REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS & HIGHWAYS

Feasibility Study
on
The Rural Road Network Development Project

FINAL REPORT (Volume 13)

PROJECT EVALUATION
IN
THE PROVINCE OF MISAMIS ORIENTAL

OCTOBER, 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

REPUBLIC OF THE PHILIPPINES

DEPARTMENT OF PUBLIC WORKS & HIGHWAYS

Feasibility Study

on

The Rural Road Network Development Project

FINAL REPORT (Volume 13)

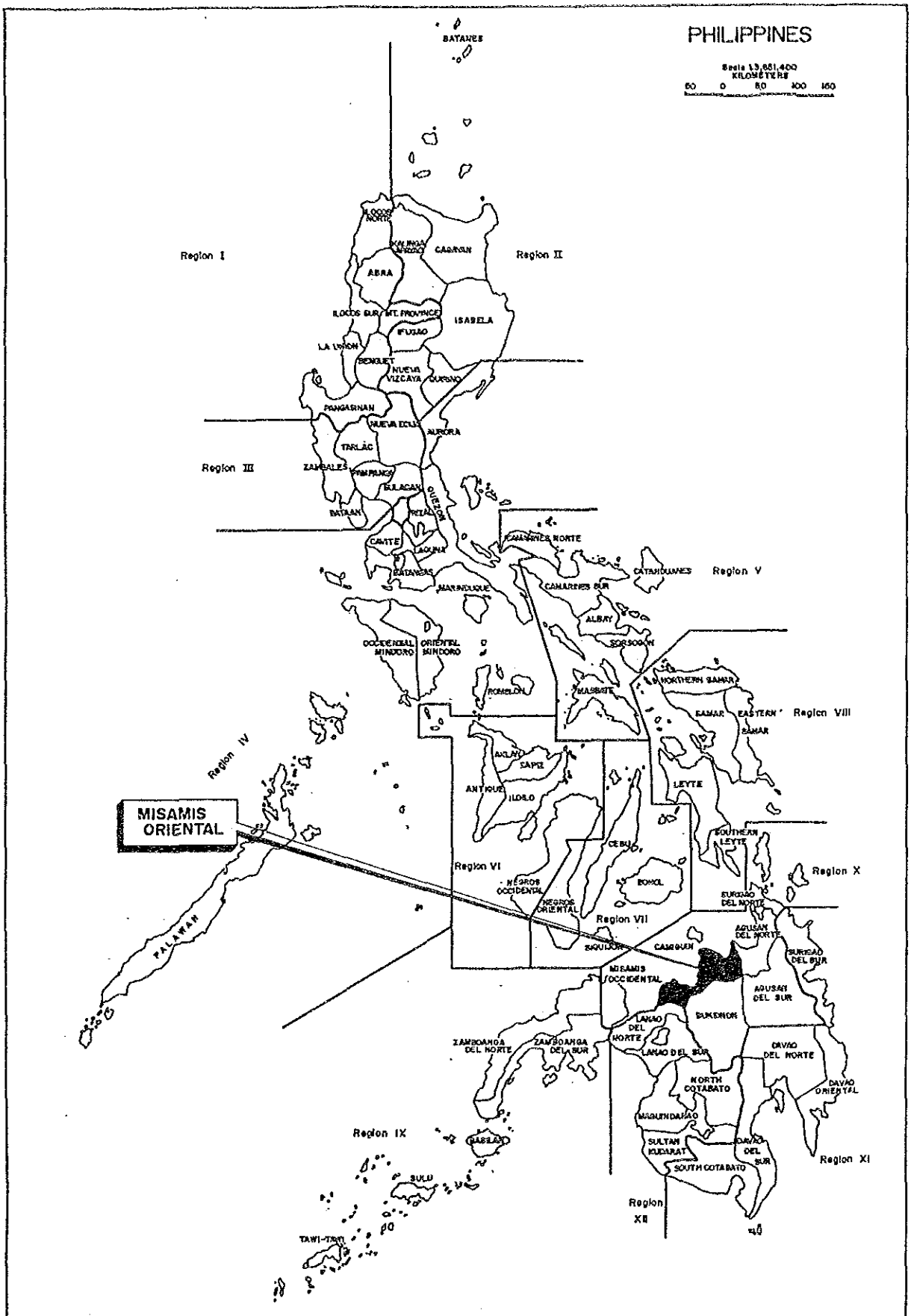
PROJECT EVALUATION

IN

THE PROVINCE OF MISAMIS ORIENTAL

OCTOBER, 1990

JAPAN INTERNATIONAL COOPERATION AGENCY



FEASIBILITY STUDY ON THE RURAL ROAD NETWORK DEVELOPMENT PROJECT	LOCATION MAP

VOLUME - 13
PROVINCE OF MISAMIS ORIENTAL

TABLE OF CONTENTS

CHAPTER 1
SOCIO-ECONOMIC PROFILE OF THE PROVINCE

1.1 GENERAL

The Province of Misamis Oriental was selected as one of the Study Provinces which represents the province of the following characteristics:

- Economically less developed
- High level in road development
- Topographically seaside mountainous

1.2 GEOGRAPHY AND TOPOGRAPHY

The province of Misamis Oriental is located at the central portion of Northern Mindanao. The Province is bounded on the north by Bohol Sea, on the east by Province of Agusan del Norte, on the south by Provinces of Bukidnon and Lanao del Norte and on the west by Iligan Bay.

The Province is predominantly mountainous. Very narrow flat land exists along the northern coastal line. The province is one of the typical sea-side mountainous provinces.

Slope map of the province is shown in Figure 1.2-1.

1.3 POPULATION

The province is composed of two (2) cities and twenty-four (24) municipalities. The provincial capital is located at Cagayan de Oro City which is also the capital of Region X.

Population in 1990 is estimated at 931,000. The average annual population growth rate for the period of 10 years from 1980 to 1990 was estimated 3.0% which is higher than the national average of 2.4%. Population density of the province in 1990 is 260.9 persons per square kilometer which is higher by 1.3 times than the national average of 205 persons per sq. km.

Population, the average annual population growth rate and population density by city/municipality are presented in Table 1.3-1. Distribution of cities and municipal towns together with their population is shown in Figure 1.3-1. All cities and municipal towns except one (1) are located along the coastal line.

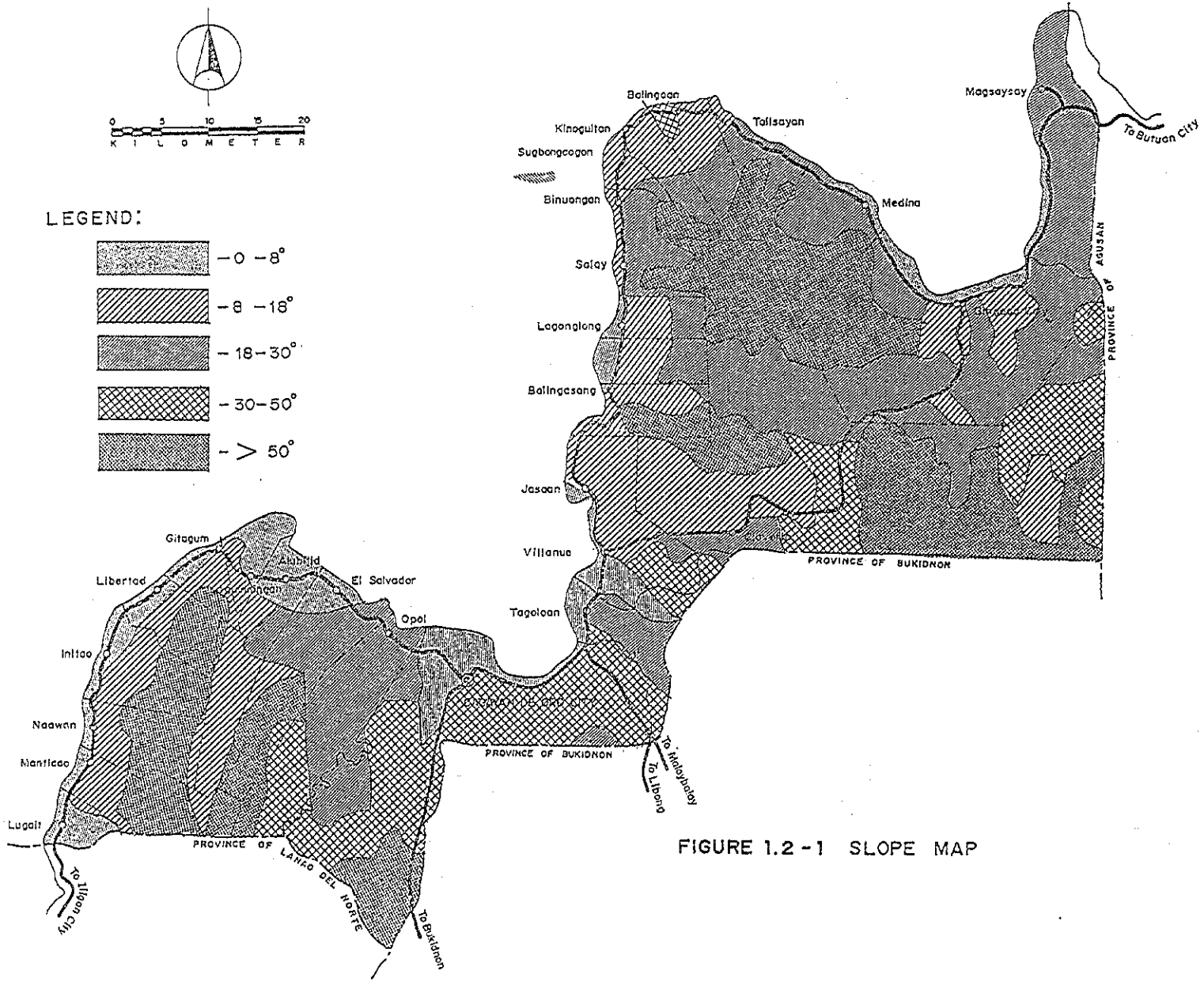


FIGURE 1.2 - 1 SLOPE MAP

Table 1.3-1

POPULATION, LAND AREA AND DENSITY (1990)
Province of Misamis Oriental

City/Municipality	Projected Population (1990)	Annual Growth Rate (%)	Land Area (km^2)	Density (p/km^2)
1. Cagayan de Oro City	345,011	4.2	412.8	835.8
2. Gingoog City	99,613	2.2	404.6	246.2
3. Alubijid	20,155	2.6	63.0	319.9
4. Balingasag	50,071	2.6	123.7	404.8
5. Balingoan	7,340	1.0	57.8	127.0
6. Binuangan	5,045	1.2	30.0	168.2
7. Claveria	38,758	2.8	894.9	43.3
8. El Salvador	25,804	2.3	136.7	188.8
9. Gitagum	12,103	2.2	37.5	322.8
10. Initao	25,588	1.5	116.5	219.6
11. Jasaan	31,244	2.9	87.2	358.3
12. Kinoguitan	7,346	0.1	22.1	332.4
13. Lagonglong	17,719	2.6	56.0	316.4
14. Laguindingan	14,908	2.1	39.4	378.4
15. Libertad	9,134	1.6	37.5	243.6
16. Lugait	13,997	2.6	22.5	622.1
17. Magsaysay	27,480	1.8	181.0	151.8
18. Manticao	20,626	1.7	112.6	183.2
19. Medina	25,957	2.6	126.1	205.8
20. Naawan	15,518	2.4	88.5	175.3
21. Opol	21,359	2.8	158.0	135.2
22. Salay	23,098	2.5	64.8	356.5
23. Sugbongcogon	7,593	1.9	23.1	328.7
24. Tagoloan	34,219	4.4	87.2	392.4
25. Talisayan	16,397	0.4	137.8	119.0
26. Villanueva	15,233	2.4	48.8	312.2
T O T A L	931,316	3.0	3,570.1	260.9

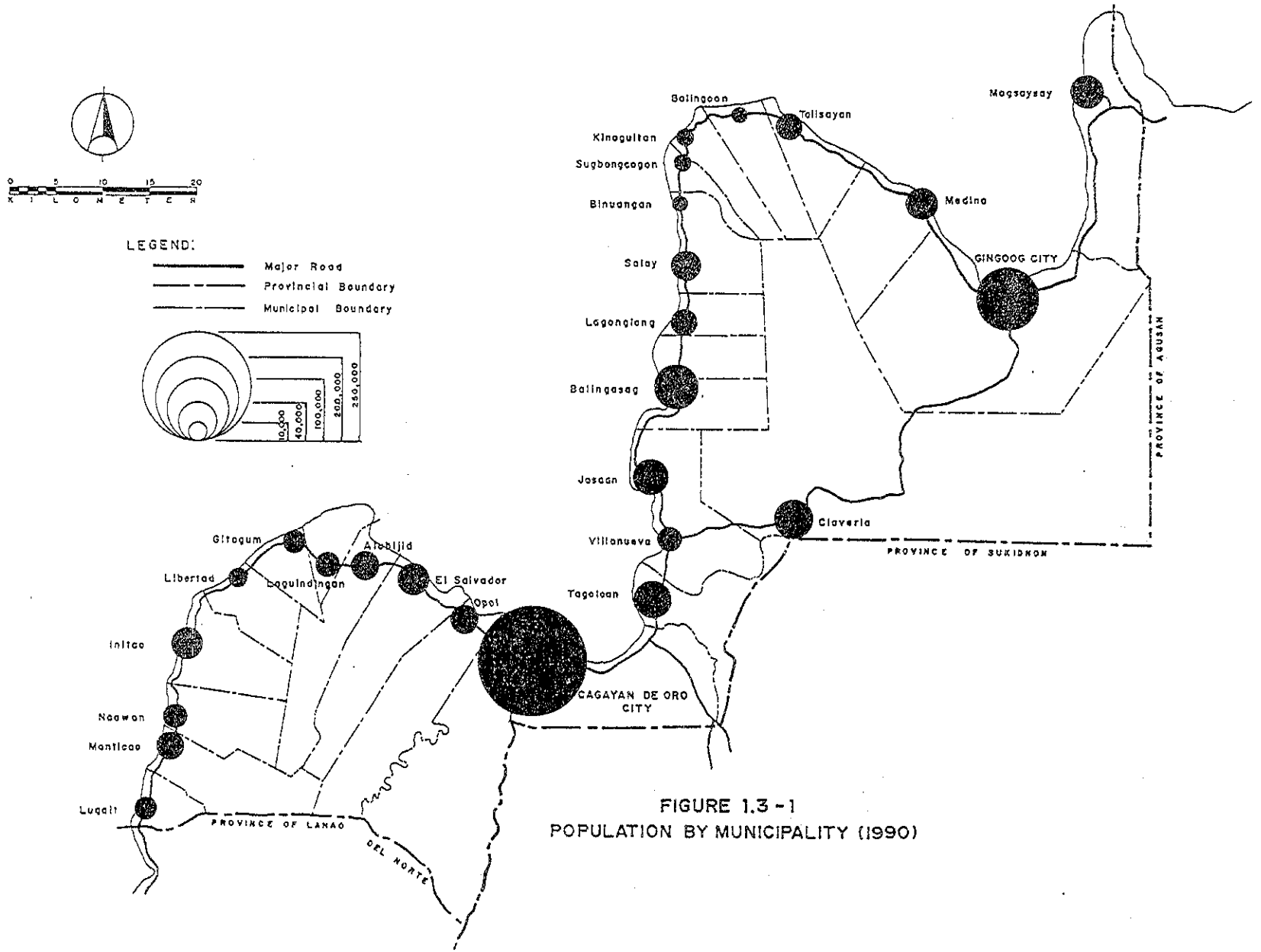


FIGURE 1.3 - 1
POPULATION BY MUNICIPALITY (1990)

1.4 SOCIO-ECONOMIC PROFILE

Table 1.4-1 shows major socio-economic data of the province in comparison with the national value.

Gross Regional Domestic Product which shows economic output of the province shares 1.5% of the total national output. In view of land area and population share of the province to the country, the province's economic output is in the level of national average.

Per capita income of the province is higher by 1.13 times than the national average, however, incidence of poverty shows much higher level than the national average. Unemployment and underemployment rates show the almost same level as the national average.

Agriculture is the predominant industry of the province and shares 51% in terms of number of workers.

Table 1.4-1
MAJOR SOCIO-ECONOMIC DATA OF PROVINCE OF MISAMIS ORIENTAL

	Misamis Oriental (A)	Philippines (B)	(A)/(B)
1. Total Land Area (sq.km.)	3,570	300,000	0.012
2. Population in 1990 (1000 persons)	931	61,483	0.015
3. Population Density (persons/sq.km.)	261	205	1.27
4. GRDP (Million ₱ at 1000 prices)	9,621	623,051	0.015
5. Per Capita Income in 1985 (₱/person)	6,335	5,593	1.13
6. Number of Workers by Industrial Sector in 1980 (1000 persons)			
* Agricultural	101.3 (51%)	7,303 (51%)	0.014
* Industry	24.5 (12%)	2,177 (15%)	0.011
* Service	68.0 (34%)	4,552 (32%)	0.015
* Total 1/	198.4 (100%)	14,197 (100%)	0.014
7. Incidence of Poverty in 1985 (%)	68.3	59.3	-
8. Unemployment Rate in 1988 (%)	8.2	8.3	-
9. Underemployment Rate in 1988 (%)	10.5	11.6	-

Note: 1/ Includes other workers who cannot be classified as any one of three (3) sectors.

1.5 AGRICULTURAL LAND USE AND MAJOR CROPS

Misamis Oriental has a total land area of 3,570 square kilometers, representing 1.2% of the total land area of the Philippines. Table 1.5-1 shows general land use of the province. About 36% of the province are occupied by agricultural land, about 22% by forest land and about 41% by grass/shrub land.

Figure 1.5-1 illustrates the agricultural land use of the province. Table 1.5-2 shows major crops produced in the province. Five (5) major crops of the province are coconut, corn, banana, palay and coffee.

Table 1.5-1
LAND USE OF MISAMIS ORIENTAL

Land Use	Area in sq.km.	%
Agricultural Land	1,288.8	36.1
Grass/Shrub Land	1,463.7	41.0
Forest	792.6	22.2
Wet Land	7.1	0.2
Built-up Area	17.9	0.5
Total	3,570.1	100.0

Source: Bureau of Soil

Table 1.5-2
MAJOR CROPS OF PROVINCE OF MISAMIS ORIENTAL

Major Crops	Area Utilized (ha.)		Production (M.T.)	
	1985	1986	1985	1986
Coconut	-	129,795	-	111,533
Corn	24,670	25,330	22,075	21,755
Banana	12,560	12,760	178,134	152,269
Palay	6,340	7,070	14,950	19,175
Coffee	6,120	6,120	8,525	7,711

Source: Bureau of Agricultural Statistics

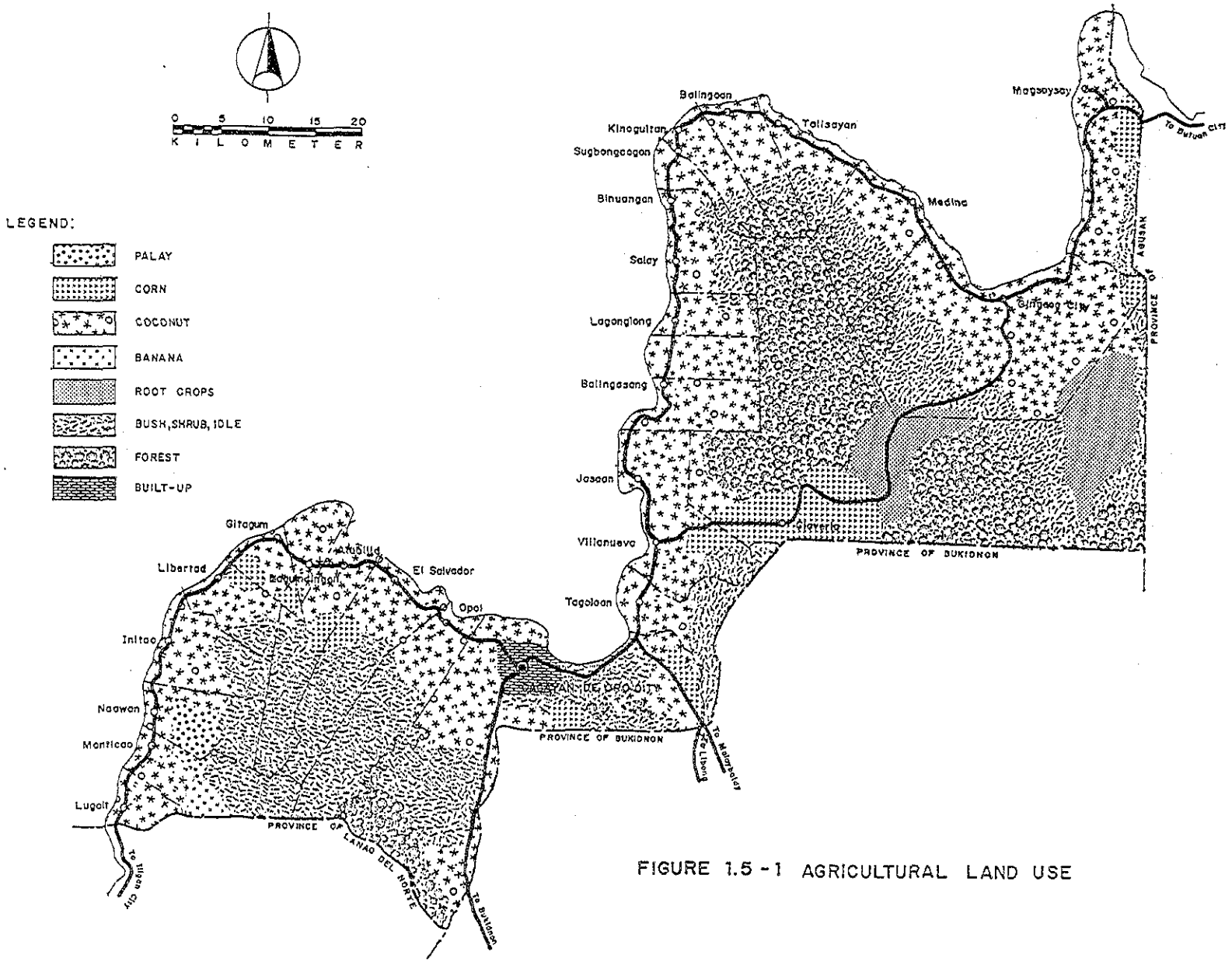


FIGURE 1.5 - 1 AGRICULTURAL LAND USE

CHAPTER 2
ROAD NETWORK OF THE PROVINCE

2.1 GENERAL

The province was classified as one of the provinces of which road network development represents the high level in the Philippines. In this Chapter, present level of road network development is assessed more in details, then general direction of the future road network development is established. Based on the said assessment and the functional road classification criteria, the major road network for the Province is proposed.

2.2 PRESENT LEVEL OF ROAD NETWORK DEVELOPMENT

Present level of the road network development level is assessed in terms of road extension (quantity of roads), surface type and conditions (quality of roads) and road network pattern.

2.2.1 Present Level of Road Development in terms of Road Extension

Misamis Oriental has a total of 3,397.2 kms. of roads, comprising 453.2 kms. of National, 501.5 kms. of Provincial, 63.5 kms. of City, 158.9 kms. of Municipal and 2,220.1 kms. of Barangay Roads in 1987.

Table 2.2-1 shows road density by class of road which is compared with national average. In comparison with the national average, road development level of the province in terms of road extension is summarized as follows:

National roads .....higher by 1.30 times
Provincial roads.....higher by 1.30 times
Barangay roads.....higher by 1.94 times
All roads.....higher by 1.62 times

In terms of road extension, road development of the Province is in quite high level.

2.2.2 Present level of Road Development in terms of surface type and surface condition

The Study Team conducted an extensive field survey on the existing road conditions of which results are summarized in Table 2.2-2.

TABLE 2.2-1
EXISTING ROAD LENGTH AND ROAD DENSITY
Province of Misamis Oriental

Road Class	Road Length In 1987 (kms.)	Road Density (L/ PA)		
		M. Oriental	Philippines	M. Oriental/Phils
National Rd.	453.2 (13.3)	0.2594	0.1994	1.30
Prov'l. Rd.	501.5 (14.8)	0.2871	0.2211	1.30
Sub-Total	954.7 (28.1)	0.5465	0.4205	1.30
City Rd.	63.5 (1.9)	0.0364	0.0304	1.20
Municipal Rd	158.9 (4.7)	0.0909	0.0981	0.93
Barangay Rd.	2,220.1 (65.3)	1.2709	0.6536	1.94
TOTAL	3,397.2(100.0)	1.9447	1.2026	1.62

*SOURCE: DPWH Infrastructure Atlas, 1989

TABLE 2.2-2
EXISTING SURFACE CONDITION (SURVEYED ROADS ONLY)
Province of Misamis Oriental

Road Class	Pavement Type	Surface Condition 1/			% of Pavement Type 2/	
		Good/Fair	Bad/Very Bad	Total (%)	M. Oriental	Phils.
National Road	PCC	232.6(100.0)	- -	232.6 (100.0)	52.7	23.6
	Bituminous	40.4 (80.0)	10.1 (20.0)	50.5 (100.0)	19.4	22.3
	Gravel	- -	44.2 (100.0)	44.2 (100.0)	27.9	51.3
	Earth	- -	16.0 (100.0)	16.0 (100.0)	-	2.8
	Total:	273.0 (79.5)	70.3 (20.5)	343.3 (100.0)	100.0	100.0
Provincial Road	PCC	11.4 (92.7)	0.9 (7.3)	12.3 (100.0)	0.9	2.5
	Bituminous	1.8 (17.8)	8.3 (82.2)	10.1 (100.0)	4.7	8.9
	Gravel	2.6 (1.0)	257.9 (99.0)	260.5 (100.0)	57.0	70.6
	Earth	- -	113.3 (100.0)	113.3 (100.0)	37.4	18.0
	Total:	15.8 (4.0)	380.4 (96.0)	396.2 (100.0)	100.0	100.0
National and Provincial Road	PCC	244.0 (99.6)	0.9 (0.4)	244.9 (100.0)	25.5	12.5
	Bituminous	42.2 (69.6)	18.4 (30.4)	60.6 (100.0)	11.6	15.3
	Gravel	2.6 (1.0)	302.1 (99.0)	304.7 (100.0)	43.2	61.4
	Earth	- -	129.3 (100.0)	129.3 (100.0)	19.7	10.8
	Total:	288.8 (39.0)	450.7 (61.0)	739.5 (100.0)	100.0	100.0

SOURCE: 1/ Survey by Study Team in 1989
2/ DPWH Infrastructure Atlas, 1989

Present level of road development in terms of surface condition (quality of roads) could be summarized as follows:

National Roads

- About 72% of national roads are already paved with PCC or bituminous surfaces, which is quite higher level than the national average of 46%.
- Surface condition is also maintained well and about 80% were assessed in good/fair condition.
- National roads in the Province are quite high level in terms of quality of roads.

Provincial Roads

- Only 6% are paved with PCC or bituminous surfaces.
- About 96% are in poor condition.
- In terms of road quality, provincial roads are still in low standard.

2.2.3 Present Road Network Pattern

Present road network is presented in Figure 2.2-1, which shows all existing national and provincial roads. Present road network of the Province is assessed as follows:

- Typical comb type of road network is formed with the Butuan - Cagayan de Oro - Iligan Road as the axis.
- There are two (2) other inter-provincial roads, both of them lead to Province of Bukidnon.
- Gingoog City - Claveria - Villanueva Road is a possible short cut road of the Coastal Road, however, it is currently impassable.
- All municipal towns are accessed with a national road.

