Table 4.5-1 PROCUREMENT PLAN OF MAJOR MATERIALS

	Procured from		Remarks
	Kingdom of Tonga	Japan or the Third Country	
Base course material	o		
Aggregate for asphalt concrete	o		Produced at site
Bitumen for asphalt concrete		o	
Prime coat material		o	
Ready mixed concrete	o		
Reinforcing steel	o		Locally procured because of small quantity
Wire mesh	o		Locally procured because of small quantity
Traffic paint		o	
Joint filler		o	
Timber for form		o	
Timber for staging		o	
Embankment material	o		
Zinc fence	o		Locally procured because of small quantity
Barbed wire	o		Locally procured because of small quantity
Colored cone		o	
Barricade		o	
Temporary traffic sign		o	
Fuel	o		

Equipment

Some equipment can be leased from local private companies. However, since most equipment is aged and spare parts are not stocked enough, it is deemed difficult to use the leased equipment continuously for the work to be completed within the limited time.

Therefore, the equipment used in the main work is planned to be procured from Japan or the third country and the equipment for temporary work from the Kingdom of Tonga.

Table 4.5-2 PROCUREMENT PLAN OF MAJOR EQUIPMENT

	Procured from		Remarks
	Kingdom of Tonga	Japan or the Third Country	
Bulldozer		o	Local equipment can be used for temporary works.
Backhoe Excavator		o	
Wheel Loader		o	
Motor Grader		o	
Water Tank Truck	o		
Vibration Roller		o	
Macadam Roller		o	
Tire Roller		o	
Asphalt Distributor		o	
Asphalt Finisher		o	
Dump Truck	o	o	
Mobil Crane	o		
Crawler Drill		o	
Crushing and Screening Plant		o	
Asphalt Plant		o	
Sewage Vacuum Car		o	
Air Compressor		o	
Generator		o	
Micro Bus	o		
Cargo Truck	o		
Low Loading Trailer		o	

Labor

Common labors, assistants and drivers are locally procured, while skilled labors, equipment operators and foremen are procured from abroad.

(2) Equipment Procurement

All proposed equipment is planned to be procured from Japan taking into consideration the reliableness to performance and after-sale service and time constraint in the system of Japan's Grant Aid Program.

In the selection of the manufacturers, only those which have an agent in the Oceanian area will be qualified to make sure of after-sale service including supply of spare parts.

The procurement of materials, equipment and labors for the construction of the crushing and screening plant is the same as that for the road improvement.

4.5.4 Implementation Schedule

Implementation schedules for the road improvement and the equipment procurement are shown is Tables 4.5-3 and 4.5-4, respectively.

Table 4.5-3 IMPLEMENTATION SCHEDULE (ROAD IMPROVEMENT)

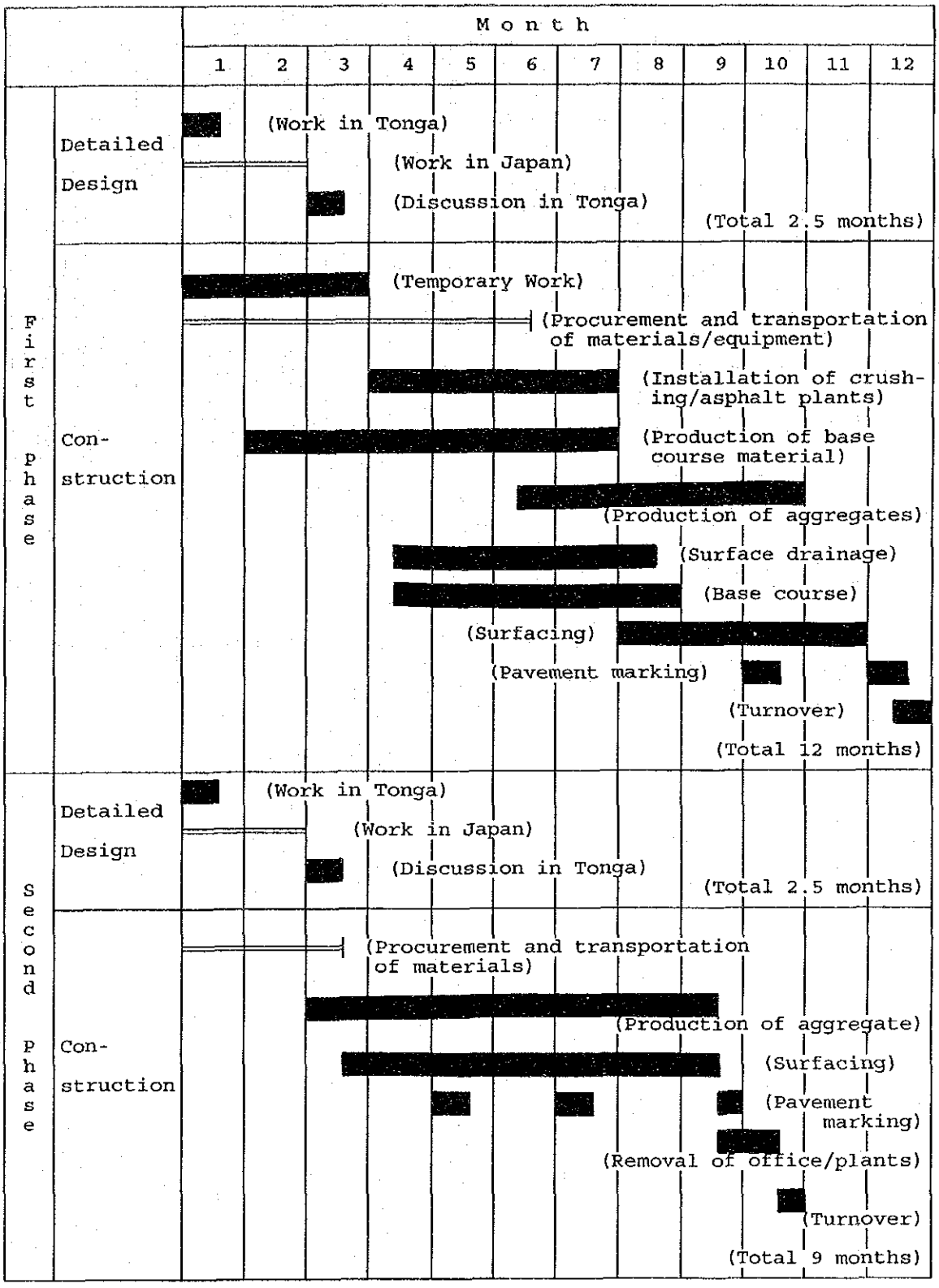
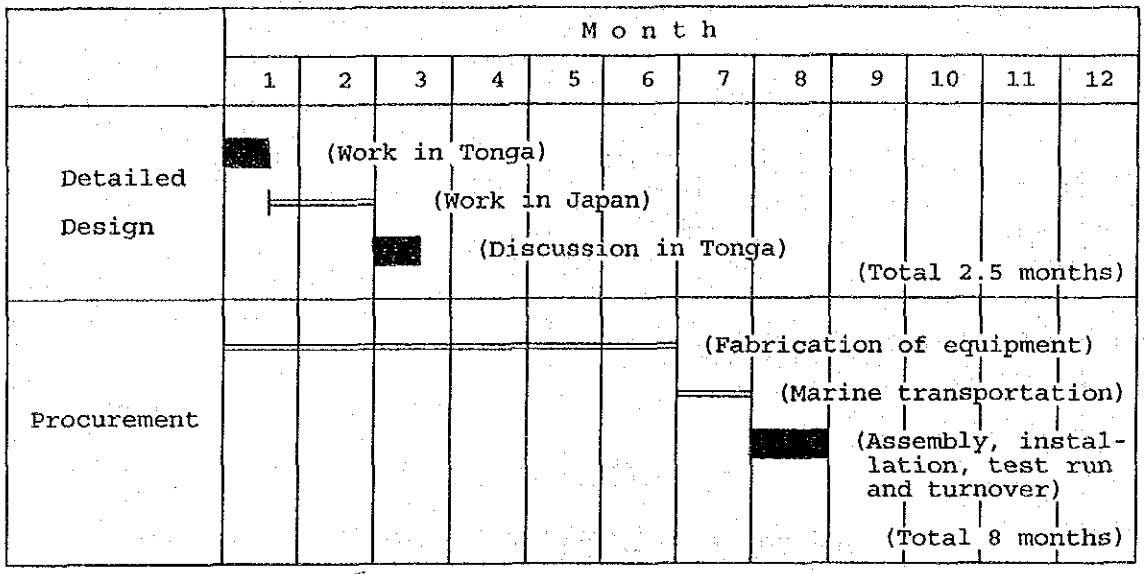


Table 4.5-4 IMPLEMENTATION SCHEDULE (EQUIPMENT PROCUREMENT)



4.5.5 Scope of Work

Undertakings of both governments, Japan and Kingdom of Tonga, are listed in Table 4.5-5.

Table 4.5-5 UNDERTAKINGS OF BOTH GOVERNMENTS

Item		Contents	Undertaken by		Remarks
			Japan	Tonga	
Road Improvement	Procurement of materials and equipment	Procurement	o		
		Customs clearance		o	
	Temporary work	Acquisition of lots		o	Lots for field office, stock yard and work shop
		Other works than the above	o		
	Acquisition of right-of-way	Acquisition of ROW		o	
		Removal of existing properties		o	Trees, electric poles, etc.
		Clearing and grubbing	o		
	Main work	Disposal of waste materials arising from existing facilities		o	
		Other works than the above	o		
Equipment Procurement	Procurement and transportation	Fabrication	o		
		Packing and shipping	o		
		Marine transportation	o		Up to Queen Salote Wharf
		Unloading	o		
		Customs clearance		o	
		Inland transportation		o	
	Turnover	Preparation and submission of operation and maintenance manuals	o		
		Assembly	o		
		Guidance of operation	o		
		Turnover	o		
	Installation of crushing and screening plant	Acquisition of site and clearing		o	
		Placement of foundation concrete and anchor bolts	o		
		Construction of slope for putting materials	o		
		Installation	o		

The cost to be shouldered by the Government of Tonga is roughly estimated as follows:

· Custom clearance fee for equipment	T$ 9,700
· Inland transportation of equipment	T$ 2,500
· Acquisition of lot for crushing and screening plant and its clearing	T$ 19,100
Total:	T$ 31,300

CHAPTER 5

INITIAL ENVIRONMENTAL EXAMINATION
FOR
CAUSEWAY CONSTRUCTION

CHAPTER 5

INITIAL ENVIRONMENTAL EXAMINATION FOR CAUSEWAY CONSTRUCTION

5.1 Environmental Impact Assessment System in the Kingdom of Tonga

(1) Environmental Impact Assessment

One of the basic ideas for sustainable development is the understanding that the environment and development are co-dependent. As Tonga tries to improve the socio-economic status of its people, it cannot disregard environmental implications. Achieving a positive socio-economic change without compromising the country's ecological systems is a fundamental premise of Environmental Impact Assessment (EIA).

Recommendations integrating environmental concerns and ecological constraints are offered. Experts within different discipline or sectors of the government are consulted.

The Cabinet decision on Environmental Impact (February 1985) states:

1. The Ministry of Lands, Survey and Natural Resources in cooperation with other appropriate ministries is to prepare a draft EIA prior to the final approval of any new physical development projects.

2. The draft EIA is to be available to be reviewed by the proposed project developer(s), appropriate government ministries and the general public.

3. All appropriate comments and changes are to be incorporated into a final EIA and submitted to Cabinet for a decision.

4. Project approval may be subject to conditions to be observed in order to mitigate any probable adverse impact on the environment, public health and welfare. These conditions are to be incorporated into final EIA.

5. Possible project alternatives are to be provided if the proposed project is determined through EIA review process as detrimental and hazardous to the Environment and public health and welfare.

Currently, an investigation is being conducted on how to best adapt EIA in the South Pacific. The researcher (Uilou F. Samani presenting doctoral thesis is attached to the Ministry of Lands, Survey and Natural Resources) seeks specifically to:

1. identify relevant characteristics in South Pacific societies;
2. evaluate EIA procedures currently existing in the region; and
3. formulate an EIA model for the region.

The Study was started in 1989 and supposed to be completed by 1991.

(2) Environmental Laws

The Kingdom of Tonga became independent of the United Kingdom on June 1970. And the development of the laws of Tonga came out specifically to address Tongan issues. Tonga's membership in the British Commonwealth permits the government to apply British laws where necessary.

Now, Environmental laws and regulations of Tonga are managed in every discrete body of legislation, and Environment policies are performed in various laws.

The birds and Fish Preservation Act was established in 1934 and amended in 1974. This Act provides for protected areas and provides for declaration of complete protection or closed seasons for specified species and prohibits the cutting or removal of mangroves in any area.

The Parks and Reserves Act of 1976 provides for the establishment and management of national parks and reserves, preliminarily with the goal of preserving wildlife and forest species. Under this Act, the whole of Fanga'uta and Fangakakau Lagoon declared protected areas. It is important to note that it is around this area where is a high concentration of mangrove ecosystem.

