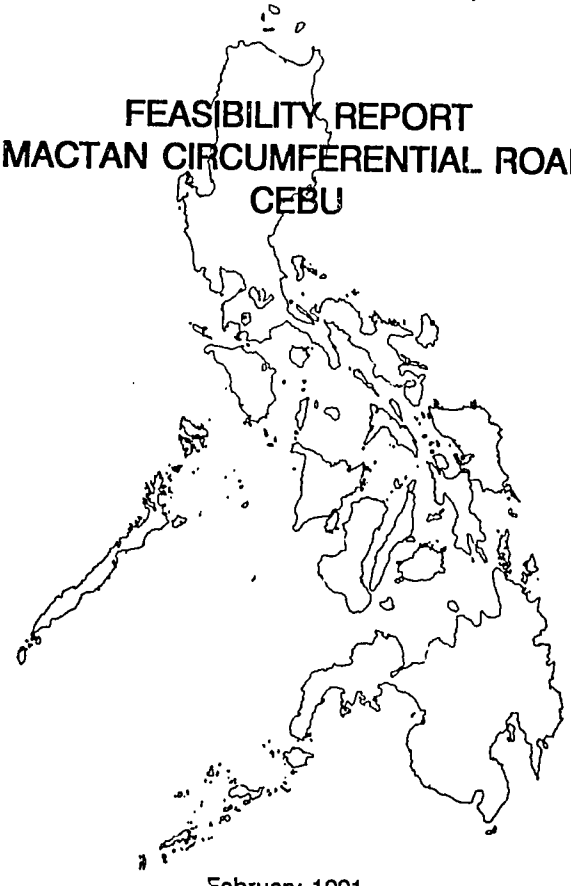
PN-ABM-452

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

RURAL INFRASTRUCTURE FUND PROJECT

(AID PROJECT NO. 492-0420)

FEASIBILITY REPORT
MACTAN CIRCUMFERENTIAL ROAD
CEBU



February 1991

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-5
II.	ECONOMIC OVERVIEW	
	A. THE PROVINCE OF CEBU	II-1
	1. General Background	II-1
	2. Population Characteristics	II-3
	3. Family Income and Expenditures	II-3
	4. Structure of Provincial Economy	II-4
	B. THE TRANSPORTATION SYSTEM	II-8
	1. Road Transport	II-8
	2. Vehicle Registration	II-10
	3. Airport	II-10
	4. Ports	II-10
	5. Public Transportation	II-14
	C. THE ZONE OF INFLUENCE	II-14
	1. Introduction and Geographic Setting	II-14
	2. Population	II-14
	3. The Local Economy	II-16
	4. Impact of the Road	II-20
III.	TRAFFIC	
	A. REVIEW OF AVAILABLE DATA	III-1
	B. RIFP TRAFFIC SURVEY	III-1
	C. HOMOGENOUS TRAFFIC SECTIONS	III-1
	D. ANALYSIS OF THE TRAFFIC DATA	III-4

E. TRAFFIC FORECAST III-4
1. Normal Traffic III-4
2. Generated Traffic III-5
3. Diverted Traffic III-6

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. Published Studies of Project Road IV-2
4. Drainage and Bridge Inventories IV-2
5. Drainage Studies IV-4

C. DESCRIPTION OF THE ROUTE IV-14

D. PRELIMINARY DESIGN IV-16
1. Proposed Design Standards and Improvements IV-16
2. Drainage Design IV-21
3. Bridges IV-22

V. PAVEMENT AND MATERIALS

A. GEOLOGY AND TOPOGRAPHY V-1

B. MATERIAL SOURCES V-1

C. EXISTING PAVEMENT CONDITIONS V-3

D. SUBGRADE SOIL V-4

E. PAVEMENT DESIGN V-5
1. Traffic Loading V-5
2. New Pavements V-5
3. Reconstruction and Rehabilitation of Pavements V-6
4. Pavement Overlaying V-7

F. FINAL COMMENTS V-7

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-9
3. Diverted and Generated Traffic Benefits VII-9
4. Generated Traffic and Development Benefits VII-10
5. Road Maintenance Benefits VII-10

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

D. COSTS VII-12
1. Construction Cost Estimates VII-12
2. Project Management Costs VII-12
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-25

G. FINANCIAL ANALYSIS VII-38
1. Introduction VII-38
2. Results VII-38

H. RECOMMENDATIONS VII-39

I. COSTS VII-39

-3'

VIII. SOCIAL SOUNDNESS ANALYSIS

A. INTRODUCTION VIII-1

B. BACKGROUND VIII-1

C. INCOME EFFECTS VIII-1
1. Tourism Benefits VIII-2
2. Transportation Benefits VIII-3
3. Agricultural Benefits VIII-3

D. POPULATION MOVEMENTS 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 Length	I-4
1-2 to 1-3	Economic Analysis - Summary Results	I-6
	Sensitivity Analysis of the Recommended Alternatives (Internal Rates of Return)	to 1-7
2-1	Main Sources of Income for Cebu Compared with Region VII (Central Visayas) and the Philippines	II-4
2-2	Agricultural Production Province of Cebu	II-6
2-3	Existing Roads by System Classification Cebu Province, 1988	II-10
2-4	Motor Vehicle Registration for the Province of Cebu, 1987	II-11
2-5	Schedule of Domestic Air Traffic in Cebu	II-12
2-6	List of Ports in Cebu Province	II-13
2-7	Cebu Tourism Demand	II-19
3-1	Summary of Traffic Forecast Section 1: Pusok-Bankal	III-7
3-2	Summary of Traffic Forecast Section 1: Pusok-Bankal	III-8
3-3	Summary of Traffic Forecast Section 2: Bankal-Maribago	III-9
3-4	Summary of Traffic Forecast Section 2: Bankal-Maribago	III-10
3-5	Summary of Traffic Forecast Section 3: Maribago-Marigondon	III-11
3-6	Summary of Traffic Forecast Section 3: Maribago-Marigondon	III-12
3-7	Summary of Traffic Forecast Section 4: Marigondon-Babag	III-13
3-8	Summary of Traffic Forecast Section 4: Marigondon-Babag	III-14
3-9	Summary of Traffic Forecast Section 5: Babag-Pajo	III-15
3-10	Summary of Traffic Forecast Section 5: Babag-Pajo	III-16
4-1	Detailed Design Criteria	IV-17
4-2	Proposed Major Drainage Structure - Mactan	IV-22
5-1	Pavement Sections	V-8

6-1	Summary of Unit Rates	VI-2
6-2	Cost Estimate Breakdown Section 1: Pusok-Bankal Junction	VI-5
6-3	Cost Estimate Breakdown Section 2: Bankal Junction-Maribago Proposed Surface Course: AC	VI-7
6-4	Cost Estimate Breakdown Section 3: Maribago-Marigondon Junction Proposed Surface Course: AC	VI-9
6-5	Cost Estimate Breakdown Section 4: Marigondon Junction-Brgy. Babag Proposed Surface Course: AC	VI-11
6-6	Cost Estimate Breakdown Section 5: Barangay Babag-Pajo Proposed Surface: AC	VI-13
6-7	Cost Estimate Breakdown Section 1: Pusok-Bankal Junction Proposed Surface Course: PCC	VI-15
6-8	Cost Estimate Breakdown Section 2: Bankal Junction-Maribago Proposed Surface Course: PCC	VI-17
6-9	Cost Estimate Breakdown Section 3: Maribago-Marigondon Junction Proposed Surface Course: PCC	VI-19
6-10	Cost Estimate Breakdown Section 4: Marigondon Junction-Brgy. Babag Proposed Surface Course: PCC	VI-21
6-11	Cost Estimate Breakdown Section 5: Barangay Babag-Pajo Proposed Surface Course: PCC	VI-23
7-1	Existing Road Length	VII-3
7-2	Vehicle Operating Costs - HDM-III Results - w/o Time Value User Cost	VII-5
7-3	Vehicle Operating Cost - HDM-III Results - w/ Time Value of User Cost	VII-7
7-4	Routine and Periodic Maintenance Unit Costs	VII-11
7-5	Economic Benefits and Feasibility Ratios Section: Pusok-Bankal Jct. Alternative: AC	VII-15
7-6	Economic Benefits and Feasibility Ratios Section: Pusok-Bankal Jct. Alternative: PCC	VII-16
7-7	Economic Benefits and Feasibility Ratios Section: Bankal Jct.-Maribago Jct Alternative: AC	VII-18
7-8	Economic Benefits and Feasibility Ratios Section: Bankal Jct.-Maribago Jct. Alternative: PCC	VII-19
7-9	Economic Benefits and Feasibility Ratios Section: Maribago Jct.-Marigondon Jct. Alternative: AC	VII-20

7-10	Economic Benefits and Feasibility Ratios Section: Maribago Jct.-Marigondon Jct. Alternative: PCC	VII-21
7-11	Economic Benefits and Feasibility Ratios Section: Marigondon Jct.-Babag Alternative: AC	VII-23
7-12	Economic Benefits and Feasibility Ratios Section: Marigondon Jct.-Babag Alternative: PCC	VII-24
7-13	Economic Benefits and Feasibility Ratios Section: Babag-Pajo Alternative: AC	VII-26
7-14	Economic Benefits and Feasibility Ratios Section: Babag-Pajo Alternative: PCC	VII-27
7-15	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Internal Rates of Return)	VII-28
7-16	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Present Value)	VII-29
7-17	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 15%)	VII-30
7-18	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 18%)	VII-31
7-19	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 12%)	VII-32
7-20	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Internal Rates of Return)	VII-33
7-21	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Present Value)	VII-34
7-22	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 15%)	VII-35
7-23	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 18%)	VII-36
7-24	Economic Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 12%)	VII-37
7-25	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Internal Rates of Return)	VII-40
7-26	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Present Value)	VII-41
7-27	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Investment 15%)	VII-42

7-28	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 18%)	VII-43
7-29	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 12%)	VII-44
7-30	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Internal Rates of Return)	VII-45
7-31	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Present Value 15%)	VII-46
7-32	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 15%)	VII-47
7-33	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 18%)	VII-48
7-34	Financial Analysis - Summary Results Sensitivity Analysis of the Recommended Alternatives (Net Benefit Over Investment 12%)	VII-49
8-1	Families by Main Source of Income and Total Family Income for Cebu	VIII-2

LIST OF FIGURES

Figure No.		Page No.
1-1	Mactan Circumferential Road	I-1
1-2	Project Road Map	I-2
2-1	Project Road Map	II-9
2-2	Land Use Opportunity Map	II-15
2-3	Locations of Tourists Sites	II-17
3-1	Traffic Survey Section	III-2
3-2	1990 Vehicle Composition	III-3
4-1	Schematic Map of Drainage Areas Road Section: Mactan Circumferential	IV-6
4-2	Climate Map of the Philippines	IV-8
4-3	Rainfall Intensity - Duration - Frequency Curves	IV-9
4-4	Normal Monthly Rainfall Distribution	IV-10
4-5	Normal Monthly No. of Rainy Days	IV-11

4-6	Cumulative Rainfall Distribution In Percent	IV-12
4-7	Maximum Daily Rainfall Distribution	IV-13
4-8	Recommended Road Section Design Standards	IV-18
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

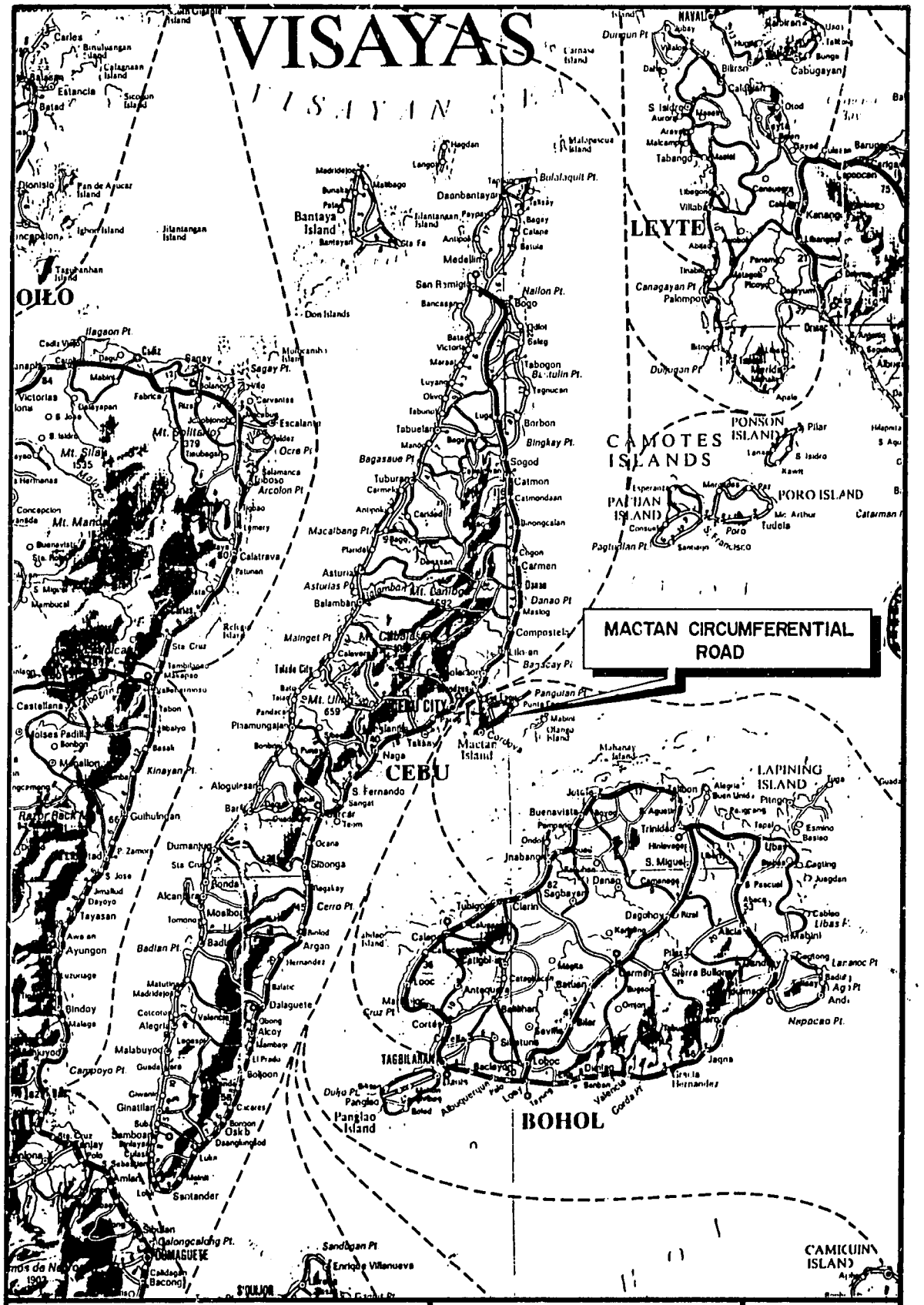
Appendix

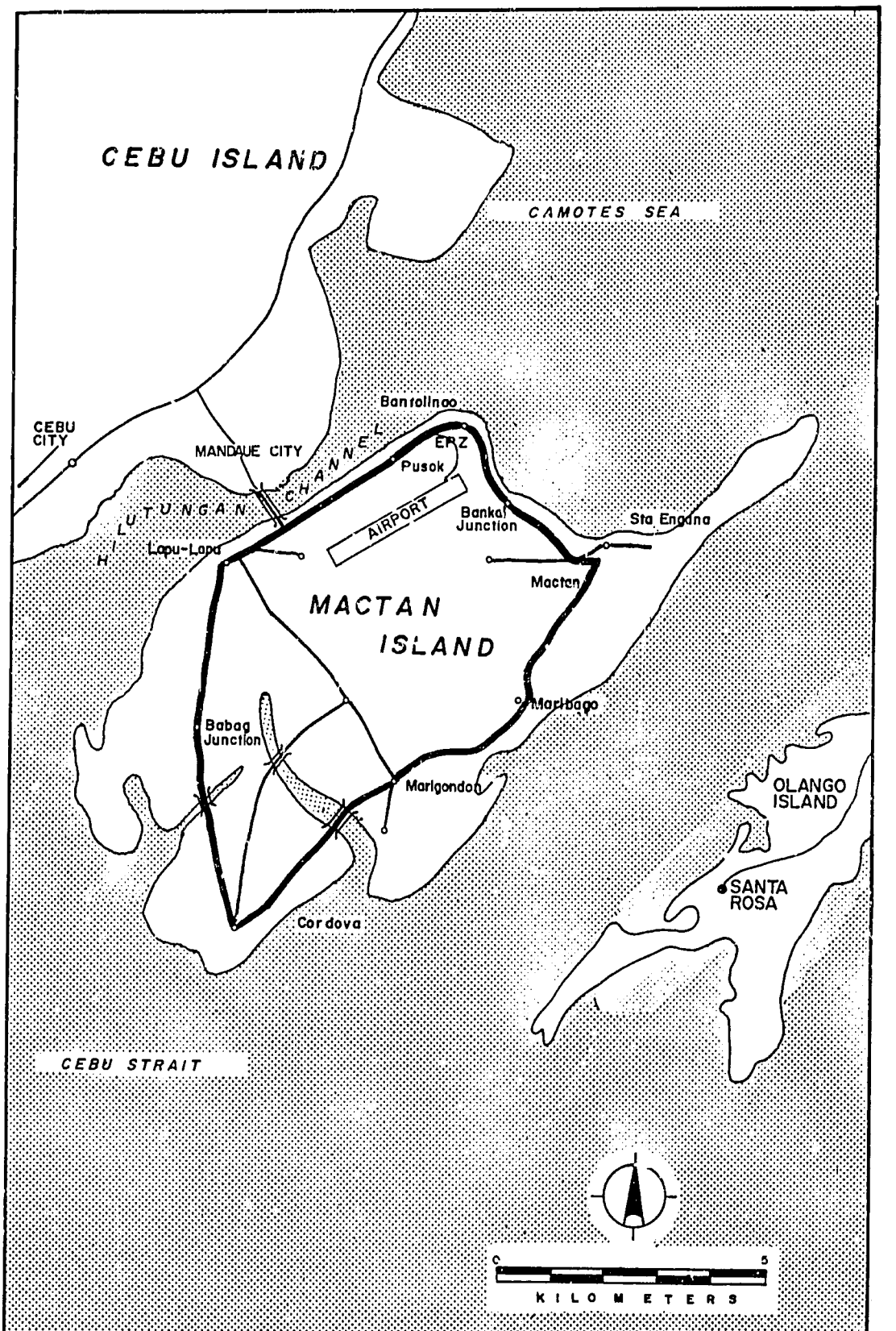
A Road Reconnaissance Survey

B Rainfall Intensity-Duration-Frequency Data
Sizing of Drainage Structures

C Transport Economics

I.
INTRODUCTION


VISAYAS
OILO
LEYTE
CAMOTES ISLANDS
PONSON ISLAND
PARIAN ISLAND
PORO ISLAND
MACTAN CIRCUMFERENTIAL ROAD
CEBU
CEBU CITY
Mactan Island
LAPINING ISLAND
BOHOL
Panglao Island
TAGBILARAN
CAMIGUIN ISLAND
Bantaya Island
Mt. Silay
Mt. Mandalagan
Mt. Canlaon
Mt. Cabojas
Mt. Ulin
Mt. Politico
Bagasaue Pt.
Macalbang Pt.
Asturias Pt.
Malinget Pt.
Badian Pt.
Cerro Pt.
Panguian Pt.
Danao Pt.
Bingkay Pt.
Nailon Pt.
Bulalaquit Pt.
Canagayan Pt.
Dumagan Pt.
Pagtudlan Pt.
Ilagan Pt.
Arcolon Pt.
Ocre Pt.
Sagay Pt.
Kinayan Pt.
Cagayoyo Pt.
Dumaguete
Santander
Sandagan Pt.
Enrique Villanueva
Tacloban
Ormoc
Baybay
Maasin
Sogod
Bogo
Medellin
Carmen
Catmon
Compostela
Talisay
Toledo City
Naga
Argao
Dalaguete
Moalboal
Alcantara
Bonda
Sibonga
Aloguinsan
Barili
Alegria
Malabuyoo
Ginatilan
Samboan
Oslob
Tayasan
Ayungon
Bindoy
Jagna
Loboc
Sierra Bullones
Clarin
Tubigon
Calape
Antequera
Cortes
Sevilla
Sikatuna
Carmen
Dagohoy
Trinidad
Buenavista
Jinabangan
Danao
Sagbayan
Talibon
Ubay
Tagbilaran
Dauis
Panglao
Dumaguete
Bacong
Zamora
Guihulngan
Tanjay
Bais
Mabinay
Vallehermoso
Canlaon
Bais
Dumaguete
Santander
Siquijor
Larena
Enrique Villanueva
Sandagan Pt.
Nepacao Pt.
Larenoc Pt.
Libas Pt.
Cabiao
Ag i Pt.
Cagting
Juagdan
Esmino
Pitogo
Tapal
Ubay
Talibon
Jagna
Loboc
Duljo Pt.
Cruz Pt.
Cortes
Sevilla
Sikatuna
Carmen
Dagohoy
Trinidad
Buenavista
Jinabangan
Danao
Sagbayan
Clarin
Tubigon
Calape
Antequera



RURAL INFRASTRUCTURE FUND PROJECT	PROJECT ROAD MAP Mactan Circumferential Road	Figure 1-2

2/27/90

I. INTRODUCTION

A. PROPOSED PROJECT

The proposed roadway improvement project is to reconstruct and rehabilitate 27 kms of the Mactan Circumferential Road. Currently, the road is paved with asphalt and portland concrete cement in good to bad condition. Most of the existing pavement can be classified as in fair condition. The road has five traffic sections: Pusok Jct.-Bankal Jct., Bankal Jct.-Maribago Jct., Maribago Jct.-Marigondon Jct., Marigondon Jct.-Babag and Babag-Pajo. These sections are scheduled for widening, geometrical improvements and paving to appropriate pavement standards.

B. OVERVIEW

This project is situated on Mactan Island in the Central Visayas Region (Region VII), the location of the Mactan International Airport, the Export Processing Zone and three municipal ports. The Mactan Circumferential Road serves as the link between these facilities, the City of Lapu-Lapu in the north, tourist resorts on the east coast, and the Municipality of Cordova to the south. The island is connected to Cebu via the hurricane-damaged Mandaue-Mactan Bridge which has been repaired but with a restriction on vehicle weights. Figure 1-1 shows the location of the project in terms of the road network of Region VII and Figure 1-2 presents the location of the road project in detail.

The economy of the area of influence is largely based on fishing and service industries, including transportation, commerce and manufacturing. Tourism is also a major income generating activity on Mactan Island, the site of major internationally known tourist developments and beach resorts.

The upgraded road will improve the movement of goods and people between the coastal villages and will expedite the movement of tourists and commodities coming from or going to the international airport. Because the proposed project improves an existing road, significant development benefits are not anticipated.

C. EXISTING ROAD CONDITION

Five traffic sections have been identified for the Mactan Circumferential Road. These sections are mostly AC in good to bad condition with some stretches of PCC in fair condition. There are a few areas where these pavements are in bad condition. The road is motorable along its project length all year round.

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

TABLE 1-1
EXISTING ROAD LENGTH

Homogeneous Section	Length (km.)	Pavement Type/ Condition
Pusok-Bankal Jct.	5.5	PCC/Fair (3.0) Asphalt/Fair (2.5)
Bankal Jct.-Maribago Jct.	5.0	PCC/Fair (2.1) Asphalt/Fair (1.8) Asphalt/Bad (1.1)
Maribago Jct.-Marigondon Jct.	3.5	PCC/Bad (0.6) Asphalt/Fair (0.7) Asphalt/Bad (1.9) Asphalt/Good (0.3)
Marigondon Jct.-Babag	6.9	Asphalt/Good (1.0) Asphalt/Fair (5.9)
Babag-Pajo	6.1	Asphalt/Fair (4.5) PCC/Fair (1.6)
TOTAL ROAD	27.0	

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 Mactan Circumferential Road Project is shown in Table 1-2 and Table 1-3. 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. These scenarios were prepared for two pavement designs: AC and PCC.

Table 1-2 displays the results of the economic analysis for the AC pavement alternative. None of the section improvements is economically feasible. The IRRs are below the required 15 percent and range from 4.7 percent to 11.1 percent.

Table 1-3 shows the results for the PCC pavement alternative. Again, none of the section improvements is economically feasible. IRRs range from 3.8 percent to 9.9 percent.

The results of the economic evaluation of the Mactan Circumferential Road indicate that better maintenance of those specific areas of the road in bad condition is needed rather than an upgrade of the entire road. This result holds even when roadway sections in fair condition with short stretches in bad condition are classified as "bad". The Consultant's evaluation model shows that proposed improvements on these "bad" sections still produce IRRs below the required 15 percent. Thus, the most cost-effective means of improving traffic flow and vehicle operating speeds is through stepped up periodic maintenance of the existing road.

The sections where the traffic flow is being impeded by short stretches of pavement in bad condition and where periodic maintenance would alleviate vehicle slowing and attendant high operating costs are: Bankal Jct.-Maribago Jct. (1.1 km AC), Maribago Jct.-Marigondon Jct. (0.6 km PCC and 1.9 km AC). The rest of the sections had short (10 to 20 meter) intermittent patches where the pavement was bad, causing vehicle slowing and/or increased vehicle operating costs. These also should be repaired as part of a periodic maintenance programme.

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

An environmental assessment is provided in a separate volume.

F. RECOMMENDATIONS

Based on the results of the economic analysis presented above, the Consultants do not recommend the reconstruction of the five sections of Mactan Circumferential Road: Pusok to Bankal Jct., Bankal Jct.-Maribago Jct., Maribago Jct.-Marigondon Jct., Marigondon Jct.-Barangay Babag and Barangay Babag-Pajo sections.

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	
AC	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
PSOK–BNKAL	8.8%	9.8%	8.8%	9.8%	7.0%	7.9%	7.0%	7.9%	7.3%	8.2%	7.3%	8.2%	5.6%	6.5%	5.6%	6.5%
BNKAL–MRBGO	3.5%	4.9%	3.5%	4.9%	2.1%	3.5%	2.1%	3.5%	2.3%	3.6%	2.3%	3.6%	1.1%	2.3%	1.1%	2.3%
MRBGO–MRGNDN	4.1%	5.2%	4.1%	5.2%	2.7%	3.7%	2.7%	3.7%	2.9%	3.9%	2.9%	3.9%	1.6%	2.6%	1.6%	2.6%
MRGNDN–BBAG	3.6%	4.7%	3.6%	4.7%	2.1%	3.1%	2.1%	3.1%	2.3%	3.3%	2.3%	3.3%	0.9%	1.9%	0.9%	1.9%
BBAG–PAJO	10.3%	11.1%	10.3%	11.1%	8.5%	9.3%	8.5%	9.3%	8.8%	9.6%	8.8%	9.6%	7.2%	7.9%	7.2%	7.9%

TABLE 1-3
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	
PCC	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
PSOK-BNKAL	9.2%	9.9%	9.2%	9.9%	7.6%	8.3%	7.6%	8.3%	7.8%	8.5%	7.8%	8.5%	6.4%	7.0%	6.4%	7.0%
BNKAL-MRBGO	3.5%	4.3%	3.5%	4.3%	2.2%	2.9%	2.2%	2.9%	2.4%	3.1%	2.4%	3.1%	1.1%	1.8%	1.1%	1.8%
MRBGO-MRGNDN	3.7%	4.3%	3.7%	4.3%	2.3%	2.9%	2.3%	2.9%	2.5%	3.1%	2.5%	3.1%	1.2%	1.8%	1.2%	1.8%
MRGNDN-BBAG	3.1%	3.8%	3.1%	3.8%	1.7%	2.3%	1.7%	2.3%	1.9%	2.5%	1.9%	2.5%	0.5%	1.1%	0.5%	1.1%
BBAG-PAJO	9.0%	9.6%	9.0%	9.6%	7.6%	8.1%	7.6%	8.1%	7.8%	8.3%	7.8%	8.3%	6.4%	6.9%	6.4%	6.9%

II.
ECONOMIC OVERVIEW

II. ECONOMIC OVERVIEW

The proposed improvements for the Mactan Circumferential Road cover 27 kms of existing pavement in good to bad condition. It consists of five sections: Pusok-Junction to Bankal Jct., Bankal Jct.-Maribago Jct., Maribago Jct.-Jct. Marigondon Jct., Marigondon Jct.-Barangay Babag, and Barangay Babag-Pajo. The road passes through urban centers, tourist sites, an industrial zone as well as agricultural farm lots and fishponds along its route.

The major economic function of the road would be to provide improved access around Mactan Island. The improved road will permit more efficient movement of goods and passengers between the coastal fishing areas, tourist sites, the International Airport and an industrial zone on the island. It will thus play a significant role in the integration of the island's economy.

A. THE PROVINCE OF CEBU

1. GENERAL BACKGROUND

Midway between Luzon and Mindanao is the island of Cebu, centrally located in the Visayas Islands. It is separated from the island of Bohol on the southeast by Cebu Strait, from Negros on the west by Tanon Strait, and from Leyte on the northeast by the Camotes Sea.

The province is composed of 167 islands/islets, the biggest by far being the island of Cebu. Other island groups are Mactan and Camotes on the east and Bantayan on the northwest. Mactan Island, however, is connected to mainland Cebu via the Mandaue-Mactan Bridge, spanning the Hilutungan channel.

a. Topography, Climate and Land use

Cebu Island is long and narrow, running about 220 kms north to south and has a width of 41 kms at its widest point. The total land area of the province is 5,088 square kilometers. Cebu is the second largest province in Region VII, also known as the Central Visayas Region.

On the other hand, Mactan Island is the smallest of the island groups of Cebu. Its total land area is only about 70 sq km, or about 1.37% of the total land area of the province.

The main island's terrain is rugged and mountainous. Deep canyons are found inland. Most of the flat or nearly level areas occur along Cebu's narrow coasts. These coastal plains are where most settlements are situated and constitute 24 percent of the total land area. Rolling hills constitute about 64 percent. The mountainous portion which makes up 12% of its land area is found in the center and rises up to 1,000 meters. These upland areas are almost entirely denuded of trees and vegetation. A few rivers and

streams cascade down from the highlands causing the steady erosion of topsoil.

Cebu has a tropical climate characterized by a uniform high temperature and heavy precipitation distributed throughout the year with no marked dry season. The rainfall conditions in the northern part are characterized by no pronounced wet and dry seasons. The central and southern portions are characterized by a short dry season (1-3 months) with no pronounced period of maximum rainfall.

The province has an annual average rainfall of about 1,750 mm, and an annual average temperature of 27.8 degrees centigrade. November has the heaviest rainfall, while April has the lowest. The province is not within the main typhoon belt; the number of typhoons passing is only 7 percent of those passing through the country annually.

The land use classification of the province is as follows:

Land Classification		Area (Has)	Percentage
Certified alienable and disposable		367,748 ha.	72%
Classified forest land		141,091	28%
Established Forest Res.	21,427		
Established Timberland	105,599		
National Parks, GRBS/ Wilderness Area	13,148		
Military and Naval Reservation	4		
Civil Reservation	114		
Fishponds	799		
Total		508,839	100%

As regards the agricultural land use, the province had the following in 1985.

Land use	Area (has.)	Percentage (%)
Arable Land	94,147	58
Land under permanent crops	55,930	34
Land under permanent meadows and pastures	5,936	3.6
All other lands	7,315	4.4
Total	163,328	100

b. Administrative Structure

The province is politically divided into 48 municipalities and five chartered cities, namely: Cebu, Mandaue, Lapulapu, Danao and Toledo. These towns and cities are situated along the coastline, with Cebu City, the seat of the provincial government, at the eastern mid-point section of the main island.

The cities and municipalities are further subdivided into 193 barangays. The municipalities with a high number of barangays are Argao (45), Dumanjug (37), Tuburan (54) and Barili (42). The city of Cebu has 79 barangays, followed by Danao with 42 and Toledo with 39. Incidentally, Lapu-lapu City and Cordova in Mactan Island have 27 and 13 barangays respectively.

2. POPULATION CHARACTERISTICS

Cebu Province has a population of 2,619,000. This includes Cebu City with a population of 637,000 and Lapu-Lapu City on Mactan with a population of 130,000. The population overwhelmingly speaks the Cebuano dialect.

In 1980, five out of eight households (63%) in Cebu Province were rural. Five out of nine (55%) owned their home.

Literacy for both men and women (78%) was lower than that of the Philippines (83%). High school and higher education was below the Philippine average (30% versus 34%). Average employment (57%) was much higher than the Philippine average (51%). Five out of six men (83%) versus 33% of women were employed. Of those employed, 54% of men and 34% of women were employed in agriculture.

Infrastructure services are also below the Philippine average. Only five out of nine (53%) urban homes and 3% of rural homes had electricity. About half (46%) of the urban homes and 18% of rural homes got their water from faucets. Only 40% of urban homes and 23% of rural homes got their water from wells. Seven out of ten (69%) urban households and 88% of rural households cooked with charcoal or wood. Three fourths (75%) of the urban households and 63% of rural households had radios.

3. FAMILY INCOME AND EXPENDITURES

Cebu province excluding Cebu City and Lapu-Lapu City is a poor province. With an average income of P 17,123 in 1985, Cebu Province ranked 67th out of the country's 74 provinces. Six out of ten Cebu families had an income under P 15,000. This excludes Cebu City (P 35,706) and Lapu-Lapu City which have relatively high average incomes. One out of three (32%) of the families are engaged in agriculture-related activities. This proportion is less than that of the Philippines (38%) and of Region VII (34%) (see Table 2-1).

21

TABLE 2-1

MAIN SOURCES OF INCOME FOR CEBU
COMPARED WITH REGION VII (CENTRAL VISAYAS)
AND THE PHILIPPINES
(PERCENTAGES)

Main Source of Income	Cebu	Region VII	Philippines
Agricultural Wages/Salaries	5.1%	4.3%	9.2%
Non-Agricultural Wages/Salaries	38.0	33.5	31.1
Agricultural Entrepreneurial	26.7	30.0	28.5
Non-Agricultural Entrepreneurial	11.2	13.9	12.4
Other	19.0	18.3	18.8
	100%	100%	100%
Total Families (Thousands)	343.6	783.8	9,847.3

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

In general, the poorer the family the higher the proportion of their income spent on food. Cebu families spend more of their income on food (62%) than the average for the Philippines (52%) and Region VII (59%).

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

4. STRUCTURE OF PROVINCIAL ECONOMY

a. Agriculture, Fishery, and Livestock

The agriculture sector ranked fourth in terms of contribution to provincial value added in 1987, after trading, manufacturing and mining. The output of the sector was close to 10 percent of Cebu's Gross Provincial Product. Despite the poor topsoil, agriculture is extensively practiced and the total cultivated area is about 154,000 has. or 30 percent of the total land area. The

22

principal crops grown are corn, coconut, sugarcane, rice, fruit and vegetables.

Corn, being the staple food, is the most important crop of the province. There are about 67,000 hectares devoted to corn production. Yet, despite the extensive cultivation of this crop, the province still experiences a shortfall of about 130,000 MT annually taking into account individual consumption, animal feed and planting materials. The province relies on surplus production from neighboring provinces in Mindanao. Corn production in 1988 was estimated at 164,361 MT, and valued at P 432 million. (see Table 2-2).

Another major agricultural crop in the province providing cash income for small farmers is coconut. It is grown on a wide range of soil types and topographic conditions. Coconut production in 1988 was estimated at 150,816 MT, and valued at P 211 million.

Sugarcane is another crop contributing significantly to the agricultural economy. Like corn, it grows best in alluvial, deep fertile soils and well-drained land with almost flat to slightly rolling topography. Sugarcane production in 1988, estimated at 150,816 MT, constituted 35% of the regional output.

The livestock industry in the province is well developed. It is almost equally divided between commercial and backyard-raised stocks. Hogs dominated the livestock population in 1988, followed by goat. There are also a number of commercial raisers of cattle and carabao in the province.

Cebu Strait is a rich fishing ground and fish production in Cebu is significant. The total fish catch in 1988 was estimated at 21,428 MT. More than three-fourths (79%) of the total catch came from municipal fishing. Frigate tuna, chub mackerel and anchovies are among the species caught in the municipal fishing waters, while shrimps and mussels abound off the coast of Asturias.

b. Manufacturing

The value of manufacturing output in 1987 represented 13 percent of Gross Provincial Product (GPP). The largest number of establishments are engaged in food processing, garment making, wood furniture and fixtures-making, and producing fabricated metal products.

The food processing subsector numbers 413 establishments and employed a total of about 7,700 persons. Eighty percent of these establishments employed less than 10 persons. The value of production from this subsector comprised 23 percent of manufacturing output. Food processing establishments are concentrated in processing of coconut oil, corn oil, fishmeal, seaweeds, fruits, rice and corn milling, mango processing and

TABLE 2 - 2

AGRICULTURAL PRODUCTION
PROVINCE OF CEBU

AGRICULTURAL ACTIVITIES	1980 OUTPUT	1988 OUTPUT (MT)	1988 VALUE (P MILLION)	1980-88 EST.GROWTH RATE(%)
CROPS				
Palay	6,390	9,724	32	5.39%
Corn	135,700	164,361	432	2.42%
Banana	68,339	68,994	138	0.12%
Mango	26,511	27,944	244	0.66%
Coffee	20	34	1	6.86%
Coconut	175,147	150,816	211	-1.85%
Sugarcane	681,109	540,818	287	-2.84%
Rootcrop	11,104	37,661	65	16.49%
Vegetable	5,149	10,803	72	9.71%
Other Crops	1,569	2,246	18	4.59%
SUB-TOTAL	1,111,038	1,013,401	1,501	-1.14%
Livestock	33,064	30,860	795	-0.86%
Poultry	3,717	3,309	87	-1.44%
SUB-TOTAL	36,781	34,169	882	-0.92%
FISHERIES				
Commercial	1,258	4,499	69	17.27%
Municipal	36,266	16,929	289	-9.08%
SUB-TOTAL	37,524	21,428	358	-6.76%
FORESTRY	*	*	-	-
TOTAL	1,185,343	1,068,998	2,741	-1.28%

Sources: 1980 Census of Agriculture and Fisheries,
Bureau of Agricultural Statistics, and Consultants.
* Data not available.

"otap" making.

The garment/wearing apparel makers number 706 establishments and employ about 2,500 persons. More than 85 percent are operating on a small-scale basis with less than 5 persons employed.

There are about 170 manufacturers of wood furniture and fixtures employing a total of 11,365 persons. Some 13 firms could be considered as medium-scale employing 200 to 400 employees. However, 73 percent are small-scale in operation and employ less than 10 persons.

Manufacturers of fabricated metal products number 115 establishments and employ 1,410 persons. The output in 1987 comprised three percent of the value of manufacturing output.

c. Other Sectors

Cebu province possesses the greater percentage of the rich mineral deposits of the region. The province's copper and gold ore deposit constitute 28% and 61%, respectively, of the country's reserves. In addition, 96% of the region's cement raw materials, which is 17% of the country's total reserves, can be found in this province. Likewise, its dolomite deposit constitutes 98% of the country's total reserves.

The biggest metallic ore mining company in the country, Atlas Consolidated Mining, operates in the province. The company's mine/quarry is located at Lutopan, Toledo City and produces copper concentrates, gold, silver and pyrite. The company employs about 3,000 person and is the main economic base of Toledo City. The value of its 1987 output represented 10 percent of total value added for "other" sectors. Together with smaller non-metallic mining establishments operating in the province, the mining and quarrying sector contributed a 12 percent share to provincial value added in 1987.

Cebu abounds is rich in tourist attractions. The province is practically surrounded by beaches except where a few high cliffs rise directly from the sea. At present, there are less than a dozen developed beach resorts that meet international standards, but there are numerous others in their natural state that await investment. In addition, it is also rich in historical landmarks, being one of the earliest provinces discovered by the Spaniards. Among the tourist attractions are the Basilica Minore del Sto. Niño, which houses the image of the Sto. Niño thought to have been left by Magellan; the Tacist Temple; the University of San Carlos Museum which houses a collection of religious carvings, ethnic artifacts, preserved botanical and zoological specimen and archeological finds; the Sta. Fe Beach Resort in Bantayan Island which offers a white sand beach and emerald-green waters and the Kawasan Falls regarded as the best waterfall on Cebu Island.

However, the more popular tourist attractions are located on Mactan Island. These include the 5-star Blue Water Resort in Maribago, the Costabella Tropical Beach, the Coral Reef Resort which offers skiing and parasailing to its members, and the Kalingaw Beach in Marigondon which offers diving lessons, skiing, windsurfacing, and many other resorts.

As regards trade and commerce, there are numerous business establishments throughout the province. There are 16,296 establishments involved in wholesale and retail trade, 227 in construction, 3,438 in community, social and personal services, 39 in transportation, storage and communication, and 1,410 in finance, insurance, real estate and business services. Banking facilities include 24 commercial banks, four government banks, four savings banks and 23 rural banks. Meanwhile, cottage industries include mat weaving, handbag making, guitar making, basketry, loomweaving and banca making.

B. THE TRANSPORTATION SYSTEM

1. ROAD TRANSPORT

The proposed Mactan Circumferential Road is located on Mactan Island. This island is connected to mainland Cebu via Mandaue - Mactan Bridge (Opon Bridge) linking Lapu-Lapu City and Mandaue City. Figure 2-1 shows the location of the road project. The purpose of this road project is to improve access between fishing areas, the tourist spots, the trading centers and the industrial sites on the island.

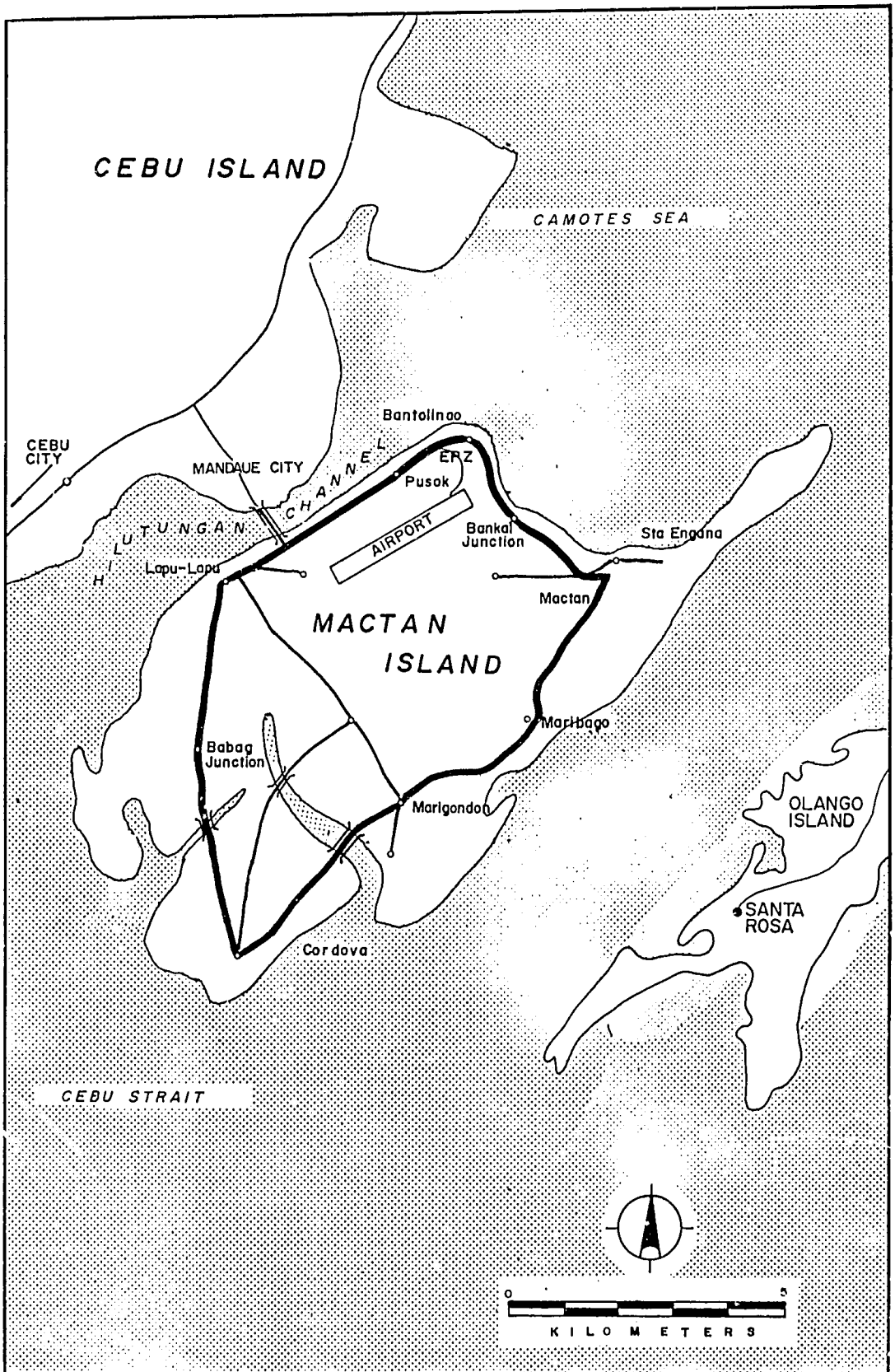
The circumferential road, with a total length of approximately 27 kms is the principal link connecting the two municipalities of the island. It is surfaced mostly with asphalt and the condition varies from bad to fair. There are also some short sections of portland cement concrete pavement.

The road network of the Mactan Island has a total length of about 120 kms of which 96 kms, or 80 percent, are in Lapu-Lapu City, while the remaining 24 kms, or 20 percent, are in the Municipality of Cordova.

Other inland barangays are served by existing asphalt and gravel-surfaced roads.

The province of Cebu has a total road network of 3,812 kms as of 1988. Table 2-3 presents the existing roads by system classification in the province.

16



RURAL INFRASTRUCTURE FUND PROJECT	PROJECT ROAD MAP Mactan Circumferential Road	Figure 2-1

2/27/90

TABLE 2-3

EXISTING ROADS BY SYSTEM CLASSIFICATION
CEBU PROVINCE, 1988

CLASSIFICATION	ROAD LENGTH
National	622
Provincial	950
City	189
Municipal	405
Barangay	1,646
Total	3,812

Source: Department of Public Works and Highways

2. VEHICLE REGISTRATION

The province of Cebu had a total of 44,665 registered vehicles as of 1987. Table 2-4 presents the motor vehicles registered in the province.

3. AIRPORT

Cebu's major airport, the Mactan International Airport, is the second busiest after Manila. It receive several direct international flights each week. Additional scheduled weekly flights are likely to be approved in the near future. Table 2-5 presents the schedule of domestic air traffic in Cebu served by the Philippine Air Lines.

4. PORTS

There are four national ports and 38 municipal ports in the province of Cebu. Three of these municipal ports are located on the island of Mactan. However, the municipal port in Barangay Pajo is the only landing point in the island which serves as the loading and unloading terminal for passengers. The opening of the Mandaue-Mactan Bridge greatly affected the water transport in the project area.

Table 2-6 shows the list of ports in the province of Cebu.

28

TABLE 2-4

MOTOR VEHICLE REGISTRATION FOR THE PROVINCE OF CEBU, 1987

License	Vehicle Classification: Car: Light	Car: Medium	Car: Heavy	Utility	Truck	Bus	Motorcycle	Trailer	Tricycle	Total	Prov'l Per centage
Private	7,822	3,258	1,955	12,659	3,583	75	8,246	285	0	37,883	85%
For Hire	409	88	88	2,844	330	192	0	67	1,961	5,979	13%
Government	87	31	13	365	114	12	181	0	0	803	2%
Total	8,318	3,377	2,056	15,868	4,027	279	8,427	352	1961	44,665	100%
Percentage	19%	8%	5%	36%	9%	1%	19%	1%	4%	100%	

Source: Land Transportation Franchising and Regulatory Board, Dept. of Transportation and Communications

TABLE 2-5

SCHEDULE OF DOMESTIC AIR TRAFFIC IN CEBU

ROUTE	AIRCRAFT TYPE	FREQUENCY
Cebu - Allah Valley	Fokker 50	4 times a week
- Bacolod	Fokker 50	daily
	B-737	daily
	SD-360	daily
- Bislig	Fokker 50	3 times a week
- Butuan	SD 360	twice daily
- Cagayan de Oro	BAC 111	daily
- Cotabato	SD-360	daily
- Cotabato via Iligan	Fokker 50	4 times a week
- Davao	BAC 111	twice daily and one-4 times a week
- Dipolog	SD-360	4 times a week
- Dumaguete	SD-360	one-daily and one-4 times a week
- General Santos	Fokker 50	twice daily
- Iloilo	B-737	daily
	Fokker 50	daily
- Kalibo	SD-360	4 times a week
- Legazpi	SD-360	daily
- Manila	A-300	4 times daily
	B-737	3 times daily and one 4 times a week
- Ormoc	SD-360	3 times a week
- Ozamis	Fokker 50	daily
- Pagadian	SD-360	daily
- Puerto Princesa	SD-360	daily
- Surigao	SD-360	daily
- Tacloban	B-737	4 times a week
- Tagbilaran	SD-360	twice daily and one-4 times a week
- Tandag	Fokker 50	6 times a week
- Zamboanga via Pagadian	Fokker 50	daily
- Zamboanga via Dipolog	Fokker 50	daily
- Zamboanga	BAC-111	4 times a week

Source: Philippine Air Lines

TABLE 2-6

LIST OF PORTS IN CEBU PROVINCE

CLASSIFICATION	LOCATION
National	Cebu City
	Toledo City
	Jagna
	Hagnaya
Municipal	Aloguinsan
	Poblacion, Argao
	Gibuangan, Barile
	Japitan, Barile
	Nailo, Bogo
	Carmen
	Cordoba
	Bantayan
	Badian
	Daanbantayan
	Pajo, Lapu-Lapu City
	Sta. Rosa, Lapu-Lapu City
	Kaongakod, Madridejos
	Malbago, Madridejos
	Malabuyoc
	Mandaue City
	Kawit, Medellin
	Minganilla
	Poblacion, Moalboal
	Naga
	Osmena, Opon
	Daang Lungsod, Oslob
	Mainit, Santander
	Pilar, Camotes Island
	Lanao, Pilar
	Poro
	Ronda
	Samboan, Bato
	Puerto Balle, San Francisco
	Borbon
	Sta. Rosa
	San Benigno, Hagnaya
	Sibonga
	Sogod
	Sta. Fe, Bantayan Island
	Tabogon
	Tabuelan
	Tudela, Camotes Island

Source: Philippine Ports Authority

5. PUBLIC TRANSPORTATION

The availability of public transportation in the province is relatively good. Bus terminals are located in Cebu City and in several major towns such as Toledo, Tuburan, Asturias, Danao City and others. Buses, mini-buses and jeepneys are usually found waiting for the arrivals of inter-island ferries in Toledo, Tuburan and other ports so that travellers can continue their journey with as little interruption as possible. Tricycles form a large proportion of the traffic, particularly in municipalities where jeepneys are relatively few.

On Mactan Island, the more common form of public transportation are taxis, jeepneys and tricycles. Due to its proximity to Cebu City, regular jeepney trips are available. Tricycles provide short distance rides within Mactan Island, whether on regular or chartered trips.

C. THE ZONE OF INFLUENCE

1. INTRODUCTION AND GEOGRAPHIC SETTING

The zone of influence consists of the Island of Mactan made up of the two Municipalities of Cordova and Lapu-lapu City. It constitutes the principal resort area of Cebu, the second city of the Philippines, serving Cebuanos, domestic and foreign tourists alike, with quality hotels along white beaches. The city's international airport is also located here, as well as a port,and a fully operational Export Processing Zone (EPZ). The zone of influence is thus more suburban and urban, rather than rural.

The area of the zone of influence consist of 58 sq km in Lapu-Lapu City and 11.7 sq km in Cordova for a total land area of 69.7 sq km.

According to the Bureau of Soils and Water Management of the Department of Agriculture, Mactan Island has only two land classifications based upon land use opportunities. (see Figure 2-2) These constitute:

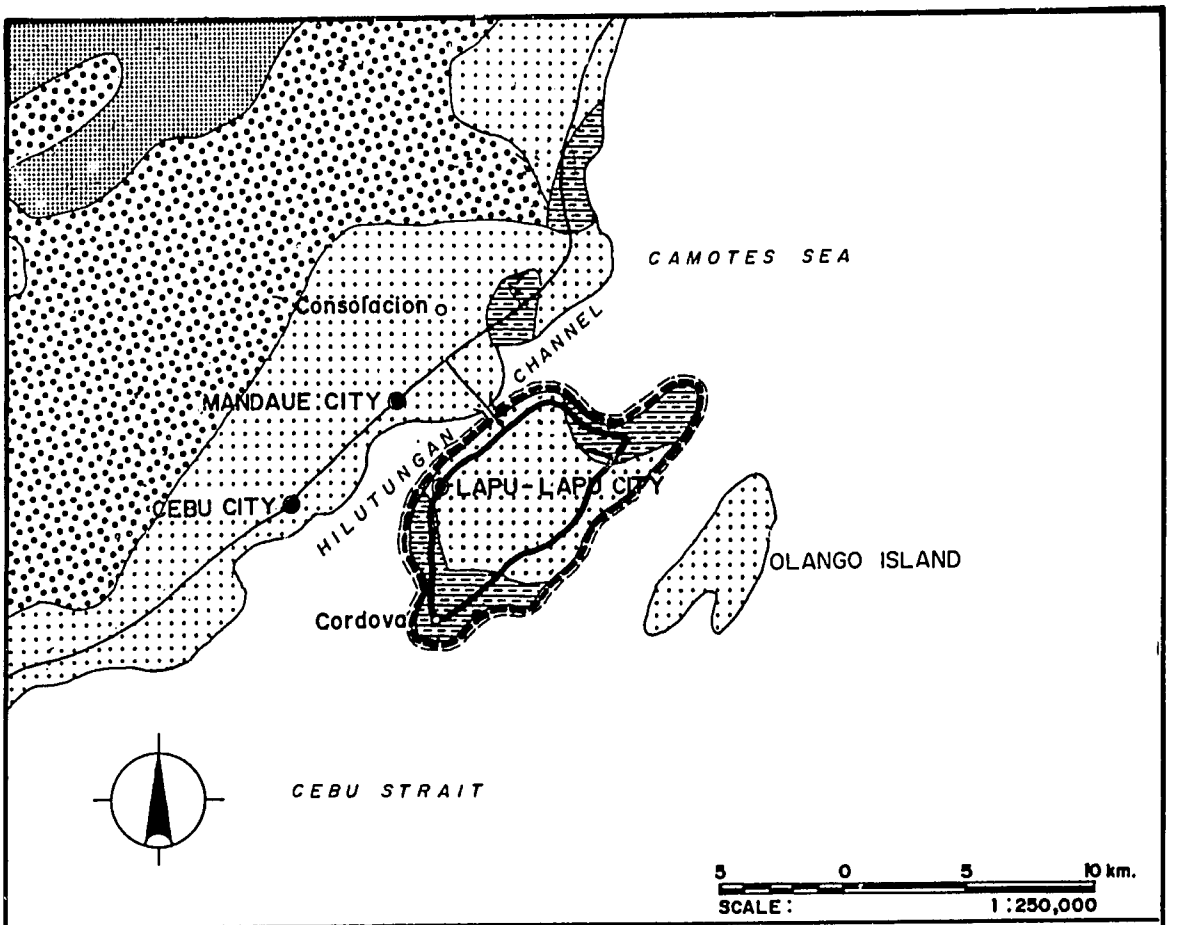
1. Lands that are actively utilized for various agricultural activities, including various infrastructure developments and human settlement areas; and

2. Brackish and freshwater wetlands including fishponds, which must be preserved to maintain a well-balanced productive aqua-marine ecology.

2. POPULATION

The population in the zone of influence is estimated at 150,000; 130,000 in Lapu-Lapu City and 20,000 in Cordova.

36



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

MACTAN CIRCUMFERENTIAL ROAD
LAND USE OPPORTUNITY MAP

Figure 2-2

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

3. THE LOCAL ECONOMY

The local economy is largely based upon service industries including transportation, tourism and commerce, as well as manufacturing, including the EPZ. These goods and services are supplied to:

- Cebu, the country's second largest city of nearly one million people, and the corresponding province;
- Central and Southern Philippines, which Cebu serves as a commercial and transportation gateway, representing 45% of the nation's population.
- tourists and investors from abroad, Manila and elsewhere in the Philippines.

a. Tourism and Transportation

i. Tourist Attractions

Major tourist developments are located along the eastern coastline of Mactan island, and include over twenty (20) established resorts with a total capacity of over 400 rooms, many meeting international standards. This resort capacity has nearly doubled in the last two to three years, with new developments along the beautiful white beaches of Punta Engano, Marigondon, Maribago, and in nearby Santa Rosa (Olango) island. (See Figure 2-3). There are also many restaurants and numerous forms of entertainment, and well recommended diving sites.

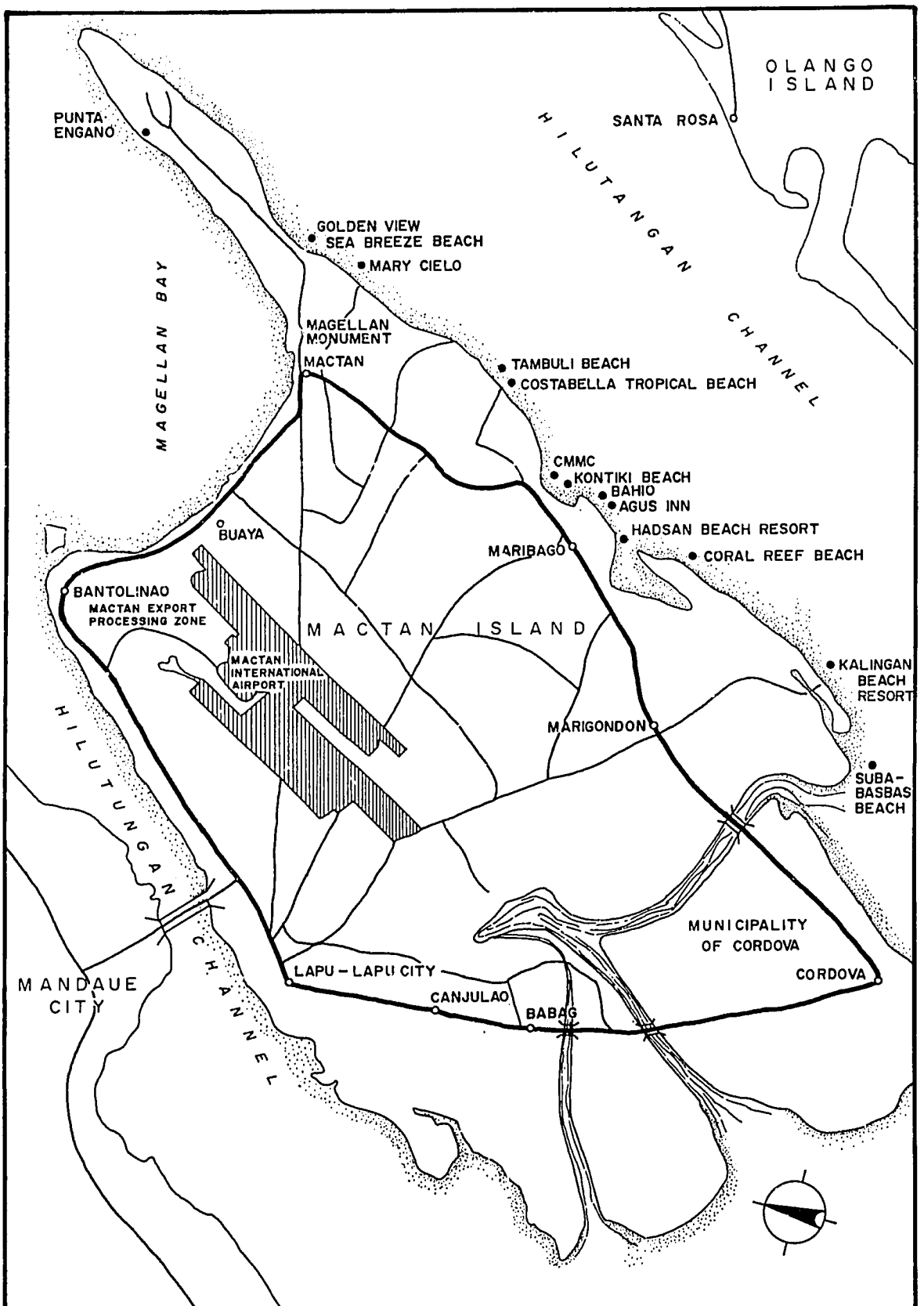
Planned developments include:

Punta Engano	-	Tan Yu Group (Taiwanese), a 300-600 room resort hotel.
	-	Shangri-la Hotel Corp. (Kuok Group of Hongkong), a nine story 336-room resort hotel.
Maribago	-	Tambuli Beach Resort, 80 room addition
Cordova	-	Japanese-financed golf course and resort facility.
Barrio Mactan	-	Proposed Philippine Tourism Authority public beach.

ii. Tourism Demand

According to the national tourist survey carried out by the Department of Tourism during 1988:

* 53% of all foreign tourists visited places outside of Manila



RURAL INFRASTRUCTURE FUND PROJECT	TOURIST SITE LOCATION IN MACTAN ISLAND	FIGURE 2 – 3

* of all tourists who visit locations outside of Manila, 19.1% of all foreign tourists and 12.6% of all overseas Filipinos visited Cebu, the second choice after Baguio.

This is equivalent to approximately 105,000 foreigners, nearly equal to the DOT Cebu Office's statistics of 108,000. Based on the island's share of Cebu's hotel capacity, approximately 24% stayed in Mactan or 26,000 guests. Many other foreign tourists staying in Cebu may visit the Mactan Island for extended trips.

The tourism demand analysis presented in Appendix B-1 of the Main Report indicates Cebu to have the highest attractiveness index of all locations studied, receiving 5.5 times more tourists than would be likely based exclusively on the cost of transportation and its population.

Cebu tourism is also growing faster than the overall rate estimated for the Philippines. According to the Cebu Tourism Situationer, published by the Department of Tourism in Region VII, growth rates are estimated at 10.3% for foreign and 12.2% for domestic tourists for the 1983-1990 period (see Table 2-7). These figures contrast with the projected national rates of 10.2% for foreign and 8.6% for domestic tourists (see Appendix B-1 of the Main Report). Thus, about 43,000 foreign and 85,000 domestic tourists will stay at Mactan Island's beaches along the proposed road improvement during 1993, the year the road would open.

iii. Tourist Profile

According to interview with tourist and resort owners, two types of tourists visit the zone of influence:

- foreign, especially Asian, and domestic tourists, seeking the pleasure and relaxation of quiet beaches with white sands, as well as numerous water sports, with quality hotels, restaurants and related services.

- Cebuanos coming to the island for the day or the weekend, whether owners or not of beach houses.

Tourists stay on an average of 4.2 days, equivalent to the average length of stay of foreign tourists outside Manila, according to the Department of Tourism's annual survey of tourists.

The average expenditures per day, based upon estimates presented in Appendix B-1 of the Main Report, projected to 1993, are about $140 for tourists arriving from abroad, a figure which takes into account the higher daily expenditure of Asian tourists, and P450 for domestic tourists (including expatriates). These consider a real annual increase in expenditures per person of 2% per year for foreign and 1.5% for domestic tourists, projected during the life of the project to continue due to increases in income per capita.

TABLE 2-7

CEBU TOURISM DEMAND

YEAR	INTERNATIONAL TOURISM	DOMESTIC TOURISM
1983	67,000	112,000
1984	96,689	139,267
1985	92,045	132,970
1986	98,982	136,780
1987	99,279	157,375
1988	110,135	208,177
1989	129,153	244,135
1990	133,028	251,459
geometric growth rate (1983-90)	10.3%	12.3%

Source: Department of Tourism, Cebu, 1989

iv. Transportation Services

As a result of growth in tourism, manufacturing and commerce, the demand for airport, port and other transportation services will increase at comparable rates.

b. Manufacturing, Commerce and Urban Development

The Export Processing Zone covering 120 has, located near the airport along the northwestern end of the island, already has over a dozen operating establishments, employing thousands of workers. Over half of the industrial lots are taken. The continued growth of industry in the EPZ will be a major factor in the accelerated growth of the island's economy.

Due to soil deficiencies and very rocky terrain the people in the ZOI have developed textile and furniture making, shellcraft, mat weaving, guitar making and other cottage industries either for export or local markets.

Shopping centers are being planned, including one in the Cordova area. These will represent an added attraction to the island for tourists and local residents alike, as well as assure continuous growth in average daily tourist expenditures.

The lack of water has limited the development of agriculture as well as urban expansion. However, increased land value makes expensive water sources financially more feasible. In addition, wetlands at the northern and southern tips have been reclaimed for (largely urban) development. See the land use opportunity

31

map shown in Figure 2-2.

c. Agriculture

Geographically, the zone of influence is not suitable to agricultural production because of its features characterized by hard, flat and rocky terrain. The island's limited agricultural activities are declining as the urbanization process absorbs rural land. At present, there are about 500 hectares or a little more than seven percent of the total land area devoted to agriculture.

Fruit trees (tamarind, jackfruits, mangoes etc.) abound on the island. Patches of corn and some rootcrops are evenly distributed inland, while coconut are scattered along the coast.

d. Fishing

Marine fishing is a major source of income of the island, since most of the villages are located along the coast. As of 1987, the municipality of Cordova had a total marine fish production of 1,170 M.T.

Inland fishing within the zone of influence has a total area of about 599 hectares with an estimated total annual production of 180 M.T.

4. IMPACT OF THE ROAD

The proposed road improvement will enhance the degree of integration of Mactan Island's economy by improving mobility within. The improved road will enhance the communication system within the island, reduce travel time between the rural and industrial areas, and provide greater travelling comforts to tourists visiting the island's attractive sites. Due to the expanding business opportunities offered by the Export Processing Zone as well as the presence the international airport in the island, other developments such as the expansion in the number of quality hotel rooms and related services, construction of major shopping centers and development of tourist attractions are expected to follow very soon.

As the zone of influence is not suitable to agricultural production, the road's impact would be on tourism, which is projected to increase as a result of these investments. The project benefits are estimated in terms of savings in vehicle operating cost. However, traffic projections take into account:

* greater growth rates of normal traffic due to these investments;

* greater generated traffic based on the road's role as a facilitating factor for the above-mentioned investment developments.

Detailed discussion of the project benefits are presented in Chapters III and VII.

III.
TRAFFIC

III. TRAFFIC

A. REVIEW OF AVAILABLE DATA

The Consultant reviewed traffic data contained in the Report on the Feasibility of the Improvement of Mactan Circumferential Road by DPWH-PMO-FS (February 1989). Considering that the report is relatively recent, the Consultant decided to use the traffic count data presented in the report. Additional traffic count gathered data from NTCP station 7501 was also used.

B. RIFP TRAFFIC SURVEY

Four types of traffic surveys are often used to collect the information needed in the engineering and economic analyses. These are:

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

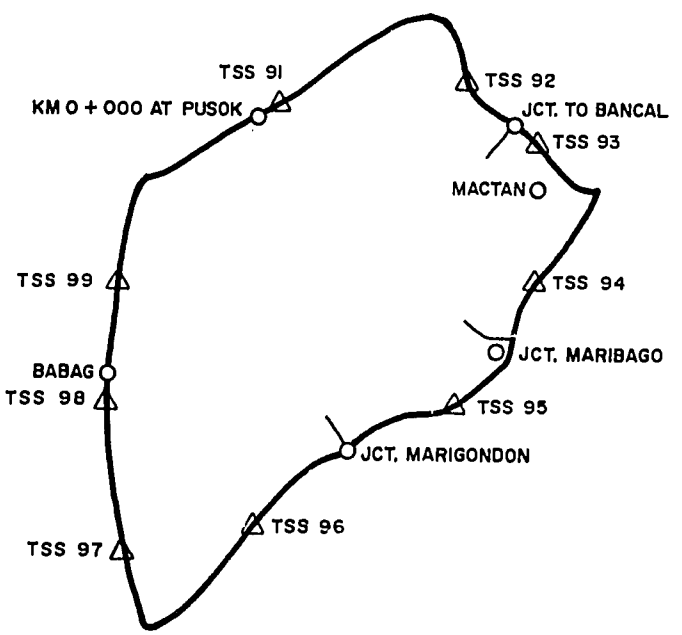
For this road project, required data were collected from secondary sources. The traffic count data as mentioned were taken from the February 1989 feasibility report of the DPWH-PMO-FS and the DPWH-NTCP count at station 7501. Locations of the traffic count stations and vehicle compositions are shown in Figures 3-1 and 3-2 respectively. Information on axle load surveys were obtained from the "Pavement and Axle Load Study", IBRD-DPWH, March 1985, by Renardet SA (see below).

C. HOMOGENEOUS TRAFFIC SECTIONS

For the purpose of preparing the traffic forecasts, the study road was 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 Mactan Circumferential Road:

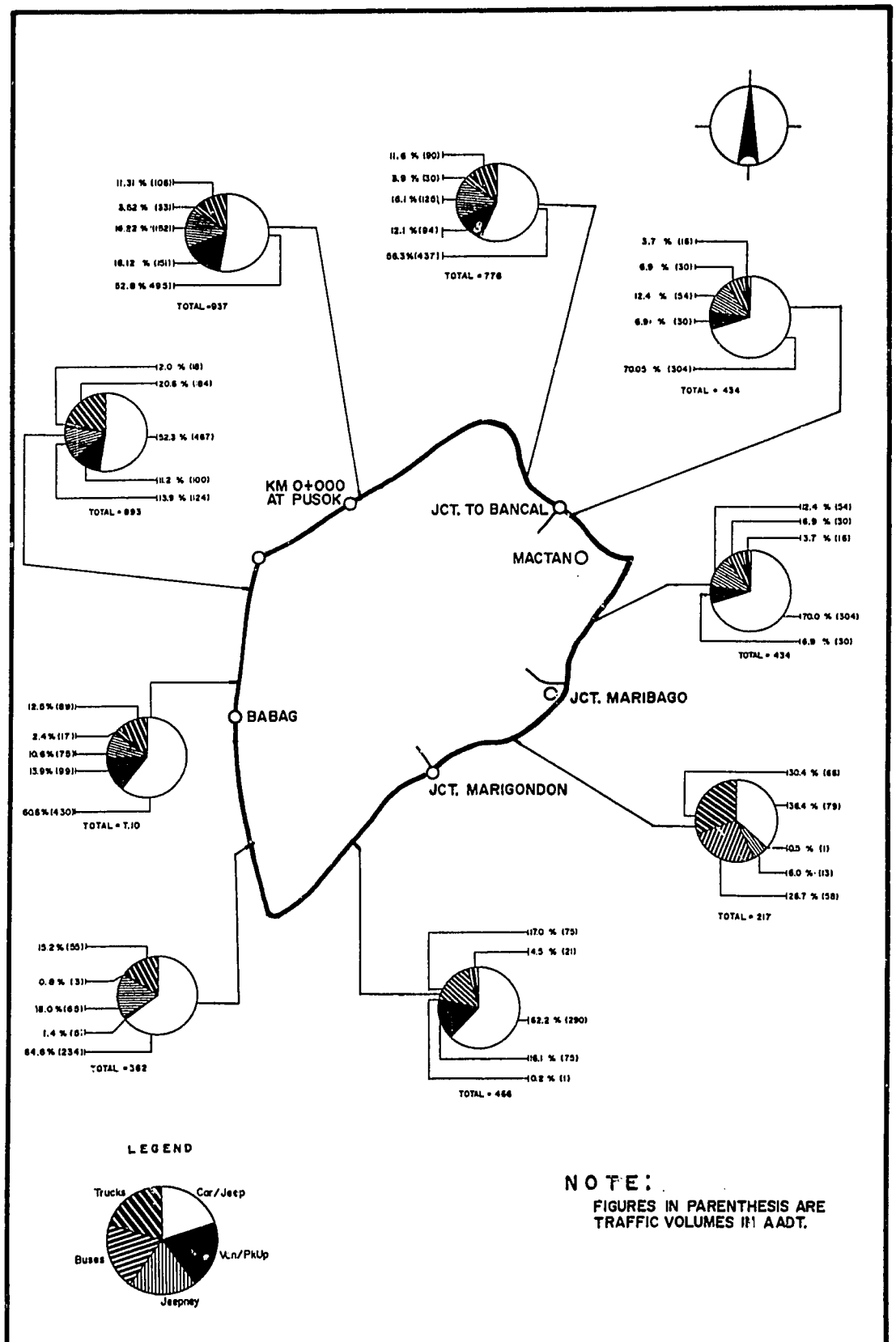
- Section 1 : km 0+000 at Pusok - Jct to Bankal
- Section 2 : Jct. to Bankal - Jct. Maribago
- Section 3 : Jct. Maribago - Jct. Marigondon
- Section 4 : Jct. Marigondon - Brgy. Babag
- Section 5 : Brgy. Babag - Looc/Pajo



LEGEND:

△ CROSS - SECTIONAL TRAFFIC COUNT

RURAL INFRASTRUCTURE FUND PROJECT	TRAFFIC SURVEY STATION Mactan Circumferential Road	FIGURE 3-1



RURAL INFRASTRUCTURE FUND PROJECT	1990 VEHICLE COMPOSITON Mactan Circumferential Road	FIGURE 3-2

D. ANALYSIS OF THE TRAFFIC DATA

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 values observed in the field in the "Pavement and Axle Load Study Reports on Surveys", Volume I, March 1985, by Renardet SA, FF Cruz & Co. and RC Gate and Associates. This study, though five years old, is the most comprehensive study of ESALs undertaken in the Philippines and has the advantage of broad coverage and large sample sizes. Because vehicle characteristics change very slowly in response to the introduction of new model types, the data from the Renardet study is considered reliable and was used to determine ESALs for this project. The following values are used in this project:

		Sections 1,5	Sections 2,3,4	
Bus	:	1.35	1.35	ESAL/vehicle
2-axle Truck	:	1.85	1.85	ESAL/vehicle
3-axle Truck	:	5.50	2.90	ESAL/vehicle
Articulated Truck	:	4.40	4.00	ESAL/vehicle

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 are usually done for normal traffic, generated traffic and diverted traffic. For this road project, diverted traffic is not significant and normal traffic has a large tourist component.