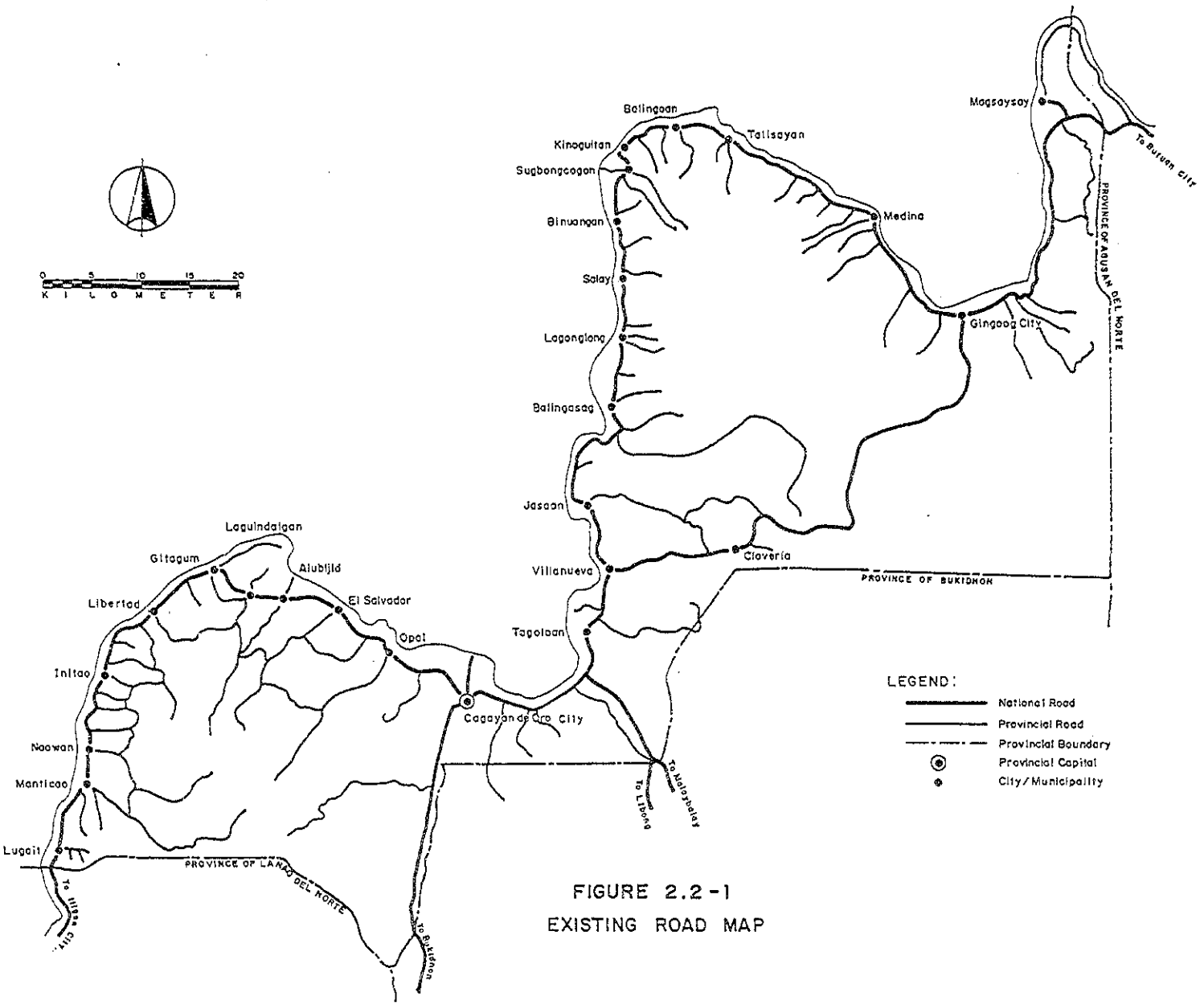


FIGURE 2.2-1
EXISTING ROAD MAP

2.3 GENERAL DIRECTION OF ROAD NETWORK DEVELOPMENT

Results of assessment of present road network development level are summarized as follows:

- In terms of road extension, all classess of roads are in quite high level.
- Though quality of national roads is in high level, provincial roads are still in poor condition.

Based on the above assessment, general direction of road network development of the Province will be as follows:

(1) As the national roads are quite extensive in length and quality of them also in high level, priority should be given to improvement of existing provincial and barangay roads.

(2) Construction of new roads will not be necessary.

2.4 PROPOSED MAJOR ROAD NETWORK

2.4.1 Procedure

To identify major roads, all existing roads are firstly classified in accordance with the functional road classification criteria which is shown in Table 2.4-1. Functional classification groups roads according to importance and quality of services they are intended to provide. Individual road links of similar importance and quality of services are organized into systems so that a road network in accordance with the hierarchy of functions can be planned and formed. They can be efficiently managed with consistent policies, design and operation.

After identification of existing major roads, necessity of additional new links is assessed. For example, if a certain municipal town has no access, a new major road is added to the existing major road network. Thus, the initial major road network is proposed and subjected to evaluation whether the proposed one is well-balanced or not. Evaluation is made by two (2) indicators as follows:

a) Network Value

$$Nv = \frac{L}{\sqrt{PA}}$$

Where: Nv = Network Value
L = Road length delineating a block
P = Population in a block
A = Land Area in a block
Block= Area delineated by major roads

b) Accessibility

Accessibility $AC = \sum pl$

Average Accessibility $A\ ave = \frac{\sum pl}{P}$

Where
p = Population of a Barangay
l = Distance from a barangay center to respective major road
P = Total population in a block

If indicators of some blocks show imbalanced value, additions or deletions of major road links are made until indicators show almost balanced values. After these adjustment, the major road network is finally proposed.

Table 2.4-1 Proposed Functional Road Classification Criteria for Rural Road Network

Functional Classification		General Definition	General Characteristics and Services Provided	Relationship with Administrative Classification				
				National Road	Provincial Road	City Road	Municipal Road	Barangay Road
Major Road	Primary Major Road	. Major inter-provincial roads. . Intra-provincial roads linking two (2) or more municipal towns to the Provincial Capital . Intra-provincial roads which form a skelton road network of a province	. Provides the highest level of service at the high speed for the long uninterrupted distance . Serves for long distance trips . Mobility is given the highest consideration	●				
	Secondary Major Road	. Roads linking municipal towns each other . Roads linking a municipal town to the Provincial Capital . Roads linking one (1) or more municipal towns to the primary major road network	. Provides high level of service . Serves for medium distance trips . Mobility is given high consideration	●	●	●		
Minor Road	Collector Road	. Roads linking secondary major roads each other or a primary road with a secondary road . Roads linking two (2) or more barangays to the municipal town or to the higher level network	. Provides rather low level of mobility . Serves for short distance trips . Collects traffic from feeder roads and connects them with major roads . Mobility and land access		●	●		●
	Feeder Road	. Roads linking one or more barangays centers to the higher level network . Roads linking farm areas to their respective barangay centers or to the higher level network	. Primarily provides access to abutting land with little or no through traffic . Serves for local traffic . Land access is given high			●		●
	S t r e e t	. Roads within built-up population centers (Poblacion) with essentially urban rather than rural rural functions	. Primarily provides access to abutting land in urban areas . Through traffic usage discouraged			●	●	

NOTE: Relationship between functional classification and administrative classification gives only general guideline, therefore, some national roads may be classified as minor roads, or some barangay roads may be classified as major roads.

2.4.2 Proposed Major Road Network

The major road network for the Province of Misamis Oriental was proposed as shown in Figure 2.4-1. For establishing the major road network, the following were taken into consideration:

- Present comb type network pattern was based to formulate the major road network.
- Construction of additional inter-provincial roads were judged not practical due to topographical constraints.
- Although sizes of blocks bounded by major roads were seemed to be larged, proposed major roads were judged to be enough in consideration of topographical characteristics of the Province.

Network value and accessibility of each block were computed to evaluate whether the proposed major road network is a balanced one. Based on these values, addition or deletion of road links was made and finally the major road network was proposed as shown in Figure 2.4-1.

Network value and accessibility of the proposed major road network are presented in Table 2.4-2.

Proposed major road network has a total length of 347.7 kms. and composed of the following roads.

National Road	343.3 kms.	(76% of all national roads)
Provincial Road	4.4 kms.	(1% of all provincial roads)
Total	347.7	

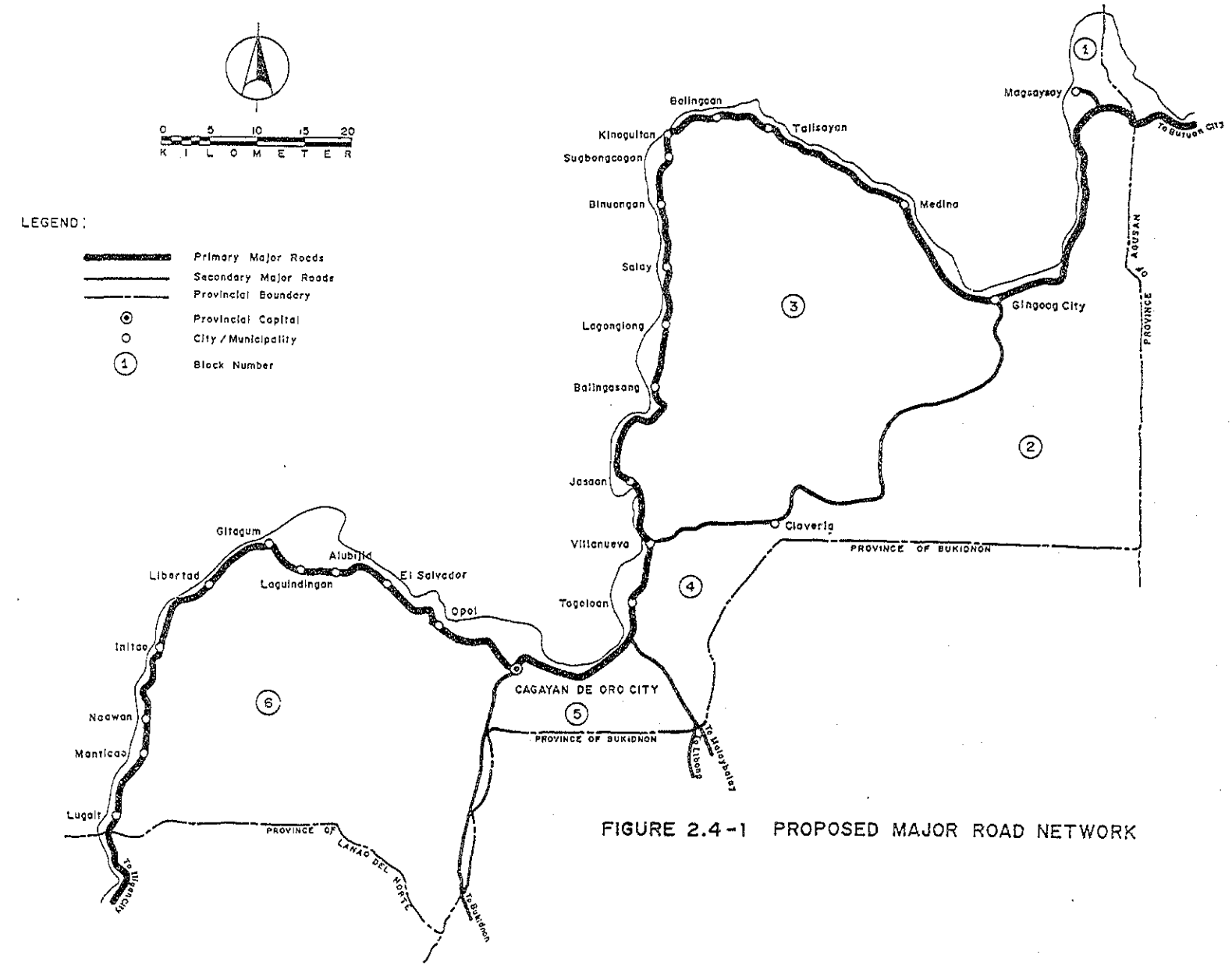


FIGURE 2.4-1 PROPOSED MAJOR ROAD NETWORK

Table 2.4-2

NETWORK VALUE/ACCESSIBILITY
Province of Misamis Oriental

Block No.	Population (1990)	Land Area (km^2)	Road Length (km)	Network Value	Access (p.km)	Average Access. (km.)
1	8,819	27.1	19.7	1.274	16,591	1.881
2	87,621	809.2	88.1	0.331	229,827	2.623
3	183,400	1,145.9	170.7	0.372	374,991	2.045
4	34,934	146.9	41.3	0.577	56,800	1.626
5	115,700	141.2	33.3	0.261	60,826	0.526
6	218,344	864.2	101.2	0.233	641,217	2.937
Ave.	108,136	522.4	75.7	0.318	230,042	2.127

CHAPTER 3
TRAFFIC

3.1. TRAFFIC SURVEY RESULTS

Roadside traffic count survey was conducted on selected roads. Traffic counts were carried out on two (2) consecutive days for 12 hours from 6:00 AM to 6:00 PM each day. Traffic volume was counted by direction and by vehicle type every hour. The vehicle type was classified as follows:

- Car
- Jeep
- Van
- Jeepney
- Bus (mini bus & large bus)
- Truck (including trailer)
- Motor-tricycle
- Motorcycle
- Animal drawn
- Pedestrian
- Others

Figure 3.1-1 shows the location of traffic count stations. Traffic survey results are summarized in Table 3.1-1.

Survey results were converted to Average Daily Traffic (ADT) by using the hourly factors based on the data from the Nationwide Traffic Counts Program (NTCP). Considering other factors such as market days, harvest season, rainy season, etc., AADT were estimated by vehicle type.

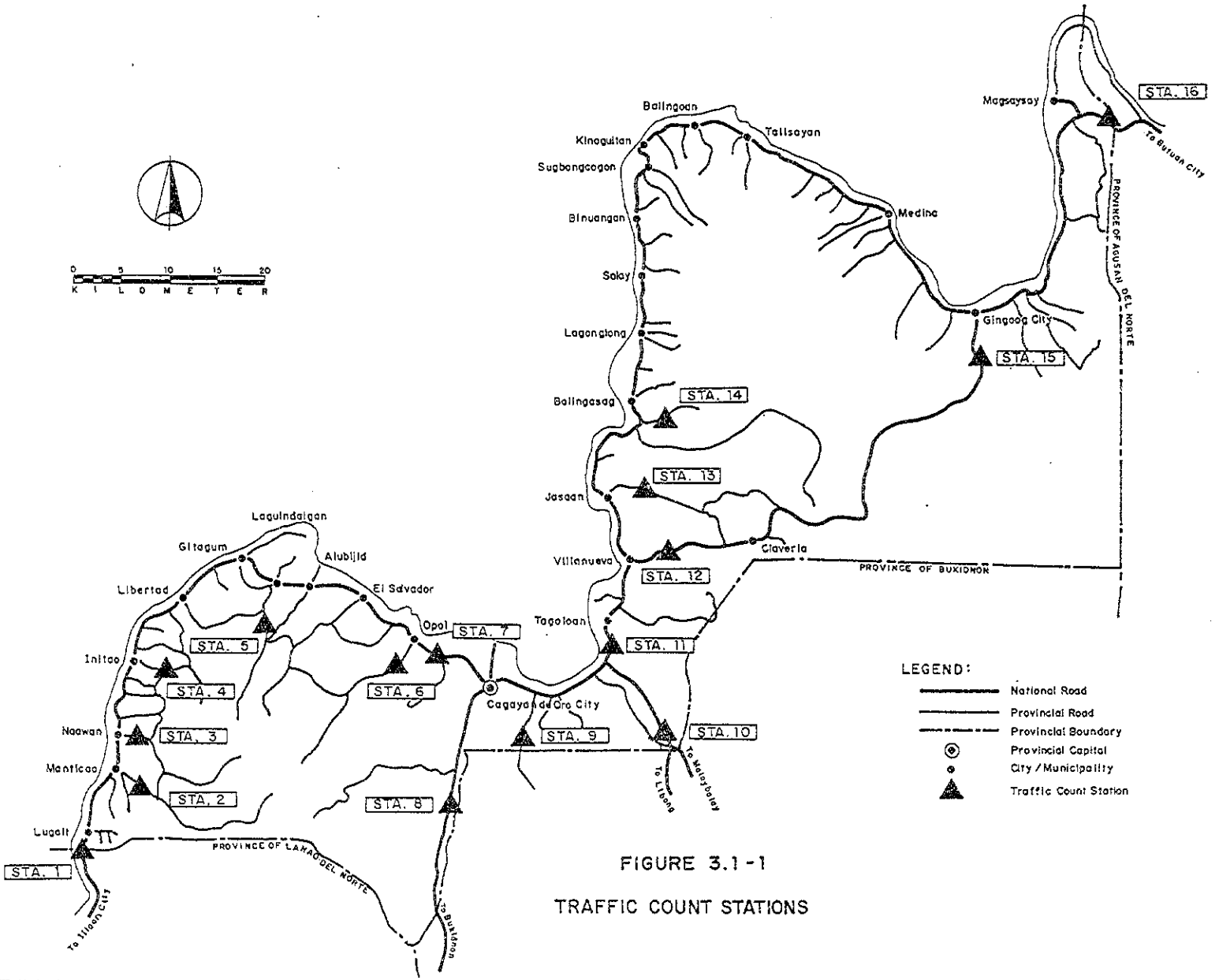


FIGURE 3.1-1

TRAFFIC COUNT STATIONS

TABLE 3.1-1 SUMMARY OF TRAFFIC SURVEY RESULTS
- MISAMIS ORIENTAL -

(ADT as of Feb. 1990)

Station No.	Car	Jeep	Pickup /Van	Jeepney	Bus	Truck	Sub-Total	Tri-cycle	Motor-cycle	Animal Drawn	Total
1	336	134	364	934	179	533	2479	6	156	0	2641
2	0	14	34	53	0	198	299	56	173	0	528
3	4	13	7	22	1	42	89	66	200	0	355
4	1	0	2	5	0	12	20	24	292	0	336
5	2	20	25	52	0	27	127	13	188	30	358
6	6	18	6	34	0	12	74	40	1	2	117
7	640	311	724	1387	148	582	3791	45	457	1	4294
8	15	35	73	325	1	142	591	1	149	0	741
9	4	11	23	112	0	17	167	22	33	0	222
10	276	191	505	590	134	793	2490	3	240	1	2734
11	962	461	1092	2506	320	1206	6548	661	869	0	8078
12	6	13	37	107	22	23	208	4	94	0	306
13	20	21	40	65	1	14	161	17	53	48	278
14	0	4	25	62	0	20	112	13	58	31	214
15	4	86	52	185	0	96	423	311	158	0	892
16	66	74	42	132	61	166	542	6	61	44	652

Source: Traffic Survey by Study Team (Feb. 1990)

3.2 TRAFFIC ANALYSIS AND FORECAST: TRAFFIC PROJECTS.

3.2.1 Analysis of Present Traffic

1) General Procedure

Present traffic on each major road network was analyzed according to the procedure shown in Figure 3.2-1.

The analysis is divided into three major steps:

Step I : Analysis of Traffic Survey Results

The number of passengers and commodity tonnage were obtained from the results of the traffic survey. These data are, however, available only on the surveyed road links and used for calibration purposes for the traffic model described below.

Step II : Analysis by Traffic Model

Traffic generation and attraction, in terms of passengers and commodity tons, were estimated based on population and per capita traffic generation factors; traffic distribution (OD distribution) was estimated by the gravity model; then, OD distribution was assigned to the major road network expressed by the node and link system. In the analysis, since only traffic generation factors were unknown, assumed values were used in the first step.

Step III : Comparison of Both Figures

The number of passengers and commodity tonnage estimated by the traffic model were compared with those derived from the traffic survey. On the basis of the comparison, traffic generation factors were appropriately adjusted and the traffic model analysis was reiterated until the traffic model reflected the actual people and freight movements with a high accuracy.

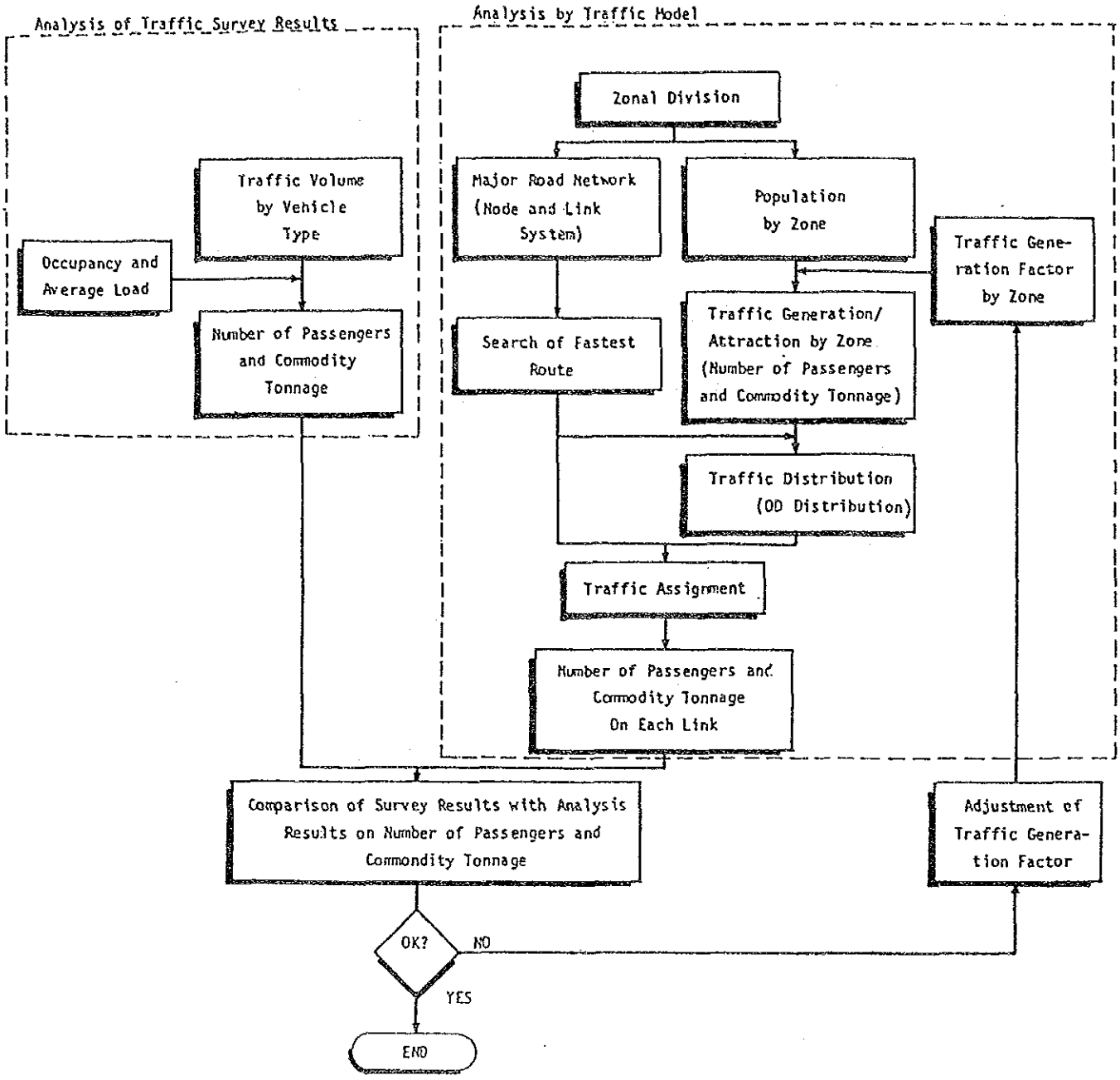


FIGURE 3.2-1
PROCEDURE OF ANALYSIS OF PRESENT TRAFFIC ON MAJOR ROAD NETWORK

2) Analysis of Traffic Survey Results

Traffic volume by vehicle type counted in the traffic survey was converted to number of passengers and commodity tonnage using the occupancy and average load shown in Table 3.2-1.

Table 3.2-1 OCCUPANCY AND AVERAGE LOAD
Province of Misamis Oriental

	Average Number of Passenger per vehicle	Average Load (ton per vehicle)
Car/Taxi	3.00	1.00
Jeep	3.40	1.00
Van/Pickup	3.40	1.00
Jeepney	20.00	1.00
Bus	30.00	1.00
Truck	4.00	3.00
Motor-tricycle	3.00	0.30
Motorcycle	1.50	0.10
Animal Drawn	2.00	0.15

3) Analysis by Traffic Model

i) Zonal Division:
The province was divided into traffic zones corresponding to municipal divisions in principle.

ii) Major Road Network:
The major road network was expressed by a node and link system. Each link was given length and average speed according to the actual road condition. A node and link system of the Province is presented in Figure 3.2-2.

iii) Search for the Fastest Route:
The fastest route for each zone pair was calculated by Moore's Method.

iv) Traffic Generation Factor:
Per capita traffic generation factors (trip/person/day and ton/person/day) vary between zones even in the same province with many factors such as:

- Economic Activity
- Size of Population
- Distance from Provincial Capital
- Road Condition
- Other Physical Conditions

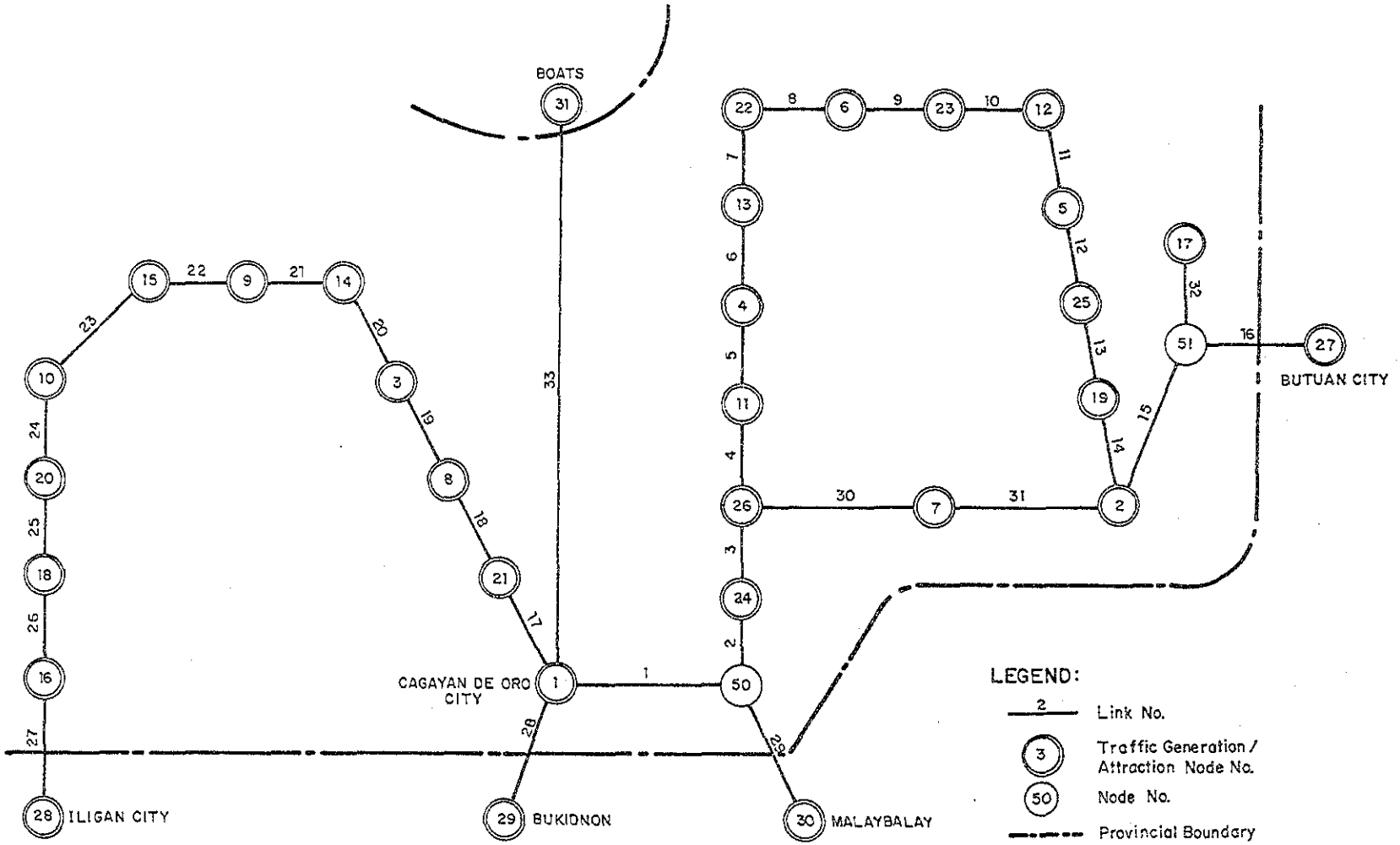


FIGURE 3.2-2 LINK / NODE SYSTEM
PROVINCE OF MISAMIS ORIENTAL

The generation factors which best illustrate the observed people and freight movement were estimated by the iterative method. The traffic generation factors thus estimated are summarized in Table 3.2-2.

