社会開発調査部報告書

JAPAN INTERNATIONAL COOPERATION AGENCY

NO. 2

MINISTRY OF COMMUNICATIONS,
WORKS AND PUBLIC UTILITIES, GRENADA

THE FEASIBILITY STUDY
ON
ROAD REHABILITATION AND IMPROVEMENT
IN
GRENADA

FINAL REPORT

EXECUTIVE SUMMARY

JANUARY 1998

KATAHIRA & ENGINEERS INTERNATIONAL

The exchange rates applied in this Study are:

US$ 1.0 =	*EC$*	*2.67*
US$ 1.0 =	*JP¥*	*120.00*
EC$ 1.0 =	*JP¥*	*44.94*

(As of October 1997)

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PREFACE

In response to a request from the Government of Grenada, the Government of Japan decided to conduct "The Feasibility Study on Road Rehabilitation and Improvement in Grenada" and entrusted it to Japan International Cooperation Agency (JICA).

JICA sent a study team headed by Mr. Tsuneo Bekki, Katahira & Engineers International to Grenada, at three different times between March 1997 and January 1998.

The team held discussions with the officials concerned of the Government of Grenada, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials of the Government of Grenada concerned with the project for their close cooperation extended to the team.

January 1998

Kimio Fujita
President
Japan International Cooperation Agency

SUMMARY

Background and Objective

The internal transport system in Grenada depends mainly on the road network. The country has a network of all-weather roads totaling about 950 kilometers, of which 30% are paved. There are three main roads in the island and numerous secondary roads branch from the three main roads. Most of these secondary roads, which have the function of connecting communities together, are in poor condition. Rehabilitation of these main and secondary roads is yet to receive enough external financial support.

The objective of the Study is to evaluate the relative priority of the following Study Roads and to carry out a feasibility study on high priority roads.

Grenada:		
R-1	Grand Etang Road	20.5 km
R-2	Morne Jaloux	3.3
R-3	Perdmontemps / St. David's	7.2
R-4	Mt. Gay / Springs	6.0
R-5	Eastern Main Road (EMR) - Grenville /Sauteurs	16.0
R-6	Paraclete / Mt. Horne	3.2
Carriacou:		
R-7	Dover (Windward / Cherryhill)	3.1 km

Future Traffic Demand (vehicle/day)

Road	2005	2025
Grand Etang Road	6,194	8,257
Morne Jaloux	1,478	2,243
Perdmontemps / St. David's	325	433
Mt. Gay / Springs	4,657	6,482
EMR (Grenville / Sauteurs)	2,490	3,254
Paraclete / Mt. Horne	946	1,434
Dover (Windward / Cherryhill)	698	931

Selection of Project Roads

In order to select Project Roads for the Feasibility Study out of the seven Study Roads, a criteria was established based on the technical, environmental and economic factors related to the improvement and rehabilitation of the Study Roads.

Three ranking levels were concluded and roads selected for the Feasibility Study are those under the high rankings of "1" and "2".

R-1:	Grand Etang Road	Rank "1"
R-2:	Morne Jaloux Road	Rank "2"
R-4:	Mt. Gay / Springs Road	Rank "1"
R-5:	EMR (Grenville /Sauteurs)	Rank "2"

In addition, the design of a permanent bridge for the only other temporary Bailey bridge (Vineyard Bridge) on R-3, was added to the Project.

Main Improvement Measures on Project Roads

Road	Alignment	Widening	Pavement	Bridge	Drainage	Slope	Safety Facilities
R-1	- Providing safe stopping sight distance	Widening - Cut Slope 1,730m - Embankment 600m	-AC Overlay 5cm -AC Pavement Reconstruction for bad and widening sections	Beaulieu: 1-lane widening Birch Grove: 1-lane new construction Balhazzar: 2-lane reconstruction St Cyr Greatriver: 2-lane new construction	- Reconstruction of all side ditch - Extension of cross drainage	- River protection 600m - Cut slope 1,730m for widening section	Standard road safety devices
R-2	None	None	Same as R-1	None	Same as R-1	None	Same as R-1
R-4	- Widening urban narrow section - Standard width for rural roads	Widening - Cut slope 2,880m - Embankment 2,750m	Same as R-1	Tempe: 1-lane widening	Same as R-1	- Cut slope 2,880m and embankment 2,750m for widening section	Same as R-1
R-5	- Widening urban narrow section - Standard width for rural roads	Widening - Cut slope 4,600m - Embankment 2,300m	Same as R-1	Dunfermiline: 1-lane widening, scouring protection Pointe Field: 2-lane reconstruction Madeys: 2-lane reconst.	Same as R-1	- Cut slope 4,600m and embankment 2,300m for widening section	Same as R-1

Improvement Work Quantities

Item		Unit	Total
Earthwork	Excavation/Embank.	m3	41,706
	Back Fill	m3	7,830
	Scarification	m2	27,891
Pavement	Sub-base Course	m3	13,247
	Asphalt Conc. Hot Mix	ton	47,071
Retaining Wall	RW-M (H = 2 – 5 m)	m	1,596
Drainage	Side Ditch	m	31,623
	RCPC	m	100
	RCBC	m	15
Bridge Construction	New Const. 2-Lane	No.	5
	New Const. 1-Lane	No.	1
	Widening	No.	3
	Rehabilitation	No.	1
Incidental Construction	Safety Facilities	LS	4
	Concrete Blocks	m	27,200

Economic Analysis

The Project, in total, shows high viability with the economic indicators of:

- B / C 2.28
- EIRR % 25.25
- NPV (EC$) 70,651,948

Implementation Program

The total investment required is MEC$ 52.6 which is divided into four years of implementation with a highest annual investment of MEC$ 26.0. Other administrative and physical contingency costs are estimated as MEC$ 7.1. In a proposed four years framework, the detailed design stage is expected to be completed by the end of 1st year and construction by mid of 4th year.

Project Evaluation

Technically: The Project is feasible with the normal methods to international standards.

Economically: The Project is feasible with a high Economic Internal Rate of Return.

Financially: The Project can be accomplished within a reasonable budgetary framework in accordance with proposed implementation plan.

Environmentally: The Project is supportive for the WID issue and acceptable in both natural and socioeconomic environmental view points.

Annual Investment (MEC$)

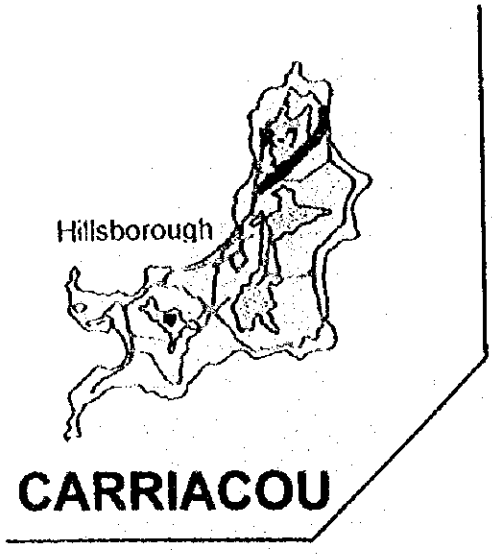
Item \ year	1st	2nd	3rd	4th	Total
Construction	-	5.60	24.51	13.73	43.74
Engineering	2.62	0.33	1.47	0.82	5.24
ROW	1.10	0.73	-	-	1.83
Resettlement	1.07	0.72	-	-	1.79
Total	4.79	7.28	25.98	14.55	52.60

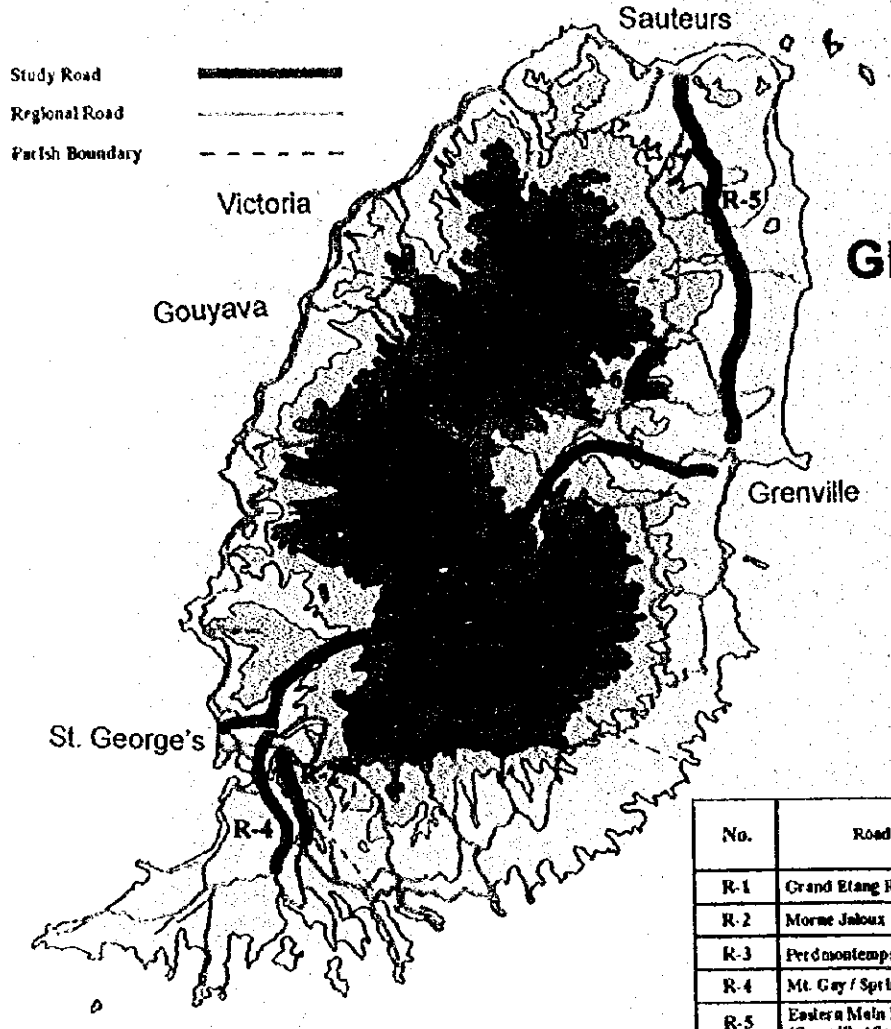
Conclusions and Recommendations

The four Study Roads play the most important role in the transportation system of Grenada. Three of the roads (R-5, R-1 & R-4) form the Trans-Grenada Highway, connecting most regions of the island. The forth road (R-2) is a tourist-oriented Sky-Line diversion road where urban traffic is congested in the center of St. George's. The roads, however, suffer from various problems such as sub-standard geometric design, progressive deterioration of pavement, winding alignment with narrow width, dilapidated bridges with structural deficiencies, inadequate drainage systems, resulting in poor riding quality, reduced traffic safety and increased transportation cost.

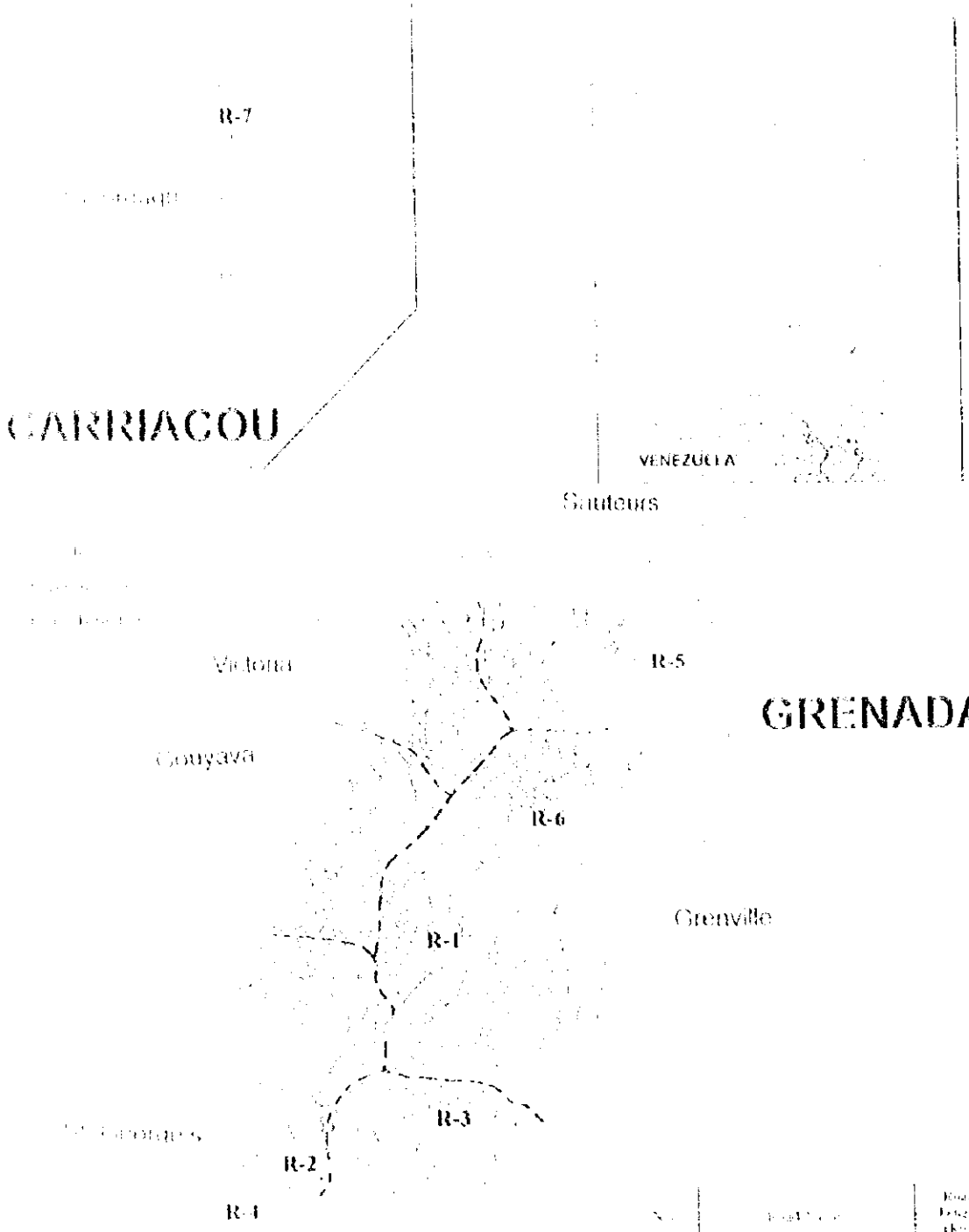
It is therefore urgent that the Project be implemented to provide a safe and reliable means of transportation, thereby stimulate the positive activation of peoples' activities, and contribute to the socioeconomic development of the country. The main recommendations of the Study are:

1. The Project should be implemented at the earliest possible time as justified in the different aspects of the Study.
2. Mitigation measures of environmental impact should be applied to minimize any adverse environmental impacts.
3. A New Highway Functional Classification should be established in accordance with the highways role and functionality and based on the adopted international standards.
4. An Advanced Road Maintenance Technology should be developed through the Project implementation activities and by procuring new equipment to be used first in Project construction and then for maintenance.





