社会開発調査部報告書

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS & HIGHWAYS

Feasibility Study
on
The Rural Road Network Development Project

FINAL REPORT (Volume I I)

PROJECT EVALUATION
IN
THE PROVINCE OF SAMAR

OCTOBER, 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS & HIGHWAYS

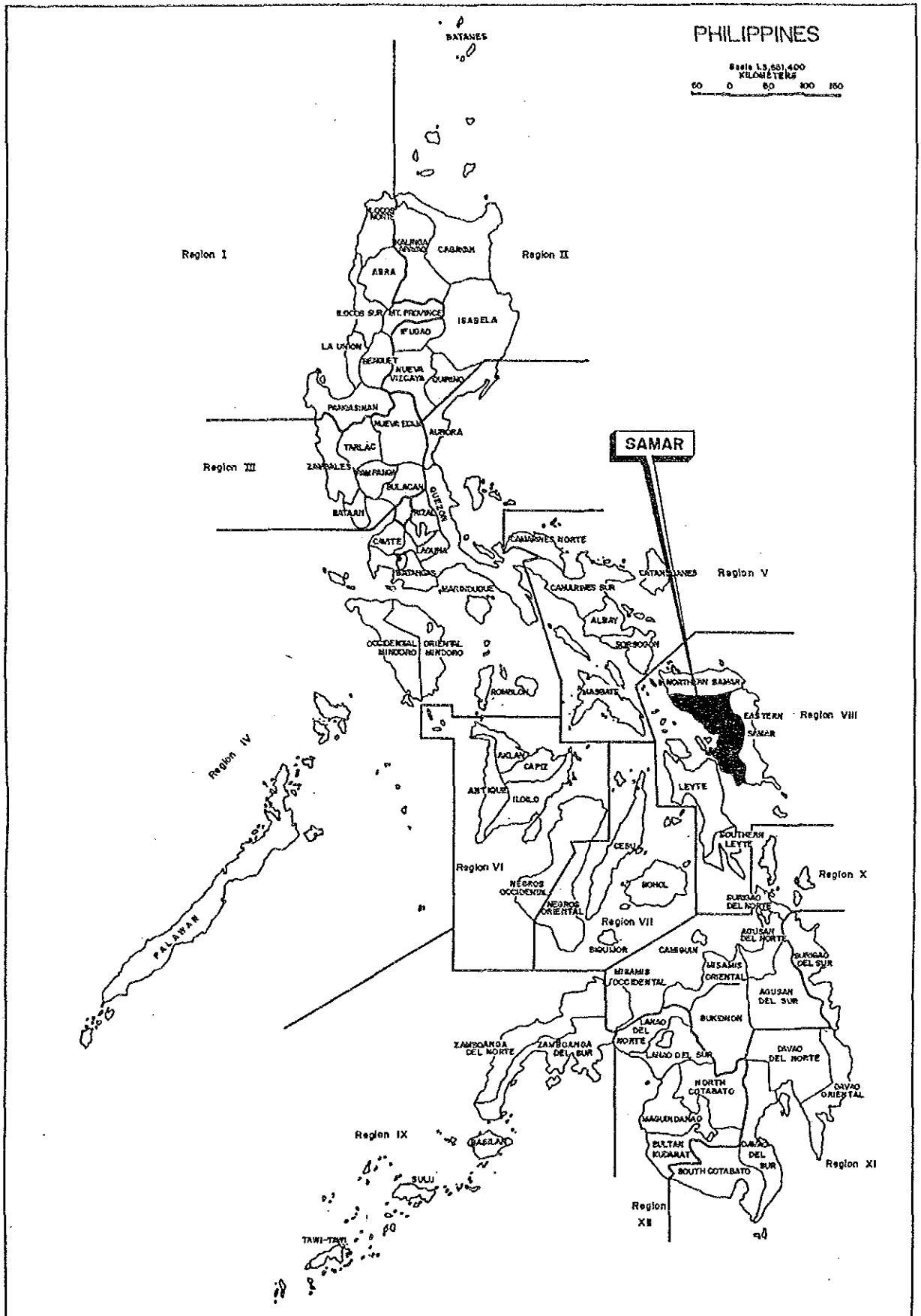
Feasibility Study
on
The Rural Road Network Development Project

FINAL REPORT (Volume I I)

PROJECT EVALUATION
IN
THE PROVINCE OF SAMAR

OCTOBER, 1990

JAPAN INTERNATIONAL COOPERATION AGENCY



FEASIBILITY STUDY ON THE RURAL ROAD NETWORK DEVELOPMENT PROJECT	LOCATION MAP

VOLUME - 11
PROVINCE OF SAMAR

TABLE OF CONTENTS

CHAPTER 1
SOCIO-ECONOMIC PROFILE OF THE PROVINCE

1.1 GENERAL

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

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

1.2 GEOGRAPHY AND TOPOGRAPHY

The province is located in the western portion of Samar Island, bounded on the north by Province of Northern Samar, on the east by Province of Eastern Samar, on the south by Leyte Gulf and on the west by Samar Sea.

Mountain ranges run from the north to the south in the central area of Samar Island. Most areas of the Province are rolling to mountainous except the western coastal area which is narrow flat land.

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

1.3 POPULATION

The province is composed of one (1) city and twenty-five (25) municipalities. Provincial capital is located at Catbalogan. Five (5) municipalities located in the islands were excluded from the Study.

Population in 1990 is estimated at 539,000. The average annual population growth rate for the period of 10 years from 1980 to 1990 was estimated 0.7% which is much lower than the national average of 2.4%. Population density of the province in 1990 is 96.3 persons per square kilometer which is less than one half of 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 city and municipal towns together with their population is shown in Figure 1.3-1. Most municipal towns are located along the western coast line which are connected by Pan-Philippine Highway.

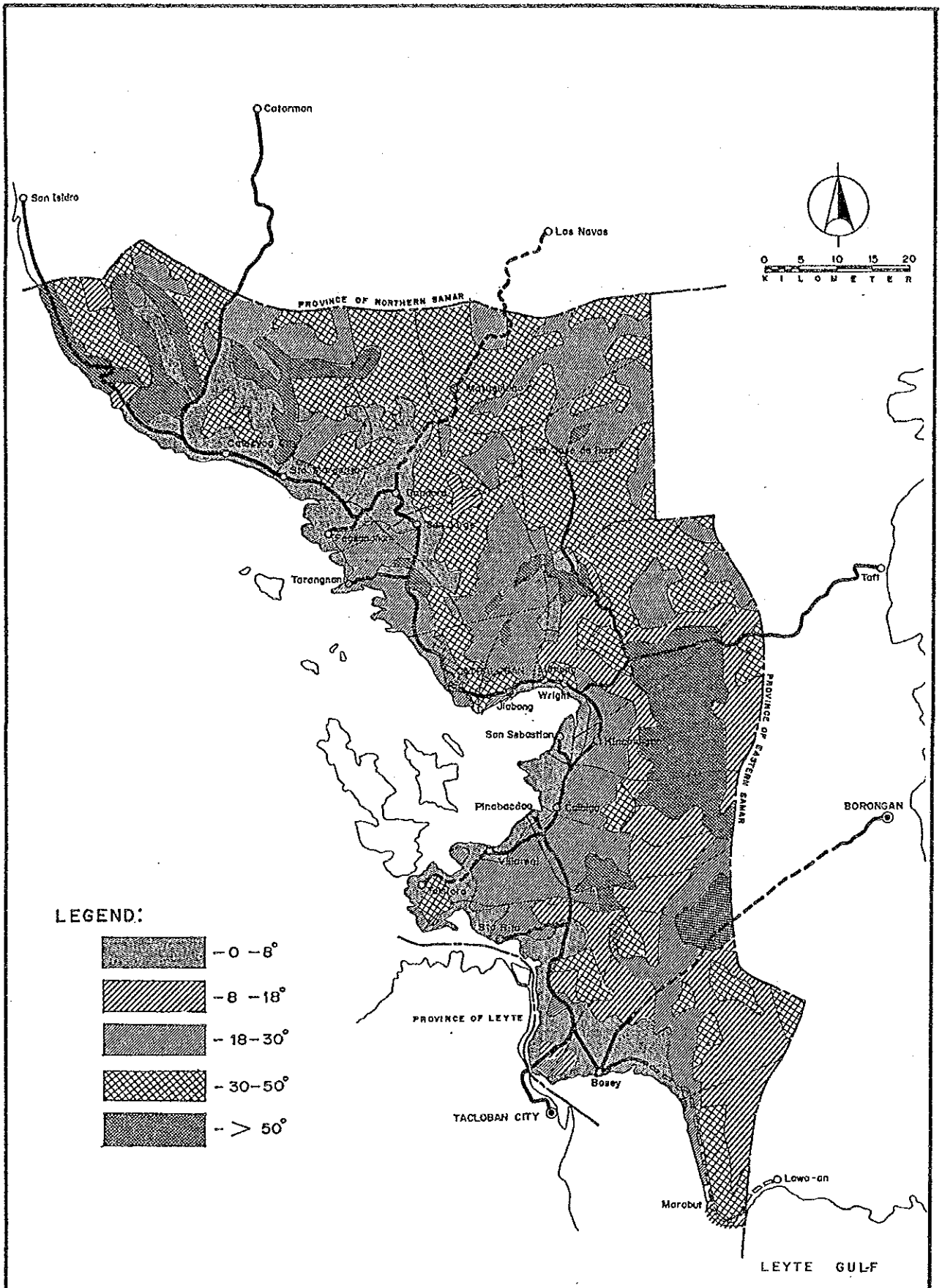


FIGURE 1.2 - 1 SLOPE MAP

Table 1.3-1

POPULATION, LAND AREA AND DENSITY (1990)
Province of Samar

	City/Municipality	Projected Population (1990)	Annual Growth Rate (%)	Land Area (km^2)	Density (p/km^2)
	1. Catbalogan	62,856	0.7	119.4	526.4
	2. Calbayog City	113,374	0.6	918.3	123.5
*	3. Almagro	11,156	1.0	27.9	399.9
	4. Basey	39,056	0.6	570.8	68.4
	5. Calbiga	13,065	(0.9)	282.8	46.2
*	6. Daram	31,993	0.4	103.1	310.3
	7. Gandara	27,286	1.0	413.0	66.1
	8. Hinabangan	9,991	(0.8)	371.0	26.9
	9. Jiabong	12,309	1.1	67.5	182.4
	10. Marabut	15,605	1.6	98.6	158.3
	11. Matuguinao	5,413	0.7	363.0	14.9
	12. Motiong	10,739	0.7	173.8	61.8
	13. Pagsanghan	8,208	2.3	77.2	106.3
	14. Pinabacdao	10,047	0.7	82.1	122.4
	15. San Jorge	9,093	(0.1)	258.8	35.1
	16. San Jose de Buan	7,974	3.9	365.7	21.8
	17. San Sebastian	4,834	0.5	27.2	177.7
	18. Sta. Margarita	18,008	0.6	143.9	125.1
	19. Sta. Rita	23,158	0.7	221.8	104.4
*	20. Sto. Nino	11,913	0.7	31.6	377.0
*	21. Tagapul-an	8,351	0.9	27.8	300.4
	22. Talalora	6,461	0.2	32.4	199.4
	23. Tarangnan	17,839	1.4	81.2	219.7
	24. Villareal	21,655	0.5	238.7	90.7
	25. Wright	24,478	1.3	455.9	53.7
*	26. Zumarraga	13,720	0.7	37.5	365.9
	T O T A L	538,582	0.7	5,591.0	96.3

Note: * - Island Municipality

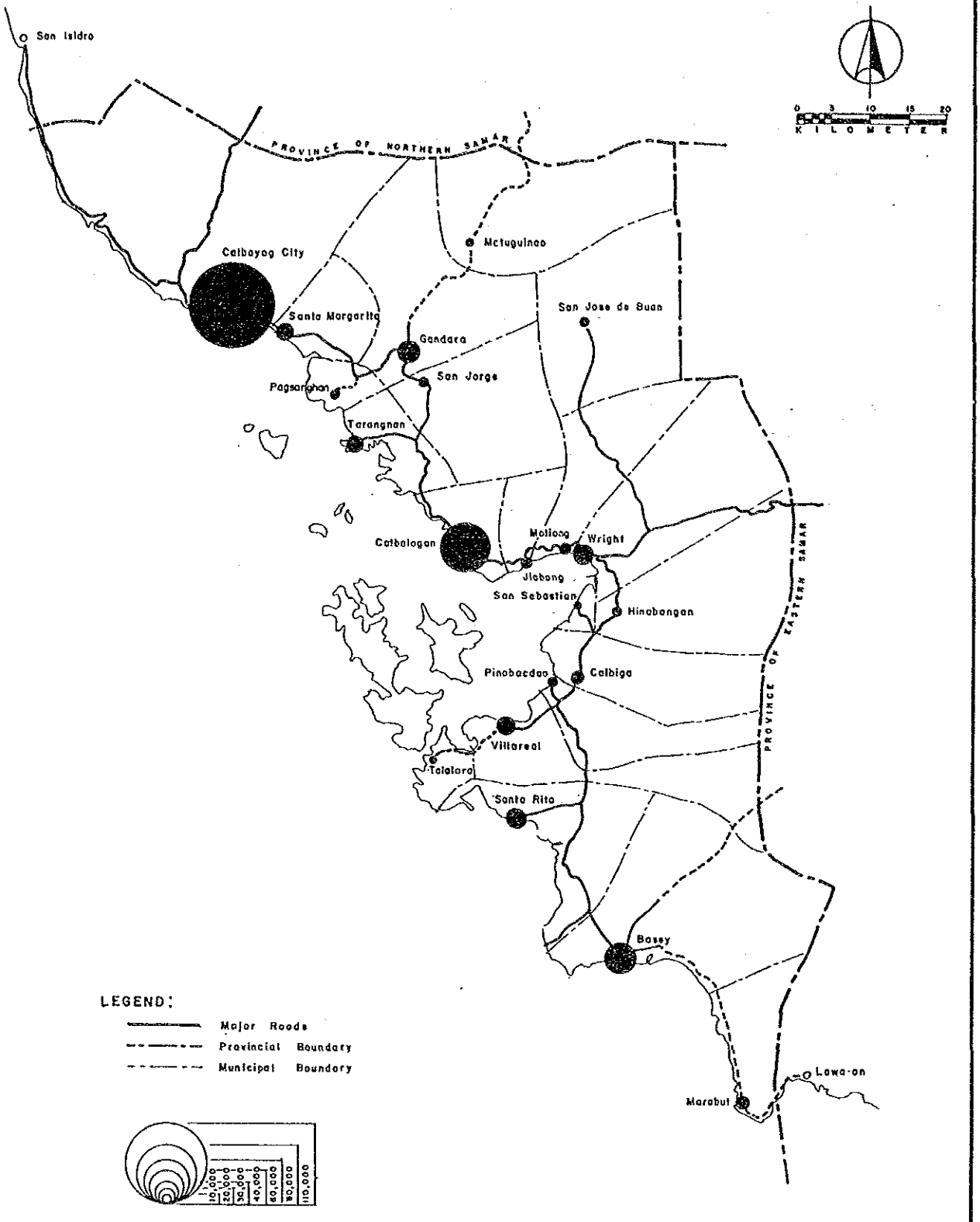


FIGURE 1.3-1 POPULATION BY MUNICIPALITY (1990)

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 0.4% 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 low level than the national average.

Per capita income of the province is low and only 60% of the national average. Incidence of poverty is quite high. Though unemployment rate is lower, underemployment rate is much higher than the the national average. The province is one of the most depressed provinces in the country.

Agriculture is the predominant industry of the province and shares 75% in terms of number of workers.

Table 1.4-1
MAJOR SOCIO-ECONOMIC DATA OF PROVINCE OF SAMAR

	Samar (A)	Philippines (B)	(A)/(B)
1. Total Land Area (sq.km.)	5,591	300,000	0.019
2. Population in 1990 (1000 persons)	539	61,483	0.009
3. Population Density (persons/sq.km.)	96	205	0.47
4. GRDP (Million ₱ at 1000 prices)	2,592	623,051	0.004
5. Per Capita Income in 1985 (₱/person)	3,532	5,593	0.63
6. Number of Workers by Industrial Sector in 1980 (1000 persons)			
* Agricultural	110.7 (75%)	7,303 (51%)	0.015
* Industry	10.4 (7%)	2,177 (15%)	0.005
* Service	25.1 (17%)	4,552 (32%)	0.006
* Total 1/	147.9 (100%)	14,197 (100%)	0.010
7. Incidence of Poverty in 1985 (%)	69.6	59.3	-
8. Unemployment Rate in 1988 (%)	5.3	8.3	-
9. Underemployment Rate in 1988 (%)	22.9	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

Samar has a total land area of 5,591 square kilometers, representing 1.9% of the total land area of the Philippines. Table 1.5-1 shows general land use of the province. About 25% of the province are occupied by agricultural land and about 44% by forest 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 palay, coconut, corn, banana and cassava.