TABLE 3.2-2 PER CAPITA TRAFFIC GENERATION FACTORS (MAJOR ROAD, 1990 W/O) Province of Misamis Oriental

	Passenger Movement (trip/person/day)	Commodity (kg/person/day)
Range	0.056 - 0.281	5.9 - 29.3
Mean Value	0.228	20.7

v) Traffic Generation and Attraction by Zone:

Traffic generation and attraction were obtained in terms of passengers and commodity tonnage as the product by generation factors.

vi) Traffic Distribution:

Traffic distribution (OD distribution) was estimated by the gravity model:

$$Xij = k\frac{Gi.Aj}{tiJ^2}$$

Where, Xij = Traffic from zone i to zone j
k = Parameter
Gi = Traffic generation in zone i
Aj = Traffic attraction in zone j
tij = Travel time from zone i to zone j along the fastest route

OD distribution was adjusted so as to satisfy the following conditions by the Frator Method:

$$Gi = \sum_{j+1}^{n} Xij$$

$$Aj = \sum_{i+1}^{n} Xij$$

Where, n = Number of zones

vii) Traffic Assignment:

Each OD traffic was assigned to the major road network expressed by the node and link system on an all-or-nothing basis. Thus, the number of passengers and commodity tonnage for each link were calculated.

3.2.2 Traffic Forecast

Figure 3.2-3 illustrates the procedure of traffic forecast.

The traffic model prepared for the analysis of present traffic was basically used for forecasting future traffic on the major road network with the following additions/ modifications:

1) Major Road Network and Fastest Route Search

The node and link system for the "with" case was prepared by changing the characteristics of the links included under this feasibility study as well as the links committed to be improved.

The fastest route search was carried out both in the "w/o" and "with" case networks.

2) Traffic Generation/Attraction and Distribution

The future population was based on the NCSO 1980 Census of Population and Housing.

Per capita traffic generation factors in the "with" case were estimated referring to the generated transport demand/transport cost reduction elasticity shown in "Highway Planning Manual, Volume 3, MPWH" and also based on the results of the analysis of present traffic. For instance, a zone showing a small generation factor at present due to poor road conditions is expected to increase the factor to some extent by road improvement, and the degree of increase can be estimated referring to other zones in similar situations but with better road conditions.

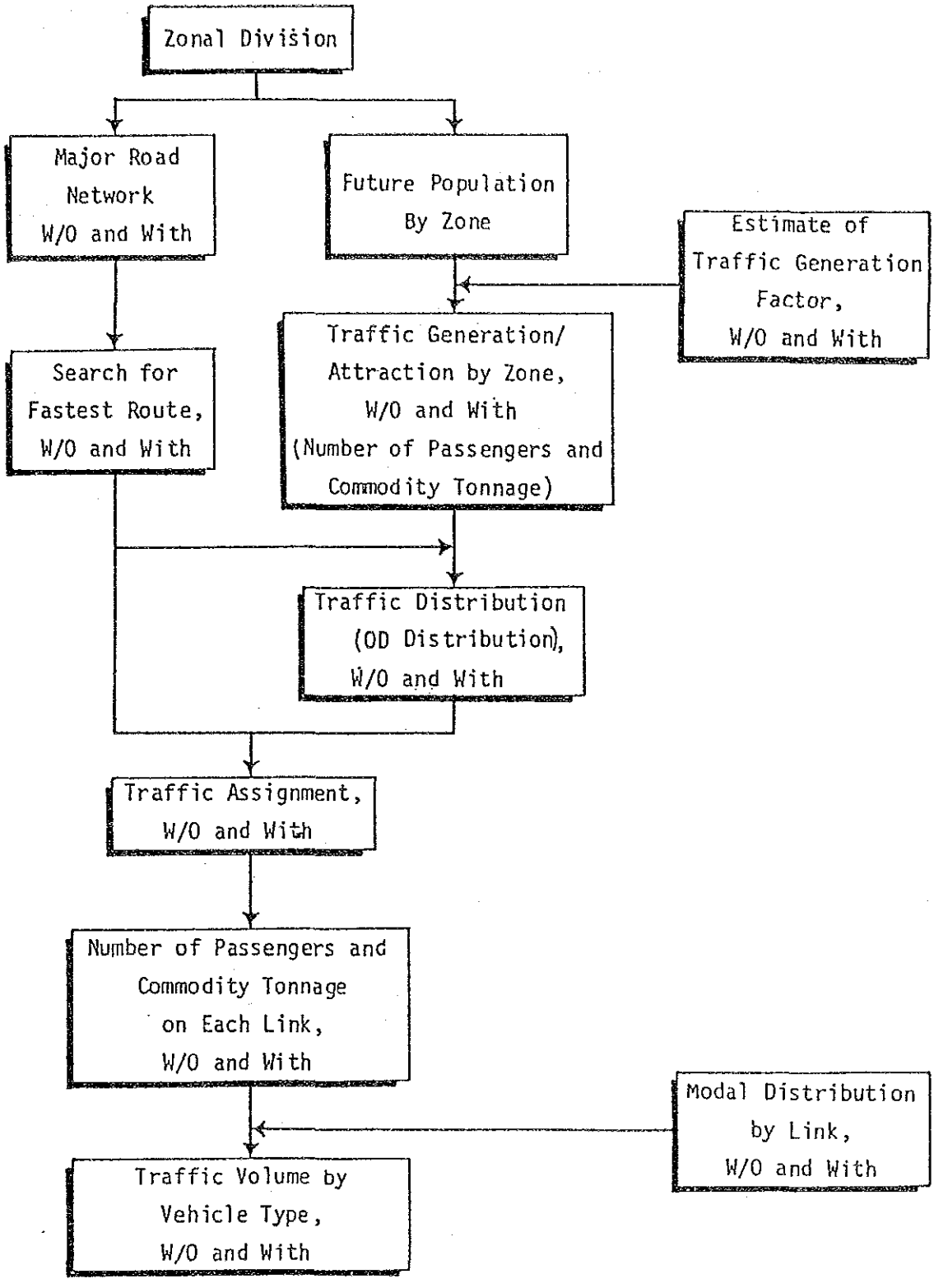


FIGURE 3.2-3
PROCEDURE OF FORECASTING TRAFFIC ON MAJOR ROAD NETWORK

The traffic generation factors thus estimated are summarized in Table 3.2-3.

TABLE 3.2-3 PER CAPITA TRAFFIC GENERATION FACTORS (MAJOR ROAD, 1990 WITH) Province of Misamis Oriental

	Passenger Movement (trip/person/day)	Commodity (kg/person/day)
Range	0.056 - 0.281	5.9 - 29.3
Mean Value	0.228	20.7

The transition period, i.e., the period which will elapse after opening of the improved road before the full impact on generation will take place, was assumed to be three years.

Traffic distribution for the "with" case was estimated by the same method as used in the analysis of present traffic.

3) Traffic Assignment

The number of passengers and commodity tonnage on each link in the "with" case was estimated by assigning OD traffic to the major road network in the "with" case. They were converted to the number of vehicles using the modal distribution in the "with" case. Changes in modal distribution with changes in road condition were estimated reffering to the present distribution in other road links in a similar situation but in the road condition. The transition period of a complete change in modal distribution was assumed to be three years.

The traffic in the "with" case was broken down into following four categories for convenience of traffic benefit estimation:

Normal Traffic: Flow of passengers and freight which will occur even without road improvement. However, changes in the number of vehicles is possible due to changes in modal distribution.

Diverted Traffic-1: Traffic which diverts to a certain road from other routes as a consequence of road improvement. This is usually called simply diverted traffic.

Diverted Traffic-2: Traffic which changes destination as a consequence of road improvement but for the same trip purpose as in the "w/o" case. This is possible in the case of improvement of the access road to the nearest town which is at present barely accessible due to poor conditions. This traffic is called "Diverted Traffic-2" in this Study, distinguished from Diverted Traffic-1.

Generated Traffic: Increased traffic brought about by road improvement.

3.2.3 Estimated Present and Future Traffic

Estimated present and future traffic on the major road is illustrated in Figure 3.2-4 and Figure 3.2-5, respectively.

Estimated present and future movements of passengers and commodity by link are presented in Table 3.2-4, and estimated traffic volumes are presented in Table 3.2-5.

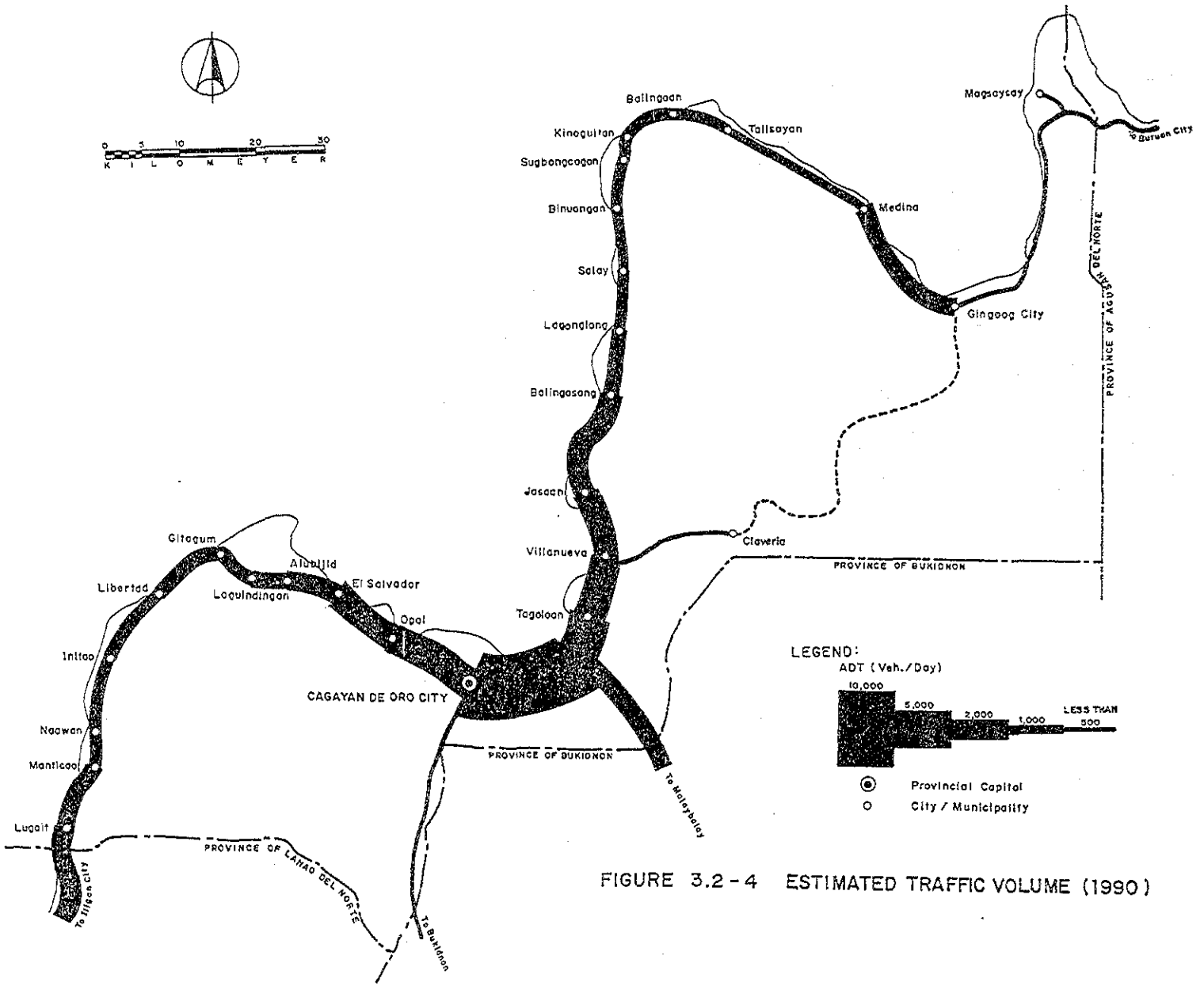


FIGURE 3.2 - 4 ESTIMATED TRAFFIC VOLUME (1990)

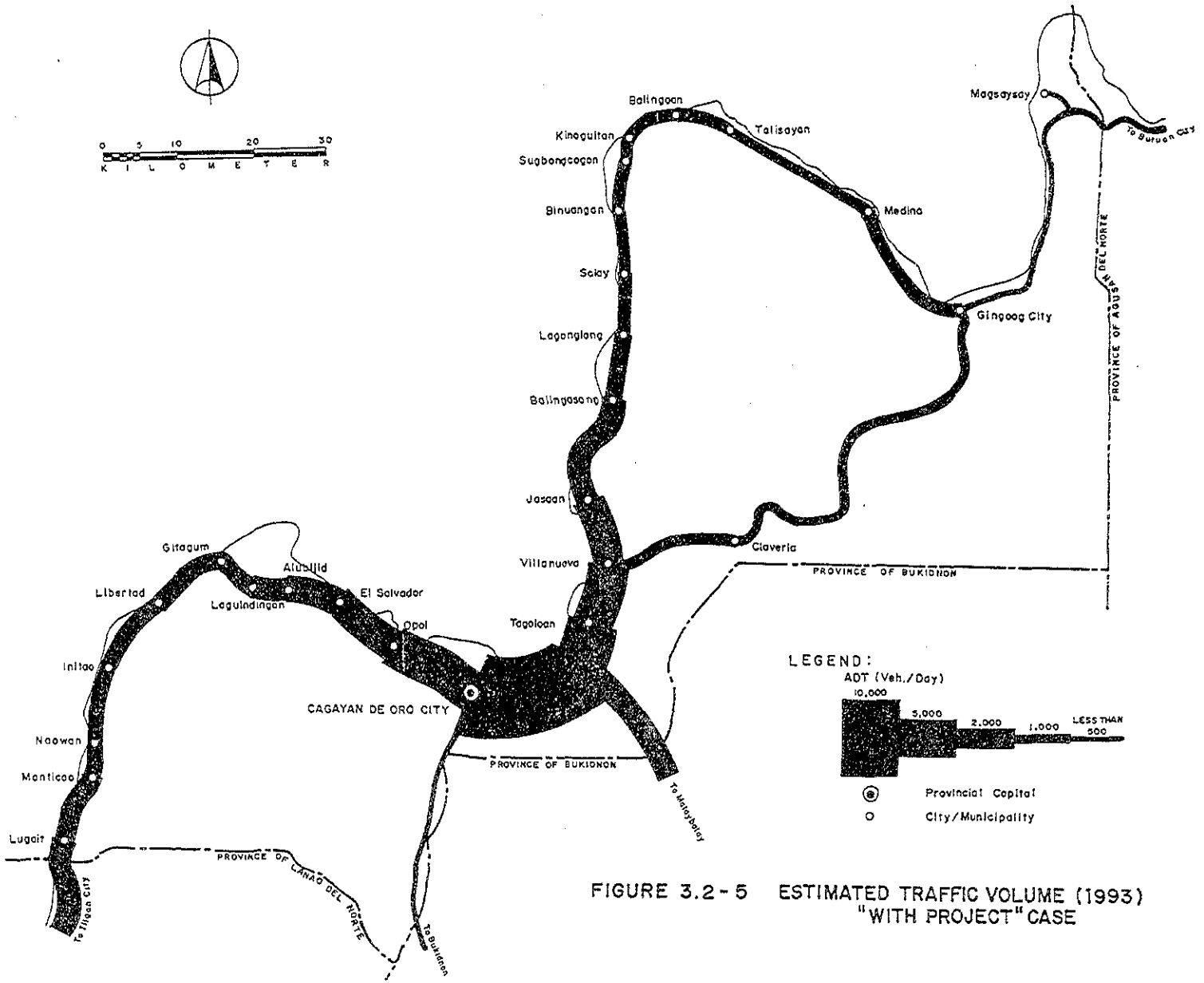


FIGURE 3.2-5 ESTIMATED TRAFFIC VOLUME (1993) "WITH PROJECT" CASE

TRAFFIC PROJECTION MISAMIS ORIENTAL

TABLE 3.2 - 4 (1)

Movement of Passengers and Commodity

Link	Year	Number of Passengers					Commodity Tonnage				
		Normal	Diverted-1	Diverted-2	Generated	Total	Normal	Diverted-1	Diverted-2	Generated	Total
	1990	60769				60769	6552.31				6552.31
	1993	74294	-	550	-	74844	7762.80	-	42.50	-	7805.30
1	1997	97272	-	692	-	97964	9741.40	-	52.48	-	9793.89
	2007	179317	-	1160	-	180477	16202.13	-	81.18	-	16283.31
	2017	309076	-	1763	-	310839	25201.64	-	111.73	-	25313.37
	1990	47222				47222	3721.31				3721.31
	1993	58055	-	580	-	58635	4463.11	-	48.64	-	4511.75
2	1997	76649	-	724	-	77373	5703.81	-	58.78	-	5762.59
	2007	143314	-	1199	-	144513	9791.58	-	88.07	-	9879.65
	2017	249717	-	1807	-	251524	15596.27	-	118.51	-	15714.78
	1990	38066				38066	2770.75				2770.75
	1993	46644	-	625	-	47269	3312.35	-	52.70	-	3365.05
3	1997	61391	-	773	-	62164	4222.85	-	63.13	-	4285.97
	2007	113876	-	1261	-	115136	7197.01	-	93.08	-	7290.09
	2017	197505	-	1879	-	199384	11417.51	-	123.69	-	11541.20
	1990	33314				33314	2390.89				2390.89
	1993	40902	-7820	-143	-	32938	2866.17	-548.43	-9.91	-	2307.83
4	1997	54020	-10308	-185	-	43527	3671.15	-708.92	-12.54	-	2949.69
	2007	101022	-19263	-293	-	81466	6320.99	-1248.44	-18.51	-	5054.03
	2017	176561	-33833	-401	-	142327	10117.77	-2045.11	-23.10	-	8049.55
	1990	27596				27596	2018.11				2018.11
	1993	33917	-7971	-89	-	25858	2424.27	-557.70	-7.42	-	1859.16
5	1997	44922	-10463	-124	-	34334	3117.77	-718.33	-9.81	-	2389.63
	2007	84666	-19434	-217	-	65014	5419.33	-1258.31	-15.34	-	4145.69
	2017	149291	-34014	-313	-	114964	8753.83	-2054.98	-19.77	-	6679.08
	1990	22144				22144	1654.59				1654.59
	1993	26948	-7971	-20	-	18957	1973.97	-557.70	-3.37	-	1412.91
6	1997	35260	-10463	-26	-	24771	2518.95	-718.33	-4.50	-	1796.12
	2007	65382	-19434	-37	-	45911	4341.41	-1258.31	-7.23	-	3075.88
	2017	114739	-34014	-41	-	80685	7009.56	-2054.98	-9.41	-	4945.16
	1990	20013				20013	1542.03				1542.03
	1993	24342	-7971	-22	-	16350	1837.63	-557.70	-2.51	-	1277.42
7	1997	31822	-10463	-19	-	21340	2340.81	-718.33	-3.04	-	1619.44
	2007	58882	-19434	-	-	39447	4019.03	-1258.31	-4.06	-	2756.66
	2017	103207	-34014	40	-	69233	6471.26	-2054.98	-4.40	-	4411.88
	1990	17963				17963	1328.22				1328.22
	1993	21833	-7971	-48	-	13814	1583.57	-557.70	-3.96	-	1021.92
8	1997	28533	-10463	-46	-	18024	2020.44	-718.33	-4.38	-	1297.73
	2007	52862	-19434	-25	-	33403	3486.88	-1258.31	-5.09	-	2223.48
	2017	92964	-34014	22	-	58973	5649.44	-2054.98	-5.00	-	3589.46

TRAFFIC PROJECTION MISAMIS ORIENTAL

TABLE 3.2 - 4 (2)

Movement of Passengers and Commodity

Link	Year	Number of Passengers					Commodity Tonnage				
		Normal	Diverted-1	Diverted-2	Generated	Total	Normal	Diverted-1	Diverted-2	Generated	Total
	1990	17789				17789	1306.56				1306.56
	1993	21606	-7971	-51	-	13584	1557.01	-557.70	-4.04	-	995.27
9	1997	28207	-10463	-47	-	17697	1985.40	-718.33	-4.35	-	1262.71
	2007	52186	-19434	-22	-	32730	3424.40	-1258.31	-4.76	-	2161.33
	2017	91726	-34014	31	-	57743	5547.94	-2054.98	-4.30	-	3488.66
	1990	17966				17966	1305.95				1305.95
	1993	21749	-7971	-46	-	13732	1550.25	-557.70	-3.82	-	988.73
10	1997	28264	-10463	-39	-	17761	1966.63	-718.33	-3.94	-	1244.35
	2007	51826	-19434	-3	-	32389	3361.17	-1258.31	-3.76	-	2099.10
	2017	90516	-34014	68	-	56570	5414.51	-2054.98	-2.55	-	3356.98
	1990	17461				17461	1255.68				1255.68
	1993	21122	-7971	-65	-	13087	1492.84	-557.70	-4.58	-	930.56
11	1997	27432	-10463	-57	-	16911	1898.01	-718.33	-4.67	-	1175.00
	2007	50327	-19434	-18	-	30875	3260.27	-1258.31	-4.37	-	1997.60
	2017	88037	-34014	59	-	54082	5272.60	-2054.98	-2.96	-	3214.66
	1990	18083				18083	1287.55				1287.55
	1993	21754	-7971	-47	-	13736	1522.31	-557.70	-3.43	-	961.18
12	1997	28034	-10463	-34	-	17537	1921.15	-718.33	-3.20	-	1199.62
	2007	50644	-19434	26	-	31236	3256.11	-1258.31	-2.01	-	1995.79
	2017	87586	-34014	135	-	53707	5220.34	-2054.98	.40	-	3165.76
	1990	17246				17246	1203.51				1203.51
	1993	20666	-7971	-168	-	12527	1422.78	-557.70	-7.97	-	857.11
13	1997	26498	-10463	-159	-	15876	1795.92	-718.33	-7.64	-	1069.95
	2007	47616	-19434	-104	-	28077	3055.04	-1258.31	-6.08	-	1790.65
	2017	82285	-34014	12	-	48283	4919.61	-2054.98	-3.11	-	2861.52
	1990	20826				20826	1376.53				1376.53
	1993	24632	-7966	-359	-	16308	1601.34	-557.00	-16.97	-	1027.37
14	1997	30889	-10457	-412	-	20019	1970.36	-717.55	-18.74	-	1234.06
	2007	52412	-19425	-576	-	32411	3166.06	-1257.32	-23.64	-	1885.10
	2017	85302	-34002	-775	-	50525	4848.03	-2053.85	-28.62	-	2765.55
	1990	4528				4528	558.57				558.57
	1993	5344	-	-144	-	5200	647.04	-	-10.55	-	636.49
15	1997	6681	-	-160	-	6520	789.33	-	-11.06	-	778.27
	2007	11390	-	-191	-	11199	1256.47	-	-11.74	-	1244.73
	2017	18753	-	-201	-	18553	1911.83	-	-11.54	-	1900.29
	1990	3972				3972	582.64				582.64
	1993	4739	-	3	-	4742	675.33	-	.25	-	675.58
16	1997	6001	-	3	-	6004	822.34	-	.29	-	822.63
	2007	10405	-	6	-	10411	1294.12	-	.51	-	1294.62
	2017	17123	-	8	-	17131	1931.87	-	.65	-	1932.52

TRAFFIC PROJECTION MISAMIS ORIENTAL

TABLE 3.2 - 4 (3)

Movement of Passengers and Commodity

Link	Year	Number of Passengers					Commodity Tonnage				
		Normal	Diverted-1	Diverted-2	Generated	Total	Normal	Diverted-1	Diverted-2	Generated	Total
	1990	33028				33028	3153.94				3153.94
	1993	40386	-	-438	-	39948	3765.36	-	-32.78	-	3732.58
17	1997	52996	-	-564	-	52431	4789.15	-	-41.91	-	4747.24
	2007	99066	-	-971	-	98094	8231.02	-	-68.10	-	8162.92
	2017	172710	-	-1520	-	171190	13166.71	-	-98.45	-	13068.26
	1990	27394				27394	2584.36				2584.36
	1993	33634	-	-418	-	33216	3099.72	-	-30.81	-	3068.91
18	1997	44426	-	-543	-	43883	3972.23	-	-39.82	-	3932.41
	2007	84344	-	-945	-	83399	6947.99	-	-65.77	-	6882.22
	2017	148891	-	-1490	-	147401	11274.24	-	-96.09	-	11178.15
	1990	22450				22450	2133.85				2133.85
	1993	27511	-	-343	-	27168	2547.97	-	-24.39	-	2523.58
19	1997	36331	-	-458	-	35874	3254.75	-	-32.53	-	3222.22
	2007	69944	-	-829	-	69115	5758.77	-	-56.27	-	5702.49
	2017	125083	-	-1347	-	123737	9455.96	-	-85.13	-	9370.83
	1990	20371				20371	1968.32				1968.32
	1993	24936	-	-274	-	24663	2344.90	-	-19.56	-	2325.35
20	1997	32881	-	-370	-	32511	2984.92	-	-26.35	-	2958.57
	2007	61902	-	-673	-	61229	5151.40	-	-45.32	-	5106.08
	2017	109079	-	-1111	-	107968	8311.85	-	-69.19	-	8242.66
	1990	17914				17914	1734.68				1734.68
	1993	21987	-	-242	-	21745	2073.33	-	-17.40	-	2055.93
21	1997	29074	-	-327	-	28747	2648.18	-	-23.32	-	2624.86
	2007	54943	-	-601	-	54342	4584.84	-	-40.46	-	4544.38
	2017	97269	-	-1007	-	96262	7427.36	-	-62.40	-	7364.97
	1990	15977				15977	1556.19				1556.19
	1993	19609	-	-213	-	19396	1859.36	-	-15.23	-	1844.13
22	1997	25931	-	-289	-	25643	2373.88	-	-20.50	-	2353.38
	2007	49120	-	-539	-	48581	4114.70	-	-36.01	-	4078.69
	2017	87301	-	-919	-	86382	6683.86	-	-56.38	-	6627.49
	1990	15003				15003	1477.47				1477.47
	1993	18376	-	-184	-	18192	1760.60	-	-13.17	-	1747.43
23	1997	24240	-	-252	-	23988	2239.75	-	-17.83	-	2221.92
	2007	45831	-	-481	-	45350	3866.33	-	-31.88	-	3834.46
	2017	81530	-	-836	-	80694	6274.21	-	-50.80	-	6223.40
	1990	13430				13430	1401.98				1401.98
	1993	16320	-	-94	-	16227	1652.93	-	-6.47	-	1646.47
24	1997	21256	-	-134	-	21123	2067.11	-	-9.05	-	2058.07
	2007	39450	-	-282	-	39168	3468.67	-	-17.64	-	3451.03
	2017	69390	-	-535	-	68855	5517.53	-	-30.52	-	5487.01

TRAFFIC PROJECTION MISAMIS ORIENTAL

TABLE 3.2 - 4 (4)

Movement of Passengers and Commodity

Link	Year	Number of Passengers					Commodity Tonnage				
		Normal	Diverted-1	Diverted-2	Generated	Total	Normal	Diverted-1	Diverted-2	Generated	Total
	1990	14054				14054	1507.73				1507.73
	1993	16983	-	-59	-	16925	1768.89	-	-4.01	-	1764.88
25	1997	21893	-	-82	-	21811	2191.42	-	-5.46	-	2185.96
	2007	39635	-	-166	-	39469	3592.96	-	-10.19	-	3582.77
	2017	67915	-	-309	-	67606	5571.99	-	-17.11	-	5554.88
	1990	15885				15885	1773.50				1773.50
	1993	19029	-	-8	-	19021	2062.72	-	-.70	-	2062.03
26	1997	24170	-	-10	-	24160	2519.47	-	-.83	-	2518.63
	2007	42374	-	-22	-	42352	4003.70	-	-1.43	-	4002.27
	2017	70283	-	-38	-	70246	6020.55	-	-1.97	-	6018.58
	1990	19697				19697	2174.09				2174.09
	1993	23518	-	-5	-	23513	2521.05	-	-.47	-	2520.57
27	1997	29754	-	-6	-	29748	3068.21	-	-.54	-	3067.67
	2007	51590	-	-11	-	51579	4827.42	-	-.88	-	4826.54
	2017	84770	-	-16	-	84754	7199.06	-	-1.01	-	7198.04
	1990	5025				5025	570.73				570.73
	1993	6002	-	-2	-	6000	662.04	-	-.22	-	661.82
28	1997	7586	-	-2	-	7584	804.97	-	-.24	-	804.73
	2007	13151	-	-4	-	13147	1266.20	-	-.32	-	1265.87
	2017	21590	-	-5	-	21585	1886.61	-	-.32	-	1886.28
	1990	13912				13912	2933.81				2933.81
	1993	16617	-	-5	-	16612	3403.22	-	-1.16	-	3402.07
29	1997	21004	-	-6	-	20998	4138.24	-	-1.22	-	4137.02
	2007	36414	-	-10	-	36404	6509.70	-	-1.68	-	6508.02
	2017	59786	-	-14	-	59772	9699.90	-	-1.70	-	9698.21
	1990	2196				2196	228.63				228.63
	1993	2610	7880	800	-	11290	263.93	548.44	64.10	-	876.46
30	1997	3279	10369	992	-	14640	318.99	708.90	77.20	-	1105.10
	2007	5560	19330	1592	-	26482	490.86	1248.32	113.10	-	1852.28
	2017	8937	33901	2319	-	45158	716.05	2044.88	148.10	-	2909.04
	1990	-				-	-				-
	1993	-	7971	878	-	8848	-	557.70	71.23	-	628.93
31	1997	-	10463	1072	-	11536	-	718.33	84.37	-	802.70
	2007	-	19434	1680	-	21114	-	1258.31	120.37	-	1378.68
	2017	-	34014	2411	-	36425	-	2054.98	155.12	-	2210.10
	1990	1546				1546	161.09				161.09
	1993	1789	-	-	-	1789	181.02	-	-.04	-	180.99
32	1997	2173	-	-	-	2174	211.47	-	-.05	-	211.42
	2007	3417	-	-	-	3417	301.48	-	-.09	-	301.39
	2017	5182	-	-	-	5182	414.78	-	-.10	-	414.68

