

Report No. 10543-EAP

Pacific Islands Transport Sector Study

(In Seven Volumes) Volume VI: Tonga — Transport Sector Survey
March 1993

Infrastructure Operations Division
Country Department III
East Asia and Pacific Region

FOR OFFICIAL USE ONLY



This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

ACRONYMIS AND ABBREVIATIONS

ADB	-	Asian Development Bank
AIDAB	-	Australian International Development Assistance Bureau
CPD	-	Central Planning Department
DCC	-	Development Coordinating Committee
FIA	-	Friendly Island Airways
MOW	-	Ministry of Works
PMCs	-	Pacific Island member countries
PITSS	-	Pacific Islands Transport Sector Study
PAD	-	Ports Administration Department
SCP	-	Shipping Corporation of Polynesia

PREFACE

The Pacific Islands Transport Sector Study (PITSS) reviews the status of the transport sectors in the six Pacific Island member countries (PMCs) of the World Bank.

The PITSS is reported in two volumes: Volume One - A Regional Perspective on Transport Issues - presents an analysis of transport issues across the region. Volume Two - Country Surveys - provides a detailed examination of the transport sector in each PMC.

This survey of the transport sector in Tonga, is one in the series for the PMCs which, as a whole, represent Volume Two. Each sector survey presents an overview of transport, identifies areas of concern and suggests priorities for consideration by Government.

Maintenance of transport infrastructure is identified as a common major problem area. Therefore, for this particular area, a separate Maintenance Annex is attached to the country sector survey.

The PMCs share several areas of common concern with their transport sectors, including strategic planning, project evaluation, regulation, modal coordination, pricing and cost-recovery, commercialization, private sector participation, as well as the management of infrastructure and its maintenance. These areas are reviewed briefly in this survey and, on the basis of the surveys for all PMCs, subjected to comparative analysis in Volume One of this study.

PITSS was undertaken by the World Bank with financial support for consultants from the Australian International Development Assistance Bureau (AIDAB) South Pacific Facility. The study was structured and managed by Colin Gannon (Senior Economist). Major contributions to the sector surveys were made by David Bray and Ian Gordon (consultants).

The kind cooperation of the many government officials and industry representatives who assisted the mission is gratefully acknowledged.

CONTENTS

1. INTRODUCTION	1
A. Review Context	1
B. Geography	1
C. Demography	1
D. Economy	2
2. INSTITUTIONAL STRUCTURE	4
A. Government Structure	4
B. Transport Agency Responsibilities	4
C. Private Sector	6
D. Public Finance	7
E. Aid Environment	7
F. Human Resources	7
3. ECONOMIC CONTEXT	9
A. Demand for Transport Services	9
B. Country Development Strategy	11
4. TRANSPORT SUBSECTORS	14
A. Land Transport	14
B. Maritime Transport	20
C. Aviation	26
5. TRANSPORT SECTOR DEVELOPMENT NEEDS	33
A. Introduction	33
B. Institutional	33
C. General Transport Sector Issues	34
D. Land Transport Sub-Sector	35
E. Maritime Sub-Sector	36
F. Aviation Sub-Sector	37
BIBLIOGRAPHY	39

CHART: International Air Services

MAP IBRD No. 24574

LIST OF TABLES

TABLE 2.1	Agency Responsibilities	5
TABLE 3.1	Exports by Major Category	10
TABLE 3.2	Merchandise Imports (T\$'000)	11
TABLE 3.3	Trading Partners (1989, T\$'000)	12
TABLE 3.4	Mode and Port of Imports, Exports and Re-exports (1989, T\$'000)	12
TABLE 3.5	Visitor Arrivals	13
TABLE 3.6	Projections of GDP Growth, 1990-99	13
TABLE 4.1	Road Inventory (in kilometers)	14
TABLE 4.2	Investment in Road Infrastructures (T\$'000)	15
TABLE 4.3	Annual Road Maintenance Expenditure (T\$'000)	16
TABLE 4.4	Licensed Vehicles (1985-1988)	18
TABLE 4.5	Inter-Island Shipping Activity (October-December 1988)	21
TABLE 4.6	Interisland Shipping Traffic at Nuku'alofa	21
TABLE 4.7	International Shipping Traffic at Nuku'alofa	22
TABLE 4.8	Container Movements at Nuku'alofa Port (TEUs)	22
TABLE 4.9	Port Administration Department Income and Expenditure (T\$'000)	24
TABLE 4.10	Domestic Scheduled Air Services	27
TABLE 4.11	Passenger and Aircraft Movements at Fua'amotu Airport	28
TABLE 4.12	Passenger and Aircraft Movements at Lupepau'u Airport	28
TABLE 4.13	Airports in Tonga	30
TABLE 4.14	Ministry of Civil Aviation Income and Expenditure (T\$'000)	31

SELECTED DATA

TONGA

Geography

Land Area	699 sq km
Sea Area	700,000 sq km

Population

Population (1987)/(1991), est.	99,000/101,000
Population Growth (1980-87)	0.9% per annum
Population Density	132 persons per sq km
Population in Capital Nuku'alofa, (1991) est.	32,000

Economic

GNP/Capita (1987)/(1991), est.	US\$720/US\$1,100
Exchange Rates:	
1980	T\$0.8582 = US\$1.00
1985	T\$1.4835 = US\$1.00
1989 (September)	T\$1.27 = US\$1.00
1991 (March)	T\$1.282 = US\$1.00

Transport

Registered Vehicles (1989)	4,687
Vehicles/'000 Population (1989)	47
Length of Road (1988)	1,789 km
% of Road Sealed (1988)	29%

CHAPTER 1

INTRODUCTION

A. REVIEW CONTEXT

i.1 This country survey presents an overview of the transport sector in Tonga, identifies areas of current and emerging concern, indicates priorities, and suggests future strategies for the sector.¹

1.2 To facilitate the present study, a desk review² of the transport sector was previously undertaken for each of the Pacific Member Countries (PMCs) of the Bank.³ That review provided preliminary information on each country, including Tonga, and working hypotheses on development needs in the transport sector. The present survey builds on this work to develop a current sector overview so as to establish first, directions for the formulation of strategies and priorities for each country, and second, the basis for selection of the specific issues addressed in Volume One of this Report.

1.3 The present survey of Tonga is complemented with similar surveys for the other PMCs. A regional overview which compares and contrasts, transport sector issues across all six PMCs and indicates priorities for improvements in sector efficiency, is presented as Part I, Volume 1 of this Report.

B. GEOGRAPHY

1.4 The Polynesian Kingdom of Tonga consists of about 170 islands with a land area of 699 km². Only about 36 islands are permanently

inhabited. The Kingdom stretches about 700 km from Niuafu'ou and Niuaotupoua in the north to Ata in the south (see map at end of text). The islands of Tonga are divided into three main groups, the Tongatapu group in the south, the central Ha'apai group and the northern Vava'u group, though the Niua islands in Vava'u and 'Eua in Tongatapu are often identified separately. The largest island is Tongatapu (114 km²), with Vava'u being the second largest island (88 km²). Both islands are raised coral; a few of the other islands are of volcanic origin. An existing volcano, Kao in the Ha'apai group, 1,030 meters in elevation, is the only significant mountain in the country. The coral islands are generally covered with a fertile volcanic ash. Nuku'alofa on Tongatapu is the capital; the only other substantial township is Neiafu on Vava'u.

1.5 The sea area of Tonga is 700,000 km². The islands are subject to hurricanes though less so than several of the other islands in the South Pacific.

C. DEMOGRAPHY

1.6 The population of Tonga was estimated at 94,535 in 1986. Two-thirds of the resident population are located on the main island of Tongatapu, with almost half of this population resident in the capital, Nuku'alofa. Vava'u and Ha'apai contain 16 percent and 9 percent of the population respectively, the remaining 8 percent of population being located in 'Eua and the Niua. Since 1986 the population has stagnated, if not declined, because of high emigration occasioned by a temporary abolition of visa

requirements for Pacific Islanders entry to New Zealand.

1.7 Emigration is a critical factor in the demography of Tonga. Estimates of residents abroad, primarily in New Zealand, Australia and the USA, are between 35,000 and 45,000 persons. This emigration involves the loss of skilled people, but is a factor compensated by substantial financial remittances.

1.8 While the islands of Tonga are spread out, virtually all the population reside in a reasonably compact region of about 360 km from north to south and 100 km from east to west. Internal migration occurs easily as the movement of vessels between main centers is regular and relatively inexpensive. During the period from 1976 to 1986, the population of Ha'apai decreased by 17 percent while that of Tongatapu increased by 11 percent. The population in other parts of the country has remained steady. Continuation of the internal migration trend will change the pattern of demand for interisland travel.

D. ECONOMY⁴

1.9 The Kingdom of Tonga has an estimated GDP per capita of US\$800, placing it in the lower middle-income group of developing countries. However, social indicators in Tonga are generally far superior to other countries in this group. With a traditional social system based on extended family ties, the incidence of poverty is considered to be very low.

1.10 *Economic activity* in Tonga is dominated by the effects of the large emigrant population and by aid flows. In the 1980s, financial remittances by emigrants were about 20 percent of GDP and twice the level of merchandise exports. In-kind remittances also occur, for example, the provision of cars and other goods to Tongan domiciles. Imports are equivalent to about 50 percent of GDP.

1.11 *Official development assistance* to Tonga in the late 1980s is estimated at about US\$173 per capita (or 22 percent of GDP in gross flows). Only about half of this aid is recorded in the balance of payments, the remainder being in the form of technical assistance, material supplies, and out-of-country training which do not necessarily result in net financial transfers to Tonga.

1.12 *Agriculture* accounts for at least 40 percent of GDP, and is derived almost wholly from small-holder activity. Much of the agricultural production is exported. Copra and coconut products dominate these exports, but exports of more specialized crops—vanilla beans, root crops, squash—and fish are increasing. The value of agricultural exports was generally stagnant in the 1980's.

1.13 *Services* are a substantial proportion of GDP, in line with the high levels of Government expenditure and development assistance. Tourism activity dominates receipts while freight payments (at about 30 percent of the f.o.b. value of imports) dominate payments. *Manufacturing* accounts for about 10 percent of GDP, and is mostly related to processing of coconut products and other businesses in a small industrial zone located in Nuku'alofa.

1.14 A large *trade* deficit is more than offset by prevailing levels of remittances and official aid.

1.15 *Development expenditure* by Government has been 20 percent of GDP during the 1980s, financed entirely by development assistance, mostly grant aid.

1.16 *Economic growth* in Tonga has averaged about 2.5 percent per annum since 1981/82, with population growth of about 0.5 percent per annum. The economic growth has resulted from prudent domestic policies, supported by continuing, large development assistance. The prospects for continued economic growth are

good, with potential in the agricultural, manufacturing and tourism sectors in particular.

1.17 There is a need for improved *public resource mobilization* to provide adequate resources for operation of services and maintenance of public infrastructure and to finance an increasing proportion of development expenditure.

CHAPTER 2 INSTITUTIONAL STRUCTURE

A. GOVERNMENT STRUCTURE

2.1 Although Tonga became a British Protectorate in 1900, it regained full sovereignty in 1970. There are three executive arms to Government (the King, Privy Council and Cabinet) and two legal bodies (the Legislative Assembly and the Judiciary). Cabinet ministers are selected by the King and, together with the Governors of Vava'u and Ha'apai, form the Privy Council. The Legislative Assembly comprises the Privy Council, seven representatives of the nobles and nine representatives of the people.

2.2 Nuku'alofa, on the island of Tongatapu, is the capital and administrative center of Tonga. Parliament, Ministries and Departments are located there. Governors, appointed by the King, are responsible for the island groups of Ha'apai and Vava'u. Ministries of the national Government are responsible for transport matters throughout the country. The agencies usually have regional offices in at least Ha'apai and Vava'u for day-to-day management of local activities. Villages are involved in maintenance of some local roads, though generally on an informal basis. There is no formal local Government.

2.3 The aviation sub-sector is wholly within the ambit of the Ministry of Aviation. Responsibilities in other transport sub-sectors are shared between the Prime Minister's Office and the Ministries of Works, Marine, Finance, Labor, Commerce and Industries; and Lands Survey and Natural Resources. No specialized

agency is responsible for developing transport sector policies and taking an intersectoral view of the transport. Insofar as these matters are addressed, it is done by the Central Planning Department within the Prime Minister's Office. The Central Planning Department also coordinates development planning.

B. Transport Agency Responsibilities

2.4 Roads. The planning, construction and maintenance of roads is the responsibility of the Ministry of Works (see Table 2.1). The Ministry has a Road Section in the Civil Engineering Division and a separate Mechanical Services Division for plant and equipment. In Nuku'alofa the Road Section contains only 3 road engineers and 11 technical and financial support staff to manage 1,790 km. of road and the operation of quarries. There are no road engineers located in Ha'apai and Vava'u. All road construction and almost all road maintenance in Tonga is undertaken by the Ministry of Works. Villages have no equipment and few skills and thus can make only a limited contribution to road maintenance. The Ministry of Works has no planning capacity. Road upgrading projects are generally identified and prioritized in the course of aid projects. The Ministry of Lands, Survey and Natural Resources is responsible for defining road rights-of-way and, where required, for facilitating land acquisition for road improvement projects.

2.5 Land Transport Operations. The road transport industry is primarily a private sector activity. Buses and taxis are privately owned,

Table 2.1: TONGA-AGENCY RESPONSIBILITIES

	Land	Maritime	Aviation	Intermodal
Policy	CPD, MOW	MOM	MOA	CPD
Planning	CPD, MOW	MOM, PAD	MOA	CPD
Construction and Maintenance	MOW	MOW	MOW	NA
Operations: Infrastructure Services	NA Private	PAD Quasi-private	MOA Quasi-private	NA Quasi-private
Regulation ^{/a}	MOP, MLCI	MOM, PAD	MOA	NA

MOW Ministry of Works

MOP Ministry of Police

MOM Ministry of Marine

CPD Central Planning Department

MLCI Ministry of Labor, Commerce and Industry

MOF Ministry of Finance

PAD Ports Administration Department

MOA Ministry of Aviation

NA Not applicable

^{/a} Includes legislation, cost-recovery and enforcement.

Source: Mission consultations.

with ownership reported to be widely distributed. Commercial freight services are provided by privately-owned trucks and trucks belonging to village co-operatives. It is probable that remittance income to Tonga facilitates investment in, and wider ownership of, vehicles-for-hire. The Ministry of Police is responsible for maintaining a register of all vehicles and for collecting and enforcing an annual license fee. The Department is also responsible for vehicle safety inspections, traffic management, road signing, accident analysis and traffic enforcement. The Ministry of Labor, Commerce and Industries issues licenses for buses and taxis. Trucks do not require permits to operate services.

2.6 Shipping. The Ministry of Marine is responsible for shipping legislation, administration and control. Ministry activities are focused on marine inspections and surveys, accident investigations, search and rescue and administration of shipping and seamen. Eight vessels were surveyed in 1989. Besides the Director of Marine, the Ministry has only two technical staff.

2.7 Ports. The Ports Administration Department, now in the Prime Minister's Office, is responsible for the provision of harbor and wharf services in Tonga, consisting of the country's principal port at Nuku'alofa and smaller ports at Lifuka in Ha'apai and Neiafu in Vava'u. The Department has also taken an

interest in the need to update marine legislation (relevant legislation being the Wharves Act, Harbors Act, Shipping and Seamen's Act and the Petroleum Regulations Act), but has made no changes to date. (Strictly, these Acts are the responsibility of the Ministry of Marine which is also a member of the supervising committee which oversees the Ports Administration Department.) Port construction and maintenance are undertaken for the Department by the Ministry of Works.

2.8 Maritime Training. The Tonga Maritime Polytechnical Institute was developed with assistance from the Government of Germany. The Institute has previously concentrated solely on training in maritime services, but has recently broadened its training to include non-marine mechanical engineering.

2.9 Aviation. The Ministry of Civil Aviation is responsible for the operation of the six airports and airfields in Tonga and for air transport policy and regulation. Three-quarters of the staff of the Ministry are located on Tongatapu. Construction activities are undertaken by the Ministry of Works or by contracts arranged by bilateral donors. Ministry officials are represented on the Board of the Government-owned Friendly Island Airways and the Board of Pacific Air Limited (in which the Tongan Government has an interest).⁵ The Ministry approves scheduled air services and air fares. There are no privately owned companies providing air services in Tonga and charter operations have not been permitted.

2.10 Policy. Objectives for the transport sector as a whole and by mode are most clearly enunciated in the Five Year Plan. They are often global in nature ("to provide road access to all rural areas in the main island") and generally lack specification of the policies and actions required for their implementation.

2.11 Planning. The Central Planning Department (CPD) in the Prime Minister's Office is responsible for preparation of each

Five Year Plan, CPD sector specialists liaise with other departments to identify and screen projects. In theory, project profiles are then prepared and sent to the Ministry of Finance for review. The CPD also sees its role as identifying projects and interacting with aid donors. In practice, the planning process is more complex, with: (a) some donors working directly with the Ministry of Foreign Affairs; (b) the separation of the CPD from the Ministry of Finance detracting from the effective planning of development activities; (c) some project proposals being taken directly to Cabinet; and (d) the normal political component to decision-making being more evident because of the small island environment of Tonga. The planning process also involves two regional development committees (for Ha'apai and Vava'u) and a national Development Coordinating Committee (DCC).

C. PRIVATE SECTOR

2.12 The private sector is responsible for the provision and operation of bus and taxi services in Tonga and for most freight services. Operations outside Tongatapu are minimal and informal. The private sector also operates local, informal boat services, however there is no documentation on the scale or nature of these services which generally involve vessels of less than 15 meters in length. The Shipping Corporation of Polynesia (SCP), which is 60 percent owned by the Government of Tonga and 40 percent by the Columbus Line of Germany, is the principal ship operator in Tonga. The SCP has four ships, one of which is chartered to the Pacific Forum Line and two of which are of limited serviceability. The SCP also operates a workshop and manages the Maritime Polytechnical Institute. The SCP does not have a monopoly on shipping operations in Tonga. For example, a catamaran with capacity for 100 passengers and some freight provided thrice-weekly service between Tongatapu and Vava'u for about four months in 1990. On occasions, other firms have attempted formal domestic

shipping operations. However, none of these operations has been sufficiently financially viable to be sustained. There are no normal barriers to the introduction and operation of such services. The small size of the domestic market and the Government's shareholding in the SCP are advanced as reasons for Government agencies to use SCP services and thus support their viability.

D. PUBLIC FINANCE

2.13 Tonga relies heavily for recurrent revenue on a narrow tax base which is expected to provide 73 percent of recurrent income in 1990/91. Three-quarters of tax revenues are derived from foreign trade, primarily taxes on imports. Recurrent revenue in 1990/91 was expected to be 95 percent of recurrent expenditure. In comparison, revenue was, on average, 5 percent greater than expenditure during the mid-1980s.

2.14 Tonga has ambitious development plans, but limited budget resources. For example, against a budgeted capital expenditure of T\$15.3 million in 1988/89, actual outlays were T\$6.3 million; T\$6.1 million of these funds were provided by bilateral and multilateral donors. The lower capital expenditure was attributed to a shortfall in actual aid funds, though aid was 50 percent greater than in the previous year.

E. AID ENVIRONMENT

2.15 During the five years to 1988/89, external grants and net borrowings were 95 and 12 percent, respectively, of the Government's development expenditure. Together external grants and net borrowings were about 22 percent of GDP. During the period 1985/86 to 1988/89, 13 percent of Government development expenditure was directed to the transport sector, divided as roads (26 percent), maritime (45 percent), aviation (25 percent) and unallocated (4 percent).

