9.3 FUTURE TRAFFIC VOLUME

The traffic volume on each link was estimated by assigning the vehicle OD matrices to the road network for the following three cases:

Case	OD Matrix	Road Network
WITHOUT	Without project case OD matrix	The same network as present (no improvement assumed)
WITH – 1	With project case OD matrix	Network with improvement of all the component roads of the Basic Road Network established in Chapter 12, but not including additional road links like bypass roads and expressway
WITH-2	With project case OD matrix	Master Plan Road Network, which includes additional road links like bypass roads and expressway, in addition to the improvement of all the component roads of the Basic Road Network

The road network is shown in Appendix 9.3-1. Traffic volumes in WITHOUT, WITH-1, and WITH-2 project cases are presented in Appendix 9.3-2 and graphically shown in Figures 9.3-1, 9.3-2 and 9.3-3, respectively.

Out of 16,899 km of arterial roads in the Study Area, 64% has a low traffic volume of less than 500 vehicles per day, while only 1.7% has a heavy traffic volume of more than 5,000 vehicles per day in 1997. The percentages of the low and heavy traffic volume sections are forecasted to change to 25.5% and 15.3%, respectively in 2016. Average traffic volumes are estimated to increase as follows:

1997	754	veh/day
2004	1,658	veh/day
2010	2,189	veh/day
2016	2,691	veh/day

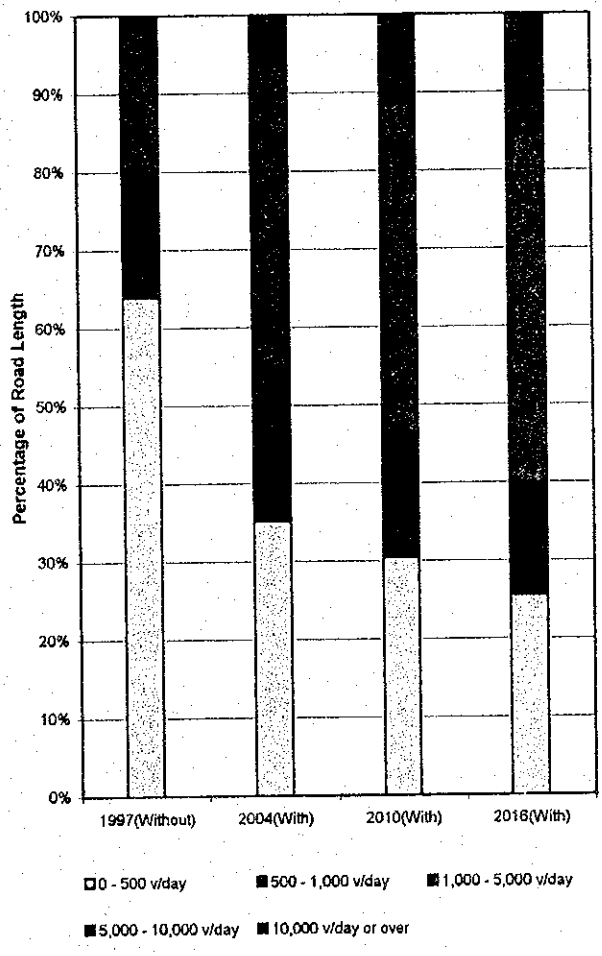


FIGURE 9.3-4 TRAFFIC VOLUME DISTRIBUTION

