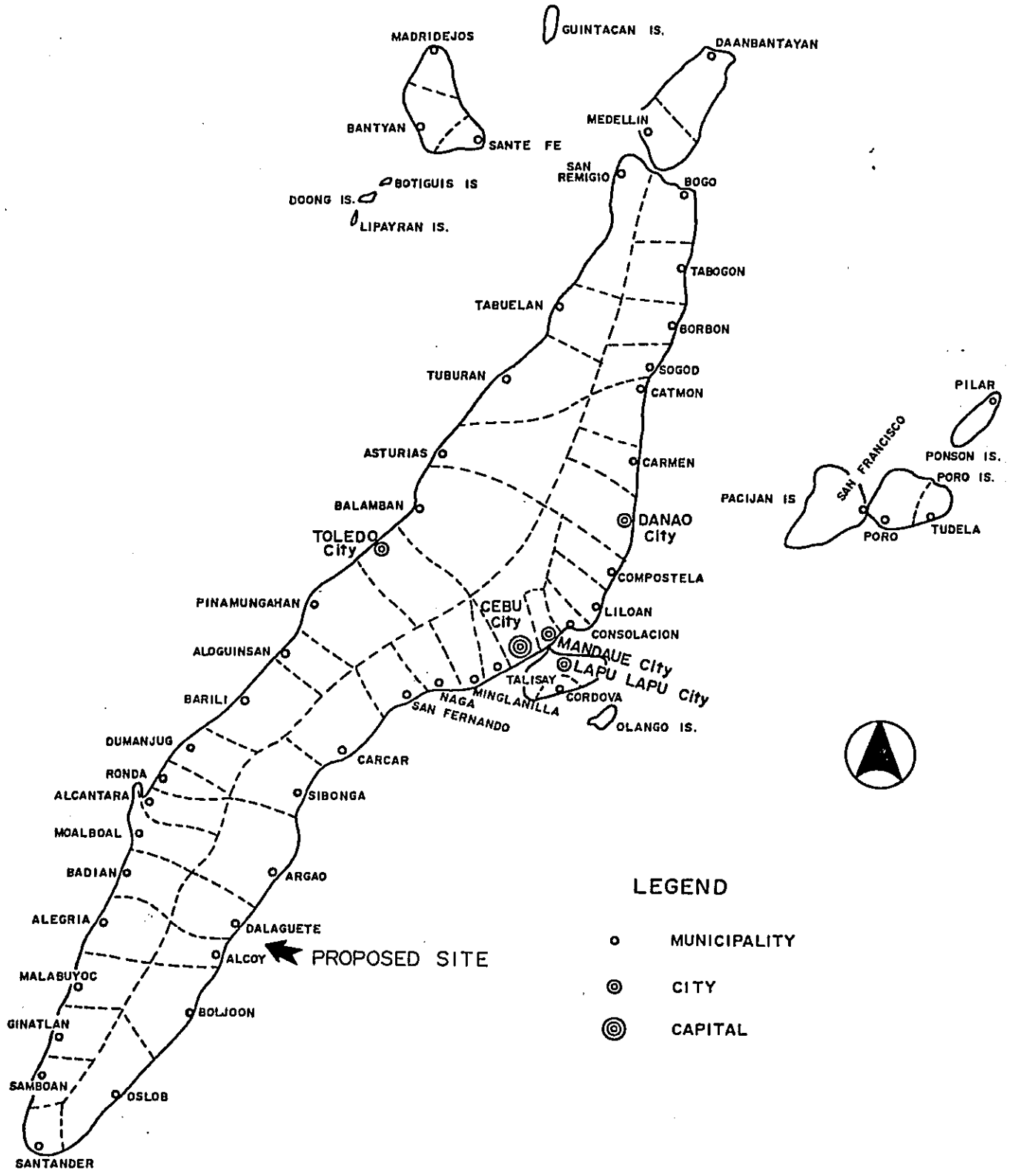
Upon presentation of this report, we wish to extend our sincere gratitude to the Ministry of Mines of the Republic of the Philippines, the Government of Cebu Province, other Government agencies and Japanese Embassy in the Republic of the Philippines.

Hiromichi Kohno

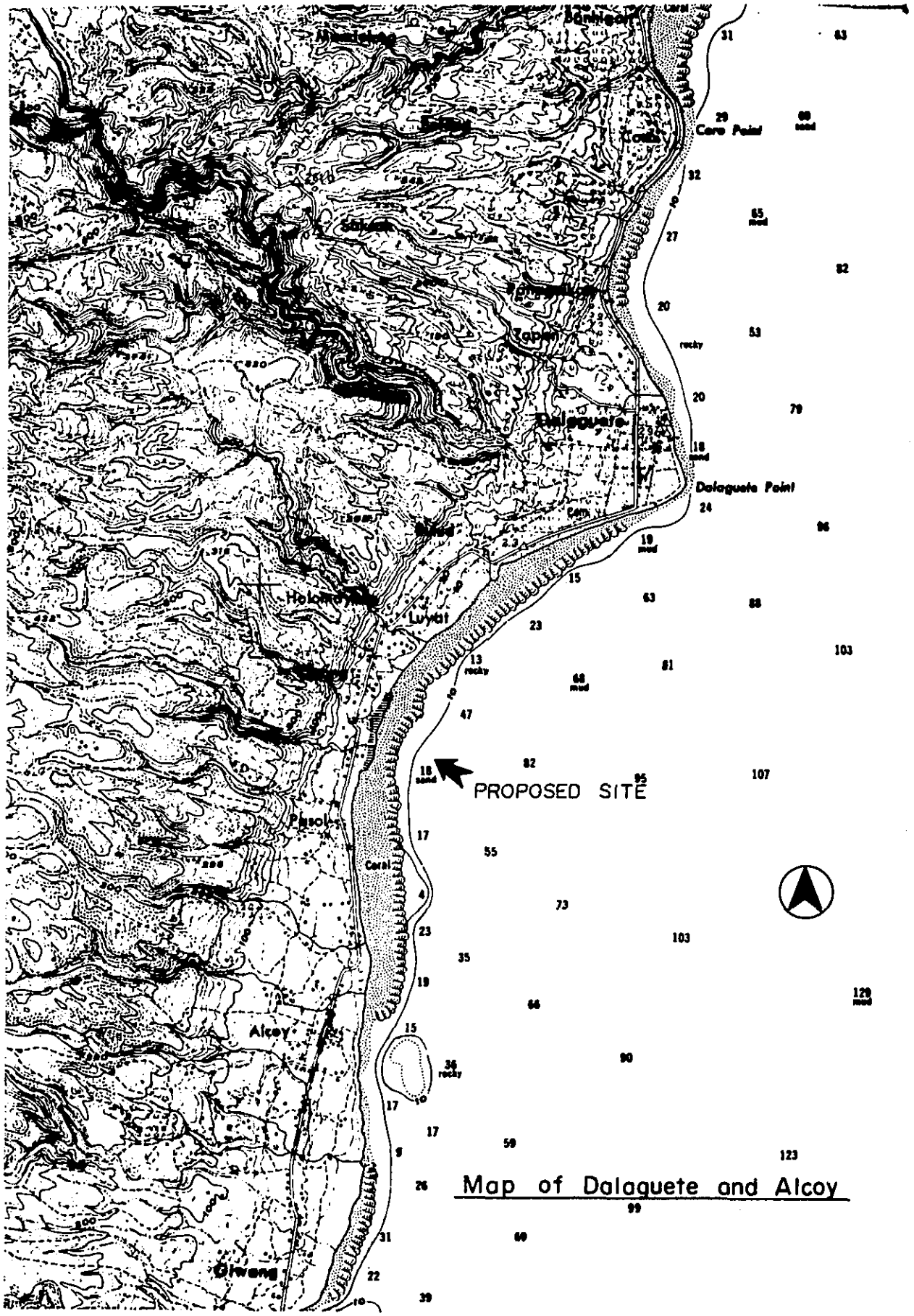
Chief, Infrastructures Survey
Team on Dolomite Exploitation
Project on the Cebu, Republic
of the Philippines



Map of the Philippnes



Map of the Cebu Province



Map of Dalaguete and Alcoy

TABLE OF CONTENTS

CHAPTER 1 SUMMARY

Chapter 1 Summary

1-1 Background and purpose of survey

In 1973, a dolomite ore deposit with an estimated reserve of 230,000,000 tons was discovered in Alcoy and Dalaquete in Cebu Island, the Philippines. Recently, Japan-Philippine joint venture, Dolomite Mining Co., Ltd., was established for the purpose of exploiting and shipping 600,000 to 1,000,000 tons of dolomite annually to Japan as a major destination.

In this connection, the Philippine authorities take a positive stance toward this mineral exploitation project as it is expected to bring forth various benefits to local society through expansion of employment opportunities and improvement of infrastructures such as port, power and water supply facilities, etc.

The present survey has conducted technical and economic studies on port, power and water supply facilities, road and bridges, other infrastructures (clinic, etc.), etc., which may be necessitated incident to the promotion of Dolomite Exploitation Project on Cebu Island and, also, assessment of the effect of the Project on the socioeconomic improvement of the locality, which is one of major requirements for granting loans, to provide the Japan International Cooperation Agency with data for banking operations.

1-2 Details of survey

We have conducted investigations and surveys on requirements to improve infrastructures as may be necessitated in the course of and in relation to the execution of the Project.

Port facilities: Studies on installation of dolomite loading berth and local berth and, in the course of field survey, offshore borings in 9 locations, submarine and coastal survey, and observation of water level and current.

Power supply facilities: Investigation of current power supply situation in Cebu River and projection of future power supply schemes, comparative study of the schemes of transmitting power from public substations or of non-utility power generation, and power supply facilities installation plans for

mineral exploitation and local service

Improvement of roads and bridges: Study of present situation of roads and bridges between Cebu City and Alcoy (about 90 km), for improvement thereof including the introduction of traffic safety measures and facilities for local residents

Water supply facilities: Field survey of water supply facilities and resources in the vicinity of projected dolomite mines and formulation of plans to develop water supply facilities for mineral exploitation and local service

Other infrastructures: Feasibility study of medical facilities, parks, library and assembly hall for miners and villagers and assignment of priority of installation

1-3 Port facilities survey

1-3-1 Background of port planning

The Dolomite Exploitation Project on the Cebu Island envisages to mine and ship dolomite as follows:

1980 - 1982	600,000 tons/year
1983 - 1985	* 1,000,000 tons/year

* 200,000 tons destined to the Mindanao

A port for the shipment of dolomite will be installed adjacent to a border between Alcoy and Dalaquete, which will not only serve the shipment of dolomite, but the shipment and delivery of fishes, agricultural products and other daily necessities, especially in trade with the Bohol, by installation of local berth.

1-3-2 Cargo volume and appropriate type of vessel

As mentioned, estimated shipments of dolomite will reach 600,000 t/y during 1980-82 and 1,000,000 t/y during 1983-85. These dolomites will be loaded aboard vessels mechanically by means of shiploaders and belt conveyors, each with a loading capacity of 1,000 t/hr.

On the other hand, most of local cargoes include vegetables shipped to the Bohol and fishes and daily necessities shipped

therefrom, which amount to a nominal quantity as compared to the amount of dolomite loaded.

Appropriate type of vessel with minimum transportation cost should be determined in consideration of transport distance and loading capacity. In this connection, we recommend for the purpose of the Project a 20,000 DWT capacity vessel in consideration of a transport distance of 1,600 nautical miles between the Cebu and Japan and a required loading capacity of 8,000/10,000 t/day.

Also, we project for local use a 30 GT capacity vessel judging from the type and capacity of commercial vessels operating in Dalaquete Port.

1-3-3 Studies on safe vessel operation

Table 1-1 shows maximum allowable weather and sea conditions for safe operation of vessels speeding at low speeds upon entry into or departure from a port.

Table 1-1 Max. limits for safe vessel operation

Projected vessel	Wind velocity	Wave height	Current
20,000 DWT	Max.10.0 m/sec.	0.5m - 1.0m	Max. 0.2m/sec.

Meteorological and oceanic conditions in the projected area satisfies the above requirements except upon occurrence of semi-annual typhoons and we recommend the area as safe port for vessel operation.

In case a vessel tries to swing its head for itself without the aid of a tugboat under favorable meteorological and sea conditions, a 2,000 DWT vessel needs a round space with a diameter of about 520m. Figure 1-1 shows a topographical map with the entry of this circle, according to which, there will be little problems in operation of the vessel despite complex submarine topography.

1-3-4 Port scale and space planning

On the basis of estimated annual shipments of dolomite and projected vessel capacity, dolomite carrier is expected to enter into port 72 times a year and to be on the berth for a total of

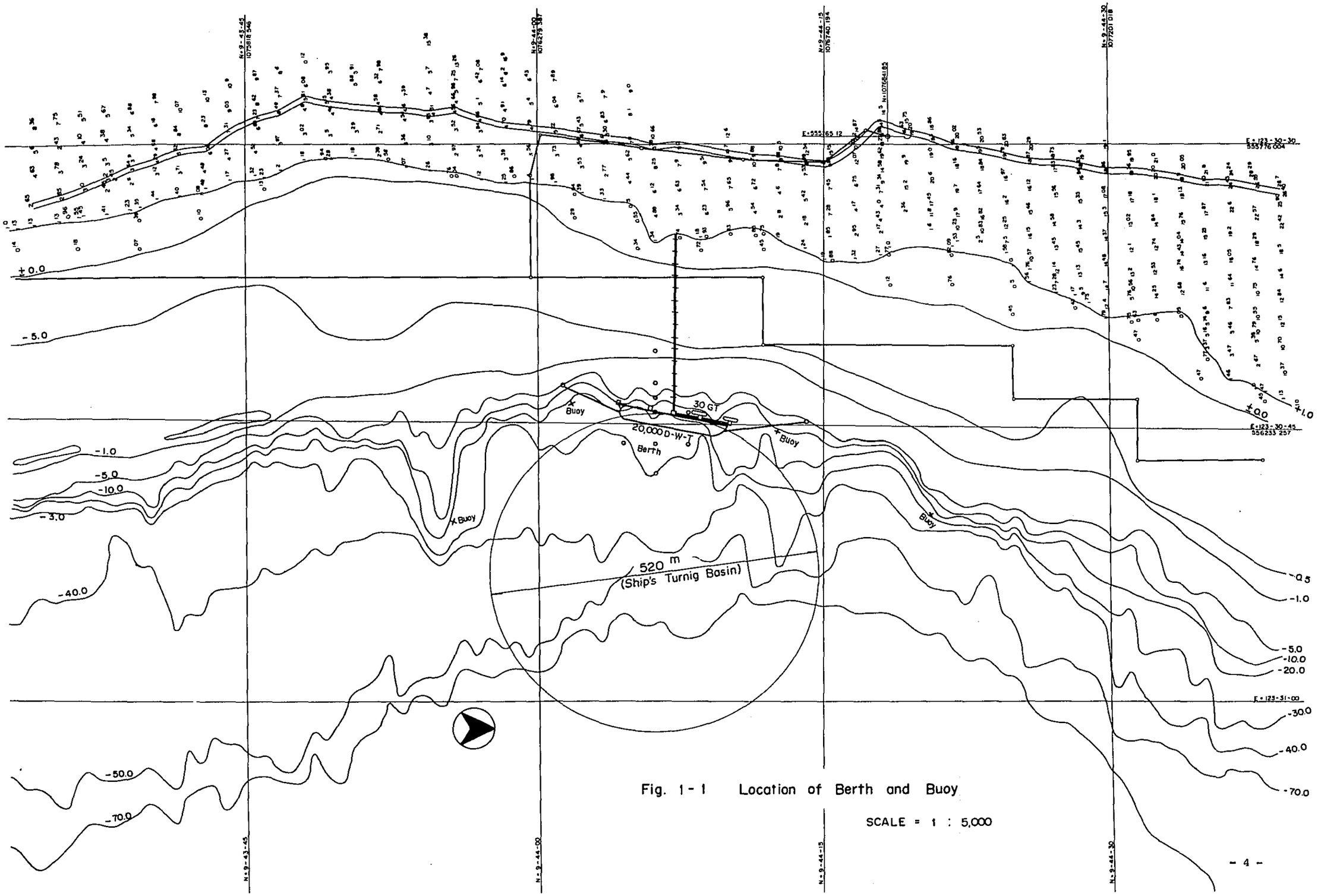


Fig. 1-1 Location of Berth and Buoy

SCALE = 1 : 5,000

76 days a year. Due to regular vessel allocation for dolomite carriers which can save queueing time, one berth will be installed for loading of dolomite.

Judging from the current situation of Dalaquete Port, two berths will be installed for local use utilizing a part of the large berth for dolomite carrier.

The waters scheduled for the port is quiet and allows safe vessel operation except upon occurrence of typhoon.

Therefore, no particular external barrier such as breakwater will be installed, but structures such as moorings will be designed in a sturdy construction to withstand typhoons. Navigational aids will be installed in 4 locations, as shown in Figure 1-1, due to complicated formation of submarine topography. On the other hand, dolomite is discharged from storage and loaded aboard vessel directly by means of belt conveyor and shiploader. The local berth will not be equipped with cargo handling facilities or warehouses because cargoes are handled in small quantities.

1-3-5 Port project

In consideration of relevant factors and requirements, the Port Project envisages to install one berth for shipment of dolomite (for 2,000 DWT capacity vessel) and two local berths for 30 GT vessels. Figure 1-1 shows the plan view.

Fig. 1-2, Table 1-2 show major port facilities.

Table 1-2 Port facilities

	Equipment installed	Remarks
For large vessels		
	Breasting dolphines	4 units
	Mooring dolphines	2 units
	Shiploader rest	1 unit
	Belt conveyor foundations	14 units
For local vessels		
	Breasting dolphine	For large vessels
	Mooring dolphine	"
	Footbridge	360m long & 2m wide
Navigational aids		
	Buoys	4 units

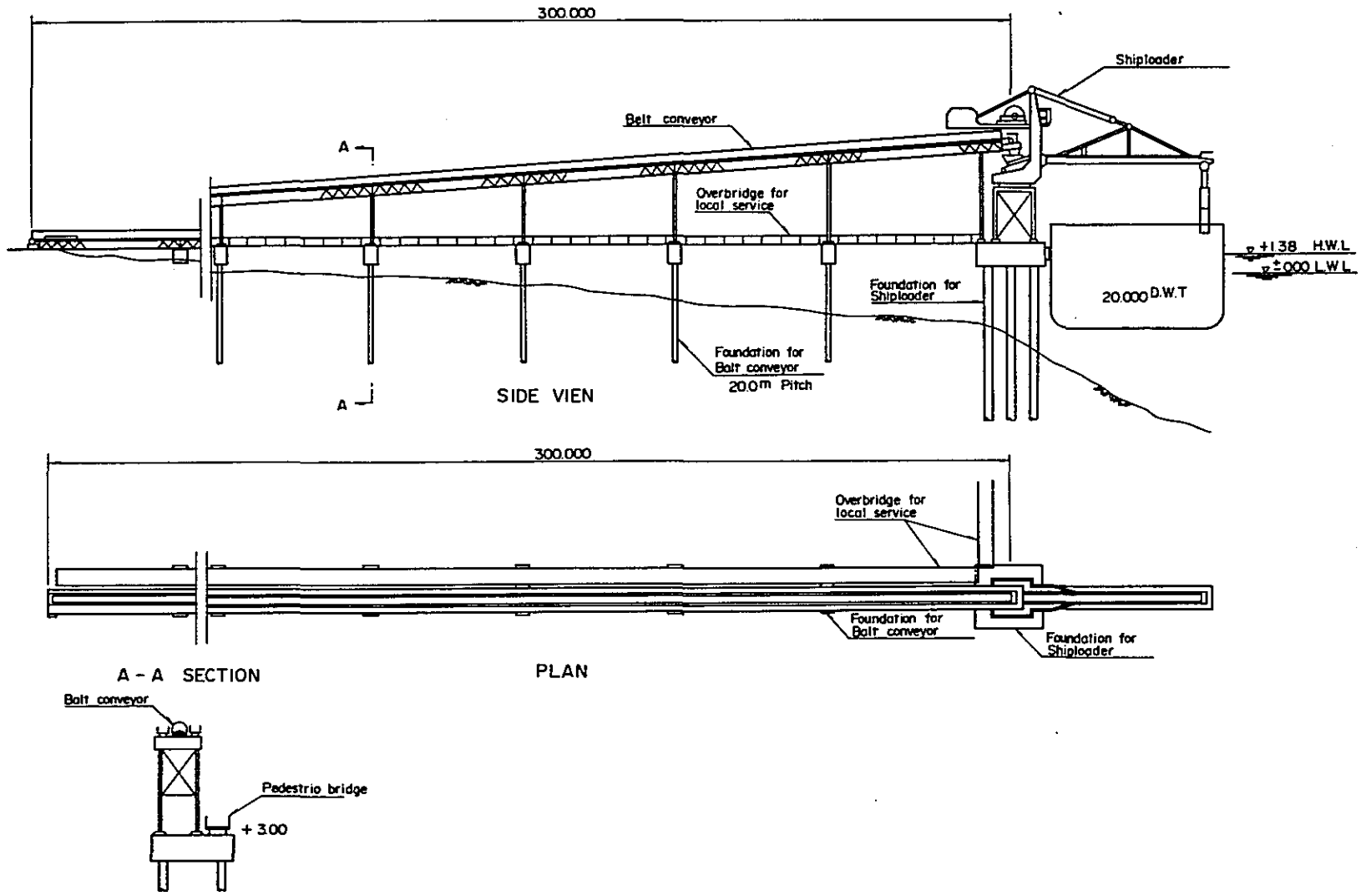


Fig. I-2 General View

1-4 Power facilities survey

1-4-1 Background of power facilities project

Total power requirements for mining dolomite buried in Alcoy and Dalaquete are estimated to reach about 1,800 kW.

At present, however, no power service has been provided to residents in Alcoy. Contrarily, people in Dalaquete are receiving power supply only for 12 hours during the night and, therefore, power supply (1,800 kW) needs to be provided by the utility power plant (or a substation) by means of transmission lines or generated by non-utility power generators.

The Project conducts the comparative studies on advantages and disadvantages of the utility power transmission and the private power generation schemes from diverse viewpoints to formulate a basic policy for power supply and is designed to improve the public welfare of citizens in Alcoy and Dalaquete through supply of surplus power to local people.

1-4-2 Power development project in Cebu Province

NPC (National Power Corporation) has power development project in Cebu Province shown in Fig. 1-3.

Of projected power plants in Cebu Province, two plants are under construction respectively under Diesel Power Project - I and Thermal Power Project at Naga, about 22 km to the south of Cebu City, with the financial loans granted by the World Bank. Figure 1-4 shows a project of transmitting power from Naga Power Plant to various substations. Lines between Naga and a part of generators in the process of construction under Diesel Power Project-I is in the stage of final testing and adjustment, with remainder due to be completed in 1978.

1-4-3 Studies on power supply method

As realistic means of supplying power for mineral exploitation, two schemes are under study - one is the reception of power through utility transmission line from Naga Power Plant and the other the installation of private, non-utility power generation plant. In this connection, we conduct extensive studies with

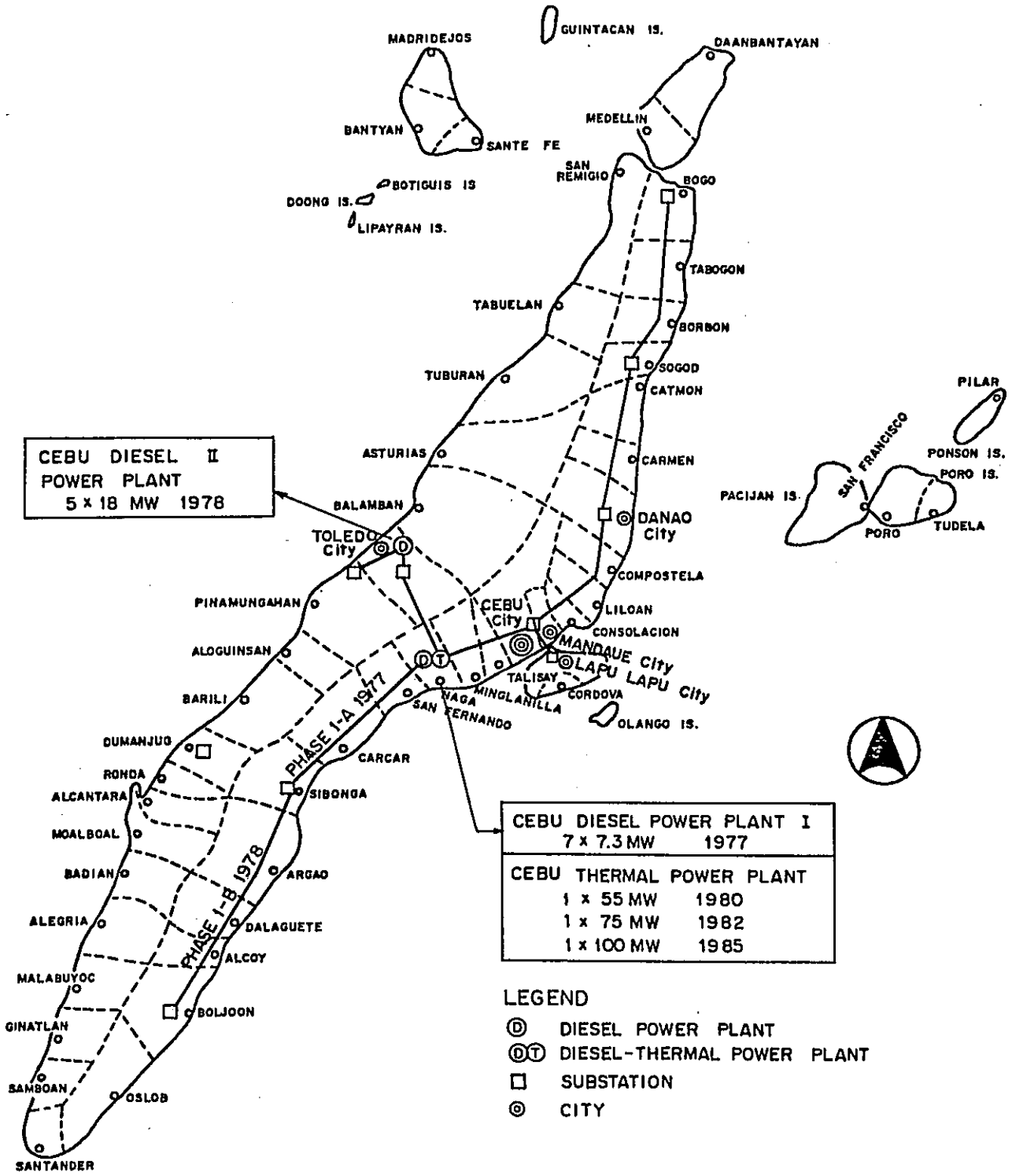


Fig. 1 - 3 CEBU Electric Power Plan

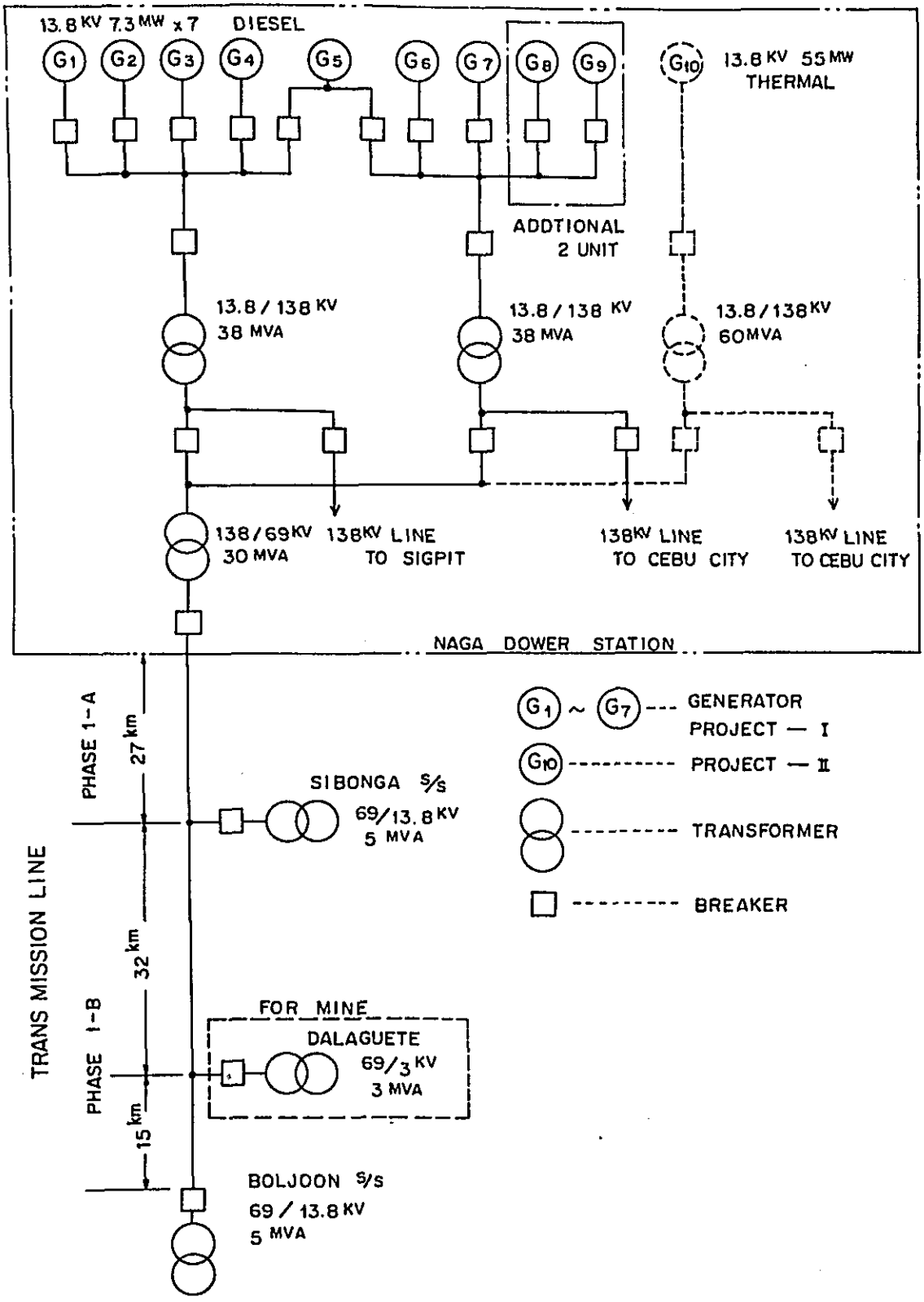


Fig. 1 - 4 One Line Diagram

regard to electrical installations, construction cost, maintenance cost and potential impact on neighboring residents.

As mentioned, power requirements for projected mineral exploitation aggregate 1,800 kW. In case the utility power transmission scheme and non-utility power generation scheme are projected on assumption that the capacity of a substation or transformer is set at 3 kV, 3,000 KVA (2,400 kW) including additional requirements in the future and a load of 300 kW for local use (presently about 150 kW in Dalaquete) plus some allowance, major equipment specified in Table 1-3 will be required. The following two methods can be considered on assumption that the power transmission system is adopted, but scheme B is considered less pertinent taking estimated power requirements into account.

A) Installation of power reception/transformation unit and reception of power through a branch line off main transmission line between Naga and Boljoon

B) Reception of power through transmission line connected directly to Sibonga or Boljoon substation without installing a receiving/transforming unit

Table 1-3 Major equipment for the utility power transmission and non-utility power generation schemes

	Equipment	Remarks
Transmission	Receiving breaker	72 kV, 1,200A, 20 kA, 1 unit
	High-tension load transformer	69/3 kV, 3,000 KVA, 1 unit
	Low-tension load transformer	3/0.44 kV, 1,500 KVA, 1 unit
	Emergency generator	440V, 300 KVA (360 PS) 1 unit
Generation	Main generator	3 kV, 1,000 KVA (1,200 PS) 1 unit
	Low-tension load transformer	3/0.44 kV, 1,500 KVA, 1 unit
	Emergency generator	440V, 300 KVA (360 PS), 1 unit

Table 1-4 compares the advantages of the power transmission and

the generation schemes with regard to reliability of power supply, requirements for load increase, potential impact on neighboring residents, other than initial and running costs.

Table 1-4 Comparison of power transmission with private generation

	Transmission	Generation
Initial cost	$790,000	$1,290,000
Running cost	$46,400/month	$48,200/month
Time of operation	As per NPC schedule	Private schedule
Reliability	Relatively low	High
Load increase	Easy	Difficult
Local power supply	Easy	Difficult
Noise	Low	High
Impact of markup in fuel price	Indirect	Direct
Industrial water supply	Unnecessary	Necessary
Communication facilities	Necessary	Unnecessary

As indicated in Table 1-4, the power transmission system costs less in the initial and the running costs (direct expenses). Besides, in the case of the non-utility power generation system, it is difficult and troublesome to secure and transport fuel and to provide routine maintenance to generators. Also, it involves fire hazard and increased maintenance cost on rotary machine year after year.

From the viewpoint of an impact on local residents, the power transmission system is more recommendable in respect of stable power supply and noise control. On the other hand, private generation scheme is more reliable in power supply. In the case of the transmission system, some means of communication will be required in the event power failure and other troubles occur between Naga Power Plant and the projected substation.

Nevertheless, phone communication is unfeasible at the present stage and the wireless is considered the most suitable means of communication.

We therefore conclude that the utility power transmission system, though to some extent influenced by work progress in Naga Plant, is more advantageous than the private power generation system.

1-5 Road and bridge survey

1-5-1 Background

The road and bridge improvement project is designed to facilitate the transport of materials and equipment employed for mineral exploitation at the projected dolomite mines.

The Project envisages to conduct survey on the national road between Cebu City and Alcoy and make plannings on the installation of access road which will connect existing roads in the vicinity of the projected mineral exploitation area with port facilities. It should be noted that in planning of the Project designed to promote the development of Alcoy and Dalaquete, study will be made on traffic safety measures for local residents.

1-5-2 Improvement of roads and bridges between Cebu City and Alcoy

Figure 1-5 shows main roads in Cebu Province, whereof, a total distance of road from Cebu City to the projected mining site is 90 km. The road extends north to south over a flat coastal area and is kept in a satisfactory condition in respect of width and pavement except a part of it. Contrarily, drainage such as gutters and traffic safety devices, such as roadsigns, guardrails, sidewalks, have been left unattended except those in Cebu City.

In Cebu City, traffic is considerably heavy and roads are from place to place congested with vehicles during the morning and evening rush hours. Even in the outskirts of Cebu City, daily traffic ranges about 5,000 to 6,500 vehicles, but in areas apart from Cebu City more than 60 km, daily vehicle traffic only ranges 100 to 500 and in Alcoy, Dalaquete, it counts about 100.

A total number of major bridges laid between Cebu City and Alcoy is 19 and most of them have been superannuated. Four bridges out of 19 have an effective width of only 4.0m and do not allow the facing traffic.

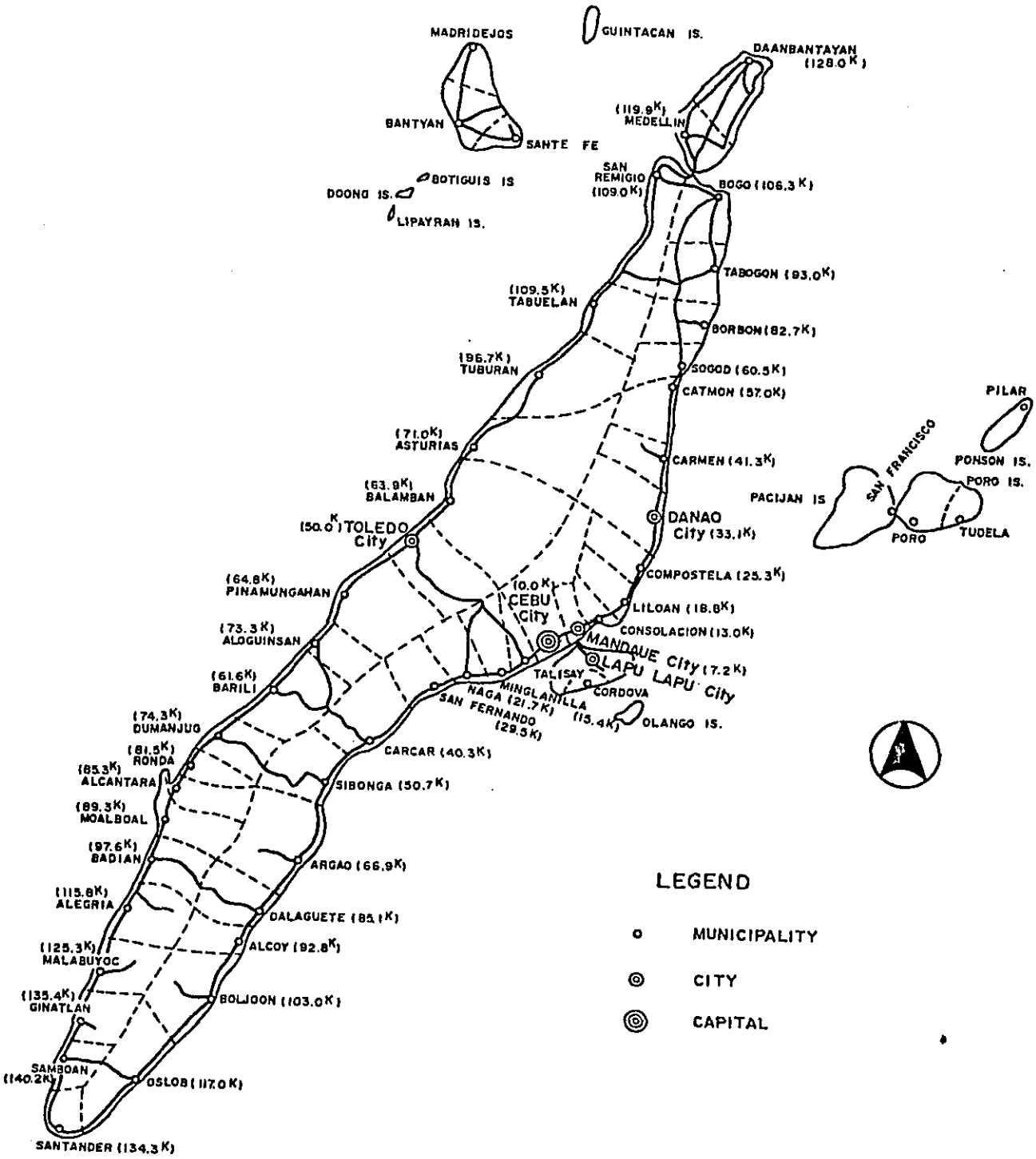


Fig. 1 – 5 Main Road Map

1-5-3 Road and bridge improvement scheme

It is expected that the national road between Cebu and Alcoy will be utilized for transport of dolomite mining machinery and equipment, but there is no prospect that it may cause traffic congestion. On the other hand, as proof load is limited to 15 tons (gross weight) for trucks and 27 tons for semi-trailors on public road and bridges, weighty equipment or machinery will have to be disassembled prior to delivery. It looks that several bridges have been superannuated, but judging from a fact that large buses loaded full with passengers are driving at high speeds, we conclude that these bridges will allow the passage of trucks and trailors loaded with cargoes within limit.

As it is clear from the above that transport of machinery and equipment will cause damage to public roads or bridges, nor does it cause environmental pollution to neighboring residents, the Road & Bridge Improvement Project envisages to install an access road for local use which links the national road with projected port facilities in the vicinity of proposed dolomite mines and provide guard rails and road signs and marks to ensure traffic safety for people in Alcoy and Dalaquete.

This access road will connect the entrace of an overbridge for local berth with the national road and be utilized by crew and local people between towns and port facilities. It also provides aid to check and maintenance of belt conveyors and port facilities.

The Project envisages to install roads with a width of 6.1m paved to a depth of 4.0cm with an osmotic surfacing process. Fig. 1-5 shows the access road project.

At present, between Alcoy and Dalaquete, there are two locations, STA 85km + 500 and STA 92km + 400, where traffic accident occurs frequently due to small plane radius of curvature and steep longitudinal slope which obstruct view. In fact,

major accidents occurred in the STA 92km + 400 location during the survey period (September 1977), causing a large number of casualties. Under the circumstances, the Project envisages to install, to ensure traffic safety, 4 road signs and a guard rail for a distance of 100m in these 2 locations.

Cebu City has a heavy traffic and its roads are from place to place congested with vehicles during morning and evening rush hours. Even in the outskirts of Cebu City, daily traffic soars as high as 5,000 to 6,000 cars, but in outlying areas more than 60km away from the city, traffic gets sparse to 100 to 500 vehicles per day. In Alcoy and Dalaquete, daily traffic of vehicles averages about 100.

1-6 Water resources survey

1-6-1 Background of water supply scheme

Survey was made into water resources in order to formulate plans for industrial and public water supply required for exploitation of dolomite.

In view of a fact that Pugalo in Alcoy, scheduled for a plant site, is far from the center of municipality and water service has not been provided, we think it much worthwhile to provide city water service to this area both for industrial and public use.

1-6-2 Present situation of water resources

This oblong coastal area (about 1km wide) consists of basin and lowland and flanked by shores and mountains.

Gorges are cut deep into the slope of mountains, but there is no steady flow of stream in these valleys.

Rainfall on these mountainous area causes temporary surface stream on the gorges only in the case of downpour. Rainwater, except the amount of evapotranspirations, permeates into the ground and contribute to the conservation of subsurface water.

Therefore, water source in this area mostly prevails as underground water as shown in Table 1-5 and available from springs and wells.

The distribution of springs is limited, but wells are scattered all over the municipalities, offering essential water resources in areas where no tap water service is provided.

However, as there are quite a number of wells which are malfunctioning or producing water of poor quality, many people go to wells in the distance for better water.

According to field inquiries on water intakes from various types of wells and tap water supplies, water consumption (less spring water) is at most 30 lit/person·day in areas where no tap water has been supplied, or about 100 lit/person·day in areas where city water service has been provided, illustrative of a fact that the convenience of water service stimulates its consumption.

Table 1-5 Underground water resources

Classification		Description	Uses
Natural spring water	in mountainous area	Fresh water, but available only in mountainous area far from service zone	City water supply in Dalaquete
	in coastal area	Close to service area, but often mixed with brine	Washing or bathing if brine is mixed
Well water		Scattered over coastal area, 30 to 40m above sea level Three different types of wells, i.e., electrically-pumped, hand-pumped and open wells (popular type) In some wells, water is salified due to specific hydrological and geological factors	Drinking, cooking, washing and bathing, depending on the quality of water In Alcoy, city water service is provided by electrically-pumped well water.

1-6-3 Estimated water consumption and supply facilities

The Project envisages to install the following water supply facilities within a framework of water resources in the surveyed area and estimated water consumption.

Table 1-6 and Figure 1-6 show respectively estimated water consumption and major equipment and facilities.

Table 1-6

Item	Details
Estimated consumption	For mines: $100m^3$/day For local supply: $100m^3$/day GT: $200m^3$/day
Equipment and facilities	Well (12" dia. and 60m deep), 1 unit Intake pump, soda hypochlorite injector, 1 unit each Water tank (concrete, 6mø x $5m^H$), 1 unit Piping (CCI pipe), 1,500m

Water intakes should be installed close to service area and at a site where ground water level is shallow and water is protected from salification and natural disaster.

Ground water lifted up by electric pumps is sterilized by injection of soda hypochlorite before it is stored in water tanks and piped into service areas.

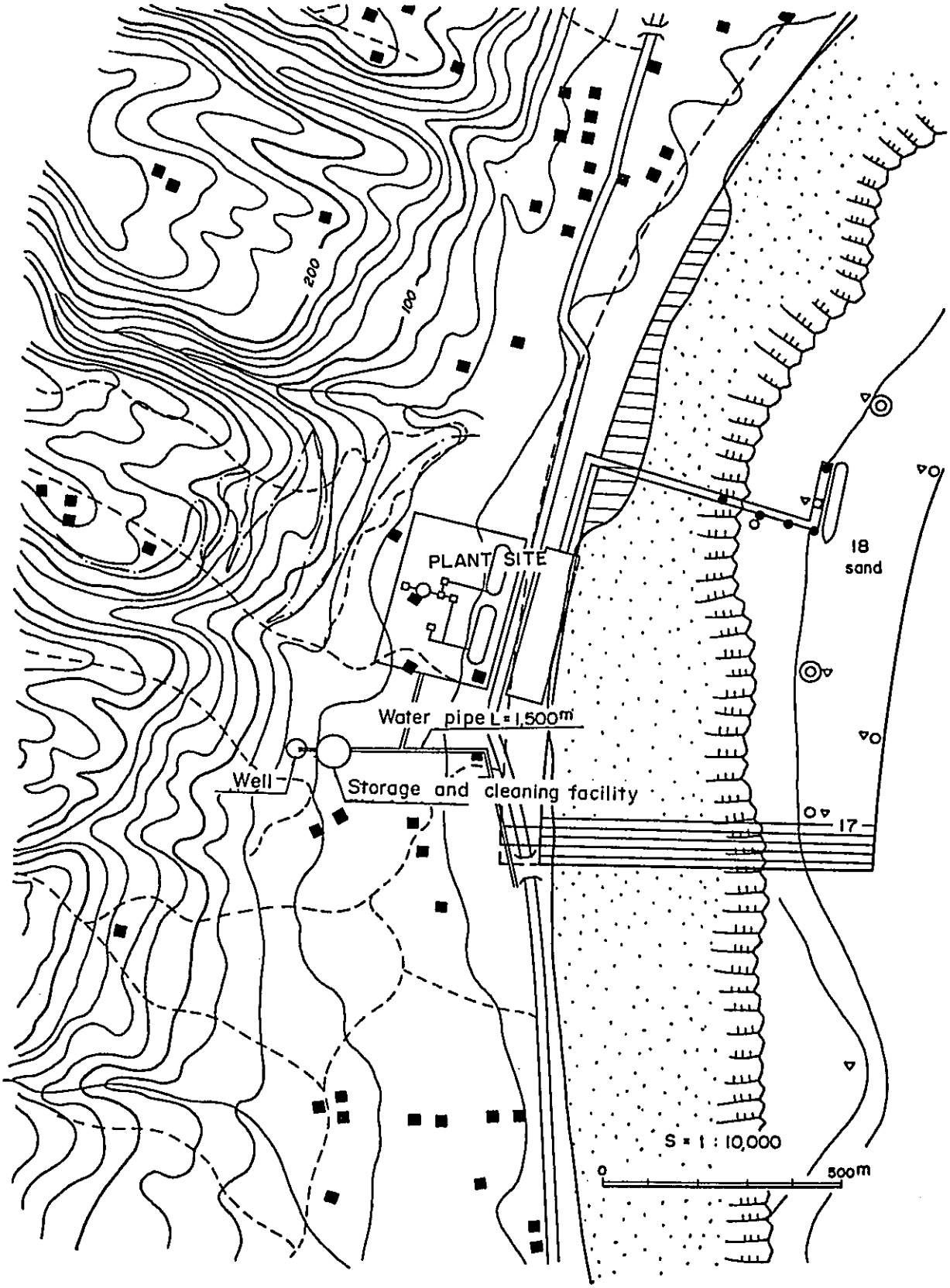


Fig. 1 - 6 Location Map of Water Supply Facilites

1-7 Other Infrastructures Survey

1-7-1 Background

Dalaquete and Alcoy, where the project will be undertaken, are inhabited with about 33,600 and 8,600 respectively. Most of villagers live on small-scale farming and the municipalities are not well equipped with urban functions or facilities.

Under the circumstances, efforts should be directed to introducing urban functions and facilities into Alcoy and Dalaquete as pre-conditions for improving local welfare and living conditions. Therefore, on the occasion of the mineral exploitation project, the infrastructure improvement scheme should be planned in proper recognition of the scale of local economy and need of economic improvement and of possibilities for agricultural development. The Project envisages to install the required facilities in sucy scale and quality as may cope with potential developments in local economy and increase of population in the coummunities. Studies will be conducted on the infrastructures including the progressive work execution schedule.

1-7-2 Present situation in Alcoy and Dalaquete

In Alcoy and Dalaquete, a majority of people live on agriculture and 70% of its land is occupied by farms and residential area and 30% by state-owned forests. They are raising corn, coconut and vegetables as major agricultural produce, but little rice in few limited areas.

As to employment by line of industries, agriculture represents 50%, fishery 15%, commerce 10% and others 15%.

Concerning social and educational institutes, both municipalities have sufficient number of primary and secondary schools in proportion to the population, but are backward in respect of general social facilities including traffic, social edducations, social welfare, medical facilities and parks, etc.

1-7-3 Designation and priority of other infrastructures

By successful introduction of urban functions, i.e., residents, job opportunities, recreations, traffic and communications to localities, formation of harmonious, integrated community can be accelerated and healthy, nonhazardous, convenient, comfortable and cultural life can be guaranteed for the benefit of citizens. In consideration of these factors, infrastructures can be designated as follows:

Traffic facilities: Bus and truck terminals

Educational facilities: Nurseries, kindergartens, primary, junior-high and senior-high schools

Social educational institutes: Libraries, public halls and community centers

Medical facilities: Hospitals and clinics

Parks and greenbelts: Juvenile parks and athletic fields

The priority of construction or improvement shall be assigned to community service facilities in consideration of the following points.

1. Presence of demand by citizens
2. Urgent needs for improvement or construction
3. Harmony with existing facilities in the community
4. Proportional facilities to the economic scale of the co-munity
5. Prospect for financial resources and specific requirements in management of facilities
6. Relationship with the mineral exploitation project and with local requirements
7. Prospect for citizens' or mining workers' future utilization

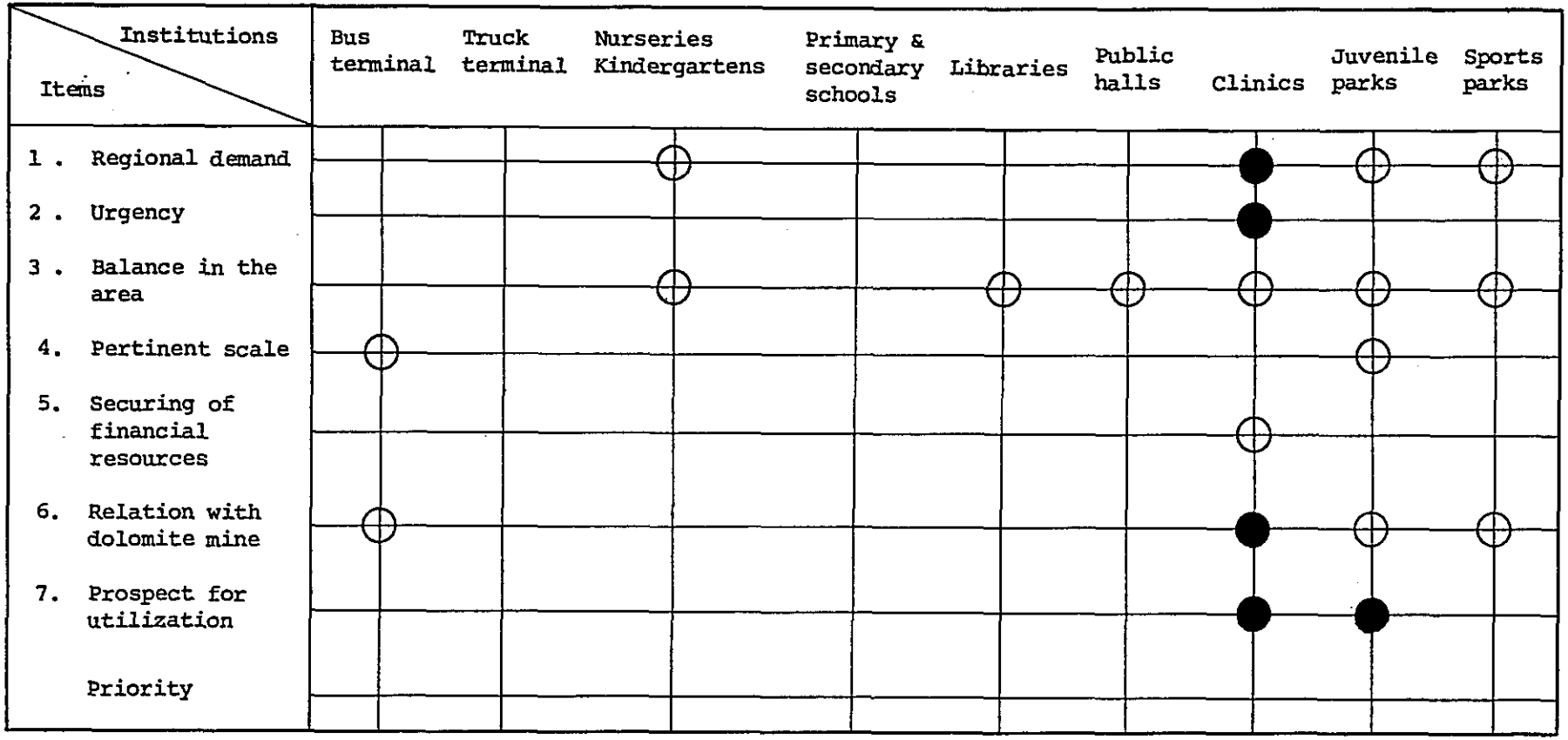
Table 1-7 shows relative results.

According to the matrix analysis, clinic has the first priority, followed by juvenile park.

Medical facilities: There are five doctors in Dalaquete, or a doctor for every 6,700 people, whereas there is only one doctor in Alcoy inhabited by 8,600 people.

These municipalities are extremely backward in respect of medical service and immediate steps should be taken to improve medical

Table I-7 MATRIX SYSTEM on priority of improvement/maintenance



services because population is expected to take upward turn following an increase in the number of mining workers engaged in the mineral exploitation project, and in particular, to meet the basic requirements of living - protection of life and health of citizens.

Juvenile parks: In Alcoy and Dalaquete, children and boys are playing in unoccupied campuses, green belts and roads free of heavy traffic, which are not always the haven for them.

Under the circumstances, it is necessary to offer safe playgrounds to children and boys and community squares or similar places to citizens as a whole, where they can rest themselves or get together with neighbors, as a post-medical program.

Figure 1-10 is a schematic view of a clinic.

1-8 Cost and term of construction

1-8-1 Construction cost

Table 1-8 shows total construction cost to be incurred on the improvement of infrastructures related to the mineral exploitation project on the Cebu of the Republic of the Philippines.

Table 1-8 Construction cost breakdown

	Port	Power supply	Road/ bridge	Water service	Medical facilities	Total
Foreign currency	210,000	547,500	-	22,600	11,300	791,400
Local currency	583,000	242,500	14,700	108,400	48,600	997,200
Total	793,000	790,000	14,700	131,000	59,900	1,788,600

In general, import duty is assessed on the cif value of imported construction equipment and materials (steel tubes and pipes, transformer, intake pump, medical equipment, etc.), but it has been deleted from cost estimation.

The estimation was based on the monthly average exchange rate prevailing in September 1977, field survey term, as follows.

$1 = ¥265 $1 = 7.24 pesos

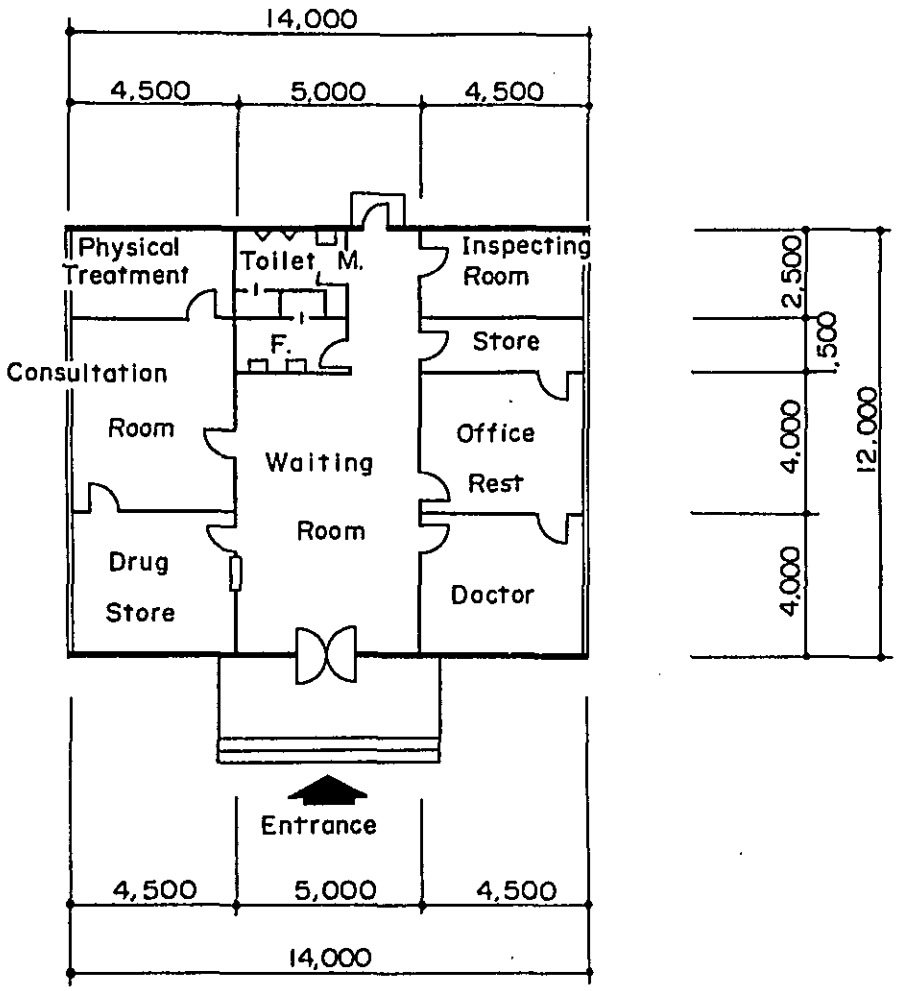


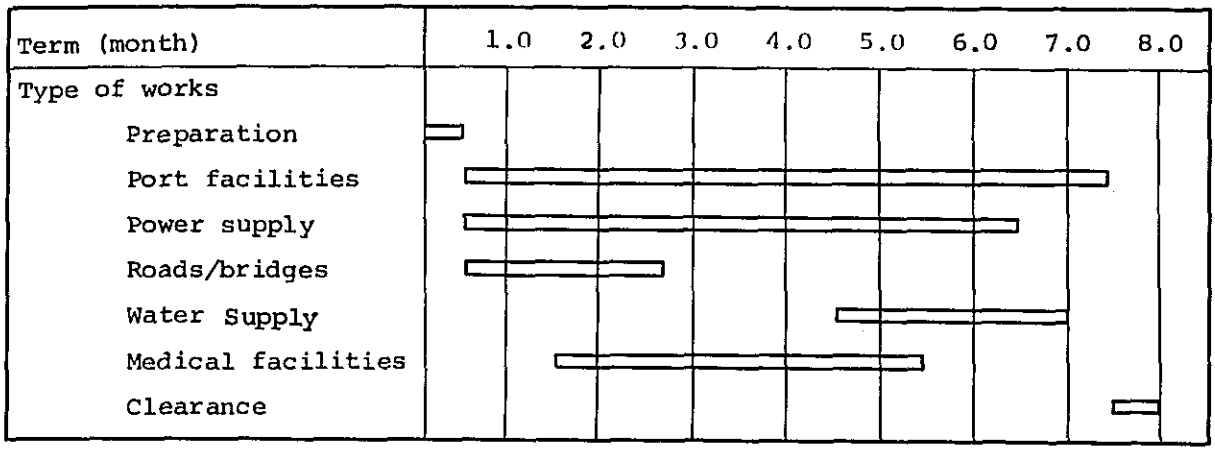
Fig. 1 - 7 THE PLAN FOR CLINIC

Scale 1 : 200

Area 168 M^2

1-8-2 Construction terms

Table 1-9 Work schedule



1-9 Assessment of socioeconomic impact

1-9-1 Assessment of effect on national economy

In order to mine dolomite in Alcoy and Dalaquete and ship it to Japan, two schemes have been proposed - Scheme A in favor of constructing a new port for loading and shipment of dolomite adjacent to the mining area and Scheme B which envisages to utilize present Cebu Port with overland transport of dolomite from the projected mine by truck.

