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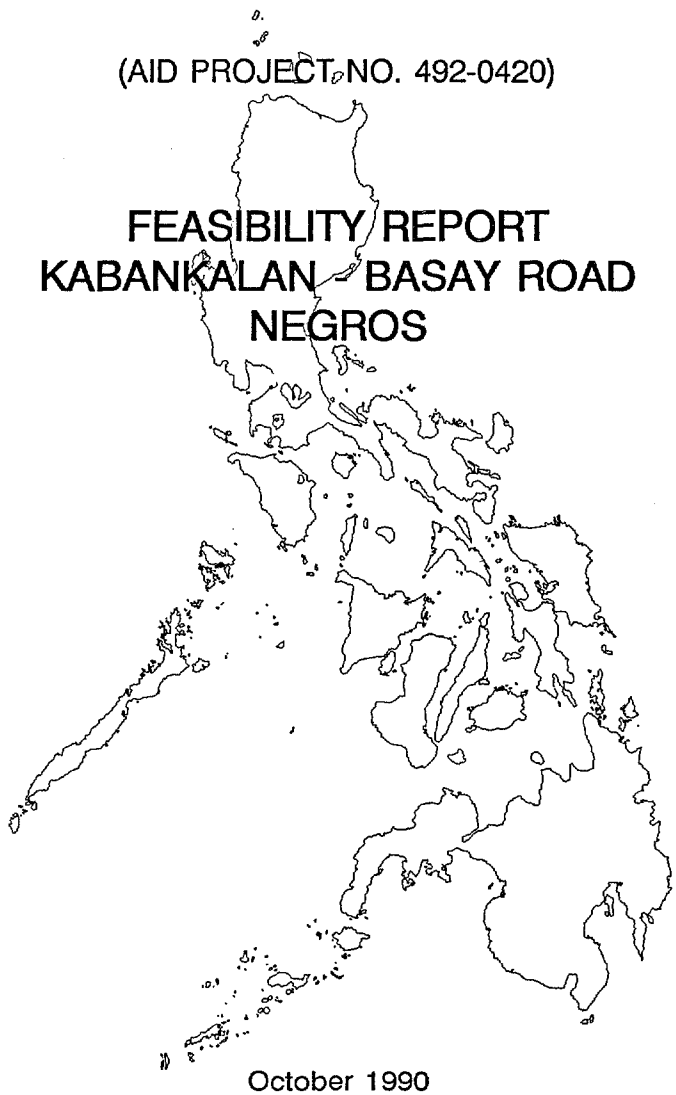
REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

RURAL INFRASTRUCTURE FUND PROJECT

(AID PROJECT NO. 492-0420)

FEASIBILITY REPORT
KABANKALAN - BASAY ROAD
NEGROS



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LOUIS BERGER INTERNATIONAL, INC.
100 Halsted Street, East Orange, NJ, 07019, U.S.A.

in joint venture with

TCGI ENGINEERS
150 Legazpi St., Legazpi Village, Makati, Metro Manila, Philippines

TABLE OF CONTENTS

	Page No.
I. INTRODUCTION	
A. PROPOSED PROJECT	I-3
B. OVERVIEW	I-3
C. EXISTING ROAD CONDITION	I-3
D. CRITERIA FOR ECONOMIC VIABILITY	I-4
E. SUMMARY OF ECONOMIC ANALYSIS	I-4
F. RECOMMENDATIONS	I-5
G. ESTIMATED COST OF PROPOSED CONSTRUCTION	I-6
II. ECONOMIC OVERVIEW	
A. PROVINCE OF NEGROS OCCIDENTAL (REGION VI) AND NEGROS ORIENTAL (REGION VII)	II-1
1. General Background	II-1
2. Population Characteristics	II-5
3. Family Income Expenditure	II-6
4. Structure of Provincial Economies	II-7
B. TRANSPORT SYSTEM	II-12
1. Road Network	II-12
2. Vehicle Registration	II-16
3. Sea Transportation	II-16
4. Airports	II-16
C. THE ZONE OF INFLUENCE	II-17
1. Introduction and Geographic Setting	II-17
2. Population	II-18
3. The Local Economy	II-18
4. Impact of Road	II-21
III. TRAFFIC	
A. REVIEW OF AVAILABLE DATA	III-1
1. NTCP Traffic Count Data	III-1
2. Historic Traffic Growth	III-1
B. RIFP TRAFFIC SURVEY	III-1
1. Traffic Count Survey	III-2

2. Travel Time and Delay Studies III-2

C. HOMOGENOUS TRAFFIC SECTIONS III-4

D. ANALYSIS OF THE TRAFFIC DATA III-4
1. Traffic Counts III-4
2. Origin - Destination Survey III-6
3. Axle Load Study III-6
4. Travel Time and Speed III-6

E. TRAFFIC FORECAST III-6
1. Normal Traffic III-11
2. Generated Traffic III-12
3. Diverted Traffic III-12

IV. ENGINEERING DESIGN

A. INTRODUCTION IV-1

B. DATA COLLECTION AND ANALYSIS PERFORMED IV-1
1. Road Inventory IV-1
2. Topographic Survey IV-2
3. Existing Feasibility Studies IV-2

C. DESCRIPTION OF THE ROUTE IV-2

D. PRELIMINARY DESIGN IV-4
1. Proposed Design Standards and Improvements IV-4
2. Drainage IV-9

V. PAVEMENT AND MATERIALS

A. GEOLOGY V-1

B. MATERIAL SOURCES V-1

C. EXISTING PAVEMENT CONDITIONS V-4

D. SUBGRADE SOIL V-6

E. PAVEMENT DESIGN V-6
1. Traffic Loading V-6
2. Existing Pavement V-7
3. New Pavement V-7
4. Pavement Overlaying V-8

F. FINAL COMMENTS V-9

VI. COSTING

A. PROPOSED IMPROVEMENTS VI-1

B. UNIT PRICES VI-1

C. QUANTITIES VI-1
1. Earthworks VI-1
2. Pavement Section VI-1
3. Structures VI-4
4. Drainage and Erosion Works VI-4
5. Incidental Works VI-4
6. Right-of-Way VI-4

D. CONSTRUCTION COSTS VI-4

E. COST OF IMPROVEMENTS VI-4

F. MAINTENANCE COSTS VI-4

VII. ECONOMIC EVALUATION

A. INTRODUCTION VII-1
1. Basic Inputs and Assumptions for the Evaluation of the Project Road VII-1

B. PROJECT BENEFITS VII-2
1. Traffic Benefits VII-2
2. Development Benefits VII-4
3. Diverted and Generated Traffic Benefits VII-9
4. Generated Traffic and Development Benefits VII-9
5. Road Maintenance Benefits VII-9

C. ENGINEERING CONSIDERATIONS VII-10
1. Homogeneous Sections for Evaluation VII-10

D. COSTS VII-10
1. Construction Cost Estimates VII-10
2. Project Management Costs VII-13
3. Allocation of Construction and Project Management Costs VII-13

E. ECONOMIC EVALUATION VII-13
1. Criteria for Economic Evaluation VII-13
2. Results VII-14

F. SENSITIVITY ANALYSIS VII-23

G. FINANCIAL ANALYSIS VII-23
1. Introduction VII-23
2. Results VII-29

H. RECOMMENDATIONS VII-29

I. COST VII-29

VIII. SOCIAL SOUNDNESS ANALYSIS

A. INTRODUCTION VIII-1

B. BACKGROUND VIII-1

C. INCOME EFFECTS VIII-1
1. Agricultural Benefits VIII-2
2. Transportation Benefits VIII-2

D. POPULATION VIII-4

E. CULTURAL MINORITIES VIII-4

F. CONCLUSIONS VIII-4

IX. ENERGY ANALYSIS IX-1

LIST OF TABLES

Table No.		Page No.
1-1	Existing Road Condition	I-4
1-2	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Internal Rates of Return)	I-7
2-1	Main Source of Income for Negros Occidental Compared with Region VI (W. Visayas) and Negros Oriental Compared with Region VII (C. Visay) and the Philippines	II-6
2-2	Agricultural Production Province of Negros Occidental	II-8
2-3	Agricultural Production Province of Negros Oriental	II-10
2-4	Existing Road by Classification Negros Occidental	II-13
2-5	Existing Roads by Classification Negros Oriental	II-13
2-6	Registered Vehicles	II-16
3-1	1990 Travel Time and Speed Kabankalan - Basay Road	III-10
3-2 to 3-11	Summary of Traffic Forecast	III-13 to III-22
4-1	Detailed Design Criteria	IV-5
4-2	Proposed Bridges for Kabankalan-Basay Road	IV-11
4-3	Reinforced Concrete Box Culverts	IV-12
5-1	Pavement Sections	V-10
6-1	Summary of Unit Rates	VI-2
6-2 to 6-6	Cost Estimate Breakdown	to VI-5 VI-12
7-1	Existing Road Condition	VII-3
7-2	Economic Vehicle Operating Costs - HDM-III Results - w/o Time Value of User Cost	VII-5
7-3	Economic Vehicle Operating Costs - HDM-III Results - w/ Time Value of User Cost	VII-7
7-4	Routine Maintenance Unit Costs	VII-11
7-5	Periodic Maintenance Unit Costs	VII-12

7-6	Economic Benefits and Feasibility Ratios Section: Kabankalan - Ilog	VII-15
7-7	Economic Benefits and Feasibility Ratios Section: Ilog - Cauayan	VII-17
7-8	Economic Benefits and Feasibility Ratios Section: Cauayan - Siply	VII-19
7-9 to 7-10	Economic Benefits and Feasibility Ratios Section: Cauayan - Siply	VII-21 VII-22
7-11 to 7-15	Economic analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives	VII-24 to VII-28
7-16 to 7-20	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives	VII-30 to VII-34
8-1	Families by Main Source of Income and Total Family Income for Negros Occidental and Negros Oriental	VIII-3

LIST OF FIGURES

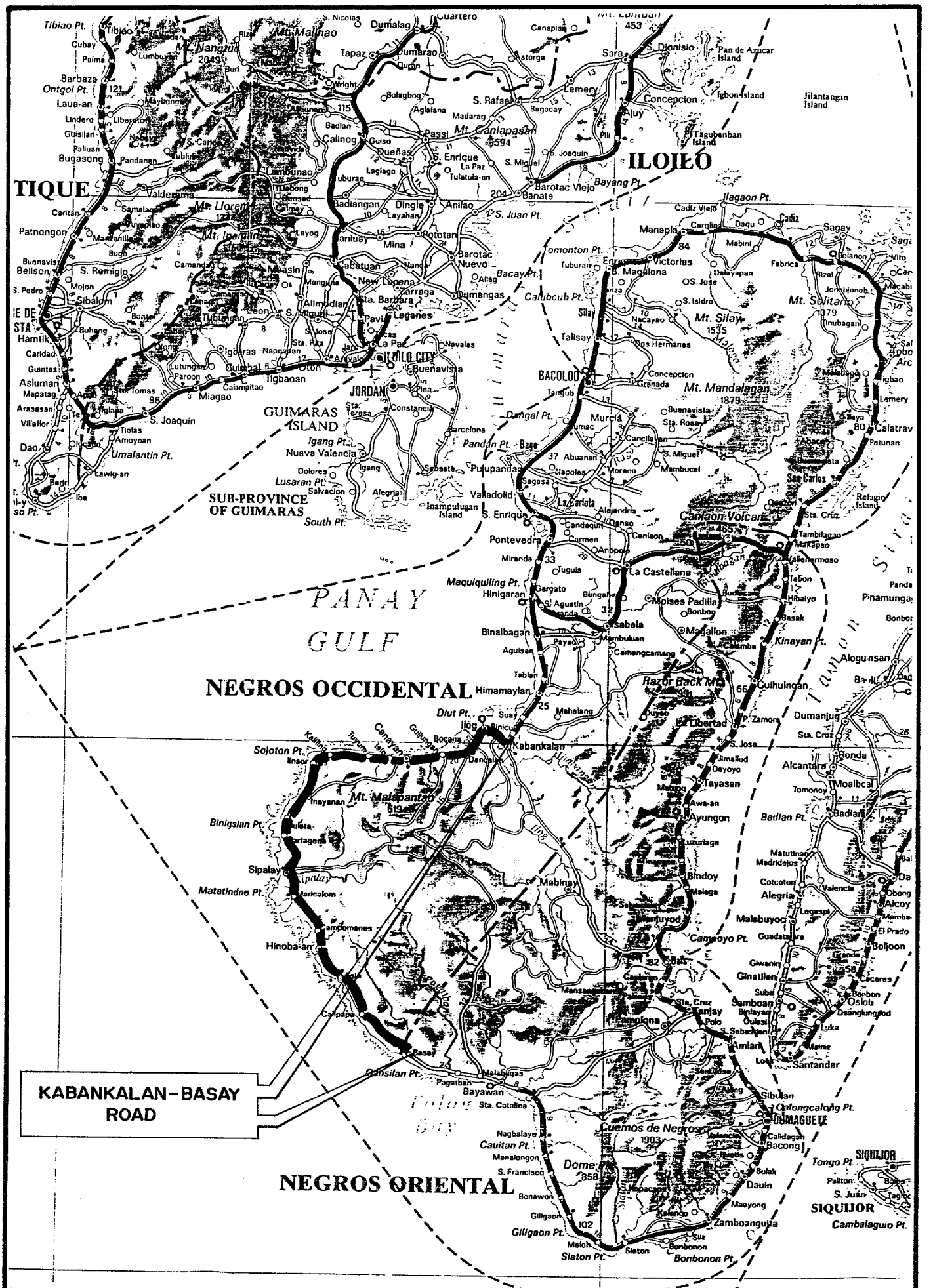
Figure No.		Page No.
1-1	Project Road Map	I-1
1-2	Kabankalan - Basay Road	I-2
2-1	Project Road Map	II-14
2-2	Kabankalan - Basay Road	II-15
2-3a	Land Use Opportunity Map	II-19
2-3b	Land Use Opportunity Map	II-20
3-1	Traffic Survey Station	III-3
3-2	1990 Vehicle Composition	III-5
3-3 to 3-5	1990 Hourly Traffic Variation	III-7 to III-9
4-1	Cross Section Type "B"	IV-6
5-1	Geology and Materials Map	V-2
9-1	Assumed Fuel Efficiencies at Roughness 2 (IRI)	IX-2
9-2	Assumed Fuel Efficiencies at Roughness 6 (IRI)	IX-3

9-3	Assumed Fuel Efficiencies at Roughness 10 (IRI)	IX-4
9-4	Assumed Fuel Efficiencies at Roughness 14 (IRI)	IX-5

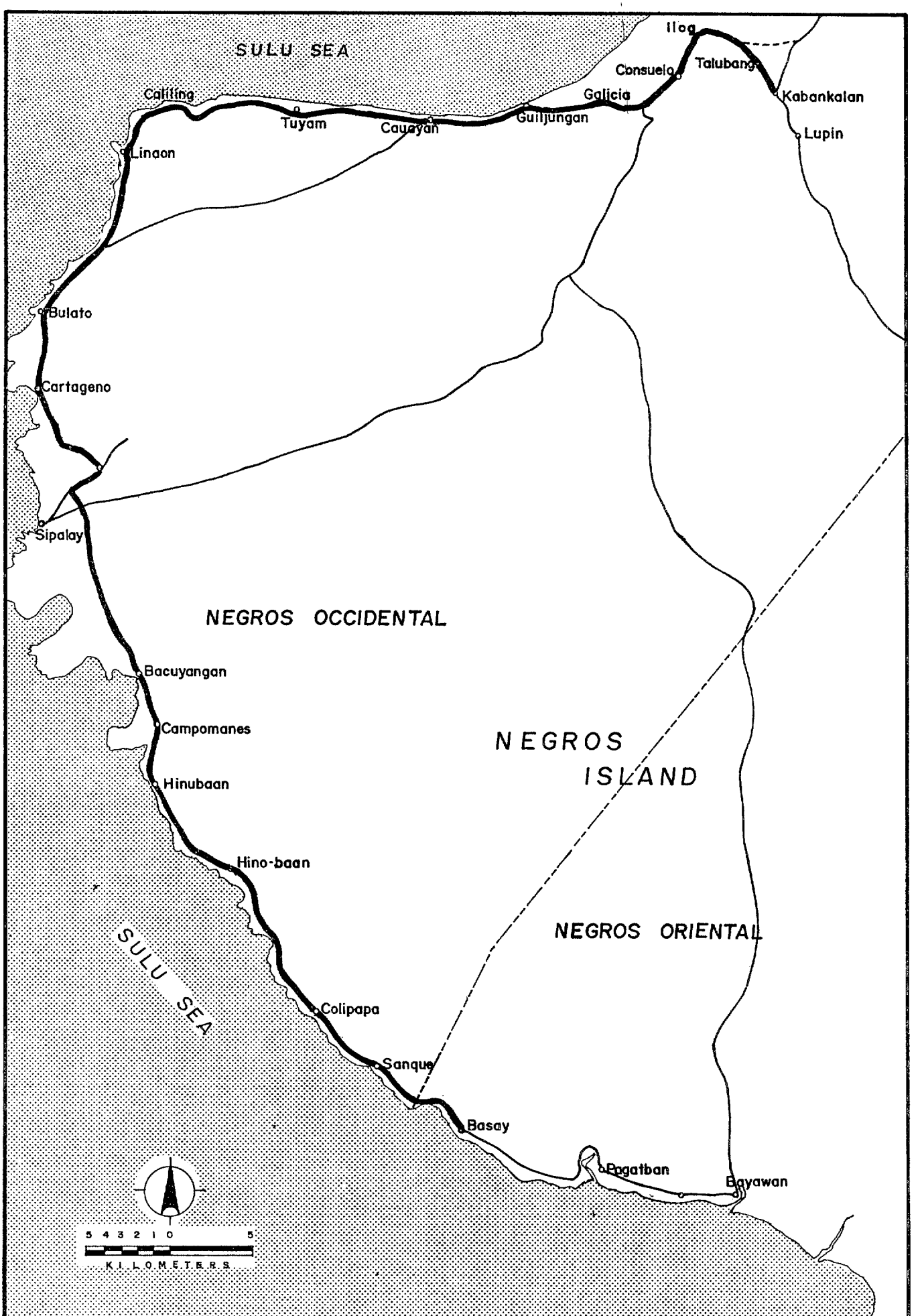
LIST OF APPENDICES

Appendix

A	Traffic
B	No Appendix B
C	Transport Economics



RURAL INFRASTRUCTURE FUND PROJECT	PROJECT ROAD MAP Kabankalan - Basay Road	Figure I-1



RURAL INFRASTRUCTURE FUND PROJECT	PROJECT ROAD MAP Kabankalan - Basay Road	Figure 1-2

10

I. INTRODUCTION

A. PROPOSED PROJECT

The proposed project comprises the improvement of the existing 132.2 km coastal road from Kabankalan to Basay on the Island of Negros. Of the road project's existing PCC-paved subsections, 23.2 km are scheduled for sealing and rehabilitation. Also, for continuity purposes, approximately 2.2 km of asphalt and gravel road subsections bounded by PCC subsections between the Municipalities of Ilog and Cauayan are scheduled to be reconstructed to PCC standards. The rest of the road project, which is mostly gravelled and in fair condition, is scheduled for widening, geometrical improvements and paving to appropriate DBST standards.

B. OVERVIEW

The proposed 132.2 km Kabankalan-Basay Road is currently motorable throughout its entire length.

This road project connects the Municipality of Kabankalan in the Province of Negros Occidental with the Municipality of Basay in the Province of Negros Oriental. It passes through the Municipalities of Ilog, Cauayan, Sipalay and Hinobaan. Figure 1-1 shows the location of the project in terms of the road network of Regions VI and VII and Figure 1-2 presents the location of the road project.

The road project is located along the southwestern coast of the Island of Negros in the Provinces of Negros Occidental and Negros Oriental. These two provinces are situated in the Western Visayas (Region VI) and Central Visayas (Region VII) Regions, respectively. Agriculture is the main economic activity in the road's area of influence with rice, sugarcane and copra as the major crops. Fishing is also one of the sources of income of the residents, particularly in coastal areas.

The primary objectives of this project are to reduce travel time and cost as well as to promote economic development in its area of influence.

C. EXISTING ROAD CONDITION

Five traffic sections have been identified for the Kabankalan-Basay Road. These traffic sections are passable by all types of vehicles all year long.

The length and present condition of this roadway is presented in Table 1-1.

TABLE 1-1

EXISTING ROAD CONDITION

Homogeneous Traffic Section	Length (km)	Pavement Type/ Condition
Kabankalan-Ilog	2.4	PCC/Good
Ilog-Cauayan	20.0	Asphalt/Bad (0.7 km)
		Gravel/Fair (8.4 km)
		PCC/Fair (10.9 km)
Cauayan-Sipalay	56.6	PCC/Fair (10.3 km)
		Gravel/Fair (45.2 km)
		Asphalt/Bad (1.1 km)
Sipalay-Hinobaan	21.0	Gravel/Fair (19.0 km)
		PCC/Fair (0.2 km)
		Asphalt/Bad (1.8 km)
Hinobaan-Basay	32.2	Gravel/Fair
TOTAL	132.2 km	

D. CRITERIA FOR ECONOMIC VIABILITY

The economic criterion employed to determine the economic viability of the road is:

- The economic internal rate of return (IRR) with development benefits, vehicle operating cost savings, road maintenance savings and time savings, e.g. "all" the benefits, should be at least 15 percent.

E. SUMMARY OF ECONOMIC ANALYSIS

A summary of the evaluation of the Kabankalan-Basay Road is shown in Table 1-2. IRRs and net present values were calculated for:

- o the base benefit and cost scenario;
- o a scenario with costs increased by 15 percent;
- o a scenario with benefits reduced by 15 percent; and
- o a scenario with costs increased by 15 percent and benefits reduced by 15 percent.

In each of the four scenarios, the economic indices are presented estimating benefits with and without passenger time savings.

12

The five sections of the proposed Kabankalan-Basay Road Project are not feasible under either the base benefit/cost scenario or under any of the sensitivity analysis scenarios.

The traffic sections of Kabankalan-Basay present economic rates of return in the range of 3.7 to 13.9 percent under the base-case scenario when considering passenger time savings. In the worst case scenario, considering an increase in costs of 15 percent, a decrease in benefits of 15 percent and no passenger time benefits, all sections show unacceptable economic returns with IRRs ranging from 1.3 to 8.6 percent.

Kabankalan-Ilog presents the poorest economic return, with a base-case "all-benefit" IRR of 3.7 percent. This section is currently paved with PCC and is in generally good condition. The costs of the proposed improvements cover mainly the upgrading of the section's shoulders, for which only limited VOC benefits can be expected.

The middle three sections of the proposed project do not meet the required economic criteria, with base-case IRRs of 9.3 percent in the case of Ilog-Cauayan, 13.9 percent in the case of Cauayan-Sipalay and 10.1 percent in the case of Sipalay-Hinobaan.

The southern most section, Hinobaan-Basay, presents an unacceptable base-case IRR of 11.6 percent. One of the elements which causes this unacceptable economic return is the number of bridges in need of reconstruction/replacement. Hinobaan-Basay would meet required economic criteria with an IRR of 15.2 percent, if bridge improvement costs were excluded. The other four sections would not be feasible even if all bridge improvement costs were excluded.

However, a road section without acceptable bridges does not serve its purpose and is not recommended for implementation. Most of the proposed bridge improvements are badly needed. Even considering a possible prioritization of these improvements, which would schedule for immediate action only a few bridges, this road section would not reach the cut-off 15-percent IRR. Only approximately P 500,000 in bridge reconstruction/replacement can be borne by this section.

Chapter VII summarizes the economic evaluation of the proposed improvements for this road project. Chapters VIII and IX provide social soundness and energy analyses, respectively.

An environmental assessment will be provided in a separate volume.

F. RECOMMENDATIONS

Based on the results presented above, the Consultants do not recommend the reconstruction of the five sections of the proposed Kabankalan-Basay Road: Kabankalan-Ilog, Ilog-Cauayan, Cauayan-Sipalay, Sipalay-Hinobaan and Hinobaan-Basay.

G. ESTIMATED COST OF PROPOSED CONSTRUCTION

No financial expenditures are scheduled for this project since there are no recommended improvements.

TABLE 1 – 2
ECONOMIC ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

INTERNAL RATES OF RETURN

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Internal Rate of Return				Internal Rate of Return				Internal Rate of Return				Internal Rate of Return			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN–ILOG	3.4%	3.7%	3.4%	3.7%	2.2%	2.5%	2.2%	2.5%	2.4%	2.7%	2.4%	2.7%	1.3%	1.5%	1.3%	1.5%
ILOG–CAUAYN	7.7%	9.3%	7.7%	9.3%	6.2%	7.7%	6.2%	7.7%	6.4%	7.9%	6.4%	7.9%	5.0%	6.4%	5.0%	6.4%
CAUAYN–SPALAY	11.9%	13.9%	11.7%	13.9%	10.1%	11.9%	9.9%	11.9%	10.3%	12.2%	10.1%	12.2%	8.6%	10.3%	8.4%	10.3%
SPALAY–HNBAAN	8.1%	10.1%	8.1%	10.1%	6.5%	8.3%	6.5%	8.3%	6.7%	8.6%	6.7%	8.6%	5.2%	6.9%	5.2%	6.9%
HNBAAN–BASAY	9.6%	11.6%	9.6%	11.6%	7.9%	9.8%	7.9%	9.8%	8.1%	10.0%	8.1%	10.0%	6.5%	8.3%	6.5%	8.3%

II. ECONOMIC OVERVIEW

The proposed Kabankalan-Basay Road is 132.2 km. long. It consists of five sections; Kabankalan-Ilog, Ilog-Cauayan, Cauayan-Sipalay, Sipalay-Hinobaan and Hinobaan-Basay. From Kabankalan in Negros Occidental, it proceeds in a northwest direction towards the municipality of Ilog, then in a westward direction to Barangay Linaon in Cauayan municipality. The road then proceeds in a southeast direction and terminates at the municipality of Basay in Negros Oriental. Almost the entire road is in Negros Occidental. The road passes through agricultural areas near or along the coastline and through a forested area along its route. The existing road condition varies from good to fair to poor and the surfacing is generally of gravel with some short stretches of concrete and asphalt pavements.

The major economic function of the road would be to provide better access between the more progressive town of Kabankalan in Negros Occidental to the rural town of Basay in the northern most part of Negros Oriental. The road would also provide improved communication and facilitate efficient movement of goods and passengers between the points along the route. Thus, the road would play an important role in the integration of the regional transportation network as well as the economy of the southern part of the island of Negros.

A. THE PROVINCES OF NEGROS OCCIDENTAL (REGION VI) AND NEGROS ORIENTAL (REGION VII)

1. GENERAL BACKGROUND

The provinces of Negros Occidental and Negros Oriental comprise Negros island in the Visayas. The provinces belong to two different regions with Negros Occidental under the Western Visayas Region and the Negros Oriental under the Central Visayas Region. The island is known as the sugarbowl of the country for its vast sugarcane plantations. Each province represents the biggest in their respective regions. They are separated from each other by the 2,470 meter high Kanlaon Volcano and the adjoining mountain ranges of Mt. Mandalagan and Mt. Silay.

Negros Island is bounded on the north by the Visayan Sea, on the east by the Tanon Strait, on the northwest by the Guimaras Strait and on the south by the Sulu Sea. It is located approximately a thousand kilometers southeast of Manila. Its total land area is 13,328 sq. kms., 60% of which is occupied by Negros Occidental. The provinces are accessible by plane from Manila and Cebu and by marine vessels coming mostly from the different parts of the Visayas.

16

a. Topography, Climate and Land Uses

i. Negros Occidental

Negros Occidental occupies a total land area of 7,926 sq. km. representing about 40% of that of the region. It consists of twenty-five municipalities and six cities. The largest municipality is Kabankalan (726 sq. km.). Bacolod City, the seat of the provincial government is 156 sq. km. in land area.

The topography of the province consist of largely level plains and gently rolling slopes in the northern and western parts. The rest is mountainous with varying elevations. The drainage system is composed of six big rivers (the biggest of which is the Ilog River) and their tributaries.

The province has a dry season from December to May in the northern part and from November to May in the southern part. It is wet for the rest of the year.

The land classification of the province as of 1988 is as follows:

Land Classification	Area (Has.)	Percentage (%)
Certified Alienable and Disposable Land	595,591	75%
Classified Forest Land	196,188	25%
Established Forest Reservation	68,915	
Established Timberland	97,569	
National Parks/GRBS/ Wilderness Area	22,651	
Civil Reservation	235	
Fishpond	6,818	
Unclassified Forest Land	828	-
Total	792,607	100%

The soil of Negros Occidental is considered to have come from two distinct origins: coralline and volcanic. The northern part of the province, which is largely influenced by the proximity of the sea coast, is of coralline origins. The southern part, especially the interior, which is strategically influenced by the presence of the Kanlaon Volcano, is of volcanic origin. The various soil types include clay, which occupies a majority of the flatlands, clay loam, gravelly loam, hydrosoil which is found along the northwestern coastline, loam, mountain

soil which is found along the mountain ranges, sandy loam, sandy clay loam and silt loam.

Based on the 1980 Census of Agriculture, the province has the following agricultural land use:

Land Use	No. of Farms	Area (Has.)
Arable Land		
Under Temporary Crops	55,527	210,393
Lying Idle	8,030	25,884
Land under permanent crops	16,722	38,787
Land under permanent meadows and pastures	1,852	5,374
Land covered with forest growth	2,635	6,941
All other lands	3,513	8,540
Total	88,279	295,919

ii. Negros Oriental

The province of Negros Oriental occupies three-fourths of the eastern coast of the island of Negros. It has a total land area of 5,402 sq. km. representing one-fourth of the total regional land area. It has 22 municipalities and three cities. The biggest municipality is Bayauan (723 sq. km.). Dumaguete City, the seat of the provincial government and the center of economic and social activities has only 56 sq. km. of land area.

The topography is characterized by rolling hills, occasional plateaus and some mountain peaks, the foothills of which extend up to the coast. Between peaks there are small fertile valleys and plains, the largest of which are the settlements of Bais, Tanjay, Dumaguete, Siaton and Sta. Catalina. The province's highest peak rising 2,470 meters above sea level, is Mt. Kanlaon, an extinct volcano which the province shares with Negros Occidental along their boundaries.

The seasons of Negros Oriental are not very pronounced, but the climate is relatively dry from January to May and wet during the rest of the year. The average annual rainfall recorded in Dumaguete weather station is 1,302 mm. The driest month is April while October has the most number of rainy days. The annual

average temperature is 28°C and the average humidity is 79%.

The soil in the province consists predominantly of igneous materials except for the eastern and western rims which have limestone soil. The igneous soil is very acidic due to low calcium content.

The province has the following land classification as of 1988:

Land Classification	Area (Has.)	Percentage (%)
Certified Alienable and Disposable Land	258,865	48%
Classified Forest Land	218,271	40%
Established Forest Reservation	8,570	
Established Timberland	207,694	
National Parks/GRBS/ Wilderness Area	1,906	
Fishpond	101	
Unclassified Forest Land	63,091	12%
Total	540,227	100%

Based on the 1980 Census of Agriculture, the province has the following agricultural land use:

Land Use	No. of Farms	Area (Has.)
Arable Land		
Under Temporary Crops	74,010	132,367
Lying Idle	13,043	28,974
Land under permanent crops	31,560	52,553
Land under permanent meadows and pastures	1,825	9,467
Land covered with forest growth	1,411	4,016
All other lands	4,575	8,757
Total	126,424	236,134

b. Administrative Structure

The province of Negros Occidental has twenty six municipalities and six cities. These cities and municipalities are divided into 650 barangays. Bacolod City has the most number of barangays at 60. Kabankalan has 31 barangays while the other municipalities traversed by the road project have the following: Cauayan (25), Hinobaan (13), Ilog (15) and Sipalay (15).

Negros Oriental has a total of 555 barangays. Bais City has the most number of barangays at 35. Basay has only ten barangays.

2. POPULATION CHARACTERISTICS

a. Negros Occidental

The 1990 population estimate for Negros Occidental is 2,346,520 with an annual average growth rate of 1.6%. The population consists of four-fifths Ilongos and one-fifth Cebuanos.

In 1980, two out of three (65%) Negros Occidental households were rural. Only three out of ten (30%) owned the land on which their house was built. Education was widespread. Four out of five (80% men and 82% women) were literate and three-tenths (30%) had received high school or higher education. Average employment level (52%) matches that of the Philippines (51%). Four out of five (80%) men versus 24% of the women were employed. Of those employed, 67% of the men and 32% of the women were employed in agriculture.

In Negros Occidental, only four out of nine (45%) of urban homes and 9% of rural homes had electricity. One out of four (27%) urban homes and 3% of rural homes had their own water tap. Only three out of fifty (7%) urban homes and one out of fifty (2%) of rural homes have their own well. Eight out of ten (78%) urban and nine out of ten (89%) of rural households cook with charcoal or wood. Seven out of ten (69%) urban households and 61% of rural households have radios.

b. Negros Oriental

The population of Negros Oriental is less than that of Negros Occidental. It is estimated at 974,331 for 1990, with a 1.3% annual average growth rate. In 1980, five out of six (83%) houses were rural and 59% of these were owned by their occupants. The population is 94% Cebuanos and the rest Ilongos and Tagalogs.

Literacy and education levels were less than for Negros Occidental. Seven out of ten (69% for men and 71% for women) were literate, and 18% had received high school or higher education. The average employment level was higher than that of Negros Occidental (55%) and more than that of the Philippines (51%). Five out of six (86%) of men over 15 years old and 24% of the women were employed. Of those employed, (80%) of the men and 50% of the women were employed in agriculture.

Urban families in Negros Oriental had more facilities than rural families. Four out of nine urban homes (43%) and 5% of rural homes had electricity. Only one out of five (21%) of urban homes and 4% of rural homes had their own water tap. Only one out of seven of urban homes (14%) and 3% of rural homes had their own wells. Four out of five (80%) urban households and 88% of rural households cooked with charcoal or wood. Two thirds (67%) of urban households and 48% of rural households had radios.

3. FAMILY INCOME AND EXPENDITURES

Negros Oriental is relatively better-off than Negros Occidental. With an average income of P 21,957 in 1985, Negros Oriental ranks 40th. Negros Occidental has an average income of P 19,874 and ranks 53rd among the country's 74 provinces.

TABLE 2-1

MAIN SOURCE OF INCOME FOR NEGROS OCCIDENTAL COMPARED WITH REGION VI (W. VISAYAS) AND NEGROS ORIENTAL COMPARED WITH REGION VII (C. VISAYAS) AND THE PHILIPPINES
(Percentages)

Main Source Of Income	Negros Occidental	Region VI	Negros Oriental	Region VII	Philippines
Agricultural Wages/Salaries	37.9%	22.8%	7.4%	4.3%	9.2%
Non-Agricultural Wages/Salaries	19.2	21.4	24.1	33.5	31.1
Agricultural Entrepreneurial	21.4	26.7	41.1	30.0	28.5
Non-Agricultural Entrepreneurial	12.3	10.3	15.6	13.9	12.4
Other	9.2	18.8	11.8	18.3	18.8
	100.0%	100.0%	100.0%	100.0%	
Total Families (Thousands)	316.7	881.6	165.8	783.8	9,847.3

SOURCE: National Census & Statistics Office. 1987. 1985 Family Income and Expenditures Survey, Vol. II. Manila: NCSO.

Three-fifths (59%) of families in Negros Occidental and 49% in Negros Oriental were engaged in agriculture-related enterprises. These percentages are higher than those of their respective regions (50% and 34%) and those of the Philippines 38%. (see Table 2-1).

In general, the poorer the family the higher the proportion of their income spent on food. Negros Occidental families spend more of their income on food than the average for Region VI and the Philippines (56% versus 52%). On the other hand, Negros Oriental families spend less of their income on food than Region VII, 57% versus 59%, but more than that of the Philippines (52%).

The above population and family income data are used both in the traffic analysis of Chapter III and the social soundness analysis of Chapter VIII.

4. STRUCTURE OF PROVINCIAL ECONOMIES

a. Introduction

The island's economy is based largely on agriculture. About 37% of the total land area in Negros Occidental and 44% of total land area in Negros Oriental was devoted to agriculture in 1980. Fifty-nine percent (59%) of the total working population in the western province is in agriculture and agri-based activity and forty-eight percent (48%) in the eastern province.

The island is known as the "sugar bowl of the Philippines". Its agricultural economy is based primarily on sugarcane production although production has dropped significantly as a result of the dramatic decline for the demand of sugar in the early 80's due to the acceptance of corn syrup as a sugar substitute and the introduction of artificial sweeteners. About thirty percent (30%) of the area planted to sugarcane was converted into prawn farms or planted with corn and palay. Nevertheless, the substituted activities were still within the agricultural sector.

Industry, particularly the mining industry, constitutes another significant sector of the provincial economies. When the vast mineral deposits in both provinces are fully mined, a significantly share in the Island's economy could come from this sector.

b. Agriculture, Fishery and Forestry

i. Negros Occidental

Negros Occidental grows sugarcane, coconut, palay, corn, banana, rootcrops, coffee, vegetables and others. The province is the top sugarcane producer of the country.

In 1988, the province had an estimated sugarcane production of 8,209,752 MT valued at P 4,351 million. (see Table 2-2). The provincial production represents 93% of the region's output and

TABLE 2 - 2

AGRICULTURAL PRODUCTION
PROVINCE OF NEGROS OCCIDENTAL

	1980 OUTPUT (MT)	1988 OUTPUT (MT)	1988 VALUE (P MILLION)	1980-88 EST.GROWTH RATE(%)
AGRICULTURAL ACTIVITIES				
Palay	214,430	238,168	719	1.32%
Corn	6,455	8,705	23	3.81%
Banana	90,772	60,768	142	-4.89%
Mango	11,611	15,196	124	3.42%
Coffee	2,109	3,012	93	4.56%
Coconut	94,731	89,482	82	-0.71%
Sugarcane	12,183,238	8,209,752	4,351	-4.81%
Rootcrop	20,961	14,278	24	-4.69%
Vegetable	6,478	4,411	32	-4.69%
Other Crops	3,847	2,960	16	-3.22%
SUB-TOTAL	12,634,632	8,646,732	5,607	-4.63%
Livestock	25,558	31,713	604	2.73%
Poultry	1,192	4,490	133	18.03%
SUB-TOTAL	26,750	36,203	737	3.86%
FISHERIES				
Commercial	100,589	93,786	1,705	-0.87%
Municipal	37,285	54,349	998	4.82%
SUB-TOTAL	137,874	148,135	2,703	0.90%
FORESTRY	*	*	-	-
TOTAL	12,799,256	8,831,070	9,046	-4.53%

Sources: 1980 Census of Agriculture and Fisheries, Bureau of Agricultural Statistics, and Consultants.

* Data not available.

52% of that of the total national production.

Palay is the second most significant crop in terms of gross value added. The estimated value of production is P 719 million from a total output of 238,168 MT. Production increased by eleven percent from 1980 as a result of an increase in production area.

Banana and mango are two significant commercial crops grown in the province. The values of production are P 101 million and P 124 million respectively. They, however, have contrasting trends in production as banana declined by 4.89% per annum, while mango grew by 3.42% annually since 1980.

As regards to livestock, the province maintains a low livestock inventory level. The total livestock population in 1988 represented 38% of that of the region. The livestock production is estimated at 31,713 MT, valued at P 604 million. On the other hand, poultry production, of which 87% is chicken, is estimated to be 4,490 MT, valued at P 133 million. Poultry production grew almost four times over its 1980 output. Both livestock and poultry production are mostly backyard-raised.

The fishery sub-sector produced a total catch of 148,135 MT valued at P 2,703 Million in 1988. About 63% of the total catch came from commercial fishing.

ii. Negros Oriental

Negros Oriental grows corn, sugarcane, palay, coconut, banana, rootcrops, abaca, coffee, vegetables and others. None of its crops significantly contribute to Central Visayas total crop output except for sugarcane, which represents approximately half of the region's production.

Sugarcane is the province's most significant crop in terms of the gross value of production. Its contribution to the agricultural economy is estimated at over half a billion pesos in 1988 from a production of 1,015,607 MT. (see Table 2-3). The area planted to this crop, however, was reduced from 26,949 hectares in 1980 to 13,409 in 1988.

Coconut is the next significant crop by virtue of its contribution to the agricultural economy of the province. Harvested from an area of 45,922 hectares, the total estimated output is 136,868 MT valued at P 390 million.

Palay and corn are two major staple crops grown which provided significant contributions to the provincial economy. Estimated production was 67,113 MT and 84,389 MT respectively for palay and corn, both experiencing growth rates of more than two percent annually since 1980. Corn area increased by 10%, while palay area was reduced by similar percentage from 1980.

The province's livestock population accounted for 28% of Central Visayas' over-all inventory. Hogs constituted about half of the livestock population in the province followed by

TABLE 2 - 3

AGRICULTURAL PRODUCTION
PROVINCE OF NEGROS ORIENTAL

	1980 OUTPUT (MT)	1988 OUTPUT (MT)	VALUE (P MILLION)	1980-88 EST.GROWTH RATE(%)
AGRICULTURAL ACTIVITIES				
Palay	55,665	67,113	215	2.37%
Corn	67,460	84,389	235	2.84%
Banana	13,767	13,562	18	-0.19%
Mango	4,713	3,795	29	-2.67%
Coffee	60	51	2	-2.01%
Coconut	139,748	136,868	390	-0.26%
Sugarcane	1,361,394	1,015,607	538	-3.60%
Rootcrop	3,372	1,606	3	-8.86%
Vegetable	1,719	2,154	14	2.86%
Other Crops	992	1,231	7	2.73%
SUB-TOTAL	1,648,890	1,326,376	1,451	-2.68%
Livestock	16,638	20,822	366	2.84%
Poultry	786	1,229	37	5.75%
SUB-TOTAL	17,424	22,051	403	2.99%
FISHERIES				
Commercial	1,688	6,029	93	17.25%
Municipal	4,974	2,299	39	-9.20%
SUB-TOTAL	6,662	8,328	132	2.83%
FORESTRY	*	*	-	-
TOTAL	1,672,976	1,356,755	1,985	-2.58%

Sources: 1980 Census of Agriculture and Fisheries, Bureau of Agricultural Statistics, and Consultants.

* Data not available.

goats (26%). Livestock production in 1988 was estimated at 20,822 MT valued at P 366 million. Poultry production on the other hand was estimated at 1,229 MT valued at P 37 million, posting an annual growth rate of 5.75% since 1980. Both poultry and livestock are mostly backyard-raised.

The fishing sub-sector provided P 132 million to the provincial economy from an estimated production of 8,328 MT. About three-fourths of the total catch came from commercial fishing.

c. Mining and Other Sectors

i. Negros Occidental

The province has great potential for diversification into non-agricultural based industries with its rich reserve of metallic as well as non-metallic minerals. It has the biggest metallic ore reserve in Region VI and its copper reserve is the second largest in the country, accounting for as much as 27% of the national reserve. Negros Occidental has the only molybdenum reserve in the region, estimated at 58,000 MT, representing the largest of the three known molybdenum deposits in the country and accounting for 78% of the national total. Its iron ore deposit, estimated at 44,000 MT is the biggest in the Western Visayas. Other metallic mineral of still unknown quantity is the titaniferous magnetite sand which can be found in the northern part of the province and the only one of its kind in the region.

The non-metallic mineral resources include limestone, cement, gypsum, clay and sulfur. Limestone deposits are estimated at 524,428 MT, representing 74% of the total regional reserve. Cement reserves are estimated at 285 million MT, the biggest in the region, can be found in the Municipality of Ilog.

The province has a number of tourist spots and activities attracting foreign and local tourists. One of these activities is the Bacolod Mardi Gras-like festival known as the "Masskara", held in the third week of October. Another is the "Sinulog" held in the third weekend of January, which is the Kabankalan version of Aklan's "Ati-atihan" and Iloilo's "Dinagyang". Tourist spots include the Mambucal Mountain Resort with its sulfurous hot springs and cool mountain streams; Santa Fe Resort, with its small zoo visited by naturalists; the Taytay Beach Resort, and the Kanlaon Volcano area for hiking, sightseeing, picnicking and swimming. The Department of Tourism in Bacolod City offers various activities such as 5-Day Steam Locomotive Tour, 4-Day Kanlaon climb, 3-Day War Memorial Tour, 8-hour sugarmill and city tour and a 3-day Island Hoping Tour. There are also a number of antique shops, hotels and restaurants catering to the needs of the foreign visitors.

Commerce and trade includes a number of cottage industries in various parts of the province involved in basketweaving, shellcraft, knitting, woodworking, fruit processing and ceramics manufacturing. Most of these products are sold in various outlets in Bacolod City but are manufactured in suburban areas.

Other forms of business include wholesaling and retailing, banking and finance, transportation, communication and service among others. As of 1985, there were 35 commercial banks, 27 pawnshops, 29 rural banks, 12 financing companies and two thrift banks. A Development Bank started operations in 1988. There are six ice plants in the province which operate in Bacolod City (2), Hinigaran (2), Silay and San Carlos City (one each). A government-operated iceplant and cold storage exists in Saravia.

ii. Negros Oriental

Negros Oriental is one of the metallic mineral-producing provinces in Region VII. Its mineral products include gold, silver, copper (metal), molybdenum (metal), copper concentrate and molybdenum concentrate. There is an estimated 54,100 MT of gypsum reserve in the municipality of Tayasan. The 1982 Bureau of Mines and Geo-Sciences statistics reveal that the total value of production of metallic minerals was estimated at P 96.5 million with copper (metal) earning 90% of the province's output.

Non-metallic minerals are also produced in the province including sand and gravel, stones, cobbles and boulders. The total production of non-metallic minerals in 1982 was estimated at P 13 million.

There are various tourist attractions in the province. Among spots visited by tourists are the Silliman University, which is the oldest Protestant Institution of higher learning in the country; the Philippine-Japanese Amity Shrine, the Siaton Bird Sanctuary and the Kanlaon Volcano Park for sightseeing. The Apo Island in the southern part of the province offers good snorkeling, swimming, and diving sites.

Commerce and trade consists of wholesaling and retailing, banking and finance, construction, manufacturing, communication, transportation, and service businesses among others. As of 1988, there were 10 commercial banks and one Development Bank in the province while as of 1985, there were 18 Rural Banks, one Savings and Mortgage Bank, and one Thrift Bank. Three private ice plants operated as of 1987 in Sibuyan, Dumaguete City and Bayawan. A number of communication facilities also operate in the province. Majority of these businesses operate in the three cities and in more developed communities of the province.

B. TRANSPORT SYSTEM

1. ROAD NETWORK

The Kabankalan-Basay road project starts in the Municipality of Kabankalan at the junction of the roads going to Bacolod City and to the Municipality of Ilog. From this point, it proceeds northwest to the Municipality of Ilog, then westward up to Barangay Linaon in the municipality of Cawayan. The road then proceeds southeast and terminates at the municipality of Basay passing through the municipalities of Sipalay and Hinobaan.

27

The existing road condition varies from good to fair to poor and the surfacing is generally of gravel with some short stretches of concrete and asphalt pavements along the route. The road passes through coastal flatlands and some mountainous terrain. Figure 2-1 shows the location of the road and Figure 2-2 shows the location of the road in the network.

a. Negros Occidental

The total road network in Negros Occidental is 5,288 kms. including that of its six cities. (see Table 2-4).

TABLE 2-4

EXISTING ROADS BY CLASSIFICATION
NEGROS OCCIDENTAL

Classification	Total Road Length (Kms)
National	870.0
Provincial	890.0
Municipal	213.0
Barangay	3,315.0
Total	5,288.0

Source: DPWH, 1988

b. Negros Oriental

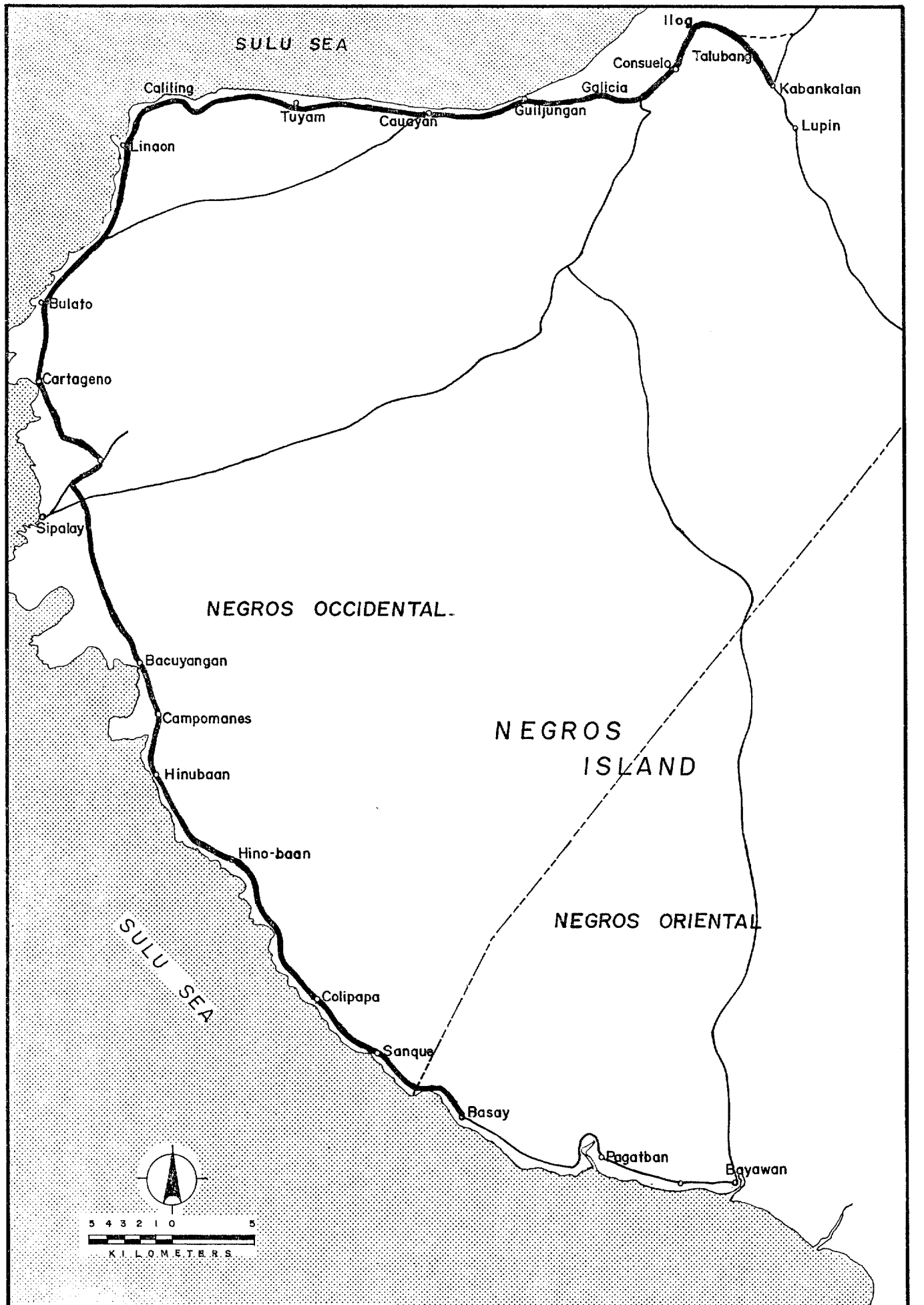
The total road network in Negros Oriental as of 1988 is 1,814 kms. including that of its three cities. (see Table 2-5).