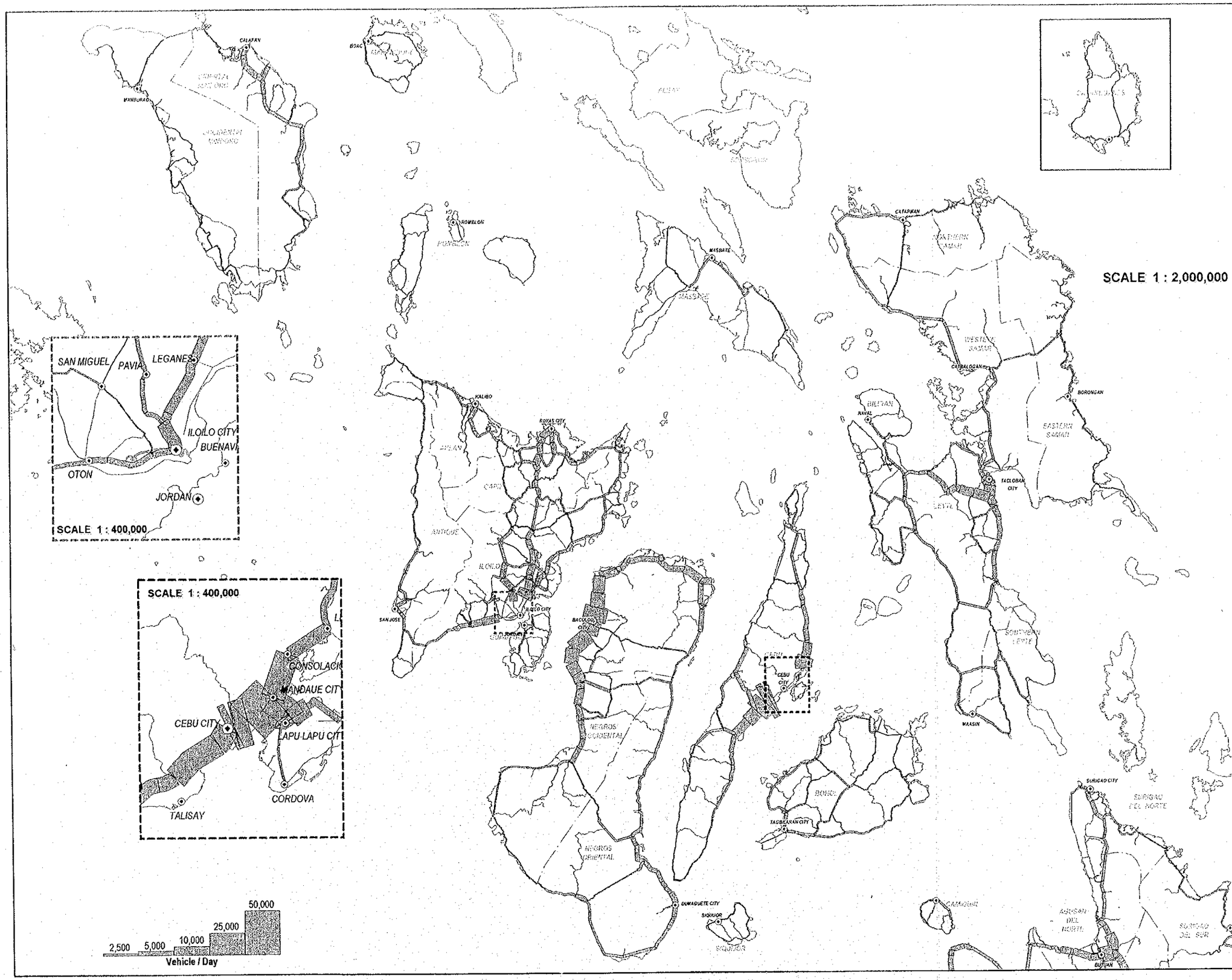


FIGURE 9.3 - 1 (1) FUTURE TRAFFIC VOLUME (Without Project) IN 2016

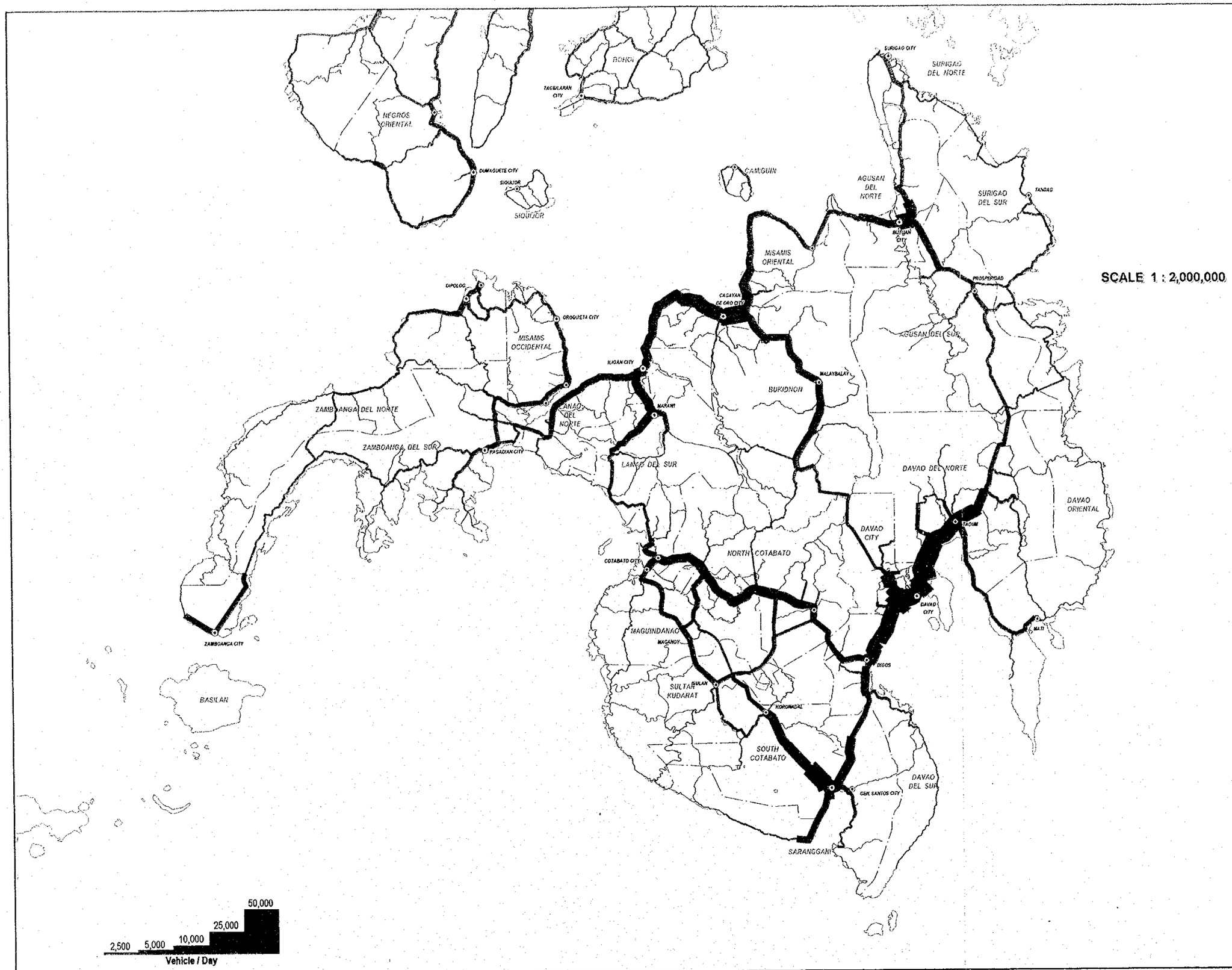


FIGURE 9.3 - 1 (2) FUTURE TRAFFIC VOLUME (Without Project) IN 2016

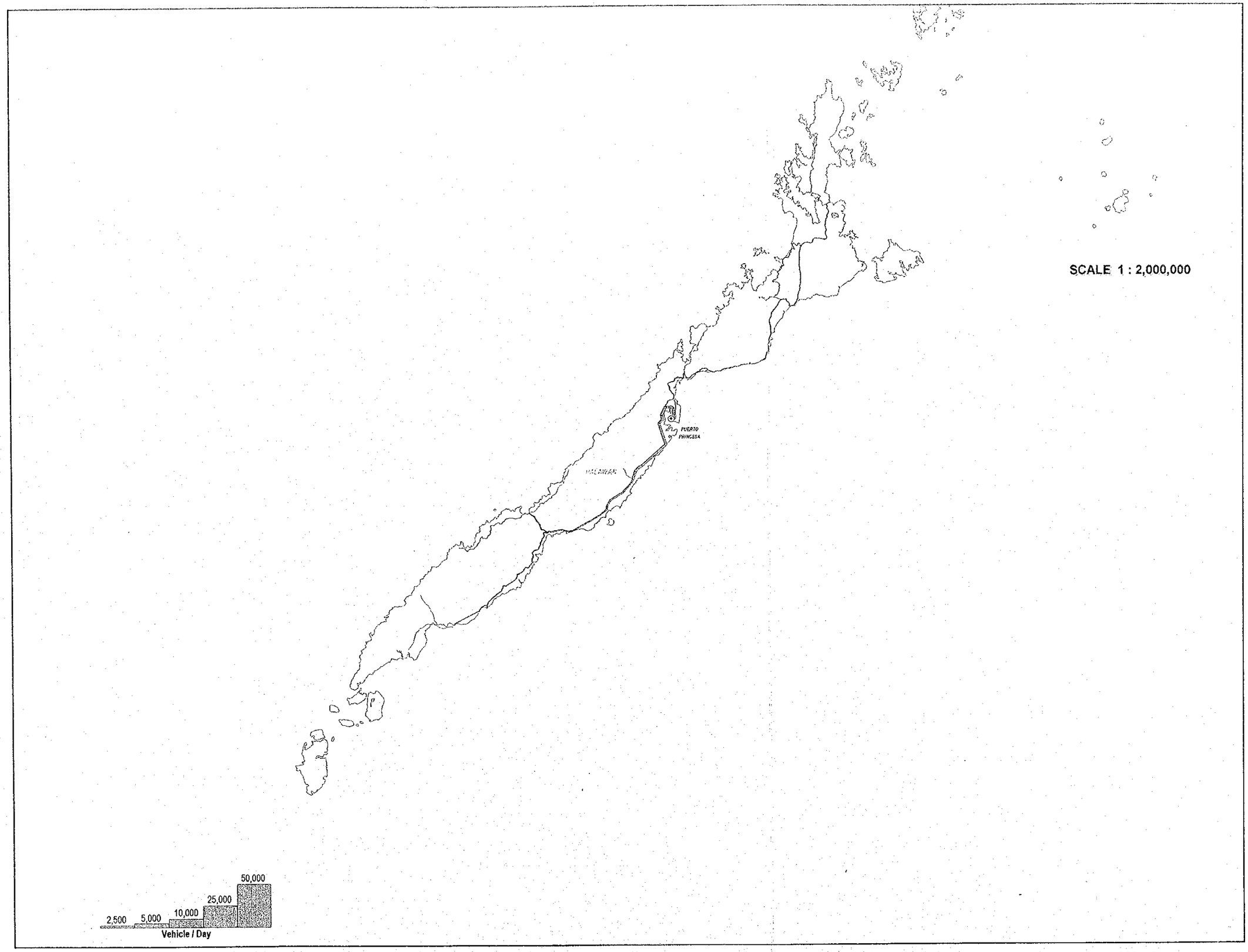


FIGURE 9.3 - 1 (3) FUTURE TRAFFIC VOLUME (Without Project) IN 2016

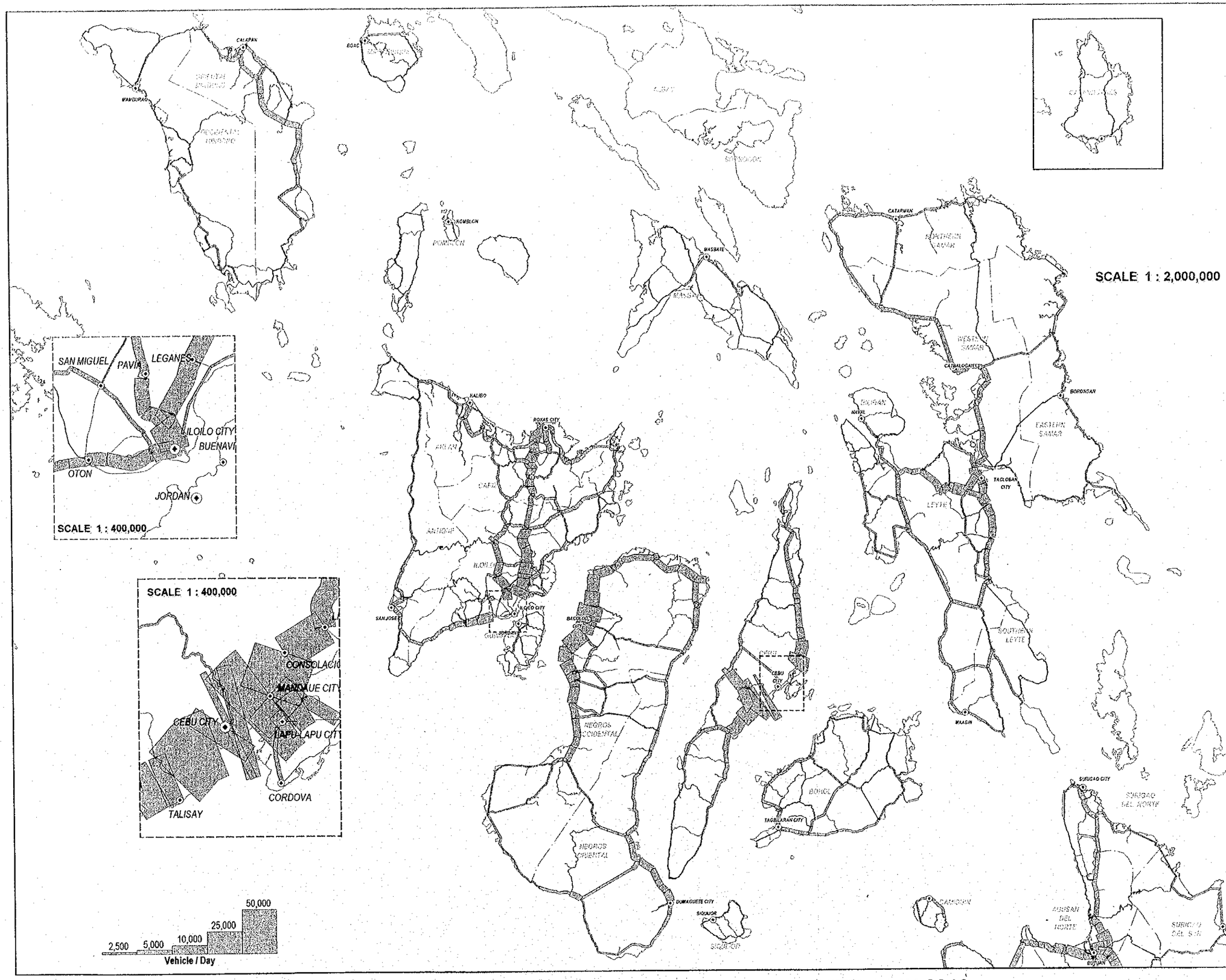


FIGURE 9.3 - 2 (1) FUTURE TRAFFIC VOLUME (WITH-1) IN 2016

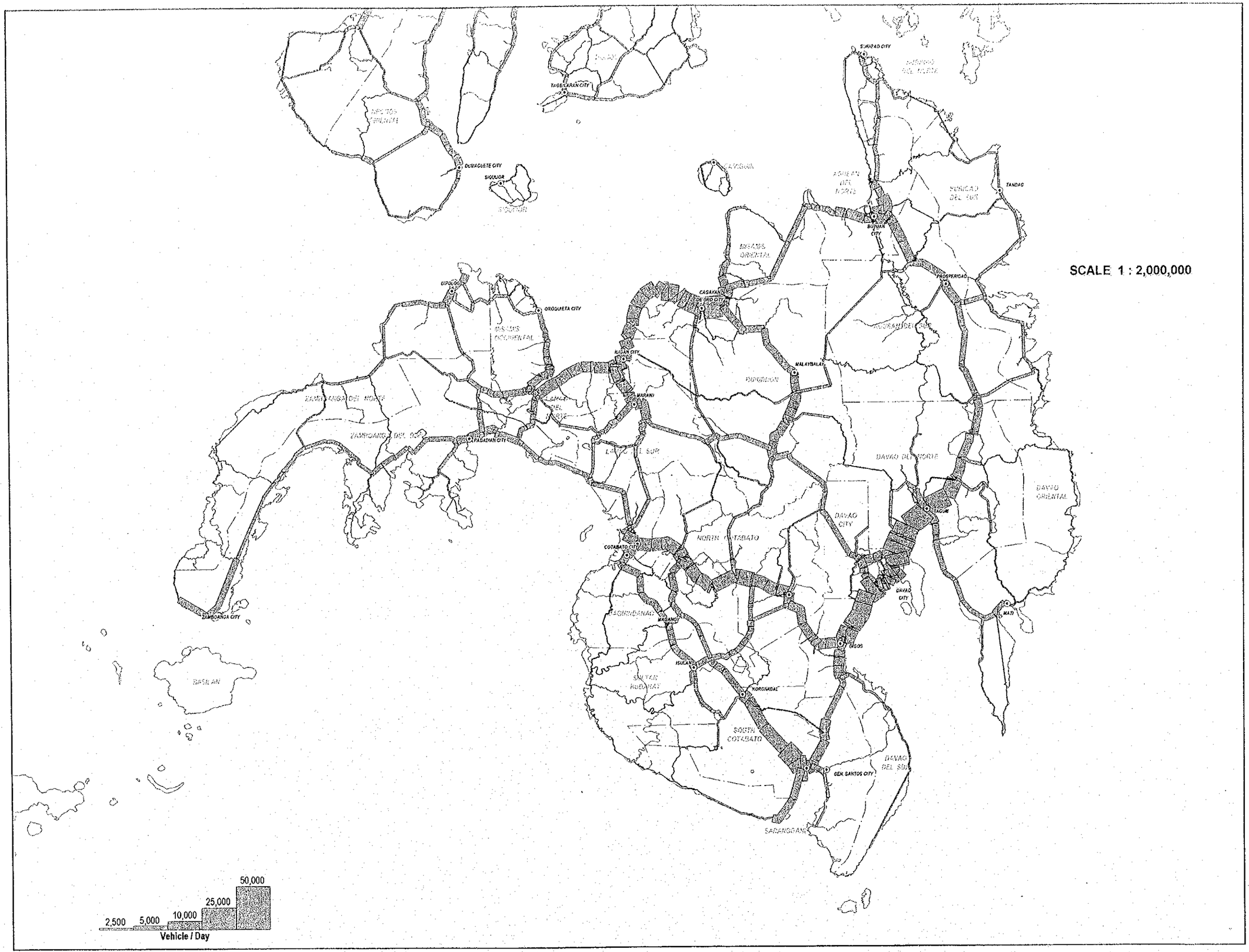


FIGURE 9.3 - 2 (2) FUTURE TRAFFIC VOLUME (WITH-1) IN 2016

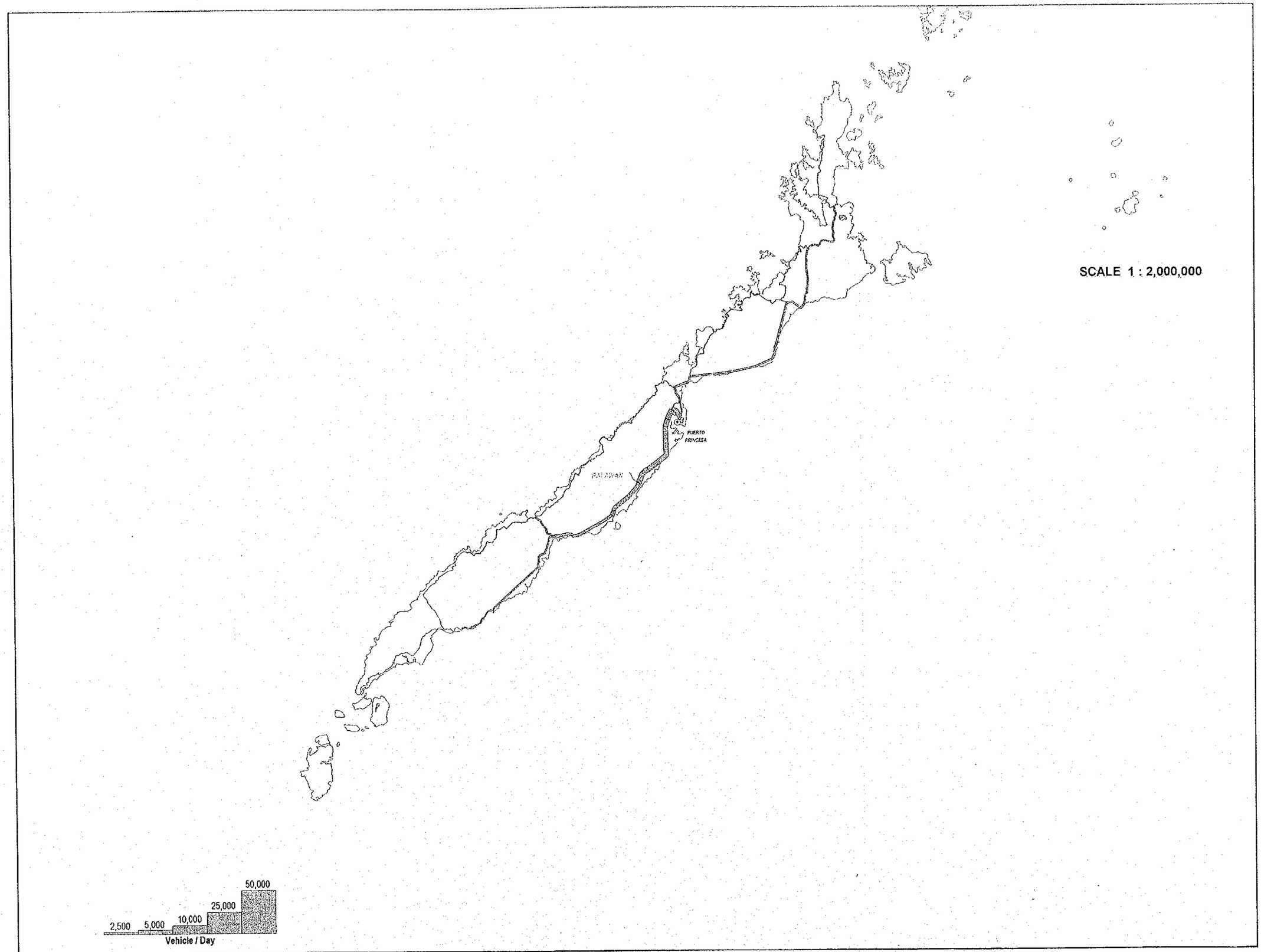


FIGURE 9.3 - 2 (3) FUTURE TRAFFIC VOLUME (WITH-1) IN 2016

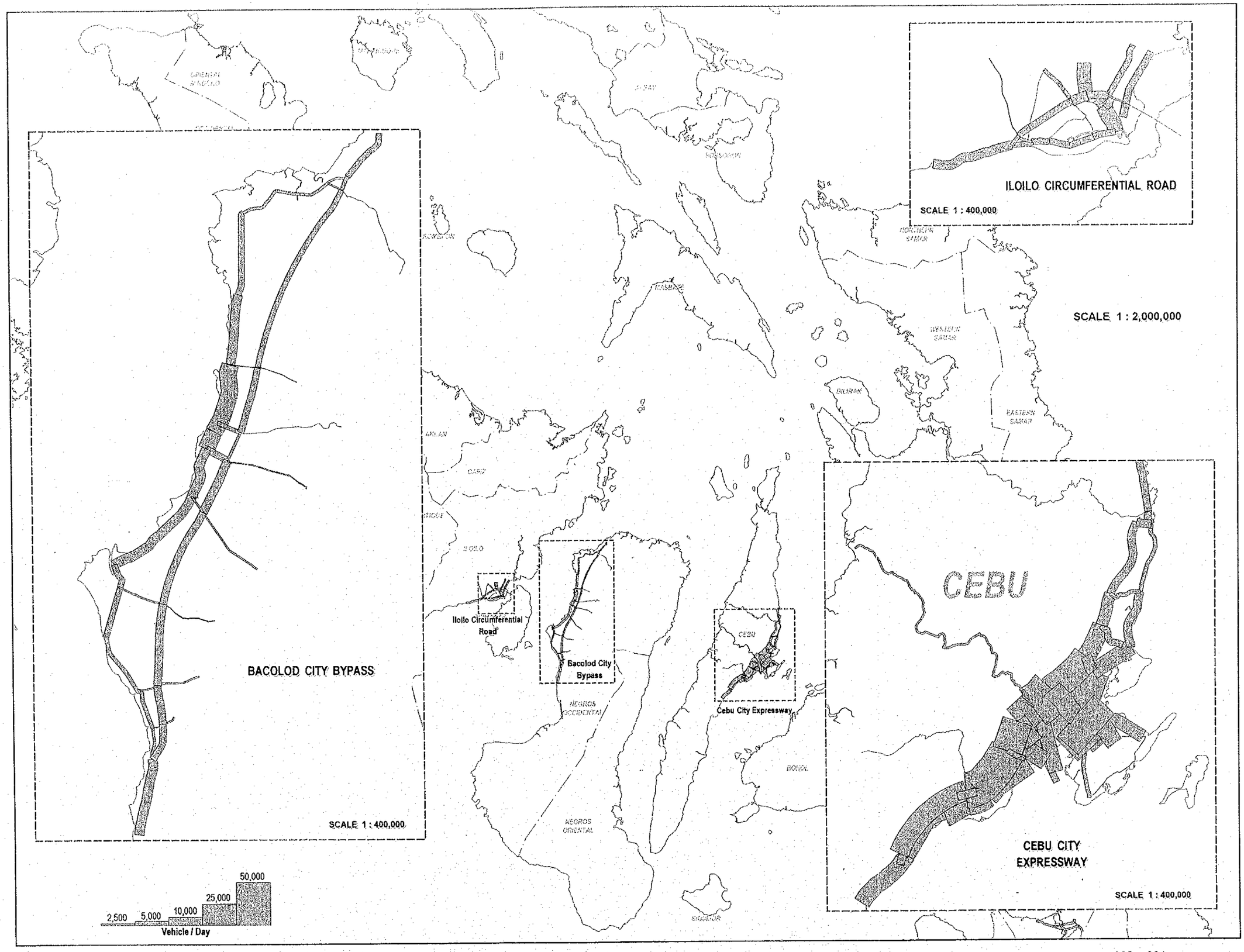


FIGURE 9.3 - 3 (1) FUTURE TRAFFIC VOLUME (WITH - 2) IN 2016

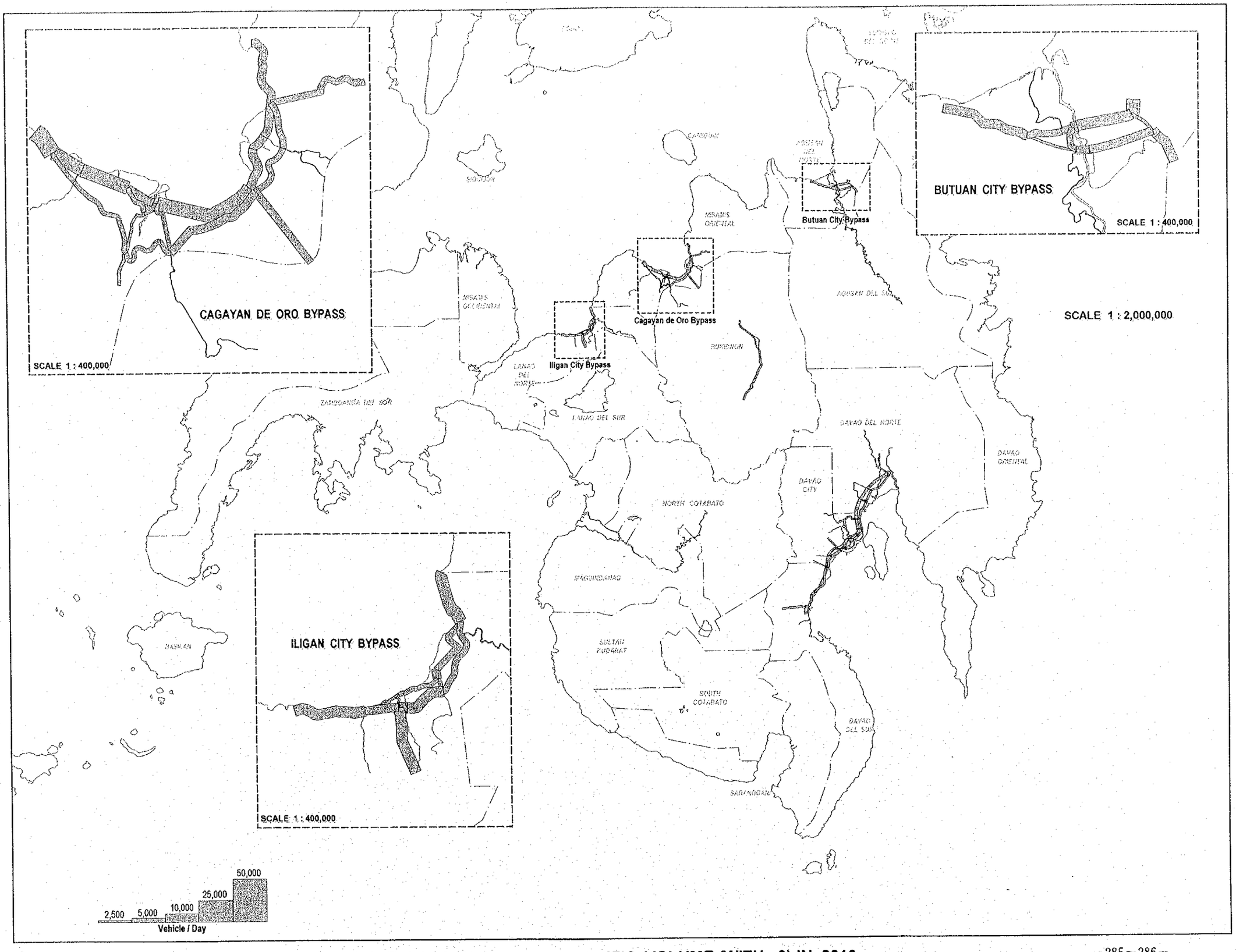


FIGURE 9.3 - 3 (2) FUTURE TRAFFIC VOLUME (WITH - 2) IN 2016

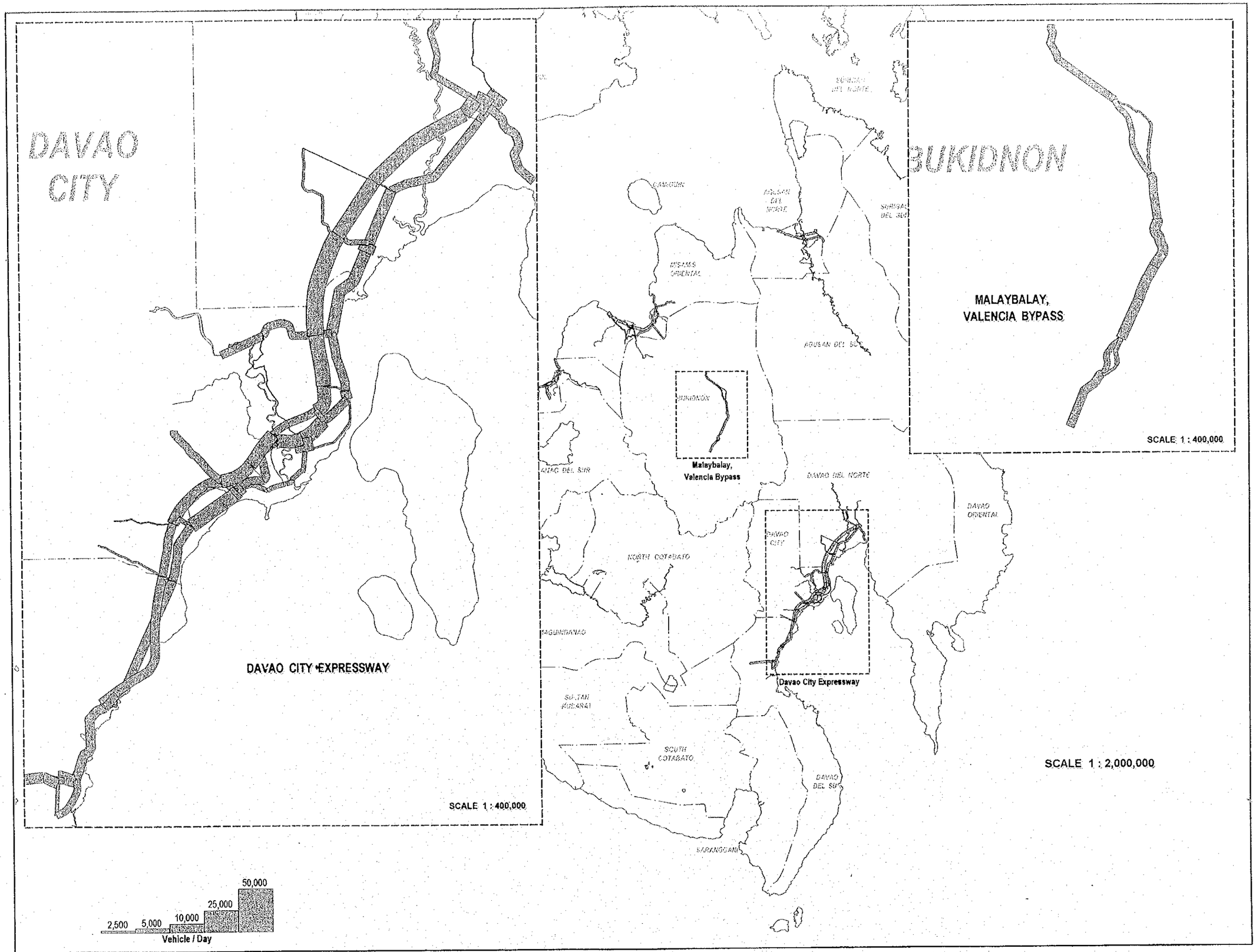


FIGURE 9.3 - 3 (3) FUTURE TRAFFIC VOLUME (WITH - 2) IN 2016

9.4 TRAFFIC DEMAND OF INTER-ISLAND LINKS

DPWH has several plans to connect islands by bridges or tunnels including:

- Iloilo-Guimaras Link (Bridge)
- Guimaras-Negros Link (Bridges and Causeways)
- Luzon (Batangas)-Mindoro Link (Undersea Tunnel)
- Luzon (Sorsogon)-Samar Link (Undersea Tunnel)
- Cebu-Negros Link (Undersea Tunnel)

To estimate the traffic demand of those inter-island links, combined OD matrices were prepared based on the OD matrices of individual islands prepared in Chapter 9.2.