2.16 To facilitate aid coordination and to encourage the provision of aid to locations other than Tongatapu, the Government has established regional development committees for the Ha'apai and Vava'u regions. The CPD acts as the secretariat for the Ha'apai region. This has been successful to the extent that Australia and the EEC, respectively, have taken particular interest in the provision of aid to these two regions. There nevertheless remains a general weakness in the ability of the Government to adequately identify and prioritize development needs and to coordinate donor activities. This work is made more difficult by the differing objectives and practices of donors, and the links between the Government and donors through different agencies (i.e., Ministry of Foreign Affairs, Ministry of Finance and the CPD).

2.17 In the transport sector, aid requests and finance have been focused on meeting immediate and perceived infrastructure deficiencies and to training, but not adequately to maintenance of infrastructure assets. No projects have been directed to changing the regulatory environment or operation of transport in recent years, nor has assistance for infrastructure development projects required significant, concurrent changes in Government policy and operations. In several cases, little account has been taken of the ability of Government to meet ongoing costs for operations and maintenance of projects implemented with aid.

F. HUMAN RESOURCES

2.18 In common with other South Pacific countries, Tonga has a shortage of indigenous staff with appropriate technical and management skills. This shortage has been exacerbated by the substantial emigration from the country. Senior positions in Government agencies are held by indigenes. Expatriate staff hold line positions in the Ministries of Works, Aviation and Finance and in the Central Planning Department. They are paid local salaries by the Government of Tonga with supplementary

income provided through arrangements with bilateral donors.

2.19 Considerable numbers of Tongans travel overseas for training (including short courses and tertiary studies) financed by multi- and bilateral donors. However, there are problems in the social benefit to Tonga of some of the extensive training supported. For example, in 1991, of a full complement of ten professional staff in the CPD, half were currently studying overseas: four for Masters degrees and one for a doctorate. The extent, nature, and conditions of this training, and its opportunity cost to the CPD's work and Tonga, should be assessed.

CHAPTER 3 ECONOMIC CONTEXT

A. DEMAND FOR TRANSPORT SERVICES

3.1 Demand for transport services in Tonga derives primarily from activities in the agricultural and service sectors. Much of this activity is traded internationally, for example exports of agricultural products and imports of processed food. *Exports* grew rapidly in the second half of the 1980s, due largely to increased trade in vanilla beans, fish and squash (see Table 3.1). Agricultural products accounted for 71 percent of total exports in 1989, and manufactured goods for most of the remainder. *Imports* have increased steadily (see Table 3.2), and exceed exports by six-fold (see Table 3.3). This imbalance, also reflected in volume terms (see Table 4.7 below), has a major effect on the cost-efficiency of port operations. With the exception of imports from Fiji (some of which may be re-exports from Fiji), intra-Pacific trade is minimal.

3.2 Virtually all imports and exports pass through Nuku'alofa (see Table 3.4). The imbalance between imports and exports is greater for sea freight than air freight, reflecting differences in the types of commodities and possibly reflecting greater discounting of return travel by air than sea.

3.3 *International visitor* arrivals rose by 10 percent annually between 1985 and 1989. The nationality of visitor arrivals became more diverse over that period, with the share of visitors from Australia declining substantially (see Table 3.5). These visitor arrivals appear to

exclude Tongan emigrants on return visits to Tonga (see paragraph 4.47 below).

3.4 There are inadequate data to enable estimates of *domestic* freight and passenger *travel demand* to be prepared. Subsequent sections of this report describe data which give an indication of the transport task. In essence, demand for land transport is high on Tongatapu where two-thirds of the population reside. Agricultural activity is widely distributed on the island. Agricultural products for local consumption and export, are carried by land transport to Nuku'alofa (which accounts for almost half of the island's population). Demand for land transport is smaller on Vava'u, and minimal elsewhere.

3.5 Virtually all international sea freight passes through Nuku'alofa. Accordingly there is a need to distribute imported products to other islands from Nuku'alofa and to consolidate export products there. There are no data and little knowledge of travel demand on informal shipping services (i.e. by vessels less than 15 meters in length).

3.6 In addition to inter-island travel by resident Tongans, visits by emigrant Tongans and tourists are sources of additional demand for passenger travel within the country. Vava'u has considerable scenic value, and attracts some tourists (though in 1987, tourist and domestic passenger movements at Vava'u were 9,360 compared with 62,640 international passenger movements at Fua'amotu Airport on Tongatapu). As there are no scheduled international services to Vava'u at present, tourists must travel by air

Table 3.1: TONGA-EXPORTS BY MAJOR CATEGORY, 1984-1989 ^{/a}

	1984/85	1985/86	1986/87	1987/88	1988/89 Est.
Copra					
Value	-	-	101	-	-
Volume	-	-	1,000	-	-
Copra meal					
Value	66	47	54	2	27
Volume	355	1,321	1,671	68	123
Coconut oil					
Value	4,050	1,465	1,237	959	654
Volume	4,262	4,253	4,108	2,001	1,352
Desiccated coconut					
Value	521	413	461	310	278
Volume	2,381	3,149	4,974	1,795	970
Bananas					
Value	578	729	1,230	563	363
Volume	2,381	3,159	4,974	1,795	970
Vanilla beans					
Value	865	827	938	866	2,041
Volume	13	13	15	13	30
Root crops					
Value	317	134	174	375	224
Volume	1,550	552	558	400	300
Watermelons					
Value	350	136	1	12	5
Volume	131	77	1	17	9
Fish					
Value	439	455	827	976	1,668
Volume	260	347	598	664	992
Other exports ^{/b}	1,472	1,551	1,863	2,656	4,263
Total Exports ^{/b}	8,657	5,757	6,886	6,718	2,523

^{/a} Value in thousands of US dollars and volumes in metric tons unless otherwise indicated.

^{/b} Includes squash in 1987/88 and 1988/89.

^{/c} Components may not add to totals because of rounding.

Sources: Data provided by the Tongan authorities and World Bank staff estimates.

or sea to visit Vava'u. Although proposals have been made for development of major tourist facilities on Tongatapu, the tourism development

potential of Tongatapu is likely to be limited. The additional demand for land travel on the island and sight-seeing to nearby islands which

Table 3.2: TONGA-MERCHANDISE IMPORTS, 1984-1989
(T\$ '000)

Item	1984/85	1985/86	1986/87	1987/88	1988/89 /a
Food and live animals	11,749	13,737	13,606	17,299	9,117
Beverages and Tobacco	2,777	3,163	3,920	3,291	1,515
Crude materials inedible	3,109	2,892	2,671	2,500	1,506
Fuels and lubricants	7,425	8,071	6,715	6,516	3,327
Oils and fats	116	129	126	153	103
Chemicals	3,357	4,075	5,234	4,924	2,123
Cement	831	1,068	1,201	1,167	404
Other manufactured goods	9,940	9,667	13,683	11,265	6,941
Vehicles	2,252	2,330	1,782	3,664	1,802
Other machinery and transport equipment	4,869	9,547	11,109	11,280	6,892
Miscellaneous manufactured articles	4,906	5,392	5,292	6,331	3,278
Commodities and transactions N.C.	221	254	230	302	302
Total	51,552	60,325	65,569	68,692	37,310

/a For the first two quarters only.

Source: Statistical Abstract, Statistics Office, Government of Tonga.

could result from additional tourism is likely to add modestly to existing transport demand.

B. COUNTRY DEVELOPMENT STRATEGY

3.7 A recent Bank study of the Pacific Island economies (World Bank, 1991) forecast increased, though modest, economic growth in all sectors of the Tongan economy (see Table 3.6). Exports of some traditional bulk agricultural products (copra and bananas) is forecast to stagnate, but exports of vanilla, root crops and squash should continue to rise. Increased growth of manufactured exports will be required to support export performance. Tourism should increase by 6 percent annually

to achieve the forecast economic growth. Remittance income and official assistance are expected to be maintained.

3.8 This scenario is likely to result in a decline in the volume of imports of agricultural products from outer islands for re-export through Nuku'alofa. It is also likely to result in increased demand for road traffic on Tongatapu and for travel by tourists between Nuku'alofa and Vava'u. Principal risks in the economic scenario include a decline in private remittances and aid, an inability to contain imports, and stagnant export performance.

Table 3.3: TONGA—TRADING PARTNERS, 1989
(T\$ '000)

Country	Imports	Exports	Reexports
Australia	15,233	2,585	86
China (Mainland)	902	-	-
China (Taiwan)	1,011	8	-
Fiji	6,259	78	107
Other Pacific	302	559	56
Hong Kong	1,319	3	0
Japan	4,895	1,999	4
New Zealand	20,906	3,566	318
Singapore	5,918	0	-
USA (Continental)	6,133	2,134	37
USA (Hawaii)	1,715	577	23
United Kingdom	959	3	-
Europe	860	1	19
Other	1,922	5	16
Total	68,334	11,518	666

Source: Annual Foreign Trade Report, Statistics Department.

Table 3.4: TONGA—MODE AND PORT OF IMPORTS, EXPORTS AND RE-EXPORTS, 1989
(T\$ '000)

	Imports	Exports	Re-exports
A. Mode			
Sea	51,975	4,225	527
Air	15,959	7,287	138
Post	400	6	-
Total	68,334	11,518	666
B. Location			
Nuku'alofa	66,389	10,719	665
Vava'u	1,945	798	1
Ha'apai	-	-	-
Total	68,334	11,518	666

Source: Annual Foreign Trade Report, Statistics Department.

Table 3.5: TONGA—VISITOR ARRIVALS, 1980-1989

	1980	1985	1986	1987	1988	1989
A. Total Arrivals by Air	12,505	14,216	16,088	17,239	19,456	21,029
Nationality (%):						
Australia	13	21	19	17	15	13
New Zealand	27	24	24	24	24	21
USA	17	18	20	24	22	20
United Kingdom	3	3	2	4	5	6
Germany	11	7	5	6	7	6
Japan	2	2	2	2	2	3
Fiji	8	8	9	6	8	7
Other Pacific Islands	9	7	8	6	5	7
Other	10	10	11	11	12	17
Total	100	100	100	100	100	100
B. Arrivals by Cruise Ship ^{/a}						
No. of ships	37	46	22	18	13	14
No. of visitors:						
Passengers	57,384	61,068	22,588	15,123	14,656	9,187
Crew	17,863	19,320	8,078	6,068	7,120	4,164

^{/a} Includes double counting of cruise ships which call at both Tongatapu and Vava'u.

Source: Tonga Visitors Bureau.

Table 3.6: TONGA—PROJECTIONS OF GDP GROWTH, 1990-99
(annual percent)

	1984/85-1988/89	1989/90-1993/94	1994/95-1998/99
Agriculture	1.4	2.6	2.7
Manufacturing	5.7	5.8	5.9
Other	3.9	3.1	3.4
Total	2.6	3.2	3.5

Source: World Bank (1991a).

CHAPTER 4 TRANSPORT SECTORS

A. LAND TRANSPORT

4.1 Road Infrastructure. There are 1,790 km of road in Tonga, a little over half of which is on Tongatapu (see Table 4.1). There is no formal road information system, and thus no systematic information on road pavement and condition nor an investment and maintenance history for road sections.

4.2 Road investment is estimated to have averaged T\$0.8 million annually between

1985/86 and 1987/88 (see Table 4.2). This has been expended almost entirely on road rehabilitation and upgrading. The total length of road increased by 54 km from 1985 to 1988, including upgrading of 20 km of road to highway status. Over this period, most new roads were in the categories of feeder and access roads. A substantial proportion of the road investment was funded under an ADB multi-project which included construction of 20 km of agricultural access roads on 'Eua island and upgrading of 30 km of road on Tongatapu at an estimated cost of about T\$0.7 million. Aid

Table 4.1: TONGA—ROAD INVENTORY, 1985 AND 1988 /a
(kilometers)

	1988					1985 Total
	Highway /b	Trunk	Feeder	Access	Total	
Tongatapu	64.6	188.6	248.0	487.0	988.1	939.1
Vava'u	9.3	93.3	123.0	97.0	322.6	322.6
Ha'apai	7.0	31.1	145.0	55.0	238.1	233.1
'Eua	0.6	20.8	85.0	40.0	146.4	146.4
Nius	-	29.3	654.0	..	94.3	94.3
Total km (1988)	81.5	363.0	666.0	679.0	1,789.5	
Total km (1985)	61.9	363.6	640.0	670.0		1,735.5

/a Excludes access roads in Niuaus and urban roads.

/b The category of Highway is sealed roads, however, some trunk roads are also sealed.

Source: Central Planning Department.

**Table 4.2: TONGA—INVESTMENT IN ROAD INFRASTRUCTURE, 1985-1991 /a
(T\$ '000)**

	1985/86	1986/87	1987/88	1990/91 /b
Tongatapu:	360	623	363	..
Nuku'alofa	78	358	310	..
Other	281	85	53	..
Subtotal	360	623	363	..
Vava'u	96	20	242	..
Ha'apai	158	69	34	..
Unspecified Agric. roads	187	37	225	..
Total	802	749	864	1,542

/a Funds which pass through the accounts of the Government of Tonga only.

/b Budget.

Source: Central Planning Department.

funds from other sources also contributed to road construction, for example, Australian assistance is provided through accountable cash grants for the supply of equipment and road expenditure by the Government of Tonga. About A\$1.0 million of equipment for the road sector was provided through AIDAB between 1981 and 1988.

4.3 Initial planning for Development Plan VI (1991 to 1995) is based on forecast annual road investment of T\$4.0 million. This is a very large increase on investment in recent years. Most of the projects are expected to be financed with aid or loan funds. No indication is available of the extent to which funds have been committed to projects.

4.4 Expenditure on *road maintenance* declined in real terms by 8 percent per annum from 1980 to 1987 (see Table 4.3). Previous studies (Beca Worley, 1988 and GITEC, 1990)

have established that funding for maintenance is inadequate. On the basis of the various data it is estimated that expenditure for minimum routine maintenance of roads in Tonga should have been almost double the T\$0.767 million budgeted for 1990/91 (where this figure itself is a substantial increase over expenditure in recent years). Additional expenditure is required to rehabilitate existing roads to a level where this forecast expenditure for routine maintenance is adequate to sustain the road network. (See Part 2 of this Report).

4.5 The Ministry of Works has undertaken all *road construction and maintenance* in Tonga on a force account basis. At present, there is little private sector capacity for road construction and maintenance.

4.6 Tonga has an adequate supply of coral material for road construction, however there are a number of features which should be taken

**Table 4.3: TONGA—ANNUAL ROAD MAINTENANCE EXPENDITURES, 1980-1987
(T\$ '000)**

Year	Current Prices	Constant 1989 Prices
1980	262	648
1981	235	493
1982	197	372
1983	202	365
1984	255	442
1985	216	337
1986	396	482
1987	304	362

Source: Ministry of Works, and GITEC (1990).

into account to better use the available materials (for example, retaining the hardest materials for aggregate for asphalt seals and elimination of clay contamination) (Beca Worley, 1988).

4.7 There is generally inadequate operable equipment for road construction and maintenance in Tonga. The quantity and condition of the equipment varies considerably by location and type. On Tongatapu the MOW has some new equipment, though it is sometimes underutilised (for example there is insufficient demand to fully utilize bitumen sprayers). In contrast, equipment in Vava'u includes a crusher built in about 1950 which is operational for only about half of the time, a single poorly-operational bulldozer, a 20 year old grader with mechanical problems, two unserviceable loaders and a single vibrating roller in need of major maintenance. Maintenance of equipment is constrained by a lack of spare parts and funding. The unit cost of maintenance is increased by the need to maintain small stocks of equipment in different parts of the country, to move equipment to Tongatapu for some major items of maintenance, and to move some lowly-utilized specialized items of equipment from one location to another.

4.8 Design standards for roads are limited to specification of features such as formation and pavement widths and pavement thickness, although the limited range of traffic, terrain and soil conditions reduce the need for complex standards and design rules.

4.9 Road construction methods range from adequate to poor. On Tongatapu some roads currently being upgraded received a prime seal in 1990, but are now deteriorating while awaiting the appropriate weather/season for a chip seal. These roads have reasonable drainage. Spalling of slurry seals and some potholing is evident on roads only five years old. Construction of feeder roads is poorer, with sections of road having no proper drainage and, sometimes, a road surface below adjacent ground level. These constraints have been evident for some years, and recommendations for improvements have been made (Beca Worley, 1988) however, the proposals appear not to have become common practice. The lack of national road design and construction standards, adequate trained staff, and operations manuals, constrains the work of MOW staff, especially in regional offices.

4.10 The MOW has no formal road or maintenance management system at present. It is not possible to establish past maintenance of individual road links nor to systematically establish current and future maintenance needs.

4.11 Some of these needs are being addressed in a current technical assistance project to MOW with staff training in road design, construction and maintenance, funding for road construction, installation of a computerized road maintenance management system, and supply and rehabilitation of equipment (AIDAB, 1991-1992). Importantly, assistance is also directed at increasing MOW's general capability to design and implement projects using private sector contractors.

4.12 **Road Planning.** No comprehensive transport planning studies have been undertaken for Tonga. An ADB/UNDP funded study of road upgrading was prepared in 1975 (Gibb, 1975). This provided the basis for much subsequent road upgrading work, but has not been referred to in recent studies which include:

- An evaluation of road upgrading projects on Tongatapu for the ADB-assisted Third Multiproject (Redecon, 1987).
- An evaluation of road standards, road construction methods and road maintenance practices, with particular emphasis on New Zealand assistance in the sector (Beca Worley, 1988).
- An appraisal of road projects on Tongatapu and 'Eua Islands for the ADB-assisted Fourth Multiproject (GITEC, 1990).

Prior to these studies, a policy paper outlining a comprehensive five year road development program had been prepared by MOW (MOW, 1986).

4.13 The *road appraisal studies* for the two Multiprojects have involved basic economic

evaluations of individual projects: screening criteria based on traffic volume and road surface condition and rudimentary evaluation of user cost saving benefits. The average size of projects evaluated has been small, for example T\$0.2 million in the ADB Fourth Multiproject. Traffic growth forecasts have generally been assumed the same for all roads, and have been based variously on past traffic growth and forecast changes in vehicle ownership. The Ministry of Works has maintained a program of annual traffic counts at eighteen locations on Tongatapu, providing useful data for planning purposes. However, the sampling and other statistical features of the traffic counts have not been assessed. The counts indicate average annual growth in traffic during the 1970s and 1980s to be about 9 percent annually for total traffic and 8 percent annually for rural traffic. Fuel consumption is estimated to have increased by 6 percent per annum between 1975 and 1988 (GITEC, 1990). In preparing traffic forecasts for major roads, little account has been taken of future economic activity. The evaluation of agricultural road projects includes estimated modest increases in production (ADB, 1986).

4.14 Project appraisals have included future road maintenance needs. However, they have not prepared summaries indicating the net effect of project investment proposals on future Government expenditure, nor have they fully addressed the capacity of Government to fund and implement increased obligations.

4.15 **Vehicle Registration.** Road vehicles are required to be registered and to be licensed annually. Large numbers of vehicles are imported to Tonga, for example 1,157 vehicles were imported in 1989 (1,076 in the previous year), equal to a quarter of the total vehicles registered. Of the 5,290 vehicles imported to Tonga during the decade to 1987, 56 percent were used vehicles. Imports in 1988 and in 1989 were about double the annual average number of vehicles imported in the previous decade. Some of the imported vehicles are left-hand drive, but the Ministry of Police does not

permit these vehicles to exceed 15 percent of the registered vehicle population for safety reasons. The greatest rate of growth in registered vehicles has been in Vava'u, although over three-quarters of vehicles are presently located on Tongatapu (see Table 4.4).

4.16 Vehicle registration and license fees were set in 1976 and implemented in 1978. The fees are now very low having remained unchanged since introduction, relative to an almost fourfold

increase in the consumer price index. The annual license fee for a typical private car is T\$15 and T\$50 for trucks greater than 3 tonnes. A driver's license is T\$2.