TABLE 2-5

EXISTING ROADS BY CLASSIFICATION
NEGROS ORIENTAL

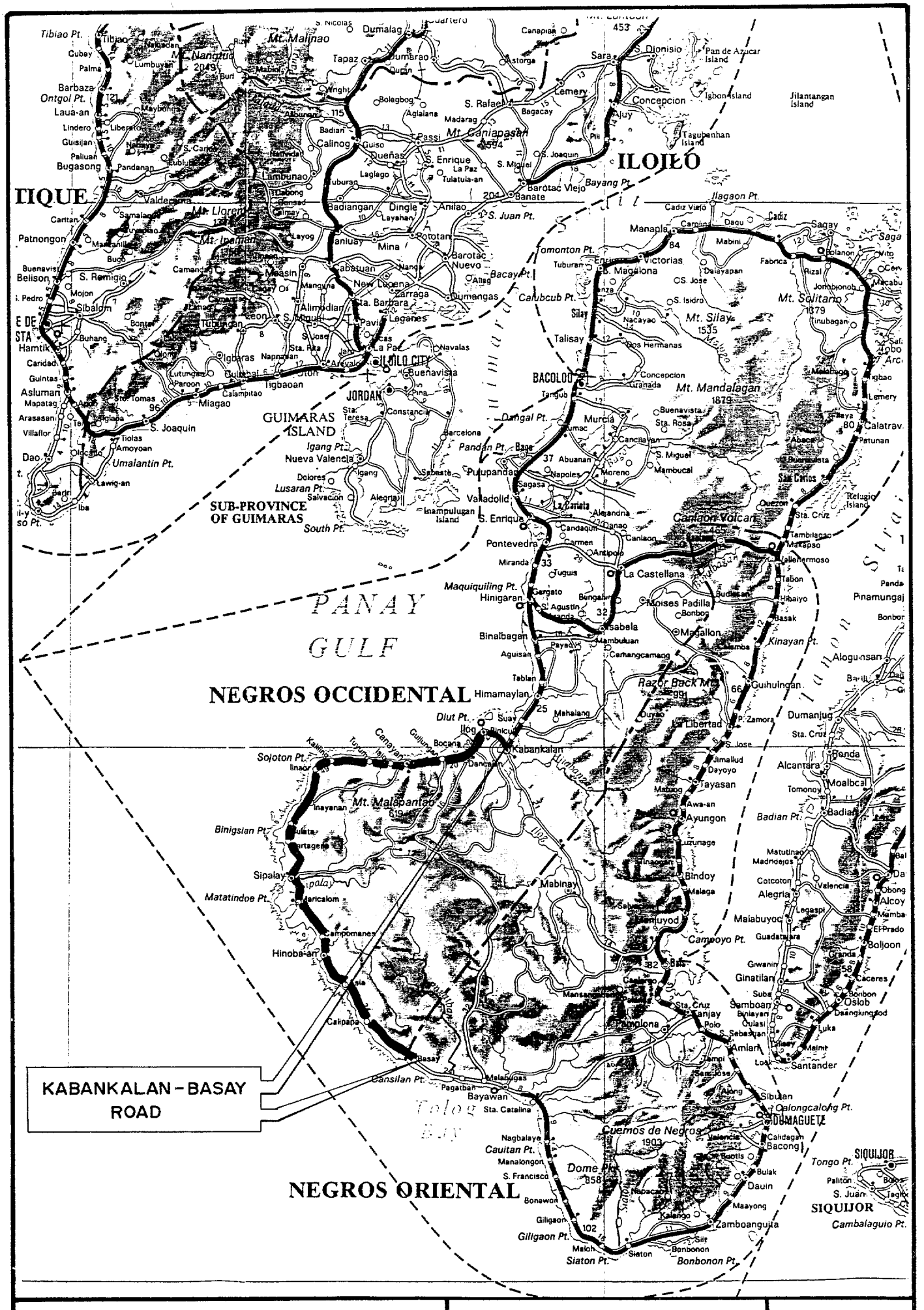
Classification	Total Road Length (Kms)
National	300.0
Provincial	195.0
Municipal	215.0
Barangay	1,104.0
Total	1,814.0

Source: DPWH, 1988



RURAL INFRASTRUCTURE FUND PROJECT	PROJECT ROAD MAP Kabankalan - Basay Road	Figure 2-1

29



RURAL INFRASTRUCTURE FUND PROJECT	PROJECT ROAD MAP Kabankalan - Basay Road	Figure 2-2

2. VEHICLE REGISTRATION

a. Negros Occidental

There was no available data on vehicle registration for the province of Negros Occidental. However, data about the vehicle registration was obtained for the municipalities of Hinobaan and Sipalay. (see Table 2-6).

TABLE 2-6

REGISTERED VEHICLE

Type of Vehicle	Hinobaan	Sipalay
Motorized tricycle	108	75
Public utility jeep	23	28
Others	129	229
Total	260	332

Source: Municipal Planning and Development Office

b. Negros Oriental

There was no available data on vehicle registration for this province.

3. SEA TRANSPORTATION

a. Negros Occidental

There is one national port, four municipal ports, four municipal fishing ports and twenty six private ports. The national port is the sub-port of Pulupandan, while the private ports are owned by big commercial/industrial firms such as Caltex, Marinduque Mining Corp., San Miguel Corporation, Petrophil and many others.

b. Negros Oriental

There are six municipal ports and two municipal fishing ports under the management of the Philippine Ports Authority in this province.

4. AIRPORTS

a. Negros Occidental

In this province, there is one national airport located in Bacolod City, and fourteen private airports.

There are four Philippine Air Lines B-737 flights covering Manila-Bacolod route daily; one B-737, two Fokker 50 and one SD-360 flights covering Cebu City-Bacolod City route daily, and one SD-360 flight covering Iloilo City-Bacolod City route daily.

b. Negros Oriental

There is one national airport located in Dumaguete City and three private airports in various parts of the province.

A Philippine Air Lines BAC-111 flight covers Manila-Dumaguete route daily, three SD-360 flights cover Cebu City-Dumaguete City route daily, and a SD-360 flight cover Dipolog-Dumaguete City route four times a week.

C. THE ZONE OF INFLUENCE

1. INTRODUCTION AND GEOGRAPHIC SETTING

The project road is a part of the Negros Island circumferential road. It connects the municipality of Kabankalan in the western province to the municipality of Basay a short distance beyond the Negros Oriental provincial limits. The existing road passes along the south western coast of the island and serves the municipalities of Hinobaan, Ilog, Cauayan and Sipalay in Negros Occidental.

The zone of influence is the rural land extending up to five kilometers on either side of the road. It consists of 17 sq. km. in the Municipality of Kabankalan, 65 sq. km. in Ilog, 119 sq. km. in Cauayan, 162 sq. km. in Sipalay, 166 sq. km. in Hinobaan and 23 sq. km. in Basay. The total land area covered by the zone of influence is 552 square kilometers. The zone of influence is limited by the coastal waters of the Sulu Sea on the west and by the influence of other existing roads linking to the project road.

The topography of the zone of influence varies from coastal flatlands and plain areas to rolling hills and mountains. The rolling hills and mountains are forested with signs of denudation and soil erosion in various parts. The coastal flatlands are extensively engaged in agricultural activities with sugarcane and coconut as the predominant crops. There are also palay, corn, fruit trees, bananas and vegetable grown in these areas. Some portions of the rolling hills and mountains are also engaged in commercial crops production like mango and coconuts. There are also fishpond areas in the municipality of Ilog.

Based on the land use opportunity map prepared by the Bureau of Soils and Water Management of the Department of Agriculture, a wide expanse of watershed region exists in Hinobaan which should be permanently retained to forest environment and should be protected from any intrusion of human or agricultural elements (see Figures 2-3a and 2-3b). However, a considerable area in Hinobaan which falls within the critical watershed is already subjected to various forms of land use abuses. Various forms of

Need in watershed not. forest

32

active and inactive erosional processes are evident. For ecological reasons, these areas are at the moment best used for forest and economic trees with the former being preferable.

2. POPULATION

The population in the zone of influence is estimated as 250,000 with 247,000 in Negros Occidental and 3,000 in Basay, Negros Oriental. The population is distributed in the five municipalities of the western province as follows: 18,000 in Kabankalan, 25,000 in Ilog, 61,000 in Cauayan, 57,000 in Sipalay and 86,000 in Hinobaan. The population were based from the estimated population densities of the two provinces.

3. THE LOCAL ECONOMY

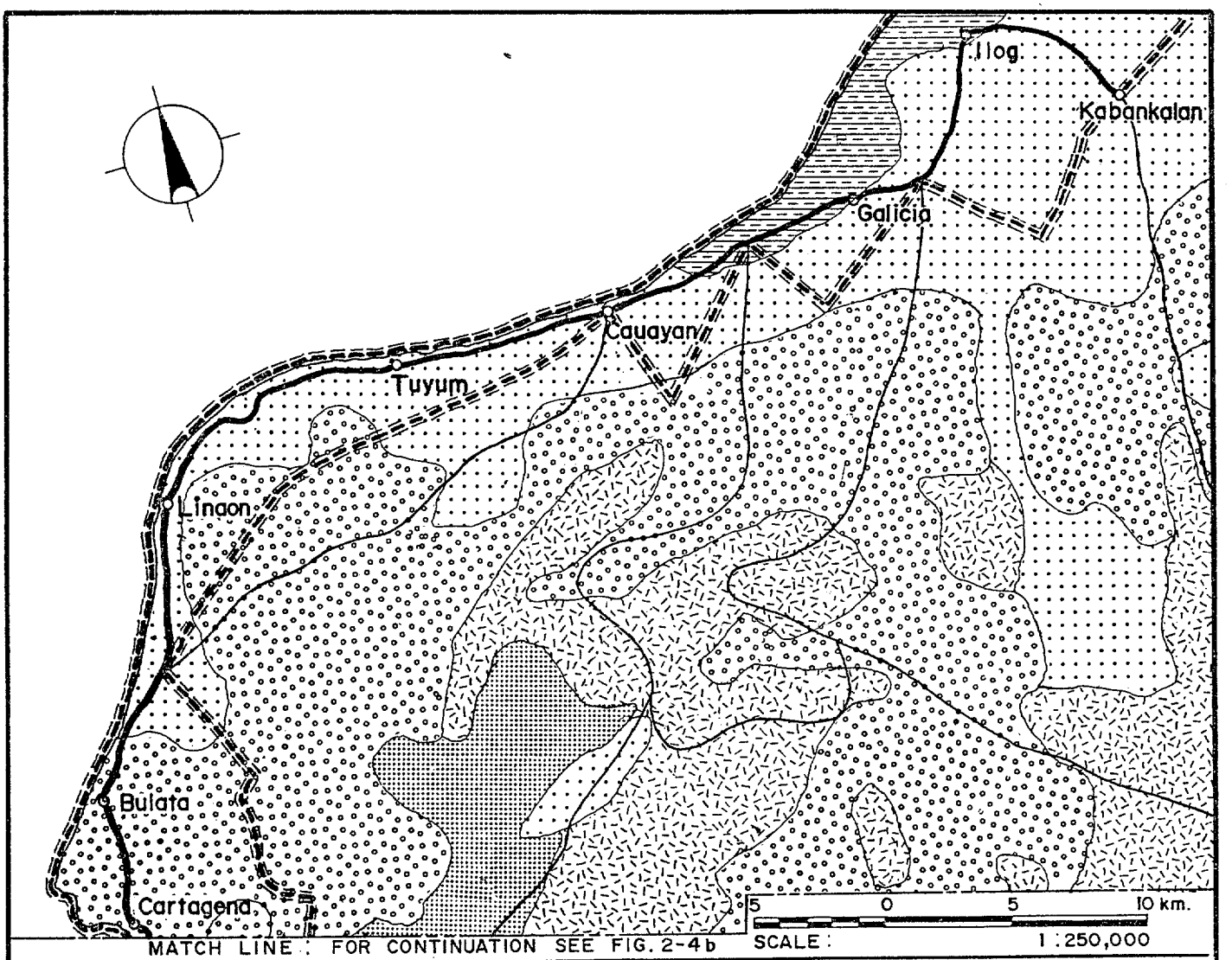
The main economic activity in the zone of influence is agriculture and fishery. The major crops grown are coconut, rice, corn and sugarcane. Other crops grown are banana, rootcrops, vegetable and fruit trees. Most of the sugarcane is grown in Kabankalan where two sugar mills exist; the Southern Negros Development Corporation and the Cagongcogon Sugar Central. Farmers already adopt modern method of farming practices like the application of fertilizer and high yielding seed varieties, integrated pest management, crop diversification and SALT (sloping agricultural land technology).

Fishing activities occur along the municipal coasts constituting the indirect zone of influence. The Sulu Sea area constitutes the zone's rich fishing ground. There are also wide areas of fishponds particularly in the municipality of Ilog, where prawns and bangus are cultured. In Hinobaan, there is no ice plant or cold storage to support the sector's 4,000 fishermen.

There are tourism activities taking place in the zone of influence, the most popular being the "Sinulog" Festival held in Kabankalan in the month of January. It is the local version of Kalibo's "Ati-Atihan" and Iloilo's "Dinagyang". Foreign and local tourists participate in these festivities. Other tourist attractions include a number of fine beaches, ideal for picnicking and swimming.

White copper mining is undertaken in Sipalay. Another municipality which has deposits of various mineral resources like gold, copper and iron ore is Hinobaan. Manganese, rock phosphate, coal and limestone can be found in Kabankalan. Their quantities, however, are still to be determined.

Trade and commerce in the zone of influence consists of various business, the majority of which are concentrated in the town centers. Among the more common enterprises, there are sari-sari stores, tailoring shops, eateries , drug stores and bakeries. Manufacturing includes rice mills, corn mills and hollow-block making among others. There is a bus company in Hinobaan with eleven bus units plying the Bacolod, Bayawan and Dumaguete routes. Cottage industries also exist such as



LEGEND :

THESE ARE LANDS THAT ARE ACTIVELY UTILIZED FOR VARIOUS AGRICULTURAL ACTIVITIES. THEY INCLUDE VARIOUS DEVELOPMENT INFRASTRUCTURE SUCH AS ROADS, BRIDGES, IRRIGATION, AND HUMAN SETTLEMENT AREAS.

THESE ARE IDLE, LESS UTILIZED LANDS THAT HAVE POTENTIAL FOR VARIOUS FORMS OF WELL MANAGED AGRICULTURAL USES. THEY INCLUDE SLOPING LANDS THAT BASICALLY NEED LOW TO MODERATE LAND DEVELOPMENT COST. IN SOME CASES, ACCESSIBILITY IS A MAJOR PROBLEM. IN GENERAL, THE BEST USE OF THESE LANDS ARE FOR ECONOMIC TREES AND WITH MINIMAL USE FOR ANNUAL CROPS LIKE RICE AND CORN. HOWEVER WHEN LAND TREATMENT SUCH AS TERRACING, STONE WALLS, TREE LINES, CONTOURING ARE FEASIBLE. THE USE OF THESE LANDS FOR HIGH INCOME ANNUALS IS ECONOMICALLY VIABLE.

THESE ARE AREAS PRIMARILY COVERED WITH TREES OR DOMINATED BY WOODY-TYPE OF VEGETATION. THEY REPRESENT AREAS THAT SHOULD BE PERMANENTLY RETAINED TO FOREST ENVIRONMENT. BY ALL MEANS, HUMAN ACTIVITIES SHOULD BE MINIMIZED TO PERPETUATE AND SUSTAIN THE GROWTH AND DESIRED DENSITY OF THE WOODY VEGETATION. THIS REFERS TO WATERSHED REGIONS AND THEREFORE SHOULD BE PROTECTED FROM ANY INTRUSION OF HUMAN AND AGRICULTURAL ELEMENTS.

THESE AREAS REPRESENT LAND WITHIN THE CRITICAL WATERSHEDS SUBJECTED TO VARIOUS FORMS OF LAND USE ABUSES. VARIOUS FORMS OF ACTIVE AND INACTIVE EROSIONAL PROCESSES ARE EVIDENT. FOR ECOLOGICAL REASONS, THESE AREAS ARE AT THE MOMENT BEST USED FOR TREES, EITHER FOREST OR ECONOMIC TREES (BUT THE FORMER IS PREFERRED). REVERTING THESE AREAS INTO ITS FORMER FOREST CONDITIONS IS RATHER EXPENSIVE BOTH IN TIME AND LABOR REQUIREMENTS.

THESE ARE BRAKISH AND FRESHWATER WETLANDS DOMINATED EITHER BY GRASSY AND WOODY VEGETATIONS. THESE AREAS INCLUDE LAKES VIABLE FISHPONDS. AND MUST BE PRESERVED TO MAINTAIN A WELL-BALANCED, PRODUCTIVE AQUA-MARINE ECOLOGY.

SUBPROJECT ROAD

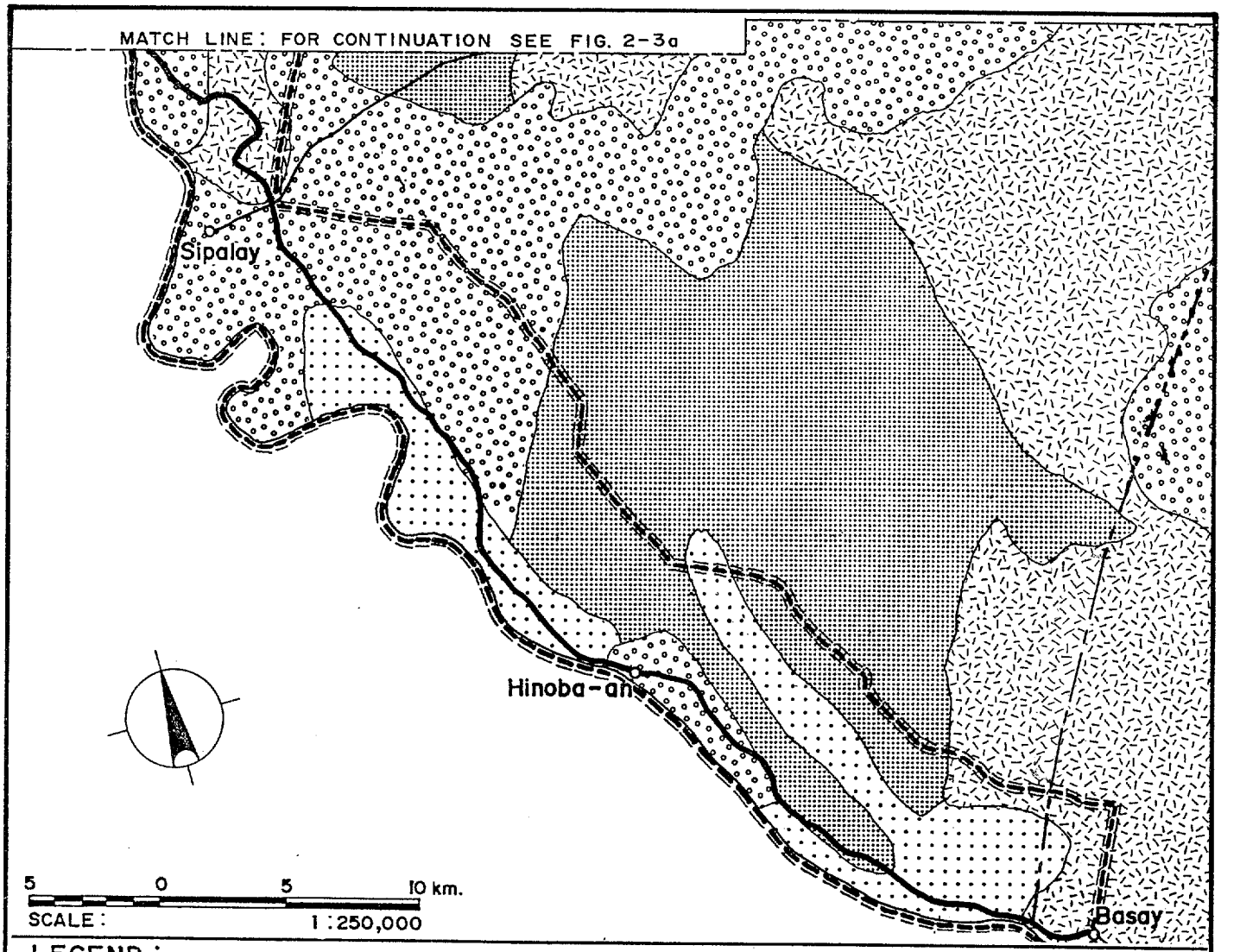
ZONE OF INFLUENCE

EXISTING ROAD

KABANKALAN-BASAY ROAD
LAND USE OPPORTUNITY MAP

Figure 2-3a

SOURCE: Department of Agriculture
Bureau of Soils and Water Management. Scale 1:1,000,000
(Variations Introduced in Enlargement)



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SUBPROJECT ROAD

ZONE OF INFLUENCE

EXISTING ROAD

KABANKALAN-BASAY ROAD
LAND USE OPPORTUNITY MAP

Figure 2-3b

SOURCE: Department of Agriculture
Bureau of Soils and Water Management. Scale 1:1,000,000
(Variations Introduced in Enlargement)

garment making, shoemaking, metalcraft, woodcraft and various food processing in Kabankalan. Communication facilities are provided by Radio Communication Philippines Inc. (RCPI) and Philippine Telephone and Telegraph Company (PT & T) in Kabankalan and Sipalay, as well as the Bureau of Telecommunications Offices in the different municipalities.

3. IMPACT OF THE ROAD

The local economy will remain largely agriculture-based following the completion of the road. The road improvement will benefit the movement of goods from the farms to the various market centers in the zone. It will also benefit the transport of passengers and improve communication along the route. Thus, the proposed road will improve the degree of integration of the island's economy by upgrading an important part of the western coastal road.

The major impact of the road is measured by the savings in vehicle operation costs and by the generated additional traffic as described in Chapters III and VII.

III. TRAFFIC

A. REVIEW OF AVAILABLE DATA

The Consultant reviewed traffic data collected by the Department of Public Works and Highways (DPWH) under the National Counting Program (NTCP).

1. NTCP TRAFFIC COUNT DATA

The NTCP is a regular nationwide traffic survey undertaken by the DPWH's Regional Offices through their District Engineering and City Engineering Offices. The NTCP falls under the direction of the Central Office Planning Services of the Department. Three types of traffic count stations are included in this program. They are:

- Coverage Stations which record traffic flows for short periods of time. Traffic is counted for 12 hours on two weekdays twice a year. These counts are done in conjunction with the 2nd and 4th cycles of the Control Stations.

- Control Stations which record traffic over a 24 hour period and for 7 consecutive days 4 times a year.

- Seasonal Stations which record traffic over a 24 hour period for 7 consecutive days each month of the year.

The data collected from the above count stations served to convert the RIFP traffic counts into Annual Average Daily Traffic (AADT). The conversion method is discussed below.

2. HISTORIC TRAFFIC GROWTH

The previous growth pattern of traffic cannot be clearly described from the data obtained from NTCP and feasibility studies. This is because of the fluctuation of traffic flow from year to year. For this reason, the base year (1990) traffic volumes could not be established by estimating from the available data. Therefore, it was necessary for the Consultant to conduct the traffic survey discussed in the following subsection.

B. RIFP TRAFFIC SURVEY

Traffic surveys provide the basis for estimating the traffic on the project road. These data obtained from traffic surveys are needed in the design of the pavement structure and in the economic

evaluation of the road. For these reasons, it is necessary to have up-to-date and accurate traffic data.

The locations of the Traffic Survey Stations take into consideration the existing traffic characteristics and road conditions observed during the reconnaissance survey.

Four (4) types of traffic surveys are usually required to collect all the information needed for the engineering and economic analyses.

- Traffic Count Survey
- Origin-Destination Survey
- Axle Load Survey
- Travel Time and Delay Survey

For this road project, traffic count and travel time and delay surveys were conducted by the Consultant. Information on axle load surveys were obtained from the 1985, IBRD-DPWH, "Pavement and Axle Load Study".

The RIFP traffic surveys and travel time and delay surveys were done jointly by DPWH and the Consultant's Traffic Team. Local personnel were hired in the vicinity of the project roads and trained to do traffic counts and other required tasks.

The locations of traffic survey stations for the Kabankalan - Basay road are shown in Figure 3-1.

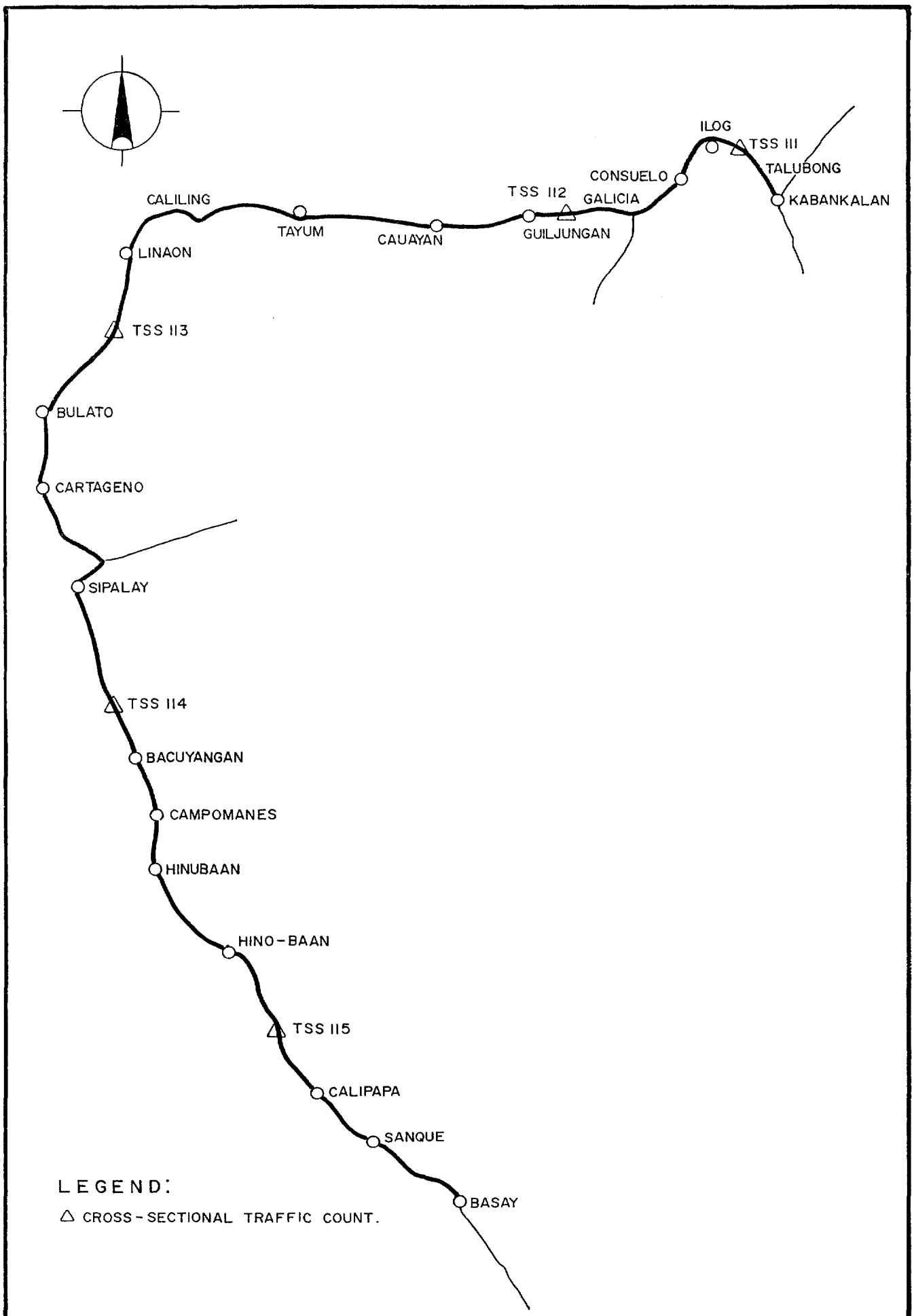
1. TRAFFIC COUNT SURVEY

The traffic count survey consisted of manual classified counts. Vehicles were grouped into 13 categories plus an "other" category. The description of each vehicle category can be found in Appendix A of this volume. The survey forms are presented in Appendix A of the Main Report. The traffic flows counted were in each direction for the period of 12 hours (6:00 AM - 6:00 PM). For Coverage Stations, the traffic counts are done for two consecutive weekdays. At Control Stations, traffic counts were conducted for seven consecutive days.

2. TRAVEL TIME AND DELAY STUDIES

Travel time and delay studies were done along the project roads in each direction. The test vehicle followed another vehicle so that its average speed could be estimated for the given road and traffic conditions. The survey form for this study is found in Appendix A of the Main Report.

Travel time and delay were recorded for every kilometer reading on the vehicle's odometer. The test vehicle overtook other vehicles or was overtaken by them. A reduction in speed of the



RURAL INFRASTRUCTURE FUND PROJECT	TRAFFIC SURVEY STATION Kabankalan-Basay Rd.	Figure 3-1

test vehicle due to the interference of slow moving vehicles ahead was not considered a delay. Full stops such as those caused by a pedestrian crossing the road or by a vehicle loading or unloading, etc. were considered as a delay.

C. HOMOGENEOUS TRAFFIC SECTIONS

For the purpose of preparing the traffic forecasts, the study roads were divided into homogeneous sections which take into account the traffic over the section of road. Each homogeneous section should have uniform traffic in terms of magnitude and vehicle composition over its entire length.

Five sections were established for the Kabankalan - Basay Road:

- Section 1 : From Kabankalan to Ilog
- Section 2 : From Ilog to Cauayan
- Section 3 : From Cauayan to Sipalay
- Section 4 : From Sipalay to Hinobaan
- Section 5 : From Hinobaan to Basay

D. ANALYSIS OF THE TRAFFIC DATA

1. TRAFFIC COUNTS

a. Traffic Count and Vehicle Composition

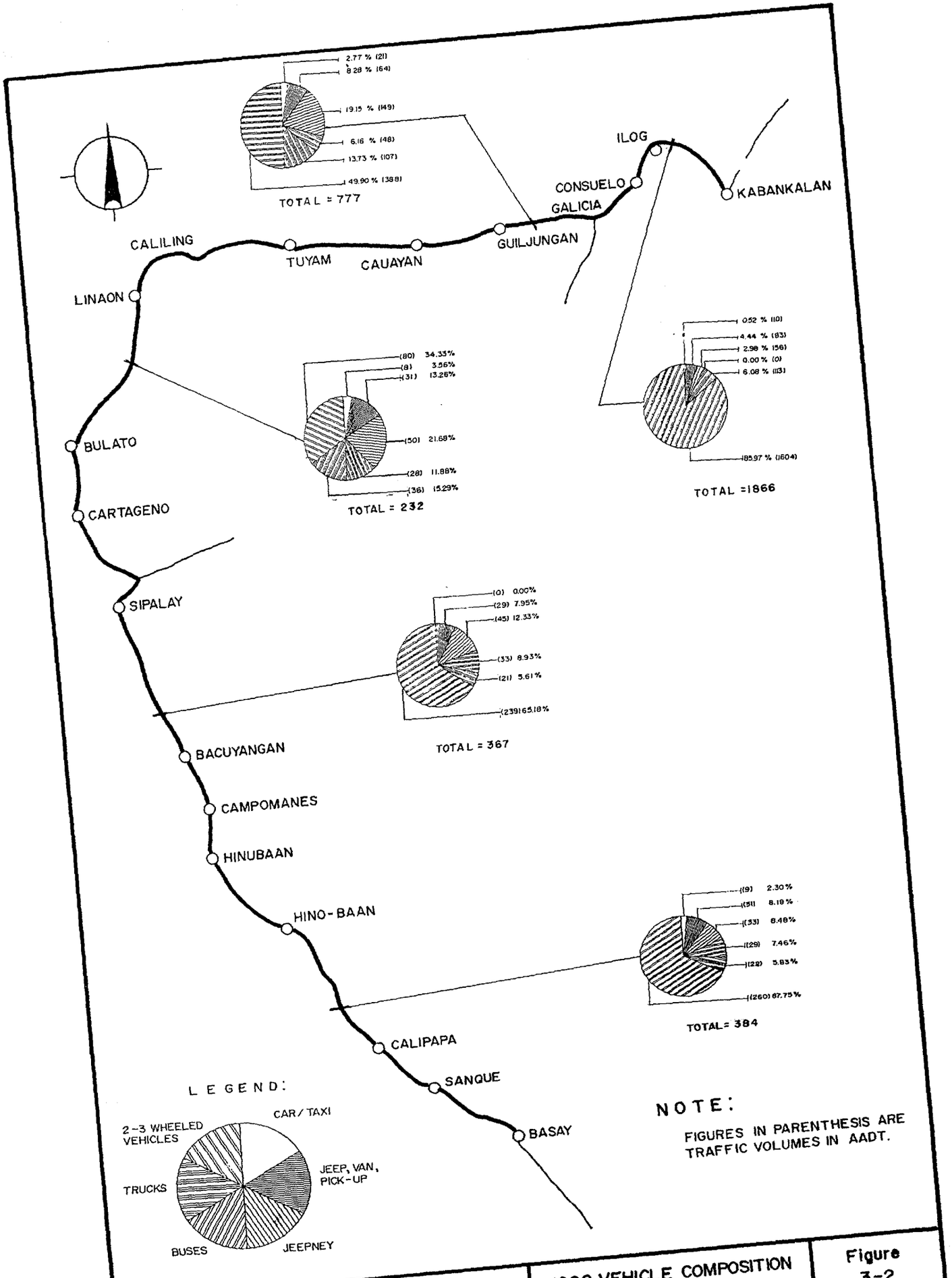
Traffic counts for each section were performed by the RIF Project with the assistance of the DPWH. Manual Counts collected during the RIF project (Sections 1, 2, 3, 4 and 5) can be found in Tables A-2 to A-6, Appendix A of this volume. Daily summary tables for these stations and conversion tables to AADT with hourly factors (HF), daily factors (DF), and monthly factors (MF) are also located in Appendix A of this volume.

Vehicle composition and AADT for all sections can be seen in Figure 3-2.

b. Hourly Variation

Hourly variation for sections 1, 2, 3, 4 and 5 are shown in Figures 3-3 to 3-5. Section 1, Kabankalan - Ilog, presented a peak of 40 vehicles in both directions at 10:00 AM. In section 2, Ilog -Cauayan, four peaks were observed, 35 vehicles in both directions at 3:00 PM, 34 vehicles in both directions at 1:00 PM, 32 vehicles in both directions at 7:00 AM and 31 vehicles in both directions at 9:00 AM. Section 3, Cauayan - Sipalay, had a peak at 10:00 AM with 20 vehicles in both directions. For section 4, Sipalay - Hinobaan, the peak was observed at 4:00 PM with 13 vehicles in both

40



RURAL INFRASTRUCTURE FUND PROJECT	1990 VEHICLE COMPOSITION Kabankalan-Basay Rd.	Figure 3-2

directions. In section 5, Hinobaan - Basay, the highest volume occurred at 5:00 PM with 18 vehicles in both directions.

2. ORIGIN - DESTINATION SURVEY

No origin - destination survey was performed as part of RIFP for this road project.

3. AXLE LOAD STUDY

Equivalent Standard Axle Load (ESAL) factors for heavy vehicles, buses, 2-axle trucks, 3-axle trucks, and articulated trucks are needed in the pavement design and in the estimation of the rate of pavement deterioration.

As explained in Appendix A-1 of the Main Report, the ESALs per heavy vehicle were derived from averages observed in the field, reported in "Pavement and Axle Load Study Reports on Surveys", Volume I, March, 1985 by Renardet SA, FF Cruz & Co. and RC Gate and Associates. The following values are used for this project:

Bus	:	1.35	ESAL/vehicle
2-axle Truck	:	1.85	ESAL/vehicle
3-axle Truck	:	5.50	ESAL/vehicle
Articulated Truck	:	4.40	ESAL/vehicle

4. TRAVEL TIME AND SPEED

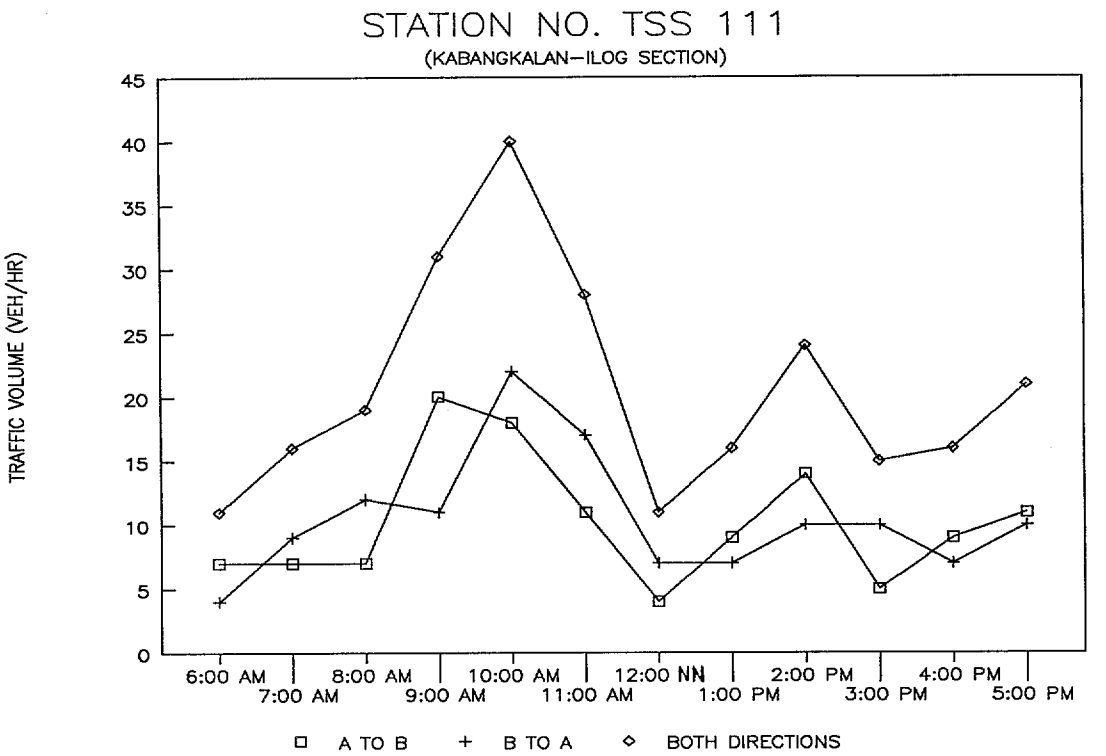
Travel time and speed depend on weather and road conditions, and roadside obstructions. Road conditions which affect vehicle time or speed are roadway width, shoulder width, degree of curvature, grade, and surface roughness. Since inclement weather reduces travel speeds and increases travel times, the travel time and speed survey was done under good weather conditions when possible.

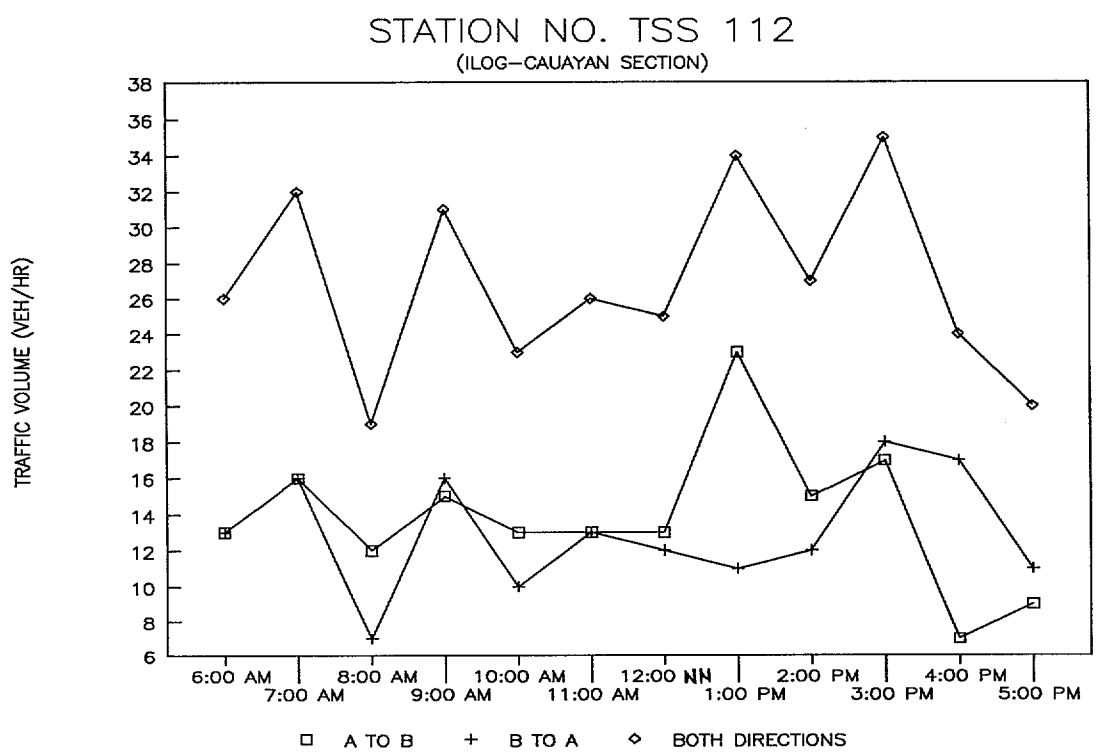
The results of travel time and speed studies for the Kabankalan - Basay road are described in Table 3-1.

E. TRAFFIC FORECAST

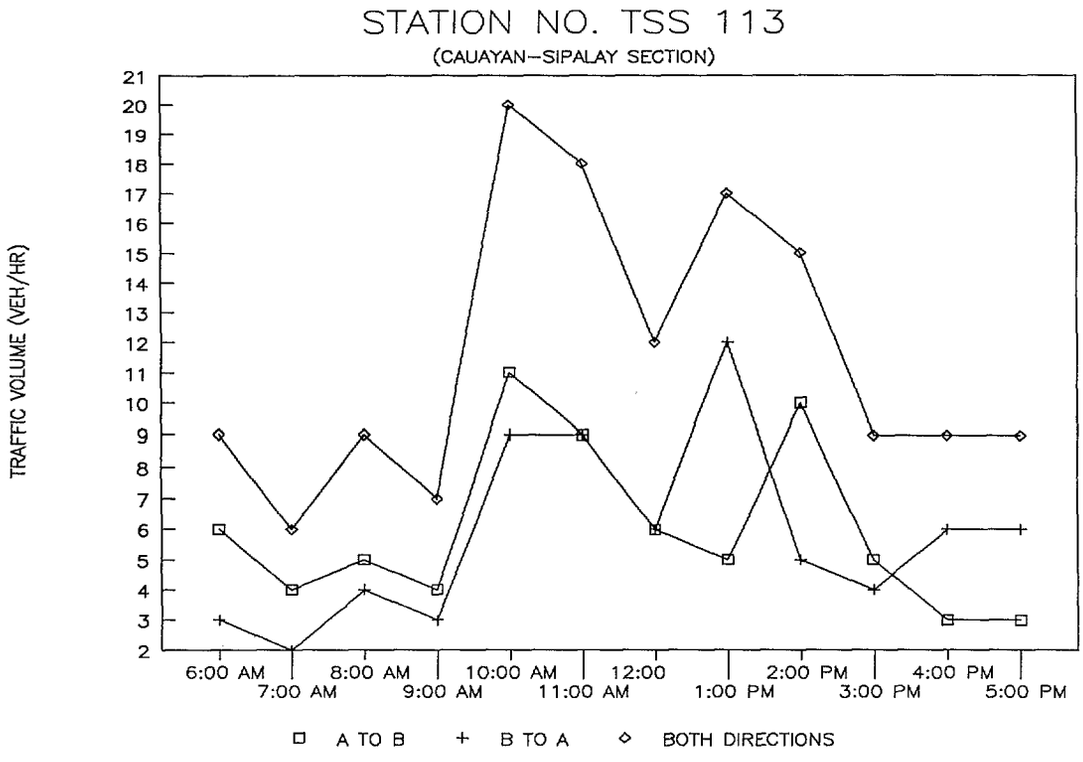
Engineering design and its economic evaluation can be prepared only after the forecasts of future traffic have been made. The traffic-survey data serves as the base on which the traffic forecasts are prepared. Forecasts were prepared for each homogeneous section using individual growth rates for each vehicle type. The base year for the forecasts is 1990.

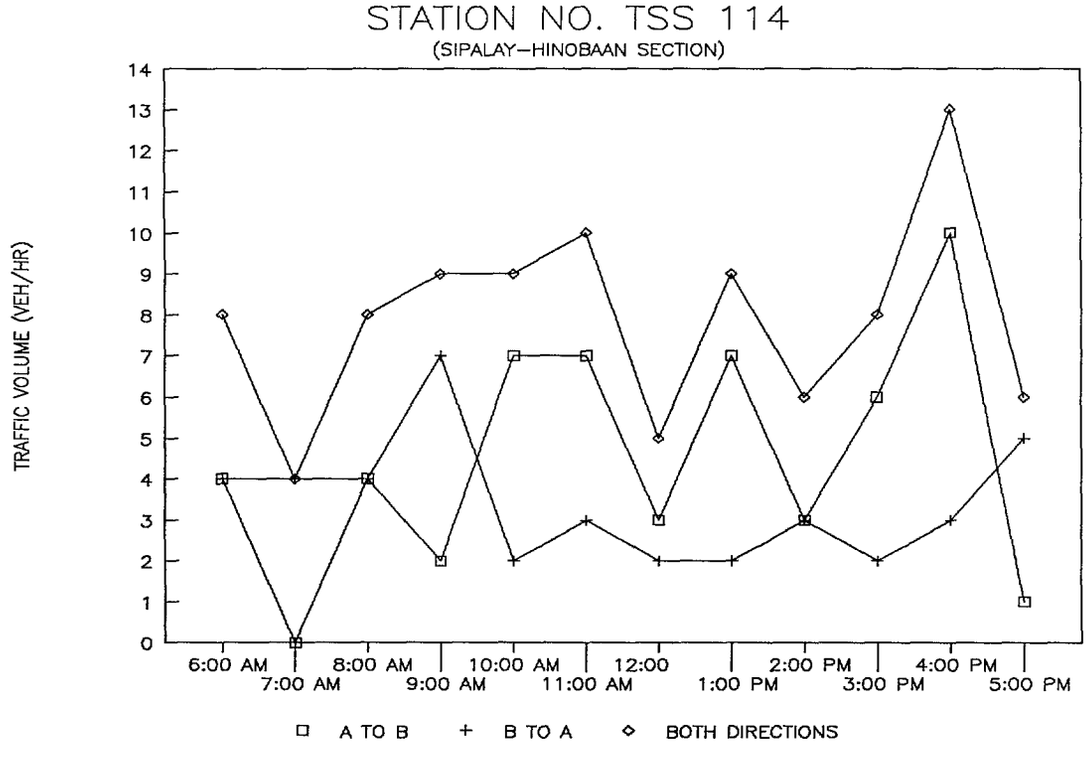
Traffic forecasts for normal traffic, diverted traffic, and generated traffic are prepared separately since the factors affecting their growth vary.



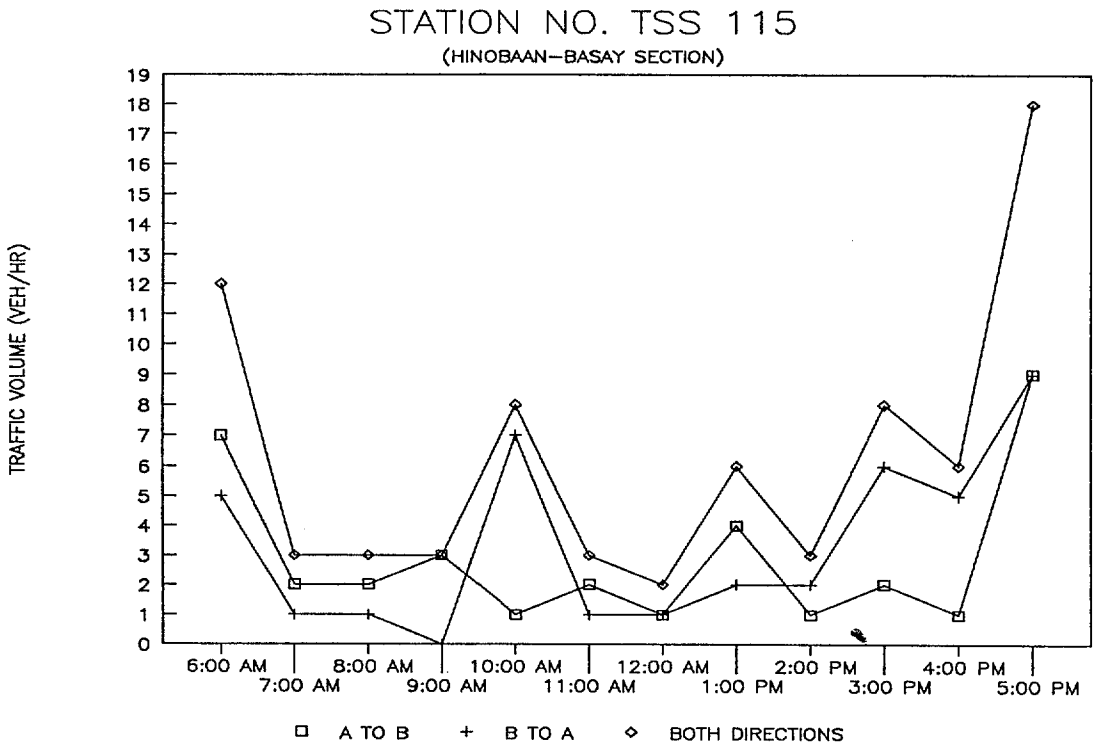


RURAL INFRASTRUCTURE FUND PROJECT	1990 HOURLY TRAFFIC VARIATION Kabankalan - Basay Rd.	FIGURE 3-3





RURAL INFRASTRUCTURE FUND PROJECT	1990 HOURLY TRAFFIC VARIATION Kabankalan-Basay Rd.	FIGURE 3-4



RURAL INFRASTRUCTURE FUND PROJECT	1990 HOURLY TRAFFIC VARIATION Kabankalan - Basay Rd.	Figure 3-5

Table 3-1

1990 Travel Time and Speed
Kabankalan-Basay Road

Section No.	Direction	Length (km)	Travel Time (min)	Running Speed (kph)
1	Northbound	8.70	13.5	38.6
	Southbound	8.70	13.6	38.4
	Average	8.70	13.6	38.5
2	Eastbound	12.30	16.6	44.5
	Westbound	12.30	18.1	40.8
	Average	12.30	17.3	42.6
3	Northbound	58.30	71.7	48.8
	Southbound	58.30	73.4	47.7
	Average	58.30	72.5	48.2
4	Northbound	17.00	36.0	28.4
	Southbound	17.00	36.4	28.0
	Average	17.00	36.2	28.2
5	Northbound	32.40	50.0	38.8
	Southbound	32.40	50.4	38.6
	Average	32.40	50.2	38.7
1-5	Northbound	128.70	187.8	41.1
	Southbound	128.70	191.8	40.3
	Average	128.70	189.8	40.7

Source : Consultant's Travel Time and Delay Survey

Two "Summary of Traffic Forecast" tables have been prepared for each section. The first table contains the basic assumptions for normal, diverted, and generated traffic, growth rates, equivalent standard axle loads (ESALs) and passenger car units (PCUs). The second table contains the total traffic forecast from 1990 to 2012. The opening year is 1993. Results can be found in Tables 3-2 to 3-11.

1. NORMAL TRAFFIC

Growth in normal traffic will occur without the proposed project. Even if the project roads are not improved, the growth of population, employment, production and income will cause transportation demand to increase within the zone of influence of the road.