These two alternative proposals are compared from a viewpoint of their impacts on the national economy.

The construction of a new port (Scheme A) costs $1,788,600, whereas total cost on overland transport for 20 years (Scheme B) aggregates $239,076,186, with annual savings amounting to huge $11,864,379 in favor of Scheme A.

Port construction cost and annual savings resulting therefrom are compared and the potential impact of port construction on the national economy was assessed on assumption that the project will continue for 20 years.

Table 1-10 shows results, which indicates that Proposal A is far more advantageous in respect of capital turnover ratio, expenditures-savings ratio and investment returns.

Table 1-10 National economic impact

Item	Amount ($)	Remarks	
Investments in infrastructures resulting from the construction of a new port	1,788,600		(A)
Annual benefits (savings)	11,864,379		(B)
Depreciation plan			
Service life		20 years	(C)
Cumulative depreciations	1,788,600		(D)
Annual depreciations	89,430		(E)
Annual expenses			
Discounts	125,202	0.07	(F)
Personnel expenses	4,500		(G)
Repair cost	5,000		(H)
Total annual expenses	134,702		(I)
Total annual expenditures	224,132	(E) + (I)	(J)
Surplus benefit (net cost savings)	11,640,247	(B) - (J)	(K)
Increase in national income	11,769,949	(F) + (G) + (K)	(L)
Capital turnover ratio	663.3%	(B) / (A)	(M)
Cost/benefit ratio	5,293.5%	(B) / (J)	(N)
Investment/income ratio	658.1%	(L) / (A)	(O)

1-9-2 Assessment of local socioeconomic impact

In case a new port is installed for shipment of dolomite, a pontential impact resulting therefrom on a local community is assessed from such viewpoints as indicated in Figure 1-11, but in this paragraph, studies are focussed on the impact of the infrastructures on the economic and social conditions of local community as follows.

(1) Benefits on earnings

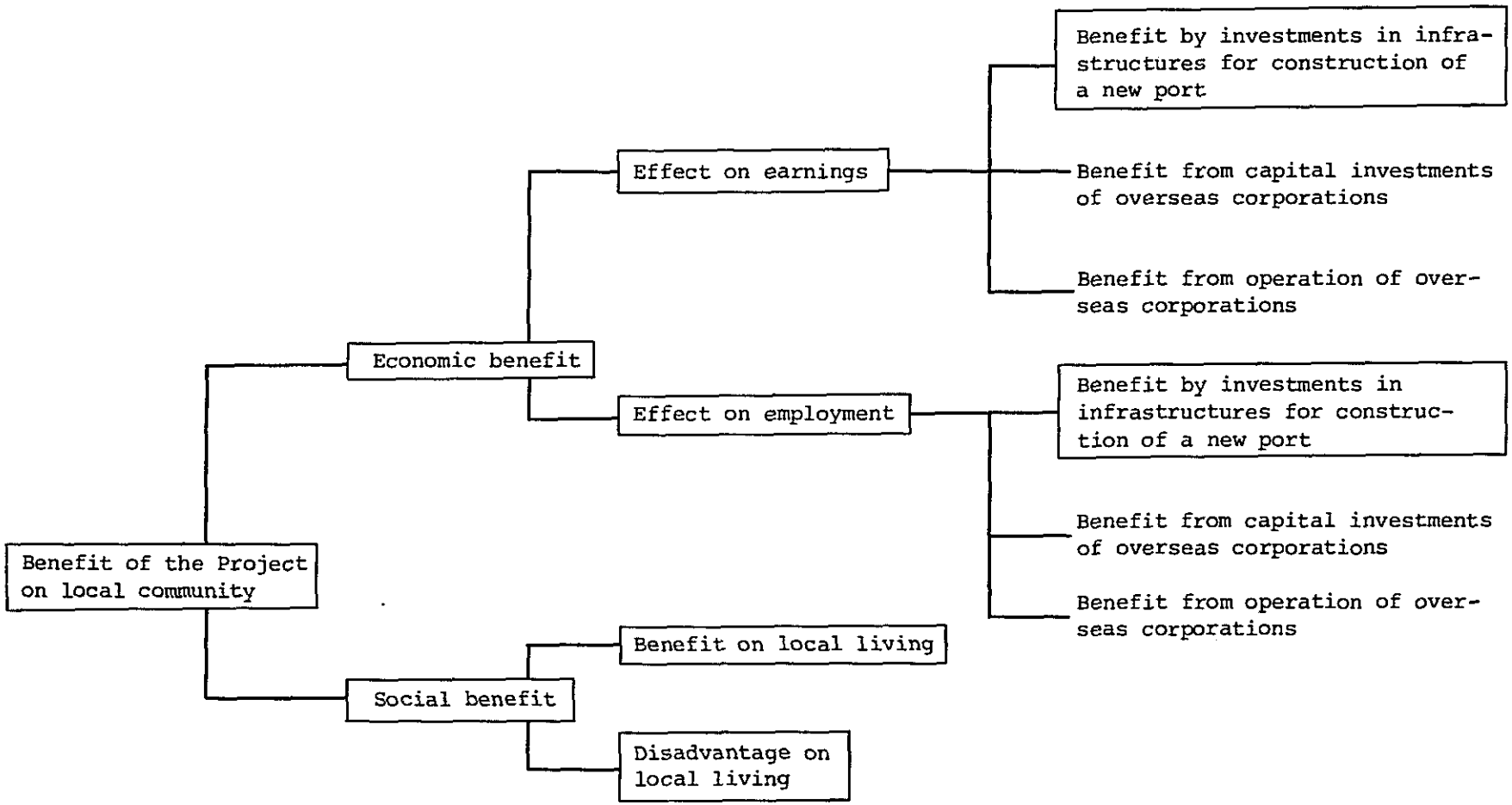
The effect of investment infrastructures for port construction is mostly produced in the following regions.

(1) Alcoy and Dalaquete

(2) Cebu City and Manila

(3) Overseas, mainly in Japan

Fig. 1-8 Impact of the project on local community



Here, total investments in infrastructures related to the execution of the Port Project are estimated as follows.

$791,400 in foreign currency

$997,200 in local currency

Total $1,788,600

Cost of material locally procured in the Philippines, equipment operating expenses, labor cost and others total $997,200.

Direct earnings resulting therefrom produce positive chain reactions on other sectors. Multiplying such earnings by a 3 to 4 normal multiplier on income expansion, we estimate that the effective demand of $3,000,000 to $4,000,000 will be produced in the Philippines directly or indirectly by investments in infrastructures placed for the construction of a new port for shipment of dolomite.

Of the above effective demand produced by the investment, it is difficult to estimate the ratio of demand produced in regions of Alcoy and Dalaquete, Cebu City and Manila, but by a rough estimation, the former assumes 10% of total effective demand and the latter 90%.

Therefore, direct and indirect effective demand produced in favor of Alcoy and Dalaquete aggregates $300,000 to $400,000.

Estimating the annual treasury revenue of Alcoy and Dalaquete as $600,000, we may conclude that this project will definitely exert substantially favorable impact on the local economy.

(2) Effect on employment

The total manpower required for each type of work performed for the infrastructure improvement project are about 230 persons, of which, 160 laborers will be hired from Alcoy and Dalaquete and 70 skilled workers from Cebu and Manila.

At present, Alcoy and Dalaquete operate nominal industrial activities if any, with 70% of workers being engaged in agriculture and 20 to 30% expatriating to Cebu City as casual workers. Under such labor condition in these municipalities, creation of job opportunities for as many as 154 workers will exert a major impact on local economy. (Including those hired by foreign corporations entering

into the project, total employment of 300 to 400 will be created during the construction stage of infrastructures and 160 during routine operation on a permanent basis.)

(3) Local benefits

It is expected that the improvement of infrastructures related to the mineral exploitation project will produce following benefits for the living of citizens.

Construction of clinic for medical service to local people: At present, medical service is in extremely backward conditions in Alcoy and Dalaquete and patients will have to make a long trip to Cebu City in the case of critical illness.

It is not only energy and time consuming, but they can hardly afford such expenses. The head of Alcoy Municipality was also complaining to us about this matter. In case a clinic is built in these municipalities as a result of implementing the project, it will certainly bring forth a major benefit to the municipality where citizens will feel indebted.

Provided that surplus water and power can be offered to local people by an agreement, it will also make a major contribution toward promoting the public welfare of citizens.

Installation of local berth for citizens: Provided that local berth is installed for the use of citizens, they can purchase fresh fish from the Bohol and sell highland vegetables to the Island, and through expanding trade with the Bohol they have been aspiring to for years, will be able to enlarge the sphere of activities and raise their living standards.

Repatriation of casual workers: As mentioned, Alcoy and Dalaquete municipalities are sending 20 to 30% of workers to Cebu and Manila cities as temporary workers. In this connection, we are convinced that the project allows some of them to come back to their home towns for job assignment, it will bring forth happiness to a large number of families.

(4) Social disadvantages

It is possible that following social nuisances will be created

by operation of the infrastructure improvement project, which is expected to exert a substantial impact on the economy of local communities, possibly, to an extent where social order may be disrupted. In other words, the project is likely to raise the prices of commodities and produce income gap between non-beneficiaries and beneficiaries of this project, whereby present social order will be disturbed and troubles will be caused to occur. Careful attention should be paid to this point when implementing this project.

Also, there prevails a persistent sense of rivalry between the peoples of Alcoy and Dalaquete. Therefore, careful attention should be paid in selection of sites for various facilities and in employment of workers so as to minimize racial friction and conflict.

CHAPTER 2 CONCLUSION AND RECOMMENDATION

Chapter 2 Conclusion and recommendation

2-1 Port facilities

Due to absence of efficient port facilities for use of local people in the neighborhood of Alcoy and Dalaquete, it is highly significant to install local berths in this area.

Especially, the master of Alcoy Muncipality has been anxious for completion of such port facilities as a means for improving local living standard by trading with the Bohol.

The utilization rate of berths serving the dolomite carrier and local vessels is much in favor of the latter, with the former comming alongside the berth 76 days a year for a single vessel and the latter 300 days a vear for 2 vessels, which will certainly provide substantial benefit to citizens. When total construction cost on port facilities under the dolomite exploitation project is classified according to the rate of utilization on the part of exploiters and local citizens, the cost on breasting dolphine, mooring dolphine, shiploader, belt conveyor foundations can be prorated between the two parties on a 50-50 basis in terms of benefit enjoyed, with overbridges entirely serving the convenience of local citizens.

As specified in the following table 2-1, about 65% of total construction cost goes to the benefit of local citizens.

Table 2-1 Proration of Port Facilities Construction Cost

	For local use	For dolomite loading
dolphine	143.2	143.2
Shiploader foundation	62.2	62.2
Mooring dolphine	45.75	45.75
Belt conveyor foundation	25.45	25.45
Overbridge	227.7	-
Navigation aids	-	2.1
Total	504.30	278.70

2-2 Power supply facilities

Power can be supplied in two different ways - 1) by utility transmission lines from Naga Power Plant and 2) by non-utility power generation. Of them, power transmission scheme is more recommendable in terms of initial and running cost and providing stable power supply to local households.

In view of a fact, however, that it is possible that Naga Power Plant cannot complete the installation of the transmission line by 1980 when the mineral exploitation project is due to start, we deem it necessary to complete the construction of the transmission line by 1980 through financial aid granted National Power Corporation as prepayment of utility charges and recommend that the power transmission scheme should be adopted for the project. As power has been supplied in Dalaquete Municipality for 12 hours during the night, local people are aware of the convenience of electricity and, therefore, many people in Dalaquete and Alcoy municipalities have been much anxious for round-the-clock power service which may be made available by the mineral exploitation project. Especially, as music is a favorite hobby for average Philippines, they can enjoy radio and stereo with ample power supply, which in turn provides many households with lights and enavles them to use electric iron, refrigerators, etc. Also, improved power service will offer substantial facilities for lighting and operation of photo reproduction machine and medical equipment in public institutions (schools, public offices and halls, churches and health centers, etc.) and contribute toward promotion of other industries. The projected substation will be provided with a capacity of 2,400kw to cover power requirements, whereof 1,800kw will be allocated the mineral exploitation project and the remaining 600kw to local use and others.

2-3 Improvement of Road and Bridges

The national roads linking Cebu with Alcoy (approx. 90km) are relatively well maintained and will be paved for the entire portion by 1980 by the Bureau of Public Highways. As to bridges, there

are four locations where facing traffic is unavailable on the 90km national road, but as it does not at all hinder the transportation of mineral exploitation machinery and equipment, we do not go as far as recommending the improvement of the national road between Cebu and Alcoy. Under the circumstances, the Project envisages to install road signs and guard rails on the national roads adjacent to the projected dolomite mines, access roads linking the national road with port facilities and in blind corners of roads where traffic accident is liable to occur in Alcoy and Dalaquete, pri-arily, for the purpose of saving citizens from traffic hazards. All these road facilities will be installed as local properties.

2-4 Water supply facilities

At present, Alcoy and Dalaquete muncipalities are equipped with water supply facilities only in the central area, but not in outlying downtowns. Pugalo in the neighborhood of the projected mineral exploitation site is located in a border between Alcoy and Dalaquete, but not equipped with tap water facilities. Therefore, residents go to springs and wells for water, but as water in some of these springs and wells is not clean, some of natives occasionally go to distant wells for water of better quality. Local water consumption averages 100 lit/day per person in areas equipped with tap water supply, or 20 to lit./day per person in Pugalo unequipped with city water supply. Under the circumstances, there is a rising demand for water supply facilities among citizens.

Following the installation of water supply facilities through exeuction of the Project, local people will be relieved of heavy labor of carrying water pails and environmental hygiene will be improved in Pugalo.

The water supply facilities will be provided with a capacity of $200m^3$/day, whereof $100m^3$/day will be allocated to dolomite exploitation and the remaining $100m^3$/day to local use in Pugalo (approx. 1,000 people).

2-5 Other Infrastructures

Other infrastructures include nurseries, kindergartens, libraries, public halls and parks. Above all, citizens badly need clinics and the village master of Alcoy is in particular emphasizing a need of improving medical facilities.

The clincis will be operated for treatment of mine workers and villagers and staffed with a physician/surgeon and two nurses on a full time basis. The clinic will be constructed of reinforced concrete and in part of bricks, with a total floor space of 168m^2.

2-6 Assessment of Socioeconomic Impact

The potential effect of the mineral exploitation project on the economy of local community, especially, with regard to improvements in income and employment, can be assessed as follows.

(1) *Income effect:*

Total effective demand produced directly and indirectly reaches high 300,000 to 400,000 dollar level in Alcoy and Dalaquete (Ann (Annual treasury revenue in these municipalities aggregate $600,000).

(2) Employment effect:

The Project will create job opportunities for about 150 workers, which is expected to offer substantial benefit to local people.

The Project also brings forth social benefits including the improvement of local living standard and public welfare through offering port facilities, power services, roads and clinics to local community. Another advantage is that creation of job opportunities in Alcoy and Dalaquete will enable expatriate workers to return home for local employment in home towns and provide many familites with happy renuion of all members.

On the other hand, we should bear in mind that the execution of the Project may possibly raise price of commodities in local communities and produce conflicts among beneficiaries and non-beneficiaries

of the Project. Careful attention should be paid to this regard in implementation of the Project. Provided that such social demerit or nuisance can be suppressed, we have every reason to believe that the Project will offer major advantage and benefit to residents in Alcoy and Dalaquete.

2-7 Others

On assumption that mineral exploitation starts in 1980, we recommend that the Project should go underway during 1978, including survey, engineering and construction.

CHAPTER 3 INTRODUCTION

Chapter 3 Introduction

3-1 Background of the Projects

The Island of Cebu is situated at N.L. 8-12° and E.L. 123-124°, stretching 220 km north to south and 36 km east to west. This oblong island is composed of 48 municipalities and 5 cities. The total population of the Cebu Island aggregates about 1.85 million (1975) and its center is Cebu City inhabited with about 420,000. The city is the second largest among all the cities in the Philippines.

In Dalaquete and Alcoy municipalities, about 90 km toward south of Cebu City, dolomite deposits were discovered in the course of surveying limestone deposit in 1973. This deposit has an estimated reserve of 234 million tons of dolomite with average magnesium oxide content of 18.6%. This ore deposit is large and produces high grade dolomite.

Total demand for dolomite in Japan amounts to 4.72 million tons which found its application to refractories, steelmaking and sheet glasses in 1975. About 80% of domestic dolomite production has been available from Kuzuu District, Tochigi Pref., but local production in sizable quantities to meet mounting demand is difficult inasmuch as local producing areas are for the most part in the inland regions where mineral deposits are maldistributed and transportation is limited. Under the circumstances, despite an outlook for increase in demand, about 2 to 3 million tons annually, for steelmaking due to reduction of fuel cost in operation of blast furnace with dolomite-fluxed pellets, it is difficult to hope for substantial increase in production locally. For this reason, hopes have been placed on reduction of cost through development of dolomite in the Island of Cebu. On the other hand, people in the Cebu, both public and private, are taking positive and forward-looking stance toward the advnace of new industry so as to industrialize agricultureal and fishing villages through development of dolomite on the basis of a concept that it will improve employment situation and infrastructure such as port facilities and equipment, thereby serving the best interests of local residents. With such situation as background, plan is underway to organize Japanese-Philippine joint

venture, Dolomite Mining Co., Ltd., which will ship the major part of 700,000 to 1,000,000 tons annually to Japan.

The present project is designed to conduct extensive survey on the potential improvement of facilities related to development of dolomite mines on the Cebu, i.e., shipping port and harbour, power supply facilities, road construction and maintenance, water supply, etc.

3-2 Objectives of Survey

The present project is designed to provide technical and economic studies on such infrastructures, i.e., port facilities, power supply, road, water supply, clinic, etc. as may be required for the operation of "Dolomite Development project on the Cebu" organized for mining dolomite deposits in Dalaquete and Alcoy districts, and also, to assess potential effect or advantage on local residents which constitute primary requirements for extension of financial loans and provide data for the banking operation and formulating plans for improvement and maintenance to be undertaken by the Japan International Cooperation Agency.

The survey covers the following scope of operations.

1) Port facilities: Plans to install berths for shipment of dolomite and for use of local residents in Dalaquete and Alcoy

2) Power supply: Public power transmission and private power generation; comparative studies

3) Improvement and maintenance of roads and bridges: Investigation of traffic situation on highways and bridges between Cebu City and Alcoy, and improvement and maintenance of roads and bridges in areas adjacent to Dalaquete and Alcoy

4) Water supply: Plans to install water supply facilities for industrial and public use in Dalaquete and Alcoy areas

5) Other infrastructures: Installation and expansion of clinics for local residents

6) Assessment of economic effect which may produce benefit to local residents

3-3 Field Survey Team

Particular points of the present survey is that prior application for approval needs to be filed with Government agencies of the Philippines because the investigation includes land survey, geological examination, and tide and current survey in Dalaquete and Alcoy. Another particular requirement is the employment of local workers. In consideration of these factors, we have selected three Japanese resident engineers in the Philippines who are familiar with local situation.

The Team was headed by Mr. Kono and staffed by 13 members, as follows:

	Name	Assignments	Employed by
Head	Hiromichi Kono	General	Mitsui Consultants Co., Ltd.
Members	Yoshikiyo Eto	Economic effect	I.P.L. Co., Ltd.
	Goichi Saeki	Power supply	Toyo Construction Co., Ltd.
	Michio Furusawa	"	"
	Senshi Ishibashi	Port facilities	Mitsui Consultants Co., Ltd.
	Tokio Yoshida	Road	"
	Koji Izumi	Water supply	"
	Takeyoshi Misumi	Other infra-structures	"
	Yasuhiko Arai	Tide and current	Sanyo Hydrographic Survey Co., Ltd.
	Yoshiaki Tahira	Cost Estimation	Toyo Construction, Co., Ltd., Manila Office
	Takao Watanabe	Soil Survey	"
	Makoto Miyoshi	Land & Hydro-graphic Survey	"
	Yoshifumi Kasahara	Coordination	Japan International Cooperation Agency

3-4 Method of Field Investigation

The present survey covers a diverse fields of data collection, interview, field survey including port facilities, power supply, road, water supply facilities and other infrastructures, and field observation including geological survey, sounding, coastal survey, and tide and current observation, etc. Under the circumstances, we organized individual teams with specific assignments to expedite work performance by division of labor. Data collection and interview were

conducted at the following public agencies and private undertakings:

Bureau of Mines:	Mines development plan
Cebu Provincial Governor:	Economic and social survey in the Cebu Island
Bureau of Public Highway:	Road construction and maintenance
Port Authority:	Improvement of Port facilities
National Power Corporation:	Power supply
Thermal power generation plant: (Naga)	Power supply and prices of equipment
Alcoy and Dalaquete municipalities:	Social and economic situation in Alcoy and Dalaquete
National Economic and Development Authority:	Social and economic situation in the Cebu Island
Bureau of Weather:	Meteorological observation data in the Cebu Island
Eastern Shipping Lines, Inc.:	Transportation
Express Car Charter Services, Inc.:	Transportation
Hi-speed Engineering Works:	Prices of equipment and materials
Silver Marketing Corporation:	Prices of equipment and materials
Bureau of Land:	Landownership and prices

Applications for Government permit and approval were filed with the following authorities:

Cebu Coast Guard:	Geological survey, land survey, tide and current survey

Field survey includes the following:

1) Port facilities

i) General

Data collection on the present situation of port facilities in the Cebu Island and consultations on the port improvement and maintenance plans

ii) Field survey

Investigation of port facilities in Alcoy and Dalaquete, especially on the structure and damage or breakage of the facilities

iii) Collection of weather observation data

iv) Geological survey

This survey includes sounding and geological survey of four

locations in depths of -3 to -12m by means of 15m x 8m large flat vessel, boring of coral at one location, collection of outer soil in 12 locations using Effmann barge, boring of seabed (-20m deep) in 4 locations into 4 to 5m into the soil using flat vessel for the purpose of checking the possibility of "anchoring" upon berthing or other operation of vessels.

v) Sounding

Sounding of 2km x 1km area with acoustic sounder for shallow waters at intervals of 20m

vi) Survey of coast line

Levelling of distance between the coast line and State highways along the coast line (2km)

viii) Tide and current survey

Tide and current survey in the area adjacent to proposed site for port and harbour for 15 consecutive days using ONO Current Tester (2 locations) and observation of sectional current velocity with the aid of CM2 Current Tester (11 points)

ix) Material and construction cost survey

2) Power supply

i) General

Power supply situation and developmental projects in the Cebu Island and utility charge survey (electricity)

ii) Construction of Naga thermal power plant

Naga power plant development plan, transmission project and construction of substations (data collection)

iii) Field survey

Power supply and consumption in Alcoy and Dalaquete

iv) Material and construction cost survey

3) Improvement of roads, highways and bridges

i) General survey on improvement of roads and bridges

Discussion of criteria and conditions for road and bridge improvement and maintenance plans and collection of data on the current conditions in the Cebu Island

ii) Field survey

Survey of road and bridge improvement and maintenance situa-

tion using existing topographical maps and data and investigation of conditions of rivers.

iii) Traffic survey

Survey of 12 hours' traffic volume in Talisay Town about 12km toward south of Cebu City

iv) Cost of material, equipment and construction

4) Water irrigation facilities survey

i) General

Investigation of water irrigation sources in Alcoy and Dalaquete and collection of data on natural and social conditions

ii) Field survey

Spouting conditions and water volume, utilization rate and structure of spring wells in Alcoy and Dalaquete, other water supply facilities and reservoirs

iii) Water analysis

Electrical resistance, Ph and temperature analysis of sampled water

iv) Material, equipment and construction cost

5) Other infrastructures

i) General

Investigation of natural, social and economic conditions in the Cebu Island, Alcoy and Dalaquete

ii) Field survey

Scale and distribution of public facilities, land utilization rate, prices and land ownership in Alcoy and Dalaquete

iii) Material, equipment and construction cost

3-5 Survey schedule

The Survey Team left Japan for the Cebu Island, Philippines, September 1, 1977 and stayed there during September 2 through October 11 for field survey.

CHAPTER 4 PRESENT SITUATION OF CEBU ISLAND

Chapter 4 General Situation in the Cebu Island

4-1 General

4-1-1 Location and area

As indicated in Figure 4-1, Cebu Province is a part of Central Visayas (Region VII). The Cebu Island, located at Lat. 8-12° N. and Long. 123-124° E., is a slender island stretching 220 km from south to north and 36 km from east to west. The Cebu Province is composed of 167 island and covers a total area of about 5,088 km^2, whereof the Cebu Island represents about 4,405 km^2. Other major islands include the Mactan and the Bantayan, with the former embracing an international airport and playing the role of a gateway of Cebu Province.

Cebu Province is composed of five cities including Cebu, Donao, Lapu Lapu, Mandaue and Toledo and 48 municipalities. The area of Cebu City, a hub of Cebu Province, totals 280.9 km^2. Balanban, the largest municipality, covers a total area of 377.0 km^2. (Fig.4-2)

4-1-2 Topography

The Cebu Island is a slender, mountainous island featured by anticlinal ridges of mountains 200 to 1,000 m above sea level extending south to north. The mountains are towering right close to the coast line, with flatland meagerly distributed along the estuary of rivers and the coast line, but more extensive plains are spread over area between Cebu City and Talisay in the center of the Cebu Island.

Reflecting such topography, rivers are short and steep and originate from the anticlinal ridges of mountains and form from place to place deep gorges and valleys before they empty into the sea in the east and west.

These rivers consist of three categories of streams, Perennial Stream, Seasonal Stream and Ephemeral Stream.

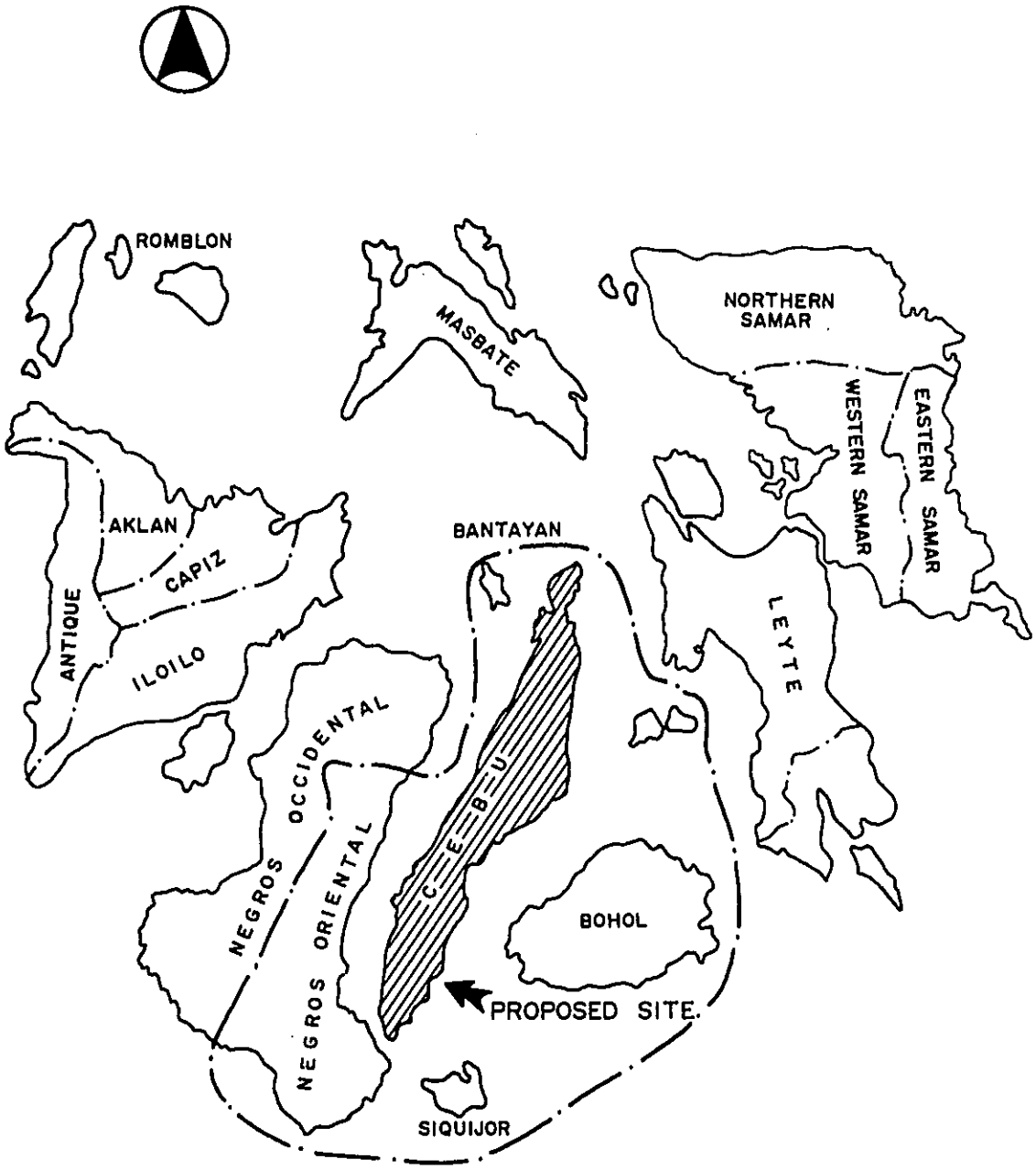


Fig. 4 - 1 Map of Central Visayas

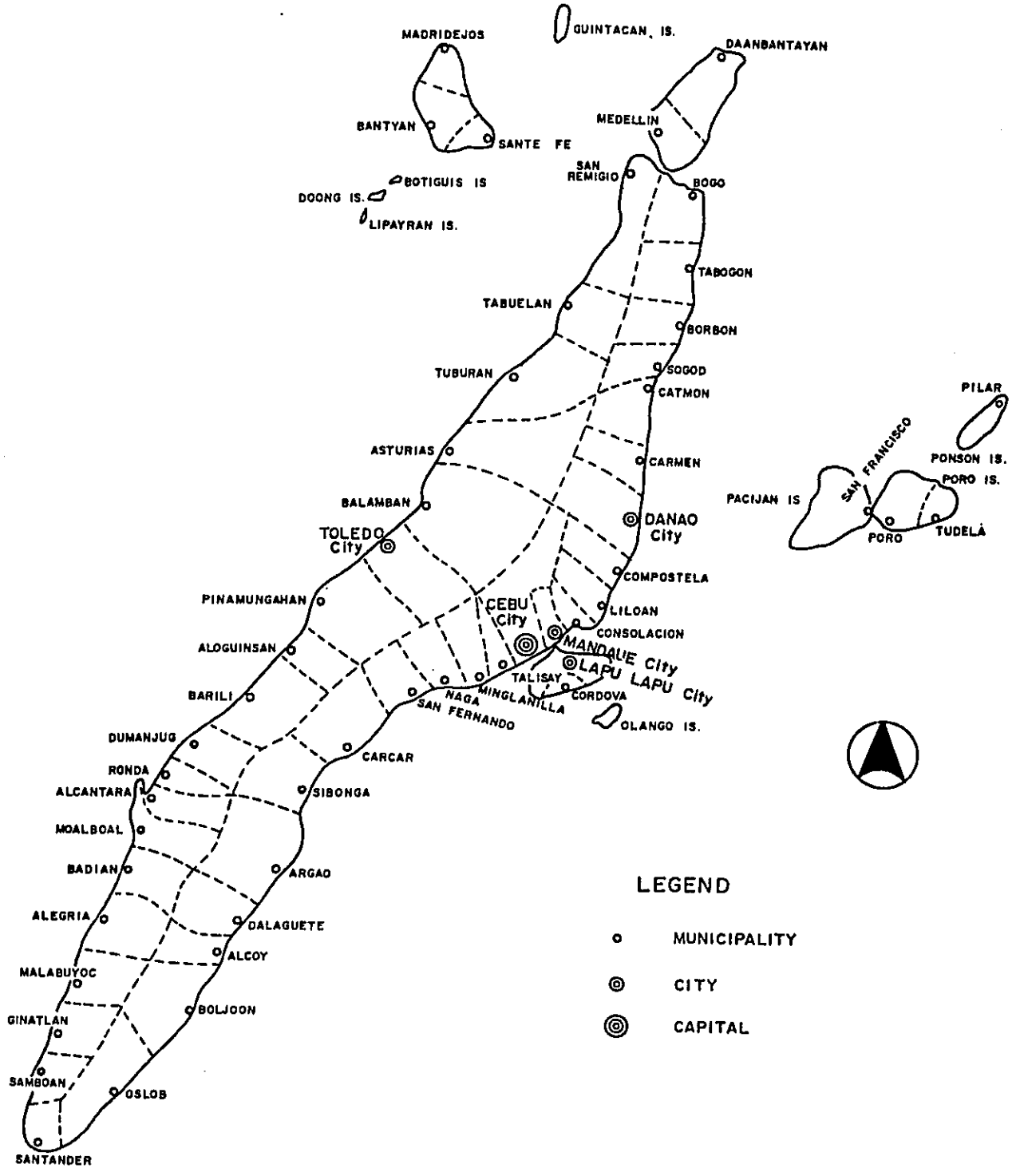


Fig. 4-2 Political Map

4-1-3 Climate and Weather

As indicated in Fig. 4-3, tropical monsoon (Am) and tropical continental (Aw) climates prevail in Cebu Province. As a whole, Cebu Province has little rainfall during February through April, but much during June through December.

Presently, Cebu Province operates 5 rainfall observatories, whereof Fig. 4-4 shows monthly average rainfall in Cebu City, Mantalongon-Dalaquete and Barili. Of these cities, Cebu City has an annual rainfall of about 1,600 mm, with average monthly rainfall devoid of major fluctuations as compared to two other cities. On the other hand, Mantalongon and Barili registered rainfall of about 2,200 mm and 1,850 mm, both of which have rainfall during November several times as much as in April, relatively dry season. Especially, in Barili, rainfall concentrates in November and December.

As shown in Table 4-1, a total number of rainy days are 192, 172 and 136 days respectively in Mantalongon, Cebu and Barili.

Judging from results in Table 4-1, Cebu City has little rainfall in proportion to the number of rainy days, but contrarily, Barili has much rainfall in proportion to the number of rainy days. Especially, Barili registered 300 mm rainfalls during 13 rainy days in November.

Table 4-1 Monthly Average Number of Rainy Days

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mantalongon	19	13	13	10	14	17	16	17	18	18	18	19
Cebu City	14	11	11	8	12	16	17	16	17	19	15	16
Barili	11	8	8	6	10	12	12	12	13	14	13	17

Cebu Province has steady temperature throughout the year, ranging 26 to 28°C, with average temperature earmarking 27°C. The Province has a high humidity of 75 to 85% throughout the year, with annual average reaching about 80%. During March and May, humidity averages 70% and is in proportion to rainfalls.

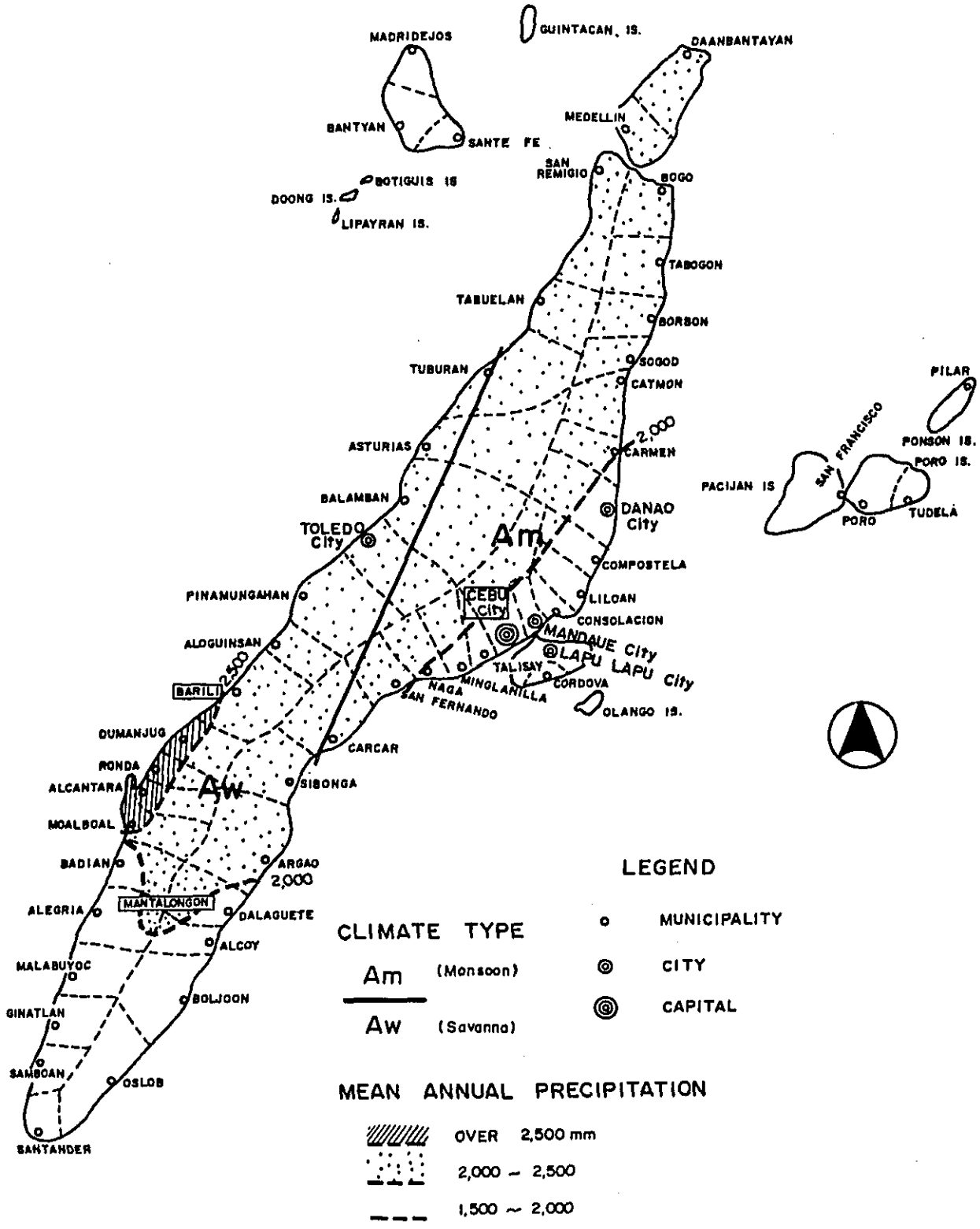


Fig. 4-3 Climate

Source : 1975 REGIONAL ECONOMIC ATLAS of the CENTRAL VISAYAS

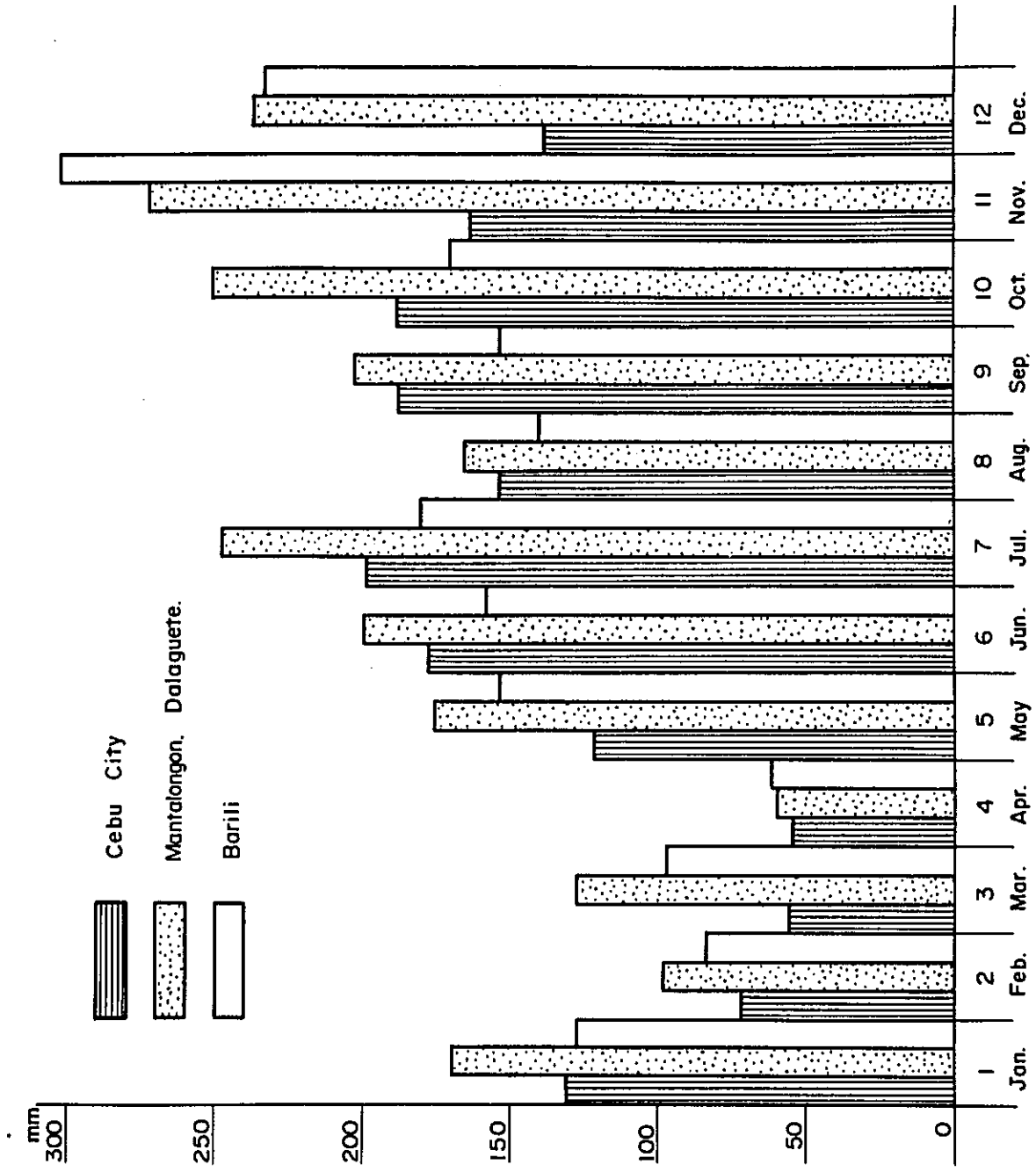


Fig. 4-4 Monthly Rain Fall

As to wind, Table 4-2 shows the monthly records of wind direction and velocity at the Mactan Island Airport, according to which, the vicinity of Cebu City is a mild climate zone with annual wind velocity averaging 1.8 m/sec.

As to wind direction, N.E. wind is predominant during January through May and November through December, with S.W. wind predominant during June through October.

Table 4-2 Monthly wind direction and velocity

Year / Month	1971		1972		1973		1974		1975		Average	
	Spd.	Dir.	Spd.	Dir.	Spd.	Dir.	Spd.	Dir.	Spd.	Dir.	Spd.	Dir.
Jan.	2.6	NE	2.0	NE	2.0	NE	2.6	NE	2.6	NE	2.4	NE
Feb.	2.6	NE	2.0	NE	2.6	NE	2.6	NE	2.1	NE	2.4	NE
Mar.	2.6	NE	2.6	NE	3.1	N	2.6	NE	2.1	NE	2.6	NE
Apr.	2.1	NE	2.1	NE	2.6	NE	2.6	NE	2.1	NE	2.3	NE
May	1.0	NE	1.5	E	2.1	NE	1.5	NE	1.5	NE	1.5	NE
Jun.	1.0	SW	1.5	SW	1.5	S	1.5	SW	1.5	NE	1.4	SW
Jul.	1.5	SW	2.6	SW	1.0	SW	1.5	SW	1.0	NE	1.5	SW
Aug.	1.5	SW	1.5	SW	1.5	SW	2.1	SW	2.1	SW	1.7	SW
Sep.	1.0	SW	1.0	SW	1.0	NE	1.5	E	1.0	NE	1.5	SW
Oct.	2.1	NE	1.0	NE	2.1	SW	1.5	SW	1.0	SW	1.5	SW
Nov.	1.0	NE	2.1	NE	2.1	NE	1.5	SW	2.1	NE	1.8	NE
Dec.	2.1	NE	2.1	NE	1.5	N	1.5	NE	1.0	NE	1.6	NE

Remarks: Figures represent average wind velocity (m/sec.)

Most of typhoons which hit the Philippines pass over the Luzon Island to the South Sea, but with a frequency of once for two years, some typhoons approach the Cebu Island via the Bohol Island and inflict major damages. Especially, a typhoon which hit the island in November 1968 recorded the maximum momentary wind velocity of 46 m/sec. and a rainfall of 560 mm per 24 hours.

In the Cebu Province, earthquakes with a magnitude of 4 to 5 has been recorded every year, but most of the earthquakes hitting Cebu City has an intensity of about 10 gal. Most destructive earthquake hit Cebu City January 1971 with an intensity equal to Mercalli scale VI (21 gal to 41 gal).

4-1-4 Population, race, language and religion

According to NCSO's 1975 census, total population of Cebu Province was 1,832,334 representing 4.36% of Philippines' total population. Annual rate of increase is 1.85%, which is below the national average earmarking 3.01% annually, which is attributable to the continued outflow of population outside the Province. Table 4-3 shows annual trend in population during a period of 1903 through 1970 in comparison between the Cebu and whole Philippines, according to which, the national population showed a 4.8-fold increase against 2.5-fold in the Cebu.

Table 4-3 Population increase (Cebu Province)

Year	Cebu	Philippines	Percent
1970	1,634,182	36,684,486	4.45
1960	1,332,847	27,087,685	4.92
1948	1,123,107	19,234,182	5.84
1939	1,068,078	16,003,303	6.67
1918	855,065	10,314,310	8.29
1903	653,727	7,635,426	8.56

Source: NCSO (National Census and Statistics Office)

Population in the Cebu Province is not evenly distributed. The population of Cebu City increased by more than 25% during the past decade to about 419,000 in 1975, which exceeds a total number of population in other four cities. (Fig.4-5)

Cebu City is followed by Toledo, Lapu Lapu, Danao and Talisay, all of which belong to Metro Cebu.

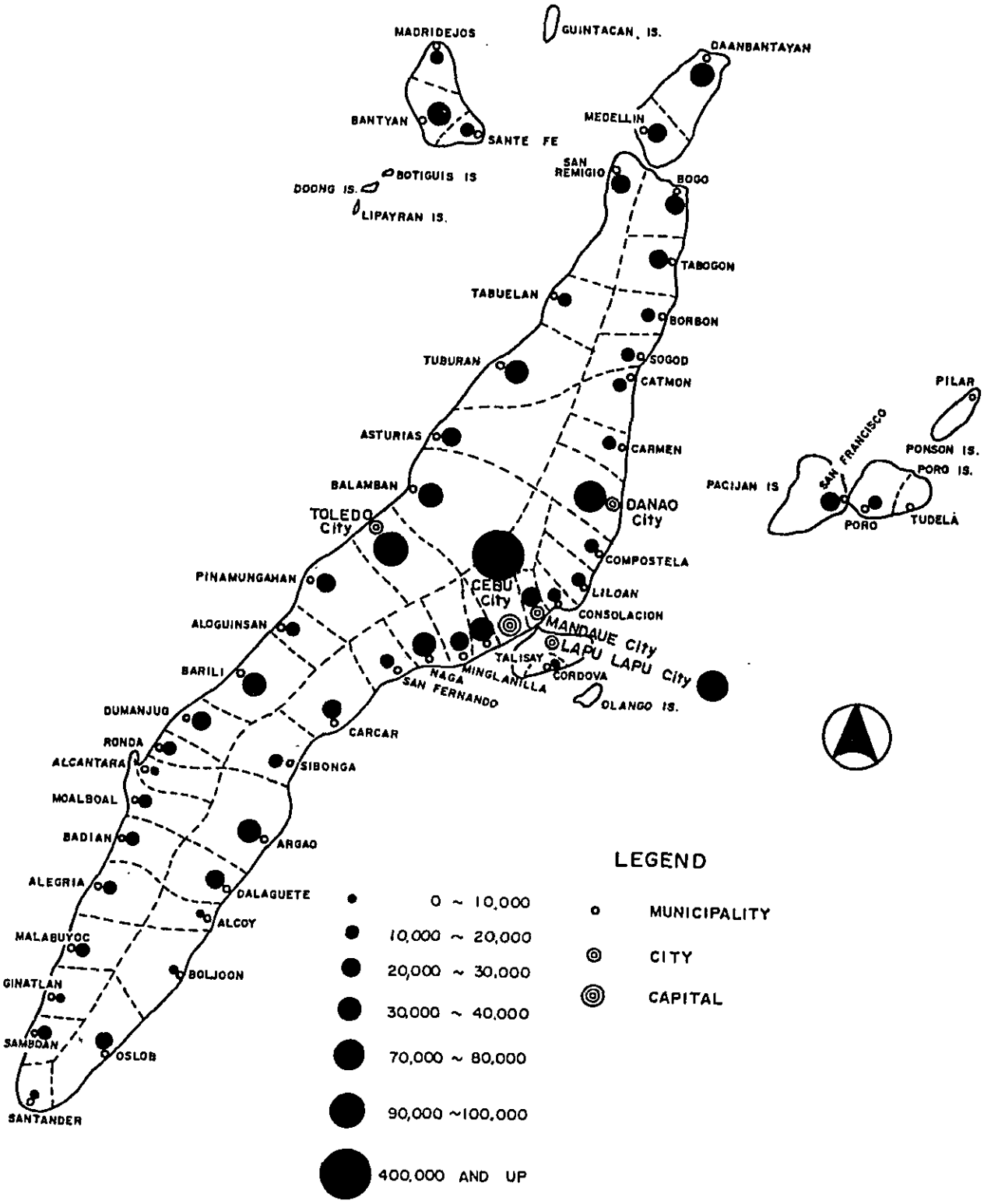


Fig. 4 – 5 Population Map

As compared to other provinces in the Central Visayas Region, Cebu Province is becoming fast urbanized and the rate of urban population accounts for 40.4% of total population in Cebu Province. In 1975, population density of Cebu Province stands at 321.2/km^2 and is higher than that of Central Visayas registering 202.8 persons/km^2. Population density is in excess of 600 persons/km^2 in Cebu, Mandane, Lapu Lapu cities, followed by Talisay, Bantayan and Pilar Municipalities with a population density of more than 500 persons/km^2.

The feature of population in the Cebu Island is that the youth accounts for a large proportion. In other words, people aged below 10 represent 29% and below 20 about 50%. Female accounts for 51% and male 49% in terms of overall population, but in the case of youth aged below 20, male represents 26% and female 24%. At present, racial mixture prevails among Malay, natives, Chinese and Spanish, most of whom are Catholic in Cebu Province.

People speak Visayas in Central Visayas, but most of them speak Tagalog, a common language of the Philippines and others who received higher education speak English.

4-2 History

The Philippines was colonized by Spain before early settlers were able to establish its own central Government. In 1521, a group of Spanish officers led by Ferdinand Magellan arrived at the Cebu and named the Island "the Philippines" after the name of Phillips II who was the heir to the King of Spain.

Later, in 1565, the Expedition Party led by Legaspi placed a colonial rulership in the Philippines. Prior to the arrival of the Spanish, the Cebu Island had been ruled by Rajah Humabon, a chief of the indigenous tribe, and the people on the Island had been engaged in active trade with neighboring countries including Borneo, Burma and China. Spanish colonialism gradually spread from the Cebu to other islands, with the center of her rulership being shifted to Luzon from the Cebu.

The fire was set to the revolutionary war in 1896, which blazed in 1889 as a conflict between the United States of America and Spain.

The Revolutionary Army cooperated with the U.S. troops, captured Manila and established the First Republic of the Philippines in 1889, but the United States of America, a victor of the U.S.-Spanish War, forced Spain to part with the Philippines in the 1899 Paris Peace Treaty and established its Government over the Philippines after it had defeated the Philippine revolutionary army.

In 1934, the Government of the United States of America declared that she would allow the complete independence from the United States within a decade therefrom, and in 1935, the Philippine Federal Government, a preliminary government for independence, was inaugurated and Mr. Quezon became the first President of the Philippines, which, however, had to wait until the end of the World War II before she became a real independent country under the presidency of Manuel Roxas.

The Cebu Province has recovered from the devastation of the World War II and soon became the center of economy, politics and culture in Visayas and Mindanao.

However, of late, areas around Cebu City came to be bothered, like other cities, with a number of problems including surplus population, vagabonds and outcasts, the slums, shortage of housing facilities, unemployment, etc.

4-3 Economy

4-3-1 Labor situation

Chronic conspicuous and latent unemployment features the Philippine labor situation. On the other hand, primary education has been widespread among the public, with much lower rate of illiteracy and higher ability of understanding as compared with peoples in other countries in Southeast Asia. The Philippines have ample aptitude for industrial workers. However, due to lack of sufficient experience and training, skilled workers have badly been needed.

The high rate of unemployment owes to the absence of active inflow of workers from nonindustrial to industrial area.

This phenomenon is attributable to the shortage of information concerning labor situation and on housing facilities, and difficulty of raising fund for relocation or transfer. Table 4-4 shows the transition of the rate of unemployment across the country. A greater number of people have been left unemployed in cities than in rural area.

Table 4-4 Transition of Unemployment Rate (Unit: 1,000)

	1971	1972	1973	1974
Total Manpower	13,220	14,200	13,886	15,204
Employed	12,584	13,217	13,262	14,479
Unemployed(%)	4.8%	6.9%	4.6%	4.8%
Cities Manpower	3,948	4,274	4,326	4,539
Employed (agriculture)	337	345	351	451
Employed (nonagri-culture)	3,254	3,400	3,630	3,754
Unemployed (%)	9.0%	12.4%	8.0%	7.7%
Villages Manpower	9,272	9,926	9,560	10,645
Employed (agriculture)	6,102	6,821	6,665	7,793
Employed (nonagri-culture)	2,890	2,652	2,616	2,480
Unemployed (%)	3.0%	4.6%	2.9%	3.5%

Source: National Census and Statistics Office

The unemployment rate in Cebu Province during 1970 is specified in Table 4-5, a slightly on the higher side as compared to national average.

Table 4-5 Unemployment in Cebu Province

	Items	1970
Cebu Province	Manpower	648,202
	Employed	593,856
	Unemployed	8.4%

Source: National Census and Statistics Office

The breakdown of the unemployment rate by male and female workers is 7.4% for the former and 11.8% for the latter, which means more female workers are left unemployed.

4-3-2 Earnings

The nominal labor wages of workers in the Philippines are rising about 10% annually, regardless of whether skilled or unskilled workers, but the prices of commodities are also on the substantial increase in the process of wage-price spirals. This inflationary trend has stalled or lowered the net earnings of industrial workers. According to the statistics of the Central Bank, consumer price index and net labor wages are following the trends shown in Table 4-6.

Table 4-6 Rise in national consumer prices and net labor earnings (with 1965 as a base year - 100%)

Year	Total	Foodstuff	Clothing	Rent	Utilities	Others	Skilled workers	Unskilled workers
1965	3.2	5.3	5.0	1.5	2.7	2.4	100.0	100.0
1966	4.8	6.1	5.8	2.1	3.0	8.6	99.6	101.8
1967	5.5	7.2	5.8	2.4	0.6	3.5	98.1	100.3
1968	2.2	1.6	3.5	3.7	-0.5	3.5	103.6	109.1
1969	1.3	1.1	2.5	1.2	1.2	1.6	106.9	112.0
1970	14.8	14.7	18.7	5.7	22.4	15.8	99.3	108.5
1971	21.8	29.3	17.5	4.9	19.7	10.7	91.3	101.3
1972	8.2	9.2	14.1	4.3	2.4	5.5	80.8	97.4
1973	12.2	13.0	20.4	5.2	10.7	8.8	82.8	90.4
1974	39.0	43.0	44.2	9.5	80.6	30.0	67.2	72.5
1975	7.4	4.7	14.4	2.3	9.9	16.0	64.5	78.5

At present, the minimum wages of unskilled workers in the Cebu Province is 9 pesos a day. According to the statistics of NEDA Central Visayas for 1976, hourly wages are as follows (See table 4-7).

Table 4-7 Labor wages in Cebu Province

Skilled crafts	
Carpenter	1.10 - 1.60 pesos/hr.
Driver	1.50 - 1.85 pesos/hr.
Electrician	2.00 - 2.10 pesos/hr.
Janitor	1.50 - 1.85 pesos/hr.
Mechanic	1.80 - 2.10 pesos/hr.
Unskilled crafts	
Laborer	1.10 - 1.30 pesos/hr.

In the case of employing workers throughout the year, however, bonus equivalent to a monthly salary and emergency allowance (110 pesos/month) as prescribed by the presidential decree should be paid to workers and, including overtime allowance averaging two hours daily, total minimum payments to a worker must aggregate about 5,250 pesos per year.

