REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS & HIGHWAYS

Feasibility Study
on
The Rural Road Network Development Project

FINAL REPORT (Volume 9)

PROJECT EVALUATION
IN
THE PROVINCE OF ALBAY

OCTOBER, 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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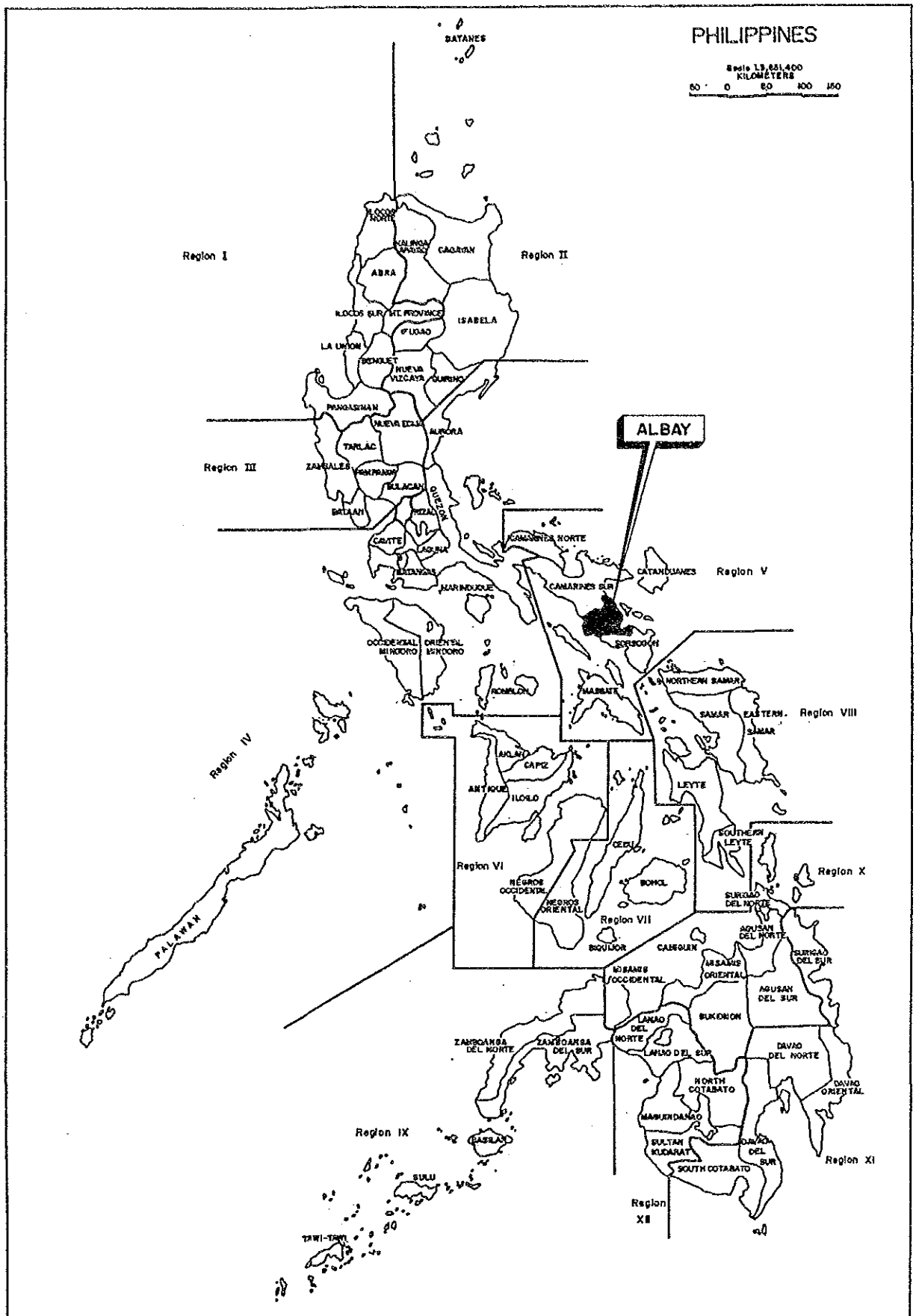


FEASIBILITY STUDY ON THE RURAL ROAD NETWORK DEVELOPMENT PROJECT	LOCATION MAP

VOLUME - 9
PROVINCE OF ALBAY

TABLE OF CONTENTS

CHAPTER 1
SOCIO-ECONOMIC PROFILE OF THE PROVINCE

1.1 GENERAL

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

- Economically less developed
- Average level in road development
- Topographically flat

1.2 GEOGRAPHY AND TOPOGRAPHY

The province is located in the southern Luzon, bounded on the north by Camarines Sur Province, on the east by Lagonoy Gulf, on the south by Sorsogon Province and on the west by Burias Pass.

The topography of the Province is described as generally flat land with several upheaved high volcanoes of which representative is Mayon Volcano.

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

1.3 POPULATION

The province is composed of one (1) city and seventeen (17) municipalities, however, the lone municipality of Rapu-Rapu in Rapu-Rapu Island was excluded from the Study. The provincial capital is located at Legaspi City which is also the capital of Region V.

Population in 1990 is estimated at 1,005,000. The average annual population growth rate for the period of 10 years from 1980 to 1990 was estimated 2.1% which is lower than the national average of 2.4%. Population density of the province in 1990 is 393.6 persons per square kilometer which is higher by 1.9 times than the national average of 205 persons per sq. km.

Population, the average annual population growth rate and population density by city/municipality are presented in Table 1.3-1. Distribution of city and municipal towns together with their population is shown in Figure 1.3-1. Most municipal towns are located in the central area which are linked to each other by Pan-Philippine Highway and in the eastern coastal area.

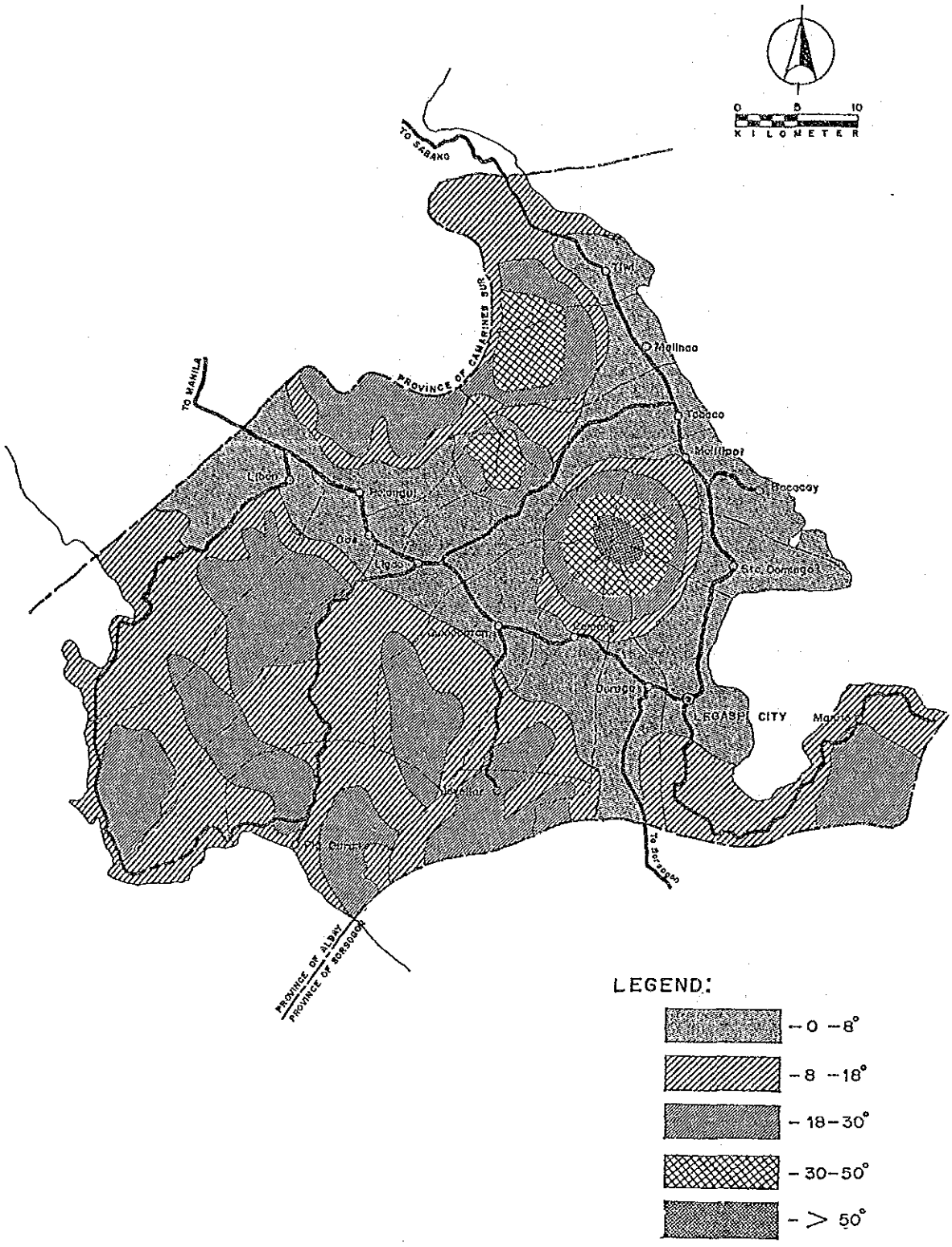


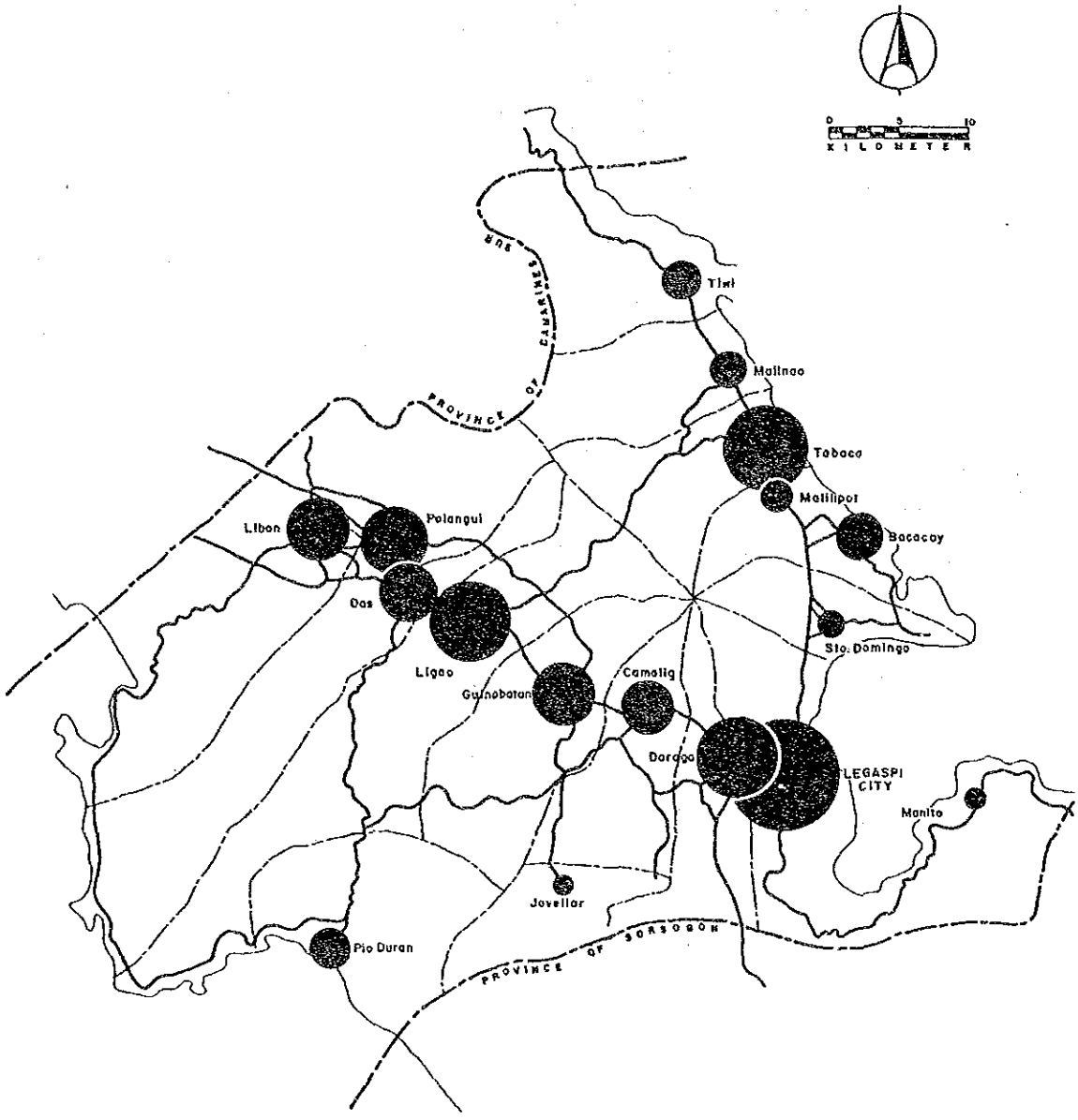
FIGURE 1.2 - 1 SLOPE MAP

Table 1.3-1

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

	City/Municipality	Projected Population (1990)	Annual Growth Rate (%)	Land Area (km^2)	Density (p/km^2)
	1. Legaspi City	124,360	2.1	153.7	809.1
	2. Bacacay	55,109	2.1	112.2	491.2
	3. Camalig	56,798	2.0	130.9	433.9
	4. Daraga	91,763	2.2	118.6	773.7
	5. Guinobatan	63,735	1.7	203.0	314.0
	6. Jovellar	18,549	2.0	105.4	176.0
	7. Libon	63,876	2.0	185.4	344.5
	8. Ligao	87,510	2.2	246.4	355.2
	9. Malilipot	29,499	2.3	53.6	550.4
	10. Malinao	35,474	2.2	107.5	330.0
	11. Manito	19,838	2.5	107.5	184.5
	12. Oas	61,575	1.6	271.3	227.0
	13. Pio Duran	41,286	2.1	133.7	308.8
	14. Polangui	69,319	2.1	145.3	477.1
*	15. Rapu-Rapu	32,612	1.0	161.8	201.6
	16. Sto. Domingo	25,258	2.4	76.6	329.7
	17. Tabaco	90,754	2.2	116.4	779.7
	18. Tiwi	37,257	2.5	123.4	301.9
	T O T A L	1,004,572	2.1	2,552.6	393.6

Note: * - Island Municipality



LEGEND:

Major Road

Provincial Boundary

Municipal Boundary

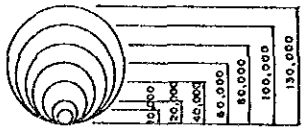


FIGURE 1.3 - 1 POPULATION BY MUNICIPALITY (1990)

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 0.9% 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 lower level than the national average.

Per capita income of the province is much lower than the national average. Incidence of poverty is higher than the national average. Unemployment and underemployment rates show the slightly lower level than the national average.

Agriculture is the predominant industry of the province and shares 55% in terms of number of workers.

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

	Albay (A)	Philippines (B)	(A)/(B)
1. Total Land Area (sq.km.)	2,553	300,000	0.008
2. Population in 1990 (1000 persons)	1,005	61,483	0.016
3. Population Density (persons/sq.km.)	394	205	1.92
4. GRDP (Million ₱ at 1000 prices)	5,458	623,051	0.009
5. Per Capita Income in 1985 (₱/person)	3,868	5,593	0.69
6. Number of Workers by Industrial Sector in 1980 (1000 persons)			
* Agricultural	127.3 (55%)	7,303 (51%)	0.017
* Industry	38.7 (17%)	2,177 (15%)	0.018
* Service	60.6 (26%)	4,552 (32%)	0.013
* Total 1/	230.3 (100%)	14,197 (100%)	0.016
7. Incidence of Poverty in 1985 (%)	68.8	59.3	-
8. Unemployment Rate in 1988 (%)	6.9	8.3	-
9. Underemployment Rate in 1988 (%)	9.7	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

Albay has a total land area of 2,553 square kilometers, representing 0.8% of the total land area of the Philippines. Table 1.5-1 shows general land use of the province. About 55% of the province are occupied by agricultural land, about 27% by grass/shrub land, and about 12% by forest.

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, abaca and cassava. The province produces about 60% of Region V's corn production.

Table 1.5-1
LAND USE OF ALBAY

Land Use	Area in sq.km.	%
Agricultural Area	1,414.1	55.4
Grass/Shrub Land	676.4	26.5
Forest	314.0	12.3
Wet Land	28.1	1.1
Built-up Area	63.8	2.5
Others	56.2	2.2
Total	2,552.6	100.0

Source: Bureau of Soil

Table 1.5-2
MAJOR CROPS OF PROVINCE OF ALBAY

Major Crops	Area Utilized (ha.)		Production (M.T.)	
	1985	1986	1985	1986
Corn	61,040	65,900	107,785	78,560
Coconut	-	57,287	-	50,231
Palay	52,660	57,620	107,785	113,355
Abaca	16,900	16,400	3,784	3,284
Cassava	6,170	5,530	53,905	48,395

Source: Bureau of Agricultural Statistics

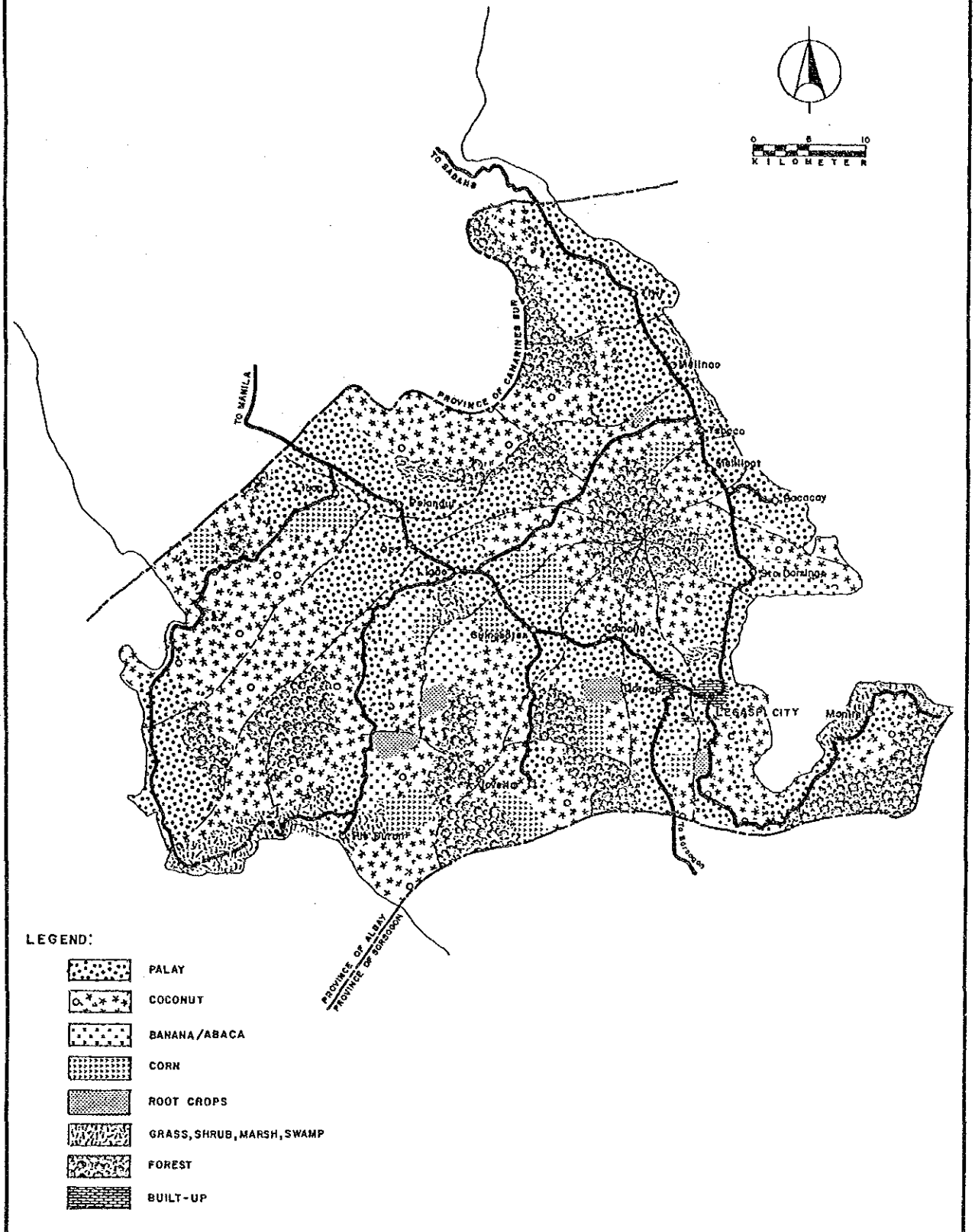


FIGURE 1.5 - 1 AGRICULTURAL LAND USE

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 average 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

Albay has a total of 1,637.6 kms. of roads, comprising 385.4 kms. of National, 374.7 kms. of Provincial, 26.9 kms. of City, 116.6 kms. of Municipal and 684.0 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	higher by 1.24 times
Provincial roads.....	higher by 1.09 times
Barangay roads.....	low at 67% of the national average
All roads.....	low at 88% of the national average

In terms of road extension, national and provincial roads are in high level, however, barangay roads are in 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 Albay

Road Class	Road Length In 1987 (kms.)	Road Density (L/ PA)		
		Albay	Philippines	Albay /Phils
National Rd.	385.4 (23.5)	0.2482	0.1994	1.24
Prov'l. Rd.	374.7 (22.9)	0.2413	0.2211	1.09
Sub-Total	760.1 (46.4)	0.4895	0.4205	1.16
City Rd.	26.9 (1.7)	0.0173	0.0304	0.57
Municipal Rd	116.6 (10.2)	0.1073	0.0981	1.09
Barangay Rd.	684.0 (41.8)	0.4406	0.6536	0.67
TOTAL	1,637.6(100.1)	1.0547	1.2026	0.88

*SOURCE: DPWH Infrastructure Atlas, 1989

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

Road Class	Pavement Type	Surface Condition 1/			% of Pavement Type 2/	
		Good/Fair	Bad/Very Bad	Total (%)	Albay	Phils.
National Road	PCC	177.8(100.0)	- -	177.8 (100.0)	50.2	23.6
	Bituminous	15.5 (33.0)	31.4 (67.0)	46.9 (100.0)	11.3	22.3
	Gravel	5.2 (7.7)	62.5 (92.3)	67.7 (100.0)	38.5	51.3
	Earth	- -	- -	- (100.0)	-	2.8
	Total:	198.5 (67.9)	93.9 (32.1)	292.4 (100.0)	100.0	100.0
Provincial Road	PCC	17.3 (95.1)	0.9 (4.9)	18.2 (100.0)	0.7	2.5
	Bituminous	11.8 (18.5)	51.9 (81.5)	63.7 (100.0)	29.5	8.9
	Gravel	6.1 (7.4)	76.8 (92.6)	82.9 (100.0)	49.4	70.6
	Earth	1.1 (28.2)	2.8 (71.8)	3.9 (100.0)	20.4	18.0
	Total:	36.3 (21.5)	132.4 (78.5)	168.7 (100.0)	100.0	100.0
National and Provincial Road	PCC	195.1 (99.5)	0.9 (0.5)	196.0 (100.0)	25.8	12.5
	Bituminous	27.3 (24.7)	83.3 (75.3)	110.6 (100.0)	20.2	15.3
	Gravel	11.3 (7.5)	139.3 (92.5)	150.6 (100.0)	43.9	61.4
	Earth	1.1 (28.2)	2.8 (71.8)	3.9 (100.0)	10.1	10.8
	Total:	234.8 (50.9)	226.3 (49.1)	461.1 (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 62% of national roads are paved with either PCC or bituminous surfaces in the Province, whereas the national average is only 46%.

