1.2.3. Sea transport

(1) Port system

The PMO-Davao is under the direction of PDO-Southern Mindanao together with the PMOs of General Santos, Zamboanga, Polloc and Jolo. All the ports in the DIDP Area are under supervision of the PMO-Davao. There are one base port, two terminal ports, four municipal and 15 private ports as listed in Table 1.14.

There are also anchorage areas under these ports. There exist 17 anchorage areas under Sasa Wharf, six under Sta. Ana Pier and seven under Mati Wharf. Malalag Port has one anchorage area. However, most anchorage areas are not fully operated.

(2) Port facilities

Existing facilities of Sasa Wharf, Sta. Ana Pier and Mati Wharf are outlined in Table 15. They are all owned and operated by the PMO-Davao.

Sasa Wharf (Davao Port): is one of the major ports in the Country. It serves as the forefront in the development of commerce and trade in the Davao Gulf area.

Agricultural products and principal commodities of this area are passing through this port. Therefore, PPA has undertaken a ₱143 million Sasa Wharf development project in 1991, which was completed in 1993. The project involved the pavement of container yard including lighting facilities, construction of access road, etc.

Sasa Wharf has 920 m long berth facility with water depth of 10.6 m. The total port area is 16.7 ha including transit-shed area, container yard, open storage area and warehouses. Cargo handling is operated by private companies of FILPORT and DIPSSCOR. Equipment for cargo handling is owned by these companies.

Sta. Ana Pier: is located in Sta. Ana, Davao City and considered as extension of Sasa Wharf. It has reinforced concrete general-purpose piers: Pier 1 with 102 x 22 m and Pier 2 with 90 x 18 m. Original water depth was 6.1 m but present effective depths are 1 m at Pier 1 and 3 m at Pier 2 due to heavy siltation. Sta. Ana Pier has 1,500 m^2 storage area and total back-up area of 37,000 m^2.

Mati wharf: is a terminal port of PMO-Davao, located at Mati, Davao Oriental in Pujada Bay. It has 80 m long concrete wharf with water depth of 6.5 m, and open storage area of 1,595 m^2. In recent years, however, the port is not being operated fully.

(3) Port traffic characteristics

Changes in cargo/passenger traffic

Table 16 shows the port traffic statistics of PMO-Davao from 1990 to 1996. The number of foreign vessel ship-calls increased from 783 in 1990 to 1,089 in 1996. The average vessel size is 3,500 DWT for domestic and 10,000DWT for foreign.

The total cargo traffic volume at PMO Davao ports has increased from 4.5 million tons in 1990 to 6.2 millions tons in 1996; especially imported cargo volume has increased from 0.5 million tons in 1990 to 1.2 million tons. Domestic cargo traffic shared 56% of the total cargo throughput in 1996. Foreign containerized cargo volume was very small, about 66,000 tons, while domestic was about 1.5 million tons in 1996. Passenger traffic volume increased from 326, 000 in 1990 to 477,000 in 1996.

Table 14 Ports under the PMO-Davao

Classification	Port Name	Location	Ownership	Major Cargoes
Base Port	Sasa Wharf	Sasa, Davao City	PPA	General cargoes, containers, etc.
	(Sta. Ana Pier)	(Sta. Ana, DC)	(PPA)	(general cargoes, etc.)
Terminal Port	Mati Wharf	Mati, Davao Oriental	PPA	corns, copra, logs, general cargoes
Municipal Port	Malalag Wharf	Malalag, Davao del Sur	Municipal Government	cane molasses, logs, general cargoes, etc.
	Dawis Pier	Digos, Davao del Sur	Municipal Government	bottled cargo, general cargoes, etc.
	Babak Pier	Babak, Samal Is., Davao	Municipal Government	mainly for residents and their goods
	Penaplata Pier	Penaplata, Samal Is., Davao	Municipal Government	mainly for residents and their goods
Private Port	Caltex Jetty I	Sasa, Davao City	Caltex Phils., Inc.	petroleum products
	Caltex Jetty II	Sasa, Davao City	Caltex Phils., Inc.	petroleum products
	Shell Jetty	Sasa, Davao City	Philipinas Shell, Inc.	petroleum products
	Petron Jetty	Bo Pampanga, Davao City	Petron Corporation	petroleum products
	LEGOIL Wharf	Sasa, Davao City	Legaspi Oil Company, Inc.	crude coconut oil, etc.
	INTERCO-Davao Wharf	Sasa, Davao City	International Copra Export Corp.	coconut oil, copra, etc.
	INTERCO-Mati Jetty	Matiao, Mati, Davao Oriental	International Copra Export Corp.	copra, coconut oil, etc.
	DUCC Wharf	Ilang, Davao City	Davao Union Cement Corp.	cement, coal, etc.
	HPI Wharf	Madaum, Davao	Hijo Plantation, Inc.	bananas, ipil-ipil, etc.
	MTBS Wharf	Tibungco, Davao City	Mondanao Terminal Brokerage Services, Inc.	bananas, fertilizers, etc.
	Pacinter Wharf	Bayawa, Panabo, Davao	Pacific International Terminal	bananas
	TADECO Wharf	Panabo, Davao	Tagum Agricultural Development, Co., Inc.	bananas, fertilizers, ore
	Tefasco Wharf (commercial)	Ilang, Davao City	Terminal Facilities and Services, Corp.	general cargoes, containers, etc.
	Universal Robina Corp.	Sasa, Davao City	Universal Robina Corp.	Flours grains
	Norcamco Wharf (commercial)	Lambajon, Baganga, Davao Oriental	North Camarines Lumber Co., Inc.	lumber products

Source: PPA - Port District of Southern Mindanao

Table 1.15 Facilities of Sasa Wharf, Sta. Ana Pier and Mati Port

Port Name	Sasa Wharf	Sta. Ana Pier	Mati Wharf
Classification	Base Port	Extension of Sasa Wharf	Terminal Port
Location	Km 10, Sasa, Davao City	Sta. Ana, Davao City	Mati, Davao Oriental
Berth / Pier (length / width)	Reinforced concrete wharf (old quay: 515 x 18 m, new quay: 405 x 35 m)	Reinforced concrete pier (Pier No.1: 22 x 102 m, Pier No.2: 18 x 90 m)	Reinforced concrete wharf (80 x 11m)
Water Depth	10.6 m below MLLW	Original: 6.1 m below MLLW At present: 1 m at Pier 1 3 m at Pier 2	6.5 m below MLLW
Storage Area	• Total port area: 16.7 ha • Transit shed area: 1,210 m^2 • Open storage: 58,000 m^2 • Container yard: 37,800 m^2 • Warehouse: 6,000 m^2	• unpaved storage area: 15,000 m^2 • total back-up area: 37,000 m^2	• open storage area: 1,595 m^2 (paved)
Cargo Handling Equipment	• 32 forklifts • 5 mobile cranes (4x35 t, 15 t) • prime mover and payloader • operated by private sector	• 1 mobile crane (2 t) • truck (15 t) • 16 forklifts (2.5-3.5 t) • operated by private sector	• 3 forklifts (2 t) • 1 forklift (3 t) • operated by private sector
Major Cargoes	General cargoes, containerized cargoes	general cargoes	Corn, copra, logs, general cargoes

Source: PPA-Port District Office of Southern Mindanao

Cargo/passenger traffic by port

Table 17 shows the distribution of 1996 cargo and passenger traffics by port. The base port of Sasa Wharf handled 2.1 million tons or 35% of total cargo throughput while 3.5 million tons or 56% was handled by private ports. Terminal and municipal ports had small cargoes only. Of the total domestic cargoes 53% was handled by private ports, but Sasa Wharf handled 65% of containerized cargoes. Sasa Wharf handled 65% of total imported cargoes, while 95% of exported cargoes were handled by private ports. Containerized cargoes for import and export were handled only by Sasa Wharf, but its volume was quite small.

Major private ports in terms of traffic volume are: TEFASCO operating as a commercial port handled 909,333 tons mainly of domestic general cargoes and containers, DUCC owned by Davao Union Cement Corp. handled 879,627 tons of cement products and materials, PACINTER and TADECO for banana export with 372,706 and 363,960 tons of cargoes handled, respectively. HPI and MTBS are also the ports for export of bananas. LEGOIL and INTERCO Sasa and Mati are the ports for export of coconut products. There are some oil ports for local consumption, such as Caltex 1 & 2, Petron and Shell.

Passenger ferry services are available only at Sasa Wharf and Sta. Ana Pier. The DIDP Area is connected by passenger ferry services with cities of Manila, Iloilo, Cebu, Zamboanga and General Santos. International ferry services are operating between Davao (Sasa Wharf) and Bitung near to Manado, Indonesia, one round trip a week. A vessel with capacity of 900 passengers is being used. The number of ferry passengers embarking/disembarking at Sasa Wharf and Sta. Ana Pier was 154,000 and 285,000, respectively.

Table 16 Port Traffic Statistics of PMO-Davao, 1990-1996

	1990	1991	1992	1993	1994	1995	1996
1. Shipping Indices							
No. of Vessels	2,952	2,910	2,659	2,733	2,742	2,945	3,012
Domestic	2,169	2,147	1,913	1,849	1,863	1,969	1,923
Foreign	783	763	746	884	879	976	1,089
Average DWT	4,106	4,264	4,221	4,734	5,328	5,786	5,731
Domestic	2,210	2,457	2,387	2,974	3,027	3,514	3,563
Foreign	9,357	9,350	8,922	8,416	10,203	10,370	9,559
2. Cargo Traffic	**('000 m.t.)**						
Total Cargo Throughput	4,504	4,281	3,973	4,485	4,928	5,397	6,196
A. Domestic	2,645	2,585	2,354	2,586	2,900	2,882	3,356
Inbound	1,469	1,402	1,329	1,436	1,749	1,763	1,770
Breakbulk	749	415	395	451	550	482	449
Bulk	199	372	456	400	437	512	519
Containerized	521	615	478	585	761	769	802
Outbound	1,176	1,183	1,025	1,150	1,151	1,119	1,586
Breakbulk	618	612	471	524	438	271	645
Bulk	109	104	77	81	83	81	246
Containerized	449	467	477	545	630	766	696
B. Foreign	1,802	1,606	1,507	1,796	1,960	2,435	2,746
Import	475	355	428	490	538	859	1,246
Breakbulk	279	178	181	158	246	296	445
Bulk	194	176	246	326	291	561	763
Containerized	1	0	1	5	1	1	37
Export	1,328	1,252	1,079	1,306	1,422	1,576	1,501
Breakbulk	861	914	811	1,130	1,119	1,214	1,194
Bulk	454	332	264	161	303	361	278
Containerized	13	6	4	15	0	2	29
C. Transit Cargo	58	90	112	103	67	81	94
Domestic	58	1	1	0	36	81	90
Foreign	0	89	111	103	32	0	4
3. Passenger Traffic ('000 pax)							
Total Passengers	326	333	320	313	385	504	440
A. Embarking	148	163	152	157	186	249	211
B. Disembarking	178	170	168	155	198	255	229

Source: PPA – Port District of Southern Mindanao

Table 17 Distribution of Cargo/Passenger Traffic by Port, 1996

Particulars	Traffic Volume ('000 tons / '000 Pax)						Total	% share by port					
	Base Sasa	S.Ana	Mati	Muni'l Ports	Private Ports	Ancho rages	Traffic Vol.	Base Sasa	S.Ana	Mati	Muni'l Ports	Private Ports	Ancho Rages
1. Cargo Traffic													
Total Cargoes	2,139	109	0	36	3,482	429	6,196	34.5	1.8	0.0	0.6	56.2	6.9
a. Domestic	1,181	109	0	23	1,779	265	3,356	35.2	3.2	0.0	0.7	53.0	7.9
Inbound	702	103	0	4	713	248	1,770	39.7	5.8	0.0	0.2	40.3	14.0
Breakbulk	125	103	0	2	134	86	449	27.8	22.9	0.0	0.4	29.8	19.0
Bulk	13	0	0	2	341	162	519	2.6	0.0	0.0	0.4	65.8	31.3
Containerized	564	0	0	0	238	0	802	70.3	0.0	0.0	0.0	29.7	0.0
Outbound	479	6	0	19	1,065	17	1,586	30.2	0.4	0.0	1.2	67.2	1.1
Breakbulk	62	6	0	4	556	17	645	9.7	0.9	0.0	0.6	86.3	2.6
Bulk	1	0	0	15	229	0	246	0.5	0.0	0.0	6.2	93.4	0.0
Containerized	416	0	0	0	280	0	696	59.8	0.0	0.0	0.0	40.2	0.0
b. Foreign	865	0	0	13	1,703	165	2,746	31.5	0.0	0.0	0.5	62.0	6.0
Import	809	0	0	0	273	164	1,246	64.9	0.0	0.0	0.0	21.9	13.1
Breakbulk	221	0	0	0	61	164	445	49.5	0.0	0.0	0.0	13.7	36.7
Bulk	551	0	0	0	212	0	763	72.2	0.0	0.0	0.0	27.8	0.0
Containerized	37	0	0	0	0	0	37	100.0	0.0	0.0	0.0	0.0	0.0
Export	56	0	0	13	1,430	1	1,501	3.7	0.0	0.0	0.9	95.3	0.1
Breakbulk	13	0	0	0	1,180	1	1,194	1.1	0.0	0.0	0.0	98.8	0.1
Bulk	15	0	0	13	250	0	278	5.3	0.0	0.0	4.8	89.9	0.0
Containerized	29	0	0	0	0	0	29	100.0	0.0	0.0	0.0	0.0	0.0
c. Transit Cargo	94	0	0	0	0	0	94	99.7	0.0	0.0	0.0	0.3	0.0
Domestic	90	0	0	0	0	0	90	99.7	0.0	0.0	0.0	0.3	0.0
Foreign	4	0	0	0	0	0	4	100.0	0.0	0.0	0.0	0.0	0.0
2. Passenger Traffic													
Total Passengers	154	285	0	0	0	0	440	35	65	0	0	0	0
a. Disembarking	74	155	0	0	0	0	229	32	68	0	0	0	0
b. Embarking	81	130	0	0	0	0	211	38	62	0	0	0	0

Source: PPA - Port District of Southern Mindanao

Major commodity types

Major commodity types in terms of volume, handled at ports of PMO-Davao in 1995, are listed in Table 18. For inbound cargoes, various types of commodities arrived from places in the Country and foreign countries. Oil products, industrial products and consumer goods are main inbound commodities. Specifically, commodities of refined petroleum & products and general cargoes accounted for 48% of total domestic inbound cargo volume, while mineral fuel, coal and fertilizers shared 46% of total volume of import cargoes.

Major types of outbound commodities are fruits and vegetables. They account for 22% and 77% of total volume of domestic outbound and export volume respectively. Other major commodities are general cargoes, corn and cement for domestic outbound flow, while coconut oil and animal feeds for export. Unprocessed and processed agricultural products and industrial products which are produced in the DIDP Area, hinterland of Davao Port, are mainly shipped from this area.

Table 18 Major Commodity Types at PMO-Davao, 1995

No	Type	Vol.	%	No	Type	Vol.	%	No	Type	Vol.	%
Inbound		000 t				000 t				000 t	
Total Inbound				Domestic				Foreign			
1.	Ref. Petroleum	420	16	1.	Ref. Petroleum	420	24	1.	Mineral Fuel	218	25
2.	Other Gen. Cargoes	418	16	2.	Other Gen. Cargoes	418	24	2.	Fertilizer	183	21
3.	Mineral Fuel	261	10	3.	Bottled Cargoes	108	6	3.	Logs	118	14
4.	Fertilizer	226	9	4.	Iron & Steel	100	6	4.	Crude Minerals	84	10
5.	Logs	194	7	5.	Logs	76	4	5.	Paper & Pulp	81	9
	Others	1,107	42		Others	641	36		Others	181	21
	Total	2,627	100		Total	1,763	100		Total	864	100
Out Bound		000 t				000 t				000 t	
Total Outbound				Domestic				Foreign			
1.	Fruits & Vegetables	1,456	54	1.	Fruits & Vegetables	248	22	1.	Fruits & Vegetables	1,209	77
2.	Coconut Oil	248	9	2.	Other Gen. Cargoes	224	20	2.	Coconut Oil	244	16
3.	Other Gen. Cargoes	226	8	3.	Corn	144	13	3.	Animal Feeds	85	5
4.	Corn	144	5	4.	Cement	129	12	4.	Copra	28	2
5.	Cement	129	5	5.	Plywood & Veneer	55	5	5.	Other Gen. Cargoes	2	0
	Others	487	18		Others	320	29		Others	3	0
	Total	2,690	100		Total	1,119	100		Total	1,571	100

Source: PPA - Port District of Southern Mindanao

Inter-regional and international cargo movements

Table 19 shows 1994 inter-regional cargo movements to/from Region XI including two base ports of Davao and General Santos. In terms of quantity, 1.5 million tons of cargoes were moved by sea transport between Region XI and National Capital Region (NCR), accounting for 44% of total volume of cargo to/from Region XI. In value terms, this represents 61% of the total. Region XI has a strong connection with NCR.

The next important region is Region VII (Central Visayas). About 24% of total cargoes handled at ports in the Region XI, or 0.8 million tons of cargoes were moved between Central Visayas Area. The total value was ₱5 billion or 17% of the total value of cargoes.