Two "Summary of Traffic Forecast" tables have been prepared for each section. The first one contains the basic assumptions for normal, tourism 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 3-1 to 3-10.

1. NORMAL TRAFFIC

Growth in normal traffic will occur even without the proposed project. Whether the project road is improved or not,

transportation demand will increase because of the continuing growth of population, employment, production, and income within the road's zone of influence.

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.

Tables of the growth rates mentioned above (T, P, and I) are shown for each province in Tables A-1-5 to A-1-7, 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 public transport as a whole since passengers are expected to shift from jeepneys to more comfortable and faster buses and to private vehicles. Consequently, the growth rate of buses is expected to grow at a slightly higher rate than the overall growth of 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 GRDP [illegible] rates for each province are shown in Table A-1-8, Appendix [illegible] the Main Report. They were used to estimate the growth rate [illegible] uck traffic in all the RIF road projects.

2. GEN[illegible] RAFFIC

The propo[illegible] ad improvement projects will reduce transport costs. This re[illegible]tion 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 for this road project would be mainly tourist traffic and has been estimated by the Development Economist to be from 10% to 20% of the base year normal traffic.

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 costs, the larger the amount of traffic which will be diverted to the project road.

For this project and as mentioned, there is no diverted traffic.

TABLE 3-1
SUMMARY OF TRAFFIC FORECAST
Mactan Circumferential Road

Section 1: Pusok – Jct. to Bankal

DESCRIPTION	VEHICLE TYPE									
	CAR JEEP	PKUP VAN	JPNY	SML BUS	LRGE BUS	2-AXL TRCK	2-AXL TRCK	ARTIC TRCK	AADT	OTHER
BASE YEAR (1990) ANNUAL AVE.DAILY TRAFFIC (AADT)	466	123	139	26	6	49	49	1	857	2049
TOURISM TRAFFIC 1990 AADT [A*0.50] (vpd)	208	54	62	11	3	22	22	0	381	912
GENERATED TRAFFIC (TOURISM) [A*0.10] (vpd)	47	12	14	3	1	5	5	0	86	205
1990 NORMAL TRAFFIC W/O TOURISM [A–B] (vpd)	258	69	77	14	3	27	27	1	475	1137
TOURIST TRAFFIC GROWTH RATE 1990–2012 (% PER YEAR)	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%		11.0%
TOURIST TRAFFIC on1993 [(B+C)*(1+E)^3]	349	90	103	19	4	36	36	1	639	1528
NORMAL TRAFFIC GROWTH RATE YEAR 1990–2000 (% PER YEAR)	9.0%	9.0%	4.5%	6.0%	6.0%	6.9%	6.9%	6.9%		6.0%
2000 NORMAL TRAFFIC W/O TOURISM	609	163	119	25	6	52	52	1	1027	2031
NORMAL TRAFFIC GROWTH RATE YEAR 1990–2012 (% PER YEAR)	9.5%	9.5%	4.7%	6.3%	6.3%	6.6%	6.6%	6.6%		6.3%
EQUIVALENT STANDARD AXLE LOAD (8.2 TONS) PER VEHICLE	0.00	0.00	0.03	0.30	1.35	1.85	5.50	4.40		0.002
EQUIVALENT PASSENGER CAR UNITS (PCUs) PER VEHICLE	1.00	1.00	1.50	1.50	2.00	2.00	2.00	3.00		0.50

TABLE 3-2
SUMMARY OF TRAFFIC FORECAST
Mactan Circumferential Road

Section 1: Pusok – Jct. to Bankal

Forecasted Annual Average Daily Traffic (AADT)
Equivalent Passenger Car Units (PCUs) ,and
Cumulative Equivalent Standard Axles 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 PKUP VAN	JPNY	SML BUS	LRGE BUS	2-AXL TRCK	3-AXL TRCK	ARTIC TRCK	AADT	OTHER			
1990	466	123	139	26	6	49	49	1	857	2049	2068		
1991	year of construction												
1992	year of construction												
1993	682	179	191	36	8	69	69	1	1236	2881	2939	1	200549
1994	750	197	206	39	9	75	75	2	1354	3130	3204	2	419150
1995	826	217	223	42	10	82	82	2	1483	3402	3494	3	657518
1996	908	239	241	46	11	90	90	2	1626	3700	3813	4	917537
1997	1000	262	261	50	12	98	98	2	1783	4026	4162	5	1201281
1998	1100	289	283	55	13	107	107	2	1955	4383	4546	6	1511029
1999	1211	318	307	59	14	117	117	2	2144	4774	4967	7	1849289
2000	1332	350	333	65	15	127	127	3	2353	5203	5429	8	2218820
2001	1470	386	363	71	17	139	139	3	2586	5679	5943	9	2622332
2002	1621	425	395	77	18	152	152	3	2843	6202	6508	10	3063126
2003	1788	469	430	84	20	166	166	3	3127	6775	7130	11	3544835
2004	1973	518	468	92	22	181	181	4	3439	7405	7814	12	4071465
2005	2176	571	511	101	24	198	198	4	3783	8097	8566	13	4647425
2006	2401	630	557	110	26	217	217	4	4163	8857	9394	14	5277579
2007	2649	695	609	121	28	238	238	5	4582	9692	10306	15	5967285
2008	2923	767	665	132	31	260	260	5	5044	10611	11310	16	6722455
2009	3225	846	728	145	34	285	285	6	5553	11622	12416	17	7549604
2010	3559	933	796	159	37	312	312	6	6115	12734	13634	18	8455924
2011	3927	1030	872	174	41	342	342	7	6735	13958	14976	19	9449345
2012	4334	1136	955	191	45	375	375	8	7419	15305	16456	20	10538624

41

TABLE 3-3
SUMMARY OF TRAFFIC FORECAST
Mactan Circumferential Road

Section 2: Jct. to Bankal - Maribago

DESCRIPTION	VEHICLE TYPE									
	CAR JEEP	PKUP VAN	JPNY	SML BUS	LRGE BUS	2-AXL TRCK	2-AXL TRCK	ARTIC TRCK	AADT	OTHER
BASE YEAR (1990) ANNUAL AVE.DAILY TRAFFIC (AADT)	304	30	54	24	6	8	8	1	434	1038
TOURISM TRAFFIC 1990 AADT [A*0.50] (vpd)	152	15	27	12	3	4	4	1	217	519
GENERATED TRAFFIC (TOURISM) [A*0.10] (vpd)	30	3	5	2	1	1	1	0	43	104
1990 NORMAL TRAFFIC W/O TOURISM [A-B] (vpd)	152	15	27	12	3	4	4	1	217	519
TOURIST TRAFFIC GROWTH RATE 1990-2012 (% PER YEAR)	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%		11.0%
TOURIST TRAFFIC on1993 [(B+C)*(1+E)^3]	249	25	44	20	5	6	6	1	356	852
NORMAL TRAFFIC GROWTH RATE YEAR 1990-2000 (% PER YEAR)	9.0%	9.0%	4.5%	6.0%	6.0%	6.9%	6.9%	6.9%		6.0%
2000 NORMAL TRAFFIC W/O TOURISM	359	35	42	21	5	7	7	1	479	928
NORMAL TRAFFIC GROWTH RATE YEAR 1990-2012 (% PER YEAR)	9.5%	9.5%	4.7%	6.3%	6.3%	6.6%	6.6%	6.6%		6.3%
EQUIVALENT STANDARD AXLE LOAD (8.2 TONS) PER VEHICLE	0.00	0.00	0.03	0.30	1.35	1.85	2.90	4.00		0.002
EQUIVALENT PASSENGER CAR UNITS (PCUs) PER VEHICLE	1.00	1.00	1.50	1.50	2.00	2.00	2.00	3.00		0.50

TABLE 3–4
SUMMARY OF TRAFFIC FORECAST
Mactan Circumferential Road

Section 2: Jct. to Bankal – Maribago

Forecasted Annual Average Daily Traffic (AADT)
Equivalent Passenger Car Units (PCUs) ,and
Cumulative Equivalent Standard Axles 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 PKUP VAN	JPNY	SML BUS	LRGE BUS	2-AXL TRCK	3-AXL TRCK	ARTIC TRCK	AADT	OTHER			
1990	304	30	54	24	6	8	8	1	434	1038	1015		
1991	year of construction												
1992	year of construction												
1993	446	44	75	34	8	11	11	1	631	1470	1453	1	30902
1994	491	48	81	37	9	12	12	2	692	1600	1588	2	64622
1995	541	53	88	40	10	13	13	2	760	1744	1735	3	101432
1996	596	59	96	44	11	14	14	2	835	1901	1898	4	141631
1997	656	65	104	48	12	15	15	2	917	2073	2076	5	185549
1998	723	71	113	52	13	17	17	2	1008	2262	2272	6	233551
1999	796	79	123	57	14	18	18	2	1108	2469	2488	7	286036
2000	877	87	134	62	16	20	20	3	1218	2696	2725	8	343446
2001	968	96	146	68	17	22	22	3	1341	2949	2990	9	406251
2002	1068	105	159	75	19	24	24	3	1477	3227	3281	10	474984
2003	1179	116	174	82	20	26	26	4	1627	3532	3601	11	550235
2004	1302	128	190	89	22	29	29	4	1793	3868	3954	12	632652
2005	1437	142	208	98	24	32	32	4	1976	4237	4343	13	722953
2006	1586	157	227	107	27	35	35	5	2178	4643	4772	14	821929
2007	1751	173	249	118	29	38	38	5	2401	5091	5245	15	930452
2008	1934	191	272	129	32	42	42	6	2647	5583	5766	16	1049486
2009	2135	211	298	142	35	46	46	6	2918	6126	6340	17	1180095
2010	2357	233	327	155	39	50	50	7	3218	6724	6974	18	1323454
2011	2603	257	359	171	43	55	55	7	3550	7383	7673	19	1480860
2012	2875	284	394	187	47	60	60	8	3915	8109	8445	20	1653749

49

TABLE 3-5
SUMMARY OF TRAFFIC FORECAST
Mactan Circumferential Road

Section 3: Jct. Maribago – Jct. Marigondon

DESCRIPTION	VEHICLE TYPE									
	CAR JEEP	PKUP VAN	JPNY	SML BUS	LRGE BUS	2-AXL TRCK	2-AXL TRCK	ARTIC TRCK	AADT	OTHER
BASE YEAR (1990) ANNUAL AVE.DAILY TRAFFIC (AADT)	79	1	13	58	0	33	33	0	217	519
TOURISM TRAFFIC 1990 AADT [A*0.50] (vpd)	47	1	8	35	0	20	20	0	130	311
GENERATED TRAFFIC (TOURISM) [A*0.10] (vpd)	8	0	1	6	0	3	3	0	22	52
1990 NORMAL TRAFFIC W/O TOURISM [A-B] (vpd)	32	0	5	23	0	13	13	0	87	208
TOURIST TRAFFIC GROWTH RATE 1990-2012 (% PER YEAR)	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%		11.0%
TOURIST TRAFFIC on1993 [(B+C)*(1+E)^3]	76	1	12	56	0	32	32	0	208	497
NORMAL TRAFFIC GROWTH RATE YEAR 1990-2000 (% PER YEAR)	9.0%	9.0%	4.5%	6.0%	6.0%	6.9%	6.9%	6.9%		6.0%
2000 NORMAL TRAFFIC W/O TOURISM	75	1	8	41	0	26	26	0	176	371
NORMAL TRAFFIC GROWTH RATE YEAR 1990-2012 (% PER YEAR)	9.5%	9.5%	4.7%	6.3%	6.3%	6.6%	6.6%	6.6%		6.3%
EQUIVALENT STANDARD AXLE LOAD (8.2 TONS) PER VEHICLE	0.00	0.00	0.03	0.30	1.35	1.85	2.90	4.00		0.002
EQUIVALENT PASSENGER CAR UNITS (PCUs) PER VEHICLE	1.00	1.00	1.50	1.50	2.00	2.00	2.00	3.00		0.50

TABLE 3-6
SUMMARY OF TRAFFIC FORECAST
Mactan Circumferential Road

Section 3: Jct. Maribago – Jct. Marigondon

Forecasted Annual Average Daily Traffic (AADT)
Equivalent Passenger Car Units (PCUs) ,and
Cumulative Equivalent Standard Axles 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 PKUP VAN	JPNY	SML BUS	LRGE BUS	2-AXL TRCK	3-AXL TRCK	ARTIC TRCK	AADT	OTHER			
1990	79	1	13	58	0	33	33	0	217	519	578		
1991	year of construction												
1992	year of construction												
1993	117	1	18	83	0	48	48	0	315	744	833	1	92690
1994	129	2	20	91	0	52	52	0	346	814	912	2	194250
1995	142	2	22	99	0	57	57	0	379	890	1000	3	305567
1996	156	2	24	109	0	63	63	0	417	974	1096	4	427620
1997	172	2	26	119	0	69	69	0	458	1066	1201	5	561486
1998	190	2	28	130	0	76	76	0	503	1168	1317	6	708357
1999	210	3	31	143	0	83	83	0	553	1280	1446	7	869548
2000	232	3	34	157	0	91	91	0	608	1403	1587	8	1046510
2001	256	3	37	172	0	100	100	0	669	1540	1743	9	1240748
2002	283	4	41	189	0	110	110	0	736	1690	1915	10	1454019
2003	313	4	45	207	0	121	121	0	810	1856	2106	11	1688264
2004	346	4	49	228	0	133	133	0	892	2039	2315	12	1945627
2005	382	5	54	250	0	146	146	0	982	2241	2546	13	2228476
2006	422	5	59	275	0	160	160	0	1082	2464	2802	14	2539431
2007	467	6	65	303	0	176	176	0	1192	2710	3083	15	2881385
2008	516	7	71	333	0	194	194	0	1314	2981	3394	16	3257538
2009	570	7	78	366	0	213	213	0	1449	3280	3738	17	3671428
2010	630	8	86	403	0	235	235	0	1597	3610	4117	18	4126967
2011	697	9	95	444	0	258	258	0	1761	3975	4535	19	4628482
2012	770	10	104	489	0	285	285	0	1943	4378	4998	20	5180758

51

TABLE 3-7
SUMMARY OF TRAFFIC FORECAST
Mactan Circumferential Road

Section 4: Jct. Marigondon – Brgy. Babag

DESCRIPTION	VEHICLE TYPE									
	CAR JEEP	PKUP VAN	JPNY	SML BUS	LRGE BUS	2-AXL TRCK	2-AXL TRCK	ARTIC TRCK	AADT	OTHER
BASE YEAR (1990) ANNUAL AVE.DAILY TRAFFIC (AADT)	262	40	33	2	40	14	14	11	414	553
TOURISM TRAFFIC 1990 AADT [A*0.50] (vpd)	67	12	7	0	12	3	3	3	106	142
GENERATED TRAFFIC (TOURISM) [A*0.10] (vpd)	38	4	7	0	4	3	3	1	60	79
1990 NORMAL TRAFFIC W/O TOURISM [A-B] (vpd)	195	28	26	1	28	11	11	7	308	411
TOURIST TRAFFIC GROWTH RATE 1990-2012 (% PER YEAR)	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%		11.0%
TOURIST TRAFFIC on1993 [(B+C)*(1+E)^3]	143	22	18	1	22	8	8	6	226	302
NORMAL TRAFFIC GROWTH RATE YEAR 1990-2000 (% PER YEAR)	9.0%	9.0%	4.5%	6.0%	6.0%	6.9%	6.9%	6.9%		6.0%
2000 NORMAL TRAFFIC W/O TOURISM	461	67	41	2	49	21	21	14	677	734
NORMAL TRAFFIC GROWTH RATE YEAR 1990-2012 (% PER YEAR)	9.5%	9.5%	4.7%	6.3%	6.3%	6.6%	6.6%	6.6%		6.3%
EQUIVALENT STANDARD AXLE LOAD (8.2 TONS) PER VEHICLE	0.00	0.00	0.03	0.30	1.35	1.85	2.90	4.00		0.002
EQUIVALENT PASSENGER CAR UNITS (PCUs) PER VEHICLE	1.00	1.00	1.50	1.50	2.00	2.00	2.00	3.00		0.50

TABLE 3-8
SUMMARY OF TRAFFIC FORECAST
Mactan Circumferential Road

Section 4: Jct. Marigondon – Brgy. Babag

Forecasted Annual Average Daily Traffic (AADT)
Equivalent Passenger Car Units (PCUs) ,and
Cumulative Equivalent Standard Axles 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 PKUP VAN	JPNY	SML BUS	LRGE BUS	2-AXL TRCK	3-AXL TRCK	ARTIC TRCK	AADT	OTHER			
1990	262	40	33	2	40	14	14	11	414	553	796		
1991	year of construction												
1992	year of construction												
1993	396	58	48	2	55	21	21	15	616	791	1162	1	86454
1994	434	64	51	2	59	23	23	16	672	854	1262	2	180039
1995	476	70	55	3	64	25	25	17	735	922	1372	3	281384
1996	523	77	59	3	69	27	27	19	803	996	1491	4	391179
1997	574	85	63	3	74	29	29	20	877	1076	1621	5	510177
1998	630	93	68	3	80	31	31	22	959	1163	1764	6	639201
1999	691	102	73	3	87	34	34	24	1049	1258	1919	7	779155
2000	758	112	78	4	94	37	37	26	1147	1362	2090	8	931028
2001	835	123	84	4	102	40	40	28	1258	1477	2280	9	1095833
2002	919	136	91	4	111	43	43	31	1379	1602	2488	10	1274748
2003	1011	150	98	5	121	47	47	34	1513	1739	2716	11	1469063
2004	1113	165	106	5	131	51	51	37	1659	1889	2966	12	1680196
2005	1226	181	114	6	143	56	56	40	1821	2052	3240	13	1909701
2006	1349	200	124	6	155	61	61	43	1998	2231	3541	14	2159285
2007	1486	220	134	7	169	66	66	47	2194	2426	3872	15	2430821
2008	1636	242	145	7	184	72	72	51	2409	2639	4234	16	2726367
2009	1801	267	157	8	200	78	78	56	2645	2873	4632	17	3048185
2010	1983	294	171	9	218	85	85	61	2905	3129	5069	18	3398758
2011	2184	324	185	9	238	92	92	66	3191	3409	5549	19	3780821
2012	2405	356	202	10	259	101	101	72	3506	3716	6076	20	4197376

53

TABLE 3-9
SUMMARY OF TRAFFIC FORECAST
Mactan Circumferential Road

Section 5: Brgy. Babag - Looc/Pajo

DESCRIPTION	VEHICLE TYPE									
	CAR JEEP	PKUP VAN	JPNY	SML BUS	LRGE BUS	2-AXL TRCK	2-AXL TRCK	ARTIC TRCK	AADT	OTHER
BASE YEAR (1990) ANNUAL AVE.DAILY TRAFFIC (AADT)	449	100	100	16	2	68	68	0	802	1070
TOURISM TRAFFIC 1990 AADT [A*0.50] (vpd)	90	20	20	3	0	14	14	0	160	214
GENERATED TRAFFIC (TOURISM) [A*0.10] (vpd)	90	20	20	3	0	14	14	0	160	214
1990 NORMAL TRAFFIC W/O TOURISM [A-B] (vpd)	359	80	80	13	1	55	55	0	641	856
TOURIST TRAFFIC GROWTH RATE 1990-2012 (% PER YEAR)	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%		11.0%
TOURIST TRAFFIC on1993 [(B+C)*(1+E)^3]	245	54	54	9	1	37	37	0	438	585
NORMAL TRAFFIC GROWTH RATE YEAR 1990-2000 (% PER YEAR)	9.0%	9.0%	4.5%	6.0%	6.0%	6.9%	6.9%	6.9%		6.0%
2000 NORMAL TRAFFIC W/O TOURISM	847	188	123	23	2	106	106	0	1396	1529
NORMAL TRAFFIC GROWTH RATE YEAR 1990-2012 (% PER YEAR)	9.5%	9.5%	4.7%	6.3%	6.3%	6.6%	6.6%	6.6%		6.3%
EQUIVALENT STANDARD AXLE LOAD (8.2 TONS) PER VEHICLE	0.00	0.00	0.03	0.30	1.35	1.85	5.50	4.40		0.002
EQUIVALENT PASSENGER CAR UNITS (PCUs) PER VEHICLE	1.00	1.00	1.50	1.50	2.00	2.00	2.00	3.00		0.50

TABLE 3-10
SUMMARY OF TRAFFIC FORECAST
Mactan Circumferential Road

Section 5: Brgy. Babag – Looc/Pajo

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

YEAR	Vehicle Type										PCUs per Day	Cumulative ESALs at En of year	
	CAR TAXI	JEEP PKUP VAN	JPNY	SML BUS	LRGE BUS	2-AXL TRCK	3-AXL TRCK	ARTIC TRCK	AADT	OTHER			
1990	449	100	100	16	2	68	68	0	802	1070	1532		
1991	year of construction												
1992	year of construction												
1993	710	157	145	24	2	104	104	0	1246	1604	2343	1	286292
1994	778	173	155	26	2	113	113	0	1360	1729	2543	2	596424
1995	854	189	166	28	3	122	122	0	1484	1865	2760	3	932496
1996	936	208	178	30	3	132	132	0	1620	2013	2998	4	1296807
1997	1027	228	191	33	3	143	143	0	1769	2173	3257	5	1691865
1998	1127	250	205	35	3	156	156	0	1932	2348	3540	6	2120419
1999	1237	274	220	38	4	169	169	0	2110	2538	3849	7	2585473
2000	1357	301	236	41	4	183	183	0	2306	2744	4187	8	3090317
2001	1493	331	254	44	4	199	199	0	2525	2973	4564	9	3637861
2002	1643	365	274	48	5	216	216	0	2766	3223	4976	10	4231959
2003	1808	401	296	52	5	234	234	0	3031	3496	5427	11	4876831
2004	1990	442	319	57	5	254	254	0	3322	3794	5921	12	5577101
2005	2190	486	345	62	6	276	276	0	3642	4119	6463	13	6337841
2006	2411	535	373	67	6	300	300	0	3993	4473	7057	14	7164611
2007	2654	589	404	73	7	327	327	0	4379	4861	7708	15	8063513
2008	2921	648	438	79	7	355	355	0	4804	5285	8423	16	9041241
2009	3216	713	475	86	8	387	387	0	5271	5749	9206	17	10105147
2010	3540	785	515	94	9	421	421	0	5784	6255	10067	18	11263301
2011	3897	865	560	102	10	458	458	0	6349	6810	11011	19	12524571
2012	4291	952	608	111	10	499	499	0	6971	7418	12048	20	13898700

55

IV.
ENGINEERING DESIGN

IV. ENGINEERING DESIGN

A. INTRODUCTION

The study road is located in DPWH Region VII on Mactan Island off the eastern coast of Cebu Island. The study road is a ring road which traverses the circumference of Mactan Island. The project begins approximately 800 meters northeast of the Mandaue-Mactan Bridge, which connects Mactan Island to Cebu, and traverses the island clockwise ending at the same point it began.

The total length of the study road is 27.0 kms, which is all paved in either asphalt or concrete surface. Nearly thirty percent of the road has been constructed of a concrete surface; however, some portions have been overlaid with asphalt. The road varies in width from 5.5 meters to 14 meters in residential areas and is located in flat terrain on a rocky subgrade of limestone. There are only three short span one-lane Bailey bridges located along the alignment, all in the Municipality of Cordova.

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

Section	Origin/Destination	Length (kms.)
1	Pusod-Jct. to Bankal	5.5
2	Jct. to Bankal-Jct. Maribago Road	5.0
3	Jct. Maribago Road-Jct. Marigondon Road	3.5
4	Jct. Marigondon Road-Barangay Babag	6.9
5	Barangay Babag-Looc-Pajo	6.1
	T O T A L	27.0 kms.

B. DATA COLLECTION AND ANALYSIS PERFORMED

1. ROAD INVENTORY

A road reconnaissance survey was carried out by the Consultant's staff during the period February 14-19, 1990. Data collected from this site visit consisted of:

1) Terrain classification
2) ROW width
3) Roadway formation width
4) Surface type, condition and width

4) Surface type, condition and width
5) Shoulder type and 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 the flooded areas
12) Location of drainage structures
13) Photographs

The road inventory data collection sheets are given in Appendix A of this report.

2. TOPOGRAPHIC SURVEY

No topographic surveys were conducted for this study road.

3. PUBLISHED STUDIES OF PROJECT ROAD

A feasibility study dated February 1989 entitled "FEASIBILITY STUDY ON SELECTED NATIONAL SECONDARY ROADS" was carried out by the DPWH Project Management Office, Region IV Compound, Quezon City. This study is a report on the feasibility of the improvements of the Mactan Circumferential road and was reviewed by the Consultant during the preparation of this report.

4. DRAINAGE AND BRIDGE INVENTORIES

a. General

Necessary information required for the feasibility design of drainage culverts and bridges for the Mactan Circumferential Road has been obtained from field investigation. Areas where flooding occurred during the past storms and heavy rainfall has been investigated. Existing drainage structures were also investigated and hydrologically assessed. Catchment area characteristics were specifically noted. The development perspective of the area, ascribing to its land use, has to a large extent, influenced design considerations.

b. Summary of Inventories

The Mactan Circumferential Road is a closed road network traversing the coast of Mactan Island. Mactan Island lies due east of Cebu City, and is geographically a part of Cebu Island Province in Region VIII, or Central Visayas. The road, being circumferential, has a common starting and terminal stations with geographical coordinates of:

Latitude - 10 18' 59" North
Longitude - 123 57' 41" East

Consistent with traffic densities, the road is segmented into five (5) engineering sections as follows;

i. Pusok-Bankal km. 0+000 - km. 5+500

This road segment begins at km. post 11 opposite the government center in Mactan Island. It runs northeast to Bantolinao, thence southeast to a portion of Bankal. It traverses a generally flat terrain.

Existing drainage culverts vary from 460 mm to 910 mm diameters with an average density of one (1) structure per 120 m. Most of these culverts have no headwalls and endwalls.

ii. Bankal-Maribago km. 5+500 - km. 10+458

This road section traverses southeast from Bankal towards Barangay Mactan, from where it moves southwest to the coastal barangay of Maribago. The road runs through generally flat terrain. The alignment lies along a residential section, marked by a sharp increase in population density.

There are no adequate drainage structures along this section. Flooding problems, however, have been least experienced in the area according to local residents. Simulated conditions based on past events has to be considered.

iii. Maribago-Marigondon km. 10+458 - km. 14+005

This road segment starts at the junction of the Maribago-Lapu-Lapu Road with the Maribago-Marigondon road alignment. It runs southwest from Maribago to another coastal town of Marigondon. The terrain is generally flat with isolated slope transitions. A 396 m. section along the alignment has been identified as flood prone. The inadequacy of drainage structures or ditches along this section has been observed. Proposed drainage structures along the alignment is given in Table B-2.

iv. Marigondon-Babag km. 14+005 - km. 20+934

This road section comprises the southern corner of the circumferential road covering the Municipality of Cordova, with three existing bailey bridges along the alignment: the Gabi Bridge, Pilipog I, and Pilipog II bridges. The alignment starts at Marigondon, then moves southwest to Cordova where it winds northwest to Babag. It traverses a generally flat terrain bounded by fishponds and hatcheries.

Drainage structures within the Cordova perimeter is inadequate. Some relief pipes along this section exist.

Provision of drainage structures along the alignment is given in Table B-2.

v. Babag-Pajo km. 20+934 - km. 27+207

From Barangay Babag, where this road section starts, the road moves northeast to Lapu-lapu City, then northeast further to Barangay Pajo at km post 11. This section completes the circumferential grid passing through flat terrain. It is along this section where the highly urbanized area lies, Lapu-Lapu City. Commercial and residential districts are the dominant land use.

The design of drainage system for this road, particularly those within the highly populated and developed area, has to account for sewer effluents.

5. DRAINAGE STUDIES

a. Rainfall Data

There are no streamflow data available for the area. For this study, the rainfall data of Cebu (Lahug) Airport Weather Station is applied. Figure 4-2 is a climatic map of the Philippines from PAGASA showing the four (4) types of seasons in the Archipelago. The area belongs to type III, not very pronounced; relatively dry from December to May and wet during the rest of the year. Mactan Island is bounded by Cebu Mainland on the west, by Magellan Bay on its north, the Hilutangan Channel at the east and the Strait of Cebu at the south. The surrounding bodies of water and the geographic location of the project area has, to a large extent, influenced the design of the drainage system.

Data on the rainfall analyses for different durations and return periods for Cebu Airport from PAGASA is given in Table B-1. From these analyses, the rainfall intensity-duration-frequency equations for the project road were derived and used in this study.

b. Rainfall Intensity-Duration Equations Used

In the development of the rainfall intensity-duration equations, a power regression analysis of the form $y = ax^b$ was used. The resulting intensity-duration equation developed is:

$$I = A(t+d)^b$$

where:

I = Intensity of rainfall in mm/hr
t = Time in minutes, and the values of A, b, and d are determined from the regression analysis.
d = A scaling constant added to t to improve the linearity

60

Figure 4-3 presents the developed rainfall intensity - duration frequency curves for recurrence intervals of 5, 10, 25 and 50 years applied to the project. Figures 4-4 thru 4-7 show normal and extreme daily rainfall per month for Cebu Airport (Lahug) Weather station and considered representative to the project area.

c. Drainage Areas

Catchment areas of drainage structures were delineated on a 1:50,000 scale topographic map of Mactan Island. This is presented as Figure 4-1 in this study. The basic parameters calculated for the drainage areas include:

- Area, in hectares;
- Length of the waterway along the main line of flow, in meters;
- Difference in elevation between the most distant point in the watershed and the outlet point, in meters; and
- Estimate of run-off coefficients, C

d. Run-off Quantity Calculation

Run-off quantities (design discharges) for drainage areas of 1,000 hectares or less were computed using the Rational Formula;

$$Q = \frac{CIA}{360}$$

where:

Q = Design discharge, in m^3/sec
C = Run-off coefficient
I = Rainfall intensity for the calculated time of concentration, t, in mm/hr
A = Drainage area, in hectares

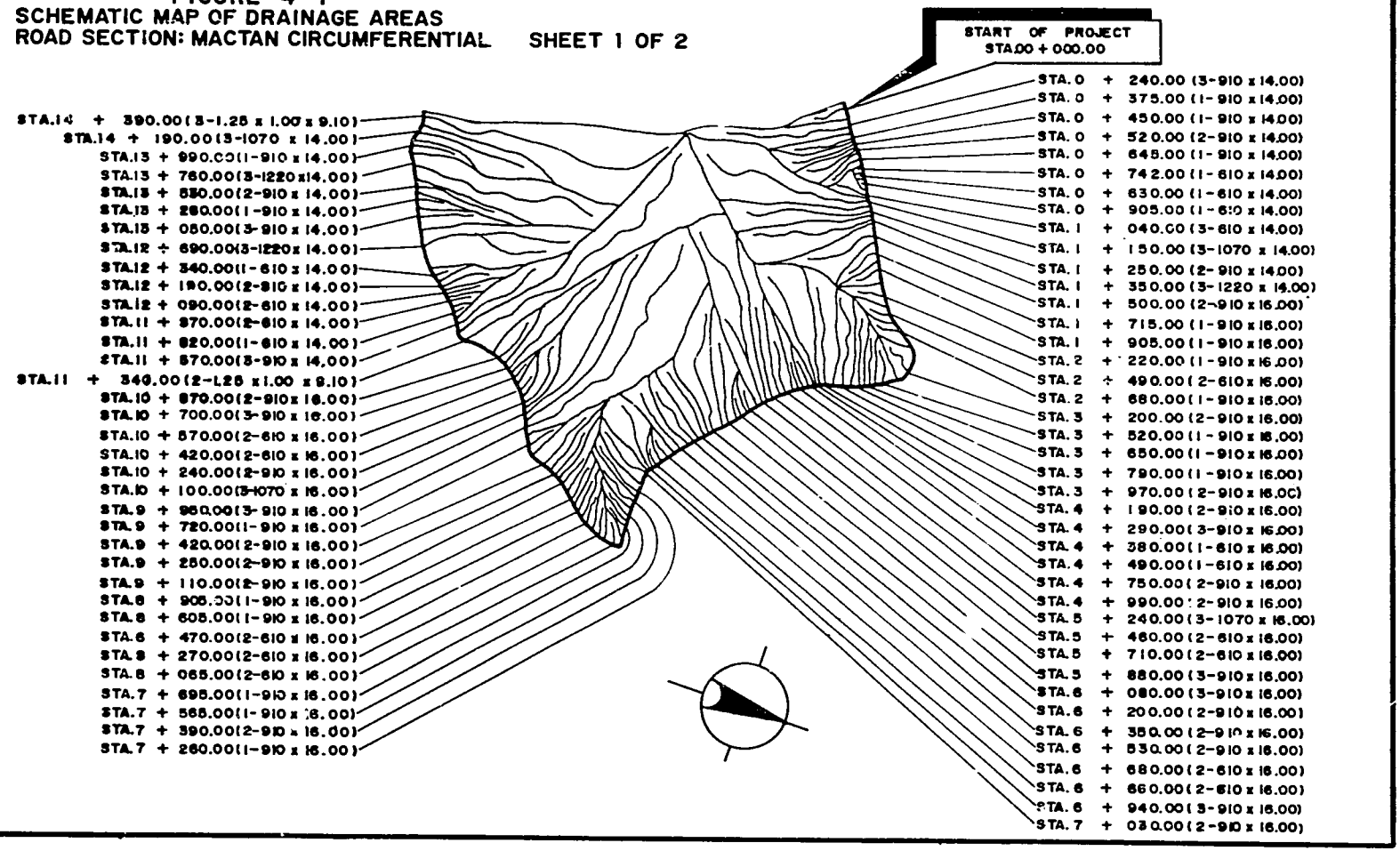
The time of concentration was determined using the Kirpich Formula

$$Tc \quad \frac{L^{1.15}}{51H^{0.385}}$$

where:

Tc = Time of concentration, in minutes
L = Length of the waterway along the mainstream, in meters

FIGURE 4-1
SCHEMATIC MAP OF DRAINAGE AREAS
ROAD SECTION: MACTAN CIRCUMFERENTIAL SHEET 1 OF 2



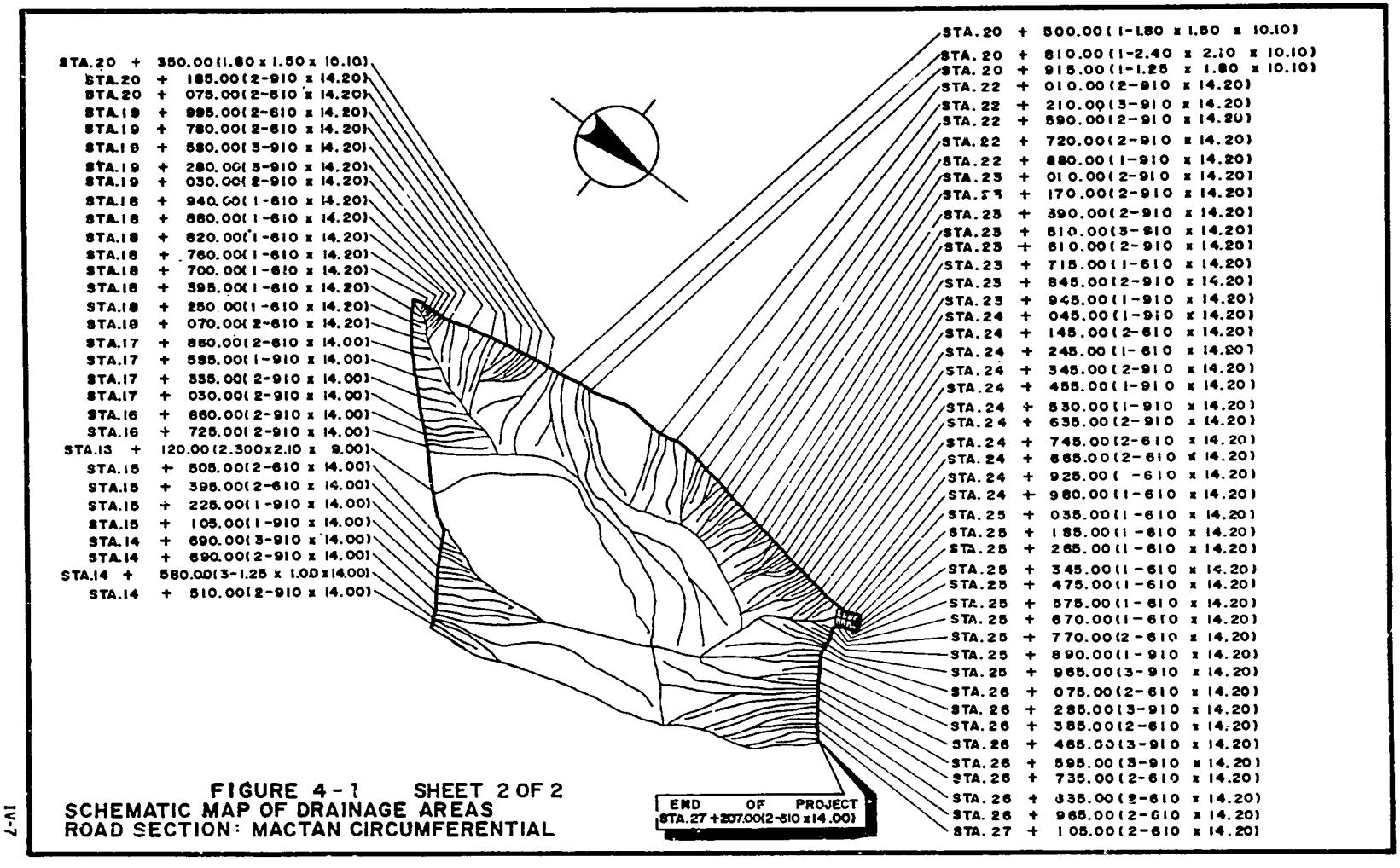


FIGURE 4-1 SHEET 2 OF 2
SCHEMATIC MAP OF DRAINAGE AREAS
ROAD SECTION: MACTAN CIRCUMFERENTIAL

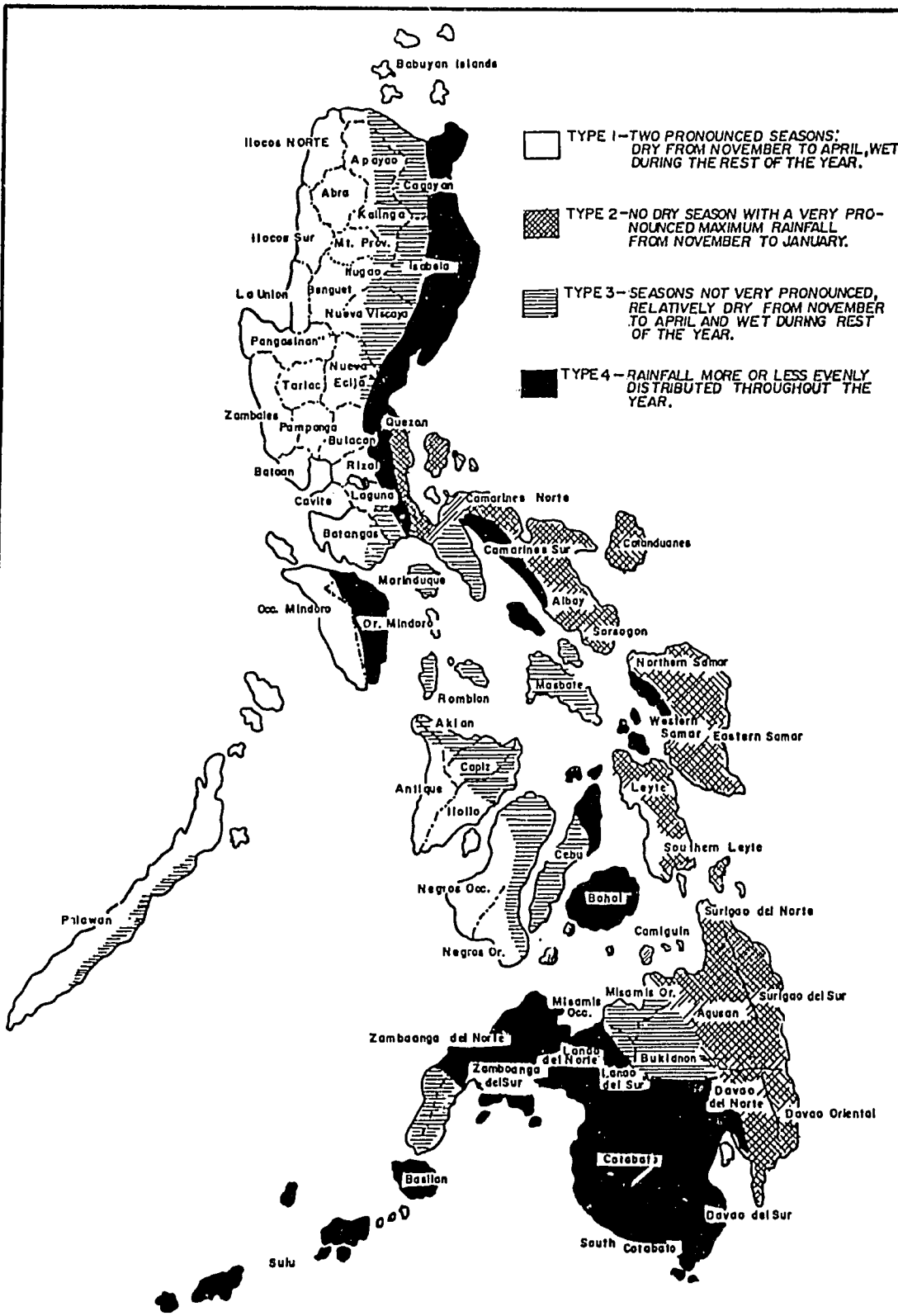


FIG. 4-2
CLIMATE MAP OF THE PHILIPPINES

64

FIGURE 4-3

RAINFALL INTENSITY - DURATION - FREQUENCY CURVES

ROAD SECTIONS : MACTAN CIRCUMFERENTIAL ROAD

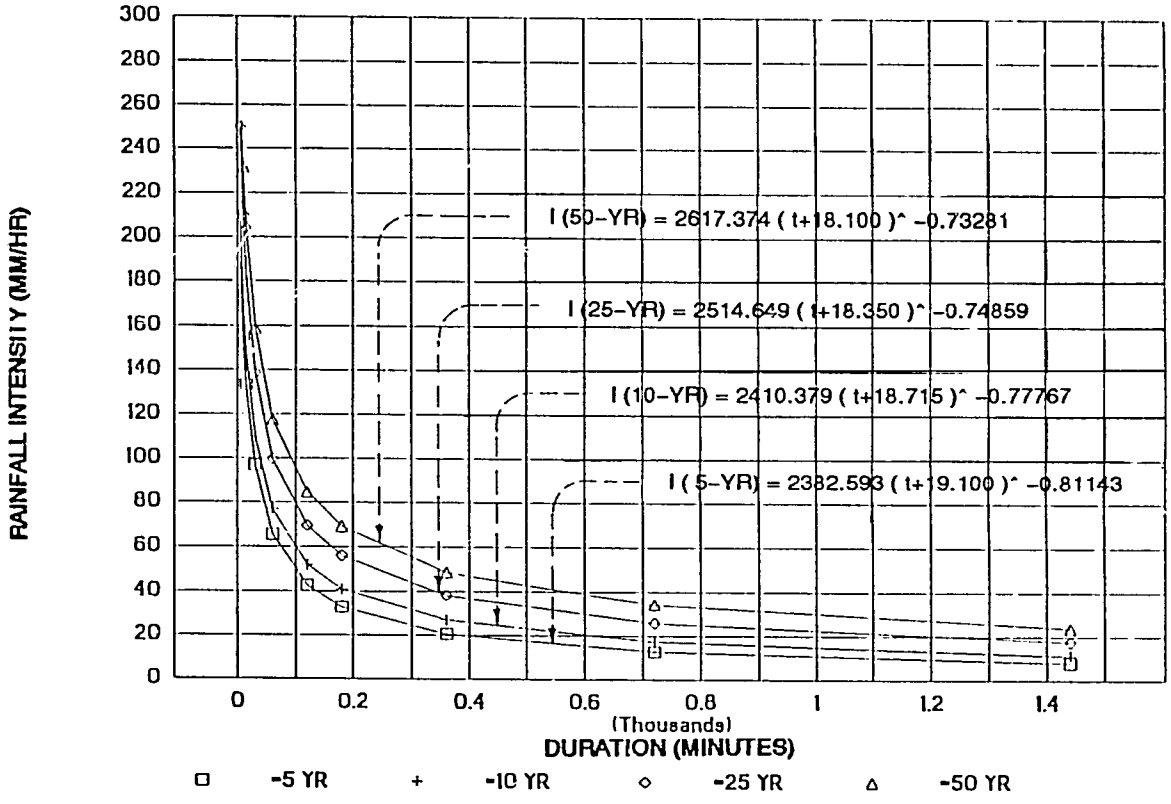
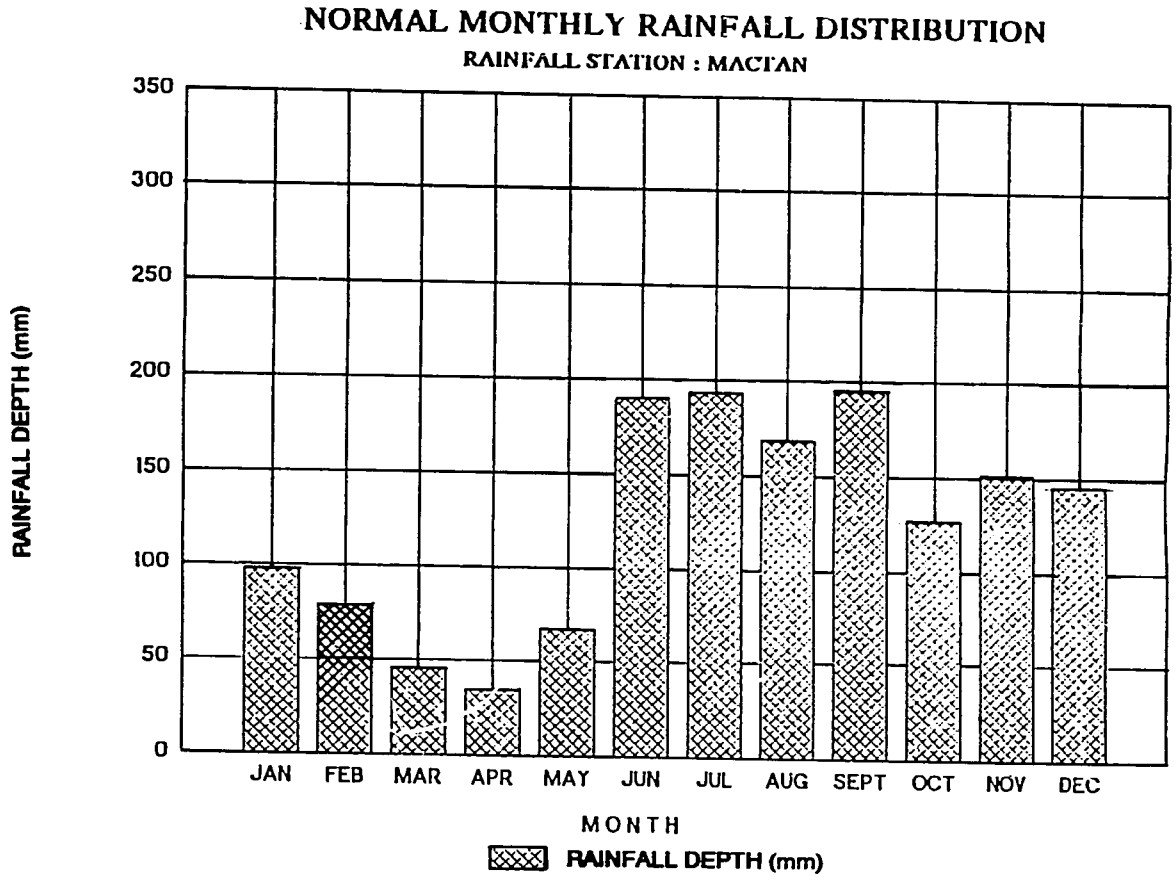


FIGURE 4-4


NORMAL MONTHLY RAINFALL DISTRIBUTION
RAINFALL STATION : MACTAN
RAINFALL DEPTH (mm)
350
300
250
200
150
100
50
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEPT
OCT
NOV
DEC
MONTH
RAINFALL DEPTH (mm)

66

FIGURE 4-5

NORMAL MONTHLY NUMBER OF RAINY DAYS

RAINFALL STATION : MACTAN

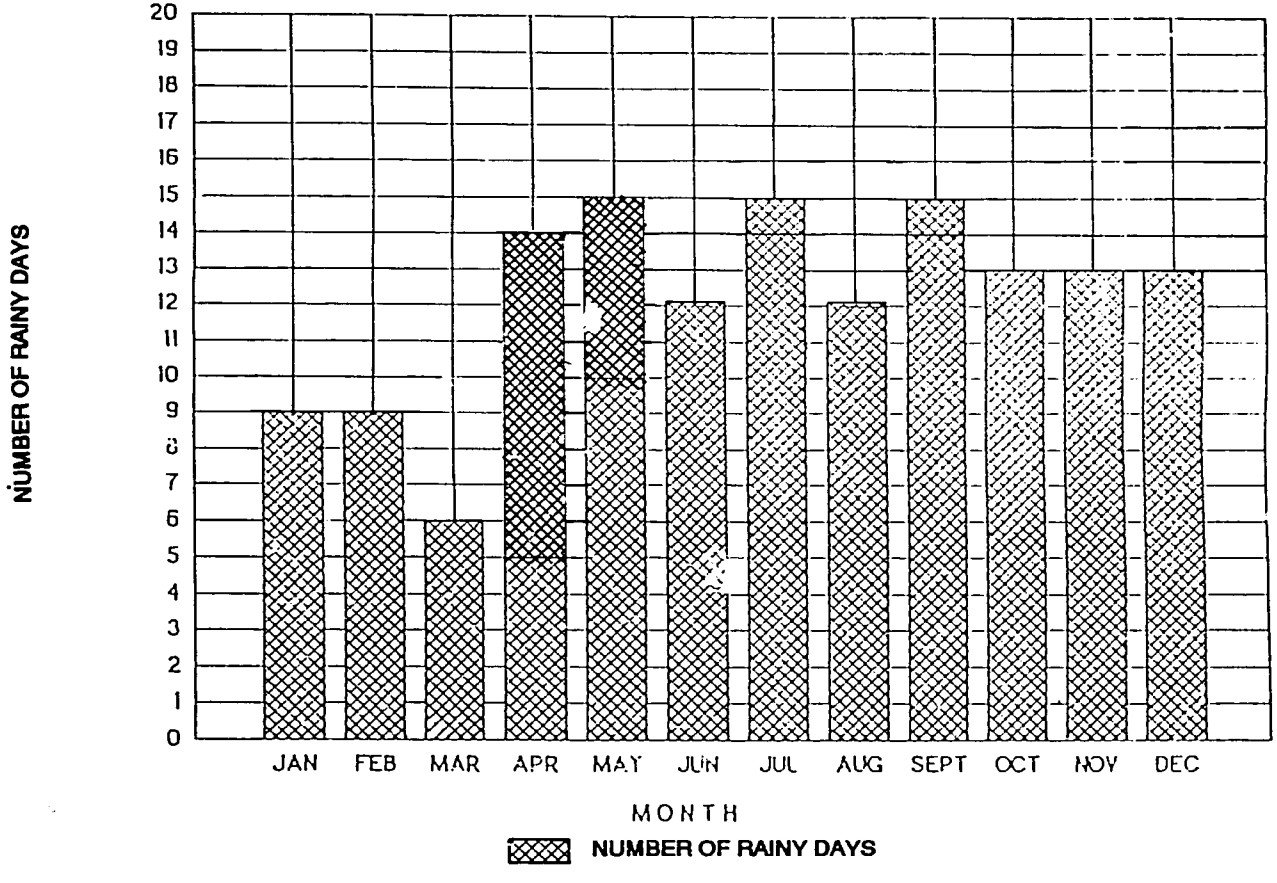


FIGURE 4-6

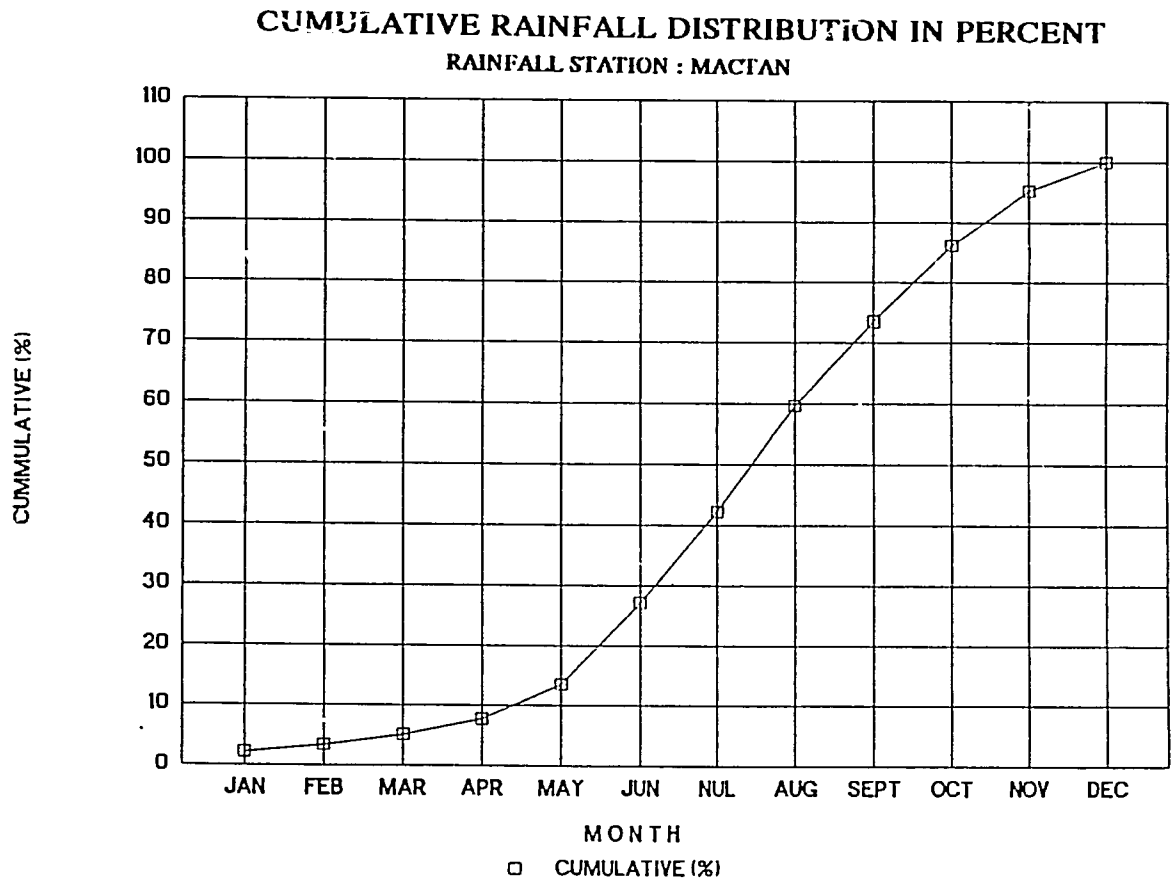
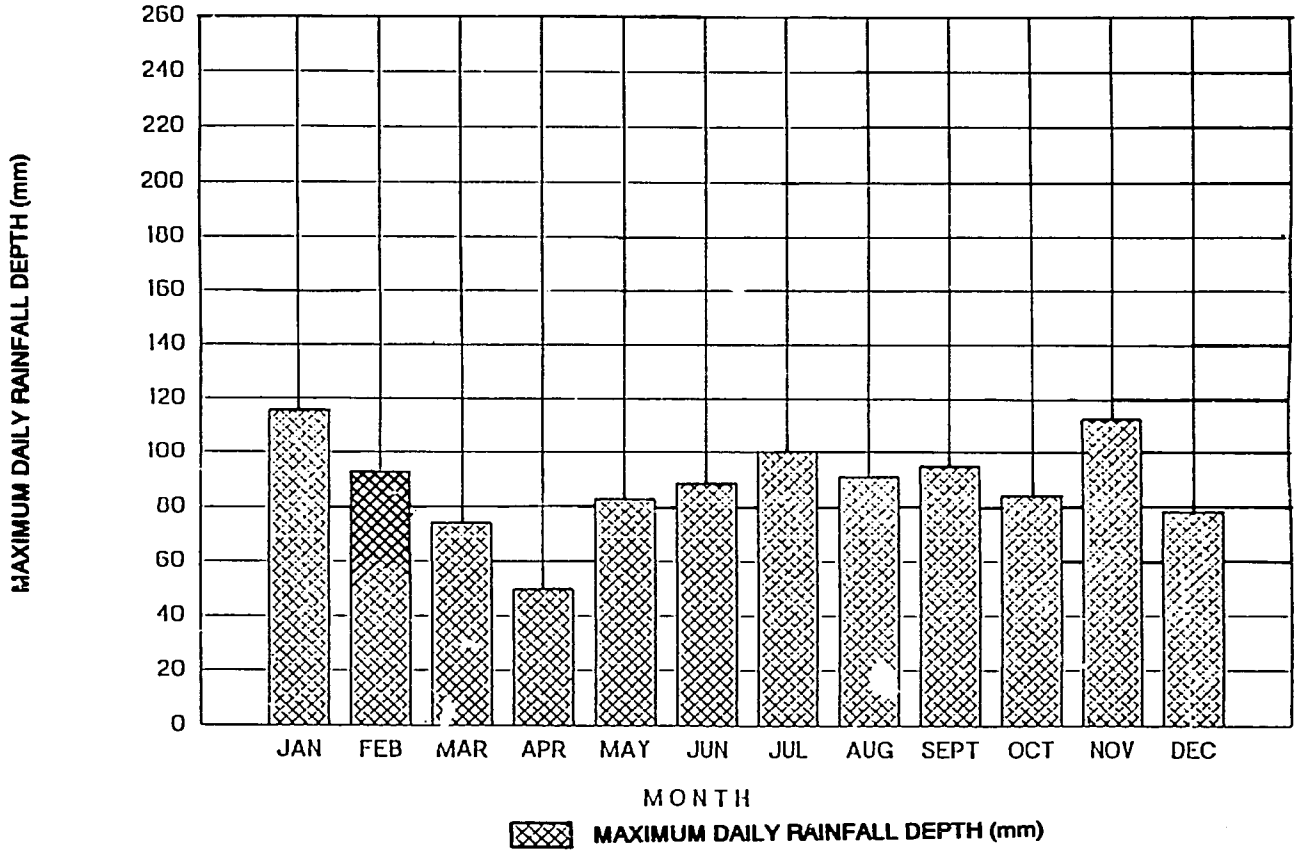

CUMULATIVE RAINFALL DISTRIBUTION IN PERCENT
RAINFALL STATION : MACTAN
CUMMULATIVE (%)
110
100
90
80
70
60
50
40
30
20
10
0
JAN
FEB
MAR
APR
MAY
JUN
NUL
AUG
SEPT
OCT
NOV
DEC
MONTH
CUMULATIVE (%)

FIGURE 4-7

MAXIMUM DAILY RAINFALL DISTRIBUTION

RAINFALL STATION : MACTAN



H = Difference in elevation between the most distant point in the watershed and the outlet point, in meters.

A minimum value of 5 minutes was used in the calculation of rainfall intensities. This value is representative of a duration most effective in producing floods in small drainage areas. The catchment area parameters used in sizing drainage structures are given in Table B-2.

e. Storm Return Periods

The following design storm frequencies were used for drainage structure's types listed below:

Structure Type	Design Storm Frequency, Years
Bridge	50
RCBC	25
RCPC	10
Road Ditch	2-5

f. Selection of Culvert Size and Type

The following hydraulic design criteria were used in the selection and sizing of drainage structures:

- A minimum Reinforced Concrete Pipe (RCP) diameter of 610 mm and a maximum of 1220 mm.

- An assumed design velocity of 3 m/sec. This value is generally considered to be the allowable maximum velocity over concrete structures. The allowable velocity over concrete usually ranges from 0.6 to 3.0 m/sec.;

- The choice between using a reinforced concrete box culvert or a pipe culvert is normally influenced by such factors as the size of the drainage area, drainage discharge capacity, the size of the waterway, and the vertical clearance available beneath the elevation of the finished roadway. For economy in design, concrete pipes should be adopted whenever possible.

C. DESCRIPTION OF THE ROUTE

The description of the existing road and the proposed alignment is best described by section as detailed below.

SECTION 1 - PUSOK - JCT. TO BANKAL (KM. 0+000-5+500)

The study road begins at km post 11, in front of the Municipal Hall, approximately 800 meters northeast of the Mandaue-Mactan (Opon) Bridge and runs in a northeast direction passing through the EPZ compound and ending at a junction with the road to Bankal. The initial 1.6 kms of road has a PCC surface 7.3 meters wide with shoulders ranging in width between 1.0-1.5 meters. The pavement is in fair condition and some portions have been overlaid with asphalt. The following 2.5 km segment of road is asphalt surfaced in fair condition 6.1 meters wide with one meter shoulders. The remaining 1.4 km segment has a concrete surface 6.1 meters wide in fair condition also with one meter shoulders. Segments of this PCC pavement have also been recently overlaid with asphalt.

SECTION 2 - JCT. TO BANKAL - JCT TO MARIBAGO ROAD (KM 5+500-10+458)

The study road continues in a clockwise direction with the same kind and size pavement for the last segment of section one. The pavement becomes asphalt just past Barangay Mactan for the next 2.9 kms; this pavement is 6.1 meters wide with 0.5-1.0 meter earth shoulders with the asphalt in fair to bad condition.

The remaining 175 meter road segment is concrete surfaced 6.1 meters wide in poor condition with similar earth shoulders. Section 2 ends at a junction with the road to Tombuli, Agus and Maribago.

SECTION 3 - JCT. TO MARIBAGO ROAD - JCT. TO MARIGONDON ROAD (KM 10+458-14+005)

Section 3 is a short segment on the southern shore of Mactan Island between the road junctions specified in its title. The initial 650 meter segment of this section is a concrete pavement 6.1 meters wide in poor condition with one meter earth shoulders. The remaining 2.85 kms of road is asphalt surfaced 5-6 meters wide with narrow, earth shoulders. The asphalt surface is in fair to poor condition, except for the last 350 meter segment which may be classified as good. Section 3 ends at a junction with the Lapu-Lapu City/Marigondon beach road.

SECTION 4 - JCT. TO MARIGONDON ROAD - BARANGAY BABAG (KM 14+005-20+934)

The first km of section 4 had a good asphalt surface 6 meters wide. The remaining 5.9 kms is also asphalt surfaced; however, the pavement is 4-5 meters wide and in fair condition with earth shoulders one half meters wide. All bridges are one-lane short span bailey structures; Gabi bridge at km. 15+487, Pilipog No. 1 at km 20+307 and Pilipog No. 2 at km. 20+433. Barangay Cordova proper, located at km. 18+430 has R/W limits of only 12 meters.

Section 4 ends in Barangay Babag.

SECTION 5 - BARANGAY BABAG - LOOC - PAJO (KM 20+934-27+000)

The first 4.2 kms of section 5, in Barangay Babag and beyond, are surfaced with asphalt 5.5-6.1 meters wide in fair condition. The following 305 meters of roadway, between kms. 25+152-25+457, are located in Lapu-Lapu City proper with a paved asphalt surface ranging from 7.5-14 meters. This segment is a built-up commercial/residential are with curb and gutters. The remaining 1.5 kms of the study road are concrete surfaced in commercial/residential areas with pavement varying in width from 7.3 to 10 meters. The junction to the Mandaue-Mactan Bridge is located at km. 26+172. The project ends at its beginning point, at km. stone 11.

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 was adopted from the "DPWH Minimum Design Standards" and are given in Table 4-1. These criteria also determined the typical section for the study road and are given in Figure 4-8.

Most of the design criteria are specified by terrain type; flat, rolling and mountainous. Only flat and rolling criteria will apply to this study road.

Two pavement types were costed for economic evaluation for the study road, an asphaltic concrete (AC) pavement section and a Portland cement concrete (PCC) pavement.

1. PUSOK - JCT. TO BANKAL (km. 0+000-5+500)

The projected traffic for this section is:

	Vehicles per day
1993 AADT	1,236
2002 AADT	2,843

The desired roadway width for this projected traffic level is a 6.7 meter carriageway with 2.5 meter shoulders. The geometric design criteria for this section are those for flat terrain.

76

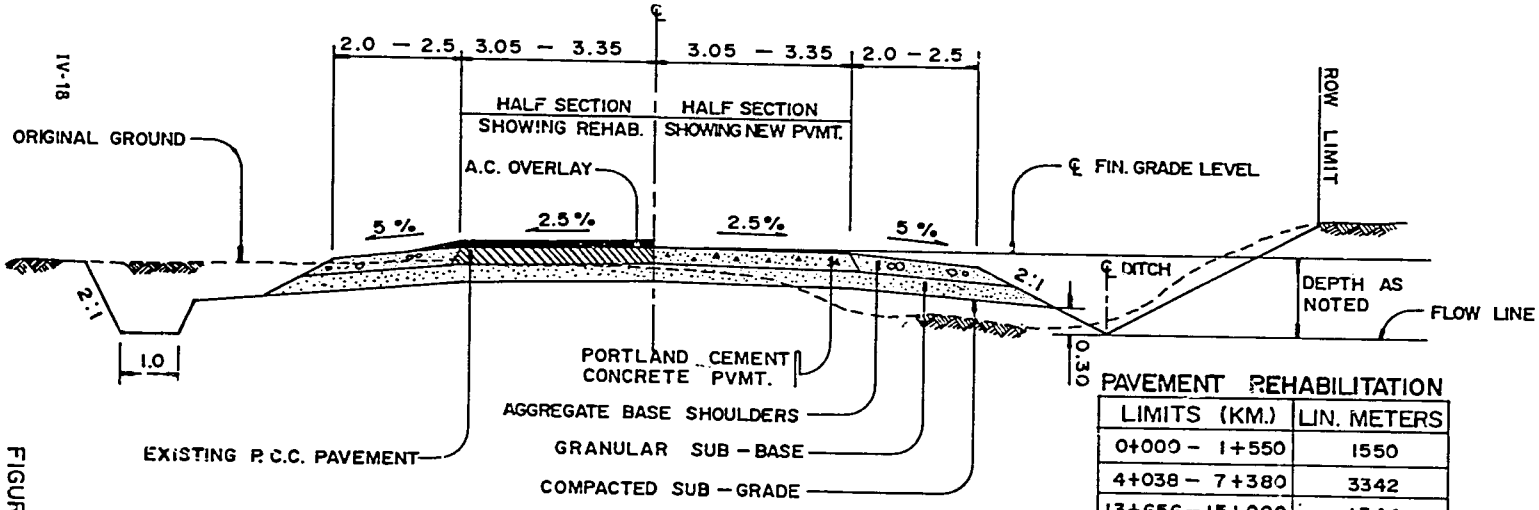
TABLE 4-1

DETAILED DESIGN CRITERIA
MACTAN CIRCUMFERENTIAL ROAD

ROAD SEGMENTS	1 & 5	2,3 & 4
DESIGN SPEED (Kph)		
Flat	95	90
Rolling	80	80
Mountainous	60	50
RADIUS (M)		
Flat	320	280
Rolling	220	220
Mountainous	120	80
GRADE (%)		
Flat	3	3
Rolling	5	5
Mountainous	6	6
PAVEMENT WIDTH (M)	6.7	6.1
SHOULDER WIDTH (M)	2.5	2.0
ROW WIDTH (M)	30	30
MAX. SUPERELEVATION (M/M)	0.10 (Max.)	0.10 (Max.)
STOPPING SIGHT DISTANCE (M)		
Flat	150	135
Rolling	115	115
Mountainous	70	60
PASSING SIGHT DISTANCE (M)		
Flat	645	615
Rolling	560	560
Mountainous	420	350

RECOMMENDED ROAD SECTION DESIGN STANDARDS

FIGURE 4 - 8



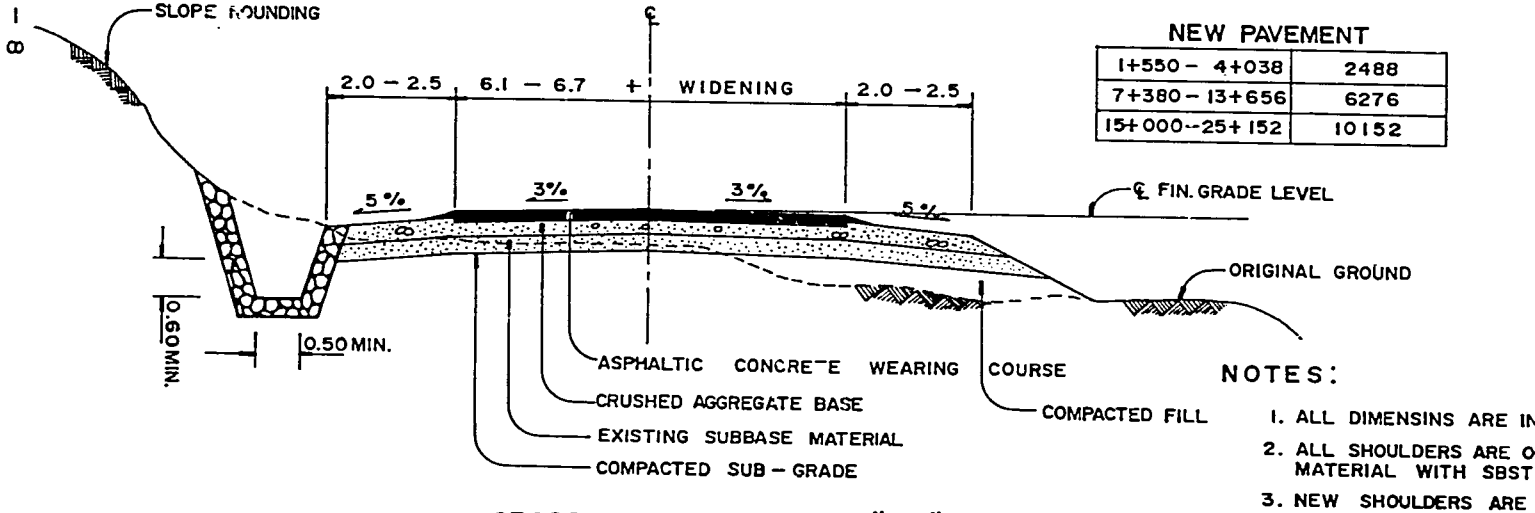
CROSS SECTION TYPE "A"
(PCC PAVEMENT)

PAVEMENT REHABILITATION

LIMITS (KM.)	LIN. METERS
0+000 – 1+550	1550
4+038 – 7+380	3342
13+656 – 15+000	1344
25+152 – 27+000	1848

NEW PAVEMENT

1+550 – 4+038	2488
7+380 – 13+656	6276
15+000 – 25+152	10152



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

NOTES:

1. ALL DIMENSINS ARE IN METERS.
2. ALL SHOULDERS ARE OF BASE COURSE MATERIAL WITH SBST SURFACE.
3. NEW SHOULDERS ARE REQUIRED ON PCC REHAB. SECTIONS.

MACTAN CIRCUMFERENTIAL ROAD

The proposed improvements to this section will consist of widening the roadway formation to the required width, adding additional drainage structures and providing a new pavement section.

It is proposed to scarify, remove and replace the 2.5 kms. of existing asphalt with a new asphaltic concrete pavement section and to rehabilitate the remaining 3.0 kms. of concrete pavement. Rehabilitation will consist of sealing of cracks, patching of potholes and a 7.5 cm. overlay of asphaltic concrete wearing course. New shoulders will be constructed of base course material and surfaced with a single bituminous surface treatment (SBST) wearing course.

