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Pacific Islands Transport Sector Study

(In Seven Volumes) Volume I: Transport Issues — A Regional Perspective

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EXCHANGE RATES
(June 28, 1991)

Fiji	F$1.00	=	US$0.667
Kiribati	A$1.00	=	US$0.765
Solomon Islands	SI$1.00	=	US$0.368
Tonga	T$1.00	=	US$0.760
Vanuatu	Vt100.00	=	US$0.884
Western Samoa	WS$1.00	=	US$0.425

Note: Unless otherwise noted, all prices in this report are in mid-1991 prices.

ACRONYMS AND ABBREVIATIONS

ADB	-	Asian Development Bank
AIDAB	-	Australian International Development Assistance Bureau
AMI	-	Airline of the Marshall Islands
ASAS	-	Australian Staffing Assistance Scheme
ASPA	-	Association of South Pacific Airlines
CAAF	-	Civil Aviation Authority of Fiji
CAD	-	Civil Aviation Department
CAF	-	Currency Adjustment Factor
CCNI	-	Compania Chilena de Navegacion Interoceania
CCS	-	Chief Container Services
CEMA	-	Commodities Export and Marketing Authority of the Solomon Islands
CGM	-	Compagnie Generale Maritime et Financiere
CNCO	-	China Navigation Co
CPD	-	Central Planning Department
CPO	-	Central Planning Office
CSAV	-	Compania Sud Americana de Vapores
DCC	-	Development Coordinating Committee
DPM	-	Department Ports and Marine
DRT	-	deadweight registered tonnes
E.A.	-	equivalent annual
EC	-	European Community
ESCAP	-	Economic and Social Commission for Asia and the Pacific
FAL	-	Freight All Kind
FCL	-	full container load
FIA	-	Friendly Island Airways
GNP	-	gross national product
IBRD	-	International Bank for Reconstruction and Development
ICAO	-	International Civil Aviation Organization
IDA	-	International Development Association
IFAD	-	International Fund for Agricultural Development
IMF	-	International Monetary Fund
JICA	-	Japanese International Cooperation Agency
LCL	-	less than container load
LTB	-	Land Transport Board
MCTW	-	Ministry of Communications, Transport and Works
MOF	-	Ministry of Finance
MOL	-	Mitsui-OSK Lines
MOT	-	Ministry of Transport
MOTC	-	Ministry of Tourism and Communications
MOW	-	Ministry of Works
MPM	-	maximum permitted mileage
NCHP	-	Navale & Commerciale Havraise Peninsulaire
NDB	-	non-directional beacons

NYK	-	Nippon Yusen Kaisha
OAA	-	Orient Airlines Association
ODA	-	Official Development Assistance
OECD	-	Organization of Economic Cooperation and Development
PAF	-	Ports Authority of Fiji
PAFCO	-	Government owned fish canner
PFL	-	Pacific Forum Line
POL	-	Polish Ocean Lines
PMC	-	Pacific Member Country
PWD	-	Public Works Department
PVU	-	Plant and Vehicle Unit
RERF	-	Revenue Equalization Reserve Fund
RTD	-	Road Transport Department
SAS	-	Scandinavian Airlines System
SBN	-	Societe Bourbonnaise de Navigation
SCI	-	Shipping Corporation of India
SCK	-	Shipping Corporation of Kiribati
SCP	-	Shipping Corporation of Polynesia
SEAL	-	Scandinavian East Africa Line
SIPA	-	Solomon Islands Port Authority
SMEC	-	Snowy Mountains Engineering Corporation
SMN	-	Societe Mauricenne de Navigation
SMTM	-	Societe Nationale Malgache de Transports Maritimes
SOM	-	shortest operated mileage
SNC	-	Societe de Navigation Cannaise
SPDC	-	Special Projects Development Corporation
STABEX	-	Export Earnings Stabilization System
TCB	-	Transport Control Board
TEU	-	twenty-foot equivalent unit
UNDP	-	United Nations Development Programme
UTA	-	Union de Transports Aeriens
VFR	-	visiting friends and relatives
WPAS	-	Western Pacific Air Services
WSSC	-	Western Samoa Shipping Corporation
WSAA	-	Western Samoa Airport Authority

PREFACE

This Pacific Islands Transport Sector Study (PITSS) has its origin in a desk review of transport in the South Pacific region that was undertaken in 1990. That review revealed that sector-wide assessment of transport was extremely limited and confirmed the desirability of preparing a formal transport sector report for the region—the first such report by the World Bank. At the time (1991) the study was undertaken there were six Pacific Island countries that were members of the Bank, namely, Fiji, Kiribati, Solomon Islands, Tonga, Vanuatu and Western Samoa (although membership was extended to the Marshall Islands in 1992 and the Federated States of Micronesia is in the process of joining the Bank). The report examines the transport sectors in the six present Pacific Island member countries as of 1991.

Efficient transport services are vital to the support of economic growth and social well being in these Pacific Island member countries (PMCs). Accordingly, sector performance is examined and areas of major concern are identified. The main objective is to provide an assessment of the transport sectors in the PMCs, and to indicate areas which warrant priority attention by PMC Governments.

The study is reported in two volumes: Volume One - A Regional Perspective on Transport Issues, and Volume Two - Country Surveys. Volume One presents an analysis of transport issues which prevail across the region. Part I provides a regional overview of the status, problems, and priorities concerning the transport sectors of the six countries. On the basis of this overview, three major transport issues were selected for in-depth examination. Part II provides an assessment of transport infrastructure and its maintenance, documents serious deficiencies, confirms that looking after existing assets should take priority over new investment, and outlines actions to establish sound infrastructure management. (Because of its size and relative development, Fiji is not included in Part II). Part III compares air and sea transport costs to the South Pacific region with other island regions, including the Indian Ocean. The hypothesis that transport costs for the South Pacific are excessively high, relative to other regions, is not supported by the evidence. Part IV explores cooperation in regional transport, specifically in aviation. Numerous cooperative arrangements among the airlines of the region have evolved to cope with the small thin market conditions. Areas where Governments can facilitate further gains in efficiency of air services are highlighted.

Volume Two of this report contains a series of transport sector surveys for the six Pacific island member countries. These surveys provide background on the institutional arrangements, market conditions, operations, regulatory regimes, finance, cost recovery, investment and maintenance, planning processes, external assistance, and major problems in each country's transport sector. Each country survey (except Fiji) is supplemented by a Maintenance Annex which sets out specific details of the transport infrastructure maintenance situation in the country.

The report is based on an initial mission visit to the region in early 1991, which allowed around 4 days in each country, and a follow-up mission to five countries, of similar duration, in September 1991. A separate brief field visit to

survey selected regional airlines was undertaken in October 1991. A draft of this report (Volume One and each individual country survey) was discussed with the Government of each PMC during the period June-July 1992.

A special thanks is extended to the government officials and industry representatives in the PMCs for their cooperation, kind assistance, and valuable comments during the course of this study.

The study was strucured and managed by Colin Gannon (Senior Economist, EA3IN) with substantial assistance from consultants, who were financed under the Australian International Development Assistance Bureau (AIDAB) South Pacific Facility. The principal authors are Colin Gannon; David Bray and Ian Gordon (Parts I, II and the Country Surveys); Paul Wait and Richard Bullock (Part III); Peter Forsyth and John King (Part IV). Helpful comments on an earlier draft were received from several Bank colleagues, as well as staff members of a number of international assistance agencies, including ADB, AIDAB and ESCAP and are gratefully acknowledged. Secretarial support in putting the report together was provided by Daphne Glass.

PACIFIC ISLANDS

TRANSPORT SECTOR STUDY

VOLUME ONE: TRANSPORT ISSUES— A REGIONAL PERSPECTIVE

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EXECUTIVE SUMMARY

THE CONTEXT FOR TRANSPORT IN THE SOUTH PACIFIC REGION

1. **Special Characteristics of the Pacific Islands.** The Pacific Island World Bank member countries (PMCs) have a number of geographic, demographic, cultural, and endowment characteristics which condition their prospects for economic development. The countries are situated in the center of the South Pacific region yet, as small groups of islands, they are geographically remote from their major markets around the Pacific Rim and in Europe. Their land areas are small and Solomon Islands and Fiji account for three-quarters of the total of 62,000 square kilometers. Several PMCs, and especially Kiribati, involve many tiny islands spread across vast areas of ocean. While climate is conducive to a wide range of activities, the PMCs are very vulnerable to tropical cyclones. Western Samoa has experienced two major cyclones in the last two years.

2. Although natural resource endowments vary considerably among the PMCs, in many respects their resource bases are better than most small island economies. Overall, agricultural commodities, fish, raw materials, and tourism dominate exports; outside Fiji manufacturing is very small. Service sectors are basic although quite well developed in Fiji and Vanuatu. Living standards are fairly sound; official GNP per capita across the PMCs is in the low- to middle-income range. With the exception of Fiji, a large share of national income comes from foreign aid, although the share is significantly lower for Solomon Islands. Remittances from abroad are also very substantial for Tonga and Western Samoa. The rich cultural traditions exert major influences, especially on the use of land, and, in keeping with the extended family structure, the attitude to provision of social services (for example, to isolated communities),

3. **Transport Circumstances.** The special geographic, economic, and social characteristics of the PMCs give rise to circumstances which shape and constrain the nature and cost of transport services. The remote and dispersed locations of the islands, combined with the small size of their populations and small scale of their economic activities, implies that transport services involve low volumes of traffic over relatively long distances, i.e., the transport markets for passenger and freight movements are "thin". These "thin" markets prevail for both international and domestic transport. Such transport markets are more costly to serve, principally because there are economies of scale—especially in transport infrastructure but also in vessels and aircraft. Moreover, in thin markets, frequency of service (ship calls, scheduled flights) will be lower; this lower quality of service can reinforce the low levels of transport demand for both passengers and cargo. In some cases, such as domestic transport service to isolated communities, the level of demand may be so low that provision of the service is not commercially viable.

4. The cost of transport services for the PMCs, and in particular, international shipping freight rates, is also increased by the difference

in size and composition of import and export cargoes. Imports are mainly containerized manufactured goods while export volumes are smaller, and with the exception of Fiji, almost exclusively bulk agricultural commodities/raw materials. As a consequence, there is an imbalance in inward/outward vessel capacity, which tends to increase transport costs. However, in some cases, rates for bulk export capacity may be set at relatively low levels, depending on voyage patterns and alternative cargo availability.

5. Transport services involve both "vehicles" (vessels, aircraft, cars and trucks, etc.) and fixed infrastructure (ports, airports, roads, etc.). Fixed infrastructure is more "lumpy" than vehicles since the indivisibilities are more significant. The size, number, and frequency of use of vehicles can be adjusted to traffic volume much more easily than infrastructure—especially where traffic volumes are quite low. Moreover, minimum levels/standards of some infrastructure (for example, runways and berths) are necessary on technical grounds. In addition, given the geographic circumstances of most PMCs, including the long access distances over water, the choice of aircraft and vessel types is constrained. However, the PMCs are located in proximity to some major trans-Pacific and South Pacific regional shipping and air routes which can be drawn upon to a limited degree, especially in shipping. Indeed, while technological changes in transport have allowed transport costs to be most substantially reduced where traffic volumes are high, at the same time these changes have also widened transport options, and lowered transport costs, for the PMCs, although to a much lesser extent.

6. For the PMCs, the combination of low traffic volumes and lumpiness of some infrastructure (principally in marine and aviation) implies that utilization of infrastructure will be low and unit fixed costs will be high. It follows that very close attention needs to be given to infrastructure investment decisions. In many cases, determination of the appropriate design *standard* for airports, ports and roads is likely to dominate adoption of the design capacity.

Transport Development in the 1980s

7. **The Existing Stock of Infrastructure.** The main development in the transport sectors of the PMCs over the last decade has been investment in infrastructure. Overall, transport facilities and networks in the PMCs are now well established. The overwhelming majority of transport infrastructure—roads, wharfs and jetties, airports and airfields, and associated facilities (such as terminals and storage sheds)—is provided by government. Relative to their size and foreseeable needs, a substantial stock of transport infrastructure now exists in all PMCs. The extent of this stock does vary; it is relatively low in Solomon Islands. The bulk of the transport infrastructure has been put in place with finance from bilateral donor grants.

8. **Capacity, Standards and Demand.** Demand for transport, including supporting infrastructure, has in general, increased moderately. However, with the possible exception of Fiji, there are no significant capacity constraints, delays or congestion. In general, major new investments are not required, although replacement of some facilities may be needed. (In Western Samoa, the two major recent cyclones have caused substantial damage to infrastructure.) In addition, infrastructure design standards are typically adequate to high. In aggregate, the stock of existing infrastructure has become quite high relative to foreseeable needs, levels of national income, and PMC capabilities to sustain the entire accumulated stock.

9. **Influence of Technology.** Advances in transport technology, especially in container vessels and wide-body aircraft, have influenced the design of infrastructure, especially for international ports and airports; in some PMCs facilities have been introduced to accommodate

these technologies. However, with the exception of Fiji, international traffic volumes are relatively low and actual use of large aircraft, in particular, is very limited. Consequently, the utilization and productivity of most major infrastructure facilities in the PMCs is low. In domestic transport, traffic flows are also modest, but in most cases the choice of transport technology is appropriate to the small volumes. Local airfields are unsealed coral/gravel or grass surfaced and small turbo-prop aircraft are used. Interisland/coastal shipping is very basic and vessel age is high but services are generally tailored to demand. Road vehicle ownership is high and social mobility important in the PMCs and investment in roads has been substantial. However, in some PMCs road standards (especially sealed roads) are somewhat high, given the low levels of traffic.

Challenges for Transport Sector Management in the 1990s

10. **Intersectoral Balance.** Development of the transport sector in the PMCs has taken place in a somewhat ad hoc manner. Moreover, the level of infrastructure investment has been high. These factors suggest that attention should be given to assessing intersectoral balance. In particular, it is important to now gauge the marginal productivity of additional expenditure in transport infrastructure relative to other sectors. Excessive allocation of resources to the transport sector also distorts intersectoral linkages. The relatively high level of transport investments in the PMCs is likely to have shifted investment responses of agents in other sectors. In general, the high level of investment in transport infrastructure has influenced the spatial distribution of population and economic activity; concentration may have been less than optimal to support economic growth. The spatial outcome, in turn, has shaped the demand patterns for transport. Transport development should serve (on the basis of economic/social merit) the development role of key growth sectors in the PMCs, for example, tourism, smallholder agricultural enterprises, and prudent harvesting of fish and timber resources. (For Fiji, the broader economic base requires more comprehensive planning of transport development.) Therefore, a challenge for the future is to address these fundamental intersectoral issues. Specifically, attention needs to be given to sector-wide and intersectoral planning and to reflect their implications in project appraisal.

11. **Management of the Existing Infrastructure.** The major challenge now confronting PMC Governments in their transport sectors is looking after the valuable stock of transport infrastructure that has been established. Accordingly, any new infrastructure investments should be subject to stringent economic appraisal; they should be evaluated against a strategic view of the sector, and against the priority needs which prevail for maintaining valuable existing facilities. Primary attention needs to be focused on the efficient operation, maintenance and, where appropriate, replacement of existing assets.

12. A key management issue which all PMC Governments face is how to obtain the best value from their existing infrastructure. This involves developing capability to take decisions on the most effective allocation of scarce maintenance resources. In order to guide these decisions, priorities will need to be established for the maintenance of existing facilities—based on cost-effective delivery of maintenance and realistic assessment of the benefits expected. The PMCs would benefit by sharing maintenance experiences and by utilizing a similar approach to maintenance management.

13. Reconstruction or upgrading of existing assets should be evaluated thoroughly, in the same way as new ("green field") investments. For small projects, guidelines (traffic volumes, unit costs, standards) should be established to facilitate cost-effective appraisal. Selected post-project evaluation should be undertaken to test appraisal and to identify major lessons (for example, the pervasive need for institutional

strengthening and inadequacies in project appraisal, design and selection.)

14. The main issues that need to be addressed are weak maintenance management, excessive deterioration of assets due to past inadequate maintenance, lack of information to articulate priority maintenance needs, inadequate budget support for economically justified maintenance, limited delivery effectiveness, and substitution of donor-financed rehabilitation for continuous maintenance.

15. **Maintenance of Infrastructure.** Increased awareness is needed to overcome the approach to maintenance often adopted at present. Given the long life of most transport infrastructure, there is a tendency to defer or minimize expenditure on its maintenance. This is understandable but it causes infrastructure to deteriorate more rapidly, and to a greater extent, than it should. This imposes increased current operating costs on users and leads to higher life cycle costs of the infrastructure. As a result, the total costs of providing and using the transport system are excessive. The higher transport operating costs increase domestic prices and impair much needed export competitiveness.

16. In all PMCs, funding and execution of maintenance of infrastructure falls well short of what would be required to keep the existing valuable assets in good condition. The efficient level of maintenance should be established based upon prioritization of assets.

17. Maintenance obligations, and their implications for recurrent budget support, should be highlighted in all project proposals, and evaluated against realistic prevailing delivery effectiveness, and financial feasibility. An action plan for improving maintenance of transport infrastructure should be developed for each PMC. These plans should be designed around three key components: management, finance, and delivery of the maintenance task. Monitoring, as well as programming (based upon an appropriately scaled information base) should form integral parts of the management component.

18. In the short-term, maintenance priorities should be based on meeting appropriate operational standards. However, as rehabilitation and reconstruction decisions arise, a full reappraisal of each facility should be undertaken. In some cases it may be appropriate to modify existing infrastructure, in particular to increase the standard of some facilities, and allow the standard of others to be reduced. Such adjustments in the existing infrastructure enable maintenance efforts to be directed to priority uses. Without such adjustments, maintenance expenditure may be attracted to less valuable facilities and entrench distortions, not only in the use of scarce maintenance resources, but also in the demand and modal choice by users.

19. **Cost Recovery for Infrastructure.** User charges for infrastructure are limited, utilization of assets is low, and total cost recovery in most cases is poor. Indeed, existing levels of transport costs, including international rates, need to be considered against the prevailing low level of cost recovery for PMC infrastructure. The share of the full cost of priority infrastructure in total transport costs is relatively low for international transport but can be high for many domestic services. Current levels of cost recovery and user charges are not only low, but vary across modes. Over time this distorts the efficient level and choice of mode.

20. The main issues are achieving balanced and increased cost recovery, and efficient infrastructure use across all modes. Addressing these issues poses special difficulty where the level of use (for example, road traffic, air passenger movements and cargo volumes) is low, and an important part of the infrastructure (roads, airfields, jetties) involves a high proportion of fixed costs. This is relatively more important in the domestic area, particularly for the social purpose of providing reliable accessibility.

21. **User Charges.** The structure and level of indirect and direct user charges should be reviewed for all infrastructure and better targeted for both increased cost recovery and consistency across modes. On efficiency and capacity grounds, a target should be set based on the efficient level of maintenance costs for each mode. Special attention should be given to the evaluation and cost-recovery of roads, wharfs and airfields that provide important basic access but at low utilization and low feasible cost recovery. Such evaluation should not only consider cost-effective provision of accessibility, but also incentives for relocation or expanding local services.

Improving Efficiency of Domestic Transport Services

22. **Enabling Entry and Exit to Markets.** Although there are some areas where the efficiency of domestic transport services can be improved, performance in domestic transport markets generally appears adequate. Surface modes (road and water) play the central role in the PMCs. In the land transport subsector, Governments have established entry conditions that are typically liberal. Freight markets involve low barriers to entry, typically lenient operator licensing, and small sunk costs (i.e., the markets are contestable). Licensing of public transport operators appears, in general, benign. As a result, market structure conditions are conducive to efficiency in operations. Domestic interisland shipping and aviation are typically subject to entry control, although for shipping, where contestability is strong and collusion weak, it is often loosely enforced in practice. In some PMCs there may be inefficiencies and foregone government revenues from controlled entry and flawed competitive bidding for franchise arrangements (for example, in stevedoring).

23. Domestic air services are subject to tight safety and economic regulation. However, internal political pressures, and the presence of limited services operated by NGOs (for example, church organizations), exert some discipline on air fares. In general, the capacity and coverage of domestic transport services are adequate and responsive to market demands. As a result, transport costs, by and large, reflect efficient operations conditions. However, excessive user costs prevail where infrastructure condition is poor due to inadequate maintenance.

24. The main issues involved in improving performance of domestic transport service operations, are regulatory reform (especially in domestic/interisland shipping), efficient provision of non-commercial transport services to remote communities, increasing commercial autonomy of government-owned operators (for example, airlines, ports, shipping) and expanding opportunities for private sector involvement (for example, in domestic shipping). Primary attention should be given to removing legislated barriers to entry. Existing entry controls by licensing of domestic/ interisland shipping operators serve no efficient economic purpose; rather they assist collusion, weaken price competition and blunt service delivery. Such controls should be discontinued. Restrictive licensing of operators by government, as a means of securing the supply of non-commercial services to remote communities by cross-subsidization, is inefficient and distortive. Such services should be treated as a part of an explicit package of policy measures designed to provide acceptable levels of social services for small/remote communities.

25. **Government Involvement in the Operation of Transport Services.** In all PMCs, in addition to their primary role as owners and operators of transport infrastructure (roads, airports and ports), public agencies remain involved to some degree in the operation of transport services—especially as ship operators and air carriers. PMC Governments should shift such service operations outside direct government economic control through corporatization (subject to commercial directives set by Government) or transfer to private ownership.

26. Although the markets for transport service operations in the PMCs are small, sunk costs and entry/exit risks are limited; vessels and aircraft can be shifted readily among routes (or sold). Thus, while the withdrawal of government operators may result in few private operators in markets at any one time, threat of easy entry can be expected to exert discipline on the prices charged, and service quality offered, by incumbents. This reinforces the need to remove subsidies and legislated (economic) barriers to entry or exit. Nevertheless, given the small size of the private sector in most PMCs, it would be desirable for Governments to monitor service conditions and provide a mechanism for the registration of user concerns.

27. **Environmental Issues.** Environmental negative impact of transport facilities and services in the PMCs is, to date, limited. However, the local natural environments are fragile in some locations (for example, coral atolls), and fixed infrastructure can disturb natural processes (for example, water flows in lagoons and in logging areas). Import of hazardous materials (for example, petroleum) places a premium on maritime safety. The impact of transport activity on the environment should be addressed in each PMC's national environment action plan.

Improving Efficiency of Regional Transport Services

28. **International Transport Costs.** By and large, regional and international transport tariffs (ocean freight rates and air fares) are consistent with tariffs for other similar countries and regions. International transport costs for the PMCs are indeed higher than for some other regions, but not excessive. The higher level of international transport costs experienced by the PMCs stems primarily from exogenous circumstances that effect transport cost structures, including market size, distance, traffic density, transhipment requirements, and variations in demand by direction and over time. International transport markets for the PMCs are small, thin, and, for freight movements, imbalanced by type, direction, and time. Against these adverse cost circumstances, international shipping services are subject to competition (particularly by non-conference "tramp" operators), and the national airlines have developed creative use of cooperative arrangements to counter their lack of individual scale economies.

29. **Government Involvement in Transport Enterprises.** Some government-owned enterprises, principally national airlines and shipping companies (such as the Pacific Forum Line), can face precarious financial positions, partly due to government pressure to serve objectives such as tourism (and other exports), at the expense of commercial performance. Also, although limited, some government-owned operators receive subsidies either directly or through the provision of equipment (such as vessels and aircraft) to governments as part of aid programs. This distorts transport markets and weakens the ability of private operators to provide competitive services.

30. National airlines, which serve almost exclusively international routes, should be given financial autonomy and directed to operate as efficient commercial enterprises. It is not efficient for governments to use airlines directly to pursue broad objectives such as tourism development, employment creation and social services; it would be more efficient if PMC Governments addressed these objectives directly. Airlines, together with other enterprises, can be induced, if judged appropriate, to serve specific tourism or social aims through specific payments or direct inducements from governments.

31. On balance prices and quality of service for international transport are in line with efficient levels. However, given the location of the PMCs, their range of export and import source markets, and the low volumes of traffic that are likely to prevail, international transport costs can be expected to remain relatively high. There is some prospect that air fares on some

routes may have potential for reduction, if substantial expansion in tourism can be achieved. However, in general, the delivered cost of imports, and the f.o.b. price received for exports, will reflect transport costs that are high relative to other countries, including those countries with which the PMCs compete for exports on international markets. The higher international transport costs increase production costs, reduce receipts and have squeeze margins. It follows that production costs in the PMCs must be sufficiently lower (for essentially homogenous commodities) than competitors with better market access, if they are to be export competitive. Therefore, emphasis should be given to fostering low cost local production and efficient internal transport.

CHANGING ROLE OF GOVERNMENT

32. **Government Planning and Project Evaluation.** PMC Governments have not given sufficient attention to strategic planning of their transport sectors. Long-term needs, commensurate with projected derived demands for transport from key sectors for growth, such as tourism and agriculture, are not soundly examined. Assessment of modal alternatives (for example, port expansion vs. road upgrading) are often overlooked. Within modes, alternative standards for infrastructure are not adequately assessed to identify minimum overall costs. Even at the project level, economic appraisal is inconsistently applied. Evaluations are often carried out (primarily for multi-lateral and major bilateral projects), but not for the many projects which are small or directed to rehabilitation.

33. Project proposals and development programs are often shaped more by recipient desires, and external financing possibilities, than priority needs. PMC Governments have tended to be reactive to proposals, rather than proactive. PMC Governments should set priorities and a strategic agenda for sustainable development of the transport sector as well as assess reallocation of aid to productive sectors. Many of the National Planning Offices are aware of these problems but have been unable to exert much influence. At the same time, Government responsibilities are typically fragmented by mode (aviation, roads, marine) and assigned to separate departments or agencies. A sector-wide perspective does not emerge and modal departments do not have adequate capability or staff to develop or screen well designed proposals. Such capability would carry weight in establishing priority programs and financing arrangements for the sector.

34. **Sector Management and Institutional Support.** To address effectively the key issues in their transport sectors, PMC Governments need to take action on two broad fronts. First, each PMC Government should concentrate its scarce managerial and professional resources on overall management of the sector. Second, each PMC Government should establish a program of institutional strengthening and staff training which is systematically designed for, and integrated with, the necessary managerial and professional skills. Each Government's management role should focus on the following tasks:

- establishment of a sectoral framework and intersectoral coordination, based on the role of transport in supporting the country's strategy for economic growth;
- policy formulation on a sector-wide basis with consistency across modes;
- adoption of explicit guidelines for the preparation, evaluation, implementation, and future maintenance of projects, together with indicators of their consistency with the sectoral framework and, in particular, their contribution to the country's growth strategy and/or their cost-effectiveness in serving social objectives; such guidelines should also require explicit assessment of the operating, maintenance and replacement

cost obligations of accepted projects and their financing;

- identification of priorities for maintaining and rehabilitating existing facilities together with a program of financing that includes both cost recovery and external assistance;

- safety regulation and enforcement;

- formulation of guidelines for protection of environmental quality, and the development and exercise of local capability to assess and address the environmental impact of projects.

- resource planning, for the sector, including manpower needs and training for all modes; and

- monitoring sector performance.

35. For transport service operations, Governments should concentrate on fostering an "enabling environment", with incentives and market conditions which promote efficiency through entry, exit, and pricing and service freedoms for private operators or autonomous government-owned enterprises. For transport infrastructure, PMC Governments should move to corporatize revenue-earning agencies and introduce clear commercial directives coupled with explicit accountability (including a schedule of target levels of cost recovery).

36. The small domestic markets in the PMCs typically will support only relatively few operators. Moreover, "natural barriers" to entry exist to some degree, for example, island remoteness. Therefore, it would be prudent for Governments to establish a means for the registration of user concerns (for example, a "Transport Ombudsman Office"). Such an office should develop independent capability and authority to monitor and assess charges and service standards and report directly to the Government at Ministerial level.

Implications for Donor Support

37. Generous assistance from donors has enabled most PMCs, and especially Tonga, Vanuatu and Western Samoa, to build up a substantial stock of valuable transport infrastructure over the last decade or so. Road investment has received the major share (around one-half), although airport development has been very substantial in Tonga, Vanuatu and Western Samoa. Transport infrastructure development has been relatively modest in Solomon Islands. By and large, the capacity of existing transport infrastructure is now more than adequate to serve foreseeable development needs.

38. **Overseas Aid Within a Sectoral Framework.** Donors should work with each PMC Government to establish a sectoral framework for strategic development, policy formulation, and overall management of their transport sector. To utilize this framework, donors should assist Governments strengthen institutional capacities, assemble key information to enable monitoring of sector performance, assess policy options which can improve efficiency in the provision of transport services, and ensure that project proposals are evaluated in a sector-wide context, are sustainable, and are consistent with economic and social objectives.

39. **Reorientation of External Assistance.** There is a pressing need for a major shift in the allocation of external assistance. In general, overseas aid should be redirected away from new investments to looking after the existing valuable stock of transport infrastructure assets. This represents a substantial reorientation of aid programs, and a major challenge for donors and the PMCs. If future aid is to be used most effectively, the focus of donors needs to shift to providing assistance that will enable Governments to manage better their transport sectors, especially existing public infrastructure. Within the transport sectors of the PMCs, assistance for establishing effective management of all transport infrastructure should be assigned highest priority. Public sector managerial skills

are scarce and support is needed to attract, select, train, and retain managerial staff. Arrangements should allow consistent and continuous development of maintenance management procedures in each PMC. Contracting-in of professional staff (expatriate or local), and use of "twinning" arrangements with overseas experienced agencies, are likely to be the best approaches in the short to medium term. Effective management of infrastructure will require, for each PMC, the establishment of key information covering inventories of assets, maintenance costs, technology options, standards, and user costs and benefits. This is an essential early task for which donor assistance would be very valuable. Its scope should be strictly limited to assembling the basic information needed to guide core management decisions—especially identification of the best use and maintenance of existing assets, expenditure priorities, budget requirements, standards, and work specifications.

40. **External Assistance for Maintenance.** Primary financial and managerial responsibility for the maintenance of infrastructure must be increasingly assumed by each PMC. At the same time, donors should focus their future assistance primarily on how best they can contribute to the care of the most valuable existing facilities. In this connection, new ways need to be established which enable external assistance to provide broad support for the various types of maintenance projects. Governments and donors will need to assess priorities and funding requirements for existing infrastructure and negotiate new financing arrangements, including the balance between donor funds and recurrent budget commitment by each PMC.

41. **Effective Maintenance.** Efficient use of maintenance resources requires effective delivery of maintenance tasks, preceded by sound quality control at the time of initial construction. Donors have been assisting in these areas. However, future assistance should be directed primarily to the transfer of responsibility from government to the private sector (including devolution of force account works to private contractors and, for routine tasks, to local communities). Aid to government agencies for maintenance equipment should be reviewed, and ways of assisting development of the private sector established.

42. **Coherence of Donor Support.** Since the PMCs share closely the technical, economic and social aspects of these efforts, there is considerable advantage to regional cooperation and combined approaches. Donors should give more serious attention to ways to coordinate their assistance. It may be desirable for donors to concentrate their individual efforts on specific subsectors (and possibly geographic areas) to facilitate procurement, establish identification, and promote stable commitment to an agreed program of development and assistance.

PART I

Regional Overview of the Transport Sector

CHAPTER 1
INTRODUCTION

A. Overview Context

1.1 **Background.** The discussion in Part I of this report provides a regional overview of the transport sector in the six Pacific Island Member Countries (PMCs) of the World Bank, namely, Fiji, Kiribati, Western Samoa, Tonga, Vanuatu and the Solomon Islands, based upon individual sector surveys for each country.[1]

1.2 The study as a whole focuses on three major transport issues in the region: maintenance of transport infrastructure (which is examined in Part II), international transport costs (Part III) and regional airline cooperation (Part IV). The overview in this first part of the report provides a regional perspective of the status of the transport sector in the six countries,and the overall context for examining these three issues.

B. Background to Economic Development

1.3 A combination of several characteristics distinguish the Pacific Island countries from other developing countries. These characteristics need to be recognized in considering the prospects and constraints for their economic development. The countries are very *small*; they are *remote* from their major export and import markets; their *populations are dispersed*, and often spread over many islands. The international and domestic *transport markets are thin* (low volumes and relatively long distances) their composition of *trade is imbalanced* (exports are largely limited to bulk primary products and tourism services, while imports are principally manufactured goods); they are *vulnerable to natural disasters*, especially cyclones; and *foreign assistance flows are a very large part of national income*. While there are differences across the six island nations, these characteristics shape the structure and performance of each country's transport sector, and are at the root of many of the priority transport problems which the countries share. Accordingly, various influences of these characteristics are examined in detail in this study.

1.4 **Geography.** The six countries occupy a central position in the Pacific, stretching from the Solomon Islands and Vanuatu (north-east of Australia) to the Line Islands of Kiribati in the longitude of Hawaii. The total land area of all countries is only 62,000 km^2, of which the Solomon Islands and Fiji account for 45 percent and 30 percent respectively. By comparison, the PMCs Exclusive Economic Zones comprise 7.6 million km^2, of which Kiribati controls nearly one half. (A map showing the location of these countries is provided at the end of this volume.)

1.5 The countries range in character from Kiribati, which consists of 33 small, generally low-lying coral atolls spread over a vast area of the Pacific to Western Samoa with two large inhabited volcanic islands separated by a narrow

strait. Sea transport is vital for economic and social integration in Kiribati, while land transport plays a greater role in Western Samoa.

1.6 **Population.** The population of all countries is small, ranging from 67,000 in Kiribati to 730,000 in Fiji (see Table 1.1). Western Samoa, Tonga and, to a lesser extent, Kiribati, have large proportions of their populations which have emigrated abroad. This emigration has resulted in a significant loss of young people with skills, but provides financial remittances of considerable magnitude relative to domestic income. Both the Solomon Islands and Kiribati face rural to urban (or remote community to central community) population drift which will influence the structure of transport services in the future. There is also potential for this situation to develop in Vanuatu.

1.7 **Institutions.** The PMCs have had different periods since independence in which to develop their institutional frameworks and public and private sector capabilities. Western Samoa gained independence in 1962, Fiji and Tonga in 1970, and Solomon Islands, Kiribati and Vanuatu in the period 1978-1980. All countries, with the exception of Vanuatu which was governed but a condominium administration (UK and France), have inherited an English-based civil service.

1.8 **External Assistance.** With the exception of Fiji, all countries are heavily dependent on external financial assistance for their development programs as current income of the national governments is barely sufficient to meet current expenditure. Annual official development assistance is high, ranging (in gross terms) from US$53 per capita in Fiji, to US$249 per capita for Kiribati, during the period 1980-1987. In 1988, for example, the six countries with a combined population of 1.5 million received US$220 million in official development assistance.

1.9 **Living standards** in the PMCs are moderate despite many constraints. GNP per capita is at the upper end of the low-income to middle-income range. Social indicators compare

Table 1.1: PACIFIC ISLANDS—POPULATION AND DEMOGRAPHIC TRENDS

	Population 1988 ('000)	Total Natural Fertility Rate 1980	Total Natural Fertility Rate 1988	Population growth rate 1980-88 (percent)	Net Migration rate 1980-88 (percent)	Net Population growth rate 1980-88 (percent)
Fiji	732	3.5	3.2	2.2	-5.2	1.8
Kiribati	67	4.6	4.3	2.3	-4.3	1.9
Solomon Islands	304	7.2	6.6	3.5	0.0	3.5
Tonga	101	4.8	4.2	2.2	-18.8	0.4
Vanuatu	151	6.1	5.8/a	3.1	-2.5	2.9
Western Samoa	168	5.6	4.7	2.9	-25.7	0.3

/a 1987.

Source: World Bank (1991a).

favorably with developing countries of the same or higher levels of income. The social system of all countries, which is based on extended family or kinship ties, and the strong subsistence sector of the economy, result in a low incidence of poverty.

C. Performance and Prospects[2]

1.10 **Growth performance** has been modest during the 1980s, despite some of the highest inflows of per capita development assistance. As a group, the six PMCs recorded an average growth rate in real GNP of only 0.6 percent per annum during 1980-1988, while population grew at 2 percent per annum. Natural disasters have had an impact (though not a dominant influence) on growth performance; all of the island economies except Kiribati suffered major devastations during the 1980s. Political events also affected the economic performance of Fiji and Vanuatu during this period.

1.11 All six countries have potential for sustainable higher growth based upon stimulation of private investment in productive sectors and a supportive government policy environment. The limitations, however, are substantial. Prospects in traditional primary commodity export areas appear weak. All countries face limited natural resources, in most cases dispersed land areas, small, fragmented and remote markets, and, as a consequence, high internal and external transport cost structures.[3]

1.12 **Human resources** present a fundamental constraint to development in both the public and private sectors. All countries, including Fiji, rely substantially on expatriates to fill key positions and to provide professional and specialist skills. The problem is compounded in countries, such as Western Samoa and Tonga, which have a high rate of emigration, particularly of highly educated and experienced professionals for whom ease of entry into developed countries of the Pacific Rim and their higher wage rates are attractive.

1.13 The **public sector** occupies a dominant position in the economy of all PMCs. Aid flows are channeled through the public sector and are used primarily for public sector projects. The public sector, therefore, has taken the lead in performing economic activities whereas, for historic and cultural reasons, private initiative has been lacking. As a result, the role of *public agencies and enterprises* in the PMCs is large; this places a considerable burden on the fiscal budget. To address this burden, public enterprise tariffs/revenues need to be reviewed to cover operating and replacement costs. Improvements in operating efficiency are also needed. In this connection, moves to corporatization and privatization of specific functions to increase management effectiveness require careful assessment of such aspects as market structure and potential monopoly power, available skills, cultural capability, monitoring capability and accountability, and the functioning of the capital market.

1.14 Except in Fiji, most employment in the PMCs stems from traditional primary sources—agriculture, forestry and fisheries. In Vanuatu, Solomon Islands, Western Samoa, Tonga, and Kiribati a large share of agricultural production is in the form of smallholder-operated, partially-subsistence holdings.

CHAPTER 2
ECONOMIC CONTEXT

A. Demand for Transport Services

International Trade and Transport

2.1 In all PMCs the principal direct linkages of the transport sector are with three key activities: trade, tourism and agriculture. Trade flows for freight are characterized by the substantial imbalance between imports and exports (up to 6 times), the imbalance in containerization of import and export cargoes, and the imbalances between sources of supply of import commodities and destination of export commodities.

2.2 In contrast to most Pacific Island countries, imports and exports (by value) to Fiji are approximately in balance. Exports are dominated by sugar, although other categories of exports (for example, fish, forestry products) have grown more rapidly. The UK is the single largest export destination for Fiji, accounting for about a third of total exports. Other trade is focused on the Pacific rim, in particular, Australia, New Zealand and increasingly, Asia. More than 46 percent of imports come from Australia and New Zealand. However, from the standpoint of transport services, Fiji (and the other PMCs) experience imbalances particularly as bulk movements dominate exports and container movements dominate imports.

2.3 For *Kiribati* the trade deficit in 1988 was equivalent to three times export earnings. Imbalance of flow by origin and destination is far greater. The Asia-Pacific region is the major supplier of Kiribati's requirements, whereas over 90 percent of exports are to the EEC. Copra and fish account for over 95 percent of all exports by volume and value. Copra shows significant variation on a year by year basis and the total export volume has mirrored this variation.

2.4 The principal exports from the *Solomon Islands* are copra, palm oil, fish and timber, the last two categories accounting for 60 percent of the export trade (by value) in 1988. Japan and Asian countries are the principal importers of commodities from the Solomon Islands, and Australia is the principal source of imports. The trade deficit is substantial and in 1988 was equivalent to about 70 percent of import earnings.

2.5 Exports from *Tonga* have grown rapidly in the second half of the 1980s, due largely to increased trade in vanilla beans, fish and squash. Imports have increased steadily, to the extent that the value of imports exceeded exports by six times in 1988. This imbalance is also reflected in volume terms. The Pacific rim countries are the main source of imports and the major destination of exports from Tonga.

2.6 The principal exports from *Vanuatu* are copra, cocoa, beef and timber. There has been no sustained growth in any major export commodity during the 1980s, whereas imports have increased over the period. For 1989, the value of imports exceeded exports by almost five times. This imbalance in shipping requirements is further reflected in trading relationships. Countries in the Asia/Pacific region (New

Zealand and Australia, in particular) are the main sources of imports and European countries the main receivers of exports.

2.7 Exports from *Western Samoa* have shown little growth over the latter half of the 1980s due to the volatility of copra prices, declining demand for coconut oil, and quality control problems with bananas. Cyclone Ofa is expected to have cut the volume of export crops by 40-50 percent in 1990 and Cyclone Val (December 1991) has further affected export potential. The volume of imports has tended to increase during the 1980s, so that in 1989 the volume of imports exceeded exports by nearly six times. Asia and Pacific Rim countries are the main sources of imports and the South Pacific Islands region, with Europe, the main receiver of exports.

2.8 In all PMCs, development of traditional crops in the agricultural sector has been beset by low export demand and international prices and the higher share of export (f.o.b.) values associated with domestic and international transport costs.[4] As a result, residual returns to growers have become marginal or even zero. However, there is scope for developing some higher value specialized crops in several PMCs (for example, vanilla in Tonga).

Tourism

2.9 Tourism is underdeveloped, with the exception of Fiji, but suffers from remoteness from major source countries, high transport and on-ground costs, limited resort facilities, and strong competition from well-developed alternative destinations. As shown in Table 2.1, Fiji is the dominant tourist destination; the number of visitor arrivals in 1988 being more than double the combined total of the other countries. Australia is the principal source market, followed by New Zealand and the USA. The figures for Kiribati, Tonga and Western Samoa are affected by visiting friends and relatives (VFR) traffic from New Zealand, other Pacific countries and Australia. Tourism to the region increased during the 1980s, albeit from a very low base. Tourist arrivals in Fiji and Vanuatu declined towards the end of the decade as a result of civil and political difficulties, and the effects of several severe cyclones (Vanuatu).[5]

Table 2.1: PACIFIC ISLANDS—VISITOR ARRIVALS, 1988

Country	No. of Visitors /a ('000s)	Visitors by Nationality (%)						
		Australia	NZ	USA/ Canada	Europe & UK	Japan	Other Pacific	Other
Fiji	208.2	36.1	10.3	28.4	13.9	1.6	6.8	2.9
Kiribati	3.4	13.0	8.0	13.0	7.0	6.0	42.0	11.0
Solomon Islands	10.7	36.2	12.1	8.5	7.2	5.5	22.2	8.3
Tonga	19.5	15.0	24.0	22.0	12.0	2.0	13.0	12.0
Vanuatu	17.5	54.8	8.3	3.6	4.0	2.9	19.9	6.5
Western Samoa	49.1	9.5	27.6	7.1	6.1	n.a.	47.2/b	2.5

/a Excludes cruise ship passengers.
/b Includes visitors from American Samoa.

Source: Country reports.

Domestic Transport Requirements

2.10 Internal transport requirements are influenced strongly by the geography, terrain and spatial distribution of population of each country. Inter-island shipping is an essential service and performs the major role in the movement of freight and passengers in Kiribati, the Solomon Islands and Vanuatu and, to a lesser but still essential degree, in Fiji and Tonga. Sea transport across the strait between the two main islands of Western Samoa (Upolu and Savaii) is of importance but overall plays a lesser role than the land transport subsector.

2.11 Inter-island air services provide a crucial means of communication for business, tourist and urgent personal travel, and for the movement of high value, fragile or urgently required commodities and equipment. Air and maritime services each provide valuable functions within all PMCs.

2.12 Land transport serves a complementary role to sea and air transport outside of the urban centers in Kiribati, the Solomon Islands and Vanuatu. Its main functions are to provide connection between village communities or from communities to wharves, beach landing areas, airstrips and regional facilities. Vehicle numbers are low and average traffic volumes on many roads are commonly less than 10 vehicles per day.

2.13 Land transport demand in Fiji is heavily influenced by the dominant size of the island of Viti Levu, and the quite widespread distribution of its economic activity and population. The land area of the island is small and there is the potential for considerable intra-island road travel. Traffic volumes and trip patterns of road transport can be expected to expand as roads are upgraded. Even with existing road conditions, there is an increasing number of full containers reported to be carried by road from Suva to Lautoka to use the latter as an export port.

2.14 In Tonga, land transport demand is relatively high on Tongatapu, where two-thirds of the population live. Agricultural products are carried by land transport to Nuku'alofa (the capital) for consumption by the urban population and for export through the port. Demand for land transport is lower on Vava'u (the other major island) and minimal elsewhere.

2.15 In Western Samoa, some 70 percent of the population lie in Upolu (where the capital Apia is located) and the fertile coastal plains have been developed extensively for agricultural uses. Savaii, which is separated by a sea strait of 21 km from Upolu, is less developed. Both islands have effective road systems for personal travel and freight movement.

CHAPTER 3
INSTITUTIONAL STRUCTURE

A. Government Structure

3.1 All countries have a national government administration, although a process of decentralization of government administration and provision of public services by provincial governments has been in progress for some time in the Solomon Islands and Fiji. Vanuatu and Kiribati have a system of local government administration which is involved in local development issues, the maintenance of some local public assets and the administration of local services. Western Samoa and Tonga have centralized government administrations.

B. Agency Responsibilities and Capacities

Major Transport Functions

3.2 Responsibility for functions in the transport sectors of the PMCs is reasonably well defined.[6] The general institutional arrangements in each country are illustrated in Table 3.1. In general, the PMCs have developed similar institutional arrangements for the planning, construction and maintenance of transport infrastructure. Without exception, central government responsibilities for *land transport infrastructure* are administered through ministries or departments of Government. These organizations cover a range of public works functions (for example, water supply, public buildings) and their responsibilities are not confined to road matters. In many cases (Kiribati, Tonga, Vanuatu, Western Samoa) they provide construction and maintenance services to other government organizations responsible for marine and aviation functions. Land transport services are provided by the private sector in all the PMCs.

3.3 In the *marine subsector* statutory authorities have been created in Fiji (Port Authority of Fiji) and the Solomon Islands (Solomon Islands Port Authority) which are responsible for the operation of the major international ports. Elsewhere public service organizations are responsible for the administration of the main ports. Although not yet implemented, Kiribati has passed legislation, and Western Samoa has a draft bill, to establish a port authority. Stevedoring services may be provided by the port organization, by contract with private enterprise for the provision of this service within the port, or through stevedoring companies competing for the service directly with ship's agents. The responsibility for the operation and maintenance of outer island wharves and jetties is less clear.[7]

3.4 Internal marine transport services (excluding the informal sector) are provided by each Government, the private sector, or both. Government-owned or supported domestic shipping services are provided in all PMCs, with the exception of Vanuatu where inter-island services are provided solely by private enterprise. Private enterprise provides the majority of services in the Solomon Islands; government services are directed to commercially unattractive routes. A similar

Table 3.1: PACIFIC ISLANDS—GENERAL INSTITUTIONAL ARRANGEMENTS

	Mode					
	Land		Marine		Aviation	
Country	Infra-structure	Services	Infra-structure	Services	Infra-structure	Services
Fiji	PSO	P	SA	P + PSO	SA	GC + P
Kiribati	PSO	P	PSO	GC + P	PSO	GC
Solomon Islands	PSO	P	SA	P + PSO	PSO	GC + P
Tonga	PSO	P	PSO	GC + P	PSO	GC
Vanuatu	PSO	P	PSO	P	PSO	GC
Western Samoa	PSO	P	PSO	GC	SA	GC

PSO Public Service Organization (Ministry, Department)
P Private Enterprise
SA Statutory Authority or Corporation
GC Government Company (wholly or substantially owned by government), Government Corporation

Source: Country reports.

situation exists in Fiji. In Western Samoa the Government is the sole operator, while in Kiribati and Tonga there is limited private enterprise competition. Adequate knowledge of the size, role and performance of the informal provision of maritime services is extremely limited for all PMCs. (Recent studies of interisland shipping, primarily financed by ADB, are revealing the importance of informal shipping.)

3.5 *Operation and maintenance of aviation infrastructure* is a responsibility of statutory authorities in Fiji and Western Samoa and undertaken by government departments (or ministries) elsewhere. Internal aviation services are provided by government owned (or controlled) airlines in all six countries. Private airlines operate only in Fiji and Solomon Islands.

Transport Regulatory Functions

3.6 Regulation of transport services is a function of government ministries or departments in all of the PMCs. The degree of regulation and the level of enforcement are variable.

3.7 In the *land transport subsector* all countries with the exception of Kiribati, do exercise some control over the operation of public transport services (taxis and buses) through entry restriction, route service licensing or both. Fare levels for the provision of services are typically set by government. By and large, entry control is liberal, there is little evidence of high rents or excess demand. Entry control and tariff regulation is not applied to the road freight industry. Vehicle weight and dimension controls exist in all countries but few (if any) resources appear to be directed to the enforcement of regulatory limits. While

localized, the suspected levels of road damage and potential safety problems arising from overloading of freight vehicles are matters for concern in most countries. (Kiribati has only a small freight vehicle fleet and limited road system—yet a road safety problem, especially for pedestrians in some locations). All PMCs have vehicle registration and driver licensing systems. Some countries (for example, Western Samoa, Solomon Islands, Vanuatu) operate vehicle inspection systems for both private and public service vehicles as a component of the vehicle registration system. Vehicle registration charges are uniformly low and unrelated to the costs of provision and maintenance of road systems; overall cost recovery is low. Overall the performance of the land transport subsector is weakened principally by inadequate cost recovery and enforcement of vehicle loading; market structure conditions are reasonably conducive to workable competition and satisfactory performance.

3.8 The administration of *marine legislation* relating to the operation and safety of vessels on national registers is carried out by government departments. Some form of entry control (licensing) is applied to the formal inter-island shipping system in all PMCs. Route licensing is applied in the Solomon Islands and Vanuatu, where shipping services are provided mainly or wholly by the private sector, but there appears to be little surveillance or enforcement of route compliance. However, the licensing is vulnerable to effective entry control and should be removed. Aside from some incumbent-vested interests, the main resistance to relaxation stems from withdrawal of operators obliged at present to serve remote non-commercial islands by cross subsidization. Explicit contracting by Government for such services would be preferable. Freight and passenger rates are essentially determined by individual operators although the Governments do exert influence on tariffs through freight rates set by the commodity marketing authorities in each country. Route licensing of inter-island services is not practiced in Fiji, although it has been recommended by a study of rationalization of inter-island services (ADB, 1986). Inter-island freight rates, however, are set by the Government's Prices Control Board.

3.9 The administration and enforcement of *air safety regulations* and the provision of air traffic services are the responsibility of government departments (or ministries) in all PMCs. With the exception of Fiji and the Solomon Islands, the provision of public aviation services is confined to organizations owned or controlled by government. The level of domestic airfares is a sensitive issue in all PMCs and increases in fares require government approval.

Corporatization and Privatization of Transport Functions

3.10 There is a growing attraction to the corporatization or privatization of transport functions in the public sector. Fiji, Kiribati and the Solomon Islands Governments have instituted specific commercialization or privatization policies. Other countries are considering the formation of statutory authorities, principally in the aviation and marine subsectors, to operate facilities on a commercial basis.

3.11 In Fiji proposals have been made for privatization of the Government shipping fleet and shipyard (geared to regional vessels), both of which are operated by the Marine Department in the Ministry of Infrastructure Public Works and Maritime. The Government of Kiribati is committed to a policy of privatization of major public enterprises as a means of reducing costs and encouraging greater private sector participation. An Act has been passed to create a Kiribati Ports Authority. In addition, the decision to separate the Shipping and the Port Divisions of the Shipping Corporation of Kiribati will require a more commercial approach to the provision of shipping services which to date have been cross-subsidized from port operations. The Solomon Islands Government has initiated a process to privatize

some public sector functions and to corporatize others. The way in which privatization of public sector activities might occur is still to be developed. Indications are that a statutory authority will be proposed for the operation of the major airports (Henderson and Munda) and for general aviation policy, air navigation and air safety. A Bill to establish a Western Samoa Ports Authority is in final draft form. When established the Port Authority would take responsibility for all port and ferry facilities and for navigation aids in Western Samoa. The Authority will be subject to the general policy of Cabinet in the exercise of its function, but would retain revenue raised to meet operating costs, interest and loan repayments and provide for depreciation and general reserves.

3.12 **Capacity and Constraints.** A program for improving the performance of statutory organizations including corporatization and privatization of selected functions should be developed. However, its feasibility and effectiveness will depend crucially on existing capabilities and market conditions. There is little tradition of private initiative in the PMCs, the capacity for entrepreneurial risk taking is limited, the effective commercial management of major enterprises is not well developed (with the exception of Fiji), and local finance and capital markets are shallow. In addition, the smallness of markets increases the potential of (private) monopoly power and hence the need for facilitating entry, effective monitoring (for example, using international norms), and, if necessary, real price reduction directives. Donors should develop means by which assistance can be given to the development of private sector capabilities in the PMCs.

Devolution of Central Government Functions

3.13 As noted above, in the Solomon Islands a process of decentralization of government administration and the provision of government services through a provincial government system (seven provincial Governments and the Honiara town Council) has been in progress for some time. Some devolution of powers, including transport functions, has occurred but has not proved satisfactory because of resource limitations and regional institutional capabilities. Decentralization of transport functions is being reassessed, particularly for road and airfield maintenance, and the operation of some government inter-island vessels. Fiji has a local government system based on fourteen provinces but responsibility is directed to village development and rural health. A policy of devolution of nominated functions to Local Government exists in Vanuatu (as set out in the Decentralization Act, 1990). Transfer of functions has been confined to village matters although the transfer of ownership and maintenance responsibility for local transport infrastructure (roads, wharves, airfields) is under consideration. A system of local government administration, consisting of 17 Island Councils and two Town Councils, has developed in Kiribati. Responsibility is confined to local administration and participation in local development issues.

3.14 In general, considerable fragmentation of the planning, construction and maintenance, operations and regulatory functions remains in the transport sector. Kiribati and Western Samoa have tended to concentrate transport sector responsibilities within one or two ministries, but other countries have a wider dispersal of functions. Given the scale of the functions, the ministerial concentration of responsibilities is feasible and would allow more effective use of the scarce executive, professional, and administrative resources within the transport sector. Furthermore, amalgamation of policy functions would promote better intra- and inter-sectoral planning and coordination. In some PMCs (for example, Fiji and Vanuatu) a transport capability or unit within the central planning agency is utilized.

C. Private Sector Participation

3.15 The private sector provides land transport services in all PMCs and is the sole, or

principal, provider of inter-island shipping services in Vanuatu, the Solomon Islands and Fiji. It has a minor role in the provision of inter-island shipping services in Kiribati and Tonga. Private sector participation in the provision of air transport services is confined to Fiji and the Solomon Islands (see Table 2.1). The private sector has an additional role (although mainly subsidiary) in the provision of services to public service organizations and government statutory authorities or corporations responsible for the transport sector.

3.16 Extensive use is made of private contractors for road construction and rehabilitation works in Fiji, the Solomon Islands and Western Samoa. Private sector contractors are also used for some road maintenance works in Fiji and Vanuatu and to a minor extent in Western Samoa. In Kiribati and Tonga all road construction and maintenance is carried out by departmental force account operations. Some limited use is made of community-based labor-intensive means for construction or maintenance of minor roads in the Solomon Islands and Vanuatu.

3.17 Major construction works for ports and airports are generally undertaken by private sector contractors in all countries. Where public sector organizations (rather than statutory authorities) are responsible for marine and aviation infrastructure, the organization and supply of construction and major infrastructure maintenance services are normally undertaken by the government public works agency.

3.18 International contractors are usually employed for major works, with domestic private sector construction organizations employed as subcontractors. With the exception of Fiji, domestic private sector contractor, professional, and technical resource capabilities are limited.

D. Public Finance[8]

3.19 The general fiscal indicators of Government revenue and current expenditure are set out in Table 3.2. Current governmental expenditures are high in relation to GDP but revenue has been generally sufficient to cover the expenditures, with the exception of the Solomon Islands and Vanuatu.

3.20 The ratios of tax revenue to GPD range from 18 percent for Kiribati to 31 percent for Western Samoa, with the other countries grouped in the 19-21 percent range. Aside from Kiribati, non-tax revenue to GDP ratios are low, ranging from 2 percent to 10 percent. With the exception of Fiji, tax revenue is drawn from a narrow tax base. Tax on international trade and transactions constituted the largest source of revenue in all countries except Fiji, where taxes on income and profits dominate. As is common in developing countries, the transport sector is a major source of tax revenues—from taxes on fuels and import duties on vehicles and parts.

3.21 The dominance of the public sector in all countries (with the exception of Fiji) is indicated by the ratio of government expenditures to GDP, which ranges from 39 percent to 85 percent.

E. Aid Environment

3.22 Official development assistance (ODA) to the South Pacific region has been substantial and levels of aid on a gross flow per capita basis are among the world's highest. For the smaller countries official development assistance has accounted for 25 to 50 percent of GDP; for Fiji the figure is only 3 to 5 percent.

3.23 Grants from bilateral donors and the EEC form the major part of the aid to the PMCs, for both capital development and technical assistance. Traditional donors have been the United Kingdom, New Zealand and Australia, with Japan and the EEC contributing significantly since the mid 1980s. At 1991,

Table 3.2: PACIFIC ISLANDS—FISCAL INDICATORS, 1985-89

	Fiji	Kiribati	Solomon Islands /a	Tonga /b	Vanuatu	Western Samoa
	(as percentages of GDP)					
Revenue	23.8	46.4/e	23.4/c	29.9	25.8	40.2
Tax revenue	19.4	17.5	21.1	20.3	20.5	30.6
Nontax revenue	4.4	28.9	2.2	9.5	5.3	9.6
Grants	1.0	36.7	7.6	19.3	25.8	15.6
Expenditure and net lending	28.0	84.6	38.7	49.2	54.0	52.4
Current expenditure	23.0	46.8/d	26.1	27.2	36.1/d	21.3
Development expenditure and net lending	5.0	37.8	12.6	22.0	17.8	31.2
Current balance, before grants	0.8	-0.4	-2.8	2.7	-10.4	18.9
Overall balance, before grants	-4.2	-38.2	-15.3	-19.3	-28.2	-12.3
Financing						
External grants	1.0	36.7	7.6	19.3	25.8	15.6
External borrowing	-0.5	..	6.7	2.6	1.5	2.1
Domestic nonbank	2.9	..	0.3	-0.5	1.1	1.4
Domestic bank	0.8	..	0.7	-2.1	-0.2	-6.8
Memorandum Item						
Overall balance, after grants	-3.3	-1.5/e	-7.8	-0.1	-2.4	3.3

/a 1985-88.
/b 1985-86 - 1988/89.
/c Includes a very small amount of capital revenue.
/d Includes technical assistance.
/e In Kiribati, if reinvested RERF income were included in nontax revenue, the figures for total revenue, nontax revenue, current balance before grants, overall balance before grants, and overall balance after grants would be 58.0, 40.5, 11.2, -26.6 and 10.1 respectively, as percentages of GDP.

Source: World Bank (1991a), Table 2.4.

about three-quarters of all aid to the region came from these five donors; the World Bank and Asian Development Bank provided 6 percent of the net ODA. The United Nations, through its agencies, also provides considerable technical assistance.

3.24 Estimates of the sectoral allocation of aid indicate that some 40 percent is directed to the primary sectors and to industry; the remainder to sectors including infrastructure and human resource development. In the transport sector, aid requests and finance have been directed, generally, to meeting perceived deficiencies in infrastructure and to training.

3.25 Aid requests for transport have reflected the almost exclusive concentration of planning in most PMCs on the public sector. In many cases, little account has been taken of the ability of government to sustain the infrastructure development, either on the basis of cost recovery or general budget support. Nor has much attention been given to private sector development, including the informal subsector.

CHAPTER 4
TRANSPORT SECTOR DEVELOPMENT NEEDS

A. INFORMATION AND PLANNING

4.1 **Data Base.** Adequate information on the existing stock of transport assets in the PMCs and their status is difficult to establish. Inventories of transport assets are either inadequate, out-of-date or non-existent. Inventory information which does exist is not based on consistent reporting standards and contains little or no information on the quality or condition of assets. Data on system capacity, existing and projected traffic demand, and costs and reviews by function, are not generally available, or are not in a readily useable form. Typically the order of accuracy of statistics is not indicated.

4.2 **Planning.** All of the PMCs, with the exception of the Solomon Islands, use a multi-year plan as the central planning instrument. Usually it is the responsibility of the ministries to undertake planning activities and to submit project proposals to the central planning organization for review and integration into national development plans. In the main, central planning tends to be reactive, rather than guiding sectoral agencies in their planning. A primary objective appears to be the identification of projects for consideration by aid donors with the result that development plans are concentrated on the public sector. The planning organizations provide a central point of contact for donors, although donors may approach Governments through different ministries. Where responsibilities for multi-lateral and bi-lateral aid projects are assigned to different agencies (which has recently occurred in the Solomon Islands), it is more difficult to draw together a cross-sectoral approach to project identification or a comprehensive strategy to guide development. The role of donors in undertaking project assessments and developing strategic plans through sectoral studies appears to have inhibited the need for development of a planning competence in sectoral agencies. Within the transport sector, with the exception of international aviation, there is limited discernable planning and programming capacity in the PMCs, although capacity does vary across countries and subsectors.

4.3 In many PMCs project preparation provides neither a clear indication of priority nor an adequate economic appraisal of projects. A national transport development plan has been completed recently in Vanuatu (Wilbur Smith 1990). The plan proposes a series of priority projects over a 15-year period but does not enunciate a strategic approach to transport development. An inter-island transport plan is being finalized for Kiribati (Danport, 1991) and similar studies are proposed for Vanuatu and Tonga. Western Samoa, unlike other PMCs, has given considerable attention to transport planning for both individual modes and multi-modal transport development. Transport planning in Fiji has been undertaken mostly on a modal basis, but a national transport sector "Master Plan" is currently proposed. Neither Tonga nor the Solomon Islands have undertaken national transport plans. The need for a national transport planning framework is most important for the Solomon Islands. An initiative to undertake a national transport plan which

resulted from an Integrated Transport Survey in 1987, did not proceed, although work has proceeded (under EEC assistance) in identifying and undertaking road rehabilitation priority projects for the Solomon Islands since then. For all PMCs there is a need for a coherent and realistic transport policy and development strategy to be systematically established for their transport sectors.

B. Investment and Maintenance

4.4 **Capacity.** There is no evidence to suggest that the present coverage or designed capacity of the major elements of transport infrastructure inhibit economic development in any of the countries. In most cases (excluding for example, some roads in urban areas), the coverage and capacity of each nation's transport infrastructure appears sufficient to meet transport demands well through the 1990s, provided that the assets are adequately maintained. Existing demands on transport infrastructure are generally well below design capacity levels.[9]

4.5 **Investment.** Large levels of investment have been made in transport infrastructure in the PMCs during the 1980s.[10] The main objectives have been to develop areas of export potential for primary products and tourism, to provide linkages to markets and trade centers and to enhance social mobility. The results, in general, have been mixed; substantial infrastructure has been put in place, in many cases, but demands for its use has been modest.

4.6 The attraction of aid funding for transport infrastructure development has not been supported by provision of recurrent funding for maintenance. The apparent willingness of donors to fund rehabilitation projects has created a "moral hazard" problem: external aid, when perceived as infrastructure "insurance", weakens attention to domestic financial and institutional capacity to meet maintenance needs; the PMCs have found that they can rely on donors to rehabilitate infrastructure when it is let decay to the point of failure.

4.7 In all countries it is evident rehabilitation and reconstruction of existing infrastructure is taking place well before the normal replacement period. A significant backlog of warranted maintenance and rehabilitation has resulted from past underfunding of maintenance—notwithstanding the additional reconstruction needs as a result of the substantial damage to facilities from natural disasters, such as Cyclones Ofa and Val in Western Samoa.[11]

4.8 Further investment in *new* transport infrastructure, in general, is not a priority for supporting economic growth in any PMC. A priority requirement is the effective management of existing transport systems, based upon a careful review of existing infrastructure and the identification of those assets that should be maintained (and at what standard), together with priorities for the allocation of scarce maintenance resources.

4.9 **Maintenance.** Road maintenance continues to be a key transport issue in all PMCs, with the exception of Kiribati, where land transport is important but small in scale. Warranted road maintenance funding requirements are generally in excess of prevailing recurrent budget support.[12] Yet existing institutional limitations do not allow present levels of maintenance funding to be deployed in a fully effective manner. Moreover, warranted maintenance funding requires confirmation of the economic justification of maintenance specific items of infrastructure.

4.10 *Land access constraints* (which are shaped by the social and cultural values placed on land ownership) are often a contributing factor to the problems of road maintenance. Discharge of water from the road reserve is often inhibited, resulting in ineffective drainage and premature pavement failure. The problem is magnified by the use of roadside verges for planting by local communities, and by the failure

to control natural growth along the roadside. With the exception of Kiribati, there appears to be appropriate legislation for the reservation of land for road purposes.

4.11 Problems also exist with the *maintenance of landings and wharves* on outer islands and of some major ports. The maintenance of landings and wharves requires specific attention in the Solomon Islands and Vanuatu and adequate maintenance funding needs to be provided for port infrastructure in all countries; in the Solomon Islands and Fiji port authorities are able to allocate funds for maintenance needs.

4.12 There is a *lack of maintenance of regional airstrips* and of air navigation aids, particularly in those countries which require extensive domestic aviation networks to serve remote communities. Tonga, Western Samoa and Vanuatu have attracted substantial aid investment in international airport facilities and the Solomon Islands and Kiribati are seeking donor support (concessional loans) for major upgrading of their facilities. These investments are perceived by the countries as important catalysts to economic development, in particular for their tourist industry. Development of airport infrastructure, with the exception of Fiji, has been in advance of complementary investment in tourist facilities. Only in Fiji is tourism a major economic activity. In the other PMCs growth in tourism has been at best modest. The capacity to fund the operations and maintenance of airport facilities and support systems, even with appropriate cost recovery policies in place, is a matter of concern and requires examination.

4.13 Improved maintenance of the valuable stock of transport infrastructure in the PMCs calls for the adoption by each PMC of an asset management strategy. The key elements of such a strategy are:

- an inventory data system from which it is possible to forecast future cyclical maintenance needs and costs;
- associated management systems which enable scheduling and programming of maintenance effort;
- equipment resources to perform the tasks;
- organizational resources and management competency to deliver the services efficiently and effectively;
- the financial resources to meet the program costs.

None of these elements has been addressed satisfactorily, to date, with the possible exception of equipment resources for which adequate utilization and maintenance is a problem.

C. Institutional Issues

4.14 **Allocation of Functional Responsibilities.** A number of countries have devolved some functional responsibilities to provincial or local government. Given the small size and limited capacities of both central and provincial governments, devolution is likely to be highly ineffective. On top of this, financial support is typically lacking. For example, in Vanuatu and the Solomon Islands maintenance of local roads and outer island wharves and jetties is neglected. These may link vital services to local communities yet these communities may not be equipped to maintain them.

4.15 *Human resources* remain a fundamental constraint in both the private and public sectors. Historically, aid donors have provided considerable technical assistance to the public sector, by direct provision of professional and technical staff and through training and development programs. the results have not met the objective of developing organizations capable of efficiently managing their assigned functions using indigenous staff. The development and retention of executive, professional, technical, and senior administrative staff remains a key

issue in all countries. Results from the provision of expatriate staff in professional and technical positions, through technical assistance programs, have been variable, and at the best temporary. Lack of trained counterpart staff, continuous turnover of personnel in key positions, and variability in the number and quality of the personnel supplied jeopardize skill transfer and the development of cohesive and motivated organizations. Consideration needs to be given to examining past experience, identifying lessons, and formulating better methods of providing institutional strengthening and development of human resources.

4.16 The *matching of training* with the existing and projected skill requirements remains largely unresolved. Kiribati has initiated a national manpower planning and training program; other countries do not appear to have done so. Substantial opportunities are available for training overseas and considerable numbers of PMCs nationals travel overseas for tertiary training on specialist courses. The appropriateness of the training, the extent to which the skills are retained within the country or the public service, and the opportunity cost of the present arrangements warrants a full review. These matters are under review. (See World Bank, 1992.) Consideration also needs to be given to the manner in which assistance can be provided to the private sector to promote the development of necessary managerial, commercial, and technical skills.

4.17 **Government Accountability.** Only in Fiji, the Solomon Islands and Tonga, do departments of government provide annual reports setting out the performance of their functions and responsibilities. Thus, there is little formal accountability to, and of, government. There is little public exposure of policies and assessment of the effectiveness of efficiency of operations. The requirement for statutory authorities to provide annual reports is less clear, but in general this does not appear mandatory in practice. In view of the greater autonomy of action, and in most cases, the requirement to meet certain objectives set by legislation or policy, state authorities and enterprises should be required to provide appropriate annual reports.

4.18 **Cost Recovery and User Charges** for the use of transport infrastructure or government transport services has been given little attention in the PMCs. Table 4.1 sets out areas in which cost recovery policies appear appropriate. There is no evident cost recovery policy for road infrastructure or for services provided to the land transport industry in any PMC, though the level of cost-recovery has been examined in Fiji. Land-based public transport services are provided by private enterprise with varying governmental regulatory control.

4.19 Both the Solomon Islands Port Authority (SIPA) and the Port Authority of Fiji (PAF) operate their facilities commercially, although return on capital investment is low. A commercial, or cost recovery policy in setting port charges is not evident for major ports elsewhere. There appears to be no user charge systems in place for outlying jetties and wharves, with the exception of Western Samoa which applies charges for the use of the inter-island ferry terminals. It is not evident that fees or charges for marine surveys or for the provision of navigation and safety aids have been designed to meet specified cost recovery objectives. Where government shipping services are provided the level of cost recovery ranges from below direct operating costs (Solomon Islands) to meeting apparent full commercial obligations (Western Samoa). In other cases there is underprovision for replacement of capital items.

4.20 Landing fees and other charges are applied for major airports in all cases, and in some instances for use of domestic airstrips. With the exception of Western Samoa and Fiji, where airport authorities operate all or some airports, organizations with commercial objectives have not been established. It is not evident that charges for air navigation and air

Table 4.1: PACIFIC ISLANDS—AREAS READILY AMENABLE TO COST RECOVERY FOR GOVERNMENT INFRASTRUCTURE AND SERVICE PROVISION

	Land	Marine	Aviation
Infrastructure	Roads	Ports, Wharves	Airports, Airstrips /a
Industry services	Vehicle Inspection Regulatory Systems /a	Vessel Surveys, Port and Marine Navigation Aids /a	Flight Services, Air Navigation Aids, Airport Services
Government Transport Systems	Public Transport Services	Inter-Island Shipping Services	International Services, Domestic Services

/a Full cost recovery may not be feasible and/or efficient.

safety services have been designed specifically to recover the cost of service provision. Available evidence suggests that national airlines owned or supported by governments are commercially oriented on international services, but that fare constraints applied to government operated domestic air services result in operating losses.

4.21 **Community Service Obligations.** A fundamental problem in all PMCs is the provision of transport services (normally shipping and air) to outer islands where markets are thin and services are not commercially viable. A minimum standard of service needs to be assessed and cost-effective arrangements established. In general, it will be desirable for the government to remove itself from direct provision of such services and to facilitate private sector provision on a contractural basis.

D. ENVIRONMENTAL IMPACTS

4.22 The natural environments of the PMCs are quite fragile and therefore vulnerable to various forms of intervention, including the construction of transport projects and the operation of transport activity. Although environmental issues and their relationship to transport are outside the scope of this report, there are several areas for which emerging concerns with this relationship should be noted. For example, causeway construction and lagoon water quality in Kiribati; logging road construction, run-off, and the ecology of virgin areas in Solomon Islands; and shipping movements, maritime safety, and coral reef protection in all PMCs.

4.23 Management of the natural environment is a general issue for the PMC Governments. The quality of their environments is important to the culture of these nations, as well as a major factor influencing the demand for tourism. Accordingly, it is important and timely for PMC Governments themselves to have available the *basic* capacity to appreciate, scrutinize and manage environmental impacts that might be associated with all projects, including those within the transport sector. Procedures need to be in place to ensure that new transport projects (including reconstruction) are designed taking

into account potential environmental impacts; such impacts should be subject to local assessment and reflect public participation. This is an important area and warrants appropriate Government attention. However, it does not require, nor should it be used as a basis for, significant additions to administrative resources.

4.24 Specific areas of environmental impact in the PMCs that may result from projects in the transport sector, and warrant special treatment in impact assessment and monitoring include:

- unsustainable, induced development in sensitive environmental areas such as forests and coastal zones;
- water quality issues relating to soil erosion and surface and near-shore water quality, and tidal interchange of water in lagoons;
- water use conflicts, particularly conflicts that affect in-stream and subsistence uses of surface and coastal waters;
- coastal zone management and protection issues, especially in relation to conservation of mangroves, coral communities, and beach erosion.