Table 20 shows the major origin/destination countries of imported/exported cargoes at the Port of Davao in 1996. In terms of value of cargoes, cargoes with value of US$80 million and US$47 million were imported from USA and Japan, respectively, accounting for 28% and 16% of total value. Export to Japan valued US$277 million or 45% of total value.

Inter-regional passenger movement

Sea passenger ODs were roughly estimated by JICA Study Team for the Master Plan Study on Visayas and Mindanao Strategic Road Network Development Project, based on port traffic statistics in 1995. Table 1.21 presents inter-regional sea passenger movements to/from Region XI. The number of sea passengers to/from Region XI was 647,220 in 1995. The number of passenger trips made to/from Region IX (Western Mindanao), Region IV (Southern Tagalog) and Region VI (Western Visayas) accounted for about 20% of total, respectively.

Table 19 Inter-Regional Domestic Cargo Movement by Sea Transport, 1994

	Quantity to/from Region 11						Value to/from Region 11					
	000 tons			% to Total			Pseo Million			% to total		
	From	To	Total	From	To	Total	From	To	Total	From	To	Total
NCR	1,167	349	1,515	51.2	30.3	44.2	12,336	8,734	21,070	64.8	57.4	61.5
Region 1	15	0	15	0.7	0.0	0.4	105	0	105	0.6	0.0	0.3
Region 2	0	0	0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0
Region 3	3	98	101	0.1	8.5	3.0	25	588	613	0.1	3.9	1.8
Region 4	46	147	194	2.0	12.8	5.7	191	986	1,177	1.0	6.5	3.4
Region 5	23	7	30	1.0	0.6	0.9	123	65	188	0.6	0.4	0.5
Region 6	69	19	88	3.0	1.6	2.6	389	270	660	2.0	1.8	1.9
Region 7	575	259	834	25.2	22.5	24.3	3,417	2,518	5,935	17.9	16.6	17.3
Region 8	30	4	34	1.3	0.3	1.0	106	76	183	0.6	0.5	0.5
Region 9	98	35	134	4.3	3.1	3.9	735	544	1,280	3.9	3.6	3.7
Region 10	39	32	71	1.7	2.8	2.1	296	223	519	1.6	1.5	1.5
Region 11	183	183	365	8.0	15.9	10.7	1,037	1,037	2,075	5.4	6.8	6.1
Region 12	26	18	43	1.1	1.5	1.3	250	163	413	1.3	1.1	1.2
ARMM	6	0	6	0.3	0.0	0.2	30	5	35	0.2	0.0	0.1
Total	2,280	1,150	3,430	100.0	100.0	100.0	19,041	15,209	34,250	100.0	100.0	100.0

Source: Philippine Statistical Yearbook 1996

Table 20 Major Origin/Destination of Import/Export Cargoes, PMO-Davao, 1994

No.	Country	Value (US$ mil.)	% to Total Value	No.	Country	Value (US$ mil.)	% to Total Value
Import				**Export**			
1.	USA	80	27.9	1.	Japan	277	45.3
2.	Japan	47	16.4	2.	USA	84	13.7
3.	Malaysia	17	5.8	3.	Middle East	60	9.8
4.	Germany	12	4.2	4.	China	60	9.8
5.	Soudi Arabia	12	4.1	5.	Korea	53	8.7
	Other Countries	119	41.5		Other Countries	77	12.6
	Total	286	100.0		Total	611	100.0

Source: Bureau of Customs - Port of Davao

Table 21 Inter-Regional Sea Passenger Movement of Region 11, 1995

Region		No. of Passengers	% share
NCR	Metro Manila	34,358	5.3
Region 1-3, CAR	Northern Luzon	-	-
Region 4	Southern Tagalog	127,548	19.7
Region 5	Bicol Region	-	-
Region 6	Western Visayas	125,620	19.4
Region 7	Central Visayas	91,772	14.2
Region 8	Eastern Visayas	14,324	2.2
Region 9	Western Mindanao	132,504	20.5
Region 10	Northern Mindanao	42,844	6.6
Region 12, ARMM	Central Mindanao	-	-
CARAGA	Eastern Mindanao	78,250	12.1
Total		647,220	100.0

Source: Master Plan Study on Visayas and Mindanao Strategic Road Network Development Project, JICA-DPWH

1.2.4. Air transport

(1) Airport system

Airports located in Mindanao are listed in Table 22. There are two alternate airports: Davao and Zamboanga, three trunk-line airports of General Santos, Cagayan de Oro and Cotabato, 13 secondary airports and seven feeder airports.

All national airports are under the supervision of ATO. There are three ATO branches in Mindanao: Davao, Zamboanga and Cagayan de Oro. The ATO-Davao supervises the alternate airport of Davao, trunk-line airports of General Santos and Cotabato, and secondary airports of Allah Valley, Bislig, Mati, and Tandag. In the DIDP Area, there are only two national airports: Davao International Airport (DIA) and Mati Airport. There are four private airstrips in Davao City, nine in Davao Province, three in Davao del Sur and one in Davao Oriental.

(2) Airport facilities

The facilities of DIA and Mati-Airport are outlined in Table 23.

Davao International Airport (DIA): The DIA classified as an alternate international airport is located at Barangays of Sasa and Pampanga, Davao City. The DIA with a 2,500 m runway of 45 m width can accommodate Airbus 300 and Boeing 737. The total land area is 104 ha, including existing runway, parking apron, passenger terminal building, control tower and parking area. Necessary renovation of the passenger terminal was undertaken to meet the demand of passengers and cargoes. The expansion of the annex international passenger terminal building and improvement of the existing terminal of the DIA started in 1995 and completed in 1997. It was funded by Philippine Tourism Authority's bridge financing assistance with an initial cost of ₱14.8 million.

The Davao International Airport Project is now on-going, involving extension of existing runway up to 3,000 m to accommodate Boeing 747 class aircraft, expansion of airport area up to 209 ha and construction of new passenger and cargo terminals, etc. Package I was commenced in September 1998 and scheduled for completion in March 2000.

Mati Airport: Mati Airport classified as secondary airport is located in Mati, Davao Oriental Province. It has a concrete 1,300 m runway with width of 36 m. At present, it is available for general aviation purposes and caters also to private planes in chartered flights but not in regular flights.

(3) Passenger flight services

The DIA is accommodating domestic passenger flights connecting with five cities in the Country: Manila, Cebu, Cagayan de Oro, General Santos and Zamboanga. The total weekly carrying capacity (one-way) is 15,400 seats, dominated by flights with Manila supplying 10,900 seats per week as of March 1998. The expansion of the domestic air transport sector in the Philippines was propelled by the liberalization of the system which provided the way for the entry of new domestic air carriers starting in 1995. The Philippine Airline (PAL) still dominates domestic air services in Mindanao, but Grand International Airways, Air Philippines, Cebu Pacific and Mindanao Express have entered some of the lucrative routes.

The DIA regularly accommodated international flights from three foreign cities of Singapore, Manado in Indonesia and Kota Kinabalu in Malaysia (stopped operation in March 1998). The total weekly carrying capacity (one-way) is 500 seats. Frequencies are 2-3 flights a week.

Table 22 Airports in Mindanao by ATO Classification

Category	Airport	Province/City	Runway (m)	1996 No. of Passengers	1996 Cargo Volume (ton)
International Airport	none	-	-	-	-
Alternate International Airport (2)	**Davao**	**Davao City**	**2,500 x 45**	**848,778**	**30,903.0**
	Zamboanga	Zamboanga del Sur	2,610 x 45	369,391	4,539.6
Trunkline Airport (3)	Cagayan de Oro	Misamis Oriental	2,380 x 36	360,632	8,144.0
	Cotabato	Maguindanao	1,900 x 30	128,044	1,036.7
	General Santos	South Cotabato	3,200 x 45	99,728	1,916.4
Secondary Airport (13)	Allah Valley	South Cotabato	1,340 x 18	-	-
	Bislig	Surigao del Sur	1,200 x 30	-	-
	Butuan	Agusan del Norte	1,852 x 36	62,111	687.5
	Dipolog	Zamboanga del Norte	1,870 x 30	65,084	416.0
	Iligan	Lanao del Norte	1,400 x 30	-	-
	Jolo	Sulu	1,500 x 30	45,431	241.5
	Malabang	Lanao del Sur	1,300 x 36	-	-
	Mati	**Davao Oriental**	**1,300 x 36**	-	-
	Ozamiz	Misamis Occidental	1,200 x 30	18,326	232.0
	Pagadian	Zamboanga der Sur	1,680 x 36	53,685	960.3
	Sanga-Sanga	Tawi-Tawi	1,600 x 36	31,815	533.9
	Surigao	Surigao del Norte	1,536 x 30	17,530	261.2
	Tandag	Surigao del Sur	1,360 x 30	12,973	40.2
Feeder Airport (7)	Barobo	Surigao del Sur	800 x 20	-	-
	Camiguin	Misamis Oriental	1,300 x 30	-	-
	Ipil	Zamboanga der Sur	735 x 30	2,590	86.2
	Liloy	Zamboanga der Norte	500 x 30	-	-
	Malaybalay	Bukidnon	962 x 30	-	-
	Siargao	Surigao del Norte	1,000 x 30	-	-
	Siocon	Zamboanga der Norte	500 x 30	904	-
		MINDANAO TOTAL		2,117,022	49,998.5

Source: ATO

Table 23 Profile of Davao International Airport and Mati Airport

Items	Davao International Airport	Mati Airport
Category	Alternate International Airport	Secondary Airport
Airport Area	104 ha	n.a.
Runway (length x width)	2,500 x 45 m (concrete)	1,300 x 36 m (concrete)
Largest Aircraft	Airbus 300 / Boeing 737	F27
Taxiway (length x width)	65 x 21 m	None
Apron	200 x 100 m for commercial 70 x 100 m for general aviation	150 x 70 m
Control Tower	1	none
Passenger Terminal Building	2	1
Cargo Terminal Building	1 (owned by PAL)	none

Source: ATO

(4) Air traffic characteristics

Passenger/cargo/traffic volume

In 1996, flight operation handled at the DIA was 19,648 in total, consisting of 7,861 for commercial flights, 7,997 for general aviation and 3,610 for military. The air passengers and cargoes handled at the DIA accounted for 40% and 60% of total in Mindanao.

Domestic cargo/passenger traffic at DIA from 1988 to 1996 is shown in Table 24. The total number of domestic air passengers increased from 445,000 in 1988 to 849,000 in 1996. Domestic cargo traffic volume increased from 11,000 tons in 1988 to 31,000 tons in 1996. Major commodity types handled at the DIA are equipment, appliances, motorcycles and material for cloths for inbound, and tuna, flowers, fruits and vegetables for outbound.

The number of international passengers was 14,000 in 1996, comprising 7,849 for Kota Kinabalu route and 6,137 for Manado route (Table 25). Operation of Davao-Singapore route started in 1997, and 3,255 passengers were transported from January to July 1997.

Domestic air passenger movements

In 1996, about 585,000 passengers were transported by air transport between the DIA and Manila, accounting for 69% of total number of air passengers to/from the DIA (Table 26). About 19% of total air passengers to/from the DIA or 165,000 passengers moved between Davao and Cebu.

Domestic air cargo movements

Cargo volume handled by air transport in the Philippines is very small. In Region XI, 15,000 tons of cargoes were transported by air between the DIA and Manila, accounting for 90% of total volume of cargo to/from the DIA (Table 1.27). The next most important trade partner is Region VII (Central Visayas) with 8.4% of total cargoes handled at the DIA or 1,500 tons of cargoes moving between Central Visayas Area.

Table 24 Domestic Airport Traffic, Davao International Airport, 1988-1996

Year	Passenger ('000 pax)		Passenger	Cargo (tons)		Cargo
	Arrival	Departure	Total	Arrival	Departure	Total
1988	219,901	224,622	444,523	5,316	5,170	10,485
1989	212,650	217,481	430,131	5,426	6,533	11,959
1990	216,443	223,800	440,243	6,526	12,338	18,864
1991	192,059	196,673	388,732	6,803	10,370	17,173
1992	217,951	220,902	438,853	7,800	8,833	16,633
1993	231,351	234,854	466,205	7,847	10,344	18,191
1994	262,407	262,272	524,679	10,274	9,912	20,186
1995	325,500	316,915	642,415	16,780	22,089	38,869
1996	421,344	427,434	848,778	14,021	16,881	30,903

Source: ATO

Table 25 International Airport Traffic, Davao International Airport, 1996-1997

Country	Passenger (pax)		Passenger
	Arrival	Departure	Total
1996			
Kota – Malaysia	3,670	4,179	7,849
Manado-Indonesia	2,897	3,240	6,137
Total	6,567	7,419	13,986
1997 (Jan.-Jun.)			
Kota – Malaysia	2,431	2,471	4,902
Manado-Indonesia	1,975	1,950	3,925
Singapore	1,601	1,624	3,225
Total	6,007	6,045	12,052

Source: ATO

Table 26 Domestic Air Passenger Movement of Davao International Airport, 1996

Origin / Destination (Airport)	No. of Air Passengers (pax)	% share
Manila	585,862	69.0
Mactan (Cebu)	164,122	19.3
Cagayan de Oro	31,256	3.7
Zamboange	23,652	2.9
Others	43,886	5.1
Total	848,778	100.0

Source: ATO

Table 27 Domestic Air Cargo Movement of Region 11, 1995

Region	Quantity (tons)		Quantity	Quantity	Value (000 pesos)		Value	Value
	From R-11	To R-11	Total	%	From R-11	To R-11	Total	%
NCR	8,406	6,624	15,030	89.8	696,253	492,708	1,188,961	90.5
CAR	1	1	2	0.0	65	62	127	0.0
Region 1	-	-	0	0.0	20	71	91	0.0
Region 2	2	-	2	0.0	136	10	146	0.0
Region 3	0	0	0	0.0	0	0	0	0.0
Region 4	4	-	4	0.0	214	16	230	0.0
Region 5	3	1	4	0.0	243	118	361	0.0
Region 6	83	36	119	0.7	5,914	3,036	8,950	0.7
Region 7	628	779	1,407	8.4	33,376	67,231	100,607	7.7
Region 8	3	1	4	0.0	135	69	204	0.0
Region 9	75	28	103	0.6	6,161	2,086	8,247	0.6
Region 10	38	23	61	0.4	4,040	1,801	5,841	0.4
within Region 11	-	-	0	0.0	-	-	97	0.0
Region 12	0	0	0	0.0	0	0	0	0.0
ARMM	1	-	1	0.0	81	23	104	0.0
	9,244	7,493	16,737	100.0	746,735	567,328	1,314,063	100.0

Source: Philippine Statistical Yearbook 1996

1.3. Major Transportation Projects

1.3.1. On-going/committed projects

(1) Road network

Foreign assisted road projects

A number of foreign assisted road projects are now on-going or committed as shown in Table 28. These are being implemented by DPWH, and funded mainly by IBRD and OECF with total cost of ₱1.5 billion. Some of the bridge construction projects are being funded by JICA. Among them, three restoration projects of Davao City – Digos, Davao City – Bukidnon and Digos – GSC roads have been designated as the Philippine Flagship Projects for accelerated implementation.

Other major road projects

Table 29 presents other major on-going/committed road projects under the DPWH Infrastructure Development Program. Projects involve mainly improvement, pavement, and widening of major arterial and national secondary roads.

Table 28 Foreign Assisted Road Projects in the DIDP Area

Projects	Type	Implementation Schedule	Project Cost (mil. pesos)	Status	Source
Davao City – Digos Road	Restoration	1995 - 1997	265.918	complete	IBRD
Davao City – Bukidnon Road	Restoration	1996 - 1998	574.949	on-going	IBRD
Digos – GSC Road	Restoration	1996 - 1998	365.014	on-going	IBRD
Phil.-Japan Friendship Highway (Davao – Agusan Road)	Rehabilitation	1998	190.000	Committed	OECF
Rural Road Network Dev't Project II (Davao Province)		1998	37.400	Committed	OECF
Tagum – Panabo Circumferential	Improvement	1998	21.266	Committed	PREMIUMED

Source: DPWH Region XI

Table 29 Other Major Road Projects in the DIDP Area

Projects	Type	Year	Length	Project Cost (mil. pesos)
Davao Oriental – Surigao del Sur Coastal Road	Improvement/Concreting/ Widening	1997	30.34 km	162.2
		1998	46.12 km	300.0
		1999 -	214.00 km	1,495.0
Davao – Agusan Road	Widening	1997	8.13 km	45.0
		1998	31.59km	173.8
		1999 -	69.00km	484.0
Davao del Sur – Sarangani Coastal Road	Construction/Concreting/ Improvement	1997	49.30 km	84.0
		1998	71.83km	202.6
		1999 -	246.00km	1,552.0
Davao del Sur – North Cotabato Road (Digos-Bansalan)	Asphalt overlay	1997	1.45 km	5.0
		1998	2.52 km	8.7
		1999 -	29.0 km	175.0
Davao City Diversion Road	Widening	1998	6.0 km	50.0
Matina – Toril Section (Davao City)	Widening	1998	8.0 km	60.0
ABS – Quimpo Blvd. (Davao City)	Widening	1998	3.0 km	20.0
Agdao Flyover (Davao City)	Flyover	1998	180 m	170.0
Bolton Bridge (Davao City)	Bridge	1998	185 m	80.0

Source: DPWH Region XI

(2) **Sea ports**

PPA Capital Infrastructure Projects

Under the Capital Infrastructure Projects of PPA, some port improvement projects are going on or committed: 1) improvement of Davao Port (Sasa Wharf) including nine projects with total project cost of ₱55.25 million; 2) RC sheet piling at Mati Wharf with project cost of ₱1.8 million; 3) berth extension and widening of berth at Malalag Port up to 18 x 50 m with project cost of ₱55 million.