No.	Road Name	Road Length (Km)
R-1	Grand Etang Road	20.5
R-2	Morne Jaloux	3.2
R-3	Perdmontemps / St. Davids	7.7
R-4	Mt. Gay / Springs	8.0
R-5	Eastern Main Road (Grenville / Sauteurs)	16.0
R-6	Paradise / Mt. Horne	3.2
R-7	Dover (Windward / Cherryhill)	3.2



LOCATION MAP

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INTRODUCTION

BACKGROUND

The internal transport system in Grenada depends mainly on the road network. The country has a network of all-weather roads totaling about 950 kilometers, of which 30% are paved. There are three main roads in the island and numerous secondary roads branch from the three main roads. Most of these secondary roads, which have the function of connecting communities together, are in poor condition. Rehabilitation of these main and secondary roads is yet to receive enough external financial support.

The urgent problem to be addressed currently is the rapid deterioration of main and secondary roads due to a combination of weakness in the pavement structures, drainage facilities, under-estimation of the growth in traffic volumes, concessions regarding the quality of construction materials and inadequate maintenance. In addition, incentives given to manufacturing and agro-industrial sectors with a reduction of import duties on motor vehicles have resulted in an increase of motor vehicles imported from 1991.

Recent budgetary constraints resulting from the economic decline caused the postponement of periodic road maintenance interventions. This policy has taken its toll mainly on secondary roads which are essential in supporting the further development of the main sectors of tourism, agriculture and manufacturing, as well as the improvement in quality of life of the people in rural communities. Therefore, one of the key actions identified in the Public Sector Investment Program (PSIP, 1992-96) is a major rehabilitation of the economic and social infrastructure with a high priority on the rehabilitation of the road network.

In response to the request of the Government of Grenada, the Government of Japan has decided to conduct "The Feasibility Study on Road Rehabilitation and Improvement in Grenada" and entrusted the Study to the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the technical assistance programs, to undertake it in close cooperation with the authorities in Grenada.

JICA has organized and dispatched a Study Team consisting of eight experts from Katahira & Engineers International, headed by Mr. Tsuneo Bekki, to carry out the Study which has a time frame of about 10 months from the end of March 1997 to January 1998.

OBJECTIVES OF THE STUDY

The objective of the Study is to evaluate the relative priority of the Study Roads and to carry out a feasibility study on high priority roads.

STUDY ROADS

The Study covers the following seven roads:

Grenada:		
R-1	Grand Etang Road	20.5 km
R-2	Morne Jaloux	3.3
R-3	Perdmontemps / St. David's	7.2
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Carriacou:		
R-7	Dover (Windward / Cherryhill)	3.1 km

REPORTS

The following reports were prepared during the course of the Study:

- Inception Report – April 1997
- Progress Report – June 1997
- Interim Report – July 1997
- Draft Final Report – November 1997
- Final Report – January 1998

PHYSICAL PROFILE

TOPOGRAPHY

Grenada consists of three main islands and many smaller islands. The largest island is Grenada with an area of 312 km², followed by Carriacou with 34 km² and Petite Matinique with 2.3 km².

Grenada Island is characterized by rugged mountainous terrain and a more subdued rolling terrain on the coastal periphery. The principal peak, Mount St. Catherine (840 m), rises in the northern half of the island as the center of a massif surrounded by lessor peaks and ridges. From these central mountains the level descends fairly regularly to the sea. The rolling coastal terrain is probably due to fluviatile and mass movement processes removing material from elevated areas and depositing that material in the lowlands.

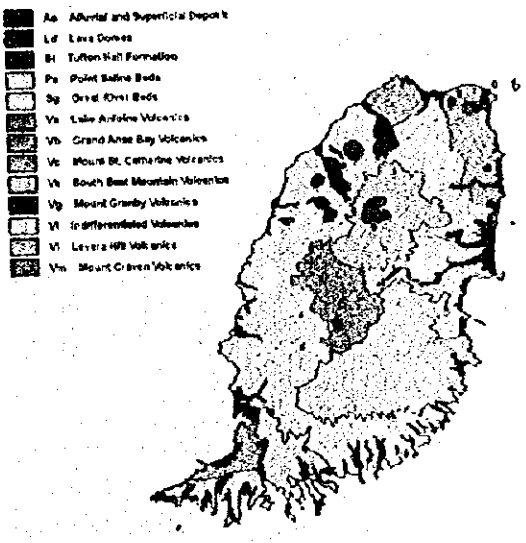
GEOLOGY

Grenada is located near the edge of the Caribbean Tectonic Plate. The geological history of Grenada began approximately 38 million years ago in the upper Eocene Period and continued in the Oligocene Period with the sedimentary deposit known as the Tufton Hall Formation. The last volcanic structures are 12,000 years old. The islands are volcanic and soils are predominantly clay-loam but clays and sandy-loam exist.

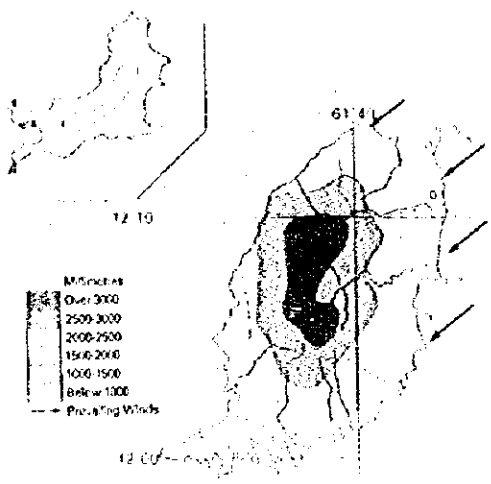
The Caribbean Plate is bounded by the North American Plate to the north and east, the South American Plate to the south and the Cocos Plate to the west and Southwest.

CLIMATE

Grenada belongs to the tropical zone and precipitation on Grenada Island is recorded between 2,000 and 4,000 mm in average a year. There is a dry season that runs from January to May. Precipitation concentrates during the rainy season which starts in June and continues until November. In St. George's in January the average daily high temperature is 30°C, while the low average is 21°C. In July the average daily high is 31°C while the low average is 25°C. During the rainy season, June to November, rainfall average's 22 days a month in St. George's and the mean relative humidity is 78%. In the driest months, January to April, there is measurable rainfall 12 days a month and the humidity averages 71%. Annual rainfall is about 1,500 mm in St. George's and more than 3,000 mm in the Grand Etang rainforest.



GEOLOGY



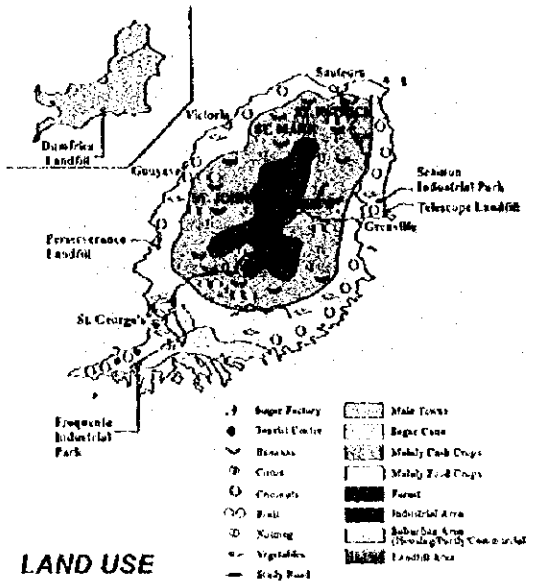
AVERAGE ANNUAL RAINFALL

SOCIOECONOMIC FRAMEWORK

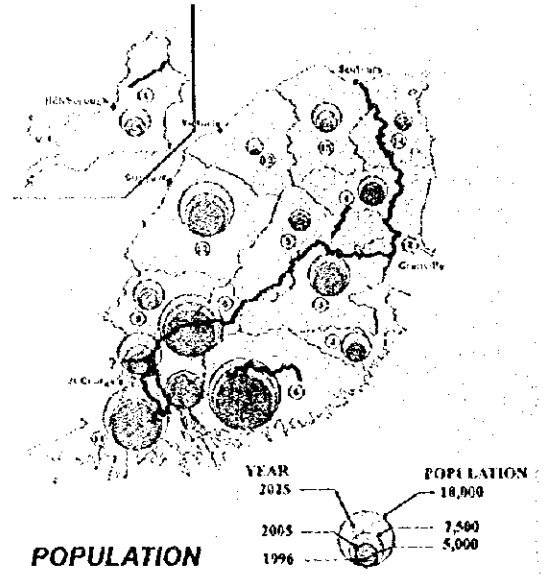
LANDUSE

Agriculture is the most important sector for Grenada's economy as agricultural products held a share of about 70% of domestic exports and about 60% of the land in Grenada Island is agricultural land. As is the case in most territories in the region, mixed cultivation is the normal practice as an insurance against the unpredictable drop in prices of export crops. Initially cocoa, banana and nutmeg were the most important tree crops, later followed by coconuts, limes and spices. Sugar cane is one of the main products which is grown in the southern areas in the vicinity of sugar factories where most of the cane is processed into sugar.

The urban area totals 8.76 km^2 which is composed of downtown commercial areas of 2.35 km^2, suburban housing areas of 6.39 km^2 and small industrial areas of only 0.02 km^2. The business area in the town is mainly offices, retail and restaurants and it occupies about 60 % of St. George's. There are three general industrial areas in Grenada, which include the Frequente Industrial Park and surrounding area, the Mt. Gay area and the Seamoon Industrial Park. Most all of the rain forest falls within the Grand Etang Forest Reserve with an area of about 39.66 km^2. The area is divided into the very tall rain forest and the lower montane formation. The woodland forest has a little economic value and consists partly of land which is unsuitable for agriculture.



LAND USE



POPULATION

POPULATION

The population of Grenada is around 100 thousand, of which 95 % live on Grenada Island and most of the others live on Carriacou Island. The major population centers are located at the capital city, St. George's in the southwest, Grenville on the east-central coast and Sauteurs in the north. The country is divided into seven parishes and is further divided into 15 electoral zones. This electoral zoning system is used as traffic zones in this Study. The population in the electoral zones vary from 4.4 thousand (St. Mark's) to 10.3 thousand (St. David's).

The average increase of national population in the 1990's was 0.7% per annum. Regarding the zonal population base, all zones of St. George's excluding St. George's Northwest attracted social migration in the country and Carriacou lose residents, however, the increase and decrease of residents extends to a range below 4%.

FUTURE POPULATION

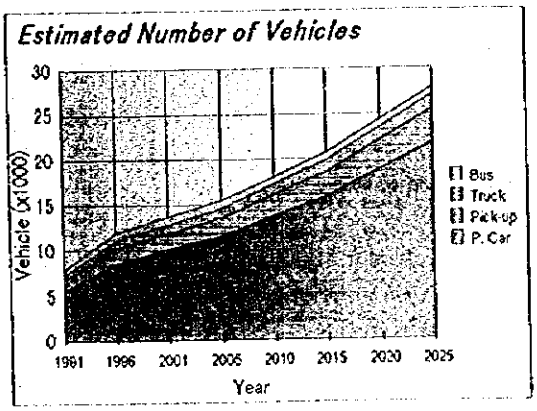
Statistics of the last 7 years shows -2.6% of growth ratio of live births and -0.5% of growth ratio of deaths, and 0.7% of growth a year of population. The number of births in 1996 was 2,096, and deaths was 782, therefore 1,314 was the increase of gross population. However, the increase of population from the year 1995 was 400, which means the net emigration was 914 persons. The ceiling of population saturation is definitely existing because Grenada is a small island.

Without significant changes in the economic environment, the said framework should not change and significant economic change in the population growth is not foreseen.

VEHICLE OWNERSHIP

Data of registration of vehicles is only available at the national level. Vehicles by Parish and by electoral zone are estimated from generated trips of electoral zones in the OD matrices. Ratios of increase of vehicles are around 9% in the 1990's and the highest increase in ratio is shown by Buses while the lowest is for Pick-ups.

In the Parish base, 52% of vehicles are found to be in St. George's and St. Andrew's follows with 21%. As for the public transportation services, private operators are carrying out their services by microbuses along routes of large demand.



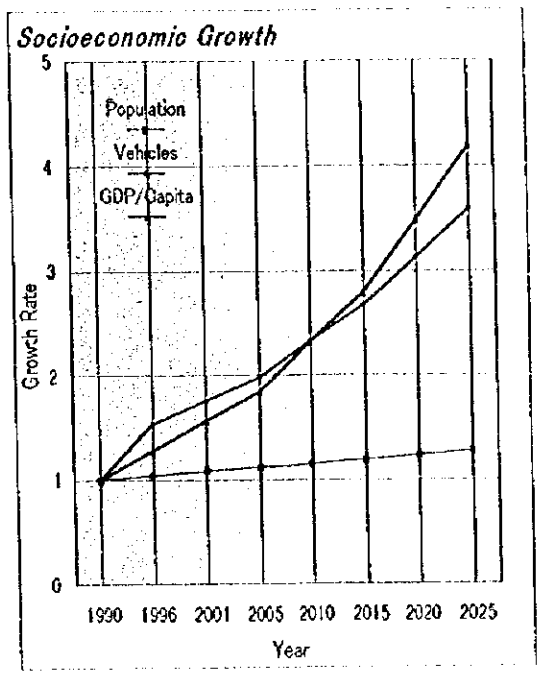
ECONOMIC GROWTH

Economic activities are characterized as a typical island economy with Agriculture and Tourism as the significant sources of foreign currency earning. The growth of the economy is low but steady and the growth rate of the GDP in the 1990s was 2.2%.

In the sectorial distribution of GDP, the Transport and Communication sector shows 23.4% which is followed by the Government Services at 16.3%. Tourism shows a growth of 9.0%, which is located between the Agriculture (9.7%) and Construction (8.2%) sectors.

The most remarkable area in the economic performance was the decline of Government Services by -4.4% in share and of Agriculture by -5.2%. The GDP per Capita at current prices show an average growth of 4.2% in the 1990's and it was 2,985 US$ in 1996.

With a steady growth in population, the growth in car ownership is expected to increase at a higher rate than the average growth in GDP/Capita up to the year 2010.



ROAD NETWORK

PRESENT NETWORK

Most of the Inner island passenger and freight transport movements are burdened to the road sector. The country has a network of all-weather roads totaling more than 950 kilometers of which 30% are paved.

The road network includes a few main roads of about 120 kilometers length in total in addition to other secondary and tertiary roads which connect communities and agriculture lands together. Some radial local networks of roads have been developed to transport farm products. Many of the minor roads have been paved at one time but the surface has become deteriorated due to lack of maintenance.