The Forest Act of 1961 provides for the setting aside of areas as forest reserves and for the control and regulation of such areas and of forest produce and related matters. The Fisheries Act, 1987 has been recently enacted to support a sustained development approach to Tonga's fisheries.

Principal Environmental laws of the Kingdom of Tonga are shown in Table 5.1-1. Among these principal laws, Land Use, Natural Resources and Environmental Planning Act is in a step of draft. This law was proposed to the national assembly, but it has not been legislated due to rejection of the national assembly.

Table 5.1-1 PRINCIPAL ENVIRONMENTAL LAWS

Fisheries Act of 1987
Agricultural Organization Act of 1973
Pesticide Act
Planting Act
Plant Quarantine Act
Noxious Weed Act
Forests Act of 1961
Water Board Act
Public Health Act → New Public Health Act
Parks and Reserves Act of 1976
Birds and Fish Preservation Act of 1934 and amended in 1974
Land Use, Natural Resources and Environmental Planning Act (draft)

The Kingdom of Tonga does not sign International Environmental Conventions such as Ramsar Convention which is a convention on important wetlands worldwide as inhabitant of water birds, and Washington Convention which is a convention on International Trade in Endangered Species of wild Fauna and Flora.

(3) IDEC Management Plan for the Kingdom of Tonga

The establishment of the Inter-Departmental Environmental Committee with heads of major government ministries and departments as members under the control and supervision of the Ministry of Lands, Survey and Natural Resources with the Permanent Secretary of the Ministry as its Chairman was carried out in October 1987 to co-ordinate and direct a master plan study for the development of an Environmental Management Plan for Tonga. Consultative meetings between representatives from Tonga, ESCAP and donor government (Norway) on the master plan study was conducted in November 1987 in Bangkok, Thailand. The committee members followed the following terms of reference:

1. To co-ordinate a study of the respective resources on a national level and to provide guidance to the study group.

2. To furnish necessary information material and facilitate fieldwork.

3. To work closely with the study group in preparing and reviewing sectoral reports.

4. To organise an Inter-Departmental symposium to discuss and finalize findings and recommendations of the study.

5. To undertake the necessary follow-up activity in implementing the recommendations of the study.

6. To submit a final comprehensive report evaluating the state of the environment of the Kingdom of Tonga to Cabinet for decision.

7. To convey terms of Cabinet decision to ESCAP.

(4) Parks and Reserves

Currently, Tonga designates 10 protected areas, 17 traditional protected areas of respect and 9 proposed protected areas, and 15 kinds of Flora and Fauna are given legal protection.

Figure 5.1-1 shows the protected reef areas in Tongatapu Island and Figure 5.1-2 mangrove areas.

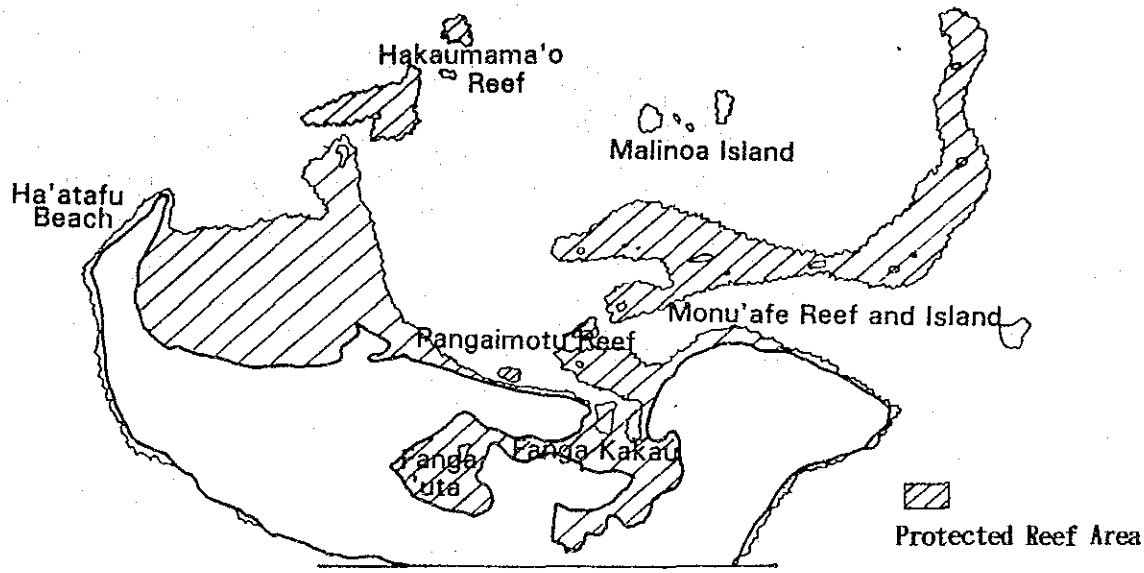


Figure 5.1-1 PROTECTED REEF AREAS IN TONGATAPU ISLAND

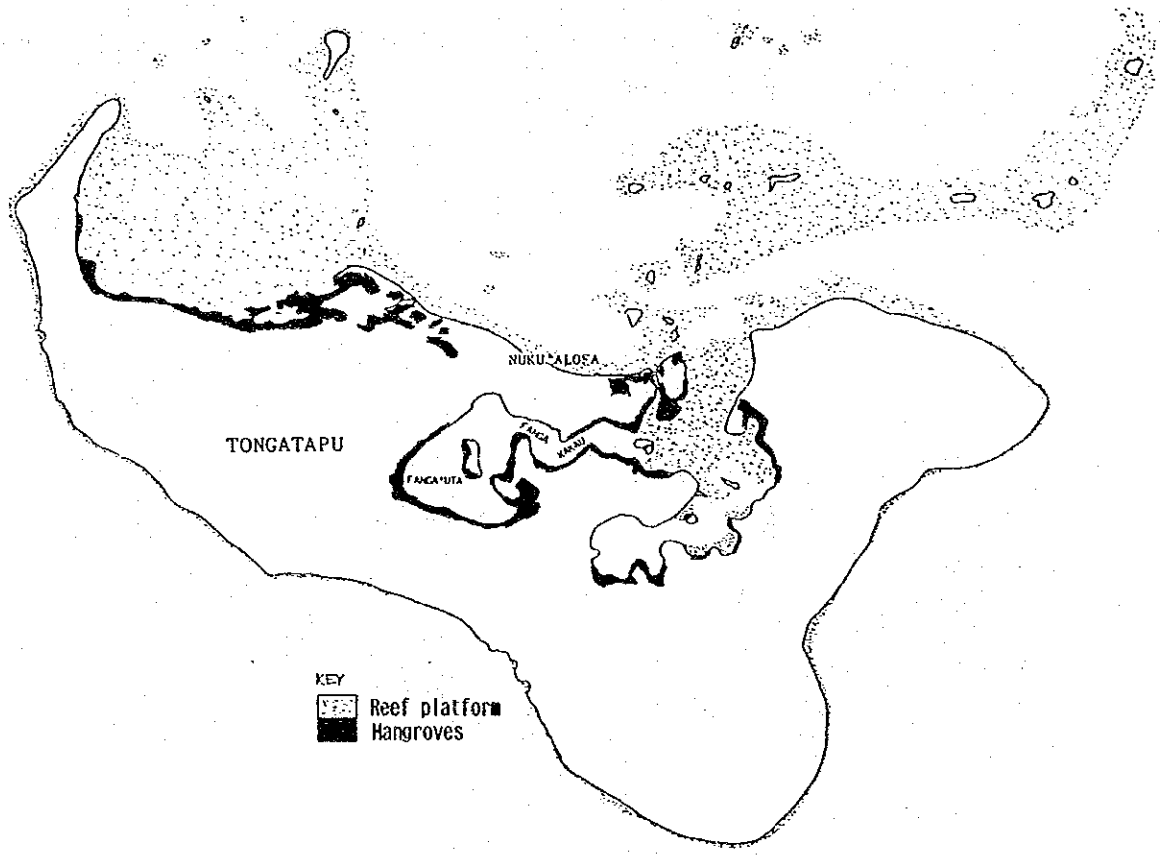


Figure 5.1-2 REEF PLATFORMS AND MANGROVE AREAS IN TONGATAPU ISLAND

5.2 Initial Environmental Examination

(1) The Present Situation of Fanga'uta Lagoon

Fanga'uta Lagoon is 27 km^2 in area, with reservoir water volume of 38,000,000 m^3. The lagoon is shallow, with a mean depth of 1.4 m, a maximum depth of 6 m and 80 km^2 of watershed area. There is no river flowing directly to the lagoon. Fanga'uta Lagoon is composed of four sectors as shown in Table 5.2-1.

Table 5.2-1 FANGA'UTA LAGOON DIMENSIONS BY SECTOR

Sector	Area (10^6m^2)	Volume (10^6m^3)	Mean depth (m)	Maximum depth (m)	Watershed Area (10^6m^2)
Nuku'alofa branch					
Pe'a	8.8	6.8	0.8	2.5	34
Folaha	4.9	7.3	1.5	3.2	7
Total	13.7	14.1	1.0	3.2	41
Mu'a branch					
Vaini	3.8	4.5	1.6	2.8	23
Mu'a	9.7	19.4	2.0	6.0	16
Total	13.5	23.9	1.8	6.0	39
TOTAL	27.2	38.0	1.4	6.0	80

A depth contour chart is shown in 5.2-1. The lagoon entrance is shallow with a depth of less than 2.0 m and its tidal difference is about 1.4 m. At the low tide, it is limited for a runabout to cruise in the lagoon.

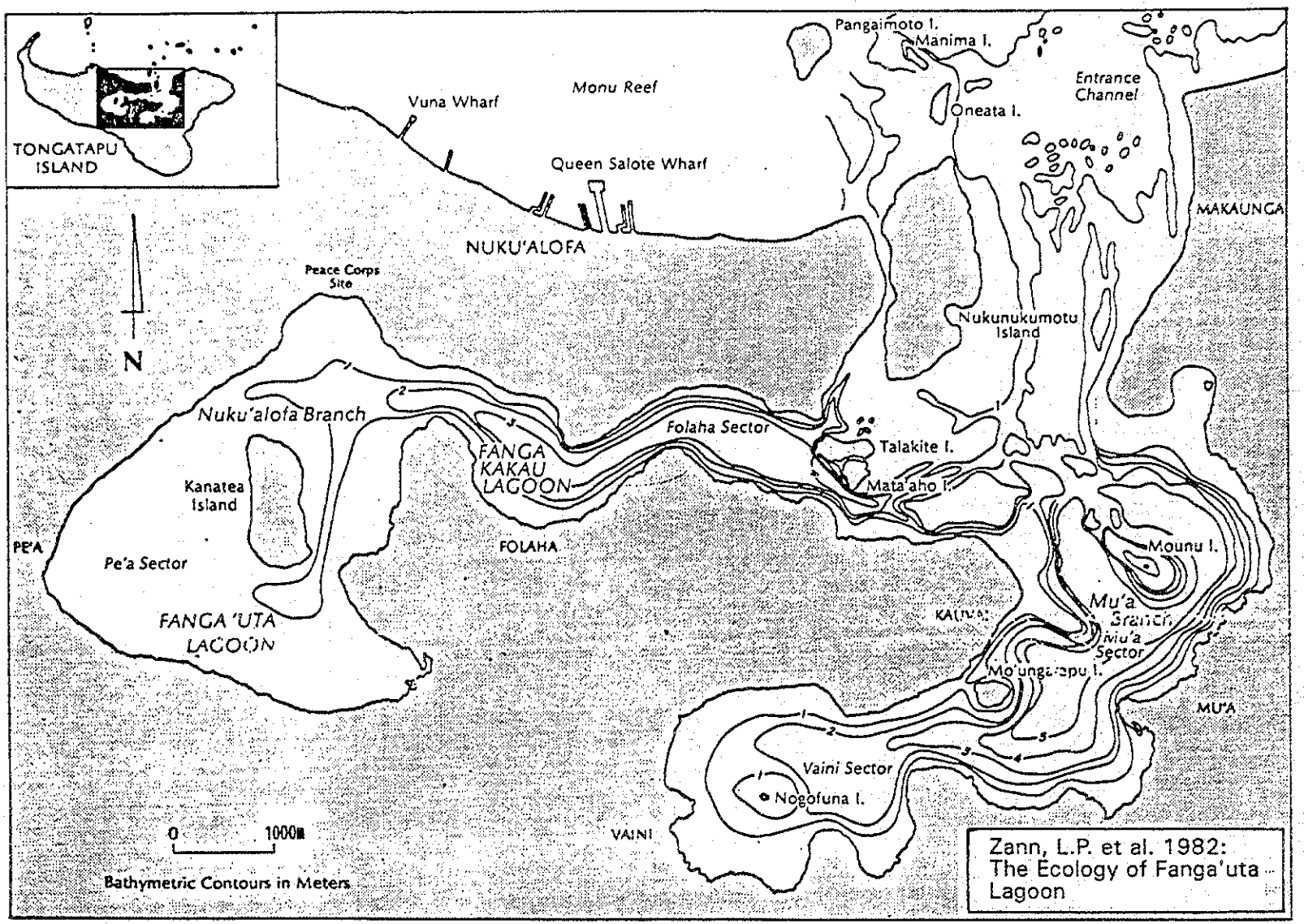


Figure 5.2-1 DEPTH CONTOUR CHART OF FANGA'UTA LAGOON

There is some area with a depth of 5 m or more in Mu'a Sector of Mu'a Branch. The depth at the entrance of Folaha Sector near Talakite Island is less than 1 m, making it difficult for even runabout to cruise.