4.17 The *freight transport* industry is almost entirely in the private sector, and loans for acquisition of trucks and vans have been made available by the Tonga Development Bank. (Fleets for their own use are operated by the Tonga Commodities Board and the Ministry of

Table 4.4: TONGA—LICENSED VEHICLES, 1980 - 1989

Vehicles	1980	1985	1986	1987	1988	1989
A. Number of Vehicles						
Cars & light trucks	1,530	1,823	2,430	2,892	2,739	2,306
Heavy trucks	350	495	544	648	2,147	895
Taxis	268	277	212	334	601	689
Buses	117	111	122	125	-	95
Motor cycles	188	392	401	543	472	473
Others	396	296	267	216	264	223
Total	2,849	3,394	3,976	4,758	6,223	4,681
B. Ownership of Vehicles						
Government	285	401	392	452	..	748
Private	2,564	2,993	3,584	4,306	..	3,933
Total	2,849	3,394	3,976	4,758	6,223	4,681
C. Regional Distribution of Vehicles						
Tongatapu	..	2,800	3,352	4,033	5,339	3,644
'Eau	..	91	72	68	130	118
Ha'apai	..	84	85	83	100	98
Vava'u	..	395	446	554	629	797
Niuas	..	24	21	20	25	24
Total	2,849	3,394	3,976	4,758	6,223	4,681

Sources: Police Department, Statistics Office (Statistical Abstract), and Central Planning Department (Review of DP-IV and Draft DP-V).

Works.) There is no economic regulation (entry, routes and rates) for freight transport, and no data on the scale of the transport task. The principal goods moved by road transport are agricultural products to major towns and ports, distribution of processed products (particularly from Nuku'alofa on Tongatapu), and movement of construction materials (in particular, for major public sector projects).

4.18 *Public transport* is provided by privately-owned bus companies, taxi companies and rental car operations. Bus services are licensed by the Ministry of Labor, Commerce and Industries. Bus operators may vary routes and the number of vehicles in response to passenger demand. Fares are set by the Government, and were reviewed last in 1988. In 1989, there were 91 private buses in Tonga, almost three-quarters of which operated in Tongatapu. Most of the buses are used for local public transport services, with only a few dedicated to the modest needs of the tourist industry. Tongatapu is a sufficiently small island to permit commuting to Nuku'alofa. The number of taxis doubled between 1987 and 1989, and are generally aged vehicles operating without meters. Fares are controlled, but entry and exit from the industry are unconstrained.

4.19 *Cost-recovery* for land transport has not been addressed in detail by the Government. Income from fuel excise tax, import duties on vehicles, tires and fuel and vehicle and driver licenses in 1988/89 were about T\$2.0 million (GITEC 1990), compared with maintenance expenditure of T\$0.6 million and capital expenditure of T\$0.7 million. However, in as much as import duties are a major source of Government revenue in general, all duty from vehicle imports cannot be readily attributed to transport cost-recovery, notwithstanding that the average duty on imports of vehicles and spare parts is about double the average rate of duty (about 13 percent) on imports. Even putting aside optimal import duty/elasticity considerations, revenues from above average duty on vehicles and spares, together with vehicle registration and license fees, and driver

license fees, are insufficient to cover required road maintenance expenditure.

4.20 *Transport regulation* primarily involves two agencies: the Ministry of Labor, Commerce and Industries (bus and taxi licensing and fare control); and the Ministry of Police (vehicle and driver licensing). There are no current proposals to change the nature of transport regulation, but an objective of the Sixth Five Year Plan will be to "better regulate the public and private transport system in order to allow the existence of safe and competitive passenger services". Care will be required to ensure that changes to regulations are focused on improved safety and economic efficiency rather than seeking to specifically influence the quantity, quality or price of services.

4.21 *Land transport development proposals* for Development Plan V (1991-1995) include:

- Tongatapu Road Works (T\$7.55 million)
 - Vuna Road Reconstruction (T\$0.6 million)
 - Urban Roads, Nuku'alofa (T\$2.5 million)
 - Rural Roads, Tongatapu (T\$1.2 million)
 - Urban Footpaths Upgrading (T\$0.75 million)
 - Urban and Village Minor Roads (T\$1 million)
- Ha'apai Road Works (T\$0.95 million)
 - Roads Reconstruction (T\$0.75 million)
 - Causeway Engineering Studies (T\$0.2 million)
- Vava'u Road works (T\$2.5 million)
 - Roads and Drainage
- 'Eua Road Works (T\$0.75 million)
 - Roads and Drainage
- Niua Road Works (T\$0.75 million)
 - Roads and Drainage
- Other Projects (T\$3.65 million)
 - Road Works for Sporting Facilities (T\$0.15 million)

- Road Works for the Second Small Industries Center, Tongatapu (T\$1 million)
- Road works for Tourism Infrastructure (T\$1.5 million)
- Agricultural Roads (T\$1 million)
- Management, Design and Technical Assistance (T\$4.075 million)
 - Staffing and Training (T\$3.5 million)
 - Road Transport Regulations (T\$0.075 million)
 - Road Traffic Engineering (T\$0.5 million).

4.22 The total cost of these proposals is T\$20.125 million.⁶ This is a substantial increase on average annual investment of about T\$0.8 million between 1985/86 and 1987/88. Little preparation has been undertaken for these projects, they have not been systematically evaluated and prioritized, and few donor funds are committed.⁷

4.23 *Road safety* is an emerging problem, with 282 accidents in 1989, up from 94 accidents in the previous year. Seventy-seven people died in accidents in the ten years to 1989, with 11 deaths in 1989. Alcohol is considered to be the principal contributing factor in casualty accidents. There has been no systematic or continuing assessment of accident trends in Tonga. Vehicles are subject to an annual safety inspection, carried out in Tongatapu for the Police by the Mechanical Division of the Ministry of Works. Present speed limits are 40 kph in towns and 65 kph elsewhere. The latter, in particular, is low and may result in reduced respect for the limit. Speed limits should be realistic and well-enforced.

B. MARITIME TRANSPORT

Port and Marine Facilities

4.24 **Port Traffic.** Nuku'alofa port is the principal port in Tonga for international traffic. About 37 percent of interisland shipping movements also occur at the port (see

Table 4.5). Almost all internationally traded goods pass through the port, with only 3 percent of international trade occurring through Vava'u (see Table 3.4). 123,730 tonnes of freight passed through Nuku'alofa port in 1989, 91 percent of which was international traffic (see Tables 4.6 and 4.7) - some of the remaining, domestic traffic are on-carriage of international freight. Exports and domestic freight movement at the port declined during the second half of the 1980s, though imports increased substantially. Recorded interisland vessels are generally between 150 and 400 gross tonnes. As no data are maintained for vessels of less than 15 meters in length, no routine data are available on the informal shipping sector. No assessments have been made of the scale, role and performance of the informal shipping sector.

4.25 After declining in 1988, the number of container movements at Nuku'alofa port rose by 44 percent in 1989. Container traffic is dictated largely by the volume and extent of containerization of imports. These both appear to be increasing (see Tables 4.7 and 4.8). Based on typical mass of loaded containers, it appears that about 45 percent of imports are containerized. There remains considerable potential to better use outbound empty containers. Efforts to do so could help exports. They would also promote increased containerization of imports by providing return traffic for containers.

4.26 Upgrading *port infrastructure* in Tonga has been accorded high priority in the past. As with other transport sub-sectors, only part of the investment is recorded in the accounts of the Government of Tonga as some aid is expended directly by donor agencies. UNDP data suggests that 59 percent of development expenditure in the transport sector through the mid-1980s was directed to the maritime subsector (World Bank 1989). During the first three years of DP-V, investment in the sub-sector was 130 percent greater than had been planned.

Table 4.5: TONGA—INTER-ISLAND SHIPPING ACTIVITY /a, OCTOBER-DECEMBER 1988

Town	Island	Ship Movements		Passengers		Cargo	
		Arr.	Dep.	Arr.	Dep.	Arr.	Dep.
Nuku'alofa	Tongatapu	140	140	4,902	5,484	1,384	2,186
Neiafu	Vava'u	20	20	1,636	1,595	1,090	776
Nafanua	'Eua	91	91	2,118	2,278	92	92
Pangai	Ha'apai	61	61	6,509	4,078	3,041	2,346
Ha'afeva and Nomuke	Ha'apai	57	57	6,434	6,606	2,987	2,951
-	Niutaoputapu	5	5	269	340	190	365
-	Niuafo'ou	5	5	340	269	365	190
Total		379	379	21,108	20,650	9,147	8,906

/a Activity is double-counted where a ship makes calls at several ports during a single voyage.

Source: Bulletin of Coastal Shipping Statistics.

Table 4.6: TONGA—INTERISLAND SHIPPING TRAFFIC AT NUKU'ALOFA, 1985 - 1989 /a

	1985	1986	1987	1988	1989
Cargo /b (Freight tonnes)					
Inward	13,752	6,970	7,704	5,486	5,454
Outward	7,188	7,915	10,103	7,399	5,695
Passengers (No.)					
Inward	21,685	22,598	21,639	23,562	18,631
Outward	19,419	23,761	23,658	21,313	19,020
Total	41,104	46,359	45,297	44,875	37,641
Vessels (No.)					
Inward	644	717	677	712	618
Outward	646	711	674	700	617
Total	1,290	1,428	1,351	1,412	1,235

/a For vessels with minimum length of 15 meters.

/b Cargo includes international traffic in transit to and from the outer islands.

Source: Ports Administration Department.

Table 4.7: TONGA—INTERNATIONAL SHIPPING TRAFFIC AT NUKU'ALOFA, 1985 - 1990

	1985	1986	1987	1988	1989	1990
Cargo (tonnes)						
Imports	63,903	61,936	100,126	90,663	98,741	111,174
Exports	19,854	23,667	20,930	14,926	13,834	16,117
Total	83,757	85,603	175,000	105,589	112,575	127,291
Vessels (No.)						
Cruise ships	..	13	13	5	9	..
Cargo ships	..	95	111	110	101	..
Tanker ships	..	24	29	27	36	..
Other	..	27	9	31	21	..
Total	157	159	182	173	167	175

Source: Ports Administration Department.

4.27 Major recent maritime projects have included: rehabilitation and extension of the Queen Salote Wharf in Nuku'alofa (completed in 1985 at a cost of T\$7.5 million and funded by AIDAB); provision of cargo handling equipment at Nuku'alofa port (A\$0.7 million funded by

AIDAB); development of a the Faua fisheries harbor adjacent to Nuku'alofa port (T\$2.9 million funded by the EC, and completed in 1987); upgrading of the wharf in Neiafu (ECU1 million funded by the EC) and improvement of Nafanua Harbor on 'Eua (US\$1 million, with

Table 4.8: TONGA—CONTAINER MOVEMENTS AT NUKU'ALOFA PORT (TEU), 1987 - 1989

	1987	1988	1989
Inward:			
Loaded	2,401	2,201	3,061
Empty	220	163	659
Total	2,621	2,364	3,720
Outwards:			
Loaded	927	394	470
Empty	1,709	1,939	2,580
Total	2,636	2,333	3,050

Source: Ports Administration Department.

parallel financing from ADB and AIDAB, and completed in 1990). Development of Nuku'alofa port, Fuaa fisheries harbor and foreshore protection works (the latter undertaken with funding assistance from Germany) were coordinated, though not until some construction activities had commenced. Other assistance includes a study by the EEC to assess requirements for a harbor dredging machine, provision of a pilot boat for Nuku'alofa port from New Zealand and a continuing program for the provision of marine navigational aids by AIDAB. These aid projects have generally resulted from individual requests for assistance (often in response to an urgent need, for example, resulting from storm damage) rather than from a systematic assessment of sector needs and project appraisal.

4.28 Few queuing delays are reported for ships at the upgraded Queen Salote Wharf, however the berth length of 110 meters is too short to allow container ships to unload their forward hatches directly onto the wharf. Vessels must either de-berth, turn around and reberth to complete unloading or must incur up to a doubling of handling times as containers are moved along the ship. Berthing may be difficult at times because of weather conditions, but the total costs of constructing and operating a better-oriented wharf would be considerably greater than total costs with the current facility. Investment in Nuku'alofa Port has been substantial and excess capacity is currently evident.

4.29 Investment in ports on *other islands* has been limited to channel and reef blasting, particularly on smaller islands. Given the past emphasis on investment in Tonga's major ports, the Government is now seeking investment in ports on outer islands. The Government has sought Australian aid for improvements in Ha'apai (as part of the Ha'apai Regional Plan) and the EEC for improvements in Vava'u (as part of the Vava'u Regional Development Programme). There has been no strategic consideration of the appropriate location and

scale of these improvements to date. While proposals for the Ha'apai region marine infrastructure program have been formulated, no appraisal has been made of the projects in the T\$2.5 million program.

4.30 Port *construction* has been undertaken almost entirely by the Ministry of Works. This represents a major construction effort with, for example, an average of T\$3 million of construction activity in each of the three years 1985/86 to 1987/88.

4.31 Annual expenditure required for adequate *maintenance* of the Queen Salote Wharf is estimated to be T\$94,000 in 1990 prices (AIDAB, 1991). In contrast, T\$15,900 was spent in 1988/89 and T\$24,200 in 1989/90. Similarly, maintenance expenditure for mechanical equipment at the port has been, at T\$60,500 in 1989/90, a little over half the T\$105,000 estimated to be required. Total annual maintenance needs for Nuku'alofa port are estimated at T\$0.26 million in 1990 prices, with budgeted expenditure of T\$0.10 million and T\$0.08 million in 1989/90 and 1990/91, respectively.

4.32 The Ports Administration Department (PAD) in the Prime Minister's Office is responsible for *port operations*. The agency has identified the need to update the Wharves Act (passed in 1903 and amended last in 1968) and the Harbors Act (also passed in 1903 and amended last in 1981). Amongst other limitations, the Harbors Act does not deal adequately with pollution. Associated legislation also in need of updating include the Shipping and Seamen's Act and the Petroleum Regulations Act. The Ports Administration Department does not have equipment or training to respond to maritime pollution, and is conscious of the need for improved industrial safety in the port area (for example, handling of containers).

4.33 Nuku'alofa is the only port to have equipment to handle containers. Neiafu port in Vava'u is the only other port with significant

container traffic (ten foot containers only), and port staff must improvise to move containers in the port area. This is currently being achieved by dragging containers along the ground behind a tractor. It is unlikely that formal container forklifts could be justified for the limited container traffic at ports other than Nuku'alofa - alternative innovative approaches, such as simple lifts or dollies for handling containers at these ports, warrant formulation and support.

4.34 *Port charges* were last revised in 1984. The revised rates were implemented in 1986. Income and expenditure for the PAD indicate almost full *cost-recovery* of operating and maintenance costs (see Table 4.9). This has been achieved largely because of underspending on maintenance of the existing infrastructure.

4.35 *Maintenance expenditure* at Nuku'alofa port has been only about 35 percent of

expenditure required to adequately maintain the infrastructure in the long term. If all maintenance activities of the PAD were similarly underspent, the level of cost-recovery for 1989/90 and 1990/91 would decline from 95 to 75 percent. In the past the PAD has been constrained to its budget vote for operating expenditure. Commencing in 1991, the Department is able to retain revenue in excess of a budgeted amount and direct it to increased spending on port operations and maintenance. The ability of the Department to increase maintenance expenditure will depend eventually, however, on an increase in port charges.

4.36 The PAD is considering use of a computerized port management system developed by the Ports Authority of Fiji and elements of a model tariff structure developed for the region (ESCAP/UNDP, 1989), but has no formal program for their adoption.

Table 4.9: TONGA—PORT ADMINISTRATION DEPARTMENT INCOME AND EXPENDITURE, 1989 - 1991 (T\$ '000)

	1989/90 <u>/a</u>	1990/91 <u>/b</u>
Port and Wharfage Revenue	679.0	738.0
Expenditure:		
Administration	47.6	58.2
Harbor Services	142.8	172.0
Wharf Services	513.6	556.4
Total	704.0	786.6
Comprising:		
Operations	591.8	686.0
Maintenance	112.2	100.6

/a Revised estimate.

/b Estimate.

Source: Ministry of Finance.

4.37 The roles of the two *institutions* in the maritime sector (the PAD and MOM) overlap, with the result that both take an interest in a range of common matters but little change appears to be effected. The MOM has formal responsibility for the planning of shipping and port services in Tonga and for maritime legislation (see paragraph 2.7). In practice, the Ministry has few resources; little planning is undertaken and no changes to legislation are being formulated.

4.38 No comprehensive *planning/priority* studies have been prepared for the maritime sub-sector, nor have inter-modal issues been formally explored. Project planning has generally occurred on a project-by-project basis in the past (for example, planning of the adjacent Queen Salote Wharf and Fuaa fisheries harbor proceeded separately, with designs being amended during construction to better integrate the two projects and to reduce project costs). In January 1991 the ADB and the Government agreed to undertake a planning study for an integrated marine infrastructure development project.⁸

4.39 Project planning has, at times, been an extended process. For example, the first feasibility study for upgrading of Nuku'alofa port was undertaken in 1975. An evaluation in 1977 indicated an economic rate of return of 13 percent, though this was based on a high forecast of freight movements. A subsequent evaluation in 1979 did not establish an internal rate of return, but noted that the value of the project depended on intangible items. The project was eventually commenced in 1982 and was completed in 1985.

4.40 *Project proposals* for Development Plan VI include:

- Acquisition of a Berthing Tug (T\$4 million)
- Queen Salote Wharf Improvement and Extension (T\$5 million)

- Vuna Wharf and Yellow Pier in Nuku'alofa (T\$1 million)
- Vava'u Region Infrastructure and Facilities (T\$1 million)
- Ha'apai Region Infrastructure and Facilities (T\$2.5 million)
- Improvements to Nafanua Harbor, 'Eua (T\$0.25 million)
- Derricks for Niuafou'u, Niuafo'u (T\$0.12 million)
- Ship Building and Repair Facilities, Tongatapu (T\$6 million)
- Yacht Marina, Tongatapu (T\$2 million)
- Establishing a Ports Authority (T\$0.15 million)
- Shipping and Ports Regulations (T\$0.1 million)
- Training (T\$0.4 million).

These projects have been identified in response to perceived needs in Tonga. Some of the projects were also included in the previous Five Year Plan, for example, a berthing tug and shipping and ports legislation, but did not receive funding support. Feasibility studies have not been prepared for any of the projects.

4.41 Total development expenditure for the period 1991 to 1995 is T\$17.9 million, 36 percent of total desired expenditure in the transport sector. This is less than the 69 percent share of actual expenditure in DP-IV but higher than the expected 21 percent in DP-V. The only significant commitment of donors funds to date for DP-VI has been by the EC for some components of the Vava'u project.

International Shipping

4.42 International shipping calls to Tonga have been steady in recent years, with a little under 140 calls by cargo and tanker ships per year. Three shipping lines regularly serve New Zealand (including the Pacific Forum Line, of which Tonga is a shareholder), three serve Japan and one each serve Hawaii, the west coast of the USA and Australia. Present service levels are appropriate to freight demand, and are likely to

be sustained. Given the imbalance in Tonga's imports and exports, the rate differential between inbound and outbound traffic is only moderate (for example, in February 1991 the rate for a loaded container from Tonga to Auckland was, at T\$2,000, 73 percent of the reverse movement, while the cost from Tonga to Sydney of T\$1,300 was 53 percent of the reverse movement).