2. JCT. TO BANKAL - MARIBAGO RD. (km. 5+500-10+458)

The projected traffic for this section is:

	Vehicles per day
1993 AADT	631
2002 AADT	1,477

The desired roadway width for this projected traffic level is a 6.1 meter carriageway with 2.0 meter shoulders. The geometric design criteria for this section are those for flat terrain.

The proposed improvements to this section will consist of widening the roadway formation to its proper width, adding additional drainage structures and providing a new pavement section.

It is proposed to scarify, remove and replace the asphalt surface course between kms. 7+380-10+284 (2904 m.) with new asphaltic concrete pavement; to break up, remove the concrete pavement between kms. 10+284-10+458 (174 m.) and replace with AC pavement and to rehabilitate the concrete pavement between kms. 5+500-7+380 (1880 m.). Rehabilitation will consist of sealing of cracks, patching potholes and a 7.5 cm. overlay of AC wearing course. New surface treated base coarse shoulders are also proposed in the improvements.

3. JCT. MARIBAGO RD. - JCT. MARIGONDON RD. (km. 10+458-14+1005)

The projected traffic for this section is:

	Vehicles per day
1993 AADT	315
2002 AADT	736

15

The desired roadway width for this projected traffic level is a 6.1 meter carriageway with 2.0 meter shoulders. The geometric design criteria for this section are those for flat terrain.

The proposed improvements to this section will consist of widening the roadway formation to its proper width, the addition of drainage structures and providing a new pavement section.

Except for the last 349 meters of pavement which is of good asphalt 6 meters wide, it is proposed to break up and remove all the pavement, both asphalt and concrete, between kms. 10+458-13+656 and replace it with a new AC pavement. The last asphalt section will be overlaid with 7.5 cms. of AC. As in the two previous road sections, surface treated base course shoulders will also be provided.

4. JCT. MARIGONDON RD. - BRGY. BABAG (km. 14+005-20+934)

The projected traffic for this section is:

	Vehicles per day
1993 AADT	616
2002 AADT	1,379

The desired roadway width for this projected traffic level is a 6.1 meter carriageway with 2.0 meter shoulders. The geometric design criteria for this section are those for flat terrain.

The proposed improvements to this section will consist of widening the roadway formation to its proper width, the addition of drainage structures, providing a new pavement section and replacing the three existing bridges with new drainage structures.

Except for the initial one km. of asphalt surface which is in good condition, it is proposed to remove the remainder of the asphalt surface course and replace it with a new AC pavement section. The existing asphalt in good condition will be overlaid with 7.5 cms. of AC wearing course.

5. BRGY. BABAG - LOOC - PAJO (km. 20+934-27+000)

The projected traffic for this section is:

	Vehicles per day
1993 AADT	1,246
2002 AADT	2,766

The desired roadway width for this projected traffic level is a 6.7 meter carriageway with 2.5 meter shoulders. The geometric design criteria for this section are those for flat terrain.

The proposed improvements to this section will consist of widening the roadway formation to its proper width, the addition of drainage structures and providing a new pavement section.

It is proposed to remove and replace the existing asphalt surface course between kms. 20+934-25+152 with a new AC wearing course. It is also proposed to retain and rehabilitate all the remaining pavement; asphalt surface between 25+152-25+457 and concrete pavement between kms. 25+457-27+000. Rehabilitation work will consist of sealing cracks, removing and replacing badly cracked PCC slabs, patching potholes and overlaying both asphalt and concrete surface with 7.5 cms of AC wearing course.

2. DRAINAGE DESIGN

a. Rainfall-Runoff Study

For this study, the rainfall data from Cebu Airport Weather Station was used. Rainfall intensity-duration-frequency analyses for this rainfall data by PAGASA are given in Table B-3. The resulting rainfall intensity-duration-frequency curve is shown in Fig. 4-3. Delineation of catchment areas and assessment of drainage terrain characteristics for the project road were made on a 1:50,000 NAMRIA topographic map of Mactan Island. The time of concentration for each catchment area was estimated using the Kirpich Formula.

The Rational Formula was used for estimating drainage design discharges considering that catchment areas were less than 1,000 hectares. Three bridge sites along the road alignment have catchment areas less than 1,000 hectares, nevertheless, design discharges were calculated using the Synthetic Unit Hydrograph Method. The sizing of each drainage structure was based on design discharge, drainage terrain characteristics, time of concentration, and corresponding type of structure proposed.

b. Physiographic Description

The Mactan Circumferential Road starts at km. post 11 approximately 800 meters northeast of the junction of the road leading to Mandaue Bridge. It moves northeast to Bantolinao, from where it turns southeast to the municipality of Mactan. From Mactan it moves southwest passing through the coastal areas of Maribago, Agos, Marigondon Dapitan and Gabi before reaching the Cordova town proper. The Cordova-Babag section which comprises the southwest alignment follows. The last link is the Babag-Pajo segment spanning Lapu-Lapu City. Mactan Island is generally a flat-terrained island with shrubs, bushes, and coconut trees being

the main vegetative cover.

This road project is essentially a coastline road network with a total length of 27.172 kms. Of this, about 7.26 kms. is concrete pavement and the rest is asphalt ranging from bad to fair condition. Urbanization in the project area is fast progressing, with various industrial complexes rising along the alignment. Appropriate consideration of this trend has been done, specifically in the calculation of design discharges and the runoff coefficient itself.

c. Structure Design

In the preliminary sizing and selection of culverts, full-flow conditions with inlet-control and a design velocity of 3 m/sec were assumed. Design of box culverts were based on a 25-yr flood using standard single, double, and triple-barrel RCBC's.

Design of pipe culverts were based on 10-yr flood using standard 610-1220 RCPC. Waterway capacities at proposed bridge sites were determined for a design flood of 50-years recurrence interval.

3. BRIDGES

There are only three short span bridges along the study road, all located in Section 4. Preliminary hydraulic design based on hydrological data described herein show box culverts are adequate to replace these existing one-lane bailey structures. Table 4-2 summarizes the existing bridges and the proposed replacement structures.

TABLE 4-2

PROPOSED MAJOR DRAINAGE STRUCTURE - MACTAN

EXISTING				REPLACEMENT STRUCTURE
KM.	NAME	SPAN/LENGTH	TYPE	TYPE
15+487	Gabi	2/15 m.	Bailey	2-3.00x2.10x14 m. RCB
20+307	Pilipog 1	1/6 m.	Bailey	1-2.40x2.10x14 m. RCB
20+433	Pilipog 2	1/6 m.	Bailey	1-1.25x1.80x14 m. RCB

Five additional box culverts are also required along the alignment based on preliminary design. The types and sizes of the proposed drainage structures are given in Appendix B.

V.
PAVEMENT AND MATERIALS

V. PAVEMENT AND MATERIALS

A. GEOLOGY AND TOPOGRAPHY

The geology of the project road corridor is shown on the Geology and Materials Map, Figure 5-1.

The youngest exposed rock formation in Mactan Island is the Carcar Formation. The type locality of the Carcar is at Carcar, East-Central Cebu. The formation is a transgressive type of limestone occupying the lower flanks of the ridges and covering practically all the coastal areas. The limestone is typically porous, coralline, poorly bedded to massive, and averages 300 m thick. The Carcar is rich in mollusks, coral stems, algae and foraminifera indicative of Pleistocene age and shallow water deposition. Color varies from light to buff brown.

The road topography is generally flat.

B. MATERIAL SOURCES

The information on material sources was taken from a previous study report prepared by Project Management Office-Feasibility Studies, DPWH Region IV Compound, EDSA, Quezon City.

A total of nine (9) material sources were selected for possible use in road construction. Two material sources are located in Mactan Island, while the remaining seven are in the Mainland Cebu. The subsequent paragraphs describe each material source.

The Pusok Quarry, located in Mactan Island, is accessible 200 m from the project road. The quarry deposit consists of mixed sand and gravel that can be used as subbase. Estimated quantities : 10,000 m^3.

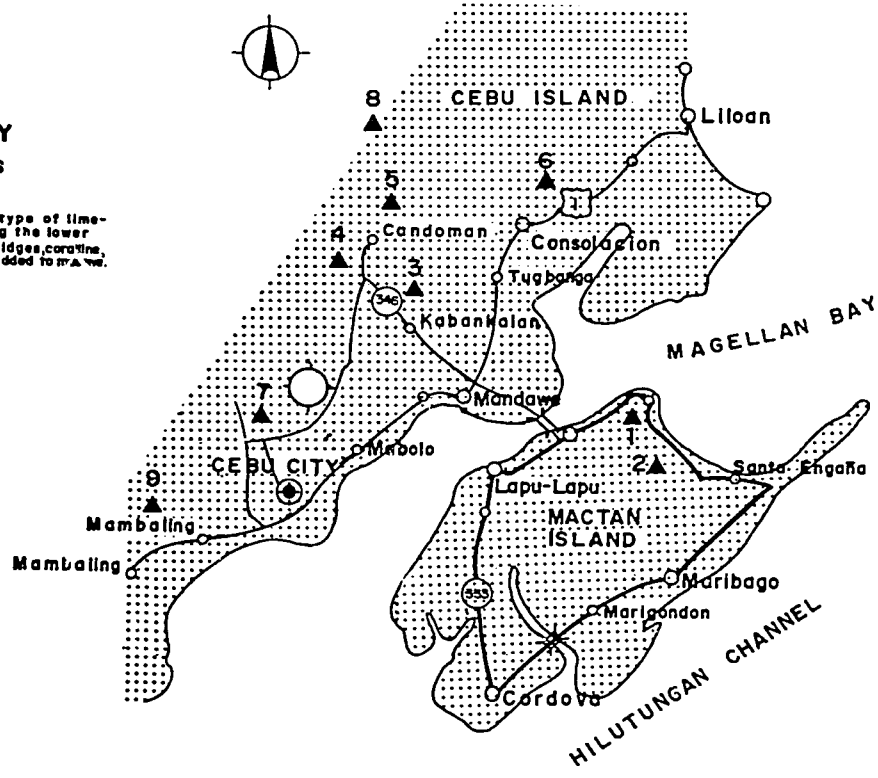
The Bankal Quarry, located in Mactan Island, is accessible 500 m from the project road. The quarry deposit consists of mixed sand and gravel that can be used as subbase. Estimated quantities: 10,000 m^3.

The Busay Quarry, located in Mainland Cebu, is accessible 6 km from the project road. The quarry deposit consists of mixed sand and gravel that can be used as subbase. Estimated quantities: unlimited.

STRATIGRAPHY

SEDIMENTARY ROCKS

Upper Pliocene-Pleistocene – Transgressive type of limestone occupying the lower flanks of the ridges, coralline, porous, poorly bedded to massive.



MATERIALS SOURCES

1. The Pusol Quarry, located in Mactan Island, accessible 250 m. from the project road. The quarry deposit consists of mixed sand and gravel that can be used as subbase.
   Estimated quantities : 10,000 Cu.m.
2. The Bankal Quarry, located in Mactan Island, accessible 500 m. from the project road. The quarry deposit consists of mixed sand and gravel that can be used as subbase.
   Estimated quantities : 10,000 Cu.m.
3. The Busay Quarry, located in Mainland Cebu, accessible 6 km. from the project road. The quarry deposit consists of mixed sand and gravel that can be used as subbase.
   Estimated quantities : Unlimited.
4. The Talamban Quarry, located in Mainland Cebu, accessible 8 km. from the project road. The quarry deposit consists of mixed sand and gravel that can be used as subbase, base and aggregate for asphalt courses and concrete. Processing of the materials is required to meet the desired quality.
   Estimated quantities : Unlimited.
5. The Pit-Os Quarry, located in Mainland Cebu, accessible 10 km. from the project road. The quarry deposit consists of mixed sand and gravel that can be used as subbase, base and aggregate for asphalt courses and concrete. Processing of the materials is required to meet the desired quality.
   Estimated quantities : Unlimited.
6. The Butuanon River, located in Mainland Cebu, accessible 11 km. from from the project road. The river deposit consists of mixed sand and gravel that can be used as subbase-base and aggregate for asphalt courses and concrete. Processing of the materials is required to meet desired quality.
   Estimated quantities : Unlimited.
7. The Guadalupe River, located in Mainland Cebu, accessible 12 km. from the project road. The river deposit consists of mixed sand and gravel that can be used as subbase, base, and aggregate for asphalt courses and concrete. Processing of the materials is required to meet the desired quality.
   Estimated quantities : Unlimited.
8. The Canbaog River, located in Mainland Cebu, accessible 20 km. from the project road road. The river deposit consists of mixed sand and gravel that can be used as subbase, base and aggregate for asphalt courses and concrete. Processing of the materials is required to meet the desired quality.
   Estimated quntities : Unlimited.
9. The Mananga River, located in Mainland Cebu, accessible 30 km. from the project road. The river deposit consists of mixed sand and gravel that can be used as subbase, base and aggregate for asphalt courses and concrete. Processing of the materials is required to meet the desired quality.
   Estimated quantities : Unlimited.

▲ – Materials Sources

——— – Project Road

FIGURE 5-1 GEOLOGY AND MATERIALS MAP
MACTAN CIRCUMFERENTIAL ROAD

SCALE

0 1 2 3 4 5 10 Kms.

The Talamban Quarry, located in Mainland Cebu, is accessible 8 km from the project road. The quarry deposit consists of mixed sand and gravel that can be used as subbase, base, and aggregate for asphalt courses and concrete. Processing of the materials is required to meet the desired quality. Estimated quantities: unlimited.

The Pit-os Quarry, located in Mainland Cebu, is accessible 10 km from the project road. The quarry deposit consists of mixed sand and gravel that can be used as subbase, base, and aggregate for asphalt courses and concrete. Processing of the materials is required to meet the desired quality. Estimated quantities: unlimited.

The Butuanon River, located in Mainland Cebu, is accessible 11 km from the project road. The river deposit consists of mixed sand and gravel that can be used as subbase, base, and aggregate for asphalt courses and concrete. Processing of the materials is required to meet desired quality. Estimated quantities: unlimited.

The Guadalupe River, located in Mainland Cebu, is accessible 12 km from the project road. The river deposit consists of mixed sand and gravel that can be used as subbase, base, and aggregate for asphalt courses and concrete. Processing of the materials is required to meet the desired quality. Estimated quantities: unlimited.

The Canbaog River, located in Mainland Cebu, is accessible 20 km from the project road. The river deposit consists of mixed sand and gravel that can be used as subbase, base, and aggregate for asphalt courses and concrete. Processing of the materials is required to meet the desired quality. Estimated quantities: unlimited.

The Mananga River, located in Mainland Cebu, is accessible 30 km from the project road. The river deposit consists of mixed sand and gravel that can be used as subbase, base, and aggregate for asphalt courses and concrete. Processing of the materials is required to meet desired quality. Estimated quantities: unlimited.

C. EXISTING PAVEMENT CONDITIONS

The Mactan Circumferential Road is 27 km long, and serves as a ring highway connecting the main coastal localities. The road pavement consists mainly of asphalt concrete (AC) segments, totalling 19.8 km, mainly in fair condition, and Portland cement concrete (PCC) stretches, totalling 7.2 km, in fair to bad condition.

The existing pavement conditions have been established after the field reconnaissance conducted by the Consultants in February

1990. The project alignment has been subdivided into five sections in accordance with traffic/engineering conditions. These road sections are described in the following paragraphs.

Section 1, from Pusok (Sta. 0+000) to the Junction to Pankal (Sta. 5+500), consists of two end PCC segment, with some overlaid portions, totalling 3.0 km, 6.1-7.3 m wide, 200 mm thick, in fair condition. The remaining 2.5 km have AC pavement, 6.1 m wide, in fair condition, due to corrugations, oxidation and depressions.

Section 2, from Jct. to Bankal (Sta. 5+500) to Junction to Maribago (Sta. 10+458), initiates with 1.88 km of PCC pavement 200 mm thick, 6.1 m wide, in fair condition. The next 2.9 km have AC pavement, 6.1 m wide, in fair to poor condition, due mainly to patching and deformation. The last 174 m have PCC pavement, 6.1 m wide, 200 mm thick, is in bad condition.

Section 3, from Jct. to Maribago (Sta. 10+458) to Junction to Marigondon (Sta. 14+005), begins with 654 m of PCC pavement, 6.1 m wide, 200 mm thick, in bad condition. The remaining 2.59 km consist of AC pavement, 5-6 m wide, in good to bad condition, due mainly to surface disintegration and deformation.

Section 4, from Jct. to Marigondon (Sta. 14+005) to Barangay Babag (Sta. 20+934), begins with 995 m of AC pavement, 6 m wide, in good condition. The remaining 5.93 km consist of AC pavement, 4-5 wide, in fair condition, mainly due to surface disintegration and deformation.

Section 5, from Barangay Babag (Sta. 20+934) to Looc-Pajo (Sta. 27+000), passes through Lapu-Lapu City, the town capital of the island. The first 4.52 km have AC pavement, 5.5-6.1 m wide, in fair condition, due mainly to surface disintegration and deformation. The remaining 1.54 km have PCC pavement, 7.3 m wide, 200 mm thick, in fair condition.

The present condition of the pavement will determine the improvement measures to be taken as discussed herein after in this chapter.

D. SUBGRADE SOIL

The subgrade along the 27.0 km of the Mactan Circumferential Road consists of rocky soil resulting from the breakdown of the parent limestone bedrock. Therefore, it is reasonable to expect high supporting value of this subgrade. A design CBR value of 25 was adopted in the pavement analysis.

E. PAVEMENT DESIGN

1. TRAFFIC LOADING

Traffic counts were taken on the road links for traffic predictions. Traffic loadings are expressed in terms of cumulative 8.2 ton equivalent single axle loadings (ESAL). 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 first (1993), 10th (2002) and 20th (2012) years.

Road Section	AADT First Year	AADT 10th Year	AADT 20th Year	ESAL* First Year	ESAL* 10th Year	ESAL* 20th Year
1. Pusok-Jct. to Bankal	1,236	2,843	7,419	200,549	3,063,126	10,438,624
2. Jct. to Bankal-Jct. to Maribago	631	1,477	3,915	30,902	474,984	1,653,749
3. Jct. to Maribago-Jct. to Marigondon	315	736	1,943	92,610	1,454,019	5,180,758
4. Jct. to Marigondon -Brgy. Babag	616	1,379	3,506	86,454	1,274,748	4,197,376
5. Babag-Looc-Pajo	1,246	2,766	6,971	286,292	4,231,959	13,898,700

* Both Directions

Due to the uncertainties involved in the behavior of the subgrade-pavement system, and traffic forecasts for periods longer than 10 years, the 20-year asphalt pavements can be conveniently designed in two stages, the second one following the initial 10-year period. Close observations of the pavement behavior and traffic volume, throughout the initial 10-year stage will allow for a more reliable design of the asphalt pavement for the second 10-year stage. The concrete pavements will be designed for a 20-year period, as stage construction of these is not practical during the adopted 20-year analysis period.

The design ESAL values (ESAL values on the traffic lane during the respective design period) along the road sections are shown on Table 5-1.

2. EXISTING PAVEMENT

This section refers to the whole study road, with PCC and AC pavements. In general the AC pavement requires reconstruction due

to the fairly high level of distress observed at the time of the field reconnaissance, that may have worsened as result of the Typhoon Ruping that struck the island on 12 November 1990. The deterioration of the AC pavements will speed up throughout the next two years until the construction starts. The reconstruction of the AC pavement sections will include the lifting of the AC surface course followed by scarification and recompaction to acceptable conditions of the underlying course, and the construction of the new base and surface courses. The design of these pavements is considered new pavement.

The PCC pavement, generally in fair condition will be better retained and overlaid with an AC layer, except for the short segment between Sta. 10+284 and Sta. 10+458 in bad condition. These PCC sections will be locally repaired before being overlaid. These repairs will include crack sealing, joint filling, levelling courses. The newly overlaid pavement will be of the concrete-asphalt mixed type.

The required thicknesses of the reconstructed AC pavements and the overlay of the concrete pavements have been determined following AASHTO's 1986 Guide for Design of Pavement Structures. The resulting pavement structures are shows on Table 5-1.

3. RECONSTRUCTION AND REHABILITATION OF PAVEMENTS

The AADT values presented above indicate that Sections 3, 1 and 5, 2 and 4 of the study road, belong to the AADT-Category ranges of less than 400, 400-1000 and 1000-2000, respectively, 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 adequate for the pavement in Section 3, while asphalt concrete (AC) is adequate for the pavement in Sections 1, 2, 4 and 5. However, since overlay is required on 6.4 km of PCC pavement, only AC pavements will be adopted for the reconstruction of the AC pavements, and the replacement of the 824 m (Sta. 10+284 to Sta. 11+112) PCC pavement.

a. AC Pavement

As was mentioned before, AC pavement will be considered for the reconstruction of both the existing 19.8 km of AC pavement and the 864 m of PCC pavement in bad condition. The existing granular layer underlaying these AC and PCC courses will serve, after its scarification and compaction, as subbase course for the reconstructed AC pavements. The required thicknesses of granular base and AC surface courses are determined following AASHTO's 1986 Guide for Design of Pavement Structures. The resulting pavement structures are shown on Table 5-1.

b. Concrete-Asphalt Pavement

The existing 6.4 km of PCC pavement in fair condition will be reinforced with AC overlay. The required overlay thicknesses are determined by assessing the structural value of the PCC and then deducting it from the total required 10-year structural number, as determined following AASHTO's 1986's Guide for Structural Design of Pavement Structures. The required AC overlays on PCC pavements are shown on Table 5-1.

4. PAVEMENT OVERLAYING

The present discussion refers to asphalt concrete (AC) overlays to be placed on AC pavements and mixed type pavements in order to strengthen the existing structure to support the additional traffic beyond the initial 10-year design period. This method of construction, usually called stage construction, should not be considered as 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 economic evaluation life cycle analysis, 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 capacity) criteria presented in AASHTO's 1986 Guide for Design of Pavement Structures have been applied for determining the loss in structural condition of these pavements through the initial 10-year of service. The required thickness of the AC overlays is shown on Table 5-1.

F. FINAL COMMENTS

- All existing AC pavements, totalling 19.8 km, are in fair to bad condition. The 864 m PCC pavement, from Sta. 10+284 to Sta. 11+112, is in bad condition. Reconstruction of these road sections with AC pavement constitutes the most workable procedure for rehabilitating these pavements, for an initial 10-year performance period.

- The remaining PCC pavement sections, totalling 6.4 km in fair conditions, can be retained. An AC overlay is the best procedure to strengthen these pavements for an initial 10-year performance period.

TABLE 5–1

PAVEMENT SECTIONS
MACTAN CIRCUMFERENTIAL ROAD

SECTION	1–1	1–2	1–3	2–1	2–2	2–3	3–1	3–2	4–1	5–1	5–2
FROM STATION	0+000	1+550	4+038	5+500	7+380	10+284	10+458	11+112	14+005	20+934	25+631
TO STATION	1+550	4+038	5+500	7+380	10+284	10+458	11+112	14+005	20+934	25+631	27+000
FROM (TOWN)	PUSOK			JCT. BANCAL			MARIBAGO RD		JCT. MARIGONDON		
TO (TOWN)			JCT. BANCAL			MARIBAGO RD		JCT. MARIGONDON	BABAG		PAJO
EXISTING PAVEMENT											
Type	PCC	AC	PCC	PCC	AC	PCC	PCC	AC	AC	AC	PCC
Thickness of surface course, mm	200	40–80	200	200	40–80	200	200	40–80	40–80	40–80	200
Subgrade Design CBR (%)	25+	25+	25+	25+	25+	25+	25+	25+	25+	25+	25+
Subgrade AASHTO Classification	A–1–b	A–1–b	A–1–b	A–1–b	A–1–b	A–1–b	A–1–b	A–1–b	A–1–b	A–1–b	A–1–b
RECONSTRUCTION AND REHABILITATION											
Design ESAL from 1992: 10 Years, ESALx10^6	1.532	1.532	1.532	0.238	0.238	0.238	0.727	0.727	0.637	2.116	2.116
RECONSTRUCTION OF AC AND PCC											
Surface Type		AC			AC	AC	AC	AC	AC	AC	
Thickness, mm		75			50	50	50	50	50	75	
Base thickness, mm		150			100	250	250	100	100	150	
REHABILITATION OF PCC											
Type of Overlay	AC		AC	AC							AC
Thickness, mm	75		75	75							75
OVERLAY 1											
Design ESAL from 2002: 10 years, ESALx10^6	3.738	3.738	3.738	0.589	0.589	0.589	1.863	1.863	1.461	4.833	4.833
Type	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC
Thickness, mm	25	90	25	25	50	70	70	70	60	100	25

1 An AC overlay to serve the 11th–20th period is considered in both AC and AC–PPC mixed pavements

VI.
COSTING

VI. COSTING

A. PROPOSED IMPROVEMENTS

The proposed improvements to the study road consist of reconstruction of the existing road to various widths (6.1 - 6.7 m.), providing additional drainage structures, rehabilitation of portions of existing pavement and replacement of portions of the existing pavement.

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 improvements, most quantities were estimated from the widening of the existing roadway to its new proposed width.

1. **Earthworks** - Quantities were developed from typical cross sections along each segment of alignment. Both excavation and embankment quantities are required for the widening of roadway width and improvements to horizontal curvature.

2. **Pavement Section** - Improvements to the pavement consists of both rehabilitation of existing pavement and replacement with new pavement. Rehabilitation work consists of sealing of cracks, patching of potholes, replacement of badly cracked concrete slabs and overlay with asphaltic concrete. New pavement construction includes the removal of existing surface, recompaction of existing sub-layers, the addition of layers of base course or subbase course and new surfacing; either Portland Cement Concrete (PCC) or Asphaltic Concrete (AC) surface course.

81

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	0.5	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	19.3			46	19.3	23	9.7	31	13.0	69	29.0	100	42
102(2)	Surplus Common Excavation	CU.M.	49	20.6			49	20.6	19	8.0	32	13.4	68	28.6	100	42
102(3)	Surplus Rock Excavation	CU.M.	28	44.2			28	44.2	54	85.3	18	28.4	82	129.6	100	158
103(1)	Structure Excavation	CU.M.	47	24.9			47	24.9	22	11.7	31	16.4	69	36.6	100	53
103(2)	Bridge Excavation	CU.M.	47	25.9			47	25.9	22	12.1	31	17.1	69	38.0	100	55
103(3)	Foundation Fill	CU.M.	47	28.2			47	28.2	28	16.8	25	15.0	75	45.0	100	60
103(4)	Excavation Below Plan Elevation	CU.M.	16	32.3	18	36.4	34	68.7	52	105.0	14	28.3	86	173.7	100	202
103(5)	Shoring, Cribbing, etc.	L.S.	45	0.5	20	0.2	65	0.7	20	0.2	15	0.2	85	0.9	100	1
103(6)	Pipe Culvert Excavation	CU.M.	47	24.9			47	24.9	22	11.7	31	16.4	69	36.6	100	53
104(1)	Embankment	CU.M.	49	24.5			49	24.5	19	9.5	32	16.0	68	34.0	100	50
104(2)	Embankment, Select Material	CU.M.	47	34.8			47	34.8	28	20.7	25	18.5	75	55.5	100	74
105(1)	Subgrade Preparation, Common	SQ.M.	49	1.5			49	1.5	19	0.6	32	1.0	68	2.0	100	3
105(2)	Subgrade Preparation, Existing Pavement	SQ.M.	50	3.0			50	3.0	18	1.1	32	1.9	68	4.1	100	6
	II. PAVEMENT															
200	Aggregate Subbase Course	CU.M.	48	70.6			48	70.6	27	39.7	25	36.8	75	110.3	100	147
201	Aggregate Base Course	CU.M.														
202	Crushed Aggregate Base Course	CU.M.	52	131.0			52	131.0	22	55.4	26	65.5	74	186.5	100	252
208	Soil Aggregate Shoulder	CU.M.	48	75.8			48	75.8	27	42.7	25	39.5	75	118.5	100	158
300(1)	Gravel Surface Course	CU.M.	48	75.8			48	75.8	27	42.7	25	39.5	75	118.5	100	158
301	Bituminous Prime Coat, MC-70	SQ.M.	5	0.6	50	6.0	55	6.6	25	3.0	20	2.4	80	9.6	100	12
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	8	0.7	47	4.2	55	5.0	24	2.2	21	1.9	79	7.1	100	9
304(1)	Single Bituminous Surface Treatment	SQ.M.	5	1.3	49	12.7	54	14.0	24	6.2	22	5.7	78	20.3	100	26
304(2)	Double Bituminous Surface Treatment	SQ.M.	5	2.6	48	24.5	53	27.0	25	12.8	22	11.2	78	39.8	100	51
310(1)	Bituminous Concrete Wearing Course	CU.M.	31	891.9	21	604.2	52	1496.0	22	632.9	26	748.0	74	2129.0	100	2877
310(2)	Bituminous Concrete Binder Course	CU.M.	31	846.3	21	573.3	52	1419.6	22	600.6	26	709.8	74	2020.2	100	2730
310(3)	Bituminous Concrete Leveling Course	MT	31	353.4	21	239.4	52	592.8	22	250.8	26	296.4	74	843.6	100	1140
311(1)	Portland Cement Concrete Pavement	CU.M.	18	354.1	32	629.4	50	983.5	31	609.8	19	373.7	81	1593.3	100	1967
311(2)	Patching Existing PCC Pavement	SQ.M.	34	42.5	21	26.3	55	68.8	24	30.0	21	26.3	79	98.8	100	125
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	11	3.1	26	7.3	37	10.4	48	13.4	15	4.2	85	23.8	100	28

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	139.1	26	241.0	41	380.1	44	407.9	15	139.1	85	788.0	100	927
400(5)	PC/PS Concrete Piles, Furnished (40 x 40c	L.M.	13	150.8	33	382.8	46	533.6	39	452.4	15	174.0	85	986.0	100	1160
400(13)	Precast Concrete Piles, Driven (40 x 40cm)	L.M.	14	92.1	32	210.6	46	302.7	38	250.0	16	105.3	84	552.7	100	658
400(14)	PC/PS Concrete Piles, Driven (40 x 40cm)	L.M.	14	147.0	32	336.0	46	483.0	38	399.0	16	168.0	84	882.0	100	1050
400(15)	Test Piles, Driven	L.M.	14	147.0	32	336.0	46	483.0	38	399.0	16	168.0	84	882.0	100	1050
400(22)	Load Test	EA.	23	50600.0	22	48400.0	45	99000.0	40	88000.0	15	33000.0	85	187000.0	100	220000
401	Concrete Bridge Railing	L.M.	6	41.7	32	222.4	38	264.1	51	354.5	11	76.5	89	618.6	100	695
404	Reinforcing Steel	KG			45	9.9	45	9.9	44	9.7	11	2.4	89	19.6	100	22
405(1)	Structural Concrete, Class A	CU.M.	15	330.8	26	573.3	41	904.1	44	970.2	15	330.8	85	1874.3	100	2205
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	1066.0	33	2706.0	46	3772.0	39	3198.0	15	1230.0	85	6970.0	100	8200
406(3)	Prestressing Steel	KG			45		45		44		11		89		100	
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	67.2			47	67.2	27	38.6	26	37.2	74	105.8	100	143
500(61)	RCPC, 61cm Diameter	L.M.	18	167.4	22	204.6	40	372.0	42	390.6	18	167.4	82	762.6	100	930
500(91)	RCPC, 91cm Diameter	L.M.	16	252.0	26	409.5	42	661.5	42	661.5	16	252.0	84	1323.0	100	1575
500(107)	PCPC, 107cm Diameter	L.M.	14	294.0	28	588.0	42	882.0	42	882.0	16	336.0	84	1764.0	100	2100
500(122)	RCPC, 122cm Diameter	L.M.	14	441.0	28	882.0	42	1323.0	42	1323.0	16	504.0	84	2646.0	100	3150
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	15	329.3	26	570.7	41	900.0	44	965.8	15	329.3	85	1865.8	100	2195
502(11)	Reinforcing Steel for Pipe Headwalls	KG			45	9.9	45	9.9	44	9.7	11	2.4	89	19.6	100	22
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	56.8	13	92.3	21	149.1	67	475.7	12	85.2	88	624.8	100	710
508(2)	Concrete Slope Protection	CU.M.														
509	Gabions	CU.M.														
	V. INCIDENTAL WORKS															
603(3)	Metal Beam Guardrail	L.M.	40	330.0			40	330.0	25	206.3	35	288.8	65	536.3	100	825
605(1)	Warning Signs	EA.	42	1247.4			42	1247.4	23	683.1	35	1039.5	65	1930.5	100	2970
605(2)	Regulatory Signs	EA.	42	1247.4			42	1247.4	23	683.1	35	1039.5	65	1930.5	100	2970
605(3)	Informatory Signs	EA.	44	4989.6			44	4989.6	21	2381.4	35	3969.0	65	7371.0	100	11340
610	Sodding	SQ.M.	51	2.6			51	2.6	16	0.8	33	1.7	67	3.4	100	5
	VI. LAND ACQUISITION	SQ.M.							90	9	10	1	90	9	100	10

3. **Structures** - No new bridges are required along the study road. Reinforced concrete box culverts (RCBC) are adequate to replace the three existing short span bailey bridges. A total of eight (8) box culverts are required for this project; three as bridge replacement structures and five at new locations. Quantities of major items were determined for these structures to estimate their cost.

4. **Drainage and Erosion Works** - Drainage and erosion protection quantities were estimated from field drainage and reconnaissance surveys. These quantities include pipe culverts of various sizes, culvert excavation and backfill, structural concrete and reinforcing steel for pipe headwalls and grouted riprap for erosion control.

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 required for this study road.

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 for the AC pavement option are given in Tables 6-2 through 6-6 and the PCC options are given in Tables 6-7 through 6-11.

E. COST OF IMPROVEMENTS

The cost of improving this road are detailed in the attached tables. The costs have been developed by traffic link for the five roadway sections 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
MACTAN CIRCUMFERENTIAL ROAD
SECTION 1: PUSOK - BANKAL JUNCTION

SECTION LENGTH: 5.5 Kilometers (Existing)
ROADWAY WIDTH: 6.7m Pavement + 2.5m Shoulder
PROPOSED SURFACE COURSE: Asphaltic Concrete

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	110,000	108	42	70	150	220
101(3)	Removal of Existing Concrete Pavement	SQ.M.	84	1,020	18	55	13	73	86
102(1)	Unsuitable Excavation	CU.M.	42	9,650	166	93	126	280	405
102(2)	Surplus Common Excavation	CU.M.	42	18,800	397	150	253	537	790
103(6)	Pipe Culvert Excavation	CU.M.	53	3,280	82	38	54	120	174
105(1)	Subgrade Preparation, Common	SQ.M.	3	55,000	81	31	53	112	165
	TOTAL EARTHWORK				862	409	568	1,271	1,839
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	147	7,330	517	291	269	808	1,078
202	Crushed Aggregate Base Course	CU.M.	252	4,100	537	227	269	765	1,033
301	Bituminous Prime Coat, MC-70	SQ.M.	12	45,100	298	135	108	433	541
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	9	20,250	100	44	38	144	182
304(1)	Single Bituminous Surface Treatment	SQ.M.	26	24,250	340	151	139	492	631
310(1)	Bituminous Concrete Wearing Course	CU.M.	2,877	2,970	4,443	1,880	2,222	6,323	8,545
311(1)	Portland Cement Concrete Pavement	CU.M.	1,967	204	201	124	76	325	401
311(2)	Patching Existing PCC Pavement	SQ.M.	125	105	7	3	3	10	13
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	28	1,220	13	16	5	29	34
	TOTAL - PAVEMENT				6,457	2,872	3,129	9,329	12,458

TABLE 6-2 COST ESTIMATE BREAKDOWN
SECTION 1: PUSOK - BANKAL JUNCTION
(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)
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	143	2,050	138	79	76	217	293
500(61)	RCPC, 61cm Diameter	L.M.	930	180	67	70	30	137	167
500(91)	RCPC, 91cm Diameter	L.M.	1,575	492	325	325	124	651	775
500(107)	RCPC, 107cm Diameter	CU.M.	2,100	90	79	79	30	159	189
500(122)	RCPC, 122cm Diameter	L.M.	3,150	42	56	56	21	111	132
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,195	194	175	187	64	362	426
502(11)	Reinforcing Steel for Pipe Headwalls	KG	22	7,750	77	75	19	152	171
504(5)	Grouted Riprap	CU.M.	710	100	15	48	9	62	71
	TOTAL - DRAINAGE/EROSION				931	920	373	1,851	2,224
	V. INCIDENTAL WORKS								
605(1)	Warning Signs	EA.	2,970	6	7	4	6	12	18
605(2)	Regulatory Signs	EA.	2,970	6	7	4	6	12	18
605(3)	Informatory Signs	EA.	11,340	6	30	14	24	44	68
	TOTAL - INCIDENTAL WORKS				45	22	36	67	104
				SUBTOTAL	8,295	4,224	4,106	12,519	16,625
				10% Contingencies	829	422	411	1,252	1,663
				SUBTOTAL	9,124	4,647	4,517	13,771	18,288
				10% Office,Vehicles, etc.	912	465	452	1,377	1,829
				SUBTOTAL	10,036	5,111	4,969	15,148	20,116
				8% Supervision Cost	803	409	3[illegible]	1,212	1,609
				TOTAL SECTION COST	10,839	5,520	5,36[illegible]	16,359	21,726

TABLE 6-3 COST ESTIMATE BREAKDOWN
MACTAN CIRCUMFERENTIAL ROAD
SECTION 2: BANKAL JUNCTION - MARIBAGO

SECTION LENGTH: 5.0 Kilometers (Existing)
ROADWAY WIDTH: 6.1m Pavement + 2.0m Shoulder
PROPOSED SURFACE COURSE: Asphaltic Concrete

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	59,500	58	23	38	81	119
101(3)	Removal of Existing Concrete Pavement	SQ.M.	84	1,635	29	88	21	117	137
102(1)	Unsuitable Excavation	CU.M.	42	7,160	138	69	93	207	301
102(2)	Surplus Common Excavation	CU.M.	42	11,050	227	88	149	316	464
103(6)	Pipe Culvert Excavation	CU.M.	53	3,460	86	40	57	127	183
105(1)	Subgrade Preparation, Common	SQ.M.	3	49,600	73	28	48	101	149
	TOTAL EARTHWORK				612	336	405	948	1,353
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	147	3,840	271	152	141	423	564
202	Crushed Aggregate Base Course	CU.M.	252	5,100	668	283	334	951	1,285
301	Bituminous Prime Coat, MC-70	SQ.M.	12	38,620	255	116	93	371	463
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	9	11,500	57	25	22	82	104
304(1)	Single Bituminous Surface Treatment	SQ.M.	26	17,500	246	109	100	355	455
310(1)	Bituminous Concrete Wearing Course	CU.M.	2,877	1,880	2,813	1,190	1,406	4,002	5,409
311(1)	Portland Cement Concrete Pavement	CU.M.	1,967	115	113	70	43	183	226
311(2)	Patching Existing PCC Pavement	SQ.M.	125	60	4	2	2	6	8
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	28	750	8	10	3	18	21
	TOTAL - PAVEMENT				4,434	1,957	2,144	6,391	8,535

TABLE 6-3 COST ESTIMATE BREAKDOWN
SECTION 2: BANKAL JUNCTION - MARIBAGO
(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)
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	143	2,150	145	83	80	228	307
500(61)	RCPC, 61cm Diameter	L.M.	930	224	83	87	37	171	208
500(91)	RCPC, 91cm Diameter	L.M.	1,575	576	381	381	145	762	907
500(107)	RCPC, 107cm Diameter	CU.M.	2,100	48	42	42	16	85	101
500(122)	RCPC, 122cm Diameter	L.M.	3,150						
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,195	194	175	187	64	362	426
502(11)	Reinforcing Steel for Pipe Headwalls	KG	22	7,750	77	75	19	152	171
503(2)	Removal Cleaning, Replacement, Salvaged Pipe Culverts	L.M.	407						
504(5)	Grouted Riprap	CU.M.	710	100	15	48	9	62	71
508(2)	Concrete Slope Protection	CU.M.							
509	Gabions	CU.M.							
	TOTAL - DRAINAGE/EROSION				917	904	370	1,821	2,191
	V. INCIDENTAL WORKS								
605(1)	Warning Signs	EA.	2,970	6	7	4	6	12	18
605(2)	Regulatory Signs	EA.	2,970	6	7	4	6	12	18
605(3)	Informatory Signs	EA.	11,340	8	40	19	32	59	91
	TOTAL - INCIDENTAL WORKS				55	27	44	82	126
				SUBTOTAL	6,019	3,225	2,963	9,243	12,206
				10% Contingencies	602	322	296	924	1,221
				SUBTOTAL	6,620	3,547	3,259	10,167	13,426
				10% Office.Vehicles, etc.	662	355	326	1,017	1,343
				SUBTOTAL	7,283	3,902	3,585	11,184	14,769
				8% Supervision Cost	583	312	287	895	1,182
				TOTAL SECTION COST	7,865	4,214	3,872	12,079	15,951

TABLE 6-4 COST ESTIMATE BREAKDOWN
MACTAN CIRCUMFERENTIAL ROAD
SECTION 3: MARIBAGO - MARIGONDON JUNCTION

SECTION LENGTH: 3.5 Kilometers (Existing)
ROADWAY WIDTH: 6.1m Pavement + 2.0m Shoulder
PROPOSED SURFACE COURSE: Aspaltic Concrete Pavement

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	42,600	42	16	27	58	85
101(3)	Removal of Existing Concrete Pavement	SQ.M.	84	3,990	70	215	50	285	335
102(1)	Unsuitable Excavation	CU.M.	42	5,650	109	55	74	164	237
102(2)	Surplus Common Excavation	CU.M.	42	1,600	33	13	22	46	67
103(1)	Structure Excavation	CU.M.	53	100	2	1	2	4	5
103(6)	Pipe Culvert Excavation	CU.M.	53	1,830	46	21	30	67	97
104(1)	Embankment	CU.M.	50	4,700	115	45	75	160	235
105(1)	Subgrade Preparation, Common	SQ.M.	3	35,500	52	20	34	72	107
	TOTAL EARTHWORK				470	385	314	855	1,169
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	147	750	53	30	28	83	110
202	Crushed Aggregate Base Course	CU.M.	252	3,750	491	208	246	699	945
301	Bituminous Prime Coat, MC-70	SQ.M.	12	33,600	222	101	81	323	403
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	9	2,150	11	5	4	15	19
304(1)	Single Bituminous Surface Treatment	SQ.M.	26	12,750	179	80	73	259	332
310(1)	Bituminous Concrete Wearing Course	CU.M.	2,877	1,180	1,765	747	883	2,512	3,395
	TOTAL - PAVEMENT				2,721	1,170	1,314	3,891	5,204

TABLE 6-4 COST ESTIMATE BREAKDOWN
SECTION 3: MARIBAGO - MARIGONDON JUNCTION
(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)
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	143	1,150	77	44	43	122	164
500(61)	RCPC, 61cm Diameter	L.M.	930	116	43	45	19	88	108
500(91)	RCPC, 91cm Diameter	L.M.	1,575	248	164	164	62	328	391
500(107)	RCPC, 107cm Diameter	CU.M.	2,100						
500(122)	RCPC, 122cm Diameter	L.M.	3,150	84	111	111	42	222	265
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,195	120	108	116	40	224	263
502(11)	Reinforcing Steel for Pipe Headwalls	KG	22	4,820	48	47	12	94	106
504(5)	Grouted Riprap	CU.M.	710	160	24	76	14	100	114
	TOTAL - DRAINAGE/EROSION				575	604	232	1,179	1,411
	V. INCIDENTAL WORKS								
605(1)	Warning Signs	EA.	2,970	6	7	4	6	12	18
605(2)	Regulatory Signs	EA.	2,970	6	7	4	6	12	18
605(3)	Informatory Signs	EA.	11,340	6	30	14	24	44	68
610	Sodding	SQ.M.	5	4,000	10	3	7	13	20
	TOTAL - INCIDENTAL WORKS				55	26	43	81	124
				SUBTOTAL	3,821	2,184	1,902	6,005	7,907
				10% Contingencies	382	218	190	601	791
				SUBTOTAL	4,203	2,403	2,092	6,606	8,698
				10% Office,Vehicles, etc.	420	240	209	661	870
				SUBTOTAL	4,623	2,643	2,301	7,266	9,568
				8% Supervision Cost	370	211	184	581	765
				TOTAL SECTION COST	4,993	2,854	2,485	7,848	10,333

TABLE 6-5 COST ESTIMATE BREAKDOWN
MACTAN CIRCUMFERENTIAL ROAD
SECTION 4: MARIGONDON JUNCTION - BARANGAY BABAG

SECTION LENGTH: 6.9 Kilometers (Existing)
ROADWAY WIDTH: 6.1m Pavement + 2.0m Shoulder
PROPOSED SURFACE COURSE: Asphaltic Concrete Pavement

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	95,100	93	36	61	129	190
101(1)	Removal of Structures & Obstructions	L.S.	1	100,000	30	55	15	85	100
102(1)	Unsuitable Excavation	CU.M.	42	9,450	183	91	123	274	397
102(2)	Surplus Common Excavation	CU.M.	42	14,850	306	119	200	424	624
103(1)	Structure Excavation	CU.M.	53	700	17	8	12	26	37
103(6)	Pipe Culvert Excavation	CU.M.	53	3,070	76	36	50	112	163
105(1)	Subgrade Preparation, Common	SQ.M.	3	69,400	102	40	67	142	208
	TOTAL EARTHWORK				807	384	527	1,192	1,719
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	147	2,040	144	81	75	225	300
202	Crushed Aggregate Base Course	CU.M.	252	7,200	943	399	472	1,343	1,814
301	Bituminous Prime Coat, MC-70	SQ.M.	12	64,000	422	192	154	614	768
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	9	6,100	30	13	12	43	55
304(1)	Single Bituminous Surface Treatment	SQ.M.	26	24,800	348	155	142	503	645
310(1)	Bituminous Concrete Wearing Course	CU.M.	2,877	2,350	3,516	1,487	1,758	5,003	6,761
	TOTAL - PAVEMENT				5,404	2,327	2,612	7,731	10,343

TABLE 6-5 COST ESTIMATE BREAKDOWN
SECTION 4: MARIGONDON JUNCTION - BARANGAY BABAG
(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								
404	Reinforcing Steel	KG	22	26,950	267	261	65	528	593
405(1)	Structural Concrete, Class A	CU.M.	2,205	285	258	277	94	534	528
	TOTAL - STRUCTURES				524	537	159	1,062	1,221
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	143	1,910	128	74	71	202	273
500(61)	RCPC, 61cm Diameter	L.M.	930	307	114	120	51	234	286
500(91)	RCPC, 91cm Diameter	L.M.	1,575	402	266	266	101	532	633
500(107)	RCPC, 107cm Diameter	CU.M.	2,100	42	37	37	14	74	88
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,195	197	177	190	65	368	432
502(11)	Reinforcing Steel for Pipe Headwalls	KG	22	7,900	78	76	19	155	174
504(5)	Grouted Riprap	CU.M.	710	450	67	214	38	281	320
	TOTAL - DRAINAGE/EROSION				868	977	360	1,846	2,206
	V. INCIDENTAL WORKS								
603(3)	Metal Beam Guardrail	L.M.	825	120	40	25	35	64	99
605(1)	Warning Signs	EA.	2,970	6	7	4	6	12	18
605(2)	Regulatory Signs	EA.	2,970	6	7	4	6	12	18
605(3)	Informatory Signs	EA.	11,340	6	30	14	24	44	68
	TOTAL - INCIDENTAL WORKS				85	47	71	132	203
				SUBTOTAL	7,688	4,274	3,729	11,962	15,691
				10% Contingencies	769	427	373	1,196	1,569
				SUBTOTAL	8,457	4,701	4,102	13,159	17,261
				10% Office,Vehicles, etc.	846	470	410	1,316	1,726
				SUBTOTAL	9,303	5,171	4,512	14,474	18,987
				8% Supervision Cost	744	414	361	1,158	1,519
				TOTAL SECTION COST	10,047	5,585	4,873	15,632	20,506

100

TABLE 6-6 COST ESTIMATE BREAKDOWN
MACTAN CIRCUMFERENTIAL ROAD
SECTION 5: BARANGAY BABAG - PAJO

SECTION LENGTH: 6.1 Kilometers (Existing)
ROADWAY WIDTH: 6.7m Pavement + 2.5m Shoulder
PROPOSED SURFACE COURSE: Asphaltic Concrete Pavement

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	48,600	48	18	31	66	97
101(3)	Removal of Existing Concrete Pavement	SQ.M.	84	590	10	32	7	42	50
102(1)	Unsuitable Excavation	CU.M.	42	7,200	139	70	34	209	302
102(2)	Surplus Common Excavation	CU.M.	42	11,850	244	95	159	338	498
103(6)	Pipe Culvert Excavation	CU.M.	53	4,550	113	53	75	166	241
105(1)	Subgrade Preparation, Common	SQ.M.	3	36,400	54	21	35	74	109
	TOTAL EARTHWORK				608	288	401	896	1,297
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	147	2,800	198	111	103	309	412
202	Crushed Aggregate Base Course	CU.M.	252	2,500	328	139	164	466	630
301	Bituminous Prime Coat, MC-70	SQ.M.	12	58,650	387	176	141	563	704
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	9	15,400	76	33	29	109	139
304(1)	Single Bituminous Surface Treatment	SQ.M.	26	27,850	391	174	159	565	724
310(1)	Bituminous Concrete Wearing Course	CU.M.	2,877	3,600	5,386	2,279	2,693	7,664	10,357
311(1)	Portland Cement Concrete Pavement	CU.M.	1,967	118	116	72	44	188	232
311(2)	Patching Existing PCC Pavement	SQ.M.	125	560	39	17	15	55	70
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	28	120	1	2	1	3	3
	TOTAL - PAVEMENT				6,921	3,002	3,348	9,923	13,271

TABLE 6-6 COST ESTIMATE BREAKDOWN
SECTION 5: BARANGAY BABAG - PAJO
(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)
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	143	2,820	190	109	105	298	403
500(61)	RCPC, 61cm Diameter	L.M.	930	450	167	176	75	343	419
500(91)	RCPC, 91cm Diameter	L.M.	1,575	660	437	437	166	873	1,040
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,195	281	253	271	93	524	617
502(11)	Reinforcing Steel for Pipe Headwalls	KG	22	11,250	111	109	27	220	248
504(5)	Grouted Riprap	CU.M.	710	150	22	71	13	94	107
	TOTAL - DRAINAGE/EROSION				1,180	1,173	479	2,353	2,832
	V. INCIDENTAL WORKS								
605(1)	Warning Signs	EA.	2,970	6	7	4	6	12	18
605(2)	Regulatory Signs	EA.	2,970	10	12	7	10	19	30
605(3)	Informatory Signs	EA.	11,340	10	50	24	40	74	113
	TOTAL - INCIDENTAL WORKS				70	35	56	105	161
				SUBTOTAL	8,779	4,497	4,285	13,276	17,561
				10% Contingencies	878	450	428	1,328	1,756
				SUBTOTAL	9,657	4,947	4,713	14,604	19,317
				10% Office,Vehicles, etc.	966	495	471	1,460	1,932
				SUBTOTAL	10,622	5,442	5,184	16,064	21,249
				8% Supervision Cost	850	435	415	1,285	1,700
				TOTAL SECTION COST	11,472	5,877	5,599	17,349	22,949

TABLE 6-7 COST ESTIMATE BREAKDOWN
MACTAN CIRCUMFERENTIAL ROAD
SECTION 1: PUSOK - BANKAL JUNCTION

SECTION LENGTH: 5.5 Kilometers (Existing)
ROADWAY WIDTH: 6.7m Pavement + 2.5m Shoulder
PROPOSED SURFACE COURSE: Portland Cement Concrete

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	110,000	108	42	70	150	220
101(3)	Removal of Existing Concrete Pavement	SQ.M.	84	1,020	18	55	13	73	86
102(1)	Unsuitable Excavation	CU.M.	42	9,650	186	93	126	280	405
102(2)	Surplus Common Excavation	CU.M.	42	18,800	387	150	253	537	790
103(6)	Pipe Culvert Excavation	CU.M.	53	3,280	82	38	54	120	174
105(1)	Subgrade Preparation, Common	SQ.M.	3	55,000	81	31	53	112	165
	TOTAL EARTHWORK				862	409	568	1,271	1,839
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	147	12,640	692	502	465	1,394	1,858
202	Crushed Aggregate Base Course	CU.M.	252	7,250	950	402	475	1,352	1,827
301	Bituminous Prime Coat, MC-70	SQ.M.	12	28,400	187	85	68	273	341
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	9	20,250	100	44	38	144	182
304(1)	Single Bituminous Surface Treatment	SQ.M.	26	25,700	361	160	147	521	668
310(1)	Bituminous Concrete Wearing Course	CU.M.	2,877	1,654	2,474	1,047	1,237	3,521	4,759
311(1)	Portland Cement Concrete Pavement	CU.M.	1,967	4,204	4,135	2,563	1,571	6,698	8,269
311(2)	Patching Existing PCC Pavement	SQ.M.	125	105	7	3	3	10	13
311(3)	Sealing Cracks, Existing PCC Pavement	LM	28	1,220	13	16	5	29	34
	TOTAL - PAVEMENT				9,119	4,823	4,009	13,942	17,951

TABLE 6-7 COST ESTIMATE BREAKDOWN
SECTION 1: PUSOK - BANKAL JUNCTION
(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)
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	143	2,050	138	79	76	217	293
500(61)	RCPC, 61cm Diameter	L.M.	930	180	67	70	30	137	167
500(91)	RCPC, 91cm Diameter	L.M.	1,575	492	325	325	124	651	775
500(107)	RCPC, 107cm Diameter	CU.M.	2,100	90	79	79	30	159	189
500(122)	RCPC, 122cm Diameter	L.M.	3,150	42	56	56	21	111	132
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,195	194	175	187	64	362	426
502(11)	Reinforcing Steel for Pipe Headwalls	KG	22	7,750	77	75	19	152	171
503(2)	Removal, Cleaning, Replacement, Salvaged Pipe Culverts	L.M.	407						
504(5)	Grouted Riprap	CU.M.	710	100	15	48	9	62	71
508(2)	Concrete Slope Protection	CU.M.							
509	Gabions	CU.M.							
	TOTAL - DRAINAGE/EROSION				931	920	373	1,851	2,224
	V. INCIDENTAL WORKS								
605(1)	Warning Signs	EA.	2,970	6	7	4	6	12	18
605(2)	Regulatory Signs	EA.	2,970	6	7	4	6	12	18
605(3)	Informatory Signs	EA.	11,340	6	30	14	24	44	68
	TOTAL - INCIDENTAL WORKS				45	22	36	67	104
				SUBTOTAL	10,957	6,175	4,987	17,132	22,119
				10% Contingencies	1,096	617	499	1,713	2,212
				SUBTOTAL	12,053	6,792	5,485	18,845	24,330
				10% Office,Vehicles, etc.	1,205	679	549	1,885	2,433
				SUBTOTAL	13,258	7,471	6,034	20,730	26,764
				8% Supervision Cost	1,061	598	483	1,658	2,141
				TOTAL SECTION COST	14,319	8,069	6,517	22,388	28,905

104

TABLE 6-8 COST ESTIMATE BREAKDOWN
MACTAN CIRCUMFERENTIAL ROAD
SECTION 2: BANKAL JUNCTION - MARIBAGO

SECTION LENGTH: 5.0 Kilometers (Existing)
ROADWAY WIDTH: 6.1m Pavement + 2.0m Shoulder
PROPOSED SURFACE COURSE: Portland Cement Concrete Pavement

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	59,500	58	23	38	81	119
101(3)	Removal of Existing Concrete Pavement	SQ.M.	84	1,635	29	88	21	117	137
102(1)	Unsuitable Excavation	CU.M.	42	7,160	138	69	93	207	301
102(2)	Surplus Common Excavation	CU.M.	42	11,050	227	88	149	316	464
103(6)	Pipe Culvert Excavation	CU.M.	53	3,460	86	40	57	127	183
105(1)	Subgrade Preparation, Common	SQ.M.	3	49,600	73	28	48	101	149
	TOTAL EARTHWORK				612	336	405	948	1,353
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	147	7,440	525	295	273	820	1,094
202	Crushed Aggregate Base Course	CU.M.	252	3,960	519	220	259	738	998
301	Bituminous Prime Coat, MC-70	SQ.M.	12	19,800	131	59	48	190	238
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	9	11,500	57	25	22	82	104
304(1)	Single Bituminous Surface Treatment	SQ.M.	26	18,700	263	117	107	379	486
310(1)	Bituminous Concrete Wearing Course	CU.M.	2,877	905	1,354	573	677	1,927	2,604
311(1)	Portland Cement Concrete Pavement	CU.M.	1,967	2,932	2,884	1,788	1,096	4,671	5,767
311(2)	Patching Existing PCC Pavement	SQ.M.	125	60	4	2	2	6	8
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	28	750	8	10	3	18	21
	TOTAL - PAVEMENT				5,743	3,088	2,487	8,832	11,318

TABLE 6-8 COST ESTIMATE BREAKDOWN
SECTION 2: BANKAL JUNCTION - MARIBAGO
(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)
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	143	2,150	145	83	80	228	307
500(61)	RCPC, 61cm Diameter	L.M.	930	224	83	87	37	171	208
500(91)	RCPC, 91cm Diameter	L.M.	1,575	576	381	381	145	762	907
500(107)	RCPC, 107cm Diameter	CU.M.	2,100	48	42	42	16	85	101
500(122)	RCPC, 122cm Diameter	L.M.	3,150						
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,195	194	175	187	64	362	426
502(11)	Reinforcing Steel for Pipe Headwalls	KG	22	7,750	77	75	19	152	171
503(2)	Removal, Cleaning, Replacement, Salvaged Pipe Culverts	L.M.	407						
504(5)	Grouted Riprap	CU.M.	710	100	15	48	9	62	71
508(2)	Concrete Slope Protection	CU.M.							
509	Gabions	CU.M.							
	TOTAL - DRAINAGE/EROSION				917	904	370	1,821	2,191
	V. INCIDENTAL WORKS								
605(1)	Warning Signs	EA.	2,970	6	7	4	6	12	18
605(2)	Regulatory Signs	EA.	2,970	6	7	4	6	12	18
605(3)	Informatory Signs	EA.	11,340	8	40	19	32	59	91
	TOTAL - INCIDENTAL WORKS				55	27	44	82	126
				SUBTOTAL	7,328	4,356	3,306	11,684	14,989
				10% Contingencies	733	436	331	1,168	1,499
				SUBTOTAL	8,061	4,791	3,636	12,852	16,488
				10% Office,Vehicles, etc.	806	479	364	1,285	1,649
				SUBTOTAL	8,867	5,271	4,000	14,137	18,137
				8% Supervision Cost	709	422	320	1,131	1,451
				TOTAL SECTION COST	9,576	5,692	4,320	15,268	19,588

TABLE 6-9 COST ESTIMATE BREAKDOWN
MACTAN CIRCUMFERENTIAL ROAD
SECTION 3: MARIBAGO - MARIGONDON JUNCTION

SECTION LENGTH: 3.5 Kilometers (Existing)
ROADWAY WIDTH: 6.1m Pavement + 2.0m Shoulder
PROPOSED SURFACE COURSE: Portland Cement Concrete Pavement

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	42,600	42	16	27	58	85
101(3)	Removal of Existing Concrete Pavement	SQ.M.	84	3,990	70	215	50	285	335
102(1)	Unsuitable Excavation	CU.M.	42	5,650	109	55	74	164	237
102(2)	Surplus Common Excavation	CU.M.	42	1,600	33	13	22	46	67
103(1)	Structure Excavation	CU.M.	53	100	2	1	2	4	5
103(6)	Pipe Culvert Excavation	CU.M.	53	1,830	46	21	30	67	97
104(1)	Embankment	CU.M.	50	4,700	115	45	75	160	235
105(1)	Subgrade Preparation, Common	SQ.M.	3	35,500	52	20	34	72	107
	TOTAL EARTHWORK				470	385	314	855	1,169
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	147	4,500	318	179	165	496	662
202	Crushed Aggregate Base Course	CU.M.	252	2,560	335	142	168	477	645
301	Bituminous Prime Coat, MC-70	SQ.M.	12	14,200	94	43	34	136	170
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	9	2,150	11	5	4	15	19
304(1)	Single Bituminous Surface Treatment	SQ.M.	26	14,000	197	87	80	284	364
310(1)	Bituminous Concrete Wearing Course	CU.M.	2,877	170	254	108	127	362	489
311(1)	Portland Cement Concrete Pavement	CU.M.	1,967	2,927	2,879	1,785	1,094	4,664	5,757
	TOTAL - PAVEMENT				4,087	2,348	1,672	6,434	8,107

TABLE 6-9 COST ESTIMATE BREAKDOWN
SECTION 3: MARIBAGO - MARIGONDON JUNCTION
(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								
404	Reinforcing Steel	KG	22	2,325	23	23	6	46	51
405(1)	Structural Concrete, Class A	CU.M.	2,205	26	24	25	9	49	57
	TOTAL - STRUCTURES				47	48	14	94	108
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	143	1,150	77	44	43	122	164
500(61)	RCPC, 61cm Diameter	L.M.	930	116	43	45	19	88	108
500(91)	RCPC, 91cm Diameter	L.M.	1,575	248	164	164	62	328	391
500(122)	RCPC, 122cm Diameter	L.M.	3,150	84	111	111	42	222	265
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,195	120	108	116	40	224	263
502(11)	Reinforcing Steel for Pipe Headwalls	KG	22	4,820	48	47	12	94	106
504(5)	Grouted Riprap	CU.M.	710	160	24	76	14	100	114
	TOTAL - DRAINAGE/EROSION				575	604	232	1,179	1,411
	V. INCIDENTAL WORKS								
605(1)	Warning Signs	EA.	2,970	6	7	4	6	12	18
605(2)	Regulatory Signs	EA.	2,970	6	7	4	6	12	18
605(3)	Informatory Signs	EA.	11,340	6	30	14	24	44	68
610	Sodding	SQ.M.	5	4,000	10	3	7	13	20
	TOTAL - INCIDENTAL WORKS				55	26	43	81	124
				SUBTOTAL	5,233	3,410	2,275	8,643	10,918
				10% Contingencies	523	341	227	864	1,092
				SUBTOTAL	5,757	3,751	2,502	9,508	12,010
				10% Office,Vehicles, etc.	576	375	250	951	1,201
				SUBTOTAL	6,332	4,126	2,753	10,458	13,211
				8% Supervision Cost	507	330	220	837	1,057
				TOTAL SECTION COST	6,839	4,456	2,973	11,295	14,268

TABLE 6-10 COST ESTIMATE BREAKDOWN
MACTAN CIRCUMFERENTIAL ROAD
SECTION 4: MARIGONDON JUNCTION - BARANGAY BABAG

SECTION LENGTH: 6.9 Kilometers (Existing)
ROADWAY WIDTH: 6.1m Pavement + 2.0m Shoulder
PROPOSED SURFACE COURSE: Portland Cement Concrete Pavement

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	95,100	93	36	61	129	190
101(1)	Removal of Structures & Obstructions	L.S.	1	100,000	30	55	15	85	100
102(1)	Unsuitable Excavation	CU.M.	42	9,450	183	91	123	274	397
102(2)	Surplus Common Excavation	CU.M.	42	14,850	306	119	200	424	624
103(1)	Structure Excavation	CU.M.	53	700	17	8	12	26	37
103(6)	Pipe Culvert Excavation	CU.M.	53	3,070	76	36	50	112	163
105(1)	Subgrade Preparation, Common	SQ.M.	3	69,400	102	40	67	142	208
	TOTAL EARTHWORK				807	384	527	1,192	1,719
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	147	9,000	635	357	331	992	1,323
202	Crushed Aggregate Base Course	CU.M.	252	5,060	663	281	332	944	1,275
301	Bituminous Prime Coat, MC-70	SQ.M.	12	27,750	183	83	67	266	333
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	9	6,100	30	13	12	43	55
304(1)	Single Bituminous Surface Treatment	SQ.M.	26	27,150	381	169	155	551	706
310(1)	Bituminous Concrete Wearing Course	CU.M.	2,877	480	718	304	359	1,022	1,381
311(1)	Portland Cement Concrete Pavement	CU.M.	1,967	5,430	5,340	3,311	2,029	8,651	10,681
	TOTAL - PAVEMENT				7,951	4,518	3,284	12,470	15,754

159

TABLE 6-10 COST ESTIMATE BREAKDOWN
SECTION 4: MARIGONDON JUNCTION - BARANGAY BABAG
(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								
404	Reinforcing Steel	KG	22	26,950	267	261	65	528	593
405(1)	Structural Concrete, Class A	CU.M.	2,205	285	253	277	94	534	628
	TOTAL - STRUCTURES				524	537	159	1,062	1,221
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	143	1,910	128	74	71	202	273
500(61)	RCPC, 61cm Diameter	L.M.	930	307	114	120	51	234	286
500(91)	RCPC, 91cm Diameter	L.M.	1,575	402	266	266	101	532	633
500(107)	RCPC, 107cm Diameter	CU.M.	2,100	42	37	37	14	74	88
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,195	197	177	190	65	368	432
502(11)	Reinforcing Steel for Pipe Headwalls	KG	22	7,900	78	76	19	155	174
504(5)	Grouted Riprap	CU.M.	710	450	67	214	38	281	320
	TOTAL - DRAINAGE/EROSION				868	977	360	1,846	2,206
	V. INCIDENTAL WORKS								
603(3)	Metal Beam Guardrail	L.M.	825	120	40	25	35	64	99
605(1)	Warning Signs	EA.	2,970	6	7	4	6	12	18
605(2)	Regulatory Signs	EA.	2,970	6	7	4	6	12	13
605(3)	Informatory Signs	EA.	11,340	6	30	14	24	44	68
	TOTAL - INCIDENTAL WORKS				85	47	71	132	203
				SUBTOTAL	10,236	6,465	4,402	16,700	21,102
				10% Contingencies	1,024	646	440	1,670	2,110
				SUBTOTAL	11,259	7,111	4,842	18,371	23,212
				10% Office,Vehicles, etc.	1,126	711	484	1,837	2,321
				SUBTOTAL	12,385	7,823	5,326	20,208	25,534
				8% Supervision Cost	991	626	426	1,617	2,043
				TOTAL SECTION COST	13,376	8,448	5,752	21,824	27,576

110

TABLE 6-11 COST ESTIMATE BREAKDOWN
MACTAN CIRCUMFERENTIAL ROAD
SECTION 5: BARANGAY BABAG - PAJO

SECTION LENGTH: 6.1 Kilometers (Existing)
ROADWAY WIDTH: 6.7m Pavement + 2.5m Shoulder
PROPOSED SURFACE COURSE: Portland Cement Concrete Pavement

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	48,600	48	18	31	66	97
101(3)	Removal of Existing Concrete Pavement	SQ.M.	84	590	10	32	7	42	50
102(1)	Unsuitable Excavation	CU.M.	42	7,200	139	70	94	209	302
102(2)	Surplus Common Excavation	CU.M.	42	11,850	244	95	159	338	498
10[illegible](6)	Pipe Culvert Excavation	CU.M.	53	4,550	113	53	75	166	241
105(1)	Subgrade Preparation, Common	SQ.M.	3	36,400	54	21	35	74	109
	TOTAL EARTHWORK				608	288	401	896	1,297
	II. PAVEMENT								
200	Aggregate Subbase Course	CU.M.	147	11,800	833	468	434	1,301	1,735
202	Crushed Aggregate Base Course	CU.M.	252	7,900	1,035	438	518	1,473	1,991
301	Bituminous Prime Coat, MC-70	SQ.M.	12	30,350	200	91	73	291	364
302(3)	Bituminous Tack Coat, CRS-2	SQ.M.	9	15,400	76	33	29	109	139
304(1)	Single Bituminous Surface Treatment	SQ.M.	26	30,350	426	189	174	615	789
310(1)	Bituminous Concrete Wearing Course	CU.M.	2,877	1,375	2,057	870	1,029	2,927	3,956
311(1)	Portland Cement Concrete Pavement	CU.M.	1,967	7,373	7,251	4,496	2,756	11,747	14,503
311(2)	Patching Existing PCC Pavement	SQ.M.	125	560	39	17	15	55	70
311(3)	Sealing Cracks, Existing PCC Pavement	L.M	28	120	1	2	1	3	3
	TOTAL - PAVEMENT				11,919	6,605	5,026	18,523	23,549

TABLE 6-11 COST ESTIMATE BREAKDOWN
SECTION 5: BARANGAY BABAG - PAJO
(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)
	IV. DRAINAGE/EROSION WORKS								
500(1)	Backfill Material, Pipe Culvert	CU.M.	143	2,820	190	109	105	298	403
500(61)	RCPC, 61cm Diameter	L.M.	930	450	167	176	75	343	419
500(91)	RCPC, 91cm Diameter	L.M.	1,575	660	437	437	166	873	1,040
502(10)	Structural Concrete for Pipe Headwalls	CU.M.	2,195	281	253	271	93	524	617
502(11)	Reinforcing Steel for Pipe Headwalls	KG	22	11,250	111	109	27	220	248
504(5)	Grouted Riprap	CU.M.	710	150	22	71	13	94	107
	TOTAL - DRAINAGE/EROSION				1,180	1,173	479	2,353	2,832
	V. INCIDENTAL WORKS								
605(1)	Warning Signs	EA.	2,970	6	7	4	6	12	18
605(2)	Regulatory Signs	EA.	2,970	10	12	7	10	19	30
605(3)	Informatory Signs	EA.	11,340	10	50	24	40	74	113
	TOTAL - INCIDENTAL WORKS				70	35	56	105	161
				SUBTOTAL	13,776	8,100	5,963	21,877	27,839
				10% Contingencies	1,378	810	596	2,188	2,784
				SUBTOTAL	15,154	8,910	6,559	24,064	30,623
				10% Office,Vehicles, etc.	1,515	891	656	2,406	3,062
				SUBTOTAL	16,670	9,801	7,215	26,471	33,686
				8% Supervision Cost	1,334	784	577	2,118	2,695
				TOTAL SECTION COST	18,003	10,585	7,792	28,589	36,381

VII.
ECONOMIC EVALUATION

VII. ECONOMIC EVALUATION

A. INTRODUCTION

Proposed road projects have to meet certain economic criteria to prove beyond 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.

Two project designs were evaluated for each homogeneous section of the Mactan Circumferential 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 each of the proposed project designs with the "without project" alternative and an incremental benefit/cost analysis to assess the adequacy of investing in the intervention alternative with higher costs.

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:

- Costs and benefits are estimated in constant 1990 pesos.

- 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, after inflation, 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 project 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

115

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 1-1
EXISTING ROAD LENGTH

Homogeneous Section	Length (km.)	Pavement Type/ Condition
Pusok-Bankal Jct.	5.5	PCC/Fair (3.0) Asphalt/Fair (2.5)
Bankal Jct.-Maribago Jct.	5.0	PCC/Fair (2.1) Asphalt/Fair (1.8) Asphalt/Bad (1.1)
Maribago Jct.-Marigondon Jct.	3.5	PCC/Bad (0.6) Asphalt/Fair (0.7) Asphalt/Bad (1.9) Asphalt/Good (0.3)
Marigondon Jct.-Babag	6.9	Asphalt/Good (1.0) Asphalt/Fair (5.9)
Babag-Pajo	6.1	Asphalt/Fair (4.5) PCC/Fair (1.6)
TOTAL ROAD	27.0	

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 diverted traffic on this RIF road.

Generated Traffic: Generated traffic occurs only with the implementation of the proposed road improvement project. 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 case 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 the 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 Mactan Circumferential Road Project have been 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 (reduced 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 Region VII, where the Mactan Circumferential Road is located, a value of 2.57 pesos per passenger hour has been assumed. This figure is based on 1988 per capita income as published in the 1989 Statistical Yearbook, adjusted for the proportion of the population of working age. Real income growth of 3.0 percent per year was used to obtain the 1990 estimate. The road is evaluated "with" and "without" time savings.