4.25 PMC Governments have prepared national reports (with assistance from UNDP and ADB) for the United Nations Conference on the Environment and Development (June 1992). These reports contain only minor discussions of the environmental impact of transport activity. In addition, under the South Pacific Regional Environmental Program (SPREP) with UNDP and ADB funding, the PMCs are preparing environment management plans. The Bank's upcoming Regional Economic Report for the Pacific Islands will also cover environmental issues, based upon a synthesis of existing analyses. These efforts should serve to satisfy IDA requirements for each PMC to prepare an Environmental Action Plan (EAP) by June 30, 1993. Specific areas of potential transport impacts should be addressed in the final EAPs.

Endnotes

1. Preliminary information on development needs in the transport sector was developed in a desk study of the transport sector in each PMC (World Bank, 1989). A survey mission to each country was undertaken early in 1991. The mission team members were Colin Gannon (Senior Economist and mission leader), David Bray (consultant—Fiji and Tonga) and Ian Gordon (consultant—Kiribati, Vanuatu, Solomon Islands and Western Samoa). Detailed surveys of the transport sector in each country are presented in Volume Two of this report.

2. The Bank Country Study, World Bank (1991a), provides a detailed review of the economy of each PMC.

3. The level of transport costs for the region, in comparison to other similar regions, is examined in Part III of this study.

4. Regional international shipping costs are discussed in Part III of this report.

5. Aspects of interrelationships between transport and tourism are discussed further in Part IV of this study.

6. In some PMCs the allocation of responsibility between central and local government is contentious. This is particularly the case for the maintenance of local roads, wharves and airfields. (See further comment below.)

7. Maintenance problems and their effects are discussed in Part II of this report.

8. World Bank (1991) presents a more detailed review of public sector finances in the PMCs.

9. Designed standards, and the associated designed quality of service for users, do not prevail due to undermaintenance.

10. Individual country transport sector surveys are presented in Volume Two of this report.

11. An assessment of damage to economic infrastructure and rehabilitation needs in Western Samoa, following Cyclone Val in December 1991, is being undertaken.

12. See Part II of this report, below.

PART II

Maintenance Management of Transport Infrastructure

CHAPTER 1
INTRODUCTION

A. CONTEXT

1.1 Part II of this study has as its point of departure the series of PMC country by country transport sector surveys.[1] The accumulation of a large stock of transport infrastructure in the PMCs, relative to their economic and institutional capacity, is identified as a common and serious problem; its dimensions are not well known and its consequences do not appear to be appreciated.[2] Accordingly, infrastructure--its sustainability and its maintenance—is examined below for five of the Pacific Island States namely, Kiribati, Solomon Islands, Tonga, Vanuatu and Western Samoa.[3]

1.2 The objective of Part II is to outline a *strategy for management of infrastrucure and its maintenance, appropriate to the region.*[4] The approach adopted to meet this objective involves four steps:

(a) *estimation of the stock* of existing transport infrastructure,

(b) *assessment of the sustainability* of the existing stock,

(c) *documentation of the current status of maintenance* and its consequences, and

(d) provision of a *framework for institutional development* of infrastructure management.

B. THE MAINTENANCE ISSUE

Sustainable Infrastructure and Warranted Maintenance

1.3 Proper assessment of the adequacy of existing maintenance requires determination of the economic merit of preserving, and at what standard, individual pieces of infrastructure—sections of road, particular wharves, and specific airfields. Maintenance is warranted only if each separate piece of infrastructure, to which it is applied, is a valuable *asset*, i.e., the item of infrastructure generates economic benefits which exceed the costs of its long-term preservation and use. Such assessments require an extensive set of micro level "asset appraisals".

1.4 It is possible, however, to gauge the sustainability of the stock of transport infrastructure at a macro level. Estimates of the physical scale and replacement plus maintenance costs, in aggregate, can be examined relative to a country's national income and geographical extent, and these relativities can be compared across similar countries. For all PMCs the existing stock of transport infrastructure is extensive and (as shown below) non-sustainable.

1.5 This situation has arisen primarily from inadequate sector investment planning and project appraisal, inadequate attention to future maintenance obligations, and large external grant assistance. As a consequence, current maintenance decisions require identification of infrastructure for which maintenance is

warranted. This is beyond the analysis of maintenance presented here which is directed at estimating the stock of existing infrastructure, the maintenance expenditure that would be required to keep it in good condition, and therefore, the sustainability of the existing stock. On the basis of this analysis, a strategy to address the overall management of infrastructure and its maintenance can be advanced.

Inadequate Maintenance and Its Consequences

1.6 Maintenance expenditure and maintenance effectiveness are inadequate in the PMCs. There are several causes: the accumulated stock is very large relative to their size, recurrent budget resources are user charges are low, delivery effectiveness is weak, and donors finance rehabilitation and reconstruction.[5] Nevertheless, the outcome is inadequate maintenance—even for warranted infrastructure.

1.7 Adequacy of maintenance for transport infrastructure in developing (and indeed developed) countries is not a new issue. Numerous studies by multi-lateral and bi-lateral assistance agencies have set out the global nature of the maintenance problem, and provided specific analyses through sectoral or subsectoral transport studies in various countries (see, for example, World Bank, 1989 and 1990).

1.8 Deterioration of infrastructure can result in substantial adverse consequences to a nation's economic performance. Poor maintenance not only increases infrastructure costs it also imposes other costs and reduces economic efficiency. For example, inadequate maintenance of infrastructure leads to higher vehicle operating costs, reduced productivity of port operations, and results in foregone net benefits from airfield closures. These additional costs are avoidable and reduce economic performance. Although quantification of the effects of under-maintenance of transport infrastructure is well developed for roads,[6] it is less systematically advanced for other modes.

1.9 Prior to project decisions recurrent maintenance cost requirements are not given sufficient attention in feasibility studies. Once a project is completed, the effects of under-maintenance of transport assets are often not transparent in the short term and the intermediate effects, which give rise to increasing transport user costs as the system decays, are often ignored or underestimated in setting budget priorities. In the longer term full consequences have sometimes been masked by external assistance for replacement.

1.10 In general, in the PMCs, maintenance of existing assets is the key issue, not new investment. At present, policies of PMC Governments do not appear to reflect this circumstance nor a high priority for a systematic approach to assess maintenance needs to assist recurrent budget planning.

Influence of External Assistance

1.11 Since infrastructure priorities involve the preservation of warranted existing infrastructure, donor assistance needs to be redirected to this task. At the same time, the primary responsibility for looking after assets rests with each PMC. Therefore, donor assistance for maintenance needs to be combined (for example, on a matching basis) with increased mobilization of domestic resources for maintenance, for example, through increased user charges.

C. Infrastructure Management Framework

1.12 An overall strategy for infrastructure maintenance, covering management, financing and delivery does not exist. *The entire stock of existing infrastructure is not sustainable without rationalization*; priorities need to be established and some infrastructure downgraded or eventually withdrawn.

Towards a Strategy for Management of Infrastructure and Its Maintenance

1.13 A basic strategy for improved management of existing transport assets in the PMCs requires:

- asset inventory information and monitoring capability;
- identification of the set of existing assets which warrant preservation, and at what standard;
- information procedures and capacity to forecast warranted cyclical maintenance and replacement costs, taking into account alternative standards;
- scheduling and programming of maintenance activities;
- organizational resources, management capacity and technical skills to ensure maintenance is delivered efficiently and in a cost-effective manner, including use of the private sector; and
- financial resources, including cost-recovery from users and donor assistance, to meet program costs.

1.14 Management decisions on these areas affect total transport costs and impact on the performance of a country's economy (see Figure 1.1). To date, the basis for such decisions has been highly inadequate; often decision emerge by default.

1.15 In focusing on a strategy directed at efficiency in the maintenance of infrastructure there are three main components: management, financing and delivery. These components are examined in Chapter 3, below.[7]

Management Information for Effective Maintenance

1.16 Management of infrastructure, including setting priorities, and programming activities requires basic information.[8] The level of information appropriate to the maintenance management task in the PMCs is rudimentary, and its cost is low. The existing level of maintenance information may be depicted by drawing upon guidelines developed recently by the Bank (World Bank, 1990). The guidelines provide for a management information system which might be progressively implemented to enable effective reporting on the status of the system and the basic planning, programming and resourcing of routine and periodic maintenance and of asset rehabilitation. Although the guidelines are directed to the management of a road system, the principles are equally applicable to the marine and aviation subsectors.

1.17 To manage infrastructure, the starting point is knowledge of the stock. Asset inventories that do exist are largely the result of project studies; the inventories are based on a specific need and are neither comprehensive nor uniform and they have become increasingly out of date. Thus, information at any level typically requires considerable effort in putting together fragments of data and/or estimation.

1.18 A consolidated assessment of the prevailing status of maintenance information for each country is summarized in Table 1.1. This table reveals the lack of data on transport infrastructure. No Ministry or department holds an adequate inventory of assets at the most aggregated level (with the exception of the Solomon Islands Port Authority) and there is no detailed information which would serve management needs at the network, project or operational levels.

1.19 An outline of the management information, classification, and depth suitable to the PMCs is presented in Annex 1.

Figure 1.1: INFRASTRUCTURE MAINTENANCE MANAGEMENT

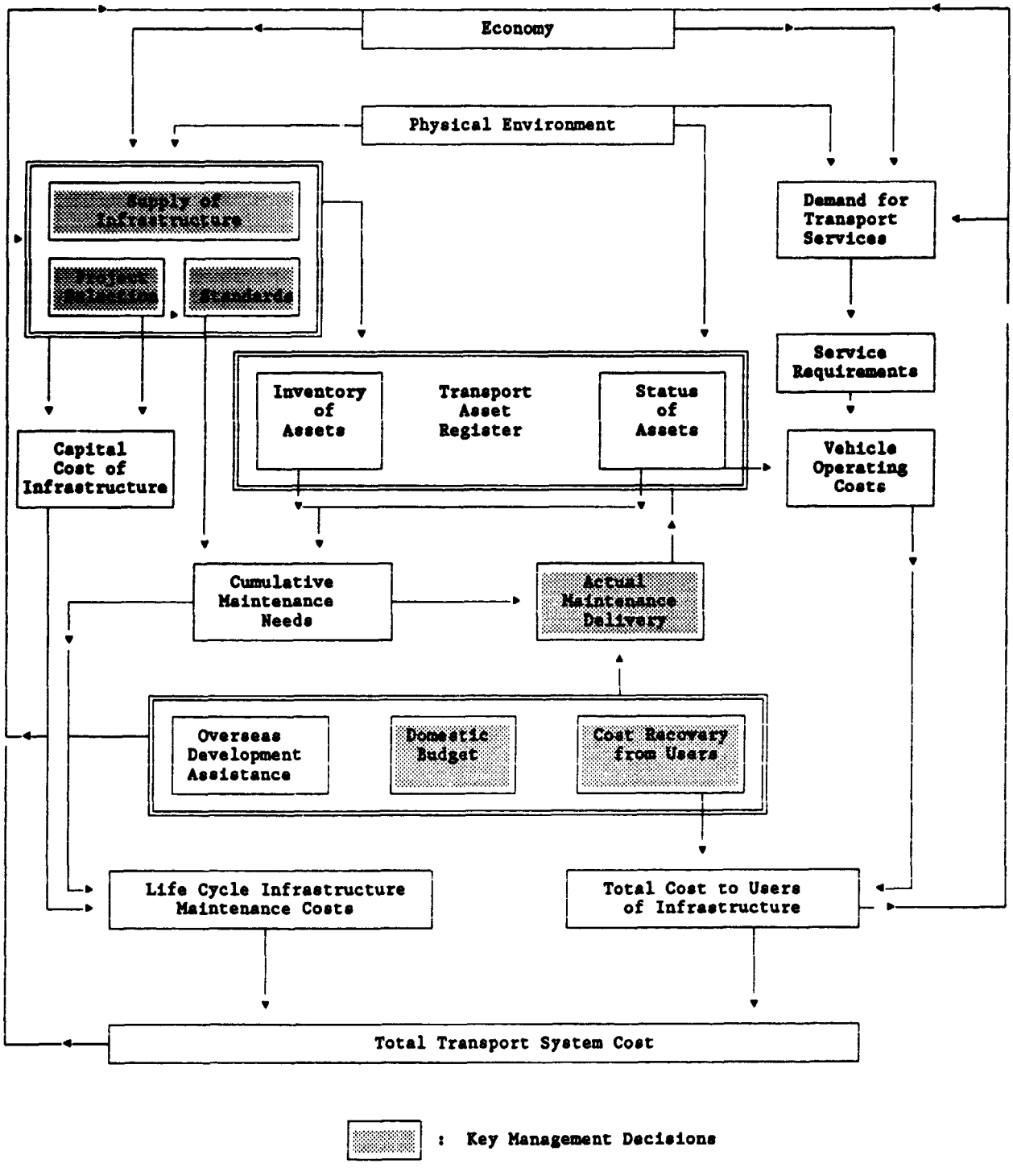


Table 1.1: Pacific Island Countries—Summary Management Information Inventory

	Roads		Ports		Aviation	
	Sectoral	Network & Operations	Sectoral	Network & Operations	Sectoral	Network & Operations
Kiribati	U	U	P	U	P	U
Solomon Islands	U	U	A/a	A/a	P	U
Tonga	P	U	P	U	P	U
Vanuatu	P	U	U	U	P	U
Western Samoa	P	U	P	U	A	U

/a Excludes local wharves and jetties outside SIPA control for which no information is available.

A - Acceptable basic information available.
P - Partial basic information available.
U - Information unavailable.

Source: Mission estimates.

CHAPTER 2
NATURE OF THE MAINTENANCE ISSUE

2.1 The presentation in this Chapter covers five principal tasks:

(a) to establish an *inventory* of transport infrastructure in each of the five PMCs;

(b) to estimate a *replacement cost valuation* for each inventory;

(c) to gauge the *sustainability* of the existing stocks of infrastructure and to assess regional patterns;

(d) to *assess the maintenance* levels that would be associated with keeping the entire stock of existing infrastructure in good condition, (if setting this was warranted);

(e) to *compare* assessed maintenance and actual maintenance expenditure;

(f) to set out the *implications of inadequate maintenance*; and

(g) to identify revenue from user charges and the existing levels of *cost recovery* by mode.

A. TRANSPORT INFRASTRUCTURE INVENTORY

2.2 Compilation of a basic inventory of transport infrastructure is the essential basis for addressing all of these tasks; it also allows determination of core information needs for maintenance management.

2.3 **Government-Owned Facilities.** Consideration in this report is limited to transport infrastructure in the public sector; this represents the overwhelming majority of facilities in the PMCs. Privately-owned fixed transport infrastructure is limited to a few private wharves and jetties in the Solomon Islands and Vanuatu, and some private airfields in the Solomon Islands. Of course, from the standpoint of the provision of transport services, the private/public ownership distinction is an artificial one.

The Existing Stock of Transport Infrastructure

2.4 A physical inventory of the existing stock of transport infrastructure in the five PMCs is presented in Table 2.1 The most extensive data are for roads. Sealed roads are less than 3 percent of the total length of roads, except in Western Samoa where they account for 14 percent. Earth roads represent a majority of total road length in Western Samoa, Kiribati and Tonga, reflecting the ability to construct reasonable graded roads in the primarily coral/sand soils in these countries. By contrast, in the Solomon Islands and Vanuatu, where the more difficult terrain and loam/clay soils make base grading difficult, a much smaller share of roads are earth formed. The major role of inter-island water and air transport in the Solomon Islands and Vanuatu is also shown by the large number of formal jetties and airfields in each of

Table 2.1: PACIFIC ISLANDS—TRANSPORT INFRASTRUCTURE INVENTORY, 1991

	Kiribati	Solomon Islands	Tonga	Vanuatu	Western Samoa	Total (or Average)
Road length (km)						
Sealed	36	101	109	115	300	661
Unsealed engineered	289	700	492	926	522	2,929
Earth	496	500	1,273	719	1,250	4,238
Total	821/a	1,301	1,874	1,760	2,072	7,828
Share of Road Length (%)						
Sealed	4	8	6	7	14	(8)
Unsealed engineered	35	54	26	53	25	(37)
Earth	60	38	68	41	60	(54)
Total	100	100	100	100	100	(100)
Marine						
Major ports	1	2	1	2	1	7
Major jetties	1	30	4	16	2	53
Total	2	32	5	18	3	60
Aviation						
Airports with sealed runways	2	1	1	2	1	7
Other airfields	14	21	5	26	2	68
Total	16	22	6	28	3	75

/a Excludes road length on Kiritimati; the relatively high non-sealed road lengths as reported for Kiribati warrant further confirmation.

Source: Mission estimates.

these countries. Among the other countries, it is likely that there are more jetties of significance (particularly in Tonga) however, there is no formal documentation. The length of road in proportion to land area, population and GNP is greatest in Tonga, and least, generally by a considerable margin, in the Solomon Islands.[9] The substantial stock of road infrastructure in most PMCs stems in part from the provision of accessibility to a population which is widely distributed and low in density.

2.5 The physical coverage of the existing infrastructure in each PMC can be gauged broadly for the road subsector, since roads are described by type and length. For aviation and marine facilities, aggregate physical capacity is less amenable to assessment; for these modes, total replacement cost is a more suitable aggregate measure—see below). In relation to roads, most PMCs have reasonably substantial physical networks, especially on their main islands. Table 2.2 presents figures on road

Table 2.2: PACIFIC ISLANDS—INTERNATIONAL COMPARISON OF ROAD SUBSECTOR INDICATORS /a

	Population /b	Land Area (km²)	Population (density people/km²)	GNP/ Capita (US$) /b	ODA/ Capita (US$) /c	Road Length (km)	Road Density (Length per) /d: Land Area (km/'000 (km²)	Capita (km/'000 people) /e	GNP (km/ US$'000) /f	Registered Vehicle (km/veh) /g	Road Replacement Value/GNP (%) h/	Road Replacement Value/ Reg. Vehicle (US$/000/veh) g/	Registered Vehicles/ GNP (Veh/US$m) f/ /g
South Pacific	(thousands)												
Fiji	732	18,270	40	1,540	74	4,994	273	11.5	4.4	0.13	..	..	..
Kiribati	67	710	100	650	243	721	1,156	12.3	17.9	0.79	41	17.9	23
Papua New Guinea	3,800	463,000	8	700	87	23,846	40	5.5	7.7	0.55	..	..	..
Solomon Islands	304	27,990	12	430	192	1,301	46	3.9	8.6	0.36	30	12.6	24
Tonga	101	720	142	800	186	1,874	2,603	18.3	20.0	0.40	69	13.9	50
Vanuatu	151	12,190	13	820	260	1,760	144	10.7	12.3	0.38	56	17.3	32
Western Samoa	168	2,830	60	600	182	2,072	732	12.2	17.8	0.33	91	16.9	54
Caribbean, Americas and Europe													
Barbados	256	430	698	4 340	..	1,670	3,884	6.4	1.5	..	..	..	..
Belize	184	22,800	8	1,150	137	1,980	87	12.5	10.9	..	..	..	..
Costa Rica	2,500	51,000	49	1,190	88	2,850	559	11.4	9.6	..	..	..	..
Cyprus	695	9,000	76	3,590	..	6,830	759	10.2	2.8	..	..	..	..
Haiti	5,400	28,000	193	320	35	4,000	143	0.7	2.3	..	..	..	..
Jamaica	2,200	11,000	200	1,150	70	17,700	1,609	8.0	7.0	..	..	..	..
Africa and Indian Ocean													
Comoros	458	2,230	200	340	116	950	425	2.2	6.6	..	..	..	..
Congo	1,800	342,000	6	1,140	75	10,940	32	6.1	5.4	..	..	..	..
Mauritius	1,100	1,850	500	1,490	57	2,590	1,398	2.5	2.3	..	..	..	..
Swaziland	761	17,000	41	800	53	2,820	166	4.0	5.0	..	..	..	..
Regions	(millions)												
Eastern and Southern Africa	201		18	310	..		53	2.9	11.5	..	35	..	..
Western Africa (excl. Nigeria)	90		10	270	..		41	3.6	9.4	..	33	..	..
East Asia and the Pacific	1,350		102	710	..		1,127	1.1	2.6	..	15	..	..
South Asia	1,008		197	220	..		328	1.7	6.5	..	13	..	..
Europe, Middle East & W. Africa	232		36	1,795	..		162	4.5	3.1	..	20	..	..
Latin America and the Caribbean	350		19	1,190	..		117	6.3	3.8	..	13	..	..
Total (incl. Nigeria)	3,327		52	..	..		118	2.3	3.9	..	16	..	..

/a Some data relate to different years and hence nominal comparisons need to be interpreted with caution.
/b 1988 population and GNP for South Pacific countries except PNG. Population and unadjusted GNP in 1984 for PNG and other countries, and median GNP/capita in 1984 for regions.
/c 1987 or 1988 as data available.
/d Road length in 1991 for South Pacific countries except PNG; 1984 for PNG and countries in other regions.
/e Estimated population in 1991 for South Pacific countries except PNG; 1984 for PNG and countries in other regions.
/f GNP in 1988 inflated by 5% p.a. to indicative 1991 prices for South Pacific countries except PNG; 1984 data for PNG and for countries in other regions.
/g Registered vehicles for latest year available.
/h 1991 for the South Pacific countries except PNG; 1984 for PNG and other countries and regions. Replacement valuations are established in Table 2.3 below.

Sources: World Bank (1991a), (1989), (1988), and mission estimates.

density for the five PMCs, and provides a comparison of these figures with other countries, in the region, as well as some other selected countries. In general, the *density of roads* by various measures (land area, population, vehicles, and GNP) is *high* in the PMCs, relative to the other countries. This suggests that the road infrastructure in the PMCs is excessive relative to aggregate demand for road use, and the capacity of the economy to sustain the road stock. This matter is examined in greater depth below for all transport modes, based on estimates of the replacement cost value of the infrastructure.

Valuation of Existing Infrastructure

2.6 Infrastructure replacement cost valuations are summarized in Table 2.3. The capital stock values reveal that transport infrastructure in the PMCs is not only high in broad physical terms, it is also *inordinately high relative to the capacity of each economy to sustain it*. On a uniform annual basis, the capital replacement cost value of transport infrastructure is estimated to represent 10.0 percent of GNP, on average, across all five PMCs. For individual PMCs, this share of GNP varies from a high of 13.1 percent in Western Samoa, to a low of 5.3 percent in Solomon Islands.

2.7 The stock value of transport infrastructure is also very high relative to other countries. For example, Table 2.3 shows that in the road subsector, where some comparable data are available, road density, in terms of its replacement cost value to GNP, is of the order of two to three times higher in the PMCs relative to the other countries.

2.8 For the marine and aviation subsectors, Table 2.4 provides indicators of infrastructure replacement values relative to use. International trade is a high proportion of GNP in the PMCs and most of this trade is by sea. The replacement cost of marine assets, in proportion to total international trade, varies across the PMCs.[10] The ratio of marine annual capital costs to value of international trade flows (on average 2.9 percent) indicates that full recovery of port costs may be possible. The main port accounts for the lion's share of the total marine subsector replacement cost in all PMCs, except Vanuatu. Port performance measures need to be established to examine cost recovery for these main facilities and to confirm their sustainability.

2.9 Aviation activity also varies considerably among the PMCs.[11] The replacement cost of aviation infrastructure at the main international airport of each PMC is generally high in proportion to international passenger movements, though expected growth in international passenger movements (particularly in Vanuatu), and the high proportion of travel between Western and American Samoa will affect the overall comparative costs. Sustainability of all existing aviation infrastructure is problematic; it requires detailed assessment of the prospects for cost recovery and the economic warrant of major airport facilities.

2.10 The inordinately high levels of transport infrastructure in the PMCs strongly indicate that the *replacement of many existing infrastructure facilities cannot be warranted—and, in addition, that the maintenance of such facilities may not be justified (at least at existing standards).* Large flows of external assistance to the PMCs, relative to their domestic economies (as indicated by the levels of ODA per capita shown in Table 2.2) have resulted in an accumulated stock of transport infrastructure which is non-sustainable. As this entire stock matures (and perhaps even increases), full replacement through overseas aid can also be expected to become non-viable. Unwarranted existing facilities can cause further inefficiencies:

(a) in attracting unjustified scarce maintenance resources,

(b) in influencing demand, notably affecting the best choice of infrastructure by users, and

Table 2.3: PACIFIC ISLANDS—INFRASTRUCTURE REPLACEMENT VALUE, 1991 /a

	Kiribati	Solomon Islands	Tonga	Vanuatu	Western Samoa	Total (or Average)
Replacement Stock Value (US$ million)						
Roads	18.7	45.7	64.9	79.8	106.7	315.9
Marine	9.3	23.8	27.6	38.0	27.2	125.9
Aviation	3.0	14.0	30.8	55.7	32.2	136.7
Total	31 [illegible]/f	83.5	123.3	174.6	166.1	578.6
Share of Stock Value (%)						
Roads	60	55	53	46	64	55
Marine	30	28	22	22	16	22
Aviation	10	17	25	33	19	24
Total	100	100	100	100	100	100
Equivalent Annual Replacement Value (US$ million) /b						
Roads	1.5	4.6	6.4	8.0	10.1	30.7
Marine	0.7	2.0	2.4	2.9	2.1	10.0
Aviation	0.5	1.4	3.0	5.9	3.0	13.8
Total	2.7	8.0	11.8	16.8	15.2	54.5
Annual Replacement Value (as % of GNP) /c						
Roads	3.2	3.1	6.9	5.2	8.7	5.7
Marine	1.5	1.3	2.6	2.1	1.8	1.8
Aviation	1.1	0.9	3.2	4.2	2.6	2.5
Total	5.8	5.3	12.7	12.1	13.1	10.0
Stock Value per Capita (US$) /d						
Roads	279	150	643	528	635	399
Marine	139	78	273	252	162	159
Aviation	45	46	305	375	192	173
Total	469	275	1,221	1,155	989	731
Unit Replacement Cost for Roads (US$'000/km)	22.8	35.1	34.6	45.3	51.5	40.4
Principal Facility as % of Total Replacement Value /e						
Marine	92	71	78	45	81	69
Aviation	49	69	87	42	95	67
Population ('000) /d	67	304	101	151	168	791
GNP (US$ million) /c	46.3	150.5	92.6	138.9	115.7	544.0
GNP per capita (US$)	690	495	917	920	689	687

/a 1991 prices unless indicated.
/b Equivalent annual replacement cost values computed at 7 percent discount rate over economic lives applicable to each type of infrastructure. (See Country Maintenance Annexes in Volume Two of this report). These values apply for maintaining the assets in good condition (i.e., with assessed levels of maintenance, see Table 2.7 below).
/c GNP in 1988, inflated by 5% per annum to indicative 1991 prices.
/d Population in 1988 increased to 1991 at the average growth rate for the period 1980-88.
/e Replacement value of single largest facility (the international airport and port) as a share of the total replacement value of infrastructure in the mode.
/f Allowance has been made for approximate value of unsealed roads/tracks on Kiritimati.

Sources: World Bank (1991a) and mission estimates.

Table 2.4: PACIFIC ISLANDS—MARINE AND AVIATION INDICATORS, 1988/1991

	Kiribati	Solomon Islands	Tonga	Vanuatu	Western Samoa	Total or Average
International trade (US$ million) /a	27.5	186.2	56.5	66.2	88.4	424.8
Share of GNP (%)	59	137	68	59	89	66
Value/Capita (US$)	351	590	548	485	534	533
Marine:						
Annual Capital Cost of Marine Assets (US$ million)	0.74	1.93	2.24	3.08	2.20	12.39
% of the value of international trade /b	2.70	1.00	4.00	4.70	2.50	2.90
Aviation:						
International Air Passenger Movements ('000) /c	27	30	67	40	186	66
Movements per US$ million of GNP /d	147	233	721	290	1,597	613
Annual Replacement Value of Principal Airport (US$ per international passenger movement) /e	35	27	39	57	16	35

/a Estimates for 1988/89; merchandize imports and exports only.
/b Replacement value of marine assets, on an equivalent annual capital cost basis (7 percent discount rate over 30 years; capital recovery factor 0.081) divided by total merchandize imports and exports in 1988 in US$ inflated by 5 percent per annum to indicative 1991 prices.
/c 35 percent of visitor arrivals in Western Samoa are from American Samoa. Visitor arrivals account for half of international passenger movements through Western Samoa.
/d For 1988.
/e Replacement value in 1991 prices. International passenger movements (visitors and nationals) estimated for 1988 (see tables in Country Surveys).

Sources: World Bank (1991a) and mission estimates.

(c) in distorting investment responses of agents in other sectors which use transport services.

Therefore, high priority needs to be given to the reassessment of all existing substantial infrastructure and to the identification of those facilities that are no longer warranted (including those for which modification, such as reduction in standard, is also not warranted). Proper allocation of, and priorities for, maintenance resources can only be made after the existing stock of infrastructure is rationalized, i.e., facilities which are warranted and justify maintenance are clearly identified.

Characteristics of the Existing Stock of Infrastructure

2.11 Since substantial transport infrastructure may not be warranted, interpretation of the patterns of investment across the PMCs needs to be made with caution. Notwithstanding this,

estimated patterns are largely as expected. While aviation and marine transport are intrinsic components of the transport task in the Pacific Island States, roads account for the majority of the value of transport assets in each PMC (from almost two-thirds in Western Samoa to a little under one-half in Vanuatu). The spatial distribution of population shapes modal shares of infrastructure. For example, the concentration of activity on the two main islands in Western Samoa is reflected in the high share in roads, and low share in marine assets.[12] The recent completion of major airport terminal and runway facilities in Vanuatu and Tonga account for the very large proportion of the value of aviation infrastructure in these countries.

2.12 The large investment in ports, jetties and airports in Vanuatu and Tonga in the 1980s is reflected in the very high value of infrastructure per capita, and as a share of GNP, in these countries. Corresponding to this is the low imputed average economic productivity of the infrastructure. On a per capita basis, the polynesian countries of Western Samoa and Tonga, and to some extent Vanuatu, have established a larger stock of transport infrastructure, relative to GNP, than Solomon Islands and Kiribati (see Figure 2.1).[13] Comparable figures covering transport infrastructure valuations are not available for other countries.

2.13 The replacement value of infrastructure gives no indication of the current condition status of existing facilities. Except for recently completed works, the current "value" of facilities will be considerably lower than the replacement cost due to deterioration with age and lack of maintenance. In Vanuatu, 20 percent of engineered roads were rated as being in good condition in 1989, with about equal proportions of the remainder rated as fair or poor. This is the *only* available systematic information on the *physical condition* of transport infrastructure in the five PMCs.

2.14 Some past studies have identified rehabilitation needs for selected infrastructure in terms of so called "maintenance overhang", i.e., the rehabilitation requirements resulting from past inadequate maintenance (based on original design standards) to restore warranted assets to "good" condition. "Working" estimates of "overhang" has been assembled based on these studies.[14] Estimates of the maintenance overhang are shown in Table 2.5.[15] The estimated overhang is greatest in the road sector where it is equal to 40 percent of the replacement cost of road infrastructure in the Solomon Islands, and about a quarter of the replacement cost in Vanuatu and Western Samoa. The identified overhang is less in the marine and aviation sectors. This reflects, in part, the more heavily engineered nature of assets in these subsectors and the greater pressure, for economic and technical reasons, to ensure major assets in these subsectors, meet international operational standards (for example, those set in aviation by ICAO). There is also less information available in the marine and aviation subsectors to establish the extent of the maintenance overhang. As stressed, *not all* existing infrastructure may warrant rehabilitation.

Overall Assessment of the Existing Stock of Transport Infrastructure

2.15 The stocks and replacement costs of transport infrastructure in the five PMCs examined are inordinately high. There is a critical need to assess the extent to which the PMCs can sustain this infrastructure from domestically generated economic activity. There is a need to determine a strategy to ensure efficient maintenance for warranted infrastructure. Elements of the strategy should include:

- Assessment of the total quantity of existing infrastructure which can be sustained, and identification of those

Figure 2.1: PACIFIC ISLANDS—INFRASTRUCTURE VALUE VS GNP, 1991

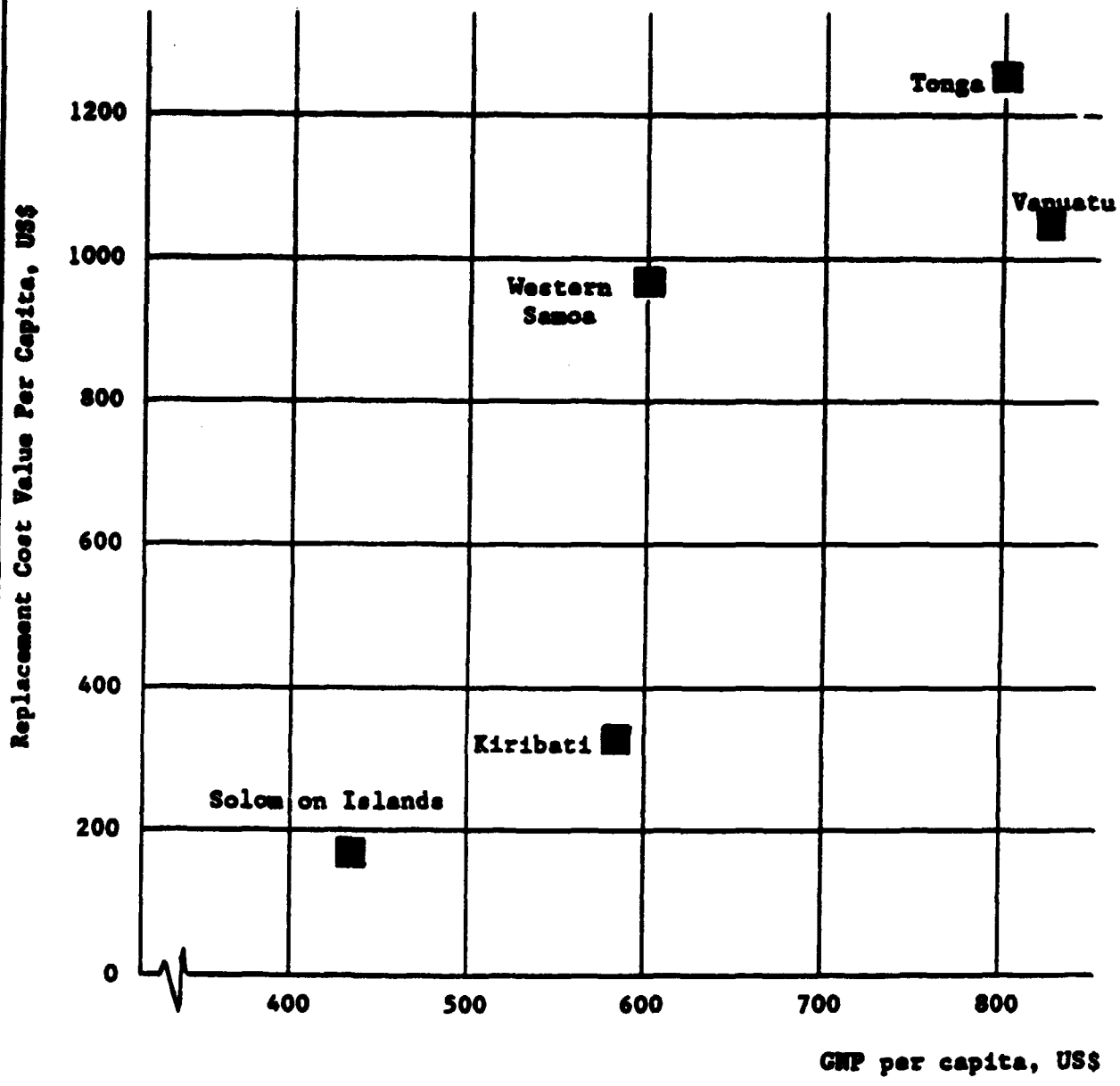


Table 2.5: PACIFIC ISLANDS—INFRASTRUCTURE MAINTENANCE OVERHANG, 1991 /a

	Kiribati	Solomon Islands	Tonga	Vanuatu	Western Samoa	Total or Average
Total Value						
Roads (US$ million)	3.1	18.4	7.6	19.1	24.2	72.5
(US$ per km)	3,775	14,153	4,055	10,852	11,680	9,262
Marine (US$ million)	1.8	n.i/b	0.2	3.5	n.i	5.6
Aviation (US$ million)	1.2	1.3	n.i	0.1	n.i	2.6
Total	6.1	19.7	7.8	22.7	24.2	80.6
As % of Replacement Value						
Roads	16	40	12	24	23	23
Marine	20	n.i	1	9	n.i	--
Aviation	24	9	n.i	0	n.i	--
Total	18	24	6	13	15	15

/a Approximate cost (in 1991 prices) of rehabilitating existing infrastructure to good condition, from which it can be treated with regular routine and periodic maintenance.

/b n.i indicates no maintenance overhang identified or indicated; for example in Western Samoa, Apia Port is being redeveloped, and cyclone damage eclipses overhang at other ports.

Source: Mission estimates.

infrastructure facilities which are warranted, together with their appropriate standards.

- Determination of the optimal level of maintenance for warranted infrastructure which minimizes capital, maintenance, and user costs (on an equivalent annual basis).
- Targets for cost recovery and appropriate user charges.
- Institutional capacity to support effective maintenance.

With the exception of the identification of warranted facilities, these elements are analyzed, in turn, below.

The Meaning of Assessed Maintenance

2.16 Reassessment of existing infrastructure and appropriate standards are outside the scope of this study. Therefore, the examination of maintenance presented below, is based necessarily on the identified entire stock of transport infrastructure in each PMC. The maintenance that would be associated with keeping these existing stocks in good condition, is estimated. This is termed "assessed

maintenance". Obviously "assessed maintenance" does *not* represent warranted or required maintenance. The purpose of estimating assessed maintenance levels is

(i) to probe further the non-sustainability of existing infrastructure, at its present size, in terms of its implied "assessed" maintenance obligations, and

(ii) to use the existing stock as a working basis to examine *actual* maintenance expenditures in the PMCs, estimate the implications for total transport system costs of "inadequate" maintenance, i.e., shortfalls between actual and assessed maintenance, and assess cost recovery for infrastructure in the sector.

B. Maintenance Expenditure

Actual Maintenance and Accounting Systems

2.17 Ministries and departments in the PMCs follow usual government accounting practices which identify expenditure by type (for example, labor and materials) and not by function (for example, construction and maintenance). Therefore, it is not possible to determine directly actual expenditure on maintenance (or whether it has been provided at minimum cost for the prescribed standard). Rather, estimates are made by taking the proportions of inputs such as labor and materials assigned to maintenance, as against construction and rehabilitation. In no case is it possible to establish a maintenance history for specific facilities which, together with condition assessment, would assist estimates of future maintenance needs and evaluation of additional standards.

Assessed Maintenance

2.18 Optimal maintenance expenditure is that level which, if effectively applied, would result in the *lowest total transport system costs*. Total system costs are the sum (on an equivalent annual basis) of the life-cycle costs [16] for infrastructure (sustained in relation to an established standard, over its potential economic life) *plus* user operating resource costs. Total system costs are set out conceptually in Box 2.1. These relationships are not well understood for conditions in the PMCs and therefore "optimal maintenance" (for warranted assets) cannot be determined. The approach adopted herein is pragmatic; that level of maintenance which would keep infrastructure in good condition (assessed maintenance) is estimated for the existing stock. The reductions in total transport system costs that could be achieved by increasing maintenance from actual to assessed levels are estimated.

2.19 The annual costs of maintenance are analyzed below for each mode. An annual expenditure of assessed maintenance for roads is estimated using an average annual cost per kilometer for each of the three categories of road covered in the road inventories. The assessed annual costs of maintenance for marine and aviation facilities are estimated on a cruder basis. "Best practice" maintenance costs, in the absence of estimates of the resources required to undertake routine and periodic maintenance, are estimated by applying a "rule of thumb" percentage factor to the estimated replacement cost of the asset. This maintenance factor includes periodic maintenance as an average equivalent annual value; this spreads the "lumpy" nature of maintenance over the economic life of the infrastructure.[17]

2.20 **Acceptance of Existing Assets.** The assessed maintenance expenditure estimates developed below are those associated with all existing infrastructure facilities and their associated design standards; it is not implied that assessed maintenance is economically warranted

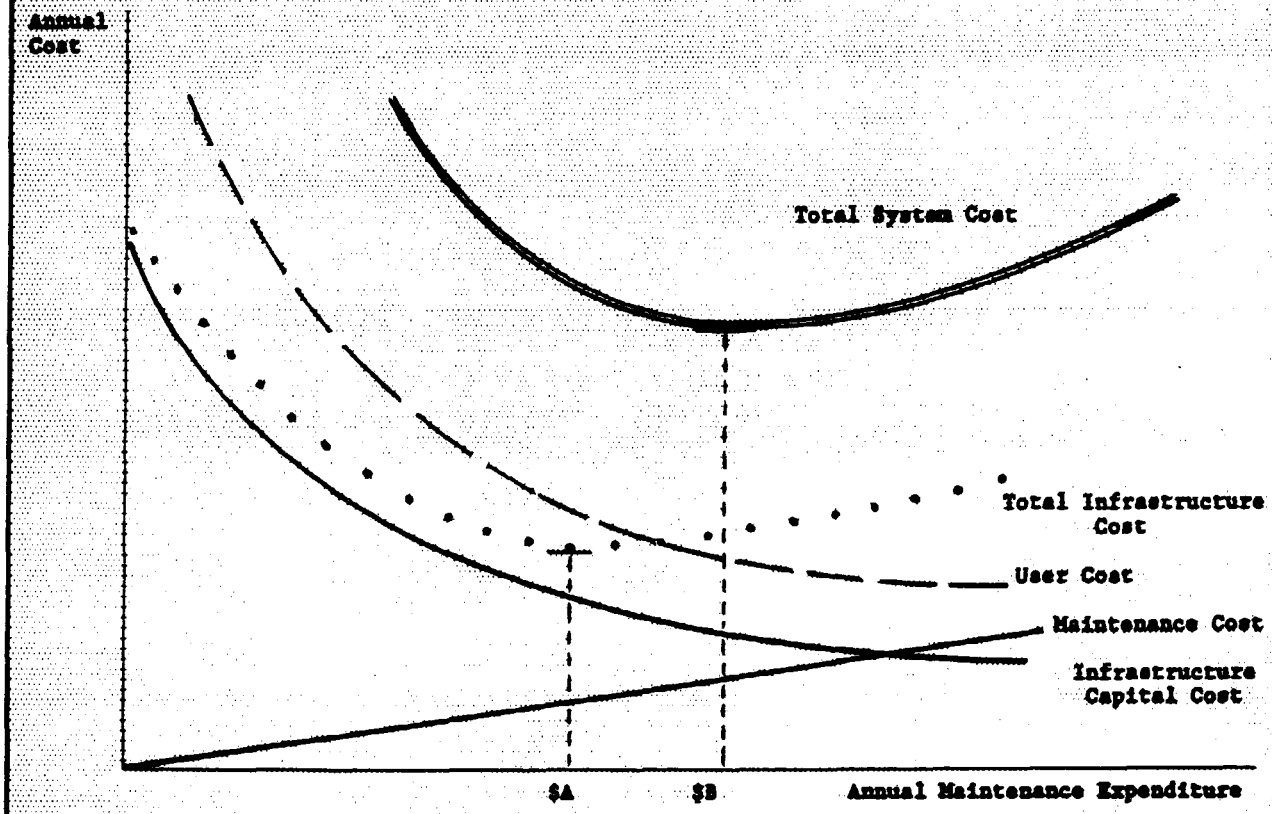
Box 2.1: MAINTENANCE, INFRASTRUCTURE, AND USER COSTS

Life cycle costs of providing public infrastructure rise rapidly if assets are not efficiently maintained. This is shown in the figure below which illustrates indicative relationships between maintenance expenditure and its effects on capital costs and user costs. Even in the early years after construction, when the need for maintenance is not visually apparent to casual observers, appropriate maintenance is crucial to the prevention of subsequent deterioration. Given other more transparent pressures for recurrent expenditure, decisions are often taken to postpone maintenance.

In the absence of any maintenance, the life of infrastructure will be low and the equivalent annual (E.A.) life-cycle construction costs high. For example, the cost of restoring deteriorated roads has been estimated at three to five times greater than the cost of timely and effective maintenance (World Bank, 1988). As effective maintenance expenditure is increased, the economic life is extended and the E.A. capital cost declines. Even limited expenditure on maintenance results in a substantial reduction in the E.A. capital cost, and the sum of the E.A. capital and maintenance costs. If only infrastructure costs are taken into account, an annual maintenance expenditure of $A, minimises total infrastructure costs.

Transport user costs will be high if maintenance is low because of the poor condition of the infrastructure. User costs decline as maintenance is improved. The total transport system cost is the sum of infrastructure and user costs, and is at a minimum where annual maintenance expenditure is $B;—the "assessed" level; the assessed maintenance cost of $B will always be higher than the level which minimises infrastructure costs alone ($A) because additional maintenance (up to $B) not only reduces capital costs, it also reduces user costs.

Expenditure of $B on timely and effective maintenance will minimise the long-term cost of providing, maintaining and using transport infrastructure; any deviation from this schedule of maintenance will result in a higher total transport system cost.



or socially justified; rather, assessed maintenance levels reveal the scale of the maintenance issue. As stressed above, existing transport infrastructure in its entirety is non-sustainable; demand for some facilities may have shifted since its original construction, some facilities may have been over-or under-designed originally, and some facilities with relatively low economic or social merit may have been introduced.

Road Maintenance Expenditure

2.21 Actual and assessed maintenance costs for all transport infrastructure, including roads, as estimated for 1991, are presented in Table 2.6.[18] The assessed annual maintenance cost for road maintenance is, as a proportion of infrastructure replacement cost, high in the Solomon Islands and Vanuatu. This arises from the high proportion of engineered roads in the two countries (see Table 2.1). Road maintenance costs in these two countries are also relatively high because of the greater need to move maintenance equipment between a number of major islands, and soil and geographic conditions which increase the cost of road maintenance. Particularly high unit maintenance costs reported for Vanuatu further raise the cost of maintenance as a proportion of asset replacement value. Unit road maintenance costs, by road type, as assessed for the five PMC, and for two comparator countries (Fiji and Thailand) are presented in Table 2.7. Clearly unit maintenance costs for unsealed engineered roads and earth roads in Vanuatu are inordinately high and they call for further review; they are 120 percent and 220 percent, respectively, greater than for similar roads in the Solomon Islands. They lead to somewhat atypical conclusions for Vanuatu, therefore, the road maintenance situation in Vanuatu is placed in perspective by supplementing the reported Vanuatu figures with results obtained by applying the road maintenance unit cost levels from Solomon Islands.[19] (Subsequent to this analysis, discussions with the Government of Vanuatu Public Works Department indicated support for this approach.)

2.22 Assessed expenditure on routine and periodic maintenance of roads in the five PMCs is estimated to be on average 2.9 percent of GNP (see Table 2.6). Actual road maintenance across all PMCs is, on average, 31 percent of assessed maintenance, and 1 percent of GNP.[20] Both assessed and actual expenditure on road maintenance are high relative to the size of the PMC economies. Yet estimated actual expenditure on maintenance falls well short of assessed maintenance in all PMCs; actual expenditure ranges from only 17 percent of assessed maintenance in Vanuatu to 69 percent in Kiribati. Current expenditure on road maintenance in Kiribati is, at 1.4 percent, a comparatively low proportion of the Government's recurrent expenditure; expenditure at the level of assessed maintenance is estimated to require 2.0 percent of government outlays; this is a lower proportion than that estimated for the other four PMCs.[21] In these four PMCs, assessed road maintenance expenditure is between two and six times the existing level. The assessed levels of road maintenance range from 6 percent of government expenditure (Tonga) to 27 percent (Vanuatu). *Such levels of road maintenance expenditure are non-sustainable*; even with increased cost recovery; maintenance obligations also indicate that *substantial rationalization of existing roads and standards is required.*

Marine Maintenance Expenditure

2.23 Assessed maintenance expenditure associated with marine infrastructure is relatively low, being, in aggregate for all five PMCs, only 13 percent of total assessed maintenance expenditure for the road subsector (see Table 2.6).[22]

2.24 The gap between actual and assessed maintenance expenditure is least in the Solomon Islands, where the commercially oriented and largely autonomous Solomon Islands Port

Table 2.6: PACIFIC ISLANDS—TRANSPORT INFRASTRUCTURE MAINTENANCE COSTS, 1991

	Kiribati	Solomon Islands	Tonga	Vanuatu /a		Western Samoa	Total or Average /a	
Assessed Maintenance								
Assessed Annual Maintenance Cost (US$ million)								
Roads	0.3	2.8	1.5	8.6	[3.8]	3.0	16.2	[11.4]
Marine	0.1	0.5	0.7	0.5		0.5	2.1	
Aviation	0.1	0.2	0.4	0.8		0.4	1.9	
Total	0.4	3.5	2.7	9.8	[5.1]	3.8	20.2	[15.4]
Assessed Annual Maintenance Cost (% of Infrastructure Replacement Value)								
Roads	1.5	6.1	2.3	10.7	[4.8]	2.8	5.1	[3.6]
Marine	0.6	2.0	2.6	1.4		1.3	1.7	
Aviation	2.1	1.5	1.3	1.3		1.4	1.4	
Total	1.3	4.2	2.1	5.6	[2.9]	2.3	3.5	[2.7]
Assessed Annual Maintenance Cost (% of GNP)								
Roads	0.6	1.9	1.6	6.0	[2.6]	2.6	2.9	[2.1]
Marine	0.2	0.3	0.8	0.4		0.3	0.4	
Aviation	0.2	0.1	0.4	0.5		0.4	0.3	
Total	1.0	2.3	2.8	6.9	[3.5]	3.3	3.7	[2.8]
Assessed Annual Maintenance Cost (% of Government Revenue)								
Roads	1.59	6.00	5.09	21.17	[8.5]	5.71	0.68	[0.3]
Marine	0..29	0.94	2.14	1.18		0.56	1.43	
Aviation	0.37	0.59	1.25	2.07		0.80	1.07	
Total	2.45	7.37	8.72	23.90	[8.4]	7.11	12.33	[4.9]
Actual Maintenance								
Actual Maintenance Expenditure (US$ million) /b								
Roads	0.19	0.99	0.83	1.49		1.49	4.99	
Marine	0.02	0.26	0.10	0.09		0.13	0.59	
Aviation	0.03	0.07	0.10	0.22		0.11	0.54	
Total	0.24	1.32	1.04	1.79		1.73	6.12	
Actual Maintenance (as % of Assessed Maintenance)								
Roads	69	35	55	17	[39]	49	31	[44]
Marine	34	53	14	17		36	28	
Aviation	54	34	24	29		25	28	
Total	61	38	39	18	[35]	45	30	[40]
Actual Maintenance (as % of Government Revenue) /c								
Roads	1.1	2.1	2.8	3.6		2.8	3.0	
Marine	0.1	0.5	0.3	0.2		0.2	0.4	
Aviation	0.2	0.2	0.3	0.6		0.2	0.3	
Total	1.5	2.8	3.4	4.3		3.2	3.7	

/a The road maintenance estimates for Vanuatu are inordinately high and the source data requires review. The figures shown [ ] thus, represent road maintenance costs for Vanuatu, based upon the unit maintenance costs for Solomon Islands. See para. 2.22 in the text.
/b Based on maintenance in 1991, or latest available year in 1991 prices.
/c Based on recurrent revenue in 1989 inflated by 5 percent per annum to indicative 1991 prices.

Sources: Mission estimates and World Bank (1991a).

Table 2.7: PACIFIC ISLANDS AND COMPARATOR COUNTRIES—ASSESSED UNIT ANNUAL ROAD MAINTENANCE COSTS, 1991
(US$ per kilometer)

Road Type	Kiribati	Solomon Islands	Tonga	Vanuatu	Western Samoa	Comparator Countries Fiji /a	Comparator Countries Thailand /a
Sealed	2,000	4,500	2,600	{ 6,800/a	4,170	4,250	3,000
Unsealed/Graveled				{			
6 m pavement		4,000			3,650	4,000	2,400
3 m pavement	200	2,100	1,100	2,000	2,580		
Earth Formed	80	1,000	620	1,000	250	1,000	700
Average	370	2,150	800	4,880	1,450	-	-

/a Estimated from total maintenance requirements for mix of road types, based on recent Bank projects.

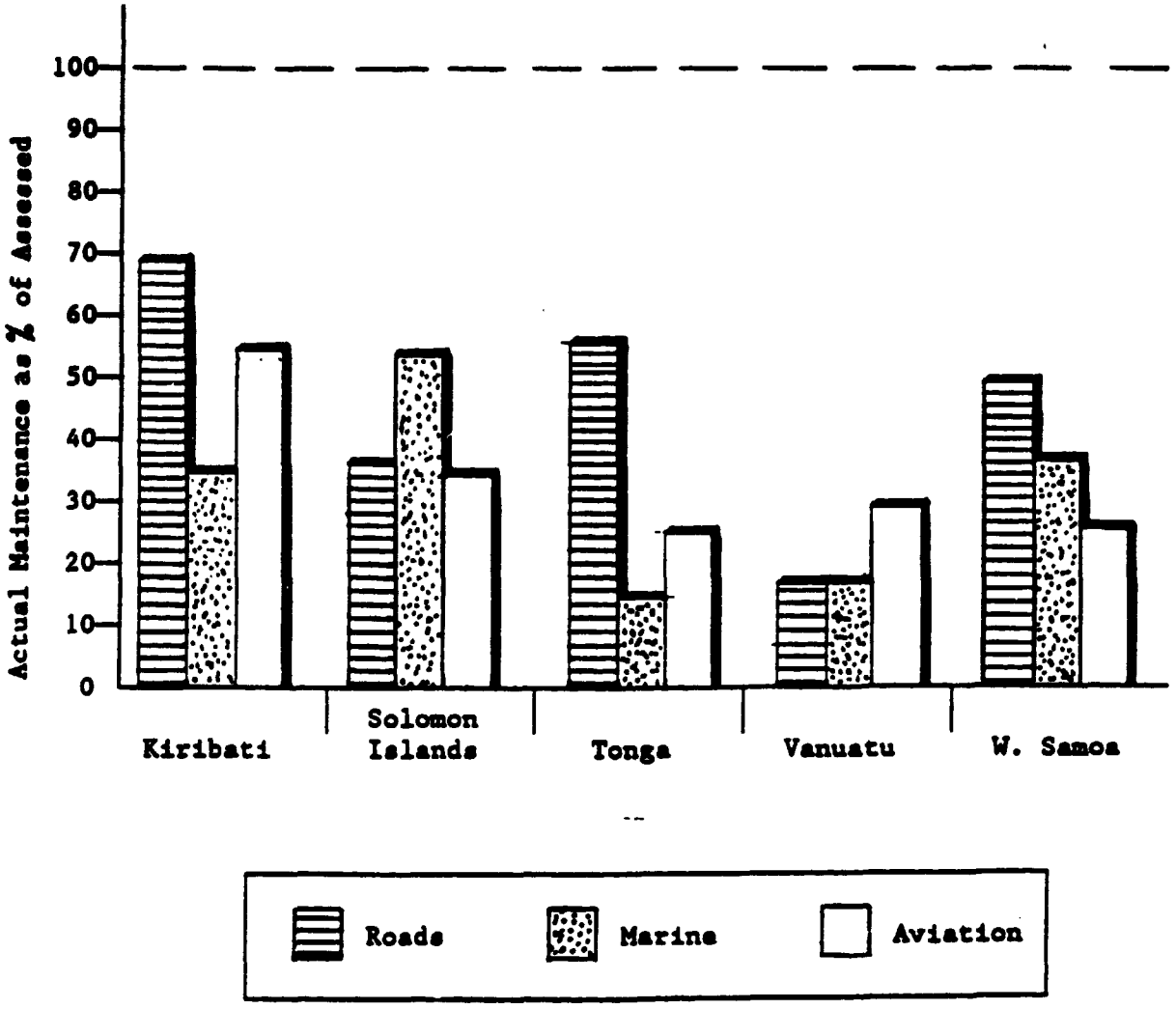
Source: Mission and Bank estimates.

Authority is in a position to exercise cost recovery measures, budget for maintenance, and control of its assets. However, there is very low expenditure on maintenance of other marine assets in the Solomon Islands and overall actual marine maintenance expenditure is one-half the assessed level. Actual maintenance expenditures are well below assessed maintenance levels in Vanuatu (with two major ports and sixteen jetties) and Tonga (where substantial investment has been made in port facilities at Nuku'alofa). Much of the investment in marine facilities in these two countries has been made during the 1980s and, so far, the effects of deferred maintenance are small. Assessed maintenance is expressed here on an equivalent annual discounted flow basis, i.e., a uniform amount per year. Actual routine and periodic maintenance needs are not uniform and increase with asset age. Unless a "sinking fund" is established based on equivalent annual requirements, adequate financial resources will not be readily available. Of course, the need for increased maintenance expenditures should be determined by reviewing the stock of marine infrastructure.

Aviation Maintenance Expenditures

2.25 Assessed maintenance expenditure in the aviation sector is, as with the marine sector, small in absolute terms. Notwithstanding the need to meet international standards for airside facilities, actual expenditure is generally only between a quarter and a third of that estimated as associated with sustainability of all aviation assets. Low maintenance in the past has been feasible, in part, because Vanuatu, Western Samoa and Tonga have had new runways and passenger terminals constructed at their respective gateway airports with grant aid during the 1980s. However, on the basis that these new facilities are warranted, a substantial increase in maintenance expenditure is implied to sustain the infrastructure over the long term.

Figure 2.2: PACIFIC ISLANDS—ACTUAL VS ASSESSED MAINTENANCE



Maintenance Expenditure in Perspective

2.26 The ratio of actual to assessed maintenance expenditure for the five PMCs as a whole is very similar for each mode (31, 28 and 28 percent respectively, for roads, marine and aviation). However, there are significant differences between the countries, as shown in Figure 2.2. Actual expenditure relative to assessed is clearly lowest (18 percent) in Vanuatu. Actual maintenance outlays in the Solomon Islands, Western Samoa and Tonga are less than one-half the assessed level, while expenditure in Kiribati is 61 percent of that assessed. For the five PMCs in aggregate, current expenditure on maintenance of transport infrastructure is 4.2 percent of recurrent government outlays. Maintenance expenditure at the assessed level for all infrastructure would require a 10 percent increase in *total* government current expenditure (though a considerably higher increase would be required in Vanuatu). This increase is unrealistic.

2.27 Limited expenditure on maintenance in the past has been made possible by substantial external assistance to rehabilitate neglected existing infrastructure, and possibly by a decline in its standard. It is unlikely that the PMCs will be able to depend on sufficient assistance being available in the future for early rehabilitation/reconstruction of all existing infrastructure.

2.28 *It is not economically feasible to maintain the entire existing stock of infrastructure* in "good" condition; some infrastructure is unwarranted and will need to be rationalized and future maintenance concentrated on the most important assets. New investments, rehabilitation, and maintenance need to be considered jointly, together with institutional requirements, in setting expenditure/assistance priorities.

C. Implications of Inadequate Maintenance

2.29 The first priority for maintenance is ensuring that it is only applied to warranted assets. The second priority is to ensure that adequate (assessed) maintenance is effectively utilized and efficiently priced at the specified standard. Inadequate maintenance results in more rapid deterioration of infrastructure assets, and poorer quality of the services they provide. Deteriorated infrastructure reduces the efficiency of transport operations and increases total transport system costs through:

- higher capital replacement costs because of the shorter economic life,
- higher maintenance costs because, in most cases, infrastructure is more difficult to maintain once it has deteriorated, and
- higher transport user costs as deteriorated infrastructure increases damage to vehicles, vessels and freight and increases transit times.

Higher total transport costs reduce overall economic performance; increases in the resource costs of collecting, handling and distributing goods lead to general price increases, weaker export competitiveness and a reduced share of export income to producers. (The general form of the relationships between capital, maintenance and user costs is indicated in Box 2.1 earlier.)

Life-Cycle Infrastructure Costs

2.30 **Estimating The Maintenance - Capital Cost Trade-Off.** The implications of inadequate maintenance of transport infrastructure in the PMCs, are examined by estimating total transport system costs (life cycle costs for existing infrastructure plus user costs) with current actual maintenance and those that would be associated with assessed maintenance. Changes in infrastructure life cycle costs and transport user costs are considered separately.

Data limitations constrain the quantitative examination of changes in transport user costs to the road subsector.[23]

Savings in Infrastructure Costs

2.31 The relationship between maintenance and capital costs in the five PMCs is examined by comparing the equivalent annual capital cost of infrastructure (based on a discount rate of 7 percent and estimated economic lives of infrastructure) under actual and assessed maintenance with the cost of actual and assessed maintenance. The results of the analysis are set out in Table 2.8. The analysis indicates that the total capital cost of transport infrastructure is 46 percent higher under actual maintenance, than under assessed maintenance, i.e., US$79.7 million compared with US$54.5 million.

2.32 The estimates of life-cycle infrastructure costs under different levels of maintenance generally confirm that the total costs,[24] for *all* existing infrastructure, are reduced by shifting from the actual level of maintenance to the assessed level. (It should be possible to reduce total costs further by increasing the productivity of maintenance activity itself.) As stressed above, these results indicate the scope for infrastructure cost savings; they are relevant only for warranted assets.

2.33 The estimated replacement capital costs and assessed maintenance levels of existing infrastructure are brought together in Table 2.9. The table illustrates (for a zero discount to simplify interpretation) how the level of maintenance affects the economic life of infrastructure, and thereby, in turn, its annual capital cost. Shifting from the actual to the assessed level of maintenance doubles economic life. Savings in annual capital cost exceed substantially the corresponding increase in maintenance. Thus, increasing the level of maintenance for all infrastructure from zero to actual (US$6.1 M p.a.), and from actual to assessed (US$14.1 M p.a.), reduces the corresponding capital costs from US$64.3 M p.a. to US$53.6 M p.a. (a saving of US$10.7 M p.a.) and from US$53.6 M p.a. to US$26.3 M p.a. (a saving of US$26.7 M p.a.). Each increment of maintenance expenditure secures a corresponding net saving in capital cost.

2.34 **Benefit - Cost Ratio of Improved Maintenance.** The benefit-cost ratios tend to be highest in the aviation subsector but are also high for other modes in certain countries.[25] For each mode, in all countries the incremental benefit-cost ratios are well above 1.0, with the exception of roads in Vanuatu. The benefit-cost ratio of shifting to the assessed level road maintenance in the Solomon Islands and Vanuatu is low compared with the ratio for the other countries.[26]

2.35 There is considerable heterogeneity in transport infrastructure, and the marginal value of additional maintenance expenditure will differ with the type. In the marine sector, for example, wharves, buildings and equipment have different economic lives and maintenance needs, and hence there are different implications of inadequate maintenance. Similarly, differences in the mix of fixed and renewable infrastructure influences the total cost implications of different levels of maintenance. For example, inadequate maintenance of a sealed road should not, at least initially, result in deterioration of the road base and drainage components of the road. By contrast, the lack of a protective sealed surface on other engineered and earth roads results in more rapid deterioration of the road base in the event of insufficient maintenance.

2.36 Unsealed roads predominate in the PMCs. The construction cost of these roads is relatively low, but maintenance costs are high and depend primarily on environmental conditions rather than traffic movement. These conditions raise the possibility that *there may be instances where a cycle of road construction with limited maintenance, followed by relatively early reconstruction, might result in lower life-cycle costs.*[27]

Table 2.8: PACIFIC ISLANDS—CAPITAL, MAINTENANCE AND USER COSTS OF INFRASTRUCTURE

	Kiribati	Solomon Islands	Tonga	Vanuatu /a		Western Samoa	Total or Average /a
Equivalent Annual Capital Cost of Infrastructure with Actual Maintenance (US$ million) /b							
Roads	2.1	7.3	9.8	12.4		14.9	46.5
Marine	0.9	2.7	3.4	3.7		2.6	13.4
Aviation	0.7	2.1	4.3	8.3		4.3	19.8
Total	3.7	12.1	17.5	24.5		21.9	79.7
Equivalent Annual Capital Cost of Infrastructure with Assessed Maintenance (US$ million)							
Roads	1.5	4.6	6.4	8.0		10.1	30.7
Marine	0.7	2.0	2.4	2.9		2.1	10.0
Aviation	0.6	1.4	3.0	5.9		3.0	13.8
Total	2.7	8.0	11.8	16.8		15.2	54.5
Additional Annual Capital Cost of Infrastructure Resulting from Inadequate Maintenance (US$ million) /c							
Roads	0.6	2.7	3.4	4.5		4.8	15.9
Marine	0.2	0.8	1.0	0.8		0.6	3.4
Aviation	0.2	0.7	1.3	2.4		1.3	5.9
Total	1.0	4.1	5.8	7.7		6.7	25.2
Incremental Cost of Shifting from Actual to Assessed Maintenance (US$ million) /d							
Roads	0.10	1.8	0.7	7.1	[2.3]	1.5	11.2
Marine	0.08	0.2	0.6	0.4		[illegible]	1.5
Aviation	0.08	0.1	0.3	0.5		.3	1.4
Total	0.26	2.1	1.6	8.0	[3.3]	2.0	14.1
Benefit/Cost Ratio /e							
Roads	6.4	1.5	6.0	0.6	[1.9]	3.1	1.4
Marine	6.1	3.3	1.6	1.9		2.6	2.2
Aviation	7.7	4.7	4.2	4.4		3.9	4.3
Total	6.5	1.9	3.6	1.0	[2.3]	3.2	1.8
Roads:							
Vehicle Operating Cost (US$ per km) /f	0.26	0.25	0.23	0.21		0.21	0.23
Vehicle Operating Cost Penalty /g							
Annual Cost (US$ million)	0.4	2.1	1.2	2.1		1.9	7.7 [7.6]
% of GNP	0.8	1.4	1.3	1.5		1.6	1.4 [1.6]

/a The figures shown [ ] thus, represent road maintenance costs for Vanuatu, based upon the unit maintenance costs by road type for Solomon Islands. See para. 2.22 in the text.
/b Equivalent Annual Cost calculated at 7 percent discount rate and economic lives based on nature of infrastructure for roads, marine and aviation. For details, see individual country Maintenance Survey Annexes, Volume Two of this report.
/c Difference between annual capital cost of infrastructure with current and assessed maintenance.
/d Difference between current and assessed annual maintenance cost.
/e Ratio of saving in equivalent annual capital cost resulting from assessed maintenance to the incremental annual cost of the improved maintenance.
/f Average vehicle operating cost (net of taxes and duties) on paved roads in good condition. (See Country Maintenance Survey Annexes, Volume Two of this report).
/g Indicative differences in economic road vehicle operating costs between current road conditions and roads in good condition. Details of calculations are presented in the Maintenance Annex to each country sector survey in Volume Two.

Source: Mission estimates.

Table 2.9: PACIFIC ISLANDS—EFFECT OF MAINTENANCE ON INFRASTRUCTURE CAPITAL COST AND ECONOMIC LIFE /a

Maintenance Level	US$ million p.a.		(US$ million p.a.) /b				Economic Life (years) /c			
			Road	Marine	Aviation	Total	Road	Marine	Aviation	Average
Assessed	20.3	[15.4]/d	15.0	3.6	7.6	26.3	21	35	18	22
Actual	6.1		31.6	7.9	13.7	53.6	10	16	10	11
Zero	0.0		45.1	10.5	15.2	64.3	7	12	9	9
			Total Replacement Cost (US$ million)							
Stock Value			316	126	137	579	-	-	-	-

/a For all five PMCs: Kiribati, Solomon Islands, Tonga, Vanuatu and Western Samoa.
/b At zero discount rate. Under zero maintenance, annual capital cost is replacement cost divided by economic life.
/c Based on judgement for zero maintenance.
/d Figure shown [ ] thus, is for adjusted road maintenance costs in Vanuatu (see para. 2.20).

Source: Mission estimates and Table 2.8.

Savings in User Costs

2.37 In addition to the savings in life-cycle infrastructure costs which may accrue to Governments and donors from shifting to assessed maintenance, users of the transport system can also secure lower costs. Transport user operating costs decrease under better infrastructure quality and more effective maintenance; with improved maintenance the costs of wear and tear (and possible delays) to vehicles, vessels and equipment, decline.[28] These savings can be estimated most readily for the road subsector.

2.38 **Road Condition and User Costs.** Road vehicle operating costs rise with inadequate road maintenance because of the increased fuel consumption, more rapid vehicle depreciation, and greater need for repairs, which result from rougher roads. These conditions may result in a further decline in economic efficiency through reduced accessibility and increased spoilage of freight, and loss in net economic output (if increased costs make a potential economic activity non-viable).[29]

2.39 Vehicle operating resource costs have been derived [30] for each of the PMCs; the average vehicle operating cost on paved roads in good condition is described in Table 2.10. Differences between the countries is largely attributable to differences in fleet composition and data quality. Vehicle operating costs were calculated for sealed and unsealed roads in good, fair and poor condition; judgements were made on the current volume of traffic on each road type by condition. In indicative terms, it is estimated that vehicle operating economic costs are between 8 percent and 14 percent higher at

Table 2.10: PACIFIC ISLANDS—COSTS AND BENEFITS OF IMPROVED ROAD MAINTENANCE, 1991

	Kiribati	Solomon Islands	Tonga	Vanuatu /c		Western Samoa	Total (or Average) /c
Road Length km /a	821	1,301	1,874	1,760		2,072	7,828
Sealed roads (percent of total length)	4	8	6	7		14	(8)
Replacement Cost							
US$ million	18.7	45.7	64.9	79.8		106.7	315.9
US$'000/km	22.8	35.1	34.66	45.3		51.5	40.4
Maintenance Cost Annual, US$ million							
Assessed	0.3	2.7	1.5	8.6	[3.8]	3.0	16.2
[11.4] Actual	0.2	0.9	0.8	1.5		1.5	5.0
Difference	0.1	1.8	0.7	7.1	[2.3]	1.5	11.2
Maintenance Cost Annual, US$/km							
Assessed	370	2,150	800	4,880	[2,160]	1,450	2,069
Actual	240	690	430	850		725	640
Replacement Cost With Current Maintenance (Equivalent Annual)							
US$ million	2.1	7.3	9.8	12.4		14.9	46.5
(US$,000/km)	(2.6)	(5.6)	(5.2)	(7.0)		(7.2)	(5.9)
Replacement Cost With Assessed Maintenance (Equivalent Annual)							
US$ million	1.5	4.6	6.4	8.0		10.1	30.7
(US$'000/km)	(1.8)	(3.5)	(3.4)	(4.5)		(4.9)	(3.9)
Saving in Replacement Cost with Assessed Maintenance							
US$ million	0.6	2.7	3.4	4.4		4.8	15.8
(US$'000/km)	(0.8)	(2.1)	(1.8)	(2.5)		(2.3)	(2.0)
Net Saving in Total Infrastructure Cost With Assessed Maintenance (Equivalent Annual)							
US$ million	0.5	0.9	2.7	-2.7	[2.1]	3.3	4.6
Vehicle Operating Cost /b Annual Savings with Assessed Maintenance							
US$ million	0.4	2.1	1.2	2.1		1.9	7.7
Net Annual Savings Total Infrastructure and User Costs with Assessed Maintenance							
US$ million	0.9	3.0	3.9	-0.6	[0.0]	5.2	12.3

/a All roads; sealed, engineered and earth. Since the mix of road type varies across the countries (see Table 2.1 above), the average figures presented here need to be interpreted with caution.
/b Relative to roads in good condition.
/c See text para. 2.22 for discussion of the inordinately high level of road maintenance costs in Vanuatu; the levels shown [ ] thus, are based on the unit maintenance costs, by road type, for Solomon Islands. See para. 2.22 in the text.

Source: Table 2.1, 2.7 and mission estimates.

present, than would occur if all roads were in good condition (see Table 2.8). This incremental cost is equivalent to an average of 1.4 percent of GNP over the five PMCs—which is high. Foreign costs are almost four-fifths of vehicle operating economic costs, and the higher vehicle operating costs add between 1 and 2 percent to the value of imports in the PMCs.

2.40 Total transport system costs can be estimated only for the roads subsector and these are shown in Table 2.10. Increasing maintenance to the assessed level across all five PMCs (an increase of US$11.2 million per annum), is estimated to reduce total road infrastructure costs by US$4.6 million per annum, and vehicle operating costs by US$7.7 million per annum. The total *net* savings across the five PMCs is US$12.3 million per annum, and the incremental benefit-cost ratio is estimated to be 2.1.

2.41 Savings in annual vehicle operating costs under assessed maintenance of roads are equal to about half of the savings in equivalent annual capital replacement costs. The savings are relatively higher in Kiribati and the Solomon Islands. In general, though, in the PMCs the savings in vehicle operating costs from improved maintenance are low in comparison with savings in infrastructure capital cost because of low traffic volumes involved. However, comparison of vehicle operating costs and road maintenance costs, which both involve a full *domestic* impact is revealing. For all PMCs, with the exception of Vanuatu, the *annual savings in vehicle operating costs exceed the additional maintenance cost to achieve them.* It follows that it is in the direct economic intreest of the PMCs to increase their maintenance of warranted road facilities.

