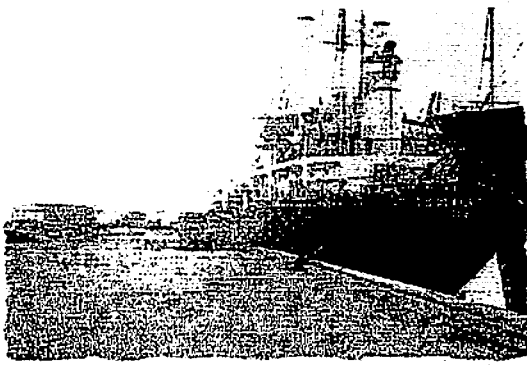




Marsman Bldg., 22 M. De San Francisco St., South Harbor,
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FEASIBILITY STUDY WITH MASTER PLAN

Port Package V

FINAL REPORT PORT OF DAVAO (Sasa Wharf)

Volume 1: Basic Studies
and Projection

May 2000



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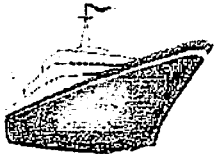


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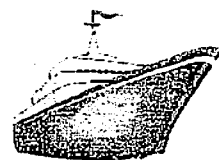
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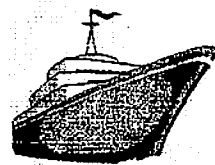
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Chapter **I**

Introduction

Chapter I

INTRODUCTION

1.1 GENERAL

Sasa Wharf, otherwise referred to as the Port of Davao, is located at the western side of Davao Gulf and is well protected against tropical cyclones due to landmasses surrounding it. The port is the principal seaport for most commodities produced in the Davao Gulf.

In 1997, Sasa Wharf handled over 2.4 million metric tons. There was an uptrend in containerization. Between 1980 and 1997, containerized cargo grew by 8.45% annually on the average. There were more domestic containerized cargoes in the inward (60%) than outward flow (40%). The port also handled significant volume of foreign cargo from 20% of the total traffic in 1980 to about 32% in 1997.

At the regional level, concerted efforts of the government and the private business sectors have resulted in an impressive inflow of capital to Southern Mindanao. As a result, the region's comparative advantage is now comparable to the leading regions of the country. Recently, the opening of the Davao - Manado (Indonesia) route has created an impetus in strengthening the country's trade relations with the BIMP-EAGA Growth Corridor. As a result of intensified trading with its neighbors, tourism activities have increased and are expected to increase even further in the many years to come.

In view of this sustained traffic growth, it is imperative that the needed port facilities and equipment be in place at the right time and at the right magnitude. This Master Plan with Feasibility Study intends to address this concern.

1.2 OBJECTIVES OF THE STUDY

The general objective of this Study is to determine the viability of any proposed improvements and/or expansion of Sasa Wharf.

Specifically, this study seeks:

- To determine the future traffic and to analyze the present technical and operational conditions of the existing ports including the surrounding environment that affects the port;
- To determine the required improvements on the existing ports and/or additional port facilities to be provided, if any, to handle the future traffic and the manner by which the ports should be operated and managed;
- To determine the economic viability of the proposed project from the national viewpoint as well as from the private viewpoint of PPA and of the private operator of the ports; and
- To assess the environmental impact of the proposed projects on its surrounding areas and to define the courses of action to be undertaken to minimize their impact.

1.3 STUDY AREA

The Feasibility Study with Master Plan for Sasa Wharf is confined to the existing wharf and its possible expansion areas to the north and to the south. See Figure 1-1.

1.4 STUDY APPROACH AND METHODOLOGY

The entire project was conducted under a multi-disciplinary approach to planning encompassing the various expertise required for this study. Figure 1-2 shows the Study Flow Diagram.

1.5 REPORT ORGANIZATION

This report is organized into three (3) volumes.

Volume 1 covers the Basic Studies and Projection necessary before a definitive master plan can be conceptualized. This include the following:

- Review and analysis of past and present climatological, meteorological and other physical data that will bear on the design, orientation and operation of the port;
- Inventory of the existing port facilities to determine their physical conditions with the end in view of recommending any repair and/or rehabilitation works to be undertaken;
- Definition and analysis of the present port operation including handling system and procedure, adequacy of cargo handling equipment, open and closed storage, labor force, utilization of port facilities, and productivity levels;
- Analysis of service time of vessels, waiting time, berth throughput, and berth occupancy;
- Analysis of adequacy of port safety and security within the port, and ancillary services;
- Review and analysis of past data on cargoes, vessels and passenger traffic;
- Projection of cargo and passenger traffic in sufficient detail that shows segregation of foreign and domestic cargo, inward and outward cargo and passengers, containerized and non-containerized cargo; and
- Analysis of existing port operation and recommendation of achievable port productivity and capacity.

Volume 2 covers the Proposed Facilities, Equipment and Operations. This includes the following:

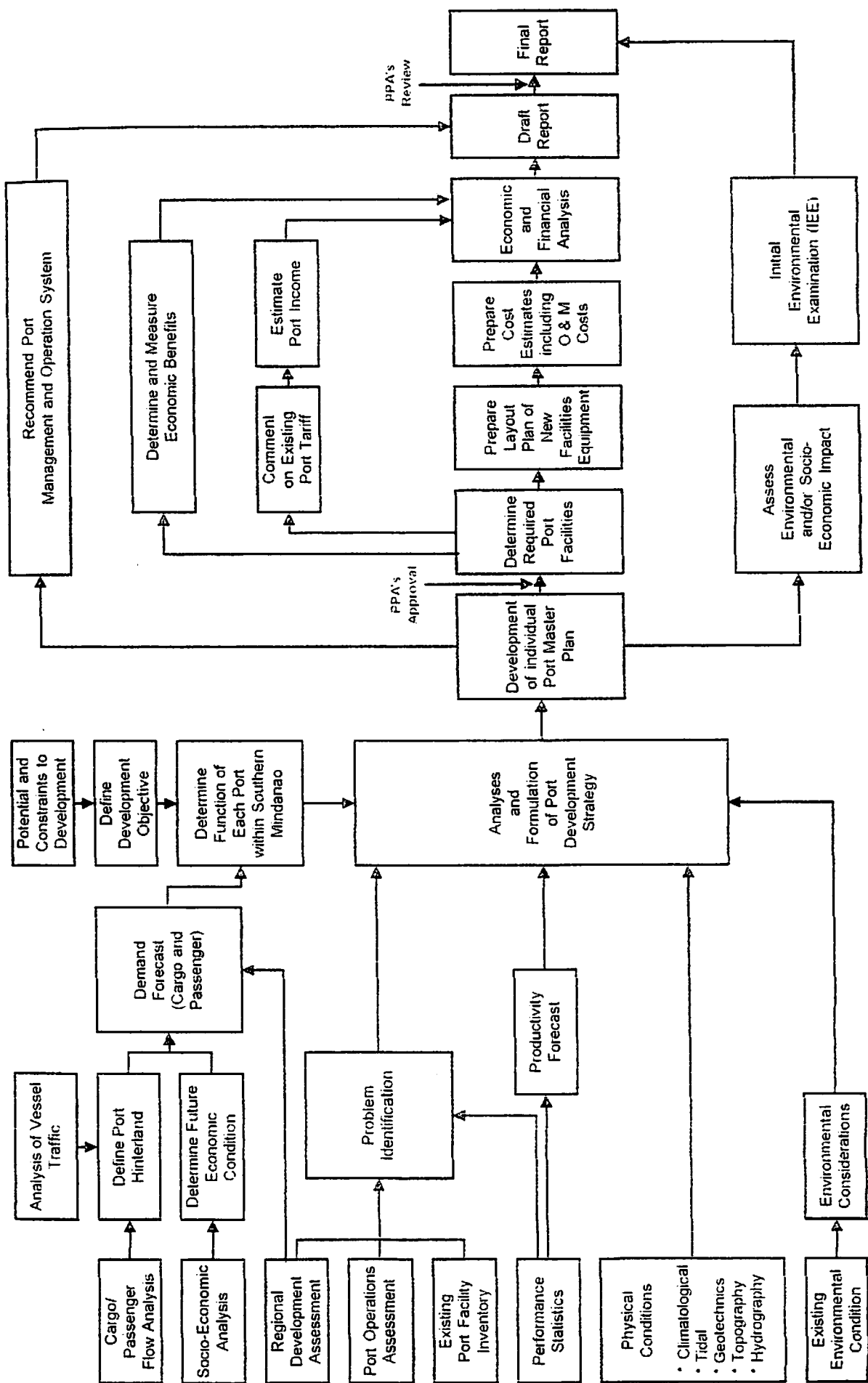
- Presentation of three (3) alternative development scenarios for the master plan and detailed port layout of the recommended scheme;
- Determination of port facilities required including the needed improvements or additional facilities, required for the design year 2006;
- Determination of number of berths, berths length, storage areas and other port facilities, and estimated costs of such facilities;
- Definition of appropriate cargo handling system and procedures, the type and number of equipment appropriate to the proposed development; and
- Preliminary design criteria;

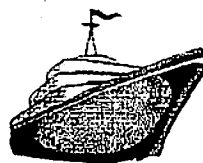
Volume 3 covers the Project Evaluation. This includes the following:

- Conceptual framework for the economic and financial evaluation;
- Identification and quantification of economic benefits and cost, the relevant financial revenue and financial costs from the private viewpoint of the authority and also for the private operation;
- Sensitivity analysis on the economic and financial evaluation;
- Environmental assessment.

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Figure 1-2
PORT PACKAGE V STUDY FLOW





Chapter 2

Description of Existing Facilities

Chapter 2

DESCRIPTION OF EXISTING FACILITIES

2.1 PORT OF SASA (DAVAO)

2.1.1 Location & Topography

Sasa Wharf is situated on the South Eastern Coast of Mindanao Island at the western side of Davao Gulf having a latitude of 7°05' North and longitude at 125°35' East. It is relatively protected by land masses on all sides at the south.

2.1.2 Water Depths

Berthing facilities consist of the old and new quays. The controlling depth along the old quay is at 10.0 MLLW and - 9.0m MLLW along the new quay.

2.1.3 Aids to Navigation

There is a lighthouse located at the southside of wharf with newly replaced light bulb.

Please refer to Communication System on Section 2.1.5.4.

2.1.4 Anchorage

Vessel awaiting berth availability anchor off 450 meters off Sta. Ana Pier at 12 fathoms deep.

2.1.5 Physical Infrastructure

Berthing Facilities (reinforced concrete beck with concrete pile support).

Old Quay	-	515m x 18m
New Quay	-	405m x 20m

Storage Facilities

Transit Shed	-	1,210 m ²
Open Storage Area (paved)	-	50,000 m ²
Open Storage Area (unpaved)	-	8,000 m ²
Container Stacking (precast concrete tiles)	-	37,800 m ²
Warehouse	-	6,000 m ²
DIPSSCOR Transit Shed	-	900 m ²
Open Storage Area (Quayside)	-	1,650 m ²
NSLC Open Storage	-	1,308 m ²
Angliongco Warehouse	-	1,080 m ²
Minterbro Warehouse	-	3,625 m ²
Denia (PPA) Warehouse	-	609 m ²
Pacific Oil Lease	-	1,000 m ²

The existing infrastructure physical showing specific locations is presented in Figure 2-1, while Figure 2-2 shows the actual photographs. Their causes, and prevention/maintenance measures are discussed in Section 2.8. Recommendation for repair and or rehabilitation details is shown in Section 2.9.

2.1.5.1 Existing Port Lighting

- Three (3) high mast cylindrical floodlight poles with 12-800 watts HPS luminaries per pole located at the container stocking area.
- Two (2) high mast angular steel tower with 8-1000 watts HPS luminaries located at the storage area behind berth 3.
- Two (2) concrete spun post at 18 meter high with 2-400 watts sodium light located behind berth 1.
- Sodium and fluorescent lamp post are provided at the gate complex and approach roads.

Refer to Figure 2-3 for the Electrical Layout Plan.

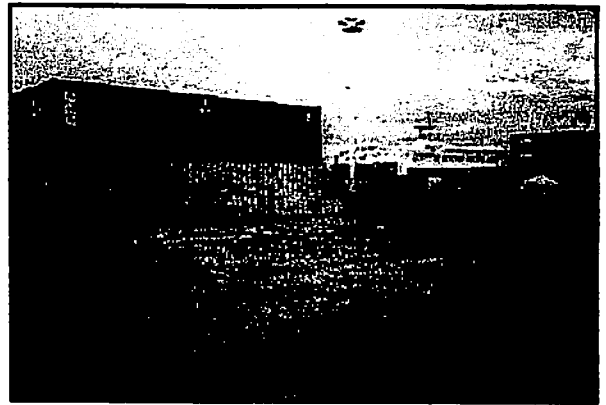
2.1.5.2 Existing Water Supply System

The water supply system at the wharf was constructed at no cost to the PPA by the City Government of Davao.

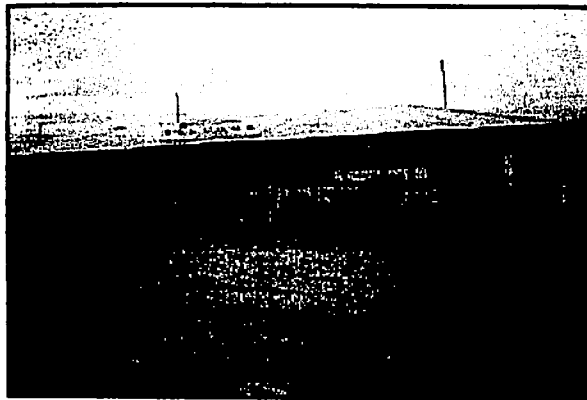
The Davao City Water Supply District (DCWSD) supplies the needs of the port as well as vessels. The system was tapped from a mainline pipe along the highway, refer to Figure 2-4, Existing Water Supply System. Only half of the area has water supply. Pressure and quantity of water at the wharf is insufficient. Additional water is being supplied by truck tankers to augment this deficiency.



Existing access road along container yard in good condition.



Proposed transit shed location.



Existing Passenger Shed in Operation



Existing Ro-Ro ramp at end side of Old Quay.
Some timber waling are missing.



Southern end of Old Quay area. Apron was used as dispensing area of fertilizers.



Existing container yard with utilities for cold storage.



Philippine Ports Authority
Port of Sasa (Davao)

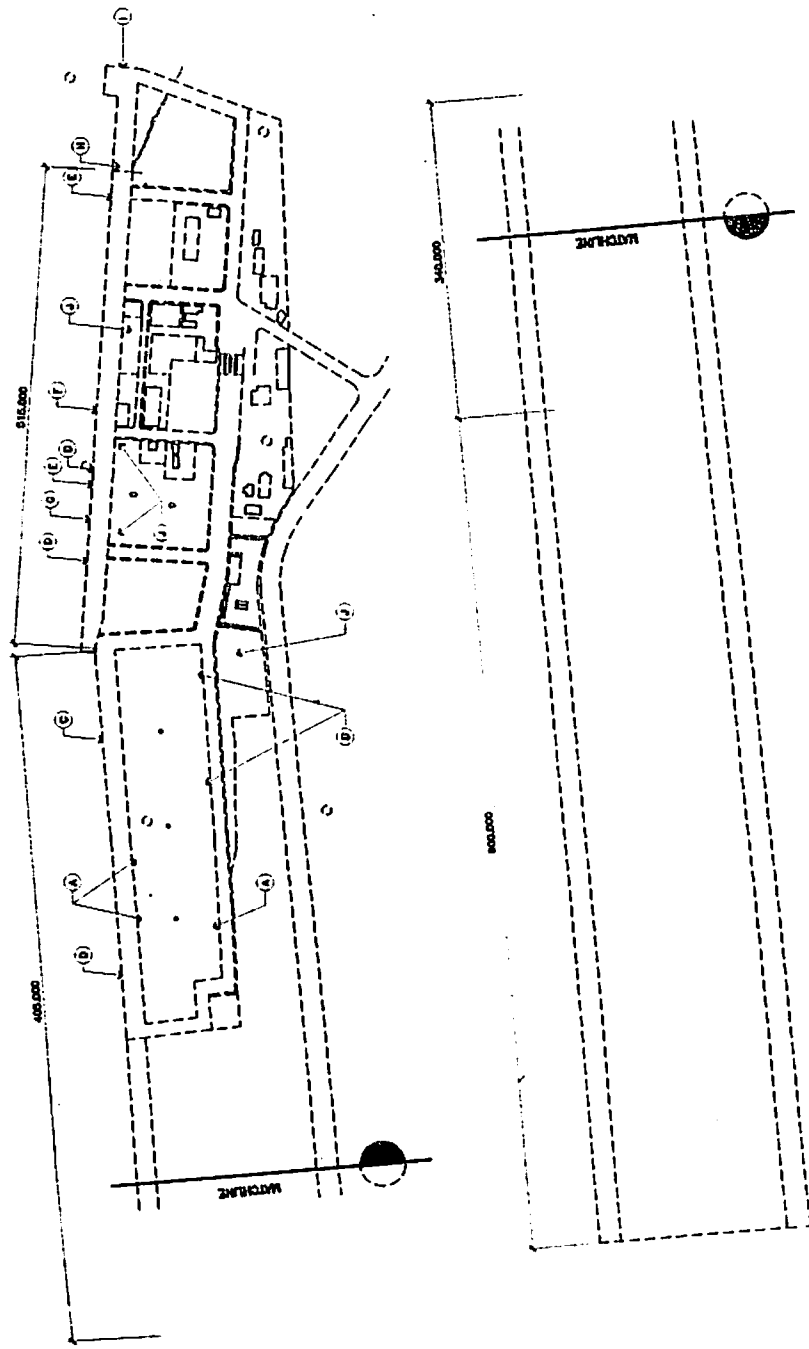


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PORT PACKAGE V

**PHOTOGRAPHS DEPICTING
ACTUAL STATE OF FACILITIES**

**Figure
2-2**





LEGEND:

- (A) EXISTING DRAINAGE MANHOLE MISSING COLLAPSE CONC. COVER
- (B) STORM WATER ACCUMULATES ALONG THE SIDES OF EXISTING DRAINAGE MANHOLE
- (C) 2-FOOTER PULL BOLLARDS OTHER BASE PLATE WAS LEFT
- (D) BROKEN PULL BOLLARDS OTHER BASE PLATES WERE LEFT ON WHARF AT ALL
- (E) TOWER WALKWAY AS STRUCTURE IS INTERFERED WITH OPERATION OF CRANES/CRANES AT THIS SIDE OF QUAY
- (F) EXISTING WATERLINE PIPE ABANDONED ON THIS SIDE OF QUAY
- (G) STEEL FENDER MISSING
- (H) ABOUT 25 CONC. PILES ARE DAMAGED ON THIS SITE INSTALLED BY PORT OFFICE
- (I) DAMAGED CONC. CURB
- (1) STORM WATER PUMPING AREA, REPAIRED BY USED TRUCK PILES

100M 0 100M
SCALE
1:5000 N

Figure 2-1
INFRASTRUCTURE PHYSICAL CONDITION PLAN (SASA WHARF)
SCALE

 <p>SCHEMA Konsult Inc. ENGINEERS ARCHITECTS PARTNERS 27th FLOOR, 200 CORPORATE CENTER, 1000 CITY DRIVE, SUITE 200, SAN FRANCISCO, CA 94103</p>	 <p>PHILIPPINE PORTS AUTHORITY MARSHALL ISLAND, 22 M. DE SAN FRANCISCO SOUTH HARBOR, MARINA 1010</p>	<p>FEASIBILITY STUDY WITH MASTER PLAN OF PORT PACKAGE V</p>	<p>INFRASTRUCTURE PHYSICAL CONDITION PLAN (SASA WHARF)</p>	<p>DATE: 01-25-99</p>	<p>PROJECT NO.</p>
				<p>DRAWN: DML</p>	<p>CHECKED: WPD/RSB</p>



P A K I P U T A N S T R A I T

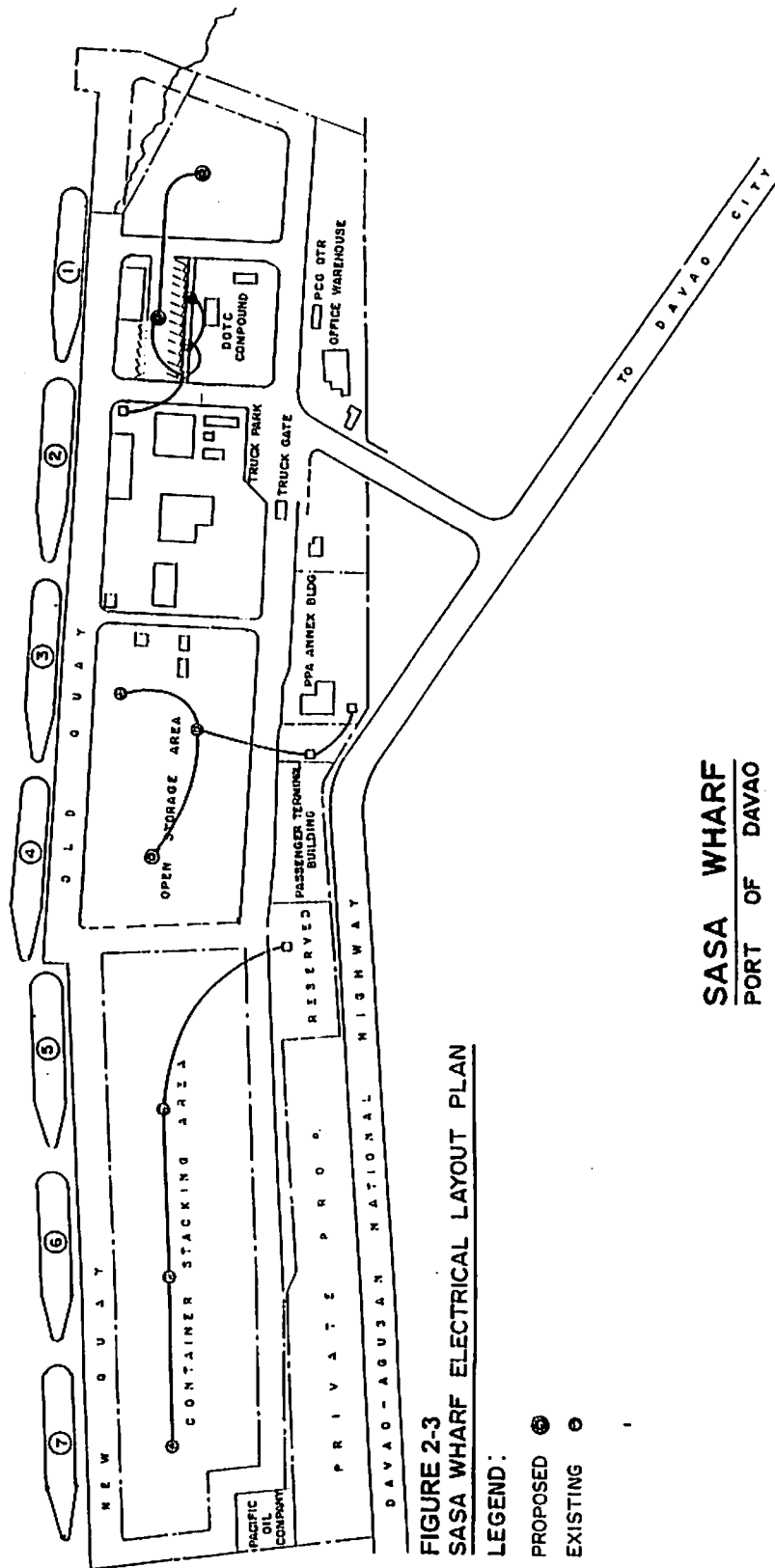


FIGURE 2-3
SASA WHARF ELECTRICAL LAYOUT PLAN

LEGEND:

- PROPOSED
- EXISTING

SASA WHARF
PORT OF DAVAO

2.1.5.3 Existing Storm Drainage System

The drainage system at Sasa is working efficiently except for some underdeveloped areas at the squatter's area. Defects on this drainage system were recorded as follows:

- Four (4) to five (5) drainage manholes have collapsed concrete cover.
- Three (3) drainage catch basins had higher lids than the catchment elevation. Stormwater accumulates around the lid during rains.

Photographs depicting the actual state of drainage facilities are shown in Figures 2-5a to 2-5b.

2.1.5.4 Existing Communication System

The Port utilizes the PLDT lines for communication. Vessel to port or vice versa utilizes a two-way radio base system at the Port Management Office Building.

Refer to Figure 2-6.

2.1.5.5 Navigational Aid System

See item 2.1.3. There is no proposed improvement so far by the Port Management Office since the existing lighthouse has adequately served its function.

2.1.5.6 Existing Fendering System

Fifty four (54) pieces of 500mm x 1m V-type rubber dock fender (RDF) fastened with nuts on embedded bolts on concrete cap over newly driven reinforce concrete piers at the old quay. Refer to Figure 2-7, Layout Plan of Rubber Dock Fenders (RDF).

Nine (9) sets of extremely dilapidated RDF and used truck tires spread over the new quay.

Defects of these fenders are recorded as follows:

- Ten (10) pieces RDF are badly damaged at the old quay.
- Nine (9) sets of dilapidated RDF at the new quay.

Refer to Figures 2-8a to 2-8b.

2.1.5.7 Existing Underdeck Structures

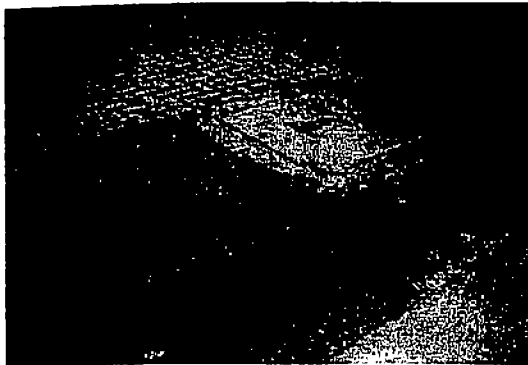
- Thirty two (32) locations of reinforced concrete deck piles have exposed rebars at joints and stems.
- Seventeen (17) locations of concrete deck beams have exposed rebars. Five (5) locations of collapse deck beam edges were identified. One (1), 2-meter diameter hole cause by heavy load from a 40 ton top lift loader carrying a 40 footer van at the old quay area was also identified.

Refer to Figure 2-9, Plan of Existing Damaged Concrete Pile.

Photographs depicting the actual state of underdeck structures are presented in Figures 2-10a to 2-10b.

2.1.6 Description of Expansion Areas

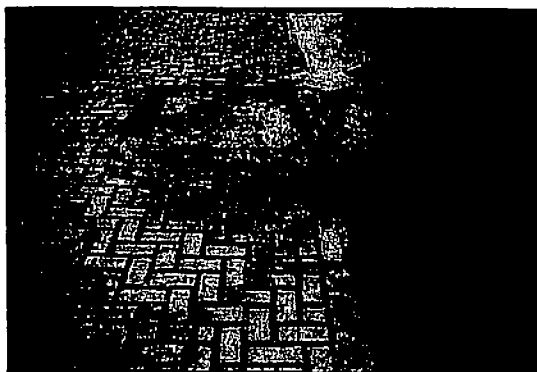
Expansion area will be at the north and southside of the wharf. The north side has an approximate area of 17 hectares and along the shore are occupied by nipa huts, mostly squatter families. On the land side area are mostly residential, commercial, small warehouses and patches of ricefields. The southside expansion has an approximate area of 16 hectares. The shores are used as small banca berthing areas by squatters living in nipa huts, however further south will hit the existing pipelines of shell and other marine structures.



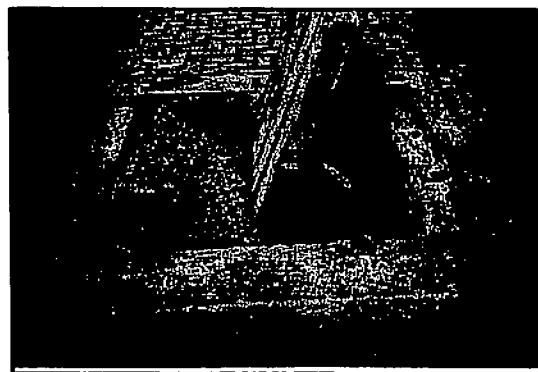
Existing drainage manhole ponded by storm water at sides. Manhole cover with drain slots was installed higher.



Existing catch basin having clogged drain slots.



Same condition in another location.



Drainage manhole had a collapsed concrete cover.



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PORT PACKAGE V



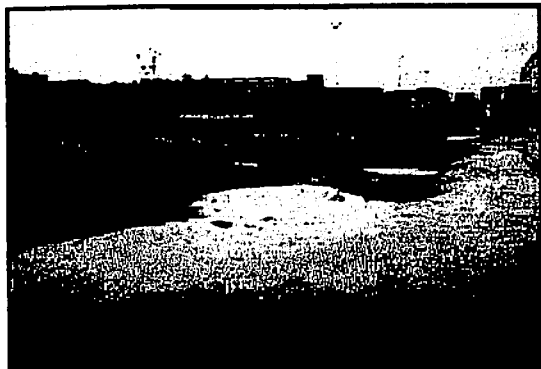
SCHEMA Konsult, Inc.
ENGINEERS ARCHITECTS PLANNERS
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**PHOTOS DEPICTING ACTUAL
STATE OF DRAINAGE FACILITIES**

**Figure
2-5a**



A low spot at back of transit shed.



Proposed transit shed area used as garbage dump site. Storm water run-off are trapped on this area.



Ponded area at corner of existing container yard.



Storm water has accumulated at this low spot along Old Quay.



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Port of Sasa (Davao)

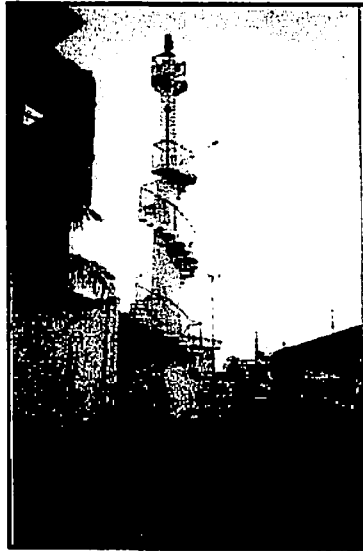


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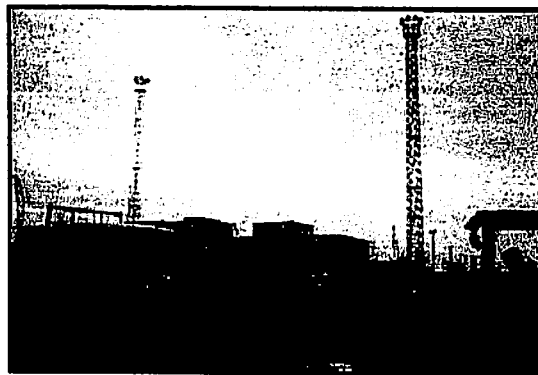
PORT PACKAGE V

**PHOTOS DEPICTING ACTUAL
STATE OF DRAINAGE FACILITIES**

**Figure
2-5b**



Existing Light Tower for Vessel Navigation.



Existing Open Storage Area. Existing two tower light beyond.



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PORT PACKAGE V

**PHOTOS DEPICTING ACTUAL
STATE OF COMMUNICATION
FACILITIES**

**Figure
2-6**



P A K I P U T A N S T R A I T

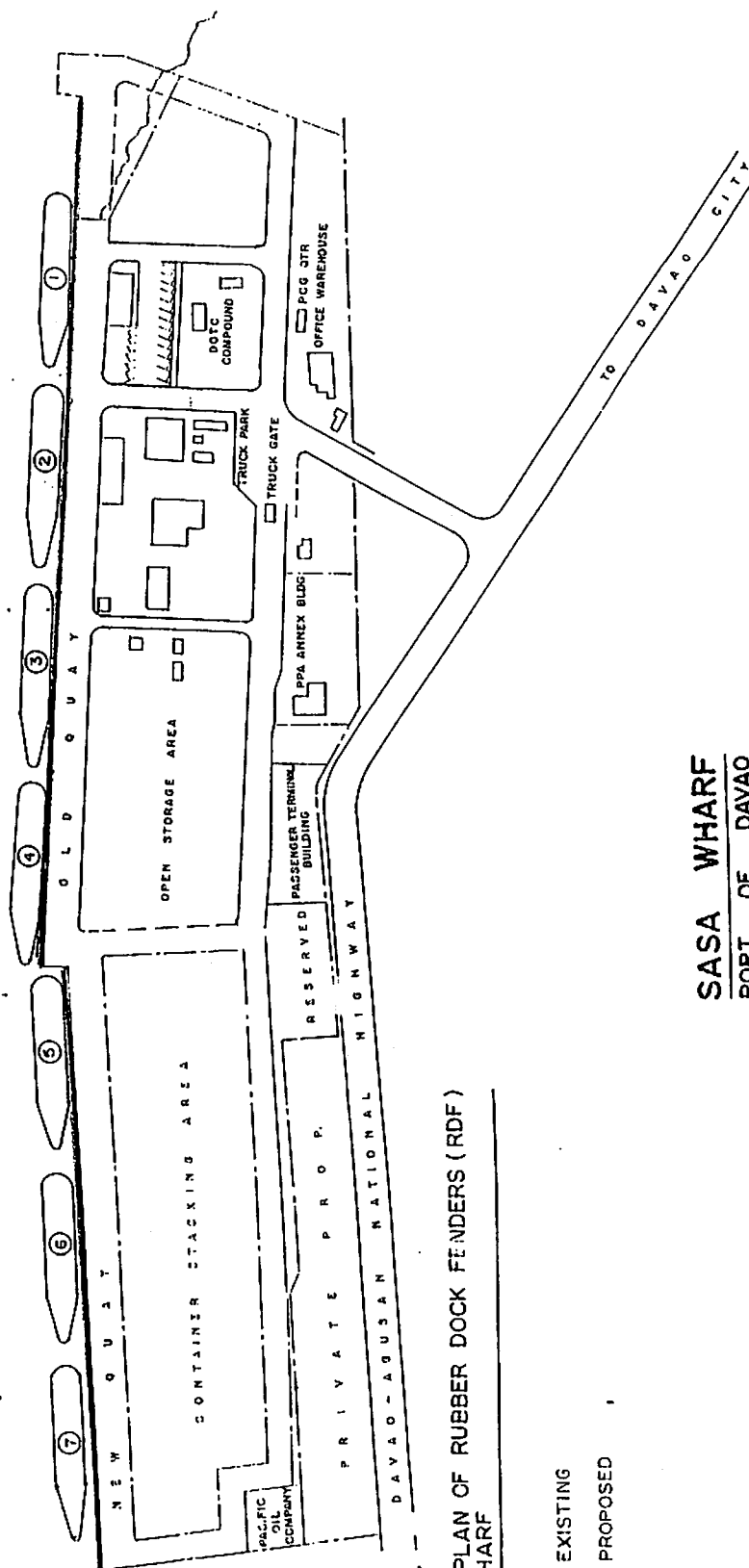


Figure 2-7
LAYOUT PLAN OF RUBBER DOCK FENDERS (RDF)
SASA WHARF

LEGEND:

- EXISTING
- - - PROPOSED

SASA WHARF
PORT OF DAVAO



Top of fender concrete block in concrete spalling condition cause by weathering and load impact.



Side of old quay. Only pull bollard base plate was left on this side of Quay cause by berthing impact. Steel fender in good condition but some are missing.



Base for pull bollard was only left at this side of Quay. Cause by vessel impact. Timber waling dislocated.



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PORT PACKAGE V

Figure
2-8a



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**PHOTOS DEPICTING ACTUAL STATE
OF FENDERING FACILITIES**



Concrete curb or cap edge eventually chipped-off to deck level.



End of New Quay concrete curb or pile cap edge damaged by loading and unloading impact.



Old Quay area ocean side uses old truck tire as fenders.



Old Quay edge at ocean side, timber waling missing and a water pipeline abandoned.