Growth in normal passenger traffic is based on the macro-economic analysis of household expenditures on transportation. For the passenger vehicles, the growth rates were estimated separately for private vehicles and for public transport.

The formula used is:

$$T = P + I*E$$

Where:

T : Annual growth rate for passenger travel
P : Annual growth rate of population for the province.
I : Annual growth rate of income per capita for the province.
E : Elasticity of passenger travel demand to change in income per capita.

Detailed tables with the growth rates mentioned above (T, P and I), for each province, for passenger traffic are shown in Tables A-1-5 to A-1-7 of Appendix A-1 of the Main Report.

The modal share between private and public transport is a function of per capita income. Among the vehicle types included in public transport, jeepneys are expected to grow at a slower rate than the public transport as a whole since passengers are expected to transfer from jeepneys to more comfortable and high speed buses and to private vehicles. Consequently, the growth rate of buses is expected to be slightly higher than the overall growth rate for public transport.

The flow of goods to and from the zone of influence will affect the growth in truck traffic. The growth in Gross Regional Domestic Product (GRDP) is used as an indicator of the growth in goods movements and in turn truck traffic.

The values of Gross Regional Domestic Product (GRDP) growth rate, for each province are shown in Table A-1-8 of Appendix A-1 of the Main Report and were used to estimate the growth rate in truck traffic throughout the RIFP.

2. GENERATED TRAFFIC

The proposed road improvement projects will reduce transport costs. This reduction will have a number of beneficial effects on the economy of the zone of influence. For instance, prices received by farmers for their produce will increase. This will induce them to grow more. Reinforcing this trend is a reduction in the cost of farm inputs such as fertilizer which in turn will allow farmers to use more modern inputs. With increased income, farmers will purchase more consumer products and services and travel more frequently. All of these changes result in greater economic activity and increases in both passenger and goods traffic.

Generated traffic along the project was determined base on the elasticity of travel demand to reduction in vehicle operating cost (VOC). An assumed value of 1 for price elasticity was used. A discussion of this assumption is in Appendix A-1 of the Main Report. The table below shows the calculated percentage reduction for each vehicle. These percentages were applied to the base year normal traffic to obtain the generated traffic base on VOC reduction.

Section	Surface Type	Surface Condition	Increase in Normal Traffic			
			Jeepney	Car, Van Jeep	Bus	Trucks
1	Paved	Fair	5%	4%	3%	3%
2	Gravel	Fair	28%	24%	16%	20%
3	Gravel	Fair	28%	24%	16%	20%
4	Gravel	Fair	28%	24%	16%	20%
5	Gravel	Fair	28%	24%	16%	20%

3. DIVERTED TRAFFIC

As a result of road improvement, traffic which is presently using other roads or other modes of transport is expected to travel over the improved project road. This is because those roads or transport modes have lower levels of services or higher costs. The greater the difference on levels of services or cost, the larger the amount of traffic which will be diverted to the project road.

For the Kabankalan - Basay road it was assumed that there is no diverted traffic.

TABLE 3-2

SUMMARY OF TRAFFIC FORECAST
Kabankalan – Basay Road

Section 1: Kabankalan – Ilog

Description	Vehicle Type									
	Car Taxi	Jeep Pick-Up Van	Jeepney	Small Bus	Large Bus	2-Axle Truck	3-Axle Truck	Artic. Truck	AADT	Others
1990 AADT, Base Year Normal Traffic (vpd)	10	83	56	0	0	93	17	3	262	1,604
1990 Diverted Traffic (vpd)	0	0	0	0	0	0	0	0	0	0
1990 Generated Traffic (vpd)	0	3	3	0	0	3	0	0	9	64
1990 Traffic (Normal+Diverted+Generated) (vpd)	10	86	59	0	0	96	17	3	271	1,668
2000 Traffic Volume (vpd)	24	202	90	0	0	178	32	6	532	2,947
ESALs (8.2 tons) per vehicle	0.002	0.004	0.03	0.3	1.35	1.85	5.5	4.4		0.002
PCUs per vehicle	1.00	1.00	1.50	1.50	2.00	2.00	2.00	3.00		0.50
Traffic Growth Rate 1990 to 2000 (% per year)	8.9%	8.9%	4.3%	5.9%	5.9%	6.4%	6.4%	6.4%		5.9%
Traffic Growth Rate 2001 to 2012 (% per year)	9.3%	9.3%	4.5%	6.1%	6.1%	6.2%	6.2%	6.2%		6.1%

TABLE 3-3

SUMMARY OF TRAFFIC FORECAST
Kabankalan – Basay Road

Section 1: Kabankalan – Ilog

Forecasted Annual Average Daily Traffic (AADT),
Equivalent Passenger Car Units (PCUs), and
Cumulative Equivalent Standard Axle Loads (ESALs)
at the End of Each Year After the Road Improvement Project.

Year	Vehicle Type										PCUs per Day	Cumulative ESALs at End of year	
	Car Taxi	Jeep Pk-up Van	Jpney	Small Bus	Large Bus	2-Axl Truck	3-Axl Truck	Artic. Truck	AADT	Other			
1990	10	83	56	0	0	93	17	3	262	1604	1208		
1991	year of construction												
1992	year of construction												
1993	13	111	67	0	0	115	20	4	331	1,979	1,497	1	127,260
1994	15	121	70	0	0	123	22	4	354	2,095	1,588	2	262,646
1995	16	132	73	0	0	131	23	4	379	2,217	1,686	3	406,678
1996	17	144	76	0	0	139	25	4	405	2,347	1,789	4	559,907
1997	19	157	79	0	0	148	26	5	433	2,484	1,899	5	722,923
1998	21	171	83	0	0	157	28	5	464	2,630	2,015	6	896,349
1999	22	186	86	0	0	167	30	5	497	2,784	2,139	7	1,080,852
2000	24	202	90	0	0	178	32	6	532	2,947	2,271	8	1,277,140
2001	27	221	94	0	0	189	34	6	570	3,127	2,415	9	1,485,589
2002	29	242	98	0	0	201	36	6	612	3,317	2,569	10	1,706,952
2003	32	264	103	0	0	213	38	7	656	3,519	2,732	11	1,942,030
2004	35	289	107	0	0	227	40	7	705	3,734	2,906	12	2,191,674
2005	38	316	112	0	0	241	43	8	756	3,962	3,092	13	2,456,787
2006	42	345	117	0	0	256	45	8	812	4,203	3,289	14	2,738,328
2007	45	377	122	0	0	271	48	8	873	4,459	3,500	15	3,037,316
2008	50	412	128	0	0	288	51	9	938	4,731	3,725	16	3,354,833
2009	54	450	134	0	0	306	54	10	1,008	5,020	3,964	17	3,692,028
2010	59	492	140	0	0	325	58	10	1,084	5,325	4,220	18	4,050,123
2011	65	538	146	0	0	345	61	11	1,166	5,650	4,492	19	4,430,412
2012	71	588	152	0	0	367	65	11	1,255	5,995	4,783	20	4,834,274

50

TABLE 3-4

SUMMARY OF TRAFFIC FORECAST
Kabankalan – Basay Road

Section 2: Ilog – Cauayan

Description	Vehicle Type									
	Car Taxi	Jeep Pick-Up Van	Jeepney	Small Bus	Large Bus	2-Axle Truck	3-Axle Truck	Artic. Truck	AADT	Others
1990 AADT, Base Year Normal Traffic (vpd)	7	69	44	5	26	37	13	0	201	88
1990 Diverted Traffic (vpd)	0	0	0	0	0	0	0	0	0	0
1990 Generated Traffic (vpd)	1	14	10	1	3	6	0	0	36	18
1990 Traffic (Normal+Diverted+Generated) (vpd)	8	83	54	6	29	43	13	0	237	106
2000 Traffic Volume (vpd)	20	194	83	10	52	80	24	0	463	187
ESALs (8.2 tons) per vehicle	0.002	0.004	0.03	0.3	1.35	1.85	5.5	4.4		0.002
PCUs per vehicle	1.00	1.00	1.50	1.50	2.00	2.00	2.00	3.00		0.50
Traffic Growth Rate 1990 to 2000 (% per year)	8.9%	8.9%	4.3%	5.9%	5.9%	6.4%	6.4%	6.4%		5.9%
Traffic Growth Rate 2001 to 2012 (% per year)	9.3%	9.3%	4.5%	6.1%	6.1%	6.2%	6.2%	6.2%		6.1%

TABLE 3–5

SUMMARY OF TRAFFIC FORECAST
Kabankalan – Basay Road

Section 2: Ilog – Cauayan

Forecasted Annual Average Daily Traffic (AADT),
Equivalent Passenger Car Units (PCUs), and
Cumulative Equivalent Standard Axle Loads (ESALs)
at the End of Each Year After the Road Improvement Project.

Year	Vehicle Type										PCUs per Day	Cumulative ESALs at End of year	
	Car Taxi	Jeep Pk-up Van	Jpney	Small Bus	Large Bus	2-Axl Truck	3-Axl Truck	Artic. Truck	AADT	Other			
1990	7	69	44	5	26	37	13	0	201	88	346		
1991	year of construction												
1992	year of construction												
1993	11	107	62	7	35	52	16	0	289	125	488	1	85,504
1994	12	116	64	7	37	55	17	0	309	133	520	2	176,372
1995	13	127	67	8	39	59	18	0	330	140	554	3	272,942
1996	14	138	70	8	41	63	19	0	353	149	589	4	375,571
1997	15	150	73	8	44	67	20	0	378	157	628	5	484,642
1998	17	164	76	9	46	71	21	0	404	167	669	6	600,558
1999	18	178	80	9	49	75	23	0	433	176	713	7	723,752
2000	20	194	83	10	52	80	24	0	463	187	760	8	854,680
2001	22	212	87	11	55	85	26	0	497	198	811	9	993,691
2002	24	232	91	11	59	91	27	0	534	210	866	10	1,141,285
2003	26	253	95	12	62	96	29	0	573	223	925	11	1,297,993
2004	28	277	99	13	66	102	31	0	616	236	989	12	1,464,377
2005	31	303	103	13	70	108	33	0	662	251	1,057	13	1,641,036
2006	34	331	108	14	74	115	35	0	711	266	1,130	14	1,828,605
2007	37	362	113	15	79	122	37	0	765	282	1,208	15	2,027,759
2008	40	395	118	16	84	130	39	0	822	300	1,292	16	2,239,214
2009	44	432	123	17	89	138	42	0	885	318	1,382	17	2,463,731
2010	48	472	129	18	94	146	44	0	952	337	1,479	18	2,702,118
2011	52	516	135	19	100	156	47	0	1,025	358	1,583	19	2,955,232
2012	57	564	141	20	106	165	50	0	1,104	380	1,695	20	3,223,985

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TABLE 3-6

SUMMARY OF TRAFFIC FORECAST
Kabankalan – Basay Road

Section 3: Cauayan – Sipalay

Description	Vehicle Type									
	Car Taxi	Jeep Pick-Up Van	Jeepney	Small Bus	Large Bus	2-Axle Truck	3-Axle Truck	Artic. Truck	AADT	Others
1990 AADT, Base Year Normal Traffic (vpd)	8	31	50	0	28	29	3	3	152	80
1990 Diverted Traffic (vpd)	0	0	0	0	0	0	0	0	0	0
1990 Generated Traffic (vpd)	2	7	13	0	4	5	0	0	30	17
1990 Traffic (Normal+Diverted+Generated) (vpd)	10	38	63	0	32	34	3	3	182	97
2000 Traffic Volume (vpd)	23	88	96	0	57	64	6	6	338	172
ESALs (8.2 tons) per vehicle	0.002	0.004	0.03	0.3	1.35	1.85	5.5	4.4		0.002
PCUs per vehicle	1.00	1.00	1.50	1.50	2.00	2.00	2.00	3.00		0.50
Traffic Growth Rate 1990 to 2000 (% per year)	8.9%	8.9%	4.3%	5.9%	5.9%	6.4%	6.4%	6.4%		5.9%
Traffic Growth Rate 2001 to 2012 (% per year)	9.3%	9.3%	4.5%	6.1%	6.1%	6.2%	6.2%	6.2%		6.1%

TABLE 3-7

SUMMARY OF TRAFFIC FORECAST
Kabankalan – Basay Road

Section 3: Cauayan – Sipalay

Forecasted Annual Average Daily Traffic (AADT),
Equivalent Passenger Car Units (PCUs), and
Cumulative Equivalent Standard Axle Loads (ESALs)
at the End of Each Year After the Road Improvement Project.

Year	Vehicle Type										PCUs per Day	Cumulative ESALs at End of year	
	Car Taxi	Jeep Pk-up Van	Jpney	Small Bus	Large Bus	2-Axl Truck	3-Axl Truck	Artic. Truck	AADT	Other			
1990	8	31	50	0	28	29	3	3	152	80	283		
1991	year of construction												
1992	year of construction												
1993	13	49	71	0	38	41	4	4	219	115	402	1	60,542
1994	14	53	74	0	40	44	4	4	232	122	426	2	124,843
1995	15	58	77	0	43	47	4	4	247	129	452	3	193,136
1996	16	63	81	0	45	50	4	4	263	137	479	4	265,670
1997	18	68	84	0	48	53	5	5	280	145	509	5	342,709
1998	19	74	88	0	50	56	5	5	298	153	540	6	424,533
1999	21	81	92	0	53	60	5	5	317	162	573	7	511,442
2000	23	88	96	0	57	64	6	6	338	172	608	8	603,751
2001	25	96	100	0	60	67	6	6	361	182	647	9	701,741
2002	27	105	104	0	64	72	6	6	385	193	688	10	805,762
2003	30	115	109	0	68	76	7	7	411	205	732	11	916,185
2004	32	126	114	0	72	81	7	7	439	217	779	12	1,033,405
2005	36	138	119	0	76	86	8	8	469	231	829	13	1,157,840
2006	39	150	124	0	81	91	8	8	501	245	882	14	1,289,936
2007	42	164	130	0	86	97	8	8	536	260	939	15	1,430,164
2008	46	180	136	0	91	103	9	9	574	276	1,000	16	1,579,027
2009	51	196	142	0	96	109	10	10	614	292	1,065	17	1,737,056
2010	55	215	148	0	102	116	10	10	657	310	1,135	18	1,904,816
2011	61	235	155	0	108	123	11	11	703	329	1,210	19	2,082,908
2012	66	257	162	0	115	131	11	11	753	349	1,289	20	2,271,969

54

TABLE 3-8

SUMMARY OF TRAFFIC FORECAST
Kabankalan – Basay Road

Section 4: Sipalay – Hinobaan

Description	Vehicle Type									
	Car Taxi	Jeep Pick-Up Van	Jeepney	Small Bus	Large Bus	2-Axle Truck	3-Axle Truck	Artic. Truck	AADT	Others
1990 AADT, Base Year Normal Traffic (vpd)	0	29	45	4	29	13	3	4	127	239
1990 Diverted Traffic (vpd)	0	0	0	0	0	0	0	0	0	0
1990 Generated Traffic (vpd)	0	7	13	1	5	3	0	0	27	57
1990 Traffic (Normal+Diverted+Generated) (vpd)	0	36	58	5	34	16	3	4	154	296
2000 Traffic Volume (vpd)	0	84	88	8	59	29	6	7	282	524
ESALs (8.2 tons) per vehicle	0.002	0.004	0.03	0.3	1.35	1.85	5.5	4.4		0.002
PCUs per vehicle	1.00	1.00	1.50	1.50	2.00	2.00	2.00	3.00		0.50
Traffic Growth Rate 1990 to 2000 (% per year)	8.9%	8.9%	4.3%	5.9%	5.9%	6.4%	6.4%	6.4%		5.9%
Traffic Growth Rate 2001 to 2012 (% per year)	9.3%	9.3%	4.5%	6.1%	6.1%	6.2%	6.2%	6.2%		6.1%

TABLE 3–9

SUMMARY OF TRAFFIC FORECAST
Kabankalan – Basay Road

Section 4: Sipalay – Hinobaan

Forecasted Annual Average Daily Traffic (AADT),
Equivalent Passenger Car Units (PCUs), and
Cumulative Equivalent Standard Axle Loads (ESALs)
at the End of Each Year After the Road Improvement Project.

Year	Vehicle Type										PCUs per Day	Cumulative ESALs at End of year	
	Car Taxi	Jeep Pk-up Van	Jpney	Small Bus	Large Bus	2-Axl Truck	3-Axl Truck	Artic. Truck	AADT	Other			
1990	0	29	45	4	29	13	3	4	127	239	324		
1991	year of construction												
1992	year of construction												
1993	0	46	65	6	40	19	4	5	184	352	468	1	49,020
1994	0	51	68	6	42	20	4	5	196	372	495	2	101,052
1995	0	55	71	6	45	21	4	5	208	394	525	3	156,283
1996	0	60	74	7	47	23	4	6	221	417	556	4	214,909
1997	0	65	78	7	50	24	5	6	235	441	589	5	277,140
1998	0	71	81	7	53	26	5	7	249	467	624	6	343,199
1999	0	77	84	8	56	27	5	7	265	495	661	7	413,320
2000	0	84	88	8	59	29	6	7	282	524	701	8	487,756
2001	0	92	92	9	63	31	6	8	301	555	744	9	566,763
2002	0	101	96	9	67	33	6	8	320	589	790	10	650,621
2003	0	110	101	10	71	35	7	9	342	625	840	11	739,629
2004	0	120	105	10	75	37	7	9	364	663	892	12	834,103
2005	0	131	110	11	80	39	8	10	389	704	948	13	934,381
2006	0	144	115	12	85	42	8	11	415	747	1,007	14	1,040,818
2007	0	157	120	12	90	44	8	11	443	792	1,071	15	1,153,793
2008	0	172	125	13	95	47	9	12	473	841	1,138	16	1,273,710
2009	0	188	131	14	101	50	10	13	506	892	1,210	17	1,400,995
2010	0	205	137	15	107	53	10	14	541	946	1,287	18	1,536,100
2011	0	224	143	16	114	56	11	14	578	1,004	1,369	19	1,679,509
2012	0	245	149	17	121	60	11	15	618	1,065	1,456	20	1,831,731

56

TABLE 3-10

SUMMARY OF TRAFFIC FORECAST
Kabankalan – Basay Road

Section 5: Hinobaan – Basay

Description	Vehicle Type									
	Car Taxi	Jeep Pick-Up Van	Jeepney	Small Bus	Large Bus	2-Axle Truck	3-Axle Truck	Artic. Truck	AADT	Others
1990 AADT, Base Year Normal Traffic (vpd)	9	31	33	0	29	22	0	0	124	260
1990 Diverted Traffic (vpd)	0	0	0	0	0	0	0	0	0	0
1990 Generated Traffic (vpd)	5	18	21	0	15	4	0	0	63	149
1990 Traffic (Normal+Diverted+Generated) (vpd)	14	49	54	0	44	26	0	0	187	409
2000 Traffic Volume (vpd)	33	114	82	0	77	49	0	0	356	722
ESALs (8.2 tons) per vehicle	0.002	0.004	0.03	0.3	1.35	1.85	5.5	4.4		0.002
PCUs per vehicle	1.00	1.00	1.50	1.50	2.00	2.00	2.00	3.00		0.50
Traffic Growth Rate 1990 to 2000 (% per year)	8.9%	8.9%	4.3%	5.9%	5.9%	6.4%	6.4%	6.4%		5.9%
Traffic Growth Rate 2001 to 2012 (% per year)	9.3%	9.3%	4.5%	6.1%	6.1%	6.2%	6.2%	6.2%		6.1%

53

TABLE 3-11

SUMMARY OF TRAFFIC FORECAST
Kabankalan – Basay Road

Section 5: Hinobaan – Basay

Forecasted Annual Average Daily Traffic (AADT),
Equivalent Passenger Car Units (PCUs), and
Cumulative Equivalent Standard Axle Loads (ESALs)
at the End of Each Year After the Road Improvement Project.

Year	Vehicle Type										PCUs per Day	Cumulative ESALs at End of year	
	Car Taxi	Jeep Pk-up Van	Jpney	Small Bus	Large Bus	2-Axl Truck	3-Axl Truck	Artic. Truck	AADT	Other			
1990	9	31	33	0	29	22	0	0	124	260	322		
1991	year of construction												
1992	year of construction												
1993	18	63	61	0	52	32	0	0	226	485	582	1	48,081
1994	20	69	64	0	55	34	0	0	241	513	618	2	99,088
1995	22	75	67	0	58	36	0	0	257	543	656	3	153,199
1996	24	81	69	0	61	38	0	0	274	575	696	4	210,603
1997	26	88	72	0	65	41	0	0	292	609	739	5	271,501
1998	28	96	76	0	69	43	0	0	312	645	784	6	336,108
1999	30	105	79	0	73	46	0	0	333	682	833	7	404,649
2000	33	114	82	0	77	49	0	0	356	722	884	8	477,365
2001	36	125	86	0	82	52	0	0	381	766	941	9	554,540
2002	40	136	90	0	87	55	0	0	408	813	1,001	10	636,448
2003	43	149	94	0	92	59	0	0	437	863	1,066	11	723,379
2004	47	163	98	0	98	62	0	0	468	915	1,135	12	815,641
2005	52	178	103	0	104	66	0	0	502	971	1,209	13	913,564
2006	57	195	107	0	110	70	0	0	539	1,030	1,288	14	1,017,493
2007	62	213	112	0	117	75	0	0	578	1,093	1,372	15	1,127,799
2008	68	233	117	0	124	79	0	0	620	1,160	1,462	16	1,244,873
2009	74	254	122	0	131	84	0	0	666	1,230	1,558	17	1,369,132
2010	81	278	128	0	139	89	0	0	715	1,305	1,660	18	1,501,016
2011	88	304	133	0	148	95	0	0	768	1,385	1,770	19	1,640,995
2012	96	332	139	0	157	101	0	0	826	1,469	1,888	20	1,789,567

58

IV. ENGINEERING DESIGN

A. INTRODUCTION

The study road is located along the coastline in the southwestern part of Negros island in Negros Occidental Province, except for the last 9 kms. which are located in Negros Oriental. The project begins in Kabankalan City and follows the coastline to the west and then due south to its terminus in Basay town, a distance of 132.2 kms. The terrain encountered along the alignment is mostly flat and rolling with several isolated hilly portions of short length.

A total length of 23.8 kms. of the existing road has a concrete pavement in fair to good condition. The remainder of the road is gravel surfaced except for six short asphalt sections totalling 4 kms. which are in poor condition. There are a total of 78 existing bridges along the total length of the study road.

The project road has been divided into the following homogeneous traffic sections for the purpose of this study.

Section	Description	Length (kms.)	Terrain
1.	Kabankalan-Ilog	2.4	Flat
2.	Ilog-Cauayan	20.0	Flat & Rolling
3.	Cauayan-Sipalay	56.6	Flat, Rolling & Hilly
4.	Sipalay-Hinobaan	21.0	Rolling & Hilly
5.	Hinobaan-Basay	32.2	Rolling
	Total	132.2	

B. DATA COLLECTION AND ANALYSIS PERFORMED

1. ROAD INVENTORY

A reconnaissance survey of the study road was made in June, 1990. Data collected from the field inventory consisted of:

1) Terrain classification
2) ROW width
3) Roadway formation width
4) Surface type, condition and width
5) Shoulder type, condition and width
6) Side ditch identification
7) Vertical grade classification
8) Horizontal curve classification
9) Land use classification

10) Roadside friction identification
11) Location of flooded areas
12) Location of drainage structure
13) Photographs

Data was also collected during the road inventory to identify bridge and culvert requirements for the proposed road improvement.

2. TOPOGRAPHIC SURVEY

A feasibility/design level topographic survey was negotiated with Sterling Consultants to begin work on June 16, 1990. This contract was however terminated before the work began due to a revision in detailed design priorities among the Consultant's package of projects.

3. EXISTING FEASIBILITY STUDIES

An additional source of soils, drainage and alignment data was available for the study from a previous study entitled "PHILIPPINE ROAD IMPROVEMENT PROJECT; SOUTHERN NEGROS ROAD STUDY" prepared by Upham International Corporation (1983) under the assistance of the United Nations Development Programme (UNDP) and sponsored by the Asian Development Bank (ADB).

C. DESCRIPTION OF THE ROUTE

The description of the existing road is best presented by traffic section, as detailed below. The proposed alignment will closely follow the existing alignment throughout the entire length. The terrain traversed by the study road is shown in the following table.

Chainage (Kms.)	Terrain
90+500 - 133+000	Flat & Rolling
133+000 - 135+500	Hilly
135+500 - 139+000	Flat & Rolling
139+000 - 141+000	Hilly
141+000 - 163+000	Flat & Rolling
163+000 - 165+000	Hilly
165+000 - 169+500	Flat & Rolling
169+500 - 188+000	Rolling & Hilly
188+000 - 222+700	Rolling

Section 1. Kabankalan-Ilog (Km. 90+500 - 92+900)

The proposed alignment begins in Kabankalan City at the junction of the Kabankalan/Bacolod and the Kabankalan/Basay roads and runs northwest for 2.4 kms. to its terminus at the 128 meter long Ilog bridge.

The roadway is paved with a Portland Cement Concrete (PCC) surface 6 meters wide and in fair to good condition. A single set of railroad tracks (200 m. long) are located within the roadway and across Ilog bridge at the end of this section.

Section 2. Ilog-Cauayan (Km. 92+900-112+900)

Section 2 continues from the Ilog bridge in a westerly direction following the coastline for 20 kms. to its terminus in Cauayan town.

The roadway contains 13 sections of varying surface along its length; PCC, asphalt and gravel. Four sections of PCC surface totalling 10.9 kms. are located between the limits of Km. 93+400 - 101+800, Km. 102+000 - 103+600, Km. 103+800 - 104+100 and Km. 105+400 - 106+000. There are three short asphalt sections totalling 1.1 kms. along this link with the paved sections in a deteriorated state. The remaining 8 kms. of gravel road are located in 6 short sections. The alignment and profile of the existing road is of a fairly high standard.

Section 3. Cauayan-Sipalay (Km. 112+900 - 169+500)

Section 3 continues westward following the coastline to Barangay Tiling and then turns south again mostly following the coastline to its terminus in Sipalay town. The road passes through flat and rolling terrain, however three short hilly sections are encountered along link 3.

As in the previous link, there are six sections of varying roadway surface; PCC, asphalt and gravel. A total of 10.3 kms of concrete surface is located along 3 portions of the road, kms. 112+900 - 113+300, Km. 152+800 - 160+700 and Km. 167+500 - 169+500. Two short segments of asphalt totalling 1.1 kms. are also located in Section 3. The concrete surface is mostly in fair condition while the asphalt sections are in poor condition. The remaining 45.2 kms. of Sections 3 contains a gravel surfaced road. Three sections of roadway between Kms. 122-134 totalling 5.5 kms. are subject to flooding.

Section 4. Sipalay-Hinobaan (Km. 169+500 - 190+500)

Upon leaving Sipalay town, the existing roadway continues due south through hilly terrain for a length of 21 kms. to its terminus in Hinobaan town.

Sharp curves and fairly steep gradients are encountered within the short hilly sections in this roadway section. The total length of Section 4 of roadway is gravel surfaced except for 3 short segments totalling 2 kms. A short piece of PCC is found in Nabulao town and a short piece of asphalt pavement in Hinobaan town. Another asphalt section (kms. 185+900 - 187+700) is in very poor condition.

Section 5. Hinobaan-Basay (Km. 190+500 - 222+700)

The roadway from Hinobaan south follows the coastline through alternating rice fields and coconut groves with generally good horizontal and vertical alignment, with Kms. 211-212 being a hilly exception. The boundary between Negros Occidental and Negros Oriental is at Km. 214+300 which equates to Km. 130+000 with stationing decreasing toward Dumaguete.

The whole length of Section 5 is gravel surfaced with several sections low in profile and subjected to flooding. The study road ends at Km. 222+700 at the intersection of the road leading into Basay town proper.

D. PRELIMINARY DESIGN

1. PROPOSED DESIGN STANDARDS AND IMPROVEMENTS

Geometric design standards were established for the proposed alignment according to projected AADT traffic levels. These criteria were adopted from the "DPWH" Minimum Design Standards" and are given in Table 4-1. These criteria also determine the typical section for the study road and are given in Figure 4-1.

Most of the design criteria are specified by terrain type; flat, rolling and mountainous. These criteria will apply to the sections of road as listed previously in this chapter by terrain type. It will be necessary to reduce the minimum radius requirement from 50 to 30 m in the hilly and mountainous sections of roadway due to a number of existing severe curves in order to save an extensive amount of soil and rock excavation.

A Double Bituminous Surface Treatment (DBST) pavement was costed for economic evaluation for links 2,3,4 and 5. Seven short segments totalling 3.2 kms. between Kms. 92+900 - 105+400 (Section 2) were designed and costed using Portland Cement Concrete (PCC) pavement. Section 1 and portions of Sections 2 and 3 have existing PCC pavement at 8 separate locations totalling 23.6 kms. which require some rehabilitation. This work consists of sealing cracks, patching holes, replacement of badly cracked slabs and the addition of base course shoulders.

a. Kabankalan - Ilog (Km. 90+500 - 92+900)

The projected traffic for this section is:

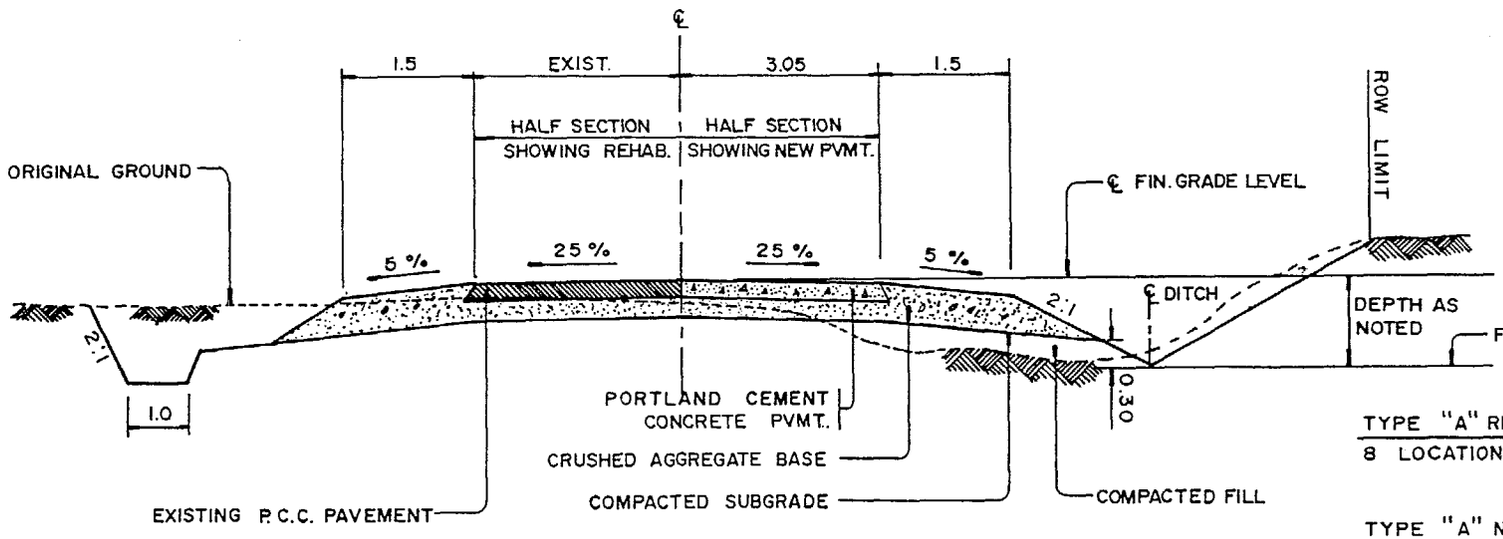
	Vehicles per day
1993 AADT	331
2002 AADT	612

The desired roadway width for this projected traffic level is a 6.1 meter carriageway with 1.5 meter shoulders. The geometric design criteria for this section are those for flat terrain.

TABLE 4-1

DETAILED DESIGN CRITERIA
KABANKALAN-BASAY ROAD

ROAD SEGMENT	Kabankalan-Ilog		Ilog - Cauayan		Cauayan - Sipalay	Sipalay - Hinobaan	Hinobaan Basay
	MIN.	DES.	MIN.	DES.			
DESIGN SPEED (Kph)							
Flat	70	90	70	90	70	70	70
Rolling	50	80	50	80	50	50	50
Mountainous	40	50	40	50	40	40	40
RADIUS (m)							
Flat	160	280	160	280	160	160	160
Rolling	85	220	85	220	85	85	85
Mountainous	50	80	50	80	50	50	50
GRADE (%)							
Flat	6	5	6	5	6	6	6
Rolling	7	5	7	5	7	7	7
Mountainous	9	7	9	7	9	9	9
PAVEMENT WIDTH (m)	6.1		6.1		6.0	6.0	6.0
SHOULDER WIDTH (m)	1.5		1.5		1.0	1.0	1.0
ROW WIDTH (m)	30		30		30	30	30
SUPERELEVATION (m/m)	0.10 (max.)		0.10 (max.)		0.10 (max.)	0.10 (max.)	0.10 (max.)
STOPPING SIGHT DISTANCE (m)							
Flat	90	135	90	135	90	90	90
Rolling	60	115	60	115	60	60	60
Mountainous	40	60	40	60	40	40	40
PASSING SIGHT DISTANCE (m)							
Flat	490	615	490	615	490	490	490
Rolling	350	560	350	560	350	350	350
Mountainous	270	360	270	360	270	270	270
PAVEMENT TYPE	Double Bituminous Surface Treatment		Double Bituminous Surface Treatment		Double Bituminous Surface Treatment	Double Bituminous Surface Treatment	Double Bituminous Surface Treatment

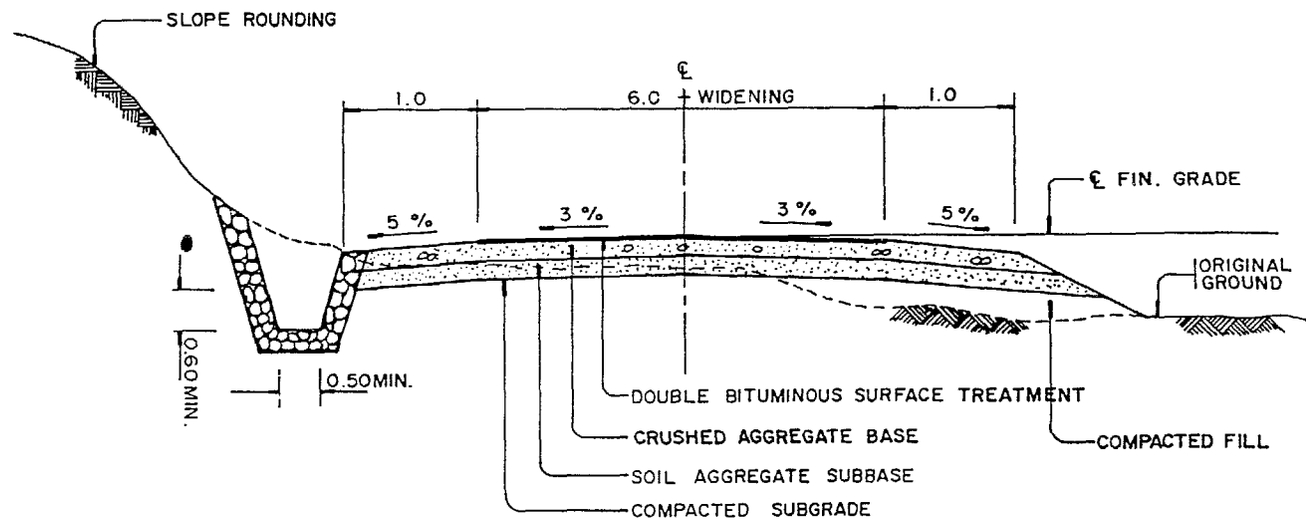


CROSS SECTION TYPE "A"
(P.C.C. PAVEMENT)

TYPE "A" REHAB. LOCATIONS
8 LOCATIONS - TOTAL 23.6 KMS.

TYPE "A" NEW LOCATIONS
7 LOCATIONS - TOTAL 3.2 KMS.

TYPE "B" LOCATIONS
106 + 600 - 222 + 700



CROSS SECTION TYPE "B"
(DBST PAVEMENT)

NOTES:

1. ALL DIMENSIONS ARE IN METERS.
2. ALL SHOULDER ARE OF BASE COURSE MATERIAL WITH SBST SURFACE.
3. REHAB. TO PCC PAVEMENTS INCLUDES SEALING CRACKS, PATCHING, REPLACEMENT OF BADLY CRACKED SLAB AND ADDITION OF BASE COURSE SHOULDERS.

KABANKALAN - BASAY ROAD

FIGURE 4 - 1

Section 1 has an existing PCC surface in fair condition throughout its entire length and will only require rehabilitation. Proposed improvements to this link will therefore consist of the sealing of cracks and patching of potholes in the concrete surface, the removal and replacement of cracked PCC slabs and the addition of base course shoulders surfaced with a single bituminous surface treatment (SBST).

b. Ilog - Cauayan (Km. 92+900 - 112+900)

The projected traffic for this sections is:

	Vehicle day
1993 AADT	289
2002 AADT	534

The desired roadway width for this projected traffic level is a 6.1 meter carriageway with 1.5 meter shoulders. The geometric design criteria for this section are those for flat and rolling terrain. Both horizontal and vertical alignment of the existing road, which is also the proposed alignment, is generally good and will require no improvement.

Section 2 consists of 13 alternating sections of varying roadway surface course; four sections of existing PCC surface, three sections asphalt surfaced and six gravel sections. The proposed improvements to the existing PCC sections (10.9 kms.) will be rehabilitation as described for Section 1 of the study road. The three short sections of asphalt pavement (1.1 kms.) are in a deteriorated condition and will require total reconstruction.

The proposed improvements to the six gravel sections consist of widening the roadway to the required 9.1 m width, providing additional drainage structures and placing a new pavement section surfaced with either a DBST or a PCC wearing course. New PCC pavement will be placed within the limits of Kms. 92+900 - 105+400 to replace existing asphalt and gravel sections and to replace badly cracked existing PCC slabs. A new DBST pavement will be placed within the limits of Kms. 106+000 - 112+900, the remaining portion of Section 2.

c. Cauayan - Sipalay (Kms. 112+900 - 169+500)

The projected traffic for this section is:

	Vehicles per day
1993 AADT	219
2002 AADT	385

The desired roadway width for this projected traffic level is a 6.0 meter carriageway with 1.0 meter shoulders. The geometric design criteria for this section are those for flat, rolling and hilly terrain.

Section 3 consists of 9 alternating sections of varying roadway surface course; three sections of existing PCC surface, two sections which are asphalt surfaced and four gravel sections. The proposed improvement to the 10.3 kms. of existing PCC surface are rehabilitation of the existing pavement by sealing cracks, patching pot holes, removing and replacing badly cracked PCC slabs and by reconstructing existing soil shoulders with base course materials surfaced with SBST. The two short sections of asphalt pavement (1.1 Kms.) are in a deteriorated state and will required complete reconstruction and a new DBST surface course.

The proposed improvements to the four gravel sections of Link 3 consist of widening the roadway to the required 8.0 m width, providing additional drainage structures and placing a new pavement section surfaced with a DBST wearing course.

d. Sipalay - Hinobaan (Km. 169+500 - 190+500)

The projected traffic for this section is:

	Vehicles per day
1993 AADT	184
2002 AADT	320

The desired roadway width for this projected traffic level is a 6.0 meter carriageway with 1.0 meter shoulders. The geometric design criteria for this section are those for rolling and hilly terrain. Since a great portion of the proposed alignment in this section follows hilly terrain, numerous small radius curves will require improvement in the new alignment.

The proposed improvements to the two short asphalt sections (2 kms.) consist of total reconstruction of the pavement since the asphalt is in a deteriorated state. The short piece of PCC pavement in Nabulao town will require rehabilitation as described previously in this chapter.

The proposed improvements to the remaining gravel sections of link 4 consist of improvement of the horizontal alignment by excavation and embankment to the required 8.0 m width, providing additional drainage structures and placing a new pavement section surfaced with a DBST wearing course.

e. Hinobaan - Basay (Km. 190+500 - 222+700)

The projected traffic for this section is:

	Vehicles per day
1993 AADT	226
2002 AADT	408

The desired roadway width for this projected traffic level is a 6.0 meter carriageway with 1.0 meter shoulders. The

geometric design criteria for this section are those for hilly, rolling and flat terrain. Improvements to the roadway geometry will be necessary in a hilly segment of link 5, between Kms. 211 to 212.

The proposed improvements to link 5 consist of the reconstruction of the existing roadway to the required 8.0 m. width, providing additional drainage structures and placing a new pavement section surfaced with a DBST wearing course. A new embankment section will be required between kms. 202+500 - 203+500 and along seaside locations (Kms. 208-209) where the existing roadway is at subgrade level.

2. DRAINAGE

a. Pipe Culverts

Since the road reconnaissance survey was limited in the acquisition of field data to determine culvert and bridge requirements, and since no special drainage survey was conducted for this study, pipe culvert and erosion protection quantities for the cost estimates were determined on a per kilometer basis based on the Consultant's experience in completing previous road studies of coastal roads with similar terrain characteristics. The proposed alignment closely follows the existing alignment and many of the required pipe culverts are existing culverts. The Consultant therefore based his quantities on retaining a portion of the existing culverts and cleaning them, a percentage of existing culverts which require replacement and an amount of new additional pipe culverts which would be required mostly in the existing gravel road sections.

b. Major Drainage Structures

The road reconnaissance survey conducted by the Consultant shows a total of 78 bridges currently exist along the alignment of the study road. This total includes 20 reinforced concrete deck girder (RCDG) types, 30 precast concrete slab (PCS) types, 2 steel truss bridges, one steel girder bridge, 2 composite "I" beam structures, 14 bailey bridges and one RC box culvert.

Data collected during the reconnaissance study also shows 42 of the existing structures are in good condition with a total of 34 requiring minor rehabilitation work. The Consultant was able to determine major structure hydraulic requirements since watershed areas and design discharges were determined by the previous Consultant, Upham International Corp., that completed a study under the UNDP assisted "Philippine Road Improvement Project" in 1983.

The study analysis determined 13 new bridges are required for this project mostly to replace existing bailey bridges and 23 RC box culverts are required mostly to replace existing short span one-lane PCS structures.

Proposed bridges for the study road are summarized in Table 4-2.

Table 4-3 is a summary of proposed RC box culverts for the study road.

TABLE 4-2

PROPOSED BRIDGES FOR KABANKALAN-BASAY ROAD

KM.	NAME	SPANS	LENGTH (M.)	TYPE
128+685	Caliling	3	39	RC "T" Beam
144+130	Bongongon	3	41	RC "T" Beam
178+170	Porong	3	25	RC Slab
199+620	Bungat	3	25	RC Slab
203+420	Bulwagan 2	3	25	RC Slab
203+720	Daug	3	25	RC Slab
205+920	Angola	1	12	RC "T" Beam
206+820	Dalig	1	12	RC "T" Beam
208+620	Culipapa	3	70	PSC-"I" Girder
210+220	Calinday	1	18	RC "T" Beam
212+350	Balogo	1	10	RC "T" Beam
212+600	Duya	1	10	RC "T" Beam
216+100	Sanque	1	18	RC "T" Beam

TABLE 4-3

REINFORCED CONCRETE BOX CULVERTS

KM.	NAME	SPANS (M)	LENGTH (M)
177+220	Banag 1	2-3.0 x 2.4	10
178+120	Banag 2	2-3.0 x 2.4	10
178+970	Banag 3	2-3.0 x 2.4	10
179+350	Nabulao 1	2-3.0 x 2.4	10
179+800	Nabulao 2	2-3.0 x 2.4	10
180+100	Nabulao 3	2-3.0 x 2.4	10
180+510	Nabulao 4	2-3.0 x 2.4	10
181+300	Nabulao 5	2-3.0 x 2.4	10
181+440	Nabulao 6	2-3.0 x 2.4	10
183+300	Nabulao 7	2-3.0 x 2.4	10
184+300	Nabulao 8	2-3.0 x 2.4	10
184+900	Nabulao 9	2-3.0 x 2.4	10
184+710	Talacagay 1	2-3.0 x 2.4	10
184+800	Talacagay 2	2-3.0 x 2.4	10
195+220	Alim-Alim	2-3.0 x 2.4	10
195+420	Manalimsim	3-3.0 x 2.75	10
197+820	Kawilan	2-3.0 x 2.4	10
198+620	San Sebastian	2-3.0 x 2.4	10
200+570	Bulwangan 1	2-3.0 x 2.4	10
207+000	Locotan	2-3.0 x 2.4	10
209+720	Camanagan	3-3.0 x 2.75	10
214+220	Panghinawan	3-3.0 x 2.75	10

V. PAVEMENT AND MATERIALS

A. GEOLOGY

In the Kabankalan - Basay area the oldest rocks consist of metavolcanic rocks probably of Pre-Tertiary age. They are in contact with quartz-diorite and appear to be formerly mafic flows which are now fractured and highly altered, especially along the vicinity of its contact with the intrusives.

Overlying the metavolcanic rocks are the interbedded lenses of volcanic conglomerate, tufaceous mudstone and shale. These rocks are of Lower Miocene age.

The rocks, above, are overlain by quartz-diorite and thick bedded dense crystalline to sandy limestone of Middle to Upper Miocene age.

Next in sequence are Pliocene rocks consisting of sequences of shale and sandstone, with thin lenses of coal and thin beds of conglomerate.

The topography along the study road varies from rolling to mountainous, as it stretches from Kabankalan to Basay.

Pleistocene rocks spread over the Pliocene rocks. These rocks consist of limestone that is massive to thin bedded, fairly dense, and crystalline to conglomeratic.

The Kabankalan Basay road is founded on the recent alluvial soil, that consists of clay to boulder size materials derived from older rock formations, and deposited on the plains, beaches, swamps and banks of rivers.

B. MATERIAL SOURCES

The sources of materials have been determined from material maps secured from government offices, and information contained in the Final Report on Feasibility, Philippine Road Improvement Project, Volumes 1 and 3, Visayas, Ministry of Public Works and Highway, December, 1982.

The location of material sources is shown on the Geology and Materials Map, Figure 5-1.

A total of ten (10) sources have been identified. They comprise ten river deposits of sand and gravel. The materials can be utilized as subbase, base and aggregates for asphalt courses and

STRATIGRAPHY

SEDIMENTARY AND METAMORPHIC ROCKS

Recent	R	Alluvium beach deposit, and raised coral reefs.
Pliocene Pleistocene	N3+Q1	Marine and terrestrial sediment associated with extensive reef limestone and sporadic terrace gravel deposits.
Upper Miocene	N2	Largely marine clastics overlain by pyroclastics. Associated with silty limestone.
Lower-Middle Miocene	N1	Conglomerate, wackes, shales and reef limestone, associated with basic to intermediate flows, and pyroclastics.
Oligocene	Pg2	Minor limestone and/or wackes and shales. Generally associated w/ keratophyres and andesites flows.
Paleocene Eocene	Pg1	Marine deposits, large wackes and shales associated with minor basalt conglomerates reef limestone, and calcarnite, sometimes with dacitic and or andecitic flows and pyroclastics.
Cretaceous Paleogene	Kpg	Undifferentiated gray wackes and metamorphose shale with spilite, basic flows and pyroclastics.
		Pattern denotes limestone bodies on the symbol assign to sedimentary rocks of the same age.

IGNEOUS ROCKS

INTRUSIVES

Neogene	N	Quartz diorite, granodiorite and andesite-porphyry.
Paleogene	Pgi	Mostly quartz diorite, granodiorite and quartz-monzonite.

EXTRUSIVES

Pliocene Quarternary	QVP	Volcanic plain and volcanic piedmont deposits, chiefly pyroclastic and volcanic debris at foot of volcanoes.
Quarternary		Unclassified intermediate to basic cone, dacite and andecite plugs.
Upper Miocene	N2	Principally dacite and/or andecite flows, generally with pyroclastics.
Oligocene - Miocene	N1	Mostly submarine andesite and/or basalts flows. Intercalated with pyroclastic and clastic sedimentary rocks and/or reef limestone lenses.

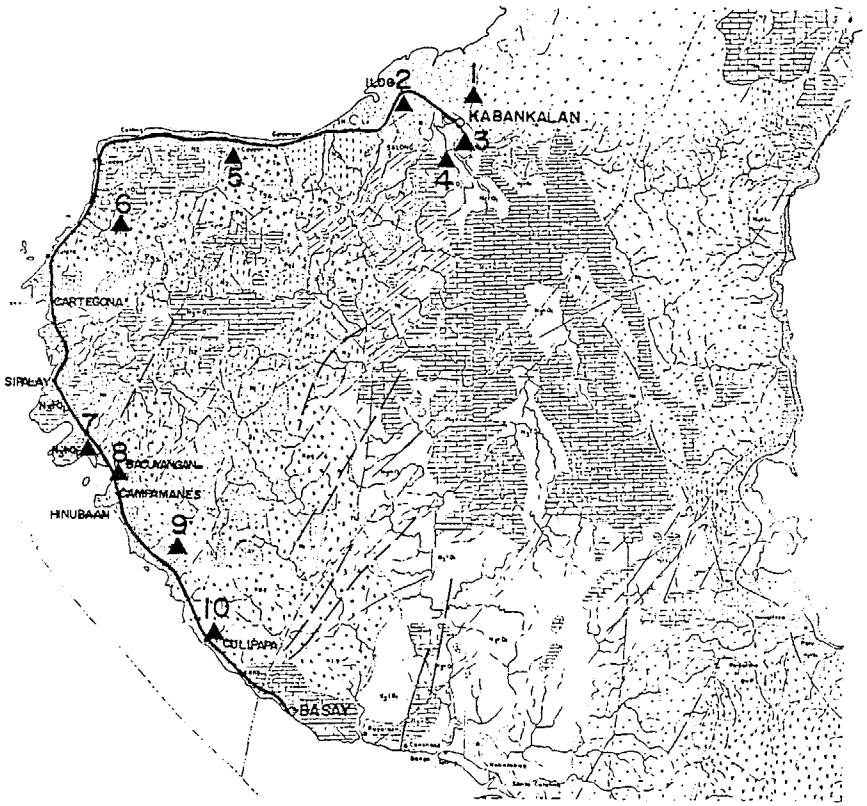


FIGURE 5-1 GEOLOGY AND MATERIALS MAP
KABANKALAN - BASAY ROAD

SCALE

20 15 10 5 0 10 20
KILOMETERS

MATERIALS SOURCES

1. The Suay River located at KM. 90 of the National Road. The river deposit consists of mixed sand, gravel boulders. The materials can be used as subbase and base and aggregate for asphalt and concrete.
   Estimated quantity : 83,000 cu.m.

2. The Ilog River located at Camugao, KM. 101 of the National Road. The river deposit consists of mixed sand gravel and boulders. The materials can be used as subbase, base course and aggregate for asphalt and concrete.
   Estimated quantity : 125,000 cu.m.

3. The Hilabangan River located KM 105 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base course and aggregate for asphalt and concrete.
   Estimated quantity : 195,000 cu.m.

4. The Ilog River located at Calasa, Km. 103 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt and concrete.
   Estimated quantity : 170,000 cu.m.

5. The Isio River located at Km. 125 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base course and aggregate for asphalt concrete.
   Estimated quantity : 117,000 cu.m.

6. The Inayawan River located at KM 151 at the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt and concrete.
   Estimated quantity : 85,000 cu.m.

7. The Nabulao River located at Km. 181 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt and concrete.
   Estimated quantity : 65,000 cu.m.