The OD Matrices prepared were:

- Panay and Guimaras combined OD matrices (for Iloilo-Guimaras Link, in case of absence of Guimaras-Negros connection)
- Panay, Guimaras and Negros combined OD matrices (for Iloilo-Guimaras and Guimaras-Negros Links, in case of existence of both)
- Cebu and Negros combined OD matrices (for Cebu-Negros Link)
- Luzon and Mindoro combined OD matrices (for Batangas-Mindoro Link)
- Luzon, Samar and Leyte combined OD matrices (for Sorsogon-Samar Link)

Items of combined OD matrices are the same as those of individual OD matrices prepared in Chapter 9.2.

The assumptions for the preparation of the combined OD matrices were as follows:

- Generation/attraction traffic volume of each zone would be constant in cases with and without the inter-island link, except for all zones in Guimaras and the zones in the vicinity of the inter-island bridge/tunnel sites (within 20 km sphere), where the socio-economic development would be induced by the projects.

- Generated/attracted traffic volume would be assumed to be re-distributed to each destination/origin including that in another connected island by the inter-island link. The trip distribution model shown in Chapter 9.1.3 was applied for determination of the OD distribution.

- The excluded passenger and commodity trips by ship in the OD matrices of individual islands were assumed to be diverted to vehicle trips.

Table 9.4-1 shows the estimated traffic demand of the inter-island links.

TABLE 9.4-1 TRAFFIC DEMAND OF INTER-ISLAND LINKS

Link	Year	Car	Jeepney	Bus	Truck	Total	
Iloilo-Guimaras	2004	1,957	72	144	913	3,086	Without Guimaras - Negros
	2010	3,394	121	246	1,729	5,490	Link
	2016	6,072	206	429	3,417	10,124	
Iloilo-Guimaras	2004	8,652	61	740	3,190	12,643	With both Iloilo-Guimaras
	2010	11,253	102	953	4,832	17,140	Link and Guimaras-Negros
	2016	15,103	173	1,252	7,581	24,109	Link
Guimaras-Negros	2004	7,907	0	666	3,126	11,699	- do -
	2010	10,190	0	841	4,717	15,748	
	2016	13,631	0	1,083	7,383	22,097	
Cebu-Negros	2004	8,675	0	348	4,329	13,352	
	2010	11,079	0	437	5,468	17,984	
	2016	13,689	0	537	9,098	23,324	
Batangas-Mindoro	2004	16,631	0	1,448	1,077	19,156	
	2010	20,469	0	1,780	1,596	23,845	
	2016	24,175	0	2,102	2,129	28,406	
Sorsogon-Samar	2004	6,981	0	617	550	8,148	
	2010	8,721	0	769	949	10,439	
	2016	10,585	0	934	1,766	13,285	

The highest traffic volume was expected at Batangas–Mindoro Link with a total traffic volume of 28,406 in 2016.

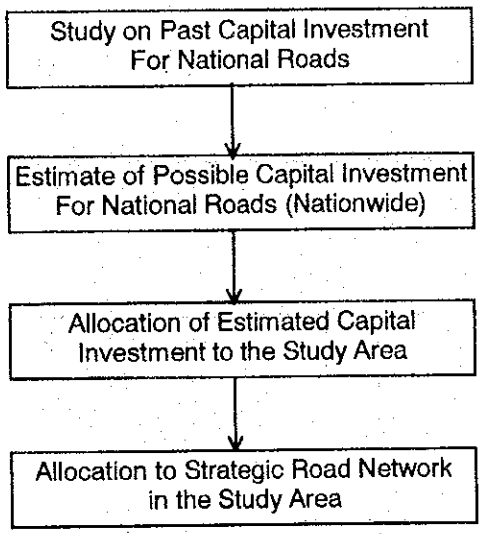
Traffic volumes of Iloilo-Guimaras Link were estimated for two cases, with and without Guimaras-Negros Link. Traffic volume of with case was estimated at more than two times of without case.

CHAPTER 10

POSSIBLE CAPITAL INVESTMENT FOR NATIONAL ROADS

10.1 PROCEDURE

The following procedure was adopted to estimate the possible investment amount for national roads in the Study Area.



10.2 PAST CAPITAL INVESTMENT FOR NATIONAL ROADS

10.2.1 Total Capital Investment For National Roads

The past investment for national roads at the current price and at the constant 1995 price is shown in Table 10.2-1 and 10.2-2, respectively. The share of the capital investment to GDP is summarized as follows:

1987 - 1995	:	0.56% ~ 0.99%
1993 - 1995	:	0.63% ~ 0.99%
Lowest (1991)	:	0.56%
Highest (1995)	:	0.99%

The share of the capital investment to GDP ranges from 0.56% to 0.99%. When the economic growth of the country registered negative growth (-0.6%) in 1991, low capital investment was set for national roads and the share to GDP was only 0.56%. With the recovery of the economic growth, the capital investment for national roads has been increased. In recent years, the share to GDP ranges from 0.63% to 0.99%.

TABLE 10.2-1 PAST INVESTMENT FOR NATIONAL ROADS

(Unit : Million Pesos at Current Prices)

Year	GDP	HIGHWAY SECTOR INVESTMENT					
		Capital Investment		Maintenance		Total	
	Amount	Amount	Share to GDP(%)	Amount	Share to GDP(%)	Amount	Share to GDP(%)
1987	682,764	4,814.34	0.705	1,795.50	0.263	6,609.84	0.968
1988	799,182	5,577.56	0.698	1,819.10	0.228	7,396.66	0.926
1989	925,444	8,105.03	0.876	1,797.80	0.194	9,902.83	1.070
1990	1,077,237	6,354.49	0.590	2,137.70	0.198	8,492.19	0.788
1991	1,248,011	6,839.28	0.548	2,136.00	0.171	8,975.28	0.719
1992	1,351,559	11,295.53	0.836	1,385.60	0.103	12,681.13	0.938
1993	1,474,457	10,435.82	0.708	1,661.40	0.113	12,097.22	0.820
1994	1,693,278	10,616.53	0.627	1,767.50	0.104	12,384.03	0.731
1995	1,906,430	18,821.05	0.987	3,237.30	0.170	22,058.35	1.157
1996	-	15,427.76	-	3,399.20	-	18,826.96	-
1997	-	22,813.33	-	3,856.10	-	26,669.43	-

SOURCE: DPWH Planning Service

TABLE 10.2-2 PAST INVESTMENT FOR NATIONAL ROADS

(Unit : Million Pesos at Constant 1995 Prices)

Year	GDP		HIGHWAY SECTOR INVESTMENT					
			Capital Outlay		Maintenance		Total	
	Amount	Growth Rate(%)	Amount	Share to GDP(%)	Amount	Share to GDP(%)	Amount	Share to GDP(%)
1987	1,463,869.88	4.30	11,001.24	0.752	4,102.90	0.280	15,104.13	1.032
1988	1,562,671.14	6.80	11,712.87	0.750	3,820.11	0.244	15,532.98	0.994
1989	1,659,658.02	6.20	15,170.19	0.914	3,364.94	0.203	18,535.13	1.117
1990	1,710,087.61	3.00	10,416.92	0.609	3,504.33	0.205	13,921.25	0.814
1991	1,700,126.59	-0.60	9,449.14	0.556	2,951.10	0.174	12,400.24	0.729
1992	1,705,930.74	0.30	14,323.86	0.840	1,757.08	0.103	16,080.94	0.943
1993	1,741,979.47	2.10	12,298.62	0.706	1,957.96	0.112	14,256.57	0.818
1994	1,818,671.93	4.40	11,474.34	0.631	1,910.31	0.105	13,384.66	0.736
1995	1,906,431.00	4.80	18,821.05	0.987	3,237.30	0.170	22,058.35	1.157
1996	-	-	14,202.79	-	3,129.30	-	17,332.10	-
1997	-	-	19,801.97	-	3,347.09	-	23,149.07	-

SOURCE: Study Team. Prepared based on DPWH Planning Service and 1996 Statistical Yearbook.

HIGHWAY SECTOR INVESTMENT

AVERAGE INCREASE PER YEAR OF CAPITAL INVESTMENT

1987 - 1997	0.880 Billion	₱ /Year
1991 - 1996	0.951 Billion	₱ /Year
1990 - 1997	1.341 Billion	₱ /Year
1991 - 1997	1.725 Billion	₱ /Year
1992 - 1997	1.096 Billion	₱ /Year
1994 - 1997	2.776 Billion	₱ /Year

The average increase amounts of the capital investment per year in real term were as follows:

1987 - 1997 (Average of past 10 years)	:	0.88 Billion ₱/Year
1991 - 1997 (Average of past 6 years)	:	1.73 Billion ₱/Year
1992 - 1997 (Average of past 5 years)	:	1.10 Billion ₱/Year
1994 - 1997 (Average of past 3 years)	:	2.78 Billion ₱/Year

As shown above, the capital investment in recent years is increasing with high rate.

10.2.2 Fund Sources

Table 10.2-3 and Figure 10.2-1 shows the fund sources of the capital investment for national roads and those are summarized as follows:

	Foreign-assisted projects	Locally funded projects
1987 - 1997	58.9%	41.1%
1993 - 1997	53.3%	46.7%
Max. foreign assisted project (1993)	95.1%	4.9%
Max. locally funded project (1997)	37.3%	62.7%

For the foreign-assisted projects:

	OECF	IBRD	ADB	Others
1987 - 1997	27.8%	12.1%	9.5%	9.5%
1993 - 1997	28.8%	9.5%	9.5%	5.5%

OECF has been the biggest funding institution followed by IBRD and ADB.

10.2.3 Regional Allocation of Capital Investment

Regional allocation of the capital investment is presented in Table 10.2-4 and graphically presented in Figure 10.2-2, and summarized as follows:

Region	1987-1997	1993-1997	1995	1997
NCR	15.0	14.3	10.8	11.1
Luzon excluding NCR	31.7	32.1	31.8	26.1
Study Area	33.5	32.6	38.3	33.7
• Region IV-B	3.9	3.4	6.2	2.6
• Visayas	18.4	17.8	16.7	19.5
• Mindanao Study Area	19.3	19.7	25.6	18.8
Mindanao Outside Study Area	1.1	1.1	1.6	1.2
Nationwide	10.6	11.6	7.3	20.7
Total	100.0%	100.0%	100.0%	100.0%

Regional fund allocation was compared with various socio-economic indicators as shown in Table 10.2-5 and Figure 10.2-3. Regional fund allocation has been made more or less in proportion to population of the region.

TABLE 10.2-3 PAST CAPITAL INVESTMENT BY FUNDING SOURCE

(Million Pesos At Current Prices)

FUNDING SOURCE	1987 (%)	1988 (%)	1989 (%)	1990 (%)	1991 (%)	1992 (%)	1993 (%)	1994 (%)	1995 (%)	1996 (%)	1997 (%)	TOTAL 1987 - 1997 (%)	TOTAL 1993 - 1997 (%)
A. Foreign- Assisted Projects	2,810.8 (58.4)	3,011.3 (54.0)	4,105.0 (50.6)	4,399.0 (69.2)	4,925.0 (72.0)	10,418.4 (92.2)	9,919.8 (95.1)	7,809.8 (73.6)	7,048.6 (37.5)	8,372.7 (54.3)	8,499.0 (37.3)	71,319.4 (58.9)	41,649.9 (53.3)
OECF	818.2 (17.0)	875.4 (15.7)	1,331.5 (16.4)	1,256.1 (19.8)	1,848.3 (27.0)	5,037.2 (44.6)	4,509.0 (43.2)	4,751.6 (44.8)	2,675.9 (14.2)	4,967.6 (32.2)	5,626.6 (24.7)	33,697.4 (27.8)	22,530.7 (28.8)
IBRD	922.8 (19.2)	949.2 (17.0)	1,078.2 (13.3)	1,186.9 (18.7)	842.2 (12.3)	2,204.0 (19.5)	1,867.9 (17.9)	474.4 (4.5)	1,946.8 (10.3)	1,733.8 (11.2)	1,424.4 (6.2)	14,630.6 (12.1)	7,447.3 (9.5)
ADB	444.4 (9.2)	456.4 (8.2)	656.8 (8.1)	606.2 (9.5)	650.7 (9.5)	1,295.8 (11.5)	1,748.2 (16.8)	1,855.6 (17.5)	1,682.5 (8.9)	1,248.2 (8.1)	840.4 (3.7)	11,485.2 (9.5)	7,374.9 (9.4)
OTHERS	625.4 (13.0)	730.3 (13.1)	1,038.5 (12.8)	1,349.8 (21.2)	1,583.8 (23.2)	1,881.4 (16.7)	1,794.7 (17.2)	728.2 (6.9)	743.4 (3.9)	423.1 (2.7)	607.6 (2.7)	11,506.2 (9.5)	4,297.0 (5.5)
B. Locally Funded Projects	2,003.5 (41.6)	2,565.9 (46.0)	4,000.0 (49.4)	1,955.4 (30.8)	1,914.3 (28.0)	877.1 (7.8)	516.0 (4.9)	2,806.7 (26.4)	11,772.5 (62.5)	7,055.1 (45.7)	14,314.3 (62.7)	49,780.8 (41.1)	36,464.6 (46.7)
TOTAL	4,814.3 (100.0)	5,577.2 (100.0)	8,105.0 (100.0)	6,354.4 (100.0)	6,839.3 (100.0)	11,295.5 (100.0)	10,435.8 (100.0)	10,616.5 (100.0)	18,821.1 (100.0)	15,427.8 (100.0)	22,813.3 (100.0)	121,100.2 (100.0)	78,114.5 (100.0)