Table 1.5-1
LAND USE OF SAMAR

Land Use	Area in sq.km.	%
Agricultural Land	1,420.1	25.4
Forest	2,476.8	44.3
Bush Land	385.8	6.9
Open Land	805.1	14.4
Marsh/Swamp	374.6	6.7
Built-up Area	128.6	2.3
Total	5,591.0	100.0

Source: Socio-Economic Profile of Samar

Table 1.5-2
MAJOR CROPS OF PROVINCE OF SAMAR

Major Crops	Area Utilized (ha.)		Production (M.T.)	
	1985	1986	1985	1986
Palay	41,240	41,400	75,870	57,795
Coconut	-	40,284	-	39,609
Corn	20,950	21,330	27,155	26,430
Banana	6,785	6,499	102,370	122,051
Cassava	5,645	6,060	27,149	24,445

Source: Bureau of Agricultural Statistics

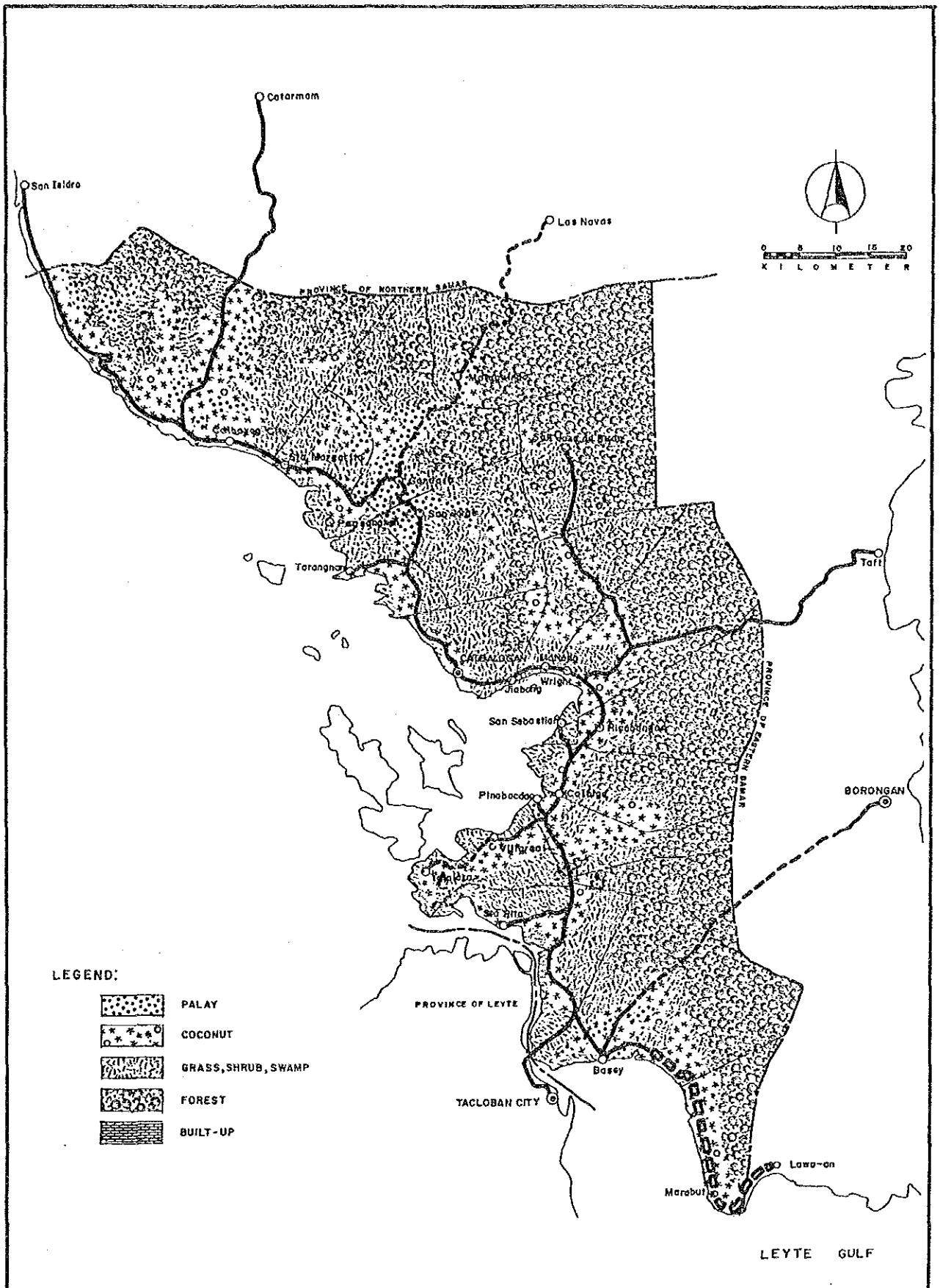


FIGURE 1.5 - 1 AGRICULTURAL LAND USE

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 poor 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

Samar has a total of 734.0 kms. of roads, comprising 232.3 kms. of National, 135.1 kms. of Provincial, 10.1 kms. of City, 56.5 kms. of Municipal and 300.0 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	low at 68% of the national average
Provincial roads.....	low at only 36% of the national average
Barangay roads.....	low at only 27% of the national average
All roads.....	low at only 35% of the national average

In terms of road extension, road development level of the Province is in extremely low 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 Samar

Road Class	Road Length In 1987 (kms.)	Road Density (L/ PA)		
		Samar	Philippines	Samar /Phils
National Rd.	232.3 (31.7)	0.1350	0.1994	0.68
Prov'l. Rd.	135.1 (18.4)	0.0786	0.2211	0.36
Sub-Total	367.4 (50.1)	0.2136	0.4205	0.51
City Rd.	10.1 (1.3)	0.0059	0.0304	0.19
Municipal Rd	56.5 (7.7)	0.0329	0.0981	0.33
Barangay Rd.	300.0 (40.9)	0.1744	0.6536	0.27
TOTAL	734.0(100.0)	0.4268	1.2026	0.35

*SOURCE: DPWH Infrastructure Atlas, 1989

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

Road Class	Pavement Type	Surface Condition 1/			% of Pavement Type 2/	
		Good/Fair	Bad/Very Bad	Total (%)	Samar	Phils.
National Road	PCC	229.9 (98.2)	4.2 (1.8)	233.2 (100.0)	61.3	23.6
	Bituminous	- -	- -	- (100.0)	12.1	22.3
	Gravel	2.0 (3.2)	59.7 (96.8)	61.7 (100.0)	26.6	51.3
	Earth	- -	3.1 (100.0)	3.1 (100.0)	-	2.8
	Total:	231.0 (77.5)	67.0 (22.5)	298.0 (100.0)	100.0	100.0
Provincial Road	PCC	2.5(100.0)	- -	2.5 (100.0)	6.1	2.5
	Bituminous	- -	- -	- (100.0)	0.9	8.9
	Gravel	4.3 (4.5)	91.1 (95.5)	95.4 (100.0)	93.0	70.6
	Earth	- -	24.5 (100.0)	24.5 (100.0)	-	18.0
	Total:	6.8 (5.6)	115.6 (94.4)	122.4 (100.0)	100.0	100.0
National and Provincial Road	PCC	231.5 (98.2)	4.2 (1.8)	235.7 (100.0)	41.0	12.5
	Bituminous	- -	- -	- (100.0)	8.0	15.3
	Gravel	6.3 (4.0)	150.8 (96.0)	157.1 (100.0)	51.0	- 61.4
	Earth	- -	27.6 (100.0)	27.6 (100.0)	-	10.8
	Total:	237.8 (56.6)	182.6 (43.4)	420.4 (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 type and surface condition (quality of roads) could be summarized as follows:

National Roads

- About 73% of national roads are paved with PCC or bituminous surfaces, which is higher level than the national average of 46 %.
- PCC paved roads quite in good condition, however, most gravel roads are in poor condition.
- National roads in the Province are relatively in high level.

Provincial Roads

- Only 7% of provincial roads are paved with PCC or bituminous surfaces.
- About 94% are in bad/very bad condition.
- Provincial roads are still in low level.

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:

- Comb type network pattern is formed with the axis of Pan-Philippine Highway which runs along the western coastal line.
- Several municipal towns, some are located at inland area and others are located in the coastal area, are not provided with access, therefore, basic network is not completed yet.
- In addition to Pan-Philippine Highway, there are two (2) inter-provincial roads.

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, road development level of the province is still in very low level.
- Quality of roads are also still in low level.
- Basic road network is not formed yet.

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

(1) Priority should be given for the improvement of all classes of existing roads.

(2) More roads will be needed. These roads which provide basic access to municipal towns should firstly be constructed in order to complete basic road network. Then, construction of provincial class of roads will follow.

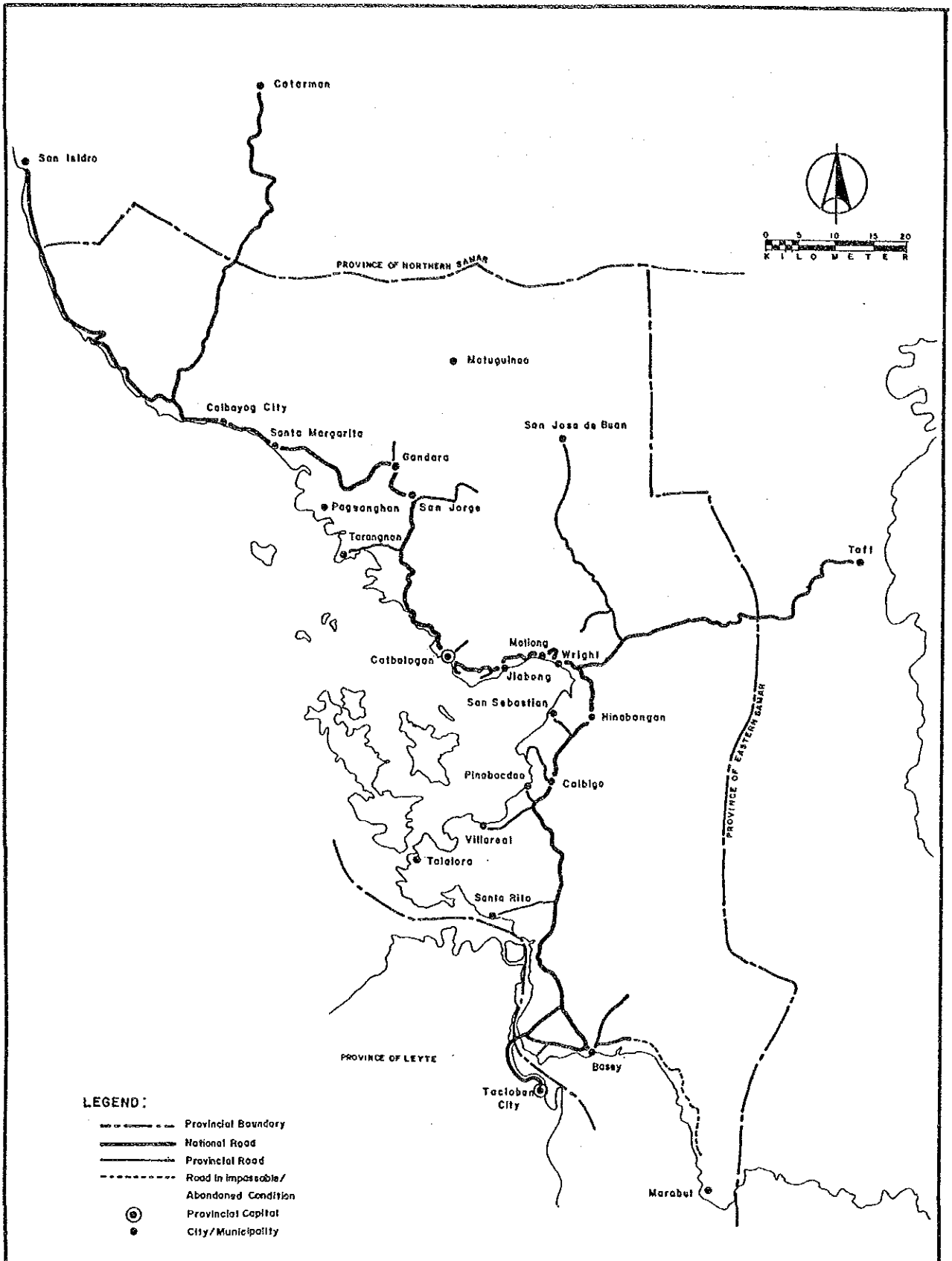


FIGURE 2.2-1 EXISTING ROAD MAP

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 Samar was proposed as shown in Figure 2.4-1. For establishing the major road network, the following are taken into consideration:

- Present pattern of comb type was based to formulate the major road network.
- Existing road network is quite scarce and several municipal towns are not accessible, therefore, new links were definitely required.
- Most of the existing national and provincial roads were included in the major road network.

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 495.5 kms. of which existing roads are 369.5 kms. and new links to be constructed are 126.0 kms. Proposed major road network is composed of the following roads:

	Existing Roads	New Links	Total
National Road	285.2	65.8	351.0
Provincial Road	84.3	51.8	136.1
Barangay Road	-	8.4	8.4
Total	369.5	126.0	495.5

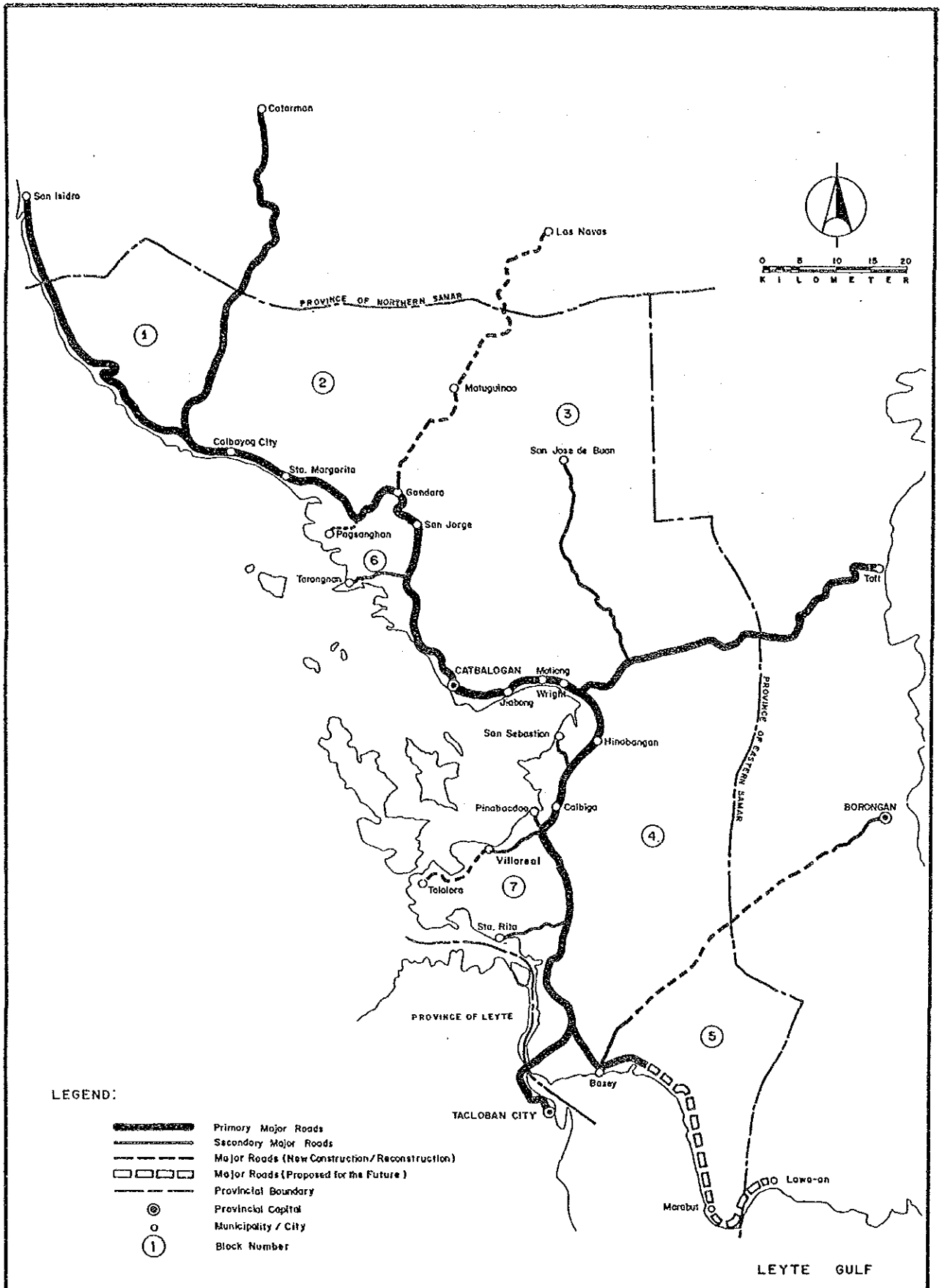


FIGURE 2.4-1 PROPOSED MAJOR ROAD NETWORK

Table 2.4-1

NETWORK VALUE/ACCESSIBILITY
Province of Samar

Block No.	Population (1990)	Land Area (km^2)	Road Length (km)	Network Value	Access (p.km)	Average Access. (km.)
1	38,490	379.9	58.9	0.487	19,699	0.512
2	85,409	867.9	106.6	0.392	217,986	2.552
3	103,762	1,794.1	216.2	0.501	140,225	1.351
4	35,391	1,193.9	138.5	0.674	63,362	1.790
5	27,311	480.5	78.6	0.686	13,310	0.487
6	37,719	171.9	80.5	1.000	31,166	0.826
7	65,971	360.4	133.9	0.868	71,793	1.088
Ave.	56,293	749.8	116.2	0.566	79,649	1.415

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.

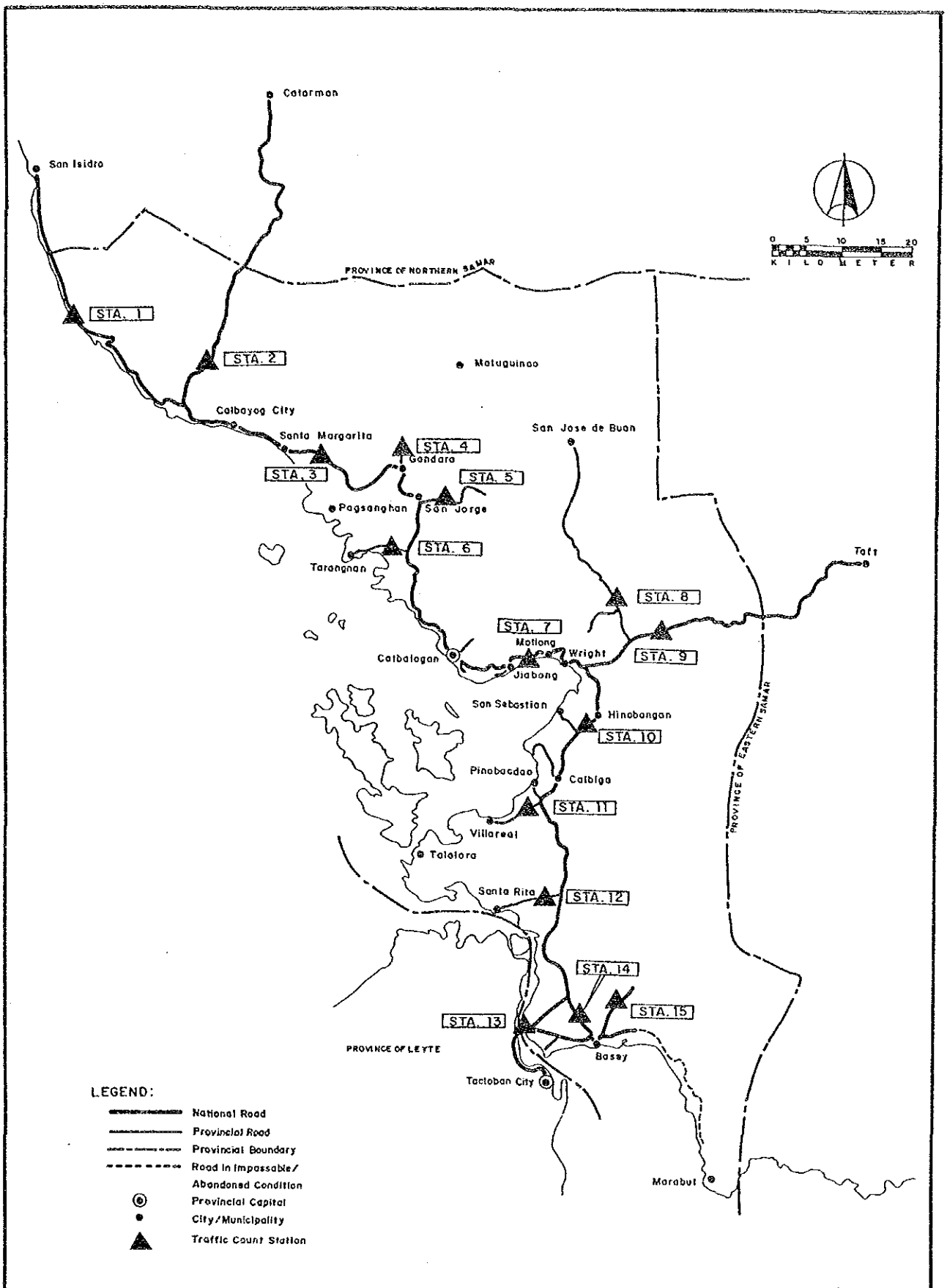


FIGURE 3.1-1 TRAFFIC COUNT STATIONS

TABLE 3.1-1 SUMMARY OF TRAFFIC SURVEY RESULTS
- SAMAR -

(ADT as of Feb. 1990)

Station No.	Car	Jeep	Pickup /Van	Jeepney	Bus	Truck	Sub-Total	Tri-cycle	Motor-cycle	Animal Drawn	Total
1	5	29	34	146	66	79	359	3	54	0	416
2	0	5	12	41	0	18	76	96	50	0	221
3	19	22	73	133	69	43	359	332	70	0	761
4	0	1	0	0	0	0	1	41	18	3	63
5	0	1	1	7	0	2	12	36	45	0	93
6	0	1	1	0	1	1	5	1	4	8	18
7	23	43	84	216	87	121	574	2	44	0	620
8	0	4	0	73	1	53	131	0	6	0	136
9	2	5	19	37	31	40	134	2	1	0	138
10	23	55	64	100	102	73	416	1	29	0	446
11	0	5	1	25	0	2	34	4	44	1	83
12	0	1	0	0	0	0	1	7	8	0	16
13	37	65	114	150	102	94	562	12	42	0	616
14	0	0	1	42	0	1	44	23	14	0	82
15	2	7	0	8	0	1	19	19	12	0	50

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.