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PHOTOS DEPICTING ACTUAL
STATE OF FENDERING FACILITIES

Figure
2-8b

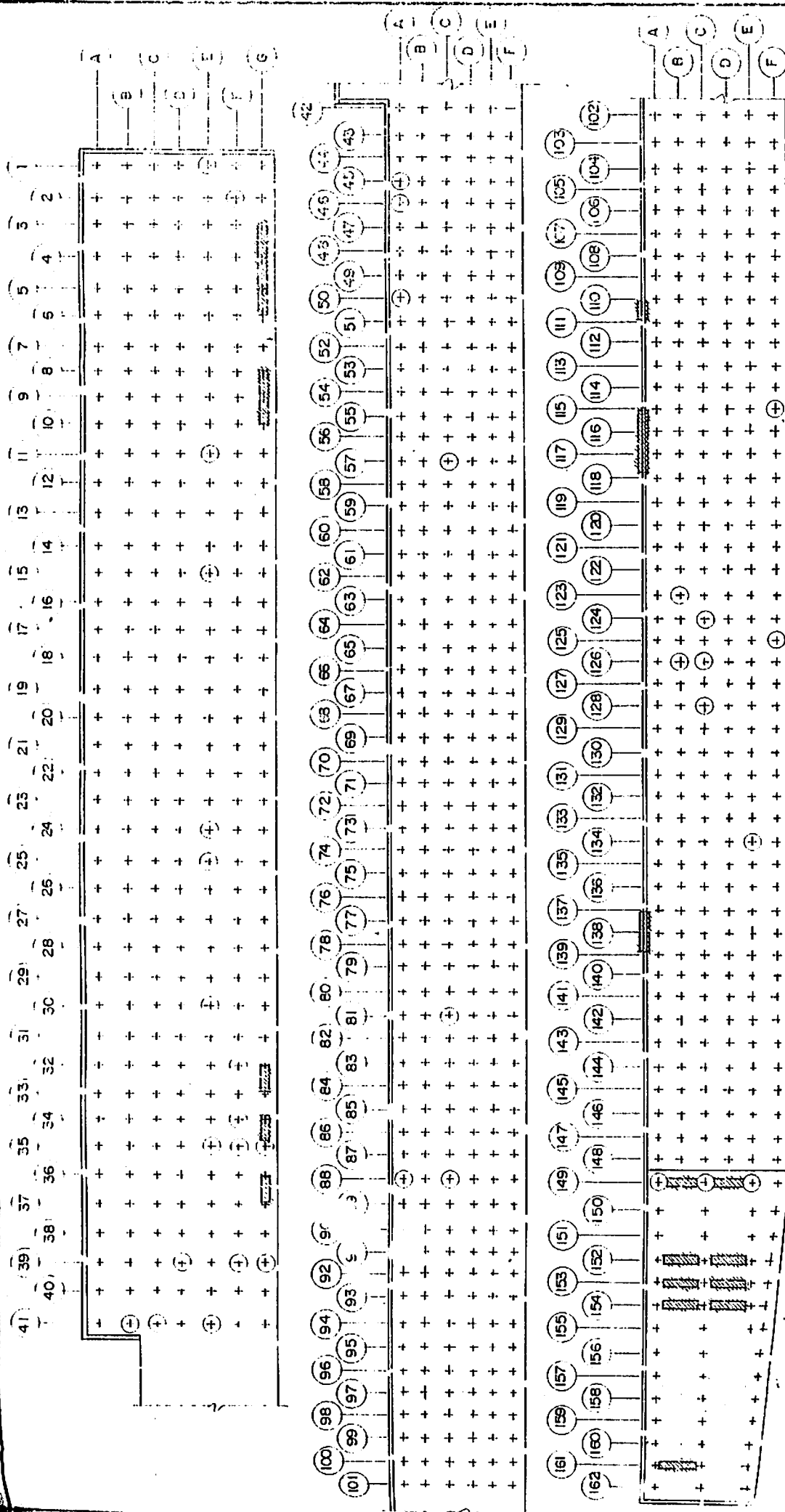
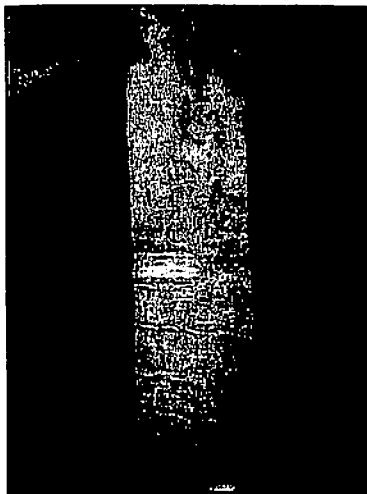
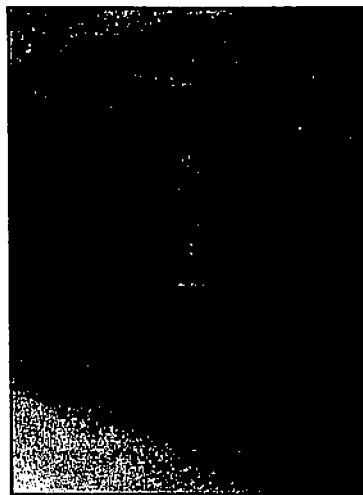


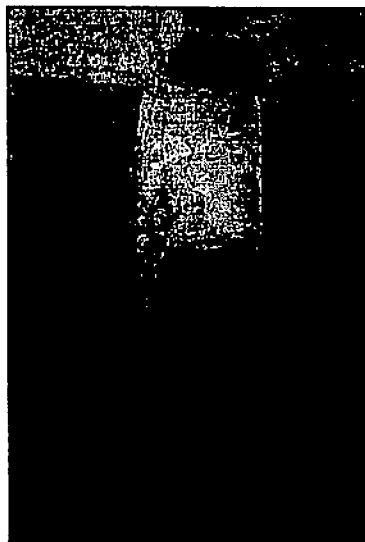
Figure 2-9
**PLAN OF EXISTING DAMAGED CONCRETE PILE,
 SLABS & DECK BEAMS**
 PORT OF SASA
 SCALE
 DAVAO
 1:500 M



R. C Deck pile with exposed rebars & structural cracks at southside of old quay near squatters' area.



Another R. C Deck Pile with similar structural defects at old quay



R.C deck piles with structural cracks and exposed re-bars about 80 meters south-edge of old quay.



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Port of Sasa (Davao)

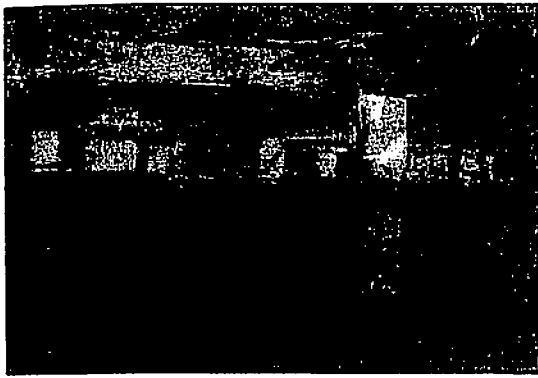
PORT PACKAGE V



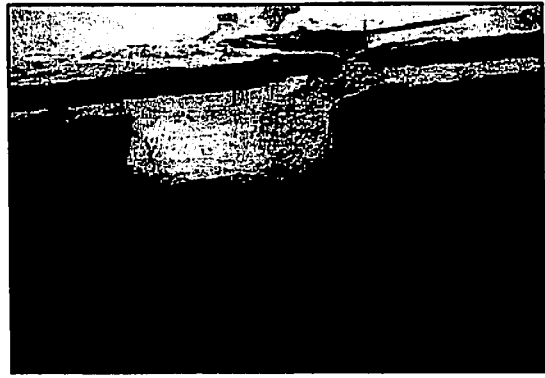
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**PHOTOS DEPICTING ACTUAL STATE
OF UNDERDECK STRUCTURES**

**Figure
2-10a**



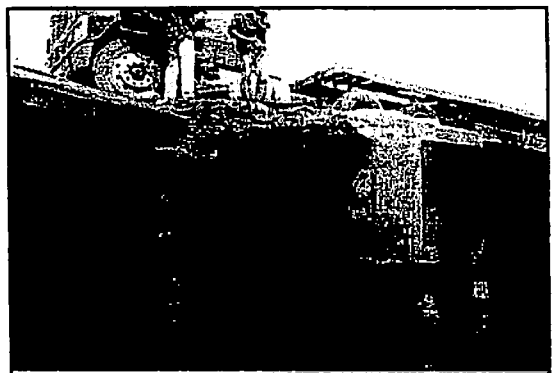
Existing storm drainage outfall at old quay.



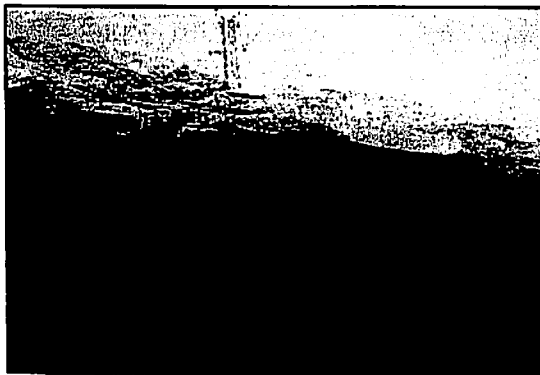
A damage pile cap edge at mid-portion of old quay.



Another case of deck edge badly damaged by berth impact located at mid portion of old quay.



A similar case where a longer length of deck edge has settled located approximately 420 meters from south corner of old quay.



Pile cap or deck edge badly damage where rebars are exposed caused by berthing impact, located 400 meters from south corner of old quay.



Some spot at another angle.



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PORT PACKAGE V

PHOTOS DEPICTING ACTUAL STATE
OF UNDERDECK STRUCTURES

Figure
2-10b

2.2 DISTRIBUTION OF PORT AREA USE

DISTRIBUTION OF PORT AREA USE	
PORT FACILITY	AREA (SQ.M)
PORT ADMINISTRATION	
Administration Building	102
PMO-Davao	260
Port Police Office	160
Fil Port Office Building & Motorpool	336
Bureau of Plant Quarantine Office Building	115
Bureau of Customs	630
Philippine Coast Guard	306
Dipsscor Office and Motorpool	
Minterbro Office	
Bureau of Animal Industry	81
STORAGE AND OPEN SPACES	
Open Storage (Asphalt)	50,000
Open Storage (Unpaved)	8,000
Container Yard	37,800
Open Storage (Quay Side)	1,650
Open Storage (NSLC)	1,308
PRIVATE WAREHOUSES	
Warehouse	6,000
Anglionto Warehouse	1,080
Minterbro Warehouse	3,625
Denia (PPA) Warehouse	609
Pacific Oil Lease	1,000
TRANSIT SHEDS	
Transhed Shed (PPA)	1,210
Dipsscor Shed	900
WHARF AREA	
Old Quay Area	9,270
New Quay Area	14,175
PORT SUPPORT FACILITIES	
Passenger Terminal Building and Parking Area	600
PORT UTILITIES	
Gate House	
Fire Protection Portable Fire Extinguishers	
Portable Fire Pump and Fire Truck	
Water System Facility	
50mm dia. Water Service Gate Valve for Vessels	
150mm dia. Main Water Line from Davao	
City District	
TOTAL LAND AREA OF PORT (Has)	13.92

2.3 DETERIORATION OF WATERFRONT STRUCTURES

2.3.1 Causes

Causes of deterioration associated with steel, concrete and timber waterfront structures are the following:

- a.) Steel Structures
 - i. Berthing, loading and unloading impact
 - ii. Abrasion
 - iii. Corrosion
- b.) Concrete Structure
 - i. Corrosion of steel reinforcement
 - ii. Chemical reactions
 - iii. Swelling of concrete
 - iv. Berthing, loading and unloading impact
- c.) Timber Structures
 - i. Corrosion and abrasion of hardware
 - ii. Borer attack
 - iii. Decay
 - iv. Berthing, loading and unloading unpaid

2.3.2 Preventive Measures

2.3.2.1 Timber Structures

Timber preservation is done by preservative treatment by dipping the timber in open tanks using boron compounds, sodium fluoride or creosote oil. Another method is by pressure impregnation. It is done by immersing a suitably seasoned timber inside a pressure vessel in a solution such as copper-chrome-arsenate and creosote or pentachlorophenol dissolved in fuel oil. A pressure of 1,400kPa to 7MPa is required.

Design detail shall provide enough ventilation around timber structures. Curb logs shall be set out on blocks. Walers shall be blocked out from face of pier. Thin spaces between chocks and wales and gaps between deck and tread planks shall be provided.

2.3.2.2 Steel Structures

All parts that will be subject to corrosion shall be accessible for inspection and repair. Framing shall be detailed in a way to shed water off to inhibit corrosion and deterioration of coatings. If the potential for ponding is unavoidable, provide drain holes with a minimum diameter of 0.10 meter to inhibit clogging.

The use of sacrificial metal in lieu of protective coatings shall be avoided.

Cathodic protection shall be accompanied by use of concrete facing or encasement to and below the MLLW (Mean Low Low Water).

2.3.2.3 Concrete Structures

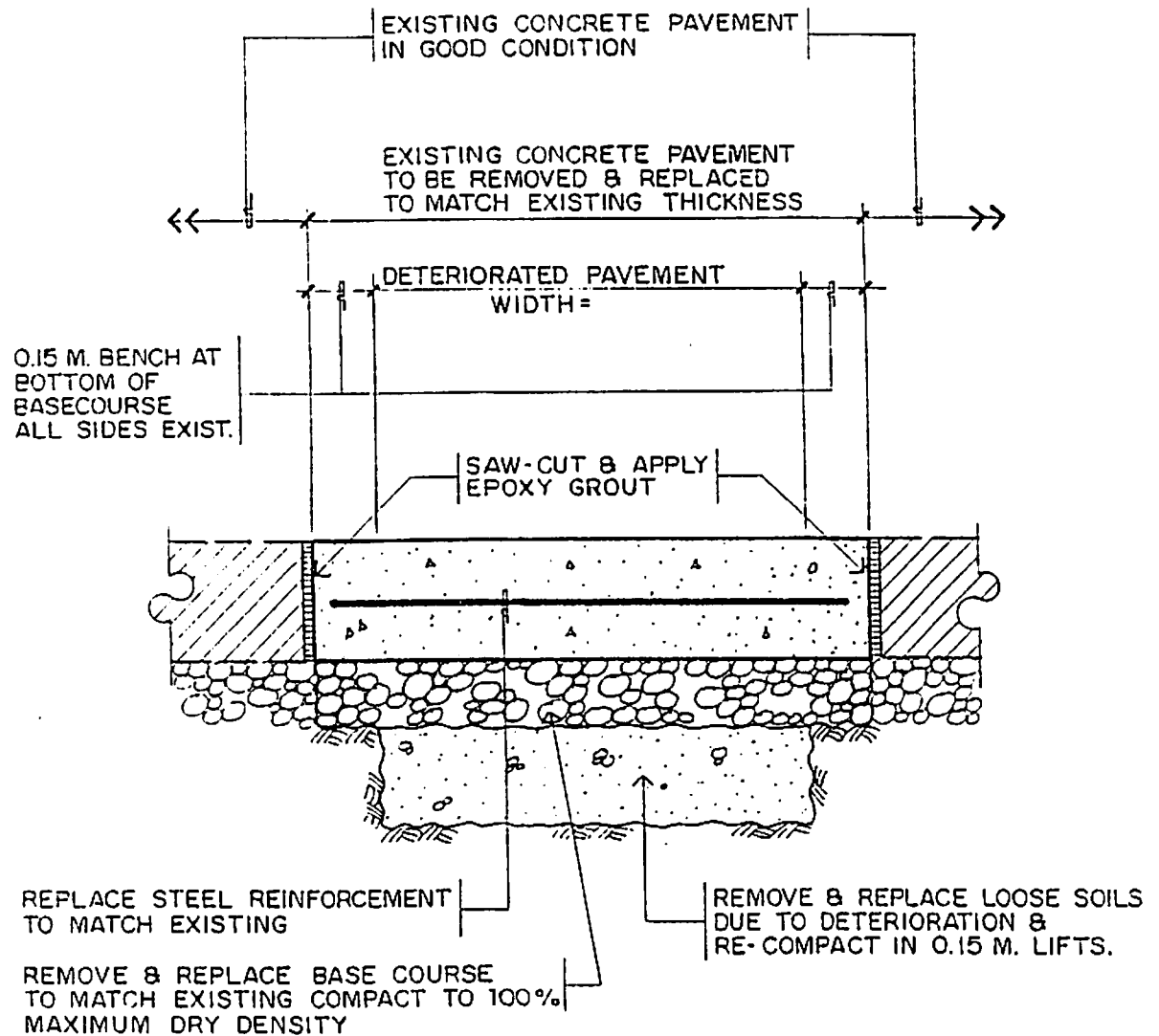
Moisture penetration and load impact cause by vessel berthing and cargo handling are the primary cause of pavement deterioration. The following measures should be taken into consideration to have a durable and sound concrete structure.

- a. A water cement ratio greater than 6 gal/sack of cement shall be avoided. A 5 gal/sack of cement for thinner sections such as slabs or where concrete cover is less than 50 millimeters shall be used.
- b. Structure shall be watertight. Use air entrainment (maximum 6% by volume) and water cement ratio not greater than 5 gal/sack of cement.
- c. Use Type II cement or sulphate resistant cement.
- d. Use expansion joints such as double bents with movement taken up by bending of the piles or elastomeric pads with some form of joint sealer.
- e. Alkali content of cement for aggregates shall not exceed 0.6 percent.
- f. Cement mix shall not exceed 6 bags/0.764m³. Excess cement tends to enhance the potential chemical reaction with seawater.
- g. Use galvanized or plastic coated reinforcing bars.
- h. Calcium chloride shall not be used in pre-stressed concrete.
- i. For jackets and facings, use timber jackets for concrete piles and stone facing for concrete seawalls work.
- j. Where feasible, scuppers and weep holes shall be detailed to drip clear of the underlying structure. Provide drip grooves in fascia beams and slab soffits.
- k. Use good quality rubber fenders and steel I-beams on edges of pier or wharf.
- l. Due to various sizes and shapes of vessels (mostly foreign vessels), proper care shall be taken on ship maneuvering so as not to impose excessive load impacts on the edges of pier or wharf.

2.4 REPAIR DETAILS OF WATERFRONT STRUCTURES

Typical Repair Details are presented in Figures 2-11a to 2-11g.

Figure 2-11a



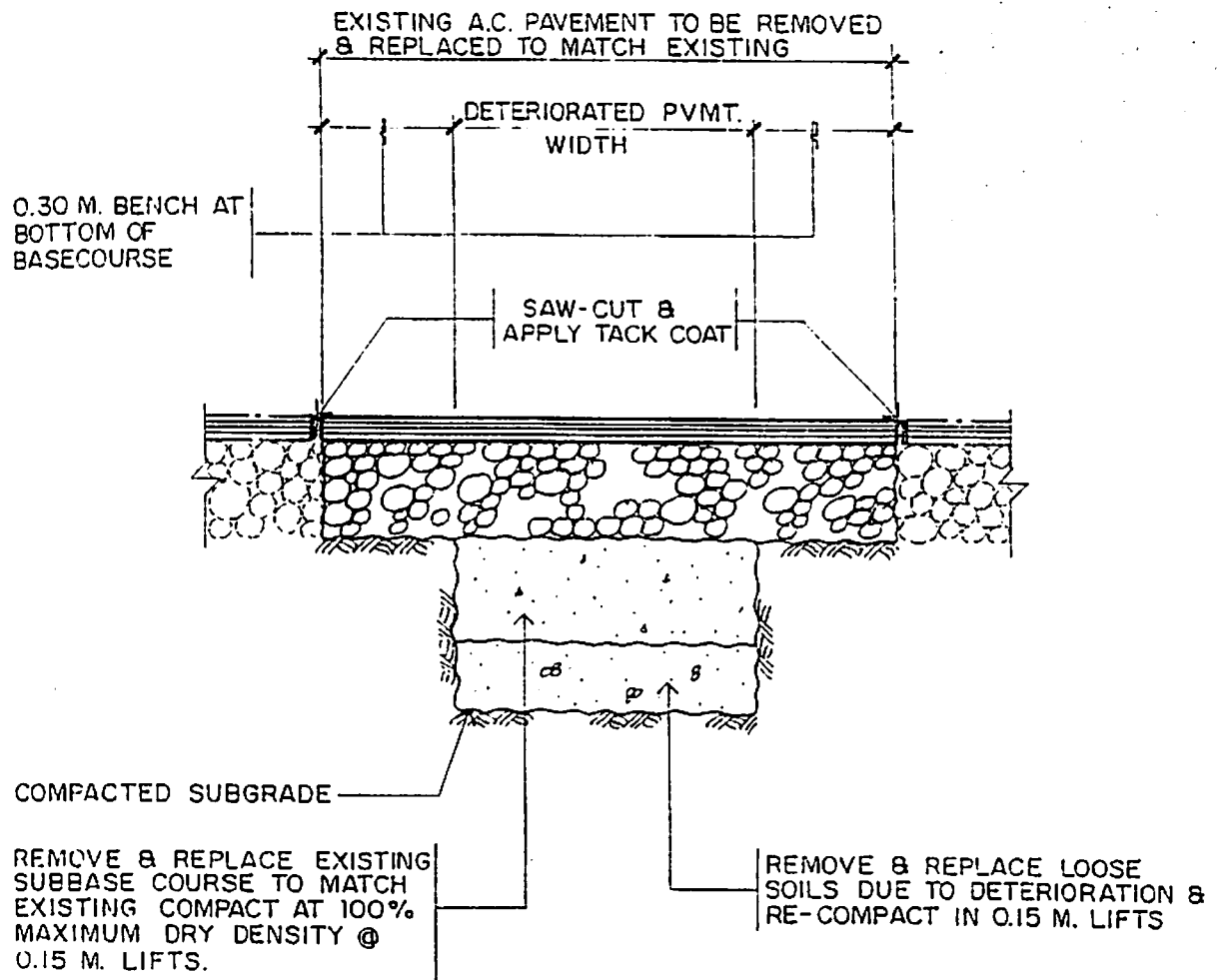
CONCRETE PAVEMENT REPAIR DET.

NOT

TO

SCALE

Figure 2-11b



A.C. PAVEMENT REPAIR DETAIL

NOT TO SCALE

Figure 2-11c

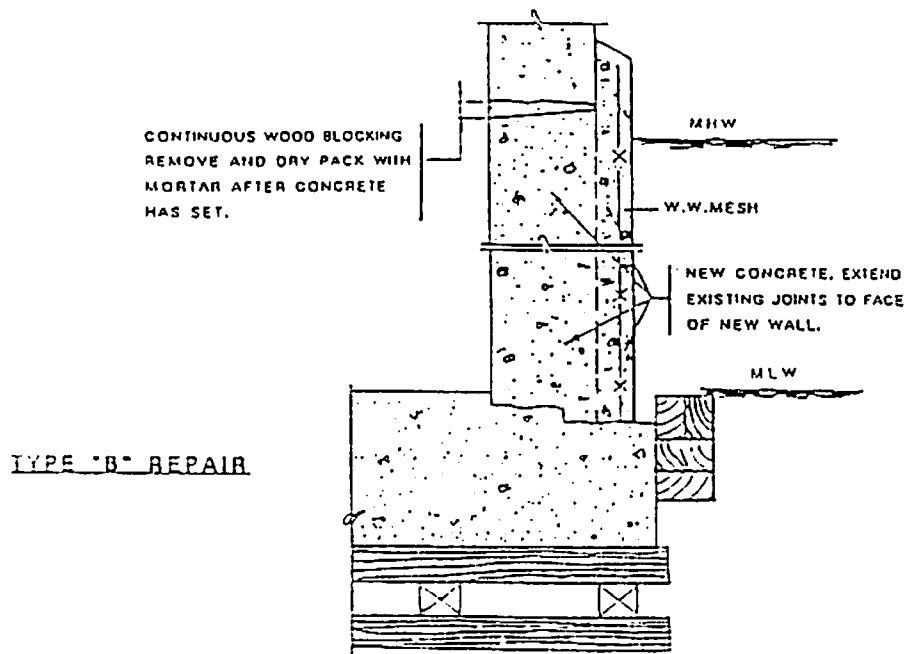
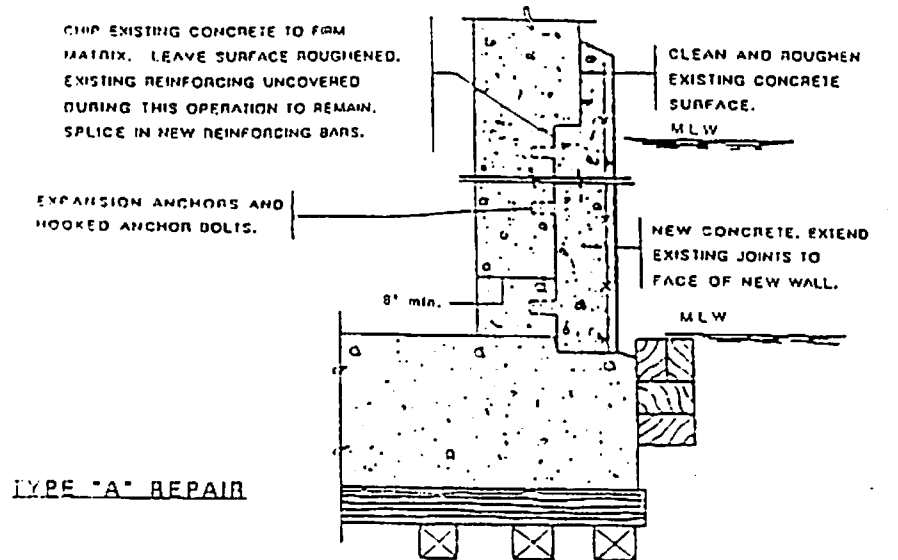


Figure 2-11d

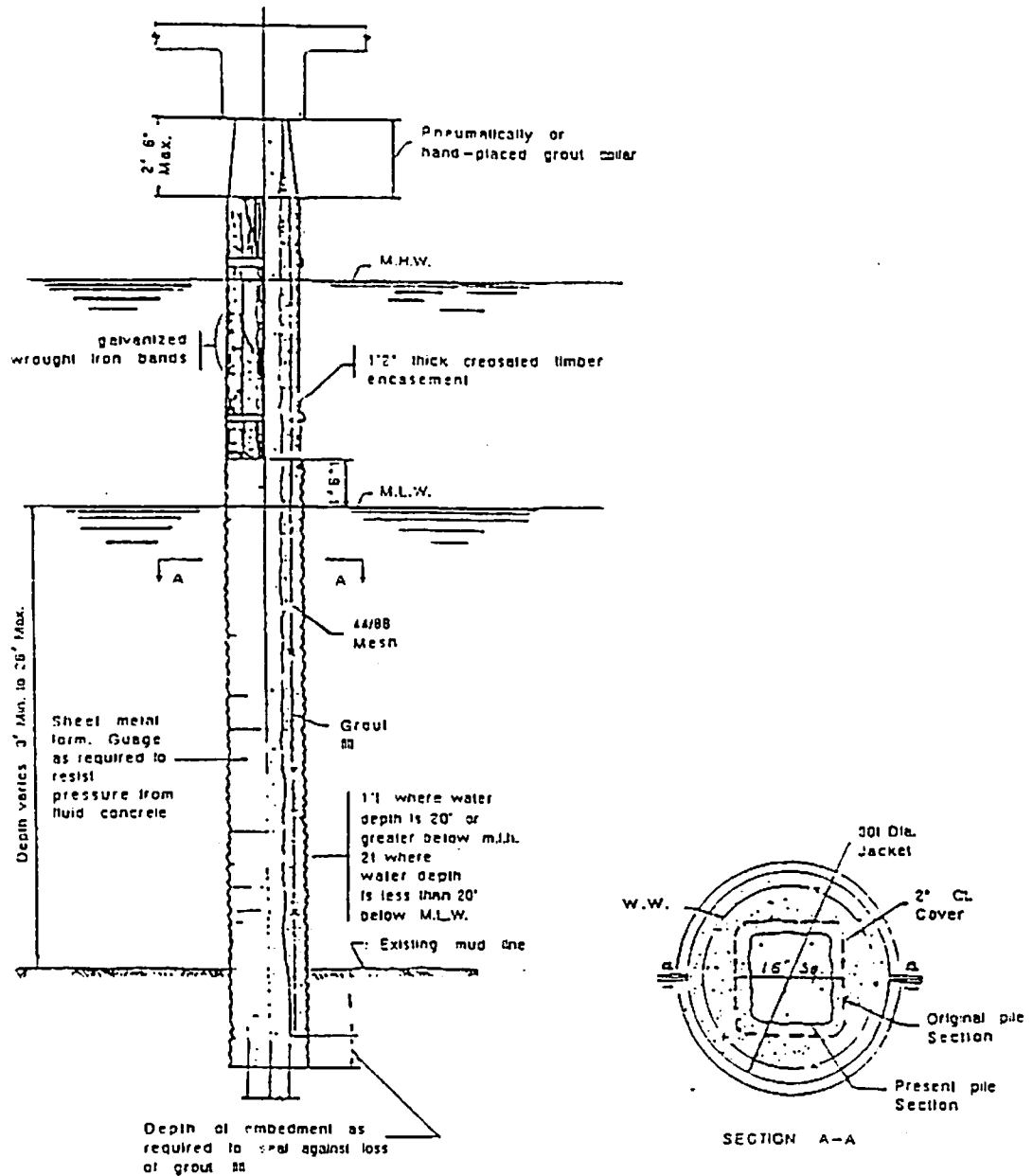


Figure 2-11e

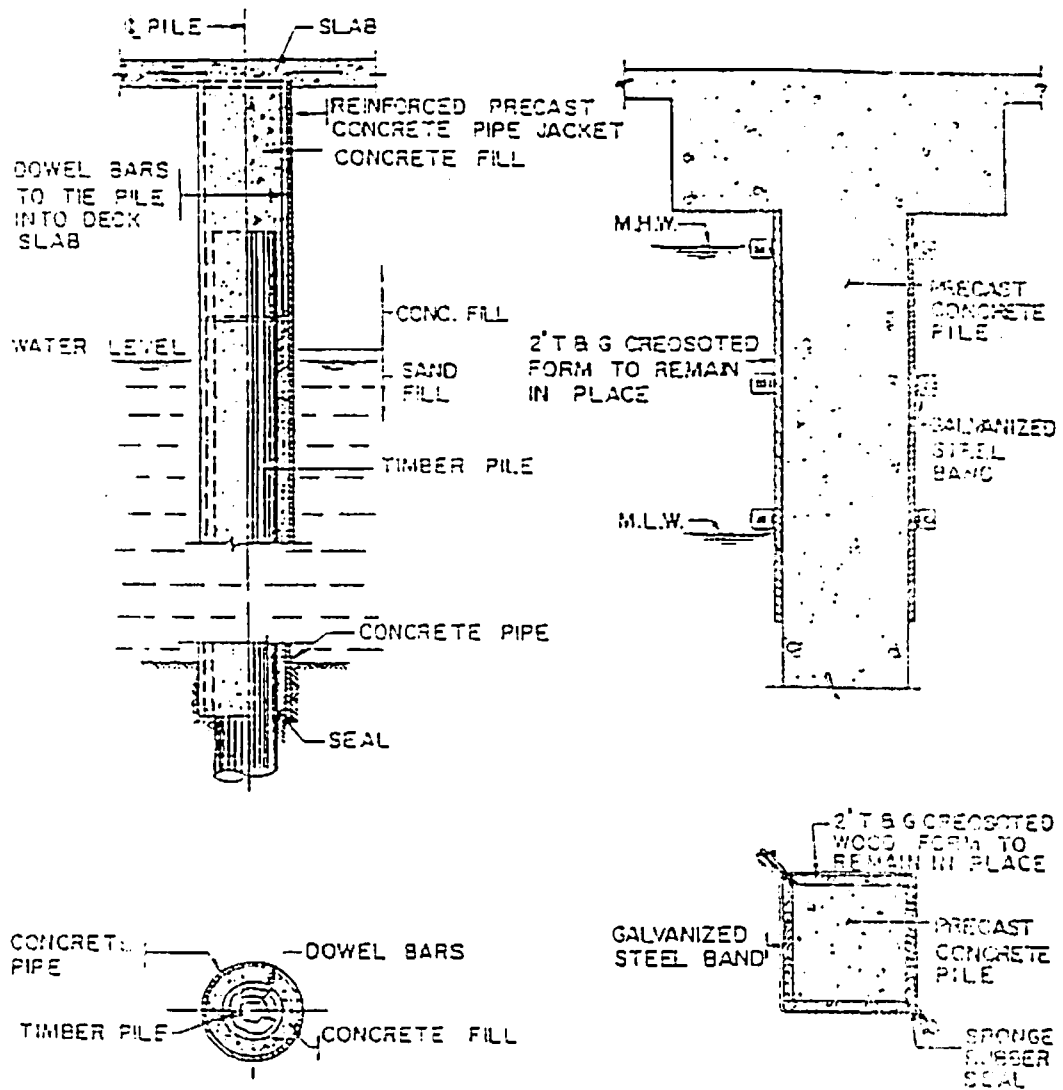
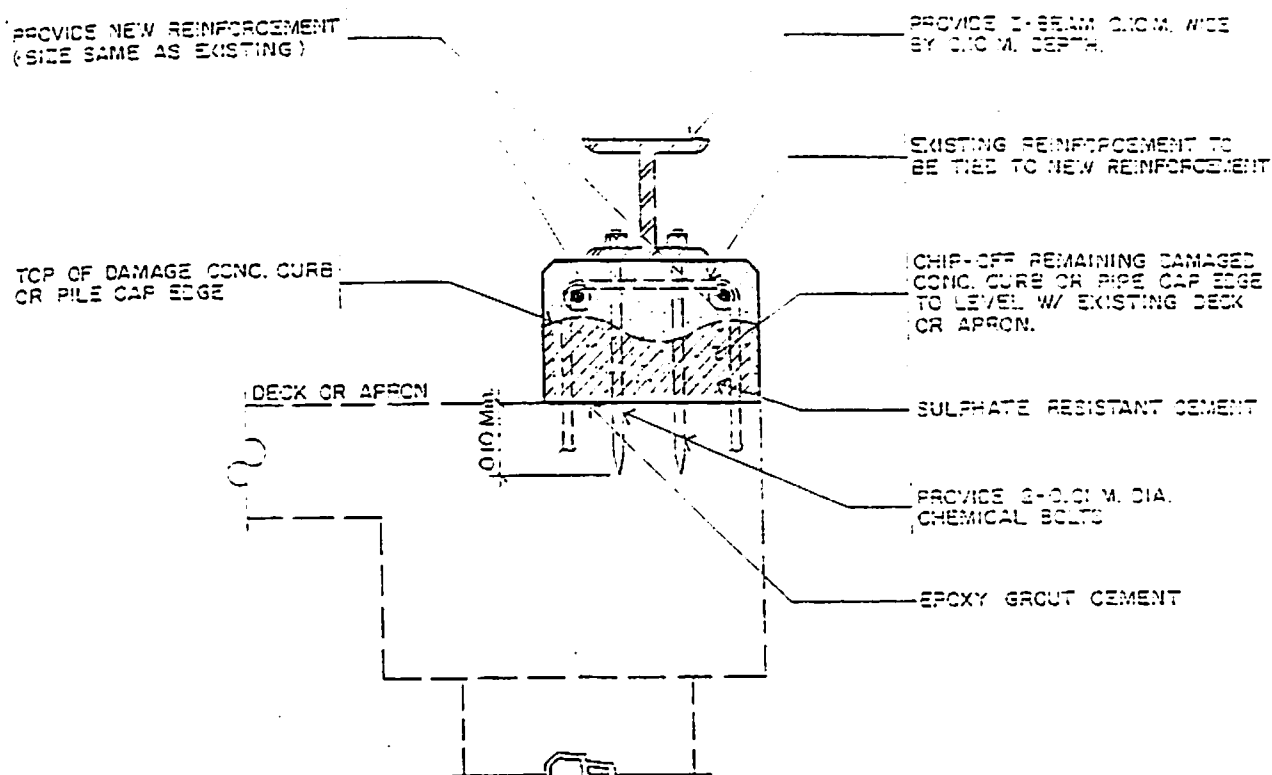
CONCRETE PIPE JACKET
FOR A TIMBER PILETIMBER JACKET FOR A
PRECAST CONCRETE PILE