SOURCE : DPWH Planning Service

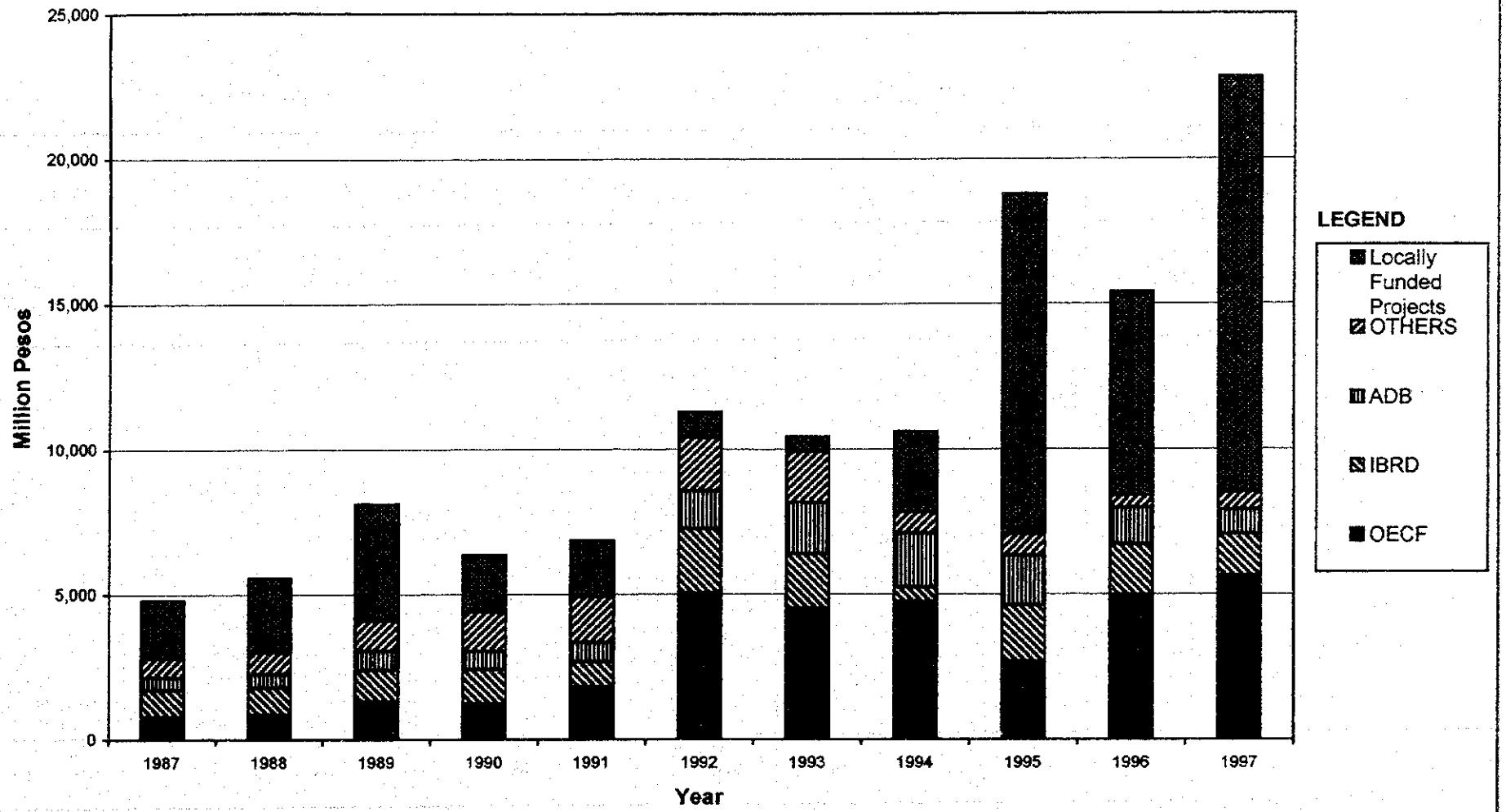


FIGURE 10.2-1 CAPITAL INVESTMENT FOR HIGHWAY SECTOR BY FUND SOURCE

TABLE 10.2-4 REGIONAL FUND ALLOCATION FOR CAPITAL INVESTMENT
1987 - 1997

REGION	1987		1988		1989		1990		1991		1992		1993		1994		1995		1996		1997		TOTAL			
	AMOUNT (in million)	%	AMOUNT (in million)	%	AMOUNT (in million)	%	AMOUNT (in million)	%	AMOUNT (in million)	%	AMOUNT (in million)	%	AMOUNT (in million)	%	AMOUNT (in million)	%	AMOUNT (in million)	%	AMOUNT (in million)	%	AMOUNT (in million)	%	1987-1997	%	1993-1997	%
NCR	478.40	9.94	492.59	8.83	956.34	11.80	919.13	14.46	1,126.41	16.47	3,020.72	26.74	1,512.34	14.49	1,549.02	14.59	2,037.55	10.83	3,558.86	23.07	2,530.46	11.09	18,181.82	15.01	11,188.23	14.32
I	468.98	9.74	391.41	7.02	308.84	3.81	251.84	3.96	185.80	2.72	442.81	3.92	446.28	4.28	554.69	5.22	560.08	2.98	514.52	3.34	600.22	2.63	4,725.47	3.90	2,675.79	3.43
CAR	-	-	-	-	329.80	4.07	263.16	4.14	103.67	1.52	148.63	1.32	118.40	1.13	396.37	3.73	842.74	4.48	554.50	3.59	1,120.46	4.91	3,877.73	3.20	3,032.47	3.88
II	311.85	6.48	305.90	5.48	366.13	4.52	390.69	6.15	171.09	2.50	853.19	7.55	674.28	6.46	930.40	8.76	1,359.75	7.22	868.16	5.63	1,176.38	5.16	7,407.82	6.12	5,008.97	6.41
III	247.24	5.14	299.04	5.36	445.45	5.50	249.81	3.93	321.22	4.70	536.52	4.75	709.00	6.79	751.31	7.08	721.08	3.83	946.11	6.13	563.45	2.47	5,790.23	4.78	3,690.95	4.73
IV-A	364.12	7.56	386.69	6.93	556.90	6.87	445.69	7.01	675.61	9.88	1,095.42	9.70	1,441.88	13.82	1,282.52	12.08	1,528.40	8.12	1,081.98	7.01	1,314.92	5.76	10,174.13	8.40	6,649.70	8.51
IV-B	325.45	6.76	262.43	4.71	273.64	3.38	321.51	5.06	519.66	7.60	314.13	2.78	181.41	1.74	211.89	2.00	1,175.69	6.25	486.72	3.15	601.14	2.64	4,673.67	3.86	2,656.85	3.40
V	278.87	5.79	313.96	5.63	436.68	5.39	352.11	5.54	408.53	5.97	584.21	5.17	461.02	4.42	698.48	6.58	969.62	5.15	685.74	4.44	1,182.57	5.18	6,371.79	5.26	3,997.43	5.12
VI	308.17	6.40	405.20	7.26	573.66	7.08	484.47	7.62	483.63	7.07	587.62	5.20	711.65	6.82	448.68	4.23	950.82	5.05	664.41	4.31	798.33	3.50	6,416.64	5.30	3,573.89	4.58
VII	251.03	5.21	410.59	7.36	616.87	7.61	387.71	6.10	399.38	5.84	427.63	3.79	665.19	6.37	467.45	4.40	1,177.35	6.26	1,095.68	7.10	2,504.45	10.98	8,403.33	6.94	5,910.12	7.57
VIII	497.40	10.33	493.78	8.85	561.48	6.93	384.68	6.05	324.33	4.74	805.27	7.13	695.14	6.66	791.25	7.45	1,013.44	5.38	784.66	5.09	1,145.46	5.02	7,496.89	6.19	4,429.95	5.67
IX	251.47	5.22	338.35	6.07	428.56	5.29	186.29	2.93	281.44	4.12	155.30	1.37	512.01	4.91	426.34	4.02	1,053.94	5.60	530.29	3.44	630.03	2.76	4,794.02	3.96	3,152.61	4.04
X	266.55	5.54	348.21	6.24	525.02	6.48	275.51	4.34	348.97	5.10	427.77	3.79	456.14	4.37	266.75	2.51	1,272.95	6.76	573.40	3.72	642.34	2.82	5,403.61	4.46	3,211.58	4.11
XI	300.75	6.25	382.19	6.85	505.55	6.24	371.74	5.85	398.54	5.83	456.13	4.04	563.62	5.40	322.50	3.04	1,619.98	8.61	894.61	5.80	1,078.24	4.73	6,893.85	5.69	4,478.95	5.73
XII	299.24	6.22	442.22	7.93	533.08	6.58	437.31	6.88	202.91	2.97	201.65	1.79	506.00	4.85	324.13	3.05	660.50	3.51	549.82	3.56	732.92	3.21	4,889.78	4.04	2,773.37	3.55
XIII	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	305.86	1.98	917.34	4.02	1,223.20	1.01	1,223.20	1.57
ARMM	-	-	-	-	-	-	-	-	-	-	37.60	0.33	-	-	-	-	513.17	2.73	371.26	2.41	560.42	2.46	1,482.45	1.22	1,444.85	1.85
N-WIDE	164.82	3.42	305.00	5.47	687.03	8.48	632.84	9.96	888.09	12.99	1,200.93	10.63	781.48	7.49	1,194.75	11.25	1,364.00	7.25	961.17	6.23	4,714.20	20.66	12,894.31	10.65	9,015.60	11.54
TOTAL	4,814.34	100.00	5,577.56	100.00	8,105.03	100.00	6,354.49	100.00	6,839.28	100.00	11,295.53	100.00	10,435.84	100.00	10,616.53	100.00	18,821.06	100.00	15,427.75	100.00	22,813.33	100.00	121,100.74	100.00	78,114.51	100.00
NCR	478.40	9.94	492.59	8.83	956.34	11.80	919.13	14.46	1,126.41	16.47	3,020.72	26.74	1,512.34	14.49	1,549.02	14.59	2,037.55	10.83	3,558.86	23.07	2,530.46	11.09	18,181.83	15.01	11,188.23	14.38
LUZON	1,671.06	34.71	1,697.00	30.43	2,443.80	30.15	1,953.30	30.74	1,865.92	27.28	3,660.78	32.41	3,850.86	36.90	4,613.77	43.46	5,981.67	31.78	4,651.01	30.15	5,958.00	26.12	38,347.15	31.67	24,755.29	31.81
I	468.98	9.74	391.41	7.02	308.84	3.81	251.84	3.96	185.80	2.72	442.81	3.92	446.28	4.28	554.69	5.22	560.08	2.98	514.52	3.34	600.22	2.63	4,725.45	3.90	2,675.79	3.44
CAR	-	-	-	-	329.80	4.07	263.16	4.14	103.67	1.52	148.63	1.32	118.40	1.13	396.37	3.73	842.74	4.48	554.50	3.59	1,120.46	4.91	3,877.72	3.20	3,032.45	3.90
II	311.85	6.48	305.90	5.48	366.13	4.52	390.69	6.15	171.09	2.50	853.19	7.55	674.28	6.46	930.40	8.76	1,359.75	7.22	868.16	5.63	1,176.38	5.16	7,407.81	6.12	5,008.97	6.44
III	247.24	5.14	299.04	5.36	445.45	5.50	249.81	3.93	321.22	4.70	536.52	4.75	709.00	6.79	751.31	7.08	721.08	3.83	946.11	6.13	563.45	2.47	5,790.24	4.78	3,390.95	4.36
IV-A	364.12	7.56	386.69	6.93	556.90	6.87	445.69	7.01	675.61	9.88	1,095.42	9.70	1,441.88	13.82	1,282.52	12.08	1,528.40	8.12	1,081.98	7.01	1,314.92	5.76	10,174.13	8.40	6,649.69	8.55
V	278.87	5.79	313.96	5.63	436.68	5.39	352.11	5.54	408.53	5.97	584.21	5.17	461.02	4.42	698.48	6.58	969.62	5.15	685.74	4.44	1,182.57	5.18	6,371.80	5.26	3,997.43	5.14
STUDY AREA	**2,424.62**	**50.36**	**2,981.47**	**53.45**	**3,889.29**	**47.99**	**2,793.33**	**43.96**	**2,874.43**	**42.03**	**3,382.51**	**29.95**	**4,237.40**	**40.60**	**3,214.22**	**30.28**	**9,132.18**	**48.52**	**6,059.95**	**39.28**	**9,331.56**	**40.90**	**50,320.95**	**41.55**	**31,975.31**	**41.09**
Region IV-B	**325.45**	**6.76**	**262.43**	**4.71**	**273.64**	**3.38**	**321.51**	**5.06**	**519.66**	**7.60**	**314.13**	**2.78**	**181.41**	**1.74**	**211.89**	**2.00**	**1,175.69**	**6.25**	**486.72**	**3.15**	**601.14**	**2.64**	**4,673.67**	**3.86**	**2,656.85**	**3.41**
Visayas	**1,056.60**	**21.95**	**1,309.57**	**23.48**	**1,752.01**	**21.62**	**1,256.86**	**19.78**	**1,207.34**	**17.65**	**1,820.52**	**16.12**	**2,071.98**	**19.85**	**1,707.38**	**16.08**	**3,141.61**	**16.69**	**2,544.75**	**16.49**	**4,448.24**	**19.50**	**22,316.84**	**18.43**	**13,913.93**	**17.88**
VI	308.17	6.40	405.20	7.26	573.66	7.08	484.47	7.62	483.63	7.07	587.62	5.20	711.65	6.82	448.68	4.23	950.82	5.05	664.41	4.31	798.33	3.50	6,416.63	5.30	3,573.87	4.59
VII	251.03	5.21	410.59	7.36	616.87	7.61	387.71	6.10	399.38	5.84	427.63	3.79	665.19	6.37	467.45	4.40	1,177.35	6.26	1,095.68	7.10	2,504.45	10.98	8,403.32	6.94	5,910.11	7.60
VIII	497.40	10.33	493.78	8.85	561.48	6.93	384.68	6.05	324.33	4.74	805.27	7.13	695.14	6.66	791.25	7.45	1,013.44	5.38	784.66	5.09	1,145.46	5.02	7,496.89	6.19	4,429.95	5.69
Mindanao	**1,042.57**	**21.66**	**1,409.47**	**25.27**	**1,863.64**	**22.99**	**1,214.96**	**19.12**	**1,147.43**	**16.78**	**1,247.86**	**11.05**	**1,984.01**	**19.01**	**1,294.95**	**12.20**	**4,814.88**	**25.58**	**3,028.48**	**19.63**	**4,282.18**	**18.77**	**23,330.44**	**19.27**	**15,404.53**	**19.80**
IX	176.03	3.66	236.85	4.25	299.99	3.70	130.40	2.05	197.01	2.88	139.00	1.23	458.25	4.39	381.57	3.59	943.28	5.01	474.51	3.08	563.88	2.47	4,000.87	3.30	2,821.59	3.63
X	266.55	5.54	348.21	6.24	525.02	6.48	275.51	4.34	348.97	5.10	427.77	3.79	456.14	4.37	266.75	2.51	1,272.95	6.76	573.40	3.72	642.34	2.82	5,403.62	4.46	3,211.59	4.13
XI	300.75	6.25	382.19	6.85	505.55	6.24	371.74	5.85	398.54	5.83	456.13	4.04	563.62	5.40	322.50	3.04	1,619.98	8.61	894.61	5.80	1,078.24	4.73	6,893.85	5.69	4,478.96	5.76
XII	299.24	6.22	442.22	7.93	533.08	6.58	437.31	6.88	202.91	2.97	201.65	1.79	506.00	4.85	324.13	3.05	660.50	3.51	549.82	3.56	732.92	3.21	4,889.78	4.04	2,773.38	3.56
ARMM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	318.17	1.69	230.18	1.49	347.46	1.52	919.12	0.76	895.81	1.15
XIII	-	-	-	-	-	-	-	-	-	-	23.31	0.21	-	-	-	-	-	-	305.86	1.98	917.34	4.02	1,223.20	1.01	1,223.20	1.57
MINDANAO Outside Study Area	75.44	1.57	101.50	1.82	128.57	1.59	55.89	0.88	84.43	1.23	30.59	0.27	53.76	0.52	44.77	0.42	305.66	1.62	196.78	1.28	279.11	1.22	1,356.50	1.12	880.08	1.13
NATIONWIDE	164.82	3.42	305.00	5.47	687.03	8.48	632.84	9.96	888.09	12.99	1,200.93	10.63	781.48	7.49	1,194.75	11.25	1,364.00	7.25	961.17	6.23	4,714.20	20.66	12,894.31	10.65	9,015.60	11.54
TOTAL	4,814.34	100.00	5,577.56	100.00	8,105.03	100.00	6,354.49	100.00	6,839.28	100.00	11,295.53	100.00	10,435.84	100.00	10,616.53	100.00	18,821.06	100.00	15,427.77	100.00	22,813.33	100.00	121,100.74	100.00	77,814.51	100.00