- Road surface condition of national roads is relatively well maintained and about 68% were assessed good or fair condition, however, gravel roads were mostly in bad/very bad condition.

- In terms of road quality, national roads in the province is in relatively high level.

Provincial Roads

- Only 30% of provincial roads in the province are paved with PCC or bituminous surfaces, which is in higher level than the national average of 11%.

- Surface condition of provincial roads are still in poor condition. Only 22% are assessed good/fair condition. Bituminous surfaced roads are also in poor condition.

- Quality of provincial roads is still in poor condition.

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:

- Present road network pattern is described as a fish-bone type with two (2) axis, one axis is Pan-Philippine Highway and the other axis is Legaspi-Tabaco-Tiwi Road.
- Road network in the area south of Pan-Philippine Highway is less developed.
- All municipal towns are accessed by a national or a provincial road.

2.3 GENERAL DIRECTION OF ROAD NETWORK DEVELOPMENT

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

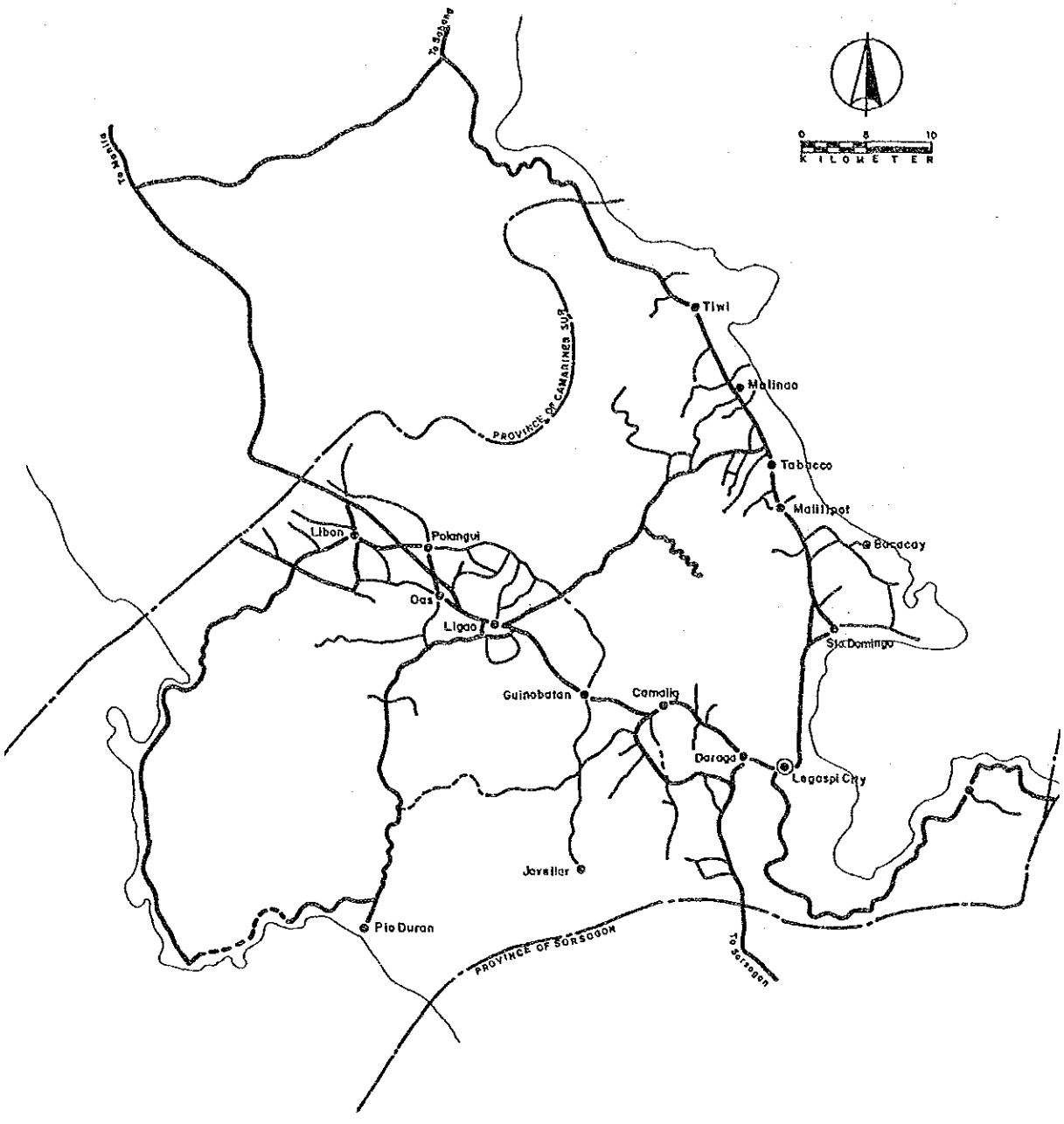
- In terms of road extension, national and provincial roads are relatively in high level, but barangay roads are in lower level than the national average.
- In terms of surface type and condition, national roads are in relatively good condition, however, provincial roads are still in poor condition.
- Basic road network is formed, however, road network in the area south of Pan-Philippine Highway is still scarce.

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

(1) Priority should be given to improvement of provincial roads, while improvement of national roads should also be pursued, particularly gravel surface national roads.

(2) Extension of barangay roads should be seeked.

(3) Road network development in the area south of Pan-Philippine Highway should be considered.



LEGEND:

- National Road
- Provincial Road
- Roads in Impassable / Abandoned Condition
- Provincial Boundary
- Provincial Capital
- City / Municipality

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			●		●
Street		. 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 Albay was proposed as shown in Figure 2.4-1. For establishing the major road network, the following were taken into consideration:

- Present road network pattern of a fish-bone type with two (2) axis was basically considered.
- In the southern area, it was judged that to formulate a mesh type network was still permature.
- As the basic network connecting all municipal towns are already formed, no new road link was considered necessary.

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 310.0 kms. and composed of the following roads.

National Road	293.8 kms.	(76% of all national roads)
Provincial Road	16.2 kms.	(4% of all national roads)
Total	310.0	

Table 2.4-2
NETWORK VALUE/ACCESSIBILITY
Province of Albay

Block No.	Population (1990)	Land Area (km^2)	Road Length (km)	Network Value	Access (p.km)	Average Access. (km.)
1	165,277	473.54	74.7	0.267	332,739	2.013
2	211,787	327.67	78.3	0.297	204,212	0.964
3	41,709	70.83	29.0	0.534	71,789	1.721
4	56,351	182.31	68.5	0.676	27,990	0.497
5	96,357	207.63	47.0	0.332	182,468	1.894
6	87,179	324.54	61.9	0.368	189,579	2.175
7	114,880	472.82	118.0	0.506	181,727	1.582
8	24,300	100.34	33.1	0.670	58,138	2.393
Ave.	99,730	269.96	63.8	0.389	156,080	1.565

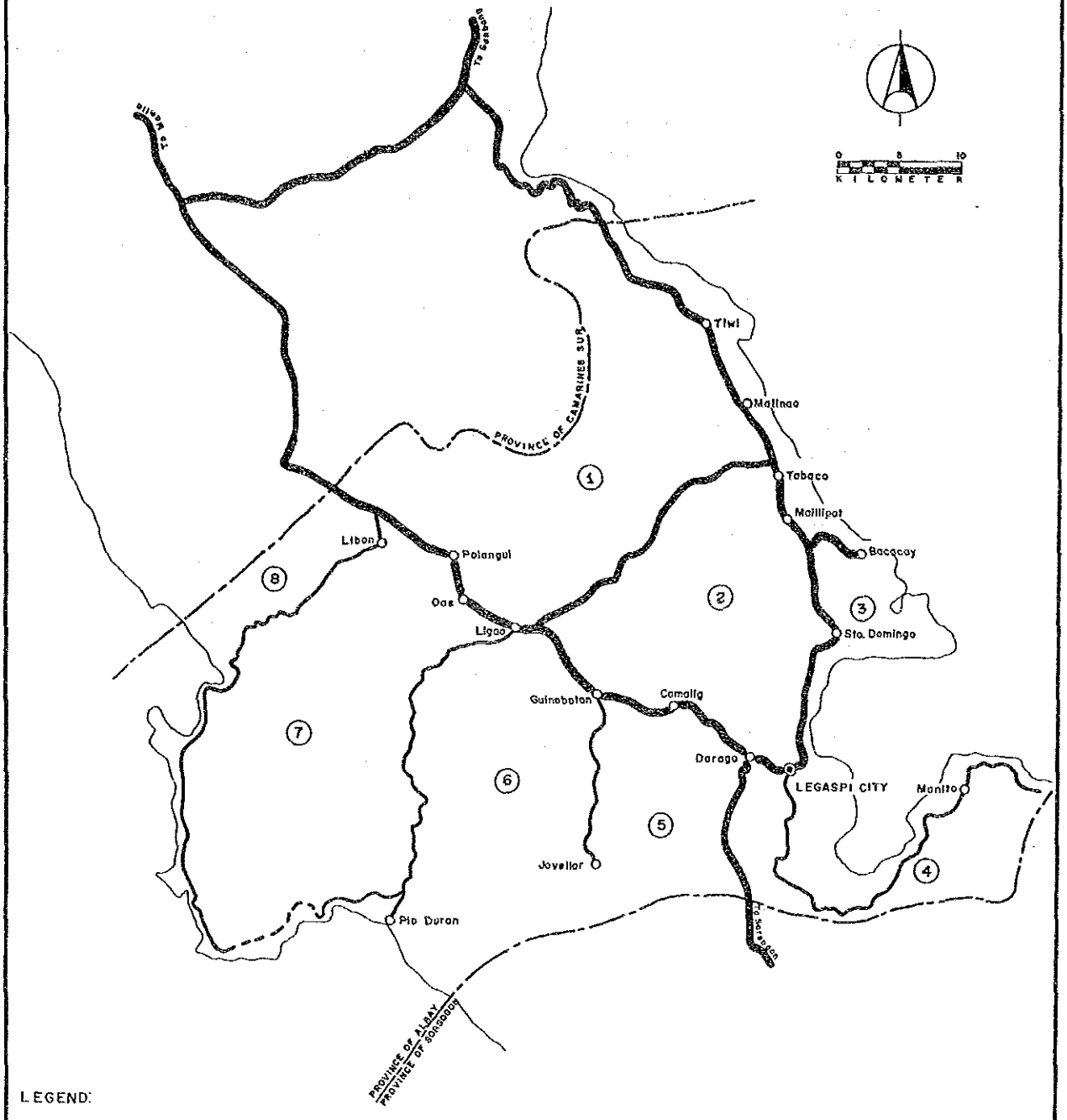


FIGURE 2.4-1 PROPOSED MAJOR ROAD NETWORK

CHAPTER 3
TRAFFIC

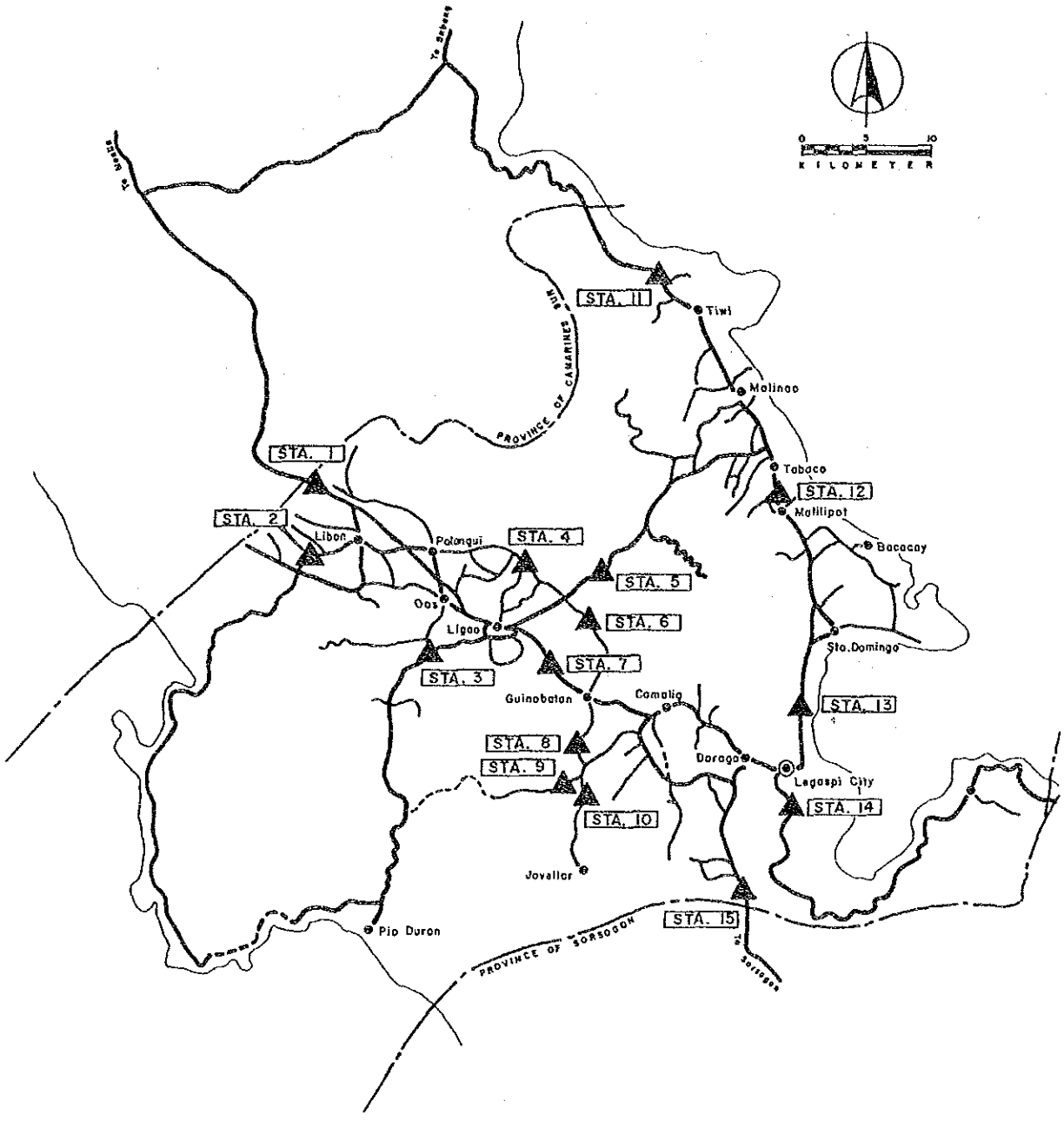
3.1 TRAFFIC SURVEY RESULTS

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.



LEGEND:

- National Road
- Provincial Road
- Roads in Impassable/ Abandoned Condition
- Provincial Boundary
- Provincial Capital
- City/Municipality
- Traffic Count Station

FIGURE 3.1-1 TRAFFIC COUNT STATIONS

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

(ADT as of Feb. 1990)

Station No.	Car	Jeep	Pickup /Van	Jeepney	Bus	Truck	Sub-Total	Tri-cycle	Motor-cycle	Animal Drawn	Total
1	187	135	274	348	466	328	1739	122	130	10	2001
2	18	53	7	36	0	11	125	141	102	0	368
3	2	16	18	175	3	18	232	43	22	0	297
4	2	158	61	199	0	218	639	245	175	0	1059
5	30	62	41	94	87	139	453	64	74	0	591
6	1	4	8	67	0	6	86	7	13	2	108
7	384	212	454	603	438	317	2408	86	251	2	2747
8	5	6	7	179	0	5	202	32	58	0	292
9	0	1	2	55	0	2	61	7	21	0	89
10	6	7	6	90	0	4	113	12	45	0	170
11	10	40	50	78	2	44	224	301	68	0	593
12	191	67	304	930	243	180	1915	787	332	0	3034
13	239	206	500	1079	254	285	2563	254	345	0	3163
14	2	4	151	202	0	21	381	8	36	0	425
15	109	105	177	484	155	187	1218	3	76	1	1298

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.

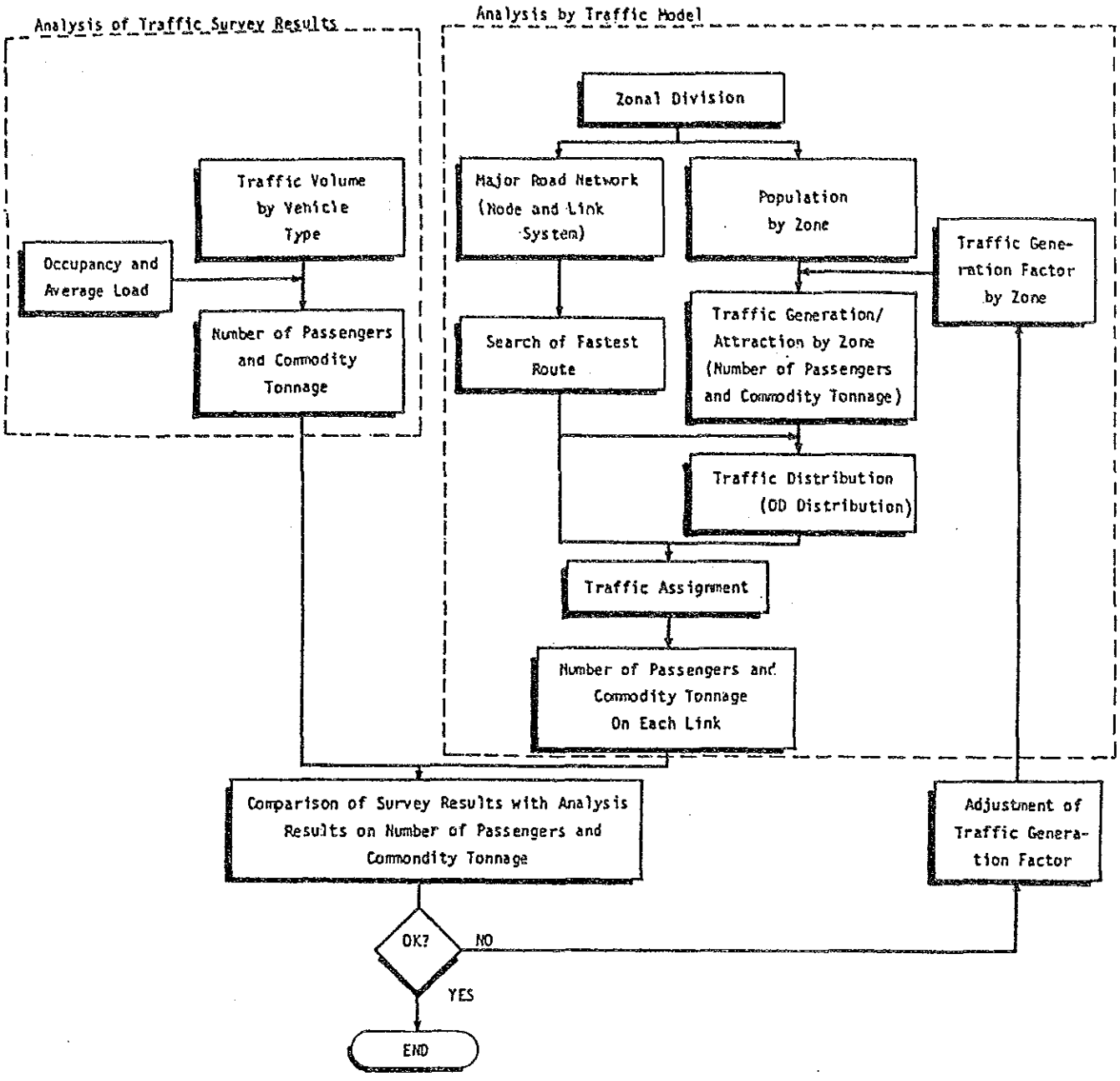


FIGURE 3.2-1
PROCEDURE OF ANALYSIS OF PRESENT TRAFFIC ON MAJOR ROAD NETWORK

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 Albay

	Average Number of Passenger per vehicle	Average Load (ton per vehicle)
Car/Taxi	3.00	0.30
Jeep	3.00	0.50
Van/Pickup	3.00	1.00
Jeepney	13.00	1.00
Bus	30.00	1.00
Truck	3.00	3.00
Motor-tricycle	4.00	0.10
Motorcycle	1.50	0.10
Animal Drawn	1.50	0.20