8. The Bakuyangan River located at KM 195 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt and concrete.
   Estimated quantity : 72,000 cu.m.

9. The Alim River located at KM. 206 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt and concrete.
   Estimated quantity : 48,000 cu.m.

10. The Culipapa River located at KM. 217 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt and concrete.
    Estimated quantity : 108,000 cu.m.

▲ — Material sources

——— — Project Road

concrete.

The river deposits will require screening and/or crushing of oversize materials and avoiding humus infected areas near the river banks, in order to yield subbase materials. Base materials and aggregates for asphalt courses and concrete will require crushing, screening, washing and blending.

The subsequent paragraphs describe the possible sources of materials.

The Suay River located at km. 90 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt courses and concrete. Estimated quantity: 83,000 cu. m.

The Ilog River located at Camugao, km. 101 of the National Road. The river deposit consists of mixed sand gravel and boulders. The materials can be used as subbase, base course and aggregate for asphalt courses and concrete. Estimated quantity: 125,000 cu. m.

The Hilabangan River located at km. 105 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base course and aggregate for asphalt courses and concrete. Estimated quantity: 195,000 cu. m.

The Ilog River located at Calasa, km. 103 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt courses and concrete. Estimated quantity: 170,000 cu.

The Isio River located at km. 125 of the National Road. The river deposit consist of mixed sand, gravel and boulders. The materials can be used as subbase, base course and aggregate for asphalt courses and concrete. Estimated quantity: 117,000 cu. m.

The Inayawan River located at km. 151 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt courses and concrete. Estimated quantity: 85,000 cu m.

The Nabulao River located at km. 181 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt courses and concrete. Estimated quantity: 65,000 cu. m.

The Bacuyangan River located at km. 195 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt courses and concrete. Estimated quantity: 72,000 cu. m.

The Alim River located at km. 206 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt courses and concrete. Estimated quantity: 48,000 cu. m.

The Culipapa River located at km. 217 of the National Road. The river deposit consists of mixed sand, gravel and boulders. The materials can be used as subbase, base and aggregate for asphalt courses and concrete. Estimated quantity: 108,000 cu. m.

C. EXISTING PAVEMENT CONDITION

The existing pavement condition has been established after a field reconnaissance conducted in February, 1990, and the review of the Final Report on Feasibility, Philippine Road Improvement Project, Volumes 1 and 3, Visayas Ministry of Public Works and Highways, December, 1982.

The study road stretches 132.2 km, from Kabankalan, (Sta. 90+800) in the Province of Negros Occidental, north-westwards to Ilog (Sta. 92+900) on the west coast, and from there following the west coastline of Negros Island, to the south, through Cauayan (Sta. 112+900), Sipalay (Sta. 169+500), Hinobaan (Sta. 190+500), to Basay (Sta. 222+700).

The project alignment has been subdivided into nine sections in accordance with the traffic volumes, the topography and the pavement conditions. These road sections are described in the following paragraphs.

Section 1-1, from Kabankalan (Sta. 90+500) to Ilog (Sta. 92+900) is a concrete pavement, 6 m wide, in good condition, with a few slabs with severe cracking. Slab thickness is about 200 mm, and the underlaying granular subbase is 200-400 mm thick.

Section 2-1, from Ilog to Sta. 106+000, is 13.1 km long, and is basically a concrete road 10.9 km long, 6 to 8 m wide, in fair to good condition. The PCC slabs are 150 mm thick. The remaining 2.2 km consist of segments, 0.2 km to 1.3 km long, of gravel and bituminous surface treatment (BST), 7 to 9 m wide. The surface layer of the gravel segments consists of sandy gravel (AASHTO A-1-a), 150 to 300 mm thick, and is in fair condition. The BST pavement is in poor condition, severely cracked and with many potholes. The granular course that underlies the bituminous surface course is 150 to 200 mm thick and consists of sandy gravel (AASHTO 1-A-a). The granular courses just described, can be used as part of the granular subbase in the reconstructed pavement, after excavation to the required formation level.

Section 2-2, from Sta. 106+000 to Cauayan (Sta. 112+900) is a 6.5 km gravel road, 7 to 9 m wide, in fair condition. The

remaining 0.4 km consist of BST pavement, 7 m wide, in poor condition. The upper granular course of the entire road consists of sandy gravel (AASHTO A-1-a), 150-300 mm thick. This course can serve as subbase in the reconstructed pavement, depending upon the new project alignment.

Section 3-1, from Cauayan to Sta. 152+800 is a 38.4 km gravel road, 7 to 8 m wide, in fair condition. The surface course consists of sandy gravel (AASHTO 1-1a), 100-350 mm thick. This section includes 0.4 km of PCC pavement in good condition, and two segments of BST pavement, totalling 5.1 km, in fair condition. The gravel surface course, and the gravel base that underlies the BST pavement can serve as granular subbase course in the reconstructed pavement.

Section 3-2, from Sta. 152+800 to Sta. 160+700, is a concrete pavement, 6.3 m wide, with concrete slabs 200 mm thick. The pavement is in fair to bad conditions; the segment between Sta. 157, and Sta. 159 shows severe cracking of slabs, while the remaining pavement has just a few severely cracked slabs.

Section 3-3, from Sta. 160+700, to Sta. 167+500, is a gravel road, 7-8 m wide, in fair condition. The existing surface course is 100 to 350 mm thick, and consists of sandy gravel (AASHTO A-1-a). This gravel course can serve in the subbase course of the reconstructed pavement.

Section 3-4, from Sta. 167+500 to Sipalay (Sta. 169+500), is a concrete pavement, 6.1 m wide, 200 mm thick, in good condition. Few slabs show extensive cracking.

Sections 4-1, from Sipalay to Hinobaan (Sta. 190+500), is basically a 19 km gravel road, with 0.2 km of concrete pavement in Nabulao Town proper, and 1.8 km of BST pavement. The road is 6 to 7 m wide. The gravel surface course is 50-150 mm thick, and consists of sandy gravel (AASHTO A-1-a). The concrete pavement is in good condition, and the BST pavement is in poor to bad condition. The granular surface course and the gravel course that underlies the BST pavement can serve in the subbase course of the reconstructed pavement.

Section 5-1, from Hinobaan to Basay (Sta. 222+700), is a gravel road, 6 to 7 m wide, in fair to bad condition. The surface course consists of sandy gravel (AASHTO A-1-a), 100 to 300 mm thick. This course can serve in the subbase of the reconstructed pavement.

The types and thicknesses of pavements are summarized on Table 5-1 at the end of this chapter.

D. SUBGRADE SOIL

The description of the subgrade soils is drawn up after the review of the report mentioned in Section C.

The subgrade soils along the Kabankalan - Basay Road are predominantly brown silty and clayey soils, mainly of the AASHTO A-6 Group, and secondly of AASHTO A-4 and A-7-6 Groups. The liquid limit varies between 23% and 57%, and the plasticity index ranges from 7% to 24%. The in-situ moisture content for these soils generally lies below the plastic limit, with values between 13% and 47%. Soaked CBR values of 6% to 7% were determined at 95% compaction (AASHTO T-99). Due to the relative high levels of in-situ moisture content, the design CBR values are estimated to be between 3% to 5%.

Table 5-1 shows the design CBR values at each road section.

E. PAVEMENT DESIGN

1. TRAFFIC LOADING

Traffic counts were taken at the road links for traffic forecasts. Traffic loadings are expressed in terms of cumulative 8.2 ton (18 kip) equivalent single axle loadings (ESALs). ESAL values have been computed from the initial traffic composition and the traffic forecasts. Traffic forecasts show the following annual average daily traffic (AADT) and ESAL at the end the first (1993), 10th (2002) and 20th (2012) years:

	A A D T			E S A L s *		
ROAD SECTION	FIRST YEAR	10TH YEAR	20TH YEAR	FIRST YEAR	10TH YEAR	20TH YEAR
1. KABANKALAN-ILOG	331	612	1255	127,260	1,706,952	4,834,274
2. ILOG-CAUAYAN	289	534	1104	85,504	1,141,285	3,223,985
3. CAUAYAN-SIPALAY	219	385	753	60,542	305,762	2,271,969
4. SIPALAY-HINOBAAN	184	320	618	49,020	650,621	1,831,731
5. HINOBAAN-BASAY	226	408	826	48,081	636,448	1,789,567

* In both directions

An initial design period of 10 years is considered adequate for the pavements of these road sections. The pavement life can be extended beyond the design period through timely rehabilitation works, like asphalt overlay. Through the initial 10-year service period, traffic trends build up, and pavement performance can be monitored, thus allowing for more accurate traffic predictions and better understanding of the behavior of the pavement, and better assessment of the pavement requirements through the second 10-year

period.

Since the project road consists of two traffic lanes, one in each direction, the ESAL values shown above have been divided by two, to obtain the design ESAL value on each traffic lane at the end of the first and second 10-year design periods. The design ESAL values along the road sections are shown on Table 5-1.

2. EXISTING PAVEMENTS

The present discussion refers to the concrete pavements in Sections 1-1, 2-1(A), 3-2 and 3-4, and the asphalt pavements in Sections 2-1, 2-2, 3-1 and 4-1.

The existing PCC pavement in sections 1-2, 2-1(A) and 3-4, as explained in part C, are in fair to good condition, with some severely cracked slabs. The concrete pavement in Section 3-2, has about 24% of its slabs severely cracked. This concrete pavement is to be rehabilitated by replacing all severely cracked slabs, and by crack sealing the less severely damaged areas. The thickness design of the replacement slabs follows the procedure recommended in TRRL Road Note 29.

The existing BST pavements in Sections 2-1, 2-2, 3-1, and A-1, as explained in part C, are mainly in poor to bad condition. Therefore these pavement sections are to be reconstructed by scarification and recompaction of the existing surface, complementing the required subbase, and laying the recommended base and surface courses. The required thicknesses at these pavements are determined in accordance with TRRL Road Note 31.

The required pavement structures are shown on Table 5-1.

3. NEW PAVEMENT

The present discussion refers to the gravel roads in sections 2-1(B), 2-2, 2-3, 3-1, 3-3, 4-1 and 5-1 totalling 105.1 km, where a new pavement structure, if the existing alignment is not followed, will be required for the initial 10-year design period.

The AADT values presented before indicate that road sections 1, 2, 3 and 5 belong to the AADT-category range of 200-400 and that section A, from Sipalay-Hinobaan, belongs to the AADT-category range of less than 200, at the end of the first year, to which the minimum DPWH Design Standards apply. In accordance with these standards, double bituminous surface treatment (DBST) is suitable for the five road sections. Section 2-1(B), refers to the 2.2 km composed of short segments of gravel and BST pavements alternating with segments of PCC pavement. Because sound rehabilitation practice dictates that the PCC pavement, totalling 10.9 km, in section 2-1, shall be preserved, a new PCC pavement will be designed for those gravel/BST segments in section 2-1. DBST

pavements will be designed for Sections 2-2, 2-3, 3-1, 3-3, 4-1 and 5-1.

a. DBST Pavement

Design ESAL values for all road sections are shown on Table 5-1. The design ESAL values, for all road sections, are less than $2.5x10^6$, which is a proven upper limit for low volume roads with DBST pavements in tropical countries, with traffic composition and construction materials similar to those prevailing in the Philippines. DBST pavements are renewed after 5-6 years with a single surface treatment or a sand seal coat. DBST allows for construction of asphalt concrete (AC) overlays after 9-10 years to extend the life of the pavement for another 10 years (or more, depending on the thickness of the overlay).

Since there are sources of good granular base course materials in the vicinity of the project, a DBST pavement constitutes a cost-effective pavement solution for road sections 2-2, 3-1, 3-3, 4-1 and 5-1. In all those cases where the existing alignment will be maintained, the existing granular course will be incorporated through scarification and recompaction of its upper 15-20 cm, and then construction of the remaining required pavement courses. The required thickness of pavement layers have been determined following the procedure recommended in TRRL Road Note 31. The required pavement structures are shown on Table 5-1.

b. PCC Pavement

New PCC pavement is designed for Section 2-1, for the reconstruction of the gravel/BST pavement subsections. The required thicknesses of the concrete slabs and the granular base course are determined in accordance with TRRL Road Note 29. The required pavement structures are shown on Table 5-1.

4. PAVEMENT OVERLAYING

The present discussion refers to asphalt concrete overlays to be placed on DBST and PCC pavements in order to strengthen the existing structure for supporting the additional traffic beyond the initial 10-year design period. This method of construction usually called stage construction, should not be considered a routine maintenance activity.

The required AC overlay shall be determined by Non-Destructive Testing (NDT) techniques near the end of the 10 year initial design period, and using updated traffic forecasts based on new traffic counts. For the purpose of estimating the costs required for the life-cycle economic evaluation, the required AC overlay is determined based on the present traffic forecasts for the 11th - 20th (2003-2012) year period, and the structural condition of the pavement after servicing through the initial 10-year period.

Deterioration (loss of structural support) criteria, presented in AASHTO's 1986 Guide for Design of Pavement Structures, have been applied for determining the loss in structural condition of the DBST. The experience of the Consultants in situations with similar traffic and pavement/subgrade conditions, indicates that AC overlay with minimum thickness of 80 mm is required for PCC pavements to minimize reflection cracking through the overlay. The required thicknesses of AC overlays for the second 10-year performance period are shown on Table 5-1.

F. FINAL COMMENTS

- DBST pavement constitutes the best, most cost-effective solution for the initial 10-year period (1993-2002), in Sections 2-2, 3-1, 3-3, 4-1 and 5-1.

- Rehabilitation of existing PCC pavements constitutes the best technical method for upgrading these pavements in Sections 1-1, 2-1, 3-2 and 3-4.

- PCC pavement is the best technical solution for the reconstruction of the gravel/BST pavements in Section 2-1.

TABLE 5-1

PAVEMENT SECTIONS
KABANKALAN - BASAY ROAD

Selected Solution After Economic Evaluation

SECTION	1-1	2-1		2-2	3-1	3-2	3-3	3-4	4-1	5-1
FROM STATION	90+500	92+900		106+000	112+900	152+800	160+700	167+500	169+500	190+500
TO STATION	92+900	106+000		112+900	152+800	160+700	167+500	169+500	190+500	222+700
FROM (TOWN)	KABANKALAN	ILOG			CAUAYAN				SIPALAY	HINOBAAN
TO (TOWN)	ILOG			CAUAYAN				SIPALAY	HINOBAAN	BASAY
EXISTING PAVEMENT		(A) *	(B) *							
Type	PCC	PCC	GR/BST	GR/BST	GR/BST	PCC	GRAVEL	PCC	GR/BST	GRAVEL
Thickness (mm)	200	150	20	20	20	200		200	20	
Range of granular thickness (mm)	200-400	150-300	150-300	150-300	100-350	200-360	100-350		50-150	100-300
Subgrade Design CBR (%)	5	3	3	3	5	5	5	5	4	4
Subgrade soil (AASHTO)	A-1-b	A-7-6	A-7-6	A-7-6	A-6,A-4	A-6,A-7-6	A-6	A-6	A-6,A-4	A-4
NEW PAVEMENT DESIGN										
Design ESAL from 1992: 10 Year, ESALx10^6	0.853	0.571	0.571	0.571	0.403	0.403	0.403	0.403	0.325	0.318
Surface course type	-	-	PCC	DBST	DBST		DBST		DBST	DBST
Surface course thickness (mm)	-	-	150							
Granular base course thickness (mm)	-	-	100	200	150		150		150	150
Granular subbase course thickness (mm)			-	320	240		240		270	270
EXISTING CONCRETE PAVEMENT REHABILITATION, 1992										
a. slab replacement (m^2)	75	1,960				12,000		60		
PCC thickness (mm)	200	120				200		200		
Granular base course thickness (mm)	100	100				100		100		
b. Crack sealing (m)	240	1,635				590		200		
OVERLAY 2										
Design ESAL from 2002: 10 years, ESALx10^6	1.564	1.041	1.041	1.041	0.733	0.733	0.733	0.733	0.591	0.577
Type	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC
Thickness (mm)	80	80	80	70	50	80	50	80	50	50

*(A): 96+400-101+800
102+000-103+600
103+800-104+100
105+400-106+000

*(B) 92+900-93+400
101+800-102+000
103+600-103+800
104+100-105+400

1] PCC pavement is joint reinforced concrete pavement (JRCP), with f'c = 27.5 MPa (4000 psi)

2] An AC overlay to serve the 11th-2oth year period is considered for the DBST and the PCC pavements.

VI. COSTING

A. PROPOSED IMPROVEMENTS

The proposed improvements to the study road consist of reconstruction of the existing road to various widths (8.0-9.1 m), providing additional drainage structures and the placing of a new pavement section. Rehabilitation of damaged sections of the 23.8 Kms. of existing concrete pavement is also included in the proposed improvements.

B. UNIT PRICES

Unit rates have been developed for all major work items required for construction. Unit rates have been developed showing a breakdown of foreign, local and tax components and include Contractor's profit and value added tax.

A summary of unit rates for the various items used in the costing are shown in Table 6-1.

C. QUANTITIES

Construction quantities were determined according to the type of improvements required for each traffic section. Since all of the existing alignment could be utilized in the proposed improvement, quantities were developed by widening the existing roadway and raising the gradient in embankment sections and by widening in cut sections.

1. **Earthworks -** Quantities were developed from typical cross sections along each portion of alignment. Excavation of rock and earth will be required in the hilly sections to improve geometrics and for roadway formation widening.

2. **Pavement Section -** Two roadway widths are required for this study; 6.1 m. pavement with 1.5 m. shoulders and 6.0 m. pavement with 1.0 m. shoulders. Shoulders were estimated of base course materials. Most of the new pavement sections will be a double bituminous surface treatment type (DBST). New portland cement concrete pavement (PCC) has been estimated between the limits of Kms. 92+900 - 105+400 (Section 2) to replace existing asphalt and gravel sections and badly cracked existing PCC slabs. New base course shoulders surfaced with a single bituminous treatment (SBST) to replace soil shoulders are also included in the rehabilitation of the

TABLE 6-1 SUMMARY OF UNIT RATES

SUMMARY OF UNIT RATES RURAL INFRASTRUCTURE FUND PROJECT			FOREIGN COMPONENT DIRECT		FOREIGN COMPONENT INDIRECT		FOREIGN COMPONENT TOTAL		LOCAL COMPONENT		TAXES		ECONOMIC COST		FINANCIAL COST	
PAY ITEM NO.	DESCRIPTION	UNIT	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)
	I. EARTHWORK															
100(1)	Clearing & Grubbing	SQ.M.	49	1.0			49	1.0	19	0.4	32	0.6	68	1.4	100	2
100(3)	Tree Removal, Large	EA.	30	46.5			30	46.5	55	85.3	15	23.3	85	131.8	100	155
101(1)	Removal of Structures & Obstructions	L.S.	30	0.3			30	0.3	55	0.6	15	0.2	85	0.9	100	1
101(3)	Removal of Existing Concrete Pavement	SQ.M.	21	17.6			21	17.6	64	53.8	15	12.6	85	71.4	100	84
102(1)	Unsuitable Excavation	CU.M.	46	21.2			46	21.2	23	10.6	31	14.3	69	31.7	100	46
102(2)	Surplus Common Excavation	CU.M.	49	22.5			49	22.5	19	8.7	32	14.7	68	31.3	100	46
102(3)	Surplus Rock Excavation	CU.M.	28	48.2			28	48.2	54	92.9	18	31.0	82	141.0	100	172
103(1)	Structure Excavation	CU.M.	47	27.3			47	27.3	22	12.8	31	18.0	69	40.0	100	58
103(2)	Bridge Excavation	CU.M.	47	31.0			47	31.0	22	14.5	31	20.5	69	45.5	100	66
103(3)	Foundation Fill	CU.M.	47	32.9			47	32.9	28	19.6	25	17.5	75	52.5	100	70
103(4)	Excavation Below Plan Elevation	CU.M.	16	38.4	18	43.2	34	81.6	52	124.8	14	33.6	86	206.4	100	240
103(5)	Shoring, Cribbing, etc.	L.S.														
103(6)	Pipe Culvert Excavation	CU.M.	47	31.0			47	31.0	22	14.5	31	20.5	69	45.5	100	66
104(1)	Embankment	CU.M.	49	26.5			49	26.5	19	10.3	32	17.3	68	36.7	100	54
104(2)	Embankment, Select Material	CU.M.	47	37.6			47	37.6	28	22.4	25	20.0	75	60.0	100	80
105(1)	Subgrade Preparation, Common	SQ.M.	49	2.5			49	2.5	19	1.0	32	1.6	68	3.4	100	5
105(2)	Subgrade Preparation, Existing Pavement	SQ.M.	50	3.5			50	3.5	18	1.3	32	2.2	68	4.8	100	7
	II. PAVEMENT															
200	Aggregate Subbase Course	CU.M.	48	76.8			48	76.8	27	43.2	25	40.0	75	120.0	100	160
201	Aggregate Base Course	CU.M.														
202	Crushed Aggregate Base Course	CU.M.	52	143.5			52	143.5	22	60.7	26	71.8	74	204.2	100	276
208	Soil Aggregate Shoulder	CU.M.	48	82.6			48	82.6	27	46.4	25	43.0	75	129.0	100	172
300(1)	Gravel Surface Course	CU.M.	48	82.6			48	82.6	27	46.4	25	43.0	75	129.0	100	172
301	Bituminous Prime Coat, MC-70	SQ.M.	5	0.7	50	6.5	55	7.2	25	3.3	20	2.6	80	10.4	100	13
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	8	0.8	47	4.7	55	5.5	24	2.4	21	2.1	79	7.9	100	10
304(1)	Single Bituminous Surface Treatment	SQ.M.	5	1.5	49	14.2	54	15.7	24	7.0	22	6.4	78	22.6	100	29
304(2)	Double Bituminous Surface Treatment	SQ.M.	5	2.9	48	27.4	53	30.2	25	14.3	22	12.5	78	44.5	100	57
310(1)	Bituminous Concrete Wearing Course	CU.M.	31	910.2	21	616.6	52	1526.7	22	645.9	26	763.4	74	2172.6	100	2936
310(2)	Bituminous Concrete Binder Course	CU.M.	31	863.7	21	585.1	52	1448.7	22	612.9	26	724.4	74	2061.6	100	2786
310(3)	Bituminous Concrete Leveling Course	MT	31	367.4	21	248.9	52	616.2	22	260.7	26	308.1	74	876.9	100	1185
311(1)	Portland Cement Concrete Pavement	SQ.M.	18	60.3	32	107.2	50	167.5	31	103.9	19	63.7	81	271.4	100	335
311(2)	Patching Existing PCC Pavement	SQ.M.	34	41.1	21	25.4	55	66.6	24	29.0	21	25.4	79	95.6	100	121
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	11	3.2	26	7.5	37	10.7	48	13.9	15	4.4	85	24.7	100	29

TABLE 6.1 SUMMARY OF UNIT RATES

(Continued)

SUMMARY OF UNIT RATES RURAL INFRASTRUCTURE FUND PROJECT			FOREIGN COMPONENT DIRECT		FOREIGN COMPONENT INDIRECT		FOREIGN COMPONENT TOTAL		LOCAL COMPONENT		TAXES		ECONOMIC COST		FINANCIAL COST	
PAY ITEM NO.	DESCRIPTION	UNIT	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)	%	UNIT COST (Pesos)
	III. STRUCTURES															
400(4)	Precast Concrete Piles, Furnished (40 x 40	L.M.	15	152.3	26	263.9	41	416.2	44	446.6	15	152.3	85	862.8	100	1015
400(13)	Precast Concrete Piles, Driven (40 x 40cm)	L.M.	14	100.8	32	230.4	46	331.2	38	273.6	16	115.2	84	604.8	100	720
400(15)	Test Piles, Driven	L.M.	14	161.0	32	368.0	46	529.0	38	437.0	16	184.0	84	966.0	100	1150
401	Concrete Bridge Railing	L.M.	6	55.7	32	297.0	38	352.6	51	473.3	11	102.1	89	825.9	100	928
404	Reinforcing Steel	KG			45	10.8	45	10.8	44	10.6	11	2.6	89	21.4	100	24
405(1)	Structural Concrete, Class A	CU.M.	15	305.0	26	528.6	41	833.5	44	894.5	15	305.0	85	1728.1	100	2033
405(2)	Structural Concrete, Class P	CU.M.	15	375.0	26	650.0	41	1025.0	44	1100.0	15	375.0	85	2125.0	100	2500
406(1)	P/S Concrete Girder, Type 4	L.M.	13	1092.0	33	2772.0	46	3864.0	39	3276.0	15	1260.0	85	7140.0	100	8400
406(3)	Prestressing Steel	KG			45	13.5	45	13.5	44	13.2	11	3.3	89	26.7	100	30
407(1)	Rehabilitation of Existing Bridges	L.S.	8	0.1	41	0.4	49	0.5	37	0.4	14	0.1	86	0.9	100	1
	IV. DRAINAGE EROSION WORKS															
500(1)	Backfill Material, Pipe Culvert	CU.M.	47	70.5			47	70.5	27	40.5	26	39.0	74	111.0	100	150
500(61)	RCPC, 61cm Diameter	L.M.	18	204.3	22	249.7	40	454.0	42	476.7	18	204.3	82	930.7	100	1135
500(91)	RCPC, 91cm Diameter	L.M.	16	269.6	26	438.1	42	707.7	42	707.7	16	269.6	84	1415.4	100	1685
500(107)	RCPC, 107cm Diameter	L.M.	14	315.7	28	631.4	42	947.1	42	947.1	16	360.8	84	1894.2	100	2255
500(122)	RCPC, 122cm Diameter	L.M.	14	467.9	28	935.8	42	1403.6	42	1403.6	16	534.7	84	2807.3	100	3342
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	15	303.0	26	525.2	41	828.2	44	888.8	15	303.0	85	1717.0	100	2020
502(11)	Reinforcing Steel for Pipe Headwalls	KG			45	10.8	45	10.8	44	10.6	11	2.6	89	21.4	100	24
503(2)	Removal, Cleaning, Replacement, Salvaged Pipe Culverts	L.M.	14	57.0	28	114.0	42	170.9	42	170.9	16	65.1	84	341.9	100	407
504(5)	Grouted Riprap	CU.M.	8	62.1	13	100.9	21	163.0	67	519.9	12	93.1	88	682.9	100	776
508(2)	Concrete Slope Protection	CU.M.														
509	Gabions	CU.M.														
	V. INCIDENTAL WORKS															
603(3)	Metal Beam Guardrail	L.M.	40	360.0			40	360.0	25	225.0	35	315.0	[illegible]	[illegible]	100	900
605(1)	Warning Signs	EA.	42	1350.3			42	1350.3	23	739.5	35	1125.3	65	[illegible]	[illegible]	3215
605(2)	Regulatory Signs	EA.	42	1350.3			42	1350.3	23	739.5	35	1125.3	65	2089.8	100	3215
605(3)	Informatory Signs	EA.	44	5940.0			44	5940.0	21	2835.0	35	4725.0	65	8775.0	100	13500
610	Sodding	SQ.M.	51	3.1			51	3.1	16	1.0	33	2.0	67	4.0	100	6
	VI. LAND ACQUISITION	L.S.							90	0.9	10	0.1	90	0.9	100	1

existing PCC pavement.

3. **Structures -** Thirteen (13) new bridges and twenty three (23) box culverts were estimated for this project based upon preliminary drainage and structural design. Quantities of major items were determined for these structures to estimate their cost.

4. **Drainage and Erosion Works -** Drainage and erosion quantities were estimated on a per kilometer basis since enough detailed information on existing culverts was not available. These quantities included pipe culverts of various diameters, pipe culvert excavation and backfill, structural concrete and reinforcing steel for headwalls and riprap slope protection.

5. **Incidental Works** - Quantities of incidental items for this estimate were limited to metal beam guardrail, roadway signs and sodding.

6. **Right-of-Way -** No land acquisition costs were estimated for this project.

D. CONSTRUCTION COSTS

The cost of construction for this project was developed from the total quantities of major work items and the unit rates. The costs per traffic link are presented in Tables 6-2 through 6-6.

E. COST OF IMPROVEMENTS

The costs of improving this road are detailed in the attached tables. The costs have been developed by traffic link for the five roadway section and contain financial costs and economic costs, including foreign, local and tax components.

Additional amounts of 10 percent for contingencies, 10 percent for office, laboratory, living accommodations and vehicles and 8 percent for supervision costs have been added to the direct cost total to determine the final cost of construction.

F. MAINTENANCE COSTS

Routine and periodic maintenance unit costs, together with the assumed maintenance policy are presented in Appendix C-1 of the Main Report. Based on the assumed policy, unit costs and the section lengths, total maintenance costs by section "with" and "without" the project are calculated. These costs are presented in Appendix C, herein.

TABLE 6-2 COST ESTIMATE BREAKDOWN
KABANKALAN - BASAY ROAD
SECTION 1: KABANKALAN - ILOG

SECTION LENGTH: 2.4 Kilometers (Existing)
ROADWAY WIDTH: 6.1m Pavement + 1.5m Shoulder
PROPOSED SURFACE COURSE: Existing PCC

PAY ITEM NO.	DESCRIPTION	UNIT	UNIT COST (Pesos)	QUANTITY	COST COMPONENTS (1000 Pesos) FOREIGN	LOCAL	TAXES	ECONOMIC COST (1000 P)	FINANCIAL COST (1000 P)
	I. EARTHWORK								
100(1)	Clearing & Grubbing	SQ.M.	2	19,200	19	7	12	26	38
102(2)	Surplus Common Excavation	CU.M.	46	4,800	108	42	71	150	221
105(1)	Subgrade Preparation, Common	SQ.M.	5	12,000	29	11	19	41	60
	TOTAL EARTHWORK				156	61	102	217	319
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	160	4,200	323	181	168	504	672
202	Crushed Aggregate Base Course	CU.M.	276	2,400	344	146	172	490	662
301	Bituminous Prime Coat, MC-70	SQ.M.	13	7,200	51	23	19	75	94
304(1)	Single Bituminous Surface Treatment	SQ.M.	29	7,200	113	50	46	163	209
311(3)	Patching Existing PCC Pavement	SQ.M.	121	24	2	1	1	2	3
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	29	320	3	4	1	8	9
	TOTAL - PAVEMENT				836	406	407	1,242	1,649
	III. DRAINAGE/EROSION WORKS								
503(2)	Removal, Cleaning, Replacement, Salvaged Pipe Culverts	L.M.	407	210	36	36	14	72	85
	TOTAL - DRAINAGE/EROSION				36	36	14	72	85
	IV. INCIDENTAL WORKS								
620	Sodding	SQ.M.	6	9,600	29	9	19	39	58
	TOTAL - INCIDENTAL WORKS				29	9	19	39	58
				SUBTOTAL	1,058	512	542	1,570	2,111
				10% Contingencies	106	51	54	157	211
				SUBTOTAL	1,164	563	596	1,726	2,322
				10% Office,Vehicles, etc.	116	56	60	173	232
				SUBTOTAL	1,280	619	655	1,899	2,555
				8% Supervision Cost	102	50	52	152	204
				TOTAL SECTION COST	1,383	669	708	2,051	2,759

TABLE 6-3 COST ESTIMATE BREAKDOWN
KABANKALAN - BASAY ROAD
SECTION 2: ILOG - CAUAYAN

SECTION LENGTH: 20.0 Kilometers (Existing)
ROADWAY WIDTH: 6.1m Pavement + 1.5m Shoulder
PROPOSED SURFACE COURSE: Double Bituminous Surface Treatment

PAY ITEM NO.	DESCRIPTION	UNIT	UNIT COST (Pesos)	QUANTITY	COST COMPONENTS (1000 Pesos) FOREIGN	LOCAL	TAXES	ECONOMIC COST (1000 P)	FINANCIAL COST (1000 P)
	I. EARTHWORK								
100(1)	Clearing & Grubbing	SQ.M.	2	160,000	157	61	102	218	320
101(3)	Removal of Existing Concrete Pavement	SQ.M.	84	7,000	123	376	88	500	588
103(6)	Pipe Culvert Excavation	CU.M.	66	1,700	53	25	35	77	112
104(1)	Embankment	CU.M.	54	27,300	722	280	472	1,002	1,474
105(1)	Subgrade Preparation, Common	SQ.M.	5	120,000	294	114	192	408	600
	TOTAL EARTHWORK				1,349	856	889	2,205	3,094
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	160	45,525	3,496	1,967	1,821	5,463	7,284
202	Crushed Aggregate Base Course	CU.M.	276	29,720	4,265	1,805	2,133	6,070	8,203
301	Bituminous Prime Coat, MC-70	SQ.M.	13	105,100	751	342	273	1,093	1,366
304(1)	Single Bituminous Surface Treatment	SQ.M.	29	63,000	987	438	402	1,425	1,827
304(2)	Double Bituminous Surface Treatment	SQ.M.	57	42,100	1,272	600	528	1,872	2,400
311(1)	Portland Cement Concrete Pavement	SQ.M.	335	19,520	3,270	2,027	1,242	5,297	6,539
311(3)	Patching Existing PCC Pavement	SQ.M.	121	109	7	3	3	10	13
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	29	4,360	47	61	19	107	126
	TOTAL - PAVEMENT				14,095	7,242	6,421	21,338	27,759

TABLE 6-3 COST ESTIMATE BREAKDOWN
SECTION 2: ILOG - CAUAYAN
(Continued)

PAY ITEM NO.	DESCRIPTION	UNIT	UNIT COST (Pesos)	QUANTITY	COST COMPONENTS (1000 Pesos) FOREIGN	LOCAL	TAXES	ECONOMIC COST (1000 P)	FINANCIAL COST (1000 P)
	III. STRUCTURES								
407(1)	Rehabilitation of Existing Bridges	L.S.	1	220,000	108	81	31	189	220
	TOTAL - STRUCTURES				108	81	31	189	220
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	150	1,070	75	43	42	119	161
500(91)	RCPC, 91cm Diameter	L.M.	1,685	200	142	142	54	283	337
500(107)	RCPC, 107cm Diameter	L.M.	2,255	180	170	170	65	341	406
500(122)	RCPC, 122cm Diameter	L.M.	3,342	40	56	56	21	112	134
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,020	307	254	273	93	527	620
502(11)	Reinforcing Steel for Pipe Headwalls	KG	24	12,300	133	130	32	263	295
503(2)	Removal, Cleaning, Replacement, Salvaged Pipe Culverts	L.M.	407	420	72	72	27	144	171
504(5)	Grouted Riprap	CU.M.	776	170	28	88	16	116	132
	TOTAL - DRAINAGE/EROSION				930	974	351	1,905	2,255
	V. INCIDENTAL WORKS								
605(1)	Warning Signs	EA.	3,215	4	5	3	5	8	13
605(2)	Regulatory Signs	EA.	3,215	4	5	3	5	8	13
605(3)	Informatory Signs	EA.	13,500	4	24	11	19	35	54
620	Sodding	SQ.M.	6	80,000	245	77	158	322	480
	TOTAL - INCIDENTAL WORKS				279	94	186	373	560
				SUBTOTAL	16,762	9,248	7,878	26,010	33,888
				10% Contingencies	1,676	925	788	2,601	3,389
				SUBTOTAL	18,438	10,173	8,666	28,611	37,277
				10% Office,Vehicles, etc.	1,844	1,017	867	2,861	3,728
				SUBTOTAL	20,282	11,190	9,532	31,472	41,004
				8% Supervision Cost	1,623	895	763	2,518	3,280
				TOTAL SECTION COST	21,905	12,085	10,295	33,990	44,285

TABLE 6-4 COST ESTIMATE BREAKDOWN
KABANKALAN - BASAY ROAD
SECTION 3: CAUAYAN - SIPALAY

SECTION LENGTH: 56.6 Kilometers (Existing)
ROADWAY WIDTH: 6.0m Pavement + 1.0m Shoulder
PROPOSED SURFACE COURSE: Double Bituminous Surface Treatment

PAY ITEM NO.	DESCRIPTION	UNIT	UNIT COST (Pesos)	QUANTITY	COST COMPONENTS (1000 Pesos) FOREIGN	LOCAL	TAXES	ECONOMIC COST (1000 P)	FINANCIAL COST (1000 P)
	I. EARTHWORK								
100(1)	Clearing & Grubbing	SQ.M.	2	412,700	404	157	264	561	825
101(1)	Removal of Structures & Obstructions	L.S.	1	175,000	53	96	26	149	175
102(3)	Surplus Rock Excavation	CU.M.	172	30,700	1,479	2,851	950	4,330	5,280
103(2)	Bridge Excavation	CU.M.	66	240	7	3	5	11	16
103(4)	Excavation Below Plan Elevation	CU.M.	240	280	23	35	9	58	67
103(6)	Pipe Culvert Excavation	CU.M.	66	7,350	228	107	150	335	485
104(1)	Embankment	CU.M.	54	164,900	4,363	1,692	2,849	6,055	8,905
105(1)	Subgrade Preparation, Common	SQ.M.	5	320,100	784	304	512	1,088	1,601
	TOTAL EARTHWORK				7,341	5,246	4,767	12,587	17,354
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	160	131,440	10,095	5,678	5,258	15,773	21,030
202	Crushed Aggregate Base Course	CU.M.	276	65,520	9,403	3,978	4,702	13,382	18,084
301	Bituminous Prime Coat, MC-70	SQ.M.	13	391,000	2,796	1,271	1,017	4,066	5,083
304(1)	Single Bituminous Surface Treatment	SQ.M.	29	113,200	1,773	788	722	2,561	3,283
304(2)	Double Bituminous Surface Treatment	SQ.M.	57	277,800	8,392	3,959	3,484	12,351	15,835
311(3)	Patching Existing PCC Pavement	SQ.M.	121	103	7	3	3	10	12
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	29	4,120	44	57	18	102	119
	TOTAL - PAVEMENT				32,510	15,734	15,202	48,244	63,446

TABLE 6-4 COST ESTIMATE BREAKDOWN
SECTION 3: CAUAYAN - SIPALAY
(Continued)

PAY ITEM NO.	DESCRIPTION	UNIT	UNIT COST (Pesos)	QUANTITY	COST COMPONENTS (1000 Pesos) FOREIGN	LOCAL	TAXES	ECONOMIC COST (1000 P)	FINANCIAL COST (1000 P)
	III. STRUCTURES								
400(4)	Precast Concrete Piles, Furnished (40 x 40cm)	L.M.	1,015	1,040	433	464	158	897	1,056
400(13)	Precast Concrete Piles, Driven (40 x 40cm)	L.M.	720	950	315	260	109	575	684
400(15)	Test Piles, Driven	L.M.	1,150	120	63	52	22	116	138
401	Concrete Bridge Railing	L.M.	928	188	66	89	19	155	174
404	Reinforcing Steel	KG	24	70,150	758	741	185	1,498	1,684
405(1)	Structural Concrete, Class A	CU.M.	2,033	538	448	481	164	930	1,094
407(1)	Rehabilitation of Existing Bridges	L.S.	1	255,000	125	94	36	219	255
	TOTAL - STRUCTURES				2,208	2,182	694	4,390	5,084
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	150	4,570	322	185	178	507	686
500(91)	RCPC, 91cm Diameter	L.M.	1,685	950	672	672	256	1,345	1,601
500(107)	RCPC, 107cm Diameter	L.M.	2,255	600	568	568	216	1,137	1,353
500(122)	RCPC, 122cm Diameter	L.M.	3,342	250	351	351	134	702	836
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,020	1,314	1,088	1,168	398	2,256	2,654
502(11)	Reinforcing Steel for Pipe Headwalls	KG	24	52,500	567	554	139	1,121	1,260
503(2)	Removal, Cleaning, Replacement, Salvaged Pipe Culverts	L.M.	407	1,800	308	308	117	615	733
504(5)	Grouted Riprap	CU.M.	776	1,220	199	634	114	833	947
	TOTAL - DRAINAGE/EROSION				4,075	4,441	1,552	8,516	10,068
	V. INCIDENTAL WORKS								
603(3)	Metal Beam Guardrail	L.M.	900	80	29	18	25	47	72
605(1)	Warning Signs	EA.	3,215	6	8	4	7	13	19
605(2)	Regulatory Signs	EA.	3,215	6	8	4	7	13	19
605(3)	Informatory Signs	EA.	13,500	4	24	11	19	35	54
620	Sodding	SQ.M.	6	200,400	613	192	397	806	1,202
	TOTAL - INCIDENTAL WORKS				682	231	454	913	1,367
				SUBTOTAL	46,817	27,833	22,670	74,650	97,320
				10% Contingencies	4,682	2,783	2,267	7,465	9,732
				SUBTOTAL	51,498	30,617	24,937	82,115	107,052
				10% Office,Vehicles, etc.	5,150	3,062	2,494	8,212	10,705
				SUBTOTAL	56,648	33,678	27,431	90,327	117,757
				8% Supervision Cost	4,532	2,694	2,194	7,226	9,421
				TOTAL SECTION COST	61,180	36,373	29,625	97,553	127,178

TABLE 6-5 COST ESTIMATE BREAKDOWN
KABANKALAN - BASAY ROAD
SECTION 4: SIPALAY - HINOBAAN

SECTION LENGTH: 21.0 Kilometers (Existing)
ROADWAY WIDTH: 6.0m Pavement + 1.0m Shoulder
PROPOSED SURFACE COURSE: Double Bituminous Surface Treatment

PAY ITEM NO.	DESCRIPTION	UNIT	UNIT COST (Pesos)	QUANTITY	COST COMPONENTS (1000 Pesos) FOREIGN	LOCAL	TAXES	ECONOMIC COST (1000 P)	FINANCIAL COST (1000 P)
	I. EARTHWORK								
100(1)	Clearing & Grubbing	SQ.M.	2	177,200	174	67	113	241	354
101(1)	Removal of Structures & Obstructions	L.S.	1	425,000	128	234	64	361	425
102(2)	Surplus Common Excavation	CU.M.	46	204,400	4,607	1,786	3,009	6,394	9,402
102(3)	Surplus Rock Excavation	CU.M.	172	22,750	1,096	2,113	704	3,209	3,913
103(1)	Structure Excavation	CU.M.	58	700	19	9	13	28	41
103(2)	Bridge Excavation	CU.M.	66	70	2	1	1	3	5
103(4)	Excavation Below Plan Elevation	CU.M.	240	130	11	16	4	27	31
103(6)	Pipe Culvert Excavation	CU.M.	66	3,300	102	48	68	150	218
104(1)	Embankment	CU.M.	54	22,200	587	228	384	815	1,199
105(1)	Subgrade Preparation, Common	SQ.M.	5	74,400	182	71	119	253	372
	TOTAL EARTHWORK				6,908	4,573	4,479	11,481	15,960
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	160	57,750	4,435	2,495	2,310	6,930	9,240
202	Crushed Aggregate Base Course	CU.M.	276	26,850	3,854	1,630	1,927	5,484	7,411
301	Bituminous Prime Coat, MC-70	SQ.M.	13	166,400	1,190	541	433	1,731	2,163
304(1)	Single Bituminous Surface Treatment	SQ.M.	29	41,600	651	290	265	941	1,206
304(2)	Double Bituminous Surface Treatment	SQ.M.	57	124,800	3,770	1,778	1,565	5,549	7,114
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	29	80	0.9	1.1	0.3	2	2
	TOTAL - PAVEMENT				13,901	6,735	6,500	20,636	27,136

TABLE 6-5 COST ESTIMATE BREAKDOWN
SECTION 4: SIPALAY - HINOBAAN
(Continued)

PAY ITEM NO.	DESCRIPTION	UNIT	UNIT COST (Pesos)	QUANTITY	COST COMPONENTS (1000 Pesos) FOREIGN	LOCAL	TAXES	ECONOMIC COST (1000 P)	FINANCIAL COST (1000 P)
	III. STRUCTURES								
400(4)	Precast Concrete Piles, Furnished (40 x 40cm)	L.M.	1,015	480	200	214	73	414	487
400(13)	Precast Concrete Piles, Driven (40 x 40cm)	L.M.	720	420	139	115	48	254	302
400(15)	Test Piles, Driven	L.M.	1,150	60	32	26	11	58	69
401	Concrete Bridge Railing	L.M.	928	66	23	31	7	55	61
404	Reinforcing Steel	KG	24	111,500	1,204	1,177	294	2,382	2,676
405(1)	Structural Concrete, Class A	CU.M.	2,033	1,289	1,074	1,153	393	2,227	2,621
407(1)	Rehabilitation of Existing Bridges	L.S.	1	60,000	29	22	8	52	60
	TOTAL - STRUCTURES				2,702	2,739	835	5,441	6,276
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	150	2,050	145	83	80	228	308
500(91)	RCPC, 91cm Diameter	L.M.	1,685	420	297	297	113	594	708
500(107)	RCPC, 107cm Diameter	L.M.	2,255	270	256	256	97	511	609
500(122)	RCPC, 122cm Diameter	L.M.	3,342	115	161	161	61	323	384
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,020	588	487	523	178	1,010	1,188
502(11)	Reinforcing Steel for Pipe Headwalls	KG	24	23,500	254	248	62	502	564
503(2)	Removal, Cleaning, Replacement, Salvaged Pipe Culverts	L.M.	407	805	138	138	52	275	328
504(5)	Grouted Riprap	CU.M.	776	870	142	452	81	594	675
	TOTAL - DRAINAGE/EROSION				1,879	2,158	726	4,037	4,763
	V. INCIDENTAL WORKS								
603(3)	Metal Beam Guardrail	L.M.	900	40	14	9	13	23	36
605(1)	Warning Signs	EA.	3,215	4	5	3	5	8	13
605(2)	Regulatory Signs	EA.	3,215	4	5	3	5	8	13
605(3)	Informatory Signs	EA.	13,500	4	24	11	19	35	54
620	Sodding	SQ.M.	6	29,600	91	28	59	119	178
	TOTAL - INCIDENTAL WORKS				140	55	99	194	293
				SUBTOTAL	25,529	16,260	12,639	41,790	54,429
				10% Contingencies	2,553	1,626	1,264	4,179	5,443
				SUBTOTAL	28,082	17,886	13,903	45,969	59,871
				10% Office,Vehicles, etc.	2,808	1,789	1,390	4,597	5,987
				SUBTOTAL	30,891	19,675	15,293	50,565	65,859
				8% Supervision Cost	2,471	1,574	1,223	4,045	5,269
				TOTAL SECTION COST	33,362	21,249	16,517	54,611	71,127

TABLE 6-6 COST ESTIMATE BREAKDOWN
KABANKALAN - BASAY ROAD
SECTION 5: HINOBAAN - BASAY

SECTION LENGTH: 32.2 Kilometers (Existing)
ROADWAY WIDTH: 6.0m Pavement + 1.0m Shoulder
PROPOSED SURFACE COURSE: Double Bituminous Surface Treatment

PAY ITEM NO.	DESCRIPTION	UNIT	UNIT COST (Pesos)	QUANTITY	COST COMPONENTS (1000 Pesos) FOREIGN	LOCAL	TAXES	ECONOMIC COST (1000 P)	FINANCIAL COST (1000 P)
	I. EARTHWORK								
100(1)	Clearing & Grubbing	SQ.M.	2	293,000	287	111	188	398	586
100(3)	Tree Removal, Large	EA.	155	1,600	74	136	37	211	248
101(1)	Removal of Structures & Obstructions	L.S.	1	930,000	279	512	140	791	930
102(2)	Surplus Common Excavation	CU.M.	46	17,700	399	155	261	554	814
102(3)	Surplus Rock Excavation	CU.M.	172	10,100	486	938	313	1,425	1,737
103(1)	Structure Excavation	CU.M.	58	600	16	8	11	24	35
103(2)	Bridge Excavation	CU.M.	66	750	23	11	15	34	50
103(4)	Excavation Below Plan Elevation	CU.M.	240	520	42	65	17	107	125
103(6)	Pipe Culvert Excavation	CU.M.	66	10,800	335	157	221	492	713
104(1)	Embankment	CU.M.	54	93,100	2,463	955	1,609	3,419	5,027
105(1)	Subgrade Preparation, Common	SQ.M.	5	177,400	435	169	284	603	887
	TOTAL EARTHWORK				4,841	3,216	3,095	8,057	11,152
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	160	89,400	6,866	3,862	3,576	10,728	14,304
202	Crushed Aggregate Base Course	CU.M.	276	41,550	5,963	2,523	2,982	8,486	11,468
301	Bituminous Prime Coat, MC-70	SQ.M.	13	257,600	1,842	837	670	2,679	3,349
304(1)	Single Bituminous Surface Treatment	SQ.M.	29	64,400	1,009	448	411	1,457	1,868
304(2)	Double Bituminous Surface Treatment	SQ.M.	57	193,200	5,837	2,753	2,423	8,590	11,012
	TOTAL - PAVEMENT				21,516	10,424	10,061	31,940	42,001

TABLE 6-6 COST ESTIMATE BREAKDOWN
SECTION 5: HINOBAAN - BASAY
(Continued)

PAY ITEM NO.	DESCRIPTION	UNIT	UNIT COST (Pesos)	QUANTITY	COST COMPONENTS (1000 Pesos) FOREIGN	LOCAL	TAXES	ECONOMIC COST (1000 P)	FINANCIAL COST (1000 P)
	III. STRUCTURES								
400(4)	Precast Concrete Piles, Furnished (40 x 40cm)	L.M.	1,015	2,976	1,238	1,329	453	2,568	3,021
400(13)	Precast Concrete Piles, Driven (40 x 40cm)	L.M.	720	2,604	862	712	300	1,575	1,875
400(15)	Test Piles, Driven	L.M.	1,150	372	197	163	68	359	428
401	Concrete Bridge Railing	L.M.	928	596	210	282	61	492	553
404	Reinforcing Steel	KG	24	259,000	2,797	2,735	684	5,532	6,216
405(1)	Structural Concrete, Class A	CU.M.	2,033	2,389	1,991	2,137	729	4,128	4,857
406(1)	P/S Concrete Girder, Type 4	L.M.	8,400	276	1,066	904	348	1,971	2,318
407(1)	Rehabilitation of Existing Bridges	L.S.	1	60,000	29	22	8	52	60
	TOTAL - STRUCTURES				8,392	8,285	2,651	16,677	19,328
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	150	6,700	472	271	261	744	1,005
500(91)	RCPC, 91cm Diameter	L.M.	1,685	1,300	920	920	350	1,840	2,191
500(107)	RCPC, 107cm Diameter	L.M.	2,255	1,050	994	994	379	1,989	2,368
500(122)	RCPC, 122cm Diameter	L.M.	3,342	300	421	421	160	842	1,003
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,020	967	801	859	293	1,660	1,953
502(11)	Reinforcing Steel for Pipe Headwalls	KG	24	38,700	418	409	102	827	929
504(5)	Grouted Riprap	CU.M.	776	2,600	424	1,352	242	1,775	2,018
	TOTAL - DRAINAGE/EROSION				4,450	5,227	1,788	9,677	11,466
	V. INCIDENTAL WORKS								
603(3)	Metal Beam Guardrail	L.M.	900	400	144	90	126	234	360
605(1)	Warning Signs	EA.	3,215	8	11	6	9	17	26
605(2)	Regulatory Signs	EA.	3,215	6	8	4	7	13	19
605(3)	Informatory Signs	EA.	13,500	4	24	11	19	35	54
620	Sodding	SQ.M.	6	96,000	294	92	190	386	576
	TOTAL - INCIDENTAL WORKS				480	204	351	684	1,035
				SUBTOTAL	39,680	27,355	17,945	67,035	84,981
				10% Contingencies	3,968	2,735	1,795	6,704	8,498
				SUBTOTAL	43,648	30,090	19,740	73,739	93,479
				10% Office,Vehicles, etc.	4,365	3,009	1,974	7,374	9,348
				SUBTOTAL	48,013	33,099	21,714	81,112	102,826
				8% Supervision Cost	3,841	2,648	1,737	6,489	8,226
				TOTAL SECTION COST	51,854	35,747	23,451	87,601	111,053

VII. ECONOMIC EVALUATION

A. INTRODUCTION

Proposed road projects have to meet certain economic criteria to prove beyond a reasonable doubt that the necessary investment will be beneficial to the community. An economic analysis has been performed for this project, estimating costs and benefits, to determine its economic viability.