According to the 1971 statistics of NCSO (National Census & Statistic Office), annual income of citizens in Cebu Province amounts to sum specified in Table 4-8, which compares unfavorably with labor wages in table 4-7.

It is chiefly attributable to a fact that a greater number of people live on private, small-scale agriculture and fishery. According to table 4-8 (Income Distribution of Cebu Province), a majority of people in Cebu Province (79.2%) do not earn more than 1,500 pesos, with only 2% earning in excess of 5,000 pesos.

At present, the minimum wages of unskilled workers in the Cebu Province is 9 pesos a day. According to the statistics of NEDA Central Visayas for 1976, hourly wages are as follows (See table 4-7.).

Table 4-7 Labor wages in Cebu Province

Skilled crafts	
Carpenter	1.10 - 1.60 pesos/hr.
Driver	1.50 - 1.85 pesos/hr.
Electrician	2.00 - 2.10 pesos/hr.
Janitor	1.50 - 1.85 pesos/hr.
Mechanic	1.80 - 2.10 pesos/hr.
Unskilled crafts	
Laborer	1.10 - 1.30 pesos/hr.

In the case of employing workers throughout the year, however, bonus equivalent to a monthly salary and emergency allowance (110 pesos/month) as pr-scribed by the presidential decree should be paid to workers and, including overtime allowance averaging two hours daily, total minimum payments to a worker must aggregate about 5,250 pesos per year.

According to the 1971 statistics of NCSO (National Census & Statistic Office), annual income of citizens in Cebu Province amounts to sum specified in Table 4, which compares unfavorably with labor wages in table 4-7.

It is chiefly attributable to a fact that a greater number of people live on private, small-scale agriculture and fishery. According to table 4-8 (Income Distribution of Cebu Province), a majority of people in Cebu Province (79.2%) do not earn more than 1,500 pesos, with only 2% earning in excess of 5,000 pesos. However, workers in Cebu Province in Central Visayas enjoy higher earnings than average income of those in other provinces, which is likely attributable to thriving industrial activities in agriculture and mining in Cebu Province.

Also, in the Cebu Province, modern production system has been introduced for coconuts, one of major agricultural products, and earnings have been largely improved.

Table 4-8 Income distribution in Cebu Province

Income (P)	Percent
Under - 500	25.4
500 - 999	37.8
1,000 - 1,499	16.0
1,500 - 1,999	9.5
2,000 - 2,499	3.9
2,500 - 2,999	1.8
3,000 - 3,999	2.7
4,000 - 4,999	0.8
5,000 - 5,999	0.7
6,000 - 7,999	0.5
8,000 - 9,999	0.5
10,000 - Over	0.3

4-4 Industry

4-4-1 Mining

Cebu Province produces various mineral resources including gold, coal, limestone, dolomite, copper, etc.

According to the estimate of the Bureau of Mines, gold ore deposits aggregate about 177 million tons, coal about 23 million tons and copper 964 million tons as major mineral resources, followed by limestone deposits of 272 million tons.

Most of gold and silver are mined in Toledo City, including 70,000 ton/day of copper. The largest coal deposits are in Argao-Dalaquete municipalities, which represent about 60% of total national resources.

Figure 4-6 indicates the location of mineral resources.

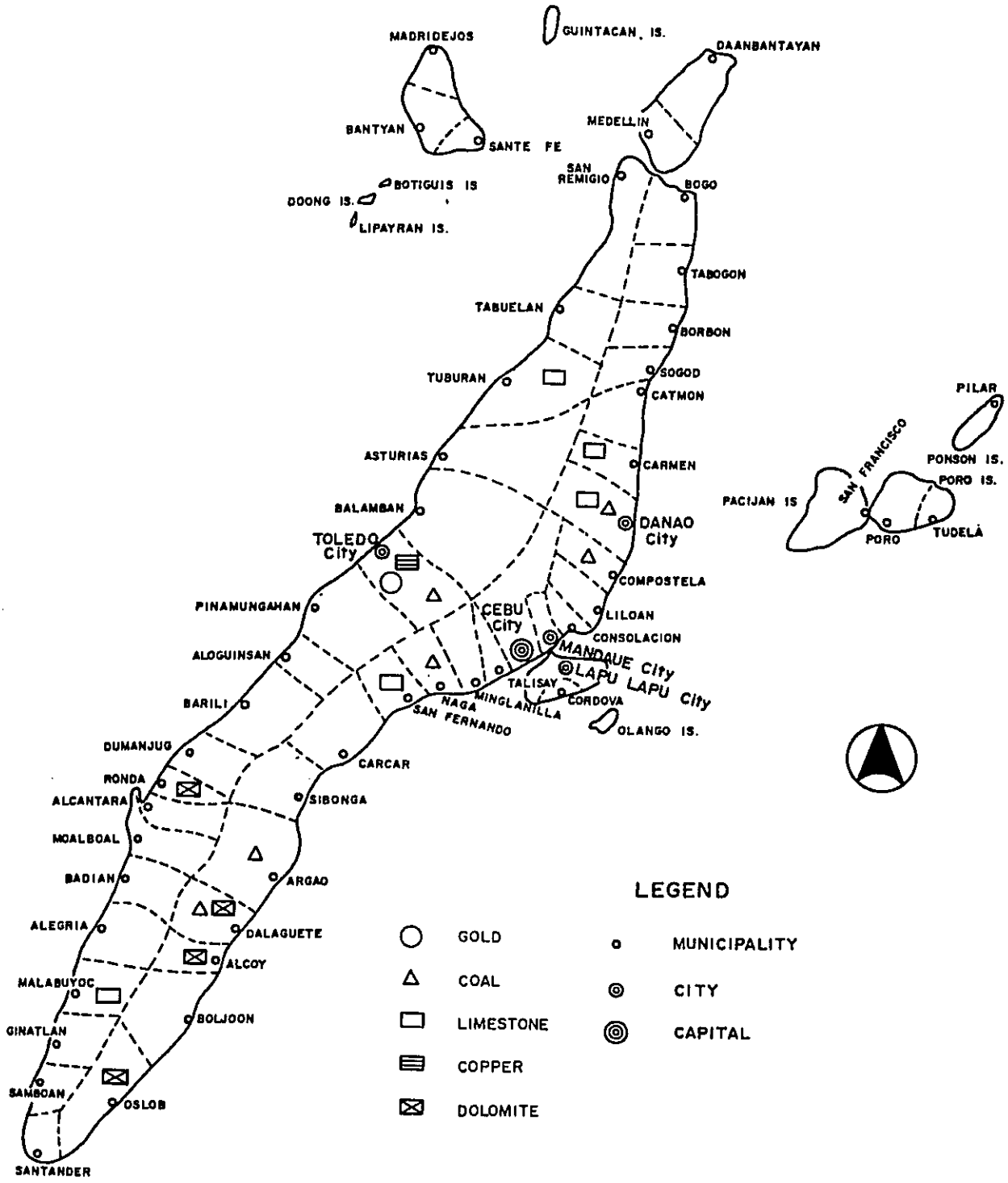


Fig. 4 - 6 Mineral Resources

4-4-2 Fishery

Cebu Province is surrounded with sea on all sides and abounds in fishery resources, especially in waters around the Bantayan Island, Tanon and Cebu Strait.

According to the report of Bureau of Fisheries, the 1970 catches of Cebu Province amounts to approximately 1,406 tons. Most of the catches are unloaded in Cebu City, Tolisay City and Daanbantayan and some in Alcoy, Dalaquete and Sibonga. Catches unloaded in Cebu, Talisay cities and Daanbantayan in 1970 are indicated in Table 4-9.

Table 4-9 Regional breakdown of unloadings

	Cebu City	Talisay City	Bantanyan
Tonnage	1,350 tons	35 tons	21 tons

On the other hand, Cebu Province operates fishing farms of 2,213 ha, with 1,582 ha run by the Government and 631 ha by private firms. These farms produced about 885 tons of fishes in 1970 and an expansion plan up to 7,930 ha is also underway. Figure 4-7 shows unloading ports.

4-4-3 Agriculture

Total farming area of Province of Cebu reaches about 153,920 ha and main crops are corn, coconut, rice, sugar cane, cigarettes, maguey, vegetables and fruits.

People in the Province live on corn (84%), rice (15%) and other food (1%). Present per-capita consumption of rice and corn are respectively 4.5 and 2.08 cavans, but crops are far below consumption in respect of both items.

(1) Corn

Total arable area of corn in the Province in 1972 aggregates 71,483 ha, with corn raised for the most part in Argao, Bogo, Tuburan, Tabuelan, Toleco and Boljoon.

Cebu Province has little plains and arable area is limited. Therefore, Cebu Province produces only one third as much as it needs for captive consumption, largely depending on other provinces for shortage. Little crops of corn owes to factors including

Fig. 4 – 7 Agriculture Map

limited arable area and conversion of rich corn fields to industrial or housing area in the neighborhood of Cebu City. Besides, some of extant corn fields employ outmoded cultural technique with lower productivity, according to sources.

Table 4-10 shows consumption, produce and shortage of corn during 1966 through 1973.

Table 4-10 Corn Consumption, Production and Shortage in Cebu Province

(Cavans)

Year	Consumption	Production	Shortage
1966 1967	3,350,170	1,536,639	1,813,531
1967 1968	3,415,180	1,710,150	1,705,010
1968 1969	3,280,727	826,800	2,453,927
1969 1970	3,541,149	963,114	2,578,035
1970 1971	3,420,644	943,603	2,407,041
1971 1972	3,760,818	907,887	2,852,931
1972 1973	3,852,596	1,339,864	2,513,532

Source: Bureau of Agricultural Economics, 1974.

2) Rice

Rice production only covers a half of consumption, too, but it does not pose serious social problem in view of the fact only 15 percent of total population live on rice.

Table 4-11 Rice Production, Consumption and Shortage in Cebu Province

(Cavans)

Year	Production	Consumption	Shortage
1966 1967	138,970	1,128,979	990,059
1967 1968	169,080	1,150,674	981,584
1968 1969	158,400	1,173,317	1,014,917
1969 1970	110,034	1,194,150	1,084,116
1970 1971	88,964	1,248,510	1,159,540
1971 1972	234,271	1,262,290	1,028,017
1972 1973	264,888	1,314,311	1,049,228

Source: Bureau of Agricultural Economics

3) Coconuts

Coconut is the agricultural product of second importance next to corn. The production of coconut shows a steady uptrend, with farming area enlarged to 53,800 ha in 1970 as compared to 35,700 ha in 1960.

Table 4-12 shows crops of copra for 8 months during January through August 1971. Lately, efforts are being made to improve the quality of coconut trees, making them shorter but more fruitful.

Table 4-12 Copra Production during January through August 1971

	Quantity	FOB $
Copra	9,500 L.T.	1,521,000
Dessicated coconut	166,699 bags	2,023,456
Coco Charcoal	2,053 M.T.	102,650
Coco Oil	84,499 L.T.	22,978,013
Copra Cope	27,150 L.T.	1,381,330

4) Sugar

Total arable area of sugar cane in 1970 aggregates 10,445 ha, with sugar production reaching 10,567 tons. The output is also increasing like coconut, with sugar plantation being concentrated in Bogo, Medellon and Danao City. In the Cebu Province, there is no corresponding increase in crops despite the use of modern tools in the case of raising sugar cane, due perhaps to absence in the effective utilization of these agricultural tools in large sugar plantations.

Table 4-13 shows developments in arable area and production of major crops during 1967 through 1971.

Table 4-13 Five Year Summary of the Production of Major Crops

Cebu Province

Crops \ Year	1967	1968	1969	1970	1971
Food crops:					
Rice					
Hectares	5,810	5,830	4,370	4,232	3,135
Cavans	138,970	169,080	158,400	110,034	88,964
Corn					
Hectares	215,160	215,750	121,400	158,040	142,788
Cavans	1,536,639	1,710,150	826,800	963,114	943,603
Vegetable					
Hectares	4,950	3,151	5,691	3,451	3,451
Tons	2,213	1,213	1,813	2,336	2,310
Fruit Trees and Nuts					
Hectares	2,482	3,534	2,243	1,850	4,626
Tons	21,308	9,175	4,234	16,065	9,276
Banana					
Hectares	3,850	3,960	3,600	1,210	1,210
Bunches	1,116,500	19,008,000	1,152,000	1,215,000	1,215,000
Commercial;					
Copra					
Hectares	46,420	49,500	49,510	49,000	53,800
Tons	30,637		26,671	30,625	30,886
Sugar					
Hectares	6,242	7,650	8,400	10,445	12,996
Tons	1,883		7,020	10,567	

See Fig. 4-7 for main producing area of corn and sugar cane.

4-4-4 Tourism

Cebu Province comprises Leyte and Bohol Islands and is the third well-known tourist spot in the Philippines.

As Spanish who came to the Philippines landed at Cebu for the first time, the Province has a number of historic relics, including the Cross of Ferdinand Magellan, Saint Augustin Church, Statue of Lup Lup on the Mactan Island, San Carlos University, one of the foremost in the Philippines.

In 1971, 5.5% of all the local tourists came to Cebu Province. The tourists include for the most part Philippines, Japanese and Americans. According to the 1975 statistics, local tourists were about 17,000 and overseas tourists were 21,000, with the latter slightly in excess of the former.

Table 4-14 shows the Cebu Tourist Inflow during January through March 1976 by nationality.

Table 4-14 Cebu Tourist Inflow (Jan. to Mar. 1976) by Nationality

Foreign	Japanese	3,103
	American	1,999
	Australians	167
	French	28
	Germans	226
	Canadians	20
	Spanish	26
	English	17
	Chinese	178
	Indonesians	9
	Koreans	64
	Other Nationality	64
Domestic		1,672

Source: Department of Tourism

4-5 Infrastructure

4-5-1 Education

The Republic of the Philippines gives top priority to the educational program in order to lower the rate of illiteracy. Therefore,

Province of Cebu shows high school enrollment rate among low graders. On the other hand, as Cebu Province is the center of economy, education and culture in Region VII, a total number of college students in Cebu Province accounts for as much as 75% of total in Region VII. Also, in Cebu City, there are three universities besides San Carlos which is one of the leading universities.

Table 4-15 shows total number of schools and students in Region VII, Negros Oriental Province, Cebu Province and Bohol Province.

Table 4-15 Total Number of Schools, Enrollment by Level and by Province in Region VII.

	Elementary		Secondary		Collegiate	
	Enrollment	No. of Schools	Enrollment	No. of Schools	Enrollment	No. of Schools
Philippines	6,802,873	23,284	1,518,042	3,262	667,876	697
Region VII	442,661	1,707	101,515	223	62,969	47
Negros Or.	125,055	470	17,030	39	5,878	11
Cebu	197,885	623	63,382	121	46,891	27
Bohol	119,721	814	21,103	63	10,180	9

Source: Department of Education

4-5-2 Medicare facilities

Province of Cebu has 25 hospitals which accommodate 1,800 beds and 92 health centers. As compared to other provinces in Region VII, medical facilities have been well equipped, but has a population of 900 per bed, which is lower than national average.

Table 4-16 Distribution of Hospitals, Bed Capacity and Health Centers in Region VII

Province	Hospitals	Bed Capacity	Health Centers
Negros Oriental	9	493	43
Cebu	25	1,800	92
Bohol	9	378	53

Source: Department of Health

4-5-3 Roads and bridges

According to the 1970 statistics of Bureau of Public Highways, Cebu Province has a total road length of about 1,975 km, representing about 30% of total in Region VII, which means that the Province has a population of 1,000 per 1.2 km road, which compares unfavorably to the national average of 1.7 km.

Cebu Province has about 14,700 motor vehicles or 72% of total vehicles registered in Region VII. The Province has about 110 inhabitants per vehicle, as unfavorably compared to the national average running up to about 75 per,

Table 4-17 Total Road Kilometerages and Motor Vehicles in Region VII (1970)

	Total Road (km)	Motor Vehicles
Philippines	72,979	488,800
Region	6,489	20,400
Negros Oriental	1,783	3,500
Cebu	1,975	14,700
Bohol	2,730	2,100

As indicated in Table 4-18, road pavement situation in Cebu Province is relatively satisfactory with regard to state highways, but local highways have been left under backward conditions, with most of them covered with macadam pavement.

Table 4-18 Existing Highway Kilometerage (Cebu Province 1970)

	National	Provincial/ cities/mun.
Earth	1.75	215
Macadom	287.26	1,093.54
Low Type Bituminous	44.40	40.28
High Type Bituminous	92.48	108.98
Concrete	69.89	21.49
Others	.28	-
Total	496.06	1,479.29

Cebu Province has a total length of bridge aggregating about 7 km, whereof coco timber bridges account for 24% of total national highways and 68% of total local highways. Most of coco timber bridges are old and badly damaged.

Table 4-19 Number of Existing Bridges
Cebu Province 1970 Bureau of Public Highways

Type	National		Provincial/Mun./Cities	
	No.	Length	No.	Length
Coco Timber	65	1,054.33	205	2,116.37
Bailey	27	802.36	21	518.08
Masonry	-	-	1	10.00
Steel	11	738.24	1	60.00
Concrete	95	1,806.67	25	396.29
Total	198	4,401.60	253	3,100.74

4-5-4 Port facilities

At present, Cebu Province has 7 national ports, 25 municipal ports and 11 other private marine facilities.

Of national and municipal ports, only Cebu, Danao and Toledo ports can be used for external trade. Most of other ports use cause ways and piers made of coco timber.

As indicated in Table 4-20, volume of external trade handled by Cebu Port, the largest in the Province, has been on the steady increase year after year.

Major imports includes machinery, electric appliances and fuel and exports coconuts and mineral ores.

Table 4-20 Import and export cargoes in Cebu Port

	Import	Export	Total
1975	110,758 tons	162,947 tons	273,705 tons
1976	94,157 tons	222,337 tons	316,494 tons

Source: BPW in Cebu

Figure 4-8 shows major transport network.

CEBU ISLAND

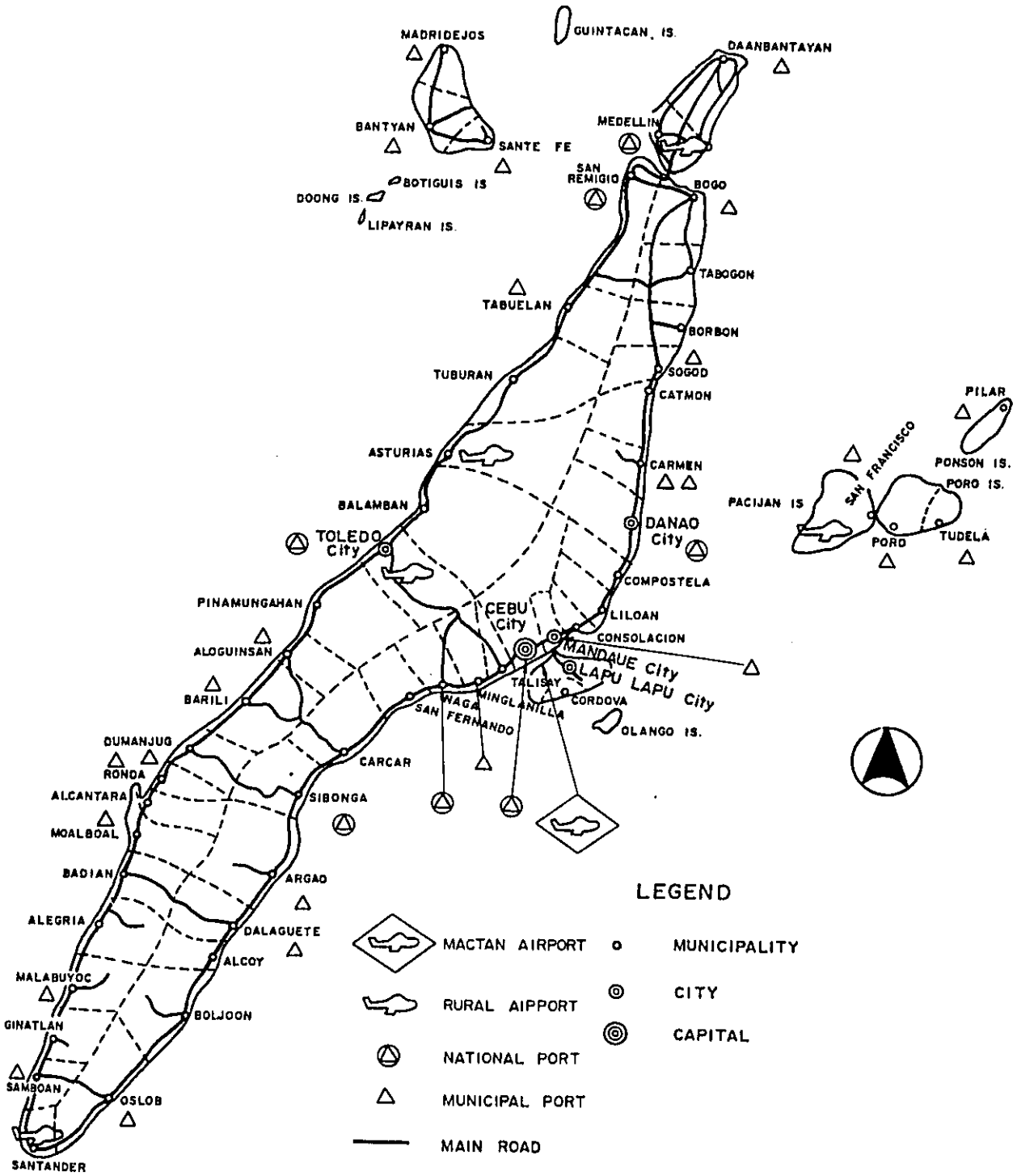


Fig. 4 – 8 Transport Network

4-5-5 Water supply facilities

Despite plentiful rainfall over tropical rainforests, water is in short supply in most of cities and municipalities in Cebu Province, which is attributable to outmoded plumbing equipment and facilities in urban areas including Cebu City.

As of 1970, Cebu Province has 70 water supply facilities, 828 deep-bored wells and 55 spring wells. Table 4-21 shows a total of number of people to whom water has been supplied from these facilities.

Table 4-21 Potable water supply (Cebu Province)

Number of water works system	70
Number of Artesian (deep-bored) wells	828
Number of springs	55
Population served by waterworks system	563,170
Population served by Artesian wells	202,500
Population served by springs	22,840

4-5-6 Power and communication

At present, of 48 major municipalities in Cebu Province, those which are receiving round-the-clock water supply are only 12. Water supply has been limited to a maximum of 12 hours daily for 25 municipalities and not provided any to the rest of 10 municipalities. Maximum power supply in Cebu Province does not exceed 122 MW, but plan is underway to expand capacity by about 200 MW in 1980.

The largest power supply organizations include VECO (Visayan Electric Company), Canao-Carmen-Compostela Complex and Atlas Mining Corporation. Most of other municipalities are getting power supply generated by small generators, which, however, is becoming uneconomical supply system due to spiralling cost of fuel in the recent years.

Under the circumstances, NPC (National Power Corporation) are proceeding with the construction of diesel and thermal power plants in Naga and Toledo as indicated in Table 4-22.

At Naga, 7 diesel power plants have almost been completed and

partial operation will be initiated in 1979 and overall operation subsequent to 1980 under the Phase I Program. It is expected the Phase II Construction Scheme may fall behind schedule.

Table 4-22 NPC Thermal Power Plant Construction Plan

	Capacity		Type of Power Generation	Year
Naga	7.3 MW x 7	51.1 MW	Diesel	1977
	55 MW x 1	55.0 MW	Thermal	1980
	75 MW x 1	75.0 MW	Thermal	1982
	100 MW x 1	100.0 MW	Thermal	1985
Toledo	18 MW x 5	90.0 MW	Diesel	1978

At present, Cebu Province issues 5 dailies and 2 weeklies, and operate 11 radio and 4 TV stations. Beside them, the Province is equipped with several telephone and telegraph offices.

4-6 General situation in Alcoy and Dalaquete

4-6-1 Location, topography and climate

Alcoy and Dalaquete municipalities border on Cebu City respectively 92.5 km and 85.1 km toward south and have areas of 57.28 km^2 and 135.4 km^2.

Alcoy and Dalaquete municipalities are located on the east of anticlinal mountains extending north to south and comprises area from the watershed of the mountains to coastline. Most of the municipalities are mountainous, dotted with gorges, river walls erroded with stream, coastal lowlands and steep slope opposite terrace.

In areas between rivers and in the neighborhood of upper streams close to watersheds of mountain, gentle slopes have been formed.

Rivers are short and steep, rising from anticlinal mountains and flowing east-southeast ward for about 10 km down to coastline. These are what we may describe as ephemeral streams where water flows only during rainy days. Of them, Tapon River in Dalaquete flow over a distance of 10 km and is a seasonal stream where water flows down during limited season.

Coastal lowlands and terraces, stretching along the coast for a distance of 0.5 to 1.5 km in the form of a strip, are of lime bedrock, either exposed or covered with a thin layer of uncoagulated soil. These lowlands and terraces are located along the boundary between the coastline and mountainous area and offers valuable plains for mountainous municipalities, utilized as the center of administration, economy, traffic while offering site for villages and agriculture.

In this district short of surface water, lowlands and terraces play an important role as sources of underground water. Alcoy and Dalaquete belong to Aw climate zone (tropical continental climate) and have a plenty of rainfalls depending on season, as compared to northern Cebu Province.

Alcoy and Dalaquete municipalities, however, comprise plains and high mountainous area up to 1,000 m above sea level, it has different climate in various localities.

For example, Mantalongon has annual rainfalls of about 2,200 mm and an average temperature of 21.8°C, cooler and more rainy than in coastal areas.

4-6-2 Population and industry

Fig. 4-9 shows the recent developments in Alcoy, Dalaquete, Cebu City and Province of Cebu.

Alcoy showed a steady developments in the number of population ranging 6,500 to 7,000, but gained a sizable increase in 1975 up to 8,600, a gain of 34% over 1903.

Contrarily, Dalaquete gained a steady increase since it had registered 21,000 in 1903, up to 34,000 in 1975 or a gain of 59%.

On the other hand, the population of Cebu City and Province of Cebu increased about 9- and 2.8-fold during 1903 through 1975, far ahead of Alcoy and Dalaquete, especially in Cebu City. Though Alcoy and Dalaquete show steady increase in population, judging from a fact that its rate of increase is lower than that of Cebu Province, it is probable that an increase has to a large degree been offset by the outflow of population to major cities,

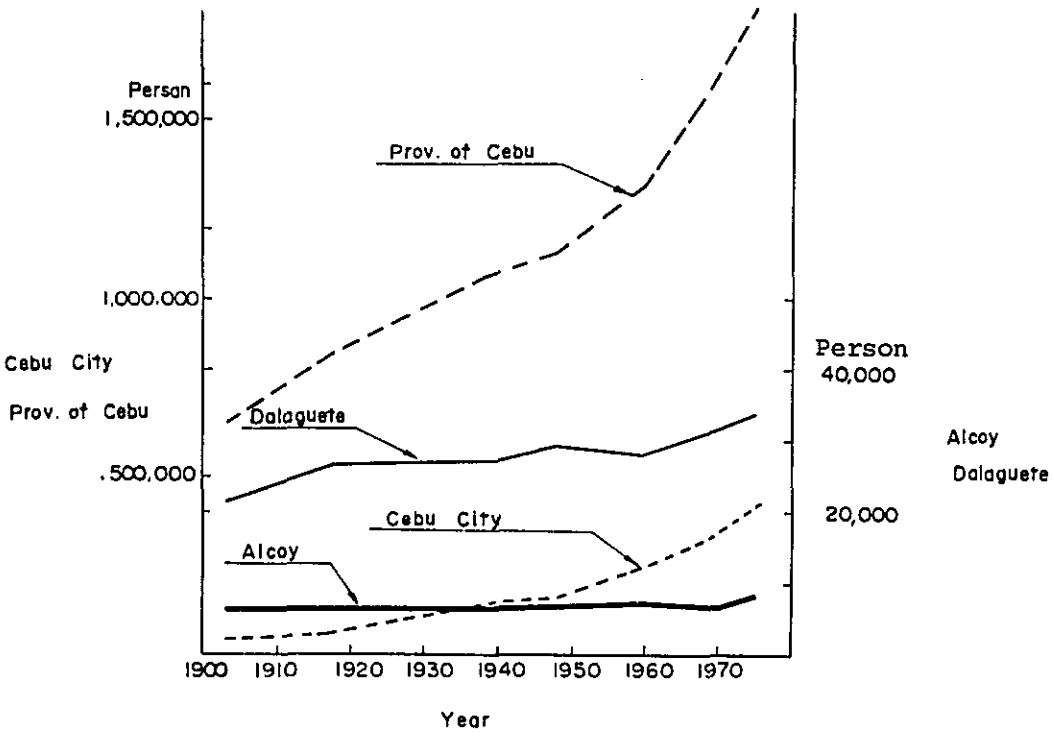


Fig. 4 - 9 Movement of Population

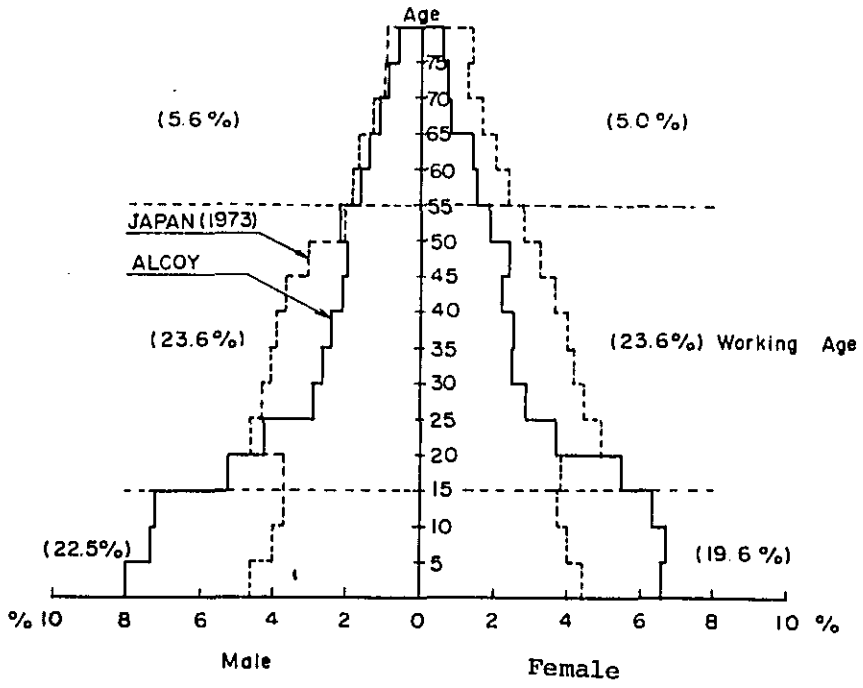


Fig. 4 - 10 Population of Alcoy by Age group (1975)

which is evidenced from a fact that as many as 2,700 villagers out of 8,600 in Alcoy are working in other provinces.

Fig. 4-10 shows the population in Alcoy by age bracket, according to which, the rate of youth to total population in Alcoy is higher than that of Japan, typical of a developing country. In respect of industrial growth, Alcoy is a backward city as evidenced by a low unemployment rate of 70%.

Major agricultural products are coconuts, banana and corn, but crop is not so rich because these vegetables have not been raised in large plantations. Fields in the neighborhood of Mantalongon, Dalaquete, tableland vegetables such as tomatoes, hot peppers and cabbages are raised and marketed in Cebu City. Also, Alcoy produces cotton, called "Alcoy Cotton". As to fishery, ports in Alcoy and Dalaquete offload horse mackerel, sword fish, cattle fish and bonito in such moderate quantities as meet the needs of local residents. The Cebu Island has large deposits of coal in Dalaquete-Argao areas with a proven reserve of 13.671×10^3 tons, which are mined in Mantalongon fields.

CHAPTER 5 PORT FACILITIES SURVEY

Chapter 5 Survey of Port Facilities

5-1 Background behind Port Planning

In the case of mining dolomite ores deposited in Alcoy and Dalaquete municipalities for shipment of 600,000 to 1,000,000 tons annually, there are two alternative ideas of employing the present Cebu Port or else constructing a new port in Alcoy and Dalaquete area for shipment of dolomite, which should be finalized after careful assessment of economic advantage. In relation to the evaluation of economic merit of a new port, planning and designing of the new ports and calculation of relative construction cost is indispensable and study will therefore be conducted on the possibility of constructing a new port accommodating berths serving the requirements of local residents.

The new port facilities will be constructed in expectation of developing Alcoy and Dalaquete municipalities so as to meet requirements for exporting dolomite ore and transporting fish, agricultural produce and daily commodities using berths for local commerce, especially in trade with the Bohol Island. The scale and structure of the new port facilities will depend largely on annual shipments of dolomite, vessel size and topography, geology, climate of proposed site for the port.

For this reason, careful survey was conducted with regard to geology, submarine topography and oceanic climate at site.

5-2 Present Situation of Cebu Port Facilities

As indicated in Figure 4-2, Cebu Province has 7 national ports and 25 municipal ports, with the former located in Cebu, Danao and Toledo cities and in San Remigio, Naga and Sibonga municipalities. However, no port except Cebu Port can berth vessels of more than 500 DWT both among national and municipal ports at its pier, but Lapu Lapu and Toledo cities have ports equipped with berths for exclusive use of private enterprises and capable of accommodating 10,000 DWT. vessels. At present, in Naga thermal power plant as well, piers (with steel piles) with a capacity of accommodating 20,000 DWT class vessels are under construction for unloading fuel oil (heavy oil).

These small ports in the Cebu Province have been employed for trading with neighboring islands, most of these ports are poorly equipped, such as, with causeways and small, wooden piers. As in the case of ports in Dalaquete, most of the piers have been damaged in part with the waves caused by typhoon, except the ports of Danao, Tudela, San Remigio, Toledo, Dumanjug and Sibonga.

Danao city port only serves small vessels from Pacijan Island and handles moderate amount of cargoes. Except Cebu City Port, most of cargoes have been handled by Cebu Port.

Table 5-1 shows a total number of berthing facilities (except privately leased berths) in Cebu City Port.

Table 5-1 Inventory of Port Facilities

Families		Depth
Wharf	Berth 1	2.4 m
	" 2 + 3	4.9 m
	" 4	6.4 m
	" 5	7.3 m
	" 6	7.9 m
	" 7	8.8 m
	" 8	7.0 m
	" 9	6.0 m
Pier	Pier 1 South Side	9.5 m
	" 1 North Side	7.5 m
	" 2 South Side	8.2 m
	" 2 North Side	7.5 m
	" 3 South Side	6.4 m
	" 3 North Side	4.9 m

Table 5-2 shows total cargo volume handled by Cebu City Port in 1975. The features of cargoes handled in this port is the predominant proportion of coconut and its products both in internal and external trades except general cargoes. Coconuts are imported from islands in Region VII and products exported.

Table 5-2 Cargoes handled in Cebu City Port (1975)

Cargo Classification	Foreign Trade		Domestic Trade		Total
	In	Out	In	Out	
General Cargoes	54,853	-	454,210	277,559	786,622
Livestock	-	-	729	3,666	4,395
Tobacco & Manufactures	-	-	619	730	1,349
Sugar & Confectionery	-	810	24,684	14,152	39,646
Coconut & By-Products	-	159,230	111,922	16,292	287,444
Construction Materials	-	-	62,332	28,679	91,011
Mech. & Elec. Eqpt.	29,939	-	34,147	18,877	82,963
Fuel. Chem. & Nat. Gas	24,576	300	28,070	39,330	92,276
Mineral Ores	-	-	50,929	10,074	61,003
Others	1,390	2,607	214,577	55,755	274,329
Total	110,758	162,947	982,219	465,014	1,720,938

(In Metric Tons)

Source: Bureau of Public Works

In Alcoy and Dalaquete, there are small and old berthing facilities, but a part of them have been damaged by the wave. In Alcoy, limestone and coral causeways are projecting into the sea, but in Dalaquete, these causeways are equipped, like other ports of Cebu Province, with piers on their tips, but it was noted that most of the wooden piles, have been damaged by the waves caused by typhoon, Causeways in these areas, Alcoy and Dalaquete, have partially been damaged, but judging from the status of damage, it is assumed that the tips of causeways were damaged first and then brine infiltrated through opening and collapsed the slope of causeways.

According to the annual statistics of wind and on-site observation during the term of survey, north-north-east and north-east wave is predominant, but it appears that these facilities were damaged by south-south-east and south-east waves caused by the typhoon.

At present, causeways have little been utilized in Alcoy, but those in Dalaquete are serving daily few small vessels (about 10 gross tons) carrying general cargoes, fishes and vegetables. Some large vessels load or unload cargoes at anchorage using small bunkers.

5-3 Natural conditions of proposed site for port

5-3-1 Topography of seabed and coastline

For surveying the topography of seabed, acoustic sounder for shallow water (capable of sounding -1.0m to -100m) was used. With this sounding device, an area of 2.0 km x 1.0 km was surveyed during three waveless days, September 25 to 27.

As a method of surveying, we installed transits on base points installed ashore at a space of 20m after conducting bar-check once daily and guided small boats loaded with echo sounder to surveying points. Aboard the boats. we determined the sounding position by measruing angle between pre-installed marker flags with a sextant. However, waters 200 to 300 m away from the coastline are shallow and seabed is covered with coral, we surveyed this area with levels at a low tide.

With regard to base points, we obtained data on Dalaquete from the Bureau of Land in Cebu City, but it only contained entries on level position, but not on altitude. We therefore finalized altitude after modification of tidal level on the basis of official tide tables and field observation data in the Philippines and the Cebu Island.

As indicated in the survey map (Fig. 5-1), seabed is covered with coral and plane with a depth of 1 m. The seabed shows a sharp downgrade at depths between 5 to 30m, forming 45° angle of inclination at the proposed site of the port. Moreover, submarine topography is highly complex due to coral structure.

On the other hand, coastline is relatively plane though visibility

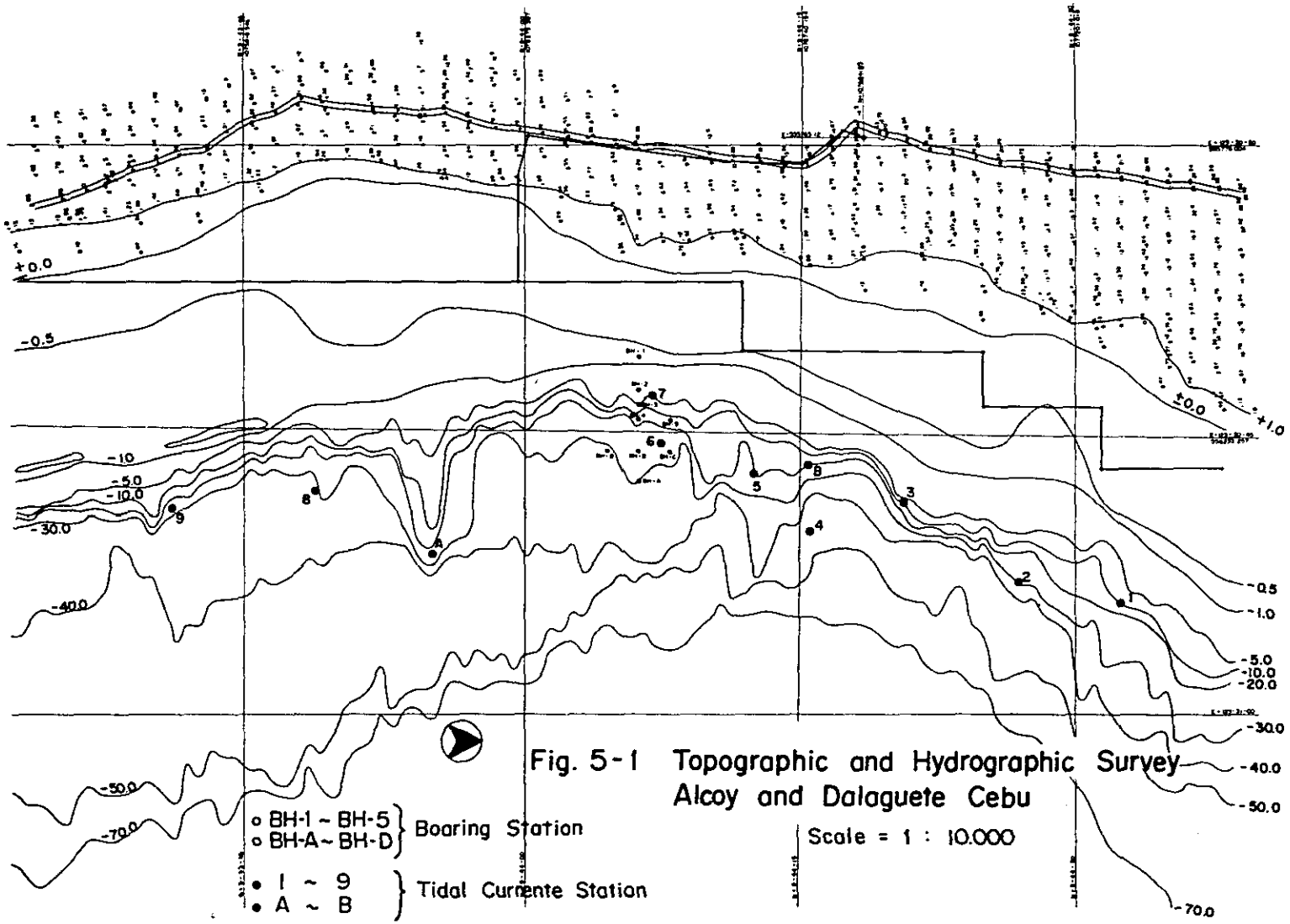


Fig. 5-1 Topographic and Hydrographic Survey Alcoy and Dalaguete Cebu

Scale = 1 : 10.000

is to some extent obstructed by dense growth of coconut trees, but considerably rugged in the part of Dalaquete close to its border with Alcoy.

5-3-2 Soil and bottom material

As indicated in Figure 5-1, soil was surveyed in 4 locations including BH-1 through BH-5 (5 locations) and BH-A through BH-D (4 locations).

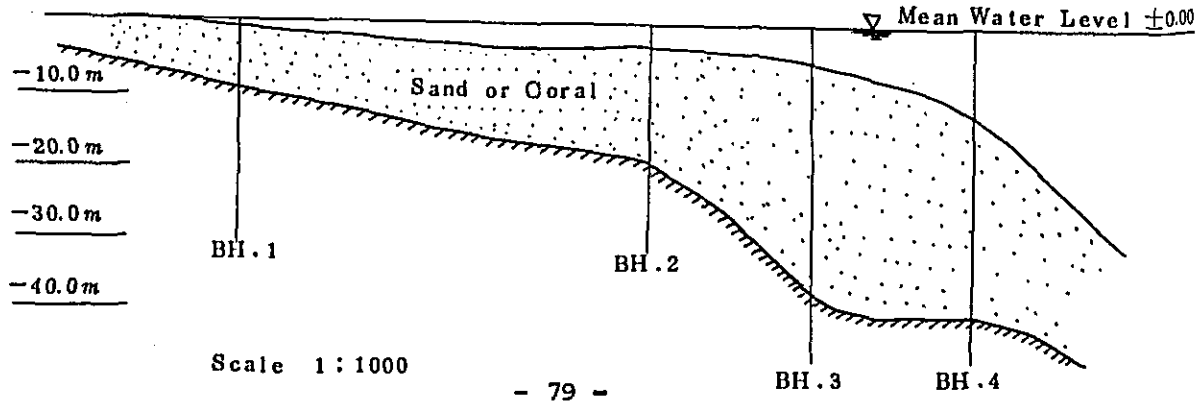
BH-1 through 5 represents soil survey for installation of machinery and equipment, which is conducted for the purpose of measuring N value and sampling agitation data. On the other hand, BH-A through D represent soil survey for collection of data on the anchoring of vessel and for sampling of agitated bottom material at a depth of 5 m into seabed.

For offshore boring, boring machines were fixed on a 15 x 8 m barge (with a loading capacity of 150 tons) secured by four anchors.

For boring into coral (BH - 1), boring stages with the dimensions of 4m (W) x 4m(D) x 2m(H) were fabricated using 2m long coconut trees, on which boring machines were mounted.

Due to rough weather at sea due to typhoons passing over the Luzon islands, we were unable to achieve fair progress in the offshore boring until mid-September, from thence on, the sea became quiet and allowed us to complete the project on schedule. Figures 5-3 through 5-7 indicate the results of boring. In all locations, there were sand or coral deposits on the basement (limestone), but substantial variation in N values at points close to surface strata, due to presence of coral on the surface or mixed deposit of coral sand depending on locations.

Fig. 5-2 Presumptive view of soil layer



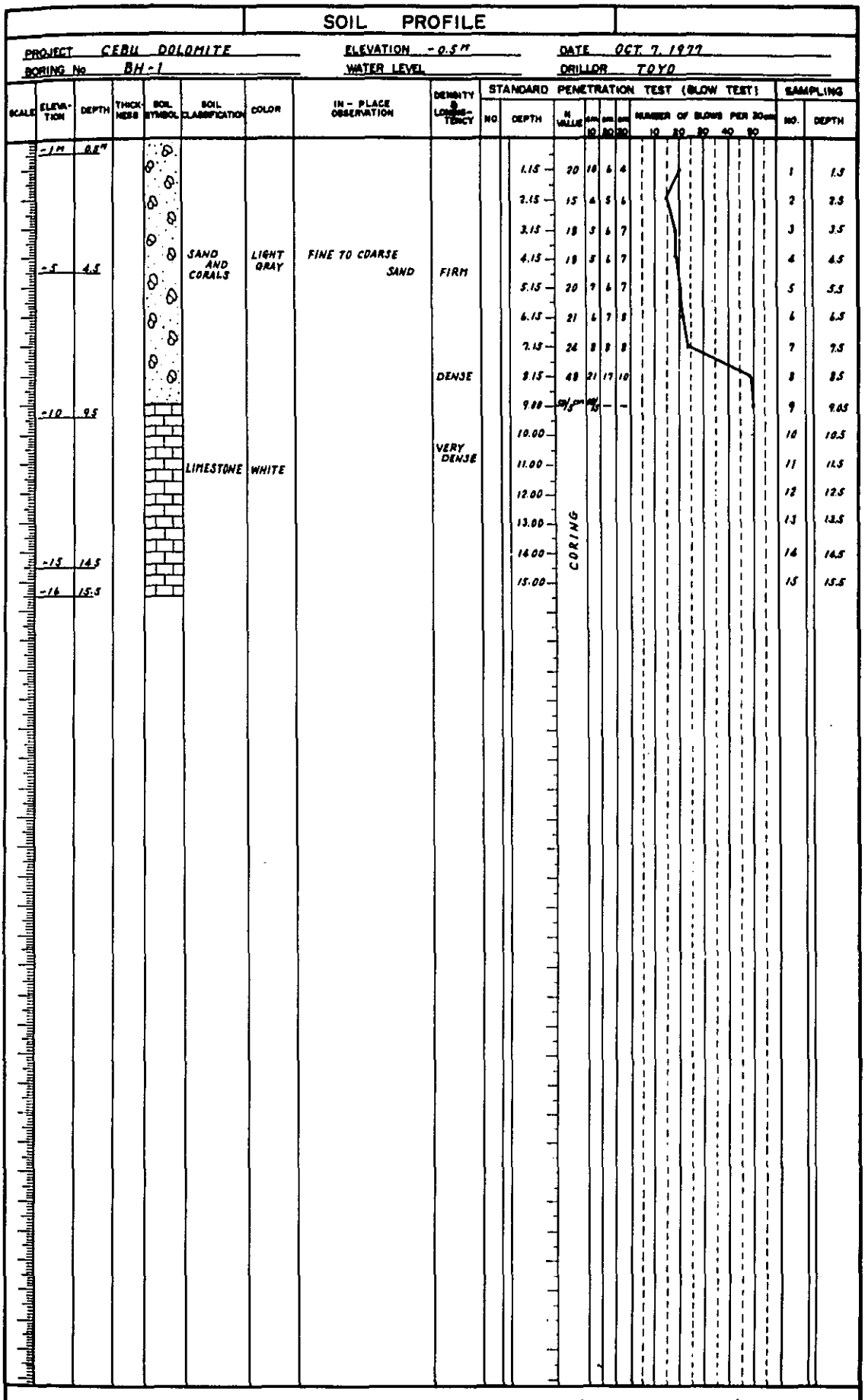


Fig. 5-3 Soil Profile (No. BH-1)

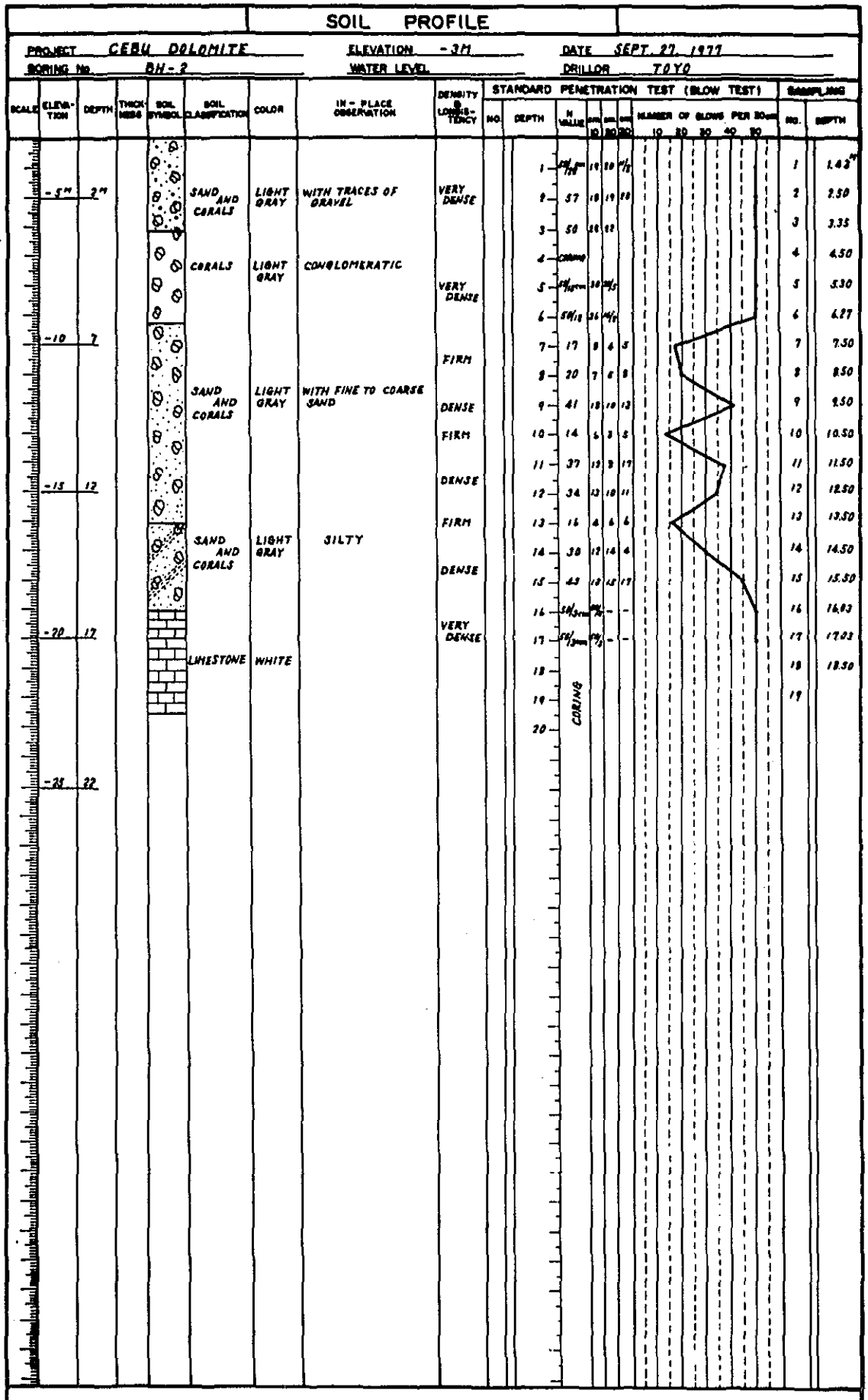


Fig. 5-4 Soil Profile (No. BH-2)

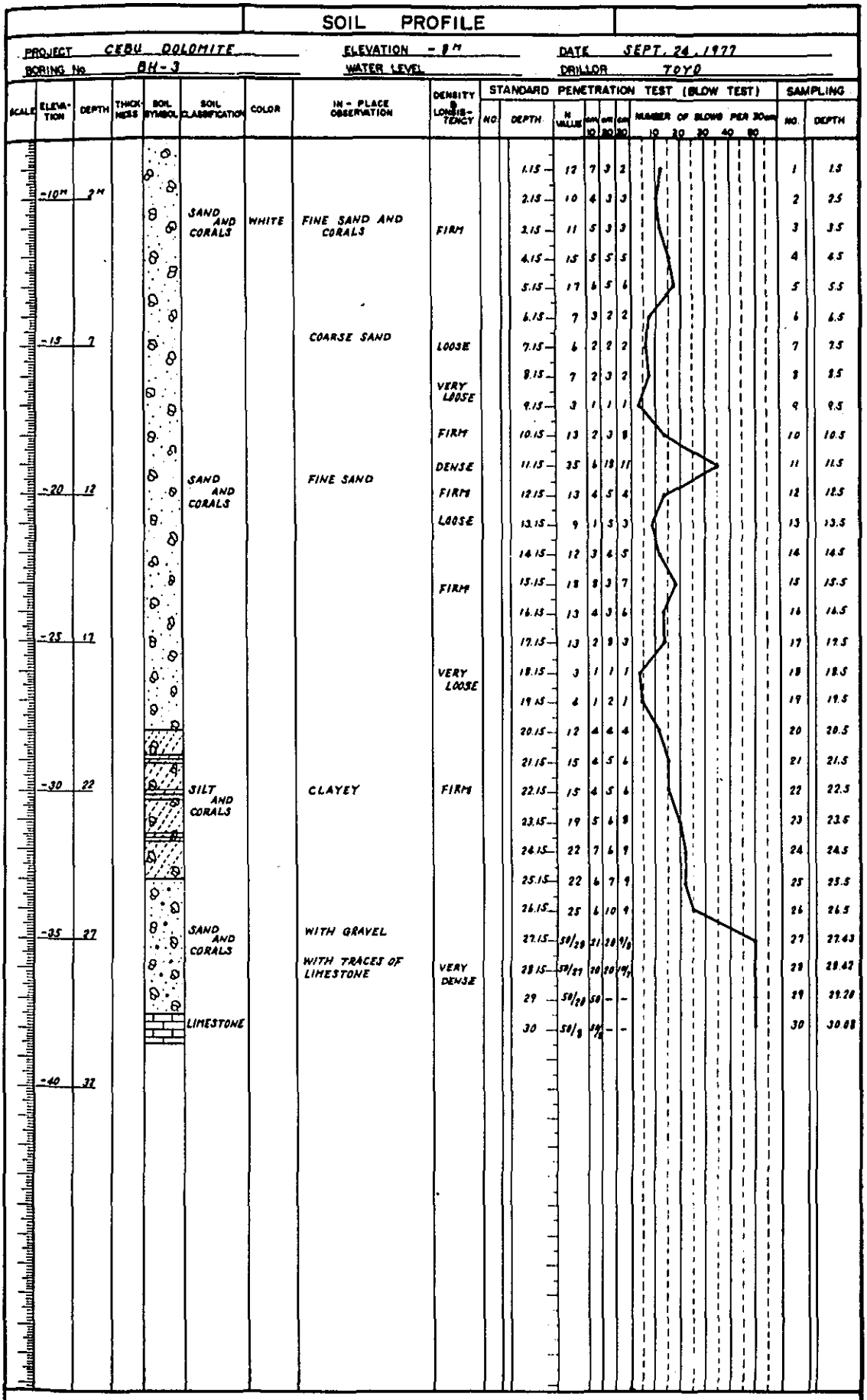


Fig. 5 - 5 Soil Profile (No. BH - 3)

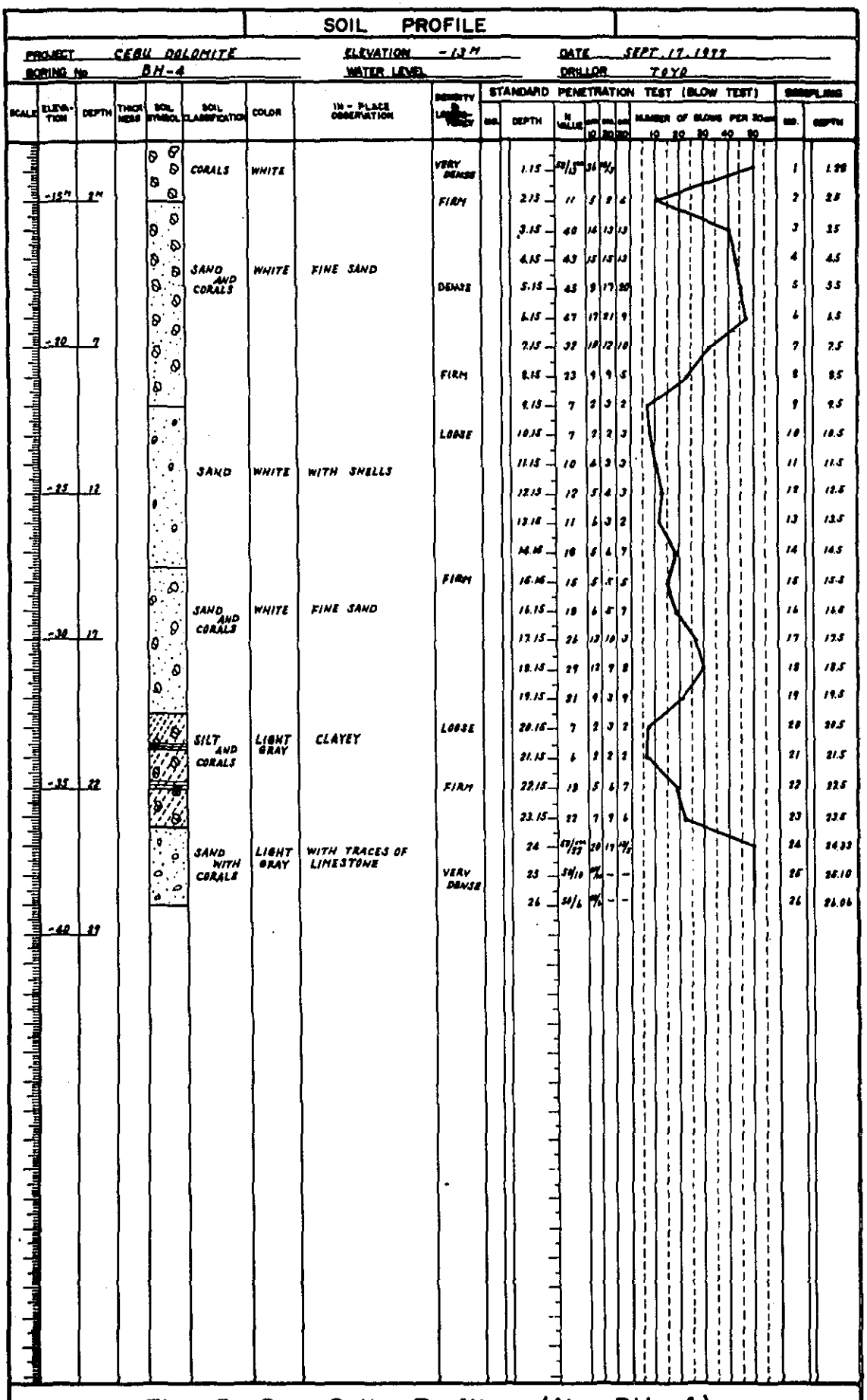


Fig. 5-6 Soil Profile (No. BH-4)

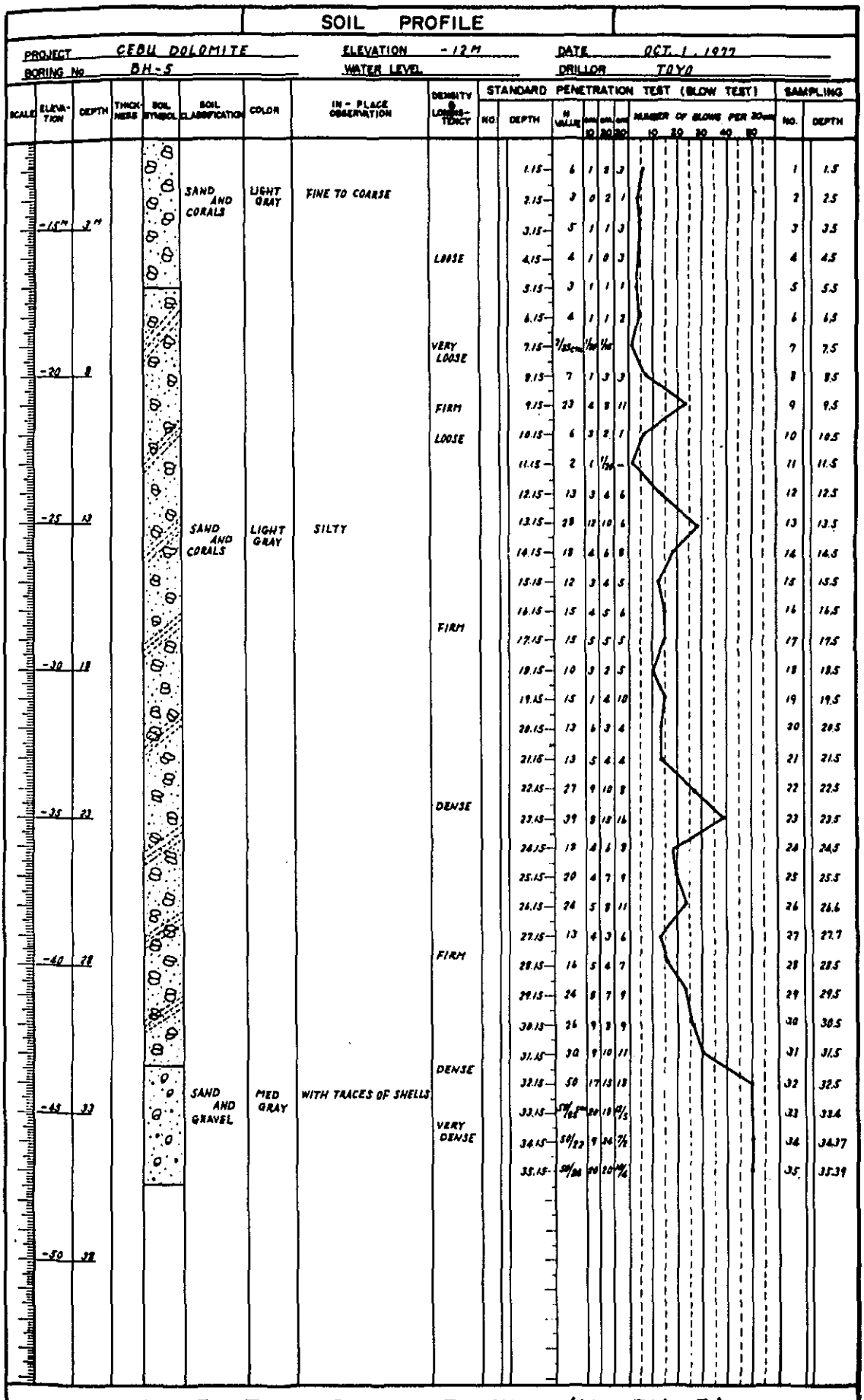


Fig. 5 - 7 Soile Profile (No. BH - 5)

On the other hand, the surface of seabed at depths of 20 to 30 m is covered either with coral sand or silt sand. We see no particular problem in anchoring of vessels.