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

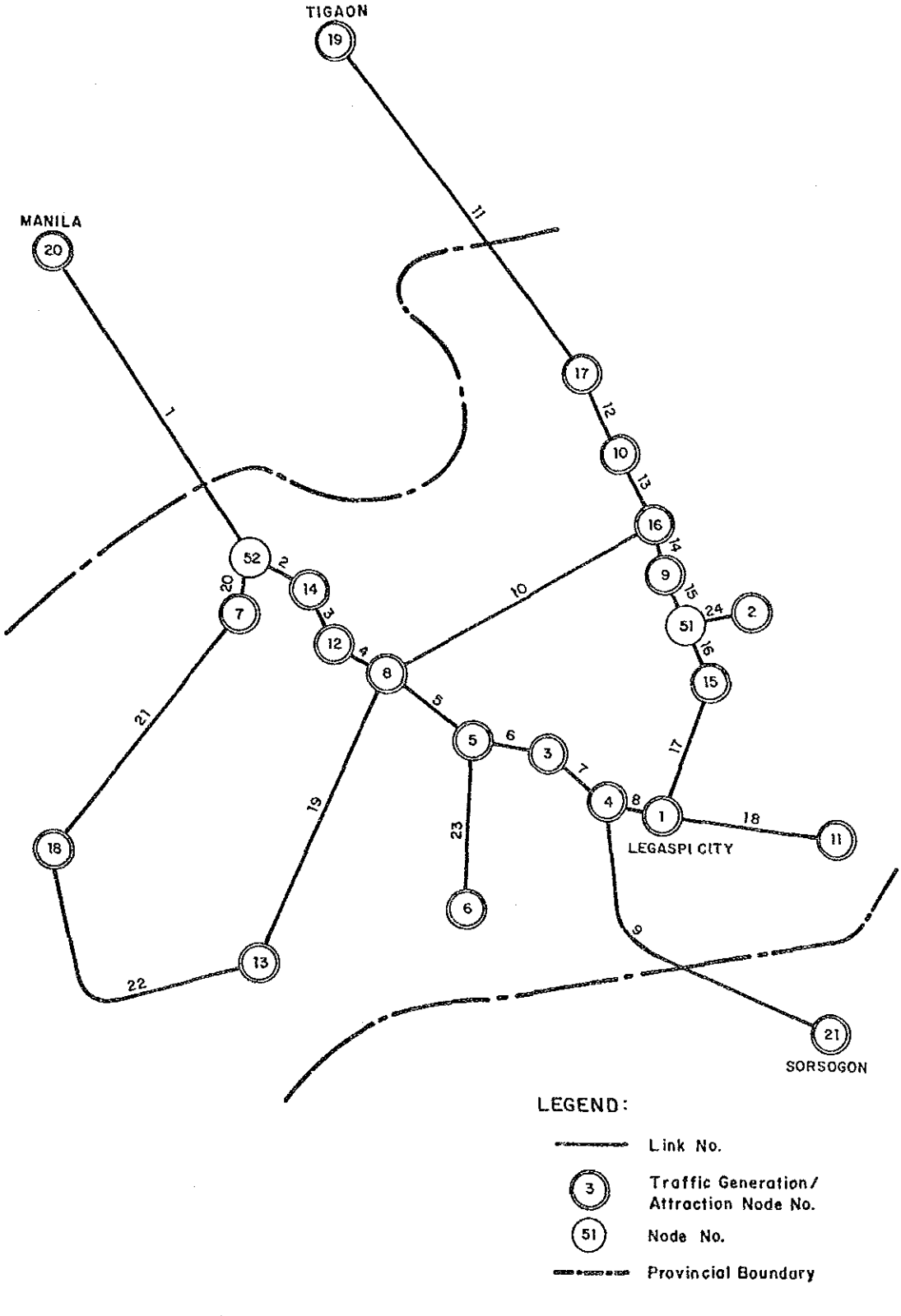


FIGURE 3.2-2 LINK / NODE SYSTEM
PROVINCE OF ALBAY

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 Albay

	Passenger Movement (trip/person/day)	Commodity (kg/person/day)
Range	0.036 - 0.428	2.8 - 33.4
Mean Value	0.176	13.9

v) Traffic Generation and Attraction by Zone:

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

vi) Traffic Distribution:

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

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

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

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

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

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

Where, n = Number of zones

vii) Traffic Assignment:

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

3.2.2 Traffic Forecast

Figure 3.2-3 illustrates the procedure of traffic forecast.

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

1) Major Road Network and Fastest Route Search

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

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

2) Traffic Generation/Attraction and Distribution

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

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

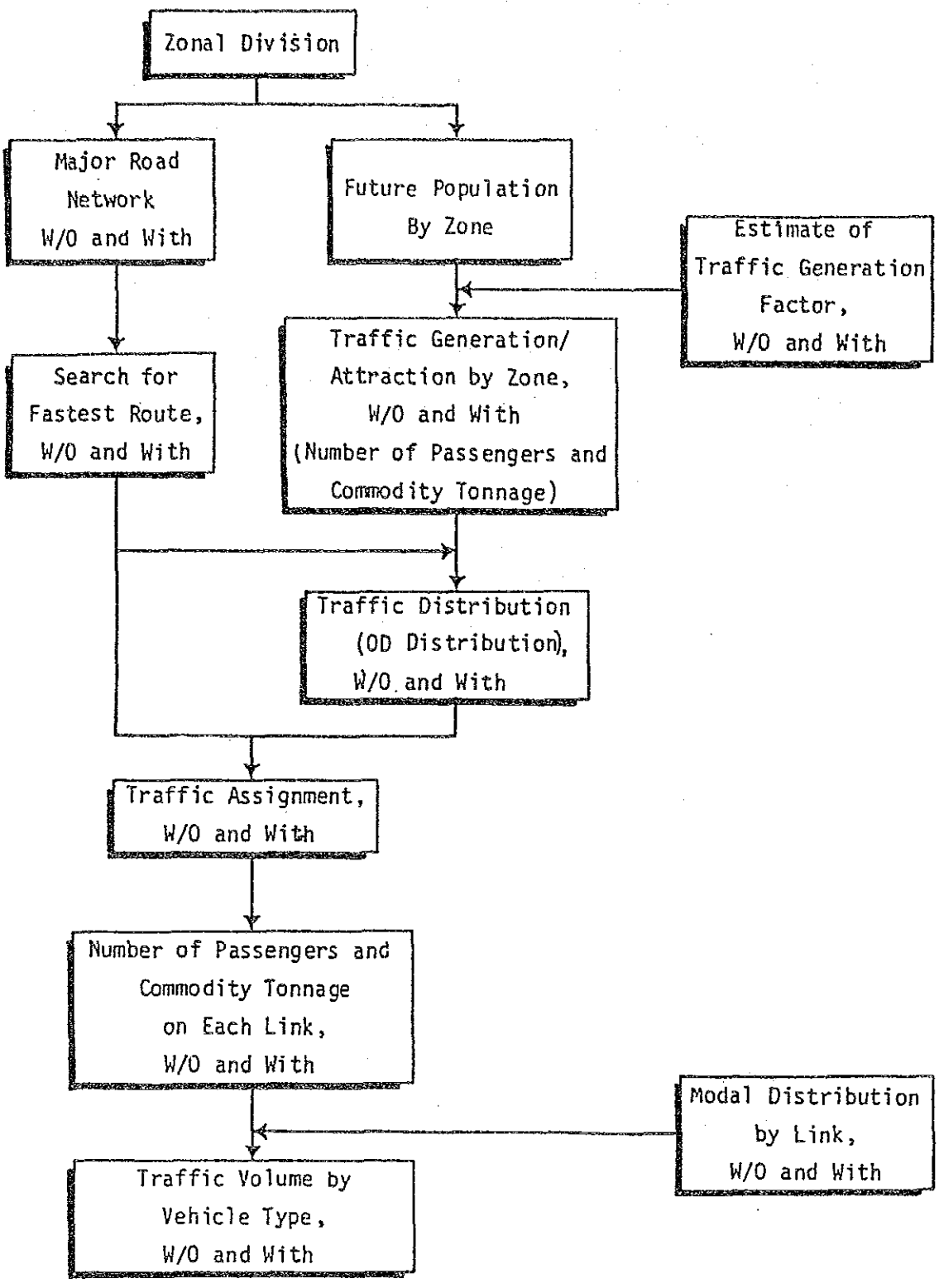


FIGURE 3.2-3
PROCEDURE OF FORECASTING TRAFFIC ON MAJOR ROAD NETWORK

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

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

	Passenger Movement (trip/person/day)	Commodity (kg/person/day)
Range	0.071 - 0.428	4.2 - 33.4
Mean Value	0.180	14.2

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.

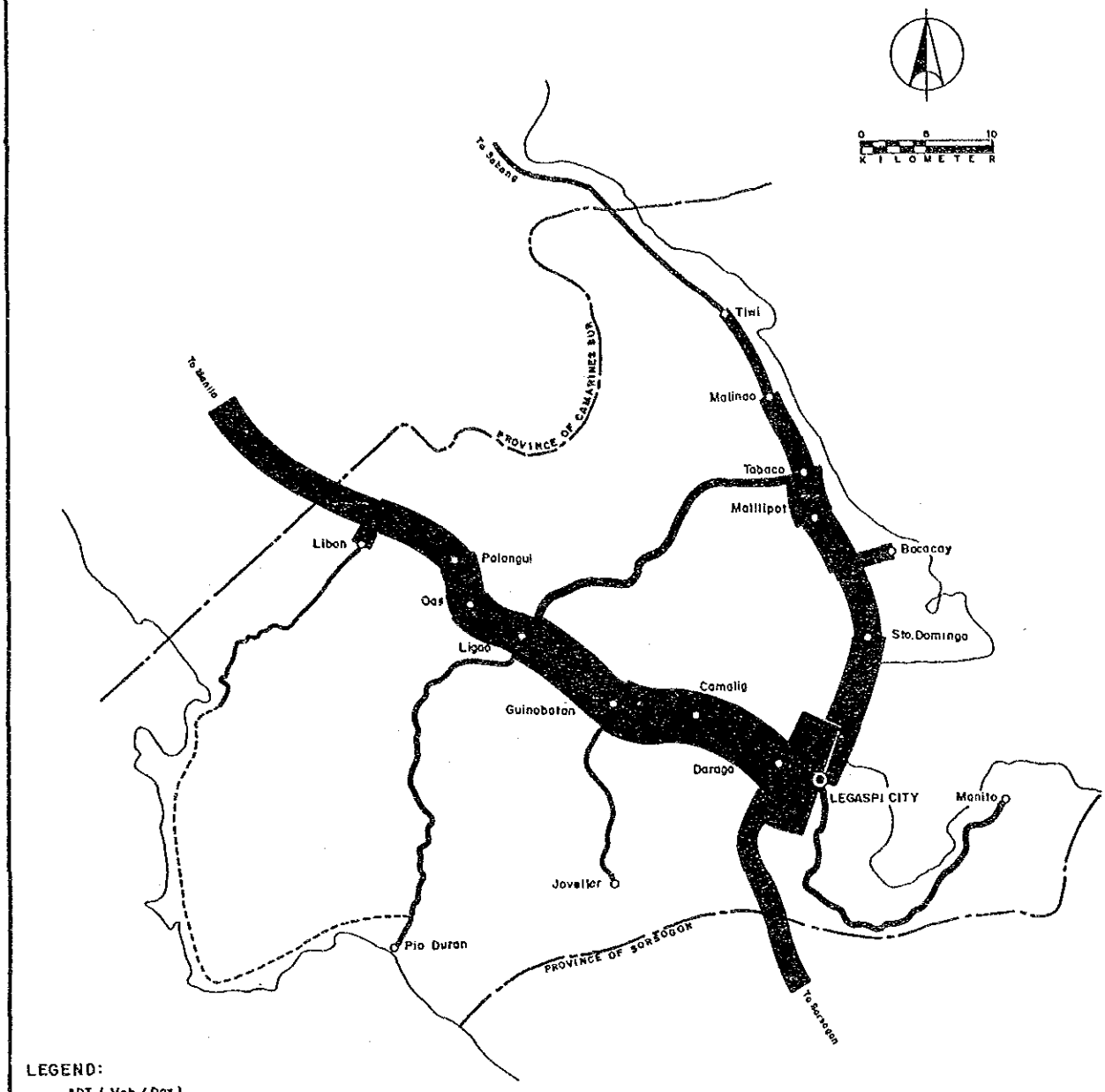
Diverted Traffic-2: Traffic which changes destination as a consequence of road improvement but for the same trip purpose as in the "w/o" case. This is possible in the case of improvement of the access road to the nearest town which is at present barely accessible due to poor conditions. This traffic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

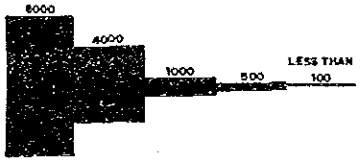
Estimated present and future traffic on the major road is illustrated in Figure 3.2-4 and Figure 3.2-5, respectively.

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.



LEGEND:

ADT (Veh./ Day)



◉ Provincial Capital

○ City / Municipality

FIGURE 3.2-4 ESTIMATED TRAFFIC VOLUME (1990)

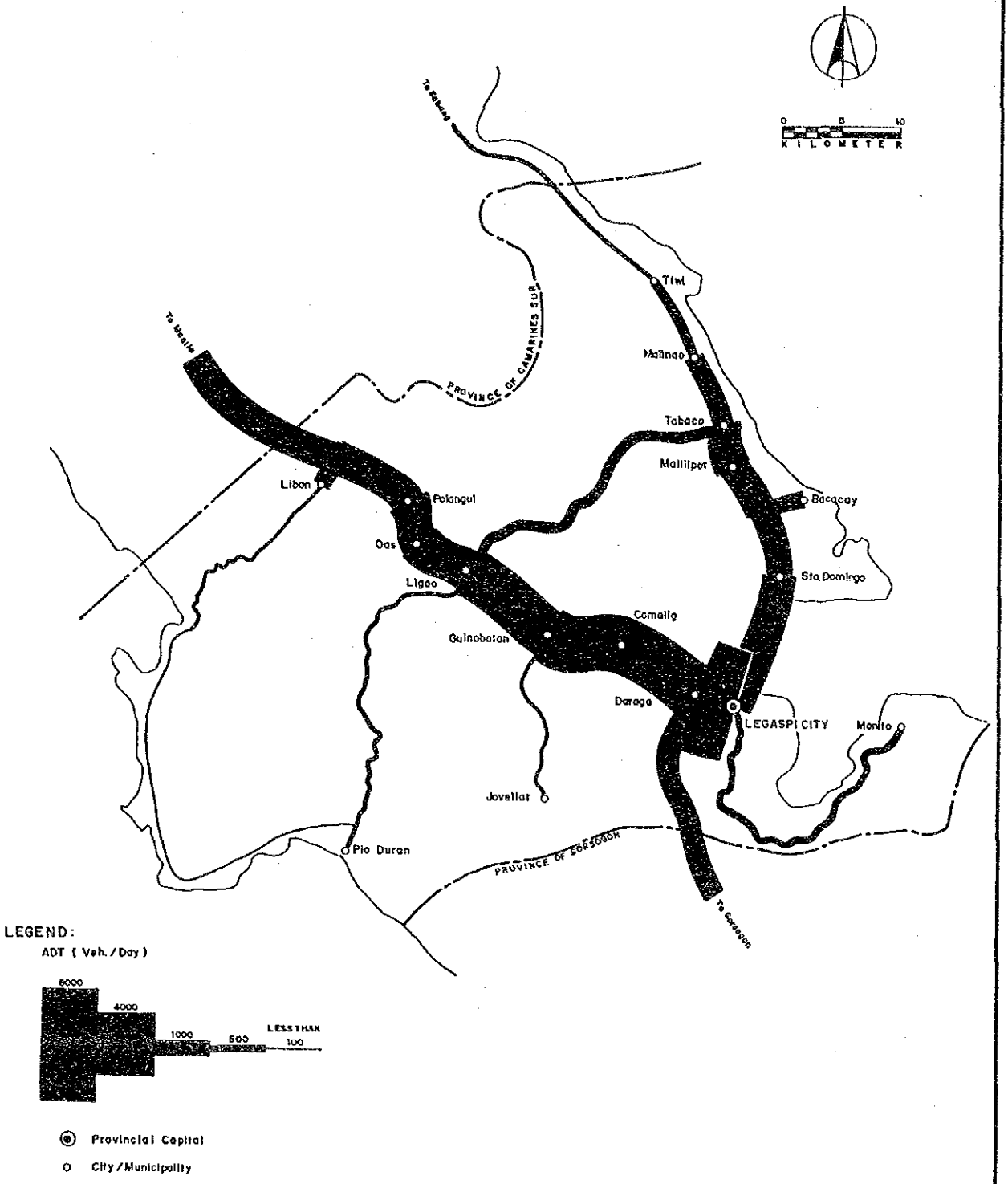


FIGURE 3.2-5 ESTIMATED TRAFFIC VOLUME (1993)
"WITH PROJECT" CASE

TRAFFIC PROJECTION ALBAY

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
1	1990	17951				17951	1389.11				1389.11
	1993	20946	-	-4	-	20942	1574.36	-	-.04	-	1574.32
	1997	25731	-	-6	-	25726	1860.35	-	-.05	-	1860.30
	2007	41662	-	-9	-	41653	2733.47	-	-.08	-	2733.39
	2017	65369	-	-14	-	65355	3892.04	-	-.11	-	3891.93
2	1990	19602				19602	1537.02				1537.02
	1993	22843	-	62	-	22905	1739.60	-	4.90	-	1744.50
	1997	28015	-	76	-	28091	2051.88	-	5.78	-	2057.66
	2007	45189	-	123	-	45312	3002.56	-	8.44	-	3011.00
	2017	70665	-	193	-	70859	4259.71	-	11.96	-	4271.67
3	1990	23210				23210	1823.99				1823.99
	1993	27075	-	75	-	27150	2066.54	-	6.13	-	2072.66
	1997	33249	-	91	-	33340	2440.91	-	7.16	-	2448.07
	2007	53793	-	144	-	53937	3583.27	-	10.22	-	3593.49
	2017	84335	-	221	-	84556	5097.38	-	14.24	-	5111.63
4	1990	24628				24628	1936.16				1936.16
	1993	28689	-	53	-	28742	2190.57	-	4.61	-	2195.17
	1997	35166	-	64	-	35230	2582.70	-	5.35	-	2588.05
	2007	56681	-	100	-	56781	3777.09	-	7.56	-	3784.65
	2017	88561	-	154	-	88715	5354.86	-	10.52	-	5365.37
5	1990	22786				22786	1813.22				1813.22
	1993	26560	-120	-217	-	26223	2053.05	-9.53	-17.46	-	2026.06
	1997	32584	-152	-269	-	32162	2422.92	-11.58	-20.85	-	2390.49
	2007	52620	-262	-446	-	51911	3551.46	-18.06	-31.36	-	3502.03
	2017	82314	-428	-711	-	81175	5042.32	-26.74	-45.37	-	4970.21
6	1990	26186				26186	2089.35				2089.35
	1993	30511	-728	-69	-	29715	2364.55	-52.12	-8.66	-	2303.78
	1997	37409	-891	-87	-	36431	2788.73	-61.35	-10.47	-	2716.92
	2007	60319	-1433	-152	-	58734	4080.69	-89.40	-16.17	-	3975.13
	2017	94342	-2239	-253	-	91851	5791.83	-126.53	-23.90	-	5641.39
7	1990	25459				25459	2049.68				2049.68
	1993	29735	-728	-28	-	28979	2325.20	-52.12	-6.67	-	2266.41
	1997	36574	-891	-37	-	35646	2751.04	-61.35	-8.08	-	2681.62
	2007	59379	-1433	-70	-	57876	4053.17	-89.40	-12.48	-	3951.28
	2017	93382	-2239	-122	-	91021	5784.28	-126.53	-18.48	-	5639.27
8	1990	50283				50283	4005.28				4005.28
	1993	58841	-728	-49	-	58065	4552.68	-52.12	-9.03	-	4491.54
	1997	72559	-891	-62	-	71606	5400.70	-61.35	-10.85	-	5328.50
	2007	118444	-1433	-109	-	116901	8001.74	-89.40	-16.55	-	7895.79
	2017	187128	-2239	-182	-	184707	11473.82	-126.53	-24.27	-	11323.02

TRAFFIC PROJECTION ALBAY

TABLE 3.2 - 4 (2)

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	9581				9581	903.29				903.29
	1993	11179	-	-3	-	11177	1023.75	-	-.01	-	1023.74
9	1997	13733	-	-3	-	13730	1209.71	-	-.01	-	1209.70
	2007	22235	-	-5	-	22230	1777.44	-	-.02	-	1777.43
	2017	34888	-	-8	-	34879	2530.79	-	-.03	-	2530.76
	1990	4362				4362	344.39				344.39
	1993	5094	728	827	-	6649	390.50	52.12	63.88	-	506.49
10	1997	6263	891	1017	-	8172	461.71	61.35	75.53	-	598.59
	2007	10164	1433	1652	-	13248	679.26	89.40	111.16	-	879.82
	2017	15967	2239	2593	-	20799	967.62	126.53	158.26	-	1252.42
	1990	881				881	211.85				211.85
	1993	1029	-	-	-	1028	240.10	-	-.02	-	240.08
11	1997	1263	-	-	-	1263	283.72	-	-.03	-	283.69
	2007	2046	-	-	-	2045	416.87	-	-.04	-	416.83
	2017	3210	-	-1	-	3209	593.55	-	-.06	-	593.50
	1990	4615				4615	464.31				464.31
	1993	5442	-	-2	-	5440	530.11	-	.17	-	530.27
12	1997	6781	-	-3	-	6778	632.61	-	.21	-	632.82
	2007	11323	-	-4	-	11318	949.82	-	.34	-	950.17
	2017	18215	-	-7	-	18208	1376.55	-	.53	-	1377.08
	1990	7963				7963	722.39				722.39
	1993	9358	-	-26	-	9332	823.25	-	-1.35	-	821.90
13	1997	11604	-	-32	-	11572	980.02	-	-1.50	-	978.42
	2007	19177	-	-52	-	19125	1463.33	-	-2.36	-	1460.97
	2017	30598	-	-83	-	30515	2111.46	-	-3.37	-	2108.09
	1990	17416				17416	1396.03				1396.03
	1993	20396	120	-385	-	20131	1587.96	9.53	-28.61	-	1568.87
14	1997	25175	152	-471	-	24856	1885.53	11.58	-33.72	-	1863.39
	2007	41181	262	-758	-	40686	2799.26	18.06	-49.28	-	2768.05
	2017	65184	428	-1180	-	64432	4021.20	26.74	-69.75	-	3978.19
	1990	13832				13832	1119.69				1119.69
	1993	16184	-11	-318	-	15855	1272.61	-.19	-24.05	-	1248.37
15	1997	19955	-10	-389	-	19556	1509.48	-	-28.31	-	1481.18
	2007	32564	-6	-623	-	31935	2235.80	.71	-41.23	-	2195.27
	2017	51447	1	-967	-	50481	3205.99	1.65	-58.20	-	3149.44
	1990	13333				13333	1085.14				1085.14
	1993	15605	-728	-242	-	14635	1233.62	-52.12	-18.90	-	1162.60
16	1997	19247	-891	-296	-	18060	1463.69	-61.35	-22.24	-	1380.10
	2007	31435	-1433	-474	-	29528	2169.55	-89.40	-32.41	-	2047.73
	2017	49697	-2239	-736	-	46722	3112.72	-126.53	-45.78	-	2940.41