(3) **Airports**

Davao International Airport Development Project

The Project covers the upgrading of the DIA into full international standards to serve as a gateway to the south. The Project involves extension of existing runway up to 3,000 m with new terminals for passengers and cargoes and other facilities for airport operation, maintenance and air navigation. Project cost was estimated at ₱2.86 billion mostly funded by Asian Development Bank (ADB) and European Investment Bank (EIB). Phase I of this project was scheduled from 1995 to 1998, but it has already been delayed due to difficulties in the site acquisition of affected areas and resettlement of affected families. Phase I is currently scheduled for completion by the year 2000.

1.3.2. Project proposals

A number of projects related to transportation are being proposed by the Central Government, LGUs, and the private sector. Since demand forecasting based on the future socioeconomic framework has not been estimated yet, projects are just outlined.

(1) **Road network**

Coastal road (Davao City)

A new coastal road has been proposed with length of 20 km. The right-of-way will be 60 m wide. The road section will start at Lizada, Toril and traverse through the Davao Fishport Complex, Talomo and Time Beaches and end at Magsaysay Park. Three permanent bridges will be constructed, specifically across the rivers of Davao, Matina, and Talomo. Project cost was estimated at ₱580 million. It is scheduled to be completed by the year 2000.

Intersection improvement

The following intersection improvement projects are being proposed as DPWH Priority Projects.

Interchange	Type	Project Cost
ABS-CBN Interchange	Flyover	₱80 million
Buhangin Interchange	Underpass	₱40 million
Ulas Interchange	Flyover	₱80 million
Ma-a Interchange	Flyover	₱75 million

(2) **Sea ports**

Davao Port Development Plan

The extension of 500 m berth was included in the 25-Year Port Development Plan of PPA under the short term period (1995-1999). However, PPA is awaiting for the result of the Feasibility Study and Master Development Plan of Package V Port Project to be undertaken by a private consultant. The Study includes the ports of Davao, Zamboanga General Santos, Isabela (Basilan) and Samal Island (tourist ferry port), and is scheduled for completion in February 1999.

Davao City International Container Terminal Facilities (DICTF)

The project involves construction of new private owned and operated container port in Davao City to serve mega-carriers which will be expected to call on Davao City to unload cargoes for BIMP-EAGA member countries. This project is being promoted by DTI. The port area is composed of 70-75 ha waterfront property with container handling facilities and 100 ha property for container yard or industrial area. Reclamation of 240-250 ha will be made for the site of DICTF. Under the project, a new six-lane tollway with length of 20 km will be constructed alongside of DICTF. This will be negotiated with the National Government based on a 25-year BOT scheme. Implementation schedule and cost are as follows.

Phase	Completion	Project Cost
Pre-F/S Activities	December 1997	₱ 10 million
Phase 1	December 1999	₱ 3,877 million
Phase 2	December 2000	₱ 705 million
Phase 3	December 2001	₱ 300 million
Total		₱ 4,892 million

Maco wharf construction

The project includes construction of a new wharf at Sitio San Roque, Maco, and Davao Province. Objectives of the project are to avoid congestion of shipping activities at the ports in Davao City, and to ensure smooth flow of transporting goods and other agricultural products. The project proponent is the local government of Maco, considering the private sector for financing and technical support under a BOT arrangement. Project cost was estimated at ₱45 million.

Tagabuli port and industrial park

The project site is located at Tagabuli, Sta. Cruz, 42 km south of Davao City. The project involves development of an industrial park with property area of 220 ha and construction of a new port to ship raw materials and products from the park. The project will provide container yard and warehouse facilities. Transport companies such as shipping and trucking services catering to the needs of businesses in the region will be available.

Super fast craft (water jet)

The project is to 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 MAGBALUSTA PAIC in coordination with BOI. Cost of two units on water jet (made in Japan) is ₱25 million. Engineering design for the

seaport in Lupon will be funded by the office of the congresswoman. Operation was scheduled to start by the end of 1997 but it has been delay.

(3) Airports

Flight operation at Mati airport

The MAGBALUSTA PAIC of Davao Oriental is now promoting installation of flight operation at the Mati airport, especially for domestic passenger and international cargoes. They are now conducting a 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.

(4) Other transportation projects

Davao light rail system

The Davao City Comprehensive Development Plan seeks for the establishment of a light-rail-transit (LRT) that will serve the 82.7-km coastal built up area of the City as well as neighboring major towns of Davao Province and Davao del Sur. There will be 37 stations. The project is composed of two phases as follows.

Phase	Section	Length	No. of Stations
Phase 1	Panacan – Toril	35.7 km	22 stations
Phase 2-A	Toril – Sta. Cruz (Davao del Sur Prov.)	25 km	10 stations
Phase 2-B	Panacan – Panabo (Davao Prov.)	22 km	5 stations

The target date for the completion of the project is the year 2000. To promote the implementation of the project, the plan suggested that a Built-Operate-Transfer (BOT) financing scheme should be adopted. The project cost has not been estimated yet.

Chapter 2 Constraints and Potentials

2.1. Constraints

Inadequate transportation facilities and services constrain economic growth as well as social and urban development in the DIDP Area. Constraints in the transport sector have been identified through the analysis on data and information, field observations, interviews and discussions at provincial/City workshops. Limited traffic counts were also conducted at selected intersections in Davao City. Major constraints are described.

(1) Roads and road transport

1) Inadequate arterial road system

The arterial road system in the DIDP Area is still inadequate with only one artery passing through the Area, limited access points from outside, network deficiencies, and generally poor surface conditions. Road density of all the roads is 0.63 km/km^2 in the DIDP Area, higher than averages in the Philippines, Mindanao and Region XI, but national roads constitute only 9% of the total road length, of which only 48% is paved. Inter-provincial roads are insufficient, and coastal roads in Davao del Sur and Davao Oriental are dilapidated in some sections.

2) Poor rural access

Access to remote rural areas is constrained by the topography dominated by mountainous and rolling terrains and peninsulas. Some sections in the highland are subject to landslide risks. Habitual flooding further aggravates the situation, and some remote villages are isolated during major floods.

3) Inadequate urban transport system

Most urbanized areas have inadequate road systems, causing already serious traffic congestion during peak times. Volume capacity on major urban and inter-city roads is becoming insufficient against the rapid increase in vehicles (8.5% per annum during 1990-96). Road-based public transport such as jeepeny and bus does not meet the increasing demand for passengers within and between larger cities. These conditions are observed more seriously in Davao City. Poor drainage in central areas makes the situation even worse. Traffic management in the City is generally poor.

(2) Seaports and sea transport

4) Limited public commercial seaports

The DIDP Area has many private ports but limited public port facilities. Sasa Wharf, owned and operated by PMO-Davao under PPA, supports commerce and trade functions of Davao City, handling 65% of imported cargoes and 35% of total cargo throughput under PMO-Davao. Mati Wharf is not fully operated. Passenger ferry services are available only at Sasa Wharf and Sta. Ana Pier.

Private ports handled 56% of the total cargo throughput of 6.2 million tons in 1996, and 1.43 million tons or 95% of exported cargoes. Many private ports are used almost exclusively to ship out certain commodities – mostly bananas,

followed by some other fruits and vegetables and cement. These facilities are not generally available for other commercial purposes.

5) Underdeveloped shipping routes

Inter-regional cargoes transport is dominated by limited destinations/origins. Of the total cargo volume to/from Region XI, 44% was with NCR, followed by 24% with Central Visayas in 1994. Inter-regional passenger movements to/from Region XI have more balanced O – D structure. In either case, however, inter-regional shipping does not make additional stops within the DIDP Area. Also coastal shipping is largely undeveloped. Moreover, shipping services to/from remote islands are at best sporadic and unreliable.

(3) Airports and air transport

6) Limited airport facilities and capacity

The Davao International Airport (DIA) is the only airport providing for regular inter-regional and international air services. In fact, it is the most important airport in Mindanao, handling 40% of passengers and 60% of cargoes in the island. The Mati airport caters only to private chartered flights. The DIDP Area also has 17 private airports, but they are not any part of public air services.

Domestic air traffic at the DIA is rapidly increasing in recent years for both passengers and cargoes. The number of passengers increased at the average annual rate of 8.4% during 1988-96 to reach 849,000 in 1996, and the cargo volume increased almost three-fold or 14.5% per annum on an average during the same period to exceed 30,000 tons in 1996. Existing capacity and services are fast becoming inadequate to meet the rapidly increasing demand.

(4) Other constraints

7) Lack of fund

Lack of fund is a major constraint to improving the transport sector in the DIDP Area. For instance, the budget allocation for artery/secondary roads in the DIDP Area was only 8.6% of the total highway budget in the Country in 1997. Although the road transport industry is developing rapidly especially in Davao City and cargo handling at Sasa Wharf is operated by private companies, private sector participation in the transport sector is still limited.

8) Difficulty in right-of-way acquisition

Right-of-way acquisition is difficult due to squatters and densely populated settlements especially in coastal areas. This constrains the realignment or expansion of existing roads and construction of new roads.

9) Environmental constraints

Construction/expansion of roads along the coast and in highland/hillyland areas calls for environmental considerations, especially when the roads pass through flood-prone areas and sections of landslide risks. Expansion of port-facilities needs to be planned with considerations on marine and coastal ecosystems as well as land access to them. Environmental considerations for infrastructure projects in the DIDP Area should be more broadly based, including social environment.

2.2. Future Traffic Demand

(1) Road traffic

Traffic volume on the major national highways was estimated by the Master Plan Study on Visayas and Mindanao Islands Strategic Road Network Development Project undertaken by DPWH and JICA. Demand forecast was done based on a future socioeconomic framework, present origin/destination matrices and forecast models formulated by existing transportation patterns.

Table 30 shows the present and future traffic volume on major road sections in the DIDP Area. Future traffic volume in 2016 will increase by more than two times of the figure in 1996. Especially along Pan-Philippine Highway, the most major national road in the DIDP Area, traffic volume will be more than 20,000 in somewhere in and near Davao City.

Traffic volume on most major road sections will exceed the existing capacity in the year 2016. Therefore, appropriate road widening and/or improvement should be done to maintain the road traffic in sufficient condition.

Table 30 Estimated Traffic Volume on Major Road Sections

Road	Section	Traffic Volume 1996 (AADT)	Traffic Volume 2016 (AADT)	Growth Ratio 2016/1996
Agusan – Tagum –Davao City Road	Monkayo, DN	1,460	8,000	5.5
	Mawab, DN	3,278	12,000	3.7
	Panabo, DN	8,345	30,000	3.6
Davao City – Digos – G. Santos City Road	Sta. Cruz, DS	3,596	23,000	6.4
	Digos, DS	6,836	24,000	3.5
	Sulop, DS	1,204	8,000	6.6
Tagum – Mati Road	Lupon	1,423	5,000	3.5
Digos – Cotabato Road	Bansalan, DS	1,830	10,000	5.4
Davao City – Bukidnon Road	Calinan, DC	1,211	3,000	2.5
Mati – Boston Coastal Road	Tarragona, DO	204	1,500	7.3
Malalag – J.A. Santos Coastal Road	Malita, DS	418	2,000	4.8

Source: DPWH Region XI and Master Plan Study on Visayas and Mindanao Islands Strategic Road Network Development Project undertaken by DPWH-JICA, 1997

(2) Port traffic

The master plan study with feasibility study for Davao Port (Sasa Wharf) is being undertaken by PPA under the Port Package V commenced July 1998. The project includes projections of port traffic, individual port master plans and development projects for five specific ports in Southern Mindanao. The study is scheduled for completion in February 1999. The development of Davao Port will be re-studied in consideration of its extension port of Sta. Ana and other nearby private commercial ports. In making the projections, considerations will be given to the effect of future development of other ports in the Area and possible additional traffic generated by the proposed development.

Although, the detailed study would be done by the PPA study, rough projection is conducted in this section to clarify whether new port construction is required.

The preliminary projection of cargo throughputs for Sasa Wharf is currently done by PPA. The results are summarized in Table 31 (Case 1). The cargo throughput for the year 2015 is estimated at more than 13 million tons. Future annual growth rate of cargo throughputs is assumed as 10%. According to the records, average growth rate is about 10% from 1990 to 1996, except for the declined years of 1991 and 1992 because of wharf extension. Considering the port expansion projects and increase of berth capacity, port capacity will increase up to 8.6 million in 2015. However, traffic volume will exceed its capacity sometime during 2005-2010.

Another projection case is generated as shown in Table 31 (Case 2). Tefasco Wharf, located near Sasa Wharf, is a private commercial port handling general cargoes, containers, break bulk and bulk cargoes. Recently, its cargo throughputs have been increasing. However, Tefasco Wharf can no longer be expanded and accommodate only up to one million tons. Assuming excess cargoes will go to Sasa Wharf, cargo throughputs will increase to exceed 17 million tons in 2015. In this case, 314,000 tons of excess cargoes are foreseen in 2000 but it could be avoided by increasing berth occupancy rate. Berth occupancy rate was assumed as 70% in the projection. The demand projection should be adjusted in the PPA study.

Table 31 Estimated Port Traffic Volume at Davao Port

	1996	2000	2005	2010	2015
CASE 1 (w/o cargoes from Tefasco Wharf)					
1. Cargo Throughput (000 MT, 10%)	2,139	3,132	5,045	8,124	13,084
2. Existing/Planned Berth Length (LM)	920	1,260	2,160	2,160	2,160
3. Berth Capacity (MT/LM)	-	2,500	3,000	3,500	4,000
4. Port Capacity (000 MT)	-	3,150	6,480	7,560	8,640
5. Excess Cargo (000 MT)	-	-	-	564	4,444
6. Length of berth to be expanded (LM)	-	-	-	161	1,111
CASE 2 (w/ excess cargoes from Tefasco Wharf)					
1. Cargo Throughput (000 MT)	2,139	3,464	6,190	10,578	17,647
Sasa Wharf (10%)	2,139	3,132	5,045	8,124	13,084
Tefasco Wharf (excess of 1 mill. MT, 10%)	-	332	1,145	2,454	4,563
2. Existing/Planned Berth Length (LM)	920	1,260	2,160	2,160	2,160
3. Berth Capacity (MT/LM)	-	2,500	3,000	3,500	4,000
4. Port Capacity (000 MT)	-	3,150	6,480	7,560	8,640
5. Excess Cargo (000 MT)	-	314	-	3,018	9,007
6. Length of berth to be expanded (LM)	-	-	-	862	2,252

Source: PPA

(3) Airport traffic

Passenger/cargo traffic volume at Davao International Airport (DIA) for the year 2010 was estimated in 1996 under the Civil Aviation Master Plan (CAMP) by DOTC. In deriving estimation, various influences on demand were taken into account, such as past trends of traffic growth, ICAO/IATA predictions for international traffic growth and GDP growth, etc. According to the study, traffic demand of the DIA will increase rapidly in the future as shown in Table 32. The

number of passengers for scheduled services will increase to 1.8 million in 2010, 2.1 times of the figure in 1996. Cargo traffic will increase to 98,000 tons in 2010, 3.8 times of the figure in 1996.

The Davao International Airport Development Project (DIADP) will increase the airport capacity for passengers and cargoes. The DIA will become a full status international airport in the DIDP Area with 3,000 m runway, new passenger/cargo terminals and other facilities. It will be able to accommodate Boeing 767/777 class aircrafts and about 30 times of takeoffs and landings per day.

Therefore, the future airport capacity could exceed the estimated traffic demand in terms of the number of operations. During the master plan period, however, situations of air traffic demand and facilities at the DIA should be observed, and further expansion or new airport construction would be studied if necessary.

Table 32 Estimated Air Traffic Volume at DIA

	1996	2010	Remarks
Passenger Throughput (000 pax/year)			
Domestic	849	1,398	Annual growth rate
International	14	451	8%/6%
Total	863	1,849	Ave. 5,000 pax/day
Cargo Throughput (tons/year)			
Domestic	25,909	76,465	Annual growth rate
International	20	22,000	10%
Total	25,929	98,465	Ave. 270 tons/day
No. of Operations (000 times/year)	10.4	13.2	Ave. 36 operations per day
Average No. of passengers (pax/flight)	73	140	

Source: Civil Aviation Master Plan, DOTC, 1996

Chapter 3 Transportation Development Strategy

3.1. Objective of Transportation Development

The objective of transportation development in the DIDP Area is to establish the *Integrated Multi-Modal Transport Network* consisting of road, water and air transportation modes. Different transportation modes must be closely connected each other for the smooth transferring of people and goods. Therefore, sub-sectors of road, air and sea transportation should not be developed independently. There must be a close coordination between them.

Another concept of the transportation network is integration of three levels of transportation system: 1) international and inter-regional transportation system, 2) intra-regional transportation system and 3) urban and rural transportation system including farm-to-market roads. These three levels of transportation system should be closely linked through functional terminal facilities such as airports, seaports and bus terminals. Basic structure of future transportation network is shown in Figure 7.