One project design was evaluated for each homogeneous section of the Kabankalan-Basay Road Project. Appropriate interventions were assessed by the pavement engineers on the basis of good engineering practice, AASHTO and DPWH guidelines, depending on the traffic level. The evaluation procedure included a comparison of the proposed project design with the "without project" alternative.

1. BASIC INPUTS AND ASSUMPTIONS FOR THE EVALUATION OF THE PROJECT ROAD

The economic feasibility of each road section is analyzed with the Project Evaluation Model described in Appendix C-5 of the Main Report. This large spreadsheet model allows for the rapid economic evaluation of the improvement proposals for the RIF roads. These alternatives include different pavement types, widening the carriageway and shoulders, improvements in the alignment and new road segments. The main inputs into the model, drawing on the data discussed in earlier chapters, are:

- Traffic forecasts "with" and "without" the project; see Chapter III of this volume.
- Geometric characteristics of the road "with" and "without" the project (roadway cross section, grade, curvature and length); see Chapter IV.
- Pavement conditions "with" and "without" the project (pavement types, roughness and modified structural number, e.g. pavement/subgrade strength).
- Maintenance costs; see Appendix C-1 of the Main Report.
- Vehicle operating costs; see Appendix C-2 of the Main Report.
- Construction costs for each alternative and construction period; see Chapter VI of this volume, and Appendix C-4 of the Main Report.

- Development benefits "with" the project, discussed below.

The quantified benefits include vehicle operating cost savings, time cost savings, maintenance cost savings, and development benefits. The economic evaluation of this project has been carried out with the following assumptions:

- The project life is assumed to be 20 years.
- For discounting purposes, the annual values are assumed to be incurred at the end of each year.
- The opportunity cost of capital is set at 15 percent.

Other benefits which are envisaged to accrue due to the opening of the road, but have not been quantified, are:

- accident cost savings,
- spoilage savings, and
- health benefits related to improved accessibility to area hospitals and health centers.

This chapter discusses how these data are used in the model, and the results of the project evaluation.

B. PROJECT BENEFITS

1. TRAFFIC BENEFITS

Traffic benefits are estimated as the difference in vehicle operating costs "with" and "without" the project. Vehicle operating costs are derived from the World Bank's HDM-III model, which was calibrated for February 1990 conditions in the Philippines (see Appendix C-2 of the Main Report).

Annual road user costs were estimated for both "with" and "without" the proposed road by means of an evaluation model developed by the Consultants. This process involved the input of road inventory data (See Table 7-1), traffic data by vehicle type (See Chapter III), and unit vehicle operating cost data for each roughness and speed combination (See Tables 7-2 and 7-3). Initial roughness after the proposed improvement, as well as the variation of roughness values over time (for the "with" and "without" alternatives) were estimated by means of appropriate deterioration curves, presented in Appendix C of the Main Report.

The methodology used in the estimation of traffic benefits for normal, diverted and generated traffic is presented below.

TABLE 7-1

EXISTING ROAD CONDITION

Homogeneous Traffic Section	Length (km)	Pavement Type/ Condition
Kabankalan-Ilog	2.4	PCC/Good
Ilog-Cauayan	20.0	Asphalt/Bad (0.7 km) Gravel/Fair (8.4 km) PCC/Fair (10.9 km)
Cauayan-Sipalay	56.6	PCC/Fair (10.3 km) Gravel/Fair (45.2 km) Asphalt/Bad (1.1 km)
Sipalay-Hinobaan	21.0	Gravel/Fair (19.0 km) PCC/Fair (0.2 km) Asphalt/Bad (1.8 km)
Hinobaan-Basay	32.2	Gravel/Fair
Total	132.2 km	

Normal Traffic: Normal traffic occurs irrespective of whether or not the project will be undertaken. The benefits from normal traffic are the full difference in the vehicle operating costs "with" and "without" the project. Briefly, normal traffic benefits are the difference in transport costs (vehicle operating costs) over a road section "without" and "with" the proposed improvements.

Diverted traffic: Diverted traffic results from persons or goods travelling by other routes or modes of transport transferring to the project road due to reductions in cost or travel time and improvements in quality of service. Diverted traffic benefits are the difference in transport costs using the route or mode of transport "without" the project improvements and "with" them. There will be no significant levels of diverted traffic on this RIF road.

Generated Traffic: Generated traffic occurs only with the implementation of the proposed road improvement projects. Based on a general consensus of transport economists, the benefits from generated traffic are half the difference in the vehicle operating costs "with" and "without" the project. Briefly, in the cases where there is an existing road, generated traffic benefits per vehicle are taken as 50 percent of the normal traffic benefits per vehicle (see Appendix C-3 of the Main Report).

a. Vehicle Operating Costs (VOC)

Vehicle operating costs "with" and "without" the project are estimated for each homogeneous traffic section. For a discussion on homogeneous traffic sections, see Chapter III of this volume.

For the purpose of VOC calculations, the nine vehicle categories used in traffic forecasting were combined into five vehicle categories, as explained in Appendix C of the Main Report. Vehicle operating costs "with" and "without" the project for these five vehicle categories are computed for each year of the analysis period. The difference in operating costs from year to year is due to changes in pavement roughness and average running speed.

The estimated unit vehicle operating costs and passenger time savings are given in Tables 7-2 and 7-3. From these unit costs, estimates of total VOCs and time savings for the Kabankalan-Basay Road are made.

b. Passenger Time Savings

Benefits from passenger time savings were estimated on the basis of increases in travel speed which will result from the proposed road improvements. These savings come from:

- a shortening of the road,
- reductions in curvature,
- reductions in grade,
- smoother riding surface, e.g. a reduction in roughness, and
- widening of the roadway and shoulders.

The vehicle speed equations employed are discussed in Appendix C-1 of the Main Report.

The estimated value of time is discussed in Appendix C-2 of the Main Report. For Regions VI and VII where the Kabankalan-Basay Road Project is located, values of 2.78 and 2.57 pesos per passenger hour, respectively have been assumed. The roads are evaluated "with" and "without" time savings.

2. DEVELOPMENT BENEFITS

The feasibility of the improvement of the Kabankalan - Basay road is enhanced by its important role in the integration of the island's regional transportation network. It will also benefit agricultural and economic activity in the zone of influence. However, these possible benefits will be measured by the reduction in vehicle operating costs for normal and generated traffic. The proposed road improvement, in and of itself, is not expected to increase agricultural production to any significant extent. The factors taken into consideration in making this determination were:

TABLE 7-2

ECONOMIC VEHICLE OPERATING COSTS - HDM-III RESULTS - W/O TIME VALUE OF USER COST (PESOS/KM)

Speed(km/h)	ROUGHNESS (m/km)																			
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	2.519	2.540	2.563	2.589	2.649	2.686	2.728	2.773	2.773	2.818	2.863	2.908	2.952	2.996	3.039	3.081	3.122	3.162	3.201	2-3W Veh
20	1.451	1.472	1.495	1.521	1.550	1.852	1.619	1.661	1.707	1.753	1.799	1.844	1.890	1.936	1.981	2.025	2.068	2.110	2.151	2-3W Veh
30	1.100	1.121	1.144	1.170	1.199	1.232	1.270	1.313	1.360	1.407	1.455	1.503	1.552	1.601	1.650	1.699	1.748	1.797	1.846	2-3W Veh
40	0.932	0.953	0.976	1.002	1.032	1.066	1.104	1.149	1.198	1.248	1.299	1.351	1.404	1.458	1.512	1.566	1.620	1.674	1.728	2-3W Veh
50	0.839	0.860	0.884	0.910	0.941	0.976	1.016	1.062	1.114	1.167	1.222	1.278	1.336	1.395	1.456	1.519	1.584	1.651	1.720	2-3W Veh
60	0.786	0.808	0.832	0.859	0.890	0.926	0.968	1.017	1.071	1.128	1.186	1.247	1.309	1.373	1.438	1.504	1.571	1.639	1.708	2-3W Veh
70	0.757	0.779	0.803	0.831	0.863	0.900	0.944	0.995	1.052	1.112	1.173	1.237	1.303	1.371	1.439	1.507	1.575	1.643	1.711	2-3W Veh
80	0.743	0.765	0.789	0.817	0.850	0.889	0.934	0.987	1.047	1.109	1.173	1.240	1.309	1.379	1.450	1.522	1.595	1.669	1.744	2-3W Veh
90	0.744	0.766	0.790	0.817	0.851	0.893	0.938	0.993	1.056	1.119	1.186	1.256	1.327	1.397	1.471	1.549	1.631	1.717	1.807	2-3W Veh
100	0.760	0.782	0.806	0.831	0.866	0.912	0.956	1.013	1.079	1.142	1.212	1.285	1.357	1.425	1.502	1.588	1.683	1.787	1.900	2-3W Veh
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	2.091	2.139	2.194	2.256	2.327	2.407	2.500	2.607	2.725	2.844	2.962	3.080	3.137	3.314	3.426	3.473	3.455	3.372	3.224	Cars
20	1.496	1.544	1.599	1.661	1.732	1.813	1.905	2.013	2.132	2.251	2.369	2.488	2.606	2.725	2.838	2.945	3.046	3.141	3.230	Cars
30	1.305	1.354	1.409	1.471	1.542	1.623	1.716	1.825	1.945	2.065	2.185	2.306	2.427	2.548	2.665	2.778	2.887	2.992	3.093	Cars
40	1.220	1.269	1.324	1.387	1.458	1.540	1.634	1.744	1.866	1.989	2.112	2.236	2.361	2.487	2.609	2.727	2.841	2.951	3.057	Cars
50	1.181	1.230	1.286	1.349	1.421	1.504	1.600	1.712	1.836	1.962	2.089	2.217	2.347	2.478	2.606	2.731	2.853	2.972	3.088	Cars
60	1.168	1.218	1.274	1.337	1.410	1.495	1.592	1.706	1.834	1.963	2.094	2.227	2.361	2.497	2.631	2.763	2.893	3.021	3.147	Cars
70	1.172	1.221	1.277	1.342	1.416	1.502	1.601	1.718	1.848	1.980	2.115	2.252	2.391	2.532	2.670	2.805	2.937	3.066	3.192	Cars
80	1.185	1.235	1.292	1.357	1.432	1.519	1.621	1.739	2.034	2.008	2.147	2.287	2.430	2.575	2.717	2.856	2.992	3.125	3.255	Cars
90	1.207	1.260	1.319	1.382	1.458	1.546	1.652	1.769	2.392	2.047	2.190	2.332	2.478	2.626	2.772	2.916	3.058	3.198	3.336	Cars
100	1.238	1.296	1.358	1.417	1.494	1.583	1.694	1.808	2.922	2.097	2.244	2.387	2.535	2.685	2.835	2.985	3.135	3.285	3.435	Cars
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	4.183	4.295	4.424	4.574	4.749	4.952	5.191	5.471	5.785	6.099	6.412	6.725	7.038	7.351	7.658	7.959	8.254	8.543	8.826	Jeepneys
20	2.908	3.021	3.151	3.302	3.477	3.682	3.922	4.205	4.520	4.837	5.154	5.471	5.788	6.105	6.447	6.814	7.206	7.623	8.065	Jeepneys
30	2.531	2.645	2.776	2.929	3.106	3.313	3.556	3.842	4.162	4.484	4.806	5.129	5.453	5.779	6.100	6.416	6.727	7.033	7.334	Jeepneys
40	2.391	2.506	2.639	2.793	2.973	3.183	3.430	3.719	4.045	4.372	4.702	5.033	5.366	5.701	6.033	6.362	6.688	7.011	7.331	Jeepneys
50	2.349	2.465	2.938	3.151	3.402	3.697	4.028	4.028	4.028	4.362	4.699	5.038	5.380	5.724	6.066	6.406	6.744	7.080	7.414	Jeepneys
60	2.357	2.475	2.610	2.769	2.953	3.170	3.425	3.725	4.061	4.020	4.746	5.093	5.442	5.795	6.145	6.492	6.836	7.177	7.515	Jeepneys
70	2.395	2.513	2.650	2.811	2.998	3.218	3.477	3.781	4.123	4.470	4.820	5.174	5.530	5.890	6.248	6.604	6.958	7.310	7.660	Jeepneys
80	2.450	2.569	2.708	2.870	3.060	3.283	3.545	3.854	4.201	4.553	4.909	5.269	5.632	5.998	6.362	6.724	7.084	7.442	7.798	Jeepneys
90	2.522	2.643	2.784	2.946	3.139	3.365	3.629	3.944	4.295	4.269	5.013	5.378	5.748	6.119	6.487	6.852	7.214	7.573	7.929	Jeepneys
100	2.611	2.735	2.878	3.039	3.235	3.464	3.729	4.051	4.405	3.618	5.132	5.501	5.878	6.253	6.623	6.988	7.348	7.703	8.053	Jeepneys

TABLE 7-2

ECONOMIC VEHICLE OPERATING COSTS - HDM-III RESULTS - W/O TIME VALUE OF USER COST (PESOS/KM)

Speed(km/h)	ROUGHNESS (m/km)																			
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	8.330	8.400	8.474	8.552	8.634	8.772	8.815	8.914	9.019	9.131	9.251	9.378	9.515	9.661	9.814	9.974	10.141	10.315	10.496	Buses
20	6.036	6.106	6.181	6.260	6.344	6.433	6.529	6.631	6.740	6.857	6.983	7.119	7.265	7.422	7.589	7.766	7.953	8.150	8.357	Buses
30	5.357	5.429	5.505	5.586	5.674	5.768	5.869	5.979	6.098	6.228	6.369	6.523	6.722	6.872	7.067	7.307	7.592	7.922	8.297	Buses
40	5.121	5.195	5.273	5.358	5.450	5.551	5.662	5.784	5.919	6.069	6.233	6.414	6.612	6.827	7.059	7.308	7.574	7.857	8.157	Buses
50	5.081	5.157	5.238	5.327	5.426	5.536	5.660	5.798	5.593	6.126	6.318	6.528	6.759	7.008	7.275	7.560	7.863	8.184	8.523	Buses
60	5.149	5.227	5.311	5.405	5.512	5.633	5.770	5.927	6.103	6.300	6.519	6.758	7.018	7.298	7.596	7.912	8.246	8.598	8.968	Buses
70	5.284	5.364	5.451	5.551	5.665	5.797	5.949	6.123	6.320	6.541	6.784	7.049	7.336	7.643	7.967	8.308	8.666	9.041	9.433	Buses
80	5.463	5.544	5.635	5.740	5.861	6.004	6.170	6.361	6.578	6.819	7.085	7.374	7.684	8.015	8.364	8.731	9.116	9.519	9.940	Buses
90	5.686	5.767	5.863	5.972	6.100	6.254	6.433	6.641	6.877	7.134	7.422	7.733	8.062	8.414	8.787	9.181	9.596	10.032	10.489	Buses
100	5.953	6.033	6.135	6.247	6.382	6.547	6.738	6.963	7.217	7.486	7.795	8.126	8.470	8.840	9.236	9.658	10.106	10.580	11.080	Buses
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	9.946	10.480	10.496	11.442	11.938	12.434	12.931	13.428	13.928	14.429	14.932	15.437	15.945	16.456	16.969	17.484	18.001	18.520	19.041	Trucks
20	8.153	8.655	9.154	9.652	10.151	10.650	11.152	11.656	12.164	12.674	13.189	13.709	14.233	14.763	15.298	15.838	16.383	16.933	17.488	Trucks
30	7.634	8.137	8.639	9.142	9.646	10.154	10.667	11.185	11.710	12.242	12.782	13.330	13.888	14.454	15.031	15.619	16.218	16.828	17.449	Trucks
40	7.477	7.984	8.489	8.998	9.152	10.032	10.562	11.101	11.652	12.214	12.789	13.377	13.977	14.589	15.213	15.849	16.497	17.157	17.829	Trucks
50	7.496	8.005	8.516	9.033	9.558	10.095	10.645	11.210	11.791	12.387	13.000	13.629	14.272	14.929	15.598	16.279	16.972	17.677	18.394	Trucks
60	7.620	8.132	8.649	9.174	9.712	10.266	10.838	11.430	12.041	12.672	13.322	13.989	14.672	15.370	16.081	16.805	17.542	18.292	19.055	Trucks
70	7.811	8.327	8.849	9.383	9.934	10.505	11.099	11.717	12.358	13.021	13.706	14.409	15.129	15.864	16.612	17.373	18.147	18.934	19.734	Trucks
80	8.048	8.566	9.094	9.637	10.200	10.789	11.404	12.046	12.715	13.409	14.125	14.862	15.616	16.386	17.170	17.968	18.780	19.606	20.446	Trucks
90	8.331	8.849	9.384	9.936	10.510	11.118	11.753	12.417	13.112	13.836	14.579	15.348	16.133	16.936	17.755	18.590	19.441	20.308	21.191	Trucks
100	8.660	9.176	9.719	10.280	10.864	11.492	12.146	12.830	13.549	14.302	15.068	15.867	16.680	17.514	18.367	19.239	20.130	21.040	21.969	Trucks

TABLE 7-3

ECONOMIC VEHICLE OPERATING COSTS - HDM-III RESULTS - W/ TIME VALUE OF USER COST (PESOS/KM)

Speed(km/h)	ROUGHNESS (m/km)																			
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	2.797	2.818	2.841	2.867	2.927	2.964	3.006	3.051	3.051	3.096	3.141	3.186	3.230	3.274	3.317	3.359	3.400	3.440	3.479	2-3W Veh
20	1.590	1.611	1.634	1.660	1.689	1.991	1.758	1.800	1.846	1.892	1.938	1.983	2.029	2.075	2.120	2.164	2.207	2.249	2.290	2-3W Veh
30	1.193	1.214	1.237	1.263	1.292	1.325	1.363	1.406	1.453	1.500	1.548	1.596	1.645	1.694	1.743	1.792	1.841	1.890	1.939	2-3W Veh
40	1.001	1.022	1.045	1.071	1.101	1.135	1.173	1.218	1.267	1.317	1.368	1.420	1.473	1.527	1.581	1.635	1.689	1.743	1.797	2-3W Veh
50	0.895	0.916	0.940	0.966	0.997	1.032	1.072	1.118	1.170	1.223	1.278	1.334	1.392	1.451	1.512	1.575	1.640	1.707	1.776	2-3W Veh
60	0.832	0.854	0.878	0.905	0.936	0.972	1.014	1.063	1.117	1.174	1.232	1.293	1.355	1.419	1.484	1.550	1.617	1.685	1.754	2-3W Veh
70	0.797	0.819	0.843	0.871	0.903	0.940	0.984	1.035	1.092	1.152	1.213	1.277	1.343	1.411	1.479	1.547	1.615	1.683	1.751	2-3W Veh
80	0.778	0.800	0.824	0.852	0.885	0.924	0.969	1.022	1.082	1.144	1.208	1.275	1.344	1.414	1.485	1.557	1.630	1.704	1.779	2-3W Veh
90	0.775	0.797	0.821	0.848	0.882	0.924	0.969	1.024	1.087	1.150	1.217	1.287	1.358	1.428	1.502	1.580	1.662	1.748	1.838	2-3W Veh
100	0.788	0.810	0.834	0.859	0.894	0.940	0.984	1.041	1.107	1.170	1.240	1.313	1.385	1.453	1.530	1.616	1.711	1.815	1.928	2-3W Veh
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	3.032	3.080	3.135	3.197	3.268	3.348	3.441	3.548	3.666	3.785	3.903	4.021	4.078	4.255	4.367	4.414	4.396	4.313	4.165	Cars
20	1.967	2.015	2.070	2.132	2.203	2.284	2.376	2.484	2.603	2.722	2.840	2.959	3.077	3.196	3.309	3.416	3.517	3.612	3.701	Cars
30	1.619	1.668	1.723	1.785	1.856	1.937	2.030	2.139	2.259	2.379	2.499	2.620	2.741	2.862	2.979	3.092	3.201	3.306	3.407	Cars
40	1.455	1.504	1.559	1.622	1.693	1.775	1.869	1.979	2.101	2.224	2.347	2.471	2.596	2.722	2.844	2.962	3.076	3.186	3.292	Cars
50	1.369	1.418	1.474	1.537	1.609	1.692	1.788	1.900	2.024	2.150	2.277	2.405	2.535	2.666	2.794	2.919	3.041	3.160	3.276	Cars
60	1.325	1.375	1.431	1.494	1.567	1.652	1.749	1.863	1.991	2.120	2.251	2.384	2.518	2.654	2.788	2.920	3.050	3.178	3.304	Cars
70	1.306	1.355	1.411	1.476	1.550	1.636	1.735	1.852	1.982	2.114	2.249	2.386	2.525	2.666	2.804	2.939	3.071	3.200	3.326	Cars
80	1.303	1.353	1.410	1.475	1.550	1.637	1.739	1.857	2.152	2.126	2.265	2.405	2.548	2.693	2.835	2.974	3.110	3.243	3.373	Cars
90	1.312	1.365	1.424	1.487	1.563	1.651	1.757	1.874	2.497	2.152	2.295	2.437	2.583	2.731	2.877	3.021	3.163	3.303	3.441	Cars
100	1.332	1.390	1.452	1.511	1.588	1.677	1.788	1.902	3.016	2.191	2.338	2.481	2.629	2.779	2.929	3.079	3.229	3.379	3.529	Cars
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	8.471	8.583	8.712	8.862	9.037	9.240	9.479	9.759	10.073	10.387	10.700	11.013	11.326	11.639	11.946	12.247	12.542	12.831	13.114	Jeepneys
20	5.052	5.165	5.295	5.446	5.621	5.826	6.066	6.349	6.664	6.981	7.298	7.615	7.932	8.249	8.591	8.958	9.350	9.767	10.209	Jeepneys
30	3.960	4.074	4.205	4.358	4.535	4.742	4.985	5.271	5.591	5.913	6.235	6.558	6.882	7.208	7.529	7.845	8.156	8.462	8.763	Jeepneys
40	3.463	3.578	3.711	3.865	4.045	4.255	4.502	4.791	5.117	5.444	5.774	6.105	6.438	6.773	7.105	7.434	7.760	8.083	8.403	Jeepneys
50	3.207	3.323	3.796	4.009	4.260	4.555	4.886	4.886	4.886	5.220	5.557	5.896	6.238	6.582	6.924	7.264	7.602	7.938	8.272	Jeepneys
60	3.072	3.190	3.325	3.484	3.668	3.885	4.140	4.440	4.776	4.735	5.461	5.808	6.157	6.510	6.860	7.207	7.551	7.892	8.230	Jeepneys
70	3.008	3.126	3.263	3.424	3.611	3.831	4.090	4.394	4.736	5.083	5.433	5.787	6.143	6.503	6.861	7.217	7.571	7.923	8.273	Jeepneys
80	2.986	3.105	3.244	3.406	3.596	3.819	4.081	4.390	4.737	5.089	5.445	5.805	6.168	6.534	6.898	7.260	7.620	7.978	8.334	Jeepneys
90	2.998	3.119	3.260	3.422	3.615	3.841	4.105	4.420	4.771	4.745	5.489	5.854	6.224	6.595	6.963	7.328	7.690	8.049	8.405	Jeepneys
100	3.040	3.164	3.307	3.468	3.664	3.893	4.158	4.480	4.834	4.047	5.561	5.930	6.307	6.682	7.052	7.417	7.777	8.132	8.482	Jeepneys

TABLE 7-3

ECONOMIC VEHICLE OPERATING COSTS - HDM-III RESULTS - W/ TIME VALUE OF USER COST (PESOS/KM)

Speed(km/h)	ROUGHNESS (m/km)																			
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	17.561	17.631	17.705	17.783	17.865	18.003	18.046	18.145	18.250	18.362	18.482	18.609	18.746	18.892	19.045	19.205	19.372	19.546	19.727	Buses
20	10.651	10.721	10.796	10.875	10.959	11.048	11.144	11.246	11.355	11.472	11.598	11.734	11.880	12.037	12.204	12.381	12.568	12.765	12.972	Buses
30	8.434	8.506	8.582	8.663	8.751	8.845	8.946	9.056	9.175	9.305	9.446	9.600	9.799	9.949	10.144	10.384	10.669	10.999	11.374	Buses
40	7.429	7.503	7.581	7.666	7.758	7.859	7.970	8.092	8.227	8.377	8.541	8.722	8.920	9.135	9.367	9.616	9.882	10.165	10.465	Buses
50	6.927	7.003	7.084	7.173	7.272	7.382	7.506	7.644	7.439	7.972	8.164	8.374	8.605	8.854	9.121	9.406	9.709	10.030	10.369	Buses
60	6.687	6.765	6.849	6.943	7.050	7.171	7.308	7.465	7.641	7.838	8.057	8.296	8.556	8.836	9.134	9.450	9.784	10.136	10.506	Buses
70	6.603	6.683	6.770	6.870	6.984	7.116	7.268	7.442	7.639	7.860	8.103	8.368	8.655	8.962	9.286	9.627	9.985	10.360	10.752	Buses
80	6.617	6.698	6.789	6.894	7.015	7.158	7.324	7.515	7.732	7.973	8.239	8.528	8.838	9.169	9.518	9.885	10.270	10.673	11.094	Buses
90	6.712	6.793	6.889	6.998	7.126	7.280	7.459	7.667	7.903	8.160	8.448	8.759	9.088	9.440	9.813	10.207	10.622	11.058	11.515	Buses
100	6.876	6.956	7.058	7.170	7.305	7.470	7.661	7.886	8.140	8.409	8.718	9.049	9.393	9.763	10.159	10.581	11.029	11.503	12.003	Buses
100	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	9.946	10.480	10.496	11.442	11.938	12.434	12.931	13.428	13.928	14.429	14.932	15.437	15.945	16.456	16.969	17.484	18.001	18.520	19.041	Trucks
20	8.153	8.655	9.154	9.652	10.151	10.650	11.152	11.656	12.164	12.674	13.189	13.709	14.233	14.763	15.298	15.838	16.383	16.933	17.488	Trucks
30	7.634	8.137	8.639	9.142	9.646	10.154	10.667	11.185	11.710	12.242	12.782	13.330	13.888	14.454	15.031	15.619	16.218	16.828	17.449	Trucks
40	7.477	7.984	8.489	8.998	9.152	10.032	10.562	11.101	11.652	12.214	12.789	13.377	13.977	14.589	15.213	15.849	16.497	17.157	17.829	Trucks
50	7.496	8.005	8.516	9.033	9.558	10.095	10.645	11.210	11.791	12.387	13.000	13.629	14.272	14.929	15.598	16.279	16.972	17.677	18.394	Trucks
60	7.620	8.132	8.649	9.174	9.712	10.266	10.838	11.430	12.041	12.672	13.322	13.989	14.672	15.370	16.081	16.805	17.542	18.292	19.055	Trucks
70	7.811	8.327	8.849	9.383	9.934	10.505	11.099	11.717	12.358	13.021	13.706	14.409	15.129	15.864	16.612	17.373	18.147	18.934	19.734	Trucks
80	8.048	8.566	9.094	9.637	10.200	10.789	11.404	12.046	12.715	13.409	14.125	14.862	15.616	16.386	17.170	17.968	18.780	19.606	20.446	Trucks
90	8.331	8.849	9.384	9.936	10.510	11.118	11.753	12.417	13.112	13.836	14.579	15.348	16.133	16.936	17.755	18.590	19.441	20.308	21.191	Trucks
100	8.660	9.176	9.719	10.280	10.864	11.492	12.146	12.830	13.549	14.302	15.068	15.867	16.680	17.514	18.367	19.239	20.130	21.040	21.969	Trucks
100	8.660	9.176	9.719	10.280	10.864	11.492	12.146	12.830	13.549	14.302	15.068	15.867	16.680	17.514	18.367	19.239	20.130	21.040	21.969	Trucks

- The condition of the existing all-weather mainly gravel road provides year-round access to the ZOI and its agricultural areas.

- The road improvement is not likely to accelerate the adoption of improved agricultural technology.

- Relevant development potentials in other sectors of the local economy have not been identified.

Thus, no development benefits have been identified for this project.

3. DIVERTED AND GENERATED TRAFFIC BENEFITS

No diverted traffic benefits have been estimated for the five sections of the Kabankalan-Basay Road.

Generated traffic represents traffic which is currently not travelling along the road but will in the future as VOCs are reduced. Generated traffic benefits have been estimated using the existing roadway as the basis for VOC calculations "without" the proposed project.

The existing road from Kabankalan to Basay traverses along flat to hilly terrain and is paved with alternate concrete, asphalt and gravel surfaces in fair to bad condition.

To evaluate VOCs along the Kabankalan-Basay Road "with" the proposed project, newly-constructed approximately six meter wide PCC-paved and DBST-paved road sections have been assumed.

4. GENERATED TRAFFIC AND DEVELOPMENT BENEFITS

To include both the generated traffic benefits (measured as VOC savings) and the development benefits (net value added) would result in double counting of benefits. For the purposes of evaluating the different benefits from the proposed RIF project, two scenarios were considered:

- a scenario which includes development or "net value added" benefits, and no generated traffic benefits; and

- a scenario which does not include development benefits but includes generated traffic benefits, if any.

As explained before, only traffic benefits and no development benefits were considered in the case of the Kabankalan-Basay Road Project.

5. ROAD MAINTENANCE BENEFITS

One of the expected results of the proposed road is a reduced need for certain maintenance activities which would otherwise have to be done "without" the proposed project. These

reductions in required road maintenance are quantified as road maintenance savings or benefits.

The estimates of both routine and periodic maintenance costs for the project roads are based on maintenance expenditure figures developed by the Consultants on the basis of cost estimates from the NRIP study and their experience from actual maintenance operations in other regions. The maintenance unit costs used in this study are updated to February 1990 prices and are presented in Tables 7-4 and 7-5.

Maintenance savings or benefits are computed by the Maintenance Spreadsheet of the Project Evaluation Model. This spreadsheet estimates routine and periodic maintenance costs for each year (see Appendix C for an estimate of yearly maintenance costs by road section). A full description of this model is given in Appendix C-1 of the Main Report.

C. ENGINEERING CONSIDERATIONS

1. HOMOGENEOUS SECTIONS FOR EVALUATION

Based on the traffic survey data and the location of traffic generators and cross roads, each road was divided into homogeneous traffic sections. Five traffic sections were identified for the Kabankalan-Basay Road: Kabankalan-Ilog, Ilog-Cauayan, Cauayan-Sipalay, Sipalay-Hinobaan and Hinobaan-Basay. Traffic volumes and composition in these sections remain approximately constant.

For the Kabankalan-Basay Road, it was necessary to subdivide some of these homogeneous traffic sections further in order to have a road section with similar pavement characteristics. For instance, a small length of road might already be paved with PCC, and only minor improvements are needed for that subsection. Another subsection of road might be graveled. In these cases, the analysis of each subsection was done separately in order to estimate the benefits; however, costs are estimated for the entire section. Thus, the benefits from one subsection are added to those of the other subsections in order to obtain the benefits over the entire road section.

D. COSTS

1. CONSTRUCTION COST ESTIMATES

The economic evaluation is made using economic costs which are derived from the financial costs by removing all taxes, duties and other transfer payments made to the Government of the Philippines.

The expected construction costs for the Kabankalan-Basay Road were estimated using appropriate unit construction costs. Unit costs and total costs for this road are summarized in

TABLE 7 – 4

ROUTINE MAINTENANCE UNIT COSTS

DESCRIPTION	UNIT	FOREIGN COMPONENT		LOCAL	TAXES	FINANCIAL UNIT	ECONOMIC UNIT
		DIRECT	INDIRECT	COMP.		COST	COST
DITCH CLEANING	P/LM	0.00	0.00	10.41	0.00	10.41	10.41
GRASS CUTTING	P/KM	0.00	0.00	2083.38	0.00	2083.38	2083.38
CULVERT CLEANING	P/LM	0.00	0.00	18.97	0.00	18.97	18.97
MINOR STRUCTURAL REPAIRS	P/EA	0.00	0.00	5959.76	0.00	5959.76	5959.76
GRAVEL ROAD MAINTENANCE (GRADING AND ROLLING)	P/KM	6668.95	0.00	2401.16	3290.95	12361.06	9070.09
GRAVEL ROAD MAINTENANCE (SPOT REGRAVELLING)	P/M^2	13.58	0.00	16.15	8.13	37.86	29.73
GRAVEL ROAD MAINTENANCE (SHOULDER GRADING)	P/M^2	0.66	0.00	0.22	0.34	1.22	0.87
BITUMINOUS SURFACE PAVEMENT MAINT. (PATCHING OF POTHOLES)	P/M^2	30.82	18.97	21.84	21.84	91.01	69.17
PCC PAVEMENT MAINTENANCE 0.15 THICK (REPLACEMENT OF SLAB)	P/M^2	53.56	78.17	79.83	49.53	260.81	211.28
PCC PAVEMENT MAINTENANCE 0.17 THICK (REPLACEMENT OF SLAB)	P/M^2	60.86	89.58	90.20	56.20	295.88	239.68
PCC PAVEMENT MAINTENANCE 0.20 THICK (REPLACEMENT OF SLAB)	P/M^2	71.03	104.34	96.05	66.03	337.45	271.42
PCC PAVEMENT MAINTENANCE 0.23 THICK (REPLACEMENT OF SLAB)	P/M^2	82.11	119.87	122.69	76.28	400.95	324.67
PCC PAVEMENT MAINTENANCE 0.25 THICK (REPLACEMENT OF SLAB)	P/M^2	91.61	124.32	134.55	84.00	434.48	350.48
PCC PAVEMENT MAINTENANCE (SEALING OF JOINTS AND CRACKS)	P/LM	2.03	4.85	8.71	2.64	18.23	15.59

TABLE 7 - 5

PERIODIC MAINTENANCE UNIT COSTS

DESCRIPTION	UNIT	FOREIGN COMPONENT		LOCAL COMP.	TAXES	FINANCIAL UNIT COST	ECONOMIC UNIT COST
		DIRECT	INDIRECT				
GRAVEL ROAD MAINTENANCE (REGRAVELLING)	P/M^2	15.30	0.00	6.52	7.78	29.60	21.82
BITUMINOUS SURFACE PAVEMENT MAINTENANCE (SEAL COAT)	P/M^2	1.60	10.64	5.15	4.42	21.81	17.39
BITUMINOUS SURFACE PAVEMENT MAINT. (ASPHALT OVERLAY)	P/M^3	860.34	550.62	825.64	619.45	2858.44	2238.99

Chapter VI. A more detailed discussion on the derivation of unit construction costs appears in the Main Report.

2. PROJECT MANAGEMENT COSTS

Project management consists of three components:

1) overall coordination of the implementation of the road projects by the executing agency, which will be the Department of Public Works and Highways. (These costs are often overlooked);

2) detailed design; and

3) construction supervision. The design and construction supervision of the proposed road project will be done by a combination of international and local consultants. Their costs are considered part of the project costs and are added to the construction costs of the project.

For the evaluation of the road improvement projects, a value of 8 percent of construction costs is recommended as project management costs. This value has been added on top of a 10 percent contingency and 10 percent for offices and vehicles in the total construction cost estimates in Chapter VI of this volume.

3. ALLOCATION OF CONSTRUCTION AND PROJECT MANAGEMENT COSTS

It is assumed that the year of completion for projects is 1992, and that the roads will be open to traffic in 1993. Project management and construction costs are allocated in the following manner:

	DURATION: 2 YEARS	
	CONSTRUCTION COST	PROJECT MANAGEMENT COST
1991	40 %	40 %
1992	60 %	60 %

E. ECONOMIC EVALUATION

1. CRITERIA FOR ECONOMIC EVALUATION

USAID considers the minimum adequate economic rate of return for projects to be 15 percent.

The inclusion of passenger time savings in the evaluation of road projects is sometimes questioned. Though benefits from passenger time savings are not very high on most RIF roads, they have been considered.

In the economic analysis and in preparing recommendations, emphasis has been placed upon the economic internal rates of return (IRRs). Other criteria, such as net benefit-over-investment ratios and net present values, have also been computed with the Consultants' evaluation model, but due to the large number of project sections being evaluated, only a single index of economic feasibility will be analyzed in detail in order to simplify the presentation and reduce confusion.

For these reasons, the Consultants have estimated benefits and economic internal rates of return (IRR) for four conditions where project benefits consist of:

a. Vehicle operating cost (VOC) benefits, road maintenance benefits, time savings, and development benefits,

b. VOC benefits, road maintenance benefits, and development benefits,

c. VOC benefits, road maintenance benefits, and time savings, and

d. VOC and road maintenance benefits only.

The highest IRRs are obtained for "a", referred to as "all" benefits case, and the lowest result from "d", referred to as "VOC benefits only". In making recommendations, the minimum IRR should be 15 percent.

2. RESULTS

a. Kabankalan-Ilog (2.4 kilometers)

This section of the Kabankalan-Basay Road extends from the junction with the Kabankalan-Bacolod Road in the Municipality of Kabankalan up to Ilog Bridge in the Municipality of Ilog. It traverses hilly terrain and currently has 2.4 km of concrete pavement in good condition.

In 1990, Kabankalan-Ilog presents an annual average daily traffic (AADT) of 1,866 vehicles, including 1,604 tricycles and motorcycles. With the proposed improvements, traffic volumes should become 2,370 AADT in 1993 and should increase to 7,250 AADT in 2012. Of these volumes, about 86 and 83 percent are expected to be two and three-wheel vehicles in 1993 and 2012, respectively.

Proposed improvements for the Kabankalan-Basay include: sealing and rehabilitation of the 2.4 km long existing PCC pavement and widening of the carriageway and shoulder widths to 6.1 m and 1.5 m, respectively.

The economic results expected for this section are shown in Table 7-6. A detailed sensitivity analysis is presented in Tables 7-11 through 7-15.

TABLE 7-6

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: KBNKALAN-BSAY SECTION: KBNKALAN-ILOG ALTERNATIVE: PCC

YEAR	VOC SAVINGS				MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
	PROJECT COSTS	NORMAL BENEFITS (1)	DIVERTED BENEFITS (1)	GENERATED BENEFITS (1,2)			
1991	820,400	0	0	0	0	0	(820,400)
1992	1,230,600	0	0	0	0	0	(1,230,600)
1993	0	0	0	0	0	0	0
1994	0	5,033	0	337	0	0	5,370
1995	0	5,159	0	355	0	0	5,513
1996	0	5,281	0	373	0	0	5,654
1997	0	5,400	0	392	0	0	5,793
1998	0	5,515	0	413	0	0	5,928
1999	0	163,557	0	2,952	0	0	166,509
2000	0	167,799	0	2,673	0	0	170,472
2001	0	178,285	0	2,840	0	0	181,124
2002	0	189,437	0	3,017	0	0	192,454
2003	0	201,300	0	3,206	0	0	204,506
2004	0	213,919	0	3,406	0	0	217,326
2005	0	227,344	0	3,620	0	0	230,964
2006	0	241,628	0	3,847	0	0	245,475
2007	0	256,826	0	4,089	0	0	260,915
2008	0	272,999	0	4,346	0	0	277,345
2009	0	290,210	0	4,621	0	0	294,830
2010	0	308,528	0	4,912	0	0	313,440
2011	0	328,026	0	5,223	0	0	333,249
2012	0	348,782	0	5,554	0	0	354,336

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	3.7%	NB/I(15%)=	0.253 (3)	IRR(%)=	3.7%	NB/I(15%)=	0.253
NPV(15%)=	(1,093,490)	NB/I(12%)=	0.353	NPV(15%)=	(1,093,490)	NB/I(12%)=	0.353
		NB/I(18%)=	0.185			NB/I(18%)=	0.185

(1) Including passenger time savings.

(2) To avoid double-counting benefits either development or generated benefits are considered.

(3) Net benefit-over-investment ratio, special case of the benefit-cost ratio which does not require to define whether a specific cash flow is a cost or a benefit, since their net is considered.

Kabankalan-Ilog is not economically feasible under any of the analysis scenarios, with an expected base internal rate of return of 3.7 percent. The expected range for the IRRs is 1.5 to 3.7 percent when considering passenger time savings benefits, and 1.3 to 3.4 percent when excluding these benefits.

Kabankalan-Ilog presents the poorest economic return of all road sections. The Kabankalan-Ilog Section is currently paved with PCC and is in generally good condition. Expected costs of the proposed improvements cover mainly the upgrading of the section's shoulders, for which only limited VOC benefits can be expected.

Appendix C shows VOC, maintenance savings and total benefits for the Kabankalan-Ilog Section, including passenger time savings.

b. Ilog-Cauayan (20.0 kilometers)

The proposed section from the Municipality of Ilog to the Municipality of Cauayan traverses through flat terrain and currently comprises 0.7 km of asphalt pavement in bad condition, 8.4 km of gravel pavement in fair condition and 10.9 km of concrete pavement in fair condition.

The 1990 AADT along this route is 289 vehicles per day, including 88 motorcycles and tricycles. With the proposed improvements, traffic volumes should reach 414 vehicles per day in 1993 and should become 1,484 vehicles per day in 2012. Of these volumes, 125 and 380 vehicles per day should be two and three-wheel vehicles in 1993 and 2012, respectively.

Proposed improvements for the Ilog-Cauayan Section include: the widening of the carriageway and shoulder widths to 6.1 m and 1.5 m, respectively; the rehabilitation of the existing 10.9 km of concrete pavement; and the reconstruction and paving of the remaining 9.1 km of asphalt and gravel pavement. Of this last segment, 2.2 km are proposed to be paved with PCC pavement for continuity purposes. The rest is proposed to be paved with double bituminous surface treatment (DBST).

The economic results for this section are presented in Table 7-7. A detailed sensitivity analysis is shown in Tables 7-11 through 7-15.

Ilog-Cauayan does not meet the required economic criteria under either the base case or any of the sensitivity analysis scenarios, with a base-case scenario IRR of 9.3 percent. The IRRs obtained under the cost/benefit sensitivity scenarios range from 5.0 to 7.9 percent.

Appendix C shows VOC, maintenance savings and total benefits for Ilog-Cauayan, including passenger time savings.

TABLE 7-7

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC\DBST

YEAR	VOC SAVINGS				MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
	PROJECT COSTS	NORMAL BENEFITS (1)	DIVERTED BENEFITS (1)	GENERATED BENEFITS (1,2)			
1991	13,596,000	0	0	0	0	0	(13,596,000)
1992	20,394,000	0	0	0	0	0	(20,394,000)
1993	0	1,557,062	0	129,802	72,262	0	1,759,126
1994	0	2,385,856	0	198,866	75,972	0	2,660,693
1995	0	3,089,722	0	257,043	75,972	0	3,422,737
1996	0	3,283,863	0	272,969	75,972	0	3,632,803
1997	0	1,300,292	0	111,125	31,452	0	1,442,869
1998	0	2,157,837	0	180,955	69,952	0	2,408,744
1999	0	3,630,346	0	299,459	102,761	0	4,032,566
2000	0	4,637,079	0	386,482	103,286	0	5,126,846
2001	0	1,969,980	0	162,981	316,851	0	2,449,813
2002	0	3,723,520	0	306,445	108,781	0	4,138,746
2003	0	5,879,370	0	489,587	(6,932,462)	0	(563,505)
2004	0	6,260,982	0	521,379	108,781	0	6,891,142
2005	0	3,319,953	0	272,389	108,781	0	3,701,123
2006	0	6,328,944	0	529,720	108,781	0	6,967,445
2007	0	7,356,676	0	612,997	108,781	0	8,078,454
2008	0	7,840,756	0	653,489	108,781	0	8,603,026
2009	0	5,190,094	0	427,184	365,081	0	5,982,359
2010	0	8,553,444	0	716,019	103,606	0	9,373,069
2011	0	9,122,590	0	763,953	103,606	0	9,990,150
2012	0	10,599,868	0	877,568	103,606	0	11,581,041

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	9.3%	NB/I(15%)=	0.609 (3)	IRR(%)=	9.3%	NB/I(15%)=	0.609
NPV(15%)=	(9,495,250)	NB/I(12%)=	0.780	NPV(15%)=	(9,495,250)	NB/I(12%)=	0.780
		NB/I(18%)=	0.488			NB/I(18%)=	0.488

(1) Including passenger time savings.

(2) To avoid double-counting benefits either development or generated benefits are considered.

(3) Net benefit-over-investment ratio, special case of the benefit-cost ratio which does not require to define whether a specific cash flow is a cost or a benefit, since their net is considered.

c. Cauayan-Sipalay (56.6 kilometers)

This road section links the Municipality of Cauayan with the Municipality of Sipalay and consists of 10.3 km of concrete, 45.2 km of gravel and 1.1 km of asphalt pavements, in fair to bad condition. Cauayan-Sipalay traverses through mainly flat to hilly terrain.

In 1990, Cauayan-Sipalay presents an annual average daily traffic (AADT) of 232 vehicles, including 80 motorcycles and tricycles. With the proposed improvements, traffic volumes should increase to 334 AADT in 1993 and 1,102 AADT in 2012. Of these 34 and 32 percent should be two and three-wheel vehicles, respectively.

Proposed improvement for Cauayan-Sipalay include: sealing and rehabilitation of 9.9 km of concrete pavement, reconstruction and paving to DBST standards of the remaining 46.7 km, and widening of the carriageway and shoulder widths to 6.0 m and 1.0 m, respectively.

A summary of the economic results for this section is presented in Table 7-8. A detailed sensitivity analysis is shown in Tables 7-11 through 7-15.

Cauayan-Sipalay does not meet the required economic criteria. Under the base benefit/cost scenario and considering passenger time savings benefits, this project falls short of meeting the required economic criteria with an expected IRR of 13.9 percent. Other sensitivity scenarios also show unacceptable economic returns with IRRs ranging from 8.6 to 12.2 percent.

Appendix C lists VOC benefits, maintenance savings benefits and total benefits for this section, including passenger time savings.

d. Sipalay-Hinobaan (21.0 kilometers)

The proposed section from the Municipality of Sipalay to the Municipality of Hinobaan traverses through hilly terrain and currently has a 19 km gravel pavement subsection in fair condition, a 0.2 km concrete pavement subsection in fair condition, and a 1.8 km asphalt pavement subsection in bad condition.

In 1990, Sipalay-Hinobaan presents an annual average daily traffic (AADT) of 366 vehicles per day, including 239 tricycles and motorcycles. With the proposed improvements, traffic volumes should become 536 AADT in 1993 and should reach 1,683 AADT in 2012. Of these volumes, about 66 and 63 percent are two and three-wheel vehicles in 1993 and 2012, respectively.

Proposed improvements for the Sipalay-Hinobaan Section include: reconstruction and paving to DBST substandards, and the widening of the carriageway and shoulder widths to 6.0 m and 1.0 m, respectively.

TABLE 7-8

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: KNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: PCC\DBST

YEAR	VOC SAVINGS				MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
	PROJECT COSTS	NORMAL BENEFITS (1)	DIVERTED BENEFITS (1)	GENERATED BENEFITS (1,2)			
1991	39,021,200	0	0	0	0	0	(39,021,200)
1992	58,531,800	0	0	0	0	0	(58,531,800)
1993	0	6,426,077	0	606,181	1,026,703	0	8,058,961
1994	0	8,820,405	0	835,184	1,026,703	0	10,682,291
1995	0	12,986,235	0	1,238,424	1,026,703	0	15,251,361
1996	0	14,918,205	0	1,420,674	1,026,703	0	17,365,582
1997	0	4,118,600	0	400,734	6,944,287	0	11,463,621
1998	0	6,569,433	0	618,894	1,013,803	0	8,202,129
1999	0	11,131,303	0	1,052,201	1,026,703	0	13,210,207
2000	0	18,111,548	0	1,722,025	1,026,703	0	20,860,276
2001	0	5,249,479	0	505,216	1,678,487	0	7,433,182
2002	0	11,674,899	0	1,100,226	1,026,703	0	13,801,828
2003	0	20,989,175	0	1,983,980	1,026,703	0	23,999,858
2004	0	24,138,134	0	2,279,525	1,026,703	0	27,444,362
2005	0	9,911,615	0	921,697	6,944,287	0	17,777,599
2006	0	18,539,287	0	1,732,849	1,140,454	0	21,412,590
2007	0	27,847,413	0	2,633,202	1,140,454	0	31,621,069
2008	0	29,588,868	0	2,795,611	1,140,454	0	33,524,933
2009	0	13,503,354	0	1,260,926	1,792,238	0	16,556,518
2010	0	30,728,715	0	2,900,958	1,140,454	0	34,770,128
2011	0	35,496,750	0	3,347,769	1,140,454	0	39,984,973
2012	0	35,717,130	0	3,380,389	1,105,429	0	40,202,948

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	13.9%	NB/I(15%)=	0.918 (3)	IRR(%)=	13.9%	NB/I(15%)=	0.918
NPV(15%)=	(5,738,206)	NB/I(12%)=	1.166	NPV(15%)=	(5,738,206)	NB/I(12%)=	1.166
		NB/I(18%)=	0.742			NB/I(18%)=	0.742

(1) Including passenger time savings.

(2) To avoid double-counting benefits either development or generated benefits are considered.

(3) Net benefit-over-investment ratio, special case of the benefit-cost ratio which does not require to define whether a specific cash flow is a cost or a benefit, since their net is considered.

A summary of the economic results for Sipalay-Hinobaan is given in Table 7-9. A detailed sensitivity analysis is presented in Tables 7-11 through 7-15.

Sipalay-Hinobaan is not economically feasible under any of the analysis scenarios, with a base-case scenario IRR of 10.1 percent. Expected IRRs for other sensitivity analysis scenarios are in the range of 5.2 to 8.6 percent.

Appendix C present VOC benefits, maintenance savings benefits and total benefits for Sipalay-Hinobaan, including passenger time savings.

e. Hinobaan-Basay (32.2 kilometers)

This section of the Kabankalan-Basay Road connects the Municipality of Hinobaan in the Province of Negros Occidental (Region VI) with the Municipality of Basay in the Province of Negros Oriental (Region VII). At present, this section is gravelled in generally fair condition and traverses through hilly terrain.

Hinobaan-Basay presents 384 vehicles per day in 1990, of which about 68 percent are motorcycles and tricycles. With the proposed improvements, traffic volumes should increase to 711 vehicles per day in 1993 and to 2,295 vehicles per day in 2012. Of these, 68 and 64 percent are two and three-wheel vehicles in 1993 and 2012, respectively.

Proposed improvements include: the reconstruction and paving of the 32.2 km long existing gravel pavement to DBST standards. The carriageway and shoulders will be widened to 6.0 m and 1.0 meters, respectively.

A summary of the economic results for the Hinobaan-Basay Section is shown in Table 7-10. A detailed sensitivity analysis is presented in Tables 7-11 through 7-15.

Hinobaan-Basay shows unacceptable economic returns under either the base benefit/cost scenario or any of the sensitivity analysis scenarios. A base-case "all-benefit" IRR of 11.6 percent is expected; lower IRRs ranging from 6.5 to 10.0 percent are obtained under the three sensitivity analysis scenarios.

One of the elements which causes this unacceptable economic return is the number of bridges in need of reconstruction/ replacement. Hinobaan-Basay would meet required economic criteria with an IRR of 15.2 percent, if bridge improvement costs were excluded. The other four sections would not be feasible even if all bridge improvement costs were excluded.