Folaha Sector in the inner part of Talakite Island is relatively deep partly with a depth of more than 3 m but Pe'a Sector is shallow mostly with a depth of less than 1 m.

Remarkable siltation is noticed in Pe'a and Folaha Sectors, with some 2 m in thickness in some portions.

Water quality in Mu'a Branch is comparatively good because of better circulation of water but water quality in Nuku'alofa Branch tends to get worth. The urbanization of surrounding area may be related thereto.

The whole lagoon is generally referred to as Fanga'uta Lagoon but in a narrow sense, Fanga'uta Lagoon means the other part of Fanga Kakau Lagoon.

(2) Schemes of Causeway Routes

Two schemes of causeway route as shown in Figure 5.2-2 were studied.

Route 1 is a route connecting Nuku'alofa and Makaunga via Nukuleka, shifted northward from the originally proposed route to avoid traversing the area where mangrove grows thick.

Routes 2 does not cross the lagoon entrance but Fanga Kakau Lagoon at the southern part of Popua Peninsula going south toward Vaini via Talakite Island by bridges and a causeway. This route intends to shorten the travel between Nuku'alofa and Vaini.

Two routes are summarized in Table 5.2-2.

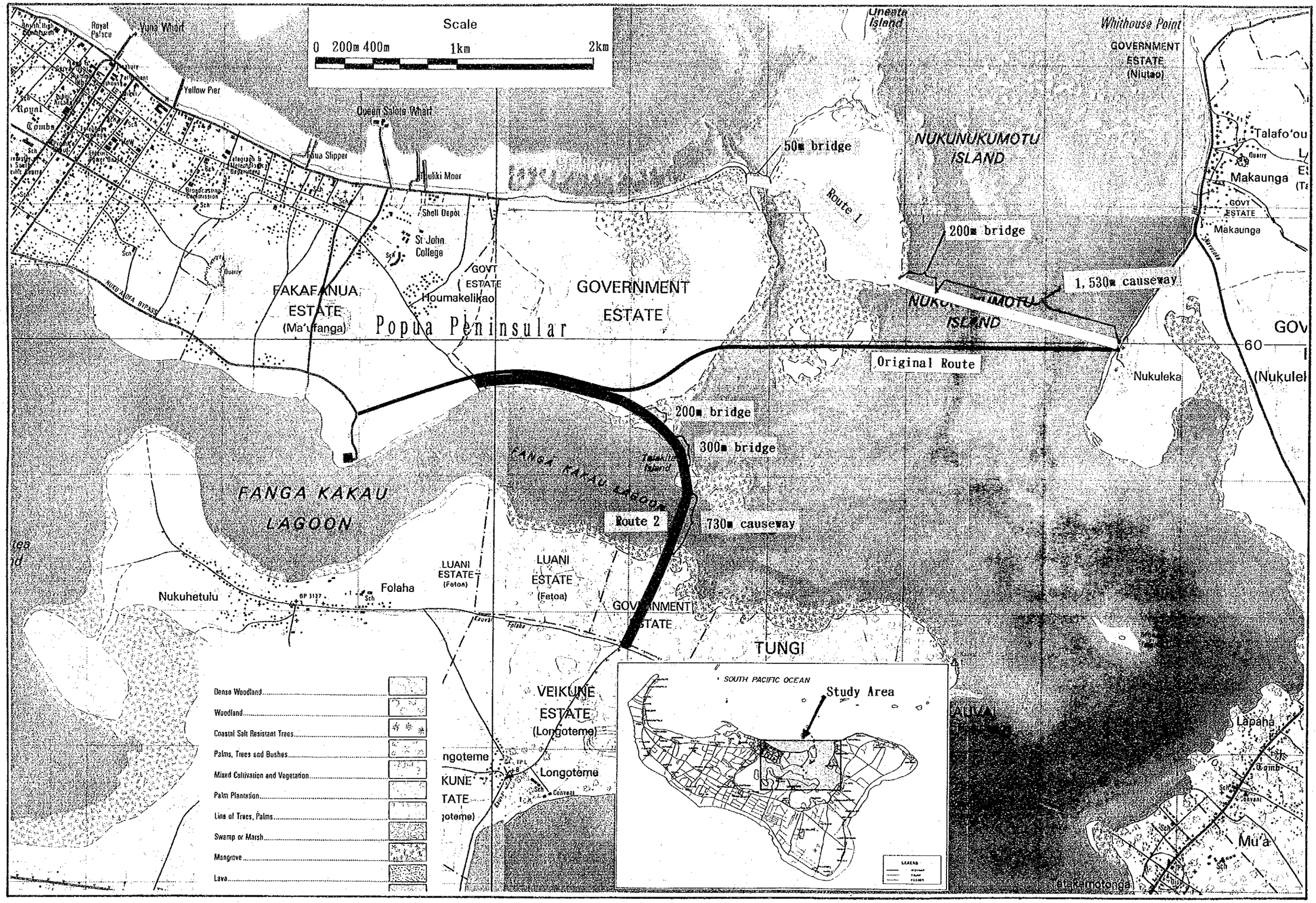


Figure 5.2-2 LOCATION OF CAUSEWAY ROUTES

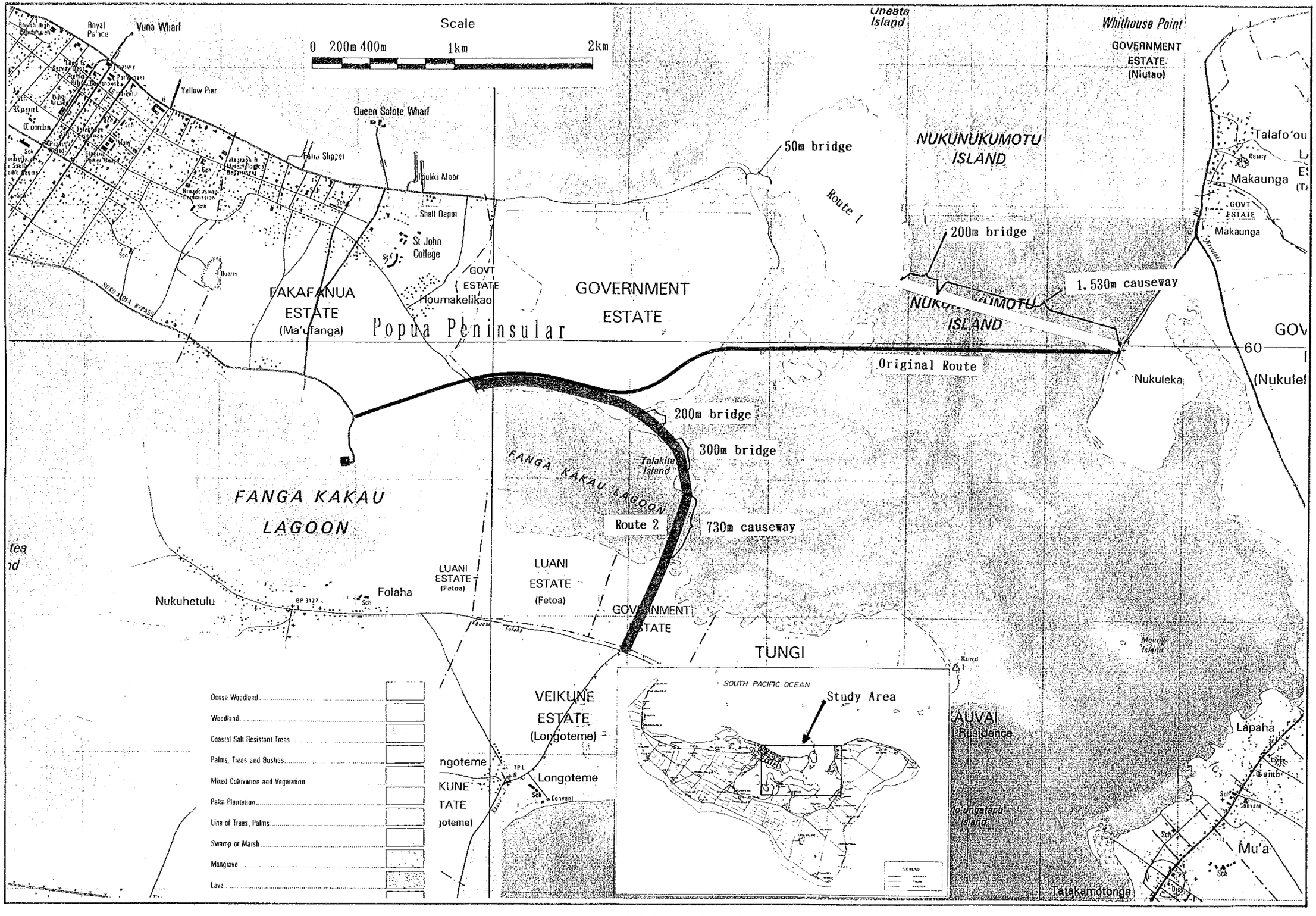


Figure 5.2-2 LOCATION OF CAUSEWAY ROUTES

Table 5.2-2 SUMMARY OF TWO ROUTES

Route 1		Route 2	
Bridge	50 m	North side approach road	1,130 m
Road on Nukunukumotu Island	1,250 m	Bridge	200 m
Bridge	200 m	Road in Island	140 m
Causeway	1,530 m	Bridge	300 m
Total:	3,030 m	Road in Talakite Island	230 m
Note 1: This route is similar to the original route but shifted northward to avoid traversing a thick mangrove forest.		Cause way	730 m
Note 2: This route passes on little mangrove.		South side approach road	430 m
		Total:	3,160 m
		Note: This route traverses a mangrove forest of 200 m in length.	

(3) Causeway and Bridge Structures

Route 1 includes two bridges (50 m and 200 m) and a causeway (1,530 m) and Route 2 includes two bridges (200 m and 300 m) and a causeway (730 m).

Proposed structures of causeway and bridges are shown in Figures 5.2-3 and 5.2-4, respectively.

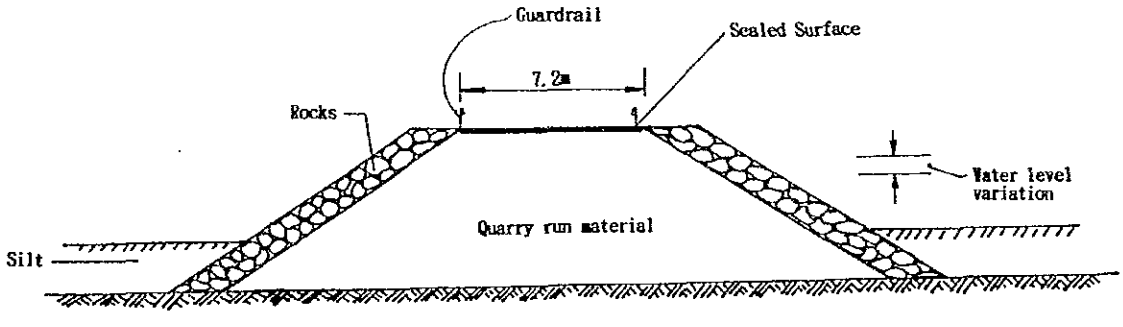
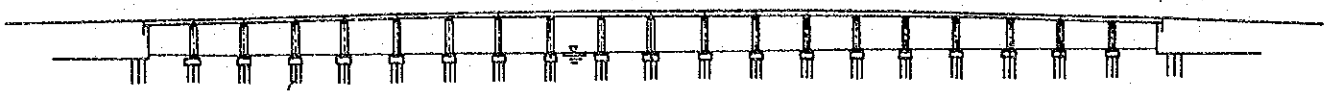
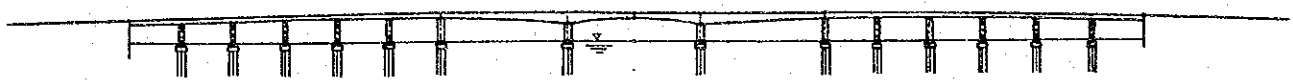


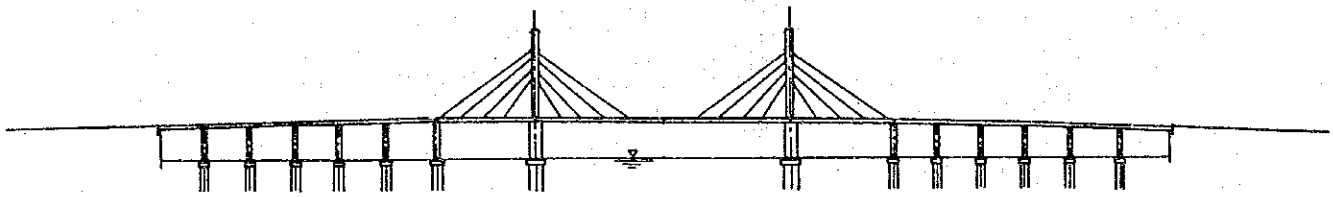
Figure 5.2-3 PROPOSED CAUSEWAY CROSS SECTION