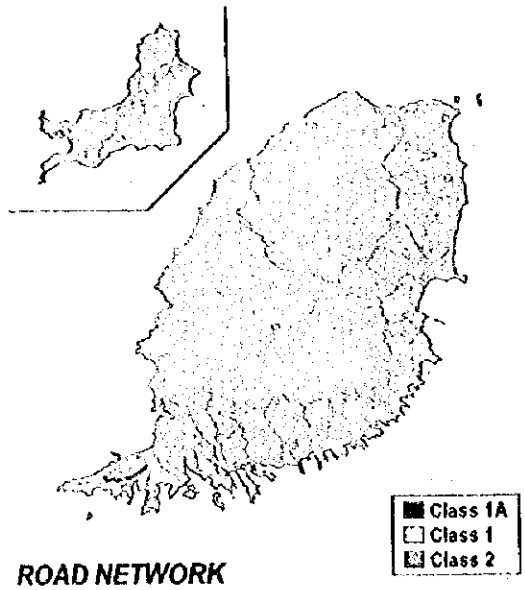
In the main island of Grenada, the arterial network consists of the two coastal roads, namely the Eastern Main Road and Western Main Road, which surround the island, and the Grand Etang Road which has steep gradients with many sharp curves as it was built in mountainous terrain, connecting St. George to Grenville.

The road network is severely constrained by the physical geography of the island and is greatly affected by the high central peaks and ridges which make east/west coastal connections difficult to achieve. These consist of Mt. St. Catherine in the north, Grand Etang Forest Reserve Area and National Park in the center and the Southeast Mt. in the south.

ROAD CLASSIFICATION

Under the classification system of roads in Grenada, the different road classes are defined as:

1) Class 1A Regional Road
   There is one road under this class which is the road between Point Saline Airport and the Sugar Mill Roundabout.



ROAD NETWORK

2) Class 1 Regional Road
   There are five roads under this class which compose the main arterial links in Grenada.
   a) Eastern Main Road
   b) Western Main Road
   c) Grand Anse Main Road
   d) Woodlands Road
   e) Grand Etang Road
3) Class 2 District Road
4) Class 3 Local Road
5) Class 4 Access Road

RELEVANT PROJECTS

The Government of Grenada has adopted the policy of improving the road network to provide an efficient transportation system in the country. There are several on-going and completed projects for the maintenance, improvement and rehabilitation of roads.

With the recent budgetary constraints, the implementation of most of the large-scale projects of roads and bridges are accomplished under foreign funded schemes. Such projects were concentrated to cover almost all of the Island's coastal main roads and some rural areas.

FUNCTION OF STUDY ROADS

R-1 Grand Etang Road – connects the largest two cities on the west coast (St. George's) and east coast (Grenville) through mountainous areas, national parks and forest reserve areas.

R-2 Morne Jaloux Road – passes through the highest portion of St. George's city in a panoramic and historical tourism area.

R-3 Perdmontemps / St. David's Road – provides a strategic and shorter alternative for EMR in the hard terrain area of Mt. Sinai.

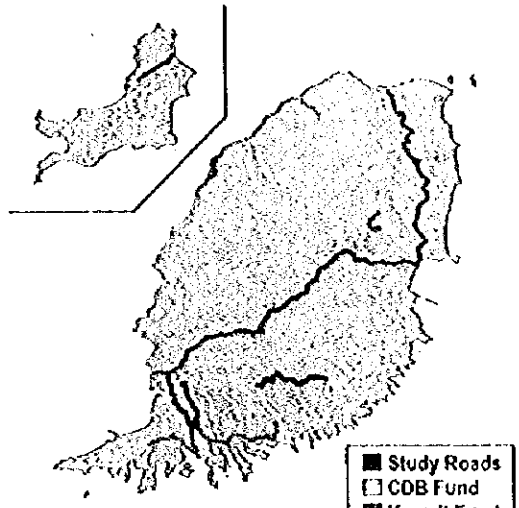
R-4 Mt. Gay / Springs Road – handles heavy traffic and heavy vehicles as an important link in the physical distribution of the transport system.

R-5 Eastern Main Road (Grenville / Sauteurs) – connects two important cities through one of the most productive agricultural land in Grenada.

R-6 Paraclete / Mt. Horne Road – provides a strategic alternative for EMR and serves several socioeconomic activities and agricultural facilities.

R-7 Dover (Windward / Cherryhill) – traverses the island of Carriacou passing through its hillside areas.

In general, the roads selected for improvement under the Study compose mainly the three arterial roads forming the Trans-Grenada Highway (R-5, R-1 and R-4) which longitudinally traverse the island from north to south, and the Sky-Line tourism and diversion road (R-2) as well as some road sections which provide better function for the road network as a whole.



RELEVANT PROJECTS

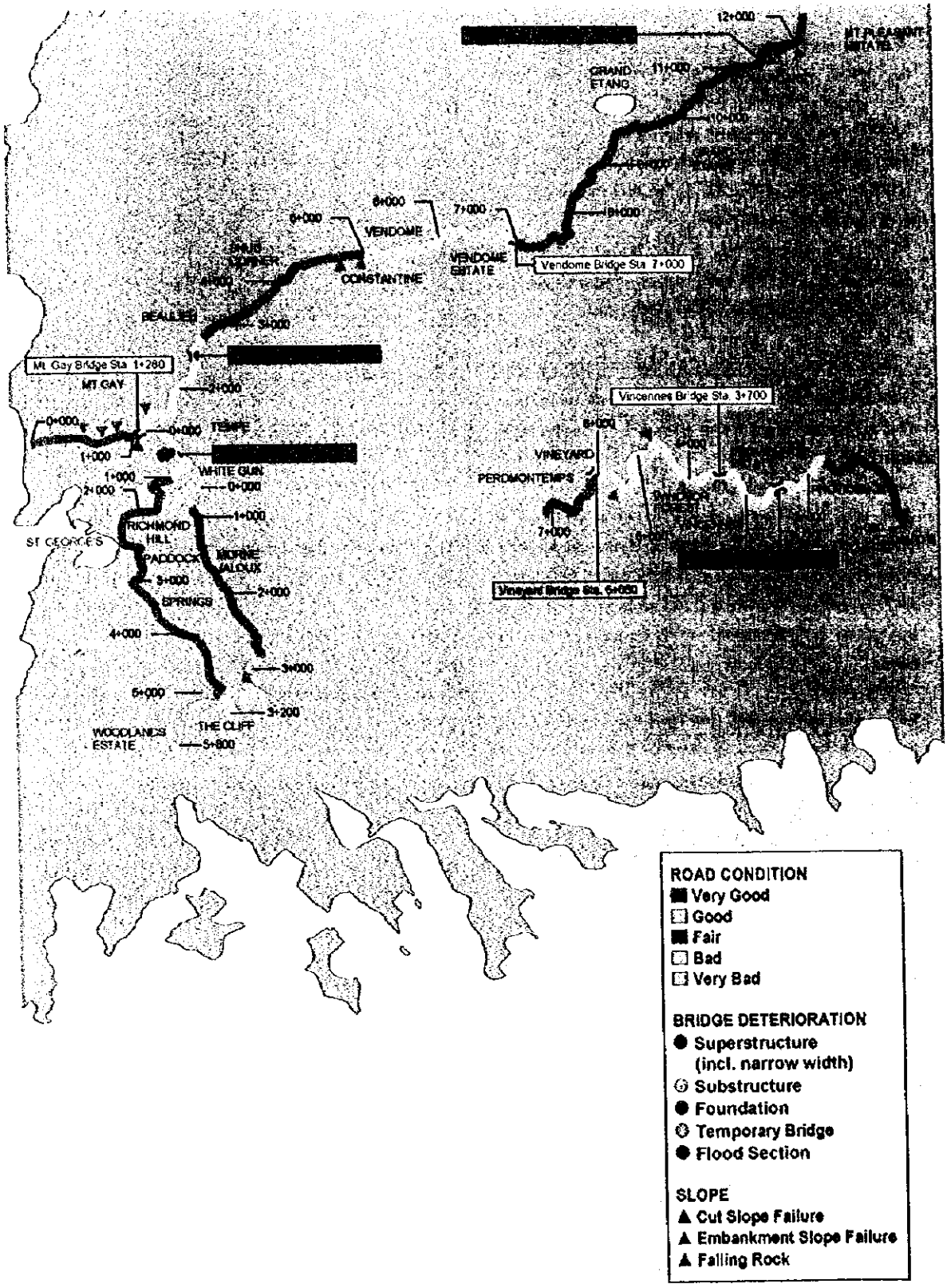
CONDITION OF STUDY ROADS

The road condition survey was conducted on the seven Study Roads to identify existing problems and ascertain the condition of all elements of the roads and bridges including the road geometric alignment, pavement structures, slopes, drainage facilities and durability of bridges.

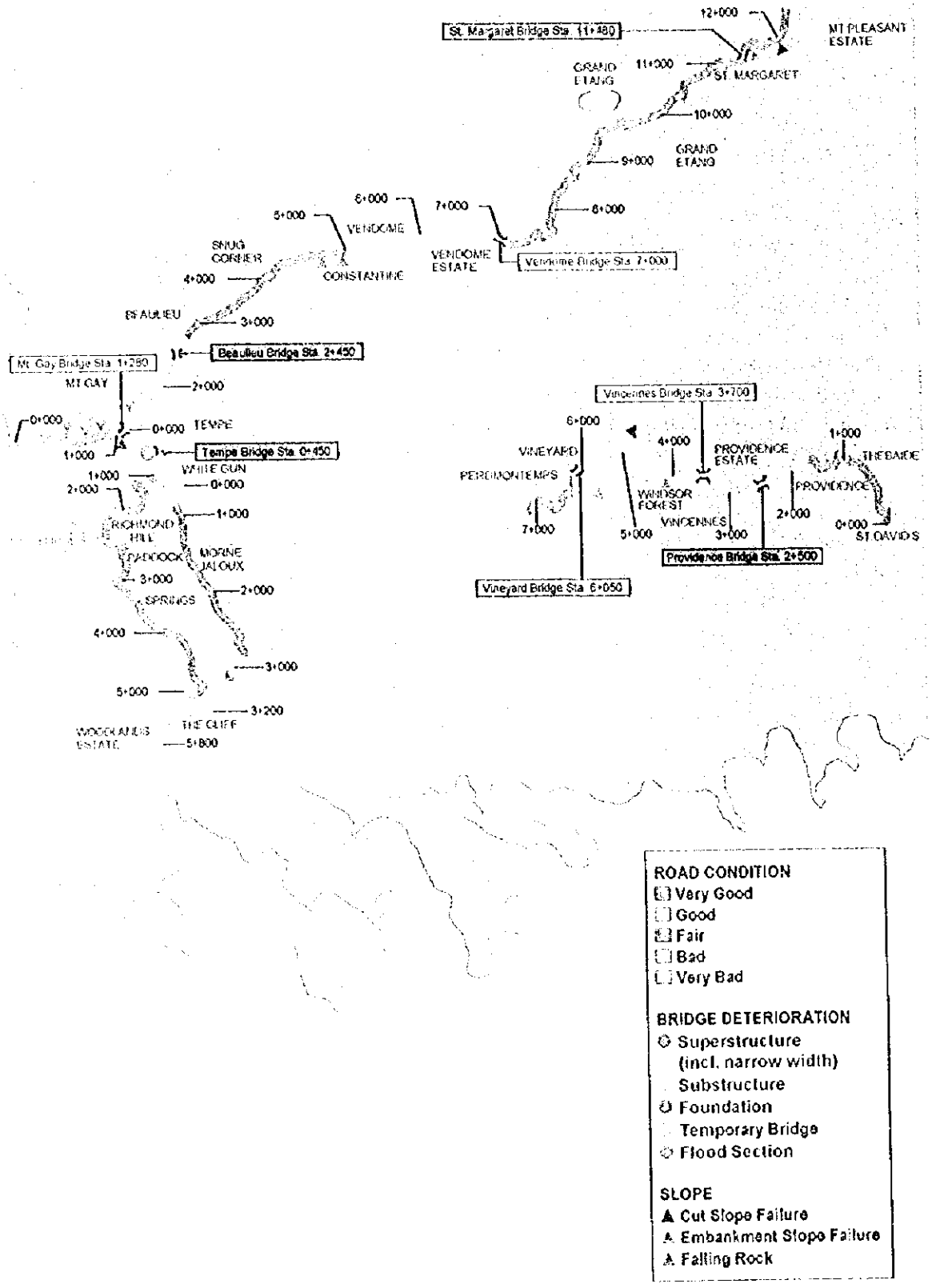
In total, there are 19.3 kms length of roads which require widening, 52.3 kms require pavement overlay or reconstruction, 40 locations require slope protection, 68.8 kms require drainage system with crossing facilities at 311 locations and 27 bridges require rehabilitation work or new construction.