TRAFFIC PROJECTION MISAMIS ORIENTAL

TABLE 3.2 - 4 (5)

Movement of Passengers and Commodity

Link	Year	Number of Passengers					Commodity Tonnage				
		Normal	Diverted-1	Diverted-2	Generated	Total	Normal	Diverted-1	Diverted-2	Generated	Total
	1990	1300				1300	183.03				183.03
	1993	1552	-	-	-	1552	212.31	-	-.07	-	212.24
33	1997	1963	-	-1	-	1962	258.24	-	-.07	-	258.16
	2007	3403	-	-1	-	3402	406.30	-	-.10	-	406.20
	2017	5589	-	-1	-	5588	605.59	-	-.11	-	605.48

TRAFFIC PROJECTION MISAMIS ORIENTAL

TABLE 3.2 - 5 (1)

Traffic Volume

Link	Year	w/o									with								
		Car /Van	Jeep- ney	Bus	Tru- ck	Sub- Total	Tri- cycl	Mot. cycl	Ani- mal	Total	Car /Van	Jeep- ney	Bus	Tru- ck	Sub- Total	Tri- cycl	Mot. cycl	Ani- mal	Total
	1990	3994	3762	352	934	9042	-	-	-	9042									
	1993	4790	4546	428	1109	10873	-	-	-	10873	4820	4576	431	1116	10942	-	-	-	10942
1	1997	6113	5859	558	1396	13926	-	-	-	13926	6150	5897	562	1404	14013	-	-	-	14013
	2007	10613	10416	1016	2340	24385	-	-	-	24385	10673	10478	1022	2352	24525	-	-	-	24525
	2017	17274	17357	1732	3669	40032	-	-	-	40032	17350	17449	1742	3686	40237	-	-	-	40237
	1990	2170	2162	293	848	5473	381	819	-	6672									
	1993	2641	2642	360	1020	6663	461	1006	-	8130	2658	2669	363	1031	6732	466	1016	-	8214
2	1997	3441	3462	474	1309	8687	598	1329	-	10613	3475	3496	478	1323	8772	604	1341	-	10716
	2007	6225	6353	880	2274	15733	1065	2484	-	19282	6279	6407	888	2294	15868	1074	2505	-	19447
	2017	10495	10867	1525	3671	26559	1768	4328	-	32655	10573	10947	1536	3698	26754	1781	4360	-	32895
	1990	1746	1713	236	592	4287	312	660	-	5259									
	1993	2119	2087	289	710	5205	376	808	-	6390	2150	2116	293	721	5279	382	819	-	6481
3	1997	2756	2728	379	907	6770	486	1064	-	8320	2793	2763	384	921	6861	493	1078	-	8432
	2007	4956	4970	700	1558	12185	859	1974	-	15018	5014	5027	708	1578	12327	870	1996	-	15193
	2017	8335	8472	1209	2492	20508	1420	3423	-	25351	8418	8554	1221	2519	20712	1434	3456	-	25602
	1990	2368	969	726	136	4200	111	222	-	4533									
	1993	2864	1178	889	163	5094	136	273	-	5503	2306	949	716	131	4102	110	220	-	4432
4	1997	3711	1538	1168	209	6626	180	360	-	7166	2985	1238	941	168	5332	145	290	-	5767
	2007	6598	2786	2159	362	11905	337	673	-	12916	5294	2239	1739	290	9562	272	543	-	10377
	2017	10948	4715	3730	584	19977	589	1177	-	21743	8758	3783	3002	465	16009	474	949	-	17432
	1990	1780	775	589	195	3339	132	184	-	3655									
	1993	2158	944	722	235	4058	162	226	-	4446	1651	721	551	180	3103	123	172	-	3399
5	1997	2809	1236	953	302	5300	212	299	-	5812	2150	946	728	232	4056	162	229	-	4447
	2007	5054	2263	1777	527	9621	391	564	-	10576	3872	1735	1364	403	7375	300	433	-	8108
	2017	8489	3871	3102	854	16316	673	995	-	17984	6505	2972	2386	652	12515	517	766	-	13798
	1990	1281	589	463	228	2561	140	148	-	2849									
	1993	1542	712	562	273	3088	169	180	-	3437	1095	504	396	195	2190	120	126	-	2436
6	1997	1991	923	733	348	3995	218	235	-	4448	1410	652	516	248	2825	154	165	-	3145
	2007	3551	1671	1348	601	7171	392	436	-	7998	2505	1176	948	426	5055	276	306	-	5637
	2017	5972	2855	2346	973	12146	663	765	-	13574	4206	2010	1650	686	8553	467	538	-	9557
	1990	1020	487	409	283	2200	154	133	-	2487									
	1993	1229	589	496	337	2652	185	162	-	2999	839	400	335	234	1808	127	109	-	2044
7	1997	1586	764	647	430	3428	239	212	-	3879	1080	517	435	297	2330	163	142	-	2635
	2007	2834	1385	1190	739	6149	424	393	-	6966	1920	934	799	507	4159	288	263	-	4710
	2017	4782	2376	2071	1193	10421	711	688	-	11820	3231	1600	1391	813	7035	481	462	-	7977
	1990	736	397	350	328	1812	246	132	-	2189									
	1993	887	481	425	392	2185	296	160	-	2641	566	306	269	253	1394	189	101	-	1684
8	1997	1146	625	555	502	2829	383	209	-	3421	729	396	351	322	1799	244	132	-	2175
	2007	2060	1141	1023	876	5100	690	388	-	6178	1306	722	647	558	3234	438	245	-	3916
	2017	3501	1974	1790	1438	8703	1177	682	-	10561	2223	1253	1136	913	5524	747	432	-	6703

TRAFFIC PROJECTION MISAMIS ORIENTAL

TABLE 3.2 - 5 (2)

Traffic Volume

Link	Year	w/o									with							
		Car /Van	Jeep- ney	Bus	Tru- ck	Sub- Total	Tri- cycl	Mot. cycl	Ani- mal	Total	Car /Van	Jeep- ney	Bus	Tru- ck	Sub- Total	Tri- cycl	Mot. cycl	Ani- mal	Total
	1990	735	393	348	323	1799	229	119	-	2147								
	1993	885	475	422	386	2169	277	144	-	2589	561	300	266	246	1373	175	91	-	1638
9	1997	1144	617	550	494	2805	358	188	-	3351	722	388	346	314	1769	226	118	-	2113
	2007	2053	1125	1013	861	5052	646	348	-	6046	1291	707	636	543	3176	406	218	-	3800
	2017	3490	1946	1771	1413	8620	1104	612	-	10335	2196	1225	1115	889	5424	695	385	-	6504
	1990	743	392	351	328	1814	187	120	-	2121									
	1993	891	473	425	390	2179	226	145	-	2549	565	299	268	249	1381	143	92	-	1616
10	1997	1146	611	551	497	2805	292	188	-	3285	722	385	346	314	1767	184	118	-	2069
	2007	2039	1105	1005	858	5007	527	346	-	5879	1274	690	628	536	3128	329	216	-	3673
	2017	3445	1900	1747	1399	8491	905	603	-	9999	2146	1186	1091	869	5291	564	377	-	6233
	1990	710	357	372	319	1758	70	35	-	1863									
	1993	852	431	449	381	2112	84	42	-	2239	529	267	278	237	1312	52	26	-	1390
11	1997	1096	557	582	486	2721	108	55	-	2884	677	344	359	300	1680	67	34	-	1781
	2007	1956	1007	1063	842	4869	194	101	-	5163	1199	618	652	516	2985	119	62	-	3166
	2017	3315	1734	1851	1378	8278	328	176	-	8783	2031	1063	1137	841	5072	201	108	-	5381
	1990	691	367	390	339	1786	55	36	-	1878									
	1993	826	440	468	401	2135	66	44	-	2244	521	278	295	253	1348	42	27	-	1417
12	1997	1055	564	602	508	2729	85	56	-	2870	659	353	377	317	1706	53	35	-	1794
	2007	1857	1005	1083	869	4814	151	101	-	5066	1143	619	667	533	2962	93	62	-	3118
	2017	3119	1713	1862	1409	8103	257	175	-	8535	1904	1048	1141	856	4950	157	107	-	5214
	1990	632	296	412	328	1667	-	-	-	1667									
	1993	753	353	494	388	1988	-	-	-	1988	455	214	299	234	1202	-	-	-	1202
13	1997	959	451	632	491	2534	-	-	-	2534	574	270	379	293	1515	-	-	-	1515
	2007	1689	801	1132	841	4462	-	-	-	4462	994	471	667	493	2626	-	-	-	2626
	2017	2846	1362	1946	1368	7522	-	-	-	7522	1665	797	1141	797	4400	-	-	-	4400
	1990	838	489	398	377	2101	12	-	-	2113									
	1993	985	576	470	440	2471	14	-	-	2485	646	379	310	284	1618	9	-	-	1627
14	1997	1228	720	588	543	3079	17	-	-	3095	787	463	380	342	1972	11	-	-	1983
	2007	2047	1208	995	880	5129	28	-	-	5157	1251	741	614	527	3133	17	-	-	3150
	2017	3268	1942	1613	1361	8185	45	-	-	8229	1914	1142	954	781	4791	26	-	-	4817
	1990	205	122	87	155	568	5	-	-	574									
	1993	240	143	102	180	665	6	-	-	671	234	139	100	177	650	6	-	-	656
15	1997	297	177	128	220	822	7	-	-	829	291	173	125	217	806	7	-	-	813
	2007	492	296	217	353	1358	12	-	-	1370	485	291	213	349	1339	12	-	-	1351
	2017	787	476	355	541	2159	19	-	-	2178	779	472	352	537	2140	19	-	-	2159
	1990	188	132	61	166	548	7	61	-	615									
	1993	222	156	73	193	644	8	73	-	724	222	156	73	193	644	8	73	-	724
16	1997	276	195	92	236	799	9	92	-	900	276	195	92	236	799	9	92	-	901
	2007	459	329	158	376	1321	16	160	-	1496	459	330	158	376	1322	16	160	-	1497
	2017	725	529	258	567	2078	24	263	-	2365	725	529	258	568	2079	24	263	-	2365

TRAFFIC PROJECTION MISAMIS ORIENTAL

TABLE 3.2 - 5 (3)

Traffic Volume

Link	Year	w/o									with								
		Car /Van	Jeep-ney	Bus	Truck	Sub-Total	Tri-cycl	Mot. cycl	Animal	Total	Car /Van	Jeep-ney	Bus	Truck	Sub-Total	Tri-cycl	Mot. cycl	Animal	Total
	1990	1939	1650	180	648	4417	43	550	-	5010									
	1993	2343	2004	219	776	5343	52	673	-	6068	2320	1983	217	769	5290	52	666	-	6007
17	1997	3029	2608	287	991	6915	67	883	-	7865	2999	2581	284	982	6847	67	874	-	7787
	2007	5444	4770	533	1721	12468	121	1651	-	14240	5395	4725	528	1706	12354	120	1635	-	14109
	2017	9134	8144	924	2785	20987	203	2879	-	24068	9059	8075	916	2764	20813	201	2853	-	23857
	1990	1571	1295	192	541	3599	35	457	-	4091									
	1993	1908	1579	236	650	4373	43	561	-	4976	1886	1561	233	644	4323	43	554	-	4919
18	1997	2484	2069	311	836	5699	56	740	-	6496	2456	2045	307	828	5635	55	731	-	6422
	2007	4540	3845	586	1477	10448	103	1406	-	11956	4493	3803	579	1463	10339	101	1390	-	11830
	2017	7723	6648	1027	2424	17822	174	2482	-	20478	7650	6584	1017	2403	17654	173	2457	-	20284
	1990	1283	1001	191	452	2928	36	299	-	3264									
	1993	1552	1218	234	542	3547	44	367	-	3957	1535	1204	231	536	3507	43	362	-	3913
19	1997	2018	1595	308	695	4615	57	484	-	5157	1995	1576	304	688	4562	56	478	-	5097
	2007	3735	3004	589	1242	8571	104	933	-	9608	3694	2970	582	1229	8477	103	922	-	9501
	2017	6432	5263	1047	2062	14805	178	1668	-	16650	6368	5209	1036	2043	14656	176	1650	-	16482
	1990	1145	850	206	429	2631	40	272	-	2942									
	1993	1383	1033	252	513	3181	48	332	-	3562	1370	1023	249	508	3150	48	329	-	3527
20	1997	1794	1350	331	655	4130	63	438	-	4631	1776	1335	328	649	4088	62	433	-	4583
	2007	3245	2485	619	1142	7490	113	825	-	8429	3212	2459	612	1132	7415	112	816	-	8344
	2017	5501	4286	1083	1863	12733	192	1454	-	14380	5449	4244	1072	1847	12613	190	1440	-	14243
	1990	1001	681	210	388	2281	41	179	-	2501									
	1993	1213	831	257	466	2766	50	220	-	3036	1201	822	254	461	2739	49	217	-	3006
21	1997	1577	1089	339	597	3602	64	291	-	3957	1561	1077	335	591	3566	64	287	-	3917
	2007	2863	2016	636	1044	6558	116	549	-	7223	2834	1995	629	1034	6492	115	543	-	7150
	2017	4873	3500	1117	1709	11200	196	973	-	12369	4827	3466	1106	1694	11093	194	963	-	12250
	1990	887	579	213	348	2027	42	107	-	2176									
	1993	1074	706	261	417	2458	51	131	-	2639	1064	698	258	414	2434	50	129	-	2614
22	1997	1397	925	344	535	3200	66	173	-	3439	1383	915	340	530	3168	66	171	-	3404
	2007	2539	1713	645	936	5834	120	327	-	6282	2514	1695	638	928	5775	119	324	-	6218
	2017	4336	2982	1138	1538	9994	206	582	-	10782	4295	2952	1126	1524	9897	204	576	-	10677
	1990	822	521	221	330	1894	50	30	-	1974									
	1993	993	633	270	395	2291	60	37	-	2387	984	627	268	392	2270	59	36	-	2366
23	1997	1287	826	355	504	2973	78	48	-	3099	1275	818	352	500	2945	77	48	-	3070
	2007	2331	1526	667	879	5402	141	92	-	5634	2309	1510	660	871	5350	139	91	-	5580
	2017	3977	2653	1178	1442	9251	240	163	-	9654	3940	2628	1166	1430	9164	238	161	-	9564
	1990	789	429	229	314	1761	32	18	-	1811									
	1993	945	516	277	371	2110	38	22	-	2170	940	514	276	370	2099	38	22	-	2159
24	1997	1206	664	360	467	2697	49	28	-	2774	1200	660	358	464	2682	48	28	-	2758
	2007	2136	1195	662	792	4786	84	53	-	4922	2123	1187	658	788	4756	84	52	-	4892
	2017	3594	2044	1156	1277	8071	138	93	-	8301	3570	2029	1147	1270	8016	137	92	-	8245

TRAFFIC PROJECTION MISAMIS ORIENTAL

TABLE 3.2 - 5 (4)

Traffic Volume

Link	Year	w/o Car /Van	Jeep-ney	Bus	Tru-ck	Sub-Total	Tri-cycl	Mot. cycl	Ani-mal	Total	with Car /Van	Jeep-ney	Bus	Tru-ck	Sub-Total	Tri-cycl	Mot. cycl	Ani-mal	Total
	1990	822	342	270	385	1818	-	-	-	1818									
	1993	980	410	325	453	2168	-	-	-	2168	977	409	324	452	2162	-	-	-	2162
25	1997	1241	523	417	564	2746	-	-	-	2746	1237	522	416	563	2737	-	-	-	2737
	2007	2152	926	750	937	4765	-	-	-	4765	2144	922	747	934	4748	-	-	-	4748
	2017	3540	1552	1277	1474	7844	-	-	-	7844	3526	1545	1271	1470	7812	-	-	-	7812
	1990	808	575	225	444	2051	-	64	-	2115									
	1993	954	683	269	518	2423	-	76	-	2499	953	683	269	518	2422	-	76	-	2498
26	1997	1189	858	340	635	3022	-	97	-	3119	1188	858	340	635	3021	-	97	-	3118
	2007	1991	1465	592	1021	5070	-	169	-	5239	1990	1465	592	1021	5067	-	169	-	5237
	2017	3163	2372	975	1555	8066	-	281	-	8347	3161	2371	975	1555	8062	-	281	-	8343
	1990	837	936	179	535	2487	14	158	-	2659									
	1993	984	1108	213	623	2928	16	188	-	3133	984	1108	213	623	2928	16	188	-	3132
27	1997	1221	1387	269	761	3637	20	238	-	3895	1221	1386	268	761	3637	20	238	-	3895
	2007	2020	2341	462	1210	6033	33	413	-	6479	2020	2340	462	1210	6031	33	413	-	6477
	2017	3174	3752	753	1827	9505	52	678	-	10235	3173	3751	753	1826	9503	52	678	-	10233
	1990	124	328	1	143	595	-	151	-	746									
	1993	145	388	1	166	700	-	180	-	881	145	388	1	166	700	-	180	-	880
28	1997	179	485	2	203	868	-	228	-	1096	179	485	2	203	868	-	228	-	1095
	2007	291	818	3	322	1434	-	395	-	1828	291	818	3	322	1433	-	394	-	1828
	2017	449	1310	4	486	2249	-	648	-	2896	448	1310	4	486	2248	-	648	-	2896
	1990	983	595	136	800	2514	-	241	-	2755									
	1993	1154	704	162	930	2951	-	288	-	3239	1153	704	162	930	2950	-	288	-	3238
29	1997	1426	880	204	1136	3647	-	364	-	4011	1426	880	204	1136	3646	-	364	-	4010
	2007	2341	1486	351	1806	5984	-	631	-	6615	2340	1485	350	1806	5982	-	631	-	6613
	2017	3647	2379	571	2723	9321	-	1036	-	10357	3647	2379	571	2723	9319	-	1036	-	10355
	1990	113	125	19	37	294	6	89	-	390									
	1993	132	147	23	42	344	7	106	-	458	495	573	95	143	1306	26	459	-	1791
30	1997	163	182	29	51	424	9	133	-	566	632	736	123	181	1672	33	595	-	2300
	2007	261	296	48	80	684	14	226	-	924	1101	1297	219	306	2923	57	1077	-	4057
	2017	398	459	76	117	1049	21	363	-	1434	1804	2153	370	483	4811	94	1836	-	6741
	1990	-	-	-	-	-	-	-	-	-									
	1993	-	-	-	-	-	-	-	-	-	534	450	41	119	1143	-	295	-	1438
31	1997	-	-	-	-	-	-	-	-	-	692	507	157	134	1490	-	385	-	1874
	2007	-	-	-	-	-	-	-	-	-	1249	909	279	230	2666	-	704	-	3370
	2017	-	-	-	-	-	-	-	-	-	2120	1535	464	368	4487	-	1214	-	5702
	1990	113	77	6	30	226	10	52	-	287									
	1993	129	88	7	34	258	12	60	-	329	129	88	7	34	258	12	60	-	329
32	1997	154	106	9	39	308	14	72	-	395	154	106	9	39	308	14	72	-	395
	2007	233	162	13	56	464	23	114	-	601	233	162	13	56	464	23	114	-	601
	2017	341	239	20	77	678	35	173	-	885	341	239	20	77	678	35	173	-	885

TRAFFIC PROJECTION MISAMIS ORIENTAL

TABLE 3.2 - 5 (5)

Traffic Volume

Link	Year	w/o									with								
		Car /Van	Jeep- ney	Bus	Tru- ck	Sub- Total	Tri- cycl	Mot. cycl	Ani- mal	Total	Car /Van	Jeep- ney	Bus	Tru- ck	Sub- Total	Tri- cycl	Mot. cycl	Ani- mal	Total
	1990	84	89	11	31	214	35	26	-	275									
	1993	99	105	13	35	252	41	31	-	324	99	105	13	35	252	41	31	-	323
33	1997	123	130	16	43	312	50	39	-	401	123	130	16	43	312	50	39	-	401
	2007	205	217	26	68	516	79	68	-	663	205	217	26	68	516	79	68	-	663
	2017	324	345	40	101	809	120	112	-	1040	324	345	40	101	809	120	112	-	1040

3.3 TRAFFIC ANALYSIS AND FORECAST: DEVELOPMENT PROJECT

Traffic on development project roads was forecasted separately for passenger traffic, non-agricultural traffic and agricultural traffic. The number of passengers and commodity tonnage were estimated first, and then they were converted to the number of vehicles assuming modal distribution and occupancy/average load. Figure 3.3.-1 shows the schematic diagram of traffic forecast for development project.

3.3.1 Passenger Traffic and Non-Agricultural Traffic

The population residing within the road influence area, which is defined as the area from which local existing or potential traffic using the road derives, was obtained mainly from distribution of barangays shown in 1:50,000 topographical maps and the NCSO 1980 Census of Population and Housing, and supplemented by information obtained from barangay interviews. The population forecasts were prepared using the NCSO report.

The number of passengers and non-agricultural commodity tonnage were obtained as the product of population by the per capita generation factor. Table 3.3-1 shows the generation factors commodity used in the analysis, which was derived mainly based on the traffic survey and referring to previous studies. In the case of particular roads where the common values were deemed inapplicale, specific values were used.

TABLE 3.3-1 PER CAPITA TRAFFIC GENERATION FACTORS (MINOR ROAD):Province of Misamis Oriental

Existing Road Condition	Passenger Movement (trip/person/day)		Non-Agricultural Commodity (kg/person/day)	
	w/o	with	w/o	with
Paved/Gravel				
Good/Fair	0.12	0.12	2.0	2.0
Bad	0.10	0.11	1.6	1.8
Very Bad	0.08	0.11	0.6	1.0
Earth Road	0.03	0.06	0.5	1.0
Impassable to motoried vehicle	0.01	0.03	0.4	1.0

The modal distribution and the occupancy/average load used in the conversion to traffic volume by vehicle type were estimated individually for each road based on the road

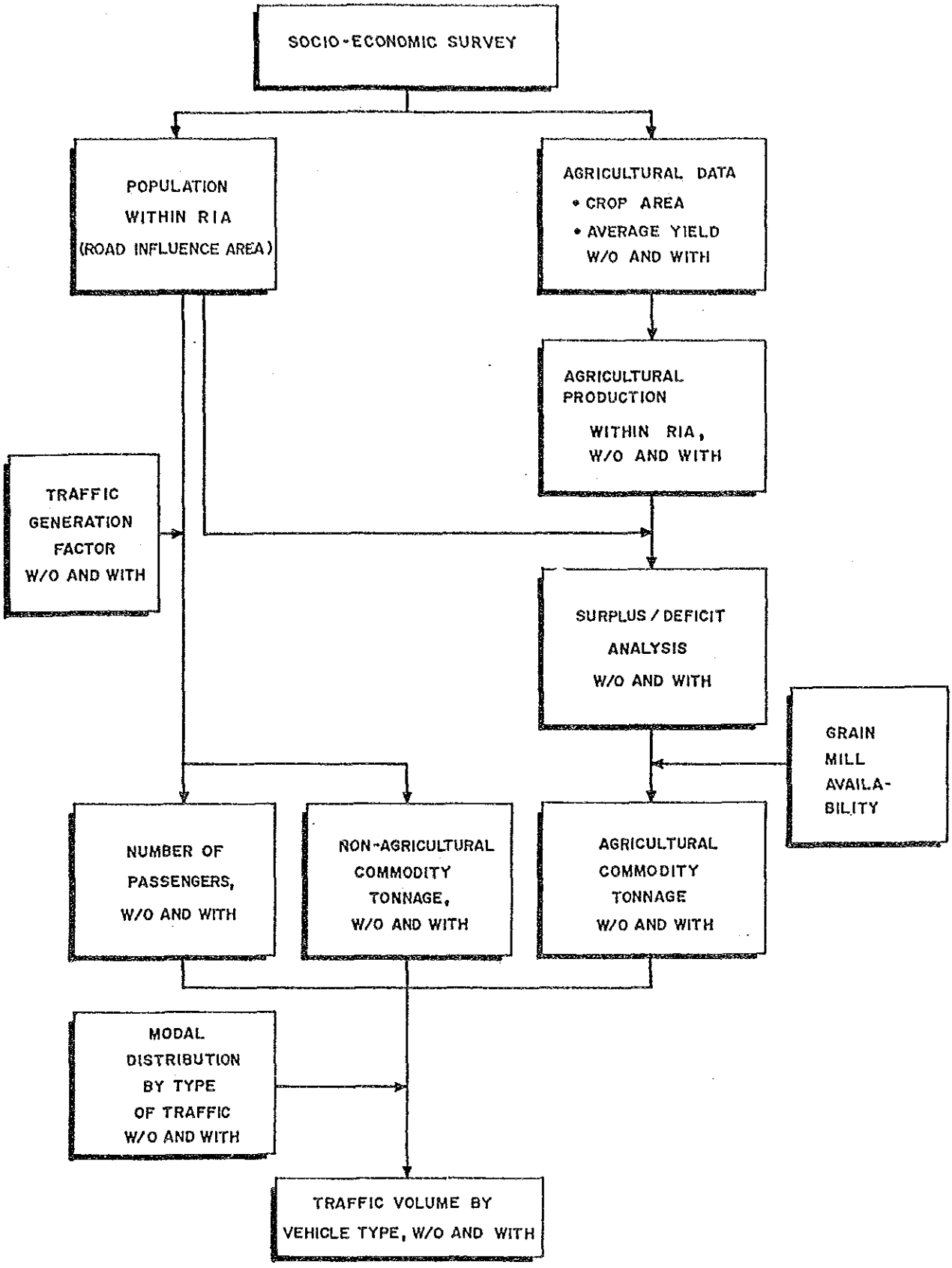


FIGURE 3.3-1
PROCEDURE OF TRAFFIC FORECAST FOR DEVELOPMENT PROJECTS

inventory survey and the traffic survey.

3.3.2 Agricultural Traffic

Agricultural commodity tonnage was estimated based on the agricultural production within the road influence area, taking into consideration i) home consuption and surplus/ deficit and ii) availability of grain mill(s) in the road influence area, as regards food grain.

i) Home consumption of food grain was calculated as population times per capita grain consumption (assumed to be 130 kg in a milled form), and the surplus or deficit production was calculated based thereupon.

ii) In case of no mill in the road influence area, all net production is assumed to move out in the form of palay/unmilled corn. Milled grain products for home comsumption are then transported back. An eventual deficit moves into the road influence area in the form of milled products.

Provided one or more mills exist in the road influence area, the transport flows are assumed as follows:

- Home consumption remains in the road influence area (no transport movement assumed).
- Surplus production would be transported out, traditionally in the form of unmilled food grains.
- Deficit production would be moved into the road influence area in milled form.

Agricultural commodity tonnage was cnverted to number of vehicles using the modal distribution and average load, which were estimated individually for each road considering the transport circumstances.

3.3.3 Estimated Present and Future Traffic

Estimated present and future traffic is presented in Table 3.4-1 in the next Section.

3.4 SUMMARY OF TRAFFIC VOLUME ON STUDIED ROADS

Estimated present and future traffic volumes of the studied roads comprising of traffic and development projects are presented by each road project in Table 3.4-1.