During the recent field survey, we also surveyed bottom material with the aid of Effmann barge other than by boring survey. As shown in Figure 5-1, mud or soil was sampled at 11 locations where tide was observed using CH2 current meter. Like data obtained from boring survey, either coral or coral sand represented bottom materials.

5-3-3 Tidal current

We have conducted tidal current survey in order to assess the potential effect of tide on vessel operation and determine the location of anchoring facilities. As indicated in Figure 5-1, ONO current testers were installed ST-A and ST-B observation points (5 m deep) for tidal survey during 15 consecutive days. With regard to locations ST-1 through 9, survey was conducted every other day by CM2 current tester for specific depths. As shown in Figures 5-8 through 5-9, north-south current is more dominant than east-west current.

As to tidal velocity, 0.10 m/sec. accounts for as much as 80%, with max. speed running 0.20 m/sec.

Figs. 5-10 through 5-11 show tidal direction and velocity according to specific depths, but, due to the influence of complex topography, current varies with surface, middle and bottom layer of the sea, with velocity not reaching 0.2 m/sec., in all cases.

Figures 5-12 through 5-13 show the results of analysis, modification and integration of data obtained from 15 consecutive days' observation with the aid of ONO current tester, from which, we found that 1) locations ST-A and ST-B are particularly subjected to the influence of half-day tidal cycle M_2, S_2, 2) tide backflowed at short intervals upon reversion from north-ward to southward direction (in Mz oval contour) and 3) east-west current appeared only ephemerally.

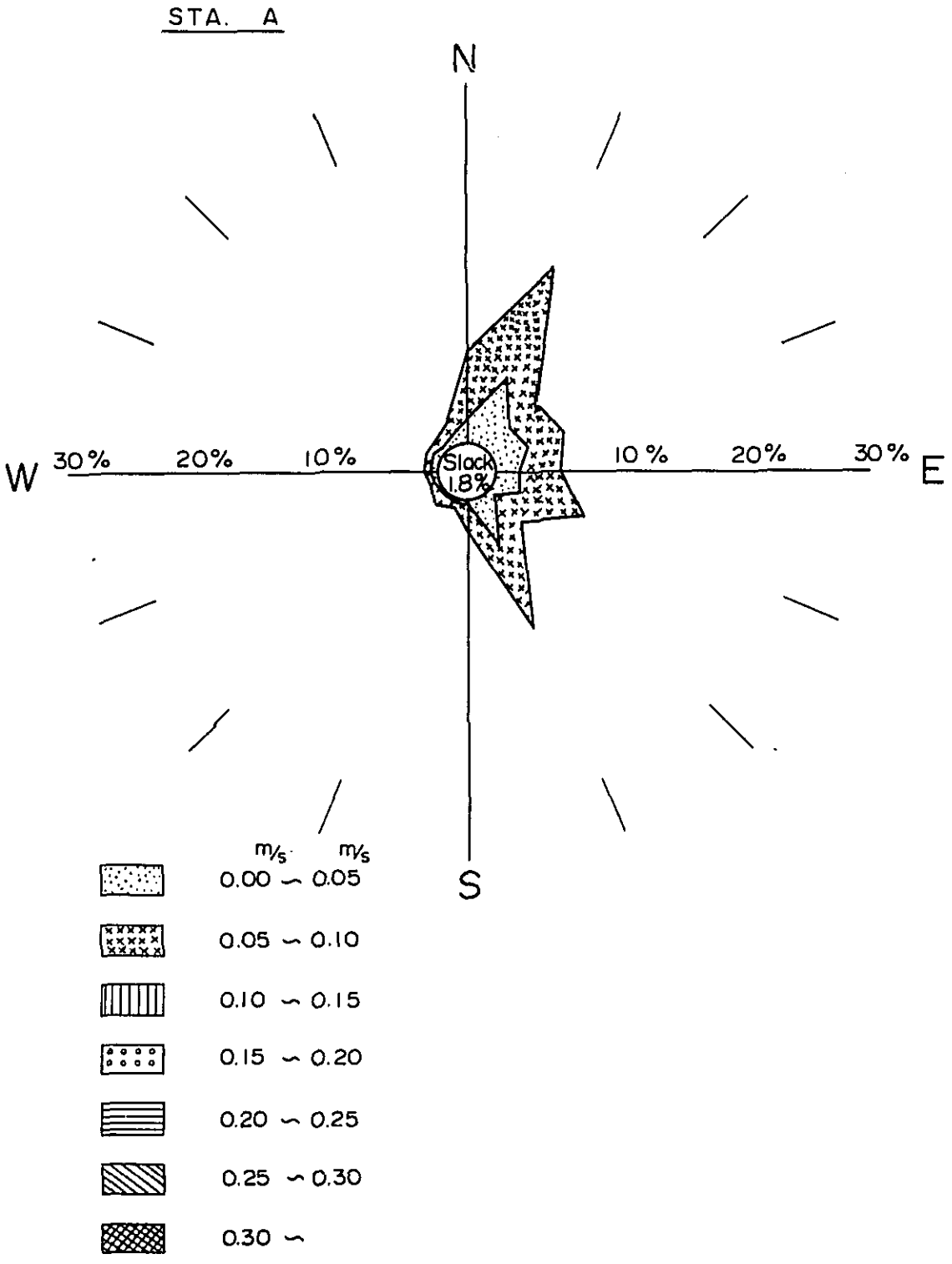


Fig. 5 - 8 Directions and Velocities Frequency Distribution of the Tidal Currents

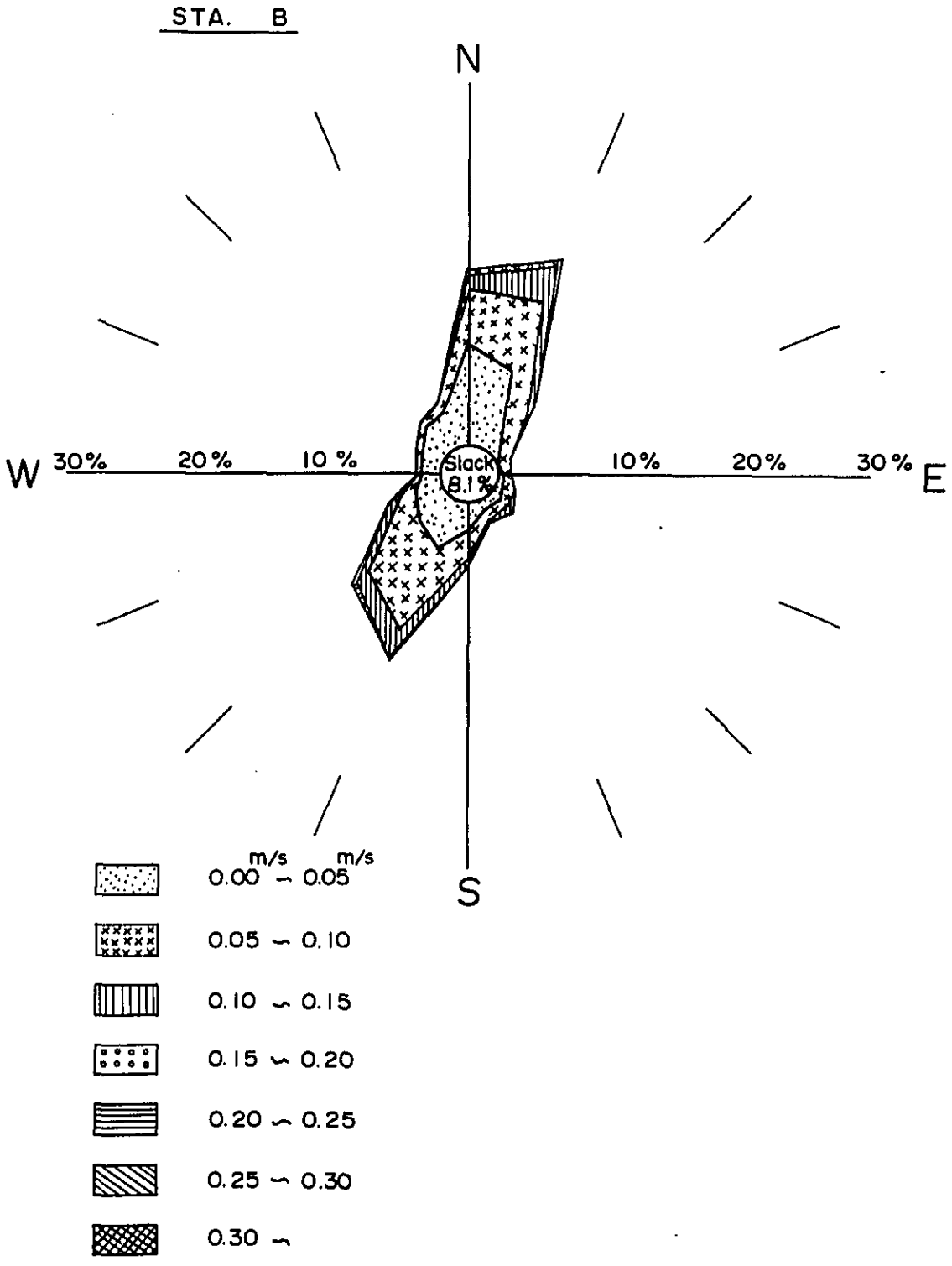


Fig. 5 - 9 Directions and Velocities Frequency Distribution of the Tidal Currents

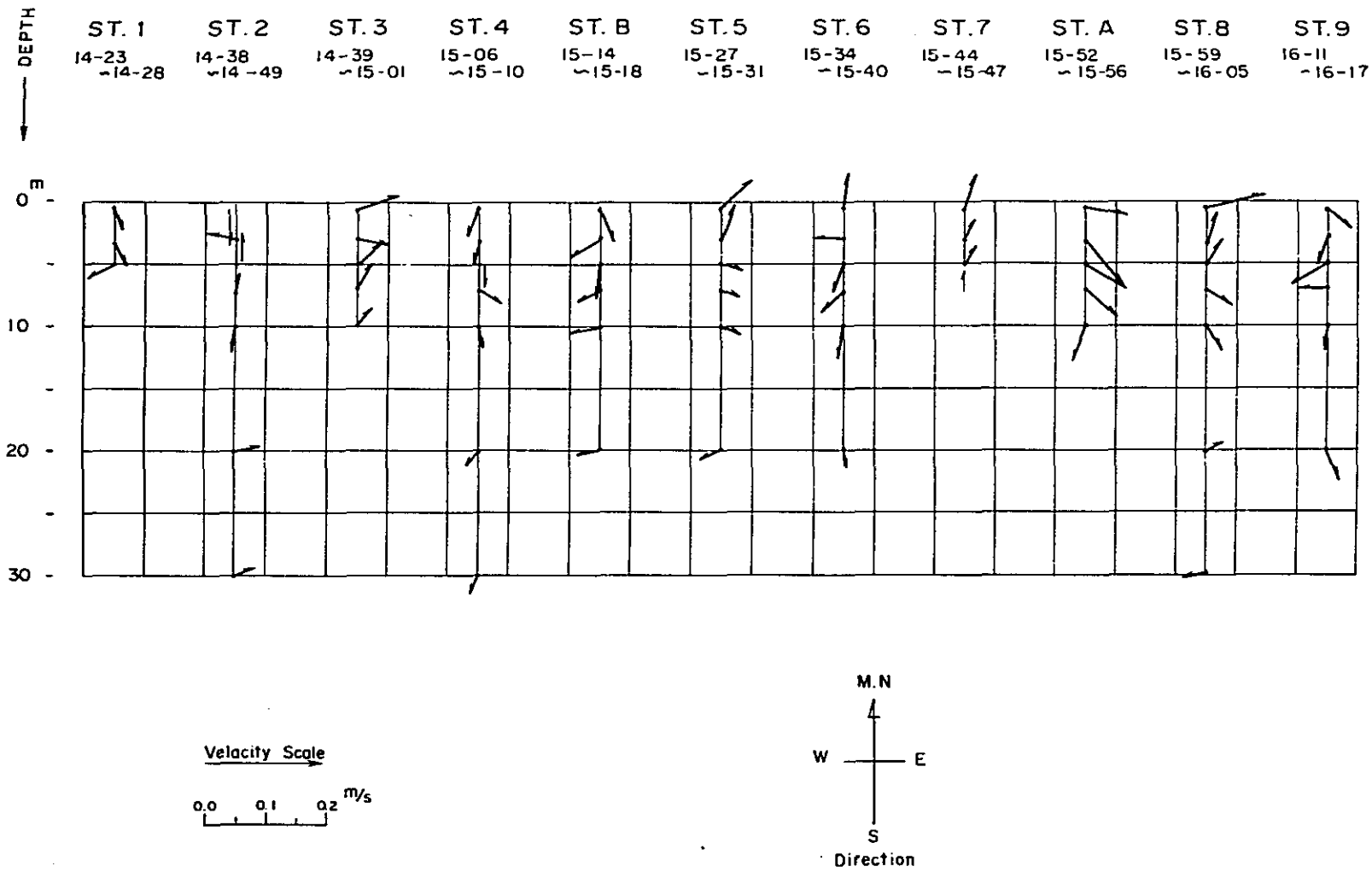


Fig. 5-10 Velocity Vectors by Depth of Tidal Currents

1977. 9. 15. P. M.

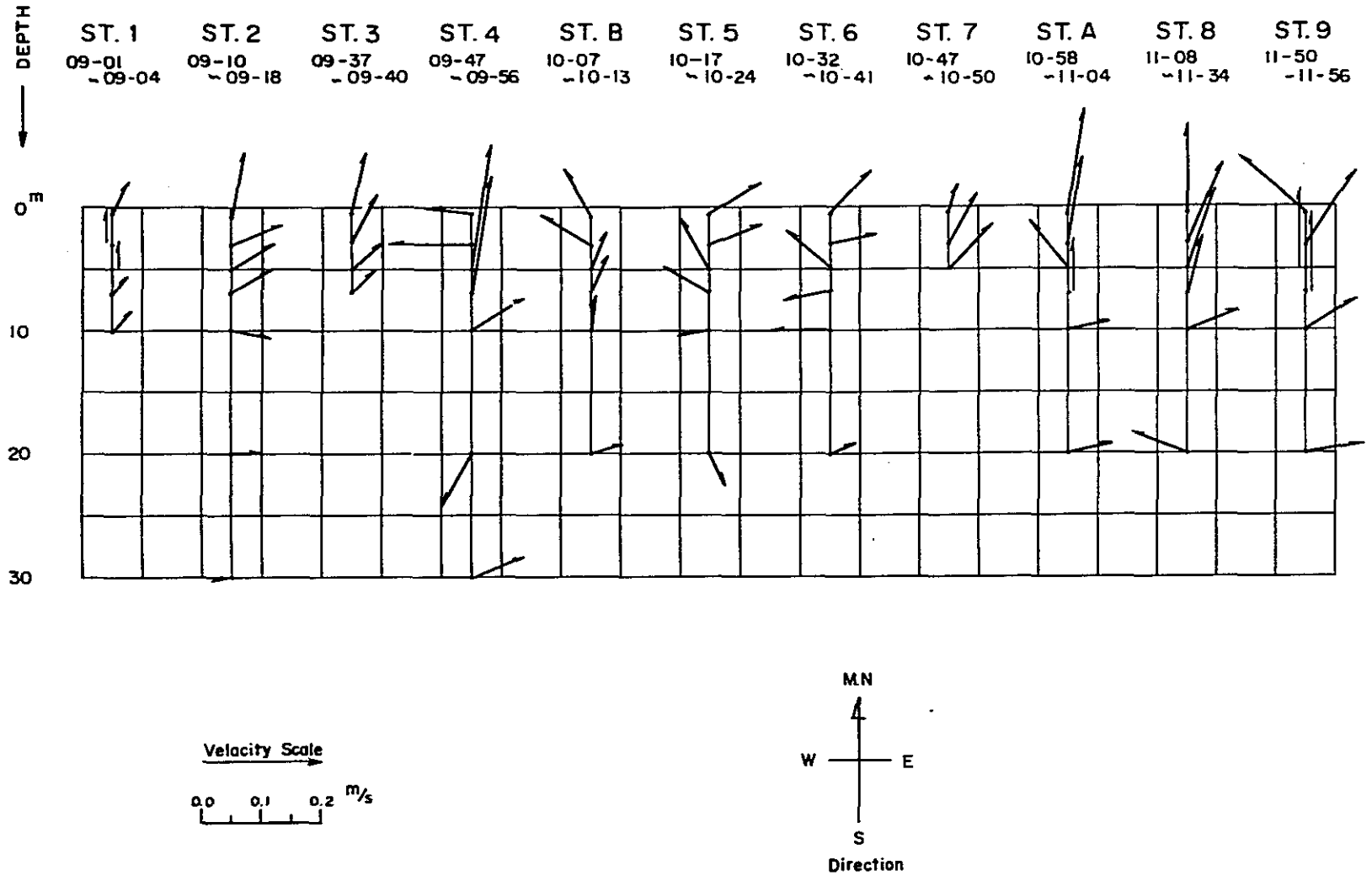


Fig. 5-1-1 Velocity Vectors by Depth of Tidal Currents

1977. 9. 17. A. M.

ST; A -5.0 (M) 1977 9 /13-9 / 28

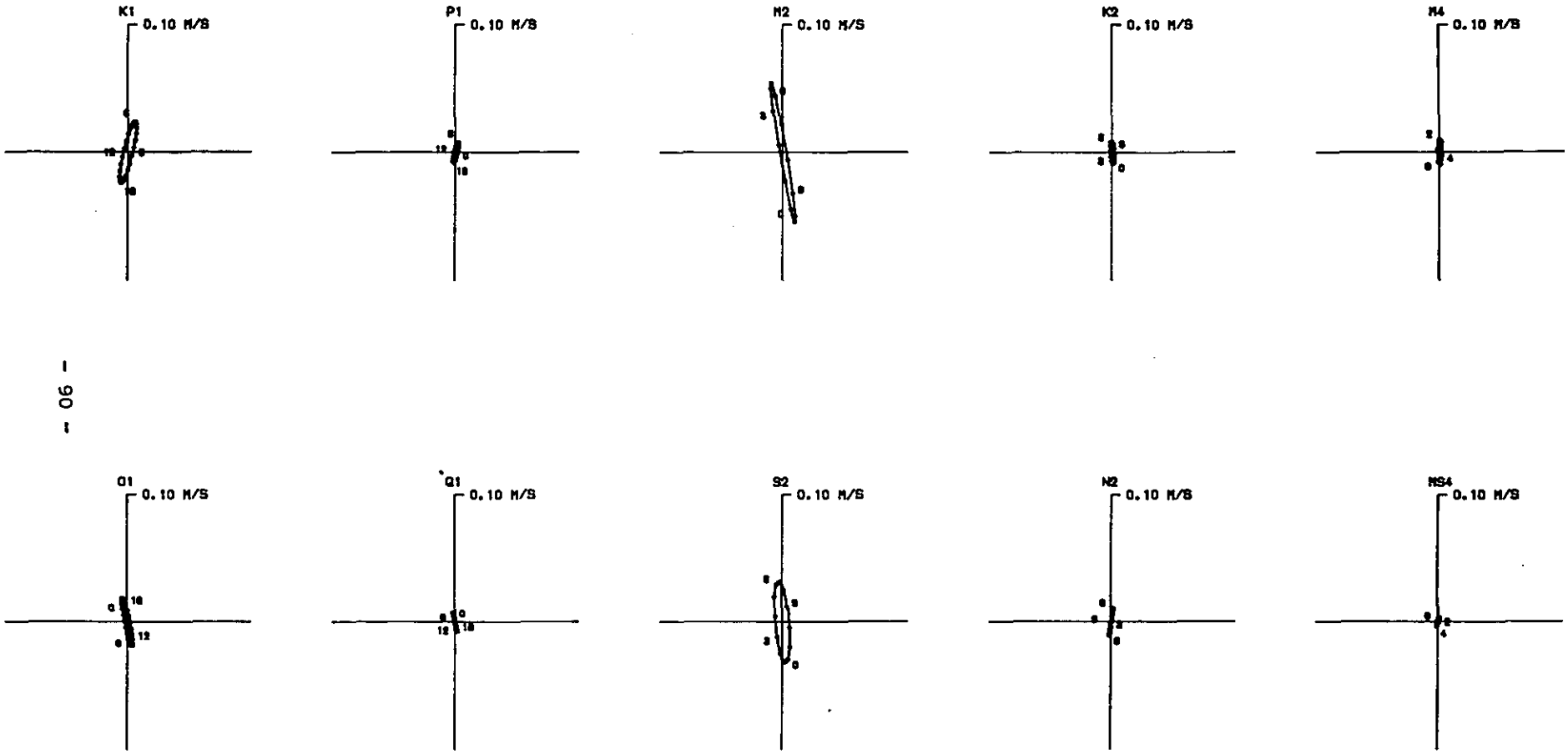


Fig. 5-12 Harmonic Analysis (ST. A)

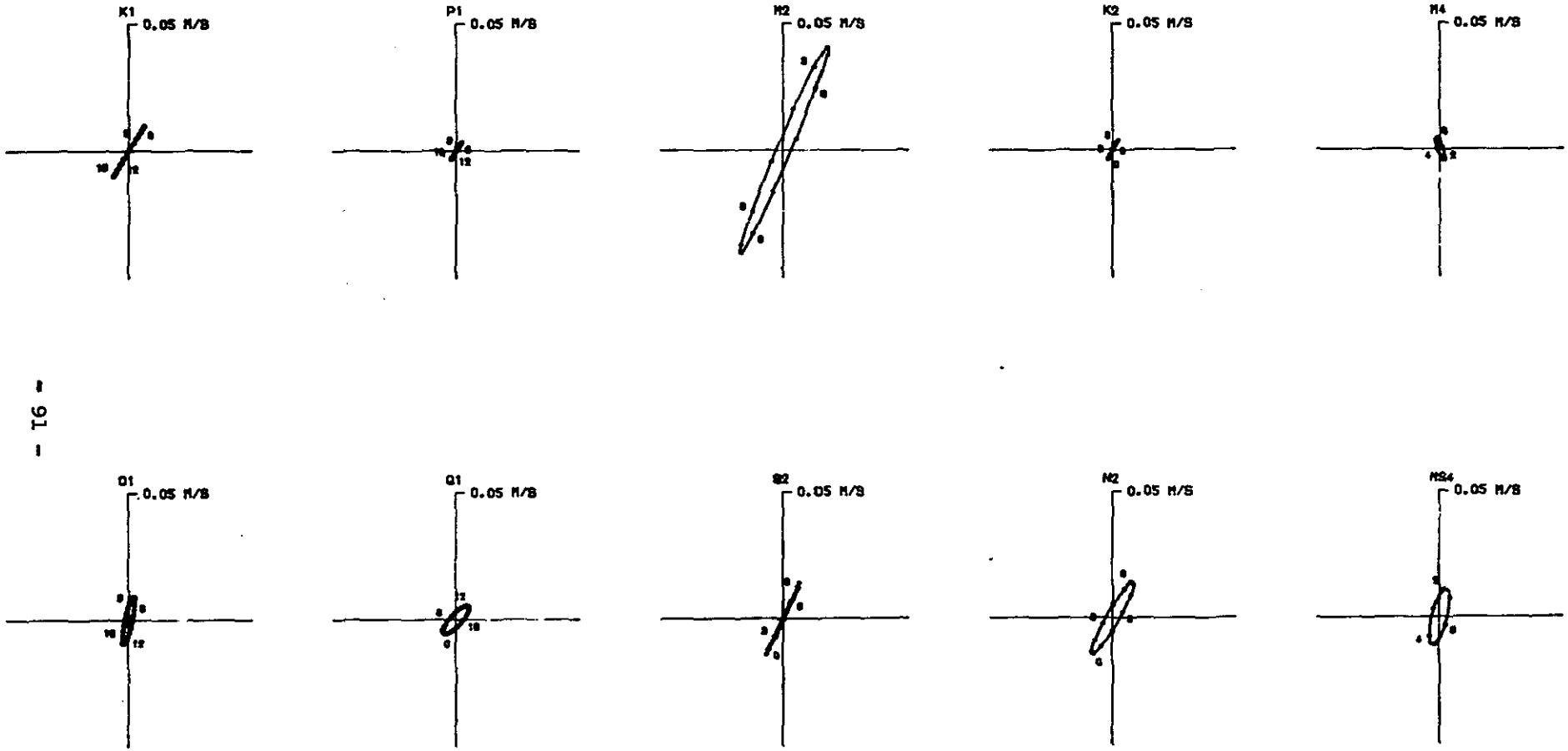


Fig. 5 - 13 Harmonic Analysis (ST. B)

5-3-4 Tidal level

Table 5-3 shows the tide station in Cebu City and tidal level in Boljoon (Bureau of Coast & Geodetic Survey).

Table 5-3 Tide Station and Tidal Differences

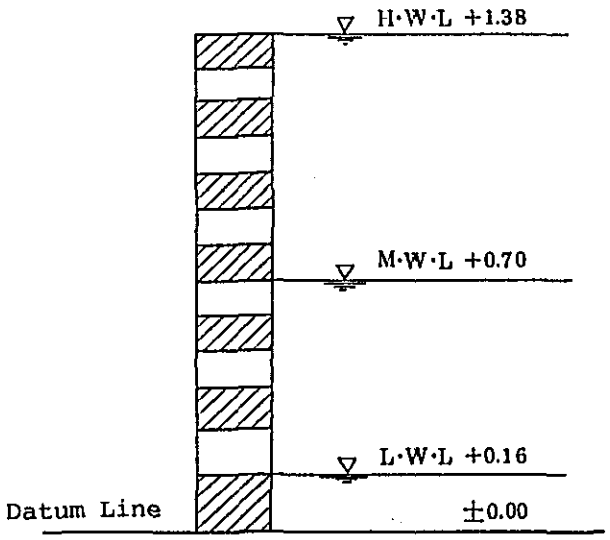
	Position	M.W.L.	L.W.L.	H.W.L.	Diff.Time
Cebu Port	10°18'N. 123°54'E	0.722	0.183	1.530	--
Boljoon	9"38'N. 123°54'E	0.700	0.9 *	0.9 *	** -15 mini.

* Value obtained by multiplying L.W.L. and H.W.L. in Cebu Port

** 15 minutes' delay in Boijoon than in Cebu Port

Under the present survey, we collected tidal records from the Cebu Port Station during the term of our stay and calculated water level in Boljoon in accordance with Table 5-3 and, on the other hand, we have conducted actual survey in the proposed site for the harbor using water level indicators, but have come up with an error of several centimeters between the two and finally adopted the calculated value for the present project.

Fig. 5-11 Tidal Differences at Alcoy



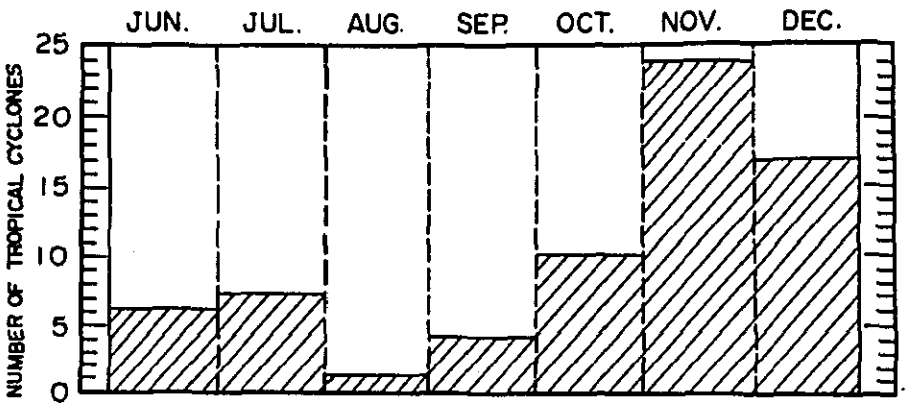


Fig. 5 - 15

Frequency distribution of the number of tropical cylones that passed within 180 n mi of Cebu (June December, 1947-1974).

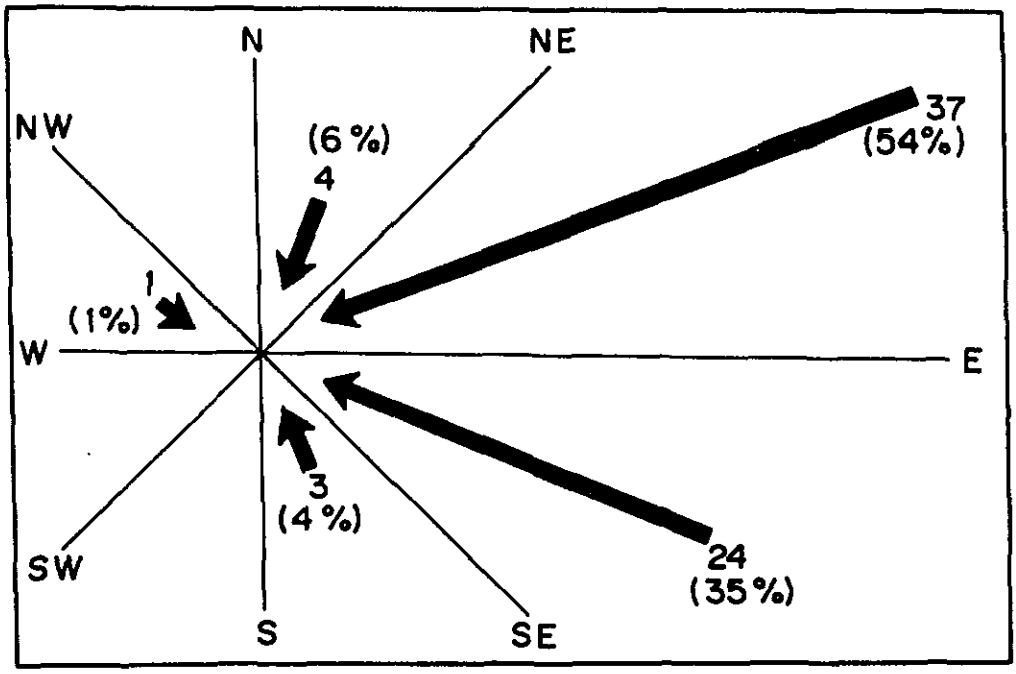


Fig. 5 - 16

Direction of approach to Cebu of the tropical cyclones (June-December, 1947-1974) which passed within 180 n mL. Open numbers indicate the number that approached from each octant. The numbers in parentheses are the percentage of the total sample (69) that approached from that octant.

5-3-5 Waves

The wave is caused by the energy of wind, but as mentioned in the preceding paragraphs, wind velocity in the neighborhood of the projected site for port facilities averages low 1.8m - sec. Therefore, the wave is correspondingly low, which is 0.3m or less in height according to observation during the survey period. It is posible that high waves may be caused by typhoon, but due to absence of meteorological record on waves in the vicinity of Alcoy and Dalaquete, estimation is made with regard to the wave on the basis of past wind data.

Observation of wind velocity for the projected area has been conducted in the Island of Mactan. According to the record of observation, maximum wind velocity exceeded 20m/sec. only three times during 1955 through 1974. It was only upon the passing of two typhoons in November 1962 and 1968 that the wind velocity exceeded 25m/sec. ; Most of the typhoons that hit the area concerned concentrate in October through December, with most of them running in NE-SE directions. See figures 5-15 and 5-16. Of these typhoons, those that passed the northern side of Cebu Island were 82% and those passed the southern side were 12%. The highest wave emerges in the proposed site when a typhoon moves northwest on the southern side of the waters concerned.

Therefore, projected port site will be most seriously threatened by a typhoon moving north-west over the southern tip of the Cebu, but past records show few typhoons take this course. In accordance with these conditions, estimation is made with regard to potential wave height at the projected area which may be caused when a typhoons take the most critical course as follows.

Wave height H 1/3 = 6.0m

Cycle T 1/3 = 8.0 sec.

As the conditions for calculation, figure 5-17 shows a model typhoon (the heaviest possible typhoon with a speed of 20 km/hr.) and figure 5-18 the projected area and fetch.

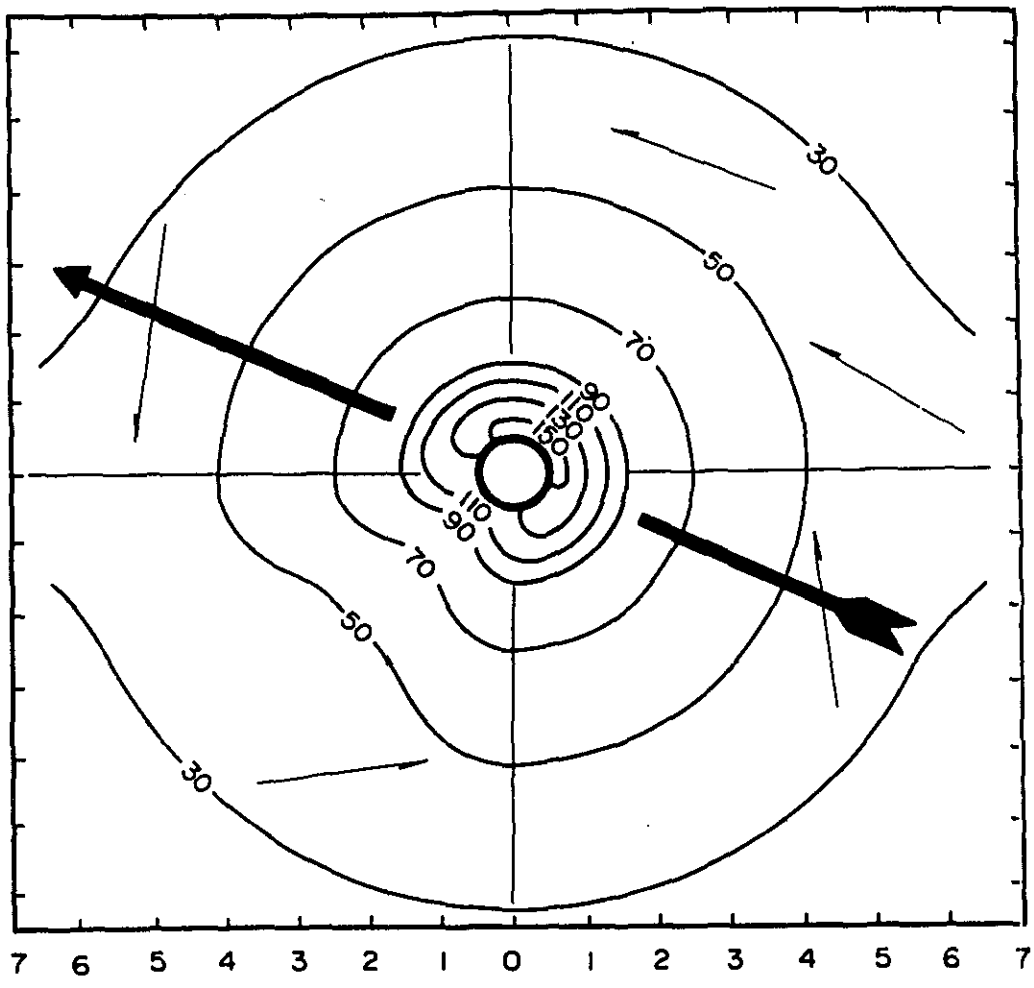


Fig. 5 - 17

Distribution of surface wind speeds (in knots) around a large, intense typhoon in the Northern Hemisphere over open water. The arrow indicates direction of movement (after Harding and Kotsch, 1965).

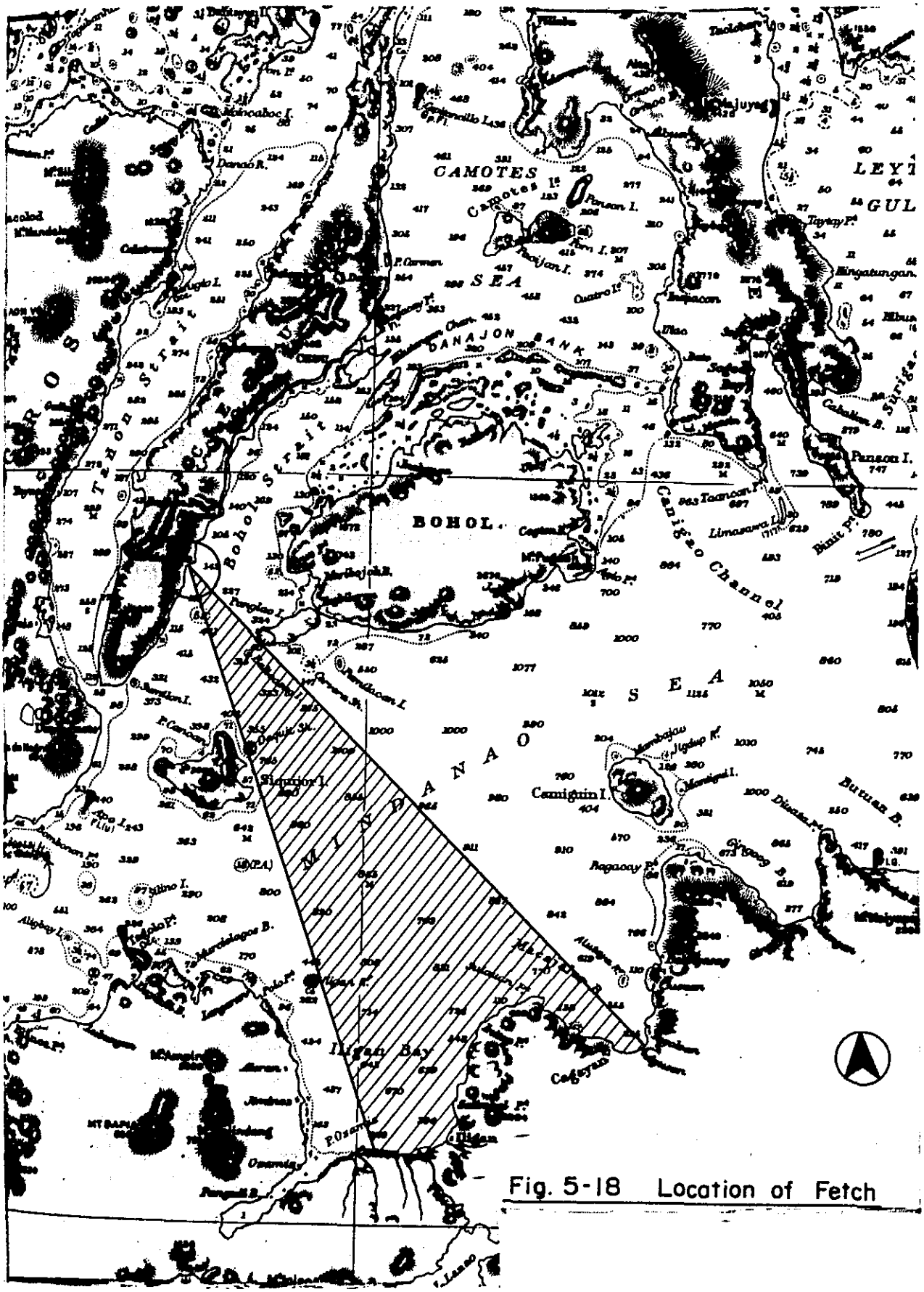


Fig. 5-18 Location of Fetch

Figure 5-17 shows the oceanic distribution of wind velocity and, theoretically, a typhoon must pass over Mindanao Island to arrive at the projected area. In general, it is said that wind that pases overland loses its velocity by 30 to 40% and consideration is given to this respect in the present calculation. It is to be noted, however, that such waves are less likely to occur. On the other hand, wave calculation is made on the biannual typhoon (with average wind velocity of 15m/sec.) as follows.

Wave height: H 1/3 = 2.5m

Cycle: T 1/3 = 6.0 sec.

Wave direction: NE

5-3-6 Earthquake and tidal wave

Of sensible earthquakes which have been recorded in Cebu City, the largest is the one that occurred January 11, 1971 at a point 86km north-northwest of Cebu City with an intensity of VI in Cebu City (21 gal - 44 gal). The estimated magnitude was 6.0 to 6.5. Table 5-4 indicates the records of sensible earthquakes registered in Cebu City during 1950 through 1975.

On the other hand, according to the past records of earthquake covering areas adjacent to Luson and Mindanao islands, there occasionally occurred earthquakes with magnitudes of over 7.0 causing substantial damages, but in the neighborhood of Cebu Island, no earthquake with a magnitude of more than 6.5 occurred with less damage than suffered by Luzon or Mindanao.

Fig. 5-19 plots the relationship between magnitudes on the bedrock and horizontal accleration. This graphic representation was completed on the basis of records of actual seismic survey.

Fig 5-19 Attenuation curve in maximum bedrock accleration

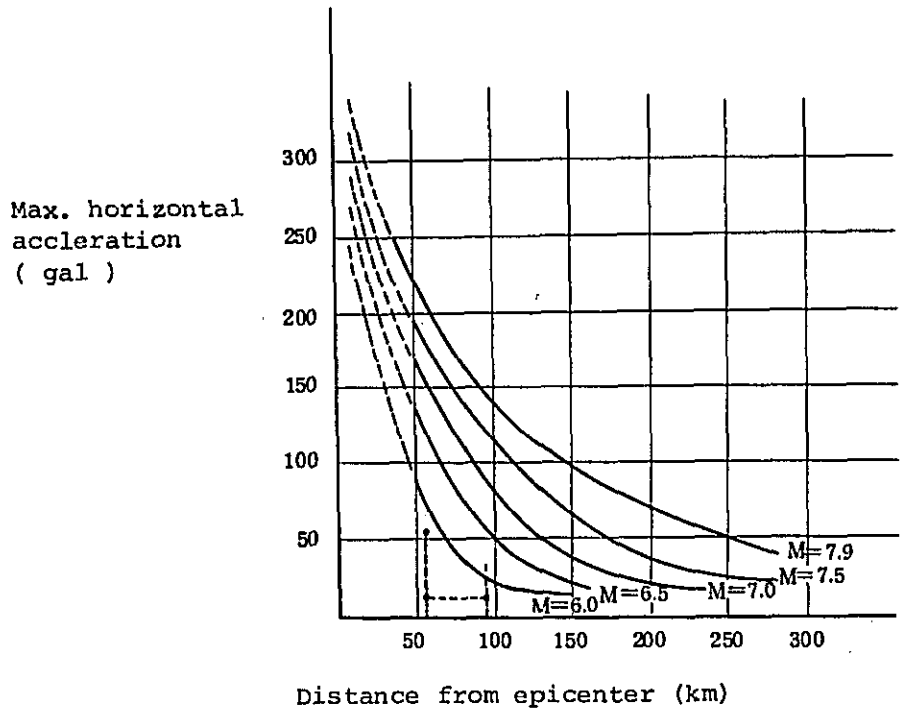


Table 5- 4 Information About Earthquakes (1950-1975)

Date	Epicenter		Felt in Cebu City	Magnitude
	N°	E°		
Jan. 23, 1950	10.5°	125.0	II	
Mar. 19, 1952	9.4	125.5	IV	
Jun. 5, 1952	9.7	125.2	I	
Sep. 10, 1952	10.5	123.6	V	
Mar. 31, 1955	7.9	124.1	V	
Apr. 10, 1955	7.9	124.1	IV	
May. 11, 1955	10.3	124.0	V	
Feb. 4, 1959	11.0	122.5	II	
Jun. 25, 1960	10.8	123.6	V	
Jan. 22, 1961	11.2	125.8	I	
Mar. 16, 1966	8.0	121.9	II	5.4
Jun. 14, 1966			II	
Dec. 25, 1969			I	
Mar. 20, 1970	6.8	126.7	II	
May. 13, 1970			III	
Jan. 11, 1971	85kms,NNW of Cebu City		VI	
Mar. 22, 1971	15.3	120.3	III	5.4
Oct. 18, 1971	13.8	124.4	IV	4.7
Dec. 2, 1971	6.5	126.6	II	6.3
Dec. 28, 1971			II	
Dec. 29, 1971			II	
Ang. 6, 1973	10.3	120.8	III	4.6
Nov. 5, 1974			II	
Mar. 10, 1975	9.6	124.1	IV	
Oct. 28, 1975	9.8	123.1	II	
Oct. 29, 1975	9.8	123.1	IV	

Note

I : 0 gal ∿ 10 gal
II : 1.0 gal ∿ 2.1 gal
III : 2.1 gal ∿ 5.0 gal
IV : 5.0 gal ∿ 10.0 gal
V : 10.0 gal ∿ 21.0 gal
VI : 21.0 gal ∿ 44.0 gal
VII : 44.0 gal ∿ 94.0 gal
VIII: 94.0 gal ∿ 202 gal

The earthquake considered most destructive in relation to the proposed site for the port is one that occurred October 29, 1975. It is estimated that the epicenter was Long. 123. 1°E and Lat. 9.8° N., with a distance between the epicenter and the proposed site being about 90km.

From Fig. 5-19, we estimate that horizontal acceleration on the site may have reached 50 to 60 gal.

In consideration of the above, we use 0.1 (98 gal) as a design earthquake intensity applied to the present project. As to tidal wave, we assume that the topography of Cebu Island surrounded with islands is relatively free of tidal waves. In fact, there is no record of tidal wave in the Cebu Island and, therefore, we disregarded this factor in formulating the present project.

5-4 Cargoes and vessels

5-4-1 Cargoes and shipping capacity

According to the Dolomite Mine Development Project, dolomite mining and shipping quantities are as follows:

1st year (1980)	600,000 t/y
2nd year (1981)	600,000 t/y
3rd year (1982)	600,000 t/y
4th year (1983)	1,000,000 t/y
5th year (1984)	1,000,000 t/y
6th year (1985)	1,000,000 t/y

Shipping facilities are projected as follows:

Belt conveyor

Width:	900 mm
Trough angle:	30°
Speed:	160 m/min.
Nominal capacity:	1,000 t/hr.
Max. capacity:	1,200 t/hr.

Ship loader

Nominal capacity:	1,000 t/hr.
Max. capacity:	1,200 t/hr.

On the other hand, the port handless local cargoes, such as shipment of vegetables and unloading of fishes and daily commodities to and from Bohol Island in nominal quantities as compared to dolomite shipped abroad.

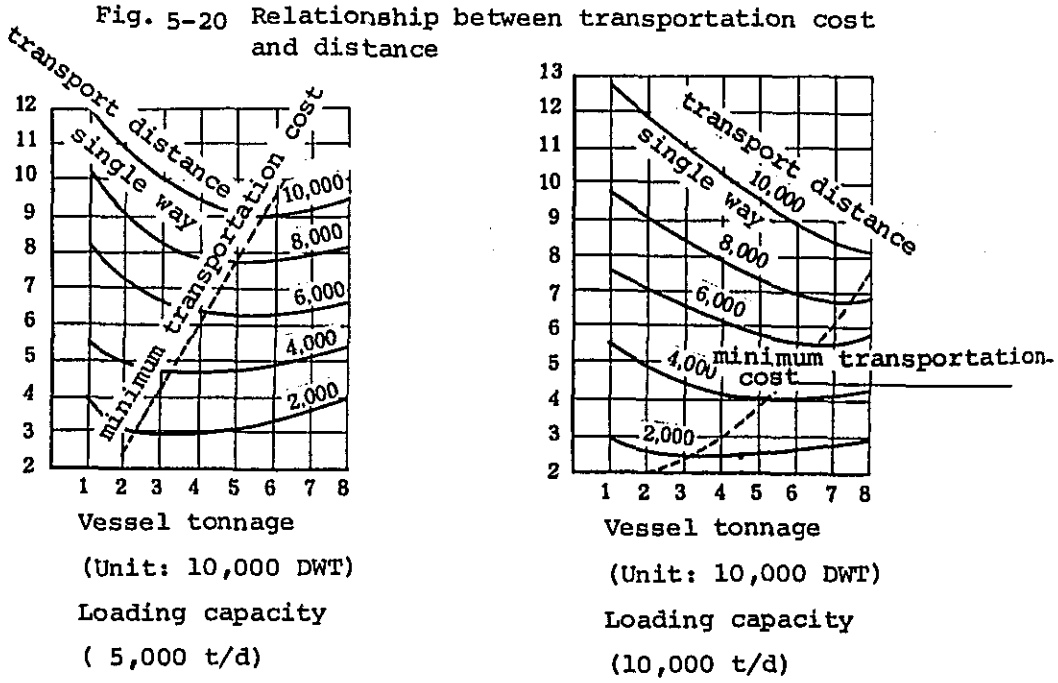
5-4-2 Vessels

Vessels of optimum type and size which provide transport of dolomite at minimum cost should be determined in consideration of distance of delivery and loading/unloading capacity of ports of departure and destinations.

Figure 5-20 shows a relationship between transportation distance and loading/unloading capacity of ports as required for selection of best size and type of vessels on the basis of statistics during 1960s.

Incidentally, a distance between Cebu Port and Kansai or Chugoku area, Japan, is about 1,600 miles (2,963km). Assuming that loading capacity is 8,000 to 10,000 tons (8 to 10 hours daily), recommendable size of vessel would be 20,000 DWT class, as determined by Fig Fig. 5-20.

Fig. 5-20 Relationship between transportation cost and distance



Also, a part of dolomite has been shipped to Minadano Island, optimum size of vessel should be 5,000 to 7,000 D.W.T.
Therefore, we recommend 6,300 DWT class vessel for the present project.

On the other hand, 10 g/t vessels are entering or leaving Dalaquete Port for local trading with Bohol Island, and therefore, we recommend 30 g/t class vessels for the purpose of the Project.

5-5 Studies on safe operation of vessels

5-5-1 Safety of vessel against climatic and oceanic conditions

When a vessel is sailing at low speeds when entering or leaving a port, marginal wind force for the operation of a vessel is defined in Table 5-5.

Table 5-5, Marginal wind force on vessel operation

Less than 1,500 DWT	Less than 15.0 m/sec.
50,000 to 65,000 DWT	7.0 m/sec. to 9.0 m/sec.

According to Table 5- 5 , it would be reasonable to define the marginal wind force for 20,000 DWT and 6,260 DWT class vessels as 10 m/sec.

On the other hand, according to wind observation record in Cebu City (Table 4-2), monthly average velocity is no more than 3.0 m/sec. and it rarely exceeds 10.0 m/sec. except when caused by typhoon. Therefore, there will be nominal impact of wind on the operation of vessels.

According to field observation and direct inquiry during the period of survey, wave height does not exceed 0.5m unless caused by typhoon and the sea is ordinarily calm and quiet.

We understand that vessels sailing at low speeds are subjected to the influence of tide and 0.25 m/sec. current pressure is likely to affect the operation of such vessels. Recent tide survey disclosed that the emergence rate of current pressure ranging 0.15 m/sec. to 0.20 m/sec. is less than 1.0%, with most of tidal pressure staying within a range of 0.0 m/sec. to 0.10 m/sec. Especially, the emergence of east tide which may adversely affect the operation of a vessel under the present project is infrequent, and under no circumstance, does tide exceed 0.1 m/sec.

According to information obtained from the Planning Section, Port Authorities and from Maritime Disaster Control Association as well as from captains' questionnaire, marginal dead calm which would allow smooth operation of vessel and other port facilities is summarized in Table 5-6.

In consideration of the above, the proposed port location is realtively satisfactory for the operation of vessels for the purpose of the Project.

5-5-2 Topographic safety

Table 5-7 shows required swing area in the case of satisfactory climate and oceanic conditions.

Table 5-7 Swing Area

In case of self-swing	A circle with 3L as a diameter
In case of tugboat-aided swing	A circles with 2L as a diameter

Remarks: L = Vessel length

In the case of a 20,000 DWT vessel with a length of 175.4m, a turning basin covering a circle with about 520m diameter will be required in the case of a self-swing.
When this circle is placed on a topographical chart, results are obtained as in Fig. 5-21. The proposed site is topographically complicated, but is expected to pose little problem for vessel operation.

Table 5-6 Marginal calmness for utilization of port facilities

		Data from Port Authorities Planning Section	Captian's questionnaire	Data from Maritime Disaster Control Association
Entry limit	Wave height	1.5 m	1.0 - 2.0 m	2.5 m
	Wind	20 m/sec.	-	10 - 17m/sec.
Limits for berthing, deberthing & operation	Wave height	-	Relatively satisfactory 0.5-1.0m Unsatisfactory 1.0-1.5m	-
	Wind	-	Extremely poor 1.0-2.0m 10 - 15 m/sec.	-
Stevedoring limit	Wave height	1,500-7,500DWT 0.5m over 7,500 DWT	0.5 - 1.0 m	- -
	Wind	15 m/sec.	10 - 15 m/sec.	-
Anchoring limit	Wave height	-	1.0 - 1.5 m	1.0 - 1.5 m
	Wind	-	20 - 30 m/sec.	1.0 - 1.5 m
Berthing & mooring limit	Wave height	1.0 m	0.5 - 1.3 m	Under 7,500DWT 0.7-1.0m Over 7,500DWT 1.0m
	Wind	25 m/sec.	10 - 17 m/sec.	Under 7,500DWT 15-20m/sec. Over 7,500DWT 20m/sec.