Single PC Composite Girder Bridge



3 Span Continuous Box Girder Bridge + Single PC Composite Girder Bridge



Cable Stayed Bridge + Single PC Composite Girder Bridge

Steel Truss Bridge + Single PC Composite Girder Bridge

ADAPTABLE BRIDGE TYPE

Bridge length (m) / Bridge Type	50 m	200 m	300 m
Single PC composite girder bridge	o	o	o
3 Span continuous box girder bridge (+ Single PC composite girder bridge)		o	o
Cable stayed bridge (+ Single PC composite girder bridge)			o
Steel truss bridge (+ Single PC composite girder bridge)		o	o

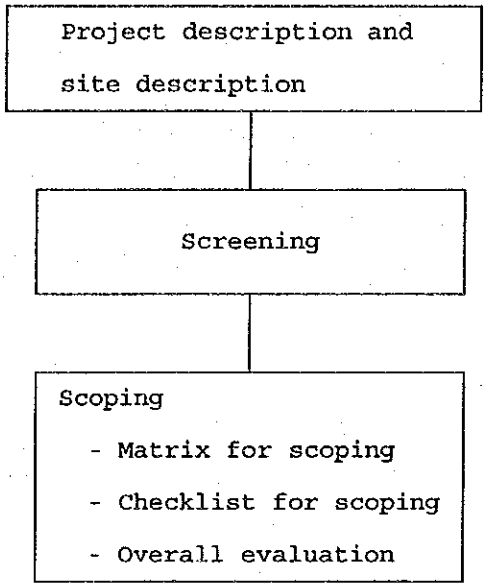
LEGEND

o : Adaptable

Figure 5.2-4 PROPOSED BRIDGE TYPE

(4) Initial Environmental Examination

The initial environment examination (IEE) was executed in the following procedures.



Initial Environmental Examination for Route 1

The results of the initial environmental examination are shown in the following tables:

Table 5.2-3 Project description
Table 5.2-4 Site description
Table 5.2-5 Screening
Table 5.2-6 Matrix for scoping
Table 5.2-7 Checklist for scoping
Table 5.2-8 Overall evaluation

Table 5.2-3 PROJECT DESCRIPTION (Route 1)

Item	Description
Project Name	Lagoon traversing road in Tongatapu Island
Background	A part of major road network development in Tongatapu Island
Objective	Promotion of regional development by directly connecting the northeastern part of Tongatapu Island to the capital
Location	Entrance of Fanga'uta Lagoon in Tongatapu Island
Executing agency	Ministry of Works, Kingdom of Tonga
Beneficial population	Approximately 4,127 (in 1986)
Kind of plan	New construction
Character of project road	Ordinary road, rural area, flat area and lagoon
Expected traffic volume	
Road length/width/ number of lanes	3.0 km / 7.2 m / 2 lanes
Other facilities	
Remarks	

Table 5.2-4 SITE DESCRIPTION (Route 1)

Item		Description
Project Name		Lagoon traversing road in Tongatapu Island
Social Environment	Resident in the area	· There is no resident because of passing the Lagoon and uninhabitant islet. · Resident along Nuku'alofa side approach is urban type (poor) and resident along Makuunga side approach is rural type.
	Land use	· Lagoon and Palm plantation
	Industry/Traffic	· Main industries are agriculture, forestry and fishery in the approach areas.
Natural Environment	Topography/geology	· Lagoon: coral reef partly with siltation · Nukunukumotu Island: low, flat and covered with green
	Rare Flora and Fauna	· Mangrove · Fishes and shells
Pollution	Occurrence of complainant	· None
	Countermeasure against complainant	· None
Special remarks		· Impact on water quality of Lagoon · Aggravation of Mangrove growing condition

Table 5.2-5 SCREENING (Route 1)

Environmental Factor			Explanation	Possibility of Impact	Remarks
Social Environment	1	Resettlement	Resettlement due to land occupation	No	Passing only the lagoon and uninhabited islet
	2	Economical activity	Lost of land productivity, change of economical structures	No	The same as above
	3	Traffic, life facilities	Traffic congestion, accident, impact on accessibility to school, hospital, etc.	No	The same as above
	4	Community disruption	Disruption of community due to obstruction of traffic	No	The same as above
	5	Historic spot, cultural assets	Loss or decrease of value of cultural assets	No	The same as above
	6	Water right, common right	Obstructions to water right, fishing right, common right, etc.	No	Fishing operation in the lagoon is already prohibited.
	7	Sanitation	Aggravation of public sanitation, e.g. generation of refuse and vermin.	Yes	Aggravation of water quality due to obstruction to water circulation in the lagoon.
	8	Waste	Generation of construction scrap, surplus soil and other wastes	No	No waste is generated.
	9	Disaster	Increase in potential of occurrence of disaster such as slope failure and cave-in.	No	Little possibility of disaster occurrence
Natural Environment	10	Topography/ geology	Change in valuable topography or geology due to excavation or embankment	Yes	Change in topography due to banking.
	11	Soil erosion	Washout of surface soil by rainwater due to deforestation	No	No possibility of washout of surface soil because no bare ground is created except road surface.
	12	Ground water	Drying up of ground water due to drainage in excavated land	No	No pomping up of ground water.
	13	Lake/river	Change in water volume or bottom elevation due to reclamation or inflow of drainage	Yes	Decrease of inflow/outflow water to/from the lagoon.
	14	Coast/sea	Coastal erosion or sedimentation due to change of coastal condition or reclamation	Yes	Possible progress of mud sedimentation
	15	Animals and plants	Obstruction to propagation or extinction due to change in growing condition	Yes	Aggravation of growing condition for mangrove and fish/shellfish
	16	Meteorology	Change in temperature or wind due to land development or big building	No	No factor causing change of weather.
	17	Landscape	Deterioration of landscape due to land development or structure	Yes	Possibility of deteriorating landscape.
Pollution	18	Air pollution	Pollution due to exhaust gas from vehicle or factory	No	Slight impact of exhaust gas from vehicles.
	19	Water pollution	Pollution due to inflow of soil or drainage from factory	Yes	Aggravation of water quality due to obstruction to water circulation in the lagoon and due to construction works.
	20	Soil pollution	Pollution due to dust, agricultural chemicals or asphalt emulsion	No	No activity causing soil pollution.
	21	Noise/ Vibration	Noise/vibration due to passage of vehicles	No	No inhabitant around the project site suffering noise/ vibration.
	22	Land subsidence	Subsidence due to land alteration or lowering of ground water	No	Stable ground and no change in ground water.
	23	Nasty smell	Generation of exhaust gas or other source of nasty smell	Yes	Inflow of filthy water to the lagoon and its accumulation due to decrease of water circulation.
Conclusion: Necessity of IEE or EIA				EIA needed	More than 2 factors with possible impact.

Table 5.2-6 MATRIX FOR SCOPING (Route 1)

Main activities related to the project	Activities which are considered to have an impact on the environment		Social Environment									Natural Environment								Pollution					
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			Resettlement	Economical activity	Traffic, life facilities	Community disruption	Historic spot, cultural assets	Water right, common right	Sanitation	Waste	Disaster	Topography/Geology	Soil erosion	Ground water	Lake/river	Coast/sea	Animals and plants	Meteorology	Landscape	Air pollution	Water pollution	Soil pollution	Noise/vibration	Land subsidence	Nasty smell
	Comprehensive evaluation								o			o			◎	◎	◎		o		◎				o
Road construction	During construction	Occupancy of area, alteration of Topography										o			o	o	o		o		o				
		Operation of construction equipment																			o				
	After completion	Occupancy of area							o			o			◎	◎	◎		o		◎				o
		Passage of vehicles																							
		Concentration of people and goods																							o

◎ Factors needing special care because of possibility of rejection of the project depending on magnitude of the impact and possibility of mitigative measures.

o Factors needing care because of possibility of increasing the impact depending on the scale and scope of the project.

No mark Factors needing no detailed study because of no or negligibly small impact.

Table 5.2-7 CHECKLIST FOR SCOPING (Route 1)

Environmental Factor			Evaluation	Remarks
Social Environment	1	Resettlement	D	Passing only the lagoon and uninhabitant islet.
	2	Economical activity	D	The same as above
	3	Traffic life facility	D	The same as above
	4	Community disruption	D	The same as above
	5	Historic spot, cultural assets	D	The same as above
	6	Water right, common right	D	No right is established.
	7	Sanitation	B	Sedimentation and stay of filth and dirty water
	8	Waste	D	No waste is generated.
	9	Disaster	D	Little possibility of disaster occurrence.
Natural Environment	10	Topography/ Geology	B	Change in topography due to banking.
	11	Soil erosion	D	No factor causing soil erosion.
	12	Ground water	D	No factor affecting ground water.
	13	Lake/river	A	Accumulation of dirty water due to lowering of self-cleansing action of the lagoon.
	14	Coastal/sea	A	Decrease of inflow of seawater
	15	Animals and plants	A	Aggravation of growing condition for mangrove, fish and shellfish.
	16	Meteorology	D	No factor causing change of weather.
	17	Landscape	B	Change of landscape by artificial structures.
Pollution	18	Air pollution	D	Slight impact of exhaust gas from vehicles.
	19	Water pollution	A	Accumulation of dirty water due to lowering of self-cleansing action of the lagoon.
	20	Soil pollution	D	No material causing soil pollution.
	21	Noise/vibration	D	No inhabitant around suffering noise/vibration.
	22	Land subsidence	D	No factor causing land subsidence such as pumping up of ground water.
	23	Nasty smell	C	Progress of nasty smell due to accumulation of filthy water.

Note : Evaluation
A: Big impact
B: A little impact
C: Unclear (needing further study to clarify)
D: No or negligibly small impact (no need to discuss in IEE/EIA)

Table 5.2-8 OVERALL EVALUATION (Route 1)

Environmental Factor	Evaluation	Follow-up Survey Plan	Remarks
7. Sanitation	B	·Investigation on the Government's measures against inflow of sewage into the lagoon ·Analysis of water circulation in the lagoon	
10. Topography/ Geology	B	·Analysis on topographic change based on the detailed design	
13. Lake/river	A	·Survey on present condition ·Simulation analysis on water movement in the lagoon	
14. Coast/sea	A	·Survey on present condition ·Simulation analysis on sedimentation of mud	
15. Animals and plants	A	·Survey on present condition ·Analysis of impact on ecosystem by change in growing condition	Especially for mangrove, fish and shellfish
17. Landscape	B	·Study on landscaping by photomontage	
19. Water pollution	A	·Investigation on the Government's measures against inflow of sewage into the lagoon ·Monitoring of water quality ·Analysis on water circulation in the lagoon	Water pollution is presently being developed.
23. Nasty smell	C	·The same as above	At present, Pe'a and Folaha Sectors are already bad-smelling a little

Note 1: Evaluation Codes
- A: Big impact
- B: A little impact
- C: Unclear (needing further study to clarify)
- D: No or negligibly small impact (no need to discuss in IEE/EIA)

According to the overall evaluation shown in Table 5.2-8, the project will give big impacts on the following environmental factors: "lake/river", "coast/sea", "animals and plants" and "water pollution", and also a little impacts on "sanitation", "topography/geology" and "landscape". The impact on "nasty smell" is unclear. The causeway construction is not a direct cause of nasty smell, but it may cause the lowering of self-cleansing action of the lagoon due to de-activation of water circulation resulting in acceleration of smell.

In short, the causeway construction will restrict the interchange of water between the ocean and lagoon causing the aggravation of water quality and growing condition for the animals and plants inhabiting the lagoon. Also it may affect the living condition of the people.

Initial Environmental Examination for Route 2

In Mu'a Branch located in the east of the causeway, the quality of water will not be affected directly. But in Nuku'alofa Branch, the environmental impact is the same as that of Route 1. Furthermore, the mangrove in Talakite Island will be cut in the area of about 200 m in length along the route.

5.3 Recommendation for Further Study

While the construction of causeway will need a large amount of fund, the direct effect of the project will be only to shorten the travel time from Nuku'alofa to Makaunga by about 20 minutes. Thus, the direct benefit of the project might not be enough to compensate the construction cost. If so, the project is not economically justified unless big regional development is promising. The project feasibility should be re-examined from the economic and financial points of view.