TABLE 7-2

VEHICLE OPERATING COSTS -- HDM III RESULTS

W/O TIME VALUE OF USER COSTS (PESOS/KM)

SPEED (km/h)	ROUGHNESS (m/km) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Vehicle Type
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	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	2-3W 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	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	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	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	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	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	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	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	2-3W Veh
	ROUGHNESS (m/km) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
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	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	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	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	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	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	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	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	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	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	Cars
	ROUGHNESS (m/km) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
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	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	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	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	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	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	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	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	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	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	Jeepneys

TABLE 7-2
VEHICLE OPERATING COSTS -- HDM III RESULTS
W/O TIME VALUE OF USER COSTS (PESOS/KM)

SPEED (km/h)	ROUGHNESS (m/km) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Vehicle Type
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	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	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	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	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	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	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	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	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	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	Buses
	ROUGHNESS (m/km) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
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	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	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	Trucks
40	7.477	7.984	8.489	8.998	9.152	10.022	10.562	11.101	11.652	12.214	12.789	13.377	13.977	14.589	15.213	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	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	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	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	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	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	Trucks

TABLE 7-3
VEHICLE OPERATING COSTS -- HDM III RESULTS
WITH TIME VALUE OF USER COSTS (PESOS/KM)
REGION VII

SPEED (km/h)	ROUGHNESS (m/km) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Vehicle Type
10	2.776	2.797	2.820	2.846	2.906	2.943	2.985	3.030	3.030	3.075	3.120	3.165	3.209	3.253	3.296	2-3W Veh
20	1.580	1.601	1.624	1.650	1.679	1.981	1.748	1.790	1.836	1.882	1.928	1.973	2.019	2.065	2.110	2-3W Veh
30	1.186	1.207	1.230	1.256	1.285	1.318	1.356	1.399	1.446	1.493	1.541	1.589	1.638	1.687	1.736	2-3W Veh
40	0.996	1.017	1.040	1.066	1.096	1.130	1.168	1.213	1.262	1.312	1.363	1.415	1.468	1.522	1.576	2-3W Veh
50	0.890	0.911	0.935	0.961	0.992	1.027	1.067	1.113	1.165	1.218	1.273	1.329	1.387	1.446	1.507	2-3W Veh
60	0.829	0.851	0.875	0.902	0.933	0.969	1.011	1.060	1.114	1.171	1.229	1.290	1.352	1.416	1.481	2-3W Veh
70	0.794	0.816	0.840	0.868	0.900	0.937	0.981	1.032	1.089	1.149	1.210	1.274	1.340	1.408	1.476	2-3W Veh
80	0.775	0.797	0.821	0.849	0.882	0.921	0.966	1.019	1.079	1.141	1.205	1.272	1.341	1.411	1.482	2-3W Veh
90	0.773	0.795	0.819	0.846	0.880	0.922	0.967	1.022	1.085	1.148	1.215	1.285	1.356	1.426	1.500	2-3W Veh
100	0.786	0.808	0.832	0.857	0.892	0.938	0.982	1.039	1.105	1.168	1.238	1.311	1.383	1.451	1.528	2-3W Veh
	ROUGHNESS (m/km) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
10	2.964	3.012	3.067	3.129	3.200	3.280	3.373	3.480	3.598	3.717	3.835	3.953	4.010	4.187	4.299	Cars
20	1.932	1.980	2.035	2.097	2.168	2.249	2.341	2.449	2.568	2.687	2.805	2.924	3.042	3.161	3.274	Cars
30	1.596	1.645	1.700	1.762	1.833	1.914	2.007	2.116	2.236	2.356	2.476	2.597	2.718	2.839	2.956	Cars
40	1.438	1.487	1.542	1.605	1.676	1.758	1.852	1.962	2.084	2.207	2.330	2.454	2.579	2.705	2.827	Cars
50	1.356	1.405	1.461	1.524	1.596	1.679	1.775	1.887	2.011	2.137	2.264	2.392	2.522	2.653	2.781	Cars
60	1.313	1.363	1.419	1.482	1.555	1.640	1.737	1.851	1.979	2.108	2.239	2.372	2.506	2.642	2.776	Cars
70	1.297	1.346	1.402	1.467	1.541	1.627	1.726	1.843	1.973	2.105	2.240	2.377	2.516	2.657	2.795	Cars
80	1.294	1.344	1.401	1.466	1.541	1.628	1.730	1.848	2.143	2.117	2.256	2.396	2.539	2.684	2.826	Cars
90	1.304	1.357	1.416	1.479	1.555	1.643	1.749	1.866	2.489	2.144	2.287	2.429	2.575	2.723	2.869	Cars
100	1.325	1.383	1.445	1.504	1.581	1.670	1.781	1.895	3.009	2.184	2.331	2.474	2.622	2.772	2.922	Cars
	ROUGHNESS (m/km) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
10	8.157	8.269	8.398	8.548	8.723	8.926	9.165	9.445	9.759	10.073	10.386	10.699	11.012	11.325	11.632	Jeepneys
20	4.895	5.008	5.138	5.289	5.464	5.669	5.909	6.192	6.507	6.824	7.141	7.458	7.775	8.092	8.434	Jeepneys
30	3.856	3.970	4.101	4.254	4.431	4.638	4.881	5.167	5.487	5.809	6.131	6.454	6.778	7.104	7.425	Jeepneys
40	3.385	3.500	3.633	3.787	3.967	4.177	4.424	4.713	5.039	5.366	5.696	6.027	6.360	6.695	7.027	Jeepneys
50	3.144	3.260	3.733	3.946	4.197	4.492	4.823	4.823	4.823	5.157	5.494	5.833	6.175	6.519	6.861	Jeepneys
60	3.019	3.137	3.272	3.431	3.615	3.832	4.087	4.387	4.723	4.682	5.408	5.755	6.104	6.457	6.807	Jeepneys
70	2.963	3.081	3.218	3.379	3.566	3.786	4.045	4.349	4.691	5.038	5.388	5.742	6.098	6.458	6.816	Jeepneys
80	2.947	3.066	3.205	3.367	3.557	3.780	4.042	4.351	4.698	5.050	5.406	5.766	6.129	6.495	6.859	Jeepneys
90	2.964	3.085	3.226	3.388	3.581	3.807	4.071	4.386	4.737	4.711	5.455	5.820	6.190	6.561	6.929	Jeepneys
100	3.008	3.132	3.275	3.436	3.632	3.861	4.126	4.448	4.802	4.015	5.529	5.898	6.275	6.650	7.020	Jeepneys

TABLE 7-3
VEHICLE OPERATING COSTS -- HDM III RESULTS
WITH TIME VALUE OF USER COSTS (PESOS/KM)
REGION VII

SPEED (km/h)	ROUGHNESS (m/km) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Vehicle Type
10	16.886	16.956	17.030	17.108	17.190	17.328	17.371	17.470	17.575	17.687	17.807	17.934	18.071	18.217	18.370	Buses
20	10.314	10.384	10.459	10.538	10.622	10.711	10.807	10.909	11.018	11.135	11.261	11.397	11.543	11.700	11.867	Buses
30	8.209	8.281	8.357	8.438	8.526	8.620	8.721	8.831	8.950	9.080	9.221	9.375	9.574	9.724	9.919	Buses
40	7.260	7.334	7.412	7.497	7.589	7.690	7.801	7.923	8.058	8.208	8.372	8.553	8.751	8.966	9.198	Buses
50	6.792	6.868	6.949	7.038	7.137	7.247	7.371	7.509	7.304	7.837	8.029	8.239	8.470	8.719	8.986	Buses
60	6.575	6.653	6.737	6.831	6.938	7.059	7.196	7.353	7.529	7.726	7.945	8.164	8.444	8.724	9.022	Buses
70	6.506	6.586	6.673	6.773	6.887	7.019	7.171	7.345	7.542	7.763	8.006	8.271	8.558	8.865	9.189	Buses
80	6.532	6.613	6.704	6.809	6.930	7.073	7.239	7.430	7.647	7.888	8.154	8.443	8.753	9.084	9.433	Buses
90	6.637	6.718	6.814	6.923	7.051	7.205	7.384	7.592	7.823	8.085	8.373	8.684	9.013	9.365	9.738	Buses
100	6.809	6.889	6.991	7.103	7.238	7.403	7.594	7.819	8.073	8.342	8.651	8.982	9.326	9.696	10.092	Buses
	ROUGHNESS (m/km) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
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	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	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	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	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	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	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	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	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	Trucks
100	8.660	9.176	9.719	10.280	10.864	11.492	12.146	12.830	13.549	14.302	15.088	15.867	16.680	17.514	18.367	Trucks

121

2. DEVELOPMENT BENEFITS

It is likely that the following development will take place in Mactan:

- continued growth in manufacturing in the Export Processing Zone (EPZ)
- expansion in the number of quality hotel rooms, and related services, to keep up with accelerated demand
- greater number of direct international flights
- construction of shopping centers
- establishment of a golf course, and
- possible reclamation of additional land from the sea.

These developments will have an impact upon tourism which can be measured in terms of the number of tourists attracted to the area, their length of stay, their expenditures and the resulting value added brought to the zone of influence.

The average stay and daily expenditures per tourist are expected to increase due to additional facilities such as the golf course and shopping centers. The number of tourists attracted to Mactan is expected to increase due to more direct flights and expanded business opportunities. Also, the zone of influence's manufacturing income is expected to increase because of continuing growth in manufacturing in the EPZ.

However, the improvement of the Mactan Circumferential Road will only be one more facilitating factor, already anticipated by investors, rather than a leading cause for these investments. For this reason, the benefits are estimated in terms of savings in vehicle operating costs associated with generated traffic.

3. DIVERTED AND GENERATED TRAFFIC BENEFITS

No diverted traffic benefits are expected for the five sections of the Mactan Circumferential Road.

Generated traffic (also discussed in Chapter III) represents traffic which is currently not using the road but will in the future as VOCs are reduced. Generated traffic benefits have been estimated using the existing roadways as the basis for VOC calculations "without" the proposed projects.

The existing road from Lapu-Lapu City around Mactan Island to Cordova traverses flat terrain and is paved with asphalt and concrete in good to bad condition.

To evaluate VOCs along the Mactan Circumferential Road "with" the proposed project, newly-constructed 6.7 meter wide PCC-paved and AC-paved road sections have been assumed for Sections 1 and 5 and 6.1 meter wide PCC-paved and AC-paved road sections for

Sections 2, 3 and 4.

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.

Only generated traffic benefits and no development benefits are considered for the improvements scheduled for the five sections of the Mactan Circumferential Road.

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 Table 7-4.

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 to 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. Traffic volumes and composition in these sections remain approximately constant.

123

TABLE 7-4

ROUTINE AND PERIODIC MAINTENANCE UNIT COSTS

DESCRIPTION OF ROUTINE MAINTENANCE TASK	UNIT	FOREIGN COMPONENT DIRECT COST	FOREIGN COMPONENT INDIRECT COST	LOCAL COMPONENT COST	TAXES	FINANCIAL UNIT COST	ECONOMIC UNIT COST
DITCH CLEANING	Linear Meter	0.00	0.00	10.41	0.00	10.41	10.41
GRASS CUTTING	Kilometer	0.00	0.00	2083.38	0.00	2083.38	2083.38
CULVERT CLEANING	Linear Meter	0.00	0.00	18.97	0.00	18.97	18.97
MINOR STRUCTURAL REPAIRS	Each	0.00	0.00	5959.76	0.00	5959.76	5959.76
GRAVEL ROAD GRADING AND ROLLING	Kilometer	6668.95	0.00	2401.16	3290.95	12361.06	9070.11
GRAVEL ROAD SPOT REGRAVELLING	Square Meter	13.58	0.00	16.15	8.13	37.86	29.73
GRAVEL ROAD SHOULDER GRADING	Square Meter	0.66	0.00	0.22	0.34	1.22	0.88
BITUMINOUS SURFACE PATCHING OF POTHOLES	Square Meter	30.82	18.97	21.84	21.84	93.47	71.63
PCC PAVEMENT SLAB REPLACEMENT (0.15 M)	Square Meter	53.56	78.17	79.83	49.53	261.09	211.56
PCC PAVEMENT SLAB REPLACEMENT (0.17 M)	Square Meter	60.86	89.58	90.20	56.20	296.84	240.64
PCC PAVEMENT SLAB REPLACEMENT (0.20 M)	Square Meter	71.03	104.34	96.05	66.03	337.45	271.42
PCC PAVEMENT SLAB REPLACEMENT (0.23 M)	Square Meter	82.11	119.87	122.69	76.28	400.95	324.67
PCC PAVEMENT SLAB REPLACEMENT (0.25 M)	Square Meter	91.61	124.32	134.55	84.00	434.48	350.48
PCC PAVEMENT SEALING OF JOINTS AND CRACKS	Linear Meter	2.03	4.85	8.71	2.64	18.23	15.59

DESCRIPTION OF PERIODIC MAINTENANCE TASK	UNIT	FOREIGN COMPONENT DIRECT COST	FOREIGN COMPONENT INDIRECT COST	LOCAL COMPONENT COST	TAXES	FINANCIAL UNIT COST	ECONOMIC UNIT COST
GRAVEL ROAD REGRAVELLING	Square Meter	15.30	0.00	6.52	7.78	29.60	21.82
BITUMINOUS SURFACE SEAL COAT	Square Meter	1.60	10.64	5.15	4.42	21.81	17.39
BITUMINOUS SURFACE OVERLAY (0.05 M)	Cubic Meter	860.34	550.62	825.64	619.45	2858.44	2238.99

NOTE: OVERLAY COSTS ASSUME A 6.7-METER CROSS SECTION

124

For most road projects, it is 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 paved with asphalt. 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. Subsection analysis was needed for all five sections of the Mactan Circumferential Road.

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 five sections of the Mactan Circumferential Road were estimated using appropriate unit construction costs. Unit costs and total costs for these roads are summarized in Chapter VI.

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 projects.

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.

125

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

126

benefits only". In making recommendations, the minimum IRR should be 15 percent.

2. RESULTS

The evaluation of the five sections of the Mactan Circumferential Road are described below for two pavement options: AC and PCC.

a. Pusok-Bankal Jct. (5.5 kilometers)

The Pusok-Bankal Jct. section starts at Pusok in front of the Government Center and terminates at Bankal Jct. It traverses flat terrain and currently consists of 3.0 km concrete pavement in fair condition and 2.5 km asphalt pavement in fair condition.

The 1990 annual average daily traffic (AADT) of Pusok-Bankal is 2,906 vehicles, including 2,049 tricycles and motorcycles. With the proposed improvements, traffic volumes in 1993 should increase to 4,117 vehicles per day and should reach 22,724 vehicles per day by 2012. Sixty eight percent of the projected AADT is attributable to two and three-wheel vehicles.

Proposed improvements for the Pusok-Bankal section include: the reconstruction of the 5.5 km existing concrete and asphalt pavements, a widening of the carriageway width to 6.7 meters and widening of the shoulders to 2.5 meters. Two alternatives were considered for the paving of this section: AC and PCC.

A summary of the economic results for Pusok-Bankal section is given in Table 7-5 for the AC alternative and Table 7-6 for the PCC alternative. A detailed sensitivity analysis is presented in Tables 7-15 through 7-24.

The Pusok-Bankal Jct. section is not economically feasible with expected base-case internal rates of return of 9.8 percent for the AC alternative and 9.9 percent for the PCC alternative.

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

b. Bankal Jct.-Maribago (5.0 kilometers)

The proposed section connects Bankal Jct. with Barangay Maribago. The road traverses flat terrain and is paved with concrete and asphalt in fair to bad condition.

In 1990, the Bankal Jct.-Maribago Jct. section shows an annual average daily traffic of 1,472 vehicles, including 1,038 tricycles and motorcycles. With the proposed improvements, traffic volumes in 1993 should become 2,101 vehicles per day and should increase

TABLE 7-5

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: AC

YEAR	PROJECT COSTS	VOC SAVINGS NORMAL BENEFITS (1)	VOC SAVINGS DIVERTED BENEFITS (1)	VOC SAVINGS GENERATED BENEFITS (1,2)	MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
1991	6,543,600	0	0	0	0	0	(6,543,600)
1992	9,815,400	0	0	0	0	0	(9,815,400)
1993	0	1,097,339	0	58,579	(41,650)	0	1,114,268
1994	0	1,144,835	0	62,313	(41,650)	0	1,165,498
1995	0	1,245,570	0	69,167	(41,650)	0	1,273,087
1996	0	1,355,804	0	76,776	(41,650)	0	1,390,929
1997	0	1,476,480	0	85,221	(41,650)	0	1,520,051
1998	0	2,321,565	0	136,438	(32,620)	0	2,425,383
1999	0	3,112,710	0	187,609	(32,620)	0	3,267,699
2000	0	3,392,556	0	208,246	(32,620)	0	3,568,182
2001	0	3,702,520	0	231,153	(382,120)	0	[illegible],553
2002	0	3,457,307	0	219,156	(19,370)	[illegible]	3,657,093
2003	0	1,227,440	0	78,828	(4,277,368)	0	(2,971,100)
2004	0	1,341,567	0	87,499	(40,870)	0	1,388,196
2005	0	1,186,135	0	77,964	(40,870)	0	1,223,230
2006	0	1,297,706	0	86,540	(40,870)	0	1,343,376
2007	0	2,923,013	0	201,053	(40,870)	0	3,083,196
2008	0	3,198,961	0	223,169	(40,870)	0	3,381,260
2009	0	3,023,215	0	214,935	(388,495)	0	2,849,655
2010	0	3,310,934	0	238,578	(38,995)	0	3,510,516
2011	0	5,341,779	0	381,949	(43,120)	0	5,680,608
2012	0	3,197,640	0	230,009	(36,745)	0	3,390,904

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	9.8%	NB/I(15%)=	0.683 (3)	IRR(%)=	9.8%	NB/I(15%)=	0.663
NPV(15%)=	(3,932,678)	NB/I(12%)=	0.830	NPV(15%)=	(3,932,678)	NB/I(12%)=	0.830
		NB/I(18%)=	0.542			NB/I(18%)=	0.542

(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.

128

TABLE 7-6

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: MACTAN CIRC. SECTION: PSOK-BNKAL 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	8,955,200	0	0	0	0	0	(8,955,200)
1992	13,432,800	0	0	0	0	0	(13,432,800)
1993	0	1,052,747	0	56,138	(47,370)	0	1,061,514
1994	0	1,144,835	0	62,313	(47,370)	0	1,159,778
1995	0	1,245,570	0	69,167	(47,370)	0	1,267,367
1996	0	1,355,804	0	76,776	(47,370)	0	1,385,209
1997	0	1,476,480	0	85,221	(47,370)	0	1,514,331
1998	0	2,321,565	0	136,438	(38,340)	0	2,419,663
1999	0	3,112,710	0	187,609	(38,340)	0	3,261,979
2000	0	3,392,556	0	208,246	(38,340)	0	3,562,462
2001	0	3,702,520	0	231,153	252,910	0	4,186,583
2002	0	4,654,922	0	295,224	(25,090)	0	4,925,056
2003	0	1,227,440	0	78,828	3,483,823	0	4,7[illegible],091
2004	0	870,423	0	55,854	(46,590)	0	879,687
2005	0	1,186,135	0	77,964	(46,590)	0	1,217,510
2006	0	1,297,706	0	86,540	(46,590)	0	1,337,656
2007	0	2,923,013	0	201,053	(46,590)	0	3,077,476
2008	0	3,198,961	0	223,169	(46,590)	0	3,375,540
2009	0	6,153,913	0	435,902	246,535	0	6,836,349
2010	0	4,922,705	0	352,042	(44,715)	0	5,230,031
2011	0	9,550,592	0	687,794	(44,715)	0	10,193,670
2012	0	11,394,562	0	829,700	(38,340)	0	12,185,922

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	9.9%	NB/I(15%)=	0.626 (3)	IRR(%)=	9.9%	NB/I(15%)=	0.626
NPV(15%)=	(5,972,415)	NB/I(12%)=	0.816	NPV(15%)=	(5,972,415)	NB/I(12%)=	0.816
		NB/I(18%)=	0.494			NB/I(18%)=	0.494

(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.

129

to 12,024 vehicles per day in 2012. Approximately 68 percent of the projected traffic is attributable to tricycles and motorcycles.

Proposed improvements include the reconstruction and paving of the 5.0 km long concrete and asphalt pavements. The carriageway and shoulders will be widened to 6.1 meters and 2.0 meters, respectively. Two alternatives were considered for the paving of this section: AC and PCC.

A summary of the economic results for this section of the Mactan Circumferential Road is shown in Table 7-7 for the AC alternative and in Table 7-8 for the PCC alternative (including passenger time savings). Detailed sensitivity analysis results are presented in Tables 7-15 through 7-24.

Bankal Jct.-Maribago section is not economically feasible under both the AC and PCC pavement alternatives with an IRR of 4.9 percent for AC alternative and 4.3 percent for PCC alternative.

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

c. Maribago Jct.-Marigondon Jct. (3.5 kilometers)

The proposed section from Maribago to Marigondon goes through flat terrain and currently has asphalt and concrete pavements in good to bad condition.

In 1990, Maribago-Marigondon shows an annual average daily traffic of 736 vehicles, including 519 tricycles and motorcycles. With the proposed improvements, traffic volumes in 1993 should increase to 1,059 vehicles per day and should reach 6,321 vehicles per day by 2012. Seventy percent of the projected AADT is attributable to two and three-wheel vehicles.

Proposed improvements for the Maribago-Marigondon section include: the reconstruction of the 0.6 km PCC and 2.9 km AC pavement, a widening of the carriageway width to 6.1 meters and widening of the shoulders to 2.0 meters. Two alternatives were considered for the paving of this section: AC and PCC.

A summary of the economic results for this section of the Mactan Circumferential Road is given in Table 7-9 for the AC alternative and Table 7-10 for the PCC alternative. A detailed sensitivity analysis is presented in Tables 7-15 through 7-24.

The Maribago-Marigondon section is not economically feasible under both pavement alternatives with an expected IRR of 5.2 percent for the AC pavement alternative and 4.3 percent for the AC pavement alternative.

TABLE 7-7

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: MACTAN CIRC. SECTION: BNKAL-MRBGO ALTERNATIVE: AC

YEAR	VOC SAVINGS				MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
	PROJECT COSTS	NORMAL BENEFITS (1)	DIVERTED BENEFITS (1)	GENERATED BENEFITS (1,2)			
1991	4,831,600	0	0	0	0	0	(4,831,600)
1992	7,247,400	0	0	0	0	0	(7,247,400)
1993	0	517,371	0	27,403	(36,446)	0	508,328
1994	0	563,899	0	30,417	(36,446)	0	557,870
1995	0	614,900	0	33,763	(36,446)	0	612,217
1996	0	670,826	0	37,477	(36,446)	0	671,857
1997	0	732,173	0	41,599	(36,446)	0	737,326
1998	0	990,422	0	57,150	(36,446)	0	1,011,126
1999	0	1,186,178	0	69,513	(30,125)	0	1,225,567
2000	0	1,296,550	0	77,160	(30,125)	0	1,343,584
2001	0	1,343,774	0	80,915	(274,775)	0	1,149,914
2002	0	2,113,289	0	129,819	(14,755)	0	2,228,352
2003	0	285,258	0	17,594	(1,539,682)	0	(1,236,830)
2004	0	312,688	0	19,529	(39,695)	0	292,522
2005	0	466,658	0	29,759	(39,695)	0	456,722
2006	0	511,689	0	33,033	(39,695)	0	505,026
2007	0	832,188	0	54,212	(39,695)	0	846,704
2008	0	1,139,482	0	75,534	(39,695)	0	1,175,321
2009	0	1,609,437	0	107,563	(282,170)	0	1,434,830
2010	0	1,767,124	0	119,395	(37,520)	0	1,848,999
2011	0	2,424,163	0	165,154	(37,520)	0	2,551,796
2012	0	3,891,304	0	268,626	(30,125)	0	4,129,805

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	4.9%	NB/I(15%)=	0.399 (3)	IRR(%)=	4.9%	NB/I(15%)=	0.399
NPV(15%)=	(5,180,147)	NB/I(12%)=	0.503	NPV(15%)=	(5,180,147)	NB/I(12%)=	0.503
		NB/I(18%)=	0.325			NB/I(18%)=	0.325

(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 7-8

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: MACTAN CIRC. SECTION: BNKAL-MRBGO 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	6,107,200	0	0	0	0	0	(6,107,200)
1992	9,160,800	0	0	0	0	0	(9,160,800)
1993	0	517,371	0	27,403	(41,646)	0	503,128
1994	0	563,899	0	30,417	(41,646)	0	552,670
1995	0	614,900	0	33,763	(41,646)	0	607,017
1996	0	670,826	0	37,477	(41,646)	0	666,657
1997	0	732,173	0	41,599	(41,646)	0	732,126
1998	0	990,422	0	57,150	(41,646)	0	1,005,926
1999	0	1,122,685	0	65,672	(35,325)	0	1,153,032
2000	0	1,227,354	0	72,896	(35,325)	0	1,264,925
2001	0	1,343,774	0	80,915	302,525	0	1,727,214
2002	0	2,113,289	0	129,819	(19,955)	0	2,223,152
2003	0	285,258	0	17,594	2,026,517	0	2,329,369
2004	0	312,688	0	19,529	(44,895)	0	287,322
2005	0	466,658	0	29,759	(44,895)	0	451,522
2006	0	511,689	0	33,033	(44,895)	0	499,826
2007	0	832,188	0	54,212	(44,895)	0	841,504
2008	0	1,139,482	0	75,534	(44,895)	0	1,170,121
2009	0	1,609,437	0	107,563	295,130	0	2,012,130
2010	0	1,767,124	0	119,395	(42,720)	0	1,843,799
2011	0	1,912,398	0	129,109	(42,720)	0	1,998,786
2012	0	3,891,304	0	268,626	(35,325)	0	4,124,605

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	4.3%	NB/I(15%)=	0.369 (3)	IRR(%)=	4.3%	NB/I(15%)=	0.369
NPV(15%)=	(6,872,449)	NB/I(12%)=	0.470	NPV(15%)=	(6,872,449)	NB/I(12%)=	0.470
		NB/I(18%)=	0.297			NB/I(18%)=	0.297

(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 7-9

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

YEAR	PROJECT COSTS	VOC SAVINGS NORMAL BENEFITS (1)	VOC SAVINGS DIVERTED BENEFITS (1)	VOC SAVINGS GENERATED BENEFITS (1,2)	MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
1991	3,139,200	0	0	0	0	0	(3,139,200)
1992	4,708,800	0	0	0	0	0	(4,708,800)
1993	0	333,660	0	17,485	(22,730)	0	328,416
1994	0	372,479	0	19,812	(22,730)	0	369,561
1995	0	407,528	0	21,991	(22,730)	0	406,789
1996	0	446,054	0	24,410	(22,730)	0	447,734
1997	0	514,229	0	28,525	(22,730)	0	520,023
1998	0	703,382	0	39,524	(22,730)	0	720,176
1999	0	770,800	0	43,871	(22,730)	0	791,942
2000	0	860,735	0	49,602	(22,505)	0	887,832
2001	0	949,259	0	55,377	(92,405)	0	912,230
2002	0	1,262,875	0	74,512	(8,725)	0	1,328,662
2003	0	127,202	0	7,603	(631,305)	0	(496,501)
2004	0	191,419	0	11,556	(24,416)	0	178,558
2005	0	179,820	0	11,030	(24,416)	0	166,434
2006	0	197,578	0	12,244	(24,416)	0	185,406
2007	0	540,571	0	33,600	(24,416)	0	549,755
2008	0	594,230	0	37,296	(24,416)	0	607,110
2009	0	1,013,557	0	64,210	(92,141)	0	985,626
2010	0	1,219,703	0	78,132	(22,241)	0	1,275,594
2011	0	1,795,746	0	115,964	(21,476)	0	1,890,234
2012	0	2,549,337	0	166,020	(14,846)	0	2,700,510

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	5.2%	NB/I(15%)=	0.413 (3)	IRR(%)=	5.2%	NB/I(15%)=	0.413
NPV(15%)=	(3,285,813)	NB/I(12%)=	0.521	NPV(15%)=	(3,285,813)	NB/I(12%)=	0.521
		NB/I(18%)=	0.337			NB/I(18%)=	0.337

(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: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: PCC

YEAR	PROJECT COSTS	VOC SAVINGS NORMAL BENEFITS (1)	VOC SAVINGS DIVERTED BENEFITS (1)	VOC SAVINGS GENERATED BENEFITS (1,2)	MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
1991	4,518,000	0	0	0	0	0	(4,518,000)
1992	6,777,000	0	0	0	0	0	(6,777,000)
1993	0	333,660	0	17,485	(26,370)	0	324,776
1994	0	372,479	0	19,812	(26,370)	0	365,921
1995	0	407,528	0	21,991	(26,370)	0	403,149
1996	0	446,054	0	24,410	(26,370)	0	444,094
1997	0	514,229	0	28,525	(26,370)	0	516,383
1998	0	703,382	0	39,524	(26,370)	0	716,536
1999	0	770,800	0	43,871	(26,370)	0	788,302
2000	0	860,735	0	49,602	(26,145)	0	884,192
2001	0	949,259	0	55,377	311,705	0	1,316,340
2002	0	1,262,875	0	74,512	(12,365)	0	1,325,022
2003	0	157,675	0	9,362	2,865,024	0	3,032,061
2004	0	224,858	0	13,509	(28,056)	0	210,311
2005	0	216,524	0	13,198	(28,056)	0	201,666
2006	0	237,877	0	14,650	(28,056)	0	224,471
2007	0	540,571	0	33,600	(28,056)	0	546,115
2008	0	594,230	0	37,296	(28,056)	0	603,470
2009	0	1,013,557	0	64,210	311,969	0	1,389,736
2010	0	1,219,703	0	78,132	(25,881)	0	1,271,954
2011	0	1,795,746	0	115,964	(25,116)	0	1,886,594
2012	0	2,549,337	0	166,020	(18,486)	0	2,696,870

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	4.3%	NB/I(15%)=	0.383 (3)	IRR(%)=	4.3%	NB/I(15%)=	0.383
NPV(15%)=	(5,133,832)	NB/I(12%)=	0.465	NPV(15%)=	(5,133,832)	NB/I(12%)=	0.465
		NB/I(18%)=	0.291			NB/I(18%)=	0.291

(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.

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

d. Marigondon Jct.-Babag (6.9 kilometers)

The Marigondon-Babag section of the Mactan Circumferential Road links Jct. Marigondon with Barangay Babag in the Municipality of Cordova. This road section traverses flat terrain and currently consists of 6.9 km asphalt pavement in good to fair condition.

In 1990, Marigondon-Babag shows an AADT of 967, 57 percent attributed to motorcycles and tricycles. With the proposed improvements, traffic volumes in 1993 should reach 1,407 vehicles per day and should increase to 7,227 vehicles in 2012. Of the projected AADT, approximately 54 percent is two and three-wheel vehicles.

Proposed improvements for the Marigondon-Babag section include the reconstruction of the 6.9 km asphalt pavement, widening of the carriageway and shoulder widths to 6.1 meters and 2.0 meters, respectively. Two alternatives were considered for the paving of this section: AC and PCC.

A summary of the economic results for this section of the Mactan Circumferential Road is presented in Table 7-11 for the AC alternative and Table 7-12 for the PCC alternative. A detailed sensitivity analysis is presented in Tables 7-15 through 7-24.

Marigondon-Babag section falls short of the required economic criteria both under the AC and PCC pavement alternatives with an expected IRR of 4.7 percent for the AC pavement alternative and 3.8 percent for the PCC pavement alternative.

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

e. Babag-Pajo (6.1 Kilometers)

The proposed Babag-Pajo section extends from Barangay Babag passes through Looc and terminates in Barangay Pajo in Lapu-Lapu City. Barangay Pajo is the only landing point on Mactan Island for the loading and unloading of passengers. Presently, this section has a 4.5 km asphalt pavement subsection in fair condition and a 1.6 km concrete subsection in fair condition.

In 1990, this Babag-Pajo section has an AADT of 1,872, 57 percent of which are two and three-wheel vehicles. with the proposed improvements, traffic volumes per day should become 2,850 in 1990 and should reach 14,389 vehicles per day in 2012. About 54 percent of these vehicles are motorcycles and tricycles.

TABLE 7-11

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: MACTAN CIRC. SECTION: MRGNDN-BBAG ALTERNATIVE: AC

YEAR	VOC SAVINGS				MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
	PROJECT COSTS	NORMAL BENEFITS (1)	DIVERTED BENEFITS (1)	GENERATED BENEFITS (1,2)			
1991	6,252,800	0	0	0	0	0	(6,252,800)
1992	9,379,200	0	0	0	0	0	(9,379,200)
1993	0	727,328	0	59,712	(51,866)	0	735,174
1994	0	812,724	0	68,581	(51,866)	0	829,439
1995	0	878,648	0	76,125	(51,866)	0	902,907
1996	0	950,305	0	84,499	(51,866)	0	982,938
1997	0	1,321,497	0	120,634	(51,866)	0	1,390,265
1998	0	1,430,631	0	133,904	(51,866)	0	1,512,669
1999	0	1,592,356	0	152,812	(51,116)	0	1,694,052
2000	0	1,725,255	0	169,622	(51,116)	0	1,843,760
2001	0	1,872,524	0	188,280	(51,116)	0	2,009,688
2002	0	2,519,155	0	259,439	(19,846)	0	2,758,748
2003	0	0	0	0	(71,336)	0	(71,336)
2004	0	8,747	0	144	(71,336)	0	(62,445)
2005	0	0	0	0	(71,336)	0	(71,336)
2006	0	0	0	0	(71,336)	0	(71,336)
2007	0	528,938	0	61,653	(71,336)	0	519,255
2008	0	575,383	0	68,435	(71,336)	0	572,482
2009	0	1,340,976	0	161,635	(66,161)	0	1,436,450
2010	0	1,802,813	0	218,466	(66,161)	0	1,955,118
2011	0	2,712,979	0	335,775	(66,161)	0	2,982,592
2012	0	4,154,419	0	525,083	(48,566)	0	4,630,936

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	4.7%	NB/I(15%)=	0.430 (3)	IRR(%)=	4.7%	NB/I(15%)=	0.430
NPV(15%)=	(6,362,608)	NB/I(12%)=	0.530	NPV(15%)=	(6,362,608)	NB/I(12%)=	0.530
		NB/I(18%)=	0.357			NB/I(18%)=	0.357

(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 7-12

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: MACTAN CIRC. SECTION: MRGNDN-BBAG 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	8,729,600	0	0	0	0	0	(8,729,600)
1992	13,094,400	0	0	0	0	0	(13,094,400)
1993	0	727,328	0	59,712	(59,042)	0	727,998
1994	0	912,724	0	68,581	(59,042)	0	822,263
1995	0	878,648	0	76,125	(59,042)	0	895,731
1996	0	950,305	0	84,499	(59,042)	0	975,762
1997	0	1,321,497	0	120,634	(59,042)	0	1,383,089
1998	0	1,430,631	0	133,904	(59,042)	0	1,505,493
1999	0	1,592,356	0	152,812	(58,292)	0	1,686,876
2000	0	1,725,255	0	169,622	(58,292)	0	1,836,584
2001	0	1,865,791	0	188,175	745,558	0	2,799,524
2002	0	2,519,155	0	259,439	(27,022)	0	2,751,572
2003	0	(8,007)	0	(130)	5,835,720	0	5,827,582
2004	0	0	0	0	(78,512)	0	(78,512)
2005	0	0	0	0	(78,512)	0	(78,512)
2006	0	0	0	0	(78,512)	0	(78,512)
2007	0	528,938	0	61,653	(78,512)	0	512,079
2008	0	575,383	0	68,435	(78,512)	0	565,306
2009	0	1,340,976	0	161,635	730,513	0	2,233,124
2010	0	1,802,813	0	218,466	(73,337)	0	1,947,942
2011	0	2,712,979	0	335,775	(73,337)	0	2,975,416
2012	0	4,154,419	0	525,083	(55,742)	0	4,623,760

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	3.8%	NB/I(15%)=	0.374 (3)	IRR(%)=	3.8%	NB/I(15%)=	0.374
NPV(15%)=	(9,755,741)	NB/I(12%)=	0.469	NPV(15%)=	(9,755,741)	NB/I(12%)=	0.469
		NB/I(18%)=	0.304			NB/I(18%)=	0.304

(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.

Proposed improvements for this section include: the reconstruction and paving of 6.1 km concrete and asphalt pavements, widening of the carriageway width to 6.7 meters and widening of the shoulders to 2.5 meters.

A summary of the economic results for the Babag-Pajo section is shown in Table 7-13 for the AC alternative and Table 7-14 for the PCC alternative. A detailed sensitivity analysis is presented in Tables 7-15 through 7-24.

Babag-Pajo section is not economically feasible under the base case and sensitivity analysis scenarios with an IRR of 11.1 percent for the AC alternative and 9.6 percent for the PCC alternative.

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

F. SENSITIVITY ANALYSIS

Tables 7-15 through 7-24 present the results of a sensitivity analysis performed for the five sections of the Mactan Circumferential 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 Mactan Circumferential Road are not economically feasible in all sensitivity analysis scenarios under both the AC and PCC pavement alternatives.

The results of the economic evaluation of the Mactan Circumferential Road indicate that better maintenance of those areas of the road in bad condition is needed rather than an upgrade of the entire road. This result holds even when roadway sections in fair condition with short stretches in bad condition are classified as "bad". The Consultant's evaluation model shows that proposed improvements on these "bad" sections still produce IRRs below the required 15 percent. Thus, the most cost-effective means of improving traffic flow and vehicle operating speeds is through stepped up periodic maintenance of the existing road.

TABLE 7-13

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

YEAR	PROJECT COSTS	VOC SAVINGS NORMAL BENEFITS (1)	VOC SAVINGS DIVERTED BENEFITS (1)	VOC SAVINGS GENERATED BENEFITS (1,2)	MAINTENANCE BENEFITS	DEV'T BENEFITS (2)	TOTAL BENEFITS
1991	6,939,600	0	0	0	0	0	(6,939,600)
1992	10,409,400	0	0	0	0	0	(10,409,400)
1993	0	1,300,645	0	142,365	(43,055)	0	1,399,955
1994	0	1,401,924	0	158,025	(43,055)	0	1,516,894
1995	0	1,545,679	0	179,126	(43,055)	0	1,681,750
1996	0	2,116,517	0	252,255	(43,055)	0	2,325,717
1997	0	2,312,887	0	283,471	(43,055)	0	2,553,302
1998	0	2,986,627	0	379,480	(38,239)	0	3,327,869
1999	0	3,745,918	0	489,072	454,518	0	4,689,508
2000	0	(291,905)	0	(38,802)	6 672,741	0	6,342,034
2001	0	(281,991)	0	(38,180)	(238,724)	0	(558,895)
2002	0	(304,958)	0	(42,379)	(52,324)	0	(399,661)
2003	0	477,044	0	68,785	(9,758,628)	0	(9,212,799)
2004	0	1,234,228	0	183,048	(52,324)	0	1,364,953
2005	0	2,083,980	0	315,677	(49,174)	0	2,350,483
2006	0	2,258,398	0	350,402	(49,174)	0	2,559,626
2007	0	3,166,485	0	499,818	(48,949)	0	3,617,353
2008	0	4,327,219	0	711,685	(38,239)	0	5,000,665
2009	0	6,358,572	0	1,072,242	(224,639)	0	7,206,175
2010	0	6,705,774	0	1,123,831	(19,789)	0	7,809,815
2011	0	7,216,913	0	1,229,353	(19,789)	0	8,426,477
2012	0	8,042,946	0	1,398,189	(19,789)	0	9,421,346

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	11.1%	NB/I(15%)=	0.737 (3)	IRR(%)=	11.1%	NB/I(15%)=	0.737
NPV(15%)=	(3,257,103)	NB/I(12%)=	0.929	NPV(15%)=	(3,257,103)	NB/I(12%)=	0.929
		NB/I(18%)=	0.603			NB/I(18%)=	0.603

(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 7-14

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJ: MACTAN CIRC. SECTION: BBAG-PAJO 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	11,435,600	0	0	0	0	0	(11,435,600)
1992	17,153,400	0	0	0	0	0	(17,153,400)
1993	0	1,300,645	0	142,365	(49,399)	0	1,393,611
1994	0	1,433,141	0	161,375	(49,399)	0	1,545,117
1995	0	1,545,679	0	179,126	(49,399)	0	1,675,406
1996	0	2,116,517	0	252,255	(49,399)	0	2,319,373
1997	0	2,312,887	0	283,471	(49,399)	0	2,546,958
1998	0	2,986,627	0	379,480	(44,583)	0	3,321,525
1999	0	3,745,918	0	489,072	448,174	0	4,683,164
2000	0	345,562	0	45,889	6,531,439	0	6,922,889
2001	0	407,332	0	55,827	465,582	0	928,742
2002	0	440,725	0	61,968	(58,668)	0	444,025
2003	0	477,044	0	68,785	(58,668)	0	487,161
2004	0	1,234,228	0	183,048	(58,668)	0	1,358,609
2005	0	2,083,980	0	315,677	(55,518)	0	2,344,139
2006	0	2,258,398	0	350,402	(55,518)	0	2,553,282
2007	0	3,166,485	0	499,818	(55,293)	0	3,611,009
2008	0	5,533,141	0	906,810	(44,583)	0	6,395,368
2009	0	7,666,712	0	1,288,832	479,667	0	9,435,211
2010	0	10,772,942	0	1,831,928	(21,558)	0	12,583,312
2011	0	13,414,627	0	2,325,500	(21,558)	0	15,718,569
2012	0	14,772,317	0	2,614,912	(21,558)	0	17,365,671

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:				ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:			
IRR(%)=	9.6%	NB/I(15%)=	0.600 (3)	IRR(%)=	9.6%	NB/I(15%)=	0.600
NPV(15%)=	(8,153,941)	NB/I(12%)=	0.786	NPV(15%)=	(8,153,941)	NB/I(12%)=	0.788
		NB/I(18%)=	0.474			NB/I(18%)=	0.474

(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.

140

TABLE 7–15
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	
AC	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
PSOK–BNKAL	8.8%	9.8%	8.8%	9.8%	7.0%	7.9%	7.0%	7.9%	7.3%	8.2%	7.3%	8.2%	5.6%	6.5%	5.6%	6.5%
BNKAL–MRBGO	3.5%	4.9%	3.5%	4.9%	2.1%	3.5%	2.1%	3.5%	2.3%	3.6%	2.3%	3.6%	1.1%	2.3%	1.1%	2.3%
MRBGO–MRGNDN	4.1%	5.2%	4.1%	5.2%	2.7%	3.7%	2.7%	3.7%	2.9%	3.9%	2.9%	3.9%	1.6%	2.6%	1.6%	2.6%
MRGNDN–BBAG	3.6%	4.7%	3.6%	4.7%	2.1%	3.1%	2.1%	3.1%	2.3%	3.3%	2.3%	3.3%	0.9%	1.9%	0.9%	1.9%
BBAG–PAJO	10.3%	11.1%	10.3%	11.1%	8.5%	9.3%	8.5%	9.3%	8.8%	9.6%	8.8%	9.6%	7.2%	7.9%	7.2%	7.9%

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

NET PRESENT VALUE (15%) (In Millions 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	
AC	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
PSOK–BNKAL	(4.6)	(3.9)	(4.6)	(3.9)	(5.6)	(5.1)	(5.6)	(5.1)	(6.3)	(5.7)	(6.3)	(5.7)	(7.4)	(6.8)	(7.4)	(6.8)
BNKAL–MRBGO	(5.7)	(5.2)	(5.7)	(5.2)	(6.2)	(5.7)	(6.2)	(5.7)	(7.0)	(6.5)	(7.0)	(6.5)	(7.5)	(7.0)	(7.5)	(7.0)
MRBGO–MRGNDN	(3.6)	(3.3)	(3.6)	(3.3)	(3.9)	(3.6)	(3.9)	(3.6)	(4.4)	(4.1)	(4.4)	(4.1)	(4.7)	(4.5)	(4.7)	(4.5)
MRGNDN–BBAG	(6.9)	(6.4)	(6.9)	(6.4)	(7.6)	(7.1)	(7.6)	(7.1)	(8.6)	(8.0)	(8.6)	(8.0)	(9.2)	(8.8)	(9.2)	(8.8)
BBAG–PAJO	(3.9)	(3.3)	(3.9)	(3.3)	(5.2)	(4.6)	(5.2)	(4.6)	(5.8)	(5.1)	(5.8)	(5.1)	(7.0)	(6.5)	(7.0)	(6.5)

TABLE 7–17
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	
AC	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
PSOK–BNKAL	0.61	0.66	0.61	0.66	0.52	0.56	0.52	0.56	0.53	0.58	0.53	0.58	0.45	0.49	0.45	0.49
BNKAL–MRBGO	0.33	0.40	0.33	0.40	0.28	0.34	0.28	0.34	0.29	0.35	0.29	0.35	0.25	0.30	0.25	0.30
MRBGO–MRGNDN	0.36	0.41	0.36	0.41	0.31	0.35	0.31	0.35	0.32	0.36	0.32	0.36	0.27	0.31	0.27	0.31
MRGNDN–BBAG	0.38	0.43	0.38	0.43	0.32	0.37	0.32	0.37	0.33	0.37	0.33	0.37	0.28	0.32	0.28	0.32
BBAG–PAJO	0.69	0.74	0.69	0.74	0.58	0.63	0.58	0.63	0.60	0.64	0.60	0.64	0.51	0.54	0.51	0.54

143

TABLE 7–18
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	
AC	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
PSOK–BNKAL	0.50	0.54	0.50	0.54	0.42	0.46	0.42	0.46	0.43	0.47	0.43	0.47	0.37	0.40	0.37	0.40
BNKAL–MRBGO	0.27	0.33	0.27	0.33	0.23	0.28	0.23	0.28	0.24	0.28	0.24	0.28	0.20	0.24	0.20	0.24
MRBGO–MRGNDN	0.30	0.34	0.30	0.34	0.25	0.29	0.25	0.29	0.26	0.29	0.26	0.29	0.22	0.25	0.22	0.25
MRGNDN–BBAG	0.31	0.36	0.31	0.36	0.27	0.30	0.27	0.30	0.27	0.31	0.27	0.31	0.23	0.26	0.23	0.26
BBAG–PAJO	0.56	0.60	0.56	0.60	0.48	0.51	0.48	0.51	0.49	0.52	0.49	0.52	0.42	0.45	0.42	0.45

TABLE 7–19
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	
AC	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
PSOK–BNKAL	0.76	0.83	0.76	0.83	0.65	0.71	0.65	0.71	0.66	0.72	0.66	0.72	0.56	0.61	0.56	0.61
BNKAL–MRBGO	0.42	0.50	0.42	0.50	0.36	0.43	0.36	0.43	0.37	0.44	0.37	0.44	0.31	0.37	0.31	0.37
MRBGO–MRGNDN	0.46	0.52	0.46	0.52	0.39	0.44	0.39	0.44	0.40	0.45	0.40	0.45	0.34	0.38	0.34	0.38
MRGNDN–BBAG	0.47	0.53	0.47	0.53	0.40	0.45	0.40	0.45	0.41	0.46	0.41	0.46	0.35	0.39	0.35	0.39
BBAG–PAJO	0.86	0.93	0.86	0.93	0.73	0.79	0.73	0.79	0.75	0.81	0.75	0.81	0.64	0.69	0.64	0.69

145

TABLE 7–20
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	
PCC	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
PSOK–BNKAL	9.2%	9.9%	9.2%	9.9%	7.6%	8.3%	7.6%	8.3%	7.8%	8.5%	7.8%	8.5%	6.4%	7.0%	6.4%	7.0%
BNKAL–MRBGO	3.5%	4.3%	3.5%	4.3%	2.2%	2.9%	2.2%	2.9%	2.4%	3.1%	2.4%	3.1%	1.1%	1.8%	1.1%	1.8%
MRBGO–MRGNDN	3.7%	4.3%	3.7%	4.3%	2.3%	2.9%	2.3%	2.9%	2.5%	3.1%	2.5%	3.1%	1.2%	1.8%	1.2%	1.8%
MRGNDN–BBAG	3.1%	3.8%	3.1%	3.8%	1.7%	2.3%	1.7%	2.3%	1.9%	2.5%	1.9%	2.5%	0.5%	1.1%	0.5%	1.1%
BBAG–PAJO	9.0%	9.6%	9.0%	9.6%	7.6%	8.1%	7.6%	8.1%	7.8%	8.3%	7.8%	8.3%	6.4%	6.9%	6.4%	6.9%

TABLE 7-21
ECONOMIC ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET PRESENT VALUE (15%) (In Millions 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	
PCC	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
PSOK–BNKAL	(6.66)	(5.97)	(6.66)	(5.97)	(8.06)	(7.47)	(8.06)	(7.47)	(9.06)	(8.37)	(9.06)	(8.37)	(10.45)	(9.87)	(10.45)	(9.87)
BNKAL–MRBGO	(7.28)	(6.87)	(7.28)	(6.87)	(7.82)	(7.48)	(7.82)	(7.48)	(8.91)	(8.51)	(8.91)	(8.51)	(9.46)	(9.11)	(9.46)	(9.11)
MRBGO–MRGNDN	(5.38)	(5.13)	(5.38)	(5.13)	(5.78)	(5.57)	(5.78)	(5.57)	(6.59)	(6.34)	(6.59)	(6.34)	(6.99)	(6.78)	(6.99)	(6.78)
MRGNDN–BBAG	(10.27)	(9.76)	(10.27)	(9.76)	(11.07)	(10.63)	(11.07)	(10.63)	(12.61)	(12.09)	(12.61)	(12.09)	(13.41)	(12.97)	(13.41)	(12.97)
BBAG–PAJO	(8.83)	(8.15)	(8.83)	(8.15)	(10.57)	(9.99)	(10.57)	(9.99)	(11.90)	(11.21)	(11.90)	(11.21)	(13.63)	(13.05)	(13.63)	(13.05)

TABLE 7-22
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	
PCC	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
PSOK–BNKAL	0.58	0.63	0.58	0.63	0.50	0.53	0.50	0.53	0.51	0.54	0.51	0.54	0.43	0.46	0.43	0.46
BNKAL–MRBGO	0.33	0.37	0.33	0.37	0.28	0.31	0.28	0.31	0.29	0.32	0.29	0.32	0.25	0.27	0.25	0.27
MRBGO–MRGNDN	0.33	0.36	0.33	0.36	0.28	0.31	0.28	0.31	0.29	0.32	0.29	0.32	0.25	0.27	0.25	0.27
MRGNDN–BBAG	0.34	0.37	0.34	0.37	0.29	0.32	0.29	0.32	0.30	0.32	0.30	0.32	0.25	0.28	0.25	0.28
BBAG–PAJO	0.57	0.60	0.57	0.60	0.48	0.51	0.48	0.51	0.49	0.52	0.49	0.52	0.42	0.44	0.42	0.44

TABLE 7-23
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	
PCC	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
PSOK–BNKAL	0.46	0.49	0.46	0.49	0.39	0.42	0.39	0.42	0.40	0.43	0.40	0.43	0.34	0.37	0.34	0.37
BNKAL–MRBGO	0.27	0.30	0.27	0.30	0.23	0.25	0.23	0.25	0.23	0.26	0.23	0.26	0.20	0.22	0.20	0.22
MRBGO–MRGNDN	0.26	0.29	0.26	0.29	0.23	0.25	0.23	0.25	0.23	0.25	0.23	0.25	0.20	0.21	0.20	0.21
MRGNDN–BBAG	0.28	0.30	0.28	0.30	0.23	0.26	0.23	0.26	0.24	0.26	0.24	0.26	0.20	0.23	0.20	0.23
BBAG–PAJO	0.45	0.47	0.45	0.47	0.38	0.40	0.38	0.40	0.39	0.41	0.39	0.41	0.33	0.35	0.33	0.35

TABLE 7-24
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	
PCC	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
PSOK–BNKAL	0.76	0.82	0.76	0.82	0.64	0.69	0.64	0.69	0.66	0.71	0.66	0.71	0.56	0.60	0.56	0.60
BNKAL–MRBGO	0.42	0.47	0.42	0.47	0.36	0.40	0.36	0.40	0.37	0.41	0.37	0.41	0.31	0.35	0.31	0.35
MRBGO–MRGNDN	0.43	0.47	0.43	0.47	0.36	0.40	0.36	0.40	0.37	0.40	0.37	0.40	0.32	0.34	0.32	0.34
MRGNDN–BBAG	0.43	0.47	0.43	0.47	0.36	0.40	0.36	0.40	0.37	0.41	0.37	0.41	0.32	0.35	0.32	0.35
BBAG–PAJO	0.74	0.79	0.74	0.79	0.63	0.67	0.63	0.67	0.64	0.68	0.64	0.68	0.55	0.58	0.55	0.58

The sections where the traffic flow is being impeded by short stretches of pavement in bad condition and where periodic maintenance would alleviate vehicle slowing and attendant high operating costs are: Bankal Jct.-Maribago Jct. (1.1 km AC), Maribago Jct.-Marigondon Jct. (0.6 km PCC and 1.9 km AC). All of the sections also have short (10 to 20), intermittent patches where the pavement is bad, causing vehicle slowing and/or increased vehicle operating costs. These are also areas that require immediate periodic maintenance.

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:

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 insights into the expected return of this project 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 7-25 to 7-34 present a summary of the results together with the sensitivity scenarios described above.

Neither pavement alternative for the five sections of the Mactan Circumferential Road is feasible under the base case and all the sensitivity analysis scenarios.

H. RECOMMENDATIONS

The results of the economic evaluation of the Mactan Circumferential Road indicate that better periodic maintenance of those few areas of the road in bad condition is needed rather than an upgrade of the entire road. This result holds even when roadway sections in fair condition with short stretches in bad condition are classified as "bad". The Consultant's evaluation model shows that proposed improvements on these "bad" sections still produce IRRs below the required 15 percent. Thus, the most cost-effective means of improving traffic flow and vehicle operating speeds is through stepped up periodic maintenance of the existing road.

The sections where the traffic flow is being impeded by short stretches of pavement in bad condition and where periodic maintenance would alleviate vehicle slowing and attendant high operating costs are: Bankal Jct.-Maribago Jct. (1.1 km AC), Maribago Jct.-Marigondon Jct. (0.6 km PCC and 1.9 km AC), and very short intermittent spots along the alignment.

Based on the economic results presented above, the Consultants do not recommend the reconstruction to either AC or PCC standards of the five proposed sections of the Mactan Circumferential Road: Pusok-Bankal Jct., Bankal Jct.-Maribago Jct, Maribago Jct.-Marigondon Jct., Marigondon Jct.-Babag and Babag-Pajo Sections.

I. COSTS

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

TABLE 7-25
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	
AC	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
PSOK–BNKAL	8.2%	9.0%	8.2%	9.0%	6.4%	7.2%	6.4%	7.2%	6.6%	7.4%	6.6%	7.4%	4.9%	5.7%	4.9%	5.7%
BNKAL–MRBGO	3.6%	4.6%	3.6%	4.6%	2.2%	3.1%	2.2%	3.1%	2.4%	3.3%	2.4%	3.3%	1.0%	1.9%	1.0%	1.9%
MRBGO–MRGNDN	3.7%	4.6%	3.7%	4.6%	2.4%	3.2%	2.4%	3.2%	2.6%	3.3%	2.6%	3.3%	1.3%	2.0%	1.3%	2.0%
MRGNDN–BBAG	3.6%	4.5%	3.6%	4.5%	2.1%	2.9%	2.1%	2.9%	2.3%	3.1%	2.3%	3.1%	0.9%	1.6%	0.9%	1.6%
BBAG–PAJO	9.4%	10.1%	9.4%	10.1%	7.8%	8.4%	7.8%	8.4%	8.0%	8.6%	8.0%	8.6%	6.5%	7.0%	6.5%	7.0%

TABLE 7-26
FINANCIAL ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET PRESENT VALUE (15%) (In Millions 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	
AC	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
PSOK–BNKAL	(6)	(5.6)	(6.2)	(5.6)	(7.6)	(7.1)	(7.6)	(7.1)	(8.5)	(7.9)	(8.5)	(7.9)	(9.9)	(9.4)	(9.9)	(9.4)
BNKAL–MRBGO	(7)	(6.6)	(7.1)	(6.6)	(7.7)	(7.3)	(7.7)	(7.3)	(8.8)	(8.3)	(8.8)	(8.3)	(9.4)	(9.0)	(9.4)	(9.0)
MRBGO–MRGNDN	(4,772)	(4.5)	(4.8)	(4.5)	(5.2)	(4.9)	(5.2)	(4.9)	(5.9)	(5.6)	(5.9)	(5.6)	(6.3)	(6.0)	(6.3)	(6.0)
MRGNDN–BBAG	(8,889)	(8.3)	(8.9)	(8.3)	(9.8)	(9.3)	(9.8)	(9.3)	(11.1)	(10.5)	(11.1)	(10.5)	(11.9)	(11.5)	(11.9)	(11.5)
BBAG–PAJO	(6,038)	(5.4)	(6.0)	(5.4)	(7.6)	(7.0)	(7.6)	(7.0)	(8.5)	(7.9)	(8.5)	(7.9)	(10.0)	(9.5)	(10.0)	(9.5)

154

TABLE 7–27
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	
AC	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
PSOK–BNKAL	0.60	0.64	0.60	0.64	0.51	0.54	0.51	0.54	0.52	0.56	0.52	0.56	0.44	0.47	0.44	0.47
BNKAL–MRBGO	0.38	0.42	0.38	0.42	0.32	0.36	0.32	0.36	0.33	0.36	0.33	0.36	0.28	0.31	0.28	0.31
MRBGO–MRGNDN	0.35	0.39	0.35	0.39	0.30	0.33	0.30	0.33	0.31	0.34	0.31	0.34	0.26	0.29	0.26	0.29
MRGNDN–BBAG	0.39	0.43	0.39	0.43	0.33	0.37	0.33	0.37	0.34	0.38	0.34	0.38	0.29	0.32	0.29	0.32
BBA[illegible]–PAJO	0.63	0.67	0.63	0.67	0.54	0.57	0.54	0.57	0.55	0.58	0.55	0.58	0.47	0.50	0.47	0.50

TABLE 7-28
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	
AC	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
PSOK–BNKAL	0.50	0.53	0.50	0.53	0.42	0.45	0.42	0.45	0.43	0.46	0.43	0.46	0.37	0.39	0.37	0.39
BNKAL–MRBGO	0.31	0.35	0.31	0.35	0.27	0.29	0.27	0.29	0.27	0.30	0.27	0.30	0.23	0.26	0.23	0.26
MRBGO–MRGNDN	0.29	0.32	0.29	0.32	0.25	0.27	0.25	0.27	0.25	0.28	0.25	0.28	0.21	0.24	0.21	0.24
MRGNDN–BBAG	0.33	0.36	0.33	0.36	0.28	0.31	0.28	0.31	0.28	0.31	0.28	0.31	0.24	0.27	0.24	0.27
BBAG–PAJO	0.52	0.55	0.52	0.55	0.44	0.47	0.44	0.47	0.45	0.48	0.45	0.48	0.38	0.41	0.38	0.41

TABLE 7-29
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	
AC	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
PSOK–BNKAL	0.74	0.79	0.74	0.79	0.63	0.67	0.63	0.67	0.64	0.69	0.64	0.69	0.55	0.58	0.55	0.58
BNKAL–MRBGO	0.47	0.52	0.47	0.52	0.40	0.44	0.40	0.44	0.41	0.45	0.41	0.45	0.35	0.38	0.35	0.38
MRBGO–MRGNDN	0.44	0.49	0.44	0.49	0.38	0.42	0.38	0.42	0.39	0.43	0.39	0.43	0.33	0.36	0.33	0.36
MRGNDN–BBAG	0.48	0.53	0.48	0.53	0.41	0.45	0.41	0.45	0.42	0.46	0.42	0.46	0.36	0.39	0.36	0.39
BBAG–PAJO	0.79	0.84	0.79	0.84	0.68	0.72	0.68	0.72	0.69	0.73	0.69	0.73	0.59	0.62	0.59	0.62

151

TABLE 7-30
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	
PCC	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
PSOK-BNKAL	7.6%	8.3%	7.6%	8.3%	6.1%	6.8%	6.1%	6.8%	6.3%	7.0%	6.3%	7.0%	4.9%	5.5%	4.9%	5.5%
BNKAL-MRBGO	3.8%	4.5%	3.8%	4.5%	2.4%	3.0%	2.4%	3.0%	2.6%	3.2%	2.6%	3.2%	1.2%	1.8%	1.2%	1.8%
MRBGO-MRGNDN	3.9%	4.4%	3.9%	4.4%	2.5%	3.0%	2.5%	3.0%	2.7%	3.2%	2.7%	3.2%	1.4%	1.8%	1.4%	1.8%
MRGNDN-BBAG	3.5%	4.1%	3.5%	4.1%	2.1%	2.6%	2.1%	2.6%	2.3%	2.8%	2.3%	2.8%	0.8%	1.3%	0.8%	1.3%
BBAG-PAJO	9.0%	9.5%	9.0%	9.5%	7.5%	7.9%	7.5%	7.9%	7.7%	8.1%	7.7%	8.1%	6.3%	6.7%	6.3%	6.7%

TABLE 7–31
FINANCIAL ANALYSIS – SUMMARY RESULTS
SENSITIVITY ANALYSIS OF THE RECOMMENDED ALTERNATIVES

NET PRESENT VALUE (15%) (In Millions 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	
PCC	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
PSOK–BNKAL	(9.9)	(9.2)	(9.9)	(9.2)	(11.5)	(10.9)	(11.5)	(10.9)	(13.0)	(12.3)	(13.0)	(12.3)	(14.6)	(14.0)	(14.6)	(14.0)
BNKAL–MRBGO	(8.8)	(8.4)	(8.8)	(8.4)	(9.6)	(9.2)	(9.6)	(9.2)	(10.9)	(10.5)	(10.9)	(10.5)	(11.7)	(11.3)	(11.7)	(11.3)
MRBGO–MRGNDN	(6.7)	(6.4)	(6.7)	(6.4)	(7.2)	(7.0)	(7.2)	(7.0)	(8.2)	(8.0)	(8.2)	(8.0)	(8.7)	(8.5)	(8.7)	(8.5)
MRGNDN–BBAG	(12.5)	(11.9)	(12.5)	(11.9)	(13.5)	(13.1)	(13.5)	(13.1)	(15.4)	(14.9)	(15.4)	(14.9)	(16.5)	(16.1)	(16.5)	(16.1)
BBAG–PAJO	(11.0)	(10.4)	(11.0)	(10.4)	(13.3)	(12.7)	(13.3)	(12.7)	(14.9)	(14.2)	(14.9)	(14.2)	(17.2)	(16.6)	(17.2)	(16.6)

TABLE 7-32
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	
PCC	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
PSOK-BNKAL	0.52	0.55	0.52	0.55	0.44	0.47	0.44	0.47	0.45	0.48	0.45	0.48	0.39	0.41	0.39	0.41
BNKAL-MRBGO	0.37	0.40	0.37	0.40	0.31	0.34	0.31	0.34	0.32	0.35	0.32	0.35	0.27	0.30	0.27	0.30
MRBGO-MRGNDN	0.34	0.37	0.34	0.37	0.29	0.31	0.29	0.31	0.30	0.32	0.30	0.32	0.25	0.27	0.25	0.27
MRGNDN-BBAG	0.37	0.39	0.37	0.39	0.31	0.33	0.31	0.33	0.32	0.34	0.32	0.34	0.27	0.29	0.27	0.29
BBAG-PAJO	0.58	0.60	0.58	0.60	0.49	0.51	0.49	0.51	0.50	0.52	0.50	0.52	0.43	0.44	0.43	0.44

TABLE 7-33
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	
PCC	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
PSOK–BNKAL	0.42	0.45	0.42	0.45	0.36	0.38	0.36	0.38	0.37	0.39	0.37	0.39	0.31	0.33	0.31	0.33
BNKAL–MRBGO	0.30	0.33	0.30	0.33	0.26	0.28	0.26	0.28	0.26	0.28	0.26	0.28	0.22	0.24	0.22	0.24
MRBGO–MRGNDN	0.27	0.29	0.27	0.29	0.23	0.25	0.23	0.25	0.24	0.26	0.24	0.26	0.20	0.22	0.20	0.22
MRGNDN–BBAG	0.30	0.32	0.30	0.32	0.25	0.27	0.25	0.27	0.26	0.28	0.26	0.28	0.22	0.24	0.22	0.24
BBAG–PAJO	0.46	0.48	0.46	0.48	0.39	0.41	0.39	0.41	0.40	0.42	0.40	0.42	0.34	0.35	0.34	0.35

TABLE 7-34
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	
PCC	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
PSOK–BNKAL	0.66	0.71	0.66	0.71	0.56	0.60	0.56	0.60	0.58	0.62	0.58	0.62	0.49	0.52	0.49	0.52
BNKAL–MRBGO	0.47	0.50	0.47	0.50	0.40	0.43	0.40	0.43	0.40	0.44	0.40	0.44	0.34	0.37	0.34	0.37
MRBGO–MRGNDN	0.44	0.47	0.44	0.47	0.37	0.40	0.37	0.40	0.38	0.41	0.38	0.41	0.33	0.35	0.33	0.35
MRGNDN–BDAG	0.46	0.49	0.46	0.49	0.39	0.42	0.39	0.42	0.40	0.43	0.40	0.43	0.34	0.36	0.34	0.36
BBAG–PAJO	0.74	0.78	0.74	0.78	0.63	0.66	0.63	0.66	0.65	0.68	0.65	0.68	0.55	0.58	0.55	0.58

VIII.
SOCIAL SOUNDNESS ANALYSIS

VIII. SOCIAL SOUNDNESS ANALYSIS

A. 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 Mactan Circumferential Road Improvement Project involves surface and drainage improvements for the circumferential highway around Mactan island in the Province of Cebu. It is given priority because Mactan is proposed to become a Regional Government and Trade/Industrial Center for the Province of Cebu. This is the main highway connecting Lapu-Lapu City and the Municipality of Cordova, the two components of Mactan Island. The road runs for 30 km. along flat coastal lands. It is mostly asphalted, with the condition varying from bad to good.

Mactan Island lies close to Cebu City. It is connected to the mainland by a Bridge near Mandaue City. It holds the Mactan Export Processing Zone and has an international airport. Its main sources of income are fishing and tourism.

C. INCOME EFFECTS

Cebu Province has a population of 2,619,000. This includes Cebu City (population 637,000) and Lapu-Lapu City (population 130,000). In 1980, five out of eight households (63%) in Cebu Province were rural. Five out of nine families (55%) owned their home. With an average family income of P 17,123 in 1985, Cebu Province ranked 67th out of the country's 74 provinces. Six out of ten Cebu families had an income under P 15,000. This excludes Cebu City (P 35,706) and Lapu-Lapu City which have relatively high average incomes. As shown in Table 8-1, the poor were

farmers or fishermen and non-agricultural laborers, or depended on "other" subsistence activities. The rich were either non-agricultural employees, or received remittances from abroad.

Three types of income benefits can be considered: tourism benefits; transportation benefits for wholesalers, retailers and other road users; and agricultural benefits for farmers and fishermen in the zone of influence.

TABLE 8-1

FAMILIES BY MAIN SOURCE OF INCOME AND TOTAL FAMILY INCOME FOR CEBU

Main Source of Income	Total	Family Income (Pesos) Under 10K	10K-14K	15K-19K	20K-29K	30K-39K	40K-59K	60K & Over
		Percent of Families						
Agricultural Wages/Salaries	5.1%	8.2%	5.1%	4.7%	1.8%	0.0%	0.0%	0.0%
Non-Agricultural Wages/Salaries	38.0	23.9	39.9	38.9	61.4	62.1	34.0	45.5
Agricultural Entrepreneurial	26.7	34.9	32.6	1.2	3.6	8.4	4.3	4.6
Non-Agricultural Entrepreneurial	11.2	6.7	8.0	16.2	22.3	12.6	21.3	11.3
Other	19.0	26.3	14.4	9.0	10.9	16.9	40.4	38.6
	100%	100%	100%	100%	100%	100%	100%	100%
Total Families (Thousands)	343.6	119.8	89.3	53.7	38.1	21.8	10.8	10.1

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

1. TOURISM BENEFITS

A major benefit of the road improvement project will go to tourism operators and tourists. Mactan Island has many tourist resorts. Lapu-Lapu City abounds with beautiful white sand beaches. In 1987, a total of 257,000 tourists visited Cebu. Four out of ten (39%) were foreigners. The tourist season peaks

165

from April to August and October to January. Some 30-40% of Cebu tourists either stay on or visit Mactan Island.

Major tourist development are located along the eastern coastline of Mactan Island and include over twenty established resorts with a total capacity of over 400 rooms. The beautiful white beaches of Punta Engano, Marigondon, Maribago and the nearby Santa Rosa Island with their restaurants and diving sites are major tourist attractions. A Department of Tourism Survey showed that of the 53% of foreign tourists who visited places outside of Manila, 19% visited Cebu. Cebu is the second choice after Baguio. This is equivalent to 105,000 foreigners of which 24% or 26,000 stayed in Mactan. Demand analysis indicated that Cebu had the highest attractiveness index of all locations studied.

Two types of tourists visit Mactan: foreign and domestic. They come seeking the white beaches, water sports, restaurants and hotels. Most foreign tourists come from Japan. Aside from flights into neighboring Cebu Airport, a direct flight from Tokyo arrives at Mactan International Airport every Wednesday. There are also forty flights per day from other parts of the Philippines. Cebuanos come to the island for the day or weekend, whether or not they own beach houses. These tourists seek smooth roads even more than farmers and fishermen.

In general, tourism provides a large number of jobs for the poor. A 1988 Department of Tourism survey shows 35% to 65% of tourism employees were semi-skilled or unskilled, depending on the region. Thus, overall equity considerations should be positive.

2. TRANSPORTATION BENEFITS

Transportation benefits include saving on vehicle operating costs, maintenance cost savings, and time savings for road users. Since jeepneys and buses provide transportation for the "lower classes" and carry an average of fifteen and 33 passengers respectively, while private cars transport the "upper classes" and carry an average of 3.36 passengers (including the driver), traffic benefits will fall to predominately to "lower class" persons.

Truck operations will also benefit. Their income earnings directly benefit merchants and vehicle owners, who are not among the poorest of the province's residents. Indirectly, however, the services they offer benefit the population as a whole.

3. 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 150,000; 130,000 in Lapu-Lapu City and 20,000 in Cordova. Lapu-Lapu City consists of 29 barangays with a total land area of 58 sq. km. Cordova consists of thirteen barangays with a total land area of 11.[illegible] sq. km.

Mactan is not well suited to farming. It is characterized by hard, flat, rocky terrain. Only 10% of its 6,980 hectares is arable. Corn and coconuts are the major crops.

Marine fishing is the major source of income for the island. Most villages are located on the coast. In 1980, 81% of the 1,519 employed persons in Cordova and 72% of the 4,043 employed persons in Lapu-Lapu City were full-time fishermen. In 1987, Cordova had a total marine fish production of 1,170 MT. and an inland fishing production of 180 MT.

The road improvement project, however, will not provide significant benefits for Mactan fishermen. They can market their fish directly to Cebu City by boat.

D. POPULATION MOVEMENTS

No significant population migration is anticipated due to the proposed road project. The zone of influence is intensively developed and there is no free land for expansion.

E. CULTURAL MINORITIES

There are no vulnerable cultural minorities in the area that might be adversely affected. The area is already built up, and the project involves essentially reconstructing the circumferential highway.

F. CONCLUSIONS

The proposed road project is socially sound. It will result in significant benefits for tourists and tourism operators, providing new employment opportunities, including a high proportion of jobs for semi-skilled and unskilled workers from the lower classes.

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

IX.
ENERGY ANALYSIS

IX. ENERGY ANALYSIS

The economic and financial costs of energy in the construction and use of the Mactan Circumferential 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.