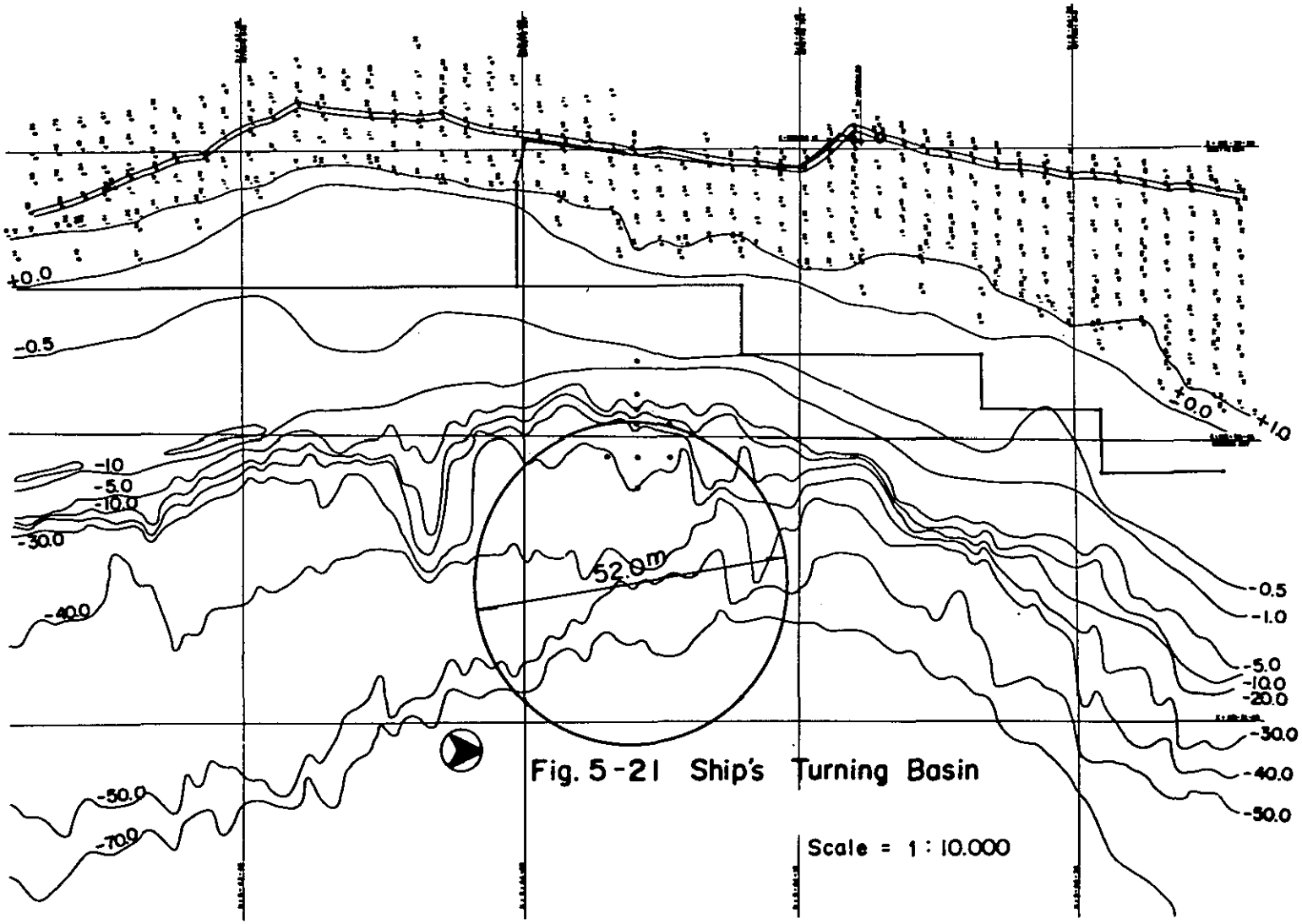


Fig. 5-21 Ship's Turning Basin

5-5-3 Operation of tugboats

In ports where vessels are overcrowded, strong tide and wind prevail or self-swing is impossible due to limited space, the operation of tugboats will be required.

Tugboats are used especially in cases where a vessel must make a major turn on a passage to a port of departure or entry, or it can not swing its head near a moorage even with the aid of an anchor, or it is difficult to bring a vessel along the pier in a safe and efficient manner when berthing it in a wide angle and pushing it against the pier after removal of moorings.

For the operation of a vessel in such locations, it is preferable to use 2,000 HP capacity tugboat. In some cases, however, this operation would be feasible without tugboat inasmuch as few problems, if any, have been posed regarding the congestion of vessels, climate, oceanic conditions and topography.

5-6 Port scale and space planning

5-6-1 Dolomite loading berth

From 1983 onwards, dolomite ore will be shipped to Japan and Mindanao respectively 800,000 tons and 200,000 tons a year. For shipment of dolomite, 20,000 DWT and 6,300 DWT vessels will be operated (See para. 5-5 dealing with cargoes and vessels.), with the former entering port 40 times/year and the latter 32 times/year respectively.

The following shows the loading time aboard each type of vessel. With berthing, deberthing and shift time included, service time for a 20,000 DWT vessel requires 1.5 days and a 6,300 DWT vessel 0.5 day. Total service time aggregates 76 days annually.

$$20{,}000 \text{ DWT} : \quad T_1 = \frac{20{,}000 \text{ ton}}{1{,}000 \text{ t/hr}} = 20 \text{ hrs.}$$

$$6{,}300 \text{ DWT} : \quad T_2 = \frac{6{,}300 \text{ ton}}{1{,}000 \text{ t/hr}} = 6.3 \text{ hrs.}$$

In case vessel enters port at irregular intervals, total queueing time shown in Table 5-8, according to the Queueing Theory Results in the United Nations' Berth Throughput Data.

Table 5-8 Queueing time of vessels

Number of berth	1	2
Service time	76 days	76 days
Berth occupancy	0.20	0.10
$\frac{\text{Queueing time}}{\text{Service time}}$	0.25	0.042
Queueing time	19 days	3 days

However, as this berth is designed for loading dolomite aboard regular vessels, the operation of even a single berth will produce no queueing time. Therefore, the present project envisages to install only one berth.

Figure 5-22 illustrates the plane views (proposals A and B) for dolomite loading berths.

From the viewpoint of topographical complexity, proposals A and B offer almost equal advantage, but in respect of operating vessels, proposal B will provide greater benefit.

On the other hand, proposal A recoomends a site closer to dolomite mining point and save initial investments and, for this reason, we adopted proposal A for the purpose of the Project.

5-6-2 Local berth

For the purpose of the present project, two local berths for 30 G/T boats will be installed in the rear of berths for 20,000 DWT ocean-going vessels (See Fig. 5-23.).

Also, berth projected for 20,000 DWT vessels may be open for local boats insofar as local cargo operation does not interfere with loading of dolomite (72 days per year).

5-6-3 Breakwater, navigational aids, etc.

The waters in a projected site is fairly calm and allows smooth vessel operation except in the case of typhoons, but structures such as moorage should be installed with a sturdy construction which would stand typhoons occurring biannually or at similar intervals.

As stevedoring equipment is made of fixed shiploader (with vertically movable arms) and belt-conveyor, it is necessary to shift a vessel when loading dolomite through individual hatches. (See Fig. 5-24.)

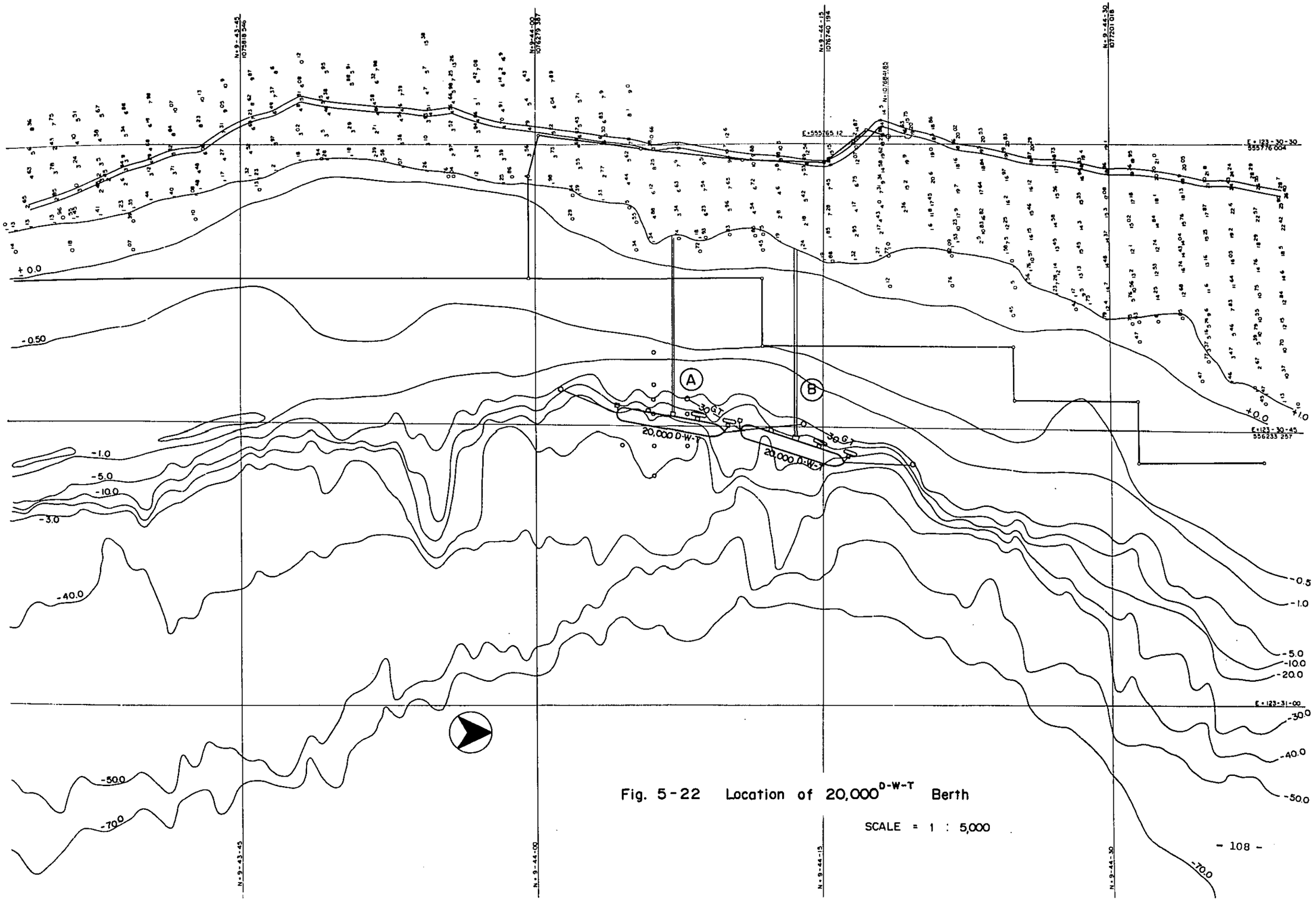


Fig. 5-22 Location of 20,000 D-W-T Berth

SCALE = 1 : 5,000

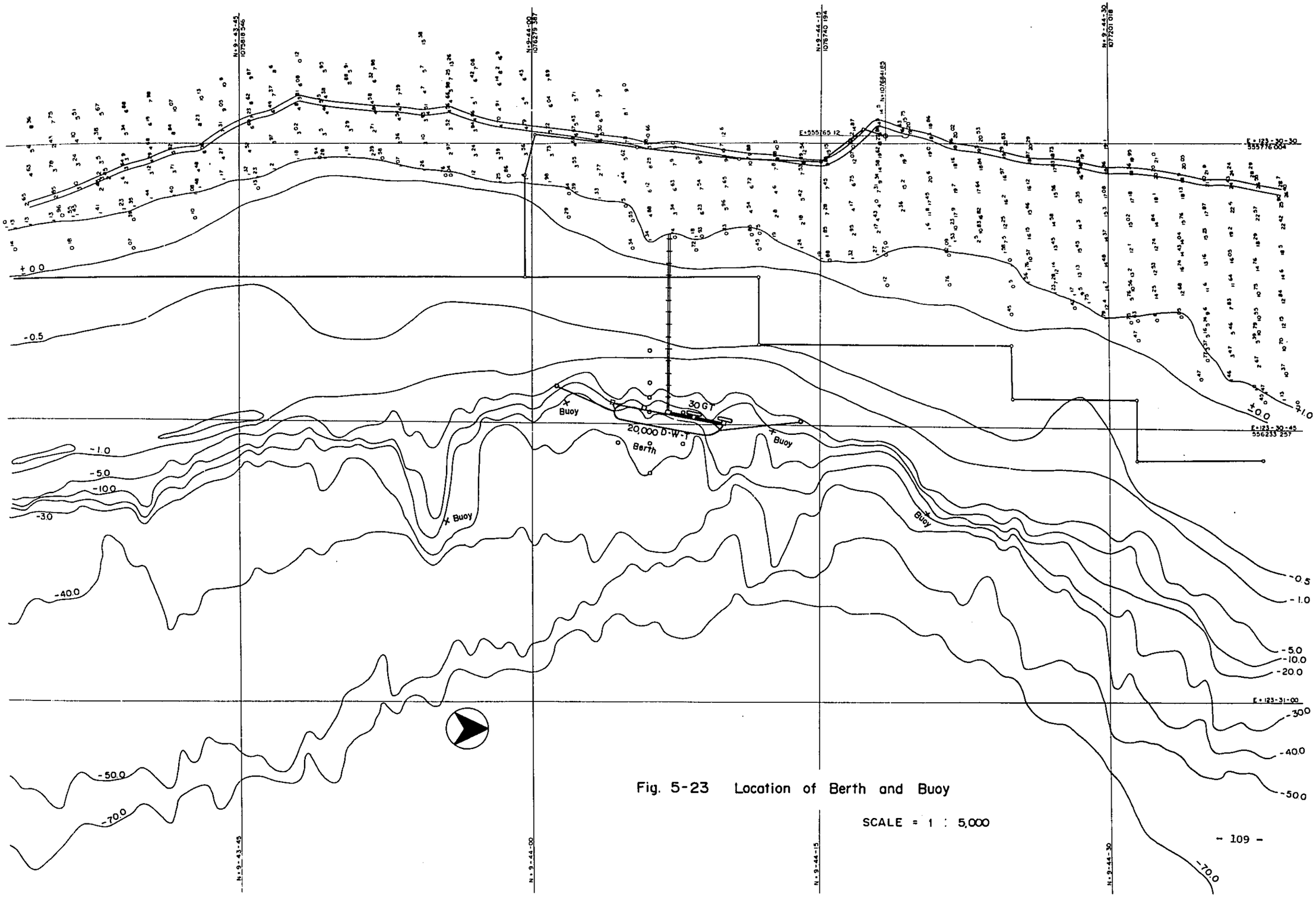
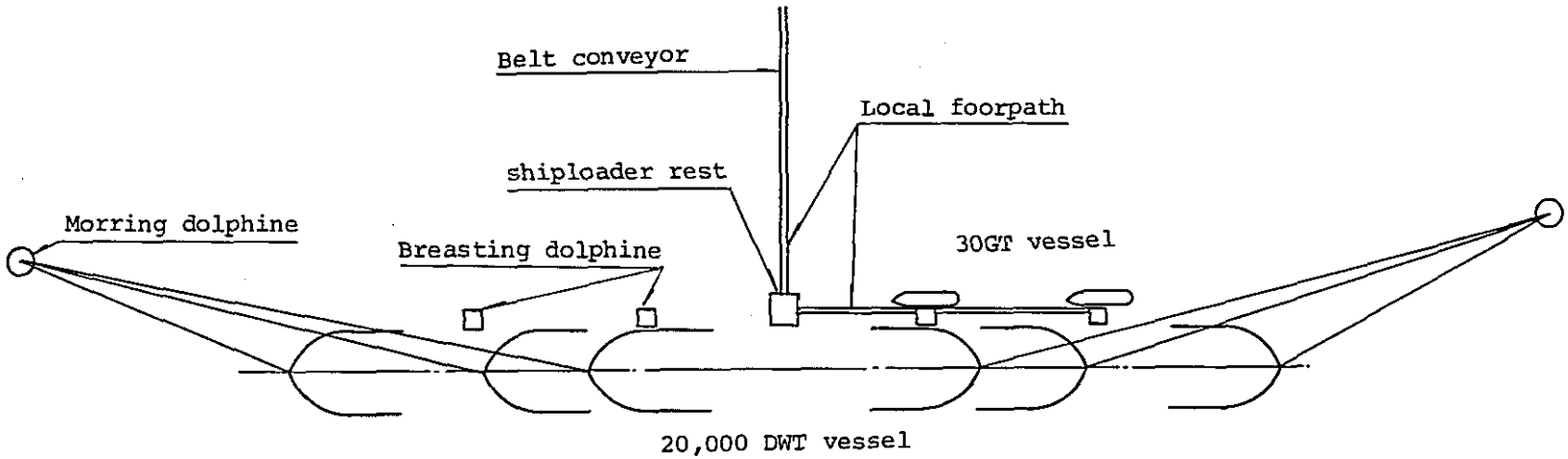


Fig. 5-23 Location of Berth and Buoy

SCALE = 1 : 5,000



Scale 1 : 2,000

Fig. 5-24 Shifting of 20,000 DWT vessel

The Project envisages that dolomite will be loaded directly aboard the vessel from ore storage by means of belt conveyor and ship-loader and, besides, volume of local cargo handled is expected small. Therefore, neither specific cargo handling facilities nor storages will be installed.

5-7 Port facility planning

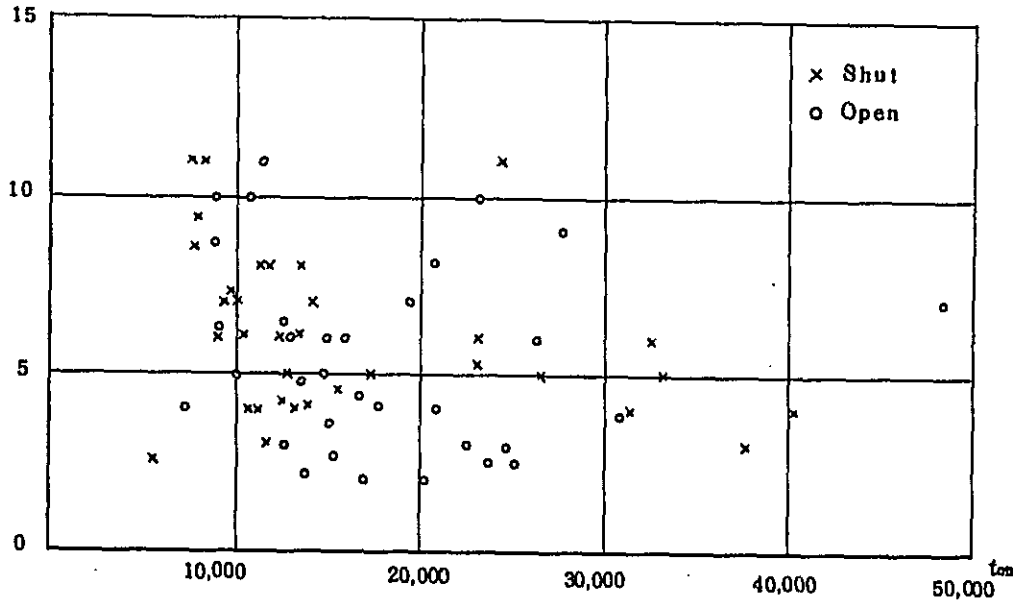
In consideration of studies which have been conducted, the Project envisages to adopt following type and structures for the projected port facilities.

5-7-1 Moorings for large vessels

Considering the ease of construction and installation and expenses involved, we recommend dolphine type moorings by means of piles as most suitable. As the size of structures is determined by the berthing force or velocity in the case of a dolphine type, the following method was used for determination of the berthing speed.

According to the results of survey on berthing speed, the relationship between the berthing speed and displacement of a vessel is shown in figure 5-25. It should be noted, however, that this diagram represents results obtained where tugboats are employed in quiet waters.

Fig. 5-25 Berthing speed and displacement on entry into port



On assumption that a vessel berths itself without the aid of tug boat in the projected operation of vessel, the berthing speed of lightly loaded vessel is calculated as 30cm/sec. by the following formula. In case a vessel is loaded fully with cargo, the berthing speed is assumed 12cm/sec. on the basis of maximum value in figure 5-25 and in consideration of the rollings and shifts of a vessel.

$$V^2 = \frac{1}{750} \times \frac{S_1}{S_2} \times \left\{1-e^{-120.S_2 \cdot \frac{g}{17x}}\right\} U^2$$

v: Berthing speed (m/sec.)

S_1: Ship's side projection area on water surface (m^2)

S_2: Underwater ship's side projection area (m^2)

g: Gravity acceleration (9.8m/sec.)

M: Estimated weight = Δf + 1/4 (draft)^2 x (hull length) x (water concentration) ton

Δf: Displacement

x: Distance between a vessel and a dolphine (20m)

U: Wind velocity (10m/sec.)

$\log S_1 = 0.733 + 0.601 \log D.W.T.$

$\log S_2 = 0.632 + 0.661 \log D.W.T.$

$\log f = 0.308 + 0.791 \log D.W.T.$

The large vessel moorings are composed of a shiploader rest, a mooring bitt and a belt conveyor foundation beside a breasting dolphine. The strength of a shiploader is determined on the basis of berthing power, seismic force and wind pressure and the mooring bitt on the basis of the towing force of a vessel and a belt conveyor foundation on the basis of seismic force and wind pressure.

5-7-2 Local berth and navigational aids

The pile dolphine for 20,000 D.W.T. vessel will be utilized for the berth of a projected 30G/T vessel and a footbridge will be installed for passengers and crew between the berth and land

utilizing the shiploader rest and belt conveyor foundation. Buoys will be used for navigational aids and care will be used to ensure its safety against the impact of waves in typhoon. Table 5-9 shows moorings for dolomite carrier and local vessel which will be installed in consideration of these factors.

Table 5-9 Port facilities

Type	Quantity	Remarks
For large vessel		
Breasting dolphine	4 units	Steel piles: 812.8 dia. t=9-12 =30m 20 pcs. Reinforced concrete: 181m^3 Mold: 295m^2 Gunwale protector: cell typ : H=1.0 5 pcs. Bent poles: For 25t capacity, 4 pcs.
Mooring dolphine	2 units	Steel piles: 812.8 dia. t=0-12 =18m 12 pcs. Reinforced concrete: 77m^3 Mould: 121m^2 Straight pole: for 100 capacity, 2 pcs.
Shiploader rest	1 unit	Steel piles: 812.8 dia. t=9-12 =40m 9 pcs. Reinforced concrete: 73m^3 Mould: 109m^2 Gunwale protector: Cell type, H=1.0m 1 pc.
Belt conveyor foundation	12 units	Steel piles: 406.4 dia. t=9 =13m 10 pcs. Reinforced concrete: 189m^3 Mould: 270m^2 Drilling (limestone): 36m^3
For local service		
Breasting dolphine		Dolphines for large vessel used
Mooring dolphine		Dolphines for large vessel used
Overbridge	360m(l), 2m(W)	Steel piles: 508.0 dia. t=9 =30m 12 pcs. H steel, L steel, steel sheet, reinforcing bar Grating: 720m^2 Gunwale protector: Type SA, H=0.15m =1.0m 6 pcs.
Navigational aid		
Buoy	4 units	

CHAPTER 6 SURVEY OF POWER SUPPLY FACILITIES

Chapter 6 Survey of Power Supply Facilities

6-1 Background of power supply plan

Table 6-1 shows power requirements for mining dolomite in Alcoy and Dalaquete.

Table 6-1 Power Consumption

Type of equipment	Consumption
Crushing & sieving machines	800 kW
Plant conveyor	240 kW
Shiploader	520 kW
Others (extra illuminations)	240 kW
Total	1,800 kW

At present, no power has been supplied to people in Alcoy, except in Dalaquete where power is supplied for 12 hours during the night only. Therefore, in order to secure 1,800 kW power supply required for mining dolomite under the Project, either power must be supplied by utility transmission line or by construction of non-utility (private) generation plant.

This project compares the advantage of utility transmission and private generation proposals regarding power supply from various viewpoints, aiming to provide surplus power to citizens and thereby improve the welfare of residents in Alcoy and Dalaquete. As this project is closely related to the power development program in Cebu Province, we conducted thorough interviews and direct inquiries in the course of the recent field survey.

6-2 Power supply to Cebu Province, Alcoy and Dalaquete

At present, NPC (National Power Corporation) and VECO (Visayan Electric Corporation) are supplying to Cebu Province.

NPC operates Amlan (800 kW) and Loboc (1,200 kW) power plants, with total output aggregating 2,000 kW.

On the other hand, in Dalaquete, power has been supplied to approximately 500 households in central downtown during the night, all for lighting purpose except for potable water pumping. In this town,

generators are owned by private citizens but operated by municipal authorities in three shifts employing 6 workers engaged in operation from 18:00 pm to 6:00 am.

Under the circumstances, no power has in fact been supplied to schools, clinics or public offices during the day.

The power station is a wooden, single-storied building and is equipped with two 93.8 KVA capacity (75 kW) generators (60 Hz, 240V manufactured in U.K. in 1957), using, as fuel, crude oil delivered from Cebu City in drums. Though this power station is located in the central part of the town and produces loud noise, no complaints have been lodged by neighboring residents.

Power consumption averages 100 to 200 W per household in Dalaquete, with utility charge being 16 pesos up to a consumption of 15 KWH and 0.6 peso per additional KWH. Total utility revenue amounts to approx. 7,000 pesos in proportion to a total running cost of 9,000 pesos including fuel and personnel expenses, with deficit born by the municipal authorities.

Alcoy operates a small power plant, but the municipality uses it only for operating pumps for potable water supply, but not for supplying electricity to residents.

6-3 Power development project in Cebu Province

6-3-1 Power demand forecast in Cebu Province

NPC (National Power Corporation) estimates potential growth in demand for power in Cebu Province as shown in Table 6-2. The table indicates a notable annual increase of 20% during 1977 through 1978. From 1978 onwards, power demand will continue to grow 4% over the preceding year up to 1990. At present, it is noted that power demand is much less in Cebu City than in Toledo City despite the presence of greater population in the former, which is apparently due to heavy demand for power by the dolomite mining program in Toledo City.

Table 6-2 Power demand forecast in Cebu Province

	1977	1978	1979	1980	1985	1990
Cebu	78,395	84,760	92,295	99,210	139,110	190,265
Danao	9,800	10,040	10,310	10,610	18,160	18,110
Mactan	6,955	7,135	2,445	8,020	9,520	12,455
Sogod	185	200	225	255	400	595
Bogo	2,365	2,385	2,450	2,525	2,925	4,365
Sibonga	1,485	1,595	1,700	1,950	2,960	4,250
Toledo	90,740	120,780	122,510	124,595	133,985	144,145
Boljoon	530	565	635	705	1,130	1,605
Total	190,455	227,710	237,630	247,870	302,190	370,450

6-3-2 Power generation project in Visayas

NPC mapped out a plan to construct power plant (Table 6-3) in Visayas in line with power demand forecast (Table 6-2).

Table 6-3 Power plant projects in Visayas

Province	Projects	Output (kW)	Target year
Cebu	Diesel Power Project-I	51,100	1977
Negros	Diesel Power Project	11,000	1977
Bohol	Diesel Power Project	11,000	1977
Panay	Diesel Power Project	29,200	1978
Cebu	Diesel Power Project-II	90,000	1979
Cebu	Thermal Power Project	55,000	1980

Table 6-3 estimates total power supply during 1980 as 196,110 kW in Cebu Province, but in fact, the execution of Cebu-Diesel Power Project-I (output: 51,100 kW) is behind schedule and, besides, there are problems of switching over to existing non-utility generation system and discontinuance of such private power generation plants. Under the circumstances, it must be difficult to carry out projects on schedule.

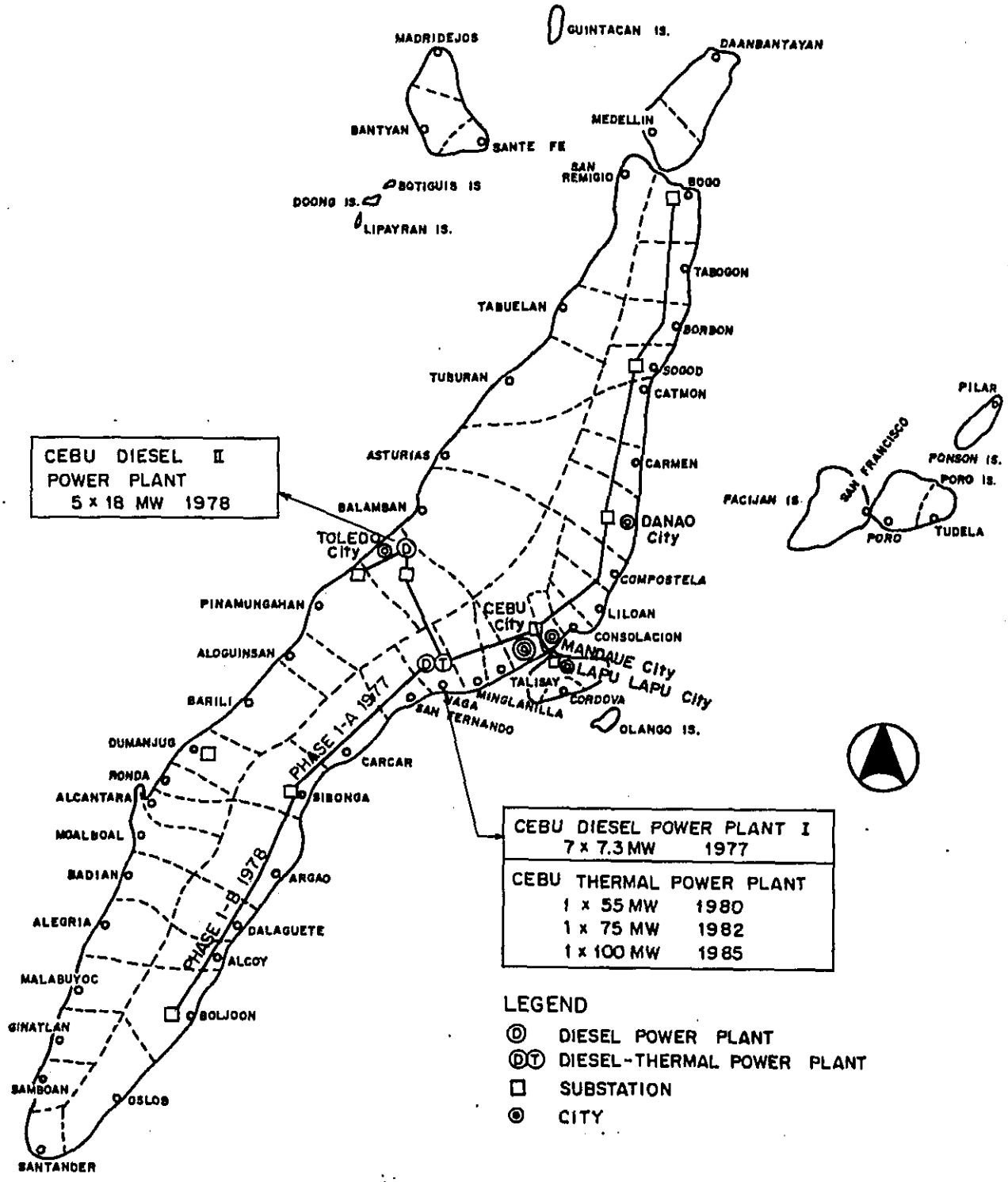


Fig. 6-1 CEBU Electric Power Plan

6-3-3 Naga Power Plant Project

Visayas Power Plant Program comprises Cebu-Diesel Power Project, I and II, which covers the construction of Naga power plant at a location 22 km south of Cebu City (Fig. 6-1).

In case power is supplied to the dolomite mining project in Alcoy and Dalaquete, NPC will be supplying power from Naga Power Station.

Table 6-4 Naga Power Plant Project

	Output	Type	Target year
Phase 1	7.3 MW x 7	Diesel	1977
Phase 2	55 MW x 1	Thermal	1980
Phase 3	75 MW x 1	Thermal	1982
Phase 4	100 MW x 1	Thermal	1985

Figure 6-1 shows the power transmission scheme from Naga Power Plant. Of this power transmission project, the line extension projects to Alcoy and Dalaquete are subdivided into phase 1-A and B as in Table 6-5. Phase 1-A is underway.

Table 6-5 Power transmission scheme

	Phase 1-A	Phase 1-B
Area	Naga-Sibonga-Dumanjug	Sibonga-Boljoon
Distance (Km)	55	47
Voltage (kV)	69	69
Cable	MCM 336.4	MCM 336.4
Expenditures	Peso 8,057,940	Peso 7,972,430
Target year	1977	1978

The projected dolomite mines are located between Sibonga and Boljoon (Phase 1-B), about 32 km away from Sibonga.

Table 6-6 shows projects on the construction of Naga Power Plant and substations in Sibonga and Boljoon.

Table 6-6 Substation projects

Substations	Capacity	Target year
Naga	138/138 kV 38 MVA 2 units	1977
	138/ 69 kV 30 MVA 1 unit	1977
Sibonga	69/138 kV 5 MVA 1 unit	1977
Boljoon	69/138 kV 5 MVA 1 unit	1978

In the case of utilizing NPC's power for development of dolomite mines, it would be best to install substations in the vicinity of Alcoy and Dalagete for reception of power from a transformer (138/69 KV, 30 MVA) at Naga Substation

On the other hand, in the case of receiving power supply directly from Sibonga or Boljoon without installing substations in the neighborhood of Alcoy or Dalaquete, it is possible that substations in Sibonga and Boljoon (5 MVA each) may not have sufficient capacity for required power supply because a transformer with a capacity of 3 MVA is necessary for transportation of dolomite ore.

6-3-4 Progress in power development prcject

1) Naga Power Plant

Phase I Project, due to be completed in 1977, includes the erection of 7 diesel generators, piping, wiring and construction of buildings and outdoor substations, fuel discharge pier and oil tank, etc. Of these, erection of generators and construction of buildings and outdoor substations have been nearly completed. Of 7 generators, two have been in the stage of testing and adjustment and remaining 5 units are likely to be completed in 1978. This power plant was designed and supervised by a French consultant.

On the other hand, fuel discharge pier has been constructed by local company under design and supervision of an Italian consultant, but work progress is about two years behind schedule.

Phase II Project, due to be completed in 1980, includes the erection of a turbine generator (55 MW) and related facilities. In this project, site planning has been completed and the foundation work of shed and turbine is underway.

This project is also considerably behind schedule and there is no outlook for the completion of work within 1980.

From the above, we estimate that Phase I Project will enter into operation in 1980 (partially in 1979) and Phase II Project during 1981 through 1982. Phase I Project alone will be able to provide sufficient power to dolomite mines. Provided NPC's power is utilized, it seems that power reception is available in 1980.

2) Transmission lines

Phase I-A Project, due to be completed in 1977, is still in the stage of building poles (Naga-Sibonga-Dumanjug), but no transmission lines have been laid yet. Though delay in the construction of Naga Power Plant may necessitate a corresponding delay in the installation of transmission lines, it is nevertheless expected that the project will be completed in 1978.

The transmission line between Naga and Sibonga is being installed over gentle slope about 500 to 1,000 m toward mountain from the national road running along the beach.

For power transmission with a voltage of 69 KV, Acsr 336.4 Mcm cable will be used. All utility poles will be wooden (impregnated with creosote) and H-shaped, either single or 2-3 poles. With Phase-I B Project (Sibonga-Boljoon) due to be completed in 1978, even transmission route survey has not been started, which means that the start of dolomite mining will be deferred beyond 1980. As practiced in the Philippines, however, it is possible to complete the Project in 1980 provided financial aid is extended to NPC, such by means of prepayments for utility charge.

3) Substations

As mentioned, the erection of three transformers and attached equipment and wiring have almost been completed. The work is roughly on schedule and will be completed in 1979.

Sibonga Substation is scheduled to be equipped with one transformer (69/13.8 KV, 5MVA), but work has not been started yet, nor is there a prospect for completing the erection of the transformer within 1977 though site planning has been completed.

It is expected for the moment that the erection work will be timed

to the progress in the construction of power plant and installation of transmission lines.

Boljoon Substation is also scheduled to be equipped with one transformer (69/138 KV 5 MVA), but work has not been started yet. On assumption that power is supplied from a substation to be installed in the neighborhood of the projected dolomite mining site, a system of Naga Power Plant transmission routes and substations would be drawn by a single-line diagram as illustrated in Fig. 6-2.

Also, thanks to interviews and direct inquiries at NPC, useful data and information were obtained regarding regulations on utility charge, laws and regulations related to power supply, electric appliances, constructors and power supply and reception facilities and climate and weather conditions.

Paragraph on Data and Information will deal with them.

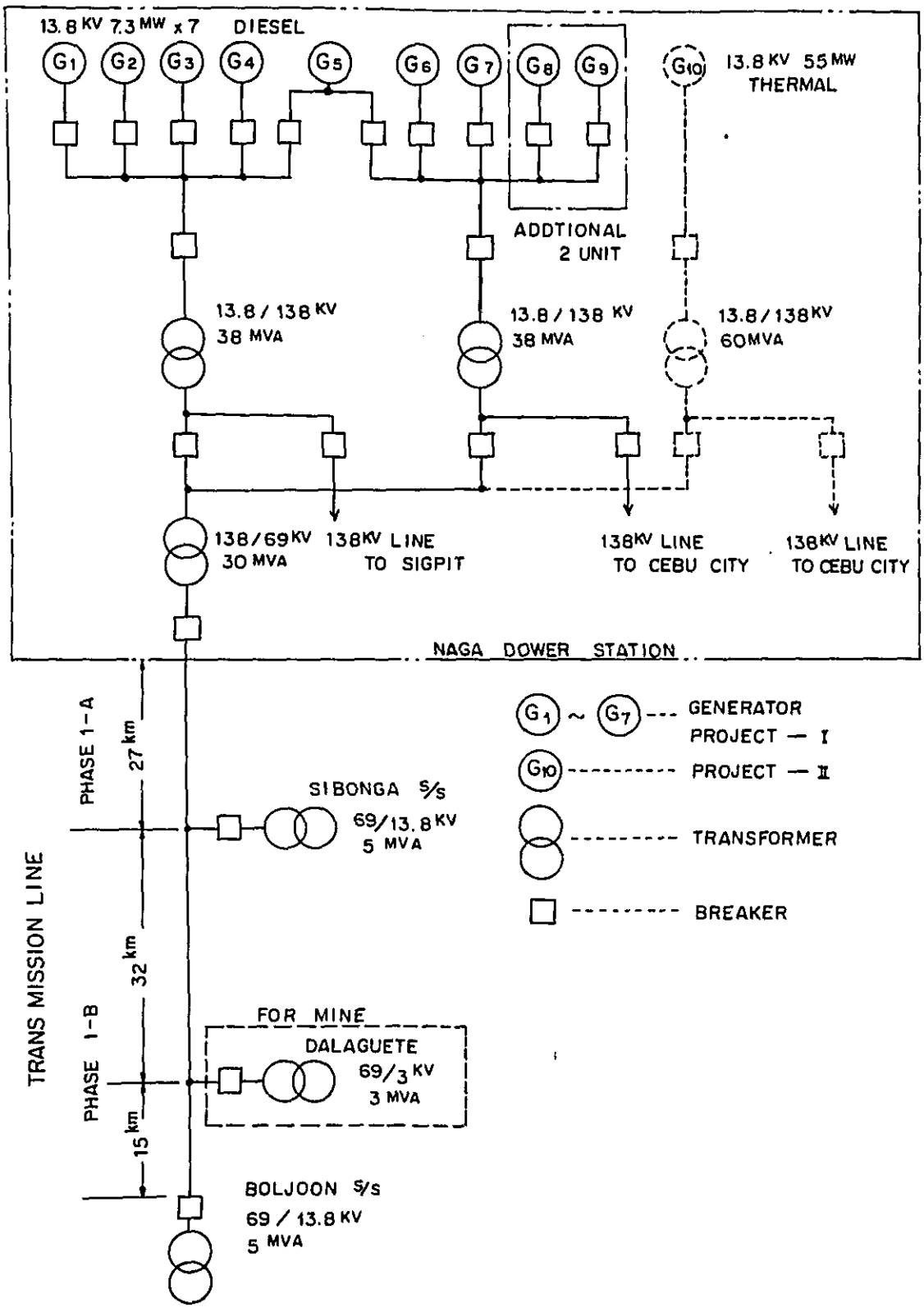


Fig. 6-2 One Line Diagram

6-4 Power supply

Whether the utility power transmission system (reception of NPC's power supply) or the non-utility power generation system for mineral exploitation is adopted will be finalized after field survey and studies on required electric installations, construction cost and ease of maintenance.

6-4-1 Industrial and local power requirements

Estimated power requirements for mineral exploitation amounts to 1,800 kw as indicated in table 6-1. The capacity of a substation or transformer will be set at 3 KV, 3000 KVA (2,400 kw) including additional requirements in the future and a load of 300 kw for local use (presently 150 kw in Dalaquete) plus a little surplus.

6-4-2 Utility power transmission system

One of the crucial problems in utilization of NPC's (National Power Corporation) power supply is that it is not clear whether Naga Power Plant and transmission lines can be completed until 1980 when the dolomite mine is scheduled to enter into operation. We shall proceed with our studies on assumption that these facilities will be completed and provide power as originally scheduled.

(1) Scale of transmisstion line and substations

Industrial and local lead-in transmission lines branch off from Phase 1-B of NPC's transmission line and is connected to the receiving and transformer substation. Though Phase 1-B Route has not been finalized, it is anticipated that the transmission line will be laid at a location 200 to 300 m away from the national road toward mountains, judging from a progress Phase 1-A where construction has been uderway.

Therefore, the transmission line should be installed for a distance of 500 m with power requirements of 3-phase, 60HZ, 3000 KVA.

Table 6-7 indicates receiving and transformer substations for mineral exploitation and local use. Total site requirements for the substation including that for the mining equipment control office reach 750m^2.

Most of major equipment will be imported, but foundation and building materials and electric poles can be locally procured.

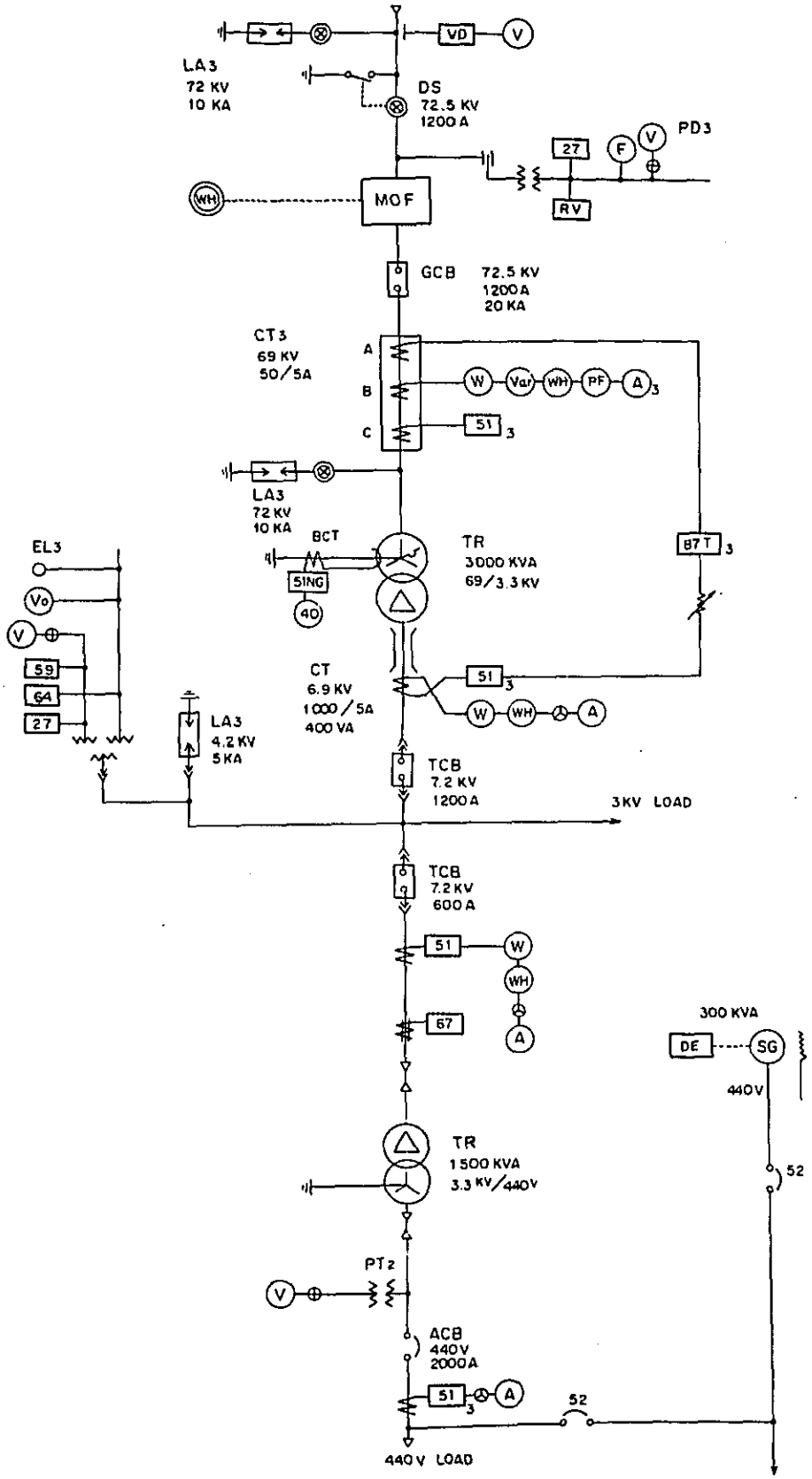


Fig. 6-3 One line Diagram of Substation 69KV, 3 MVA

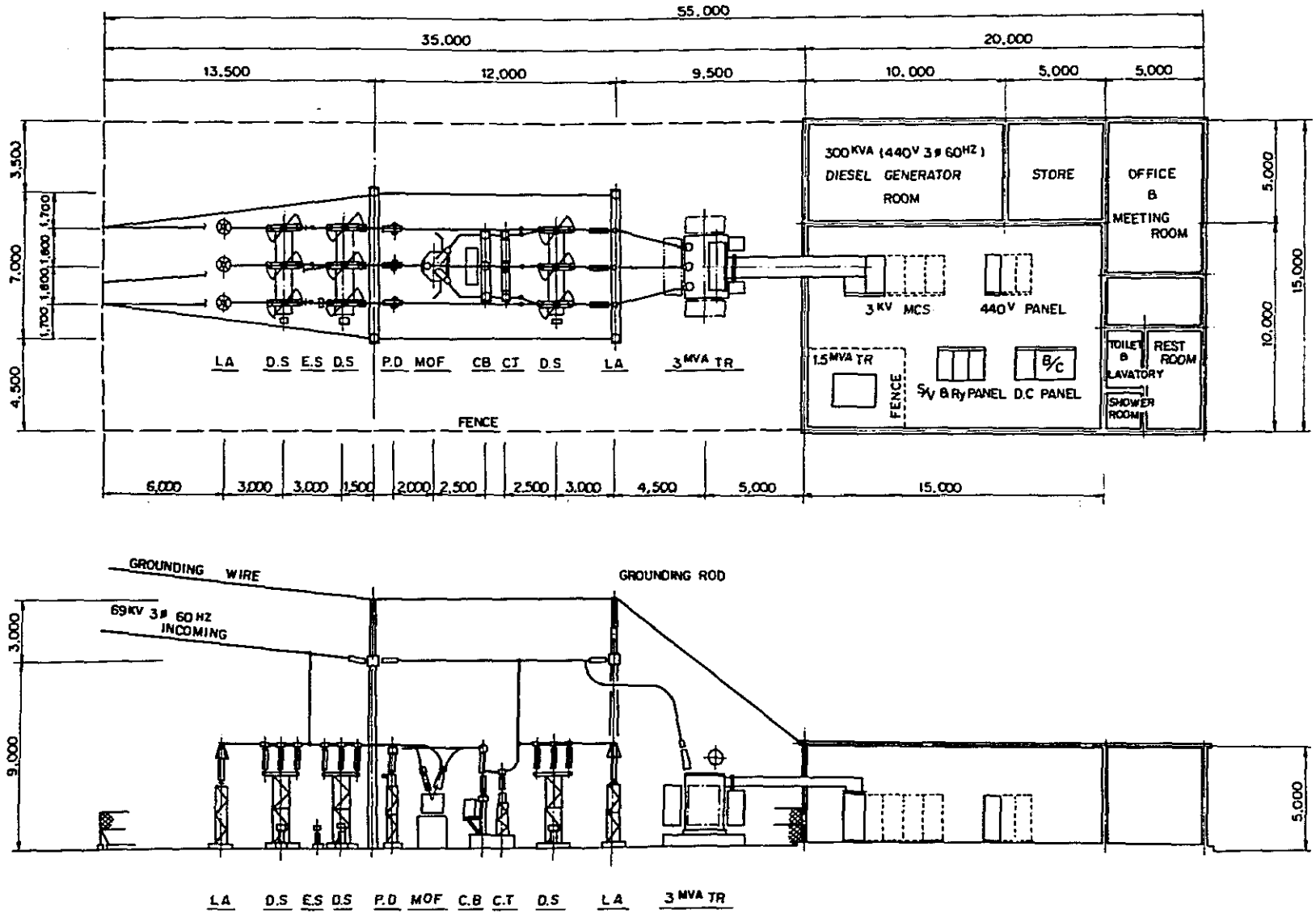


Fig. 6-4 Layout of Substation, 69 KV, 3 MVA

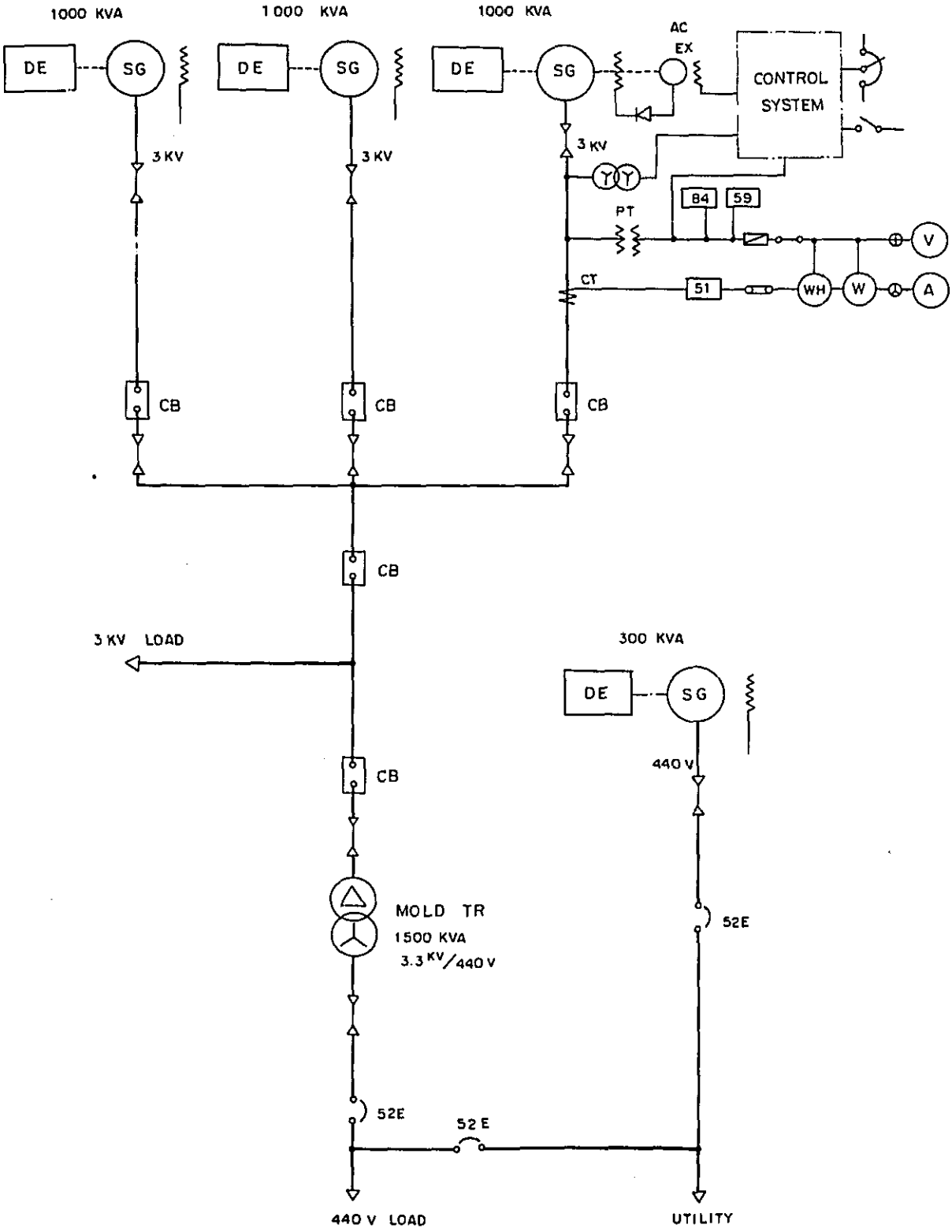


Fig. 6-5 One line Diagram of Power Station, 3KV, 3MVA

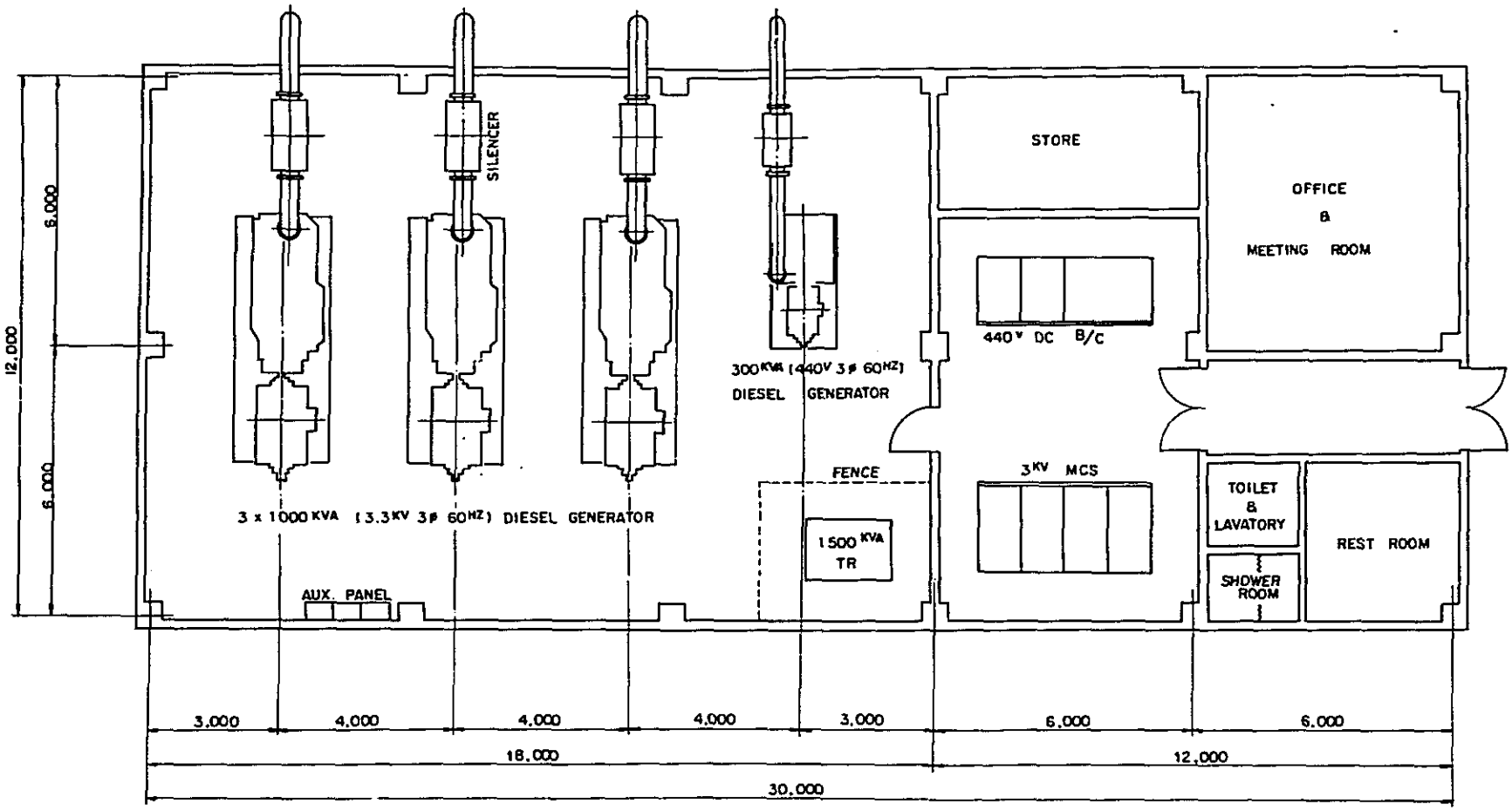


Fig. 6-6 Layout of Power Station , 3KV , 3MVA

Figures 6-3 and 6-4 show single-line diagram and equipment layout.

Table 6-7 Substation equipment

Receving breaker	72KV, 1,200A, 20KA (1 unit)
High-tension load transformer	69/3KV, 3,000KVA (1 unit)
Low-tension load transformer	3/0.44KV, 1,500KVA (1 unit)
Emergency generator	440V, 300KVA (w/360 PS motor) (1 unit)
Others	Consult figures 6-3 and 6-4.

6-4-3 Non-utility power generation

Table 6-8 shows projected Non-utility power generation capacity. The Project envisages to install three 1,000KVA generators to facilitate the selection of appropriate number of generators meeting load requirements, efficient operation of generators, interchangeability of component parts and erection of generators. Emergency generator will be used during the night and holidays as required. Total site requirements are 400m^2 (approx.) and major equipment will also be imported as in the case of installing the substation. Figures 6-5 and 6-6 show single-line diagram and equipment layout.

Table 6-8 Non-utility power generation equipment

Main generators	3KV, 1,000KVA (w/1,200PS motor) (3 units)
Low-tension load transformer	3/0.44KV, 1,500KVA (1 unit)
Emergency generator	400V, 300KVA (w/360PS motor) (1 unit)

6-5 Comparison of power transmission and private generation

Table 6-9 shows the comparison of advantage of power transmission and private (non-utility) power generation with regard to the reliability of power supply, ease of increasing load and influence on local residents, other than initial and running cost.