TRAFFIC PROJECTION ALBAY

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
17	1990	16223				16223	1312.52				1312.52
	1993	19005	-728	-119	-	18158	1493.44	-52.12	-11.24	-	1430.08
	1997	23471	-891	-145	-	22435	1774.07	-61.35	-13.17	-	1699.56
	2007	38438	-1433	-227	-	36778	2636.51	-89.40	-18.97	-	2528.14
	2017	60807	-2239	-347	-	58311	3790.39	-126.53	-26.55	-	3637.31
18	1990	2124				2124	276.48				276.48
	1993	2505	-	-	-	2505	316.79	-	.05	-	316.84
	1997	3123	-	-	-	3122	379.83	-	.06	-	379.89
	2007	5218	-	-1	-	5217	575.97	-	.09	-	576.06
	2017	8398	-	-1	-	8397	841.21	-	.13	-	841.34
19	1990	1730				1730	134.98				134.98
	1993	2013	-	-6	-	2007	152.61	-	-.43	-	152.18
	1997	2465	-	-7	-	2458	179.73	-	-.51	-	179.23
	2007	3962	-	-12	-	3950	262.14	-	-.74	-	261.40
	2017	6184	-	-18	-	6165	371.28	-	-1.06	-	370.23
20	1990	5334				5334	416.27				416.27
	1993	6142	-	-68	-	6075	465.60	-	-5.25	-	460.35
	1997	7414	-	-81	-	7333	540.59	-	-6.07	-	534.52
	2007	11526	-	-125	-	11401	762.63	-	-8.47	-	754.16
	2017	17435	-	-187	-	17247	1046.87	-	-11.52	-	1035.35
21	1990	869				869	67.66				67.66
	1993	1011	-	-6	-	1005	76.46	-	-.43	-	76.03
	1997	1237	-	-7	-	1230	90.00	-	-.51	-	89.49
	2007	1984	-	-11	-	1973	131.05	-	-.75	-	130.30
	2017	3087	-	-18	-	3069	184.99	-	-1.07	-	183.93
22	1990	36				36	2.94				2.94
	1993	42	-	6	404	452	3.31	-	.44	30.69	34.44
	1997	51	-	7	1483	1541	3.88	-	.52	108.40	112.79
	2007	82	-	12	2381	2474	5.60	-	.76	157.94	164.29
	2017	126	-	18	3709	3854	7.85	-	1.08	223.32	232.25
23	1990	1654				1654	77.40				77.40
	1993	1931	-	-	-	1931	87.77	-	-	-	87.77
	1997	2374	-	-	-	2374	103.79	-	-	-	103.80
	2007	3849	-	-	-	3848	152.72	-	-	-	152.72
	2017	6049	-	-1	-	6048	217.81	-	-	-	217.82
24	1990	5903				5903	460.87				460.87
	1993	6899	-	-4	-	6895	523.16	-	-.09	-	523.07
	1997	8493	-	-5	-	8488	619.50	-	-.10	-	619.39
	2007	13811	-	-8	-	13803	914.23	-	-.15	-	914.08
	2017	21756	-	-12	-	21743	1306.91	-	-.22	-	1306.69

TRAFFIC PROJECTION ALBAY

TABLE 3.2 - 5 (1)

Traffic Volume

Link	Year	w/o									with								
		Car /Van	Jeep-ney	Bus	Truck	Sub-Total	Tri-cycl	Mot. cycl	Ani-mal	Total	Car /Van	Jeep-ney	Bus	Truck	Sub-Total	Tri-cycl	Mot. cycl	Ani-mal	Total
1	1990	633	387	449	324	1793	-	-	-	1793									
	1993	727	448	524	367	2066	-	-	-	2066	664	485	524	376	2048	-	-	-	2048
	1997	875	545	643	434	2497	-	-	-	2497	652	675	643	465	2435	-	-	-	2435
	2007	1350	860	1042	638	3889	-	-	-	3889	1022	1051	1041	683	3798	-	-	-	3798
	2017	2024	1317	1634	908	5883	-	-	-	5883	1556	1589	1634	973	5752	-	-	-	5752
2	1990	696	425	490	359	1969	-	-	-	1969									
	1993	798	491	571	406	2266	-	-	-	2266	731	533	573	417	2253	-	-	-	2253
	1997	959	595	700	479	2734	-	-	-	2734	715	741	702	514	2673	-	-	-	2673
	2007	1474	935	1130	701	4240	-	-	-	4240	1117	1149	1133	753	4151	-	-	-	4151
	2017	2200	1428	1767	994	6389	-	-	-	6389	1694	1731	1771	1068	6264	-	-	-	6264
3	1990	825	503	580	426	2333	-	-	-	2333									
	1993	947	582	677	482	2688	-	-	-	2688	867	632	679	495	2673	-	-	-	2673
	1997	1140	707	831	570	3248	-	-	-	3248	849	880	833	612	3175	-	-	-	3175
	2007	1757	1114	1345	836	5052	-	-	-	5052	1330	1369	1348	898	4946	-	-	-	4946
	2017	2629	1705	2108	1189	7632	-	-	-	7632	2023	2068	2114	1278	7482	-	-	-	7482
4	1990	875	534	616	452	2476	-	-	-	2476									
	1993	1004	617	717	511	2849	-	-	-	2849	918	669	719	524	2830	-	-	-	2830
	1997	1206	748	879	603	3435	-	-	-	3435	898	930	881	647	3356	-	-	-	3356
	2007	1851	1174	1417	881	5324	-	-	-	5324	1401	1441	1420	946	5207	-	-	-	5207
	2017	2761	1791	2214	1249	8016	-	-	-	8016	2122	2170	2218	1341	7851	-	-	-	7851
5	1990	1096	1185	334	314	2929	-	-	-	2929									
	1993	1257	1371	390	356	3373	-	-	-	3373	1334	1219	431	353	3338	-	-	-	3338
	1997	1508	1665	478	420	4071	-	-	-	4071	1837	1149	643	422	4051	-	-	-	4051
	2007	2307	2628	772	616	6322	-	-	-	6322	2851	1793	1038	619	6301	-	-	-	6301
	2017	3428	4023	1207	874	9532	-	-	-	9532	4296	2718	1623	878	9516	-	-	-	9516
6	1990	1262	1362	384	362	3371	-	-	-	3371									
	1993	1446	1575	447	410	3879	-	-	-	3879	1515	1382	489	402	3787	-	-	-	3787
	1997	1734	1913	549	483	4678	-	-	-	4678	2084	1303	729	480	4595	-	-	-	4595
	2007	2648	3014	885	707	7254	-	-	-	7254	3230	2031	1175	702	7138	-	-	-	7138
	2017	3933	4613	1384	1004	10934	-	-	-	10934	4867	3079	1837	997	10779	-	-	-	10779
7	1990	1233	1328	373	355	3290	-	-	-	3290									
	1993	1416	1539	436	403	3794	-	-	-	3794	1484	1351	477	395	3707	-	-	-	3707
	1997	1704	1874	536	477	4591	-	-	-	4591	2046	1278	713	474	4511	-	-	-	4511
	2007	2620	2973	871	703	7166	-	-	-	7166	3194	2007	1158	698	7056	-	-	-	7056
	2017	3911	4575	1370	1003	10859	-	-	-	10859	4839	3059	1820	996	10714	-	-	-	10714
8	1990	2421	2615	737	694	6467	-	-	-	6467									
	1993	2785	3037	863	789	7475	-	-	-	7475	2956	2699	955	784	7394	-	-	-	7394
	1997	3359	3709	1064	936	9069	-	-	-	9069	4092	2558	1432	941	9024	-	-	-	9024
	2007	5196	5916	1737	1387	14236	-	-	-	14236	6423	4040	2338	1395	14196	-	-	-	14196
	2017	7797	9148	2745	1989	21678	-	-	-	21678	9780	6187	3694	2000	21662	-	-	-	21662

TRAFFIC PROJECTION ALBAY

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	376	476	160	187	1199	-	-	-	1199									
	1993	432	551	186	212	1381	-	-	-	1381	421	533	199	215	1367	-	-	-	1367
9	1997	519	669	229	250	1667	-	-	-	1667	480	601	275	262	1618	-	-	-	1618
	2007	797	1054	371	367	2589	-	-	-	2589	747	937	445	385	2513	-	-	-	2513
	2017	1189	1613	581	523	3906	-	-	-	3906	1128	1418	698	548	3792	-	-	-	3792
	1990	129	94	103	98	424	-	-	-	424									
	1993	149	110	121	111	490	-	-	-	490	186	138	160	144	628	-	-	-	628
10	1997	181	134	148	131	594	-	-	-	594	208	156	204	170	738	-	-	-	738
	2007	285	214	241	192	932	-	-	-	932	326	248	331	249	1155	-	-	-	1155
	2017	435	331	378	274	1418	-	-	-	1418	497	383	520	355	1754	-	-	-	1754
	1990	99	111	5	27	242	-	-	-	242									
	1993	113	127	6	30	276	-	-	-	276	111	110	11	34	266	-	-	-	266
11	1997	134	153	7	36	331	-	-	-	331	130	92	25	47	294	-	-	-	294
	2007	202	236	12	53	503	-	-	-	503	197	139	41	69	447	-	-	-	447
	2017	295	354	18	75	742	-	-	-	742	291	205	64	99	659	-	-	-	659
	1990	279	400	26	59	764	-	-	-	764									
	1993	323	467	31	67	888	-	-	-	888	331	392	57	74	853	-	-	-	853
12	1997	392	574	38	80	1084	-	-	-	1084	422	296	136	105	959	-	-	-	959
	2007	616	928	64	120	1728	-	-	-	1728	672	470	226	158	1527	-	-	-	1527
	2017	934	1450	103	174	2662	-	-	-	2662	1034	723	364	230	2351	-	-	-	2351
	1990	453	668	45	92	1258	-	-	-	1258									
	1993	523	778	53	104	1458	-	-	-	1458	537	649	97	115	1398	-	-	-	1398
13	1997	633	953	66	124	1776	-	-	-	1776	689	482	231	163	1566	-	-	-	1566
	2007	989	1531	109	185	2814	-	-	-	2814	1090	763	382	243	2479	-	-	-	2479
	2017	1495	2380	173	267	4316	-	-	-	4316	1671	1168	610	351	3800	-	-	-	3800
	1990	623	1018	255	233	2129	-	-	-	2129									
	1993	717	1181	299	265	2461	-	-	-	2461	784	1037	331	288	2440	-	-	-	2440
14	1997	864	1441	369	314	2988	-	-	-	2988	1145	946	497	404	2992	-	-	-	2992
	2007	1333	2291	604	467	4694	-	-	-	4694	1827	1493	814	600	4733	-	-	-	4733
	2017	1995	3532	956	670	7154	-	-	-	7154	2824	2283	1289	862	7257	-	-	-	7257
	1990	498	811	203	187	1698	-	-	-	1698									
	1993	572	940	237	212	1962	-	-	-	1962	621	819	261	229	1930	-	-	-	1930
15	1997	689	1145	293	252	2378	-	-	-	2378	904	748	391	321	2363	-	-	-	2363
	2007	1060	1817	478	373	3727	-	-	-	3727	1438	1176	639	475	3728	-	-	-	3728
	2017	1584	2795	755	534	5668	-	-	-	5668	2218	1795	1010	682	5705	-	-	-	5705
	1990	482	783	196	181	1641	-	-	-	1641									
	1993	553	908	229	206	1896	-	-	-	1896	576	759	241	213	1788	-	-	-	1788
16	1997	666	1107	282	244	2299	-	-	-	2299	837	693	361	299	2190	-	-	-	2190
	2007	1027	1756	461	362	3606	-	-	-	3606	1332	1091	591	444	3458	-	-	-	3458
	2017	1534	2704	729	519	5486	-	-	-	5486	2057	1666	934	637	5295	-	-	-	5295

TRAFFIC PROJECTION ALBAY

TABLE 3.2 - 5 (3)

Traffic Volume

Link	Year	w/o									with								
		Car /Van	Jeep-ney	Bus	Truck	Sub-Total	Tri-cycl	Mot. cycl	Ani-mal	Total	Car /Van	Jeep-ney	Bus	Truck	Sub-Total	Tri-cycl	Mot. cycl	Ani-mal	Total
	1990	584	951	238	219	1991	-	-	-	1991									
	1993	672	1104	279	249	2303	-	-	-	2303	711	939	299	262	2210	-	-	-	2210
17	1997	810	1347	344	296	2796	-	-	-	2796	1037	858	449	368	2711	-	-	-	2711
	2007	1251	2144	564	439	4398	-	-	-	4398	1656	1354	736	548	4293	-	-	-	4293
	2017	1873	3308	893	632	6706	-	-	-	6706	2562	2073	1166	788	6589	-	-	-	6589
	1990	159	223	-	21	403	-	-	-	403									
	1993	183	260	-	24	467	-	-	-	467	160	244	14	30	448	-	-	-	448
18	1997	219	321	-	29	570	-	-	-	570	138	258	52	51	499	-	-	-	499
	2007	334	524	-	44	902	-	-	-	902	220	407	87	77	790	-	-	-	790
	2017	491	825	-	64	1380	-	-	-	1380	336	621	140	112	1209	-	-	-	1209
	1990	36	179	3	19	237	-	-	-	237									
	1993	41	207	3	22	273	-	-	-	273	49	170	13	26	258	-	-	-	258
19	1997	49	250	4	26	329	-	-	-	329	80	119	41	39	278	-	-	-	278
	2007	74	391	7	38	509	-	-	-	509	123	186	66	57	432	-	-	-	432
	2017	108	595	10	53	766	-	-	-	766	186	283	103	80	652	-	-	-	652
	1990	759	350	-	78	1186	-	-	-	1186									
	1993	868	400	-	87	1355	-	-	-	1355	639	363	34	91	1126	-	-	-	1126
20	1997	1039	479	-	101	1619	-	-	-	1619	238	355	122	116	831	-	-	-	831
	2007	1583	731	-	142	2457	-	-	-	2457	356	537	190	163	1246	-	-	-	1246
	2017	2351	1087	-	195	3633	-	-	-	3633	521	791	287	224	1824	-	-	-	1824
	1990	124	57	-	13	193	-	-	-	193									
	1993	143	66	-	14	223	-	-	-	223	106	60	6	15	186	-	-	-	186
21	1997	173	80	-	17	270	-	-	-	270	40	60	20	19	139	-	-	-	139
	2007	272	126	-	24	423	-	-	-	423	62	93	33	28	216	-	-	-	216
	2017	416	192	-	35	643	-	-	-	643	93	141	51	40	324	-	-	-	324
	1990	5	2	-	.5	8	-	-	-	8									
	1993	6	3	-	.6	9	-	-	-	9	48	27	3	7	84	-	-	-	84
22	1997	7	3	-	.7	11	-	-	-	11	50	75	26	24	175	-	-	-	175
	2007	11	5	-	1	18	-	-	-	18	77	117	41	36	271	-	-	-	271
	2017	17	8	-	1	26	-	-	-	26	117	177	64	50	408	-	-	-	408
	1990	20	179	-	5	204	-	-	-	204									
	1993	23	207	-	6	235	-	-	-	235	41	181	6	8	236	-	-	-	236
23	1997	27	252	-	7	286	-	-	-	286	95	156	24	16	290	-	-	-	290
	2007	42	397	-	10	450	-	-	-	450	151	246	38	23	459	-	-	-	459
	2017	64	608	-	15	687	-	-	-	687	234	377	60	33	705	-	-	-	705
	1990	90	768	-	31	888	-	-	-	888									
	1993	104	886	-	35	1025	-	-	-	1025	172	775	23	49	1019	-	-	-	1019
24	1997	125	1074	-	41	1240	-	-	-	1240	376	670	85	93	1224	-	-	-	1224
	2007	193	1681	-	61	1935	-	-	-	1935	597	1048	138	137	1921	-	-	-	1921
	2017	289	2555	-	87	2931	-	-	-	2931	921	1592	217	196	2926	-	-	-	2926

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 Albay

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

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

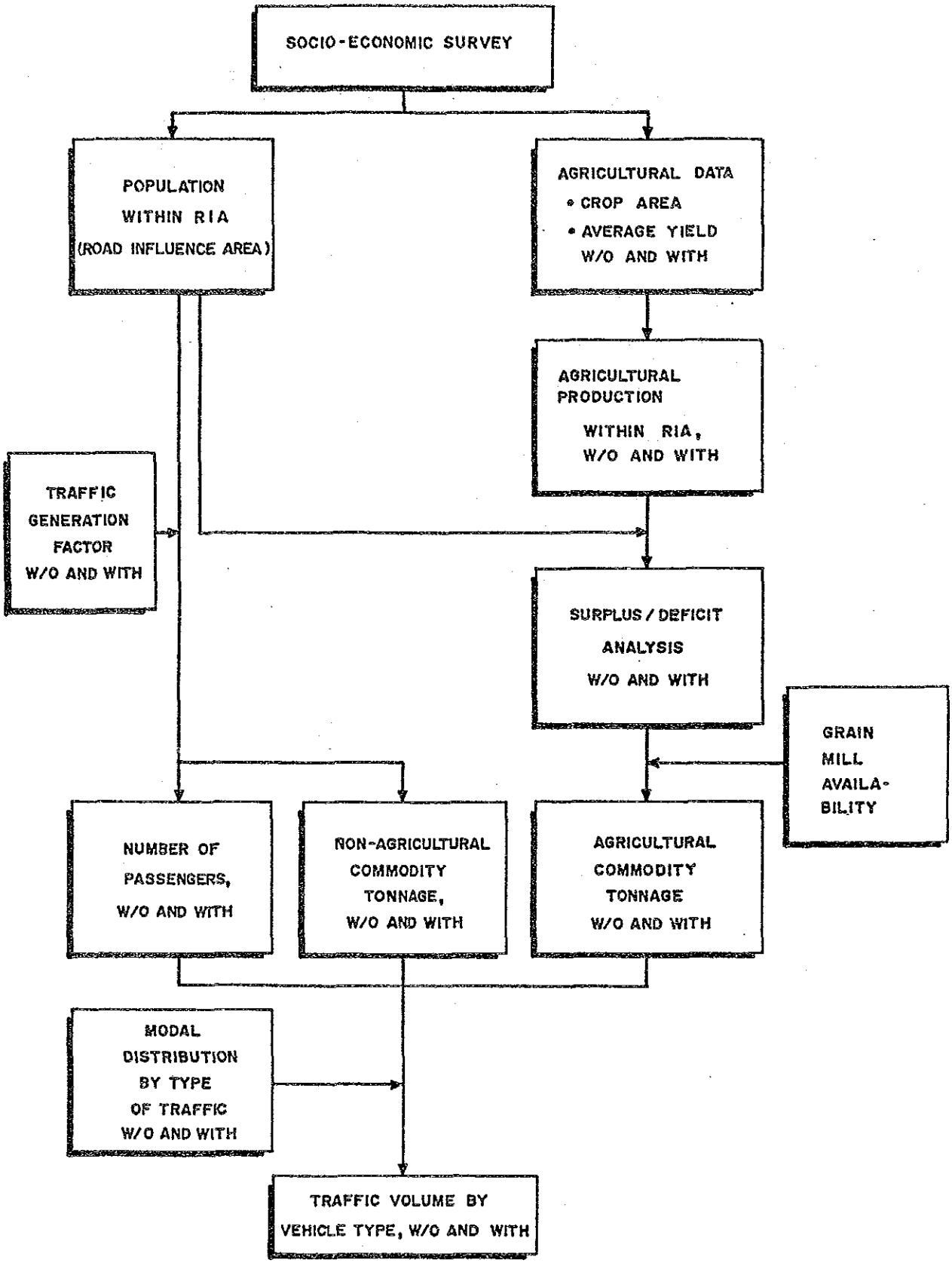


FIGURE 3.3-1
PROCEDURE OF TRAFFIC FORECAST FOR DEVELOPMENT PROJECTS

inventory survey and the traffic survey.