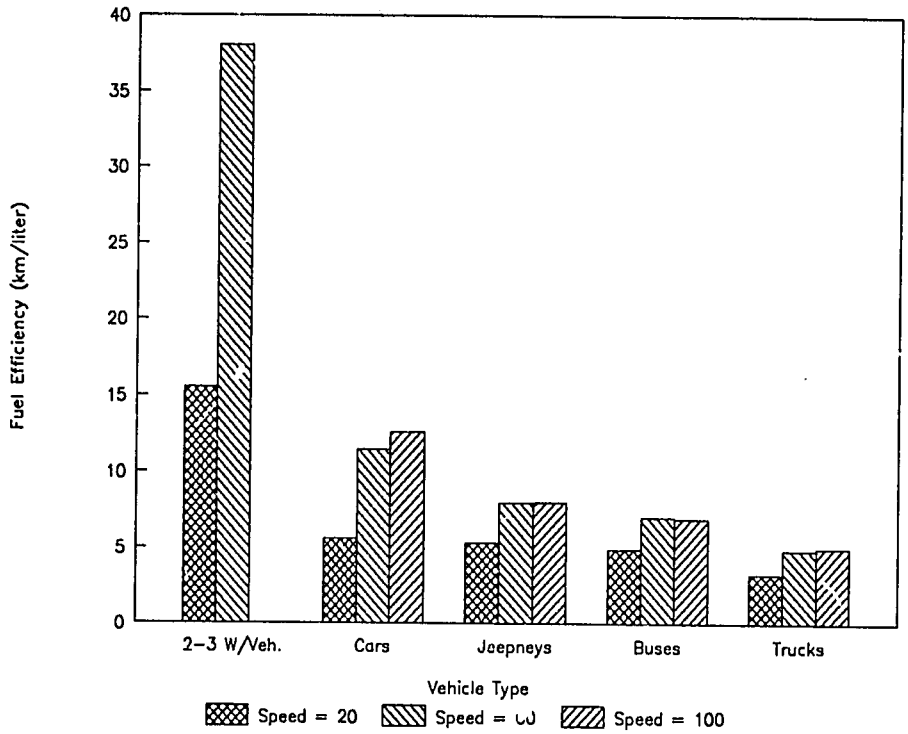
Road user energy costs are a function of the fuel consumption of the types of vehicles using the road and the volume of use. An improved road surface will improve fuel efficiency and will increase average speed within the range of speeds to be considered here. Figures 9-1 to 9-4 show the average fuel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

These values are estimated by the HDM-III vehicle operating cost model and are 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)

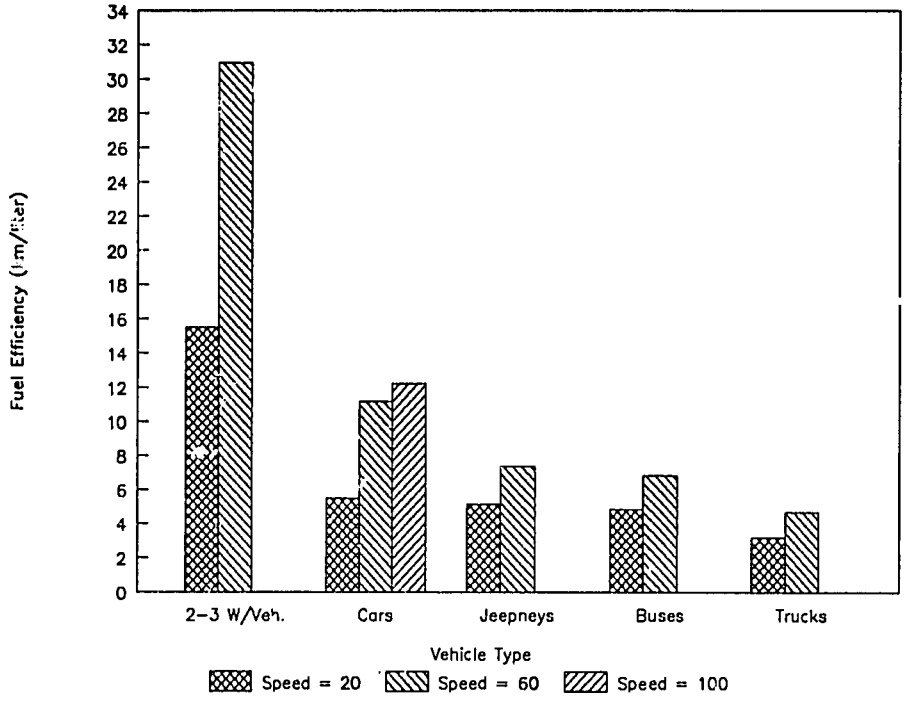


Roughness (IRI) = 2

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)

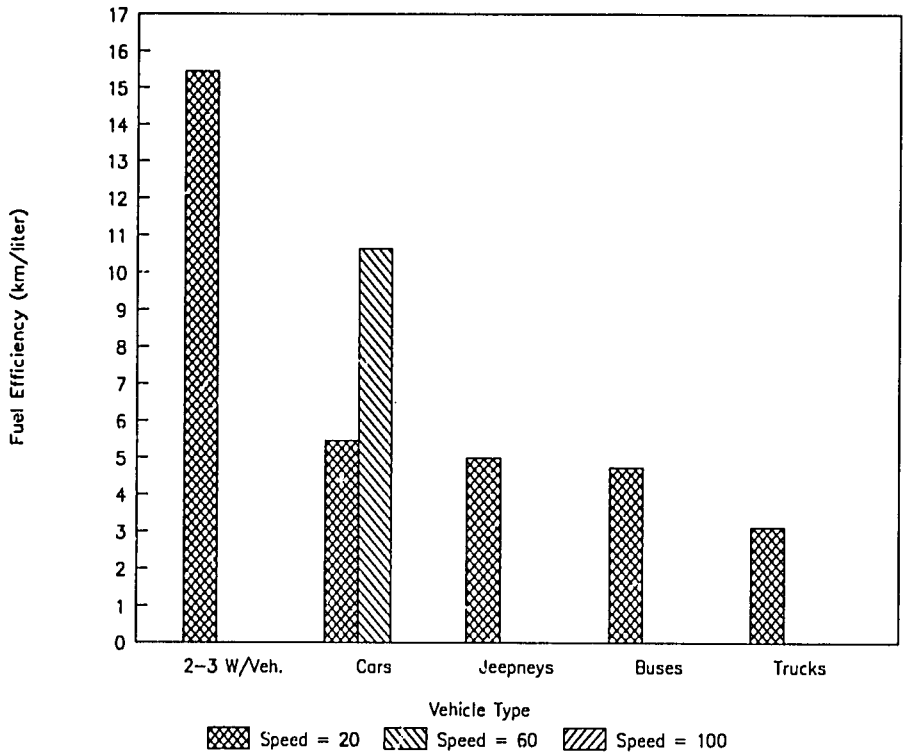


Roughness (IRI) = 6

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)

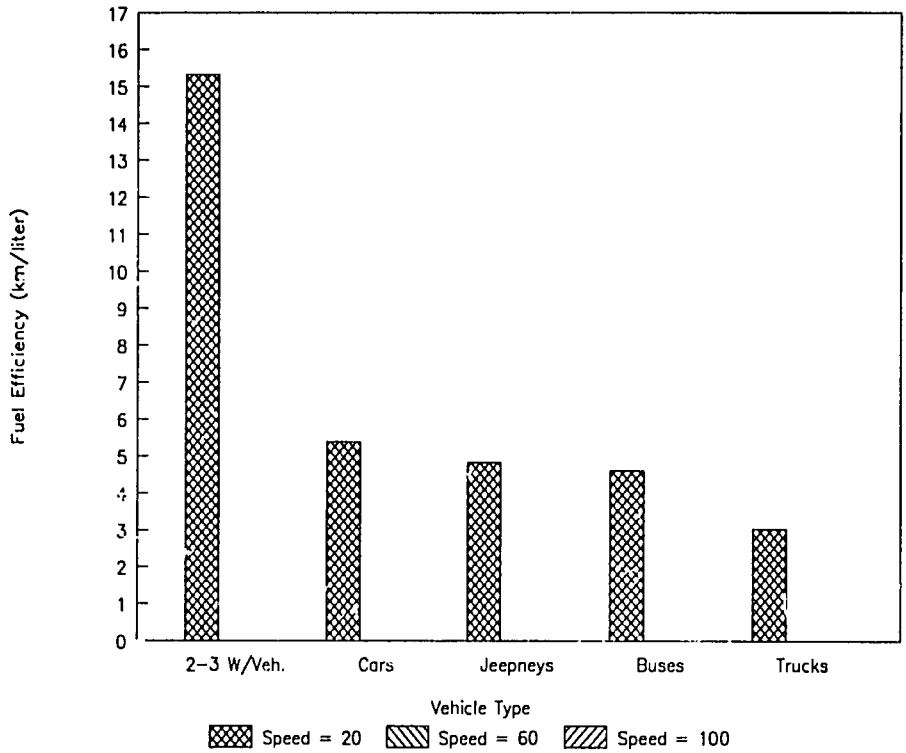


Roughness (IRI) = 10

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		

APPENDICES

APPENDIX A
ROAD RECONNAISSANCE SURVEY

RURAL INFRASTRUCTURE FUND PROJECT
INITIAL ROAD RECONNAISANCE SURVEY

Road Name: HACTAN CIRCUMFERENTIAL ROAD To: _____ Island: VISAYAS Region: _____

Road Section: PUSOK-IBO-BUAYA-HACTAN SECTION (0+000 to 7+380) To: _____ Date of Survey: _____

STATION	Topography	Right of Way	Formation Width	Surfacing Type	Surfacing Cond.	Surfacing Width	Shoulder Type	Shoulder Cond.	Side Ditches L	Side Ditches R	Gradient	Curve Category	Land Use L	Land Use R	Road Side Friction	Flood Ht.	Cut/Fill L	Cut/Fill R	Cross Drainage	Photo No.	REMARKS
0+000	F		9.5	C	F	7.30	A	B	-				Com/Res	Com Res							IN FRONT OF GOVT. CEN
						?															shoulder is bad c
1+000	F		11.3	C	F	7.30	G	F					Com/Res	Com/Res							
2+000	F		8.6	A	F	6.10	G	F					SHB	SHB							ILL TREES AT RIGHT
3+000	F		8.1	A	F	6.10	G	F					SHB	SHB							-- do-
4+000	F		8.1			6.1	G	F					SHB	SHB							
5+000	F		8.1	C	F	6.1	G	F					RES	RES							FEW HOUSES & SHRUBS
6+000	F		8.1	C	F	6.1	G	F					RES	RES							— do-
6+972	F		8.65	C	F	6.1	G	F					RES	RES							Junction to Banka
7+370	F		8.3	C	F	6.1	G	F					RES	RES							KM 18
7+380	F		8.3	C	F	6.1	G	F					RES	RES							End of SECTION

TEAM LEADER _____ CODER _____

NOTE: SHB = SHRUBS
DRL = DRY FARM LAND

RURAL INFRASTRUCTURE FUND PROJECT
INITIAL ROAD RECONNAISANCE SURVEY

Road Name MACTAN CIRCUMFERENTIAL ROAD To: _____ Island _____ Region _____

Road Section: MACTAN-MARIBAGO-CORDOVA SECT. To: _____ Date of Survey _____

KM 7+380 – 18+430

STATION	Topography	Right of Way	Formation Width	Surfacing (*) Type	Surfacing Cond.	Surfacing Width	Shoulder Type	Shoulder Cond.	Side Ditches L	Side Ditches R	Gradient	Curve Category	Land Use L	Land Use R	Road Side Friction	Flood Ht.	Cut/Fill L	Cut/Fill R	Cross Drainage	Photo No. (*)	REMARKS
7+380	F		8.1	A	G	6.1	G	F					RES	RES							BEGINNING OF ECT BEGINNING OF ASP
																					END OF CONCRETE
8+000	F		7.6	A	G	6.1	G	F					RES	RES							
8+794	F		8.1	A	G	6.1	G	F					RES	RES							JUNCTION TO DAPDAT
9+000	F		7.1	A	G	6.1	G	F					RES	RES							Residential Area of a 20 H interval
9+186	F		7.1	A	B	6.1	G	B					RES	RES							End of good asphal Beginning of very bo.
9+499	F		7.1	A	B	6.1	G	B					RES.	RES							End of Barangay Ha Beginning of deteriora
10+000	F		7.1	A	B	6.1	G	B					RES	RES							Deteriorated asphal

TEAM LEADER CODER

RURAL INFRASTRUCTURE FUND PROJECT
INITIAL ROAD RECONNAISANCE SURVEY

Road Name: MACTAN CIRCUMFERENTIAL ROAD To: _____ Island _____ Region _____

Road Section: MACTAN - MARIGOND - CORDOVA SECT. To: _____ Date of Survey _____

KM 7+380 - 18+430

STATION	Topography	Right of Way	Formation Width	Surfacing Type	Surfacing Cond.	Surfacing Width	Shoulder Type	Shoulder Cond.	Side Ditches L	Side Ditches R	Gradient	Curve Category	Land Use L	Land Use R	Road Side Friction	Flood Ht.	Cut/Fill L	Cut/Fill R	Cross Drainage	Photo No	REMARKS
10+196	F		8.10	A	B	6.1	G	F					RES	RES							Beginning of very
10+384	F		8.1	C	B	6.1	G	F					RES	RES							Beginning of bad
10+458	F		8.1	C	B	6.1	G	F					RES	RES							Junction to Tambul and Maribago
10+700	F		8.1	C	B	6.1	G	F					RES	RES		.50M					Flooded area with
11+000	F		8.1	C	B	6.1	G	F					RES	RES							
11+112	F		8.1	C	B	6.1	G	F					RES	RES							Junction Dagat and
11+700	F		5.9	A	F	4.9	G	F					DFL	DFL							End of good asph

TEAM LEADER CODER NOTE: DFL = DRY FARM LAND

RURAL INFRASTRUCTURE FUND PROJECT
INITIAL ROAD RECONNAISANCE SURVEY

Road Name MACTAN CIRCUMFERENTIAL ROAD To: _____ Island _____ Region _____

Road Section: MACTAN - MARIBAGO - CORDOVA SECT. To: _____ Date of Survey _____

KM 7+380 - 18-430

STATION	Topography	Right of Way	Formation Width	Surfacing Type	Surfacing Cond.	Surfacing Width	Shoulder Type	Shoulder Cond.	Side Ditches L	Side Ditches R	Gradient	Curve Category	Land Use L	Land Use R	Road Side Friction	Flood Ht.	Cut/Fill L	Cut/Fill R	Cross Drainage	Photo No.	REMARKS
12+262	F			A	B	4.9	G	F					Res	Res							Junction to barang
13+000	F		6.4	A	B	6.0	G	F					Res	Res							Deteriorated cspl
13+656	F		6.4	A	G	6.0	G	F					Res	Res							Beginning of good
14+005	F		6.4	A	G	6.0	G	F					DFL	DFL							Junction to Lapu- and Mariqub
15+000	F		5.0	A	B	4.0	G	F					DFL	DFL							
15+313	F		5.0	A	B	4.0	G	F					DFL	DFL							Junction Masbas Basag
15+487	F		5.0	A	B	4.0	G	F					DFL	DFL							GABI BRIDGE

TEAM LEADER _____ CODER _____

NOTE: DFL = DRY FARM LAND

179

RURAL INFRASTRUCTURE FUND PROJECT
INITIAL ROAD RECONNAISANCE SURVEY

Road Name MACTAN CIRCUMFERENTIAL ROAD To: _____ Island _____ Region _____

Road Section: MACTAN - MARIBAGO - CORDOVA SECT. KM 7+380 - 18+430 To: _____ Date of Survey _____

STATION	Topography	Right of Way	Formation Width	Surfacing (*) Type	Surfacing (*) Cond.	Surfacing (*) Width	Shoulder Type	Shoulder Cond.	Side Ditches L	Side Ditches R	Gradient	Curve Category	Land Use L	Land Use R	Road Side Friction	Flood Ht.	Cut/Fill L	Cut/Fill R	Cross Drainage	Photo No. (*)	REMARKS
16+000	F		5.0	A	F	4.0	G	F					DFL	DFL							
17+000	F		5.3	A	F	4.3	G	F					DFL	DFL							
18+000	F		6.2	A	F	4.7	G	F					DFL	DFL							
18+084	F		5.8	A	F	4.3	G	F					Res	Res							Junction to Bab.
18+430	F		6.2	A	F	4.7	G	F					Res	DFL							End of section 2
																					proper with RWI

TEAM LEADER CODER

NOTE: DFL = DR ; FARM LAND

RURAL INFRASTRUCTURE FUND PROJECT
INITIAL ROAD RECONNAISANCE SURVEY

Road Name MACTAN CIRCUMFERENTIAL ROAD To: _____ Island _____ Region _____

Road Section: CORDOVA - CANSILLO - BABAG - LOOC SECT. To: _____ Date of Survey _____

KM 18+430 - 27+000

STATION	Topography	Right of Way	Formation Width	Surfacing (*) Type	Surfacing (*) Cond.	Surfacing (*) Width	Shoulder Type	Shoulder Cond.	Side Ditches L	Side Ditches R	Gradient	Curve Category	Land Use L	Land Use R	Road Side Friction	Flood Ht.	Cut/Fill L	Cut/Fill R	Cross Drainage	Photo No. (*)	REMARKS
18+430	F		6.2	A	F	4.7	G	F					Res	DFL							Beginning of secti
19+000	F		6.2	A	F	4.7	G	F					Res	DFL							
20+000	F		6.0	A	F	5.0	G	F					Res	DFL							
20+307																					BRIDGE
20+433																					BRIDGE
21+000	F		6.6	A	F	5.6	G	F					Res	DFL							Barangay Babagi
22+000	F		8.1	A	G	6.1	G	F													

TEAM LEADER CODER

NOTE: DF = DRY FARM LAND

181

RURAL INFRASTRUCTURE FUND PROJECT
INITIAL ROAD RECONNAISANCE SURVEY

Road Name MACTAN CIRCUMFERENTIAL ROAD To: _____ Island _____ Region _____

Road Section: CORDOVA-CANSULAO-BABAG-LOOC SECT. To: _____ Date of Survey _____

STATION	Topography	Right of Way	Formation Width	Surfacing (*) Type	Surfacing (*) Cond.	Surfacing (*) Width	Shoulder Type	Shoulder Cond.	Side Ditches L	Side Ditches R	Gradient	Curve Category	Land Use L	Land Use R	Road Side Friction	Flood Ht.	Cut/Fill L	Cut/Fill R	Cross Drainage	Photo No. (*)	REMARKS
23+000	F		8.1	A	G	6.1	G	F					Res	Res							
24+000	F		8.1	A	G	6.1	G	F					Res	Res							
25+000	F		7.2	A	G	5.2	G	F					Res	Res							Residential/commerc with RWL + 10 M
25+152	F		14	A									Com/Res	Com/Res							City proper with and gutter
25+457	F		15	C	F	10	G	F					Com/Res	Com/Res							Junction Caltex
26+172	F		10.3	C	F	7.3	G	F					Com/Res	Com/Res							TO MANDAUE B
27+000	F		9.5	C	F	7.3	A	A					Com/Res	Com/Res							End of project

TEAM LEADER CODER

APPENDIX B
RAINFALL INTENSITY - DURATION FREQUENCY DATA
SIZING OF DRAINAGE STRUCTURES

TABLE B - 1

RAINFALL INTENSITY -DURATION- FREQUENCY DATA
RAINFALL STATION : MACTAN AIRPORT
BASED ON 30 YEARS OF RECORDS

COMPUTED EXTREME VALUES (IN MM) OF PRECIPITATION

RETURN PERIOD YEARS	5 MINS	10 MINS	15 MINS	30 MINS	60 MINS	120 MINS	180 MINS	360 MINS	720 MINS	1440 MINS
2.0	12.0	19.3	26.4	38.8	50.2	61.7	65.8	73.4	80.1	80.7
5.0	15.3	24.4	33.7	50.4	67.1	90.6	102.7	119.6	134.3	148.3
10.0	17.5	27.7	38.5	58.1	78.3	109.8	127.1	150.2	170.1	184.9
15.0	18.8	29.6	41.2	62.4	84.6	120.6	140.9	167.5	190.4	206.5
20.0	19.7	30.9	43.2	65.4	89.0	128.2	150.6	179.6	204.5	221.7
25.0	20.3	31.9	44.6	67.8	92.4	134.0	158.0	188.9	215.4	233.4
50.0	22.4	35.1	49.2	75.0	102.9	152.0	180.9	217.6	249.1	269.3
100.0	24.5	38.2	53.7	82.1	113.3	169.8	203.6	246.1	282.4	304.9

INTENSITY(IN MM/HR) OF COMPUTED EXTREME VALUES

RETURN PERIOD YEARS	5 MINS	10 MINS	15 MINS	30 MINS	60 MINS	120 MINS	180 MINS	360 MINS	720 MINS	1440 MINS
2.0	144.0	115.8	105.6	77.6	50.2	30.9	21.9	12.2	6.7	3.7
5.0	183.6	183.6	134.8	100.8	67.1	45.3	34.2	19.9	11.2	6.1
10.0	210.0	210.0	154.0	116.2	78.3	54.9	42.4	25.0	14.2	7.7
15.0	225.6	225.6	164.8	124.8	84.6	60.3	47.0	27.9	15.9	8.5
20.0	236.4	236.4	172.8	130.8	89.0	64.1	50.2	29.9	17.0	9.2
25.0	243.6	243.6	178.4	135.6	92.4	67.0	52.7	31.5	18.0	9.7
50.0	268.8	268.8	196.8	150.0	102.9	76.0	60.3	36.3	20.8	11.2
100.0	294.0	294.0	214.8	164.2	113.3	84.9	67.9	41.0	23.5	12.7

TABLE B - 2
SIZING OF DRAINAGE STRUCTURES
ROAD SECTION : MACTAN CIRCUMFERENTIAL ROAD

BASIN NO.	STATION (KM)	D.A. (HAS)	ELEVATION HIGH (M)	ELEVATION LOW (M)	H (M)	L (M)	Tc (MIN)	R.OFF C	RAINFALL INTENSITY I=(MM/HR) 10 YR.	25 YR.	50 YR.	DISCHARGE (CUMECS) 10 YR.	25 YR.	50 YR.	S.O.S RCPC/RCBC BRIDGE	L.O.S (M)	I.ELEV INLET (M)	I.ELEV OUTLET (M)	F.R. ELEV. (M)	REMARKS
1	0+240	31.00	5.00	3.00	2.00	1440.00	64.37	0.40	77.51	92.26		2.67			3-910	14.00				INSTALL 3-910 RCPC
2	0+375	7.80	5.00	3.00	2.00	690.00	27.62	0.40	122.06	143.21		1.06			1-910	14.00				INSTALL 1-910 RCPC
3	0+450	7.50	5.00	3.00	2.00	740.00	29.93	0.40	117.52	138.04		0.98			1-910	14.00				INSTALL 1-910 RCPC
4	0+520	9.40	5.00	3.00	2.00	600.00	23.32	0.45	131.18	153.59		1.54			2-910	14.00				INSTALL 2-910 RCPC
5	0+645	5.10	5.00	3.00	2.00	400.00	14.75	0.40	157.19	183.11		0.89			1-910	14.00				INST. 1-910 RCPC
6	0+742	1.00	5.00	3.00	2.00	80.00	5.00	0.40	205.48	237.79		0.23			1-610	14.00				INSTALL 1-610 RCPC
7	0+830	1.00	5.00	3.00	2.00	80.00	5.00	0.40	205.48	237.79		0.23			1-610	14.00				INSTALL 1-610 RCPC
8	0+905	1.00	5.00	3.00	2.00	80.00	5.00	0.40	205.48	237.79		0.23			1-610	14.00				INSTALL 1-610 RCPC
9	1+040	6.20	5.00	3.00	2.00	400.00	14.75	0.45	157.19	183.11		1.22			3-610	14.00				INSTALL 3-610 RCPC
10	1+150	76.00	5.00	3.00	2.00	1980.00	92.83	0.35	61.64	73.93		4.55			3-1070	14.00				INSTALL 3-1070 RCPC
11	1+250	30.50	3.00	2.50	0.50	1380.00	104.52	0.35	57.04	68.60		1.69			2-910	14.00				INSTALL 2-910 RCPC
12	1+350	44.00	3.00	2.50	0.50	1380.00	104.52	0.40	57.04	68.60		2.79			3-1220	14.00				INSTALL 3-1220 RCPC
13	1+500	21.00	3.00	2.50	0.50	900.00	63.93	0.35	77.83	92.62		1.59			2-910	16.00				INSTALL 2-910 RCPC
14	1+715	7.50	4.00	3.00	1.00	420.00	20.38	0.35	139.30	162.82		1.02			1-910	16.00				INSTALL 1-910 RCPC
15	1+905	6.20	4.00	3.00	1.00	320.00	14.91	0.35	156.64	182.48		0.94			1-910	16.00				INSTALL 1-910 RCPC

LEGEND :

D.A.-DRAINAGE AREA	HAS-HECTARES	S.O.S.-SIZE OF STRUCTURE
H-DIFFERENCE IN ELEVATION	M-METER	L.O.S-LENGTH OF STRUCTURE
L-LENGTH	MIN-MINUTES	RCPC-REINFORCED CONCRETE PIPE CULVERT
Tc-TIME OF CONCENTRATION	CUMECS-M^3/SEC	RCBC-REINFORCED CONCRETE BOX CULVERT
R.OFF-RUNOFF	MM-MILLIMETER	RCDG-REINFORCED CONCRETE DECK GIRDER
C-COEFFICIENTS	T.B.-	I.ELEV.-INVERT ELEVATION
KM-KILOMETER	B.B.-BAILEY BRIDGE	F.R.ELEV.-FINISHED ROAD ELEVATION

TABLE B - 2
SIZING OF DRAINAGE STRUCTURES
ROAD SECTION : MACTAN CIRCUMFERENTIAL ROAD

BASIN NO.	STATION	D.A.	ELEVATION HIGH	ELEVATION LOW	H	L	Tc	R.OFF	RAINFALL INTENSITY I=(MM/HR)			DISCHARGE (CUMECS)			S.O.S RCPC/RCBC	L.O.S	I.ELEV INLET	I.ELEV OUTLET	F.R. ELEV.	REMARKS
	(KM)	(HAS)	(M)	(M)	(M)	(M)	(MIN)	C	10 YR.	25 YR.	50 YR.	10 YR.	25 YR.	50 YR.	BRIDGE	(M)	(M)	(M)	(M)	
16	2+220	5.50	4.00	3.00	1.00	310.00	14.37	0.35	158.60	184.71		0.85			1-910	16.00				INSTALL 1-910 RCPC
17	2+490	3.60	4.00	3.00	1.00	200.00	8.68	0.40	183.67	213.10		0.78			2-610	16.00				INSTALL 2-610 RCPC
18	2+680	5.10	4.00	3.00	1.00	250.00	11.22	0.40	171.43	199.25		0.97			1-910	16.00				INSTALL 1-910 RCPC
19	3+200	8.20	4.00	3.00	1.00	380.00	18.16	0.40	145.77	170.16		1.33			2-910	16.00				INSTALL 2-910 RCPC
20	3+520	6.30	5.00	3.50	1.50	440.00	18.39	0.40	145.07	169.36		1.02			1-910	16.00				INSTALL 1-910 RCPC
21	3+650	7.60	5.00	3.50	1.50	380.00	25.27	0.40	127.10	148.95		1.00			1-910	16.00				INSTALL 1-910 RCPC
22	3+790	9.20	5.00	3.50	1.50	770.00	35.00	0.40	108.80	128.10		1.11			1-910	16.00				INSTALL 1-910 RCPC
23	3+870	23.00	5.00	4.00	1.00	1020.00	56.54	0.35	83.71	99.39		1.87			2-910	16.00				INSTALL 2-910 RCPC
24	4+190	29.00	5.00	4.00	1.00	1[illegible].00	66.85	0.35	75.75	90.23		2.14			2-910	16.00				INSTALL 2-910 RCPC
25	4+290	48.00	5.00	4.00	1.00	1380.00	80.04	0.35	67.76	81.02		3.16			3-910	16.00				INSTALL 3-910 RCPC
26	4+380	3.00	4.00	3.50	0.50	350.00	21.58	0.35	136.07	159.14		0.40			1-610	16.00				INSTALL 1-610 RCPC
27	4+490	2.40	4.00	3.50	0.50	350.00	21.58	0.35	136.07	159.14		0.32			1-610	16.00				INSTALL 1-610 RCPC
28	4+750	13.00	4.00	3.50	0.50	650.00	42.42	0.40	98.39	116.21		1.42			2-910	16.00				INSTALL 2-910 RCPC
29	4+990	23.00	5.00	4.00	1.00	1120.00	62.96	0.35	78.55	93.45		1.76			2-910	16.00				INSTALL 2-910 RCPC
30	5+240	71.50	5.00	4.00	1.00	2200.00	136.84	0.35	47.59	57.60		3.31			3-1070	16.00				INSTALL 3-1070 RCPC

LEGEND :

D.A.-DRAINAGE AREA	HAS-HECTARES	S.O.S.-SIZE OF STRUCTURE
H-DIFFERENCE IN ELEVATION	M-METER	L.O.S-LENGTH OF STRUCTURE
L-LENGTH	MIN-MINUTES	RCPC-REINFORCED CONCRETE PIPE CULVERT
Tc-TIME OF CONCENTRATION	CUMECS-M^3/SEC	RCBC-REINFORCED CONCRETE BOX CULVERT
R.OFF-RUNOFF	MM-MILLIMETER	RCDG-REINFORCED CONCRETE DECK GIRDER
C-COEFFICIENTS	T.B.-	I.ELEV.-INVERT ELEVATION
KM-KILOMETER	B.B.-BAILEY BRIDGE	F.R.ELEV.-FINISHED ROAD ELEVATION

TABLE B - 2
SIZING OF DRAINAGE STRUCTURES
ROAD SECTION : MACTAN CIRCUMFERENTIAL ROAD

BASIN NO.	STATION (KM)	D.A. (HAS)	ELEVATION HIGH (M)	ELEVATION LOW (M)	H (M)	L (M)	Tc (MIN)	R.OFF C	RAINFALL INTENSITY I=(MM/HR) 10 YR.	25 YR.	50 YR.	DISCHARGE (CUMECS) 10 YR.	25 YR.	50 YR.	S.O.S RCPC/RCBC BRIDGE	L.O.S (M)	I.ELEV INLET (M)	I.ELEV OUTLET (M)	F.R. ELEV. (M)	REMARKS
31	5+430	4.20	5.00	4.00	1.00	270.00	12.26	0.40	166.94	194.17		0.78			2-610	16.00				INSTALL 2-610 RCPC
32	5+710	3.50	5.00	4.00	1.00	220.00	9.69	0.40	178.59	207.35		0.69			2-610	16.00				INSTALL 2-610 RCPC
33	5+880	24.00	5.50	4.00	1.50	950.00	44.57	0.45	95.78	113.22		2.87			3-910	16.00				INSTALL 3-910 RCPC
34	6+080	39.50	5.50	4.00	1.50	1530.00	77.10	0.40	69.37	82.88		3.04			3-910	16.00				INSTALL 3-910 RCPC
35	6+200	14.00	6.00	4.00	1.00	950.00	52.10	0.45	87.76	104.04		1.54			2-910	16.00				INSTALL 2-910 RCPC
36	6+350	15.50	6.00	4.50	1.50	800.00	36.58	0.35	106.38	125.34		1.60			2-910	16.00				INSTALL 2-910 RCPC
37	6+530	13.00	6.50	5.00	1.50	850.00	39.75	0.45	101.87	120.18		1.66			2-910	16.00				INSTALL 2-910 RCPC
38	6+680	3.20	6.50	5.00	1.50	250.00	9.60	0.45	179.02	207.84		0.72			2-610	16.00				INSTALL 2-610 RCPC
39	6+860	2.70	8.00	6.50	1.50	170.00	6.16	0.45	197.98	229.31		0.67			2-610	16.00				INSTALL 2-610 RCPC
40	6+940	22.00	8.00	6.65	1.35	860.00	41.39	0.45	93.69	117.70		2.74			3-910	16.00				INSTALL 3-910 RCPC
41	7+030	12.50	8.00	6.65	1.35	660.00	30.53	0.45	116.41	136.78		1.82			2-910	16.00				INSTALL 2-910 RCPC
42	7+260	8.00	7.00	6.50	0.50	710.00	46.67	0.45	91.21	107.99		0.91			1-910	16.00				INSTALL 1-910 RCPC
43	7+390	7.20	6.00	4.50	1.50	300.00	11.94	0.45	158.73	186.19		1.52			2-910	16.00				INSTALL 2-910 RCPC
44	7+565	5.40	5.00	4.00	1.00	400.00	17.27	0.45	142.46	166.41		0.96			1-910	16.00				INSTALL 1-910 RCPC
45	7+695	4.00	5.00	4.00	1.00	310.00	14.37	0.45	158.60	184.71		0.95			1-910	16.00				INSTALL 1-910 RCPC

LEGEND :

D.A.-DRAINAGE AREA	HAS-HECTARES	S.O.S.-SIZE OF STRUCTURE
H-DIFFERENCE IN ELEVATION	M-METER	L.O.S-LENGTH OF STRUCTURE
L-LENGTH	MIN-MINUTES	RCPC-REINFORCED CONCRETE PIPE CULVERT
Tc-TIME OF CONCENTRATION	CUMECS-M^3/SEC	RCBC-REINFORCED CONCRETE BOX CULVERT
R.OFF-RUNOFF	MM-MILLIMETER	RCDG-REINFORCED CONCRETE DECK GIRDER
C-COEFFICIENTS	T.B.-	I.ELEV.-INVERT ELEVATION
KM-KILOMETER	B.B.-BAILEY BRIDGE	F.R.ELEV.-FINISHED ROAD ELEVATION

TABLE B - 2
SIZING OF DRAINAGE STRUCTURES
ROAD SECTION : MACTAN CIRCUMFERENTIAL ROAD

BASIN NO.	STATION	D.A.	ELEVATION HIGH	ELEVATION LOW	H	L	Tc	R.OFF	RAINFALL INTENSITY I-(MM/HR)			DISCHARGE (CUMECS)			S.O.S RCPC/RCBC	L.O.S	I.ELEV INLET	I.ELEV OUTLET	F.R. ELEV.	REMARKS
	(KM)	(HAS)	(M)	(M)	(M)	(M)	(MIN)	C	10 YR.	25 YR.	50 YR.	10 YR.	25 YR.	50 YR.	BRIDGE	(M)	(M)	(M)	(M)	
46	8+065	3.90	4.00	3.50	0.50	250.00	14.65	0.45	157.55	183.52		0.77			2-610	16.00				INSTALL 2-610 RCPC
47	8+270	4.20	4.00	3.50	0.50	320.00	19.46	0.45	141.89	165.75		0.74			2-610	16.00				INSTALL 2-610 RCPC
48	8+470	3.50	5.00	4.00	1.00	280.00	12.78	0.45	164.78	191.72		0.72			2-610	16.00				INSTALL 2-610 RCPC
49	8+565	4.60	5.00	4.00	1.00	370.00	17.61	0.45	147.43	172.10		0.85			1-910	16.00				INSTALL 1-910 RCPC
50	8+905	4.80	6.00	4.50	1.50	410.00	16.96	0.45	149.59	174.49		0.90			1-910	16.00				INSTALL 1-910 RCPC
51	9+110	7.50	6.00	4.50	1.50	380.00	15.54	0.45	154.38	179.93		1.45			2-910	16.00				INSTALL 2-910 RCPC
52	9+250	10.00	6.00	5.00	1.00	650.00	33.67	0.45	110.94	130.54		1.39			2-910	16.00				INSTALL 2-910 RCPC
53	9+420	14.00	8.00	5.50	2.50	760.00	28.32	0.40	120.63	141.59		1.88			2-910	16.00				INSTALL 2-910 RCPC
54	9+720	6.20	6.00	5.50	0.50	330.00	20.17	0.40	139.99	163.49		0.96			1-910	16.00				INSTALL 1-910 RCPC
55	9+950	161.00	10.00	5.00	5.00	3000.00	105.20	0.40	56.80	68.32		10.16			3-910	16.00				INSTALL 3-910 RCPC
56	10+100	67.00	8.00	5.00	3.00	2400.00	99.08	0.40	59.08	70.97		4.40			3-1070	16.00				INSTALL 3-1070 RCPC
57	10+240	15.00	6.00	4.50	1.50	760.00	34.48	0.40	109.63	129.05		1.83			2-910	16.00				INSTALL 2-910 RCPC
58	10+420	3.20	10.00	4.50	5.50	200.00	5.00	0.40	205.48	237.79		0.79			2-610	16.00				INSTALL 2-610 RCPC
59	10+570	2.80	10.00	4.50	5.50	200.00	5.00	0.40	205.48	237.79		0.64			2-610	16.00				INSTALL 2-610 RCPC
60	10+700	29.00	10.00	4.50	5.50	1520.00	46.40	0.40	93.68	110.82		3.02			3-910	16.00				INSTALL 3-910 RCPC

LEGEND :

D.A.-DRAINAGE AREA	HAS-HECTARES	S.O.S.-SIZE OF STRUCTURE
H-DIFFERENCE IN ELEVATION	M-METER	L.O.S-LENGTH OF STRUCTURE
L-LENGTH	MIN-MINUTES	RCPC-REINFORCED CONCRETE PIPE CULVERT
Tc-TIME OF CONCENTRATION	CUMECS-M^3/SEC	RCBC-REINFORCED CONCRETE BOX CULVERT
R.OFF-RUNOFF	MM-MILLIMETER	RCDG-REINFORCED CONCRETE DECK GIRDER
C-COEFFICIENTS	T.B.	I.ELEV.-INVERT ELEVATION
KM-KILOMETER	B.B.-BAILEY BRIDGE	F.R.ELEV.-FINISHED ROAD ELEVATION

TABLE B - 2
SIZING OF DRAINAGE STRUCTURES
ROAD SECTION : MACTAN CIRCUMFERENTIAL ROAD

BASIN NO.	STATION (KM)	D.A. (HAS)	ELEVATION HIGH (M)	ELEVATION LOW (M)	H (M)	L (M)	Tc (MIN)	R.OFF C	RAINFALL INTENSITY I=(MM/HR) 10 YR.	25 YR.	50 YR.	DISCHARGE (CUMECS) 10 YR.	25 YR.	50 YR.	S.O.S RCPC/RCBC BRIDGE	L.O.S (M)	I.ELEV INLET (M)	I.ELEV OUTLET (M)	F.R. ELEV. (M)	REMARKS
61	10+870	11.00	8.00	4.50	3.50	480.00	14.67	0.35	157.50	183.46		1.68			2-910	16.00				INSTALL 2-910 RCPC
62	11+340	148.50	10.00	5.00	5.00	3670.00	132.65	0.35	48.61	58.79		7.02	8.49		2-1.25x1.00	9.10				CONSTRUCT 2-1.25x1.00 RCBC
63	11+570	28.00	10.00	5.00	5.00	1120.00	35.08	0.35	110.60	130.16		3.01			3-910	14.00				INSTALL 3-910 RCPC
64	11+690	1.50	5.00	4.75	0.25	130.00	9.02	0.35	181.92	211.12		0.27			1-610	14.00				INSTALL 1-610 RCPC
65	11+970	3.20	5.00	4.50	0.50	240.00	13.98	0.45	160.07	186.37		0.64			2-610	14.00				INSTALL 2-610 RCPC
66	12+090	5.30	5.50	4.50	1.00	430.00	20.94	0.45	137.77	161.08		0.91			2-610	14.00				INSTALL 2-610 RCPC
67	12+190	10.50	6.00	4.50	1.50	610.00	26.78	0.45	123.81	145.21		1.63			2-910	14.00				INSTALL 2-910 RCPC
68	12+340	2.40	5.00	4.75	0.25	180.00	13.12	0.35	163.44	190.20		0.38			1-610	14.00				INSTALL 1-610 RCPC
69	12+690	65.00	10.00	4.50	5.50	1800.00	56.36	0.35	63.86	99.56		5.30			3-1220	14.00				INSTALL 3-1220 RCPC
70	13+050	15.00	10.00	4.50	5.50	600.00	15.93	0.35	153.02	178.38		2.23			3-910	14.00				INSTALL 3-910 RCPC
71	13+260	5.40	6.00	4.50	1.50	320.00	12.75	0.35	164.91	191.87		0.87			1-910	14.00				INSTALL 1-910 RCPC
72	13+530	13.50	8.00	4.50	3.50	960.00	32.55	0.35	112.82	132.69		1.48			2-910	14.00				INSTALL 2-910 RCPC
73	13+760	81.00	10.00	4.50	5.50	2300.00	74.71	0.35	70.75	84.47		5.57			3-1220	14.00				INSTALL 3-1220 RCPC
74	13+990	7.00	8.00	4.25	3.75	530.00	16.01	0.35	152.75	178.03		1.04			1-910	14.00				INSTALL 1-910 RCPC
75	14+190	32.00	10.00	4.00	6.00	1280.00	36.62	0.35	106.01	124.92		3.30			3-1070	14.00				INSTALL 3-1070 RCPC
76	14+590	153.00	10.00	4.00	6.00	3020.00	98.62	0.35	59.18	71.09		8.80	10.57		3-1.25x1.00	9.10				CONSTRUCT 3-1.25x1.00 RCBC

LEGEND :

D.A.-DRAINAGE AREA	HAS-HECTARES	S.O.S.-SIZE OF STRUCTURE
H-DIFFERENCE IN ELEVATION	M-METER	L.O.S-LENGTH OF STRUCTURE
L-LENGTH	MIN-MINUTES	RCPC-REINFORCED CONCRETE PIPE CULVERT
Tc-TIME OF CONCENTRATION	CUMECS-M^3/SEC	RCBC-REINFORCED CONCRETE BOX CULVERT
R.OFF-RUNOFF	MM-MILLIMETER	RCDG-REINFORCED CONCRETE DECK GIRDER
C-COEFFICIENTS	T.B.-TIMBER BRIDGE	I.ELEV.-INVERT ELEVATION
KM-KILOMETER	B.B.-BAILEY BRIDGE	F.R.ELEV.-FINISHED ROAD ELEVATION

TABLE B - 2
SIZING OF DRAINAGE STRUCTURES
ROAD SECTION : MACTAN CIRCUMFERENTIAL ROAD

BASIN NO.	STATION (KM)	D.A. (HAS)	ELEVATION HIGH (M)	ELEVATION LOW (M)	H (M)	L (M)	Tc (MIN)	R.OFF C	RAINFALL INTENSITY I=(MM/HR) 10 YR.	25 YR.	50 YR.	DISCHARGE (CUMECS) 10 YR.	25 YR.	50 YR.	S.O.S RCPC/RCBC BRIDGE	L.O.S (M)	I.ELEV INLET (M)	I.ELEV OUTLET (M)	F.R. ELEV. (M)	REMARKS
77	14+510	9.00	6.00	4.00	2.00	610.00	23.97	0.40	130.10	152.36		1.30			2-910	14.00				INSTALL 2-910 RCPC
78	14+580	165.00	10.00	4.00	6.00	3040.00	99.57	0.35	58.89	70.75		9.45	11.35		3-1.25x1.00	14.00				CONSTRUCT 3-1.25x1.00 RCBC
79	14+690	15.00	8.00	4.00	4.00	920.00	29.44	0.35	118.45	139.10		1.73			2-910	14.00				INSTALL 2-910 RCPC
80	14+890	20.00	10.00	4.50	5.50	960.00	27.35	0.43	122.61	143.83		3.07			3-910	14.00				INSTALL 3-910 RCPC
81	15+105	6.20	10.00	5.00	5.00	470.00	12.48	0.35	166.02	193.13		1.00			1-910	14.00				INSTALL 1-910 RCPC
82	15+225	5.10	10.00	5.50	4.50	400.00	10.80	0.35	173.34	201.42		0.86			1-910	14.00				INSTALL 1-910 RCPC
83	15+295	3.20	10.00	5.50	4.50	310.00	8.05	0.35	187.01	216.89		0.58			2-610	14.00				INSTALL 2-610 RCPC
84	15+505	3.00	6.00	5.50	0.50	200.00	11.34	0.35	170.92	198.67		0.50			2-610	14.00				INSTALL 2-610 RCPC
85	16+120	335.00	10.00	5.00	5.00	3850.00	140.15	0.70	46.82	56.70			36.93		2-3.00x2.10	9.00				REPLACE B.B. BY 2-3.00x2.10 RCBC
86	16+725	13.70	8.00	4.50	3.50	740.00	24.13	0.35	129.72	151.92		1.73			2-910	14.00				INSTALL 2-910 RCPC
87	16+860	13.00	6.00	4.50	1.50	600.00	26.27	0.35	124.89	146.43		1.58			2-910	14.00				INSTALL 2-910 RCPC
88	17+030	11.50	5.00	4.20	0.80	580.00	32.19	0.35	113.45	133.40		1.27			2-910	14.00				INSTALL 2-910 RCPC
89	17+335	9.40	5.00	3.50	1.50	480.00	20.33	0.35	139.45	162.98		1.27			2-910	14.00				INSTALL 2-910 RCPC
90	17+585	6.20	4.00	3.50	0.50	310.00	18.77	0.35	143.94	168.08		0.87			1-910	14.00				INSTALL 1-910 RCPC
91	17+860	4.80	4.00	3.50	0.50	230.00	13.31	0.35	162.66	189.31		0.76			2-610	14.00				INSTALL 2-610 RCPC

LEGEND :

D.A.-DRAINAGE AREA	HAS-HECTARES	S.O.S.-SIZE OF STRUCTURE
H-DIFFERENCE IN ELEVATION	M-METER	L.O.S-LENGTH OF STRUCTURE
L-LENGTH	MIN-MINUTES	RCPC-REINFORCED CONCRETE PIPE CULVERT
Tc-TIME OF CONCENTRATION	CUMECS-M^3/SEC	RCBC-REINFORCED CONCRETE BOX CULVERT
R.OFF-RUNOFF	MM-MILLIMETER	RCDG-REINFORCED CONCRETE DECK GIRDER
C-COEFFICIENTS	T.B.-TIMBER BRIDGE	I.ELEV.-INVERT ELEVATION
KM-KILOMETER	B.B.-BAILEY BRIDGE	F.R.ELEV.-FINISHED ROAD ELEVATION

TABLE B - 2
SIZING OF DRAINAGE STRUCTURES
ROAD SECTION : MACTAN CIRCUMFERENTIAL ROAD

BASIN NO.	STATION (KM)	D.A. (HAS)	ELEVATION HIGH (M)	ELEVATION LOW (M)	H (M)	L (M)	Tc (MIN)	R.OFF C	RAINFALL INTENSITY I=(MM/HR) 10 YR.	25 YR.	50 YR.	DISCHARGE (CUMECS) 10 YR.	25 YR.	50 YR.	S.O.S RCPC/RCBC BRIDGE	L.O.S (M)	I.ELEV INLET (M)	I.ELEV OUTLET (M)	F.R. ELEV. (M)	REMARKS
92	18+070	4.20	4.00	3.00	1.00	210.00	9.18	0.35	181.10	210.19		0.74			2-610	14.00				INSTALL 2-610 RCPC
93	18+250	1.50	4.00	3.00	1.00	170.00	7.20	0.35	191.77	222.28		0.28			1-610	[illegible]				INSTALL 1-610 RCPC
94	18+395	1.20	4.00	3.00	1.00	170.00	7.20	0.35	191.77	222.28		0.22			1-610	14.20				INSTALL 1-610 RCPC
95	18+700	0.80	3.00	2.50	0.50	60.00	5.00	0.45	205.48	237.79		0.21			1-610	14.20				INSTALL 1-610 RCPC
96	18+760	0.70	3.00	2.50	0.50	65.00	5.00	0.45	205.48	237.79		0.18			1-610	14.20				INSTALL 1-610 RCPC
97	18+820	0.80	3.00	2.50	0.50	70.00	5.00	0.45	205.48	237.79		0.21			1-610	14.20				INSTALL 1-610 RCPC
98	18+880	1.20	3.00	2.50	0.50	80.00	5.00	0.45	205.46	237.79		0.31			1-610	14.20				INSTALL 1-610 RCPC
99	18+940	2.20	3.00	2.50	0.50	200.00	11.34	0.45	170.92	198.67		0.47			1-610	14.20				INSTALL 1-610 RCPC
100	19+030	11.50	4.00	2.50	1.50	520.00	22.29	0.45	134.23	157.06		1.93			2-910	14.20				INSTALL 2-910 RCPC
101	19+260	22.00	4.00	2.50	1.50	760.00	34.48	0.45	109.63	129.05		3.01			3-910	14.20				INSTALL 3-910 RCPC
102	19+580	15.40	4.00	2.50	1.50	700.00	31.37	0.45	114.89	135.05		2.21			3-910	14.20				INSTALL 3-910 RCPC
103	19+780	4.50	3.00	2.50	0.50	220.00	12.65	0.35	165.32	192.33		0.72			2-610	14.20				INSTALL 2-610 RCPC
104	19+955	6.20	3.00	2.50	0.50	400.00	25.16	0.35	127.35	149.23		0.77			2-610	14.20				INSTALL 2-610 RCPC
105	20+075	4.30	3.00	2.50	0.50	350.00	21.58	0.35	136.07	159.14		0.57			2-610	14.20				INSTALL 2-610 RCPC
106	20+185	4.00	3.00	2.50	0.50	310.00	18.77	0.70	143.94	168.08		1.12			2-910	14.20				INSTALL 2-910 RCPC
107	20+350	48.00	4.00	2.50	1.50	1200.00	58.30	0.70	82.21	97.66			9.12		1-1.80x1.50	10.10				CONSTRUCT 1-1.80x1.50 RCBC

LEGEND :

D.A.-DRAINAGE AREA	HAS-HECTARES	S.O.S.-SIZE OF STRUCTURE
H-DIFFERENCE IN ELEVATION	M-METER	L.O.S-LENGTH OF STRUCTURE
L-LENGTH	MIN-MINUTES	RCPC-REINFORCED CONCRETE PIPE CULVERT
Tc-TIME OF CONCENTRATION	CUMECS-M^3/SEC	RCBC-REINFORCED CONCRETE BOX CULVERT
R.OFF-RUNOFF	MM-MILLIMETER	RCDG-REINFORCED CONCRETE DECK GIRDER
C-COEFFICIENTS	T.B.-TIMBER BRIDGE	I.ELEV.-INVERT ELEVATION
KM-KILOMETER	B.B.-BAILEY BRIDGE	F.R.ELEV.-FINISHED ROAD ELEVATION

TABLE B - 2

SIZING OF DRAINAGE STRUCTURES

ROAD SECTION : MACTAN CIRCUMFERENTIAL ROAD

BASIN NO.	STATION (KM)	D.A. (HAS)	ELEVATION HIGH (M)	ELEVATION LOW (M)	H (M)	L (M)	Tc (MIN)	R.OFF C	RAINFALL INTENSITY I-(MM/HR) 10 YR	25 YR	50 YR	DISCHARGE (CUMECS) 10 YR	25 YR	50 YR	S.O.S RCPC/RCBC BRIDGE	L.O.S (M)	I.ELEV INLET (M)	I.ELEV OUTLET (M)	F.R. ELEV. (M)	REMARKS
108	20+500	47.20	4.00	2.50	1.50	1150.00	55.52	0.70	84.60	100.41			9.22		1-1.80x1.50	10.10				CONSTRUCT 1-1.80x1.50 RCBC
109	20+610	194.50	5.00	2.50	2.50	3850.00	183.02	0.70	38.88	47.39			17.92		1-2.40x2.10	10.10				REPLACE T.B. BY 1-2.40x2.10 RCBC
110	20+915	58.00	3.00	2.50	0.50	1440.00	109.76	0.70	55.22	66.49			7.50		1-1.25x1.80	10.10				REPLACE T.B. BY 1-1.25x1.80 RCBC
111	22+010	14.80	3.00	2.50	0.50	750.00	51.84	0.40	88.01	104.32		1.45			2-910	14.20				INSTALL 2-910 RCPC
112	22+21[illegible]	34.00	3.00	2.50	0.50	1000.00	72.16	0.40	72.28	86.24		2.73			3-910	14.20				INSTALL 3-910 RCPC
113	22+390	4.80	2.50	2.00	0.50	150.00	8.14	0.70	186.52	216.33		1.74			2-910	14.20				INSTALL 2-910 RCPC
114	22+720	6.00	2.50	2.00	0.50	180.00	10.04	0.70	176.87	205.40		2.75			2-910	14.20				INSTALL 2-910 RCPC
115	22+880	3.20	2.50	2.00	0.50	170.00	9.40	0.70	179.98	208.93		1.12			1-910	14.20				INSTALL 1-910 RCPC
116	23+010	6.50	2.50	2.00	0.50	190.00	10.69	0.70	173.84	201.96		2.20			2-910	14.20				INSTALL 2-910 RCPC
117	23+170	6.30	2.50	2.00	0.50	180.00	10.04	0.70	176.87	205.40		2.17			2-910	14.20				INSTALL 2-910 RCPC
118	23+390	4.80	2.50	2.00	0.50	160.00	8.77	0.70	183.20	212.58		1.71			2-910	14.20				INSTALL 2-910 RCPC
119	23+510	12.00	2.50	2.00	0.50	300.00	18.07	0.70	146.05	170.47		3.41			3-910	14.20				INSTALL 3-910 RCPC
120	23+610	9.60	2.50	2.00	0.50	450.00	26.81	0.70	119.68	140.50		2.23			2-910	14.20				INSTALL 2-910 RCPC
121	23+715	1.80	2.50	2.00	0.50	180.00	10.04	0.45	176.87	205.40		0.40			1-610	14.20				INSTALL 1-610 RCPC
122	23+845	11.50	2.50	2.00	0.50	540.00	35.53	0.45	107.98	127.16		1.55			2-910	14.20				INSTALL 2-910 RCPC
123	23+945	5.00	2.50	2.00	0.50	300.00	18.07	0.45	146.05	170.47		0.91			1-910	14.20				INSTALL 1-910 RCPC
124	24+045	7.60	2.50	2.00	0.50	580.00	38.57	0.45	103.[illegible]	122.04		0.98			1-910	14.20				INSTALL 1-910 RCPC
125	24+145	2.80	2.50	2.00	0.50	250.00	14.65	0.45	157.55	183.52		0.55			2-610	14.20				INSTALL 2-610 RCPC

LEGEND :

D.A.-DRAINAGE AREA	HAS-HECTARES	S.O.S.-SIZE OF STRUCTURE
H-DIFFERENCE IN ELEVATION	M-METER	L.O.S-LENGTH OF STRUCTURE
L-LENGTH	MIN-MINUTES	RCPC-REINFORCED CONCRETE PIPE CULVERT
Tc-TIME OF CONCENTRATION	CUMECS-M^3/SEC	RCBC-REINFORCED CONCRETE BOX CULVERT
R.OFF-RUNOFF	MM-MILLIMETER	RCDG-REINFORCED CONCRETE DECK GIRDER
C-COEFFICIENTS	T.B.-TIMBER BRIDGE	I.ELEV.-INVERT ELEVATION
KM-KILOMETER	B.B.-BAILEY BRIDGE	F.R.ELEV.-FINISHED ROAD ELEVATION

TABLE B - 2
SIZING OF DRAINAGE STRUCTURES
ROAD SECTION : MACTAN CIRCUMFERENTIAL ROAD

BASIN NO.	STATION (KM)	D.A. (HAS)	ELEVATION HIGH (M)	ELEVATION LOW (M)	H (M)	L (M)	Tc (MIN)	R.OFF C	RAINFALL INTENSITY I=(MM/HR) 10 YR.	25 YR.	50 YR.	DISCHARGE (CUMECS) 10 YR.	25 YR.	50 YR.	S.O.S RCPC/RCBC BRIDGE	L.O.S (M)	I.ELEV INLET (M)	I.ELEV OUTLET (M)	F.R. ELEV. (M)	REMARKS
126	24+245	1.40	2.50	2.00	0.50	180.00	10.04	0.45	176.87	205.40		0.31			1-610	14.20				INSTALL 1-610 RCPC
127	24+345	17.20	3.00	2.50	0.50	760.00	52.63	[illegible]	87.25	103.45		1.88			2-910	14.20				INSTALL 2-910 RCPC
128	24+455	6.50	3.00	2.50	0.50	420.00	26.61	0.45	124.16	145.61		1.01			1-910	14.20				INSTALL 1-910 RCPC
129	24+530	3.70	3.00	2.50	0.50	280.00	16.69	0.45	150.[illegible]	175.47		0.70			1-910	14.20				INSTALL 1-910 RCPC
130	24+635	11.50	3.00	2.50	0.50	640.00	43.19	0.45	97.43	[illegible]5.11		1.40			2-910	14.20				INSTALL 2-910 RCPC
131	24+745	4.60	3.00	2.50	0.50	380.00	23.72	0.45	130.70	153.0[illegible]		0.75			2-610	14.20				INSTALL 2-610 RCPC
132	24+865	3.50	3.00	2.50	0.50	300.00	18.07	0.45	146.05	170.47		0.64			2-610	14.20				INSTALL 2-610 RCPC
133	24+925	1.00	3.00	2.50	0.50	65.00	5.00	0.45	205.48	237.79		0.26			1-610	14.20				INSTALL 1-610 RCPC
134	24+980	1.60	3.00	2.50	0.50	65.00	5.00	0.45	205.48	237.79		0.41			1-610	14.20				INSTALL 1-610 RCPC
135	25+035	1.55	3.00	2.50	0.50	65.00	5.00	0.45	205.48	237.79		0.40			1-610	14.20				INSTALL 1-610 RCPC
136	25+185	1.76	3.00	2.50	0.50	50.00	5.00	0.45	205.48	237.79		0.45			1-610	14.20				INSTALL 1-610 RCPC
137	25+265	1.00	3.00	2.50	0.50	50.00	5.00	0.45	205.48	237.79		0.26			1-610	14.20				INSTALL 1-610 RCPC
138	25+345	1.90	3.00	2.50	0.50	50.00	5.00	0.45	205.48	237.79		0.49			1-610	14.20				INSTALL 1-610 RCPC
139	25+475	1.40	3.00	2.50	0.50	50.00	5.00	0.45	205.48	237.79		0.36			1-610	14.20				INSTALL 1-610 RCPC
140	25+575	1.00	3.00	2.50	0.50	50.00	5.00	0.45	205.48	237.79		0.26			1-610	14.20				INSTALL 1-610 RCPC
141	25+670	1.60	3.00	2.50	0.50	100.00	5.11	0.45	204.75	236.96		0.41			1-610	14.20				INSTALL 1-610 RCPC

LEGEND :

D.A.-DRAINAGE AREA	HAS-HECTARES	S.O.S.-SIZE OF STRUCTURE
H-DIFFERENCE IN ELEVATION	M-METER	L.O.S-LENGTH OF STRUCTURE
L-LENGTH	MIN-MINUTES	RCPC-REINFORCED CONCRETE PIPE CULVERT
Tc-TIME OF CONCENTRATION	CUMECS-M³/SEC	RCBC-REINFORCED CONCRETE BOX CULVERT
R.OFF-RUNOFF	MM-MILLIMETER	RCDG-REINFORCED CONCRETE DECK GIRDER
C-COEFFICIENTS	T.B.-TIMBER BRIDGE	I.ELEV.-INVERT ELEVATION
KM-KILOMETER	B.B.-BAILEY BRIDGE	F.R.ELEV.-FINISHED ROAD ELEVATION

TABLE B - 2
SIZING OF DRAINAGE STRUCTURES
ROAD SECTION : MACTAN CIRCUMFERENTIAL ROAD

BASIN NO.	STATION	D.A.	ELEVATION HIGH	ELEVATION LOW	H	L	Tc	R.OFF	RAINFALL INTENSITY I-(MM/HR)			DISCHARGE (CUMECS)			S.O.S RCPC/RCBC	L.O.S	I.ELEV INLET	I.ELEV OUTLET	F.R. ELEV.	REMARKS
	(KM)	(HAS)	(M)	(M)	(M)	(M)	(MIN)	C	10 YR.	25 YR.	50 YR.	10 YR.	25 YR.	50 YR.	BRIDGE	(M)	(M)	(M)	(M)	
142	25+770	3.00	3.00	2.50	0.50	220.00	12.65	[illegible]	165.32	192.33		0.32			2-610	14.20				INSTALL 2-610 RCPC
143	25+890	7.20	3.00	2.50	0.50	600.00	40.11	0.45	101.39	119.63		0.91			1-910	14.20				INSTALL 1-910 RCPC
144	25+955	35.00	3.00	2.50	0.50	1250.00	93.28	0.45	61.45	73.71		2.69			3-910	14.20				INSTALL 3-910 RCPC
145	26+075	6.00	3.00	2.50	0.50	410.00	25.88	0.45	125.74	147.39		0.94			2-610	14.20				INSTALL 2-610 RCPC
146	26+285	20.00	3.00	2.50	0.50	420.00	26.61	0.45	124.16	145.61		3.10			3-910	14.20				INSTALL 3-910 RCPC
147	26+385	5.40	3.00	2.50	0.50	500.00	32.52	0.45	112.88	132.75		0.76			2-610	14.20				INSTALL 2-610 RCPC
148	26+465	30.00	3.00	2.50	0.50	1000.00	72.16	0.45	72.28	86.24		2.71			3-910	14.20				INSTALL 3-910 RCPC
149	26+595	46.50	3.00	2.50	0.50	1640.00	127.47	0.45	49.95	60.35		2.90			3-910	14.20				INSTALL 3-910 RCPC
150	26+735	12.70	3.00	2.75	0.25	1260.00	125.17	0.45	50.57	61.07		0.80			2-610	14.20				INSTALL 2-610 RCPC
151	26+835	4.20	3.00	2.75	0.25	430.00	35.70	0.45	107.71	126.85		0.57			2-610	14.20				INSTALL 2-610 RCPC
152	26+965	11.00	3.00	2.75	0.25	1020.00	96.41	0.45	60.14	72.20		0.83			2-610	14.20				INSTALL 2-610 RCPC
153	27+105	5.40	3.00	2.75	0.25	500.00	42.47	0.45	98.33	116.14		0.66			2-610	14.20				INSTALL 2-610 RCPC
154	27+207	4.30	3.00	2.75	0.25	330.00	26.33	0.45	124.76	146.28		0.67			2-610	14.20				INSTALL 2-610 RCPC

LEGEND :

D.A.-DRAINAGE AREA	HAS-HECTARES	S.O.S.-SIZE OF STRUCTURE
H-DIFFERENCE IN ELEVATION	M-METER	L.O.S-LENGTH OF STRUCTURE
L-LENGTH	MIN-MINUTES	RCPC-REINFORCED CONCRETE PIPE CULVERT
Tc-TIME OF CONCENTRATION	CUMECS-M³/SEC	RCBC-REINFORCED CONCRETE BOX CULVERT
R.OFF-RUNOFF	MM-MILLIMETER	RCDG-REINFORCED CONCRETE DECK GIRDER
C-COEFFICIENTS	T.B.-TIMBER BRIDGE	I.ELEV.-INVERT ELEVATION
KM-KILOMETER	B.B.-BAILEY BRIDGE	F.R.ELEV.-FINISHED ROAD ELEVATION

APPENDIX C
TRANSPORT ECONOMICS

06-Feb-91

TABLE C-1

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: AC

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	6.4	1.6	65	81	1.5	1.3	3719	2.5	2.5	5,259,301	4,387,749	871,552
1994	6.5	1.7	65	80	1.6	1.3	4043	2.5	2.5	5,718,003	4,792,312	925,691
1995	6.7	1.8	64	79	1.6	1.3	4396	2.5	2.5	6,219,708	5,212,625	1,007,083
1996	6.8	2.0	63	78	1.6	1.3	4782	2.5	2.5	6,768,667	5,672,517	1,096,150
1997	7.0	2.1	62	77	1.6	1.3	5205	2.5	2.5	7,369,564	6,175,912	1,193,652
1998	7.2	2.3	61	76	1.6	1.3	5668	2.5	2.5	8,407,166	6,727,137	1,680,029
1999	7.4	2.5	59	74	1.7	1.3	6176	2.5	2.5	9,579,199	7,330,966	2,248,233
2000	7.6	2.7	58	73	1.7	1.3	6731	2.5	2.5	10,442,777	7,992,663	2,450,113
2001	7.8	2.9	57	71	1.7	1.3	7350	2.5	2.5	11,399,580	8,725,832	2,673,748
2002	8.1	3.2	55	69	1.8	1.4	8029	2.5	2.5	13,061,714	10,074,650	2,987,063
2003	1.5	1.5	73	73	1.3	1.3	8774	2.5	2.5	10,413,226	10,413,226	0
2004	1.8	1.7	71	71	1.3	1.3	9592	2.5	2.5	11,382,642	11,382,642	0
2005	2.2	2.0	68	69	1.3	1.3	10490	2.5	2.5	12,681,303	12,681,303	0
2006	2.6	2.3	66	67	1.3	1.3	11477	2.5	2.5	13,872,751	13,872,751	0
2007	3.0	2.6	63	64	1.4	1.3	12561	2.5	2.5	15,752,522	15,182,080	570,443
2008	3.5	3.0	60	62	1.4	1.3	13753	2.5	2.5	17,245,923	16,621,374	624,550
2009	4.1	3.4	57	59	1.5	1.4	15064	2.5	2.5	20,552,597	19,627,029	925,568
2010	4.7	3.8	53	55	1.5	1.4	16506	2.5	2.5	22,516,849	21,503,419	1,013,430
2011	5.4	4.3	50	52	1.6	1.5	18093	2.5	2.5	27,105,961	24,677,879	2,428,081
2012	6.2	4.9	46	49	1.7	1.6	19838	2.5	2.5	30,642,516	28,684,972	1,957,544

(1) Benefits include passenger time savings.

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

TABLE C-2 06-Feb-91

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: AC

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	1.6	74	81	1.3	1.3	3719	3.0	3.0	5,491,085	5,265,298	225,787
1994	3.7	1.7	73	80	1.3	1.3	4043	3.0	3.0	5,969,919	5,750,775	219,145
1995	3.8	1.8	73	79	1.3	1.3	4396	3.0	3.0	6,493,637	6,255,150	238,487
1996	3.9	2.0	72	78	1.3	1.3	4782	3.0	3.0	7,066,675	6,807,021	259,654
1997	3.9	2.1	71	77	1.3	1.3	5205	3.0	3.0	7,693,921	7,411,094	282,827
1998	4.0	2.3	70	76	1.4	1.3	5668	3.0	3.0	8,714,101	8,072,565	641,536
1999	4.1	2.5	69	74	1.4	1.3	6176	3.0	3.0	9,661,636	8,797,159	864,477
2000	4.2	2.7	68	73	1.4	1.3	6731	3.0	3.0	10,533,638	9,591,196	942,442
2001	4.3	2.9	67	71	1.4	1.3	7350	3.0	3.0	11,499,770	10,470,998	1,028,772
2002	4.3	3.2	66	69	1.4	1.4	8029	3.0	3.0	12,559,823	12,089,580	470,243
2003	4.4	1.5	65	73	1.4	1.3	8774	3.0	3.0	13,723,311	12,495,871	1,227,440
2004	4.5	1.7	63	71	1.4	1.3	9592	3.0	3.0	15,000,737	13,659,170	1,341,567
2005	4.6	2.0	62	69	1.4	1.3	10490	3.0	3.0	16,403,699	15,217,564	1,186,135
2006	4.7	2.3	60	67	1.4	1.3	11477	3.0	3.0	17,945,007	16,647,301	1,297,706
2007	4.9	2.6	58	64	1.5	1.3	12561	3.0	3.0	20,571,066	18,218,496	2,352,570
2008	5.0	3.0	56	62	1.5	1.3	13753	3.0	3.0	22,520,059	19,945,648	2,574,411
2009	5.1	3.4	54	59	1.6	1.4	15064	3.0	3.0	25,650,083	23,552,435	2,097,648
2010	5.2	3.8	52	55	1.6	1.4	16506	3.0	3.0	28,101,607	25,804,103	2,297,504
2011	5.4	4.3	50	52	1.6	1.5	18093	3.0	3.0	32,527,153	29,613,455	2,913,698
2012	5.5	4.9	47	49	1.6	1.6	19838	3.0	3.0	35,662,061	34,421,966	1,240,095

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-3

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: AC

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	6.4	1.6	65	81	0.0	0.0	0	2.5	2.5	0	0	0
1994	6.5	1.7	65	80	0.0	0.0	0	2.5	2.5	0	0	0
1995	6.7	1.8	64	79	0.0	0.0	0	2.5	2.5	0	0	0
1996	6.8	2.0	63	78	0.0	0.0	0	2.5	2.5	0	0	0
1997	7.0	2.1	62	77	0.0	0.0	0	2.5	2.5	0	0	0
1998	7.2	2.3	61	76	0.0	0.0	0	2.5	2.5	0	0	0
1999	7.4	2.5	59	74	0.0	0.0	0	2.5	2.5	0	0	0
2000	7.6	2.7	58	73	0.0	0.0	0	2.5	2.5	0	0	0
2001	7.8	2.9	57	71	0.0	0.0	0	2.5	2.5	0	0	0
2002	8.1	3.2	55	69	0.0	0.0	0	2.5	2.5	0	0	0
2003	1.5	1.5	73	73	0.0	0.0	0	2.5	2.5	0	0	0
2004	1.8	1.7	71	71	0.0	0.0	0	2.5	2.5	0	0	0
2005	2.2	2.0	68	69	0.0	0.0	0	2.5	2.5	0	0	0
2006	2.6	2.3	66	67	0.0	0.0	0	2.5	2.5	0	0	0
2007	3.0	2.6	63	64	0.0	0.0	0	2.5	2.5	0	0	0
2008	3.5	3.0	60	62	0.0	0.0	0	2.5	2.5	0	0	0
2009	4.1	3.4	57	59	0.0	0.0	0	2.5	2.5	0	0	0
2010	4.7	3.8	53	55	0.0	0.0	0	2.5	2.5	0	0	0
2011	5.4	4.3	50	52	0.0	0.0	0	2.5	2.5	0	0	0
2012	6.2	4.9	46	49	0.0	0.0	0	2.5	2.5	0	0	0

(1) Benefits include passenger time savings.