3.2. Transportation Development Strategy for the DIDP Area

Establishment of the stable and efficient transportation network will not only satisfy the basic needs on movements of people and good but also supports/enhances the economic growth in the DIDP Area. In order to establish the integrated multi-modal transportation network under the DIDP strategy, the following need to be undertaken.

Internal integration

- to strengthen intra-regional road system,
- to improve rural access roads,
- to improve urban traffic management especially for Davao City and other larger urban centers,
- to establish coastal shipping routes, and
- to provide regular shipping services to remote islands.

Globalization drive

- to strengthen inter-regional road system,
- to strengthen urban transport system for Davao City,
- to improve feeder port and airport facilities and shipping and air transport services, and
- to upgrade transport infrastructures and services serving tourist attractions.

High tech – high services

- to establish alternative inter-regional highways,
- to introduce an urban rail transit system serving more advanced coastal areas,
- to upgrade international/inter-regional access points such as DIA and Davao Port, and
- to connect Samal and Talikud Islands with the mainland.

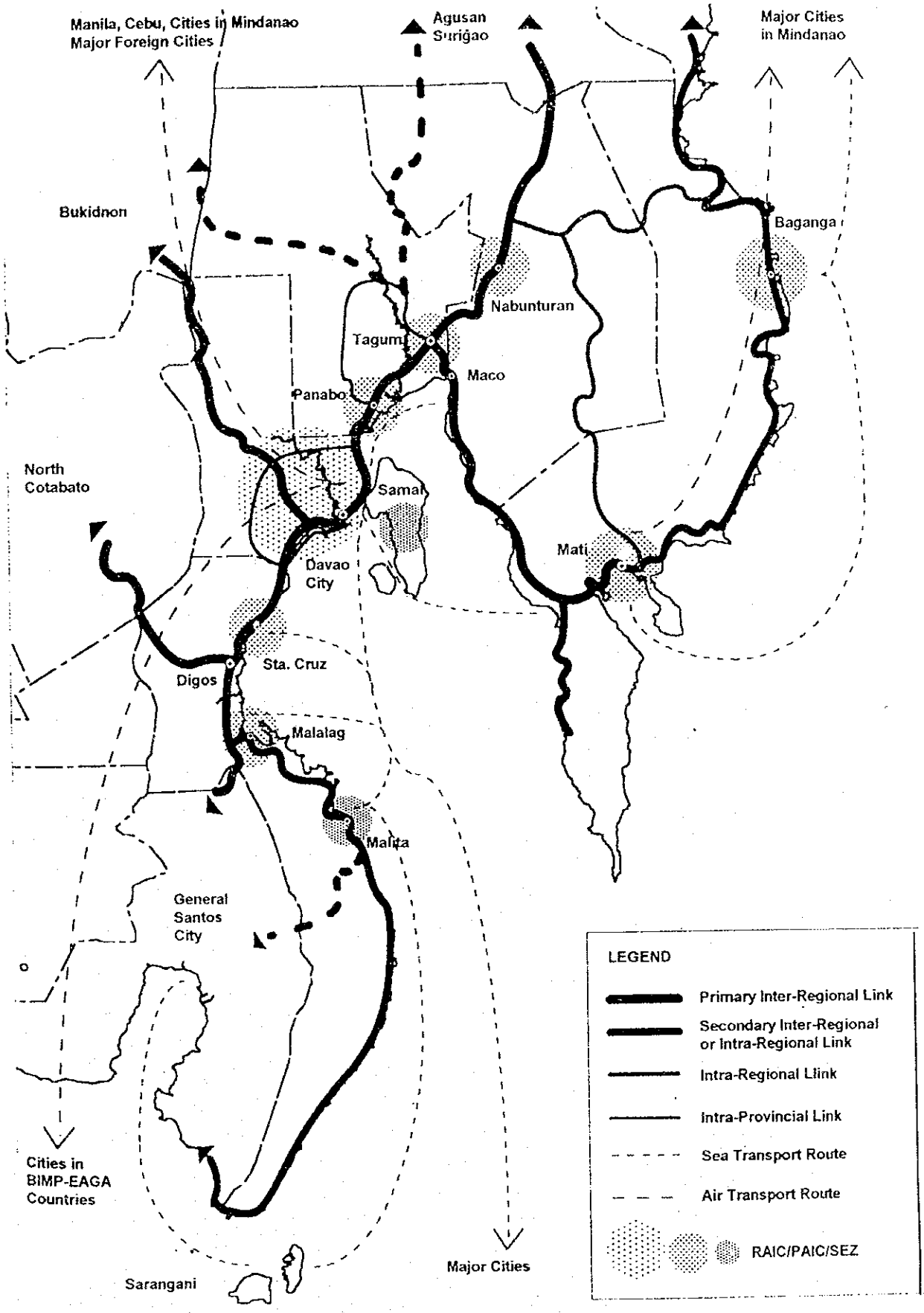


Figure 7 Structure of Future Transportation Network for the DIDP Area

(1) Internal integration strategy

1) Strengthening intra-regional road system: unpaved road sections traversing coastal areas of Davao Oriental and Davao del Sur should be improved and paved such as (a) Mati – Baganga - Boston, (b) Lupon – G. Generoso and (c) Malalag – J.A. Santos – Sarangani coastal roads and alternative intra-regional routes, (d) Montevista – Compostela – Cateel, (e) Compostela – Maragusan – Mati, and (f) Tagum – Panabo circumferential roads.

2) Improvement of rural access roads: rural and farm-to-market roads should be improved and/or constructed to all-weather roads to support efficient transport of agricultural products and to establish a community-based alternative system utilizing self-help efforts.

3) Improvement of urban traffic management: traffic management schemes such as signalization, channelization, improvement of traffic law enforcement etc. should be conducted at major intersections in urbanized areas, especially in Davao City. Traffic bottlenecks such as bridges, major loading/unloading points should also be improved or widened.

4) Establishment of coastal shipping routes: to provide efficient and alternative transportation services for the increasing agricultural products of the Area, coastal shipping network connecting rural settlements to markets should be established.

5) Providing regular shipping services to remote islands: the connection between Sarangani and Balut Islands and mainland is very weak, and shipping service is available only between G. Santos City at present. Regular passenger/cargo ship services should be provided for Sarangani and Balut Islands.

(2) Globalization drive strategy

1) Strengthening inter-regional road system: the existing primary inter-regional roads: (a) Davao City – Tagum – Agusan, (b) Davao City – Digos – G. Santos City, (c) Davao City – Bukidnon, (d) Tagum – Mati, and (e) Digos – North Cotabato roads should be widened to four lanes. A well developed inter-regional road network could support expansion of economic activities, especially along the advanced corridors in the DIDP Area.

2) Strengthening urban transportation system for Davao City: urban radial and circumferential road network in Davao City including a coastal road should be established to meet with increasing traffic demand and rapid urbanization due to the concentration of population and economic activities. Some heavy traffic intersections need to be replaced with grade separation structure.

   To formulate the efficient urban transportation network and system, a study on urban transportation development master plan should be undertaken for Davao City. Improvement of public transportation system including an urban rail system and traffic management scheme such as grade separation and bridge expansion should also be studied.

   Integrated transportation terminals connecting both provincial and city/intra-municipal public transportation services will support the establishment of multi-modal transport network in the DIDP Area. Davao City and other urbanized municipal centers should establish this kind of terminal facilities.

3) Improvement of facilities of feeder ports and airport: to support the PAIC development and the transportation strategy through the establishment of coastal shipping network, a number of ports should be improved or constructed. These ports will also play a role of feeder function to Davao Port. It was tentatively identified that the feeder ports could be located at coastal PAIC/SEZ centers such as a) Mati, b) Malalag, c) Baganga, d) Sta. Cruz, e) Malita and f) Maco. In parallel with port improvements, maritime navigation aids and communication facilities need to be improved to enhance the safety of shipping operations.

The facilities of the Mati airport should be improved to accommodate regular as well as irregular flight operations, especially for domestic passengers/tourists and export of high-value agricultural products in the Area.

4) Upgrading transportation infrastructures and services serving tourist attractions: for the tourism development in the DIDP Area, transportation system is one of the important factors. Efficient road network, rapid passenger ferry and frequent roll-on/roll-off services will serve tourists with shorter travel time to reach tourism destinations. The upgrading of the Davao International Airport and the Mati airport and various air routes will increase the domestic/international tourist arrivals.

(3) High tech – high services strategy

1) Establishment of alternative inter-regional highways: in addition to existing inter-regional routes, road sections such as (a) Assuncion – Agusan, (b) Kapalong – Talaingod – Bukidnon, and (c) Malita – G. Santos City roads should be established as new alternative inter-regional linkages.

2) Introduction of an urban rail transit system serving more advanced coastal areas: urban rail system traversing the coastal urbanized areas in Davao City and surrounding municipalities should be studied and constructed to provide rapid and reliable public transportation services for passengers.

3) Upgrading international/inter-regional access points: Davao Port (Sasa Wharf) should be upgraded to accommodate increasing cargo traffic due to the expanding economic activities. The existing berth facilities and yard area should be expanded and cargo handling equipment should be improved. To support the expansion of containerized cargoes for export and to meet with the site limitation of Davao Port in the future, a new international port designated as a container terminal needs to be established.

The existing Davao International Airport should be upgraded to increase their operational efficiency and service levels, safety and security as one of gateways of the Philippines to reach major commercial centers and tourism destinations. The upgraded airport will promote various international and domestic air routes connecting with major cities in the Philippines, and BIMP-EAGA countries etc. by route sharing between the DIA and the GSC airport.

4) Connection of Samal and Talikud Islands with the mainland: to increase tourism potential of the islands of Samal and Talikud, the service frequency of existing ferry boats including roll-on/roll-off ships between Davao City and berths in the islands should be increased. New type modernized boats could be installed to increase the passengers' convenience. Berth facilities need to be improved. The

connection by bridges may be considered during the master plan implementation period based on the situation of industrial and residential land uses.

3.3. Transportation Infrastructure Investment Plan

The infrastructure investment program has been prepared by NEDA for 1999-2004. The program includes the development of national roads, seaports and airport. For the DIDP Area, the total fund of ₱7.7 billion was allocated for the forthcoming medium term period.

The projects identified in the program are those that are on-going, in the pipeline or have been approved for implementation with funding commitment and have detailed engineering and feasibility study ready for funding and implementation.

For the DIDP Area, road projects include widening, concrete paving, maintenance and some new construction of national arterial/secondary roads and urban roads in Davao City. Seaport projects focus on the improvement of port facilities and wharf extension at Sasa Wharf in Davao City. The fund for construction of a new international container terminal in Panabo, Davao del Norte is also included in the program after the year 2001. The Davao International Airport Development Project funded by GOP/ADB/EIB is the only one project on airport development in the DIDP Area.

Most part of funds are allocated for road projects, 66% of the total fund. Investment requirements for various transportation infrastructure are summarized below.

Table 33 Investment Requirement in Transportation Development, 1999-2004

(in million Pesos)

Transportation Infrastructure	Implementing Agency (Funding Source)	1999	2000	2001	2002	2003	2004	Total
National Roads	DPWH (GOP)	**934.8**	**792.7**	**870.0**	**768.1**	**742.7**	**938.2**	**5,046.5**
Davao City		447.1	270.7	277.0	118.4	128.7	310.2	1,552.1
Davao Prov.		202.3	149.5	112.5	134.5	158.0	183.0	939.8
Davao Oriental		106.0	126.5	160.5	137.7	94.0	106.0	730.7
Davao del Sur		179.5	246.0	320.0	377.5	362.0	339.0	1,824.0
Seaports	DOTC-PPA	**481.5**	**1.6**	**536.0**	**536.0**	**536.0**	**537.0**	**2,628.1**
Sasa Wharf	(GOP)	481.5	1.6	-	-	-	-	483.1
Panabo (new)		0.0	0.0	536.0	536.0	536.0	537.0	2,145.0
Airports	DOTC-ATO	**1.1**	**0.3**	-	-	-	-	**1.5**
Davao Int'l Airport	(GOP/ADB/EIB)							
Total		**1,417.4**	**794.7**	**1,406.0**	**1,304.1**	**1,278.7**	**1,475.2**	**7,676.1**

Source: Southern Mindanao Regional Development Investment Program 1999-2004, NEDA, Region-XI

Chapter 4 Transportation Development Projects/Programs

4.1. Road System Development Projects

(1) Inter-regional roads upgrading project

The project includes widening and/or rehabilitation of primary inter-regional roads connecting urban centers in the DIDP Area with surrounding regions in Mindanao. A well-developed road network will serve efficient movement of peoples and goods in the Area. Most road sections are basically paved by concrete with two lanes. Some parts of road were widened to four lanes, especially in urbanized municipal centers. Remaining sections should be widened and rehabilitated.

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 going on as the Philippine Flagship Project; after the project, road widening to four lanes should follow.

4) Digos – North Cotabato road: widening to four lanes is to be started.

(2) Intra-regional road development project

The project intends to improve a number of intra-regional roads to link urban centers within the DIDP Area by higher density arterial road network including inter-regional roads. Most of those roads are opened but still in gravel conditions. Some coastal sections such as southern coastal roads in Davao del Sur and Davao Oriental are still unopened or impassable.

1) Tagum – Mati road: this road is entirely paved with concrete or asphalt; most of road sections should be widened to four lanes.

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.

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 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.

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 should have improvement of banks to avoid landslides; a section from Don Marcerino to the south until the boundary with Sarangani Province should be opened with at least all-weather conditions.

5) Montevista – Compostela – Cateel road: this road connects northern coastal areas of Davao Oriental and Compostela Valley passing through upland; the road should be widened and improved from gravel to paved conditions.

6) Compostela – Maragusan – Mati road: this road connects southern part of Davao Oriental and Compostela Valley passing through mountainous areas; the road should be widened and improved from gravel to paved conditions.

7) Tagum – Panabo Circumferential road: this road serves to connect urbanized areas in Davao del Norte; the grade of road should be raised to avoid influence of flooding and paved entirely.

(3) Alternative inter-regional road establishment project

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 Midanao.

1) Assuncion – Agusan road: this road will provide an 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 though upland areas.

3) Malita – G. Santos City road: this road will connect the southern coastal areas in Davao del Sur, specifically Malita and Sarangani Province and G. Santos City; most of the routes will pass though mountainous sections.

(4) Rural and farm-to-market road program

Poor conditions of rural roads, especially farm to market access roads affect economic activities in rural areas. Some rural communities are facing difficulty in marketing their products due to inadequate farm-to-market roads. Since the DIDP Area is the agriculture oriented region, improvement of rural access roads are as important as improvement of regional arterial roads.

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 a study to review the existing conditions of rural roads. Then, priority criteria should be established for rural road development with design standards coordination with DA. 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 also be formulated based on the self-help efforts of the local communities.

(5) Special purpose roads improvement project

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

1) Nabunturan – Maini Park Road Widening,
2) Toril – Bayabas – Eden Road Pavement and
3) Mt. Apo National Park Road Pavement.

The project will also improve the Babak – Penaplata – 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. The Digos Diversion Road Widening is also covered by the project.

4.2. International/Inter-Regional Access Points/Services Development Projects

(1) Davao port development projects

This is the 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 and inter-regional container cargoes.

Sasa Wharf expansion and improvement project

Sasa Wharf will be developed in accordance with the PPA's 25-Year Port Development Plan. 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.

The project includes staged berth extension. The total berth length will reach 2,160 m with capacity of more than 8.6 million tons per year. Concrete paving of open storage area, development of area vacated by squatters and constructions of passenger terminal shed, transit shed and amenity block are included in the project.

International container terminal development project

After the completion of the above project, Sasa Wharf can no longer be expanded due to the limitation of port area. The analysis shows that the estimated cargo volume will exceed the berth capacity around the year 2010. To accommodate excess cargoes at Sasa Wharf, new port development was planned as a long-term project.

The project involves construction of a new international container port at Panabo in Davao del Norte to serve mega carriers which will be expected to call on Davao City and surrounding economically growing zones and to load/unload cargoes for BIMP-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 Sasa Wharf. Sasa Wharf will handle mainly general, break bulk and bulk cargoes etc.

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 the national road to the port should be constructed.

In planning of a new port, a feasibility study and detail design should be conducted through reviewing port statistics of Sasa Wharf and other ports. If there is a possibility of private sector participation to the project, a sort of BOT (built-operate-transfer) arrangement could be promoted and adopted.

(2) Coastal shipping service establishment project

Rapid passenger ferry services

The project includes the establishment of rapid passenger ferry services between Davao Gulf coastal areas. The new services 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 buses and passenger cars. Accordingly, modern fast sea crafts should be installed and berth facilities should be improved to accommodate passenger crafts and for the safe landing of passengers. Desirable routes are proposed: (a) Lupon – Davao City, and (b) Davao City – Malalag – Malita

The services should be 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.

Relevant local governments 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.

Shipping services to remote islands

The project intends to establish shipping routes for Sarangani and Balut Islands to connect them with the nearest mainland as well as the provincial capital of Digos or Malita. At present, the islands are connected only with G. Santos City by irregularly scheduled ships and not connected with areas in Davao del Sur. Regular shipping services will bring the island's stronger connection with Davao del Sur province and increase in tourists/visitors and potential for business activities. The project also includes some small improvements of berth facilities at the islands to increase the safety of passengers and ships.

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 at a lower level initially.

Samal Island ferry service expansion

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 islands.

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.