Domestic Shipping

4.43 *Formal* domestic shipping services are currently provided by the Shipping Corporation of Polynesia (SCP). The SCP is a joint venture of the Government of Tonga (60 percent) and Columbus Line of Germany (40 percent). The SCP operates four ships, one of which (the Fua Kavenga) is chartered to the Pacific Forum Line and two of which are old and have limited usefulness. The remaining ship, the Olovaha, operates weekly services from Tongatapu to Ha'apai and Vava'u. Fares were last revised in 1989, and the present fare for the 24 hour trip to Vava'u is T\$36 (compared with the airfare of T\$109). The Olovaha was provided to the Government of Tonga by the Government of Germany under a concessional loan having a ten year grace period and loan repayment over a subsequent twenty year period. Present revenue for the SCP is sufficient to provide a small surplus after operating costs and interest charges, however the surplus is insufficient to meet principal repayments which are about to commence. Moreover, the Olovaha is considered to have a practical life of twenty years, and its usefulness will deteriorate before the loan for its purchase is repaid. Some competition to SCP has occurred in the domestic market, but this has been sporadic. For example, a 100 passenger catamaran operated three services a week from Tongatapu to Vava'u via Ha'apai for about four months in 1990, making the one-way trip within daylight hours on a single day compared with the 24-hour trip with the Olovaha. The service provided a considerable increase in capacity and improvement in passenger service, but was

terminated, apparently because it was not financially viable.

4.44 No information is available on *informal boat services* in Tonga. Given the geography of Tonga, it is likely that most operations occur within the Ha'apai Group of islands.

C. AVIATION

Air Routes

4.45 *International* air services to Tonga involve five airlines: Air Pacific, Polynesian Airlines, Air New Zealand, Hawaiian Airlines, Royal Tonga Airlines and Samoa Air. With the exception of Samoa Air which serves Vava'u, all international services operate to Fua'amotu airport on Tongatapu. Royal Tonga Airlines was introduced in July 1991 by renaming Friendly Island Airways; international services (Auckland-Tongatapu) have been established on the basis of a "wet-lease" cooperative arrangement with Solomon Airlines (see Part IV of this Report). There has been a small increase in services in recent years: changes have included an increase in the number of flights to Fiji by one per week, the transfer of the Vava'u to Pago Pago link from Hawaiian Airlines to Samoa Air and the replacement of one of the B737 services by Air New Zealand on the Auckland-Tongatapu-Apia route with a B767 aircraft. Air Pacific's replacement of B737 services from Fiji to Tonga in the mid-1980s with ATR42 aircraft and continued use of the latter aircraft suggests them to be appropriate aircraft for the sector. Half of the international services to Tonga are operated by propeller-driven aircraft. The total market for international air traffic is limited and VFR traffic may stagnate. Current seat capacity appears more than adequate and some rationalization may occur.

4.46 *Domestic* services changed substantially in 1985 when the Government-owned Friendly Island Airways (Royal Tonga Airlines as of

1991) was established to operate all domestic air services which had previously been provided by the privately-owned Tonga Air and South Pacific Island Airways. The present principal scheduled domestic services are from Fua'amotu to 'Eua, Ha'apai and Vava'u, with services operated from Vava'u to Niuatoputapu and Niuafou'ou when warranted (see Table 4.10). Scheduled services are cancelled or consolidated at short notice when there is low passenger demand.

Airport Traffic

4.47 International and domestic passenger movements at *Fua'amotu airport* almost doubled between 1984 and 1988 (see Table 4.11). Data in Table 3.5 appears to exclude temporary residents, i.e. emigrant Tongans returning temporarily to Tonga; these travellers have been a reasonably steady 34 percent of total international passenger movements during the period 1985 to 1988. The effect of emigration is also reflected by 10 percent more embarking passengers than arrivals during the period 1985 to 1989.

4.48 *Air freight* has accounted for almost one quarter of the value of imports and, more importantly, almost two-thirds of the value of exports (see Table 3.4). Air cargo is currently estimated at 700 tonnes per year, up from 290 tonnes in 1983. A fuller understanding of the

role of international air freight in facilitating export performance, and opportunities for further investment to support its growth should be undertaken.

4.49 *Lupepau'u airport* in Vava'u is the second most heavily used airport, serving the tourist industry and one international route (to Pago Pago) in addition to other domestic traffic. Most of the international passengers recorded at Lupepau'u airport in the past were in transit to or from Fua'amotu airport. There was little growth in the number of passengers on domestic services in the mid-1980s (see Table 4.12); given stagnant population in Vava'u in this period, there appears to have been little growth in tourism.

Airport Facilities and Investment

4.50 *Fua'amotu airport* on Tongatapu is 20 km from Nuku'alofa. Jet aircraft first used the airport in 1976 following sealing of the runway with assistance from New Zealand. Upgrading of a deteriorated pavement and lengthening of the runway by 600 meters (to 2,671 meters) was completed in 1990 with bilateral aid from Australia (with respective costs of A\$3.7 and A\$3.8 million). The runway is now used by B767 aircraft without restriction, and is capable of accommodating B747 aircraft with some restrictions. At 1991, there were sixteen

Table 4.10: TONGA—DOMESTIC SCHEDULED AIR SERVICES, 1991

Route	Aircraft	Frequency
Fua'amotu to:		
'Eua	BS2A	11/week
Ha'apai-Vava'u	Twin Otter	6/week
Vava'u	Twin Otter	12/week
Vava'u-Niuatoputapu-Niuafou'ou	Twin Otter	As required (about 1/week)

Source: Friendly Island Airways.

Table 4.11: TONGA—PASSENGER AND AIRCRAFT MOVEMENTS AT FUA'ALOFU AIRPORT, 1984 - 1990

	1984	1985	1986	1987	1988	1989	1990
Passengers							
International	38,834	55,771	54,086	62,643	67,401	62,163	106,030
Domestic	10,761	22,270	26,301	31,033	29,466	28,158	
Total	49,595	78,041	80,387	93,676	96,867		
Aircraft Movements							
International	1,412	1,358	1,499	1,784	1,838	1,660	1,886
Domestic	1,087	999	2,519	3,050	2,897	2,379	
Total	2,499	2,357	4,018	4,834	4,735	4,039	

Source: Central Planning Department.

scheduled jet aircraft and about seventy propeller aircraft movements weekly at the airport. A new airport terminal was completed in March, 1991 with Japanese aid (at an unofficial estimated cost of T\$12 million). Other aid projects have included the provision of

equipment from the EEC (T\$1.6 million) and a control tower and airport lighting from New Zealand (NZ\$0.8 million and NZ\$0.7 million, respectively).

Table 4.12: TONGA—PASSENGER AND AIRCRAFT MOVEMENTS AT LUPEPAU'U AIRPORT, 1983 - 1989

	1983	1984	1985	1986	1987	1988	1989
Passengers							
International	2,446	1,959	1,463	249	1,794		
Domestic	7,233	7,012	7,144	12,042	7,565		
Total	9,679	8,971	8,607	12,291	9,359	17,075	17,203
Aircraft							
International	287	208	176	70	362		
Domestic	1,010	833	990	1,558	2,008		
Total	1,297	1,041	1,166	1,628	2,370	1,545	815

Source: Ministry of Aviation, in EEC (1988).

4.51 While no B747 aircraft currently use Fua'amotu airport, the Government of Tonga has argued for development of the airport to its present status on the basis that it needed facilities equal to those in neighboring countries in order not to be disadvantaged. Moreover, infrastructure is seen as an important catalyst to economic development, in particular to support the development of tourism. Accordingly, development of airport infrastructure has been in advance of complementary investment, notably, tourist facilities. No studies have been undertaken to examine these hypotheses. Tourism travel is a derived demand which responds to the relative attraction of alternative travel destinations. Tonga will need to progress its tourism sector strategy, focus on its particular strengths, and establish those expenditures which appear attractive and who should undertake them.

4.52 The remaining five *regional airports* in Tonga all have unsealed runways (see Table 4.13) and are used only by propeller aircraft. Investment has been made at Niuatoputapu and Niuafo'ou airports during the 1980s using Australian aid (for airstrip construction, communications equipment and non-directional beacons at a total cost of A\$0.5 million). Upgrading of Lupepau'u airport in Vava'u (in 1991-1992), involves possible sealing of the airstrip using assistance from the EEC. This will allow accommodation of 40-50 seat propeller aircraft (ATR 42s) and, on a restricted basis, small jet aircraft. A more limited option, with a likely higher priority, involves reconstruction with strengthening of the existing coral runway. The planning study for the upgrading of Lupepau'u airport does not include quantification of full costs and benefits associated with the project, but implies that it is necessary to support tourism development in Vava'u. Runways at the regional airports in Tonga are generally of an adequate standard for existing aircraft movements, while other facilities are of a basic standard.

Operations and Administration

4.53 Tonga is under the Nadi region for air traffic control services. The *Ministry of Aviation* is responsible for the administration and regulation of air transport services, including operation of the country's airports. New Zealand Civil Aviation Regulations and Investigation of Accident Regulations apply in Tonga. An expatriate presently serves as the Director of Civil Aviation.

4.54 Expenditure of the Ministry of Civil Aviation was estimated to be 6 percent greater than income in 1989/90 and 37 percent above income in 1990/91 (see Table 4.14). Revenues are expected to increase in 1990/91 by 24 percent. However, costs in airport services and meteorological services are budgeted to increase by over 60 percent by comparison with 1989/90 as the Ministry meets the full cost of meteorological services, makes allowance for the greater cost of operating the new passenger terminal, and increases staffing levels. It is not possible to precisely delineate the share of increased expenditure attributable to the latter two items, but the increase explicitly attributable to maintenance of the terminal is only T\$3,000. An increase of T\$16,000 is allowed for electricity, much of which can be attributed to the new terminal. The bulk of the increase in expenditure for airport services is attributable to increases in flight service and fire crew staff and acquisition of new vehicles.

4.55 Previous studies have noted that inadequate funds have been spent on *maintenance of airports* (AIDAB, 1987). Expenditure on maintenance was budgeted to rise at a lower rate than operating costs in 1990/91. Given the T\$12 million capital cost of the new terminal building, the annual cost of its maintenance and operation is likely to be of the order of several hundred thousand dollars (apparently no estimates of annual O&M obligations were established in connection with the terminal feasibility study). Maintenance expenditure, excluding staffing cost, for the

Table 4.13: TONGA—AIRPORTS IN TONGA, 1991

Airport	Island	Runway Length (meters)	Surface
Fua'amotu	Tongatapu	2,671	Asphalt Concrete
Lupepau'u	Vava'u	1,700	Coral
Salote Pilolevu	Ha'apai	1,145	Coral
Kaufana	'Eua	730	Grass
Mata'aho	Niuatoputapu	729	Coral
Lavinia	Niuafou'ou	1,039	Grass

Source: Ministry of Aviation.

terminal building in 1990/91 is budgeted at only T\$10,000. Only limited consideration has been given to means for funding the increased cost of operating and maintaining the new terminal.

4.56 Tonga has been recorded as having aviation charges amongst the lowest in the South Pacific (AIDAB, 1987). Fee increases are currently being considered. Fees were last increased in 1989, with only minor increases having occurred during the earlier part of the 1980s. Higher fees are, questionably, viewed as inimical to expanding tourism.

4.57 Consideration has been given to creation of a Civil Aviation Administration in Tonga, but there are no immediate plans to proceed.

4.58 **Airline Operations.** The Government is concerned that domestic air services (and tourist promotion) are constrained by the inability of Lupepau'u airport in Vava'u to accommodate aircraft larger than the present Twin Otter aircraft. However, the average load factor of 65 percent for Friendly Island Airways (FIA) (now Royal Tonga Airlines) and sometime cancellation or consolidation of domestic flights for lack of traffic suggests the airline has adequate spare capacity at present to accommodate increased traffic.

4.59 Prior to the establishment of Royal Tonga Airlines (and its cooperative arrangement with Solomon Islands) there had been interest in obtaining a new aircraft for FIA to operate international services (possibly between Fiji and Vava'u, in association with Air Pacific, to enhance the tourist potential of Vava'u). However, operation of such international routes are not dependent on the acquisition of new aircraft by Tonga. Commercial viability needs to be tested before major investment is made in an aircraft. Use of aid funds to subsidize acquisition of an aircraft should be examined in the context of the opportunity cost of using aid funds for this purpose instead of alternative uses, the sustainability of the investment (i.e. will revenue from fares be sufficient to allow for replacement of the aircraft at the end of its life), the beneficiaries of the subsidy (i.e. will they be foreign tourists who can afford to pay the full cost of air services) and the effect on the market (i.e. will the subsidized service inhibit the ability of other operators to continue services). The recent approach of forming cooperative aircraft sharing arrangements with other carriers in the region is likely to be far more cost effective, if not fully viable commercially (see Part IV of this Report).

**Table 4.14: TONGA—MINISTRY OF CIVIL AVIATION INCOME AND EXPENDITURE,
1989/90 - 1990/91
(T\$ '000)**

	1989/90 <i>/a</i>	1990/91 <i>/b</i>
Revenue	581.0	720.0
Expenditure:		
Administration <i>/c</i>	91.7	27.2
Airport Services	592.2	889.1
Meteorological Services	3.0	69.3
Total	614.9	985.6
Comprising:		
Operations	500.0	864.7
Maintenance	114.9	120.9

/a Revised estimate.

/b Estimate.

/c Excludes costs of Minister's office and Directorate.

Source: Ministry of Finance.

4.60 Planning. Planning studies have been prepared for Fua'amotu and Lupepau'u airports in the past. However, airport development in Tonga has not been guided by its economic rate of return; rather, the objective has been to develop facilities which promote the aviation and tourist sectors. As there are no clear criteria to establish the appropriate quantity and quality of facilities to be developed given this objective, there are continuing proposals to upgrade airports and air service facilities. For example, a new terminal, control tower and fire/rescue service at Lupepau'u airport, to upgrading the airport on Ha'apai to the same standard as Lupepau'u airport, and further extension of the runway at Fua'amotu airport have been proposed. Given the substantial funds required for these projects, careful consideration should be given to their cost-effectiveness and their implications for subsequent future expenditure. For example, upgrading Lupepau'u airport to the

standard suggested will require an increase in staffing of the airport from 11 to 24 people. Higher costs will also be incurred for operation and maintenance of the new facilities. Moreover, the nexus between aviation and tourism, and especially the use of subsidies for the former to expand the latter is questionable and requires careful assessment lest scarce funds be poorly utilized. (For an elaboration on this issue, see Part IV of this Report).

4.61 Project proposals for Development Plan VI include:

- Upgrading of security, communications and other services at Fua'amotu airport (T\$0.6 million).
- Upgrading of Lupepau'u airport (T\$1.0 million).
- Lighting for Salote Pilolevu airport (T\$0.05 million).

- Upgrading of Kafana, Mata'aho and Lavinia airports (T\$0.25 million).
- Feasibility studies and construction of new airports at Ha'afeva and Nomuka in Ha'apai to support tourism development (T\$0.5 million).
- Investment in aircraft for Friendly Island Airways (T\$7.0 million).
- Investment in air cargo facilities (T\$0.3 million).
- Investment in improved administration, including the possible creation of a Civil Aviation Authority (T\$1.1 million).
- Training (T\$.38 million).

4.62 The desired development expenditure during the period 1991 to 1995 is T\$11.2 million. The only major commitments of donor funds to date have been for some of the improvements at Fua'amotu airport and the upgrading of Lupepau'u airport. In addition to these projects, other proposals are being considered, for example, further lengthening of the runway at Fua'amotu airport to 3,000 meters and additional nav aids. The net contribution of these proposals to the Tongan economy (bearing in mind their O&M obligations) has not been established, but would appear questionable.

CHAPTER 5 TRANSPORT SECTOR DEVELOPMENT NEEDS

A. INTRODUCTION

5.1 There is no evidence of transport capacity bottlenecks in Tonga. Supported by foreign aid and private remittances, investment in fixed and mobile infrastructure has generally been adequate for the demands placed on the transport system. Indeed, there are instances of over-investment, in particular in the aviation sector. Yet, there remain areas of deficiency: the single greatest need is improved maintenance of valuable transport infrastructure assets. There are also opportunities for improved institutional and operational performance. Economic growth in Tonga requires that the most effective use be made of the existing stock of assets and future aid funds; it is likely that improvements can be made in these areas.

5.2 The past practice of global objectives for the transport sector and a "shopping list" approach to project selection and implementation has been an effective tool for obtaining donor support and has provided a measure of specific consideration of development activities. But as the transport sector has become more developed, there is a need for a more explicit and comprehensive strategy to guide its further development and operation. Such a strategy should enunciate transport policies, indicate the nature of future transport demand, establish a framework for the formulation, evaluation and scrutiny of transport development projects and guide priorities. The strategy must be cognizant of the political context of Tonga, the nature of

its institutions and customs, and the present aid environment. However, a number of these features are not invariable and, together with changes in activities in the transport sector, will result in a more responsive, appropriate and efficient transport sector.

B. INSTITUTIONAL

5.3 **Investment Justification.** Implied in investment decision-making, particularly in the aviation sub-sector, is a belief in the leading role of infrastructure in economic development. The effectiveness of this leading role is dependent on complementary activities; benefits attributable to it must be offset against the opportunity cost of premature or excessively large investment and of alternative investment opportunities.

5.4 **Government Accountability.** Government is being pressed for greater accountability. This will offer both a challenge to Government to ensure the effective performance of agencies and an opportunity to promote improved pricing and cost-recovery of Government activities.

5.5 **Transport Strategy.** The present process for the preparation of Five Year Plans is in need of review. Past plans have included "shopping lists" of projects, with no clear link between the strategic role of the transport sector and economic development objectives and financial resources of the country. These links can provide the basis for consistent objectives, policies and plans for development of the transport sector. Constraints which result from

the lack of a planning context are further exacerbated by the existing fragmentation of responsibilities in the transport sector.

5.6 In addition to considering alternative institutional arrangements in the transport sector, consideration could also be given to incorporating the Central Planning Department into the Ministry of Finance (as occurs in Fiji) where it can coordinate programs from various agencies within the financial resources of Government. Sector planning currently undertaken by the Central Planning Department could, with appropriate reallocation of resources, be undertaken within sector agencies under the guidance of the Central Planning Department.

5.7 **Human Resource Development.** Tonga has given a high priority to training its citizens to undertake tasks in the transport sector. However, there continues to be a need for further well targeted training. Budgetary and staffing constraints require that this training be undertaken in the most efficient manner. While there is a continuing need for Tongans to complete tertiary studies overseas, the opportunity cost of post-graduate studies is high given the funds expended, their absence from Tonga, limited appropriate positions for them upon their return to Tonga, and competing opportunities outside Tonga. Solid undergraduate training overseas and technical on-the-job training in Tonga will, in many instances, be a more effective approach to upgrading needed local skills. Development of local skills and responsibilities will be assisted by reassigning expatriate staff from line positions in Government and using them as advisors and educators. Use of twinning arrangements with similar overseas organizations warrants exploration.

5.8 **Aid Environment.** Aid to Tonga is dominated by bilateral assistance for investment in infrastructure and equipment and the provision of technical assistance. There is a spectrum of assistance, ranging from T\$12 million for the new air terminal funded outside

the formal budget to amounts of a few thousand dollars for road projects which pass through the Government's accounts. Aid donors are exploring means for better identification and implementation of assistance projects. For example, AIDAB and the EEC have taken a regional focus (in Ha'apai and Vava'u, respectively). Actions which lead to more systematic planning and better coordination of development assistance should be encouraged.

5.9 Few projects have identified the need for, or have sought institutional or policy changes by, the Tongan Government to accompany project implementation. Such actions need to be encouraged, for example, try to ensure that Government can generate adequate funds for, and make commitment to, adequate maintenance of projects. Moreover, it is likely that there will be instances in which policy and institutional changes can provide a greater rate of economic return than additional physical investment.

C. GENERAL TRANSPORT SECTOR ISSUES

5.10 **Project Selection and Appraisal.** There is a need for project formulation to be based on a sound perspective of the strategic role of the transport sector in the economy and the appropriate role of each transport mode and the private and public sectors. Such a perspective should allow a more systematic approach to the identification of infrastructure development needs. Given the small scale of many projects, screening tools could avoid the need for detailed economic evaluations of individual small projects. The activities of present regional development committees would be enhanced by a clear, practical vision of the development potential of the regions. In addition, some overall coordination of development across regions should be undertaken.