2.42 **Marine and Aviation Infrastructure Condition and User Costs.** It is more difficult to quantify the cost penalty of poor condition infrastructure to transport users in the marine and aviation subsectors. Quantitative guidelines of the implications of inadequate maintenance in these subsectors are far less developed than for roads. Increased port operation costs result from inadequately maintained port facilities. For example, the load-carrying capacity of wharves and jetties may be reduced by insufficient deck and pile maintenance, and equipment may be in disrepair. Increased port costs and delays add to the cost of imported goods and make exports, most of which pass through sea ports, less competitive on international markets. Safety for port workers may also be reduced. Quantification of these implications has not been possible.

2.43 While major airports are not generally at risk of closure because of inadequate maintenance, such closure would have a severe impact on travel and, in particular, tourism. Deterioration of airport terminals and other public facilities will have an adverse impact on user perception and marketing credibility. Provincial and local airfields are more prone to closure. In the Solomon Islands, for example, about two airfields are closed each month, often because of maintenance problems which can be easily remedied.[31]

Maintenance Incidence and Responsibility

2.44 The incidence of costs and financial savings from improved maintenance will differ. A high proportion of transport infrastructure investment in the PMCs, including rehabilitation, is funded through overseas aid. The external contribution to maintenance is generally limited to the provision of equipment and technical assistance. In the absence of additional donor grant assistance for maintenance, improved maintenance requires additional outlays by the Governments of the PMCs. The savings in rehabilitation costs to external donors would be about 80 percent greater than the increased maintenance outlays. Infrastructure user cost savings will accrue directly to vehicle operators; where these operators are providing a transport service for others (passengers and shippers), the savings should be passed on to these individuals, since

the structure of the transport service markets in the PMCs is effectively competitive.

2.45 While the need for aid funds for transport infrastructure in the long-term will be reduced if maintenance is improved, there will remain a need for assistance,particularly in the near term. Attention should be focused on the prevailing maintenance overhang (i.e., the amount of investment required to rehabilitate warranted existing infrastructure to good condition), particularly in the road sector.

2.46 Total transport infrastructure maintenance needs to be considered against competing needs for external assistance. Table 2.11 indicates transport infrastructure replacement and assessed maintenance costs in comparison to total government and development expenditure, and external assistance. The expenditure data plainly demonstrate the large and unrealistic demands that sustainable existing transport infrastructure would place on existing Government expenditure and ODA for each PMC.

2.47 These findings are reinforced by examining the primary sources of ODA. Major bilateral assistance to the PMCs is provided by Australia, New Zealand and Japan. Table 2.12 reveals the order of magnitude of transport infrastructure assessed maintenance in comparison to prevailing levels of assistance from Australia and New Zealand. Although the difference between existing and assessed maintenance represents a small percentage of existing capital project assistance, total infrastructure (replacement and assessed maintenance) costs represent an inordinately high proportion of total assistance. This brings into question the long-term sustainability by donors of the entire accumulated stock of existing transport infrastructure.

2.48 **Organizational Costs of Implementing Effective Maintenance.** The benefits and costs associated with shifting to "assessed" maintenance indicated here do not take into account the costs of implementing and securing improved maintenance. These costs include the additional management, administration supervision, and training involved. Since the number of personnel that would be required is small (possibly 2-3 semi-professionals for each modal area, or a total of less than 10), the additional staffing costs should be modest. Moreover, efficiency gains can be anticipated from contracting out, where possible, maintenance delivery "on the ground" to the private sector. Nevertheless, several alternative approaches are available for establishing these new management and implementation tasks—varying from using expatriate professionals ("imported services") to indigenous staff and training ("import substitution"). A cost-effective choice across these alternatives needs to be taken. A perspective on the net gains of improved maintenance (i.e., after implementation costs) in the roads subsector alone, can be obtained by considering the order of magnitude of the estimated net equivalent annual savings as shown in Table 2.10. In 1991 prices, these vary from US$900,000 in Kiribati to US$5,200,000 in Western Samoa. (Vanuatu is the exception, with no net gains given the inordinately high reported road maintenance costs.) Notwithstanding the likely low accuracy of these estimates, they are orders of magnitude above the likely range of implementation costs. A similar conclusion can be drawn for the marine and aviation subsectors; annual net savings in life-cycle infrastructure costs vary from US$500,000 for marine in Tonga, Vanuatu and Western Samoa, to US$1 million and US$1.9 million for aviation in Tonga and Vanuatu, respectively. These estimates do not include the additional savings accruing to users of the facilities.[32]

2.49 In brief, the stock of infrastructure is substantial, significant savings in its long-term costs are possible (following rationalization), and the modest personnel costs in securing these savings would yield a high rate of return.

Table 2.11: PACIFIC ISLANDS—TRANSPORT INFRASTRUCTURE AND DEVELOPMENT EXPENDITURE, 1985-1988, 1991

	Kiribati	Solomon Islands	Tonga	Vanuatu	Western Samoa	Total or Average
Population ('000)	67	304	101	151	158	158
GNP US$ million	46.3	15.1	92.6	138.9	115.7	81.7
per capita	650	430	800	820	580	517
Gov't Expenditure /b US$ million (Annual)	18.0	5.9	40.7	64.3	53.6	182.5
Development Expenditure /b US$ million (Annual)	17.5	1.9	20.3	24.7	36.1	100.5
Overseas Devel. Expend. /a US$ million (Annual)	16.3	5.8	18.8	39.3	30.6	163.3
% Gov't expend.	90.5	84.9	49.1	61.2	55.5	55.1
per capita	243	192	186	260	182	207
Infrastructure /c Replacement Value						
US$ million	31.0	83.5	123.3	174.6	166.1	578.6
US$'000 (Equiv.Annual)	2.7	8.0	11.8	16.8	15.2	54.5
% Dev. Exp. /b						
% GNP	73	55	132	122	142	165
per capita	438	248	1,207	1,061	980	685
Maintenance Assessed US$'000 (Annual)	300	2,800	1,500	8,600	3,000	16,200
% Gov't expend.	1.7	47.5	3.7	6.2	4.7	8.9
% ODA	1.8	4.8	7.0	21.9	9.8	9.9
Maintenance Actual (Annual) US$ '000	200	900	800	1,500	1,500	5,000
% Gov't expend.	1.1	15.2	2.0	2.3	2.8	2.7
% ODA	1.2	1.5	4.2	3.8	4.9	3.1
Total Infrastructure Cost with Assessed Maintenance US$'000 (Equiv. Ann.)	2,700	8,000	11,800	16,800	15,200	54,500
% Gov't expend.	15.0	136	28.9	26.1	28.4	29.9
% ODA	16.6	137	62.8	42.7	61.5	54.2

/a 1988.
/b 1985-88, Tonga 1985/86-1988/89; averaged as percent of GNP over corresponding years.
/c Infrastructure figures are as estimated for 1991, in 1991 prices; ODA and Government expenditure figures are based on average percentages of GNP over the indicated periods, generally 1985-88.

Source: Table 2.8, and World Bank (1991a).

Table 2.12: INFRASTRUCTURE AND ODA—AUSTRALIA AND NEW ZEALAND, 1988

	Kiribati	Solomon Islands	Tonga	Vanuatu	Western Samoa	Total
	(US$ million)					
Total Assistance						
Australia	2.03	7.57	7.44	7.68	6.63	46.35
New Zealand	-	1.69	2.43	1.89	3.79	13.45
Total	2.03	9.26	10.81	68.57	10.42	59.85
Economic Infrastructure						
Australia	0.29	0.15	3.37	0.74	0.74	4.12
New Zealand	-	-	0.14	0.34	0.07	0.54
Total	0.29	0.15	3.51	1.08	0.81	4.66
(% of Total ODA)	(14.3)	(1.6)	(32.5)	(12.6)	(7.8)	(7.8)
Transport Infrastructure						
Assessed Maintenance	0.3	2.8	1.5	8.6	3.0	16.2
Assessed Replacement Costs (Equivalent Annual)	2.7	8.9	11.8	16.8	15.2	54.5
Total Infrastructure Costs (Equivalent Annual)	3.0	10.8	13.3	25.4	18.2	70.7

Source: Table 2.8; Table 2.10; South Pacific Economic and Social Data Base, National Centre for Development Studies (Canberra); and World Bank (1991a).

Maintenance Impact and Accountability

2.50 Government agencies responsible for the maintenance of roads are largely insulated from the transport user cost implications of inadequate maintenance, but are faced with the need to sustain deteriorated roads with limited funds. Their funding is sourced almost entirely from aid funds and government consolidated revenue, with the scale of the latter being largely independent of road conditions. There are direct user fees in the maritime and aviation sectors, but the income from them is usually funneled to government consolidated revenue. The limited direct link between income collected by infrastructure supply agencies and the capital and recurrent funding provided to them, weakens the obligation of the agencies to justify the price and quality of their infrastructure to users. This separation of revenue and cost functions reduces more broadly the incentive for efficient development, use and maintenance of transport infrastructure. Improved accountability between agencies and their users "clients" should be established; greater autonomy and commercialization of the agencies should be introduced.

Implications for Future Planning Activities

2.51 **Need for Information Based on Conditions in the PMCs.** The current difficulty in adequately maintaining existing infrastructure results from funding constraints, management capacity, delivery limitations, and excessive past investment in projects with inadequate economic rates of return. Development of a strategy for improved maintenance requires an understanding of the cost of infrastructure to PMC Governments, to donors, and to transport users, and alternative approaches to maintenance. This, in turn, requires:

- The engineering and cost information needed for effective maintenance management.
- An understanding of the effects of inadequate maintenance and of alternative design standards on asset life and transport user costs.
- An understanding of the social and economic opportunities foregone because of deteriorated infrastructure.

2.52 An improved database and more detailed study than is available in this present study is required to specify in operational detail the best maintenance practices for transport infrastructure, and the full implications of inadequate maintenance. There is, however, sufficient evidence that the total cost of sustaining satisfactory services from the stock of warranted existing transport infrastructure can be reduced by improved basic maintenance.

D. Maintenance Funding and Cost Recovery

2.53 There is generally no hypothecation of revenue from user charges for maintenance of transport infrastructure in the five PMCs. Exceptions are in the Solomon Islands where the Port Authority retains its revenue and is responsible for development and maintenance of its assets, in Tonga where port income in excess of a designated amount may be retained by the Ports Administration Department for its own use to supplement its usual budget appropriations, and in Kiribati where income from a toll on the Bairiki to Betio causeway is retained for maintenance of the causeway.

2.54 The level and structure of user charges reflects government objectives and revenue needs to support general government activities (including social obligations) and to promote economically efficient use of transport assets. It will be rare that fees levels associated with each of these objectives will be consistent. Ideally, the pursuit of economic efficiency should take precedence as this expands scope for the pursuit of other objectives. However, the need for an assured, stable flow of funds for maintenance of transport assets is of key importance and should be given greater priority in the five PMCs as a tool of economic and infrastructure management. Statutory obligations, such as with the Solomon Islands Port Authority, are a means for promoting a change in emphasis and accountability. But improved management can also achieve much of this without new organizations. These circumstances may justify the use of formal "earmarking" of revenue from taxes on users for warranted maintenance.[33] Such modification alone is insufficient to secure optimal maintenance, and must be supported with developments in other areas, in particular institutional capacity, management and effectiveness in delivery.

2.55 There is little knowledge of the level of cost recovery in each transport subsector at present. Cost-recovery has been estimated for each mode, in each of the five PMCs, using available data on revenue, and data on infrastructure capital and maintenance costs as presented in Table 2.9. The estimates of cost-recovery are based on assessed levels of expenditure on maintenance, not actual levels. In only a few instances is current income greater than actual maintenance expenditure. In no case

is revenue sufficient to recover both maintenance and capital charges (see Table 2.13). The total cost of all existing infrastructure with actual maintenance is greater than would be the case with maintenance at the assessed level (with the possible exception of roads in Vanuatu). In addition, existing infrastructure needs to be rationalized and maintenance allocated to the highest priority assets. Therefore, levels of cost-recovery indicated below are *lower* than those that would result from rationalization, but *higher* than those that actually prevail at present.

Roads

2.56 With the exception of the toll on the Bairiki-Betio causeway in Kiribati, there are no direct charges for road use in any of the five PMCs. Road users contribute to the cost of development, maintenance and operation of the road system indirectly through vehicle registration fees, and annual vehicle and driver license fees. The fee for annual vehicle road-worthiness inspections required in some countries is considered a user charge to recoup the cost of the inspection, rather than a contribution to the cost of the road system. Import duties are usually imposed on vehicles at a higher rate than other commodities; a sales tax on vehicles in Tonga applies generally to goods. A petroleum import commission is also imposed in Tonga. These duties are economy-wide fiscal measures, and part of the overall design of each country's taxation structure; they are not normally regarded as user charges for transport infrastructure. However, they can be considered contributions to transport cost recovery, and they may be viewed as having a similar effect to equivalent user charges. An estimate has been made of the approximate scale of these duties regarded as charges, and they are identified separately (see Table 2.12). The revenue generated from them is five and a half times that from registration and license fees.

2.57 Revenue from vehicle registration and license fees, and driver license fees, is equal to 17 percent of the cost of operating the road system (including maintenance at the assessed level) in Western Samoa, but an average of only 8 percent for the five PMCs in aggregate. Even with the inclusion of all revenues from import duties on vehicles and fuel attributed to road cost recovery, revenue from road users is significantly less than that required for recovery of capital and maintenance costs. Across all PMCs, the implied level of cost recovery in the roads subsector is 34 percent (Table 2.13). Cost recovery is highest in Western Samoa (52 percent); Tonga and Vanuatu are very similar (42 percent and 44 percent, respectively), if unit maintenance costs in Vanuatu are based on Solomon Island levels (see para. 2.20 above). The higher unit road maintenance costs reported for Vanuatu would increase the maintenance expenditure for that country and reduce the level of cost-recovery (to 31 percent). Duties on road vehicles and fuel for these three countries are, on average, double the average rate of duty on other imports. It has not been possible to estimate revenue from duties in Kiribati and the Solomon Islands. In any event, duties on vehicles imported into the Solomon Islands have recently been reduced substantially, and current revenue will be much less than that indicated by historic data. About two-thirds of income in Kiribati is derived from the toll for use of the Bairiki-Betio causeway. Revenue from this source is only available for maintenance of the causeway; cost recovery for the remainder of the road system would be less than the average 8 percent estimated as shown in Table 2.13.

2.58 It is improbable that total revenue from road users can be increased sufficiently to achieve full cost-recovery, even in Tonga and Western Samoa, where implied cost recovery is relatively high. This circumstance parallels over-investment in road infrastructure, and its non-sustainability, at least at original design standards.

2.59 Two key equity issues relate to cost recovery in the land transport sector: (a) the geographical distribution of sources of revenue

Table 2.13: PACIFIC ISLANDS—TRANSPORT SECTOR COST RECOVERY, 1991 /a

	Kiribati	Solomon Islands	Tonga	Vanuatu /h	Western Samoa	Total or Average
Roads						
Income						
Registration & License Fees	0.1/f	0.2	0.2	0.5	0.5	1.4
Import Duties /b	..	..	3.2	4.7	6.4	14.3
Total	0.1	0.2	3.4	5.2	6.9	15.7
Operating Expenditure /c	0.3	2.8	1.5	8.6 [3.8]	3.0	16.2
Operating Surplus	-0.1	-2.6	1.8	-3.4 [1.8]	3.9	-0.5
Capital Charge /d	1.5	4.6	6.4	8.0	10.1	30.6
Total Surplus (Deficit)	-1.6	-7.2	-4.6	-11.4 [-6.2]	-6.3	-31.1
Cost Recovery /e	8%	3%	42%	31% [44%]	52%	34%
Marine						
Income /g	0.0	2.0	0.5	0.5	0.7	3.8
Operating Expenditure	0.1	1.4	1.2	0.9	0.7	4.2
Operating Surplus	-0.0	0.6	-0.7	-0.3	0.0	-0.4
Capital Charge	0.7	2.0	2.4	2.9	2.0	10.0
Total Surplus (Deficit)	-0.7	-1.4	-3.1	-3.2	-2.0	-10.4
Cost Recovery	5%	60%	15%	15%	26%	27%
Aviation						
Income /g	0.1	0.2	0.6	1.1	1.1	3.0
Operating Expenditure	0.1	0.5	1.1	1.3	1.1	4.1
Operating Surplus	-0.1	-0.3	-0.5	-0.1	-0.0	-1.1
Capital Charge	0.6	1.4	3.0	5.9	3.1	13.9
Total Surplus (Deficit)	-0.6	-1.8	-3.5	-6.0	-3.1	-14.9
Cost Recovery	10%	9%	14%	16%	26%	17%
Total						
Income /g	0.2	2.4	4.5	6.8	8.6	22.6
Operating Expenditure	0.5	4.7	3.9	10.7	4.8	24.5
Operating Surplus	-0.2	-2.3	-0.6	-3.9	3.8	-2.0
Capital Charge	2.7	8.0	11.8	16.8	15.2	54.5
Deficit: (US$ million)	-2.9	-10.3	-11.2	-20.7	-11.4	-56.4
(% GNP)	7%	12%	12%	14%	10%	10%
(% Government revenue)	16%	22%	37%	49%	21%	30%
(US$/capita)	41	31	109	126	67	67
Cost Recovery	7%	19%	29%	25%	43%	29%

/a In US$ million, 1991 prices.
/b Revenue from import duties on road vehicles and fuel.
/c Includes allowance for maintenance at assessed level rather than current expenditure.
/d Equivalent annual capital cost with maintenance at the assessed level.
/e Revenue as a share of the sum of the maintenance and capital replacement expenditure.
/f Includes revenue from an earmarked toll on the Bairiki-Betio causeway.
/g Income from import duties for the marine and aviation sectors is not available. Import duties in these subsectors are lower than for the road subsector.
/h The figures shown [ ] thus, represent road maintenance costs for Vanuatu, based upon unit maintenance costs, by road type, for Solomon Islands. See para. 2.22 in text for explanation.

Source: Mission estimates.

and disbursement of expenditure; and (b) the apportionment of costs and revenue by vehicle category. In relation to the first issue, it is likely that the proportion of vehicles and road use is more geographically concentrated than the replacement value of the road network. Thus, cost recovery can be expected to be higher on the main islands. This requires more detailed assessment to ensure social equity without loss of economic efficiency. In all PMCs 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 *basic reliable 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 charges and general taxes.[34] The issue of providing reliable access to small, often remote, communities also arises in maritime and aviation with small wharves and airfields. Local "ownership" and responsibility for maintenance may be more feasible in these subsectors, as the facilities are localized. However, they may still serve a wide "catchment area", involving many separate communities/villages. Cost recovery in this area needs to be considered in a much broader context. The issue of provision of basic transport requires a specification of threshold service and the alternatives for its provision. The alternatives include direct transport options (infrastructure standards and "vehicle" combinations) and indirect approaches such as the location of services as a partial substitute for transport.

2.60 The second equity issue pertains to the allocation of costs and revenue to vehicle types. Trucks (heavier axle loads) cause more damage to the road system than smaller vehicles. While registration fees are higher for trucks in most PMCs, the differential is small and makes only a minor contribution to the higher costs that trucks generally impose on the road system. Moreover, import duties on trucks are lower than those on cars, in all countries except Tonga. The urgency of this issue is lessened by the small number of large vehicles in use in most of the countries at present; most trucks are small in size (3 tonnes or less).

Marine

2.61 Data in Table 2.13 indicate that only in the Solomon Islands and Western Samoa is current revenue sufficient to meet operating costs inclusive of an increased allowance for assessed maintenance. (The data for the Solomon Islands combine the income and expenditure for the Solomon Islands Port Authority with other Government expenditure on maritime facilities.) Across the PMCs, port fees may be relatively low in some locations, however, the almost fourfold increase in revenue, associated with meeting the long-term cost of sustaining the present maritime infrastructure, indicates that there has been over-investment in PMC port infrastructure.[35] It is not likely that the five PMCs will be able to sustain all of their marine infrastructure.

Aviation

2.62 Current income would exceed operating expenditure for airport facilities with assessed maintenance only in Western Samoa. A fivefold increase in revenue is required to meet the long-term minimum cost of sustaining aviation infrastructure in the five PMCs. As with the marine sector, over-investment in aviation infrastructure is indicated, and the Governments of the five PMCs will not be able to sustain all of their aviation infrastructure from their own resources.

2.63 **User charges and levels of cost recovery should be consistent across subsectors to promote efficient choice of mode.** In the PMCs at present, modal competition is limited, but occurs for domestic transport, principally between road and marine. Therefore, user charges, in relation to costs, should be consistent between these subsectors.

E. CONCLUSIONS

2.64 **Infrastructure.** Each of the PMCs has a substantial stock of transport infrastructure. The aggregate replacement value of this stock across all PMCs is US$579 million (1991 prices) or US$685 per capita. This stock of infrastructure, has been accumulated over time, and represents a major resource for the PMCs. However, estimated assessed maintenance and replacement costs for the existing stock of transport infrastructure is US$70.7 million per annum; this amounts to 17 percent of regional aggregate GNP for the five PMCs (US$408.6 million) and over one-third of external assistance.

2.65 **Maintenance Expenditure.** Actual expenditure on maintenance is about 30 percent of that assessed to keep the existing stock in good condition. To date, considerable premature and avoidable rehabilitation has been applied to unwarranted investments, and to compensate for maintenance deficiencies. This is highly inefficient; infrastructure and user resources costs are substantially higher than necessary. Maintenance priorities needs to be set for those assets that are warranted.

2.66 **Incidence of Costs.** Aid donors provide substantial assistance for rehabilitation of transport assets and for development of new assets, primarily through grant aid. Only limited assistance is provided directly for maintenance. Governments of the PMCs must fund maintenance almost entirely from their own resources, or seek donor assistance for the rehabilitation of infrastructure let deteriorate. Undermaintenance of facilities significantly impairs domestic economic performance and growth; most of the consequences impact directly on users of the transport system and the community at large.

2.67 **Cost-Recovery and Maintenance Funding.** Across all five PMCs, for the whole transport sector (roads, marine and aviation), current total tax and fee revenues from transport users is only about 29 percent of the capital and operating cost of sustaining all existing transport infrastructure. This level would be higher with rationalization.

2.68 Targets corresponding to higher levels of cost-recovery for warranted assets need to be established, and new efficient user charges introduced on a consistent basis across subsectors. An initial target should be to cover warranted maintenance costs from user charges; this requires only modest increases in revenue in the marine and aviation sectors.

2.69 There is merit in the provision of direct external grant support for maintenance activities. This involves the risk of weakening rationalization of existing infrastructure. It therefore needs to be matched by commitments by Governments to the funding of maintenance and a timetable for cost recovery.

2.70 **Rationalization of Infrastructure and Justified Maintenance.** Major changes are necessary in transport infrastructure management. First, there is an urgent need for PMCs to proceed with *a program of rationalization.* This rationalization should be undertaken systematically by establishing *priorities* for maintenance based upon explicit evaluation of the economic and social merit of individual infrastructure facilities. Second, existing infrastructure should be subjected to stringent economic/social evaluation; reconstruction and *new investment should not be undertaken* unless the economic/social justification is demonstrably strong. Third, PMCs need to *increase mobilization of their own domestic resources to maintain the high priority assets.*

CHAPTER 3
MAINTENANCE DEVELOPMENT

A. Components of a Maintenance System

3.1 A basic reappraisal is required of the manner in which each PMC manages its transport infrastructure assets, and the level of funding which is applied to their maintenance. A key part of this reappraisal is assessment of all substantial existing infrastructure, and identification of those assets which warrant maintenance and are sustainable. Once this is achieved, it is important to direct attention to the effective provision of maintenance for warranted assets. In this Chapter attention is focused on this latter task, and specifically on the organization of an effective maintenance system.

3.2 There are three main components of a well designed maintenance system:

- management
- finance
- delivery

The roles of these components in the provision of maintenance are illustrated in Figure 3.1.

3.3 The *Management component* provides the strategic and operational decisionmaking framework to maintain the transport system in an effective condition. It comprises a data base containing essential information on the operating condition of the stock of assets, and current and forecasted demand for use of those assets. Its function is to produce priority programs and estimated costs of current and projected maintenance and rehabilitation needs.

3.4 The *Finance component* provides information on current levels of funding allocations and/or revenue which can be applied to the maintenance function, and the options available to change funding levels. Information from the finance component determines the level at which maintenance and rehabilitation needs can be satisfied, and the most effective maintenance strategy (including standards) conditional on the feasible levels of funding.

3.5 The *Delivery component* contains the mechanisms through which maintenance services are provided. It involves the assignment of maintenance responsibility and the means of executing the required maintenance effort, including the private sector.

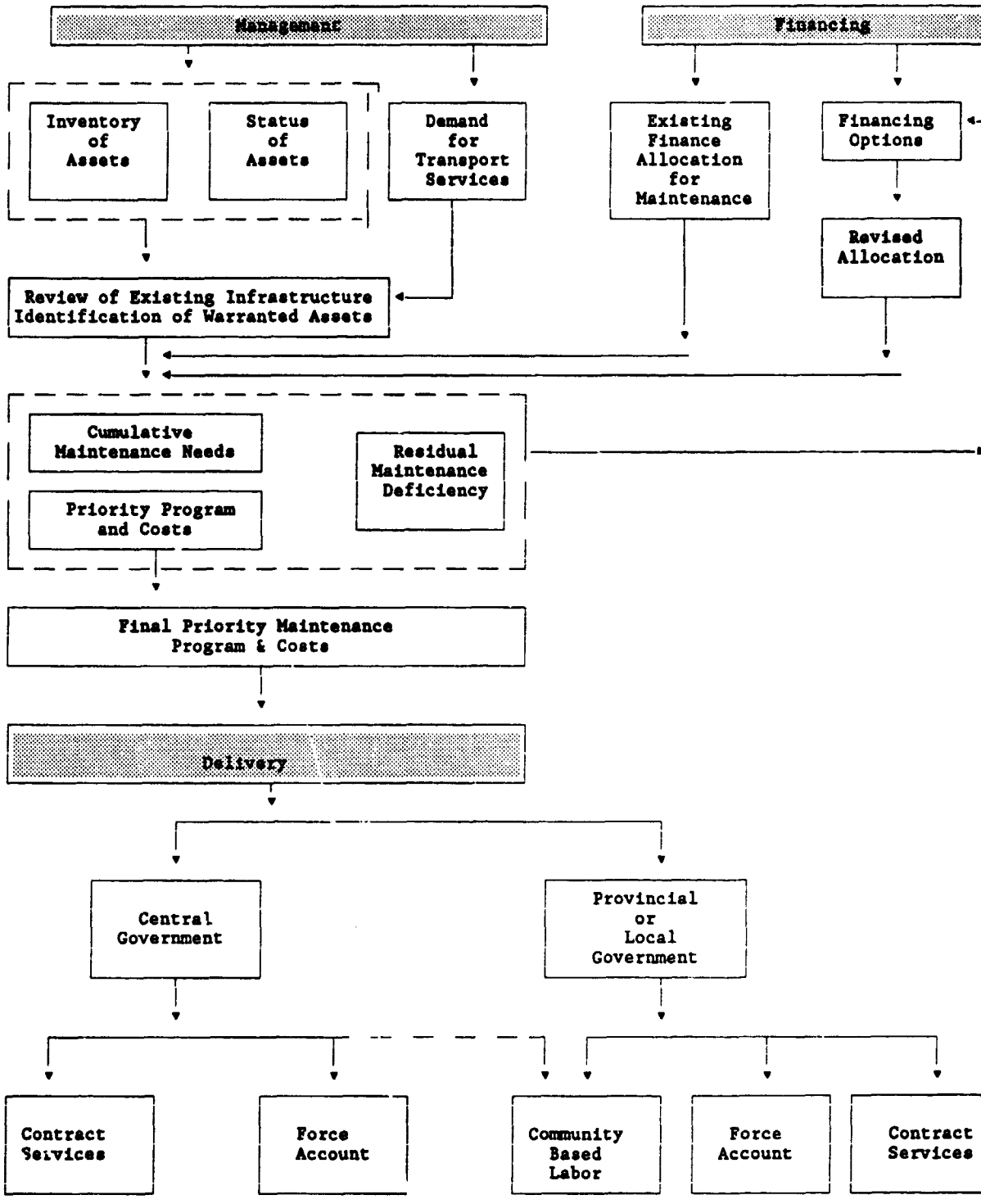
3.6 These components are addressed in turn below.

B. Institutional Development

Management Information

3.7 The development, implementation and ongoing maintenance of decision-driven management information is a fundamental requirement for effective and efficient management of a country's transport infrastructure. Such information needs to be tailored to each PMC, the nature of its maintenance task, and the institutional, technical, managerial and financial constraints.

Figure 3.1: MANAGEMENT, FINANCE AND DELIVERY ROLES FOR MAINTENANCE



3.8 At present there is little information which can be used to understand and resolve the problems of maintenance and rehabilitation of infrastructure associated with the road, maritime and aviation modes in each PMC's transport sector. For example, only a rudimentary inventory currently exists for the various transport agencies and departments in each PMC.[36] The capacity to develop a programmed approach to maintenance, from which the financial and institutional requirements can be derived, is entirely lacking.

3.9 In these circumstances, ministries are not able to advise Governments adequately of maintenance priorities and the efficient level of funding for maintenance and rehabilitation. Neither are they in a position to quantify the consequential effects of lesser budgetary support to maintenance, in order that a more rational consideration might be made by Governments of the allocation of its scarce budget resources.

3.10 Government departments and agencies in some PMCs are subject to problems arising from frequent changes in executive and professional personnel, particularly in the relatively large number of expatriates employed through bilateral staffing assistance schemes (see Box 3.1). The development of consistent management policies and stable organizational practice and priorities is limited by these conditions. Management information arrangements need to survive frequent changes at management level, and be tailored to the limited resources and needs of the PMCs. External technical assistance needs to be provided in a way that supports this approach.

3.11 If the institutional strengthening needs of organizations are to be addressed, changes will be required in the emphasis of technical assistance, and in the selection of personnel through staff assistance schemes. Effort needs to be directed to the development of organizational structures, systems and procedures which support the *effective management* of development of the transport system.[37]

Box 3.1: Continuity of Organizational Arrangements

Because of the almost exclusive reliance on public sector force account operations (particularly in the roads subsector) the available professional and management resources have been directed to the administration and management of construction and maintenance workforce and the design and management of projects. The perceived priority for staffing assistance has been in these areas and selection of expatriate contract officers has been based on these requirements.

The size of the day-to-day workloads coupled with the short-term length of the contract (normally 2 years), and the varying backgrounds and experience of contract officers, results in little opportunity or motivation to implement or maintain management arrangements designed to provide an ongoing and long term corporate approach. Arrangements which are initiated tend, therefore, to be designed to meet immediate needs and to be based on selective experience. They are vulnerable to changes in senior management personnel.

3.12 **Size, Government Responsibilities and Management Development.** The provision of sound policy advice on transport matters, and the management of the system, are primary roles of departments. Skilled management personnel are scarce, although the requirements for maintenance management are small. The alternatives for securing management capacity range from training indigenous staff to using expatriates—and phasing over time from the latter to the former via counterpart training. While the cost-effectiveness of these alternatives needs to be examined, the question turns as much on commitment to maintenance management as a priority activity as availability of personnel.

Financing System

3.13 In all PMCs, existing financial arrangements for the maintenance of road and aviation transport infrastructure assets are

unsatisfactory; in several PMCs the same applies to marine infrastructure. The level of financial provision is low and unrelated to an assessment of requirements. The stock and standards of existing infrastructure are excessive and non-sustainable, yet the tight maintenance budgets have not resulted in essential/priority maintenance requirements being identified and funded. Agencies are unable to establish warranted maintenance financing needs nor the economic and financial implications of current or alternative funding levels.

3.14 Cost recovery for all modes is low in all PMCs. Yet despite maintenance needs, little attention has been given, or incentives provided, to agencies to increase user charges.

3.15 Financial and accounting systems within road, aviation, and maritime transport organizations do not provide comparability between budget allocations and actual costs of program delivery. The present line budgeting, does not assist monitoring and cost control.

Maintenance Delivery Systems

3.16 A number of options are available to Governments for the way maintenance services are provided "on the ground". The cost-effective choice of approach relates to departmental organization and responsibilities, system and training needs, and financing methods. There are two main dimensions which define options for delivery: assignment of responsibility by level of government, and assignment of tasks between the public and private sectors. The primary consideration is the *division of responsibility* for asset maintenance between the national government and, where applicable, provincial governments. Government policy in several PMCs is to devolve responsibilities for the maintenance of local transport infrastructure (roads, wharves, airfields) to provincial administrations. In these countries, the process of devolution has been slow and constrained by the lack of financial, institutional and technical resources and skills within provincial governments. It appears to have resulted in a situation where the responsibility for some transport infrastructure (roads and wharves) is ill defined. Given the small size of the PMCs, the scarcity of supervision and semi-skilled personnel, and the lumpiness of mechanized maintenance, the viability of effective provincial local maintenance, in excess of routine tasks, is highly questionable.

3.17 The second major policy consideration is the extent to which *private sector* capabilities can be developed and used in the delivery of maintenance services through, for example, *period maintenance contracts*. The use of scarce public sector professional and management resources in the day-to-day organization, direction and supervision of maintenance activities is a significant misallocation. Those resources can be more effectively employed in the programming, scheduling, budget allocation and cost control functions associated with the overall management of maintenance needs. The relative efficiency of using the domestic private sector hinges to a large extent on scale; effective completion needs to prevail among private contractors. Where the domestic private sector is limited, overseas private contracts can be used for major maintenance and rehabilitation; in this case, substantial fixed costs, such as plant and equipment relocation, are involved and the contract period needs to be adequate, say three years. Opportunities exist to use *community based* resources for undertaking routine, labor intensive, maintenance, as has already been initiated in some PMCs. This work could be under the direction of either central or (where it exists) provincial government. Recognition of these requirements has important implications for the targeting, and nature, of technical assistance, training, and organizational strengthening in both the public and private sectors.

C. Implementation Requirements

3.18 In this section conclusions and recommendations concerning maintenance of infrastructure are considered under four headings: management, finance, delivery and external assistance.

Management

3.19 Improved management arrangements are needed for effective management of infrastructure. These arrangements must be tailored in parallel with the development of managerial and administrative capacities in government departments/agencies.

3.20 Given the general consistency of needs in the PMCs, and their similar resource limitations, as far as possible, common approaches should be developed and implemented in each PMC. This would aid efficiency in the development of core capacities, and internalize economies in the provision of support for their preservation and extension, as required. It would also provide a standard base against which to assess the requirements for donor assistance in the management of transport infrastructure in the region. In this regard, a "pilot" management maintenance system should be developed, tested, and its adaptability and transferability assessed.

3.21 In subsectors (such as aviation and maritime) where management functions include revenue raising through direct user charges for services provided, management arrangements should be commercially oriented, and be supported by cost center accounting. This does not necessarily require the creation of government authorities, but will require the setting of commercial performance objectives and accountability procedures by Government. For roads, expenditure, service standards, traffic volumes, and indirect user charges should be reported by program to provide basic management information for monitoring cost recovery and planning.

3.22 The primary role of government organizations should be to meet needs for strategic planning and overall operational management which support efficiency of the transport system. Priority should be given to applying scarce managerial and professional resources in these areas, rather than to day-to-day construction and maintenance implementation tasks.

Finance

3.23 A major review of maintenance recurrent budget funding requirements is necessary, based upon those assets identified as warranted. This review must be undertaken after the recommended program of reassessment and rationalization of existing infrastructure.

3.24 The operation and maintenance costs of all proposed new transport infrastructure investments should be explicitly identified as part of all project assessments. Provision should be made in user charges, and in recurrent budgets, for the net increases (or reductions) resulting from accepted projects.

3.25 Clear financial targets should be set for cost recovery to cover maintenance and asset replacement. The mix of direct user charges, taxes and duties for each mode to achieve these targets should be established.

3.26 Funding of a base level of maintenance expenditure through hypothecation of specified revenues should be assessed where there is persistent under-funding of warranted maintenance from recurrent budgets. Although "ear-marking" is not a first-best (efficient) approach, since resources should be kept fungible for allocation to their overall best use, existing financing allocations and their stability are far from optimal. Under these imperfect circumstances, "ear-marking" can ensure a consistent base line level of funding, circumscribe opportunities for ad hoc redirection of resources to non-programmed purposes, and

provide a demonstrable commitment for attracting donor assistance with maintenance.

3.27 Financial and accounting systems within transport organizations should be designed to provide information on the actual costs of program delivery. The introduction of very basic program budgeting systems should be considered in place of, or as an adjunct to, the present line budgeting systems.

Delivery

3.28 If devolution does proceed in some PMCs, there should be clear identification of the assets to be transferred, the financial arrangements for their transfer, the plans for strengthening provincial agencies, and the time frame within which transfer is to occur. Appropriate arrangements may include the use of agency agreements for the maintenance of identified assets, as an initial step to the full transfer of responsibilities. Responsibilities should not be transferred without the concurrent implementation of these activities.

3.29 Given the small size of the PMCs, and the scarcity of management, technical skills, and other resources in the central government (and in many PMCs, in the private sector as well), devolution of responsibility for such areas as maintenance should be seriously reconsidered.

3.30 The recommended emphasis on the higher level management functions in government transport organizations goes in hand with government placing increased reliance on the private sector (or local community) to provide maintenance services. Three main options should be considered, depending on the task and available capacities: domestic private contractors (where mechanized equipment is required, for example, grading), community-based services, (low skilled labor routine operations) and overseas organizations (medium-term management and rehabilitation). Given the vulnerability of community-based operations to high cost and unreliability, payment for the work should be performance based for each community area. In reducing public sector force account operations, Governments will need to enunciate maintenance policy and intended arrangements, establish stable funding for maintenance activities, develop well designed contracting procedures, and be able to open-up a sufficient size of activities to attract effective competition among domestic (or external) private contractors. Transition to contract-based maintenance will need to be phased-in over time, commensurate with the growth in domestic private and/or overseas involvement.

External Assistance Implications

3.31 External assistance for transport infrastructure, in general, should be redirected from new investment to the maintenance and rehabilitation of *existing priority assets*. This will improve the productivity of assistance, and lower total transport system costs.

3.32 There is a need for donors to review policies regarding assistance for asset maintenance,[28] in parallel with efforts by PMC Governments to rationalize their existing stocks of infrastructure, and to develop effective maintenance practices. Incentive packages for recipient governments (such as co-pay or matching arrangements) should be designed, tying assistance for maintenance funding to the development of improved management, finance, and effective delivery of asset maintenance.

3.33 Present approaches to technical assistance, staff support and training, within public service organizations responsible for transport infrastructure, require re-examination. The present priorities in training programs appear to be directed to the development of professional, technical and in-the-field work skills to support the force account operations of Departments. A reassessment is required of these priorities, with emphasis on management, planning, information systems operation, and contract management (including specifications, procurement and supervision). Stability and

continuity in organization development, managerial arrangements, training, information processing and work practices, are crucial in establishing effective organizations. "Twinning" arrangements[39] between competent mature overseas organizations in neighboring countries, with training experience, and similar responsibilities to PMC public sector road, port and aviation agencies, should be adopted. In addition, PMCs should be supported in the establishment and/or strengthening of regional road, maritime and aviation infrastructure professional associations, to enable exchange of views and experience on common problems. The small size of the potential membership should, on balance, assist their usefulness. Several of these approaches have been successfully adopted by national airlines in the South Pacific region. In addition, PMCs involvement and representation with well established Pacific, Asian and international organizations should be expanded. For example, PMC participation through area groups in such organizations as the Road Engineering Association of Asia and Australasia (REAAA), the Permanent International Association of Road Congresses (PIARC), International Civil Aviation Organization (ICAO) and others should be supported. To some extent transport agencies of the PMCs do participate already in these associations, however, a more proactive role should be taken.

3.34 Donor assistance for establishing major plant workshops and road maintenance units within road authorities, and the direct provision of plant and equipment, should be reviewed. Ways should be devised to provide assistance to local private enterprise to develop the financial capabilities, business management, and technical skills necessary to take up maintenance and related functions. Similarly, for those PMCs who insist on pushing ahead with devolution of maintenance, training schemes will need to be available to provincial government and community based maintenance units.

D. Action Plan

3.35 An action plan for each PMC Government to develop a program for maintenance management should include the following core steps:

(1) Develop a Transport Infrastructure Maintenance Strategy

- Reach agreement with donors on key elements of a maintenance strategy covering management, finance and delivery, based on key criteria (including economic value and social accessibility) which enable facilities to be assigned a priority;

- Seek joint endorsement with donors of guiding principles for maintenance:

(a) Maintenance, rehabilitation and reconstruction of existing infrastructure should be limited to those assets for which they are warranted on a priority basis.

(b) External assistance should be conditional on an agreed timetable of progress on improvements in management, finance and delivery arrangements for asset maintenance.

(c) New investment in infrastructure should only be undertaken if its economic merit exceeds identified priorities for maintenance and rehabilitation of *existing* assets.

(d) Primary financial responsibility for the maintenance of infrastructure should be assumed by each PMC, and be geared to an agreed timetable of cost recovery targets.

(2) Establish a Transport Infrastructure Maintenance Management Information Base

- Identify key data needs tied to priority management tasks.

- Keep data collection to crucial core needs and commensurate with institutional capacity.

(3) **Review Public Sector Management Responsibilities and Expand Opportunities for Participation of Private Sector**

- Establish requirements, including contract and work specifications, and a work program, to facilitate transition from force account to contract and community-based private sector arrangements.

- Identify areas most attractive for competitive bidding.

(4) **Review Maintenance Funding Arrangements**

- Assess alternative direct and indirect user charges for revenue potential and fiscal efficiency.

- Establish feasible cost recovery targets by mode.

- Examine alternative financial arrangements with donors for joint capital/maintenance expenditure programs.

Endnotes

1 These surveys are presented in Volume Two of this report.

2. Details of the maintenance situation in each country are provided in an Annex to each country sector survey.

3. Fiji has not been included in this present examination because of its special characteristics: Fiji is considerably larger than the other PMCs, and Fiji is currently addressing maintenance needs. Nevertheless, the issues considered in the other five PMCs are similar to those in Fiji, and many of the general findings for these countries are transferable.

4. Costing of the organizational and personnel components of implementing the strategy is not developed in detail, although orders of magnitude are indicated. This task is important and should be addressed in the design and selection of a specific implementation plan to assess cost-effectiveness of alternative approaches, and to ensure that positive net benefits are achieved.

5. Difficult pressures arise in the use of external assistance resources to maintain infrastructure. Premature and higher cost rehabilitation and reconstruction are often substituted for effective and systematic routine and periodic maintenance. Aspects of external financing, in effect, foster a form of "moral hazard" for governments, that is, readily available support for major rehabilitation reduces (and may eliminate) the willingness of PMC Governments to commit an adequate share of their own resources to proper maintenance of their assets.

6. Substantial resources have been applied by the Bank and participating governments (especially since 1971) to the collection and analysis of road and vehicle operating cost data, culminating in the Highway Design and Maintenance Standards Model (World Bank, 1987) and the companion Expenditure Budgeting Model (World Bank, 1987). The effects of inappropriate and/or under expenditure on proper maintenance of roads on total road transport costs can be quantified, provided the required data are available and the application is within the calibrated range of the model.

7. Choice of a specific implementation strategy will need to be based on an assessment of the relative costs of alternative organizational arrangements. The most cost effective approach (for example, training indigenous staff and/or use of expatriates) will turn on current organizational arrangements, the scarcity of skilled local management, and the availability and long-term costs of training and expatriate personnel. Nevertheless, in all PMCs the personnel requirements should be modest; substantial net increase in public service employees is *not* needed. For the basic tasks of establishing and maintaining an inventory of facilities, their condition and use status, functional expenditures, and the preparation of regular maintenance reports, staff requirements are modest; order of 1-2 semi-professionals for each mode should be adequate.

8. Data collection and processing is costly, especially with the scarce professional and management skills available in the PMCs. The value of additional information needs to be weighed against the additional costs. At the same time the reliability/accuracy of data should be indicated.

9. The density of roads (length in relation to land area) should be interpreted with caution as the proportion of land which is inhabited and/or used in productive activity varies significantly across the countries. In addition, in the PMCs, a majority of population typically resides in small villages around the coast (circumference) of the islands. This geographical form tends to increase road length per capita in these countries.

10. This ratio is low in the Solomon Islands, reflecting the export of timber from private and informal facilities (no inventory or replacement values are readily available for private transport infrastructure), and possibly relatively efficient use of port infrastructure. The high ratio of marine assets to trade in Tonga results from the particularly large port investment at Nuku'alofa. The ratio is marginally higher in Vanuatu, and is attributable there to two international ports, one at Santo, which is primarily used for exports, and one at Port Vila which is used mostly for imports.

11. The ratio of passenger movements to GNP in Western Samoa is relatively high as a result of the large social travel involving American Samoa, and links with Western Samoans resident in the USA, New Zealand and Australia. Nationals from Tonga in these three countries also contribute to the similarly high ratio for Tonga. The tourist industry in Vanuatu has recovered rapidly in recent years and the ratio of passenger movements to GNP is expected to become higher than indicated in Table 2.4. International aviation is less important to the economies of the Solomon Islands and Kiribati. Domestic aviation is relatively more important in the Solomon Islands and Vanuatu.

12. This is exacerbated by the exclusion of two deteriorated (and unlikely to be redeveloped) facilities from the inventory of marine assets in Western Samoa.

13. The increase in infrastructure with GNP across the PMCs is consistent with the normal observation that transport (and complementary infrastructure) services are income elastic (for example, taking a cross-sectoral view of the PMC region, if gross national product increases by 10 percent, transport activity increases by more than 10 percent, say 12 percent), where existing infrastructure capacity is warranted and satisfactorily utilized.

14. Where no data exist, estimates are based on evidence from discussions and limited field inspections. In some cases there is insufficient information to permit even broad estimates to be prepared.

15. The estimates are based on assembled inventories which are likely to omit some infrastructure (especially in the marine subsector). Therefore the costs of rehabilitation of all existing infrastructure is likely to exceed these estimates.

16. Strictly, the overall optimal maintenance level should be jointly determined with the corresponding optimal design standard; it is associated with the minimum total system costs of construction, maintenance and user costs (under prescribed user charge and vehicle/vessel/aircraft size regimes). In this study the focus is on maintenance per se; the question of "best" standards, vehicle sizes and compliance are important ones in the PMCs, but are set aside here. It might be noted that it is not immediately transparent in the environment of the PMCs, whether undermaintenance, if persistent, should be matched by higher or lower standards relative to those associated with assessed effective maintenance. Such choices should be made based on total transport system costs, i.e., infrastructure plus user/operator costs. For roads, with the low traffic volumes in the PMCs, the small and uncertain benefits, and the limited implementation effectiveness, it is likely to be safer to keep to lower (i.e., unpaved) standards. This issue is discussed more below.

17. The method used to determine assessed maintenance expenditure of road, marine and aviation assets should normally be applied to the replacement cost of assets net of once-off costs that are incurred for green field situations, such as land acquisition and site preparation. Data limitations do not permit such costs to be treated systematically in the present analysis. Land acquisition costs are generally not included in the replacement value of assets. The inclusion of costs such as site preparation are unlikely to result in substantial distortion, and needs to be seen in the context of order of accuracy of the existing data and analysis.

18. Derivation of these costs for each country, including vehicle operating costs for road use, is described in the Maintenance Annex to each Country Sector Survey presented in Volume Two.

19. The Solomon Islands has an environment (terrain, soil, weather and island geography) closest (among the PMCs) to Vanuatu, and hence provides the most suitable data at hand for reestimating road maintenance costs for Vanuatu. The application of unit maintenance costs from the Solomon Islands to Vanuatu reduces average road maintenance costs in Vanuatu to 44 percent of their reported level.

20. In thirty-four Sub-Saharan African countries (over the period 1986-88) road maintenance expenditure was only about 0.2 percent of GNP; see World Bank and Economic Commission for Africa (1990).

21. The total length of *sealed* road in Kiribati, at 36 km, is very small in absolute terms, and relative to the other four PMCs. This illustrates the problem of the different mix of road types (sealed vs. non-sealed) across the five PMCs.

22. The variation in the ratio of assessed maintenance to asset replacement value for marine assets in the PMCs is attributable to the different composition of marine assets, in particular the share of asset value attributable to equipment, for which maintenance costs are a much higher proportion of asset value, than for fixed assets (wharves, jetties, and buildings).

23. Because of limitations in the quality and unknown reliability of data, aggregate data for the five PMCs may balance some of the irregularities in data for individual countries, and thus be a better basis for conclusions. Nevertheless, inter-country comparisons are made where clear differences are evident. It should be noted that these findings are suggested as indicative; they are based on a limited database and are hampered by the uncertain applicability of relationships, such as those in the roads subsector, between maintenance and life-cycle costs, derived elsewhere for activity levels (such as traffic volumes) considerably higher than generally occurs in the PMCs. Thus, for example, the same economic lives for infrastructure under current and assessed maintenance expenditure have been adopted for all countries. It can be expected that the extension in economic life in moving from existing to assessed levels of maintenance expenditure would be less where current maintenance is a higher proportion of assessed maintenance (for example, Kiribati).

24. Estimates of changes in total transport system costs, including user costs, are only made for roads; for marine and aviation infrastructure costs alone are considered.

25. The only exception is in the road sector in Vanuatu where the data suggest that increased expenditure on maintenance exceeds the reduced equivalent annual capital cost of infrastructure. This anomaly stems from the particularly high maintenance costs reported in Vanuatu; use of unit maintenance costs levels established for the Solomon Islands would reduce the incremental annual cost of road maintenance in Vanuatu to US$3.1 million; the ratio of the saving in the equivalent annual capital cost to the incremental annual cost of improved maintenance rises from 1.0 to 1.4, which is similar to the ratio of 1.5 for the Solomon Islands.

26. The lower ratio may be attributable in part to adoption of a uniform differential in the economic life of infrastructure with current and improved maintenance; the lower proportion of assessed maintenance currently expended in these two countries would justify the use of a lesser differential in the economic life of road assets with current and good maintenance for Kiribati than the other countries. This would result in a lesser saving in the equivalent annual capital cost of infrastructure in Kiribati, and a lower benefit ratio than the stated value of 6.4. However, even with such an adjustment, the benefit-cost ratio for increased road maintenance in the Solomon Islands and Vanuatu are still likely to be lower than for the other PMCs. This is in contrast to the *larger* gap between actual and assessed road maintenance in these countries (35 percent in Solomon Islands and 17 percent in Vanuatu). Since it would be expected that the larger the gap, the higher the incremental benefit cost ratio, this finding reinforces the view that there is, in aggregate, over-investment in these countries; traffic volumes appear low in Solomon Islands and road construction and maintenance costs high in Vanuatu.

27. This suggests the need for better information on the road maintenance—(re)construction cost trade off in conditions where road deterioration is dominated by the physical environment (rainfall, soil conditions and so on) and not traffic loads and volume. In addition, low traffic volumes also raise the question of appropriate treatment of user benefits; for low volume roads basic access at acceptable reliability may dominate conventional user cost savings (predominantly in vehicle operating costs); valuation of reliable access by willingness to pay poses different empirical problems in the PMCs where surrogates such as land value differentials typically cannot be examined.

28. Transport user costs savings from improved maintenance imply that the level of warranted (optimal) maintenance is higher than would be the case if infrastructure capital and maintenance costs alone were considered. (See Box 2.1).

29. A further source of benefit from improved maintenance may stem from lowering user costs on feeder transport links. This may have a significant effect on the incentive to invest in crops and may increase producer surplus. However, reductions in the total cost of delivery of agricultural output overseas may be small unless there are avoidable constraints elsewhere. This requires analysis of the link between transport costs (including maintenance and user costs) and marginal agricultural production.

30. The estimates of vehicle operating costs in the PMCs should be regarded as indicative. Total vehicle operating costs for travel on sealed roads, in good condition 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 indices and relationships in the RTIM model. These computations are set out in the Maintenance Annex to each country sector survey presented in Volume Two. Variations of vehicle operating costs with road roughness are estimated for fuel oil, tires and maintenance. The resultant vehicle operating costs are summarized in Box 2.1. Traffic volumes are low in all PMCs and representative volumes are used in estimating the total vehicle operating cost savings. More detailed work is needed to refine these estimates.

31. Examples include failure to mow airfield grass, at a cost of US$220 per month, and the lack of a replacement windsock, with a value of US$75. The economic loss associated with a foregone (or deferred) flight, due to airfield closure, can be substantial. For example, in the Solomon Islands, the air fare for a one-hour flight is US$51 greater than the tariff for the alternative 24-hour ship journey. The (minimum) premium which air travellers are prepared to pay over the fare for sea travel is high in proportion to the cost of some critical elements of airfield maintenance.

32. The annual net savings in life cycle costs estimated here far exceed the guideline figure of 5-15 percent savings in annual maintenance budgets that can be expected with the adoption of effective information data bases (for roads) suggested in World Bank (1989). Even if savings are limited to 10 percent of annual maintenance, the expected net gains from warranted maintenance become of the order of US$300,000 (roads), US$65,000 (marine) and US$50,000 (aviation). The fixed costs of information system development, implementation and initial support for the small size PMCs can be expected to be in the range of US$500,000 (or $35,000 p.a.) for roads, and US$150,000 (or US$10,500 p.a.) for ports and aviation. It follows that conservative estimates of the upper limit of justifiable additional annual personnel costs are US$265,000 for roads, US$54,500 for marine, and US$39,500 for aviation. These limits should be well within both the economic cost, and financial salary levels, for two additional local personnel.

33. The desirability of earmarking is open to question. It ensures a stable source of finance but may jeopardize supplementary government funding when expenditures in excess of the prevailing (earmarked) fund balance are warranted.

34. The structure of road user charges and other fees/taxes for road cost recovery is more complex in such situations. On benefit taxation principles, some form of property tax would be suitable, however, its practical application in the PMCs is very limited.

35. Data on revenue from duty on the import of marine and aviation equipment and fuel are not readily available. The revenue is likely to be low, however, since vessels and aircraft, and fuel used for aviation and for interisland shipping, are usually subject to lower (sometimes zero) rates of duty than apply to the road subsector.

36. As noted earlier, there are important exceptions, for example, the Solomon Islands Port Authority.

37. These needs involve only small personnel requirements (of the order of 2 semi-professional staff in each modal area). The provision of professional and technical support for the day-to-day delivery of construction and maintenance services is important, and needs to complement the management task. However, given existing institutional weaknesses, delivery needs should be considered a secondary priority.

38. Donor support for recurrent cost financing, including maintenance, has been advanced under certain circumstances, recently. See AIDAB and MERTNZ (1991).

39. See World Bank (1990).

PART III

COMPARISON OF REGIONAL TRANSPORT COSTS

CHAPTER 1
INTRODUCTION

A. Background and Objectives

1.1 As described in Part I (Overview) above, the island States of the South Pacific region are very small and widely dispersed; they are also remote from their export markets and their sources of imports. It is often claimed that they face inordinately high international transport costs which constrain their economic performance and growth.

1.2 This Part III provides a comparative analysis of the costs and levels of service for sea and air transport to and from the six PMCs and Papua New Guinea (PNG).[1] The objective of this analysis is to assess how transport costs between the PMCs and their major trading partners (including major sources of tourists) are affected by the remoteness of their regional location and the characteristics of their transport markets. The underlying hypothesis to be tested is that the PMCs experience intrinsically higher international transport costs compared to similar island States in other regions.

1.3 **Remoteness, Accessibility and Transport Cost Structures.** The notion of remoteness is not easy to operationally define. A large distance from neighboring countries is not sufficient. For example, Europe is some 4,000 miles from North America, but neither continent is generally viewed as remote. On the other hand, there are islands (for example, Chatham Islands and the Seychelles) reasonably close to their adjacent mainland areas (New Zealand and East Africa) which adequately reflect the notion of remoteness. For the purposes of this study, remoteness is more usefully thought of in terms of *accessibility* (of the PMCs) to export and import markets. On this basis, the distance to, and size of, these markets become key factors. At the same time, remoteness and accessibility hinge on the cost, time and ease of interaction, especially trade. It follows that generalized transport costs best reflect these concerns. In particular it is the set of basic factors that shape the structure, and affect the level, of transport costs to countries, such as the PMCs, that best capture the issue of remoteness.

1.4 **Factors Affecting Transport Costs.** Numerous factors influence the level of transport costs and service. In the context of the PMCs, some of the most important are:

- distances to and from major markets;
- route networks;
- volume of trade (freight and passenger movements);
- transport market structure and regulation;
- the efficiency of infrastructure;
- directional imbalances in traffic
- transhipment
- institutional arrangements and constraints; and
- service frequencies and routes.

1.5 Several of these factors are interrelated; notably traffic volumes and levels of service interact through vehicle scale economies (ship and aircraft size); low volumes of cargoes and

passenger movements involve a higher level of unit transport costs, but this level can be lowered by reducing service frequency and increasing vehicle size.

1.6 The principal independent factors that can be expected to shape transport costs for the PMCs are distance, volume of traffic and, especially for shipping, route and voyage networks. Therefore, the analysis of transport costs for shipping and air services relevant to the PMCs, is conducted with emphasis on these factors.

B. APPROACH

1.7 The approach to determining whether the PMCs experience "abnormal" transport costs involves testing a series of hypotheses relating transport costs to the volume of traffic and distance carried, using data that are readily available.

1.8 The associated analysis addresses two key questions:

(a) Are transport costs to and from the PMCs comparable with those to and from other small Island States, and

(b) Are they comparable with those to and from other countries?

1.9 The assessment covers both sea freight transport and air passenger transport. First, transport tariffs and services to/from the PMCs are compared with those for a set of similar "comparator" island countries. Next, transport costs to/from all the island countries are compared with transport costs to/from a larger sample of countries and regions.

1.10 Different approaches are adopted for the shipping and aviation subsectors because of their different operational and institutional structures. Sea freight rates are assessed using a shipping cost model, supplemented by statistical analysis of actual rates. Air fares are assessed by a statistical comparison of international air fares for the PMCs with air fares on similar routes in the Pacific region.

Comparator Countries

1.11 Comparator countries were selected on the basis of their similar size and geographic characteristics to the PMCs. Two groups of comparator islands are used:

(a) Non PMC islands in the Pacific Ocean (see Figure 1.1):

- Society Islands (Tahiti)
- New Caledonia

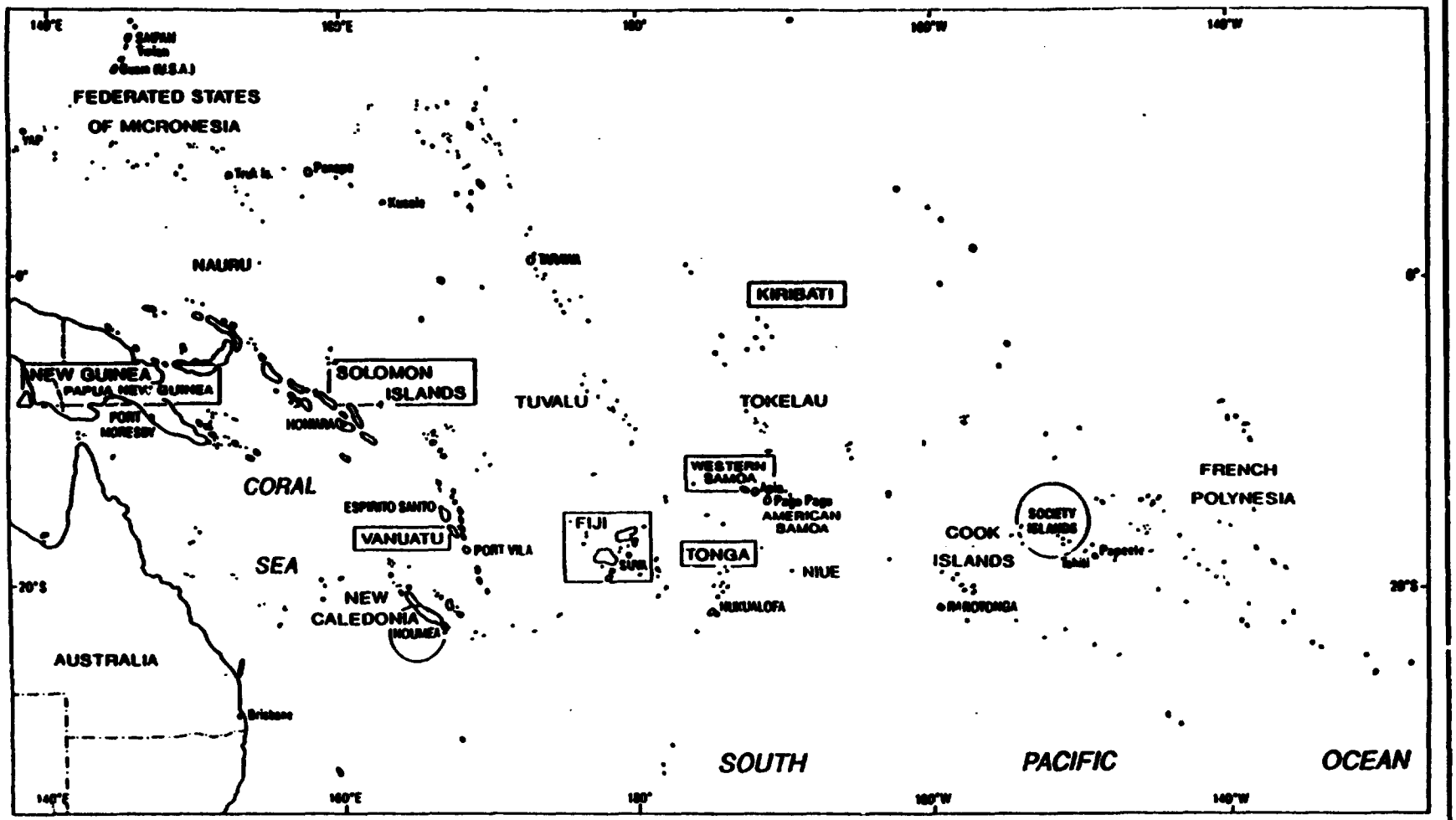
(b) Similar islands in the Indian Ocean (see Figure 1.2):

- Mauritius
- Réunion
- Seychelles
- Christmas Island
- Cocos Islands
- Comoro Islands
- Maldives

1.12 The two Pacific Island comparator countries are administered and significantly supported by France and were included, in part, to determine whether this resulted in materially different transport conditions. In the Indian Ocean, Mauritius and Réunion have similarity in their economies to Fiji. Christmas Island and Cocos Islands are supported by Australia, and are generally regarded as remote. The Seychelles, Comoro Islands and the Maldives have geographic and economic similarity to the PMCs.

1.13 Socio-economic characteristics and trade flows for the PMCs, and comparator countries, are presented in Annex 1, in Table 1 and Table 2, respectively. The PMCs are highly

Figure 1.1: PACIFIC OCEAN ISLANDS—PMCS AND COMPARATORS



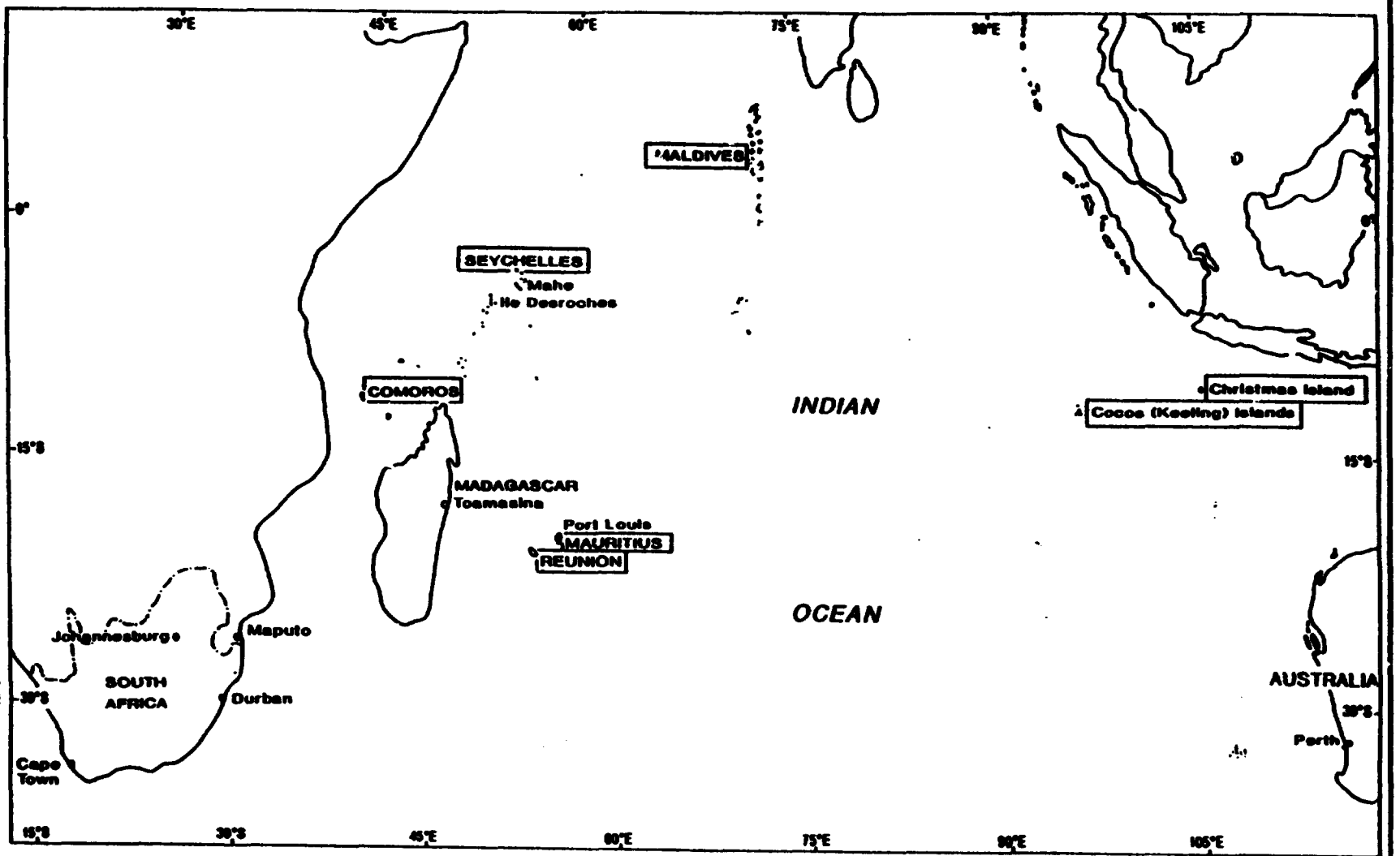
Pacific Member Countries (PMCs)

Comparator Islands

dependent on imports for their domestic requirements and primary commodities dominate exports (for example, sugar, copra and coconut oil). As a result, the majority of freight flows are imbalanced; flows to the islands dominate, are non-bulk, and containerized; flows from the PMCs are primarily bulk. The major trade partners of the PMCs, and comparator countries, are shown in Annex 1, Table 3 and Table 4, respectively. With the exception of Fiji and Vanuatu, the tourism industries in the PMCs are relatively underdeveloped. The major tourist movements, for the PMCs and comparator countries, are shown in Annex 1, in Table 5 and Table 6, respectively.

1.14 **Structure of the Assessment.** The assessment of regional transport costs is presented below, first for shipping (Chapter 2), and then for aviation (Chapter 3). In each case a description of services, for the PMCs and comparator countries, precedes the analysis of costs and rates. (Descriptions of the various sources of data used in these assessments are provided in Annexes 1, 3 and 4).

Figure 1.2: INDIAN OCEAN COMPARATAORS ISLANDS



Indinan Ocean Comparator Islands

CHAPTER 2
ASSESSMENT OF SHIPPING SERVICES

A. SHIPPING SERVICES TO THE SOUTH PACIFIC

2.1 The scheduled international shipping services to the small island nations of the South Pacific can be divided into three categories:[2]

- passing services
- dedicated extra-regional services
- regional services.

Passing Services

2.2 These services are primarily on major trans-oceanic routes, but include wayport calls at Pacific Islands ports close to their itineraries for which the cost of deviation is low. Passing services are listed in Table 2.1 and shown on Figure 3 of Annex 2. Generally, passing services call at only one or two island ports; the size and strategic location of Fiji and Tahiti make them the calls most commonly included.

2.3 Since the vessel size on these routes is determined by the demands of the major end-point markets, it is not surprising that these services employ the largest vessels seen in the Pacific Islands trades: several of the services (for example, OSCL, Euroceania, Barbican) use vessels with capacity in excess of 1,000 twenty-foot container equivalent units (TEU).

Table 2.1: SOUTH PACIFIC ISLANDS "PASSING" SERVICES, 1991

Service	To/From	Island Calls
Barbican	S Africa/Australia to S America	Fiji, Solomons, PNG, Tahiti
Blue Star	NZ/USA	Fiji
PACE (West)	Aust/USA	New Caledonia,Fiji
SeaPac /a	S.America/ Singapore	Tahiti, Fiji, PNG
Tasman Asia	NZ/ Asia	Fiji, New Caledonia
Euroceania /b	USA/Aust-Far East	Tahiti, New Caledonia, PNG
TransPacific	Australia/ North Asia	PNG
Ocean Star Container Line	USA/Australia	Tahiti

/a Compania Chilena de Navegacion Interoceania (CCNI)/Compania Sud Americana de Vapores (CSAV)
/b Compagnie Generale Maritime et Financiere (CGM).

Source: Industry publications and interviews.

Dedicated Extra-Regional Services

2.4 These services are either provided exclusively, or significantly tailored to cater, for the trading demands of the South Pacific, and link the countries of the region to Asia, Europe and the Americas. Dedicated extra-regional services are set out in Table 2.2 and shown in Figures 4 and 5 of Annex 2.

2.5 Services are assigned to this category if South Pacific Island trades are judged to be essential to the viability of the service. For nearly all dedicated services from Asia and the

Table 2.2: PACIFIC ISLANDS—DEDICATED EXTRA-REGIONAL SERVICES, 1991

Service	To/From	Island Calls
Bali Hai	N Asia	Fiji, Western Samoa, American Samoa, Kiribati, Tahiti, Tonga, New Caledonia, Vanuatu, Solomon Island
Kyowa	E Asia/N Asia	Guam, Solomon Islands, Vanuatu, New Caledonia, Fiji, Western Samoa, American Samoa
Paradise /a	N Asia	PNG
EPACSA /b	Europe	Tahiti, Fiji, New Caledonia
SOPAC /c	N Europe/UK	Tahiti, Fiji, New Caledonia, Solomon Islands, PNG
South Pacific Line /d	Europe	Tahiti, New Caledonia, Vanuatu, Solomon Islands, PNG
New Guinea Pacific Line	East Asia/S Asia	PNG, Solomon Islands, Vanuatu, New Caledonia
Blue Star Line (PCIS)	USA	Tahiti, Tonga
Polynesia Line	USA	Tahiti
South Seas Steamship Co	USA	Tahiti
Hawaii-Pacific Lines	USA	Western Samoa, Tonga
America- Niugini	USA	PNG

/a Nippon Yusen Kaisha (NYK)/China Navigation Co (CNCO)/Mitsui-OSK Lines (MOL).
/b NedLloyd: Westabout only.
/c Bank Line/Columbus Line.
/d Polish Ocean Lines (POL).

Source: Industry publications and interviews.

USA, the islands trade ·rms the entire trade base.

2.6 In the case of the European connections (SOPAC, EPACSA and South Pacific Line), matters are not quite so clear cut. In each case, the service provides only a southbound (that is, import) service to the South Pacific. Return cargoes for Europe are obtained either by continuing onwards to SE Asia (South Pacific, SOPAC), or returning to South America (EPACSA). However, in each case: (a) there are few other southbound ports of call; (b) the naming of the service suggests a South Pacific marketing orientation; (c) the service operator runs separate services covering the trades served by the homeward journey. These factors all suggest that the South Pacific trades are essential to the continued operation of each service.

2.7 The range of ports covered by dedicated services is much broader than those covered by passing services, with most Island States receiving direct calls from at least one service. However, there is a marked disparity between countries in service frequency: Fiji, Tahiti and PNG are the best served, while Kiribati attracts calls from only the comprehensive Bali Hai service, and even this call is sometimes omitted. Vessel sizes for the main dedicated services are typically in the 250-500 TEU range, although larger vessels are used in the USA-Tahiti services.