TABLE 3.4 - 1 (1)

Traffic Volume by Vehicle Type MISAMIS ORIENTAL

Class of Road	Type of Impr't	Road Number	w/o										with									
			Car	Jeep-ney	Bus	Truck	Total	Tri-cycle	Motor cycle	Ani-mal	Walk-ing	Boat	Car	Jeep-ney	Bus	Truck	Total	Tri-cycle	Motor cycle	Ani-mal	Walk-ing	Boat
Second'y Major	Rehab/ Imp-1	N4-1	132	147	23	42	344	7	106	-	-	-	495	573	95	143	1306	26	459	-	-	-
		N4-2	-	-	-	-	-	-	-	-	-	-	534	450	41	119	1143	0	295	-	-	-
		P88-1	129	88	7	34	258	12	60	-	-	-	129	88	7	34	258	12	60	-	-	-

TABLE 3.4 - 1 (2)

Traffic Volume by Vehicle Type MISAMIS ORIENTAL

Class of Road	Type of Impr't	Road Number	w/o										with									
			Car	Jeep-ney	Bus	Truck	Total	Tri-cycle	Motor cycle	Ani-mal	Walk-ing	Boat	Car	Jeep-ney	Bus	Truck	Total	Tri-cycle	Motor cycle	Ani-mal	Walk-ing	Boat
Minor (Nat'l/ Prov'l)	Rehab/ Impr-1	P53	51	29	7	9	96	39	-	-	193	-	79	52	-	1	133	-	53	-	-	-
		P38	46	31	-	16	94	2	-	7	-	-	34	24	3	3	64	19	18	26	-	-
		P74	1	5	-	-	7	-	49	47	162	-	19	10	1	3	34	15	2	-	36	-
		P34	37	53	-	-	90	23	71	-	163	-	55	35	6	5	101	20	31	4	-	-
		P56	51	4	-	4	60	123	17	-	-	-	54	36	-	2	92	5	37	-	-	-
		P51	2	28	-	0	30	68	37	2	387	-	78	50	-	1	129	-	52	1	-	-
		P39	23	24	-	1	48	-	21	10	115	-	31	17	3	3	54	13	17	-	-	-
		P64	0	0	-	0	0	-	1	21	115	-	10	7	-	1	18	1	8	-	6	-
		P49	-	-	-	-	-	-	-	15	470	-	47	13	-	15	76	-	-	-	-	-
		P5	-	43	-	1	44	75	34	182	489	-	99	76	-	4	180	39	70	14	-	-
		P85	-	12	-	1	12	23	11	9	241	-	33	20	-	2	55	-	23	-	-	-
		P48	52	47	-	2	101	26	47	16	-	-	61	40	-	6	107	3	40	-	-	-
		P81	-	1	-	2	3	-	2	20	132	-	10	10	-	0	19	1	9	-	15	-
		P46	-	10	-	1	11	18	8	9	131	-	25	18	-	1	44	-	18	-	-	-
		P28	32	34	-	1	68	-	31	3	50	-	40	21	4	2	68	17	23	-	-	-
		P18	3	5	-	1	8	2	4	-	7	-	8	5	-	1	13	-	5	-	-	-
		P63	-	9	-	1	10	14	6	12	103	-	20	13	-	2	35	-	13	-	-	-
		P31	50	50	-	2	103	7	51	7	138	-	65	34	7	3	109	28	37	-	-	-
		P27	9	11	-	0	20	5	14	-	32	-	14	8	1	1	25	5	7	-	-	-
		P79	-	0	-	0	1	-	1	14	194	-	1	1	1	1	5	8	1	11	-	-
		P4	-	11	-	-	11	-	-	84	27	-	14	18	-	-	32	13	27	-	59	-
		P77	-	0	-	1	1	-	4	18	105	-	6	4	1	1	12	4	-	-	13	-
		P7-1	89	63	-	3	155	35	63	8	-	-	92	55	-	5	152	36	65	-	-	-
		P84	17	24	-	1	42	13	24	12	142	-	31	20	-	3	54	4	50	-	32	-
		P82	0	0	-	-	0	-	-	17	115	-	5	6	-	1	12	4	7	-	11	-
		P23	-	-	-	-	-	-	-	8	278	-	11	9	-	0	20	5	11	4	-	-
		P16	32	38	-	3	74	34	41	-	66	-	66	42	-	2	110	6	45	-	-	-
		P67	1	2	-	0	3	0	24	8	73	-	12	7	-	0	19	4	9	-	-	-
		P44	53	56	-	1	109	5	62	10	88	-	82	51	-	2	136	5	57	-	-	-
		P17	8	16	-	1	25	7	12	3	19	-	21	13	-	2	35	-	14	-	-	-
		P26	24	27	-	1	51	-	25	3	40	-	40	27	4	-	71	-	28	2	-	-
		P88-2	16	19	-	2	37	18	19	-	30	-	28	18	3	1	49	11	15	-	-	-
		P60	-	15	-	2	17	28	13	-	184	-	33	20	-	3	55	3	53	-	34	-
		P66	1	2	-	0	3	-	21	9	63	-	9	6	-	0	15	0	14	-	44	-
	Imp-2/ Widen	P55	32	-	-	-	32	102	14	-	-	-	34	-	-	-	34	95	15	-	-	-
		P59	29	19	-	2	50	1	45	-	29	-	35	23	-	0	58	1	23	-	-	-

TABLE 3.4 - 1 (3)

Traffic Volume by Vehicle Type MISAMIS ORIENTAL

Class of Road	Type of Impr t	Road Number	w/o										with									
			Car	Jeep -ney	Bus	Truck	Total	Tri- cycle	Motor cycle	Ani- mal	Walk -ing	Boat	Car	Jeep -ney	Bus	Truck	Total	Tri- cycle	Motor cycle	Ani- mal	Walk -ing	Boat
Minor (Baran- gay)	Rehab/ Imp-1	B07-14	-	30	-	24	53	-	-	49	319	-	30	36	-	3	69	28	38	-	60	-
		B00-21	-	56	-	-	56	-	-	407	121	-	141	92	-	4	237	2	105	10	-	-
		B20-6	7	2	-	0	9	-	-	20	71	-	10	5	1	1	17	4	5	-	-	-
		B07-13	-	53	-	44	98	-	-	54	245	-	97	66	-	2	165	7	64	-	-	-
		B02-12	1	1	4	-	6	17	54	29	156	-	27	19	-	1	48	3	18	-	-	-
		B00-16	2	5	-	-	7	-	62	46	199	-	16	19	-	2	37	15	20	-	32	-
		B03-2	-	4	-	1	6	-	2	47	87	-	9	11	-	0	20	6	8	-	13	-
		B07-6	2	-	-	0	3	-	101	46	453	-	44	27	-	4	75	-	29	-	-	-
		B16-5	-	-	-	-	-	-	-	39	41	-	5	7	-	1	13	-	4	2	-	-
		B07-12	-	18	-	15	33	-	-	29	180	-	38	25	-	1	64	3	25	-	-	-
		B00-19	13	13	-	0	26	8	14	-	22	-	15	15	-	0	30	9	17	-	27	-
		B05-22	-	3	-	2	5	-	2	43	100	-	17	14	-	0	32	1	15	4	-	-
		B23-3	-	-	-	-	-	-	-	19	62	-	7	5	-	0	13	-	4	-	-	-
		B12-1	2	10	-	0	11	17	8	-	109	-	17	17	-	0	34	-	17	-	27	-
		B00-1	24	17	-	1	42	7	22	4	-	-	24	17	-	2	42	1	16	-	-	-
		B07-8	78	96	-	1	176	12	99	25	129	-	129	83	-	28	240	29	-	-	-	-
		B00-18	-	7	-	1	8	11	5	7	125	-	16	11	-	1	28	2	10	-	-	-
		B00-2	10	8	-	0	18	3	10	2	-	-	10	8	-	1	18	1	7	-	-	-
		B00-8	13	7	-	1	20	-	21	14	63	-	28	6	1	0	35	5	8	-	-	-
		B00-4	23	23	-	0	46	-	25	-	47	-	37	25	-	0	62	1	25	-	-	-
		B09-2	9	7	-	2	18	-	-	1	-	-	10	7	-	0	17	-	7	-	-	-
	Imp-2/ Widen	B00-23	131	89	-	13	233	-	223	-	200	7	170	106	6	1	283	7	135	-	-	-
	New Const.	B02-7	1	0	-	-	1	-	8	39	178	-	12	9	-	2	23	1	7	-	-	-

CHAPTER 4
PROJECT IDENTIFICATION AND SCREENING

4.1 PROJECT IDENTIFICATION

4.1.1 Field Surveys

Field survey was conducted by the Study Team to assess present condition of all major roads and some other typical minor roads (these are referred to as "Surveyed Roads").

Road projects (mostly minor roads) proposed by the local officials were also collected and road conditions of these roads were obtained by the interview survey (these are referred to as " Road Projects proposed by local officials").

Road projects surveyed by the Study Team and proposed by the local officials were combined and integrated, because some road projects were both surveyed by the Study Team and also proposed by the local officials, and a list of Studied Roads was prepared.

Summaries of "Surveyed Roads", "Road Projects proposed by Local officials "and" Studied Roads" are shown in Table 4.1-1.

TABLE 4.1-1 SUMMARY OF SURVEYED ROADS
Road Projects Proposed by Local Officials and Studied Roads
Province of Misamis Oriental

	Road Class	National Roads	Prov'l/City Roads	Barangay Roads	Total
Surveyed Road	Major Rd.	343.3	4.4	-	347.7
	Minor Rd.	-	391.8	-	391.8
	Total	343.3	396.2	-	739.5
Rd. Proj. Proposed by Local Officials	Major Rd.	84.3	4.4	-	88.7
	Minor Rd.	-	277.0	293.3	570.3
	Total	84.3	281.4	293.3	659.0
Studied Road	Major Rd.	343.3	4.4	-	347.7
	Minor Rd.	-	495.0	313.8	808.8
	Total	343.3	499.4	313.8	1,156.5

4.1.2 Project Identification

1) Project Identification Criteria

Project identification criteria are shown in Table 4.1-2.

TABLE 4.1-2 PROJECT IDENTIFICATION CRITERIA

Item	Condition of Identification	
	Major Roads	Minor Roads
(1) Existing Links		
* Carriageway Width	Less than 6.0 meter	Less than 4.0 meters
* Pavement Type	Inferior to recommended type in the engineering Standards	Inferior to gravel
* Surface Condition	Bad or very bad 1/	Bad or very bad2/
(2) New Links	Impassable Abandoned Non-existing	
(3) Bridges	Ford crossing Spillway Timber bridge Bailey bridge	Ford crossing Spillway in structurally unsound condition Bailey bridge for AADT more than 300

Notes: 1/ Gravel road which is proposed for improvement by local officials shall be identified, even though surface condition is "fair".

2/ Gravel road of which surface condition is "fair" shall be identified, as the surface condition of gravel minor roads is easily deteriorated.

2) Identified Road Projects

All studied Roads, except those of the national primary roads and committed roads, were evaluated in accordance with the identification criteria. Road projects identified are summarized in Table 4.1-3.

TABLE 4.1-3 SUMMARY OF IDENTIFIED ROAD PROJECTS
Province of Misamis Oriental

Road Class		National Road	Prov'l/City Road	Barangay Road	Total
Major Road	Length (kms.)	70.8	4.1	-	75.2
	(% to Studied Roads)	(21%)	(100%)	-	(22%)
Minor Road	Length (kms.)	-	495.0	293.3	788.3
	(% to Studied Roads)	-	(100%)	(93%)	(97%)
Total	Length (kms.)	70.8	499.4	293.3	863.5
	(% to Studied Roads)	(21%)	(100%)	(93%)	(75%)

4.2 PROJECT SCREENING

4.2.1 Categorization

Road projects are categorized by the following factors in order to establish comprehensive prioritization criteria:

(1) Class of Roads

Major Roads	Minor Roads
* Primary major roads	*National/provincial/city roads
* Secondary major roads	* Barangay roads

(2) Urgency of work

Improvement criteria for roads and bridges are established as shown in Tables 4.2-1 and 4.2-2, respectively. Improvement works are classified into five (5) types as shown in Table 4.2-3. In view of the urgency of work to be implemented, the types of improvement are grouped into two (2) as follows:

Type A (Urgent Projects)

* Rehabilitation: Improvement of deteriorated road surface, but standard or superior class pavement, to acceptable condition.
* Improvement -1: Improvement of deteriorated road surface and substandard class pavement, to acceptable and standard pavement.
* New Construction: Construction of new road including re-construction of abandoned road.

Type B (Less Urgent Projects)

* Improvement -2: Upgrading of substandard pavement class to standard pavement class, though existing road surface condition is acceptable.
* Widening : Widening of roads with substandard carriageway width, other conditions meet engineering standards.

Note: Road projects which include only improvement of bridges are classified as "Rehabilitation".

(3) Economic Viability

Major Roads

Simplified economic evaluation is conducted for major roads. Internal Rate of Return (IRR) is calculated based on roughly estimated construction cost and traffic cost savings. Categorization is made as follows:

Improvment Type A:

* IRR of 7.5% or more
* IRR of less than 7.5%

Improvement Type B:

* IRR of 15% or more
* IRR of less than 15.0%

Minor Roads

Minor road Pre-evaluation Indicator (MPI) is developed based on Phase-1 Study results. Categorization of minor roads is made based on calculated MPI as follows:

* MPI of 7.5 or more
* MPI of less than 7.5

TABLE 4.2-1 IMPROVEMENT CRITERIA FOR ROAD

Road Class	Major Road		Minor Road	
	Standard/ Superior	Substandard	Standard/ Superior	Substandard
Good/Fair	No improvement or widening (widening)	Upgrading of pavement type (improvement-2)	No improvement	No improvement
Bad/Very bad	Improvement of surface condition (Rehabilitation)	Upgrading of pavement type (improvement-1)	Improvement surface con (Rehabilitation)	Upgrading of pavement type (Improvement-1)
Abandoned/ Non-existing	Construction of new road (New Construction)			

Note: 1) In case of carriageway width less than 6.0 meters.

TABLE 4.2-2 IMPROVEMENT CRITERIA FOR BRIDGES

Existing Bridge Type	Proposed Improvement	
	Major Road	Minor Road
Ford Crossing	2-lane permanent bridge	Carriageway width 4.0 m: 1-lane spillway Carriageway width 6.0 m: 2-lane spillway
Spillway	2-lane permanent bridge	No improvement
Timber Bridge	2-lane permanent bridge	AADT less than 200 : 1-lane permanent bridge AADT more than 200 : 2-lane permanent bridge
Bailey Brridge	2-lane permanent bridge	AADT less than 300 : No improvement AADT more than 300 : 2-lane permannet bridge

Note: 1) Where the site condition is not favorable for a spillway, a permanent bridge should be planned in accordance with the criteria for a timber bridge.

2) When the existing spillway is structurally sound and traffic disturbance is estimated less, the existing one can be utilized. Under other conditions, a permanent bridge should be planned in accordance with the criteria for a timber bridge.

TABLE 4.2-3 TYPES OF IMPROVEMENT

Type	Existing Pavement Type	Existing Surface Condition	Proposed Improvement Work
Rehabilitation	Standard or superior	Bad/ very bad	Improvement of surface condition
Improvement-1	Substandard	Bad/ very bad	Upgrading of surface type
Improvement-2	Substandard	Good/Fair	Upgrading of surface type
Widening	Standard (carriageway is narrowed than standard)	Good/Fair	Widening of existing road
New Construction	Impassable/abandoned non-existing		Construction of new road

Note: Improvement-2 and widening are not applied to minor roads.

4.2.2 Prioritization and Selection Criteria

Prioritization and selection criteria of road projects for feasibility studies are established as shown in Tables 4.2-4 and 4.2-5.

TABLE 4.2-4 PRIORITIZATION AND SELECTION OF ROAD PROJECTS
- Major Roads -

Category	Road Class	Type of Improvement	IRR	Priority Criteria	Selection Criteria
1	Primary	A	7.5 ≦ IRR	MA-1	↑
2	Secondary	A	7.5 ≦ IRR	MA-1	↑
3	Primary	B	15.0 ≦ IRR	MA-2	To be selected for F/S
4	Secondary	B	15.0 ≦ IRR	MA-2	To be selected for F/S
5	Primary	A	IRR < 7.5	MA-2	To be selected for F/S
6	Secondary	A	IRR < 7.5	MA-2	To be selected for F/S
7	Primary	B	IRR < 15.0	MA-3	↓
8	Secondary	B	IRR < 15.0	MA-3	↓

TABLE 4.2-5 PRIORITIZATION AND SELECTION OF ROAD PROJECTS
- Minor Roads -

Category	Road Class	Type of Improvement	MPI	Priority Criteria	Selection Criteria
1	National/Provincial/City	A	7.5 ≦ MPI	MI-1	↑
2	Barangay	A	7.5 ≦ MPI	MI-1	To be selected for F/S
3	National/Provincial/City	A	MPI < 7.5	MI-2	↓
4	Barangay	A	MPI < 7.5	MI-2	↓

Note: Improvement Type A: Rehabilitation, Improvement-1, New Construction
Improvement Type B: Improvement-2, Widening

4.2.3 Priority of Identified Road Projects

Identified projects were evaluated and prioritized in accordance with criteria discussed and summarized in Tables 4.2-6 and 4.2-7.

TABLE 4.2-6 PRIORITY OF IDENTIFIED MAJOR ROADS
Province of Misamis Oriental

Category	Road Class	Type of Improvement	IRR	Priority Group	Road Length	No. of Road Links
1	Primary	A	7.5 ≤ IRR	MA-1	-	-
2	Secondary	A	7.5 ≤ IRR	MA-1	70.8	2
3	Primary	B	15.0 ≤ IRR	MA-2	-	-
4	Secondary	B	15.0 ≤ IRR	MA-2	-	-
5	Primary	A	IRR<7.5	MA-2	-	-
6	Secondary	A	IRR<7.5	MA-2	4.4	1
7	Primary	B	IRR<15.0	MA-3	-	-
8	Secondary	B	IRR<15.0	MA-3	-	-
	Total				75.2	3

Table 4.2-7 PRIORITY OF IDENTIFIED MINOR ROADS
Province of Misamis Oriental

Category	Road Class	Type of Improvement	MPI	Priority Group	Road Length	No. of Rd.Links
1	Nat'l/Provi/ City	A	7.5 ≤ MPI	MI-1	355.6	50
2	Barangay	A	7.5 ≤ MPI	MI-1	179.8	32
3	Nat'l/Provi/	A	MPI < 7.5	MI-2	139.4	35
4	Barangay	A	MPI < 7.5	MI-2	113.5	29
	Total				788.3	146

4.2.4 Selection of Road Projects For Feasibility Studies

In accordance with selection criteria discussed above, road projects under priority groups MA-1 and MA-2 for major roads and priority groups MI-1 for minor roads were initially selected, and these were plotted on 1:100,000 map to evaluate the following:

- Distribution of initially selected road projects (when these are concentrated in certain area, some minor roads were deleted, and where road projects are scarce, some minor roads were added.)

- Linkage of road projects
  (There is a case that a selected lower class road is connected with a higher class road, however, the latter is not selected due to lower priority. Such a case, a higher class road is also selected to maintain similar condition of road after implementation.)

After adjustment mentioned above, road projects were finally selected and summarized as follows:

Major Road	74.2 kms.	(3 projects)
Minor Road	425.6 kms.	(59 projects)
Total	499.8 kms.	(62 projects)

CHARTER 5
PROJECT EVALUATION

5.1 PRELIMINARY DESIGN AND COST ESTIMATE

5.1.1 Preliminary Design

1) Design Concept
There are two options in design concept for rural road improvement, as follows :

* Designing rural roads with optimum standards aimed at improving all aspects including horizontal and vertical alignments, which sometimes require massive earth works and is costly.

* Designing rural roads by basically concentrating on improving surface conditions, thus improving horizontal and vertical alignments is limited to the required minimum.

Rural roads are extensive in the number of road links as well as in length, and their present conditions are still at a poor level. Thus, requirements for rural road improvement are quite huge, while financial resources are limited. Under these circumstances, the Study Team placed priority on improving surface conditions of more roads. The preliminary design was undertaken in line with the concept of the second option.

2) Preliminary Design
On the basis of the findings of the road inventory survey, the type of improvement was determined for each subsection of road in accordance with the engineering standards and the improvement criteria.

Typical road sections for each type of improvement/rehabilitation are summarized as shown in Table 5.1-1.

Special considerations were given to steep gradient sections and flood section.

"PCC pavement for steep gradient section" was applied to sections with steep gradients where otherwise gravel surfacing might be applied, as a countermeasure against excessive gravel losses during heavy rains and impossibility for vehicles to climb. "Grade raising in flood area", was applied to sections located in flood areas.

Table 5.1-2 shows the proposed improvement for each road project subjected to the feasibility study.

TABLE 5.1-1 EXISTING CONDITION VS PROPOSED IMPROVEMENT/REHABILITATION

Type of Improvement	Road Section Type	Existing Pavement Type	Existing Pavement Condition	Proposed Pavement Type	Pavement Structure (cm) Surface Course	Base	Subbase
Rehabilitation	1 - 1	PCC	Bad/Very Bad	PCC	20 - 23	-	10
	1 - 2	PCC	Bad/Very Bad	AC Overlay	5	-	-
	1 - 3	Bituminous	- do -	AC	5	20	10
	1 - 4	Bituminous	- do -	AC Overlay	5	-	-
	1 - 5	Bituminous	- do -	BMP/DBST	5.5/1.6	15	5
	1 - 6	Gravel	- do -	Gravel	15	-	10
Improvement - 1	2 - 1	Bituminous	Bad/Very Bad	PCC	20 - 23	-	10
	2 - 2	Gravel	- do -	PCC	20 - 23	-	20
	2 - 3	Gravel	- do -	AC	5	20	20
	2 - 4	Gravel	- do -	BMP/DBST	5.5/1.6	15	15
	2 - 5	Earth	Any Condition	PCC	20 - 23	-	20
	2 - 6	Earth	- do -	AC	5	20	20
	2 - 7	Earth	- do -	BMP/DBST	5.5/1.6	15	15
	2 - 8	Earth	- do -	Gravel	15	-	10
Improvement - 2	3 - 1	Bituminous	Good/fair	PCC	20 - 23	-	10
	3 - 2	Gravel	- do -	PCC	20 - 23	-	10
	3 - 3	Gravel	- do -	AC	5	20	10
	3 - 4	Gravel	- do -	BMP/DBST	5.5/1.6	15	5
Widening	4 - 1	PCC	Good/fair	Widening w/PCC	20 - 23	-	20
	4 - 2	Bituminous	- do -	Widening w/AC	5	20	20
	4 - 3	Bituminous	- do -	Widening w/BMP/DBST	5.5/1.6	15	15
	4 - 4	Gravel	- do -	Widening w/Gravel	15	-	10
New Construction	5 - 1	-	-	PCC	20 - 23	-	20
	5 - 2	-	-	AC	5	20	20
	5 - 3	-	-	BMP/DBST	5.5/1.6	15	15
	5 - 4	-	-	Gravel	15	-	10
Special Treatment	6	PCC pavement for steep gradient section					
	7	Grade raising in flood area					

TABLE 5.1 - 2 (1)

Summary of Proposed Improvement MISAMIS ORIENTAL

Secondary Major

Type of Impr't	Road Number	Length (km)	1993 AADT w/o	1993 AADT with	Existing Condition L	Width	Type	Condition	Proposed Improvement	Proposed Bridge (Number/Total Length)	Cost (Million Peso) Road	Bridge	Total	IRR (%)
Rehab/ Imp-1	N4-1	17.0	344	1306	2.3	6.0	BT	Bad/V.Bad	Imp-1(6.0-PCC)		8.44	.00	8.44	100.0 (T)
					13.8	6.0	BT	Good/Fair	-					
					.9	4.9	GRV	Fair	Imp-2(6.0-PCC)					
	N4-2	53.0	0	1143	1.2	8.0	PCC	Good	-	1-cell BC (n= 1,L= 4m)	170.47	32.41	202.88	20.6 (T)
					2.0	4.0	GRV	Fair	Imp-2(6.0-PCC)	2-lane Br (n=14,L=396m)				
					39.6	2.5-5.0	GRV	Bad/V.Bad	Imp-1(6.0-PCC)					
					10.2	3.0-4.5	EAR	V.Bad/Impa	Imp-1(6.0-PCC)					
	P88-1	4.2	258	258	1.2	5.0	PCC	Good	Widen(6.0-PCC)		6.67	.00	6.67	6.8 (T)
					2.1	6.0	GRV	Bad	Imp-1(6.0-BMP)					
					.9	4.7	GRV	Fair	Imp-2(6.0-BMP)					

(T):Traffic Project
(D):Development Project

TABLE 5.1 - 2 (2)

Summary of Proposed Improvement MISAMIS ORIENTAL

Minor(National/Provincial)

Type of Impr't	Road Number	Length (km)	1993 AADT w/o	1993 AADT with	Existing Condition L	Width	Type Condition	Proposed Improvement	Proposed Bridge (Number/Total Length)	Cost (Million Peso) Road	Bridge	Total	IRR (%)
Rehab/ Imp-1	P53	2.8	96	133	1.8	4.5-6.0	GRV Fair/Bad	Rehab(6.0-GRV)		1.08	.00	1.08	29.9 (D)
					1.0	6.0	PCC Good	-					
	P38	12.5	94	64	2.6	3.2-3.3	GRV Bad/V.Bad	Rehab(6.0-GRV)		12.32	.00	12.32	21.4 (D)
					9.9	3.2-3.6	EAR Bad/V.Bad	Imp-1(6.0-GRV)					
	P74	3.1	7	34	.3	5.1	PCC Good	Widen(6.0-PCC)		2.58	.00	2.58	18.9 (D)
					2.8	2.8-3.9	GRV Bad/V.Bad	Rehab(6.0-GRV)					
	P34	19.2	90	101	2.1	6.0	PCC Good	-	2-lane Sp (n= 2,L= 22m)	15.09	.97	16.05	17.5 (D)
					4.7	4.5-6.0	GRV Bad	Rehab(6.0-GRV)	2-cell BC (n= 1,L= 8m)				
					1.8	5.5	GRV Fair	Widen(6.0-GRV)					
					10.6	2.4-4.3	EAR Bad/V.Bad	Imp-1(6.0-GRV)					
	P56	1.2	60	92	.4	3.2	GRV Fair	Widen(6.0-GRV)		1.57	.00	1.57	16.5 (D)
					.8	4.0	BT V.Bad	Rehab(6.0-BMP)					
	P51	8.8	30	129	4.9	2.4-3.6	GRV Bad/V.Bad	Rehab(6.0-GRV)		8.26	.00	8.26	15.4 (D)
					1.3	3.0	GRV Fair	Widen(6.0-GRV)					
					2.6	2.6-3.2	EAR V.Bad	Imp-1(6.0-GRV)					
	P39	16.2	48	54	3.5	2.4-3.4	GRV Bad	Rehab(6.0-GRV)	2-lane Sp (n= 4,L= 80m)	19.17	2.02	21.19	15.0 (D)
					12.7	2.4-3.0	EAR Bad/V.Bad	Imp-1(6.0-GRV)	2-cell BC (n= 1,L= 10m)				
	P64	2.9	0	18	2.3	3.0-3.2	EAR V.Bad	Imp-1(6.0-GRV)		1.92	.00	1.92	14.3 (D)
					.6	2.8	GRV Bad	Rehab(6.0-GRV)					
	P49	2.2	0	76	1.7	2.6-2.7	GRV V.Bad	Rehab(6.0-GRV)		2.46	.00	2.46	14.0 (D)
					.4	2.1-4.2	PCC Good/Fair	Widen(6.0-PCC)					
					.1	2.4	GRV V.Bad	Imp-1(6.0-PCC)					
	P5	23.0	44	180	.1	5.5	BT Good	Widen(6.0-BMP)		49.58	.00	49.58	11.0 (D)
					19.1	2.4-4.9	GRV Bad/V.Bad	Imp-1(6.0-BMP)					
					1.8	3.8	GRV Fair	Imp-2(6.0-BMP)					
					2.0	.4-1.6	EAR V.Bad/Impa	Imp-1(6.0-BMP)					
	P85	3.9	12	55	3.9	3.2-4.5	GRV Bad/V.Bad	Rehab(6.0-GRV)		3.29	.00	3.29	10.6 (D)
	P48	21.5	101	107	.1	6.0	PCC Good	-		20.80	.00	20.80	10.1 (D)
					19.7	2.8-5.0	GRV Bad/V.Bad	Rehab(6.0-GRV)					
					1.7	3.2	EAR V.Bad	Imp-1(6.0-GRV)					
	P81	1.2	3	19	1.2	2.4-2.8	GRV Bad	Rehab(6.0-GRV)		1.42	.00	1.42	9.8 (D)
	P46	11.3	11	44	11.3	2.0-3.5	GRV Bad/Impas	Rehab(6.0-GRV)		8.55	.00	8.55	9.7 (D)
	P28	12.4	68	68	4.2	6.0	GRV Fair	-		6.08	.00	6.08	9.5 (D)
					2.2	4.5-5.5	GRV Fair	Widen(6.0-GRV)					
					1.4	3.2-6.0	GRV Bad	Rehab(6.0-GRV)					
					.2	5.0	PCC Good	Widen(6.0-PCC)					
					4.4	2.4-2.8	EAR V.Bad	Imp-1(6.0-GRV)					