Figure 2-11f



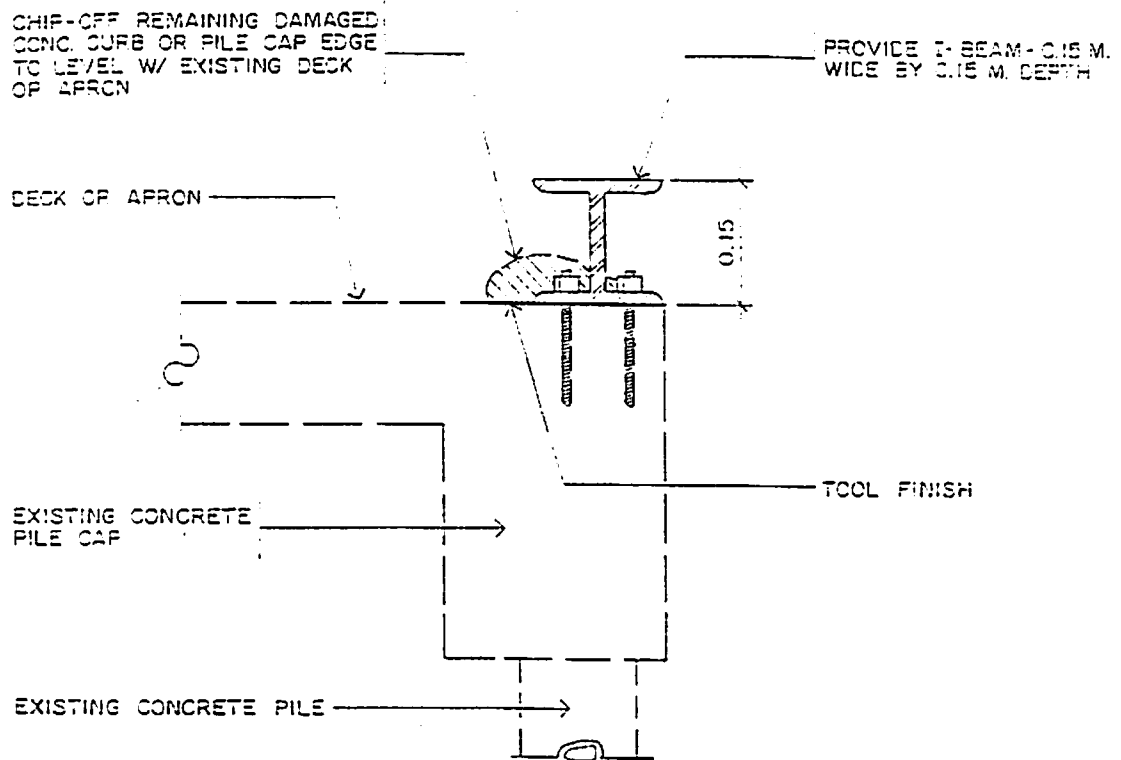
CONC. CURB OR CONC. PILE CAP EDGE REPAIR DETAIL (OPTION 1)

NOT

TO

SCALE

Figure 2-11g



CONC. CURB OR CONC. PILE CAP EDGE REPAIR DETAIL (OPTION 2)

NOT

TO

SCALE



Chapter 3

Physical Conditions

PHYSICAL CONDITIONS

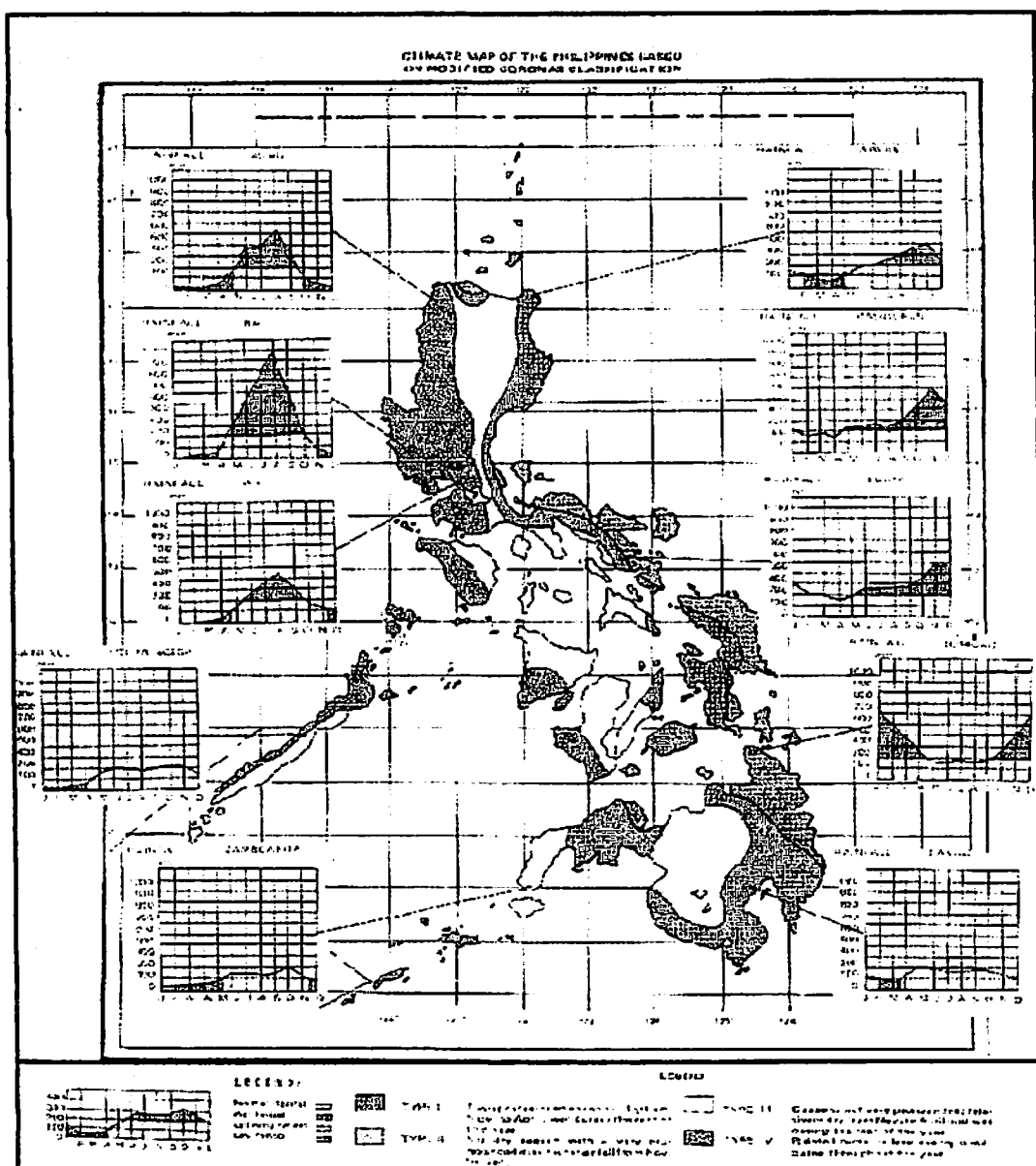
3.1 METEOROLOGICAL

3.1.1 Climate

The climate of Davao Gulf cluster falls under Type IV of Modified Coronas Classification, characterized by no pronounced maximum rain period and no dry season. The rainfall is more or less evenly distributed throughout the year.

The climate map of the Philippines is shown in Figure 3-1.

Figure 3-1
CLIMATE MAP OF THE PHILIPPINES



Source: PAGASA

3.1.2 Wind

The winds in the Davao Gulf area generally blow from the south or from the north. Normally, winds with a mean velocity of two meters per second blow towards north from November to April and towards south from May to October. These data are presented in Table 3-1, the climatological normals for Davao. The climatological extreme values are likewise presented in Table 3-2. It shows that based from the PAGASA record as of 1996, the wind with a highest speed of 31 meters per second (111.6 kilometers per hour) occurred in May 1976.

There are three (3) classifications of tropical cyclones, namely: depressions which have wind speed of 45 to 63 kph, storms which have wind speed to 64 to 119 kph and typhoons which have maximum speed of 120 kph or stronger.

These records from PAGASA on the annual distribution of tropical cyclone in the Philippines area of responsibility from 1948-1997 (50 years) showed that the annual average number of cyclones passing the country is 19.8. Of which 3.8 are considered depressions, 5.4 are storms and 10.6 are typhoons. From these total records, the average annual number of occurrence in the project area is 0.10. This indicates that Davao Gulf is rarely passed by tropical cyclones. Figures 3-2a, 3-2b and 3-3 show that Davao Gulf has low frequency of occurrence of tropical cyclones.

Table 3-1
CLIMATOLOGICAL NORMALS

STATION : 753-DAVAO CITY
LATITUDE : 07°07' N
LONGITUDE : 125° 39' E
ELEVATION : 18.0m
PERIOD : 1961 – 1995

MONTH	RAIN-FALL (MM)	NO. OF RD	TEMPERATURE DEG. C						VP MBS	RH %	MSLP MBS	WIND				
			MAX.	MIN.	MEAN	DRY BULB	WET BULB	DEW PT.				DIR	SPD MPS	CLD OKT	DAYS TSTM	WITH LTNG
JAN	110.5	13	31.1	22.3	26.7	26.3	23.8	22.9	27.7	81	1010.3	N	2	6	2	3
FEB	105.0	12	31.3	22.3	26.8	26.4	23.8	22.8	27.7	80	1010.8	N	2	6	2	2
MAR	84.9	11	32.3	22.7	27.5	27.1	24.2	23.1	28.2	79	1010.6	N	2	6	3	3
APR	148.3	11	33.1	23.3	28.2	27.9	24.8	23.7	29.2	78	1009.7	N	2	5	8	6
MAY	190.7	16	32.8	23.6	28.2	27.9	25.2	24.3	30.2	80	1009.2	S	2	6	14	13
JUNE	193.9	18	31.9	23.3	27.6	27.4	25.0	24.2	30.0	82	1009.3	S	2	6	13	12
JULY	156.3	15	31.6	23.0	27.3	27.2	24.8	23.9	29.6	82	1009.3	S	2	6	11	12
AUG	180.4	14	31.8	23.0	27.4	27.3	24.8	23.9	29.6	82	1009.4	S	2	6	12	11
SEP	183.8	15	32.1	23.0	27.6	27.4	24.8	23.9	26.5	81	1009.4	S	2	6	12	12
OCT	165.4	15	32.3	23.0	27.7	27.4	24.8	23.9	26.5	81	1009.3	S	2	6	14	14
NOV	131.1	15	32.3	23.0	27.6	27.3	24.7	23.8	26.3	81	1009.3	N	2	6	10	12
DEC	99.5	13	31.6	22.7	27.1	26.8	24.3	23.4	28.6	81	1009.8	N	2	6	5	7
ANNUAL	1749.8	168	32.0	22.9	27.5	27.2	24.6	23.7	28.3	81	1009.7	N	2	6	106	107

PREPARED BY: PAGASA/CAB/CDS

Table 3-2
CLIMATOLOGICAL EXTREMES VALUES

STATION : DAVAO CITY
YEAR : AS OF 1996

MONTH	TEMPERATURE, DEG. C				GREATEST DLY RAINFALL, MM		HIGHEST WIND, MPS			SEA LEVEL PRESSURE, MBS			
	HIGH	DATE	LOW	DATE	AMT.	DATE	SPD	DIR	DATE	HIGH	DATE	LOW	DATE
JAN	35.0	15-73	17.0	10-12	87.7	30-86	22/	N	25-62	1018.6	17-59	1001.1	22-89
FEB	36.7	25-15	16.1	3-62	124.3	20-70	18/	N	15-52	1018.4	27-69	1002.1	3-89
MAR	36.7	25-15	17.4	16-12	132.2	27-88	15/	N	3-76	1018.5	30-58	1002.3	3-54
APR	37.0	30-77	19.1	13-12	193.0	2-93	18/	N	23-74	1016.6	7-65	1001.8	12-85
MAY	37.3	5-5	20.2	1-14	174.3	8-66	31/	NNW	15-76	1016.5	9-57	1002.3	30-70
JUNE	35.2	2-5	20.3	10-61	129.4	3-82	21/	NW	18-62	1016.6	6-66	1001.2	30-70
JULY	35.6	16-73	20.0	3-17	179.6	2-2	16/	NW	15-95	1016.0	2-65	1001.3	26-78
AUG	36.0	2-5	18.5	7-18	242.6	2-2	15/	NW	30-82	1015.7	3-65	1001.2	17-90
SEP	35.1	17-77	20.0	3-16	133.7	21-11	20/	S	21-83	1018.2	22-50	1001.3	24-70
OCT	35.4	2-4	19.2	1-18	149.6	8-85	16/	NW	22-95	1016.1	7-59	998.6	18-70
NOV	36.2	17-8	19.1	14-11	90.8	22-35	15/	N	8-74	1016.8	17-65	999.8	6-96
DEC	35.0	8-87	16.2	24-18	153.6	2-10	15/	N	15-62	1016.7	10-67	1001.4	18-80
ANNUAL	37.3	5-5-05	16.1	2-3-62	242.6	8-2-02	31/	NNW	5-15-76	1018.6	1-17-59	998.6	10-18-70

PERIOD OF RECORD 1903-1996 1902-1996 1950-1996 1949-1996

NOTE: 1 EQUAL SIGN (=) MEANS YEAR 1800
 2 NO RECORD FOR THE PERIOD 1941-1945

Prepared by: PAGASA/CAB/CDS

3.1.3 Temperature

The mean monthly temperature in Davao varies from 26.7 to 28.2°C, with an annual mean of 27.5°C as shown in Table 3-1. It could be seen that the temperature variability is very small.

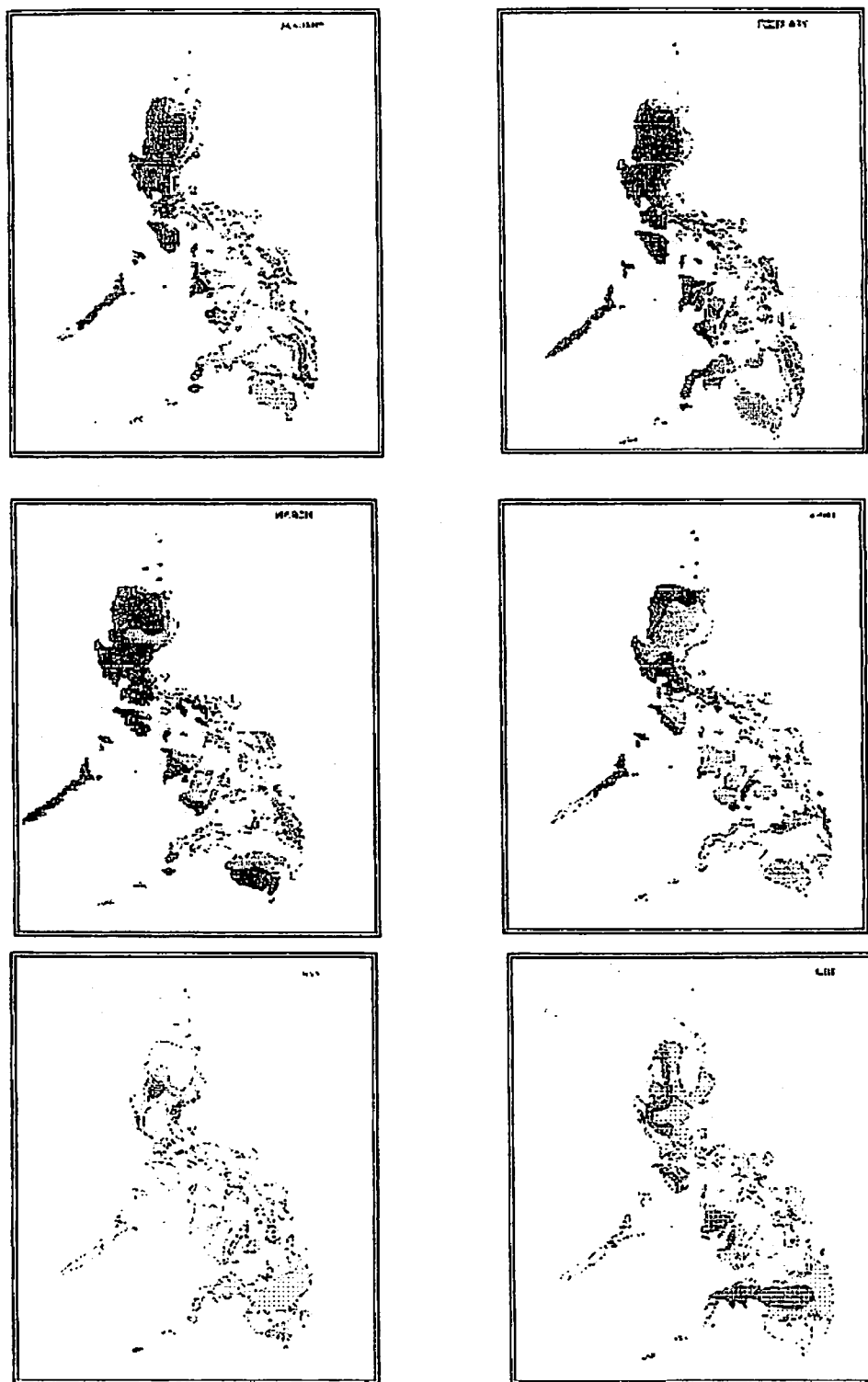
As presented in Table 3-2, the highest recorded temperature is 37.3°C which was recorded in May 1905 while the lowest recorded temperature is 16.1°C which occurred in February 1962.

3.1.4 Rainfall

The available rainfall data from PAGASA on the project area was taken at their gauging station at Davao City. The average total annual rainfall is 1,749.8mm with the minimum average in a month of 84.9mm occurring in March and the maximum average in a month of 193.9mm occurring in June. The highest recorded 24-hr rainfall is 242.6mm which occurred in August 1902. The annual average rainfall in the country is shown in Figure 3-4.

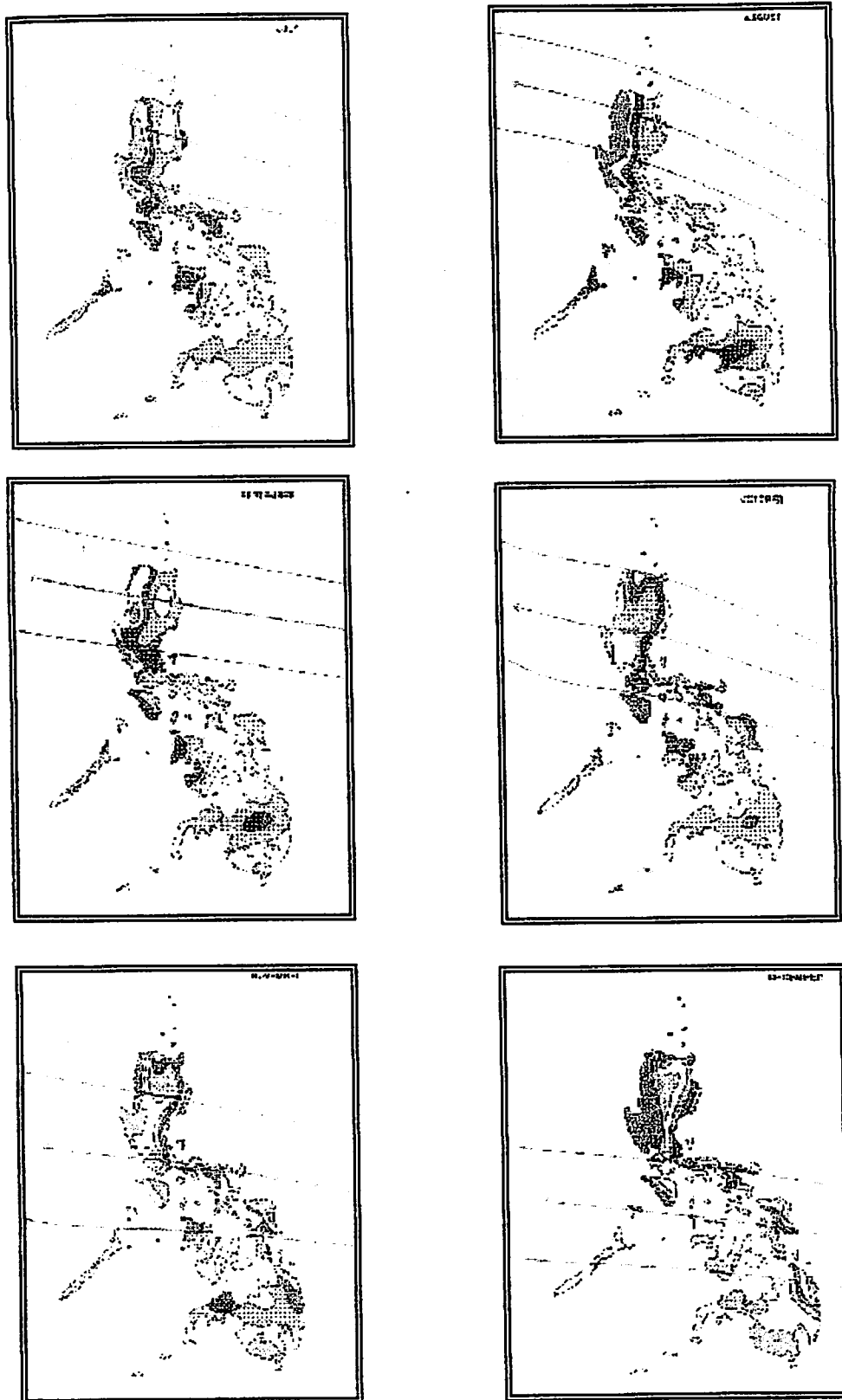
The rainfall intensity was computed by PAGASA for different durations and return period based on the records taken from the gauging station in Davao City. It is presented in Table 3-3.

Figure 3-2a
NORMAL PATH OF TROPICAL CYCLONES
(January to June)



Source: PAGASA

Figure 3-2b
NORMAL PATH OF TROPICAL CYCLONE
(July to December)



Source: PAGASA

Figure 3-3
FREQUENCY OF TROPICAL CYCLONES

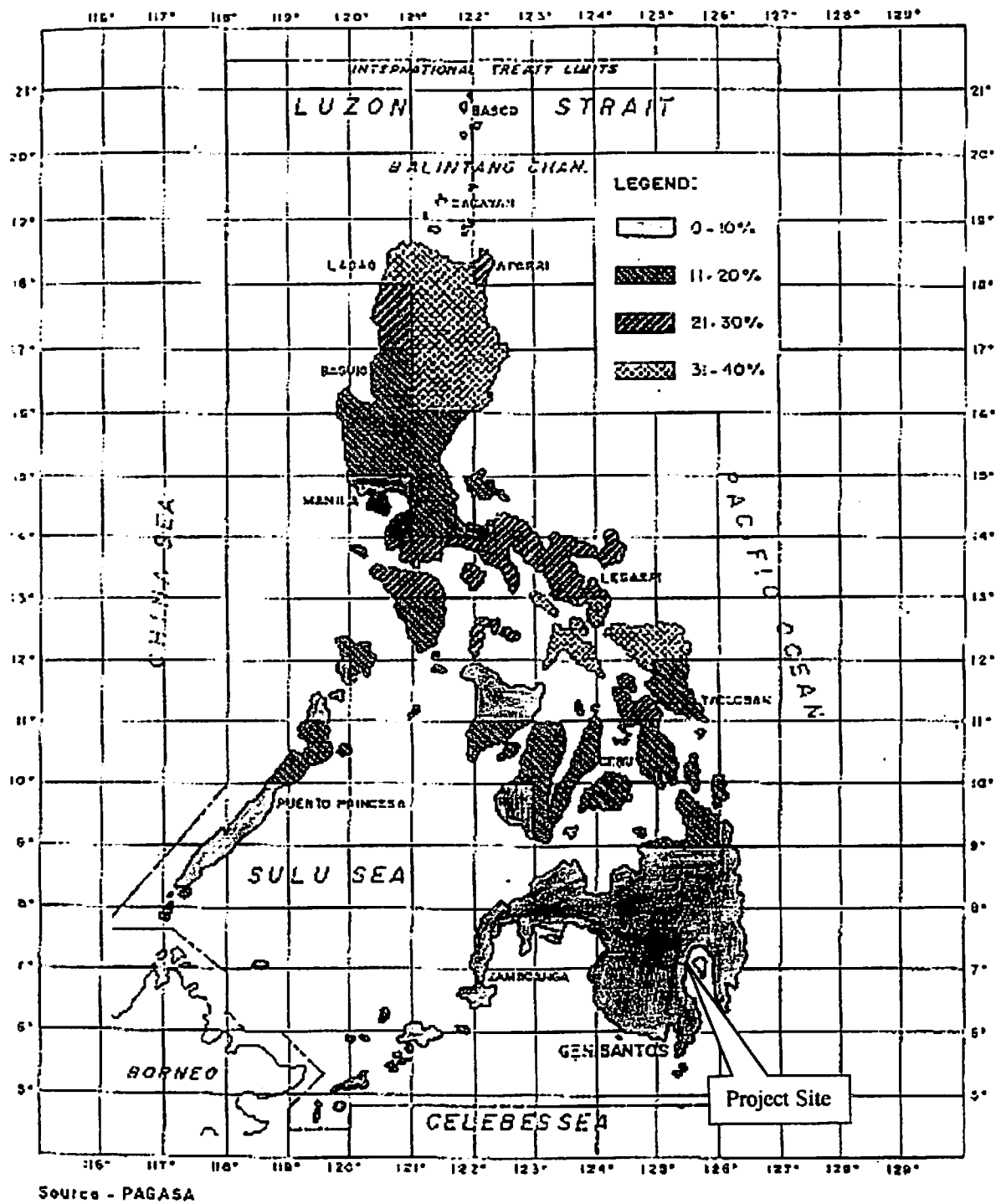


Table 3-3
RAINFALL INTENSITY-DURATION-FREQUENCY DATA
DAVAO CITY

Based on 41 years of record

Computed Extreme Values (in mm) of Precipitation

Return Period (years)	5 Mins	10 Mins	15 Mins	20 Mins	30 Mins	45 Mins	60 Mins	80 Mins	100 Mins	120 Mins	150 Mins	3 Hrs	6 Hrs	12 Hrs	24 Hrs
2	11.1	18.6	24.0	28.5	36.3	44.2	50.0	55.4	59.4	62.6	67.1	71.0	82.1	89.3	93.7
5	14.2	24.3	31.8	38.2	49.8	61.2	70.4	76.9	80.4	82.5	85.9	89.2	104.2	112.7	120.5
10	16.3	28.2	36.9	44.6	58.8	72.4	84.0	91.1	94.3	95.7	98.3	101.3	118.9	128.1	138.3
15	17.4	30.3	39.8	48.3	63.9	78.7	91.6	99.2	102.1	103.1	105.3	108.0	127.1	136.8	148.3
20	18.2	31.9	41.8	50.8	67.4	83.2	96.9	104.8	107.6	108.3	110.2	112.8	132.9	142.9	155.3
25	18.8	33.0	43.4	52.8	70.1	86.6	101.1	109.1	111.8	112.3	113.9	116.5	137.4	147.6	160.7
50	20.7	36.6	48.2	58.8	78.5	97.1	113.7	122.5	124.8	124.7	125.6	127.7	151.1	162.1	177.3
100	22.6	40.2	53.0	64.8	86.9	107.5	126.3	135.7	137.8	137.0	137.1	138.9	167.8	176.5	193.8

EQUIVALENT AVERAGE INTENSITY (in mm/hr) OF COMPUTED EXTREME VALUES

Return Period (years)	5 Mins	10 Mins	15 Mins	20 Mins	30 Mins	45 Mins	60 Mins	80 Mins	100 Mins	120 Mins	150 Mins	3 Hrs	6 Hrs	12 Hrs	24 Hrs
2	133.2	111.6	96.0	85.5	72.6	58.9	50.0	41.5	35.6	31.3	26.8	23.7	13.7	7.4	3.9
5	170.4	145.8	127.2	114.6	99.6	81.6	70.4	57.7	48.2	41.3	34.4	29.7	17.4	9.4	5.0
10	195.6	169.2	147.6	133.8	117.6	96.5	84.0	68.3	56.6	47.9	39.3	33.8	19.8	10.7	5.8
15	208.8	181.8	159.2	144.9	127.8	104.9	91.6	74.4	61.3	51.5	42.1	36.0	21.2	11.4	6.2
20	218.4	191.4	167.2	152.4	134.8	110.9	96.9	78.6	64.6	54.2	44.1	37.6	22.2	11.9	6.5
25	225.6	198.0	173.6	158.4	140.2	115.5	101.1	81.8	67.1	56.2	45.6	38.8	22.9	12.3	6.7
50	248.4	219.6	192.8	176.4	157.0	129.5	113.7	91.9	74.9	62.4	50.2	42.6	25.2	13.5	7.4
100	271.2	241.2	212.0	194.4	173.8	143.3	126.3	101.8	82.7	68.5	54.8	46.3	27.5	14.7	8.1

Source Basic Data: PAGASA

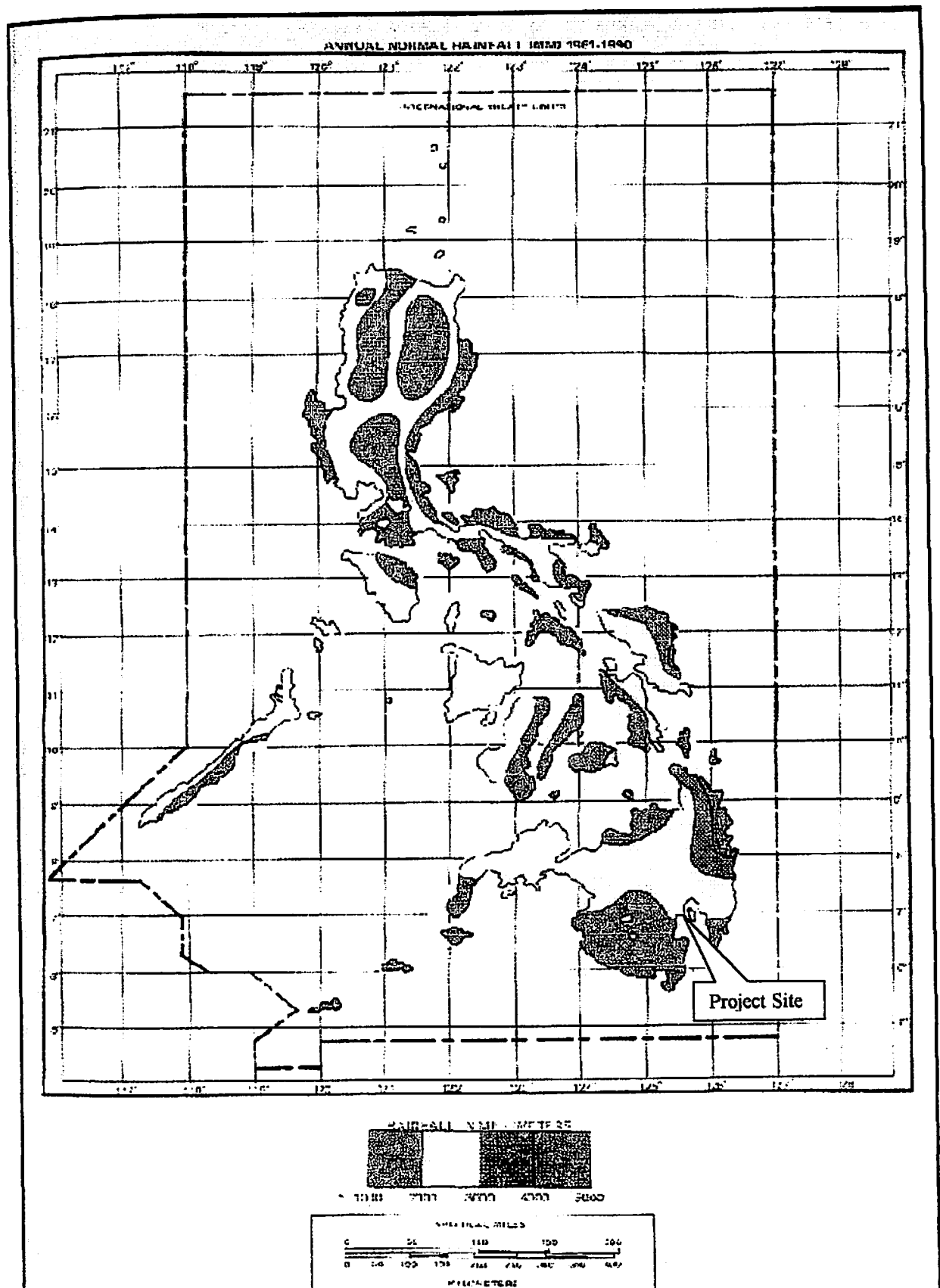
3.2 OCEANOLOGICAL CONDITION

3.2.1 Tides

The predicted tides for Davao Gulf can be obtained from the 1998 predicted tide and current tables of the Philippines published by the National Mapping and Resources Information Authority, Department of Environment and Natural Resources. The tides are semidiurnal in Davao Gulf. The mean tidal records of Davao and Samal based from the 19-year tidal series (1951-1969) are as follows:

Station Reference station Datum planes	Davao	Samal Davao
Mean high water	1.405 meters	1.326 meters
Mean higher high water	1.545	1.384
Mean tide level	0.753	0.719
Mean low water	0.100	0.113
Mean lower low water	0.000	0.000
Great range	1.305	1.213
High water interval	6 ^h 09 ^m	6 ^h 10 ^m
Low water interval	12 ^h 17 ^m	12 ^h 17 ^m

Figure 3-4
ANNUAL NORMAL RAINFALL (MM) 1961-1990



Source: PAGASA

3.2.2 Tsunamis

Tsunamis are high-energy sea waves generated by earthquakes. When they reach the coast under certain condition they may get as high as 10m. The time interval between successive waves is from 20 to 30 minutes. Tsunamis travel at approximately 700 to 800kph, depending on the water depth.

A report published by the Philippine Institute of Volcanology (PHILVOCS) mentions that the coastal areas of Southern Mindanao facing the Celebes Sea are prone to tsunamis because tsunamigenic earthquakes often originates under the bottom of Celebes Sea. The areas with recorded tsunami hits are shown in Figure 3-5 while the tsunami risk areas in the Philippines are shown in Figure 3-6.

3.3 REGIONAL GEOLOGY

3.3.1 Introduction

The Philippine Archipelago lies in the West Pacific Ocean, just north of the junction of three great tectonic plates of the lithosphere, the Eurasian Plate, Pacific Plate and Indo-Australian Plate. Morphologically, the Philippines may be described as a composite of linear sub-parallel ridges alternating with basins and troughs following the trend of bordering trenches. The ridges are upthrust and/or uplifted belts of ophiolite and volcanic-plutonic complexes. The intervening lows are sedimentary basins and troughs exposed partly on land areas following uplift or folding.

The Archipelago is classified into two major structural units, a mobile belt and a stable region. The mobile belt, a broad zone of active deformation characterized by pronounced seismicity and volcanism runs longitudinally throughout the entire length of the archipelago. Tectonic activity is defined by active crustal under thrusting or subduction along its bordering trenches. On the east, the Philippine Sea floor is under thrust along a west-dipping subduction zone marked by the Philippine Trench. On the west, the South China sea bottom is under thrust along the east-dipping Negros and Cotabato trenches.