Table 6-9 Comparison of power transmission with private generation

	Power Transmission scheme	Private power generation scheme
Initial cost	$790,000	$1,290,000
Running cost	$ 46,400/month	$ 48,200/mounth
Time of operation	As per NPC schedule	Private schedule
Reliability	Relatively low	High
Load increase	Easy	Difficult
Local power supply	Easy	Difficult
Noise	Low	High
Impact of markup in fuel price	Indirect	Direct
Industrial water supply	Unnecessary	Necessary
Communication facilities	Necessary	Unnecessary

As indicated in table 6-9, the power transmission system costs less in the initial and the running costs (direct expenses). Besides, in the case of the non-utility power generation system, it is difficult and troublesome to secure and transport fuel and provide routine maintenance to generators. Also, it involves fire hazard and increased maintenance cost on rotary machine year after year.

From the viewpoint of impact on local residents, the power transmission program is more recommendable in respect of stable power supply and noise control. On the other hand, private generation scheme is more reliable in power supply. In the case of the power transmission scheme, there must be some means of communication between Naga Power Plant and the Projected Substation in case of power failure and other electrical or mechanical troubles.

For this reason, we checked appropriate means of communication with Philippine Long Distance Telephone and Bureau of Telecommunication and learned that wireless is the most suitable device for the moment.

In conclusion, the power transmission scheme is more advantageous than the private power generation scheme, though to some extent influenced by progress in installation of NPC's Naga Power Plant. The Chapter of Information deals with the comparison of running costs between the transmission and private generation schemes.

CHAPTER 7 ROAD AND BRIDGE SURVEY

Chapter 7 Road & Bridge Survey

7-1 Background

The road and bridge construction/improvement plan is closely associated with the projected site of port facilities. In other words, in case port facilities are constructed near Alcoy or Dalaquete, the national road between Cebu and Alcoy would only be utilized for transportation of a small quantity of equipment and materials required for the dolomite mining project. On the other hand, if a dolomite loading point is installed within existing Cebu Port, the national road would facilitate the traffic of a considerable number of large dump trucks. Thus, depending on the location of dolomite loading point, the object and scope of roads and bridges to be constructed or improved are different, but this comparison should be made through the assessment of economic benefits including the port facilities project.

This Chapter chiefly deals with the plan to install dolomite loading facilities near a boundary between Alcoy and Dalaquete, with the dolomite transportation plan between Cebu and Alcoy referred to in the Chapter of Information.

The road and bridge construction/improvement project also envisages to promote the development of Alcoy and Dalaquete municipalities and traffic safety measures for local residents.

7-2 Improvement of roads and bridges between Cebu and Alcoy

7-2-1 Present situation

Figure 7-1 shows main roads in Cebu Province, whereof a distance between Cebu City and the projected dolomite mine is about 90 km. This national road runs south to north over a plain along the coast. As specified in Figure 7-2, accidents are liable to occur in three locations of the road due to the small plane radius of curve and steep longitudinal slope.

(1) Road width

The national roads in Cebu City are 4-lanes divided way composed of carriage ways, sidewalks and Medians. Contrarily, roads

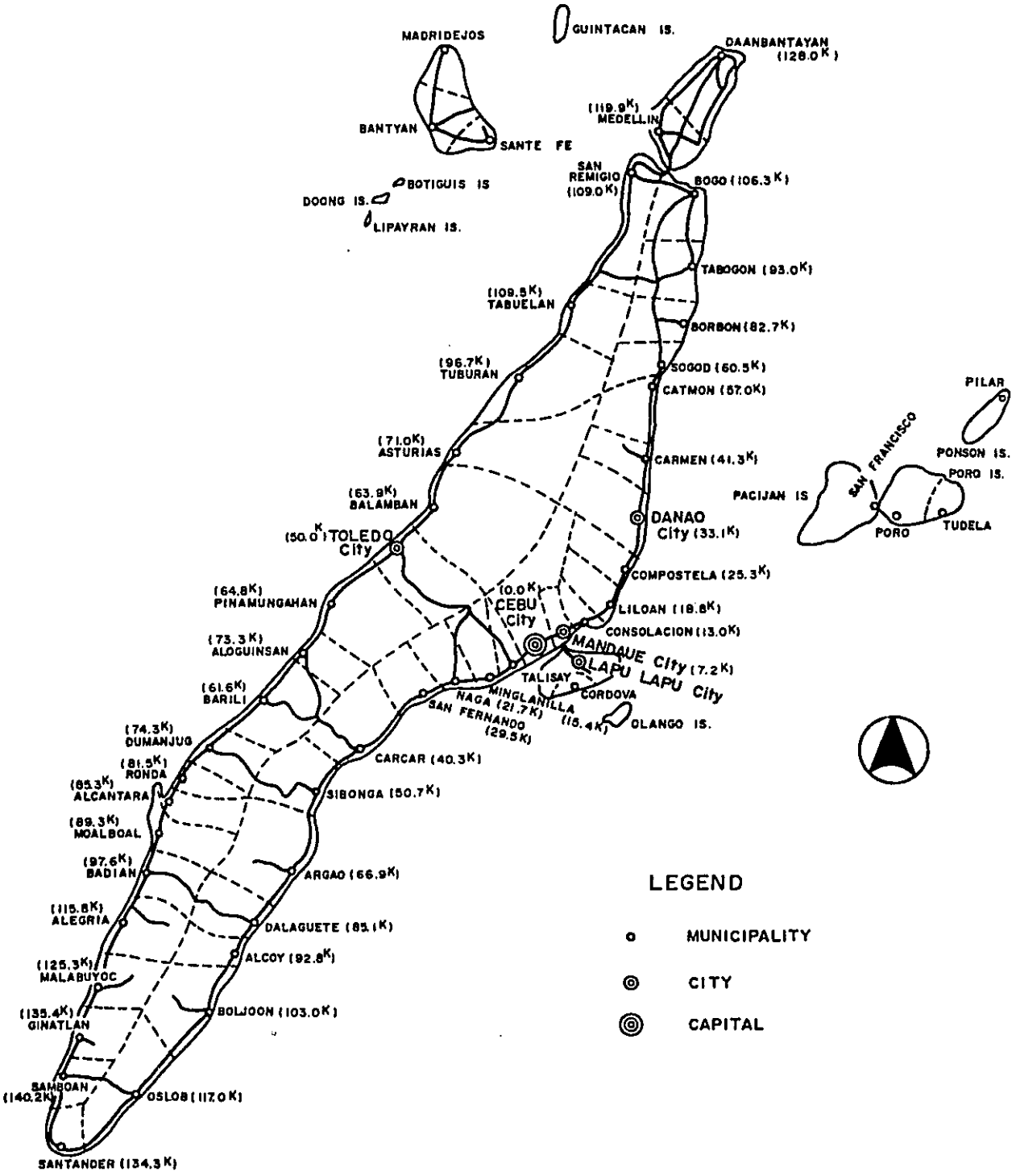


Fig. 7-1 Main Road Map

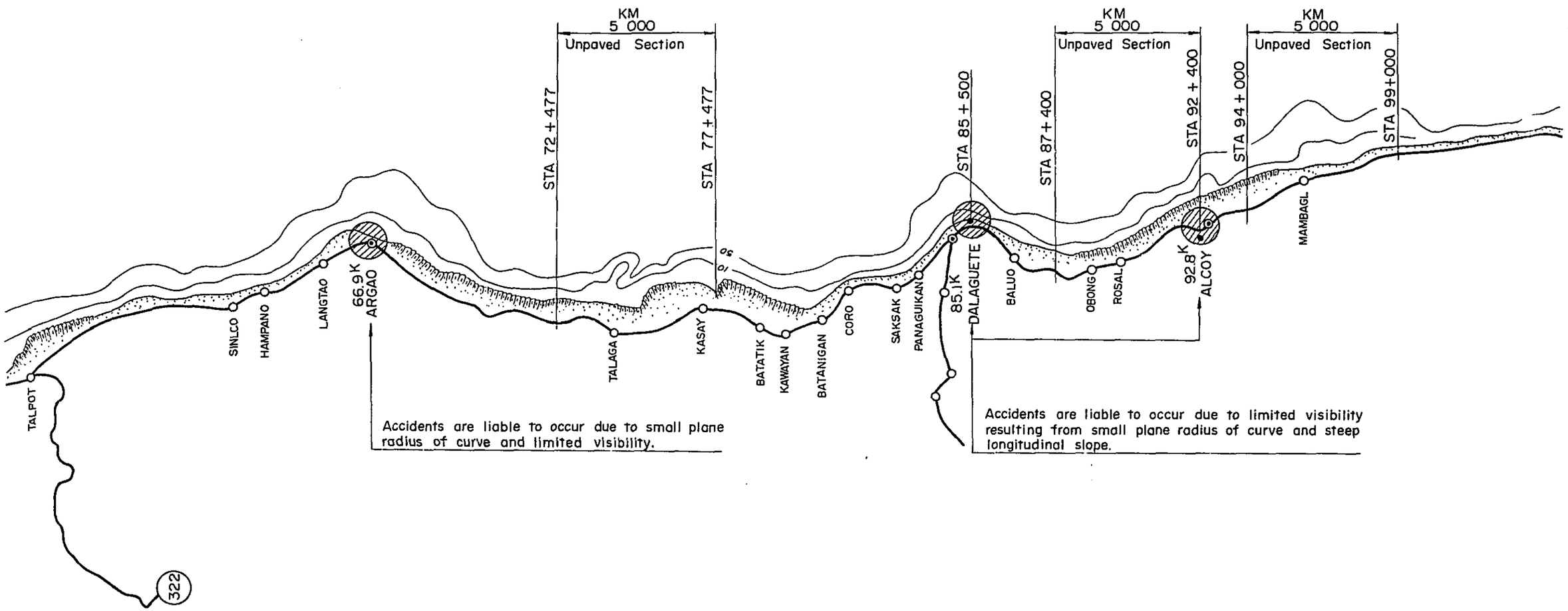
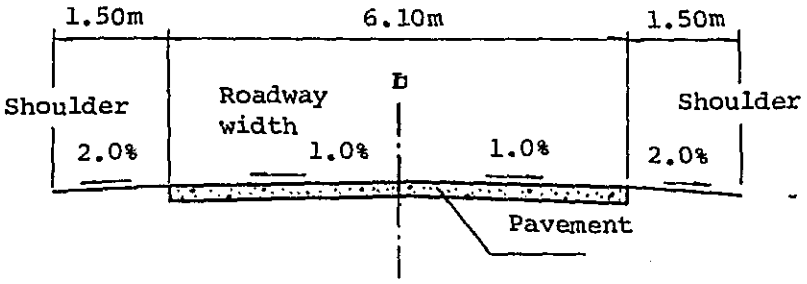


Fig. 7-2 Existing Road Map = between Argao and Alcoy

between Talisay and Alcoy have two lanes. Fig. 7-3 shows typical cross section. Proper maintenance has not been provided to some shoulders.

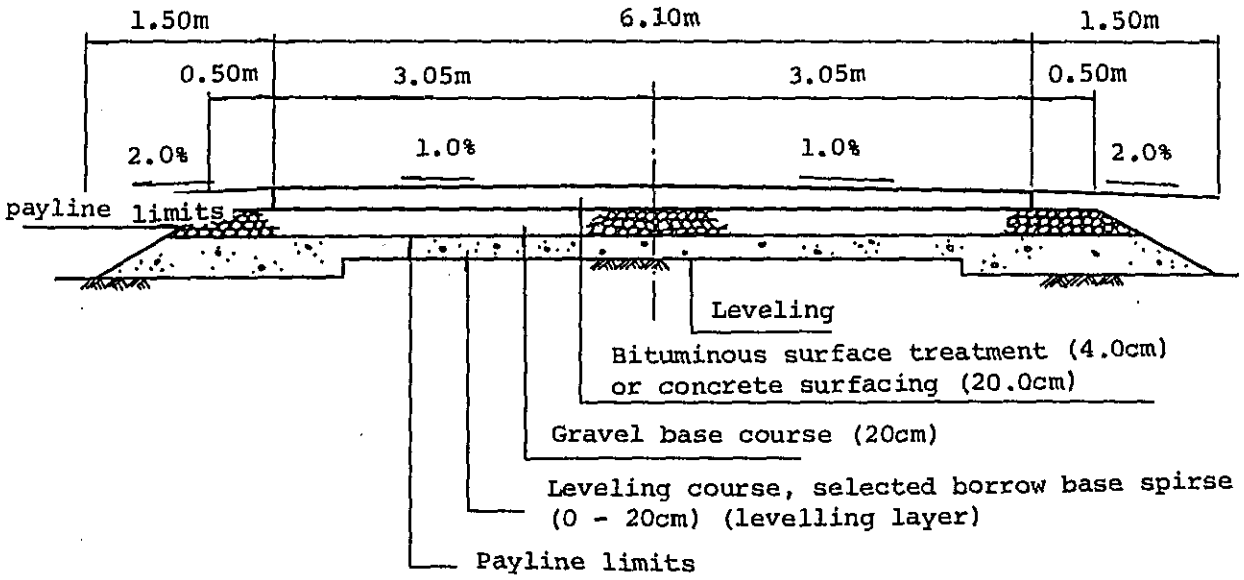
(Fig. 7-3) Standard cross sectional view



(2) Pavement

Roads are paved either with concrete or bituminous, as indicated in Figure 7-4.

(Fig. 7-4) Pavement structure



As indicated in Fig. 7-2, roads between Cebu City and Alcoy are left unpaved in three locations, about 5 km each between Argao and Dalaquete, Dalaquete and Alcoy and in Alcoy municipality. The Bureau of Public Highways disclosed its plan to pave the following roads, but it is likely that the pavement work will be completed ahead of schedule because pavement work had already in part been set about during the period of survey (October 1977).

Argao - Dalaquete	5.0 km	July 1979 through April 1980
Dalaquete - Alcoy	5.0 km	September 1979 through June 1980
Alcoy	5.0 km	From 1980 onwards

(3) Traffic between Cebu City and Alcoy

Roads in Cebu City are congested with the heavy traffic volumes of vehicles during morning and evening peak hours. Even in the outskirts of Cebu City, average daily traffic reaches about 5,000 to 6,000 vehicles, but in the section about 60 km away from the city proper, average daily traffic is reduced to 100 to 500 vehicles. Table 7-1 shows the traffic volume as surveyed by the Bureau of Public Highways in 1976.

According to the table, daily traffic volume between Cebu City and Alcoy totals about 6,500 vehicles near Minglanilla, about 2,100 near Sanfernando, about 610 near Carcar, about 320 near Sibonga, about 220 near Argao and about 100 near Alcoy.

Table 7-2 shows the results of a traffic survey conducted on September 13, 1977 for 12 hours (6:00 am to 6:00 pm) in Talisay. According to the survey, the volume of traffic during 12 hours was 4,800 vehicles, similar to the statistics compiled by the Bureau Bureau of Public Highways in 1976.

The traffic survey was made by three types of vehicles, 1) passenger car and taxi, 2) jeepney and 3) bus and truck.

Table 7-1 Daily traffic in Cebu City

Route	Post (Km)	Number of vehicles
Talisay - Minglanilla	14.00	6,464
Naga - Sanfernando	29.00	2,053
Carcar - Sibonga	44.00	609
Sibonga - Argao	55.00	315
Argao - Dalaquete	72.00	222
Dalaquete - Boljoon	95.00	104
Boljoon - Oslob	110.00	100
Oslob - Santander	186.00	99
Talisay - Teledo	12.00	1,099
Mandaue - Consolacion	12.50	4,941
Liloan - Compostela	21.50	2,147
Carmen - Catmon	55.00	427
Tabogon - Bogo	98.50	573
Bogo - San Remegio	105.00	390
Carcar - Balili	44.00	301
Balili - Dumanjug	66.00	203
Dumanjug - Renda	80.00	246
Moalboal - Badian	90.00	112
Badian - Alegria	107.00	84
Alegria - Malabuyok	127.00	61
Ginatlan - Santander	139.00	115

Average annual daily traffic of the new nationwide traffic counting program for the year 1976, Cebu Island.

Table 7-2 Daily Traffic in Talisay

September 13, 1977

Time	Alcoy to Talisay			Talisay to Alcoy			Total
	(1)	(2)	(3)	(1)	(2)	(3)	
A.M.							
6.0 - 7.0	26	74	16	19	39	18	186
7.0 - 8.0	116	143	33	38	83	30	443
8.0 - 9.0	102	104	52	90	90	46	484
9.0 - 10.0	89	88	40	101	103	47	468
10.0 - 11.0	83	79	46	86	85	40	419
11.0 - 12.0	88	91	52	69	85	50	435
P.M.							
12.0 - 1.0	57	63	41	64	56	32	313
1.0 - 2.0	74	81	45	66	84	38	388
2.0 - 3.0	81	85	64	61	71	59	421
3.0 - 4.0	75	86	59	62	71	50	403
4.0 - 5.0	92	79	46	55	91	63	426
5.0 - 6.0	70	98	40	74	94	51	427
Total	953	1,071	534	785	952	518	4,813

(1) Passenger car and taxi

(2) Jeepney

(3) Bus and truck

7-2-2 Present situation of bridges

A total number of major bridges between Cebu City and Alcoy is 19, but most of them have been superannuated.

Of these bridges, several old ones were installed in 1910. Four out of 19 bridges have an effective width of only 4.0 m where encountering is impossible.

By types of bridges, there are 3 metal bridges, 1 through-truss type and 1 I-beam type bridges. Others are concrete bridges, including prestressed concrete bridge, reinforced concrete slab bridge and concrete arch bridge.

Most of bridges have a span ranging 15 to 20 m and the longest bridge is Mananga Bridge measuring about 190 m.

Table 7-3 shows the material, type, length and span of bridges and Figure 7-5 locations.

Table 7-3 Structures in Existence

Bridge	KM	Material and Type	Length and Eash Span
1 Mananga	10.57	RCDG	13 @14.60 = 189.80 m
2 Pingan	13.81	"	1 @12.00 = 12.00 m
3 Pakigne	14.34	"	3 @ 8.50 = 25.50 m
4 Abuno	16.89	"	3 @14.00 = 42.00 m
5 Tina-An	22.77	Stone Composite	1 @13.20 = 3@ 7.60 2 @ 9.00 = 54.00 m
6 Langtad	25.76	Precast Concrete	1 @ 6.00 = 6.00 m
7 Langtad	26.00	RCDG	1 @ 8.00 = 8.00 m
8 San Isidro	27.78	Cast Iron Beam	1 @16.438 = 16.438 m
9 Suba	34.77	RCDG	1 @10.00 = 10.00 m
10 Villadolid	37.69	Cast Iron Beam	3 @ 18.18 = 54.54 m
11 Carcar	40.11	RCDG	2 @16.70 = 33.40 m
12 Bolinawan	41.89	Concrete Arch	1 @7.70 = 7.70 m
13 Ocana	44.56	"	1 #6.80 = 6.80 m
14 Saba	51.25	"	1 @12.00 = 12.00 m
15 Bahay	52.00	Pile Slab	1 @5.00 = 5.00 m
16 Sta. Flomena	55.21	RCDG	1 @36.00 = 36.00 m
17 Dumlog	55.69	"	1 @5.00 = 5.00 m
18 Argao	60.31	"	7 @15.00 = 105.00 m
19 Dalaquete	84.66	Concrete Arch	1 @40.00 = 40.00 m

RCDG : Reinforcement Concrete Desk Grider

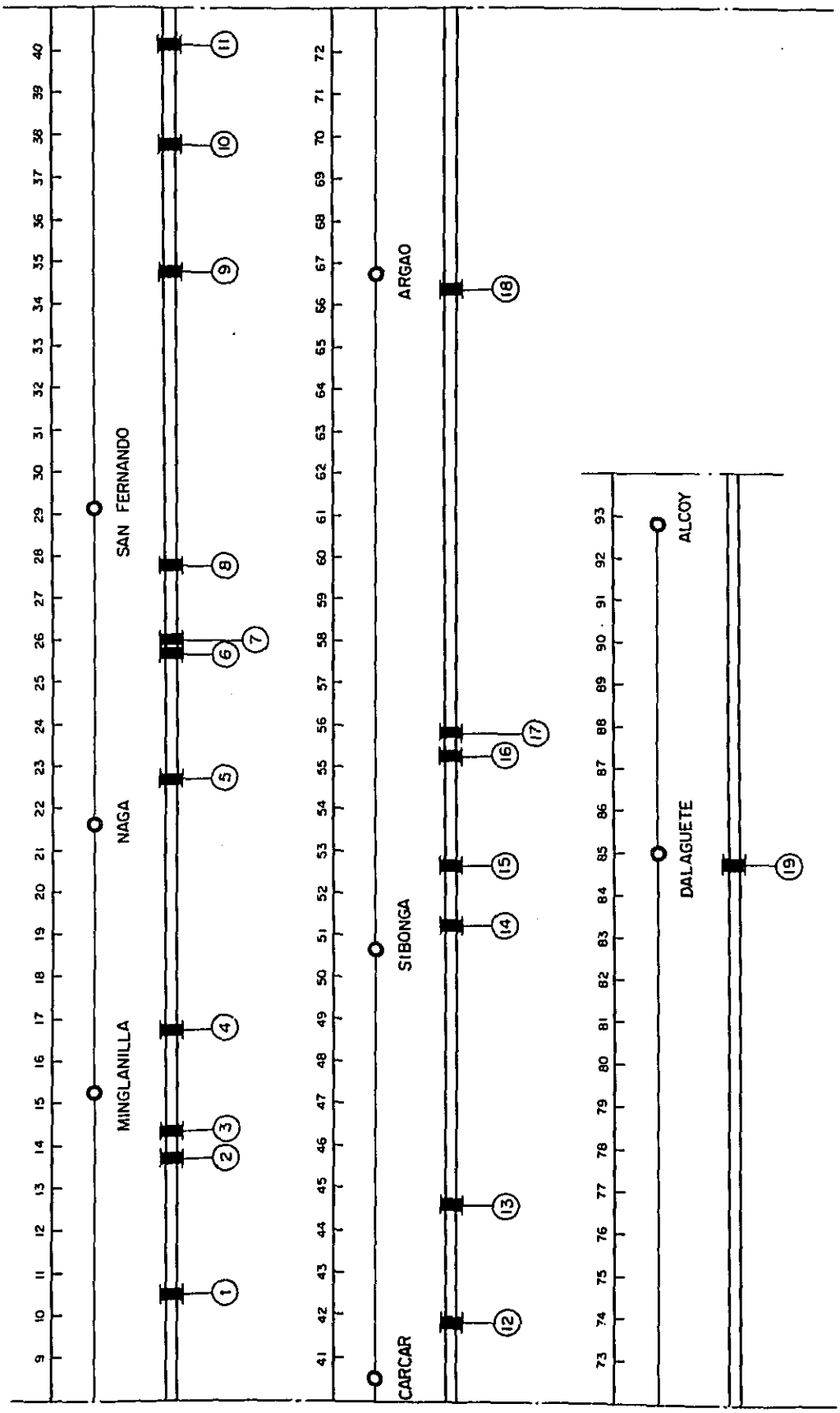


Fig. 7-5 Location of Bridges

7-3 Road and bridge construction/maintenance plan

7-3-1 Outline

The road construction and maintenance project will be mapped out on assumption that dolomite loading port is installed in the neighborhood of Alcoy and Dalaquete. In this instance, the national road between Cebu City and Alcoy will only be utilized for transportation of equipment and materials required for mining of dolomite.

Construction vehicles, equipment and materials include dozer, shoveldozer, road roller, dump truck, mobile crane, concrete mixer, generator, transformer, water pumps, piping, crusher, sieving machine, belt conveyor and reinforcing bar and frame. There is no likelihood of causing traffic congestion for transportation of these equipment and materials. Maximum load limits for public roads and bridges are 15 tons (gross weight) for a truck and 27 tons for a semi-trailer (gross weight). Therefore, if bulky or weighty equipment or materials are disassembled prior to delivery, smooth transportation should be possible between Cebu City and Alcoy. Though several bridges have been superannuated, we assume that these bridges allow the passage of vehicles provided maximum load limit is not exceeded, judging from a fact that large buses fully loaded with passengers going at high speeds. As there is no likelihood that the transportation of equipment or material may damage public road or bridges, or cause environmental deterioration to local residents, the Road Plan envisages to install, in the neighborhood of a boundary between Alcoy and Dalaquete, access roads for local residents which will link the national road with the port facilities.

Also, the Road Plan envisages to install road signs and marks as well as guard rails as a measure to ensure the traffic safety of residents in Alcoy and Dalaquete.

7-3-2 Construction of approach roads

This access road, designed to connect the overbridges of the port facilities with the national road, will be utilized by local residents and seamen for commuting to the port facilities. The

access road will also facilitate the maintenance and inspection of belt conveyors and the port facilities.

As indicated in Fig. 7-2, the carriageway width of this access road is 6.10 m. The road surface will be treated by bitumen of 4.0 cm. Figure 7-6 shows the linear of the access road.

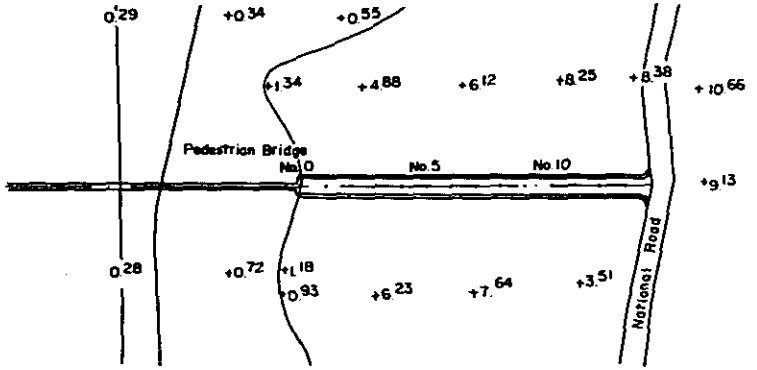
7-3-3 Traffic safety measures

Figure 7-2 shows two locations (STA. 85 km + 500 and STA 92 km + 400) where accidents are liable to occur due to small plane radius of curve and steep longitudinal slope.

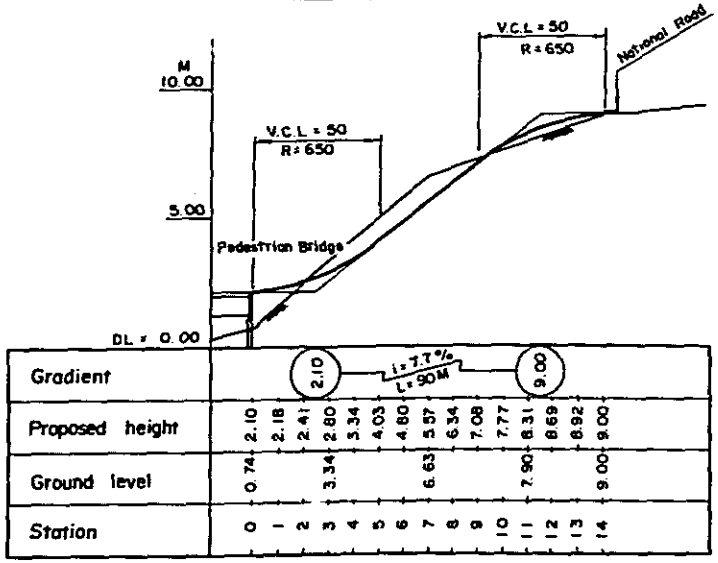
In fact, during the period of the latest survey (September 1977), a major accident occurred at STA 92 km + 400 causing many casualties. Under the circumstances, the Road Plan envisages to install 4 road signs and a guard rail (100 m long) in those two locations to prevent the recurrence of traffic accidents.

Figure 7-7 shows road sign and the structure of a guard rail.

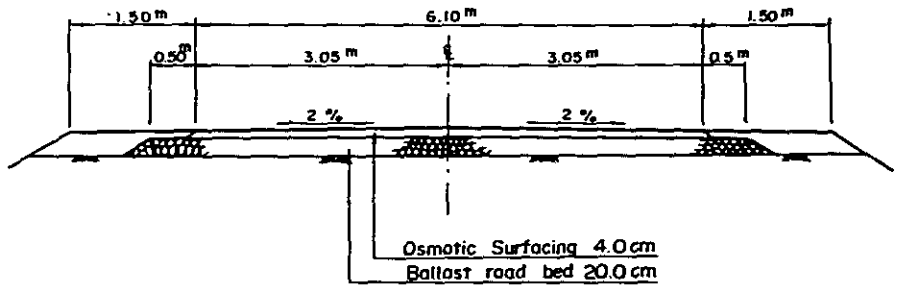
Plan S = 1 : 2000



Profile S = H 1:2000 / V 1:200



Typical Cross Section S = 1 : 60



Cross Section S=1:200

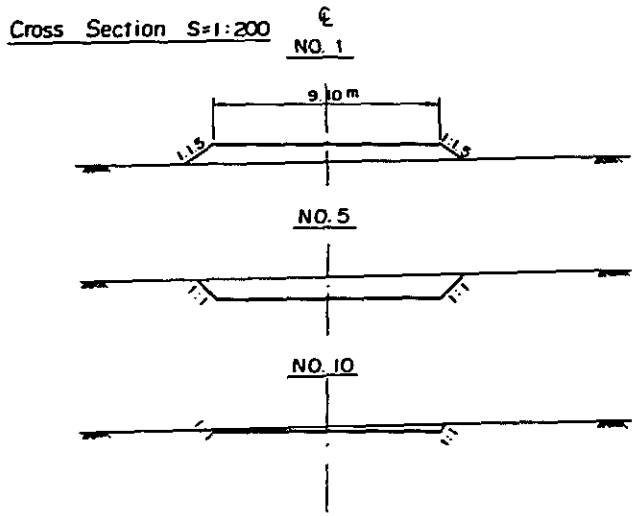
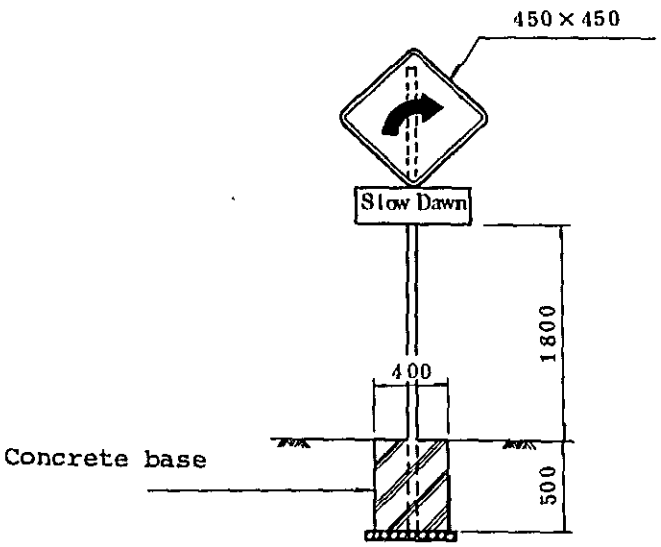


Fig. 7 - 6 Access Rod

Figure 7-7 shows road sign and the structure of a guard rail.

Road sign



Guard rail

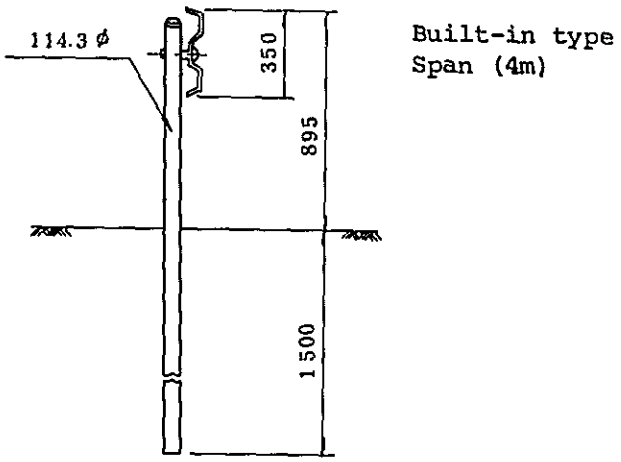


Fig. 7-7 Road sign and guard rail

CHAPTER 8 WATER RESOURCES SURVEY

Chapter 8 Water resources survey

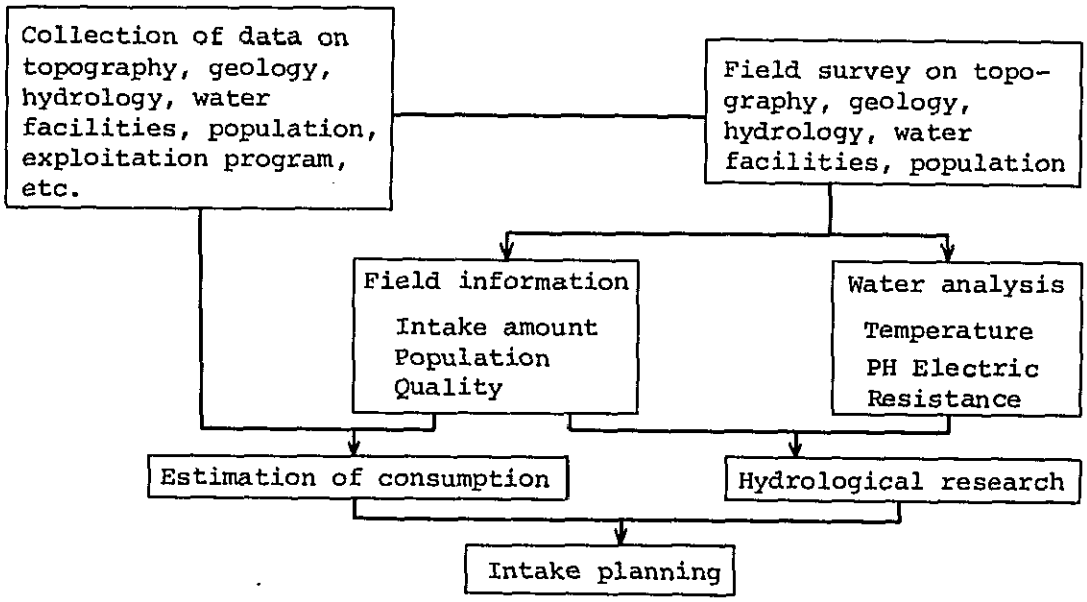
8-1 Background of water supply scheme

Survey was made into water resources in order to formulate plans for industrial and public water supply required in relation to the development of dolomite mines.

In accordance with procedures set forth in Fig. 8-1, studies and surveys were made on determination of potential consumption, available resources, source, intake and quality of water to provide basic statistical data for the water intake scheme. The Pugalo District in Alcoy, scheduled for a plant site, is located on a outlying border between Alcoy and Dalaquete municipalities and left in a backward condition where no water service has been provided.

Therefore, it is highly significant to map out plans to provide water service for public use as well as for industrial use.

Fig. 8-1 Survey procedures



8-2 Current water resources

8-2-1 Natural and hydrological conditions

Water resources survey was conducted in the coastal area projected for plant site in Alcoy and Dalaquete. This coastal area consists of platforms and lowlands lower than 100m above sea level and is

separated from mountanous area by steep slopes stretching straight in parallel with coastline. In front of the lowland, stretches a coastline consisting of small sand and rock beaches where calcareous rocks forming a platform are exposed. In many cases, there appears a large scale reef flat measuring 200 to 300m in width beside the coastline. In some parts of the reef flat, there emerge mangrove zones.

Soil near the surveyed area consists of alternate strata of porous limestone and dolomite, where bedrocks are from place to place exposed due to immaturity of soil. There also develop poljes and basins over heights of about 700m above sea level and there is no outflow of surface water.

Water does not ordinarily flow down drainage textures inscribed deep into mountains, and in flatlands and plains, dry river course cannot be identified. Water flows temporarily down these rivers only in the case of torrential rain.

In Dalaquete River with large basin and abundant water source in its upstream, the course of river is clear even in the plains and seasonal flow of water is observed. Some of water in several spring wells in inland areas gets exhausted before it is emptied into sea as surface stream.

As mentioned, it is assumed that rainwater in this area becomes ephemeral surface stream only on the occasion of torrential rain. Most of rainwater other than those evapotranspired infiltrate underground and contribute toward conservation of subsurface water. The water balance which basically governs total amount of water resources can be defined by the following equation on assumption that surface runoff is ignored judging from the regional characteristics of this area.

$$P = E + I$$

where

P : Precipitations

E: Evapotranspirations

I : Infiltrations

Precipitations are calculated on the basis of observation records

and evapotranspirations on the basis of Thornthwaite's equation of potential evapotranspirations.

$$e = 1.6\ (10\ t/I)^a$$

$$a = (0.675I^3 - 77.1I^2 + 17,920I + 492,390) \times 10^{-6}$$

$$I = \sum_{1}^{12} \left(\frac{t}{5}\right)^{1.514} \qquad i = \left(\frac{t}{5}\right)^{1.514}$$

where

e: Monthly evapotranspirations (mm/month)

t: Av. monthly temperature (°C)

There is little difference in monthly average temperature by year and season in the Cebu Island, which differs considerably according to elevations as indicated in Fig. 8-2.

Precipitations also differ considerably according to region and elevation.

Therefore, calculation was based on data recorded by Mantalongon Observatory as a typical example in highland and by observatories in Cebu City and Mactan Airport having similar conditions due to absence of meteorological observatories in lowland.

As monthly average temperature remains constant throughout the year in Cebu Island, annual average temperature represents average monthly temperature in this calculation for the convenience's sake.

where

Highland: In case t equals 21.8°C, i equals 9.294

$$I = \sum_{1}^{12} \left(\frac{x}{5}\right)^{1.514} = 111.53$$

Lowland: In case t equals 27.7°C, i equals 13.36

$$I = \sum_{1}^{12} \left(\frac{x}{5}\right)^{1.514} = 160.32$$

Therefore, from relative values in the chart and from lattitude-corrected values, total evapotranspirations for 12 months are given as follows:

Highland: E = 8.6cm x 12.27 = 1,055mm

Lowland : E = 14.53cm x 12.27 = 1,782mm

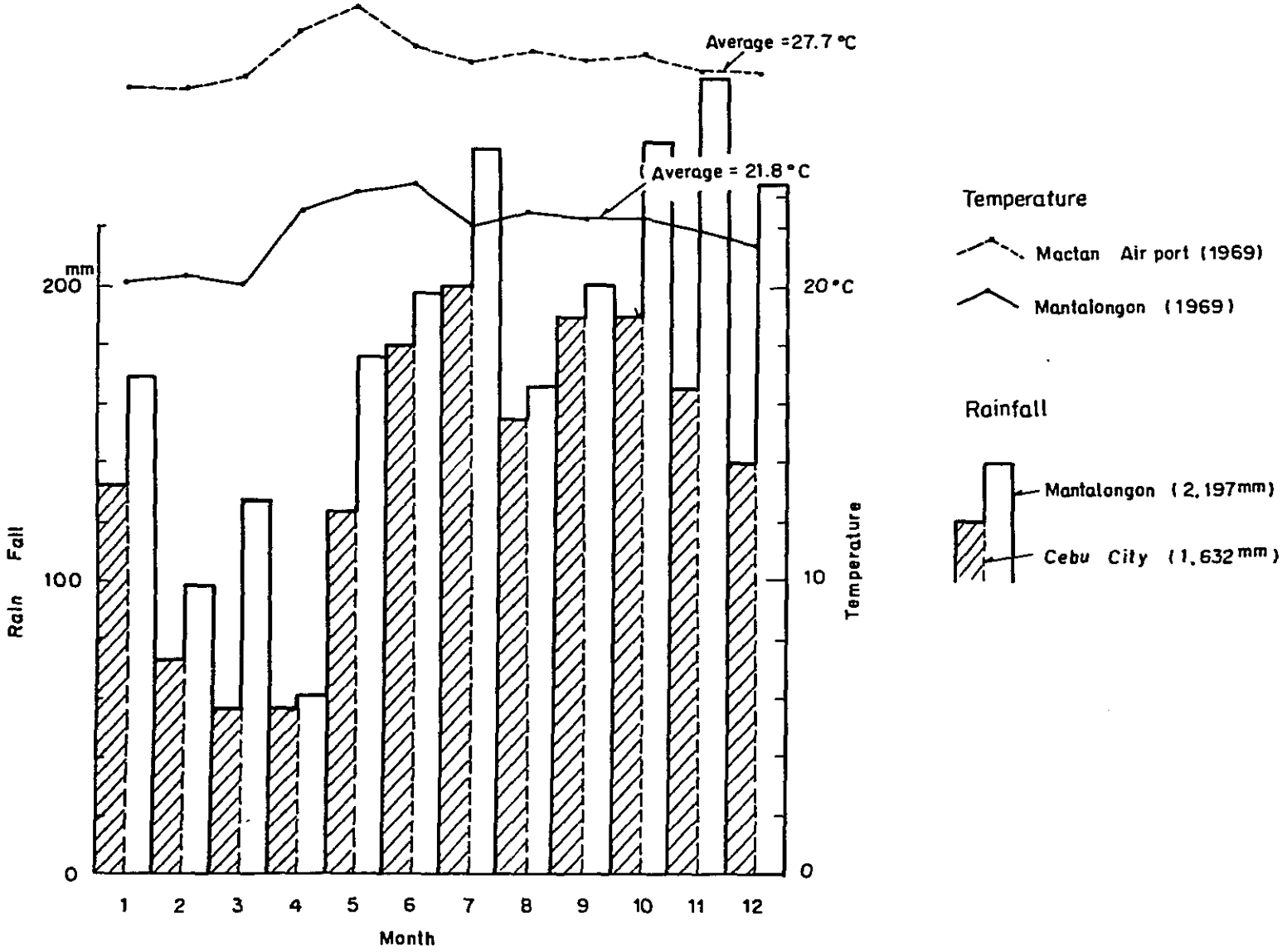


Fig. 8-2 Monthly Rainfall and Temperature

Table 8-1 gives a summary of the results. Annual precipitations, which vary considerably with year as shown in Fig. 8-3, only reach one fourth (1/4) during the dry year as compared to ordinary years. In the phase of detailed studies, therefore, careful attention should be given to this respect.

Table 8-1 Water Balance Sheet

Item / District	Observatory	Rainfall (P)	Average temperature (t)	Evapotranspiration (E)	Infiltration (I)	
						Average
Highland	Mantalongon (Elev.745m)	2,197 mm/year	21.8°C	1,055 mm/ Year (88mm/ month)	1,142 mm/year (3.12 mm/day)	496 mm/ year (1.35 mm/ day)
Lowland	Cebu City Mactan Air Port (near sea level)	1,632 mm/year	27.7°C	1,782 mm/ year (149mm/ month)	-150mm/ year (-0.411 mm/day)	

As indicated in Figure 8-4, anticlinal axis is running longitudinally over the central area of anticlinal mountains in Cebu Island, and it is therefore assumed that a ground water conservation area for this district stretches about 7.5 km to the east of the anticlinal axis. Total flow of subsurface water per km is given below on assumption that infiltrated water flows down toward sea over the inclined strata.

$$\frac{1.35}{1,000}\ ^{mm/day} \times 1,000^{m} \times 7,500^{m} = 10,125^{m^3/day}$$

$$\fallingdotseq 10,000 m^3/day$$

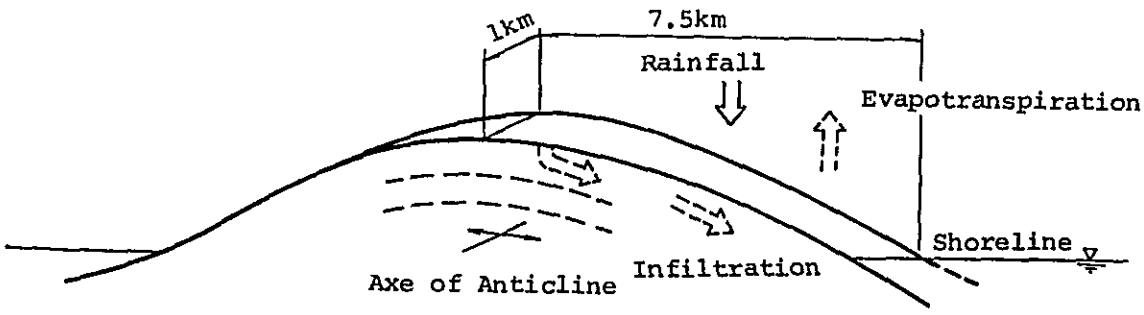


Fig. 8-4 Schematic diagram of water balance

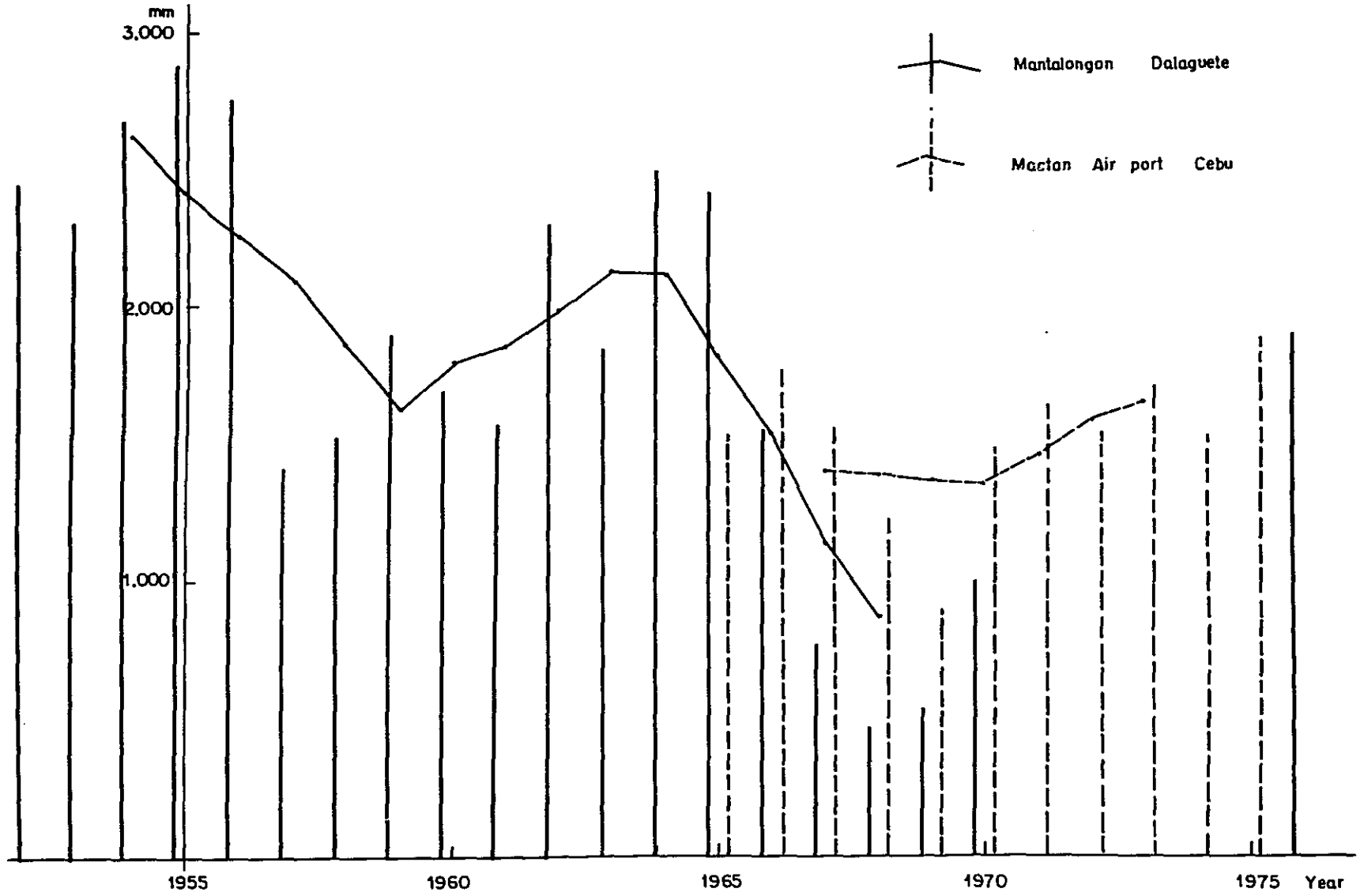


Fig. 8-3 Annual Rain Fall and its Running Mean (5 years)

8-2-2 Present situation of water resources and facilities

(1) Alcoy and Dalaquete

Table 8-2 shows the breakdown of regional water resources by barrio and Figure 8-5 the distribution of barrio and community pipe systems. Spring water and wells from major water resources because fresh water supply from lakes, swamps or rivers is unavailable.

Spring water is maldistributed over inland mountainous areas and along the coastline. It is assumed that spring water gushing in inland mountainous area is subjected to hydro-geological structures including stalactite grotto in calcareous rocks and the distribution of watertight strata composed of noncalcareous, fine-grained sedimentary rocks.

Except a certain season in Dalaquete River, spring water goes back into underground without being emptied into sea as river water and flows down as subsurface water.

On the other hand, subsurface water flowing down water-permeating calcareous rocks gushes out as spring water in the coastal area. In such cases, if outlets are either in contact with or under sea water, spring water turns into brine.

In some locations where ground water level is high, spring water gushes out as fresh water before it flows down into the sea. Ground water flowing down the mountain does not appear on the ground surface, but is mixed with seawater in sand beaches, but gushes out as fresh spring water in rocky beaches where ground water level is kept in a higher position.

Therefore, ground water level is relatively high in locations where spring water emerges. In case it gushes out above sea water level, it gushes out as fresh spring water, or else as brine if it gushes out in the sea.

Table 8-2 List of water sources

Source: Sept. 1977 Municipality

	Community Pipe System	Artesian well	Dub well Open well	Spring	etc.	Remark
Alcoy		8		4		
1. Poblacion	o	2				
2. Atabay	o	1				
3. D.Lungsod		2		1		
4. Cufwang		1				
5. Nug-as				2		
6. Pasol	o	1				
7. Pugalo		1		1		
Dalaquete		38	4	46		
1. Poblacion	o	10	2			
2. Ablayan				3		
3. Babayongan				3		
4. Balud	o		2			
5. Banhigan	o	1		3		
6. Bulak				5		
7. Caliongan				5		
8. Caleriohan				1		
9. Casay	o					
10. Catolohan				2		
11. Cawayan	o	13		3		
12. Coro	o	1				
13. Dugyan				2		
14. Dumalan				2		
15. Jolomaynan					Rain Water from banana stalk	
16. Langkas				1		
17. Lumbang		2				
18. Malones	o				Rain water	
19. Maloray				3		
20. Manangal	o					
21. Manlapay				3		
22. Mantalongon	o			4		
23. Nalhub				1		
24. Obo	o			2		
25. Obong	o	2		1		
26. Panas		1				
27. Sacsac	o					
28. Salug				2		
29. Tapon	o	3				
30. Tuba		2				
31. Consolacion	o	3				
32. Lanao					Rain water	

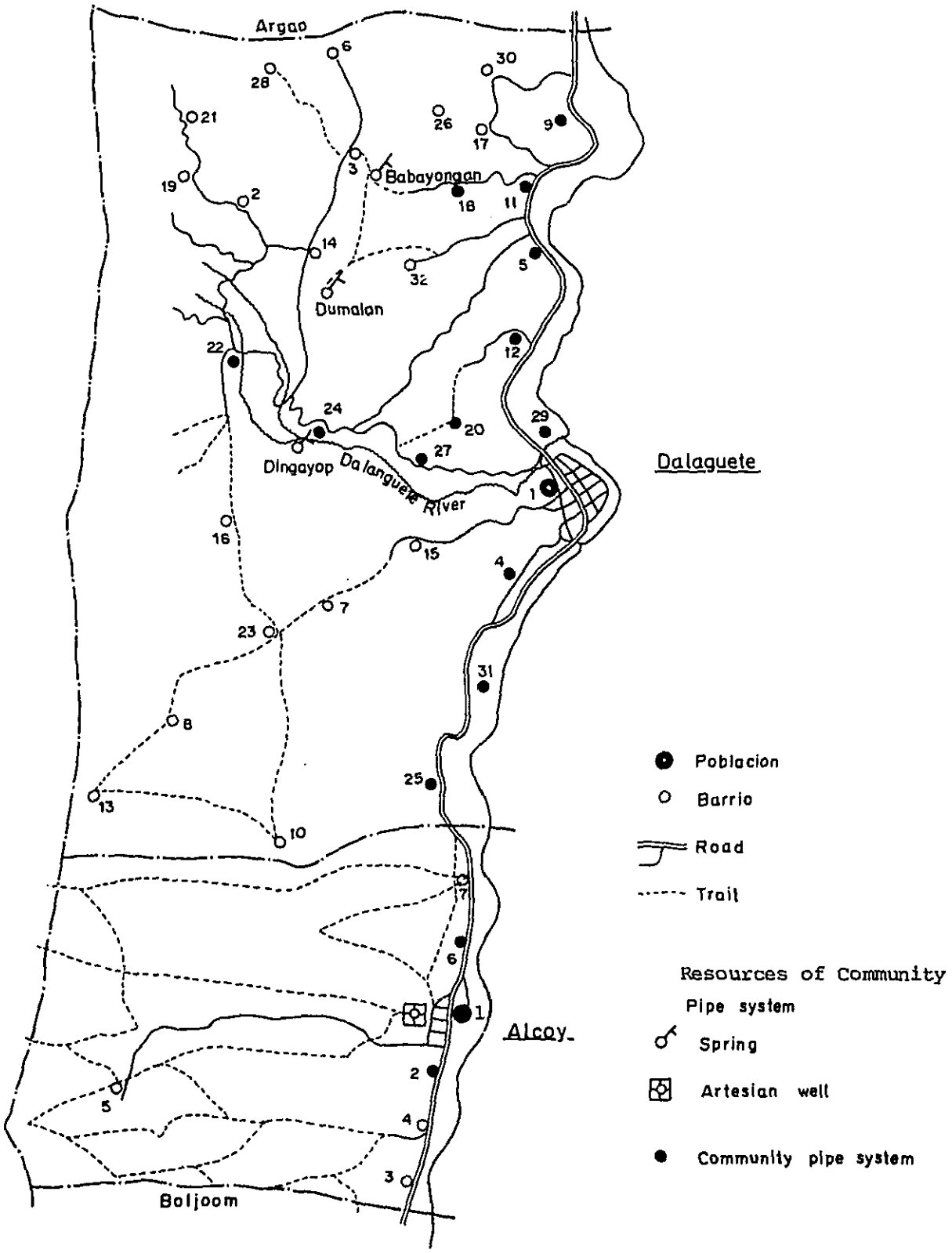


Fig.8-5 Distribution of Barrio and Community pipe system

Wells are maldistributed in tableland and lowland in the coastal area, close to water service area, where ground water is obtained by shallow boring to a depth of 10 to 30m.

These wells, however, contain fresh water and occasionally salt water, which is an evidence of a fact that brine has penetrated into some of the wells in the coastal area.

These ground water resources have been utilized as spring water, well water (electric-pumped and pipe transmitted, hand-pumped and open wells) and direct exploitation of spring water. About 40% of barrio are equipped with the community pipe system receiving water supply from wells and springs.

Water service has been supplied to about 60% of a total population in Alcoy and 33% in Dalaquete. In other words, water service is not in a good condition.

In Alcoy, water is pumped from powered wells in Poblacion and supplied to two neighboring barrios by water pipes.

In Dalaquete, spring water gushing in Dingayop, Dumalan and Babayongan in mountainous area is transmitted to Barrio in coastal area by means of pipeline.

Except quality city water, well and spring water is used for adequate purposes, such as potable water, cooking water, washing water and bathing water, etc., depending on the quality of water.

Table 8-3 shows the application of underground water which constitutes the bulk of total water resources.

Table 8-3 Underground water resources

Classification		Description	Uses
Natural spring water	in mountainous area	Fresh water, but available only in mountanius area far from service zone	City water service in Dalaquete
	in coastal area	Close to service area, but often mixed with brine	Launfry or bathing if brine is mixed
Well water		Scattered over coastal area, 30 to 40m above sea level Three different types of wells, i.e., electrically-pumped, hand-pumped and open wells (popular type) In some wells, water turned into brine due to hydrological and geological conditions	Potable, cooking, laundry and bathing depending on the quality of water In Alcoy, city water service is provided by electrical pump-up of well water

2) Surveyed area

Field survey was conducted on the projected port site in the coastal area stretching over Alcoy and Dalaquete municipalities as indicated in Figure 8-6.

Public and private well and spring waters scattered in Barrios in the coastal area offer most of water resources in the surveyed area.

In each water resource, condition of reservoir, amount of available water, number of prospective consumers, water quality (pH, temperature, electric resistivity and field inquiries) and other factors were investigated.

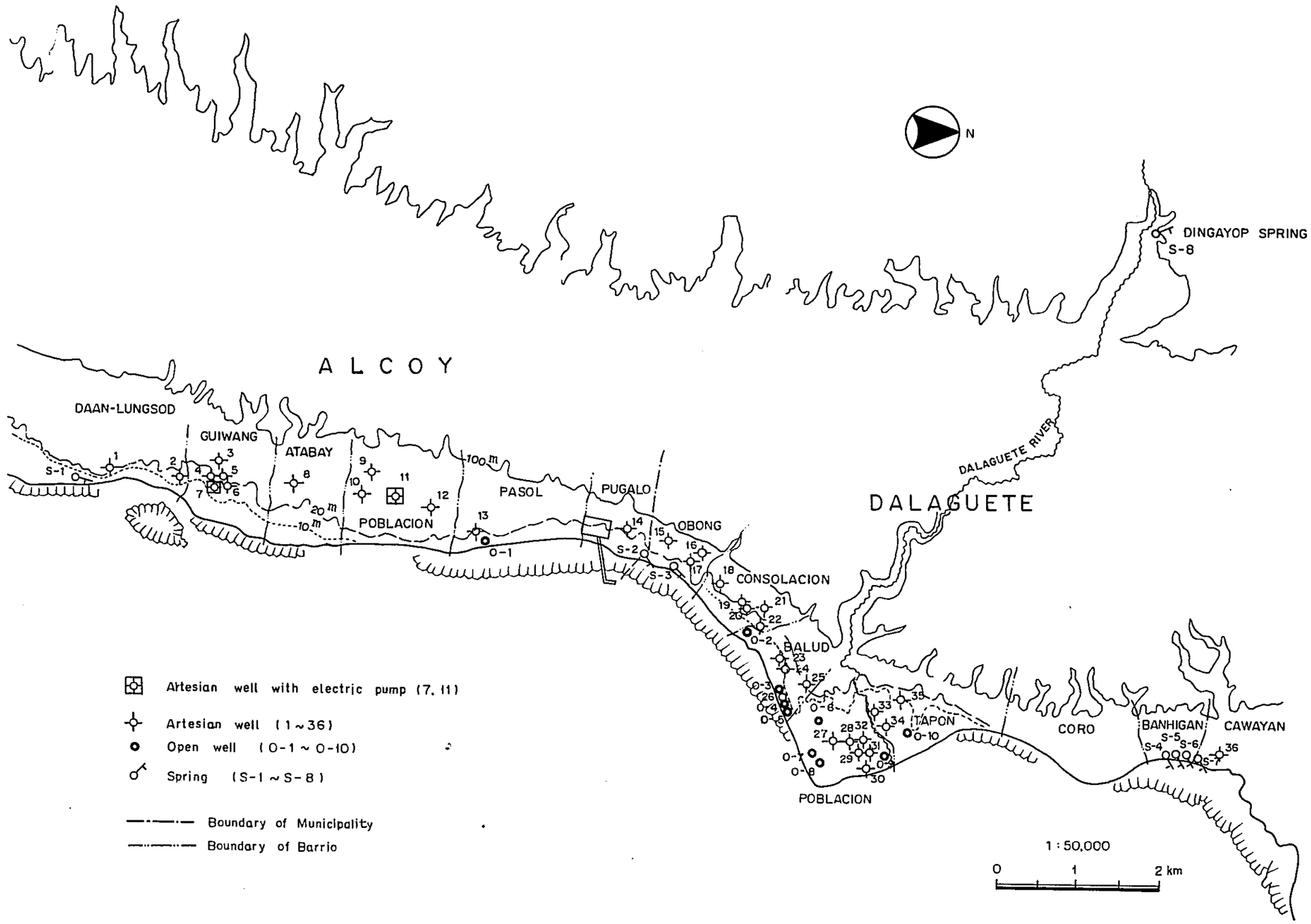


Fig. 8-6 Location of Investigation Area and Water Resources

The Chapter of Information deals with results obtained.