Should the project be economically and financially justified, it should be ascertained prior to deciding the project implementation that the project is not detrimental to the environment and public health and welfare. In the initial environmental impact assessment, as described in 5.2, the environmental factors related to the project were identified. They are "sanitation", "topography/geology", "lake/river", "coast/sea", "animals and plants", "landscape", "water pollution" and "nasty smell". To esti-

mate the magnitudes of impacts on such factors as accurately as possible, the further study is proposed to be conducted including the following items:

(1) Study and Analysis of Present Condition

- Topography of the bottom of the lagoon
- Quantity and distribution of sediments on the bottom and their ingredient
- Volume of inflow/outflow water from/to the ocean and cycle time of water exchange (The cycle time, related to such factors as distance from the entrance, water depth, wind and inflow of water from the land, is analyzed by simulation technique using a fluid mechanics model.)
- Analysis of water quality and water pollution, especially on concentration of salt and contents of organic substances and inorganic substances such as nitrogen, silica and so on for at least one sample for each sector of the lagoon
- Kinds of animals and plants living in and around the lagoon and their distribution (mangrove, plankton, coral, algae, fishes, shellfishes, birds, etc.)
- Range of concentration of salt allowing the mangrove to live (Mangrove has three species by kind of water fitted; seawater, fresh water and their median.)
- Quality, quantity and entrances of waste water flowing into the lagoon
- Government's measures against inflow of sewage into the lagoon
- Traffic on the lagoon

(2) Forecast of Impacts of Construction Works

- Change in water quality and progress of pollution caused by disturbance of the bottom, placement of embankment materials, discharge of bilge from construction ships, etc.

(3) Forecast of Impacts after Completion

- Change in topography (impact on "topography/geology")
- Changes in water flow, cycle time of water exchange and condition of sediments on the bottom (impacts on "lake/river" and "coast/sea")
- Change in water quality resulting from the changes in water flow and cycle time of water exchange (impact on "water pollution")
- Progress of water pollution resulting from inflow of living and industrial waste water and solid waste (impact on "water pollution")
- Nasty smell and sanitary deterioration caused by the change in water quality (impacts on "sanitation" and "nasty smell")
- Impact on ecological system caused by the change in water quality, especially for mangrove, gray mullet and shellfishes (impacts on "animals and plants")
- If decrease of mangrove is predicted, secondary repercussions such as increase of nasty smell and decrease of marine resources, resulting from decline of mangrove's performance of purifying water and providing fishes and shellfishes with their living environment (impacts on "sanitation", "animals and plants", "water pollution" and "nasty smell")
- Study on landscaping by photomontage technique (impact on "landscape")

For the lagoon to be inherited in good environmental condition by future generations, it is strongly hoped to make a careful decision of the project implementation based on an appropriate environmental impact assessment.

Figure 5.3-1 shows the proposed study flow for the environmental impact assessment.

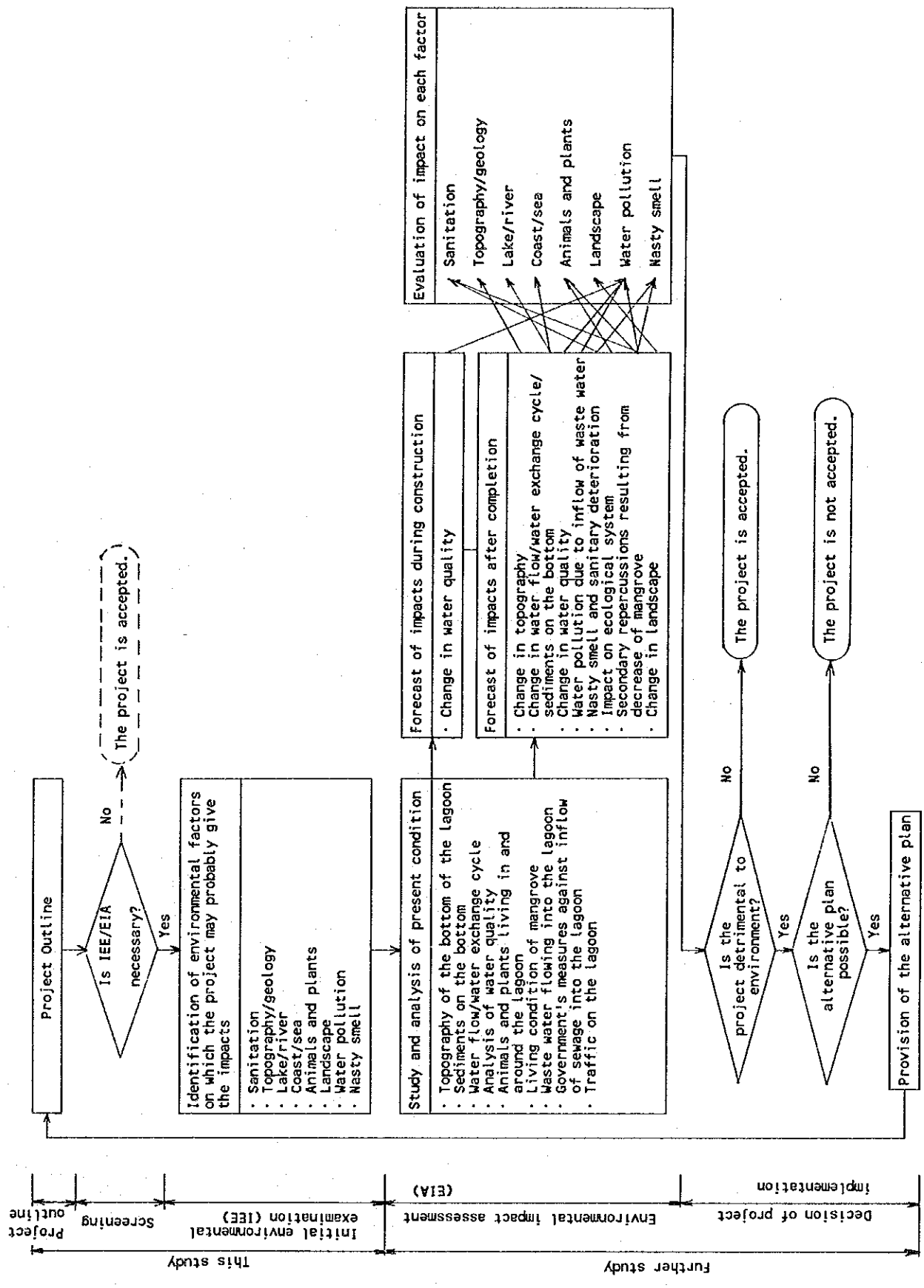


Figure 5.3-1 PROPOSED STUDY FLOW FOR ENVIRONMENTAL IMPACT ASSESSMENT

CHAPTER 6

PROJECT EVALUATION AND CONCLUSION

CHAPTER 6

PROJECT EVALUATION AND CONCLUSION

Present situation and problems and expected effects by the project are evaluated as summarized in Table 6-1.

Table 6-1 EXPECTED EFFECTS BY IMPLEMENTING THE PROJECT

Present Situation and Problems	Proposed Measures	Effects by the Project
1. The proposed roads are composed of arterial roads in the capital and the roads interconnecting the capital, port and airport. However, since they are in bad condition, their transport efficiency is low.	They are improved with asphalt concrete pavement.	Transport costs and travel time are expected to be much reduced. The beneficiaries are about 37,000 people.
2. The roads are paved with surface treatment or chip seal. These pavements are of low strength and easily damaged. Consequently, frequent repair works are required.	Durable pavement is constructed.	Maintenance costs are expected to be much reduced.
3. In some portions, drainage facilities are not adequately constructed causing a flood during heavy rain and an obstacle to traffic.	Drainage facilities are constructed where necessary and existing facilities are cleaned up.	Road surface is well drained resulting in no flood and preventing pavement from deterioration due to moisture.
4. The roads are dusty because of excess sand used in the construction of prime seal.	Construction method in which no dust is generated is applied.	Roads become clean without dust.
5. Equipment is insufficient in number and mostly aged, hampering a smooth implementation of road construction and maintenance.	Necessary and lacking equipment is procured.	By improving the equipment fleet of the Ministry of Works, implementation of road construction and maintenance is facilitated.
6. Socio-economic development is impeded by underdeveloped road network.	Road network in the Island is strengthened by improvement of the proposed roads and reinforcement of equipment fleet to facilitate other road projects.	Improvement of road network contributes to enhancement of the quality of life, acceleration of industrial development, and activation of socio-economic activities.

Since this Project will contribute to the enhancement of the quality of life and the development of industry as described above, it is concluded to be appropriate to execute this Project in Japan's Grant Aid Program. The Government of Tonga is considered to cope with the operation and management of the roads to be improved and the equipment to be procured under this Project.

APPENDIX 1

MEMBER LIST OF STUDY TEAM,

SURVEY SCHEDULE AND MEMBER LIST OF

OFFICIALS CONCERNED OF THE KINGDOM OF TONGA

APPENDIX 1

MEMBER LIST OF STUDY TEAM, SURVEY SCHEDULE AND MEMBER LIST OF OFFICIALS CONCERNED OF THE KINGDOM OF TONGA

1. MEMBER LIST OF STUDY TEAM

1.1 Basic Design Study Team

Mr. Hidenao HAYASHI	Leader, Advisory Officer, Engineering Department, Hanshin Expressway Public Corporation
Mr. Takamasa HAYASE	Grant Aid Programme, Deputy Director, Planning Division, Grant Aid Project Management Department, JICA
Mr. Kunihiko SAWANO	Project Manager, Katahira & Engineers International
Mr. Yoichi KIMURA	Road Planning, Chodai Co., Ltd.
Mr. Satoshi KOGAWA	Equipment Planning, Katahira & Engineers International
Mr. Yoshitaka YANAGISAWA	Environmental Assessment Katahira & Engineers International
Mr. Tatsuo TSUCHIGANE	Environmental Study Katahira & Engineers International

1.2 Draft Report Explanation Team

Mr. Hidenao HAYASHI	Leader, Advisory Officer, Engineering Department, Hanshin Expressway Public Corporation
Mr. Ichirou MUKAI	Project Coordination, Programme Officer, Second Basic Design Study Division, Grant Aid Study & Design Department, JICA
Mr. Kunihiko SAWANO	Project Manager, Katahira & Engineers International
Mr. Satoshi KOGAWA	Equipment Planning, Katahira & Engineers International

2. SURVEY SCHEDULE

2.1 Basic Design Study Team

No.	Date	Activities
1	1993 Sep. 30 (Thu)	• Messrs. SAWANO and KIMURA leave Tokyo.
2	Oct. 1 (Fri)	• Above two members arrive at Fiji. • Discussions at Embassy of Japan and JICA.
3	Oct. 2 (Sat)	• Above two members leave Fiji for Tonga. • Site survey (Sections 1, 7, 8 and 3).
4	Oct. 3 (Sun)	• Site survey (Sections 4, 5, 6 and 9). • Mr. KOGAWA leaves Tokyo.
5	Oct. 4 (Mon)	• Courtesy call at Ministry of Foreign Affairs (MFA), Central Planning Department and JOCV. • Mr. KOGAWA arrives at Tonga.
6	Oct. 5 (Tue)	• Explanation and discussion on Inception Report and questionnaires at Ministry of Works (MOW).
7	Oct. 6 (Wed)	• Collecting data at MOW.
8	Oct. 7 (Thu)	• Collecting data at Tonga Visitors Bureau and Tonga Meteorological Service. • Road condition survey (eastern area). • Equipment condition survey.
9	Oct. 8 (Fri)	• Collecting data at Statistics Department, Ministry of Lands, Survey & Natural Resources. • Road condition survey (central area). • Equipment condition survey.
10	Oct. 9 (Sat)	• Road condition survey (western area).
11	Oct. 10 (Sun)	• Review/analysis of collected data.
12	Oct. 11 (Mon)	• Meeting with local consultant on topographic survey and traffic survey. • Site inspection of quarries. • Mr. YANAGISAWA leaves Tokyo.
13	Oct. 12 (Tue)	• Evaluation on necessity and urgency of requested roads. • Messrs. HAYASHI & HAYASE leave Tokyo. • Mr. YANAGISAWA arrives at Fiji.

No.	Date	Activities
14	Oct. 13 (Wed)	• Review on equipment procurement plan. • Messrs. HAYASHI and HAYASE arrive at Auckland. • Mr. YANAGISAWA leaves Fiji for Tonga.
15	Oct. 14 (Thu)	• Environmental survey around Lagoon. • Messrs. HAYASHI and HAYASE leave Auckland for Tonga. • Internal Meeting.
16	Oct. 15 (Fri)	• Courtesy call at MFA, MOW and JOCV. • Site survey (Sections 1, 7, 8 and 3).
17	Oct. 16 (Sat)	• Site survey (Sections 4, 5, 6 and 9). • Internal Meeting.
18	Oct. 17 (Sun)	• Review/analysis of collected data.
19	Oct. 18 (Mon)	• Discussion on selection of study roads and equipment. • Collection of environmental data at Ministry of Lands, Survey and Natural Resources.
20	Oct. 19 (Tue)	• Drafting Minutes of Discussions. • Site inspection of crushing plant and quarry. • Collection of environmental data at Ministry of Fishery (MOF) and Ministry of Health. • Mr. TSUCHIGANE leaves Tokyo.
21	Oct. 20 (Wed)	• Discussion on Draft Minutes of Discussions with Director of MOW. • Site inspection of ADB assisted and Australian aided road projects. • Mr. TSUCHIGANE arrives at Tonga.
22	Oct. 21 (Thu)	• Signing of Minutes of Discussions. • Inspection of proposed site for crushing and screening plant. • Collection of environmental data at MOF and WHO.
23	Oct. 22 (Fri)	• Site inspection of Lagoon by boat. • Review/analysis of the collected data. • Courtesy call at JOCV.
24	Oct. 23 (Sat)	• Messrs. HAYASHI, HAYASE and KOGAWA leave Tonga for Fiji. • Above three members report to Embassy of Japan and JICA. • Meeting with local consultant on topographic survey.
25	Oct. 24 (Sun)	• Review/analysis of collected data. • Messrs. HAYASHI, HAYASE and KOGAWA leave Fiji for Tokyo.

