will break in the approach portion of the fisheries channel at mean low water level.

However, rate of occurance of such waves will be rare only several times per year and even the fishing boats will be able to pass smoothly through the approach portion of the channel after waiting only about 3 hours for mean sea level.

In the case of the waves which are not from a southwestern direction, the fishing boats will be able to safely sail into the fisheries channel because waves will not break in the enlarged center area of its approach portion.

(iv) Navigation Aids

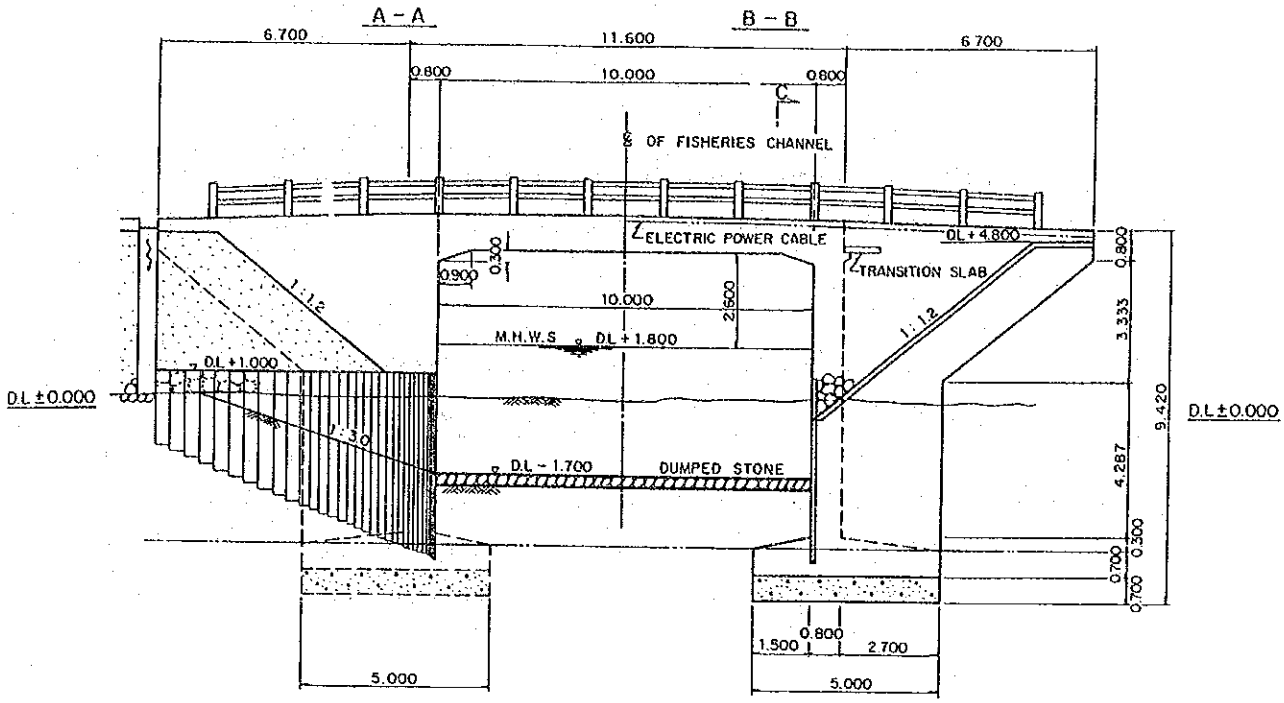
Navigation aids to show the location of the channel will be installed at 2 locations near the entrances of each side (Ocean & lagoon) and at 4 locations along standard portion of the channel. These navigations aids will consist of pair of steel pales (one painted red and one painted green). Refer to Drawing No. 4/5.

(3) Causeway Bridge

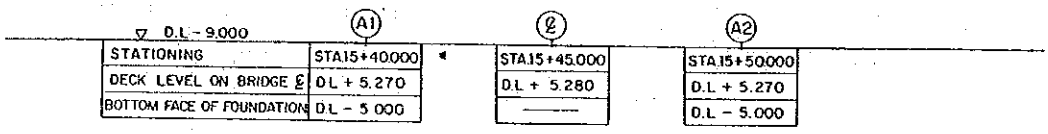
The end and side elevation views of bridge are shown in Fig. 4-6. In preparing the design, the following considerations were made.