Improvement of feeder ports

The project intends to improve or construct a number of ports that are located at major coastal municipalities designated as PAIC centers or special economic zone. Port facilities such as berths, cargo handling equipment and yard areas should be improved or constructed to accommodate increasing agricultural products and general cargoes in the Area. Further, maritime navigation aids and communication facilities should be modernized. Subject feeder ports have been tentatively identified such as: (a) Mati, (b) Malalag, (c) Baganga, (d) Sta. Cruz and (e) Maco.

The upgraded ports are expected to play the role of feeder function of Davao Port as well as to promote the coastal shipping route network in the DIDP Area. The feeder ports should be open for all public uses. Most types of commercial cargoes could be accommodated. Port management should be organized by municipalities or PPA in cooperation with PAICs to promote coastal shipping service to consignors, consignees and forwarders.

(3) Davao international airport development project (DIADP)

The project covers the upgrading of the DIA (Davao International Airport) into full international standards to serve as a gateway to the south. The project involves extension of existing runway up to 3,000 m with new passenger and cargo terminals and other airport operation, maintenance and air navigation aids and communication facilities. The project is 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 delayed due to difficulties in the site acquisition of affected areas and resettlement of affected families. However, this problem has been solved and implementation will go into the construction stage.

The DIA will be upgraded in stages. During the master plan period, airport capacity will be sufficient comparing with the estimated traffic increase. Therefore, the most important issue is that the project is to be implemented on schedule.

(4) Mati airport improvement project

The project includes the small improvement of terminal building and navigational facilities to accommodate more passengers, visitors and high-value commodities. The project will provide alternative means of transport for the movements of peoples and goods and accelerate economic activities such as business, agro-industry and tourism in the Area.

4.3. Urban Transportation System Development Projects

(1) Urban traffic management program

Generally, the installation of signals at heavy-traffic intersections results in a substantial reduction in the number of traffic accidents, 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 accumulation of population and economic activities.

The program includes installation of traffic signals at heavy-traffic intersections along arterial roads in major urban centers such as cities of Davao and Tagum, and Digos etc. The program should include improvement and/or widening of bottlenecks such as intersections, bridges and public transport passenger loading/unloading points etc. Further, heavy-traffic intersections should be vertically separated like structures of overpass, underpass and flyover.

(2) Integrated public transportation terminal improvement project

The project consists of improvement of terminal facilities such as parking lots, passenger shelters, toilets and information desks providing operation timetables, description of intra-municipal routes and city guide maps. Terminals should be

expanded for loading/unloading spaces for intra-municipal services and taxis. Some rerouting for some related intra-municipal services should be done.

Candidate locations selected for this projects are (a) Davao City: two terminals at Panacan and Ulas in addition to the existing overland transport terminal at Ecoland, (b) Tagum City, Davao del Norte, (c) Digos, Davao del Sur, (d) Mati, Davao Oriental, (e) Nabuntran, Compostela Valley, and (f) other urbanized centers.

(3) Davao City urban arterial roads development projects

Davao City formulated a City's arterial road network plan. The planned network is composed of five radial roads, three circumferential roads and a coastal road. Radial roads include Davao – Bukidnon (R1), Toril – Calinan (R2), Catalunan Grande – Dacudao (R3), Ma-a – Talandang (R4) and Buhangin – Callawa roads. Circumferential roads include the Diversion Road (C1), Bunawan – Binugao road (C2), and Bunawan – Calinan road (C3). The right-of-way is 60-meter wide for most proposed roads, 80 m for R1, and 40 m for C1.

In addition, a new coastal road has been proposed with 20 km. The right-of-way will be 60 m wide. The road section will start at Lizada, Toril and traverse through the Davao Fishport Complex, Talomo and Time Beaches and end at Magsaysay Park. Three permanent bridges will be constructed, specifically across the rivers of Davao, Matina, and Talomo.

This proposed road network should be studied and evaluated under the proposed Davao Urban Transportation Development Master Plan Study. Further, a feasibility study and detail engineering design study should be conducted.

(4) Davao metropolitan area rail transit system project

An urban rail transit system that will serve coastal built up areas of Davao City as well as neighboring municipalities in Davao del Norte and Davao del Sur has been proposed by the city government. Along the coastal areas of Davao City, a rail transit system makes sense from the view point of the predicted 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. To promote the implementation of the project, the plan suggested that a BOT (built-operate-transfer) financing scheme should be adopted.

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. In the feasibility study, specific alignment and route selection, locations of stations and depot and type of rail system should be determined based on the ridership forecast. Preliminary engineering/technical study and economic evaluation 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. In this case, the feasibility study can utilize the reliable transportation database and forecast models of the master plan study.

During the conduct of the feasibility study, the government should promote the project to investors. Detail design and construction should be followed in Phase 1. Operation will start and route extension will be considered in Phase 2.

(5) Davao urban transportation development master plan study

Davao City has prepared the Comprehensive Development Plan, 1996-2021 in 1995. The plan for transportation infrastructures was included in the plan; however, 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 a person-trip survey should be conducted for the urban transportation development.

In the study, urban arterial road network, public transportation including rail transit, traffic management scheme and institutional aspects should be further studied and evaluated.

4.4. Phased Development Plan

Preferable implementation schedule is shown in Table 34 according to the criteria set in the transportation development strategies.

Table 34 Project Phasing

Projects / Programs	Phase 1 (1999-2004)	Phase 2 (2005-2010)	Phase 3 (2011-2016)	Davao City	Davao del Norte	Compostela Valley	Davao Oriental	Davao del Sur
Road System Development Projects								
(1) Inter-Regional Road Upgrading Projects				O	O	O	O	O
(2) Intra-Regional Road Development Project				-	O	O	O	O
(3) Alternative Inter-Regional Road Establishment Project				O	O	-	-	O
(4) Rural and Farm-to-Market Road Program				O	O	O	O	O
(5) Special Purpose Roads Improvement Project				O	O	O	-	O
Ports Sea Transport Development Projects								
(5): Davao Port Development Projects								
a) Sasa Wharf Expansion and Improvement Project				O	-	-	-	-
b) International Container Terminal Development Project				-	O	-	-	-
(7): Coastal Shipping service Establishment Projects								
a) Rapid Passenger Ferry Service				O	-	O	O	O
b) Shipping Service to Remote Islands				-	-	-	-	O
c) Samal Island Ferry Service Expansion				O	O	-	-	-
d) Improvements of Feeder Ports				-	-	O	O	O
Airports and Air Transportation Development Projects								
(8) Davao International Airport Development Project (DIADP)				O	-	-	-	-
(9) Mati Airport Improvement Project				-	-	-	O	-
Urban Transportation System Development Projects								
(10) Urban Traffic Management Program				O	O	-	O	O
(11) Integrated Public Transportation Terminal Improvement Project				O	O	O	O	O
(12) Davao City Urban Arterial Road Development Project				O	-	-	-	-
(13) Davao Metropolitan Area Rail Transit System Project				O	O	-	-	O
(14) Davao Urban Transportation Development Master Plan Study				O	O	-	-	O

APPENDICES

Appendix 1-1 Vehicle OD Table (1997)

1. Private Vehicles

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	80	22	26	694	64	51	0	4	66	194	397	14	1,612
2	27	65	63	34	38	0	0	0	0	20	34	1	1	283
3	0	0	30	58	64	0	0	0	0	2	0	0	0	154
4	620	91	179	41	56	8	2	2	1	80	50	8	5	1,143
5	53	13	16	41	222	2	0	0	0	9	9	0	1	366
6	360	1	1	0	4	242	128	26	0	3	3	101	28	897
7	0	0	0	0	0	22	90	8	0	0	0	0	1	121
8	19	0	0	0	1	16	23	46	0	1	0	1	3	110
9	4	3	0	0	0	0	0	0	59	2	14	0	0	82
10	117	5	0	0	2	0	0	0	0	88	7	5	2	226
11	2	10	0	0	6	0	1	0	9	0	3,662	729	19	4,438
12	20	3	0	3	8	11	9	0	1	1	794	3,729	183	4,762
13	197	1	0	0	3	2	4	0	0	0	8	276	2,604	3,095
Total	1,419	272	311	203	1,098	367	308	82	74	272	4,775	5,247	2,861	17,289

2. Jeepneys

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	0	2	1	352	10	7	0	0	2	22	54	3	453
2	1	44	57	33	42	0	0	0	0	36	15	0	0	228
3	0	0	18	40	105	0	0	0	0	0	0	0	0	163
4	24	62	115	23	98	1	0	0	0	74	18	0	0	415
5	0	12	12	74	342	0	0	0	0	1	1	0	0	442
6	111	0	0	0	1	31	191	23	0	0	0	58	6	421
7	0	0	0	0	0	55	93	5	0	0	0	0	0	153
8	0	0	0	0	0	13	14	40	0	0	0	0	0	67
9	1	0	0	0	0	0	0	0	27	5	12	0	0	45
10	1	2	0	0	0	0	0	0	0	216	0	0	0	219
11	15	2	0	1	7	0	0	0	7	0	2,914	289	14	3,249
12	2	0	0	0	2	2	0	0	0	1	442	2,723	124	3,296
13	15	0	0	0	4	9	0	0	0	0	3	52	1,845	1,928
Total	170	122	204	172	953	121	305	68	34	335	3,427	3,176	1,992	11,079

3. Buses

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	80	9	2	13	3	2	0	2	7	142	183	1	444
2	23	28	11	9	0	0	0	0	2	3	4	0	0	80
3	0	0	6	9	0	0	0	0	0	0	0	0	0	15
4	257	21	15	6	0	0	0	0	0	10	2	1	0	312
5	26	0	3	0	0	0	0	0	0	1	0	0	0	30
6	53	0	0	0	0	6	22	14	0	0	1	3	2	101
7	0	0	0	0	0	12	11	7	0	0	0	0	0	30
8	20	0	0	0	0	6	13	3	1	0	0	0	0	43
9	1	5	0	0	0	0	0	0	4	1	4	0	0	15
10	79	2	0	0	0	0	0	0	0	4	1	1	0	87
11	1	0	0	0	2	0	0	0	2	0	239	163	7	414
12	26	0	0	0	0	1	1	0	0	0	323	739	33	1,123
13	109	0	0	0	0	0	0	0	0	0	4	33	189	335
Total	595	136	44	26	15	28	49	24	11	26	720	1,123	232	3,029

4. Trucks

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	46	17	17	390	70	63	0	3	33	161	236	10	1,046
2	12	138	73	61	52	0	0	0	2	30	32	0	1	401
3	0	0	18	37	93	0	0	0	0	0	0	0	0	148
4	229	183	112	22	96	7	4	0	0	28	41	11	10	743
5	25	16	11	65	371	4	2	0	0	6	10	0	2	512
6	255	1	0	0	6	69	49	13	0	4	7	75	21	500
7	0	0	0	0	0	12	30	5	0	0	0	0	0	47
8	15	0	0	0	0	7	13	34	0	0	2	0	5	76
9	4	4	0	0	1	0	0	0	53	5	24	0	1	92
10	44	3	0	0	2	0	0	0	0	166	1	0	1	217
11	2	15	0	0	10	5	0	0	16	1	2,133	371	15	2,568
12	17	1	0	3	7	20	23	1	0	2	433	2,019	148	2,674
13	120	1	0	0	10	3	11	0	0	1	18	146	1,744	2,054
Total	723	408	231	205	1,038	197	195	53	74	276	2,862	2,858	1,958	11,078

5. All Vehicles

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	206	50	46	1,449	147	123	0	9	108	519	870	28	3,555
2	63	275	204	137	132	0	0	0	4	89	85	1	2	992
3	0	0	72	144	262	0	0	0	0	2	0	0	0	480
4	1,130	357	421	92	250	16	6	2	1	192	111	20	15	2,613
5	104	41	42	180	935	6	2	0	0	17	20	0	3	1,350
6	779	2	1	0	11	348	390	76	0	7	11	237	57	1,919
7	0	0	0	0	0	101	224	25	0	0	0	0	1	351
8	54	0	0	0	1	42	63	123	1	1	2	1	8	296
9	10	12	0	0	1	0	0	0	143	13	54	0	1	234
10	241	12	0	0	4	0	0	0	0	474	9	6	3	749
11	20	27	0	1	25	5	1	0	34	1	8,948	1,552	55	10,669
12	65	4	0	6	17	34	33	1	1	4	1,992	9,210	488	11,855
13	441	2	0	0	17	14	15	0	0	1	33	507	6,382	7,412
Total	2,907	938	790	606	3,104	713	857	227	193	909	11,784	12,404	7,043	42,475

ZONE SYSTEM

Zone	Province / City (Municipality)
1	DAVAO CITY
2	DAVAO (Compostela, Maragusan, Mawab, Monkayo, Montevista, Nabunturan, New Bataan)
3	DAVAO (Asuncion, Kapalong, New Corella, San Vicente, Talaingod)
4	DAVAO (Mabini, Maco, Pantukan, Tagum)
5	DAVAO (Carmen, Panabo, Santo Tomas)
6	DAVAO DEL SUR (Bansalan, Digos, Magsaysay, Matanao, Santa Cruz)
7	DAVAO DEL SUR (Hagonoy, Kiblawan, Malalag, Padada, Santa Maria, Sulop)
8	DAVAO DEL SUR (Don Marcelino, J. A. Santos, Malita)
9	DAVAO ORIENTAL (Baganga, Boston, Caraga, Cateel, Manay)
10	DAVAO ORIENTAL (Banaybanay, G. Generoso, Lupon, Mati, San Isidro, Tarragona)
11	OUTSIDE DIDP (Surigao del Norte/Sur, Agusan del Norte/Sur, Bukidnon, Misamis Occidental)
12	OUTSIDE DIDP (Other Provinces in Mindanao)
13	OUTSIDE DIDP (South Cotabato, Sarangani)

Appendix 1-2 Passenger OD Table (1997)

1. Private Vehicle Passengers

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	320	67	2,038	2,182	974	129	49	24	653	668	1,590	533	9,227
2	320	376	201	382	133	1	0	0	11	66	169	13	12	1,684
3	67	201	208	727	233	2	0	0	0	3	0	0	0	1,441
4	2,038	382	727	254	288	19	8	3	5	193	189	40	25	4,171
5	2,182	133	233	288	1,234	8	0	1	0	18	55	27	10	4,189
6	974	1	2	19	8	1,376	426	114	0	18	15	598	88	3,639
7	129	0	0	8	0	426	566	87	0	0	3	32	8	1,259
8	49	0	0	3	1	114	87	254	0	6	0	2	4	520
9	24	11	0	5	0	0	0	0	298	9	62	2	0	411
10	653	66	3	193	18	18	0	6	9	548	24	23	6	1,567
11	668	169	0	189	55	15	3	0	62	24	23,486	5,726	78	30,475
12	1,590	13	0	40	27	598	32	2	2	23	5,726	31,832	2,040	41,925
13	533	12	0	25	10	88	8	4	0	6	78	2,040	18,433	21,237
Total	9,227	1,684	1,441	4,171	4,189	3,639	1,259	520	411	1,567	30,475	41,925	21,237	121,745

2. Jeepney Passengers

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	27	8	344	4,773	2,315	125	15	7	36	652	498	114	8,914
2	27	960	661	1,101	733	4	0	0	19	503	83	7	0	4,098
3	8	661	686	2,245	1,628	1	0	0	12	3	2	0	0	5,246
4	344	1,101	2,245	1,638	2,317	8	0	0	12	949	44	9	7	8,674
5	4,773	733	1,628	2,317	9,836	9	0	0	9	4	117	9	0	19,435
6	2,315	4	1	8	9	934	3,376	503	0	1	2	1,122	151	8,426
7	125	0	0	0	0	3,376	3,706	162	0	1	0	4	20	7,394
8	15	0	0	0	0	503	162	1,202	0	0	0	0	3	1,885
9	7	19	12	12	9	0	0	0	1,086	16	253	0	0	1,414
10	36	503	3	949	4	1	1	0	16	6,800	1	0	0	8,314
11	652	83	2	44	117	2	0	0	253	1	94,844	9,909	274	106,181
12	498	7	0	9	9	1,122	4	0	0	0	9,909	89,062	2,398	103,018
13	114	0	0	7	0	151	20	3	0	0	274	2,398	58,164	61,131
Total	8,914	4,098	5,246	8,674	19,435	8,426	7,394	1,885	1,414	8,314	106,181	103,018	61,131	344,130

3. Bus Passengers

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	1,968	259	9,229	5,868	3,090	529	642	92	2,186	3,428	5,822	3,007	36,120
2	1,968	2,374	328	1,098	0	2	0	0	149	71	982	52	2	7,026
3	259	328	324	732	36	2	0	0	1	18	5	2	0	1,707
4	9,229	1,098	732	1,104	0	185	22	27	7	1,029	1,025	175	100	14,733
5	5,868	0	36	0	0	153	19	15	8	115	233	112	71	6,630
6	3,090	2	2	185	153	202	1,109	392	0	12	49	2,059	432	7,687
7	529	0	0	22	19	1,109	1,292	592	0	4	7	5	36	3,615
8	642	0	0	27	15	392	592	342	0	4	3	9	5	2,031
9	92	149	1	7	8	0	0	0	400	26	198	2	1	884
10	2,186	71	18	1,029	115	12	4	4	26	118	21	25	33	3,662
11	3,428	982	5	1,025	233	49	7	3	198	21	28,390	17,633	367	52,341
12	5,822	52	2	175	112	2,059	5	9	2	25	17,633	73,289	2,893	102,078
13	3,007	2	0	100	71	432	36	5	1	33	367	2,893	15,688	22,635
Total	36,120	7,026	1,707	14,733	6,630	7,687	3,615	2,031	884	3,662	52,341	102,078	22,635	261,149