Road Condition

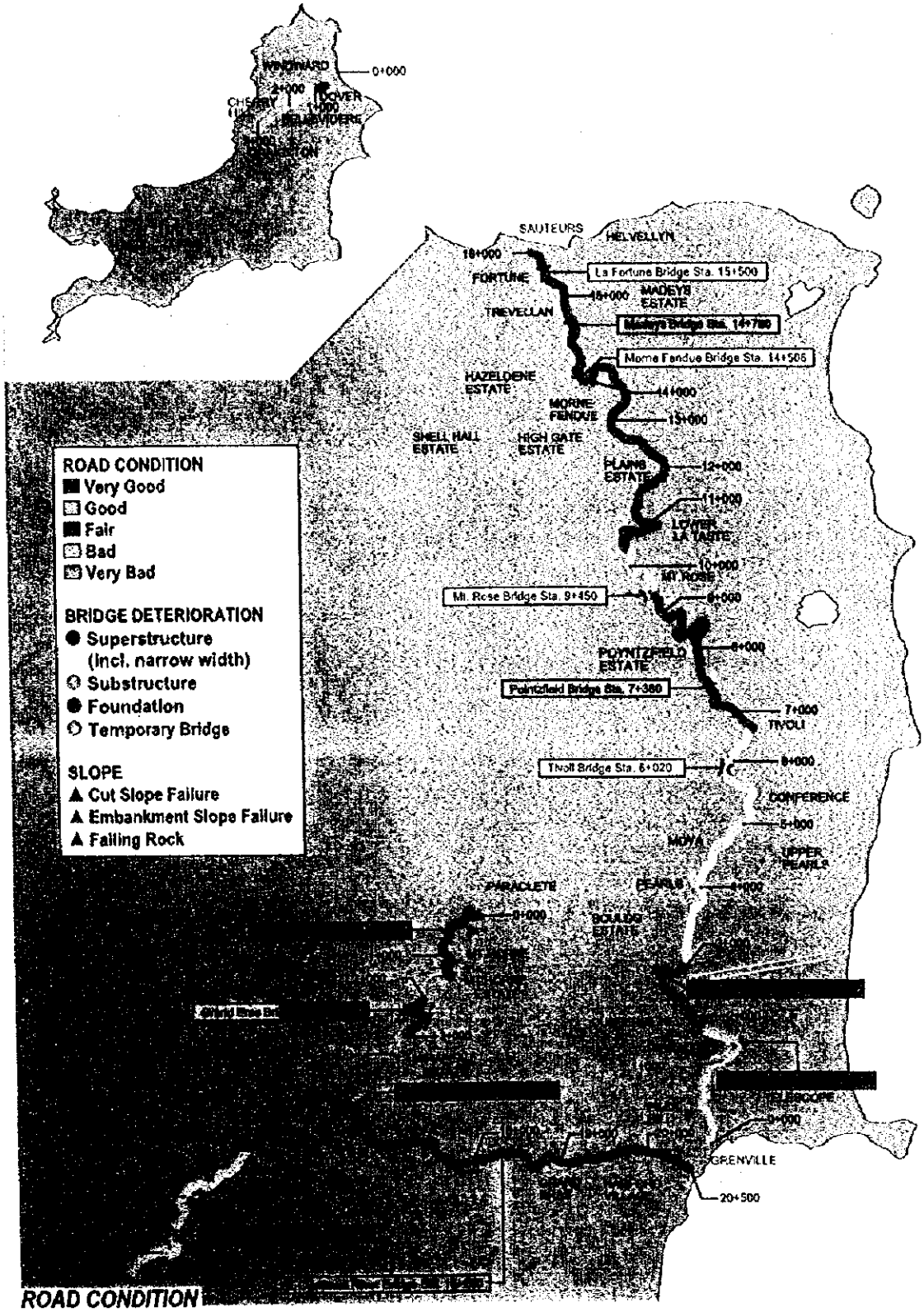
Condition	Unit	R-1	R-2	R-3	R-4	R-5	R-6	R-7
Length	Km	20.50	4.00	7.20	5.80	16.00	3.20	3.10
Width: >6 m	Km	18.70	-	-	5.80	16.00	-	-
5 – 6 m	Km	1.80	3.00	7.20	-	-	2.50	3.10
< 5 m	Km	-	1.00	-	-	-	0.70	-
Pavement: Good	Km	-	0.80	-	-	1.70	-	-
Fair	Km	14.30	1.91	2.70	4.30	4.80	2.50	0.50
Bad	Km	6.20	1.29	4.50	1.50	4.50	0.70	2.60
Slope Failure: Cut	Quantity	16	-	2	-	-	-	-
Embankment	Quantity	21	-	1	-	-	-	-
Drainage: Side Ditch	Km	24.90	3.32	6.80	6.75	20.05	5.10	1.90
Cross Drainage	Quantity	119	3	42	31	85	19	12
Bridge: Good	Quantity	2	-	-	-	2	-	-
Fair	Quantity	3	-	12	1	4	2	-
Bad	Quantity	2	-	1	0	2	-	-

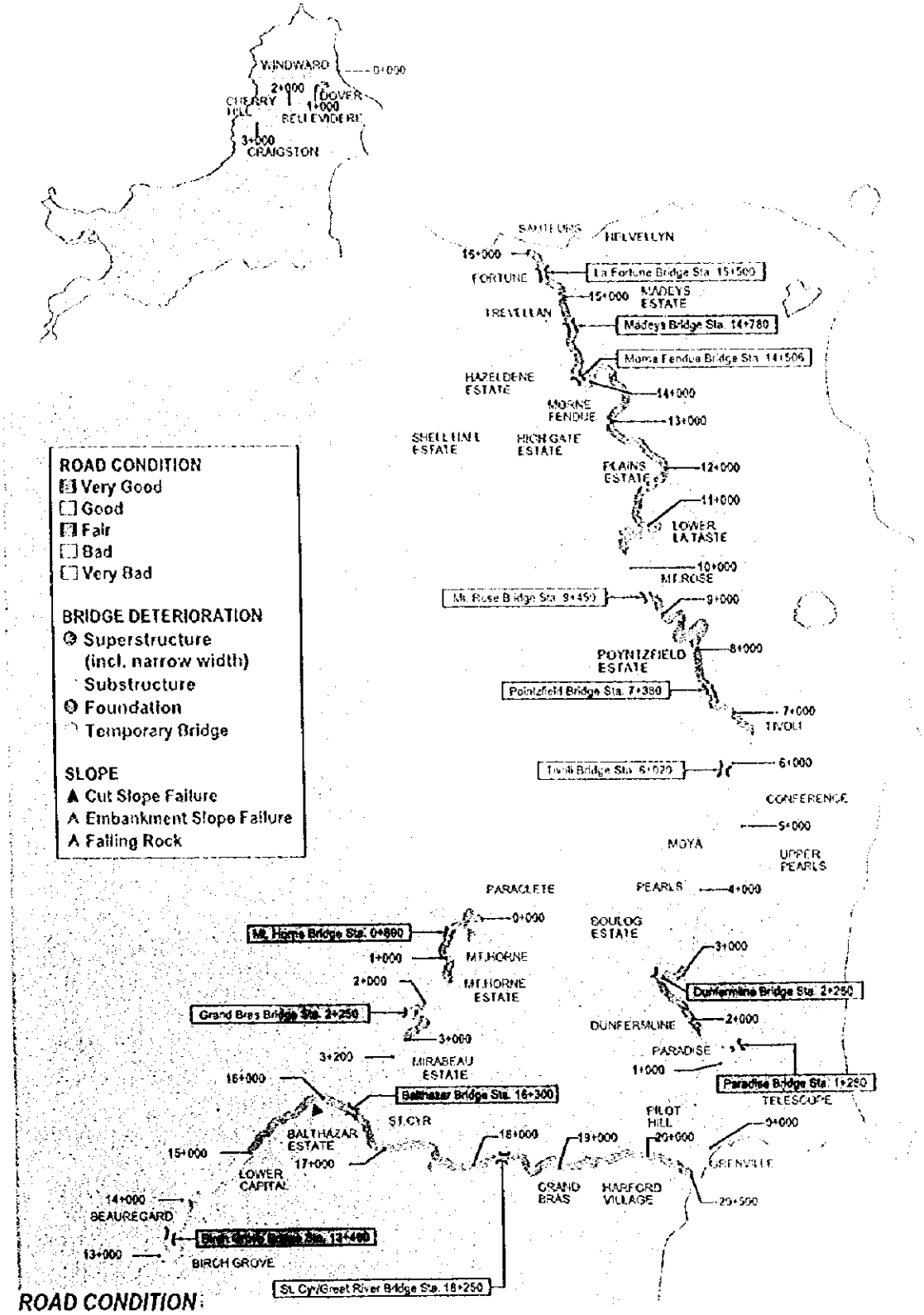


ROAD CONDITION



ROAD CONDITION


ROAD CONDITION
Very Good
Good
Fair
Bad
Very Bad
BRIDGE DETERIORATION
Superstructure
(Incl. narrow width)
Substructure
Foundation
Temporary Bridge
SLOPE
Cut Slope Failure
Embankment Slope Failure
Failing Rock
SAUTEURS
HELVELLYN
FORTUNE
La Fortune Bridge Sta. 15+500
MADEYN ESTATE
TREVELLAN
HAZELDENE ESTATE
MORNE FENDUE
Morne Fendue Bridge Sta. 14+505
SHELL HALL ESTATE
HIGH GATE ESTATE
PLAINS ESTATE
LOWER LA TAUSTE
MT. ROSE
Mt. Rose Bridge Sta. 9+450
POYNTZFIELD ESTATE
Poyntzfield Bridge Sta. 7+380
TIVOLI
Tivoli Bridge Sta. 6+020
CONFERENCE
MOYA
UPPER PEARLS
PEARLS
PARACLETE
BOULOGNE ESTATE
GRENVILLE
20+500
ROAD CONDITION



ROAD CONDITION:

TRAFFIC DEMAND FORECAST

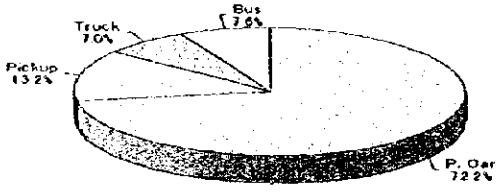
PRESENT TRAFFIC

The present traffic pattern on the island of Grenada was investigated in order to identify present traffic characteristics and to estimate parameters to be used in forecasting future traffic demand on the Study Roads. Several traffic surveys were conducted on the established basic road network and data was supplemented to establish present OD matrices based on the electoral zoning system by applying the maximum entropy trip matrix method.

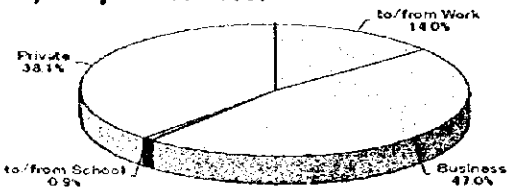
Traffic counting survey results indicate high traffic volumes on urban sections of the road network with more than 11,000 veh/day on the South St. George's Main Road. The Grand Etang Road (R-1) has an ADT of about 5,000 veh/day and the Mt. Gay / Springs Road (R-4) of about 4,000 veh/day, while other Study Roads have lower volumes.

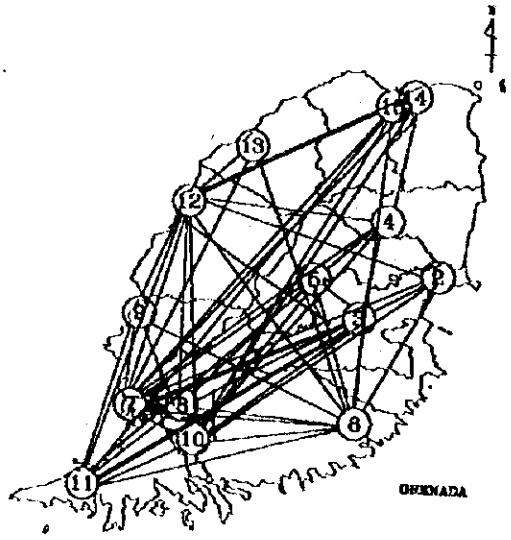
The OD survey results indicate a high rate for business and work trips with the capital region as the most trip generation/attraction zone. Although most of the roads are narrow with bad surface condition, the speed survey results show relatively high average driving speeds ranging between 30 to 60 km/hr on R-1 and 40 to 50 km/hr on R-4.

Traffic Composition % - 1997

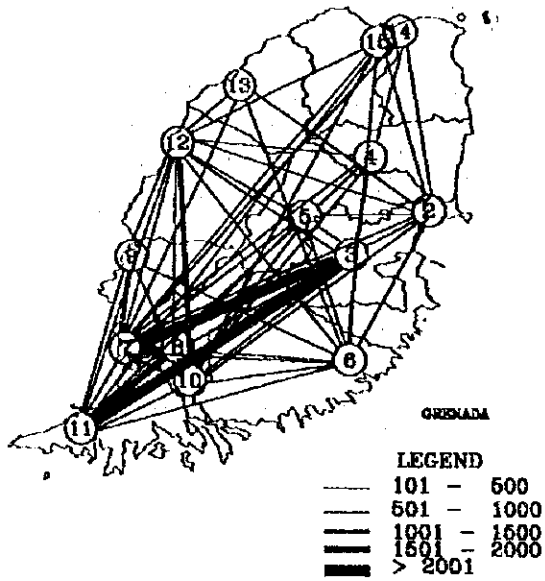


Trip Purpose % - 1997





- 1997 -



- 2025 -

Present and Future OD Desire-Line Charts

Present ADT on Study Roads (veh./day)

No.	Name	ADT
R-1	Grand Etang Road	5,261
R-2	Morne Jaloux	1,034
R-3	Perdmontemps / St. David's	276
R-4	Mt. Gay / Springs	3,734
R-5	EMR (Grenville / Sauteurs)	1,533
R-6	Paraclete / Mt. Horne	353
R-7	Dover (Windward / Cherryhill)	593

FUTURE TRAFFIC

Assignment results of the cases of "Do Nothing" and "All Road Improved in Option III" show that the pattern of traffic flow did not change due to the simple network. The only notable changes were:

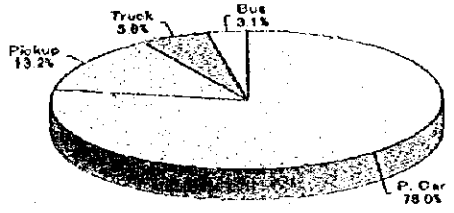
- Traffic increased on the Grand Etang Road after improvement and equally decreased on the Eastern Main Road.
- Traffic increased on Upper Eastern Main Road, St. David's / Perdmontemps section and decreased on the same section of Lower Eastern Main Road by the same amount of the increment.

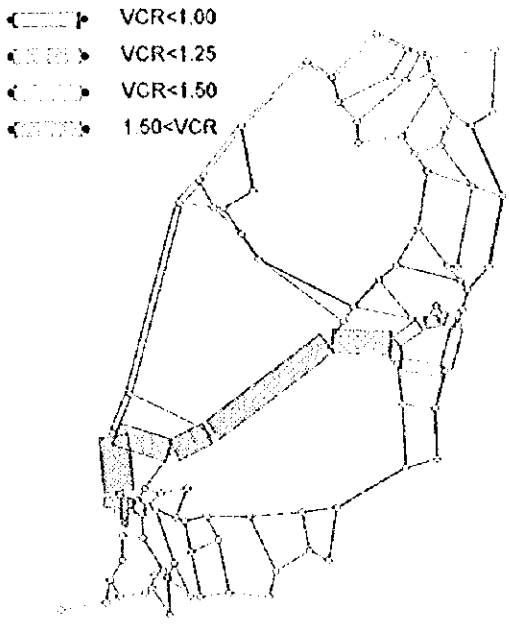
Although traffic patterns had no significant changes in regard to the used roads, there were rather significant improvements in driving speed and consequently the travel time. Results of the total PCU-km and the total PCU-hr of both cases show the ratio of decrease of PCU-km was 0.5% but the ratio of decrease of PCU-hr was 14.4%.