A road section without acceptable bridges does not serve its purpose and is not recommended for implementation. Most of the proposed bridge improvements are badly needed. Even considering a possible prioritization of these improvements, which would schedule for immediate action only a few bridges, this road

TABLE 7-9

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: KBNKALAN-BSAY SECTION: SPALAY-HNBAAN ALTERNATIVE: DBST

YEAR	VOC SAVINGS				MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
	PROJECT COSTS	NORMAL BENEFITS (1)	DIVERTED BENEFITS (1)	GENERATED BENEFITS (1,2)			
1991	21,844,400	0	0	0	0	0	(21,844,400)
1992	32,766,600	0	0	0	0	0	(32,766,600)
1993	0	2,695,496	0	287,866	420,230	0	3,403,592
1994	0	3,648,653	0	390,460	420,230	0	4,459,343
1995	0	5,642,220	0	607,928	420,230	0	6,670,378
1996	0	6,431,526	0	691,713	420,230	0	7,543,470
1997	0	1,948,495	0	210,889	2,918,310	0	5,077,693
1998	0	2,907,516	0	311,090	430,830	0	3,649,436
1999	0	3,838,231	0	411,654	413,630	0	4,663,515
2000	0	6,942,863	0	748,603	413,630	0	8,105,096
2001	0	2,161,491	0	238,546	687,610	0	3,087,648
2002	0	3,982,709	0	425,285	413,630	0	4,821,623
2003	0	8,060,428	0	862,140	(1,020,286)	0	7,902,282
2004	0	10,027,458	0	1,070,278	415,130	0	11,512,866
2005	0	4,032,412	0	425,962	2,902,610	0	7,360,984
2006	0	6,497,878	0	686,073	420,230	0	7,604,181
2007	0	10,789,213	0	1,155,202	420,230	0	12,364,645
2008	0	12,460,556	0	1,331,438	430,830	0	14,222,824
2009	0	4,935,563	0	526,817	704,810	0	6,167,190
2010	0	12,167,096	0	1,302,059	430,830	0	13,899,985
2011	0	15,091,282	0	1,611,080	430,830	0	17,133,192
2012	0	15,272,752	0	1,637,086	415,080	0	17,324,918

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	10.1%	NB/I(15%)=	0.669 (3)	IRR(%)=	10.1%	NB/I(15%)=	0.669
NPV(15%)=	(12,902,981)	NB/I(12%)=	0.847	NPV(15%)=	(12,902,981)	NB/I(12%)=	0.847
		NB/I(18%)=	0.543			NB/I(18%)=	0.543

(1) Including passenger time savings.

(2) To avoid double-counting benefits either development or generated benefits are considered.

(3) Net benefit-over-investment ratio, special case of the benefit-cost ratio which does not require to define whether a specific cash flow is a cost or a benefit, since their net is considered.

TABLE 7-10

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: KBNKALAN-BSAY SECTION: HNBAAN-BASAY ALTERNATIVE: DBST

YEAR	VOC SAVINGS				MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
	PROJECT COSTS	NORMAL BENEFITS (1)	DIVERTED BENEFITS (1)	GENERATED BENEFITS (1,2)			
1991	35,040,400	0	0	0	0	0	(35,040,400)
1992	52,560,600	0	0	0	0	0	(52,560,600)
1993	0	4,347,530	0	1,055,032	700,994	0	6,103,556
1994	0	5,940,906	0	1,434,183	700,994	0	8,076,083
1995	0	9,921,219	0	2,443,716	700,994	0	13,065,930
1996	0	10,516,960	0	2,588,031	700,994	0	13,805,985
1997	0	2,857,661	0	694,957	4,916,618	0	8,469,236
1998	0	5,345,568	0	1,310,272	700,994	0	7,356,834
1999	0	7,457,828	0	1,811,538	700,994	0	9,970,360
2000	0	12,757,821	0	3,152,472	700,994	0	16,611,287
2001	0	4,638,544	0	1,159,659	1,165,318	0	6,963,521
2002	0	7,844,507	0	1,909,853	700,994	0	10,455,354
2003	0	14,770,076	0	3,629,537	(22,385,054)	0	(3,985,440)
2004	0	16,943,415	0	4,151,015	700,994	0	21,795,424
2005	0	6,641,177	0	1,623,168	4,916,618	0	13,180,963
2006	0	15,039,363	0	3,719,193	700,994	0	19,459,550
2007	0	19,526,908	0	4,818,589	700,994	0	25,046,491
2008	0	20,764,115	0	5,123,522	700,994	0	26,588,630
2009	0	8,896,532	0	2,191,306	1,165,318	0	12,253,156
2010	0	23,490,204	0	5,795,895	700,994	0	29,987,093
2011	0	24,990,919	0	6,166,318	700,994	0	31,858,231
2012	0	24,974,135	0	6,159,386	676,844	0	31,810,365

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	11.6%	NB/I(15%)=	0.763 (3)	IRR(%)=	11.6%	NB/I(15%)=	0.763
NPV(15%)=	(14,847,995)	NB/I(12%)=	0.965	NPV(15%)=	(14,847,995)	NB/I(12%)=	0.965
		NB/I(18%)=	0.619			NB/I(18%)=	0.619

(1) Including passenger time savings.

(2) To avoid double-counting benefits either development or generated benefits are considered.

(3) Net benefit-over-investment ratio, special case of the benefit-cost ratio which does not require to define whether a specific cash flow is a cost or a benefit, since their net is considered.

115

section should not reach the cut-off 15-percent IRR. Only approximately P 500,000 in bridge reconstruction/replacement can be borne by this section.

Appendix C presents VOC benefits, maintenance savings benefits, and total benefits for this section, including passenger time savings.

F. SENSITIVITY ANALYSIS

Tables 7-11 to 7-15 present the results of a sensitivity analysis performed for the five sections of the Kabankalan-Basay Road. IRRs, NB/Is and net present values were calculated for:

- the base benefit and cost scenario,
- a scenario with costs increased by 15 percent,
- a scenario with benefits reduced by 15 percent, and
- a scenario with costs increased by 15 percent and benefits reduced by 15 percent.

In each of the four scenarios, the economic indices are presented with and without passenger time savings.

The five sections of the proposed Kabankalan-Basay Road Project are not feasible under either the base benefit/cost scenario or under any of the sensitivity analysis scenarios.

The traffic sections of Kabankalan-Basay present economic rates of return in the range of 3.7 to 13.9 percent under the base-case scenario when considering passenger time savings. In the worst case scenario, considering an increase in costs of 15 percent, a decrease in benefits of 15 percent and no passenger time benefits, all sections show unacceptable economic returns with IRRs ranging from 1.3 to 8.6 percent.

G. FINANCIAL ANALYSIS

1. INTRODUCTION

An analysis similar to the economic analysis presented above has been performed in financial terms. Project financial costs are developed in Chapter VI and used here. Both benefits and costs were estimated including taxes and transfer payments, and financial IRRs, NB/Is and net present values were calculated. As before, financial indices have been calculated for:

TABLE 7-11
ECONOMIC ANALYSIS - SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

INTERNAL RATES OF RETURN

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Internal Rate of Return				Internal Rate of Return				Internal Rate of Return				Internal Rate of Return			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN-ILOG	3.4%	3.7%	3.4%	3.7%	2.2%	2.5%	2.2%	2.5%	2.4%	2.7%	2.4%	2.7%	1.3%	1.5%	1.3%	1.5%
ILOG-CAUAYN	7.7%	9.3%	7.7%	9.3%	6.2%	7.7%	6.2%	7.7%	6.4%	7.9%	6.4%	7.9%	5.0%	6.4%	5.0%	6.4%
CAUAYN-SPALAY	11.9%	13.9%	11.7%	13.9%	10.1%	11.9%	9.9%	11.9%	10.3%	12.2%	10.1%	12.2%	8.6%	10.3%	8.4%	10.3%
SPALAY-HNBAAN	8.1%	10.1%	8.1%	10.1%	6.5%	8.3%	6.5%	8.3%	6.7%	8.6%	6.7%	8.6%	5.2%	6.9%	5.2%	6.9%
HNBAAN-BASAY	9.6%	11.6%	9.6%	11.6%	7.9%	9.8%	7.9%	9.8%	8.1%	10.0%	8.1%	10.0%	6.5%	8.3%	6.5%	8.3%

TABLE 7-12
ECONOMIC ANALYSIS - SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET PRESENT VALUE (15%) (In Thousands of Pesos)

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Net Present Value (15%)				Net Present Value (15%)				Net Present Value (15%)				Net Present Value (15%)			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN-ILOG	(1,132)	(1,093)	(1,132)	(1,093)	(1,182)	(1,149)	(1,182)	(1,149)	(1,352)	(1,313)	(1,352)	(1,313)	(1,401)	(1,369)	(1,401)	(1,369)
ILOG-CAUAYN	(11,709)	(9,495)	(11,709)	(9,495)	(13,592)	(11,710)	(13,592)	(11,710)	(15,348)	(13,134)	(15,348)	(13,134)	(17,230)	(15,349)	(17,230)	(15,349)
CAUAYN-SPALAY	(15,132)	(5,738)	(16,178)	(5,738)	(23,306)	(15,321)	(24,196)	(15,321)	(25,575)	(16,182)	(26,622)	(16,182)	(33,750)	(25,765)	(34,639)	(25,765)
SPALAY-HNBAAN	(17,303)	(12,903)	(17,303)	(12,903)	(20,554)	(16,814)	(20,554)	(16,814)	(23,149)	(18,750)	(23,149)	(18,750)	(26,400)	(22,661)	(26,400)	(22,661)
HNBAAN-BASAY	******	******	******	******	******	******	******	******	******	******	******	******	******	******	******	(31,378)

TABLE 7-13
ECONOMIC ANALYSIS - SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET BENEFIT OVER INVESTMENT (15%)

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Net Benefit Over Investment (15%)				Net Benefit Over Investment (15%)				Net Benefit Over Investment (15%)				Net Benefit Over Investment (15%)			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN-ILOG	0.23	0.25	0.23	0.25	0.19	0.22	0.19	0.22	0.20	0.22	0.20	0.22	0.17	0.19	0.17	0.19
ILOG-CAUAYN	0.52	0.61	0.52	0.61	0.44	0.52	0.44	0.52	0.45	0.53	0.45	0.53	0.38	0.45	0.38	0.45
CAUAYN-SPALAY	0.78	0.92	0.77	0.92	0.67	0.78	0.65	0.78	0.68	0.80	0.67	0.80	0.58	0.68	0.57	0.68
SPALAY-HNBAAN	0.56	0.67	0.56	0.67	0.47	0.57	0.47	0.57	0.48	0.58	0.48	0.58	0.41	0.49	0.41	0.49
HNBAAN-BASAY	0.64	0.76	0.64	0.76	0.54	0.65	0.54	0.65	0.56	0.66	0.56	0.66	0.47	0.56	0.47	0.56

TABLE 7–14
ECONOMIC ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET BENEFIT OVER INVESTMENT (18%)

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Net Benefit Over Investment (18%)				Net Benefit Over Investment (18%)				Net Benefit Over Investment (18%)				Net Benefit Over Investment (18%)			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN–ILOG	0.16	0.18	0.16	0.18	0.14	0.16	0.14	0.16	0.14	0.16	0.14	0.16	0.12	0.14	0.12	0.14
ILOG–CAUAYN	0.42	0.49	0.42	0.49	0.35	0.42	0.35	0.42	0.36	0.42	0.36	0.42	0.31	0.36	0.31	0.36
CAUAYN–SPALAY	0.63	0.74	0.62	0.74	0.54	0.63	0.53	0.63	0.55	0.65	0.54	0.65	0.47	0.55	0.46	0.55
SPALAY–HNBAAN	0.45	0.54	0.45	0.54	0.38	0.46	0.38	0.46	0.39	0.47	0.39	0.47	0.33	0.40	0.33	0.40
HNBAAN–BASAY	0.52	0.62	0.52	0.62	0.44	0.53	0.44	0.53	0.45	0.54	0.45	0.54	0.38	0.46	0.38	0.46

TABLE 7–15
ECONOMIC ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET BENEFIT OVER INVESTMENT (12%)

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Net Benefit Over Investment (12%)				Net Benefit Over Investment (12%)				Net Benefit Over Investment (12%)				Net Benefit Over Investment (12%)			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN–ILOG	0.32	0.35	0.32	0.35	0.27	0.30	0.27	0.30	0.28	0.31	0.28	0.31	0.24	0.26	0.24	0.26
ILOG–CAUAYN	0.66	0.78	0.66	0.78	0.56	0.66	0.56	0.66	0.58	0.68	0.58	0.68	0.49	0.58	0.49	0.58
CAUAYN–SPALAY	0.99	1.17	0.97	1.17	0.84	0.99	0.83	0.99	0.86	1.01	0.85	1.01	0.73	0.86	0.72	0.86
SPALAY–HNBAAN	0.70	0.85	0.70	0.85	0.60	0.72	0.60	0.72	0.61	0.74	0.61	0.74	0.52	0.63	0.52	0.63
HNBAAN–BASAY	0.81	0.97	0.81	0.97	0.69	0.82	0.69	0.82	0.70	0.84	0.70	0.84	0.60	0.71	0.60	0.71

a - Vehicle operating cost (VOC) benefits, road maintenance benefits, time savings, and development benefits;

b - VOC benefits, road maintenance benefits, and development benefits;

c - VOC benefits, road maintenance, and time savings; and

d - VOC and road maintenance benefits only.

The highest IRRs are obtained for "a" above, referred to as the "all" benefits case, and the lowest result from "d", referred to as "VOC benefits only". In making recommendations, a minimum acceptable IRR of 15 percent is expected.

The financial analysis should provide some insight into the expected return of these projects to the community when considering actual cash flows. Sensitivity analyses were performed for the following scenarios:

- costs increased by 15 percent,
- benefits reduced by 15 percent, and
- costs increased by 15 percent and benefits reduced by 15 percent.

2. RESULTS

Tables 7-16 to 7-20 present a summary of the results, together with the sensitivity analysis scenarios described above.

The five sections of the proposed Kabankalan-Basay Road are not financially feasible under either the base benefit/cost scenario or any of the sensitivity analysis scenarios. A base financial internal rate of return of 2.7 percent is expected for Kabankalan-Ilog; of 8.9 percent for Ilog-Cauayan; of 12.7 percent for Cauayan-Sipalay; of 9.0 percent for Sipalay-Hinobaan; and of 10.7 percent for Hinobaan-Basay.

H. RECOMMENDATIONS

Based on the results presented above, the Consultants do not recommend the reconstruction of the five sections of the Kabankalan-Basay Road: Kabankalan-Ilog, Ilog-Cauayan, Cauayan-Sipalay, Sipalay-Hinobaan and Hinobaan-Basay.

I. COSTS

No financial expenditures are scheduled for this project since there are no recommended improvements.

TABLE 7–16
FINANCIAL ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

INTERNAL RATES OF RETURN

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Internal Rate of Return				Internal Rate of Return				Internal Rate of Return				Internal Rate of Return			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN–ILOG	2.4%	2.7%	2.4%	2.7%	1.3%	1.5%	1.3%	1.5%	1.5%	1.7%	1.5%	1.7%	0.4%	0.6%	0.4%	0.6%
ILOG–CAUAYN	7.6%	8.9%	7.6%	8.9%	6.1%	7.3%	6.1%	7.3%	6.3%	7.5%	6.3%	7.5%	4.9%	6.0%	4.9%	6.0%
CAUAYN–SPALAY	11.2%	12.7%	11.2%	12.7%	9.4%	10.8%	9.4%	10.8%	9.6%	11.1%	9.6%	11.1%	7.9%	9.3%	7.9%	9.3%
SPALAY–HNBAAN	7.4%	9.0%	7.4%	9.0%	5.8%	7.4%	5.8%	7.4%	6.0%	7.6%	6.0%	7.6%	4.5%	6.0%	4.5%	6.0%
HNBAAN–BASAY	9.1%	10.7%	9.1%	10.7%	7.4%	8.9%	7.4%	8.9%	7.6%	9.2%	7.6%	9.2%	6.0%	7.5%	6.0%	7.5%

TABLE 7–17
FINANCIAL ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET PRESENT VALUE (15%) (In Thousands of Pesos)

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Net Present Value (15%)				Net Present Value (15%)				Net Present Value (15%)				Net Present Value (15%)			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN–ILOG	(49,668)	(39,311)	(49,668)	(39,311)	(59,164)	(50,361)	(59,164)	(50,361)	(66,615)	(56,258)	(66,615)	(56,258)	(76,111)	(67,308)	(76,111)	(67,308)
ILOG–CAUAYN	(58,513)	(21,968)	(58,513)	(21,968)	(84,611)	(53,547)	(84,611)	(53,547)	(93,388)	(56,842)	(93,388)	(56,842)	(119,485)	(88,421)	(119,485)	(88,421)
CAUAYN–SPALAY	28,770	32,474	28,770	32,474	21,334	24,482	21,334	24,482	25,650	29,354	25,650	29,354	18,214	21,362	18,214	21,362
SPALAY–HNBAAN	4,379	21,945	4,379	21,945	(3,172)	11,759	(3,172)	11,759	(2,515)	15,050	(2,515)	15,050	(10,066)	4,864	(10,066)	4,864
HNBAAN–BASAY	4,910	9,577	4,910	9,577	685	4,652	685	4,652	1,421	6,089	1,421	6,089	(2,803)	1,164	(2,803)	1,164

TABLE 7–18
FINANCIAL ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET BENEFIT OVER INVESTMENT (15%)

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Net Benefit Over Investment (15%)				Net Benefit Over Investment (15%)				Net Benefit Over Investment (15%)				Net Benefit Over Investment (15%)			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN–ILOG	0.19	0.21	0.19	0.21	0.16	0.18	0.16	0.18	0.17	0.19	0.17	0.19	0.14	0.16	0.14	0.16
ILOG–CAUAYN	0.51	0.58	0.51	0.58	0.43	0.49	0.43	0.49	0.44	0.50	0.44	0.50	0.37	0.43	0.37	0.43
CAUAYN–SPALAY	0.73	0.84	0.73	0.84	0.62	0.71	0.62	0.71	0.64	0.73	0.64	0.73	0.54	0.62	0.54	0.62
SPALAY–HNBAAN	0.52	0.61	0.52	0.61	0.44	0.52	0.44	0.52	0.45	0.53	0.45	0.53	0.38	0.45	0.38	0.45
HNBAAN–BASAY	0.61	0.71	0.61	0.71	0.52	0.60	0.52	0.60	0.53	0.61	0.53	0.61	0.45	0.52	0.45	0.52

TABLE 7–19
FINANCIAL ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET BENEFIT OVER INVESTMENT (18%)

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Net Benefit Over Investment (18%)				Net Benefit Over Investment (18%)				Net Benefit Over Investment (18%)				Net Benefit Over Investment (18%)			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN–ILOG	0.14	0.15	0.14	0.15	0.12	0.13	0.12	0.13	0.12	0.13	0.12	0.13	0.10	0.11	0.10	0.11
ILOG–CAUAYN	0.40	0.46	0.40	0.46	0.34	0.39	0.34	0.39	0.35	0.40	0.35	0.40	0.30	0.34	0.30	0.34
CAUAYN–SPALAY	0.59	0.68	0.59	0.68	0.50	0.58	0.50	0.58	0.52	0.59	0.52	0.59	0.44	0.50	0.44	0.50
SPALAY–HNBAAN	0.42	0.49	0.42	0.49	0.36	0.42	0.36	0.42	0.37	0.43	0.37	0.43	0.31	0.36	0.31	0.36
HNBAAN–BASAY	0.50	0.57	0.50	0.57	0.42	0.49	0.42	0.49	0.43	0.50	0.43	0.50	0.37	0.42	0.37	0.42

126

TABLE 7–20
FINANCIAL ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET BENEFIT OVER INVESTMENT (12%)

SEGMENT/ ALTERNATIVE	BASE CASE				BENEFITS REDUCED BY 15%				COSTS INCREASED BY 15%				BENEFITS REDUCED BY 15% AND COSTS INCREASED BY 15%			
	Net Benefit Over Investment (12%)				Net Benefit Over Investment (12%)				Net Benefit Over Investment (12%)				Net Benefit Over Investment (12%)			
	WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits		WITH Dev't Benefits		W/O Dev't Benefits	
	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time	No Time	With Time
KBNKLAN–ILOG	0.28	0.30	0.28	0.30	0.24	0.25	0.24	0.25	0.24	0.26	0.24	0.26	0.21	0.22	0.21	0.22
ILOG–CAUAYN	0.65	0.74	0.65	0.74	0.55	0.63	0.55	0.63	0.57	0.65	0.57	0.65	0.48	0.55	0.48	0.55
CAUAYN–SPALAY	0.93	1.06	0.93	1.06	0.79	0.90	0.79	0.90	0.81	0.92	0.81	0.92	0.69	0.79	0.69	0.79
SPALAY–HNBAAN	0.66	0.77	0.66	0.77	0.56	0.65	0.56	0.65	0.57	0.67	0.57	0.67	0.49	0.57	0.49	0.57
HNBAAN–BASAY	0.77	0.89	0.77	0.89	0.65	0.76	0.65	0.76	0.67	0.78	0.67	0.78	0.57	0.66	0.57	0.66

VIII. SOCIAL SOUNDNESS ANALYSIS

I. INTRODUCTION

Social soundness analyses evaluate the effect of construction projects from the perspective of the intended beneficiaries, residents of the Zone of Influence and local institutions. Social sensitivity in feasibility analyses of rural road projects can improve understanding of real needs, projection of future usage, and anticipation of negative social impacts. Social consideration in project design can help in mitigating or compensating for negative impacts and developing community capabilities for self-directed and self-sustained growth. In particular, this analysis focuses on three important aspects of social impact: influences on family income for various social strata, implications for population movements, and potential negative consequences, especially for vulnerable cultural minorities.

This report consists of six sections: (A) this Introduction, (B) Background, (C) Income Effects, (D) Population Movements, (E) Cultural Minorities, and (F) Conclusions.

B. BACKGROUND

The Kabankalan-Basay Road Subproject is located on the western coast of the island of Negros in the provinces of Negros Occidental and Negros Oriental. It is 132.2 km. long and runs through flat, highly developed agricultural lands from Kabankalan in Negros Occidental to Basay in Negros Oriental. The project in these segments will involve surface and drainage improvements.

C. INCOME EFFECTS

Negros Occidental has a population of 2,346,520. In 1980, two-thirds of households (65%) were rural, and 30% owned the land on which they lived. With an average family income of P19,874 in 1985, Negros Occidental ranked 53rd out of the country's 74 provinces. Six out of ten families cited agriculture-related enterprises as their main source of income. As shown in Table 8-1, the poor depended largely on agriculture, while the rich engaged in non-agricultural activities or received remittances from abroad.

The population of Negros Oriental (941,331) is less than half that in Negros Occidental. In 1980, five out of six households (83%) were rural, and 59% owned the land on which their house was built. With an average family income of P21,957 in 1985, Negros

Oriental ranked 40th among the country's 74 provinces. As shown in Table 8-1, half the families depend on agriculture-related enterprises. The poor were mostly small farmers, while most of the rich engaged in non-agricultural activities or received remittances from abroad.

Two types of income benefits could be anticipated from the improved road: agricultural benefits to the 250,000 farmers living in the zone of influence along the road, and traffic benefits to wholesalers, retailers and other road users.

1. AGRICULTURAL BENEFITS

The agricultural zone of influence is defined as the land five kilometers on either side of the road. The population in the zone of influence is estimated at 250,000, with 247,000 in Negros Occidental and 3,000 in Basay, Negros Oriental. In Negros Occidental, the municipalities are Kabankalan with 18,000, Ilog with 25,000, Cauayan with 61,000, Sipalay with 57,000 and Hinobaan with 86,000.

Kabankalan is primarily devoted to large sugar plantations, and the remaining municipalities to rice and corn production and coconuts intercropped with bananas. In 1980, only about one-fourth of the farms in the zone of influence were greater than five hectares. Sixty percent of the farms in Kabankalan, and 40% of those in other municipalities were fully owned by the person working the land. Only about 11% were share cropped. Most farmers employed about 2 seasonal workers, except in Hinobaan where farmers employed about 8 seasonal workers per year. Most farmers transported their produce on foot, but some utilized animals, carts, or motor vehicles.

The proposed road improvement would facilitate the marketing of crops, primarily rice and copra, for farmers in the zone of influence. These benefits, however, would not be significant since the road already has an all-weather surface.

2. TRANSPORTATION BENEFITS

Transportation cost savings for through traffic will also be reflected in family incomes, primarily for merchants. By the Year 2000, traffic benefits are estimated at 55 million pesos. Additional traffic is estimated at 358 vehicles per day, which will be 25% jeepneys, 37% cars, 17% bus and 21% trucks. Since jeepneys provide transportation for the poor and carry an average of fifteen passengers, while cars transport the relatively rich and carry an average of 3.36 passengers (including the driver), traffic benefits will fall to roughly 8.5 "lower class" persons for every "upper class" person.

TABLE 8-1

FAMILIES BY MAIN SOURCE OF INCOME AND TOTAL FAMILY INCOME FOR NEGROS OCCIDENTAL AND NEGROS ORIENTAL

Main Source Of Income	Total	Family Income (Pesos) Under 10K	10K-14K	15K-19K	20K-29K	30K-39K	40K-59K	60K & Over
NEGROS OCCIDENTAL			Percent of Families					
Agricultural Wages/Salaries	37.9	48.6	51.6	36.1	28.9	0.0	5.2	8.4
Non-Agricultural Wages/Salaries	19.2	8.4	13.3	18.6	25.0	38.2	56.3	43.2
Agricultural Entrepreneurial	21.4	21.5	17.7	21.7	25.3	26.2	20.7	22.6
Non-Agricultural Entrepreneurial	12.3	5.8	9.7	18.5	18.6	15.2	14.2	0.0
Other	9.2	15.7	7.7	5.1	2.2	20.4	3.6	25.8
	100%	100%	100%	100%	100%	100%	100%	100%
Total Families (Thousands)	316.7	72.9	87.6	64.1	52.0	18.5	13.4	8.2
NEGROS ORIENTAL			Percent of Families					
Agricultural Wages/Salaries	7.4	7.8	7.9	11.9	9.0	4.6	0.0	0.0
Non-Agricultural Wages/Salaries	24.1	9.2	30.7	20.7	34.9	48.6	42.4	36.7
Agricultural Entrepreneurial	41.1	57.1	36.7	30.0	33.1	32.8	34.6	0.0
Non-Agricultural Entrepreneurial	15.6	8.5	20.2	30.0	21.1	7.0	14.3	18.5
Other	11.8	17.4	4.5	7.4	1.9	7.0	8.7	44.8
	100%	100%	100%	100%	100%	100%	100%	100%
Total Families (Thousands)	165.8	63.6	36.0	15.7	23.5	10.0	8.2	8.8

SOURCE: National Census & Statistics Office. 1987. 1985 Family Income and Expenditures Survey, Vol. II. Manila: NCSO.

The additional 75 trucks per day anticipated by the year 2000 will average 10 tons of cargo. Their income earnings will directly benefit merchants and vehicle owners, who are not among the poorest of the province's residents. Indirectly, however, the services they offer provide benefits to the population as a whole.

D. POPULATION

No significant population migration is anticipated due to the proposed road project. The zone of influence is intensively cultivated with sugar plantations and there is little free land for expansion.

E. CULTURAL MINORITIES

The major cultural minority in Negros is the Ati. This is one of the most severely disposed cultural minorities. Few concentrations of Ati remain, and none are known near the highly populated and intensively farmed area of the proposed road improvement. Thus, this project is unlikely to add any new indignities to the history of socio-cultural exploitation of the Ati.

F. CONCLUSIONS

The proposed road project is socially sound. It will result in maringal benefits for some farmers and significant benefits for merchants and other road users. The road will not disproportionately serve large commercial interests.

For further analysis, refer to the general discussion of social soundness in Appendix D of the Main Report.

IX. ENERGY ANALYSIS

The economic and financial costs of energy in the construction and use of the Kabankalan - Basay road are included in the project evaluation presented in Chapter VII. Construction energy is implicitly included in the estimate of construction costs developed in Chapter VI. User energy consumption by vehicle type is included in the analysis of overall vehicle operating cost changes with and without the project. Overall project costs are developed and compared in a benefit-cost analysis in Chapter VII.

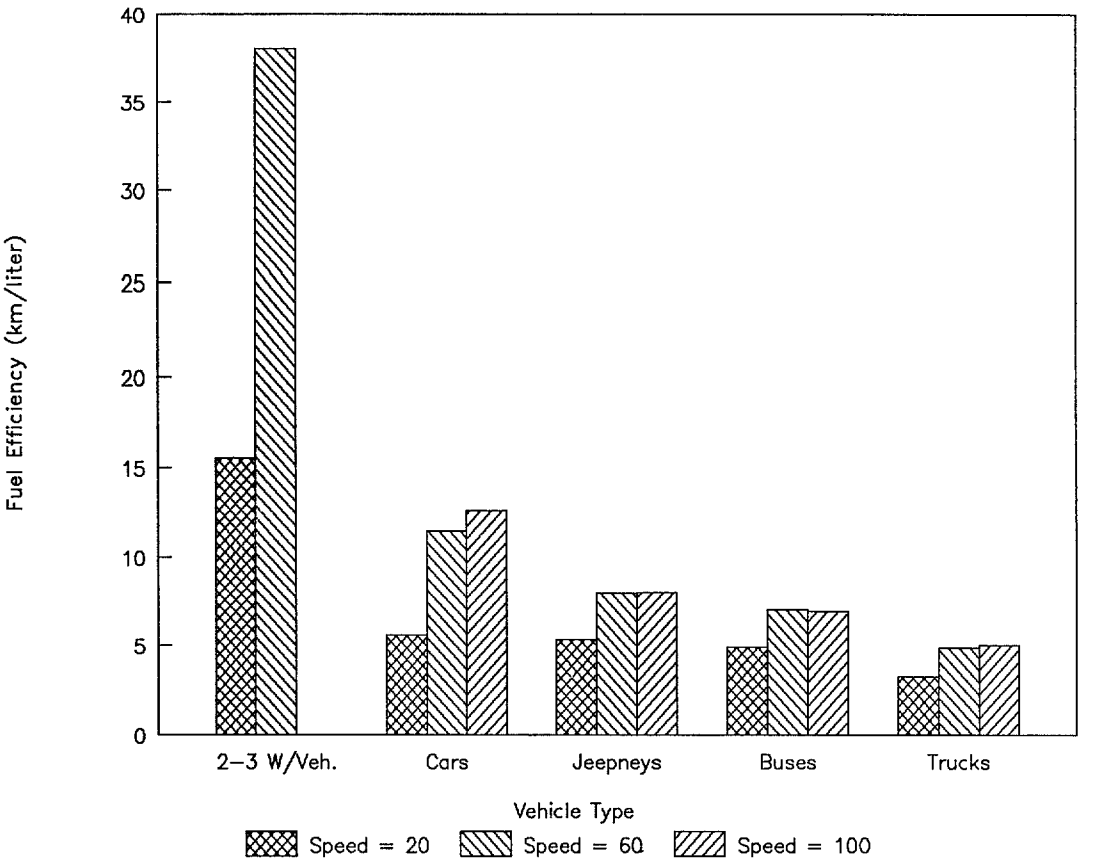
Road user energy costs are a function of the fuel consumption of the types of vehicles using the road and the volume of use. An improved road surface will improve fuel efficiency as it will increase average speed within the range of speeds to be considered here. Figures 9-1 to 9-4 show the average fuel consumption in km/liter at 4 levels of roughness for 5 classes of vehicles and 3 speeds.

These are the values estimated by the HDM-III vehicle operating cost model and used in the vehicle operating cost analysis.

In the context of total Philippine energy consumption, the construction and use of this road will be marginal and probably positive in that it is designed to increase speed through improved road condition.

FIGURE 9-1

Assumed Fuel Efficiencies at Roughness 2 (IRI)

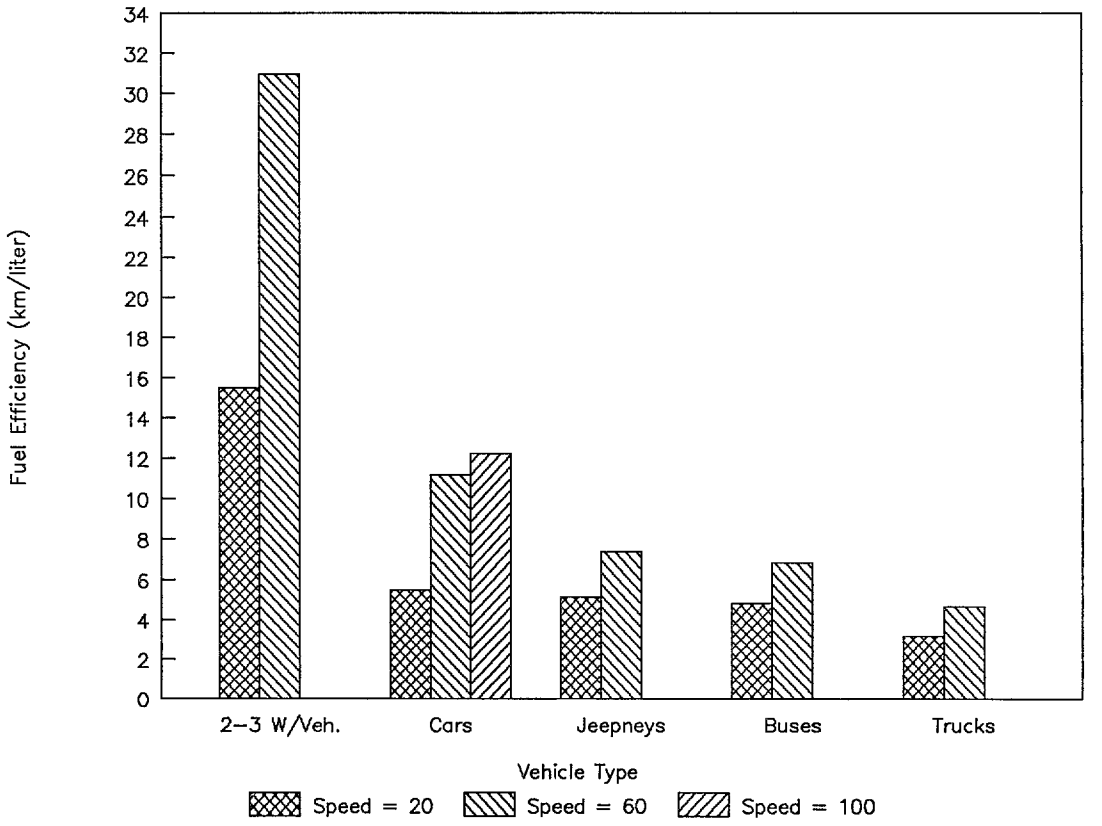


Roughness (IRI) = 2

Vehicle Type	Speed (km./hr.) 20	60	100
2–3 W/Veh.	15.55	38.01	
Cars	5.58	11.47	12.61
Jeepneys	5.34	7.96	7.97
Buses	4.90	7.00	6.91
Trucks	3.26	4.87	5.02

FIGURE 9–2

Assumed Fuel Efficiencies at Roughness 6 (IRI)

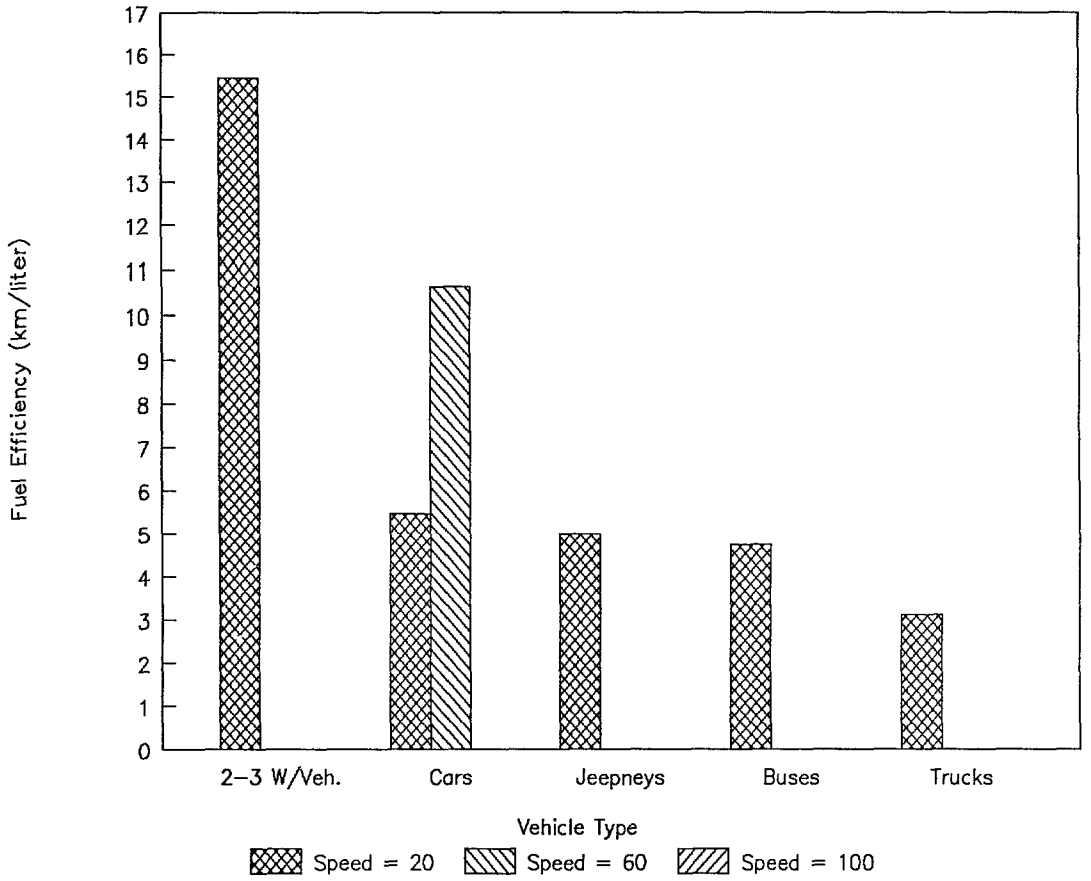


Roughness (IRI) = 6

Vehicle Type	Speed (km./hr.) 20	60	100
2–3 W/Veh.	15.49	30.94	
Cars	5.52	11.15	12.20
Jeepneys	5.16	7.37	
Buses	4.82	6.82	
Trucks	3.19	4.70	

FIGURE 9-3

Assumed Fuel Efficiencies at Roughness 10 (IRI)

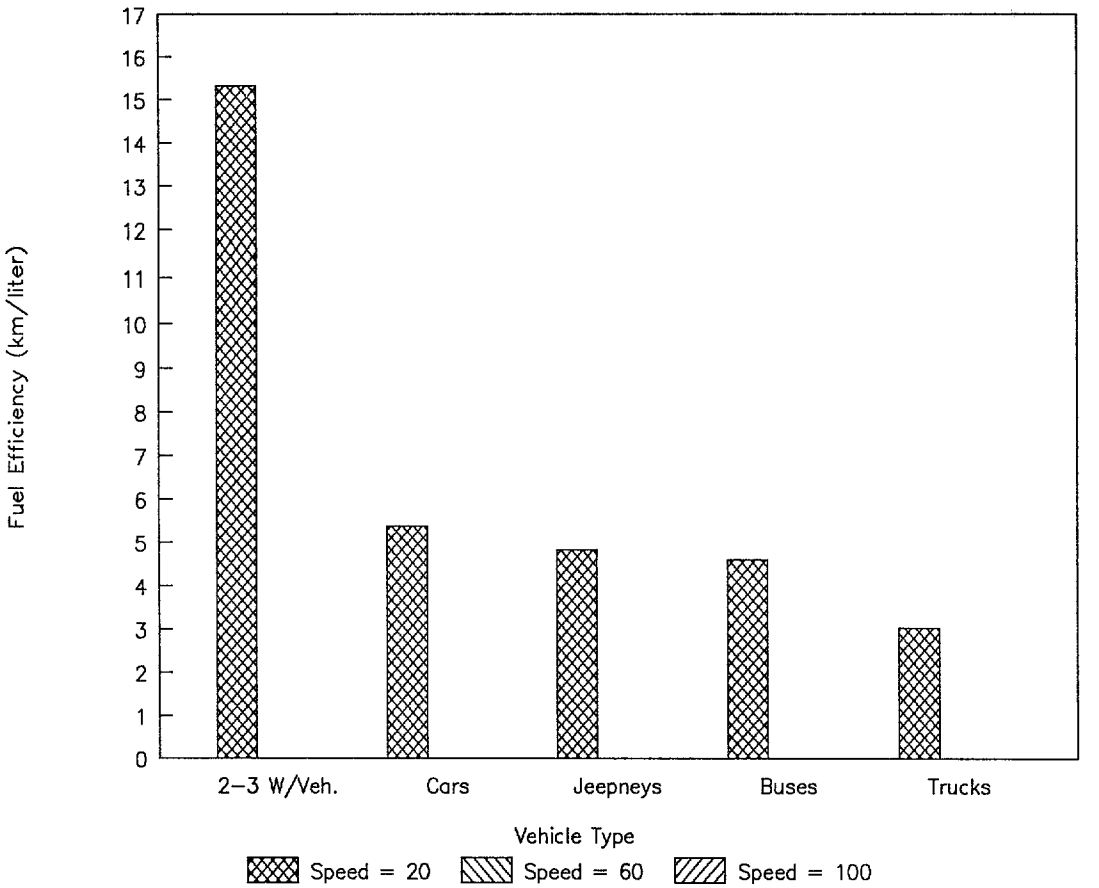


Roughness (IRI) = 10

Vehicle Type	Speed (km./hr.) 20	60	100
2-3 W/Veh.	15.43		
Cars	5.45	10.63	
Jeepneys	4.99		
Buses	4.73		
Trucks	3.12		

FIGURE 9-4

Assumed Fuel Efficiencies at Roughness 14 (IRI)



Roughness (IRI) = 14

Vehicle Type	Speed (km./hr.) 20	60	100
2-3 W/Veh.	15.33		
Cars	5.38		
Jeepneys	4.82		
Buses	4.61		
Trucks	3.03		

APPENDIX A
TRAFFIC

TABLE A-1

VEHICLE CLASSIFICATION

Vehicle Type	Vehicle Description	# of Axles	Rear Tire	Plate Color
Car	All private passenger cars including sedans, station wagons, sport cars, ambulances, etc.	2	Single	G/R/B
Taxi	All passenger cars for hire including sedans, station wagons, etc.	2	Single	Y
Jeep	Any Jeep (Land Rover, Land Cruiser)	2	Single	Any
Pick-up	Originally open-body vehicle for transport of goods or passengers with single rear tire and gross weight <3T	2	Single	Any
Van	Closed-body vehicle for transport of goods or passengers (private mini-buses are included in this category)	2	Single	Any
Jeepney	Any Jeepney (Public or Private)	2	Single	Any
Small Bus	Public transport bus <30 seats	2	1/2	Y
Large Bus	Public transport bus >30 seats	2	Double	Y
2 Ax Truck	Vehicle for transport of goods consisting of one straight body having double rear tires and gross vehicle weight >3T		Double	Any
3 Ax Truck	Vehicle for transport of goods consisting of one straight body having double rear tires on a tandem axle and gross vehicle weight >5T	3	Double	Any
Articulated Truck	Vehicle for transport of goods consisting of two different elements, includes prime mover/semi trailer as well as truck/trailer combinations	3-6	Double	Any
2-3 Wheel Motorized	Motorcycles and tricycles (Traysikel) for transport of goods and passengers	2	Single	Any
2-3 Wheel Non-motor	Bicycles and tricycles (Traysikel de pedal) for transport of goods and passengers	2	Single	Any

TABLE A-2

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
PROJECT MANAGEMENT OFFICE-RURAL INFRASTRUCTURE FUND PROJECT

Survey Team: Region: VI Date:THU 8 MAR 1990
Road: KABANGKALAN-ILOG Station: 11-1 Section: 1

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	13	0	41	48	2	40	0	0	84	17	3	603	16	15	248
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	16	0	50	59	2	47	0	0	107	22	5	795	21	20	308
WEEK ADJ.	0.99	0.99	0.99	0.99	0.99	0.98	0.92	0.98	1.08	1.08	1.01	0.95	0.95	0.95	
ADT	16	0	51	60	2	48	0	0	100	20	5	841	22	21	301
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	16	0	51	59	2	53	0	0	99	20	5	1636	43	41	305

Survey Team: Region: VI Date:FRI 9 MAR 1990
Road: KABANGKALAN-ILOG Station: 11-1 Section: 1

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	3	0	23	24	0	44	0	0	79	12	1	457	25	9	186
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	4	0	28	29	0	51	0	0	101	15	2	603	33	12	230
WEEK ADJ.	1.07	1.07	1.07	1.07	1.07	0.98	1.04	0.99	1.12	1.12	0.99	0.85	0.85	0.85	
ADT	3	0	26	28	0	53	0	0	90	14	2	712	39	14	215
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	3	0	26	27	0	58	0	0	89	14	2	1385	76	27	220

Road: KABANGKALAN-ILOG Station: 11-1 Section: 1

BOTH DIRECTIONS AVERAGE OF ABOVE COUNTS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
AADT	10	0	38	43	1	56	0	0	94	17	3	1510	60	34	262
AADT (RD1990)	10		83			56			93	17	3	1604			262

TABLE A-3

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
PROJECT MANAGEMENT OFFICE-RURAL INFRASTRUCTURE FUND PROJECT

Survey Team: Region: VI Date:THU 8 MAR 1990
Road: ILOG - CAUAYAN Station: 11-2 Section: 2

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	16	0	26	31	5	128	0	28	87	4	0	175	6	0	325
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	20	0	32	38	6	150	0	40	111	5	0	231	8	0	402
WEEK ADJ.	0.99	0.99	0.99	0.99	0.99	0.98	0.92	0.98	1.08	1.08	1.01	0.95	0.95	0.95	
ADT	20	0	32	38	6	153	0	41	103	5	0	244	8	0	399
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	20	0	32	38	6	170	0	43	102	5	0	475	16	0	416

Survey Team: Region: VI Date:FRI 9 MAR 1990
Road: ILOG - CAUAYAN Station: 11-2 Section: 2

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	13	0	21	19	6	112	0	32	95	6	0	148	16	4	304
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	16	0	26	23	7	131	0	46	121	8	0	195	21	5	378
WEEK ADJ.	1.07	1.07	1.07	1.07	1.07	0.98	1.04	0.99	1.12	1.12	0.99	0.85	0.85	0.85	
ADT	15	0	24	22	7	134	0	46	108	7	0	231	25	6	363
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	15	0	24	22	7	149	0	49	107	7	0	449	48	12	378

Survey Team: Region: VI Date:SAT 10 MAR 1990
Road: ILOG - CAUAYAN Station: 11-2 Section: 2

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	22	0	25	25	7	130	0	40	87	3	3	130	17	3	342
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	27	0	31	31	9	152	0	58	111	4	5	171	22	4	426
WEEK ADJ.	1.05	1.05	1.05	1.05	1.05	1.05	0.98	0.99	0.99	0.99	1.05	1.06	1.06	1.00	
ADT	26	0	29	29	8	145	0	58	111	4	4	161	21	4	416
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	26	0	29	29	8	161	0	61	111	4	5	313	41	8	434

TABLE A-3 (CONT.)

Survey Team: Region: VI Date:SUN 11 MAR 1990
Road: ILOG - CAUAYAN Station: 11-2 Section: 2

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	22	0	14	23	5	114	2	33	73	5	2	156	7	1	293
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	27	0	17	28	6	133	2	48	93	6	3	206	9	1	364
WEEK ADJ.	0.97	0.97	0.97	0.97	0.97	1.03	0.98	1.02	0.74	0.74	0.91	1.00	1.00	1.00	
ADT	28	0	18	29	6	129	3	47	125	9	3	205	9	1	397
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	28	0	18	29	6	144	3	49	124	8	4	399	18	3	413

Survey Team: Region: VI Date:MON 12 MAR 1990
Road: ILOG - CAUAYAN Station: 11-2 Section: 2

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	16	0	24	28	9	137	0	30	86	1	0	141	9	0	331
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	20	0	29	34	11	160	0	43	110	1	0	186	12	0	409
WEEK ADJ.	0.93	0.93	0.93	0.93	0.93	0.97	1.04	1.00	0.97	0.97	0.92	1.12	1.12	1.12	
ADT	21	0	32	37	12	166	0	43	113	1	0	166	11	0	425
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	21	0	31	37	12	184	0	46	112	1	0	322	21	0	444

Survey Team: Region: Date:TUE 13 MAR 1990
Road: ILOG - CAUAYAN Station: 11-2 [illegible] 2

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	18	0	30	18	11	97	0	23	51	2	0	105	8	3	250
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	22	0	37	22	14	113	0	33	65	3	0	138	11	4	309
WEEK ADJ.	0.99	0.99	0.99	0.99	0.99	0.99	1.03	1.01	1.06	1.06	1.04	1.00	1.00	1.00	
ADT	22	0	37	22	14	115	0	33	62	2	0	138	11	4	307
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	22	0	37	22	14	127	0	34	61	2	0	269	20	8	320

TABLE A-3 (CONT.)