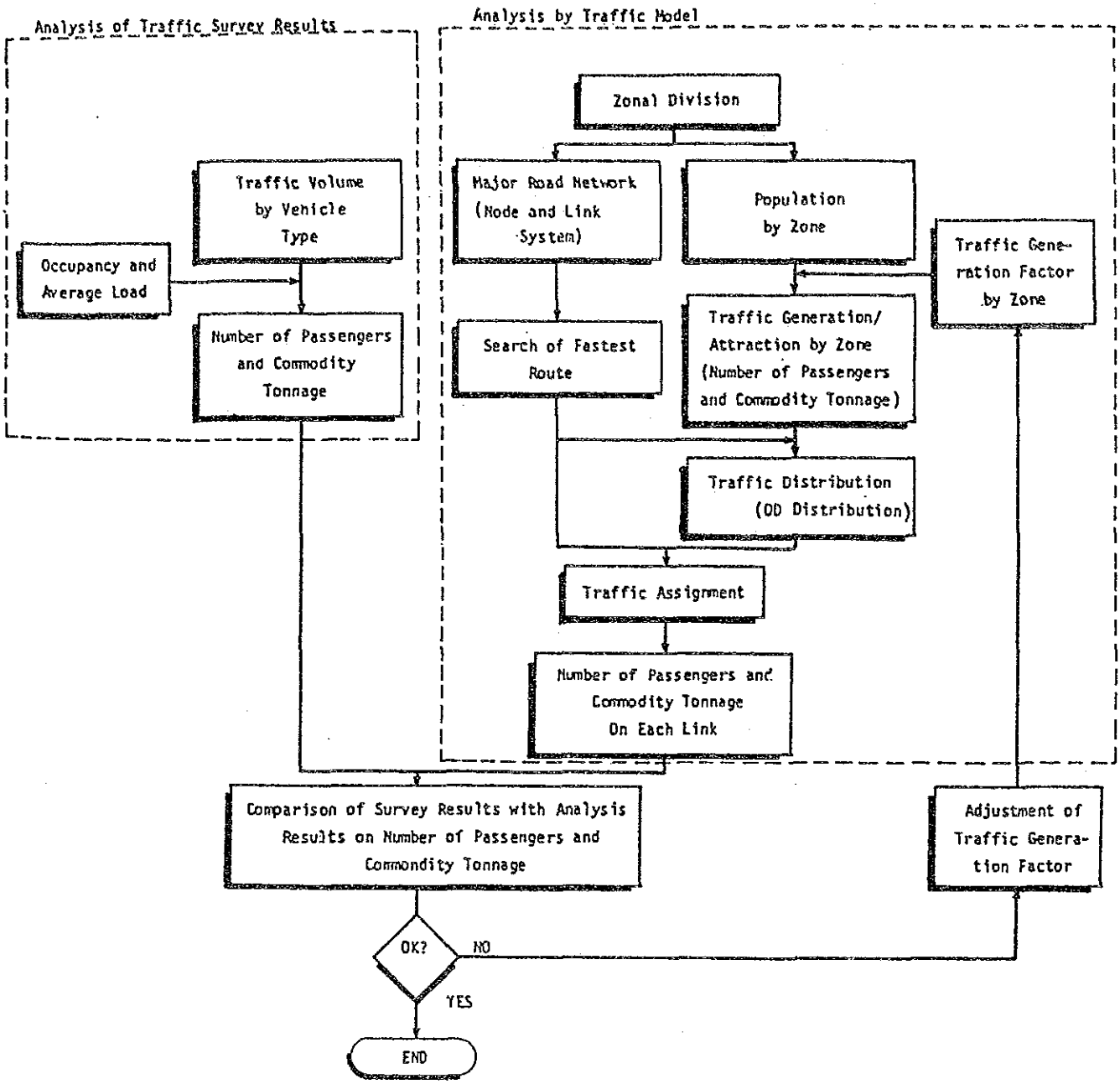


FIGURE 3.2-1
PROCEDURE OF ANALYSIS OF PRESENT TRAFFIC ON MAJOR ROAD NETWORK

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 Samar

	Average Number of Passenger per vehicle	Average Load (ton per vehicle)
Car/Taxi	3.50	0.50
Jeep	3.00	0.80
Van/Pickup	4.00	1.00
Jeepney	18.00	1.50
Bus	40.00	1.00
Truck	6.00	4.00
Motor-tricycle	3.00	0.30
Motorcycle	3.00	0.10
Animal Drawn	3.00	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

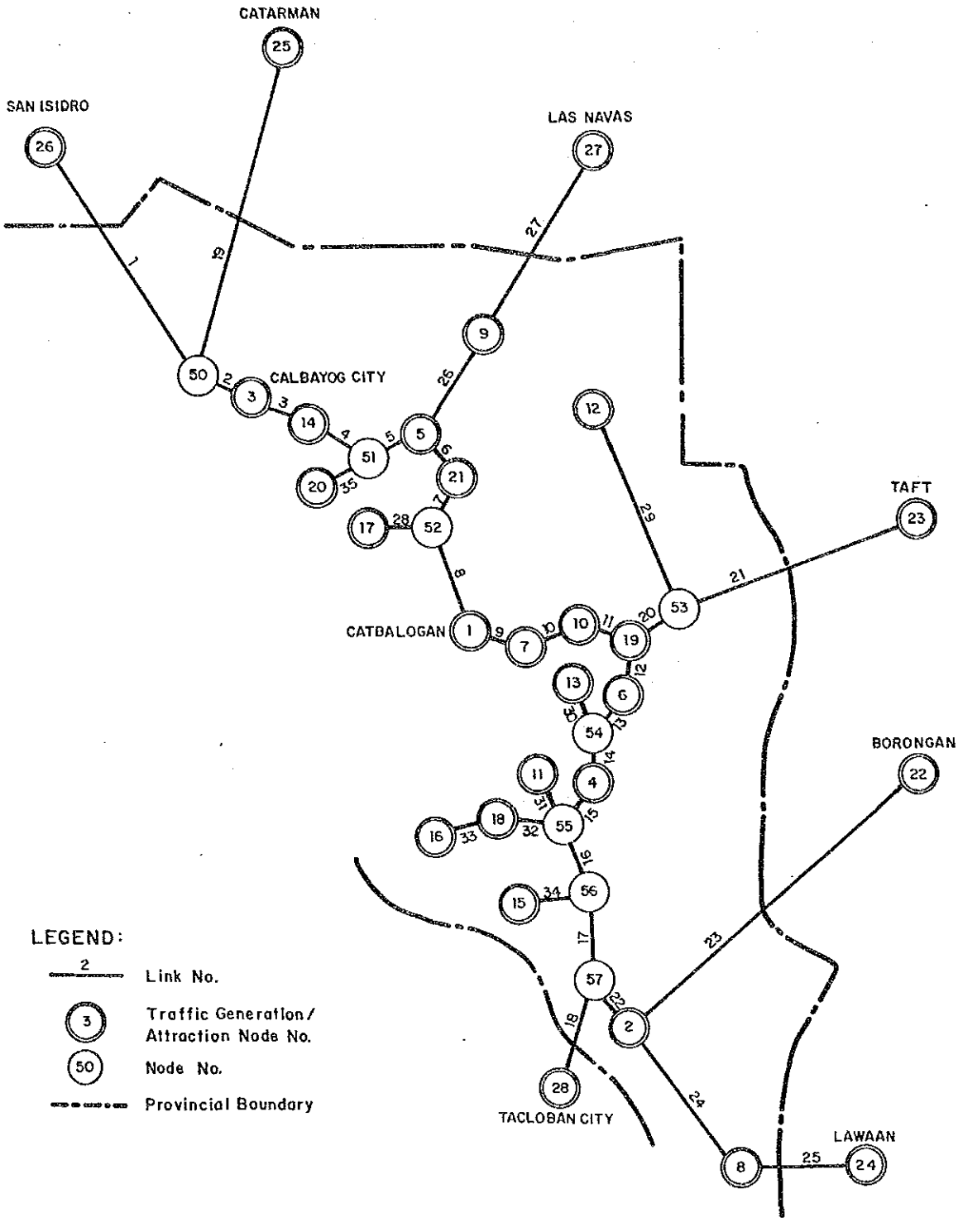


FIGURE 3.2-2 LINK / NODE SYSTEM
PROVINCE OF SAMAR

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 Samar

	Passenger Movement (trip/person/day)	Commodity (kg/person/day)
Range	0.0001 - 0.002	0.1 - 0.8
Mean Value	0.0011	0.5

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:

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

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

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.

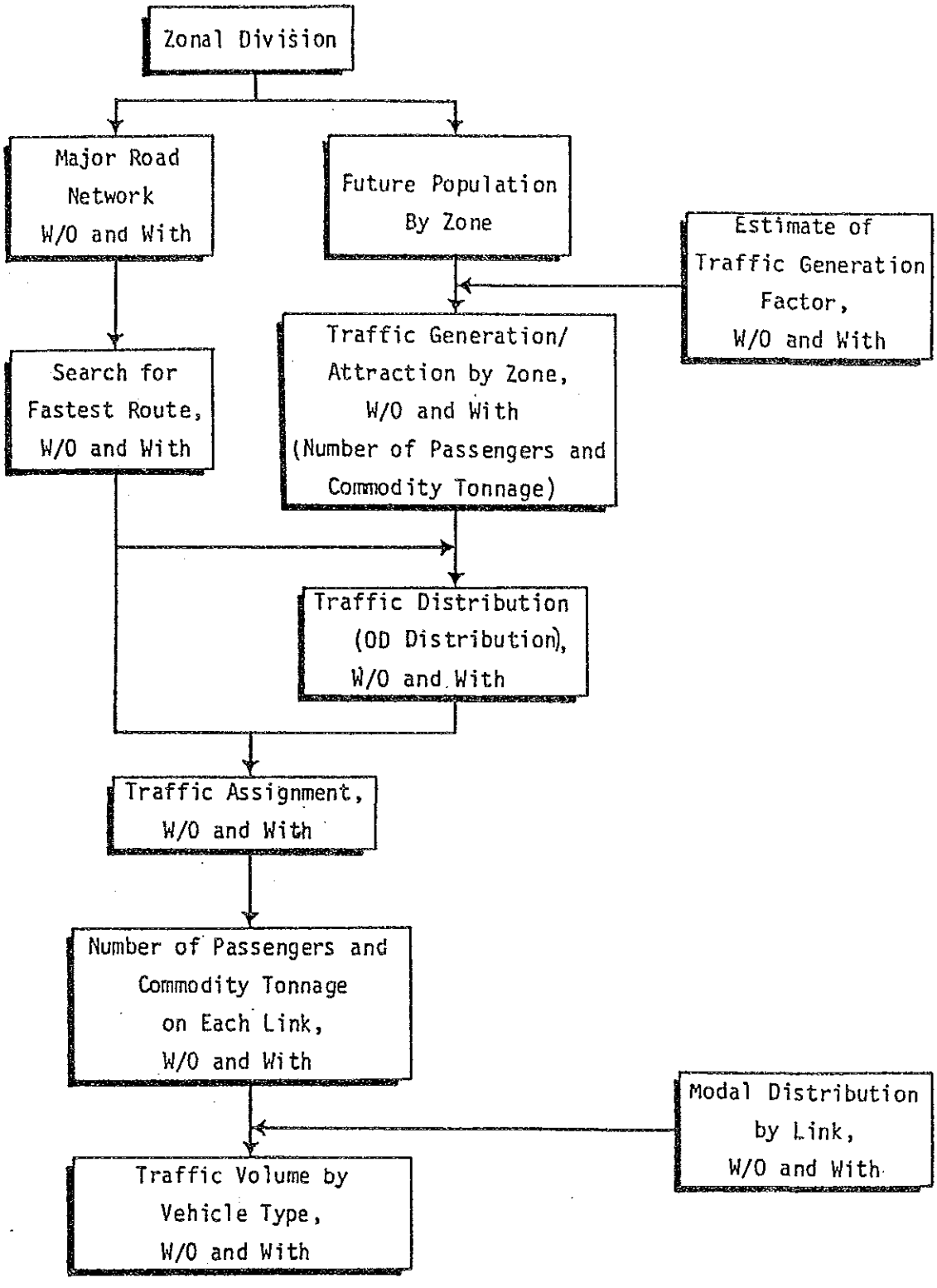


FIGURE 3.2-3
PROCEDURE OF FORECASTING TRAFFIC ON MAJOR ROAD NETWORK

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 Samar

	Passenger Movement (trip/person/day)	Commodity (kg/person/day)
Range	0.001 - 0.002	0.5 - 0.8
Mean Value	0.0012	0.6

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.

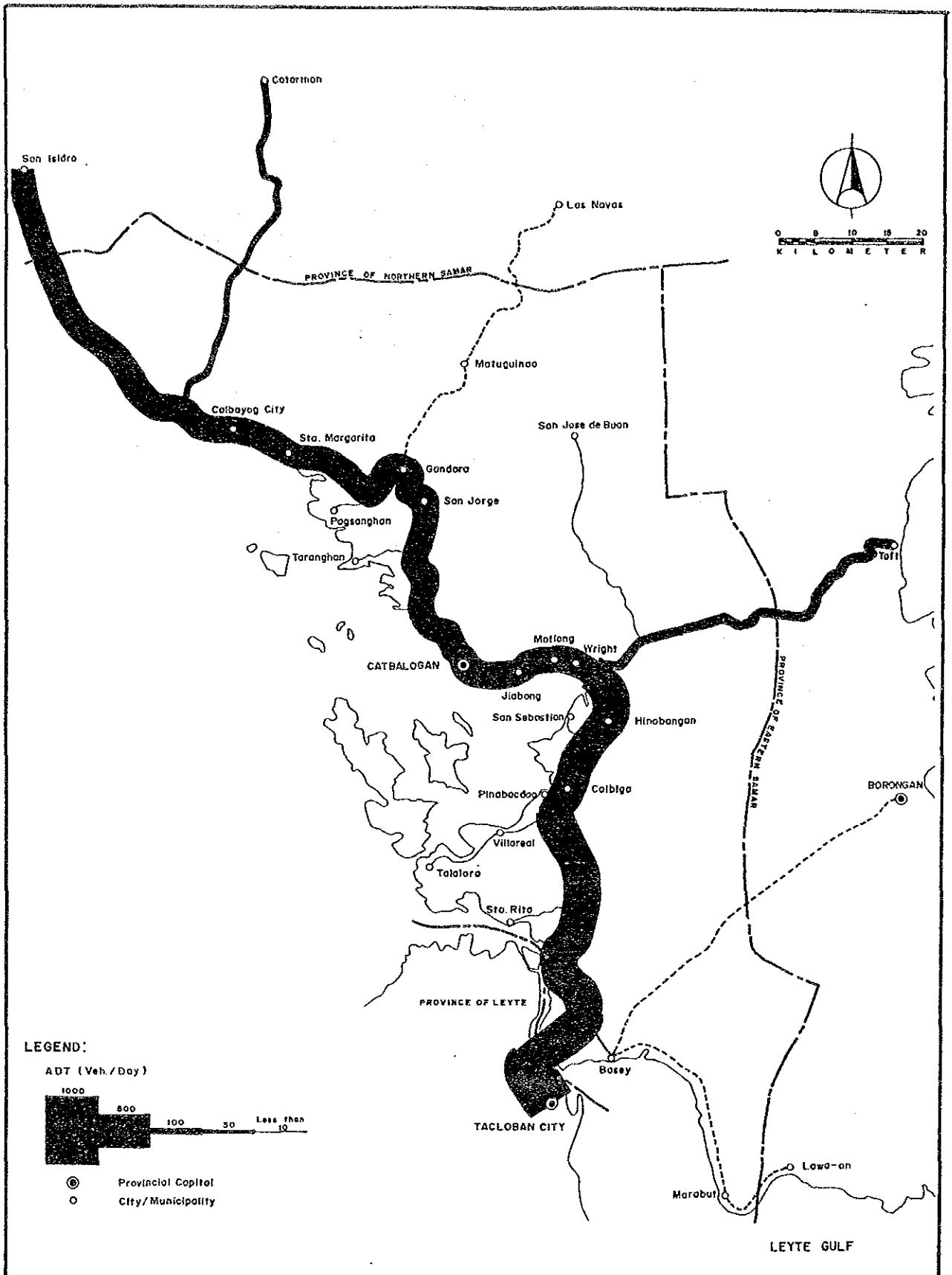


FIGURE 3.2-4 ESTIMATED TRAFFIC VOLUME (1990)