In contrast to the mobile belt, the southwestern part of the archipelago which embraces mainly Palawan and Sulu Sea is generally considered a stable or a seismic zone.

The Archipelago is divided into four physiographic units, namely: Palawan, Western, Central and Eastern physiographic provinces. These physiographic provinces are shown in Figure 3-7. Davao, where the Port of Sasa is located, is part of the Central Physiographic Province.

3.3.2 Regional Physiography

Davao belongs to the Cotabato Sub-province of the Central Physiographic Province. This sub-province is composed of two prominent physiographic features: Cotabato Valley and Daguma Range.

Davao is in the area bound by two physiographic units called the Mindanao Central Cordillera and the Agusan-Davao Lowlands.

The Mindanao Central Cordillera has a complex basement inferred to be an ophiolitic melange possibly of Cretaceous to Paleogene age, covered by a sequence of Upper Miocene sediments with intercalated andesitic volcanics and pyroclastics. It extends 390km north-south.

The Agusan-Davao Lowlands is structurally a half graben, regionally tilted eastward toward the major faults along with eastern Mindanao is raised. Older Tertiary rocks are exposed along the margins of the valley while younger rocks, mostly Pliocene and Pleistocene are in the central part.

3.3.3 Regional Stratigraphy

According to the Geology and Mineral Resources of the Philippines published by the Bureau of Mines and Geo-sciences, regional metamorphism of basement rocks probably took place during the Late Paleozoic, producing amphibolite schists. Sedimentation and extrusion of basalts, andesites and spilites with minor keratophyres, were also reported to have occurred during the Jurassic to Late Cretaceous time. Bedded tuff, graywacke and metamorphosed sedimentary rocks are intercalated with the volcanic rocks. Intrusions of peridotite and related ultramafics and development of land areas occurred during the latter part of the period. These serpentinized ultramafics are localized along the fault zone.

Paleocene to Eocene sedimentary rocks consisting of basal conglomerate, clastics with few lenses of limestone intercalated with minor volcanic flows and tuffs unconformably overlie the pre-Tertiary volcanic and sedimentary rocks. They cover most of the southwestern and northwestern parts of the area.

Miocene limestone apparently transgressed on the pre-Tertiary volcanic and sedimentary rocks and the Paleocene rocks as well. The limestone, re-crystallized in places is Early to Middle Miocene. Intrusion of quartz diorite probably took place during Middle Miocene time. It intruded principally the pre-Tertiary volcanics and a portion of the base of Paleocene sedimentary rocks.

Along the southwest margin of the Agusan-Davao trough, the oldest exposed section is the Kabagtican Formation, a series of sandstone and shale. It is considered as Late Miocene to Early Pliocene. The Kabagtican disconformably overlies the older sediments. The formation is locally intruded by the Apo Volcanics.

Conformably overlying the Kabagtican is the Upian Limestone formation consisting principally of coralline limestone and partly of marl. It is Pliocene. The Upian is in turn overlain by the Masuhi Formation of Late Pliocene age. The Masuhi is a series of interbedded sandstone and shale with occasional conglomerate beds containing pebbles of plutonic and metamorphic rocks. The unit is conformably overlain by the Mandog Sandstone.

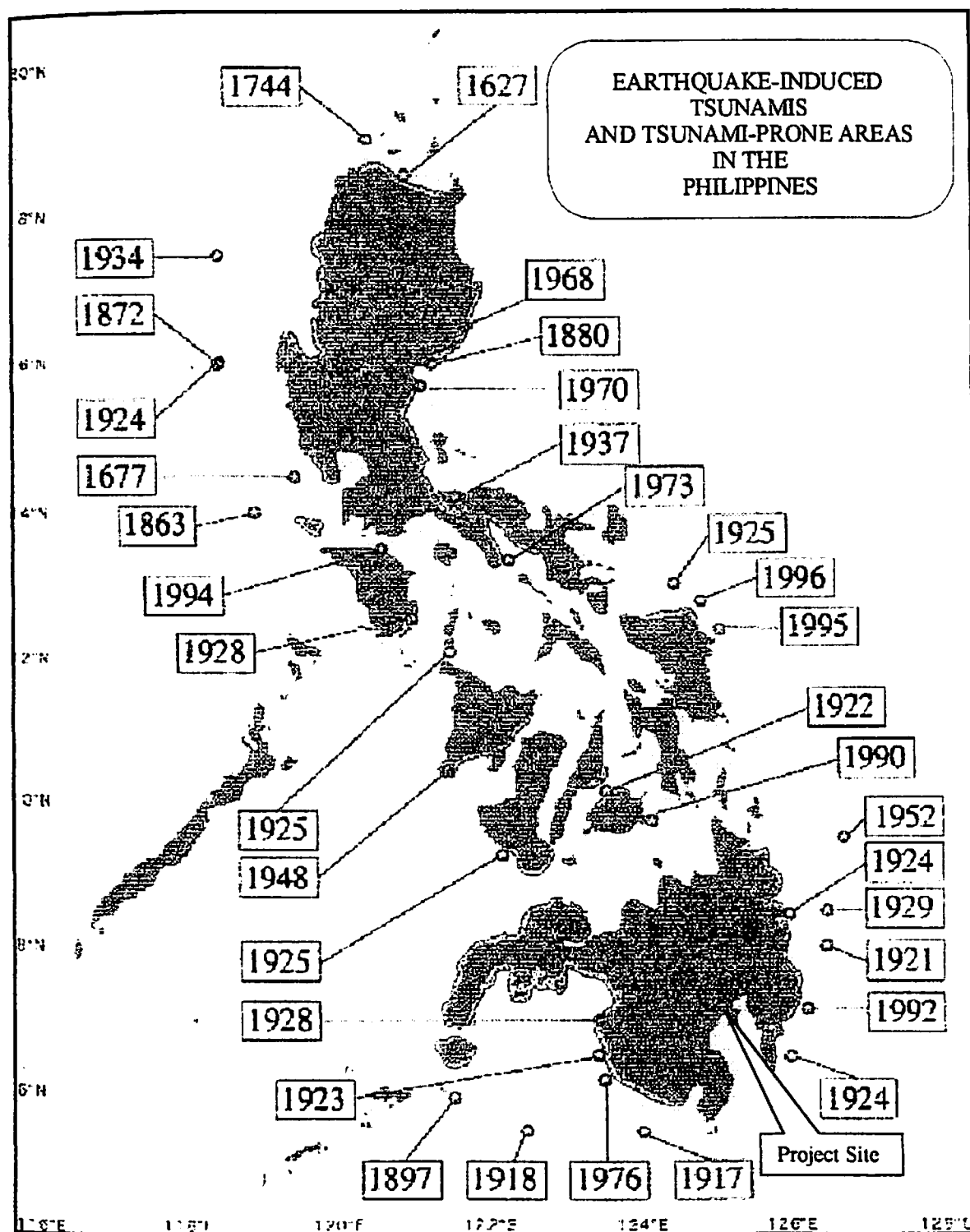
The Mandog, of Late Pleistocene, is the most widespread rock unit in western Davao including Samal Island. The formation is essentially sandstone with gray to brown compacted shale stringers or partings. The sandstone grades from medium to coarse grain and is partly conglomerate. The Apo Volcanics also intrude the Mandog.

The Pleistocene Apo Volcanics and tuff unconformably overlie the Pliocene sediments. The highly porous coralline reef limestone extensively exposed in Samal Island, along the coastal fringes of Davao Gulf and deeper inland at the northern border of Davao Plain is designated the Samal Reef Limestone.

The reef limestone is overlain in part by the Tigatto Terrace Gravel, which is best exposed in Bo. Tigatto along the eastern bank of Davao River. This rock unit forms the basal part of the Recent alluvial deposits in the Davao Plain.

The regional geology and stratigraphy are shown in Figure 3-8, Geologic Map of Davao Quadrangle.

Figure 3-5
DISTRIBUTION OF TSUNAMI HIT AREAS IN THE PHILIPPINES



Source: PHILVOCS

Source: PHILVOCS

EASTERN PHYSIOGRAPHIC PROVINCE

- Northern Sierra Madre Sub-province
- Batac Sub-province
- Samar-Davao Sub-province

CENTRAL PHYSIOGRAPHIC PROVINCE

- Banayan Sub-province
- Cagayan-Caraballo Sub-province
- Central Luzon Sub-province
- Ilocos-Sarangani Sub-province
- Central Visayas Sub-province
- Carabara Sub-province

WESTERN PHYSIOGRAPHIC PROVINCE

- Zamboanga Sub-province
- Angeles Sub-province
- Zamboanga-Sulu Sub-province

PALAWAN PHYSIOGRAPHIC PROVINCE

- Palawan Sub-province
- Cuyo Shelf Sub-province
- Harpurist Sulu Sea Basin Sub-province
- Capeyan de Sulu Ridge Sub-province

Map Labels:

- TAIWAN
- BERNABY PLATEAU
- Luzon
- Visayas
- Mindanao
- South China Sea
- Celebes Sea
- Philippine Trench
- Reed Bank
- Borneo
- Palawan
- Subic Bay
- Manila Bay
- Bay of Manila
- San Francisco Bay
- San Pedro Bay
- San Juan Bay
- San Carlos Bay
- San Antonio Bay
- San Miguel Bay
- San Andres Bay
- San Fernando Bay
- San Jose Bay
- San Luis Bay
- San Mateo Bay
- San Nicolas Bay
- San Pablo Bay
- San Rafael Bay
- San Roque Bay
- San Sebastian Bay
- San Vicente Bay
- San Ysidro Bay
- San Zebadia Bay
- San Blas Bay
- San Blas Strait
- San Blas Channel
- San Blas Sound
- San Blas Gulf
- San Blas Lagoon
- San Blas Lake
- San Blas River
- San Blas Creek
- San Blas Stream
- San Blas Spring
- San Blas Pond
- San Blas Swamp
- San Blas Marsh
- San Blas Plain
- San Blas Hill
- San Blas Mountain
- San Blas Volcano
- San Blas Island
- San Blas Atoll
- San Blas Reef
- San Blas Shoal
- San Blas Bank
- San Blas Spit
- San Blas Point
- San Blas Head
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- San Blas Peninsula
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3.4 REGIONAL SEISMICITY

The Philippines is situated along the Circum-Pacific Seismic Belt where more than 80% of the world's earthquake occur. Philippine seismicity is mainly related to crustal under-thrusting along several subduction systems and partly to strike-slip movements along transcurrent faults. Earthquakes are generally shallow near the ocean trenches and progressively go deeper landward, defined by a Benioff Zone that in some parts reaches a maximum of 700 km in depth.

Figures 3-9 and 3-10 show the distribution of shallow, moderate and deep focus earthquake epicenters. It is apparent that the seismically active portion of the archipelago is confined to the Main Philippine Arc. However, within this active zone, there are comparatively quiet areas as well as local concentration of seismicity.

To define in detail the location of active and quiet zones, a frequency distribution of epicenter per unit area was determined for earthquakes of magnitude greater than 5.0 and depths of less than 300 kilometers. The frequency distribution shown in Figure 3-11 defines certain shapes which strikingly correlate with the location of ocean trenches.

From these seismic zones Figure 3-12, Davao can be seen to fall within Zone IV which is related to the Philippine Trench Subduction Zone, dipping west. The project location is however located near the boundary between Zones IV and V where it is diffused, probably due to concurrent activities in the Cotabato Trench, Philippine Trench and the Sangihe Trough to the south. These earthquake generators are shown in Figure 3-13.

Figure 3-14 to Figure 3-14f, Seismicity Map and Data of Region XI, shows the frequency of occurrence of earthquakes with magnitude equal or greater than 5, with depths ranging from 0 to 700kms. M5 earthquakes are earthquakes with moderate strength and are felt over wide areas, some of them causing small local damage near the epicenters.

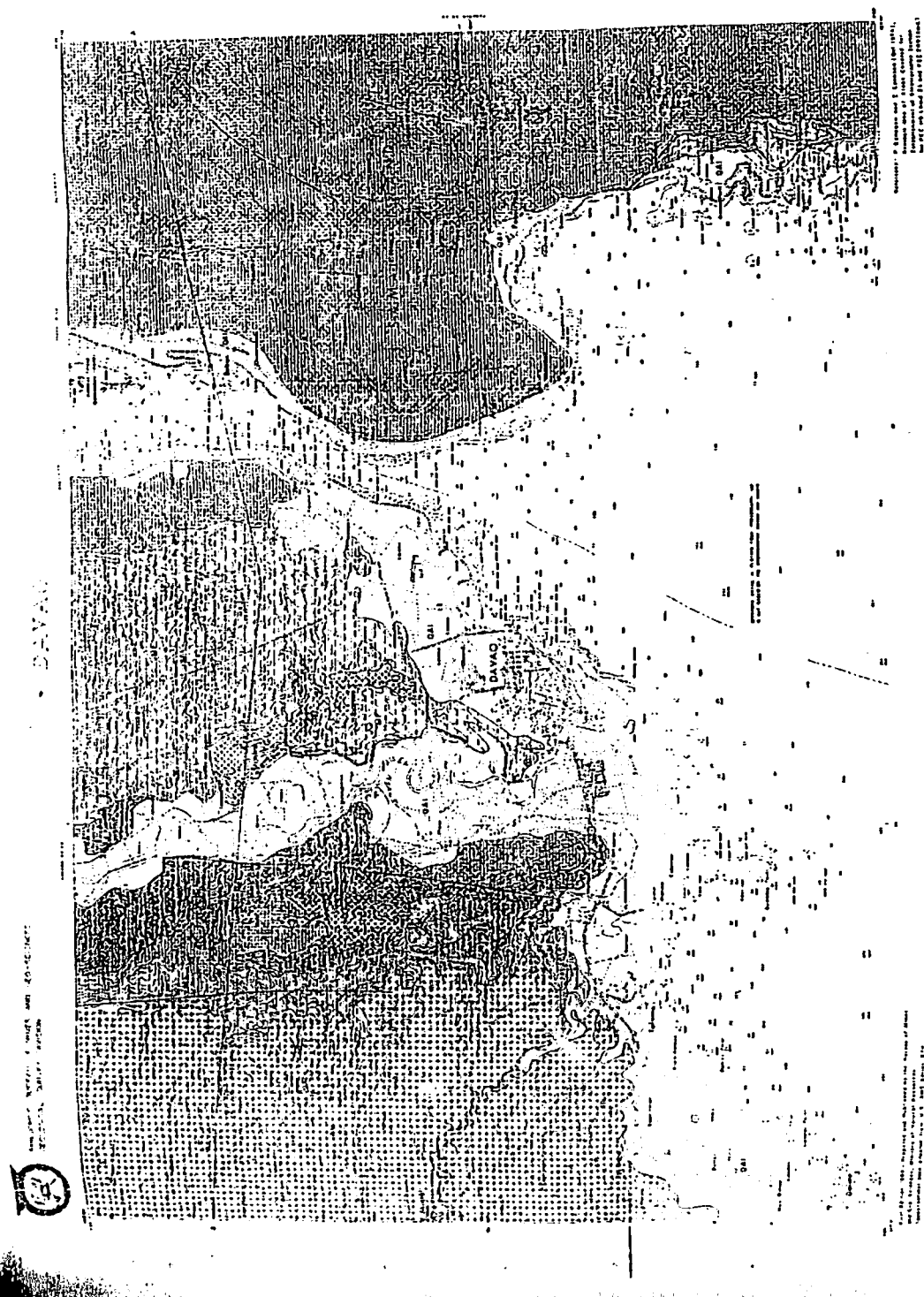
3.4.1 Subsoil Condition at the Site

For purposes of foundation feasibility studies, the Presidential Economic Staff contracted Certeza Geophysical Exploration, Inc. to undertake boring operations at the Port of Sasa. The findings from said exploration is presented in this preliminary report as reference for subsequent studies and as basis for the conceptual design of the master plan for the Port of Sasa.

Said exploration consisted of six boreholes, each nearly 30 m deep, drilled along a 700 m stretch running parallel to and north of the existing marginal wharf. Standard penetration tests and undisturbed samplings were undertaken.

The exploration confirmed that the Port itself is underlain by quaternary alluvium composed of unconsolidated alluvial sand and gravel deposits. The soil profile showed a top layer of coralline sand with variable mixture of silts. This layer is underlain by clayey or silty sand. Coralline deposits of varying densities and sizes abound in the area.

Figure 3-8
GEOLOGICAL MAP OF DAVAO QUADRANGLE



EXPLANATION

SYMBOLS

- Quaternary Alluvium**
Unconsolidated alluvial sand and gravel deposits
- Tertiary Tuffaceous Gravel**
Loose, friable, porous, and coarse-grained
- Semiprecious Limestone**
Highly porous and coarse-grained limestone with corals, mollusks, shells and fragments
- Apog Volcanics**
Pyroclastics, lava flows, and other volcanic fragments
- Mandoc Formation**
Series of interbedded, thin to medium thickness sandstone with minor (thin) layers of shale and conglomerate to pebbly sand
- Masahi Formation**
Increased sandstone and thin with some conglomerate beds. Sandstone is light to dark gray, fine to medium grained, and contains thin beds of dark gray, dark brown, conglomerate and calcareous conglomerate in composition of light to dark grayish sand

SEOLOGIC STRUCTURES

- LITHOLOGY**
 - Alluvium
 - Limestone
 - Sand
 - Sandstone
 - Conglomerate
 - Pyroclastics
 - Gravel
- Formations**
 - Quaternary
 - Tertiary
 - Sandstone
 - Gravel
- Structures**
 - Strike and dip of fault
 - Strike and dip of fold
 - Strike and dip of fault
 - Strike and dip of fold

PHILIPPINE BUREAU OF MINES AND GEOLOGICAL SCIENCES
MANILA, PHILIPPINES

Figure 3-9
MAP SHOWING DISTRIBUTION OF SHALLOW FOCUS EARTHQUAKES

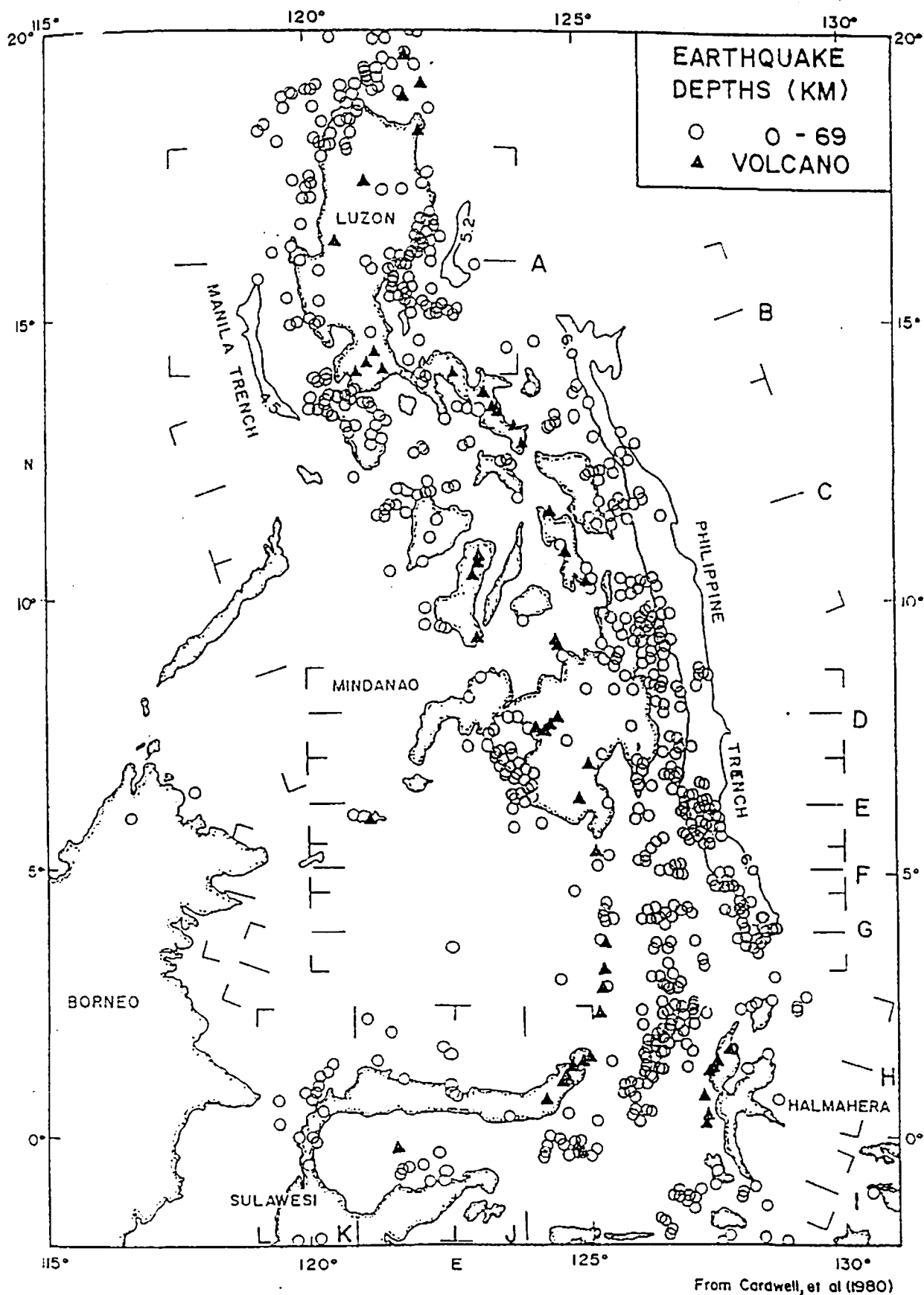
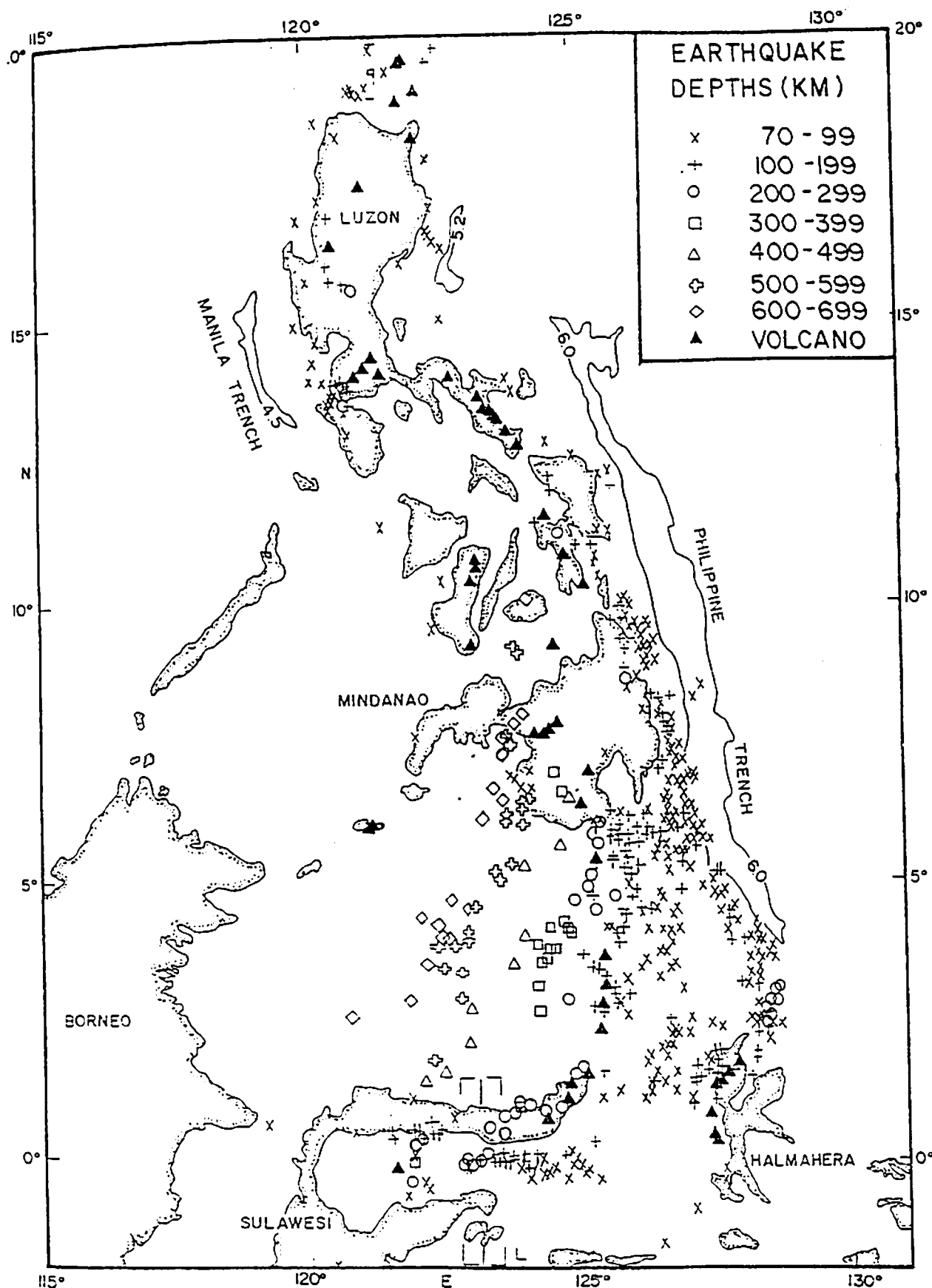


Figure 3-10
MAP SHOWING DISTRIBUTION OF INTERMEDIATE
AND DEEP FOCUS EARTHQUAKES



From Corawell, et al (1980)

A map of the Hawaiian Islands is shown, with numbers placed in various locations, likely representing a data set or a puzzle. The numbers are distributed across the islands and surrounding waters, with some numbers appearing in clusters and others in isolation. The map includes the main islands of Hawaii, Maui, Oahu, and Kauai, as well as the Line Islands and the Phoenix Islands. The numbers are arranged in a way that suggests a specific pattern or sequence, possibly related to the islands' geography or history.

EXPLANATION: Figures indicate the number of earthquakes with $33 \text{ km.} \leq h \leq 300 \text{ km.}$ and magnitude > 5 per area of 0.25 degree square.

Figure 3-12
SEISMIC ZONES IN THE PHILIPPINES

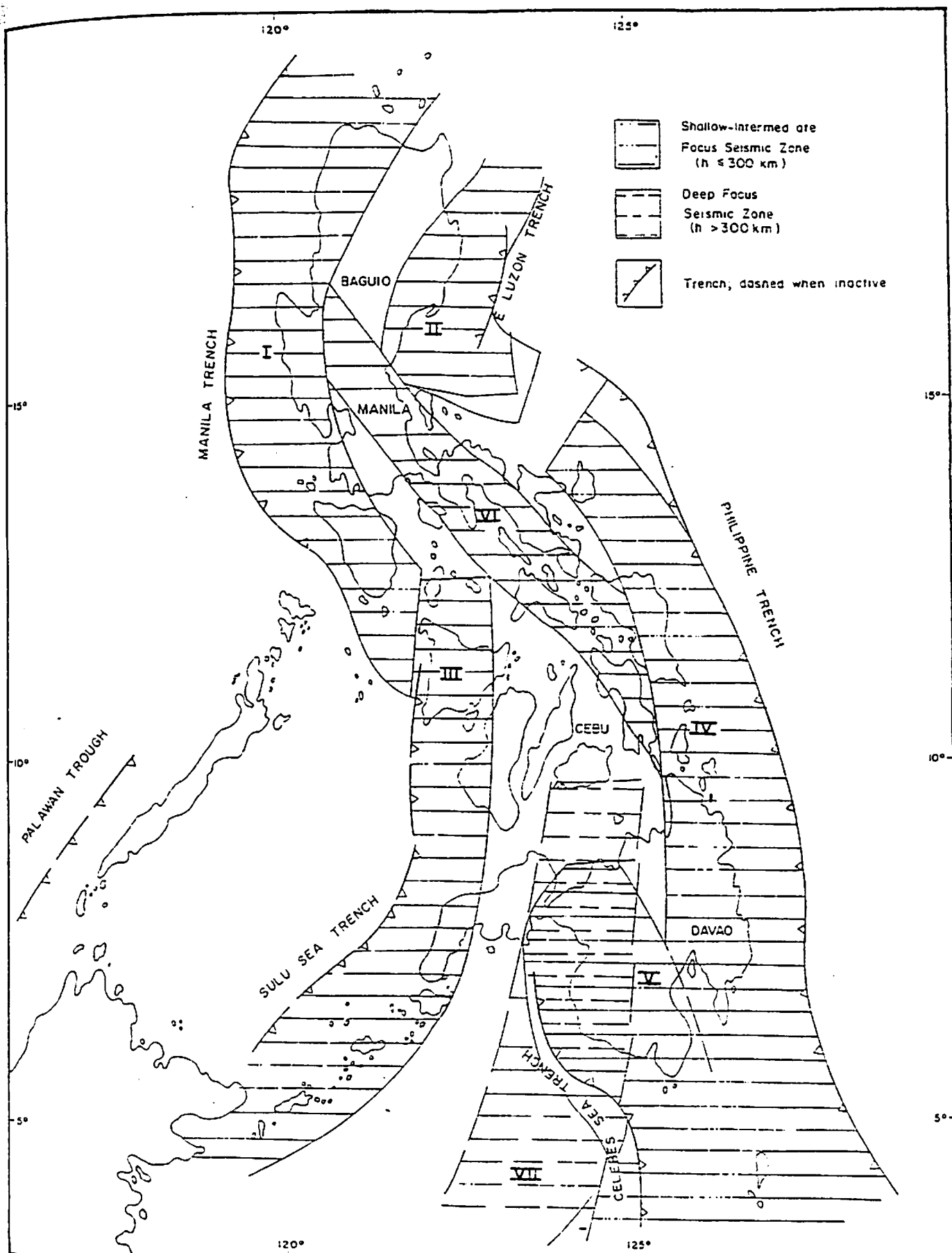


Figure 3-13
DISTRIBUTION OF EARTHQUAKE GENERATORS IN THE PHILIPPINES

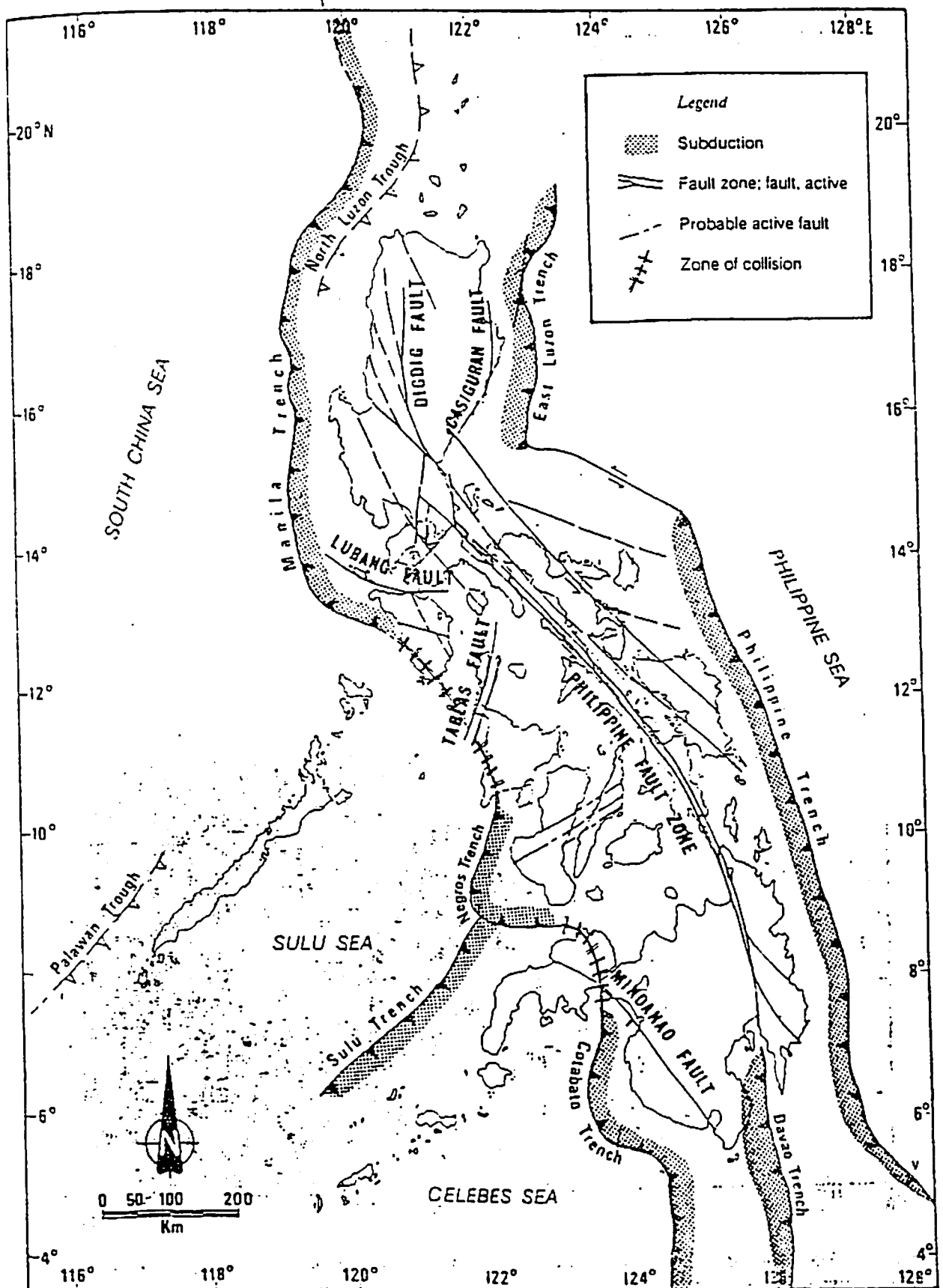
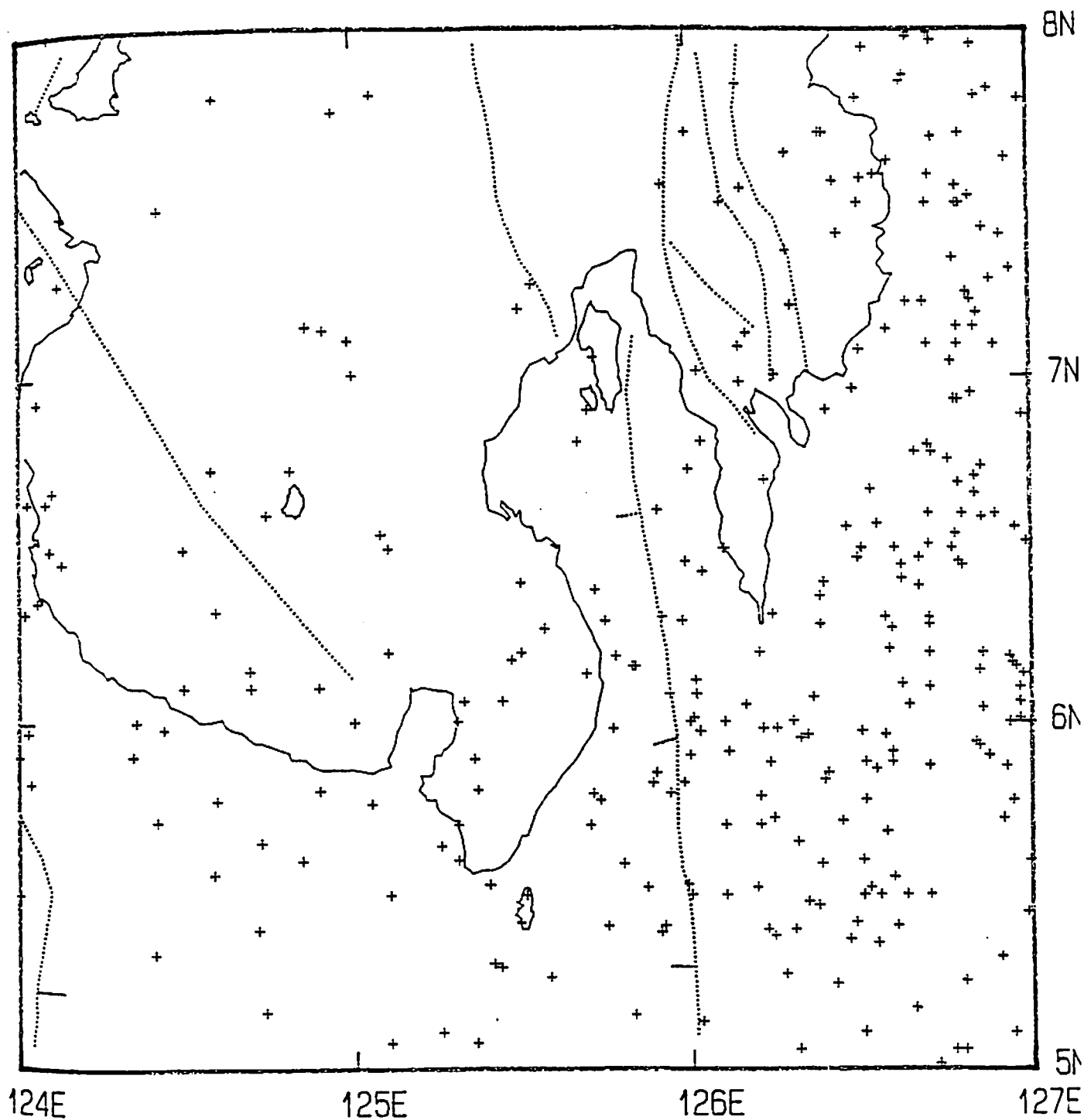