(T):Traffic Project

TABLE 5.1 - 2 (3)

Summary of Proposed Improvement MISAMIS ORIENTAL

Minor(National/Provincial)(Continued)

Type of Impr't	Road Number	Length (km)	1993 AADT w/o	1993 AADT with	Existing Condition L	Width	Type Condition	Proposed Improvement	Proposed Bridge (Number/Total Length)	Cost (Million Peso) Road	Bridge	Total	IRR (%)
Rehab/ Imp-1	P18	2.7	8	13	.6	2.8	GRV V.Bad	Rehab(4.0-GRV)		1.37	.00	1.37	8.6 (D)
					2.1	2.8-3.2	EAR Bad/V.Bad	Imp-1(4.0-GRV)					
	P63	5.0	10	35	.4	4.3	PCC Good	Widen(6.0-PCC)		5.74	.00	5.74	8.6 (D)
					3.7	3.0-3.4	GRV Bad/V.Bad	Rehab(6.0-GRV)					
					.9	3.4	EAR V.Bad	Imp-1(6.0-GRV)					
	P31	7.3	103	109	5.7	2.4-3.4	GRV Bad/V.Bad	Rehab(6.0-GRV)		6.60	.00	6.60	8.4 (D)
					1.1	2.4	EAR Bad	Imp-1(6.0-GRV)					
					.5	2.8	GRV Fair	Widen(6.0-GRV)					
	P27	6.7	20	25	1.2	4.0	GRV Bad	Rehab(6.0-GRV)	2-lane Br (n= 2,L= 17m)	4.61	2.27	6.88	7.0 (D)
					5.5	2.4-4.0	EAR V.Bad	Imp-1(6.0-GRV)					
	P79	3.4	1	5	1.6	2.2-2.9	GRV Bad/V.Bad	Rehab(6.0-GRV)		4.50	.00	4.50	6.8 (D)
					1.8	2.0-3.2	EAR V.Bad	Imp-1(6.0-GRV)					
	P4	4.7	11	32	2.5	3.0	GRV Bad/V.Bad	Rehab(6.0-GRV)		4.02	.00	4.02	6.7 (D)
					2.2	2.8	EAR Impas	Imp-1(6.0-GRV)					
	P77	3.0	1	12	1.7	3.2-3.4	GRV Bad/V.Bad	Rehab(6.0-GRV)		2.49	.00	2.49	5.8 (D)
					1.3	4.0	EAR Impas	Imp-1(6.0-GRV)					
	P7-1	9.8	155	152	.2	5.3	PCC Good	Widen(6.0-PCC)		6.26	.00	6.26	5.4 (D)
					3.2	4.0	GRV Fair	Widen(6.0-GRV)					
					6.4	4.0	GRV Bad/V.Bad	Rehab(6.0-GRV)					
	P84	9.0	42	54	1.0	5.2	BT Bad	Rehab(6.0-BMP)		6.93	.00	6.93	5.2 (D)
					.3	4.7	GRV Bad	Rehab(6.0-GRV)					
					.2	5.2	PCC Good	Widen(6.0-PCC)					
					.7	2.8	GRV Fair	Widen(4.0-GRV)					
					6.8	1.6-3.2	GRV Bad/Impas	Rehab(4.0-GRV)					
	P82	3.2	0	12	2.2	2.9-3.2	GRV Bad/V.Bad	Rehab(6.0-GRV)		3.15	.00	3.15	4.5 (D)
					1.0	3.2	GRV Fair	Widen(6.0-GRV)					
	P23	13.8	0	20	.1	4.0	BT Fair	Widen(6.0-BMP)		13.29	.00	13.29	4.3 (D)
					.7	4.2	PCC Good	Widen(6.0-PCC)					
					3.1	3.2-4.5	GRV Bad	Rehab(6.0-GRV)					
					9.9	2.8-4.5	EAR Bad/Impas	Imp-1(6.0-GRV)					
	P16	11.4	74	110	.1	3.2	GRV Fair	Widen(6.0-GRV)	2-lane Sp (n= 3,L= 95m)	10.60	1.72	12.33	3.0 (D)
					.1	5.0	PCC Good	Widen(6.0-PCC)					
					10.6	2.8-3.6	GRV Bad/V.Bad	Rehab(6.0-GRV)					
					.6	4.0	BT V.Bad	Rehab(6.0-BMP)					
	P67	3.0	3	19	.6	3.5-5.0	BT Bad/V.Bad	Rehab(6.0-BMP)		2.56	.00	2.56	2.3 (D)
					.3	5.0	PCC Good	Widen(6.0-PCC)					
					.7	3.5	EAR Bad	Imp-1(6.0-GRV)					
					1.4	3.2	GRV V.Bad	Rehab(6.0-GRV)					

(T):Traffic Project
(D):Development Project

TABLE 5.1 - 2 (4)

Summary of Proposed Improvement MISAMIS ORIENTAL

Minor(National/Provincial)(Continued)

Type of Impr't	Road Number	Length (km)	1993 AADT w/o	1993 AADT with	Existing Condition L	Width	Type	Condition	Proposed Improvement	Proposed Bridge (Number/Total Length)	Cost (Million Peso) Road	Bridge	Total	IRR (%)
Rehab/ Imp-1	P44	9.6	109	136	.4	6.2	BT	V.Bad	Rehab(6.0-BMP)		19.52	.00	19.52	2.2 (D)
					1.5	6.0-6.5	BT	Fair	-					
					2.2	6.0	GRV	Fair	-					
					.1	6.0	PCC	Good	-					
					5.4	4.0-4.5	GRV	Bad/V.Bad	Rehab(6.0-GRV)					
	P17	8.6	25	35	7.5	2.8-4.5	GRV	V.Bad	Rehab(6.0-GRV)	2-lane Sp (n= 1,L= 10m)	6.23	.18	6.41	1.7 (D)
					1.1	2.8-3.2	EAR	V.Bad	Imp-1(6.0-GRV)					
	P26	8.2	51	71	.2	4.0	PCC	Good	Widen(6.0-PCC)	2-lane Br (n= 2,L= 24m)	11.44	2.60	14.04	1.6 (D)
					8.0	3.2-3.6	GRV	V.Bad	Rehab(6.0-GRV)					
	P88-2	9.8	37	49	5.2	2.6-4.7	EAR	Bad	Imp-1(6.0-GRV)		6.91	.00	6.91	1.5 (D)
					4.3	3.2-4.0	GRV	Bad	Rehab(6.0-GRV)					
					.3	4.0	BT	V.Bad	Rehab(6.0-BMP)					
	P60	3.0	17	55	.1	4.7	BT	Fair	Widen(6.0-BMP)	2-lane Sp (n= 1,L= 60m)	2.99	1.09	4.07	1.5 (D)
					.3	5.0	PCC	Good	Widen(6.0-PCC)					
					1.8	3.1-3.6	GRV	Bad	Rehab(6.0-GRV)					
					.8	4.0	BT	Bad	Rehab(6.0-BMP)					
	P66	3.0	3	15	.2	4.0	PCC	Good	Widen(6.0-PCC)		2.05	.00	2.05	.0 (D)
					2.8	2.2-2.8	GRV	Bad/V.Bad	Rehab(6.0-GRV)					
Imp-2/ Widen	P55	1.7	32	34	1.0	4.0	GRV	Fair	Widen(6.0-GRV)		1.05	.00	1.05	3.4 (D)
					.7	2.8	GRV	V.Bad	Rehab(6.0-GRV)					
	P59	2.1	50	58	.1	5.1	BT	Bad	Imp-1(6.0-PCC)		1.64	.00	1.64	3.1 (D)
					1.6	5.0	PCC	Good	Widen(6.0-PCC)					
					.4	3.9	GRV	Bad	Rehab(6.0-GRV)					

(T):Traffic Project
(D):Development Project

TABLE 5.1 - 2 (5)

Summary of Proposed Improvement MISAMIS ORIENTAL

Minor(Barangay)

Type of Impr't	Road Number	Length (km)	1993 AADT w/o	1993 AADT with	Existing Condition L	Existing Condition Width	Existing Condition Type Condition	Proposed Improvement	Proposed Bridge (Number/Total Length)	Cost (Million Peso) Road	Cost (Million Peso) Bridge	Cost (Million Peso) Total	IRR (%)
Rehab/ Imp-1	B07-14	9.7	53	69	4.4	2.8-3.6	GRV Bad/V.Bad	Rehab(4.0-GRV)	1-cell BC (n= 1,L= 4m)	6.17	.33	6.49	30.6 (D)
					.5	4.1	BT Bad	Rehab(6.0-BMP)					
					1.0	3.3	GRV Fair	Widen(4.0-GRV)					
					3.8	2.8-3.4	EAR V.Bad	Imp-1(4.0-GRV)					
	B00-21	7.3	56	237	6.4	3.2-4.7	GRV Bad/V.Bad	Imp-1(6.0-BMP)		13.83	.00	13.83	25.1 (D)
					.6	3.2-4.9	BT V.Bad	Rehab(6.0-BMP)					
					.3	5.1	PCC Fair	Widen(6.0-PCC)					
	B20-6	5.0	9	17	3.8	2.4-3.4	EAR V.Bad	Imp-1(4.0-GRV)	1-lane Sp (n= 2,L= 30m)	2.85	.40	3.25	22.3 (D)
					1.2		None	New-C(4.0-GRV)					
	B07-13	11.4	98	165	9.3	4.0-5.5	GRV Bad	Rehab(4.0-GRV)	1-lane Br (n= 4,L=105m)	5.60	6.16	11.76	20.7 (D)
					2.1	2.4-2.8	EAR V.Bad	Imp-1(4.0-GRV)					
	B02-12	4.1	5	48	3.0	2.4-3.2	GRV Bad/V.Bad	Rehab(4.0-GRV)		4.10	.00	4.10	20.1 (D)
					1.1	3.2	EAR Bad	Imp-1(4.0-GRV)					
	B00-16	11.7	7	37	10.9	2.8-3.2	GRV Bad/V.Bad	Rehab(4.0-GRV)	1-lane Br (n= 2,L= 52m)	7.69	3.59	11.28	19.9 (D)
					.7	2.8	EAR V.Bad	Imp-1(4.0-GRV)	1-lane Sp (n= 1,L= 15m)				
					.1	5.0	PCC Good	-	1-cell BC (n= 1,L= 4m)				
	B03-2	3.0	6	20	2.0	4.0	GRV Bad/V.Bad	Rehab(4.0-GRV)		1.76	.00	1.76	19.5 (D)
					1.0	2.8-3.8	EAR V.Bad	Imp-1(4.0-GRV)					
	B07-6	13.4	3	75	6.5	2.4-4.0	GRV Bad/Impas	Rehab(4.0-GRV)		8.61	.00	8.61	18.8 (D)
					2.0		None	New-C(4.0-GRV)					
					4.9	3.2	EAR Bad/V.Bad	Imp-1(4.0-GRV)					
	B16-5	7.0	0	13	.1	4.0	PCC Good	-		4.39	.00	4.39	16.0 (D)
					6.9	3.6	EAR V.Bad/Impa	Imp-1(4.0-GRV)					
	B07-12	6.0	33	64	2.8	2.6-3.6	GRV Fair	Widen(6.0-GRV)	2-lane Br (n= 2,L= 20m)	5.32	2.41	7.73	14.4 (D)
					3.2	2.4-3.2	EAR V.Bad	Imp-1(6.0-GRV)					
	B00-19	1.7	26	30	1.1	3.9-4.0	EAR Bad	Imp-1(4.0-GRV)		.73	.00	.73	13.4 (D)
					.2	5.1	PCC Good	-					
					.4	3.2	GRV V.Bad	Rehab(4.0-GRV)					
	B05-22	4.3	5	32	2.4	2.8-3.2	GRV Bad/V.Bad	Rehab(4.0-GRV)	1-lane Sp (n= 2,L= 50m)	9.82	.66	10.48	9.8 (D)
					1.9	3.2-4.0	EAR V.Bad	Imp-1(4.0-GRV)					
	B23-3	5.0	0	13	5.0	1.2-4.0	GRV Bad/Impas	Rehab(4.0-GRV)		3.86	.00	3.86	9.4 (D)
	B12-1	2.7	11	34	2.7	3.2-3.7	GRV V.Bad	Rehab(4.0-GRV)		1.64	.00	1.64	9.3 (D)
	B00-1	7.2	42	42	3.7	3.2-4.5	GRV Bad/V.Bad	Rehab(6.0-GRV)		6.35	.00	6.35	8.3 (D)
					3.2	4.0	GRV Fair	Widen(6.0-GRV)					
					.3	5.0	PCC Good	-					

(T):Traffic Project

TABLE 5.1 - 2 (6)

Summary of Proposed Improvement MISAMIS ORIENTAL

Minor(Barangay) (Continued)

Type of Impr't	Road Number	Length (Km)	1993 AADT w/o	1993 AADT with	Existing Condition L	Width	Type Condition	Proposed Improvement	Proposed Bridge (Number/Total Length)	Cost (Million Peso) Road	Bridge	Total	IRR (%)
Rehab/ Imp-1	B07-8	7.5	176	240	7.5	2.6-4.5	GRV Bad/V.Bad	Imp-1(6.0-BMP)	2-lane Br (n= 4,L= 82m) 2-lane Sp (n= 1,L= 50m)	14.93	8.05	22.98	8.2 (D)
	B00-18	10.7	8	28	.1	5.0	PCC Good	-	1-lane Br (n= 4,L= 48m)	23.50	4.66	28.16	5.3 (D)
					8.7	3.0-3.2	GRV Bad/V.Bad	Rehab(4.0-GRV)	1-lane Sp (n= 2,L= 47m)				
					1.9	2.8-3.0	EAR V.Bad	Imp-1(4.0-GRV)	1-cell BC (n= 1,L= 4m)				
	B00-2	5.0	18	18	1.1	4.0	GRV Fair	Widen(6.0-GRV)		4.51	.00	4.51	2.2 (D)
					1.6	4.0-4.5	EAR V.Bad	Imp-1(6.0-GRV)					
					2.0	4.0	GRV Bad/V.Bad	Rehab(6.0-GRV)					
					.3	2.4	EAR Bad	Imp-1(4.0-GRV)					
	B00-8	4.9	20	35	.5	5.1-6.0	PCC Good	-		5.72	.00	5.72	1.4 (D)
					1.2	4.0	EAR V.Bad	Imp-1(4.0-GRV)					
					3.2	3.2-3.6	GRV Bad/V.Bad	Rehab(4.0-GRV)					
	B00-4	6.1	46	62	.6	5.1	PCC Good	-		8.92	.00	8.92	1.0 (D)
					3.7	5.0	BT V.Bad	Rehab(6.0-BMP)					
					1.5	3.4	EAR V.Bad	Imp-1(4.0-GRV)					
					.3	4.0	GRV Fair	Rehab(4.0-GRV)					
	B09-2	2.3	18	17	2.3	2.0-2.4	GRV Bad/V.Bad	Rehab(4.0-GRV)		1.16	.00	1.16	.0 (D)
Imp-2/ Widen	B00-23	9.4	233	283	4.0	4.0-5.3	GRV Fair	Imp-2(6.0-BMP)	2-lane Br (n= 2,L=140m)	14.76	10.03	24.79	9.3 (D)
					.5	3.8-5.6	BT Bad	Rehab(6.0-BMP)					
					.8	5.0-5.1	PCC Good	Widen(6.0-PCC)					
					2.9	3.2-4.6	GRV Bad/V.Bad	Imp-1(5.0-BMP)					
					.8	5.6	BT Fair	Widen(6.0-BMP)					
					.4	6.0	GRV Fair	-					
New Const.	B02-7	9.0	1	23	1.1	2.8-3.2	GRV Bad/V.Bad	Rehab(4.0-GRV)		6.16	.00	6.16	20.4 (D)
					7.9		None	New-C(4.0-GRV)					

(T):Traffic Project
(D):Development Project

5.1.2 Cost Estimate

1) Unit Cost

Unit prices for construction equipment, materials and labor were obtained from Associated Construction Equipment Lessors, Inc. (ACEL), the Price Monitoring Section of DPWH, market price survey by the Study Team and relevant studies. Based on the data collected, unit prices at April 1990 prices were developed. Exchange rates used were : P22.50 = US$1.00 = Y155.

Unit costs for major construction items are presented in Table 5.1-3.

2) Construction Cost Estimate

Based on the results of the road inventory survey and proposed type of improvement, the quantity of each construction item was computed for each road project. Then the constuction cost was estimated.
Table 5.1-4 presents estimated quantities and construction cost of each road project.

TABLE 5.1-3 UNIT COST OF MAJOR CONSTRUCTION ITEMS

Unit: Pesos at April 1990 Prices

Item No.	Description	Unit	Unit Price
100	Clearing nad Grubbing	sq.m.	2.10
102	Stripping	cu.m.	52.00
106	Roadway and Drainage Excavation	cu.m.	58.00
107	Borrow	cu.m.	110.00
108	Aggregate Subbase	cu.m.	225.00
118-1	Preparation Of Previously Constructed Road (Gravel)	sq.m.	7.00
118-2	Preparation Of Previously Constructed Road (Asphalt)	sq.m.	8.00
118-3	Preparation of Existing Pavement Surface (PCC)	sq.m.	22.50
118-4	Preparation of Existing Pavement Surface (AC)	sq.m.	17.00
200	Crushed Aggregate Base Course	cu.m.	305.00
300	Crushed Aggregate Surface Course	cu.m.	305.00
302	Bituminous Prime Coat	MT	11,100.00
303	Bituminous Tact Coat	MT	11,500.00
306	Bituminous Macadam Pavement	sq.m.	95.00
310	Bituminous Concrete Surface Course	MT	1,350.00
314	Double Bituminous Surface Treatment	sq.m.	45.00
316-1	PCC Pavement (t = 23cm)	sq.m.	320.00
316-2	PCC Pavement (t = 20cm)	sq.m.	280.00
316-3	PCC Pavement (t = 18cm)	sq.m.	250.00
413-1	RCPC (Ø 910mm)	sq.m.	1,550.00
413-2	Headwal T for RCPC (Ø 910mm)	set	2,900.00
500	Grouted Riprap	sq.m.	625.00
517	Side Ditch (Grouted Riprap)	m	360.00
Bridge Cost			
	2-lane Superstructure	m	43,500.00
	Abutment for 2-lane bridge	each	330,000.00
	Pier for 2-lane bridge	each	285,000.00
	1-lane Superstructure	m	32,000.00
	Abutment for 1-lane bridge	each	230,000.00
	Pier for 1-lane bridge	each	200,000.00
Reinforced Concrete Box Culvert			
	1-Cell RCBC	m	20,600.00
	2-Cell RCBC	m	36,000.00
	Wing wall and Apron for 1-Cell RCBC	set	132,000.00
	Wing wall and Apron for 2-Cell RCBC	set	155,000.00
Spillway			
	2-lane Spillway	m	16,500.00
	1-lane Spillway	m	12,000.00
Slope Protection Cost			
	Cut Slope Protection	m	23,000.00
	Embankment Slope Protection	m	25,000.00

TABLE 5.1 - 4 (1)

Quantity and Construction Cost — MISAMIS ORIENTAL

		Unit	N4-1	N4-2	P88-1	P53	P38	P74	P34	P56	P51	P39	P64
Total Road Length		km	17.0	53.0	4.2	2.8	12.5	3.1	19.2	1.2	8.8	16.2	2.9
Improvement Length		km	3.2	51.8	4.2	1.8	12.5	3.1	17.1	1.2	8.8	16.2	2.9
Proposed Pavement Type			6.0-PCC	6.0-PCC	5.0-PCC 6.0-BMP	6.0-GRV	6.0-GRV	6.0-PCC 6.0-GRV	6.0-GRV	6.0-GRV 6.0-BMP	6.0-GRV	6.0-GRV	6.0-GRV
Quantity													
100	Clearing & Grubbing	m2	-	-	-	-	-	-	-	-	-	-	-
	Stripping	m3	-	-	-	-	-	-	-	-	-	-	-
102	Roadway & Drainage Excavation	m3	5133	333710	10954	1680	43800	7361	50210	1930	30146	105300	2175
104	Borrow	m3	-	-	-	797	3489	725	5607	138	2959	3926	914
200	Aggregate Subbase	m3	7563	132380	7341	528	8250	2130	10296	1491	5413	10692	1914
	Preparation of Prev.Road(Grvl)	m2	4410	375610	26112	11280	66070	16310	94970	1280	39372	50230	19140
	Preparation of Prev.Road(Asph)	m2	13800	-	-	-	-	-	-	3200	-	-	-
	Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
	Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	-	-
202	Crushed Aggregate Base Course	m3	-	-	3069	-	-	-	-	818	-	-	-
300	Crushed Aggr. Surface Course	m3	-	-	-	1620	10890	2520	15030	360	7550	14310	2610
301	Bituminous Prime Coat	M.T.	-	-	22	-	-	-	-	6	-	-	-
302	Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305	Bituminous Macadam Pavement	m2	-	-	18000	-	-	-	-	4800	-	-	-
310	Bitum.Concrete Surface Course	M.T.	-	-	-	-	-	-	-	-	-	-	-
304	Double Bitum.Surface Treatment	m2	-	-	-	-	-	-	-	-	-	-	-
311-1	PCC Pavement (t=23 cm)	m2	-	-	-	-	-	-	-	-	-	-	-
311-2	PCC Pavement (t=20 cm)	m2	19200	310800	1200	-	-	270	-	-	-	-	-
311-3	PCC Pavement (t=18 cm)	m2	-	-	-	-	2400	-	2400	-	1800	1800	-
500	RCPC (dia.910mm)	m	90	1560	106	60	375	83	510	30	270	480	90
	Headwall for RCPC (dia.910mm)	Set	6	104	8	4	25	6	34	2	18	32	6
504	Grouted Riprap	m3	-	-	-	-	-	-	-	-	-	-	-
	Side Ditch (Grouted Riprap)	m	-	31000	500	-	2550	700	3150	-	1900	6900	-
	Slope Protection (Cut Slope)	m	-	100	-	-	20	-	-	-	-	-	-
	Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Superstructure	m	-	396	-	-	-	-	-	-	-	-	-
	1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Abutment	Each	-	28	-	-	-	-	-	-	-	-	-
	1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Pier	Each	-	9	-	-	-	-	-	-	-	-	-
	1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
	2-lane Spillway	m	-	-	-	-	-	-	22	-	-	80	-
	1-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
	1-cell RCBC	m	-	14	-	-	-	-	-	-	-	-	-
	2-cell RCBC	m	-	-	-	-	-	-	10	-	-	10	-
	Wingwall for 1-cell RCBC	Set	-	1	-	-	-	-	-	-	-	-	-
	Wingwall for 2-cell RCBC	Set	-	-	-	-	-	-	1	-	-	1	-
	Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost		M.p.	8.44	170.47	6.67	1.08	12.32	2.58	15.09	1.57	8.26	19.17	1.92
Bridge Construction Cost		M.p.	.00	32.41	.00	.00	.00	.00	.97	.00	.00	2.02	.00
Total Construction Cost		M.p.	8.44	202.88	6.67	1.08	12.32	2.58	16.06	1.57	8.26	21.19	1.92
Road Construction Cost/Impr't km		M.p.	2.64	3.29	1.59	.60	.99	.83	.88	1.31	.94	1.18	.66
Total Construction Cost/Total km		M.p.	.50	3.83	1.59	.39	.99	.83	.84	1.31	.94	1.31	.66

TABLE 5.1 - 4 (2)

Quantity and Construction Cost MISAMIS ORIENTAL

	Unit	P49	P5	P85	P48	P81	P46	P28	P18	P63	P31	P27
Total Road Length	km	2.2	23.0	3.9	21.5	1.2	11.3	12.4	2.7	5.0	7.3	6.7
Improvement Length	km	2.2	23.0	3.9	21.4	1.2	11.3	8.2	2.7	5.0	7.3	6.7
Proposed Pavement Type		6.0-GRV 6.0-PCC	6.0-BMP	6.0-GRV	6.0-GRV	6.0-GRV	6.0-GRV	6.0-GRV 6.0-PCC	4.0-GRV	6.0-PCC 6.0-GRV	6.0-GRV	6.0-GRV
Quantity												
100 Clearing & Grubbing	m2	-	-	-	-	-	-	-	-	-	-	-
Stripping	m3	-	-	-	-	-	-	-	-	-	-	-
102 Roadway & Drainage Excavation	m3	5475	110230	2925	78192	6953	14550	18030	2363	28028	25725	5025
104 Borrow	m3	479	-	1804	5897	209	3733	2191	883	1557	2435	3786
200 Aggregate Subbase	m3	1778	39315	2574	14124	792	7458	4332	1242	3440	4678	4422
Preparation of Prev.Road(Grvl)	m2	10230	126720	25740	113150	4860	71010	43800	12090	19260	36480	44220
Preparation of Prev.Road(Asph)	m2	-	-	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	-	-
202 Crushed Aggregate Base Course	m3	-	21824	-	-	-	-	-	-	-	-	-
300 Crushed Aggr. Surface Course	m3	1395	-	3078	19170	1080	9819	7200	1566	4050	6570	6030
301 Bituminous Prime Coat	M.T.	-	154	-	-	-	-	-	-	-	-	-
302 Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305 Bituminous Macadam Pavement	m2	-	127970	-	-	-	-	-	-	-	-	-
310 Bitum.Concrete Surface Course	M.T.	-	-	-	-	-	-	-	-	-	-	-
304 Double Bitum.Surface Treatment	m2	-	-	-	-	-	-	-	-	-	-	-
311-1 PCC Pavement (t=23 cm)	m2	-	-	-	-	-	-	-	-	-	-	-
311-2 PCC Pavement (t=20 cm)	m2	1760	-	-	-	-	-	200	-	680	-	-
311-3 PCC Pavement (t=18 cm)	m2	900	9480	2880	600	-	2340	-	360	600	-	-
500 RCPC (dia.910mm)	m	53	690	120	645	30	345	240	40	143	225	195
Headwall for RCPC (dia.910mm)	Set	4	46	8	43	2	23	16	5	10	15	13
504 Grouted Riprap	m3	-	-	-	-	-	-	-	-	-	-	-
Side Ditch (Grouted Riprap)	m	450	13500	-	4750	750	450	800	-	1900	1500	-
Slope Protection (Cut Slope)	m	-	-	-	40	-	-	-	-	-	-	-
Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	17
1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	4
1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
1-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
1-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
2-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
Wingwall for 1-cell RCBC	Set	-	-	-	-	-	-	-	-	-	-	-
Wingwall for 2-cell RCBC	Set	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost	M.p.	2.46	49.58	3.29	20.80	1.42	8.55	6.08	1.37	5.74	6.60	4.61
Bridge Construction Cost	M.p.	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	2.27
Total Construction Cost	M.p.	2.46	49.58	3.29	20.80	1.42	8.55	6.08	1.37	5.74	6.60	6.88
Road Construction Cost/Impr't km	M.p.	1.12	2.16	.84	.97	1.18	.76	.74	.51	1.15	.90	.69
Total Construction Cost/Total km	M.p.	1.12	2.16	.84	.97	1.18	.76	.49	.51	1.15	.90	1.03

TABLE 5.1 - 4 (3)