5.11 **Maintenance** is perhaps the single most important issue which must be addressed. While the opportunity cost of reduced maintenance is low in the short term, its cost increases over

time as deterioration of infrastructure accelerates. At present Tonga is dependent on donor support for reconstruction of deteriorated infrastructure. There is thus a need for adequate budget support for maintenance, particularly for roads for which annual maintenance needs are perhaps three to four times that spent in the 1980s. Moreover, the recurrent budgetary implications of future infrastructure development projects needs to become a formal part of project appraisal, with donor assistance cognizant of its importance and the means to fund it. It is likely that consideration of life-cycle capital and maintenance costs will affect *design standards*. For example, design standards might be modified to simplify ongoing maintenance needs. The first step in improving maintenance management is a review of existing transport infrastructure to establish the most valuable assets. Based on these priorities, maintenance and funding requirements can be identified.

5.12 Plant and equipment for maintenance is in limited supply and is in poor condition. The poor condition of some equipment is attributable to the limited skills of personnel, and maintenance neglect, but much of it is due to age.

5.13 There is a need to articulate policies on *user charges, cost-recovery and regulation* which will promote economic efficiency and generate funds for operations and maintenance in the transport sector. User charges set by Government should be modified more frequently to be responsive to changes in costs. Specification of cost-recovery policies for Government activities will assist the management of these activities and will aid the setting of user charges. Regulation of the transport sector should continue to be minimized and focused on ensuring safety; when directed to economic matters, it should be directed to articulated objectives and its justification quantified. It is likely that transport demand will change in response to policies set in this manner, resulting

in a more efficient transport sector and changing infrastructure development needs and priorities.

5.14 **Institutional Responsibilities.** A constraint to improved performance of the transport sector is the unclear and fragmented allocation of institutional responsibilities between Government agencies. In the maritime sub-sector, for example, it would seem more appropriate that the Ministry of Marine take full responsibility for policy and regulatory matters and the Ports Administration Department focus on port operations. The mix of controls affecting road traffic management and road use involving the Ministry of Police and the Ministry of Lands and Labor should be reviewed and responsibilities consolidated. It is also likely that performance is hindered by the limited use of the private sector made by Government (for example, road construction and maintenance).

D. LAND TRANSPORT SUBSECTOR

5.15 **Management Systems.** Activities in the road sub-sector are constrained by the lack of formal road inventory and of maintenance and financial management systems. As a result there is poor knowledge of the present status and maintenance history of existing infrastructure and of outstanding maintenance needs. This reduces the efficiency of existing maintenance activities, and inhibits the formulation and articulation of road maintenance needs. There is a poor perception of the full social cost to the economy of inadequate maintenance.

5.16 **Private Sector Participation.** The Government has limited direct involvement in the provision of transport services, but has imposed price regulation of passenger transport. Care is required to ensure that regulation does not inhibit private sector operations by not permitting an adequate financial rate of return, nor that it leads to inefficiency or excessive rates of return by private operators. This can be assisted by continuing to allow free entry and

exit by private operators to the transport industry.

5.17 The scope for substantial private sector involvement in road construction and maintenance in Tonga is limited by the small scale of these activities, the irregularity of construction over time and the difficulty in developing a competitive contractor market. Nevertheless, the efficiency of construction and maintenance activities will be improved by such participation, and opportunities for private sector involvement should be encouraged. Consideration should also be given to privatization of quarries.

5.18 User Charges and Cost Recovery. The land transport sector will become more efficient through a regime of market prices, with intervention only where there are demonstrable market distortions. There is an urgent need to increase road user charges from the present low levels to reflect the replacement costs of assets consumed by road transport and to establish the appropriate funds available for maintenance and management (traffic management and enforcement) of road transport. There may be further gains in economic efficiency by reviewing import duties on vehicles and raising fees related to vehicle licensing and use.

5.19 Road Investment. There is limited need for construction of new roads in Tonga in the near future (assuming no natural disasters). Roads which are required will be those which provide links to agricultural and tourism development projects.

5.20 Road Safety and Traffic Operations. Road safety and traffic management are emerging issues. It will be necessary in the longer term that the Ministry of Works develop traffic engineering skills and be responsible for road signs and other traffic management devices. Education and enforcement programs are required to improve road safety, particularly in the areas of speeding and driving under the influence of alcohol. Consideration should be

given to establishing and enforcing more realistic speed limits.

E. MARITIME SUBSECTOR

5.21 Strategy and Policies. A proposed study to prepare maritime projects should incorporate formulation of a strategy to guide development and management of the subsector. This strategy should lead to maritime policies and a context in which potential investment projects can be assessed. It is likely that domestic maritime transport demand will stagnate or grow little as an increasing proportion of economic activity occurs on Tongatapu. Development needs for maritime infrastructure on outer islands should, therefore, be assessed carefully.

5.22 Maritime Regulations. Tonga has shown a reluctance to ensure commitments to join regional international maritime codes and associations. This policy should be reviewed and associated legislation considered.

5.23 Domestic Shipping. Formal domestic shipping services are adequate at present, and the presence of a contestable market with free entry will promote reasonable efficiency. The Shipping Corporation of Polynesia needs to increase its surplus to repay principal on the loan used to purchase the Olovaha.

5.24 There is no information on services provided by vessels with a length of less than 15 meters. The presence and role of the informal shipping industry needs to be appreciated when formulating strategies for the maritime sub-sector.

5.25 Port Operations. There has been considerable investment in port infrastructure, particularly at Nuku'alofa. Given the need to better maintain the existing infrastructure, it is important that cost-recovery be improved and that further investment have the capacity to increase revenue sufficiently to provide adequate funds for maintenance and replacement.

Moreover, there is a need to better optimize investment project design, including use of greater innovation in project formulation. For example, there may be simpler, more efficient alternatives to purchasing imported container-handling equipment for ports such as Neiafu port on Vava'u.

F. AVIATION SUBSECTOR

5.26 Strategy and Policies. Tonga has been successful in securing substantial donor assistance for the development of its airports. Given the large quantity of funds expended, it is an opportune time to re-assess the present policies which guide airport development. This reassessment should examine the extent to which the development of airports has encouraged tourism, the rate of return on the investment, and means for financing the increased recurrent expenditure which accompany the investments.

5.27 Airport Operations and Maintenance. Tonga will continue to incur increasing costs for operation and maintenance of its airport facilities as recent and ongoing investments become operational and age. As cost-recovery is not currently achieved, particular attention is required to enhance revenue⁹ to meet the higher costs which will occur in the future. Establishment of maintenance priorities will become increasingly important.

5.28 Airline Operations. There has been relative stability in international air services to Tonga in recent years. There can thus be less concern that international air services are at risk and that major concessions must be made to ensure continuing services. However, the leasing arrangements to provide Royal Tonga Airline services should be carefully assessed to ensure cost-effective and profitable operations.

5.29 The new international services under Royal Tonga Airlines, based on a cooperative aircraft sharing arrangement with Solomon Airlines, is a measured approach for Tonga. Although the success of this approach remains to be established, such arrangements reduce capital costs and commercial risks. To be sustainable, air services should operate profitably and without grant assistance. Subsidies to serve social obligations need careful design and assessment, especially regarding their cost effectiveness.

5.30 There appears to be adequate domestic air service capacity in Tonga for present levels of demand. However, the lack of competition to FIA/Royal Tonga Airlines resulting from the prohibition of entry to other operators may reduce the efficiency of domestic air services.

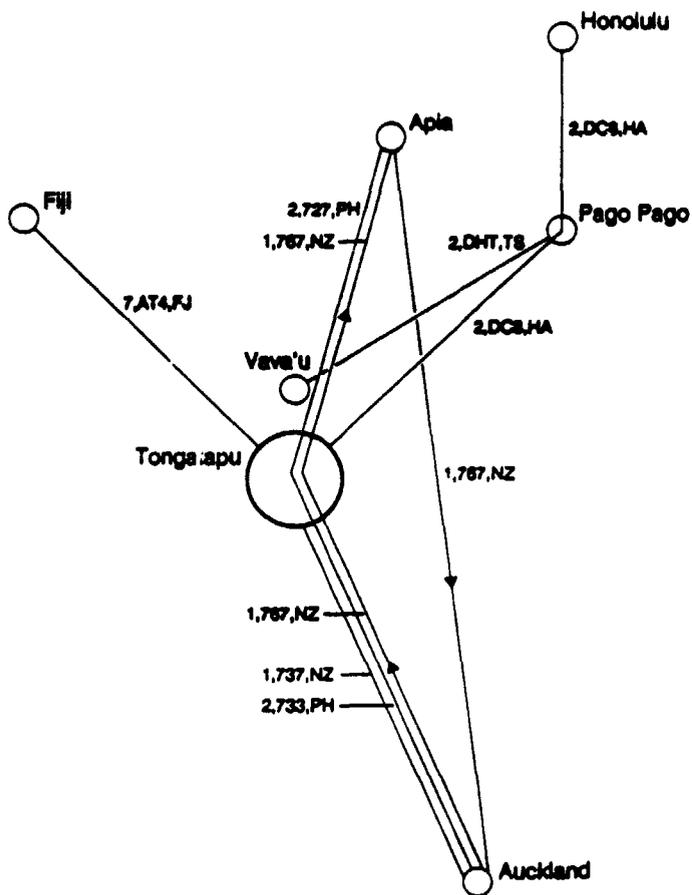
Endnotes

1. This transport sector survey is based on a mission to Tonga in February 11-14, 1991. The mission members were Colin Gannon (Senior Economist and mission leader), and David Bray (consultant). A draft of this report was discussed with the Government of Tonga June 22-24, 1992.
 2. World Bank (1989).
 3. The five other South Pacific island countries which were members of the World Bank at the time of this study were Fiji, Kiribati, Solomon Islands, Vanuatu and Western Samoa.
 4. The World Bank country study of the Pacific Island Economies (World Bank, 1991a) presents a more detailed review of the Solomon Islands economy and its development projects.
 5. In late 1991, the Government of Tonga renamed Friendly Island Airways as Royal Tonga Airways which added international services through a collaboration arrangement with Solomon Airlines. Further discussion of this new arrangement is presented in Part IV, Volume One, of the report on this study.
 6. Total desired investment for DPVI is T\$49.2 million, distributed as roads (41 percent), ports (36 percent) and aviation (23 percent).
 7. AIDAB has a current program which includes about T\$1.1 million for projects included in DP-VI, and proposals for funding projects in Ha'apai and Vava'u are currently being discussed with AIDAB and the EEC, respectively. Expenditure proposals for DP-VI exclude some committed projects, for example, an AIDAB project to implement a pavement maintenance management system (T\$0.1 million) and to supply equipment (T\$0.9 million).
 8. An interim report, Maritime Infrastructure Study was issued in June 1992. A major focus of this study is upgrading (strengthening and possible lengthening) of the Queen Salote, No. 1 Wharf.
 9. Landing fees were increased by 40 percent in March 1992 and the departure tax has been increased from T\$10.00 to T\$15.00.
-

BIBLIOGRAPHY

- Australian International Assistance Bureau (1991), *Ministry of Works Infrastructure Development Project, Pacific Regional Team*, Sydney, February.
- Australian International Assistance Bureau (1987), *Fua'amotu Airport, Tonga - Airport Development Study*, prepared by Airport Consulting and Construction Australia Pty. Ltd.
- Beca Worley International (1988), *Road Evaluation - Tonga*, December.
- European Community (1988), "Project Appraisal for Lupepau'u Airport Improvements, Vava'u Island".
- GITEC Consult GMBH (1990), *Fourth Multiproject Appraisal and Implementation Study, Subproject B, Road Improvement Appraisal Report*, prepared for the Asian Development Bank and the Kingdom of Tonga, September.
- Government of Tonga (1986), *Five Year Roads Programme*, prepared by the Ministry of Works.
- REDECON Australia (1987), *Third Multiproject, Road Improvements Tongatapu*, prepared for the Asian Development Bank, July.
- Transport and Road Research Laboratory (1982), *The TRRL Road Investment Model for Developing Countries (RTIM2)*, TRRL Laboratory Report 1057.
- World Bank (1991a), *Towards Higher Growth in Pacific Island Economies: Lessons of the 1980s*, Report No. 9059-ASIA, January, 18.
- World Bank (1989), *South Pacific Transport Sector Review*.
- World Bank (1989), *South Pacific Islands Transport Sector Review, Country Report - Tonga*, prepared by PPK Consultants Pty. Ltd., December.
-

Tonga



NZ Air New Zealand
 FJ Air Pacific
 HA Hawaiian Airlines
 PH Polynesian Airlines
 TS Samoa Airlines

← One-way only
 2, 737, IE — Airline
 — Aircraft type
 — No. of weekly flights in each direction

INTERNATIONAL AIR SERVICES

TONGA

TRANSPORT SECTOR SURVEY

ANNEX 1

CONTENTS

1	INTRODUCTION	44
	A. Context	44
	B. Maintenance Management Framework	44
2	NATURE OF THE MAINTENANCE ISSUE	47
	A. Transport Infrastructure Inventory	47
	B. Assessed Maintenance	51
	C. Maintenance Practices	52
	D. Implications of Inadequate Maintenance	57
	E. Maintenance Funding	59
	F. Situation Summary	64
3	EQUIVALENT ANNUAL VALUE FOR TRANSPORT INFRASTRUCTURE	66
4	ROAD VEHICLE OPERATING COSTS	68

LIST OF TABLES

Table No.

1	Tonga—Management Information Inventory Roads	45
2	Tonga—Management Information Inventory Ports	45
3	Tonga—Management Information Inventory Airports	46
4	Tonga—Estimated Road Length, 1991	48
5	Tonga—Estimated Road Lengths by Surface Type 1991	48
6	Tonga—Road Construction Costs	49
7	Tonga—Estimated Replacement Cost Government Marine Facilities, 1991	50
8	Tonga—Estimated Replacement Cost Government Aviation Facilities, 1991	50
9	Tonga—Average Annual Road Maintenance Costs, 1991	51
10	Tonga—Annual Average Maintenance Cost as a Percentage of Replacement Value for Marine Facilities	52
11	Tonga—Estimated Average Annual Maintenance Cost Government Marine Facilities	53
12	Tonga—Estimated Average Annual Maintenance Cost Government Aviation Facilities	53
13	Tonga—Recurrent Income and Expenditure for Ministry of Works	54
14	Tonga—Recurrent Income and Expenditure for Ports Administration Department	56
15	Tonga—Recurrent Income and Expenditure Ministry of Civil Aviation	58
16	Tonga—Summary of Infrastructure and Maintenance Costs	59
17	Tonga—Income from Import Duty and Service Tax (1990)	62
18	Tonga—Summary of Cost Recovery	65
19	Tonga—Summary of Infrastructure Value and Maintenance Costs, 1991	67
20	Road Roughness and Condition	68
21	Tonga—Vehicle Operating Parameters, 1991	70
22	Tonga—Vehicle Operating Costs, 1991	71

LIST OF BOXES

Box No.

2.1	Vehicle Operating Cost	60
4.1	Traffic Volumes	69

CHAPTER 1 INTRODUCTION

A. CONTEXT

1.1 This annex provides documentation of a survey of the maintenance situation in Tonga.¹ This survey, along with similar surveys for other PMCs, represents the background for the regional analysis of transport infrastructure maintenance for the five PMCs presented in Volume One (Part II) of this report.

1.2 Previous studies (Beca Worley 1988 and GITEC 1990) identify the inadequacy of road maintenance on Tonga, as noted in the Country Survey. The current National Development Plan (DPVI) reiterates the key transport issues and constraints identified in DPV—the need for effective management of existing road assets and the development of a road user charge system to contribute to the provision of maintenance funds.

1.3 The present rudimentary asset inventories, held by the responsible Departments, contain no information on asset conditions, nor historical data (other than an estimate of the total length of road in the country). Existing evidence of insufficient maintenance is circumstantial, and generally consists of descriptive observations of the present poor condition of on the basis of infrastructure. Little analysis has been undertaken of the need for cost effective maintenance. Beca Worley (1988) estimates the minimum requirement for road maintenance should have been almost double the funds budgeted in 1990/91.

B. MAINTENANCE MANAGEMENT FRAMEWORK

1.4 Tables 1 to 3 indicate the extent of management information available for each transport subsector.²

1.5 The tables illustrate the almost complete lack of information available below the sectoral level which would assist in the development, operation and maintenance of the transport system. An adequate road traffic counting system exists, particularly for the main island of Tongatapu, but there are deficiencies in all other aspects of the road information system. Some additional information is available in the aviation subsector, directed mainly to meeting international operational and air safety requirements. The major deficiencies relate to information useful to the development of adequate maintenance management strategies and systems.

**Table 1: TONGA—MANAGEMENT INFORMATION INVENTORY
ROADS**

Functional Level	Purpose	Technical Grouping /a						
		Road Inventory	Pavement	Structures	Traffic	Finance	Activity	Resources
Sectoral	Overall budgetary and statistical information	P	U	U	A	P	P	P
Network	Traffic demand and physical characteristics by link	P	U	U	P	U	U	P
Project	Specific information related to construction, betterment and maintenance	— Not Assessed —						
Operations	Maintenance of the system to provide effective service	U	U	U	U	U	U	U
Research and Development	Used for specific investigations of development of the system or its operational efficiency	U	U	U	U	U	U	U

/a See para 1.1.7.

A - acceptable basic information available

P - partial basic information available

U - information unavailable.

Source: Mission review.

**Table 2: TONGA—MANAGEMENT INFORMATION INVENTORY
PORTS**

Functional Level	Purpose	Technical Grouping /a						
		Structures	Civil Works	Buildings	Plant & Equipment	Traffic	Finance	Resources
Sectoral	Overall budgetary and statistical information	U	U	U	U	P	P	P
Network	Traffic demand and physical characteristics by location	P	P	U	U	P	U	U
Project	Specific data	— Not Assessed —						
Operations	Maintenance of the system to provide effective service	U	U	U	U	U	U	U
Research and Development	Used for specific investigations	U	U	U	U	U	U	U

/a See para 1.1.7.

A - acceptable basic information available

P - partial basic information available

U - information unavailable.

Source: Mission review.

Table 3: TONGA--MANAGEMENT INFORMATION INVENTORY AIRPORTS

Functional Level	Purpose	Technical Grouping /A						
		Civil Works	Buildings	Plant & Equipment	Communications	Traffic	Finance	Resources
Sectoral	Overall budgetary and statistical information	P	P	U	A	A	P	P
Network	Traffic demand and physical characteristics by location	P	U	U	A	A	U	U
Project	Specific data	--- Not Assessed ---						
Operations	Maintenance of the system to provide effective service	U	U	U	A	A	U	U
Research and Development	Used for specific investigations	U	U	U	U	A	U	U

/A See para 1.1.7.

A - acceptable basic information available

P - partial basic information available

U - information unavailable.

Source: Mission review.

CHAPTER 2 NATURE OF THE MAINTENANCE ISSUE

A. TRANSPORT INFRASTRUCTURE INVENTORY

2.1 Very little data are available on transport infrastructure in Tonga. Such information which exists is presented below.³

2.2 The value of major transport assets in Tonga has been established using estimates of the replacement cost of identified assets. Where projects have been completed recently, the replacement cost is assumed equal to the construction cost, adjusted to present prices. For older assets the replacement values have been calculated by comparison with the recorded value of similar recent assets. By using a 'replacement' value for the asset, no consideration has been given to the condition of the asset. In most cases the actual value of the asset would be considerably lower than the replacement cost, due to age and lack of maintenance.

Road Inventory

2.3 The Public Works Department does not maintain a formal road inventory. As set out in Table 1, there is little or no data which would assist with the strategic planning, work programming, project development or operational control of the road system. No information is available on pavement condition and no inventory exists of bridges and culverts. Traffic volume information for major roads on Tongatapu however, is well detailed.