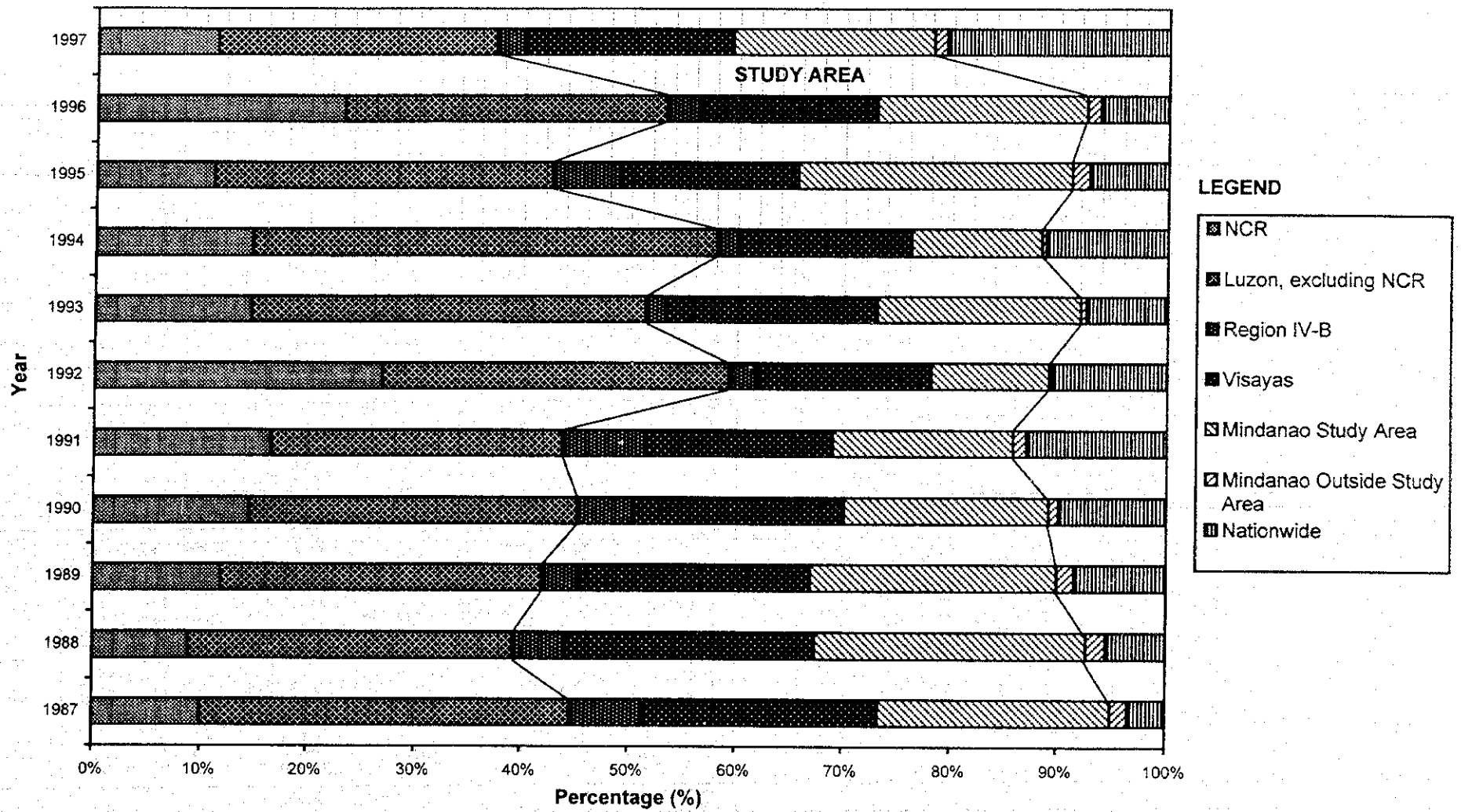


FIGURE 10.2-2 REGIONAL FUND ALLOCATION FOR CAPITAL INVESTMENT 1987 - 1997

TABLE 10.2-5 COMPARISON OF REGIONAL FUND ALLOCATION WITH VARIOUS INDICATORS

		Population 1995 (in 1,000)	Land Area (sq.km)	No. of Province	GRDP 1995 (Million Pesos)	Average Family Income 1994 (Pesos/Year)	Road Length		National Road Density (km/sq.km)	Past Capital Investment For Highway Sector 1/	
							National Road (km)	Unpaved Nat'l Road (km)		1987-1997 (Million Pesos)	1993-1997 (Million Pesos)
Philippines		68,614 (100.0%)	300,000 (100.0%)	76	1,906,431 (100.0%)	83,161 (100.0%)	26,781 (100.0%)	11,526 (100.0%)	0.089 (100.0%)	108,206 (100.0%)	69,098 (100.0%)
NCR		9,454 (13.8%)	636 (0.2%)	-	619,061 (32.5%)	173,599 (208.8%)	858 (3.2%)	-	1.350 (1516.8%)	18,182 (16.8%)	11,188 (16.2%)
Luzon excluding NCR		26,766 (39.0%)	113,304 (37.8%)	32	572,949 (30.1%)	80,028 (96.2%)	10,930 (40.8%)	4,249 (36.9%)	0.097 (109.0%)	38,347 (35.5%)	25,055 (36.3%)
STUDY AREA	Region IV-B	2,030 (3.0%)	27,454 (9.1%)	5	53,823 (2.8%)	57,754 (69.4%)	1,739 (6.5%)	1,175 (10.2%)	0.073 (82.0%)	4,674 (4.3%)	2,657 (3.8%)
	Visayas	14,159 (20.6%)	56,607 (18.9%)	16	309,273 (16.2%)	58,314 (70.1%)	6,465 (24.1%)	2,436 (21.1%)	0.123 (138.2%)	22,317 (20.6%)	13,914 (20.1%)
	Mindanao in the Study Area	15,123 (22.0%)	97,984 (32.7%)	20	338,743 (17.8%)	61,470 (73.9%)	6,499 (24.3%)	3,490 (30.3%)	0.066 (74.2%)	23,330 (21.6%)	15,405 (22.3%)
	Study Area Total	31,312 (45.6%)	182,045 (60.7%)	41	701,839 (36.8%)	59,817 (71.9%)	14,703 (54.9%)	7,101 (61.6%)	0.081 (91.0%)	50,321 (46.5%)	31,975 (46.3%)
Mindanao outside Study Area		1,082 (1.6%)	4,015 (1.3%)	3	12,582 (0.7%)	51,000 (61.3%)	290 (1.1%)	176 (1.5%)	0.072 (80.9%)	1,357 (1.3%)	880 (1.3%)

SOURCE: DPWH Planning Service and 1996 Statistical Yearbook.
NOTE: 1/ Allocation to nationwide projects is excluded from past capital investment.

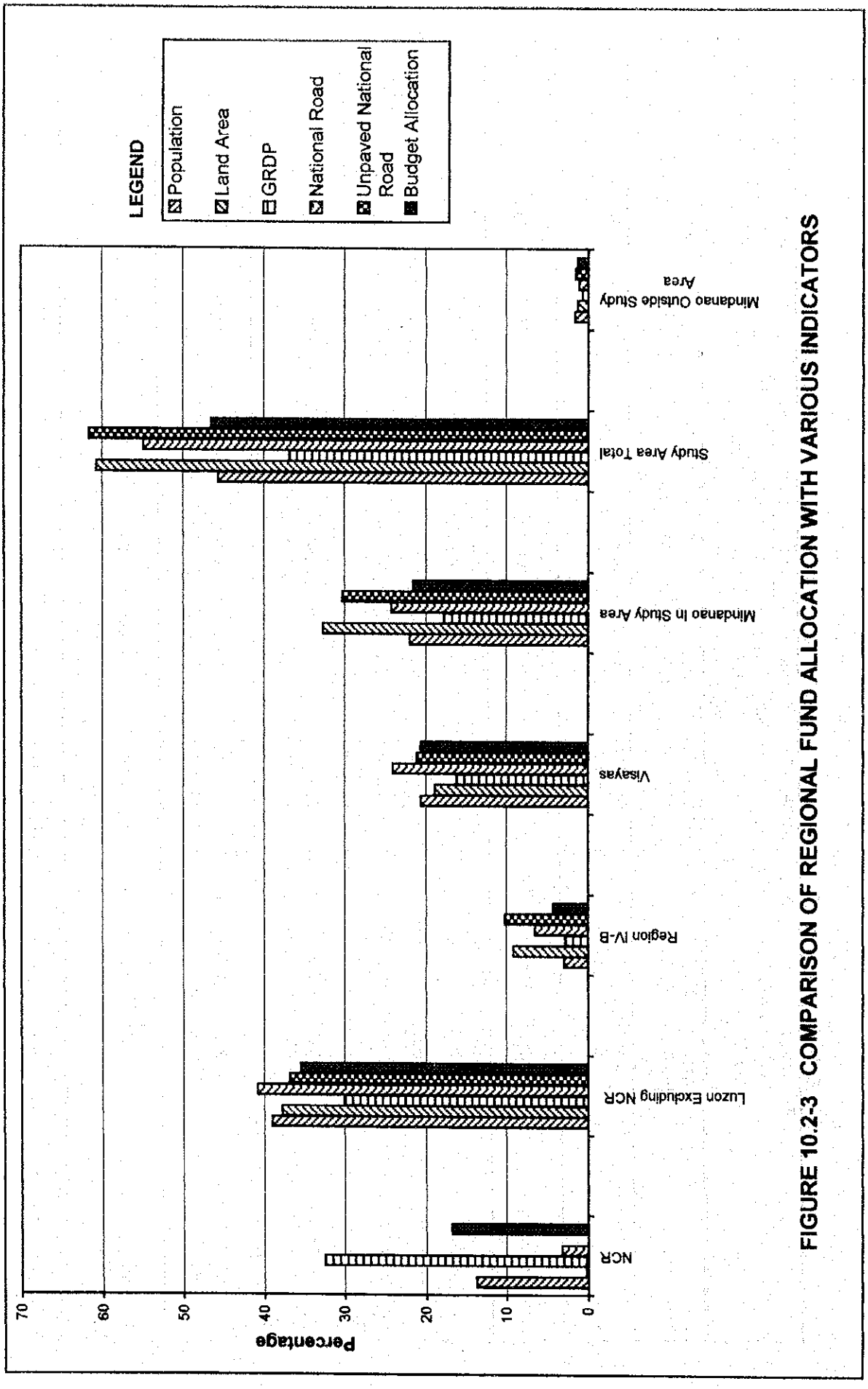


FIGURE 10.2-3 COMPARISON OF REGIONAL FUND ALLOCATION WITH VARIOUS INDICATORS

10.2.4 Fund Allocation to Arterial Roads and Secondary Roads

There is no statistics regarding fund allocation to arterial roads and secondary roads. Only the 1993-1998 Medium Term Public Investment Program showed the target allocation to these roads as shown in Table 10.2-6.

TABLE 10.2-6 TARGET ALLOCATION TO EACH CLASS OF ROADS BY 1993-1998 MEDIUM TERM PUBLIC INVESTMENT PROGRAM

Road Class	Fund Allocation (%)						
	1993	1994	1995	1996	1997	1998	1993-1998
Arterial Roads	52	60	67	63	61	60	61
Secondary Roads	36	24	19	23	24	24	24
Urban Roads	12	16	14	14	15	16	15

SOURCE: DPWH Planning Service

10.3 ESTIMATE OF POSSIBLE CAPITAL INVESTMENT FOR NATIONAL ROADS: NATIONWIDE

The analysis of the past investment trend indicated two methods for estimation of the possible capital investment for national roads as follows:

Method 1: Based on a share to GDP
Method 2: Based on an average net increase of investment amount per year

Six scenarios were prepared as follows:

Period	Method 1: Share to GDP			Method 2: Average Net Increase per Year in Constant 1995 Prices		
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High Assumption
1999 - 2004	0.75%	0.80%	0.90%	1,800 MP/ Year	2,000 MP/ Year	2,200 MP/ Year
2005 - 2010	0.90%	0.95%	1.05%	2,000 MP/ Year	2,200 MP/ Year	2,500 MP/ Year
2011 - 2016	1.00%	1.05%	1.15%	2,200 MP/ Year	2,500 MP/ Year	2,800 MP/ Year

Results are shown in Table 10.3-1 and graphically presented in Figure 10.3-1.

Possible investment generally increase in accordance with the growth of the country's economy. Method 1 was judged to be appropriate for estimation of possible investment amount and was adopted in the Study.

TABLE 10.3-1 ESTIMATE OF CAPITAL INVESTMENT FOR NATIONAL ROADS

UNIT: Million Pesos at Constant 1995 Prices

Year	GDP	CAPITAL INVESTMENT FOR NATIONAL ROADS	(Share to GDP in %)	PTSS Forecast (Medium Assumption)	FORECAST OF CAPITAL INVESTMENT FOR HIGHWAY SECTOR Method 1: Based on Share to GDP			Method 2: Based on Average Net Increase Per Year		
						Low	Medium	High	Low	Medium	High
1995	1,906,430	18,821	(0.99%)		1999 - 2004	0.75%	0.80%	0.90%	1,800 M/Year	2,000 M/Year	2,200 M/Year
1996	2,021,977	14,209	(0.70%)		2005 - 2010	0.90%	0.95%	1.05%	2,000 M/Year	2,200 M/Year	2,500 M/Year
1997	2,144,525	19,802	(0.92%)	23,000	2011 - 2016	1.00%	1.05%	1.15%	2,200 M/Year	2,500 M/Year	2,800 M/Year
1998	2,279,051	16,149	(0.71%)	24,300		16,149	16,149	16,149	16,149	16,149	16,149
1999	2,422,016	(18,387)	(0.76%)	25,600		18,165	19,376	21,798	17,949	18,149	18,349
2000	2,573,964			27,200		19,305	20,592	23,166	19,749	20,149	20,549
2001	2,734,721			29,000		20,510	21,878	24,612	21,549	22,149	22,749
2002	2,905,518			31,200		21,791	23,244	26,150	23,349	24,149	24,949
2003	3,086,982			32,500		23,152	24,696	27,783	25,149	26,149	27,149
2004	3,279,774			34,500		25,838	27,471	30,736	26,949	28,149	29,349
2005	3,441,136					28,525	30,246	33,689	28,949	30,349	31,849
2006	3,605,684					31,264	33,069	36,680	30,949	32,549	34,349
2007	3,778,101					34,003	35,892	39,670	32,949	34,749	36,849
2008	3,958,762					35,629	37,608	41,567	34,949	36,949	39,349
2009	4,148,062					37,333	39,406	43,555	36,949	39,149	41,849
2010	4,346,413					40,120	42,284	46,612	38,949	41,349	44,349
2011	4,505,183					42,908	45,162	49,670	41,149	43,849	47,149
2012	4,669,753					45,655	47,993	52,667	43,349	46,349	49,949
2013	4,840,334					48,403	50,824	55,664	45,549	48,849	52,749
2014	5,017,147					50,171	52,680	57,697	47,749	51,349	55,549
2015	5,200,430					52,004	54,605	59,805	49,949	53,849	58,349
2016	5,374,541					53,745	56,433	61,807	52,149	56,349	61,149
1999 - 2004				180,000		128,761	137,257	154,245	134,694	138,894	143,094
2005 - 2010						206,874	218,505	241,773	203,694	215,094	228,594
2011 - 2016						292,886	307,697	337,310	279,894	300,594	324,894

Note: PTSS = Philippine Transport Strategic Study, 1997
Inflation rate: 9.1%, 6.0% and 8.0% (assumption) was used for year 1996, 1997 and 1998, respectively.

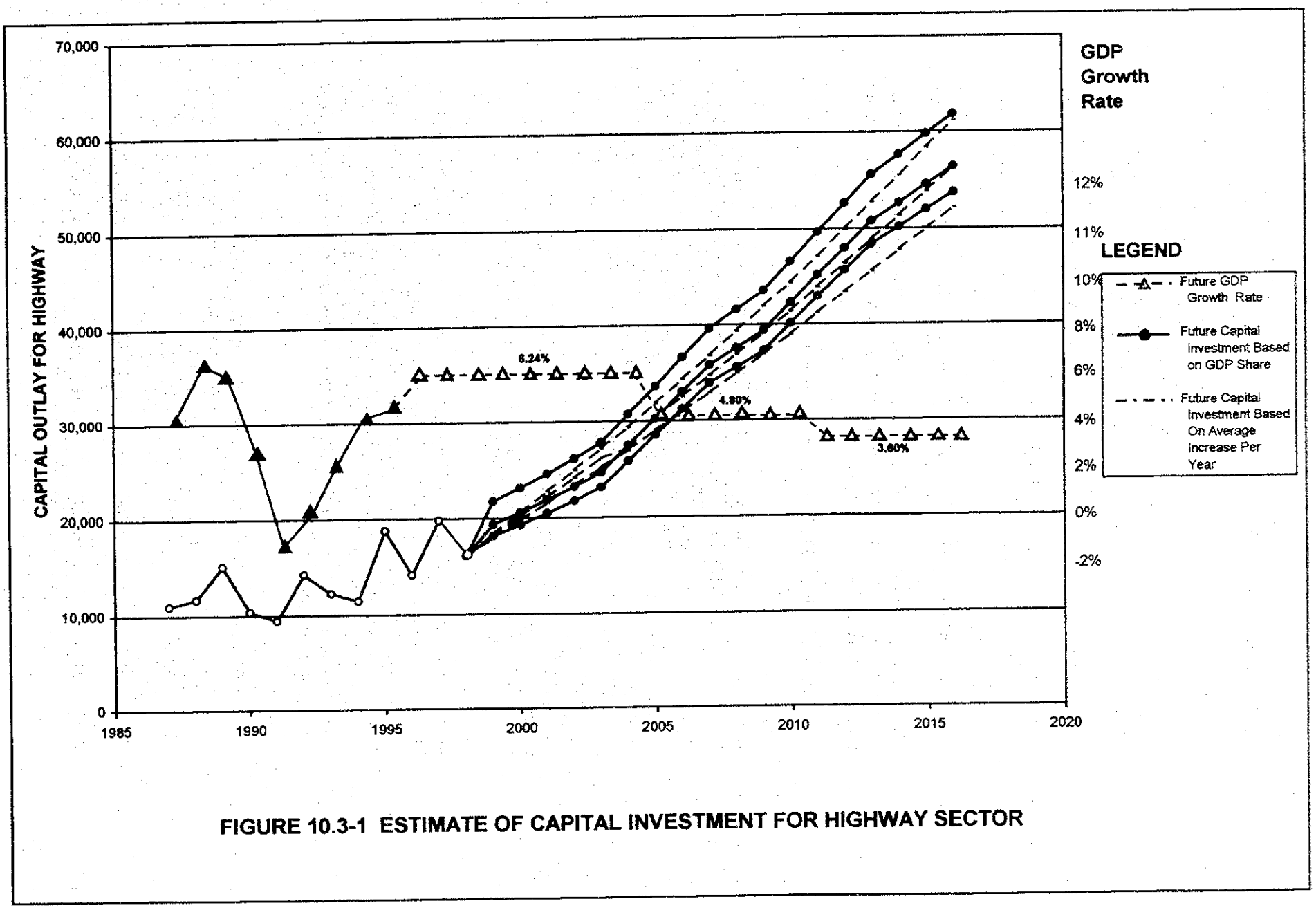


FIGURE 10.3-1 ESTIMATE OF CAPITAL INVESTMENT FOR HIGHWAY SECTOR

By using the result of Method 1, the recommended budgetary framework for the plan period was determined.

Plan Period	Budgetary Framework of Highway Sector Capital Investment (in Million Pesos at constant 1995 prices)		
	Low	Medium	High
1999 - 2004	128,761	137,257	154,245
2005 - 2010	206,874	218,505	241,773
2011 - 2016	292,886	307,697	337,310

10.4 ALLOCATION OF ESTIMATED CAPITAL INVESTMENT TO STUDY AREA

The past regional fund allocation was estimated by the DPWH formula. (See Appendix 10.4-1). The formula was not applicable to NCR, therefore, the share of NCR was assumed to be 15%.

Past fund and estimated allocation are shown in Table 10.4-1.

TABLE 10.4-1 PAST FUND ALLOCATION, ESTIMATED FUND ALLOCATION BASED ON DPWH FORMULA AND RECOMMENDED ALLOCATION

Region	Past Allocation 1/			DPWH Formula 2/	Recommended Allocation
	1987-1997	1993-1997	1997		
NCR	16.8%	16.2%	14.0%	15.0%	15.0%
Luzon (excluding NCR)	35.5%	36.3%	32.9%	29.5%	30.0%
Study Area	46.5%	46.3%	51.6%	53.7%	53.2%
• Region IV-B	4.3%	3.8%	3.3%	7.6%	6.0%
• Visayas	20.6%	20.1%	24.6%	16.3%	18.0%
• Mindanao Study Area	21.6%	22.3%	23.7%	29.8%	29.2%
Mindanao Outside Study Area	1.3%	1.3%	1.5%	1.8%	1.8%

Note: 1/ % share of allocated fund excluding allocation to nationwide projects.
2/ NCR's share was assumed to be 15%

In the past, fund allocation to Region IV-B and Mindanao was lower than these calculated by the DPWH formula, resulting in low level of road development. In order to accelerate road development in two areas, fund allocation needs to be made in accordance with the DPWH formula. On the other hand, fund allocation to Visayas could be lowered than the past level. Fund allocation of 53.2% to the Study Area as shown in Table 10.4-1 was adopted in the Study.