PCU-km and PCU-hr in 2025

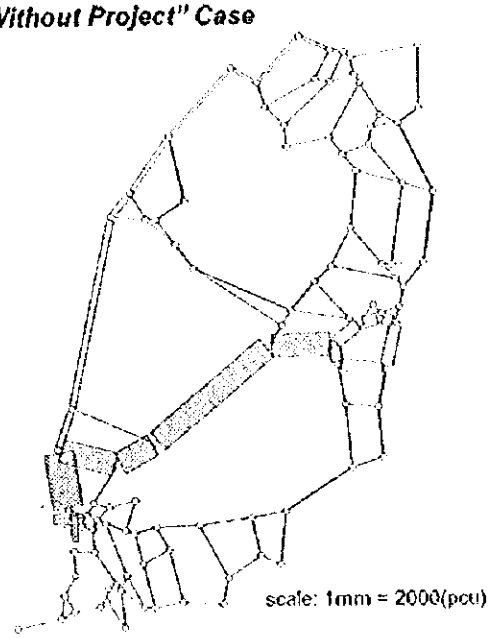
Case	PCU-km / day	PCU-hr / day
Do Nothing (a)	383,452	8,580
Do All In Option III (b)	381,565	7,345
Difference (b) - (a)	-1,887	-1,235
Ratio (b) / (a)	0.995	0.856

Traffic Composition % - 2025





- "Without Project" Case



- "With Project" Case for Option III

Future Assigned Traffic Volumes

Future Traffic Volumes on Study Roads

(veh./day)

No.	Name	2005				2025			
		Total	Car/Bus	L Truck	H Truck	Total	Car/Bus	L Truck	H Truck
R-1	Grand Etang Road	6,194	4,522	1,053	619	8,257	6,027	1,404	826
R-2	Morne Jaloux	1,478	1,271	163	44	2,244	1,930	247	67
R-3	Perdmontemps / St. David's	325	234	65	26	433	312	87	35
R-4	Mt. Gay / Springs	4,657	3,492	838	326	6,482	4,861	1,167	454
R-5	EMR (Grenville / Sauteurs)	2,490	1,980	336	174	3,254	2,587	439	228
R-6	Paraclete / Mt. Horne	946	652	246	47	1,434	989	373	72
R-7	Dover (Windward / Cherryhill)	698	422	192	84	931	564	256	112

BASIC IMPROVEMENT PLAN

IMPROVEMENT POLICIES

The established improvement policies and plan are governed by both engineering requirements, which differ for each Study Road based on its functional classification, level-of-service, design speed and width and investment requirements which depend on available funds and budgetary constraints.

IMPROVEMENT LEVELS AND OPTIONS

The established improvement levels and options are based on the basic design concepts and policies taking into consideration road problems identified during field surveys. Design Standards for three improvement options were studied in order to determine the optimum improvement level required for each of the Study Roads based on the highest value of EIRR that resulted from a preliminary economic analysis.

Preliminary Economic Analysis

Road	EIRR			Recomm. Option
	Option I	Option II	Option III	
R-1	21.77	23.99	22.82	II
R-2	7.51	3.09	3.45	I
R-3	-1.48	0.65	1.47	-
R-4	1.51	8.15	6.34	II
R-5	1.27	4.88	2.03	II
R-6	2.72	1.41	1.07	-
R-7	-7.60	-3.33	-2.88	-

Recommended Basic Policies

AASHTO Classification		Level of Service	Design Speed (km/h)	Min. Traveled Way (m)	Cross Section	Study Road
Rural Road	Major Collector	C (F, R) D (M)	100 (F) 80 (R) 60 (M)	7.2	2.4 7.2m 2.4	Class 1A
	Minor Collector	C (F, R) D (M)	80 (F) 60 (R) 50 (M)	6.0 ~ 6.6	1.5 6.6 1.5	Class 1 R-1 Grand Etang Road R-5 Eastern Main Road
	Local Road	D	60 (F) 50 (R) 40 (M)	5.4	0.6 5.4 0.6	Class 1 R-1 Perd /St. Davids R-6 Para /Mt. Home R-7 Dover
Urban Road	Collector Street	C (F, R) D (U)	Over 50	Lane width 3.0 ~ 3.6	2.5 7.2 2.5	Class 1A / Class 1 R-4 Mt. Gay/Springs
	Local Street	D	30 ~ 50	Lane width 2.7 ~ 3.6	0.6 7.2 0.6	Class 2 R-2 Morne Jaloux
Special Road	• Recreational Road • Resource Development Road • Local Service Road		60 50 (F) 50 30 (R) 30 10 (M)	(1) 5.4 ~ 6.0 (2) 3.6	0.6 5.4 0.6	Class 3 Class 4

Note F: Flat Terrain R Rolling Terrain M Mountainous Terrain

Improvement Levels and Options

Option	Option I: Do Minimum	Option II: Rehabilitation	Option III: Improvement
Requirement	Absolute Minimum Requirement	Safety and Minimum Function Requirement	Function and Riding Quality Requirement
Road Width	(below the class requirement)	• Maintain existing roadway including shoulder, with exceptional widening • Provide min. shoulder (class requirement)	• Widen to the road class standard requirement • Provide wide/paved shoulder (class requirement)
Road Alignment		• Improve horizontal alignment for stopping sight distance	• Improvement sharp curves and steep grades • Provide adequate super-elevation run off
Pavement	• Overlay/reconstruction	• Widening and overlay / reconstruction	• Widening and overlay/ reconstruction • Pavement of shoulder in populated areas
Bridge	• Reconstruction of old bridges (dangerous/hazardous to traffic)	• Reconstruction of old bridges • Reconstruction of temporary bridges	• Reconstruction of old bridges • Reconstruction of temporary bridges • Reconstruction of bridges with insufficient capacity
Drainage	• Provide side ditches	• Provide side ditches • Provide cross drainage	• Provide side ditches • Provide cross pipes • Provide subsurface drainage if necessary
Slope	• No improvement	• Cut slopes for safety (stopping sight distance) • Protect embankment for road widening	• Cut slope and protect embankment to improve sharp curves and steep grades
Safety Facility	• Minimum safety facility	• Standard safety facility	• Standard safety facility

SELECTION OF PRIORITY ROADS

PRIORITIZATION CRITERIA

To provide a ranking system for the Study Roads and to select roads for the Feasibility Study, a criteria has been established based on the technical, environmental and economic factors related to the improvement and rehabilitation of the Study Roads.

Technically roads included in national and road development plans are given higher ranking to realize the targets of such plans, especially roads supporting the agriculture and tourism sectors. In addition, road network requirements were evaluated for each road class, role and traffic volume as each of the improvement works should have the target of improving the functionality of the whole road network. Engineering conditions of all road elements were also assessed to investigate the existence of technical problems which require urgent rehabilitation or improvement works.

Natural and socioeconomic environment was given the high importance as construction activities may cause some negative impact. Based on an initial environmental examination, roads with positive or low negative impact have higher priority.

Results of the preliminary economic analysis were also used in prioritizing the Study Roads. The best parameters under the three improvement options provide a higher rating in the evaluation.

SELECTED ROADS FOR F/S

Roads selected for the Feasibility Study (F/S) are those under the high rankings of "1" and "2".

R-1:	Grand Etang Road	Rank "1"
R-2:	Morne Jaloux Road	Rank "2"
R-4:	Mt. Gay / Springs Road	Rank "1"
R-5:	Eastern Main Road (Grenville / Sauteurs)	Rank "2"

Evaluation of Study Roads

Evaluation Items		R-1	R-2	R-3	R-4	R-5	R-6	R-7
Technical Evaluation								
National Plan		A (Yes)	C (No)	C (No)	A (Yes)	A (Yes)	C (No)	C (No)
Network	Road Class	a (1)	c (2)	c (2)	a (1)	a (1)	c (2)	C (2)
	Major Roles	a (Main)	b (Tourism)	c (Second)	a (Main)	a (Main)	c (Second)	b (Local)
	Traffic Volume (2005)	a (6,194)	b (1,478)	c (325)	a (4,657)	b (2,490)	c (946)	c (698)
	Rating	A (3a)	B (2b+c)	C (3c)	A (3a)	A (2a+b)	C (3c)	C (b+2c)
Engineering	Functionality	b (Fair)	a (Bad)	a (Bad)	b (Fair)	b (Fair)	a (Bad)	a (Bad)
	Geometric (safety)	a (Bad)	a (Bad)	b (Fair)	a (Bad)	c (Good)	c (Good)	c (Good)
	Urgency	a	b	c	b	a	c	c
	Rating	A (2a+b)	A (2a+b)	B (a+b+c)	B (a+2b)	B (a+b+c)	B (a+2c)	B (a+2c)
Development	Agriculture	c	c	a	b	b	b	b
	Agro-Industry	a	c	b	a	a	b	b
	Tourism Promotion	a	a	c	b	b	c	c
	Rating	B (2a+c)	B (a+2c)	B (a+b+c)	B (a+2b)	B (a+2b)	B (2b+c)	B (2b+c)
Subtotal		3A+B	A+2B+C	2B+2C	2A+2B	2A+2B	2B+2C	2B+2C
Technical Evaluation		A	B	C	A	A	C	C
Environmental Evaluation								
R.O.W. Acquisition		B	A	B	B	B	A	A
Env. acceptance	Natural Environment	b	b	b	B	b	b	b
	Socioeconomic Env.	a	b	b	A	a	c	c
	Rating	A (a+b)	B (2b)	B (2b)	A (a+b)	A (a+b)	C (b+c)	C (b+c)
Subtotal		A+B	A+B	2B	A+B	A+B	A+C	A+C
Environmental Evaluation		A	A	B	A	A	B	B
Economic and Overall Evaluation (A=3, B=2 & C=1)								
Technical Evaluation		A	B	C	A	A	C	C
Environmental Evaluation		A	A	B	A	A	B	B
Economic Evaluation		3A	A	C	2A	A	C	C
Overall Evaluation		5A=15	2A+B=8	B+2C=4	4A=12	3A=9	B+2C=4	B+2C=4
Ranking		Rank "1"	Rank "2"	Rank "3"	Rank "1"	Rank "2"	Rank "3"	Rank "3"

* R.O.W. Right of Way

PROPOSED IMPROVEMENT WORKS

ROAD ALIGNMENT

The island of Grenada is dominated by steep cliffs along the coastlines and mountainous interior in which the Study Roads pass. This topography and restricted alignment, both horizontal and vertical, make it difficult to provide a high level of design standard. However, proposed improvement levels and options provide measures to afford enough roadway width at narrow sections with side-walk where possible and turn-out for 1-lane roads, secure a safe stopping sight distance along the roads and increase curve radius. Minor realignment is required at sections of widening and new construction of bridges.

PAVEMENT

Results of field and road roughness surveys are used as indicators to assess and evaluate the necessity of rehabilitation of pavement. Two types of rehabilitation methods are proposed with the following selection criteria:

- AC Pavement Reconstruction: Weak base course section where existing pavement has shown structural deficiencies with many patches and cracks.
- AC Overlay: All required sections other than that where the above method is applied.

An initial performance period, which refers to the period of time that a rehabilitated or reconstructed pavement will last before the need for the next rehabilitation, is selected as 10 years for both AC Reconstruction and AC Overlay.

BRIDGE

Major problems in the existing bridges can be summarized into sub-standard design, hydraulic regime and structural deterioration.

Countermeasures for sub-standard design:

- Widening of carriageway from 1-lane to 2-lane in cases where approaching roads are 2-lane or more with high traffic volume.
- Widening of sidewalk for bridges located in residential and populated areas.
- Total reconstruction or super-structure re-construction of sub-loading limit bridges.

Countermeasures for hydraulic regime:

- Protection measures against local scour such as abutment slope protection and pier foundation protection.

Main Improvement Measures on Study Roads

Road	Alignment	Widening	Pavement	Bridge	Drainage	Slope	Safety Facilities
R-1: Grand Etang Road	- Providing safe stopping sight distance	Widening - Cut Slope 1,730m - Embankment 600m	- AC Overlay 5cm on existing road - AC Pavement Reconstruction for bad and widening sections	Beaulieu: 1-lane Widening Birch Grove: 1-lane New construction Balhazzar: Reconstruction St Cyr Greatriver: New construction	- Reconstruction of side ditch on some sections - Extension of cross drainage	- River protection 600m - Cut slope 1,730m for widening section	Standard road safety devices
R-2: Morne Jaloux	None	None	Same as R-1	None	Same as R-1	None	Same as R-1
R-3 *	None	None	None	Vineyard Br.: Reconst	None	None	None
R-4: Mt. Gay~ Springs	- Widening urban narrow section - Standard width for rural	Widening - Cut slope 2,880m - Embankment 2,750m	Same as R-1	Tempe: 1-lane Widening	Same as R-1	- Cut slope 2,880m and embankment 2,750m for widening	Same as R-1
R-5: Eastern Main Road (Grenville ~ Sauteurs)	- Widening urban narrow section - Standard width for rural roads	Widening - Cut slope 4,600m - Embankment 2,300m	Same as R-1	Dunfermline: 1-lane widening, scouring protection Pointe Field: 2-lane reconstruction Madeys: 2-lane reconstruction	Same as R-1	- Cut slope 4,600m and embankment 2,300m for widening section	Same as R-1

* The only other temporary Bailey bridge, (Vineyard Bridge) on R-3, was included to be replaced by a permanent bridge.

Countermeasures for structural deterioration:

- Reconstruction of main structures (slab, girder, sub-structure, etc.) with heavy deterioration.
- Repair or reinforcement of main structures if they are damaged but still repairable or economically justified.
- Replacement or repair of other damaged components.

SLOPE

The optimum protection method for slopes shall be selected and designed in due consideration of various factors such as meteorological, geological and topographical conditions, economic aspects, method of construction, impact on passing traffic during construction, etc. General guidelines applied in this Study are:

- Re-cutting of slope gradient is an effective and economical way for cut slope failure if applicable. In addition, it is recommended to protect the cut slope surface by measures of vegetation, concrete spraying, concrete crib, etc., depending on the surface material.
- Either concrete retaining wall or masonry is recommended for cut and embankment slope failure. Where surface water concentrates, special care shall be taken to well drain by installing a culvert of sufficient capacity and providing proper inlet and outlet treatment.

DRAINAGE

In the recommended drainage system, side ditch and pipe and box culvert improvement criteria is:

- Earth side-ditch shall be replaced with masonry or concrete ditch.
- Damaged or low capacity side-ditch shall be improved and rehabilitated.
- Where needed, additional masonry or concrete type ditch shall be provided.
- Low capacity culvert shall be replaced with new one or an additional culvert should be provided.
- Additional culverts shall be provided at flood prone areas.