2.4 The *estimated* lengths of road in Tonga by road classification are set out in Table 4. The table includes an estimated length of 42 km of urban roads in Nuku'alofa, additional to road lengths which are generally reported. Reported lengths of Highway, Trunk, Federal and Access roads in DPVI have been increased to reflect the situation at 1991.

2.5 The road lengths in Table 5 have been retabulated to give estimated lengths of road by surface type; sealed, coral surfaced and earth formed. No formal inventory of roads by surface type exists and the figures are based on partial information from available source material.

2.6 The *replacement cost* of the road assets is estimated on the basis of road construction costs prepared for road studies (ADB 1987, GITEC 1990) and Ministry of Works, Tonga, cost figures. As it is not possible to differentiate road lengths by surface type and by pavement width (Road Classification) the construction cost for a sealed highway (Class A road) has been used for all sealed road and the construction cost for a coral surfaced trunk road (Class B road) has been used for all coral surfaced roads within the Highway/Trunk classification.

2.7 The calculated replacement cost of road assets is T\$77.64 million (1991 prices) based on estimates in Table 6. This estimate does not include bridge and major drainage structures, for which no inventory or estimated value is available. The topography of Tonga is flat and these structures are unlikely to be extensive. If

Table 4: TONGA—ROAD LENGTH, 1991
(km)

Region	Highway	Trunk	Feeder	Access	Urban	Total
Tongatapu	64.6	192.0	287.0	487.0	42.0	1,072.6
Vava'u	9.3	93.3	123.0	97.0	-	322.6
Ha'apai	7.0	31.1	145.0	55.0	-	238.1
'Eua	1.0	20.8	85.0	40.0	-	146.8
Niuas	-	29.3	65.0	-	-	94.3
Total kms	81.9	366.5	705.0	679.0	42.0	1,874.4

Source: Ministry of Works, Central Planning Department.

these assets are assessed at 10 percent of road costs, the total replacement cost of public road assets is some T\$85 million (1991 prices).

Marine Infrastructure Inventory

2.8 The Ports Administration Department does not maintain an inventory of assets, use an asset depreciation system, or prepare commercially oriented financial accounts.

2.9 An unpublished review of transport facilities in Tonga (AIDAB, 1990) estimates an expenditure of T\$19.7 million on the Tonga marine subsector in the period 1978 to 1988. In present (1991) prices this expenditure is equivalent to T\$32.4 million using an average annual inflation factor of 7 percent. This

expenditure includes funding for interisland shipping, marine navigation aids and other marine works in addition to port facilities at Nuku'alofa, Neiafu and Nafanua Harbor.

2.10 The replacement cost of port facilities at Nuku'alofa has been estimated by assessing the present value of major construction works carried out at Nuku'alofa during the period 1983 - 1987, including the development of the Faua fishing harbor and adjacent foreshore protection works. Construction cost reports during 1985 and 1986 were used to assess the costs of major components of the development. An estimated cost of existing facilities (the original Queen Salote Wharf) has been included.

Table 5: TONGA—ROAD LENGTHS BY SURFACE TYPE, 1991
(km)

Classification	Urban	Rural		Total
		Highway/Trunk	Feeder/Access	
Sealed	24	85	-	109
Coral Surfaced	18	363	111	492
Earth	-	-	1,273	1,273
		448	1,384	1,874

Source: Mission estimates

**Table 6: TONGA—ROAD CONSTRUCTION COSTS
(1991 prices)**

Road Type	Class	Construction Cost (T\$/km)	Road Length (km)	Replacement Cost (T\$ millions)
Sealed	Urban, Highway & Trunk	140,000	109	15.26
Coral Surfaced	Highway and Trunk	85,000	381	32.39
Coral Surface	Feeder	50,000	111	5.55
Earth Formed	Feeder	24,000	594	14.26
Earth Formed	Access	15,000	679	10.18
Total Road Replacement Cost				77.64

Source: Mission Estimates.

2.11 An estimate of the replacement cost of outer island port facilities has been made by using the present cost of developments in Ha'apai, Neiafu ('Eau) and Nafanua (Vava'u) which were financed through aid funding in the early 1980s and later during 1987-1990. The resultant estimate is a conservative valuation of assets as it does not include the value of previous works.

2.12 Table 7 sets out the estimated replacement cost of port assets and includes an allowance for marine navigation facilities. The total estimated replacement cost is T\$36.3 million (1991 prices).

Aviation Infrastructure Inventory

2.13 The Ministry of Civil Aviation has not developed an asset inventory which can provide the basis for an asset management system. General data are available on the facilities at Fua'amotu and the five regional airfields (for example, runway length and surface, buildings and facilities).

2.14 The unpublished review of transport facilities in Tonga (AIDAB, 1990) estimates an expenditure of T\$11.91 million on the Tonga aviation subsector over the period 1978 to 1988. This expenditure is equivalent to T\$16.88 million in present (1991) dollars, using an average annual inflation factor of 7 percent. The addition of T\$12 million for the new terminal at Fua'amotu, completed in 1991, indicates a total investment in the aviation subsector of some T\$29 million (1991 prices) from 1978 to the present.

2.15 The replacement cost of aviation facilities at Fua'amotu has been estimated by assessing the present value of major investments in the runway, terminal, control tower and lighting, most of which has occurred since 1987, and adding an estimated cost for previous investment in the runway, taxiway and apron. A provisional allowance has been made for navigation and communications equipment, building plant and mobile equipment.

2.16 The five regional airports have coral surfaced runways varying in length from 1700 meters at Lupepau'u (Vava'u) to 730 meters at

Table 7: TONGA—GOVERNMENT MARINE FACILITIES REPLACEMENT COST, 1991
(T\$ million)

Location	Facility	Replacement Cost
Nuku'alofa and Fua	• Harbor, foreshore protection works	1.5
	• Wharves and jetties	15.6
	• Hardstand	4.5
	• Buildings	1.8
	• Shipworking equipment	1.5
	• Tugs and workboats	3.0
	• Other (ship lifting facility)	0.5
	Subtotal	28.4
Outer Islands	All facilities	5.4
General	Navigation Aids	2.5
Total Marine Infrastructure Replacement Cost		36.3

Source: Mission Estimates.

Kaufano and Mata'aho. The Ministry of Civil Aviation estimates that a total of T\$3.9 million (nominal prices) has been invested in their airports over the past 5 years. This figure has

been taken as the replacement value. As shown in Table 8, the total replacement of government aviation assets is estimated at T\$40.5 million (1991 prices).

Table 8: TONGA—GOVERNMENT AVIATION FACILITIES REPLACEMENT COST
(T\$ million, 1991 prices)

Location	Item	Facility Cost
Fua'amotu	• Runway, taxiway, apron	20.2
	• Terminal	12.0
	• Control Tower	0.9
	• Equipment, plant	2.2
	Subtotal	35.3
Regional	Navigation, radio equipment beacons	1.3
Regional	Airfields and facilities	3.9
Total Aviation Infrastructure Replacement Cost		40.5

Source: Ministry of Civil Aviation and Mission Estimates.

B. ASSESSED MAINTENANCE

Roads

2.17 Average annual road maintenance costs are developed based on estimates prepared for the Road Evaluation Study, Tonga (Beca Worley 1988), adjusted to 1991 prices. The estimates used include periodic reseal and regravels costs, reduced to an average annual equivalent cost. The estimated values on a kilometer base have been applied to the lengths of road by class and surface condition (Table 6) to derive total annual maintenance costs (Table 9).

2.18 The estimated annual maintenance cost assumes that the road system is in good maintainable condition and that maintenance is directed to preserving design standards. This is not the case, although no pavement or structure inventory exists from which to calculate the backlog of the rehabilitation or reconstruction costs. A number of reports (ADB 1987, Beca Worley 1988, GITEC 1990) have commented on the underprovision of funding for maintenance. The general conclusion has been that the annual provision for road maintenance should be twice the level provided. Reports indicate that roads in the outer regions are generally in poor condition and that rehabilitation of some roads on Tongatapu is required. The National Development Plan 1991-1995 (DPVI) indicates

a road development program totalling T\$20.125 million (1991 prices) over the plan period. Of this amount T\$10.05 million appears from the program to be for reconstruction and rehabilitation works and can be assumed to reflect the present backlog in road maintenance needs.

Marine Infrastructure

2.19 Annual average maintenance costs for the marine subsector have been calculated by applying industry-wide guideline percentage factors to the estimated replacement costs of marine structures and equipment. Because costings of replacement value are aggregated, rather than individually detailed, general percentages have been used (see Table 10). On the basis of these data, the estimated average annual maintenance cost is T\$0.73 million (1991 prices) for facilities at the main port of Nuku'alofa and T\$0.21 million (1991 prices) for outer island wharves and jetties and for navigation aids (see Table 11). This represents a total annual maintenance requirement of T\$0.94 million (1991 prices).

2.20 There is firm evidence of maintenance and rehabilitation needs in the marine subsector. The Ports administration Department commissioned a Maintenance Audit of Port Facilities in Tonga in 1991. The audit did not

Table 9: TONGA—AVERAGE ANNUAL ROAD MAINTENANCE COSTS, (T\$, 1991 prices)

Road Type	Class	Cost/km T\$	Length (km)	Total Cost (T\$ million)
Sealed	Urban, Highway & Trunk	3,300	109	0.36
Coral Surfaced	Urban, Highway & Trunk	1,400	381	0.53
Coral & Earth	Feeder & Access	800	1,384	1.11
Total				2.00

Source: Mission Estimates.

Table 10: TONGA—MARINE FACILITIES ANNUAL AVERAGE MAINTENANCE COST AS A PERCENTAGE OF REPLACEMENT VALUE

Facility	Percent of Capital Value
<ul style="list-style-type: none"> • Quay, wharf structures <ul style="list-style-type: none"> - reinforced concrete deck with steel piles - hardwood deck and steel or reinforced concrete piles - mass concrete 	1.0
<ul style="list-style-type: none"> • Buildings, offices, sheds 	1.5
<ul style="list-style-type: none"> • Mobile equipment and boats 	0.15
	1.5
	10.0

Source: Ports Authority of Fiji and UNDP.

include ship working equipment, tugs, workboats and other mobile equipment. The audit found that structural repairs were required to wharf structures and general repairs to a number of buildings and sheds, totalling TSS\$267,000 (1991 prices) for the port of Nuku'alofa and the Fua Harbor. Outer island wharf repairs required an estimated T\$38,000 (1991 prices). This level of outstanding maintenance needs is not excessive, and approximates the estimated long term annual maintenance requirements of relevant items in Table 28. A major project to upgrade and replace about 50 percent of navigation aids in Tonga has been completed recently (AIDAB) at a cost of TSS\$1.2 million (1991 prices) which should reduce the outstanding rehabilitation needs of these facilities.

Aviation Infrastructure

2.21 Annual maintenance costs for the aviation subsector have been calculated by applying percentage factors to the estimated replacement cost of facilities. No specific source documents have been identified which provide indicative values, as is the case for marine infrastructure. Percentage values have been based on general figures for building maintenance, building plant maintenance and civil works maintenance in the case of major airports. For regional airports the annual costs of maintaining the runway and general area have been estimated at 2 percent of

the replacement cost. These figures include periodic as well as routine maintenance (see Table 12). The estimated average annual maintenance requirement for aviation infrastructure at Fua'amotu is T\$0.44 million (1991 prices) and for the five regional airstrips and the navigation aids T\$0.1 million (1991 prices). The total for all facilities is T\$0.54 million (1991 prices).

2.22 Facilities at Fua'amotu have been reconstructed or replaced recently and there is little evidence of any outstanding rehabilitation requirements. The regional airstrips are understood to be in reasonable condition with the exception of Salote Pilolevu airport (Ha'apai) which needs resurfacing of the coral runway.

C. MAINTENANCE PRACTICES

Roads

2.23 Published data pertaining to the Ministry of Works is set out in Table 13. Allocations for road maintenance by region are set out in the budget and the total has varied between TSS\$680,000 and TSS\$850,000 over the period from 1988/89 to 1990/91. The budget estimate for 1991/92 provides a significant increase for road maintenance, with funding increased by 30 percent over the 1990/91 allocation. These appropriations cover labor, plant (at the

**Table 11: TONGA—GOVERNMENT MARINE FACILITIES
AVERAGE ANNUAL MAINTENANCE COST, 1991
(T\$, 1991 prices)**

Item	Replacement Value (T\$ million)	Factor (percent)	Average Annual Maintenance (T\$)
Nuku'alofa			
• Protection works	1.5	0.5	7,500
• Wharves & jetties	15.6	1.0	156,000
• Hardstand	4.5	1.0	45,000
• Buildings	1.8	1.5	27,000
• Shipworking equipment	1.5	10.0	150,000
• Tugs/workboats	3.0	10.0	300,000
• Other	0.5	10.0	50,000
Subtotal			735,500
Outer Islands	5.4	1.5	81,000
Navigation Aids	2.5	5.0	125,000
TOTAL			941,500

Source: Mission Estimates.

**Table 12: TONGA—GOVERNMENT AVIATION FACILITIES
ESTIMATED AVERAGE ANNUAL MAINTENANCE COST, 1991
(T\$, 1991 prices)**

Facility	Facility Value (T\$ million)	Factor (percent)	Average Annual Maintenance (T\$)
Major Facilities			
• Terminal and other buildings	12.9	1.0	129,000
• Runway/aprons/taxiways	20.2	1.5	202,000
• Fire tenders, mobile equipment/plant	2.2	5.0	110,000
Regional Airfields			
• Lump sum estimate (per airfield)	3.9	2.0	78,000
Regional Navigation Aids	1.3	2.0	26,000
TOTAL			545,000

Source: Mission estimates.

**Table 13: TONGA—RECURRENT INCOME AND EXPENDITURE
FOR MINISTRY OF WORKS, 1988/89 - 1991/92
(T\$ 000's, current prices)**

Revenues	1988/89	1989/90	1990/91	1991/92 (budget)
Income:				
• Building Architectural Services	..	..	81.0	83.2
• Mechanical Services	..	..	380.0	381.0
• Sale of Aggregate	..	..	200.0	210.0
• Rent of Buildings	..	..	50.0	52.0
Total	..	..	711.0	726.0
Expenditure:				
• Ministers Office	22.0	24.6	27.9	29.5
• Directors Office (Engineering)	71.9	92.5	117.2	153.0
• Administration	75.1	93.4	116.9	121.8
• Transport, travel, other services	172.2	198.9	201.9	162.5
• Mechanical Services:				
- staff	105.5	146.4	196.6	210.6
- maintenance of machine shop	19.6	22.5	19.7	20.0
- Maintenance/operation vehicles & plant	189.9	723.3	912.4	820.0
• Building Services				
• Roads Services:	424.5	405.4	674.3	611.1
- staff				
- maintenance:	56.6	67.4	96.1	135.1
Tongatapu				
Ha'apai	412.8	386.8	511.6	515.3
Vava'u	25.0	19.3	19.9	28.0
'Eua	182.6	164.2	173.3	176.0
other	26.1	21.8	29.1	30.0
special works	9.4	12.2	15.9	18.0
• Maintenance/ops of quarries	30.9	11.8	-	192.5
• Other Services	514.2	606.1	479.9	533
	261.5	257.1	235.7	279.7
Total	3,563.3	3,253.7	3,828.4	4,036.3
Of which the direct allocation to Road Maintenance is	743.4	683.5	845.9	1,095.3

Source: Ministry of Works.

approved hire rates) and materials purchase. The apportionment of the *net* costs of plant and vehicle maintenance and quarry operations (expenditure less income) to road maintenance is

not possible, given the other services in the Ministry which utilize these functions. The apportionment of other overhead costs (office, administration etc.), however, would increase

the allocation to road maintenance by some 10 percent. The appropriation for road maintenance has not met demands for routine maintenance and funding is normally fully utilized within the first 9 months of the financial year.

2.24 The present system of budget allocation and cost reporting does not provide information on a program or project cost basis and the actual expenditure attributable to road maintenance cannot be defined. In addition the plant hire rates for maintenance works, historically, have been set at levels well below real operating costs. The hire rates were increased on 15 July, 1991 by some 25 percent over the previous rates which were set in 1986. The plant hire charges are based on general estimates of costs, as there is no effective plant costing system in operation.

Ports

2.25 The Ports Administration Department is responsible for the maintenance of port facilities at Nuku'alofa and for the maintenance of public wharves and jetties outside of the main port. Funds for maintenance are appropriated to the Department. The Ministry of Works undertakes maintenance of fixed facilities on request from the Ports Administration Department. Other general maintenance works are carried out by Port personnel.

2.26 During the period 1988/89 to 1991/92 the difference between expenditure and income has increased from 2 percent to 15 percent of income (see Table 14). Income increased by only 8 percent and declined in real terms by 14 percent while expenditure remained constant in real terms over the period.

2.27 Allocations for maintenance increased substantially in 1989/90 but have declined since then. Budgeted expenditure for maintenance in 1991/92 is less in real terms than the allocation in 1988/89. As shown in Table 14 the allocations for maintenance of lights, buoys and beacons and maintenance of plant and equipment

comprise 70-80 percent of the total maintenance budget. The allocation for harbor works, wharves and jetties has averaged just over T\$30,000 per annum during the period. Although much of the harbor facilities at Nuku'alofa are relatively new and maintenance requirements can be expected to be low during the early life of the port structures, the provision for maintenance is inadequate. The Maintenance Audit of the port facilities (see para. 2.23) identified T\$267,000 (1991 prices) of outstanding maintenance works at Juku'alofa which is equivalent to 9-10 times the recent annual maintenance allocations for the relevant facilities. The total allocation for maintenance falls well below the estimated long term average requirements of T\$0.94 million (1991 prices) (see Table 11).

Aviation

2.28 Funding for the maintenance of aviation facilities is appropriated to the Ministry of Civil Aviation. Routine maintenance of general facilities is carried out by Ministry staff. Periodic maintenance of airstrips, buildings and equipment is undertaken by contract in accordance with priorities determined by the Ministry of Civil Aviation. Maintenance of navigation acts and communication equipment is undertaken using in-house resources and private sector contracts.

2.29 The recurrent funding for the Ministry of Civil Aviation for the years 1988/89 to 1991/92 is set out in Table 15. Expenditure has exceeded income in each year. The deficit in income has declined in percentage terms in each year and a substantial reduction in the deficit is estimated for the 1991/92 year. About 88 percent of income collected by the Ministry is derived from landing fees and passenger departure taxes. In the period since 1988 income has increased substantially, the 1991/92 budgeted income being more than double actual income in 1988/89 (current year prices). Expenditure on airport and meteorological services has also increased substantially, but the

**Table 14: TONGA—RECURRENT INCOME AND EXPENDITURE FOR
PORTS ADMINISTRATION DEPARTMENT, 1988/89 - 1991/92
(T\$ 000's, current prices)**

	1988/89	1989/90	1990/91	1991/92 (budget estimate)
Income:				
• Tonnage Due	34.4	31.7	38	39
• Harbor Due	42.8	47.2	52	53.5
• Pilotage	53.3	64.8	60	62
• Recoverable Charges	546.3	550.2	530	555
• Other	..	..	21.3	22.3
Total	676.8	693.9	701.3	731.8
Expenditure:				
• Administration of Office	45.7	43.8	59.3	63.6
• Harbor Services:				
- pilots/Pilotage	27.5	18.5	44.3	15.9
- labor	37.8	51.8	68.8	93.3
- maintenance:				
lights, beacons, buoys	29.0	36.4	35.11	36.0
other equipt	16.8	13.2	17.8	18.9
harbors/wharves (outer islands)	5.3	8.1	10.6	9.6
- other	0.9	1.0	0.5	1.0
• Wharf Services:				
- labor	116.4	137.1	147.8	135.0
- maintenance:				
equipment	45.7	61.4	60.1	50.5
Salote Wharf	15.5	24.0	17.3	12.0
Faua Harbor	-	15.9	13.7	5.0
other	3.4	6.2	7.4	4.0
• Utilities	79.9	54.3	52.2	49.1
• Handling Cargo	231.3	254.2	282.2	345.1
• Other	29.5	6.0	2.8	3.3
Total	687.8	708.6	822.1	842.8
Of which maintenance to:				
• lights, beacons, buoys	29.0	36.4	35.1	36.0
• equipment	62.5	74.6	77.9	69.4
• outer island wharves	5.3	8.1	10.6	9.6
• Queen Salote wharf	15.5	24.0	17.3	12.0
• Faua Harbor	-	15.9	13.7	5.0
• other facilities	3.4	6.2	7.4	3.3
Total	115.7	165.2	162.0	135.3

Source: Ports Administration Department.

budgeted allocation for maintenance has reduced in real terms over the period. The separate figures for actual maintenance expenditure have been provided by the Ministry and are set out as part of Table 15. The overall actual and budgeted maintenance figures are similar, although there are differences in the apportionment to the various facilities.