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

TABLE C-4 06-Feb-91

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: AC

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	1.6	74	81	0.0	0.0	0	3.0	3.0	0	0	0
1994	3.7	1.7	73	80	0.0	0.0	0	3.0	3.0	0	0	0
1995	3.8	1.8	73	79	0.0	0.0	0	3.0	3.0	0	0	0
1996	3.9	2.0	72	78	0.0	0.0	0	3.0	3.0	0	0	0
1997	3.9	2.1	71	77	0.0	0.0	0	3.0	3.0	0	0	0
1998	4.0	2.3	70	76	0.0	0.0	0	3.0	3.0	0	0	0
1999	4.1	2.5	69	74	0.0	0.0	0	3.0	3.0	0	0	0
2000	4.2	2.7	68	73	0.0	0.0	0	3.0	3.0	0	0	0
2001	4.3	2.9	67	71	0.0	0.0	0	3.0	3.0	0	0	0
2002	4.3	3.2	66	69	0.0	0.0	0	3.0	3.0	0	0	0
2003	4.4	1.5	65	73	0.0	0.0	0	3.0	3.0	0	0	0
2004	4.5	1.7	63	71	0.0	0.0	0	3.0	3.0	0	0	0
2005	4.6	2.0	62	69	0.0	0.0	0	3.0	3.0	0	0	0
2006	4.7	2.3	60	67	0.0	0.0	0	3.0	3.0	0	0	0
2007	4.9	2.6	58	64	0.0	0.0	0	3.0	3.0	0	0	0
2008	5.0	3.0	56	62	0.0	0.0	0	3.0	3.0	0	0	0
2009	5.1	3.4	54	59	0.0	0.0	0	3.0	3.0	0	0	0
2010	5.2	3.8	52	55	0.0	0.0	0	3.0	3.0	0	0	0
2011	5.4	4.3	50	52	0.0	0.0	0	3.0	3.0	0	0	0
2012	5.5	4.9	47	49	0.0	0.0	0	3.0	3.0	0	0	0

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-5

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: AC

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	6.4	1.6	65	81	1.5	1.3	397	2.5	2.5	561,331	468,303	46,514
1994	6.5	1.7	65	80	1.5	1.3	441	2.5	2.5	623,077	522,280	50,399
1995	6.7	1.8	64	79	1.5	1.3	490	2.5	2.5	691,616	579,730	55,943
1996	6.8	2.0	63	78	1.5	1.3	543	2.5	2.5	767,694	643,501	62,096
1997	7.0	2.1	62	77	1.5	1.3	603	2.5	2.5	852,140	714,286	68,927
1998	7.2	2.3	61	76	1.6	1.3	670	2.5	2.5	990,445	792,857	98,794
1999	7.4	2.5	59	74	1.7	1.3	743	2.5	2.5	1,151,436	880,071	135,682
2000	7.6	2.7	58	73	1.7	1.3	825	2.5	2.5	1,278,094	976,879	150,607
2001	7.8	2.9	57	71	1.7	1.3	916	2.5	2.5	1,418,685	1,084,336	167,174
2002	8.1	3.2	55	69	1.8	1.4	1016	2.5	2.5	1,652,029	1,272,766	189,631
2003	1.5	1.5	73	73	1.3	1.3	1128	2.5	2.5	1,336,010	1,336,010	0
2004	1.8	1.7	71	71	1.3	1.3	1252	2.5	2.5	1,482,972	1,482,972	0
2005	2.2	2.0	68	69	1.3	1.3	1390	2.5	2.5	1,678,032	1,678,032	0
2006	2.6	2.3	66	67	1.3	1.3	1543	2.5	2.5	1,862,615	1,862,615	0
2007	3.0	2.6	63	64	1.4	1.3	1713	2.5	2.5	2,144,684	2,067,503	38,591
2008	3.5	3.0	60	62	1.4	1.3	1901	2.5	2.5	2,380,600	2,294,928	42,836
2009	4.1	3.4	57	59	1.5	1.4	2110	2.5	2.5	2,880,986	2,748,249	66,368
2010	4.7	3.8	53	55	1.5	1.4	2343	2.5	2.5	3,197,895	3,050,557	73,669
2011	5.4	4.3	50	52	1.6	1.5	2600	2.5	2.5	3,896,889	3,549,663	173,613
2012	6.2	4.9	46	49	1.7	1.6	2886	2.5	2.5	4,458,046	4,176,674	140,686

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-6

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: AC

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	1.6	74	81	1.3	1.3	397	3.0	3.0	586,093	561,963	12,065
1994	3.7	1.7	73	80	1.3	1.3	441	3.0	3.0	650,564	626,735	11,914
1995	3.8	1.8	73	79	1.3	1.3	490	3.0	3.0	722,126	695,676	13,225
1996	3.9	2.0	72	78	1.3	1.3	543	3.0	3.0	801,560	772,201	14,679
1997	3.9	2.1	71	77	1.3	1.3	603	3.0	3.0	889,731	857,143	16,294
1998	4.0	2.3	70	76	1.4	1.3	670	3.0	3.0	1,026,716	951,429	37,644
1999	4.1	2.5	69	74	1.4	1.3	743	3.0	3.0	1,159,939	1,056,086	51,926
2000	4.2	2.7	68	73	1.4	1.3	825	3.0	3.0	1,287,532	1,172,255	57,638
2001	4.3	2.9	67	71	1.4	1.3	916	3.0	3.0	1,429,160	1,301,203	63,979
2002	4.3	3.2	66	69	1.4	1.4	1016	3.0	3.0	1,586,358	1,527,319	29,524
2003	4.4	1.5	65	73	1.4	1.3	1128	3.0	3.0	1,760,868	1,603,212	78,828
2004	4.5	1.7	63	71	1.4	1.3	1252	3.0	3.0	1,954,564	1,779,566	87,499
2005	4.6	2.0	62	69	1.4	1.3	1390	3.0	3.0	2,169,566	2,013,638	77,964
2006	4.7	2.3	60	67	1.4	1.3	1543	3.0	3.0	2,408,218	2,235,138	86,540
2007	4.9	2.6	58	64	1.5	1.3	1713	3.0	3.0	2,805,928	2,481,003	162,462
2008	5.0	3.0	56	62	1.5	1.3	1901	3.0	3.0	3,114,580	2,753,914	180,333
2009	5.1	3.4	54	59	1.6	1.4	2110	3.0	3.0	3,595,032	3,297,899	148,566
2010	5.2	3.8	52	55	1.6	1.4	2343	3.0	3.0	3,990,485	3,660,668	164,909
2011	5.4	4.3	50	52	1.6	1.5	2600	3.0	3.0	4,676,267	4,259,596	208,336
2012	5.5	4.9	47	49	1.6	1.6	2886	3.0	3.0	5,190,657	5,012,009	89,324

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-7

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: AC

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	6.4	1.6	32,260	38,600	0	0	2.5	2.5	80,650	96,500	(15,850)
1994	6.5	1.7	32,260	38,600	0	0	2.5	2.5	80,650	96,500	(15,850)
1995	6.7	1.8	32,260	38,600	0	0	2.5	2.5	80,650	96,500	(15,850)
1996	6.8	2.0	32,260	38,600	0	0	2.5	2.5	80,650	96,500	(15,850)
1997	7.0	2.1	32,260	38,600	0	0	2.5	2.5	80,650	96,500	(15,850)
1998	7.2	2.3	32,260	38,600	0	0	2.5	2.5	80,650	96,500	(15,850)
1999	7.4	2.5	32,260	38,600	0	0	2.5	2.5	80,650	96,500	(15,850)
2000	7.6	2.7	32,260	38,600	0	0	2.5	2.5	80,650	96,500	(15,850)
2001	7.8	2.9	32,260	38,600	116,500	116,500	2.5	2.5	371,900	387,750	(15,850)
2002	8.1	3.2	37,560	38,600	0	0	2.5	2.5	93,900	96,500	(2,600)
2003	1.5	1.5	28,960	38,600	1,412,166	1,412,166	2.5	2.5	3,602,814	3,626,914	(24,100)
2004	1.8	1.7	28,960	38,600	0	0	2.5	2.5	72,400	96,500	(24,100)
2005	2.2	2.0	28,960	38,600	0	0	2.5	2.5	72,400	96,500	(24,100)
2006	2.6	2.3	28,960	38,600	0	0	2.5	2.5	72,400	96,500	(24,100)
2007	3.0	2.6	28,960	38,600	0	0	2.5	2.5	72,400	96,500	(24,100)
2008	3.5	3.0	28,960	38,600	0	0	2.5	2.5	72,400	96,500	(24,100)
2009	4.1	3.4	29,710	38,600	116,500	116,500	2.5	2.5	365,525	387,750	(22,225)
2010	4.7	3.8	29,710	38,600	0	0	2.5	2.5	74,275	96,500	(22,225)
2011	5.4	4.3	29,710	39,350	0	0	2.5	2.5	74,275	98,375	(24,100)
2012	6.2	4.9	32,260	39,350	0	0	2.5	2.5	80,650	98,375	(17,725)

202

TABLE C-8

ECONOMIC MAINTENANCE COST SAVINGS

06-Feb-91

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: AC

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	1.6	30,000	38,600	0	0	3.0	3.0	90,000	115,800	(25,800)
1994	3.7	1.7	30,000	38,600	0	0	3.0	3.0	90,000	115,800	(25,800)
1995	3.8	1.8	30,000	38,600	0	0	3.0	3.0	90,000	115,800	(25,800)
1996	3.9	2.0	30,000	38,600	0	0	3.0	3.0	90,000	115,800	(25,800)
1997	3.9	2.1	30,000	38,600	0	0	3.0	3.0	90,000	115,800	(25,800)
1998	4.0	2.3	33,010	38,600	0	0	3.0	3.0	99,030	115,800	(16,770)
1999	4.1	2.5	33,010	38,600	0	0	3.0	3.0	99,030	115,800	(16,770)
2000	4.2	2.7	33,010	38,600	0	0	3.0	3.0	99,030	115,800	(16,770)
2001	4.3	2.9	33,010	38,600	0	116,500	3.0	3.0	99,030	465,300	(366,270)
2002	4.3	3.2	33,010	38,600	0	0	3.0	3.0	99,030	115,800	(16,770)
2003	4.4	1.5	33,010	38,600	0	1,412,166	3.0	3.0	99,030	4,352,298	(4,253,268)
2004	4.5	1.7	33,010	38,600	0	0	3.0	3.0	99,030	115,800	(16,770)
2005	4.6	2.0	33,010	38,600	0	0	3.0	3.0	99,030	115,800	(16,770)
2006	4.7	2.3	33,010	38,600	0	0	3.0	3.0	99,030	115,800	(16,770)
2007	4.9	2.6	33,010	38,600	0	0	3.0	3.0	99,030	115,800	(16,770)
2008	5.0	3.0	33,010	38,600	0	0	3.0	3.0	99,030	115,800	(16,770)
2009	5.1	3.4	33,010	38,600	0	116,500	3.0	3.0	99,030	465,300	(366,270)
2010	5.2	3.8	33,010	38,600	0	0	3.0	3.0	99,030	115,800	(16,770)
2011	5.4	4.3	33,010	39,350	0	0	3.0	3.0	99,030	118,050	(19,020)
2012	5.5	4.9	33,010	39,350	0	0	3.0	3.0	99,030	118,050	(19,020)

TABLE C-9

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: AC

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	6,543,600	0	0	0	0	0	(6,543,600)
1992	9,815,400	0	0	0	0	0	(9,815,400)
1993	0	1,097,339	0	58,579	(41,650)	0	1,114,268
1994	0	1,144,835	0	62,313	(41,650)	0	1,165,498
1995	0	1,245,570	0	69,167	(41,650)	0	1,273,087
1996	0	1,355,804	0	76,776	(41,650)	0	1,390,929
1997	0	1,476,480	0	85,221	(41,650)	0	1,520,051
1998	0	2,321,565	0	136,438	(32,620)	0	2,425,383
1999	0	3,112,710	0	187,609	(32,620)	0	3,267,699
2000	0	3,392,556	0	208,246	(32,620)	0	3,568,182
2001	0	3,702,520	0	231,153	(382,120)	0	3,551,553
2002	0	3,457,307	0	219,156	(19,370)	0	3,657,093
2003	0	1,227,440	0	78,828	(4,277,368)	0	(2,971,100)
2004	0	1,341,567	0	87,499	(40,870)	0	1,388,196
2005	0	1,186,135	0	77,964	(40,870)	0	1,223,230
2006	0	1,297,706	0	86,540	(40,870)	0	1,343,376
2007	0	2,923,013	0	201,053	(40,870)	0	3,083,196
2008	0	3,190,961	0	223,169	(40,870)	0	3,381,260
2009	0	3,023,215	0	214,935	(388,495)	0	2,849,655
2010	0	3,310,934	0	238,578	(38,995)	0	3,510,516
2011	0	5,341,779	0	381,949	(43,120)	0	5,680,608
2012	0	3,197,640	0	230,009	(36,745)	0	3,390,904

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)= 9.8% NB/I(15%)= 0.663 (3)

NPV(15%)= (3,932,678) NB/I(12%)= 0.830

NB/I(18%)= 0.542

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)= 9.8% NB/I(15%)= 0.663

NPV(15%)= (3,932,678) NB/I(12%)= 0.830

NB/I(18%)= 0.542

(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.

06-Feb-91

TABLE C-10

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km) W/O PROJ	ROUGHNESS (m/km) W/ PROJ	SPEED (km/h)(2) W/O PROJ	SPEED (km/h)(2) W/ PROJ	TRFFC MIX AVG UNIT USR CST W/O PROJ	TRFFC MIX AVG UNIT USR CST W/ PROJ	AADT (W/ 2-3W VEH)	LENGTH (km) W/O PROJ	LENGTH (km) W/ PROJ	TOTAL USER COST W/O PROJ	TOTAL USER COST W/ PROJ	YEARLY BENEFITS
1993	6.4	2.0	45	79	1.5	1.3	3719	2.5	2.5	5,259,301	4,408,018	851,283
1994	6.5	2.1	65	79	1.6	1.3	4043	2.5	2.5	5,718,003	4,792,312	925,691
1995	6.7	2.1	64	78	1.6	1.3	4396	2.5	2.5	6,219,708	5,212,625	1,007,083
1996	6.8	2.1	63	77	1.6	1.3	4782	2.5	2.5	6,768,667	5,672,517	1,096,150
1997	7.0	2.2	62	77	1.6	1.3	5205	2.5	2.5	7,369,564	6,175,912	1,193,652
1998	7.2	2.2	61	76	1.6	1.3	5668	2.5	2.5	8,407,166	6,727,137	1,680,029
1999	7.4	2.3	59	75	1.7	1.3	6176	2.5	2.5	9,579,199	7,330,966	2,248,233
2000	7.6	2.3	58	74	1.7	1.3	6731	2.5	2.5	10,442,777	7,992,663	2,450,113
2001	7.8	2.3	57	73	1.7	1.3	7350	2.5	2.5	11,399,580	8,725,832	2,673,748
2002	8.1	2.4	55	72	1.8	1.3	8029	2.5	2.5	13,061,714	9,530,280	3,531,434
2003	1.5	2.4	73	70	1.3	1.3	8774	2.5	2.5	10,413,226	10,413,226	0
2004	1.8	2.5	71	69	1.3	1.3	9592	2.5	2.5	11,382,642	11,596,798	(214,156)
2005	2.2	2.5	68	68	1.3	1.3	10490	2.5	2.5	12,681,303	12,681,303	0
2006	2.6	2.6	66	66	1.3	1.3	11477	2.5	2.5	13,872,751	13,872,751	0
2007	3.0	2.6	63	64	1.4	1.3	12561	2.5	2.5	15,752,522	15,182,080	570,443
2008	3.5	2.7	60	62	1.4	1.3	13753	2.5	2.5	17,245,923	16,621,374	624,550
2009	4.1	2.7	57	60	1.5	1.3	15064	2.5	2.5	20,552,597	18,203,985	2,348,612
2010	4.7	2.8	53	58	1.5	1.4	16506	2.5	2.5	22,516,849	20,770,796	1,746,053
2011	5.4	2.8	50	56	1.6	1.4	18093	2.5	2.5	27,105,961	22,764,783	4,341,178
2012	6.2	2.9	46	53	1.7	1.4	19838	2.5	2.5	30,642,516	24,959,098	5,683,418

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-11

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL 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	74	79	1.3	1.3	3719	3.0	3.0	5,491,085	5,289,621	201,463
1994	3.7	2.1	73	79	1.3	1.3	4043	3.0	3.0	5,969,919	5,750,775	219,145
1995	3.8	2.1	73	78	1.3	1.3	4396	3.0	3.0	6,493,637	6,255,150	238,487
1996	3.9	2.1	72	77	1.3	1.3	4782	3.0	3.0	7,066,675	6,807,021	259,654
1997	3.9	2.2	71	77	1.3	1.3	5205	3.0	3.0	7,693,921	7,411,094	282,827
1998	4.0	2.2	70	76	1.4	1.3	5668	3.0	3.0	8,714,101	8,072,565	641,536
1999	4.1	2.3	69	75	1.4	1.3	6176	3.0	3.0	9,661,636	8,797,159	864,477
2000	4.2	2.3	68	74	1.4	1.3	6731	3.0	3.0	10,533,638	9,591,196	942,442
2001	4.3	2.3	67	73	1.4	1.3	7350	3.0	3.0	11,499,770	10,470,998	1,028,772
2002	4.3	2.4	66	72	1.4	1.3	8029	3.0	3.0	12,559,823	11,436,335	1,123,488
2003	4.4	2.4	65	70	1.4	1.3	8774	3.0	3.0	13,723,311	12,495,871	1,227,440
2004	4.5	2.5	63	69	1.4	1.3	9592	3.0	3.0	15,000,737	13,916,158	1,084,580
2005	4.6	2.5	62	68	1.4	1.3	10490	3.0	3.0	16,403,699	15,217,564	1,186,135
2006	4.7	2.6	60	66	1.4	1.3	11477	3.0	3.0	17,945,007	16,647,301	1,297,706
2007	4.9	2.6	58	64	1.5	1.3	12561	3.0	3.0	20,571,066	18,218,496	2,352,570
2008	5.0	2.7	56	62	1.5	1.3	13753	3.0	3.0	22,520,059	19,945,648	2,574,411
2009	5.1	2.7	54	60	1.6	1.3	15064	3.0	3.0	25,650,083	21,844,782	3,805,301
2010	5.2	2.8	52	58	1.6	1.4	16506	3.0	3.0	28,101,607	24,924,955	3,176,652
2011	5.4	2.8	50	56	1.6	1.4	18093	3.0	3.0	32,527,153	27,317,739	5,209,414
2012	5.5	2.9	47	53	1.6	1.4	19838	3.0	3.0	35,662,061	29,950,917	5,711,144

(1) Benefits include passenger time savings.

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

206

06-Feb-91

TABLE C-12

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL 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	6.4	2.0	65	79	0.0	0.0	0	2.5	2.5	0	0	0
1994	6.5	2.1	65	79	0.0	0.0	0	2.5	2.5	0	0	0
1995	6.7	2.1	64	78	0.0	0.0	0	2.5	2.5	0	0	0
1996	6.8	2.1	63	77	0.0	0.0	0	2.5	2.5	0	0	0
1997	7.0	2.2	62	77	0.0	0.0	0	2.5	2.5	0	0	0
1998	7.2	2.2	61	76	0.0	0.0	0	2.5	2.5	0	0	0
1999	7.4	2.3	59	75	0.0	0.0	0	2.5	2.5	0	0	0
2000	7.6	2.3	58	74	0.0	0.0	0	2.5	2.5	0	0	0
2001	7.8	2.3	57	73	0.0	0.0	0	2.5	2.5	0	0	0
2002	8.1	2.4	55	72	0.0	0.0	0	2.5	2.5	0	0	0
2003	1.5	2.4	73	70	0.0	0.0	0	2.5	2.5	0	0	0
2004	1.8	2.5	71	69	0.0	0.0	0	2.5	2.5	0	0	0
2005	2.2	2.5	68	68	0.0	0.0	0	2.5	2.5	0	0	0
2006	2.6	2.6	66	66	0.0	0.0	0	2.5	2.5	0	0	0
2007	3.0	2.6	63	64	0.0	0.0	0	2.5	2.5	0	0	0
2008	3.5	2.7	60	62	0.0	0.0	0	2.5	2.5	0	0	0
2009	4.1	2.7	57	60	0.0	0.0	0	2.5	2.5	0	0	0
2010	4.7	2.8	53	58	0.0	0.0	0	2.5	2.5	0	0	0
2011	5.4	2.8	50	56	0.0	0.0	0	2.5	2.5	0	0	0
2012	6.2	2.9	46	53	0.0	0.0	0	2.5	2.5	0	0	0

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-13

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL 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	74	79	0.0	0.0	0	3.0	3.0	0	0	0
1994	3.7	2.1	73	79	0.0	0.0	0	3.0	3.0	0	0	0
1995	3.8	2.1	73	78	0.0	0.0	0	3.0	3.0	0	0	0
1996	3.9	2.1	72	77	0.0	0.0	0	3.0	3.0	0	0	0
1997	3.9	2.2	71	77	0.0	0.0	0	3.0	3.0	0	0	0
1998	4.0	2.2	70	76	0.0	0.0	0	3.0	3.0	0	0	0
1999	4.1	2.3	69	75	0.0	0.0	0	3.0	3.0	0	0	0
2000	4.2	2.3	68	74	0.0	0.0	0	3.0	3.0	0	0	0
2001	4.3	2.3	67	73	0.0	0.0	0	3.0	3.0	0	0	0
2002	4.3	2.4	66	72	0.0	0.0	0	3.0	3.0	0	0	0
2003	4.4	2.4	65	70	0.0	0.0	0	3.0	3.0	0	0	0
2004	4.5	2.5	63	69	0.0	0.0	0	3.0	3.0	0	0	0
2005	4.6	2.5	62	68	0.0	0.0	0	3.0	3.0	0	0	0
2006	4.7	2.6	60	66	0.0	0.0	0	3.0	3.0	0	0	0
2007	4.9	2.6	58	64	0.0	0.0	0	3.0	3.0	0	0	0
2008	5.0	2.7	56	62	0.0	0.0	0	3.0	3.0	0	0	0
2009	5.1	2.7	54	60	0.0	0.0	0	3.0	3.0	0	0	0
2010	5.2	2.8	52	58	0.0	0.0	0	3.0	3.0	0	0	0
2011	5.4	2.8	50	56	0.0	0.0	0	3.0	3.0	0	0	0
2012	5.5	2.9		53	0.0	0.0	0	3.0	3.0	0	0	0

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-14

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL 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	6.4	2.0	65	79	1.5	1.3	397	2.5	2.5	561,331	470,522	45,404
1994	6.5	2.1	65	79	1.5	1.3	441	2.5	2.5	623,077	522,280	50,399
1995	6.7	2.1	64	78	1.5	1.3	490	2.5	2.5	691,616	579,730	55,943
1996	6.8	2.1	63	77	1.5	1.3	543	2.5	2.5	767,694	643,501	62,096
1997	7.0	2.2	62	77	1.5	1.3	603	2.5	2.5	852,140	714,286	68,927
1998	7.2	2.2	61	76	1.6	1.3	670	2.5	2.5	990,445	792,857	98,794
1999	7.4	2.3	59	75	1.7	1.3	743	2.5	2.5	1,151,436	880,071	135,682
2000	7.6	2.3	58	74	1.7	1.3	825	2.5	2.5	1,278,094	976,879	150,607
2001	7.8	2.3	57	73	1.7	1.3	916	2.5	2.5	1,418,685	1,084,336	167,174
2002	8.1	2.4	55	72	1.8	1.3	1016	2.5	2.5	1,652,029	1,203,613	224,208
2003	1.5	2.4	73	70	1.3	1.3	1128	2.5	2.5	1,336,010	1,336,010	0
2004	1.8	2.5	71	69	1.3	1.3	1252	2.5	2.5	1,482,972	1,511,740	(14,384)
2005	2.2	2.5	68	68	1.3	1.3	1390	2.5	2.5	1,678,032	1,678,032	0
2006	2.6	2.6	66	66	1.3	1.3	1543	2.5	2.5	1,862,615	1,862,615	0
2007	3.0	2.6	63	64	1.4	1.3	1713	2.5	2.5	2,144,684	2,067,503	38,591
2008	3.5	2.7	60	62	1.4	1.3	1901	2.5	2.5	2,380,600	2,294,928	42,836
2009	4.1	2.7	57	60	1.5	1.3	2110	2.5	2.5	2,880,986	2,547,370	166,808
2010	4.7	2.8	53	58	1.5	1.4	2343	2.5	2.5	3,197,895	2,947,407	125,244
2011	5.4	2.8	50	56	1.6	1.4	2600	2.5	2.5	3,896,889	3,271,622	312,634
2012	6.2	2.9	46	53	1.7	1.4	2886	2.5	2.5	4,458,046	3,631,501	413,272

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-15

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL 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	74	79	1.3	1.3	397	3.0	3.0	586,093	564,627	10,733
1994	3.7	2.1	73	79	1.3	1.3	441	3.0	3.0	650,564	626,735	11,914
1995	3.8	2.1	73	78	1.3	1.3	490	3.0	3.0	722,126	695,676	13,225
1996	3.9	2.1	72	77	1.3	1.3	543	3.0	3.0	801,560	772,201	14,679
1997	3.9	2.2	71	77	1.3	1.3	603	3.0	3.0	889,731	857,143	16,294
1998	4.0	2.2	70	76	1.4	1.3	670	3.0	3.0	1,026,716	951,429	37,644
1999	4.1	2.3	69	75	1.4	1.3	743	3.0	3.0	1,159,939	1,056,086	51,926
2000	4.2	2.3	68	74	1.4	1.3	825	3.0	3.0	1,287,532	1,172,255	57,638
2001	4.3	2.3	67	73	1.4	1.3	916	3.0	3.0	1,429,160	1,301,203	63,979
2002	4.3	2.4	66	72	1.4	1.3	1016	3.0	3.0	1,586,368	1,444,336	71,016
2003	4.4	2.4	65	70	1.4	1.3	1128	3.0	3.0	1,760,868	1,603,212	78,828
2004	4.5	2.5	63	69	1.4	1.3	1252	3.0	3.0	1,954,564	1,814,088	70,238
2005	4.6	2.5	62	68	1.4	1.3	1390	3.0	3.0	2,169,566	2,013,638	77,964
2006	4.7	2.6	60	66	1.4	1.3	1543	3.0	3.0	2,408,218	2,235,138	86,540
2007	4.9	2.6	58	64	1.5	1.3	1713	3.0	3.0	2,805,928	2,481,003	162,462
2008	5.0	2.7	56	62	1.5	1.3	1901	3.0	3.0	3,114,580	2,753,914	180,333
2009	5.1	2.7	54	60	1.6	1.3	2110	3.0	3.0	3,595,032	3,056,844	269,094
2010	5.2	2.8	52	58	1.6	1.4	2343	3.0	3.0	3,990,485	3,536,889	226,798
2011	5.4	2.8	50	56	1.6	1.4	2600	3.0	3.0	4,676,267	3,925,947	375,160
2012	5.5	2.9	47	53	1.6	1.4	2886	3.0	3.0	5,190,657	4,357,621	416,428

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-16

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL 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	6.4	2.0	32,260	39,640	0	0	2.5	2.5	80,650	99,100	(18,450)
1994	6.5	2.1	32,260	39,640	0	0	2.5	2.5	80,650	99,100	(18,450)
1995	6.7	2.1	32,260	39,640	0	0	2.5	2.5	80,650	99,100	(18,450)
1996	6.8	2.1	32,260	39,640	0	0	2.5	2.5	80,650	99,100	(18,450)
1997	7.0	2.2	32,260	39,640	0	0	2.5	2.5	80,650	99,100	(18,450)
1998	7.2	2.2	32,260	39,640	0	0	2.5	2.5	80,650	99,100	(18,450)
1999	7.4	2.3	32,260	39,640	0	0	2.5	2.5	80,650	99,100	(18,450)
2000	7.6	2.3	32,260	39,640	0	0	2.5	2.5	80,650	99,100	(18,450)
2001	7.8	2.3	32,260	39,640	116,500	0	2.5	2.5	371,900	99,100	272,800
2002	8.1	2.4	37,560	39,640	0	0	2.5	2.5	93,900	99,100	(5,200)
2003	1.5	2.4	28,960	39,640	1,412,165	0	2.5	2.5	3,602,813	99,100	3,503,713
2004	1.8	2.5	28,960	39,640	0	0	2.5	2.5	72,400	99,100	(26,700)
2005	2.2	2.5	28,960	39,640	0	0	2.5	2.5	72,400	99,100	(26,700)
2006	2.6	2.6	28,960	39,640	0	0	2.5	2.5	72,400	99,100	(26,700)
2007	3.0	2.6	28,960	39,640	0	0	2.5	2.5	72,400	99,100	(26,700)
2008	3.5	2.7	28,960	39,640	0	0	2.5	2.5	72,400	99,100	(26,700)
2009	4.1	2.7	29,710	39,640	116,500	0	2.5	2.5	365,525	99,100	266,425
2010	4.7	2.8	29,710	39,640	0	0	2.5	2.5	74,275	99,100	(24,825)
2011	5.4	2.8	29,710	39,640	0	0	2.5	2.5	74,275	99,100	(24,825)
2012	6.2	2.9	32,260	39,640	0	0	2.5	2.5	80,650	99,100	(18,450)

06-Feb-91

TABLE C-17

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL 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	39,640	0	0	3.0	3.0	90,000	118,920	(28,920)
1994	3.7	2.1	30,000	39,640	0	0	3.0	3.0	90,000	118,920	(28,920)
1995	3.8	2.1	30,000	39,640	0	0	3.0	3.0	90,000	118,920	(28,920)
1996	3.9	2.1	30,000	39,640	0	0	3.0	3.0	90,000	118,920	(28,920)
1997	3.9	2.2	30,000	39,640	0	0	3.0	3.0	90,000	118,920	(28,920)
1998	4.0	2.2	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
1999	4.1	2.3	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2000	4.2	2.3	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2001	4.3	2.3	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2002	4.3	2.4	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2003	4.4	2.4	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2004	4.5	2.5	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2005	4.6	2.5	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2006	4.7	2.6	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2007	4.9	2.6	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2008	5.0	2.7	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2009	5.1	2.7	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2010	5.2	2.8	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2011	5.4	2.8	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)
2012	5.5	2.9	33,010	39,640	0	0	3.0	3.0	99,030	118,920	(19,890)

212

TABLE C-18

09-Feb-91

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: MACTAN CIRC. SECTION: PSOK-BNKAL 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	8,955,200	0	0	0	0	0	(8,955,200)
1992	13,432,800	0	0	0	0	0	(13,432,800)
1993	0	1,052,747	0	56,138	(47,370)	0	1,061,514
1994	0	1,144,835	0	62,313	(47,370)	0	1,159,778
1995	0	1,245,570	0	69,167	(47,370)	0	1,267,367
1996	0	1,355,804	0	76,776	(47,370)	0	1,385,209
1997	0	1,476,480	0	85,221	(47,370)	0	1,514,331
1998	0	2,321,565	0	136,438	(38,340)	0	2,419,663
1999	0	3,112,710	0	187,609	(38,340)	0	3,261,979
2000	0	3,392,556	0	208,246	(38,340)	0	3,562,462
2001	0	3,702,520	0	231,153	252,910	0	4,186,583
2002	0	4,654,922	0	295,224	(25,090)	0	4,925,056
2003	0	1,227,440	0	78,828	3,483,823	0	4,790,091
2004	0	870,423	0	55,854	(46,590)	0	879,687
2005	0	1,186,135	0	77,964	(46,590)	0	1,217,510
2006	0	1,297,706	0	86,540	(46,590)	0	1,337,656
2007	0	2,923,013	0	201,053	(46,590)	0	3,077,476
2008	0	3,198,961	0	223,169	(46,590)	0	3,375,540
2009	0	6,153,913	0	435,902	246,535	0	6,836,349
2010	0	4,922,705	0	352,042	(44,715)	0	5,230,031
2011	0	9,550,592	0	687,794	(44,715)	0	10,193,670
2012	0	11,394,562	0	829,700	(38,340)	0	12,185,922

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)= 9.9% NB/I(15%)= 0.626 (3)

NPV(15%)= (5,972,415) NB/I(12%)= 0.816

NB/I(18%)= 0.494

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)= 9.9% NB/I(15%)= 0.626

NPV(15%)= (5,972,415) NB/I(12%)= 0.816

NB/I(18%)= 0.494

(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.

06-Feb-91

TABLE C-19

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO ALTERNATIVE: AC

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	1.5	77	84	1.2	1.2	1899	2.1	2.1	1,774,510	1,702,653	71,856
1994	3.7	1.6	76	83	1.2	1.2	2069	2.1	2.1	1,933,922	1,855,630	78,292
1995	3.8	1.6	76	83	1.2	1.2	2256	2.1	2.1	2,108,645	2,023,300	85,344
1996	3.8	1.6	75	83	1.2	1.2	2460	2.1	2.1	2,300,218	2,207,142	93,076
1997	3.9	1.7	75	82	1.2	1.2	2684	2.1	2.1	2,510,343	2,408,788	101,556
1998	4.0	1.7	74	82	1.2	1.2	2930	2.1	2.1	2,740,897	2,630,038	110,859
1999	4.0	1.8	74	81	1.3	1.2	3200	2.1	2.1	3,098,058	2,872,883	225,175
2000	4.1	1.8	73	80	1.3	1.2	3496	2.1	2.1	3,385,632	3,139,519	246,113
2001	4.2	1.9	72	80	1.3	1.2	3826	2.1	2.1	3,705,533	3,467,871	237,662
2002	4.2	1.9	72	79	1.3	1.2	4189	2.1	2.1	4,057,219	3,796,891	260,327
2003	4.3	1.5	71	80	1.3	1.2	4588	2.1	2.1	4,443,956	4,158,698	285,258
2004	4.4	1.5	70	79	1.3	1.2	5026	2.1	2.1	4,869,356	4,556,668	312,688
2005	4.5	1.6	69	78	1.3	1.2	5509	2.1	2.1	5,461,193	4,994,535	466,658
2006	4.6	1.7	68	77	1.3	1.2	6039	2.1	2.1	5,988,112	5,476,424	511,689
2007	4.6	1.7	67	76	1.3	1.2	6624	2.1	2.1	6,568,156	6,006,896	561,261
2008	4.7	1.8	66	75	1.3	1.2	7267	2.1	2.1	7,206,839	6,590,994	615,845
2009	4.8	1.9	65	73	1.3	1.2	7975	2.1	2.1	7,910,259	7,234,296	675,963
2010	4.9	1.9	64	72	1.3	1.2	8755	2.1	2.1	8,685,159	7,942,967	742,192
2011	5.0	2.0	62	71	1.3	1.2	9615	2.1	2.1	9,538,997	8,723,828	815,169
2012	5.1	2.1	61	69	1.3	1.2	10562	2.1	2.1	10,864,650	9,820,370	1,044,281

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-20

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: NACTAN CIRC. SECTION: BNKAL-MRBGO ALTERNATIVE: AC

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	6.4	1.5	68	84	1.4	1.2	1899	2.9	2.9	2,796,797	2,351,283	445,514
1994	6.5	1.6	67	83	1.4	1.2	2069	2.9	2.9	3,048,144	2,562,537	485,607
1995	6.7	1.6	66	83	1.4	1.2	2256	2.9	2.9	3,323,638	2,794,082	529,556
1996	6.8	1.6	66	83	1.4	1.2	2460	2.9	2.9	3,625,708	3,047,958	577,750
1997	7.0	1.7	65	82	1.4	1.2	2684	2.9	2.9	3,957,038	3,326,421	630,617
1998	7.1	1.7	64	82	1.5	1.2	2930	2.9	2.9	4,511,520	3,631,957	879,563
1999	7.3	1.8	63	81	1.5	1.2	3200	2.9	2.9	4,928,318	3,967,315	961,003
2000	7.6	1.8	62	80	1.5	1.2	3496	2.9	2.9	5,385,963	4,335,526	1,050,437
2001	7.8	1.9	61	80	1.5	1.2	3826	2.9	2.9	5,895,077	4,788,965	1,106,112
2002	8.0	1.9	60	79	1.6	1.2	4189	2.9	2.9	7,096,287	5,243,326	1,852,961
2003	1.5	1.5	80	80	1.2	1.2	4588	2.9	2.9	5,742,964	5,742,964	0
2004	1.8	1.5	78	79	1.2	1.2	5026	2.9	2.9	6,292,542	6,292,542	0
2005	2.2	1.6	76	78	1.2	1.2	5509	2.9	2.9	6,897,215	6,897,215	0
2006	2.6	1.7	74	77	1.2	1.2	6039	2.9	2.9	7,562,680	7,562,680	0
2007	3.0	1.7	72	76	1.2	1.2	6624	2.9	2.9	8,566,164	8,295,237	270,927
2008	3.5	1.8	70	75	1.3	1.2	7267	2.9	2.9	9,625,486	9,101,849	523,637
2009	4.1	1.9	67	73	1.3	1.2	7975	2.9	2.9	10,923,691	9,990,218	933,473
2010	4.7	1.9	64	72	1.3	1.2	8755	2.9	2.9	11,993,791	10,968,859	1,024,932
2011	5.4	2.0	61	71	1.3	1.2	9615	2.9	2.9	13,656,185	12,047,191	1,608,994
2012	6.2	2.1	58	69	1.5	1.2	10562	2.9	2.9	16,408,486	13,561,463	2,847,023

(1) Benefits include passenger time savings.

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

TABLE C-21 06-Feb-91

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO ALTERNATIVE: AC

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	1.5	77	84	0.0	0.0	0	2.1	2.1	0	0	0
1994	3.7	1.6	76	83	0.0	0.0	0	2.1	2.1	0	0	0
1995	3.8	1.6	76	83	0.0	0.0	0	2.1	2.1	0	0	0
1996	3.8	1.6	75	83	0.0	0.0	0	2.1	2.1	0	0	0
1997	3.9	1.7	75	82	0.0	0.0	0	2.1	2.1	0	0	0
1998	4.0	1.7	74	82	0.0	0.0	0	2.1	2.1	0	0	0
1999	4.0	1.8	74	81	0.0	0.0	0	2.1	2.1	0	0	0
2000	4.1	1.8	73	80	0.0	0.0	0	2.1	2.1	0	0	0
2001	4.2	1.9	72	80	0.0	0.0	0	2.1	2.1	0	0	0
2002	4.2	1.9	72	79	0.0	0.0	0	2.1	2.1	0	0	0
2003	4.3	1.5	71	80	0.0	0.0	0	2.1	2.1	0	0	0
2004	4.4	1.5	70	79	0.0	0.0	0	2.1	2.1	0	0	0
2005	4.5	1.6	69	78	0.0	0.0	0	2.1	2.1	0	0	0
2006	4.6	1.7	68	77	0.0	0.0	0	2.1	2.1	0	0	0
2007	4.6	1.7	67	76	0.0	0.0	0	2.1	2.1	0	0	0
2008	4.7	1.8	66	75	0.0	0.0	0	2.1	2.1	0	0	0
2009	4.8	1.9	65	73	0.0	0.0	0	2.1	2.1	0	0	0
2010	4.9	1.9	64	72	0.0	0.0	0	2.1	2.1	0	0	0
2011	5.0	2.0	62	71	0.0	0.0	0	2.1	2.1	0	0	0
2012	5.1	2.1	61	69	0.0	0.0	0	2.1	2.1	0	0	0

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-22

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO ALTERNATIVE: AC

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	6.4	1.5	68	84	0.0	0.0	0	2.9	2.9	0	0	0
1994	6.5	1.6	67	83	0.0	0.0	0	2.9	2.9	0	0	0
1995	6.7	1.6	66	83	0.0	0.0	0	2.9	2.9	0	0	0
1996	6.8	1.6	66	83	0.0	0.0	0	2.9	2.9	0	0	0
1997	7.0	1.7	65	82	0.0	0.0	0	2.9	2.9	0	0	0
1998	7.1	1.7	64	82	0.0	0.0	0	2.9	2.9	0	0	0
1999	7.3	1.8	63	81	0.0	0.0	0	2.9	2.9	0	0	0
2000	7.6	1.8	62	80	0.0	0.0	0	2.9	2.9	0	0	0
2001	7.8	1.9	61	80	0.0	0.0	0	2.9	2.9	0	0	0
2002	8.0	1.9	60	79	0.0	0.0	0	2.9	2.9	0	0	0
2003	1.5	1.5	80	80	0.0	0.0	0	2.9	2.9	0	0	0
2004	1.8	1.5	78	79	0.0	0.0	0	2.9	2.9	0	0	0
2005	2.2	1.6	76	78	0.0	0.0	0	2.9	2.9	0	0	0
2006	2.6	1.7	74	77	0.0	0.0	0	2.9	2.9	0	0	0
2007	3.0	1.7	72	76	0.0	0.0	0	2.9	2.9	0	0	0
2008	3.5	1.8	70	75	0.0	0.0	0	2.9	2.9	0	0	0
2009	4.1	1.9	67	73	0.0	0.0	0	2.9	2.9	0	0	0
2010	4.7	1.9	64	72	0.0	0.0	0	2.9	2.9	0	0	0
2011	5.4	2.0	61	71	0.0	0.0	0	2.9	2.9	0	0	0
2012	6.2	2.1	58	69	0.0	0.0	0	2.9	2.9	0	0	0

(1) Benefits include passenger time savings.

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

217

06-Feb-91

TABLE C-23

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO ALTERNATIVE: AC

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	1.5	77	84	1.2	1.2	201	2.1	2.1	188,024	180,404	3,810
1994	3.7	1.6	76	83	1.2	1.2	224	2.1	2.1	208,707	200,248	4,229
1995	3.8	1.6	76	83	1.2	1.2	248	2.1	2.1	231,664	222,276	4,694
1996	3.8	1.6	75	83	1.2	1.2	275	2.1	2.1	257,147	246,726	5,211
1997	3.9	1.7	75	82	1.2	1.2	306	2.1	2.1	285,434	273,866	5,784
1998	4.0	1.7	74	82	1.2	1.2	339	2.1	2.1	316,831	303,991	6,420
1999	4.0	1.8	74	81	1.3	1.2	377	2.1	2.1	363,836	337,430	13,203
2000	4.1	1.8	73	80	1.3	1.2	418	2.1	2.1	403,858	374,547	14,655
2001	4.2	1.9	72	80	1.3	1.2	464	2.1	2.1	448,282	419,723	14,280
2002	4.2	1.9	72	79	1.3	1.2	515	2.1	2.1	497,593	465,892	15,851
2003	4.3	1.5	71	80	1.3	1.2	572	2.1	2.1	552,329	517,140	17,594
2004	4.4	1.5	70	79	1.3	1.2	635	2.1	2.1	613,085	574,026	19,529
2005	4.5	1.6	69	78	1.3	1.2	704	2.1	2.1	696,687	637,169	29,759
2006	4.6	1.7	68	77	1.3	1.2	782	2.1	2.1	773,322	707,257	33,033
2007	4.6	1.7	67	76	1.3	1.2	868	2.1	2.1	858,388	785,055	36,666
2008	4.7	1.8	66	75	1.3	1.2	963	2.1	2.1	952,810	871,412	40,699
2009	4.8	1.9	65	73	1.3	1.2	1069	2.1	2.1	1,057,620	967,267	45,176
2010	4.9	1.9	64	72	1.3	1.2	1187	2.1	2.1	1,173,958	1,073,666	50,146
2011	5.0	2.0	62	71	1.3	1.2	1318	2.1	2.1	1,303,093	1,191,769	55,662
2012	5.1	2.1	61	69	1.3	1.2	1462	2.1	2.1	1,498,881	1,356,472	71,205

(1) Benefits include passenger time savings.

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

TABLE C-24

06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO ALTERNATIVE: AC

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	6.4	1.5	68	84	1.4	1.2	201	2.9	2.9	296,315	249,129	23,593
1994	6.5	1.6	67	83	1.4	1.2	224	2.9	2.9	328,909	276,533	26,188
1995	6.7	1.6	66	83	1.4	1.2	248	2.9	2.9	365,089	306,952	29,069
1996	6.8	1.6	66	83	1.4	1.2	275	2.9	2.9	405,249	340,717	32,266
1997	7.0	1.7	65	82	1.4	1.2	306	2.9	2.9	449,827	378,196	35,816
1998	7.1	1.7	64	82	1.5	1.2	339	2.9	2.9	521,257	419,797	50,730
1999	7.3	1.8	63	81	1.5	1.2	377	2.9	2.9	578,595	465,975	56,310
2000	7.6	1.8	62	80	1.5	1.2	418	2.9	2.9	642,241	517,232	62,504
2001	7.8	1.9	61	80	1.5	1.2	464	2.9	2.9	712,887	579,617	66,635
2002	8.0	1.9	60	79	1.6	1.2	515	2.9	2.9	871,312	643,375	113,968
2003	1.5	1.5	80	80	1.2	1.2	572	2.9	2.9	714,146	714,146	0
2004	1.8	1.5	78	79	1.2	1.2	635	2.9	2.9	792,702	792,702	0
2005	2.2	1.6	76	78	1.2	1.2	704	2.9	2.9	879,900	879,900	0
2006	2.6	1.7	74	77	1.2	1.2	782	2.9	2.9	976,688	976,688	0
2007	3.0	1.7	72	76	1.2	1.2	868	2.9	2.9	1,119,215	1,084,124	17,546
2008	3.5	1.8	70	75	1.2	1.2	963	2.9	2.9	1,273,047	1,203,378	34,835
2009	4.1	1.9	67	73	1.3	1.2	1069	2.9	2.9	1,460,522	1,335,749	62,386
2010	4.7	1.9	64	72	1.3	1.2	1187	2.9	2.9	1,621,180	1,482,682	69,249
2011	5.4	2.0	61	71	1.3	1.2	1318	2.9	2.9	1,864,760	1,645,777	109,492
2012	6.2	2.1	58	69	1.5	1.2	1462	2.9	2.9	2,268,067	1,873,224	197,422

(1) Benefits include passenger time savings.

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

TABLE C-25

ECONOMIC MAINTENANCE COST SAVINGS

11-Feb-91

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO ALTERNATIVE: AC

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	1.5	25,180	33,780	0	0	2.1	2.1	52,878	70,938	(18,060)
1994	3.7	1.6	25,180	33,780	0	0	2.1	2.1	52,878	70,938	(18,060)
1995	3.8	1.6	25,180	33,780	0	0	2.1	2.1	52,878	70,938	(18,060)
1996	3.8	1.6	25,180	33,780	0	0	2.1	2.1	52,878	70,938	(18,060)
1997	3.9	1.7	25,180	33,780	0	0	2.1	2.1	52,878	70,938	(18,060)
1998	4.0	1.7	25,180	33,780	0	0	2.1	2.1	52,878	70,938	(18,060)
1999	4.0	1.8	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)
2000	4.1	1.8	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)
2001	4.2	1.9	28,190	33,780	0	116,500	2.1	2.1	59,199	315,588	(256,389)
2002	4.2	1.9	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)
2003	4.3	1.5	28,190	33,780	0	714,280	2.1	2.1	59,199	1,570,925	(1,511,726)
2004	4.4	1.5	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)
2005	4.5	1.6	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)
2006	4.6	1.7	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)
2007	4.6	1.7	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)
2008	4.7	1.8	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)
2009	4.8	1.9	28,190	33,780	0	116,500	2.1	2.1	59,199	315,588	(256,389)
2010	4.9	1.9	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)
2011	5.0	2.0	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)
2012	5.1	2.1	28,190	33,780	0	0	2.1	2.1	59,199	70,938	(11,739)

220

06-Feb-91

TABLE C-26

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO ALTERNATIVE: AC

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	6.4	1.5	27,440	33,780	0	0	2.9	2.9	79,576	97,962	(18,386)
1994	6.5	1.6	27,440	33,780	0	0	2.9	2.9	79,576	97,962	(18,386)
1995	6.7	1.6	27,440	33,780	0	0	2.9	2.9	79,576	97,962	(18,386)
1996	6.8	1.6	27,440	33,780	0	0	2.9	2.9	79,576	97,962	(18,386)
1997	7.0	1.7	27,440	33,780	0	0	2.9	2.9	79,576	97,962	(18,386)
1998	7.1	1.7	27,440	33,780	0	0	2.9	2.9	79,576	97,962	(18,386)
1999	7.3	1.8	27,440	33,780	0	0	2.9	2.9	79,576	97,962	(18,386)
2000	7.6	1.8	27,440	33,780	0	0	2.9	2.9	79,576	97,962	(18,386)
2001	7.8	1.9	27,440	33,780	116,500	116,500	2.9	2.9	417,426	435,812	(18,386)
2002	8.0	1.9	32,740	33,780	0	0	2.9	2.9	94,946	97,962	(3,016)
2003	1.5	1.5	24,140	33,780	714,280	714,280	2.9	2.9	2,141,417	2,169,373	(27,956)
2004	1.8	1.5	24,140	33,780	0	0	2.9	2.9	70,006	97,962	(27,956)
2005	2.2	1.6	24,140	33,780	0	0	2.9	2.9	70,006	97,962	(27,956)
2006	2.6	1.7	24,140	33,780	0	0	2.9	2.9	70,006	97,962	(27,956)
2007	3.0	1.7	24,140	33,780	0	0	2.9	2.9	70,006	97,962	(27,956)
2008	3.5	1.8	24,140	33,780	0	0	2.9	2.9	70,006	97,962	(27,956)
2009	4.1	1.9	24,890	33,780	116,500	116,500	2.9	2.9	410,031	435,812	(25,781)
2010	4.7	1.9	24,890	33,780	0	0	2.9	2.9	72,181	97,962	(25,781)
2011	5.4	2.0	24,890	33,780	0	0	2.9	2.9	72,181	97,962	(25,781)
2012	6.2	2.1	27,440	33,780	0	0	2.9	2.9	79,576	97,962	(18,386)

TABLE C-27 11-Feb-91

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO ALTERNATIVE: AC

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	4,831,600	0	0	0	0	0	(4,831,600)
1992	7,247,400	0	0	0	0	0	(7,247,400)
1993	0	517,371	0	27,403	(36,446)	0	508,328
1994	0	563,899	0	30,417	(36,446)	0	557,870
1995	0	614,900	0	33,763	(36,446)	0	612,217
1996	0	670,826	0	37,477	(36,446)	0	671,857
1997	0	732,173	0	41,599	(36,446)	0	737,326
1998	0	990,422	0	57,150	(36,446)	0	1,011,126
1999	0	1,186,178	0	69,513	(30,125)	0	1,225,567
2000	0	1,296,550	0	77,160	(30,125)	0	1,343,584
2001	0	1,343,774	0	80,915	(274,775)	0	1,149,914
2002	0	2,113,289	0	129,819	(14,755)	0	2,228,352
2003	0	285,258	0	17,594	(1,539,682)	0	(1,236,830)
2004	0	312,688	0	19,529	(39,695)	0	292,522
2005	0	466,658	0	29,759	(39,695)	0	456,722
2006	0	511,689	0	33,033	(39,695)	0	505,026
2007	0	832,188	0	54,212	(39,695)	0	846,704
2008	0	1,139,482	0	75,534	(39,695)	0	1,175,321
2009	0	1,609,437	0	107,563	(282,170)	0	1,434,830
2010	0	1,767,124	0	119,395	(37,520)	0	1,848,999
2011	0	2,424,163	0	165,154	(37,520)	0	2,551,796
2012	0	3,891,304	0	268,626	(30,125)	0	4,129,805

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)= 4.9% NB/I(15%)= 0.399 (3)

NPV(15%)= (5,180,147) NB/I(12%)= 0.503

NB/I(18%)= 0.325

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)= 4.9% NB/I(15%)= 0.399

NPV(15%)= (5,180,147) NB/I(12%)= 0.503

NB/I(18%)= 0.325

(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-28

06-Feb-91

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO 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	77	82	1.2	1.2	1899	2.1	2.1	1,774,510	1,702,653	71,856
1994	3.7	2.1	76	82	1.2	1.2	2069	2.1	2.1	1,933,922	1,855,630	78,292
1995	3.8	2.1	76	81	1.2	1.2	2256	2.1	2.1	2,108,645	2,023,300	85,344
1996	3.8	2.1	75	81	1.2	1.2	2460	2.1	2.1	2,300,218	2,207,142	93,076
1997	3.9	2.2	75	81	1.2	1.2	2684	2.1	2.1	2,510,343	2,408,788	101,556
1998	4.0	2.2	74	80	1.2	1.2	2930	2.1	2.1	2,740,897	2,630,038	110,859
1999	4.0	2.2	74	80	1.3	1.2	3200	2.1	2.1	3,098,058	2,899,550	198,508
2000	4.1	2.3	73	79	1.3	1.2	3496	2.1	2.1	3,385,632	3,168,581	217,051
2001	4.2	2.3	72	78	1.3	1.2	3826	2.1	2.1	3,705,533	3,467,871	237,662
2002	4.2	2.3	72	78	1.3	1.2	4189	2.1	2.1	4,057,219	3,796,891	260,327
2003	4.3	2.4	71	77	1.3	1.2	4588	2.1	2.1	4,443,956	4,158,698	285,258
2004	4.4	2.4	70	76	1.3	1.2	5026	2.1	2.1	4,869,356	4,556,668	312,688
2005	4.5	2.5	69	75	1.3	1.2	5509	2.1	2.1	5,461,193	4,994,535	466,658
2006	4.6	2.5	68	75	1.3	1.2	6039	2.1	2.1	5,988,112	5,476,424	511,689
2007	4.6	2.5	67	74	1.3	1.2	6624	2.1	2.1	6,568,156	6,006,896	561,261
2008	4.7	2.6	66	72	1.3	1.2	7267	2.1	2.1	7,206,839	6,590,994	615,845
2009	4.8	2.6	65	71	1.3	1.2	7975	2.1	2.1	7,910,259	7,234,296	675,963
2010	4.9	2.7	64	70	1.3	1.2	8755	2.1	2.1	8,685,159	7,942,967	742,192
2011	5.0	2.7	62	69	1.3	1.2	9615	2.1	2.1	9,538,997	8,938,769	600,228
2012	5.1	2.7	61	67	1.3	1.2	10562	2.1	2.1	10,864,650	9,820,370	1,044,281

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-29

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO 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	6.4	2.0	68	82	1.4	1.2	1899	2.9	2.9	2,796,797	2,351,283	445,514
1994	6.5	2.1	67	82	1.4	1.2	2069	2.9	2.9	3,048,144	2,562,537	485,607
1995	6.7	2.1	66	81	1.4	1.2	2256	2.9	2.9	3,323,638	2,794,082	529,556
1996	6.8	2.1	66	81	1.4	1.2	2460	2.9	2.9	3,625,708	3,047,958	577,750
1997	7.0	2.2	65	81	1.4	1.2	2684	2.9	2.9	3,957,038	3,326,421	630,617
1998	7.1	2.2	64	80	1.5	1.2	2930	2.9	2.9	4,511,520	3,631,957	879,563
1999	7.3	2.2	63	80	1.5	1.2	3200	2.9	2.9	4,928,318	4,004,141	924,177
2000	7.6	2.3	62	79	1.5	1.2	3496	2.9	2.9	5,385,963	4,375,660	1,010,303
2001	7.8	2.3	61	78	1.5	1.2	3826	2.9	2.9	5,895,077	4,788,965	1,106,112
2002	8.0	2.3	60	78	1.6	1.2	4189	2.9	2.9	7,096,287	5,243,326	1,852,961
2003	1.5	2.4	80	77	1.2	1.2	4588	2.9	2.9	5,742,964	5,742,964	0
2004	1.8	2.4	78	76	1.2	1.2	5026	2.9	2.9	6,292,542	6,292,542	0
2005	2.2	2.5	76	75	1.2	1.2	5509	2.9	2.9	6,897,215	6,897,215	0
2006	2.6	2.5	74	75	1.2	1.2	6039	2.9	2.9	7,562,680	7,562,680	0
2007	3.0	2.5	72	74	1.2	1.2	6624	2.9	2.9	8,566,164	8,295,237	270,927
2008	3.5	2.6	70	72	1.3	1.2	7267	2.9	2.9	9,625,486	9,101,849	523,637
2009	4.1	2.6	67	71	1.3	1.2	7975	2.9	2.9	10,923,691	9,990,218	933,473
2010	4.7	2.7	64	70	1.3	1.2	8755	2.9	2.9	11,993,791	10,968,859	1,024,932
2011	5.4	2.7	61	69	1.3	1.2	9615	2.9	2.9	13,656,185	12,344,015	1,312,170
2012	6.2	2.7	58	67	1.5	1.2	10562	2.9	2.9	16,408,486	13,561,463	2,847,023

(1) Benefits include passenger time savings.

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

TABLE C-30 06-Feb-91

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO 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	77	82	0.0	0.0	0	2.1	2.1	0	0	0
1994	3.7	2.1	76	82	0.0	0.0	0	2.1	2.1	0	0	0
1995	3.8	2.1	76	81	0.0	0.0	0	2.1	2.1	0	0	0
1996	3.8	2.1	75	81	0.0	0.0	0	2.1	2.1	0	0	0
1997	3.9	2.2	75	81	0.0	0.0	0	2.1	2.1	0	0	0
1998	4.0	2.2	74	80	0.0	0.0	0	2.1	2.1	0	0	0
1999	4.0	2.2	74	80	0.0	0.0	0	2.1	2.1	0	0	0
2000	4.1	2.3	73	79	0.0	0.0	0	2.1	2.1	0	0	0
2001	4.2	2.3	72	78	0.0	0.0	0	2.1	2.1	0	0	0
2002	4.2	2.3	72	78	0.0	0.0	0	2.1	2.1	0	0	0
2003	4.3	2.4	71	77	0.0	0.0	0	2.1	2.1	0	0	0
2004	4.4	2.4	70	76	0.0	0.0	0	2.1	2.1	0	0	0
2005	4.5	2.5	69	75	0.0	0.0	0	2.1	2.1	0	0	0
2006	4.6	2.5	68	75	0.0	0.0	0	2.1	2.1	0	0	0
2007	4.6	2.5	67	74	0.0	0.0	0	2.1	2.1	0	0	0
2008	4.7	2.6	66	72	0.0	0.0	0	2.1	2.1	0	0	0
2009	4.8	2.6	65	71	0.0	0.0	0	2.1	2.1	0	0	0
2010	4.9	2.7	64	70	0.0	0.0	0	2.1	2.1	0	0	0
2011	5.0	2.7	62	69	0.0	0.0	0	2.1	2.1	0	0	0
2012	5.1	2.7	61	67	0.0	0.0	0	2.1	2.1	0	0	0

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-31

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO 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	6.4	2.0	68	82	0.0	0.0	0	2.9	2.9	0	0	0
1994	6.5	2.1	67	82	0.0	0.0	0	2.9	2.9	0	0	0
1995	6.7	2.1	66	81	0.0	0.0	0	2.9	2.9	0	0	0
1996	6.8	2.1	66	81	0.0	0.0	0	2.9	2.9	0	0	0
1997	7.0	2.2	65	81	0.0	0.0	0	2.9	2.9	0	0	0
1998	7.1	2.2	64	80	0.0	0.0	0	2.9	2.9	0	0	0
1999	7.3	2.2	63	80	0.0	0.0	0	2.9	2.9	0	0	0
2000	7.6	2.3	62	79	0.0	0.0	0	2.9	2.9	0	0	0
2001	7.8	2.3	61	78	0.0	0.0	0	2.9	2.9	0	0	0
2002	8.0	2.3	60	78	0.0	0.0	0	2.9	2.9	0	0	0
2003	1.5	2.4	80	77	0.0	0.0	0	2.9	2.9	0	0	0
2004	1.8	2.4	78	76	0.0	0.0	0	2.9	2.9	0	0	0
2005	2.2	2.5	76	75	0.0	0.0	0	2.9	2.9	0	0	0
2006	2.6	2.5	74	75	0.0	0.0	0	2.9	2.9	0	0	0
2007	3.0	2.5	72	74	0.0	0.0	0	2.9	2.9	0	0	0
2008	3.5	2.6	70	72	0.0	0.0	0	2.9	2.9	0	0	0
2009	4.1	2.6	67	71	0.0	0.0	0	2.9	2.9	0	0	0
2010	4.7	2.7	64	70	0.0	0.0	0	2.9	2.9	0	0	0
2011	5.4	2.7	61	69	0.0	0.0	0	2.9	2.9	0	0	0
2012	6.2	2.7	58	67	0.0	0.0	0	2.9	2.9	0	0	0

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-32

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO 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	77	82	1.2	1.2	201	2.1	2.1	188,024	180,404	3,810
1994	3.7	2.1	76	82	1.2	1.2	224	2.1	2.1	208,707	200,248	4,229
1995	3.8	2.1	76	81	1.2	1.2	248	2.1	2.1	231,664	222,276	4,694
1996	3.8	2.1	75	81	1.2	1.2	275	2.1	2.1	257,147	246,726	5,211
1997	3.9	2.2	75	81	1.2	1.2	306	2.1	2.1	285,434	273,866	5,784
1998	4.0	2.2	74	80	1.2	1.2	339	2.1	2.1	316,831	303,991	6,420
1999	4.0	2.2	74	80	1.3	1.2	377	2.1	2.1	363,836	340,656	11,590
2000	4.1	2.3	73	79	1.3	1.2	418	2.1	2.1	403,858	378,129	12,865
2001	4.2	2.3	72	78	1.3	1.2	464	2.1	2.1	448,282	419,723	14,280
2002	4.2	2.3	72	78	1.3	1.2	515	2.1	2.1	497,593	465,892	15,851
2003	4.3	2.4	71	77	1.3	1.2	572	2.1	2.1	552,329	517,140	17,594
2004	4.4	2.4	70	76	1.3	1.2	635	2.1	2.1	613,085	574,026	19,529
2005	4.5	2.5	69	75	1.3	1.2	704	2.1	2.1	696,687	637,169	29,759
2006	4.6	2.5	68	75	1.3	1.2	782	2.1	2.1	773,322	707,257	33,033
2007	4.6	2.5	67	74	1.3	1.2	868	2.1	2.1	858,388	785,055	36,666
2008	4.7	2.6	66	72	1.3	1.2	963	2.1	2.1	952,810	871,412	40,699
2009	4.8	2.6	65	71	1.3	1.2	1069	2.1	2.1	1,057,620	967,267	45,176
2010	4.9	2.7	64	70	1.3	1.2	1187	2.1	2.1	1,173,958	1,073,666	50,146
2011	5.0	2.7	62	69	1.3	1.2	1318	2.1	2.1	1,303,093	1,222,047	40,523
2012	5.1	2.7	61	67	1.3	1.2	1462	2.1	2.1	1,498,881	1,356,472	71,205

(1) Benefits include passenger time savings.

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

TABLE C-33 06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO 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	6.4	2.0	68	82	1.4	1.2	201	2.9	2.9	296,315	249,129	23,593
1994	6.5	2.1	67	82	1.4	1.2	224	2.9	2.9	328,909	276,533	26,188
1995	6.7	2.1	66	81	1.4	1.2	248	2.9	2.9	365,089	306,952	29,069
1996	6.8	2.1	66	81	1.4	1.2	275	2.9	2.9	405,249	340,717	32,266
1997	7.0	2.2	65	81	1.4	1.2	306	2.9	2.9	449,827	378,196	35,816
1998	7.1	2.2	64	80	1.5	1.2	339	2.9	2.9	521,257	419,797	50,730
1999	7.3	2.2	63	80	1.5	1.2	377	2.9	2.9	578,595	470,430	54,082
2000	7.6	2.3	62	79	1.5	1.2	418	2.9	2.9	642,241	522,178	60,032
2001	7.8	2.3	61	78	1.5	1.2	464	2.9	2.9	712,887	579,617	66,635
2002	8.0	2.3	60	78	1.6	1.2	515	2.9	2.9	871,312	643,375	113,968
2003	1.5	2.4	80	77	1.2	1.2	572	2.9	2.9	714,146	714,146	0
2004	1.8	2.4	78	76	1.2	1.2	635	2.9	2.9	792,702	792,702	0
2005	2.2	2.5	76	75	1.2	1.2	704	2.9	2.9	879,900	879,900	0
2006	2.6	2.5	74	75	1.2	1.2	782	2.9	2.9	976,688	976,688	0
2007	3.0	2.5	72	74	1.2	1.2	868	2.9	2.9	1,119,215	1,084,124	17,546
2008	3.5	2.6	70	72	1.2	1.2	963	2.9	2.9	1,273,047	1,203,378	34,835
2009	4.1	2.6	67	71	1.3	1.2	1069	2.9	2.9	1,460,522	1,335,749	62,386
2010	4.7	2.7	64	70	1.3	1.2	1187	2.9	2.9	1,621,180	1,482,682	69,249
2011	5.4	2.7	61	69	1.3	1.2	1318	2.9	2.9	1,864,760	1,687,589	88,586
2012	6.2	2.7	58	67	1.5	1.2	1462	2.9	2.9	2,268,067	1,873,224	197,422

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-34

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO 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	25,180	34,820	0	0	2.1	2.1	52,878	73,122	(20,244)
1994	3.7	2.1	25,180	34,820	0	0	2.1	2.1	52,878	73,122	(20,244)
1995	3.8	2.1	25,180	34,820	0	0	2.1	2.1	52,878	73,122	(20,244)
1996	3.8	2.1	25,180	34,820	0	0	2.1	2.1	52,878	73,122	(20,244)
1997	3.9	2.2	25,180	34,820	0	0	2.1	2.1	52,878	73,122	(20,244)
1998	4.0	2.2	25,180	34,820	0	0	2.1	2.1	52,878	73,122	(20,244)
1999	4.0	2.2	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2000	4.1	2.3	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2001	4.2	2.3	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2002	4.2	2.3	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2003	4.3	2.4	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2004	4.4	2.4	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2005	4.5	2.5	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2006	4.6	2.5	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2007	4.6	2.5	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2008	4.7	2.6	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2009	4.8	2.6	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2010	4.9	2.7	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2011	5.0	2.7	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)
2012	5.1	2.7	28,190	34,820	0	0	2.1	2.1	59,199	73,122	(13,923)

229

06-Feb-91

TABLE C-35

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO 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	6.4	2.0	27,440	34,820	0	0	2.9	2.9	79,576	100,978	(21,402)
1994	6.5	2.1	27,440	34,820	0	0	2.9	2.9	79,576	100,978	(21,402)
1995	6.7	2.1	27,440	34,820	0	0	2.9	2.9	79,576	100,978	(21,402)
1996	6.8	2.1	27,440	34,820	0	0	2.9	2.9	79,576	100,978	(21,402)
1997	7.0	2.2	27,440	34,820	0	0	2.9	2.9	79,576	100,978	(21,402)
1998	7.1	2.2	27,440	34,820	0	0	2.9	2.9	79,576	100,978	(21,402)
1999	7.3	2.2	27,440	34,820	0	0	2.9	2.9	79,576	100,978	(21,402)
2000	7.6	2.3	27,440	34,820	0	0	2.9	2.9	79,576	100,978	(21,402)
2001	7.8	2.3	27,440	34,820	116,500	0	2.9	2.9	417,426	100,978	316,448
2002	8.0	2.3	32,740	34,820	0	0	2.9	2.9	94,946	100,978	(6,032)
2003	1.5	2.4	24,140	34,820	714,280	0	2.9	2.9	2,141,418	100,978	2,040,440
2004	1.8	2.4	24,140	34,820	0	0	2.9	2.9	70,006	100,978	(30,972)
2005	2.2	2.5	24,140	34,820	0	0	2.9	2.9	70,006	100,978	(30,972)
2006	2.6	2.5	24,140	34,820	0	0	2.9	2.9	70,006	100,978	(30,972)
2007	3.0	2.5	24,140	34,820	0	0	2.9	2.9	70,006	100,978	(30,972)
2008	3.5	2.6	24,140	34,820	0	0	2.9	2.9	70,006	100,978	(30,972)
2009	4.1	2.6	24,890	34,820	116,500	0	2.9	2.9	410,031	100,978	309,053
2010	4.7	2.7	24,890	34,820	0	0	2.9	2.9	72,181	100,978	(28,797)
2011	5.4	2.7	24,890	34,820	0	0	2.9	2.9	72,181	100,978	(28,797)
2012	6.2	2.7	27,440	34,820	0	0	2.9	2.9	79,576	100,978	(21,402)

TABLE C-36

09-Feb-91

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: MACTAN CIRC. SECTION: BNKAL-MRBGO 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	6,107,200	0	0	0	0	0	(6,107,200)
1992	9,160,800	0	0	0	0	0	(9,160,800)
1993	0	517,371	0	27,403	(41,646)	0	503,128
1994	0	563,899	0	30,417	(41,646)	0	552,670
1995	0	614,900	0	33,763	(41,646)	0	607,017
1996	0	670,826	0	37,477	(41,646)	0	666,657
1997	0	732,173	0	41,599	(41,646)	0	732,126
1998	0	990,422	0	57,150	(41,646)	0	1,005,926
1999	0	1,122,685	0	65,672	(35,325)	0	1,153,032
2000	0	1,227,354	0	72,896	(35,325)	0	1,264,925
2001	0	1,343,774	0	80,915	302,525	0	1,727,214
2002	0	2,113,289	0	129,819	(19,955)	0	2,223,152
2003	0	285,258	0	17,594	2,026,517	0	2,329,369
2004	0	312,688	0	19,529	(44,895)	0	287,322
2005	0	466,658	0	29,759	(44,895)	0	451,522
2006	0	511,689	0	33,033	(44,895)	0	499,826
2007	0	832,188	0	54,212	(44,895)	0	841,504
2008	0	1,139,482	0	75,534	(44,895)	0	1,170,121
2009	0	1,609,437	0	107,563	295,130	0	2,012,130
2010	0	1,767,124	0	119,395	(42,720)	0	1,843,799
2011	0	1,912,398	0	129,109	(42,720)	0	1,998,786
2012	0	3,891,304	0	268,626	(35,325)	0	4,124,605

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)= 4.3% NB/I(15%)= 0.369 (3)

NPV(15%)= (6,872,449) NB/I(12%)= 0.470

NB/I(18%)= 0.297

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)= 4.3% NB/I(15%)= 0.369

NPV(15%)= (6,872,449) NB/I(12%)= 0.470

NB/I(18%)= 0.297

(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.

231

06-Feb-91

TABLE C-37

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	1.6	74	85	2.1	2.0	958	0.6	0.6	445,633	415,134	30,499
1994	4.8	1.6	74	85	2.1	2.0	1047	0.6	0.6	487,221	453,863	33,358
1995	4.9	1.7	73	84	2.1	2.0	1145	0.6	0.6	532,913	496,413	36,500
1996	5.0	1.7	73	84	2.1	2.0	1253	0.6	0.6	583,131	543,178	39,953
1997	5.1	1.8	72	83	2.2	2.0	1371	0.6	0.6	664,155	594,590	69,566
1998	5.2	1.9	72	83	2.2	2.0	1501	0.6	0.6	727,340	651,129	76,211
1999	5.3	2.0	71	82	2.2	2.0	1644	0.6	0.6	796,847	713,325	83,521
2000	5.5	2.1	71	82	2.2	2.0	1801	0.6	0.6	873,331	781,765	91,566
2001	5.6	2.2	70	81	2.2	2.0	1976	0.6	0.6	962,962	857,327	105,635
2002	5.8	2.3	69	80	2.2	2.0	2168	0.6	0.6	1,056,427	940,529	115,898
2003	5.9	1.5	68	83	2.2	2.0	2380	0.6	0.6	1,159,370	1,032,168	127,202
2004	6.0	1.6	68	82	2.3	2.0	2614	0.6	0.6	1,324,545	1,133,126	191,419
2005	6.0	1.7	67	81	2.3	2.0	2871	0.6	0.6	1,454,610	1,244,378	210,232
2006	6.0	1.8	67	80	2.3	2.0	3155	0.6	0.6	1,597,972	1,367,004	230,968
2007	6.0	2.0	66	79	2.3	2.0	3468	0.6	0.6	1,756,028	1,494,610	261,418
2008	6.0	2.1	66	78	2.3	2.0	3813	0.6	0.6	1,930,325	1,642,947	287,378
2009	6.0	2.3	65	77	2.3	2.0	4194	0.6	0.6	2,122,573	1,806,562	316,011
2010	6.0	2.5	65	76	2.3	2.0	4614	0.6	0.6	2,334,668	1,987,069	347,599
2011	6.0	2.7	64	74	2.3	2.0	5078	0.6	0.6	2,568,707	2,186,252	382,455
2012	6.0	3.0	63	73	2.3	2.0	5590	0.6	0.6	2,827,013	2,406,089	420,924

(1) Benefits include passenger time savings.

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

232

TABLE C-38

06-Feb-91

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	6.4	1.6	69	85	2.3	2.0	958	2.6	2.6	2,102,076	1,798,914	303,162
1994	6.5	1.6	68	85	2.3	2.0	1047	2.6	2.6	2,298,292	1,966,739	331,553
1995	6.7	1.7	68	84	2.3	2.0	1145	2.6	2.6	2,513,874	2,151,124	362,750
1996	6.8	1.7	67	84	2.3	2.0	1253	2.6	2.6	2,750,810	2,353,770	397,040
1997	7.0	1.8	66	83	2.3	2.0	1371	2.6	2.6	3,011,299	2,576,556	434,743
1998	7.2	1.9	65	83	2.4	2.0	1501	2.6	2.6	3,437,867	2,821,559	616,307
1999	7.4	2.0	65	82	2.4	2.0	1644	2.6	2.6	3,766,453	3,091,077	675,376
2000	7.6	2.1	64	82	2.4	2.0	1801	2.6	2.6	4,128,029	3,387,648	740,381
2001	7.8	2.2	63	81	2.4	2.0	1976	2.6	2.6	4,527,133	3,715,083	812,050
2002	8.1	2.3	61	80	2.5	2.0	2168	2.6	2.6	5,187,963	4,075,626	1,112,337
2003	1.5	1.5	83	83	2.0	2.0	2380	2.6	2.6	4,472,730	4,472,730	0
2004	1.8	1.6	81	82	2.0	2.0	2614	2.6	2.6	4,910,214	4,910,214	0
2005	2.2	1.7	79	81	2.0	2.0	2871	2.6	2.6	5,365,040	5,392,306	(27,265)
2006	2.6	1.8	78	80	2.0	2.0	3155	2.6	2.6	5,893,747	5,923,683	(29,936)
2007	3.1	2.0	76	79	2.0	2.0	3468	2.6	2.6	6,726,921	6,476,645	250,276
2008	3.7	2.1	73	78	2.0	2.0	3813	2.6	2.6	7,394,547	7,119,438	275,109
2009	4.3	2.3	71	77	2.1	2.0	4194	2.6	2.6	8,447,943	7,828,437	619,506
2010	4.9	2.5	68	76	2.1	2.0	4614	2.6	2.6	9,354,577	8,610,631	743,946
2011	5.7	2.7	65	74	2.2	2.0	5078	2.6	2.6	10,695,822	9,473,758	1,222,064
2012	6.5	3.0	62	73	2.3	2.0	5590	2.6	2.6	12,250,389	10,426,386	1,824,003

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-39

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	2.9	1.6	81	85	2.0	2.0	958	0.3	0.3	207,567	207,567	0
1994	3.0	1.6	80	85	2.0	2.0	1047	0.3	0.3	234,500	226,931	7,569
1995	3.2	1.7	79	84	2.0	2.0	1145	0.3	0.3	256,486	248,207	8,279
1996	3.3	1.7	78	84	2.0	2.0	1253	0.3	0.3	280,649	271,589	9,060
1997	3.5	1.8	78	83	2.0	2.0	1371	0.3	0.3	307,214	297,295	9,919
1998	3.7	1.9	77	83	2.0	2.0	1501	0.3	0.3	336,428	325,565	10,864
1999	4.0	2.0	76	82	2.0	2.0	1644	0.3	0.3	368,566	356,663	11,903
2000	4.2	2.1	75	82	2.1	2.0	1801	0.3	0.3	419,671	390,882	28,788
2001	4.5	2.2	73	81	2.1	2.0	1976	0.3	0.3	460,237	428,663	31,574
2002	4.8	2.3	72	80	2.1	2.0	2168	0.3	0.3	504,905	470,265	34,641
2003	1.5	1.5	83	83	2.0	2.0	2380	0.3	0.3	516,084	516,084	0
2004	1.9	1.6	81	82	2.0	2.0	2614	0.3	0.3	566,563	566,563	0
2005	2.3	1.7	79	81	2.0	2.0	2871	0.3	0.3	619,043	622,189	(3,146)
2006	2.8	1.8	77	80	2.0	2.0	3155	0.3	0.3	680,048	683,502	(3,454)
2007	3.3	2.0	75	79	2.0	2.0	3468	0.3	0.3	776,183	747,305	28,878
2008	4.0	2.1	72	78	2.0	2.0	3813	0.3	0.3	853,217	821,474	31,743
2009	4.6	2.3	70	77	2.1	2.0	4194	0.3	0.3	981,321	903,281	78,040
2010	5.4	2.5	67	76	2.2	2.0	4614	0.3	0.3	1,121,692	993,534	128,158
2011	6.3	2.7	63	74	2.3	2.0	5078	0.3	0.3	1,284,353	1,093,126	191,227
2012	7.3	3.0	60	73	2.5	2.0	5590	0.3	0.3	1,507,454	1,203,045	304,409

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-40

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	1.6	74	85	0.0	0.0	0	0.6	0.6	0	0	0
1994	4.8	1.6	74	85	0.0	0.0	0	0.6	0.6	0	0	0
1995	4.9	1.7	73	84	0.0	0.0	0	0.6	0.6	0	0	0
1996	5.0	1.7	73	84	0.0	0.0	0	0.6	0.6	0	0	0
1997	5.1	1.8	72	83	0.0	0.0	0	0.6	0.6	0	0	0
1998	5.2	1.9	72	83	0.0	0.0	0	0.6	0.6	0	0	0
1999	5.3	2.0	71	82	0.0	0.0	0	0.6	0.6	0	0	0
2000	5.5	2.1	71	82	0.0	0.0	0	0.6	0.6	0	0	0
2001	5.6	2.2	70	81	0.0	0.0	0	0.6	0.6	0	0	0
2002	5.8	2.3	69	80	0.0	0.0	0	0.6	0.6	0	0	0
2003	5.9	1.5	68	83	0.0	0.0	0	0.6	0.6	0	0	0
2004	6.0	1.6	68	82	0.0	0.0	0	0.6	0.6	0	0	0
2005	6.0	1.7	67	81	0.0	0.0	0	0.6	0.6	0	0	0
2006	6.0	1.8	67	80	0.0	0.0	0	0.6	0.6	0	0	0
2007	6.0	2.0	66	79	0.0	0.0	0	0.6	0.6	0	0	0
2008	6.0	2.1	66	78	0.0	0.0	0	0.6	0.6	0	0	0
2009	6.0	2.3	65	77	0.0	0.0	0	0.6	0.6	0	0	0
2010	6.0	2.5	65	76	0.0	0.0	0	0.6	0.6	0	0	0
2011	6.0	2.7	64	74	0.0	0.0	0	0.6	0.6	0	0	0
2012	6.0	3.0	63	73	0.0	0.0	0	0.6	0.6	0	0	0

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-41

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	6.4	1.6	69	85	0.0	0.0	0	2.6	2.6	0	0	0
1994	6.5	1.6	68	85	0.0	0.0	0	2.6	2.6	0	0	0
1995	6.7	1.7	68	84	0.0	0.0	0	2.6	2.6	0	0	0
1996	6.8	1.7	67	84	0.0	0.0	0	2.6	2.6	0	0	0
1997	7.0	1.8	66	83	0.0	0.0	0	2.6	2.6	0	0	0
1998	7.2	1.9	65	83	0.0	0.0	0	2.6	2.6	0	0	0
1999	7.4	2.0	65	82	0.0	0.0	0	2.6	2.6	0	0	0
2000	7.6	2.1	64	82	0.0	0.0	0	2.6	2.6	0	0	0
2001	7.8	2.2	63	81	0.0	0.0	0	2.6	2.6	0	0	0
2002	8.1	2.3	61	80	0.0	0.0	0	2.6	2.6	0	0	0
2003	1.5	1.5	83	83	0.0	0.0	0	2.6	2.6	0	0	0
2004	1.8	1.6	81	82	0.0	0.0	0	2.6	2.6	0	0	0
2005	2.2	1.7	79	81	0.0	0.0	0	2.6	2.6	0	0	0
2006	2.6	1.8	78	80	0.0	0.0	0	2.6	2.6	0	0	0
2007	3.1	2.0	76	79	0.0	0.0	0	2.6	2.6	0	0	0
2008	3.7	2.1	73	78	0.0	0.0	0	2.6	2.6	0	0	0
2009	4.3	2.3	71	77	0.0	0.0	0	2.6	2.6	0	0	0
2010	4.9	2.5	68	76	0.0	0.0	0	2.6	2.6	0	0	0
2011	5.7	2.7	65	74	0.0	0.0	0	2.6	2.6	0	0	0
2012	6.5	3.0	62	73	0.0	0.0	0	2.6	2.6	0	0	0

(1) Benefits include passenger time savings.