Regional Services

2.8 These comparatively short haul routes link the South Pacific Island States to each other, and to Australia and New Zealand. These services are shown in Table 2.3, and in Figures 6,7, 8 and 9 of Annex 2. The three principal regional operators are the Pacific Forum Line (owned by a consortium of Pacific Island national Governments and New Zealand), Chief Container Lines and Sofrana Unilines. There appears to be considerable cross-chartering of capacity between these operators, allowing each line to offer a far wider spread of destinations than the actual routes plied by its vessels would suggest. Services provided by the major lines are supplemented by those provided by a number of smaller operators using conventional vessels.

2.9 Pacific Forum Line (PFL) provides the most comprehensive network of services, offering direct sailings to PNG, Solomons Islands, Fiji, Tonga, and Western Samoa out of both Australia and New Zealand. PFL also provides a transhipment service over Fiji to Kiribati and Tuvalu using a dedicated feeder vessel. Chief Container Line focusses on services from Australia to the western Pacific, offering direct services to a wide range of PNG ports and the Solomon Islands. The Australia Pacific Islands Line service uses an extension of the Chief service to the eastern PNG ports (for example, Kavieng, Rabaul and Kieta) to directly serve Vanuatu and Kiribati. APIL also charters space on PFL and Sofrana vessels. Sofrana offers direct services to all major destinations west of Fiji out of New Zealand. It also operates vessels out of Australia to Vanuatu and Fiji, and serves the Australia-PNG trade by slot chartering on the CGM Euroceania service.

B. Structure of Pacific Islands Market Competition

2.10 Competitive pressure in the liner trades serving the South Pacific comes from three sources: competition between dedicated operators; actual and potential competition for operators making wayport calls; and the possibility of substitution between import sources. The balance of these forces differs from trade to trade, and the intensity of competition varies with the size of the market concerned. However, no market has been identified—taking all three sources into account—in which a significant prospect of exercising monopoly/market power exists.

Table 2.3: PACIFIC ISLANDS—REGIONAL SHIPPING OPERATORS, 1991

Service	Description
Pacific Forum Line	Australia-South Pacific service: serves Fiji, Western Samoa, Tonga
Pacific Forum Line	Australasia/PNG-South Pacific Service: serves PNG, Solomon Islands, Fiji
Pacific Forum Line	New Zealand/South Pacific Service: serves Fiji, Tonga, Western Samoa
Pacific Forum Line	Fiji-Tuvalu/Kiribati feeder service
Chief Container Lines	Australia/PNG-Solomon Islands
Aust Pacific Islands Line (Chief)	Australia/PNG, Vanuatu, Kiribati, New Caledonia
Sofrana Unilines	Australia/Vanuatu, New Caledonia, Fiji
Sofrana Unilines	West Pacific Service: New Zealand/PNG, New Caledonia, Solomon Islands, Vanuatu
Sofrana Unilines	New Zealand/Fiji
Maasmond Express Lines	Australia/New Caledonia, Fiji, Vanuatu
Translink Pacific	New Zealand/Fiji, Western Samoa, Tonga
Translink Pacific	New Zealand/New Caledonia, Fiji, Wallis & Futuna Islands
W Islands Line	New Zealand/ Fiji, Tonga
Warner Pacific	New Zealand/Fiji, Western Samoa, American Samoa, Tonga
Warner Pacific	Australia/Tonga, American Samoa

Source: Industry publications and interviews.

Competition Between Dedicated Operators

2.11 The degree of competition between dedicated operators depends on the market size and the number of operators offering services. But it is also influenced by the institutional framework within which the services operate.

2.12 The 'dedicated' services provide a comparatively stable core to the liner shipping services to the South Pacific. Three major lines—Pacific Forum Line, Sofrana Unilines (owned by the French Delmas Group), and Chief Container Lines (owned by the Hong Kong Swire Group)—compete on the short-haul Australia/New Zealand routes. Competition between these operators is limited by differences in their operational focus: Chief, for instance, offers services only out of Australia and has strong PNG orientations, whereas Sofrana is strongest out of New Zealand. As a consequence, only the Brisbane-Lae sub-market is at present served independently by all three carriers. This is unlikely, however, to be a permanent division of spheres of influence: all parties are continually making adjustments to their operations that have impacts on the other operators. Chief Container Lines until recently

operated an independent Fiji service; Sofrana has recently contracted its PNG operations, while PFL has added a second vessel, and expanded its PNG services. Competition between dedicated operators out of Australia is further affected by the existence of a conference, called the Australia Pacific Islands Rate Agreement (APIRA), of which all three major lines are members. No corresponding agreement exists in the New Zealand trades.

2.13 A number of smaller operators compete with the major lines for particular markets. Not surprising, entry and exit at this level is more frequent—three smaller lines offering competitive regional services to the nominated countries (Translink Pacific, Maasmond, and W Islands Line) have entered since the mid 1980s.

2.14 There is a surprisingly wide range of dedicated services from Europe into the South Pacific, with NedLloyd (EPACSA), Bank/Columbus (SOPAC), and Polish Ocean Lines (South Pacific Line) all providing independent services whose primary focus is serving Pacific Island destinations. Dedicated services from Asia to the Pacific are dominated by a consortium of shipping conference operators (NYK, CNCO and MOL), which provide two services: the Paradise service, serving PNG from Japan, New Guinea Pacific Line (E Asia/SE Asia to PNG), and the Bali Hai service, serving the rest of the South Pacific. The only other significant dedicated service is provided by Kyowa, which links East Asia and Japan with a wide range of South Pacific destinations.

Competition from Cross-Traders

2.15 Shipping markets are typically *contestable*. The actual and potential competition from cross-trading operators is dictated by a combination of market size and the costs and benefits of the route deviations and port calls involved in serving a market. Because of the ease with which cross-traders can enter and leave a market, competition from cross-traders plays a significant role in enforcing efficient performance, even though their size and market share are small.

2.16 The activity of cross-traders has reduced shipping rates in the major trades in recent years. This has been associated with a succession of entries and/or exits. For example, the recent entry of the PACE service into Australia-Fiji trade has seen rates on that route drop by over $A1,000 per TEU or about 30 percent. Significantly, although the PACE line has subsequently joined the APIRA conference, its place as the 'threatening outsider' has been taken by Barbican Line, which continues to offer rates $200-$400 per TEU below those offered by conference members for the same service.

2.17 The recent history of the Australia-PNG trade is similar. Rates in that trade have dropped by in the order of $1,000/TEU (again about 30 percent), largely as a result of continued pressure from entrants. Transpacific has recently left the trade, but pressure is maintained through the activities of Barbican and by the perception that there are a number of lines sailing between Australia and Asia that are continuously on the lookout for entry opportunities.

2.18 Cross-traders are also active in a number of the other trades. Blue Star's service from New Zealand to the Pacific calls at Fiji, providing an important source of additional competition on that route. Tasman Asia makes calls at Fiji and New Caledonia en route to Asia; CGM offers slots between Australia and Papua New Guinea on its round the world Euroceania service.

Competition from Alternative Import Sources

2.19 The structure of liner shipping services to the South Pacific is invariably dictated by the needs of the import trades. Export volumes

generally amount to a small percentage (frequently below 10 percent) of imports.

2.20 Since imports consist principally of basic consumables that are available from a number of trading partners, the possibility of substitution between import sources adds an important dimension to the competitive discipline on liner shipping operators. This applies with particular force to services operating from the two major import sources, Australia and New Zealand. The market shares of these two supplier countries are reported to be highly volatile. For instance, the volume carried by PFL from Australia to PNG has halved over the period 1990-1991, while PFL's volume out of New Zealand to PNG has more than doubled.

Market Structure and Contestability

2.21 The general picture of shipping services to the South Pacific is one of a contestable market. The stable core of the service network is provided by a small number of liner operators providing a comprehensive range of services. Competition between these operators varies in intensity from sub-market to sub-market. Nevertheless, competition in each sub-market is brought together by two forces: the smaller scale operators seeking opportunities to establish local services, and the larger cross-traders seeking profitable wayport calls to top up voyage revenue. These two forces, combined with the ever-present possibility that trades will be lost because of changes in import sourcing, provide a substantial degree of competitive pressure. The result is a well-articulated service network which offers a quality of service as high, and, as is documented below, freight rates as low, as could reasonably be expected, given the low traffic density and extremely imbalanced flows that characterize the demand for liner shipping services in the region.

C. Shipping Services to the Indian Ocean Islands (Mauritius, Madagascar, Réunion, Seychelles, Comoros)

2.22 **Passing Services.** The general pattern of services to Indian Ocean island countries is in many ways similar to that to South Pacific countries. However, the reliance on 'passing' services is more marked and more focussed on the nodal port of Port Louis (Mauritius), which lies directly in the main sea lane from North and East Asia to South Africa. The MOL and SCI services from Asia to East Africa also make wayport calls at Seychelles. Passing services are described in Table 2.4 and shown in Figures 10 and 11 in Annex 2.

2.23 **Dedicated Extra-Regional Services.** Dedicated extra-regional services from Europe are dominated by the Capricorne service. This service, provided by a consortium of European lines, serves two routes: the A-service, serving the main ports on a fortnightly basis with cellular tonnage; and the B-service, offering monthly sailings with multi-purpose tonnage covering some of the smaller ports. Dedicated extra-regional services are shown in Table 2.5 and in Figure 12 of Annex 2.

2.24 **Regional Operators.** Regional services are shown in Figure 13 of Annex 2.

D. Assessment Methodology

2.25 **Factors Affecting Shipping Costs.** The cost of transporting freight by sea is influenced by many factors, but predominantly depends on two variables: the *distance* goods are shipped, and the traffic *density* on the route. In general, the longer and denser the route, the larger the vessels used. However, costs do not increase proportionally with distance, as a significant part of total costs, particularly for general freight, is associated with loading and unloading, and possibly transshipment. Nor do costs reduce

Table 2.4: INDIAN OCEAN ISLANDS—"PASSING" SERVICES CALLING, 1991

Service	From/To	Island Calls
Ahrenkiel	Japan, Korea, Hong Kong, Singapore to South Africa	Mauritius
NedLloyd (Asacon)	WCNA, Japan/Korea, Hong Kong, Singapore to South Africa & S America	Mauritius
Barbican	S America, Australia to South Africa	Mauritius
Kien Hung	Far East to South Africa	Mauritius
Mitsui-OSK Line (MOL)	ANZ to east coast of South America	Mauritius
Mitsui-OSK Line (MOL)	Japan, Far East to East & South Africa, South America	Mauritius, Réunion
Nantai	Japan, Far East to South Africa	Mauritius
Nippon Yusen Kaisha (NYK)	Japan/Far East to East Africa	Seychelles
Arrow /a	SE Asia to South Africa	Comoros, Réunion (on inducement)
Shipping Corporation of India (SCI)	India to East Africa	Mauritius
P&OCL	India to East Africa	Seychelles

/a A subsidiary of NedLloyd.

Source: Industry publications and interviews.

Table 2.5: INDIAN OCEAN ISLANDS—DEDICATED EXTRA-REGIONAL SERVICES, 1991

Service	Trade Region	Countries Served
Capricorne (A-Service) /a	UK,North Europe, Med	Seychelles, Réunion, Mauritius, Madagascar
Capricorne (B-Service)	North Europe, Med	Réunion, Comoros, Madagascar
Besta Line (Baltic Shipping)	N Europe to East Africa	Mauritius, Madagascar
Marfret /b	N Europe, Med	Réunion, Madagascar
Mediterranean Shipping Co	Mediterranean	Réunion, Madagascar, Mauritius
Nedlloyd (Eacon)	Singapore (Japan/Far East cargo tranship from Asacon service)	Mauritius, Réunion, Seychelles
Mitsui-OSK Line Réunion	Japan, Far East	Madagascar, Mauritius,
SBN/SMN /c	SE Asia	Réunion, Mauritius

/a A joint service of CGM, Navale & Commerciale Havraise Peninsulaire (NCHP), Societe de Navigation Cannaise (SNC), Scandinavian East Africa Line (SEAL), Hapag-Lloyd and Societe Nationale Malgache de Transports Maritimes (SMTM). P&OCL/Ellerman and Harrison Lines slot charter space for a UK-Mauritius service.
/b Compagnie Maritime Marfret
/c Societe Bourbonnaise de Navigation (SBN); Societe Mauricenne de Navigation (SMN).

Source: Industry publications.

uniformly with vessel size; for example, the savings in linehaul costs arising from scale economies in vessel size are partly offset by the increased port time required for cargo handling. A third factor, which is more important in determining the tariff charged, is the *extent of back-loading*; a route with a large proportion of back-loading enables a lower average tariff to be charged for each leg of the voyage. The Pacific Island routes have limited backloading and therefore involve higher inward rates than other routes which attract return cargo. In addition to these factors, ocean freight *rates* are shaped by market structure, especially ease of entry.

Approach and Methodology

2.26 The assessment of the shipping services in the South Pacific and, in particular, to the PMCs, is approached in two ways: (a) by comparison of *actual* freight rates on specific voyages for major services to the Pacific Islands from Australia and New Zealand and "expected" freight rates estimated using a shipping cost model, and (b) by statistical analysis of the relationship between actual freight rates and, distances and volumes. The objective of these analyses is to establish:

(i) whether rates to and from the *PMCs* are different *relative* to the selected comparator *Island* countries, taking into account route distance and traffic volumes; and

(ii) whether rates to and from *all* Island countries are different compared to other countries.

2.27 **Services Selected.** In the case of the Pacific Island countries, the analysis of services to the PMCs and comparator islands centered on those to and from Australia and New Zealand, and the regional shipping centers of Singapore and Hong Kong. In the case of the Indian Ocean countries, the services covered those from Singapore and Hong Kong, as well as those from London and Rotterdam.

2.28 The comparison with shipping services for other countries focused on passing services to the Pacific Islands and the Indian Ocean Islands as follows:

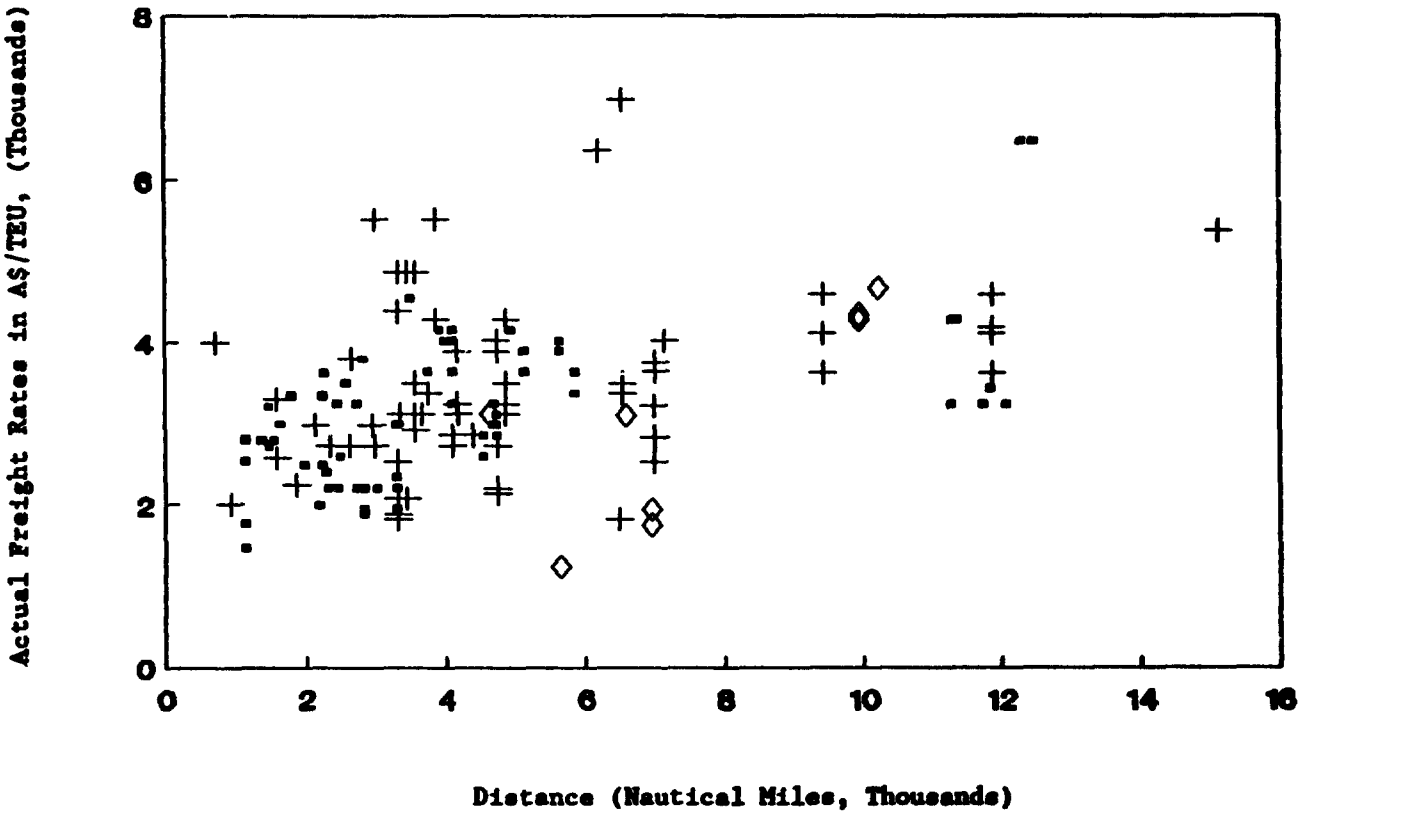
- Hong Kong - Chile
- Singapore - Chile
- Hong Kong - South Africa
- Singapore - South Africa
- Australia - US west coast
- Fiji - US west coast.

2.29 **Container Traffic Rates.** Two-thirds of the total freight moved to/from the majority of the South Pacific Islands is by container.[3] Therefor, the analysis is confined to container-carrying vessels, and is concentrated on full container load (FCL) traffic. Unless otherwise specified, the freight rates used in the shipping assessment are basic commodity rates, Freight All Kind rates (FAK), or general cargo rates for Full Container Load (FCL) traffic, on a wharf-to-wharf basis, excluding terminal handling costs as levied by local port authorities.[4] Port operations and infrastructure also influence the total door-to-door charges, but they represent a small fraction of ocean freight costs; differences in these charges between ports are also small.

2.30 The freight rates used are as quoted by agents; they do not take into account any customer rebates that a shipping line might offer. Where these exist, actual rates will be up to 10-15 percent below the tariffs used herein. However, in some isolated cases (generally promotional backload rates), discounts of up to 50 percent were quoted. A schedule of typical prevailing shipping tariffs is given in Annex 3.

2.31 **Freight Rates in Relation to Distance.** Figure 2.1 shows a plot of actual ocean freight rates for services ex Australia, New Zealand, Hong Kong, Singapore, Rotterdam and the UK against distance. The plot indicates that there is

Figure 2.1: ACTUAL DISTANCE AND FREIGHT RATES—PMCS AND COMPARATORS



■ Nominated Pacific Islands + Comparator Islands Other comparators

no prima facie case that freight costs for the PMCs as a group are any different to the Pacific and Indian Ocean comparator countries. Figure 2.1 also shows that rates on the island routes are similar to rates on many non-island routes. Non-island routes with the lowest rates are between South East Asia and South Africa, where backloading is substantial.

2.32 **Freight Rates in Relation to Frequency.** Table 2.6 shows that the PMCs have service frequencies similar to those of the comparator Islands. Mauritius (Port Louis), which lies directly on a major route from East Asia to South Africa, receives the most calls per month among the comparators. As a satellite of Mauritius, Réunion benefits from relatively frequent services. However, the freight rates to Réunion are generally higher than the rates to

Table 2.6: PACIFIC AND COMPARATOR ISLANDS AVERAGE FREQUENCY OF MAJOR CONTAINER SERVICES, 1991

Destination	Average No. of Calls per Month /a	Destination	Average No. of Calls per Month /a
Pacific Islands		**Comparator Islands**	
Kieta	2	Mozothe	1
Popendetta	3	Dzaoudzi	1
Tarawa	3	Christmas Island	1
Kavieng	5	Cocos Islands	1
Kimbe	7	Moroni	1
Alotau	7	Mutsamudu	2
Santo	8	Yap	2
Wewak	10	Truk	3
Nuku'alofa	11	Mayotte	4
Vila	11	Pago Pago	6
Madang	12	Male	7
Lautoka	12	Tamatave	9
Honiara	12	Mahe	10
Apia	13	Papeete	18
Rabaul	16	Réunion	18
Port Moresby	29	Noumea	27
Suva	29	Port Louis	35
Lae	29		

/a Calls offered by the forty shipping agencies and freight forwarders sampled. Actual service frequency often differs from the frequency "offered" by the shipping lines. For example, a service offered as a monthly service may call at a port as often as fourteen times per year or as few as four times per year, depending on the prevailing demand.

Source: Industry Publications and Survey.

Port Louis, because of transhipment costs and lower volumes.

2.33 Noumea and Papeete receive frequent calls as both countries have relatively large trade flows. New Caledonia and the Society Islands are amongst the largest merchandise importers in the South Pacific region (see Annex 1, Table 1). Services to Noumea (ex Singapore, Hong Kong, and Australia) are generally comparable to services to Fiji and Papua New Guinea in terms of freight rates, volume and distance. However, it is claimed that rates to New Caledonia are slightly higher to cover the higher port handling costs in Noumea.

2.34 Of the PMCs (including Papua New Guinea), Port Moresby, Lae and Suva receive the highest number of calls per month (see Table 2.6) reflecting the volume of import cargo and greater backloading at these ports. Exports from some of the smaller islands (for example, Tonga and Western Samoa) are reportedly so low that vessels often carry return cargo back at highly reduced "development" rates. Given excess backhaul capacity, relatively low outbound rates are efficient and should prevail; comparison of outbound rates alone from the PMCs would reveal them to be low relative to other countries. The Solomon Islands receives fairly frequent calls as a result of its proximity to Papua New Guinea (about 12 calls per month in the sample). Regarded as an extension of the PNG trade, shipping lines serve Honiara on a monthly basis, either direct, or by transhipment using smaller vessels. Services to Kiribati and the Comoros are at the higher end of the rates scale. Both these island countries receive relatively infrequent service reflecting their low traffic density.

E. Assessment of Shipping Rates

Application of the Shipping Cost Model

2.35 Shipping services are assessed using a voyage cost simulation model (described in Annex 5) which calculates the expected" rates for a voyage, given nominated ports of call, volumes carried, distances travelled, and the size and age of vessels employed. In practice, commercial freight rates principally aim to recover total voyage costs and maximize profits. For any one route, a range of rates will exist which is affected by local demand/supply factors, within the overall constraint that total voyage revenues at least equal total voyage avoidable costs.

2.36 The cost model estimates the cost of operating container vessels of a specified size over a fixed route, given a defined pattern of cargo uplift and discharge. The costs are a function of three sets of data:

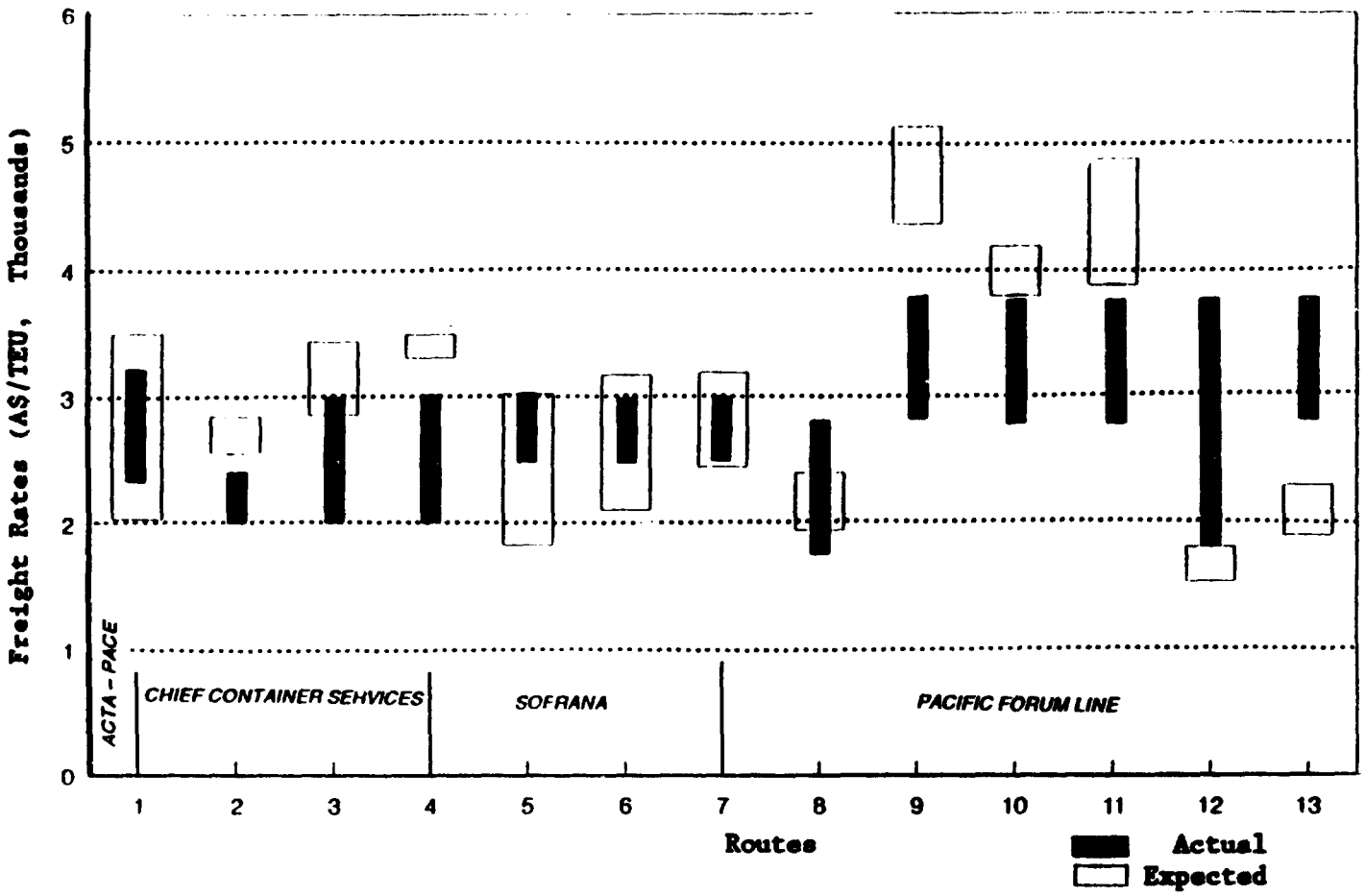
- Vessel characteristics
- Route definition
- Operating and cost parameters.

Cost Model Results

2.37 A comparison of the freight rates generated by the shipping cost model ("expected freight rates") and actual reported freight rates is presented in Figure 2.2. On average, freight rates to the Pacific Ocean islands (including Noumea) are consistent with the expected costs of serving them, given current market conditions and traffic density.

2.38 At present, the Australian Pacific Islands Rate Agreement covers the trade areas of Australia to New Caledonia, Fiji and Vanuatu. To some extent, the similarity in actual rates reflects the existence of the conference since the selected lines all serve one or more of these countries. In addition, existing and potential competition outside the conference tends to keep

Figure 2.2: PACIFIC ISLANDS—ESTIMATED SHIPPING COSTS AND ACTUAL FREIGHT RATES



1. Melbourne.Sydney.Brisbane.Noumea.Suva.United States
2. Melbourne.Sydney.Brisbane.Port Moresby.Lae.Honiara
3. Melbourne.Sydney.Brisbane.Port Moresby.Lae.Honiara.Tarawa
4. Melbourne.Sydney.Brisbane.Noumea.Vila.Honiara.Tarawa. Port Moresby.Lae.Kavieng.Rabaul.Kieta
5. Melbourne.Sydney.Brisbane.Noumea.Vila.Santo.Lautoka.Suva
6. Nth.New Zealand.Noumean.Vila.Santo.Honiara.Rabaul.Lae
7. Nth.New Zealand.Sth.New Zealand.Noumea.Lae.Port Moresby
8. Sth.New Zealand.Nth.New Zealand.Suva.Brisbane.Port Moresby.Lae.Brisbane.Suva.New Zealand
9. Sth.New Zealand.Nth.New Zealand.Brisbane.Port Moresby.Honiara
10. Sth.New Zealand.Nth.New Zealand.Brisbane.Lae.Rabaul
11. Sydney.Brisbane.Suva.Tarawa
12. Nth.New Zealand.Lautoka.Suva.Apia.Pago Pago.Nuku'alofa
13. Sydney.Brisbane.Suva.Apia.Pago Pago.Nuku'alofa.Suva

rates down generally, as well as reduce the disparities between rates. For example, the entry of the PACE service into Australia-Fiji trade has resulted in a cumulative reduction in freight rates in excess of A$1,000 per TEU.

2.39 The range of actual rates for Acta-Pace and Sofrana Unilines fall entirely within the range of expected rates. It is important to note that the service by Acta-Pace is essentially a passing service to New Caledonia and Fiji en route to the US west coast, whereas Sofrana is historically the islands' trader. Both Acta-Pace and Sofrana have a service which calls Melbourne/Sydney/Brisbane/Noumea. It is claimed that the Fiji and Noumea markets are static and that the trade areas are now less attractive with higher costs and lower rates. Furthermore, the conference has set a Currency Adjustment Factor (CAF) of 14.5 percent for Noumea. Noumea also has relatively high port charges. Nevertheless, the shipping lines have continued to offer frequent services to these islands as indicated in Table 3.1.

2.40 Figure 2.2 indicates that the expected rates for Chief Container Services (CCS) are consistently higher than the actual rates. This reflects the competitive pressures in the Papua New Guinea-Solomon Islands trade which is CCS's core business. It is claimed that rates to Papua New Guinea have fallen as much as A$1,000 per TEU in the past ten years, and there is evidence that there are currently competitors charging as low as A$1,700 per TEU. CCS's other trades, New Caledonia, Vanuatu and Kiribati face similar pressures. It is alleged that Vanuatu market rates fluctuate because of its vulnerability to cross-traders. The cost simulation model demonstrates that servicing Kiribati is a relatively high cost operation given the long distance and the low volume.

2.41 There are considerable differences between the expected rates and the actual rates for the Pacific Forum Line for the island routes. However, the Forum Papua New Guinea and the Forum New Zealand II are involved in three trades: Papua New Guinea, Fiji and Trans-Tasman (represented by Route No.8 in Figure 2.2), and the freight rates for this latter route are generally in line with expected rates.

2.42 The routes which involve *transhipment* (Route Nos. 9, 10 and 11 in Figure 2.2) have higher expected rates. In the model transhipment is treated as two separate voyages whereas most shipping operators view transhipment on an incremental cost basis. Thus, the higher expected rates can be partly explained by the model's approach to transhipment. It is understood that the shipping line "bears" the cost of transhipment to destinations including the Solomon Islands and the minor ports of Papua New Guinea.

2.43 The expected rates for PFL's direct services to Tonga, Western Samoa and American Samoa (Route Nos. 12 and 13 in Figure 2.2) are lower than actual freight rates. The consistent overestimation of rates for routes involving transhipment and the underestimation of the rates for direct routes in Figure 3.2 suggest the possibility of a tariff "equalization" policy in the region where the full costs of transhipment are not passed on. Although the present traffic to Samoa and Tonga is quite low, inter-island traffics between Fiji, Western Samoa, American Samoa and Tonga are claimed to make contributions to voyage revenue.

2.44 Despite the low traffic growth in the Pacific market, the level of service in the area has increased without an increase in freight rates. In fact, there has been no rate increase for New Caledonia, Fiji and Vanuatu since the conference was formed in July 1988. This again supports the view that the Pacific Islands market is reasonably competitive. Evidently, the competitive pressures yield considerable benefits to the islands, mainly in the form of regular services at reasonably efficient freight rates. This is particularly significant as the shipping

operators believe that the current volume of cargo does not warrant the number of vessels servicing the islands.

2.45 **The Impact of Traffic Density on Freight Rates in the South Pacific.** The impact of distance and traffic density on freight rates in the South Pacific is shown Figures 2.3 and 2.4, respectively. In general, longer distances involve higher freight rates, and denser traffic routes involve lower freight rates. In this assessment, traffic density is measured as a volume/distance ratio, i.e., the number of TEU per 1000 nautical miles. For simplicity, the distances used are based on a straight port-to-port movement. The routes Melbourne to Noumea (served by Acta-Pace and Sofrana), Melbourne to US, and Suva to US (served by Acta-Pace) are included for comparison.

2.46 The combination of long distances and low volumes for the PMCs characterize thin traffic routes for which, a priori, freight rates would be expected to be relatively high. Figure 2.4 indicates that thinner routes are indeed associated with relatively high rates, for example, Sydney/Brisbane to Tarawa/Apia/Pago Pago. Conversely, dense routes are generally associated with lower rates, as illustrated by the routes New Zealand to Fiji, Melbourne to Port Moresby, Melbourne to the US, and Brisbane to Fiji. However, there are a number of low density routes which have relatively low freight rates. These routes include Melbourne to Honiara, Melbourne to Vila, Melbourne to Noumea, and Melbourne to Suva. Some of these "thinner" legs connect to other legs which are more dense. Some vessels call at several ports and traffic density also varies between different sections of the voyage.

Statistical Analysis of Shipping Rates

2.47 Shipping cost structures and contestable market structures predict that ocean freight *rates* depend heavily on distance and traffic density. In this supplemental assessment, this relationship is tested directly by statistical analysis. Although the density data were necessarily partial, the results confirm the general conclusion reached from the results of the voyage simulation cost model assessment, namely, rates to and from the Pacific Islands are consistent with the distance travelled and the prevailing traffic density.

2.48 The general shipping freight rate relationship estimated is:

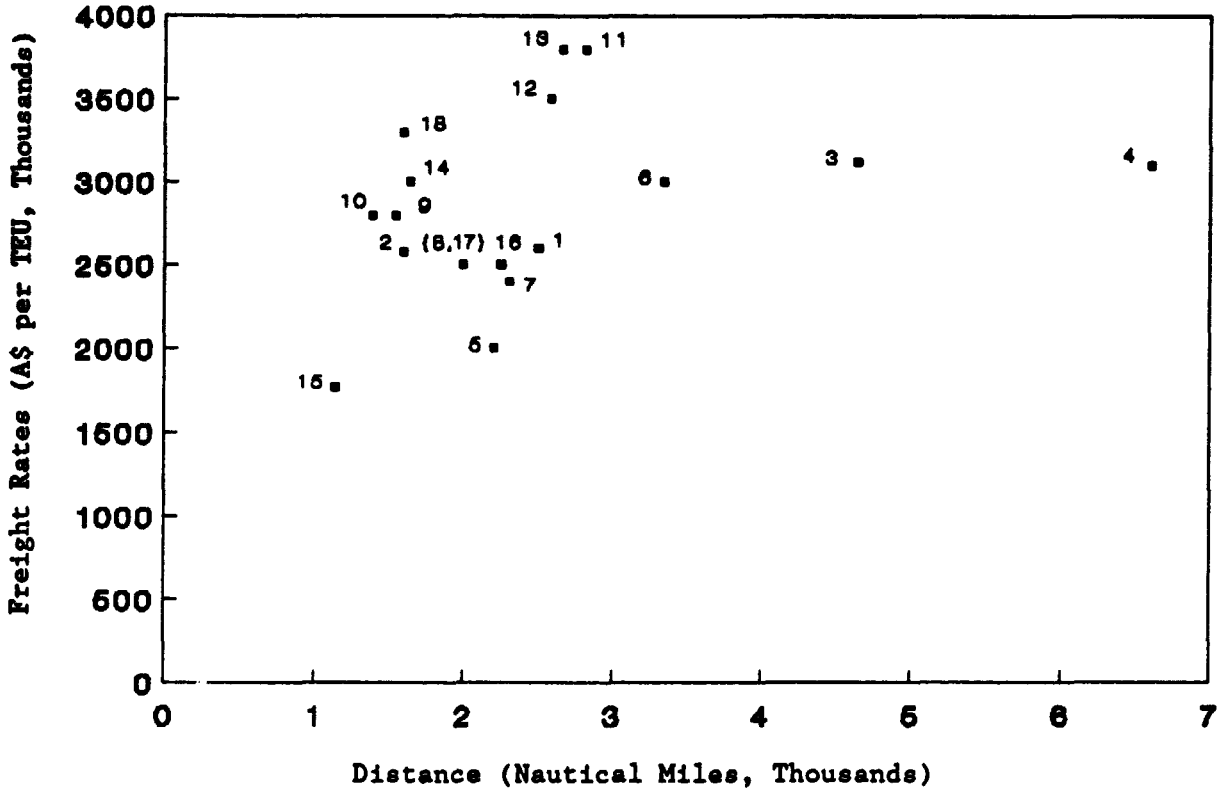
$$Y = A * D^a * V^b$$

where Y = freight rate charged per TEU for the route
D = distance shipped
V = volume of traffic on the route (TEU per annum)
and A, a, b are calibration parameters.

That is, shipping rates are hypothesized to depend (multiplicatively) on distance and volume. It is expected that the calibration parameter a (for distance) will be positive and the calibration parameter b (for volume) will be negative. The relationship was estimated and the Pacific Islands rates, as a regional group, were also tested to see if they were statistically different to the rates for comparator countries. Estimation results are set out in Annex 5.[5] (The shipping data set used is provided in Annex 1.)

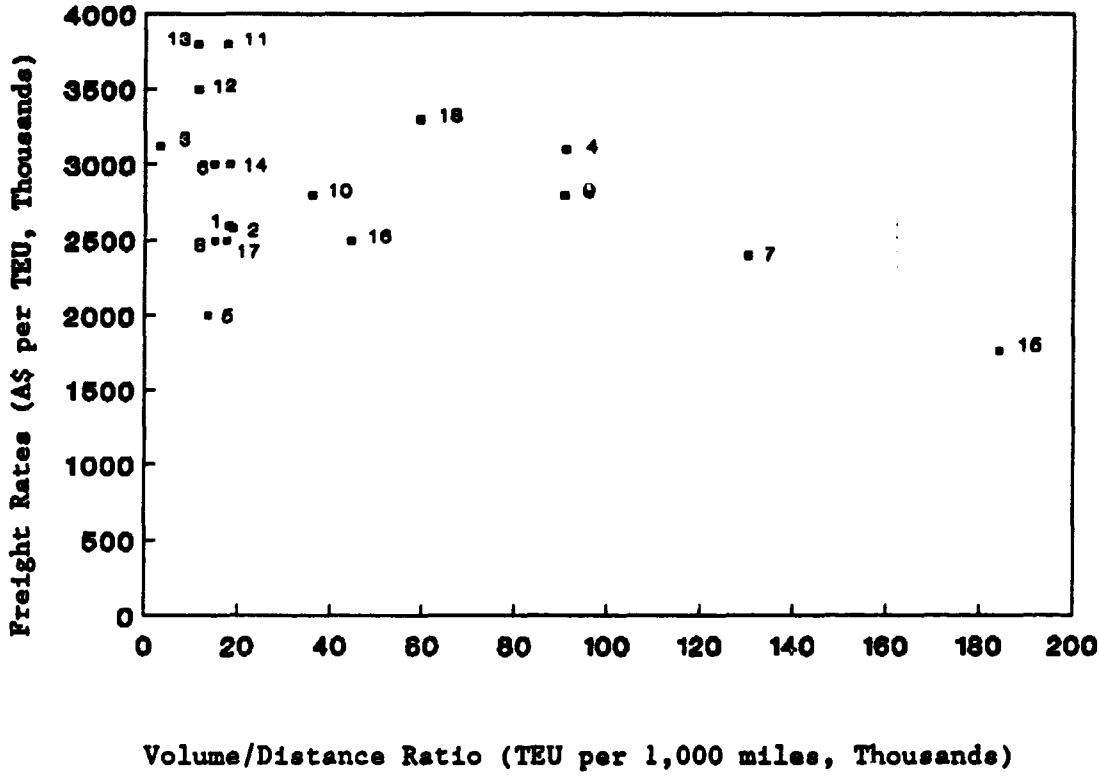
2.49 The statistical analysis of shipping rates shows that the effect of both distance and trade density on rates is significant. The results also show that the ocean freight rates to the PMCs and other island groups do *not* differ in the manner in which they depend on distance and density—either among themselves as individual island groups, or as a group between other comparator countries. The results of the statistical analysis are illustrated in Figure 2.5.[6] The most extreme outliers in Figure 2.5 are (with actual rates shown in parentheses):

Figure 2.3: PACIFIC ISLANDS REGION—ACTUAL FREIGHT RATES AND DISTANCE



1	Melbourne-Suva	10	Brisbane-Papua New Guinea
2	Melbourne-Noumea	11	Sydney-Tarawa (via Brisbane)
3	Suva-USA	12	Sydney-Apia (via Brisbane)
4	Melbourne-USA	13	Sydney-Pago Pago (via Brisbane)
5	Melbourne-Honiara	14	Sydney-Honiara (via Brisbane)
6	Melbourne-Tarawa	15	North New Zealand-Fiji
7	Melbourne-Port Moresby	16	Melbourne-Suva
8	Melbourne-Vila	17	Melbourne-Vila
9	Brisbane-Fiji	18	Melbourne-Noumea

Figure 2.4: PACIFIC ISLANDS REGION—ACTUAL FREIGHT RATES AND TRAFFIC DENSITY



1	Melbourne-Suva	10	Brisbane-Papua New Guinea
2	Melbourne-Noumea	11	Sydney-Tarawa (via Brisbane)
3	Suva-USA	12	Sydney-Apia (via Brisbane)
4	Melbourne-USA	13	Sydney-Pago Pago (via Brisbane)
5	Melbourne-Honiara	14	Sydney-Honiara (via Brisbane)
6	Melbourne-Tarawa	15	North New Zealand-Fiji
7	Melbourne-Port Moresby	16	Melbourne-Suva
8	Melbourne-Vila	17	Melbourne-Vila
9	Brisbane-Fiji	18	Melbourne-Noumea

- Hong Kong - Santo (A$4,156)
- Hong Kong - Port Vila (A$4,156)
- Hong Kong - Nukualofa (A$4,156)
- Hong Kong - Tarawa (A$4,545)
- Singapore - Apia (A$3,896)
- Singapore - Nukualofa (A$3,896)
- Sydney/Brisbane - Tarawa (A$3,800).

Six of these seven routes involve *transhipment*. Freight is transported from Hong Kong to Santo and Port Vila with a transhipment at Sydney. The routes from Hong Kong to Nukualofa and Tarawa both involve transhipment at Kobe in Japan, which is reported to cost about A$900 per TEU. The rates to Apia and Nukualofa include an extra cost of A$1,000 per TEU for transhipment at Suva. It is also reported that one transhipment can be double the direct freight rate.

2.50 The actual freight rate from Sydney/Brisbane to Tarawa (in Kiribati) is higher than estimated (on the basis of distance and route density). This may be explained by an unusually high degree of uncertainty in service level and difficulties at the Tarawa port (Betio). Although the service to Tarawa is offered as a monthly service, calls at Tarawa are made on demand rather than with a fixed frequency, and in practice may be as infrequent as once every eight weeks. Furthermore, inclement weather can cause considerable vessel delays in Kiribati. While a vessel can clear Betio port in two to three days in good conditions, it is not uncommon for vessels to spend up to seven days in port.

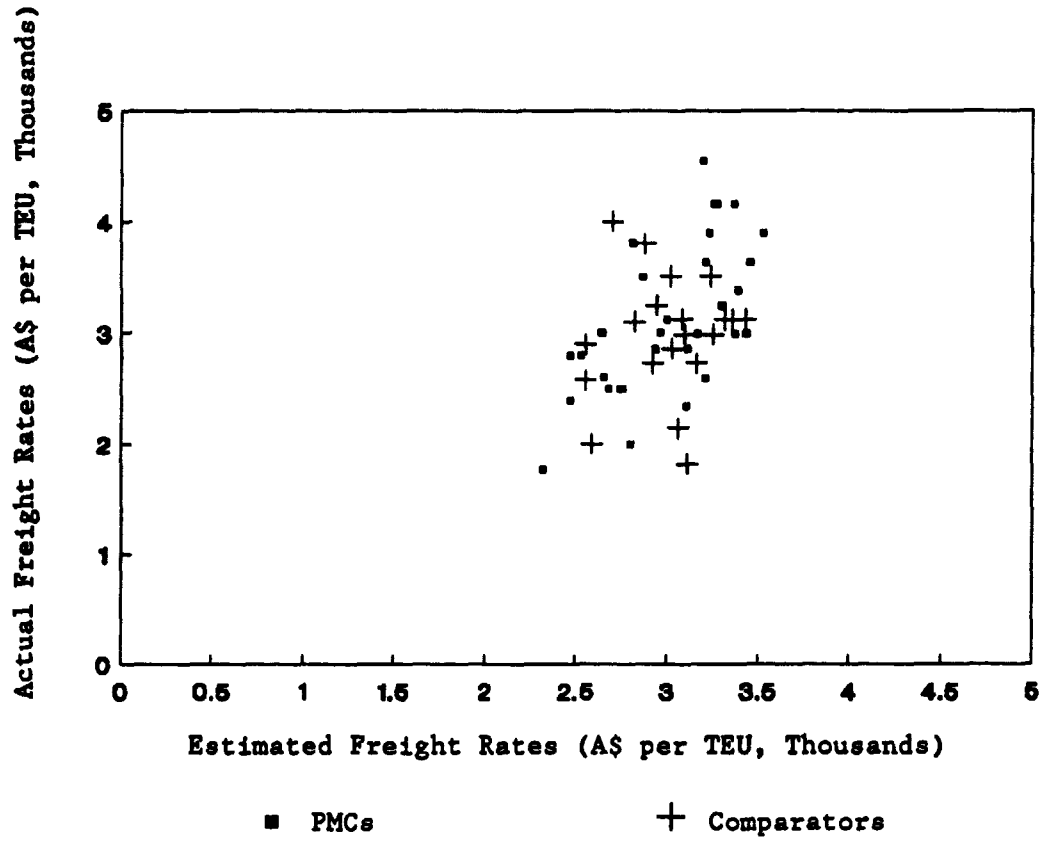
F. CONCLUSIONS

2.51 In sum, the results of the assessments of shipping costs and freight rates confirm that *costs/rates to and from the PMCs are consistent with costs/rates to and from both the comparator islands and other countries, when distance and traffic density are taken into account.* In addition, the evidence reveals that *ocean freight rates for the PMCs are not intrinsically higher than for these comparator countries;* traffic density and distance affect shipping costs to the PMCs in the same systematic manner that they affect shipping costs for other countries.

2.52 Although the evidence reveals that shipping rates for the PMCs are in line with rates that apply for comparable routes for other countries, the *ocean freight rates for the PMCs are nevertheless high*—relative to countries with high volumes of cargo flows and/or shorter distances to/from key markets. Specifically, a route for other countries, with ten times the volume of PMC routes, can be expected to be associated with freight rates of the order of 40 percent lower than rates on PMC routes. Routes which involve half the shipping distance, typically involve rates 30 percent lower.

2.53 Cargo volumes for the PMCs can be expected to remain low, in particular, relative to some countries with whom they compete for exports. Since the PMCs face international prices for their exports, the higher transport costs they confront presents a considerable constraint on their ability to compete on world markets. Their higher international shipping costs dictate lower f.o.b. prices. These lower f.o.b. prices, given internal transport costs, imply lower "farm-gate" prices for export commodities. (Indeed, it is possible that for some commodities implied farm-gate prices may be even below zero, i.e., local production of the commodity is not commercially viable—at prevailing world prices and transport costs.) The main implication of the relatively high transport costs faced by the PMCs is that *local production costs must be correspondingly lower,* if commodities for export are to be competitive. For economic growth in the PMCs, it is especially important that local production and internal transport are efficient.

Figure 2.5: PACIFIC ISLANDS AND COMPARATORS—SHIPPING RATE ANALYSIS RESULTS



CHAPTER 3
ASSESSMENT OF AIR SERVICES

A. AIR SERVICES IN THE PACIFIC REGION

3.1 The air services to the PMCs and comparator countries included in this assessment are described under the following main headings:

- Pacific Rim to Pacific Islands;
- Pacific Island intra-regional services; and
- other routes.

3.2 A total of 111 routes are included in the analysis. Details of the routes covering fares, distances and traffic volumes are shown in Annex 6. In addition to the Pacific Rim to Pacific Islands (34 routes) and the Pacific Island intra-regional services (27 routes), other routes included are:

- Australian International routes (9)
- Australian Domestic Tourist routes (11)
- New Zealand Domestic routes (7)
- Papua New Guinea Domestic routes (8)
- Western Australian Domestic routes (8)
- Indian Ocean Islands routes (7).

Pacific Rim to Pacific Islands

3.3 **Pacific Island Countries.** The major routes to and from the Pacific Islands, and major destinations on the Pacific Rim, are listed in Table 1 of Annex 7 and shown by map in Figure 1 of Annex 8.

3.4 The larger Pacific Islands, such as Fiji and Papua New Guinea, receive relatively frequent services. Fiji (Nadi) is both a major hub in the regional network, and an origin/destination in its own right. As a consequence, it has frequent services from both Sydney and Auckland at relatively low air fares. As with shipping cost structures, increasing distances lead to higher air service costs and fares (and, with low travel demand, reduced flight frequency). High volumes and traffic density (largely arising from the size of the tourist industry) allow larger aircraft sizes, especially over longer distances, and allow lower unit seat costs and fares; this is notable for Fiji.

3.5 Passenger volume also affects costs and fares, especially for smaller Island States, such as to Tonga and Kiribati. The incremental costs of flying to Pacific Island countries beyond Nadi, given the lower volumes of passengers, are significantly higher on a per mile basis. For example, the additional fare to Kiribati from Fiji represents around twice the Sydney/Auckland to Fiji fare for one-half of the distance. Moreover, with small passenger volumes and higher seat costs, excursion or promotional fares are rarely available on low density routes.

3.6 Although services to the PMCs (other than Fiji and PNG) have increased significantly over the past decade, the current levels of demand do not warrant the use of wide-bodied aircraft. Instead, the airlines employ smaller aircraft (such as B727, 737, ATR42 and

HS748), which involve higher unit seat costs and hence higher fares.

3.7 **Comparator Pacific Islands.** Noumea and Papeete are served by medium-sized aircraft and at higher levels of frequency, reflecting higher volumes of international visitors. In addition, Tahiti is a stopover for four of the six flights to Los Angeles from Sydney and Auckland. The fares from Sydney to Port Vila and Noumea are broadly comparable, although there is a slight disparity in the fares ex Auckland. In addition, the number of flights from Auckland to Noumea is double that to Port Vila and involves more carriers (3 compared with 1), and (some) larger aircraft (DC10s and 767s). The focus for international services to and from Noumea and Papeete is much more strongly centered on direct flight movements into and out of the South Pacific region rather than within the region. For example, there is only one flight a week between Noumea and Nadi and none between Papeete and Nadi, even though Nadi is a regional hub, (partly reflecting the division between the Anglophone and Francophone countries in the region).

Intra-Pacific Island Regional Services

3.8 Major intra-Pacific regional services are listed in Table 2 of Annex 7 and shown on Figure 2 of Annex 8. In general, the inter-island international services between the Pacific Island States are reasonably frequent given the traffic density. Fiji acts as a regional hub with over 40 international flights to and from Nadi each week.

Other Routes

3.9 A list and map of the other air service routes, used as comparators in the assessment of air fares and level of service for the PMCs, are provided in Annex 7 and Annex 8, respectively as follows:

Comparator Route Groups	Annex 7, Table No.	Annex 8, Figure No.
Australian International	3	3
Indian Ocean	4	4
Australian Domestic Tourist	5	5
Western Australia Domestic	6	6
New Zealand Domestic	7	7
Papua New Guinea Domestic	8	8

B. Assessment Methodology

3.10 This section presents a two-stage assessment of air services to the PMCs:

(a) a qualitative assessment of the current levels of service and aircraft type, given the levels of air travel demand; and

(b) a quantitative assessment based upon a statistical analysis of air fares for the PMCs, comparator Islands, and other routes in the Pacific basin.

Qualitative Assessment of Air Services for the PMCs[7]

3.11 There are significant differences in the level and composition [8] of demand for air services involving the PMCs, both in terms of movements into and out of the region, and within the region. Consequently, different aircraft types and service frequencies are used on the various routes. This is illustrated in Table 3.1 which lists services from the Pacific Rim to the PMCs.[9] For example, for Fiji the high level of tourist demand is reflected in the use of wide-bodied jets such as B747s and B767s. As the major tourist destination in the region, Fiji also receives more frequent services. For example, non-stop flights to Fiji each week include 7 from Sydney, 4 from Melbourne, 3 from Brisbane, and 11 from Auckland utilizing the larger jet aircraft. In addition, there are 11 flights each week from Nadi to Honolulu. No other Island State in the South Pacific matches

the tourist traffic of Fiji. As a result, the other PMCs, with their lower levels of demand, are generally served by smaller aircraft, typically with capacity ranging from 50 to 200 seats, often from Nadi as a hub. Vanuatu, Western Samoa, Solomon Islands and Tonga are all generally served by medium-sized jets, such as B727s and B737s, with capacities around 144 and 109 seats, respectively. Furthermore, the frequency of services to these islands, even with smaller aircraft, is lower than to Fiji. Also, direct services are often incorporated within a multi-point route structure, for example, Western Samoa is served via Tonga, rather than by non-stop flights from Sydney and Auckland.

3.12 Papua New Guinea receives relatively frequent services from Australia and New Zealand. There are currently five services per week from Sydney to Port Moresby via Brisbane using B767 and A310 aircraft. Auckland to Port Moresby is not served directly but is via Sydney or Cairns. At present, there are eight services from Auckland to Cairns, seven of which are via Sydney. Small aircraft such as F28s fly the route between Cairns and Port Moresby. Unlike Fiji, the demand for air travel to and from Papua New Guinea is not driven by tourist traffic but by the commercial and government sectors. In 1988, approximately 62 percent of total arrivals from South Asia and Oceania to Papua New Guinea were arrivals for business.[10]

3.13 Volumes of traffic on routes involving the other PMCs are much smaller; international visitor arrivals are 20 percent (Western Samoa) or less than 10 percent, of the level to Fiji. Thus, total available seat capacity, aircraft size, and frequency are all substantially lower. There are no direct services to Kiribati from Sydney and Auckland. The main route is through Fiji, with a connecting flight to Tarawa (over Tuvalu en route to the Marshall Islands) by turboprop aircraft (HS 748) twice a week.[11]

3.14 Comparator islands with significant tourist industries also receive commensurate levels of service and frequency, typically with wide-bodied aircraft. For example, Mauritius is served by B747, B767 and Airbus A310 aircraft with 13 flights per week from London, Paris and Johannesburg. Similarly, there are nine flights from Sydney to Bali each week, using B747 and DC10 aircraft. The services to New Caledonia from Sydney and Auckland (seven and three per week, respectively) use B737 and B767 aircraft, reflecting the medium level of demand. In addition, given the demand ex-Japan, there are two DC10 services weekly from Tokyo. These services from Sydney and Auckland to Noumea are more frequent than services to Tahiti, despite Noumea's relatively lower international arrivals. But, Tahiti is both a tourist destination in its own right, as well as being a stopover on trans-Pacific flights. Also Tahiti is served by on-connection over Noumea.

3.15 In sum, with the exception of Fiji and, to some extent, Vanuatu, the *aviation markets to and from the PMCs are thin* (low traffic volumes over relatively long distances). As a result, *aircraft sizes are small and frequencies are low;* as a consequence cost structures for air services operating in these markets can be expected to be relatively high.

Statistical Analysis of Air Fares

3.16 **Specification of Air Fare Relationship.** As arguded above and as with sea freight tariffs, air fares are predominantly influenced by distance and traffic density. However, there are some added complications because airlines offer a range of *fare types* reflecting different service conditions. For the purposes of this analysis, air fares are grouped into two types: (a) *full economy fares*[12]; (b) *excursion fares.*[13]

3.17 The large difference between full economy and excursion fares has a major influence on any comparative analysis of air fares. On some routes, excursion fares are

Table 3.1: PACIFIC ISLANDS FROM THE PACIFIC RIM—INTERNATIONAL AIRLINE SERVICES, 1991

Total No. of International Visitors (000) (1988)	Origin / Destination	Sydney	Melbourne	Brisbane	Cairns	Auckland	Singapore	Hong Kong	Tokyo
250.6	FIJI - Nadi /c Flights per week Aircraft type	7 747	4 767	2 767		11 767			3 747
23.9	VANUATU - Port Vila Flights per week Aircraft type	2 727	1 727	2 727		2 737			
51.7	WESTERN SAMOA - Apia Flights per week Aircraft type	2 727				5 737/727			
9.9	SOLOMON ISLANDS - Honiara Flights per week Aircraft type	1 767		2 737	1 737	2 737			
20.3	TONGA - Tongatapu Flights per week Aircraft type	1 727				6 737			
48.9	PNG - Port Moresby Flights per week Aircraft type	5 767		5 767/A310	4 A310/F28	7 767 & F28/b	2 A310	1 A310	3 A310
3.0	KIRIBATI - Tarawa Flights per week Aircraft type	2 747 & HS748/a				2 767 & HS748/a			
82.0	NEW CALEDONIA - Noumea Flights per week Aircraft type	7 737/767	2 737/767	3 737/767		3 737/767/ DC10	2 747		2 DC10
139.7	TAHITI-Papeete /c Flights per week Aircraft type	3 747/737				3 747/DC10			

/a HS748 from Nadi to Tarawa.
/b F28 from Cairns to Port Moresby.
/c Also services ex USA.

Source: Airline Timetables and World Bank (1991a).

limited, generally either because of low demand or because of the regulatory environment. This is the case on a number of intra-Pacific Island routes; however, there are many excursion fares available to and from the region.

3.18 The statistical analysis comparing air fares was undertaken using data on eight groups of routes:

(a) to and from the Pacific Islands;
(b) between the Pacific Islands;
(c) international routes from Australia;
(d) domestic routes in Western Australia;
(e) tourist routes within Australia;
(f) New Zealand domestic routes;
(g) Papua New Guinea domestic routes; and
(h) to and from Indian Ocean Islands.

3.19 Air fares typically vary systematically with distance; there is an implicit flagfall component and a component variable with distance. An objective of the present analysis is to determine if there are differences in air fares across regions that cannot be explained simply in terms of distance and traffic density.

3.20 The general relationship tested is:

$$Y = A * D^a * V^b$$

where Y = air fare charged
D = distance travelled
V = volume (seat capacity per annum)
and A, a, b are calibration parameters.

3.21 This relationship was examined to test whether any of the eight groups (including the PMCs) were statistically different from the remainder.[14]

3.22 **Definition of Fares, Distance and Density.** Given the wide range of excursion fares available, an average of the low season excursion fare (designated YLE) and high season excursion fare (designated YHE) were used. Where these fares were not available, comparable promotional fares were used. Two measures of distance were used. Full economy fares were related to maximum permitted mileage (MPM) and excursion fares were related to shortest operated mileage (SOM). MPM takes into account the alternative routings available to economy fare travellers on longer journeys. A number of proxies for traffic density were identified, including total visitor numbers and flight seats capacity. Although seat capacity is a measure of supply, information on visitors is not consistently available across the routes selected. *Seat capacity* is adopted as a measure of traffic density and, hence, a proxy for traffic demand on the basis that, in the medium to long run, airlines systematically allocate aircraft types and frequencies, and therefore seats, to particular routes based on market demand. Seat capacity per annum, was estimated as the product of the number of flights per year and the typical seat capacity on the aircraft serving the route. Passenger seat capacity for typical aircraft types and configuration in the Pacific and comparator regions is shown in Table 3.2. Where the route is served by different types of aircraft, a weighted average of the typical number of seats available was calculated.

C. Assessment of Air Fares

3.23 The data set represents 111 routes with the current economy and excursion fares, the shortest operated distance and the maximum permitted distance, and the number of seats offered on the route per year. Table 3.3 summarizes these data for each of the eight route groups. The full data set is provided in Annex 6.

3.24 The international routes receive the greatest discounts on full economy fares (see Table 3.3). Higher volumes allow larger aircraft, lower average seat cost, and a wider range of excursion fares. Considerable discounts are available for the high volume

Table 3.2: AIRCRAFT TYPES AND TYPICAL SEAT CAPACITY

Aircraft Types	Typical Passenger Seating Capacity
Wide-bodied jets	
B747-300/400	380-440
B747-100/200	370-430
DC-10	250
A300	250
A310	210
B767-200	210
Narrow-bodied jets	
B727	144
A320	132
B737-300	109
DC-9	92
British Aerospace BA3 (BA3 146)	75
F28-4000	72
Large turbo-prop	
Fokker 50	50
F27	36
De Havilland Canada Dash 8 (Dash 8)	36
Aerospatiale ATR 42	44
Hawker Siddeley 748	30
Light twin-prop	
Embraer Bandeirante	18
De Havilland Canada Twin Otter (Twin Otter)	20

Source: Aviation industry.

Australian international routes. In addition, highly trafficked tourist routes are generally associated with lower fares. This is demonstrated by the large difference between the average economy fare and the average excursion fare for the Indian Ocean island routes. Table 3.3 also indicates that there is some discounting available on fares to and from the Pacific Islands, although the extent of discounting is not as great as the other two groups of international fares, where traffic density is higher. Seat capacity for intra-Pacific Island routes is relatively low. These routes are thin and served by small aircraft with higher per unit costs, and tourist traffic is small and oriented to niche markets. As a result, discounting on intra-Pacific Island routes is relatively modest and limited.[15]

3.25 The average economy fares and excursion fares per seat mile are plotted in Figures 3.1 and 3.2, respectively. As is to be expected, the

Table 3.3: PACIFIC AND COMPARATOR REGIONS—AIR FARES, SECTOR DISTANCES AND CAPACITY, 1991 /a

Route Group	Return Economy Fare (A$)	Return Excursion Fare (A$)	Discount Between Economy & Excursion Fare (A$)	Maximum Permitted Mileage (miles)	Shortest Operated Mileage (miles)	Annual Seat Capacity (000)	Economy Fare per Seat Mile (A$ per m)	Excursion Fare per Seat Mile (A$ per m)
1. Pacific Rim to Pacific Islands	1,816	1,049	767	2,277	2,061	27.3	0.399	0.254
2. Intra-Pacific Islands	959	745	214	1,349	1,162	27.0	0.355	0.321
3. Australian International	3,555	1,344	2,211	5,193	4,252	401.5	0.342	0.158
4. Western Australia Domestic	635	419	216	720	720	53.7	0.441	0.291
5. Australian Domestic Tourist	688	505	183	857	857	221.8	0.401	0.294
6. New Zealand Domestic	365	253	112	356	356	246.1	0.512	0.355
7. Papua New Guinea Domestic	342	280	62	297	297	55.9	0.575	0.471
8. Indian Ocean Islands	3,434	1,576	1,858	4,785	4,011	57.9	0.359	0.196

/a Details are provided in Annex 6.

Source: Industry surveys.

comparatively shorter domestic routes of Papua New Guinea and New Zealand have the highest average fares per seat mile. Furthermore, Papua New Guinea domestic routes are not highly trafficked routes, and are serviced mainly by small aircraft. Economy and excursion fares per mile to and from the Pacific Islands, and between the Pacific Islands, are lower than those of domestic flights in Papua New Guinea, New Zealand and Australia. The lower economy fares per mile for the Indian Ocean Island routes and Australian international routes result from longer average distances and the use of wide-bodied aircraft.

Statistical Analysis Results

3.26 Two sets of statistical analyses were undertaken: one tested economy air fares and the other tested excursion fares. Detailed results are provided in Annex 10. The general funding of the statistical analyses is that the pattern of air fares is indeed largely explained by distance and traffic density. Excursion fares, where available are used by most travellers, are strongly related to distance and inversely related to density. Economy fares are even more strongly related to distance, but show no statistical dependence on traffic density. Both these results confirm general experience.[16]

3.27 The tests for regional differences in the fare relationship were negative, except for economy fares on intra-Pacific Island routes. On these routes *economy* fares are lower for other regions/routes, at the same levels of distance and density. If anything, the results suggest that the intra-Pacific Island routes are experiencing a modest relative fare advantage.[17]

3.28 Figures 3.3 and 3.4 show a plot of actual against estimated fares for economy and excursion air fares, respectively. Both figures illustrate the result of the statistical analysis; the Pacific Islands, including the PMCs, are not disadvantaged in comparison to other groups.

3.29 In Figure 3.3. there are only two Pacific Island routes where the actual economy fare is substantially different from the estimated fare, namely, Sydney-Papeete and, Apia-Honolulu and neither of these routes involve the Pacific Islands. Similarly, Figure 3.4 shows that the majority of the Pacific Islands' excursion air fares fall in the middle of the sample; only five Pacific Island routes are identified where the excursion fare is not in line with expectations: Noumea-Papeete, Singapore-Noumea, Apia-Honolulu, Sydney-Tarawa. and Auckland-Tarawa. Only three of these excursion fares involve PMCs; two involve Tarawa, where the fare is a sum of sector fares constructed over Nadi. Excursion fares are available from Australia and New Zealand to Nadi, but not Nadi to Tarawa, which is a very low density, relatively high cost route.

D. CONCLUSIONS

3.30 In summary, the evidence reveals that air fares in the Pacific Islands and comparator regions are shaped by distance and traffic density. *The evidence does not support the hypothesis that air fares for the PMCs are intrinsically higher than for other comparable States; distance and traffic density exert a systematic and uniform influence on air fares.*

3.31 At the same time air service routes to and from the PMCs are thin; distances are relatively long and traffic densities are low. Thus, air fares are high—relative to shorter hauls and relative to routes with high volumes. The evidence indicates that a four-fold increase in airline passenger movements (which corresponds to a doubling of total arrivals) corresponds to air fares that are 28 percent lower.

3.32 Notwithstanding the potential for securing larger volumes of traffic in concert with lower fares, since existing fares are high, the attraction of more visitors hinges on the *total* visitor costs and the intrinsic attraction of PMCs relative to

Figure 3.1: PACIFIC AND COMPARATOR REGIONS—AVERAGE ECONOMY FARES, 1991

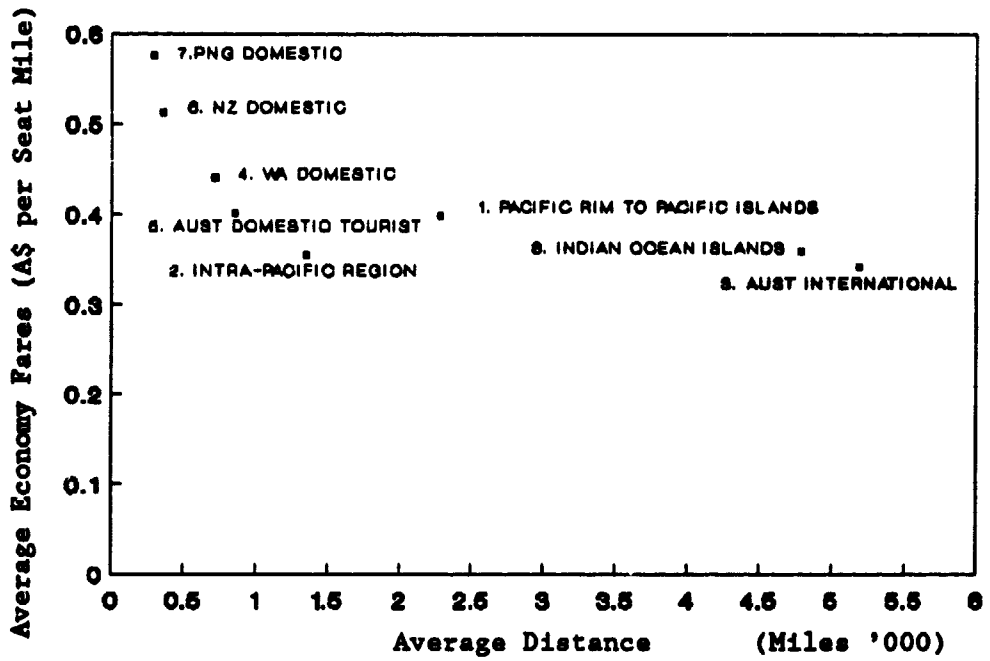


Figure 3.2: PACIFIC AND COMPARATOR REGIONS—AVERAGE EXCURSION FARES, 1991

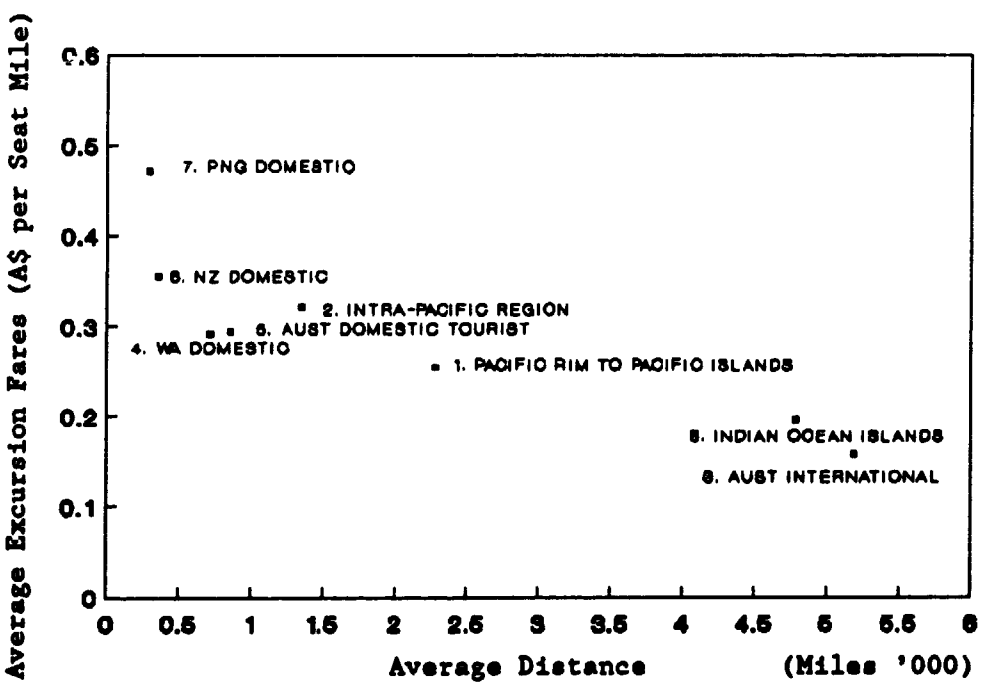


Figure 3.3: PACIFIC AND COMPARATOR REGIONS—ESTIMATED AND ACTUAL ECONOMY AIR FARES

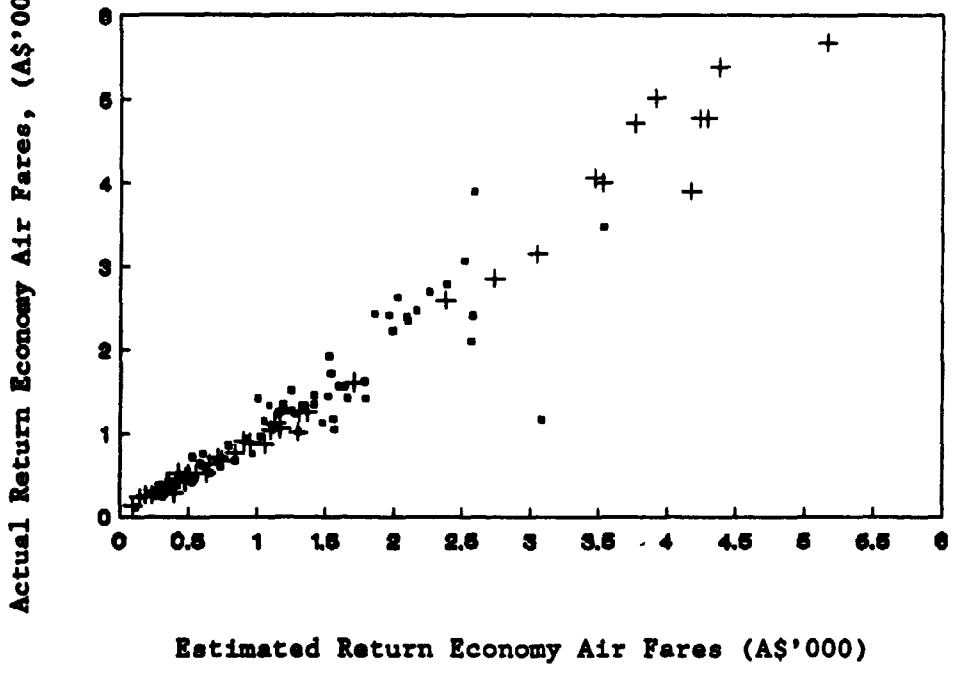
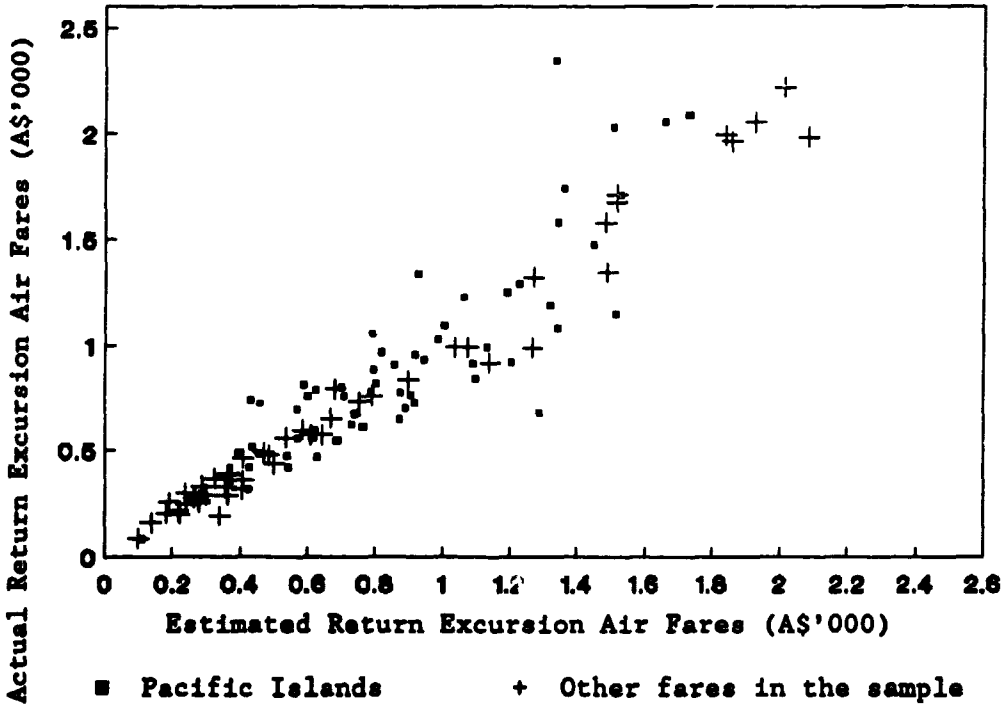


Figure 3.4: PACIFIC AND COMPARATOR REGIONS—ESTIMATED AND ACTUAL EXCURSION AIR FARES



alternative destinations. For tourists, the local cost of key facilities—hotels, resort/leisure activities—needs to be that much *lower* relative to competing destinations for which volumes and proximity to source markets allow lower air fares.