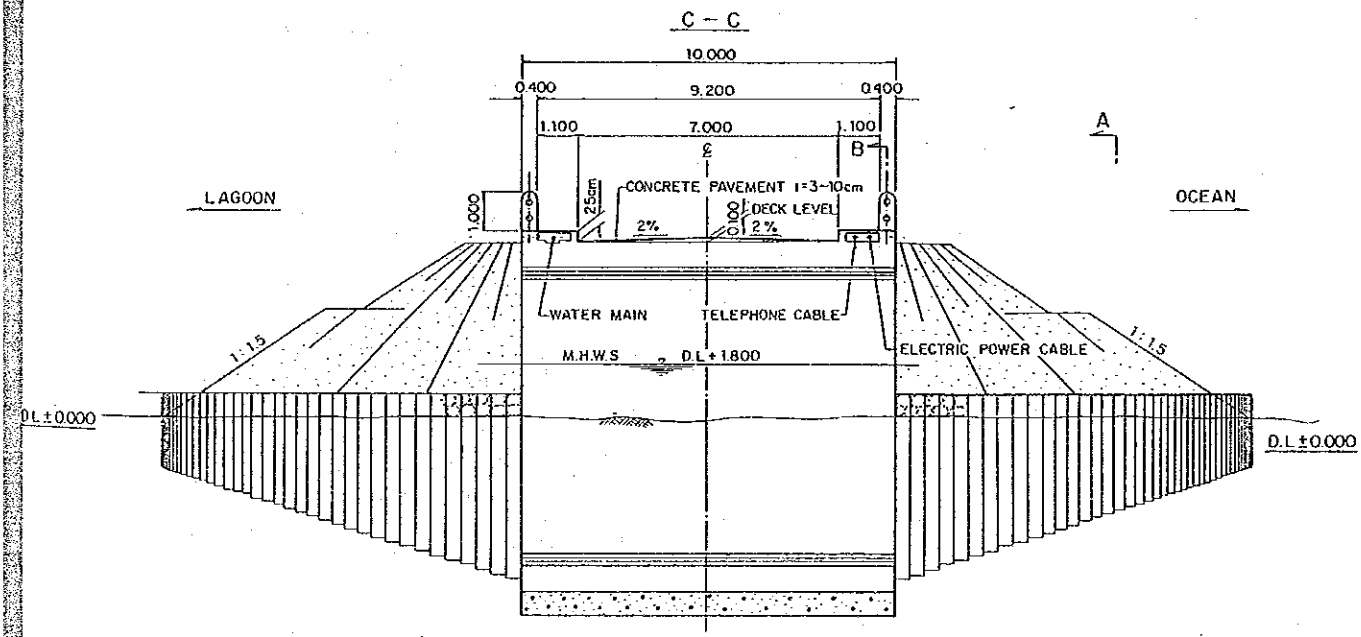
(i) The water pipe and phone/electric cables will be installed under the sidewalks with the water pipe being on the lagoon side and telephone and electric cables on the ocean side.

(ii) The bridge deck is paved with portland cement concrete.



SIDE ELEVATION OF BRIDGE





END ELEVATION OF BRIDGE

Figure 4-6 Causeway Bridge

(iii) The approach slabs, 1 m long for the width of sidewalks, will be constructed to protect the pipe and cables.

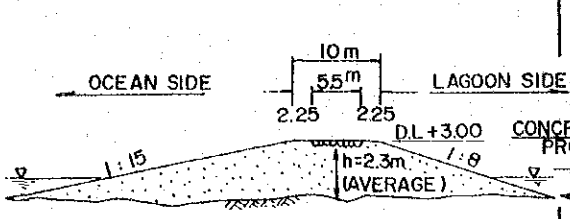
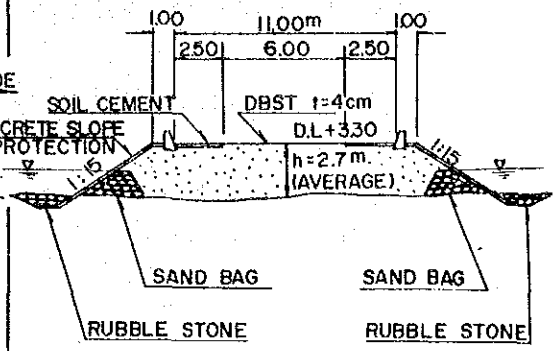
(iv) Portal Rahmen-type of slab bridge was designed as the most economical form of bridge type.