3.3.2 Agricultural Traffic

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

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

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

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

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

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

3.3.3 Estimated Present and Future Traffic

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

3.4 SUMMARY OF TRAFFIC VOLUME ON STUDIED ROADS

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

TABLE 3.4 - 1 (1)

Traffic Volume by Vehicle Type ALBAY

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	N4-8	672	1104	279	249	2303	0	-	-	-	-	711	939	299	262	2210	0	-	-	-	-
		N2-1	149	110	121	111	490	0	-	-	-	-	186	138	160	144	628	0	-	-	-	-
		N4-1	113	127	6	30	276	-	-	-	-	-	111	110	11	34	266	-	-	-	-	-
Second'y Major	Rehab/Imp-1	N5-2	183	260	-	24	467	0	-	-	-	-	160	244	14	30	448	0	-	-	-	-
		N10-2	6	3	-	1	9	0	-	-	-	-	48	27	3	7	84	0	-	-	-	-
		N9	143	66	-	14	223	0	-	-	-	-	106	60	6	15	186	0	-	-	-	-
		N5-1	183	260	-	24	467	0	-	-	-	-	160	244	14	30	448	0	-	-	-	-
		N7-2	41	207	3	22	273	0	-	-	-	-	49	170	13	26	258	0	-	-	-	-
		P23	23	207	-	6	235	0	-	-	-	-	41	181	6	8	236	0	-	-	-	-
		N7-1	41	207	3	22	273	0	-	-	-	-	49	170	13	26	258	0	-	-	-	-
	Imp-2/Widen	N10-1	6	3	-	1	9	0	-	-	-	-	48	27	3	7	84	0	-	-	-	-

TABLE 3.4 - 1 (2)

Traffic Volume by Vehicle Type ALBAY

Class of Road	Type of Impr't	Road Number	w/o									with								
			Car	Jeep-ney	Bus	Truck	Total	Tri-cycle	Motor cycle	Animal	Walking	Boat	Car	Jeep-ney	Bus	Truck	Total	Tri-cycle	Motor cycle	Animal	Walking	Boat
Minor (Nat'l/ Prov'l)	Rehab/ Imp-1	P51	-	35	-	-	35	-	249	11	549	-	-	78	-	0	78	42	196	-	-	-
		P53	-	26	-	-	26	-	190	3	476	-	-	58	-	0	58	32	135	-	-	-
		P5	-	275	-	0	275	211	1271	9	803	-	-	384	-	1	385	212	863	-	-	-
		N6	-	290	-	6	296	143	1211	121	553	-	-	363	-	12	376	144	930	-	-	-
		P11	-	88	-	-	88	171	481	37	295	-	62	107	-	-	169	79	511	18	-	-
		P61	46	67	-	0	113	117	256	8	225	-	47	84	-	1	133	61	384	-	-	-
		P36	-	17	-	-	17	-	123	22	276	-	-	23	-	-	23	56	135	11	-	-
		N8	-	201	-	1	203	138	906	29	534	-	108	202	-	3	312	139	909	-	-	-
		P41	-	22	-	-	22	-	158	13	352	-	24	32	-	0	56	59	132	-	101	-
		P50	-	52	-	-	52	-	377	10	918	-	-	113	-	0	114	62	275	-	-	-
		P49	-	12	-	-	12	-	94	4	219	-	-	27	-	0	27	14	69	-	-	-
		P65	-	24	-	-	24	-	173	10	423	-	-	31	-	-	31	88	187	3	-	-
		P12	-	40	-	-	40	108	294	9	367	-	40	53	-	-	93	102	212	2	191	-
		P43	-	29	-	-	29	-	211	15	500	-	29	40	-	0	69	74	165	-	135	-
		P60	58	80	-	0	139	151	291	7	244	-	65	106	-	1	172	80	480	-	-	-
		P39	-	37	-	-	37	88	279	22	341	-	35	50	-	-	86	91	213	6	175	-
		P21	-	48	-	-	48	-	326	48	689	-	47	67	-	1	114	116	291	-	197	-
		P55	-	12	-	-	12	-	79	13	173	-	11	20	-	0	31	14	102	-	-	-
		P46	-	7	-	-	7	-	50	9	114	-	8	12	-	0	19	20	52	-	38	-
		P37	-	48	-	-	48	123	343	22	422	-	-	60	-	-	60	166	360	5	-	-
		P54	-	34	-	-	34	-	249	6	606	-	-	79	-	0	79	43	187	-	-	-
		P22	-	85	-	1	86	141	423	16	235	-	55	102	-	2	158	69	451	-	-	-
		P32	-	9	-	-	9	-	64	10	146	-	8	12	-	0	20	20	46	2	38	-
		P17	-	95	-	-	95	-	700	12	1787	-	92	121	-	0	213	235	481	-	450	-
		P26	29	41	-	-	71	82	162	3	140	-	30	50	-	0	81	38	242	-	-	-
		P16	-	24	-	-	24	-	165	18	388	-	-	31	-	-	31	83	182	9	-	-
		P40	-	11	-	-	11	-	73	13	160	-	11	16	-	0	27	27	73	-	51	-
		P33	-	4	-	-	4	-	33	28	87	-	5	10	-	-	15	6	49	6	-	-
		P24	-	7	-	-	7	-	53	7	125	-	7	10	-	-	16	17	41	3	32	-
		P66	-	13	-	-	13	-	91	14	203	-	-	19	-	-	19	48	109	7	-	-
		P58	-	19	-	-	19	45	140	12	170	-	17	25	-	0	42	45	106	-	86	-
		P9	-	15	-	0	15	-	98	2	238	-	13	18	-	0	31	32	70	-	61	-
		P30	-	13	-	-	13	-	102	6	255	-	13	18	-	-	31	33	74	1	64	-
		P47	-	24	-	-	24	55	169	9	179	-	24	33	-	0	57	59	139	-	102	-
		P35	-	13	-	-	13	-	94	4	235	-	-	17	-	-	17	47	100	1	-	-
		P7	61	120	-	1	182	86	504	17	-	-	-	156	-	2	158	79	364	-	-	-
		P10	-	14	-	-	14	-	94	21	203	-	11	20	-	-	31	26	101	9	38	-
		P28	-	27	-	-	27	67	190	16	221	-	27	36	-	-	63	66	152	4	119	-
		P34	-	7	-	-	7	-	40	17	68	-	-	9	-	-	9	18	60	4	-	-
	Imp-2/ Widen	P6	-	85	-	0	86	155	482	8	300	-	-	144	-	1	145	77	329	-	-	-
		P31	-	20	-	-	20	-	148	13	360	-	-	27	-	-	27	72	157	7	-	-

TABLE 3.4 - 1 (3)

Traffic Volume by Vehicle Type ALBAY

Class of Road	Type of Impr't	Road Number	w/o										with									
			Car	Jeep-ney	Bus	Truck	Total	Tri-cycle	Motor cycle	Animal	Walk-ing	Boat	Car	Jeep-ney	Bus	Truck	Total	Tri-cycle	Motor cycle	Animal	Walk-ing	Boat
Minor (Barangay)	Rehab/Imp-1	B5-2	-	-	-	-	-	-	-	28	540	-	-	17	-	-	17	44	101	6	-	-
		B12-4	-	-	-	-	-	-	-	19	591	-	-	19	-	-	19	53	112	4	-	-
		B3-7	-	16	-	-	16	-	120	6	298	-	-	21	-	-	21	59	123	3	-	-
		B17-1	-	38	-	-	38	99	272	15	342	-	36	49	-	-	85	92	203	4	178	-
		B1-3	-	-	-	-	-	-	-	19	246	-	-	6	-	-	6	14	46	8	52	-
		B0-2	-	33	-	-	33	82	256	6	316	-	-	44	-	-	44	123	262	3	-	-
		B4-1	-	12	-	-	12	-	78	16	163	-	10	16	-	0	26	25	73	-	46	-
		B3-1	-	66	-	-	66	166	509	8	642	-	-	66	-	-	66	166	509	8	642	-
		B10-2	-	6	-	-	6	-	41	4	91	-	-	8	-	-	8	23	49	1	-	-
		B13-2	-	12	-	-	12	-	77	18	159	-	-	16	-	-	16	38	100	4	-	-
		B15-1	-	-	-	-	-	-	-	15	85	-	-	3	-	-	3	6	22	6	27	-
		B12-1	-	-	-	-	-	-	-	9	110	-	-	4	-	-	4	10	25	2	-	-
		B15-2	-	-	-	-	-	-	-	19	150	-	-	5	-	-	5	10	36	8	40	-
		B16-1	-	7	-	-	7	-	51	6	120	-	6	9	-	0	16	16	41	-	31	-
		B8-3	-	10	-	-	10	-	74	5	184	-	9	13	-	-	23	24	54	3	47	-

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 Albay

	Road Class	National Roads	Prov'l/City Roads	Barangay Roads	Total
Surveyed Road	Major Rd.	248.9	16.2	-	265.1
	Minor Rd.	43.5	152.5	12.4	208.4
	Total	292.4	168.7	12.4	473.5
Rd. Proj. Proposed by Local Officials	Major Rd.	44.9	-	-	44.9
	Minor Rd.	-	185.9	273.2	459.1
	Total	44.9	185.9	273.2	504.0
Studied Road	Major Rd.	293.8	16.2	-	310.0
	Minor Rd.	43.5	338.4	285.6	667.5
	Total	337.3	354.6	285.6	977.5

4.1.2 Project Identification

1) Project Identification Criteria

Project identification criteria are shown in Table 4.1-2.

TABLE 4.1-2 PROJECT IDENTIFICATION CRITERIA

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

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

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

2) Identified Road Projects

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

TABLE 4.1-3 SUMMARY OF IDENTIFIED ROAD PROJECTS
Province of Albay

Road Class		National Road	Prov'l/City Road	Barangay Road	Total
Major Road	Length (kms.)	203.0	16.2	-	219.2
	(% to Studied Roads)	(69%)	(100%)	-	(71%)
Minor Road	Length (kms.)	43.5	280.8	242.0	566.3
	(% to Studied Roads)	(100%)	(83%)	(85%)	(85%)
Total	Length (kms.)	246.5	297.0	242.0	785.5
	(% to Studied Roads)	(73%)	(84%)	(85%)	(85%)

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	$7.5 \leqq$ IRR	MA-1	↑
2	Secondary	A	$7.5 \leqq$ IRR		
3	Primary	B	$15.0 \leqq$ IRR	MA-2	To be selected for F/S
4	Secondary	B	$15.0 \leqq$ 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	$7.5 \leqq$ MPI	MI-1	↑
2	Barangay	A	$7.5 \leqq$ 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 Albay

Category	Road Class	Type of Improvement	IRR	Priority Group	Road Length	No. of Road Links
1	Primary	A	7.5 ≤ IRR	MA-1	35.5	3
2	Secondary	A	7.5 ≤ IRR	MA-1	130.8	6
3	Primary	B	15.0 ≤ IRR	MA-2	-	-
4	Secondary	B	15.0 ≤ IRR	MA-2	-	-
5	Primary	A	IRR<7.5	MA-2	15.6	1
6	Secondary	A	IRR<7.5	MA-2	25.5	1
7	Primary	B	IRR<15.0	MA-3	4.5	1
8	Secondary	B	IRR<15.0	MA-3	7.3	1
	Total				219.2	13

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

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	275.4	54
2	Barangay	A	7.5 ≤ MPI	MI-1	107.7	40
3	Nat'l/Provi/	A	MPI < 7.5	MI-2	48.9	13
4	Barangay	A	MPI < 7.5	MI-2	134.3	34
	Total				566.3	141

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	225.3 kms.	(11 projects)
Minor Road	309.6 kms.	(56 projects)
Total	534.9 kms.	(67 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

	Road Section		Existing Pavement		Proposed	Pavement Structure (cm)	
Type of Improvement	Type	Type	Condition	Pavement Type	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 ALBAY

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	N4-8	11.5	2303	2210	10.0	7.1	PCC Good	-	2-lane Br (n= 4,L=295m)	.00	19.84	19.84	100.0 (T)
					1.5	7.1	BT Fair	-					
	N2-1	22.8	490	628	10.6	6.0-8.0	PCC Good	-		33.13	.00	33.13	34.0 (T)
					12.2	5.5-6.0	GRV Bad	Imp-1(6.7-AC)					
	N4-1	16.8	276	266	16.2	6.8	PCC Good	-	2-cell BC (n= 1,L= 7m)	1.92	2.10	4.02	6.5 (T)
					.6	6.0	GRV Bad	Imp-1(6.8-PCC)	2-lane Br (n= 1,L= 13m)				

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

TABLE 5.1 - 2 (2)

Summary of Proposed Improvement ALBAY

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	Existing Condition Condition	Proposed Improvement	Proposed Bridge (Number/Total Length)	Cost (Million Peso) Road	Cost (Million Peso) Bridge	Cost (Million Peso) Total	IRR (%)
Rehab/ Imp-1	N5-2	8.5	467	448	8.5	4.5	GRV	Bad/V.Bad	Imp-1(6.0-AC)	2-lane Br (n= 1,L= 22m)	20.78	1.78	22.56	28.8 (T)
	N10-2	32.0	9	84	3.0	4.0	GRV	Fair	Widen(6.0-GRV)	2-lane Br (n= 2,L= 36m)	38.36	5.83	44.19	18.2 (T)
					25.3	1.6-5.5	GRV	Bad/Impas	Rehab(6.0-GRV)	2-cell BC (n= 4,L= 29m)				
					3.7	3.2	EAR	V.Bad	Imp-1(6.0-GRV)	1-cell BC (n= 1,L= 3m)				
	N9	25.5	223	186	6.0	6.1-6.7	PCC	Good	-	2-cell BC (n= 1,L= 7m)	25.51	4.83	30.34	16.9 (T)
					11.7	5.0-6.0	GRV	Bad/V.Bad	Rehab(6.0-GRV)	2-lane Br (n= 3,L= 44m)				
					7.8	5.0-5.5	GRV	Fair	Widen(6.0-GRV)					
	N5-1	40.0	467	448	25.6	6.1	PCC	Good	-	2-lane Br (n=10,L=134m)	46.76	14.32	61.08	16.9 (T)
					10.8	4.0	BT	Fair/V.Bad	Rehab(6.0-AC)	2-cell BC (n= 1,L= 7m)				
					3.1	4.5	GRV	Bad	Imp-1(6.0-AC)					
					.5	5.0	PCC	Fair	Widen(6.0-PCC)					
	N7-2	14.3	273	258	11.7	6.0-7.0	GRV	Bad	Imp-1(6.0-BMP)	2-lane Br (n= 3,L= 70m)	33.26	5.84	39.10	6.8 (T)
					.4	6.0	PCC	Good	-					
					2.2	7.0	BT	Bad	Rehab(6.0-Ov1)					
	P23	16.3	235	236	11.2	4.5	BT	Bad/V.Bad	Rehab(6.0-BMP)	2-lane Br (n= 1,L= 38m)	23.01	2.86	25.86	6.6 (T)
					4.2	4.5	BT	Fair	Widen(6.0-BMP)					
					.9	5.0	PCC	Good	Rehab(6.0-PCC)					
	N7-1	25.5	273	258	12.6	6.0	PCC	Good	-	2-lane Br (n= 1,L= 51m)	31.45	3.79	35.24	3.2 (T)
					2.0	6.0	BT	Good/Fair	-					
					10.9	4.5-6.0	GRV	Bad	Imp-1(6.0-BMP)					
Imp-2/ Widen	N10-1	12.1	9	84	12.1	4.0-4.5	GRV	Fair	Widen(6.0-GRV)	2-lane Br (n= 5,L=131m) 2-cell BC (n= 1,L= 8m) 1-cell BC (n= 1,L= 4m)	8.91	11.46	20.37	8.3 (T)

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

TABLE 5.1 - 2 (3)
Summary of Proposed Improvement ALBAY
Minor(National/Provincial)

Type of Impr't	Road Number	Length (km)	1993 AADT w/o	1993 AADT with	Existing Condition L	Width	Type	Condition	Proposed Improvement	Proposed Bridge (Number/Total Length)	Cost (Million Peso) Road	Bridge	Total	IRR (%)
Rehab/ Imp-1	P51	2.6	35	78	2.6	4.0-6.0	GRV	Bad/V.Bad	Rehab(6.0-GRV)		1.73	.00	1.73	39.9 (D)
	P53	6.0	26	58	.8	6.0	PCC	Good	-		4.33	.00	4.33	37.3 (D)
					5.2	3.2-5.5	GRV	Bad/V.Bad	Rehab(6.0-GRV)					
	P5	13.4	275	385	3.8	6.0	PCC	Good	-		12.45	.00	12.45	28.9 (D)
					9.6	6.0	BT	Bad	Rehab(6.0-Ovl)					
	N6	15.2	296	376	8.2	5.0	BT	Bad	Rehab(6.0-BMP)	2-lane Br (n= 1,L= 30m)	20.36	2.47	22.84	27.5 (D)
					7.0	5.0	BT	Fair	Widen(6.0-BMP)					
	P11	4.1	88	169	.3	5.0	BT	V.Bad	Rehab(6.0-BMP)	2-cell BC (n= 1,L= 7m)	3.14	.61	3.75	27.1 (D)
					1.1	5.5	GRV	Fair	Widen(6.0-GRV)					
					2.7	5.5	GRV	Bad	Rehab(6.0-GRV)					
	P61	3.9	113	133	3.9	4.0	BT	Bad	Rehab(6.0-BMP)		6.55	.00	6.55	24.0 (D)
	P36	3.8	17	23	3.8	3.2	GRV	Bad	Rehab(6.0-GRV)		3.41	.00	3.41	23.9 (D)
	N8	15.6	203	312	.8	4.1	BT	Fair	Widen(6.0-BMP)	2-cell BC (n= 3;L= 21m)	23.54	3.48	27.01	23.8 (D)
					8.5	4.0-4.1	BT	Bad	Rehab(6.0-BMP)	2-lane Br (n= 1,L= 13m)				
					6.3	6.1	PCC	Good	-	2-lane Sp (n= 1,L= 11m)				
	P41	3.4	22	56	3.4	3.2-4.0	GRV	V.Bad	Rehab(6.0-GRV)		2.31	.00	2.31	23.3 (D)
	P50	8.4	52	114	1.5	3.0	BT	Fair	Widen(6.0-BMP)		7.93	.00	7.93	22.6 (D)
					1.7	4.0	BT	Bad	Rehab(6.0-BMP)					
					5.0	3.2-4.5	GRV	Bad/V.Bad	Rehab(6.0-GRV)					
					.2	4.0	PCC	Good	Widen(6.0-PCC)					
	P49	2.0	12	27	.7	6.0	BT	Fair	-		1.40	.00	1.40	21.8 (D)
					.5	4.0	BT	Bad	Rehab(6.0-BMP)					
					.8	6.0	GRV	Bad	Rehab(6.0-GRV)					
	P65	2.9	24	31	.9	3.0	BT	Bad/V.Bad	Rehab(6.0-BMP)		3.54	.00	3.54	21.1 (D)
					1.0	3.0	BT	Fair	Widen(6.0-BMP)					
					.4	4.5	GRV	V.Bad	Imp-1(6.0-BMP)					
					.6	4.5	GRV	Bad	Rehab(6.0-GRV)					
	P12	6.3	40	93	3.9	4.0	BT	Bad/V.Bad	Rehab(6.0-BMP)		7.74	.00	7.74	20.8 (D)
					1.3	6.0	GRV	Fair	-					
					1.1	4.5	GRV	Bad	Rehab(6.0-GRV)					
	P43	3.9	29	69	.4	3.0	BT	V.Bad	Rehab(6.0-BMP)		3.83	.00	3.83	20.3 (D)
					2.4	4.0	GRV	Bad/V.Bad	Rehab(6.0-GRV)					
					1.1	3.0	BT	Fair	Widen(6.0-BMP)					
	P60	12.0	139	172	6.6	4.0	BT	V.Bad	Rehab(6.0-BMP)		19.15	.00	19.15	18.9 (D)
					5.4	3.2	GRV	Bad/V.Bad	Rehab(6.0-GRV)					

TABLE 5.1 - 2 (4)
Summary of Proposed Improvement ALBAY
Minor(National/Provincial)(Continued)

Type of Impr't	Road Number	Length (km)	1993 AADT w/o	1993 AADT with	Existing Condition L	Width	Type	Condition	Proposed Improvement	Proposed Bridge (Number/Total Length)	Cost (Million Peso) Road	Bridge	Total	IRR (%)
Rehab/ Imp-1	P39	2.6	37	86	1.3	3.0	BT	Fair	Widen(6.0-BMP)	2-lane Sp (n= 1,L= 20m)	3.02	.36	3.38	18.8 (D)
					.6	4.5	GRV	Bad	Rehab(6.0-GRV)					
					.7	3.0	BT	Bad	Rehab(6.0-BMP)					
	P21	20.0	48	114	3.1	5.0-6.0	BT	V.Bad	Rehab(6.0-BMP)	2-lane Br (n= 1,L= 26m)	21.71	2.28	23.99	18.5 (D)
					16.9	4.0-4.5	GRV	V.Bad	Rehab(6.0-GRV)					
	P55	7.0	12	31	7.0	3.2	GRV	V.Bad/Impa	Rehab(6.0-GRV)		4.62	.00	4.62	17.2 (D)
	P46	2.3	7	19	2.3	3.2-4.5	EAR	Bad/V.Bad	Imp-1(6.0-GRV)		1.55	.00	1.55	16.8 (D)
	P37	8.8	48	60	.7	4.0	BT	Fair	Widen(6.0-BMP)	2-cell BC (n= 2,L= 14m)	13.48	1.13	14.61	16.7 (D)
					1.8	3.0	BT	Bad/V.Bad	Rehab(6.0-BMP)					
					3.1	3.2-4.0	GRV	Fair	Widen(6.0-GRV)					
					3.2	3.2-4.5	GRV	Bad	Rehab(6.0-GRV)					
	P54	2.0	34	79	2.0	4.0	GRV	Bad/V.Bad	Rehab(6.0-GRV)		1.38	.00	1.38	16.3 (D)
	P22	9.8	86	158	4.2	4.0	BT	Bad/V.Bad	Rehab(6.0-BMP)	2-lane Br (n= 4,L=385m)	12.42	25.40	37.83	13.7 (D)
					2.0	4.0	BT	Fair	Widen(6.0-BMP)					
					3.6	4.0-4.5	GRV	Bad/V.Bad	Rehab(6.0-GRV)					
	P32	3.0	9	20	3.0	3.2	GRV	Bad	Rehab(6.0-GRV)	2-cell BC (n= 1,L= 7m)	2.27	.61	2.87	13.1 (D)
	P17	5.6	95	213	.7	3.0	BT	V.Bad	Rehab(6.0-BMP)		7.16	.00	7.16	12.6 (D)
					1.1	5.5	GRV	Fair	Imp-2(6.0-BMP)					
					2.4	5.5-6.0	GRV	Bad	Imp-1(6.0-BMP)					
					1.4	6.0	GRV	Fair	-					
	P26	6.6	71	81	6.1	3.2-4.5	GRV	Bad	Rehab(6.0-GRV)	2-lane Br (n= 1,L= 19m)	9.18	2.18	11.36	12.4 (D)
					.5	4.0	BT	V.Bad	Rehab(6.0-BMP)	2-cell BC (n= 1,L= 7m)				
	P16	5.9	24	31	4.2	5.5-6.0	GRV	Bad/V.Bad	Rehab(6.0-GRV)	2-lane Br (n= 2,L= 54m)	7.68	4.93	12.62	12.3 (D)
					.4	5.5	EAR	Bad	Imp-1(6.0-GRV)	2-cell BC (n= 1,L= 8m)				
					1.3	4.5	GRV	Fair	Widen(6.0-GRV)					
	P40	2.0	11	27	.6	4.5	GRV	V.Bad	Rehab(6.0-GRV)	2-lane Br (n= 1,L= 30m)	1.38	2.47	3.85	11.9 (D)
					1.4	4.0	EAR	V.Bad	Imp-1(6.0-GRV)					
	P33	3.3	4	15	.9	2.8-3.2	GRV	Bad	Rehab(6.0-GRV)		3.03	.00	3.03	11.3 (D)
					2.4	2.4-2.8	EAR	V.Bad/Impa	Imp-1(6.0-GRV)					
	P24	2.0	7	16	.2	3.0	BT	Bad	Rehab(6.0-BMP)		2.90	.00	2.90	10.6 (D)
					1.8	2.4	GRV	Bad	Rehab(6.0-GRV)					
	P66	6.0	13	19	1.2	5.0	BT	Bad	Rehab(6.0-BMP)	2-cell BC (n= 1,L= 7m)	8.93	.57	9.50	8.5 (D)
					2.4	3.2-4.5	GRV	V.Bad	Rehab(6.0-GRV)					
					2.4	3.2	EAR	V.Bad	Imp-1(6.0-GRV)					
	P58	1.7	19	42	.6	5.0	BT	Fair	Widen(6.0-BMP)		2.13	.00	2.13	8.2 (D)
					1.1	5.0	BT	Bad	Rehab(6.0-BMP)					