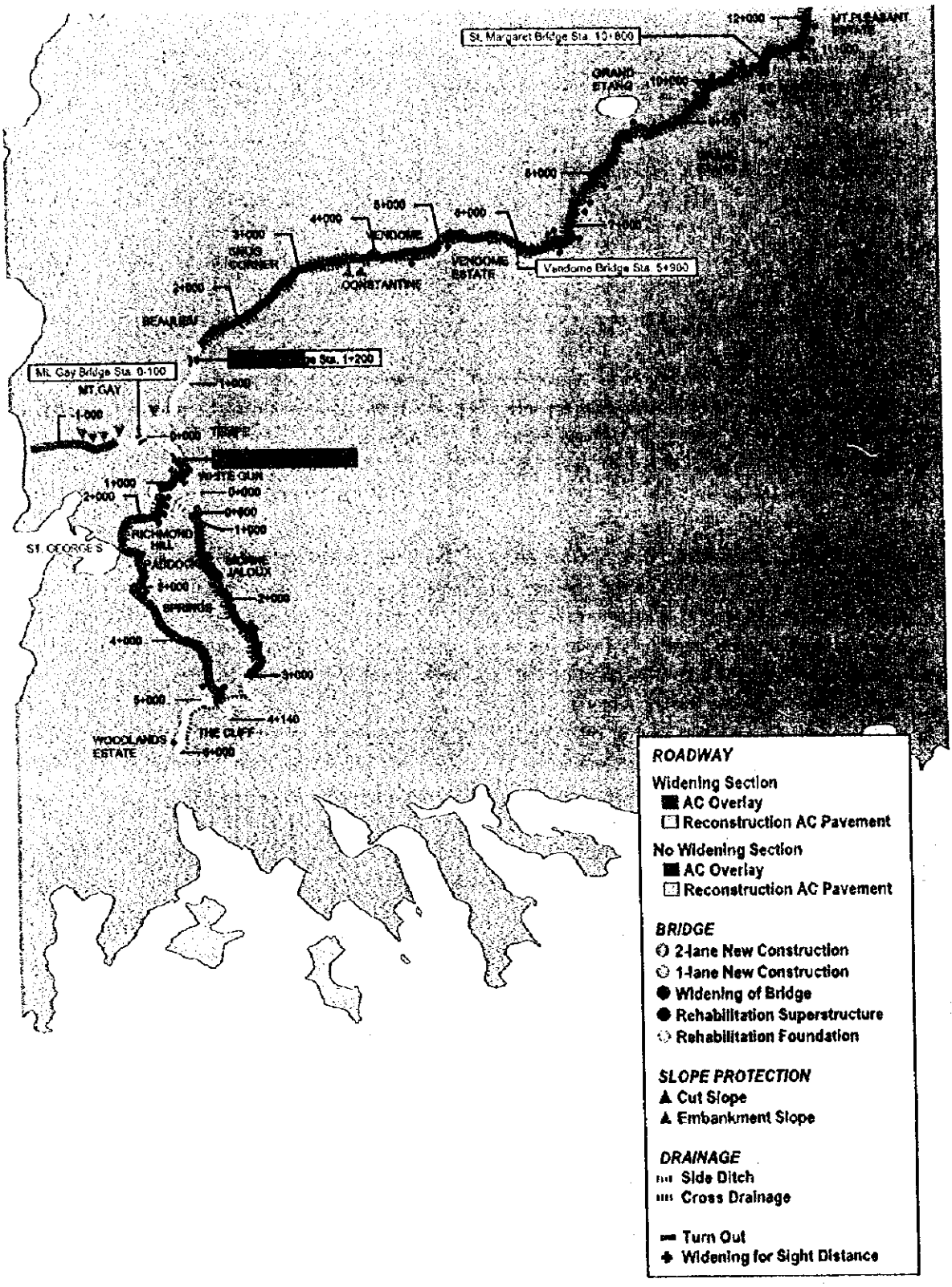
SAFETY FACILITIES

The Study Roads are characterized with many sharp curves and a low safety level for road-users. With the improvement of the road elements, higher speeds are expected by drivers which require applying safety and control facilities.

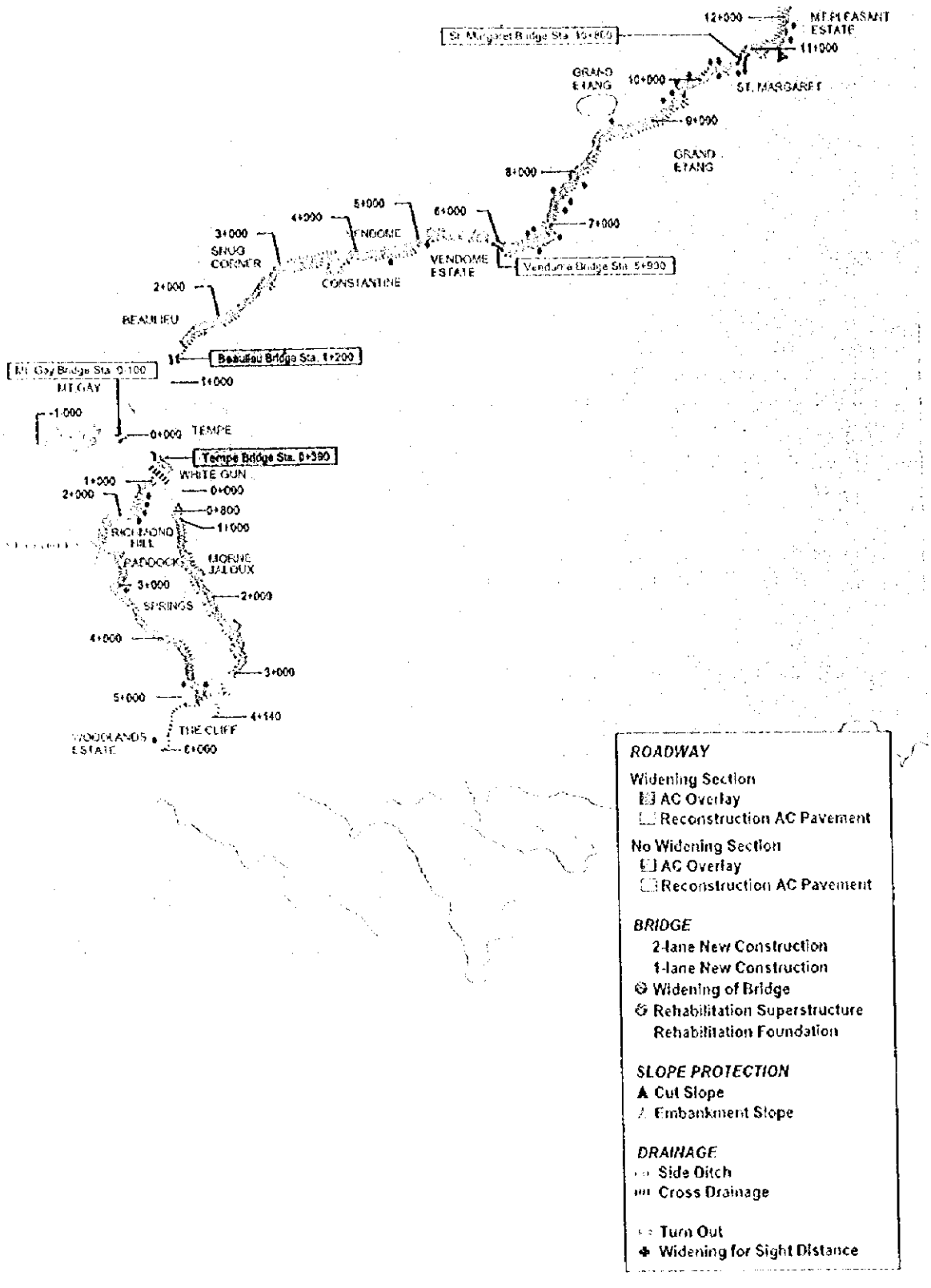
Facilities recommended in this Study include warning, regulatory and informatory signs, markings for centerline and pedestrian, guardrails to separate motorized and non-motorized traffic at populated areas, delineators and curve mirrors at sharp curves, etc.

Bill of Quantities

Item		Unit	R-1	R-2	R-3	R-4	R-5	Total
Earthwork	Excavation/Embankment	m3	34,568	954	165	4,299	1,720	41,706
	Back Fill	m3	4,910	-	284	535	2,101	7,830
	Scarification	m2	10,800	5,508	-	11,583	-	27,691
Pavement	Sub-base Course	m3	8,886	58	-	402	3,901	13,247
	Asphalt Concrete Hot Mix	ton	27,335	1,830	-	5,914	11,992	47,071
Retaining Wall	RW-M (H = 2 – 5 m)	m	919	300	60	257	60	1,596
Drainage	Side Ditch	m	22,223	1,700	-	1,650	6,050	31,623
	RCPC	m	68	6	-	26	-	100
	RCBC	m	-	-	-	15	-	15
Bridge Construction	New Construction 2-Lane	No.	2	-	1	-	2	5
	New Construction 1-Lane	No.	1	-	-	-	-	1
	Widening	No.	1	-	-	1	1	3
	Rehabilitation	No.	1	-	-	-	-	1
Incidental Construction	Safety Facilities	LS	1	1	-	1	1	4
	Concrete Blocks	m	11,000	4,100	-	2,400	10,500	27,200



PROPOSED IMPROVEMENT



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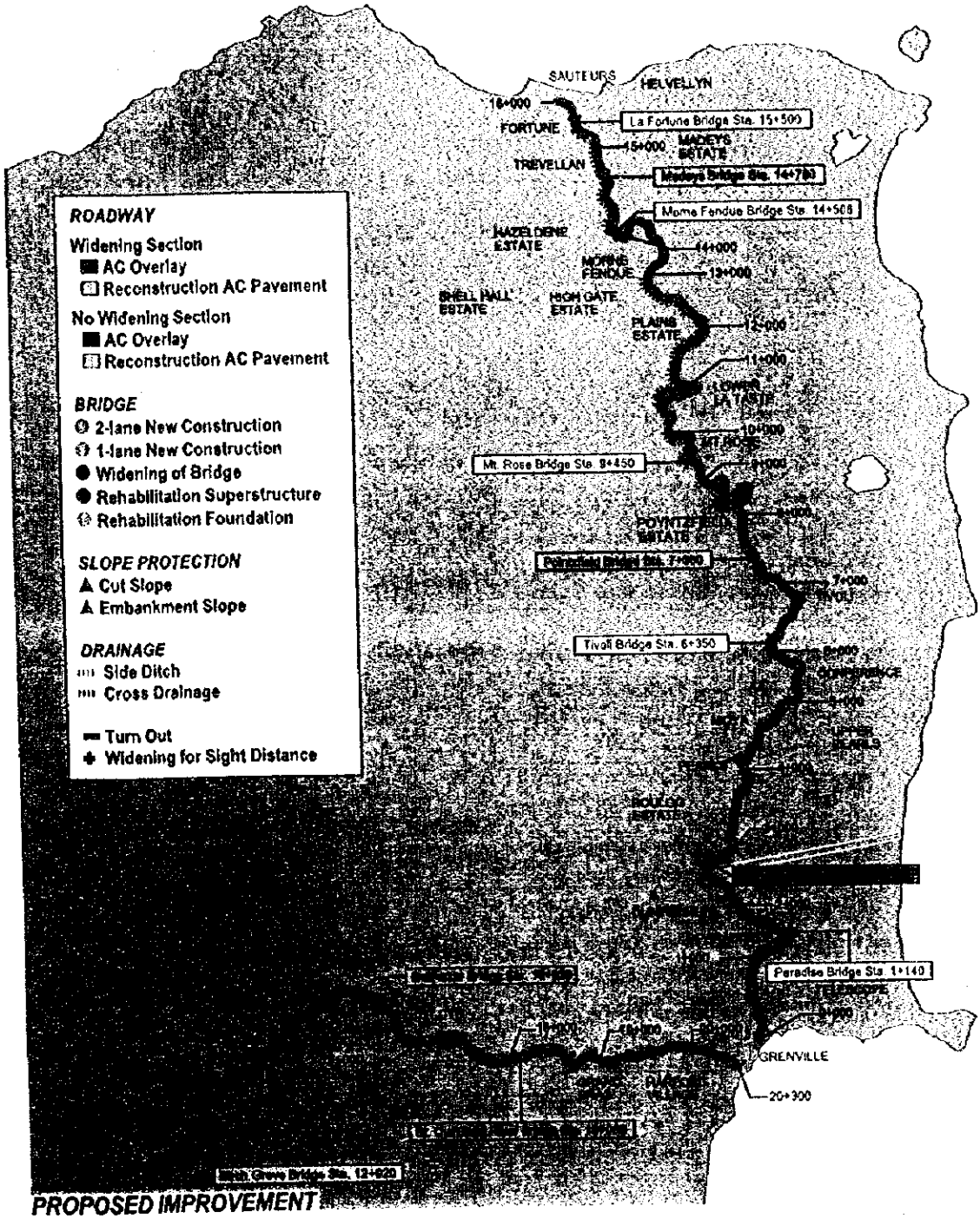
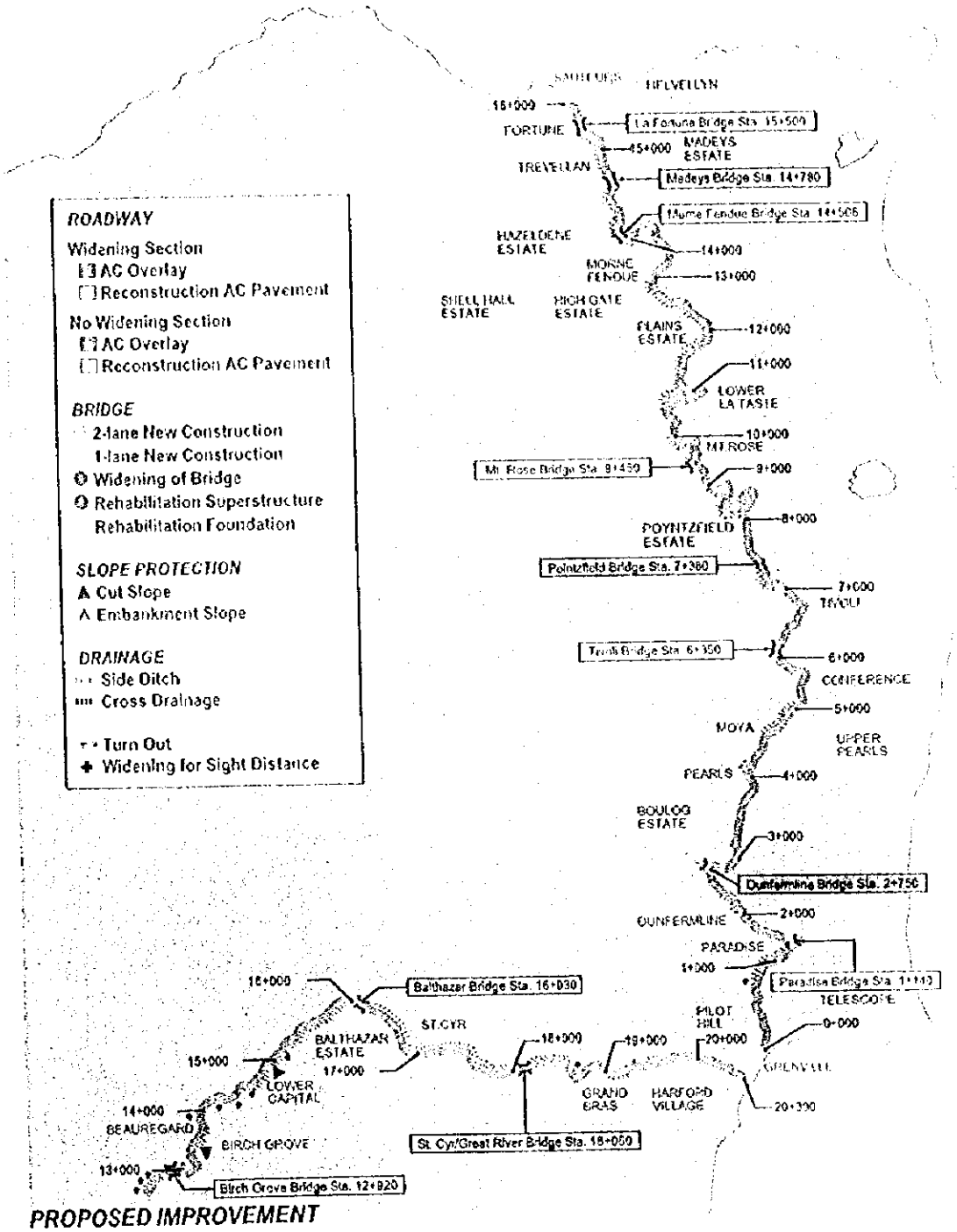