Endnotes

1. In Part III it is taken as understood that Papua New Guinea (PNG) is included in the set of PMCs.

2. Local and coastal shipping services are outside the scope of this study.

3. Touche Ross (1984).

4. "FAK rates" is a general term for freight rates offered to freight forwarders for consolidated cargo. General cargo rates refer to rates for cargo not otherwise specified on the freight schedule. In the case of the Pacific Islands, both rates can be viewed as "typical" rates.

5. This test employed the use of regional "dummy" variables in the regression analysis of the shipping rate relationship (see Annex 5).

6. The size of the effects are reflected in the values of the calibration parameters (coefficients) a and b, which represent elasticities. The estimates of these (0.15 and -0.04, respectively) seem low but are consistent with those found in other studies. In particular, a study of rates for 8,100 pairs of ports to and from the US in 1979 gave elasticities of 0.22 and -0.056. See Jansson and Shneerson (1987). The elasticity levels indicate that doubling shipping distance increases unit rates by 30 percent, while doubling route volume decreases rates by 8 percent.

7. A more detailed examination of air services for the PMCs is presented in Part IV of this report, in the context of cooperative arrangements among the airlines.

8. Composition by trip purpose, namely business, tourism and visiting friends and relatives (VFR), requires analysis of immigration arrival records and is not consistently available.

9. Passenger volume data on individual routes or sectors—on an uplift-discharge or true origin destination basis—are not readily available.

10. World Tourism Organization (1989).

11. Other connections to Tarawa are available over Nauru, and Air Tungaru (of Kiribati) may introduce jet (737) service between Tarawa and Nadi, possibly under a lease arrangement with Air Nauru.

12. Economy fares have almost no restrictions. There is no minimum booking period, the validity of the ticket is generally for up to one year, they can be used on all services, flight changes are allowed and cancellation carries no penalty. For international services, there is the added advantage that unlimited transit stops can be made, and a variety of alternative routings are often available for those routes with low direct service frequencies.

13. Excursion fares offer significant discounts but have tight restrictions on booking period, advance purchase, cancellation penalty, changes in itinerary, length of stay and intermediate stops. Nevertheless, they are by far the most common ticket in general use, especially for tourism, and they represent an estimated three-quarters of all travel from Australia to the Pacific Islands.

14. In terms of statistical methodology, the airfare relationship is a simple log linear model. Regional differences are tested for by the use of region specific dummy variables.

15. Table 3.3 also shows that there is the difference between economy fares and excursion fares for domestic routes in Australia and New Zealand, in comparison to domestic routes in Papua New Guinea. This reflects the heavy discounting which has resulted from airline deregulation in Australia and New Zealand. Although Western Australia and Papua New Guinea routes have comparable seat capacity, the average excursion fare within Western Australia is about 66 percent of the full economy fare, whereas the average excursion fare for Papua New Guinea domestic routes is over 80 percent of the economy fare.

16. The responsiveness ("elasticity") of air fares to distance and traffic density are estimated to be 0.68 and -0.07, respectively for excursion fares and 0.79 and 0, respectively for economy fares (economy fares show no statistical dependence on traffic density). These figures mean, for example, that a 100 percent increase in traffic density, is associated, on average, with a 7 percent decrease in excursion air fares. It should be noted, however, that as traffic density increases, the fare mix between economy and excursion changes. Much of the reduced unit seat costs from larger aircraft on high density routes is captured by substantial increase in the share of excursion and other discount fare types. Since fares and costs are treated equivalently, the results need to be interpreted with caution. More rigorous econometric analysis is required to examine market demand and supply conditions.

17. Availability of access to excursion fares on specific services, however, may be limited.

PART IV

REGIONAL AIRLINE COOPERATION

CHAPTER 1
INTRODUCTION AND BACKGROUND

A. The Problems of Smallness and Remoteness

1.1 Cooperation in transport, and especially aviation, is a long-standing issue in the South Pacific. The island States of the region are all small, many consist of widely dispersed islands, and they are separated from each other by long distances. For their size and income, they have a high dependence on aviation. Air services are necessary for internal communication, for travel between the States, and for international tourism. An efficient aviation sector is important to economic growth; in particular, it is essential for external competitiveness that the total "generalized" cost of air service, including the cost to airlines, and the time costs to users, be kept as low as possible. The air services networks for the Pacific Island Member Countries in the Pacific Rim region are shown in Annex 1.[1]

1.2 Air Service costs in the South Pacific region are shaped heavily by market conditions, in particular size and distance.[2] The island States, including the Pacific Member Countries (PMCs) of the Bank, are small in size and their air travel *markets are thin* (i.e., low traffic volumes over relatively long distances).[3] These factors give rise to higher cost structures. Thinness of markets leads to high costs since the cost per seat or per passenger of air travel falls with the size of the aircraft used. There is a trade off between airline costs (and hence, air fares) and the cost of convenience (time) to the passenger. If large aircraft are used, fares can be low, but frequency is low and so passengers are inconvenienced. Alternatively, if small aircraft are used, frequency is high, but so are airline seat costs. Apart from some routes to and from Fiji , which are moderately dense, the routes in the South Pacific are quite thin. Thus, even with the most efficient aviation possible, generalized costs are bound to be relatively high.

1.3 A related problem is that of small traffic volumes both for individual PMCs, and for the region as a whole. This gives rise to *diseconomies of low scale*. It is often stated that there are few economies in air transport, at least so far as operational costs are concerned.[4] However, this is true only when a minimum efficient scale is reached. There may be few economies in moving from fifty to one hundred aircraft, but there are considerable economies in moving from one to two aircraft or from a small to a larger aircraft. For the small airlines of the South Pacific scale economies matter. This has implications for the importance of cooperation—a small airline will need to contract out, or cooperate with other airlines, for many functions that larger airlines would undertake in-house. In addition, smallness brings along problems of indivisibilities. Some airlines do not require four or five aircraft of an appropriate type—rather they require 3/7 or 4/7 of an aircraft. This puts greater demands on cooperative arrangements.

1.4 A further problem in the South Pacific is the atypicality of air routes. The ideal aircraft would be small with relatively long ranges. By and large, these do not exist, or if they do, they

are special aircraft with high operating costs. There are scale economies in building aircraft, and manufacturers concentrate on large aircraft for long hauls, and small aircraft for short hauls. The larger aircraft can operate South Pacific routes (though sometimes airport facilities are a constraint), but they are difficult to fill; smaller aircraft often are inappropriate for the long stage lengths. This cost penalty is intrinsic to the geography of the region.

1.5 Limited experience of some South Pacific airlines is another factor affecting cost structures. Moreover, all airlines operate from developing countries with limited skilled labor. (Indeed, some Governments are keen to encourage their airline as a way of building up skills in a technologically advanced, tradable, industry.)

1.6 In spite of the importance of keeping costs low, all PMCs have their own airline, in one form or another, many of which are very small, and some incur significant losses. Several airlines need to fly sectors without traffic rights, resulting in poor seat occupancy (load factor), and some airlines find it difficult to obtain good utilization from the aircraft. For the traveller, movement around the South Pacific can be slow due to low flight frequencies combined with many indirect services. Several of these problems appear to be amenable to alleviation by expanded cooperation.

B. The Cooperative Response: Proposals and Actual Arrangements

1.7 Cooperative arrangements are seen as a way to lessen some of the regional air transport problems. To deal with smallness, cooperation is a way to directly reduce the small-scale cost disadvantages. However, even if the airlines cooperated to the point of becoming one airline, they would not, as a whole, constitute a large or even a medium size airline. Other problems impose cost penalties which cannot be avoided (for example, airport suitability problems). But, if the form of cooperation can result in inefficiencies being removed, the overall cost disadvantages would be lessened.

1.8 **A Regional Airline.** The common response to these problems has been to suggest various *institutional* forms within which the size problem could be addressed. The most important of these is the concept of a regional airline (which at one stage, there was the possibility that Air Pacific might become). The idea is to have one airline serve a group of Pacific States, owned jointly by them.[5]

1.9 **Aircraft Leasing.** Another suggested arrangement is a Pacific aircraft leasing company which would own aircraft and lease them to individual airlines on the basis that scale economies would be achieved in the ownership and maintenance of aircraft, Tourism Council of the South Pacific (1989). Yet since only about 10 - 20 percent of an airline's total costs are related to the ownership and maintenance of aircraft, potential gains are modest. Moreover, individual airlines have different requirements for aircraft and coordinating these requirements would be difficult. Thus, there has been no clear move towards operationalizing the Pacific leasing idea.

1.10 **Ad hoc Cooperative Arrangements.** The more ambitious proposals, for regional airlines or leasing companies have been overtaken by ad hoc developments. Aircraft have been a major problem for the South Pacific airlines, which want access to modern, efficient aircraft, but do not have the markets to make effective full time use of them. To resolve the problem, the individual airlines have made agreements to *share aircraft* with a number of Australian and New Zealand airlines, and between themselves (see Box 1.1 for a list of current arrangements). The airlines have shown considerable ingenuity in devising arrangements to make effective use of 'lumpy' aircraft capacity. This is perhaps the most obvious manifestation of cooperation, but cooperative agreements also cover a number of other aspects

Box 1.1: Aircraft Sharing Arrangements in the South Pacific

Country	Airline	Partner Airline	Aircraft
Fiji	Air Pacific	Qantas (Australia)	Boeing 747
Vanuatu	Air Vanuatu	Australian (Australia)	Boeing 727
Western Samoa	Polynesian	Ansett (Australia)	Boeing 727
Tonga	Royal Tongan	Solomons Islands	Boeing 727
Solomons Islands	Solomon Islands	Royal Tongan	Boeing 737
Kiribati	Air Tongaru	Air Nauru	Boeing 737

of operations, such as maintenance, and managerial support. In addition, there are seat purchase and code share agreements which make for better utilization of aircraft.

1.11 There have been problems with these agreements. In some cases, the parties to them have become dissatisfied and ended them, but then typically sought replacement agreements with the other parties. Dependence can also become a problem.[6] Most cooperation is on a bilateral, airline to airline basis. While these arrangements may appear unsystematic, they have the very real advantage that they are in place; it has not been necessary to wait for multilateral institutions to be established.

1.12 Approaches such as the regional airline and regional aircraft leasing company involve an institutional solution to cooperation; the solution would be imposed rather than emerge. The problem with these approaches is that they need not be in the interests, actual or perceived, of all States whose agreement is necessary for its success. While these approaches offer reduced airline operating costs and better coordinated schedules, they may not meet the requirements of the individual States.[7]

C. Structure of the Analysis

1.13 Airline cooperation should be facilitated by Governments ensuring that the operational, policy and regulatory environment in which aviation takes place enables gains from cooperation, consistent with economic efficiency, to be achieved.

1.14 The analysis of cooperation proceeds by examining the following matters in turn. The objectives of individual States and constraints facing them (Chapters 2 and 3), actual cooperation that has taken place (Chapter 5), gains from further cooperation (Chapter 6), and finally, interventions which enable cooperation (Chapter 7). The forms of cooperation that can work most effectively are best determined by those actively involved in aviation in the region. At the same time, there can be risks of market power with cooperation and therefore airlines also need to have incentives to pursue efficiency and, where appropriate, through cooperative means.

CHAPTER 2
ISSUES IN AIRLINE COOPERATION

A. Cooperation as a Management Decision

2.1 Cooperation is best viewed, not as a set of specific prescribed forms, but as a possible option for airline management in the manner it chooses to obtain and employ some of its inputs (such as aircraft, training, maintenance) in producing air services.

2.2 There may be good reasons why cooperation often does not take place, for example, government imposed objectives may be broader than, and in conflict with, simply low cost air transport. Also, there may be constraints on, and lack of incentives in relation to, cooperation. Furthermore, where there is potential for various types of market failures (for example, monopoly airlines using their market power, and external benefits or costs from tourism and unemployment), some forms of cooperation may not be in the interest of some countries. For example, cooperation may offer lower air transport costs, lower fares, more tourism, and gains to the region as a whole, but an individual country may lose, with tourists bypassing it to reach others. In this case, it is not in the interest of the country (which may lose) to cooperate—unless there are ways for other countries to provide compensation (see Box 2.1).

B. Costs of Cooperation

2.3 Direct familiarity with the airline industry is necessary to assess the various transaction costs and risks associated with cooperative actions. For example, low aircraft utilization rates may suggest that airlines could cooperate by sharing aircraft and thereby keep capital costs down. But, cooperation may increase some costs of doing business (for example, insurance), expand risks and reduce gains from specialization. Highly specific external recommendations about forms of cooperation are, in general, inappropriate. Airlines are the parties to cooperation and they need the discretion to adopt or reject particular cooperative arrangements.

2.4 At the same time, airline managements have their own objectives. Therefore, governments should structure incentives to airlines and their managements, to pursue government objectives. It follows that governments need to monitor the overall performance of their airline (for example, by comparing leading indicators with industry norms).

C. Efficient Cooperation

2.5 Cooperation is a way of efficiently achieving objectives, it is not an objective in its own right. Thus, if an airline is given incentives to pursue minimum costs it will seek out those cooperative arrangements which lessen

Box 2.1: The "Freedoms" of the Air

The rights that an airline may or may not possess to fly between one country and another are often summarized on terms of the "Freedoms of the Air". There are five formal freedoms, and an informal, sixth freedom. They are illustrated as follows.

First Freedom — The right to overfly a territory without stopping

Home State | Foreign State

Second freedom — The right to land for technical and non-traffic reasons

Home State | Foreign State

Third Freedom — The right to set down traffic from the Home State

Home State | Foreign State

Fourth freedom — The right to pick up traffic bound for the home state.

Home State | Foreign State

Fifth freedom — The right to carry traffic between the Foreign State and another Foreign State.

Home State | Foreign State | Foreign State

Sixth State — The (informal) right to carry traffic between Foreign States via the Home State.

Foreign State | Home State | Foreign State

Cabotage — Carrying traffic within the one State.

Home State

Individual countries negotiate, usually bilaterally, to determine which rights will be granted to airlines from the various countries to fly on international routes. Only first and second freedoms are generally available—other freedoms must be established through negotiation.

costs. However, cooperation is just one of many ways in which an airline may be able to reduce its costs.

2.6 Setting up an environment which facilitates cooperation where it enhances efficiency, and giving airline management incentives to pursue efficiency, is a difficult and demanding task; it is not achieved perfectly anywhere. Where objectives for an enterprise are simple (such as maximizing profits), an incentive structure can be created which serves this quite effectively (for example, within the airline). However, where objectives are more complex (as those given to aviation regulators or chief executives of government-owned airlines), incentive structures often break down. Yet, if airlines do not have *direct incentives* to pursue set objectives, they will not pursue cooperative agreements which advance them, and they may enter agreements which are contrary to the set objectives. Thus, the factors underlying decisions as to whether cooperation takes place or not need to be identified. To do this, the objectives of governments and airlines (and whether the airlines have incentives to pursue cooperation where it is efficient) need to be considered[8] and constraints that face airlines and governments identified and assessed. Where cooperation means gains to the group (of countries or airlines) as a whole, but losses to some, options need to be devised to provide for compensation arrangements. These issues are examined in detail below.

CHAPTER 3
CONSTRAINTS TO AIRLINE COOPERATION

A. Reasons for Non-Cooperation

3.1 In examining the scope for more cooperation between airlines, it is useful to explore the reasons for non-cooperation. In some cases of non-cooperation, there may be real barriers, while in others barriers may be artificial and relatively easily lowered.

3.2 There are several distinct reasons why cooperation, which could potentially reduce costs, does not take place. These may be grouped under four headings:

- market imperfections at the airline level;
- broader objectives of government;
- incentive structures;
- negotiation costs.

These are discussed in turn below.

B. Market Failures at the Airline Level

Market Presence and Concern with Monopoly

3.3 In a free trade situation, where any airline could serve routes in the Pacific, a monopoly may emerge. This monopoly might be able to use its market power, and raise prices. The country which owns the monopoly may gain or lose, (gaining through higher profits but losing tourists through higher fares) but other countries are very likely to lose. One way for a country to guarantee that it is not losing out is for that country to have its own airline. In principle, it is possible that it will be to this country's advantage to have an airline, even if this airline operates a loss, since the loss it incurs is more than made up for by the benefits of competition in the form of lower fares. However, this may be an expensive way of dealing with the perceived problems of a potential monopoly, since it may be possible for the country to use its power over aviation rights to force fares down or share in the profits of the monopoly.

Employment and Training

3.4 Where there is unemployment or underemployment in a country, the social opportunity cost of labor (the "shadow" wage) is likely to be less than the market wage. If so, the country will prefer that some services be produced domestically rather than imported. Airline services are a type of service that the home country can produce directly, and hence it may prefer to have a home based airline and employ nationals, rather than rely on another country's airline, even if this would be cheaper financially. If this consideration is relevant, it would be applicable to all industries, not just airlines, and the best approach would be to tackle the problem directly (for example, through subsidies to employment), if this is possible.

3.5 In aviation, specialized skilled labor is involved and this may be in short supply, not excess supply, in the South Pacific Island States. The shadow wage for trained personnel could be above, not below, the market wage. If so, care is needed in encouraging an industry which uses some labor that is scarce.

3.6 At the same time, airlines (along with other industries) may create useful external benefits through training labor.[9] By employing people in areas where they can develop skills in high demand throughout the local economy, an airline may be creating benefits for which it is not paid (when employees leave, it loses the benefits of training them). This would be another reason why the shadow wage could be less than the market wage.

3.7 Quantification of these externalities and how they can be best taken into account are difficult to gauge. However, Governments may take these human resource factors into account in having a *home based* airline.

Prestige and Defence Benefits

3.8 Sovereign governments sometimes operate airlines for prestige or defence reasons. However, it should be noted that benefits from an airline as a national flag carrier, or as a defence resource, may have high opportunity costs in terms of achievement of the country's other objectives.

C. Government Objectives: The Interaction of Tourism and Aviation

3.9 The tourism industry is a major potential source of economic growth for the PMCs and air transport is a major factor in influencing the flow of tourists.[10] Moreover since there can be positive and negative externalities, associated with tourism, and it may be easier to affect tourism flows through aviation than directly, this link is of policy interest and can constrain airline cooperation. However, tourism is an area where the benefits are prone to exaggeration (see Box 3.1); policy intervention in this sector requires careful assessment. Some of the possible external benefits are noted below in the context of the use of airline services to support them.

Foreign Exchange

3.10 Tourism is popular as an earner of foreign exchange. As foreign tourists arrive, they spend money on domestic goods and services, and add to foreign exchange receipts. Net receipts are significantly less than the gross receipts, especially for South Pacific countries, as many of the goods sold to tourists must be imported.[11] Any gains in foreign exchange from tourists (and from providing the air transport they use) is appropriately valued at the shadow price of foreign exchange. Only if this differs from the market price will there be any net external benefit. The two prices might differ if exchange markets are not free to adjust, or there are significant trade distortions such as tariffs, quotas and input subsidies on other goods.

3.11 Adjustment problems can arise if there are fixed exchange rates, and there is either excess demand for foreign currency, or excess demand for the local currency. But this is *not* a major issue in the PMCs. Trade distortions arise when imports are subject to tariffs. If more foreign exchange is earned from tourism, then the exchange rate rises, and imports of other goods and services also rise. The value that consumers put on these, their domestic market price, includes the cost to the country, the traded price, and the government obtains the difference as tariff revenues. The value of the foreign exchange, in terms of goods and services at domestic prices, is underestimated by the market exchange rate. *Trade distortions,* especially as a result of import tariffs, *do* apply to the PMCs. However, estimates of their full impact for individual countries are difficult to establish.

Box 3.1: Some Myths About Tourism

Foreign tourism expenditure is generally to the benefit of a country, however, the benefits it creates can be grossly exaggerated. Some myths are:

"Tourism benefits are measured by the size of the expenditure by foreign tourists."

This is not correct because it fails to take into account the costs of serving the tourists. Imports are required, goods and services must be diverted from other uses, and labor must be diverted from other industries. Normally there are net benefits, but they will be a fraction of the gross benefits.

"Foreign exchange earnings of tourism are the same as its impact on the current account."

Quite apart from the fact that imports will be necessary to serve tourists, other factors enter. More foreign exchange earnings will push up the exchange rate, encourage more imports, and discourage exports. The net impact on the current account is likely to be much smaller, and possibly negligible.

"Tourism results in significant increases in overall employment, especially through multiplier effects."

Tourism can contribute to increased employment, especially where there is unemployment. However its net contribution is reduced by its indirect impacts. A foreign tourism boom will raise the exchange rate, leading to lower employment in other tradeable industries. The net impact is difficult to estimate, but it is likely to be much less than the immediate impact.

3.12 A premium on foreign exchange receipts (and encouragement of industries, like tourism, that attract them) may be sound. However, current account deficit exposure, as experienced by several PMCs, does not constitute a valid reason for a premium on foreign exchange. The source of deficits is more in domestic savings and investment behavior, than in overvalued exchange rates.

Employment

3.13 Many PMCs do perceive tourism as being desirable as a way of increasing employment. Expansion in tourism usually results in a direct increase in demand for labor. The impact it has on *overall* employment is not clear, since some workers will be hired away from other industries, and rises in exchange rates will result in contraction of other export and import competing industries. With the underemployment in several PMCs, tourism will contribute towards increasing overall employment and if the shadow wage is less than the market wage in the formal sector, additional tourism will create net benefits.

Environmental and Social Impacts

3.14 Tourism has many environmental and social impacts; some are generally regarded as desirable, others as undesirable. Tourists add to congestion of facilities, but make extensions to facilities viable, giving benefits to residents. Tourists can over-use fragile parts of the physical environment, and thus degrade it. As against this, they can make preservation, which may not have occurred otherwise, a viable proposition. Tourists may weaken the local cultural identity, but they can provide a market for local crafts. In some cases, tourism is regarded as a threat to the way of life. Workers are attracted into the market sector, leaving their villages and their traditional industries;

communities may perceive a loss in their cultural identity. General assessments of whether these impacts are positive or negative are not possible; the net outcome depends on individual value judgments and circumstances.

Prices, Taxes, and Terms of Trade Effects

3.15 An increase in overseas tourism expenditure in a country leads to a change similar to a terms of trade improvement, and the country gains. An increase in demand for local resources, such as beaches, historical places or areas of natural beauty, increases their value. Since each country has an element of uniqueness, the demand for tourism increases as its price falls. Changes in complementary inputs, such as those induced by better aviation links, shift the demand for tourism, and with tourism being in less than perfectly elastic supply, prices rise. The owners of tourism facilities gain. Thus, even if there are no true externalities associated with tourism, a country may wish to increase demand for its tourism services through improving its air service links. A country also has the scope to tax or subsidize tourism. By taxing it, it can use its market power, and increase receipts received, at the cost of some reductions in flow.

3.16 All countries, and especially PMCs, face dilemmas in their tourism/aviation polices. Two such dilemmas are: (a) whether to tax or subsidize tourism (b) whether to do so at the tourism stage or the transport/aviation stage. If a country does not consider that there are substantial gains to be made from foreign exchange and employment,it may be more willing to take advantage of its market power, and tax tourism. Alternatively, if it considers that there are important externalities, it may encourage tourism by subsidies.

3.17 Once a country has decided whether to tax or subsidize, it can exercise its policy at the tourism *or aviation* level. Keeping air fares down may be an effective way of encouraging tourists—so too may be keeping up flight frequencies. The airline industry is more concentrated than the tourism industry, which consists of many independent suppliers, and it may be administratively simpler to grant subsidies or impose taxes at the airline level. The problem is that it is less direct (non-tourists will be affected as well as tourists) and any benefits may be dissipated amongst others, such as foreign airlines. For example, indirectly "taxing" aviation through tight capacity controls and high fares may be to the benefit of foreign airlines on the routes, as well as the home airline.

3.18 **Implications for Airline Cooperation.** If a PMC values tourism highly, then this places a premium on convenient and frequent airline services which connect effectively with others; this encourages tourism across the region. If a PMC is keen to maximize its share of tourism expenditure, facilitating travel to substitute destinations, may dilute its share of tourism.

D. Institutions and Incentives

3.19 In the aviation subsector, cooperation takes place at the national (Government) level, and the airline level. The key organizations directly involved are the airlines and ministries of civil aviation, or their equivalent.

3.20 The outcome of cooperative efforts depends upon the objectives of these organizations, and the incentives structures that they face. A private airline will normally have profit as its core, or only, objective. If airline owners structure the incentives for management such that they seeks profit, cooperation will be entered into where it lowers costs. In this respect, the private airline will perform well. However, it will also seek to cooperate with other airlines to increase profits in other ways, for example by raising international fares. Normally, this is undesirable behavior, since it reduces benefits overall. However, in the South Pacific context, the owners of the airlines are the Governments/nationals of the PMCs, whereas, in

the main, travelers are not. Thus, by raising fares a PMC airline is taxing tourists; this might or might not be in the interest of the airline's home country.

3.21 Airlines of the PMC are Government-owned and there are several ways in which broader government objectives may differ from the narrow profit objective of a private, or commercially-oriented, airline. The most important conflict of interest is likely to arise from tourism: a government may want low air fares to encourage tourism, while the airline can profit most from a high fare.

3.22 **Managerial Discretion and Organization Objectives.** Airlines, like other companies, whether privately or government owned, are under the day to day control of their managements, and it has long been recognized that the objectives of owners and managers diverge. Managers may seek greater size, growth or internal satisfaction, at the expense of profit. The scope for this tends to be greater with a government-owned enterprise where the discipline of the shareholders through the capital market cannot emerge. To address this issue, the rewards of managers need to be structured so that they have a keen incentive to pursue profit. Ways of doing this include relating senior management remuneration to profits, performance targets, and share ownership schemes. Airlines which possess market power, and are less subject to the discipline of competition, have more scope to pursue "managerial objectives".

3.23 Government-owned enterprises, including airlines, tend to be given very broad objectives which may be in partial conflict; typically little explicit guidance is provided by Governments as to how the conflicting objectives are to be resolved. Incentive mechanisms are usually not specified, and may depend more on informal 'hidden agendas', than on explicit performance. These circumstances pose problems for airline managers, and for Governments in evaluating performance. It follows that scope may exist for airline management to be independent, and pursue organizational objectives, such as expanding the size of the airline. If this occurs, the airline will often prefer to undertake tasks in house, possibly at higher cost, rather than contract out or cooperate with other airlines.

3.24 Existing evidence indicates that the government-owned airlines of the PMCs are typical of public enterprises around the world. Some are given explicit objectives, some are not. For some, commercial performance is an important objective, for others not. Some PMC airlines publish financial statements, others do not. All have been set objectives broader than profit alone, such as encouraging tourism. Explicit mechanisms, linking performance to managerial rewards, are rare, though with some, informal mechanisms may be in place. For some cooperative agreements, it is clear that *airline managers are unlikely to be rewarded for putting them in place, even though they would be valuable.* If the institutions which can make cooperation work have inadequate incentives to do so, it will not happen.

3.25 Many countries are addressing the problems of public enterprises. One option is to privatize, and another is to institute explicit objectives and incentive structures based on performance relative to objectives. Another approach is to "corporatize" the enterprise: give it a corporate form, give prominence to profit as an objective, but constrain (for example, through price regulation) inefficient behavior that this might lead to. With corporatization of airlines by PMCs it is necessary to establish how broader government objectives (for example, tourism and employment) can be included within a corporatized framework. The same issues need to be resolved with privatization.

3.26 To an important extent, airline *cooperation also depends on the regulatory authorities,* such as the ministries of civil aviation (or their equivalent). These authorities have the power to allow or disallow various forms of cooperation such as agreement to third

country seat purchases. The attitude of airlines and aviation authorities is shaped by the objectives that are set. For cooperative agreements to be adopted, there needs to be mechanisms for facilitating them in a way that those entering the agreement gain, or be seen to have performed well. For example, an aviation authority may be willing to cooperate by granting fifth freedom rights but choose not to do so as there may not be any way it can secure payment, from those who gain from this cooperation. As a result, potentially valuable cooperation may not come about.

E. Negotiation Costs

3.27 Bargaining problems are often a reason why gains from cooperation are not achieved, especially in the aviation sector. Countries may agree on what is the best course of cooperative action, but do not move to it because of disagreement about how the gains are to be shared. In the short term, refusing to agree, and holding out for more in a bargaining context, can be perfectly rational. In the long term, such a situation should not prevail if the parties are rational, because some compromise is better than none.

CHAPTER 4
EFFICIENCY, COOPERATION AND COMPETITION

A. Giving Meaning to Efficiency

4.1 Efficiency concerns the extent to which objectives are achieved subject to prevailing constraints; the simplest approach to economic efficiency involves maximization of the total of net benefits to consumers (travellers), producers (airline profits) and governments (revenues).[12]

4.2 Two aspects of efficiency are particularly relevant to the issues facing aviation in the PMCs. These are: *allocative efficiency*—which involves whether the types, levels and prices of air services that best serve travellers are being supplied (in terms of what travellers are prepared to pay) and *productive efficiency*—which involves whether the costs of air services are as low as possible. Cooperative arrangements have the potential to affect both aspects.

4.3 **Efficiency at the Industry and National Level.** Economic efficiency can be examined with respect to a narrow or broad base. Taking a narrow base, efficiency is considered at the level of the airline industry; interactions with other parts of the economy are set aside. Improving the efficiency of air services is regarded as improving a country's overall economic position. However, for the aviation subsector in the South Pacific, simply ensuring that the airlines (of one or more countries) perform efficiently may not lead to efficiency on the broader base of the overall economy. This difference between industry level and economy wide efficiency arises from the following:

(a) Many users of the airlines are foreign visitors, whereas the airlines and those who enjoy the profits, or finance the losses, are nationals (mainly national governments). These groups may be viewed differently by the countries concerned.

(b) Foreign tourists are valued for the benefits they may bring and therefore, a country prefers lower fares which encourage more tourists (to that country).

(c) Costs faced by an airline may not be the true opportunity social costs to the country. If there is unemployment of labor, the shadow wage (opportunity cost of labor) may be less than the market wage actually paid by the airline. If the skilled labor required by the airline is in excess demand, the reverse could be the case.

(d) Gains in net benefits by the PMCs as a whole may coincide with a loss for some individual countries. It may not be easy for the gainers to compensate the losers.

4.4 In order to address net benefits over the whole South Pacific region, it is necessary to take a broad view of efficiency, rather than one limited to the airline industry. The different countries in the region see the aviation problem as more than one of simply ensuring cooperation between airlines, or efficiency of the airlines, or of just aviation and tourism. Unless the broader concerns of individual countries are taken

account of, some valuable cooperation will not take place. Steps toward operationalizing this broader approach to economic efficiency are outlined below.

B. Cooperation and Efficiency

4.5 **Risks from Cooperation.** Cooperation is not always desirable since competition usually promotes efficiency.[13] Indeed, in many countries, for many areas of economic activity, cooperation is prohibited, or at the least discouraged.[14]

4.6 In some cases, there is cooperation in aviation between countries to establish traffic rights, regulate safety, or develop operating standards. This type of cooperation need have no major impact on competition. Other cases of cooperation may have the effect of enhancing competition (whether or not that is the object), for example, when two countries allow 5th Freedom operators (see Box 2.1) on a route between them. Airlines may also cooperate in ways which do not diminish competition and may indirectly increase it. For example, two airlines which serve different routes may cooperate in joint use of an aircraft, or arrange their schedules so as to make interlining convenient for passengers. But in cases where cooperation is directed at supply conditions, for example, fares or capacity, it can be directly anti-competitive. Thus, any given cooperative agreement can have both positive and negative aspects—it may reduce costs and also reduce competition.

4.7 **The Value of Competition.** Competition provides pressure on airlines to keep prices close to costs, and to provide the types of services that travellers want. Competition also provides pressure on airlines to push costs down as low as feasible—if necessary, by cooperating with other firms rather than doing everything "in-house". If competition is weak, airlines have the scope to allow costs to rise. After all, they can pass on cost increases, whether or not they are justified—although this will reduce airline performance and traffic. Airlines may not use this scope; this depends on the objectives and incentives they face.

4.8 There is also value in cooperation. Airlines may be able to take advantage of economies of scale in certain functions (for example, maintenance) and achieve greater aircraft utilization and better trained staff through cooperation. In addition to reducing costs, cooperation may also enable better products to be offered to the traveller, through more convenient schedules, connections, and transfers.

4.9 Just as cooperation may undermine efficiency (for example, collusion to raise prices above costs), it is true also that competition is not always conducive to efficiency. When numbers of competitors are small, competition can lead to inappropriate product mixes, such as parallel scheduling of flights, which is inconvenient for passengers.[15]

4.10 **Trade off between Competition and Cooperation.** Cooperative arrangements may enable costs savings to be made, or better services to be provided, but reduce competition and weaken the pressure to perform. As a result cost savings may be dissipated. This trade off is a particularly delicate one for the PMCs. The small size of the airlines, and the thinness of their routes, makes inter-airline cooperation to reduce costs and offer better schedules an obvious option. At the same time, competition between airlines is weak, and the internal incentives to pursue cost efficiency are not strong. Lessening competition through inter-airline agreements will weaken the already limited pressure to perform well on the part of some of the airlines. Some possible trade-offs are indicated in Box 4.1.

4.11 A practical approach to the problem of cooperation involves setting out the various possible forms of cooperation, looking at the benefits, and assessing whether they are likely to

Box 4.1: Competition and Cooperation: Some Traffic Trade-Offs

Three aspects of performance are considered here: cost efficiency, price/cost ratios and passenger convenience. Positive Desirable (+) and Negative Undesirable (-) impacts are suggested. Some common forms of co-operation are listed here:

Form of Co-operation	Impact on Costs	Impact on Price/Cost Margins	Impact on Passenger Convenience
Baggage Handling	+	-	+ ve
Revenue Pooling	-	- ve	+ ve (possibly)
Seat Purchases	+	? Possibly - ve	+ ve
Aircraft Sharing	+	? Possibly - ve	- ve (possibly)
Code Sharing	-	? Possibly - ve	+ ve
Maintenance	+	-	-
Staff Training	+ (possibly)	-	+ ve (possibly)

involve problems of lessening competition or not. On this basis, guidelines can be established as to what forms of cooperation are desirable, undesirable, or problematic. Again, given information limitations, external assessment can only provide a general indication of the benefits and costs. Design of a framework under which desirable forms of cooperation are encouraged, and undesirable forms are not, is set out in Chapter 7 below.

C. The Decision to Cooperate

4.12 It is rarely possible to state unambiguously whether cooperation of one form or another among firms will actually reduce costs. Managers are employed to work out and activate the best ways of getting tasks done,[16] in particular whether to have a task performed "in house", to contract out to non-airlines, or to cooperate with another airline (which may or may not be a competitor). The most cost efficient choice depends on many factors. Some areas have more obvious solutions than others—for example, where an airline has an aircraft which is not used for 50 percent of the time, one cost reducing solution is to lease it out part time to another airline. Other areas have less obvious solutions—for example, should an airline train staff "in-house", or in cooperation with others? The many different forms of potential cooperation are discussed in Chapter 5 below.

4.13 Where an airline cooperates with other enterprises, including airlines, some costs may be reduced but other costs are incurred, principally:

(a) **Transaction Costs.** These include the costs of negotiations, costs of travel, the costs of additional administration, etc.

(b) **Coordination Costs.** In cooperating, it is necessary to standardize some products and procedures; this may lead to higher costs for individual airlines.

(c) **Control Costs.**[17] When one airline (the principal) gets another airline (the agent) to undertake a task, it cannot be sure that the latter will do it as well as it would do it itself. If an aircraft is shared, the

other airline may not always make it available in time (there are always excuses for lateness), or if an aircraft is maintained by another, "unavoidable cost overruns" may occur. Cooperation always involves risk which is normally lower by doing things "in house", where managers can keep things more closely under surveillance.

4.14 A key role of airline managers is to weigh up the benefits of cooperation with the costs and the risks. Ideas which look promising from outside the airline may not prove cost effective; caution must be exercised when suggesting what forms of cooperation will be cost effective.

4.15 **Management Incentives.** The way in which an airline is structured, and the incentives faced by the managers, are critical for cost effective cooperation. It is essential that airline managers have the freedom, incentive and responsbility, to choose forms that are cost effective and reject those that are not. If managers are actively seeking efficient performance of the airline as a whole, they will make good decisions concerning cooperative ventures. Thus, addressing the structure of, and *incentives* within, airlines, to ensure that they are consistent with generally pursuing efficiency, is the key factor in establishing a framework in which efficient cooperation can come about.

CHAPTER 5
COOPERATION BETWEEN AIRLINES IN THE SOUTH PACIFIC

A. COOPERATION BETWEEN AIRLINES

5.1 One of the most evident worldwide trends in aviation has been increasing cooperation between individual airlines, especially among international carriers. Within the US, cooperation between separate airlines is limited by antitrust policy, but there has been a sharp reduction in the number of airlines, often by merger, and the formation of "mega-carriers". Undoubtedly, this is in part a reflection of underlying economic pressures.[18] The pattern of changes amongst the international airlines has been different, even though it reflects the same economic forces. Ownership (many airlines are still government owned) and the different regulatory environments at the international level are possible reasons for this. Though mergers have been few, there have been several cases of cross-shareholding arrangements. At the operational/scheduling level, there has been integration of schedules and code sharing,[19] and joint developments of reservations systems.

B. COOPERATION IN THE SOUTH PACIFIC

5.2 In the South Pacific region, the forms of cooperation tried have been *numerous, and the airlines have shown considerable ingenuity* in resolving the difficulties they face. However, with different challenges, especially the small size of markets and airlines, the airlines of the PMCs have developed quite different forms of cooperation, generally at the operational level.[20] As an example, one of the more pervasive forms of cooperation in the region has been the sharing of aircraft—this is not necessary, nor common, among larger airlines.

5.3 The types of cooperation arrangements currently in place [21] can be divided into three main groupings:

- use of aircraft, seat purchases, and revenue pooling;
- coordination of schedules and cooperative advertising;
- ground handling, catering, staff training, and technical standards.

Apart from these, other forms of cooperation, such as management contracts and cross shareholdings, are present.

5.4 Cooperation takes place at two different levels: between the airlines of the South Pacific themselves, and between the South Pacific airlines and larger airlines (mainly based in the Pacific Rim, in particular Australia and New Zealand).

5.5 Patterns of airline cooperation between the South Pacific countries are summarised in Table 5.1, which indicates whether cooperation of a particular form does, or might, take place—it does not indicate its likely significance.

5.6 In Table 5.2 cooperation between the South Pacific airlines and other airlines is indicated.

Table 5.1: COOPERATION BETWEEN SOUTH PACIFIC AIRLINES, 1991

	Air Caledonie	Air Nauru	Air Niugini	Air Pacific	Polynesian Airlines	Solomon Airlines	Royal Tonga Airlines	Air Vanuatu
Operational								
Joint Ownership A/c								
Full Time lease a/c			P					
Part Time lease a/c			P			X	X	X
Co-operation in choice of Aircraft	N							
Maintenance						X	X	
Spares Holding								
Aircraft Scheduling	X	P				X	X	
Crew Scheduling		P				X	X	
Seat Purchase	X	P	X	X	X	X	X	X
Pooling		P						
Sales and Marketing								
Passenger Scheduling		P	X					
Access to 5th Freedom		P		N	X			
Reservation Systems								
Fares Setting	X							X
Promotion								
Advertising								
Infrastructural								
Corporate Seminars	X		X	X	X		X	X
Ground Handling	X		X		X	X	X	
Catering	X		X			X		
Staff Training			X			X		
Accounting Systems								
Multilateral Negotiations								
Technical Standards			X					
Negotiation of Traffic Rights			X			X		
Other								
Cross Shareholdings		P	N	X	X			N

Code: X = Current P = Possible N = No longer present

Source: Survey of Airlines, Annual Reports.

C. PATTERNS OF COOPERATION

5.7 Several airlines have some form of cooperation in place which affects the provision of aircraft. They may cooperate between each other (Solomon Airlines and Royal Tongan) or with airlines of the Pacific Rim (Polynesian with Ansett), especially in connection with maintenance and spare parts stockholding. There are some examples of aircraft and crew scheduling cooperation between airlines of both groups. Seat purchases, by one airline on

Table 5.2: COOPERATION BETWEEN SOUTH PACIFIC AND PACIFIC RIM AIRLINES, 1991

Form of Co-operation	Air Caledonie	Air Nauru	Air Niugini	Air Pacific	Polynesian Airlines	Solomons Airlines	Royal Tongan Airlines	Air Vanuatu
Operational								
Joint Ownership A/c								
Full Time lease A/c					X			
Part Time lease			X	X			X	X
Co-operation in Choice of Aircraft		X	X		X	X		X
Maintenance	X	X	X	X	X			X
Spares Holding	X	X	X	X	X			X
Aircraft Scheduling	X		X					X
Crew Scheduling				X	X			X
Seat Purchases	X			X				
Pooling	X		X					
Sales and Marketing								
Passenger Scheduling			X					P
Access to 5th Freedom					X			
Reservations Systems	X	X	X	X	X	X	X	X
Fares Setting	X		X		X			X
Promotion	X		P					
Advertising								
Infrastructure								
Corporate Seminars			X				X	X
Ground Handling	X		X	X	X	X	X	X
Catering	X		X	X	X	X	X	
Staff Training	X		X		X	X	X	
Accounting Systems								
Multilateral Negotiating			X		X			
Technical Standards						X		
Negotiation of Traffic Rights						X		
Other								
Shareholdings			N	X	N	N		N
Managerial Assistance			N	X	X			N

Code: X = Current P = Possible in Future N = No longer Present

Source: Survey of Airlines, Annual Reports.

another's flight, are quite common. There are some attempts to coordinate individual airlines' schedules for passenger convenience. (For example, Air Caledonie International links its Noumea-Vila flights with UTA's flights.) The South Pacific airlines rely quite heavily on the Australian airlines for computer reservations systems. They cooperate a little between themselves, but more with the Pacific Rim airlines, on fare setting. There is modest

cooperation on promotion and advertising. The airlines take advantage of ASPA (Association of South Pacific Airlines), to a lesser extent, the OAA (Orient Airlines Association) (Air Niugini), and IATA (International Air Transport Association) in handling industry wide issues. Cooperation between airlines of both groups, in ground handling and catering, is very common. There is some cooperation between the South Pacific airlines on staff training, but most rely, to some extent, on Facific Rim airlines for assistance. At a more general level, several rely on the Rim airlines for the provision of some of their management expertise (see Box 5.1).

5.8 Several forms of cooperation are conspicuous by their absence, or at least, their rarity. Cross-shareholdings do exist, but they are minor and of limited importance. Pooling appears to be of minor importance, especially on the routes internal to the region. This is perhaps because many routes are operated by only one airline (and other airlines gain a presence by seat purchases). There is less joint advertising and promotion than one might expect. The same is true of staff training, and the development of accounting systems. Code sharing is a form of cooperation often practiced by large airlines, but it is not that common in the South Pacific, possibly because the airlines wish to market themselves as specialists, rather than airlines with comprehensive networks.

Box 5.1: Choice of Partner: South Pacific Airline or Pacific Rim Airline?

1. **Aircraft Leasing: who has aircraft available at the right time?**

   Rim airlines have larger fleets and more flexibility in making aircraft available part of the week. Two South Pacific airlines may have sufficient demand for one aircraft, and may be able to share. Co-ordination of aircraft schedules may be easier for them than if a South Pacific Airline co-operates with a Rim airline.

2. **Managerial Assistance : who has the greatest expertise?**

   The larger size, and greater experience of operation, means that managerial assistance is more readily available from Rim airlines.

3. **Which airlines have similar tasks?**

   South Pacific airlines face similar tasks and problems (small size, thin routes) and may be more adept at meeting some of the challenges than larger airlines from the Rim.

4. **Which airlines are competing in the market place?**

   Airlines which are actually competing in the market may find it difficult to co-operate, e.g. on sharing an aircraft. While the South Pacific airlines do compete with Rim airlines (especially Air New Zealand and Qantas) they do not compete very much with domestic airlines like Australian. They may feel that there are fewer conflicts of interest with Rim airlines.

5. **Do some airlines have greater power in negotiations because of size?**

   The Rim airlines are much bigger than the South Pacific airlines, and they may use their advantages to gain a lion's share of the benefits from co-operation. At different stages, however, they have been quite competitive in offering agreements to the South Pacific airlines.

6. **Which airlines can get tasks performed cheaply?**

   By virtue of their size, the Rim airlines may be able to undertake tasks (e.g., maintenance) relatively cheaply. They can take advantage of scale economies whereas even if all the South Pacific airlines co-operated, they would not be able to achieve the same scale.

5.9 There appears to be more cooperation between airlines of the South Pacific States and those of the Pacific Rim, than among the South Pacific airlines themselves. The larger Rim airlines have a wider range of services available, and are able to take advantage of scale economies in them. The South Pacific airlines are small, and in some cases, inexperienced, while those of the Rim are significantly larger and more experienced.

5.10 There are some types of services that are best supplied by larger airlines. These include maintenance (there are scale economies in maintenance of any particular type of aircraft) and reservations systems (for which there are large set-up costs). Proximity is moderately important for these services, though it is not critical, and the small airline can shop around amongst a few airlines for the best partner. This applies also for staff training.

5.11 Other forms of cooperation are more dependent on proximity. This is especially true of aircraft sharing arrangements; for these to make sense, they must be made with airlines which have operations close by. Other arrangements are specific to location, such as ground handling and catering. Thus, some arrangements are made between South Pacific airlines, and others are made with airlines of Rim countries to which the South Pacific airlines operate. (For example, Air Vanuatu shares an aircraft with Australian Airlines, and it operates between Vanuatu and Australia.) With these arrangements, there is some, though limited, scope for shopping around.

5.12 When cooperative arrangements involve aircraft scheduling, pooling and seat purchases, the possible partners are defined by routes and networks. For examaple, if Air Vanuatu is to purchase seat on a specified route, the only airline it can purchase from might be Solomons Airlines.

5.13 There are also arrangements which can be undertaken with airlines anywhere. Although they are not common in the South Pacific, cross shareholdings could be with airlines of any part of the world. Managerial agreements are more common, and while any airline could supply expertise, existing cases only involve airlines of the Pacific Rim countries.

5.14 Beyond these aspects, there do not seem to be any dominant patterns of cooperation. The ties that come about appear to be somewhat ad-hoc, and depend on which airline has spare aircraft capacity at the time, or which airline is able to offer a better management contract. The contractual ties do appear fluid, if not fragile. While there have been longstanding relationships (for example, between Air Pacific and Qantas), the nature of these relationships has tended to change. There have been some major changes of partner, for example, Air Vanuatu was originally operated by Ansett, though now it has a lease agreement with Australian. A one stage, in the 1980's, it looked as though Ansett Airlines might have taken a dominant role in the South Pacific; its involvement is now very limited (see Box 5.2).

5.15 As indicated, there are several reasons for these cooperative efforts. Size is one; the small South Pacific airlines can reduce costs by contracting out to larger airlines. Inexperience is another; managerial expertise may be in short supply, and staff training schemes take time to develop. Cooperation to assist in marketing and developing an attractive network with convenient scheduled for passengers takes place, though it does not appear to be a dominant consideration. Finally, cooperation to limit competition and use market power sometimes takes place, but it does not appear to be significant in the South Pacific. This is perhaps because several of the thin routes of region do not have more than one independent operator.

Box 5.2: A History of Cooperative Involvements: The Case of ANSETT

Ansett has been involved in a variety of co-operative and other arrangements for the provision of air services in the South Pacific. The arrangements are listed in chronological order by country.

Papua New Guinea

i. Operated scheduled service to and within Papua New Guinea (1961 to 1973).
ii. Operated Australia to New Guinea scheduled service on their own behalf and on behalf of Air Niugini (1973 to 1976).
iii. Become a 16% shareholder in Air Niugini.
iv. Now holds no shares in Air Niugini.

Republic of Vanuatu

i. Operated and assumed economic risk of Air Vanuatu Ltd (a joint venture company 60% owned by the Republic of Vanuatu and 40% by Ansett (through a subsidiary company). (1981 to 1986).
ii. Operated by agreement from Qantas (ANR Reg 201) the Australian capacity entitlement to Vanuatu. These services were operated with "AN" designation but have ceased to operate.

Independent State of Western Samoa

D. Problems with Cooperation

5.16 While numerous examples of cooperation exist amongst the South Pacific airlines, several examples of cooperation have broken down. (See Box 5.3) There are several reasons for this.

5.17 **Non-viability.** In a few cases, a cooperative venture has been tried, and later discontinued, essentially because the venture was not a financial or economic success. The cooperation between the Cook Islands and Ansett (in the Cook Islands International venture) did not persist, basically because the operation itself was not economic. It is inevitable that some of the ventures tried will not be successful; this need not be because of a failure of the cooperative arrangements per se.

5.18 **Moral Hazard or Control Problems.** When two parties come to an agreement about a joint venture, or where one party undertakes to do certain tasks for another, problems can arise because of the lack of information. One party may not pull its weight, and not do all it can to make the venture succeed, and even may take actions which put the venture in jeopardy. One party may not be able to monitor the performance of the other accurately; there is always an element of uncertainty, each will claim to be upholding its part of the bargain. This type of problem is more likely to arise with non-standard, as compared to standard, agreements. For example, if ground handling by one airline for another is not efficient, this will be obvious: negotiation or separation will quickly take place. Some of the cooperative arrangements in the South Pacific are unique and complex, and it is not easy for one party to check all aspects of performance by the other. Thus, disagreements develop and cooperation breaks down. This type of problem may underlie the recent disagreements between Ansett, Polynesian Airlines and the Western Samoan Government.

5.19 **Changing Cost Structures and Networks.** A cooperative arrangement may work well for a time, and then circumstances may change, leading to its demise. For example, an airline may have spare aircraft capacity which it leases to another. It may change its aircraft, or its own network, and its spare capacity may cease to be available, necessitating the end of the agreement. This is quite likely in the South Pacific where aircraft constitute a significant "indivisibility", and

BOX 5.3: AIRLINE COOPERATION IN THE SOUTH PACIFIC: SOME VENTURES THAT NO LONGER EXIST

i. **Ansett/Australian (Trans Australian as it then was) and Air Niugini.** Shareholdings and operations on behalf of Air Niugini. Ceased because of independence of the country and the political desire for the airline to become independent.

ii. **Ansett and Air Vanuatu.** A shareholding and economic risk-taking venture by Ansett. It was not possible for Ansett or The Republic of Vanuatu to agree on terms for renewal of the first contract. Among the matters in dispute were the failure of Ansett to introduce ni-Vanuatu as cabin crew (Vanuatu complaint) and the wish of Ansett to have Vanuatu participate in the risk sharing of the operation whilst Vanuatu wished to retain the royalty basis of its income.

iii. **UTA and Air Nauru.** UTA chartered B.737-200 capacity (wet) from Air Nauru to operate services between Noumea and Port Vila and Noumea and Wallis Island via Nadi. The arrangement ceased when the newly established Air Caledonie International obtained its own aircraft, a Caravelle SE.12.

iv. **Polynesian Airlines and Air Vanuatu.** Polynesian Airlines, having recognized that in order to provide a fully comprehensive service to the Cook Islands, it should serve the destination twice a week from Sydney via Apia, came to an arrangement with Air Vanuatu to part charter its aircraft to Air Vanuatu for the Sydney to Port Vila leg of the SYD-VLI-APW-RAR vv service. This arrangement provided several benefits:

a. it gave extra capacity to Port Vila from Sydney at a day time slot when Air Vanuatu could not itself operate.
b. it gave Polynesian Airlines additional revenues on the SYD-APW services
c. it established a new air route Port Vila to Samoa.
d. it enabled new, more comprehensive South Pacific tour itineraries to be developed.

where excess or under capacity are much more likely than in a large, dense airline system. The airline which has been purchasing the excess capacity of another may well regard itself as having been let down.

5.20 Two parties may set up a cooperative venture which is successful. However, they may disagree about how the gains are to be shared; one party may regard the original agreement as unfair. (Collapse of the agreement between Ansett and the original Air Vanuatu may have involved this perception.)

5.21 **Cooperating with Competitors.** Airlines often cooperate with competitors; for example, one airline may provide ground handling for its competitors. When this cooperation takes a standard form, with agreed prices, it usually works smoothly. However, where the form of cooperation is less standard, and uncertainty is greater, it may be difficult for two competitors to cooperate, even if cooperation takes place on one route and competition on another. It is significant that several of the more complex cooperative arrangements are between airlines which, under current national policies and air service agreements, *cannot* compete (Australian and Air Vanuatu), or airlines which, in practice, are not likely to compete strongly (Solomons Airlines and Royal Tongan).

5.22 **Costs of Cooperation.** Cooperation usually involves some costs that could be avoided if the tasks were all done in-house. There are costs of negotiation, of drawing up agreements, and of policing them. *Such costs do not seem to have been a major problem* in the South Pacific.

5.23 **Cultural Differences.** Differences in the ways business is done, or the languages that are spoken, can make cooperation more difficult and

costly. For example, one airline may require its crews to have a knowledge of French, while others may not; this would lessen the scope for cooperation in staff training. These problems do exist in the South Pacific, but they are understood, and *do not appear to have constituted major difficulties.*

5.24 Only some of the problems encountered with cooperative arrangements come about because of cooperation per se. If a joint venture ends because it is not viable, or because costs and circumstances change, it is not a failure of cooperation as such, since much the same would happen if one airline had responsibility for all services. The moral hazard problem is inherent with cooperation, as is disagreement about the sharing of gains, the transaction costs of cooperation, and the problems of cooperating with competitors. Cultural and language problems could pose a problem no matter what institutional arrangements are adopted.

E. General Assessment

5.25 The airlines of the South Pacific participate in a wide variety of cooperative agreements possibly more than most other airlines. No doubt, this is because they need to. They face a number of problems, of which small scale, thinness of markets and, in some cases, lack of experience, are severe. All these problems are addressed through the cooperative agreements in which they participate. Most enter aircraft sharing arrangements which lessen the cost disability of small scale. Many have code sharing and seat purchase agreements, which help them keep a presence in low density markets. They have maintenance and managerial assistance agreements which help them overcome problems of inexperience and small scale. Most of the cooperation which exists in the South Pacific is primarily directed towards cost reduction and product improvement; it is not simply to lessen competition and raise prices.

5.26 Each country and airline has its own solutions to the problems it faces, and the solutions adopted differ. As a result, there is not the same homogeneity as would be the case with an overall, multilateral solution, such as a regional airline. Nevertheless, the *present patchwork of arrangements is viable and appears to be serving the region quite well.*

CHAPTER 6
ASSESSING THE GAINS FROM IMPROVED COOPERATION

A. INDICATORS OF INADEQUATE COOPERATION

6.1 Considerable airline cooperation already exists for the PMCs. Two outstanding questions are what is the extent of potential gains from further cooperation and, if these are significant, what are the barriers that are preventing their achievement?

6.2 Assessment of possible gains from better cooperation in aviation matters is a difficult task. Part of the problem lies in the sketchy data on the finances and operations of the South Pacific airlines.[22] This limits quantitative assessment;[23] only the order of magnitude of potential gains can be indicated. Moreover, for some forms of cooperation measures of performance are possible; for others, they are not. Some forms of cooperation reduce costs (for example, better aircraft utilization), others do not lower airline costs, but improve the quality of air service (for example, better schedule coordination). Further, some forms of cooperation may improve some indicators (for example, lower costs) while impairing others (for example, passenger convenience). Aircraft subleasing may reduce costs but at the expense of lower schedule reliability.

6.3 **Approach.** Notwithstanding these difficulties, it is possible to put together a picture of whether significant net gains can be expected from (further) cooperation or not. The analysis which follows indicates that costs can be reduced by better cooperation, although the evidence suggests modest gains. The analysis proceeds as follows: first, a general measure of costs and fares is considered; next, various indicators of performance such as aircraft utilization, load factors and lack of traffic rights, are examined, then, indicators of convenience to passengers (parallel schedules and schedule coordination); finally, forms of cooperation which can indirectly improve performance are noted.

B. AIRFARES AND GENERAL COST LEVELS

Airline Operating Costs

6.4 An overall indicator of whether there might be gains from cooperation would be higher than expected costs of operation and fares. Airline costs are affected by a number of characteristics, such as route densities and stage lengths, and any meaningful comparison of costs needs to adjust for these. However, relevant cost data do not exist for most South Pacific airlines, so it is necessary to compromise and to examine whether the prices of the final output, i.e., air fares, are higher than should be expected.

6.5 **Air Fares.** An examination of whether air fares for the South Pacific Islands are higher than those available in other regions is presented in Part III of this report.[24] South Pacific air fares are found to be essentially similar in comparison with air fares in Australia, New Zealand, internal Papua New Guinea, and some other small Islands.[25] These findings confirm

the view that the smallness and remoteness of the South Pacific States creates problems for aviation which may be alleviated, but only in part, by further cooperation.

6.6 In considering the case for cooperation, however; other possibilities also need to be evaluated:

(a) **Input prices** may be higher; wages for skilled staff (pilots, managers) may be higher but wage rates of unskilled and semi-skilled labor, may be lower. Remoteness may build in cost penalties, such as with aircraft maintenance. Overall, input costs should not be much higher than elsewhere in the Pacific region.

(b) **Airline efficiency** may be less; it is possible that higher fares and costs might be reduced, not by cooperation, but by more efficient performance of individual airlines.

(c) **Small scale** of operations may impose a cost disadvantage on the South Pacific airlines; even when they cooperate to the fullest feasible extent, partly because their scale will still be small in aggregate, and because cooperation itself is not costless.

(d) **Market Power** may be available to airlines; airline costs may be at the same level as elsewhere, but airlines may be able to raise fares above costs; it is also possible that subsidies to airlines make air fare differences understate cost differences.

6.7 **Financial Performance.** The financial position of many South Pacific airlines is difficult to document. Ratios of operating revenues to operating costs are available and presented in Table 6.1. These ratios and their comparison need to be treated with caution. Capital cost of airline assets, including aircraft, may not be fully included in operating costs. As against this, some airlines over-depreciate, and underestimate operating profits, only to record "extraordinary" profits on the sale of capital items.

Table 6.1: COST RECOVERY IN SOUTH PACIFIC AIRLINES, 1990

Airline	Ratio-operating revenues/operating costs
Air Niugini	1.04 (1989)
Air Pacific	1.03
Air Nauru	0.43
Air Caledonie	0.89
Air Vanuatu	0.83
Polynesian Airlines	<1.00
Solomons Island Airlines	<1.00
Royal Tongan	0.80

Sources: Field surveys and Airline Annual Reports.

6.8 On balance, it is likely that the South Pacific airlines are optimistic in reporting their financial position. While some are making profits (for example, Air Pacific), others are not, although they are trying to move towards full recovery of costs. Thus, there is not much evidence of pricing above cost.[26]

Summary of the Limited Evidence on Costs

6.9 Airfares, and most likely airline costs, are higher in the South Pacific and in other similar regions, due, at least in part to low traffic densities. *There is only limited scope for cooperation in addressing this market circumstance.*

C. AIRCRAFT UTILIZATION

6.10 Low aircraft utilization may be an indicator of potential gains from cooperation. In the South Pacific, there is a problem for airlines in achieving high utilization of equipment. This is partly because of indivisibilities—several have the routes and/or traffic densities to utilize only a fraction of an aircraft of a technically appropriate type. One way to achieve "fractional operation" is to share aircraft with another airline. Apart from this, routes may be structured such that it is difficult for a single airline to obtain high utilization because aircraft are in the wrong place at the wrong time, and they may not be able to fly them on income-earning routes. (For example, at existing traffic demand, Air Pacific must leave its Boeing 747 in Tokyo for an extended period). Cooperation can lessen this problem, for example, when one airline leases another's aircraft during its "unused" time.

6.11 The actual position of aircraft utilization for airlines in the region is summarized in Table 6.2. Utilization for the main type of aircraft in each airline's fleet is given, along with some indicators of "normal" utilization, taken from U.S. utilization rates; for the smaller aircraft types, (for example, DHC 6) an arbitrary level of 6.0 hours per day is taken as the "norm".

Table 6.2: SOUTH PACIFIC AIRLINES—AIRCRAFT UTILIZATION RATES (HOUR/DAY), 1990

Airline	Type	Hours	Norm (US)
Air Niugini	A 310	11.06	11.0
	F 28	6.14	6.2
Air Pacific /a	B 747	9.31	11.6
	B 767	11.8	10.4
	ATR 42	7.2	6.0
Air Nauru /a	B 737	11.8	7.3
Air Caledonie International	B 737	9.3	7.3
	DHC 6	1.20	6.0
Air Vanuatu /a	B 727	12.0	7.6
Polynesian Airlines /a	B 727		
	DHC 6	5.1	6.0
Solomon Islands Airlines /a	B 737	9.9	7.3
Royal Tongan /a	DHC 6	3.8	6.0

/a Undertakes part time leasing of large aircraft.

Source: Field surveys, Annual Reports and Avmark; *Quarterly Aircraft Operating Costs and Statistics*, March 1990.

6.12 Utilization rates for the large aircraft are satisfactorily high. The airlines appear to have assessed their needs accurately, and undertaken arrangements to secure the appropriate availability level of these aircraft. Utilization rates for the smaller aircraft, which most airlines operate as sole users, are, for some airlines, low.[27]

6.13 Aircraft utilization data need to be interpreted with care. The forms of cooperation (aircraft sharing) relied upon at present to improve utilization are useful but there may be more cost effective forms of cooperation. High utilization may be being achieved by flying aircraft on unprofitable routes. These routes might be unprofitable because fares are too low, or because load factors are too low. The evidence discussed above does not indicate that fares are low, however, load factors for some routes may be.[28]

D. Load Factors[29]

6.14 The evidence on load factors, given in Table 6.3, reveals that the levels are typical for scheduled airlines. Air Nauru's load factor of 52 percent is fairly low, but all of the others are acceptable. There is little evidence, in load factors, of problems of lack of cooperation. Indeed, the airlines, through the cooperative arrangements, have been able to substantially lessen the problems of flying aircraft with unremunerative loads.

E. Unremunerative Sectors

6.15 Most international airlines are obliged to fly some sectors on which they have no traffic rights. Thus, an airline from country A may fly from A to B and then on to C, but it may have only the right to carry passengers from A to B and A to C (so called "3rd Freedom rights") not from B to C (so called "5th Freedom rights"). Since it can expect to lose some passengers in B, it will have some spare seats from B to C. One aspect of cooperation at the country level is on the granting of traffic rights. Countries B and C could grant traffic rights between B and C for airlines of country A, and the airline system as a whole would be more efficient, in the sense that there would be fewer wasted seats. If airlines are flying unremunerative sectors, better cooperation by countries could enable improved airline efficiency.

Table 6.3: South Pacific Airlines—Load Factors, 1989 or 1990

Airline	Load Factor (%)
Air Vanuatu	66
Polynesian Airlines	65
Royal Tongan	65
Air Niugini	64
Air Pacific	60
Air Caledonie International	58
Solomon Island Airlines	55
Air Nauru	52
AVERAGE	61

Source: Field visits and Airline Annual Reports.

Exchange Devices

6.16 There are ways around constraints on traffic rights. One option is for one airline to sell seats to another which has the rights (for example, country A's airline could sell seats to country B's airline for the B to C sector). Another option would be to "code share" with

an airline that has the traffic rights. Thus, Flight 100 of Country A's airline from A to C via B might also become Flight 300 of Country C, when it operates between B and C. These devices mean that the otherwise empty seats can be used productively.

6.17 A group of routes with sectors on which particular airlines do *not* have traffic rights is shown in Table 6.4. However, in many cases, seat purchases, or code share arrangements, enable airlines to obtain revenue from the sector (see Box 6.1).

6.18 **Traffic Rights.** Although airlines have successfully lessened the problem of unremunerative sectors by cooperation amongst themselves, the devices used are imperfect. Airlines may find it difficult to cooperate with airlines with whom they compete on other sectors. Further, only sectors which are flown without traffic rights are observable. There may be attractive but unflown sectors, because of the lack of rights. Thus, as illustrated in Figure 6.1, an airline of country A may fly to C via D, because it has traffic rights from D to C, rather than via B, which would be a more economic and profitable routing, if it could carry traffic between B and C. Thus, lack of traffic rights could constitute something of a problem for several airlines. Quantitatively, this problem is not likely to be large, since the sectors flown without rights would be a small proportion of the total. Nevertheless, greater flexibility in operations and sales would reduce costs.

Box 6.1: Traffic Rights and Seat Purchases

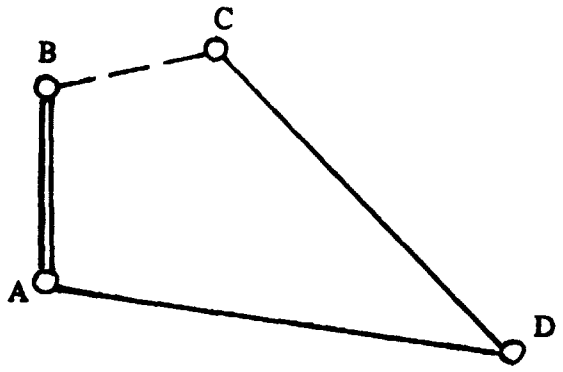
Solomon Airlines does not have traffic rights between Port Vila (Vanuatu) and Nadi (Fiji) and between Port Vila and Auckland (New Zealand). However, it is efficient for it to operate these sectors as part of its Honiara (Solomons)-Nadi and Honiara-Auckland services. The solution has been for Air Vanuatu, which does have rights to carry traffic on these sectors to purchase seats on the Solomons Airline flights. Thus, Solomons Airlines flight IE708 (which is also Air Pacific flight FJ505) from Honiara to Nadi also becomes Air Vanuatu flight NF108 from Port Vila to Nadi.

Table 6.4: Sharing Arrangements on Sectors Without Traffic Rights

Airline	Sector	Form of Sharing Arrangement
Air Vanuatu Brisbane - Sydney	Domestic Australian	
Air Nauru	Honiara - Sydney	
Polynesian Airlines	Noumea - Sydney	
Air Nuigini Brisbane - Sydney		Domestic Australian
Solomon Islands Airlines	Cairns - Brisbane	Domestic Australian
	Cairns - Brisbane	Domestic Australian
	Port Villa - Nadi	Seat Purchase
	Port Villa - Auckland	Code share
	Nadi - Auckland	Limited rights

Source: Field surveys and airline timetables.

Figure 6.1: TRAFFIC RIGHTS AND NETWORK EFFICIENCY



F. SCHEDULE INCONVENIENCE

6.19 A serious inefficient ramification of lack of cooperation would arises if the schedules of the different airlines are designed without any reference to one another. The result is inconvenient delays to passengers.[30] Independent airlines do have incentives to coordinate their schedules, since more people will use an airline's flights if they know they can make connections easily.

6.20 Since market densities in the South Pacific are low, limited frequencies (some routes are served only once a week) are inevitable and air travel in the region is relatively inconvenient. This in turn puts a premium on good connections since the wait imposed by a poor connection is long. Poor connections are not unusual in the South Pacific. For example, flights from Nadi to Kiribati depart before the flights from Sydney to Nadi arrive; an overnight stay in Nadi is required for the Sydney/Kiribati trip. However, there is not strong evidence of "avoidable" poor connections in the South Pacific, when the low (weekly) frequencies and sector demand are taken into account; Nadi does function quite effectively as a hub for the region.

Constraints on Scheduling

6.21 When different airline systems interact, some poor connections are inevitable. There are limitations on equipment (for example, their speed and whether they can use particular airports), there are limitations on available airport slots and times of flights (airport curfews in the surrounding countries), and there are other network demands, such as requirements for connections elsewhere. For most of the perceived poor connections in the region, there are good reasons why they exist, and in the main, greater cooperation between airlines is unlikely to significantly reduce their incidence.

Parallel Scheduling

6.22 As indicated above, airlines acting independently are often motivated to schedule flights at about the same time, usually the most popular time, rather than spread services out over time in a way more convenient for passengers. However, for the South Pacific region, inspection of schedules suggests that this is *not* a serious problem. Such examples as do occur usually can be explained, like poor connections, by operational factors (see Box 6.2).

G. OTHER GAINS FROM COOPERATION

6.23 Many forms of cooperation can lead to small cost reductions, and it is virtually impossible to ascribe particular performance improvements to them. But, in aggregate, their cost impact could be significant. There may be economies in joint purchasing or leasing of equipment, or at least, in harmonizing choice of equipment. There are inventory economies in spares holding. It may be cheaper to coordinate maintenance, possibly with much of it being done at a hub, or there may be gains in group negotiations with prospective non South Pacific

BOX 6.2: PARALLEL SCHEDULES

These are not a major problem in the South Pacific, but a few examples exist. It is possible that they come about for operational or market demand reasons, and would not be subject to elimination if more cooperation took place.

Route	Services
Port Vila - Nadi	5 services per week 2 on Sunday
Port Moresby	6 services per week 2 on Sunday
Cairns - Port Moresby	7 services per week 2 on Friday and Saturday
Port Moresby - Sydney	5 services per week 2 on Sunday

airlines for maintenance. Coordination in marketing may result in better promotion of the region, and a more attractive product for visitors (easier transfers between airlines). There may be economies in training personnel and in developing accounting systems.

Costs of Cooperation

6.24 Cooperation does have its costs. By coordinating the purchasing or leasing of equipment, incremental gains from specialization are lost. For example, harmonization of aircraft choice will lead to savings in purchase/leasing, economies in spares and economies in training. However, it may mean that the aircraft are not the most appropriate for some airlines. Even though the group as a whole may gain, some individual airlines may lose. This need not happen if incentives are given to internalize with the group (for example, if an airline is offered a service such as maintenance, on a marginal rather than average cost basis). However, while possible, constructing incentives for individual airlines to coordinate can be difficult (in negotiations every airline will wish to portray itself as the 'marginal' operator).

Potential for Further Cooperation

6.25 Evidence from field surveys of airlines in the region indicates that a good deal of cooperation already takes place. Scope for more cooperation appears modest. It is significant that no airline in the region considers that there are important untapped areas of potential cooperation available.

H. CONCLUSION

6.26 The PMC airlines already cooperate to a very significant extent, both between each other and between themselves and selected airlines of the developed Pacific Rim countries. In some cases, it is possible that better internal cooperation would lessen the need for cooperation with Rim country airlines, and induce cost savings. However, there is no evidence for this, and in many respects the Rim country airlines may have more complementarities with the South Pacific airlines than the South Pacific airlines have with one another.