Figure 3-14
SEISMICITY MAP OF REGION XI



SEISMICITY MAP OF REGION XI Mag=> 5.0 Depth: 0- 700KMS
Time: 032907-073198
PHIVOLCS

Figure 3-14a
SEISMICITY DATA OF REGION XI

PHILIPPINE INSTITUTE OF VOLCANOLOGY AND SEISMOLOGY

DATE	TIME	LAT	LONG	DEPTH	MAG	REMARKS
10119	1 33 42.0	8.00 N	126.00 E	33	7.4	
20718	5 20 30.0	6.50 N	126.50 E	120	7.5	
81518	17 30 11.0	5.50 N	126.10 E	33	7	
30611	17 30 0.0	6.00 N	126.00 E	100	6.7	
40829	10 16 53.0	7.80 N	124.60 E	610	6.7	
60429	15 15 58.0	6.50 N	124.50 E	300	7	
121928	11 37 12.0	6.10 N	124.50 E	33	7.3	
111627	21 10 9.0	6.50 N	126.10 E	50	7	
32625	10 25 12.0	5.50 N	125.10 E	180	6.5	
30223	16 48 52.0	6.50 N	124.10 E	33	7.2	
31623	22 1 38.0	6.00 N	127.00 E	33	7	
111121	18 36 8.0	8.00 N	127.00 E	33	7.5	
20439	11 34 5.0	7.20 N	126.30 E	100	6	
12036	16 56 18.0	6.00 N	127.00 E	80	7.1	
70536	18 55 13.0	6.30 N	126.70 E	60	7.3	
50735	5 55 20.0	5.70 N	126.10 E	50	6	
60135	14 39 52.0	7.50 N	126.50 E	100	6	
100435	5 15 36.0	6.00 N	125.00 E	400	6.5	
11634	18 39 42.0	6.10 N	124.70 E	33	6.3	
81234	23 49 12.0	8.00 N	127.00 E	34	6.9	
90634	2 16 52.0	6.50 N	126.10 E	150	6	
22233	3 48 10.0	5.50 N	125.10 E	33	5.6	
40133	8 7 35.0	6.00 N	127.00 E	33	5.6	
92533	13 45 45.0	6.00 N	126.00 E	33	6	
92833	0 27 58.0	7.00 N	127.00 E	100	5.7	
42932	17 30 40.0	7.00 N	127.00 E	33	5.6	
60832	14 54 38.0	8.00 N	126.00 E	100	6.3	
70932	20 23 54.0	5.50 N	126.50 E	120	6	
121632	7 14 22.0	7.00 N	127.00 E	33	5.6	
31831	20 13 30.0	6.00 N	127.00 E	50	7	
102631	11 57 29.0	8.00 N	126.00 E	33	5.6	
100740	6 43 3.0	5.50 N	126.00 E	33	7	
61641	11 26 59.0	7.20 N	126.30 E	33	6.5	
43049	1 23 32.0	6.50 N	125.10 E	130	7.4	
90659	1 27 59.0	5.50 N	126.55 E	33	5.3	
121459	17 58 33.0	5.50 N	125.50 E	200	5.8	
70458	18 34 14.0	5.80 N	124.90 E	85	6	
90158	18 0 44.0	7.50 N	126.79 E	82	6	
41357	10 10 54.0	5.10 N	126.50 E	100	6	
42857	1 23 40.0	7.00 N	127.00 E	42	5.9	
92657	18 46 48.0	6.00 N	126.94 E	10	6	
122756	21 31 28.0	7.50 N	126.10 E	33	5.5	
33155	18 17 8.4	8.00 N	124.10 E	96	7.3	
41055	17 38 12.0	8.00 N	125.00 E	33	6.5	
122852	15 1 19.0	6.00 N	127.00 E	33	6.4	
70251	5 8 23.0	6.10 N	124.50 E	100	6.1	
80750	2 44 44.0	6.00 N	126.00 E	33	6.7	
83150	7 5 38.0	6.00 N	126.00 E	33	7	
22688	1 35 4.8	5.27 N	126.27 E	80	5.3	
40268	21 36 44.0	6.00 N	126.10 E	80	5	
50169	11 52 29.4	5.10 N	125.25 E	222	5.1	

Figure 3-14b
SEISMICITY DATA OF REGION XI

PHILIPPINE INSTITUTE OF VOLCANOLOGY (continued)

DATE	TIME	LAT	LONG	DEPTH	MAG	REMARKS
62889	14 22 13.7	6.78 N	126.71 E	103	5.3	
71689	4 47 38.1	5.17 N	126.65 E	84	5.1	
80869	6 2 1.5	7.19 N	125.49 E	58	5.1	
91469	10 2 23.8	6.27 N	125.56 E	54	5.1	
91809	0 29 38.4	6.08 N	126.32 E	106	5.5	
101809	12 26 44.9	7.70 N	126.00 E	58	5.3	
11168	4 40 13.4	5.01 N	126.72 E	33	5.2	
22168	12 34 48.0	6.95 N	126.83 E	88	5.2	
40668	21 41 21.0	7.47 N	124.14 E	41	5.2	
53068	17 58 37.0	5.25 N	126.80 E	56	5.2	
80468	11 41 23.8	6.60 N	126.80 E	96	5.9	
92668	18 43 20.0	5.83 N	126.39 E	49	5	
102468	0 42 23.0	7.21 N	126.64 E	82	5.3	
102468	15 51 16.0	6.06 N	126.97 E	44	5.5	
102768	13 42 26.2	5.91 N	126.59 E	194	5	
111268	5 46 33.0	6.00 N	125.30 E	138	5	
112568	18 36 52.3	5.05 N	126.77 E	25	5.3	
32667	17 0 33.0	5.60 N	126.50 E	81	5.1	
40867	20 13 55.0	6.00 N	127.00 E	85	5.2	
60867	7 1 55.0	6.18 N	126.83 E	161	5.1	
80867	13 51 24.0	5.32 N	126.91 E	100	5	
81867	9 36 42.3	5.70 N	125.70 E	165	5	
110367	10 31 19.9	6.19 N	125.78 E	87	5	
112467	18 46 53.8	5.86 N	126.54 E	117	5.2	
121367	15 36 1.5	5.39 N	125.91 E	119	5.2	
21866	6 59 5.0	6.73 N	124.82 E	58	5.3	
40966	20 0 59.0	5.41 N	125.92 E	134	5.1	
82766	4 35 48.6	5.82 N	125.98 E	125	5.1	
110766	8 55 51.0	7.26 N	125.53 E	84	5	
120166	11 38 25.2	6.21 N	126.58 E	114	5.1	
12565	12 15 34.3	6.01 N	126.01 E	166	5	
32165	13 40 32.5	6.35 N	124.06 E	61	5.1	
51665	11 35 52.1	5.26 N	125.57 E	93	5.6	
62465	7 45 13.9	7.00 N	126.25 E	51	5.7	
72765	7 54 35.9	6.08 N	126.02 E	93	5.1	
80865	4 32 45.4	6.60 N	126.70 E	99	5	
82065	8 31 25.5	5.53 N	125.39 E	82	5.2	
83065	14 0 55.8	5.52 N	125.87 E	121	5.2	
91665	13 50 12.2	7.13 N	126.58 E	178	5.9	
111665	6 45 57.2	6.60 N	126.90 E	103	5.4	
122265	0 52 56.8	6.67 N	124.11 E	552	5.2	
122565	1 7 20.3	6.73 N	126.00 E	87	5.1	
40264	15 56 52.5	5.77 N	125.73 E	168	5.5	
71164	16 35 55.5	5.98 N	126.34 E	183	5	
90864	7 54 57.8	5.91 N	126.11 E	182	5.5	
90864	20 22 57.1	6.93 N	126.79 E	59	5.5	
92304	17 18 7.2	5.88 N	126.51 E	85	5.1	
101164	23 33 23.4	6.19 N	126.94 E	120	5.3	
110464	21 2 43.0	6.90 N	125.70 E	62	5.5	

Figure 3-14c
SEISMICITY DATA OF REGION XI

PHILIPPINE INSTITUTE OF VOLCANOLOGY (continued)

DATE	TIME	LAT	LONG	DEPTH	MAG	REMARKS
12483	22 27 38.0	7.80 N	126.98 E	113	5.7	
50883	15 24 0.0	8.00 N	126.00 E	50	5	
52363	15 12 10.0	5.98 N	126.25 E	127	6	
80263	19 26 26.0	8.10 N	124.90 E	105	5	
92963	19 35 1.0	8.06 N	125.43 E	103	5.3	
111763	7 50 40.0	7.00 N	125.00 E	33	5.6	
30282	13 3 10.0	5.55 N	126.59 E	96	5.5	
30302	12 14 58.0	7.58 N	126.71 E	88	5.5	
43082	20 39 57.0	8.48 N	124.14 E	117	5.3	
50761	10 22 54.0	5.93 N	126.85 E	149	6.1	
11860	9 4 43.0	5.10 N	126.50 E	33	5.9	INTENSITY 5
50980	2 48 8.0	5.50 N	124.00 E	33	5.4	
90860	11 7 40.8	6.20 N	126.20 E	47	5.5	
11070	12 7 8.6	6.90 N	126.40 E	68	5.9	
11070	13 13 1.3	6.69 N	126.79 E	76	5.1	
11070	13 59 40.8	6.74 N	126.86 E	88	5.4	
11070	14 16 31.3	6.71 N	126.84 E	81	5.5	
11070	15 12 19.0	6.80 N	126.70 E	47	5.1	
11070	16 30 49.0	7.04 N	126.77 E	38	5	
11070	17 12 38.9	7.00 N	127.00 E	98	5	
11170	5 2 5.0	7.43 N	126.87 E	60	5.4	
11170	21 2 22.3	6.52 N	126.99 E	84	5	
11270	4 25 1.1	8.01 N	126.97 E	70	5.1	
11370	20 48 27.2	7.09 N	126.79 E	74	5.3	
30570	4 29 6.9	7.28 N	126.89 E	55	5.2	
31070	2 11 7.3	7.85 N	126.63 E	108	5.1	
32070	11 7 38.4	6.07 N	125.35 E	90	5.7	
32370	9 8 6.0	7.14 N	126.84 E	20	5	
33070	16 48 48.2	6.78 N	126.88 E	82	5.8	
33070	16 55 17.0	7.70 N	126.80 E	179	6	
61670	5 49 59.5	7.22 N	126.83 E	86	5	
61970	16 40 10.0	6.89 N	126.98 E	87	5	
70570	14 12 17.9	7.50 N	126.80 E	68	5.5	
82470	12 53 22.8	5.98 N	125.77 E	130	7.8	
102770	21 59 1.1	7.50 N	126.70 E	92	5.1	
110470	23 34 47.3	6.60 N	124.75 E	381	5	
121370	12 29 14.8	5.87 N	126.93 E	148	5	
12771	3 51 31.9	6.18 N	126.96 E	33	5.2	
22571	14 38 2.2	5.87 N	126.70 E	88	5.8	
31871	9 45 3.8	7.97 N	126.72 E	43	5	
50871	18 9 21.9	5.53 N	125.99 E	114	5.1	
51071	11 53 53.0	7.96 N	126.84 E	33	5.8	
60571	9 20 54.0	6.05 N	126.18 E	87	5.5	
60671	12 8 59.0	7.48 N	124.43 E	54	5.1	
80471	21 23 38.0	5.85 N	125.90 E	81	5.1	
92671	3 20 7.7	6.85 N	126.40 E	120	5.3	

Figure 3-14d
SEISMICITY DATA OF REGION XI

PHILIPPINE INSTITUTE OF VOLCANOLOGY (continued)

DATE	TIME	LAT	LONG	DEPTH	MAG	REMARKS
110871	22 43 0.8	5.77 N	126.51 E	164	5.7	S MINDANAO-RF2
121771	3 56 9.0	6.28 N	126.70 E	96	5.1	
121772	15 29 23.2	6.96 N	126.48 E	183	5.2	
31672	21 47 51.2	5.98 N	124.44 E	67	5	
50272	13 10 24.1	5.56 N	124.59 E	387	5.2	
52472	23 26 49.0	5.78 N	126.20 E	90	5.2	
70372	5 31 27.5	5.79 N	125.94 E	96	5.6	
100672	20 0 47.6	5.97 N	124.03 E	540	5.2	
111372	20 19 17.9	6.20 N	126.86 E	124	5.1	
120272	0 19 47.2	6.47 N	126.67 E	33	6.3	DAVAO-RF6TSUNAMI-1METER
120272	0 19 52.0	6.41 N	126.62 E	73	6	
120272	1 40 47.8	6.45 N	126.62 E	54	5.9	
120272	1 40 51.5	6.39 N	126.67 E	84	5.6	
120272	2 56 37.6	6.51 N	126.70 E	63	5.2	
120372	1 1 46.9	5.72 N	126.92 E	62	5.1	
120372	7 45 2.6	6.54 N	126.78 E	82	5.3	
120572	6 3 7.3	5.77 N	126.95 E	77	5.1	
120672	10 23 59.1	6.10 N	126.97 E	80	5.2	
120972	6 3 41.3	7.34 N	126.78 E	92	5	
120972	7 27 49.0	7.18 N	126.85 E	93	5.1	
120972	12 55 47.5	7.41 N	126.92 E	66	5.2	
121172	2 28 2.6	6.05 N	126.64 E	96	5.2	
121272	17 46 47.8	6.47 N	126.49 E	3	5.3	
121272	18 0 41.8	6.67 N	126.53 E	41	5.4	
121672	23 48 25.7	5.52 N	126.52 E	64	5	
121772	3 15 24.0	5.68 N	126.57 E	33	5.1	
121872	10 3 3.2	6.56 N	126.46 E	33	5.1	
121672	15 22 22.2	6.11 N	126.62 E	14	5.8	
121972	15 22 30.0	6.14 N	126.98 E	66	5.2	
10973	6 14 25.3	6.98 N	126.15 E	51	5.3	
11973	8 5 9.6	5.94 N	126.84 E	63	5.2	
20773	9 51 17.6	6.45 N	128.80 E	207	5.3	
21173	11 17 58.3	6.66 N	126.84 E	71	5.1	
30573	23 20 26.0	6.15 N	126.85 E	84	5.3	
30773	3 9 11.5	5.50 N	126.63 E	81	5.2	
32273	22 39 15.5	5.95 N	126.32 E	102	5.1	
33173	0 36 13.6	5.82 N	124.04 E	554	5	
41373	4 3 56.9	5.47 N	126.37 E	30	5.3	
41473	16 17 42.1	6.64 N	124.09 E	23	5.4	
41473	16 17 46.9	6.64 N	124.03 E	57	5.4	
42473	3 52 33.6	7.09 N	126.90 E	33	5	
62573	20 46 46.3	6.93 N	126.78 E	73	5.2	
70973	7 47 51.1	5.97 N	126.50 E	90	5.1	
71473	5 19 57.8	5.15 N	125.83 E	112	5	
72273	15 27 1.5	6.32 N	124.02 E	33	5.1	
72573	18 28 32.1	7.14 N	126.79 E	73	5.1	
92273	1 41 3.6	6.32 N	124.60 E	528	5.1	
92573	22 26 31.6	7.52 N	126.83 E	94	5.2	
100173	13 41 57.5	5.41 N	125.75 E	134	5.1	
100373	5 27 45.1	5.79 N	125.71 E	132	5	
20474	9 2 3.8	6.20 N	125.10 E	25	5.1	
81674	19 43 46.1	6.17 N	126.95 E	97	5.4	
91874	22 18 25.2	7.83 N	126.89 E	33	5	
92274	19 4 45.9	5.36 N	126.54 E	51	5.4	
111274	0 46 21.0	5.90 N	124.00 E	33	5	
12975	15 30 32.2	5.40 N	126.30 E	62	5.2	
20575	18 25 1.7	5.90 N	126.00 E	73	5	
20575	18 25 1.0	6.00 N	126.30 E	62	5.1	
21875	15 10 40.7	5.60 N	127.00 E	60	5.1	
21875	15 10 42.0	5.50 N	126.70 E	72	5	
22375	2 58 41.0	8.00 N	124.00 E	623	5.6	

Figure 3-14e
SEISMICITY DATA OF REGION XI

PHILIPPINE INSTITUTE OF VOLCANOLOGY (continued)

DATE	TIME	LAT	LONG	DEPTH	MAG	REMARKS
41375	1 34 36.2	5.70 N	125.30 E	225	5.7	
41375	1 34 37.4	5.60 N	125.30 E	235	5.5	
42175	23 3 30.3	6.10 N	126.70 E	108	5	
42175	23 3 31.0	8.00 N	124.00 E	33	5.1	
42175	23 3 29.0	6.20 N	126.70 E	96	5	
61475	18 27 44.0	6.50 N	126.77 E	62	5.1	
71075	18 29 16.0	6.50 N	126.60 E	86	6.2	
81676	22 49 33.0	7.27 N	124.13 E	33	5.1	ZMP-RF3C.DE ORO-RF2
81776	18 9 40.3	5.33 N	124.41 E	33	5.2	A.S. OF 081676 W/ OT-1611
82376	3 43 0.0	6.50 N	124.10 E	50	5	C.D.ORO-RF4COT-RF3ZMP-RF
92976	21 4 34.0	6.93 N	124.06 E	50	5.2	COTABATO-RF4
11977	13 54 6.1	5.05 N	126.80 E	119	5.5	G.SANTOS;CMP-RF3DAV-RF2
70377	14 39 59.0	5.13 N	126.03 E	33	5.4	
13078	13 14 56.2	6.59 N	126.86 E	144	5.3	
61678	7 56 58.0	7.69 N	126.72 E	196	5.3	HINATUAN-RF4C.DE ORO-RF3
82178	5 41 45.8	5.52 N	126.19 E	105	5	
21179	17 30 12.1	5.16 N	124.74 E	97	5.1	TACLOBAN CITY RF2
21179	22 22 19.8	5.76 N	125.05 E	100	5.8	
21979	0 35 43.3	5.40 N	124.72 E	50	5.2	
91679	17 56 25.5	5.88 N	126.23 E	33	5	
111979	22 17 22.3	5.80 N	125.36 E	157	5.9	
10280	20 58 40.2	5.90 N	126.88 E	129	5.7	G.SANTOS-RF5C.DE ORO-RF3
10280	21 48 14.8	5.97 N	126.03 E	88	5.5	GEN.SANTOS-RF5
10380	20 22 27.7	5.71 N	124.42 E	197	5.6	GEN.SANTOS-RF3
10480	4 44 0.9	6.07 N	126.36 E	66	5	
10480	6 22 9.2	5.98 N	126.21 E	63	5.3	
10880	10 8 43.3	5.42 N	125.48 E	50	5.7	
22980	11 13 29.6	6.30 N	126.57 E	167	5.6	G.SANTOS-RF4C.DE ORO-RF2
70880	4 39 29.0	6.61 N	125.91 E	241	5.6	
92180	1 1 0.6	7.07 N	126.50 E	50	5	HINATUAN;G.SANTOS-RF2
121780	11 41 38.8	7.99 N	126.71 E	50	5.4	SURIGAO-RF5HINATUAN-RF4
70481	10 26 19.7	6.14 N	125.69 E	76	5	
90381	4 29 49.7	6.57 N	126.55 E	68	5.6	DAVAO;GEN.SANTOS-RF2
12282	16 4 42.2	6.76 N	126.76 E	144	5.1	
92482	22 51 49.5	5.88 N	126.59 E	50	5.2	
21283	8 47 12.5	5.59 N	126.38 E	103	5.4	
21383	14 22 59.4	5.41 N	126.60 E	52	5	
21283	10 49 50.7	5.38 N	126.24 E	61	5.5	
31083	11 58 25.0	5.48 N	126.34 E	105	5.2	
31583	19 58 33.3	5.24 N	126.42 E	115	5.5	
42283	7 51 49.9	5.96 N	126.57 E	68	5.3	PALO-RF1
71483	19 47 46.0	5.40 N	126.22 E	43	5.2	
71583	10 45 35.9	5.37 N	126.46 E	49	5.4	
91383	2 3 20.3	7.63 N	126.94 E	42	5.3	MT.PASIAN-RF4DAVAO-RF3
91683	4 22 49.5	5.65 N	126.31 E	200	5.1	
111183	21 19 29.2	6.16 N	125.84 E	146	5.3	HINATUAN-RF2
10984	7 18 0.4	6.56 N	126.96 E	78	5.1	
32684	9 36 50.2	7.01 N	126.03 E	94	5.2	
42084	9 55 41.7	5.60 N	124.85 E	106	5.1	
71184	5 40 17.6	5.42 N	125.48 E	55	5.3	
81884	9 14 32.6	6.30 N	125.92 E	33	5	
112084	8 15 15.9	5.07 N	125.10 E	202	6.1	S.DEL SUR-RF4ZAM.-RF2
50287	18 16 59.6	6.08 N	125.94 E	145	5.1	
51287	1 30 25.0	7.09 N	126.70 E	25	5.3	C.DE ORO;PALO-RF2
81087	9 59 2.8	5.70 N	126.20 E	33	5.1	
102387	4 53 25.2	5.30 N	125.40 E	100	5.3	BISLIG-RF2
112887	4 5 29.5	7.70 N	126.40 E	57	5.2	
122387	10 11 46.1	7.80 N	126.50 E	55	5	
70588	8 6 42.5	6.54 N	125.08 E	178	5	
81089	1 55 54.9	5.90 N	124.35 E	37	5.2	
81089	11 46 27.9	6.00 N	124.35 E	38	5.3	COT-RF6
21389	12 15 16.5	5.10 N	126.95 E		5.1 B	SP-RF3
41490	5 29 50.1	7.98 N	126.64 E	66	5.5	MB:BSP-RF4;V6-RF2

Figure 3-14f
SEISMICITY DATA OF REGION XI

PHILIPPINE INSTITUTE OF VOLCANOLOGY (continued)

DATE	TIME	LAT	LONG	DEPTH	MAG	REMARKS
31590	22 19 23.7	5.45 N	126.99 E	33	5	MB
31890	16 48 55.3	6.20 N	125.49 E	33	5	MB
110790	14 36 27.7	5.64 N	125.25 E	78	5.5	MB;NEIC
112290	5 30 17.4	5.29 N	125.42 E	33	5.1	MB
21690	22 50 26.7	7.41 N	126.44 E	33	5.1	MB
21490	18 3 57.3	6.28 N	126.38 E	90	5.2	MB
21690	22 50 26.7	7.41 N	126.44 E	33	5.1	MB
51590	16 33 35.4	5.72 N	126.24 E	33	5	MB
61390	16 41 53.4	6.40 N	126.39 E	78	5.6	MB
61390	23 0 43.9	5.77 N	124.60 E	77	5	MB
61990	21 33 3.1	5.89 N	125.35 E	34	5	MB
80590	18 48 20.1	6.04 N	126.86 E	129	5	
91290	10 21 49.3	6.35 N	126.38 E	90	5.6	MB
91790	18 41 54.7	5.65 N	124.73 E	42	5.2	MB
112390	7 41 56.8	5.58 N	125.79 E	20	5.7	BSP RF2 MINDANAO FAULT
120190	18 25 41.5	7.62 N	126.59 E	77	5.2	BSP-RFII,CGP-RFI(MB)PFAUL
42691	17 37 4.2	7.84 N	126.15 E	17	6	9STA BSP-RF5,CGP-RF2
72391	11 22 10.1	5.82 N	125.89 E	146	5.6	MB; NEIC DATA
112191	12 38 49.0	7.05 N	125.72 E	12	6.2	DAVAO-RFIII
20692	13 50 52.4	7.10 N	124.98 E	14	5.3	FELT AT DAVAO
32492	22 48 3.4	7.13 N	124.92 E	18	5	
50792	22 12 43.1	6.73 N	124.59 E	10	5.1	CTB-RF2;CGP-RF1
50892	20 53 20.9	7.76 N	124.95 E	33	5.6	CGP-RF2
50992	2 25 55.1	7.81 N	125.06 E	17	5	CGP-RF3
51792	10 15 31.6	7.31 N	126.95 E	16	7.3	BIP-RF5;PLP-RF3;MAP-RF2
70892	23 10 3.0	7.81 N	126.85 E	70	5	BIP-RFII
51193	18 46 54.4	7.57 N	126.51 E	11	6.6	
51493	10 1 40.7	7.14 N	124.87 E	29	5.2	
51593	1 55 40.2	7.23 N	126.82 E	13	5.4	BISLIG-RF3,CAG DE ORO RF2
60493	10 50 27.2	7.08 N	126.15 E	17	5.7	
72493	2 2 38.5	7.64 N	126.29 E	58	5.1	DAVAO RF2
81993	15 21 50.7	7.70 N	126.39 E	8	5.7	BISLIG, S.DEL SUR-RF3
81993	21 52 8.2	7.21 N	126.69 E	12	5.2	BISLIG, S.DEL SUR-RF2
100893	5 16 29.9	7.36 N	126.29 E	8	5	
102793	7 18 46.2	6.81 N	125.67 E	23	5.1	DMP-RF5;KCP-RF3;CTB-RF3
112393	15 2 13.5	6.38 N	125.72 E	14	5.1	G.SANTOS, D.DEL SUR-RF2
112293	3 1 11.1	6.81 N	126.04 E	23	5.3	DAVAO CITY-RF1
112493	12 29 56.4	6.46 N	125.99 E	59	5.6	
121193	8 47 43.0	7.54 N	126.15 E	18	5.1	BISLIG-RF2
51792	10 15 31.3	7.19 N	126.76 E	33	7.5	
61194	11 19 39.0	7.57 N	126.55 E	28	5.2	BISLIG - RF2
70694	9 13 19.4	6.50 N	125.90 E	110	5.6	KCP-RF3,DMP-RF4,GSP-RF3
82894	15 41 27.7	5.71 N	126.44 E	30	5.8	
92094	8 45 30.8	7.56 N	126.43 E	4	5.6	DMP RF3
110694	11 53 11.6	7.55 N	125.93 E	23	5.7	DAVAO RF2
21995	0 17 44.4	5.05 N	126.31 E	7	5.5	DAVAO,BUTUAN-RF3,KCP-RF2
40495	17 21 12.0	6.27 N	126.59 E	104	5.8	GENERAL SANTOS - RFI
42095	5 54 25.8	6.29 N	125.75 E	4	5	
42095	8 45 17.2	6.46 N	126.79 E	70	6	DMP-RFV,MMP-RFIII,BIP-II
110495	2 9 54.5	6.96 N	125.40 E	16	5	DAVAO-RF3,KCP,GEN.SAN-RF2
52896	20 45 33.0	6.12 N	126.02 E	79	5.4	BISLIG RF3, DAVAO RF2
80496	15 39 33.3	6.15 N	124.70 E	3	5.1	GSP - II
101096	8 22 44.3	7.12 N	126.16 E	4	5.2	DAVAO -PEIS II
101796	16 15 36.6	6.40 N	125.49 E	7	5.6	GSP-3,DMP-2
112196	7 43 37.9	6.50 N	126.45 E	12	5.7	BIP3,DMP2,KCP2,GSP2
41397	4 53 59.4	7.95 N	126.52 E	23	5	BIP - III , SCP - I
52197	10 9 30.1	6.98 N	126.22 E	81	5	
71097	3 40 31.4	7.87 N	126.64 E	31	5.2	
81097	14 13 8.7	6.31 N	126.24 E	6	5.3	DMP-II,GSP-II
91597	13 5 43.9	7.99 N	126.65 E	42	5.9	BIP,PLP-V,SCP,CGP-III
100597	19 0 11.6	6.18 N	125.46 E	190	5.3	GSP INT II,DMP INT II
31198	0 37 45.3	6.43 N	126.04 E	38	5.3	DMP-INT III, GSP-INT II I
42598	15 33 29.0	7.55 N	126.79 E	27	5.1	
71898	16 4 27.0	6.29 N	125.98 E	133	5.3	DMP-II,GSP-II

3.4.2 Conclusions and Recommendations

Recommended Foundation

For preliminary design and cost evaluation purposes, the Consultant does not see any reason to change the report's recommendation to use precast, prestressed concrete piling system consisting 14" x 14" prestressed concrete piles with allowable load capacity of 50 tons each at the following embedment depth:

Northernmost end of expansion	-	21.5 m
Middle of expansion	-	20.0 m
Junction of existing and expansion	-	18.5 m

Liquefaction Potential of the Embankment/Reclamation Material

Intergranular sliding occurs when fine sand or silty sand in a saturated state is subjected to transient loadings such as earthquake loadings. This attempt of the soil mass to achieve denser packing results in pore pressure increase and in a drastic decrease in effective strength, to a point where the soil resistance between particles become non-existent, thus creating a "quicksand" condition.

To avoid such condition, all fill materials must be cohesionless soil and must have a gradation when tested in accordance with ASTM D422 in which not more than 10% of the material passes the ASTM designation sieve size No. 200. The portion passing the No. 200 sieve must be non-plastic, as defined in accordance with ASTM designation 4318, Liquid Limit, Plastic Limit and Plasticity Index of Soils.

Filling operation, whether hydraulic or land hauled, must be so organized as to prevent the accumulation and concentration of silts and fines and other deleterious materials within the site. During the reclamation, it is necessary to carry out field and laboratory tests to ensure that the fill materials meet the required gradation and compaction parameters.

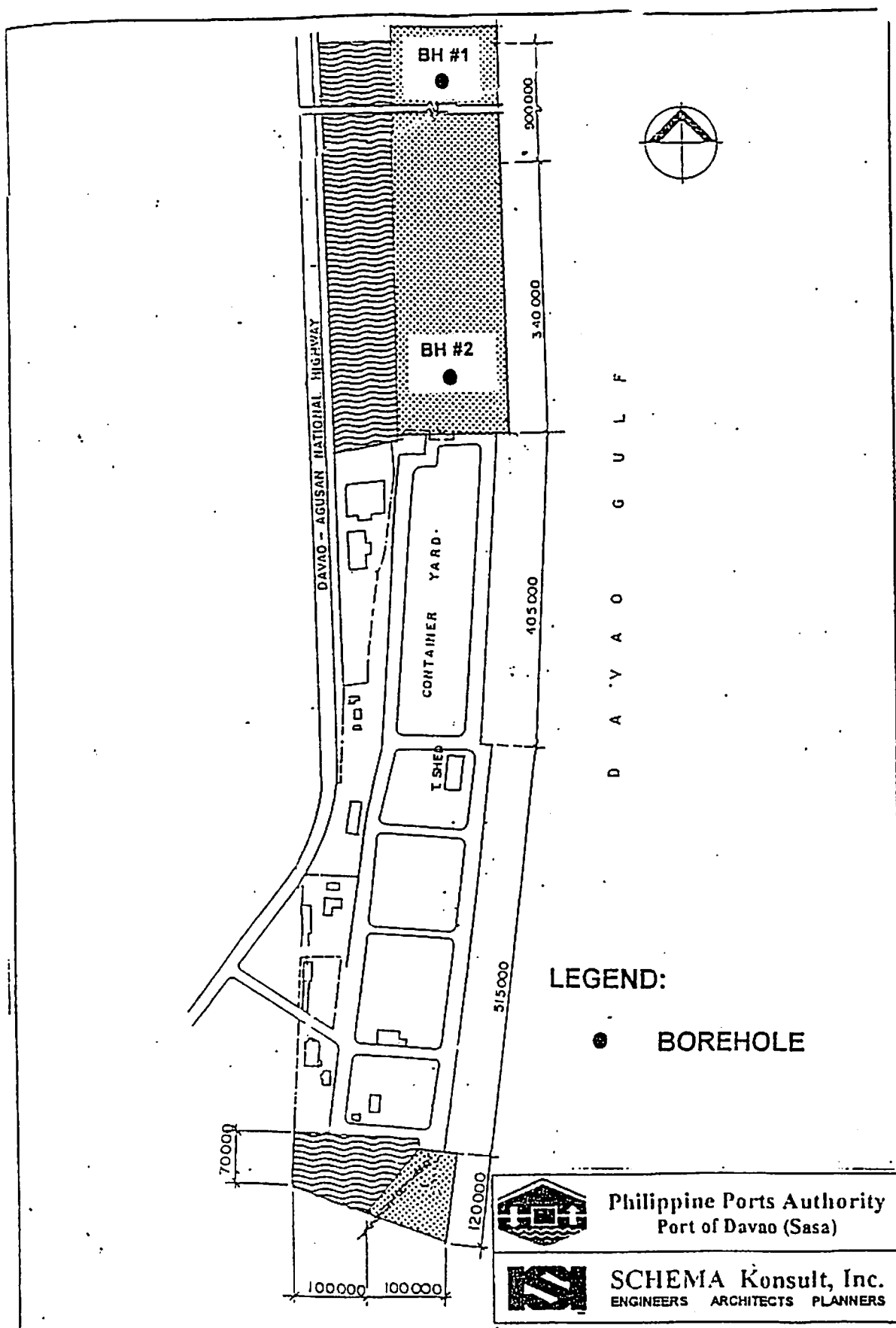
Liquefaction Potential of the Subgrade Soils

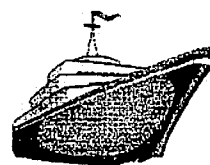
Because of the presence of loose granular soils in the foundation soils, there is concern relative to the liquefaction potential of these soils under seismic loading. Initial analysis indicates that their relative densities will improve during anticipated surcharging, thus reducing the liquefaction susceptibility. It may at times be necessary to utilize stockpiling at areas where the SPT blow counts are low to hasten surcharging.

Lateral Pressures on Cut-Off Walls

Cut-off walls are subjected to earth pressure from the retained soil and from surcharge loadings, including an earthquake acceleration of 0.20g. Provision of drainage of backfill soils must be made to prevent the build-up of hydrostatic pressures behind the wall. Lateral pressure due to the backfill soil depends on the fill material characteristics.

Figure 3-15
BOREHOLE LOCATION (SASA, DAVAO)





Chapter 4

Assessment of Existing Port Operations

Chapter 4

ASSESSMENT OF EXISTING PORT OPERATION

4.1 GENERAL

Port operations and resource planning policies emanate from the PPA Head Office in Manila to the Port District Office and subsequently to the Port Management Office. With the objective of maintaining an orderly arrangement, appropriate utilization of resources, and balanced development of the country, the PPA engages in the following activities:

- overall activities related to the development, utilization, and maintenance of ports including preparation of port projects, research and studies, preparation of statistical data, promotion for utilization of facilities, setting and dissemination of port tariff;
- enhancing port facilities through construction, improvement, and land reclamation;
- maintenance and administration of ports and its facilities including oil waste collection, treatment, and disposal;
- controlling the use of port facilities such as restriction on utilization of water basin facilities and mooring facilities, acceptance of entrance and clearance notices, restrictions on utilization of sheds and cargo handling equipment; and
- provision of ancillary services.