4. All Passengers

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	2,315	334	11,611	12,823	6,379	783	706	123	2,875	4,748	7,910	3,654	54,261
2	2,315	3,710	1,190	2,581	866	7	0	0	179	640	1,234	72	14	12,808
3	334	1,190	1,218	3,704	1,897	5	0	0	13	24	7	2	0	8,394
4	11,611	2,581	3,704	2,996	2,605	212	30	30	24	2,171	1,258	224	132	27,578
5	12,823	866	1,897	2,605	11,070	170	19	16	17	137	405	148	81	30,254
6	6,379	7	5	212	170	2,512	4,911	1,009	0	31	66	3,779	671	19,752
7	783	0	0	30	19	4,911	5,564	841	0	5	10	41	64	12,268
8	706	0	0	30	16	1,009	841	1,798	0	10	3	11	12	4,436
9	123	179	13	24	17	0	0	0	1,784	51	513	4	1	2,709
10	2,875	640	24	2,171	137	31	5	10	51	7,466	46	48	39	13,543
11	4,748	1,234	7	1,258	405	66	10	3	513	46	146,720	33,268	719	188,997
12	7,910	72	2	224	148	3,779	41	11	4	48	33,268	194,183	7,331	247,021
13	3,654	14	0	132	81	671	64	12	1	39	719	7,331	92,285	105,003
Total	54,261	12,808	8,394	27,578	30,254	19,752	12,268	4,436	2,709	13,543	188,997	247,021	105,003	727,024

Appendix 1-3 Cargo OD Table (1997)

1. Agricultural Products

Unit: ton

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	3	3	64	35	13	1	0	2	64	167	84	26	462
2	136	253	120	494	88	0	0	0	3	37	80	0	0	1,211
3	22	33	17	83	66	0	0	0	0	0	0	0	0	221
4	473	276	179	60	183	3	20	0	0	30	89	54	4	1,371
5	531	42	60	110	353	1	0	0	0	3	15	10	1	1,126
6	1,095	16	0	4	29	290	210	75	0	0	37	279	52	2,087
7	329	0	0	4	13	112	159	39	0	0	0	10	8	674
8	56	0	0	0	0	23	35	92	0	0	0	0	0	206
9	45	12	1	1	3	0	0	0	181	8	15	0	0	266
10	145	27	0	9	6	3	0	0	4	361	1	0	0	556
11	146	11	0	15	8	10	0	2	17	0	5,028	1,392	10	6,639
12	759	2	0	8	6	72	317	0	0	5	824	5,382	526	7,901
13	122	0	0	10	7	10	6	2	0	4	44	350	3,352	3,907
Total	3,859	675	380	862	797	537	748	210	207	512	6,300	7,561	3,979	26,627

2. Manufactured Products

Unit: ton

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	55	18	264	380	469	24	37	2	119	256	805	406	2,835
2	8	276	61	115	40	0	0	0	4	24	30	0	0	558
3	3	26	32	92	57	0	0	0	0	0	0	0	0	210
4	77	81	190	29	97	4	0	0	0	33	16	20	1	548
5	100	30	72	87	344	7	0	1	0	3	8	3	1	656
6	10	0	0	0	0	153	46	16	0	2	1	40	42	310
7	2	0	0	0	0	66	39	10	0	0	0	2	18	137
8	0	0	0	0	0	25	15	63	0	0	0	0	0	103
9	3	0	0	0	0	0	0	0	11	2	15	0	0	31
10	52	15	0	23	0	1	0	0	2	284	1	0	0	378
11	97	3	0	24	1	18	0	0	3	1	4,491	823	28	5,489
12	171	0	0	14	0	158	2	0	0	12	653	4,035	221	5,266
13	152	2	0	12	22	69	37	0	0	0	49	362	1,702	2,407
Total	675	488	373	660	941	970	163	127	22	480	5,520	6,090	2,419	18,928

3. Mineral Products

Unit: ton

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	81	34	335	128	123	41	39	0	58	43	119	63	1,064
2	13	124	59	224	36	0	0	0	0	10	0	0	0	466
3	16	76	40	260	78	0	0	0	0	0	0	0	0	470
4	58	43	87	21	47	4	0	0	0	2	0	0	7	269
5	16	21	82	78	116	0	0	0	0	0	1	0	0	314
6	7	0	0	0	0	40	24	8	0	5	0	0	0	84
7	19	0	0	0	0	25	33	9	0	0	0	0	0	86
8	0	0	0	0	0	9	9	50	0	0	0	0	0	68
9	0	2	0	0	0	0	0	0	0	1	6	0	0	9
10	19	4	0	0	0	0	0	0	0	119	0	0	0	142
11	38	0	0	1	6	0	0	0	2	0	1,658	234	5	1,944
12	43	0	0	0	0	22	3	0	0	0	153	1,865	61	2,147
13	0	0	0	0	0	0	0	0	0	0	1	155	829	985
Total	229	351	302	919	411	223	110	106	2	195	1,862	2,373	965	8,048

4. Construction Material

Unit: ton

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	79	0	170	194	221	11	0	18	80	113	331	182	1,399
2	40	176	10	64	27	0	0	0	4	21	0	0	0	342
3	26	78	35	252	118	0	0	0	0	0	0	0	0	509
4	151	87	53	25	83	2	0	0	0	5	0	8	5	419
5	2,858	188	298	492	1,896	0	0	0	2	4	0	26	0	5,764
6	130	0	0	0	0	108	45	21	0	0	0	180	0	484
7	0	0	0	0	0	55	25	12	0	0	0	159	0	251
8	0	0	0	0	0	7	3	14	0	0	0	0	0	24
9	0	3	0	0	0	0	0	0	29	1	4	0	0	37
10	40	8	0	0	0	0	0	0	6	222	0	0	0	276
11	28	0	0	0	0	0	0	0	1	0	2,146	193	2	2,370
12	54	0	0	0	12	0	0	0	0	0	459	3,604	98	4,227
13	35	0	0	0	0	0	0	0	0	0	1	55	290	381
Total	3,362	619	396	1,003	2,330	393	84	47	60	333	2,723	4,556	577	16,483

5. All Cargoes

Unit: ton

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	218	55	833	737	826	77	76	22	321	579	1,339	677	5,760
2	197	829	250	897	191	0	0	0	11	92	110	0	0	2,577
3	67	213	124	687	319	0	0	0	0	0	0	0	0	1,410
4	759	487	509	135	410	13	20	0	0	70	105	82	17	2,607
5	3,505	281	512	767	2,709	8	0	1	2	10	24	39	2	7,860
6	1,242	16	0	4	29	591	325	120	0	7	38	499	94	2,965
7	350	0	0	4	13	258	256	70	0	0	0	171	26	1,148
8	56	0	0	0	0	64	62	219	0	0	0	0	0	401
9	48	17	1	1	3	0	0	0	221	12	40	0	0	343
10	256	54	0	32	6	4	0	0	12	986	2	0	0	1,352
11	309	14	0	40	15	28	0	2	23	1	13,323	2,642	45	16,442
12	1,027	2	0	22	18	252	322	0	0	17	2,089	14,886	906	19,541
13	309	2	0	22	29	79	43	2	0	4	95	922	6,173	7,680
Total	8,125	2,133	1,451	3,444	4,479	2,123	1,105	490	291	1,520	16,405	20,580	7,940	70,086

Appendix 2 Profile of the Ports (1/4)

Port Name	Sasa Wharf	Sta. Ana Pier	Mati Wharf	Malalag Wharf	Dawis Pier
Classification	Base Port	Extension of Sasa Wharf	Terminal Port	Municipal Port	Municipal Port
Location	km 10, Sasa, Davao City	Sta. Ana, Davao City	Mati, Davao Oriental	Malalag, Davao del Sur	Digos, Davao del Sur
Owner-Operator	PPA, PMO-Davao	PPA, PMO-Davao	PPA, PMO-Davao	Municipality of Malalag, Davao del Sur	Municipality of Digos, Davao del Sur
Major Cargoes	General cargoes, containerized cargoes	general cargoes	Corn, copra, logs, general cargoes	Cane molasses, logs, ipil-ipil for export and general cargoes for domestic trade	Bottled cargoes, empty bottles, general cargoes and chemicals
Berth / Pier (length / width)	Reinforced concrete wharf (total length of 920 m, old quay: 515 x 18 m, new quay: 405 x 35 m)	Reinforced concrete pier (Pier 1: 22 x 102 m, Pier 2: 18 x 90 m)	Reinforced concrete wharf (80 x 11m)	Reinforced concrete wharf (30 x 15 m)	Finger pier, 2 berths (29 x 14 m)
Water Depth	10.6 m below MLLW	6.1 m below MLLW	6.5 m below MLLW	2 m below MLLW	1.5 m below MLLW
Storage Area	• total port area: 16.7 ha • transit shed area: 1,210 m^2 • open storage area: 50,000 m^2 (paved), 8,000 m^2 (unpaved) • container stacking yard: 37,800 m^2 • warehouse: 6,000 m^2	• unpaved storage area: 15,000 m^2 • total back-up area: 37,000 m^2	• open storage area: 1,595 m^2 (paved)	• 2 tanks for molasses	
Cargo Handling Equipment	• 32 forklifts • 5 mobile crane (4 x 35 t, 1 x 15 t) • primemover and payloader • pallet boards and etc. • stevedoring: Filipinas Port Services Inc. (FILPORT) & Davao Integrated Port and Stevedoring Services Corp. (DIPSSCOR)	• 1 mobile crane (2 t) • truck (15 t) • 16 forklifts (2.5-3.5 t) • Stevedoring: Filipinas Port Service Inc. (FILPORT)	• 3 forklifts (2 t) • 1 forklift (3 t) • Stevedoring: JRC Arrastre and Stevedoring Services (JASS)	• 2 pipelines (30/40 cm in diameter for conducting cane molasses) • Stevedoring: Matubang & Sons Stevedoring, Inc.	

Source: PPA - Port District of Southern Mindanao

Appendix 2 Profile of the Ports (2/4)

Port Name	Babak Pier	Peñaplata Pier	Caltex Jetty I	Caltex Jetty II	Shell Jetty	Petron
Classification	Municipal Port	Municipal Port	Private	Private	Private	Private
Location	Babak, Samal Is., Davao	Peñaplata, Samal Is., Davao	Sasa, Davao City	Sasa, Davao City	Sasa, Davao City	Bo. Pampanga, Davao City
Owner-Operator	Municipality of Babak, Davao	Municipality of Kaputian, Davao	Caltex Phils., Inc.	Caltex Phils., Inc.	Philipinas Shell Petroleum Corp.	Petron Corporation
Major Cargoes	pier is mainly used by passengers incoming to the city and for loading/• unloading cargoes for local consumption	pier is mainly used by residence to/from the city and in the transport of their basic goods	Petroleum products in bulk, drums, cans, cylinders and bottles	Petroleum products in bulk, drums, cans, cylinders and bottles	Petroleum products in bulk, drums, cans, cylinders and bottles	Petroleum products in bulk, drums, cans, cylinders and bottles
Berth / Pier (length / width)	Reinforced concrete pier (15 x 7.3 m) connected unpaved causeway (92 x 3 m)	Reinforced concrete piles on timber landing (15 x 7.5 m)	Concrete finger pier (30 x 5 m)	Concrete finger pier (120 x 20 m)	Concrete finger pier (40 x 3 m)	2 breasting dolphin (3 x 3 m) 2 mooring dolphin (1.5 x 1.5 m) w/ 99 m-causeway
Water Depth	2.5 m below MLLW	2 m below MLLW	10 m below MLLW	10 m below MLLW	10 m below MLLW	9 m below MLLW
Storage Area			• Storage of drums: 5,000 m^2	• 9 storage tanks with combined capacity of 10,000 m^3	• 1 warehouse • 10 storage tanks with combined capacity of 21,330 m^3	
Cargo Handling Equipment			• 8 pipeline connecting tanks to Pier	• pipelines	• pipelines	

Source: PPA - Port District of Southern Mindanao

Appendix 2 Profile of the Ports (3/4)

Port Name	LEGOIL Wharf	Interco-Davao Wharf	Interco-Mati Jetty	DUCC Wharf	HPI Wharf	MTBS Wharf
Classification	Private	Private	Private	Private	Private	Private
Location	km 8, Sasa, Davao City	Sasa, Davao City	Matiao, Mati, Davao Oriental	Ilang, Davao City	Madaum, Davao	Tibungco, Davao City
Owner-Operator	Legaspi Oil Company, Inc.	International Copra Export Corp. (Interco)	International Copra Export Corp. (Interco)	Davao Union Cement Corp.	Owned by Hijo Plantation, Inc. Operated by Madaum Arrastre, Inc.	Mindanao Terminal Brokerage Services, Inc. under lease by Del Monte Phils. (formerly PPC)
Major Cargoes	Crude coconut oil, edible oil, cochin oil, copra pellets	Coconut oil copra, pellets, general cargoes	Copra, coconut oil, copra pellets	Cement, coal slag, gypsum, BI coals	Mainly bananas, ipil-ipil, palm oil and minor cargoes for owner's consumption	Mainly bananas, fertilizers, knockdown, cartons, general cargoes
Berth / Pier (length / width)	1 Wharf (200 m) 2 berths	1 berth (99 m)	1 berth	1 berth (100 m)	2 berths (124, 150 m) 1 berth for barges(45m) RC apron (27 m wide)	1 berth (93 x 20 m)
Water Depth	10 m below MLLW	10 m below MLLW		9 m below MLLW	10 m below MLLW	11 m below MLLW
Storage Area	• 4 shads with combined capacity of 16,000 m.t.	• warehouse (2,350 m²) • 2 storage sheds for copra pellets • 3 storage tanks with capacity of 6,500 m³ for coconut oil	• 1 warehouse • 1 loading platform	• 2 bodegas for cement • 1 bodega for coal • open storage for coal	• 4 warehouses for stockpiling knockdown cartons • 1 shed (1,300 m²)	• 1 shed (3,600 m²)
Cargo Handling Equipment	• Oil pipeline, loading conveyor system (100 t/h), payloader, forklift, crane (50 t), dump truck • stevedoring: Northern Carrier Corp.	• stevedoring: GA Suarez Arrastre/Stevedoring Corp. (GAS)	• 1 conveyor • pipeline • stevedoring: GA Suarez Arrastre/Stevedoring Corp. (GAS)	• 3 forklifts (3 t) • 1 mobile crane (35 t) • 1 reversible conveyor • 1 payloader • 3,000 pallet boards • Stevedoring: DUCC Arrastre Stevedoring Service	• pallet boards (1.8 x 1.2) • conveyors • 1 crane (20 t) • 10 forklifts • 2 tankers with capacity of 2,000,000 litters • stevedoring: Madaum Arrastre, Inc.	• provided by MTBS

Source: PPA - Port District of Southern Mindanao

Appendix 2 Profile of the Ports (4/4)

Port Name	Pacinter Wharf	TADECO Wharf	Tefasco Wharf	Universal Robina Corp.	Norcamco Wharf
Classification	Private	Private	Private (Commercial Port)	Private	Private (Commercial Port)
Location	Bayawa, Panabo, Davao	Panabo, Davao	Ilang, Davao City	Sasa, Davao City	Lambajon, Baganga, Davao Oriental
Owner-Operator	Owned by Pacific International Terminal Operated by Stanfilco - a division of Dole Phils., Inc.	Tagum Agricultural Development, Co., Inc.	Terminal Facilities and Services, Corp.	Universal Robina Corp.	North Camarines Lumber Co., Inc.
Major Cargoes	Mainly bananas	Bananas, fertilizers, ore	General cargoes, containers, breakbulk, fertilizers and bulk cargoes	Flours grains	Lumber products
Berth / Pier (length / width)	1 berth (110 m)	2 berth (115, 140 m)	3 berths	1 berth (36.5 x 14 m)	1 wooden pier (2 x 8 m) 1 wooden walling (3.5 x 48.75 m)
Water Depth	10 m below MLLW	12-15 m below MLLW	9 m below MLLW	10 m below MLLW	
Storage Area	• 1 shed (5,600 m²)	• 1 bodega for pre stacking of empty knockdown cartons		• 1 warehouse	• 1 GI roofing warehouse
Cargo Handling Equipment	• forklifts • conveyors • rollers • non-standardized pallets • stevedoring: Mindanao Integrated Logistics Services, Inc. (MLSI)	• forklifts • pallets • stevedoring gears • stevedoring: San Vincent Terminal & Brokerage Services Company, Inc. (SANTERBROS)	• 26 forklifts • 1 mobile crane (30 t) • 1 payloader • 3 trucks (1 x 6-wheels, 3 x 10-wheels) • 1 backhoe • stevedoring: Tefasco	• 1 conveyor	

Source: PPA - Port District of Southern Mindanao

Spatial/Infrastructure Sector Report

Part 4: Power and Energy

Chapter 1 Power and Energy Situations in the Philippines

This section will clarify power and energy situations in the Philippines as an introduction to the following chapters studying on the DIDP Area.