6.27 Most of the specific performance indicators which would be affected by lack of cooperation, such as aircraft utilization and load factors, give no evidence of major gains to be reaped from better cooperation. There is some evidence of low utilization of smaller aircraft and it may be possible to achieve gains from cooperation for them. Several flights are made over routes where the operating airlines do not

have traffic rights. In some cases, devices such as seat purchases do already lessen the waste in capacity from this, and although there is scope for further savings.

6.28 In summary, *there is already considerable cooperation amongst the airlines of the South Pacific which reduces the problem of their small scale. Further aspects of cooperation may be tapped, however, they cannot be expected to produce large reductions in overall costs and fares or important gains in overall service quality. Lack of coopration is not a serious problem.*

CHAPTER 7
AN ENVIRONMENT AND INCENTIVES FOR EFFICIENT COOPERATION

A. THE CONSTRAINTS ON COOPERATION

7.1 Fostering cooperation in aviation needs to be examined against potential constraints. Constraints can exist at the airline level and at the country level.

Constraints on Airlines

7.2 Several types of constraints on airlines may apply which limit cooperation:

(a) **Legal Limitations on Cooperation.** An airline may not be permitted by its own Government, or a potential partner's Government, to enter into particular types of cooperative arrangements. These do *not* appear to be significant for the PMC airlines.

(b) **General Economic Policies.** Economic policies, which are applied generally (and not particularly to airlines) can prove a constraint on cooperation. For example, foreign exchange restrictions may induce an airline to undertake tasks at home, at higher cost, rather than cooperatively abroad. Economic restrictions can also encourage cooperative solutions, even where these need not be the lowest cost. Thus, foreign borrowing restrictions may prevent an airline from owning an aircraft, but it may make arrangement with others to lease one. Various economic policies, on balance, appear to be neutral in their impact on cooperation.

(c) **Taxation Policy.** Taxes can create artificial incentives to cooperate or not cooperate, lowering the cost of the airline but raising costs overall. At present, for the PMCs, there is no apparent evidence of tax influences on cooperation

(d) **Technical Differences.** Differences in technical regulation can circumscribe the scope for cooperation. If standards differ from country to country, it may not be possible, or economically feasible, for an airline to undertake a task on behalf of an other. Technical differences do exist between countries of the South Pacific however, they are recognized, and to a certain extent, are being addressed (Enari, 1991).

(e) **Cultural and Linguistic.** These are natural barriers and they are present in the South Pacific. They are not easily removed, and they can lessen the scope for cooperation. For example, language differences make cooperative training ventures more costly and cumbersome, and may result in less cooperation. More general cultural differences, for example, business practices make coordination less easy. These constraints, of which there are some in the South Pacific, are not easily removed.

(f) **Government Pressures.** A country's airline, especially if it is owned by the national Government, is subject to Government influence. This pressure need not be explicit or systematic. At times the airline may be expected to: serve markets that are not commercial, modify its purchasing policy, and market tourism from a particular region. Airlines around the world, including those in the PMCs, are subject to government pressures which affect whether they enter cooperative arrangements.

(g) **Limitations on Traffic Rights.** Airlines require traffic rights, of some form or another, to operate in certain markets. These rights may be formal rights, such as third, fourth, or fifth freedom rights, or informal "rights" such as sixth freedom rights, or acceptance of seat purchase or code share arrangements. The denial of one form of operation (for example, fifth freedom rights) can lead to substitute cooperative agreements, such as seat sales. This issue is of moderate importance in the South Pacific, since there is a significant proportion of sectors which are flown without traffic rights, and a variety of ways are used to fill the available capacity.

In short, several factors do constrain the ability of PMC airlines to cooperate. Removal of these would assist cooperation.

Constraints on Countries

7.3 **Government Limitations.** There are few immutable constraints on the countries which would stop then from cooperating on aviation matters, or permitting their airlines to cooperate.[31] However, governments are not perfectly well informed, nor can they always act unilaterally. Thus, they do face limitations which circumscribe cooperation.

(a) **Regional Gain vs. Individual Country Loss.** It may not be possible for a country to gain, even though the region as a whole gains, from cooperation. This is a fundamental problem which often occurs worldwide with aviation, and other trade negotiations. For example, an airline (and its home country) may gain from being granted fifth freedom rights on a sector but one of the countries on the sector may lose out through loss of profits to its airline or loss of tourism. Overall, air service costs may fall, and tourism among the countries may rise, and so the group as a whole gains. However, unless it can secure other concessions, the country which loses will veto the grant of traffic rights.[32]

(b) **Scope of Trade Negotiations.** In aviation, negotiations are sometimes undertaken on a "tit-for-tat" basis, trading like for like, and this limits the scope for cooperation. But more often, negotiations are broader, and one form of aviation concession (fifth freedom rights) is traded for another. This widens the scope for cooperation, but it does not do so completely, as the loser country may not be able to gain from the aviation concessions. Trade may take place on the basis of aviation concessions for non-aviation concessions—this further explains the scope for cooperation. Plainly, if countries are willing to trade aviation concessions for money, the scope will be as wide as possible; cooperation which is to the benefit of the group can take place and compensation made to any individual countries that may lose.[33]

(c) **Broad Objectives.** As noted earlier, Governments have broader objectives than simply minimizing airline costs. In particular, they may wish to encourage tourism and increase employment, and

they may use their airline to advance these objectives. Thus, they may prefer the airline to employ home residents, at higher cost, rather than cooperate with other airlines. Broader objectives are not necessarily a constraint on efficient cooperation, but they do mean that, to achieve it, matters become very much more complex, especially when the instruments available to advance the objectives are limited (for example, where employment is an objective but employment subsidies are not feasible). Design of practical ways of recognizing broader objectives, but also facilitating efficient cooperation, is a difficult task.

(d) **Information Limitations.** Governments may not be well informed about how various policies, such as one which affects airline cooperation, will affect government objectives. For example, a 5th freedom arrangement between countries could affect tourism to a country--but its affect would be difficult to quantify. The country may not have a good measure of the value of additional tourism, and the trade offs involved—for example, would an additional 1,000 tourists be worth a reduction in airline profit of $50,000? Non-airline effects (tourism, employment) tend to be much less concrete than airline effects (cost reductions, profits) and it is difficult to compare them. If anything, there may well be an exaggeration of the value of tourism and employment aspects, leading to a downplaying of the gains from airline cooperation (see Box 3.2 above).

(e) **Political Pressures.** Governments, while sovereign, are also subject to internal and external pressures. A government may be convinced of the desirability of a policy, but may be under pressure from voters or interest groups to adopt a contrary policy. Thus, leasing an aircraft from the airline of another country may be the most cost effective way of obtaining capacity, but the Government may be under pressure to induce the airline to purchase its own. Domestic pressures will sometimes limit a government's ability to pursue cooperation with its neighbors.

7.4 The various constraints on cooperation are best addressed by Government, for example, better information can be collected (though at a cost). Other constraints, such as domestic political constraints, are always present to through support of an environment in which cooperation is feasible, and decision makers have an incentive to pursue it.

B. Supporting an Environment for Cooperation

7.5 Aviation in the South Pacific will, for the foreseeable future, take place in an environment which is at least partly determined by individual countries, and operations will be carried out by individual airlines. It is unlikely that any multilateral cooperative solutions, either with countries creating an environment in which cooperation between airlines is unconstrained ("full deregulation"), or airlines all agreeing on an overall cooperative solution ("single regional airline"), will come about. Cooperation will take place between individual countries, and between individual airlines.

7.6 **Bilateral and Multilateral Cooperation.** Aviation rights are such that they are determined and exercised on a bilateral basis. Groups of countries can agree to form a regional regulatory structure. This is happening in Europe, but in the context of the much broader range of EEC agreements affecting most economic activity. This could happen in the South Pacific, though it is not likely in the near future. The various individual countries could, however, agree to particular aspects of coordination, for example, on technical regulation, even though they are unlikely to create a single aviation market.

7.7 Individual countries entering (mainly) bilateral arrangements, along with individual airlines making arrangements between themselves, is a situation which is consistent with the efficient degree of cooperation taking place. Where there are gains from cooperation, individual countries or airlines trading can ensure that no individual losses, and all gain, so that if self interest prevails, cooperation will take place. This requires that agreements can take place between countries and airlines where aviation concessions can be traded for more than just aviation concessions—for example, where a country or an airline can be paid money to cooperate. Within this environment, it is still possible that negotiations may falter because of the bargaining stances of the parties.

7.8 Notwithstanding this, there is a chance that countries will not cooperate even though it is in their interest to do so. This raises the question of what is in a country's interest. For example, a country may refuse to concede 5th Freedom rights to others, no matter how much it is offered in return for them. Non cooperation by one country can impose costs on others. With a group of individual countries and airlines, it is inevitable that cooperation will be less than that which is economically warranted. To the extent that costs are thereby imposed on others, these will have to be borne, as there is no way of enforcing cooperation.

7.9 **The Cooperation Process.** Achieving the gains from cooperation is a two stage process. First, countries themselves must enter arrangements with other countries which enable their airlines to cooperate and secondly, where one country may gain and another lose, there must be a compensation mechanism. If, for example, the technical standards of one country are agreed upon, some costs will be imposed on others which must adjust to conform to the new standards. Somehow, they must be compensated if they are to agree to the change. Once an environment exists which enable cooperation, airlines must have the incentive to undertake cooperation where it is economically justified. If they are commercial they will cooperate where their costs are reduced and their revenues improved.

7.10 **An Environment for Cooperation vs.** Specific Prescriptions. A popular means of addressing the cooperation issue in South Pacific aviation is to suggest specific forms that it might take. These include particular forms of industry structure for the airline sector, such as a single airline, or an aircraft leasing company. (See Boxes 7.1, 7.2). It is also possible to suggest regulatory structures for the region—for example, there could be a deregulated environment within the region, or, alternatively, a restriction of traffic to a 3rd/4th freedom basis. These specific suggestions could have merit, and they could come about as the result of cooperation between states or airlines. However, as discussed earlier, *it is not likely to be helpful to advocate specific forms of cooperation* as being "the ideal", since the best forms of cooperation depend on many specific details which, in general, are not known sufficiently outside the airlines. The best approach at a general level, is to *support an environment which will enable the best solutions*

Box 7.1: A Regional Airline: Advantages and Disadvantages

Advantages

* Scale economies lead to cost effectiveness
* Schedules would be coordinated
* More bargaining power when dealing with other airlines and governments

Disadvantages

* Airline would be dominant and possess market power, using this to raise fares
* Lack of competition would give it scope to be cost efficient
* Firms with market power, and so imperative to make profits tend to be unresponsive to market demands, and may ignore the requirements of some countries, especially the remote ones.

to be pursued by those able to take decisions. At a more specific level, some of the costs and benefits of different types of cooperation can be collated and processes for their detailed examination suggested.

Box 7.2: A Pacific Aircraft Leasing Company: Advantages and Disadvantages

Advantages

* Could lessen the problem of undesirabilities in equipment for South Pacific airlines
* May enable scale economies in related areas, e.g. maintenance
* May improve the airlines bargaining power

Disadvantages

* Airlines needs are diverse, and would not be met very well by the small fleet possessed by the Leasing Company
* There would be major problems in coordinating demand for aircraft and availability at particular times—all would want the same aircraft at the same time.
* Either the countries and airlines jointly agree to only lease from the Leasing Company, and they will create market power in the airline sector, leading to high fares and slack performance, or if it not given a monopoly, it will break down as individual airlines are offered better deals elsewhere.

7.11 **Efficiency and Cooperation.** Several characteristics of a desirable environment can be identified. Fundamentally, it should be possible for airlines to cooperate where cooperation will lead to lower overall costs. If an airline can operate on a route as cost efficiently as any others on that route, it should be possible for it to operate, and sell seats, on it; technical and legal conditions should facilitate this. It should not be the case that airlines are forced, by regulatory constraints, to operate at inefficiently low load factors on a sector, or adopt higher cost routings than would otherwise be possible. In short, it should be possible for airlines to provide services in the region, and to and from it, at minimum cost. In addition, it is important that airlines have incentives to minimize their own costs.

7.12 Such an environment need *not* involve complete commercial freedom to airlines, nor "open skies" within the region. Complete commercial freedom might mean airlines which have strong market power on some routes raising prices to well above costs, or airlines colluding with one another to create and use market power. The balance between allowing airlines, which have some market power, the commercial freedom to minimize cost (desirable) but also raise prices (undesirable) is always a sensitive one. Moreover in addressing it, there are many complications in regulating price behavior, or setting codes of competitive conduct. To achieve the best practical solution, it may be necessary to compromise in one direction or another—for example, allow the airlines scope to raise prices above costs in order to preserve incentives to minimize costs.

7.13 **Regulatory Regimes and Cooperation.** There are several regulatory environments which can be consistent with efficient cooperation and cost efficiency. One might be a regional "open skies" policy, under which all airlines from the region have rights to fly and sell seats on all routes under their own name. An alternative environment would be one which any airline could operate on any route, but only 3rd/4th freedom operators could sell seats on a route. Other operators would find it cost effective to sell seats, on routes for which they have no traffic rights, to the airlines which do. The 3rd/4th freedom operators, in turn, would be able to gain by buying capacity from others. In both environments, the airlines involved have an incentive to minimize costs. However, the distribution of the gains (or profits) from operating the routes will be different (also profits, and fares, will tend to be higher where 5th freedom rights are not present since competition between individual airlines will be less). Under the 5th freedom environment, the country, and also airline operating services on a

5th freedom basis, will gain a greater share of the gains than otherwise.

7.14 The environment outlined above is one which is capable of facilitating low cost air transport. Even where this is the primary objective, a number of specific issues, concerned with the ownership and control of airlines, regulation of market behavior, and structure of aviation negotiation still need to be resolved. These are discussed next, below.

C. Issues to be Resolved

7.15 **A Framework for Facilitating Efficient Cooperation.** In general it is desirable for countries to support a framework within which efficiency in the provision of airline services is made possible, and encouraged. One way in which this can happen is through cooperation between different airlines, and between different countries. Each country can choose whether or not it wishes to take advantage of the gains possible from cooperation or not.

7.16 In pursuing aviation cooperation and efficiency more generally, each country must resolve a number of issues:

(a) **The Corporate Form and Objectives of its Airline.** A private, or public but corporatised, airline will most effectively seek cooperation. Airline corporate objectives should be kept limited, simple, explicit, consistent with good economic performance, and be driven by clear managerial reward incentives.

(b) **Competition and Regulatory Policy.** Airlines in the South Pacific possess some market power; few routes are highly competitive. The problem of market power does not appear to be a severe one at present (air fares are not abnormally high), however, it could become more of a concern if airlines become more profit oriented or highly inefficient.[34] Governments can control competitive behavior to an extent—for example, they can prohibit forms of anti-competitive behavior, such as pooling.

(c) **Imposed Obligations.** Governments may impose specific obligations on airlines. For example, a Government may decide that certain uneconomic services should be provided, and it may negotiate separate "contracts" for subsidies with the airline to provide them. Alternatively, a Government may require the airline to provide them, but offer compensation.

(d) **Constraints on Airline Operations.** A Government may, for political or other reasons, decide that its airlines meet certain minimum conditions: the airline may be required to be fully based in the country, possess, or at least have prescribed access to, a minimum number of aircraft and use a minimum number of local cabin crew. Each of these requirements limits cooperation with other countries, and each has a cost. Governments must resolve whether the gains from these restrictions outweigh their costs.

(e) **Non Aviation Objectives.**[35] Governments may need to make choices between higher airline profits and more tourism. If the aviation environment is to work to a country's advantage, it is clearly important that Governments have some assessment of how important other objectives are, and how different aviation policies will affect them. The nature of linkages between aviation and other sectors, such as tourism needs to be established to guide aviation policy.

(f) **Scope of Trade in Aviation Negotiations.** Each country needs at some point, to determine how wide the set of trades it is prepared to make when

entering aviation negotiation. Cooperation and efficiency are greatest when this set is widely drawn.

(g) **Response to Non-Cooperative Behavior.** As the difficulties being experienced in the current (1991/92) GATT Uruguay Round of trade negotiations are an eloquent reminder. Cooperation between nations (or companies) is not always easy to achieve. Indeed, some countries appear to go against their own self-interest in not cooperating. By not cooperating, these countries may be imposing greater costs on other countries.

Countries could attempt to sanction those who do not cooperate, by imposing a cost on themselves, for example, through air traffic rights. This option is only in a country's interest if the sanction has some chance of altering the other country's policy in the future.

CHAPTER 8
CONCLUSIONS

8.1 **Case for Cooperation.** The PMCs face a number of transport disadvantages which stem from the small size and long distances associated with their transport markets. Anything which can help reduce transport costs is of considerable value. The PMCs operate their independent airlines and not surprisingly, the issue of cooperation between them is a contentious one. Many consider that the problems faced could be alleviated, and perhaps eliminated by better cooperation on aviation by both the countries of the region and their airlines. Cooperation is sometimes perceived from outside to be less extensive than it might be; when some solutions are suggested, they often do not come to fruition. Each country seems to be pursuing its own agenda, and cooperation appears difficult to achieve.

8.2 **Bilateral vs Multilateral Arrangements.** The individual PMC Governments, and their individual airlines, have their own distinct objectives. Cooperation is possible, but it does require the resolution of a number of issues. Perfect coordination on a multi-lateral basis is unlikely to be desirable or to come about. But bi-lateral arrangements, between countries and airlines, can and do, alleviate a number of problems.

8.3 **Existing Cooperation.** In fact, *there is extensive cooperation* in place between the countries of the region on aviation matters, and especially between airlines. The PMC airlines have addressed a number of problems they face, as a result of small scale or inexperience, through a wide range of cooperative agreements between themselves, and with airlines of the Pacific Rim countries. There do not seem to be many major problems which could be eliminated or substantially reduced by adopting cooperative agreements. The *agreements in place are largely on a bi-lateral basis*, sometimes ad hoc, and differ from case to case. They may appear unsystematic, but *they are fairly effective.* Nevertheless, there remain some problems which better cooperation could help solve, and there are likely to be gains from more extensive cooperation. However, it is difficult to measure these, and specify their details, since the costs and benefits from specific forms of cooperation are only known with accuracy by the airlines themselves.

8.4 The traditional approach to promoting cooperation has been to suggest particular forms. A "regional airline" has been one approach, and an "aircraft leasing company" has been another. These approaches have potential advantages, but also severe disadvantages. Many of them require multi-lateral action, which is very difficult to achieve.

8.5 **The Enabling Environmental Approach to Cooperation.** Rather than specify what specific forms of cooperation are appropriate, the *Governments of the PMCs should concentrate on supporting an environment in which forms of cooperation that lead to improved performance are facilitated and encouraged.* In such an environment, *airlines should be able to choose what types of agreement they wish to make, and with whom;* it is they who will have to make cooperation work.

8.6 Airline Objectives and Management Incentives. Much of the burden for pursuing cooperative arrangements falls on airlines and their managements. It is critical that airline management be given a framework and incentives which are consistent with the pursuit of both cooperative arrangements and efficiency. *Cooperation should not be seen as an end in itself but as an option to improve efficiency.* Efficiency involves keeping costs as low as feasible for a given standard of service, and in ensuring that the services that the users are prepared to pay for are provided. Airlines which have profit as an objective, and which face competition in their product markets will operate efficiently in this sense.

8.7 Like many public enterprises around the world, the airlines of the South Pacific have often been given vague and conflicting objectives. This is not conducive to efficiency, and there is a danger that an airline will try to satisfy too many objectives and in the process, do nothing well. It is being recognized elsewhere that clarity and simplicity of objectives for public enterprises is needed to encourage efficient performance. In addition, *airline managers must be given a direct incentive to pursue such efficiency, notably by linking rewards to performance.* Privatization is one option, another is to restructure public enterprises so that they pursue profit and act commercially, (corporatization). Such reforms would increase the vigor with which airlines pursue cooperative arrangements that increase efficiency.

8.8 Governments do have broad objectives which their airlines are often expected to serve. In particular, Governments want to increase employment and encourage tourism. The former objective is unlikely to be pursued effectively through imposing hiring requirements on airlines. However, tourism and aviation go naturally together, and it is not surprising that Governments see airlines as devices through which tourism can be encouraged. Efficient, low cost aviation, is in the interest of the PMCs generally, and overall, it will encourage tourism. Nevertheless, for individual countries there are trade-offs between tourism and aviation objectives, and the problem is how to resolve the conflicts (see Annex 2).

8.9 A first step, which is essential, is for Governments to determine the value of tourism (compared to other objectives, such as profits from airlines). One approach is to address tourism issues directly (for example, through tourism promotion and tax treatment of the tourism industry and broad-based aviation negotiations). An alternative is to require an airline to be profit-oriented but entice it to provide services deemed by Government to be of importance to tourism (for example, flights to particular destinations), by directly "contracting" with the airline to provide them services. In this way, airlines do not become overloaded with conflicting objectives; airlines can be left obliged to pursue efficiency, including the use of cooperative arrangements which advance efficiency. At the same time, the Governments' more general objectives can be addressed.

8.10 In sum, a sound approach to airline cooperation problems should involve several distinct elements as follows:

- Simple commercial objectives established by Governments.
- Airline management incentives and rewards tied to performance.
- Capability to monitor price/cost ratios and market behavior.
- Separation of non-aviation Objectives.
- Explicit compensation for non-commercial services.
- Broad-based aviation negotiations.

Endnotes

1. Additional details of the international air service routes for individual PMCs are shown in each Country Transport Sector Survey presented in Volume Two.

2. Higher route traffic volumes are shown to be associated with lower air fares for the Pacific region, in Part III of this report. The high costs of low density air service markets, have also been demonstrated in several econometric studies. See Caves, Christensen and Tretheway (1984).

3. Data on air service routes for the PMCs and comparator countries are presented in Part III, Annex 6.

4. It is important to distinguish between economies of *density*, which refer to how costs vary as the traffic volume on individual route markets change, and economies of *scale*, which refer to how costs vary as the overall size of the airline increases. Economies of scale are not substantial, but economies of density are (see Srinivasaw (1986).

5. This would be similar to the successful Scandinavian Airlines System (SAS), jointly owned by Sweden, Norway and Denmark. Other examples of multi-national airlines include Air Afrique, formed by former French colonies in Africa, which has operated since 1961 and East African Airways which collapsed in the 1970's due to differences between the shareholder States.

6. See Kaspar (1991) on Air Pacific and Qantas.

7. The basis for Air Pacific was Fiji Airways, which was formerly owned by several larger British Commonwealth airlines. The various countries of the South Pacific were to take a shareholding in Air Pacific; a few still retain small shareholdings to this day. Air Pacific is now effectively a Fijian carrier. For a time it had a role as a regional airline, though in the 1980s it developed more as an airline operating between the region and the Pacific Rim countries. In addition, most of the States wished to develop their own airlines; these individual States did not perceive it in their interests to grant monopoly rights to an airline based in Fiji.

8. For a view of the problems faced in airline co-operation see Eiliku (1991).

9. Externalities occur when actions of one party impose costs or benefits on others, and these are not compensated for or paid for.

10. See Dwyer and Forsyth (1991).

11. See Dwyer (1988).

12. In some cases, costs and benefits may be "weighted" according to who gains or loses; in this discussion all gainers and losers are treated equally, regardless of who they are. In the simplest case, this involves maximizing the difference between gross benefits to consumers and gross costs to the producers or equivalently, maximizing the sum of consumers' and producers' surpluses. For a recent example, see Sherman (1989).

13. Collusion between sellers to raise prices is a form of cooperation, but it is usually inefficient because the losses to consumers outweigh the gain in profits.

14. Every country faces problems of deciding between competition and cooperation, both internally and externally, for example, in national policy towards mergers and takeovers. Mergers offer the benefits of cooperation, but they lessen the domestic competition between firms, and the benefits that may bring.

15. As an example, consider a route with only two flights per week, and the most popular day for travel is Saturday. If only two carriers serve the route, such as under 3rd/4th Freedom traffic rights, it will be in the interest of both to schedule their flight on Saturday. One Saturday flight and (say) a Wednesday flight would be more convenient to passengers and more efficient. The airlines would have a profit incentive to cooperate and operate this schedule, if the airline which carried the fewer passengers could be compensated by the other (for example, through seat purchase arrangements on each flight). This result of competition is observed when there are only two or very few competitors. This happened extensively in the past on Australian domestic trunk routes. It is most likely to occur when there are only two operators on the route, they use similar type (capacity, speed) equipment, and substitute routings are more costly and/or inconvenient. The phenomenon was first analyzed by Hotelling (1929) and applied to the airline industry by Hocking (1972) and Gannon (1979).

16. Recent summaries of developments in the understanding of enterprise behavior are given in Holmstron and Tirole (1989).

17. The control issues here relate to a class of problems denoted the principal/agent problem. For a discussion of these in the context of public enterprises, see Vickers and Yarrow (1988).

18. One of the more important of these was the increased dependence on reservations systems, for which the scale economies are very substantial. These have been significant in providing a degree of market power to the (airline) owners which first developed them.

19. Code sharing, where separate airlines operate flights that connect, and give each flight a number for each airline, enables the airlines to offer flights to a wide range of destinations. For example, British Airways is able to offer flights to hundreds of destinations in the USA through its code-share agreement with United.

20. Cooperation between the major world airlines has tended to be at the marketing and financial levels.

21. These arrangements were identified, in part, from a field survey of PMC airlines undertaken in August 1991.

22. Some broad statistical indicators for the South Pacific airlines and selected Pacific Rim airlines are given in Annex 1. The financial data for the South Pacific airlines is subject to limitations.

23. As noted earlier, airline management (and one with good internal accounting) is best placed to assess the transaction costs, risks,and synergies available.

24. See "Assessment of Air Services", Chapter 3 of Part III.

25. This is based on a statistical analysis, which relates air fares to sector distance and market density (proxied by seats available) and test for regional differences in the air fare relationship.

26. It is possible, of course, that other airlines in the region, producing air services against which the South Pacific services were compared, are themselves incurring systematic losses. While it is true that several airlines in Australia and New Zealand have recently reported losses, these losses have amounted to a few percent of total revenue, and there is no evidence of widespread subsidization. Thus, air fares in adjacent regions can be considered as unsubsidized, "normal" fares. Among the South Pacific routes, it is likely that some cross subsidization takes place—however it is unlikely to be so extensive as to distort the overall picture.

27. Special circumstances may account for these, for example, Air Caledonie International uses two DHC 6 aircraft to operate "essential services" for the Government between Wallis and Futuna.

28. Low utilization may also be due to poor investment decisions. An airline may over-invest in aircraft, or adopt poor scheduling, and have aircraft underutilized. At different stages in the past, some South Pacific airlines appear to have been in this position. More recently, they have cut back on fleet size. Indeed, most of the airlines in the region operate arrangements whereby they do not have access to large aircraft all of the time; they lease in or lease out on a part time basis. This form of cooperation enables higher utilization to be achieved.

29. Load factors might be low for several reasons—airlines may be trying to get good utilization from their aircraft, or they might have inappropriate fare structures (performance includes yield, as well as load factor), or they might be operating larger aircraft than needed for their routes, given the frequency. Low load factors may also result from a "need" to maintain acceptable frequencies with the aircraft available.

30. Even some parallel scheduling (where two flights to the same place leave at about the same day/time) can arise. Given the low overall frequencies in the region, this is an inefficient outcome. Cooperation in scheduling can facilitate both efficiency and commercial performance.

31. In some cases, countries are constrained by international treaty obligations—however these should not prove serious constraints to airline cooperation.

32. The problem is thus one of lack of instruments for trade, since the countries gaining could win the support of the country which loses with appropriate inducements.

33. Quite often, countries declare that they are only willing to trade aviation concessions for other aviation concessions. But it is not uncommon for aviation negotiation deadlocks to be broken at the same time as other trade problems are sorted out, perhaps at the highest political level.

34. Regulation of airline pricing is a difficult task—few countries have done it effectively for long periods. Nor is it sufficient to rely on potential competition to discipline price behavior. The largest air transport market, that with the US, has been revealed to be not very contestable [See Morrison and Winston (1987)], and the markets in the South Pacific are likely to be far less contestable.

35. Further discussion on the relationship between broader (government) objectives and aviation (cooperation) is presented in Annex 2.

BIBLIOGRAPHY

ABC. 1991. *World Airways Guide.* United Kingdom.

Air Tariff. 1991. *Worldwide Fares Book 1.* United Kingdom.

Air Tariff. 1991. *Worldwide Rules, Add-Ons, Routings and Mileage Book 1.* United Kingdom.

Asian Development Bank (1981), *Solomon Islands Inter-Island Shipping Problems and Potential,* Mission Report.

Asian Development Bank (1987), *Road Maintenance Report,* Western Samoa, prepared by Beca Worley International, 1987.

Asian Development Bank (1989), *National Transport Development Plan,* prepared for the Republic of Vanuatu by Wilbur Smith and Associates.

Asian Development Bank (1989a), *Road User Revenues and Road Expenditures in Fiji (Draft Final Report,* November.

Asian Development Bank (1989b), *Road Traffic Safety in Fiji,* November.

Asian Development Bank (1989c), *Commercialization of the Government Shipyard - Interim Report,* November.

Asian Development Bank (1989d), *Divestiture of the Government Shipping Fleet and Rationalization of the Inter-island Shipping Services - Interim Report,* November.

Asian Development Bank (1990), *Privatization and Commercialization Policies and Strategies Project in Solomon Islands,* Ernst & Young.

Australian International Assistance Bureau (1987), *Fua'amotu Airport, Tonga - Airport Development Study,* prepared by Airport Consulting and Construction Australia Pty. Ltd.

Australian International Development Assistance Bureau (1988a), *Outer Islands Airfields, Project Identification, Vanuatu,* prepared by McIntyre & Associates.

Australian International Development Assistance Bureau (1988b), *Review of Public Works Department, Vanuatu,* prepared for the Department of Public Works by Cameron McNamara Pty. ltd.

Australian International Development Assistance Bureau (1989), *Resealing of Main Rural Highways, Western Samoa*, prepared by Cardno & Davies Pty. Ltd.

Australian International Assistance Bureau (1991a), *Ministry of Works, Tonga, Infrastructure Development Project*, Pacific Regional Team, Sydney, February.

Australian International Development Assistance Bureau (1991b), *Review of the Ministry of Transport Works and Utilities, Solomon Islands*, SMEC and the Mayo Group.

Australian International Development Assistance Bureau (1991c), *Feasibility Study of Provincial Airports Development in the Solomon Islands*. Airplan.

Australian International Assistance Bureau and New Zealand Ministry of External Relations and Trade (1991), *Joint Australia/New Zealand Study on Recurrent Cost Finance in South Pacific Island Countries*, Canberra/Wellington, October.

Beca Worley International (1988), *Road Evaluation - Tonga*, December.

Bradfield (1986), *Nadi International Airport Master Plan*, August.

Boadway and Bruce (1984), *Welfare Economics*. Oxford: Blackwell.

Caves, Christensen, Tretheway (1984) "Economies of Density and Economies of Scale: Why Trunk and Local Service Airlines' Costs Differ", *Rand Journal of Economics*, Vol. 15, Winter, pp. 471-89.

CEMA (1988), *A Proposal for Market Development in the Solomon Islands*.

Cole and Dorrance (eds) (1990) "Statistical Annex." *Pacific Economic Bulletin*, Vol. 5, No. 1, pp. 35-56.

Cole and Dorrance (eds) (1990) "Statistical Annex." *Pacific Economic Bulletin*, Vol. 5, No. 2, pp. 45-74.

Cole and Parry (eds) (1986) *Pacific Policy Papers No 2: Selected Issues in Pacific Islands Development*, National Centre for Development Studies (The Australian National University), Canberra.

Department of Transport and Communications (Australia) (1991), *Air Transport Statistics: Monthly Provisional Statistics of International Scheduled Air Transport*, p. 16. April.

Dwyer and Forsyth (1991), "Measuring the Benefits and Costs of Foreign Tourism", Center for Economic Policy Research, Australian National University Discussion Paper No 248 February.

Dwyer (1986), "Tourism in The South Pacific" in Cole and Parry (Eds) (1986).

Dwyer (1988), "Import Content of Hotel Food and Beverage Purchases in The South Pacific", *Pacific Economic Bulletin* Vol 3 No 2, December.

Eiliku (1991) "*National Needs and Economic Viability in Airline Operations : The Task for ASPA*". Address to the 9th AGM, Association of South Pacific Airlines, Tonga, June.

Enari, K. L. *The Need for Assistance in Legislative Drafting to Aviation in the South Pacific*, Consulting Report, South Pacific Forum Secretariat, September, 1991.

Europa World Year Book (1991), (31st Edition), Europa Publications Ltd.

European Community (1988), "Project Appraisal for Lupepau'u Airport Improvements, Vava'u Island".

Forsyth (1991), "The Economics of Thin Air Service Markets" Seminar Paper. *Strategic Options Transport Development*, Conference organized by The Department of Transport and Civil Aviation, Papua New Guinea, Port Moresby, September.

Gannon (1978), "Paarallel Scheduling", in *Domestic Air Transport Policy Review*, Volume 2, Appendix A12-1, Canberra: Australian Government Publishing Service.

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 Solomon Islands (1984), "*Economic and Engineering Studies for the Extension and Upgrading of the Lambi-Aola to Marau Sound Roads.*

Government of Fiji (1990), *Socio-Economic Development Strategies and External Assistance Priorities (Volume 1), Development Cooperation and Aid Coordination (Volume 2) and Project Profiles (Volume 3)*, Suva, May.

Government of Kiribati (1987), *Sixth National Development Plan 1987-1991.*

Government of Kiribati (1989), *Second Kiribati Development Conference*, Kiritimati 1989.

Government of Tonga (1986), *Five Year Roads Programme*, prepared by the Ministry of Works.

Government of Western Samoa (1987), *Western Samoa's Sixth Development Plan 1988-1990*, Apia, Western Samoa.

Government of Solomon Islands (1984). "Economic and Engineering Studies for the Extension and Upgrading of the Lambi-Aola to Marau Sound Roads.

Gutteridge Haskins & Davey Pty. Ltd. (GHD) (1990), *Survey of Domestic Aerodromes to Determine Safety-Related Deficiencies*, prepared for the Australian International Development Assistance Bureau, May.

Hocking (1972), *Some Economic Aspects of Australia's Two Airline Policy*, Melbourne, Committee for the Economic Development of Australia.

Hotelling (1929), "Stability in Competition" *Economic Journal* Vol 39 1929 pp 41-57.

Holmstrom and Tirole (1989), "The Theory of the Firm", D. Williamson "Transactional Cost Economies" in R. Schmalensee and R. Willig (eds) *Handbook of Industrial Organization* (Amsterdam: North Holland, 1989)

International Civil Aviation Organization, 1990, *Organization Study of the Civil Aviation Authority of Fiji,* Project TF/FIJ/89/201, March.

International Maritime Organization (1988), *Study of the Establishment of a Ports Authority in Western Samoa,* Mission Report.

Jansson and Schneerson (1987), *Liner Shipping Economics,* Chapman and Hall.

Japanese International Cooperation Agency (1987), *The Study on Development of the Ports in Western Samoa.*

Kasper (1991), "The Economies and Politics of South Pacific Development: An Outsiders's View. *Aid and Development in the South Pacific.* Pacific Papers 2, Center for Independent Studies, St. Leonards, NSW, 1991 p67.

King (1984), *The Air Traffic Market and Tourism: Some Thoughts on the South Pacific* in C. Kissling, (ed). *Transport and Communications for Pacific Microstates* (Suva, University of the South Pacific, 1984).

Morrison and Winston (1987), "Empirical Implications and Tests of the Contestability Hypothesis" *Journal of Law and Economics,* April, pp 53-66.

New Zealand Ministry of Foreign Affairs (1988), *Road Maintenance in Western Samoa,* prepared by TGB Armitage.

Pacific Area Travel Association (1990), *Annual Statistical Report 1989,* pp. 5-64.

Perry (1989), "Vertical Integration: Determinants and Effects", in R. Schmalensee and R. Willig (eds) *Handbook of Industrial Organization* (Amsterdam: North Holland).

Port of Singapore Authority (1990), *PSA Tariff 1990.*

Ports Authority of Fiji (1989), "*Port Maintenance Policy*", Report No. TR-64-16, Suva, Fiji.

Ravenhorst (1991), *Shipping Activity Between Rotterdam and Indian/Pacific Ocean Islands,* Maritime Economic Research Centre, August.

Redecon Australia (1987), *Third Multiproject, Road Improvements Tongatapu,* prepared for the Asian Development Bank, July.

Roughton and Partners (1988), *Guadalcanal Road Improvement Project, Maintenance Report.* Ministry of Transport, Works and Utilities.

Roughton and Partners (1989), *Road Upgrading Project - Final Report*, prepared for the government of Fiji and the Asian Development Bank (TA No. 1046-FIJ), November.

Sherman (1989), *The Regulation of Monopoly*, Cambridge University Press, Cambridge.

South Pacific Bureau for Economic Cooperation (1990), *Review of Non-Directional Beacon Requirements, Vanuatu*, prepared by the Civil Aviation Authority of Australia.

Srinivasaw (1986), "The Costs and Benefits of Being a Small, Remote Island, Landlocked or Ministate Economy", *World Bank Research Observer*, Vol. No 2 July, pp 205-218.

TecnEcon (1988), *Solomon Islands Rural Transport Project*. Commission of the European Communities.

Touche Ross and Co. (1984a), *Regional Transport Survey of the South Pacific - Snipping Study Analysis Report - Ports*, London.

Touche Ross and Co. (1984b), *Regional Transport Survey of the South Pacific - Shipping Database Reports*, London.

Tourism Council of the South Pacific (1989), *Air Transport - Tourism Linkage Study Final Report*, April.

Tourism Council of the South Pacific (1990), *Solomon Islands Tourism Development Plan 1991-2000*, Ministry of Tourism and Aviation.

Tourism Council of the South Pacific (1990), *Tourism Sector Report, Western Samoa*.

United Nations Development Program (1985), "*Port Development - A Handbook for Planners in Developing Countries*", TD/B/C.4/175.01.

United Nations, (1990), *Economic and Social Survey of Asia and the Pacific*, New York.

United Nations (1990), *National Accounts Statistics Aggregates and Detailed Tables 1988*. New York.

United Nations (1990), *Statistics Year Book for Asia and the Pacific 1989*. New York.

United Nations (1988), *Survey of Economic and Social Conditions in Africa 1985-86*, New York.

Vickers and Yarrow (1988), *Privatization : An Economy Analysis*, M.I.T. Press, Cambridge, Mass.

Western Samoa Airport Authority (1990), *Master Plan Update for Faleolo International Airport*, prepared by Henry Fan (Singapore Airport Authority).

Western Samoa Accident Compensation Board (1990), *A Study of Accidents*.

World Bank (1987), *The Highway Design and Maintenance Standards Model*.

World Bank (1988), "*Road Deterioration in Developing Countries - Causes and Remedies*", World Bank Policy Study, Washington (June).

World Bank (1989), *South Pacific Islands Transport Review: Country Reports*, prepared by Pak-Pok and Kneebone Pty Ltd., December.

World Bank and Economic Commission for Africa (1990), "The Road Maintenance Initiative - Building Capacity for Policy Reform", prepared by the Economic Development Institute and the World Bank (Africa Technical Department, Infrastructure Division), Washington, June.

World Bank (1990), "Information Systems for Road Management: Draft Guidelines on Systems Design and Data Issues", World Bank Technical Paper, Washington (September).

World Bank (1991a), *Toward Higher Growth in Pacific Island Economies : Lessons from the 1980s.* Report No. 9059-ASIA, Washington, September.

World Bank, (1990), *Western Samoa Emergency Road Rehabilitation Project.*

World Bank (1992), *Pacific Regional Post Secondary Education Study*, Report No. 10522-EAP, Washington, May.

World Tourism Organisation (1989), *Compendium of Tourism Statistics*, United Nations, New York.

World Tourism Organisation (1991), *International Tourism in East Asia and the Pacific 1970-1990*, United Nations, New York.

W.S. Atkins International, circa (1989), *Vava'u Regional Development Program* prepared for the Ministry of Foreign Affairs, Tonga.

ANNEXES

PACIFIC ISLANDS

TRANSPORT SECTOR STUDY

MANAGEMENT INFORMATION FOR INFRASTRUCTURE

1. Five primary functional levels or classifications, related to the level at which the system is viewed, may be defined. These functional levels are:

- **Budgeting:** The sectoral level, viewed by government and the public, in terms of budgets and statistics of the extent and level of service provided.
- **Network Planning:** The planning, programming and budgeting of public works and expenditures for road development and maintenance, encompasses strategic planning and work programming.
- **Design Standards:** Used in the functional and technical design of road works, embraces the design of new construction, betterment, rehabilitation and periodic maintenance works.
- **Maintenance:** Information related to facilities and operational management. Examples include routine maintenance management, traffic operations management, equipment management and construction management.
- **Research and Development:** Data are usually study specific and usually more detailed and precise than for project-level or operations. (Very limited in PMCs.)

2. These functional classifications are combined with technical groupings of information to form a systematic basis for classifying information needs. The technical groupings for *road* management comprise:

Element	Aspects
Road Inventory	Network/location/geometry, appurtenances environment
Pavement	Pavement structure Pavement condition
Structures	Structures inventory Bridge condition
Traffic	Volume, loadings, accidents
Finance	Unit costs, budget revenue
Activity	Projects, interventions commitments
Resources	Institutional Materials Equipment

3. A further classification—that of Information Quality and Detail—is used to indicate the level of detail for application to the various functional levels. Four levels of differentiation are used. These are set out below.

Infrastructure Information—Quality and Detail Classification

Level I	:	Comprehensive; In depth field investigation; Special project design; High skills and resources needed.
Level II	:	Standard design needs; Sample coverage for planning; Sufficient for evaluation; Reliable support and resources needed.
Level III	:	Sufficient for network planning; Suitable for elementary project design; Combined manual and semiautomatic data collection.
Level IV	:	Basic only; Summary statistics of inventory, performance and utilization; Suitable only for standardized design of very low volume roads, simplest basic collection methods.

Level IV information is most suited to the small agencies, with very limited resources, in the PMCs.

4. In the detailed examination of maintenance in the PMCs presented in Part II of the text, the extent of existing management information has been developed for each transport subsector in each PMC, based on this classification system. The Management Information Inventory Table for roads uses the classifications outlined above. Notional classifications are used in the marine and aviation subsectors to provide similar information however, no comparison standards are available for these modes and subjective assessments have to be made. These should be subject to further consideration and refinement, if development of appropriate data bases is to be undertaken.[1]

Endnotes

1. For detailed discussion of the transport infrastructure maintenance situation in each PMC, see the maintenance annexes to each country sector survey, in Volume Two of this report.

PACIFIC ISLANDS

TRANSPORT SECTOR STUDY

DATA AND METHODOLOGICAL ISSUES IN THE ANALYSIS OF INFRASTRUCTURE MAINTENANCE

DATA ISSUES

Existing Data Limitations. The estimated replacement cost of transport infrastructure, rehabilitation requirements, assessed maintenance needs, and actual maintenance expenditure, are established in separate country surveys.[1] The estimates are derived from existing databases that are severely limited in quality and coverage. While analyses prepared separately for each PMC indicate moderate consistency, the results should be treated with caution, cognizant of the quality of the data. The objective of the estimates is to provide an *indicative quantitative perspective* of the present situation and to illustrate the nature and scale of the transport infrastructure maintenance issue.

Lack of Data on Use of Infrastructure. Data on traffic throughput volumes and composition for transport facilities are key indicators of the value of an existing infrastructure; unfortunately in the PMCs these data are very limited. Available data and observation for the road subsector indicate that traffic volumes are below 100 vehicles per day outside the immediate vicinity of major towns, and are sometimes less than ten vehicles per day on much of the road network. Such low traffic volumes, with apparent relatively low growth, indicates a need for traffic data over the network and for careful review of the incremental economic benefits gained from road expenditure and the appropriate standard at which roads should be constructed and maintained.[2]

Existing Asset Inventories. There are very limited data on transport infrastructure in each of the five countries examined. With the exception of the Solomon Islands Port Authority which maintains full commercial accounts, no government ministry or department in any of the countries holds a formal inventory of assets which would serve management needs at the network, project or operational levels. Present inventory information, such as it does exist, is generally limited to basic physical data, for example, road length, the number (and occasionally the length) of wharves, and the number and length of runways and surface material.[3] No data are available on the present condition of transport infrastructure, except as reflected in the accounting data of the Solomon Islands Port Authority and a broad assessment of road quality prepared in a recent transport sector development study for Vanuatu.

METHODOLOGICAL ISSUES

Basis for Estimating Replacement Cost of Transport Infrastructure

The replacement costs of transport assets have been estimated using the prepared infrastructure inventory and estimates of current unit construction costs. Transport infrastructure assets exclude equipment used for maintenance, but include some equipment and facilities which are an integral part of infrastructure services. For example, marine infrastructure includes buildings, hardstand areas, shipworking equipment, navigation aids and tugs and workboats in addition to wharves and jetties. Aviation facilities include runways, terminals,

control towers, navigation equipment, and beacons and firefighting equipment. Replacement cost estimates exclude the opportunity cost of land used for transport infrastructure. Unit construction costs have been derived from recent construction costs and estimates of "typical" costs where recent specific cost estimates are not available.

Endnotes

1. See the Maintenance Annex to each individual country transport sector survey, presented in Volume Two of this report.

2. This is reinforced by the scarcity of maintenance supervision resources and the distance of much of the road network from primary centers. With such low traffic volumes, environmental factors are likely to exert more influence on road deterioration than road use. Technical knowledge of road maintenance and deterioration, for example, through the Highway Design Model (World Bank, 1988), is of limited use for analysis in the PMCs because road conditions lie outside the range of detailed investigation and model calibration.

3. This information is not always readily available, but as complete an inventory as possible has been assembled for the present study.

PACIFIC ISLANDS

TRANSPORT SECTOR STUDY
PART III: COMPARISON OF REGIONAL TRANSPORT COSTS

STATISTICAL DATA AND SOURCES

Socio-economic data and trade flows for the PMCs, and the comparator countries, are available from a number of publications.

The most recent socio-economic data available on all the islands is largely for 1988.[1] Consequently, the most recent year for any data series varies from country to country. All costs are converted to US dollars (1988) for the purpose of analysis.

Additional data on Christmas Island and the Cocos Islands, and data on tourist movements in 1989 from Pacific Area Travel Association and World Tourism Organization were provided by the Federal Department of the Arts, Sport, the Environment, Tourism, and Territories (DASETT) in Australia.

Freight rates, cargo movements and additional shipping charges were collected from shipping lines and agents in Australia, New Zealand, Hong Kong, Singapore, Rotterdam and the United Kingdom. Although rebates are common in the shipping industry and are generally regarded as commercially sensitive, their impact is relatively minor on the routes included in this study and the data collected is a reliable indicator of current market rates.

Air fares and hotel costs were obtained from travel agents. Additional aviation data such as route structure and aircraft types were obtained from *World Airways Guide* and *Air Tariff Guide*.

Endnotes

1. A more detailed assessment of the PMC economies is contained in World Bank (1991a).

Table 1: PACIFIC ISLANDS—SOCIO-ECONOMIC CHARACTERISTICS, 1984/1987

	Year	Fiji	Kiribati	PNG	Solomon Islands	Tonga	Vanuatu	Western Samoa
Land Area (Sq Km)	1988	18,272	710	462,840	28,900	699	12,190	2,935
Population (000)	1988	719	67	3,560	304	99	150	162
Population growth (p.a.)	1980-88	1.6%	1.8%	2.2%	3.8%	0.8%	3.4%	0.6%
GNP (US$m)	1988	1,130	40	2,920	130	80	120	100
GNP/Capita (US$)	1988	1,540	650	820	430	800	820	588
Av. real GNP growth (p.a.) /a	1980-88	-0.4%	-5.9%/k	2.6%	6.1%	3.0%	1.2%/k	-0.6%
Total Aid Flows (US$m)	1988	43	12	300	35	13	29	19
Aid as Percent of GDP /b	1980-85	3.0%/k	74.0%	..	20.0%	28.0%	26.0%	25.0%
Merchandise Exports (US$m)	1988	304.2	4.6	1,409.6	77.2	6.2/j	15.4	14.2
Merchandise Imports (US$m)	1988	460.7	22.1	1,170.0/j	74.8	90.0	67.7	68.5
Number of Visitors /c	1989	250,565	3,000	48,918	9,880	20,348	23,865	51,740
Sea freight loaded (tonnes)/d	1987	661,000/g	10,000/h	2,623,000	39,795	64,000/h	59,000/h	43,000/h
Sea freight unloaded (tonnes) /e	1987	807,000	25,000	1,860,000	140,842	20,000	61,000	87,000
Economic Activity By Sector (% of GDP) /f								
Agriculture	1987	23.7	20.3	29.0	44.3	41.8	28.0	41.2
Industry	1987	20.9	10.8	35.1	8.0	17.3	12.9	15.4
Services	1987	55.4	68.9	35.9	47.7	40.9	59.1	43.4
Total:	1987	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Major Domestic Exports (% of Total Exports)								
Banana	1988	-	-	-	-	15.9/j	-	-
Beef	1988	-	-	-	-	-	14.9	-
Cement	1988	0.1	-	-	-	-	-	-
Cocoa	1988	-	-	3.8	4.6	-	7.3	4.2
Coconut Oil	1988	0.8	-	-	-	18.3/j	-	39.3
Coffee	1988	-	-	9.3	-	-	-	-
Copper	1988	-	-	36.6	-	-	-	-
Copra	1988	-	71.8	-	9.7	-	59.5	6.6
Desiccated Coconut	1988	-	-	-	-	6.3/j	-	-
Fish	1988	-	27.5	-	48.8	-	-	-
Forest Products	1988	-	-	8.0	-	-	-	-
Gold	1988	18.7	-	33.2	-	-	-	-
Molasses	1988	2.6	-	-	-	-	-	-
Palm Oil	1988	-	-	-	7.4	-	-	-
Sugar	1988	45.6	-	-	-	-	-	-
Taro & Taamu	1988	-	-	-	-	-	-	17.5
Timber	1988	-	-	-	22.8	-	6.6	3.7
Vanilla	1988	-	-	-	-	8.1/j	-	-
Major Exports as % of Total Exports:	1988	67.9	99.3	90.8	93.4	48.6/j	88.2	71.3
Major Imports (% of Total Imports)								
Food & live animals	1987	17.8	31.0	16.9	15.0	21.6	13.7	23.0
Minerals/Fuels etc	1987	16.2	10.6	11.0	14.7	10.2	8.5	17.0
Chemicals	1987	8.6	5.1	8.4	6.7	6.5	6.0	6.0
Machinery & Transport Equip	1987	19.4	14.5	33.5	29.1	18.3	25.7	20.0
Other manufacturing	1987	31.0	24.2	26.5	29.8	27.6	35.0	27.0
Major Imports as % of Total Imports:	1987	93.1	85.4	96.3	95.3	84.1	89.0	93.0

/a *Europa World Year Book*, 1990.
/b Pak-Poy & Kneebone Pty Ltd and the World Bank, *South Pacific Islands Transport Sector Review: Country Reports* December 1989.
/c World Tourism Organization, 1991; Pacific Area Travel Association, *Annual Statistical Report*, 1989.
/d *Europa World Year Book*, 1990; Pak Poy and Kneebone and World Bank, 1989.
/e *Europa World Year Book*, 1990; Pak Poy and Kneebone and World Bank, 1989.
/f For Tonga: United Nations, *UN Economic and Social Survey of Asia and the Pacific*, 1990.

Key: /g = 1984 data; /h = 1985 data; /i = 1987 data; /j = 1980-85 data; /k = 1980-87 data.

Indicators: .. indicates data not available; - indicates the value of zero; n/a = not applicable.

Sources: *Pacific Economic Bulletin: Statistical Annex*, June 1990 and *Pacific Economic Bulletin: Statistical Annex*, December 1990.

	Year	New Caledonia	Society Islands	Mauritius	Réunion	Seychelles	Christmas Island[1]	Cocos Islands[1]	The Comoros	The Maldives
Land Area (Sq Km)	1989	16,750	4,200	2,040	2,512	454	135	14	1,862	298
Population (000)	1988/89	164	189	1,036	579	62[e]	1.35[f]	0.57[f]	335[d]	206
Population growth (p.a.)	1980-88	1.4%	1.9%	1.0%	1.6%	0.9%	..	.	3.5%[h]	3.4%
GNP ($M)	1988	860[c]	1,370[c]	1,890	3,200[c]	260	n/a	n/a	200	80
GNP/Capita ($)	1988	5,760[c]	7,810[c]	1,810	5,672[c]	3,800	n/a	n/a	440	410
Av. real GNP growth (p.a.)	1980-88	..	..	6.1%	1.0%[g]	2.5%	n/a	n/a	3.0%[h]	3.3%[h]
Merchandise Exports (US$m)	1987/88	212.1	78.8	1010.1	1,556.2	16.9	n/a	n/a	11.6	44.6
Merchandise Imports (US$m)	1987/88	593.8	784.9	1157.0	1,378.5	129.5	n/a	n/a	46.2	94.5
Number of Visitors[2]	1988	82,000	135,387	240,000	144,300	77,721	100	500	2,000	155,758
Shipping freight loaded (MT)	1988	1,334,900[d]	..	937,000	337,600	4,500[d]	..	..	10,000	1,154[b]
Shipping freight unloaded (MT)	1988	811,300	..	1,484,000	1,565,300	235,000	..	..	95,000	96,037
Economic Activity By Sector (% of GDP)										
Agriculture	1987/88	1.8	4.0	13.2	7.0	6.3	n/a	n/a	41.9	30.5
Industry	1987/88	24.0	19.0	32.5	16.8	20.1	n/a	n/a	13.9	14.8
Services	1987/88	74.2	77.0	54.2	76.2	73.6	n/a	n/a	44.2	54.7
Total:	1987/88	100.0	100.0	100.0	100.0[e]	100.0[e]	n/a	n/a	100.0[d]	100.0[d]
Major Exports (% of Total Exports)[3]										
Clothes	1987/88	-	-	38.0	-	-	-	-	-	-
Cloves	1987/88	-	-	-	-	-	-	-	7.3	34.6
Copra	1987/88	-	-	-	-	3.9	-	..	-	-
Copra oil	1987/88	-	3.6	-	-	-	-	-	-	-
Cultured black pearls	1987/88	-	21.8	-	-	-		-	-	-
Ferro nickel	1987/88	51.1	-	-		-		-	-	-
Fish products	1987/88	-	-	-		-	-	-	-	64.8
Nickel matte	1987/88	9.1	-	-	-	-	-	-	-	-
Nickel ore	1987/88	11.0	-	-	-	-	-	-	-	-
Phosphates	1987/88	-	-	-	-	-	..	-	-	-
Rum	1987/88	-	-	-	1.7	-	-	-	-	-
Spiny lobsters	1987/88	-	-	-	2.8	-	-	-	-	-
Sugar	1987/88	-	-	33.7	75.7	-	-	-	-	-
Tea	1987/88	-	-	0.7	-	-	-	-	-	-
Tuna	1987/88	-	-	-	-	75.0	-	-	-	-
Vanilla	1987/88	-	-	-	0.7	-	-	-	77.7	-
Woven fabric	1987/88	-	-	-	-	-	-	-	-	-
Ylang-ylang	1987/88	-	-	-	-	-	-	-	11.6	-
Major Domestic Exports as a % of Total Exports:	1987/88	71.2	28.4	72.4	80.9	78.9[e]	..	..	96.6	99.4[d]
Major Imports (% of Total Imports)[4]										
Food and live animals	1987/88	2.3	0.5	5.5	20.6	17.9	..	..	15.6	27.7
Minerals/Fuels etc	1987/88	9.2	5.8	5.0	4.6	26.2	..	..	6.8	13.5
Chemicals	1987/88	..	..	..	..	6.7	..	..	..	..
Machinery & Transport Equipment	1987/88	..	..	10.2	33.1	25.5	..	..	7.9	32.2
Other manufacturing	1987/88	0.3	7.4	12.8	41.7	23.2	..	..	9.4	26.6
Major Imports as a % of Total Imports:	1987/88	11.8	13.7	33.5	100.0	99.5[e]	..	..	39.7	100.0

Sources: UN, National Accounts Statistics, and IMF, International Financial Statistics in Europa World Year Book, 1990.

Notes: (1) Commonwealth Department of the Arts, Sport, the Environment, Tourism and Territories, 1991
(2) Pacific Area Travel Association, Annual Statistical Report, 1989
(3) Europa World Year Book, 1990
(4) Europa World Year Book, 1990

Key: a = 1982 data; b = 1984 data; c = 1985 data; d = 1986 data; e = 1987 data; f = 1991 data; g = 1973-86 data, h = 1980-87 data

Indicators: .. indicates data not available; - indicates the value of zero; n/a = not applicable

ANNEX III.1

Table 3: PACIFIC ISLANDS AND MAJOR TRADING PARTNERS, 1983/1988

NOMINATED COUNTRY	MAJOR TRADING PARTNERS					
	Year	Destination of Exports	%	Year	Source of Imports	%
Fiji	1988	United Kingdom	29	1988	Australia	29
		New Zealand	24		New Zealand	19
		Australia	22		Japan	10
		Others	25		Others	42
			100			100
Kiribati	1988	Netherlands	69	1988	Australia	44
		Fiji	23		Fiji	15
		USA	4		Japan	11
		Others	4		Others	30
			100			100
Papua New Guinea	1988	Japan	41	1987	Australia	43
		Federal Republic of Germany	39		Japan	18
		Australia	12		USA	8
		Others	8		Others	31
			100			100
Solomon Islands	1987	Japan	36	1987	Australia	41
		United Kingdom	12		Japan	19
		Thailand	14		Singapore	9
		Others	38		Others	31
			100			100
Tonga	1986	New Zealand	39	1986	New Zealand	39
		Australia	30		Australia	30
		Japan	9		Japan	9
		Others	22		Others	22
			100			100
Vanuatu	1986	Netherlands	33	1986	Australia	36
		France	26		Japan	13
		Japan	19		New Zealand	10
		Others	22		Others	41
			100			100
Western Samoa	1983	USA	31	1983	New Zealand	38
		New Zealand	25		Australia	15
		Australia	13		Japan	15
		Others	31		Others	32
			100			100

Source: *Europa World Year Book*, 1990.

Table 4: COMPARATOR ISLAND COUNTRIES—MAJOR TRADING PARTNERS

Comparator Islands	Major Trading Partners					
	Year	Destination of Exports	%	Year	Source of Imports	%
The Society Island	1987	France	54	1987	France	52
		USA	19		USA	10
		Others	27		Australia	5
					Others	33
			100			100
New Caledonia	1987	France	44	1987	France	53
		Japan	19		Australia	8
		Federal Republic of Germany	9		USA	[illegible]
		Others	28		Others	31
			100			100
Mauritius	1988	United Kingdom	36	1988	France	12
		France	23		USA	12
		USA	13		South Africa	90
		Others	28		Japan	7
					United Kingdom	7
					Others	53
			100			100
Réunion	1988	France	70	1988	France	67
		Italy	4		Others	32
		Germany	3			
		Others	23			
			100			100
Seychelles	1985	Pakistan	35	1985	United Kingdom	15
		Réunion	12		France	9
		France	9		South Africa	9
		Others	44		Others	67
			100			100
The Comoros	1977	France	65	1977	France	41
		USA	21		Madagascar	20
		Madagascar	5		Pakistan	8
		Others	9		Others	31
			100			100

Source: *Europa World Year Book*, 1990.

Note: Exports and imports by major markets were not available for the Maldives, the Cocos Islands and Christmas Island.

Table 5: PACIFIC ISLANDS—VISITOR ARRIVALS BY ORIGIN, 1989

VISITOR ARRIVALS BY ORIGIN (%)	NOMINATED COUNTRIES						
	Fiji	Kiribati /a	PNG	Solomon Islands	Tonga	Vanuatu	Western Samoa
The Americas	20.3	33.3	14.7	10.1	20.7	2.9	10.3
Europe	14.1	-	13.3	6.7	19.2	3.0	6.8
South Asia	0.0	-	0.6	-	0.4	-	-
North East Asia	5.5	-	5.4	5.5	11.9	2.9	-
South-East Asia	0.0	-	7.0	-	0.7	-	-
Australia/New Zealand	50.0	66.7	52.8	48.3	32.8	66.8	39.7
South & Central Pacific	7.2	-	4.0	20.4	14.2	17.9	40.7
Other areas /b	2.9	-	2.2	9.0	0.1	6.5	2.5
	100.0	100.0	100.0	100.0	100.0	100.0	100.0

/a 1988 data.

/b Other Areas include Africa, Middle East, and the USSR.

Source: Pacific Area Travel Association, *Annual Statistical Report*, 1989.

Table 6: COMPARATOR ISLAND COUNTRIES—VISITOR ARRIVALS BY ORIGIN, 1988

Visitor arrivals by origin (%)	New /a Caledonia	Society /a Islands	Mauritius	Réunion	Seychelles	Christmas Island	Cocos Islands	The /b Comoros	The Maldives
The Americas	2.4	44.4	0.8	-	2.6	-	-	-	1.3
Europe	20.9	34.1	43.3	45.0	83.1	-	-	-	77.8
South Asia	-	-	1.7	-	-	-	-	-	11.1
North East Asia	33.1	6.9	-	-	-	-	-	-	-
South East Asia	-	0.4	-	-	-	-	-	-	-
Australia/New Zealand	31.1	11.4	1.7	-	1.3	100.0	100.0	-	9.8
South & Central Pacific	3.9	2.3	-	-	-	-	-	-	-
Other areas /c	8.6	0.5	52.5	55.0/d	13.0	-	-	-	-
	100.0	100.0	100.0	100.0	100.0	100.0	100.0		100.0

/a 1989 data.

/b The most frequent visitors to the Comoros are the French and the South Africans.

/c Other areas include Africa, Middle East, and the USSR.

/d Includes visitors from the other regions listed above.

Sources: Pacific Area Travel Association, *Annual Statistical Report*, 1989.
Estimates for Christmas Island and Cocos Islands provided by Islands Liaison Office, Australia, 1991.