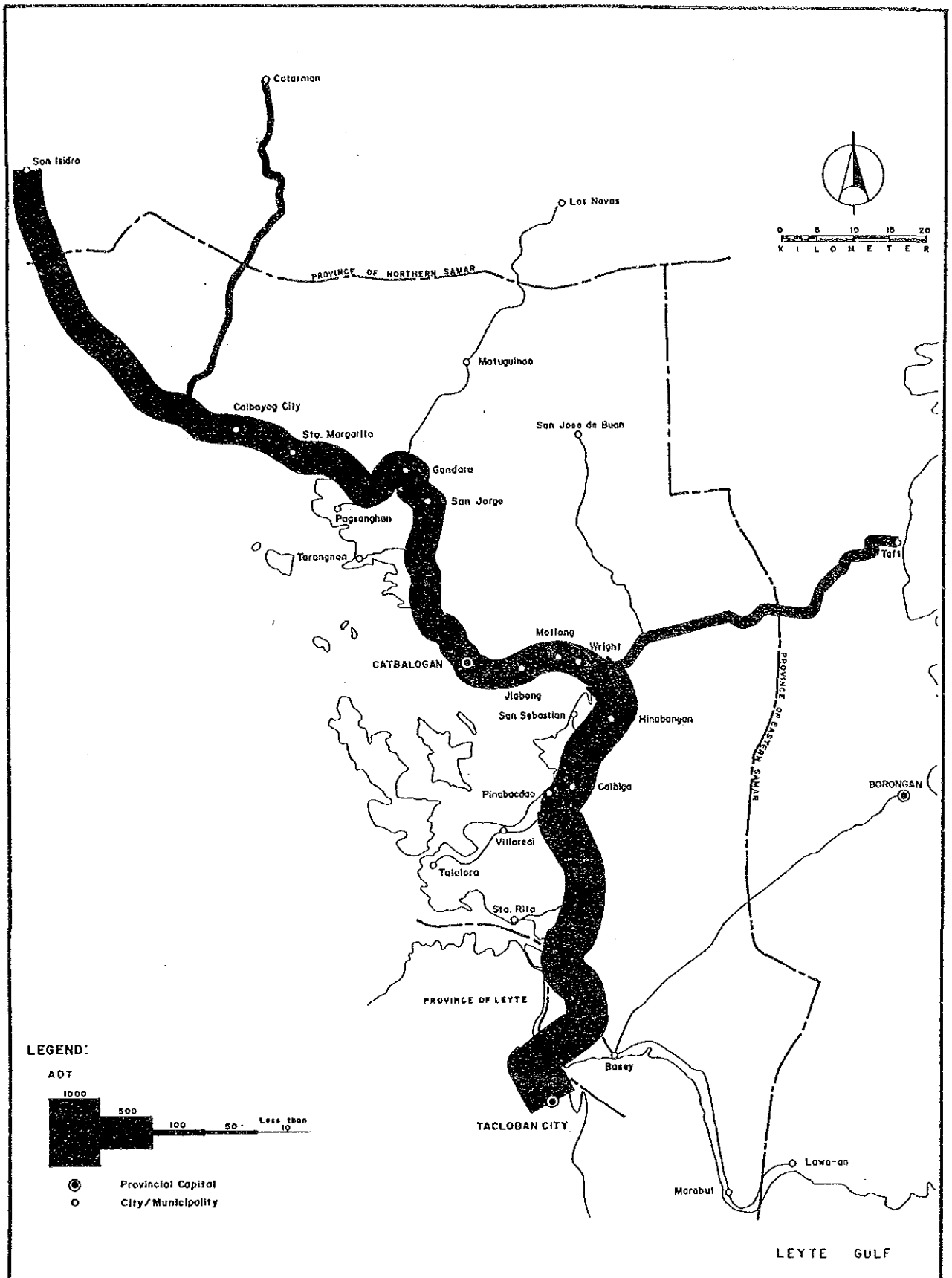


FIGURE 3.2-5 ESTIMATED TRAFFIC VOLUME (1993)
"WITH PROJECT" CASE

TRAFFIC PROJECTION SAMAR

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	4445				4445	362.26				362.26
	1993	5029	-	-	-	5029	398.09	-	.28	-	398.37
1	1997	5929	-	1	-	5929	451.44	-	.32	-	451.76
	2007	8808	-	1	-	8809	608.62	-	.44	-	609.05
	2017	12904	-	1	-	12905	809.10	-	.58	-	809.69
	1990	4517				4517	353.23				353.23
	1993	5111	-	-34	-	5077	388.25	-	-4.67	-	383.58
2	1997	6027	-	-40	-	5986	440.40	-	-5.31	-	435.08
	2007	8955	-	-60	-	8896	594.02	-	-7.20	-	586.82
	2017	13122	-	-87	-	13034	789.98	-	-9.63	-	780.35
	1990	4463				4463	324.09				324.09
	1993	5050	-	-31	-	5019	356.53	-	-4.09	-	352.44
3	1997	5956	-	-37	-	5919	404.86	-	-4.65	-	400.21
	2007	8853	-	-55	-	8798	547.46	-	-6.34	-	541.13
	2017	12976	-	-81	-	12895	729.69	-	-8.50	-	721.19
	1990	4454				4454	317.29				317.29
	1993	5041	-	-31	-	5010	349.13	-	-4.08	-	345.05
4	1997	5944	-	-37	-	5908	396.59	-	-4.65	-	391.95
	2007	8837	-	-54	-	8782	536.70	-	-6.33	-	530.37
	2017	12953	-	-80	-	12873	715.83	-	-8.48	-	707.35
	1990	4454				4454	317.29				317.29
	1993	5041	-	-31	4	5013	349.13	-	-4.08	1.56	346.61
5	1997	5944	-	-37	14	5922	396.59	-	-4.65	5.54	397.49
	2007	8837	-	-54	23	8806	536.70	-	-6.33	8.24	538.61
	2017	12953	-	-80	38	12911	715.83	-	-8.48	11.77	719.12
	1990	4459				4459	317.09				317.09
	1993	5046	-	-30	13	5028	348.89	-	-3.99	5.46	350.35
6	1997	5950	-	-36	49	5963	396.27	-	-4.54	19.58	411.31
	2007	8846	-	-53	84	8876	536.13	-	-6.18	29.61	559.56
	2017	12966	-	-78	137	13025	714.95	-	-8.28	44.03	750.70
	1990	4460				4460	315.32				315.32
	1993	5047	-	-30	13	5030	346.99	-	-3.96	5.46	348.49
7	1997	5952	-	-36	49	5965	394.19	-	-4.51	19.58	409.27
	2007	8848	-	-53	84	8879	533.53	-	-6.13	29.61	557.00
	2017	12969	-	-78	137	13028	711.71	-	-8.22	44.03	747.53
	1990	4471				4471	316.20				316.20
	1993	5060	-	-30	13	5043	347.97	-	-3.93	5.69	349.73
8	1997	5967	-	-35	49	5981	395.32	-	-4.47	20.84	411.69
	2007	8871	-	-52	84	8903	535.12	-	-6.08	32.51	561.55
	2017	13004	-	-76	137	13065	713.90	-	-8.15	49.69	755.44

TRAFFIC PROJECTION SAMAR

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	4525				4525	334.43				334.43
	1993	5121	-	-29	13	5105	367.89	-	-3.68	5.69	369.90
9	1997	6038	-	-34	49	6053	417.75	-	-4.19	20.84	434.40
	2007	8975	-	-50	84	9008	564.79	-	-5.72	32.51	591.59
	2017	13152	-	-74	137	13216	752.58	-	-7.68	49.69	794.59
	1990	4536				4536	335.91				335.91
	1993	5133	-	-28	13	5118	369.56	-	-3.66	5.69	371.59
10	1997	6053	-	-33	49	6068	419.70	-	-4.17	20.84	436.37
	2007	8996	-	-50	84	9031	567.60	-	-5.69	32.51	594.42
	2017	13184	-	-73	137	13249	756.50	-	-7.64	49.69	798.55
	1990	4547				4547	339.63				339.63
	1993	5145	-	-28	13	5130	373.64	-	-3.66	5.69	375.67
11	1997	6067	-	-33	49	6082	424.30	-	-4.17	20.84	440.97
	2007	9017	-	-50	84	9051	573.72	-	-5.69	32.51	600.54
	2017	13214	-	-73	137	13278	764.53	-	-7.64	49.69	806.58
	1990	5822				5822	423.70				423.70
	1993	6589	-	-3	13	6599	466.48	-	-1.40	5.69	470.77
12	1997	7772	-	-3	49	7817	530.29	-	-1.59	20.84	549.54
	2007	11558	-	-5	84	11637	718.79	-	-2.14	32.51	749.16
	2017	16947	-	-7	137	17078	959.96	-	-2.85	49.69	1006.80
	1990	5831				5831	426.59				426.59
	1993	6599	-	-3	13	6609	469.52	-	-1.37	5.69	473.83
13	1997	7783	-	-3	49	7828	533.54	-	-1.56	20.84	552.82
	2007	11572	-	-4	84	11651	722.65	-	-2.12	32.51	753.04
	2017	16965	-	-7	137	17096	964.58	-	-2.82	49.69	1011.46
	1990	5837				5837	428.85				428.85
	1993	6606	-	-2	13	6616	471.99	-	-1.34	5.69	476.33
14	1997	7791	-	-3	49	7836	536.30	-	-1.53	20.84	555.61
	2007	11584	-	-4	84	11663	726.24	-	-2.07	32.51	756.69
	2017	16982	-	-6	137	17113	969.21	-	-2.75	49.69	1016.15
	1990	5850				5850	433.98				433.98
	1993	6620	-	-2	13	6630	477.38	-	-1.34	5.69	481.73
15	1997	7806	-	-3	49	7852	542.06	-	-1.52	20.84	561.39
	2007	11603	-	-4	84	11683	733.06	-	-2.06	32.51	763.52
	2017	17008	-	-6	137	17139	977.35	-	-2.74	49.69	1024.31
	1990	5891				5891	450.58				450.58
	1993	6666	-	-2	15	6679	495.47	-	-1.15	6.64	500.95
16	1997	7860	-	-2	56	7914	562.35	-	-1.31	24.11	585.15
	2007	11681	-	-3	95	11773	759.69	-	-1.76	36.95	794.88
	2017	17118	-	-5	154	17267	1011.85	-	-2.34	55.57	1065.07

TRAFFIC PROJECTION SAMAR

TABLE 3.2 - 4 (3)

Movement of Passengers and Commodity

Link	Year	Number of Passengers					Commodity Tonnage				
		Normal	Diver-ted-1	Diver-ted-2	Gene-rated	Total	Normal	Diver-ted-1	Diver-ted-2	Gene-rated	Total
	1990	5915				5915	454.72				454.72
	1993	6692	-	-2	16	6707	499.98	-	-1.07	8.77	507.68
17	1997	7891	-	-2	61	7949	567.42	-	-1.21	31.54	597.75
	2007	11726	-	-3	102	11824	766.37	-	-1.64	47.36	812.09
	2017	17182	-	-5	163	17341	1020.53	-	-2.18	69.60	1087.95
	1990	5977				5977	483.80				483.80
	1993	6762	-	-1	-	6762	531.65	-	-.42	-	531.23
18	1997	7972	-	-1	-	7971	602.90	-	-.47	-	602.42
	2007	11843	-	-1	-	11842	812.82	-	-.64	-	812.18
	2017	17350	-	-2	-	17348	1080.59	-	-.86	-	1079.74
	1990	561				561	86.37				86.37
	1993	634	-	-	-	634	94.91	-	-.05	-	94.86
19	1997	748	-	-	-	747	107.63	-	-.06	-	107.57
	2007	1111	-	-1	-	1110	145.11	-	-.08	-	145.03
	2017	1627	-	-1	-	1627	192.91	-	-.10	-	192.81
	1990	1689				1689	167.86				167.86
	1993	1912	-	-	-	1912	184.81	-	-.10	-	184.71
20	1997	2256	-	-	-	2256	210.14	-	-.13	-	210.00
	2007	3357	-	-	-	3357	285.21	-	-.26	-	284.95
	2017	4926	-	-	-	4926	381.50	-	-.43	-	381.07
	1990	1679				1679	163.75				163.75
	1993	1899	-	-	-	1899	179.95	-	.12	-	180.07
21	1997	2239	-	-	-	2239	204.07	-	.13	-	204.20
	2007	3326	-	1	-	3327	275.12	-	.18	-	275.30
	2017	4873	-	1	-	4874	365.74	-	.24	-	365.98
	1990	64				64	30.33				30.33
	1993	72	-	-	16	88	33.04	-	.19	8.77	42.00
22	1997	84	-	1	61	145	37.02	-	.22	31.54	68.79
	2007	121	-	1	102	223	48.53	-	.29	47.36	96.18
	2017	172	-	1	163	337	62.81	-	.39	69.60	132.80
	1990	-				-	-				-
	1993	-	-	-	23	23	-	-	-	11.26	11.26
23	1997	-	-	-	87	87	-	-	-	40.89	40.89
	2007	-	-	-	146	146	-	-	-	61.99	61.99
	2017	-	-	-	232	232	-	-	-	91.19	91.19
	1990	2				2	.85				.85
	1993	2	-	-	7	10	.94	-	.16	2.94	4.04
24	1997	2	-	1	27	30	1.07	-	.18	10.55	11.81
	2007	4	-	1	44	49	1.48	-	.24	15.66	17.39
	2017	5	-	1	69	75	2.00	-	.32	22.32	24.64

TRAFFIC PROJECTION SAMAR

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	1				1	.35				.35
	1993	1	-	-	3	3	.38	-	-	1.14	1.52
25	1997	1	-	-	9	10	.42	-	-	3.77	4.19
	2007	1	-	-	13	14	.53	-	-	4.80	5.33
	2017	2	-	-	18	20	.68	-	-	6.11	6.79
	1990	1				1	.27				.27
	1993	1	-	-	11	11	.30	-	-	4.93	5.23
26	1997	1	-	-	39	40	.33	-	-	17.20	17.54
	2007	1	-	-	64	65	.44	-	-	24.77	25.21
	2017	2	-	-	102	103	.58	-	-	35.25	35.82
	1990	-				-	-				-
	1993	-	-	-	11	11	-	-	-	5.17	5.17
27	1997	-	-	-	38	38	-	-	-	17.71	17.71
	2007	-	-	-	58	58	-	-	-	24.58	24.58
	2017	-	-	-	89	89	-	-	-	33.53	33.53
	1990	26				26	5.36				5.36
	1993	30	-	-	-	30	5.94	-	-	1.32	7.27
28	1997	36	-	-	-	36	6.83	-	-	4.55	11.38
	2007	55	-	-	-	55	9.46	-	-	6.32	15.78
	2017	82	-	-	-	82	12.78	-	-	8.54	21.32
	1990	13				13	5.99				5.99
	1993	15	-	-	-	15	7.08	-	-	-	7.08
29	1997	20	-	-	-	20	8.83	-	-	-	8.83
	2007	36	-	-	-	36	14.63	-	.01	-	14.64
	2017	63	-	-	-	63	22.79	-	.01	-	22.80
	1990	7				7	3.40				3.40
	1993	8	-	-	-	8	3.69	-	-	-	3.69
30	1997	9	-	-	-	9	4.11	-	-	-	4.12
	2007	13	-	-	-	13	5.34	-	-	-	5.34
	2017	19	-	-	-	19	6.85	-	.01	-	6.85
	1990	13				13	6.06				6.06
	1993	14	-	-	-	14	6.61	-	.01	-	6.62
31	1997	17	-	-	-	17	7.42	-	.01	-	7.43
	2007	24	-	-	-	24	9.76	-	.01	-	9.77
	2017	35	-	-	-	35	12.68	-	.01	-	12.69
	1990	32				32	15.24				15.24
	1993	36	-	-	2	39	16.57	-	.01	1.17	17.75
32	1997	42	-	-	8	50	18.52	-	.02	3.85	22.38
	2007	60	-	-	12	72	24.12	-	.02	4.91	29.06
	2017	86	-	-	16	102	31.07	-	.03	6.20	37.30

TRAFFIC PROJECTION SAMAR

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	-				-	-				-
	1993	-	-	-	2	2	-	-	-	1.17	1.17
33	1997	-	-	-	8	8	-	-	-	3.85	3.85
	2007	-	-	-	12	12	-	-	-	4.91	4.91
	2017	-	-	-	16	16	-	-	-	6.20	6.20
	1990	25				25	4.66				4.66
	1993	28	-	-	1	29	5.08	-	.01	2.55	7.63
34	1997	32	-	-	5	37	5.71	-	.01	8.51	14.22
	2007	47	-	-	7	53	7.51	-	.01	11.25	18.77
	2017	67	-	-	10	76	9.74	-	.01	14.59	24.35
	1990	-				-	-				-
	1993	-	-	-	4	4	-	-	-	1.56	1.56
35	1997	-	-	-	14	14	-	-	-	5.54	5.54
	2007	-	-	-	23	23	-	-	-	8.24	8.24
	2017	-	-	-	38	38	-	-	-	11.77	11.77

TRAFFIC PROJECTION SAMAR

TABLE 3.2 - 5 (1)

Traffic Volume

Link	Year	w/o									with							
		Car/Van	Jeepney	Bus	Truck	Sub-Total	Tricycl	Mot. cycl	Animal	Total	Car/Van	Jeepney	Bus	Truck	Sub-Total	Tricycl	Mot. cycl	Animal	Total
1	1990	94	151	67	71	383	6	-	-	389									
	1993	104	169	76	78	428	7	-	-	434	128	158	77	77	440	4	6	-	450
	1997	120	197	89	90	495	8	-	-	503	205	159	93	83	541	-	20	-	561
	2007	167	284	131	124	706	10	-	-	717	295	228	138	114	775	-	29	-	805
	2017	231	405	190	168	995	13	-	-	1009	420	323	202	153	1098	-	43	-	1141
2	1990	117	142	70	62	392	13	-	-	406									
	1993	131	160	79	69	438	15	-	-	453	145	151	79	69	443	10	6	-	459
	1997	151	186	93	78	508	17	-	-	526	204	158	94	81	536	-	20	-	556
	2007	214	268	137	107	727	25	-	-	751	294	227	139	110	770	-	30	-	800
	2017	300	382	200	144	1026	35	-	-	1061	419	321	203	149	1092	-	43	-	1135
3	1990	111	137	69	58	375	13	-	-	388									
	1993	124	154	78	64	420	14	-	-	434	139	146	78	64	426	9	6	-	441
	1997	144	180	91	73	488	17	-	-	505	197	152	93	75	517	-	20	-	536
	2007	205	260	135	100	699	24	-	-	723	285	219	137	103	744	-	29	-	773
	2017	288	371	196	135	990	34	-	-	1024	407	311	201	139	1057	-	43	-	1100
4	1990	110	136	69	57	372	13	-	-	385									
	1993	123	153	78	63	416	14	-	-	430	137	144	78	63	422	9	6	-	437
	1997	142	178	91	71	483	17	-	-	500	196	151	93	74	512	-	20	-	532
	2007	203	258	134	98	693	24	-	-	717	283	217	137	101	738	-	29	-	767
	2017	285	369	196	133	982	34	-	-	1016	404	309	200	136	1050	-	43	-	1093
5	1990	110	136	69	57	372	13	-	-	385									
	1993	123	153	78	63	416	14	-	-	430	137	145	78	63	423	9	6	-	438
	1997	142	178	91	71	483	17	-	-	500	197	152	93	74	516	-	20	-	535
	2007	203	258	134	98	693	24	-	-	717	285	219	137	102	743	-	29	-	772
	2017	285	369	196	133	982	34	-	-	1016	407	311	201	138	1057	-	43	-	1100
6	1990	105	141	65	64	375	5	15	-	396									
	1993	117	159	74	71	420	6	17	-	443	134	149	75	69	428	4	17	-	448
	1997	135	185	87	81	488	7	20	-	515	200	154	94	77	524	-	20	-	544
	2007	192	268	128	113	700	9	29	-	739	289	223	139	106	756	-	30	-	786
	2017	269	383	186	154	993	12	43	-	1048	414	317	203	144	1078	-	43	-	1121
7	1990	104	141	65	64	375	5	15	-	395									
	1993	116	158	74	71	419	6	17	-	442	134	149	75	69	427	4	17	-	448
	1997	135	185	87	81	487	7	20	-	514	199	154	94	76	523	-	20	-	543
	2007	191	268	128	112	699	9	29	-	738	289	222	139	105	755	-	30	-	785
	2017	268	383	186	154	991	12	43	-	1046	414	317	203	143	1077	-	43	-	1120
8	1990	98	149	61	68	376	5	30	-	411									
	1993	109	167	69	75	421	6	34	-	460	129	155	72	72	429	4	28	-	460
	1997	127	195	81	86	489	7	40	-	535	200	155	94	77	525	-	20	-	545
	2007	179	283	119	120	702	9	59	-	770	290	223	139	106	759	-	30	-	789
	2017	251	406	174	165	995	12	87	-	1093	416	318	204	145	1082	-	44	-	1126