(v) The aggregate available for concrete contains much salt. In order to retard corrosion of the reinforcing bars by salt, the reinforced concrete was designed with covering of more than 7 cm.

(4) Comparison between Requested Plan and the Design

Table 4-4 shows the finalized plan of the causeway, fisheries channel and bridge in this basic design as compared with that which was listed in the request from the Government of the Republic of Kiribati.

Table 4-4 Comparison between Requested Plan and Finalized Plan of Basic Design

	Requested Plan	Finalized Plan in Basic Design
Causeway	 Estimated Embankment Volume = 285,000 m^3	 Estimated Embankment Volume = 144,000 m^3
Fisheries Channel	Width = 5m Min. depth=-0.3m(MLWS+0.09m) Dredging will be executed by available equipment in Kilibati.	Width = 10m Bottom Elevation=DL-1.7m(lower than CDL) Slope = 1:3 Dredging will be executed by backhoe or clamshell on pontoon.
Bridge	Reinforced concrete bridge Width = 10.0m Span = 5.0m Min. Clearance=1.5m above MHWS (DL+1.8m), Girder bottom height =DL+3.5m,Deck elevation=DL+4.0m	Portal Rahmen Type RC bridge Width = 10.0m Span = 10.0m Min. Clearance=2.60m above MHWS (DL+1.8m), Girder bottom height =DL+4.4m,Deck elevation=DL+5.28m
Selection of borrow Areas	(1) 90,000m^3 from borrow area adjacent to causeway by pushing, filling and compaction by bulldozer (Borrow Area B). (2) 195,000m^3 from flat lagoon between Bairiki port and *MTS channel in Betio (Borrow Area C) (3) Excavation depth shall be limitted to 2.5m so as not to cause scouring of the reef.	(1) 75,000m^3 (excavation depth =1.5m) from northern reef on Betio side and 75,000m^3 (excavation depth =1.5m) from southern reef on Bairiki side (Borrow areas B and C)

* Marine Training School

4.4 Construction Program

4.4.1 Selection of Borrow Areas

The embankment material for the construction of causeway can be obtained from the 3 borrow areas shown in Fig. 4-7.