PROPOSED IMPROVEMENT



PROPOSED IMPROVEMENT

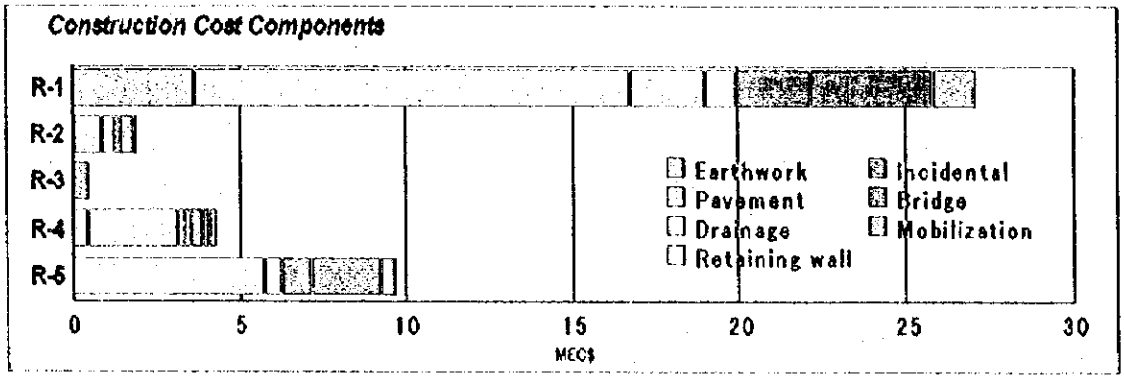
COST ESTIMATE

COSTRUCTION COST

The project cost consisted of land acquisition, compensation, materials, labor, construction, maintenance and engineering consultancy costs. Most of these costs were estimated based on the unit cost of work items obtained from a unit price analysis and in comparison with costs of similar projects in the country.

Project Construction Cost (MEC$)

No.	Road	Bridge	Mobili-zation	Total
R-1	22.22	3.60	1.29	27.11
R-2	1.86	0.00	0.09	1.95
R-3	0.00	0.57	0.03	0.60
R-4	3.93	0.22	0.21	4.36
R-5	7.16	2.10	0.46	9.72
Total	35.17	6.49	2.08	43.74

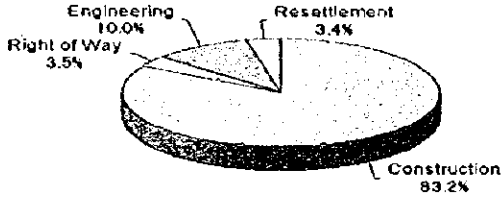


Costs were estimated for each work item in which pavement works occupy more than half of the total construction cost and is followed by bridges cost. Incidental cost includes works of slope protection measures, safety and control facilities and minor structures.

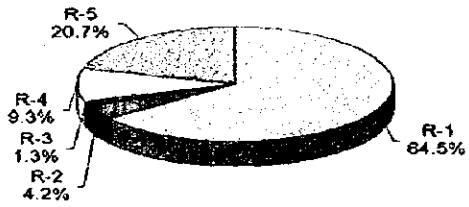
PROJECT COST

In addition to the construction cost, the project cost includes Right of Way and resettlement cost of about 7.3%, engineering cost for detailed design and construction supervision of about 10% of the total cost. The total project cost for improvement and rehabilitation of the four selected roads as well as the reconstruction of Vineyard bridge on R-3 is estimated as EC$ 52.6 million which is equivalent to about US$ 19.7 million or JP¥ 2,364 million.

Project Cost Components



Cost of Project Roads



Project Cost (MEC$)

Component	R-1	R-2	R-3	R-4	R-5	Total
Length * (km)	21.7	3.3	-	6.0	16.5	47.5
Construction Cost	27.11	1.95	0.60	4.36	9.72	43.74
Right-of-Way Cost	1.79	0.01	0.00	0.01	0.02	1.83
Resettlement Cost	1.79	0.00	0.00	0.00	0.00	1.79
Engineering Cost	3.25	0.23	0.07	0.52	1.17	5.24
Total	33.94	2.19	0.67	4.89	10.91	52.60

* Lengths are based on the results of the Topographic Survey of this Study.

ECONOMIC EVALUATION

ECONOMIC COST

To determine the economic viability of the Project by implementing the proposed improvement and rehabilitation works on the selected roads, an economic evaluation procedure was conducted for a period of 25 years of operation after completion of the construction.

Financial costs were shadow-priced and taxes and transfer costs were deducted to determine the economic costs for each project component of road and bridge.

Project Economic Cost (MEC$)

Item	R-1	R-2	R-4	R-5	Total
Road	25.3	2.0	4.2	7.7	39.2
Bridge	4.1	-	0.2	2.2	6.5
Total	29.4	2.0	4.4	9.9	45.7

ECONOMIC BENEFIT

The road improvement project is expected to generate direct and indirect benefits as it aims mainly at upgrading the level-of-service for present and future traffic.

Direct benefits of savings in vehicle operating cost in pcu-km and pcu-hr as well as the travel time in pcu-hr for both road and bridge improvement schemes are estimated based on the local conditions in Grenada and applied on a monetary basis in the evaluation procedure. These benefits were determined by comparing the two cases of "with Project" and "without Project".

Indirect benefits were investigated and assessed, but not quantified, in regard to the socioeconomic development impact of the Project.

Project Economic Benefit (MEC$)

Item	R-1	R-2	R-4	R-5	Total
Road	224.3	4.4	14.8	23.6	267.1
Bridge	63.2	2.7*	18.9	56.3	141.1
Total	287.5	7.1	33.7	79.9	408.2

* Benefit of providing a second lane

EVALUATION RESULTS

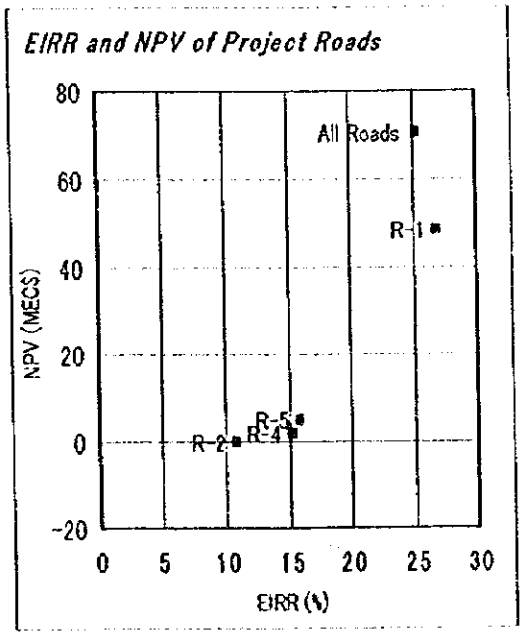
When implementing the whole project, an Internal Rate of Return (EIRR) of 25.25% is estimated with High values of Benefit/Cost (B/C) ratio and Net Present Value (NPV). Individual road projects give high indicators except R-2 which gives the lowest values, however, it has a high potential for tourism development in the future.

Economic Parameters

Road	Cost (MEC$)	B/C	EIRR %	NPV (MEC$)
R-1	33.94	2.39	26.74	48.44
R-2	2.19	0.90	10.70	-0.18
R-4	4.89	1.32	15.12	1.91
R-5	10.91	1.42	15.78	4.97
All	51.93	2.28	25.25	70.65

CONCLUSION

Economically, implementing the Project gives in total high economic indicators even when applying extreme values in the sensitivity analysis. The case of +20% cost increase and -20% benefit decrease gives a high EIRR of 17.9% with over MEC$ 35 of NPV and 1.54 of B/C.



ENVIRONMENTAL IMPACT ASSESSMENT

NATURAL ENVIRONMENT IMPACT

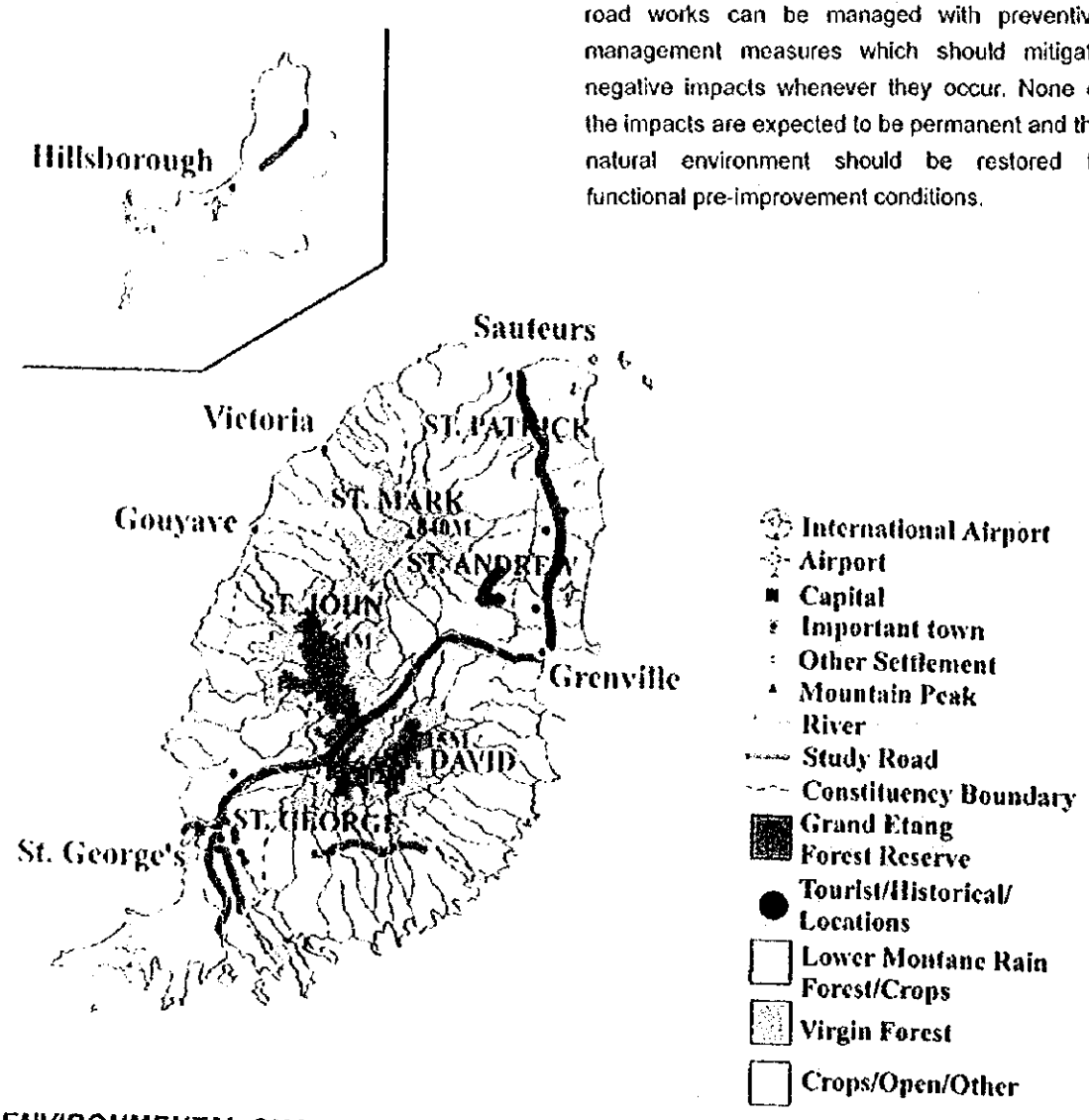
Environment management in Grenada, as a government policy, is not long ago and it was only recently that ecosystem management became a major topic of concern.

The Environmental Impact Assessment (EIA) is not required by legislation but routinely requested by the Land Development Control Authority for large-scale projects.

As the Project is to rehabilitate and improve the condition of existing roads and bridges, the EIA for the natural environment generally anticipates that the Project will not have a negative environmental impact.

The only action that may have the potential to produce minor negative impact on the natural environment is road widening at some sections and bridge reconstruction.

The environmental impacts which may result from road works can be managed with preventive management measures which should mitigate negative impacts whenever they occur. None of the impacts are expected to be permanent and the natural environment should be restored to functional pre-improvement conditions.



ENVIRONMENTAL CHARACTERISTICS

SOCIAL ENVIRONMENT IMPACT

Economically, road improvement projects have their positive impact on income, employment and development in such sectors as construction, agriculture, commerce and tourism. Socially, better roads mean better life standard for all affected population.

The Social Environment Impact Assessment (SIA) can be summarized to state that the proposed road rehabilitation and improvement will have a great positive impact, not only on the communities in which the Project will be implemented, but on more wider circle of socioeconomic activities. Positive impacts are materialized through the following:

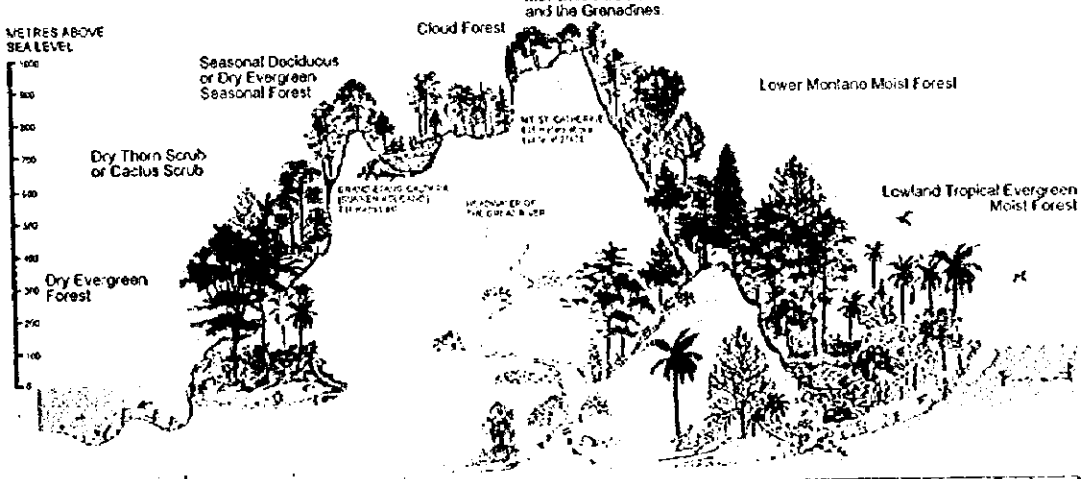
- Reduction in travel time
- Savings in vehicle operation and maintenance cost
- Efficient public transport system
- Improved road safety
- Stimulation of investment opportunities
- Creation of more job opportunities
- Access to tourism and attraction areas
- Development of business and commercial activities.