No.	Date	Activities
26	Oct. 25 (Mon)	• Site inspection for investigation on pavement type and drainage facilities (Sections 1 and 7). • Initial Environmental Evaluation (IEE).
27	Oct. 26 (Tue)	• Site inspection for investigation on pavement type and drainage facilities (Sections 8, 3, 5, 6 and 9). • IEE.
28	Oct. 27 (Wed)	• Review of the results of topographic survey. • Messrs. YANAGISAWA and TSUCHIGANE leave Tonga.
29	Oct. 28 (Thu)	• Review of the results of topographic survey. • Mr. SAWANO leaves Tonga. • Messrs. YANAGIWASA and TSUCHIGANE arrive at Tokyo.
30	Oct. 29 (Fri)	• Review of the results of topographic survey. • Mr. SAWANO arrives at Tokyo.
31	Oct. 30 (Sat)	• Mr. KIMURA leaves Tonga.
32	Oct. 31 (Sun)	• Mr. KIMURA arrives at Tokyo.

2.2 Draft Report Explanation Team

No.	Date	Activities
	1994	
1	Feb. 12 (Sat)	● Mr. HAYASHI leaves Osaka. ● Messrs. MUKAI, SAWANO and KOGAWA leave Tokyo.
2	Feb. 13 (Sun)	● Mr. HAYASHI arrives at Auckland.
3	Feb. 14 (Mon)	● Messrs. MUKAI, SAWANO and KOGAWA arrive at Auckland. ● All members leave Auckland for Tonga.
4	Feb. 15 (Tue)	● Courtesy call at MFA and MOW.
5	Feb. 16 (Wed)	● Explanation and discussion on Draft Report at MOW. ● Courtesy call at JOCV.
6	Feb. 17 (Thu)	● Discussion on Draft Report at MOW. ● Preparation of Draft Minutes of Discussions.
7	Feb. 18 (Fri)	● Signing of Minutes of Discussions. ● Report to MFA.
8	Feb. 19 (Sat)	● Messrs. HAYASHI and MUKAI leave Tonga for Fiji. ● Above two members report to Embassy of Japan and JICA. ● Messrs. SAWANO and KOGAWA: supplemental site survey.
9	Feb. 20 (Sun)	● Messrs. HAYASHI and MUKAI leave Fiji for Sydney.
10	Feb. 21 (Mon)	● Messrs. HAYASHI and MUKAI leave Sydney for Tokyo. ● Messrs. SAWANO and KOGAWA: supplemental site survey.
11	Feb. 22 (Tue)	● Messrs. SAWANO and KOGAWA: supplemental site survey.
12	Feb. 23 (Wed)	● Messrs. SAWANO and KOGAWA leave Tonga for Auckland.
13	Feb. 24 (Thu)	● Messrs. SAWANO and KOGAWA leave Auckland.
14	Feb. 25 (Fri)	● Messrs. SAWANO and KOGAWA arrive at Tokyo.

3. LIST OF OFFICIALS CONCERNED OF THE KINGDOM OF TONGA

Ministry of Foreign Affairs

Mr. TU'A TAUMOEPEAU-TUPOU	Secretary for Foreign Affairs
Ms. LUPE ILAIU	Senior Assistant Secretary (Japan Desk)

Central Planning Department

Mr. PAULA LAVULO	Director of Planning
Mr. PAULO KAUTOKE	Deputy Director of Planning
Mr. HA'UNGA PETELO	Principal Economist (Aid Co-ordinator)
Ms. MELESEINI LOMU	Principal Economist (Sectoral)
Ms. LISIA MAHE	Economist (Infrastructure and Tourism)

Ministry of Works

Mr. SIONE TAUMOEPEAU	Director
Mr. ROBERT JENKINS	Chief Engineer
Mr. ISIKELI PULINI	Senior Works Officer
Mr. PAPANI TAUMOEFOLAU	Assistant Senior Engineer
Mr. SEVENITINI TOUMOU'A	Civil Engineer
Mr. KUPA TU'IVAI	Senior Mechanical Supervisor
Mr. VILIAMI MANU	Mechanical Supervisor

Tonga Visitors Bureau

Mr. SEMISI TAUMOEPEAU	Director of Tourism

Tonga Meteorological Service

Mr. PAEA HAVEA	Senior Meteorological Officer

Ministry of Lands, Survey and Natural Resources

Mr. UILOU SAMANI	Environmentalist
Mr. EDWIN TUPOU	Chief Surveyor
Mr. 'IKANI PRESCOTT	Surveyor

Ministry of Fisheries

Mr. 'ULUNGA FA'ANUNU	Fisheries Officer
Mr. YOSHIMASA EMOTO	Chief Advisor, Aquaculture Research and Development Project
Mr. SHIGEAKI SONE	Chief Advisor, Aquaculture Research and Development Project
Mr. KAZUO UDAGAWA	Chief Advisor, Aquaculture Research and Development Project

Ministry of Health

Mr. SANI WOLFGRAM	Health Planning Officer

Statistics Department

Mr. SIONE MOSA'ATI	Acting Government Statistician

W H O

Mr. TOSHIO AKIBA	Technical Officer

EMBASSY OF JAPAN IN FIJI

Mr. HIROYUKI OHNISHI	First Secretary
Mr. MAKOTO YAMASHITA	Second Secretary
Mr. YASUHIKO KAMATA	Third Secretary

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Mr. SHIRO KIUCHI

Mr. HAJIME WATANABE

JAPAN OVERSEAS COOPERATION VOLUNTEERS COORDINATOR

Ms. TOMOYO KOBATSU	Coordinator
Mr. RYUUJI SHISHIDO	Coordinator

APPENDIX 2

MINUTES OF DISCUSSIONS

1. Basic Design Study

MINUTES OF DISCUSSIONS
ON
THE BASIC DESIGN STUDY
ON
THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU
IN
THE KINGDOM OF TONGA

In response to a request from the Government of the Kingdom of Tong, the Government of Japan decided to conduct a basic design study on the Project for Road Improvement Works in Tongatapu (hereinafter referred to as the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Tonga a study team headed by Mr. Hidenao HAYASHI, Advisory Officer, Engineering Department, Hanshin Expressway Public Corporation and scheduled to stay in the country from the 2nd to the 30th of October, 1993.

The Team held a series of discussions on the Project with the officials concerned of the Government of Tonga and conducted a series of site survey at the study areas.

In the course of discussions and survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further works and prepare the Basic Design Study Report.

Nukualofa, the 21st October, 1993

H. Hayashi

Mr. Hidenao HAYASHI
Team Leader
Basic Design Study Team
JICA

Mr. Sione M. TAUMOEPEAU
Director
Ministry of Works

TONGA MINISTRY OF WORKS WORKS

ATTACHMENT

1. OBJECTIVE OF THE PROJECT

The objective of the Project is to improve roads in Tongatapu in order to contribute to socio-economic development of Tonga.

2. RESPONSIBLE MINISTRY AND IMPLEMENTING AGENCY

The responsible and implementing agency of the Project is the Ministry of Works.

3. SITES FOR ROAD IMPROVEMENT WORKS

The sites of the road improvement works would be selected from the list in the Annex 1.

4. REQUEST FOR ROAD EQUIPMENT BY TONGA SIDE

After a series of discussions, the items listed in Annex 2 have finally been requested by the Tonga side. However, the final contents of the Project will be decided after further studies.

5. INITIAL ENVIRONMENTAL EVALUATION FOR CAUSEWAY PLAN

Both parties have agreed that the construction of the causeway is excluded from the Project. Nevertheless, an Initial Environmental Evaluation will be made available by the Japanese team.

The Tonga side has assured that the Environmental Impacts on the lagoon will be minimized in implementing the causeway plan in future.

6. JAPAN'S GRANT AID PROGRAMME

The Tonga side has understood the system of the Japan's Grant Aid Programme explained by the Team.

7. NECESSARY MEASURES TO BE TAKEN BY TONGA SIDE

The Tonga side will take necessary measures listed in Annex 3 on condition that the Grant Aid by the Government of Japan is extended to the Project.

8. FURTHER SCHEDULE OF THE STUDY

(1) The consultants will proceed to further studies in Tonga until the 30th October, 1993.

14, 14.

(2) JICA will prepare a Draft Study Report in English, and dispatch a Draft Report Explanation Mission to Tonga for the purpose to explain and discuss its contents in January, 1994.

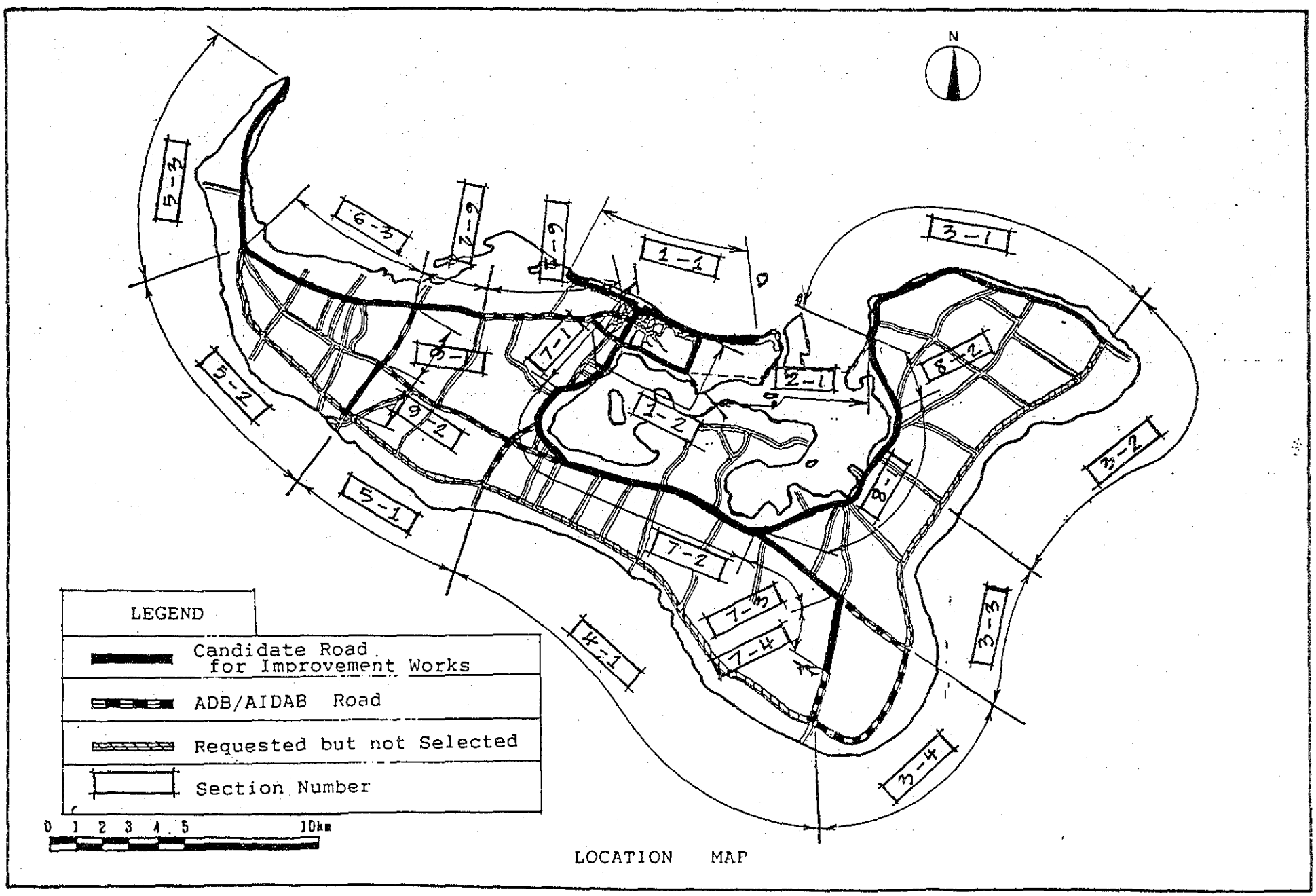
The Study Report will be completed and sent to Tonga in April, 1994.