TARGET AMOUNT OF CAPITAL INVESTMENT FOR THE STUDY AREA

(In Million Pesos at Constant 1995 Prices)

	Low	Medium	High
1999 – 2003	65,500	73,020	82,060
2005 – 2010	110,060	116,240	128,620
2011 – 2016	155,820	163,690	179,450

10.5 ALLOCATION TO STRATEGIC ROAD NETWORK IN THE STUDY AREA

In the 1993-1998 Medium Term Public Investment Program, DPWH planned to allocate 60% to 67% of capital investment to arterial roads. In this Study, allocation of 65% to the strategic road network in the Study Area, was adopted.

TARGET AMOUNT OF CAPITAL INVESTMENT FOR THE STRATEGIC ROAD NETWORK IN THE STUDY AREA

Plan Period		In Million Pesos at Constant 1995 Prices	In Million Pesos at Constant 1998 Prices
Low Assumption	1999 - 2004	42,600	53,200
	2005 - 2010	71,500	89,300
	2011 - 2016	101,300	126,500
	Total	**215,400**	**269,000**
Medium Assumption	1999-2004	47,460	59,300
	2005-2010	75,560	94,400
	2011-2016	106,400	132,900
	Total	**229,420**	**286,600**
High Assumption	1999-2004	53,300	66,600
	2005-2010	83,600	104,400
	2011-2016	116,600	145,600
	Total	**253,500**	**316,600**

Note: Inflation rate : 9.1% in 1996, 6% in 1997 and 8% in 1998, (assumptions)

PART III

STRATEGIC ROAD NETWORK DEVELOPMENT

CHAPTER 11

OBJECTIVES AND TARGETS OF THE MASTER PLAN

11.1 PROBLEMS ON EXISTING ROAD NETWORK

Problems on the existing road network were identified in Chapter 3 and summarized hereunder.

1) Insufficient condition and sub-standards of existing roads

Even national roads are still insufficient conditions and substandards as described below (see Table 11.1-1):

- Pavement ratio is only 52% and 6,637 km of roads still remain unpaved.
- 16% of paved roads (or 1,267 km) are in bad/very bad condition.
- There are still 2,994 km of 1-lane section.
- 382 km of roads are impassable.
- 1,174 bridges (or 31,843 m in length) are still temporary bridges.
- 189 bridges (or 8,492 m in length) need major repair and 674 bridges (or 26,811 m in length) need minor repair.
- There are many natural disaster-prone sections.

Still many improvements/rehabilitations must be done for the existing arterial roads.

2) Many inaccessible areas

Many areas still remain inaccessible and isolated, particularly in Mindanao Island, Mindoro Island, Palawan Island and Samar Island. Although most of these are mountainous area, it is noted that these areas have the high potential for agro-forestry development and highway network development would promote it.

3) Insufficient development of east-west lateral links

The east-west lateral links which are to form an important arterial road network are not well developed yet, due mainly to constraints of mountain ranges which run north to south.

4) Inefficient transport network between and among regional activity centers

Although major regional activity centers are provided with road accessibility, many of links are still in bad/very bad conditions. Therefore, socio-economic linkage of regional centers is still weak. To integrate the socio-economic activity in the Study Area it is necessary to develop more efficient transport network in the area.

TABLE 11.1-1 SUMMARY OF NATIONAL ROADS AND ARTERIAL ROADS CONDITION

		Length (km)	Type of Pavement			Pavement Condition of Paved Roads		1-lane Section	Impassable Section	Bridges					
										Temporary Bridges		Permanent Bridges			
												Needs Major Repair		Needs Minor Repair	
			Paved (km)	Unpaved (km)	Pavement Ratio (%)	Good/Fair (km)	Bad/ Very Bad (km)	(km)	(km)	No.	Length (m)	No.	Length (m)	No.	Length (m)
National Road		15,340	7,969	6,637	52%	6,702 (84%)	1,267 (16%)	2,994	382	1,174	31,843	189	8,492	674	26,811
Present DPWH Functional Classification	N-S Backbone	3,551	2,765	585	78%	2,260 (82%)	505 (18%)	99	22	41	1,205	56	2,568	269	12,239
	E-W Lateral	1,372	669	642	49%	564 (84%)	106 (16%)	222	222	67	1,928	26	868	42	1,118
	Other Strategic	5,716	3,138	2,342	55%	2,679 (85%)	441 (15%)	1,103	159	594	16,714	70	3,267	250	10,306
	Total for Arterial Roads	10,639	6,572	3,569	62%	5,503 (84%)	1,052 (16%)	1,424	403	702	19,847	152	6,703	561	23,663
	National Secondary	4,988	1,457	3,231	29%	1,216 (83%)	241 (17%)	1,634	224	479	12,289	37	1,788	93	3,357
	Total	15,627	8,029	6,800	51%	6,719 (84%)	1,293 (16%)	3,058	627	1,181	32,136	189	8,491	654	27,020

Notes:

1) Type of pavement: Length does not include sections under construction and impassable
2) Pavement Ratio: (Paved Length / Total Length) x 100

5) Insufficient inter-modal linkage

The Study Area comprises many islands, therefore, efficient inter-modal linkage, particularly the land and the sea transport, should be achieved. In recent years, Ro-Ro services, speed boat services, or superferry services has been developed for the part of the sea transport, however, the land transport has not been developed in an integrated manner.

6) Traffic interruption by natural disaster

There are many natural disaster-prone sections. The road network is not sufficient enough to provide alternative routes for these section. These sections must be properly treated and reliable road network should be achieved.

7) Traffic capacity problems

There are several road sections which suffer traffic congestions, particularly in and around major cities. Such sections are expected to increase in future with the growth of economic activities. Some proper measures should be urgently planned and implemented.

11.2 GOALS AND OBJECTIVES OF THE MASTER PLAN

To solve the existing problems and vitally support the planned socio-economic growth and a balanced regional development in the future, the goals of the Master Plan are established as follows:

Goals of the Master Plan

- To enlarge and reinforce the physical foundation of the regional economy.
- To promote the effective land use and contribute to unity of nation and preservation of peace.

The objectives of the Master Plan are established as follows:

- To complete a major road network which connects major urban centers.
- To cover whole island by a major road network to eliminate inaccessible areas.
- To achieve effective multi-modal transport linkages.
- To take proper preventive measures against road closures due to natural calamities.
- To maintain all component roads in acceptable service level.

11.3 STRATEGIES OF THE MASTER PLAN

According to the goals and objectives of the Master Plan, the following strategies are established:

Strategies

- To strengthen transport linkage between and among **important activity centers** (Primary, Secondary, Tertiary Centers)
- To provide efficient access to **agricultural and forestry production areas** and to achieve efficient transport linkage between **production areas** and **agro-industrial centers**.
- To provide efficient access to **industrial growth centers**, and **eco-zones**.
- To provide high standard transport means for **growth corridors**.
- To provide access to **isolated areas**.
- To construct **stronger roads against road disaster** or to provide **alternative route** for disaster-prone section of important road.
- To achieve "**trans-Visaya-Mindanao highway / waterway linkage**" or "**western Pan-Philippine transport axis**"
- To strengthen roads leading to **ports / airports**.

11.4 TARGETS OF THE PLAN

The following targets are established in accordance with the strategies:

Targets of the Plan

- To achieve major road networks
  - Connecting primary, secondary and tertiary activity centers with road(s) in good condition.
  - Covering whole island, not leaving the area which is more than 25-30 km distance from the nearest component road, thus to eliminate poor accessibility area.
  - Eliminating stub connection (or dead end condition) to make roads continuous, thus to make road network flexible except special cases.
  - Well distributing roads over the islands according to transport demand to achieve a balanced road network.

- To satisfy the following requirements for all roads
  - Carriageway of 6.0-6.7m in width to eliminate 1-lane sections
  - Pave with PCC or AC to eliminate gravel surface
  - Convert all temporary bridges to permanent ones

- To take proper preventive measures against natural disasters

- To maintain acceptable traffic level of service with volume/capacity ratio of 0.8 or less.

CHAPTER 12

FORMULATION OF MASTER PLAN ROAD NETWORK

12.1 PROCEDURE FOR ESTABLISHMENT OF MASTER PLAN ROAD NETWORK

The Visayas and Mindanao Islands Strategic Road Network (hereinafter referred to as "Master Plan Road Network") was formulated in two steps as shown in Figure 12.1-1.

First, the Basic Road Network which meets to the requirement of the functional road classification criteria was established.

The additional roads to the Basic Road Network were identified to make the network stronger and more flexible to increasing traffic growth and natural disasters and the road network formulated in this step is called as the "Master Plan Road Network".

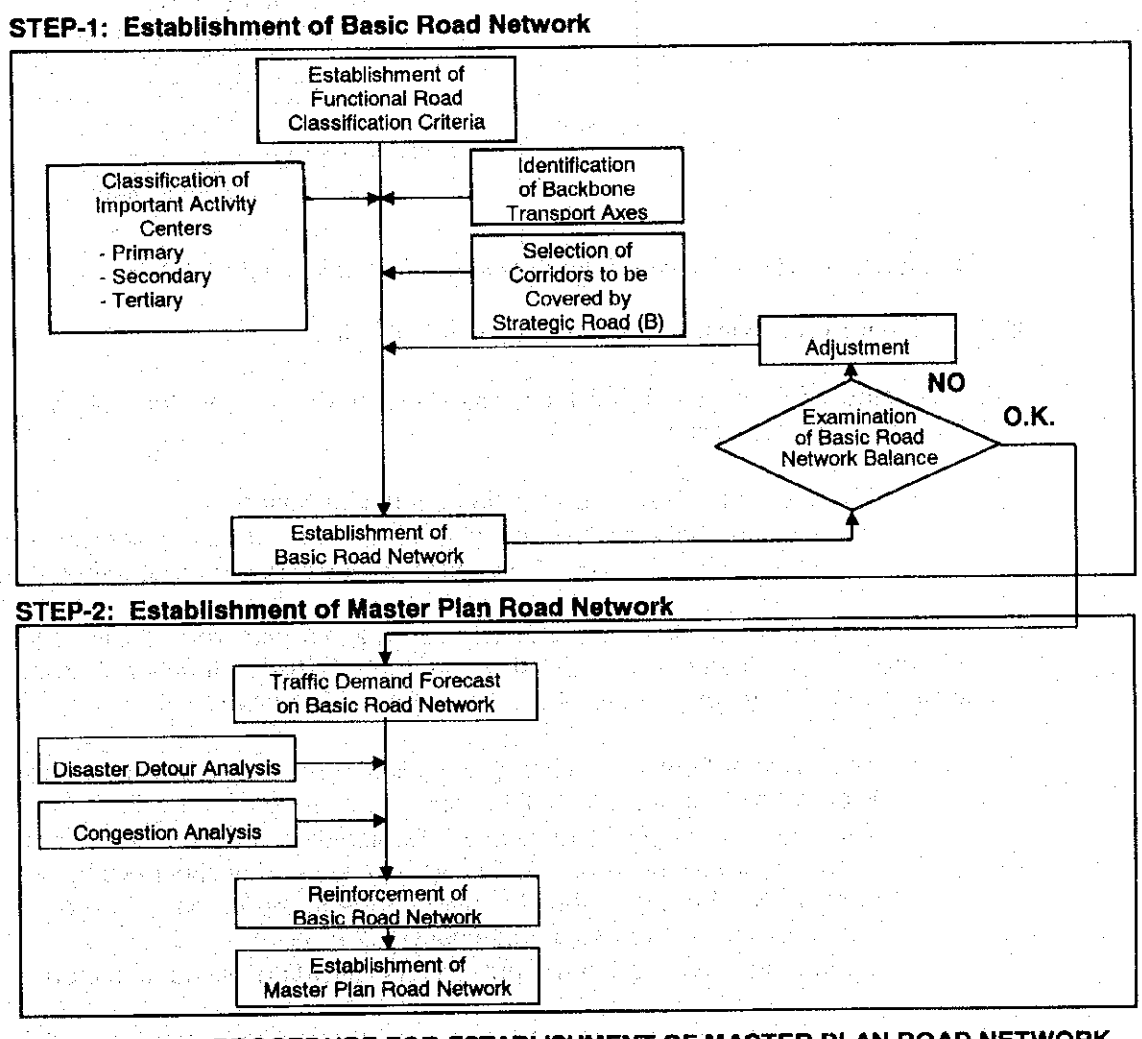


FIGURE 12.1-1 PROCEDURE FOR ESTABLISHMENT OF MASTER PLAN ROAD NETWORK

12.2 ESTABLISHMENT OF BASIC ROAD NETWORK

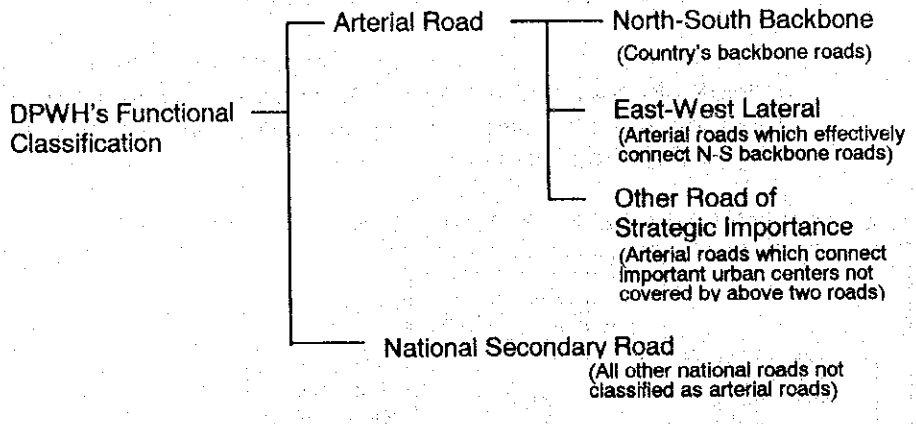
12.2.1 Establishment of Functional Road Classification Criteria

(1) Functional Road Classification of Previous Studies and DPWH

There are two following studies considering the functional road classification.

- Philippine Road Classification Study, (PRCS) ADB, 1993
- Luzon Island Strategic Road Network Development Project, (LISR), JICA, 1993

DPWH adopts another functional road classification as follows:



Each functional classification criteria is summarized in Table 12.2-1.

(2) Functional Road Classification adopted in this Study

To develop the functional road classification in the Study, the following principals were determined:

- The present DPWH classification should be based.
- Inter-relation between this study and LISR should be considered, so that two master plans can be integrated easily and consistently.

The Study Team consulted with the DPWH officials with regards to legal background, familiarity, etc. of the present DPWH functional road classification. They advised the Study Team on the following:

- The present DPWH functional classification is authorized by Public Works Act, therefore, it shall be followed as much as possible.
- The present DPWH functional classification system has been installed for several years, and is well-known and well-utilized by not only DPWH but also other agencies, thus it should be followed as much as possible to avoid unnecessary confusion.
- Upgrading in function of the present classification will be acceptable.

Based on the principles established and the above discussion with the DPWH officials, the functional road classification criteria was established as shown in Table 12.2-2. In order to inter-relate this Study and LISR, other

TABLE 12.2-1 FUNCTIONAL ROAD CLASSIFICATION BY PREVIOUS STUDIES

ADB-assisted Philippine Road Classification Study (1993)

- Functional Classification of Rural Roads -

Functional Classification	Definition of Function
Primary Arterial Road	• Serve corridor movements having trip lengths and travel density characteristics indicative of substantial provincewide or inter-province travel. • Serve all urbanized areas of 50,000 population and over and a large majority of medium urban areas with population of 25,000 and over. • Provide an integrated network without stub connections except where unusual geographic or traffic flow conditions dictate otherwise (e.g., connections to coastal cities or specific government installations)
Secondary Arterial Road	• Link cities and larger towns (and other traffic generators, such as major resort areas that are capable of attracting travel over similarly long distances) and form an integrated network providing inter-province services. • Be spaced at such intervals, consistent with population density, so that all developed areas of the province are within a reasonable distance of an arterial highway. • Provide (because of the two characteristics defined above) service to corridors with trip lengths and travel density greater than those predominantly served by rural collector or local system. Secondary arterials, therefore, constitute routes whose design should be expected to provide for relatively high overall travel speeds, with minimum interference to through movement.
Provincial Collector Road	• Provide service to any municipality not on arterial route, to the larger towns not directly served by the higher systems, and to other traffic generators of equivalent intra municipal importance, such as hospitals, shipping points, important mining and agricultural areas, etc. • Link these places with nearby larger towns or cities, or with routes of higher classification. • Serve the more important intra municipal travel corridors.
Municipalities Collector Road	• Be spaced at intervals, consistent with population density, to collect traffic from local roads and bring all developed areas within a reasonable distance of a collector road. • Provide service to the remaining smaller communities. • Find the locally important traffic generators with their rural hinterland.
Local Road	• Provide access to the properties along their immediate length. • Constitute all the mileage not otherwise classified as arterial or collector.

JICA-assisted Master Plan Study on Luzon Island Strategic Road Network Development Project (1993)

- Functional Classification of Arterial Roads -

Functional Classification	Definition of Function
Inter-Province-Capital Road	• Interconnect provincial capitals through the shortest routes as possible. (28 provincial capitals)
Inter-Major-Activity-Center Road	• Connect the major activity centers to the inter-province-capital roads (98 major activity centers)
Agricultural Development Support Roads	• Penetrate vast agricultural areas not covered by the above two categories of roads.
National Integration Road	• Run along the coast which are not covered by the above three categories of roads over a wide area.

Major activity Centers:

- City
- Municipality with 50,000 or more population and 500 per square kilometers or more population density in 1990.
- City/municipality with base or terminal port.
- City/municipality with airport which handled 10,000 or more passengers in 1991.
- City/municipality with PNR station which handled 10,000 or more passengers in 1991.
- Regional Industrial Center (RIC) identified by NEDA in Updates on the Medium-Term Philippine Development Plan 1990-1992.
- Base city/municipality of major tourism spots.