The well is classified into two categories, one is the artesian well with a small diameter of 8.5cm equipped with a hand pump and the other an open well with a large diameter in which water can be scooped up with pails.

The depth of the artesian well ranges 10 to 30m depending on the ground level of a site where it is installed, but with most of artesian wells, their beds are on the sea level.

On the other hand, open wells are installed in lowlands with an elevation of less than 5m above sea level, with their depths averaging less than 5m.

Most of these wells were installed during the latter 1960s, but some of old ones date back to 1800s. Public wells are scattered from place to place in each Barrio, with most of public wells concentrating in Poblacion, Dalaquete, Balud and Consolacion. The recent survey found two private and 12 public artesian wells inoperable for mechanical troubles. Such defective wells account for about 40% of total surveyed artesian wells.

Springs in the surveyed area concentrate in Oblong, Banhigan and Cawayan villages in Daan-Lungsod, Pusalo and Dalaquete municipalities, and water is gushing out from these springs through crevices of calcareous rocks projecting toward shores. It is estimated that big springs in Pugalo (S-2) and Obong (S-3) gush out water of 10^3 - 10^4 order m^3/day. Also, Dingayop Spring, located in the upstream of the Dalaquete River which is the source of water for residents in Dalaquete Municipality, gushes out water of 10^3 order m^3/day.

There is a seasonal fluctuation in the amount of water in Sac Sac Spring (S-1) and it is said that spring is abundant with water during the rainy season of June through December.

At the time of survey, water in the Dalaquete River was brown and turbid, but was gushing out water of 10^5 order m^3/day. On the other hand, water flows the Dalaquete River only during September through December. It turns out a dry river during other seasons.

As a result of field inquiries and the water level observation as in Figure 8-7, it was disclosed that some of spring water along the shore and well water have been influenced by the tide. The reaction of well and spring water varies according to the location of water source and to hydrological and geological conditions. In these wells and springs, ground water and sea water are mixed, as evidenced by the quality of subsurface water referred to in the preceding paragraphs.

ii) Quality of water

Ground water in any sources shows a neutral pH ranging 7 to 7.5 and temperatures of 26° to 29°C. The temperature is higher in the order of artesian well and open well influenced by ambient temperature.

Table 8-4 and Figure 8-8 show the classification of water sources by quality compiled on the basis of measurement of electric resistance with testers conducted to check the entry of brine into ground water.

It was identified that water had been salified in about 50% of surveyed water sources. Under the circumstances, residents are consuming water for appropriate uses depending on the degree of salification and quality. Water in many wells adjacent to the shore has been salified, but the degree of salification is not directly in proportion to the distance of water sources from the shoreline. The salification of ground water is not only influenced by natural conditions including hydrological and geological factors but also by well structures and pumping conditions. Therefore, we consider that a fact that water in inland wells is salified, but water in those close to the shore remains unsalified is attributable to the presence of such natural and artificial factors.

Table 8-4 Number of water sources classified by water quality

Water source / Classification		Artesian well		Open well		Spring		Sum	
Fresh	Fresh	9	18	4	5	2	2	15	25
Mixed I	Mixed	7	18	3	5	1	6	11	29
Mixed II		4		3		5		12	

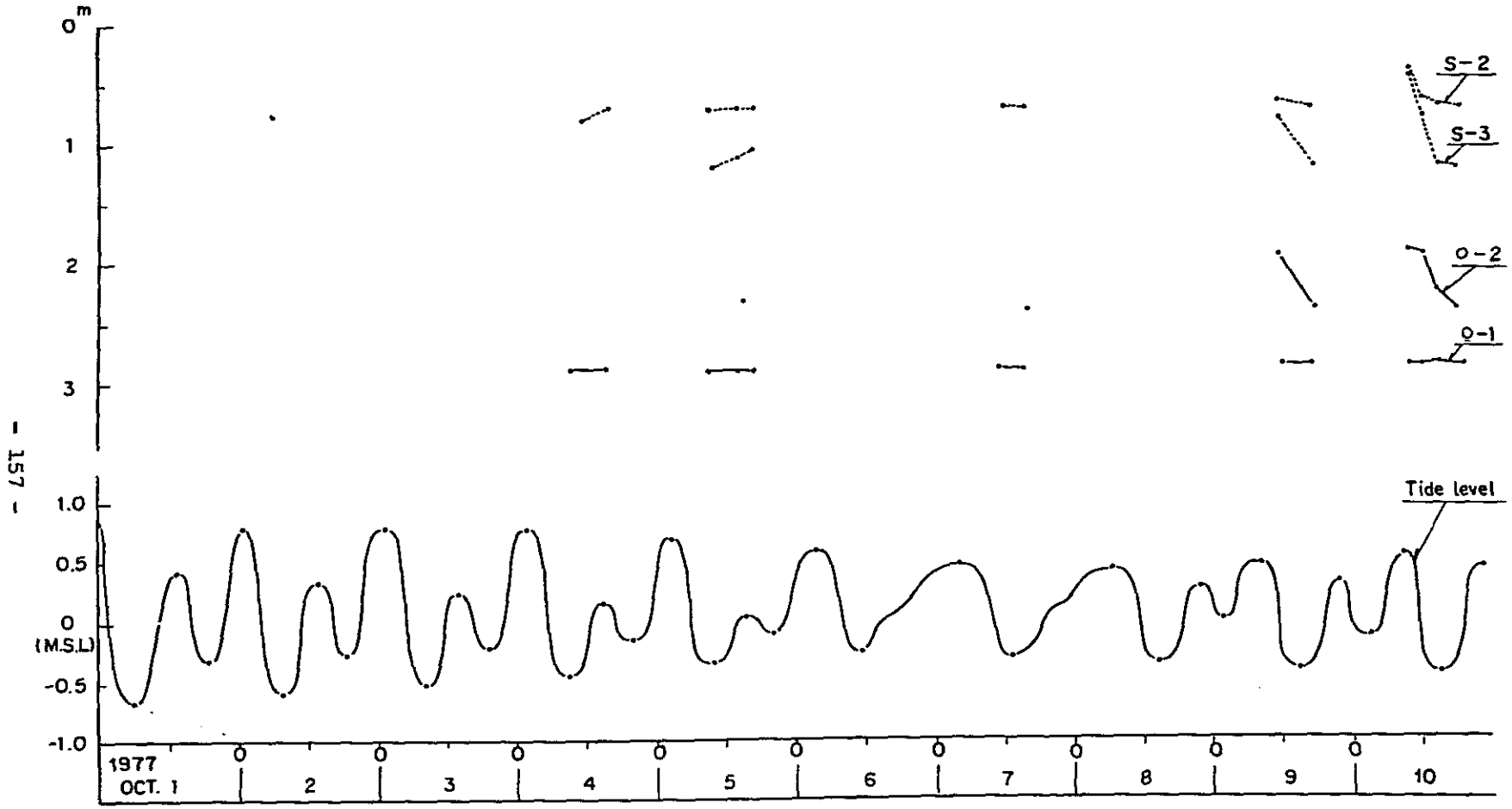
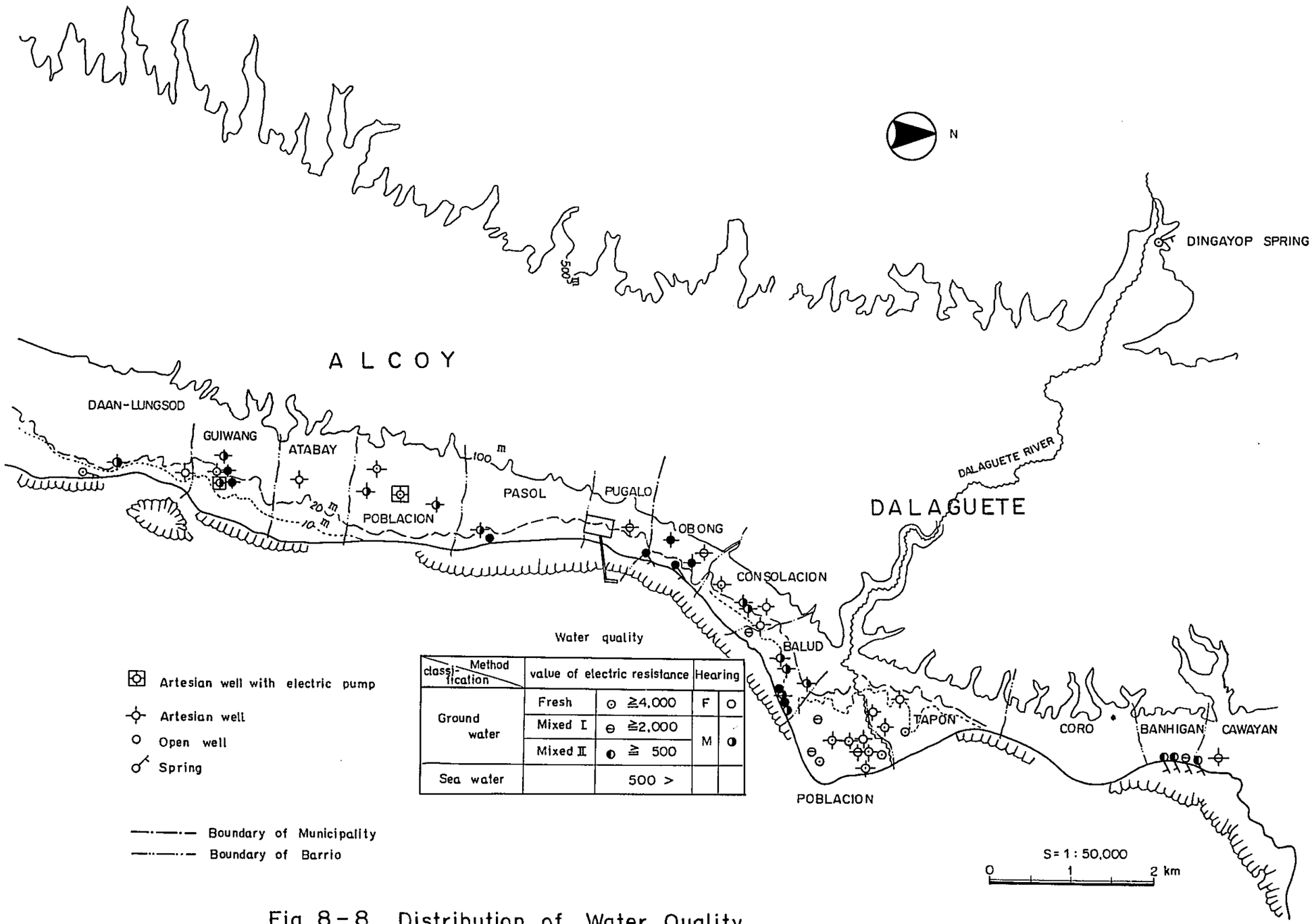


Fig. 8-7 Fluctuation of Tide level and Groundwater Level



classification \ Method	value of electric resistance		Hearing	
Ground water	Fresh	⊙ ≧4,000	F	○
	Mixed I	⊖ ≧2,000	M	◑
	Mixed II	◐ ≧ 500		
Sea water		500 >		

Fig. 8-8 Distribution of Water Quality

Therefore, pertinent study should be conducted on the location of water sources, well structures and projected pumpings on the occasion of detailed design of wells.

iii) Utilization of water resources

Water sources in the surveyed area are city water supply, wells and springs, of which, the ratio of utilization varies regionally according to the rate of diffusion of town water service and the distribution of springs.

Wells are key water resources in districts where city water service has not been amply provided. Except few households who own private wells, residents are mostly receiving routine water supply from public wells scattered in the municipality.

Due to frequent trouble of wells and limited number of those producing quality water, people are often compelled to go far for routine water supply. Springs are maldistributed and consumers come from relatively distant places. Springs in Pugalo, Obong and Banhingan are producing water in abundant quantity, though relatively poor in quality, and has been utilized for washing and bathing.

As compared to conventional exploitation of water resources, modern water service became diffused during the first half of 1970s and, at present, water pipes have been laid to each Barrio except those in Daan-Lungsod, Guiwang and Pagalo.

In districts where city water service is available, citizens are switching to city water supply occasionally abandoning wells that produce water of inferior quality.

On the other hand, due to limited installation of water pipes - only in areas along main highways -, low maintenance of water service facilities and limited water supply capacity, it will certainly take much more time before stable supply of quality water to individual households can be achieved.

According to field inquiries, water consumption from each well shows a major variation ranging 10 to 100 lit./person.day, averaging 30 lit./person•day For calculation of total consumption, consumption of spring and city water should be added.

Table 8-5 shows the breakdown of water consumption by barrio and population, according to the present survey.

From the table, we understand that the convenience of town water service has expedited the consumption of water.

Table 8-5 Water consumption

Municipality	Barrio	Population	Community pipe line (m^3/day)	well (m^3/day)	Spring (m^3/day)	Consumption except spring (ℓ/person•day)
Alcoy	Daan-Lungsad	1,141	—	50	12	44
	Guiwang	1,464	—	77	—	52.6
	Alabay	1,085	127	200	—	97
	Poblacion	1,695		25	—	
	Pasol	856			—	
	Pugalo	1,158	—	16	7,700	14
Dalaquete	Obong	1,451	982	59	53,423	41
	Consolacion	645		37.9	—	104
	Balud	1,174		135.2	—	
	Poblacion	2,773		6.08	—	
	Tapon	1,673		110	—	
	Coro Banhigan Cairagan Malons Managal Sac Sac	6,007		.	?	

8-3 Estimated water consumption

The Project envisages the consumption of water as follows within the framework of water resources available in the surveyed area.

8-3-1 Water requirements

Table 8-6 shows estimated water consumption.

Table 8-6 Estimated water consumption

Application	Installations	Water consumption (m^3/day)
Mines	Cooling of generators Offices Maintenance Cleaning of vehicles Cleaning of conveyors Others	100
Households	Water requirements are estimated on assumption that about 1,000 persons, equal to total number of residents in Pugalo, consumes 100 lit./person day as determined by the survey.	·100
Total		200

8-3-2 Water supply facilities

Figures 8-9 and 8-10 and Table 8-7 show the outline of water supply facilities to be installed in consideration of water requirements, scope of supply, uses, intake position and other preconditions. The water intake should be installed close to service area for economic advantage and at a site where ground water level is shallow. On the other hand, the water intake should also be installed, for the purpose of ensuring safety, far from the shores and at a location where ground water level is deep and less subjected to salification of fresh water and set apart from a valley or a gorge where water intake may be threatened by flood or avalanche of earth and soil caused by torrential rain. Therefore, we propose that water intake should be installed on the foot of a mountain, about 50-60m above sea level and apart from a valley or a gorge. Ground water lifted by an electric pump should be sterilized by injection of soda hypochlorite before it is stored in a storage tank and pipe-transmitted to service areas (mining plant sites and private households).

Fig. 8-9 Schematic diagram of water transmission system

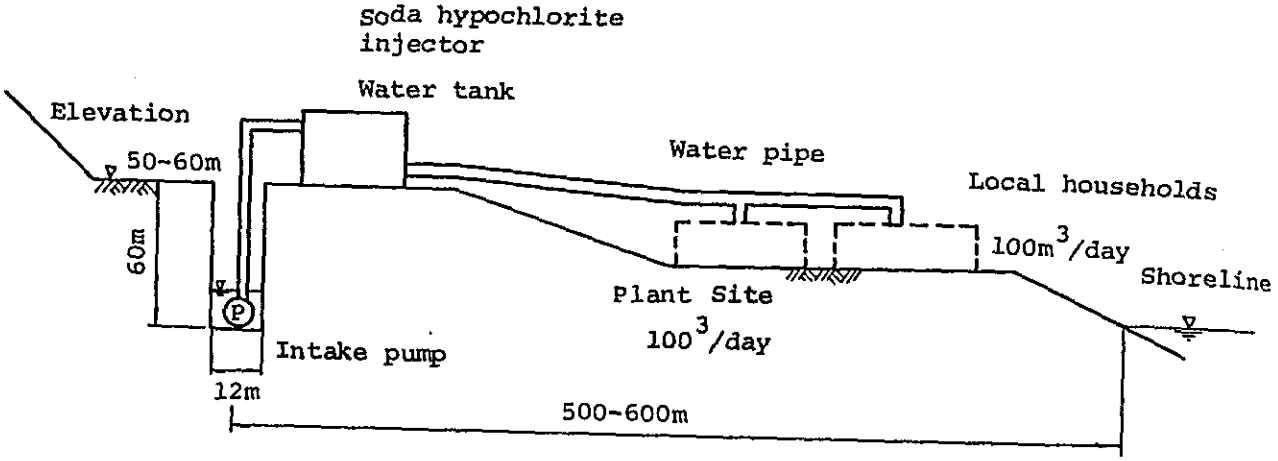


Table 8-7 Outline of water transmission system

Item	Specifications	Quantity	Remarks
Well	Dia.: 12" (300mm) Depth: 60m	One location	
Intake & cleaning	1) Intake pump Model: 50 BHS VII Capacity: 160 ℓ/min x 70 m x 3,550 rpm x 5.5kW Type: Underwater, multi-stage turbine pump Power requirements: 60Hz, 200V, 3-phase	one unit	Intake amount 200m3/day
	2) Soda hypochlorite injector tank, injection pump, instrumentation system	one set	
Storage tank	6mø x 5mH (125 m3) Concrete	One unit	
Piping	1) Water pipe (CCI pipe) 6" dia. L=1,500m	L=1,500m	
	2) Mode of installation: Embedded		

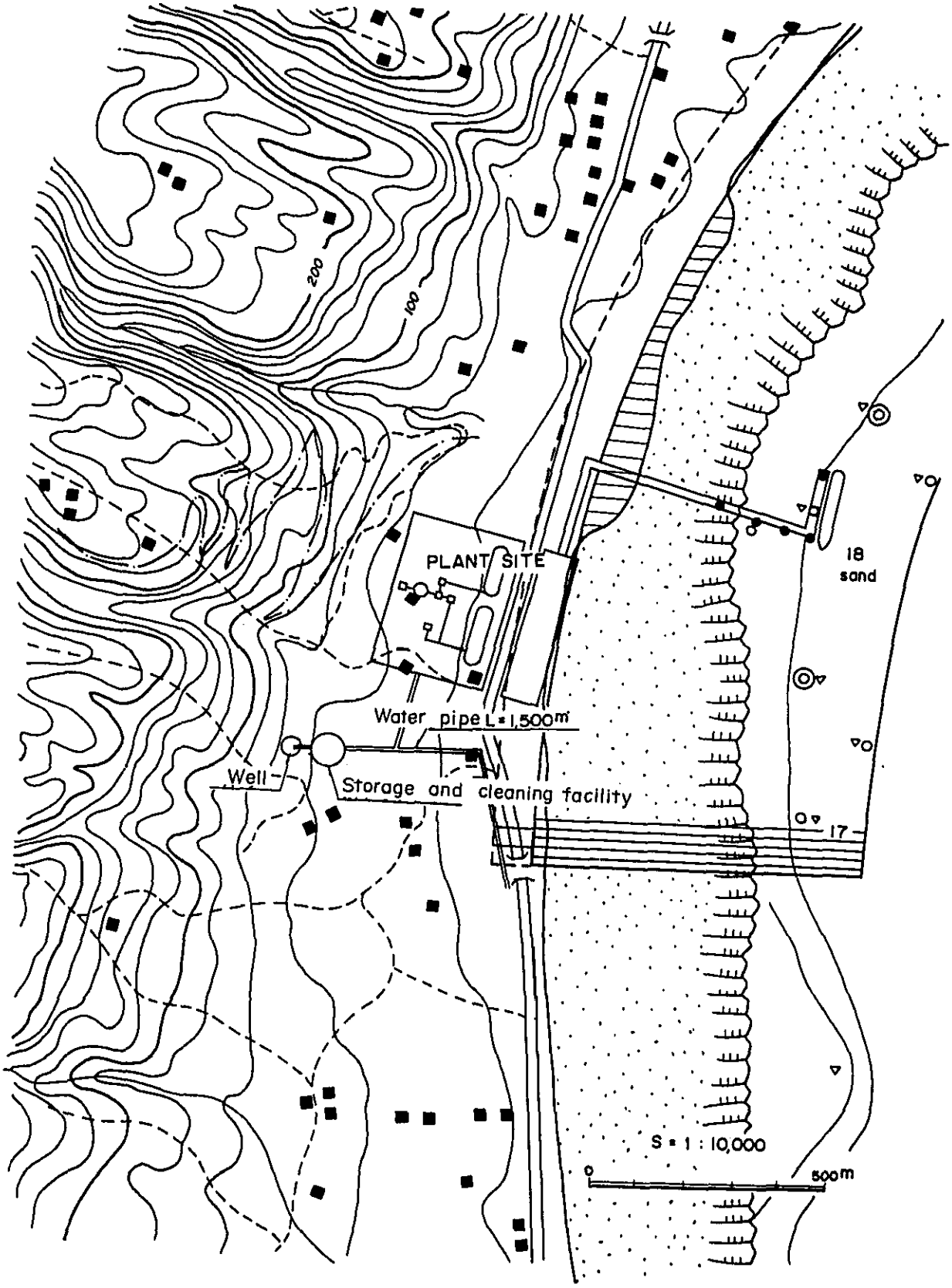


Fig. 8-10 Location Map of Water Supply Facilites

CHAPTER 9 SURVEY OF OTHER INFRASTRUCTURES

Chapter 9 Survey of Other Infrastructures

9-1 Basic concept of the Project

The Project envisages to improve the infrastructures of Dalaquete (population, 33,642) and Alcoy (population, 8,652) small coastal villages situated 85.1 km - 92.8 km to the south of Cebu City.

In these municipalities, corn, coconut, cabbage and other vegetables have been raised on a small scale.

Farmhouses, which constitute the bulk of households in this district, are sparsely populated over a wide stretch of the villages, forming relatively backward community.

As compared to established cities such as Carcar and Cebu with regard to the improvement of infrastructures, i.e., road and living environment, etc., municipal function or institution has not been developed to a satisfactory degree. Under the circumstances, it is necessary to improve the municipal institutions in order to promote local welfare and living conditions.

Therefore, it is desirable to promote the improvement of infrastructures in line with the development of agriculture on the occasion of proceeding with development of dolomite mines in consideration of these factors and thorough recognition of the scale and need of stimulating local economy.

To begin with, it is of utmost importance to expand and reinforce the basis of industry and living by securing utility facilities and improving roads, transportation and communication facilities. Especially, in the densely populated central area, infrastructures have not been laid sufficiently to meet local demand, and voice is high among the public for improvement thereof. Under the circumstances, we deem it necessary to reinforce central function by construction of houses, securing housing sites, improving water supply and sewerage system, education, health and welfare, traffic and other social and environmental institutions such as parks for example.

In the outer periphery of these municipalities, it is necessary to improve infrastructures such as highway network, while paying close

attention to the maintenance of smoother relationship with established towns and villages and farms in order, and conservation of nature and scenic beauty.

9-2 Basic policy and premise

Basically, the Project envisages to;

1) install social environmental institutions in boundaries between the municipalities of Dalaquete and Alcoy.

2) not only improve facilities directly relating to the development of dolomite mines, but contribute to the promotion of local welfare in Dalaquete, especially in Alcoy.

3) install social environmental institutions on such scale and level as may keep up with the continued economic development and increase in population of local community, including studies on step-by-step work execution schedule.

4) discuss matters relating to utility and related works, water supply and highway construction and maintenance in other paragraphs.

9-3 Present situation of the Project Area

The Project Area (Dalaquete and Alcoy municipalities) is for the most part covered with soil mixed with hard and soft dolomite ore deposits with a layer of coralloidal limestone generated during Pilocene and Pleistocene ages underlying beneath. In this area, no rice has been raised in paddies due to the difficulty of irrigation, and the agriculture largely depends on the cultivation of vegetables such as corn, coconut, etc. on dry fields as shown in Fig. 9-1 and 2 (Land Utilization Map). As to the status of land utilization, agricultural and housing area accounts for 70% of total area, state-owned forests the rest of 30%.

As to the number of workers by line of business, agriculture represents 60%, fishery 15%, commerce 10% and other 15%, with farmers constituting the bulk of the population.

In this area, agricultural productivity is low because a large

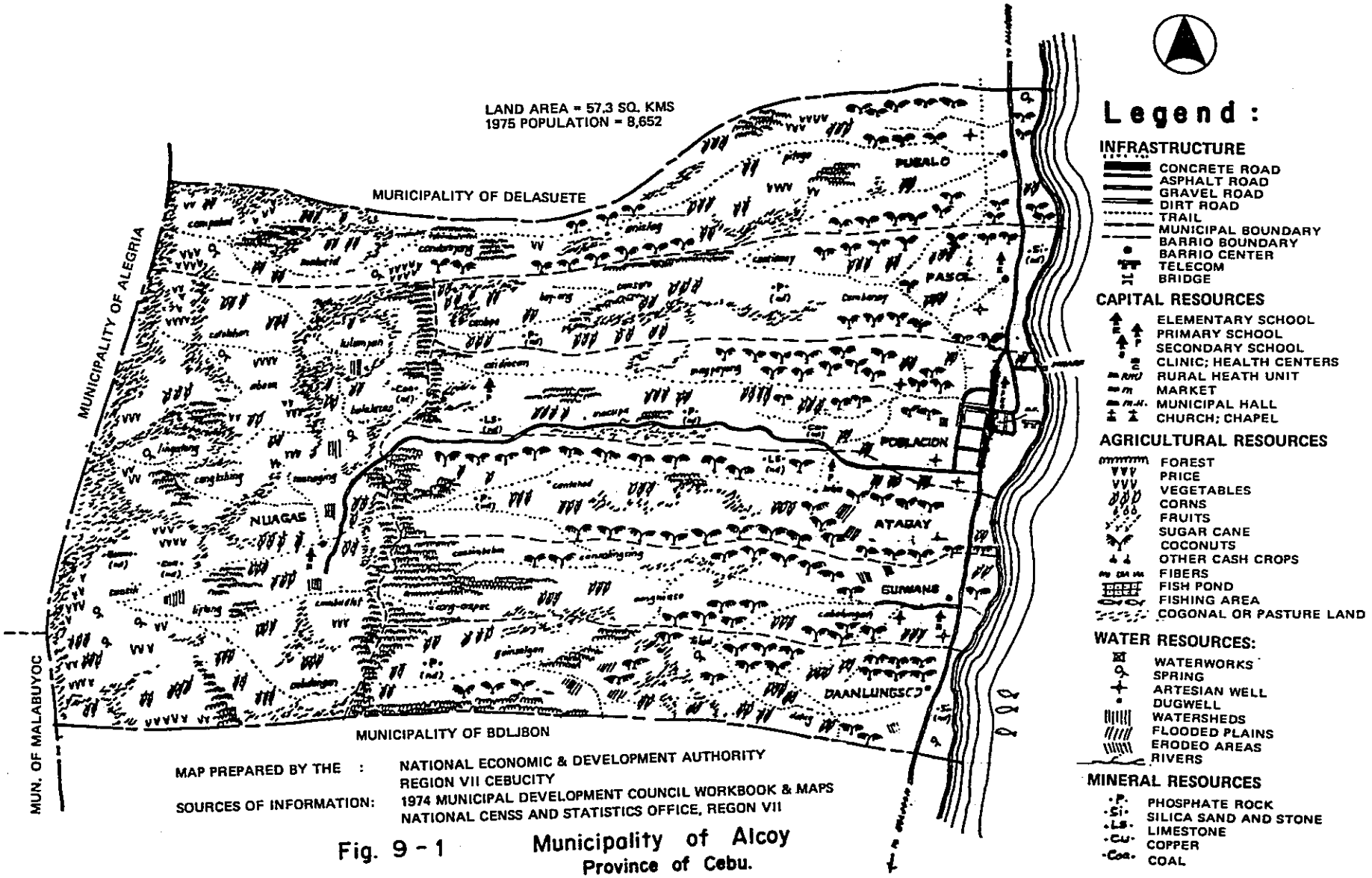


Fig. 9 - 1 Municipality of Alcoy
Province of Cebu.

PROVINCE OF CEBU

LAND AREA = 135.4 SQ. kms
1975 POPULATION = 33,642

AGRIGULTURAL RESOURCES:

- COCONUT
- CORN
- RICE
- VEGETABLE
- FIBERS
- FOREST
- OTHER CROPS
- FISHING AREA

INFRASTRUCTURE:

- CONCRETE
- GRAVEL
- DIRT
- BRIDGE

CAPITAL RESOURCES:

- P — PRIMARY
- E — ELEMENTARY
- SECONDARY
- RHU — RURAL HEALTH UNIT
- WH — WAREHOUSE
- M — MARKET

WATER RESOURCES:

- SPRING
- WATERWORKS
- PERENNIAL LAKE
- ARTESIAN WELL
- DUG WELL
- CAUSEWAY

MINERAL RESOURCES:

- Py — PYRITE
- Coa — COAL
- G — GYPSUM
- Ls — LIMESTONE
- (Nd) — NOT DEVELOPED
- (d) — DEVELOPED

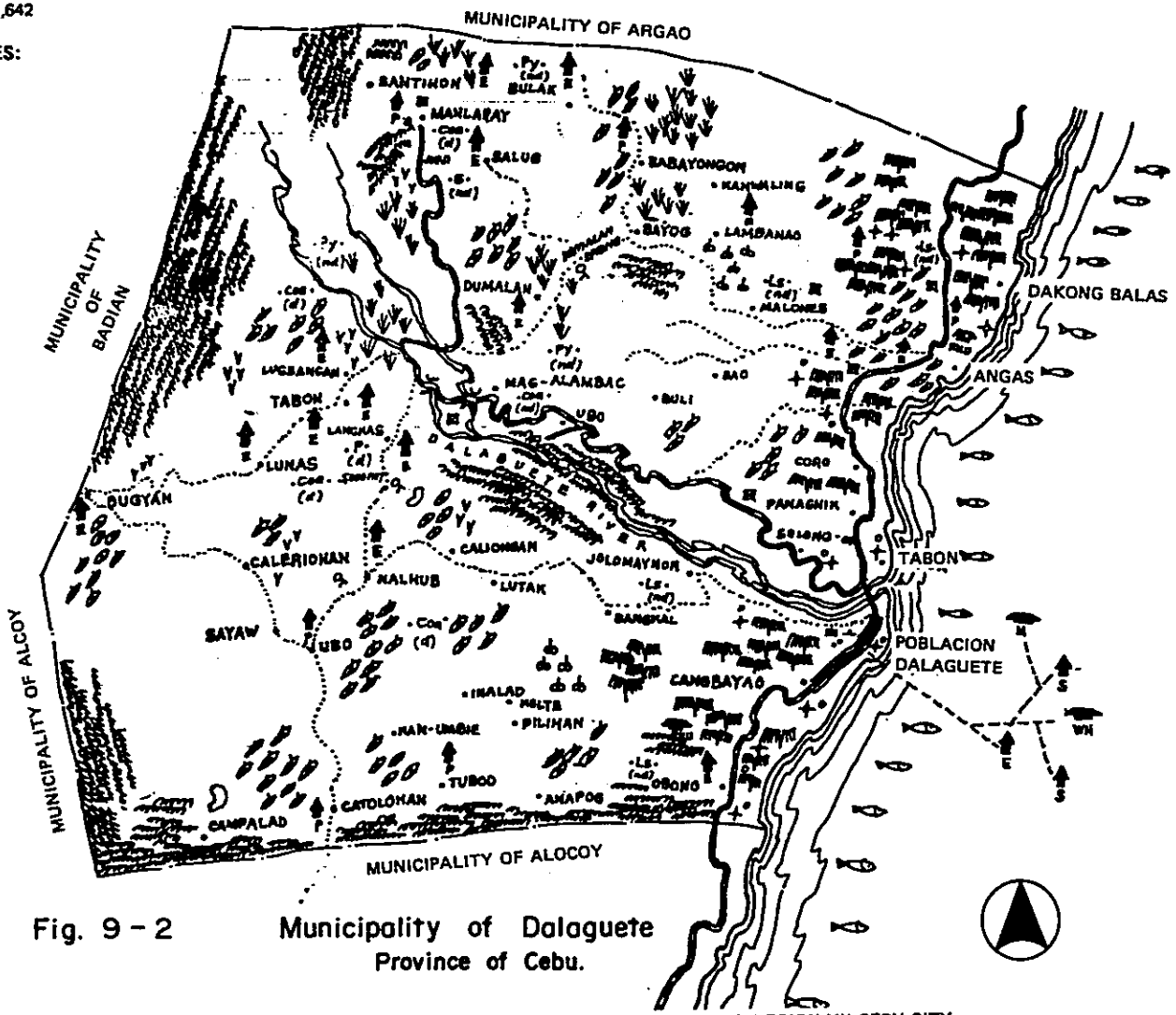


Fig. 9 - 2 Municipality of Dalaguete
Province of Cebu.

▲ MAP PREPARED BY THE: NATIONAL ECONOMIC & DEVELOPMENT AUTHORITY, REGION VII CEBU CITY
▲ SOURCES OF INFORMATION: 1974 – 1975 MUNICIPAL DEVELOPMENT COUNCIL WORKBOOK and MAPS
NATIONAL CENSUS & STATISTICS OFFICE, REGION VII

number of farmers raise their products on a small patch of fields, most of which have been subjected to adverse topography. Therefore, there has been active outflow of labor force from Alcoy and Dalaquete into Cebu City and others, which in turn reduces the number of people who utilize the social environmental institutions and leaves the latter less attended.

As to social environmental institutions, Dalaquete and Alcoy are in more satisfactory conditions in respect of the ratio of schools (primary & secondary) to population, but backward in aspects of traffic, social education and welfare, medical facilities and parks, etc.

The following is a summary of overall infrastructures in the Project Area.

9-3-1 Alcoy Municipality

1) Roads, bridges and other facilities

The road has a total length of 55.35 km, but its paving rate is extremely low. Most of the roads have been left unpaved except state highways and roads around the City Office and markets.

The bridge has a total length of 1,300 m and, besides, there is only one stone-bonded public wharf, but it is partly damaged by waves and unusable.

2) Water resources

Underground water is the sole water resources and water has been pumped up electrically and manually.

3) Power supply

Power has been supplied from public utilities in Alcoy by means of diesel engines, but due to limited generation capacity, only 300 households have been covered (100 - 200 W/household).

At present, however, power has only been supplied to water pumps for financial reason.

4) Transportation

Principal means of transportation is two jeepneies and side-cars (three wheelers) and regular bus service provides transportation to other areas.

5) Schools

There are 2 primary schools, 4 elementary schools and a secondary school.

6) Medical institutions

There are 2 clinics with a floor space of about 100 m^2 operated by a single doctor.

7) Other facilities

See Fig. 9-3 (Alcoy Municipality).

9-3-2 Dalaquete Municipality

1) Roads, bridges and other facilities

Road has a total length of 83 km, but its paving rate is low except state highways as in the case of Alcoy.

Total length of bridges reaches 80 m. Besides, there is a stone-bonded municipal port, but it is partly damaged by waves and unusable like that in Alcoy.

2) Water resources

Water has been supplied by two water works as well as from 30 artesian and 25 spring wells.

3) Power supply

Power has been supplied by 150 kW capacity diesel engine operated by the public utility. At present, the diesel engine operates only during the night.

4) Transportation

Principal means of transportation is 8 side-cars (three wheelers) and 15 jeepneies. Like in Alcoy, regular bus service provides transportation to other areas.

5) Schools

There are 40 schools, including 9 primary schools, 25 elementary schools and 6 secondary schools.

6) Financial organs

Community banks provide service to residents in the municipality.

7) There are two rural health units and a private clinic, operated by 5 doctors.

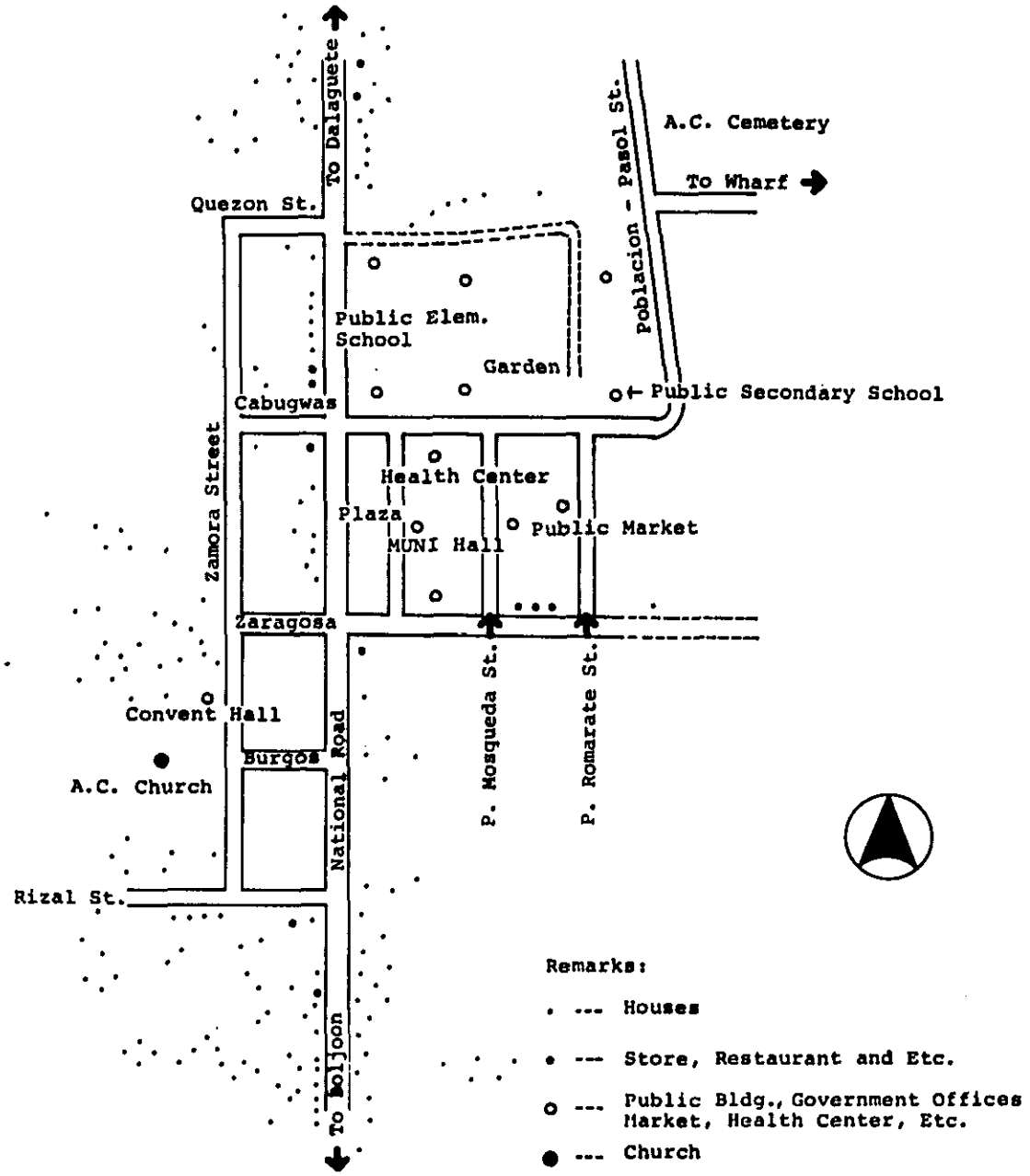


Fig. 9 -3 Existing Public Facilities (Alcoy)

8) Other facilities

See Fig. 9-4 (Dalaquete Municipality).

9-4 Classification and priority of other infrastructures

9-4-1 Classification

By introduction and settlement of citizens, industries, recreational activities and other urban functions such as traffic and communications into the Project Area, the formation of integrated community can be promoted and cultural community life which provides citizens with health, safety, convenience and comfort can be secured.

Therefore, public institutions for the purpose of the Project can be classified as follows from a viewpoint of promoting the best public interest of citizens.

Community institutions

1. Transportation: Regular bus terminal
   Distribution center (Truck terminal)
2. Education: Nurseries, kindergartens, public elementary schools, secondary schools and high schools
3. Social Educational facilities: Libraries, public halls and clubhouses
4. Parks and greeneries: Juvenile parks and sports parks

9-4-2 Priority

It is difficult to make quantitative evaluation of individual projects and, therefore, for determination of the priority of projects, qualitative assessment will be conducted on natural, social and planned conditions, and besides, on the potential welfare of community and citizens.

a) Correlation between community function and institution

Men aspire, through daily living, to obtain or create facilities and benefits in order to make their living more comfortable. As the formation of such facilities and benefits is considered one of the functions of a community, it is necessary to provide community institutions with conveniences and benefits so as to amply

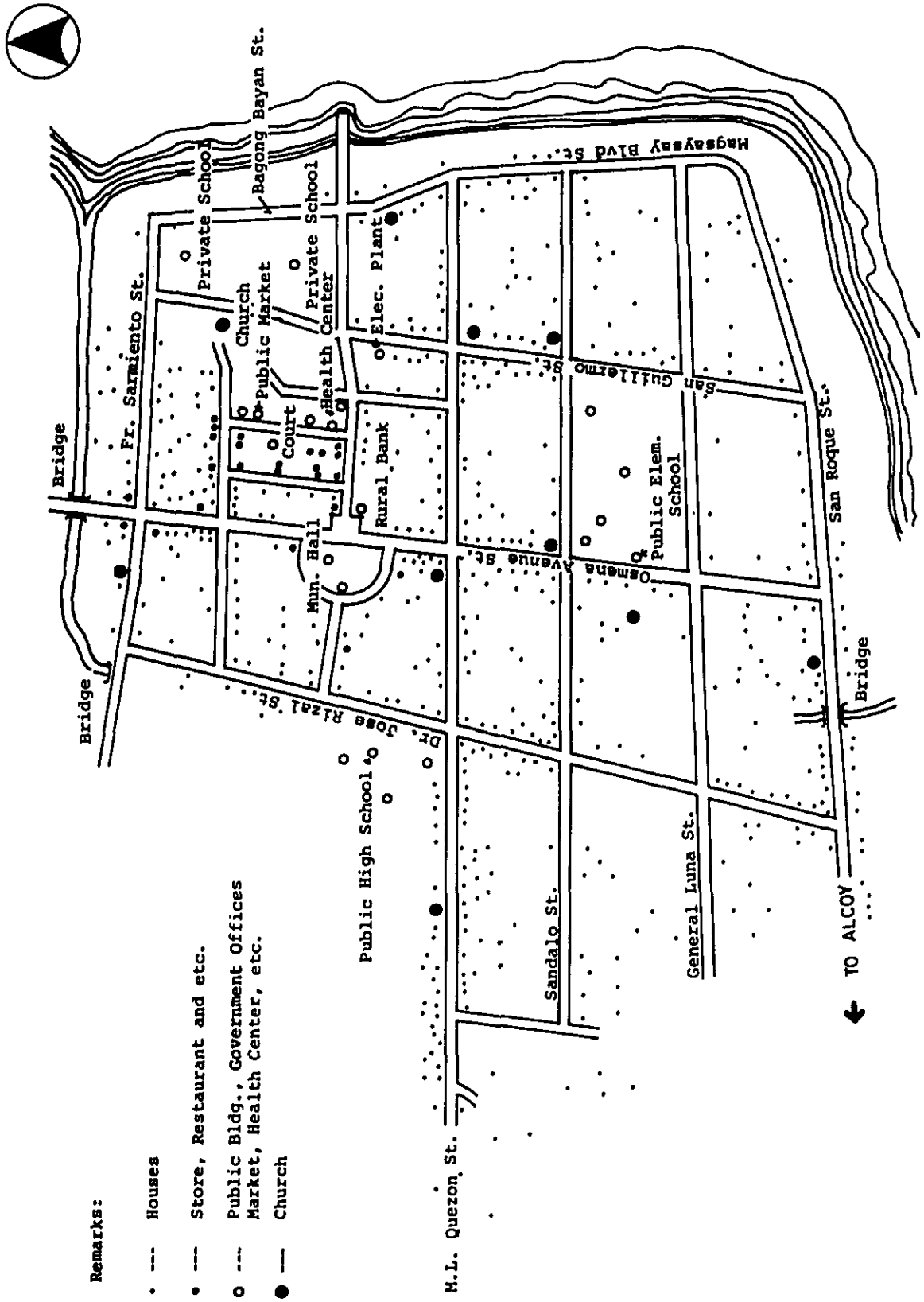


Fig. 9 - 4 Existing Public Facilities
(Dalaguete)

meet the needs of citizens.

From the above viewpoint, we conducted reviews on the correlation between community function and institution, and its relationship with health, safety, convenience and comfort of citizens.

Table 9-1 shows results of studies.

Relating to Table 9-1, following definitions are given.

1. Conservation of mental environment
   It is designed to conserve physical environment which provides mental contribution toward the growth and development of human emotion on the community level.

2. Mode of utilization
   A given institution, capable of performing its functions provided facilities are offered in the hard aspect alone, is defined as "hard."

   A given institution is defined as "hard and soft" provided it cannot perform its functions unless something in the soft aspect as well as in the hard aspect is offered by officers of the institutions concerned.

3. Specific users
   Specific users are those who utilize specific facilities installed for limited users or operators.

   No entry is made on facilities serving the general interest of citizens as a whole.

b) Priority of installation

As mentioned, community facilities are short and backward, and have only been improved or mended in limited portions. Under the circumstances, prompt action should be taken to resolve the situation, but, due to financial strain and other reasons, it is impossible to install in the Project Area as much community facilities as have been required.

Therefore, there is no alternative, upon effecting specific improvements on facilities concerned, but to improve them step by step in close consideration of developments in community activities and residents' way of thinking.

Table 9-1. Relations between community functions and service facilities

o applicable

Facilities / Functions	Traffic		Education, institutional		Education, social		Medical service	Parks	
	Bus terminal	Truck termianl	Nursery	Schools, primary and secondary	Library	Public hall	Clinics	Juvenile parks	Athletic field
Culture					o	o			
Education				o					
Communication						o		o	o
Playground			o					o	o
Sports				o					o
Recreation								o	o
Social education and rest					o			o	
Children			o						
Physically handicapped			o						
Information					o				
Medical service							o		
Routine communication	o								
Mdse. distribution		o							
Safety								o	o
Environment, mental					o			o	o
Environment, natural								o	
Distance									
Very near			o		o	o		o	
Within a reasonable walking distance	o			o			o		o
Mode of utilization									
Hard only	o	o				o		o	o
Hard & soft			o	o	o		o		
Users			Children	School boys				children	
Mode of facilities	Safe space	Clarification of functions	Safe space		Space enough for lending reference	Space allowing multi-purpose applications	Space allowing adequte medical services	Safe space	Safe space

In other words, in installation of facilities, priority should be determined on the basis of areas and facilities concerned. Major precautions required upon determination of priority are summarized below;

1) Recognition of potential demand of citizens as users and assessment of priority

2) Urgency for installation

3) Harmonious relationship with established facilities in the Project Area

4) Pertinent construction scale proportionate to regional economic scale

5) Assessment of financial resources for construction and managerial requirements

6) Facilities serving regional requirements in relation to execution of the dolomite ore mining project

7) Prospect for utilization of facilities by citizens or mining workers

Table 9-2 shows relative evaluation results.

c) Evaluation

Medical services: Clinics (Fig. 9-5)

Table 9-2 shows that the construction of clinic is of utmost importance and priority to meet regional requirements and local administrative policy and to promote the dolomite mining program.

At present, as few as 5 doctors look after 33,692 people in Dalaquete, namely one doctor for every 6,782 citizens.

Situation is even worse in Alcoy, where only one doctor takes care of 8,652 people (doctor/citizen ratio).

Medical service is backward and sanitary condition is poor. Moreover, it is expected that mining workers will increase in proportion to continued progress in the development of dolomite mines in the future. Under the circumstances, it is essential, through recognition of importance of protecting the life and health of citizens, to reinforce medical service facilities.

Table 9-2 MATRIX SYSTEM on priority of improvement/maintenance

Items \ Institutions	Bus terminal	Truck terminal	Nurseries Kindergartens	Primary & secondary schools	Libraries	Public halls	Clinics	Juvenile parks	Sports parks
1. Regional demand	○		○				●	○	○
2. Urgency							●		
3. Balance in the area			○		○	○	○	○	○
4. Pertinent scale	○							○	
5. Securing of financial resources							○		
6. Relation with dolomite mine	○						●	○	○
7. Prospect for utilization							●	●	
Priority							1	2	3

● : especially applicable

○ : applicable

Juvenile parks

One of the features of this district is the extremely high rate of children and school boys against total population (Fig. 4-10, 4-6-2).

Their main playground are often campuses open to public, a small patch of ground, fields, streets relatively free of traffic.

As the Project makes progress, there will be increased traffic of people and vehicles, and distribution of merchandise. It then becomes all the more necessary to introduce a positive measure of providing children with sufficient playground or open space, other than providing traffic safety zones or facilities, namely offering them places where they can play without being threatened by the traffic of vehicles. Such playground will at once serve citizens as places of rest and social gathering, serving the formation of a friendly community.

For such reason, it is necessary to map out plans to make parks after completion of programs on medical institutions in relation to future progress in the Project.

9-5 Technical studies

Details are given on projected medical service facilities as per recommendations in preceding paragraphs.

1) Location

As clinics are designed to serve dolomite mine workers and local residents, careful planning is required in parallel with the construction scheme of mining facilities.

2) Scale

In the average, a doctor can look after about 200 patients a month, with a slight difference depending on the nature of disease. It is, however, difficult, to estimate accurate space of medical facilities without detailed data on patients and disease. Therefore, the Project envisages to construct clinics after overall review of regional requirements, and local administrative policy and the dolomite mining program, and careful adjustment of relevant factors.

We propose, for the purpose of the Project, a clinic with a space

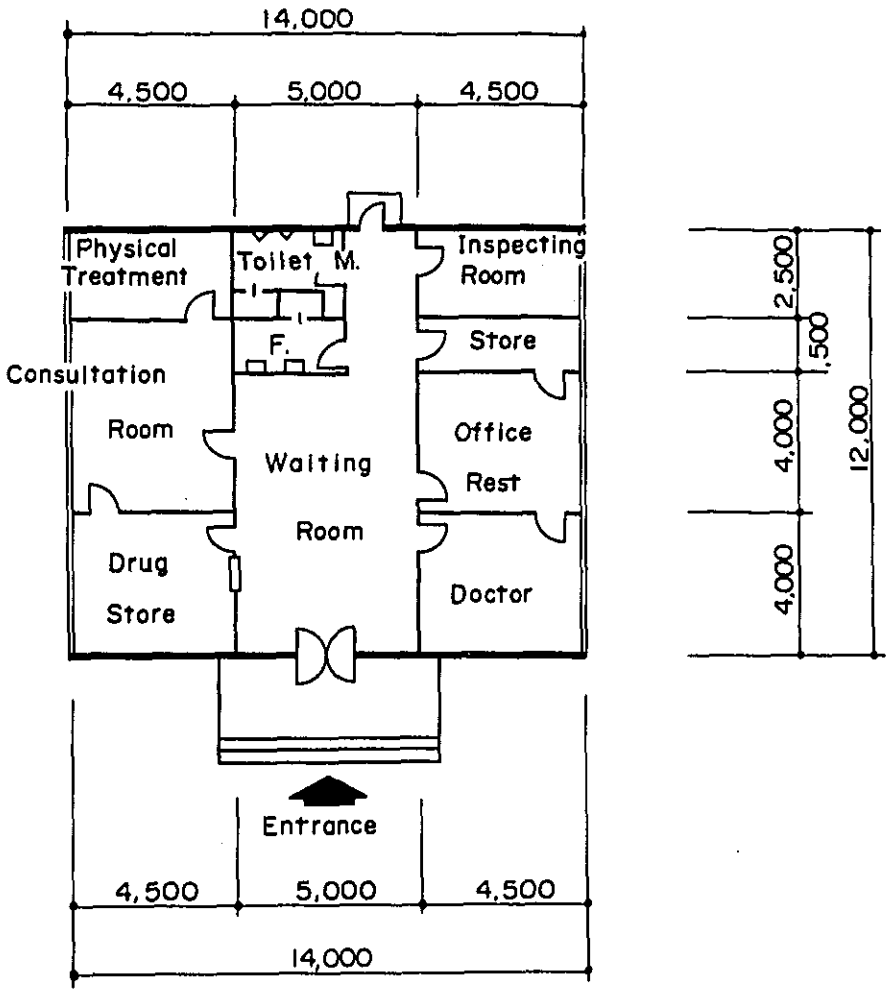


Fig. 9 -5 THE PLAN FOR CLINIC

Scale 1 : 200

Area 168 M^2

of 168 m^2 (Existing clinic has a space of 100 m^2). See Fig. 9-5 for illustration.

3) Structures

The clinic will be made of reinforced concrete partly with bricks, like other buildings, in consideration of fireproofness, durability, appearance and ease of maintenance.

4) Organization and medical departments

The clinic will operate, other than an internal department, a surgical department taking into account inherent requirements in mining operations and will be staffed with a physician (concurrently a surgeon), two nurses and two clerks.

9-6 Waste disposal

In the Project Area favored with bountiful natural environment, it is important to improve, other than those facilities referred to in the preceding paragraphs, waste disposal systems, but judging from a number of factors including the distribution, scale, population and environmental pollution of towns and villages, we recommend that centralized disposal system should not for the time being be introduced, but sewage and wastes should be disposed of on individual cases within a framework of present disposal capacity.

We regard it necessary to make the planning of disposal systems proportionate to the scale and way of developments of the Project Area which may occur after completion of the dolomite mining program.

CHAPTER 10 COST AND TERM OF CONSTRUCTION

Chapter 10 Cost and Term of Construction

10-1 Construction cost

10-1-1 Port facilities

Table 10-1 Details of construction/engineering cost (1)

Items	Q'ty	Unit	Total amount ($)
Breasting dolphine	1.0	complete set	286,400
Shiploader rest	1.0	"	124,400
Mooring dolphine	1.0	"	91,500
Belt conveyor foundation work	1.0	"	50,900
Port facilities for local residents	1.0	"	227,700
Navigational aids & related facilities	1.0	"	2,100
Total			783,000

Table 10-2 shows the breakdown of Table 10-1 by material cost, labor cost, equipment cost and other expenses.

Table 10-2 Breakdown of port facilities construction cost (2)

	Total amount ($)
Material cost	404,000
Labor cost	100,000
Equipment cost	95,000
Other expenses	184,000
Total	783,000

These construction costs were calculated on the basis of the exchange rates prevailing during the survey period (September 1977) as follows:

US$1.00 = ¥265 US$1.00 = ₱ 7.24

In fact, about 50% import duty is levied on the cif price of imported materials and equipment, i.e., steel piles, rubber fender, etc., which, however, have been excluded from the present calculations.

10-1-2 Power supply survey (Transmission lines)

Table 10-3 Details of transmission installation cost (1)

Items	Q'ty	Unit	Total amount ($)
Special high-tension side equipment	1.0	Complete set	292,110
High-tension distribution panel and monitoring panel	1.0	"	79,670
Transformer board for low-tension load	1.0	"	39,830
Emergency generator & spare parts	1.0	"	132,780
Auxiliary materials	1.0	"	95,110
Foundation & buildings	1.0	"	150,500
Total			790,000

Table 10-4 is the breakdown of Table 10-3 by material cost, labor cost, equipment cost and other expenses.

Table 10-4 Breakdown of transmission line installation cost (2)

	Total amount ($)
Material cost	632,000
Labor cost	60,000
Equipment cost	18,000
Other expenses	80,000
Total	790,000

Practically, substantial import duty is levied on the cif price of imported materials and equipment, which, however, has been excluded from the present calculations.

10-1-3 Power supply investigation (non-utility generation)

Table 10-5 Details of non-utility power plant cost (1)

Item	Q'ty	Unit	Total amount ($)
Generators (4 units)	1.0	Complete set	175,300
Motors (4 units)	1.0	"	537,550
Generator control & distribution boards	1.0	"	140,240
Intake tower & spare parts	1.0	"	58,430
Transformer for low-tension load	1.0	"	23,370
Auxiliary materials	1.0	"	97,610
Foundation & buildings	1.0	"	257,500
Total			1,290,000

Table 10-6 is the breakdown of Table 10-5 by material cost, labor cost, equipment cost and other expenses.

Table 10-6 Breakdown of non-utility power plant cost (2)

	Total amount ($)
Material cost	1,100,000
Labor cost	80,000
Equipment cost	30,000
Other expenses	80,000
Total	1,290,000

Import duty to be levied on major equipment has been excluded from calculations as in the case of the transmission lines.