TRAFFIC PROJECTION SAMAR

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	102	153	62	71	387	6	30	-	423								
	1993	113	171	70	78	433	6	34	-	474	134	159	73	75	441	4	28	-	474
9	1997	131	200	82	90	503	7	40	-	550	205	159	95	81	540	-	20	-	560
	2007	185	290	121	125	721	9	60	-	790	297	229	141	111	779	-	30	-	809
	2017	259	415	176	171	1021	13	88	-	1121	425	326	206	151	1109	-	44	-	1153
	1990	102	153	62	71	389	6	30	-	424								
	1993	114	172	70	79	435	6	34	-	475	134	159	74	76	443	4	28	-	475
10	1997	132	201	83	90	505	7	40	-	552	206	159	95	81	542	-	20	-	562
	2007	186	291	122	125	724	9	60	-	793	298	230	141	112	781	-	30	-	811
	2017	260	416	177	172	1024	13	88	-	1125	427	327	207	152	1112	-	44	-	1157
	1990	103	154	62	72	391	6	30	-	427								
	1993	115	173	71	79	437	6	34	-	478	135	160	74	76	445	4	28	-	478
11	1997	132	202	83	91	508	7	40	-	555	207	160	96	82	545	-	20	-	565
	2007	187	292	122	126	727	10	60	-	797	300	231	142	113	785	-	30	-	815
	2017	261	418	177	174	1030	13	88	-	1130	428	329	207	153	1118	-	44	-	1162
	1990	148	186	85	80	499	7	29	-	535								
	1993	165	209	96	89	558	8	33	-	599	185	197	99	89	570	5	29	-	604
12	1997	191	243	113	102	649	9	39	-	697	263	204	123	102	692	-	26	-	718
	2007	273	353	166	140	932	12	58	-	1002	382	294	182	141	999	-	39	-	1038
	2017	384	505	242	191	1321	16	85	-	1422	546	419	266	192	1424	-	57	-	1481
	1990	149	186	85	81	501	7	29	-	537								
	1993	166	209	96	89	560	8	33	-	601	186	198	99	89	572	5	29	-	606
13	1997	192	244	113	102	651	9	39	-	699	264	204	123	103	694	-	26	-	720
	2007	274	354	166	141	934	12	58	-	1004	383	295	182	142	1001	-	39	-	1040
	2017	385	506	242	192	1325	16	85	-	1426	548	420	267	193	1427	-	57	-	1484
	1990	149	187	85	81	502	7	29	-	538								
	1993	166	210	96	90	562	8	33	-	603	186	198	99	90	573	5	29	-	608
14	1997	193	245	113	103	653	9	39	-	701	265	205	123	103	696	-	26	-	722
	2007	274	354	167	142	937	12	58	-	1007	384	295	183	142	1004	-	39	-	1043
	2017	386	507	242	193	1328	16	85	-	1429	549	421	267	194	1430	-	57	-	1487
	1990	150	188	85	82	505	7	29	-	542								
	1993	167	211	96	91	565	8	33	-	606	187	199	99	91	577	5	29	-	611
15	1997	194	246	113	104	656	9	39	-	705	266	206	123	104	699	-	26	-	726
	2007	276	356	167	143	941	12	58	-	1011	385	297	183	144	1008	-	39	-	1047
	2017	388	508	243	194	1333	16	85	-	1434	550	422	267	195	1435	-	57	-	1492
	1990	177	191	86	89	543	8	-	-	550								
	1993	197	214	97	99	607	8	-	-	615	209	203	100	97	609	6	7	-	622
16	1997	229	250	113	113	705	9	-	-	715	271	210	125	108	714	-	26	-	740
	2007	327	361	167	157	1012	13	-	-	1025	392	302	185	149	1027	-	39	-	1067
	2017	462	515	243	214	1434	17	-	-	1451	560	430	270	202	1461	-	58	-	1518

TRAFFIC PROJECTION SAMAR

TABLE 3.2 - 5 (3)

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	178	192	86	90	546	8	-	-	553									
	1993	199	215	97	100	611	8	-	-	619	211	204	100	99	614	6	7	-	627
17	1997	230	251	114	114	709	9	-	-	719	274	212	125	110	722	-	26	-	748
	2007	329	363	168	158	1018	13	-	-	1030	396	305	185	152	1038	-	39	-	1078
	2017	465	518	244	215	1442	17	-	-	1459	565	434	271	206	1475	-	58	-	1533
	1990	184	197	87	95	563	8	-	-	571									
	1993	205	221	99	105	630	9	-	-	639	215	209	101	102	628	6	8	-	641
18	1997	238	258	116	120	731	10	-	-	741	275	213	126	111	725	-	27	-	751
	2007	339	372	170	165	1046	14	-	-	1060	396	306	186	152	1039	-	39	-	1079
	2017	478	530	247	225	1480	18	-	-	1498	564	433	271	204	1472	-	58	-	1530
	1990	17	41	-	18	76	-	-	-	76									
	1993	19	46	-	20	85	-	-	-	85	21	38	3	19	82	3	1	-	87
19	1997	22	54	-	23	98	-	-	-	98	30	27	12	19	89	11	5	-	104
	2007	30	78	-	31	139	-	-	-	139	42	38	18	26	125	15	7	-	147
	2017	42	111	-	43	195	-	-	-	195	59	53	26	36	174	19	11	-	204
	1990	27	38	31	41	137	-	-	-	137									
	1993	30	42	35	46	153	-	-	-	153	40	47	34	42	163	6	4	-	174
20	1997	34	49	42	52	177	-	-	-	177	72	66	36	41	214	21	15	-	250
	2007	48	72	62	72	253	-	-	-	253	102	94	53	57	306	28	22	-	357
	2017	67	103	90	99	358	-	-	-	358	143	133	78	78	431	38	33	-	502
	1990	26	37	31	40	135	-	-	-	135									
	1993	29	42	35	44	150	-	-	-	150	40	46	34	41	161	6	4	-	171
21	1997	33	49	41	51	174	-	-	-	174	70	65	36	40	211	20	15	-	246
	2007	47	70	61	70	248	-	-	-	248	100	92	53	55	300	28	22	-	349
	2017	65	101	88	95	349	-	-	-	349	140	130	77	75	422	37	32	-	491
	1990	1	20	-	1	22	-	-	-	22									
	1993	1	22	-	1	24	-	-	-	24	4	21	.5	3	29	1	.2	-	30
22	1997	1	25	-	1	28	-	-	-	28	14	12	2	11	40	7	1	-	48
	2007	2	34	-	2	37	-	-	-	37	20	18	4	15	57	10	1	-	68
	2017	2	44	-	2	49	-	-	-	49	29	25	6	21	81	13	2	-	96
	1990	-	-	-	-	-	-	-	-	-									
	1993	-	-	-	-	-	-	-	-	-	.8	.7	.1	.6	2	.4	.1	55	58
23	1997	-	-	-	-	-	-	-	-	-	9	7	1	6	24	4	.6	-	29
	2007	-	-	-	-	-	-	-	-	-	13	12	2	10	37	6	1	-	44
	2017	-	-	-	-	-	-	-	-	-	20	17	4	14	55	9	2	-	66
	1990	-	-	-	-	-	-	-	6	6									
	1993	-	-	-	-	-	-	-	7	7	.3	.3	.1	.2	.8	.1	.0	20	21
24	1997	-	-	-	-	-	-	-	8	8	3	2	.5	2	7	1	.2	-	9
	2007	-	-	-	-	-	-	-	11	11	4	3	.8	3	11	2	.3	-	13
	2017	-	-	-	-	-	-	-	15	15	6	5	1	4	16	2	.5	-	19

TRAFFIC PROJECTION SAMAR

TABLE 3.2 - 5 (4)

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
25	1990	-	-	-	-	-	-	-	3	3									
	1993	-	-	-	-	-	-	-	3	3	.1	.1	.0	.1	.3	.1	.0	8	8
	1997	-	-	-	-	-	-	-	3	3	.9	.8	.2	.7	3	.4	.1	-	3
	2007	-	-	-	-	-	-	-	4	4	1	1	.2	.8	3	.5	.1	-	4
	2017	-	-	-	-	-	-	-	5	5	2	1	.3	1	4	.7	.1	-	5
26	1990	-	-	-	-	-	-	-	2	2									
	1993	-	-	-	-	-	-	-	2	2	.4	.3	.1	.3	1	.2	.0	26	27
	1997	-	-	-	-	-	-	-	2	2	4	3	.7	3	10	2	.3	-	12
	2007	-	-	-	-	-	-	-	3	3	5	5	1	4	15	3	.4	-	18
	2017	-	-	-	-	-	-	-	4	4	8	7	2	6	22	4	.7	-	27
27	1990	-	-	-	-	-	-	-	-	-									
	1993	-	-	-	-	-	-	-	-	-	.4	.3	.1	.3	1	.2	.0	25	27
	1997	-	-	-	-	-	-	-	-	-	4	3	.7	3	10	2	.3	-	12
	2007	-	-	-	-	-	-	-	-	-	5	5	1	4	15	2	.4	-	18
	2017	-	-	-	-	-	-	-	-	-	7	6	1	5	21	3	.6	-	25
28	1990	2	1	.2	1	4	1	.7	-	6									
	1993	2	1	.2	1	5	1	.7	-	7	2	2	.2	1	5	1	.6	-	7
	1997	3	1	.2	2	6	1	.9	-	8	3	3	.2	2	8	2	.2	-	10
	2007	4	2	.3	2	8	2	1	-	11	4	4	.4	3	11	2	.4	-	14
	2017	5	3	.5	3	12	3	2	-	16	5	6	.5	3	15	4	.5	-	19
29	1990	.1	1	.0	1	3	-	.1	-	3									
	1993	.1	2	.0	2	3	-	.1	-	3	.6	1	.1	1	4	.3	.1	-	4
	1997	.1	2	.0	2	4	-	.1	-	4	2	2	.2	1	5	1	.2	-	7
	2007	.2	3	.0	3	7	-	.2	-	7	3	3	.4	2	9	2	.4	-	11
	2017	.4	6	.1	5	11	-	.3	-	12	5	5	.6	4	14	3	.6	-	18
30	1990	.2	.0	-	.2	.4	.1	2	19	22									
	1993	.2	.0	-	.2	.5	.2	3	21	24	.4	.3	.0	.4	1	.4	2	14	17
	1997	.2	.1	-	.3	.6	.2	3	24	27	.9	.8	.1	.7	2	1	.1	-	4
	2007	.3	.1	-	.4	.8	.3	4	31	36	1	1	.1	1	3	1	.1	-	5
	2017	.4	.1	-	.5	1	.4	5	40	46	2	1	.1	1	4	2	.1	-	6
31	1990	.4	3	-	.7	4	.8	2	1	7									
	1993	.4	3	-	.7	4	.9	2	1	8	.7	2	.0	.9	4	1	1	.8	7
	1997	.5	3	-	.8	4	1	2	1	9	2	1	.1	1	4	2	.1	-	6
	2007	.7	4	-	1	6	1	3	2	12	2	2	.2	2	6	3	.2	-	9
	2017	.9	6	-	1	8	2	4	3	16	3	3	.3	2	8	4	.2	-	12
32	1990	2	7	-	1	10	1	6	-	18									
	1993	3	7	-	1	11	1	7	-	19	3	6	.2	2	12	2	5	-	18
	1997	3	8	-	1	13	2	8	-	22	5	4	.6	4	14	3	.3	-	17
	2007	4	11	-	2	17	2	10	-	29	6	6	.9	5	18	4	.5	-	23
	2017	5	14	-	2	22	3	14	-	39	8	8	1	6	24	5	.7	-	30

TRAFFIC PROJECTION SAMAR

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
33	1990	-	-	-	-	-	-	-	-	-									
	1993	-	-	-	-	-	-	-	-	-	.2	.3	.0	.1	.7	.1	.2	.5	1
	1997	-	-	-	-	-	-	-	-	-	.8	.7	.1	.6	2	.5	.1	-	3
	2007	-	-	-	-	-	-	-	-	-	1	1	.1	.8	3	.7	.1	-	4
	2017	-	-	-	-	-	-	-	-	-	1	1	.2	1	4	.9	.1	-	5
34	1990	2	-	-	-	2	13	8	-	23									
	1993	2	-	-	-	2	14	9	-	25	3	.7	.1	.5	4	14	7	-	25
	1997	3	-	-	-	3	16	10	-	28	3	3	.3	2	9	2	.2	-	12
	2007	3	-	-	-	3	21	14	-	39	4	4	.5	3	12	3	.4	-	16
	2017	5	-	-	-	5	29	19	-	53	6	6	.6	4	16	4	.5	-	21
35	1990	-	-	-	-	-	-	-	-	-									
	1993	-	-	-	-	-	-	-	-	-	.1	.1	.0	.1	.3	.1	.0	8	8
	1997	-	-	-	-	-	-	-	-	-	1	1	.1	.9	3	1	.1	-	5
	2007	-	-	-	-	-	-	-	-	-	2	2	.2	1	5	2	.2	-	7
	2017	-	-	-	-	-	-	-	-	-	3	3	.3	2	8	3	.3	-	11

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 Samar

Existing Road Condition	Passenger Movement (trip/person/day)		Non-Agricultural Commodity (kg/person/day)	
	w/o	with	w/o	with
Paved/Gravel				
Good/Fair	0.06	0.06	2.0	2.0
Bad	0.05	0.055	1.6	1.8
Very Bad	0.04	0.055	0.6	1.0
Earth Road	0.015	0.03	0.5	1.0
Impassable to motoried vehicle	0.005	0.015	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

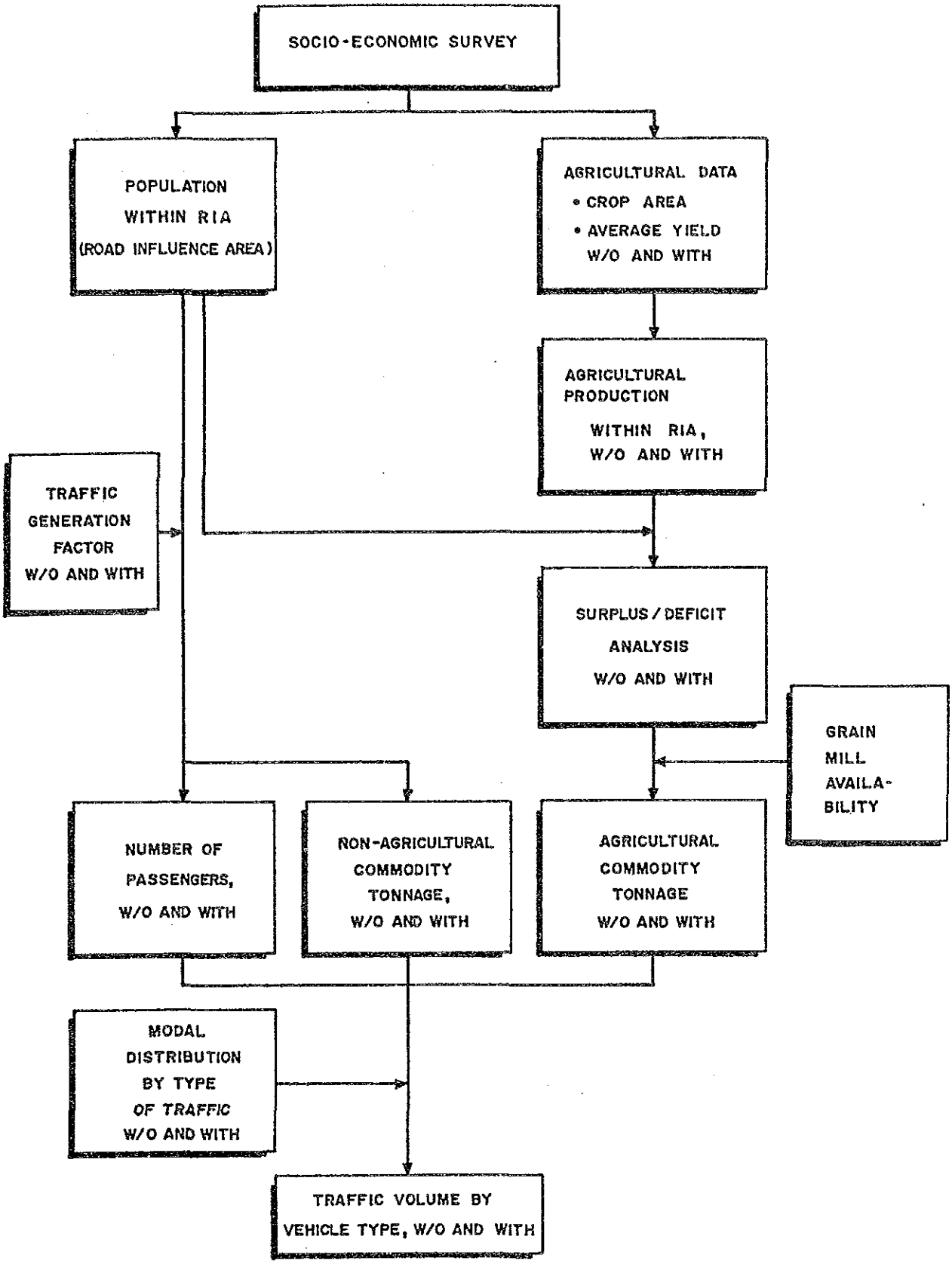


FIGURE 3.3-1
PROCEDURE OF TRAFFIC FORECAST FOR DEVELOPMENT PROJECTS

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 SAMAR

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
Primary Major	Rehab/Imp-1	N6-1	-	-	-	-	-	-	-	-	690	363	29	32	15	23	99	-	17	-	-	-
		N2	37	39	21	26	122	-	25	-	-	-	36	37	21	23	117	-	27	-	-	-
		N4	40	59	-	30	129	140	71	46	229	-	46	45	27	26	144	-	38	-	-	-
	New Const.	N6-2	-	-	-	-	-	-	-	-	85	41	3	3	1	3	10	-	1	-	-	-
Second'y Major	Rehab/Imp-1	P10	3	5	-	1	9	9	4	5	38	-	3	6	-	4	13	-	4	-	-	-
		P8	6	9	-	1	16	17	10	6	65	-	6	12	-	9	27	-	11	-	-	-
		P6-2	19	43	-	17	79	78	25	-	-	-	22	23	11	16	72	-	13	-	-	-
		P6-1	5	9	-	4	17	18	7	-	-	-	5	5	3	3	17	-	4	-	-	-
	New Const.	N5-3	-	-	-	-	-	-	-	178	956	-	13	15	6	12	45	-	5	-	-	-
		P1-2	-	-	-	-	-	-	-	74	372	-	4	5	2	5	16	-	1	-	-	-
		B23-1	-	-	-	-	-	-	-	-	68	33	2	5	-	2	9	6	1	-	-	-