TABLE 5.1 - 2 (5)

Summary of Proposed Improvement ALBAY

Minor(National/Provincial)(Continued)

Type of Impr't	Road Number	Length (km)	1993 AADT w/o	1993 AADT with	Existing Condition L	Existing Condition Width	Existing Condition Type	Existing Condition 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	5.2	15	31	1.4	5.0	BT	Bad/V.Bad	Rehab(6.0-BMP)		4.65	.00	4.65	7.7 (D)
					.2	4.5	GRV	Fair	Imp-2(6.0-BMP)					
					1.7	6.0	GRV	Bad	Rehab(6.0-GRV)					
					.7	5.0	BT	Fair	Widen(6.0-BMP)					
					1.2	5.5	GRV	Fair	Widen(6.0-GRV)					
	P30	3.4	13	31	1.6	4.0	BT	Fair	Widen(6.0-BMP)		4.12	.00	4.12	5.9 (D)
					1.8	4.0	GRV	Bad	Rehab(6.0-GRV)					
	P47	5.1	24	57	3.5	3.0	BT	Bad/V.Bad	Rehab(6.0-BMP)		8.25	.00	8.25	5.0 (D)
					1.6	4.0	GRV	V.Bad	Rehab(6.0-GRV)					
	P35	2.3	13	17	1.3	3.0	BT	Bad	Rehab(6.0-BMP)		3.04	.00	3.04	3.6 (D)
					1.0	3.2	GRV	Bad/V.Bad	Rehab(6.0-GRV)					
	P7	10.0	182	158	.4	3.0	BT	Fair	Widen(6.0-BMP)	2-lane Br (n= 2,L= 36m)	13.60	3.17	16.77	2.8 (D)
					.4	3.2	GRV	Fair	Widen(6.0-GRV)					
					.2	3.0	PCC	Fair	Widen(6.0-PCC)					
					5.8	3.2	GRV	Bad	Rehab(6.0-GRV)					
					3.2	3.0	BT	Bad/V.Bad	Rehab(6.0-BMP)					
	P10	14.0	14	31	1.2	4.6	GRV	Fair	Widen(6.0-GRV)	2-lane Br (n= 3,L= 78m)	11.87	7.11	18.98	.5 (D)
					7.5	3.2-4.5	GRV	Bad/V.Bad	Rehab(6.0-GRV)	2-cell BC (n= 1,L= 8m)				
					5.3	2.4	EAR	Impas	Imp-1(6.0-GRV)					
	P28	5.7	27	53	1.7	4.0	BT	Fair	Widen(6.0-BMP)		8.50	.00	8.50	.4 (D)
					4.0	4.0	BT	V.Bad	Rehab(6.0-BMP)					
	P34	9.4	7	9	3.0	3.0	BT	V.Bad	Rehab(6.0-BMP)		11.07	.00	11.07	.0 (D)
					6.4	4.0-4.5	GRV	Bad/Impas	Rehab(6.0-GRV)					
Imp-2/ Widen	P6	8.3	86	145	1.4	7.0	BT	Good	-	2-cell BC (n= 2,L= 14m)	.26	2.46	2.72	45.6 (D)
					.5	5.0	BT	Fair	Widen(6.0-BMP)	2-lane Br (n= 1,L= 13m)				
					6.4	6.0	GRV	Fair	-					
	P31	2.0	20	27	.9	4.5	GRV	Bad	Rehab(6.0-GRV)		2.96	.00	2.96	23.4 (D)
					1.1	4.0	GRV	Fair	Widen(6.0-GRV)					

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

TABLE 5.1 - 2 (6)

Summary of Proposed Improvement ALBAY

Minor(Barangay)

Type of Impr't	Road Number	Length (km)	1993 AADT w/o	1993 AADT with	Existing Condition L	Width	Type Condition	Proposed Improvement	Proposed Bridge (Number/Totai Length)	Cost (Million Peso) Road	Bridge	Total	IRR (%)
Rehab/ Imp-1	B5-2	6.0	0	17	.8	4.0	PCC Good	-	2-cell BC (n= 1,L= 7m)	2.64	.49	3.13	48.9 (D)
					5.2	2.4-4.0	GRV Bad/Impas	Rehab(4.0-GRV)					
	B12-4	2.0	0	19	.3	4.0	BT Bad	Rehab(4.0-Ovl)		1.09	.00	1.09	46.5 (D)
					.2	4.0	GRV Fair	Rehab(4.0-GRV)					
					1.5	4.0	EAR Bad	Imp-1(4.0-GRV)					
	B3-7	3.0	16	21	3.0	3.2-4.0	GRV Fair/Bad	Rehab(4.0-GRV)		1.40	.00	1.40	38.6 (D)
	B17-1	2.4	38	85	.9	4.5	GRV Fair	-		.71	.00	.71	33.5 (D)
					1.0	3.2-4.0	GRV Bad	Rehab(4.0-GRV)					
					.5	4.0	EAR Bad	Imp-1(4.0-GRV)					
	B1-3	3.0	0	6	1.0	2.4-6.0	EAR V.Bad	Imp-1(4.0-GRV)	1-lane Sp (n= 3,L=100m)	1.50	1.32	2.82	23.4 (D)
					2.0	3.2	GRV Bad	Rehab(4.0-GRV)					
	B0-2	3.1	33	44	1.4	5.0	BT Bad	Rehab(6.0-BMP)		2.51	.00	2.51	21.4 (D)
					1.4	5.0	BT Good/Fair	-					
					.3	5.0	BT Bad	Rehab(5.0-Ovl)					
	B4-1	5.4	12	26	3.1	4.0	EAR Bad	Imp-1(4.0-GRV)	1-lane Br (n= 1,L= 12m)	2.95	.93	3.88	21.3 (D)
					2.3	4.0-4.5	GRV Bad/V.Bad	Rehab(4.0-GRV)					
	B3-1	1.9	66	66	1.0	5.0	BT Fair	-		.30	.00	.30	18.6 (D)
					.2	5.0	BT Bad	Rehab(6.0-BMP)					
					.7	6.1	PCC Good	-					
	B10-2	2.2	6	8	2.2	4.5	GRV V.Bad	Rehab(4.0-GRV)		1.03	.00	1.03	12.3 (D)
	B13-2	11.8	12	16	9.0	4.0-4.5	GRV Bad/V.Bad	Rehab(4.0-GRV)		8.91	.00	8.91	11.6 (D)
					2.8	4.0	EAR Bad	Imp-1(4.0-GRV)					
	B15-1	3.0	0	3	3.0	2.4	EAR Impas	Imp-1(4.0-GRV)		1.41	.00	1.41	10.2 (D)
	B12-1	2.5	0	4	2.2	2.4	EAR Impas	Imp-1(4.0-GRV)		1.25	.00	1.25	8.5 (D)
					.3	2.4	GRV Bad	Rehab(4.0-GRV)					
	B15-2	3.7	0	5	3.7	3.2	EAR Fair/V.Bad	Imp-1(4.0-GRV)	2-cell BC (n= 1,L= 5m)	1.79	.49	2.28	7.5 (D)
	B16-1	1.1	7	16	1.1	4.0	GRV Bad	Rehab(4.0-GRV)		.58	.00	.58	6.1 (D)
	B8-3	1.0	10	23	.2	3.2	GRV Fair	Widen(4.0-GRV)		1.69	.00	1.69	4.3 (D)
					.8	2.4	GRV Bad	Rehab(4.0-GRV)					

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

5.1.2 Cost Estimate

1) Unit Cost

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

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

2) Construction Cost Estimate

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

TABLE 5.1-3 UNIT COST OF MAJOR CONSTRUCTION ITEMS

Unit: Pesos at April 1990 Prices

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

TABLE 5.1 - 4 (1)

Quantity and Construction Cost ALBAY

	Unit	N4-8	N2-1	N4-1	N5-2	N10-2	N9	N5-1	N7-2	P23	N7-1	N10-1
Total Road Length	km	11.5	22.8	16.8	8.5	32.0	25.5	40.0	14.3	16.3	25.5	12.1
Improvement Length	km	.0	12.2	.6	8.5	32.0	19.5	14.4	13.9	16.3	10.9	12.1
Proposed Pavement Type			6.7-AC	6.8-PCC	6.0-AC	6.0-GRV	6.0-GRV	6.0-AC 6.0-PCC	6.0-BMP 6.0-Ovl	6.0-BMP 6.0-PCC	6.0-BMP	6.0-GRV
Quantity												
100 Clearing & Grubbing	m2	-	-	-	-	-	-	-	-	-	-	-
Stripping	m3	-	-	-	-	-	-	-	-	-	-	-
102 Roadway & Drainage Excavation	m3	-	8250	450	10575	137070	118660	125210	102650	28738	53423	16164
104 Borrow	m3	-	5400	-	-	46566	7182	-	-	-	42005	5036
200 Aggregate Subbase	m3	-	38494	2208	23582	19920	8790	32950	20347	20877	18296	3096
Preparation of Prev.Road(Grvl)	m2	-	140600	8040	89880	163420	112370	33480	102400	-	94016	48900
Preparation of Prev.Road(Asph)	m2	-	-	-	-	-	-	43200	-	54900	-	-
Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	13200	-	-	-
202 Crushed Aggregate Base Course	m3	-	18178	-	11475	-	-	18765	11151	12661	10742	-
300 Crushed Aggr. Surface Course	m3	-	-	-	-	28350	14580	-	-	-	-	9810
301 Bituminous Prime Coat	M.T.	-	98	-	61	-	-	100	94	88	76	-
302 Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305 Bituminous Macadam Pavement	m2	-	-	-	-	-	-	-	65400	73500	63000	-
310 Bitum.Concrete Surface Course	M.T.	-	8991	-	5610	-	-	9174	1452	-	-	-
304 Double Bitum.Surface Treatment	m2	-	-	-	-	-	-	-	-	-	-	-
311-1 PCC Pavement (t=23 cm)	m2	-	-	-	-	-	-	-	-	-	-	-
311-2 PCC Pavement (t=20 cm)	m2	-	-	4080	-	-	-	500	-	5400	-	-
311-3 PCC Pavement (t=18 cm)	m2	-	-	-	-	3000	19800	-	4800	-	2400	7200
500 RCPC (dia.910mm)	m	-	360	15	255	1110	585	428	420	439	405	360
Headwall for RCPC (dia.910mm)	Set	-	24	1	17	74	39	29	28	33	27	24
504 Grouted Riprap	m3	-	-	-	-	4700	-	-	-	-	3992	239
Side Ditch (Grouted Riprap)	m	-	-	-	400	5300	6500	11800	11700	-	6100	-
Slope Protection (Cut Slope)	m	-	-	-	-	-	-	50	-	-	-	-
Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	70	-	-	-	-
2-lane Bridge,Superstructure	m	295	-	13	22	36	44	134	70	38	51	131
1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Abutment	Each	8	-	2	2	4	6	20	6	2	2	10
1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Pier	Each	9	-	-	-	-	-	-	1	1	2	2
1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
1-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
1-cell RCBC	m	-	-	-	-	10	-	-	-	-	-	10
2-cell RCBC	m	-	-	15	-	41	10	12	-	-	-	10
Wingwall for 1-cell RCBC	Set	-	-	-	-	1	-	-	-	-	-	1
Wingwall for 2-cell RCBC	Set	-	-	1	-	4	1	1	-	-	-	1
Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost	M.p.	.00	33.13	1.92	20.78	38.36	25.51	46.76	33.26	23.01	31.45	8.91
Bridge Construction Cost	M.p.	19.84	.00	2.10	1.78	5.83	4.83	14.32	5.84	2.86	3.79	11.46
Total Construction Cost	M.p.	19.84	33.13	4.02	22.56	44.19	30.34	61.08	39.10	25.86	35.24	20.37
Road Construction Cost/Impr't km	M.p.	.00	2.72	3.20	2.44	1.20	1.31	3.25	2.39	1.41	2.89	.74
Total Construction Cost/Total km	M.p.	1.73	1.45	.24	2.65	1.38	1.19	1.53	2.73	1.59	1.38	1.68

TABLE 5.1 - 4 (2)

Quantity and Construction Cost ALBAY

		Unit	P51	P53	P5	N6	P11	P61	P36	N8	P41	P50	P49
Total Road Length		km	2.6	6.0	13.4	15.2	4.1	3.9	3.8	15.6	3.4	8.4	2.0
Improvement Length		km	2.6	5.2	9.6	15.2	4.1	3.9	3.8	9.3	3.4	8.4	1.3
Proposed Pavement Type			6.0-GRV	6.0-GRV	6.0-Ovl	6.0-BMP	6.0-BMP 6.0-GRV	6.0-BMP	6.0-GRV	6.0-BMP	6.0-GRV	6.0-BMP 6.0-GRV 6.0-PCC	6.0-BMP 6.0-GRV
Quantity													
100	Clearing & Grubbing	m2	-	-	-	-	-	-	-	-	-	-	-
	Stripping	m3	-	-	-	-	-	-	-	-	-	-	-
102	Roadway & Drainage Excavation	m3	1950	11325	-	37566	3815	6638	2100	28153	2550	9831	1451
104	Borrow	m3	994	2539	-	1313	2241	-	9147	41904	1571	2825	452
200	Aggregate Subbase	m3	1716	3432	1440	15240	2381	6607	2508	13715	2244	7982	1375
	Preparation of Prev.Road(Grvl)	m2	17160	30690	28800	-	23870	-	22480	-	22440	33000	5280
	Preparation of Prev.Road(Asph)	m2	-	-	-	41000	1500	15600	-	34540	-	6800	2000
	Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
	Preparation of Pave.Surf.(AC)	m2	-	-	57600	-	-	-	-	-	-	-	-
202	Crushed Aggregate Base Course	m3	-	-	-	9643	307	3990	-	8768	-	2506	512
300	Crushed Aggr. Surface Course	m3	2340	4590	-	-	3420	-	3420	-	3060	4500	720
301	Bituminous Prime Coat	M.T.	-	-	69	66	2	28	-	62	-	18	4
302	Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305	Bituminous Macadam Pavement	m2	-	-	-	54900	1800	23400	-	51320	-	14700	3000
310	Bitum.Concrete Surface Course	M.T.	-	-	6336	-	-	-	-	-	-	-	-
304	Double Bitum.Surface Treatment	m2	-	-	-	-	-	-	-	-	-	-	-
311-1	PCC Pavement (t=23 cm)	m2	-	-	-	-	-	-	-	-	-	-	-
311-2	PCC Pavement (t=20 cm)	m2	-	-	-	-	-	-	-	-	-	400	-
311-3	PCC Pavement (t=18 cm)	m2	-	600	-	1300	-	-	-	1200	-	-	-
500	RCPC (dia.910mm)	m	75	150	285	352	135	120	120	316	105	227	45
	Headwall for RCPC (dia.910mm)	Set	5	10	19	30	9	8	8	22	7	17	3
504	Grouted Riprap	m3	-	-	-	163	172	-	-	3008	-	-	-
	Side Ditch (Grouted Riprap)	m	-	550	-	6900	-	-	-	2300	-	-	-
	Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	-	-	-
	Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Superstructure	m	-	-	-	30	-	-	-	13	-	-	-
	1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Abutment	Each	-	-	-	2	-	-	-	2	-	-	-
	1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Pier	Each	-	-	-	1	-	-	-	-	-	-	-
	1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
	2-lane Spillway	m	-	-	-	-	-	-	-	11	-	-	-
	1-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
	1-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
	2-cell RCBC	m	-	-	-	-	11	-	-	36	-	-	-
	Wingwall for 1-cell RCBC	Set	-	-	-	-	-	-	-	-	-	-	-
	Wingwall for 2-cell RCBC	Set	-	-	-	-	1	-	-	3	-	-	-
	Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost		M.p.	1.73	4.33	12.45	20.36	3.14	6.55	3.41	23.54	2.31	7.93	1.40
Bridge Construction Cost		M.p.	.00	.00	.00	2.47	.61	.00	.00	3.48	.00	.00	.00
Total Construction Cost		M.p.	1.73	4.33	12.45	22.84	3.75	6.55	3.41	27.01	2.31	7.93	1.40
Road Construction Cost/Impr't km		M.p.	.67	.83	1.30	1.34	.77	1.68	.90	2.53	.68	.94	1.08
Total Construction Cost/Total km		M.p.	.67	.72	.93	1.50	.91	1.68	.90	1.73	.68	.94	.70

TABLE 5.1 - 4 (3)

Quantity and Construction Cost ALBAY

	Unit	P65	P12	P43	P60	P39	P21	P55	P46	P37	P54	P22
Total Road Length	km	2.9	6.3	3.9	12.0	2.6	20.0	7.0	2.3	8.8	2.0	9.8
Improvement Length	km	2.9	5.0	3.9	12.0	2.6	20.0	7.0	2.3	8.8	2.0	9.8
Proposed Pavement Type		G.0-BMP G.0-GRV	G.0-BMP G.0-GRV	G.0-BMP G.0-GRV	G.0-BMP G.0-GRV	G.0-BMP G.0-GRV	G.0-BMP G.0-GRV	G.0-GRV	G.0-GRV	G.0-BMP G.0-GRV	G.0-GRV	G.0-BMP G.0-GRV
Quantity												
100 Clearing & Grubbing	m2	-	-	-	-	-	-	-	-	-	-	-
Stripping	m3	-	-	-	-	-	-	-	-	-	-	-
102 Roadway & Drainage Excavation	m3	4187	4975	8633	50252	4713	64251	5250	1725	56844	1500	13398
104 Borrow	m3	339	5514	1071	1094	230	4039	2205	875	759	1130	7435
200 Aggregate Subbase	m3	3682	7333	3453	13928	3013	15226	4620	1518	5923	1320	10575
Preparation of Prev.Road(Grvl)	m2	8128	7260	14880	17820	3570	78880	46200	15180	27310	13200	23760
Preparation of Prev.Road(Asph)	m2	2700	15600	1200	26400	2100	16300	-	-	5400	-	16800
Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	-	-
202 Crushed Aggregate Base Course	m3	1841	3990	972	6752	1381	3069	-	-	2094	-	5020
300 Crushed Aggr. Surface Course	m3	540	990	2160	3780	459	15210	6300	2070	5490	1800	3240
301 Bituminous Prime Coat	M.T.	13	28	7	48	10	22	-	-	15	-	35
302 Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305 Bituminous Macadam Pavement	m2	10800	23400	5700	39600	8100	18000	-	-	12200	-	29200
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	-	-	-	7200	540	600	-	-	1200	-	-
500 RCPC (dia.910mm)	m	76	150	106	360	54	600	210	75	263	60	332
Headwall for RCPC (dia.910mm)	Set	6	10	8	24	5	40	14	5	18	4	24
504 Grouted Riprap	m3	-	-	-	-	-	-	-	-	-	-	1206
Side Ditch (Grouted Riprap)	m	-	-	600	2700	150	7600	-	-	4900	-	-
Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	50	-	-
Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Superstructure	m	-	-	-	-	-	26	-	-	-	-	385
1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Abutment	Each	-	-	-	-	-	2	-	-	-	-	8
1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Pier	Each	-	-	-	-	-	1	-	-	-	-	13
1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Spillway	m	-	-	-	-	20	-	-	-	-	-	-
1-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
1-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
2-cell RCBC	m	-	-	-	-	-	-	-	-	20	-	-
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	1	1
Road Construction Cost	M.p.	3.54	7.74	3.83	19.15	3.02	21.71	4.62	1.55	13.48	1.38	12.42
Bridge Construction Cost	M.p.	.00	.00	.00	.00	.36	2.28	.00	.00	1.13	.00	25.40
Total Construction Cost	M.p.	3.54	7.74	3.83	19.15	3.38	23.99	4.62	1.55	14.61	1.38	37.83
Road Construction Cost/Impr't km	M.p.	1.22	1.55	.98	1.60	1.16	1.09	.66	.67	1.53	.69	1.27
Total Construction Cost/Total km	M.p.	1.22	1.23	.98	1.60	1.30	1.20	.66	.67	1.66	.69	3.86

TABLE 5.1 - 4 (4)