10-1-4 Road maintenance equipment

Table 10-5 Details of road maintenance cost (1)

Item		Q'ty	Unit	Total amount ($)
Approach road	Earthwork	1.0	Complete set	6,400
	Ballast roadbed work	1.0	"	2,500
	Infiltration surfacing work	1.0	"	3,700
Road safety device	Guard rail	1.0	"	1,600
	Road signs & marks	1.0	"	500
Total				14,700

Table 10-6 is the breakdown of Table 10-5 by material cost, labor cost, equipment cost and other expenses

Table 10-6 Breakdown of road maintenance cost (2)

	Total amount ($)
Material cost	6,615
Labor cost	735
Equipment cost	4,410
Other expenses	2,940
Total	14,700

10-1-5 Water supply facilities

Table 10-7 Details of water storage cost (1)

Item	Q'ty	Unit	Total amount ($)
Well boring	1.0	Complete set	13,800
Installation of intake pump and soda hypochlorite injector	1.0	"	22,700
Installation of storage tank	1.0	"	19,350
Piping	1.0	"	75,150
Total			131,000

Table 10-8 is the breakdown of Table 10-7 by material cost, labor cost, equipment cost and other expenses.

Table 10-8 Breakdown of water storage cost (2)

	Total amount ($)
Material cost	93,000
Labor cost	9,070
Equipment cost	2,760
Other expenses	26,170
Total	131,000

Practically, about 50% import duty is levied on the cif price of imported intake pump and soda hypochlorite, which, however, have been excluded from the present calculations.

10-1-6 Other infrastructures (clinic)

Table 10-9 Details of clinic construction cost (1)

Item	Q'ty	Unit	Total amount ($)
Land improvement	1.0	Complete set	2,200
Building foundation	1.0	"	37,120
Other construction expenses	1.0	"	9,280
Medical facilities	1.0	"	11,300
Total			59,900

Table 10-10 is the breakdown of Table 10-9 by material cost, labor cost, equipment cost and other expenses

Table 10-10 Breakdown of clinic construction cost (2)

Item	Total amount ($)
Material cost	35,980
Labor cost	9,400
Equipment cost	4,810
Other expenses	9,710
Total	59,900

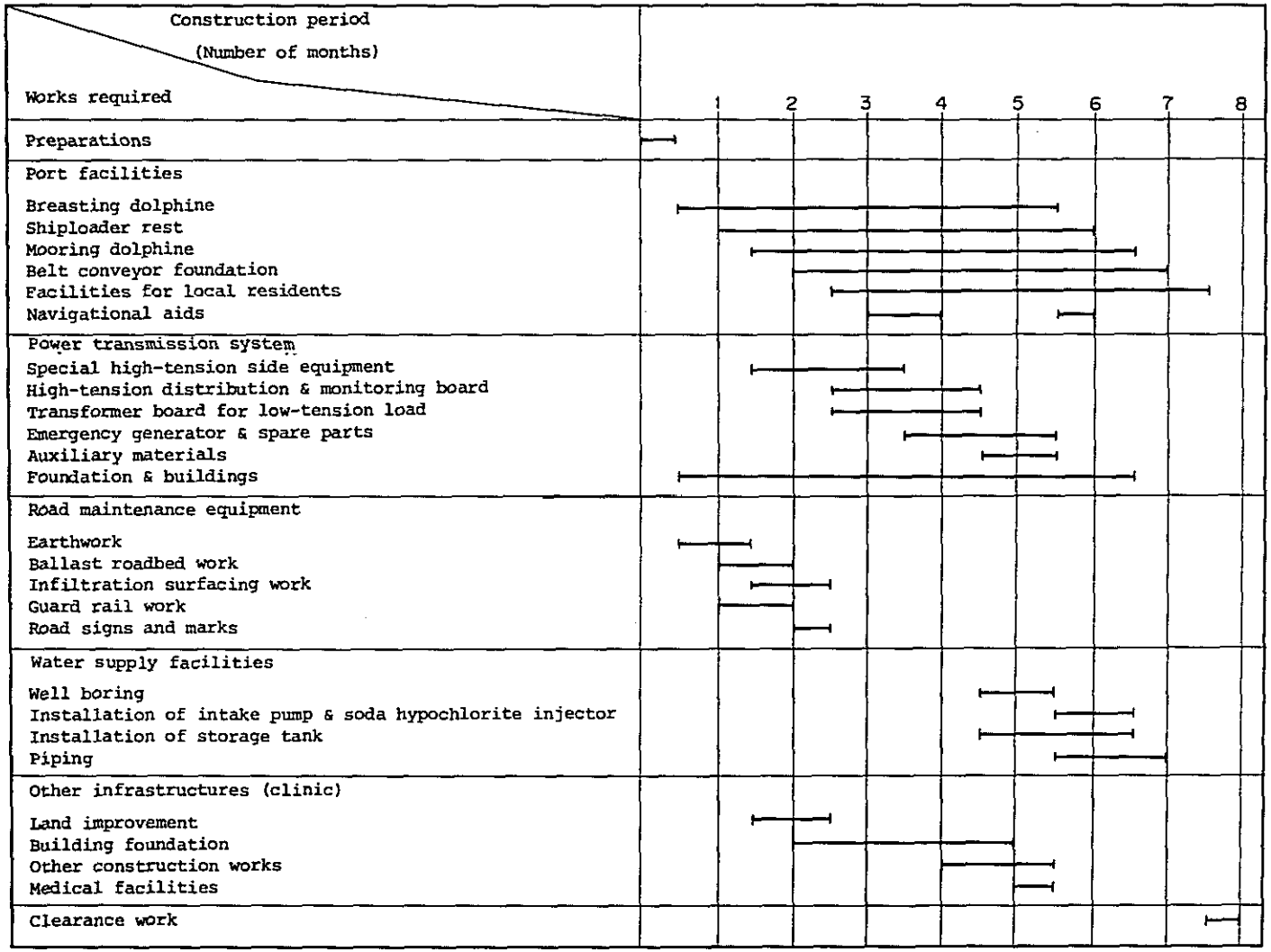
Practically, import duty is levied on the cif price of imported medical equipment, which, however, has been excluded from the present calculations.

10-1-7 Total construction cost

Table 10-11 Details of total expenditures ($)

Port facilities	Power transmission	Road & Bridges	Water supply facilities	Medical facilities	Total
793,000	790,000	14,700	131,000	59,900	1,788,600

Table 10-12 Work Progress Chart



Remarks: This construction term does not include time required for survey of soil and topography or execution drawings.

CHAPTER 11 ASSESSMENT OF SOCIOECONOMIC BENEFIT

Chapter 11 Assessment of socioeconomic benefit

11-1 Comparative study of alternative projects

Method for economic evaluation

In order to mine dolomite in Alcoy and ship it to Japan, there will be two alternative ideas of constructing a new port for shipment of dolomite in the projected area (Program A) or transporting dolomite to existing Cebu Port by shuttling trucks for shipment therefrom (Program B).

The following paragraphs compare the potential advantages of the two alternative proposals, first, with regard to the merit of constructing a new loading port from national economic viewpoint and, second, from regional socioeconomic viewpoint.

11-2 Evaluation of benefit from viewpoint of national economy

Two alternative proposals A and B are compared as to whether a port for shipment of dolomite should be established or not from a national economic viewpoint as follows.

11-2-1 Expenditures

(a) Construction of a new port

We estimate a total construction cost of the port as $1,788,600 (as of September 1977) ..... (1), including related expenditures on power plant and substations, water supply facilities, roads and bridges, clinic, etc. (Refer to 10-1-7).

It takes 6 months for construction and running and repair cost is nominal.

(b) Utilization of existing Cebu Port

Unless a new port is constructed, there would be no alternative but to deliver dolomite to Cebu Port by trucks and stockpile it outdoors prior to loading aboard a vessel each time as it enters the port. In this instance, following expenses will be incurred annually (as of September 1977). Refer to Chapter of Information.

In the case of shipping 600,000 tons $5,458,000/year
In the case of shipping 1,000,000 tons ... $9,097,000/year

Total cost for 20 year aggregates $239,076,186 (.... (2)) (as of

September 1977) on assumption that 600,000 tons will be shipped annually during the first three years and 170,000 tons from the 4th year onward for the rest of a 20-year project period, with a discount rate of 7% and annual cost increase of 10%.

Table 11-1 Total expenditures on utilization of Cebu Port

Year	Annual shipments (10,000 tons)	Annual cost	Cost increase (10%) minus discount (7%) = 3%	Total expenditures as of 1977
1	50	$5,458,000	1.0000	$5,458,000
2	60	$5,458,000	1.0300	$5,621,740
3	60	$5,458,000	1.0609	$5,790,392
4	100	$9,097,000	1.0927	$9,940,292
5	100	$9,097,000	1.1255	$10,238,674
6	100	$9,097,000	1.1941	$10,862,728
7	100	$9,097,000	1.2299	$11,188,400
8	100	$9,097,000	1.2668	$11,524,080
9	100	$9,097,000	1.3048	$11,869,766
10	100	$9,097,000	1.3439	$12,225,458
11	100	$9,097,000	1.3842	$12,592,067
12	100	$9,097,000	1,4258	$12,970,503
13	100	$9,097,000	1.4685	$13,358,945
14	100	$9,097,000	1.5126	$13,760,122
15	100	$9,097,000	1.5580	$14,173,126
16	100	$9,097,000	1.6047	$14,597,956
17	100	$9,097,000	1.6528	$15,035,522
18	100	$9,097,000	1.7024	$15,486,733
19	100	$9,097,000	1.7535	$15,951,590
20	100	$9,097,000	1.8061	$16,430,092
Total				$239,076,186

11-2-2 Cost savings

From the calculations in 11-2-1, total cost savings achieved by construction of the new port are as follows:

$$\frac{(2) - (1)}{20} = \$11,864,379$$

11-2-3 Assessment of potential benefit on national economy

As a result of comparison of cost and benefit for 20 years' project period, national economic advantage resulting from the construction of the new port is estimated in Table 11-2.

It shows that much higher capital turnover ratio, cost-benefit

ratio and investment returns will be gained by installation of a new port than by utilization of the existing Cebu Port.

Table 11-2 Benefits on national economy

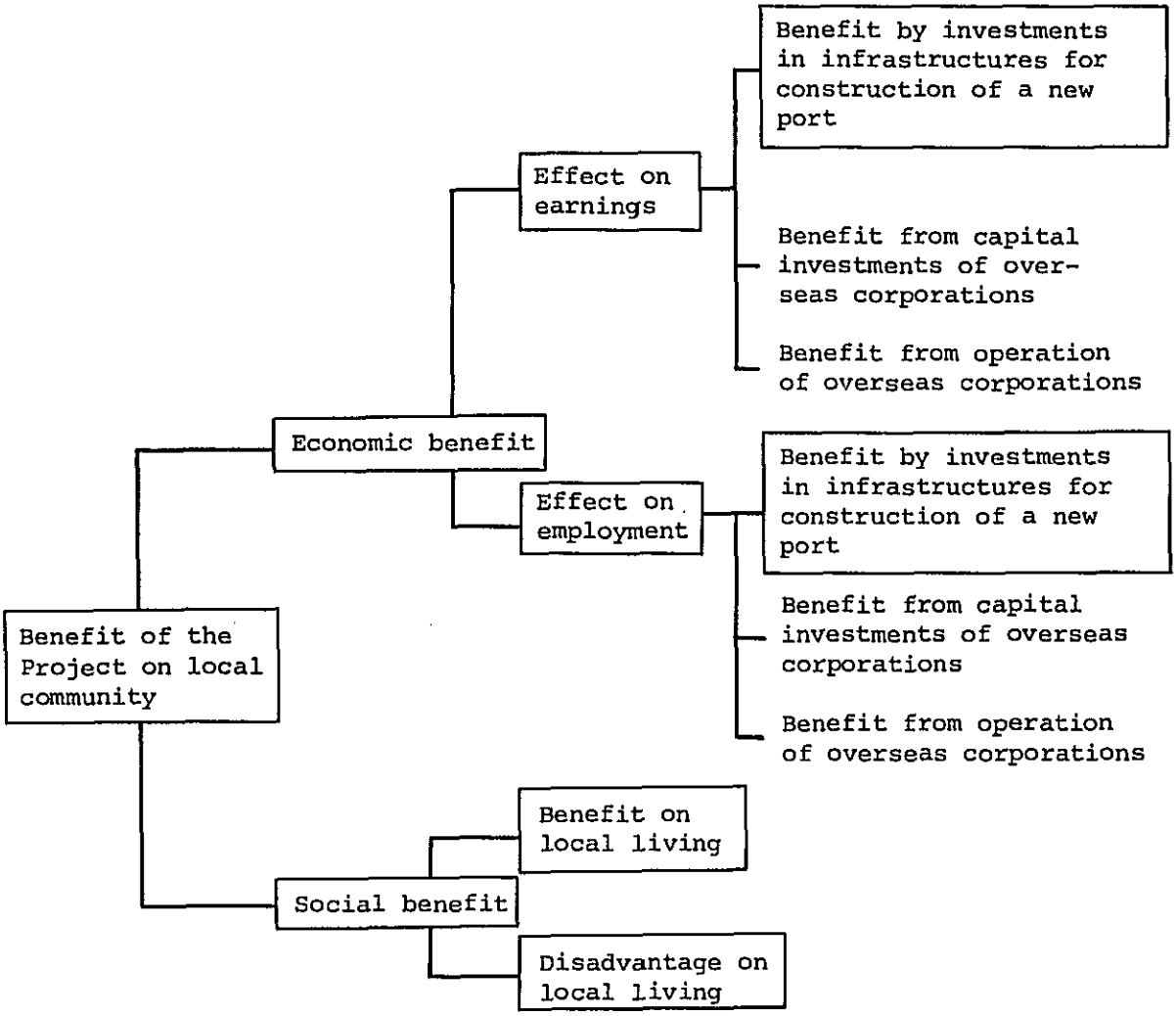
Items	Amount	Remarks	
Investments in infrastructures incident to construction of a new port	$1,788,600		(A)
Annual benefits	$11,864,379		(B)
Depreciation program			
Service life		20 years	(C)
Total depreciations	$1,788,600		(D)
Annual depreciations	$89,430		(E)
Annual expenses			
Discounts	$125,202	7%	(F)
Personnel expenses	$4,500		(G)
Repair cost	$5,000		(H)
Annual expenses	$134,702		(I)
Total annual expenditures	$224,132	(E) + (I)	(J)
Net cost savings	$11,640,247	(B) - (J)	(K)
Increase in national earnings	$11,769,949	(F) + (G) + (K)	(L)
Capital turnover ratio	663.3%	(B)/(A)	(M)
Cost/benefit ratio	5,293.5%	(B)/(J)	(N)

11-3 Assessment of the effect of Project on local economic and social improvements

11-3-1 Viewpoints of assessment

In case a new port is constructed in the projected area, the potential effect on local community will be assessed from the following viewpoints.(Fig. 11-1)

Fig. 11-1



Also, it is necessary to conduct studies as follows from the viewpoint of classifying the effect by time.

Effect of Project by time
- in the stage of construction
- after construction

11-3-2 Benefit on earnings

The effect of investment in infrastructures for port construction is mostly produced in the following regions.

(1) Alcoy and Dalaquete

(2) Cebu City and Manila

(3) Overseas (mainly in Japan)

Of the above, studies are conducted on (1) and (2).

As shown in Table 10-11, total investments in infrastructures in relation to the execution of the Port Project are estimated as follows.

$791,400 in foreign currency

$997,200 in local currency

GT: $1,788,600

Cost of material locally procured in the Philippines, equipment operating expenses, labor cost and others total $997,200.

Direct earnings resulting therefrom produce positive chain reactions on other sectors. Multiplying such earnings by a 3 to 4 normal multiplier on income expansion, we estimate that the effective demand of $3,000,000 to $4,000,000 will be produced in the Philippines directly or indirectly by investments in infrastructures placed for the construction of a new port for shipment of dolomite.

Of the above effective demand produced by the investment, it is difficult to estimate the ratio of demand produced in regions of 1) Alcoy and Dalaquete and 2) Cebu City and Manila, but according to the rough estimation, the former enjoys 10% of total effective demand and the latter 90%.

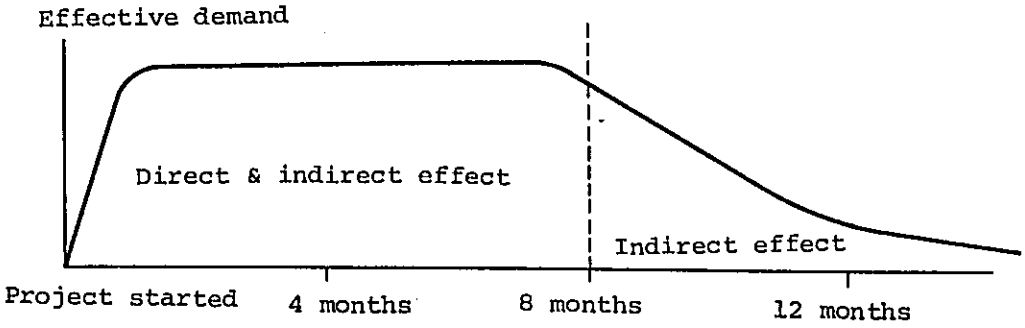
Therefore, direct and indirect effective demand produced in favor of Alcoy and Dalaquete aggregates $300,000 to $400,000.

On the other hand, total direct and indirect demand produced in favor of Cebu City and Manila aggregates $2,700,000 to $3,600,000.

Estimating the annual treasury revenue of Alcoy and Dalaquete as $600,000, we may conclude that this Project will definitely exert extremely favorable effect on the economy of these municipalities.

The periodical classification of the effect of the Project on earnings

is as follows.



11-3-3 Effect on employment

Effect on employment as a result of improvements in infrastructure for construction of the new port will be produced in the following areas.

1) Alcoy and Dalaquete
2) Cebu City and Manila

Table 11-3 shows the breakdown of manpower, labor quality and employment period by sectors required for the infrastructure improvement program.

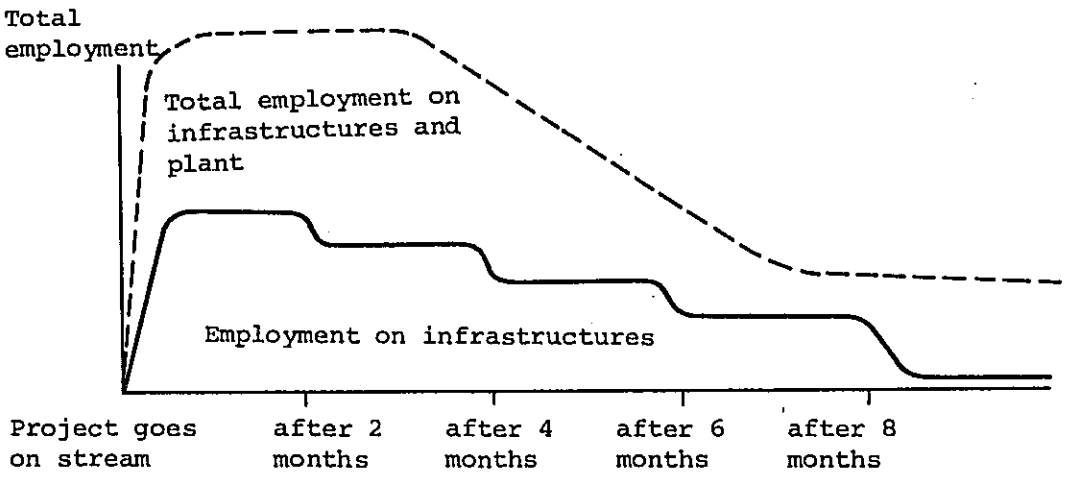
Table 11-3 Total manpower and construction period required for the infrastructure improvement project

	Type of workers	Number of workers	Period
Port facilities	Skilled workers	35	8 months
	Laborers	70	"
*Power supply facilities	Skilled workers	23	6 months
	Laborers	34	"
Road construction	Skilled workers	1	2 months
	Laborers	4	"
Water supply facilities	Skilled workers	8	2.5 months
	Laborers	18	"
Clinic	Skilled workers	5	4 months
	Laborers	28	"
Total	Skilled workers	72	
	Laborers	154	

Remarks (*) Continued employment of 3 skilled workers will be required for maintenance after completion of the construction.

The Project envisages to hire 154 laborers from Alcoy and Dalaquete and 72 skilled workers from Cebu City and Manila.

At present, there is no industrial facility in Alcoy and Dalaquete and even agricultural workers representing 70% of total work force only work 1 to 2 hours each in the morning and evening (Practically, they do not have to work longer.). They are partly jobless. In such villages where 20 to 30% of workers are working in urban cities as casual workers, creation of job opportunities for 154 workers on a full time basis should improve their labor situation. Overseas corporations will create additional employment opportunities of 300 to 400 during the construction stage and about 160 during routine operations. The periodical classification of the effect of the project on the creation of job opportunities is as follows:



11-3-4 Social benefit

The infrastructure improvement programs to be implemented following the construction of a port will bring forth following benefits to the localities.

a. Construction of clinic for medical service to local people

Especially in Alcoy, medical services are very poor and, as there is practically no doctor in this municipality, people are compelled to consult doctors in neighboring Dalaquete, or those in Cebu City, 90 km away from Alcoy, in the case of critical illness. It is not only time and labor consuming, but they cannot afford it economically.

The head of Alcoy Municipality was also complaining to us about this matter. We are therefore convinced that if medical service can be offered to local residents as a result of implementing this Project, it will surely bring forth a major benefit to the municipality.

b. Water and power supply

Provided surplus water and power are supplied to the municipality, it will play a substantial role in improving the welfare of citizens to a large measure.

c. Installation of local berth

Due to absence of a berth which accommodates small vessels, fishes caught in the waters off Bohol located opposite Alcoy are processed as dried fish for marketing in Alcoy and Dalaquete. Provided a berth is constructed under the Project and offered to local people , fresh fishes can be purchased from the Bohol. It will also become possible for them to sell vegetables raised in elevated hinterlands to people in the Bohol. The execution of the Project will no doubt satisfy the cherished desire of villagers for trading with the Bohol and, thereby, expansion of the scope of activities and improvement of local living standards.

d. Repatriation of seasonal workers

As mentioned in the preceding paragraph, as much as 20 to 30% of workers in Alcoy and Dalaquete leave their homes for Cebu City or Manila for seasonal or temporary job assignment. If we can bring some of them back home by creation of job opportunities in Alcoy and Dalaquete through operation of the Project, especially with industrial facilities on a long term contract basis, many households will recover happiness by reunion of family members.

11-3-5 Social disadvantages

It is likely that such disadvantages or inconveniences may be produced in local communities through operation of the infrastructure project.

a. The Project is expected to give a major impact to local communities. It is possible that it may disrupt the existing social order in

the local communities. In other words, substantial income gap will be produced between non-beneficiaries and beneficiaries of this Project. It is likely that some sort of troubles may occur in between the disruption of the existing order and the settlement of a new order.

b. There is a persistent sense of rivalry between peoples in Alcoy and Dalaquete. In particular, people of Alcoy have a sharp sense of rivalry against the people of Dalaquete. Therefore, careful attention should be paid in selection of sites for various facilities and in employment of workers so as to minimize racial frictions and conflict.

c. In the waters adjacent to the projected port site, there are small fishing grounds where small catches of fish can be expected. Especially, in the waters near the coast, several small fishing boats are engaged in fishery operations. It is likely that the sea will be kept clean and unpolluted, even after the dolomite mines have entered into operation, if proper care is used so that no plant discharges pollutants or no dolomite carrier dumps waste oil into the sea while on the berth.

We are under the impression that no fishery right has been instituted, and there is unlikely such problem as fishery compensation.

d. As mountains are scrapped off for exploitation of dolomite, natural environment may be damaged to a certain degree, where the life of wild animals, birds and plants will slightly be affected. However, as plant site is far from private houses, we do not think that there is no particular problem which may have direct bearing on the living conditions of villagers.

ANNEX

ANNEX -1

QUEUEING THEORY RESULTS

1. The table below gives the queueing time/service time ratios for various numbers of berths and berth occupancies of a port. The queueing time and the service time when added together give the average ship time in port. The ratios are based on the assumption that ships arrive with a poisson distribution and that the service times of the ships follow an exponential distribution.[a] The number of berths where th e ships can be serviced is used with the average time between ship arrivals and the average service time[b] of a ship to calculate the berth occupancy as follows:

Berth occupancy = Average service time/(No. of berths x average inter-arrival time).

Using the berth occupancy and number of berths as co-ordinates, the appropriate ratio can be read from the table. Multiplying this ratio by the average service time gives the expected or average queueing time. The total ship time in port is then given by adding this queueing time to the service time.

2. The effect of additional berths can be shown by recalculating the berth occupancy and using this with the new number of berths to determine the new ratio. In addition, the effects of a change in average service time can also be shown by recalculating the berth occupancy and selecting the new ratio.

a These assumptions were approximately true in all three case-study ports.

b The time for discharging, loading, and manocuvring onto and from the berth.

ANNEX TABLE

Queueing time/service time ratios

		Number of berthing points															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	.050	0.053	0.003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.050
	.100	0.111	0.010	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.100
	.150	0.176	0.023	0.004	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.150
	.200	0.250	0.042	0.010	0.003	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.200
	.250	0.333	0.067	0.020	0.007	0.003	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.250
	.300	0.429	0.099	0.033	0.013	0.006	0.003	0.001	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.300
	.350	0.538	0.140	0.053	0.023	0.011	0.006	0.003	0.002	0.001	0.001	0.0	0.0	0.0	0.0	0.0	.350
	.400	0.667	0.190	0.078	0.038	0.020	0.011	0.006	0.004	0.002	0.001	0.001	0.001	0.0	0.0	0.0	.400
	.450	0.818	0.254	0.113	0.058	0.033	0.020	0.012	0.008	0.005	0.003	0.002	0.002	0.001	0.001	0.001	.450
	.500	1.0	0.333	0.158	0.087	0.052	0.033	0.022	0.015	0.010	0.007	0.005	0.004	0.003	0.002	0.002	.500
	.550	1.222	0.434	0.217	0.126	0.079	0.053	0.037	0.026	0.019	0.014	0.010	0.008	0.006	0.005	0.004	.550
	.575	1.353	0.494	0.254	0.151	0.097	0.066	0.047	0.034	0.025	0.019	0.014	0.011	0.009	0.007	0.005	.575
	.600	1.500	0.562	0.296	0.179	0.118	0.082	0.059	0.044	0.033	0.025	0.020	0.016	0.012	0.010	0.008	.600
Berth	.625	1.667	0.641	0.344	0.213	0.143	0.101	0.074	0.056	0.043	0.034	0.027	0.021	0.017	0.014	0.012	.625
Occupancy	.650	1.857	0.732	0.401	0.253	0.173	0.124	0.093	0.071	0.055	0.044	0.035	0.029	0.024	0.020	0.016	.650
	.675	2.077	0.837	0.468	0.301	0.209	0.152	0.115	0.090	0.071	0.057	0.047	0.038	0.032	0.027	0.023	.675
	.700	2.333	0.961	0.547	0.357	0.252	0.187	0.143	0.113	0.091	01074	0.061	0.051	0.043	0.037	0.031	.700
	.725	2.636	1.108	0.642	0.426	0.305	0.299	0.178	0.142	0.115	0.095	0.080	0.067	0.058	0.049	0.043	.725
	.750	3.0	0.286	0.757	0.509	0.369	0.281	0.221	0.178	0.147	0.123	0.104	0.089	0.076	0.066	0.058	.750
	.775	3.444	1.504	0.899	0.614	0.451	0.347	0.276	0.225	0.187	0.158	0.135	0.117	0.102	0.089	0.079	.775
	.800	4.0	1.778	1.079	0.746	0.554	0.431	0.347	0.286	0.240	0.205	0.176	0.154	0.135	0.119	0.106	.800
	.825	4.714	2.131	1.311	0.917	0.689	0.543	0.441	0.367	0.311	0.267	0.232	0.204	0.181	0.161	0.145	.825
	.850	5.667	2.604	1.623	1.149	0.873	0.693	0.569	0.477	0.408	0.353	0.310	0.274	0.245	0.220	0.199	.850
	.875	7.0	3.267	2.062	1.476	1.132	0.908	0.751	0.635	0.547	0.478	0.422	0.376	0.338	0.306	0.278	.875
	.900	9.0	4.263	2.724	1.969	1.525	1.234	1.028	0.877	0.761	0.669	0.594	0.533	0.482	0.439	0.402	.900
	.925	12.333	5.926	3.829	2.796	2.185	1.782	1.497	1.285	1.122	0.993	0.888	0.802	0.729	0.668	0.614	.925
	.950	19.0	9.256	6.047	4.457	3.511	2.885	2.441	2.110	1.855	1.651	1.486	1.348	1.233	1.134	1.049	.950
	.975	38.999	19.252	12.708	9.451	7.504	6.211	5.291	4.602	4.068	3.642	3.295	3.006	2.762	2.553	2.373	.975

Source : Calculated by UNCTAD secretariat from queueing theory formula with posson arrivals and exponential service times with first-come, first-served queue discipline.

ANNEX - 2

Tarff-Visayan Electric Company

The following is the electric rate schedule followed by Visayan Electric Company (NPC's subsidiary in Visayan).

1) Application

This tariff will be applicable to power consumption in excess of 100HP for general power, heating and lighting purposes.

2) Monthly electric rates

(1) Demand charge

(a) Peak rate: 12.5 pesos (monthly) per contract demand (KW)

(b) Off-peak rate: 8.0 pesos

(2) Energy charge: 0.41 peso/KWH up to first 200 hrs. of contract demand

0.38 peso/KWH up to second 200 hrs. of contract demand

0.35 peso/KWH up for consumption in excess of 400 hrs.

3) Fuel price escalation clause

The prices of bunker and diesel oil were set for 0.7055 peso/lit. and 0.9050 peso/lit. respectively effective as of May 16, 1975.
In case this reference price is raised or reduced, electric rates shall be adjusted thereto per KWH in the following rates.

0.00038 peso/KWH: In case the cost of bunker oil fluctuates 0.001 peso/lit.

0.00036 peso/KWH: In case the cost of diesel oil fluctuates 0.001 peso/lit.

Remarks: The electric rate was raised 0.062272 peso/KWH as fuel price adjustment, effective from April 21, 1977.

4) Others

Details are set forth on exchange adjustment, minimum rate, contract demand rate, power-factor premium and discount.

ANNEX-3

ENGINEERING COMPANIES AND ELECTRIC APPLIANCES

Local electrical engineering and construction companies have sufficient technical background and can execute general and electrical works for construction of the substation for power reception/transformation and the power generation plant under the supervision of Japanese engineers.

The following are Manila-based engineering companies.

General Engineering Companies

- E.E.I.
- A.G. & P.
- ERECTORS
- P.E.C. Co.

Electric Engineering Companies

- P.I.E. Co.
- AUDION ELECTRIC
- PACES

Most of electric appliances, such as small transformer, small motor, distribution panel, etc. have been imported.

ANNEX - 4

ELECTRICAL CODE AND PROCEDURES

The Philippine Electrical Code, counterpart of Japanese Technical Standards on Electric Installations, were established in accordance with the U.S. criteria and it sets forth details on the execution of works as well as on technical standards. As to electrical appliances, no official standards have been established by the Philippines, but instead, U.S. standards, such as NEMA, has been applied.

Japanese standards, JIS or JEC, may be applied, but in this case, prior consultation with BLS (Bureau of Labor Standards) and with NPC should be made as necessary.

As procedural steps, an application for approval of installation should be filed with the Government Agency concerned (BLS), accompanied with relative documents.

Any work should not be started prior to the BLS's approval, which takes one to two months after acceptance of application. The BLS's inspection is mandatory after work completion. In the case of receiving power supply from electric companies, no power would be supplied without BLS's inspection certificate. Among documents accompanying the application, there are some that obligate applicants to acquire the signature of a professional electrical engineer of the Philippine nationality. In this connection, particular care must be drawn to a fact that the personal screening of the professional electrical engineer concerned takes one to three months. It means that it takes two to five months to go through all the official procedures from filing of application to acquisition of approval.

ANNEX - 5

CALCULATION OF RUNNING COST
ON POWER TRANSMISSION AND NON-UTILITY POWER GENERATION

Basis of integration:

Calculation is made on assumption that total load is 1,900 KW, including 1,300 KW for high-voltage equipment, 400 KW for low-voltage equipment and 200 KW for offices and dormitories, with a load factor of mining equipment estimated at 0.8 and daily operating hours for 16 hours (25 days/month).

Exchange rate: 1 peso = 37 yen

H: hour
D: day
M: month
Unit: yen

1) *In case power is supplied by NPC (monthly) Unit: yen*

(1) Contract rate

1,900 KW x 12.5 pesos/HW.M x 37 = 880,000/M ..... (1)

(2) Demand rate (adjusted to oil markup)

Power consumption (KWH)/M

Work days (mine): 1,700 KW x 0.8 x 16 h/D x 25 D/M +
200 KW x 24 M/D x 25 D/M = 664,000 KWH/M

Holidays: 200 KW x 24 H/D x 5 D/M = 24,000 KWH/M

Total: 688,000 KWH/M

Hence,

Initial 200 hrs.: 1,900 KW x 200H x 0.473^{P}/KWH x 37
= 6,650,000

Balance: (688,000 KWH - 1,900 KW x 200 H) x 0.442^{P}/KWH
x 37 = 5,040,000

GT: 11,690,000 -/M ..... (2)

(3) Maintenance and repair cost

Miscellaneous expenses ..... (3)

(4) Personnel expenses

2 persons x 2,000P/man/M x 37 = 150,000 ..... (4)

Grand total

(1) + (2) + (3) + (4) = 12,820,000/M

* Unit cost/KWH 12,820,000 -/M/688,000/M = 18.6-/KWH

2) Non-utility power generation (monthly) Unit: Yen

(1) Fuel cost

Fuel consumption

Routine operation hrs.:

1,000 PS x 16 H/D x 25 D/M x 0.18 ℓ/PS.H x 3

= 259,200 ℓ/M

Night & holidays:

(360 PS x 8H/D x 25 D/M + 360PS x 24 H/D x 5 D/M)

x 0.18 ℓ/PSH = 20,736 ℓ/M

Total: 279,936 ℓ/M

* Fuel cost: 279,936 ℓ/M x 1.07 l/ℓ x 37 ≒ 11,080,000 -/M

..... (1)

(2) Cost of lubricants

279,936 lit./H x 0.02 x 4.16 pesos/lit. x 37 = 860,000

..... (2)

(3) Maintenance and repair cost (on assumption that periodical overhaul is provided at every 3,000 hours)

1,200 PS motor (16 H/D x 25 D/M)/3,000H x @4,000,000

x 3 units = 1,600,000 -/M

360 PS motor (8 H/D x 25 D/M + 24 H/D x 5 D/M)/3,000H

x @800,000 = 80,000 -/M

Total 1,680,000 -/M ..... (3)

(4) Personnel expenses

10 persons x 2,000 pesos/man.M x 37 = 740,000 .... (4)

Total (1) + (2) + (3) + (4) = 14,360,000 -/M

* Unit cost/KWH 14,360,000-/H/688,000 KWH = 20.9-/KWH

ANNEX-6

ROAD & BRIDGE CONSTRUCTION/MAINTENANCE COST FOR TRANSPORTATION OF DOLOMITE TO CEBU PORT

Construction and improvement cost on roads and bridges between Cebu City and Alcoy required in case 2,000 t/day of dolomite is transported by a 8-ton dump truck (250 round trips) is as follows:

	Type of works	Q'ty	Amount (US$ 1,000)
Pavement	Osmotic surfacing	91,500 m^2	314
	Ballast roadbed	106,500 m^2	328
	Reinforced roadbed	124,500 m^2	77
	Coating of emulsion	195,450 m^2	64
	Surface levelling	142,500 m^2	23
Safety devices	Guard rail	1,000 m^2	21
	Curve mirror	1 unit	193
	Marks & signs	2 units	111
TOTAL			1,131

ANNEX - 7

Table of Meteorological Record

Station Mantalongon, Dalaquete (9°47'N Elevation 123"27'E 2441 feet)

Annual Climatological Review, Weather Bureau

Year	Item	1	2	3	4	5	6	7	8	9	10	11	12	Annual
1952	R	119.7	58.4	90.4	26.7	261.1	191.0	467.6	190.8	214.9	445.3	207.5	188.2	2,455.9
	T	21.3	21 6	21.9	23.2	23.8	23.1	22.9	22.1	22.8	22.4	22.0	22.0	22.4
1953	R	236.2	130.0	120.7	32.5	115.3	215.9	163.3	257.3	265.7	196.6	326.6	239.8	2,300.0
	T	20.8	20.9	22.2	23 6	23.9	23.2	23.3	22.4	22.7	23.4	22.8	22.2	22.6
1954	R	151.1	69.6	285.0	15.5	454.7	247.1	265.7	219.7	165.9	190.2	251.5	371.6	2,687.6
	T	21.9	22.2	22.1	23.6	23.5	23.2	22.9	22.9	21.8	22.6	22.0	21.1	22.4
1955	R	277.1	45.7	83.1	75.4	167.4	338.6	175.5	194.3	316.2	261.6	747.3	198.9	2,881.1
	T	20.7	21.6	22.3	23.2	23.4	22.8	22.7	23.0	23.1	22.6	22.2	20.7	22.3
1956	R	149.1	39 9	131.3	198.1	305.8	123.7	364.7	198.6	178.1	414.5	84.8	589.5	2,778.3
	T	20.2	21.2	21.2	22.0	22.4	22.3	22.4	22.2	22.2	22.2	21.8	20.8	21.7
1957	R	159.0	119.9	68.3	80.0	59.7	171.7	300.7	166.6	63.2	134.6	51.6	38.1	1,413.5
	T	21.4	19.1	21.8	22.7	23.5	22.9	22.5	22.8	22.2	23.5	22.5	21.6	22.2
1958	R	98.8	125.2	98.8	67.6	113.8	152.1	109.7	122.7	88.6	237.2	266.2	51.8	1,532.6
	T	21.0	21.0	21.6	22.5	23.7	23.9	22.8	23.0	22.8	22.6	21.4	21.6	22.4
1959	R	119.6	105.4	124.5	106.2	242.8	92.2	150.9	253.0	237.7	154.2	119.1	204.0	1,909.6
	T	20.5	20.9	21.3	22.4	23.0	23.3	22.4	22.0	22.5	22.4	22.2	21.6	22.0
1960	R	184.9	126.2	68.6	97.3	129.0	231.4	179.1	128.5	103.9	181.1	203.7	59.7	1,693.4
	T	20.9	20.8	22.0	22.2	23.3	22.8	22.5	22.9	22.5	22.8	22.0	21.0	22.1
1961	R	111.5	78.0	48.3	91.4	239.3	162.1	149.6	110.5	113.8	210.8	130.6	127.5	1,573.3
	T	19.4	20.6	21.7	22.5	22.9	22.3	22.3	20.4	22.6	21.7	21.5	21.3	21.6
1962	R	28.2	164.8	148.8	105.7	85.6	288.3	353.6	290.1	215.4	147.6	354.1	126.0	2,308.1
	T	20.1	19.6	20.8	22.3	22.3	22.8	22.0	22.0	22.1	22.5	21.6	20.6	21.6
1963	R	123.2	90.9	227.6	19.6	77.0	96.0	211.3	315.0	182.1	303.5	88.9	114.0	1,849.1
	T													
1964	R	209.8	292.6	34.0	212.7	254.3	307.9	263.1	67.3	184.4	197.6	439.9	38.9	2,502.8
	T	20.7	20.0						22.4	22.3	22.4	21.5	21.1	
1965	R	175.0	159.8	234.2	226.6	131.8	231.1	248.4	151.4	215.9	255.3	220.5	167.9	2,417.9
	T	19.9	19.5	21.0	21.4	22.8	22.3	21.1	22.0	21.4	22.0	21.4	20.3	21.3
1966	R	118.0	77.1	46.1	31.2	219.2	127.5	303.8	154.2	154.9	219.0	49.9	46.3	1,547.2
	T	20.2	20.5	21.4	22.4	22.5	22.4	22.1	22.5	22.4	22.2	22.0	21.5	21.8

R: Rainfall (mm) T: Temperature (°C)

Table of Meteorological Record

Station: Mantalongon

Year \ Month / Item		1	2	3	4	5	6	7	8	9	10	11	12	Annual
1967	R	105.3	64.7	78.3	8.3	32.4	21.3	87.4	63.2	53.8	99.2	107.6	48.2	769.7
	T	22.2	21.6	20.6	22.1	23.1	22.9	22.7	20.1	22.4	21.9	20.6	20.4	22.0
1968	R	45.8	34.4	18.0	8.4	40.2	61.5	23.1	6.0	37.2	33.3	116.1	49.2	473.2
	T	20.1	20.2	21.2	22.5	23.5	23.4	22.9	22.5	22.8	22.7	20.3	19.8	21.8
1969	R	21.7	6.1	33.0	10.4	23.8	51.3	43.6	90.2	89.9	74.8	28.3	62.6	535.7
	T	20.1	20.3	20.0	22.5	23.2	23.5	22.1	22.5	22.4	22.3	21.9	21.3	21.8
1970	R	53.4	45.5	17.8	13.9	61.6	87.7	82.8	47.0	53.5	209.2	230.1	107.3	1,009.8
	T	20.9	20.7	21.7	22.5	23.3	23.2	22.5	22.4	22.6				
1971	R													
	T													
1972	R													
	T													
1973	R													
	T													
1974	R													
	T													
1975	R													
	T													
1976	R	81.1	91.8	127.8	18.4	198.6	197.4	114.5	99.9	194.4	320.6	206.3	237.7	
	T	20.8	21.3	22.1	23.1	23.3	20.9	19.4	20.9	21.0	21.0	21.1	19.2	
1977	R	101.2	242.2	136.6	2.3	82.5	221.8	212.5	279.4	345.9				
	T	20.5	19.2	19.4	20.3	21.3	21.4	21.0	20.9	20.4				
	R													
	T													
	R													
	T													
	R													
	T													
	R													
	T													

R: Rainfall (mm) T: Temperature (°C)

Table of Meteorological Record

Station: Mactan Airport, Cebu

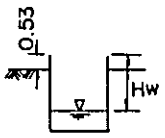
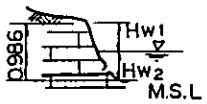
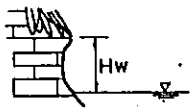
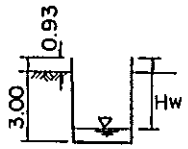
Annual Climatological Review Work Sheet

Year \ Month / Item		1	2	3	4	5	6	7	8	9	10	11	12	Annual
1965	R	82.8	99.7	134.7	77.9	32.8	287.6	86.5	182.1	67.0	221.1	109.7	146.5	1,528.4
	T	26.0	26.1	26.7	27.8	28.6	27.5	27.2	27.4	27.3	27.7	27.6	26.6	
1966	R	70.3	38.4	8.0	24.5	271.8	125.2	305.2	214.8	142.5	202.1	208.9	161.8	1,773.5
	T	26.8	27.1	27.9	29.1	28.6	28.6	27.6	28.7	28.0	27.9	27.7	27.0	
1967	R	463.7	73.5	77.8	12.4	57.7	187.9	180.4	98.5	113.0	107.1	139.3	59.6	1,570.9
	T	25.8	25.9	26.3	28.2	29.4	28.7	27.6	27.9	28.0	27.1	26.8	26.3	
1968	R	51.1	56.4	58.1	32.6	5.1	144.6	115.7	134.9	177.3	147.6	265.8	41.1	1,230.3
	T	26.1	26.0	27.4	28.3	29.3	28.6	27.9	27.7	27.8	27.7	26.5	26.6	
1969	R	11.5	4.8	26.5	5.5	54.5	172.5	103.7	181.5	141.3	89.0	47.5	66.2	904.5
	T	26.8	26.7	27.1	28.7	29.5	28.2	27.7	28.0	27.8	27.9	27.4	27.3	
1970	R	51.8	22.8	17.6	17.0	43.8	239.6	238.7	182.0	98.1	197.5	231.1	152.0	1,492
	T	27.1	27.2	28.3	29.1	29.9	28.7	27.8	27.8	27.9	27.7	27.3	27.3	
1971	R	84.1	53.5	21.4	86.0	194.0	301.5	137.0	96.1	253.4	295.1	138.4	77.7	1,654.1
	T	25.8	26.4	26.5	27.4	27.7	27.0	26.8	27.7	27.5	26.9	26.9	26.7	
1972	R	253.2	16.8	83.7	82.7	126.7	166.3	86.8	194.6	249.4	100.3	100.2	70.5	1,530.9
	T	25.5	26.8	26.6	27.6	28.4	27.7	27.9	27.7	27.1	28.2	27.5	27.4	
1973	R	12.3	70.0	20.4	10.8	28.4	154.1	234.4	172.1	315.8	109.7	480.3	112.8	1,721.1
	T	26.9	26.8	27.7	29.1	29.2	29.2	27.5	27.7	27.3	27.6	27.1	26.7	
1974	R	67.6	137.5	113.4	35.2	194.7	96.9	103.9	72.8	103.6	309.2	106.2	191.4	1,532.4
	T	25.8	26.0	26.3	27.7	28.2	27.3	27.5	28.0	28.5	27.1	27.1	26.3	
1975	R	173.4	104.8	20.1	56 9	50.3	280.6	187.6	179.7	315.0	247.1	43.4	225.8	1,884.6
	T	26.2	26.4	27.4	28.0	28.9	28.0	27.7	27.9	27.0	27.6	27.6	26.5	
	R													
	T													
	R													
	T													
	R													
	T													
	R													
	T													

R: Rainfall (mm) T: Temperature (°C)

Annex - 8

Record of Water Level (unit: m)

Point / Date	O-1	S-2 (Pugalo Spring)	S-3 (Obong Spring)	O-2	
					
	Time Level	Time Level	Time Level	Time Level	
1977 Oct. 1	17:15 2.90	Hw1 (Hw2)			
Oct. 4	9:20 2.89 14:45 2.895	10:30 0.69 15:45 0.69 (0.296)			
Oct. 5	8:45 2.895 13:40 2.895 16:25 2.905	9:00 0.70 (0.286) 13:50 0.69 (0.296) 16:15 0.69 (0.296)	9:30 1.18 14:00 1.09 16:05 1.03	14:30 2.315	
Oct. 5					
Oct. 7	10:45 2.875 14:50 2.873	11:25 0.68 (0.306) 15;05 0.69 (0.296)	15:05 1.17	15:15 2.39	
Oct. 8					
Oct. 9	11:25 2.86 16:48 2.87	11:15 0.645 (0.341) 16:55 0.69 (0.296)	11:10 0.80 17:00 1.19	11:00 1.945 17:07 2.395	
Oct.10	9:57 2.87 11:40 2.87 14:52 2.855 16:55 2.87	9:49 0.39 (0.596) 11:48 0.62 (0.366) 14:42 0.685 (0.301) 17:33 0.695 (0.291)	9:40 0.43 11:55 0.77 14:34 1.19 17:40 1.20	9:25 1.91 12:01 1.933 14:23 2.245 17:50 2.395	

ANNEX - 9

Record of Water Resources Research (1)

Item / Barrio	Type No		Date of Accomplishment	Out of order	Location & structure (m)	Yield (t/day)	User Person (house)	Water quality				Remark
								Interview	Ph	T °C	R Ω	
DAAN-LONGSOD	1	Artesian well	Sep.9,1975	Out of order July, 1977	D : 20∿30 GH: 20∿30 HD: 200	10		M				
	2	Artesian well	Feb.1,1941	Out of order Feb.10,1977	D : 30∿40 GH: 20∿30 HD: 150∿200	40	1,800	F				
	S-1	Spring			GH: 2∿3	12		F	7	25	4000	Seasonal exchange of yield
GUIWANG	3	Artesian well	Jan. 1975	Out of order July, 1977	D : 27 GH: 20∿30 HD: 500	30	300 (80)	M				High tide: fresh Low tide: salty
	④	Artesian well	Sep. 1975		D : 27 GH: 20∿25 HD: 500	30	(100)	F	7	29	4000	
	⑤	Artesian well	Aug. 1977		D: 27 GH: 20∿25 HD: 500	2 ∿ 3	(5)	M	7.5	29	950	
	⑥	Artesian well	Feb.25,1973		D: 12 GH: 12 HD: 200∿300	0.2	(1)	M	7.5	28.5	1000	
	7	Artesian well with electric pump			D : 12 GH: 12 HD: 200∿300	14.4		M				
A. TABAY	8	Artesian well	1933	Out of order 1974	D : 5.4 GH: 12∿15 HD: 500∿600	200	2,000	F				
POBLACION	9	Artesian well	1953		D : 54 GH: 60 HD: 850	10	230 (50)	F	7.5 ∿8	27	4500	
	10	Artesian well	1923	Out of order 1976	D . 24 GH: 30 HD: 550			M				High tide: salty Low tide: fresh
	11	Artesian well with electric pump	1974		D : 42 GH. 40 HD: 600	127	5,000	F	7.5	27	4000	Fee: 100/ outlet-month
	12	Artesian well	Jan.14,1941	Out of order 1975	D : 36 GH: 40∿50 HD: 550	15	(50)	M				
PASOL	13	Artesian well	1975	Out of order	D : 27 GH: 3 HD: 200			M				
	S-1	Open well			D: 4∿5 GH: 2 HD: 50			M	8	28.5	1500	
PUGALO	14	Artesian well	July 26,1931		D : 21 GH: 20 HD: 250	16	1,400 (200)	F	7.5	28	2200	
	S-2	Spring				7,700		M	7∿ 7.5	25.5 26	700 500	
OBONG	15	Artesian well	Mar.5,1957		D: 30 GH: 30 HD: 250			M	7.5	26.5	1500	for cooking, washing

◯..... Private

D : Depth
GH: Ground Height
HD: Horizontal Distance from shore line

F: Fresh
M: Mixed

T: Temperature
R: Electric Resistance

Record of Water Resources Research (2)

Item / Barrio	Type No		Date of Accomplishment	Out of order	Location & structure (m)	Yield (t/day)	User Person (house)	Water quality: Interview	Ph	T (°C)	R (Ω)	Remark
OBONG	16	Artesian well	1927		D : 30 GH: 30+α HD: 400	29.5	(295)	F	7.5	26	3500	for drinking, cooking
	17	Artesian well	Oct.8,1972		D : 38 GH: 30 HD: 300	29.5	(295)	M	7	26	1500	for all purpose except drinking
	S-3	Spring				53,423		M	7	26	1100	for bathing, washing
CONSOLACION	18	Artesian well	Jun.23,1971		D : 30 GH: 36 HD: 300	32	1,400 (200)	F	7.5	26.5	4000	
	(19)	Artesian well	1968		D : 24 GH: 24 HD: 300	0.8	8 (1)	M	7	27.5	2300	for cooking, washing cattle brown colored
	(20)	Artesian well	1971		D : 26 GH: 26 HD. 300	0.4	8 (1)	M	7∿ 7.5	28	2500	for cooking, washing brown colored
	(21)	Artesian well	1973	Out of order 1976	D : 18 GH: 16	0.7	50 (8)	F				
	22	Artesian well	Jan.7,1957	Out of order 1973	D : 15 GH: 10∿20 HD: 300	4	175 (25)	F				
BALUD	23	Artesian well	1969	Out of order 1971	D : 22 GH: 5∿10 HD: 200	38	(239)	M				Before water pipeline for drinking, washing, bathing
	24	Artesian well	before 1937	Out of order 1953 or 54	D : 22 GH: 5∿10 HD: 200	38	(239)	M				"
	25	Artesian well	Dec.20,1955	Out of order 1973	D : 18 GH: 15 HD: 300	30	900 (150)	M				High tide: salty Low tide: fresh
	(26)	Artesian well	Sep.8,1968		D : 6 GH: 2∿3 HD: 50>	18	100 (15)	M	7.5	28.5	2000	for cooking, washing, bathing
	O-2	Open well	Jul.17,1924		D : 2.07 GH: 2∿3 HD: 100	4.8∿ 5.6	400∿500 (60∿70)	F	7∿ 7.5	27	2500	for bathing, washing
	(O-3)	Open well	Mar. 1952		D : 2.27 GH: 2∿3 HD: 30	6	75 (15)	M	7.5	28	1700	for bathing, washing High tide: salty high water level Low tide: not so much salty low water level
	(O-4)	Open well	1968		D: 2.18 GH: 1.5∿2 HD: 20∿30			M	7∿ 7.5	27.5	1300	Out of use after water pipeline High tide: salty, High water level Low tide: not much salty LOW water level
	(O-5)	Open well	Jun.7,1968		D : 2 GH: 2 HD: 15			M	7∿ 7.5	27.2	4000	Out of use after water pipeline High tide: salty Low tide: fresh

(○) ..... Private

D : Depth
GH: Ground Height
HD: Horizontal Distance from shore line

F: Fresh
M: Mixed

T: Temperature
R: Electric Resistance

Record of Water Resources Research (3)

Item / Barrio	Type No		Date of Accomplishment	Out of order	Location & structure (m)	Yield t/day	User Person (house)	Water quality: Interview	Ph	T °C	R Ω	Remark
POBLACION	㉗	Artesian well	1972		D : 13 GH: 5 HD: 450	2.4	(3)	F	7	28	4800	
	㉘	Artesian well	Dec.12,1972		D : 15 GH: 5 HD: 400	3	(3)	F	7∿7.5	27.5	4700	
	㉙	Artesian well	1972		D : 20 GH: 5 HD: 300	0.36	(1)	M	7∿7.5	29	2500	
	㉚	Artesian well	1832		D : 7∿8 GH: 2∿3 HD: 50	0.09	(for Academy)	F	7.5	28.5	5000	
	㉛	Artesian well	1969		D : 15 GH: 5 HD: 250			M	7∿7.5	28.5	4000	Out of use
	㉜	Artesian well	1953	Out of order 1968	D : 10 GH: 5 HD: 350	0.23	(1)	F				
	ⓞ-6	Open well			D : 5.53 GH: 5∿10 HD: 350			F	7	28	2500	for washing Rainy season: High water Dry season: Low water
	ⓞ-7	Open well	1913		D : 2.95 GH: 2∿3 HD: 150			M	7.5	28	3000	for washing, bathing
	ⓞ-8	Open well	1901		D : 2.225 GH: 2∿3 HD: 200			F	7.5	28	5000	
	ⓞ-9	Open well	1800's		D : 1.95 GH: 2∿3 HD: 150∿200			F	7.5	27	4700	for washing, bathing
TAPON	33	Artesian well	Dec.29,1956	Out of order 1974	D : 30 GH: 10 HD: 900	8∿10	300 (40)	F				
	34	Artesian well	1890		D : 30 GH: 5∿10 HD: 700	100	500 (150)	F	7	28	4000	Out of use after water pipeline
	35	Aftesian well			GH: 10∿20 HD: 700							
	O-10	Open well	before 1770		D : 3 GH: 5 HD: 300		(10)	F	7∿7.5	27.5	4000	
BANHIGAN	S-4	Spring						M	7∿7.5	26	1800	all purpose before water pipeline
	S-5	Spring						M	7∿7.5	27	980	Fresh water before construction of concrete wall
	S-6	Spring						M	7∿7.5	26	2000	High tide: salty Low tide: not salty brown color at rainfall
CAWAYAN	36	Artesian well	Sep.17,1957		D : 9 GH: 30 HD: 200	10	350 (50)	F	7	26.5	2000	for all purpose
	S-7	Spring						M	7	28	650	High tide: salty Low tide: fresh
OBO	S-8	Dinagayop Spring			GH: 500 HD: 6,500	5,000∿9,000		F	7∿7.5	28 31	4000 4000	

o ..... Private

D : Depth
GH: Ground Height
HD: Horizontal Distance from shore line

F: Fresh
M: Mixed

T: Temperature
R: Electric Resistance

ANNEX-10

OVERLAND TRANSPORTATION COST OF DOLOMITE TO CEBU PORT BY TRUCKS
(TRANSPORTATION COST FROM PLANT SITE TO LOADING POINT)

1. In the case of shipping 600,000 tons yearly

1-1 Shuttle transportation by trucks $1,858,000/year

Remarks (1) Assuming that 8-ton capacity dump trucks will be used, two round trips (one each during the day and the night) between Alcoy and Cebu City (about 90 km) would be the maximum limit. On assumption that 600,000 tons yearly or 50,000 tons monthly by trucks engaged in delivery 25 days a month, 125 trucks will be required to cover the transportation of 2,000 tons daily, or 140 trucks including 15 spare trucks for example. In Japan, a reconditioned 8-ton dump truck costs about 90,000 pesos and total expenditures therefore amount to 12,600,000 pesos. In the case of three-year depreciation (360,000 km is ordinarily covered during this period), annual running cost reaches 4,200,000 pesos

..... (1)

(2) Fuel cost

The fuel cost amounts to approximately 200 pesos per truck on assumption that it drives 400 km daily.

200 pesos x 125 trucks = 25,000 pesos

Assuming that the trucks operate 300 days a year, annual fuel expenses aggregate 7,500,000 pesos (25,000 pesos x 300)

..... (2)

(3) Payments to drivers

Total payments to drivers amount to 1,250,000 pesos (125 drivers x 10,000 pesos) on assumption that each driver makes 10,000 pesos.

Including 10% overhead, total payments to drivers run up to 1,375,000 pesos (1,250,000 pesos x 1.1) ..... (3)

(4) Total maintenance cost aggregates 375,000 pesos on assumption that it costs 3,000 pesos per truck (125 trucks x 3,000 pesos) ..... (4)

(5) Total expenses on trucks in the case of transporting 600,000 tons yearly

(1) + (2) + (3) + (4) = 13,450,000 pesos = $1,858,000 ... (5)

1-2 Shipping charges at Cebu Port $3,600,000/year

Remarks : Total shipping charges for 600,000 tons of dolomite aggregate about $3,600,000/year, including stevedorage, rent for stevedoring equipment, ground rent for outdoor stockpiling, custom handling fee, etc. ..... (3)

As Cebu Port is congested with vessels and facilities employed to full capacity, dolomite is usually stockpiled outdoors adjacent to the port, awaiting redelivery, by special steel containers and conveyors, to a vessel each time as it is berthed. This operation involves huge expenses.

3. Total

Total annual transportation cost (para. 1-1 & 1-2) on 600,000 tons of dolomite from plants in Alcoy to vessels in Cebu Port aggregates $5,458,000 (1.1 + 1.2).

2. In the case of shipping 1,000,000 tons yearly

2-1 Shuttle transportation by trucks ..... about $3,096,000/year

2-2 Shipping charges at Cebu Port ..... about $6,000,000/year

2-3 Total: $9,097,000/year (2.1 + 2.2)