1.1. Administration and Organization of Energy Development and Supply

Figure 1 summarizes the current administration/organization of energy development and supply in the Philippines.

(1) DOE and ERB

The Department of Energy (DOE) and the Energy Regulatory Board (ERB) are the two key government institutions. ERB is an independent and quasi-judicial body under the Office of the President to regulate the rates for the entire power and energy sector.

DOE is the lead government agency for the power and energy sector. It was established in December 1992 with the mission objectives as shown in Figure 1. DOE was mandated to coordinate and supervise all activities of the Government relating to the exploration, development, utilization, distribution, and conservation of energy. DOE's responsibilities are also extended to the policies relative to privatization and deregulation of the power and energy sector.

DOE controls and supervises all government-owned power and energy sector entities such as the National Power Corporation (NPC), the Philippines National Oil Corporation (PNOC), and the National Electrification Administration (NEA).

NPC is responsible for the generation and transmission of electricity throughout the Philippines.

PNOC is a wholly government owned corporation having its four subsidiaries: three for the exploration and development of indigenous energy resources, and one (Petron) for the refining and marketing of oil products as shown in Figure 1.

NEA was created in 1969 to promote the total electrification of the country through organizing rural electric cooperatives (RECs).

(2) Power supply

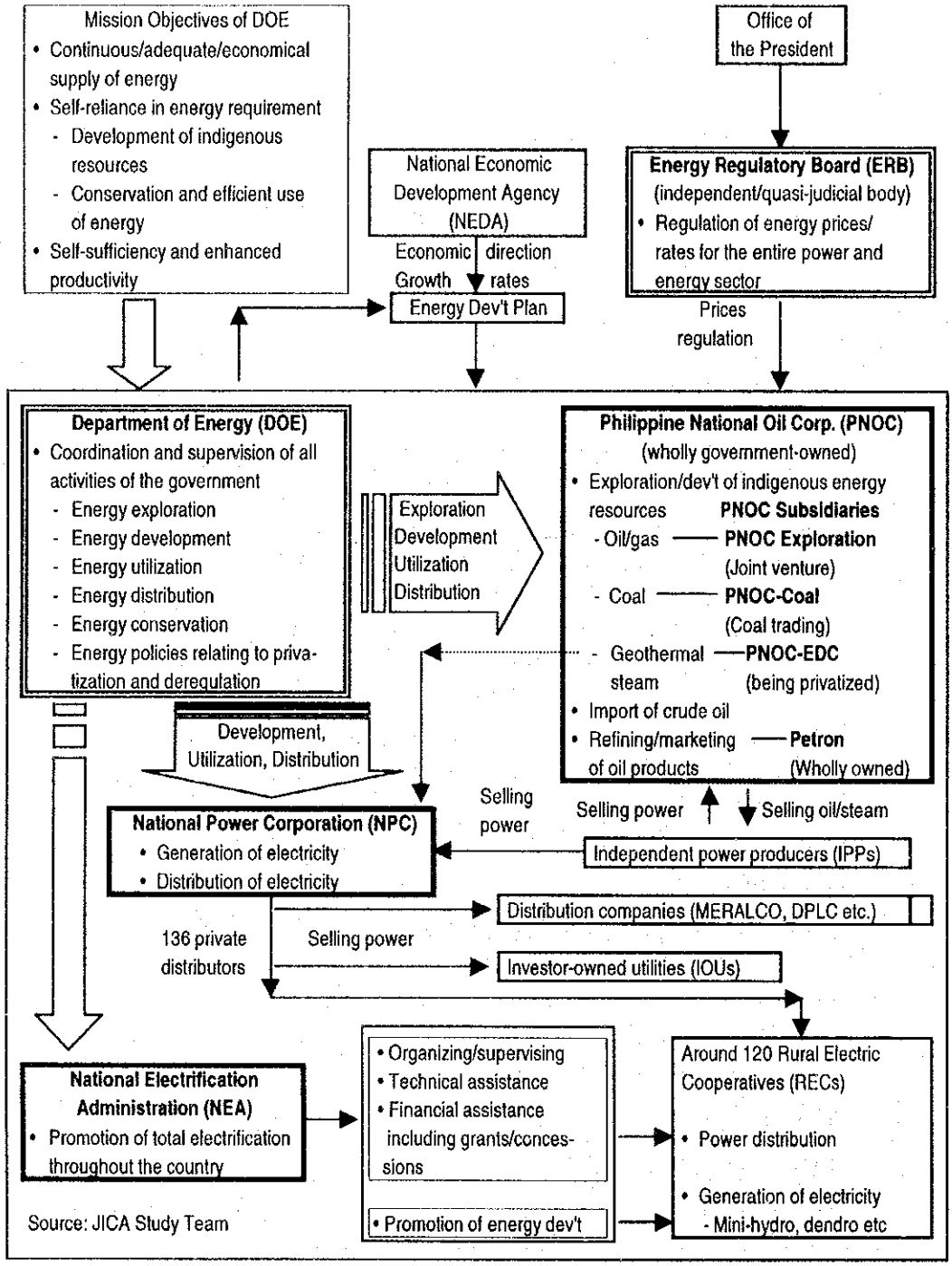
Participation of the private sector

In recent years, the private sector has been invited to participate in power generation in the form of BOT, and "build, own, and operate" (BOO).

By the early 1997, there are 32 independent power producers (IPPs). They convert the fuel provided by NPC into power and sell it back to NPC. There is a take or pay provision guaranteed by the Government.

Some IPPs sell power directly to MERALCO, the largest distribution company in the Philippines, and NPC charges some transmission costs. The power purchase agreements (PPA) between MERALCO and IPPs are not guaranteed by the Government. Under the proposed NPC restructuring, both power generation and distribution will be dominated by the private sector. NPC will still have the control of load dispatch and transmission functions, at least in the initial stage.

Figure 1 Administration/Organization of Energy Development and Supply



Rural electric cooperatives (RECs)

There are 136 distribution companies in 1996, and five flows of power distribution: 1) NPC to distribution companies, 2) NPC to investor-owned utilities (IOUs) including big consumers and industrial estate developers, 3) NPC to RECs, 4) IPPs to big consumers or distribution companies, and 5) IPPs to NPC through PNOC.

RECs have been playing an important role in rural electrification/energization. Presently, there are around 120 RECs, a majority of which experience poor financial performances.

In the DIDP Area, there are one distribution company covering Davao City and three RECs in the three provinces.

1.2. Energy Consumption

(1) Per capita energy consumption

Per capita energy consumption (primary energy) of the Philippines in 1995 was 304 kg (in terms of oil equivalent) according to the "World Bank Atlas." This was smaller than those of Thailand (878 kg), Malaysia (1,655 kg), and Indonesia (442 kg). On the other hand, per capita GNP in 1995 was US$1,050 in the Philippines, US$2,740 in Thailand, US$3,890 in Malaysia, and US$980 in Indonesia. Historical data shows that the level of energy consumption is closely related to income level, though there are some deviations among countries.

(2) Energy consumption by source

Energy consumption in the Philippines in 1996 amounted to 217.62 million barrels of fuel-oil equivalent (MMBFOE), increased from 1992 at an annual average growth rate (AAGR) of 12.2% as shown in Table 1. This volume corresponds to around six oil refineries with capacity of 100,000 BPSD, which is the minimum production capacity for economies of scale.

Table 1 Energy Consumption in the Philippines (primary energy base)

	MMBFOE			Percent Shares			AAGR (annu. ave. growth rates)		
	1986	1991	1996	1986	1991	1996	87-96	87-91	92-96
Total	93.27	122.46	217.62	100.0	100.0	100.0	8.8%	5.6%	12.2%
1. Indigenous Energy	41.34	40.61	95.37	44.3	33.2	43.8	8.7%	-0.4%	18.6%
1-1 Conventional	25.13	25.07	28.98	26.9	20.5	13.3	1.4%	0.0%	2.9%
Oil	2.85	1.06	0.45	3.1	0.9	0.2	-16.9%	-17.9%	-15.7%
Coal	4.02	5.21	5.06	4.3	4.3	2.3	2.3%	5.3%	-0.6%
Hydro	10.37	8.87	12.17	11.1	7.2	5.6	1.6%	-3.1%	6.5%
Geothermal	7.89	9.93	11.30	8.5	8.1	5.2	3.7%	4.7%	2.6%
1-2 Non-Conventional	16.21	15.54	66.39	17.4	12.7	30.5	15.1%	-0.8%	33.7%
Bagasse	4.09	6.15	7.69	4.4	5.0	3.5	6.5%	8.5%	4.6%
Agri-wastes	11.65	9.03	17.10	12.5	7.4	7.9	3.9%	-5.0%	13.6%
Others	0.47	0.36	41.60	0.5	0.3	19.1	56.6%	-5.2%	158.6%
2. Imported Energy	51.93	81.85	122.25	55.7	66.8	56.2	8.9%	9.5%	8.4%
Oil	49.76	78.58	117.60	53.4	64.2	54.0	9.0%	9.6%	8.4%
Coal	2.17	3.28	4.65	2.3	2.7	2.1	7.9%	8.6%	7.2%
Oil subtotal	52.61	79.64	118.05	56.4	65.0	54.2	8.4%	8.6%	8.2%
Coal subtotal	6.19	8.49	9.71	6.6	6.9	4.5	4.6%	6.5%	2.7%
(Reference)									
Oil for Power Generation		24.4	29.5		19.9	13.6			3.9%
P. Generation Capacity (MW)		3,341	4,319						5.3%
Oil consumption (barrles/Kw)		7.303	6.830						-1.3%

Note: MMBFOE = million barrels of fuel-oil equivalent

Source: 1997 Philippine Statistical Yearbook (NSO) and Department of Energy (DOE)

Decreasing dependence on imported energy/oil

Imported energy amounted to 122.25 MMBFOE in 1996, increasing during 1992-1996 by 8.4% per annum, but its share of the total energy decreased to 56.2% in 1996 from 66.8% in 1991.

Indigenous energy: a rapid increase from 1995 due partly to statistical reasons

Indigenous energy amounted to 95.37 MMBFOE in 1996, accounting for 43.8% of the total. It rapidly increased from 1995, centering on non-conventional energy. This was due partly to statistical reasons. From 1995, data on wood/wood wastes and charcoal were newly compiled in the statistics; wood/wood wastes 39.25 MMBFOE, and charcoal 2.10 MMBFOE in 1996. Also, coconut husk/shell and rice husk were independent statistically from the category of agri-wastes, amounting to 12.98 MMBFOE and 4.12 MMBFOE in 1996, respectively.

(3) Factors on energy consumption

While the Philippine GDP grew by 3.6% per annum during 1987-1996, the energy consumption grew by 8.8% per annum. This means that the energy consumption elasticity (ECE) to GDP was 2.44 (8.8% / 3.6%) during the same period, which was quite high.

On the other hand, the ECE in advanced countries has been mostly smaller than unity, e.g., 0.33 in USA, 0.57 in European OECD countries, and 0.47 in Japan during 1973-1992. Likewise, the ECE in ASEAN countries was 1.30. Thus, the energy consumption in the Philippines may not be the sole result of economic growth but the result of improvement of people's life or rather consumption driven, i.e., motorization and electrification.

1.3. Power Generation

Installed capacity of power generation totaled 10,489 MW as of the end of 1996 in the Philippines, consisting of 52.3% oil-based thermal, 21.5% hydro, 12.2% geothermal, and 14% coal fired thermal plant. By producer, the private sector owned or operated power plants accounted for 4,569 MW or 44% of the total, generating 7,644 GWh.

By region, Mindanao installed a total 1,632 MW or 15.6% of the national total, consisting of 36.9% oil/gas-based thermal, 60% hydro, 2.9% geothermal, and no coal fired thermal plant.

As for power generation, hydropower plants generating 4,315 GWh in Mindanao are mostly assigned to meeting the base-load demand, accounting for 86.7% of the total as shown in Table 2.

The hydropower's share (86.7%) is 27 percentage points higher than that of the capacity (60%), quite contrasted with the national average which showed no difference between the both shares (21.6% for capacity and 19.4% for generation). In other words, operation rate of power plants in Mindanao is relatively high, and their power generation cost might be lower than those of other regions.

Table 2 Gross Power Generation by Source and by Region in the Philippines (1996)

	GWh				Percent Shares				Shares of the Country		
	Total	Luzon	Visa-yas	Min-danao	Total	Luzon	Visa-yas	Min-danao	Luzon	Visa-yas	Min-danao
Total	35,613	26,709	3,688	4,978	100.0	100.0	100.0	100.0	75%	10%	14%
Oil	16,287	14,593	904	559	45.7	54.6	24.5	11.2	90%	6%	3%
Gas	722	242	377	103	2.0	0.9	10.2	2.1	34%	52%	14%
Coal	5,234	4,692	542		14.7	17.6	14.7		90%	10%	
Hydro	6,810	2,477	11	4,315	19.1	9.3	0.3	86.7	36%	0%	63%
Geothermal	6,560	4,705	1,854	1	18.4	17.6	50.3	0.0	72%	28%	0%

Source: 1996 Annual Report (NPC)

1.4. Energy Prices and Power Tariff

(1) General situations

The Energy Regulatory Board (ERB) used to regulate oil prices including all hauling charges, the dealer's margin, and the rate of return on oil refineries' rate base (9.65 %) since 1993. The prices were deregulated in 1997. However, a recent Supreme Court decision returned the regulatory power to ERB, at least temporarily.

ERB has the power to regulate coal prices, but it has not intervened in the coal market. Domestic coal is blended with imported coal to achieve the desirable levels of quality and heat content. In 1995, Indonesia provided nearly one-half of coal imports, and nearly one-quarter came from Australia. The World Bank projects a slight decline in coal prices (in constant 1990 prices) through the period to 2005. For US Terminal coal, the price is projected to decline by 2.2% during 1995-2000.

Geothermal energy accounted for 12.2% of power generation capacity in 1996. PNOC usually supplies steam to IPPs, and pays conversion fees. PNOC then sells the electricity to NPC, generally on the basis of a flat rate per kWh.

(2) Electricity tariff

The Philippines has the highest electricity tariff in Asia only after Japan.

NPC's tariff rate is usually published with several adjustments. After the prompt payment and primary voltage discounts, a foreign exchange (FOREX) adjustment and a fuel and purchased power adjustment are applied, typically over a monthly billing period.

NPC's tariff rate in Mindanao was the lowest among the three regions, ₱1.2538 per kWh in 1996, while its transmission cost was the highest ₱0.340 per kWh. On the other hand, NPC's tariff rate was highest in Luzon, ₱2.083 per kWh but its transmission cost was the lowest ₱0.151 per kWh. Transmission cost corresponds to 27% and 7% of the tariff rate in Mindanao and Luzon, respectively as shown in Table 3. Tariff rate excluding transmission cost was ₱1.932 per kWh in Luzon, and ₱0.914 per kWh in Mindanao.

Table 3 NPC Power Tariff Rate by Region

	Tariff Rate (Pesos per kWh)										Transmission Cost	
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	in 1996 (P/kWh)	
Luzon	0.9793	1.0031	0.9877	1.2049	1.4728	1.6576	1.7194	1.8576	1.8026	2.0830	0.151	(1.932)
Visayas	0.8671	0.9252	1.0385	1.2424	1.5293	1.6922	1.7343	1.8702	1.8866	2.0230	0.289	(1.734)
Mindanao	0.5657	0.6252	0.6669	0.7043	0.9028	0.9644	1.1596	1.2217	1.2435	1.2538	0.340	(0.914)
	Tariff Increase Rates										Transmission Cost/	
	87-96	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	Tariff Rate	
Luzon	9.9%	2.4%	-1.5%	22.0%	22.2%	12.5%	3.7%	8.0%	-3.0%	15.6%	7%	
Visayas	11.2%	6.7%	12.2%	19.6%	23.1%	10.7%	2.5%	7.8%	0.9%	7.2%	14%	
Mindanao	10.5%	10.5%	6.7%	5.6%	28.2%	6.8%	20.2%	5.4%	1.8%	0.8%	27%	

Note: Transmission Cost ( ) = Tariff Rate - Transmission Cost (in 1996)

Source: 1996 Annual Report, Financial Highlights (NPC)

The highest transmission cost in Mindanao reflects that the transmission lines are longer, the transmission efficiency is lower due to low voltage distribution, and/or

lack of critical mass in power consumption, compared with Luzon.

There are cross-grid subsidies probably in favor of Luzon. Over the years, the Mindanao grid has been dominated by hydropower, which is generally the cheapest energy source. However, its electricity tariff increased at a higher rate than that of Luzon, which is dominated by oil, gas and geothermal generation. The separation of transmission and generation charge in the NPC grid may further widen the gap between Luzon and Mindanao tariffs.

1.5. Rural Electrification

The National Electrification Administration (NEA) has promoted the total electrification throughout the country. In this context, electrification is to energize through RECs and connect the consumers by distribution lines. Accordingly, it does not always mean that non-connected households are without electricity. They sometimes use self-generators or other means of lighting. Metro Manila excluded from the rural electrification program is fully energized.

Table 4 shows the rural electrification ratio by RECs. Out of covered 1,417 municipalities in the Philippines, 1,384 or 98% were connected in 1996. Electrification ratio was 68% based on the number of connected barangays, and 57% based on the number of connected households.