Annex-1 List of Candidate Roads for Improvement Works

Section	Name of Road	Approximate Length in Km
1-1	Vuna Road	7.5
1-2	By-pass Road	5.6
3-1	Makaunga-Niutoua	10.6
5-3	Fo'ui-Ha'atafu	5.7
6-2	Sia'atoutai College-Fatai	2.7
6-3	Fatai-Fo'ui	6.7
7-1	Nuku'alofa-Koloua	4.5
7-2	Koloua-Malapo	10.6
7-3	Malapo-Jct.Taupi Road	3.7
7-4	Jct.Taupi Road-Airport	2.6
8-1	Malapo-Mu'a	7.0
8-2	Mu'a-Makaunga	2.6
9-2	Holoipepe-Houma	2.5

(See location map)

Id, Id



LOCATION MAP

Annex-2 List of Equipment (1/2)

Equipment	Specification	Q'ty	Remarks
Water Tank Truck	Loading cap. 8ton	1	
Motor Grader	Blade length 3.7m Engine rated 150 HP	2	
Vibration Roller	Weight 10ton	1	
Vibration Roller	Weight 0.7ton	1	
Plate Compactor	Weight 70kg	2	
Asphalt Distributor	Loading cap. 3 4m	1	
Dump Truck	Loading cap. 8ton	1	
Dump Truck	Loading cap. 8ton	2	With chip spreader
Dump Truck	Loading cap. 2ton	1	
Cargo Truck	Tail gate up-down type Loading cap. 4ton	1	
Pick-up Truck	Diesel engine 4x2, Double cabin	1	
Crushing and Screening Plant	Product cap. 50 60t/h Product 3 sizes	1	
Wheel Loader	Bucket cap.(heaped)2.7m	1	
Backhoe Excavator	Crawler type Bucket cap.(heaped)0.45m	1	With 800kg hydraulic breaker
Bulldozer	Weight 35 ton Engine rated 280HP	1	With ripper
Concrete Cutter	Cutting depth 100mm Engine rated 5HP	1	
Pneumatic Hand Breaker	Weight 8kg Length 450mm	2	With hose and hose-coupling
Air Compressor	Portable type Free air delivery 2.5m/min	1	

ld, ld

Annex-2 List of Equipment (2/2)

Equipment	Specification	Q'ty	Remarks
Asphalt Burner	Kerosene type	1	
Asphalt Sprayer	Kerosene heating type Kettle cap. 200 lit.	1	

Note: Spare parts included for the above equipment.

ld, ld

Annex-3 NECESSARY MEASURES TO BE TAKEN BY TONGA SIDE

1. To secure a lot of land necessary for the Project and to clear the site.

2. To provide enough space for construction, such as temporary offices, working areas, stock-yards and others.

3. To construct detours at the sites prior to the commencement of the construction, if necessary.

4. To dump waste materials arising from existing facilities in the manner not to cause adverse environmental impact.

5. To provide necessary facilities for implementing the Project, such as electricity, water supply, drainage, telephone and other incidental facilities.

6. To ensure prompt unloading and customs clearance at the port of disembarkation in Tonga and internal transportation therein of the products purchased under the Grant Aid.

7. To exempt Japanese nationals engaged in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in Tonga with respect to the supply of the products and services under the verified contracts.

8. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such facilities as may be necessary for their entry into Tonga and stay therein for the performance of their work.

9. To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid.

10. To provide necessary permissions, licenses and other authorizations for carrying out the Project.

11. To bear two kinds of commissions to the Japanese foreign exchange bank for the banking services, based upon the "Banking Arrangement", namely, the advising commission of the "Authorization to Pay" and payment commission.

12. To bear all the expenses, other than those to be borne by the Grant Aid.

2. Draft Report Explanation

MINUTES OF DISCUSSIONS ON THE BASIC DESIGN STUDY

ON

THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU

IN

THE KINGDOM OF TONGA

(EXPLANATION ON A DRAFT REPORT)

In October, 1993, the Japan International Cooperation Agency (JICA) dispatched the Basic Design Study Team on the Project for Road Improvement Works in Tongatapu (hereinafter referred to as "the Project") to Tonga, and through discussions, field survey, and examination of such results in Japan, has prepared a Draft Report of the Study.

In order to explain and to consult to the Tonga side on the components of the Draft Report, JICA sent to Tonga a Draft Report Explanation Team, which is headed by Mr Hidenao HAYASHI, Advisory Officer, Engineering Department, Hanshin Expressway Public Corporation, and is scheduled to stay in the country from the 14th to the 23rd of February, 1994.

As a result of discussions, both parties have confirmed the main items described on the attached sheets.

Nuku'alofa, the 18th February, 1994

H. Hayashi
.....

Mr Hidenao HAYASHI
Team Leader
Basic Design Study
Draft Report Explanation Team
JICA

.....

Mr Sione M. Taumoepeau
Director
Ministry of Works

MINISTRY OF WORKS TONGA WORKS

A T T A C H M E N T

1. Components of Draft Report

The Tonga side has agreed and accepted in principle the contents of the Draft Report prepared by the Team.

2. Japan's Grant Aid System

The Tonga side has understood the system of the Japan's Grant Aid Programme explained by the Team.

3. Necessary Measures to be taken by the Tonga Side

The Tonga side will take the necessary measures described in Annex-1 for smooth implementation of the Project, on condition that the Grant Aid by the Government of Japan is extended to the Project.

4. Operation of the Equipment provided under the Project

The Tonga side has informed the Japanese side that there are enough number of concretely planned road construction and rehabilitation projects in the next few years. Therefore, Tonga side has assured the Japanese side that the equipment provided under the Japan's Grant Aid would be used for such Projects.

5. Result of the Initial Environmental Evaluation for Causeway Plan

The Tonga side has expressed that the result of the Initial Environmental Evaluation studied by the Team will be taken into their consideration in making plan for the Causeway in future.

6. Further Schedule

The Team will prepare a Final Report and send it to the Tonga side by May, 1994.

ANNEX - I

NECESSARY MEASURES TO BE TAKEN BY TONGA SIDE

1. To secure a lot of land necessary for implementing the Project and to clear the site;

2. To provide enough space for construction, such as temporary offices, working areas, stock-yards and others;

3. To construct detours at the sites prior to the commencement of the construction, if necessary;

4. To dump waste materials arising from existing facilities in the manner not to cause adverse environmental impact;

5. To provide necessary facilities for implementing the Project, such as electricity, water supply, drainage, telephone and other incidental facilities;

6. To ensure prompt unloading, customs clearance at the port of disembarkation in Tonga and prompt internal transportation therein of the products purchase under the Grant Aid;

7. To exempt Japanese nationals engaged in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in Tonga with respect to the supply of the products and services under the verified contracts;

8. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry into Tonga and stay therein for the performance of their work;

9. To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid;

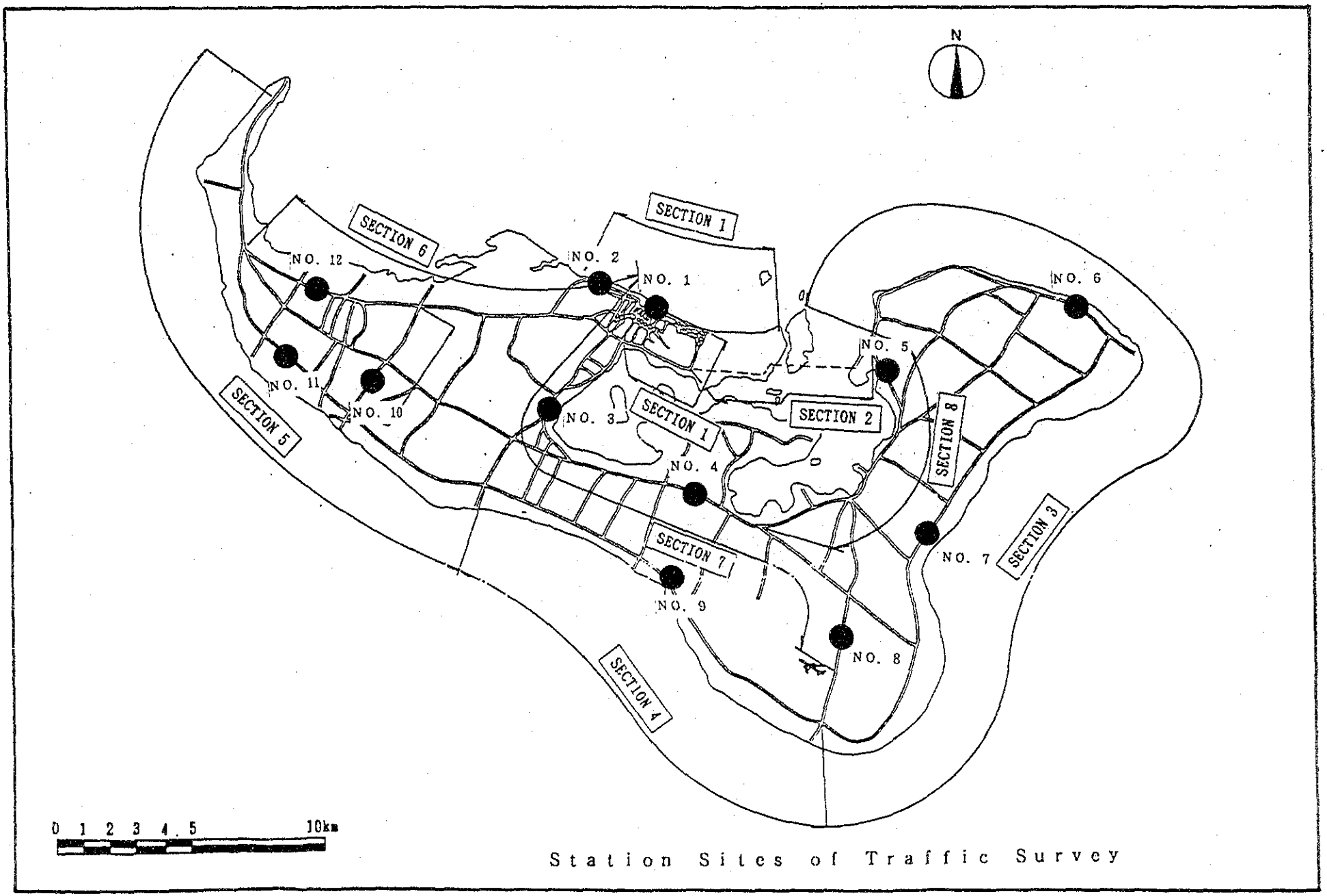
10. To provide necessary permissions, licences and other authorizations for carrying out the Project;

11. To bear two kinds of commissions to the Japanese foreign exchange bank for the banking services, based upon the "Banking Arrangement", namely, the advising commission of the "Authorization to Pay" and payment commission; and

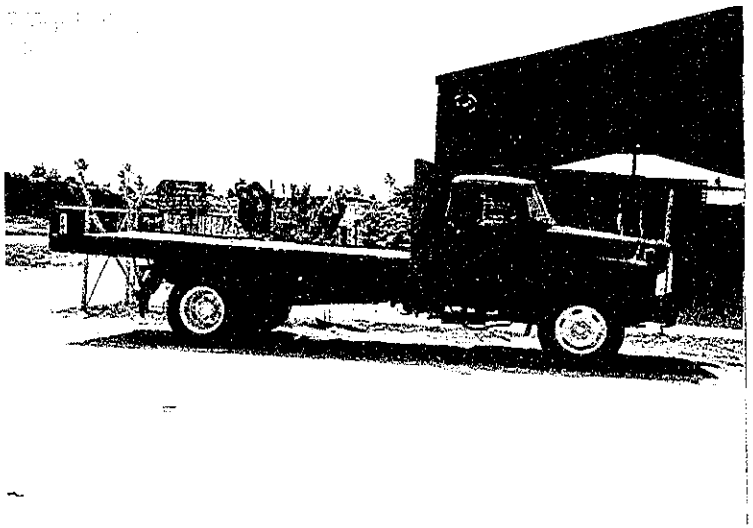
12. To bear all the expenses, other than those to be borne by the Grant Aid.