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

TABLE C-42 06-Feb-91

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	2.9	1.6	81	85	0.0	0.0	0	0.3	0.3	0	0	0
1994	3.0	1.6	80	85	0.0	0.0	0	0.3	0.3	0	0	0
1995	3.2	1.7	79	84	0.0	0.0	0	0.3	0.3	0	0	0
1996	3.3	1.7	78	84	0.0	0.0	0	0.3	0.3	0	0	0
1997	3.5	1.8	78	83	0.0	0.0	0	0.3	0.3	0	0	0
1998	3.7	1.9	77	83	0.0	0.0	0	0.3	0.3	0	0	0
1999	4.0	2.0	76	82	0.0	0.0	0	0.3	0.3	0	0	0
2000	4.2	2.1	75	82	0.0	0.0	0	0.3	0.3	0	0	0
2001	4.5	2.2	73	81	0.0	0.0	0	0.3	0.3	0	0	0
2002	4.8	2.3	72	80	0.0	0.0	0	0.3	0.3	0	0	0
2003	1.5	1.5	83	83	0.0	0.0	0	0.3	0.3	0	0	0
2004	1.9	1.6	81	82	0.0	0.0	0	0.3	0.3	0	0	0
2005	2.3	1.7	79	81	0.0	0.0	0	0.3	0.3	0	0	0
2006	2.8	1.8	77	80	0.0	0.0	0	0.3	0.3	0	0	0
2007	3.3	2.0	75	79	0.0	0.0	0	0.3	0.3	0	0	0
2008	4.0	2.1	72	78	0.0	0.0	0	0.3	0.3	0	0	0
2009	4.6	2.3	70	77	0.0	0.0	0	0.3	0.3	0	0	0
2010	5.4	2.5	67	76	0.0	0.0	0	0.3	0.3	0	0	0
2011	6.3	2.7	63	74	0.0	0.0	0	0.3	0.3	0	0	0
2012	7.3	3.0	60	73	0.0	0.0	0	0.3	0.3	0	0	0

(1) Benefits include passenger time savings.

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

TABLE C-43

06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	1.6	74	85	2.1	2.0	101	0.6	0.6	46,754	43,558	1,598
1994	4.8	1.6	74	85	2.1	2.0	112	0.6	0.6	51,897	48,350	1,774
1995	4.9	1.7	73	84	2.1	2.0	124	0.6	0.6	57,605	53,668	1,969
1996	5.0	1.7	73	84	2.1	2.0	138	0.6	0.6	63,942	59,572	2,185
1997	5.1	1.8	72	83	2.2	2.0	153	0.6	0.6	73,834	66,124	3,855
1998	5.2	1.9	72	83	2.2	2.0	170	0.6	0.6	81,956	73,398	4,279
1999	5.3	2.0	71	82	2.2	2.0	188	0.6	0.6	90,971	81,472	4,750
2000	5.5	2.1	71	82	2.2	2.0	209	0.6	0.6	100,978	90,434	5,272
2001	5.6	2.2	70	81	2.2	2.0	232	0.6	0.6	112,722	100,382	6,170
2002	5.8	2.3	69	80	2.2	2.0	258	0.6	0.6	125,122	111,424	6,849
2003	5.9	1.5	68	83	2.2	2.0	286	0.6	0.6	138,885	123,680	7,603
2004	6.0	1.6	68	82	2.3	2.0	317	0.6	0.6	160,396	137,285	11,556
2005	6.0	1.7	67	81	2.3	2.0	352	0.6	0.6	178,040	152,386	12,827
2006	6.0	1.8	67	80	2.3	2.0	391	0.6	0.6	197,624	169,149	14,238
2007	6.0	2.0	66	79	2.3	2.0	434	0.6	0.6	219,363	186,839	16,262
2008	6.0	2.1	66	78	2.3	2.0	482	0.6	0.6	243,492	207,392	18,050
2009	6.0	2.3	65	77	2.3	2.0	535	0.6	0.6	270,277	230,205	20,036
2010	6.0	2.5	65	76	2.3	2.0	593	0.6	0.6	300,007	255,527	22,240
2011	6.0	2.7	64	74	2.3	2.0	659	0.6	0.6	333,008	283,635	24,686
2012	6.0	3.0	63	73	2.3	2.0	731	0.6	0.6	369,639	314,835	27,402

(1) Benefits include passenger time savings.

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

TABLE C-44

06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	6.4	1.6	69	85	2.3	2.0	101	2.6	2.6	220,528	188,752	15,888
1994	6.5	1.6	68	85	2.3	2.0	112	2.6	2.6	244,786	209,515	17,635
1995	6.7	1.7	68	84	2.3	2.0	124	2.6	2.6	271,712	232,562	19,575
1996	6.8	1.7	67	84	2.3	2.0	138	2.6	2.6	301,600	258,143	21,728
1997	7.0	1.8	66	83	2.3	2.0	153	2.6	2.6	334,776	286,539	24,119
1998	7.2	1.9	65	83	2.4	2.0	170	2.6	2.6	387,325	318,059	34,633
1999	7.4	2.0	65	82	2.4	2.0	188	2.6	2.6	429,930	353,045	38,443
2000	7.6	2.1	64	82	2.4	2.0	209	2.6	2.6	477,223	391,880	42,671
2001	7.8	2.2	63	81	2.4	2.0	232	2.6	2.6	529,717	434,987	47,365
2002	8.1	2.3	61	80	2.5	2.0	258	2.6	2.6	614,074	482,835	65,619
2003	1.5	1.5	83	83	2.0	2.0	286	2.6	2.6	535,947	535,947	0
2004	1.8	1.8	81	82	2.0	2.0	317	2.6	2.6	594,901	594,901	0
2005	2.2	1.7	79	81	2.0	2.0	352	2.6	2.6	657,119	660,341	(1,611)
2006	2.6	1.8	78	80	2.0	2.0	391	2.6	2.6	729,402	732,978	(1,788)
2007	3.1	2.0	76	79	2.0	2.0	434	2.6	2.6	840,726	809,637	15,544
2008	3.7	2.1	73	78	2.0	2.0	482	2.6	2.6	933,206	898,697	17,254
2009	4.3	2.3	71	77	2.1	2.0	535	2.6	2.6	1,075,987	997,553	39,217
2010	4.9	2.5	68	76	2.1	2.0	593	2.6	2.6	1,202,658	1,107,284	47,687
2011	5.7	2.7	65	74	2.2	2.0	659	2.6	2.6	1,386,954	1,229,086	78,934
2012	6.5	3.0	62	73	2.3	2.0	731	2.6	2.6	1,601,768	1,364,285	118,741

(1) Benefits include passenger time savings.

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

TABLE C-45 06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	2.9	1.6	81	85	2.0	2.0	101	0.3	0.3	21,779	21,779	0
1994	3.0	1.6	80	85	2.0	2.0	112	0.3	0.3	24,981	24,175	403
1995	3.2	1.7	79	84	2.0	2.0	124	0.3	0.3	27,729	26,834	447
1996	3.3	1.7	78	84	2.0	2.0	138	0.3	0.3	30,779	29,786	496
1997	3.5	1.8	78	83	2.0	2.0	153	0.3	0.3	34,164	33,062	551
1998	3.7	1.9	77	83	2.0	2.0	170	0.3	0.3	37,922	36,699	612
1999	4.0	2.0	76	82	2.0	2.0	188	0.3	0.3	42,094	40,736	679
2000	4.2	2.1	75	82	2.1	2.0	209	0.3	0.3	48,534	45,217	1,659
2001	4.5	2.2	73	81	2.1	2.0	232	0.3	0.3	53,873	50,191	1,841
2002	4.8	2.3	72	80	2.1	2.0	258	0.3	0.3	59,799	55,712	2,044
2003	1.5	1.5	83	83	2.0	2.0	286	0.3	0.3	61,840	61,840	0
2004	1.9	1.6	81	82	2.0	2.0	317	0.3	0.3	68,642	68,642	0
2005	2.3	1.7	79	81	2.0	2.0	352	0.3	0.3	75,821	76,193	(186)
2006	2.8	1.8	77	80	2.0	2.0	391	0.3	0.3	84,162	84,574	(206)
2007	3.3	2.0	75	79	2.0	2.0	434	0.3	0.3	97,007	93,420	1,794
2008	4.0	2.1	72	78	2.0	2.0	482	0.3	0.3	107,678	103,696	1,991
2009	4.6	2.3	70	77	2.1	2.0	535	0.3	0.3	125,016	115,102	4,957
2010	5.4	2.5	67	76	2.2	2.0	593	0.3	0.3	144,174	127,764	8,205
2011	6.3	2.7	63	74	2.3	2.0	659	0.3	0.3	166,504	141,818	12,343
2012	7.3	3.0	60	73	2.5	2.0	731	0.3	0.3	197,171	157,418	19,877

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-46

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	1.6	28,190	33,780	0	0	0.6	0.6	16,914	20,268	(3,354)
1994	4.8	1.6	28,190	33,780	0	0	0.6	0.6	16,914	20,268	(3,354)
1995	4.9	1.7	28,190	33,780	0	0	0.6	0.6	16,914	20,268	(3,354)
1996	5.0	1.7	28,190	33,780	0	0	0.6	0.6	16,914	20,268	(3,354)
1997	5.1	1.8	28,190	33,780	0	0	0.6	0.6	16,914	20,268	(3,354)
1998	5.2	1.9	28,190	33,780	0	0	0.6	0.6	16,914	20,268	(3,354)
1999	5.3	2.0	28,190	33,780	0	0	0.6	0.6	16,914	20,268	(3,354)
2000	5.5	2.1	28,190	33,780	0	0	0.6	0.6	16,914	20,268	(3,354)
2001	5.6	2.2	28,190	33,780	0	116,500	0.6	0.6	16,914	90,168	(73,254)
2002	5.8	2.3	28,190	33,780	0	0	0.6	0.6	16,914	20,268	(3,354)
2003	5.9	1.5	28,190	33,780	0	999,991	0.6	0.6	16,914	620,263	(603,349)
2004	6.0	1.6	39,680	33,780	0	0	0.6	0.6	23,808	20,268	3,540
2005	6.0	1.7	39,680	33,780	0	0	0.6	0.6	23,808	20,268	3,540
2006	6.0	1.8	39,680	33,780	0	0	0.6	0.6	23,808	20,268	3,540
2007	6.0	2.0	39,680	33,780	0	0	0.6	0.6	23,808	20,268	3,540
2008	6.0	2.1	39,680	33,780	0	0	0.6	0.6	23,808	20,268	3,540
2009	6.0	2.3	39,680	33,780	0	116,500	0.6	0.6	23,808	90,168	(66,360)
2010	6.0	2.5	39,680	33,780	0	0	0.6	0.6	23,808	20,268	3,540
2011	6.0	2.7	39,680	33,780	0	0	0.6	0.6	23,808	20,268	3,540
2012	6.0	3.0	39,680	33,780	0	0	0.6	0.6	23,808	20,268	3,540

TABLE C-47

ECONOMIC MAINTENANCE COST SAVINGS

06-Feb-91

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: AC

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	6.4	1.6	27,440	33,730	0	0	2.6	2.6	71,344	87,828	(16,484)
1994	6.5	1.6	27,440	33,780	0	0	2.6	2.6	71,344	87,828	(16,484)
1995	6.7	1.7	27,440	33,780	0	0	2.6	2.6	71,344	87,828	(16,484)
1996	6.8	1.7	27,440	33,780	0	0	2.6	2.6	71,344	87,828	(16,484)
1997	7.0	1.8	27,440	33,780	0	0	2.6	2.6	71,344	87,828	(16,484)
1998	7.2	1.9	27,440	33,780	0	0	2.6	2.6	71,344	87,828	(16,484)
1999	7.4	2.0	27,440	33,780	0	0	2.6	2.6	71,344	87,828	(16,484)
2000	7.6	2.1	27,440	33,780	0	0	2.6	2.6	71,344	87,828	(16,484)
2001	7.8	2.2	27,440	33,780	116,500	116,500	2.6	2.6	374,244	390,728	(16,484)
2002	8.1	2.3	32,740	33,780	0	0	2.6	2.6	85,124	87,828	(2,704)
2003	1.5	1.5	24,140	33,780	999,991	999,991	2.6	2.6	2,662,741	2,687,805	(25,064)
2004	1.8	1.6	24,140	33,780	0	0	2.6	2.6	62,764	87,828	(25,064)
2005	2.2	1.7	24,140	33,780	0	0	2.6	2.6	62,764	87,828	(25,064)
2006	2.6	1.8	24,140	33,780	0	0	2.6	2.6	62,764	87,828	(25,064)
2007	3.1	2.0	24,140	33,780	0	0	2.6	2.6	62,764	87,828	(25,064)
2008	3.7	2.1	24,140	33,780	0	0	2.6	2.6	62,764	87,828	(25,064)
2009	4.3	2.3	24,890	33,780	116,500	116,500	2.6	2.6	367,614	390,728	(23,114)
2010	4.9	2.5	24,890	33,780	0	0	2.6	2.6	64,714	87,828	(23,114)
2011	5.7	2.7	24,890	33,780	0	0	2.6	2.6	64,714	87,828	(23,114)
2012	6.5	3.0	27,440	33,780	0	0	2.6	2.6	71,344	87,828	(16,484)

2 of 2

06-Feb-91

TABLE C-48

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: HRBGO-MRGNDN ALTERNATIVE: AC

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	2.9	1.6	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
1994	3.0	1.6	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
1995	3.2	1.7	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
1996	3.3	1.7	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
1997	3.5	1.8	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
1998	3.7	1.9	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
1999	4.0	2.0	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
2000	4.2	2.1	24,890	33,780	0	0	0.3	0.3	7,467	10,134	(2,667)
2001	4.5	2.2	24,890	33,780	116,500	116,500	0.3	0.3	42,417	45,084	(2,667)
2002	4.8	2.3	24,890	33,780	0	0	0.3	0.3	7,467	10,134	(2,667)
2003	1.5	1.5	24,140	33,780	999,991	999,991	0.3	0.3	307,239	310,131	(2,892)
2004	1.9	1.6	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
2005	2.3	1.7	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
2006	2.8	1.8	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
2007	3.3	2.0	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
2008	4.0	2.1	24,140	33,780	0	0	0.3	0.3	7,242	10,134	(2,892)
2009	4.6	2.3	24,890	33,780	116,500	116,500	0.3	0.3	42,417	45,084	(2,667)
2010	5.4	2.5	24,890	33,780	0	0	0.3	0.3	7,467	10,134	(2,667)
2011	6.3	2.7	27,440	33,780	0	0	0.3	0.3	8,232	10,134	(1,902)
2012	7.3	3.0	27,440	33,780	0	0	0.3	0.3	8,232	10,134	(1,902)

283

TABLE C-49 08-Feb-91

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRCNDN ALTERNATIVE: AC

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	3,139,200	0	0	0	0	0	(3,139,200
1992	4,708,800	0	0	0	0	0	(4,708,800
1993	0	333,660	0	17,485	(22,730)	0	328,416
1994	0	372,479	0	19,812	(22,730)	0	369,561
1995	0	407,528	0	21,991	(22,730)	0	406,789
1996	0	446,054	0	24,410	(22,730)	0	447,734
1997	0	514,229	0	28,525	(22,730)	0	520,023
1998	0	703,382	0	39,524	(22,730)	0	720,176
1999	0	770,800	0	43,871	(22,730)	0	791,942
2000	0	860,735	0	49,502	(22,505)	0	887,832
2001	0	949,259	0	55,377	(92,405)	0	912,230
2002	0	1,262,875	0	74,512	(8,725)	0	1,328,662
2003	0	127,202	0	7,603	(631,305)	0	(496,501
2004	0	191,419	0	11,556	(24,416)	0	178,558
2005	0	179,820	0	11,030	(24,416)	0	166,434
2006	0	197,578	0	12,244	(24,416)	0	185,406
2007	0	540,571	0	33,600	(24,416)	0	549,755
2008	0	594,230	0	37,296	(24,416)	0	607,110
2009	0	1,013,557	0	64,210	(92,141)	0	985,626
2010	0	1,219,703	0	78,132	(22,241)	0	1,275,594
2011	0	1,795,746	0	115,964	(21,476)	0	1,890,234
2012	0	2,549,337	0	166,020	(14,846)	0	2,700,510

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)=	5.2%	NB/I(15%)=	0.413 (3)
NPV(15%)=	(3,285,813)	NB/I(12%)=	0.521
		NB/I(18%)=	0.337

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)=	5.2%	NB/I(15%)=	0.413
NPV(15%)=	(3,285,813)	NB/I(12%)=	0.521
		NB/I(18%)=	0.337

(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-50 06-Feb-91

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	74	83	2.1	2.0	958	0.6	0.6	445,633	415,134	30,499
1994	4.8	2.1	74	83	2.1	2.0	1047	0.6	0.6	487,221	453,863	33,358
1995	4.9	2.1	73	83	2.1	2.0	1145	0.6	0.6	532,913	496,413	36,500
1996	5.0	2.1	73	82	2.1	2.0	1253	0.6	0.6	583,131	543,178	39,953
1997	5.1	2.2	72	82	2.2	2.0	1371	0.6	0.6	664,156	594,590	69,566
1998	5.2	2.2	72	82	2.2	2.0	1501	0.6	0.6	727,340	651,129	76,211
1999	5.3	2.2	71	81	2.2	2.0	1644	0.6	0.6	796,847	713,325	83,521
2000	5.5	2.3	71	81	2.2	2.0	1801	0.6	0.6	873,331	781,765	91,566
2001	5.6	2.3	70	81	2.2	2.0	1976	0.6	0.6	962,962	857,327	105,635
2002	5.8	2.4	69	80	2.2	2.0	2168	0.6	0.6	1,056,427	940,529	115,898
2003	5.9	2.4	68	80	2.2	2.0	2380	0.6	0.6	1,159,370	1,026,944	132,426
2004	6.0	2.4	68	79	2.3	2.0	2614	0.6	0.6	1,324,545	1,127,394	197,151
2005	6.0	2.5	67	79	2.3	2.0	2871	0.6	0.6	1,454,610	1,238,086	216,524
2006	6.0	2.5	67	78	2.3	2.0	3155	0.6	0.6	1,597,972	1,360,095	237,877
2007	6.0	2.6	66	77	2.3	2.0	3468	0.6	0.6	1,756,028	1,494,610	261,418
2008	6.0	2.6	66	77	2.3	2.0	3813	0.6	0.6	1,930,325	1,642,947	287,378
2009	6.0	2.7	65	76	2.3	2.0	4194	0.6	0.6	2,122,573	1,806,562	316,011
2010	6.0	2.7	65	75	2.3	2.0	4614	0.6	0.6	2,334,668	1,987,069	347,599
2011	6.0	2.8	64	74	2.3	2.0	5078	0.6	0.6	2,568,707	2,186,252	382,455
2012	6.0	2.8	63	73	2.3	2.0	5590	0.6	0.6	2,827,013	2,406,089	420,924

(1) Benefits include passenger time savings.

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

245

TABLE C-51 06-Feb-91

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	6.4	2.0	[illegible]	83	2.3	2.0	958	2.6	2.6	2,102,076	1,798,914	303,162
1994	6.5	2.1	68	83	2.3	2.0	1047	2.6	2.6	2,298,292	1,966,739	331,553
1995	6.7	2.1	68	83	2.3	2.0	1145	2.6	2.6	2,513,874	2,151,124	362,750
1996	6.8	2.1	67	82	2.3	2.0	1253	2.6	2.6	2,750,810	2,353,770	397,040
1997	7.0	2.2	66	82	2.3	2.0	1371	2.6	2.6	3,011,299	2,576,556	434,743
1998	7.2	2.2	65	82	2.4	2.0	1501	2.6	2.6	3,437,867	2,821,559	616,307
1999	7.4	2.2	65	81	2.4	2.0	1644	2.6	2.6	3,766,453	3,091,077	675,376
2000	7.6	2.3	64	81	2.4	2.0	1801	2.6	2.6	4,128,029	3,387,648	740,381
2001	7.8	2.3	63	81	2.4	2.0	1976	2.6	2.6	4,527,133	3,715,083	812,050
2002	8.1	2.4	61	80	2.5	2.0	2168	2.6	2.6	5,187,963	4,075,626	1,112,337
2003	1.5	2.4	83	80	2.0	2.0	2380	2.6	2.6	4,472,730	4,450,092	22,638
2004	1.8	2.4	81	79	2.0	2.0	2614	2.6	2.6	4,910,214	4,885,373	24,840
2005	2.2	2.5	79	79	2.0	2.0	2871	2.6	2.6	5,365,040	5,365,040	0
2006	2.6	2.5	78	78	2.0	2.0	3155	2.6	2.6	5,893,747	5,893,747	0
2007	3.1	2.6	76	77	2.0	2.0	3468	2.6	2.6	6,726,921	6,476,645	250,276
2008	3.7	2.6	73	77	2.0	2.0	3813	2.6	2.6	7,394,547	7,119,438	275,109
2009	4.3	2.7	71	76	2.1	2.0	4194	2.6	2.6	8,447,943	7,828,437	619,506
2010	4.9	2.7	68	75	2.1	2.0	4614	2.6	2.6	9,354,577	8,610,631	743,946
2011	5.7	2.8	65	74	2.2	2.0	5078	2.6	2.6	10,695,822	9,473,758	1,222,064
2012	6.5	2.8	62	73	2.3	2.0	5590	2.6	2.6	12,250,389	10,426,386	1,824,003

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-52

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	2.9	2.0	81	83	2.0	2.0	958	0.3	0.3	207,567	207,567	0
1994	3.0	2.1	80	83	2.0	2.0	1047	0.3	0.3	234,500	226,931	7,569
1995	3.2	2.1	79	83	2.0	2.0	1145	0.3	0.3	256,486	248,207	8,279
1996	3.3	2.1	78	82	2.0	2.0	1253	0.3	0.3	280,649	271,589	9,060
1997	3.5	2.2	78	82	2.0	2.0	1371	0.3	0.3	307,214	297,295	9,919
1998	3.7	2.2	77	82	2.0	2.0	1501	0.3	0.3	336,428	325,565	10,864
1999	4.0	2.2	76	81	2.0	2.0	1644	0.3	0.3	368,566	356,663	11,903
2000	4.2	2.3	75	81	2.1	2.0	1801	0.3	0.3	419,671	390,882	28,788
2001	4.5	2.3	73	81	2.1	2.0	1976	0.3	0.3	460,237	428,663	31,574
2002	4.8	2.4	72	80	2.1	2.0	2168	0.3	0.3	504,905	470,265	34,641
2003	1.5	2.4	83	80	2.0	2.0	2380	0.3	0.3	516,084	513,472	2,612
2004	1.9	2.4	81	79	2.0	2.0	2614	0.3	0.3	566,563	563,697	2,866
2005	2.3	2.5	79	79	2.0	2.0	2871	0.3	0.3	619,043	619,043	0
2006	2.8	2.5	77	78	2.0	2.0	3155	0.3	0.3	680,048	680,048	0
2007	3.3	2.6	75	77	2.0	2.0	3468	0.3	0.3	776,183	747,305	28,878
2008	4.0	2.6	72	77	2.0	2.0	3813	0.3	0.3	853,217	821,474	31,743
2009	4.6	2.7	70	76	2.1	2.0	4194	0.3	0.3	981,321	903,281	78,040
2010	5.4	2.7	67	75	2.2	2.0	4614	0.3	0.3	1,121,692	993,534	128,158
2011	6.3	2.8	63	74	2.3	2.0	5078	0.3	0.3	1,284,353	1,093,126	191,227
2012	7.3	2.8	60	73	2.5	2.0	5590	0.3	0.3	1,507,454	1,203,045	304,409

(1) Benefits include passenger time savings.

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

247

06-Feb-91

TABLE C-53

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	74	83	0.0	0.0	0	0.6	0.6	0	0	0
1994	4.8	2.1	74	83	0.0	0.0	0	0.6	0.6	0	0	0
1995	4.9	2.1	73	83	0.0	0.0	0	0.6	0.6	0	0	0
1996	5.0	2.1	73	82	0.0	0.0	0	0.6	0.6	0	0	0
1997	5.1	2.2	72	82	0.0	0.0	0	0.6	0.6	0	0	0
1998	5.2	2.2	72	82	0.0	0.0	0	0.6	0.6	0	0	0
1999	5.3	2.2	71	81	0.0	0.0	0	0.6	0.6	0	0	0
2000	5.5	2.3	71	81	0.0	0.0	0	0.6	0.6	0	0	0
2001	5.6	2.3	70	81	0.0	0.0	0	0.6	0.6	0	0	0
2002	5.8	2.4	69	80	0.0	0.0	0	0.6	0.6	0	0	0
2003	5.9	2.4	68	80	0.0	0.0	0	0.6	0.6	0	0	0
2004	6.0	2.4	68	79	0.0	0.0	0	0.6	0.6	0	0	0
2005	6.0	2.5	67	79	0.0	0.0	0	0.6	0.6	0	0	0
2006	6.0	2.5	67	78	0.0	0.0	0	0.6	0.6	0	0	0
2007	6.0	2.6	66	77	0.0	0.0	0	0.6	0.6	0	0	0
2008	6.0	2.6	66	77	0.0	0.0	0	0.6	0.6	0	0	0
2009	6.0	2.7	65	76	0.0	0.0	0	0.6	0.6	0	0	0
2010	6.0	2.7	65	75	0.0	0.0	0	0.6	0.6	0	0	0
2011	6.0	2.8	64	74	0.0	0.0	0	0.6	0.6	0	0	0
2012	6.0	2.8	63	73	0.0	0.0	0	0.6	0.6	0	0	0

(1) Benefits include passenger time savings.

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

248

TABLE C-54

06-Feb-91

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	6.4	2.0	69	83	0.0	0.0	0	2.6	2.6	0	0	0
1994	6.5	2.1	68	83	0.0	0.0	0	2.6	2.6	0	0	0
1995	6.7	2.1	68	83	0.0	0.0	0	2.6	2.6	0	0	0
1996	6.8	2.1	67	82	0.0	0.0	0	2.6	2.6	0	0	0
1997	7.0	2.2	66	82	0.0	0.0	0	2.6	2.6	0	0	0
1998	7.2	2.2	65	82	0.0	0.0	0	2.6	2.6	0	0	0
1999	7.4	2.2	65	81	0.0	0.0	0	2.6	2.6	0	0	0
2000	7.6	2.3	64	81	0.0	0.0	0	2.6	2.6	0	0	0
2001	7.8	2.3	63	81	0.0	0.0	0	2.6	2.6	0	0	0
2002	8.1	2.4	61	80	0.0	0.0	0	2.6	2.6	0	0	0
2003	1.5	2.4	83	80	0.0	0.0	0	2.6	2.6	0	0	0
2004	1.8	2.4	81	79	0.0	0.0	0	2.6	2.6	0	0	0
2005	2.2	2.5	79	79	0.0	0.0	0	2.6	2.6	0	0	0
2006	2.6	2.5	78	78	0.0	0.0	0	2.6	2.6	0	0	0
2007	3.1	2.6	76	77	0.0	0.0	0	2.6	2.6	0	0	0
2008	3.7	2.6	73	77	0.0	0.0	0	2.6	2.6	0	0	0
2009	4.3	2.7	71	76	0.0	0.0	0	2.6	2.6	0	0	0
2010	4.9	2.7	68	75	0.0	0.0	0	2.6	2.6	0	0	0
2011	5.7	2.8	65	74	0.0	0.0	0	2.6	2.6	0	0	0
2012	6.5	2.8	62	73	0.0	0.0	0	2.6	2.6	0	0	0

(1) Benefits include passenger time savings.

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

249

TABLE C-55

06-Feb-91

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	2.9	2.0	81	83	0.0	0.0	0	0.3	0.3	0	0	0
1994	3.0	2.1	80	83	0.0	0.0	0	0.3	0.3	0	0	0
1995	3.2	2.1	79	83	0.0	0.0	0	0.3	0.3	0	0	0
1996	3.3	2.1	78	82	0.0	0.0	0	0.3	0.3	0	0	0
1997	3.5	2.2	78	82	0.0	0.0	0	0.3	0.3	0	0	0
1998	3.7	2.2	77	82	0.0	0.0	0	0.3	0.3	0	0	0
1999	4.0	2.2	76	81	0.0	0.0	0	0.3	0.3	0	0	0
2000	4.2	2.3	75	81	0.0	0.0	0	0.3	0.3	0	0	0
2001	4.5	2.3	73	81	0.0	0.0	0	0.3	0.3	0	0	0
2002	4.8	2.4	72	80	0.0	0.0	0	0.3	0.3	0	0	0
2003	1.5	2.4	83	80	0.0	0.0	0	0.3	0.3	0	0	0
2004	1.9	2.4	81	79	0.0	0.0	0	0.3	0.3	0	0	0
2005	2.3	2.5	79	79	0.0	0.0	0	0.3	0.3	0	0	0
2006	2.8	2.5	77	78	0.0	0.0	0	0.3	0.3	0	0	0
2007	3.3	2.6	75	77	0.0	0.0	0	0.3	0.3	0	0	0
2008	4.0	2.6	72	77	0.0	0.0	0	0.3	0.3	0	0	0
2009	4.6	2.7	70	76	0.0	0.0	0	0.3	0.3	0	0	0
2010	5.4	2.7	67	75	0.0	0.0	0	0.3	0.3	0	0	0
2011	6.3	2.8	63	74	0.0	0.0	0	0.3	0.3	0	0	0
2012	7.3	2.8	60	73	0.0	0.0	0	0.3	0.3	0	0	0

(1) Benefits include passenger time savings.

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

250

TABLE C-56

06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	74	83	2.1	2.0	101	0.6	0.6	46,754	43,558	1,598
1994	4.8	2.1	74	83	2.1	2.0	112	0.6	0.6	51,897	48,350	1,774
1995	4.9	2.1	73	83	2.1	2.0	124	0.6	0.6	57,605	53,668	1,969
1996	5.0	2.1	73	82	2.1	2.0	138	0.6	0.6	63,942	59,572	2,185
1997	5.1	2.2	72	82	2.2	2.0	153	0.6	0.6	73,834	66,124	3,855
1998	5.2	2.2	72	82	2.2	2.0	170	0.6	0.6	81,956	73,398	4,279
1999	5.3	2.2	71	81	2.2	2.0	188	0.6	0.6	90,971	81,472	4,750
2000	5.5	2.3	71	81	2.2	2.0	209	0.6	0.6	100,978	90,434	5,272
2001	5.6	2.3	70	81	2.2	2.0	232	0.6	0.6	112,722	100,382	6,170
2002	5.8	2.4	69	80	2.2	2.0	258	0.6	0.6	125,122	111,424	6,849
2003	5.9	2.4	68	80	2.2	2.0	286	0.6	0.6	138,885	123,077	7,904
2004	6.0	2.4	68	79	2.3	2.0	317	0.6	0.6	160,396	136,615	11,890
2005	6.0	2.5	67	79	2.3	2.0	352	0.6	0.6	178,040	151,643	13,198
2006	6.0	2.5	67	78	2.3	2.0	391	0.6	0.6	197,624	168,324	14,650
2007	6.0	2.6	66	77	2.3	2.0	434	0.6	0.6	219,363	186,839	16,262
2008	6.0	2.6	66	77	2.3	2.0	482	0.6	0.6	243,492	207,392	18,050
2009	6.0	2.7	65	76	2.3	2.0	535	0.6	0.6	270,277	230,205	20,036
2010	6.0	2.7	65	75	2.3	2.0	593	0.6	0.6	300,097	255,527	22,240
2011	6.0	2.8	64	74	2.3	2.0	659	0.6	0.6	333,008	283,635	24,686
2012	6.0	2.8	63	73	2.3	2.0	731	0.6	0.6	369,639	314,835	27,402

(1) Benefits include passenger time savings.

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

TABLE C-57 06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	6.4	2.0	69	83	2.3	2.0	101	2.6	2.6	220,528	188,752	15,888
1994	6.5	2.1	68	83	2.3	2.0	112	2.6	2.6	244,786	209,515	17,635
1995	6.7	2.1	68	83	2.3	2.0	124	2.6	2.6	271,712	232,562	19,575
1996	6.8	2.1	67	82	2.3	2.0	138	2.6	2.6	301,600	258,143	21,728
1997	7.0	2.2	66	82	2.3	2.0	153	2.6	2.6	334,776	286,539	24,119
1998	7.2	2.2	65	82	2.4	2.0	170	2.6	2.6	387,325	318,059	34,633
1999	7.4	2.2	65	81	2.4	2.0	188	2.6	2.6	429,930	353,045	38,443
2000	7.6	2.3	64	81	2.4	2.0	209	2.6	2.6	477,223	391,880	42,671
2001	7.8	2.3	63	81	2.4	2.0	232	2.6	2.6	529,717	434,987	47,365
2002	8.1	2.4	61	80	2.5	2.0	258	2.6	2.6	614,074	482,835	65,619
2003	1.5	2.4	83	80	2.0	2.0	286	2.6	2.6	535,947	533,333	1,307
2004	1.8	2.4	81	79	2.0	2.0	317	2.6	2.6	594,901	591,999	1,451
2005	2.2	2.5	79	79	2.0	2.0	352	2.6	2.6	657,119	657,119	0
2006	2.6	2.5	78	78	2.0	2.0	391	2.6	2.6	729,402	729,402	0
2007	3.1	2.6	76	77	2.0	2.0	434	2.6	2.6	840,726	809,637	15,544
2008	3.7	2.6	73	77	2.0	2.0	482	2.6	2.6	933,206	898,697	17,254
2009	4.3	2.7	71	76	2.1	2.0	535	2.6	2.6	1,075,987	997,553	39,217
2010	4.9	2.7	68	75	2.1	2.0	593	2.6	2.6	1,202,658	1,107,284	47,687
2011	5.7	2.8	65	74	2.2	2.0	659	2.6	2.6	1,386,954	1,229,086	78,934
2012	6.5	2.8	62	73	2.3	2.0	731	2.6	2.6	1,601,768	1,364,285	118,741

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-58

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km) W/O PROJ	ROUGHNESS (m/km) W/ PROJ	SPEED (km/h)(2) W/O PROJ	SPEED (km/h)(2) W/ PROJ	TRFFC MIX AVG UNIT USR CST W/O PROJ	TRFFC MIX AVG UNIT USR CST W/ PROJ	AADT (W/ 2-3W VEH)	LENGTH (km) W/O PROJ	LENGTH (km) W/ PROJ	TOTAL USER COST W/O PROJ	TOTAL USER COST W/ PROJ	YEARLY BENEFITS
1993	2.9	2.0	81	83	2.0	2.0	101	0.3	0.3	21,779	21,779	0
1994	3.0	2.1	80	83	2.0	2.0	112	0.3	0.3	24,981	24,175	403
1995	3.2	2.1	79	83	2.0	2.0	124	0.3	0.3	27,729	26,834	447
1996	3.3	2.1	78	82	2.0	2.0	138	0.3	0.3	30,779	29,786	496
1997	3.5	2.2	78	82	2.0	2.0	153	0.3	0.3	34,164	33,062	551
1998	3.7	2.2	77	82	2.0	2.0	170	0.3	0.3	37,922	36,699	612
1999	4.0	2.2	76	81	2.0	2.0	188	0.3	0.3	42,094	40,736	679
2000	4.2	2.3	75	81	2.1	2.0	209	0.3	0.3	48,534	45,217	1,659
2001	4.5	2.3	73	81	2.1	2.0	232	0.3	0.3	53,873	50,191	1,841
2002	4.8	2.4	72	80	2.1	2.0	258	0.3	0.3	59,799	55,712	2,044
2003	1.5	2.4	83	80	2.0	2.0	286	0.3	0.3	61,840	61,538	151
2004	1.9	2.4	81	79	2.0	2.0	317	0.3	0.3	68,642	68,308	167
2005	2.3	2.5	79	79	2.0	2.0	352	0.3	0.3	75,821	75,821	0
2006	2.8	2.5	77	78	2.0	2.0	391	0.3	0.3	84,162	84,162	0
2007	3.3	2.6	75	77	2.0	2.0	434	0.3	0.3	97,007	93,420	1,794
2008	4.0	2.6	72	77	2.0	2.0	482	0.3	0.3	107,678	103,696	1,991
2009	4.6	2.7	70	76	2.1	2.0	535	0.3	0.3	125,016	115,102	4,957
2010	5.4	2.7	67	75	2.2	2.0	593	0.3	0.3	144,174	127,764	8,205
2011	6.3	2.8	63	74	2.3	2.0	659	0.3	0.3	166,504	141,818	12,343
2012	7.3	2.8	60	73	2.5	2.0	731	0.3	0.3	197,171	157,418	19,877

(1) Benefits include passenger time savings.

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

TABLE C-59 06-Feb-91

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
1994	4.8	2.1	28,190	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
1995	4.9	2.1	28,190	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
1996	5.0	2.1	28,190	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
1997	5.1	2.2	28,190	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
1998	5.2	2.2	28,190	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
1999	5.3	2.2	28,190	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
2000	5.5	2.3	28,190	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
2001	5.6	2.3	28,190	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
2002	5.8	2.4	28,190	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
2003	5.9	2.4	28,190	34,820	0	0	0.6	0.6	16,914	20,892	(3,978)
2004	6.0	2.4	39,680	34,820	0	0	0.6	0.6	23,808	20,892	2,916
2005	6.0	2.5	39,680	34,820	0	0	0.6	0.6	23,808	20,892	2,916
2006	6.0	2.5	39,680	34,820	0	0	0.6	0.6	23,808	20,892	2,916
2007	6.0	2.6	39,680	34,820	0	0	0.6	0.6	23,808	20,892	2,916
2008	6.0	2.6	39,680	34,820	0	0	0.6	0.6	23,808	20,892	2,916
2009	6.0	2.7	39,680	34,820	0	0	0.6	0.6	23,808	20,892	2,916
2010	6.0	2.7	39,680	34,820	0	0	0.6	0.6	23,808	20,892	2,916
2011	6.0	2.8	39,680	34,820	0	0	0.6	0.6	23,808	20,892	2,916
2012	6.0	2.8	39,680	34,820	0	0	0.6	0.6	23,808	20,892	2,916

06-Feb-91

TABLE C-60

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	6.4	2.0	27,440	34,820	0	0	2.6	2.6	71,344	90,532	(19,188)
1994	6.5	2.1	27,440	34,820	0	0	2.6	2.6	71,344	90,532	(19,188)
1995	6.7	2.1	27,440	34,820	0	0	2.6	2.6	71,344	90,532	(19,188)
1996	6.8	2.1	27,440	34,820	0	0	2.6	2.6	71,344	90,532	(19,188)
1997	7.0	2.2	27,440	34,820	0	0	2.6	2.6	71,344	90,532	(19,188)
1998	7.2	2.2	27,440	34,820	0	0	2.6	2.6	71,344	90,532	(19,188)
1999	7.4	2.2	27,440	34,820	0	0	2.6	2.6	71,344	90,532	(19,188)
2000	7.6	2.3	27,440	34,820	0	0	2.6	2.6	71,344	90,532	(19,188)
2001	7.8	2.3	27,440	34,820	116,500	0	2.6	2.6	374,244	90,532	283,712
2002	8.1	2.4	32,740	34,820	0	0	2.6	2.6	85,124	90,532	(5,408)
2003	1.5	2.4	24,140	34,820	999,991	0	2.6	2.6	2,662,741	90,532	2,572,209
2004	1.8	2.4	24,140	34,820	0	0	2.6	2.6	62,764	90,532	(27,768)
2005	2.2	2.5	24,140	34,820	0	0	2.6	2.6	62,764	90,532	(27,768)
2006	2.6	2.5	24,140	34,820	0	0	2.6	2.6	62,764	90,532	(27,768)
2007	3.1	2.6	24,140	34,820	0	0	2.6	2.6	62,764	90,532	(27,768)
2008	3.7	2.6	24,140	34,820	0	0	2.6	2.6	62,764	90,532	(27,768)
2009	4.3	2.7	24,890	34,820	116,500	0	2.6	2.6	367,614	90,532	277,082
2010	4.9	2.7	24,890	34,820	0	0	2.6	2.6	64,714	90,532	(25,818)
2011	5.7	2.8	24,890	34,820	0	0	2.6	2.6	64,714	90,532	(25,818)
2012	6.5	2.8	27,440	34,820	0	0	2.6	2.6	71,344	90,532	(19,188)

TABLE C-61

06-Feb-91

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	2.9	2.0	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
1994	3.0	2.1	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
1995	3.2	2.1	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
1996	3.3	2.1	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
1997	3.5	2.2	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
1998	3.7	2.2	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
1999	4.0	2.2	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
2000	4.2	2.3	24,890	34,820	0	0	0.3	0.3	7,467	10,446	(2,979)
2001	4.5	2.3	24,890	34,820	116,500	0	0.3	0.3	42,417	10,446	31,971
2002	4.8	2.4	24,890	34,820	0	0	0.3	0.3	7,467	10,446	(2,979)
2003	1.5	2.4	24,140	34,820	999,991	0	0.3	0.3	307,239	10,446	296,793
2004	1.9	2.4	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
2005	2.3	2.5	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
2006	2.8	2.5	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
2007	3.3	2.6	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3.204)
2008	4.0	2.6	24,140	34,820	0	0	0.3	0.3	7,242	10,446	(3,204)
2009	4.6	2.7	24,890	34,820	116,500	0	0.3	0.3	42,417	10,446	31,971
2010	5.4	2.7	24,890	34,820	0	0	0.3	0.3	7,467	10,446	(2,979)
2011	6.3	2.8	27,440	34,820	0	0	0.3	0.3	8,232	10,446	(2,214)
2012	7.3	2.8	27,440	34,820	0	0	0.3	0.3	8,232	10,446	(2,214)

TABLE C-62 09-Feb-91

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: MACTAN CIRC. SECTION: MRBGO-MRGNDN 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	4,518,000	0	0	0	0	0	(4,518,000)
1992	6,777,000	0	0	0	0	0	(6,777,000)
1993	0	333,660	0	17,485	(26,370)	0	324,776
1994	0	372,479	0	19,812	(26,370)	0	365,921
1995	0	407,528	0	21,991	(26,370)	0	403,149
1996	0	446,054	0	24,410	(26,370)	0	444,094
1997	0	514,229	0	28,525	(26,370)	0	516,383
1998	0	703,382	0	39,524	(26,370)	0	716,536
1999	0	770,800	0	43,871	(26,370)	0	788,302
2000	0	860,735	0	49,602	(26,145)	0	884,192
2001	0	949,259	0	55,377	311,705	0	1,316,340
2002	0	1,262,875	0	74,512	(12,365)	0	1,325,022
2003	0	157,675	0	9,362	2,865,024	0	3,032,061
2004	0	224,858	0	13,509	(28,056)	0	210,311
2005	0	216,524	0	13,198	(28,056)	0	201,666
2006	0	237,877	0	14,650	(28,056)	0	224,471
2007	0	540,571	0	33,600	(28,056)	0	546,115
2008	0	594,230	0	37,296	(28,056)	0	603,470
2009	0	1,013,557	0	64,210	311,969	0	1,389,736
2010	0	1,219,703	0	78,132	(25,881)	0	1,271,954
2011	0	1,795,746	0	115,964	(25,116)	0	1,886,594
2012	0	2,549,337	0	166,020	(18,486)	0	2,696,870

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)=	4.3%	NB/I(15%)=	0.363 (3)
NPV(15%)=	(5,133,832)	NB/I(12%)=	0.465
		NB/I(18%)=	0.291

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)=	4.3%	NB/I(15%)=	0.363
NPV(15%)=	(5,133,832)	NB/I(12%)=	0.465
		NB/I(18%)=	0.291

(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.

251

TABLE C-63

06-Feb-91

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG ALTERNATIVE: AC

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	2.9	1.6	80	84	1.5	1.5	1217	1.0	1.0	684,677	684,049	629
1994	3.0	1.6	79	84	1.6	1.5	1315	1.0	1.0	766,372	738,989	27,383
1995	3.2	1.7	78	84	1.6	1.5	1422	1.0	1.0	828,261	798,669	29,592
1996	3.4	1.7	78	83	1.6	1.5	1538	1.0	1.0	895,516	863,525	31,991
1997	3.6	1.8	77	83	1.6	1.5	1665	1.0	1.0	968,634	934,034	34,600
1998	3.8	1.9	76	82	1.6	1.5	1802	1.0	1.0	1,048,155	1,010,717	37,437
1999	4.0	1.9	75	82	1.7	1.5	1952	1.0	1.0	1,177,628	1,094,150	83,478
2000	4.3	2.0	74	81	1.7	1.5	2115	1.0	1.0	1,275,392	1,184,962	90,431
2001	4.6	2.1	72	80	1.7	1.5	2297	1.0	1.0	1,383,772	1,285,648	98,124
2002	4.9	2.2	71	80	1.6	1.5	2495	1.0	1.0	1,501,965	1,396,514	105,451
2003	1.5	1.5	81	81	1.5	1.5	2712	1.0	1.0	1,515,240	1,515,240	0
2004	1.9	1.6	80	81	1.5	1.5	2949	1.0	1.0	1,647,238	1,645,970	1,268
2005	2.3	1.7	78	80	1.5	1.5	3208	1.0	1.0	1,790,078	1,790,078	0
2006	2.7	1.8	76	79	1.5	1.5	3491	1.0	1.0	1,946,076	1,946,076	0
2007	3.2	1.9	74	78	1.6	1.5	3801	1.0	1.0	2,193,163	2,116,505	76,658
2008	3.8	2.0	72	77	1.6	1.5	4139	1.0	1.0	2,386,151	2,302,763	83,389
2009	4.4	2.2	69	76	1.7	1.5	4509	1.0	1.0	2,730,840	2,506,388	224,452
2010	5.1	2.3	66	74	1.7	1.5	4914	1.0	1.0	3,090,025	2,729,074	360,951
2011	5.9	2.5	63	73	1.7	1.5	5358	1.0	1.0	3,365,872	2,972,686	393,185
2012	6.7	2.7	60	72	1.9	1.5	5843	1.0	1.0	3,954,006	3,239,276	714,730

(1) Benefits include passenger time savings.

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

TABLE C-64 06-Feb-91

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG ALTERNATIVE: AC

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	6.4	1.6	68	84	1.8	1.5	1217	5.9	5.9	4,762,587	4,035,887	726,699
1994	6.5	1.6	68	84	1.8	1.5	1315	5.9	5.9	5,145,373	4,360,033	785,340
1995	6.7	1.7	67	84	1.8	1.5	1422	5.9	5.9	5,561,204	4,712,147	849,056
1996	6.8	1.7	66	83	1.8	1.5	1538	5.9	5.9	6,013,111	5,094,798	918,313
1997	7.0	1.8	65	83	1.9	1.5	1665	5.9	5.9	6,797,695	5,510,798	1,286,897
1998	7.2	1.9	65	82	1.9	1.5	1802	5.9	5.9	7,356,426	5,963,233	1,393,194
1999	7.4	1.9	64	82	1.9	1.5	1952	5.9	5.9	7,964,364	6,455,487	1,508,878
2000	7.6	2.0	63	81	1.9	1.5	2115	5.9	5.9	8,626,098	6,991,274	1,634,824
2001	7.9	2.1	62	80	1.9	1.5	2297	5.9	5.9	9,359,722	7,585,322	1,774,400
2002	8.1	2.2	61	80	2.0	1.5	2495	5.9	5.9	10,653,139	8,239,435	2,413,704
2003	1.5	1.5	81	81	1.5	1.5	2712	5.9	5.9	8,939,915	8,939,915	0
2004	1.8	1.6	80	81	1.5	1.5	2949	5.9	5.9	9,718,702	9,711,223	7,479
2005	2.2	1.7	78	80	1.5	1.5	3208	5.9	5.9	10,561,458	10,561,458	0
2006	2.6	1.8	77	79	1.5	1.5	3491	5.9	5.9	11,481,851	11,481,851	0
2007	3.0	1.9	75	78	1.6	1.5	3801	5.9	5.9	12,939,660	12,487,380	452,280
2008	3.5	2.0	72	77	1.6	1.5	4139	5.9	5.9	14,078,293	13,586,300	491,994
2009	4.0	2.2	70	76	1.6	1.5	4509	5.9	5.9	15,904,212	14,787,688	1,116,524
2010	4.6	2.3	67	74	1.7	1.5	4914	5.9	5.9	17,543,400	16,101,538	1,441,862
2011	5.3	2.5	65	73	1.7	1.5	5358	5.9	5.9	19,858,642	17,538,849	2,319,793
2012	6.0	2.7	62	72	1.8	1.5	5843	5.9	5.9	22,551,419	19,111,730	3,439,689

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-65

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG ALTERNATIVE: AC

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	2.9	1.6	80	84	0.0	0.0	0	1.0	1.0	0	0	0
1994	3.0	1.6	79	84	0.0	0.0	0	1.0	1.0	0	0	0
1995	3.2	1.7	78	84	0.0	0.0	0	1.0	1.0	0	0	0
1996	3.4	1.7	78	83	0.0	0.0	0	1.0	1.0	0	0	0
1997	3.6	1.8	77	83	0.0	0.0	0	1.0	1.0	0	0	0
1998	3.8	1.9	76	82	0.0	0.0	0	1.0	1.0	0	0	0
1999	4.0	1.9	75	82	0.0	0.0	0	1.0	1.0	0	0	0
2000	4.3	2.0	74	81	0.0	0.0	0	1.0	1.0	0	0	0
2001	4.6	2.1	72	80	0.0	0.0	0	1.0	1.0	0	0	0
2002	4.9	2.2	71	80	0.0	0.0	0	1.0	1.0	0	0	0
2003	1.5	1.5	81	81	0.0	0.0	0	1.0	1.0	0	0	0
2004	1.9	1.6	80	81	0.0	0.0	0	1.0	1.0	0	0	0
2005	2.3	1.7	78	80	0.0	0.0	0	1.0	1.0	0	0	0
2006	2.7	1.8	76	79	0.0	0.0	0	1.0	1.0	0	0	0
2007	3.2	1.9	74	78	0.0	0.0	0	1.0	1.0	0	0	0
2008	3.8	2.0	72	77	0.0	0.0	0	1.0	1.0	0	0	0
2009	4.4	2.2	69	76	0.0	0.0	0	1.0	1.0	0	0	0
2010	5.1	2.3	66	74	0.0	0.0	0	1.0	1.0	0	0	0
2011	5.9	2.5	63	73	0.0	0.0	0	1.0	1.0	0	0	0
2012	6.7	2.7	60	72	0.0	0.0	0	1.0	1.0	0	0	0

(1) Benefits include passenger time savings.

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

260

06-Feb-91

TABLE C-66

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDOW-BBAG ALTERNATIVE: AC

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	6.4	1.6	68	84	0.0	0.0	0	5.9	5.9	0	0	0
1994	6.5	1.6	68	84	0.0	0.0	0	5.9	5.9	0	0	0
1995	6.7	1.7	67	84	0.0	0.0	0	5.9	5.9	0	0	0
1996	6.8	1.7	66	83	0.0	0.0	0	5.9	5.9	0	0	0
1997	7.0	1.8	65	83	0.0	0.0	0	5.9	5.9	0	0	0
1998	7.2	1.9	65	82	0.0	0.0	0	5.9	5.9	0	0	0
1999	7.4	1.9	64	82	0.0	0.0	0	5.9	5.9	0	0	0
2000	7.6	2.0	63	81	0.0	0.0	0	5.9	5.9	0	0	0
2001	7.9	2.1	62	80	0.0	0.0	0	5.9	5.9	0	0	0
2002	8.1	2.2	61	80	0.0	0.0	0	5.9	5.9	0	0	0
2003	1.5	1.5	81	81	0.0	0.0	0	5.9	5.9	0	0	0
2004	1.8	1.6	80	81	0.0	0.0	0	5.9	5.9	0	0	0
2005	2.2	1.7	78	80	0.0	0.0	0	5.9	5.9	0	0	0
2006	2.6	1.8	77	79	0.0	0.0	0	5.9	5.9	0	0	0
2007	3.0	1.9	75	78	0.0	0.0	0	5.9	5.9	0	0	0
2008	3.5	2.0	72	77	0.0	0.0	0	5.9	5.9	0	0	0
2009	4.0	2.2	70	76	0.0	0.0	0	5.9	5.9	0	0	0
2010	4.6	2.3	67	74	0.0	0.0	0	5.9	5.9	0	0	0
2011	5.3	2.5	65	73	0.0	0.0	0	5.9	5.9	0	0	0
2012	6.0	2.7	62	72	0.0	0.0	0	5.9	5.9	0	0	0

(1) Benefits include passenger time savings.

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

TABLE C-67 06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG ALTERNATIVE: AC

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	2.9	1.6	80	84	1.6	1.6	190	1.0	1.0	107,781	107,768	7
1994	3.0	1.6	79	84	1.6	1.6	211	1.0	1.0	124,239	119,622	2,308
1995	3.2	1.7	78	84	1.6	1.6	234	1.0	1.0	137,905	132,781	2,562
1996	3.4	1.7	78	83	1.6	1.6	260	1.0	1.0	153,075	147,387	2,844
1997	3.6	1.8	77	83	1.6	1.6	288	1.0	1.0	169,913	163,599	3,157
1998	3.8	1.9	76	82	1.6	1.6	320	1.0	1.0	188,603	181,595	3,504
1999	4.0	1.9	75	82	1.7	1.6	355	1.0	1.0	217,709	201,570	8,069
2000	4.3	2.0	74	81	1.7	1.6	394	1.0	1.0	241,657	223,743	8,957
2001	4.6	2.1	72	80	1.7	1.6	438	1.0	1.0	268,239	248,355	9,942
2002	4.9	2.2	71	80	1.7	1.6	486	1.0	1.0	297,745	275,708	11,019
2003	1.5	1.5	81	81	1.6	1.6	539	1.0	1.0	305,998	305,998	0
2004	1.9	1.6	80	81	1.6	1.6	599	1.0	1.0	339,700	339,658	21
2005	2.3	1.7	78	80	1.6	1.6	665	1.0	1.0	377,067	377,067	0
2006	2.7	1.8	76	79	1.6	1.6	738	1.0	1.0	418,544	418,544	0
2007	3.2	1.9	74	78	1.6	1.6	819	1.0	1.0	482,454	464,584	8,935
2008	3.8	2.0	72	77	1.6	1.6	909	1.0	1.0	535,524	515,688	9,918
2009	4.4	2.2	69	76	1.7	1.6	1009	1.0	1.0	625,743	572,414	26,664
2010	5.1	2.3	66	74	1.8	1.6	1120	1.0	1.0	723,060	635,379	43,841
2011	5.9	2.5	63	73	1.8	1.6	1243	1.0	1.0	802,597	705,271	48,663
2012	6.7	2.7	60	72	1.9	1.6	1380	1.0	1.0	966,262	782,851	91,706

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-68

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG ALTERNATIVE: AC

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	6.4	1.6	68	84	1.8	1.6	190	5.9	5.9	755,241	635,830	59,705
1994	6.5	1.6	68	84	1.8	1.6	211	5.9	5.9	838,317	705,771	66,273
1995	6.7	1.7	67	84	1.8	1.6	234	5.9	5.9	930,532	783,406	73,563
1996	6.8	1.7	66	83	1.8	1.6	260	5.9	5.9	1,032,891	869,581	81,655
1997	7.0	1.8	65	83	1.9	1.6	288	5.9	5.9	1,200,188	965,235	117,477
1998	7.2	1.9	65	82	1.9	1.6	320	5.9	5.9	1,332,209	1,071,410	130,399
1999	7.4	1.9	64	82	1.9	1.6	355	5.9	5.9	1,478,752	1,189,266	144,743
2000	7.6	2.0	63	81	1.9	1.6	394	5.9	5.9	1,641,415	1,320,085	160,665
2001	7.9	2.1	62	80	1.9	1.6	438	5.9	5.9	1,821,970	1,465,294	178,338
2002	8.1	2.2	61	80	2.0	1.6	486	5.9	5.9	2,123,517	1,626,676	248,420
2003	1.5	1.5	81	81	1.6	1.6	539	5.9	5.9	1,805,389	1,805,389	0
2004	1.8	1.6	80	81	1.6	1.6	599	5.9	5.9	2,004,228	2,003,982	123
2005	2.2	1.7	78	80	1.6	1.6	665	5.9	5.9	2,224,693	2,224,693	0
2006	2.6	1.8	77	79	1.6	1.6	738	5.9	5.9	2,469,409	2,469,409	0
2007	3.0	1.9	75	78	1.6	1.6	819	5.9	5.9	2,846,480	2,741,044	52,718
2008	3.5	2.0	72	77	1.6	1.6	909	5.9	5.9	3,159,593	3,042,559	58,517
2009	4.0	2.2	70	76	1.7	1.6	1009	5.9	5.9	3,647,182	3,377,241	134,971
2010	4.6	2.3	67	74	1.7	1.6	1120	5.9	5.9	4,097,988	3,748,737	174,625
2011	5.3	2.5	65	73	1.8	1.6	1243	5.9	5.9	4,735,322	4,161,099	287,112
2012	6.0	2.7	62	72	1.8	1.6	1380	5.9	5.9	5,485,574	4,618,819	433,377

(1) Benefits include passenger time savings.

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

TABLE C-69

06-Feb-91

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG ALTERNATIVE: AC

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	2.9	1.6	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
1994	3.0	1.6	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
1995	3.2	1.7	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
1996	3.4	1.7	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
1997	3.6	1.8	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
1998	3.8	1.9	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
1999	4.0	1.9	24,890	38,600	0	0	1.0	1.0	24,890	38,600	(13,710)
2000	4.3	2.0	24,890	38,600	0	0	1.0	1.0	24,890	38,600	(13,710)
2001	4.6	2.1	24,890	38,600	116,500	116,500	1.0	1.0	141,390	155,100	(13,710)
2002	4.9	2.2	24,890	38,600	0	0	1.0	1.0	24,890	38,600	(13,710)
2003	1.5	1.5	24,140	38,600	857,135	857,135	1.0	1.0	881,275	895,735	(14,460)
2004	1.9	1.6	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
2005	2.3	1.7	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
2006	2.7	1.8	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
2007	3.2	1.9	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
2008	3.8	2.0	24,140	38,600	0	0	1.0	1.0	24,140	38,600	(14,460)
2009	4.4	2.2	24,890	38,600	116,500	116,500	1.0	1.0	141,390	155,100	(13,710)
2010	5.1	2.3	24,890	38,600	0	0	1.0	1.0	24,890	38,600	(13,710)
2011	5.9	2.5	24,890	38,600	0	0	1.0	1.0	24,890	38,600	(13,710)
2012	6.7	2.7	27,440	38,600	0	0	1.0	1.0	27,440	38,600	(11,160)

TABLE C-70

06-Feb-91

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG ALTERNATIVE: AC

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	6.4	1.6	27,440	33,780	0	0	5.9	5.9	161,896	199,302	(37,406)
1994	6.5	1.6	27,440	33,780	0	0	5.9	5.9	161,896	199,302	(37,406)
1995	6.7	1.7	27,440	33,780	0	0	5.9	5.9	161,896	199,302	(37,406)
1996	6.8	1.7	27,440	33,780	0	0	5.9	5.9	161,896	199,302	(37,406)
1997	7.0	1.8	27,440	33,780	0	0	5.9	5.9	161,896	199,302	(37,406)
1998	7.2	1.9	27,440	33,780	0	0	5.9	5.9	161,896	199,302	(37,406)
1999	7.4	1.9	27,440	33,780	0	0	5.9	5.9	161,896	199,302	(37,406)
2000	7.6	2.0	27,440	33,780	0	0	5.9	5.9	161,896	199,302	(37,406)
2001	7.9	2.1	27,440	33,780	116,500	116,500	5.9	5.9	849,246	886,652	(37,406)
2002	8.1	2.2	32,740	33,780	0	0	5.9	5.9	193,166	199,302	(6,136)
2003	1.5	1.5	24,140	33,780	857,135	857,135	5.9	5.9	5,199,523	5,256,399	(56,876)
2004	1.8	1.6	24,140	33,780	0	0	5.9	5.9	142,426	199,302	(56,876)
2005	2.2	1.7	24,140	33,780	0	0	5.9	5.9	142,426	199,302	(56,876)
2006	2.6	1.8	24,140	33,780	0	0	5.9	5.9	142,426	199,302	(56,876)
2007	3.0	1.9	24,140	33,780	0	0	5.9	5.9	142,426	199,302	(56,876)
2008	3.5	2.0	24,140	33,780	0	0	5.9	5.9	142,426	199,302	(56,876)
2009	4.0	2.2	24,890	33,780	116,500	116,500	5.9	5.9	834,201	886,652	(52,451)
2010	4.6	2.3	24,890	33,780	0	0	5.9	5.9	146,851	199,302	(52,451)
2011	5.3	2.5	24,890	33,780	0	0	5.9	5.9	146,851	199,302	(52,451)
2012	6.0	2.7	27,440	33,780	0	0	5.9	5.9	161,896	199,302	(37,406)

TABLE C-71 08-Feb-91

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: MACTAN CIRC. SECTION: MRGNDN-BBAG ALTERNATIVE: AC

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	6,252,800	0	0	0	0	0	(6,252,800)
1992	9,379,200	0	0	0	0	0	(9,379,200)
1993	0	727,328	0	59,712	(51,866)	0	735,174
1994	0	812,724	0	68,581	(51,866)	0	829,439
1995	0	878,648	0	76,125	(51,866)	0	902,907
1996	0	950,305	0	84,499	(51,866)	0	982,938
1997	0	1,321,497	0	120,634	(51,866)	0	1,390,265
1998	0	1,430,631	0	133,904	(51,866)	0	1,512,669
1999	0	1,592,356	0	152,812	(51,116)	0	1,694,052
2000	0	1,725,255	0	169,622	(51,116)	0	1,843,760
2001	0	1,872,524	0	188,280	(51,116)	0	2,009,688
2002	0	2,519,155	0	259,439	(19,846)	0	2,758,748
2003	0	0	0	0	(71,336)	0	(71,336)
2004	0	8,747	0	144	(71,336)	0	(62,445)
2005	0	0	0	0	(71,336)	0	(71,336)
2006	0	0	0	0	(71,336)	0	(71,336)
2007	0	528,938	0	61,653	(71,336)	0	519,255
2008	0	575,383	0	68,435	(71,336)	0	572,482
2009	0	1,340,976	0	161,635	(66,161)	0	1,436,450
2010	0	1,802,813	0	218,466	(66,161)	0	1,955,118
2011	0	2,712,979	0	335,775	(66,161)	0	2,982,592
2012	0	4,154,419	0	525,083	(48,566)	0	4,630,936

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)=	4.7%	NB/I(15%)=	0.430 (3)
NPV(15%)=	(6,362,608)	NB/I(12%)=	0.530
		NB/I(18%)=	0.357

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)=	4.7%	NB/I(15%)=	0.430
NPV(15%)=	(6,362,608)	NB/I(12%)=	0.530
		NB/I(18%)=	0.357

(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.

06-Feb-91

TABLE C-72

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDCN-BBAG 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	2.9	2.0	80	83	1.5	1.5	1217	1.0	1.0	684,677	684,049	629
1994	3.0	2.1	79	82	1.6	1.5	1315	1.0	1.0	766,372	738,989	27,383
1995	3.2	2.1	78	82	1.6	1.5	1422	1.0	1.0	828,261	798,669	29,592
1996	3.4	2.1	78	82	1.6	1.5	1538	1.0	1.0	895,516	863,525	31,991
1997	3.6	2.2	77	81	1.6	1.5	1665	1.0	1.0	968,634	934,034	34,600
1998	3.8	2.2	76	81	1.6	1.5	1802	1.0	1.0	1,048,155	1,010,717	37,437
1999	4.0	2.2	75	81	1.7	1.5	1952	1.0	1.0	1,177,628	1,094,150	83,478
2000	4.3	2.3	74	80	1.7	1.5	2115	1.0	1.0	1,275,392	1,184,962	90,431
2001	4.6	2.3	72	80	1.7	1.5	2297	1.0	1.0	1,383,772	1,286,624	97,149
2002	4.9	2.3	71	79	1.6	1.5	2495	1.0	1.0	1,501,965	1,396,514	105,451
2003	1.5	2.4	81	79	1.5	1.5	2712	1.0	1.0	1,515,240	1,516,400	(1,160)
2004	1.9	2.4	80	78	1.5	1.5	2949	1.0	1.0	1,647,238	1,647,238	0
2005	2.3	2.5	78	77	1.5	1.5	3208	1.0	1.0	1,790,078	1,790,078	0
2006	2.7	2.5	76	77	1.5	1.5	3491	1.0	1.0	1,946,076	1,946,076	0
2007	3.2	2.6	74	76	1.6	1.5	3801	1.0	1.0	2,193,163	2,116,505	76,658
2008	3.8	2.6	72	75	1.6	1.5	4139	1.0	1.0	2,386,151	2,302,763	83,389
2009	4.4	2.6	69	74	1.7	1.5	4509	1.0	1.0	2,730,840	2,506,388	224,452
2010	5.1	2.7	66	73	1.7	1.5	4914	1.0	1.0	3,090,025	2,729,074	360,951
2011	5.9	2.7	63	72	1.7	1.5	5358	1.0	1.0	3,365,872	2,972,686	393,185
2012	6.7	2.8	60	71	1.9	1.5	5843	1.0	1.0	3,954,006	3,239,276	714,730

(1) Benefits include passenger time savings.

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

267

TABLE C-73 06-Feb-91

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG 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	6.4	2.0	68	83	1.8	1.5	1217	5.9	5.9	4,762,587	4,035,887	726,699
1994	6.5	2.1	68	82	1.8	1.5	1315	5.9	5.9	5,145,373	4,360,033	785,340
1995	6.7	2.1	67	82	1.8	1.5	1422	5.9	5.9	5,561,204	4,712,147	849,056
1996	6.8	2.1	66	82	1.8	1.5	1538	5.9	5.9	6,013,111	5,094,798	918,313
1997	7.0	2.2	65	81	1.9	1.5	1665	5.9	5.9	6,797,695	5,510,798	1,286,897
1998	7.2	2.2	65	81	1.9	1.5	1802	5.9	5.9	7,356,426	5,963,233	1,393,194
1999	7.4	2.2	64	81	1.9	1.5	1952	5.9	5.9	7,964,364	6,455,487	1,508,878
2000	7.6	2.3	63	80	1.9	1.5	2115	5.9	5.9	8,626,098	6,991,274	1,634,824
2001	7.9	2.3	62	80	1.9	1.5	2297	5.9	5.9	9,359,722	7,591,079	1,768,643
2002	8.1	2.3	61	79	2.0	1.5	2495	5.9	5.9	10,653,139	8,239,435	2,413,704
2003	1.5	2.4	81	79	1.5	1.5	2712	5.9	5.9	8,939,915	8,946,762	(6,847)
2004	1.8	2.4	80	78	1.5	1.5	2949	5.9	5.9	9,718,702	9,718,702	0
2005	2.2	2.5	78	77	1.5	1.5	3208	5.9	5.9	10,561,458	10,561,458	0
2006	2.6	2.5	77	77	1.5	1.5	3491	5.9	5.9	11,481,851	11,481,851	0
2007	3.0	2.6	75	76	1.6	1.5	3801	5.9	5.9	12,939,660	12,487,380	452,280
2008	3.5	2.6	72	75	1.6	1.5	4139	5.9	5.9	14,078,293	13,586,300	491,994
2009	4.0	2.6	70	74	1.6	1.5	4509	5.9	5.9	15,904,212	14,787,688	1,116,524
2010	4.6	2.7	67	73	1.7	1.5	4914	5.9	5.9	17,543,400	16,101,538	1,441,862
2011	5.3	2.7	65	72	1.7	1.5	5358	5.9	5.9	19,858,642	17,538,849	2,319,793
2012	6.0	2.8	62	71	1.8	1.5	5843	5.9	5.9	22,551,419	19,111,730	3,439,689

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-74

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG 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	2.9	2.0	80	83	0.0	0.0	0	1.0	1.0	0	0	0
1994	3.0	2.1	79	82	0.0	0.0	0	1.0	1.0	0	0	0
1995	3.2	2.1	78	82	0.0	0.0	0	1.0	1.0	0	0	0
1996	3.4	2.1	78	82	0.0	0.0	0	1.0	1.0	0	0	0
1997	3.6	2.2	77	81	0.0	0.0	0	1.0	1.0	0	0	0
1998	3.8	2.2	76	81	0.0	0.0	0	1.0	1.0	0	0	0
1999	4.0	2.2	75	81	0.0	0.0	0	1.0	1.0	0	0	0
2000	4.3	2.3	74	80	0.0	0.0	0	1.0	1.0	0	0	0
2001	4.6	2.3	72	80	0.0	0.0	0	1.0	1.0	0	0	0
2002	4.9	2.3	71	79	0.0	0.0	0	1.0	1.0	0	0	0
2003	1.5	2.4	81	79	0.0	0.0	0	1.0	1.0	0	0	0
2004	1.9	2.4	80	78	0.0	0.0	0	1.0	1.0	0	0	0
2005	2.3	2.5	78	77	0.0	0.0	0	1.0	1.0	0	0	0
2006	2.7	2.5	76	77	0.0	0.0	0	1.0	1.0	0	0	0
2007	3.2	2.6	74	76	0.0	0.0	0	1.0	1.0	0	0	0
2008	3.8	2.6	72	75	0.0	0.0	0	1.0	1.0	0	0	0
2009	4.4	2.6	69	74	0.0	0.0	0	1.0	1.0	0	0	0
2010	5.1	2.7	66	73	0.0	0.0	0	1.0	1.0	0	0	0
2011	5.9	2.7	63	72	0.0	0.0	0	1.0	1.0	0	0	0
2012	6.7	2.8	60	71	0.0	0.0	0	1.0	1.0	0	0	0

(1) Benefits include passenger time savings.