TABLE 3.4 - 1 (2)

Traffic Volume by Vehicle Type SAMAR

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/ Imp-l	P9	4	7	-	2	13	13	4	9	58	-	4	8	-	4	16	13	5	-	-	-
		P13	4	6	-	1	11	12	8	3	41	-	4	7	-	3	14	15	8	-	-	-
		P2	-	-	-	-	-	-	-	72	400	-	5	11	-	5	21	17	6	-	-	-
		P4	10	13	-	1	24	24	18	8	97	-	10	14	-	7	31	34	18	-	-	-
		P7	3	6	-	1	10	11	4	6	46	-	3	7	-	5	16	-	5	-	-	-
	New Const.	P5	-	-	-	-	-	-	-	-	234	141	17	32	-	25	74	-	31	-	-	-
		P6-3	-	-	-	-	-	-	-	44	220	-	3	3	1	3	11	-	1	-	-	-

TABLE 3.4 - 1 (3)

Traffic Volume by Vehicle Type SAMAR

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 (Barangay)	Rehab/Imp-1	B15-1	-	-	-	-	-	-	-	168	854	-	7	18	-	12	36	-	3	-	-	-
		B21-1	-	-	-	-	-	-	-	61	315	-	3	7	-	5	14	-	2	-	-	-
		B03-8	-	6	-	7	13	30	10	26	73	-	5	11	-	4	20	16	5	-	-	-
		B03-11	-	14	-	21	35	67	34	51	156	-	13	27	-	20	59	-	18	-	-	-
		B06-1	-	-	-	-	-	-	-	42	209	-	1	4	-	3	8	-	0	-	-	-
		B07-1	-	-	-	-	-	-	-	138	692	-	5	14	-	9	28	-	2	-	-	-
		B02-1	-	-	-	-	-	-	-	10	85	19	3	5	-	2	10	11	5	-	-	-
		B23-2	-	-	-	-	-	-	-	116	606	-	6	14	-	10	30	-	5	-	-	-
		B08-2	7	18	-	12	37	-	7	-	-	-	7	17	-	12	36	-	9	-	-	-
		B03-6	10	18	-	4	32	34	14	20	142	-	10	21	-	15	46	-	14	-	-	-
	Imp-2/Widen	B00-1	8	15	-	3	26	27	12	14	110	-	8	16	-	7	31	29	13	-	-	-
	New Const.	B20-2	-	-	-	-	-	-	-	60	302	-	2	8	-	3	12	7	0	-	-	-
		B03-1	-	-	-	-	-	-	-	77	384	-	2	7	-	5	14	-	0	-	-	-
		B11-1	-	-	-	-	-	-	-	100	528	-	5	13	-	9	27	-	5	-	-	-
		B16-2	-	-	-	-	-	-	-	52	261	-	2	7	-	2	11	6	0	-	-	-
		B19-2	-	-	-	-	-	-	-	20	153	31	2	5	-	4	11	-	1	-	-	-
		B06-2	-	-	-	-	-	-	-	-	196	94	3	10	-	7	20	-	1	-	-	-
		B03-9	-	-	-	-	-	-	-	109	544	-	4	11	-	7	22	-	1	-	-	-
		B18-1	-	-	-	-	-	-	-	24	180	36	3	7	-	5	14	-	1	-	-	-
		B03-3	-	-	-	-	-	-	-	25	135	-	1	3	-	2	7	-	1	-	-	-
		B16-1	-	-	-	-	-	-	-	15	114	23	2	5	-	3	10	-	1	-	-	-
		B19-3	-	-	-	-	-	-	-	6	49	10	1	2	-	1	4	-	0	-	-	-
		B19-1	-	-	-	-	-	-	-	19	153	32	4	9	-	6	19	-	6	-	-	-
		B03-2	-	-	-	-	-	-	-	28	139	-	1	3	-	2	6	-	0	-	-	-

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 Samar

	Road Class	National Roads	Prov'l/City Roads	Barangay Roads	Total
Surveyed Road	Major Rd.	341.8	104.8	-	446.6
	Minor Rd.	12.8	44.1	56.7	113.6
	Total	354.6	148.9	56.7	560.2
Rd. Proj. Proposed by Local Officials	Major Rd.	87.5	47.7	8.4	143.6
	Minor Rd.	-	54.3	416.2	470.5
	Total	87.5	102.0	424.6	614.1
Studied Road	Major Rd.	351.0	136.1	8.4	495.5
	Minor Rd.	12.8	65.1	416.2	494.1
	Total	363.8	201.2	424.6	989.6

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 Samar

Road Class		National Road	Prov'l/City Road	Barangay Road	Total
Major Road	Length (kms.)	112.3	65.7	8.4	186.4
	(% to Studied Roads)	(32%)	(48%)	(100%)	(38%)
Minor Road	Length (kms.)	1.3	65.1	416.2	482.6
	(% to Studied Roads)	(10%)	(100%)	(100%)	(98%)
Total	Length (kms.)	113.6	130.8	424.6	669.0
	(% to Studied Roads)	(31%)	(65%)	(100%)	(68%)

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		
3	Primary	B	15.0 ≦ IRR	MA-2	To be selected for F/S
4	Secondary	B	15.0 ≦ IRR		
5	Primary	A	IRR < 7.5		
6	Secondary	A	IRR < 7.5		
7	Primary	B	IRR <15.0	MA-3	
8	Secondary	B	IRR <15.0		

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		To be selected for F/S
3	National/Provincial/ City	A	MPI < 7.5	MI-2	
4	Barangay	A	MPI < 7.5		

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 Samar

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	-	-
3	Primary	B	15.0 ≤ IRR	MA-2	-	-
4	Secondary	B	15.0 ≤ IRR	MA-2	-	-
5	Primary	A	IRR<7.5	MA-2	78.9	4
6	Secondary	A	IRR<7.5	MA-2	107.5	7
7	Primary	B	IRR<15.0	MA-3	-	-
8	Secondary	B	IRR<15.0	MA-3	-	-
	Total				186.4	11

Table 4.2-7 PRIORITY OF IDENTIFIED MINOR ROADS
Province of Samar

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	57.3	6
2	Barangay	A	7.5 ≤ MPI	MI-1	270.4	24
3	Nat'l/Provi/	A	MPI < 7.5	MI-2	9.1	2
4	Barangay	A	MPI < 7.5	MI-2	145.8	23
	Total				482.6	55

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	181.5 kms.	(11 projects)
Minor Road	345.5 kms.	(31 projects)
Total	527.0 kms.	(42 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 SAMAR

Primary Major

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	N6-1	37.1	0	99	25.2	3.2-5.5	GRV Bad/V.Bad	Imp-1(6.0-BMP)	2-lane Br (n=16,L=772m)	93.08	55.46	148.54	8.6 (D)
					6.7	4.5	GRV Fair	Imp-2(6.0-BMP)					
					5.2		None	New-C(6.0-BMP)					
	N2	25.2	122	117	8.2	6.0	PCC Fair	-	2-cell BC (n= 1,L= 7m)	64.72	.61	65.33	7.5 (D)
					1.0	6.0	GRV Bad	Imp-1(6.0-PCC)					
					1.5	6.0	PCC Fair	Rehab(6.0-PCC)					
					14.5	5.5-6.0	GRV Bad/V.Bad	Imp-1(6.0-BMP)					
	N4	6.8	129	144	6.8	4.0	GRV Bad	Imp-1(6.0-BMP)	2-cell BC (n= 1,L= 6m) 2-lane Br (n= 1,L= 24m)	16.96	2.56	19.52	5.8 (D)
New Const.	N6-2	13.3	0	10	13.3		None	New-C(6.0-BMP)		41.60	.00	41.60	.0 (D)

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

TABLE 5.1 - 2 (2)

Summary of Proposed Improvement SAMAR

Secondary Major

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	P10	3.2	9	13	2.9 .3	4.0-5.5 3.0	GRV Bad/V.Bad PCC Good	Rehab(6.0-GRV) Widen(6.0-PCC)		3.69	.00	3.69	13.2 (D)
	P8	6.7	16	27	5.2 1.1 .2 .2	4.0-4.5 4.5 3.0 6.0	GRV Bad/V.Bad EAR V.Bad PCC Fair PCC Fair	Rehab(6.0-GRV) Imp-1(6.0-GRV) Widen(6.0-PCC) -	2-lane Br (n= 1,L= 13m)	9.12	1.35	10.47	12.7 (D)
	P6-2	32.8	79	72	32.8	3.2-4.5	GRV V.Bad	Rehab(6.0-GRV)	2-lane Br (n=11,L=252m) 2-cell BC (n= 1,L= 7m)	35.12	21.60	56.72	6.7 (D)
	P6-1	3.9	17	17	3.9	4.0-4.5	GRV Bad/V.Bad	Rehab(6.0-GRV)	2-lane Br (n= 1,L= 43m)	4.36	3.10	7.46	4.3 (D)
New Const.	N5-3	30.2	0	45	7.5 1.8 20.9	6.0 6.0	GRV Bad EAR Bad None	Rehab(6.0-GRV) Imp-1(6.0-GRV) New-C(6.0-GRV)	1-cell BC (n= 1,L= 4m)	46.02	.39	46.41	15.9 (D)
	P1-2	18.0	0	15	18.0		None	New-C(6.0-GRV)		31.90	.00	31.90	11.7 (D)
	B23-1	4.3	0	9	4.3		None	New-C(6.0-GRV)	2-lane Br (n= 2,L=145m)	6.68	9.64	16.33	10.9 (D)

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

TABLE 5.1 - 2 (3)

Summary of Proposed Improvement SAMAR

Minor(National/Provincial)

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	P9	7.5	13	16	.2	6.0	PCC Good	-	2-cell BC (n= 1,L= 7m) 2-lane Sp (n= 1,L= 17m)	6.11	.87	6.98	15.2 (D)
					7.3	3.2-4.0	GRV V.Bad/Impa	Rehab(6.0-GRV)					
	P13	2.9	11	14	2.7	5.5	GRV Bad/V.Bad	Rehab(6.0-GRV)	1-cell BC (n= 1,L= 5m)	2.28	.39	2.67	12.9 (D)
					.2	6.1	PCC Good	-					
	P2	13.1	0	21	1.0	6.0	PCC Good	-	2-lane Br (n= 1,L=150m)	12.75	9.47	22.23	11.1 (D)
					12.1	4.5-6.0	GRV Bad/Impas	Rehab(6.0-GRV)					
	P4	2.3	24	31	1.3	6.1	PCC Good/Fair	-		1.24	.00	1.24	9.2 (D)
					.5	3.0	PCC Good	Widen(6.0-PCC)					
					.5	4.5	GRV Bad	Rehab(6.0-GRV)					
	P7	7.6	10	16	7.6	3.2-4.0	GRV Bad/V.Bad	Rehab(6.0-GRV)	2-lane Br (n= 3,L= 36m)	6.89	3.90	10.79	5.1 (D)
New Const.	P5	11.1	0	74	2.7	6.0-***	PCC Good/Fair	-	2-lane Br (n= 3,L= 90m)	12.42	7.40	19.82	.0 (D)
					.5	3.0	PCC Good	Widen(6.0-PCC)	2-cell BC (n= 1,L= 8m)				
					2.1	2.4-4.0	GRV V.Bad	Rehab(6.0-GRV)					
					5.8		None	New-C(6.0-GRV)					
	P6-3	21.0	0	11	21.0		None	New-C(6.0-GRV)	2-lane Br (n= 2,L= 42m)	36.53	3.46	39.99	.0 (D)

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

TABLE 5.1 - 2 (4)

Summary of Proposed Improvement SAMAR

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	B15-1	26.8	0	36	.9	3.2	GRV V.Bad	Rehab(4.0-GRV)	1-lane Br (n= 2,L= 38m)	14.71	2.51	17.22	35.1 (D)
					16.7	3.2	EAR V.Bad/Impa	Imp-1(4.0-GRV)	1-lane Sp (n= 1,L= 12m)				
					9.2		None	New-C(4.0-GRV)					
	B21-1	6.3	0	14	.7	3.2	GRV V.Bad	Rehab(4.0-GRV)	1-lane Br (n= 2,L= 26m)	3.00	2.24	5.25	31.3 (D)
					5.6	1.6-3.2	EAR V.Bad/Impa	Imp-1(4.0-GRV)	1-lane Sp (n= 2,L= 24m)				
	B03-8	5.0	13	20	.4	4.0	PCC Good	-		2.73	.00	2.73	25.3 (D)
					2.1	3.2-4.0	GRV Bad/V.Bad	Rehab(4.0-GRV)					
					2.5	4.0-4.6	EAR V.Bad	Imp-1(4.0-GRV)					
	B03-11	10.7	35	59	1.0	4.0-6.7	PCC Good	-	2-cell BC (n= 4,L= 25m)	4.91	2.27	7.18	24.8 (D)
					7.1	.4-5.3	GRV Bad/V.Bad	Rehab(4.0-GRV)	1-lane Sp (n= 1,L= 12m)				
					2.6	2.4	EAR Impas	Imp-1(4.0-GRV)					
	B06-1	4.0	0	8	2.5	3.2	GRV Impas	Rehab(4.0-GRV)	1-lane Br (n= 1,L= 22m)	2.17	1.41	3.58	24.4 (D)
					1.5		None	New-C(4.0-GRV)	1-lane Sp (n= 1,L= 10m)				
	B07-1	40.5	0	28	9.4	2.4	GRV Impas	Rehab(4.0-GRV)	1-lane Br (n= 3,L= 71m)	23.01	5.94	28.95	24.0 (D)
					11.7	2.4	EAR Impas	Imp-1(4.0-GRV)	2-cell BC (n= 1,L= 7m)				
					19.4		None	New-C(4.0-GRV)	1-lane Sp (n= 5,L= 76m)				
	B02-1	1.5	0	10	1.5	5.5	GRV Bad	Rehab(4.0-GRV)		.68	.00	.68	23.9 (D)
	B23-2	14.1	0	30	12.6	3.2	EAR V.Bad/Impa	Imp-1(4.0-GRV)	2-cell BC (n= 2,L= 12m)	8.29	.97	9.26	23.9 (D)
					1.5		None	New-C(4.0-GRV)					
	B08-2	13.4	37	36	5.7	4.0-4.5	GRV V.Bad	Rehab(4.0-GRV)	1-lane Br (n= 4,L= 51m)	6.99	4.41	11.40	11.1 (D)
					7.7	3.2-4.0	EAR V.Bad/Impa	Imp-1(4.0-GRV)	1-lane Sp (n= 3,L= 44m)				
	B03-6	17.2	32	46	3.8	4.5-5.5	GRV Fair	-	1-lane Br (n= 5,L= 66m)	15.46	5.08	20.54	8.9 (D)
					13.2	3.2-4.5	GRV Bad/V.Bad	Rehab(4.0-GRV)					
					.2	2.0	PCC Good	Rehab(4.0-PCC)					
Imp-2/ Widen	B00-1	.8	26	31	.6	3.0	PCC Good	Widen(4.0-PCC)		.70	.00	.70	36.5 (D)
					.1	3.2	GRV V.Bad	Rehab(4.0-GRV)					
					.1	3.2	EAR V.Bad	Imp-1(4.0-GRV)					
New Const.	B20-2	6.9	0	12	6.9		None	New-C(4.0-GRV)		4.22	.00	4.22	37.3 (D)
	B03-1	13.9	0	14	13.9		None	New-C(4.0-GRV)	1-lane Sp (n= 1,L= 40m)	8.94	.53	9.46	35.0 (D)
	B11-1	17.6	0	27	3.7	3.2-4.0	GRV V.Bad	Rehab(4.0-GRV)	1-lane Br (n= 1,L= 13m)	10.69	3.31	14.00	30.8 (D)
					5.0	2.4	EAR V.Bad/Impa	Imp-1(4.0-GRV)	1-cell BC (n= 5,L= 15m)				
					8.9		None	New-C(4.0-GRV)	1-lane Sp (n= 3,L= 55m)				
	B16-2	7.1	0	11	7.1		None	New-C(4.0-GRV)		4.46	.00	4.46	26.2 (D)
	B19-2	8.2	0	11	8.2		None	New-C(4.0-GRV)		5.01	.00	5.01	20.1 (D)
	B06-2	16.2	0	20	16.2		None	New-C(4.0-GRV)	1-lane Br (n= 2,L= 50m)	10.41	3.63	14.04	17.7 (D)
									1-lane Sp (n= 4,L= 48m)				
	B03-9	16.4	0	22	16.4		None	New-C(4.0-GRV)		11.12	.00	11.12	16.2 (D)
	B18-1	12.6	0	14	5.1	3.2	EAR Impas	Imp-1(4.0-GRV)	2-cell BC (n= 2,L= 12m)	7.22	1.29	8.51	14.3 (D)

				7.5		None	New-C(4.0-GRV)	1-lane Sp (n= 2,L= 24m)				
B03-3	4.9	0	7	4.9		None	New-C(4.0-GRV)		3.09	.00	3.09	10.9 (D)
B16-1	14.5	0	10	14.5		None	New-C(4.0-GRV)	1-lane Br (n= 2,L=112m) 1-lane Sp (n= 4,L= 30m)	9.19	6.01	15.20	10.0 (D)
B19-3	3.2	0	4	3.2		None	New-C(4.0-GRV)		1.96	.00	1.96	9.4 (D)
B19-1	10.5	0	19	1.3 9.2	3:2	EAR V.Bad None	Imp-1(4.0-GRV) New-C(4.0-GRV)	1-lane Sp (n= 1,L= 12m)	7.05	.16	7.20	9.1 (D)
B03-2	7.7	0	6	7.7		None	New-C(4.0-GRV)		4.89	.00	4.89	8.2 (D)