Table 4 Rural Electrification in the Philippine (1996: excluding Metro Manila)

	Municipality (1)		Barangays (2)		Households (3)		Electrification Ratio (a)	(b)	
	Cove-rage	Conne-cted	Cove-rage	Conne-cted	Poten-tial	Conne-cted	Baran-gay	House-hold	= a - b
Philippines	1,417	1,384	35,362	24,031	7,247,000	4,131,749	68.0%	57.0%	10.9%
1 CAR: Cordillera Admi. Region	72	69	1,072	775	205,000	118,650	72.3%	57.9%	14.4%
2 Region I: Ilocos	116	115	3,014	2,842	545,000	433,472	94.3%	79.5%	14.8%
3 Region II: Cagayan Valley	97	93	2,371	1,668	429,000	262,979	70.4%	61.3%	9.0%
4 Region III: Central Luzon	91	91	2,065	1,936	638,000	536,574	93.8%	84.1%	9.7%
5 Region IV: Southern Tagalog	141	139	3,446	2,517	701,000	436,128	73.0%	62.2%	10.8%
6 Region V: Bicol	112	108	3,380	2,282	656,000	389,379	67.5%	59.4%	8.2%
7 Region VI: Western Visayas	131	131	3,862	2,598	865,000	409,559	67.3%	47.3%	19.9%
8 Region VII: Central Visayas	121	121	2,717	1,947	584,000	294,313	71.7%	50.4%	21.3%
9 Region VIII: Eastern Visayas	143	134	4,368	2,493	544,000	256,756	57.1%	47.2%	9.9%
10 Region IX: Western Mindanao	79	79	2,100	1,008	427,000	194,098	48.0%	45.5%	2.5%
11 Region X: Northern Mindanao	66	66	1,428	1,088	315,000	195,660	76.2%	62.1%	14.1%
12 Region XI: Southern Mindanao	65	63	1,214	750	509,000	242,994	61.8%	47.7%	14.0%
13 Region XII: Central Mindanao	39	38	924	491	216,000	104,546	53.1%	48.4%	4.7%
14 Auoto. R. of Muslim Mindanao	71	66	2,121	757	303,000	56,991	35.7%	18.8%	16.9%
15 CARAGA	73	71	1,280	879	310,000	199,650	68.7%	64.4%	4.3%
MINDANAO (10 to 15)	393	383	9,067	4,973	2,080,000	993,939	54.8%	47.8%	7.1%

Source: 1997 Philippine Statistical Yearbook (NSO)/National Electrification Administration (NEA)

By region and household base, electrification ratio was 47.7% in Region XI including the DIDP Area, and 47.8% in the whole Mindanao. There was some 14 percentage points difference between the electrification ratios of barangay base and household base in Region XI. The difference was larger than those of the national average (10.9%) and Mindanao average (7.1%), which suggests that barangays in Region XI are relatively less urbanized and concentrated, which was made rural electrification more difficult.

1.6. Philippine Energy Plan

The Department of Energy (DOE) formulated the Philippine Energy Plan (PEP) in 1996 with the target year 2025. The PEP is a long-term plan and a guideline also for the power and energy development in the DIDP Area.

(1) Forecasted growth of GDP and energy up to 2025

The "vision statement" of the PEP stresses the importance of 1) energy supply availability, 2) competitive, affordable, and reasonable energy prices, and 3) socially and environmentally compatible energy infrastructures.

Energy demand forecasted by the PEP is based on GDP growth projected by NEDA; 6.9% per annum during 1997-2025, 7.2% during 1997-2005 and 2006-2015, and 6.3% during 2016-2025.

Table 5 summarizes the forecasted growth rates of energy (primary energy base) by the PEP. An annual average growth rates (AAGR) are almost the same between GDP and the energy total. In other words, the energy consumption elasticity (ECE) to GDP is almost 1.00, practically 0.92-0.99. This is quite contrasted with the past performance of the ECE in the Philippines, 2.44 during 1987-1996 as seen before. Thus, the PEP might take into account a rapid progress of efficient energy use or energy conservation including the demand side management (DSM).

Table 5 Growth Rates of GDP and Energy in PEP (primary energy base)

	Annual Average Growth Rates (AAGR)						Energy Consump. Elasticity/ECE to GDP				
	GDP	Energy Total	Petro-leum	Natural Gas	Coal	Power	Energy Total	Petro-leum	Natural Gas	Coal	Power
1997-2025	6.9%	6.6%	6.2%	11.0%	10.6%	9.2%	0.96	0.90	1.59	1.54	1.33
1997-2005	7.2%	7.1%	6.4%	15.5%	14.9%	12.0%	0.99	0.89	2.15	2.07	1.67
2006-2015	7.2%	6.6%	6.8%	10.3%	11.2%	8.9%	0.92	0.94	1.43	1.56	1.24
2016-2025	6.3%	6.1%	5.5%	9.9%	6.3%	6.9%	0.97	0.87	1.57	1.00	1.10

Source: Philippine Energy Plan 1996-2025 (DOE)

By energy source, the ECE will be more or less 0.9 for petroleum, 1.43-2.15 for natural gas, 1.00-2.07 for coal, and 1.10-1.67 for power/electricity. The PEP forecasts a rapid energy conservation in petroleum, or a drastic shift of energy source from oil to other sources resultings to diversification of energy source.

The following is a set of assumptions taken by DOE regarding the PEP other than those already mentioned:

- A constant foreign exchange rate of ₱26.3 to a US dollar was used through the 30-year planning period (not taken into account the Peso depreciation since summer in 1997 due to a time limitation);
- A flat growth rate for industrial energy demand; and
- A very optimistic growth for non-conventional energy and demand-supply of natural gas.

(2) Structure of energy demand-supply

The energy demand in the Philippines is expected by the PEP to increase from 219.0 million barrels of fuel oil equivalent (MMBFOE) in 1996 to 552.4 MMBFOE in 2010 and to 768.2 MMBFOE in 2015 as shown in Table 6.

Table 6 **Forecasted Energy Demand-Supply in PEP (primary energy base)**

TOTAL ENERGY

	MMBFOE				Percent Shares				AAGR (annu. ave. growth rates)			
	1996	2005	2010	2015	1996	2005	2010	2015	97-15	97-05	06-10	11-15
Total	218.95	404.30	552.44	768.20	100.0	100.0	100.0	100.0	5.0%	7.1%	6.4%	6.8%
1. Indigenous Energy	95.72	191.65	236.19	316.89	43.7	47.4	42.8	41.3	4.9%	8.0%	4.3%	6.1%
1-1 Conventional	33.77	107.58	132.64	190.85	15.4	26.6	24.0	24.8	7.5%	13.7%	4.3%	7.5%
Oil	0.45	15.46	2.07	4.48	0.2	3.8	0.4	0.6	8.4%	48.1%	-33.1%	16.7%
Gas	0.15	21.71	40.25	57.70	0.1	5.4	7.3	7.5	34.2%	73.8%	13.1%	7.5%
Coal	9.63	25.71	33.98	60.21	4.4	6.4	6.2	7.8	6.9%	11.5%	5.7%	12.1%
Hydro	9.50	19.77	22.95	27.71	4.3	4.9	4.2	3.6	4.8%	8.5%	3.0%	3.8%
Geothermal	14.04	24.93	33.39	40.75	6.4	6.2	6.0	5.3	4.7%	6.6%	6.0%	4.1%
1-2 Non-Conventional	61.90	84.08	103.55	126.04	28.3	20.8	18.7	16.4	2.7%	3.5%	4.3%	4.0%
2. Imported Energy	123.23	212.66	316.25	451.31	56.3	52.6	57.2	58.7	5.1%	6.3%	8.3%	7.4%
Oil	111.44	163.72	234.68	295.24	50.9	40.5	42.5	38.4	4.0%	4.4%	7.5%	4.7%
Coal	11.79	48.94	81.57	156.07	5.4	12.1	14.8	20.3	10.7%	17.1%	10.8%	13.9%
Oil subtotal	111.89	179.18	236.75	299.72	51.1	44.3	42.9	39.0	4.0%	5.4%	5.7%	4.8%
Coal subtotal	21.42	74.65	115.55	216.28	9.8	18.5	20.9	28.2	9.3%	14.9%	9.1%	13.4%

Note: MMBFOE = million barrels of fuel-oil equivalent

ELECTRICITY/POWER

					Operation Rate				AAGR (annu. ave. growth rates)			
	1996	2005	2010	2015	1996	2005	2010	2015	97-15	97-05	06-10	11-15
a) Sales (10 GWh)	3353	9331	14811	21975	(a / 8,760 / b *1000)				8.1%	12.0%	9.7%	8.2%
b) Capacity Demand (10 MW)	586	1526	2556	3793					8.1%	11.2%	10.9%	8.2%
					65%	70%	66%	66%	0.1%	0.7%	-1.1%	0.0%

Source: Philippine Energy Plan 1996-2025 (DOE)

1) Oil and gas

Oil made up around 75 % of the Philippines' energy needs before the exploitation of geothermal resources, and almost all of it is imported even today.

The oil's share of the total energy consumption has reduced to 51 % in 1996. However, the demand for petroleum products is expected to increase by around 6% per annum for the next 20 years. The transport sector, along with the rapid urbanization process, is the largest consumer of petroleum products, accounting for 45 % of the total consumption in 1996, followed by the power sector 20 %, the industry sector 17 %, and households 8.5 %.

Diversification of energy source depends on the exploration of natural gas reserves. The promising Malampaya-Camago field is expected to have around 3,600 BCF of gas reserve. It has a gas production potential of up to 350-600 MMCFD for around 15 years, and more than 50,000 barrels of oil and condensate per day.

The scheme for Mindanao gas, which is targeted to be on-stream by the year 2015, would make gas available to provinces along the northwestern coast of the island.

2) Coal

The demands for coal were 6.4 million tons in 1996, of which the power sector consumed around 56 % and cement 34 %. Some 55 % of the coal were imported.

Demand for coal is expected to grow faster as more coal-fired power plants will come on-stream to achieve diversification in energy supplies. In 1996, the Philippines

produced 2.86 million tons of coal, most of which came from the Semirara mines operated by the government-owned Semirara Coal Corporation.

The Government has plans to meet the future demand also through expanding local production of coal. One is to expand the Semirara mines. The other is the development of the second-tier coal deposits in Isabela, Cagayan, Samar, and Surigao del Sur to supply mine-mouth power plants.

DOE expects coal production to increase by 8.2 % per annum up to the year 2025. That may prove to be a daunting task. During the same period, coal import is expected to increase at a fast pace over the next two decades. The Country currently hosts nine coal terminals, of which three are located in Luzon, four in Visayas, and two in Mindanao. Four new terminals are programmed to be constructed.

3) Hydropower

Hydropower contributed to 19.1 % of the total power generation with a total installed capacity of 2,333 MW in 1996. The potential in the Philippines is estimated at around 11,000MW-14,000 MW. Feasibility studies have been completed for the sites having a total generating capacity of 4,100 MW. Among the potential capacity, about 73 % is in Luzon, 23 % in Mindanao, and 4 % in Visayas.

To achieve its goal of adding a total of 7,064 MW by the year 2025, NPC has offered the private sector to develop 11 projects with an aggregate capacity of 2,500 MW, plus 40 small hydro projects (10-50 MW) each. Three factors will determine the outcome of this plan: the costs of hydro relative to alternatives, the transmission distance and cost, and environmental considerations. The Government also provides tax-incentives to developers of mini-hydropower.

4) Geothermal energy

The Philippines is now the second largest producer of electricity from geothermal energy after USA. At the present level of installed capacity, the geothermal power saves the country the equivalent of around 12 million barrels of fuel oil (MMBFOE) per year. By the end of 1996, a total generation capacity of 1,414 MW has been installed with an additional 650 MW to be developed by the year 2000. The overall generation potential is estimated at 4,000 MW.

Power demand from geothermal is expected to reach a total of 6,309 MW by the year 2025. Most geothermal capacity comes from the Tiwi and Makiling-Banahaw fields in Luzon. Geothermal energy is mainly developed and operated by the Energy Development Corporation (EDC) under PNOC. Currently, BOT arrangement is available for private participation.

A dozen of geothermal sites, among the 40 prospects under investigation, have proven sufficient commercial resources, which have either been developed or are under development. Geothermal energy development is dependent on the electricity demand and prices of alternative fuels. When the oil prices collapse in the 1990s, the growth of geothermal will slow substantially. However, the recent currency crises may push up domestic oil prices and make geothermal more attractive.

There are around 18 potential geothermal sites in Mindanao, and only two sites at Mt. Apo have been developed (54 MW and 30 MW, respectively) in North Cotabato.

The total generation potential at Mt. Apo is estimated at 548 MW. The sales price is ₱1.56 per kWh, which is higher than NPC's sales prices ranging ₱1.3025 to ₱1.3496

per kWh to the distribution companies in the DIDP Area.

Geothermal has a great potential in the Philippines and Mindanao. The issue is that it is still more expensive to develop a geothermal plant than a conventional thermal power plant, plus the cost of the transmission lines since geothermal plants are usually located far from load centers.

The World Bank co-financed a Leyte-Luzon geothermal Project in 1994. The estimated cost without physical and price contingencies for power plant (BOT) was US$ 535 million with 90.2 % for foreign cost. The cost per kW was US$ 1,216 (The conventional cost for a coal-fired thermal is US$ 1000 per kW. In the Philippine case, some projects went above that level.). The project costs also include the following:

- Field development (drilling 65 additional producer and injector wells, constructing steam gathering system, and related sub-transmission system); and
- Construction of two high voltage DC converter, lectrode stations, and transmission lines which makes the total cost to US$ 1,267 million (86.5 % for foreign cost), resulting to the cost per kW at a stunning US$ 2,880.

The total investment cost for Mt. Apo Phase I (54MW) was US$ 413 million to arrive at US$2,750 per kWh without considering transmission cost. The distances from Mt. Apo to the nearest two load centers are 130 km and 150 km, respectively. A quick run of economic analysis has shown that to break even at a discount rate of 12 %, the price for per kWh should be at ₱5.00. The cost is expected to be reduced when the Phase II comes on-stream.

5) Electricity/power

Electricity sales are expected to increase from 33,532 GWh in 1996 to 148,112 GWh in 2010 and to 219,751 GWh in 2015. The growth will slow down gradually; 12.0% during 1997-2005, 9.7% during 2006-2010, and 8.2% during 2011-2015.

Capacity demand will follow an almost similar trend to that of sales from 5,855 MW in 1996 to 25,564 MW in 2010, and to 37,928 MW in 2015. Operation rate of power plants will stay at around 66% but higher in 2005, at 70%. This might correspond to the installation of high-efficiency power generation plants. The PEP envisions to provide for a share of 33.1 % (natural gas-based generation) of the total 19,600 MW capacity additions. The first natural gas-fired power plant with a capacity of 1,800 MW will be commissioned in 2001, followed by two units of 600 MW.

6) Renewable energy

Non-conventional energies are expected to grow rapidly. Among them, biomass is the main player as a renewable energy. However, the biomass energy resources are expected to exhibit a very modest growth during the 30-year planning period of the PEP, since they have been already exploited for energy use to some significant extent. Despite their slow growth, they will still account for around 37 % of indigenous energy to be produced.

The aggregate biomass supply potential for 1996 was equivalent to 132.8 MMBFOE, or 65 % of the total indigenous energy produced. Wood and wood wastes accounted for 61 %, coconut residues 14 %, animal wastes 9 %, and bagasse 8 %.

Table 7 shows percentage utilization of biomass forecasted by PEP. Among biomass resources, use of municipal wastes is expected to expand rapidly up to 61.6% in 2015, mainly for power generation by their direct incineration. Residues derived fuel

(RDF) from municipal ,wastes are already commercialized in some advanced countries. Also, some 47.3% of animal wastes will be utilized by the year 2015, mainly for power generation by their fermented methane.

Table 7 Forecasted Percentage Utilization of Biomass in the Philippines

	Percentage Utilization				Increase in Percentage Utilization			
	1996	2005	2010	2015	1997-2005	1997-2005	2006-2010	2011-2015
Rice Hull	35.3%	46.6%	52.6%	58.6%	23.3%	11.3%	6.1%	6.0%
Coconut Residues	31.2%	43.3%	49.9%	56.6%	25.4%	12.1%	6.7%	6.7%
Bagasse	53.5%	63.3%	68.7%	74.2%	20.7%	9.8%	5.4%	5.5%
Wood/Wood Wastes	58.6%	55.5%	54.5%	54.1%	-4.5%	-3.2%	-0.9%	-0.4%
Animal Wastes	4.0%	24.7%	35.9%	47.3%	43.3%	20.7%	11.2%	11.4%
Municipal Wastes		25.7%	51.3%	61.6%	61.6%	25.7%	25.7%	10.3%

Note: Some percent shares are averages of original data; 2005 = (2000+2010) / 2, 2015 = (2010+2020) / 2

Source: Philippine Energy Plan 1996-2025 (DOE)

Natural energies have a large potential also to address to the global warming or the CO_2 problem. The Philippines has site-specific wind energy potential for power generation. The average mean wind power density is 30.8 W/m^2 with a range of 9-88 W/m^2. This is estimated by the Philippine Atmospheric Geophysical and Astronomical Service Administration (PAGASA). PAGASA also estimated that the country's average solar radiation is 161.7 W/m^2. On the other hand, NEA data show that an aggregate micro-hydropower potential amounts to around 27.8 MW.