Port operations cover a whole range of facilities and services from the time the ship enters the port to the landside access to the port.

To ensure smooth operations and administrative activities in the port the following procedures has been developed;

- a) Procedures for exchange of persons – these are activities related to emigration/ immigration, which are being handled by the Bureau of Investigation and Deportation.
- b) Procedures for exchange of goods are being undertaken by Bureau of Customs (Department of Finance), Bureau of Quarantine (Department of Health) and Bureau of Animal Industry (Department of Agriculture).

The PPA, on the other hand, has been granted the power to give clearance to vessels in lieu of other government agencies above which include activities to supervise port laborers and enterprises related to the port; provision of institutions for ship berthing and movement in cooperation with local harbor pilots association; and activities related to planning, designing, and construction which is manned by the PPA Head Office.

Private companies which are authorized by PPA provide most of the port-related services including pilotage, towage, warehousing, freight forwarding, bunkering, chandlery, water supply, ship repair, and cargo handling which is the major service at the quay.

Port operations is an important factor since it affects the capacity of a port. Improving port operations will enhance availability of berths for ships, capability of the port to move cargo into and out of vessels, inter-modality of cargo in the port, meaning that cargo and passengers into and out of the port area receive other transportation systems such as airport, rail, and land transport, and also increase in the capability of the port to store all kinds of cargo within the port area.

Thus, the need to examine the existing port operations, taking into consideration the following factors:

- the size and type of ships and the patterns of ship arrivals
- the volume, packing type, and arrival pattern of cargo in and out of the port
- the fixed costs of port facilities, especially cargo handling equipment, storage facilities, and land and sea port facilities
- the cost of ship time in port.

4.2 PORT SERVICES

PPA ports provide services to its users, viz; ships, passengers, and cargo. These include:

Services to Ships	Services to Cargo	Services to Passengers
Aids to navigation Pilotage Towage Mooring/unmooring	Stevedoring Cargo handling on quay Tallying Weighing or weighbridge services	Passenger shed Toilet facilities Canteen Porterage
Water supply Bunker supply Chandlery (food service) Repair of ships	Surveillance Security of cargo Trucking Parking for trucks	Parking space for cars Public transportation Board and lodging Communication facilities
Firefighting Garbage collection and disposal Communication services Emergency facilities for oil spill, etc	Warehousing Freight forwarding Container rental Container cleaning Container repair Equipment and gear rental First aid for oil spill and hazardous waste Disaster in the port Fire truck and fire-fighting capability	Mobile clinic/first aid Public assistance counter

The above services are provided by the PPA and private companies as shown in Table 4-1.

Table 4-1
STANDARD PORT SERVICES

VESSELS SERVICE	PPA	PRIVATE COMPANY
Aids to Navigation	x	
Pilotage		x
Towage		x
Mooring/unmooring		x
Water Supply		x
Bunker Fuel Supply		x
Ship Repair		x
Firefighting	x	
Garbage Collection and Disposal		x
Vessel Traffic Management System	x	
CARGO		
Stevedoring		x
Cargo handling on quay		x
Tallying		x
Cargo surveillance		x
Storage and warehousing		x
Security of cargo	x	
Trucking service		x
Weighbridge service	x	
Parking space for trucks	x	
Freight forwarding		x
Container rental		x
Container cleaning		x
Container repair		x
Port equipment and gear rental		x
Firetrucks and firefighting men	x (LGU)	x

PPA assumes the maintenance of aids to navigation, channels and fairways for safe navigation of vessels within the harbor limits, assignment of anchorage and berthing space, weighing, port police service, and in some ports, watering service. Other port services are contracted out by the PPA to private companies.

Services to Ships

Ships entering the PPA ports are guided by aids to navigation, harbor pilots, tugboats, and communication services from ship to shore. Pilotage is compulsory. Towage assistance is also compulsory for vessels greater than 100 GRT or more, depending on particular port rules and regulations. Aids to navigation such as beacons, buoys, and markers within the harbor limits are maintained by the PPA,

When the ship arrives at anchorage, the harbor pilot, quarantine and customs officials board the ship. The ship waits until its assigned berth is ready and the boarding formalities are finished.

Services to Ships, Cargo, and Passengers at Berth

At berth, passengers are given priority in disembarking operations. Meanwhile, the cargo handler assigned prepares its gang and equipment for unloading and loading of cargo. Bunkering, watering, chandlery, and ship garbage collection are done simultaneously while the ship waits for the passengers to disembark and embark before the start of cargo handling operations. The ship crew and shipping agent present their bill of lading, cargo manifest and other papers to the PPA and other officials for entry and clearance requirements.

Other services, which are provided in the port, include mooring and unmooring (also known as line handling service or berthing/unberthing) which is handled by private companies.

Services to Cargo and Passengers to and from the Hinterland

Most passengers disembarking the ship take public transportation to their destination. Passenger amenities provided by the port include passenger shed, portorage, canteen, parking space for cars and other vehicles, and in some ports, toilet facilities.

Cargoes are unloaded from the ship to the quay while waiting for the delivery truck or from the ship to the quay to the marshalling yard or transit shed or container yard using the cargo handling operator equipment and port labor.

4.3 ROLE OF PPA AND ITS CONTRACTORS IN SERVICING SHIPS, CARGO, AND PASSENGERS

PPA Assigns Berths to Incoming Ships

PPA reserves the right to assign berths to incoming ships, to transfer ships to another berth, as necessary, and to clear ships for departure. When a ship wishes to enter a PPA port, the shipping agent applies for berthing allocation with the Marine Terminal Section of the Port Services Division, at least 24 hours before ship arrival.

The Harbor Master, the head of the Marine Terminal Section calls for a berthing meeting with the representatives of shipping lines, the cargo handling operator, harbor pilot association, tugboat association or company, and the consignee or shipper. Berthing meetings are held daily. During the meeting, the Vessel Operations Commitment (VOC) is forged between the shipping line and the cargo handling operator as regards to labor and equipment deployment and number of hours or days it would take to unload and load the cargo of the vessel. When the work is finished, the cargo-handling operator submits a post-vessel operations evaluation report (PVOER) to the PPA. The harbor pilot is given a copy of the application for berth allocation (ABA) for reference.

Berths are usually given on a "public-use principle" or a "common-user principle". Other factors, however, are considered in the assignment of berth to ships and these include, availability of berthing space, ship characteristics (LOA, draft, GRT, whether passenger ship or cargo ship or carrying perishable cargo or specialized cargo), and estimated staytime of the ship. Ships whose company leased a storage area in the port are given priority in the berth next to their leased area.

PPA Builds the Port Infrastructure and Some Superstructures, as Well as Repairs and Maintains these Facilities.

PPA builds the quay, buildings, provides electricity, lighting facilities, and water in the port. It also repairs and maintains these facilities. Then, it awards cargo-handling operations and permits to occupy and permits to operate ancillary services and other businesses in the port.

PPA Contracts Out Cargo Handling on Quay including Storage Space in the Port Area

PPA qualifies, accredits, bids, and awards contracts for cargo handling in all PPA ports. This is a joint responsibility of the PPA Head Office, through the Port Operations and Systems Department (POSD), the Port District Office, and the Port Management Office.

Cargo handling on quay refers to the following activities:

- a. receiving and loading cargo from the ship's tackle to the quay;
- b. checking cargo by marks and quantity, acknowledging and signing tally sheets;
- c. sorting and piling cargo in sheds/open storage if not taken direct to truck;
- d. delivery/transfer of cargo to consignee or ship's tackle;
- e. provision of mechanical equipment for receiving/storing/ delivery/ transfer shifting of cargo; and
- f. provision of checking services only when cargo is unloaded or loaded to and from ship side, to and from barges alongside vessels.

Upon award of the contract to the cargo-handling operator, the latter is required, among others, to declare a productivity rate indicator. This is not necessarily the same as that which is agreed upon during berthing meetings using the Vessel Operations Commitment (VOC). Thus, these are two possible sources of productivity indicators for the cargo-handling operator.

The cargo handling operator leases an area as working or operational area and as storage space for cargo handled and its equipment.

The cargo handling operator maintains its own regular dock labor or gangs, its own equipment, and office space. It hires laborers on a contractual or temporary basis, depending on the contract requirements with the shipping lines or tramping companies. It maintains its own equipment pool.

It is also in-charge of collecting garbage from its assigned ships as well as maintaining cleanliness and good housekeeping in its assigned operational area, as agreed upon with the PPA.

The cargo-handling operator likewise provides for security of cargo handled by hiring security guards for this purpose.

— **PPA Leases Space or Working Areas and Permits to Service Producers in the Port.**

PPA manages use of land, buildings, and other appurtenant structures in the port. It has the power to issue permits to occupy, permits to operate, permits to enter, and to use. PPA acts as landlord of the port, with powers to determine land use and to set the limits of its development.

— **PPA Bills and Collects Port Users.**

PPA collects port fees, charges, and rent for use of its facilities and services provided. Usage fees are charges on ships while wharfage fees are charges on cargo. Shipping lines pay their usage fees through their shipping agent or direct to the PPA. Wharfage fees are collected by the cargo handling operator and a percentage given to the PPA. In private ports or unmanned ports, the cargo-handling operator collects on behalf of the PPA and remits payment to it. Rent for use of space or facilities are often paid direct to the PPA.

— **PPA Monitors and Supervises Performance of its Contractors in the Port Area**

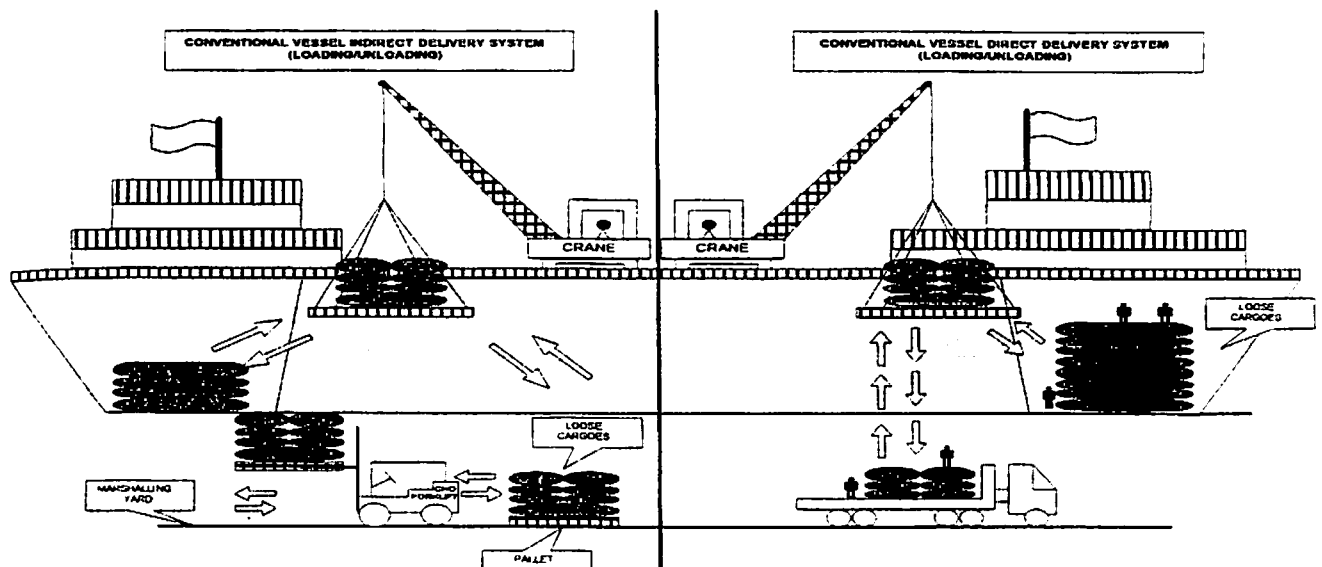
Cargo handling operators are usually assigned to one Terminal Supervisor (TS) for day-to-day monitoring purposes. The TS submits a daily report to the Port Manager about the status of work done on the hatch or movement in cargo or ships. He monitors the performance of the Contractor/Operator using the VOC and the PVOER.

Some statistical reports which are required of cargo handling operators are as follows:

- Vessel Operations Commitment (VOC)
- Post-Vessel Operations Evaluation Report (PVOER)
- Accident Report
- Arrastre Shifting Report
- Report on Damages/Pilferage
- Monthly Equipment Utilization Report

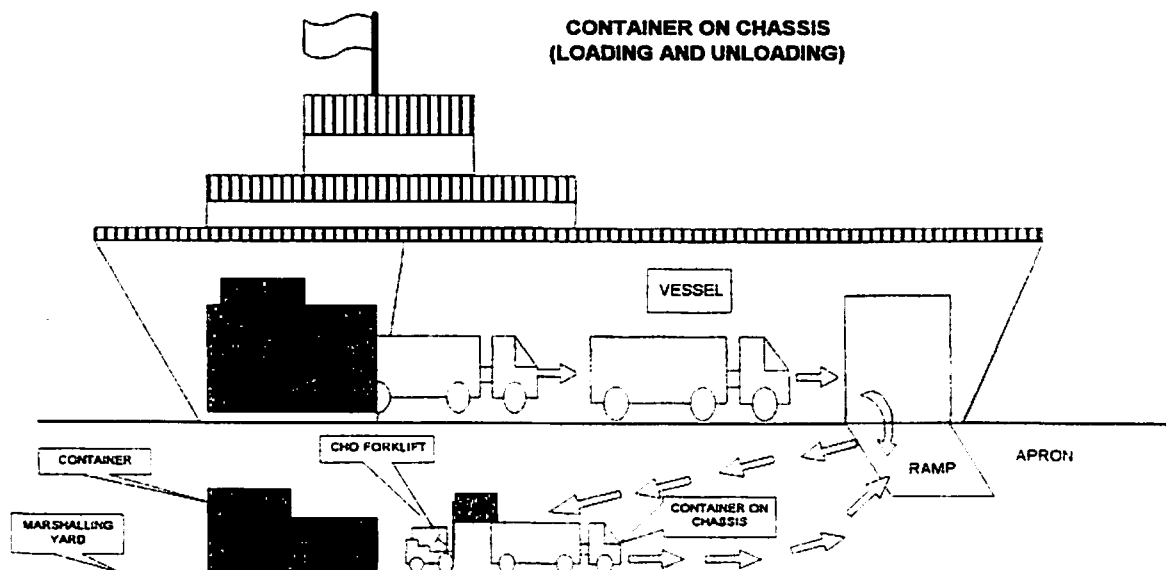
Terminal Supervisors are required to submit a report to the Port Manager about the compliance of the cargo handler through analysis and submission of the above reports.

Figure 4-1
FLOW OF CONVENTIONAL CARGO HANDLING



The flow of container cargo handling is similar although it depends on whether the container is mounted on chassis trailer or stowed on deck or at vessel hatch as presented below:

Figure 4-2
FLOW OF CONTAINER ON CHASSIS



Inbound Container/Unloading Operations

Roll-on- Roll Off Ships: Container on Chassis

Inbound Container/Unloading Operation

Container mounted on chassis is hustled from ship to port apron through the ramp by a prime mover owned by the shipping line. Van number is reflected on tally sheet as it passes the ramp.

At the apron, the van is discharged from chassis through the use of the Cargo Handling Operator's (CHO) forklift. Then Van is stacked at designated area.

Empty chassis is brought to designated area outside the marshalling yard, or sometimes, left at the marshalling yard.

Loading

Empty chassis is hustled from designated area to vans stacked at the marshalling yard.

Van is loaded to empty chassis through the use of the CHO forklift.

Van mounted on chassis is hustled to port apron to ramp and stacked inside the ship.

Van number is reflected on the tally sheet while passing through the vessel ramp.

4.4 CARGO HANDLING OPERATIONS

4.4.1 General

The dock side cargo handling at the port of Davao is done using equipment, laborers and drivers of the private companies or cargo handling operators which are authorized by the PPA. Stevedoring or activities for unloading and loading cargo from ship to shore are done mostly using equipment and men of the client or port user or the shipping company.

Cargo handling consists of many stages and it involves the interface of functions of the PPA and private companies. PPA exercises supervisory and monitoring functions for most of the cargo handling services rendered.

Rationalizing cargo handling operations is important because this is one area where the vessel stay time in the port can be substantially decreased with improvement in cargo handling operations.

The flow of conventional or break-bulk cargo handling is discussed below.

Inbound Cargo/Unloading Operations

Loose cargoes are piled on pallets by laborers inside vessel hatch. Palletized cargo is hooked to ship's gear and lifted from hatch to apron or to waiting truck. Cargo at apron is lifted by cargo handling operator (CHO) forklift truck (FLT) and transferred to waiting truck or to shed or warehouse. Laborers transfer cargo from pallet to truck. FLT takes pallet from truck or warehouse and piles it at designated area. At warehouse, laborers shift and pile cargo.

Outbound Cargo/Loading Operations/Vice-Versa:

Loose cargoes are piled on pallets by laborers. CHO FLT brings pallets alongside ship. Pallets are hooked on ship's gear and lifted to vessel hatch where laborers remove hook. Ship's hook is connected to another cargo on pallet. Ship's gear with palletized cargo is lifted from vessel hatch to waiting truck or apron. Laborer's unhook and hooks the same to another palletized cargo for loading to vessel hatch

Container on Board Roll-on Roll-Off Ship

Unloading Operation

Container van is brought down from ship through the ramp to port apron through the use of shipping lines forklift.

Container van is received at the port apron by the CHO forklift and brought to designated area for temporary stacking. Process continues until all inbound vans are unloaded.

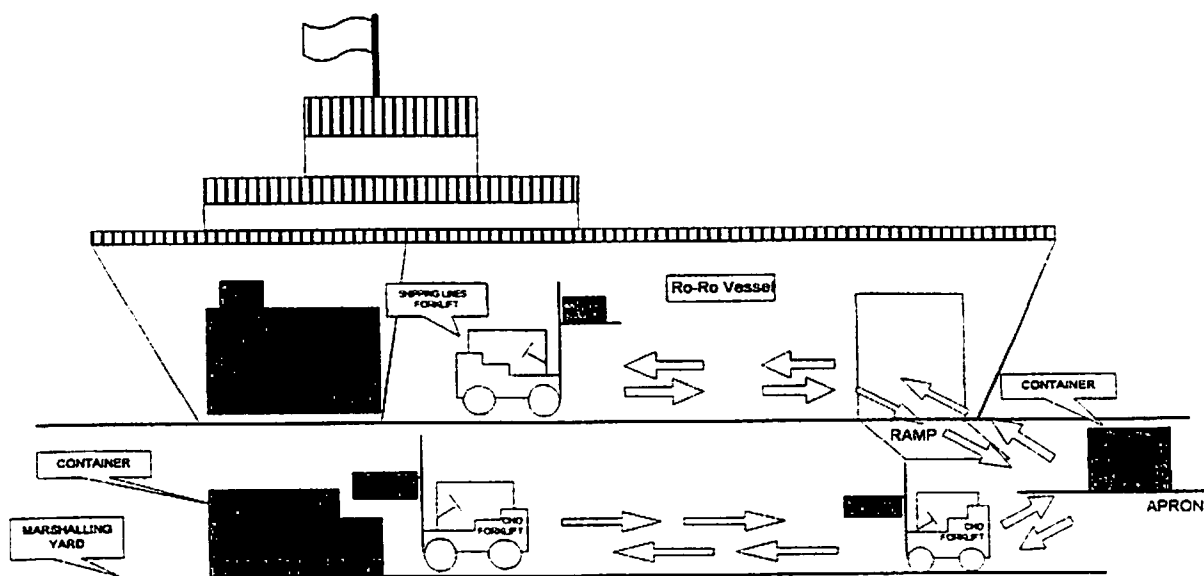
Loading Operation

Outbound vans are brought to the marshalling yard, if possible, before ship arrival. Outbound vans are hustled to the ship through the ramp using the CHO forklift.

On its way back to the marshalling yard, the CHO forklift hustles in bound container to a designated permanent stacking area. The CHO forklift picks up outbound van and brings van to ship through the ramp.

Inbound/outbound vans are reflected in the tally sheet while passing through the ship ramp.

Figure 4-3
FLOW OF CONTAINER ON BOARD ON RO-RO SHIP
(Loading and Unloading)



Conventional Container Carriers (Concarriers) (Gantry/Derrick)

Unloading Operation

Container vans are unloaded from ship hatch to port apron through the use of vessel derrick. All gears below ship's tackle are owned by the shipping lines.

Van number of reflected at tally sheet while at the apron

Van is hustled by CHO forklift from port apron to designated area at the marshalling yard, see Figure 4-4.

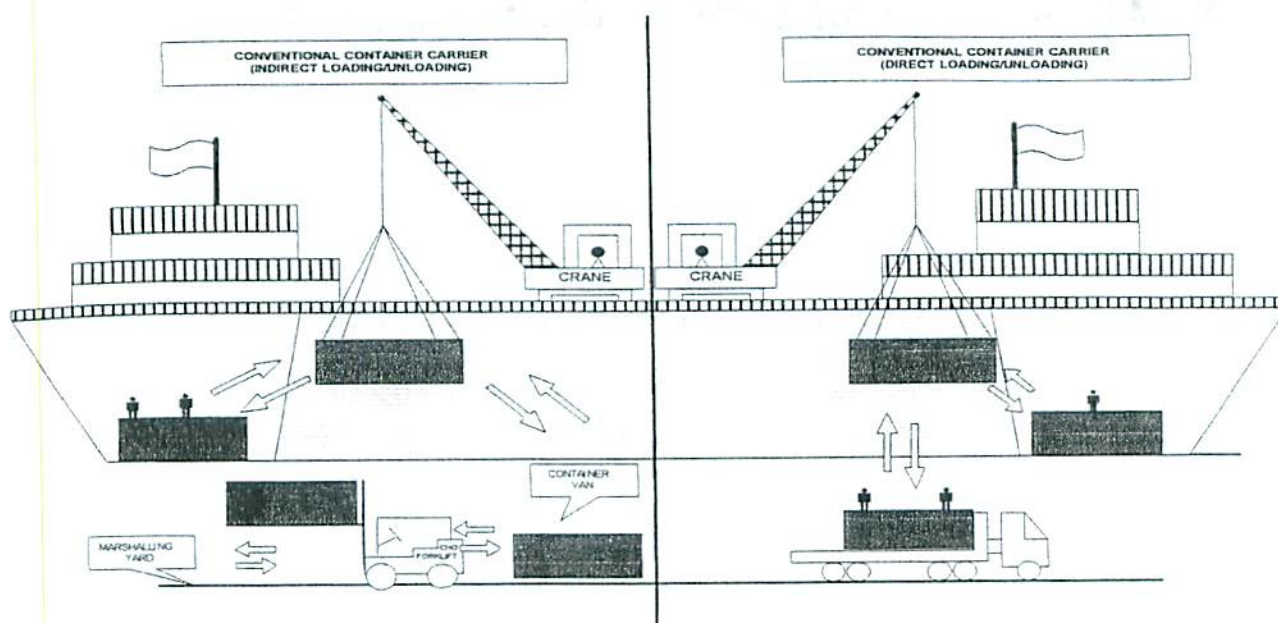
Loading Operation

Container vans are brought by CHO forklift from marshalling yard to alongside ship. Vans are hooked to ship boom and loaded on deck or ship hatch.

Vans are reflected in tally sheet at the apron before it is hooked to ship boom.

Two dockworkers are deployed per boom at dockside to hook van while six stevedores are assigned to vessel hatch to unhook and position the van in designated area.

Figure 4-4
FLOW OF CONVENTIONAL CONTAINER CARRIER



4.4.2 Port Facilities

Sasa wharf measures around 920m x 200m. The old quay measures about 515 LM or five berths while the new quay is about 405 LM or four berths. Depth along side quay in some portions is 10.6m at MLLW. Sasa wharf is a multi-purpose port catering to both domestic and foreign vessels, including Maersk Shipping Lines.

Sasa port operates 24 hours, with two shiftings: day and night shift, from 7:00 am to 7:00 pm, and 7:00 pm to 7:00 am.

Sasa port has passenger terminal facilities including small-improvised cover shed provided by WG&A Shipping Lines for passengers of each fastcrafts.

Sasa port has bagging equipment facilities with a capacity of 4.5 million bags per month at 90 percent capacity.

Top commodities passing through the port are:

Domestic	–	Inbound
		General cargo
		Machinery
		Iron and steel
		Refined petrol
		Chemicals/transport
Domestic	–	Outbound
		Cement
		Fruits and vegetables
		Copra
		Rice and corn
		Live animals

Foreign	-	Import
		Clinker
		Fertilizer
		Paper and pulp
		Machinery and equipment
		Salt

Foreign	-	Export
		Fruits and vegetables
		Coconut oil
		Copra
		Rubber
		Activated carbon

Shipping lines which regularly call on the port have leased some areas in the port for its operations. Examples are WG&A, Sulpicio Lines, and Nenaco for domestic operations and the APL, Maersk, and Gold Link for international shipping line operations.

Sasa wharf has two authorized cargo handling operators: FILPORT and DIPSSCORP. They have the following assignments.

DIPSSCORP	-	APL, Maersk, Gold Link, WG&A
FILPORT	-	Anflo Management, Sulpicio Lines and Negros Navigation Company (NENACO)

Sasa port utilizes the forklift and chassis trailer system for its operation. Domestic inter-island vessels use direct loading too because they own container yards outside the port.

4.4.3 Labor Deployment

Port labor deployment in Sasa wharf depends on the cargo handled. One typical labor deployment for break-bulk cargo is shown below:

Composition of one gang for break-bulk cargo:

6	stevedorers
1	signal man
1	capataz (gang boss)
1	foreman
1	head checker
1	forklift operator
2	slingmen (arrastre)
1	timekeeper
1	delivery checker
1	delivery checker

Total: 16 men

4.4.4 Productivity

Interviews with some cargo handling men revealed that productivity rate for fertilizer is about 500 to 700 bags per gang-hour assuming 50 kilos multiplied by 500 bags per gang-hour or 25,000 kilos, we got about 2.5mt/gang-hour. Foreign vessels often request for more gangs, say 4 gangs instead of 2 gangs which are regularly supplied to domestic vessels.

Work is on two shifts: 8:00 a.m. to 7:00 p.m. and 7:00 p.m. to 8:00 a.m..

4.5 PRIVATE PORTS IN DAVAO CITY

4.5.1 TEFASCO Wharf

Terminal Facilities Services Corporation (TEFASCO) wharf is one of the private ports near Sasa wharf. It is located around 5 kms. away from the downtown area of Sta. Ana. TEFASCO has 400m of berthing space, 4 warehouses and 2 transit sheds. One transit shed is for common users while another shed is exclusively for banana cargo of Solid Shipping Lines.

TEFASCO wharf has ample facilities, with a container yard at the back-up area, estimated at about 30 hectares. It also has facilities for handling break-bulk cargo on pallets, a warehouse for storing cement bags and other commodities, an office building, a canteen and concrete pavement.

Regular calling vessels are from Solid Shipping Lines which is TEFASCO's sister company. Other vessels come from foreign countries such as Korea and other neighboring countries. Vessels of Solid Shipping Lines make approximately two vessel calls each week. They have an assigned berthing space. Inbound cargoes are general cargoes, such as salt, fertilizer, cement and various commodities. Outbound cargoes are mostly bananas.

Port working hours is 24 hours although effective working hours is only 20 hours excluding shift breaks.

Interviews revealed an indicative cargo handling rate, particularly, 3,700mt of fertilizer unloaded at 30 hours.

4.5.2 MINTERBROS Wharf

Mindanao Terminal Brokerage and Services (MINTERBROS) is another private port in Davao Gulf which handles its own cargo. It has a finger pier, with pallets stacked up along the pier.

Approximately one vessel a day calls on the MINTERBROS Wharf. It has front loader forklift equipment and 45ft reefer containers.

Packing system for cargo loaded is "morning packed", "p.m. packed", and "evening packed".

4.6 PORT SAFETY AND SECURITY

The safety system in a port ideally considers passenger activity and the type and quantity of cargo that are handled in the port. PPA considers port safety and security as a primordial concern in the port. It has a system for managing the safety of the port and handling, storage, and transport of dangerous cargo. These systems are partly included in its two basic documents namely, the 'Dockworkers Safety and Health Standards' and the PPA Administrative Order Number C8-97 entitled 'Code of Safe Handling, Storage, and Transport of Dangerous Cargo in Ports'.

The framework for evaluating port safety and security will hinge on these systems and those of other authorities responsible for the safety of the port, cooperation among authorities, bureaucratic procedures, if any, infrastructure, and qualification of those responsible for the safety of the port.

Current responsibilities and procedures of the PPA in promoting port safety, presence of supporting infrastructure, training and related programs, and concerns for future legislation and projects will be studied further.

The Study Team will also use the following indicators in its evaluation scheme as follows:

4.6.1 Passenger Safety and Security at Port

1. When there is a segregation of passenger and cargo activity in the port such that the passengers are not exposed to danger from getting run over by vehicles or hurt by falling cargo.
2. When there is sufficient lighting for passengers while at the port.
3. When there are no cases of theft and robbery in the port.
4. When the aisle and grounds where passengers walk are free from obstruction from cargo and equipment, not slippery, and well lit.
5. When there is a covered walk from ship ramp to passenger shed to prevent passengers from getting soaked in the rain or exposed too much sunlight.
6. When the distance from vessel or passenger shed to parking area for public transportation is as straight and short as possible.
7. When passengers are informed about the portage rates, taxi rates and do not feel harassed by some ancillary service providers.
8. When there is a complaint desk for women, especially and also men and these are addressed on time.
9. when there is a safe and affordable shelter for passengers who were not accommodated in the intended trip.
10. When there are plenty of communications services, especially land phones, within easy reach of port users.

11. When PPA officials or somebody who is in charge of operations and safety become visible to passengers as those who would like to assist.
12. When there is immediate medical service within sight for passenger use while at port.
13. When there are precautionary measures and structures within the port for emergency cases, such as Dockworkers having contact with dangerous cargo.

4.6.2 Cargo Safety and Security at Port

1. When there is minimal pilferage, damages, or loss of cargo.
2. When some types of cargo such as bulk cargo are placed on covered structures in the port.
3. When dangerous cargo are segregated and kept in areas beyond the port limit or preferably directly transported outside the port.
4. When containers are properly stowed in the open yard.
5. When cargo handlers observe proper stowing and combination of cargo in the shed or warehouse.
6. When there are abundant fire extinguishers at strategic places in the port, in case of fire.
7. When there is sufficient lighting and ventilation for cargo.

Initial findings of the Study Team showed that both the PPA and the cargo handling operator provide security men in the port. The PPA-PMO maintains a port police division while the cargo handling operator hires security guards to watch over their office, equipment and cargoes.

PPA-PMO coordinates with Philippine National Police (PNP) and the cargo handling operator for the promotion of port safety and security. The main concern of PPA security personnel is the safety of PPA personnel and properties of the PPA in the port. The Port Police Division is also concerned with some order in the port.

Cargo-handling operators are likewise given responsibility to respond to emergency situations such as fire and other and natural disasters in the port. They are required to put up safety signs and slogans in conspicuous places in the port and to send their operations men to training on port safety, fire fighting, first-aid and similar training courses. PPA implements the Performance Standard and Rating System (PSRS) which rates every month the compliance of the cargo operator to their management contract with PPA regarding safety and fire fighting.

Interviews and reports also revealed that the most of the cargo handling personnel and PMO personnel need more training in port safety and security. The cargo handling operator also needs to provide additional firefighting equipment and facilities for emergency situations for port workers, passengers, and personnel as regards to oil spill and other dangerous cases.

4.7 ANCILLARY SERVICES

Ancillary services are those services (except cargo handling, portorage services, and pilotage services) performed inside the port, including its fairways, harbors, and extensions, involving provision/application/use of equipment, facility, utility, manpower/expertise, and goods (PPA AO-08-96).

Examples of ancillary services are as follows:

- cargo cleaning service
- equipment/appliance hire
- vessel maintenance/repair
- waste disposal service
- bunker supply
- canteen service
- cargo surveying service
- chandling
- cleaning service
- container repair
- communications service
- fumigation
- laundering
- lighterage/barging service
- parking/garage service
- reproduction service
- security service
- shops/stores
- transport service
- towing service
- water supply
- water taxi
- weighbridge/truck scale

Ancillary services which are oftentimes provided by the PPA include weighing/weighbridge services, lighting services, and water supply services. Some services such as aids to navigation, firefighting and rescue operations, port police protection are provided by the PPA and subsumed on a different fee or charge. The rest are on account of the private company service providers.

Permits and contracts for ancillary services are given on a one-year, two-year, or three-year or more basis. Permits that are valid for one year are issued by the PMO. Those which last for two years are processed by the PDO and PMO. Three years and beyond will be processed through the PMO and sometimes, the Head Office.

Ancillary service providers pay 10 percent of their revenues if they are classified as either cargo cleaning service, equipment/appliance hire, vessel maintenance/repair service, or waste disposal service. Other service providers pay an annual registration fee of P1,500.00.

At the PMO, the Permits and Licensing Officer (PLO) processes applications for ancillary services. The application is routed to the Engineering Services Division (ESD) for comments on the area to be allocated and whether or not the business will affect engineering plans or operations. It also needs comments of the Port Services Division (PSD) on whether it will affect port operations and the Resource

Management Division (RMD) for rates, fees, or charges, and to check for any outstanding obligations of the applicant.

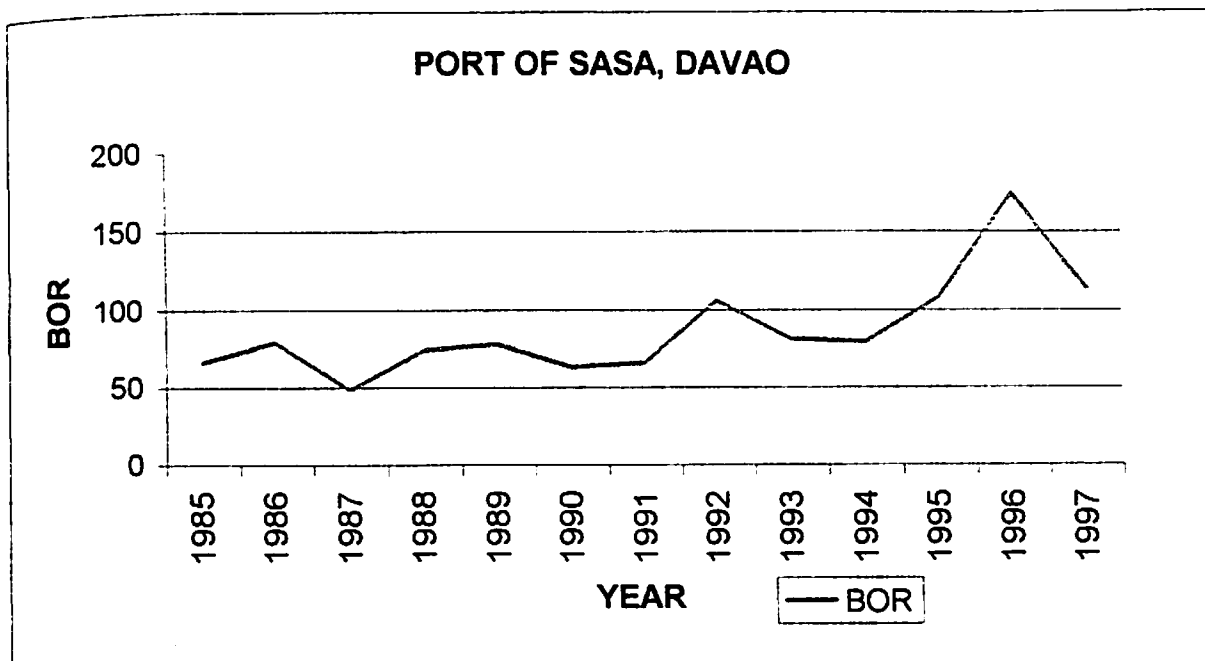
Qualification standards for ancillary service operators are based on their administrative/organizational, financial, and operations standing. The 'Terms and Conditions' of the permit/contract are explicit. Permits may be revoked on valid grounds which are stipulated in AO No. 08-96.