APPENDIX 3

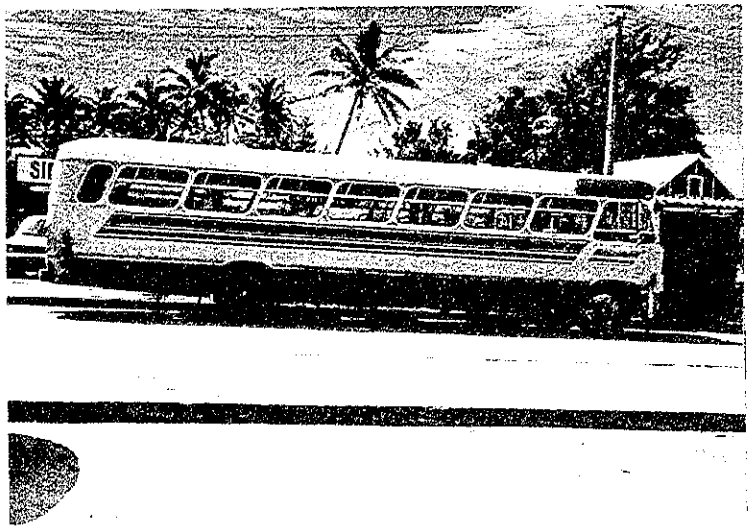
TRAFFIC SURVEY DATA



Station Sites of Traffic Survey

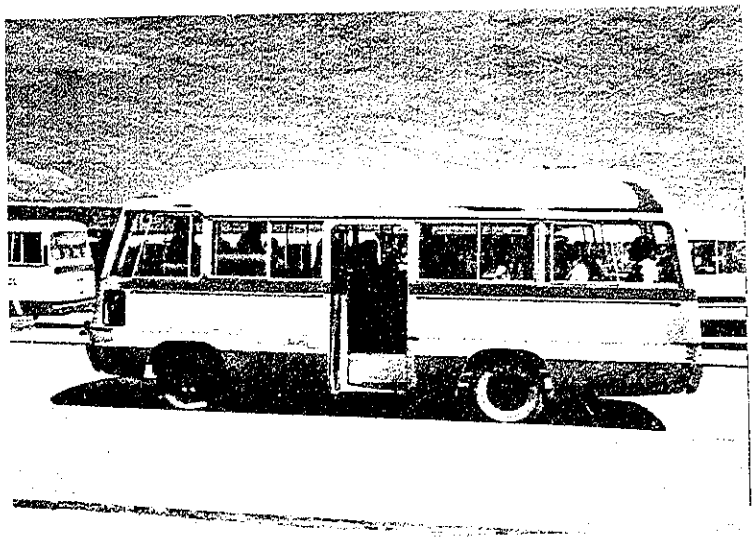


Truck heavy



Bus heavy

Truck light



Bus light

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 1 Road Name : VUNA Rd Date: 19/10/93

Direction : from MAUFANGA to TOWN Weather: Rainy

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy	2		2	1		3	2	4	1	4	28	7	54
Truck Light	5	13	11	47	45	43	50	30	41	38	41	20	384
Horse & Cart													
Bus Heavy				2					4		1		7
Bus Light	2	2		2	1		2		3	1	1	1	15
Car	58	158	343	260	276	260	275	294	295	275	270	231	2995
Motor Cycle	2	12	9	13	2	4	10	9	5	5	10	11	92
Tractor									1				1
Others													
Total	69	185	365	325	324	310	339	337	350	323	351	270	(2) * 3548

[4080]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 1 Road Name : VUNA Rd Date: 19/10/93

Direction : from TOWN to MAUFANGA Weather: Rainy

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy	1	2	1	3	3	1	5	3	2	3	3	2	29
Truck Light	5	15	45	40	51	48	42	42	33	40	39	10	410
Horse & Cart													
Bus Heavy				2		2		2		1			7
Bus Light		1			3	1	1		1			3	10
Car	49	153	285	96	160	180	249	210	213	220	240	177	2232
Motor Cycle	5	6	17	10	7	5	18	4	5	4	8	1	90
Tractor													
Others													
Total	60	177	348	151	224	237	315	261	254	268	290	193	(2) * 2778

[3195]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 2 Road Name : VUNA Rd Date: 20/10/93

Direction : from EAST to WEST Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy			1	1	1		1		1	1			6
Truck Light	3	3	6	4	3	1	6	1	3	3	2	1	36
Horse & Cart													
Bus Heavy													
Bus Light											1		1
Car	9	14	27	11	17	22	20	25	25	27	24	18	239
Motor Cycle	1	3	9			1	1	2		1	1		19
Tractor													
Others													
Total	13	20	43	16	21	24	28	28	29	32	28	19	(2) * 301

[346]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 2 Road Name : VUNA Rd Date: 20/10/93

Direction : from WEST to EAST Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy			1	1	1						1		4
Truck Light	3	3	6	4	3	1	6	1	3	3	2	1	36
Horse & Cart					1								1
Bus Heavy													
Bus Light											1		1
Car	12	12	26	12	20	15	13	24	20	32	22	23	231
Motor Cycle			6	3		2	2			1	3	1	18
Tractor													
Others													
Total	15	15	39	20	25	18	21	25	23	36	29	25	(2) * 291

[335]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 3 Road Name : TAUFAAHAU Rd Date: 21/10/93

Direction : from RURAL AREA to TOWN Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy	2	7	7	11	11	16	7	13	13	15	19	7	128
Truck Light	23	92	84	74	68	51	50	43	53	60	78	59	735
Horse & Cart													
Bus Heavy		9	6	2	1	1	4	1	3	6	4		37
Bus Light	10	40	31	24	22	19	18	19	32	36	30	9	290
Car	63	210	323	174	143	146	115	133	205	231	185	140	2068
Motor Cycle	3	5	8	5	5	1	2	1	3	2	4		39
Tractor				1	3	2		1	1	1	2	5	16
Others			1					1	1	1			4
Total	101	363	460	291	253	236	196	212	311	352	322	220	(5) * 3317

[3815]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 3 Road Name : TAUFAAHAU Rd Date: 21/10/93

Direction : from TOWN to RURAL AREA Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy		5	11	20	16	7	15	7	18	15	21	12	147
Truck Light	23	42	88	80	71	51	60	98	85	75	124	116	913
Horse & Cart													
Bus Heavy		3	5	3	2	1			1	5	10	3	33
Bus Light	6	30	30	25	23	17	35	27	25	40	29	25	312
Car	63	109	195	177	150	155	136	185	176	183	261	318	2108
Motor Cycle	2	1	5	5	3	3	1	3	5		1		29
Tractor	1		3	3	1	2		1	1	3		3	18
Others			1	2	2	1							6
Total	95	190	338	315	268	237	247	321	311	321	446	477	(5) * 3566

[4101]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 4 Road Name : TAUFAAHAU Rd Date: 22/10/93

Direction : from TOWN to VAINI Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy	1	1	1	7	4	5	7	4	7	3	7	4	51
Truck Light	29	34	27	28	35	32	57	23	40	59	57	49	470
Horse & Cart													
Bus Heavy		1	12	4	2		5	2	4	3	2	13	48
Bus Light	1	8	8	7	10	10	9	6	9	11	9	16	104
Car	40	45	39	40	50	40	69	50	60	99	84	184	800
Motor Cycle				1	1	1			4		2	3	12
Tractor		3	3	2					1	1	1		11
Others													
Total	71	92	90	89	102	88	147	85	125	176	162	269	(7) * 1496

[1720]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 4 Road Name : TAUFAAHAU Rd Date: 22/10/93

Direction : from VAINI to TOWN Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy	3	3	4	4	8	4	5	5	6	3	2	4	51
Truck Light	27	64	44	37	29	28	54	36	31	46	27	34	457
Horse & Cart													
Bus Heavy		8	7	1	3	3	3	1	5	13	6		50
Bus Light	7	14	10	9	9	9	9	12	13	11	9	2	114
Car	54	138	102	52	45	68	72	40	74	81	48	84	858
Motor Cycle	1	3	2	3			1	1	1		1		13
Tractor	1	1	3		2				2			1	10
Others													
Total	93	231	172	106	96	112	144	95	132	154	93	125	(7) * 1553

[1786]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 5 Road Name : TAUFAAHAU Rd Date: 19/10/93

Direction : from NUKUALOFA to TALAFOOU Weather: Rainy

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy			1	8	1		1	1	3	1	4	6	26
Truck Light	3	7	9	11	15	7	11	5	10	11	14	30	133
Horse & Cart													
Bus Heavy		4	3		2		2		1	1	1	8	22
Bus Light	1	1	4	2	5	2	3	3	2	2	2	2	29
Car	7	12	5	11	11	14	11	8	10	9	24	30	152
Motor Cycle										5	2		7
Tractor				1									1
Others							1			1	1		3
Total	11	24	22	33	34	23	29	17	26	30	48	76	(13) * 373

[429]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 5 Road Name : TAUFAAHAU Rd Date: 19/10/93

Direction : from TALAFOOU to NUKUALOFA Weather: Rainy

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy				1	2	3			1	3	1	4	15
Truck Light	3	7	13	9	9	7	10	5	8	7	10	21	109
Horse & Cart													
Bus Heavy		4		1				1	1	2	2	4	15
Bus Light	1	7	2	3	5	2	3	2		1	3	1	30
Car	5	22	23	13	8	10	7	9	11	17	11	23	159
Motor Cycle							1	1		2	1	2	7
Tractor						1					1		2
Others			1										1
Total	9	40	39	27	24	23	21	18	21	32	29	55	(9) * 338

[389]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 6 Road Name : HAAMONGA Rd Date: 20/10/93

Direction : from NIUTOUA to NUKUALOFA Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy												1	1
Truck Light	2	8	1	1	2			2	1	1	2	6	26
Horse & Cart					1								1
Bus Heavy	2	1	3		1	2	2	1		2		3	17
Bus Light	1				1	1							3
Car	4	8	5	2	1	2	9	2	5	2	9	10	59
Motor Cycle	1									1			2
Tractor													
Others													
Total	10	17	9	3	6	5	11	5	6	6	11	20	(17) * 109

[125]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 6 Road Name : HAAMONGA Rd Date: 22/10/93

Direction : from NIUTOUA to NUKUALOFA Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy								1					1
Truck Light	5	1	5	3	4	2		3	2	1	6	8	40
Horse & Cart													
Bus Heavy	3	1	2	2	2	1	1	1		2		3	18
Bus Light					1							1	2
Car	1	3	2	3	4	2	3	5	3	4	7	16	53
Motor Cycle	2	1							1		2		6
Tractor													
Others													
Total	11	6	9	8	11	5	4	10	6	7	15	28	(16) * 120

[138]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 7 Road Name : HAVELULIKU Rd Date: 21/10/93

Direction : from NIUTOUA to LEVENGATONGA Weather: Sunny

Hour	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	Total
Truck Heavy										1			1
Truck Light			1		2			1	3	1	3	3	14
Horse & Cart													
Bus Heavy													
Bus Light	1			1				1	2	2		1	8
Car			1		1	1	2	2	8	2	3	5	25
Motor Cycle												1	1
Tractor								1					1
Others													
Total	1		2	1	3	1	2	5	13	6	6	10	(2) * 50

[56]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 7 Road Name : HAVELULIKU Rd Date: 21/10/93

Direction : from LEVENGA TONGA to NIUTOUA Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy													
Truck Light	2	2	1	2	2	1	1	1	2		4	1	19
Horse & Cart													
Bus Heavy													
Bus Light	1	1							1	1		1	5
Car	1			2	1		6	5		5		7	27
Motor Cycle									1			1	2
Tractor													
Others													
Total	4	3	1	4	3	1	7	6	4	6	4	10	(0) * 53

[61]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 8 Road Name : TAUPI Rd Date: 22/10/93

Direction : from NORTH to SOUTH Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy				2	1		2				1		6
Truck Light	7	11	6	6	3	3	3	3	8	7	14	11	82
Horse & Cart													
Bus Heavy			1		1		1	1	1			2	7
Bus Light	1						1					1	3
Car	18	13	3	11	15	15	22	10	18	17	29	28	199
Motor Cycle			1		1				2			1	5
Tractor		1		2					1		2		6
Others					1						1		2
Total	26	25	11	21	22	18	29	14	30	24	47	43	(5) * 310

[357]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 8 Road Name : TAUPI Rd Date: 22/10/93

Direction : from SOUTH to NORTH Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy				2	1	2			1		1		7
Truck Light	5	20	9	10	2	8	6	5	3	10	4	12	94
Horse & Cart													
Bus Heavy		2	2			1							5
Bus Light	1										1		2
Car	13	36	14	8	9	25	21	15	16	15	17	34	223
Motor Cycle				1							1	1	3
Tractor				3							1	2	6
Others					2								2
Total	19	58	25	24	14	36	27	20	20	25	25	49	(4) * 342

[393]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 9 Road Name : LIKU Rd Date: 19/10/93

Direction : from EAST to WEST Weather: Rainy

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy							1						1
Truck Light			1						2			3	6
Horse & Cart													
Bus Heavy													
Bus Light													
Car	3	2	2	5	2		3	3	1		1	5	27
Motor Cycle				1						1	2		4
Tractor													
Others													
Total	3	2	3	6	2		4	3	3	1	3	8	(3) * 38

[44]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 9 Road Name : LIKU Rd Date: 19/10/93

Direction : from WEST to EAST Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy													
Truck Light			2	3	1		1		1			1	9
Horse & Cart													
Bus Heavy													
Bus Light													
Car	1	4	3	4	2	3		1	2	1	4	6	31
Motor Cycle		1			2	1				1			5
Tractor											1		1
Others													
Total	1	5	5	7	5	4	1	1	3	2	5	7	(0) * 46

[53]**

* The ratio of heavy vehicle by percentage

** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)

TRAFFIC COUNT FORM

BASIC DESIGN STUDY ON THE PROJECT FOR ROAD IMPROVEMENT WORKS IN TONGATAPU IN THE KINGDOM OF TONGA

Station No: 10 Road Name : VAEA Rd Date: 20/10/93

Direction :from SOUTH to NORTH Weather: Sunny

Hour	6－7	7－8	8－9	9－10	10－11	11－12	12－13	13－14	14－15	15－16	16－17	17－18	Total
Truck Heavy											1		1
Truck Light	5	6	5	6	3	3	6	2	6	5	2	8	57
Horse & Cart			1		1								2
Bus Heavy													
Bus Light													
Car	4	11	7	1	5	2	4	3	2	1	1	3	44
Motor Cycle													
Tractor				1						1			2
Others													
Total	9	17	13	8	9	5	10	5	8	7	4	11	(1) * 106

[122]**

* The ratio of heavy vehicle by percentage
** Dairy traffic volume converted by the ratio of dairy traffic to daytime traffic (r=1.15)