Quantity and Construction Cost MISAMIS ORIENTAL

	Unit	P79	P4	P77	P7-1	P84	P82	P23	P16	P67	P44	P17
Total Road Length	km	3.4	4.7	3.0	9.8	9.0	3.2	13.8	11.4	3.0	9.6	8.6
Improvement Length	km	3.4	4.7	3.0	9.8	9.0	3.2	13.8	11.4	3.0	5.8	8.6
Proposed Pavement Type		6.0-GRV	6.0-GRV	6.0-GRV	6.0-PCC 6.0-GRV	6.0-BMP 6.0-GRV 6.0-PCC 4.0-GRV	6.0-GRV	6.0-BMP 6.0-PCC 6.0-GRV	6.0-GRV 6.0-PCC 6.0-BMP	6.0-BMP 6.0-PCC 6.0-GRV	6.0-BMP 6.0-GRV	6.0-GRV
Quantity												
100 Clearing & Grubbing	m2	-	-	-	-	-	-	-	-	-	-	-
Stripping	m3	-	-	-	-	-	-	-	-	-	-	-
102 Roadway & Drainage Excavation	m3	21450	10275	5411	9463	14577	14376	38899	36976	3119	34343	9578
104 Borrow	m3	587	2756	743	3495	2897	738	4245	3387	662	1331	3849
200 Aggregate Subbase	m3	2244	3102	1980	5236	5210	1792	9435	8142	2548	4154	5676
Preparation of Prev.Road(Grvl)	m2	11810	27020	17460	55040	24480	11460	74050	55750	13860	25520	55500
Preparation of Prev.Road(Asph)	m2	-	-	-	-	5200	-	-	2400	2400	2480	-
Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	-	-
202 Crushed Aggregate Base Course	m3	-	-	-	-	1023	-	36	614	614	409	-
300 Crushed Aggr. Surface Course	m3	2835	4230	2700	8640	4050	2880	11250	9630	1890	4860	7740
301 Bituminous Prime Coat	M.T.	-	-	-	-	7	-	0	4	4	3	-
302 Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305 Bituminous Macadam Pavement	m2	-	-	-	-	6000	-	200	3600	3600	2400	-
310 Bitum.Concrete Surface Course	M.T.	-	-	-	-	-	-	-	-	-	-	-
304 Double Bitum.Surface Treatment	m2	-	-	-	-	-	-	-	-	-	-	-
311-1 PCC Pavement (t=23 cm)	m2	-	-	-	-	-	-	-	-	-	-	-
311-2 PCC Pavement (t=20 cm)	m2	-	-	-	140	160	-	1260	100	300	-	-
311-3 PCC Pavement (t=18 cm)	m2	1500	-	-	-	4800	-	3000	-	-	-	-
500 RCPC (dia.910mm)	m	105	150	90	300	165	90	406	345	83	180	255
Headwall for RCPC (dia.910mm)	Set	7	10	6	20	18	6	28	23	6	12	17
504 Grouted Riprap	m3	-	223	-	-	-	-	-	-	-	-	-
Side Ditch (Grouted Riprap)	m	2150	500	900	-	-	1200	4000	2050	-	2200	600
Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	-	500	-
Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Spillway	m	-	-	-	-	-	-	-	95	-	-	10
1-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
1-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
2-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
Wingwall for 1-cell RCBC	Set	-	-	-	-	-	-	-	-	-	-	-
Wingwall for 2-cell RCBC	Set	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost	M.p.	4.50	4.02	2.49	6.26	6.93	3.15	13.29	10.60	2.56	19.52	6.23
Bridge Construction Cost	M.p.	.00	.00	.00	.00	.00	.00	.00	1.72	.00	.00	.18
Total Construction Cost	M.p.	4.50	4.02	2.49	6.26	6.93	3.15	13.29	12.33	2.56	19.52	6.41
Road Construction Cost/Impr't km	M.p.	1.32	.86	.83	.64	.77	.99	.96	.93	.85	3.37	.72
Total Construction Cost/Total km	M.p.	1.32	.86	.83	.64	.77	.99	.96	1.08	.85	2.03	.75

TABLE 5.1 - 4 (4)

Quantity and Construction Cost MISAMIS ORIENTAL

	Unit	P26	P88-2	P60	P66	P55	P59	B07-14	B00-21	B20-6	B07-13	B02-12
Total Road Length	km	8.2	9.8	3.0	3.0	1.7	2.1	9.7	7.3	5.0	11.4	4.1
Improvement Length	km	8.2	9.8	3.0	3.0	1.7	2.1	9.7	7.3	5.0	11.4	4.1
Proposed Pavement Type		6.0-PCC 6.0-GRV	6.0-GRV 6.0-BMP	6.0-BMP 6.0-PCC 6.0-GRV	6.0-PCC 6.0-GRV	6.0-GRV	6.0-PCC 6.0-GRV	4.0-GRV 6.0-BMP	6.0-BMP 6.0-PCC	4.0-GRV	4.0-GRV	4.0-GRV
Quantity												
100 Clearing & Grubbing	m2	-	-	-	-	-	-	-	-	18000	-	-
Stripping	m3	-	-	-	-	-	-	-	-	1800	-	-
102 Roadway & Drainage Excavation	m3	57675	7606	3462	2475	1865	3461	11758	22987	9375	9912	6113
104 Borrow	m3	910	4318	1017	882	741	126	2918	-	1881	3344	8539
200 Aggregate Subbase	m3	5512	6672	2910	2040	722	2021	4569	9296	2300	5244	1886
Preparation of Prev.Road(Grvl)	m2	35940	62700	11880	18480	8620	2540	35790	42396	11320	51930	16220
Preparation of Prev.Road(Asph)	m2	-	1200	3200	-	-	510	2050	2090	-	-	-
Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	-	-
202 Crushed Aggregate Base Course	m3	-	307	844	-	-	-	512	6793	-	-	-
300 Crushed Aggr. Surface Course	m3	7200	8550	1530	2520	1530	360	4902	-	3000	6720	2460
301 Bituminous Prime Coat	M.T.	-	2	6	-	-	-	4	48	-	-	-
302 Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305 Bituminous Macadam Pavement	m2	-	1800	4930	-	-	-	3000	39840	-	-	-
310 Bitum.Concrete Surface Course	M.T.	-	-	-	-	-	-	-	-	-	-	-
304 Double Bitum.Surface Treatment	m2	-	-	-	-	-	-	-	-	-	-	-
311-1 PCC Pavement (t=23 cm)	m2	-	-	-	-	-	-	-	-	-	-	-
311-2 PCC Pavement (t=20 cm)	m2	400	-	300	400	-	2200	-	270	-	-	-
311-3 PCC Pavement (t=18 cm)	m2	-	-	500	-	-	-	4120	2160	-	800	-
500 RCPC (dia.910mm)	m	240	300	83	90	45	39	159	225	104	184	96
Headwall for RCPC (dia.910mm)	Set	16	20	6	6	3	4	19	15	13	23	12
504 Grouted Riprap	m3	-	-	-	-	-	-	-	-	-	-	1541
Side Ditch (Grouted Riprap)	m	7600	-	-	-	-	-	-	4000	-	-	-
Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	-	-	-
Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Superstructure	m	24	-	-	-	-	-	-	-	-	-	-
1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	105	-
2-lane Bridge,Abutment	Each	4	-	-	-	-	-	-	-	-	-	-
1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	8	-
2-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	2	-
2-lane Spillway	m	-	-	60	-	-	-	-	-	-	-	-
1-lane Spillway	m	-	-	-	-	-	-	-	-	30	-	-
1-cell RCBC	m	-	-	-	-	-	-	8	-	-	-	-
2-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
Wingwall for 1-cell RCBC	Set	-	-	-	-	-	-	1	-	-	-	-
Wingwall for 2-cell RCBC	Set	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost	M.p.	11.44	6.91	2.99	2.05	1.05	1.64	6.17	13.83	2.85	5.60	4.10
Bridge Construction Cost	M.p.	2.60	.00	1.09	.00	.00	.00	.33	.00	.40	6.16	.00
Total Construction Cost	M.p.	14.04	6.91	4.07	2.05	1.05	1.64	6.49	13.83	3.25	11.76	4.10
Road Construction Cost/Impr't km	M.p.	1.39	.71	1.00	.68	.62	.78	.64	1.89	.57	.49	1.00
Total Construction Cost/Total km	M.p.	1.71	.71	1.36	.68	.62	.78	.67	1.89	.65	1.03	1.00

TABLE 5.1 - 4 (5)

Quantity and Construction Cost MISAMIS ORIENTAL

		Unit	B00-16	B03-2	B07-6	B16-5	B07-12	B00-19	B05-22	B23-3	B12-1	B00-1	B07-8
Total Road Length		km	11.7	3.0	13.4	7.0	6.0	1.7	4.3	5.0	2.7	7.2	7.5
Improvement Length		km	11.6	3.0	13.4	6.9	6.0	1.5	4.3	5.0	2.7	6.9	7.5
Proposed Pavement Type			4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	6.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	6.0-GRV	6.0-BMP
Quantity													
100	Clearing & Grubbing	m2	-	-	30000	-	-	-	-	-	-	-	-
	Stripping	m3	-	-	3000	-	-	-	-	-	-	-	-
102	Roadway & Drainage Excavation	m3	20400	3406	19063	12938	21845	1575	8063	5663	4613	29788	28602
104	Borrow	m3	3053	678	3665	1397	1349	453	736	1384	592	2262	-
200	Aggregate Subbase	m3	5336	1380	6164	3174	3025	690	1978	2300	1242	3274	11654
	Preparation of Prev.Road(Grvl)	m2	36740	13600	48590	26220	29152	6380	15690	18550	9430	27220	50976
	Preparation of Prev.Road(Asph)	m2	-	-	-	-	-	-	-	-	-	-	-
	Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
	Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	-	-
202	Crushed Aggregate Base Course	m3	-	-	-	-	-	-	-	-	-	-	7673
300	Crushed Aggr. Surface Course	m3	5940	1596	6978	3618	5310	900	2580	2880	1440	6210	-
301	Bituminous Prime Coat	M.T.	-	-	-	-	-	-	-	-	-	-	54
302	Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305	Bituminous Macadam Pavement	m2	-	-	-	-	-	-	-	-	-	-	45000
310	Bitum.Concrete Surface Course	M.T.	-	-	-	-	-	-	-	-	-	-	-
304	Double Bitum.Surface Treatment	m2	-	-	-	-	-	-	-	-	-	-	-
311-1	PCC Pavement (t=23 cm)	m2	-	-	-	-	-	-	-	-	-	-	-
311-2	PCC Pavement (t=20 cm)	m2	-	-	-	-	-	-	-	-	-	-	-
311-3	PCC Pavement (t=18 cm)	m2	6800	1360	7080	3480	600	-	-	800	1200	-	-
500	RCPC (dia.910mm)	m	192	48	248	112	180	24	72	80	40	210	225
	Headwall for RCPC (dia.910mm)	Set	24	6	31	14	12	3	9	10	5	14	15
504	Grouted Riprap	m3	223	-	-	-	-	-	-	-	-	-	-
	Side Ditch (Grouted Riprap)	m	-	-	-	-	1250	-	-	-	-	1700	3700
	Slope Protection (Cut Slope)	m	-	-	-	-	-	-	300	50	-	-	-
	Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Superstructure	m	-	-	-	-	20	-	-	-	-	-	82
	1-lane Bridge,Superstructure	m	52	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Abutment	Each	-	-	-	-	4	-	-	-	-	-	8
	1-lane Bridge,Abutment	Each	4	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	1
	1-lane Bridge,Pier	Each	1	-	-	-	-	-	-	-	-	-	-
	2-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	50
	1-lane Spillway	m	15	-	-	-	-	-	50	-	-	-	-
	1-cell RCBC	m	8	-	-	-	-	-	-	-	-	-	-
	2-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
	Wingwall for 1-cell RCBC	Set	1	-	-	-	-	-	-	-	-	-	-
	Wingwall for 2-cell RCBC	Set	-	-	-	-	-	-	-	-	-	-	-
	Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost		M.p.	7.69	1.76	8.61	4.39	5.32	.73	9.82	3.86	1.64	6.35	14.93
Bridge Construction Cost		M.p.	3.59	.00	.00	.00	2.41	.00	.66	.00	.00	.00	8.05
Total Construction Cost		M.p.	11.28	1.76	8.61	4.39	7.73	.73	10.48	3.86	1.64	6.35	22.98
Road Construction Cost/Impr't km		M.p.	.66	.59	.64	.64	.89	.49	2.28	.77	.61	.92	1.99
Total Construction Cost/Total km		M.p.	.96	.59	.64	.63	1.29	.43	2.44	.77	.61	.88	3.06

TABLE 5.1 - 4 (6)

Quantity and Construction Cost MISAMIS ORIENTAL

		Unit	B00-18	B00-2	B00-8	B00-4	B09-2	B00-23	B02-7
Total Road Length		km	10.7	5.0	4.9	6.1	2.3	9.4	9.0
Improvement Length		km	10.6	5.0	4.4	5.5	2.3	9.0	9.0
Proposed Pavement Type			4.0-GRV	6.0-GRV 4.0-GRV	4.0-GRV	6.0-BMP 4.0-GRV	4.0-GRV	6.0-BMP 6.0-PCC	4.0-GRV
Quantity									
100	Clearing & Grubbing	m2	-	-	-	-	-	-	118500
	Stripping	m3	-	-	-	-	-	-	11850
102	Roadway & Drainage Excavation	m3	18975	16182	8250	28009	2288	10761	20575
104	Borrow	m3	2192	1458	3199	352	1062	14013	3725
200	Aggregate Subbase	m3	4876	2800	2024	3495	1058	11310	4140
	Preparation of Prev.Road(Grvl)	m2	34470	24940	16120	6450	9780	40738	5060
	Preparation of Prev.Road(Asph)	m2	-	-	-	18500	-	2440	-
	Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-
	Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-
202	Crushed Aggregate Base Course	m3	-	-	-	3785	-	7667	-
300	Crushed Aggr. Surface Course	m3	5616	4230	2640	1080	1380	-	5400
301	Bituminous Prime Coat	M.T.	-	-	-	27	-	54	-
302	Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-
305	Bituminous Macadam Pavement	m2	-	-	-	22200	-	44720	-
310	Bitum.Concrete Surface Course	M.T.	-	-	-	-	-	-	-
304	Double Bitum.Surface Treatment	m2	-	-	-	-	-	-	-
311-1	PCC Pavement (t=23 cm)	m2	-	-	-	-	-	-	-
311-2	PCC Pavement (t=20 cm)	m2	-	-	-	-	-	780	-
311-3	PCC Pavement (t=18 cm)	m2	4960	1200	-	-	-	-	-
500	RCPC (dia.910mm)	m	168	143	96	137	40	279	272
	Headwall for RCPC (dia.910mm)	Set	21	10	12	11	5	20	34
504	Grouted Riprap	m3	-	-	825	-	-	815	-
	Side Ditch (Grouted Riprap)	m	-	1000	-	3700	-	-	-
	Slope Protection (Cut Slope)	m	670	-	100	-	-	-	-
	Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-
	2-lane Bridge,Superstructure	m	-	-	-	-	-	140	-
	1-lane Bridge,Superstructure	m	48	-	-	-	-	-	-
	2-lane Bridge,Abutment	Each	-	-	-	-	-	4	-
	1-lane Bridge,Abutment	Each	8	-	-	-	-	-	-
	2-lane Bridge,Pier	Each	-	-	-	-	-	6	-
	1-lane Bridge,Pier	Each	-	-	-	-	-	-	-
	2-lane Spillway	m	-	-	-	-	-	-	-
	1-lane Spillway	m	47	-	-	-	-	-	-
	1-cell RCBC	m	8	-	-	-	-	-	-
	2-cell RCBC	m	-	-	-	-	-	-	-
	Wingwall for 1-cell RCBC	Set	1	-	-	-	-	-	-
	Wingwall for 2-cell RCBC	Set	-	-	-	-	-	-	-
	Miscellaneous	l.s.	1	1	1	1	1	1	1
Road Construction Cost		M.p.	23.50	4.51	5.72	8.92	1.16	14.76	6.16
Bridge Construction Cost		M.p.	4.66	.00	.00	.00	.00	10.03	.00
Total Construction Cost		M.p.	28.16	4.51	5.72	8.92	1.16	24.79	6.16
Road Construction Cost/Impr't km		M.p.	2.22	.90	1.30	1.62	.50	1.64	.68
Total Construction Cost/Total km		M.p.	2.63	.90	1.17	1.46	.50	2.64	.68

5.1.3 Summary of Preliminary Design

Results of preliminary design were summarized in Tables 5.1-5 and 5.1-6 for major and minor roads, respectively.

TABLE 5.1-5 SUMMARY OF PRELIMINARY DESIGN :
Province of Misamis Oriental
- Major Roads -

	Type of Improvement			
	Rehabilitation/ Improvement - 1	Improvement-2/ Widening	New Construction	Total
Primary Major Roads				
1. No. of Links	-	-	-	-
2. Total Length (km)	-	-	-	-
3. Improvement Length (km)	-	-	-	-
4. Construction Cost (million P)	-	-	-	-
5. Const. Cost/Imp. Length (MP/km)	-	-	-	-
Secondary Major Roads				
1. No. of Links	3	-	-	3
2. Total Length (km)	74.2	-	-	74.2
3. Improvement Length (km)	59.2	-	-	59.2
4. Construction Cost (million P)	218.0	-	-	218.0
5. Const. Cost/Imp. Length (MP/km)	3.68	-	-	3.68
Major Roads Total				
1. No. of Links	3	-	-	3
2. Total Length (km)	74.2	-	-	74.2
3. Improvement Length (km)	59.2	-	-	59.2
4. Construction Cost (million P)	218.0	-	-	218.0
5. Const. Cost/Imp. Length (MP/km)	3.68	-	-	3.68

TABLE 5.1-6 SUMMARY OF PRELIMINARY DESIGN
Province of Misamis Oriental
- Minor Roads -

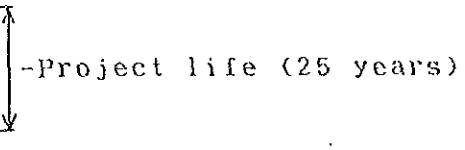
	Type of Improvement		
	Rehabilitation/ Improvement-1&2/ Widening	New Construction	Total
Minor Roads (National/ Provincial/City)			
1. No. of Links	36	-	36
2. Total Length (km)	271.2	-	271.2
3. Improvement Length (km)	260.0	-	260.0
4. Construction Cost (million P)	289.0	-	289.0
5. Const. Cost/Imp. Length (MP/km)	1.11	-	1.11
Minor Roads (Barangay)			
1. No. of Links	22	1	23
2. Total Length (km)	145.4	9.0	154.4
3. Improvement Length (km)	143.1	9.0	152.1
4. Construction Cost (million P)	192.5	6.2	198.7
5. Const. Cost/Imp. Length (MP/km)	1.35	0.69	1.31
Minor Roads Total			
1. No. of Links	58	1	59
2. Total Length (km)	416.6	9.0	425.6
3. Improvement Length (km)	403.1	9.0	412.1
4. Construction Cost (million P)	481.5	6.2	487.7
5. Const. Cost/Imp. Length (MP/km)	1.19	0.69	1.18

5.2 ECONOMIC EVALUATION

5.2.1 Basic Assumptions

The commonly used cost-benefit analysis was applied under the following basic assumptions:

i) Analysis Period



ii) Discount Rate: 15% pa

iii) Quantified Cost

Initial construction/improvement costs
Periodic maintenance costs

iv) Quantified Benefit

Traffic benefit
Development benefit (only for development projects)
Maintenance cost savings

The periodic maintenance costs, or rehabilitation costs, such as overlay, reconstruction and regravelling which will be needed after completion of the project to prolong the pavement life, were treated as project costs in this study, while the difference between routine maintenance costs and total maintenance costs in the "w/o" case was taken into account as a project benefit. In the case where the routine maintenance costs are higher than the "w/o" maintenance costs, the difference is considered as a negative benefit.

5.2.2 Economic Costs

1) Initial Construction/Improvement Costs

The construction costs discussed in Section 5.2.1 are the financial costs and do not include the costs for detailed design and construction supervision. In the cost-benefit analysis, the following economic cost was used:

Construction Cost	100%
-Tax	-15%
+Detailed Design Cost	4%
+Construction Supervision Cost	6%
Total Economic Cost	95%

In the cost-benefit stream, 4% for detailed design cost was assumed to be spent in 1991 and the remaining 91% in 1992.

2) Periodic Maintenance Costs

Periodic maintenance, or rehabilitation, will be necessary when the riding quality of a pavement decreases to a certain minimum level of acceptability. Table 5.2-1 shows the periodic maintenance assumed in this Study.

TABLE 5.2-1 PERIODIC MAINTENANCE COST ASSUMED IN THE ANALYSIS

Surface Type	Periodic Maintenance Work	Timing	Financial Cost 1) (million₱/Km)	Economic Cost
Gravel	10cm Regravelling	When thickness of gravel is reduced by 10cm, assuming 1.5cm loss annually from rainfall and 1.5cm loss every 100,000 vehicles (2-6 years)	4.0 m Gravel: ₱ 0.210 M 6.0 m Gravel: ₱ 0.320 M	85% of Cost
BMP	5.5cm BMP Overlay	When pavement serviceability decreases to 2.0, assuming 85,000 ESAL or 350,000 vehicle repetitions (4-10 years)	₱ 0.830 M	85% of Cost
AC	5 cm AC Overlay	When pavement serviceability decreases to 2.0, assuming 800,000 ESAL or 2,300,000 vehicle repetitions (8-20 years)	₱ 1.170 M	85% of Cost
PCC	5 cm AC Overlay	When pavement serviceability decreases to 2.0, assuming 2,000,000 ESAL or 5,700,000 vehicle repetitions (10-25 years)	₱ 1.200 M	85% of Cost

Note: 1) As of April 1990

5.2.3 Benefits

1) Traffic Benefits

a) Traffic Cost

Basic Traffic Costs

The basic traffic costs were provided by PMO-FS, as shown in Table 5.2-2.

TABLE 5.2-2 BASIC TRAFFIC COSTS EXCLUDING TAX (AS OF DECEMBER 1989)

	Running Cost (₱/km)	Fixed Cost (₱/hour)	Time Cost (₱/hour)
Car/Van	1.75	6.30	17.70
Jeepney	1.12	23.76	26.40
Bus	2.81	35.64	95.04
Truck	3.48	38.88	0
Motor-tricycle	0.36	8.76	4.98
Motorcycle	0.31	0.72	8.34

Actual Traffic Costs

The actual traffic costs were estimated according to the dl-system concerning running costs and the dt-system with regard to fixed and time costs. The dl-values and operating speed for different surface conditions are shown in Tables 5.2-3 and 5.2-4, respectively.

TABLE 5.2-3 DL-VALUES IN KM PER ACTUAL KM

Surface Type / Surface Condition	PCC/AC	BMP/DBST	Gravel	Earth
Good	0	0.14	0.29	-
Fair	0.17	0.38	0.60	-
Bad	0.43	0.65	0.87	1.20
Very Bad	0.89	1.04	1.20	1.56
Impassable	1.73	1.73	1.73	1.73

TABLE 5.2-4 OPERATING SPEED IN KM/HOUR

Surface Condition	Surface Type: PCC/AC OV	TR	MC	BMP/DBST OV	TR	MC	Gravel OV	TR	MC	Earth OV	TR	MC
Good	65	40	60	63	38	55	60	35	50	-	-	-
Fair	55	35	50	53	33	45	50	30	40	-	-	-
Bad	30	20	20	30	20	20	30	20	20	20	10	10
Very Bad	20	10	10	20	10	10	20	10	10	10	5	5
Impassable	10	5	5	10	5	5	10	5	5	10	5	5

Note: OV = Car/Jeepney/Bus/Truck
TR = Motor-tricycle
MC = Motorcycle

Traffic Costs of Other Transport Modes

In addition to the land-based motorized vehicles, the traffic costs of other modes were estimated as shown in Table 5.2-5.

TABLE 5.2-5 TRAFFIC COST OF OTHER MODES (COMMON TO ALL SURFACE TYPES AND CONDITIONS)

Mode	Traffic Cost in ₱/Km
Animal Drawn	4.0
Walking (head loading)	1.2
Banca Boat	2.25

b) Traffic Benefits in Traffic Projects

Traffic on the project roads wwas broken down into four categories: normal traffic, diverted traffic-1, diverted traffic-2 and generated traffic.

The traffic benefits were estimated as follows:

i) Normal Traffic : Difference in traffic costs between "w/o" and "with" cases. The change in traffic costs results not only from the improvement of surface type and condition but also from consequent change in modal distribution.

ii) Diverted Traffic-1 : Difference between traffic costs along the "w/o" route and those along the "with" route. Where diverted traffic passes through two or more project roads, the benefits were allocated to each road in proportion to length.

iii) Diverted Traffic-2 and Generated Traffic: Half of the difference in traffic costs between "w/o" and "with" cases. This is the commonly used approximation.

Traffic costs were calculated assuming the following surface conditions:

"W/O" Case : Present surface condition is maintained.
"With" Case: Gravel/BMP are maintained in a fair condition.
AC/PCC are maintained in a good condition

c) Traffic Benefits in Development Projects

No diverted traffic is expected in most development projects. The benefits from normal traffic generated traffic were estimated in the same way as used for the traffic projects paying attention to the following:

i) The travel distance considered in the benefit calculation is the distrance from the average gravity point of transport (gravity of population for passenger traffic and non-agricultural traffic and gravity of agricultural production for agricultural traffic) to the connecting point with a higher road.

ii) The benefit from generated agricultural traffic is not considered as a traffic benefit because it is included in the development benefit. Therefore, the generated traffic benefits are only from passenger traffic and non-agricultural traffic.

2) Development Benefits

Development benefits were assessed using the producer surplus approach, under the hypothesis that substantial road improvement which removes constraints on development will permit and encourage farmers to adopt modern agricultural techniques and inputs. The development benefit consists of the difference in the

net value of total production (farmgate value less production costs) between the "w/o" and "with" cases. Changes in the volume and value of agricultural production will be achieved by one or more of the following:

i) Increase in cultivated area
ii) Increase in yield
iii) Increase in intensity of land use through increasing the number of harvest or intercropping
iv) Changes in the type of crop

Using the data obtained from the socio-economic survey, development benefits were calculated from the following equation:

Benefit = PRODw(FGPw-CPw)-(FGPw-CPw/o)

where, PRODw = Production in metric tons, with
PRODw/o= Production in metric tons, w/o
FGPw = Farmgate price in pesos per metric ton, with
CPw = Production cost in pesos per metric ton, with
CPw/o = Production cost in pesos per metric ton, w/o

The increase in farmgate price resulting from reduction in traffic cost is not included in the development benefits, because it is considered a part of the traffic benefits.

Table 5.2-6 presents the summary of demographic and agricultural data.