2.30 The maintenance outlays for regional airports in 1990/91 appears consistent with the estimated requirement in Table 12 (T\$78,000). Present provision for maintenance of Fua'amotu Airport is well below the estimated long term average maintenance requirements. Present maintenance needs are low as the terminal has recently been constructed (1991) and the runway repaved and extended (1987). Nevertheless, provision needs to be made for major periodic maintenance requirements in the future.

Summary

2.31 The estimated replacement value of transport infrastructure, maintenance overhang, assessed maintenance and actual maintenance expenditure derived in this and preceding sections are summarized in Table 16. The estimates are derived from a very limited database. The objective of the estimates is to provide an *indicative quantified perspective of the present situation* for the purpose of illustrating the nature and scale of the transport infrastructure maintenance issue. The current replacement value of transport infrastructure has been based on data assembled on the quantity of infrastructure and unit construction costs. The maintenance overhang (i.e., rehabilitation requirements resulting from past inadequate maintenance) is derived from past studies which have identified infrastructure rehabilitation needs; however, none of these is comprehensive or up-to-date, and rehabilitation needs are greater than presented in Table 16. The expenditure required to adequately maintain current infrastructure, suitably rehabilitated so that it is maintainable, is estimated on the basis of unit maintenance costs for roads and a

proportion of the replacement value of marine and aviation infrastructure. This level of expenditure is used as an approximation of the amount assessed as optimal maintenance (maintenance expenditure which results in a minimum life-cycle cost for the asset at a given design standard). *Assessed maintenance does not imply it is warranted; this requires a benefit-cost appraisal of individual assets.* The optimal level of maintenance expenditure cannot be established. Current maintenance expenditure is derived from budget data.

2.32 The replacement value of Government transport infrastructure is estimated at T\$162 million (US\$123 million) or T\$1,620/capita (at 1991 prices). Current maintenance expenditure on transport infrastructure is only 40 percent of that estimated as being required. If there was no accrued maintenance overhang will require expenditure greater than the assessed maintenance of T\$3.5 million per year if the average condition of infrastructure is to be improved.

2.33 Inadequate maintenance results in more rapid deterioration of infrastructure than need be the case. An estimate of the increase in the equivalent annual cost of infrastructure resulting from poor maintenance is also presented in Table 16. This item is discussed in the next section.

D. IMPLICATIONS OF INADEQUATE MAINTENANCE

2.34 Reduced expenditure on maintenance is offset by more rapid deterioration of infrastructure than would be the case with optimal maintenance. Indicative estimates of the equivalent annual capital cost of infrastructure with current and optimal maintenance is derived in below. The increase in the cost is summarized in Table 16. The (equivalent annual) cost of more rapid deterioration of transport infrastructure is nearly four times the cost of improved maintenance (i.e., T\$7.6 million compared with T\$2.1 million).

Table 15: TONGA—RECURRENT INCOME AND EXPENDITURE
MINISTRY OF CIVIL AVIATION, 1988/89 - 1991/92
(T\$ 000's current prices)

	1988/89	1989/90	1990/91	1991/92 (budget)
Income:				
• Landing Fees	247.9	253.5	370.8	450
• Passenger Service Charge	137.6	179.3	311.3	350
• Other	51.2	47.9	80.5	110
Total	436.7	480.7	762.6	910
Expenditure:				
• Admin & Airport Services	399.7	462.4	661.0	784.3
• Maintenance:				
- plant, equipment, radio	20.4	20.5	13.2	15.0
- Fua'amotu:				
lighting	11.4	16.4	24.4	16.0
airfield	35.7	14.0	13.0	35.0
terminal	6.5	7.7	8.5	20.0
- regional airfields	55.0	63.1	86.1	45.5
• Other	84.1	68.0	187.0	48.8
• Meteorological Services	-	-	53.3	75.9
Total	612.8	652.1	1,046.4	1,040.5
Of which the <i>budgeted</i> direct allocation to maintenance is:	129.1	121.7	145.2	131.5
Actual Maintenance Expenditure:				
• Fua'amotu				
- buildings	36.4	14.9	8.1	
- fire/crash	15.1	13.8	16.5	
- civil	45.9	26.1	42.0	
Subtotal	97.4	54.6	66.6	
• Regional Airports	48.4	61.5	88.6	
Total	145.8	116.1	155.2	

Source: Ministry of Civil Aviation.

2.35 In addition to the higher costs which accrue to the Government from inadequate maintenance, *users of the transport system incur higher costs*. For road users, this includes increased vehicle operating costs; these in turn may result in further decline in economic efficiency through reduced accessibility and increased spoilage of products, and suppressed foregone productive economic activity, if the

increased costs make a potential industry unviable. The current poor road conditions increase road user costs by around 10 percent through increased fuel and tire use and additional wear and tear on vehicles (see Box 2.1 on Vehicle Operating Costs). Similarly, increases in port costs which result from inadequately maintained port infrastructure will add to the cost of imported goods and make exports, most of which pass through sea ports

**Table 16: TONGA—SUMMARY OF INFRASTRUCTURE
AND MAINTENANCE COSTS, 1991
(T\$ million, 1991 prices)**

	Road	Marine	Aviation	Total
Replacement Cost	85.4	36.3	40.5	162.2
Maintenance Overhang <i>/a</i>	10.0	0.3	-	10.3
Assessed Average Annual Maintenance Requirements <i>/b</i>	2.0	0.9	0.5	3.5
Estimated Current Annual Maintenance Expenditure	1.1	0.1	0.1	1.4
(as percentage of assessed requirement)	(55)	(14)	(20)	(40)
Additional Expenditure to Achieve Assessed Maintenance <i>/c</i>	0.9	0.8	0.4	2.1
Additional Annual Capital Expenditure arising from Inadequate Maintenance <i>/d</i>	4.5	1.3	1.7	7.6

- /a* Cost required to rehabilitate infrastructure to a sound standard, i.e., the standard through time which would have been the case with assessed maintenance and for which the assessed annual maintenance expenditure is sufficient to adequately maintain the infrastructure.
- /b* Expenditure required for assessed maintenance.
- /c* Difference between current annual expenditure on maintenance and the equivalent annual assessed maintenance expenditure.
- /d* Difference between equivalent annual capital cost for replacement of assets with assessed and current maintenance—see below.

Source: Mission estimates.

less competitive on international markets. For example, inadequate maintenance of wharves and jetties may result in reduced safe working loads for forklifts and vehicles and consequent increases in the costs of handling cargo. Tourism could be severely affected if deficient maintenance results in unreliability and delay of services due to closure of airports—deterioration of the airport terminal could also have an adverse effect on user perception and marketing credibility.

2.36 There are opportunities for agricultural development in Tonga, primarily in root crops, fruit and other vegetables. However, the connection between improvement of transport links to improve accessibility and economic

development needs to be better understood to ensure that agricultural development is sustainable. Development of local transport links will increase producer surplus and may have a significant effect on the propensity to produce. However, the reduction in the total cost of delivery of agricultural output overseas is likely to be small, unless there are avoidable constraints elsewhere in the transport system, and may not secure significantly greater sales.

E. MAINTENANCE FUNDING

2.37 There is no hypothecation of revenue to maintenance of road, marine or aviation infrastructure in Tonga. Nor is there a formal

Box 2.1: VEHICLE OPERATING COSTS

Vehicle operating costs rise rapidly as roads deteriorate, more so on gravel than sealed roads as shown below:

Road Condition	Grave Road	Sealed Road
Good	0.282	0.274 ^{1/}
Fair	0.311 (8%) ^{2/}	0.280 (2%)
Poor	0.353 (23%)	0.312 (14%)

There is an almost complete absence of data on traffic volume by road type and condition. Therefore, it is not possible to estimate, with any measure of accuracy, the total cost of operating vehicles over the road network in its current condition and the cost with roads in good condition. However, working assumptions, based on judgment, have been made to provide an indicative estimate of such vehicle operating costs.

Based on say 5,000 registered vehicles travelling an average of 14,000 km per year (say, half of which is on sealed roads) and with say a third of the roads each in bad, fair and good condition, total annual economic vehicle operating costs will be T\$21.2 million. The equivalent cost if roads are in good condition is T\$19.6 million, i.e., current vehicle operating costs are 8 percent higher than would be the case if roads were in good condition. Foreign costs account for 76 percent of these costs. The T\$1.6 million difference between vehicle operating costs on good and poor roads thus represents an incremental import bill of T\$1.2 million per year (equal to 2 percent of current imports).

- ^{1/} Average economic vehicle operating costs in T\$/km (see below). Vehicle financial operating costs are 40 percent greater.
- ^{2/} Increase compared with the cost on a road in good condition.

policy on cost-recovery in the road sector where specific fees for use of the road system are not imposed. The Ports Administration Department, however, is now able to retain revenue in excess of a specified amount for its own use in addition to its usual budget appropriations.

Roads

2.38 There are no specific charges for use of the road system in Tonga which are directed to development, maintenance and operation of the system. Road users contribute to the cost of developing and maintaining the road system indirectly through: (a) annual road license paid for each vehicle; (b) driving license fee; (c) import duty on vehicles and (d) fuel excise. The cost of annual vehicle road-worthiness, inspections is considered a user charge to recoup the cost of the inspection rather than contribute to the cost of providing the road system. A

sales tax of 5 percent of the retail price of vehicles is considered a form of general taxation rather than a charge for cost recovery in the transport sector. The fuel sales tax of T\$0.02 per liter (1991) is only 3 percent of the retail price of petrol, and is also considered a form of general taxation. The fuel sales tax generated an estimated T\$8.0 million in 1990/91. All imports are subject to a port service tax at a rate of 20 percent of CIF value, with the exception of imports for Government purposes and aid projects which are free of the tax and goods for economic development purposes. This Tax too is not considered as contributing to cost recovery because of its generally universal coverage.

2.39 Revenue from the vehicle registration and license fees and driving license fees was budgeted at T\$0.22 million in 1990. Based on data from other countries, it is estimated that collection costs are about 10 percent of this sum,

leaving net revenue of T\$0.20 million (T\$0.22 million in 1991 prices based on inflation of 11.5 percent).

2.40 The Government of Tonga derived 50 percent of its income from import duties and the port and service tax. The rate of import duty is 45 percent for motor vehicles, although aggregate data indicates the average rate of duty to be marginally less for cars and vans and higher for trucks and buses (see Table 17). Import duty for petrol and diesel was T\$0.03 per liter in 1990, but has since been changed to 35 percent of the CIF value of imports. On average, vehicles and fuel were subject to an average rate of import duty 28 percent, compared with 18 percent of other imports (see Table 17). The revised rate of import duty for fuel would assuming zero elasticity raise the average rate of duty on the transport sector to 36 percent. The fiscal efficiency of imposing a higher rate of these duties in the transport sector is an open matter. Imposing tax "mark-ups" where price elasticities are relatively low ("Ramsey" pricing) might justify higher tariffs for the road transport subsector, with higher tariffs for road transport resources being a fiscal measure, and not treated as cost-recovery. Alternatively, all income from duties can be considered as contributing to cost-recovery, to the extent that the duties are imposed on road transport users, and revenue from the duties is less than that required for full cost-recovery. The analysis presented in this Annex is based on only that revenue from the duty on road transport resources in excess of the average rate of duty for all other imports as contributing to cost-recovery. (The regional analysis presented in Volume One of this study presents the effect of all revenue from duties being treated as cost-recovery.) The revenue from these duties in excess of the average rate for other imports is viewed here as a specific levy on road users. An import duty/excise tax of 18 percent of the value of vehicles and fuel would produce revenue of T\$1.76 million in 1990 (also assuming price elasticity of demand equal to zero). The average 38 percent import

duty/excise tax thus results in an additional levy on road users of T\$1.97 million in that year. There is no incremental cost associated with the collection of the higher rate of tax applied to vehicles and fuel, and the amount of T\$1.97 million can be considered an additional charge to road users to meet the cost of development and maintenance of public roads and as a fiscal/general revenue raising measure. Finally, a Petroleum Import Commission is imposed by the Customs Department which was budgeted to generate T\$0.06 million in 1990/91. This too is considered a specific charge on the transport sector.

2.41 If the incremental import duty/service tax is viewed as contributing to cost recovery, and inflating 1990 data by 11.5 percent to 1991 prices, costs and revenue associated with development and maintenance of the road system are estimated for 1991 at:

	T\$ million
Net Revenue:	
• Registration Fees and Driving Licenses	0.22
• "Excess" Import Duties and Petroleum Import Commission	2.27
Total	2.49
Expenditure:	
• Current Maintenance	1.10
• Incremental Maintenance Requirement	0.90
• Annual Capital Charge	8.40
Total	10.40

2.42 Notwithstanding the question of attribution of some import duty revenue as indirect road user charges, total revenue from the sector is only a quarter of the minimum total long term cost of sustaining the present road system. Donors have financed construction of roads in Tonga and currently provide some grand funds for road rehabilitation required as a result of past inadequate maintenance. However, it is unlikely that this aid is sufficient

Table 17: TONGA—INCOME FROM IMPORT DUTY AND SERVICE TAX (1990)

	CIF Value of Imports (T\$ million)			Import Duty and Service Tax (T\$ million)	Average Rate of Duty and Tax (%) <i>/a</i>
	Total Imports	Exempt from Duty	Dutiable		
Vehicles					
• Cars	2.206	0.604	1,602	0.709	44
• Trucks	1.556	0.584	0.864	0.480	49
• Motorcycles, tires and parts	1.558	0.067	0.260	0.054	21
Fuel					
• Petrol	2.842	-	2.842	0.625	22
• Distillate <i>/b</i>	4.290	-	4.290	0.965	22
Total	11,223	1,255	9,968	2,833	28
Total Imports					
• Including Vehicles and Fuel	78.989	18.837	60.152	11.692	19
• Excluding Vehicles and Fuel	67.766	17.582	50.184	9.520	18

/a Percent of CIF value of imports subject to duty.

/b Excludes distillate fuel used for power generators.

Source: Customs Department.

to finance the gap between the revenue being derived by the Government from the road transport sector and its expenditure on it. Road users are thus being subsidized with funds from overseas aid grants and from Government general revenue. In the long term the Government will need to increase its revenue or secure increased and continuing aid funding to sustain the present road network.

2.43 Two key *equity* issues relate to cost recovery in the land transport subsector: (a) the geographical distribution of sources of receipts and disbursements of expenditure; and (b) the apportionment of costs and revenue by vehicle category. Given the distribution of economic activity and road infrastructure between Tongatapu and Vava'u in particular, it is likely that there is a higher level of cost-recovery on

Tongatapu. This may be warranted on social and development grounds, but should be monitored to ensure affordability and sustainability including adoption of appropriate road design standards. A major proportion of the road network involves low traffic volumes (less than 100 vehicles per day). Such roads, typically gravel and earth formed, provide accessibility as a social service. Fixed costs for maintaining these roads are high—over 75 percent. In such circumstances, a lower share of revenue for cost recovery will derive from specific vehicle-related fees; a higher share will need to be supported by more indirect and general taxes.⁴ The second equity issue pertains to the allocation of cost and revenue to vehicle types. Trucks cause considerable damage to the road system, disproportionately more than their share of total vehicle kilometers by all road

vehicles, and road user charges should be designed to reflect this incremental cost to the system. Registration fees for trucks are higher than for cars, but, for example are only three times in the case of a three tonne truck (T\$65 for the truck and T\$20 for a mid-size car); these fees are very low and make only a minor contribution to the greater damage imposed on the road system by the larger vehicles. The immediate urgency of this issue is lessened by the small number of large vehicles in use in Tonga at present—trucks and buses make up 21 percent of the vehicle fleet, but many of them are small in size (3 tonne trucks and mini-buses).

Ports

2.44 Data in Tables 14 and 16 indicates estimate costs and revenue associated with development, operations and maintenance of the ports and other activities of the Ports Division of the Ministry of Transport in 1991 to be about:

	T\$ Million
Income	0.70
Operating Expenditure	
• With Current Maintenance	0.82
• Incremental Maintenance Needs	0.80
Operating Surplus (Loss)	(0.92)
Less: Annual Capital Charge	3.20
Net Surplus (Loss)	(4.12)

2.45 The Ports Administration Department does not generate sufficient revenue at present to fund even its current inadequate level of maintenance expenditure. Current revenue would need to be increased substantially to provide sufficient revenue to meet the cost of sufficient maintenance and capital replacement to sustain the present marine infrastructure in Tonga. While port fees in Tonga are lower than those in some other countries, the scale of this increase suggests that there has been over-investment in port infrastructure and that the

Government may not be able to sustain all of the infrastructure from its own resources. Further funds are required for rehabilitation of current port infrastructure which has deteriorated due to inadequate maintenance in the past.

Airports

2.46 Data in Tables 15 and 16 indicates estimated costs and revenue associated with development, operation and maintenance of airports by the Ministry of Civil Aviation in 1991 to be about:

	T\$ Million
Income	0.76
Operating Expenditure	
• With Current Maintenance	1.05
• Incremental Maintenance Needs	0.40
Operating Surplus (Loss)	(0.69)
Less: Annual Capital Charge	3.90
Net Surplus (Loss)	(+.59)

2.47 The revenue of the Ministry is insufficient to meet the cost of current maintenance and operations. The Ministry's revenue would need to increase substantially to generate sufficient revenue to cover the cost of sustaining the present airport infrastructure. While the airport and aviation charges have been very low in the past, income increased by 74 percent from 1989 to 1991, and is expected to increase by a further 19 percent to 1992. It will be difficult for the Ministry to generate sufficient revenue to sustain the present aviation infrastructure. As with ports, this suggests there has been over-investment in infrastructure in the past, with insufficient Government capacity to sustain the infrastructure. Further funds would be required for rehabilitation of current airport infrastructure which has deteriorated due to inadequate maintenance in the past.

F. SITUATION SUMMARY

2.48 The previous sections of this survey indicate the problems facing the Government in providing for the maintenance and rehabilitation of the nation's infrastructure. The analysis reflects the rudimentary nature of the information which is available to assess asset management needs, even from the most general perspective.

2.49 The replacement value of Tonga's transport infrastructure (excluding the vehicles, vessels and aircraft which use the system) is estimated to be close to T\$162 million (US\$123 million) (1991 prices). The average annual assessed maintenance for the transport system is estimated conservatively at T\$3.56 million (US\$2.7 million) (1991 prices). The annual assessed maintenance is on average equal to some 3 percent of the replacement value of the assets.

2.50 The estimated annual outlays required for asset maintenance presume that the system has been well maintained in the past and that rehabilitation or reconstruction requirements should only relate to the general ageing of the system. This is not the present situation in Tonga.