WOMEN IN DEVELOPMENT (WID)

The strategy to address the issue of WID should have three distinct phases. The first phase, which starts before the Project, should focus on building awareness, establishing policies, strengthening on-going programs and training. The second phase, during the Project, can provide direct and indirect participation and jobs for women in the Project itself or other related activities. In the third phase, after the Project, the participatory approach in development ensures sustainability of efforts long after direct women participation stimulus and actual project has been removed.

Schematic Elevation
THE ISLAND OF GRENADA

A purely volcanic "Oceanic" Island which rose from the sea. Biological plant and animal material arrived by flight, wind, or as part of a large vegetative floating mat which would form in the ocean current and float haphazardly to Grenada and the Grenadines.



	Point Saline	Annandale Falls	Mt. St. Catherine	Lake Antone	Levera Pond
Wildlife – 150 Spices of Birds	House Gecko Spinous Gecko Wall Lizard Tree Lizard Ground Lizard	German's Woodland Frog Highland Piping Frog Allen's Ground Lizard African Mona Monkey (introduced)	Manicou of large opposum Mouse opposum Forest crab Giant toad Piping Frog 6 Spices of snakes	Tilapia and other fresh water fish Moroccoy or red-ledded Tortise 11 Spices of bats Agouties Extinct	Rich in Aquatic Waterfowl migratory warblers, herons Iguana, ground lizard, Ghost crab, Mole crab
Protected Area	Canoe Bay Protected Seascape Quarantine Pt. Natural Landmark	Annandale Falls Natural Landmark Annandale Multiple-Use watershed		Mt. Hope Clabony Lake Antoine Natural Landmark	Levera National Park
Unique Amenities	Scona and Ash deposits	Oldest known rocks in Grenada – Folded and faulted Sedimentary Formation	Andesite Dome Basalt flows Crater Lake Endemic vegetation	Grenville water supply Explosion Crater Herbacious swamp	Andeeks Dome Beautiful beaches Mangrove Salt pond

Source: Government of Grenada / OAS

MAINTNANCE AND MANAGEMENT PLAN

MAINTENANCE AND MANAGEMENT STRATEGY

Maintenance Planning and Programming. The main objectives of this task are the allocation of appropriate funds required for each road segment based on the actual condition and including the preparation of inventory and database.

Contract System: It is suggested to study and adopt the most practical and sufficient system of Maintenance Work by Administration (MWA) or by Contract (MWC).

Organization and Management: It is preferred to provide two units of a head office for work program plans and budgeting, and a field operation office for monitoring and actual maintenance work.

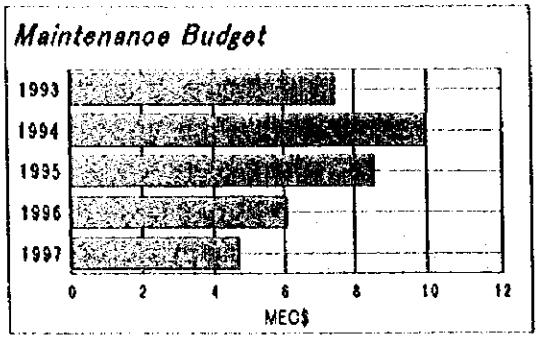
Equipment and Spare Parts: To economize this issue, the Government should procure equipment utilizing Project cost and lent them out to Project contractors, then to be used for road maintenance.

Maintenance Technique: Proper timing in releasing required fund, securing proper materials and equipment and skillful well-trained crews are the most vital factors in the system.

MAINTENANCE ORGANIZATION

For purposes of operation and administration, the Roads Department under the MOW is divided into the following two regional subdivisions:

- Western Roads Division (WRD)
  1. St. Patrick's
  2. St. Mark's
  3. St. John's
  4. St. George's
  5. Carriacou



- Eastern Road Division (ERD)
  1. St. Andrew's
  2. St. David's

In the future, a road maintenance management system (RMMS) should be established, under a maintenance planning and programming frame-work, in order to allocate the routine maintenance budget and to prepare the annual maintenance work program and performance budget for the road sections under the system.

A database system with daily records, central laboratory, maintenance manuals and on-the-job training on maintenance works and repairing of equipment are basic requirements to strengthen the organizational function and role.

MAINTENANCE EQUIPMENT

The Roads Department is utilizing few equipment, mostly in poor condition, for maintenance as major rehabilitation and improvement projects are done comprehensively by contractors without utilizing the department equipment. In order to allow the MOW to carry out its role in the road maintenance task, a proper and new fleet of equipment is required. It is recommended to procure, utilizing a part of Project cost, new equipment to be lent out to contractors during construction and then to be used for maintenance works. The cost of required equipment is estimated as MEC$ 13.77.

IMPLEMENTATION PROGRAM

IMPLEMENTATION STRATEGY

For the successful implementation of the Project, the following Strategy is recommended:

Project Management: A special Management Office is recommended to be established to facilitate smooth implementation of the Project and to ensure satisfactory quality of works.

Community Participation System: Greater involvement of the people affected by the Project is recommended not only in the project assessment but also in service delivery including all levels of project implementation. Particularly, women's participation in the Project implementation shall be encouraged to the maximum possible extent.

International Engineering Services: Detailed Engineering and Construction Supervision shall be undertaken by professional consultants in accordance with the rules and regulations of the international lending agency and to insure the international engineering quality.

Optimum Construction Methods: Construction of the Project shall be executed by professional contractors to be selected through international competitive bidding (ICB) in accordance with the rules and regulation of the international lending agency. Construction equipment will be procured by the Government and lent to contractors.

Road Maintenance: An advanced system for road and bridge maintenance shall be established taking advantage of the construction of the Project and procured equipment.

IMPLEMENTATION SCHEDULE

Based on the time-span requirements for each stage of the Project, an implementation schedule was established in which the construction activities are expected to be completed within four years.

To meet the national targets to early implement the Project, all the Project tasks should be in accordance with the schedule, or even ahead of it, so unexpected delay can be avoided.

ANNUAL FUND REQUIREMENT

The total investment required is MEC$ 52.60 which is divided into four years of implementation with a highest annual investment of MEC$ 26.0. The local portion in this investment is about 22.5%.

Other administrative and physical contingency costs are estimated in total as MEC$ 7.1 in which an amount of about 20% is covered as a local portion.

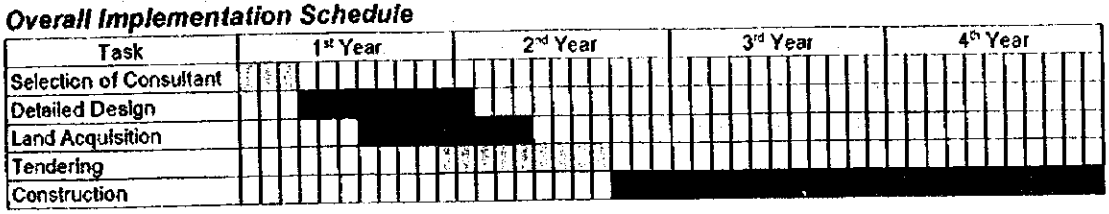
Annual Investment (MEC$)

Year	1st	2nd	3rd	4th	Total
Construction	-	5.50	24.51	13.73	43.74
Engineering	2.62	0.33	1.47	0.82	5.24
ROW	1.10	0.73	-	-	1.83
Resettlement	1.07	0.72	-	-	1.79
Total	4.79	7.28	25.98	14.55	52.60

Annual Construction Cost (MEC$)

Year	2nd	3rd	4th	Total
R-1	2.71	15.72	8.68	27.11
R-2	1.66	0.29	-	1.95
R-3	-	0.22	0.38	0.60
R-4	1.13	3.23	-	4.36
R-5	-	5.05	4.67	9.72
Total	5.50	24.51	13.73	43.74

Overall Implementation Schedule



CONCLUSION AND RECOMMENDATIONS

CONCLUSIONS

The four Study Roads play the most important role in the transportation system of Grenada. Three of the roads (R-5, R-1 & R-4) formulate the Trans-Grenada Highway, connecting the four regions of: North, East, West and South. The forth road (R-2) is a tourist-oriented Sky-Line diversion road where urban traffic is congested in the center of St. George's.

The roads, however, suffer from various problems such as sub-standard geometric design, progressive deterioration of pavement, winding alignment with narrow width, dilapidated bridges with structural deficiencies, inadequate drainage systems, resulting in poor riding quality, reduced traffic safety and increased transportation cost.

It is therefore urgent that the Project be implemented to provide a safe and reliable means of transportation, thereby stimulate the positive activation of peoples' activities, and contribute to the socioeconomic development of the country.

Engineering Aspect: The Project is technically feasible with the normal construction methods to international standards. The Government intends to procure various heavy equipment which will be lent out to project contractors for construction, and then be used for road maintenance after construction by the MOW maintenance crews.

Economic Aspect: The Project is economically feasible with an Economic Internal Rate of Return (EIRR) of 25.25%, a Benefit-Cost Ratio (B/C) of 2.28 and an approximate Net Present Value (NPV) of MEC$ 70.65.

Financial Aspect: Implementation of the Project can be accomplished within a reasonable budgetary framework in accordance with the proposed implementation plan and schedule.

Environmental Aspect: The Project is supportive for the WID issue and acceptable in both natural and socioeconomic environmental view points.

Implementation Aspect: The four years implementation framework is employed with an estimated amount of MEC$ 52.6 as the total project cost and MEC$ 26.0 as the highest annual investment. The Government of Grenada has highly emphasized that the Project should be implemented at the earliest feasible time in view of technical, economic and other aspects with the target completion year.

Social and Development Aspect: The Project is highly appreciated in providing a reliable means of transportation. The Project will contribute to an increase in socioeconomic activities, promotion of the tourism industry, and thus the development of the country as a whole.

RECOMENDATIONS

Early Implementation: It is recommended to implement the Project at the earliest possible time as justified previously.

Mitigation Measures of Environmental Impact: Due consideration should be given to mitigate adverse environmental impacts. The main adverse impact is the relocation of inhabitants, for which a resettlement action plan shall be executed by the Government with involvement of the local community, and in particular women.

Establishment of a New Highway Functional Classification: Highways in the country are recommended to be classified in accordance with their role and functionality, based on the adopted international standards for roads.

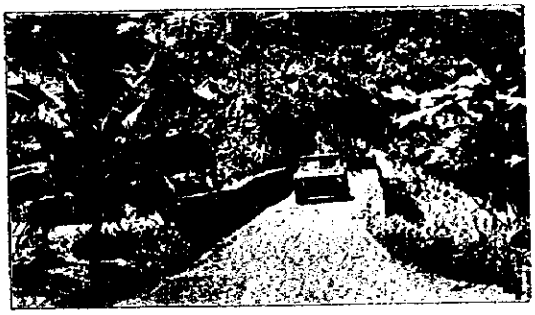
Development of Advanced Road Maintenance Technology: The advanced technology of road/ bridge maintenance shall be, through the Project implementation, developed in order to protect the huge investment for infrastructure facilities.

PHOTOGRAPHS

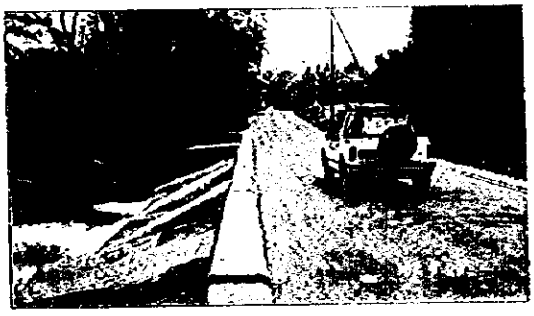
R – 1 Grand Etang Road

Narrow section with 5.5m width - Widening

Grand Etang Forest Reserve section



Balthazan Bridge – Reconstruction



St. Cyr Greatriver Spillway – New Bridge

R – 2 Morne Jaloux Road

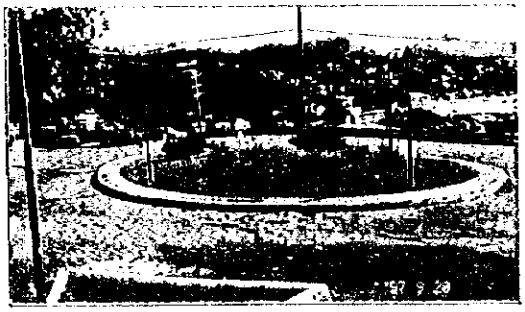
Rehabilitation starting point

Typical section without shoulder

Bad condition pavement at narrow section

Bad condition pavement at hair-pin curve

R – 4 Mt. Gay / Springs Road



Bad pavement condition at roundabout

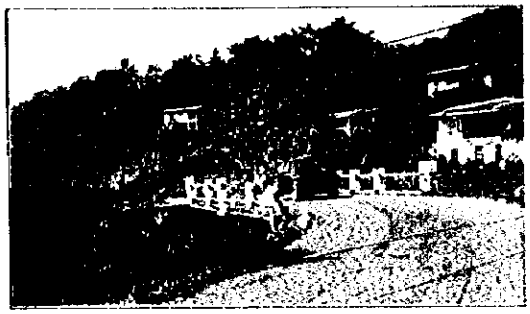
Short sight-distance at urban section

Sub-standard intersection design – Improvement

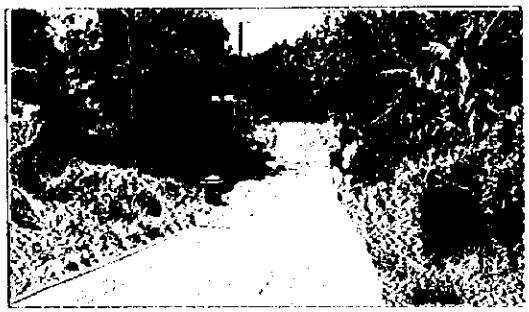
Very bad pavement condition – New pavement

R – 5 Grenville / Sauteurs Road (EMR)

Unfinished shoulder on rehabilitated section



Deteriorated Dunfermiline Bridge at sharp curve



Pointe Field spillway – New bridge

Temporary Bailey Bridge - Reconstruction

JICA