(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 SAMAR

		Unit	N6-1	N2	N4	N6-2	P10	P8	P6-2	P6-1	N5-3	P1-2	B23-1
Total Road Length		km	37.1	25.2	6.8	13.3	3.2	6.7	32.8	3.9	30.2	18.0	4.3
Improvement Length		km	37.1	17.0	6.8	13.3	3.2	6.5	32.8	3.9	30.2	18.0	4.3
Proposed Pavement Type			6.0-BMP	6.0-PCC 6.0-BMP	6.0-BMP	6.0-BMP	6.0-GRV 6.0-PCC	6.0-GRV 6.0-PCC	6.0-GRV	6.0-GRV	6.0-GRV	6.0-GRV	6.0-GRV
Quantity													
100	Clearing & Grubbing	m2	114400	-	-	320500	-	-	-	-	475000	396000	86000
	Stripping	m3	12480	-	-	34710	-	-	-	-	51510	43200	9030
102	Roadway & Drainage Excavation	m3	226300	98590	1125	167500	14492	25287	174680	2550	189450	126000	4300
104	Borrow	m3	55254	113560	40253	17300	850	13475	11751	8954	52703	41670	21780
200	Aggregate Subbase	m3	76474	35811	16641	24549	2274	4510	21648	2574	19932	11880	2838
	Preparation of Prev.Road(Grvl)	m2	138450	141720	34000	-	15210	35740	174130	25190	61380	-	-
	Preparation of Prev.Road(Asph)	m2	-	9000	-	-	-	-	-	-	-	-	-
	Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
	Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	-	-
202	Crushed Aggregate Base Course	m3	37953	14834	6956	13606	-	-	-	-	-	-	-
300	Crushed Aggr. Surface Course	m3	-	-	-	-	2610	5670	28998	3510	27180	16200	3870
301	Bituminous Prime Coat	M.T.	267	104	49	96	-	-	-	-	-	-	-
302	Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305	Bituminous Macadam Pavement	m2	222600	87000	40800	79800	-	-	-	-	-	-	-
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	-	15000	-	-	900	600	-	-	-	-	-
311-3	PCC Pavement (t=18 cm)	m2	-	-	-	-	-	-	3480	-	-	-	-
500	RCPC (dia.910mm)	m	1275	705	210	795	90	255	990	150	1515	1080	195
	Headwall for RCPC (dia.910mm)	Set	85	47	14	53	6	17	66	10	101	72	13
504	Grouted Riprap	m3	-	9879	-	-	-	1795	-	1195	-	-	-
	Side Ditch (Grouted Riprap)	m	23440	9600	100	11170	1650	1700	8250	-	15360	12600	1720
	Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	-	-	-
	Slope Protection (Embank't Sl)	m	-	100	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Superstructure	m	772	-	24	-	-	13	252	43	-	-	145
	1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Abutment	Each	32	-	2	-	-	2	22	2	-	-	4
	1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Pier	Each	22	-	-	-	-	-	3	1	-	-	4
	1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
	2-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
	1-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
	1-cell RCBC	m	-	-	-	-	-	-	-	-	11	-	-
	2-cell RCBC	m	-	11	13	-	-	-	11	-	-	-	-
	Wingwall for 1-cell RCBC	Set	-	-	-	-	-	-	-	-	1	-	-
	Wingwall for 2-cell RCBC	Set	-	1	1	-	-	-	1	-	-	-	-
	Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost		M.p.	93.08	64.72	16.96	41.60	3.69	9.12	35.12	4.36	46.02	31.90	6.68
Bridge Construction Cost		M.p.	55.46	.61	2.56	.00	.00	1.35	21.60	3.10	.39	.00	9.64
Total Construction Cost		M.p.	148.54	65.33	19.52	41.60	3.69	10.47	56.72	7.46	46.42	31.90	16.33
Road Construction Cost/Impr't km		M.p.	2.51	3.81	2.49	3.13	1.15	1.40	1.07	1.12	1.52	1.77	1.55
Total Construction Cost/Total km		M.p.	4.00	2.59	2.87	3.13	1.15	1.56	1.73	1.91	1.54	1.77	3.80

TABLE 5.1 - 4 (2)

Quantity and Construction Cost SAMAR

	Unit	P9	P13	P2	P4	P7	P6-3	P5	B15-1	B21-1	B03-8	B03-11
Total Road Length	km	7.5	2.9	13.1	2.3	7.6	21.0	11.1	26.8	6.3	5.0	10.7
Improvement Length	km	7.3	2.7	12.1	1.0	7.6	21.0	8.4	26.8	6.3	4.6	9.7
Proposed Pavement Type		6.0-GRV	6.0-GRV	6.0-GRV	6.0-PCC 6.0-GRV	6.0-GRV	6.0-GRV	6.0-PCC 6.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV
Quantity												
100 Clearing & Grubbing	m2	-	-	-	-	-	462000	123400	110400	-	-	-
Stripping	m3	-	-	-	-	-	50400	13290	11040	-	-	-
102 Roadway & Drainage Excavation	m3	14700	681	56017	3146	19678	210000	59388	40288	5625	6600	9638
104 Borrow	m3	5783	5622	5085	174	3584	23415	7457	9378	1872	1472	3798
200 Aggregate Subbase	m3	4818	1782	7986	974	5016	13860	5714	12328	2898	2116	4462
Preparation of Prev.Road(Grvl)	m2	40570	17740	70760	2910	43660	-	8750	60290	27680	19950	35280
Preparation of Prev.Road(Asph)	m2	-	-	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	-	-
202 Crushed Aggregate Base Course	m3	-	-	-	-	-	-	-	-	-	-	-
300 Crushed Aggr. Surface Course	m3	6570	2430	10890	450	6561	18900	7110	16080	3780	2508	5694
301 Bituminous Prime Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
302 Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305 Bituminous Macadam Pavement	m2	-	-	-	-	-	-	-	-	-	-	-
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	-	-	-	1500	-	-	1500	-	-	-	-
311-3 PCC Pavement (t=18 cm)	m2	-	-	-	-	1860	-	-	-	-	1580	840
500 RCPC (dia.910mm)	m	225	75	360	23	225	1260	413	576	104	72	152
Headwall for RCPC (dia.910mm)	Set	15	5	24	2	15	84	28	72	13	9	19
504 Grouted Riprap	m3	-	-	196	-	-	-	-	-	-	-	-
Side Ditch (Grouted Riprap)	m	850	50	3950	250	1200	10500	3935	-	-	-	-
Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	-	-	-
Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Superstructure	m	-	-	150	-	36	42	90	-	-	-	-
1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	38	26	-	-
2-lane Bridge,Abutment	Each	-	-	2	-	6	4	6	-	-	-	-
1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	4	4	-	-
2-lane Bridge,Pier	Each	-	-	5	-	-	-	1	-	-	-	-
1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Spillway	m	17	-	-	-	-	-	-	-	-	-	-
1-lane Spillway	m	-	-	-	-	-	-	-	12	24	-	12
1-cell RCBC	m	-	11	-	-	-	-	-	-	-	-	-
2-cell RCBC	m	10	-	-	-	-	-	11	-	-	-	36
Wingwall for 1-cell RCBC	Set	-	1	-	-	-	-	-	-	-	-	-
Wingwall for 2-cell RCBC	Set	1	-	-	-	-	-	1	-	-	-	4
Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost	M.p.	6.11	2.28	12.75	1.24	6.89	36.53	12.42	14.71	3.00	2.73	4.91
Bridge Construction Cost	M.p.	.87	.39	9.47	.00	3.90	3.46	7.40	2.51	2.24	.00	2.27
Total Construction Cost	M.p.	6.98	2.67	22.23	1.24	10.79	39.99	19.82	17.22	5.25	2.73	7.18
Road Construction Cost/Impr't km	M.p.	.84	.84	1.05	1.24	.91	1.74	1.48	.55	.48	.59	.51
Total Construction Cost/Total km	M.p.	.93	.92	1.70	.54	1.42	1.90	1.79	.64	.83	.55	.67

TABLE 5.1 - 4 (3)

Quantity and Construction Cost SAMAR

	Unit	B06-1	B07-1	B02-1	B23-2	B08-2	B03-6	B00-1	B20-2	B03-1	B11-1	B16-2
Total Road Length	km	4.0	40.5	1.5	14.1	13.4	17.2	.8	6.9	13.9	17.6	7.1
Improvement Length	km	4.0	40.5	1.5	14.1	13.4	13.4	.8	6.9	13.9	17.6	7.1
Proposed Pavement Type		4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV 4.0-PCC	4.0-PCC 4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV
Quantity												
100 Clearing & Grubbing	m2	18000	208800	-	15000	-	-	-	82800	179700	114900	77800
Stripping	m3	1800	20880	-	1500	-	-	-	8280	17970	11490	7780
102 Roadway & Drainage Excavation	m3	3375	50563	-	22875	20963	14436	1388	6900	20350	28247	4510
104 Borrow	m3	2260	26034	848	9912	4756	4850	77	3899	7209	8661	7342
200 Aggregate Subbase	m3	1840	18630	690	6486	6164	6496	412	3174	6394	8095	3266
Preparation of Prev.Road(Grvl)	m2	11500	48530	6900	42490	51640	60720	790	-	-	28040	-
Preparation of Prev.Road(Asph)	m2	-	-	-	-	-	400	-	-	-	-	-
Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	-	-
202 Crushed Aggregate Base Course	m3	-	-	-	-	-	-	-	-	-	-	-
300 Crushed Aggr. Surface Course	m3	2400	24300	900	8304	8040	7740	120	4140	8340	10350	4260
301 Bituminous Prime Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
302 Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305 Bituminous Macadam Pavement	m2	-	-	-	-	-	-	-	-	-	-	-
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	-	-	-	-	-	800	600	-	-	-	-
311-3 PCC Pavement (t=18 cm)	m2	-	-	-	1040	-	1200	-	-	-	1400	-
500 RCPC (dia.910mm)	m	88	864	24	240	216	216	16	224	448	400	200
Headwall for RCPC (dia.910mm)	Set	11	108	3	30	27	27	2	28	56	50	25
504 Grouted Riprap	m3	-	-	-	-	-	-	-	-	-	-	-
Side Ditch (Grouted Riprap)	m	-	-	-	-	-	-	600	-	-	-	-
Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	-	-	-
Slope Protection (Embank't Sl)	m	-	-	-	-	-	300	-	-	-	-	-
2-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
1-lane Bridge,Superstructure	m	22	71	-	-	51	66	-	-	-	13	-
2-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
1-lane Bridge,Abutment	Each	2	6	-	-	8	10	-	-	-	2	-
2-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
1-lane Bridge,Pier	Each	-	2	-	-	-	1	-	-	-	-	-
2-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
1-lane Spillway	m	10	76	-	-	44	-	-	-	40	55	-
1-cell RCBC	m	-	-	-	-	-	-	-	-	-	40	-
2-cell RCBC	m	-	8	-	16	-	-	-	-	-	-	-
Wingwall for 1-cell RCBC	Set	-	-	-	-	-	-	-	-	-	5	-
Wingwall for 2-cell RCBC	Set	-	1	-	2	-	-	-	-	-	-	-
Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost	M.p.	2.17	23.01	.68	8.29	9.99	15.46	.70	4.22	8.94	10.69	4.46
Bridge Construction Cost	M.p.	1.41	5.94	.00	.97	4.41	5.08	.00	.00	.53	3.31	.00
Total Construction Cost	M.p.	3.58	28.94	.68	9.26	11.40	20.55	.70	4.22	9.46	14.00	4.46
Road Construction Cost/Impr't km	M.p.	.54	.57	.45	.59	.52	1.15	.88	.61	.64	.61	.63
Total Construction Cost/Total km	M.p.	.89	.71	.45	.66	.85	1.19	.88	.61	.68	.80	.63

TABLE 5.1 - 4 (4)

Quantity and Construction Cost SAMAR

	Unit	B19-2	B06-2	B03-9	B18-1	B03-3	B16-1	B19-3	B19-1	B03-2
Total Road Length	km	8.2	16.2	16.4	12.6	4.9	14.5	3.2	10.5	7.7
Improvement Length	km	8.2	16.2	16.4	12.6	4.9	14.5	3.2	10.5	7.7
Proposed Pavement Type		4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV
Quantity										
100 Clearing & Grubbing	m2	98400	162000	217400	90000	53000	152600	38400	124500	81400
Stripping	m3	9840	16200	21740	9000	5300	15260	3840	12450	8140
102 Roadway & Drainage Excavation	m3	8200	4860	27930	17063	2870	7010	3200	19498	3850
104 Borrow	m3	4633	23733	11516	5270	5379	17823	1808	6916	9301
200 Aggregate Subbase	m3	3772	7452	7544	5796	2254	6670	1472	4830	3542
Preparation of Prev.Road(Grvl)	m2	-	-	-	16830	-	-	-	4290	-
Preparation of Prev.Road(Asph)	m2	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-
202 Crushed Aggregate Base Course	m3	-	-	-	-	-	-	-	-	-
300 Crushed Aggr. Surface Course	m3	4920	9720	9840	7560	2940	8700	1920	6300	4620
301 Bituminous Prime Coat	M.T.	-	-	-	-	-	-	-	-	-
302 Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-
305 Bituminous Macadam Pavement	m2	-	-	-	-	-	-	-	-	-
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	-	-	-	-	-	-	-	-	-
500 RCPC (dia.910mm)	m	264	392	488	320	136	376	104	296	208
Headwall for RCPC (dia.910mm)	Set	33	49	61	40	17	47	13	37	26
504 Grouted Riprap	m3	-	-	-	-	-	-	-	-	-
Side Ditch (Grouted Riprap)	m	-	-	-	-	-	-	-	-	-
Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	-
Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-
2-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-
1-lane Bridge,Superstructure	m	-	50	-	-	-	112	-	-	-
2-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-
1-lane Bridge,Abutment	Each	-	4	-	-	-	4	-	-	-
2-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-
1-lane Bridge,Pier	Each	-	1	-	-	-	3	-	-	-
2-lane Spillway	m	-	-	-	-	-	-	-	-	-
1-lane Spillway	m	-	48	-	24	-	30	-	12	-
1-cell RCBC	m	-	-	-	-	-	-	-	-	-
2-cell RCBC	m	-	-	-	16	-	-	-	-	-
Wingwall for 1-cell RCBC	Set	-	-	-	-	-	-	-	-	-
Wingwall for 2-cell RCBC	Set	-	-	-	2	-	-	-	-	-
Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1
Road Construction Cost	M.p.	5.01	10.41	11.12	7.22	3.09	9.19	1.96	7.05	4.89
Bridge Construction Cost	M.p.	.00	3.63	.00	1.29	.00	6.01	.00	.16	.00
Total Construction Cost	M.p.	5.01	14.04	11.12	8.51	3.09	15.20	1.96	7.20	4.89
Road Construction Cost/Impr't km	M.p.	.61	.64	.68	.57	.63	.63	.61	.67	.63
Total Construction Cost/Total km	M.p.	.61	.87	.68	.68	.63	1.05	.61	.69	.63

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 Samar
- Major Roads -

	Type of Improvement			
	Rehabilitation/ Improvement - 1	Improvement-2/ Widening	New Construction	Total
Primary Major Roads				
1. No. of Links	3	-	1	4
2. Total Length (km)	69.1	-	13.3	82.4
3. Improvement Length (km)	60.9	-	13.3	74.2
4. Construction Cost (million P)	233.4	-	41.6	275.0
5. Const. Cost/Imp. Length (MP/km)	3.83	-	3.13	3.71
Secondary Major Roads				
1. No. of Links	4	-	3	7
2. Total Length (km)	46.6	-	52.5	99.1
3. Improvement Length (km)	46.4	-	52.5	98.9
4. Construction Cost (million P)	78.3	-	94.6	172.9
5. Const. Cost/Imp. Length (MP/km)	1.69	-	1.80	1.75
Major Roads Total				
1. No. of Links	7	-	4	11
2. Total Length (km)	115.7	-	65.8	181.5
3. Improvement Length (km)	107.3	-	65.8	173.1
4. Construction Cost (million P)	311.7	-	136.2	447.9
5. Const. Cost/Imp. Length (MP/km)	2.90	-	2.07	2.59

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

	Type of Improvement		
	Rehabilitation/ Improvement-1&2/ Widening	New Construction	Total
Minor Roads (National/ Provincial/City)			
1. No. of Links	5	2	7
2. Total Length (km)	33.4	32.1	65.5
3. Improvement Length (km)	30.7	29.4	60.1
4. Construction Cost (million P)	43.9	59.8	103.7
5. Const. Cost/Imp. Length (MP/km)	1.43	2.03	1.73
Minor Roads (Barangay)			
1. No. of Links	11	13	24
2. Total Length (km)	140.3	139.7	280.0
3. Improvement Length (km)	135.1	139.7	274.8
4. Construction Cost (million P)	107.5	103.2	210.7
5. Const. Cost/Imp. Length (MP/km)	0.80	0.74	0.77
Minor Roads Total			
1. No. of Links	16	15	31
2. Total Length (km)	173.7	171.8	345.5
3. Improvement Length (km)	165.8	169.1	334.9
4. Construction Cost (million P)	151.4	163.0	314.4
5. Const. Cost/Imp. Length (MP/km)	0.91	0.96	0.94

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

1991 - Detailed design
1992 - Construction
1993 ┐
     │
     │ -Project life (25 years)
     │
2017 ┘

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	PCC/AC			BMP/DBST			Gravel			Earth		
Surface Type	OV	TR	MC	OV	TR	MC	OV	TR	MC	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 SAMAR

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 (%)
Primary Major	Rehab/ Imp-1	N6-1	37.1	10948	295	6254	3597(Coco.) 2158(Palay) 355(Sugar) 144(Root)	0	99	8.6
		N2	25.2	14624	580	7758	5372(Coco.) 1790(Palay) 596(Banan)	122	117	7.5
		N4	6.8	20518	3017	2409	1606(Coco.) 669(Palay) 80(Banan) 54(Root)	129	144	5.8
	New Const.	N6-2	13.3	5000	376	1282	816(Coco.) 350(Palay) 116(Abaca)	0	10	.0
Second'y Major	Rehab/ Imp-1	P10	3.2	1128	352	572	395(Coco.) 103(Palay) 41(Root) 25(Banan) 8(Corn)	9	13	13.2
		P8	6.7	3691	551	913	442(Coco.) 357(Palay) 114(Banan)	16	27	12.7
		P6-2	32.8	8949	273	6303	3002(Coco.) 1801(Corn) 1260(Palay) 240(Banan)	79	72	6.7
		P6-1	3.9	2506	643	883	376(Coco.) 290(Palay) 174(Corn) 43(Root)	17	17	4.3
	New Const.	N5-3	30.2	6354	210	6859	2810(Coco.) 2080(Palay) 1011(Banan) 592(Corn) 197(Root)	0	45	15.9
		P1-2	18.0	6318	351	3140	3140(Coco.)	0	16	11.7
		B23-1	4.3	2847	662	1085	814(Coco.) 271(Palay)	0	9	10.9
Minor (Nat'l/ Prov'l)	Rehab/ Imp-1	P9	7.5	2220	296	1420	750(Coco.) 445(Palay) 150(Root) 75(Banan)	13	16	15.2
		P13	2.9	2242	773	361	253(Coco.) 97(Palay) 11(Banan)	11	14	12.9
		P2	13.1	2734	209	2717	1622(Coco.) 871(Corn) 187(Palay) 37(Vege.)	0	21	11.1
		P4	2.3	4299	1869	196	143(Coco.) 29(Banan) 24(Root)	24	31	9.2
		P7	7.6	1577	208	1078	735(Coco.) 184(Palay) 147(Corn) 12(Banan)	10	16	5.1
	New Const.	P5	11.1	13425	1209	580	501(Coco.) 46(Banan) 33(Root)	0	74	.0
		P6-3	21.0	5361	255	1520	1385(Coco.) 100(Palay) 35(Banan)	0	11	.0
Minor (Baran-gay)	Rehab/ Imp-1	B15-1	26.8	2855	107	8091	6688(Coco.) 825(Corn) 578(Palay)	0	36	35.1
		B21-1	6.3	1638	260	2224	1349(Coco.) 720(Palay) 116(Root) 39(Banan)	0	14	31.3
		B03-8	5.0	2333	467	2209	1506(Coco.) 402(Banan) 301(Palay)	13	20	25.3
		B03-11	10.7	6109	571	3533	2031(Coco.) 893(Palay) 609(Banan)	35	59	24.8
		B06-1	4.0	1351	338	1616	1200(Coco.) 271(Banan) 145(Palay)	0	8	24.4
		B07-1	40.5	3500	86	6194	4838(Coco.) 583(Palay) 514(Root) 259(Corn)	0	28	24.0
		B02-1	1.5	1565	1043	257	209(Coco.) 48(Palay)	0	10	23.9
		B23-2	14.1	4826	342	3400	2000(Coco.) 700(Palay) 700(Banan)	0	30	23.9
		B08-2	13.4	5279	394	4009	3000(Coco.) 347(Corn) 347(Banan) 278(Palay) 37(Root)	37	36	11.1
		B03-6	17.2	3932	229	3037	2071(Coco.) 690(Banan) 207(Palay) 69(Root)	32	46	8.9
	Imp-2/ Widen	B00-1	.8	3548	4435	1669	982(Coco.) 409(Banan) 278(Root)	26	31	36.5
	New Const.	B20-2	6.9	2135	309	1902	1084(Coco.) 660(Palay) 158(Root)	0	12	37.3
		B03-1	13.9	529	38	3486	2900(Coco.) 244(Root) 147(Banan) 122(Corn) 73(Palay)	0	14	35.0
		B11-1	17.6	5091	289	3996	2970(Coco.) 594(Palay) 270(Banan) 162(Corn)	0	27	30.8
		B16-2	7.1	1579	222	999	625(Palay) 312(Corn) 62(Coco.)	0	11	26.2
		B19-2	8.2	2211	270	1628	941(Coco.) 409(Banan) 278(Root)	0	11	20.1
		B06-2	16.2	3728	230	3171	1518(Palay) 800(Corn) 495(Coco.) 220(Root) 138(Banan)	0	20	17.7
		B03-9	16.4	4626	282	4333	3350(Coco.) 694(Palay) 289(Corn)	0	22	16.2
		B18-1	12.6	6105	485	1617	1100(Coco.) 214(Palay) 125(Banan) 89(Corn) 89(Root)	0	14	14.3
		B03-3	4.9	1815	370	760	447(Coco.) 206(Palay) 107(Corn)	0	7	10.9
		B16-1	14.5	6315	436	1565	1180(Coco.) 237(Palay) 118(Banan) 30(Root)	0	10	10.0
		B19-3	3.2	563	176	498	282(Coco.) 141(Banan) 75(Root)	0	4	9.4
		B19-1	10.5	6157	586	1278	1102(Coco.) 147(Banan) 29(Palay)	0	19	9.1
		B03-2	7.7	1973	256	1356	1000(Coco.) 214(Corn) 142(Palay)	0	6	8.2

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 Grading Pothole Repair	4.0 m Gravel: 2,650 + 40 AADT 6.0 m Gravel: 3,000 + 45 AADT
	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.