Survey Team: Region: VI Date:WED 14 MAR 1990
Road: ILOG - CAUAYAN Station: 11-2 Section: 2

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	16	0	21	16	4	83	0	33	71	3	2	96	10	10	249
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	20	0	26	20	5	97	0	48	90	4	3	127	13	13	312
WEEK ADJ.	1.01	1.01	1.01	1.01	1.01	1.01	1.02	1.01	1.04	1.04	1.08	1.02	1.02	1.02	
ADT	19	0	26	19	5	96	0	47	87	4	3	124	13	13	306
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	19	0	25	19	5	107	0	50	86	4	3	242	25	25	318

Road: ILOG - CAUAYAN Station: 11-2 Section: 2

BOTH DIRECTIONS AVERAGE OF ABOVE COUNTS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
AADT	21	0	28	28	8	149	0	47	101	4	2	353	27	8	389
AADT (RD1990)	21		64			149	0	47	101	4	2	388			389

TABLE A-4

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
PROJECT MANAGEMENT OFFICE-RURAL INFRASTRUCTURE FUND PROJECT

Survey Team: Region: VI Date:THU 8 MAR 1990
Road: CAUAYAN-SIPALAY Station: 11-3 Section: 3

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	6	0	6	19	0	25	0	17	22	1	2	13	0	0	98
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	7	0	7	23	0	29	0	25	28	1	3	17	0	0	124
WEEK ADJ.	0.99	0.99	0.99	0.99	0.99	0.98	0.92	0.98	1.08	1.08	1.01	0.95	0.95	0.95	
ADT	7	0	7	24	0	30	0	25	26	1	3	18	0	0	124
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	7	0	7	23	0	33	0	26	26	1	3	35	0	0	128

Survey Team: Region: VI Date:FRI 9 MAR 1990
Road: CAUAYAN-SIPALAY Station: 11-3 Section: 3

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	8	0	8	17	2	51	0	19	29	4	2	41	0	0	140
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	10	0	10	21	2	60	0	27	37	5	3	54	0	0	175
WEEK ADJ.	1.07	1.07	1.07	1.07	1.07	0.98	1.04	0.99	1.12	1.12	0.99	0.85	0.85	0.85	
ADT	9	0	9	20	2	61	0	28	33	5	3	64	0	0	169
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	9	0	9	19	2	68	0	29	33	5	3	124	0	0	177

Road: CAUAYAN-SIPALAY Station: 11-3 Section: 3

BOTH DIRECTIONS AVERAGE OF ABOVE COUNTS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
AADT	8	0	8	21	1	50	0	28	29	3	3	80	0	0	153
AADT (RD1990)	8		31			50		28	29	3	3	80			153

TABLE A-5

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
PROJECT MANAGEMENT OFFICE-RURAL INFRASTRUCTURE FUND PROJECT

Survey Team: Region: VI Date:MON 12 MAR 1990
Road: SIPALAY-HINOBAAN Station: 11-4 Section: 4

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	0	0	9	11	0	38	5	16	11	5	0	87	7	0	95
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	0	0	11	14	0	44	6	23	14	6	0	115	9	0	119
WEEK ADJ.	0.93	0.93	0.93	0.93	0.93	0.97	1.04	1.00	0.97	0.97	0.92	1.12	1.12	1.12	
ADT	0	0	12	15	0	46	6	23	14	7	0	102	8	0	123
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	0	0	12	14	0	51	7	24	14	7	0	199	16	0	129

Survey Team: Region: VI Date:TUE 13 MAR 1990
Road: SIPALAY-HINOBAAN Station: 11-4 Section: 4

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	0	0	12	11	3	30	1	22	10	0	5	103	0	0	94
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	0	0	15	14	4	35	1	32	13	0	8	136	0	0	120
WEEK ADJ.	0.99	0.99	0.99	0.99	0.99	0.99	1.03	1.01	1.06	1.06	1.04	1.00	1.00	1.00	
ADT	0	0	15	14	4	35	1	31	12	0	7	136	0	0	120
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	0	0	15	14	4	39	1	33	12	0	8	264	0	0	126

Road: SIPALAY-HINOBAAN Station: 11-4 Section: 4

BOTH DIRECTIONS AVERAGE OF ABOVE COUNTS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
AADT	0	0	13	14	2	45	4	29	13	3	4	231	8	0	128
AADT (RD1990)	0		29			45	4	29	13	3	4	239			128

TABLE A-6

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
PROJECT MANAGEMENT OFFICE-RURAL INFRASTRUCTURE FUND PROJECT

Survey Team: Region: VI Date:MON 12 MAR 1990
Road: HINOBAAN-BASAY Station: 11-5 Section: 5

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	5	0	3	12	0	23	0	17	15	0	0	68	3	1	75
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	6	0	4	15	0	27	0	25	19	0	0	90	4	1	95
WEEK ADJ.	0.93	0.93	0.93	0.93	0.93	0.97	1.04	1.00	0.97	0.97	0.92	1.12	1.12	1.12	
ADT	7	0	4	16	0	28	0	25	20	0	0	80	4	1	99
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	7	0	4	16	0	31	0	26	20	0	0	155	7	2	103

Survey Team: Region: VI Date:TUE 13 MAR 1990
Road: HINOBAAN-BASAY Station: 11-5 Section: 5

BOTH DIRECTIONS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
12Hr Total	9	0	6	22	7	26	0	21	21	0	0	131	8	0	112
12/24 ADJ.	0.81	0.81	0.81	0.81	0.81	0.86	0.81	0.69	0.78	0.78	0.65	0.76	0.76	0.76	
24Hr Total	11	0	7	27	9	30	0	30	27	0	0	173	11	0	141
WEEK ADJ.	0.99	0.99	0.99	0.99	0.99	0.99	1.03	1.01	1.06	1.06	1.04	1.00	1.00	1.00	
ADT	11	0	7	27	9	31	0	30	25	0	0	172	11	0	141
MO. ADJ.	1.01	1.01	1.01	1.01	1.01	0.90	0.85	0.95	1.01	1.01	0.89	0.51	0.51	0.51	
AADT	11	0	7	27	9	34	0	31	25	0	0	335	20	0	145

Road: HINOBAAN-BASAY Station: 11-5 Section: 5

BOTH DIRECTIONS AVERAGE OF ABOVE COUNTS

	Car	Taxi	Jeep	Pick -Up	Van	Jeep -ney	Sm. Bus	Lg. Bus	2 Ax Tr.	3 Ax Tr.	Art. Tr.	2-3 Mot.	Wheel Non	Oth.	Tot.
AADT	9	0	6	21	4	33	0	29	22	0	0	245	14	1	124
AADT (RD1990)	9		31			33		29	22	0		260			124

APPENDIX C
TRANSPORT ECONOMICS

TABLE C-1 28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: KBNKALAN-ILOG ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	2.7	2.0	80	82	1.3	1.3	2222	2.4	2.4	2,558,953	2,558,953	0
1994	2.8	2.1	80	82	1.3	1.3	2356	2.4	2.4	2,720,685	2,715,652	5,033
1995	2.8	2.1	80	82	1.3	1.3	2498	2.4	2.4	2,887,279	2,882,120	5,159
1996	2.9	2.1	79	81	1.3	1.3	2648	2.4	2.4	3,064,260	3,058,979	5,281
1997	2.9	2.2	79	81	1.3	1.3	2808	2.4	2.4	3,252,292	3,246,891	5,400
1998	3.0	2.2	79	81	1.3	1.3	2977	2.4	2.4	3,452,076	3,446,561	5,515
1999	3.0	2.2	78	80	1.4	1.3	3157	2.4	2.4	3,822,298	3,658,741	163,557
2000	3.1	2.3	78	80	1.4	1.3	3347	2.4	2.4	4,057,756	3,889,957	167,799
2001	3.1	2.3	78	80	1.4	1.3	3557	2.4	2.4	4,311,244	4,132,959	178,285
2002	3.2	2.4	77	79	1.4	1.3	3780	2.4	2.4	4,580,886	4,391,449	189,437
2003	3.2	2.4	77	79	1.4	1.3	4018	2.4	2.4	4,867,739	4,666,439	201,300
2004	3.3	2.4	76	78	1.4	1.3	4271	2.4	2.4	5,172,927	4,959,008	213,919
2005	3.4	2.5	76	78	1.4	1.3	4540	2.4	2.4	5,497,654	5,270,309	227,344
2006	3.4	2.5	75	77	1.4	1.3	4826	2.4	2.4	5,843,202	5,601,575	241,628
2007	3.5	2.6	75	77	1.4	1.3	5131	2.4	2.4	6,210,944	5,954,118	256,826
2008	3.5	2.6	74	76	1.4	1.3	5455	2.4	2.4	6,602,341	6,329,343	272,999
2009	3.6	2.7	74	76	1.4	1.3	5800	2.4	2.4	7,018,959	6,728,749	290,210
2010	3.7	2.7	73	75	1.4	1.3	6167	2.4	2.4	7,462,467	7,153,939	308,528
2011	3.7	2.7	72	75	1.4	1.3	6559	2.4	2.4	7,934,650	7,606,624	328,026
2012	3.8	2.8	72	74	1.4	1.3	6975	2.4	2.4	8,437,415	8,088,633	348,782

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-2

28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: KBNKALAN-ILOG ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	2.7	2.0	80	82	0.0	0.0	0	2.4	2.4	0	0	0
1994	2.8	2.1	80	82	0.0	0.0	0	2.4	2.4	0	0	0
1995	2.8	2.1	80	82	0.0	0.0	0	2.4	2.4	0	0	0
1996	2.9	2.1	79	81	0.0	0.0	0	2.4	2.4	0	0	0
1997	2.9	2.2	79	81	0.0	0.0	0	2.4	2.4	0	0	0
1998	3.0	2.2	79	81	0.0	0.0	0	2.4	2.4	0	0	0
1999	3.0	2.2	78	80	0.0	0.0	0	2.4	2.4	0	0	0
2000	3.1	2.3	78	80	0.0	0.0	0	2.4	2.4	0	0	0
2001	3.1	2.3	78	80	0.0	0.0	0	2.4	2.4	0	0	0
2002	3.2	2.4	77	79	0.0	0.0	0	2.4	2.4	0	0	0
2003	3.2	2.4	77	79	0.0	0.0	0	2.4	2.4	0	0	0
2004	3.3	2.4	76	78	0.0	0.0	0	2.4	2.4	0	0	0
2005	3.4	2.5	76	78	0.0	0.0	0	2.4	2.4	0	0	0
2006	3.4	2.5	75	77	0.0	0.0	0	2.4	2.4	0	0	0
2007	3.5	2.6	75	77	0.0	0.0	0	2.4	2.4	0	0	0
2008	3.5	2.6	74	76	0.0	0.0	0	2.4	2.4	0	0	0
2009	3.6	2.7	74	76	0.0	0.0	0	2.4	2.4	0	0	0
2010	3.7	2.7	73	75	0.0	0.0	0	2.4	2.4	0	0	0
2011	3.7	2.7	72	75	0.0	0.0	0	2.4	2.4	0	0	0
2012	3.8	2.8	72	74	0.0	0.0	0	2.4	2.4	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-3

28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: KBNKALAN-ILOG ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	2.7	2.0	80	82	1.2	1.2	87	2.4	2.4	89,330	89,330	0
1994	2.8	2.1	80	82	1.2	1.2	93	2.4	2.4	95,404	94,730	337
1995	2.8	2.1	80	82	1.2	1.2	98	2.4	2.4	101,173	100,463	355
1996	2.9	2.1	79	81	1.2	1.2	104	2.4	2.4	107,298	106,552	373
1997	2.9	2.2	79	81	1.2	1.2	110	2.4	2.4	113,802	113,018	392
1998	3.0	2.2	79	81	1.2	1.2	117	2.4	2.4	120,710	119,885	413
1999	3.0	2.2	78	80	1.2	1.2	124	2.4	2.4	133,083	127,179	2,952
2000	3.1	2.3	78	80	1.2	1.2	132	2.4	2.4	141,187	135,841	2,673
2001	3.1	2.3	78	80	1.2	1.2	140	2.4	2.4	149,977	144,298	2,840
2002	3.2	2.4	77	79	1.2	1.2	149	2.4	2.4	159,328	153,294	3,017
2003	3.2	2.4	77	79	1.2	1.2	158	2.4	2.4	169,276	162,864	3,206
2004	3.3	2.4	76	78	1.2	1.2	168	2.4	2.4	179,861	173,048	3,406
2005	3.4	2.5	76	78	1.2	1.2	178	2.4	2.4	191,124	183,885	3,620
2006	3.4	2.5	75	77	1.2	1.2	190	2.4	2.4	203,112	195,418	3,847
2007	3.5	2.6	75	77	1.2	1.2	201	2.4	2.4	215,871	207,693	4,089
2008	3.5	2.6	74	76	1.2	1.2	214	2.4	2.4	229,454	220,761	4,346
2009	3.6	2.7	74	76	1.2	1.2	228	2.4	2.4	243,914	234,673	4,621
2010	3.7	2.7	73	75	1.2	1.2	242	2.4	2.4	259,310	249,485	4,912
2011	3.7	2.7	72	75	1.2	1.2	258	2.4	2.4	275,706	265,259	5,223
2012	3.8	2.8	72	74	1.2	1.2	274	2.4	2.4	293,167	282,059	5,554

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-4

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: KBNKALAN-BSAY SECTION: KBNKALAN-ILOG ALTERNATIVE: PCC

28-Sep-90

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	2.7	2.0	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
1994	2.8	2.1	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
1995	2.8	2.1	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
1996	2.9	2.1	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
1997	2.9	2.2	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
1998	3.0	2.2	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
1999	3.0	2.2	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2000	3.1	2.3	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2001	3.1	2.3	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2002	3.2	2.4	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2003	3.2	2.4	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2004	3.3	2.4	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2005	3.4	2.5	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2006	3.4	2.5	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2007	3.5	2.6	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2008	3.5	2.6	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2009	3.6	2.7	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2010	3.7	2.7	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2011	3.7	2.7	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0
2012	3.8	2.8	30,000	30,000	0	0	2.4	2.4	72,000	72,000	0

TABLE C-5 15-Oct-90

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: KBNKALAN-BSAY SECTION: KBNKALAN-ILOG ALTERNATIVE: PCC

YEAR	PROJECT COSTS	VOC SAVINGS NORMAL BENEFITS (1)	VOC SAVINGS DIVERTED BENEFITS (1)	VOC SAVINGS GENERATED BENEFITS (1,2)	MAINTENANCE BENEFITS	DEVELOPMENT BENEFITS (2)	TOTAL BENEFITS
1991	820,400	0	0	0	0	0	(820,400)
1992	1,230,600	0	0	0	0	0	(1,230,600)
1993	0	0	0	0	0	0	0
1994	0	5,033	0	337	0	0	5,370
1995	0	5,159	0	355	0	0	5,513
1996	0	5,281	0	373	0	0	5,654
1997	0	5,400	0	392	0	0	5,793
1998	0	5,515	0	413	0	0	5,928
1999	0	163,557	0	2,952	0	0	166,509
2000	0	167,799	0	2,673	0	0	170,472
2001	0	178,285	0	2,840	0	0	181,124
2002	0	189,437	0	3,017	0	0	192,454
2003	0	201,300	0	3,206	0	0	204,506
2004	0	213,919	0	3,406	0	0	217,326
2005	0	227,344	0	3,620	0	0	230,964
2006	0	241,628	0	3,847	0	0	245,475
2007	0	256,826	0	4,089	0	0	260,915
2008	0	272,999	0	4,346	0	0	277,345
2009	0	290,210	0	4,621	0	0	294,830
2010	0	308,528	0	4,912	0	0	313,440
2011	0	328,026	0	5,223	0	0	333,249
2012	0	348,782	0	5,554	0	0	354,336

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	3.7%	NB/I(15%)=	0.253 (3)	IRR(%)=	3.7%	NB/I(15%)=	0.253
NPV(15%)=	(1,093,490)	NB/I(12%)=	0.353	NPV(15%)=	(1,093,490)	NB/I(12%)=	0.353
		NB/I(18%)=	0.185			NB/I(18%)=	0.185

(1) Including passenger time savings.
(2) To avoid double-counting benefits either development or generated benefits are considered.
(3) Net benefit-over-investment ratio, special case of the benefit-cost ratio which does not require to define whether a specific cash flow is a cost or a benefit, since their net is considered.

15

TABLE C-6

28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	3.7	2.0	80	84	3.2	3.1	349	10.9	10.9	4,462,545	4,320,805	141,740
1994	3.7	2.1	79	84	3.2	3.1	372	10.9	10.9	4,741,335	4,590,727	150,608
1995	3.8	2.1	79	84	3.2	3.1	397	10.9	10.9	5,038,162	4,878,106	160,056
1996	3.8	2.1	79	84	3.2	3.1	423	10.9	10.9	5,354,233	5,184,110	170,123
1997	3.9	2.2	79	83	3.2	3.1	452	10.9	10.9	5,690,843	5,509,992	180,852
1998	4.0	2.2	79	83	3.2	3.1	482	10.9	10.9	6,049,376	5,857,088	192,288
1999	4.0	2.2	78	83	3.3	3.0	514	10.9	10.9	6,716,309	6,226,833	489,477
2000	4.1	2.3	78	83	3.3	3.0	549	10.9	10.9	7,141,481	6,620,756	520,725
2001	4.2	2.3	78	83	3.3	3.0	587	10.9	10.9	7,598,292	7,044,231	554,061
2002	4.3	2.3	77	82	3.2	3.0	628	10.9	10.9	8,085,517	7,495,892	589,625
2003	4.3	2.4	77	82	3.2	3.0	672	10.9	10.9	8,605,273	7,977,699	627,574
2004	4.4	2.4	77	82	3.2	3.0	719	10.9	10.9	9,159,831	8,491,757	668,074
2005	4.5	2.5	77	82	3.2	3.0	770	10.9	10.9	9,751,629	9,040,323	711,306
2006	4.6	2.5	76	82	3.2	2.9	824	10.9	10.9	10,383,281	9,625,820	757,462
2007	4.6	2.5	76	81	3.1	2.9	883	10.9	10.9	11,057,599	10,250,849	806,750
2008	4.7	2.6	76	81	3.1	2.9	946	10.9	10.9	11,777,598	10,918,205	859,393
2009	4.8	2.6	75	81	3.1	2.9	1014	10.9	10.9	12,546,519	11,630,888	915,631
2010	4.9	2.7	75	80	3.1	2.9	1087	10.9	10.9	13,367,844	12,392,122	975,722
2011	5.0	2.7	74	80	3.1	2.8	1166	10.9	10.9	14,245,314	13,205,373	1,039,941
2012	5.1	2.8	74	80	3.2	2.8	1251	10.9	10.9	15,876,026	13,928,751	1,947,275

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-7 28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	7.5	2.0	70	84	3.8	3.1	349	0.7	0.7	342,226	277,483	64,743
1994	8.8	2.1	66	84	4.0	3.1	372	0.7	0.7	381,588	294,817	86,770
1995	9.5	2.1	64	84	4.2	3.1	397	0.7	0.7	426,498	313,273	113,226
1996	9.5	2.1	64	84	4.2	3.1	423	0.7	0.7	453,299	332,925	120,375
1997	9.5	2.2	64	83	4.2	3.1	452	0.7	0.7	481,847	353,853	127,995
1998	1.5	2.2	85	83	3.1	3.1	482	0.7	0.7	376,143	376,143	0
1999	3.2	2.2	80	83	3.2	3.0	514	0.7	0.7	417,400	399,888	17,512
2000	5.1	2.3	76	83	3.4	3.0	549	0.7	0.7	479,550	425,186	54,363
2001	7.1	2.3	70	83	3.7	3.0	587	0.7	0.7	560,360	452,382	107,978
2002	9.3	2.3	64	82	4.1	3.0	628	0.7	0.7	655,844	481,388	174,457
2003	9.5	2.4	64	82	4.1	3.0	672	0.7	0.7	698,054	512,329	185,725
2004	9.5	2.4	64	82	4.0	3.0	719	0.7	0.7	743,099	545,342	197,757
2005	9.5	2.5	64	82	4.0	3.0	770	0.7	0.7	791,179	580,571	210,608
2006	9.5	2.5	63	82	4.0	2.9	824	0.7	0.7	842,508	618,172	224,336
2007	9.5	2.5	63	81	4.0	2.9	883	0.7	0.7	897,315	658,311	239,004
2008	9.5	2.6	63	81	4.0	2.9	946	0.7	0.7	955,849	701,169	254,680
2009	9.5	2.6	63	81	3.9	2.9	1014	0.7	0.7	1,018,374	746,938	271,437
2010	9.5	2.7	63	80	3.9	2.9	1087	0.7	0.7	1,085,177	795,824	289,353
2011	9.5	2.7	63	80	3.9	2.8	1166	0.7	0.7	1,156,564	848,051	308,513
2012	9.5	2.8	63	80	3.9	2.8	1251	0.7	0.7	1,232,866	894,507	338,359

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-8

28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.9	2.6	48	82	4.4	3.1	349	6.9	6.9	3,844,593	2,735,189	1,109,404
1994	12.5	2.7	43	82	5.0	3.1	372	6.9	6.9	4,670,877	2,906,057	1,764,821
1995	14.0	2.8	40	82	5.4	3.1	397	6.9	6.9	5,401,480	3,087,975	2,313,505
1996	14.0	3.0	40	81	5.4	3.1	423	6.9	6.9	5,740,520	3,281,684	2,458,836
1997	7.0	3.1	54	81	3.9	3.2	452	6.9	6.9	4,427,648	3,640,479	787,169
1998	10.2	3.3	48	80	4.5	3.2	482	6.9	6.9	5,455,524	3,869,937	1,585,587
1999	13.5	3.4	41	80	5.1	3.1	514	6.9	6.9	6,613,698	4,071,198	2,542,500
2000	14.0	3.6	40	79	5.5	3.1	549	6.9	6.9	7,640,843	4,328,792	3,312,051
2001	7.8	3.8	52	79	3.8	3.1	587	6.9	6.9	5,653,921	4,605,704	1,048,218
2002	11.8	4.0	44	78	4.6	3.1	628	6.9	6.9	7,304,174	4,901,055	2,403,119
2003	14.0	2.5	40	82	5.4	3.0	672	6.9	6.9	9,211,519	5,050,103	4,161,416
2004	14.0	2.7	40	81	5.4	3.0	719	6.9	6.9	9,807,247	5,375,516	4,431,731
2005	8.8	2.9	50	81	4.0	3.0	770	6.9	6.9	7,692,591	5,722,773	1,969,818
2006	14.0	3.1	40	80	5.2	3.1	824	6.9	6.9	10,704,807	6,360,139	4,344,668
2007	14.0	3.3	39	79	5.3	3.0	883	6.9	6.9	11,848,572	6,702,759	5,145,813
2008	14.0	3.5	39	79	5.3	3.0	946	6.9	6.9	12,624,069	7,139,244	5,484,826
2009	10.3	3.8	47	78	4.2	3.0	1014	6.9	6.9	10,850,249	7,605,392	3,244,857
2010	14.0	4.0	39	77	5.2	3.1	1087	6.9	6.9	14,338,792	8,462,213	5,876,579
2011	14.0	4.3	39	76	5.2	3.1	1166	6.9	6.9	15,286,018	9,017,676	6,268,342
2012	14.0	4.6	39	75	5.2	3.1	1251	6.9	6.9	16,298,999	9,611,226	6,687,773

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-9

28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.9	2.0	48	84	4.4	3.1	349	1.5	1.5	835,781	594,606	241,175
1994	12.5	2.1	43	84	5.0	3.1	372	1.5	1.5	1,015,408	631,751	383,657
1995	14.0	2.1	40	84	5.4	3.1	397	1.5	1.5	1,174,235	671,299	502,936
1996	14.0	2.1	40	84	5.4	3.1	423	1.5	1.5	1,247,939	713,410	534,529
1997	7.0	2.2	54	83	3.9	3.1	452	1.5	1.5	962,532	758,256	204,276
1998	10.2	2.2	48	83	4.5	3.1	482	1.5	1.5	1,185,983	806,021	379,962
1999	13.5	2.2	41	83	5.1	3.0	514	1.5	1.5	1,437,761	856,904	580,857
2000	14.0	2.3	40	83	5.5	3.0	549	1.5	1.5	1,661,053	911,113	749,940
2001	7.8	2.3	52	83	3.8	3.0	587	1.5	1.5	1,229,113	969,390	259,724
2002	11.8	2.3	44	82	4.6	3.0	628	1.5	1.5	1,587,864	1,031,545	556,319
2003	14.0	2.4	40	82	5.4	3.0	672	1.5	1.5	2,002,504	1,097,849	904,656
2004	14.0	2.4	40	82	5.4	3.0	719	1.5	1.5	2,132,010	1,168,590	963,420
2005	8.8	2.5	50	82	4.0	3.0	770	1.5	1.5	1,672,302	1,244,081	428,221
2006	14.0	2.5	40	82	5.2	2.9	824	1.5	1.5	2,327,132	1,324,654	1,002,478
2007	14.0	2.5	39	81	5.3	2.9	883	1.5	1.5	2,575,777	1,410,667	1,165,109
2008	14.0	2.6	39	81	5.3	2.9	946	1.5	1.5	2,744,363	1,502,505	1,241,858
2009	10.3	2.6	47	81	4.2	2.9	1014	1.5	1.5	2,358,750	1,600,581	758,169
2010	14.0	2.7	39	80	5.2	2.9	1087	1.5	1.5	3,117,129	1,705,338	1,411,791
2011	14.0	2.7	39	80	5.2	2.8	1166	1.5	1.5	3,323,047	1,817,253	1,505,794
2012	14.0	2.8	39	80	5.2	2.8	1251	1.5	1.5	3,543,261	1,916,801	1,626,460

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-10

28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	3.7	2.0	80	84	0.0	0.0	0	10.9	10.9	0	0	0
1994	3.7	2.1	79	84	0.0	0.0	0	10.9	10.9	0	0	0
1995	3.8	2.1	79	84	0.0	0.0	0	10.9	10.9	0	0	0
1996	3.8	2.1	79	84	0.0	0.0	0	10.9	10.9	0	0	0
1997	3.9	2.2	79	83	0.0	0.0	0	10.9	10.9	0	0	0
1998	4.0	2.2	79	83	0.0	0.0	0	10.9	10.9	0	0	0
1999	4.0	2.2	78	83	0.0	0.0	0	10.9	10.9	0	0	0
2000	4.1	2.3	78	83	0.0	0.0	0	10.9	10.9	0	0	0
2001	4.2	2.3	78	83	0.0	0.0	0	10.9	10.9	0	0	0
2002	4.3	2.3	77	82	0.0	0.0	0	10.9	10.9	0	0	0
2003	4.3	2.4	77	82	0.0	0.0	0	10.9	10.9	0	0	0
2004	4.4	2.4	77	82	0.0	0.0	0	10.9	10.9	0	0	0
2005	4.5	2.5	77	82	0.0	0.0	0	10.9	10.9	0	0	0
2006	4.6	2.5	76	82	0.0	0.0	0	10.9	10.9	0	0	0
2007	4.6	2.5	76	81	0.0	0.0	0	10.9	10.9	0	0	0
2008	4.7	2.6	76	81	0.0	0.0	0	10.9	10.9	0	0	0
2009	4.8	2.6	75	81	0.0	0.0	0	10.9	10.9	0	0	0
2010	4.9	2.7	75	80	0.0	0.0	0	10.9	10.9	0	0	0
2011	5.0	2.7	74	80	0.0	0.0	0	10.9	10.9	0	0	0
2012	5.1	2.8	74	80	0.0	0.0	0	10.9	10.9	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-11 28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	7.5	2.0	70	84	0.0	0.0	0	0.7	0.7	0	0	0
1994	8.8	2.1	66	84	0.0	0.0	0	0.7	0.7	0	0	0
1995	9.5	2.1	64	84	0.0	0.0	0	0.7	0.7	0	0	0
1996	9.5	2.1	64	84	0.0	0.0	0	0.7	0.7	0	0	0
1997	9.5	2.2	64	83	0.0	0.0	0	0.7	0.7	0	0	0
1998	1.5	2.2	85	83	0.0	0.0	0	0.7	0.7	0	0	0
1999	3.2	2.2	80	83	0.0	0.0	0	0.7	0.7	0	0	0
2000	5.1	2.3	76	83	0.0	0.0	0	0.7	0.7	0	0	0
2001	7.1	2.3	70	83	0.0	0.0	0	0.7	0.7	0	0	0
2002	9.3	2.3	64	82	0.0	0.0	0	0.7	0.7	0	0	0
2003	9.5	2.4	64	82	0.0	0.0	0	0.7	0.7	0	0	0
2004	9.5	2.4	64	82	0.0	0.0	0	0.7	0.7	0	0	0
2005	9.5	2.5	64	82	0.0	0.0	0	0.7	0.7	0	0	0
2006	9.5	2.5	63	82	0.0	0.0	0	0.7	0.7	0	0	0
2007	9.5	2.5	63	81	0.0	0.0	0	0.7	0.7	0	0	0
2008	9.5	2.6	63	81	0.0	0.0	0	0.7	0.7	0	0	0
2009	9.5	2.6	63	81	0.0	0.0	0	0.7	0.7	0	0	0
2010	9.5	2.7	63	80	0.0	0.0	0	0.7	0.7	0	0	0
2011	9.5	2.7	63	80	0.0	0.0	0	0.7	0.7	0	0	0
2012	9.5	2.8	63	80	0.0	0.0	0	0.7	0.7	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-12

28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.9	2.6	48	82	0.0	0.0	0	6.9	6.9	0	0	0
1994	12.5	2.7	43	82	0.0	0.0	0	6.9	6.9	0	0	0
1995	14.0	2.8	40	82	0.0	0.0	0	6.9	6.9	0	0	0
1996	14.0	3.0	40	81	0.0	0.0	0	6.9	6.9	0	0	0
1997	7.0	3.1	54	81	0.0	0.0	0	6.9	6.9	0	0	0
1998	10.2	3.3	48	80	0.0	0.0	0	6.9	6.9	0	0	0
1999	13.5	3.4	41	80	0.0	0.0	0	6.9	6.9	0	0	0
2000	14.0	3.6	40	79	0.0	0.0	0	6.9	6.9	0	0	0
2001	7.8	3.8	52	79	0.0	0.0	0	6.9	6.9	0	0	0
2002	11.8	4.0	44	78	0.0	0.0	0	6.9	6.9	0	0	0
2003	14.0	2.5	40	82	0.0	0.0	0	6.9	6.9	0	0	0
2004	14.0	2.7	40	81	0.0	0.0	0	6.9	6.9	0	0	0
2005	8.8	2.9	50	81	0.0	0.0	0	6.9	6.9	0	0	0
2006	14.0	3.1	40	80	0.0	0.0	0	6.9	6.9	0	0	0
2007	14.0	3.3	39	79	0.0	0.0	0	6.9	6.9	0	0	0
2008	14.0	3.5	39	79	0.0	0.0	0	6.9	6.9	0	0	0
2009	10.3	3.8	47	78	0.0	0.0	0	6.9	6.9	0	0	0
2010	14.0	4.0	39	77	0.0	0.0	0	6.9	6.9	0	0	0
2011	14.0	4.3	39	76	0.0	0.0	0	6.9	6.9	0	0	0
2012	14.0	4.6	39	75	0.0	0.0	0	6.9	6.9	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-13 28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.9	2.0	48	84	0.0	0.0	0	1.5	1.5	0	0	0
1994	12.5	2.1	43	84	0.0	0.0	0	1.5	1.5	0	0	0
1995	14.0	2.1	40	84	0.0	0.0	0	1.5	1.5	0	0	0
1996	14.0	2.1	40	84	0.0	0.0	0	1.5	1.5	0	0	0
1997	7.0	2.2	54	83	0.0	0.0	0	1.5	1.5	0	0	0
1998	10.2	2.2	48	83	0.0	0.0	0	1.5	1.5	0	0	0
1999	13.5	2.2	41	83	0.0	0.0	0	1.5	1.5	0	0	0
2000	14.0	2.3	40	83	0.0	0.0	0	1.5	1.5	0	0	0
2001	7.8	2.3	52	83	0.0	0.0	0	1.5	1.5	0	0	0
2002	11.8	2.3	44	82	0.0	0.0	0	1.5	1.5	0	0	0
2003	14.0	2.4	40	82	0.0	0.0	0	1.5	1.5	0	0	0
2004	14.0	2.4	40	82	0.0	0.0	0	1.5	1.5	0	0	0
2005	8.8	2.5	50	82	0.0	0.0	0	1.5	1.5	0	0	0
2006	14.0	2.5	40	82	0.0	0.0	0	1.5	1.5	0	0	0
2007	14.0	2.5	39	81	0.0	0.0	0	1.5	1.5	0	0	0
2008	14.0	2.6	39	81	0.0	0.0	0	1.5	1.5	0	0	0
2009	10.3	2.6	47	81	0.0	0.0	0	1.5	1.5	0	0	0
2010	14.0	2.7	39	80	0.0	0.0	0	1.5	1.5	0	0	0
2011	14.0	2.7	39	80	0.0	0.0	0	1.5	1.5	0	0	0
2012	14.0	2.8	39	80	0.0	0.0	0	1.5	1.5	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-14 28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	3.7	2.0	80	84	2.7	2.6	65	10.9	10.9	697,012	673,449	11,781
1994	3.7	2.1	79	84	2.7	2.6	69	10.9	10.9	740,170	715,157	12,507
1995	3.8	2.1	79	84	2.7	2.6	73	10.9	10.9	786,132	759,572	13,280
1996	3.8	2.1	79	84	2.7	2.6	78	10.9	10.9	835,086	806,880	14,103
1997	3.9	2.2	79	83	2.7	2.6	84	10.9	10.9	887,239	857,277	14,981
1998	4.0	2.2	79	83	2.7	2.6	89	10.9	10.9	942,808	910,975	15,916
1999	4.0	2.2	78	83	2.8	2.6	95	10.9	10.9	1,045,153	968,201	38,476
2000	4.1	2.3	78	83	2.8	2.5	101	10.9	10.9	1,111,020	1,029,198	40,911
2001	4.2	2.3	78	83	2.7	2.5	109	10.9	10.9	1,182,311	1,095,246	43,533
2002	4.3	2.3	77	82	2.7	2.5	116	10.9	10.9	1,258,426	1,165,762	46,332
2003	4.3	2.4	77	82	2.7	2.5	124	10.9	10.9	1,339,708	1,241,065	49,322
2004	4.4	2.4	77	82	2.7	2.5	133	10.9	10.9	1,426,529	1,321,497	52,516
2005	4.5	2.5	77	82	2.7	2.5	143	10.9	10.9	1,519,286	1,407,428	55,929
2006	4.6	2.5	76	82	2.7	2.5	153	10.9	10.9	1,618,410	1,499,255	59,578
2007	4.6	2.5	76	81	2.6	2.5	164	10.9	10.9	1,724,361	1,597,405	63,478
2008	4.7	2.6	76	81	2.6	2.4	176	10.9	10.9	1,837,638	1,702,339	67,649
2009	4.8	2.6	75	81	2.6	2.4	188	10.9	10.9	1,958,774	1,814,552	72,111
2010	4.9	2.7	75	80	2.6	2.4	202	10.9	10.9	2,088,348	1,934,578	76,885
2011	5.0	2.7	74	80	2.6	2.4	217	10.9	10.9	2,226,978	2,062,990	81,994
2012	5.1	2.8	74	80	2.7	2.4	233	10.9	10.9	2,482,420	2,185,927	148,246

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-15

28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	7.5	2.0	70	84	3.2	2.6	65	0.7	0.7	53,638	43,249	5,195
1994	8.8	2.1	66	84	3.4	2.6	69	0.7	0.7	59,863	45,927	6,968
1995	9.5	2.1	64	84	3.6	2.6	73	0.7	0.7	67,025	48,780	9,123
1996	9.5	2.1	64	84	3.6	2.6	78	0.7	0.7	71,200	51,818	9,691
1997	9.5	2.2	64	83	3.5	2.6	84	0.7	0.7	75,649	55,054	10,297
1998	1.5	2.2	85	83	2.6	2.6	89	0.7	0.7	58,503	58,503	0
1999	3.2	2.2	80	83	2.7	2.6	95	0.7	0.7	64,791	62,178	1,306
2000	5.1	2.3	76	83	2.9	2.5	101	0.7	0.7	74,566	66,095	4,235
2001	7.1	2.3	70	83	3.1	2.5	109	0.7	0.7	87,222	70,337	8,442
2002	9.3	2.3	64	82	3.5	2.5	116	0.7	0.7	102,885	74,865	14,010
2003	9.5	2.4	64	82	3.4	2.5	124	0.7	0.7	109,534	79,701	14,916
2004	9.5	2.4	64	82	3.4	2.5	133	0.7	0.7	116,637	84,867	15,885
2005	9.5	2.5	64	82	3.4	2.5	143	0.7	0.7	124,227	90,385	16,921
2006	9.5	2.5	63	82	3.4	2.5	153	0.7	0.7	132,340	96,282	18,029
2007	9.5	2.5	63	81	3.4	2.5	164	0.7	0.7	141,013	102,586	19,214
2008	9.5	2.6	63	81	3.4	2.4	176	0.7	0.7	150,288	109,325	20,482
2009	9.5	2.6	63	81	3.3	2.4	188	0.7	0.7	160,209	116,531	21,839
2010	9.5	2.7	63	80	3.3	2.4	202	0.7	0.7	170,823	124,239	23,292
2011	9.5	2.7	63	80	3.3	2.4	217	0.7	0.7	182,181	132,486	24,848
2012	9.5	2.8	63	80	3.3	2.4	233	0.7	0.7	194,339	140,381	26,979

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-16 28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.9	2.6	48	82	3.8	2.6	65	6.9	6.9	611,670	426,312	92,679
1994	12.5	2.7	43	82	4.3	2.6	69	6.9	6.9	747,428	452,714	147,357
1995	14.0	2.8	40	82	4.7	2.6	73	6.9	6.9	866,311	480,830	192,740
1996	14.0	3.0	40	81	4.7	2.6	78	6.9	6.9	920,135	510,777	204,679
1997	7.0	3.1	54	81	3.3	2.7	84	6.9	6.9	702,421	565,453	68,484
1998	10.2	3.3	48	80	3.9	2.7	89	6.9	6.9	867,699	600,889	133,405
1999	13.5	3.4	41	80	4.4	2.6	95	6.9	6.9	1,057,100	634,312	211,394
2000	14.0	3.6	40	79	4.8	2.6	101	6.9	6.9	1,230,972	674,271	278,350
2001	7.8	3.8	52	79	3.3	2.6	109	6.9	6.9	895,584	717,541	89,022
2002	11.8	4.0	44	78	4.0	2.6	116	6.9	6.9	1,163,448	763,738	199,855
2003	14.0	2.5	40	82	4.7	2.5	124	6.9	6.9	1,484,416	785,628	349,394
2004	14.0	2.7	40	81	4.7	2.5	133	6.9	6.9	1,580,722	836,544	372,089
2005	8.8	2.9	50	81	3.4	2.5	143	6.9	6.9	1,218,754	890,941	163,907
2006	14.0	3.1	40	80	4.5	2.6	153	6.9	6.9	1,724,574	988,934	367,820
2007	14.0	3.3	39	79	4.6	2.5	164	6.9	6.9	1,911,448	1,046,543	432,452
2008	14.0	3.5	39	79	4.6	2.5	176	6.9	6.9	2,037,374	1,115,299	461,037
2009	10.3	3.8	47	78	3.6	2.5	188	6.9	6.9	1,729,110	1,188,827	270,142
2010	14.0	4.0	39	77	4.6	2.6	202	6.9	6.9	2,316,339	1,321,981	497,179
2011	14.0	4.3	39	76	4.5	2.6	217	6.9	6.9	2,470,742	1,409,739	530,502
2012	14.0	4.6	39	75	4.5	2.6	233	6.9	6.9	2,636,090	1,503,653	566,218

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-17 28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.9	2.0	48	84	3.8	2.6	65	1.5	1.5	132,972	92,677	20,148
1994	12.5	2.1	43	84	4.3	2.6	69	1.5	1.5	162,484	98,416	32,034
1995	14.0	2.1	40	84	4.7	2.6	73	1.5	1.5	188,328	104,528	41,900
1996	14.0	2.1	40	84	4.7	2.6	78	1.5	1.5	200,029	111,038	44,495
1997	7.0	2.2	54	83	3.3	2.6	84	1.5	1.5	152,700	117,974	17,363
1998	10.2	2.2	48	83	3.9	2.6	89	1.5	1.5	188,630	125,364	31,633
1999	13.5	2.2	41	83	4.4	2.6	95	1.5	1.5	229,804	133,239	48,283
2000	14.0	2.3	40	83	4.8	2.5	101	1.5	1.5	267,603	141,633	62,985
2001	7.8	2.3	52	83	3.3	2.5	109	1.5	1.5	194,692	150,722	21,985
2002	11.8	2.3	44	82	4.0	2.5	116	1.5	1.5	252,923	160,426	46,249
2003	14.0	2.4	40	82	4.7	2.5	124	1.5	1.5	322,699	170,789	75,955
2004	14.0	2.4	40	82	4.7	2.5	133	1.5	1.5	343,635	181,857	80,889
2005	8.8	2.5	50	82	3.4	2.5	143	1.5	1.5	264,947	193,683	35,632
2006	14.0	2.5	40	82	4.5	2.5	153	1.5	1.5	374,907	206,319	84,294
2007	14.0	2.5	39	81	4.6	2.5	164	1.5	1.5	415,532	219,826	97,853
2008	14.0	2.6	39	81	4.6	2.4	176	1.5	1.5	442,907	234,267	104,320
2009	10.3	2.6	47	81	3.6	2.4	188	1.5	1.5	375,894	249,709	63,092
2010	14.0	2.7	39	80	4.6	2.4	202	1.5	1.5	503,552	266,226	118,663
2011	14.0	2.7	39	80	4.5	2.4	217	1.5	1.5	537,118	283,898	126,610
2012	14.0	2.8	39	80	4.5	2.4	233	1.5	1.5	573,063	300,816	136,124

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-18

28-Sep-90

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	3.7	2.0	30,000	30,000	0	0	10.9	10.9	327,000	327,000	0
1994	3.7	2.1	30,000	30,000	0	0	10.9	10.9	327,000	327,000	0
1995	3.8	2.1	30,000	30,000	0	0	10.9	10.9	327,000	327,000	0
1996	3.8	2.1	30,000	30,000	0	0	10.9	10.9	327,000	327,000	0
1997	3.9	2.2	30,000	30,000	0	0	10.9	10.9	327,000	327,000	0
1998	4.0	2.2	30,000	30,000	0	0	10.9	10.9	327,000	327,000	0
1999	4.0	2.2	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2000	4.1	2.3	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2001	4.2	2.3	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2002	4.3	2.3	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2003	4.3	2.4	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2004	4.4	2.4	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2005	4.5	2.5	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2006	4.6	2.5	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2007	4.6	2.5	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2008	4.7	2.6	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2009	4.8	2.6	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2010	4.9	2.7	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2011	5.0	2.7	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809
2012	5.1	2.8	33,010	30,000	0	0	10.9	10.9	359,809	327,000	32,809

TABLE C-19

28-Sep-90

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	7.5	2.0	32,260	30,000	0	0	0.7	0.7	22,582	21,000	1,582
1994	8.8	2.1	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
1995	9.5	2.1	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
1996	9.5	2.1	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
1997	9.5	2.2	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
1998	1.5	2.2	28,960	30,000	0	0	0.7	0.7	20,272	21,000	(728)
1999	3.2	2.2	28,960	30,000	0	0	0.7	0.7	20,272	21,000	(728)
2000	5.1	2.3	29,710	30,000	0	0	0.7	0.7	20,797	21,000	(203)
2001	7.1	2.3	32,260	30,000	116,500	0	0.7	0.7	104,132	21,000	83,132
2002	9.3	2.3	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
2003	9.5	2.4	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
2004	9.5	2.4	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
2005	9.5	2.5	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
2006	9.5	2.5	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
2007	9.5	2.5	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
2008	9.5	2.6	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
2009	9.5	2.6	37,560	30,000	116,500	0	0.7	0.7	107,842	21,000	86,842
2010	9.5	2.7	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
2011	9.5	2.7	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292
2012	9.5	2.8	37,560	30,000	0	0	0.7	0.7	26,292	21,000	5,292

TABLE C-20

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: DBST

16-Oct-90

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.9	2.6	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
1994	12.5	2.7	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
1995	14.0	2.8	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
1996	14.0	3.0	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
1997	7.0	3.1	32,260	28,960	0	0	6.9	6.9	222,594	199,824	22,770
1998	10.2	3.3	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
1999	13.5	3.4	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
2000	14.0	3.6	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
2001	7.8	3.8	32,260	28,960	116,500	116,500	6.9	6.9	1,026,444	1,003,674	22,770
2002	11.8	4.0	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
2003	14.0	2.5	37,560	28,960	0	1,020,470	6.9	6.9	259,164	7,241,067	(6,981,903)
2004	14.0	2.7	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
2005	8.8	2.9	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
2006	14.0	3.1	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
2007	14.0	3.3	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
2008	14.0	3.5	37,560	28,960	0	0	6.9	6.9	259,164	199,824	59,340
2009	10.3	3.8	37,560	28,960	116,500	116,500	6.9	6.9	1,063,014	1,003,674	59,340
2010	14.0	4.0	37,560	29,710	0	0	6.9	6.9	259,164	204,999	54,165
2011	14.0	4.3	37,560	29,710	0	0	6.9	6.9	259,164	204,999	54,165
2012	14.0	4.6	37,560	29,710	0	0	6.9	6.9	259,164	204,999	54,165

TABLE C-22 16-Oct-90

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC\DBST

YEAR	PROJECT COSTS	VOC SAVINGS NORMAL BENEFITS (1)	VOC SAVINGS DIVERTED BENEFITS (1)	VOC SAVINGS GENERATED BENEFITS (1,2)	MAINTENANCE BENEFITS	DEVELOPMENT BENEFITS (2)	TOTAL BENEFITS
1991	13,596,000	0	0	0	0	0	(13,596,000)
1992	20,394,000	0	0	0	0	0	(20,394,000)
1993	0	1,557,062	0	129,802	72,262	0	1,759,126
1994	0	2,385,856	0	198,866	75,972	0	2,660,693
1995	0	3,089,722	0	257,043	75,972	0	3,422,737
1996	0	3,283,863	0	272,969	75,972	0	3,632,803
1997	0	1,300,292	0	111,125	31,452	0	1,442,869
1998	0	2,157,837	0	180,955	69,952	0	2,408,744
1999	0	3,630,346	0	299,459	102,761	0	4,032,566
2000	0	4,637,079	0	386,482	103,286	0	5,126,846
2001	0	1,969,980	0	162,981	316,851	0	2,449,813
2002	0	3,723,520	0	306,445	108,781	0	4,138,746
2003	0	5,879,370	0	489,587	(6,932,462)	0	(563,505)
2004	0	6,260,982	0	521,379	108,781	0	6,891,142
2005	0	3,319,953	0	272,389	108,781	0	3,701,123
2006	0	6,328,944	0	529,720	108,781	0	6,967,445
2007	0	7,356,676	0	612,997	108,781	0	8,078,454
2008	0	7,840,756	0	653,489	108,781	0	8,603,026
2009	0	5,190,094	0	427,184	365,081	0	5,982,359
2010	0	8,553,444	0	716,019	103,606	0	9,373,069
2011	0	9,122,590	0	763,953	103,606	0	9,990,150
2012	0	10,599,868	0	877,568	103,606	0	11,581,041

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)= 9.3% NB/I(15%)= 0.609 (3)

NPV(15%)= (9,495,250) NB/I(12%)= 0.780

NB/I(18%)= 0.488

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)= 9.3% NB/I(15%)= 0.609

NPV(15%)= (9,495,250) NB/I(12%)= 0.780

NB/I(18%)= 0.488

(1) Including passenger time savings.

(2) To avoid double-counting benefits either development or generated benefits are considered.

(3) Net benefit-over-investment ratio, special case of the benefit-cost ratio which does not require to define whether a specific cash flow is a cost or a benefit, since their net is considered.