Quantity and Construction Cost ALBAY

	Unit	P32	P17	P26	P16	P40	P33	P24	P66	P58	P9	P30
Total Road Length	km	3.0	5.6	6.6	5.9	2.0	3.3	2.0	6.0	1.7	5.2	3.4
Improvement Length	km	3.0	4.2	6.6	5.9	2.0	3.3	2.0	6.0	1.7	5.2	3.4
Proposed Pavement Type		6.0-GRV	6.0-BMP	6.0-GRV 6.0-BMP	6.0-GRV	6.0-GRV	6.0-GRV	6.0-BMP 6.0-GRV	6.0-BMP 6.0-GRV	6.0-BMP	6.0-BMP 6.0-GRV	6.0-BMP 6.0-GRV
Quantity												
100 Clearing & Grubbing	m2	-	-	-	-	-	-	-	-	-	-	-
Stripping	m3	-	-	-	-	-	-	-	-	-	-	-
102 Roadway & Drainage Excavation	m3	5178	4719	20951	5127	1500	8550	13840	37922	2887	6469	16500
104 Borrow	m3	1064	-	9538	20048	1130	905	162	972	-	950	365
200 Aggregate Subbase	m3	1980	7803	4873	3309	1320	2178	1476	5081	2202	3787	2149
Preparation of Prev.Road(Grvl)	m2	18150	31058	32670	36210	13200	18570	5400	16640	-	18720	7740
Preparation of Prev.Road(Asph)	m2	-	2100	2000	-	-	-	600	6000	5500	7000	-
Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	-	-
202 Crushed Aggregate Base Course	m3	-	4297	512	-	-	-	205	1228	1252	1785	542
300 Crushed Aggr. Surface Course	m3	.2700	-	4770	5310	1800	2799	1620	3690	-	2610	1530
301 Bituminous Prime Coat	M.T.	-	30	4	-	-	-	1	9	9	12	4
302 Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305 Bituminous Macadam Pavement	m2	-	25200	3000	-	-	-	1200	7200	7200	10300	3000
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	-	-	4800	-	-	1140	-	4200	-	-	800
500 RCPC (dia.910mm)	m	90	120	240	240	60	105	60	180	38	143	84
Headwall for RCPC (dia.910mm)	Set	6	8	16	16	4	7	4	12	3	10	7
504 Grouted Riprap	m3	-	-	1233	2316	-	-	-	-	-	-	-
Side Ditch (Grouted Riprap)	m	250	-	1150	-	-	600	1800	2400	-	-	2500
Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	-	-	-
Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Superstructure	m	-	-	19	54	30	-	-	-	-	-	-
1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Abutment	Each	-	-	2	4	2	-	-	-	-	-	-
1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Bridge,Pier	Each	-	-	-	1	1	-	-	-	-	-	-
1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
2-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
1-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
1-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
2-cell RCBC	m	11	-	10	11	-	-	-	10	-	-	-
Wingwall for 1-cell RCBC	Set	-	-	-	-	-	-	-	-	-	-	-
Wingwall for 2-cell RCBC	Set	1	-	1	1	-	-	-	1	-	-	-
Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost	M.p.	2.27	7.16	9.18	7.68	1.38	3.03	2.90	8.93	2.13	4.65	4.12
Bridge Construction Cost	M.p.	.61	.00	2.18	4.93	2.47	.00	.00	.57	.00	.00	.00
Total Construction Cost	M.p.	2.87	7.16	11.36	12.62	3.85	3.03	2.90	9.50	2.13	4.65	4.12
Road Construction Cost/Impr't km	M.p.	.76	1.71	1.39	1.30	.69	.92	1.45	1.49	1.25	.89	1.21
Total Construction Cost/Total km	M.p.	.96	1.28	1.72	2.14	1.93	.92	1.45	1.58	1.25	.89	1.21

TABLE 6.1 - 4 (5)

Quantity and Construction Cost ALBAY

		Unit	P47	P35	P7	P10	P28	P34	P6	P31	B5-2	B12-4	B3-7
Total Road Length		km	5.1	2.3	10.0	14.0	5.7	9.4	8.3	2.0	6.0	2.0	3.0
Improvement Length		km	5.1	2.3	10.0	14.0	5.7	9.4	.5	2.0	5.2	2.0	3.0
Proposed Pavement Type			6.0-BMP 6.0-GRV	6.0-BMP 6.0-GRV	6.0-BMP 6.0-GRV 6.0-PCC	6.0-GRV	6.0-BMP	6.0-BMP 6.0-GRV	6.0-BMP	6.0-GRV	4.0-GRV	4.0-Ovl 4.0-GRV	4.0-GRV
Quantity													
100	Clearing & Grubbing	m2	-	-	-	-	-	-	-	-	-	-	-
	Stripping	m3	-	-	-	-	-	-	-	-	-	-	-
102	Roadway & Drainage Excavation	m3	14960	3795	5073	36111	12545	23871	938	2149	4609	1341	2547
104	Borrow	m3	857	270	34418	4030	-	2141	-	8151	1458	917	837
200	Aggregate Subbase	m3	7171	2992	10396	8688	6302	8498	374	880	2392	735	966
	Preparation of Prev.Road(Grvl)	m2	10000	6080	30200	80990	-	42240	-	10340	23440	8600	13260
	Preparation of Prev.Road(Asph)	m2	10500	3900	9600	-	16000	9000	-	-	-	-	-
	Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
	Preparation of Pave.Surf.(AC)	m2	-	-	-	-	-	-	-	-	-	1200	-
202	Crushed Aggregate Base Course	m3	3581	1330	3478	-	4707	2762	106	-	-	-	-
300	Crushed Aggr. Surface Course	m3	1296	873	5580	12240	-	5750	-	1710	3000	1020	1740
301	Bituminous Prime Coat	M.T.	25	9	24	-	33	19	1	-	-	1	-
302	Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305	Bituminous Macadam Pavement	m2	21000	7800	20400	-	27400	16200	500	-	-	-	-
310	Bitum.Concrete Surface Course	M.T.	-	-	-	-	-	-	-	-	-	132	-
304	Double Bitum.Surface Treatment	m2	-	-	-	-	-	-	-	-	-	-	-
311-1	PCC Pavement (t=23 cm)	m2	-	-	-	-	-	-	-	-	-	-	-
311-2	PCC Pavement (t=20 cm)	m2	-	-	600	-	-	-	-	-	-	-	-
311-3	PCC Pavement (t=18 cm)	m2	960	180	-	2400	-	1800	-	600	800	-	400
500	RCPC (dia.910mm)	m	150	75	293	420	144	285	8	75	80	32	48
	Headwall for RCPC (dia.910mm)	Set	10	5	20	28	11	19	1	5	10	4	6
504	Grouted Riprap	m3	-	-	-	-	-	-	-	956	-		
	Side Ditch (Grouted Riprap)	m	1400	200	-	1850	2200	2400	-	-	-	-	-
	Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	-	-	-
	Slope Protection (Embank't Sl)	m	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Superstructure	m	-	-	36	78	-	-	13	-	-	-	-
	1-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Abutment	Each	-	-	4	6	-	-	2	-	-	-	-
	1-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
	2-lane Bridge,Pier	Each	-	-	-	2	-	-	-	-	-	-	-
	1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
	2-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
	1-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
	1-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
	2-cell RCBC	m	-	-	-	10	-	-	20	-	8	-	-
	Wingwall for 1-cell RCBC	Set	-	-	-	-	-	-	-	-	-	-	-
	Wingwall for 2-cell RCBC	Set	-	-	-	1	-	-	2	-	1	-	-
	Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost		M.p.	8.25	3.04	13.60	11.87	8.50	11.07	.26	2.96	2.64	1.09	1.40
Bridge Construction Cost		M.p.	.00	.00	3.17	7.11	.00	.00	2.46	.00	.49	.00	.00
Total Construction Cost		M.p.	8.25	3.04	16.77	18.98	8.50	11.07	2.72	2.96	3.13	1.09	1.40
Road Construction Cost/Impr't km		M.p.	1.62	1.32	1.36	.85	1.49	1.18	.53	1.48	.51	.55	.47
Total Construction Cost/Total km		M.p.	1.62	1.32	1.68	1.36	1.49	1.18	.33	1.48	.52	.55	.47

TABLE 5.1 - 4 (6)

Quantity and Construction Cost ALBAY

		Unit	B17-1	B1-3	B0-2	B4-1	B3-1	B10-2	B13-2	B15-1	B12-1	B15-2	B16-1
Total Road Length		km	2.4	3.0	3.1	5.4	1.9	2.2	11.8	3.0	2.5	3.7	1.1
Improvement Length		km	1.5	3.0	1.7	5.4	.2	2.2	11.8	3.0	2.5	3.7	1.1
Proposed Pavement Type			4.0-GRV	4.0-GRV	6.0-BMP 5.0-Ovl	4.0-GRV	6.0-BMP	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV	4.0-GRV
Quantity													
100	Clearing & Grubbing	m2	-	-	-	-	-	-	-	-	-	-	-
	Stripping	m3	-	-	-	-	-	-	-	-	-	-	-
102	Roadway & Drainage Excavation	m3	1125	2250	2100	9788	300	1650	15465	2250	1875	4125	1838
104	Borrow	m3	473	1695	-	927	-	693	4017	945	1413	1031	340
200	Aggregate Subbase	m3	690	1380	1780	2484	248	1012	5428	1380	1150	1702	506
	Preparation of Prev.Road(Grvl)	m2	6900	13800	900	24450	-	10120	53850	13800	11500	15460	5060
	Preparation of Prev.Road(Asph)	m2	-	-	7000	-	1000	-	-	-	-	-	-
	Preparation of Pave.Surf.(PCC)	m2	-	-	-	-	-	-	-	-	-	-	-
	Preparation of Pave.Surf.(AC)	m2	-	-	1500	-	-	-	-	-	-	-	-
202	Crushed Aggregate Base Course	m3	-	-	1432	-	205	-	-	-	-	-	-
300	Crushed Aggr. Surface Course	m3	900	1800	-	3240	-	1320	5256	1800	1500	2220	660
301	Bituminous Prime Coat	M.T.	-	-	12	-	1	-	-	-	-	-	-
302	Bituminous Tack Coat	M.T.	-	-	-	-	-	-	-	-	-	-	-
305	Bituminous Macadam Pavement	m2	-	-	8400	-	1200	-	-	-	-	-	-
310	Bitum.Concrete Surface Course	M.T.	-	-	165	-	-	-	-	-	-	-	-
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	-	-	-	-	-	-	12160	-	-	-	-
500	RCPC (dia.910mm)	m	24	48	45	88	-	32	192	48	40	56	16
	Headwall for RCPC (dia.910mm)	Set	3	6	3	11	-	4	24	6	5	7	2
504	Grouted Riprap	m3	-	-	-	-	-	-	239	-	-	-	-
	Side Ditch (Grouted Riprap)	m	-	-	-	-	-	-	-	-	-	-	-
	Slope Protection (Cut Slope)	m	-	-	-	-	-	-	-	-	-	-	-
	Slope Protection (Embank't Sl)	m	-	-	-	5	-	-	-	-	-	-	-
	2-lane Bridge,Superstructure	m	-	-	-	-	-	-	-	-	-	-	-
	1-lane Bridge,Superstructure	m	-	-	-	12	-	-	-	-	-	-	-
	2-lane Bridge,Abutment	Each	-	-	-	-	-	-	-	-	-	-	-
	1-lane Bridge,Abutment	Each	-	-	-	2	-	-	-	-	-	-	-
	2-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
	1-lane Bridge,Pier	Each	-	-	-	-	-	-	-	-	-	-	-
	2-lane Spillway	m	-	-	-	-	-	-	-	-	-	-	-
	1-lane Spillway	m	-	100	-	-	-	-	-	-	-	-	-
	1-cell RCBC	m	-	-	-	-	-	-	-	-	-	-	-
	2-cell RCBC	m	-	-	-	-	-	-	-	-	-	8	-
	Wingwall for 1-cell RCBC	Set	-	-	-	-	-	-	-	-	-	-	-
	Wingwall for 2-cell RCBC	Set	-	-	-	-	-	-	-	-	-	1	-
	Miscellaneous	l.s.	1	1	1	1	1	1	1	1	1	1	1
Road Construction Cost		M.p.	.71	1.50	2.51	2.95	.30	1.03	8.91	1.41	1.25	1.79	.58
Bridge Construction Cost		M.p.	.00	1.32	.00	.93	.00	.00	.00	.00	.00	.49	.00
Total Construction Cost		M.p.	.71	2.82	2.51	3.88	.30	1.03	8.91	1.41	1.25	2.28	.58
Road Construction Cost/Impr't km		M.p.	.47	.50	1.47	.55	1.50	.47	.75	.47	.50	.48	.53
Total Construction Cost/Total km		M.p.	.29	.94	.81	.72	.16	.47	.75	.47	.50	.62	.53

TABLE 5.1 - 4 (7)

Quantity and Construction Cost ALBAY

	Unit	B8-3
Total Road Length	km	1.0
Improvement Length	km	1.0
Proposed Pavement Type		4.0-GRV
Quantity		
100 Clearing & Grubbing	m2	-
Stripping	m3	-
102 Roadway & Drainage Excavation	m3	844
104 Borrow	m3	4984
200 Aggregate Subbase	m3	396
Preparation of Prev.Road(Grvl)	m2	4320
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	600
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	32
Headwall for RCPC (dia.910mm)	Set	4
504 Grouted Riprap	m3	924
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	-
2-lane Bridge,Abutment	Each	-
1-lane Bridge,Abutment	Each	-
2-lane Bridge,Pier	Each	-
1-lane Bridge,Pier	Each	-
2-lane Spillway	m	-
1-lane Spillway	m	-
1-cell RCBC	m	-
2-cell RCBC	m	-
Wingwall for 1-cell RCBC	Set	-
Wingwall for 2-cell RCBC	Set	-
Miscellaneous	l.s.	1
Road Construction Cost	M.p.	1.69
Bridge Construction Cost	M.p.	.00
Total Construction Cost	M.p.	1.69
Road Construction Cost/Impr't km	M.p.	1.69
Total Construction Cost/Total km	M.p.	1.69

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 Albay
- Major Roads -

	Type of Improvement			
	Rehabilitation/ Improvement - 1	Improvement-2/ Widening	New Construction	Total
Primary Major Roads				
1. No. of Links	3	-	-	3
2. Total Length (km)	51.1	-	-	51.1
3. Improvement Length (km)	12.8	-	-	12.8
4. Construction Cost (million P)	57.0	-	-	57.0
5. Const. Cost/Imp. Length (MP/km)	4.45	-	-	4.45
Secondary Major Roads				
1. No. of Links	7	1	-	8
2. Total Length (km)	162.1	12.1	-	174.2
3. Improvement Length (km)	115.5	12.1	-	127.6
4. Construction Cost (million P)	258.4	20.4	-	278.8
5. Const. Cost/Imp. Length (MP/km)	2.24	1.69	-	2.18
Major Roads Total				
1. No. of Links	10	1	-	11
2. Total Length (km)	213.2	12.1	-	225.3
3. Improvement Length (km)	128.3	12.1	-	140.4
4. Construction Cost (million P)	315.4	20.4	-	335.8
5. Const. Cost/Imp. Length (MP/km)	2.46	1.69	-	2.39

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

	Type of Improvement		
	Rehabilitation/ Improvement-1&2/ Widening	New Construction	Total
Minor Roads (National/ Provincial/City)			
1. No. of Links	41	-	41
2. Total Length (km)	257.6	-	257.6
3. Improvement Length (km)	235.4	-	235.4
4. Construction Cost (million P)	351.8	-	351.8
5. Const. Cost/Imp. Length (MP/km)	1.49	-	1.49
Minor Roads (Barangay)			
1. No. of Links	15	-	15
2. Total Length (km)	52.1	-	52.1
3. Improvement Length (km)	47.3	-	47.3
4. Construction Cost (million P)	33.0	-	33.0
5. Const. Cost/Imp. Length (MP/km)	0.70	-	0.70
Minor Roads Total			
1. No. of Links	56	-	56
2. Total Length (km)	309.7	-	309.7
3. Improvement Length (km)	282.7	-	282.7
4. Construction Cost (million P)	384.8	-	384.8
5. Const. Cost/Imp. Length (MP/km)	1.36	-	1.36

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

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

Traffic Costs of Other Transport Modes

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

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

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

b) Traffic Benefits in Traffic Projects

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

The traffic benefits were estimated as follows:

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

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

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

Traffic costs were calculated assuming the following surface conditions:

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

c) Traffic Benefits in Development Projects

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

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

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

2) Development Benefits

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

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

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

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

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

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

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

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

TABLE 5.2 - 6 (1)

Summary of Demographic and Agricultural Data ALBAY

Class of Road	Type of Impr't	Road Number	Road Length (km)	1990 Population Total	1990 Population /km	1990 Crop Area (ha) Total	1990 Crop Area (ha) Major Crop	1993 AADT w/o	1993 AADT with	IRR (%)
Minor (Nat'l/ Prov'l)	Rehab/ Imp-1	P51	2.6	9857	3791	820	450(Banan) 300(Coco.) 70(Palay)	35	78	39.9
		P53	6.0	6694	1116	450	400(Palay) 50(Coco.)	26	58	37.3
		P5	13.4	41858	3124	2700	2000(Palay) 700(Coco.)	275	385	28.9
		N6	15.2	28268	1860	13850	****(Palay) 3200(Corn) 300(Banan) 100(Root)	296	376	27.5
		P11	4.1	16694	4072	770	400(Palay) 350(Coco.) 20(Banan)	88	169	27.1
		P61	3.9	12669	3248	3100	2000(Coco.) 700(Palay) 400(Banan)	113	133	24.0
		P36	3.8	3888	1023	600	400(Palay) 200(Coco.)	17	23	23.9
		N8	15.6	27429	1758	4450	2300(Coco.) 1200(Palay) 950(Banan)	203	312	23.8
		P41	3.4	7572	2227	600	300(Coco.) 200(Palay) 100(Banan)	22	56	23.3
		P50	8.4	12921	1538	1920	1000(Coco.) 500(Banan) 420(Palay)	52	114	22.6
		P49	2.0	2840	1420	200	100(Palay) 100(Coco.)	12	27	21.8
		P65	2.9	6218	2144	300	150(Palay) 100(Coco.) 50(Banan)	24	31	21.1
		P12	6.3	10872	1726	650	600(Palay) 50(Banan)	40	93	20.8
		P43	3.9	8516	2184	170	100(Palay) 30(Banan) 20(Coco.) 20(Root)	29	69	20.3
		P60	12.0	20338	1695	2500	1700(Coco.) 500(Palay) 300(Banan)	139	172	18.9
		P39	2.6	8663	3332	750	400(Coco.) 200(Banan) 150(Palay)	37	86	18.8
		P21	20.0	15024	751	4600	3300(Coco.) 900(Palay) 400(Banan)	48	114	18.5
		P55	7.0	6589	941	540	300(Coco.) 200(Banan) 40(Palay)	12	31	17.2
		P46	2.3	5288	2299	180	50(Corn) 50(Coco.) 50(Banan) 30(Palay)	7	19	16.8
		P37	8.8	10920	1241	1000	800(Coco.) 200(Banan)	48	60	16.7
		P54	2.0	9803	4902	110	60(Banan) 50(Coco.)	34	79	16.3
		P22	9.8	16091	1642	1690	1000(Palay) 650(Coco.) 40(Vege.)	86	158	13.7
		P32	3.0	2071	690	520	400(Coco.) 100(Palay) 20(Corn)	9	20	13.1
		P17	5.6	23285	4158	900	500(Palay) 300(Coco.) 100(Banan)	95	213	12.6
		P26	6.6	8132	1232	1470	900(Coco.) 550(Palay) 20(Banan)	71	81	12.4
		P16	5.9	6315	1070	530	300(Coco.) 200(Palay) 30(Banan)	24	31	12.3
		P40	2.0	6071	3036	630	300(Coco.) 150(Corn) 100(Banan) 80(Palay)	11	27	11.9
		P33	3.3	2998	908	580	300(Coco.) 280(Palay)	4	15	11.3
		P24	2.0	1775	888	550	400(Coco.) 80(Corn) 50(Palay) 20(Vege.)	7	16	10.6
		P66	6.0	5101	850	1050	850(Coco.) 100(Palay) 100(Corn)	13	19	8.5
		P58	1.7	4378	2575	550	300(Coco.) 250(Banan)	19	42	8.2
		P9	5.2	3377	649	600	600(Coco.)	15	31	7.7
		P30	3.4	3261	959	230	200(Coco.) 20(Banan) 10(Vege.)	13	31	5.9
		P47	5.1	7466	1464	260	200(Palay) 30(Coco.) 30(Banan)	24	57	5.0
		P35	2.3	3301	1435	130	130(Coco.)	13	17	3.6
		P7	10.0	16678	1668	1050	1050(Palay)	182	158	2.8
		P10	14.0	4905	350	1900	1600(Coco.) 300(Palay)	14	31	.5
		P28	5.7	7782	1365	760	600(Coco.) 80(Root) 80(Banan)	27	63	.4
		P34	9.4	2625	279	1500	1000(Coco.) 300(Palay) 200(Banan)	7	9	.0
	Imp-2/ Widen	P6	8.3	13950	1681	1000	600(Coco.) 250(Vege.) 150(Palay)	86	145	45.6
		P31	2.0	4607	2304	710	600(Coco.) 60(Palay) 50(Vege.)	20	27	23.4
Minor (Baran-gay)	Rehab/ Imp-1	B5-2	6.0	7061	1177	880	480(Palay) 400(Coco.)	0	17	48.9
		B12-4	2.0	6729	3365	60	50(Palay) 10(Coco.)	0	19	46.5
		B3-7	3.0	3892	1297	310	200(Coco.) 60(Palay) 50(Vege.)	16	21	38.6
		B17-1	2.4	10498	4374	330	300(Coco.) 30(Palay)	38	85	33.5
		B1-3	3.0	1770	590	350	250(Coco.) 80(Palay) 20(Banan)	0	6	23.4
		B0-2	3.1	8072	2604	300	200(Banan) 80(Coco.) 20(Root)	33	44	21.4
		B4-1	5.4	4262	789	580	350(Coco.) 200(Palay) 30(Vege.)	12	26	21.3
		B3-1	1.9	14964	7876	40	20(Coco.) 20(Root)	66	66	18.6
		B10-2	2.2	1982	901	180	150(Coco.) 30(Palay)	6	8	12.3

TABLE 5.2 - 6 (2)