PACIFIC ISLANDS

TRANSPORT SECTOR STUDY

MAPS OF SHIPPING SERVICES FOR PACIFIC ISLANDS, COMPARATOR COUNTRIES AND PACIFIC RIM

Figure 1: PACIFIC ISLANDS—PASSING SHIPPING SERVICES

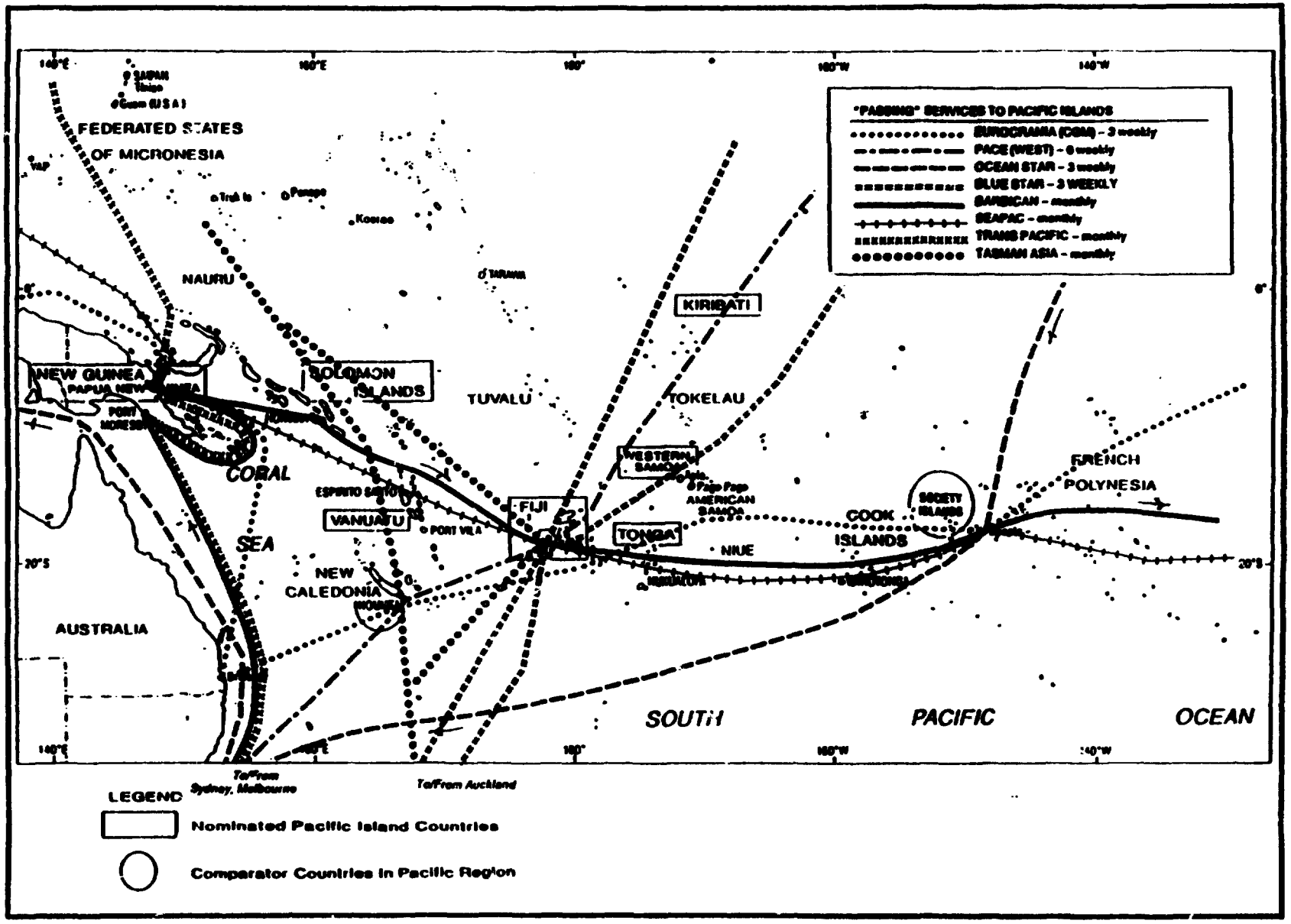
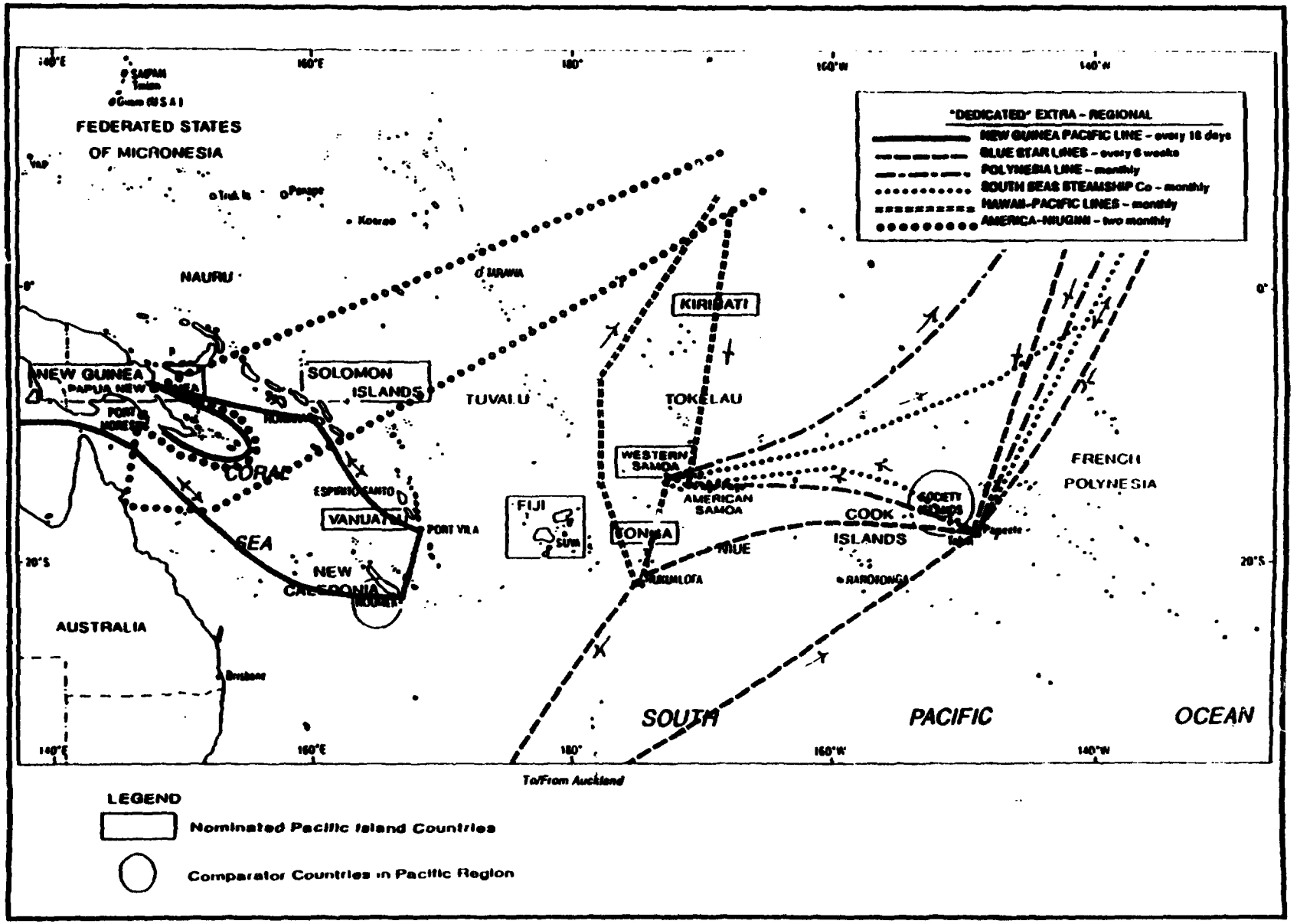


Figure 2: PACIFIC ISLANDS—"DEDICATED" EXTRA-REGIONAL SHIPPING SERVICES



ANNEX III.2

ANNEX III.2

Figure 3: PACIFIC ISLANDS—"DEDICATED" EXTRA-REGIONAL SHIPPING SERVICES

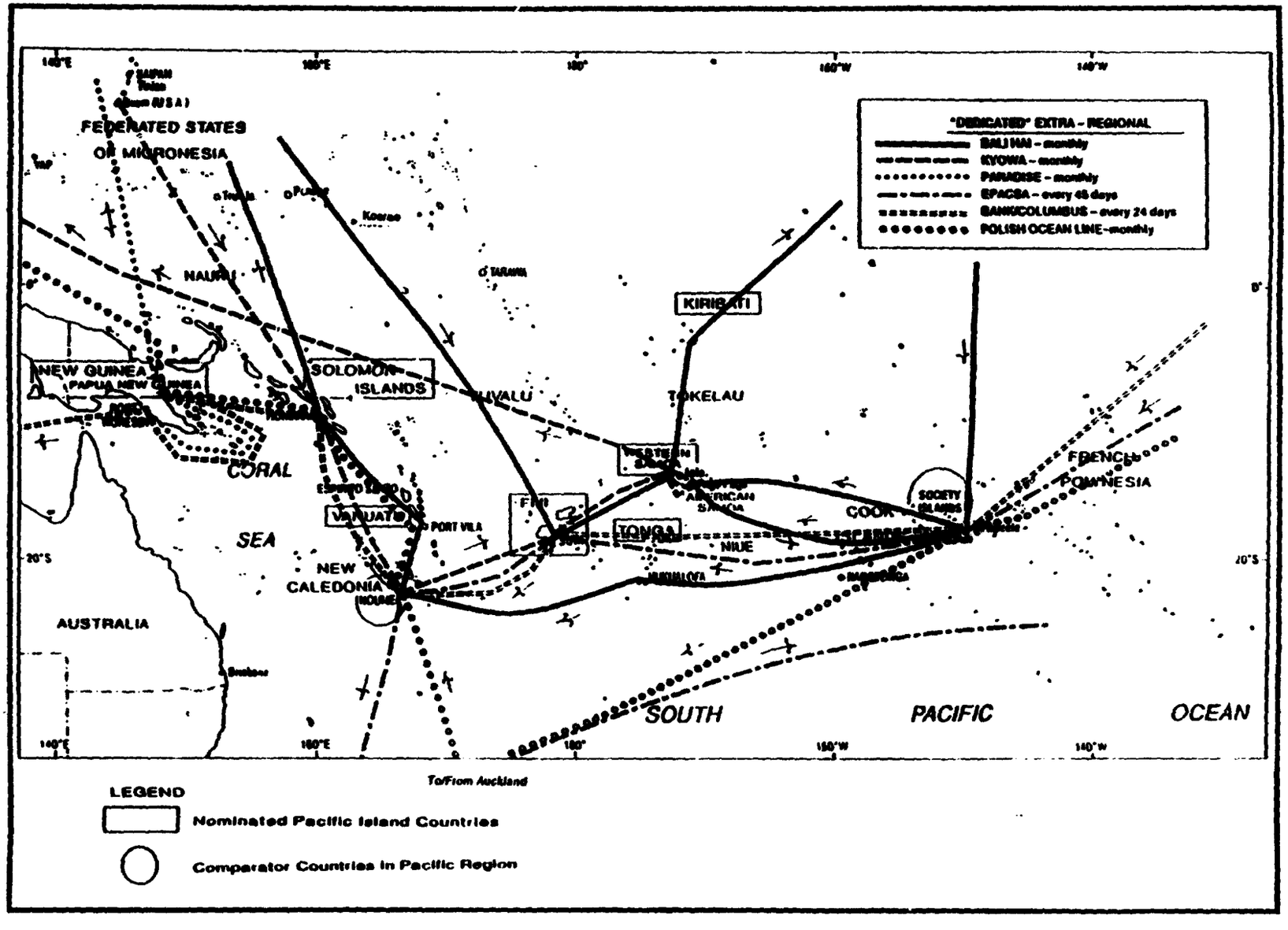


Figure 4: PACIFIC ISLANDS—REGIONAL SHIPPING SERVICES

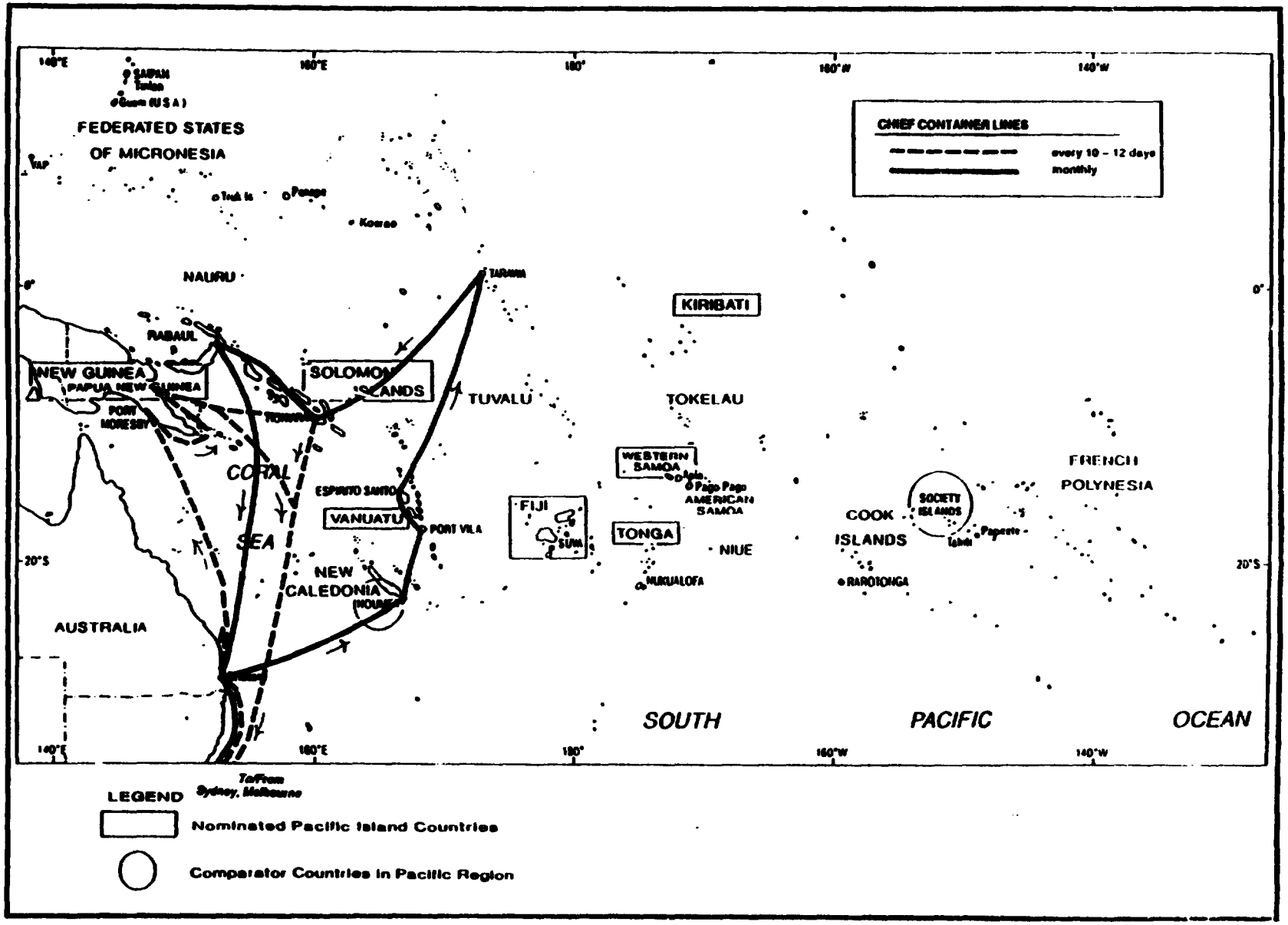
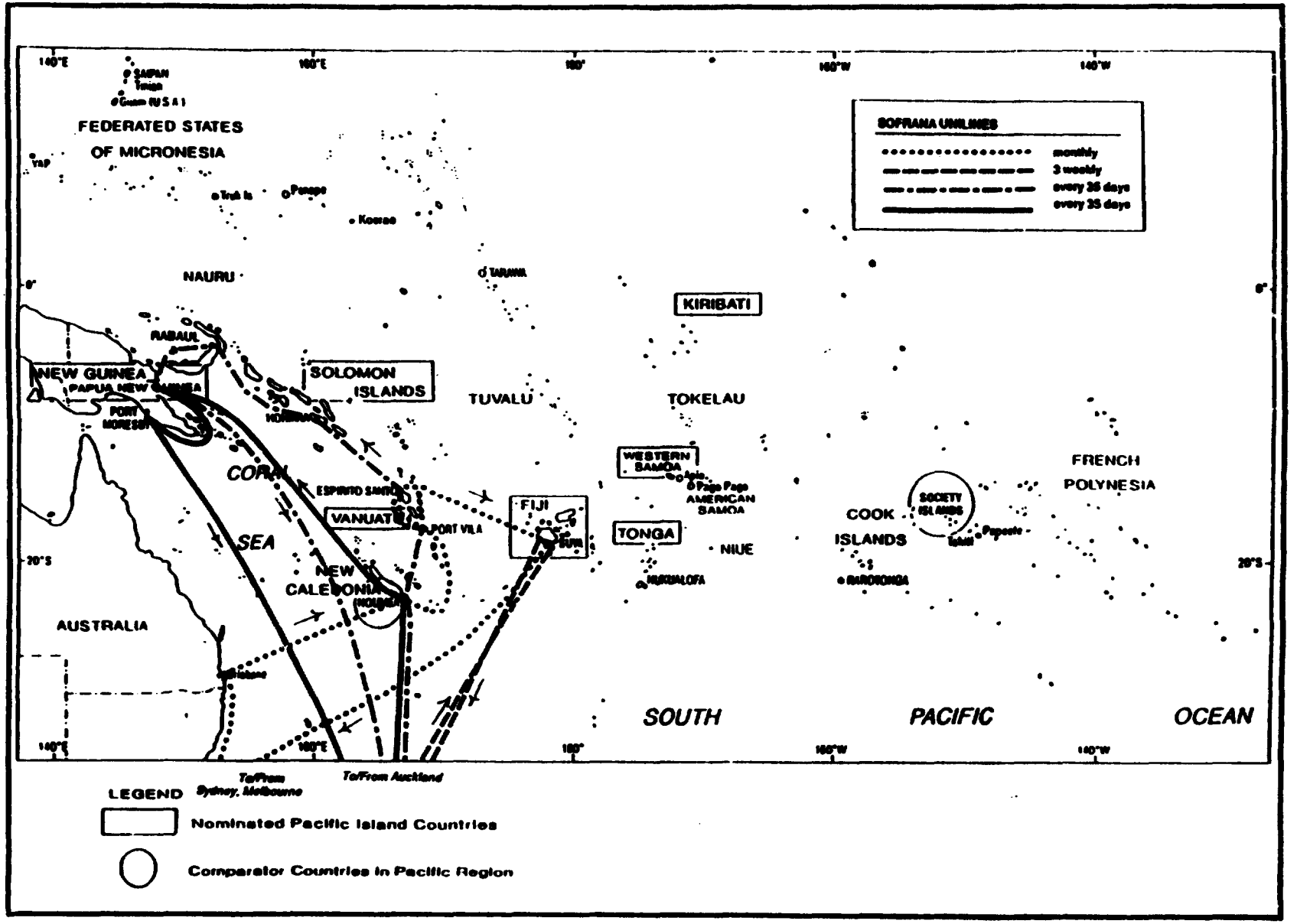


Figure 5: PACIFIC ISLANDS—REGIONAL SHIPPING SERVICES



ANNEX III.2

Figure 6: PACIFIC ISLANDS—REGIONAL SHIPPING SERVICES

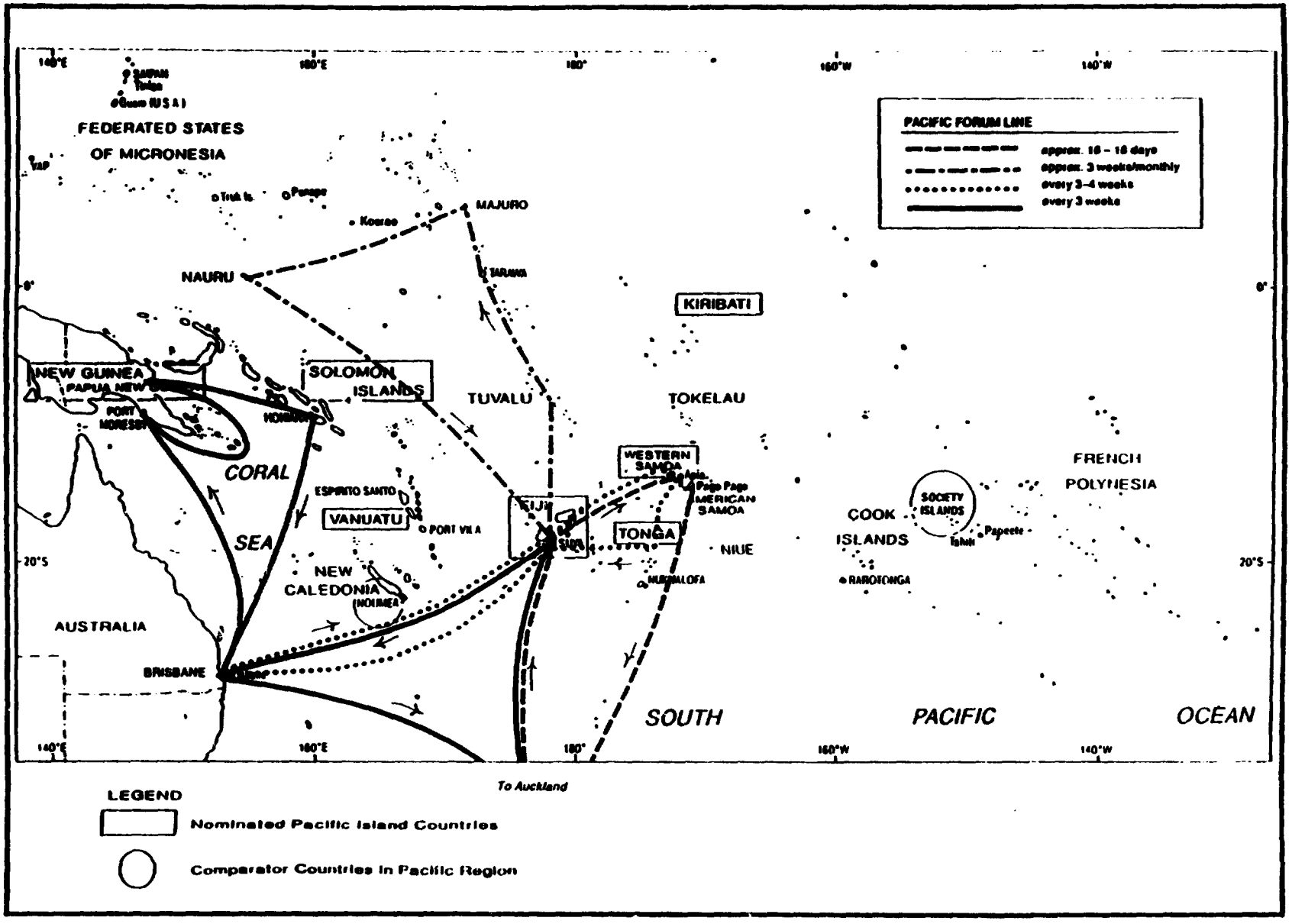


Figure 7: PACIFIC ISLANDS—REGIONAL SHIPPING SERVICES

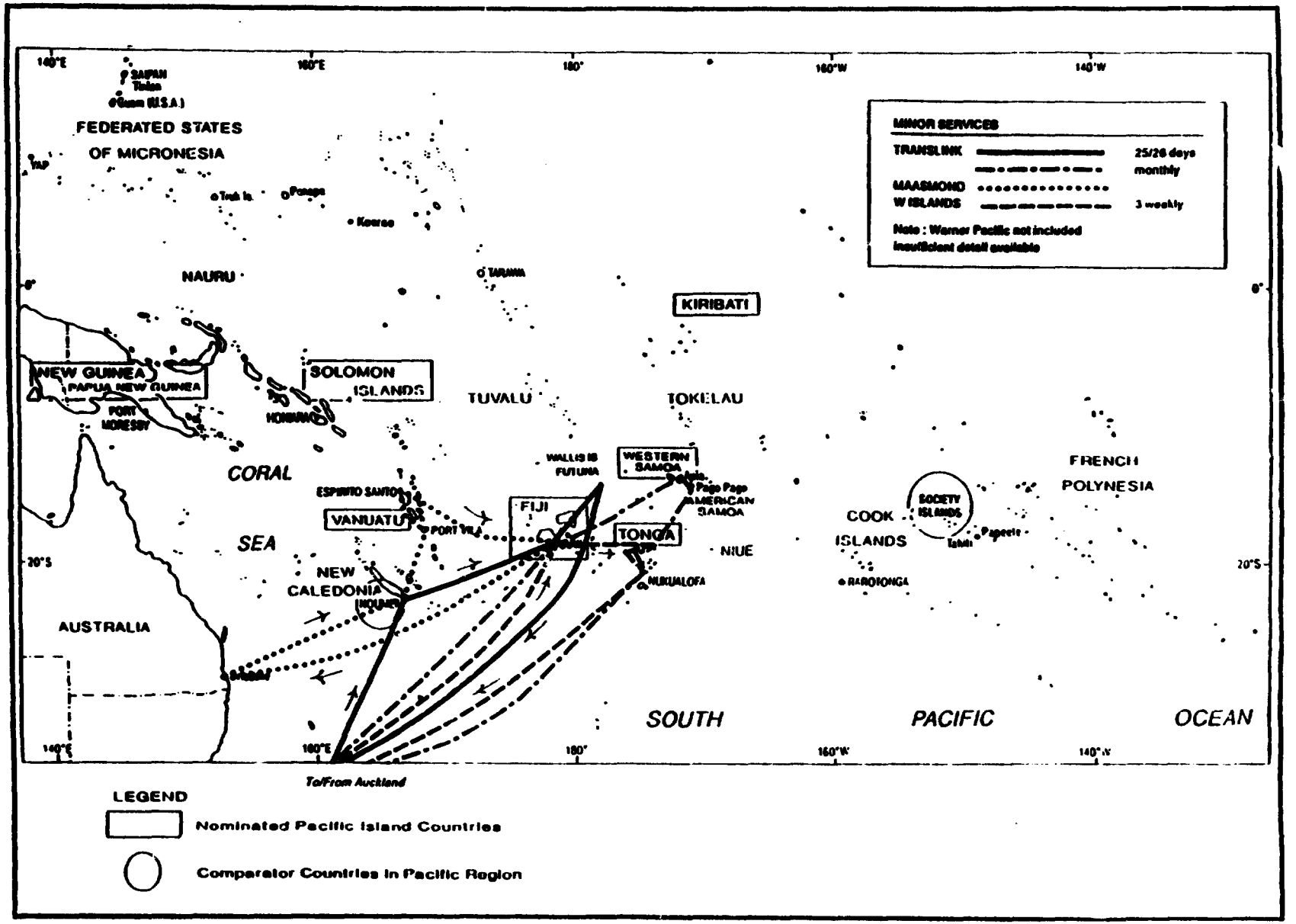
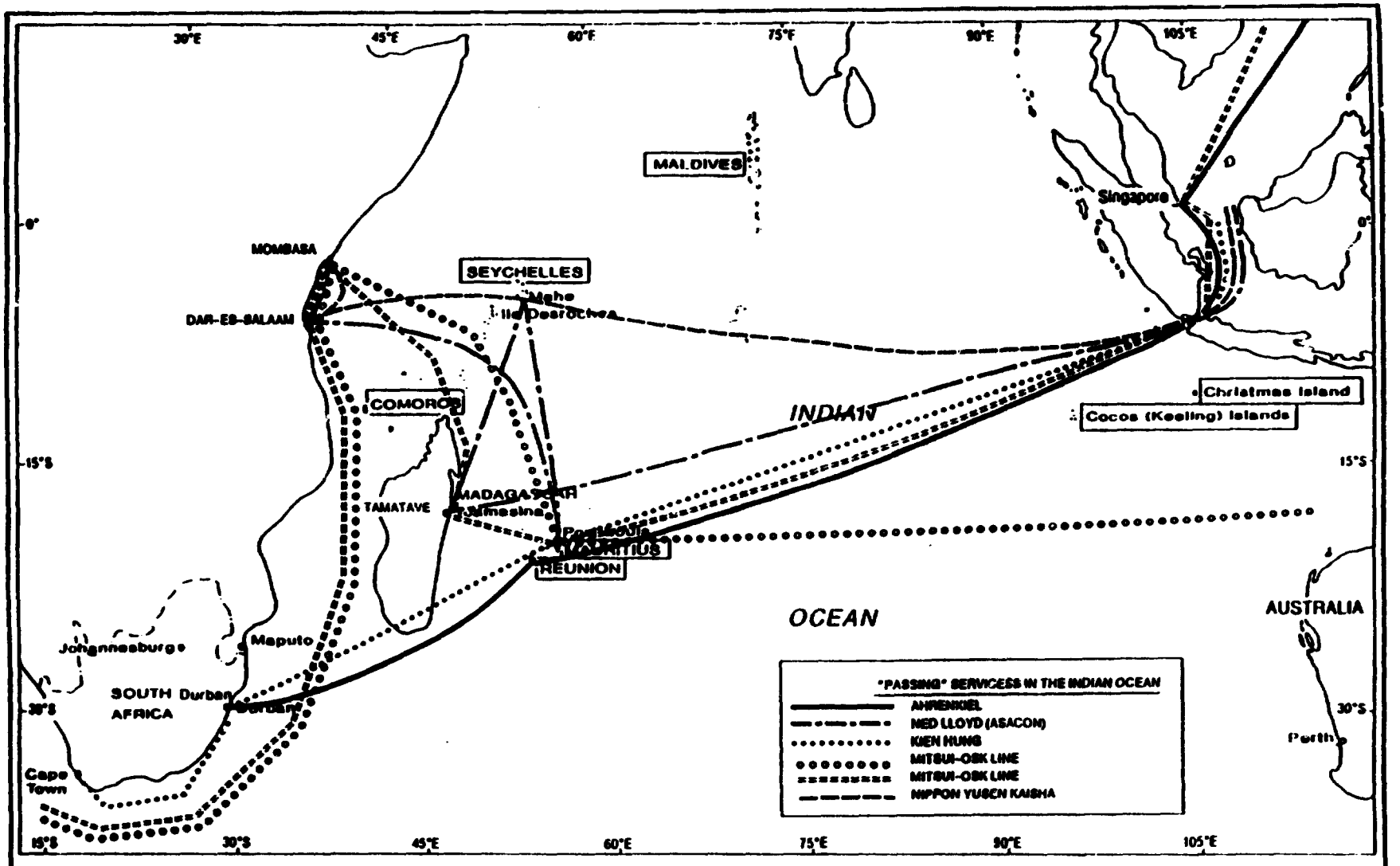


Figure 8: INDIAN OCEAN ISLANDS—PASSING SHIPPING SERVICES



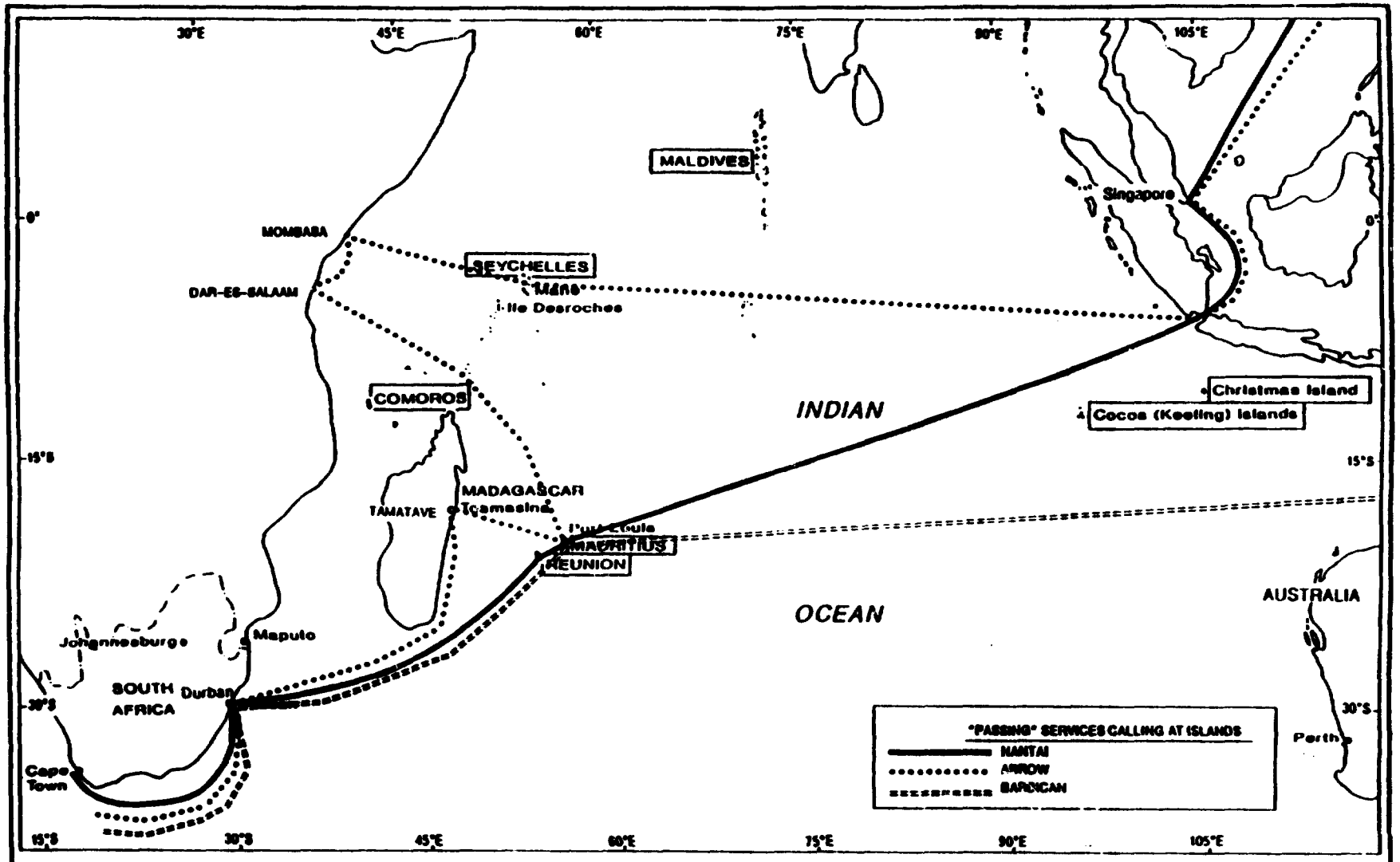
LEGEND :

Indian Ocean Comparator Islands.

NOTE : EXACT ROUTE STRUCTURE NOT AVAILABLE

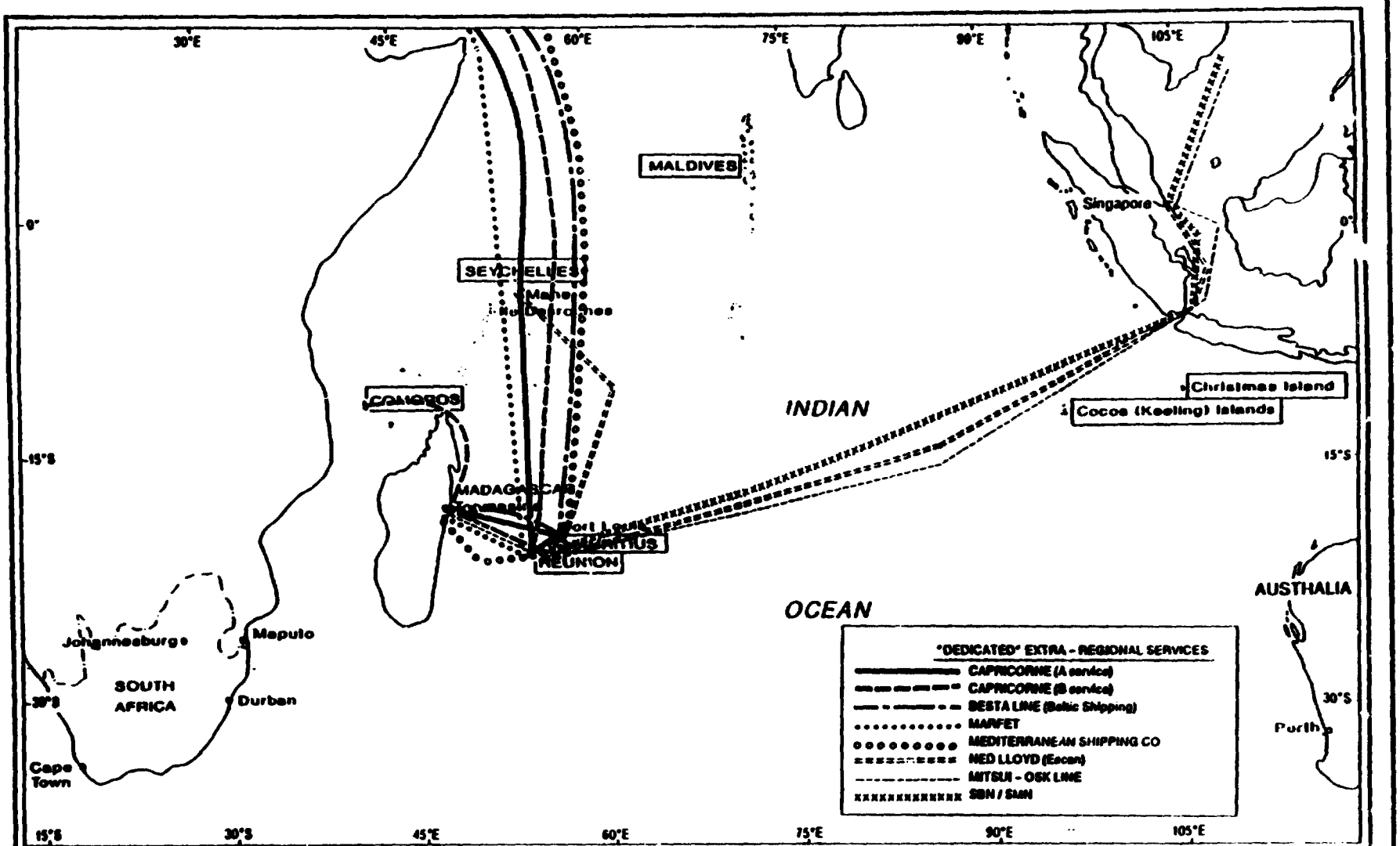
ANNEX III.2

Figure 9: INDIAN OCEAN ISLANDS—PASSING SHIPPING SERVICES



ANNEX III.2

Figure 10: INDIAN OCEAN ISLANDS—"DEDICATED" EXTRA-REGIONAL SHIPPING SERVICES

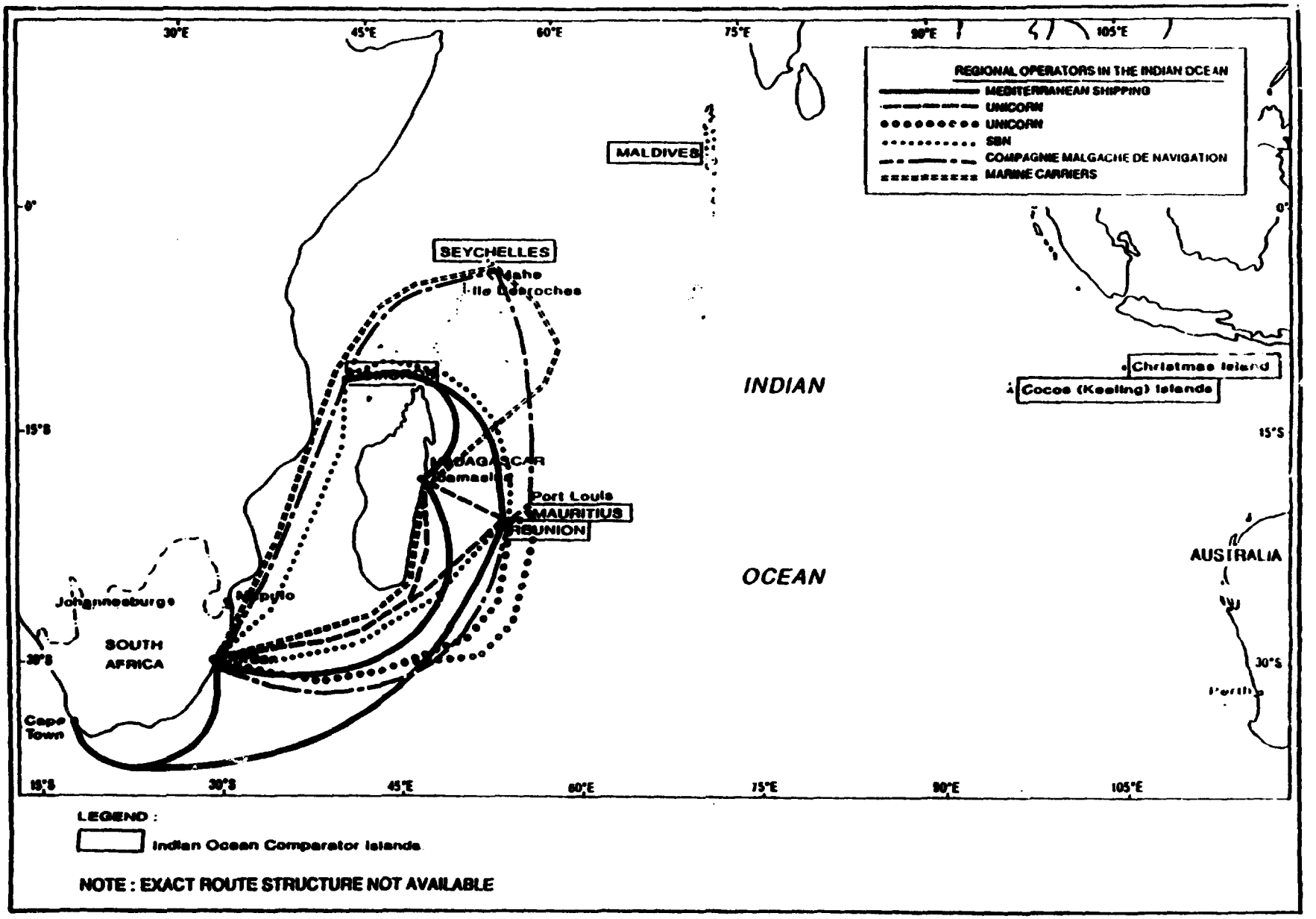


LEGEND :

Indian Ocean Comparator Islands

NOTE : EXACT ROUTE STRUCTURE NOT AVAILABLE

Figure 11: INDIAN OCEAN ISLANDS—REGIONAL SHIPPING SERVICES



PACIFIC ISLANDS

TRANSPORT SECTOR STUDY

SCHEDULE OF SHIPPING ROUTE TARIFFS AND VOLUMES

PACIFIC ISLANDS

TRANSPORT SECTOR STUDY

Schedule of Shipping Route Tariffs and Volumes

ROUTE GROUP	ROUTES	ACTUAL FREIGHT RATE (A$/TEU)	DISTANCE (miles)	VOLUME (TEU per annum)
Comparator Islands (incl. Pacific and Indian Ocean Islands)	Singapore-Cocos Islands	4,000	725	12
	Singapore-Guam	2,727	2,625	242
	Singapore-Koeree	3,117	3,663	24
	Hong Kong-Mahe	2,727	3,000	..
	Rotterdam-Mahe	6,371	6,201	..
	Singapore-Mahe	5,519	3,000	..
	Hong Kong-Mahe	3,377	3,765	..
	Singapore-Majuro	3,117	4,188	24
	Singapore-Male	2,247	1,863	..
	Rotterdam-Male	1,818	6,491	..
	Singapore-Moroni	5,519	3,870	..
	Rotterdam-Moroni	6,985	6,543	..
	Singapore-Mozothe	4,286	3,870	..
	Singapore-Mutsamudu	4,286	3,870	..
	Singapore-Noumea	3,247	4,172	1,209
	Rotterdam-Noumea	4,191	11,876	..
	Melbourne-Noumea	2,580	1,597	1,095
	Rotterdam-Noumea	3,638	11,876	..
	Singapore-Noumea	2,857	4,400	..
	Rotterdam-Noumea	4,114	11,876	..
	Rotterdam-Noumea	3,638	11,876	..
	Rotterdam-Noumea	4,605	11,876	..
	Hong Kong-Noumea	2,727	4,103	181
	Hong Kong-Noumea	2,857	4,103	548
	Melbourne-Noumea	2,900	1,597	1,149
	Hong Kong-Noumea	3,396	4,172	..
	Sydney/Brisbane-Pago Pago	3,800	2,660	363
	Singapore-Port Louis	2,078	3,324	..
	Rotterdam-Port Louis	3,224	6,997	..
	Singapore-Port Louis	4,870	3,324	..
	Rotterdam-Port Louis	2,340	6,997	..
	Singapore-Port Louis	1,818	3,324	121
	Rotterdam-Port Louis	2,533	6,997	..
	Singapore-Port Louis	1,818	3,324	..
	Hong Kong-Port Louis	2,208	4,747	..
	Hong Kong-Port Louis	2,143	4,747	730
	Hong Kong-Port Louis	2,727	4,747	..
	Hong Kong-Port Louis	2,143	4,747	..
	Hong Kong-Port Louis	2,208	4,747	..
	Singapore-Port Louis	1,883	3,324	..
	Hong Kong-Port Louis	2,208	4,747	..
	Singapore-Ponape	3,117	3,363	24
	Rotterdam-Papeete	4,114	9,417	..
	Singapore-Papeete	3,377	6,549	..
	Rotterdam-Papeete	4,605	9,417	..
	London-Papeete	5,390	15,128	..

ROUTE GROUP	ROUTES	ACTUAL FREIGHT RATE (A$/TEU)	DISTANCE (miles)	VOLUME (TEU per annum)
	Rotterdam-Papeete	3,638	9,417	..
	Singapore-Papeete	3,506	6,549	605
	Rotterdam-Papeete	3,638	9,417	..
	Hong Kong-Papeete	4,026	7,158	..
	Hong Kong-Reunion	3,247	4,872	..
	Hong Kong-Reunion	3,506	4,872	1,123
	Rotterdam-Reunion	3,781	7,021	..
	Hong Kong-Reunion	3,117	4,872	..
	Rotterdam-Reunion	2,840	7,021	..
	Rotterdam-Reunion	3,646	7,021	..
	Singapore-Reunion	4,870	3,450	..
	Hong Kong-Reunion	4,236	4,872	..
	Hong Kong-Reunion	3,117	4,872	..
	Hong Kong-Truk	2,727	2,353	..
	Singapore-Truk	2,987	2,962	24
	Singapore-Tamatave	3,117	3,575	..
	Hong Kong-Tamatave	3,506	3,575	..
	Singapore-Tamatave	4,870	3,575	..
	Hong Kong-Tamatave	4,026	4,738	..
	Singapore-Tamatave	2,922	3,575	..
	Hong Kong-Tamatave	3,396	4,738	..
	Singapore-Christmas Island	2,004	925	97
	Singapore-Yap	2,987	2,150	24
Other Comparators (Non-island routes)	Singapore-Valparaiso	4,351	9,945	..
	Hong Kong-Valparaiso	4,675	10,218	..
	Singapore-Valparaiso	4,236	9,945	..
	Hong Kong-Durban	1,948	6,960	..
	Hong Kong-Durban	1,753	6,960	..
	Singapore-Durban	1,234	5,650	..
	Melbourne-US	3,100	6,600	21,900
	Suva-US	3,120	4,640	548
Nominated Pacific Islands	Auckland-Apia	3,211	1,473	..
	Auckland-Apia	2,758	1,473	..
	Hong Kong-Apia	3,636	5,350	73
	Singapore-Apia	4,026	5,635	..
	Singapore-Apia	3,396	5,635	36
	Singapore-Apia	3,396	5,635	..
	Sydney/Brisbane-Apia	3,500	2,580	363
	Auckland-Apia	2,721	1,473	..
	Hong Kong-Apia	3,377	5,350	121
	Auckland-Fiji	2,802	1,140	..
	Hong Kong-Fiji	2,597	4,545	181
	Brisbane-Fiji	2,300	1,545	2,427
	Hong Kong-Fiji	2,3[illegible]	4,545	1,325
	Auckland-Fiji	2,538	1,140	..
	Singapore-Fiji	3,117	4,736	..
	New Zealand-Fiji	1,765	1,140	3,640
	Auckland-Fiji	2,506	1,140	..
	Auckland-Fiji	1,471	1,140	..
	Melbourne-Honiara	2,000	2,200	363
	Auckland-Honiara	3,350	1,800	..
	Hong Kong-Honiara	2,987	3,300	73
	Singapore-Honiara	1,948	3,300	..
	Singapore-Honiara	2,208	3,300	..
	Hong Kong-Honiara	2,333	3,300	121

ROUTE GROUP	ROUTES	ACTUAL FREIGHT RATE (A$/TEU)	DISTANCE (miles)	VOLUME (TEU per annum)
	Rotterdam-Honiara	3,442	11,843	..
	Sydney/Brisbane-Honiara	3,000	1,640	520
	Auckland-Honiara	3,346	1,800	..
	Singapore-Kimbe	2,208	2,329	..
	Singapore-Lae	2,208	3,021	..
	Rotterdam-Lae	3,247	11,288	..
	Singapore-Lautoka	3,247	4,690	..
	Hull-Lautoka	4,286	11,365	..
	Singapore-Lautoka	2,987	4,690	36
	Hull-Madang	3,247	12,084	..
	Singapore-Madang	3,247	2,459	..
	Singapore-Madang	2,208	2,459	..
	Hong Kong-Nuku'alofa	4,156	4,935	73
	Singapore-Nuku'alofa	3,636	5,126	..
	Singapore-Nuku'alofa	3,896	5,126	242
	Brisbane-Papua New Guinea	2,800	1,388	867
	Singapore-Papua New Guinea	1,883	2,840	..
	Singapore-Papua New Guinea	1,948	2,840	..
	Melbourne-Port Moresby	2,400	2,303	10,950
	Auckland-Port Moresby	3,350	2,254	..
	Hull-Port Moresby	3,247	11,739	..
	Auckland-Port Moresby	3,346	2,254	..
	Singapore-Port Moresby	2,208	2,340	..
	Hull-Rabaul	3,247	12,084	..
	Singapore-Santo	4,026	4,000	..
	Hong Kong-Santo	4,156	3,920	73
	Rotterdam-Santo	6,486	12,476	..
	Singapore-Suva	2,987	4,736	..
	Singapore-Suva	2,987	4,736	60
	Singapore-Suva	2,857	4,736	484
	Singapore-Suva	3,117	4,736	1,209
	Hull-Suva	4,286	11,295	..
	Melbourne-Suva	2,500	2,250	1,209
	Melbourne-Suva	2,600	2,250	1,643
	Singapore-Tarawa	3,636	3,750	..
	Sydney/Brisbane-Tarawa	3,800	2,820	367
	Hong Kong-Tarawa	4,545	3,500	73
	Auckland-Tarawa	3,624	2,270	..
	Melbourne-Tarawa	3,000	3,347	433
	Melbourne-Vila	2,500	1,990	423
	Singapore-Vila	3,247	4,100	60
	Auckland-Vila	2,791	1,360	..
	Singapore-Vila	4,026	4,100	..
	Hong Kong-Vila	3,636	4,100	121
	Melbourne-Vila	2,500	1,990	363
	Rotterdam-Vila	6,486	12,296	..
	Hong Kong-Vila	4,156	4,100	73
	Singapore-Wewak	2,208	2,729	..
	Singapore-Wewak	3,247	2,729	..
Total:	152			

Notes: (1) .. Not available.

(2) The distance from London to Papeete is 15,128 miles via the Suez Canal.

PACIFIC ISLANDS

TRANSPORT SECTOR SURVEY

THE SHIPPING COST MODEL

The shipping cost model used in the assessment of shipping rates is a spreadsheet model which calculates voyage costs as a function of a range of user-supplied parameters. This annex defines the main inputs and describes the main options available.

MODEL STRUCTURE

The costing model estimates the cost of operating container vessels of a specified size over a fixed route, given a defined pattern of cargo uplift and discharge. Voyage costs are calculated from vessel information, route information and operating and cost parameter information.

Vessel Information

The minimum information that must be supplied is the size (in TEU capacity) of the vessel and its age. Using relationships derived from analysis of the current fleet, these two parameters are then used to estimate the other vessel characteristics required in the costing process. However, these characteristics such as crew size, consumption and deadweight can be subsequently modified if required.

Some of the cost elements—e.g., port charges—are estimated using step functions, with breaks at 100 TEU, 300 TEU, 700 TEU and 1,000 TEU. Varying vessel size within each segment of these functions will have no impact on these cost components. However, most cost elements are estimated using functions that respond to changes in vessel size in a continuous fashion.

Route Information

A route is defined as a sequence of port calls. The volume of cargo loaded and discharged at each port (including the first port of call) must be also specified.

Sailing distances are from an internal cross-reference table, and the number of calls made at a port is also automatically retrieved.

A route that has already been defined can be modified to include changes in port calls, loading patterns and sailing distances.

Operating and Cost Parameters

The model includes "typical" unit cost data, and a set of relationships for estimating derived characteristics (such as crew size and fuel consumption), which are used as the default values in route costing. Table 1 shows the parameters which can be modified:

COST STRUCTURES

The majority of costs incurred in operating a liner shipping service are "direct" in the sense that they could be avoided if a particular service was not offered.

Conventionally, shipping service costings divide costs into three cost categories: vessel costs, voyage costs and cargo costs.

Cargo Costs

Cargo costs are those costs which vary directly with the volume of cargo carried, and include such item as container hire, stevedoring

Table 1: OPERATING AND COST PARAMETER INFORMATION

Parameters		Examples
1.	Capital Costs	Building costs, interest rates, economic life of the asset for depreciation and scrap value of the vessel
2.	Operating Costs	Crew costs, maintenance costs and insurance administration costs
3.	Voyage Costs	Fuel consumption, fuel prices and speed for vessel size
4.	Cargo Costs	Costs of container hire, pre-tripping costs and agency fees
5.	Ports	Port to port distance, port charges and cargo handling rates by port

costs and agency fees (usually paid on a commission basis).

Voyage Costs

Voyage costs are those which are determined by the voyage pattern: principally fuel costs and port charges.

All costs in either of these categories are avoidable costs associated with the making of a particular voyage.

Vessel Costs

Vessel costs are those costs which are fixed by holding a vessel in service, irrespective of the route on which it is deployed. These include financing and depreciation costs directly associated with the particular vessel, repair, maintenance and survey costs, essential stores and victuals, insurance and crew wages. All of these costs are avoidable if the vessel is disposed of.

In addition, it is conventional to include amongst the vessel costs an allocation of "administration" costs—essentially corporate overheads. In the management structure of most liner shipping companies, each service comprises a separate profit center, and it is likely that the abandonment of a service would lead directly to reductions in administrative costs. In this sense, the bulk of administrative costs are also "direct".

DATA SOURCES

The unit costs and relationships used in the shipping cost model as defaults are drawn from a variety of sources.

In general, the starting point for cost information was the joint ESCAP/SEATAC study. Intra-Asean Shipping Study (ESCAP: Bangkok, 1988). Vessel cost data, particularly relating to vessel capital costs, was supplemented by information drawn from articles and schedules in various issues of *Lloyd's-Maritime Asia* and *Containerization International*. Published and unpublished data are also drawn from a number of studies of Australia/Asian shipping; (Gallagher and Meyrick, *ASEAN-Australia Liner Shipping: A Cost-based Simulation Analysis* (Canberra, 1984); Thomspon-Clarke, *Japan-Korea Shipping Service Study for Transport Tasmania*, (Hobart, 1986); Center for Transport Policy Analysis, University of Wollongong (CTPA); *Australian Flag Shipping and the Balance of Payments* (CTPA: Wollongong, 1988); CTPA, *Stateships External Benefits Study* (CTPA: Wollongong, 1990); ESCAP, *Regional Maritime Strategy*

Study) (*Liner Shipping Services to and from Australia* (BTCE 1986); *Trans-Tasman Shipping* (BTCE 1987), *A Model for Estimating Cargo Ship Costs* (BTCE 1987).

Port charges, handling rates and delays are estimates, primarily based on the rates used for smaller ports in the ESCAP *Regional Maritime Strategy Study*. For the Pacific Island ports, however, this was supplemented by information collated in the 1984, *Regional Transport Survey of the South Pacific*, and information collected in the current study.

Relationships between vessel size and age and characteristics such as crew size and operating speed were obtained by analysis of the details of the current fleet operating Pacific Island routes provided in *Containerization International Yearbook 1991* (National Magazine Co: London, 1991).

Port to port distances were taken, wherever possible, from the port to port distance tables presented in *Lloyd's Maritime Atlas*. However, the coverage of these tables is limited. Where the distance between a pair of ports was not obtainable from this source, the port to port distance table from the ESCAP Regional Maritime Strategy Study was consulted. If the distance sought was unavailable from either of these sources—and this was commonly the case with the Pacific Island ports other than Suva and Port Moresby—distances were estimated by scaling from maps; if possible, from *Lloyds Maritime Atlas*, otherwise from the Encyclopedia Britannica World Atlas.

ADDITIONAL SHIPPING CHARGES

Indicative costs, which are additional to the net ocean freight rates (i.e., liner in liner out rates), used in the shipping cost model analysis are set out below.

AUSTRALIA

Stevedoring costs are typically about A$300 per TEU in Australia and the Pacific Island countries. At present (1991) stevedoring costs are relatively lower in New Zealand (approximately A$200 per TEU), Apia and Nuku'alofa (about A$250) and rather higher in Pago Pago.

Currently the Australian Pacific Islands Rate Agreement has zero Bunker Adjustment Factor (BAF) and a 14.5 percent Currency Adjustment Factor (CAF) for the Noumea trade. BAF and CAF for the Australia to Fiji trade are presently set at zero.

HONG KONG

Terminal handling charges in Hong Kong are typically HK$500 per TEU. Container stuffing charge (CFS) average about HK$80 per revenue tonne or HK$62 per cubic meter.

Some shipping lines avoid terminal handling costs by loading and discharging cargo mid-stream.

There are currently no terminal charges being levied on Indian Ocean services ex Hong Kong because of competition.

SINGAPORE

A current list of official port and handling tariffs in Singapore are listed in Table 2 and Table 3. These charges are indicative of the charges levied by major ports in the world.

UNITED KINGDOM

Currency Adjustment Factor (CAF) to the Indian Ocean islands is currently +7.13 percent.

For services to New Caledonia, there is a terminal handling fee of £11.00 per tonne/cubic meter or part thereof.

For services to Fiji, the terminal handling fee is £125 per container load.

ROTTERDAM

Currently, a Bunker Adjustment Factor of +8.1 percent is added on rates to the Comoros, Mauritius, Réunion and Seychelles ex Rotterdam.

A bunker charge of -101 ECU (European Currency Units) is levied on rates for some services to New Caledonia, Tahiti and Vanuatu.

Table 2: MAIN CHARGES /a FOR CONTAINER OPERATIONS, /b 1990

Port of Singapore Authority:	20' box	40' box
Stevedorage Charge:		
FCL-Loaded	155.00	220.00
FCL-Empty	85.00	123.00
LCL	325.00	452.00
Transhipment /c	100.00	145.00
Overheight/Overwidth		
FCL	300.00	500.00
LCL	400.00	600.00
Transhipment	200.00	300.00
Lift on/Lift off charge:		
Loaded	55.00	82.50
Empty	20.00	30.00

/a All amounts in Singapore dollars.
/b Most shipping lines quote a terminal handling charge between S$150-165 per TEU in addition to the net ocean rates.
/c Excluding rebates.

Source: Port of Singapore Authority, *PSA Tariff*, 1990.

Table 3: OTHER CHARGES IN SINGAPORE, 1991

Local haulage (say 1 hour)	S$140 per 20' box S$200 per 40' box
Breakbulk freight	S$12 per revenue tonne
Minimum charge	S$60 per bill of lading
Documentation (Tradenet)	S$40 per bill of lading
Storage	S$3 per TEU per day S$5 per m^3 per week (breakbulk)
Forklift	S$2.50 per revenue tonne
Stuffing/Unstuffing (LCL)	S$100 per 20' box S$160 per 40' box S$12/metric tonne (one end)
Laborer	S$40 per manday

Source: Singapore Freight Forwarders Association 1991.

Table 4: CHARGES FOR SHIPPING SERVICES EX UNITED KINGDOM, 1991

	Pacific Islands	Port Louis	Male
UK Terminal handling charge	£75.00	£60 per 20' box £95 per 40' box $11 per tonne/$m^3$	£11 per tonne
Bunker Adjustment Factor	+15%	+29%	+16%
Bill of Lading (per shipment)	£15.00	£15.00	£15.00
Freight agency commission (% of the Basic rate)	2.5%	2.5%	2.5%

Source: Ariel Maritime, UK, 1991.

PACIFIC ISLANDS

TRANSPORT SECTOR STUDY
PART III: COMPARISON OF REGIONAL TRANSPORT COSTS

STATISTICAL ANALYSIS OF SHIPPING RATES—DETAILED RESULTS

Two models are estimated. The first model (Test 1) includes separate dummy variables for the PMCs, the comparator Pacific Islands, and the Indian Ocean comparators. The results in Table 1 show that both distance and volume have a statistically significant effect on freight rates, but that there is no evidence that the estimated coefficients for distance and density are different as between any of the island groups. The second model (Test 2) includes a single dummy variable for all islands as one group; this model gives similar results to the first. Detailed results are given in Table 2.

Table 1: SHIPPING RATE MODEL—REGRESSION RESULTS

Base Model

$$\hat{Y} = 1099.17 * \underset{(2.86)}{D^{0.15}} * \underset{(-2.38)}{V^{-0.04}}$$

Test 1: Significance of Island Type

$$\hat{Y} = 1584.59 * \underset{(2.14)}{D^{0.12}} * \underset{(-2.59)}{V^{-0.05}} * \underset{(-0.46)}{(e^{N})^{-0.07}} * \underset{(-0.59)}{(e^{C})^{-0.10}} * \underset{(-1.25)}{(e^{I})^{-0.22}}$$

where N = dummy variable for the nominated Pacific Islands (1,0)
C = dummy variable for the comparator Pacific Islands (1,0)
I = dummy variable for the comparator Indian Ocean Islands (1,0)

Test 2: Significance of Island Routes

$$\hat{Y} = 1252.77 * \underset{(2.61)}{D^{0.14}} * \underset{(-2.37)}{V^{-0.04}} * \underset{(-0.44)}{(e^{AI})^{-0.07}}$$

where AI = dummy variable for all islands (1,0)

Notes: (1) T-statistics are in parentheses.
(2) Independent variable is significant at 0.05 level when t-statistic is greater than +1.96 or less than -1.96.

Table 2: SHIPPING FREIGHT RATES—LOGLINEAR REGRESSION RESULTS

BASE MODEL

Regression Output:

Constant			7.002309	A = 1099.168
Std Err of Y Est			0.190296	
R Squared			0.240249	
No. of Observations			51	
Degdrees of Freedom			48	
X Coefficient(s)		0.151304	-0.03888	
Std Err of Coef.		0.052938	0.016315	
T-Statistics 2.86	-2.38			
		Ln Dist.	Ln. Vol.	

TEST 1

Regression Output:

Constant		7.368079				A = 1584.587
Std Err of Y Est		0.190646				
R Squared		0.285116				
No. of Observations		51				
Degrees of Freedom		45				
X Coefficient(s)	0.121913	-0.04618	-0.69334	-0.095266	-0.22411	
Std Err of Coef.	0.056853	0.017823	0.1509336	0.1603096	0.179789	
T-Statistics 2.14	-2.59	-0.46	-0.59	-1.25		
	Ln Dist.	Ln Vol.	Nominated Pacific Islands Dummy (1.0)	Comparator Pacific Island Dummy (1.0)	Indian Ocean Island Dummy (1.0)	

TEST 2

Regression Output:

Constant		7.133108		A = 1252.765
Std Err of Y Est		0.191923		
R Squared		0.243308		
No. of Observations		51		
Degrees of Freedom		47		
X Coefficient(s)	0.144786	-0.04154	-0.066079	
Std Err of Coef.	0.055445	0.01748	0.1516000	
T-Statistics 2.61	-2.37	-0.44		
	Ln Dist.	Ln Vol.	Island/ Non-island Dummy (1.0)	

PACIFIC ISLANDS

TRANSPORT SECTOR STUDY

VOLUME ONE

AIR FARES, DISTANCES AND TRAFFIC VOLUMES FOR PACIFIC ISLAND AND OTHER ROUTES, 1991

Table 1: AIR SERVICES ROUTE DATA

ROUTE TYPES	ROUTES	ACTUAL RETURN ECONOMY FARES A$	ACTUAL AVERAGE RETURN EXCURSION FARES A$	DISTANCE: MAXIMUM PERMITTED MILEAGE	DISTANCE: SHORTEST OPERATED MILEAGE	ANNUAL SEAT CAPACITY (000)
1. PACIFIC RIM TO PACIFIC ISLANDS	Auckland-Nadi	1,087	677	1,341	1,341	38.2
	Auckland-Port Vila	1,224	649	1,392	1,392	5.7
	Auckland-Apia	1,345	933	1,801	1,801	22.9
	Auckland-Honiara	1,418	990	2,191	2,191	11.3
	Auckland-Tongatapu	1,147	772	1,246	1,246	8.5
	Auckland-Port Moresby	2,226	1,581	2,750	2,750	9.1
	Auckland-Tarawa	2,627	2,028	2,793	2,793	2.0
	Auckland-Noumea	1,064	548	1,374	1,145	26.5
	Auckland-Papeete	2,468	1,247	3,052	2,544	23.4
	Brisbane-Honiara	1,238	814	1,587	1,323	11.3
	Brisbane-Nadi	1,332	764	1,688	1,688	21.8
	Brisbane-Noumea	1,166	811	2,035	908	24.9
	Brisbane-Port Moresby	1,268	796	1,560	1,300	69.0
	Brisbane-Port Vila	1,422	625	1,180	1,180	15.0
	Cairns-Honiara	1,022	672	1,529	1,089	5.7
	Cairns-Port Moresby	756	489	628	524	35.9
	Hong Kong-Port Moresby	2,095	1,475	3,760	3,134	10.9
	Manila-Guam	1,121	614	1,915	1,596	148.3
	Manila-Port Moresby	2,387	1,239	2,930	2,442	10.3
	Melbourne-Nadi	1,618	842	2,403	2,403	43.7
	Melbourne-Noumea	1,716	952	2,004	1,669	16.6
	Melbourne-Port Vila	1,922	914	1,981	1,981	7.5
	Singapore-Noumea	3,471	2,083	5,608	4,674	41.5
	Singapore-Port Moresby	3,065	1,743	3,686	3,072	21.8
	Sydney-Nadi	1,440	702	1,971	1,971	124.8
	Sydney-Port Vila	1,510	774	1,544	1,544	15.0
	Sydney-Apia	2,416	1,191	2,695	2,695	9.4
	Sydney-Honiara	1,548	1,027	2,145	1,785	10.9
	Sydney-Tongatapu	2,428	1,078	2,511	2,511	3.7
	Sydney-Port Moresby	1,556	904	2,100	1,712	54.6
	Sydney-Tarawa	2,781	2,053	3,423	3,423	3.7
	Sydney-Noumea	1,264	756	1,477	1,231	35.1
	Sydney-Papeete	3,896	1,712	3,802	3,802	32.5
	Sydney-Rarotonga	2,696	1,147	3,217	3,217	7.5
2. INTRA-PACIFIC REGION	Apia-Honolulu	1,161	676	4,722	2,607	9.6
	Apia-Noumea	1,045	724	2,035	1,541	7.5
	Apia-Pago Pago	110	83	85	85	68.9
	Apia-Rarotonga	670	466	944	944	15.0
	Apia-Suva	521	418	700	700	6.6
	Apia-Tongatapu	461	321	557	557	22.5
	Funafuti-Suva	560	560	661	661	1.9
	Funafuti-Majuro	966	966	1,214	1,214	3.7
	Funafuti-Tarawa	594	594	802	802	3.7
	Guam-Pohnpei	935	788	1,074	1,074	56.9
	Guam-Truk	616	517	635	635	56.9
	Guam-Kosrae	1,248	1,053	1,418	1,418	27.0
	Majuro-Honolulu	1,414	1,228	2,419	2,419	72.4
	Nadi-Tongatapu	419	419	540	540	15.3

AIR SERVICES ROUTE DATA cont'd.

ROUTE TYPES	ROUTES	ACTUAL RETURN ECONOMY FARES A$	ACTUAL AVERAGE RETURN EXCURSION FARES A$	DISTANCE: MAXIMUM PERMITTED MILEAGE	DISTANCE: SHORTEST OPERATED MILEAGE	ANNUAL SEAT CAPACITY (000)
	Nadi-Port Vila	643	488	602	602	17.9
	Nadi-Tarawa	1,341	1,341	1,452	1,452	3.7
	Nadi-Apia	669	475	761	761	16.2
	Nadi-Honiara	1,334	984	1,304	1,304	11.3
	Nadi-Honolulu	2,409	917	3,308	3,174	172.1
	Nadi-Port Moresby	1,563	1,095	2,177	2,177	59.2
	Nadi-Noumea	756	756	1,122	783	4.5
	Nadi-Rarotonga	1,446	738	1,800	528	10.9
	Nadi-Wallis Island	723	723	527	527	4.5
	Noumea-Papeete	2,341	2,341	2,949	2,949	19.2
	Port Moresby-Honiara	857	555	873	873	9.4
	Port Moresby-Jayapura	698	698	844	704	3.3
	Port Vila-Noumea	383	291	399	333	28.3
3. AUSTRALIAN INTERNATIONAL	Sydney-Bangkok	4,002	1,346	5,624	4,687	364.8
	Sydney-Honolulu	4,716	1,713	6,093	5,078	610.9
	Sydney-Auckland	1,042	576	1,343	1,343	705.0
	Sydney-Hong Kong	4,062	1,580	5,503	4,586	313.0
	Sydney-Los Angeles	5,678	1,932	8,997	7,498	291.2
	Sydney-Bali	2,594	916	3,446	2,872	140.4
	Sydney-Tokyo	3,902	1,678	6,925	4,863	395.2
	Sydney-Jakarta	2,354	985	4,105	3,421	172.4
	Sydney-Singapore	3,144	1,323	4,699	3,916	620.9
4. WESTERN AUSTRALIA DOMESTIC	Perth-Albany	284	192	375	375	12.4
	Perth-Broome	906	596	1,042	1,042	103.2
	Perth-Carnarvon	486	316	507	507	18.7
	Perth-Derby	886	575	1,115	1,115	53.8
	Perth-Geraldton	302	200	230	230	44.8
	Perth-Kalgoolie	394	265	334	334	69.3
	Perth-Karratha	712	478	777	777	85.3
	Perth-Kununurra	1,110	730	1,376	1,376	42.3
5. AUSTRALIAN DOMESTIC TOURIST	Sydney-Gold Coast	448	332	422	422	455.4
	Sydney-Hamilton Island	760	560	949	949	147.4
	Sydney-Alice Springs	874	650	1,256	1,256	90.7
	Sydney-Launceston	518	386	569	569	174.2
	Melbourne-Gold Coast	676	492	827	827	250.8
	Melbourne-Cairns	1,055	792	1,440	1,440	265.4
	Brisbane-Townsville	626	462	692	692	345.3
	Brisbane-Mackay	516	384	497	497	77.4
	Brisbane-Rockhampton	402	298	323	323	434.3
	Adelaide-Alice Springs	672	437	820	820	92.1
	Adelaide-Darwin	1,016	758	1,630	1,630	107.1
6. NEW ZEALAND DOMESTIC	Auckland-Wellington	305	214	299	299	738.5
	Auckland-Christchurch	434	290	464	464	574.1
	Auckland-Dunedin	524	361	668	668	242.1
	Auckland-Hamilton	123	86	66	66	22.5
	Auckland-Rotorua	230	161	113	113	52.0
	Wellington-Queenstown	524	368	406	406	45.5
	Wellington-Invercargill	415	290	479	479	47.8

AIR SERVICES ROUTE DATA cont'd.

ROUTE TYPES	ROUTES	ACTUAL RETURN ECONOMY FARES A$	ACTUAL AVERAGE RETURN EXCURSION FARES A$	DISTANCE: MAXIMUM PERMITTED MILEAGE	DISTANCE: SHORTEST OPERATED MILEAGE	ANNUAL SEAT CAPACITY (000)
7. PAPUA NEW GUINEA DOMESTIC	Port Moresby-Lae	256	205	202	202	179.7
	Port Moresby-Mt.Hagen	356	285	321	321	76.8
	Port Moresby-Goroka	307	246	264	264	53.2
	Port Moresby-Madang	348	278	308	308	71.1
	Port Moresby-Wewak	485	388	474	474	41.2
	Port Moresby-Wau Papua	256	256	150	150	6.2
	Port Moresby-Tari	413	330	384	384	8.3
	Port Moresby-Daru	315	252	275	275	10.4
8. INDIAN OCEAN ISLANDS	Johannesburg-Mauritius	1.600	833	2.286	1.905	78.0
	London-Mauritius	5.385	2.216	7.322	6.074	62.4
	London-Seychelles	5.018	1.961	6.357	5.066	32.8
	Paris-Mauritius	4.769	2.051	7.140	5.867	81.9
	Paris-Reunion	4.769	1.991	7.039	5.819	145.4
	Perth-Cocos Islands	1.250	990	1.720	1.720	3.7
	Perth-Christmas Island	1.250	990	1.628	1.628	1.3
TOTAL	111					

PACIFIC ISLANDS TRANSPORT SECTOR STUDY

AIR SERVICE ROUTES FOR PACIFIC ISLANDS, COMPARATOR COUNTRIES AND PACIFIC RIM

Table 1: PACIFIC RIM TO PACIFIC ISLANDS—AIR SERVICE ORIGINS-DESTINATIONS, 1991

Origin-Destination	Airlines/a	No. of Flights per Week	Flight Routings
1. Auckland-Nadi	FJ	3	Auckland-Nadi
	NZ	1	Auckland-Nadi
	IE	1	Auckland-Nadi-Port Vila-Honiara
	NZ/CP	2	Auckland-Nadi-Honolulu-Vancouver
	NZ	1	Auckland-Nadi-Rarotonga
	NZ	1	Auckland-Nadi-Honolulu-Los Angeles
	NZ	2	(1) Brisbane-Auckland-Nadi-Honolulu (2) Auckland-Nadi-Honolulu-Los Angeles (3) Adelaide-Auckland-Nadi-Honolulu
2. Auckland-Port Vila	NF	2	Auckland-Port Vila
3. Auckland-Apia	PH	2	Auckland-Tongatapu-Apia
	PH	1	Sydney-Auckland-Tongatapu-Apia
	NZ	2	Auckland-Tongatapu-Apia
4. Auckland-Honiara	IE	1	Auckland-Nadi-Port Vila-Honiara
	IE	1	Auckland-Port Vila-Honiara
5. Auckland-Tongatapu	NZ	3	Auckland-Tongatapu
	PH	1	Sydney-Auckland-Tongatapu-Apia
	PH	2	Auckland-Tongatapu-Apia
6. Auckland-Port Moresby			
Auckland-Cairns	NZ/QF	7	Auckland-Sydney-Cairns
	NZ	1	Auckland-Cairns
Cairns-Port Moresby	PX/QF	6/7	Cairns-Port Moresby
7. Auckland-Tarawa			
Auckland-Nadi			
Nadi-Tarawa	CW	2	Nadi-Funafuti-Tarawa-Majuro
8. Auckland-Noumea	NZ	1	Auckland-Noumea
	SB	1	Auckland-Noumea
	UT	1	Papeete-Auckland-Noumea
9. Auckland-Papeete	UT	1	Noumea-Auckland-Papeete
	NZ	2	Melbourne-Auckland-Papeete-Los Angeles
10. Brisbane-Honiara	IE	1	Brisbane-Cairns-Honiara
	IE	1	Brisbane-Honiara
	QF	1	Sydney-Brisbane-Honiara
11. Brisbane-Nadi	FS/QF	2	Brisbane-Nadi
	PH	1	Sydney-Brisbane-Nadi-Apia-Pago Pago-Rarotonga
12. Brisbane-Noumea	SB	3	Brisbane-Noumea

Table 1: PACIFIC RIM TO PACIFIC ISLANDS—AIR SERVICE ORIGINS-DESTINATIONS, 1991

Origin-Destination	Airlines	No. of Flights per Week	Flight Routings
13. Brisbane-Port Moresby	PX/QF	5	Sydney-Brisbane-Port Moresby
	PX	1	Brisbane-Port Moresby
14. Brisbane-Port Vila	NF	1	Brisbane-Port Vila
	NF	1	Sydney-Brisbane-Port Vila
15. Cairns-Honiara	IE	1	Brisbane-Cairns-Honiara
16. Cairns-Port Moresby	PX/QF	3/4	Cairns-Port Moresby
17. Hong Kong-Port Moresby	PX/CX	1	Hong Kong-Port Moresby
18. Manila-Guam	CO	2	Manila-Guam
	PR	2	Manila-Guam
	ON	1	Manila-Guam-Nauru Island
	CO	4	Manila-Guam-Saipan
	CO	3	Manila-Koror-Guam-Saipan
	CO	2	Manila-Saipan-Guam
19. Manila-Port Moresby	PX	1	Manila-Port Moresby
20. Melbourne-Nadi	FJ/QF	4	Melbourne-Nadi
21. Melbourne-Noumea	SB	1	Melbourne-Noumea
	ON	1	Melbourne-Sydney-Noumea-Nauru Island
22. Melbourne-Port Vila	NF	1	Melbourne-Port Vila
23. Singapore-Noumea	VT	1	Paris-Singapore-Jakarta-Noumea
	VT	1	Paris-Singapore-Jakarta-Sydney-Noumea
24. Singapore-Port Moresby	PX/SQ	2	Singapore-Port Moresby
25. Sydney-Nadi	FJ/QF	3	Sydney-Nadi
	CP	1	Sydney-Nadi-Honolulu-Toronto
	PH	1	Sydney-Brisbane-Nadi-Apia-Pago Pago-Rarotonga
	FJ/QF	2	Sydney-Nadi-Honolulu-Los Angeles Ha'apai (Tonga)-Sydney-Nadi-Honolulu-Los Angeles
26. Sydney-Port Vila	NF	1	Sydney-Brisbane-Port Vila
	NF	1	Sydney-Port Vila
27. Sydney-Apia	PH	1	Sydney-Brisbane-Nadi-Apia-Pago Pago-Rarotonga
	PH	1	Sydney-Auckland-Tongatapu-Apia
28. Sydney-Honiara	QF	1	Sydney-Brisbane-Honiara
29. Sydney-Tongatapu	PH	1	Sydney-Auckland-Tongatapu-Apia
30. Sydney-Port Moresby	PX	2	Sydney-Brisbane-Port Moresby
	QF	3	Sydney-Brisbane-Port Moresby

Table 1: PACIFIC RIM TO PACIFIC ISLANDS—AIR SERVICE ORIGINS-DESTINATIONS, 1991

Origin-Destination	Airlines	No. of Flights per Week	Flight Routings
31. Sydney-Tarawa			
Sydney-Nadi			
Nadi-Tarawa	CW	2	Nadi-Funafuti-Tarawa-Majuro
32. Sydney-Noumea	QF	2	Sydney-Noumea
	UT	1	Paris-Singapore-Jakarta-Sydney-Noumea
	ON	1	Melbourne-Sydney-Noumea-Nauru Island
	UT	1	Sydney-Noumea-Wallis Island-Papeete
	SB	2	Sydney-Noumea
33. Sydney-Papeete	UT	1	Sydney-Noumea-Wallis Island-Papeete
	QF	2	Melbourne-Sydney-Papeete-Los Angeles
34. Sydney-Rarotonga	PH	1	Sydney-Brisbane-Nadi-Apia-Pago Pago-Rarotonga

/a Airline codes are given in Annex 9.

Source: World Airways Guide, 1991; Qantas Timetable, 1991, and Ansett Timetable, 1991.

Table 2: INTRA-PACIFIC REGION—AVIATION ORIGINS-DESTINATIONS, 1991

Origin-Destination	Airlines /a	No. of Flights per Week	Flight Routings
1. Apia-Honolulu	HA	1	Apia-Honolulu
2. Apia-Noumea	PH	1	Apia-Noumea
3. Apia-Pago Pago	PH	32	Apia-Pago Pago
	TS	18	Apia-Pago Pago
4. Apia-Rarotonga	PH	1	Sydney-Brisbane-Nadi-Apia-Pago Pago-Rarotonga
5. Apia-Suva	FJ	1	Apia-Suva
	FJ	2	Apia-Nadi-Suva
6. Apia-Tongatapu	PH	2	Apia-Tongatapu-Auckland
	PH	1	Apia-Tongatapu-Auckland-Sydney
	WR		Apia-Tongatapu
	NZ	2	Apia-Tongatapu
7. Funafuti-Suva	PC	1	Funafuti-Nadi-Suva
8. Funafuti-Majuro	CW	2	Nadi-Funafuti-Tarawa-Majuro
9. Funafuti-Tarawa	CW	2	Nadi-Funafuti-Tarawa-Majuro
10. Guam-Pohnpei (Ponape)	CO	4	Guam-Truk-Pohnpei-Kosrae (Kusaie)- Kwajalein (Marshall Islands)- Majuro-Johnston Islands-Honolulu Guam-Truk-Pohnpei-Kosrae- Kwajalein-Majuro-Honolulu
	CO	3	Guam-Truk-Pohnpei
	ON	1	Guam-Truk-Pohnpei
11. Guam-Truk	CO	4	Guam-Truk-Pohnpei Guam-Truk-Pohnpei
	CO	3	Guam-Truk-Pohnpei
	ON	1	Guam-Truk-Pohnpei
12. Guam-Kosrae (Kusaie)	CO	3/4	Guam-Truk-Pohnpei-Kosrae (Kusaie)- Kwajalein (Marshall Islands)- Majuro-Johnston Islands-Honolulu Guam-Truk-Pohnpei-Kosrae- Kwajalein-Majuro-Honolulu
	ON	1	Guam-Truk-Pohnpei-Kosrae
13. Majuro-Honolulu	CW	2	Majuro-Kwajalein-Honolulu
	CW	2	Majuro-Honolulu
	CO	4	Guam-Truk-Pohnpei-Kosrae- Kwajalein-Majuro-Johnston Island- Honolulu Guam-Truk-Pohnpei-Kosrae-Kwajalein-Majuro-Honolulu
14. Nadi-Tongatapu	FJ	6	Suva-Nadi-Tongatapu Nadi-Suva-Tongatapu
	FJ	1	Suva-Nadi-Tongatapu
15. Nadi-Port Vila	FJ	3	Suva-Nadi-Port Vila
	NF	1/2	Nadi-Port Vila

Table 2: INTRA-PACIFIC REGION—AVIATION ORIGINS-DESTINATIONS, 1991 (cont'd)

Origin-Destination		No. of Flights Airlines	per Week	Flight Routings
16.	Nadi-Tarawa	CW	2	Nadi-Funafuti-Tarawa-Majuro
17.	Nadi-Apia	FJ	4	Suva-Nadi-Apia Nadi-Suva-Apia
		PH	1	Sydney-Brisbane-Nadi-Apia-Pago Pago-Rarotonga
18.	Nadi-Honiara	FJ	1	Nadi-Port Vila-Honiara
		IE	1	Nadi-Port Vila-Honiara
19.	Nadi-Honolulu	CP/NZ	2	Auckland-Nadi-Honolulu-Vancouver
		NZ	1	Brisbane-Auckland-Nadi-Honolulu
			2	Auckland-Nadi-Honolulu-Los Angeles
			1	Adelaide-Auckland-Nadi-Honolulu
		CP	1	Sydney-Nadi-Honolulu-Vancouver
		QF	1	Sydney-Nadi-Honolulu-Los Angeles
			1	Hobart-Sydney-Nadi-Honolulu-Los Angeles
			1	Melbourne-Nadi-Honolulu-Los Angeles
		VK	1	Nadi-Tarawa-Christmas Island-Honolulu
20.	Nadi-Port Moresby	QF	2	Nadi-Sydney-Brisbane-Port Moresby
		QF	2	Nadi-Brisbane-Port Moresby
		IE	1	Nadi-Port Vila-Honiara
21.	Nadi-Noumea	SB	1	Wallis Island-Nadi-Noumea
22.	Nadi-Rarotonga	NZ/PH	1	Auckland-Nadi-Rarotonga
			1	Sydney-Brisbane-Nadi-Apia-Pago Pago-Rarotonga
23.	Nadi-Wallis Island	SB	1	Noumea-Nadi-Wallis Island
24.	Noumea-Papeete	UT	1	Noumea-Auckland-Papeete
		SB/UT	1	Sydney-Noumea-Wallis Island-Papeete
25.	Port Moresby-Honiara	IE/PX	2	Port Moresby-Honiara
26.	Port Moresby-Jayapura	PX	1	Port Moresby-Madang-Wewak
27.	Port Vila-Noumea	SB	5	Port Vila-Noumea

/a Airline codes are listed in Annex 9.