TABLE C-21

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: KBNKALAN-BSAY SECTION: ILOG-CAUAYAN ALTERNATIVE: PCC

28-Sep-90

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.9	2.0	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
1994	12.5	2.1	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
1995	14.0	2.1	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
1996	14.0	2.1	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
1997	7.0	2.2	32,260	30,000	0	0	1.5	1.5	48,390	45,000	3,390
1998	10.2	2.2	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
1999	13.5	2.2	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2000	14.0	2.3	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2001	7.8	2.3	32,260	30,000	116,500	0	1.5	1.5	223,140	45,000	178,140
2002	11.8	2.3	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2003	14.0	2.4	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2004	14.0	2.4	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2005	8.8	2.5	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2006	14.0	2.5	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2007	14.0	2.5	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2008	14.0	2.6	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2009	10.3	2.6	37,560	30,000	116,500	0	1.5	1.5	231,090	45,000	186,090
2010	14.0	2.7	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2011	14.0	2.7	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340
2012	14.0	2.8	37,560	30,000	0	0	1.5	1.5	56,340	45,000	11,340

TABLE C-23 28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	4.7	2.0	72	79	3.4	3.1	277	9.9	9.9	3,375,055	3,109,669	265,385
1994	4.8	2.1	72	79	3.4	3.1	295	9.9	9.9	3,577,665	3,296,093	281,572
1995	4.9	2.1	72	78	3.4	3.1	313	9.9	9.9	3,792,860	3,494,081	298,779
1996	5.0	2.1	71	78	3.3	3.1	332	9.9	9.9	4,021,450	3,704,378	317,072
1997	5.1	2.2	71	78	3.5	3.1	353	9.9	9.9	4,451,472	3,927,775	523,697
1998	5.2	2.2	71	78	3.5	3.1	375	9.9	9.9	4,720,935	4,165,117	555,818
1999	5.3	2.2	70	78	3.5	3.1	399	9.9	9.9	5,007,285	4,417,308	589,977
2000	5.4	2.3	70	78	3.5	3.1	424	9.9	9.9	5,311,617	4,685,309	626,309
2001	5.5	2.3	70	77	3.5	3.0	451	9.9	9.9	5,642,160	4,973,338	668,823
2002	5.6	2.3	69	77	3.4	3.0	481	9.9	9.9	5,989,644	5,279,732	709,912
2003	5.7	2.4	69	77	3.4	3.0	512	9.9	9.9	6,359,344	5,605,712	753,632
2004	5.8	2.4	69	77	3.4	3.0	546	9.9	9.9	6,752,738	5,952,582	800,157
2005	5.9	2.5	68	77	3.4	3.0	582	9.9	9.9	7,171,413	6,321,737	849,676
2006	6.0	2.5	68	76	3.5	3.0	621	9.9	9.9	7,955,695	6,714,671	1,241,024
2007	6.0	2.5	68	76	3.5	3.0	662	9.9	9.9	8,451,221	7,132,982	1,318,238
2008	6.0	2.6	68	76	3.5	3.0	706	9.9	9.9	8,978,849	7,578,380	1,400,469
2009	6.0	2.6	67	75	3.5	3.0	754	9.9	9.9	9,540,752	8,052,696	1,488,055
2010	6.0	2.7	67	75	3.5	2.9	805	9.9	9.9	10,139,256	8,557,892	1,581,364
2011	6.0	2.7	67	75	3.5	2.9	859	9.9	9.9	10,776,854	9,096,066	1,680,787
2012	6.0	2.8	67	75	3.5	2.9	917	9.9	9.9	11,456,215	9,669,470	1,786,745

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-24

28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.5	2.6	64	83	4.2	3.1	277	1.5	1.5	644,087	475,145	168,942
1994	9.5	2.7	64	82	4.2	3.1	295	1.5	1.5	682,704	503,661	179,043
1995	9.5	2.8	64	82	4.2	3.1	313	1.5	1.5	723,721	533,947	189,775
1996	9.5	2.9	64	82	4.2	3.1	332	1.5	1.5	767,294	566,117	201,178
1997	9.5	3.0	64	81	4.2	3.2	353	1.5	1.5	813,588	625,224	188,364
1998	1.5	3.1	85	81	3.1	3.2	375	1.5	1.5	636,601	663,069	(26,468)
1999	9.5	3.3	64	81	4.2	3.2	399	1.5	1.5	915,054	703,285	211,769
2000	9.5	3.4	64	80	4.2	3.2	424	1.5	1.5	970,615	746,024	224,591
2001	9.5	3.6	64	80	4.2	3.2	451	1.5	1.5	1,030,214	785,010	245,204
2002	9.5	3.7	64	79	4.2	3.2	481	1.5	1.5	1,093,617	833,375	260,241
2003	9.5	2.5	64	82	4.1	3.1	512	1.5	1.5	1,161,076	856,920	304,157
2004	9.5	2.6	64	82	4.1	3.0	546	1.5	1.5	1,232,864	909,956	322,908
2005	9.5	2.8	64	81	4.1	3.0	582	1.5	1.5	1,309,271	966,399	342,872
2006	9.5	3.0	64	81	4.1	3.0	621	1.5	1.5	1,390,605	1,026,477	364,129
2007	9.5	3.1	64	80	4.1	3.1	662	1.5	1.5	1,477,201	1,135,890	341,311
2008	9.5	3.3	64	80	4.1	3.1	706	1.5	1.5	1,569,414	1,196,218	373,196
2009	9.5	3.5	64	79	4.0	3.1	754	1.5	1.5	1,667,624	1,271,087	396,537
2010	9.5	3.7	63	78	4.0	3.1	805	1.5	1.5	1,772,240	1,350,830	421,410
2011	9.5	4.0	63	78	4.0	3.1	859	1.5	1.5	1,883,700	1,435,778	447,922
2012	9.5	4.2	63	77	4.0	3.2	917	1.5	1.5	2,002,472	1,591,007	411,465

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-25 28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.5	2.6	45	77	4.4	3.1	7	45.2	45.2	20,189,431	14,197,681	5,991,749
1994	11.7	2.7	41	77	4.8	3.1	5	45.2	45.2	23,408,616	15,048,827	8,359,789
1995	13.9	2.8	37	77	5.5	3.1	313	45.2	45.2	28,450,455	15,952,775	12,497,681
1996	14.0	2.9	37	76	5.7	3.1	332	45.2	45.2	31,312,871	16,912,916	14,399,955
1997	6.4	3.0	51	76	3.8	3.2	353	45.2	45.2	22,085,945	18,679,406	3,406,539
1998	9.0	3.1	46	76	4.2	3.2	375	45.2	45.2	25,849,081	19,808,999	6,040,082
1999	11.7	3.3	41	75	4.8	3.2	399	45.2	45.2	31,338,857	21,009,301	10,329,557
2000	14.0	3.4	37	75	5.7	3.2	424	45.2	45.2	39,545,547	22,284,898	17,260,649
2001	7.0	3.6	49	74	3.8	3.2	451	45.2	45.2	27,990,408	23,654,956	4,335,452
2002	10.1	3.7	44	74	4.5	3.2	481	45.2	45.2	35,817,113	25,112,368	10,704,745
2003	13.4	2.5	38	77	5.4	3.0	512	45.2	45.2	45,525,140	25,593,754	19,931,386
2004	14.0	2.6	36	76	5.6	3.0	546	45.2	45.2	50,192,512	27,177,443	23,015,069
2005	7.7	2.8	48	76	3.9	3.0	582	45.2	45.2	37,581,947	28,862,880	8,719,067
2006	11.5	3.0	41	75	4.6	3.0	621	45.2	45.2	47,591,017	30,656,883	16,934,135
2007	14.0	3.1	36	75	5.5	3.1	662	45.2	45.2	60,115,364	33,927,500	26,187,864
2008	14.0	3.3	36	74	5.5	3.1	706	45.2	45.2	63,861,236	36,046,033	27,815,203
2009	8.6	3.5	46	73	4.0	3.1	754	45.2	45.2	49,920,860	38,302,097	11,618,762
2010	13.5	3.7	37	73	5.2	3.1	805	45.2	45.2	69,430,958	40,705,017	28,725,941
2011	14.0	4.0	36	72	5.4	3.1	859	45.2	45.2	76,632,817	43,264,776	33,368,041
2012	14.0	4.2	36	71	5.4	3.2	917	45.2	45.2	81,461,255		[illegible]

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-26

28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	4.7	2.0	72	79	0.0	0.0	0	9.9	9.9	0	0	0
1994	4.8	2.1	72	79	0.0	0.0	0	9.9	9.9	0	0	0
1995	4.9	2.1	72	78	0.0	0.0	0	9.9	9.9	0	0	0
1996	5.0	2.1	71	78	0.0	0.0	0	9.9	9.9	0	0	0
1997	5.1	2.2	71	78	0.0	0.0	0	9.9	9.9	0	0	0
1998	5.2	2.2	71	78	0.0	0.0	0	9.9	9.9	0	0	0
1999	5.3	2.2	70	78	0.0	0.0	0	9.9	9.9	0	0	0
2000	5.4	2.3	70	78	0.0	0.0	0	9.9	9.9	0	0	0
2001	5.5	2.3	70	77	0.0	0.0	0	9.9	9.9	0	0	0
2002	5.6	2.3	69	77	0.0	0.0	0	9.9	9.9	0	0	0
2003	5.7	2.4	69	77	0.0	0.0	0	9.9	9.9	0	0	0
2004	5.8	2.4	69	77	0.0	0.0	0	9.9	9.9	0	0	0
2005	5.9	2.5	68	77	0.0	0.0	0	9.9	9.9	0	0	0
2006	6.0	2.5	68	76	0.0	0.0	0	9.9	9.9	0	0	0
2007	6.0	2.5	68	76	0.0	0.0	0	9.9	9.9	0	0	0
2008	6.0	2.6	68	76	0.0	0.0	0	9.9	9.9	0	0	0
2009	6.0	2.6	67	75	0.0	0.0	0	9.9	9.9	0	0	0
2010	6.0	2.7	67	75	0.0	0.0	0	9.9	9.9	0	0	0
2011	6.0	2.7	67	75	0.0	0.0	0	9.9	9.9	0	0	0
2012	6.0	2.8	67	75	0.0	0.0	0	9.9	9.9	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-27

28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.5	2.6	64	83	0.0	0.0	0	1.5	1.5	0	0	0
1994	9.5	2.7	64	82	0.0	0.0	0	1.5	1.5	0	0	0
1995	9.5	2.8	64	82	0.0	0.0	0	1.5	1.5	0	0	0
1996	9.5	2.9	64	82	0.0	0.0	0	1.5	1.5	0	0	0
1997	9.5	3.0	64	81	0.0	0.0	0	1.5	1.5	0	0	0
1998	1.5	3.1	85	81	0.0	0.0	0	1.5	1.5	0	0	0
1999	9.5	3.3	64	81	0.0	0.0	0	1.5	1.5	0	0	0
2000	9.5	3.4	64	80	0.0	0.0	0	1.5	1.5	0	0	0
2001	9.5	3.6	64	80	0.0	0.0	0	1.5	1.5	0	0	0
2002	9.5	3.7	64	79	0.0	0.0	0	1.5	1.5	0	0	0
2003	9.5	2.5	64	82	0.0	0.0	0	1.5	1.5	0	0	0
2004	9.5	2.6	64	82	0.0	0.0	0	1.5	1.5	0	0	0
2005	9.5	2.8	64	81	0.0	0.0	0	1.5	1.5	0	0	0
2006	9.5	3.0	64	81	0.0	0.0	0	1.5	1.5	0	0	0
2007	9.5	3.1	64	80	0.0	0.0	0	1.5	1.5	0	0	0
2008	9.5	3.3	64	80	0.0	0.0	0	1.5	1.5	0	0	0
2009	9.5	3.5	64	79	0.0	0.0	0	1.5	1.5	0	0	0
2010	9.5	3.7	63	78	0.0	0.0	0	1.5	1.5	0	0	0
2011	9.5	4.0	63	78	0.0	0.0	0	1.5	1.5	0	0	0
2012	9.5	4.2	63	77	0.0	0.0	0	1.5	1.5	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-28

28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.5	2.6	45	77	0.0	0.0	0	45.2	45.2	0	0	0
1994	11.7	2.7	41	77	0.0	0.0	0	45.2	45.2	0	0	0
1995	13.9	2.8	37	77	0.0	0.0	0	45.2	45.2	0	0	0
1996	14.0	2.9	37	76	0.0	0.0	0	45.2	45.2	0	0	0
1997	6.4	3.0	51	76	0.0	0.0	0	45.2	45.2	0	0	0
1998	9.0	3.1	46	76	0.0	0.0	0	45.2	45.2	0	0	0
1999	11.7	3.3	41	75	0.0	0.0	0	45.2	45.2	0	0	0
2000	14.0	3.4	37	75	0.0	0.0	0	45.2	45.2	0	0	0
2001	7.0	3.6	49	74	0.0	0.0	0	45.2	45.2	0	0	0
2002	10.1	3.7	44	74	0.0	0.0	0	45.2	45.2	0	0	0
2003	13.4	2.5	38	77	0.0	0.0	0	45.2	45.2	0	0	0
2004	14.0	2.6	36	76	0.0	0.0	0	45.2	45.2	0	0	0
2005	7.7	2.8	48	76	0.0	0.0	0	45.2	45.2	0	0	0
2006	11.5	3.0	41	75	0.0	0.0	0	45.2	45.2	0	0	0
2007	14.0	3.1	36	75	0.0	0.0	0	45.2	45.2	0	0	0
2008	14.0	3.3	36	74	0.0	0.0	0	45.2	45.2	0	0	0
2009	8.6	3.5	46	73	0.0	0.0	0	45.2	45.2	0	0	0
2010	13.5	3.7	37	73	0.0	0.0	0	45.2	45.2	0	0	0
2011	14.0	4.0	36	72	0.0	0.0	0	45.2	45.2	0	0	0
2012	14.0	4.2	36	71	0.0	0.0	0	45.2	45.2	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-29 28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	4.7	2.0	72	79	2.9	2.7	56	9.9	9.9	599,941	553,143	23,399
1994	4.8	2.1	72	79	2.9	2.7	60	9.9	9.9	635,283	585,692	24,796
1995	4.9	2.1	72	78	2.9	2.7	63	9.9	9.9	672,801	620,243	26,279
1996	5.0	2.1	71	78	2.9	2.7	67	9.9	9.9	712,636	656,926	27,855
1997	5.1	2.2	71	78	3.1	2.7	72	9.9	9.9	788,445	695,878	46,283
1998	5.2	2.2	71	78	3.0	2.7	76	9.9	9.9	835,378	737,247	49,066
1999	5.3	2.2	70	78	3.0	2.7	81	9.9	9.9	885,235	781,188	52,024
2000	5.4	2.3	70	78	3.0	2.7	86	9.9	9.9	938,206	827,870	55,168
2001	5.5	2.3	70	77	3.0	2.7	91	9.9	9.9	999,262	878,245	60,508
2002	5.6	2.3	69	77	3.0	2.7	97	9.9	9.9	1,060,193	931,834	64,179
2003	5.7	2.4	69	77	3.0	2.6	104	9.9	9.9	1,125,024	988,854	68,085
2004	5.8	2.4	69	77	3.0	2.6	110	9.9	9.9	1,194,017	1,049,535	72,241
2005	5.9	2.5	68	77	3.0	2.6	118	9.9	9.9	1,267,455	1,114,125	76,665
2006	6.0	2.5	68	76	3.1	2.6	125	9.9	9.9	1,406,564	1,182,891	111,836
2007	6.0	2.5	68	76	3.1	2.6	134	9.9	9.9	1,493,576	1,256,115	118,730
2008	6.0	2.6	68	76	3.1	2.6	143	9.9	9.9	1,586,250	1,334,105	126,073
2009	6.0	2.6	67	75	3.1	2.6	152	9.9	9.9	1,684,976	1,417,185	133,895
2010	6.0	2.7	67	75	3.0	2.6	162	9.9	9.9	1,790,169	1,505,708	142,231
2011	6.0	2.7	67	75	3.0	2.6	173	9.9	9.9	1,902,278	1,600,049	151,115
2012	6.0	2.8	67	75	3.0	2.5	185	9.9	9.9	2,021,783	1,700,612	160,586

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-30

28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.5	2.6	64	83	3.8	2.7	56	1.5	1.5	115,795	84,255	15,770
1994	9.5	2.7	64	82	3.7	2.7	60	1.5	1.5	122,597	89,219	16,689
1995	9.5	2.8	64	82	3.7	2.7	63	1.5	1.5	129,818	94,489	17,665
1996	9.5	2.9	64	82	3.7	2.7	67	1.5	1.5	137,485	100,084	18,701
1997	9.5	3.0	64	81	3.7	2.8	72	1.5	1.5	145,627	110,374	17,626
1998	1.5	3.1	85	81	2.7	2.8	76	1.5	1.5	112,335	116,947	(2,306)
1999	9.5	3.3	64	81	3.7	2.8	81	1.5	1.5	163,460	123,929	19,765
2000	9.5	3.4	64	80	3.7	2.8	86	1.5	1.5	173,219	131,347	20,936
2001	9.5	3.6	64	80	3.7	2.8	91	1.5	1.5	183,734	138,534	22,600
2002	9.5	3.7	64	79	3.7	2.8	97	1.5	1.5	194,921	146,987	23,967
2003	9.5	2.5	64	82	3.6	2.7	104	1.5	1.5	206,824	150,704	28,060
2004	9.5	2.6	64	82	3.6	2.6	110	1.5	1.5	219,491	159,955	29,768
2005	9.5	2.8	64	81	3.6	2.6	118	1.5	1.5	232,975	169,803	31,586
2006	9.5	3.0	64	81	3.6	2.6	125	1.5	1.5	247,331	180,286	33,522
2007	9.5	3.1	64	80	3.6	2.7	134	1.5	1.5	262,618	199,326	31,646
2008	9.5	3.3	64	80	3.6	2.7	143	1.5	1.5	278,901	210,442	34,230
2009	9.5	3.5	64	79	3.6	2.7	152	1.5	1.5	296,248	223,547	36,351
2010	9.5	3.7	63	78	3.5	2.7	162	1.5	1.5	314,733	237,510	38,611
2011	9.5	4.0	63	78	3.5	2.7	173	1.5	1.5	334,434	252,391	41,022
2012	9.5	4.2	63	77	3.5	2.8	185	1.5	1.5	355,437	279,581	37,928

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-31 28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.5	2.6	45	77	3.9	2.7	56	45.2	45.2	3,659,485	2,525,461	567,012
1994	11.7	2.7	41	77	4.3	2.7	60	45.2	45.2	4,261,465	2,674,067	793,699
1995	13.9	2.8	37	77	5.0	2.7	63	45.2	45.2	5,220,777	2,831,816	1,194,480
1996	14.0	2.9	37	76	5.2	2.7	67	45.2	45.2	5,747,534	2,999,298	1,374,118
1997	6.4	3.0	51	76	3.4	2.8	72	45.2	45.2	3,980,933	3,307,285	336,824
1998	9.0	3.1	46	76	3.7	2.8	76	45.2	45.2	4,648,291	3,504,024	572,134
1999	11.7	3.3	41	75	4.3	2.8	81	45.2	45.2	5,673,830	3,713,006	980,412
2000	14.0	3.4	37	75	5.1	2.8	86	45.2	45.2	7,226,874	3,935,030	1,645,922
2001	7.0	3.6	49	74	3.3	2.8	91	45.2	45.2	5,018,698	4,174,483	422,107
2002	10.1	3.7	44	74	4.0	2.8	97	45.2	45.2	6,453,373	4,429,214	1,012,080
2003	13.4	2.5	38	77	4.9	2.6	104	45.2	45.2	8,290,437	4,514,767	1,887,835
2004	14.0	2.6	36	76	5.0	2.6	110	45.2	45.2	9,146,847	4,791,816	2,177,516
2005	7.7	2.8	48	76	3.5	2.6	118	45.2	45.2	6,713,606	5,086,714	813,446
2006	11.5	3.0	41	75	4.1	2.6	125	45.2	45.2	8,575,653	5,400,673	1,587,490
2007	14.0	3.1	36	75	5.0	2.7	134	45.2	45.2	10,936,274	5,970,623	2,482,826
2008	14.0	3.3	36	74	4.9	2.7	143	45.2	45.2	11,611,938	6,341,321	2,635,308
2009	8.6	3.5	46	73	3.6	2.7	152	45.2	45.2	8,917,576	6,736,216	1,090,680
2010	13.5	3.7	37	73	4.7	2.7	162	45.2	45.2	12,597,207	7,156,974	2,720,116
2011	14.0	4.0	36	72	4.9	2.7	173	45.2	45.2	13,916,650	7,605,383	3,155,633
2012	14.0	4.2	36	71	4.8	2.8	185	45.2	45.2	14,788,469	8,424,718	3,181,876

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-32

28-Sep-90

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	4.7	2.0	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
1994	4.8	2.1	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
1995	4.9	2.1	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
1996	5.0	2.1	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
1997	5.1	2.2	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
1998	5.2	2.2	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
1999	5.3	2.2	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
2000	5.4	2.3	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
2001	5.5	2.3	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
2002	5.6	2.3	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
2003	5.7	2.4	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
2004	5.8	2.4	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
2005	5.9	2.5	28,190	25,180	0	0	9.9	9.9	279,081	249,282	29,799
2006	6.0	2.5	39,680	25,180	0	0	9.9	9.9	392,832	249,282	143,550
2007	6.0	2.5	39,680	25,180	0	0	9.9	9.9	392,832	249,282	143,550
2008	6.0	2.6	39,680	25,180	0	0	9.9	9.9	392,832	249,282	143,550
2009	6.0	2.6	39,680	25,180	0	0	9.9	9.9	392,832	249,282	143,550
2010	6.0	2.7	39,680	25,180	0	0	9.9	9.9	392,832	249,282	143,550
2011	6.0	2.7	39,680	25,180	0	0	9.9	9.9	392,832	249,282	143,550
2012	6.0	2.8	39,680	25,180	0	0	9.9	9.9	392,832	249,282	143,550

TABLE C-33

15-Oct-90

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.5	2.6	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
1994	9.5	2.7	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
1995	9.5	2.8	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
1996	9.5	2.9	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
1997	9.5	3.0	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
1998	1.5	3.1	24,140	24,140	0	0	1.5	1.5	36,210	36,210	0
1999	9.5	3.3	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
2000	9.5	3.4	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
2001	9.5	3.6	32,740	24,140	116,500	116,500	1.5	1.5	223,860	210,960	12,900
2002	9.5	3.7	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
2003	9.5	2.5	32,740	24,140	0	716,958	1.5	1.5	49,110	1,111,647	(1,062,537)
2004	9.5	2.6	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
2005	9.5	2.8	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
2006	9.5	3.0	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
2007	9.5	3.1	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
2008	9.5	3.3	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
2009	9.5	3.5	32,740	24,140	116,500	116,500	1.5	1.5	223,860	210,960	12,900
2010	9.5	3.7	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
2011	9.5	4.0	32,740	24,140	0	0	1.5	1.5	49,110	36,210	12,900
2012	9.5	4.2	32,740	24,890	0	0	1.5	1.5	49,110	37,335	11,775

TABLE C-34

15-Oct-90

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.5	2.6	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
1994	11.7	2.7	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
1995	13.9	2.8	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
1996	14.0	2.9	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
1997	6.4	3.0	45,910	24,140	130,920	0	45.2	45.2	7,992,716	1,091,128	6,901,588
1998	9.0	3.1	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
1999	11.7	3.3	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
2000	14.0	3.4	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
2001	7.0	3.6	45,910	24,140	130,920	116,500	45.2	45.2	7,992,716	6,356,928	1,635,788
2002	10.1	3.7	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
2003	13.4	2.5	45,910	24,140	0	716,958	45.2	45.2	2,075,132	33,497,630	(31,422,498)
2004	14.0	2.6	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
2005	7.7	2.8	45,910	24,140	130,920	0	45.2	45.2	7,992,716	1,091,128	6,901,588
2006	11.5	3.0	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
2007	14.0	3.1	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
2008	14.0	3.3	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
2009	8.6	3.5	45,910	24,140	130,920	116,500	45.2	45.2	7,992,716	6,356,928	1,635,788
2010	13.5	3.7	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
2011	14.0	4.0	45,910	24,140	0	0	45.2	45.2	2,075,132	1,091,128	984,004
2012	14.0	4.2	45,910	24,890	0	0	45.2	45.2	2,075,132	1,125,028	950,104

TABLE C-35 16-Oct-90

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: KBNKALAN-BSAY SECTION: CAUAYAN-SIPLY ALTERNATIVE: PCC\DBST

YEAR	PROJECT COSTS	VOC SAVINGS NORMAL BENEFITS (1)	VOC SAVINGS DIVERTED BENEFITS (1)	VOC SAVINGS GENERATED BENEFITS (1,2)	MAINTENANCE BENEFITS	DEVELOPMENT BENEFITS (2)	TOTAL BENEFITS
1991	39,021,200	0	0	0	0	0	(39,021,200)
1992	58,531,800	0	0	0	0	0	(58,531,800)
1993	0	6,426,077	0	606,181	1,026,703	0	8,058,961
1994	0	8,820,405	0	835,184	1,026,703	0	10,682,291
1995	0	12,986,235	0	1,238,424	1,026,703	0	15,251,361
1996	0	14,918,205	0	1,420,674	1,026,703	0	17,365,582
1997	0	4,118,600	0	400,734	6,944,287	0	11,463,621
1998	0	6,569,433	0	618,894	1,013,803	0	8,202,129
1999	0	11,131,303	0	1,052,201	1,026,703	0	13,210,207
2000	0	18,111,548	0	1,722,025	1,026,703	0	20,860,276
2001	0	5,249,479	0	505,216	1,678,487	0	7,433,182
2002	0	11,674,899	0	1,100,226	1,026,703	0	13,801,828
2003	0	20,989,175	0	1,983,980	1,026,703	0	23,999,858
2004	0	24,138,134	0	2,279,525	1,026,703	0	27,444,362
2005	0	9,911,615	0	921,697	6,944,287	0	17,777,599
2006	0	18,539,287	0	1,732,849	1,140,454	0	21,412,590
2007	0	27,847,413	0	2,633,202	1,140,454	0	31,621,069
2008	0	29,588,868	0	2,795,611	1,140,454	0	33,524,933
2009	0	13,503,354	0	1,260,926	1,792,238	0	16,556,518
2010	0	30,728,715	0	2,900,958	1,140,454	0	34,770,128
2011	0	35,496,750	0	3,347,769	1,140,454	0	39,984,973
2012	0	35,717,130	0	3,380,389	1,105,429	0	40,202,948

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)=	13.9%	NB/I(15%)=	0.918 (3)
NPV(15%)=	(5,738,206)	NB/I(12%)=	1.166
		NB/I(18%)=	0.742

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)=	13.9%	NB/I(15%)=	0.918
NPV(15%)=	(5,738,206)	NB/I(12%)=	1.166
		NB/I(18%)=	0.742

(1) Including passenger time savings.

(2) To avoid double-counting benefits either development or generated benefits are considered.

(3) Net benefit-over-investment ratio, special case of the benefit-cost ratio which does not require to define whether a specific cash flow is a cost or a benefit, since their net is considered.

TABLE C-36

28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: SPALAY-HNBAAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	6.6	2.6	67	77	2.3	2.0	435	2	2	745,497	638,659	106,838
1994	7.0	2.7	66	77	2.3	2.0	461	2	2	789,306	676,187	113,119
1995	7.4	2.8	65	77	2.4	2.0	489	2	2	870,587	715,983	154,604
1996	7.8	2.9	64	76	2.4	2.0	518	2	2	921,910	758,188	163,723
1997	8.2	3.0	63	76	2.5	2.0	549	2	2	1,020,077	802,951	217,126
1998	8.7	3.1	62	76	2.5	2.1	582	2	2	1,080,402	879,394	201,008
1999	1.5	3.2	79	75	2.0	2.1	617	2	2	900,807	931,509	(30,703)
2000	2.0	3.4	78	75	2.0	2.1	654	2	2	954,250	986,803	(32,554)
2001	2.6	3.5	76	74	2.0	2.1	695	2	2	1,012,295	1,046,830	(34,535)
2002	3.2	3.7	75	74	2.1	2.1	739	2	2	1,110,618	1,110,618	0
2003	3.9	2.5	73	76	2.1	2.0	786	2	2	1,178,411	1,139,530	38,881
2004	4.7	2.6	71	76	2.1	2.0	835	2	2	1,294,731	1,209,207	85,524
2005	5.5	2.8	69	75	2.2	2.0	888	2	2	1,442,008	1,283,277	158,731
2006	6.4	2.9	67	75	2.3	2.0	944	2	2	1,589,753	1,362,026	227,727
2007	7.3	3.1	64	74	2.4	2.0	1004	2	2	1,757,645	1,495,110	262,535
2008	8.4	3.3	62	74	2.5	2.0	1068	2	2	1,949,152	1,587,202	361,950
2009	9.5	3.5	59	73	2.7	2.0	1136	2	2	2,237,558	1,685,151	552,407
2010	9.5	3.7	58	72	2.7	2.0	1208	2	2	2,375,388	1,789,343	586,045
2011	9.5	3.9	58	72	2.7	2.0	1286	2	2	2,522,017	1,900,190	621,827
2012	9.5	4.1	58	71	2.7	2.1	1368	2	2	2,678,031	2,089,621	588,410

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-37

28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: SPALAY-HNBAAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.3	2.6	45	77	2.9	2.0	435	19	19	8,655,922	6,067,264	2,588,658
1994	11.2	2.7	42	77	3.1	2.0	461	19	19	9,959,314	6,423,779	3,535,535
1995	13.2	2.8	38	77	3.6	2.0	489	19	19	12,289,454	6,801,838	5,487,616
1996	14.0	2.9	37	76	3.7	2.0	518	19	19	13,470,585	7,202,782	6,267,804
1997	6.1	3.0	51	76	2.5	2.0	549	19	19	9,359,407	7,628,037	1,731,369
1998	8.4	3.1	47	76	2.7	2.1	582	19	19	11,060,752	8,354,244	2,706,508
1999	10.7	3.2	43	75	3.0	2.1	617	19	19	12,718,271	8,849,337	3,868,933
2000	13.2	3.4	38	75	3.6	2.1	654	19	19	16,350,049	9,374,633	6,975,417
2001	6.6	3.5	50	74	2.5	2.1	695	19	19	12,140,913	9,944,886	2,196,027
2002	9.3	3.7	45	74	2.8	2.1	739	19	19	14,533,580	10,550,872	3,982,709
2003	12.1	2.5	40	76	3.5	2.0	786	19	19	18,847,079	10,825,532	8,021,547
2004	14.0	2.6	36	76	3.7	2.0	835	19	19	21,429,402	11,487,468	9,941,934
2005	7.1	2.8	49	75	2.6	2.0	888	19	19	16,064,811	12,191,131	3,873,681
2006	10.5	2.9	42	75	2.9	2.0	944	19	19	19,209,394	12,939,243	6,270,151
2007	14.0	3.1	36	74	3.6	2.0	1004	19	19	24,730,221	14,203,543	10,526,678
2008	14.0	3.3	36	74	3.7	2.0	1068	19	19	27,177,029	15,078,422	12,098,606
2009	7.9	3.5	47	73	2.6	2.0	1136	19	19	20,392,093	16,008,937	4,383,156
2010	12.0	3.7	39	72	3.4	2.0	1208	19	19	28,579,808	16,998,757	11,581,051
2011	14.0	3.9	36	72	3.6	2.0	1286	19	19	32,521,259	18,051,804	14,469,455
2012	14.0	4.1	35	71	3.6	2.1	1368	19	19	34,535,745	19,851,402	14,684,343

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-38

28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: SPALAY-HNBAAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	6.6	2.6	67	77	0.0	0.0	0	2	2	0	0	0
1994	7.0	2.7	66	77	0.0	0.0	0	2	2	0	0	0
1995	7.4	2.8	65	77	0.0	0.0	0	2	2	0	0	0
1996	7.8	2.9	64	76	0.0	0.0	0	2	2	0	0	0
1997	8.2	3.0	63	76	0.0	0.0	0	2	2	0	0	0
1998	8.7	3.1	62	76	0.0	0.0	0	2	2	0	0	0
1999	1.5	3.2	79	75	0.0	0.0	0	2	2	0	0	0
2000	2.0	3.4	78	75	0.0	0.0	0	2	2	0	0	0
2001	2.6	3.5	76	74	0.0	0.0	0	2	2	0	0	0
2002	3.2	3.7	75	74	0.0	0.0	0	2	2	0	0	0
2003	3.9	2.5	73	76	0.0	0.0	0	2	2	0	0	0
2004	4.7	2.6	71	76	0.0	0.0	0	2	2	0	0	0
2005	5.5	2.8	69	75	0.0	0.0	0	2	2	0	0	0
2006	6.4	2.9	67	75	0.0	0.0	0	2	2	0	0	0
2007	7.3	3.1	64	74	0.0	0.0	0	2	2	0	0	0
2008	8.4	3.3	62	74	0.0	0.0	0	2	2	0	0	0
2009	9.5	3.5	59	73	0.0	0.0	0	2	2	0	0	0
2010	9.5	3.7	58	72	0.0	0.0	0	2	2	0	0	0
2011	9.5	3.9	58	72	0.0	0.0	0	2	2	0	0	0
2012	9.5	4.1	58	71	0.0	0.0	0	2	2	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-39

28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: SPALAY-HNBAAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.3	2.6	45	77	0.0	0.0	0	19	19	0	0	0
1994	11.2	2.7	42	77	0.0	0.0	0	19	19	0	0	0
1995	13.2	2.8	38	77	0.0	0.0	0	19	19	0	0	0
1996	14.0	2.9	37	76	0.0	0.0	0	19	19	0	0	0
1997	6.1	3.0	51	76	0.0	0.0	0	19	19	0	0	0
1998	8.4	3.1	47	76	0.0	0.0	0	19	19	0	0	0
1999	10.7	3.2	43	75	0.0	0.0	0	19	19	0	0	0
2000	13.2	3.4	38	75	0.0	0.0	0	19	19	0	0	0
2001	6.6	3.5	50	74	0.0	0.0	0	19	19	0	0	0
2002	9.3	3.7	45	74	0.0	0.0	0	19	19	0	0	0
2003	12.1	2.5	40	76	0.0	0.0	0	19	19	0	0	0
2004	14.0	2.6	36	76	0.0	0.0	0	19	19	0	0	0
2005	7.1	2.8	49	75	0.0	0.0	0	19	19	0	0	0
2006	10.5	2.9	42	75	0.0	0.0	0	19	19	0	0	0
2007	14.0	3.1	36	74	0.0	0.0	0	19	19	0	0	0
2008	14.0	3.3	36	74	0.0	0.0	0	19	19	0	0	0
2009	7.9	3.5	47	73	0.0	0.0	0	19	19	0	0	0
2010	12.0	3.7	39	72	0.0	0.0	0	19	19	0	0	0
2011	14.0	3.9	36	72	0.0	0.0	0	19	19	0	0	0
2012	14.0	4.1	35	71	0.0	0.0	0	19	19	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-40 28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: SPALAY-HNBAAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	6.6	2.6	67	77	2.0	1.7	101	2	2	149,495	127,569	10,963
1994	7.0	2.7	66	77	2.0	1.7	107	2	2	158,101	134,920	11,591
1995	7.4	2.8	65	77	2.1	1.7	113	2	2	174,408	142,710	15,849
1996	7.8	2.9	64	76	2.1	1.7	120	2	2	184,485	150,966	16,759
1997	8.2	3.0	63	76	2.2	1.7	127	2	2	204,302	159,718	22,292
1998	8.7	3.1	62	76	2.2	1.8	134	2	2	216,150	174,560	20,795
1999	1.5	3.2	79	75	1.7	1.8	143	2	2	178,834	184,724	(2,945)
2000	2.0	3.4	78	75	1.7	1.8	151	2	2	189,265	195,502	(3,118)
2001	2.6	3.5	76	74	1.7	1.8	161	2	2	200,651	207,262	(3,305)
2002	3.2	3.7	75	74	1.8	1.8	171	2	2	219,758	219,758	0
2003	3.9	2.5	73	76	1.8	1.7	181	2	2	233,037	225,606	3,716
2004	4.7	2.6	71	76	1.8	1.7	193	2	2	255,743	239,270	8,236
2005	5.5	2.8	69	75	1.9	1.7	205	2	2	286,025	253,795	16,115
2006	6.4	2.9	67	75	2.0	1.7	218	2	2	315,301	269,237	23,032
2007	7.3	3.1	64	74	2.1	1.7	231	2	2	348,809	295,065	26,872
2008	8.4	3.3	62	74	2.2	1.7	246	2	2	387,316	313,104	37,106
2009	9.5	3.5	59	73	2.4	1.7	262	2	2	449,757	332,292	58,732
2010	9.5	3.7	58	72	2.3	1.7	278	2	2	477,223	352,706	62,258
2011	9.5	3.9	58	72	2.3	1.7	296	2	2	506,445	374,428	66,008
2012	9.5	4.1	58	71	2.3	1.8	315	2	2	537,540	411,358	63,091

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-41 28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: SPALAY-HNBAAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.3	2.6	45	77	2.5	1.7	101	19	19	1,765,709	1,211,903	276,903
1994	11.2	2.7	42	77	2.8	1.7	107	19	19	2,039,477	1,281,738	378,869
1995	13.2	2.8	38	77	3.2	1.7	113	19	19	2,539,902	1,355,744	592,079
1996	14.0	2.9	37	76	3.4	1.7	120	19	19	2,784,088	1,434,180	674,954
1997	6.1	3.0	51	76	2.2	1.7	127	19	19	1,894,516	1,517,323	188,597
1998	8.4	3.1	47	76	2.4	1.8	134	19	19	2,238,912	1,658,322	290,295
1999	10.7	3.2	43	75	2.6	1.8	143	19	19	2,584,076	1,754,877	414,600
2000	13.2	3.4	38	75	3.2	1.8	151	19	19	3,360,711	1,857,268	751,722
2001	6.6	3.5	50	74	2.2	1.8	161	19	19	2,452,693	1,968,990	241,852
2002	9.3	3.7	45	74	2.5	1.8	171	19	19	2,938,268	2,087,698	425,285
2003	12.1	2.5	40	76	3.1	1.7	181	19	19	3,860,102	2,143,252	858,425
2004	14.0	2.6	36	76	3.3	1.7	193	19	19	4,397,145	2,273,061	1,062,042
2005	7.1	2.8	49	75	2.3	1.7	205	19	19	3,230,744	2,411,049	409,847
2006	10.5	2.9	42	75	2.6	1.7	218	19	19	3,883,838	2,557,755	663,042
2007	14.0	3.1	36	74	3.2	1.7	231	19	19	5,059,775	2,803,116	1,128,329
2008	14.0	3.3	36	74	3.3	1.7	246	19	19	5,563,150	2,974,485	1,294,332
2009	7.9	3.5	47	73	2.3	1.7	262	19	19	4,092,942	3,156,773	468,085
2010	12.0	3.7	39	72	3.0	1.7	278	19	19	5,830,307	3,350,707	1,239,800
2011	14.0	3.9	36	72	3.2	1.7	296	19	19	6,647,209	3,557,066	1,545,072
2012	14.0	4.1	35	71	3.2	1.8	315	19	19	7,055,890	3,907,900	1,573,995

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-42 15-Oct-90

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: KBNKALAN-BSAY SECTION: SPALAY-HNBAAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	6.6	2.6	27,440	24,140	0	0	2	2	54,880	48,280	6,600
1994	7.0	2.7	27,440	24,140	0	0	2	2	54,880	48,280	6,600
1995	7.4	2.8	27,440	24,140	0	0	2	2	54,880	48,280	6,600
1996	7.8	2.9	27,440	24,140	0	0	2	2	54,880	48,280	6,600
1997	8.2	3.0	32,740	24,140	0	0	2	2	65,480	48,280	17,200
1998	8.7	3.1	32,740	24,140	0	0	2	2	65,480	48,280	17,200
1999	1.5	3.2	24,140	24,140	0	0	2	2	48,280	48,280	0
2000	2.0	3.4	24,140	24,140	0	0	2	2	48,280	48,280	0
2001	2.6	3.5	24,140	24,140	116,500	116,500	2	2	281,280	281,280	0
2002	3.2	3.7	24,140	24,140	0	0	2	2	48,280	48,280	0
2003	3.9	2.5	24,140	24,140	0	716,958	2	2	48,280	1,482,196	(1,433,916)
2004	4.7	2.6	24,890	24,140	0	0	2	2	49,780	48,280	1,500
2005	5.5	2.8	24,890	24,140	0	0	2	2	49,780	48,280	1,500
2006	6.4	2.9	27,440	24,140	0	0	2	2	54,880	48,280	6,600
2007	7.3	3.1	27,440	24,140	0	0	2	2	54,880	48,280	6,600
2008	8.4	3.3	32,740	24,140	0	0	2	2	65,480	48,280	17,200
2009	9.5	3.5	32,740	24,140	116,500	116,500	2	2	298,480	281,280	17,200
2010	9.5	3.7	32,740	24,140	0	0	2	2	65,480	48,280	17,200
2011	9.5	3.9	32,740	24,140	0	0	2	2	65,480	48,280	17,200
2012	9.5	4.1	32,740	24,890	0	0	2	2	65,480	49,780	15,700

TABLE C-43

15-Oct-90

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: KBNKALAN-BSAY SECTION: SPALAY-HNBAAN ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.3	2.6	45,910	24,140	0	0	19	19	872,290	458,660	413,630
1994	11.2	2.7	45,910	24,140	0	0	19	19	872,290	458,660	413,630
1995	13.2	2.8	45,910	24,140	0	0	19	19	872,290	458,660	413,630
1996	14.0	2.9	45,910	24,140	0	0	19	19	872,290	458,660	413,630
1997	6.1	3.0	45,910	24,140	130,920	0	19	19	3,359,770	458,660	2,901,110
1998	8.4	3.1	45,910	24,140	0	0	19	19	872,290	458,660	413,630
1999	10.7	3.2	45,910	24,140	0	0	19	19	872,290	458,660	413,630
2000	13.2	3.4	45,910	24,140	0	0	19	19	872,290	458,660	413,630
2001	6.6	3.5	45,910	24,140	130,920	116,500	19	19	3,359,770	2,672,160	687,610
2002	9.3	3.7	45,910	24,140	0	0	19	19	872,290	458,660	413,630
2003	12.1	2.5	45,910	24,140	0	716,958	19	19	872,290	14,080,862	(13,208,572)
2004	14.0	2.6	45,910	24,140	0	0	19	19	872,290	458,660	413,630
2005	7.1	2.8	45,910	24,140	130,920	0	19	19	3,359,770	458,660	2,901,110
2006	10.5	2.9	45,910	24,140	0	0	19	19	872,290	458,660	413,630
2007	14.0	3.1	45,910	24,140	0	0	19	19	872,290	458,660	413,630
2008	14.0	3.3	45,910	24,140	0	0	19	19	872,290	458,660	413,630
2009	7.9	3.5	45,910	24,140	130,920	116,500	19	19	3,359,770	2,672,160	687,610
2010	12.0	3.7	45,910	24,140	0	0	19	19	872,290	458,660	413,630
2011	14.0	3.9	45,910	24,140	0	0	19	19	872,290	458,660	413,630
2012	14.0	4.1	45,910	24,890	0	0	19	19	872,290	472,910	399,380

TABLE C-44 16-Oct-90

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: KBNKALAN-BSAY SECTION: SPALAY-HNBAAN ALTERNATIVE: DBST

YEAR	PROJECT COSTS	VOC SAVINGS NORMAL BENEFITS (1)	VOC SAVINGS DIVERTED BENEFITS (1)	VOC SAVINGS GENERATED BENEFITS (1,2)	MAINTENANCE BENEFITS	DEVELOPMENT BENEFITS (2)	TOTAL BENEFITS
1991	21,844,400	0	0	0	0	0	(21,844,400)
1992	32,766,600	0	0	0	0	0	(32,766,600)
1993	0	2,695,496	0	287,866	420,230	0	3,403,592
1994	0	3,648,653	0	390,460	420,230	0	4,459,343
1995	0	5,642,220	0	607,928	420,230	0	6,670,378
1996	0	6,431,526	0	691,713	420,230	0	7,543,470
1997	0	1,948,495	0	210,889	2,918,310	0	5,077,693
1998	0	2,907,516	0	311,090	430,830	0	3,649,436
1999	0	3,838,231	0	411,654	413,630	0	4,663,515
2000	0	6,942,863	0	748,603	413,630	0	8,105,096
2001	0	2,161,491	0	238,546	687,610	0	3,087,648
2002	0	3,982,709	0	425,285	413,630	0	4,821,623
2003	0	8,060,428	0	862,140	(1,020,286)	0	7,902,282
2004	0	10,027,458	0	1,070,278	415,130	0	11,512,866
2005	0	4,032,412	0	425,962	2,902,610	0	7,360,984
2006	0	6,497,878	0	686,073	420,230	0	7,604,181
2007	0	10,789,213	0	1,155,202	420,230	0	12,364,645
2008	0	12,460,556	0	1,331,438	430,830	0	14,222,824
2009	0	4,935,563	0	526,817	704,810	0	6,167,190
2010	0	12,167,096	0	1,302,059	430,830	0	13,899,985
2011	0	15,091,282	0	1,611,080	430,830	0	17,133,192
2012	0	15,272,752	0	1,637,086	415,080	0	17,324,918

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)= 10.1% NB/I(15%)= 0.669 (3)

NPV(15%)= (12,902,981) NB/I(12%)= 0.847

NB/I(18%)= 0.543

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)= 10.1% NB/I(15%)= 0.669

NPV(15%)= (12,902,981) NB/I(12%)= 0.847

NB/I(18%)= 0.543

(1) Including passenger time savings.

(2) To avoid double-counting benefits either development or generated benefits are considered.

(3) Net benefit-over-investment ratio, special case of the benefit-cost ratio which does not require to define whether a specific cash flow is a cost or a benefit, since their net is considered.

190

TABLE C-45 28-Sep-90

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: HNBAAN-BASAY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.6	2.6	45	77	2.7	1.9	458	32.2	32.2	14,452,711	10,105,181	4,347,530
1994	11.8	2.7	41	77	2.9	1.9	486	32.2	32.2	16,655,014	10,714,108	5,940,906
1995	14.0	2.8	37	76	3.5	1.9	516	32.2	32.2	21,282,021	11,360,802	9,921,219
1996	14.0	2.9	37	76	3.5	1.9	548	32.2	32.2	22,564,642	12,047,682	10,516,960
1997	6.5	3.0	50	76	2.3	1.9	581	32.2	32.2	15,634,986	12,777,325	2,857,661
1998	9.2	3.1	45	75	2.7	1.9	617	32.2	32.2	19,375,994	14,030,426	5,345,568
1999	11.9	3.2	40	75	2.9	1.9	655	32.2	32.2	22,341,439	14,883,611	7,457,828
2000	14.0	3.4	36	74	3.5	1.9	696	32.2	32.2	28,548,079	15,790,259	12,757,821
2001	7.1	3.5	49	74	2.5	1.9	740	32.2	32.2	21,413,672	16,775,129	4,638,544
2002	10.4	3.6	43	73	2.8	1.9	788	32.2	32.2	25,667,921	17,823,414	7,844,507
2003	13.8	2.5	36	76	3.4	1.9	839	32.2	32.2	33,062,560	18,292,484	14,770,076
2004	14.0	2.6	36	75	3.5	1.9	893	32.2	32.2	36,383,301	19,439,886	16,943,415
2005	7.9	2.8	47	75	2.4	1.8	951	32.2	32.2	27,302,843	20,661,666	6,641,177
2006	12.0	2.9	39	74	3.1	1.8	1012	32.2	32.2	37,002,196	21,962,833	15,039,363
2007	14.0	3.1	36	74	3.4	1.9	1078	32.2	32.2	43,702,072	24,175,164	19,526,908
2008	14.0	3.3	35	73	3.4	1.9	1149	32.2	32.2	46,468,150	25,704,035	20,764,115
2009	8.9	3.4	44	72	2.5	1.9	1224	32.2	32.2	36,229,524	27,332,992	8,896,532
2010	14.0	3.6	35	71	3.4	1.9	1304	32.2	32.2	52,559,054	29,068,850	23,490,204
2011	14.0	3.8	35	71	3.4	1.9	1389	32.2	32.2	55,909,831	30,918,912	24,990,919
2012	14.0	4.1	35	70	3.4	2.0	1481	32.2	32.2	59,483,032	34,508,897	24,974,135

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-46 28-Sep-90

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: HNBAAN-BASAY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.6	2.6	45	77	0.0	0.0	0	32.2	32.2	0	0	0
1994	11.8	2.7	41	77	0.0	0.0	0	32.2	32.2	0	0	0
1995	14.0	2.8	37	76	0.0	0.0	0	32.2	32.2	0	0	0
1996	14.0	2.9	37	76	0.0	0.0	0	32.2	32.2	0	0	0
1997	6.5	3.0	50	76	0.0	0.0	0	32.2	32.2	0	0	0
1998	9.2	3.1	45	75	0.0	0.0	0	32.2	32.2	0	0	0
1999	11.9	3.2	40	75	0.0	0.0	0	32.2	32.2	0	0	0
2000	14.0	3.4	36	74	0.0	0.0	0	32.2	32.2	0	0	0
2001	7.1	3.5	49	74	0.0	0.0	0	32.2	32.2	0	0	0
2002	10.4	3.6	43	73	0.0	0.0	0	32.2	32.2	0	0	0
2003	13.8	2.5	36	76	0.0	0.0	0	32.2	32.2	0	0	0
2004	14.0	2.6	36	75	0.0	0.0	0	32.2	32.2	0	0	0
2005	7.9	2.8	47	75	0.0	0.0	0	32.2	32.2	0	0	0
2006	12.0	2.9	39	74	0.0	0.0	0	32.2	32.2	0	0	0
2007	14.0	3.1	36	74	0.0	0.0	0	32.2	32.2	0	0	0
2008	14.0	3.3	35	73	0.0	0.0	0	32.2	32.2	0	0	0
2009	8.9	3.4	44	72	0.0	0.0	0	32.2	32.2	0	0	0
2010	14.0	3.6	35	71	0.0	0.0	0	32.2	32.2	0	0	0
2011	14.0	3.8	35	71	0.0	0.0	0	32.2	32.2	0	0	0
2012	14.0	4.1	35	70	0.0	0.0	0	32.2	32.2	0	0	0

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-47 28-Sep-90

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: KBNKALAN-BSAY SECTION: HNBAAN-BASAY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		SPEED (km/h)(2)		TRFFC MIX AVG UNIT USR CST		AADT	LENGTH (km)		TOTAL USER COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.6	2.6	45	77	2.3	1.6	252	32.2	32.2	6,878,857	4,768,793	1,055,032
1994	11.8	2.7	41	77	2.5	1.6	268	32.2	32.2	7,920,104	5,051,739	1,434,183
1995	14.0	2.8	37	76	3.1	1.6	284	32.2	32.2	10,239,526	5,352,093	2,443,716
1996	14.0	2.9	37	76	3.1	1.6	301	32.2	32.2	10,847,032	5,670,970	2,588,031
1997	6.5	3.0	50	76	2.0	1.6	320	32.2	32.2	7,399,473	6,009,559	694,957
1998	9.2	3.1	45	75	2.3	1.6	339	32.2	32.2	9,181,949	6,561,406	1,310,272
1999	11.9	3.2	40	75	2.5	1.6	360	32.2	32.2	10,578,058	6,954,982	1,811,538
2000	14.0	3.4	36	74	3.0	1.6	382	32.2	32.2	13,678,026	7,373,081	3,152,472
2001	7.1	3.5	49	74	2.1	1.6	407	32.2	32.2	10,151,321	7,832,004	1,159,659
2002	10.4	3.6	43	73	2.4	1.6	433	32.2	32.2	12,140,367	8,320,661	1,909,853
2003	13.8	2.5	36	76	2.9	1.6	461	32.2	32.2	15,840,496	8,581,422	3,629,537
2004	14.0	2.6	36	75	3.0	1.6	491	32.2	32.2	17,421,395	9,119,365	4,151,015
2005	7.9	2.8	47	75	2.1	1.6	523	32.2	32.2	12,938,781	9,692,446	1,623,168
2006	12.0	2.9	39	74	2.7	1.6	557	32.2	32.2	17,741,452	10,303,066	3,719,193
2007	14.0	3.1	36	74	3.0	1.6	593	32.2	32.2	20,922,954	11,285,776	4,818,589
2008	14.0	3.3	35	73	3.0	1.6	631	32.2	32.2	22,247,630	12,000,587	5,123,522
2009	8.9	3.4	44	72	2.2	1.6	673	32.2	32.2	17,145,272	12,762,661	2,191,306
2010	14.0	3.6	35	71	3.0	1.6	717	32.2	32.2	25,167,065	13,575,276	5,795,895
2011	14.0	3.8	35	71	3.0	1.6	764	32.2	32.2	26,774,584	14,441,948	6,166,318
2012	14.0	4.1	35	70	3.0	1.7	814	32.2	32.2	28,489,935	16,171,163	6,159,386

(1) Benefits include passenger time savings.

(2) Weighted average between peak and off-peak periods.

TABLE C-48

ECONOMIC MAINTENANCE COST SAVINGS

15-Oct-90

PROJECT: KBNKALAN-BSAY SECTION: HNBAAN-BASAY ALTERNATIVE: DBST

YEAR	ROUGHNESS (m/km)		UNIT RTN MNT COST		UNIT PRDC MAINT. COST		LENGTH (km)		TOTAL MAINT. COST		YEARLY
	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	9.6	2.6	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
1994	11.8	2.7	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
1995	14.0	2.8	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
1996	14.0	2.9	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
1997	6.5	3.0	45,910	24,140	130,920	0	32.2	32.2	5,693,926	777,308	4,916,618
1998	9.2	3.1	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
1999	11.9	3.2	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
2000	14.0	3.4	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
2001	7.1	3.5	45,910	24,140	130,920	116,500	32.2	32.2	5,693,926	4,528,608	1,165,318
2002	10.4	3.6	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
2003	13.8	2.5	45,910	24,140	0	716,958	32.2	32.2	1,478,302	23,863,356	(22,385,054)
2004	14.0	2.6	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
2005	7.9	2.8	45,910	24,140	130,920	0	32.2	32.2	5,693,926	777,308	4,916,618
2006	12.0	2.9	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
2007	14.0	3.1	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
2008	14.0	3.3	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
2009	8.9	3.4	45,910	24,140	130,920	116,500	32.2	32.2	5,693,926	4,528,608	1,165,318
2010	14.0	3.6	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
2011	14.0	3.8	45,910	24,140	0	0	32.2	32.2	1,478,302	777,308	700,994
2012	14.0	4.1	45,910	24,890	0	0	32.2	32.2	1,478,302	801,458	676,844

TABLE C-49 16-Oct-90

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: KBNKALAN-BSAY SECTION: HNBAAN-BASAY ALTERNATIVE: DBST

YEAR	PROJECT COSTS	VOC SAVINGS NORMAL BENEFITS (1)	VOC SAVINGS DIVERTED BENEFITS (1)	VOC SAVINGS GENERATED BENEFITS (1,2)	MAINTENANCE BENEFITS	DEVELOPMENT BENEFITS (2)	TOTAL BENEFITS
1991	35,040,400	0	0	0	0	0	(35,040,400)
1992	52,560,600	0	0	0	0	0	(52,560,600)
1993	0	4,347,530	0	1,055,032	700,994	0	6,103,556
1994	0	5,940,906	0	1,434,183	700,994	0	8,076,083
1995	0	9,921,219	0	2,443,716	700,994	0	13,065,930
1996	0	10,516,960	0	2,588,031	700,994	0	13,805,985
1997	0	2,857,661	0	694,957	4,916,618	0	8,469,236
1998	0	5,345,568	0	1,310,272	700,994	0	7,356,834
1999	0	7,457,828	0	1,811,538	700,994	0	9,970,360
2000	0	12,757,821	0	3,152,472	700,994	0	16,611,287
2001	0	4,638,544	0	1,159,659	1,165,318	0	6,963,521
2002	0	7,844,507	0	1,909,853	700,994	0	10,455,354
2003	0	14,770,076	0	3,629,537	(22,385,054)	0	(3,985,440)
2004	0	16,943,415	0	4,151,015	700,994	0	21,795,424
2005	0	6,641,177	0	1,623,168	4,916,618	0	13,180,963
2006	0	15,039,363	0	3,719,193	700,994	0	19,459,550
2007	0	19,526,908	0	4,818,589	700,994	0	25,046,491
2008	0	20,764,115	0	5,123,522	700,994	0	26,588,630
2009	0	8,896,532	0	2,191,306	1,165,318	0	12,253,156
2010	0	23,490,204	0	5,795,895	700,994	0	29,987,093
2011	0	24,990,919	0	6,166,318	700,994	0	31,858,231
2012	0	24,974,135	0	6,159,386	676,844	0	31,810,365

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)= 11.6% NB/I(15%)= 0.763 (3)

NPV(15%)= (14,847,995) NB/I(12%)= 0.965

NB/I(18%)= 0.619

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)= 11.6% NB/I(15%)= 0.763

NPV(15%)= (14,847,995) NB/I(12%)= 0.965

NB/I(18%)= 0.619

1) Including passenger time savings.

) To avoid double-counting benefits either development or generated benefits are considered.

) Net benefit-over-investment ratio, special case of the benefit-cost ratio which does not require to define whether a specific cash flow is a cost or a benefit, since their net is considered.