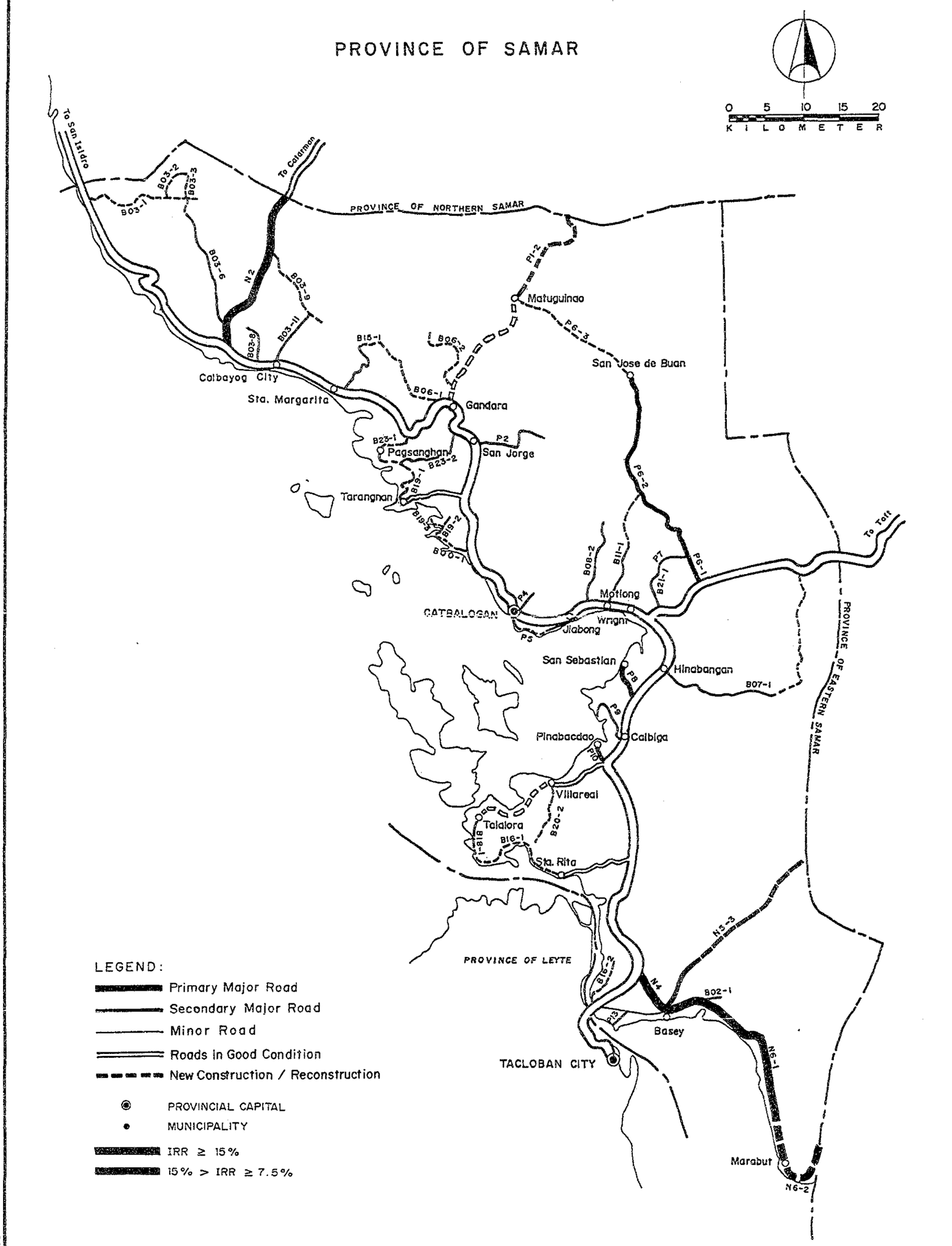


FIGURE 5.2 - 1 PROJECT ROADS and ECONOMIC EVALUATION RESULTS

TABLE 5.2 - 9 (1)

Road Length and Construction Cost SAMAR

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	2	62.3	54.1	157.8	56.1	213.9	-	-	-	-	-	-	-	-	-	-	-	-
	<7.5	1	6.8	6.8	17.0	2.6	19.5	-	-	-	-	-	-	1	13.3	13.3	41.6	-	41.6
	Total	3	69.1	60.9	174.8	58.6	233.4	-	-	-	-	-	-	1	13.3	13.3	41.6	-	41.6
Second'y Major	15<	-	-	-	-	-	-	-	-	-	-	-	-	1	30.2	30.2	46.0	.4	46.4
	10-15	2	9.9	9.7	12.8	1.3	14.2	-	-	-	-	-	-	2	22.3	22.3	38.6	9.6	48.2
	7.5-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<7.5	2	36.7	36.7	39.5	24.7	64.2	-	-	-	-	-	-	-	-	-	-	-	-
	Total	4	46.6	46.4	52.3	26.0	78.3	-	-	-	-	-	-	3	52.5	52.5	84.6	10.0	94.6
Minor (Nat'l/ Prov'l)	15<	1	7.5	7.3	6.1	.9	7.0	-	-	-	-	-	-	-	-	-	-	-	-
	10-15	2	16.0	14.8	15.0	9.9	24.9	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	1	2.3	1.0	1.2	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	<7.5	1	7.6	7.6	6.9	3.9	10.8	-	-	-	-	-	-	2	32.1	29.4	48.9	10.9	59.8
	Total	5	33.4	30.7	29.3	14.6	43.9	-	-	-	-	-	-	2	32.1	29.4	48.9	10.9	59.8
Minor (Baran-gay)	15<	8	108.9	107.5	59.5	15.3	74.8	1	.8	.8	.7	-	.7	7	86.3	86.3	54.9	7.5	62.3
	10-15	1	13.4	13.4	7.0	4.4	11.4	-	-	-	-	-	-	3	32.0	32.0	19.5	7.3	26.8
	7.5-10	1	17.2	13.4	15.5	5.1	20.5	-	-	-	-	-	-	3	21.4	21.4	13.9	.2	14.1
	<7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	10	139.5	134.3	82.0	24.8	106.8	1	.8	.8	.7	-	.7	13	139.7	139.7	88.2	14.9	103.2
Total	15<	9	116.4	114.8	65.6	16.2	81.8	1	.8	.8	.7	-	.7	8	116.5	116.5	100.9	7.9	108.7
	10-15	5	39.3	37.9	34.8	15.6	50.5	-	-	-	-	-	-	5	54.3	54.3	58.1	16.9	75.0
	7.5-10	4	81.8	68.5	174.5	61.1	235.7	-	-	-	-	-	-	3	21.4	21.4	13.9	.2	14.1
	<7.5	4	51.1	51.1	63.3	31.2	94.5	-	-	-	-	-	-	3	45.4	42.7	90.5	10.9	101.4
	Total	22	288.6	272.3	338.3	124.1	462.4	1	.8	.8	.7	-	.7	19	237.6	234.9	263.4	35.8	299.2

TABLE 5.2 - 9 (2)

Road Length and Construction Cost SAMAR

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	2	62.3	54.1	157.8	56.1	213.9
	<7.5	2	20.1	20.1	58.6	2.6	61.1
	Total	4	82.4	74.2	216.4	58.6	275.0
Second'y Major	15<	1	30.2	30.2	46.0	.4	46.4
	10-15	4	32.2	32.0	51.4	11.0	62.4
	7.5-10	-	-	-	-	-	-
	<7.5	2	36.7	36.7	39.5	24.7	64.2
	Total	7	99.1	98.9	136.9	36.1	173.0
Minor (Nat'l/ Prov'l)	15<	1	7.5	7.3	6.1	.9	7.0
	10-15	2	16.0	14.8	15.0	9.9	24.9
	7.5-10	1	2.3	1.0	1.2	-	1.2
	<7.5	3	39.7	37.0	55.8	14.8	70.6
	Total	7	65.5	60.1	78.2	25.5	103.7
Minor (Baran-gay)	15<	16	196.0	194.6	115.1	22.8	137.9
	10-15	4	45.4	45.4	26.5	11.7	38.2
	7.5-10	4	38.6	34.8	29.4	5.2	34.6
	<7.5	-	-	-	-	-	-
	Total	24	280.0	274.8	170.9	39.8	210.7
Total	15<	18	233.7	232.1	167.2	24.1	191.3
	10-15	10	93.6	92.2	92.9	32.6	125.5
	7.5-10	7	103.2	89.9	188.4	61.3	249.7
	<7.5	7	96.5	93.8	153.9	42.0	195.9
	Total	42	527.0	508.0	602.4	160.0	762.4

TABLE 5.2 - 10 (1)
Summary of Economic Analysis SAMAR

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	Diverted	Generated	Develop't	Maint sav'g	Benefit (Mp/km) Total	Econom. Indicator NPV (Mp)	B/C	IRR (%)
Minor (Barangay)	Rehab/ Imp-1	B15-1	0	36	26.8	26.8(4.0-GRV)	.53	.12	.65	1.11	-	.03	.36	-.01	1.49	22.5	2.3	35.1
		B21-1	0	14	6.3	6.3(4.0-GRV)	.69	.11	.81	1.07	-	.03	.73	.00	1.83	6.5	2.3	31.3
		B03-8	13	20	5.0	4.6(4.0-GRV)	.49	.11	.61	.58	-	.02	.45	.00	1.06	2.1	1.7	25.3
		B03-11	35	59	10.7	9.7(4.0-GRV)	.62	.13	.74	.75	-	.03	.46	.01	1.25	5.0	1.7	24.8
		B06-1	0	8	4.0	4.0(4.0-GRV)	.74	.11	.86	.88	-	.03	.53	.00	1.44	2.3	1.7	24.4
		B07-1	0	28	40.5	40.5(4.0-GRV)	.59	.11	.71	.73	-	.02	.39	-.01	1.13	17.1	1.6	24.0
		B02-1	0	10	1.5	1.5(4.0-GRV)	.38	.11	.49	.30	-	.01	.52	.01	.83	.5	1.7	23.9
		B23-2	0	30	14.1	14.1(4.0-GRV)	.55	.11	.66	.62	-	.03	.42	.00	1.06	5.7	1.6	23.9
		B08-2	37	36	13.4	13.4(4.0-GRV)	.71	.12	.82	.25	-	.03	.32	.01	.60	-3.0	.7	11.1
		B03-6	32	46	17.2	13.2(4.0-GRV) .2(4.0-PCC)	1.27	.12	1.39	.44	-	.01	.37	.01	.84	-7.4	.6	8.9
	Imp-2/ Widen	B00-1	26	31	.8	.6(4.0-PCC) .2(4.0-GRV)	.73	.03	.76	.47	-	.02	2.72	-.04	3.17	1.9	4.2	36.5
	New Const.	B20-2	0	12	6.9	6.9(4.0-GRV)	.51	.11	.62	1.16	-	.04	.32	-.02	1.49	6.0	2.4	37.3
		B03-1	0	14	13.9	13.9(4.0-GRV)	.57	.11	.68	1.00	-	.02	.70	-.03	1.69	14.0	2.5	35.0
		B11-1	0	27	17.6	17.6(4.0-GRV)	.66	.11	.78	1.21	-	.05	.32	-.01	1.57	14.0	2.0	30.8
		B16-2	0	11	7.1	7.1(4.0-GRV)	.52	.11	.64	.85	-	.02	.20	-.02	1.05	2.9	1.6	26.2
		B19-2	0	11	8.2	8.2(4.0-GRV)	.51	.11	.62	.53	-	.03	.28	-.02	.82	1.6	1.3	20.1
		B06-2	0	20	16.2	16.2(4.0-GRV)	.72	.11	.83	.72	-	.03	.25	-.03	.97	2.2	1.2	17.7
		B03-9	0	22	16.4	16.4(4.0-GRV)	.56	.11	.68	.45	-	.02	.29	-.03	.73	.8	1.1	16.2
		B18-1	0	14	12.6	12.6(4.0-GRV)	.56	.11	.68	.37	-	.05	.23	-.01	.64	-.4	1.0	14.3
		B03-3	0	7	4.9	4.9(4.0-GRV)	.52	.11	.64	.24	-	.01	.24	-.02	.47	-.8	.7	10.9
		B16-1	0	10	14.5	14.5(4.0-GRV)	.87	.11	.99	.36	-	.04	.29	-.03	.67	-4.6	.7	10.0
		B19-3	0	4	3.2	3.2(4.0-GRV)	.51	.11	.62	.10	-	.01	.30	-.02	.38	-.8	.6	9.4
		B19-1	0	19	10.5	10.5(4.0-GRV)	.57	.11	.68	.13	-	.01	.30	-.02	.41	-2.8	.6	9.1
		B03-2	0	6	7.7	7.7(4.0-GRV)	.53	.11	.64	.18	-	.02	.20	-.02	.38	-2.0	.6	8.2

TABLE 5.2 - 10 (2)

Summary of Economic Analysis SAMAR

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	Diverted	Generated	Development	Maint savg	Benefit (Mp/km) Total	Econom. Indicator NPV (Mp)	B/C	IRR (%)
Minor (Nat'l/ Prov'l)	Rehab/ Imp-1	P9	13	16	7.5	7.3(6.0-GRV)	.79	.17	.97	.23	-	.01	.73	.00	.98	.1	1.0	15.2
		P13	11	14	2.9	2.7(6.0-GRV)	.82	.17	1.00	.12	-	.01	.70	.00	.83	-.4	.8	12.9
		P2	0	21	13.1	12.1(6.0-GRV)	1.53	.17	1.70	1.04	-	.05	.20	.00	1.30	-4.8	.8	11.1
		P4	24	31	2.3	.5(6.0-PCC) .5(6.0-GRV)	1.03	.09	1.12	.26	-	.00	.41	-.03	.65	-.5	.6	9.2
		P7	10	16	7.6	7.6(6.0-GRV)	1.18	.17	1.35	.21	-	.01	.34	.00	.57	-6.0	.4	5.1
	New Const.	P5	0	74	11.1	.5(6.0-PCC) 7.9(6.0-GRV)	1.96	.20	2.16	.34	-	.03	.06	-.04	.39	-14.9	.2	.0
		P6-3	0	11	21.0	21.0(6.0-GRV)	1.58	.17	1.76	.04	-	.02	.20	-.03	.22	-32.2	.1	.0

TABLE 5.2 - 10 (3)

Summary of Economic Analysis SAMAR

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	Diverted	Generated	Develop't	Maint savg	Benefit (Mp/km) Total	Econom. Indicator NPV (Mp)	B/C	IRR (%)
Primary Major	Rehab/Imp-1	N6-1	0	99	37.1	37.1(6.0-BMP)	3.33	.16	3.48	1.94	-	.04	.28	-.09	2.16	-49.2	.6	8.6
		N2	122	117	25.2	2.5(6.0-PCC) 14.5(6.0-BMP)	3.19	.13	3.33	.32	-	.02	1.18	.03	1.55	-30.3	.5	7.5
		N4	129	144	6.8	6.8(6.0-BMP)	2.39	.16	2.54	.73	-	.04	.33	.04	1.14	-9.5	.5	5.8
	New Const.	N6-2	0	10	13.3	13.3(6.0-BMP)	2.60	.16	2.76	.32	-	.03	.14	-.12	.38	-31.6	.1	.0
Second'y Major	Rehab/Imp-1	P10	9	13	3.2	2.9(6.0-GRV) .3(6.0-PCC)	.96	.16	1.12	.14	-	.00	.80	.00	.95	-.5	.9	13.2
		P8	16	27	6.7	6.3(6.0-GRV) .2(6.0-PCC)	1.34	.17	1.51	.26	-	.02	.95	.00	1.23	-1.8	.8	12.7
		P6-2	79	72	32.8	32.8(6.0-GRV)	1.44	.20	1.64	.25	-	.01	.45	.08	.80	-27.8	.5	6.7
		P6-1	17	17	3.9	3.9(6.0-GRV)	1.59	.17	1.76	.36	-	.03	.27	.01	.66	-4.3	.4	4.3
	New Const.	N5-3	0	45	30.2	30.2(6.0-GRV)	1.28	.18	1.46	.83	-	.05	.69	-.03	1.54	2.5	1.1	15.9
		P1-2	0	16	18.0	18.0(6.0-GRV)	1.47	.17	1.65	.41	-	.04	.82	-.03	1.24	-7.3	.8	11.7
		B23-1	0	9	4.3	4.3(6.0-GRV)	3.16	.17	3.33	.20	-	.07	1.94	-.03	2.19	-4.9	.7	10.9