2.51 Much of the port and aviation infrastructure has been built or reconstructed in the past 10 years. Estimated investment in the marine subsector since 1979 is in excess of T\$30 million (1991 dollars—para. 2.9) and T\$17 million in the aviation subsector (1991 dollars—para. 2.14). In the circumstances the immediate maintenance needs are less than the long term average, which includes periodic and specific maintenance outlays. The situation in regard to road assets is different. The rehabilitation overhang for the road system is estimated at T\$10 million (1991 prices), whereas the estimated annual maintenance requirement is T\$2 million (1991 prices). It needs to be reiterated that these estimates are based on

imprecise data; nevertheless they indicate the significant level of deferred maintenance.

2.52 The historic levels of actual maintenance expenditure are difficult to establish and hence assess. Departmental budget allocations and costing procedures are not designed to provide information on a program functional/basis (e.g., maintenance task). The lack of function based financial data is a constraint to understanding and managing maintenance. An apportionment of recurrent expenditures for all transport modes indicates that some T\$1.37 million was spent on maintenance in 1991/92; this is estimated to represent only 40 percent of assessed average annual maintenance requirements.

2.53 At present virtually all maintenance is undertaken by Government Ministries using force account and Government-owned equipment. This approach fails to give sufficient consideration to the separation of management and technical activities, and has resulted in almost exclusive emphasis on the latter. The approach also places heavy demands on the limited number of qualified staff in Ministries, and fails to take advantage of the greater flexibility available in private companies.

2.54 An indication of cost recovery, with assessed maintenance, as presented in Table 18, indicates substantial under-recovery of costs for road, marine and aviation transport. Use of current maintenance expenditure and the equivalent, higher annual capital charges would result in a lower level of cost recovery.

2.55 Assessment of all existing infrastructure and determination of what assets warrant maintenance (and at what standard) is needed. So too is attention to maintenance priorities and higher cost recovery through user charges. Each of these actions should be weighed against the costs of their implementation.

Table 18: TONGA—SUMMARY OF COST RECOVERY, 1991
(T\$ Million, 1991 prices)

	Roads	Marine	Aviation
Income			
• Direct	0.22	0.70	0.76
• Indirect	2.27 /a	..	-
Total	2.49	0.70	0.76
Operating Expenditure			
• With Current Maintenance	1.10	0.82	1.05
• Incremental Maintenance Needs	0.90	0.80	0.40
Operating Surplus (Loss)	0.49	(0.92)	(0.69)
Less: Annual Capital Charge	8.40	3.20	3.90
Net Surplus (Loss)	(7.91)	(4.12)	(4.59)

/a Share of import duty in excess of average rate of duty for all imports.

Source: Mission estimates.

CHAPTER 3 EQUIVALENT ANNUAL VALUE FOR TRANSPORT INFRASTRUCTURE

3.1 Introduction. Inadequate maintenance results in more rapid deterioration of transport infrastructure than would be the case with optimum maintenance. This Annex estimates the extent of this effect.

3.2 Infrastructure Value. The value of current infrastructure estimated in Section A of Chapter 2 is summarized in Table 19. The cost of this infrastructure comprises two parts: a fixed component and a renewable component. The former includes, for example, clearing and construction of the base for a road.

3.3 The renewable component of infrastructure is that part which periodically requires reconstruction, for example the surface of a road. The approximate proportion of the total cost of infrastructure which is fixed and renewable is described in Table 19. The estimates are drawn from construction cost estimates for typical construction projects.

3.4 Economic Life. With optimum maintenance, the fixed component of infrastructure should have a life of at least 50 years. By definition, all elements of the fixed component of infrastructure should not be affected by the level of maintenance. This is not necessarily the case, however, in practice. For example, poor maintenance of a road may result in adequate drainage and pot-holing. Water can then penetrate the base structure of the road and result in deterioration of this element of the fixed component. The lives of the fixed components of infrastructure adopted for the

current assessment are presented in Table 19. An opportunity cost of capital of 7 percent is used. The data illustrate that the current equivalent annual capital cost with current maintenance patterns is about 50 percent greater than would be the case of optimum maintenance was undertaken (i.e., T\$23.1 million compared with T\$15.5 million). The data also shows the importance of adequate maintenance of engineered, unsealed roads, with the incremental capital cost of this item alone accounting for 55 percent of the incremental capital cost for all infrastructure.

Table 19: TONGA—SUMMARY OF INFRASTRUCTURE VALUE AND MAINTENANCE COSTS, 1991
(T\$ million, 1991 prices)

Item	Roads				Marine				Aviation				Total
	Sealed	Engi- neered	Earth	Total	Wharves & Yards	Bldg.- Other	Equip. & Other	Total	Runways	Bldg.- Other	Equip. & Other	Total	
Asset Replacement Value	16.8	41.7	26.9	85.4	27.0	1.8	7.5	36.3	24.1	12.9	3.5	40.5	162.2
Maintenance Overhang ^a	..	..	..	10.0	..	..	..	0.3	..	..	..	..	10.3
Assessed Annual Maintenance ^b	0.4	0.5	1.1	2.0	0.3	0.0	0.6	0.9	0.3	0.1	0.1	0.5	3.5
Current Maintenance Expenditure	..	..	..	1.1	..	..	..	0.1	..	..	..	0.1	1.4
% of Assessed Maintenance	..	..	..	55%	..	..	..	14%	..	..	..	20%	40%
Incremental Maintenance Expenditure	..	..	..	0.9	..	..	..	0.8	..	..	..	0.4	2.1
for Optimal Maintenance ^c	..	..	..	0.9	..	..	..	0.8	..	..	..	0.4	2.1
Equivalent Annual Capital Cost	1.4	4.5	2.5	8.4	2.0	1.1	1.1	3.2	2.4	1.0	0.5	3.9	15.5
^d	1.8	7.3	3.8	12.9	2.4	1.8	1.8	4.5	3.6	1.4	0.6	5.7	23.1
With Optimum Maintenance	0.4	2.9	1.3	4.5	0.5	0.8	0.8	1.3	1.2	0.4	0.2	1.7	7.6
With Current Maintenance	..	..	..	..	..	..	..	..	..	..	..	..	..
Incremental Capital Cost	..	..	..	..	..	..	..	..	..	..	..	..	..
Proportion of Capital Cost:													
Fixed Component	65%	80%	100%		20%	100%	0%		20%	100%	0%		
Renewable Component	35%	20%	0%		80%	0%	100%		80%	0%	100%		
Economic Life: (years)													
Fixed Component													
With Optimum Maintenance	30	30	20		30	30	0		30	30			
With Current Maintenance	40	30	10		40	15	0		40	15			
Renewable Component													
With Optimum Maintenance	16	5	-		30		10		16		10		
With Current Maintenance	"	2.0	-		20		5		8		7		

^a Cost required to rehabilitate infrastructure to a normal standard, i.e., the standard through time which would have been the case with optimal maintenance and for which the assessed annual maintenance expenditure is sufficient to adequately maintain the infrastructure.

^b Expenditure required for optimal maintenance.

^c Difference between current annual expenditure on maintenance and the equivalent annual expenditure assessed as being optimal.

^d Based on opportunity cost of capital of 7 percent and parameters described in the lower part of the table.

CHAPTER 4 ROAD VEHICLE OPERATING COSTS

4.1 **Introduction.** Vehicle operating costs have been established using the RTIM2 model,⁵ with two exceptions:

- (a) The model to determine road roughness (based on, for example, the number of vehicle passes since the last grading on unpaved roads) has not been used as traffic volumes are commonly very low, and the rate of road deterioration will be heavily affected by environmental conditions in addition to traffic activity. Moreover, no systematic data are available on the present condition of roads. For indicative purposes three road conditions have been adopted, as shown in Table 20.

**Table 20: ROAD ROUGHNESS
AND CONDITION**

Road Condition	Road Roughness (mm/km)	
	Gravel Road	Sealed Road
Good	3,000	2,000
Fair	5,000	3,000
Poor	8,000	5,000

Source: Mission estimates.

- (b) Data on the age profile of vehicles in Tonga and scrappage rates are not available, and the cost of capital and depreciation have been based on the

average annual cost over the economic life of vehicles.

4.2 **Vehicle Features.** Representative vehicle types for the most commonly found types of vehicles in use in Tonga are:

- Car (Toyota Corona)
- Light Utility (Mazda 1 tonne pickup)
- Four Wheel Drive (Toyota Hilux, 2.4 liter, double cab)
- Light Truck (3 tonne Nissan flat bed)

Other vehicles will have operating costs similar to these vehicles. Features of these vehicles which influence operating costs are presented in Table 21. The data has been obtained from investigations in Tonga. The share of each vehicle type is based on the share of registered vehicles and the annual distance travelled by each vehicle category. The number of vehicles registered in 1990/91 was:

Motor cars, taxis and light trucks	2,995
Heavy trucks	895
Buses	95
Other	696
Total	4,681

Some of these vehicles span the four vehicle categories for which operating costs have been derived. Specific data to disaggregate the vehicle types is not available, but it is assumed that 70 percent of cars, taxis and light truck category are cars, with a further 15 percent each being pickups and 4-WD vehicles respectively. This results in the distribution of vehicles types

as shown in Table 21; the distribution is similar to that in other Pacific countries currently being reviewed. Vehicle resource consumption for travel on good sealed roads derived from the RTIM model is also presented in Table 21.

4.3 Vehicle Operating Costs. Total vehicle operating costs, in T\$ per kilometer (1991 prices), for travel on sealed roads in good condition are described in Table 22. (Note these economic operating costs are 71 percent of financial costs.) These figures are used as a datum from which vehicle operating costs are estimated for sealed roads in fair and poor condition and unsealed roads (in each of the three conditions) using road roughness as described in Table 20, and relationships in the RTIM model.⁶ Traffic volumes are low (see Box 4.1) and representative volumes have been used in estimating total vehicle operating cost savings.

4.4 The principal items with a substantial imported component are fuel, oil, tires, spare parts for maintenance and capital charges. About a quarter of these costs can be attributed to local distribution and retailing; however, there is an import component to these latter costs. This component is estimated as 40 percent, the share of net imports in GDP in Tonga.⁷ Applying this proportion to other components of vehicle operating costs, the foreign cost component of financial vehicle operating costs is estimated to be 81 percent. Average vehicle operating costs on gravel and sealed roads in the three conditions described in Table 20 are presented in Box 2.1 of Volume One of this present report.

Box 4.1: TRAFFIC VOLUMES

The distribution of traffic volumes over the road network is highly skewed. Traffic volumes on Tongatapu are relatively heavy. Volumes on the main roads within Tongatapu generally exceed 10,000 vehicles per day with in excess of 2,500 vehicles per day on the main roads close to the urban areas. Elsewhere on the main road system traffic volumes are generally in excess of 250 vehicles per day. On the outer islands traffic volumes can be as low as only a few vehicles per day.

**Table 21: TONGA—VEHICLE OPERATING PARAMETERS:
SEALED ROADS IN GOOD CONDITION, 1991**

	Car	Light Utility	4WD	Light Truck
Physical Data				
Free Speed	60	50	60	45
Power-Weight Ratio (BHP/t)	-	-	-	25
Annual Use:	1.0	1.0	1.5	3.0
Distance (km)				
Time (hours)	12,500	14,750	12,500	17,000
Effective Life (years)	500	600	500	680
Average Vehicle Age (years)	10	10	10	10
Vehicle Crew:	4	4	5	5
Driver				
Other	0	1	1	1
Traffic Composition	0	1	1	1
	34%	6%	5%	20%
Unit Price Data (1991 prices)				
(i) Financial Prices /a				
Vehicle	31,000	17,000	29,000	39,800
Tire	90	90	160	130
Fuel	0.63	0.63	0.62	0.62
Oil	7.00	7.00	7.00	7.00
Driver Time (/hr)	2.20	2.20	2.20	2.20
Crew Time (/hr)	0.66	0.66	0.66	0.66
Maintenance Labor (/hr)	2.20	2.20	2.20	2.20
Insurance	1,200	700	1,200	1,600
Annual Registration	25	40	27	55
Real Interest Rate	7%	7%	7%	7%
(ii) Economic Prices /b				
Vehicle	19,050	10,450	17,820	24,460
Tire	74	74	132	107
Fuel	0.44	0.44	0.43	0.43
Oil	5.00	5.00	5.00	5.00
Derived Data /c				
Average Speed (kph)	58	48	59	44
Fuel Consumption (l/'000 km)	72	67	113	134
Oil Consumption (l/'000 km)	1.2	1.8	1.8	4.0
Tires (Consumed/'000 km)	0.139	0.139	0.139	0.331
Spare Parts (%/'000 km)	0.001	0.001	0.001	0.001
Maintenance Labor: (hrs/km)	0.001	0.001	0.001	0.001

/a Includes Sales Tax of 5 percent of retail price.

/b Excludes taxes and duties.

/c Derived from RTIM for sealed roads with roughness of 2,000 mm/km.

Source: Mission estimates.

**Table 22: TONGA—VEHICLE OPERATING COSTS ON PAVED ROADS
IN GOOD CONDITION, 1991
(T\$/km, 1991 Values)**

	Car	Light Utility	4WD	Light Truck	Average
Financial Cost					
Fuel	0.045	0.042	0.070	0.083	0.038
Oil	0.008	0.013	0.013	0.028	0.010
Tires	0.012	0.012	0.022	0.043	0.015
Maintenance	0.038	0.025	0.044	0.051	0.027
Interest and Depreciation	0.353	0.164	0.330	0.333	0.215
Licenses and Insurance	0.098	0.050	0.098	0.097	0.061
Driver and Crew	0.000	0.059	0.049	0.065	0.019
Total	0.555	0.366	0.626	0.700	0.385
Economic Cost					
Fuel	0.032	0.029	0.048	0.057	0.027
Oil	0.006	0.009	0.009	0.020	0.007
Tires	0.010	0.010	0.018	0.035	0.012
Maintenance	0.024	0.016	0.028	0.032	0.017
Interest and Depreciation	0.217	0.101	0.203	0.205	0.132
Insurance	0.096	0.047	0.096	0.094	0.060
Driver and Crew	0.000	0.059	0.049	0.065	0.019
Total	0.385	0.273	0.451	0.509	0.274

^a Vehicle operating costs for paved roads in good condition (roughness index 2,000 mm/km) are used as the datum, against which vehicle operating costs for other road types (unsealed and earth) and road conditions (fair and poor) are estimated. The total annual cost of owning and operating vehicles is expressed in T\$/km; variations in operating costs with road conditions are tested only for fuel, oil, tires and maintenance.

Source: Mission estimates.

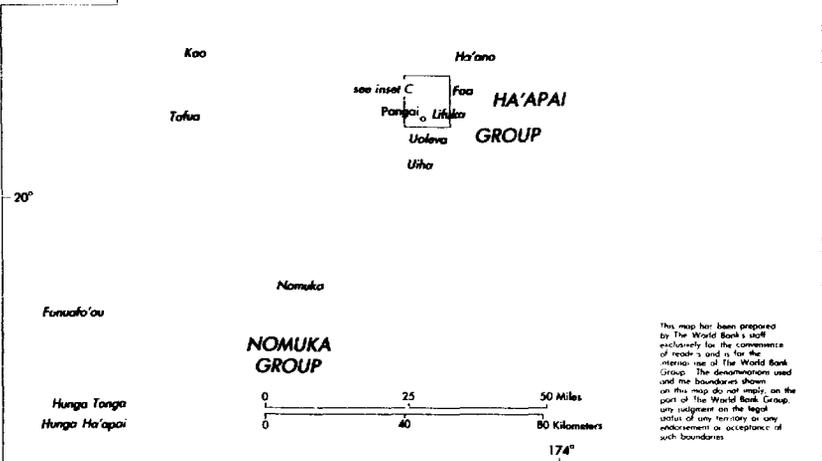
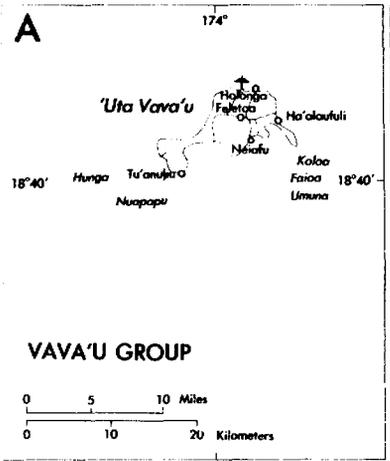
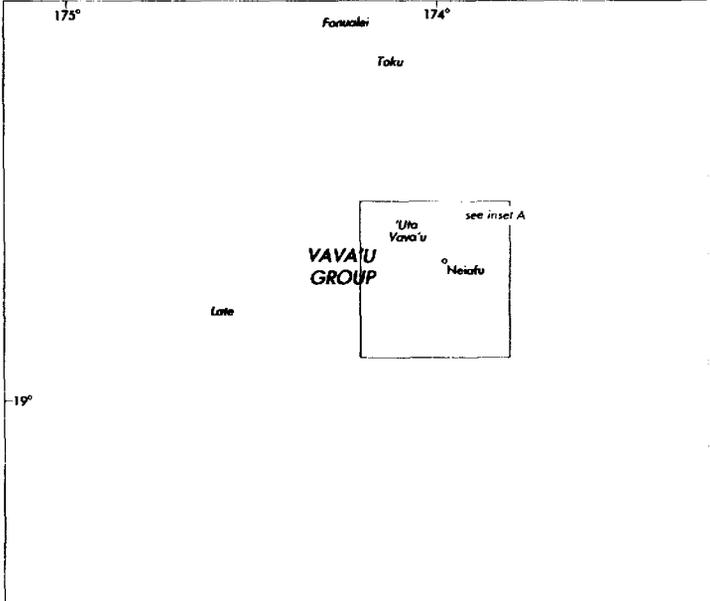
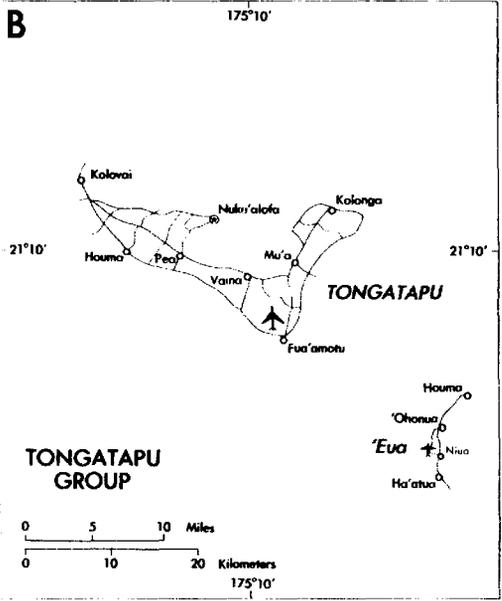
Endnotes

1. The survey of the maintenance situation presented here is based upon a World Bank mission visit to Tonga September 24-25, 1991.
 2. These tables are based on a classification system outlined in Volume One, Part II. The notional classifications used in the marine and aviation subsectors are subject to further refinement.
 3. The information is derived from two sources. A questionnaire setting out the data required was circulated prior to the mission visit and used as the reference for discussions with the relevant Ministries and Departments. In addition to the information from the mission, data have been drawn from sectoral and subsectoral reports on transport in Tonga.
 4. The structure of road user charges and other fees/taxes for road cost recovery is more complex in such situations. This issue of providing reliable access to small, often remote, communities also arises in maritime and aviation with small wharves and airfields.
 5. Transport and Road Research Laboratory (1982).
 6. The vehicle operating costs are summarized in Box 2.1 in Volume One of this report.
 7. Based on data for 1989 when imports, exports and GDP were T\$50.3 million, T\$8.7 million and T\$127 million respectively.
-

MAP SECTION

TONGA PACIFIC ISLANDS TRANSPORT SECTOR REPORT

- MAIN ROADS
- ⊕ CAPITAL
- ⊕ MAJOR PORT
- ↑ AIRSTRIPS
- ↑ INTERNATIONAL AIRPORT



This map has been prepared by The World Bank's staff exclusively for the convenience of readers and is for the internal use of The World Bank Group. The denominations used and the boundaries shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.