DPWH's Functional Classification

Functional Classification		Definition of Function
Arterial Roads	North-South Backbone Road	• Country's backbone roads in consideration of road and sea (or ferry service) linkage, thus a road is not necessarily in the north-south direction.
	East-West Lateral Road	• Country's arterial roads which effectively connect North-South Backbone roads each other.
	Other Roads of Strategic Importance (hereinafter referred to as "Strategic Roads")	• Roads which connect important major urban centers not on the above two categories. • Roads which provide alternative route to above category roads. • Roads which interconnect above category roads at an appropriate interval.
National Secondary Roads		• All other national roads not classified as arterial roads.

TABLE 12.2-2 FUNCTIONAL ROAD CLASSIFICATION CRITERIA IN THE STUDY

Functional Classification		Definition of Functions	Relation With Other Study's Classification	
			LISR	PRCS
Arterial Road	North-South Backbone Road	• Roads which form **backbone transport axes** in the country by achieving highway and waterway linkages. • Roads which interconnect most of **Primary Centers**. • Roads which serve **the growth corridors**.	• Inter-Provincial-Capital Roads	• Primary Arterial Roads
	East-West Lateral Road	• Roads which form **the east-west linkage** across the Philippine archipelago at an interval of 50-100 kilometers.		
	Strategic Road (A)	• Roads which connect remaining Primary Centers and **all of Secondary and Tertiary Centers** not on the above category roads. • Roads which interconnect above category roads at an appropriate interval. • Above two-category roads plus this category roads shall form closed network. • Roads which serve as an alternative route of above category roads.	• Inter-Major-Activity-Center Roads	
		For small islands and remote island • Coastal circumferential road and/or cross-island road(s)	(No category of this kind as small islands were not covered by the Study)	
	Strategic Road (B)	• Roads which penetrate **vast agricultural lands,** not covered by above three Categories	• Agricultural Development Support Roads	• Secondary Arterial Roads or Provincial Collector Roads
		• Roads which penetrate lands **where currently no access is provided** and to achieve effective use of lands and integration of the country (mostly roads along the coastal area and mountainous area)	• National Integration Roads	
National Secondary Road		• All remaining national roads (Not Studied in this Study)	(Not Studied)	• Remaining categories of roads

road of strategic importance (of DPWH classification) was sub-divided into Strategic Roads (A) and (B).

12.2.2 Classification of Important Activity Centers

Classification of important activity centers is presented in Chapter 3, and summarized as follows:

RATING CRITERIA TO CLASSIFY ACTIVITY CENTERS

Description		Rating	(Points)
• Regional Center		---- A	(10)
• Provincial Capital		---- A	(10)
• City (other than Regional/Provincial Capital		---- B	(5)
• Population	- 300,000 or more	---- AA	(20)
	- 200,000 < P <300,000	---- A	(10)
	- 100,000 < P <200,000	---- B	(5)
	- 50,000 < P <100,000 with Population Density of 100 Person/sq.km or more	---- C	(2)
	- Population is less than 50,000 but population density is 500 person/ sq.km. or more	---- C	(2)
• Airport	- International / Alternate International Airport	---- A	(10)
	- Trunkline Airport	---- A	(10)
	- Secondary Airport	---- B	(5)
	- Feeder Airport	---- C	(2)
• Port	- Base Port	---- A	(10)
	- Terminal Port	---- B	(5)
	- Ro-Ro Service Port	---- B	(5)
• Industrial Center	- EPZ	---- A	(10)
	- Regional Growth Center/ Regional Industrial Center	---- A	(10)
	- Private Eco-zone	---- A	(5)
• Tourism Spot/Base City or Municipality for Tourism		---- B	(5)

Classification Criteria

Primary Center : Regional / Provincial Capital
or
Scored 20 points or more

Secondary Center: Scored 5 to 19 points

Tertiary Centers : Scored 2 to 4 points

TABLE 12.2-3 RESULTS OF ACTIVITY CENTER CLASSIFICATION

Island	Region	Primary Center	Secondary Center		Tertiary Center		
Marinduque	IV-B	Boac	Sta. Cruz		-		
Mindoro	IV-B	Mamburao San Jose Calapan	Abra de Ilog Sablayan Sta. Cruz	Mansalay Puerto Galera Roxas	Bongabong Naujan Pinamalayan		
Palawan	IV-B	Puerto Princesa	Brooke's Point El Nido Roxas Taytay		-		
Romblon Tablas Sibuyan	IV-B	Romblon	Alcantara Odiogan				
Catanduanes	V	Virac	-		-		
Masbate	V	Masbate	Milagros		Aroroy		
Panay	VI	Kalibo San Jose Roxas Iloilo	Malay Ajuy Estancia		Numancia Belison Pandan Patnongon Balasan Cabatuan Dumangas	Gulmbal Janiuay Lambunao Leganes Miagao Oton Passi	Pavia Pototan San Miguel Sta. Barbara Tigbauan Tubungan
Guimaras	VI	Jordan	-		-		
Negros	VI & VII	Bacolod San Carlos Dumaguete	Bago Cadiz Escalante Kabankalan La Carlota Manapla Pulupandan	Sagay Silay Bais Canlaon Guihulngan Manjuyod	Binalbagan Calatrava Cauayan E.B. Magalona Himamaylan Hinigaran Ilog	Isabela La Castellana Murcia Pontevedra San Enrique Sipalay Talisay	Valladolid Victorias Bayawan Mabinay Sta. Catalina Siaton Tanjay
Bohol	VII	Tagbilaran	Carmen Jagna Loon Panglao	Talibon Tubigon Ubay	Dauis		
Cebu	VII	Cebu Lapu-Lapu Toledo	Argao Carmen Danao Dumanjug Mandaue Moalboal Naga	Samboan San Fernando San Remigio Santander Sogod Talisay Tuburan	Barili Bogo Consolacion Cordova Dann Bantayan Liloan Medellin	Minglanilla	
Siquijor	VII	Siquijor	Larena		-		
Leyte	VIII	Ormoc Tacloban Maasin	Bato Baybay Dulag	Isabel Palompon San Isidro	Albuera Burauen Hilongos	Palo Tanauan Tolosa	Sogod
Samar	VIII	Borongan Catarman Calbayog Catbalogan	Oras Allen	San Isidro	Dolores Guiuan		
Biliran	VIII	Biliran	-		Naval		
Mindanao	IX	Dapitan Dipolog Pagadian Zamboanga	Malangas		Liloy Sindangan Siocon Dinas	Ipil	
	X	Malaybalay Oroquieta Ozamis Cagayan de Oro	Valencia Jimenez Tangub Balingoan	Gingoog Languindingan Tagoloan Villanueva	Don Carlos Manolo Fortich Maramag Quezon	Lugait	
	XI	Tagum Davao Digos Matl Gen. Santos Koronadal Alabel	Panabo Kiamba		Carmen Compostela Maco Monkayo Nabunturan Santo Tomas Malita	Matanao Santa Cruz Banga Polomoloc Surallah Glan Malugon	
	XII	Iligan Kidapawan Isulan Cotabato Marawi	Linamon Tubod		Lala Kabacan Makilala Matalam Midsayap	M'lang Pikit Lebak Tacurong	
	ARMM	Maganoy Parang	Malabang		Bacolod Grande Balindong Bayang Madalum Madamba	Masiu Mulondo Piagapo Ditsaan-Ramain Saguiaran	Tamparan Datu Piang Dinaig Sultan Kudarat
	XIII	Butuan Prosperidad Surigao Tandag	Nasipit Tubay Bislig		Cabadbaran Bayugan San Francisco Barobo		
Camiguin	X	Mambajao	-		-		
TOTAL		56	78		116		

12.2.3 Backbone Transport

In the Study Area, the multi-modal transport linkage, particularly the land and sea transport linkage, is an important issue. By efficient multi-modal transport means, islands and cities would become nearer in terms of travel time, and their socio-economic activities would be integrated and more active.

In the Mindanao Island, judging from trip desire lines, major cities are still functioning rather independently and inter-action between and among major cities is still weak. Only the linkage between Metro Cebu and other Visayas islands and between Metro Cebu and northern coastal cities in Mindanao (Metro Cebu based movement) is strong.

In this Master Plan, the backbone transport axes by connecting land and sea transport routes were established, and were also proposed along the growth corridor.

In due consideration of above, the following backbone transport axes were identified (see Figure 12.2-1):

Eastern Transport Axis

- Existing Pan-Philippine Highway connecting Luzon, Samar, Leyte and Mindanao Islands.

Central Transport Axis

- This axis connects Luzon, Masbate, Cebu, Bohol and Mindanao Islands.
- Proposed route is as follows:

Bulan/Matnog (Luzon) —sea→ Masbate —land→ Cataingan —sea→ Bogo (or Daanbantayan) —land→ Cebu City —sea→ Tagbilaran —land→ Jagna (or Talibon —land→ Jagna) —sea→ Cagayan de Oro —land→ Malaybalay —land→ Davao City

Western Transport Axis

- This axis connects Luzon, Mindoro, Panay, Guimaras, Negros, Mindanao Islands.
- Proposed route is as follows:

Batangas (Luzon) —sea→ Calapan —land→ Roxas (Mindoro) —land→ San Jose (Mindoro) —sea→ Kalibo (Panay) —land→ Roxas (Panay) —land→ Iloilo (Panay) —sea→ Bacolod (Negros) —land→ Dumaguete (or Iloilo —Bridge→ Guimaras —Bridge→ Bago

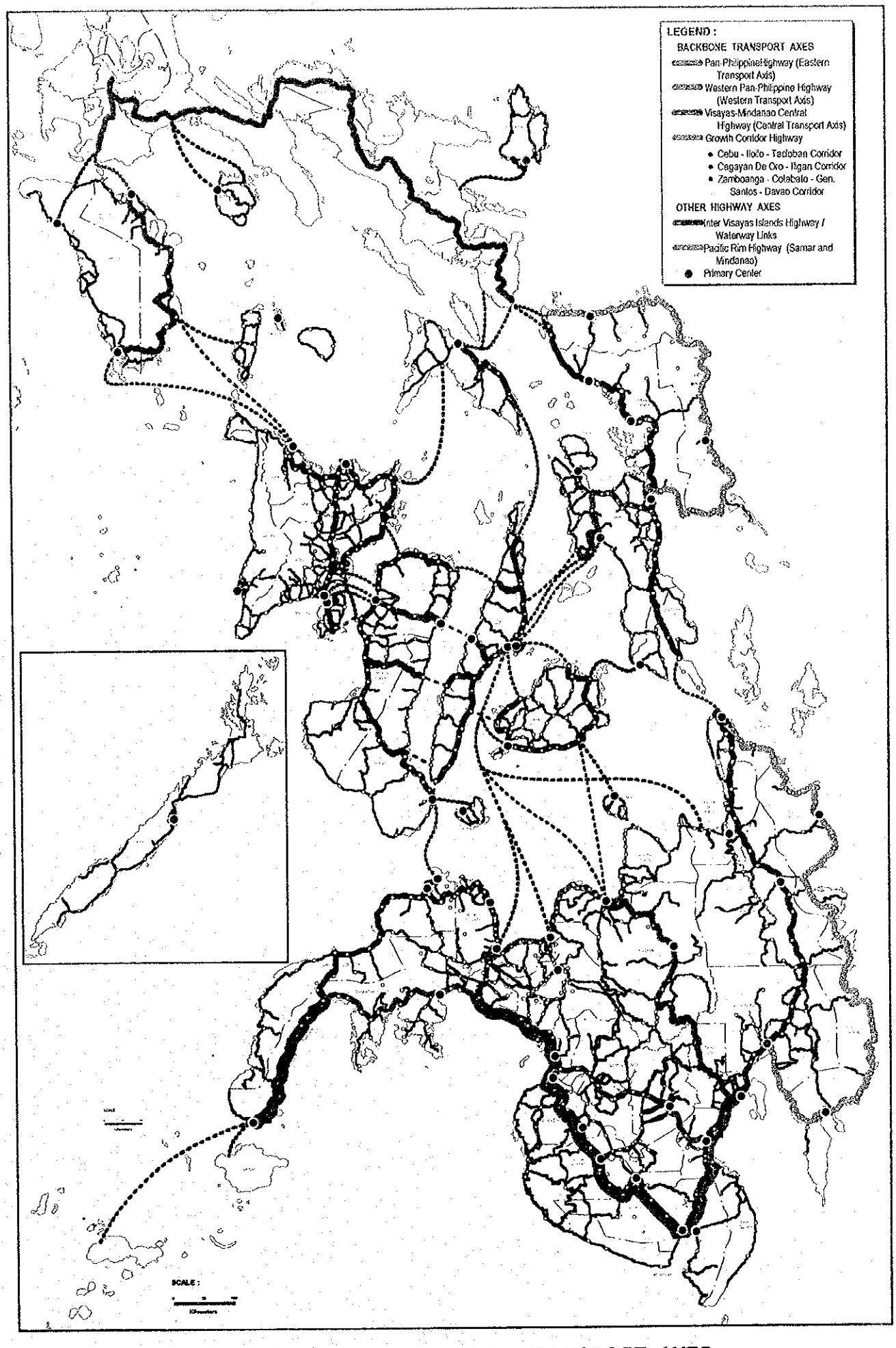


FIGURE 12.2 - 1 BACKBONE TRANSPORT AXES

land → Dumaguete: Future Link) sea ⇢ Dapitan City

(Mindanao) land → Cotabato City land → Gen. Santos City

land → Davao City
Western Branch: Dapitan land → Liloy land → Ipil
land → Zamboanga City

Growth Corridor Transport Axes

- Iloilo --- Cebu --- Tacloban Growth Corridor

  Proposed route is: Iloilo City sea ⇢ Bacolod City

  land → San Carlos City sea ⇢ Toledo City land →
  Cebu City sea ⇢ Isabel/Ormoc City land → Tacloban

- Cagayan de Oro - Iligan Growth Corridor

  Proposed route is: Tubod land → Iligan land →
  Cagayan de Oro City land → Villanueva

- Zamboanga - Cotabato - Gen. Santos - Davao Growth Corridor

  Proposed route is: Zamboanga City land →
  Pagadian City land → Cotabato City
  Gen. Santos City land → Davao City and from
  Cotabato City land → Digos land → Davao City

This Master Plan intends to develop other transport axes as next hierarchy of backbone transport axes. These are as follows (see Figure 12.2-1):

- Inter Visayas Islands Highway/Waterway Links
- Pacific Rim Highways (Samar and Mindanao)

12.2.4 Selection of Corridors To Be Covered by Strategic Road (B)

Strategic Road (B) includes the following two kinds of roads:

- Agricultural Development Support Road ----- roads which penetrate vast agricultural lands not covered by higher category roads.
- National Integration Road ---- roads which penetrate areas where no traffic access is provided and to achieve the effective use of lands and integration of the country (mostly coastal areas and mountain areas)

The corridors of above two kinds of roads were identified on the present land use map and topographic map and summarized in Table 12.2-4.

TABLE 12.2-4 IDENTIFIED CORRIDORS FOR STRATEGIC ROAD (B)

Island	Agricultural Development Support Road Corridor	National Integration Road Corridor
Mindoro	• North-eastern area • South-western area	• North-western area
Palawan	——	• Western coastal area
Masbate	——	• Southern coastal area
Panay	• North-eastern area	• Peninsula south-western area • Mountain area in South-western area
Negros	• North-eastern area • South-western area	-
Cebu	• North-eastern area	-
Leyte	——	• Peninsula in north-western area • Southern Pacific coast area • Central mountain area
Samar	——	• Northern and southern mountainous areas
Mindanao	• Northern and central area of Bukidnon • Northern area in South Cotabato	• Northern areas in Surigao del Norte, Surigao del Sur and Agusan del Norte • Central areas in Agusan del Sur, Bukidnon and Davao del Norte. • Peninsula in Davao Oriental • Sultan Kudarat Province area • Zamboanga Peninsula

12.2.5 Proposed Basic Road Network

Based on the above studies, the Basic Road Network was established as shown in Figure 12.2-2.

Road length of the proposed Basic Road Network is shown in Table 12.2-5.

TABLE 12.2-5 ROAD LENGTH OF PROPOSED BASIC ROAD NETWORK

Unit: Km

Functional Classification	Under Existing DPWH Classification (Existing)	Under This Study		
		Existing	New Link	Total
N-S Backbone	3,551	4,085	10	4,095
E-W Lateral	1,372	2,060	364	2,424
Strategic Road (A)	5,716	6,915	118	7,033
Strategic Road (B)		2,106	1,254	3,360
Total	10,639	15,166	1,746	16,912

The present condition of existing component roads of proposed basic road network is summarized in Table 12.2-6.