Almost all kinds of services which can be offered in the port are existing in most major PPA ports. There are existing rules and regulations on the entry and exit of ancillary service providers. But there are no standards or methods of determining the adequacy of port services, or of protecting the investments of prior investors. The port users choose and negotiate with the ancillary service providers.

During the site inspection of the Study Team, it was observed that some ancillary services are more than adequate such as eateries, shops/stores while some services are hardly adequate either because they are seldom availed of (as in container repair and cleaning services) and cleaning of port grounds from wastes due to operation, passengers, and bystanders litter which are most of the time insufficient since this function is relegated to the cargo handling contractors.

BERTH OCCUPANCY RATE (BOR) DATA AND COMPUTATION

PORT OF SASA, DAVAO CITY



YEAR	No. of Ves. Vt	Ave. LM.of Ves. Asl	Ave.Gross Ser. Agst	Total LM of Berth L	Total No. of days T	BOR
1997	898	118	37	920	8640	54
1996	1030	90	72	920	8640	92
1995	787	108	42	920	8640	49
1994	625	108	44	920	8640	41
1993	621	102	54	920	8640	47
1992	497	105	49	920	8640	35
1991	586	104	42	920	8640	35
1990	712	90	61	920	8640	54
1989	718	89	80	920	8640	71
1988	810	85	66	920	8640	63
1987	769	75	65	920	8640	52
1986	580	95	57	920	8640	43
1985	638	64	59	920	8640	33



Chapter 5

Socio Economic and Regional Infrastructure Profile

Chapter 5

SOCIO-ECONOMIC AND REGIONAL INFRASTRUCTURE PROFILE

5.1 GENERAL

This chapter discusses the socio-economic setting of Davao cluster where the Port of Sasa, Davao is located. The discussions in this chapter were generally lifted from the Mindanao 2000 Development Plan ¹.

5.2 SOCIO-ECONOMIC PROFILE OF DAVAO GULF AREA

A. Location and Natural Resources

The Davao Gulf Area Development Zone lies in the southeastern section of Mindanao, bounded by the SOSKSARGEN in the south, CARAGA in the North, Central Mindanao in the west, CIC ADZ² in the northwest and the Davao Gulf and Pacific Ocean in the east. Spanning a total land area of 19,671.83 sq.km, it is composed of Davao City, Davao del Sur, Davao Province (or Davao del Norte), and Davao Oriental. Forestland occupies 63% of the total land area, while the remaining land is classified as alienable and disposable. The area is characterized by extensive mountain ranges in the southern, central, and northwestern portions, and an uneven distribution of wide fertile valleys, flat areas, plateaus, swamps, and low land areas which are found mostly in the central portion of each province.

Davao Gulf is blessed with mild tropical weather and adequate rainfall, which varies from 908mm to 1,804.3mm per annum, and temperature ranging from 20°C to 33°C.

Mineral deposits of gold, copper, silver, iron, lead, and chromium, and non-metallic mineral deposits of shale, limestone, lime, silica, white clay, molybdenum, sulfur, phosphate, guano, sand, and gravel are found in the area.

B. Demographic Profile

Population

Based on the 1995 census, the Davao Gulf ADZ has a population of approximately 3.66 million; average annual growth rate is 3%. Davao del Norte accounts for the largest share, comprising 42.6% of the zone's population. It also has the highest growth rate, with an average of 4.6%. Davao Oriental is the least populated, comprising some 11.3% of the zone, and with an annual growth rate of 1.6%. The zone has a population density of 185 persons per square kilometers in 1995.

Prepared under the Agricultural Policy Research and Advocacy Program, Office of the President for Mindanao, and DMJM International, Inc.

ADZ - Area Development Zone

PORT OF SASA, DAVAO

Significantly, Davao City - the commercial and regional center of the ADZ, is also the largest city in Mindanao and in the EAGA with a population of 1,006,840.

Labor Force

Roughly 60% of the total population, or 2.2 million people, belong to the working age bracket of 15 years and above. Of the total, 63.4% are in the labor force.

Out of the 1.4 million persons in the labor force, 94.2% are employed. About 30.5% are underemployed, or working less than 40 hours a week and still seeking additional employment. The agriculture sector accounts for more than half of the total number of people employed.

Income

In 1994, the estimated total household income for the Davao Gulf ADZ reaches P62.72 Billion with an average annual family income of P70,711.

In 1988, nearly 33% of the total number of families had a yearly income of less than P20,000. Majority of the families, or 54%, earned more than P20, 000. The up trend is likewise reflected for those earning P60, 000 and over as their percentage increased from 7% in 1985 to 13% in 1988.

But between these periods, total family expenditures grew by P2.9 Billion while the average family expenditures rose by P15, 163.

C. Economy

The Davao Gulf ADZ shall be the trade, commerce, and tourism hub of Mindanao, particularly for the EAGA/ASEAN, East ASEAN and Oceania markets backed by a globally competitive agriculture sector.

Agriculture/Agri-Industry

Davao Oriental is the source of 61% of the zone's total coconut production. Davao del Norte accounts for 63% of banana, 76% of rubber, 66% of camote (sweet potato) and 56% of rice produced in the entire ADZ. Of the 220,606 MT of corn harvested in the Davao Gulf zone, the biggest portion (47%) comes from Davao del Norte. Davao del Sur is the only major producer of sugarcane. It also supplies most of the zone's cacao and mango (73% and 60%, respectively).

The Republic Flour Mills (RFM), San Miguel and Vitarich are among the major feed milling and livestock companies in the zone. Other large industries are Davao Activated Carbon, Interco Manufacturing Corporation, Legaspi Oil Mills and Franklin Baker Co. which are involved in coco processing; and the United Cotton Ginnery of Mindanao Inc. which does primary cotton processing.

The Davao Gulf ADZ is one of Mindanao's top exporters of agricultural products. Exports, which originated or are transshipped from Davao City are mainly food and live animals, and crude materials. In 1993, about 67.8% of Davao City's exports were fresh bananas, followed by crude and refined coconut oil. Other major exports of Davao City were fresh and/or dried coconuts (2.4%) and natural rubber (2.3%). Fresh and chilled fish are also major products transshipped through Davao City.

Some of the potential agricultural and agri-industrial activities for the zone are:

- a) Establishment of fruit and vegetable processing centers. This includes expanding the fruit production area and developing the capability for vapor heat treatment of export fruits. In addition, seedling banks should be set-up to monitor and supervise the distribution of good quality planting materials;
- b) Intensification of rice production by providing adequate inputs. This is to be supported by post-harvest facilities for drying and storage;
- c) Setting up of an industrial tree plantation in Davao del Norte which has extensive areas of logged-over forests. Increased production of bamboo is likewise encouraged.
- d) Expansion of abacca fiber production in Davao del Norte. It is proposed that fiber crops be raised on sloping land so that prime level land may continue to be allowed to annual crops;
- e) Diversification of coconut by products;
- f) Expansion of the livestock and poultry industry; and
- g) Development of the ornamental horticulture industry which has promising prospects in the foreign market.

Manufacturing

In the manufacturing sector, 95% of the 1,184 firms in the three Davao provinces are small scale, of which 43% are primarily engaged in the manufacture of fabricated metal (excluding machinery/equipment and furniture/fixtures). The second top manufacturing activity is for other non-metallic mineral products and the third is the manufacture of machinery (except electrical). The remaining 37 medium scale and 15 large scale manufacturing establishments operating in the three provinces are engaged in the manufacture of the above commodities and other such as non-metallic mineral products, rubber products, non-ferrous basic metal industries, industrial chemicals, transport equipment, and paper products. They are also into printing/publishing and allied industries.

Heavy Industries

Heavy industries found in the economic zone are limited to plywood manufacturing, cement manufacturing and shipbuilding/ship repair. Most heavy industries are based in Davao City.

The Davao Union Cement Corporation is presently serving the Mindanao and Visayas markets. Currently, it is undergoing an expansion program to satisfy the needs of the domestic market and allow the company to explore markets abroad, particularly EAGA.

The shipbuilding/ship repair industry is still in its planning stage, but once it becomes operational, the Davao Shipyard is foreseen to service vessels with a dead weight tonnage of up to 10,000. Its strategic location in Samal Island will also enable it to service commercial vessels plying the Southern Mindanao, North Sulawesi, and Celebes Sea routes.

Services

In the provinces of Davao del Sur, Davao Oriental, and Davao del Norte, there are 8,139 establishments concerned with community, social and personal services, 97% of which are small scale in nature. The top three (3) services establishments are (1) restaurants, cafes, and other eating and drinking centers; (2) repair of motor vehicles and motorcycles; and (3) amusement and recreational services.

A total of 8,016 establishments in the zone are engaged in wholesale/retail trade activities. Of this total, 44% are classified as small-scale establishments.

The Davao Gulf ADZ has about 980 establishments engaged in financing, insurance, real estate and business services, with or 80% of the establishments employing less than 20 persons, the most common of which is the provision of professional services.

Infrastructure

The Davao Gulf ADZ is said to have the most developed infrastructure of all the ADZs in Mindanao because of the presence of an extensive arterial road network, an international airport and an adequate container port.

In terms of road network, its arterial roads inter-link the major agricultural production areas to the commercial centers, in Davao del Sur, Davao City, Davao Province and Davao Oriental. The eastern parts of North Cotabato also use Davao City as a source of inputs and a channel to sell their products. The Pan-Philippine Highway, which then links Davao to Cagayan-Iligan Corridor (CIC), Leyte, Samar, and Luzon, links the ADZ itself to the CARAGA ADZ Area (occupied by Surigao City, Butuan City, Surigao del Sur, Surigao del Norte, Agusan del Norte and Agusan del Sur). It is also linked by paved roads to the Greater Cotabato Lanao Area, to SOSKSARGEN and to the CIC ADZ.

Table 5-1 shows the list of road projects under the Davao Integrated Development Program (DIDP). Figure 5-1 shows the Transport Artery System for the Davao Integrated Development Project Area.

The Sasa Wharf is the central seaport and is the principal outlet for most commodities produced in the Davao Gulf ADZ. It is complemented by the Sta. Ana wharf which has a limited capacity depth, by TEFASCO which is a private wharf catering to general cargo, and by other private wharves which cater to specific industrial needs like shipping bananas to Japan and bulk handling of copra, coconut oil and related products, and inputs to flour milling.

The airports in Davao and Gen. Santos City are the largest and most developed in Mindanao. At present, they are the only airport serviced by Airbus A300s bound for Manila and Cebu. Davao airport also has regular flights to Zamboanga and Cagayan de Oro. Two international flights serviced by Bouraq Airlines connect the Davao airport to Manado-Denpasar in Indonesia. Philippine Airlines also opened a route to Hongkong via Cebu, using an Airbus A300.

All of the urban centers of the ADZ have telecommunications services with Davao City having a wide array that includes cellular services, satellite and microwave links, as well as national and international direct dialing. The most number of telephones are located in the Davao Gulf ADZ, but aside from the urban centers, few of the municipalities have telephone services. In these areas, the two-way radio is the only means of modern communication.

The ADZ is integrated into the Mindanao Power grid, and the franchise area covered by the Davao Light and Power Corporation is supported by a diesel power generating plant which serves to stabilize the voltage of power during periods of peak demand and acts as a buffer when power supply from the National Power Corporation falls short of demand in Davao City.

D. Strength Analysis of Davao ADZ

➤ Adequate infrastructure

A major strength of the Davao ADZ is the presence of basic transportation infrastructure and services for efficient production and export. Many of the rural areas are linked to Davao City with only the municipalities in the East Coast of Davao Oriental and Davao Sur relatively isolated by poor arterial roads.

➤ Presence of respected educational institutions

The Davao Gulf also takes pride in its public and private educational institutions, which have good quality primary, secondary and tertiary education standards. Professional courses such as medicine, architecture and computer science are offered by various institutions. While the Ateneo is already well established in the City, prospects are even brighter for the advancement of the Gulf's education sector as the University of the Philippines opens its first Mindanao campus in Davao City.

➤ Well organized private sector groups

The presence of well-organized private sector association allows for the meaningful participation of the private sector in the development of the ADZ. For example, the Davao City Chamber of Commerce and Industry, Inc. has exhibited the capacity to administer development programs for small and medium scale business. It is also active in strengthening chambers in other areas.

Cooperatives and people's organizations are successfully operating small and large enterprises involved in grains procurement, marketing and management of post-harvest facilities servicing primary cooperatives, fresh milk and dairy processing, meat processing, medical services, construction material manufacturing and credit.

➤ Geographic advantage especially within the EAGA

Davao is the largest urban center in Mindanao and the EAGA, and has a wide range of products and services, which can be offered to the region, especially to the EAGA market. This advantage has strategic importance to the zone's goal of being a trade and tourism hub. In addition, EAGA offers vast sources of raw materials, which can be processed or used as inputs to manufactured goods in Davao Gulf.

The EAGA also has a wide range of eco-tourism attractions and Davao can serve as the gateway to this tourism region.

➤ Agro-climate endowment

The gulf is blessed with productive soil, even rainfall throughout the year and is outside the typhoon belt, making it an ideal site for agricultural production. The climate likewise appeals to tourists.

Agriculture and Agri-Industry

The agricultural sector of the Davao Gulf builds its reputation of strength on the following:

i) *Strong market share in global and domestic markets*

The Davao Gulf dominates the Japanese banana market and directly export coconut oil and other processed coconut products to the world, while serving as the transshipment point for air cargo of fresh fish to Japan. Davao is also a major supplier of fruits (i.e., durian, bananas, and papaya), cutflowers and livestock for the Manila market.

ii) *Tradition of export orientation*

Many of the agribusiness firms here have strong network and experience in exporting, mainly because of the banana and coconut exports. But they have shown capacity to diversify into other products to meet new market opportunities.

iii) *Pockets of global quality excellence*

The Davao Cavendish banana has successfully established a global reputation for good quality and has set the standard for exports in the Asian market.

iv) *Large Agribusiness Firms with Established Marketing Network Infrastructure*

Agribusiness companies such as Dole, Del Monte, San Miguel, Universal Robina, RFM and others have the installed capacity for agri-processing as well as global Networks. These companies' production and marketing infrastructure serve well to benefit even the small farmers through various production arrangements such as contract growing and joint ventures.

E. Industry and Services

Well Developed Banking and Financial Services

Given such factors as an able workforce, strong Private sector organizations and geographic advantage to the EAGA, many major commercial banks have set up Mindanao branches in Davao City.

F. Tourism

Davao's advantages in this sector lend support to environmental and eco-tourism thereby becoming the tourism hub of Mindanao.

Diversity and Beauty of its Tourism Resource Close to City Center

A diverse mix of tourism enticements is all within a few hours of the major urban center. Among the Gulf's major attractions are the white sand and black sand beaches, Mount Apo nature park, game fishing, diverse cultures and ethnic groups, the Philippine Eagle breeding grounds and cool upland resort areas.

Samal Island Tourism Estate as Flagship of Philippine Tourism Master Plan

The flagship status of the Samal Island Tourism Estate will create the "critical mass" for the full development of the tourism industry in the gulf. Pioneering in the development of the estate is the Malaysian group Ekran Berhad, which has plans to set up accommodation, recreational and sports facilities in a total area of 6,000 hectares in the Samal and Talikud islands.

International Airline Service

With the upgrading of the Davao airport, the Gulf is now a destination of international flights such as Bali-Manado-Davao and Hongkong-Cebu-Davao routes. Other airlines are also keen on opening services to Davao.

5.3 REGIONAL INFRASTRUCTURE IN MINDANAO

Adding to Mindanao's extensive transportation infrastructure network, a host of projects from bridges and ports to airports are being implemented all over the southern island in preparation for the greater public works requirements of the island.

Based on Department of Public Works and Highways (DPWH) figures, Central Mindanao registered third highest accomplishment level at 59.2%, 4.5 percentage points higher than its target of 54.7 percent. It was also one of the three regions which surpassed their targets for the region.

5.3.1 Road Network

Mindanao Arterial Roads System

Mindanao has a road network consisting of 53,102 km or 33% of the country's total of 160,843 km. Of the entire Mindanao road network, only a small portion (8.7%) is classified as paved, the lowest ratio among the three main islands of the Philippines. Paved ratio for local roads is 3.8% which is also far below the national average of 9.6%. To reach the national average and to make the area more competitive, Mindanao must pave an additional 2,694 km. of local roads.

Mindanao's public road network, as with the rest of the Philippines, has been classified into four categories based on administrative responsibility: National Roads (or arterial roads), Provincial Roads (mainly secondary), Municipal/City Roads (generally urban) and Barangay Roads. The Department of Public Works and Highways (DPWH) directly undertakes the construction and maintenance of all national roads, while the local government units (LGUs) handle the secondary or feeder road which are the provincial, municipal/city and barangay roads.

The Mindanao arterial road network is further classified according to importance and contribution to the physical integration of the island. The *North-South Backbone* is the network that provides the major arterial roads connecting all regions of Mindanao. This also serves as the major road link between and among the urban centers of the whole island. The *East-West Laterals* are the roads that cut across the island to provide lateral interconnection to the north-south backbone network. There are also *Other Strategic Roads*, which provide vital access to important areas and to other coastal municipalities in mainland Mindanao, as well as in the offshore islands.

The Mindanao arterial road network is in the process of being upgraded by on-going road improvement projects which are funded both from official development assistance (ODA) and locally generated funds. The least developed sections of the arterial road network lie in the northwest and central sections of Mindanao encompassing the provinces of Zamboanga del Sur, Lanao del Sur and Maguindanao, which are also among the poorest provinces in the country.

The road sub-sector thrust for Mindanao is aimed at the development of the national arterial roads network and the national secondary roads network to provide an efficient trunk line system linking other transport modes to serve the regional and provincial growth corridors and major urban areas (particularly in the existing and potential major agro-industrial and tourism centers). Also, the participation of the private sectors will be encouraged in the implementation, maintenance and development of road projects.

Table 5-2 and Figures 5-2 to 5-3 shows and illustrate the status of arterial road improvement in Mindanao.

5.3.2 Airport Transportation

At present, available air transport service is not adequate for the needs of Mindanao. There is no airport serving carriers to major destinations like Japan, the United States or Europe. Most international passengers and air cargo from Mindanao must first pass through Manila and Cebu airports in order to reach these major international destinations.

There are two classified international airports in Mindanao: Davao International Airport (DIA) on the eastern side, and the Zamboanga International Airport (ZIA) on the western side of the island. DIA serves international connections to Manado (Indonesia) and Kota Kinabalu (Malaysia), while ZIA serves connection to Labuan, also in Malaysia. The facilities of both airports are not international-standard. DIA, however, is slated for upgrading with funding assistance from the Asian Development Bank and the European Investment Bank.

The airport system in Mindanao also includes three truck line airports (General Santos, Cagayan de Oro, and Cotabato), eight secondary airports (Butuan, Dipolog, Iligan, Ozamis, Pagadian, Surigao, Jolo, and Tawi-Tawi), and 13 feeder airports.

The deregulation of air transport routes started in 1995, but the Philippine Airlines (PAL) still dominates domestic air services in Mindanao. Other air carriers such as Grand Air, Cebu Air, Air Philippines have entered some of the more lucrative routes, e.g., Manila-Davao, Manila-Cagayan de Oro, Manila-Zamboanga and Cebu-Davao. Inter city scheduled flights in Mindanao are also available for Davao-General Santos City, and Davao-Tandag-Butuan City via Mindanao Express (subsidiary of Cebu Air). These air carriers currently undertake vigorous promotional campaigns and offer discounted fares.

The airport sub sector development plan for Mindanao aims to upgrade several airports to enable them to operate during nighttime hours, thereby expanding capacity at a relatively low cost, and increasing the options for the scheduling of air transport services.

Furthermore, the sub-sectoral plan also covers the upgrading of several airports to accommodate B737 jet aircraft; improving direct air access to some areas which are relatively isolated at present by rehabilitating or constructing airfields adequate for turboprop aircraft; and, providing air cargo terminals and other facilities at airports where they are needed.

5.3.3 Mindanao Seaports

5.3.3.1 Background and Institutional Setting

Mindanao is served mainly by public common-user ports which are owned and operated by a government corporation, the Philippine Ports Authority (PPA). Under the country's integrated port system, Mindanao has 45 common-user ports which are administratively divided into two port districts: Northern Mindanao District composed of five base ports (Surigao, Nasipit, Cagayan de Oro, Iligan and Ozamis Port), 11 terminal ports and a number of feeder/municipal ports; and, Southern Mindanao District consisting also of five base ports (Davao, General Santos, Polloc, Zamboanga and Jolo), 11 terminal ports and other feeder/municipal ports.

Much of the export-import trade of the island requires transshipment to Manila (or to a lesser extent to Cebu), which puts Mindanao's shipment at a disadvantage vis-a-vis that of Luzon. Some Asian regional shipping companies provide regular services to the eight ports of entry (Davao, General Santos, Polloc, Cagayan de Oro, Zamboanga, Iligan, Jolo and Tawi-Tawi) but their services, as well as the facilities in the ports, are insufficient for the increasing traffic of Mindanao trade.

5.3.2.2 Investment Opportunities

The port system of Mindanao and the shipping services in the ports are coping with the domestic and international sea transport demand of the island. With the rapid economic and trade growth envisioned for Mindanao, however, there is a need to ensure that further development of the port system corresponds with the island's growth potential. Investment opportunities in port development is available for the envisaged expansion of the Ports of Davao, General Santos, Cagayan de Oro and Zamboanga.

5.3.3.3 Options for Private Sector Involvement

To provide more efficient and competitive service in major ports of Mindanao, private sector involvement is encouraged in the development and operation of ports. In accordance to PPA's regulation, a private firm can be permitted to construct and operate its own port dedicated for use in its operation only (e.g., those in Davao, General Santos, Cagayan de Oro, etc.). Firms can also be licensed to construct and operate private commercial ports subject to payment of an annual royalty fee. For public ports, such as those listed, PPA is open to the following arrangements: space lease for specialized facilities, whole port and operation, joint venture and built-operate-transfer (BOT) arrangement.

5.4 IMPACT OF ROAD INFRASTRUCTURE ON THE PORT'S HINTERLAND

As gleaned from the socio-economic profile, Sasa Wharf is expected to continue to play a major role in Mindanao, being its most urbanized center.

The development of roads to Davao City would in effect improve its market access to its hinterland. The hinterland as defined here would include the entire provinces of Davao, Davao Oriental, Davao City, Samal Island, and parts of the provinces of North Cotabato and Davao del Sur.

For low-value high volume agricultural raw materials, and manufactured products, the envisaged completion of the Davao-Cagayan de Oro Road would not significantly change the hinterland of Sasa Wharf. However, for highly perishable products that should be at its destination (say Cebu City) within a day or two, the two alternatives would be through the Port of Cagayan de Oro via the Davao-Cagayan de Oro Road, or through the Davao International Airport. At any rate, this would not significantly alter the overall trade pattern of the Port of Davao.

TABLE 5-1 - LIST OF IDENTIFIED PROJECTS
DAVAO INTEGRATED DEVELOPMENT PROGRAM

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
Inter-Regional Roads Upgrading Project	To widen and improve inter-regional roads in Mindanao; and to establish strong inter-regional linkages.	DPWH	<p>The project includes widening and/or rehabilitation of primary inter-regional roads connecting major urban centers in the DIDP Area with surrounding regions in Mindanao. A well-developed road network will serve efficient movement of people and goods in the area. Most road sections are basically paved by concrete with two lanes. Some parts of roads have been widened to four lanes, especially in urbanized municipal centers. Remaining sections should be widened and rehabilitated.</p> <p>Specific road sections for the project and its improvement are as follows:</p> <ol style="list-style-type: none"> 1. Davao City - Tagum - Agusan road: this road is entirely paved with concrete; some sections have been widened from two to four lanes; remaining sections should be widened and rehabilitated. 2. Davao City - Digos - G. Santos City road: the restoration works are going on as the Philippine Flagship Project, especially for sections in upland areas; after the project, road widening to four lanes should follow. 3. Davao City - Bukidnon road: the restoration works are on-going under the Philippine Flagship Project; after the project road widening to four lanes should follow. 4. Digos - North Cotabato road: this road is entirely paved with concrete; widening to four lanes is to be started.
Inter-Regional Roads Upgrading Project	1. To improve or construct intra-regional roads; and to establish alternative routes and a more dense arterial road network within the DIDP Area.	DPWH	<p>The project intends to improve a number of intra-regional roads to link urban centers within the DIDP Area by a more dense arterial road network including inter-regional roads. Most of these roads are opened but still in gravel conditions. Some coastal section such as southern coastal roads in Davao del Sur and Davao Oriental are still unopened or impassable.</p> <p>Specific road sections for the project and its improvement are as follow:</p> <ol style="list-style-type: none"> 1. Tagum - Mati road: this road is entirely paved with concrete or asphalt; most road sections should be widened to four lanes.

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
			<p>2. Mati-Baganga-Boston Coastal road: this road connects coastal municipalities in Davao Oriental from the south to the north; most sections are still in gravel conditions; the road should be paved with concrete; and some small bridges are to be constructed; the upland sections of the roads should have improvement of banks to avoid landslides.</p> <p>3. Lupon-G. Generoso Coastal road; this road is going to relatively isolated areas of G. Generoso in Davao Oriental; the section between the Tagum - Mati road and the municipal capital town of G. Generoso should be converted from gravel to paved conditions, and the section towards the south until the Cape San Agustin should be opened with at least all-weather conditions.</p> <p>4. Malalag - J. A Santos - Sarangani Coastal road: this road connects coastal municipalities in Davao del Sur from Malalag to J. A Santos; most sections are still in gravel conditions; the road should be paved and some small bridges are to be constructed; the upland sections of the roads should have improvement of banks to avoid landslides; a section from Don Marcelino to the south until the boundary of Sarangani Province should be opened with at least all-weather conditions.</p> <p>5. Montevista - Compostela - Cateel road: this road connects the northern coastal area of Davao Oriental and Compostela Valley passing through upland; the road should be widened and improved from gravel to paved conditions.</p> <p>6. Compostela - Maragusan - Mati road: this road connects the southern part of Davao Oriental and Compostela Valley passing through mountainous areas; the road should be widened and improved from gravel to paved conditions.</p> <p>7. Tagum - Panabo Circumferential road: this road serves to connect urbanized areas in Davao del Norte; the trade of the road should be raised to avoid influence and paved entirely.</p>
Alternative Inter-Regional links Establishment Project	<p>1. To establish alternative inter-regional roads and;</p> <p>2. To provide alternative linkages with other regions in Mindanao</p>	DPWH	<p>The project intends to establish new inter-regional linkages. Although the existing inter-regional roads are proposed to be upgraded, traffic volume will increase more than their capacities. The proposed new road sections will provide alternative linkages between the DIDP Area and other regions in Mindanao.</p>

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
			Specific road sections for the project are as follow: <ol style="list-style-type: none"> 1. Assuncion – Agusan Road: this road will provide alternative linkage between Davao del Norte and Agusan Provinces or the north-eastern part of Mindanao in parallel with the existing Davao City – Tagum – Agusan road; sections of existing rural roads will be used as the alignment of this road. 2. Kapalong – Talaingod – Bukidnon road: this road will connect areas in Davao del Norte with Bukidnon Province; the roads on this route are existing but still in gravel or impassable conditions; most of the routes will pass through upland roads. 3. Malita – G. Santos City road: this road will connect the southern coastal areas in Davao del Sur, specially Malita with Sarangani Province and G. Santos City; most of the routes will pass through mountainous sections. <p>At present, in the DIDP Area, conditions of rural roads, especially farm-to-market access roads are very poor. This situation affects economic activities in the rural area. Some rural communities are facing difficulty in marketing their products due to inadequate farm-to-market roads. Since the DIDP Area is the agricultural oriented region, improvement of the rural access roads are as important as improvement of regional arterial roads.</p> <p>The project includes the improvement of the existing rural and primary farm-to-market roads to paved or all-weather conditions. The project should start with the study to review the present rural road development and maintenance system and to evaluate existing conditions of rural roads. Based on the existing conditions, priority criteria should be established for rural road development with design standards. Equipment for road construction and maintenance should be upgraded and maintained in good conditions.</p> <p>To accelerate and sustain the development of rural roads, effective improvement and maintenance system including budgeting should be also formulated based on the self-help efforts of the local communities.</p>
<p>General and Farm-to-Market Road Program</p>	<ol style="list-style-type: none"> 1. To improve rural and farm-to-market roads to all weather conditions; and 2. To establish a maintenance system of rural roads based on self-help efforts 	Province and municipalities	
<p>Agusan Road Widening Project</p>	<ol style="list-style-type: none"> 1. To improve roads serving tourism areas or urban/industrial areas; and 2. To serve local communities around the tourism/urban/industrial areas 	Provincial Government	<p>The following will be undertaken to improve the access to promising tourism areas:</p> <ul style="list-style-type: none"> • Nabunturan – Maini Part Road Widening • Toril – Bayabas – Eden Road Pavement, and • Mt. Apo National Park Road Pavement

PROJECT DESCRIPTION

Specific road sections for the project are as follow:

1. Assuncion - Agusan Road: this road will provide alternative linkage between Davao del Norte and Agusan Provinces or the north-eastern part of Mindanao in parallel with the existing Davao City - Tagum - Agusan road; sections of existing rural roads will be used as the alignment of this road.
2. Kapalong - Talaingod - Bukidnon road: this road will connect areas in Davao del Norte with Bukidnon Province; the roads on this route are existing but still in gravel or impassable conditions; most of the routes will pass through upland roads.
3. Malita - G. Santos City road: this road will connect the southern coastal areas in Davao del Sur, specially Malita with Sarangani Province and G. Santos City; most of the routes will pass through mountainous sections.

At present, in the DIDP Area, conditions of rural roads, especially fam-lo-market access roads are very poor. This situation affects economic activities in the rural area. Some rural communities are facing difficulty in marketing their products due to inadequate fam-lo-market roads. Since the DIDP Area is the agricultural oriented region, improvement of the rural access roads are as important as improvement of regional arterial roads.

The project includes the improvement of the existing rural and primary fam-lo-market roads to paved or all-weather conditions. The project should start with the study to review the present rural road development and maintenance system and to evaluate existing conditions of rural roads. Based on the existing conditions, priority criteria should be established for rural road development with design standards. Equipment for road construction and maintenance should be upgraded and maintained in good conditions.

To accelerate and sustain the development of rural roads, effective improvement and maintenance system including budgeting should be also formulated based on the self-help efforts of the local communities.

The following will be undertaken to improve the access to promising tourism areas:

- Nabunturan - Maini Part Road Widening
- Toril - Bayabas - Eden Road Pavement, and
- Mt. Apo National Park Road Pavement

IMPLEMENTING AGENCY

OBJECTIVES

PROJECT TITLE

Province and municipalities

1. To improve rural and fam-to-market roads to all weather conditions; and
2. To establish a maintenance system of rural roads based on self-help efforts

Rural and Fam-to-market Road Development Project

Provincial Government

1. To improve roads serving tourism areas or urban/industrial areas; and
2. To serve local communities around the tourism/urban/industrial areas

Rural and Fam-to-market Road Development Project

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
			<p>The project will also improve the Babak-Peñaplata – Kaputian road connecting major town centers in Samal Island for tourism and other purposes. The road should be widened and improved from gravel to paved conditions.</p> <p>The Digos Diversion Road Widening is also covered by the Project.</p> <p>This is a long-term project to be implemented in stages. In the first stage, existing facilities at Sasa wharf will be improved and expanded; the berth will be extended in steps. In the next stage, a new container port will be established in Panabo to handle international container cargoes.</p>
Davao Port Development Project	<ol style="list-style-type: none"> 1. To improve the existing port facilities at Sasa Wharf in the short-term; and 2. To establish a new international container terminal in the medium to long term 	PPA	<p>Davao Port (Sasa Wharf) will be developed in accordance with the PPA's 25-year Port Development Plan prepared in 1995. Although the plan has not been approved yet, the draft plan has proposed a series of berth extensions and a number of improvements in order to meet the future cargo traffic increase.</p> <p>The short-term projects (1995-2000) include 340m berth extension, concrete paving of open storage area, development of area vacated by squatters and construction of passenger terminal sheds, transit shed and amenity block. Total project cost is estimated at P984.3 million.</p> <p>The medium-term project (2000-2025) includes another 900m berth extension with estimated cost of P2.5 billion. Total berth length will reach to 2,160m with capacity of more than 6.5 million tons per year.</p> <p>After 2005, however, Davao Port can no longer be expanded due to the limitation of port area. The analysis shows that the estimated cargo volume will be more than the berth capacity after the year 2010. To accommodate excess cargoes, new port development at Panabo was planned as long-term project.</p>
Sasa Wharf Expansion and Improvement Project	To extend berth and to improve port facilities	PPA	
International Container Terminal Development Project	<ol style="list-style-type: none"> 1. To establish a new international container port; and 2. To accommodate increasing cargoes of the DIDP Area in cooperation with existing Davao Port 	PPA	<p>The project involves construction of a new international container port at Panabo in Davao del Norte Province to serve mega carriers which will be expected to call on Davao City and surrounding economically growing zones and to load/unload cargoes for BIMPE-EAGA member countries in the future. The project is being planned by PPA. The port should be designated, as a container port to share its function in cooperation with the existing Davao Port Davao Port will handle mainly general, break bulk and bulk cargoes.</p>

PROJECT DESCRIPTION

IMPLEMENTING AGENCY

OBJECTIVES

PROJECT TITLE

The port area should be composed of waterfront property with container handling facilities and properties for container yard and industrial area. Under the project, an access road from national road to the port should be constructed.

It is estimated that cargo volume at the existing Davao Port will exceed its capacity by the end of Phase 2 of the DIDP Master Plan. Therefore, during the Phase 2, a feasibility study and detailed design for the project should be conducted by reviewing port statistics of Davao Port. If there is a possibility of private sector participation to the project, a sort of BOT (build-operate-transfer) arrangement could be promoted and adopted.

The project includes the establishment of rapid passenger ferry service between Davao Gulf coastal areas. The new ferry service should not only provide alternative means of transport between major municipal centers along the Davao Gulf but also make the travel time shorter than by land transportation such as uses and passenger cars. In this sense, modern fast sea crafts should be installed and port facilities, especially berths, should be improved to accommodate passenger crafts and for the sage landing of passengers.

This rapid passenger ferry service should operated and managed by the private sector, while the ferry ports should be supervised and controlled by local governments. Port supervisor should levy an appropriate port charge from ferry operators depending on the number of departures and other specific conditions.

Desirable routes are proposed below:

- G. Generoso – Lupon – Davao City
- Maco- Davao City
- Davao City – Sta. Cruz - Malalag – Malita

Relevant local government should conduct the investment promotion for the project, and a preliminary financial study should be prepared based on the cost estimation and level of services such as fare and frequency. Business permission should be obtained from DOTC.

As a part of this project, there is a project proposal named Super Fast Craft (Water Jet) that will provide passenger ferry services for Davao – Lupon – Gov. Generoso. A project study was prepared and papers for the project realization are being processed by the Mabalusta PAIC in coordination with BOI. Cost of two units of water jet (made in Japan) is 25 million pesos. Engineering design of the seaport in Lupon will be funded by the office of the Congresswoman.