Summary of Demographic and Agricultural Data ALBAY

Class of Road	Type of Impr't	Road Number	Road Length (km)	1990 Population Total	1990 Population /km	1990 Crop Area (ha) Total	1990 Crop Area (ha) Major Crop	1993 AADT w/o	1993 AADT with	IRR (%)
Minor (Barangay)	Rehab/Imp-1	B13-2	11.8	3558	302	1550	1200(Coco.) 350(Corn)	12	16	11.6
		B15-1	3.0	3152	1051	250	200(Coco.) 50(Banan)	0	3	10.2
		B12-1	2.5	2626	1050	110	100(Coco.) 10(Palay)	0	4	8.5
		B15-2	3.7	2766	748	480	400(Coco.) 80(Banan)	0	5	7.5
		B16-1	1.1	1694	1540	400	300(Coco.) 100(Banan)	7	15	6.1
		B8-3	1.0	2530	2530	250	200(Coco.) 50(Banan)	10	23	4.3

3) Maintenance Cost Savings

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

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

a) Maintenance Cost in "w/o" Case

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

TABLE 5.2-7
EMK FACTOR FOR DIFFERENT SURFACING AND AADT

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

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

b) Routine Maintenance Costs in "with" Case

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

TABLE 5.2-8
ESTIMATED ROUTINE MAINTENANCE COSTS

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

5.2.4 Economic Evaluation

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

PROVINCE OF ALBAY

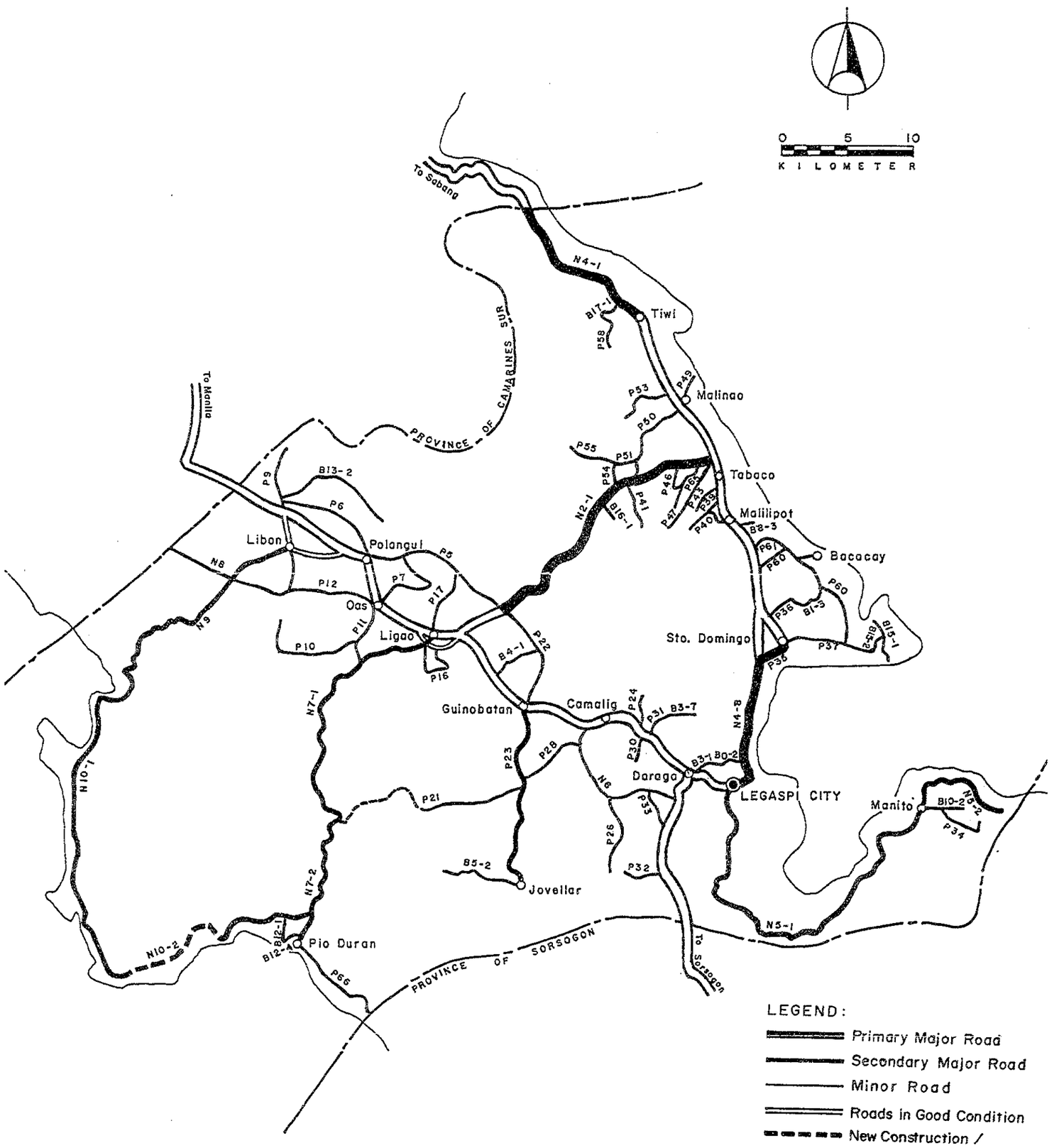


FIGURE 5.2 - 1 PROJECT ROADS and ECONOMIC EVALUATION RESULTS

TABLE 5.2 - 9 (1)

Road Length and Construction Cost ALBAY

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<	2	34.3	12.2	33.1	19.8	53.0	-	-	-	-	-	-	-	-	-	-	-	-
	10-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<7.5	1	16.8	.6	1.9	2.1	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	Total	3	51.1	12.8	35.1	21.9	57.0	-	-	-	-	-	-	-	-	-	-	-	-
Second'y Major	15<	4	106.0	74.4	131.4	26.8	158.2	-	-	-	-	-	-	-	-	-	-	-	-
	10-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	-	-	-	-	-	-	1	12.1	12.1	8.9	11.5	20.4	-	-	-	-	-	-
	<7.5	3	56.1	41.1	87.7	12.5	100.2	-	-	-	-	-	-	-	-	-	-	-	-
	Total	7	162.1	115.5	219.1	39.2	258.4	1	12.1	12.1	8.9	11.5	20.4	-	-	-	-	-	-
Minor (Nat'l/ Prov'l)	15<	21	146.2	133.3	167.2	10.3	177.5	2	10.3	2.5	3.2	2.5	5.7	-	-	-	-	-	-
	10-15	8	38.2	36.8	46.0	35.6	81.6	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	3	12.9	12.9	15.7	.6	16.3	-	-	-	-	-	-	-	-	-	-	-	-
	<7.5	7	49.9	49.9	60.4	10.3	70.7	-	-	-	-	-	-	-	-	-	-	-	-
	Total	39	247.2	232.9	289.3	56.8	346.1	2	10.3	2.5	3.2	2.5	5.7	-	-	-	-	-	-
Minor (Baran-gay)	15<	8	26.8	22.0	13.1	2.7	15.8	-	-	-	-	-	-	-	-	-	-	-	-
	10-15	3	17.0	17.0	11.3	-	11.3	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	1	2.5	2.5	1.3	-	1.3	-	-	-	-	-	-	-	-	-	-	-	-
	<7.5	3	5.8	5.8	4.1	.5	4.5	-	-	-	-	-	-	-	-	-	-	-	-
	Total	15	52.1	47.3	29.7	3.2	33.0	-	-	-	-	-	-	-	-	-	-	-	-
Total	15<	35	313.3	241.9	344.8	59.7	404.5	2	10.3	2.5	3.2	2.5	5.7	-	-	-	-	-	-
	10-15	11	55.2	53.8	57.4	35.6	93.0	-	-	-	-	-	-	-	-	-	-	-	-
	7.5-10	4	15.4	15.4	17.0	.6	17.5	1	12.1	12.1	8.9	11.5	20.4	-	-	-	-	-	-
	<7.5	14	128.6	97.4	154.1	25.4	179.5	-	-	-	-	-	-	-	-	-	-	-	-
	Total	64	512.5	408.5	573.3	121.2	694.5	3	22.4	14.6	12.1	13.9	26.0	-	-	-	-	-	-

TABLE 5.2 - 9 (2)

Road Length and Construction Cost ALBAY

Class of Road	Range of IRR	Total					
		No.	Total Length	Improv Length	Road Cost	Bridge Cost	Total Cost
Primary Major	15<	2	34.3	12.2	33.1	19.8	53.0
	10-15	-	-	-	-	-	-
	7.5-10	-	-	-	-	-	-
	<7.5	1	16.8	.6	1.9	2.1	4.0
	Total	3	51.1	12.8	35.1	21.9	57.0
Second'y Major	15<	4	106.0	74.4	131.4	26.8	158.2
	10-15	-	-	-	-	-	-
	7.5-10	1	12.1	12.1	8.9	11.5	20.4
	<7.5	3	56.1	41.1	87.7	12.5	100.2
	Total	8	174.2	127.6	228.0	50.7	278.7
Minor (Nat'l/ Prov'l)	15<	23	156.5	135.8	170.4	12.8	183.2
	10-15	8	38.2	36.8	46.0	35.6	81.6
	7.5-10	3	12.9	12.9	15.7	.6	16.3
	<7.5	7	49.9	49.9	60.4	10.3	70.7
	Total	41	257.5	235.4	292.6	59.2	351.8
Minor (Baran-gay)	15<	8	26.8	22.0	13.1	2.7	15.8
	10-15	3	17.0	17.0	11.3	-	11.3
	7.5-10	1	2.5	2.5	1.3	-	1.3
	<7.5	3	5.8	5.8	4.1	.5	4.5
	Total	15	52.1	47.3	29.7	3.2	33.0
Total	15<	37	323.6	244.4	348.0	62.1	410.2
	10-15	11	55.2	53.8	57.4	35.6	93.0
	7.5-10	5	27.5	27.5	25.9	12.0	37.9
	<7.5	14	128.6	97.4	154.1	25.4	179.5
	Total	67	534.9	423.1	585.4	135.1	720.5

TABLE 5.2 - 10 (1)

Summary of Economic Analysis ALBAY

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 (%)
Primary Major	Rehab/ Imp-1	N4-8	2303	2210	11.5	-	16.49	-	16.49	139.23	-	-	-	-	139.23	122.7	8.4	100.0
		N2-1	490	628	22.8	12.2(6.7-AC)	2.26	.10	2.36	4.78	.58	.39	-	.10	5.85	42.7	2.5	34.0
		N4-1	276	266	16.8	.6(6.8-PCC)	5.57	-	5.57	2.54	-	-	-	.10	2.64	-1.8	.5	6.5
Second'y Major	Rehab/ Imp-1	N5-2	467	448	8.5	8.5(6.0-AC)	2.21	.04	2.25	4.60	-	.00	-	.10	4.70	20.8	2.1	28.8
		N10-2	9	84	32.0	32.0(6.0-GRV)	1.15	.29	1.44	.12	-	1.65	-	-.04	1.74	9.6	1.2	18.2
		N9	223	186	25.5	19.5(6.0-GRV)	1.29	.27	1.56	1.61	-	-	-	.14	1.74	3.6	1.1	16.9
		N5-1	467	448	40.0	13.9(6.0-AC) .5(6.0-PCC)	3.53	.04	3.57	3.99	-	.00	-	.05	4.04	6.8	1.1	16.9
		N7-2	273	258	14.3	11.7(6.0-BMP) 2.2(6.0-Ovl)	2.34	.25	2.59	1.33	-	-	-	.06	1.40	-16.6	.5	6.8
		P23	235	236	16.3	15.4(6.0-BMP) .9(6.0-PCC)	1.32	.32	1.64	.98	-	.00	-	-.03	.94	-11.4	.6	6.6
		N7-1	273	258	25.5	10.9(6.0-BMP)	2.69	.30	2.98	1.10	-	-	-	.08	1.18	-19.7	.4	3.2
	Imp-2/ Widen	N10-1	9	84	12.1	12.1(6.0-GRV)	1.40	.29	1.69	.07	-	.99	-	-.04	1.03	-8.0	.6	8.3

TABLE 5.2 - 10 (2)
Summary of Economic Analysis — ALBAY — Cost/Benefit:1991-2017 Discounted Total

Class of Road	Type of Impr't	Road Number	1993 AADT w/o	1993 AADT with	Length (km) Total	Length (km) Improvement	Economic Cost (Mp/km) Const-ruct.	Economic Cost (Mp/km) Period Maint.	Economic Cost (Mp/km) Total	Benefit (Mp/km) Normal	Diver-ted	Gene-rated	Deve-lop't	Maint sav'g	Total	Econom. Indicator NPV (Mp)	B/C	IRR (%)
Minor (Nat'l/ Prov'l)	Rehab/ Imp-1	P51	35	78	2.6	2.6(6.0-GRV)	.55	.24	.79	1.39	-	.16	.53	.01	2.09	3.4	2.6	39.9
		P53	26	58	6.0	5.2(6.0-GRV)	.69	.20	.89	1.36	-	.05	1.07	.01	2.49	8.3	2.8	37.3
		P6	275	385	13.4	9.6(6.0-Ovl)	1.08	.03	1.10	1.79	-	.02	.65	-.01	2.46	13.0	2.2	28.9
		N6	296	376	15.2	15.2(6.0-BMP)	1.25	.58	1.83	1.22	-	.01	2.33	-.04	3.51	25.7	1.9	27.5
		P11	88	169	4.1	.3(6.0-BMP)	.76	.34	1.10	.85	-	.04	1.09	.06	2.03	3.8	1.9	27.1
						3.8(6.0-GRV)												
		P61	113	133	3.9	3.9(6.0-BMP)	1.40	.16	1.55	.51	-	.02	2.42	-.03	2.92	5.3	1.9	24.0
		P36	17	23	3.8	3.8(6.0-GRV)	.75	.17	.92	.48	-	.02	1.11	.01	1.61	2.6	1.8	23.9
		N8	203	312	15.6	9.3(6.0-BMP)	2.41	.45	2.87	2.11	-	.02	2.90	-.04	4.98	19.7	1.7	23.8
		P41	22	56	3.4	3.4(6.0-GRV)	.56	.20	.77	.91	-	.17	.04	.00	1.12	1.2	1.5	23.3
		P50	52	114	8.4	3.2(6.0-BMP)	.78	.22	1.00	.81	-	.04	.71	.00	1.56	4.6	1.5	22.6
						5.0(6.0-GRV)												
						.2(6.0-PCC)												
		P49	12	27	2.0	.5(6.0-BMP)	.90	.17	1.06	.63	-	.01	1.03	-.01	1.66	.8	1.6	21.8
						.8(6.0-GRV)												
		P65	24	31	2.9	2.3(6.0-BMP)	1.01	.16	1.17	1.44	-	.07	.16	-.03	1.66	1.4	1.4	21.1
						.6(6.0-GRV)												
		P12	40	93	6.3	3.9(6.0-BMP)	1.29	.18	1.46	.63	-	.03	1.69	-.02	2.21	3.8	1.5	20.8
						1.1(6.0-GRV)												
		P43	29	69	3.9	1.5(6.0-BMP)	.82	.19	1.01	1.10	-	.11	.13	-.01	1.33	1.3	1.3	20.3
						2.4(6.0-GRV)												
		P60	139	172	12.0	6.6(6.0-BMP)	1.33	.31	1.64	1.26	-	.22	.56	.02	2.06	5.1	1.3	18.9
						5.4(6.0-GRV)												
		P39	37	86	2.6	2.0(6.0-BMP)	1.08	.17	1.26	.78	-	.02	.83	-.02	1.61	.9	1.3	18.8
						.6(6.0-GRV)												
		P21	48	114	20.0	3.1(6.0-BMP)	1.00	.25	1.25	1.27	-	.21	.02	.00	1.50	5.0	1.2	18.5
						16.9(6.0-GRV)												
		P55	12	31	7.0	7.0(6.0-GRV)	.55	.18	.73	.57	-	.14	.11	.00	.82	.6	1.1	17.2
		P46	7	19	2.3	2.3(6.0-GRV)	.56	.18	.73	.53	-	.21	.07	.00	.81	.2	1.1	16.8
		P37	48	60	8.8	2.5(6.0-BMP)	1.38	.19	1.57	1.08	-	.01	.02	.02	1.73	1.5	1.1	16.7
						6.3(6.0-GRV)												
		P54	34	79	2.0	2.0(6.0-GRV)	.57	.24	.81	.71	-	.07	.09	.01	.87	.1	1.1	16.3
		P22	86	158	9.8	6.2(6.0-BMP)	3.21	.25	3.45	1.33	-	.12	1.64	.00	3.09	-3.6	.9	13.7
						3.6(6.0-GRV)												
		P32	9	20	3.0	3.0(6.0-GRV)	.80	.17	.97	.38	-	.02	.44	.00	.84	-.4	.9	13.1
		P17	95	213	5.6	4.2(6.0-BMP)	1.42	.27	1.69	1.03	-	.01	.38	.01	1.43	-1.1	.8	12.6
		P26	71	81	6.6	6.1(6.0-GRV)	1.43	.23	1.66	.61	-	.03	.66	.06	1.35	-2.0	.8	12.4
						.5(6.0-BMP)												
		P16	24	31	5.9	5.9(6.0-GRV)	1.78	.18	1.96	1.04	-	.09	.44	.01	1.58	-2.2	.8	12.3
		P40	11	27	2.0	2.0(6.0-GRV)	1.60	.18	1.78	.63	-	.18	.68	-.01	1.38	-.8	.8	11.9
		P33	4	16	3.3	3.3(6.0-GRV)	.76	.17	.94	.17	-	.02	.50	.00	.70	-.8	.7	11.3
		P24	7	16	2.0	.2(6.0-BMP)	1.20	.17	1.38	.28	-	.01	.65	.00	.95	-.9	.7	10.6
						1.8(6.0-GRV)												
		P66	13	19	6.0	1.2(6.0-BMP)	1.32	.17	1.49	.63	-	.13	.16	.00	.91	-3.5	.6	8.5
						4.8(6.0-GRV)												
		P58	19	42	1.7	1.7(6.0-BMP)	1.04	.16	1.20	.28	-	.00	.44	-.03	.70	-.9	.6	8.2
		P9	15	31	5.2	2.3(6.0-BMP)	.74	.17	.91	.47	-	.02	.08	-.01	.56	-1.8	.6	7.7
						2.9(6.0-GRV)												
		P30	13	31	3.4	1.6(6.0-BMP)	1.01	.17	1.17	.46	-	.00	.14	-.01	.59	-2.0	.5	5.9
						1.8(6.0-GRV)												
		P47	24	57	5.1	3.5(6.0-BMP)	1.34	.17	1.51	.51	-	.08	.12	-.02	.69	-4.2	.5	5.0
						1.6(6.0-GRV)												
		P35	13	17	2.3	1.3(6.0-BMP)	1.10	.16	1.26	.51	-	.02	.01	-.01	.53	-1.7	.4	3.6
						1.0(6.0-GRV)												
		P7	182	158	10.0	3.6(6.0-BMP)	1.39	.26	1.65	.24	-	.01	.32	.06	.62	-10.3	.4	2.8
						6.2(6.0-GRV)												
						.2(6.0-PCC)												
		P10	14	31	14.0	14.0(6.0-GRV)	1.13	.18	1.31	.23	-	.02	.15	.00	.40	-12.8	.3	.5
		P28	27	63	5.7	5.7(6.0-BMP)	1.24	.16	1.39	.14	-	.01	.21	-.03	.34	-6.0	.2	.4
		P34	7	9	9.4	3.0(6.0-BMP)	.98	.17	1.15	.09	-	.00	.18	.00	.26	-8.3	.2	.0
						6.4(6.0-GRV)												
	Imp-2/ Widen	P6	86	145	8.3	.5(6.0-BMP)	4.52	.16	4.68	0.22	-	.00	17.65	-.94	23.83	9.6	5.1	45.6
		P31	20	27	2.0	2.0(6.0-GRV)	1.23	.18	1.41	1.14	-	.04	1.20	.01	2.39	2.0	1.7	23.4

TABLE 5.2 - 10 (3)

Summary of Economic Analysis ALBAY

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	B5-2	0	17	6.0	5.2(4.0-GRV)	.50	.11	.61	1.27	-	.19	.98	.01	2.45	9.6	4.0	48.9
		B12-4	0	19	2.0	.3(4.0-Ovl) 1.7(4.0-GRV)	.45	.10	.55	1.42	-	.27	.08	.00	1.76	2.4	3.2	46.5
		B3-7	16	21	3.0	3.0(4.0-GRV)	.39	.11	.50	.83	-	.02	.58	.01	1.44	2.8	2.9	38.6
		B17-1	38	85	2.4	1.5(4.0-GRV)	.39	.16	.55	.81	-	.04	.36	.01	1.22	1.0	2.2	33.5
		B1-3	0	6	3.0	3.0(4.0-GRV)	.78	.11	.90	1.01	-	.07	.37	.01	1.46	1.7	1.6	23.4
		B0-2	33	44	3.1	1.4(6.0-BMP) .3(5.0-Ovl)	1.23	.13	1.36	1.83	-	.02	.13	-.03	1.94	1.0	1.4	21.4
		B4-1	12	26	5.4	5.4(4.0-GRV)	.60	.11	.71	.27	-	.04	.78	.00	1.09	2.1	1.5	21.3
		B3-1	66	66	1.9	.2(6.0-BMP)	1.25	.16	1.41	.77	-	.00	1.06	-.03	1.80	.1	1.3	18.6
		B10-2	5	8	2.2	2.2(4.0-GRV)	.39	.11	.50	.30	-	.06	.06	.01	.43	-.2	.8	12.3
		B13-2	12	16	11.8	11.8(4.0-GRV)	.63	.11	.74	.38	-	.07	.13	.01	.58	-1.9	.8	11.6
		B15-1	0	3	3.0	3.0(4.0-GRV)	.39	.11	.50	.21	-	.14	.02	.01	.38	-.4	.7	10.2
		B12-1	0	4	2.5	2.5(4.0-GRV)	.42	.11	.53	.22	-	.10	.02	.01	.35	-.4	.7	8.5
		B15-2	0	5	3.7	3.7(4.0-GRV)	.51	.11	.63	.25	-	.09	.03	.01	.38	-.9	.6	7.5
		B16-1	7	16	1.1	1.1(4.0-GRV)	.44	.11	.55	.22	-	.01	.07	.01	.30	-.3	.6	6.1
		B8-3	10	23	1.0	1.0(4.0-GRV)	1.41	.11	1.52	.26	-	.01	.28	.00	.56	-1.0	.4	4.3