TABLE 5.2 - 6 (1)

Summary of Demographic and Agricultural Data MISAMIS ORIENTAL

Class of Road	Type of Impr't	Road Number	Road Length (km)	1990 Population Total	1990 Population /km	1990 Crop Area (ha) Total	Major Crop					1993 AADT w/o	1993 AADT with	IRR (%)
Minor (Nat'l/ Prov'l)	Rehab/ Imp-1	P53	2.8	6372	2276	330	200(Coco.)	100(Banan)	30(Corn)			96	133	29.9
		P38	12.5	7167	573	3125	1201(Corn)	666(Banan)	523(Coco.)	408(Palay)	327(Root)	94	64	21.4
		P74	3.1	2242	723	1069	419(Banan)	341(Coco.)	309(Vege.)			7	34	18.9
		P34	19.2	8355	435	3046	1264(Coco.)	948(Banan)	771(Corn)	63(Root)		90	101	17.5
		P56	1.2	5218	4348	905	485(Banan)	179(Corn)	179(Vege.)	62(Root)		60	92	16.5
		P51	8.8	8282	941	719	298(Palay)	198(Coco.)	132(Corn)	83(Banan)	8(Vege.)	30	129	15.4
		P39	16.2	5864	362	1355	847(Corn)	339(Banan)	169(Coco.)			48	54	15.0
		P64	2.9	1832	632	516	258(Coco.)	258(Banan)				0	18	14.3
		P49	2.2	3129	1422	190	73(Coco.)	65(Banan)	26(Corn)	26(Vege.)		0	76	14.0
		P5	23.0	10582	460	3500	1965(Coco.)	1228(Banan)	307(Root)			44	180	11.0
		P85	3.9	3208	823	444	300(Coco.)	90(Vege.)	54(Corn)			12	55	10.6
		P48	21.5	6114	284	4157	1569(Coco.)	1177(Corn)	941(Banan)	235(Vege.)	235(Root)	101	107	10.1
		P81	1.2	1202	1002	204	102(Coco.)	102(Banan)				3	19	9.8
		P46	11.3	2828	250	608	538(Corn)	40(Banan)	30(Coco.)			11	44	9.7
		P28	12.4	4781	386	637	255(Corn)	191(Coco.)	89(Banan)	64(Vege.)	38(Root)	68	68	9.5
		P18	2.7	1460	541	245	245(Coco.)					8	13	8.6
		P63	5.0	2117	423	690	224(Palay)	224(Coco.)	149(Banan)	93(Corn)		10	35	8.6
		P31	7.3	7760	1063	487	286(Banan)	201(Coco.)				103	109	8.4
		P27	6.7	2851	426	1059	457(Corn)	326(Coco.)	196(Banan)	80(Vege.)		20	25	7.0
		P79	3.4	1100	324	742	318(Coco.)	318(Banan)	106(Root)			1	5	6.8
		P4	4.7	4304	916	783	636(Coco.)	147(Banan)				11	32	6.7
		P77	3.0	1282	427	337	171(Banan)	166(Coco.)				1	12	5.8
		P7-1	9.8	8687	886	1260	706(Coco.)	404(Banan)	150(Palay)			155	152	5.4
		P84	9.0	3660	407	853	509(Coco.)	344(Banan)				42	54	5.2
		P82	3.2	1006	314	204	102(Coco.)	102(Banan)				0	12	4.5
		P23	13.8	2219	161	624	574(Coco.)	50(Banan)				0	20	4.3
		P16	11.4	6493	570	1713	1462(Coco.)	251(Palay)				74	110	3.0
		P67	3.0	1381	460	234	126(Banan)	108(Coco.)				3	19	2.3
		P44	9.6	7170	747	815	324(Corn)	285(Coco.)	176(Palay)	20(Banan)	10(Root)	109	136	2.2
		P17	8.6	2414	281	967	494(Coco.)	263(Banan)	210(Corn)			25	35	1.7
		P26	8.2	4335	529	657	657(Coco.)					51	71	1.6
		P88-2	9.8	4383	447	1066	574(Coco.)	410(Banan)	82(Corn)			37	49	1.5
		P60	3.0	3503	1168	353	212(Coco.)	141(Banan)				17	55	1.5
		P66	3.0	928	309	272	97(Coco.)	97(Banan)	78(Corn)			3	15	.0
	Imp-2/ Widen	P55	1.7	2862	1684	225	161(Coco.)	64(Banan)				32	34	3.4
		P59	2.1	2587	1232	261	179(Banan)	82(Coco.)				50	58	3.1
Minor (Baran-gay)	Rehab/ Imp-1	B07-14	9.7	6779	699	1430	650(Coco.)	468(Banan)	312(Root)			53	69	30.6
		B00-21	7.3	13226	1812	1912	566(Corn)	543(Coco.)	386(Banan)	226(Vege.)	96(Root)	56	237	25.1
		B20-6	5.0	2780	556	355	135(Corn)	135(Banan)	85(Coco.)			9	17	22.3
		B07-13	11.4	9426	827	1526	681(Coco.)	545(Banan)	218(Root)	82(Corn)		98	165	20.7
		B02-12	4.1	3020	737	1058	658(Coco.)	282(Banan)	118(Corn)			6	48	20.1
		B00-16	11.7	2932	251	1331	454(Coco.)	365(Banan)	284(Corn)	133(Vege.)	95(Palay)	7	37	19.9
		B03-2	3.0	1541	514	901	386(Banan)	309(Vege.)	206(Coco.)			6	20	19.5
		B07-6	13.4	6794	507	1258	871(Coco.)	387(Banan)				3	75	18.8
		B16-5	7.0	2978	425	727	291(Coco.)	218(Corn)	218(Banan)			0	13	16.0
		B07-12	6.0	4463	744	685	527(Coco.)	158(Banan)				33	64	14.4
		B00-19	1.7	3678	2164	129	57(Coco.)	29(Vege.)	29(Banan)	14(Root)		26	30	13.4
		B05-22	4.3	2353	547	510	205(Corn)	205(Root)	50(Coco.)	50(Banan)		5	32	9.8
		B23-3	5.0	875	175	236	176(Palay)	30(Coco.)	20(Banan)	10(Root)		0	13	9.4
		B12-1	2.7	2587	958	250	150(Coco.)	100(Banan)				11	34	9.3

TABLE 5.2 - 6 (2)

Summary of Demographic and Agricultural Data MISAMIS ORIENTAL

Class of Road	Type of Impr't	Road Number	Road Length (km)	1990 Population Total	1990 Population /km	1990 Crop Area (ha) Total	1990 Crop Area (ha) Major Crop	1993 AADT w/o	1993 AADT with	IRR (%)
Minor (Barangay)	Rehab/Imp-1	B00-1	7.2	2079	289	847	306(Coco.) 153(Palay) 102(Vege.) 102(Root) 102(Banan)	42	42	8.3
		B07-8	7.5	11208	1494	1773	767(Banan) 706(Coco.) 218(Root) 82(Corn)	176	240	8.2
		B00-18	10.7	1583	148	617	265(Coco.) 176(Vege.) 176(Banan)	8	28	5.3
		B00-2	5.0	1076	215	500	219(Coco.) 125(Root) 94(Vege.) 31(Corn) 31(Banan)	18	18	2.2
		B00-8	4.9	1738	355	345	257(Coco.) 88(Corn)	20	35	1.4
		B00-4	6.1	4034	661	368	160(Banan) 80(Coco.) 64(Corn) 64(Vege.)	46	62	1.0
		B09-2	2.3	1148	499	110	110(Coco.)	18	17	.0
	Imp-2/Widen	B00-23	9.4	13352	1420	2014	649(Coco.) 585(Palay) 325(Corn) 260(Banan) 195(Root)	233	283	9.3
	New Const.	B02-7	9.0	3815	424	787	429(Banan) 179(Corn) 179(Vege.)	1	23	20.4

3) Maintenance Cost Savings

The difference in maintenance costs between the "w/o" and "with" cases is considered one of the benefits. Maintenance costs in the "w/o" case were estimated based on the current EMK system, while maintenance costs in the "with" case were estimated as shown in b) below. It is noted that periodic maintenance cost in the "with" case is not included in the calculation of maintenance cost savings, because it is treated as a part of project costs.

In the case where the routine maintenance costs in the "with" case are higher than the maintenance costs in the "w/o" case (especially in the case of new construction, the maintenance cost in the "w/o" case in zero), the difference is considered as a negative benefit).

a) Maintenance Cost in "w/o" Case

According to the current EMK system, the annual maintenance cost per km was estimated as basic maintenance cost of ₱17,143.00/km times the EMK factor as shown in Table 5.2-7.

TABLE 5.2-7
EMK FACTOR FOR DIFFERENT SURFACING AND AADT

AADT / Surface Type	25	50	75	100	150	200	300	400
Earth	0.35	0.40	0.50					
Gravel	0.40	0.60	0.90	1.40	1.90	2.20	2.40	2.50	2.60

AADT / Surface Type	400	600	1000	1500	2000	3000	5000	10000
Bituminous	1.10	1.55	2.10	2.50	2.60			
Gravel	0.50	0.60	0.80	0.85	0.90	0.95	1.00	1.05	1.10

b) Routine Maintenance Costs in "with" Case

The costs deemed necessary to maintain the improved roads in a fair condition were estimated as shown in Table 5.2-8.

TABLE 5.2-8
ESTIMATED ROUTINE MAINTENANCE COSTS

Surface Type	Operation	Annual Cost (peso/km)
Gravel	Vegetation Control	1,150
	Ditch Cleaning	4.0 m Gravel: 2,650 + 40 AADT
	Grading	6.0 m Gravel: 3,000 + 45 AADT
	Pothole Repair	
	Total	4.0 m Gravel: 3,800 + 45 AADT
		6.0 m Gravel: 4,150 + 45 AADT
BMP	Vegetation Control	1,150
	Ditch Cleaning	1,100
	Shoulder Repair	2,150
	Patching	8,000 + 7.5 AADT
	Regravelling Shoulder	8,600
	Total	21,000 + 7.5 AADT
AC	Vegetation Control	1,150
	Ditch Cleaning	1,100
	Shoulder Repair	2,150
	Crack and Joint Sealing	9,300
	Regravelling Shoulder	8,600
	Total	20,400
PCC	Vegetation Control	1,150
	Ditch Cleaning	1,100
	Shoulder Repair	2,150
	Crack and Joint Sealing	5,600
	Regravelling Shoulder	8,600
	Total	18,600

5.2.4 Economic Evaluation

Results of economic evaluation are summarized in Table 5.2-9 and illustrated in Figure 5.2-1. Results of economic evaluation of each project road is presented in Table 5.2-10.

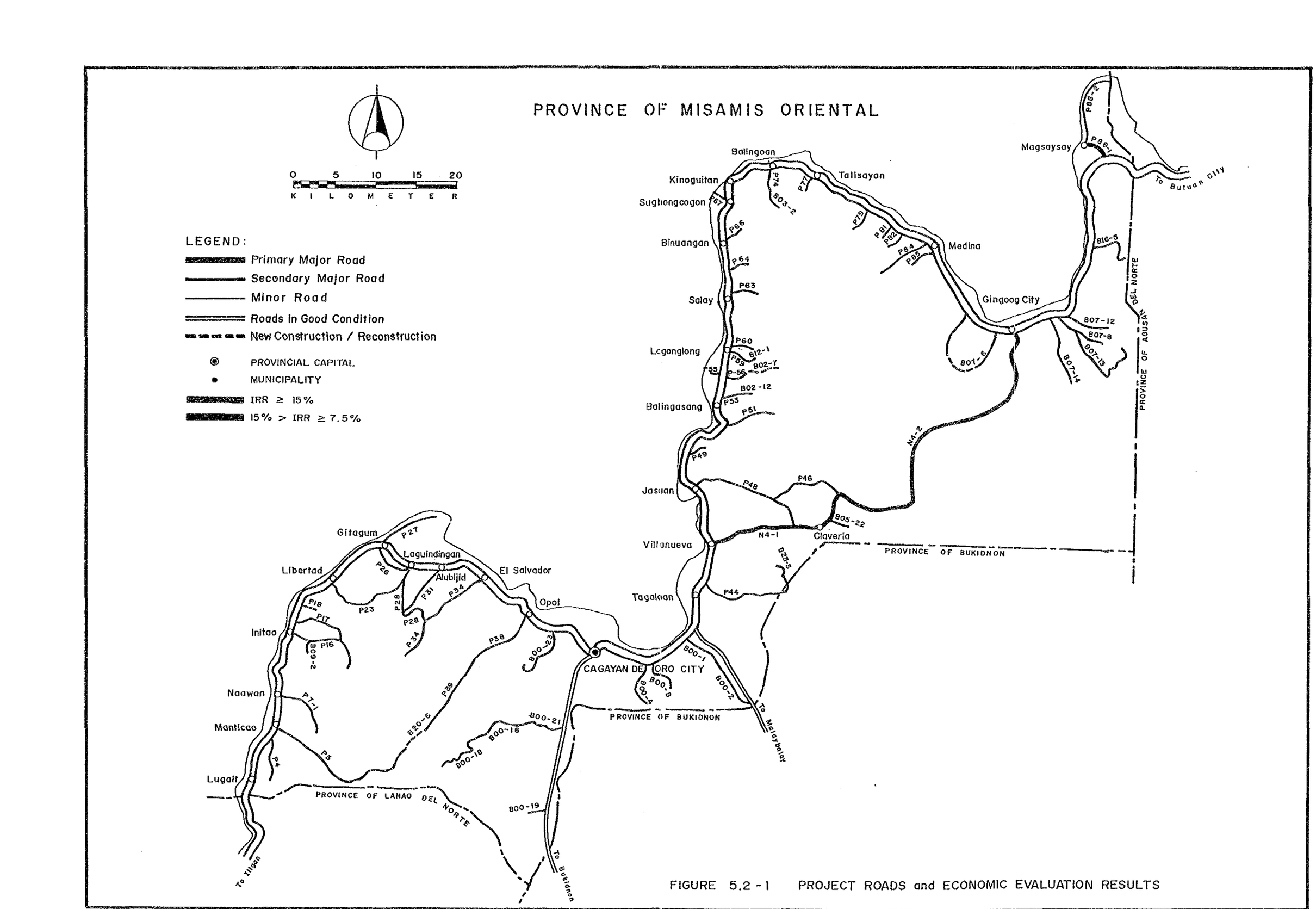


FIGURE 5.2 - 1 PROJECT ROADS and ECONOMIC EVALUATION RESULTS

TABLE 5.2 - 9 (1)

Road Length and Construction Cost MISAMIS ORIENTAL

Class of Road	Range of IRR	Rehabilitation/Improvement-1						Improvement-2/Widening						New Construction					
		No.	Total Length	Improv Length	Road Cost	Bridge Cost	Total Cost	No.	Total Length	Improv Length	Road Cost	Bridge Cost	Total Cost	No.	Total Length	Improv Length	Road Cost	Bridge Cost	Total Cost
Primary Major	15<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Second'y Major	15<	2	70.0	55.0	178.9	32.4	211.3	-	-	-	-	-	-	-	-	-	-	-	-
	10-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<7.5	1	4.2	4.2	6.7	-	6.7	-	-	-	-	-	-	-	-	-	-	-	-
	Total	3	74.2	59.2	185.6	32.4	218.0	-	-	-	-	-	-	-	-	-	-	-	-
Minor (Nat'l/ Prov'l)	15<	6	47.6	44.5	40.9	1.0	41.9	-	-	-	-	-	-	-	-	-	-	-	-
	10-15	6	69.7	69.6	97.2	2.0	99.3	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	6	39.9	35.7	29.8	-	29.8	-	-	-	-	-	-	-	-	-	-	-	-
	<7.5	16	110.2	106.4	107.6	7.9	115.4	2	3.8	3.8	2.7	-	2.7	-	-	-	-	-	-
	Total	34	267.4	256.2	275.5	10.8	286.3	2	3.8	3.8	2.7	-	2.7	-	-	-	-	-	-
Minor (Baran-gay)	15<	9	72.6	72.4	55.0	10.5	65.5	-	-	-	-	-	-	1	9.0	9.0	6.2	-	6.2
	10-15	2	7.7	7.5	6.0	2.4	8.5	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	5	26.7	26.4	36.6	8.7	45.3	1	9.4	9.0	14.8	10.0	24.8	-	-	-	-	-	-
	<7.5	5	29.0	27.8	43.8	4.7	48.5	-	-	-	-	-	-	-	-	-	-	-	-
	Total	21	136.0	134.1	141.5	26.2	167.7	1	9.4	9.0	14.8	10.0	24.8	1	9.0	9.0	6.2	-	6.2
Total	15<	17	190.2	171.9	274.8	43.8	318.6	-	-	-	-	-	-	1	9.0	9.0	6.2	-	6.2
	10-15	8	77.4	77.1	103.3	4.4	107.7	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	11	66.6	62.1	66.4	8.7	75.1	1	9.4	9.0	14.8	10.0	24.8	-	-	-	-	-	-
	<7.5	22	143.4	138.4	158.1	12.5	170.6	2	3.8	3.8	2.7	-	2.7	-	-	-	-	-	-
	Total	58	477.6	449.5	602.5	69.5	672.0	3	13.2	12.8	17.4	10.0	27.5	1	9.0	9.0	6.2	-	6.2

TABLE 5.2 - 9 (2)

Road Length and Construction Cost MISAMIS ORIENTAL

Class of Road	Range of IRR	Total					
		No.	Total Length	Improv Length	Road Cost	Bridge Cost	Total Cost
Primary Major	15<	-	-	-	-	-	-
	10-15	-	-	-	-	-	-
	7.5-10	-	-	-	-	-	-
	<7.5	-	-	-	-	-	-
	Total	-	-	-	-	-	-
Second'y Major	15<	2	70.0	55.0	178.9	32.4	211.3
	10-15	-	-	-	-	-	-
	7.5-10	-	-	-	-	-	-
	<7.5	1	4.2	4.2	6.7	-	6.7
	Total	3	74.2	59.2	185.6	32.4	218.0
Minor (Nat'l/ Prov'l)	15<	6	47.6	44.5	40.9	1.0	41.9
	10-15	6	69.7	69.6	97.2	2.0	99.3
	7.5-10	6	39.9	35.7	29.8	-	29.8
	<7.5	18	114.0	110.2	110.3	7.9	118.1
	Total	36	271.2	250.0	278.1	10.8	289.0
Minor (Baran-gay)	15<	10	81.6	81.4	61.2	10.5	71.6
	10-15	2	7.7	7.5	6.0	2.4	8.5
	7.5-10	6	36.1	35.4	51.4	18.7	70.1
	<7.5	5	29.0	27.8	43.8	4.7	48.5
	Total	23	154.4	152.1	162.4	36.3	198.7
Total	15<	18	199.2	180.9	281.0	43.8	324.8
	10-15	8	77.4	77.1	103.3	4.4	107.7
	7.5-10	12	76.0	71.1	81.1	18.7	99.9
	<7.5	24	147.2	142.2	160.7	12.5	173.3
	Total	62	499.8	471.3	626.1	79.5	705.6

TABLE 5.2 - 10 (1)

Summary of Economic Analysis MISAMIS ORIENTAL

Cost/Benefit:1991-2017 Discounted Total

Class of Road	Type of Impr't	Road Number	1993 AADT w/o	1993 AADT with	Length (km) Total	Length (km) Improvement	Economic Cost (Mp/km) Construct.	Economic Cost (Mp/km) Period Maint.	Economic Cost (Mp/km) Total	Benefit (Mp/km) Normal	Benefit (Mp/km) Diverted	Benefit (Mp/km) Generated	Benefit (Mp/km) Develop't	Benefit (Mp/km) Maint sav'g	Benefit (Mp/km) Total	Econom. Indicator NPV (Mp)	B/C	IRR (%)
Second'y Major	Rehab/ Imp-1	N4-1	344	1306	17.0	3.2(6.0-PCC)	2.19	.09	2.28	2.72	23.51	.36	-	.04	26.63	77.9	11.7	100.0
		N4-2	0	1143	53.0	51.8(6.0-PCC)	3.26	.07	3.33	-	4.15	.75	-	-.07	4.83	78.1	1.5	20.6
		P88-1	258	258	4.2	1.2(6.0-PCC) 3.0(6.0-BMP)	1.32	.25	1.57	.86	-	.00	-	.03	.90	-2.8	.6	6.8

TABLE 5.2 - 10 (2)

Summary of Economic Analysis — MISAMIS ORIENTAL

Cost/Benefit:1991-2017 Discounted Total

Class of Road	Type of Impr't	Road Number	1993 AADT w/o	1993 AADT with	Length (km) Total	Length (km) Improvement	Economic Cost (Mp/km) Const-ruct.	Economic Cost (Mp/km) Period Maint.	Economic Cost (Mp/km) Total	Benefit (Mp/km) Normal	Diver-ted	Gene-rated	Deve-lop't	Maint sav'g	Benefit (Mp/km) Total	Econom. Indicator NPV (Mp)	B/C	IRR (%)
Minor (Nat'l/ Prov'l)	Rehab/ Imp-1	P53	96	133	2.8	1.8(6.0-GRV)	.50	.29	.79	.98	-	.03	.38	.09	1.48	1.2	1.9	29.9
		P38	94	64	12.6	12.5(6.0-GRV)	.82	.22	1.03	.79	-	.21	.52	.01	1.53	6.2	1.5	21.4
		P74	7	34	3.1	.3(6.0-PCC) 2.8(6.0-GRV)	.69	.16	.85	.72	-	.04	.32	-.01	1.08	.7	1.3	18.9
		P34	90	101	19.2	17.1(6.0-GRV)	.78	.25	1.03	.77	-	.04	.36	.02	1.19	2.7	1.2	17.5
		P56	60	92	1.2	.4(6.0-GRV) .8(6.0-BMP)	1.09	.19	1.28	.60	-	.06	.81	-.01	1.46	.2	1.1	16.5
		P51	30	129	8.8	8.8(6.0-GRV)	.78	.29	1.07	.79	-	.09	.24	-.03	1.09	.2	1.0	15.4
		P39	48	54	16.2	16.2(6.0-GRV)	1.09	.20	1.29	.84	-	.10	.34	.00	1.28	-.2	1.0	15.0
		P64	0	18	2.9	2.9(6.0-GRV)	.55	.17	.72	.40	-	.09	.20	.00	.69	-.1	1.0	14.3
		P49	0	76	2.2	1.7(6.0-GRV) .5(6.0-PCC)	.93	.19	1.12	.87	-	.09	.11	-.03	1.04	-.2	.9	14.0
		P5	44	180	23.0	23.0(6.0-BMP)	1.79	.22	2.01	1.32	-	.06	.21	-.06	1.52	-11.4	.8	11.0
		P85	12	55	3.9	3.9(6.0-GRV)	.70	.20	.90	.45	-	.05	.18	-.01	.67	-.9	.7	10.6
		P48	101	107	21.5	21.4(6.0-GRV)	.81	.27	1.08	.28	-	.03	.36	.09	.76	-6.8	.7	10.1
		P81	3	19	1.2	1.2(6.0-GRV)	.98	.17	1.16	.40	-	.02	.33	.00	.75	-.5	.7	9.8
		P46	11	44	11.3	11.3(6.0-GRV)	.63	.20	.83	.44	-	.04	.11	-.01	.59	-2.7	.7	9.7
		P28	68	68	12.4	8.0(6.0-GRV) .2(6.0-PCC)	.62	.21	.83	.35	-	.02	.18	.02	.57	-2.1	.7	9.5
		P18	8	13	2.7	2.7(4.0-GRV)	.42	.11	.53	.10	-	.03	.18	.00	.31	-.6	.6	8.6
		P63	10	35	5.0	.4(6.0-PCC) 4.6(6.0-GRV)	.95	.17	1.12	.35	-	.03	.28	-.01	.65	-2.3	.6	8.6
		P31	103	109	7.3	7.3(6.0-GRV)	.75	.27	1.02	.54	-	.02	.06	.08	.70	-2.3	.7	8.4
		P27	20	25	6.7	6.7(6.0-GRV)	.85	.18	1.03	.37	-	.07	.13	.00	.57	-3.1	.6	7.0
		P79	1	5	3.4	3.4(6.0-GRV)	1.10	.17	1.27	.41	-	.02	.22	.01	.66	-2.1	.5	6.8
		P4	11	32	4.7	4.7(6.0-GRV)	.71	.18	.89	.39	-	.07	.06	.00	.51	-1.8	.6	6.7
		P77	1	12	3.0	3.0(6.0-GRV)	.69	.17	.87	.31	-	.03	.12	.00	.47	-1.2	.5	5.8
		P7-1	156	152	9.8	.2(6.0-PCC) 9.6(6.0-GRV)	.53	.30	.83	.36	-	.01	.06	.11	.54	-2.9	.6	5.4
		P84	42	54	9.0	1.0(6.0-BMP) .3(6.0-GRV) .2(6.0-PCC) 7.5(4.0-GRV)	.64	.13	.77	.21	-	.01	.12	.02	.36	-3.7	.5	5.2
		P82	0	12	3.2	3.2(6.0-GRV)	.82	.17	.99	.39	-	.03	.04	.01	.47	-1.7	.5	4.5
		P23	0	20	13.8	.1(6.0-BMP) .7(6.0-PCC) 13.0(6.0-GRV)	.80	.16	.97	.32	-	.04	.09	.00	.44	-7.2	.5	4.3
		P16	74	110	11.4	10.7(6.0-GRV) .1(6.0-PCC) .6(6.0-BMP)	.90	.26	1.16	.36	-	.03	.08	.05	.52	-7.2	.5	3.0
		P67	3	19	3.0	.6(6.0-BMP) .3(6.0-PCC) 2.1(6.0-GRV)	.71	.15	.86	.17	-	.03	.12	-.01	.30	-1.7	.4	2.3
		P44	109	136	9.6	.4(6.0-BMP) 5.4(6.0-GRV)	2.80	.31	3.11	.48	-	.02	.30	.09	.89	-12.8	.3	2.2
		P17	25	35	8.6	8.6(6.0-GRV)	.62	.18	.80	.11	-	.02	.14	.01	.27	-4.5	.3	1.7
		P26	51	71	8.2	.2(6.0-PCC) 8.0(6.0-GRV)	1.42	.21	1.64	.24	-	.04	.16	.03	.48	-9.5	.3	1.6
		P88-2	37	49	9.8	9.5(6.0-GRV) .3(6.0-BMP)	.59	.20	.78	.13	-	.02	.14	.00	.29	-4.9	.4	1.5
		P60	17	55	3.0	.9(6.0-BMP) .3(6.0-PCC) 1.8(6.0-GRV)	1.13	.17	1.30	.39	-	.02	.04	-.02	.43	-2.6	.3	1.5
		P66	3	15	3.0	.2(6.0-PCC) 2.8(6.0-GRV)	.57	.16	.73	.09	-	.01	.10	.00	.20	-1.6	.3	.0
	Imp-2/ Widen	P55	32	34	1.7	1.7(6.0-GRV)	.52	.18	.69	.21	-	.02	.07	.02	.31	-.6	.4	3.4
		P59	50	58	2.1	1.7(6.0-PCC) .4(6.0-GRV)	.65	.04	.69	.12	-	.00	.10	-.04	.18	-1.1	.3	3.1

TABLE 5.2 - 10 (3)

Summary of Economic Analysis MISAMIS ORIENTAL

Cost/Benefit:1991-2017 Discounted Total

Class of Road	Type of Impr't	Road Number	1993 AADT w/o	1993 AADT with	Length (km) Total	Length (km) Improvement	Economic Cost (Mp/km) Const-ruct.	Economic Cost (Mp/km) Period Maint.	Economic Cost (Mp/km) Total	Benefit (Mp/km) Normal	Diver-ted	Gene-rated	Deve-lop't	Maint sav'g	Benefit (Mp/km) Total	Econom. Indicator NPV (Mp)	B/C	IRR (%)
Minor (Baran-gay)	Rehab/ Imp-1	B07-14	53	69	9.7	9.2(4.0-GRV) .5(6.0-BMP)	.56	.14	.70	1.05	-	.10	.27	.02	1.44	7.2	2.1	30.6
		B00-21	56	237	7.3	7.0(6.0-BMP) .3(6.0-PCC)	1.58	.36	1.93	2.48	-	.24	.73	-.04	3.41	10.8	1.8	25.1
		B20-6	9	17	5.0	5.0(4.0-GRV)	.54	.11	.65	.42	-	.11	.55	-.01	1.08	2.1	1.6	22.3
		B07-13	98	165	11.4	11.4(4.0-GRV)	.86	.22	1.07	1.03	-	.05	.36	.06	1.49	4.8	1.4	20.7
		B02-12	6	48	4.1	4.1(4.0-GRV)	.83	.13	.96	.79	-	.10	.45	-.01	1.34	1.5	1.4	20.1
		B00-16	7	37	11.7	11.6(4.0-GRV)	.81	.12	.93	.86	-	.12	.30	.00	1.29	4.1	1.4	19.9
		B03-2	6	20	3.0	3.0(4.0-GRV)	.49	.11	.60	.51	-	.04	.24	.00	.79	.6	1.3	19.5
		B07-6	3	75	13.4	13.4(4.0-GRV)	.53	.16	.70	.57	-	.10	.22	-.02	.86	2.2	1.2	18.8
		B16-5	0	13	7.0	6.9(4.0-GRV)	.53	.11	.64	.25	-	.07	.36	.00	.69	.3	1.1	16.0
		B07-12	33	64	6.0	6.0(6.0-GRV)	1.07	.21	1.28	1.09	-	.12	.02	.00	1.22	-.3	1.0	14.4
		B00-19	26	30	1.7	1.5(4.0-GRV)	.40	.12	.52	.22	-	.06	.18	.01	.46	-.1	.9	13.4
		B05-22	5	32	4.3	4.3(4.0-GRV)	2.03	.12	2.14	.87	-	.15	.34	.00	1.37	-3.3	.6	9.8
		B23-3	0	13	5.0	5.0(4.0-GRV)	.64	.11	.76	.25	-	.03	.18	.01	.46	-1.5	.6	9.4
		B12-1	11	34	2.7	2.7(4.0-GRV)	.51	.12	.62	.26	-	.04	.10	.00	.41	-.6	.7	9.3
		B00-1	42	42	7.2	6.9(6.0-GRV)	.77	.20	.96	.24	-	.01	.26	.03	.54	-2.9	.6	8.3
		B07-8	176	240	7.5	7.5(6.0-BMP)	2.55	.34	2.89	.83	-	.03	.67	.06	1.60	-9.7	.6	8.2
		B00-18	8	28	10.7	10.6(4.0-GRV)	2.21	.12	2.33	.45	-	.03	.37	.00	.85	-15.6	.4	5.3
		B00-2	18	18	5.0	4.7(6.0-GRV) .3(4.0-GRV)	.75	.17	.92	.09	-	.00	.18	.01	.28	-3.2	.3	2.2
		B00-8	20	35	4.9	4.4(4.0-GRV)	1.08	.12	1.20	.27	-	.02	.05	.01	.35	-3.7	.3	1.4
		B00-4	46	62	6.1	3.7(6.0-BMP) 1.8(4.0-GRV)	1.35	.15	1.50	.27	-	.05	.09	-.02	.39	-6.1	.3	1.0
		B09-2	18	17	2.3	2.3(4.0-GRV)	.42	.11	.53	.11	-	.02	.02	.01	.16	-.9	.3	.0
	Imp-2/ Widen	B00-23	233	283	9.4	8.2(6.0-BMP) .8(6.0-PCC)	2.29	.41	2.70	1.16	-	.04	.44	.04	1.69	-9.1	.6	9.3
	New Const.	B02-7	1	23	9.0	9.0(4.0-GRV)	.57	.11	.68	.71	-	.17	.08	-.03	.93	2.2	1.4	20.4