TABLE 12.2-6 PRESENT CONDITION OF EXISTING COMPONENT ROADS OF PROPOSED BASIC NETWORK

Functional Road Classification	Pavement Type	Pavement Condition		Impassable	Under Construction	Total
		Good/Fair	Bad/VeryBad			
	(km)	(km)	(km)	(km)	(km)	(km)
North-South Backbone	PCC	1,529.84	446.20	-	-	1,976.03
	AC	1,167.86	224.02	-	-	1,391.88
	Gravel / Earth	178.71	330.00	-	-	508.71
	Sub-total	**2,876.41**	**1,000.22**	**6.42**	**178.02**	**4,061.06**
East-West Lateral	PCC	633.42	54.20	-	-	687.61
	AC	254.08	65.45	-	-	319.54
	Gravel / Earth	438.54	528.67	-	-	967.21
	Sub-total	**1,326.04**	**648.32**	**39.76**	**15.43**	**2,029.55**
Strategic Road (A)	PCC	1,144.14	56.86	-	-	1,200.99
	AC	1,121.08	428.83	-	-	1,549.91
	Gravel / Earth	1,478.28	2,251.62	-	-	3,729.90
	Sub-total	**3,743.50**	**2,737.31**	**260.46**	**164.38**	**6,905.65**
Strategic Road (B)	PCC	161.55	31.27	-	-	192.81
	AC	4.18	5.97	-	-	10.15
	Gravel / Earth	626.19	1,114.68	-	-	1,740.87
	Sub-total	**791.92**	**1,151.92**	**188.61**	**22.92**	**2,155.37**
Total	PCC	3,468.94	588.52	-	-	4,057.46
	AC	2,547.20	724.27	-	-	3,271.47
	Gravel / Earth	2,721.73	4,224.97	-	-	6,946.70
	Sub-total	**8,737.86**	**5,537.77**	**495.25**	**380.75**	**15,151.64**

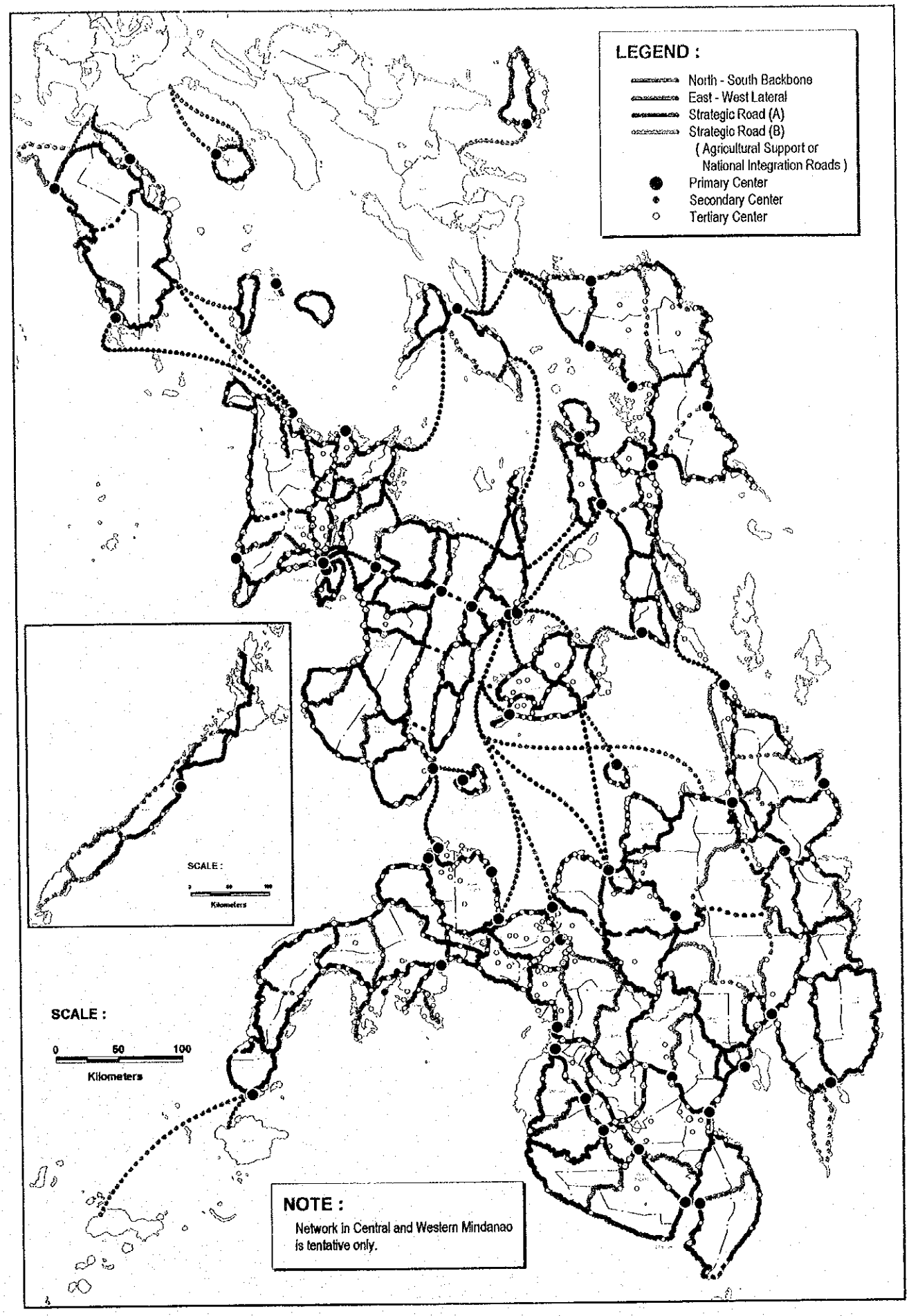


FIGURE 12.2 - 2 PROPOSED BASIC NETWORK

12.2.6 Examination of Balance of Road Distribution

In order to examine the balance of road distribution, an indicator called as "Network Value" was introduced. Network Value is defined as follows:

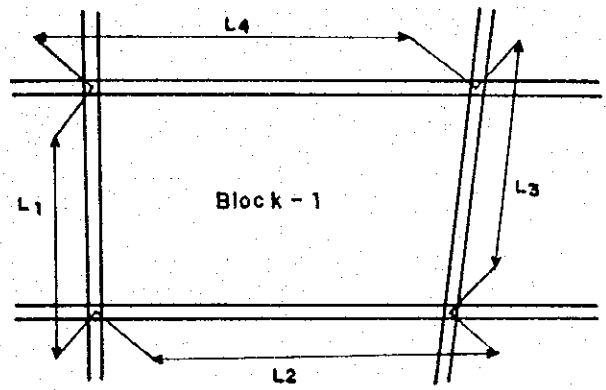
Network Value

The area is divided into blocks by the component roads of the basic road network and Network Value of each block is determined as follows:

$$NV = L/\sqrt{PA}$$

where:

NV = Network value
L = Total length of roads surrounding a block (=L1 + L2 + L3 + L4 in case of Block-1 in the figure below), in km
P = Population in a block, in 1,000 persons
A = Land area of a block, in km^2



Network value of each block is shown in Table 12.2-7 and graphically shown in Figure 12.2-3. Network Value ranges from 0.093 to 0.952.

Blocks of which Network Value is low are as follows:

Block Number	Reasons of Low Value
9 in Panay Island	Due to stub connection of a road. No additional arterial road is needed.
4 in Cebu Island	Due to high concentration of population in Cebu Metropolitan area. There are many urban roads in the areas, no additional arterial road is needed.
13 in Mindanao Island	Though land area is wide, it is mostly mountainous. No additional arterial road is needed.
51 and 54 in Mindanao Island	Same as 9 in Panay Island

In view of above, the balance of road distribution was judged adequate as Basic Road Network.

TABLE 12.2-7 NETWORK VALUE OF EACH BLOCK

ISLAND	BLOCK NUMBER	Road Length (km) L	Population (1000) P	Land Area (Sq.Km.) A	Network Value NV = L/ (PA)	Remarks
Marinduque	1	123.00	79.51	431.00	0.564	
Mindoro	1	137.70	29.30	713.80	0.952	
	2	256.30	226.46	2,958.00	0.316	
	3	129.69	144.19	481.30	0.493	
	4	371.60	437.59	4,157.00	0.276	
	5	118.20	75.11	325.60	0.756	
Palawan	1	77.12	27.59	774.20	0.528	
	2	235.10	99.43	2,277.00	0.494	
	3	313.20	164.70	2,697.00	0.470	
	4	196.20	90.86	1,436.00	0.543	
	5	82.45	29.96	3,165.00	0.268	
Romblon	1	126.75	84.25	519.40	0.606	
	2	19.37	34.29	86.56	0.356	
	3	93.15	47.51	440.20	0.644	
Catanduanes	1	169.10	127.08	898.30	0.560	
Masbate	1	24.35	27.90	158.90	0.366	
	2	120.41	154.42	598.80	0.396	
	3	188.70	259.86	1,333.00	0.321	
	4	52.39	78.90	205.80	0.411	
Panay	1	88.02	68.53	359.00	0.561	
	2	361.88	516.31	3,695.00	0.262	
	3	123.24	149.53	510.80	0.446	
	4	66.99	248.42	329.30	0.304	
	5	161.70	246.21	994.60	0.327	
	6	77.34	59.26	261.40	0.621	
	7	71.66	57.50	230.20	0.623	
	8	83.69	65.22	345.50	0.558	
	9	11.15	37.02	104.00	0.180	Low due to stub connection
	10	157.40	277.74	838.80	0.374	
	11	118.90	340.58	557.70	0.273	
	12	226.80	367.66	1,254.00	0.334	
	13	175.00	218.19	1,006.00	0.375	
	14	98.33	245.14	303.80	0.360	
	15	80.97	88.19	252.60	0.542	
Guimaras	1	86.78	71.16	258.10	0.640	
	2	41.37	32.25	66.60	0.893	
Negros	1	241.00	544.92	1,692.00	0.251	
	2	155.00	247.61	551.600	0.419	
	3	15.76	59.28	95.460	0.210	
	4	57.85	249.16	157.600	0.292	
	5	82.64	375.97	319.900	0.238	
	6	153.50	233.69	1,051.00	0.390	
	7	183.00	312.10	1,010.00	0.326	
	8	229.80	486.01	2,194.00	0.223	
	9	139.40	141.49	703.40	0.442	
	10	266.90	230.76	2,326.00	0.364	
	11	167.00	176.82	950.40	0.406	
	12	180.30	369.22	1,696.00	0.228	
Bohol	1	156.90	261.49	741.40	0.356	
	2	128.80	198.88	833.60	0.316	
	3	148.90	200.55	841.30	0.362	
	4	130.80	123.95	669.00	0.454	
	5	71.27	132.05	275.50	0.374	
	6	14.38	42.14	95.78	0.226	

ISLAND	BLOCK NUMBER	Road Length (km) L	Population (1000) P	Land Area (Sq.Km.) A	Network Value NV = L/ (PA)	Remarks
Cebu	1	32.81	125.84	120.60	0.266	
	2	132.40	109.61	472.60	0.582	
	3	77.56	97.80	182.50	0.581	
	4	164.90	1,158.13	1,056.00	0.149	
	5	26.22	200.36	35.65	0.310	
	6	118.50	634.20	505.40	0.209	
	7	104.50	238.78	430.50	0.326	
	8	135.90	304.84	743.30	0.265	
	9	142.80	160.10	755.80	0.411	
Siquijor	1	77.73	73.76	273.90	0.547	
Leyte	1	185.45	205.89	707.50	0.486	
	2	-	-	-	-	
	3	120.30	178.83	449.90	0.424	
	4	162.50	214.99	1,146.00	0.327	
	5	98.39	287.61	485.00	0.310	
	6	47.75	108.63	57.07	0.606	
	7	78.20	143.80	330.70	0.359	
	8	86.74	98.70	167.40	0.675	
	9	143.10	115.76	789.80	0.473	
	10	139.80	179.65	843.20	0.359	
	11	201.20	149.30	978.00	0.527	
	12	122.10	177.18	664.60	0.356	
Samar	1	174.00	211.16	1,291.00	0.333	
	2	325.80	444.24	3,274.00	0.270	
	3	313.20	224.64	3,171.00	0.371	
	4	255.00	330.50	1,906.00	0.321	
	5	224.70	150.52	1,996.00	0.410	
	6	34.70	61.27	179.90	0.331	
Biliran	1	106.87	110.94	477.40	0.464	
Camiguin	1	64.65	68.04	230.80	0.516	
Mindanao	1	183.10	181.13	760.80	0.493	
	2	193.20	181.54	1,265.00	0.403	
	3	246.80	244.53	2,146.00	0.341	
	4	120.00	92.72	485.00	0.566	
	5	247.70	183.78	1,943.00	0.415	
	6	123.30	111.92	439.80	0.556	
	7	115.40	64.49	650.10	0.564	
	8	172.80	261.07	1,167.00	0.313	
	9	439.90	398.71	4,590.00	0.325	
	10	248.30	88.32	2,614.00	0.517	
	11	207.20	134.89	1,222.00	0.510	
	12	208.70	178.99	1,533.00	0.398	
	13	278.00	802.88	2,603.00	0.192	
	14	204.40	419.32	1,552.00	0.253	
	15	90.04	170.70	271.60	0.418	
	16	62.00	137.73	93.90	0.577	
	17	271.00	275.96	1,936.00	0.371	
	18	246.10	318.09	1,787.00	0.326	
	19	307.20	164.92	2,804.00	0.452	
	20	237.10	261.63	1,744.00	0.351	
	21	241.40	171.29	1,407.00	0.492	
	22	283.40	229.92	1,786.00	0.442	
	23	368.10	759.92	2,909.00	0.248	
	24	278.40	348.42	2,033.00	0.331	
	25	91.84	209.92	389.60	0.321	

ISLAND	BLOCK NUMBER	Road Length (km) L	Population (1000) P	Land Area (Sq.Km.) A	Network Value NV = L/ (PA)	Remarks
	26	184.60	219.33	1,562.00	0.313	
	27	250.80	594.53	2,465.00	0.208	
	28	68.40	251.71	168.70	0.314	
	29	78.39	251.71	275.30	0.298	
	30	278.20	384.92	2,281.00	0.305	
	31	320.30	332.71	3,486.00	0.297	
	32	138.20	71.71	696.40	0.618	
	33	304.40	613.53	3,323.00	0.213	
	34	99.13	181.66	516.50	0.324	
	35	259.30	386.42	2,917.00	0.244	
	36	145.50	341.16	809.00	0.277	
	37	195.90	324.92	1,463.00	0.284	
	38	271.60	199.85	2,555.00	0.380	
	39	212.70	328.36	1,300.00	0.326	
	40	259.70	281.45	2,236.00	0.327	
	41	146.20	336.89	860.00	0.272	
	42	84.02	136.12	411.90	0.355	
	43	177.80	374.59	1,362.00	0.249	
	44	183.30	235.43	1,020.00	0.374	
	45	175.80	300.84	972.50	0.325	
	46	229.60	307.92	1,195.00	0.379	
	47	232.20	107.60	1,386.00	0.601	
	48	326.40	189.94	2,453.00	0.478	
	49	91.67	124.79	276.20	0.494	
	50	273.60	237.69	1,670.00	0.434	
	51	297.00	355.31	2,307.00	0.328	
	52	47.48	211.27	1,222.00	0.093	Low due to stub connection
	53	203.60	205.02	1,585.00	0.357	
	54	48.73	87.14	839.40	0.180	Low due to stub connection
	55	231.20	233.38	1,853.00	0.352	
	56	205.10	207.73	1,062.00	0.437	
	57	157.50	352.38	1,074.00	0.256	

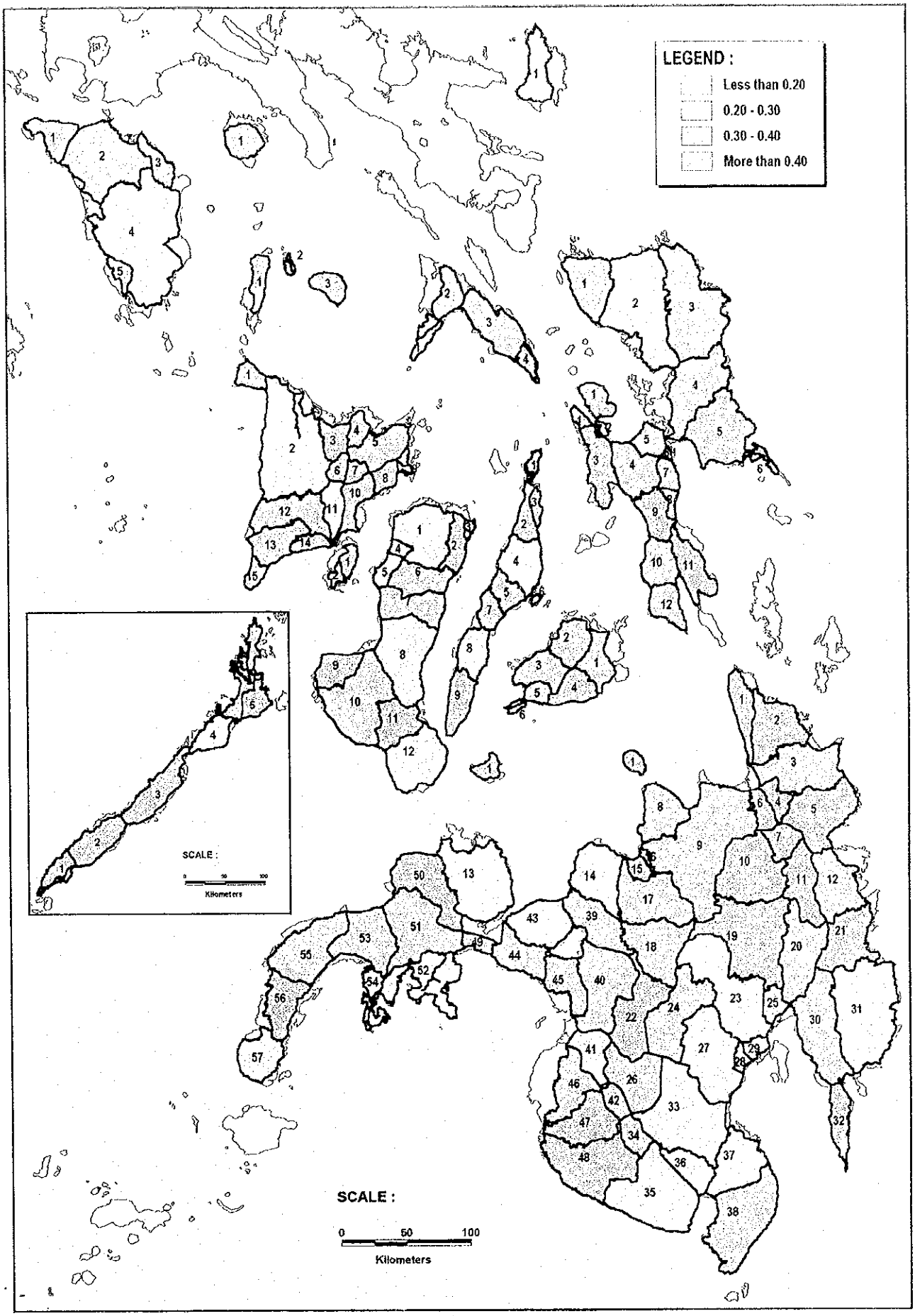


FIGURE 12.2 - 3 BLOCK NUMBER AND NETWORK VALUE