Source: World Airways Guide, 1991; Qantas Timetable, 1991, and Ansett Timetable, 1991.

Table 3: AUSTRALIAN INTERNATIONAL AIR ROUTES, 1991

Origin-Destination	Airlines /a	No. of Flights per Week	Flight Routings
1. Sydney-Bangkok	QF	9	Sydney-Bangkok
	QF	1	Sydney-Melbourne-Hong Kong-Bangkok
	TG	2	Sydney-Melbourne-Bangkok
	TG	3	Sydney-Bangkok
	AZ	2	Sydney-Melbourne-Bangkok
	BA	2	Sydney-Bangkok
	LH	1	Sydney-Bangkok
	LH	1	Sydney-Melbourne-Bangkok
	NG	1	Sydney-Bangkok
2. Sydney-Honolulu	AA	4	Sydney-Honolulu
	CP	2	Sydney-Honolulu
	CP	1	Sydney-Nadi-Honolulu
	CO	2	Sydney-Auckland-Honolulu
	CO	7	Sydney-Honolulu
	UA	7	Sydney-Auckland-Honolulu
	QF	2	Sydney-Nadi-Honolulu
	QF	7	Sydney-Honolulu
3. Sydney-Auckland	QF/NZ	26	Sydney-Auckland
	CO	5	Sydney-Auckland
	PH	1	Sydney-Auckland
	UA	7	Sydney-Auckland
4. Sydney-Hong Kong	QF	5	Sydney-Hong Kong
	QF	2	Sydney-Brisbane-Hong Kong
	QF	2	Sydney-Melbourne-Hong Kong
	CX	5	Sydney-Hong Kong
	CX	2	Sydney-Melbourne-Hong Kong
5. Sydney-Los Angeles	QF	7	Sydney-Los Angeles
	QF	3	Sydney-Honolulu-Los Angeles
	QF	2	Sydney-Papeete-Los Angeles
	QF	1	Sydney-Brisbane-Honolulu-Los Angeles
	AA	4	Sydney-Honolulu-Los Angeles
	CO	2	Sydney-Auckland-Honolulu-Los Angeles
	UA	7	Sydney-Los Angeles
	NZ	2	Sydney-Auckland-Honolulu-Los Angeles
6. Sydney-Bali	QF	1	Sydney-Bali
	QF	2	Sydney-Melbourne-Bali
	GA	6	Sydney-Bali
7. Sydney-Tokyo	QF	8	Sydney-Tokyo
	QF	1	Sydney-Perth-Tokyo
	JL	7	Sydney-Tokyo
	NH	5	Sydney-Tokyo
8. Sydney-Jakarta	QF	2	Sydney-Jakarta
	GA	6	Sydney-Denpasar-Jakarta
	UT	1	Sydney-Jakarta

Table 3: AUSTRALIAN INTERNATIONAL AIR ROUTES, 1991 cont'd

Origin-Destination	Airlines /a	No. of Flights per Week	Flight Routings
9. Sydney-Singapore	QF	7	Sydney-Singapore
	QF	7	Sydney-Melbourne-Singapore
	SQ	7	Sydney-Singapore
	JU	2	Sydney-Melbourne-Singapore
	BA	5	Sydney-Singapore-London
	OA	2	Sydney-Melbourne-Singapore-Athens
	GF	2	Sydney-Singapore-Bahrain
	LH	1	Sydney-Melbourne-Singapore-Frankfurt
	UT	1	Noumea-Sydney-Jakarta-Singapore-Paris

/a Airline codes are listed in Annex 9.

Source: World Airways Guide, 1991; Qantas Timetable, 1991, and Ansett Timetable, 1991.

Table 4: INDIAN OCEAN ISLANDS—AIR SERVICES, 1991

Origin-Destination	Airlines	No. of Flights per Week	Flight Routings
1. Johannesburg-Mauritius	MK	2	Johannesburg-Mauritius
		2	Johannesburg-Harare-Mauritius
	SA	4	Johannesburg-Mauritius
2. London-Mauritius	MK	2	Johannesburg-Mauritius
	BA	2	London-Dubai-Seychelles-Mauritius
3. London-Mahe	BA	2	London-Dubai-Mahe-Mauritius
	HM	1	London-Paris-Mahe
	HM	1	London-Frankfurt-Mahe
	HM	1	London-Rome-Mahe
4. Paris-Mauritius	MK	2	Paris-Mauritius
	MK	1	Paris-Munich-Mauritius
	AF	2	Paris-Djibouti-Mauritius-Réunion
	AF	2	Sydney-Paris-Nice-Jeddha-Seychelles-Mauritius-Réunion
5. Paris-Réunion	AF	8	Paris-Djibouti-Antananarivo (Madagascar)-Réunion Paris-Djibouti-Seychelles-Réunion-Mauritius Paris-Djibouti-Réunion Paris-Djibouti-Mauritius-Réunion Paris-Nairobi-Harare-Réunion
	OV	7	Paris-Lyon-Réunion Paris-Mauritius-Réunion
6. Perth-Cocos Islands	-	1	Perth-Cocos Islands
7. Perth-Christmas Island	-	1	Perth-Cocos Islands-Christmas Island

/a Airline codes are listed in Annex 9.
/b Air charter service.

Source: World Airways Guide, 1991; Qantas Timetable, 1991, and Ansett Timetable, 1991.

Table 5: AUSTRALIAN DOMESTIC TOURIST ROUTES, 1991

Origin-Destination	Airlines /a	No. of Flights per Week	Flight Routings
1. Sydney-Gold Coast	TN	22	Sydney-Coolangatta
	AN	22	Sydney-Coolangatta
	EW	40	Sydney-Coolangatta
	EW	6	Sydney-Tamworth-Coolangatta
2. Sydney-Hamilton Island	AN	14	Sydney-Hamilton Island
	EW	12	Sydney-Hamilton Island
	EW	2	Sydney-Brisbane-Hamilton Island
	EW	5	Sydney-Coolangatta-Brisbane-Hamilton Island
3. Sydney-Alice Springs	TN	6	Sydney-Alice Springs
	AN	7	Sydney-Alice Springs
	AN	1	Sydney-Melbourne-Alice Springs
	EW	2	Sydney-Ayers Rock-Alice Springs
4. Sydney-Launceston	TN	2	Sydney-Launceston
	TN	11	Sydney-Melbourne-Launceston
	AN	28	Sydney-Melbourne-Launceston
5. Melbourne-Gold Coast	AN	11	Melbourne-Coolangatta
	AN	6	Melbourne-Sydney-Coolangatta
	TN	9	Melbourne-Coolangatta
	TN	8	Melbourne-Sydney-Coolangatta
	EW	7	Melbourne-Coolangatta
	EW	7	Melbourne-Sydney-Coolangatta
6. Melbourne-Cairns	AN	7	Melbourne-Sydney-Cairns
	AN	8	Melbourne-Sydney-Brisbane-Cairns
	AN	1	Melbourne-Brisbane-Cairns
	TN	6	Melbourne-Sydney-Brisbane-Cairns
	TN	7	Melbourne-Brisbane-Cairns
	TN	1	Melbourne-Brisbane-Townsville-Cairns
7. Brisbane-Townsville	OF	7	Brisbane-Townsville (with various stops)
	AN	21	Brisbane-Townsville
	AN	14	Brisbane-Gladstone-Rockhampton-Mackay-Townsville
	TN	19	Brisbane-Townsville
	YC	1	Brisbane-Townsville
8. Brisbane-Mackay	OF	6	Brisbane-Mackay (with various stops)
	AN	14	Brisbane-Gladstone-Rockhampton-Mackay
	AN	14	Brisbane-Rockhampton-Mackay
	AN	6	Brisbane-Mackay
	TN	8	Brisbane-Mackay
	TN	7	Brisbane-Rockhampton-Mackay
	YC	7	Brisbane-Gladstone-Rockhampton-Mackay

Table 5: Australian Domestic Tourist Routes, 1991 (cont.)

Origin-Destination	Airlines	No. of Flights per Week	Flight Routings
9. Brisbane-Rockhampton	OF	11	Brisbane-Rockhampton
	OF	5	Brisbane-Bundaberg-Gladstone-Rockhampton
	AN	3[illegible]	Brisbane-Rockhampton
	AN	14	Brisbane-Gladstone-Rockhampton
	TN	17	Brisbane-Rockhampton
	YC	7	Brisbane-Gladstone-Rockhampton
10. Adelaide-Alice Springs	AN	7	Adelaide-Alice Springs
	TN	7	Adelaide-Alice Springs
11. Adelaide-Darwin	TN	7	Adelaide-Alice Springs-Darwin
	AN	1	Adelaide-Darwin
	AN	7	Adelaide-Alice Springs-Darwin
	MH	1	Adelaide-Darwin-Kuala Lumpur

/a Airline codes are listed in Annex 9.

Source: World Airways Guide, 1991; Qantas Timetable, 1991, and Ansett Timetable, 1991.

Table 6: WESTERN AUSTRALIA DOMESTIC ROUTES, 199.

Origin-Destination	Airlines /a	No. of Flights per Week	Flight Routings
1. Perth-Albany	YT	12	Perth-Albany
2. Perth-Broome	MV	5	Perth-Broome
	MV	8	Perth-Port Hedland-Broome
	MV	1	Perth-Newman-Port Hedland-Broome
3. Perth-Carnarvon	MV	3	Perth-Carnarvon
	MV	4	Perth-Geraldton-Carnarvon
4. Perth-Derby	MV	3	Perth-Derby
	MV	2	Perth-Broome-Derby
	MV	8	Perth-Port Hedland-Broome-Derby
	MV	1	Perth-Newman-Port Hedland-Broome-Derby
5. Perth-Geraldton	MV	8	Perth-Geraldton
	YT	10	Perth-Geraldton
6. Perth-Kalgoolie	MV	15	Perth-Kalgoolie
	YT	13	Perth-Kalgoolie
7. Perth-Karratha	MV	18	Perth-Karratha
	MV	2	Perth-Paraburdoo-Karratha
	MV	2	Perth-Geraldton-Carnarvon-Learmonth-Karratha
8. Perth-Kununurra	MV	4	Perth-Kununurra
	MV	3	Perth-Derby-Kununurra
	MV	2	Perth-Broome-Derby-Kununurra
	MV	2	Perth-Newman-Port Headland-Derby-Kununurra

/a Airline codes are listed in Annex 9.

Source: World Airways Guide, 1991; Qantas Timetable, 1991, and Ansett Timetable, 1991.

Table 7: NEW ZEALAND DOMESTIC ROUTES, 1991

Origin-Destination	Airlines /a	No. of Flights per Week	Flight Routings
1. Auckland-Wellington	ZQ	76	Auckland-Wellington
	ZQ	7	Auckland-Palmerston-Wellington
	NZ	77	Auckland-Wellington
	PG	7	Auckland-Wanganui-Wellington
2. Auckland-Christchurch	NZ	64	Auckland-Christchurch
	ZQ	55	Auckland-Christchurch
	ZQ	10	Auckland-Wellington-Christchurch
	NM	7	Auckland-Rotorua-Christchurch
3. Auckland-Dunedin	NZ	26	Auckland-Christchurch-Dunedin
	NZ	7	Auckland-Wellington-Dunedin
	ZQ	13	Auckland-Christchurch-Dunedin
	ZQ	5	Auckland-Wellington-Dunedin
4. Auckland-Hamilton	EX	19	Auckland-Hamilton
		5	Auckland-Tauranga-Hamilton
5. Auckland-Rotorua	NM	20	Auckland-Rotorua
6. Wellington-Queenstown	ZQ	7	Wellington-Christchurch-Queenstown
	NM	7	Wellington-Christchurch-Mount Cook-Queenstown
7. Wellington-Invercargill	NZ	5	Wellington-Christchurch-Invercargill
	ZQ	5	Auckland-Wellington-Dunedin-Invercargill

/a Airline codes are listed in Annex 9.

Source: World Airways Guide, 1991; Qantas Timetable, 1991, and Ansett Timetable, 1991.

Table 8: PAPUA NEW GUINEA—DOMESTIC AIR ROUTES, 1991

Origin-Destination	Airlines /a	No. of Flights per Week	Flight Routings
1. Port Moresby-Lae	PX	36	Port Moresby-Lae
	GV	6	Port Moresby-Lae
	GV	6	Port Moresby-Wau Papua-Bulolo-Lae
2. Port Moresby-Mount Hagen	PX	13	Port Moresby-Mount Hagen
	PX	1	Port Moresby-Lae-Mount Hagen
	PX	1	Port Moresby-Lae-Goroka-Mount Hagen
	GV	1	Port Moresby-Mount Hagen
	GV	4	Port Moresby-Mendi-Tari-Mount Hagen
	GV	6	Port Moresby-Lae-Goroka-Mount Hagen
	GV	1	Port Moresby-Kundiawa-Mount Hagen
Moresby-Goroka	PX	9	Port Moresby-Goroka
	PX	3	Port Moresby-Lae-Goroka
	GV	6	Port Moresby-Lae-Goroka
	GV	2	Port Moresby-Kundiawa-Goroka
4. Port Moresby-Madang	PX	4	Port Moresby-Madang
	PX	2	Port Moresby-Mount Hagen-Madang
	PX	9	Port Moresby-Lae-Madang
	PX	2	Port Moresby-Goroka-Madang
	GV	2	Port Moresby-Kundiawa-Madang
5. Port Moresby-Wewak	PX	3	Port Moresby-Madang-Wewak
	PX	1	Port Moresby-Mount Hagen-Wewak
	PX	5	Port Moresby-Lae-Madang-Wewak
	GV	1	Port Moresby-Mount Hagen-Wewak
6. Port Moresby-Wau Papua	GV	6	Port Moresby-Wau Papua
7. Port Moresby-Tari	PX	2	Port Moresby-Tari
	PX	2	Port Moresby-Mendi-Tari
	GV	4	Port Moresby-Mendi-Tari
8. Port Moresby-Daru	PX	2	Port Moresby-Daru
	GV	8	Port Moresby-Daru

/a Airline codes are listed in Annex 9.

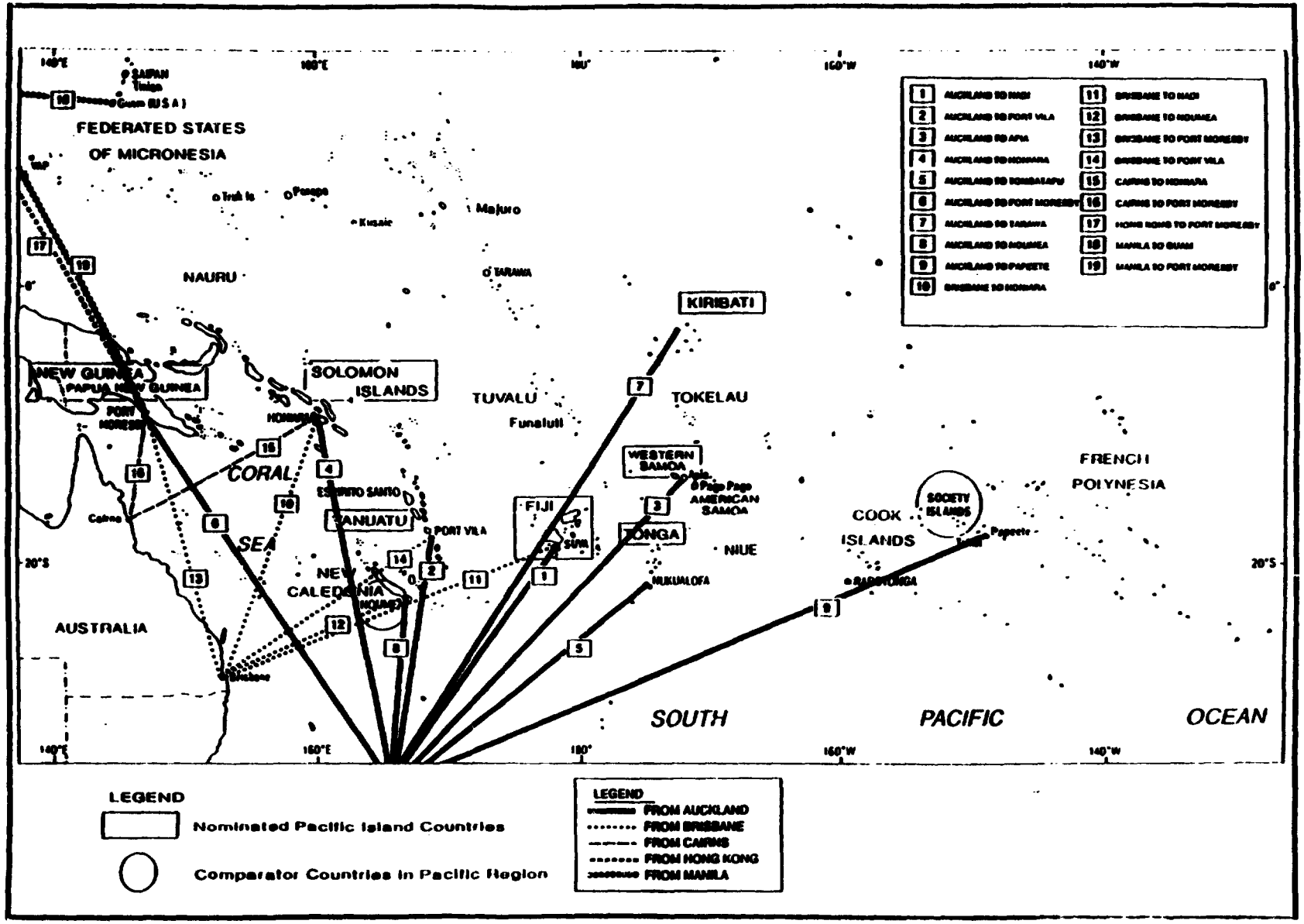
Source: World Airways Guide, 1991; Qantas Timetable, 1991, and Ansett Timetable, 1991.

PACIFIC ISLANDS

TRANSPORT SECTOR STUDY

MAPS OF AIR SERVICES FOR PACIFIC ISLANDS, COMPARATOR COUNTRIES AND PACIFIC RIM

Figure 1: PACIFIC ISLANDS—AVIATION ORIGINS—DESTINATIONS FROM PACIFIC RIM



ANNEX III.8

Figure 2: PACIFIC ISLANDS—AVIATION ORIGINS—DESTINATIONS FROM PACIFIC RIM

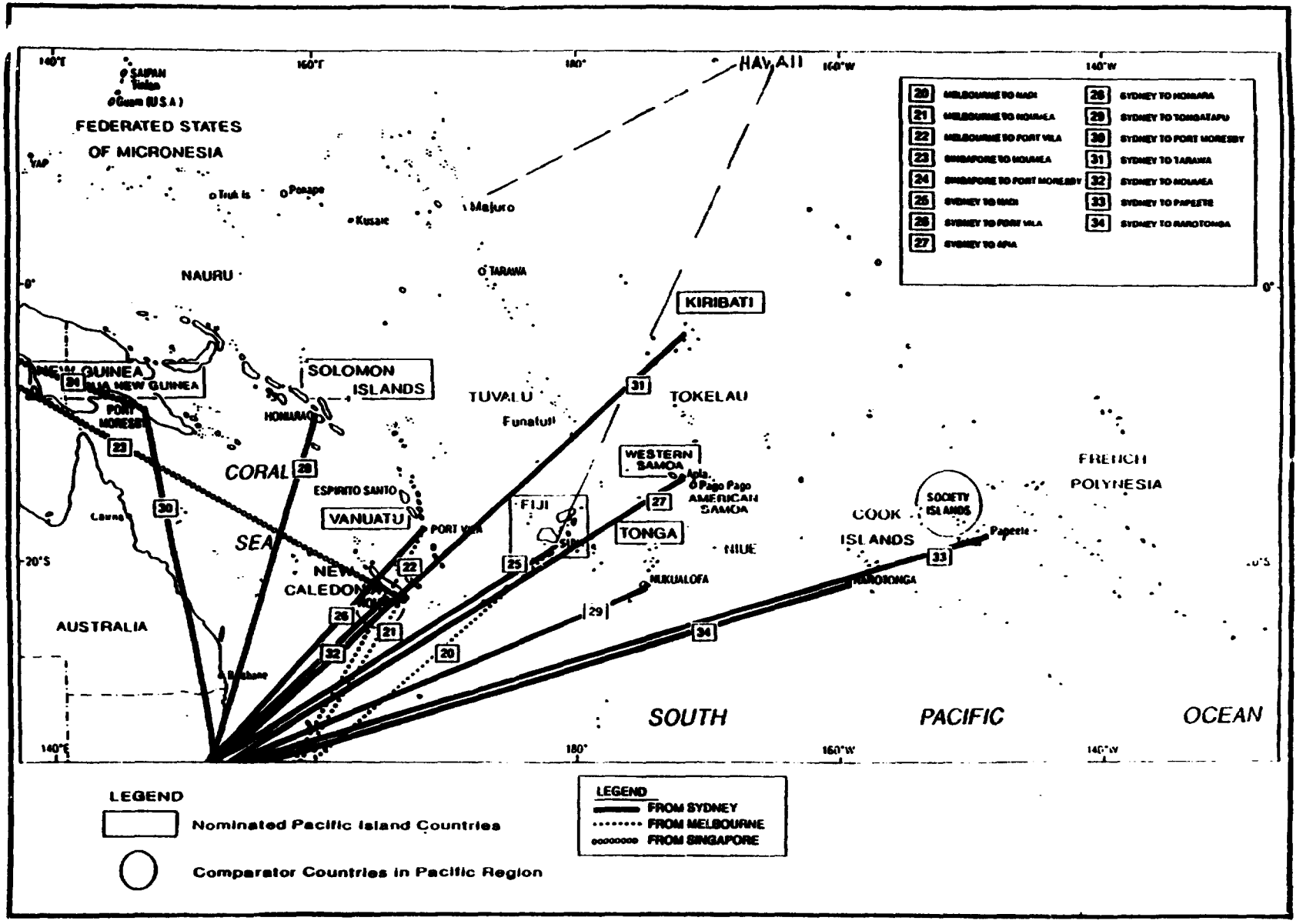
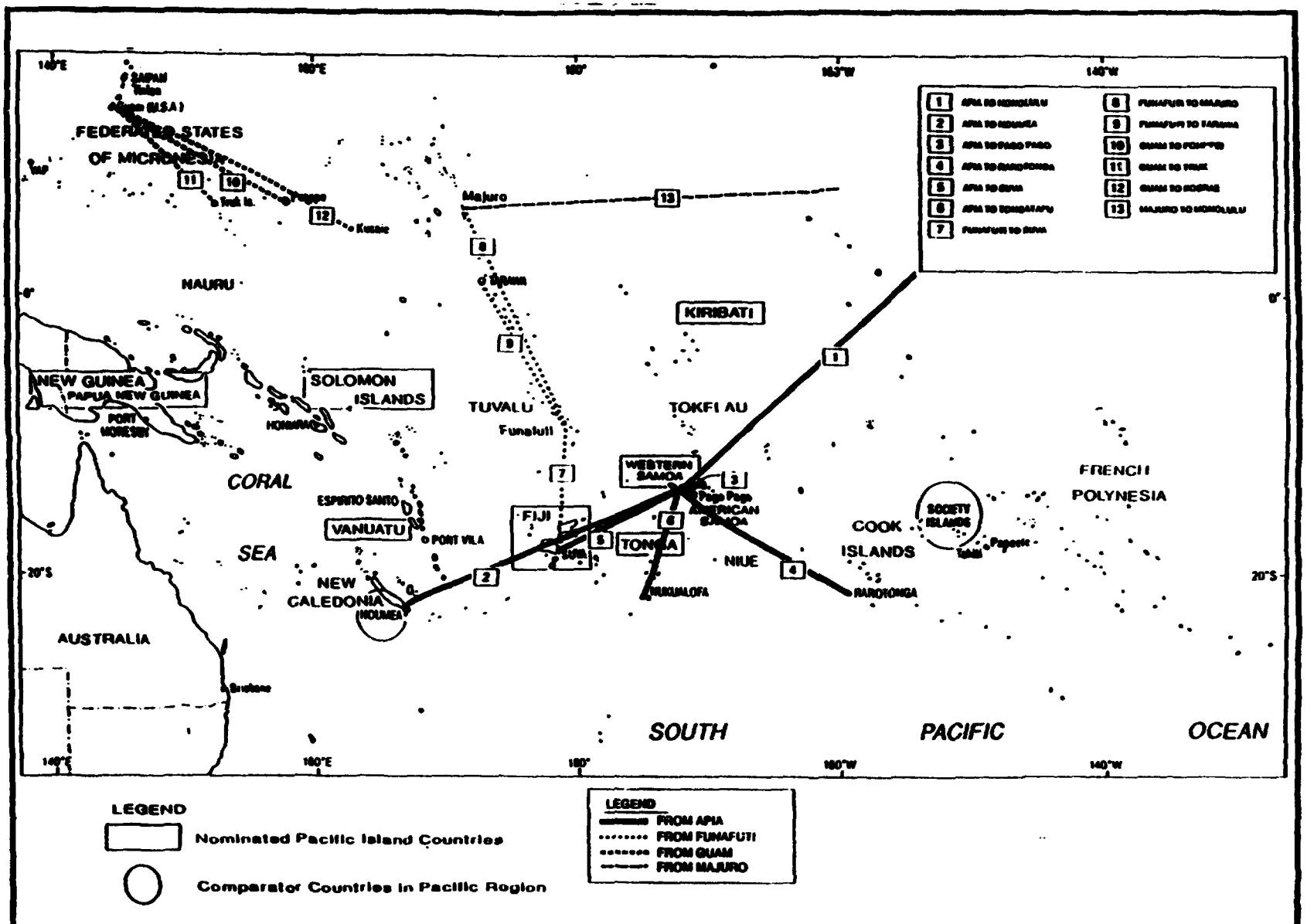


Figure 3: PACIFIC RIM PACIFIC ISLANDS—AIR SERVICES ORIGINS—DESTINATIONS



ANNEX III.8

Figure 4: PACIFIC ISLANDS—INTRA-REGIONAL AVIATION ORIGINS—DESTINATIONS

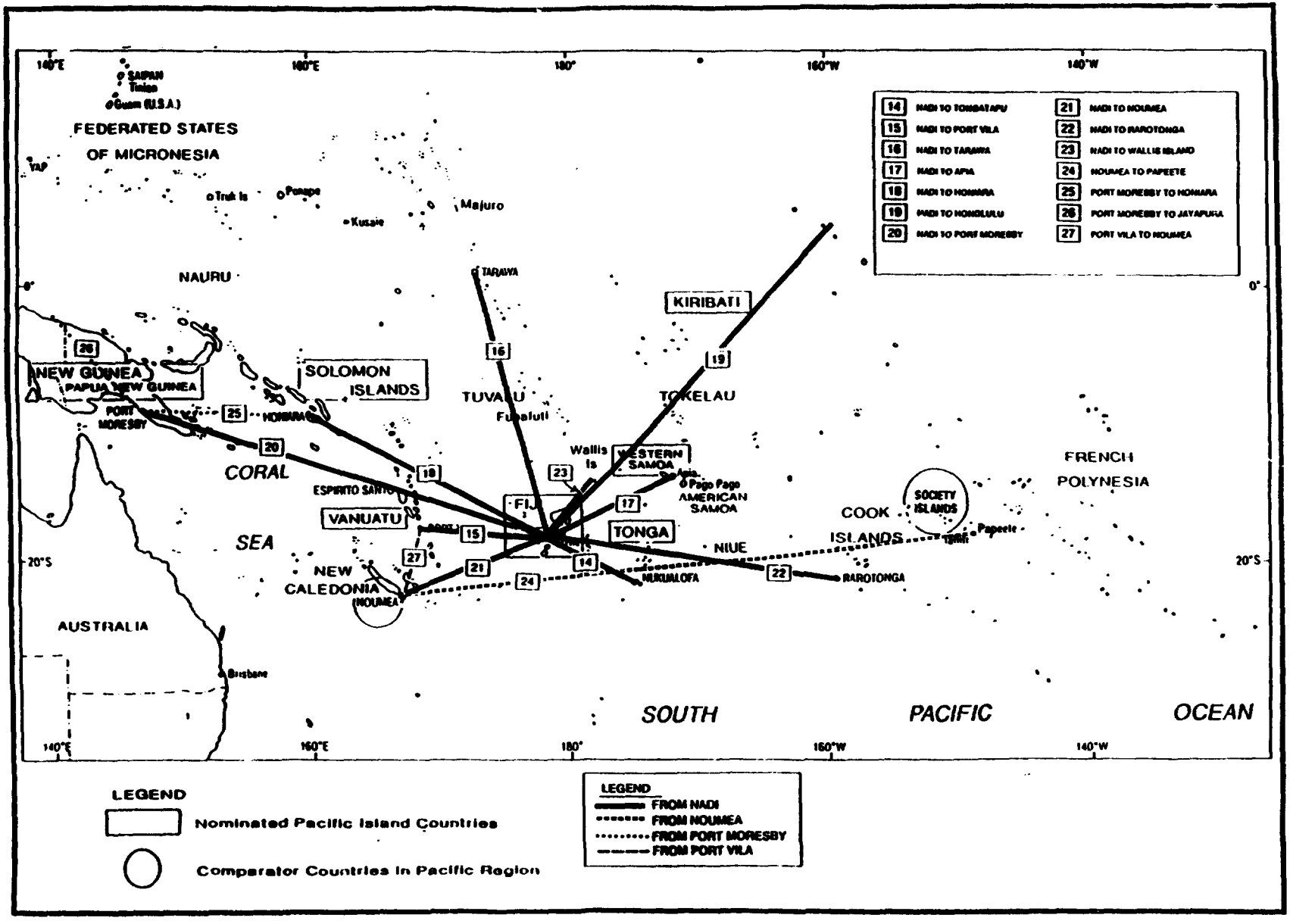


Figure 5: AUSTRALIAN INTERNATIONAL AIR ROUTES—ORIGINS—DESTINATIONS

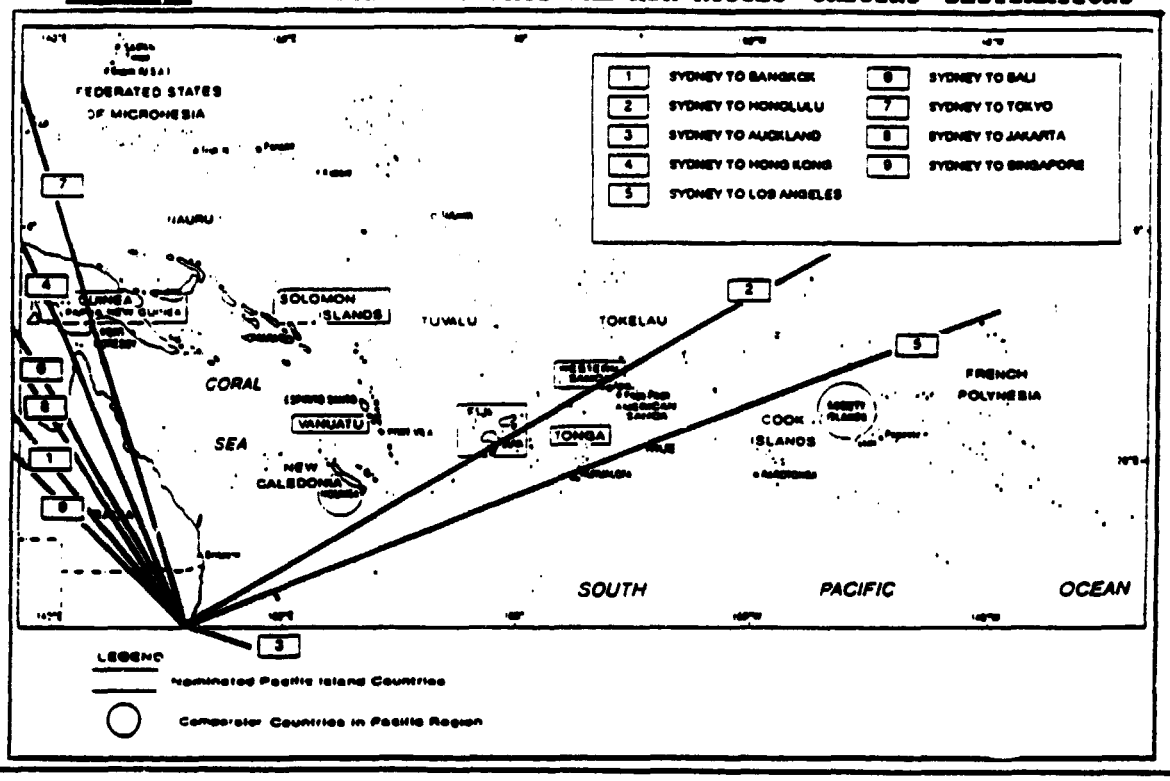


Figure 6: INDIAN OCEAN ISLAND AIR ROUTES—ORIGINS—DESTINATIONS

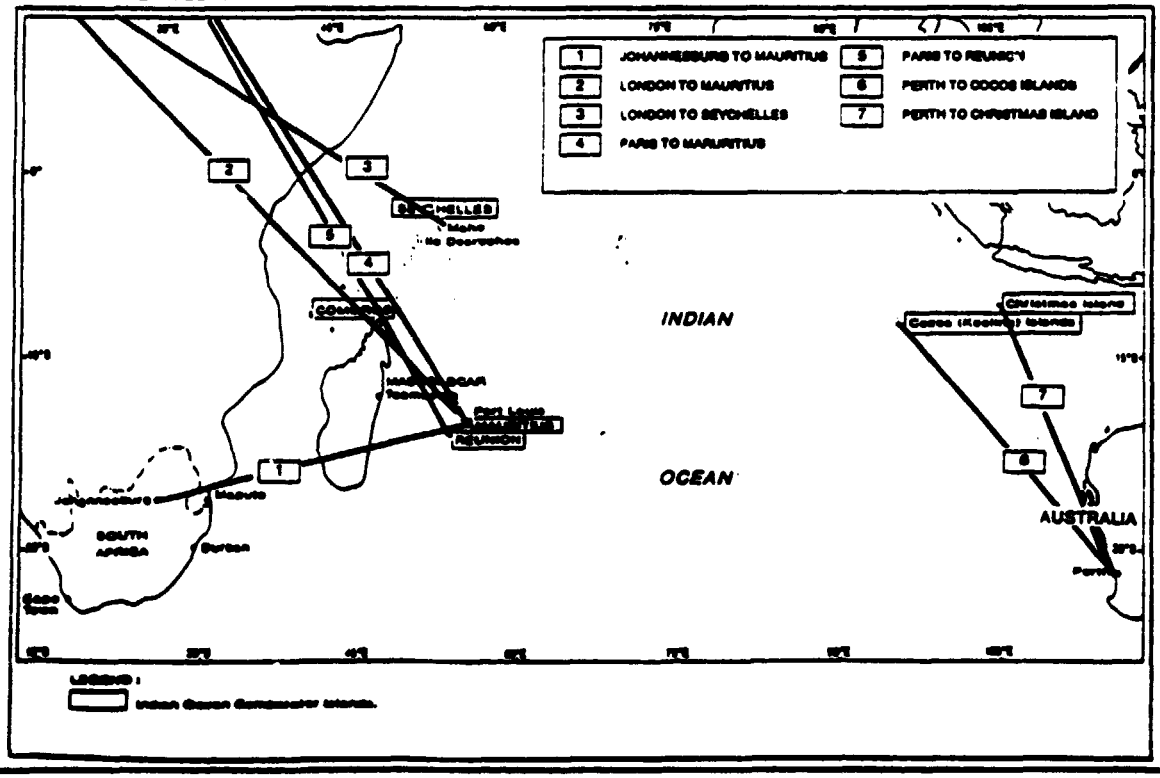


Figure 7: WESTERN AUSTRALIA DOMESTIC AIR ROUTES—ORIGINS—DESTINATIONS

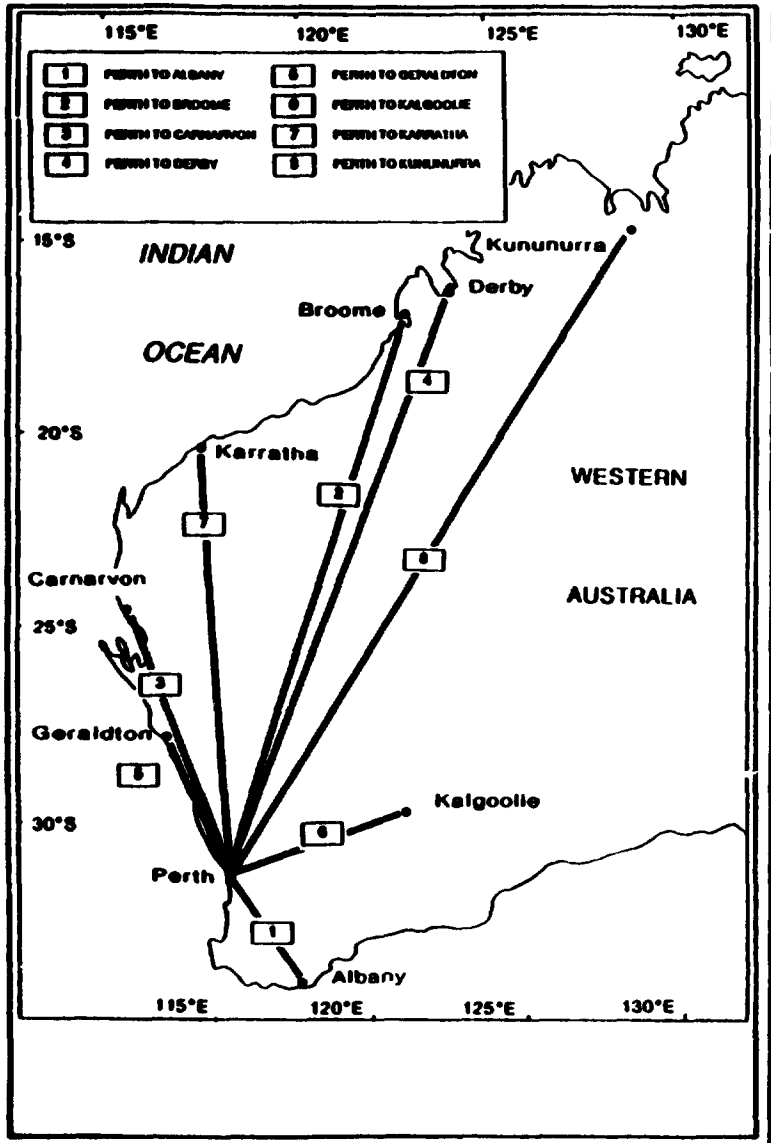
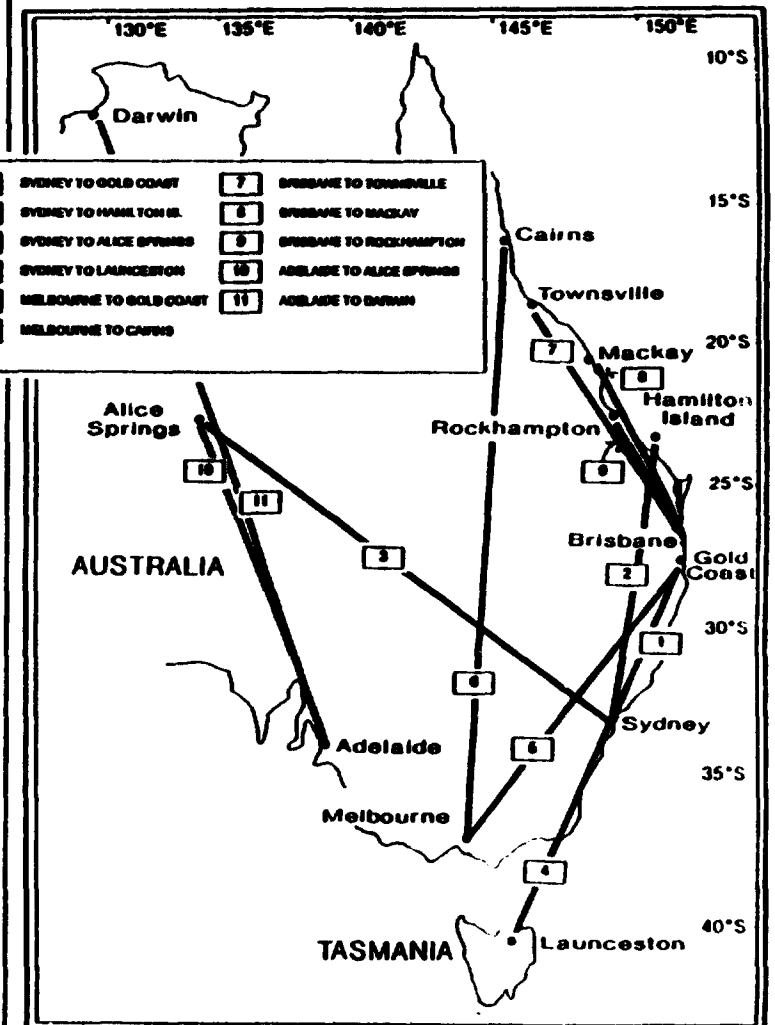


Figure 8: AUSTRALIAN TOURIST DOMESTIC AIR ROUTES—ORIGINS—DESTINATIONS



ANNEX III.8

Figure 9: NEW ZEALAND DOMESTIC AIR ROUTES ORIGINS—DESTINATIONS

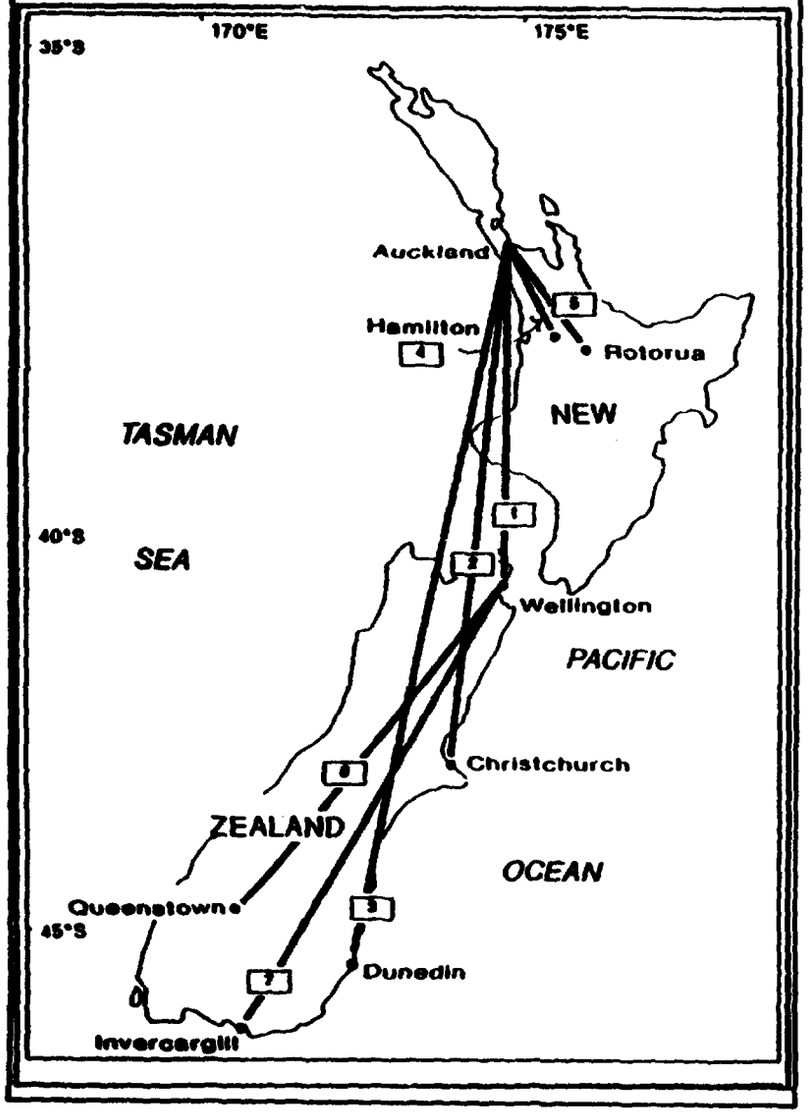
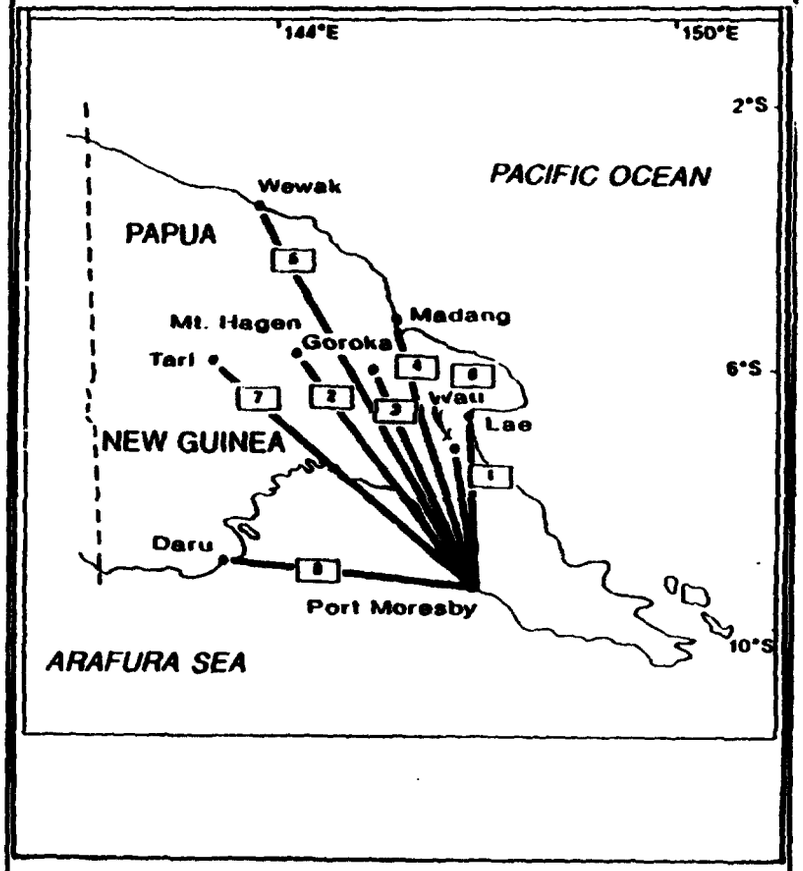


Figure 10: PAPUA NEW GUINEA DOMESTIC AIR ROUTES—ORIGINS—DESTINATIONS



1	AUCKLAND TO WELLINGTON
2	AUCKLAND TO CHRISTCHURCH
3	AUCKLAND TO DUNEDIN
4	AUCKLAND TO HAMILTON
5	AUCKLAND TO ROTORUA
6	WELLINGTON TO QUEENSTOWN
7	WELLINGTON TO INVERCARGILL

1	PORT MORESBY TO LAE
2	PORT MORESBY TO MT. HAGEN
3	PORT MORESBY TO GOROKA
4	PORT MORESBY TO MADANG
5	PORT MORESBY TO WEWAK
6	PORT MORESBY TO WAU
7	PORT MORESBY TO TARI
8	PORT MORESBY TO DARU

PACIFIC AIRLINES

TRANSPORT SECTOR SURVEY

AIRLINE CODES

Code	Airline	Code	Airline
AA	American Airlines	OF	Sunstate Airlines
AF	Air France	ON	Air Nauru
AN	Ansett Australia	OV	Aeromaritime
AZ	Alitalia	PC	Fiji Air
BA	British Airways	PG	Air Nelson
CO	Continental Airlines	PH	Polynesian Airlines
CP	Canadian Airlines	PR	Philippines Airlines
CW	Air Marshalls Islands	PX	Air Niugini
CX	Cathay Pacific Airways	QF	Qantas Airways
EW	Eastwest Airlines	SA	South African Airways
EX	Eagle Airways	SB	Air Caledonie International
FJ	Air Pacific International	SQ	Singapore Airlines
GA	Garuda Indonesia	TG	Thai Airways International
GF	Gulf Air	TN	Australian Airlines
GV	Talair	TS	Samoan Aviation
HA	Hawaii Airlines	UA	United Airlines
IE	Solomon Islands Airlines	UT	Union de Transports Aeriens (UTA French Airlines)
JL	Japan Airlines	VK	Air Tungaru Corporation
LH	Lufthansa German Airlines	WR	Friendly Islands Airways Limited
MK	Air Mauritius	YC	Flightwest Airlines
MV	Ansett-Western Australia	YT	Skywest Airlines
NF	Air Vanuatu	ZQ	Ansett-New Zealand
NG	Lauda Air		
NH	All Nippon Airways		
NM	Mount Cook Airlines		
NZ	Air New Zealand		

Source: *World Airways Guide*, 1991.

PACIFIC ISLANDS

TRANSPORT SECTOR SURVEY

RESULTS OF STATISTICAL ANALYSIS OF AIR FARES FOR PMCS AND COMPARATORS

This annex presents the results of the log linear regression models estimates for economyc and excursion fares.

Table 1: PACIFIC AND COMPARATOR REGIONS—REGRESSION RESULTS FOR ECONOMY AIR FARES

Base Model

$$\hat{Y} = 3.35 * \underset{(45.92)}{D^{0.81}} * \underset{(-0.16)}{V^{-0.002}}$$

Test 1

$$\hat{Y} = 4.82 * \underset{(26.27)}{D^{0.76}} * \underset{(-0.46)}{V^{-0.008}} * \underset{(0.66)}{(e^{N})^{0.03}} * \underset{(0.66)}{(e^{P})^{0.07}} * \underset{(1.20)}{(e^{I})^{0.14}} * \underset{(-3.27)}{(e^{IP})^{-0.17}} * \underset{(1.38)}{(e^{AI})^{0.17}} * \underset{(-0.58)}{(e^{WA})^{-0.05}} * \underset{(-0.73)}{(e^{ADT})^{-0.07}} * \underset{(0.01)}{(e^{NZ})^{0.0007}}$$

Test 2

$$\hat{Y} = 3.84 * \underset{(37.72)}{D^{0.79}} * \underset{(-0.21)}{V^{-0.003}} * \underset{(0.90)}{(e^{N})^{0.05}} * \underset{(0.36)}{(e^{P})^{0.02}} * \underset{(1.00)}{(e^{I})^{0.09}} * \underset{(-2.86)}{(e^{IP})^{-0.15}}$$

where
- $\hat{Y}$ = estimated return excursion air fare
- D = distance (shortest operated mileage)
- V = volume (seat capacity per annum)
- N = dummy variable for the nominated Pacific Islands (1,0)
- P = dummy variable for all the Pacific Islands (1,0)
- I = dummy variable for the comparator Indian Ocean Islands (1,0)
- IP = dummy variable for the Intra-Pacific Island routes (1,0)
- AI = dummy variable for the Australian international routes (1,0)
- WA = dummy variable for the Western Australia domestic routes (1,0)
- ADT = dummy variable for the Australian domestic tourist routes (1,0)
- NZ = dummy variable for the New Zealand domestic routes (1,0)

Notes:
(1) t-statistics are in parentheses.
(2) Independent variable is significant at 0.05 level when t-statistic is greater than +1.96 or less than -1.96.

Table 2: Pacific and Comparator Regions—Regression Results for Excursion Air Fares

Base Model

$$\hat{Y} = 7.13 * \underset{(35.07)}{D^{0.68}} * \underset{(-5.56)}{V^{-0.07}}$$

Test 1

$$\hat{Y} = 6.81 * \underset{(21.56)}{D^{0.70}} * \underset{(-3.64)}{V^{-0.07}} * \underset{(-1.10)}{(e^{N})^{-0.06}} * \underset{(-0.55)}{(e^{P})^{-0.06}} * \underset{(-0.66)}{(e^{I})^{-0.09}} * \underset{(0.84)}{(e^{IP})^{0.05}} * \underset{(-1.10)}{(e^{AI})^{-0.15}} * \underset{(-2.04)}{(e^{WA})^{-0.21}} * \underset{(-0.19)}{(e^{ADT})^{-0.02}} * \underset{(-0.89)}{(e^{NZ})^{-0.09}}$$

Test 2

$$\hat{Y} = 6.93 * \underset{(28.31)}{D^{0.68}} * \underset{(-3.74)}{V^{-0.06}} * \underset{(-1.10)}{(e^{N})^{-0.06}} * \underset{(0.72)}{(e^{P})^{0.05}} * \underset{(0.37)}{(e^{I})^{0.04}} * \underset{(0.65)}{(e^{IP})^{0.04}}$$

where $\hat{Y}$ = estimated return excursion air fare
- D = distance (shortest operated mileage)
- V = volume (seat capacity per annum)
- N = dummy variable for the nominated Pacific Islands (1,0)
- P = dummy variable for all the Pacific Islands (1,0)
- I = dummy variable for the comparator Indian Ocean Islands (1,0)
- IP = dummy variable for the Intra-Pacific Island routes (1,0)
- AI = dummy variable for the Australian international routes (1,0)
- WA = dummy variable for the Western Australia domestic routes (1,0)
- ADT = dummy variable for the Australian domestic tourist routes (1,0)
- NZ = dummy variable for the New Zealand domestic routes (1,0)

Notes: (1) t-statistics are in parentheses.
(2) Independent variable is significant at 0.05 level when t-statistic is greater than +1.96 or less than -1.96.

LOGLINEAR REGRESSION RESULTS—ECONOMY FARES

BASE MODEL

Regression Output:

Constant		1.208450	A =	3.35
Std Err of Y Est		0.188147		
R Squared		0.951303		
No. of Observations		111		
Degrees of Freedom		108		
X Coefficient(s)	0.807369	-0.00187		
Std Err of Coef.	0.017580	0.011993		
T-statistics	45.92	-0.16		
	ln Dist.	ln Vol.		

TEST 1

Regression Output:

Constant		1.573052	A =	4.82						
Std Err of Y Est		0.177793								
R Squared		0.959736								
No. of Observations		111								
Degrees of Freedom		100								
X Coefficient(s)	0.756533	-0.00778	0.033558	0.066823	0.143360	-0.17423	0.169773	-0.053110	-0.066456	0.0006573
Std Err of Coef.	0.028800	0.017016	0.050843	0.100997	0.119606	0.053348	0.122851	0.0916383	0.0915358	0.0945229
T-statistics	26.27	-0.46	0.66	0.66	1.20	-3.27	1.38	-0.58	-0.73	0.01
	ln Dist.	ln Vol.	Nominated Pacific Island dummy (1,0)	Pacific Island dummy (1,0)	Indian Ocean Island dummy (1,0)	Intra-Pacific Island dummy (1,0)	Aust. Int'l routes dummy (1,0)	W.A. Domestic routes dummy (1,0)	Aust. Domestic Tourist routes dummy (1,0)	N.Z. Domestic routes dummy (1,0)

TEST 2

Regression Output:

Constant		1.345798	A =	3.84		
Std Err of Y Est		0.180470				
R Squared		0.956855				
No. of Observations		111				
Degrees of Freedom		104				
X Coefficient(s)	0.789023	-0.00334	0.045605	0.024315	0.087017	-0.14662
Std Err of Coef.	0.020920	0.015921	0.050813	0.066780	0.087301	0.051184
T-statistics	37.72	-0.21	0.90	0.36	1.00	-2.86
	ln Dist.	ln Vol.	Nominated Pacific Island dummy (1,0)	Pacific Island dummy (1,0)	Indian Ocean Island dummy (1,0)	Intra-Pacific Island dummy (1,0)

LOGLINEAR REGRESSION RESULTS--EXCURSION FARES

BASE MODEL

Regression Output:

Constant		1.964857	A =	7.13
Std Err of Y Est		0.197270		
R Squared		0.920501		
No. of Observations		111		
Degrees of Freedom		108		
X Coefficient(s)	0.680706	-0.06994		
Std Err of Coef.	0.019408	0.012576		
T-statistics	35.07	-5.56		
	ln Dist.	ln Vol.		

TEST 1

Regression Output:

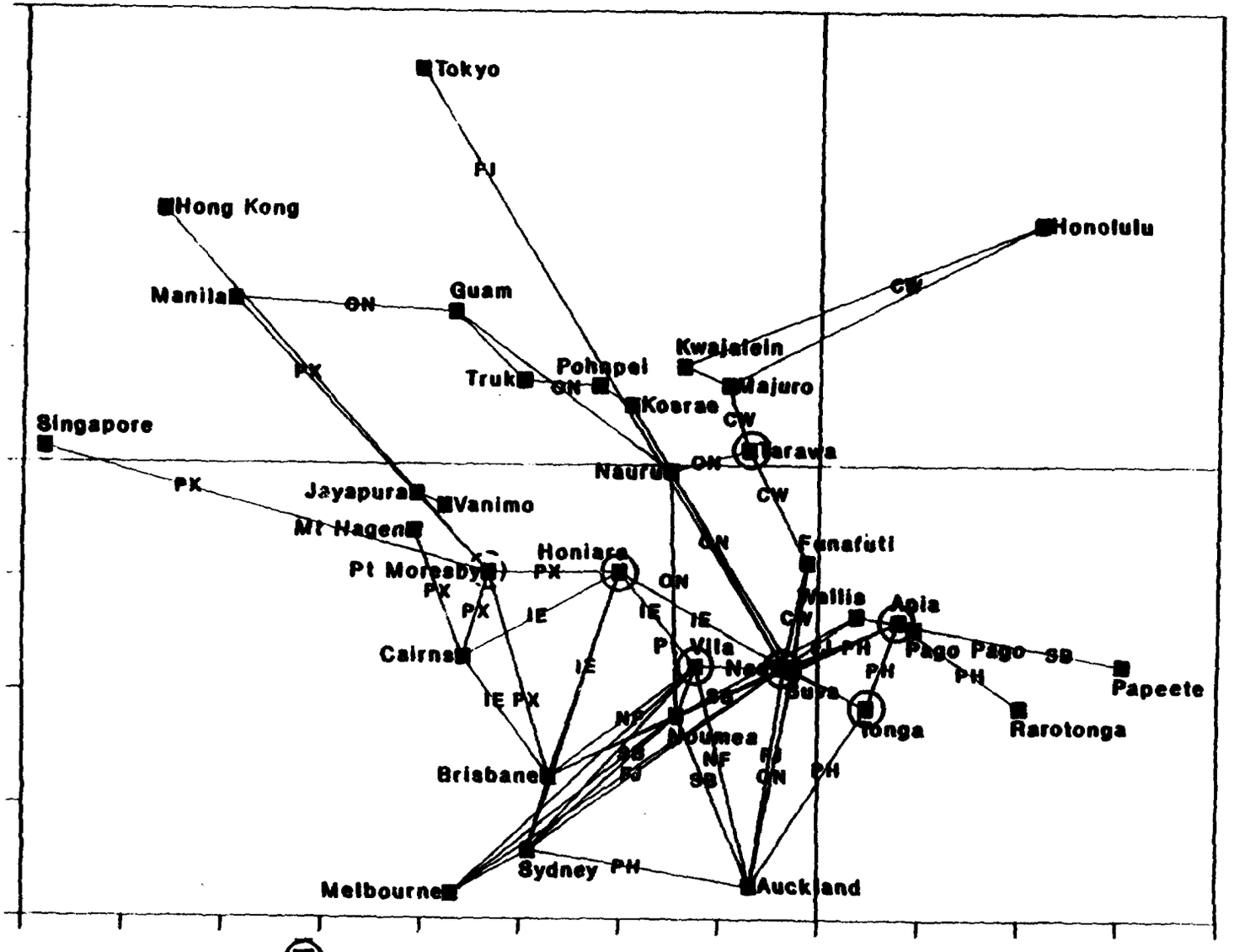
Constant		1.918014	A =	6.81						
Std Err of Y Est		0.196227								
R Squared		0.927166								
No. of Observations		111								
Degrees of Freedom		100								
X Coefficient(s)	0.697696	-0.06777	-0.06120	-0.05931	-0.08606	0.049462	-0.14514	-0.206334	-0.019197	-0.093214
Std Err of Coef.	0.032353	0.018639	0.055490	0.107729	0.130112	0.058982	0.132467	0.1012217	0.1009779	0.1042828
T-statistics	21.56	-3.64	-1.10	-0.55	-0.66	0.84	-1.10	-2.04	-0.19	-0.89
	ln Dist.	ln Vol.	Nominated Pacific Island dummy (1,0)	Pacific Island dummy (1,0)	Indian Ocean Island dummy (1,0)	Intra-Pacific Island dummy (1,0)	Aust. Int'l routes dummy (1,0)	W.A. Domestic routes dummy (1,0)	Aust. Domestic Tourist routes dummy (1,0)	N.Z. Domestic routes dummy (1,0)

TEST 2

Regression Output:

Constant		1.935354	A =	6.93		
Std Err of Y Est		0.198149				
R Squared		0.922762				
No. of Observations		111				
Degrees of Freedom		104				
X Coefficient(s)	0.679544	-0.06492	-0.06108	0.051889	0.035011	0.036990
Std Err of Coef.	0.024007	0.017374	0.055712	0.072323	0.095457	0.056740
T-statistics	28.31	-3.74	-1.10	0.72	0.37	0.65
	ln Dist.	ln Vol.	Nominated Pacific Island dummy (1,0)	Pacific Island dummy (1,0)	Indian Ocean Island dummy (1,0)	Intra-Pacific Island dummy (1,0)

Figure 1: AIR SERVICE ROUTE NETWORKS—PACIFIC ISLANDS AND PACIFIC RIM, 1991 /a



Pacific Member Country, International Airport

/a Routes shown focus on Pacific Member Countries; not all air service routes for the region are shown.

PACIFIC ISLANDS

TRANSPORT SECTOR STUDY

BROADER OBJECTIVES AND AVIATION COOPERATION

Multiple Objectives. Aviation is seen as linked to other government objectives, such as greater tourism and employment opportunities. Thus, some cooperative ventures which lower airline costs may be seen as lessening home employment and tourism, and therefore not in the interests of particular countries. Airlines which are set broad and possibly conflicting objectives are likely to reject cooperative ventures because they are seen as being contrary to some of these broad objectives.

The problem is one of recognizing non-aviation objectives and of creating a workable structure to facilitate pursuit of several objectives. This requires specifying how airlines are to operate, what constraints they are to be subject to, and what incentives they are to be given. For countries, it is also important to determine what factors are relevant in aviation regulation, their relative importance, and how broad aviation negotiations can be, in terms of what rights and concessions can be traded.[1]

Treating Separate Objectives Separately. A practical approach of addressing the several key objectives of the South Pacific countries is to treat the differing objectives independently. Thus, if underemployment is a problem, an airline should not be expected to have any preference for local, rather than foreign, employees. Airlines should be instructed to concentrate on commercial performance; underemployment is best handled by addressing it directly. Likewise, airlines should not be expected to be vehicles for encouraging tourism. If a route brings tourists, but is losing money, it should be dropped. If tourism is deemed to warrant special treatment by governments, it is best encouraged in other ways.

Airline objectives can and should be kept simple. If airlines are required to concentrate on commercial performance, this will lead to airlines minimizing costs and serving all markets that are commercially viable. If an airline possesses and uses market power, it can be regulated (at some cost in terms of incentives and efficiency). At the aviation negotiation level, airline efficiency, profits, and tourism, need to be taken into account. However, in general, objectives such as employment and tourism are best handled separately, and especially separate from the controls and objectives set for airlines.

Well Specified Objectives and Incentives. For an airline (as for other enterprises), simple objectives and constraints produce the best performance. If commercial performance and profit is the objective, and airline management is given a clear incentive to advance it, the airline will try to minimize costs and serve all viable markets.[2] There is an additional reason why special attention should be given to getting the *internal* incentives for efficiency right in the airlines of the South Pacific. This is because the *external* pressures, through competition, are not strong. Many of the routes which these airlines fly are thin, and have only one or two operators (who may have commercial agreements). The pressure of competition is not strong, and the airlines are not under strong pressure to keep costs at the minimum feasible level consistent with the standard of service offered. In such an environment, it is necessary to rely more on internal

incentives to keep costs low.[3] Of course, there are difficulties in corporatizing public enterprises—in setting profit objectives for them, in establishing managerial incentives tied to profit, and in eliminating political intervention. Such firms may make decisions, such as to reduce home employment and cooperate with foreign firms to reduce costs which will be politically unpopular—it is difficult for government to resist the temptation to intervene and override the enterprise.

Airlines in Support of Non-Aviation Objectives. Notwithstanding the difficulties of multiple objectives, they need not be incompatible. Governments may advance specific objectives which *are* best handled at the airline level, for example, airlines may be an efficient way of providing training in certain skills. If so, a government can offer training subsidies (to airlines and others). Airlines are in a good position to market their countries as tourism destinations—tourism authorities can form joint ventures with airlines to do this. Government may want certain commercially non-viable services provided for social reasons—it can offer the airline specific subsidies. Specific, targeted, measures, within the context of a commercially oriented airline can be used effectively to serve specific non-aviation objectives; under these conditions the airline is not being expected to advance a range of vague and conflicting objectives.

Treatment of Other Objectives. Other objectives can be handled separately. If there is a problem of unemployment or underemployment, it is usually an economy-wide, or regional, problem. There is little to be said for expecting particular industries to face higher costs through increasing their employment beyond that which they would otherwise choose on commercial grounds. Indeed, it does not follow that when a particular firm of industry employs more people, that overall employment will rise. (This is because of indirect, and general equilibrium effects.) Less home employment by an airline could mean lower costs, fares, and ultimately more tourism.

Higher profits mean more revenue to the government, and thus lower taxes or greater spending elsewhere—this could have an impact on employment. More purchases overseas by an airline puts downward pressure on the country's exchange rate, and thus it improves prospects for import competing and export industries. Quite apart from the fact that airlines tend to employ skilled people, who are more likely to be in excess demand rather than excess supply, employment policies at the airline level will be ineffective ways of addressing a country's overall employment objectives.

Tourism. Encouragement of tourism, partly for its employment effects, is a common objective of governments. This is true for most, if not all, South Pacific countries. It can be addressed directly, through tourism promotion, through the tax treatment of the tourism industry, and through specific grants or subsidies. It can also be effected through lowering the cost of tourism infrastructure, including perhaps aviation infrastructure, such as airports. As noted above, aviation negotiations may need to take into account tourism aspects, since the structure of traffic rights may have an impact on tourism flow. There is no need to involve airlines directly in pursuing tourism objectives.

In reality, airlines of many countries, and especially those in the developing world, are often regarded as means of encouraging tourism. Clearly, air services are essential for tourism to island economies. However, providing air services does not guarantee tourists in sufficient numbers to warrant the costs of an air service. It is possible to create a framework in which corporatized public or private firms are free to pursue profit objectives, but in which governments use airlines as instruments to attract tourists.

One way is for the government to offer support for subsidiaries (in principle, to any airline) to operate specific commercially non-viable services that are regarded as important for tourism development purposes. If the subsidy is sufficient, airlines will operate the route, and the cost of advancing the tourism objective will be explicit. Alternatively, tourism development can be set as an objective for an airline, in addition to profit, and the airline rewarded for its performance in terms of this objective. This would involve (a) determining the value of additional tourism, and offering the airline a subsidy (for example, $40 for each additional tourist), (b) estimating the contribution the airline makes to tourism, and (c) ensuring that management incentives are linked to overall profit, including payments for (or numbers of) tourists. This would be a complex procedure, and it would not be easy to implement. However, it would be superior to the present situation, whereby airlines are often expected to encourage tourism and make a profit, but they are given no guidance as to how to balance any conflict between these objectives.

Where airlines are given simple objectives, such as profit, they will seek to operate cost efficiently. In doing this they will enter those cooperative arrangements which are likely to lead to cost reduction—however, they will not pursue cooperation for its own sake. If all airlines operate in this way, costs of air transport in the region will be as low as feasible. If some countries and airlines pursue other objectives and operate differently, cost of air travel in the region will be higher, but the remainder of the countries and airlines will be acting so as to make air transport as cost efficient as possible, granted that cooperation is incomplete.

Low Air Fares and Other Objectives. Low air transport costs are likely to be in the interest of the region as a whole. This is not self-evident, granted that other objectives exist. However, looking at the two other objectives which could be of importance, employment and tourism, it is unlikely that these are harmed by efficient aviation. While more direct employment in aviation may be improved at the expense of higher air transport costs, it need not follow that overall employment is increased. However, aviation costs within the region can result in lower fares, so that the region as a whole can attract more tourists and more employment. Thus, the region as a whole can gain through having more efficient aviation.

Negotiations to Secure Net Gains. Individual countries may lose under certain arrangements, even though it should be possible to compensate them. For example, low air fares could mean that tourists go to other countries in the region, and a particular country loses out. This is best handled, not by restrictive regulation and high cost air transport, but by the country which loses negotiating for a share of the other countries gains (for example, through seat sales to its airline rather than granting 5th freedom rights to other countries airlines). The country will lose tourism, but gain other benefits.[4] What is needed, most fundamentally, is knowledge, on the part of the countries involved, of the likely scale of gains and losses from a particular proposal, and a willingness to negotiate a settlement acceptable to all. In practice, this will not always be the case. However, where it is, it is possible to have an efficient air transport system, with independent but cooperative airlines, and no country lose out.

Endnotes

1. At a theoretical level, it is possible to suggest a solution based upon the concept of a country "social welfare function" determined by government which reflects trade-offs (shadow prices) between various objectives. Airlines would be instructed or induced to evaluate proposals on the basis of the appropriate shadow prices, not market prices; for example, airlines with commercial obligations would face market prices which are made equal to shadow prices by taxes and subsidies. Thus, if shadow wages were less than market wages, employment would be subsidized. This solution is sketched out as a benchmark, not because it is workable. Shadow prices are sometimes used in the evaluation of projects, but broad adjustments of market prices by tax/subsidy mechanisms is rare, except in simple situations. Even countries with advanced price mechanisms and well developed information flows do not attempt very detailed corrections of market prices. Rather, they identify the imperfections in their economies, and usually address them one by one, rather than all at the same time. This approach is theoretically imperfect, but it is practical. (See Broadway and Bruce (1984).

2. Publicly owned airlines can be given corporate forms, and managers can be set incentives to seek profit and behave commercially; i.e., they can be corporatized. Where this happens in a competitive market, profit will be consistent with overall efficient market performance. Problems do arise if market power is significant, and regulation of firm behavior may be desirable.

3. There are alternatives, but they have not proved very satisfactory. Public enterprises around the world are often given broad objectives, rarely with explicit weighting, and it is impossible to either measure performance or to gear incentives to performance. The result is that none of the objectives is met. The use of public enterprises as broad political instruments (with vague and conflicting objectives, coupled with inappropriate incentives) is the major reason why cost efficiency of these enterprises is often so low.

4. If a country loses, but other countries gain more, yet that country's approval is required, then other countries should be prepared to grant concessions to gain its approval.