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

TABLE C-75 06-Feb-91

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG 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	6.4	2.0	68	83	0.0	0.0	0	5.9	5.9	0	0	0
1994	6.5	2.1	68	82	0.0	0.0	0	5.9	5.9	0	0	0
1995	6.7	2.1	67	82	0.0	0.0	0	5.9	5.9	0	0	0
1996	6.8	2.1	66	82	0.0	0.0	0	5.9	5.9	0	0	0
1997	7.0	2.2	65	81	0.0	0.0	0	5.9	5.9	0	0	0
1998	7.2	2.2	65	81	0.0	0.0	0	5.9	5.9	0	0	0
1999	7.4	2.2	64	81	0.0	0.0	0	5.9	5.9	0	0	0
2000	7.6	2.3	63	80	0.0	0.0	0	5.9	5.9	0	0	0
2001	7.9	2.3	62	80	0.0	0.0	0	5.9	5.9	0	0	0
2002	8.1	2.3	61	79	0.0	0.0	0	5.9	5.9	0	0	0
2003	1.5	2.4	81	79	0.0	0.0	0	5.9	5.9	0	0	0
2004	1.8	2.4	80	78	0.0	0.0	0	5.9	5.9	0	0	0
2005	2.2	2.5	78	77	0.0	0.0	0	5.9	5.9	0	0	0
2006	2.6	2.5	77	77	0.0	0.0	0	5.9	5.9	0	0	0
2007	3.0	2.6	75	76	0.0	0.0	0	5.9	5.9	0	0	0
2008	3.5	2.6	72	75	0.0	0.0	0	5.9	5.9	0	0	0
2009	4.0	2.6	70	74	0.0	0.0	0	5.9	5.9	0	0	0
2010	4.6	2.7	67	73	0.0	0.0	0	5.9	5.9	0	0	0
2011	5.3	2.7	65	72	0.0	0.0	0	5.9	5.9	0	0	0
2012	6.0	2.8	62	71	0.0	0.0	0	5.9	5.9	0	0	0

(1) Benefits include passenger time savings.

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

270

06-Feb-91

TABLE C-76

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG 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	2.9	2.0	80	83	1.6	1.6	190	1.0	1.0	107,781	107,768	7
1994	3.0	2.1	79	82	1.6	1.6	211	1.0	1.0	124,239	119,622	2,308
1995	3.2	2.1	78	82	1.6	1.6	234	1.0	1.0	137,905	132,781	2,562
1996	3.4	2.1	78	82	1.6	1.6	260	1.0	1.0	153,075	147,387	2,844
1997	3.6	2.2	77	81	1.6	1.6	288	1.0	1.0	169,913	163,599	3,157
1998	3.8	2.2	76	81	1.6	1.6	320	1.0	1.0	188,603	181,595	3,504
1999	4.0	2.2	75	81	1.7	1.6	355	1.0	1.0	217,709	201,570	8,069
2000	4.3	2.3	74	80	1.7	1.6	394	1.0	1.0	241,657	223,743	8,957
2001	4.6	2.3	72	80	1.7	1.6	438	1.0	1.0	268,239	248,385	9,927
2002	4.9	2.3	71	79	1.7	1.6	486	1.0	1.0	297,745	275,708	11,019
2003	1.5	2.4	81	79	1.6	1.6	539	1.0	1.0	305,998	306,036	(19)
2004	1.9	2.4	80	78	1.6	1.6	599	1.0	1.0	339,700	339,700	0
2005	2.3	2.5	78	77	1.6	1.6	665	1.0	1.0	377,067	377,067	0
2006	2.7	2.5	76	77	1.6	1.6	738	1.0	1.0	418,544	418,544	0
2007	3.2	2.6	74	76	1.6	1.6	819	1.0	1.0	482,454	464,584	8,935
2008	3.8	2.6	72	75	1.6	1.6	909	1.0	1.0	535,524	515,688	9,918
2009	4.4	2.6	69	74	1.7	1.6	1009	1.0	1.0	625,743	572,414	26,664
2010	5.1	2.7	66	73	1.8	1.6	1120	1.0	1.0	723,060	635,379	43,841
2011	5.9	2.7	63	72	1.8	1.6	1243	1.0	1.0	802,597	705,271	48,663
2012	6.7	2.8	60	71	1.9	1.6	1380	1.0	1.0	966,262	782,851	91,706

(1) Benefits include passenger time savings.

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

TABLE C-77 06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG 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	6.4	2.0	68	83	1.8	1.6	190	5.9	5.9	755,241	635,830	59,705
1994	6.5	2.1	68	82	1.8	1.6	211	5.9	5.9	838,317	705,771	66,273
1995	6.7	2.1	67	82	1.8	1.6	234	5.9	5.9	930,532	783,406	73,563
1996	6.8	2.1	66	82	1.8	1.6	260	5.9	5.9	1,032,891	869,581	81,655
1997	7.0	2.2	65	81	1.9	1.6	288	5.9	5.9	1,200,188	965,235	117,477
1998	7.2	2.2	65	81	1.9	1.6	320	5.9	5.9	1,332,209	1,071,410	130,399
1999	7.4	2.2	64	81	1.9	1.6	355	5.9	5.9	1,478,752	1,189,266	144,743
2000	7.6	2.3	63	80	1.9	1.6	394	5.9	5.9	1,641,415	1,320,085	160,665
2001	7.9	2.3	62	80	1.9	1.6	438	5.9	5.9	1,821,970	1,465,474	178,248
2002	8.1	2.3	61	79	2.0	1.6	486	5.9	5.9	2,123,517	1,626,676	248,420
2003	1.5	2.4	81	79	1.6	1.6	539	5.9	5.9	1,805,389	1,805,611	(111)
2004	1.8	2.4	80	78	1.6	1.6	599	5.9	5.9	2,004,228	2,004,228	0
2005	2.2	2.5	78	77	1.6	1.6	665	5.9	5.9	2,224,693	2,224,693	0
2006	2.6	2.5	77	77	1.6	1.6	738	5.9	5.9	2,469,409	2,469,409	0
2007	3.0	2.6	75	76	1.6	1.6	819	5.9	5.9	2,846,480	2,741,044	52,718
2008	3.5	2.6	72	75	1.6	1.6	909	5.9	5.9	3,159,593	3,042,559	58,517
2009	4.0	2.6	70	74	1.7	1.6	1009	5.9	5.9	3,647,182	3,377,241	134,971
2010	4.6	2.7	67	73	1.7	1.6	1120	5.9	5.9	4,097,988	3,748,737	174,625
2011	5.3	2.7	65	72	1.8	1.6	1243	5.9	5.9	4,735,322	4,161,099	287,112
2012	6.0	2.8	62	71	1.8	1.6	1380	5.9	5.9	5,485,574	4,618,819	433,377

(1) Benefits include passenger time savings.

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

272

06-Feb-91

TABLE C-78

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km) W/O PROJ	ROUGHNESS (m/km) W/ PROJ	UNIT RTN MNT COST W/O PROJ	UNIT RTN MNT COST W/ PROJ	UNIT PRDC MAINT. COST W/O PROJ	UNIT PRDC MAINT. COST W/ PROJ	LENGTH (km) W/O PROJ	LENGTH (km) W/ PROJ	TOTAL MAINT. COST W/O PROJ	TOTAL MAINT. COST W/ PROJ	YEARLY BENEFITS
1993	2.9	2.0	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
1994	3.0	2.1	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
1995	3.2	2.1	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
1996	3.4	2.1	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
1997	3.6	2.2	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
1998	3.8	2.2	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
1999	4.0	2.2	24,890	39,640	0	0	1.0	1.0	24,890	39,640	(14,750)
2000	4.3	2.3	24,890	39,640	0	0	1.0	1.0	24,890	39,640	(14,750)
2001	4.6	2.3	24,890	39,640	116,500	0	1.0	1.0	141,390	39,640	101,750
2002	4.9	2.3	24,890	39,640	0	0	1.0	1.0	24,890	39,640	(14,750)
2003	1.5	2.4	24,140	39,640	857,135	0	1.0	1.0	881,275	39,640	841,635
2004	1.9	2.4	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
2005	2.3	2.5	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
2006	2.7	2.5	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
2007	3.2	2.6	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
2008	3.8	2.6	24,140	39,640	0	0	1.0	1.0	24,140	39,640	(15,500)
2009	4.4	2.6	24,890	39,640	116,500	0	1.0	1.0	141,390	39,640	101,750
2010	5.1	2.7	24,890	39,640	0	0	1.0	1.0	24,890	39,640	(14,750)
2011	5.9	2.7	24,890	39,640	0	0	1.0	1.0	24,890	39,640	(14,750)
2012	6.7	2.8	27,440	39,640	0	0	1.0	1.0	27,440	39,640	(12,200)

TABLE C-79 06-Feb-91

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: MRGNDON-BBAG 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	6.4	2.0	27,440	34,820	0	0	5.9	5.9	161,896	205,438	(43,542)
1994	6.5	2.1	27,440	34,820	0	0	5.9	5.9	161,896	205,438	(43,542)
1995	6.7	2.1	27,440	34,820	0	0	5.9	5.9	161,896	205,438	(43,542)
1996	6.8	2.1	27,440	34,820	0	0	5.9	5.9	161,896	205,438	(43,542)
1997	7.0	2.2	27,440	34,820	0	0	5.9	5.9	161,896	205,438	(43,542)
1998	7.2	2.2	27,440	34,820	0	0	5.9	5.9	161,896	205,438	(43,542)
1999	7.4	2.2	27,440	34,820	0	0	5.9	5.9	161,896	205,438	(43,542)
2000	7.6	2.3	27,440	34,820	0	0	5.9	5.9	161,896	205,438	(43,542)
2001	7.9	2.3	27,440	34,820	116,500	0	5.9	5.9	849,246	205,438	643,808
2002	8.1	2.3	32,740	34,820	0	0	5.9	5.9	193,166	205,438	(12,272)
2003	1.5	2.4	24,140	34,820	857,135	0	5.9	5.9	5,199,523	205,438	4,994,085
2004	1.8	2.4	24,140	34,820	0	0	5.9	5.9	142,426	205,438	(63,012)
2005	2.2	2.5	24,140	34,820	0	0	5.9	5.9	142,426	205,438	(63,012)
2006	2.6	2.5	24,140	34,820	0	0	5.9	5.9	142,426	205,438	(63,012)
2007	3.0	2.6	24,140	34,820	0	0	5.9	5.9	142,426	205,438	(63,012)
2008	3.5	2.6	24,140	34,820	0	0	5.9	5.9	142,426	205,438	(63,012)
2009	4.0	2.6	24,890	34,820	116,500	0	5.9	5.9	834,201	205,438	628,763
2010	4.6	2.7	24,890	34,820	0	0	5.9	5.9	146,851	205,438	(58,587)
2011	5.3	2.7	24,890	34,820	0	0	5.9	5.9	146,851	205,438	(58,587)
2012	6.0	2.8	27,440	34,820	0	0	5.9	5.9	161,896	205,438	(43,542)

06-Feb-91

TABLE C-80

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: MACTAN CIRC. SECTION: MRGNDN-BBAG 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	8,729,600	0	0	0	0	0	(8,729,600)
1992	13,094,400	0	0	0	0	0	(13,094,400)
1993	0	727,328	0	59,712	(59,042)	0	727,998
1994	0	812,724	0	68,581	(59,042)	0	822,263
1995	0	878,648	0	76,125	(59,042)	0	895,731
1996	0	950,305	0	84,499	(59,042)	0	975,762
1997	0	1,321,497	0	120,634	(59,042)	0	1,383,089
1998	0	1,430,631	0	133,904	(59,042)	0	1,505,493
1999	0	1,592,356	0	152,812	(58,292)	0	1,686,876
2000	0	1,725,255	0	169,622	(58,292)	0	1,836,584
2001	0	1,865,791	0	188,175	745,558	0	2,799,524
2002	0	2,519,155	0	259,439	(27,022)	0	2,751,572
2003	0	(8,007)	0	(130)	5,835,720	0	5,827,582
2004	0	0	0	0	(78,512)	0	(78,512)
2005	0	0	0	0	(78,512)	0	(78,512)
2006	0	0	0	0	(78,512)	0	(78,512)
2007	0	528,938	0	61,653	(78,512)	0	512,079
2008	0	575,383	0	68,435	(78,512)	0	565,306
2009	0	1,340,976	0	161,635	730,513	0	2,233,124
2010	0	1,802,813	0	218,466	(73,337)	0	1,947,942
2011	0	2,712,979	0	335,775	(73,337)	0	2,975,416
2012	0	4,154,419	0	525,083	(55,742)	0	4,623,760

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)= 3.8% NB/I(15%)= 0.374 (3)

NPV(15%)= (9,755,741) NB/I(12%)= 0.469

NB/I(18%)= 0.304

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)= 3.8% NB/I(15%)= 0.374

NPV(15%)= (9,755,741) NB/I(12%)= 0.469

NB/I(18%)= 0.304

(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.

215

TABLE C-81

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

06-Feb-91

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	1.6	75	82	1.7	1.6	2338	1.6	1.6	2,312,504	2,222,117	90,387
1994	3.7	1.8	75	81	1.7	1.6	2521	1.6	1.6	2,492,708	2,395,329	97,380
1995	3.8	2.0	74	80	1.7	1.6	2718	1.6	1.6	2,687,957	2,574,079	113,877
1996	3.9	2.1	73	79	1.7	1.6	2932	1.6	1.6	2,899,585	2,776,702	122,883
1997	4.0	2.3	73	78	1.7	1.6	3165	1.6	1.6	3,129,056	2,996,407	132,648
1998	4.0	2.6	72	77	1.8	1.6	3417	1.6	1.6	3,530,725	3,234,726	296,000
1999	4.1	2.8	71	75	1.8	1.6	3690	1.6	1.6	3,813,097	3,493,333	319,765
2000	4.2	3.1	70	74	1.8	1.7	3987	1.6	1.6	4,119,622	3,941,265	178,357
2001	4.3	3.4	69	72	1.8	1.7	4319	1.6	1.6	4,490,299	4,263,773	226,526
2002	4.4	3.7	68	71	1.8	1.7	4681	1.6	1.6	4,859,617	4,614,481	245,136
2003	4.5	1.5	67	76	1.8	1.6	5074	1.6	1.6	5,261,381	4,784,337	477,044
2004	4.6	1.8	66	74	1.8	1.6	5503	1.6	1.6	5,698,604	5,182,043	516,561
2005	4.7	2.1	65	72	1.8	1.6	5970	1.6	1.6	6,174,592	5,615,019	559,573
2006	4.8	2.5	64	70	1.8	1.6	6479	1.6	1.6	6,692,973	6,086,567	606,407
2007	5.0	2.9	62	68	1.8	1.6	7034	1.6	1.6	7,257,730	6,656,531	601,199
2008	5.1	3.4	61	65	1.8	1.7	7640	1.6	1.6	8,234,566	7,537,567	696,999
2009	5.2	3.9	59	63	1.9	1.7	8301	1.6	1.6	9,217,633	8,180,094	1,037,538
2010	5.4	4.5	57	60	1.9	1.8	9022	1.6	1.6	10,006,348	9,575,318	431,029
2011	5.5	5.1	55	57	1.9	1.9	9810	1.6	1.6	10,866,843	10,866,843	0
2012	5.7	5.8	53	53	1.9	1.9	10671	1.6	1.6	11,805,982	11,805,982	0

(1) Benefits include passenger time savings.

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

2-76

06-Feb-9?

TABLE C-82

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

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	4.5	1.6	72	82	1.8	1.6	2338	0.3	0.3	453,161	416,647	36,514
1994	4.7	1.8	72	81	1.8	1.6	2521	0.3	0.3	488,484	449,124	39,360
1995	4.8	2.0	71	80	1.8	1.6	2718	0.3	0.3	526,756	482,640	44,116
1996	5.0	2.1	70	79	1.8	1.6	2932	0.3	0.3	572,619	520,632	51,987
1997	5.1	2.3	69	78	1.9	1.6	3165	0.3	0.3	646,256	561,826	84,429
1998	5.3	2.6	68	77	1.9	1.6	3417	0.3	0.3	697,659	606,511	91,148
1999	1.5	2.8	79	75	1.6	1.6	3690	0.3	0.3	655,000	655,000	0
2000	1.7	3.1	78	74	1.6	1.7	3987	0.3	0.3	707,636	738,987	(31,351)
2001	2.0	3.4	76	72	1.6	1.7	4319	0.3	0.3	765,556	799,457	(33,901)
2002	2.3	3.7	75	71	1.6	1.7	4681	0.3	0.3	828,542	865,215	(36,673)
2003	2.6	1.5	73	76	1.6	1.6	5074	0.3	0.3	897,063	897,063	0
2004	3.0	1.8	71	74	1.6	1.6	5503	0.3	0.3	971,633	971,633	0
2005	3.4	2.1	69	72	1.7	1.6	5970	0.3	0.3	1,108,345	1,052,816	55,528
2006	3.8	2.5	66	70	1.7	1.6	6479	0.3	0.3	1,201,406	1,141,231	60,175
2007	4.3	2.9	64	68	1.8	1.6	7034	0.3	0.3	1,360,824	1,248,100	112,725
2008	4.9	3.4	61	65	1.8	1.7	7640	0.3	0.3	1,476,231	1,413,294	62,938
2009	5.5	3.9	58	63	1.9	1.7	8301	0.3	0.3	1,728,306	1,533,768	194,538
2010	6.1	4.5	55	60	2.0	1.8	9022	0.3	0.3	1,964,982	1,795,372	169,610
2011	6.9	5.1	52	57	2.0	1.9	9810	0.3	0.3	2,133,953	2,037,533	96,420
2012	7.7	5.8	48	53	2.2	1.9	10671	0.3	0.3	2,514,316	2,213,622	300,694

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-83

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

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/ 2-3 /EH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	6.5	1.6	66	82	2.0	1.6	2338	4.2	4.2	7,006,801	5,833,058	1,173,744
1994	6.7	1.8	65	81	2.0	1.6	2521	4.2	4.2	7,552,922	6,287,737	1,265,184
1995	7.0	2.0	64	80	2.0	1.6	2718	4.2	4.2	8,144,644	6,756,958	1,387,686
1996	7.3	2.1	63	79	2.1	1.6	2932	4.2	4.2	9,230,488	7,288,842	1,941,646
1997	7.6	2.3	61	78	2.1	1.6	3165	4.2	4.2	9,961,378	7,865,569	2,095,809
1998	7.9	2.6	60	77	2.1	1.6	3417	4.2	4.2	11,090,636	8,491,156	2,599,480
1999	8.2	2.8	58	75	2.2	1.6	3690	4.2	4.2	12,596,152	9,169,998	3,426,153
2000	1.5	3.1	79	74	1.6	1.7	3987	4.2	4.2	9,906,909	10,345,820	(438,911)
2001	1.9	3.4	77	72	1.6	1.7	4319	4.2	4.2	10,717,788	11,192,404	(474,616)
2002	2.4	3.7	74	71	1.6	1.7	4681	4.2	4.2	11,599,592	12,113,013	(513,421)
2003	2.9	1.5	72	76	1.6	1.6	5074	4.2	4.2	12,558,884	12,558,884	0
2004	3.5	1.8	69	74	1.7	1.6	5503	4.2	4.2	14,320,530	13,602,862	717,668
2005	4.1	2.1	67	72	1.8	1.6	5970	4.2	4.2	16,208,303	14,739,425	1,468,879
2006	4.8	2.5	64	70	1.8	1.6	6479	4.2	4.2	17,569,055	15,977,238	1,591,817
2007	5.6	2.9	60	68	1.8	1.6	7034	4.2	4.2	19,925,955	17,473,394	2,452,561
2008	6.5	3.4	57	65	2.0	1.7	7640	4.2	4.2	23,353,396	19,786,113	3,567,283
2009	7.5	3.9	53	63	2.1	1.7	8301	4.2	4.2	26,599,243	21,472,747	5,126,495
2010	8.6	4.5	49	60	2.3	1.8	9022	4.2	4.2	31,240,346	25,135,211	6,105,135
2011	9.5	5.1	45	57	2.4	1.9	9810	4.2	4.2	35,645,958	28,525,464	7,120,494
2012	9.5	5.8	44	53	2.4	1.9	10671	4.2	4.2	38,732,955	30,990,703	7,742,252

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-84

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

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 FROJ	W/ PROJ	(W/ 2-3W VEH)	W/O PROJ	W/ PROJ	W/O PROJ	W/ PROJ	BENEFITS
1993	3.7	1.6	75	82	0.0	0.0	0	1.6	1.6	0	0	0
1994	3.7	1.8	75	81	0.0	0.0	0	1.6	1.6	0	0	0
1995	3.8	2.0	74	80	0.0	0.0	0	1.6	1.6	0	0	0
1996	3.9	2.1	73	79	0.0	0.0	0	1.6	1.6	0	0	0
1997	4.0	2.3	73	78	0.0	0.0	0	1.6	1.6	0	0	0
1998	4.0	2.6	72	77	0.0	0.0	0	1.6	1.6	0	0	0
1999	4.1	2.8	71	75	0.0	0.0	0	1.6	1.6	0	0	0
2000	4.2	3.1	70	74	0.0	0.0	0	1.6	1.6	0	0	0
2001	4.3	3.4	69	72	0.0	0.0	0	1.6	1.6	0	0	0
2002	4.4	3.7	68	71	0.0	0.0	0	1.6	1.6	0	0	0
2003	4.5	1.5	67	76	0.0	0.0	0	1.6	1.6	0	0	0
2004	4.6	1.8	66	74	0.0	0.0	0	1.6	1.6	0	0	0
2005	4.7	2.1	65	72	0.0	0.0	0	1.6	1.6	0	0	0
2006	4.8	2.5	64	70	0.0	0.0	0	1.6	1.6	0	0	0
2007	5.0	2.9	62	68	0.0	0.0	0	1.6	1.6	0	0	0
2008	5.1	3.4	61	65	0.0	0.0	0	1.6	1.6	0	0	0
2009	5.2	3.9	59	63	0.0	0.0	0	1.6	1.6	0	0	0
2010	5.4	4.5	57	60	0.0	0.0	0	1.6	1.6	0	0	0
2011	5.5	5.1	55	57	0.0	0.0	0	1.6	1.6	0	0	0
2012	5.7	5.8	53	53	0.0	0.0	0	1.6	1.6	0	0	0

(1) Benefits include passenger time savings.

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

TABLE C-85

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: RBAG-PAJO ALTERNATIVE: AC

06-Feb-91

YEAR	ROUGHNESS (m/km) W/O PROJ	ROUGHNESS (m/km) W/ PROJ	SPEED (km/h)(2) W/O PROJ	SPEED (km/h)(2) W/ PROJ	TRFFC MIX AVG UNIT USR CST W/O PROJ	TRFFC MIX AVG UNIT USR CST W/ PROJ	AADT (W/ 2-3W VEH)	LENGTH (km) W/O PROJ	LENGTH (km) W/ PROJ	TOTAL USER COST W/O PROJ	TOTAL USER COST W/ PROJ	YEARLY BENEFITS
1993	4.5	1.6	72	82	0.0	0.0	0	0.3	0.3	0	0	0
1994	4.7	1.8	72	81	0.0	0.0	0	0.3	0.3	0	0	0
1995	4.8	2.0	71	80	0.0	0.0	0	0.3	0.3	0	0	0
1996	5.0	2.1	70	79	0.0	0.0	0	0.3	0.3	0	0	0
1997	5.1	2.3	69	78	0.0	0.0	0	0.3	0.3	0	0	0
1998	5.3	2.6	68	77	0.0	0.0	0	0.3	0.3	0	0	0
1999	1.5	2.8	79	75	0.0	0.0	0	0.3	0.3	0	0	0
2000	1.7	3.1	78	74	0.0	0.0	0	0.3	0.3	0	0	0
2001	2.0	3.4	76	72	0.0	0.0	0	0.3	0.3	0	0	0
2002	2.3	3.7	75	71	0.0	0.0	0	0.3	0.3	0	0	0
2003	2.6	1.5	73	76	0.0	0.0	0	0.3	0.3	0	0	0
2004	3.0	1.8	71	74	0.0	0.0	0	0.3	0.3	0	0	0
2005	3.4	2.1	69	72	0.0	0.0	0	0.3	0.3	0	0	0
2006	3.8	2.5	66	70	0.0	0.0	0	0.3	0.3	0	0	0
2007	4.3	2.9	64	68	0.0	0.0	0	0.3	0.3	0	0	0
2008	4.9	3.4	61	65	0.0	0.0	0	0.3	0.3	0	0	0
2009	5.5	3.9	58	63	0.0	0.0	0	0.3	0.3	0	0	0
2010	6.1	4.5	55	60	0.0	0.0	0	0.3	0.3	0	0	0
2011	6.9	5.1	52	57	0.0	0.0	0	0.3	0.3	0	0	0
2012	7.7	5.8	48	53	0.0	0.0	0	0.3	0.3	0	0	0

(1) Benefits include passenger time savings.

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

280

06-Feb-91

TABLE C-86

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

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	6.5	1.6	66	82	0.0	0.0	0	4.2	4.2	0	0	0
1994	6.7	1.8	65	81	0.0	0.0	0	4.2	4.2	0	0	0
1995	7.0	2.0	64	80	0.0	0.0	0	4.2	4.2	0	0	0
1996	7.3	2.1	63	79	0.0	0.0	0	4.2	4.2	0	0	0
1997	7.6	2.3	61	78	0.0	0.0	0	4.2	4.2	0	0	0
1998	7.9	2.6	60	77	0.0	0.0	0	4.2	4.2	0	0	0
1999	8.2	2.8	58	75	0.0	0.0	0	4.2	4.2	0	0	0
2000	1.5	3.1	79	74	0.0	0.0	0	4.2	4.2	0	0	0
2001	1.9	3.4	77	72	0.0	0.0	0	4.2	4.2	0	0	0
2002	2.4	3.7	74	71	0.0	0.0	0	4.2	4.2	0	0	0
2003	2.9	1.5	72	76	0.0	0.0	0	4.2	4.2	0	0	0
2004	3.5	1.8	69	74	0.0	0.0	0	4.2	4.2	0	0	0
2005	4.1	2.1	67	72	0.0	0.0	0	4.2	4.2	0	0	0
2006	4.8	2.5	64	70	0.0	0.0	0	4.2	4.2	0	0	0
2007	5.6	2.9	60	68	0.0	0.0	0	4.2	4.2	0	0	0
2008	6.5	3.4	57	65	0.0	0.0	0	4.2	4.2	0	0	0
2009	7.5	3.9	53	63	0.0	0.0	0	4.2	4.2	0	0	0
2010	8.6	4.5	49	60	0.0	0.0	0	4.2	4.2	0	0	0
2011	9.5	5.1	45	57	0.0	0.0	0	4.2	4.2	0	0	0
2012	9.5	5.8	44	53	0.0	0.0	0	4.2	4.2	0	0	0

(1) Benefits include passenger time savings.

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

TABLE C-87

06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

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	1.6	75	82	1.7	1.6	512	1.6	1.6	506,146	486,330	9,908
1994	3.7	1.8	75	81	1.7	1.6	568	1.6	1.6	561,822	539,826	10,998
1995	3.8	2.0	74	80	1.7	1.6	631	1.6	1.6	623,622	597,256	13,183
1996	3.9	2.1	73	79	1.7	1.6	700	1.6	1.6	692,220	662,954	14,633
1997	4.0	2.3	73	78	1.7	1.6	777	1.6	1.6	768,365	735,879	16,243
1998	4.0	2.6	72	77	1.8	1.6	863	1.6	1.6	891,314	816,826	37,244
1999	4.1	2.8	71	75	1.8	1.6	957	1.6	1.6	989,359	906,677	41,341
2000	4.2	3.1	70	74	1.8	1.7	1063	1.6	1.6	1,098,188	1,050,839	23,675
2001	4.3	3.4	69	72	1.8	1.7	1180	1.6	1.6	1,228,771	1,166,431	31,170
2002	4.4	3.7	68	71	1.8	1.7	1309	1.6	1.6	1,363,936	1,294,739	34,598
2003	4.5	1.5	67	76	1.8	1.6	1453	1.6	1.6	1,513,969	1,376,399	68,785
2004	4.6	1.8	66	74	1.8	1.6	1613	1.6	1.6	1,680,505	1,527,803	76,351
2005	4.7	2.1	65	72	1.8	1.6	1791	1.6	1.6	1,865,361	1,695,861	84,750
2006	4.8	2.5	64	70	1.8	1.6	1988	1.6	1.6	2,070,550	1,882,406	94,072
2007	5.0	2.9	62	68	1.8	1.6	2206	1.6	1.6	2,298,311	2,108,433	94,939
2008	5.1	3.4	61	65	1.9	1.7	2449	1.6	1.6	2,667,718	2,442,721	112,498
2009	5.2	3.9	59	63	1.9	1.7	2718	1.6	1.6	3,064,506	2,711,421	176,543
2010	5.4	4.5	57	60	1.9	1.8	3017	1.6	1.6	3,401,601	3,255,019	73,291
2011	5.5	5.1	55	57	1.9	1.9	3349	1.6	1.6	3,775,778	3,775,778	0
2012	5.7	5.8	53	53	1.9	1.9	3718	1.6	1.6	4,191,113	4,191,113	0

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-88

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

YEAR	ROUGHNESS (m/km) W/O PROJ	ROUGHNESS (m/km) W/ PROJ	SPEED (km/h)(2) W/O PROJ	SPEED (km/h)(2) W/ PROJ	TRFFC MIX AVG UNIT USR CST W/O PROJ	TRFFC MIX AVG UNIT USR CST W/ PROJ	AADT (W/ 2-3W VEH)	LENGTH (km) W/O PROJ	LENGTH (km) W/ PROJ	TOTAL USER COST W/O PROJ	TOTAL USER COST W/ PROJ	YEARLY BENEFITS
1993	4.5	1.6	72	82	1.8	1.6	512	0.3	0.3	99,178	91,187	3,996
1994	4.7	1.8	72	81	1.8	1.6	568	0.3	0.3	110,088	101,217	4,435
1995	4.8	2.0	71	80	1.8	1.6	631	0.3	0.3	122,198	111,986	5,106
1996	5.0	2.1	70	79	1.8	1.6	700	0.3	0.3	136,728	124,304	6,212
1997	5.1	2.3	69	78	1.9	1.6	777	0.3	0.3	158,704	137,977	10,363
1998	5.3	2.6	68	77	1.9	1.6	863	0.3	0.3	176,162	153,155	11,503
1999	1.5	2.8	79	75	1.6	1.6	957	0.3	0.3	170,002	170,002	0
2000	1.7	3.1	78	74	1.6	1.7	1063	0.3	0.3	188,702	197,032	(4,165)
2001	2.0	3.4	76	72	1.6	1.7	1180	0.3	0.3	209,459	218,706	(4,623)
2002	2.3	3.7	75	71	1.6	1.7	1309	0.3	0.3	232,500	242,764	(5,132)
2003	2.6	1.5	73	76	1.6	1.6	1453	0.3	0.3	258,075	258,075	0
2004	3.0	1.8	71	74	1.6	1.6	1613	0.3	0.3	286,463	286,463	0
2005	3.4	2.1	69	72	1.7	1.6	1791	0.3	0.3	334,893	317,974	8,460
2006	3.8	2.5	66	70	1.7	1.6	1988	0.3	0.3	371,731	352,951	9,390
2007	4.3	2.9	64	68	1.8	1.6	2206	0.3	0.3	430,933	395,331	17,801
2008	4.9	3.4	61	65	1.8	1.7	2449	0.3	0.3	478,336	458,010	16,163
2009	5.5	3.9	58	63	1.9	1.7	2718	0.3	0.3	574,595	508,391	33,102
2010	6.1	4.5	55	60	2.0	1.8	3017	0.3	0.3	667,991	610,316	28,837
2011	6.9	5.1	52	57	2.0	1.9	3349	0.3	0.3	741,470	707,958	16,756
2012	7.7	5.8	48	53	2.2	1.9	3718	0.3	0.3	890,247	785,834	52,207

(1) Benefits include passenger time savings.

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

TABLE C-89 06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

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	6.5	1.6	66	82	2.0	1.6	512	4.2	4.2	1,533,537	1,276,615	128,461
1994	6.7	1.8	65	81	2.0	1.6	568	4.2	4.2	1,702,226	1,417,043	142,592
1995	7.0	2.0	64	80	2.0	1.6	631	4.2	4.2	1,889,471	1,567,797	160,837
1996	7.3	2.1	63	79	2.1	1.6	700	4.2	4.2	2,203,074	1,740,255	231,410
1997	7.6	2.3	61	78	2.1	1.6	777	4.2	4.2	2,445,412	1,931,683	256,865
1998	7.9	2.6	60	77	2.1	1.6	863	4.2	4.2	2,805,633	2,144,168	330,733
1999	8.2	2.8	58	75	2.2	1.6	957	4.2	4.2	3,275,488	2,380,026	447,731
2000	1.5	3.1	79	74	1.6	1.7	1063	4.2	4.2	2,641,829	2,758,453	(58,312)
2001	1.9	3.4	77	72	1.6	1.7	1180	4.2	4.2	2,932,430	3,061,883	(64,726)
2002	2.4	3.7	74	71	1.6	1.7	1309	4.2	4.2	3,254,998	3,398,690	(71,846)
2003	2.9	1.5	72	76	1.6	1.6	1453	4.2	4.2	3,613,048	3,613,048	0
2004	3.5	1.8	69	74	1.7	1.6	1613	4.2	4.2	4,223,878	4,010,483	106,697
2005	4.1	2.1	67	72	1.8	1.6	1791	4.2	4.2	4,896,572	4,451,636	222,468
2006	4.8	2.5	64	70	1.8	1.6	1988	4.2	4.2	5,435,195	4,941,316	246,939
2007	5.6	2.9	60	68	1.9	1.6	2206	4.2	4.2	6,308,792	5,534,636	387,078
2008	6.5	3.4	57	65	2.0	1.7	2449	4.2	4.2	7,590,191	6,412,143	589,024
2009	7.5	3.9	53	63	2.1	1.7	2718	4.2	4.2	8,842,675	7,117,479	862,598
2010	8.6	4.5	49	60	2.3	1.8	3017	4.2	4.2	10,587,830	8,544,425	1,021,702
2011	9.5	5.1	45	57	2.4	1.9	3349	4.2	4.2	12,336,609	9,911,416	1,212,597
2012	9.5	5.8	44	53	2.4	1.9	3718	4.2	4.2	13,693,636	11,001,672	1,345,982

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-90

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

YEAR	ROUGHNESS (m/km) W/O PROJ	ROUGHNESS (m/km) W/ PROJ	UNIT RTN MNT COST W/O PROJ	UNIT RTN MNT COST W/ PROJ	UNIT PRDC MAINT. COST W/O PROJ	UNIT PRDC MAINT. COST W/ PROJ	LENGTH (km) W/O PROJ	LENGTH (km) W/ PROJ	TOTAL MAINT. COST W/O PROJ	TOTAL MAINT. COST W/ PROJ	YEARLY BENEFITS
1993	3.7	1.6	30,000	38,600	0	0	1.6	1.6	48,000	61,760	(13,760)
1994	3.7	1.8	30,000	38,600	0	0	1.6	1.6	48,000	61,760	(13,760)
1995	3.8	2.0	30,000	38,600	0	0	1.6	1.6	48,000	61,760	(13,760)
1996	3.9	2.1	30,000	38,600	0	0	1.6	1.6	48,000	61,760	(13,760)
1997	4.0	2.3	30,000	38,600	0	0	1.6	1.6	48,000	61,760	(13,760)
1998	4.0	2.6	33,010	38,600	0	0	1.6	1.6	52,816	61,760	(8,944)
1999	4.1	2.8	33,010	38,600	0	0	1.6	1.6	52,816	61,760	(8,944)
2000	4.2	3.1	33,010	38,600	0	0	1.6	1.6	52,816	61,760	(8,944)
2001	4.3	3.4	33,010	38,600	0	116,500	1.6	1.6	52,816	248,160	(195,344)
2002	4.4	3.7	33,010	38,600	0	0	1.6	1.6	52,816	61,760	(8,944)
2003	4.5	1.5	33,010	38,600	0	1,569,073	1.6	1.6	52,816	2,572,277	(2,519,461)
2004	4.6	1.8	33,010	38,600	0	0	1.6	1.6	52,816	61,760	(8,944)
2005	4.7	2.1	33,010	38,600	0	0	1.6	1.6	52,816	61,760	(8,944)
2006	4.8	2.5	33,010	38,600	0	0	1.6	1.6	52,816	61,760	(8,944)
2007	5.0	2.9	33,010	38,600	0	0	1.6	1.6	52,816	61,760	(8,944)
2008	5.1	3.4	33,010	38,600	0	0	1.6	1.6	52,816	61,760	(8,944)
2009	5.2	3.9	33,010	38,600	0	116,500	1.6	1.6	52,816	248,160	(195,344)
2010	5.4	4.5	33,010	39,350	0	0	1.6	1.6	52,816	62,960	(10,144)
2011	5.5	5.1	33,010	39,350	0	0	1.6	1.6	52,816	62,960	(10,144)
2012	5.7	5.8	33,010	39,350	0	0	1.6	1.6	52,816	62,960	(10,144)

285

TABLE C-91

06-Feb-91

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

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	4.5	1.6	29,710	38,600	0	0	0.3	0.3	8,913	11,580	(2,667)
1994	4.7	1.8	29,710	38,600	0	0	0.3	0.3	8,913	11,580	(2,667)
1995	4.8	2.0	29,710	38,600	0	0	0.3	0.3	8,913	11,580	(2,667)
1996	5.0	2.1	29,710	38,600	0	0	0.3	0.3	8,913	11,580	(2,667)
1997	5.1	2.3	29,710	38,600	0	0	0.3	0.3	8,913	11,580	(2,667)
1998	5.3	2.6	29,710	38,600	0	0	0.3	0.3	8,913	11,580	(2,667)
1999	1.5	2.8	28,960	38,600	1,569,073	0	0.3	0.3	479,410	11,580	467,830
2000	1.7	3.1	28,960	38,600	0	0	0.3	0.3	8,688	11,580	(2,892)
2001	2.0	3.4	28,960	38,600	116,500	116,500	0.3	0.3	43,638	46,530	(2,892)
2002	2.3	3.7	28,960	38,600	0	0	0.3	0.3	8,688	11,580	(2,892)
2003	2.6	1.5	28,960	38,600	0	1,569,073	0.3	0.3	8,688	482,302	(473,614)
2004	3.0	1.8	28,960	38,600	0	0	0.3	0.3	8,688	11,580	(2,892)
2005	3.4	2.1	28,960	38,600	0	0	0.3	0.3	8,688	11,580	(2,892)
2006	3.8	2.5	28,960	38,600	0	0	0.3	0.3	8,688	11,580	(2,892)
2007	4.3	2.9	29,710	38,600	0	0	0.3	0.3	8,913	11,580	(2,667)
2008	4.9	3.4	29,710	38,600	0	0	0.3	0.3	8,913	11,580	(2,667)
2009	5.5	3.9	29,710	38,600	116,500	116,500	0.3	0.3	43,863	46,530	(2,667)
2010	6.1	4.5	32,260	39,350	0	0	0.3	0.3	9,678	11,805	(2,127)
2011	6.9	5.1	32,260	39,350	0	0	0.3	0.3	9,678	11,805	(2,127)
2012	7.7	5.8	32,260	39,350	0	0	0.3	0.3	9,678	11,805	(2,127)

286

11-Feb-91

TABLE C-92

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: AC

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	6.5	1.6	32,260	38,600	0	0	4.2	4.2	135,492	162,120	(26,628)
1994	6.7	1.8	32,260	38,600	0	0	4.2	4.2	135,492	162,120	(26,628)
1995	7.0	2.0	32,260	38,600	0	0	4.2	4.2	135,492	162,120	(26,628)
1996	7.3	2.1	32,260	38,600	0	0	4.2	4.2	135,492	162,120	(26,628)
1997	7.6	2.3	32,260	38,600	0	0	4.2	4.2	135,492	162,120	(26,628)
1998	7.9	2.6	32,260	38,600	0	0	4.2	4.2	135,492	162,120	(26,628)
1999	8.2	2.8	37,560	38,600	0	0	4.2	4.2	157,752	162,120	(4,368)
2000	1.5	3.1	28,960	38,600	1,601,206	0	4.2	4.2	6,846,697	162,120	6,684,577
2001	1.9	3.4	28,960	38,600	116,500	116,500	4.2	4.2	610,932	651,420	(40,488)
2002	2.4	3.7	28,960	38,600	0	0	4.2	4.2	121,632	162,120	(40,488)
2003	2.9	1.5	28,960	38,600	0	1,601,206	4.2	4.2	121,632	6,887,185	(6,765,553)
2004	3.5	1.8	28,960	38,600	0	0	4.2	4.2	121,632	162,120	(40,488)
2005	4.1	2.1	29,710	38,600	0	0	4.2	4.2	124,782	162,120	(37,338)
2006	4.8	2.5	29,710	38,600	0	0	4.2	4.2	124,782	162,120	(37,338)
2007	5.6	2.9	29,710	38,600	0	0	4.2	4.2	124,782	162,120	(37,338)
2008	6.5	3.4	32,260	38,600	0	0	4.2	4.2	135,492	162,120	(26,628)
2009	7.5	3.9	32,260	38,400	116,500	116,500	4.2	4.2	624,792	651,420	(26,628)
2010	8.6	4.5	37,560	39,350	0	0	4.2	4.2	157,752	165,270	(7,518)
2011	9.5	5.1	37,560	39,350	0	0	4.2	4.2	157,752	165,270	(7,518)
2012	9.5	5.8	37,560	39,350	0	0	4.2	4.2	157,752	165,270	(7,518)

TABLE C-93 11-Feb-91

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: MACTAN CIRC. SECTION: RBAG-PAJO ALTERNATIVE: AC

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	6,939,600	0	0	0	0	0	(6,939,600)
1992	10,409,400	0	0	0	0	0	(10,409,400)
1993	0	1,300,645	0	142,365	(43,055)	0	1,399,955
1994	0	1,401,924	0	158,025	(43,055)	0	1,516,894
1995	0	1,545,679	0	179,126	(43,055)	0	1,681,750
1996	0	2,116,517	0	252,255	(43,055)	0	2,325,717
1997	0	2,312,887	0	283,471	(43,055)	0	2,553,302
1998	0	2,986,627	0	379,480	(38,239)	0	3,327,869
1999	0	3,745,918	0	489,072	454,518	0	4,689,508
2000	0	(291,905)	0	(38,802)	6,672,741	0	6,342,034
2001	0	(281,991)	0	(38,180)	(238,724)	0	(558,895)
2002	0	(304,958)	0	(42,379)	(52,324)	0	(399,661)
2003	0	477,044	0	68,785	(9,758,628)	0	(9,212,799)
2004	0	1,234,228	0	183,048	(52,324)	0	1,364,953
2005	0	2,083,980	0	315,677	(49,174)	0	2,350,483
2006	0	2,258,398	0	350,402	(49,174)	0	2,559,626
2007	0	3,166,485	0	499,818	(48,949)	0	3,617,353
2008	0	4,327,219	0	711,685	(38,239)	0	5,000,665
2009	0	6,358,572	0	1,072,242	(224,639)	0	7,206,175
2010	0	6,705,774	0	1,123,831	(19,789)	0	7,809,815
2011	0	7,216,913	0	1,229,353	(19,789)	0	8,426,477
2012	0	8,042,946	0	1,398,189	(19,789)	0	9,421,346

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)= 11.1% NB/I(15%)= 0.737 (3)

NPV(15%)= (3,257,103) NB/I(12%)= 0.929

NB/I(18%)= 0.603

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)= 11.1% NB/I(15%)= 0.737

NPV(15%)= (3,257,103) NB/I(12%)= 0.929

NB/I(18%)= 0.603

(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.

06-Feb-91

TABLE C-94

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFF (1)

PROJECT: MACTAN CIRC. SECTION: 68AG-PAJO 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	75	80	1.7	1.6	2338	1.6	1.6	2,312,504	2,222,117	90,387
1994	3.7	2.1	75	80	1.7	1.6	2521	1.6	1.6	2,492,708	2,387,140	105,568
1995	3.8	2.1	74	79	1.7	1.6	2718	1.6	1.6	2,687,957	2,574,079	113,877
1996	3.9	2.1	73	79	1.7	1.6	2932	1.6	1.6	2,899,585	2,776,702	122,883
1997	4.0	2.2	73	78	1.7	1.6	3165	1.6	1.6	3,129,056	2,996,407	132,648
1998	4.0	2.2	72	78	1.8	1.6	3417	1.6	1.6	3,530,725	3,234,726	296,000
1999	4.1	2.3	71	77	1.8	1.6	3690	1.6	1.6	3,813,097	3,493,333	319,765
2000	4.2	2.3	70	76	1.8	1.6	3987	1.6	1.6	4,119,622	3,774,060	345,562
2001	4.3	2.3	69	75	1.8	1.6	4319	1.6	1.6	4,490,299	4,082,967	407,332
2002	4.4	2.4	68	74	1.8	1.6	4681	1.6	1.6	4,859,617	4,418,892	440,725
2003	4.5	2.4	67	73	1.8	1.6	5074	1.6	1.6	5,261,381	4,784,337	477,044
2004	4.6	2.5	66	72	1.8	1.6	5503	1.6	1.6	5,698,604	5,182,043	516,561
2005	4.7	2.5	65	71	1.8	1.6	5970	1.6	1.6	6,174,592	5,615,019	559,573
2006	4.8	2.6	64	70	1.8	1.6	6479	1.6	1.6	6,692,973	6,086,567	606,407
2007	5.0	2.6	62	69	1.8	1.6	7034	1.6	1.6	7,257,730	6,656,531	601,199
2008	5.1	2.7	61	67	1.8	1.6	7640	1.6	1.6	8,234,566	7,221,260	1,013,306
2009	5.2	2.8	59	66	1.9	1.6	8301	1.6	1.6	9,217,633	7,836,975	1,380,657
2010	5.4	2.8	57	64	1.9	1.6	9022	1.6	1.6	10,006,348	8,508,520	1,497,827
2011	5.5	2.9	55	62	1.9	1.6	9810	1.6	1.6	10,866,843	9,241,214	1,625,630
2012	5.7	2.9	53	60	1.9	1.6	10671	1.6	1.6	11,805,982	10,040,901	1,765,081

(1) Benefits include passenger time savings.

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

TABLE C-95

06-Feb-91

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BRAG-PAJO 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	4.5	2.0	72	80	1.8	1.6	2338	0.3	0.3	453,161	416,647	36,514
1994	4.7	2.1	72	80	1.8	1.6	2521	0.3	0.3	488,484	447,589	40,895
1995	4.8	2.1	71	79	1.8	1.6	2718	0.3	0.3	526,756	482,640	44,116
1996	5.0	2.1	70	79	1.8	1.6	2932	0.3	0.3	572,619	520,632	51,987
1997	5.1	2.2	69	78	1.9	1.6	3165	0.3	0.3	646,256	561,826	84,429
1998	5.3	2.2	68	78	1.9	1.6	3417	0.3	0.3	697,659	606,511	91,148
1999	1.5	2.3	79	77	1.6	1.6	3690	0.3	0.3	655,000	655,000	0
2000	1.7	2.3	78	76	1.6	1.6	3987	0.3	0.3	707,636	707,636	0
2001	2.0	2.3	76	75	1.6	1.6	4319	0.3	0.3	765,556	765,556	0
2002	2.3	2.4	75	74	1.6	1.6	4681	0.3	0.3	828,542	828,542	0
2003	2.6	2.4	73	73	1.6	1.6	5074	0.3	0.3	897,063	897,063	0
2004	3.0	2.5	71	72	1.6	1.6	5503	0.3	0.3	971,633	971,633	0
2005	3.4	2.5	69	71	1.7	1.6	5970	0.3	0.3	1,108,345	1,052,816	55,528
2006	3.8	2.6	66	70	1.7	1.6	6479	0.3	0.3	1,201,406	1,141,231	60,175
2007	4.3	2.6	64	69	1.8	1.6	7034	0.3	0.3	1,360,824	1,248,100	112,725
2008	4.9	2.7	61	67	1.8	1.6	7640	0.3	0.3	1,476,231	1,353,986	122,245
2009	5.5	2.8	58	66	1.9	1.6	8301	0.3	0.3	1,728,306	1,469,433	258,873
2010	6.1	2.8	55	64	2.0	1.6	9022	0.3	0.3	1,964,982	1,595,348	369,634
2011	6.9	2.9	52	62	2.0	1.6	9810	0.3	0.3	2,133,953	1,732,728	401,225
2012	7.7	2.9	48	60	2.2	1.6	10671	0.3	0.3	2,514,316	1,882,669	631,647

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-96

VEHICLE OPERATING COST SAVINGS: NORMAL TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km) W/O PROJ	ROUGHNESS (m/km) W/ PROJ	SPEED (km/h)(2) W/O PROJ	SPEED (km/h)(2) W/ PROJ	TRFFC MIX AVG UNIT USR CST W/O PROJ	TRFFC MIX AVG UNIT USR CST W/ PROJ	AADT (W/ 2-3W VEH)	LENGTH (km) W/O PROJ	LENGTH (km) W/ PROJ	TOTAL USER COST W/O PROJ	TOTAL USER COST W/ PROJ	YEARLY BENEFITS
1993	6.5	2.0	66	80	2.0	1.6	2338	4.2	4.2	7,006,801	5,833,058	1,173,744
1994	6.7	2.1	65	80	2.0	1.6	2521	4.2	4.2	7,552,922	6,266,244	1,286,678
1995	7.0	2.1	64	79	2.0	1.6	2713	4.2	4.2	8,144,644	6,756,958	1,387,686
1996	7.3	2.1	63	79	2.1	1.6	2932	4.2	4.2	9,230,488	7,288,842	1,941,646
1997	7.6	2.2	61	78	2.1	1.6	3165	4.2	4.2	9,961,378	7,865,569	2,095,809
1998	7.9	2.2	60	78	2.1	1.6	3417	4.2	4.2	11,090,636	8,491,156	2,599,480
1999	8.2	2.3	58	77	2.2	1.6	3690	4.2	4.2	12,596,152	9,169,998	3,426,153
2000	1.5	2.3	79	75	1.6	1.6	3987	4.2	4.2	9,906,909	9,906,909	0
2001	1.9	2.3	77	75	1.6	1.6	4319	4.2	4.2	10,717,788	10,717,788	0
2002	2.4	2.4	74	74	1.6	1.6	4681	4.2	4.2	11,599,592	11,599,592	0
2003	2.9	2.4	72	73	1.6	1.6	5074	4.2	4.2	12,558,884	12,558,884	0
2004	3.5	2.5	69	72	1.7	1.6	5503	4.2	4.2	14,320,530	13,602,862	717,668
2005	4.1	2.5	67	71	1.8	1.6	5970	4.2	4.2	16,208,303	14,739,425	1,468,879
2006	4.8	2.6	64	70	1.8	1.6	6479	4.2	4.2	17,569,055	15,977,238	1,591,817
2007	5.6	2.6	60	69	1.8	1.6	7034	4.2	4.2	19,925,955	17,473,394	2,452,561
2008	6.5	2.7	57	67	2.0	1.6	7640	4.2	4.2	23,353,396	18,955,807	4,397,590
2009	7.5	2.8	53	66	2.1	1.6	8301	4.2	4.2	26,599,243	20,572,060	6,027,182
2010	8.6	2.8	49	64	2.3	1.6	9022	4.2	4.2	31,240,346	22,334,866	8,905,480
2011	9.5	2.9	45	62	2.4	1.6	9810	4.2	4.2	35,645,958	24,258,136	11,387,772
2012	9.5	2.9	44	60	2.4	1.6	10671	4.2	4.2	38,732,955	26,357,366	12,375,589

(1) Benefits include passenger time savings.

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

TABLE C-97

06-Feb-91

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO 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	75	80	0.0	0.0	0	1.6	1.6	0	0	0
1994	3.7	2.1	75	80	0.0	0.0	0	1.6	1.6	0	0	0
1995	3.8	2.1	74	79	0.0	0.0	0	1.6	1.6	0	0	0
1996	3.9	2.1	73	79	0.0	0.0	0	1.6	1.6	0	0	0
1997	4.0	2.2	73	78	0.0	0.0	0	1.6	1.6	0	0	0
1998	4.0	2.2	72	78	0.0	0.0	0	1.6	1.6	0	0	0
1999	4.1	2.3	71	77	0.0	0.0	0	1.6	1.6	0	0	0
2000	4.2	2.3	70	76	0.0	0.0	0	1.6	1.6	0	0	0
2001	4.3	2.3	69	75	0.0	0.0	0	1.6	1.6	0	0	0
2002	4.4	2.4	68	74	0.0	0.0	0	1.6	1.6	0	0	0
2003	4.5	2.4	67	73	0.0	0.0	0	1.6	1.6	0	0	0
2004	4.6	2.5	66	72	0.0	0.0	0	1.6	1.6	0	0	0
2005	4.7	2.5	65	71	0.0	0.0	0	1.6	1.6	0	0	0
2006	4.8	2.6	64	70	0.0	0.0	0	1.6	1.6	0	0	0
2007	5.0	2.6	62	69	0.0	0.0	0	1.6	1.6	0	0	0
2008	5.1	2.7	61	67	0.0	0.0	0	1.6	1.6	0	0	0
2009	5.2	2.8	59	66	0.0	0.0	0	1.6	1.6	0	0	0
2010	5.4	2.8	57	64	0.0	0.0	0	1.6	1.6	0	0	0
2011	5.5	2.9	55	62	0.0	0.0	0	1.6	1.6	0	0	0
2012	5.7	2.9	53	60	0.0	0.0	0	1.6	1.6	0	0	0

(1) Benefits include passenger time savings.

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

06-Feb-91

TABLE C-98

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO 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	4.5	2.0	72	80	0.0	0.0	0	0.3	0.3	0	0	0
1994	4.7	2.1	72	80	0.0	0.0	0	0.3	0.3	0	0	0
1995	4.8	2.1	71	79	0.0	0.0	0	0.3	0.3	0	0	0
1996	5.0	2.1	70	79	0.0	0.0	0	0.3	0.3	0	0	0
1997	5.1	2.2	69	78	0.0	0.0	0	0.3	0.3	0	0	0
1998	5.3	2.2	68	78	0.0	0.0	0	0.3	0.3	0	0	0
1999	1.5	2.3	79	77	0.0	0.0	0	0.3	0.3	0	0	0
2000	1.7	2.3	78	76	0.0	0.0	0	0.3	0.3	0	0	0
2001	2.0	2.3	76	75	0.0	0.0	0	0.3	0.3	0	0	0
2002	2.3	2.4	75	74	0.0	0.0	0	0.3	0.3	0	0	0
2003	2.6	2.4	73	73	0.0	0.0	0	0.3	0.3	0	0	0
2004	3.0	2.5	71	72	0.0	0.0	0	0.3	0.3	0	0	0
2005	3.4	2.5	69	71	0.0	0.0	0	0.3	0.3	0	0	0
2006	3.8	2.6	66	70	0.0	0.0	0	0.3	0.3	0	0	0
2007	4.3	2.6	64	69	0.0	0.0	0	0.3	0.3	0	0	0
2008	4.9	2.7	61	67	0.0	0.0	0	0.3	0.3	0	0	0
2009	5.5	2.8	58	66	0.0	0.0	0	0.3	0.3	0	0	0
2010	6.1	2.8	55	64	0.0	0.0	0	0.3	0.3	0	0	0
2011	6.9	2.9	52	62	0.0	0.0	0	0.3	0.3	0	0	0
2012	7.7	2.9	48	60	0.0	0.0	0	0.3	0.3	0	0	0

(1) Benefits include passenger time savings.

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

TABLE C-99

VEHICLE OPERATING COST SAVINGS: DIVERTED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: PCC

06-Feb-91

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	6.5	2.0	66	80	0.0	0.0	0	4.2	4.2	0	0	0
1994	6.7	2.1	65	80	0.0	0.0	0	4.2	4.2	0	0	0
1995	7.0	2.1	64	79	0.0	0.0	0	4.2	4.2	0	0	0
1996	7.3	2.1	63	79	0.0	0.0	0	4.2	4.2	0	0	0
1997	7.6	2.2	61	78	0.0	0.0	0	4.2	4.2	0	0	0
1998	7.9	2.2	60	78	0.0	0.0	0	4.2	4.2	0	0	0
1999	8.2	2.3	58	77	0.0	0.0	0	4.2	4.2	0	0	0
2000	1.5	2.3	79	76	0.0	0.0	0	4.2	4.2	0	0	0
2001	1.9	2.3	77	75	0.0	0.0	0	4.2	4.2	0	0	0
2002	2.4	2.4	74	74	0.0	0.0	0	4.2	4.2	0	0	0
2003	2.9	2.4	72	73	0.0	0.0	0	4.2	4.2	0	0	0
2004	3.5	2.5	69	72	0.0	0.0	0	4.2	4.2	0	0	0
2005	4.1	2.5	67	71	0.0	0.0	0	4.2	4.2	0	0	0
2006	4.8	2.6	64	70	0.0	0.0	0	4.2	4.2	0	0	0
2007	5.6	2.6	60	69	0.0	0.0	0	4.2	4.2	0	0	0
2008	6.5	2.7	57	67	0.0	0.0	0	4.2	4.2	0	0	0
2009	7.5	2.8	53	66	0.0	0.0	0	4.2	4.2	0	0	0
2010	8.6	2.8	49	64	0.0	0.0	0	4.2	4.2	0	0	0
2011	9.5	2.9	45	62	0.0	0.0	0	4.2	4.2	0	0	0
2012	9.5	2.9	44	60	0.0	0.0	0	4.2	4.2	0	0	0

(1) Benefits include passenger time savings.

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

TABLE C-100 06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO 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	75	80	1.7	1.6	512	1.6	1.6	506,146	486,330	9,908
1994	3.7	2.1	75	80	1.7	1.6	568	1.6	1.6	561,822	538,068	11,877
1995	3.8	2.1	74	79	1.7	1.6	631	1.6	1.6	623,622	597,256	13,183
1996	3.9	2.1	73	79	1.7	1.6	700	1.6	1.6	692,220	662,954	14,633
1997	4.0	2.2	73	78	1.7	1.6	777	1.6	1.6	768,365	735,879	16,243
1998	4.0	2.2	72	78	1.8	1.6	863	1.6	1.6	891,314	816,826	37,244
1999	4.1	2.3	71	77	1.8	1.6	957	1.6	1.6	989,359	906,677	41,341
2000	4.2	2.3	70	76	1.8	1.6	1063	1.6	1.6	1,098,188	1,006,411	45,889
2001	4.3	2.3	69	75	1.8	1.6	1180	1.6	1.6	1,228,771	1,117,116	55,827
2002	4.4	2.4	68	74	1.8	1.6	1309	1.6	1.6	1,363,936	1,239,999	61,968
2003	4.5	2.4	67	73	1.8	1.6	1453	1.6	1.6	1,513,969	1,376,399	68,785
2004	4.6	2.5	66	72	1.8	1.6	1613	1.6	1.6	1,680,505	1,527,803	76,351
2005	4.7	2.5	65	71	1.8	1.6	1791	1.6	1.6	1,865,361	1,695,861	84,750
2006	4.8	2.6	64	70	1.8	1.6	1988	1.6	1.6	2,070,550	1,882,406	94,072
2007	5.0	2.6	62	69	1.8	1.6	2206	1.6	1.6	2,298,311	2,108,433	94,939
2008	5.1	2.7	61	67	1.9	1.6	2449	1.6	1.6	2,667,718	2,340,360	163,679
2009	5.2	2.8	59	66	1.9	1.6	2718	1.6	1.6	3,064,506	2,597,800	233,353
2010	5.4	2.8	57	64	1.9	1.6	3017	1.6	1.6	3,401,601	2,883,558	259,022
2011	5.5	2.9	55	62	1.9	1.6	3349	1.6	1.6	3,775,778	3,200,749	287,514
2012	5.7	2.9	53	60	1.9	1.6	3718	1.6	1.6	4,191,113	3,552,832	319,141

(1) Benefits include passenger time savings.

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

TABLE C-101

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

06-Feb-91

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO 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	4.5	2.0	72	80	1.8	1.6	512	0.3	0.3	99,178	91,187	3,996
1994	4.7	2.1	72	80	1.8	1.6	568	0.3	0.3	110,088	100,888	4,600
1995	4.8	2.1	71	79	1.8	1.6	631	0.3	0.3	122,198	111,986	5,106
1996	5.0	2.1	70	79	1.8	1.6	700	0.3	0.3	136,728	124,304	6,212
1997	5.1	2.2	69	78	1.9	1.6	777	0.3	0.3	158,704	137,977	10,363
1998	5.3	2.2	68	78	1.9	1.6	863	0.3	0.3	176,162	153,155	11,503
1999	1.5	2.3	79	77	1.6	1.6	957	0.3	0.3	170,002	170,002	0
2000	1.7	2.3	78	76	1.6	1.6	1063	0.3	0.3	188,702	188,702	0
2001	2.0	2.3	76	75	1.6	1.6	1180	0.3	0.3	209 459	209,459	0
2002	2.3	2.4	75	74	1.6	1.6	1309	0.3	0.3	232,500	232,500	0
2003	2.6	2.4	73	73	1.6	1.6	1453	0.3	0.3	258,075	258,075	0
2004	3.0	2.5	71	72	1.6	1.6	1613	0.3	0.3	286,463	286,463	0
2005	3.4	2.5	69	71	1.7	1.6	1791	0.3	0.3	334,893	317,974	8,460
2006	3.8	2.6	66	70	1.7	1.6	1988	0.3	0.3	371,731	352,951	9,390
2007	4.3	2.6	64	69	1.8	1.6	2206	0.3	0.3	430,933	395,331	17,801
2008	4.9	2.7	61	67	1.8	1.6	2449	0.3	0.3	478,336	438,818	19,759
2009	5.5	2.8	58	66	1.9	1.6	2718	0.3	0.3	574,595	487,088	43,754
2010	6.1	2.8	55	64	2.0	1.6	3017	0.3	0.3	667,991	540,667	63,662
2011	6.9	2.9	52	62	2.0	1.6	3349	0.3	0.3	741,470	600,141	70,665
2012	7.7	2.9	48	60	2.2	1.6	3718	0.3	0.3	890,247	666,156	112,046

(1) Benefits include passenger time savings.

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

296

TABLE C-102 06-Feb-91

VEHICLE OPERATING COST SAVINGS: GENERATED TRAFFIC (1)

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO 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	6.5	2.0	66	80	2.0	1.6	512	4.2	4.2	1,533,537	1,276,615	128,461
1994	6.7	2.1	65	80	2.0	1.6	568	4.2	4.2	1,702,226	1,412,430	144,898
1995	7.0	2.1	64	79	2.0	1.6	631	4.2	4.2	1,889,471	1,567,797	160,837
1996	7.3	2.1	63	79	2.1	1.6	700	4.2	4.2	2,203,074	1,740,255	231,410
1997	7.6	2.2	61	73	2.1	1.6	777	4.2	4.2	2,445,412	1,931,683	256,865
1998	7.9	2.2	60	78	2.1	1.6	863	4.2	4.2	2,805,633	2,144,168	330,733
1999	8.2	2.3	58	77	2.2	1.6	957	4.2	4.2	3,275,488	2,380,026	447,731
2000	1.5	2.3	79	76	1.6	1.6	1063	4.2	4.2	2,641,829	2,641,829	0
2001	1.9	2.3	77	75	1.6	1.6	1180	4.2	4.2	2,932,430	2,932,430	0
2002	2.4	2.4	74	74	1.6	1.6	1309	4.2	4.2	3,254,998	3,254,998	0
2003	2.9	2.4	72	73	1.6	1.6	1453	4.2	4.2	3,613,048	3,613,046	0
2004	3.5	2.5	69	72	1.7	1.6	1613	4.2	4.2	4,223,878	4,010,483	106,697
2005	4.1	2.5	67	71	1.8	1.6	1791	4.2	4.2	4,896,572	4,451,636	222,468
2006	4.8	2.6	64	70	1.8	1.6	1988	4.2	4.2	5,435,195	4,941,316	246,939
2007	5.6	2.6	60	69	1.9	1.6	2206	4.2	4.2	6,308,792	5,534,636	387,078
2008	6.5	2.7	57	67	2.0	1.6	2449	4.2	4.2	7,590,191	6,143,446	723,372
2009	7.5	2.8	53	66	2.1	1.6	2718	4.2	4.2	8,842,675	6,819,225	1,011,725
2010	8.6	2.8	49	64	2.3	1.6	3017	4.2	4.2	10,587,830	7,569,346	1,509,265
2011	9.5	2.9	45	62	2.4	1.6	3349	4.2	4.2	12,336,609	8,401,967	1,967,321
2012	9.5	2.9	44	60	2.4	1.6	3718	4.2	4.2	13,693,636	9,326,184	2,183,726

(1) Benefits include passenger time savings.

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

TABLE C-103

ECONOMIC MAINTENANCE COST SAVINGS

06-Feb-91

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO 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	39,640	0	0	1.6	1.6	48,000	63,424	(15,424)
1994	3.7	2.1	30,000	39,640	0	0	1.6	1.6	48,000	63,424	(15,424)
1995	3.8	2.1	30,000	39,640	0	0	1.6	1.6	48,000	63,424	(15,424)
1996	3.9	2.1	30,000	39,640	0	0	1.6	1.6	48,000	63,424	(15,424)
1997	4.0	2.2	30,000	39,640	0	0	1.6	1.6	48,000	63,424	(15,424)
1998	4.0	2.2	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
1999	4.1	2.3	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2000	4.2	2.3	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2001	4.3	2.3	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2002	4.4	2.4	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2003	4.5	2.4	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2004	4.6	2.5	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2005	4.7	2.5	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2006	4.8	2.6	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2007	5.0	2.6	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2008	5.1	2.7	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2009	5.2	2.8	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2010	5.4	2.8	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2011	5.5	2.9	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)
2012	5.7	2.9	33,010	39,640	0	0	1.6	1.6	52,816	63,424	(10,608)

TABLE C-104 06-Feb-91

ECONOMIC MAINTENANCE COST SAVINGS

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO 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	4.5	2.0	29,710	39,640	0	0	0.3	0.3	8,913	11,892	(2,979)
1994	4.7	2.1	29,710	39,640	0	0	0.3	0.3	8,913	11,892	(2,979)
1995	4.8	2.1	29,710	39,640	0	0	0.3	0.3	8,913	11,892	(2,979)
1996	5.0	2.1	29,710	39,640	0	0	0.3	0.3	8,913	11,892	(2,979)
1997	5.1	2.2	29,710	39,640	0	0	0.3	0.3	8,913	11,892	(2,979)
1998	5.3	2.2	29,710	39,640	0	0	0.3	0.3	8,913	11,892	(2,979)
1999	1.5	2.3	28,960	39,640	1,569,073	0	0.3	0.3	479,410	11,892	467,518
2000	1.7	2.3	28,960	39,640	0	0	0.3	0.3	8,688	11,892	(3,204)
2001	2.0	2.3	28,960	39,640	116,500	0	0.3	0.3	43,638	11,892	31,746
2002	2.3	2.4	28,960	39,640	0	0	0.3	0.3	8,688	11,892	(3,204)
2003	2.6	2.4	28,960	39,640	0	0	0.3	0.3	8,688	11,892	(3,204)
2004	3.0	2.5	28,960	39,640	0	0	0.3	0.3	8,688	11,892	(3,204)
2005	3.4	2.5	28,960	39,640	0	0	0.3	0.3	8,688	11,892	(3,204)
2006	3.8	2.6	28,960	39,640	0	0	0.3	0.3	8,688	11,892	(3,204)
2007	4.3	2.6	29,710	39,640	0	0	0.3	0.3	8,913	11,892	(2,979)
2008	4.9	2.7	29,710	39,640	0	0	0.3	0.3	8,913	11,892	(2,979)
2009	5.5	2.8	29,710	39,640	116,500	0	0.3	0.3	43,863	11,892	31,971
2010	6.1	2.8	32,260	39,640	0	0	0.3	0.3	9,678	11,892	(2,214)
2011	6.9	2.9	32,260	39,640	0	0	0.3	0.3	9,678	11,892	(2,214)
2012	7.7	2.9	32,260	39,640	0	0	0.3	0.3	9,678	11,892	(2,214)

TABLE C-105

ECONOMIC MAINTENANCE COST SAVINGS

06-Feb-91

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO ALTERNATIVE: PCC

YEAR	ROUGHNESS (m/km) W/O PROJ	ROUGHNESS (m/km) W/ PROJ	UNIT RTN MNT COST W/O PROJ	UNIT RTN MNT COST W/ PROJ	UNIT PRDC MAINT. COST W/O PROJ	UNIT PRDC MAINT. COST W/ PROJ	LENGTH (km) W/O PROJ	LENGTH (km) W/ PROJ	TOTAL MAINT. COST W/O PROJ	TOTAL MAINT. COST W/ PROJ	YEARLY BENEFITS
1993	6.5	2.0	32,260	39,640	0	0	4.2	4.2	135,492	166,488	(30,996)
1994	6.7	2.1	32,260	39,640	0	0	4.2	4.2	135,492	166,488	(30,996)
1995	7.0	2.1	32,260	39,640	0	0	4.2	4.2	135,492	166,488	(30,996)
1996	7.3	2.1	32,260	39,640	0	0	4.2	4.2	135,492	166,488	(30,996)
1997	7.6	2.2	32,260	39,640	0	0	4.2	4.2	135,492	166,488	(30,996)
1998	7.9	2.2	32,260	39,640	0	0	4.2	4.2	135,492	166,488	(30,996)
1999	8.2	2.3	37,560	39,640	0	0	4.2	4.2	157,752	166,488	(8,736)
2000	1.5	2.3	28,960	39,640	1,569,073	0	4.2	4.2	6,711,739	166,488	6,545,251
2001	1.9	2.3	28,960	39,640	116,500	0	4.2	4.2	610,932	166,488	444,444
2002	2.4	2.4	28,960	39,640	0	0	4.2	4.2	121,632	166,488	(44,856)
2003	2.9	2.4	28,960	39,640	0	0	4.2	4.2	121,632	166,488	(44,856)
2004	3.5	2.5	28,960	39,640	0	0	4.2	4.2	121,632	166,488	(44,856)
2005	4.1	2.5	29,710	39,640	0	0	4.2	4.2	124,782	166,488	(41,706)
2006	4.8	2.6	29,710	39,640	0	0	4.2	4.2	124,782	166,488	(41,706)
2007	5.6	2.6	29,710	39,640	0	0	4.2	4.2	124,782	166,488	(41,706)
2008	6.5	2.7	32,260	39,640	0	0	4.2	4.2	135,492	166,488	(30,996)
2009	7.5	2.8	32,260	39,640	116,500	0	4.2	4.2	624,792	166,488	458,304
2010	8.6	2.8	37,560	39,640	0	0	4.2	4.2	157,752	166,488	(8,736)
2011	9.5	2.9	37,560	39,640	0	0	4.2	4.2	157,752	166,488	(8,736)
2012	9.5	2.9	37,560	39,640	0	0	4.2	4.2	157,752	166,488	(8,736)

200

TABLE C-106 06-Feb-91

ECONOMIC BENEFITS AND FEASIBILITY RATIOS

PROJECT: MACTAN CIRC. SECTION: BBAG-PAJO 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	11,435,600	0	0	0	0	0	(11,435,600)
1992	17,153,400	0	0	0	0	0	(17,153,400)
1993	0	1,300,645	0	142,365	(49,399)	0	1,393,611
1994	0	1,433,141	0	161,375	(49,399)	0	1,545,117
1995	0	1,545,679	0	179,126	(49,399)	0	1,675,406
1996	0	2,116,517	0	252,255	(49,399)	0	2,319,373
1997	0	2,312,887	0	283,471	(49,399)	0	2,546,958
1998	0	2,986,527	0	379,480	(44,583)	0	3,321,525
1999	0	3,745,918	0	489,072	448,174	0	4,683,164
2000	0	345,562	0	45,889	6,531,439	0	6,922,889
2001	0	407,332	0	55,827	465,582	0	928,742
2002	0	440,725	0	61,968	(58,668)	0	444,025
2003	0	477,044	0	68,785	(58,668)	0	487,161
2004	0	1,234,228	0	183,048	(58,668)	0	1,358,609
2005	0	2,083,980	0	315,677	(55,518)	0	2,344,139
2006	0	2,258,398	0	350,402	(55,518)	0	2,553,282
2007	0	3,166,485	0	499,818	(55,293)	0	3,611,009
2008	0	5,533,141	0	906,810	(44,583)	0	6,395,368
2009	0	7,666,712	0	1,288,832	479,667	0	9,435,211
2010	0	10,772,942	0	1,831,928	(21,558)	0	12,583,312
2011	0	13,414,627	0	2,325,500	(21,558)	0	15,718,569
2012	0	14,772,317	0	2,614,912	(21,558)	0	17,365,671

ECONOMIC INDICES INCLUDING DVLPMNT BNFTS:

IRR(%)=	9.6%	NB/I(15%)=	0.600 (3)
NPV(15%)=	(8,153,941)	NB/I(12%)=	0.786
		NB/I(18%)=	0.474

ECONOMIC INDICES EXCLUDING DVLPMNT BNFTS:

IRR(%)=	9.6%	NB/I(15%)=	0.600
NPV(15%)=	(8,153,941)	NB/I(12%)=	0.786
		NB/I(18%)=	0.474

(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.