1. To provide rapid passenger ferry service connecting the areas along the Davao Gulf, and

2. To establish means of transport connecting the most of PAICs in the DIDP Area.

Rapid Passenger Ferry Service Establishment Project

PROJECT DESCRIPTION

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
Shipping Service to Remote Islands	To establish regular shipping service between Sarangani/ Balut island and provincial capital	Private ship operators, relevant municipalities, Provincial government of Davao del Sur	<p>The project intends to establish shipping routes for Sarangani and Balut islands to connect with the provincial capital of Digos and/or Malita. At present, the islands are connected only with General Santos City by regularly scheduled ships and not connected with the areas in Davao del Sur. Regular service will bring the island's stronger connection with provincial capital of Digos and increase in tourists/ visitors and potential for business activities.</p> <p>However, since the traffic volume of passengers and cargoes by shipping is not so large to cover the ship operating cost of private operators, an appropriate percentage of the ship operating cost should be subsidized by provincial and/or municipal government to keep the fare in lower level.</p> <p>The project also includes some small improvement of berth facilities at the islands to increase the safety to passengers and ships.</p> <p>The project intends to increase the service frequency of existing ferry boats including roll on/roll-off ships between Davao City and berths in the islands of Samal and Talikud. The project will not only improve passengers' convenience but also increase the tourism potential of the island.</p> <p>The project also includes installation of new type modernized boats by private operator and improvement of berth facilities in the islands. For the Davao City side, the Sta. An pier could be a base ferry terminal to access to the tourism destinations in the islands with tourism information desk and pleasant waterfront environments such as Marina (yacht harbor), seaside park and restaurants.</p> <p>Further, the connection by bridges may be considered during the master plan period based on the situation of industrial and residential land uses in the islands.</p>
Samal Island Ferry Service Expansion	<ol style="list-style-type: none"> To increase service frequency. To install modernize ferry boat; and To improve berth facilities 	Private sectors, MARINA, DOT (Department of Tourism), government of the Island Garden City of Samal and Davao City	<p>The project covers the upgrading of the DIA (Davao International Airport) into an international standard to serve as a gateway to the south. The project involves extension of existing runway up to 3,000m with new passenger and cargo terminals and other airport operation, maintenance and air navigation aids and communication facilities. Project cost was estimated at 4,245 billion pesos to be funded mostly by Asian Development Bank (ADB) and European Investment Bank (EIB). Project period for Phase I was scheduled four years from 1995 to 1998, but it has already been due to difficulties in the acquisition of affected families. However, this problem has been solved and implementation will go into construction stage.</p> <p>Original schedule and development items of the project were shown below.</p>
Davao International Airport Development Project (DIADP)	To expand and improve airport facilities and services to meet with international standards	DOT, ATO (Air Transportation Office)	

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
Shipping Service to Remote Islands	To establish regular shipping service between Sarangani/ Balut island and provincial capital	Private ship operators, relevant municipalities, Provincial government of Davao del Sur	<p>The project intends to establish shipping routes for Sarangani and Balut islands to connect with the provincial capital of Digos and/or Malita. At present, the islands are connected only with General Santos City by regularly scheduled ships and not connected with the areas in Davao del Sur. Regular service will bring the island's stronger connection with provincial capital of Digos and increase in tourists/ visitors and potential for business activities.</p> <p>However, since the traffic volume of passengers and cargoes by shipping is not so large to cover the ship operating cost of private operators, an appropriate percentage of the ship operating cost should be subsidized by provincial and/or municipal government to keep the fare in lower level.</p> <p>The project also includes some small improvement of berth facilities at the islands to increase the safety to passengers and ships.</p> <p>The project intends to increase the service frequency of existing ferry boats including roll-on/roll-off ships between Davao City and berths in the islands of Samal and Talikud. The project will not only improve passengers' convenience but also increase the tourism potential of the island.</p> <p>The project also includes installation of new type modernized boats by private operators and improvement of berth facilities in the islands. For the Davao City side, the Sta. Ana pier could be a base ferry terminal to access to the tourism destinations in the islands with tourism information desk and pleasant waterfront environments such as Marina (yacht harbor), seaside park and restaurants.</p> <p>Further, the connection by bridges may be considered during the master plan period based on the situation of industrial and residential land uses in the islands.</p>
Samal Island Ferry Service Expansion	<ol style="list-style-type: none"> 1. To increase service frequency, 2. To install modernize ferry boat; and 3. To improve berth facilities 	Private sectors, MARINA, DOT (Department of Tourism), government of the Island Garden City of Samal and Davao City	<p>The project covers the upgrading of the DIA (Davao International Airport) into full international standard to serve as a gateway to the south. The project involves extension of existing runway up to 3,000m with new passenger and cargo terminals and other airport operation, maintenance and air navigation aids and communication facilities. Project cost was estimated at 4.245 billion pesos to be funded mostly by Asian Development Bank (ADB) and European Investment Bank (EIB). Project period for Phase I was scheduled for four years from 1995 to 1998, but it has already been due to difficulties in the site acquisition of affected families. However, this problem has been solved and implementation will go into construction stage.</p> <p>Original schedule and development items of the project were shown below.</p>
Davao International Airport Development Project (DIADP)	To expand and improve airport facilities and services to meet with international standards	DOT, ATO (Air Transportation Office)	

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
			<p>Phase I (December 1998, capacity good through 2010)</p> <ul style="list-style-type: none"> • Expansion of land area from 104 ha to 209 ha • Expansion of runway from 2,500m to 3,000m • Construction of new passenger/ cargo terminals, new control tower parking apron, central plant fire/crash/rescue bldg., car parking. <p>Phase II (2010-2015, capacity good through 2020)</p> <ul style="list-style-type: none"> • Construction of parallel taxiway • Expansion of passenger/ cargo terminals, parking apron and car parking • Construction of service industries, hotel/convention center <p>Phase III (2015-2020, capacity good through 2030-2035)</p> <ul style="list-style-type: none"> • Construction of second passenger terminal • Expansion of car parking <p>Phase IV (2030-2035, capacity of terminals good through 2040-2050)</p> <ul style="list-style-type: none"> • Ultimate expansion of second passenger terminal, parking apron • Second expansion of cargo terminal
Mati Airport Improvement Project	<ol style="list-style-type: none"> 1. To improve airport facilities and navigational aids; and 2. To promote flight operation for domestic passenger and domestic/ international cargo transportation. 	DOTC, ATO, provincial government of Davao Oriental and municipal government of Mati Magbalusta PAIC	<p>The existing Mati Airport classified as secondary airport is located in Mati, Davao Oriental. It has a concrete 1,300m runway with width of 36m. At present, it is available for general aviation purposes and caters also to private planes in chartered flight but not in regular flights. The airport is used mainly for military purposes.</p> <p>In the DIDP Area, at present, the Mati area is relatively apart from major international/ inter-regional access points such as business, agro-industry and tourism in this area, alternative transportation means should be provided for the movements of people and goods improvement of airport will bring more passengers, tourists and high-value goods to and from Mati area.</p> <p>The project includes the improvement terminal building, runway and navigational facilities to accommodate more passengers, visitors and high-value commodities.</p> <p>The MAGBALUSTA PAIC of Davao Oriental is now promoting installation of flight operation at Mati Airport, especially for domestic passenger and international cargoes. They are now conducting situation analysis and demand survey on domestic flights and coordinating with MENZI on their volume of mango export. Discussion with the Air Philippines staff has been done.</p>

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
Urban Traffic Management Program	<ol style="list-style-type: none"> To install signals at heavy-traffic intersections; and To improve/widen bottleneck road sections. 	City and Municipal Governments, DPWH	<p>Generally, the installation of signals at heavy-traffic intersections results in a substantial reduction in the number of traffic accidents, and expansion of intersection traffic capacity, securing orderly traffic flow and protection of pedestrians, at present, traffic signals are installed at limited intersections in the Area, even in Davao City. Recently, traffic volume in urbanized areas has been increasing rapidly due to the accumulations of population and economic activities. Since construction of new urban roads cannot keep pace with increasing traffic volume, traffic management scheme is an important task in the future.</p> <p>The program includes installation of traffic signals at heavy-traffic intersections along arterial roads in major municipal centers such as Davao City, Tagum City, Digos etc. basic criteria for selection of intersections are as follows:</p> <ol style="list-style-type: none"> Traffic signal has to be basically installed at intersections: a) on arterial roads in major secondary roads; b) where traffic is so heavy that the requirement of full stop on the inferior road would rather aggravate traffic confusion; and c) where saturation rate is 0.5 or over (as installation standard). To identify such intersections, traffic count survey and analysis should be done. Automatic fixed-cycle signal is basically to be installed. It is desirable that two or more signals installed with small intervals between them and synchronized with each other (in the direction of the main flow). In order to maximize the effect of traffic signal, appropriate road signs and marking are to be installed in or near the intersection. Appropriate traffic restrictions are to be effected in the vicinity (with about 40 meters) of intersection, to include the restriction of entry and exit premises and the prohibition of on-street parking and PUG/PUE loading/unloading points. <p>For example, in Davao City, a total of 14 traffic signals have been installed mostly on Quezon Ave., San Padre Street and C.A. Recto Avenue. These signals are manually operated by policemen or automatic fixed-cycle system. In and around Publican, 4 intersections have been identified for the installation of necessary signals.</p> <p>The program should also include improvement and/or widening of bottlenecks such as intersections, bridges and PT loading/unloading points, etc. further, heavy-traffic intersections should be vertically, separated like structures of overpass, underpass and flyer. The following intersection improvement projects are being proposed as DPWH Priority Projects.</p>

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION		
			Interchange	Type	Project Cost
			ABS-CBN interchange	Flyover	P80 million
			Buhangin interchange	Underpass	P40 million
			Ulas interchange	Flyover	P80 million
			MA-A interchange	Flyover	P75 million
Integrated Public Transportation Terminals Improvements Project	<ol style="list-style-type: none"> 1. To provide basic facilities to public transportation passengers; 2. To integrate both provincial bus service and city public transportation services by bus, jeepney and tricycle 3. To support public transportation industry. 	Provincial, city and municipal governments, DOTC, PUB/PUJ Tricycle cooperatives.	<p>Bus terminals exist in major city/ municipal centers, especially for provincial and inter-municipal public transportation services. However, basic facilities like bus shelters, information desks and toilets, etc. are very poor at the terminals. Also intra-municipal routes are not physically connected. As public transportation services as well as to formulate a multi-modal transportation network.</p> <p>The project consists of improvement of terminal facilities such as parking lots, passenger shelters, toilets, and information desks providing operation timetables, description of inter-municipal routes and city guide map. Terminals should be expanded for loading/unloading spaces for intra-municipal services and taxis. Rerouting for some related intra-municipal services should be done.</p> <p>The costs of the improvements could be financed with not only by local government but also with license duties paid by shops and cafeterias around the terminal and terminal charges from bus operators. Each bus operator should pay the terminal charge to the terminal operator (possibly independent organization composed of local government and bus operators) depending on the facility they use and the number of departures.</p> <p>Candidate locations selected for this project are 1) Davao City: two terminals at Panacan and Ulas in addition to the existing overland transport terminal at Ecoland, 2) Tagum City: Davao del Norte, 3) Digos: Davao del Sur, 4) Mati: Davao oriental, 5) Nabunturan: Compostela Valley, 6) other urbanized center.</p> <p>The Arterial Road network plan was formulated in the City's Comprehensive Development Plan, 1996-2021 in 1995 to expand and/or utilize some existing road sections. Planned arterial road network is composed of five radial roads, three circumferential roads and a coastal road. Radial roads include Davao- Bukidnon road (R1), Toril-Calinan road (R2), Calalunan Grande- Dacudao road (R3), Ma-a - Talandang road (R4) and Buhangin - Callawa roads. Circumferential roads include the Diversion Road (C1), Bunawan - Binugao (C2), and Bunawan - Calinan (C3). Most of proposed roads will have 60 meter wide right-of-way, 80m for R1, and 40m for C1.</p>		
Davao City Urban Arterial Roads Development Project	<ol style="list-style-type: none"> 1. To establish a functional urban arterial road network for Davao City. 2. To provide an efficient road network in Davao City; and 3. To separate through-traffic from intra-city traffic. 	DPWH, Davao City government			

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION												
			<p>In addition, a new coastal road has been proposed with length of 20km. The right-of-way will be 60m wide. The road section will start at Lizada, Toril and Traverse through Davao Fishport Complex, Talomo And Time Beaches and end at Magsaysay Park. Three permanent bridges will be constructed, especially across the rivers of Davao, Matina, and Talomo. Project cost was estimated at P580 million.</p> <p>This proposed road network should be studied and evaluated under the Davao Urban Transportation Development Master Plan. Further, a feasibility study and detail engineering design should be conducted.</p> <p>The Davao City Comprehensive Plan seeks for the establishment of an urban LRT(Light Rail Transit) system that will serve coastal built up area of the city as well as neighboring municipalities in Davao del Norte and Davao del Sur. Along the coastal areas of Davao City, a rail transit system makes sense from the view point of the projected demand increase and geographical shape of the city's urbanized areas. Without a rail transit system, it is evident that traffic congestion on urban roads will get much worse.</p> <p>Although the target year for the completion of the project was the year 2000, budget has not been prepared yet. therefore, to promote the implementation of the project, the plan suggested that a BOT (Build- Operate-Transfer) financing scheme should be adopted.</p> <p>The plan prepared by city is as follows,</p> <table> <tr> <td>Stage 1</td><td>Panacan - Toril</td><td>35.7km</td><td>22 stations</td></tr> <tr> <td>Stage 2-A</td><td>Toril - Sta. Cruz</td><td>25.0km</td><td>10 stations</td></tr> <tr> <td>Stage 2-B</td><td>Panacan - Panabo</td><td>22.0km</td><td>5 stations</td></tr> </table> <p>Since the plan was prepared as an initial proposal, a full-scale feasibility study should be conducted to facilitate DOTC's decision and discussion with NEDA towards implementation of the project. In the feasibility study, specific alignment and route section, locations of stations and depot and type of rail system should be included. In considering the BOT arrangement, feasible financial schemes should be studied for prospective investors. The study could be done under the proposed Davao Urban Transportation development master plan study. If so the feasibility study can utilize the reliable transport database and forecast models of the masterplan study.</p> <p>During the conduct of the feasibility study, the government should promote the project to the investors. Detail design and construction should be followed in Phase 2. Operation will start and route extension will be considered in Phase 3.</p>	Stage 1	Panacan - Toril	35.7km	22 stations	Stage 2-A	Toril - Sta. Cruz	25.0km	10 stations	Stage 2-B	Panacan - Panabo	22.0km	5 stations
Stage 1	Panacan - Toril	35.7km	22 stations												
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Stage 2-B	Panacan - Panabo	22.0km	5 stations												
Davao Metropolitan Area Light Rail Transit Project	<ol style="list-style-type: none"> To establish rail transit along coastal areas of Davao City and neighboring municipalities; and To provide faster, stable and reliable services to public transportation passengers. 	Governments of Davao City and relevant municipalities, DOTC and the private sector													

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
Davao Urban Transportation Development (Master Plan Study)	1. To formulate the urban transportation master plan for Davao City and municipalities	DPWH, DOTC, NEDA, Government s of Davao City and related municipalities	<p>Davao City has prepared the comprehensive Development Plan, 1996-2021 in 1995. The plan for transportation infrastructure was included in the plan, but road network and public transportation system was not planned based on the proper future traffic demand forecast in considering the relationship between future socio-economic activities, land use plan, passenger/commodity movements and modal choice mechanism. To formulate more efficient network plan and programs, a full-scale master plan study including person-trip surveys should be conducted for the urban transportation development.</p> <p>In the study, urban arterial road network, public transportation including rail transit, traffic management scheme and institutional aspects should be further studied and evaluated. Scope of works could be tentatively itemized below .</p> <ul style="list-style-type: none"> • Collection of existing data and information • Conduct of transportation, traffic and environmental surveys • Analysis of survey results • Transportation database establishment • Analysis on urban transportation problems • Future demand forecast • Formulation of transportation master plan (road network, public transportation, traffic management, institutional aspects) • Engineering design and cost estimation • Investment program • Project evaluation • Initial environmental evaluation • Urban transportation development plan • Technology transfer (data processing, demand forecast, planning) <p>Diversification of energy source is the essential strategy, and renewal/non-conventional energy is an option for the DIDP Area. Renewable energy potentials are identified as follows.</p> <ul style="list-style-type: none"> • Power generation by solar photovoltaic in upland areas and remote barangays; • Mini-hydro power generation (Aliwagwag, Domago-oc, Sumlog River, Tandik-New Bataan, Camanlangan-Maragusan, Don Marcelino, Tudaya Fall-Sta. Cruz, Tinagao Springs-Bansalan, Kapulian, Talaingod, Sarangani, etc); • Geotechnical power generation (compostela Valley, Sarangani); • Tidal wave (Sarangani); • Solid hybrid fuel making from garbage and other waste/residues (Davao City); and • Power generation by other resource.
Davao Urban Transportation Development (Renewal Energy Program)	To achieve optimum energy mix as a whole based on conditions of energy supply and resources toward the fully energized DIDP Area	RECs, LGUs/economic enterprises (EC), the private sector/ NGOs depending on energy situation while coordinating with DOE, EDC, NPC.	

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
			<p>In view of sustainable and environment-friendly energy development, this program will be implemented with the following components;</p> <ol style="list-style-type: none"> 1. To formulate a DIDP renewable energy development plan as a guideline 2. To coordinate concerned organizations for the preparation of proper conditions for renewable energy development such as: <ul style="list-style-type: none"> • Loan guarantee, subsidy mobilization, and the like; • Wheeling and banking power generated by renewable energy of existing power transmission/distribution lines; and • Institutional arrangements with power distributors to allow private renewable generators to sell directly to consumers; 3. To conduct basic studies for application of the relevant technology; and 4. For these purpose, to establish a renewable energy development council under strengthened DIDP-PMO, consisting of concerned agencies, LGUs, RECs, NGOs, etc. <p>Use of renewable energy is a promising option for rural electrification especially in remote rural areas, but exploitation as well as application of various forms of renewable energy is quite limited, more promising application sites are located in remote areas, where the availability of technology and equipment is most limited. The project is to establish a center for research and application of renewable energy in the remote area in the DIDP Area.</p> <p>The Sarangani island is most endowed with renewable energy potentials- plenty of sunshine closest to the equator, tidal wave surrounding the island, wind and geothermal potential, the establishment of the renewable energy island should be planned in line with the tourism development- another promising potential of the island. Geothermal potential should be explored to determine the reserve and alternative uses for tourism and energy development. A solar system may be installed relatively easily for immediate use, while other forms of renewable energy are examined and experimented such as wind, tidal wave, OTEC and biomass.</p> <p>This a long-term project to be implemented in stages, In the first stage, existing facilities at Sasa wharf will be improved and expanded; the berth will be extended in steps. In the next stage, a new container port will be established in Panabo to handle international container cargoes.</p>
Sarangani Renewable Energy Island Project	<ol style="list-style-type: none"> 1. To experiment on alternative renewable energy sources for rural electrification for wide application in the DIDP Area; and 2. To create additional man-made attractions for tourism on the Sarangani island 	EDC, LGUs, NGO	
Davao Port Development Project	<ol style="list-style-type: none"> 1. To improve the existing port facilities at Sasa wharf in the short-term; and 2. To establish a new international container terminal in the medium to long term 	PPA	

PROJECT TITLE	OBJECTIVES	IMPLEMENTING AGENCY	PROJECT DESCRIPTION
International Container Terminal Development Project	<ol style="list-style-type: none"> <li data-bbox="290 1469 388 1816">1. To establish a new international container port; and <li data-bbox="420 1469 545 1816">2. To accommodate increasing cargoes of the DIDP Area in cooperation with existing Davao Port 	PPA	<p>The project involves construction of a new international container port at Panabo in Davao del Norte Province to serve mega carriers which will be expected to call on Davao City and surrounding economically growing zones and to; load/unload cargoes for BIMPEAGA member countries in the future. The project is being planned by PPA. The port should be designated as a container port to share its function in cooperation with the existing Davao Port. Davao Port will handle mainly general, break and bulk cargoes etc.</p> <p>The port area should be composed of waterfront property with container handling facilities and properties for container yard and industrial area. Under the project, an access road from national road from road to the port should be constructed.</p> <p>It is estimated that cargo volume at the existing Davao Port will exceed its capacity by the end of phase 2 of the DIDP Master Plan. Therefore, during the Phase 2, a feasibility study and detail design for the project should be conducted by reviewing port statistics of Davao Port. If there is a possibility of private sector participation to the project, a sort of BOT (build-operate-transfer) arrangement could be promoted and adopted.</p>

TABLE 5-2
STATUS OF ARTERIAL ROADS IMPROVEMENT IN MINDANAO
(as of June 1998)

A. Existing Roads in Good or Fair Condition

No.	Road Section	Province/City Covered	Length (km)
1	Davao - Digos Road	Davao City/Digos, Davao del Sur	51.6
2	GSC - Koronadal - Isulan - Cotabato City Road	South Cotabato/Sultan Kudarat/ Maguindanao	187
3	Makilala/Matalam - Bagontapay - Tacurong - Marbel Road	North Cotabato/Sultan Kudarat/ South Cotabato	115
4	Iligan - Cagayan de Oro - Butuan Road	Iligan City / Misamis Oriental / Butuan City	272
5	Ozamiz - Oroquieta Road	Misamis Occidental	44
6	Gen. Santos City - Maitum Road	Gen. Santos City / Sarangani Province	105
7	Gen. Santos City - Glan Road	Gen. Santos City / Sarangani Province	48
8	Davao City - Panabo Road	Davao City / Davao del Norte	32
9	Tagum - Mati Road	Davao del Norte / Davao Oriental	102
10	Marawi - Iligan Road	Marawi City / Iligan City	32
11	Iligan - Tubod Road	Iligan City / Lanao del Norte	60

B. Roads with On-Going Improvement or Newly Completed

No.	Road Section	Province/City Covered	Length (km)	Status / Remarks
12	Digos - Gen. Santos City Road	Davao del Sur - Sarangani - Gen. Santos City	81.4	Under the WB-IBRD Highway Mgt. Project I; 53.76% complete
13	Davao - Bukidnon Road	Davao City / Bukidnon	238	Under the WB-IBRD Highway Mgt. Project I; Ulas-Calinan section is 53.54% complete while the Calinan-Campo Uno section is 10.66% complete
14	Maramag - Kibawe Road	Bukidnon	60	Under the WB-IBRD Highway Mgt. Project I; 50M Php has been released from the CY 1998 local funds to finance portion of the project
15	Buug - Kabasalan Road	Zamboanga del Sur	52	Under the WB-IBRD Highway Mgt. Project I; 17% complete
16	Oroquieta - Dipolog - Liloy - Ipil Road	Misamis Occidental / Zamboanga del Norte	246	Under the 4th ADB Road Project and 1st Kuwaiti Road Project; 100% completed since 1996
17	Cotabato - Malabang - Marawi Road	Maguindanao / Lanao del Sur	138	Under the DPWH Program; Parang - Malabang section newly-completed by Philippine Army Eng'g Brigade

C.

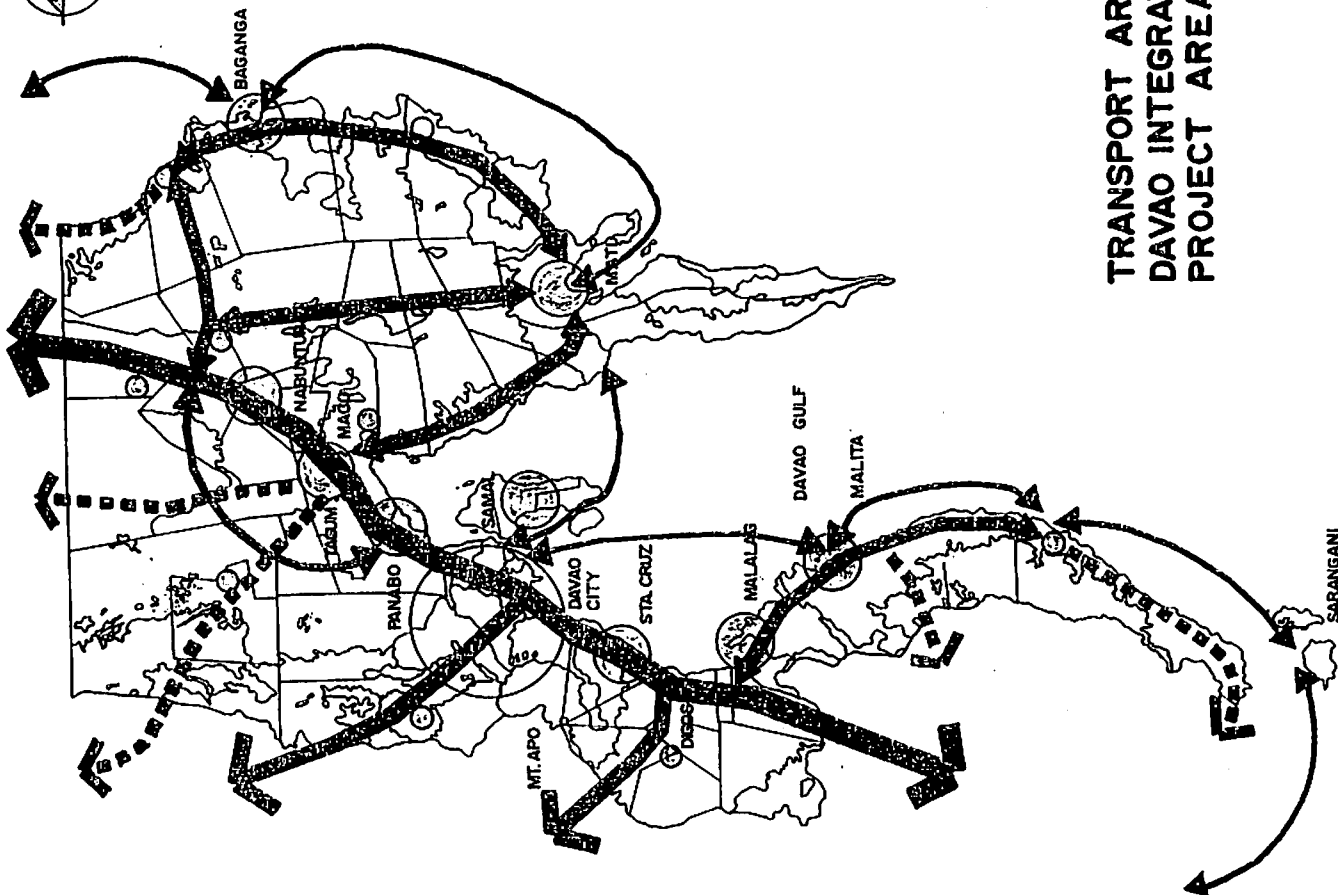
Roads with Committed Pipeline ODA

No.	Road Section	Province / City Covered	Length (km)	Status / Remarks
18	Zamboanga – Pagadian Road	Zamboanga City / Zamboanga del Sur	272	Proposed under the 6th ADB Road Improvement Project
19	Malalag – Malita - Jose Abad Santos Road	Davao del Sur	107	Proposed under WB-IBRD Highway Mgt. Project II
20	Mati – Boston Road	Davao Oriental	138	Proposed under WB-IBRD Highway Mgt. Project II
21	Basilan Circumferential Road (Isabela – Lamitan - Maluso Section)	Basilan	42	Proposed under WB-IBRD Highway Mgt. Project II
22	Sulop Junction – Malalag Road	Davao del Sur	18	Proposed under WB-IBRD Highway Mgt. Project II (DBST overlay only)
23	Cotabato City - Digos Road	Davao del Sur / North Cotabato / Maguindanao	175	Proposed under WB-IBRD Highway Mgt. Project II (AC overlay only)
24	Sayre Highway (CDO - Bukidnon Road)	Cagayan de Oro / Bukidnon	78	Proposed under WB-IBRD Highway Mgt. Project II (overlay)
25	Aurora - Dipolog Road	Zamboanga del Sur / Zamboanga del Norte	90	Proposed under the 2nd Kuwait Road Improvement Project
26	Molave - Ozamiz – Oroquieta City Road (Bypass and Diversion)	Misamis Occidental	90	Proposed under the 2nd Kuwait Road Improvement Project
27	Pagadian - Cotabato Road (Pagadian – Malabang Section)	Lanao del Sur / Lanao del Norte	87	Proposed under the 2nd Kuwait Road Improvement Project
28	Pan Philippine Highway (Lipata – Kitcharao - Tabon Tabon - Maitum – Panabo Section)	Surigao del Norte / Agusan del Norte / Agusan del Sur / Davao del Norte	262	Proposed under the Overseas Economic Cooperation Fund (OECF) Program
29	Jolo Circumferential Road	Sulu	70	Under the DPWH-ARMM Program
30	Tawi-Tawi Transcentral Road	Tawi-Tawi	40	Under the DPWH-ARMM Program

D. Proposed Road Projects Without Committed Funding

Road Section	Province / City Covered	Length (km)	Investment Requirement (Php M)
General Santos City Circumferential Road	General Santos City Cotabato City	9.77	10.14
Cotabato Circumferential Road and Alternate Bridge	Cagayan de Oro City	28	418
Cagayan de Oro City Third Bridge and Diversion Road		10.7	110
Mindanao Rural Roads Improvement Project			
Villanueva-Claveria-Gingoog Road	Misamis Oriental/ Gingoog City	70	63.26
Kidapawan-Pres. Roxas - Antipas-Arakan-Junction Buda Road	North Cotabato	65	46.01
Surallah-Lake Sebu Road	South Cotabato	12	6.43
Tagum-Asuncion-Kapalong-Sto-Tomas-Panabo Road	Davao del Norte	72	32.44
Banisilan-Alamada-Libungan Road	North Cotabato Maguindanao Zamboanga del Sur	95 67.8 36.2	58.81 93.13 90.36
Zamboanga Coastal Road (Limpapa-Liloy Section)	Zamboanga del Norte	271	521.7
Molave - Dipolog (Cross Island) Road	Zamboanga del Sur	116	372.73
Lake Lanao Circumferential Road (Pualas-Taraka Section)	Lanao del Sur	71	192.94
Surigao - Davao Coastal Road			
Placer-Carrascal Section	Surigao del Norte Surigao del Norte /	48	36.47
Carrascal-Boston	Surigao del Sur /	305	231.69

Road Section	Province / City Covered	Length (km)	Investment Requirement (Php M)
Section	Davao Oriental		
Bayugan-San Miguel-Tandag Road (Bayugan-Gamut Junction)	Agusan del Sur / Surigao del Sur	49	231.69
East-West Lateral Road (Surigao Sur - Agusan Sur - Bukidnon - Lanao Sur Road)	Surigao del Sur / Agusan del Sur	20	66.48
└ Bislig-Trento Section	Agusan del Sur / Bukidnon	106	332.15
└ Trento-San Fernando Section	Bukidnon/Lanao del Sur	75	221.35
└ San Fernando-Wao Section	Lanao del Sur	64	215.86
└ Wao-Saguiran-Junction Overtone			
Camiguin Circumferential Road	Camiguin	54	114.27
Davao del Sur - Sarangani Province Coastal Road (Jose Abad Santos-Bulataki-Glan Section)	Davao del Sur / Sarangani	96	346.10
Sarangani-Sultan Kudarat Coastal Road (Maitum-Palembang-Kalamansig Section)	Sultan Kudarat	112	185.91
Mindanao Cities Urban Roads and Bridges Project Butuan Bypass Road and Alternate Bridge	Butuan City	8.27	40.02

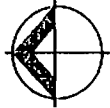


LEGEND:

- INTER-REGIONAL (PRIMARY)
- INTER - PROVINCIAL LINK
- INTER - REGIONAL (SECONDARY)
- SEA TRANSPORT ROUTE
- SERVICE URBAN CENTERS

**TRANSPORT ARTERY SYSTEM FOR
DAVAO INTEGRATED DEVELOPMENT
PROJECT AREA**

MINDANAO RAILWAYS INFRASTRUCTURE MAP



LEGEND :

----- RAILWAY

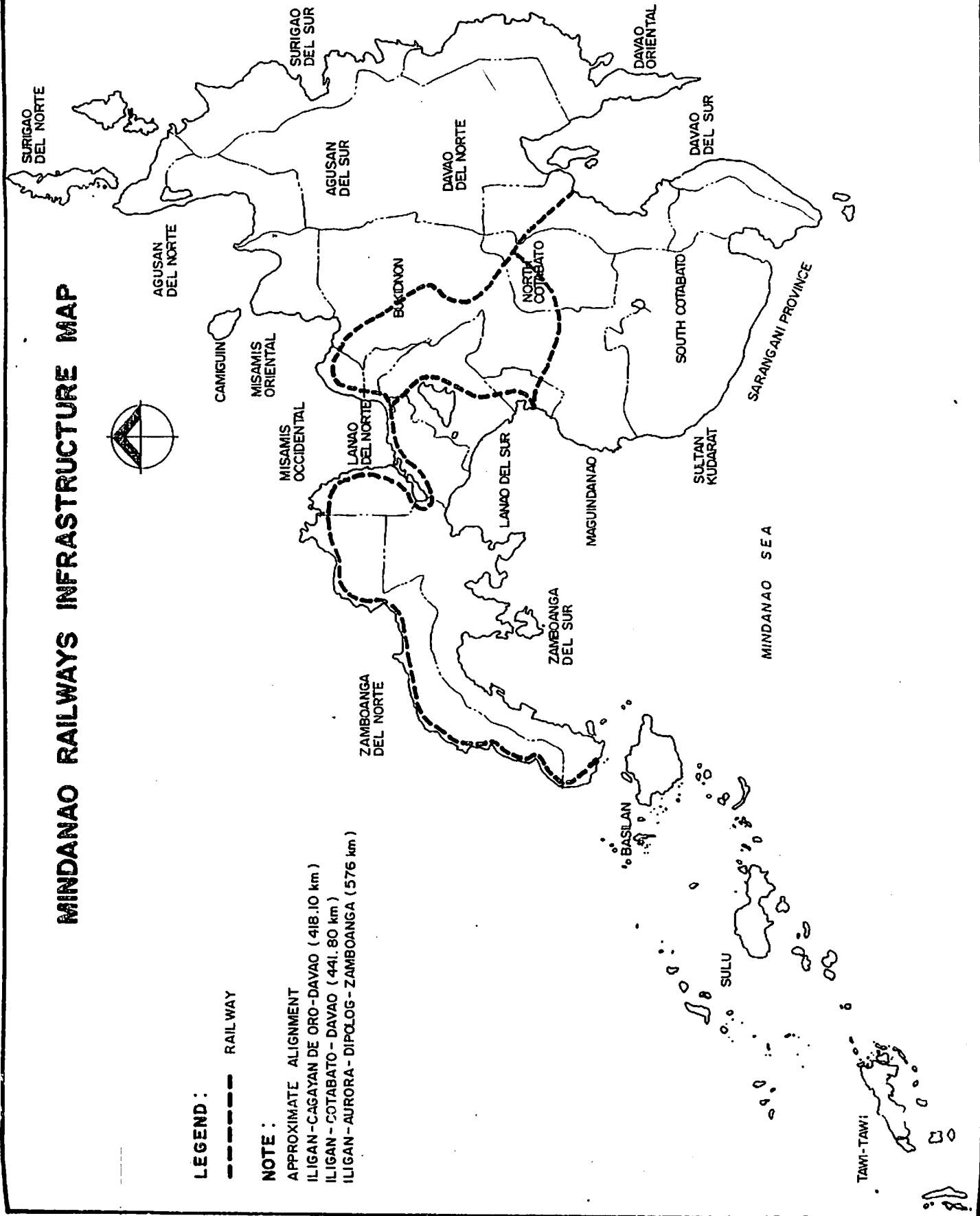
NOTE :

APPROXIMATE ALIGNMENT

ILIGAN - CAGAYAN DE ORO - DAVAO (418.10 km)

ILIGAN - COTABATO - DAVAO (441.80 km)

ILIGAN - AURORA - DIPLOG - ZAMBOANGA (576 km)



MINDANAO ROAD INFRASTRUCTURE MAP

LEGEND :

- EXISTING & ON-GOING ROAD
- - - COMMITTED / PIPELINE
- - - PROPOSED ROAD