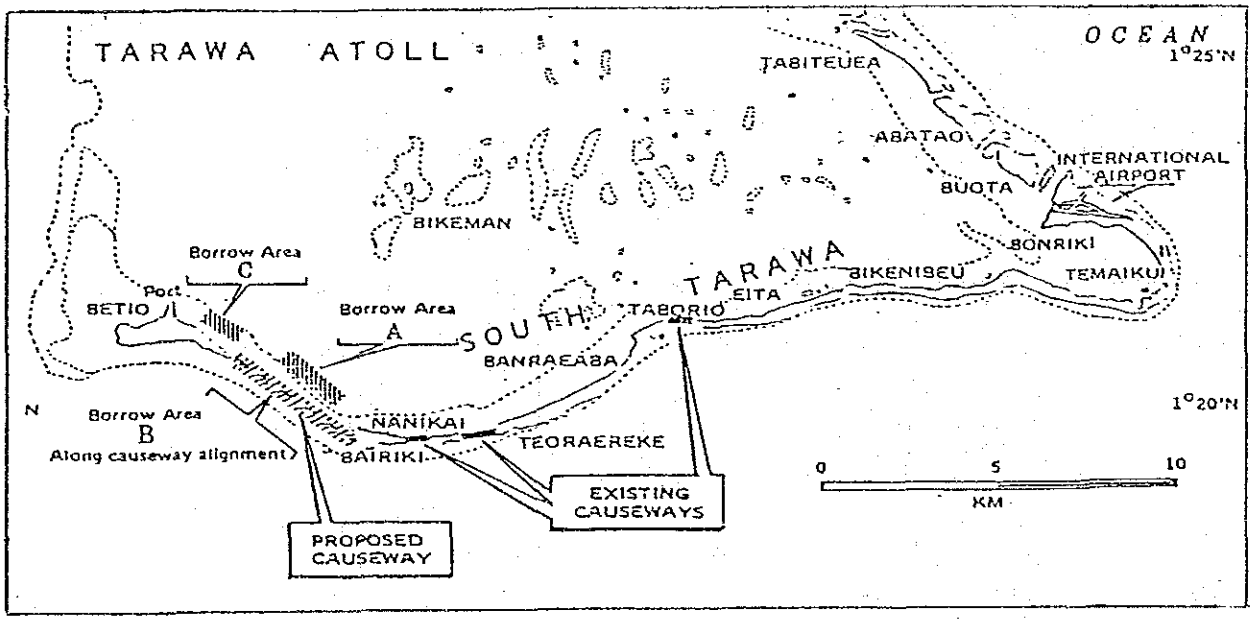


Figure 4-7 Location of Borrow Areas

The results of the comparison of these borrow areas in regard to the required type of equipment for excavation, hauling, etc. are listed in Table 4-5. Borrow Areas B and C were selected as the most appropriate ones.

Table 4-5 Comparison of Borrow Areas

	Borrow Area		
	A	B	C
Material	Sand/Rocks	Sand/Rocks	Sand/Rocks
Condition of Deposit	Seabed Coral Rock	Reef	Reef
Collection Method	By grab dredger or pump dredger	By bulldozer/ backhoe	By backhoe
Hauling Distance	0.5-3.0 km	0.1-2.0 km	3 km
Hauling Method	By barge or pipeline	By bulldozer or dump truck	By dump truck
Cost for Collection and Hauling	High	Low	Medium
Problems	Collection of material is difficult and costly because of mixed in rock block	Shallow and wide excavation is required to keep reef from erosion	Same as B
Total Evaluation	Fair	Excellent	Good

4.4.2 Investigation of Unexploded Ordnance

At the selected Borrow Areas B and C. The possible existence of unexploded ordnance was investigated by metal ditector at selected Borrow Areas B and C.

(1) Results of Investigation

Borrow Area B (adjacent area to the proposed causeway on the Bairiki side) is about 3 km away from Betio where the center of battlefield was; however no bombs or shells were found in the area.

Borrow Area C is situated on the reef next to the Betio side and in this area many responses were obtained by metal detector. The responses were mostly small except for one location. Further observations made at low water showed that most of the substances were iron, pieces of drum, wire and empty cans on the ground surface of the reef. No metal substance could be confirmed as being underground.

(2) Further Investigation Required

In Borrow Area C, there were responses which indicated possible existence of large metal substances. Further detailed investigation should be made before construction starts to check an such unconfirmed substances.

In case unexploded ordnance is found during construction, they should be buried underground again and such area should be abandoned for material collection, with proper authorities being informed.

4.4.3 Availability of Local Construction Resouces

The following conditions of construction business including available equipment, material and manpower should be taken into consideration when programing construction activities.

(1) Construction equipment

Usual construction equipment used on land are owned by the Plant and Vehicle Unit of the Government of the Republic of Kiribati (refer to Appendix 4-10) and they are available on a lease basis. However, they include many old and poorly maintained items of equipment and thus careful checking about their operating condition will be required before usage. The Plant and Vehicle Unit owns such equipement as dump trucks, bulldozers and concrete mixers which could be used for the Project, but it has no excavating equipment such as backhoes.

(2) Cargo handling equipment in Betio port

The Shipping Corperation, which is under the direct control of the Government owns a 100HP tugboat and a 60-ton capacity pontoon. Private companies also have similar equipment and they are available on lease. The maximum capacity of derick cranes at Betio port is 25 ton.

(3) Construction materials

Most of the construction materials are imported from abroad except for embankment material, concrete aggregate, rocky material, sand and water. In Kiribati, most of import goods are handled by the Supply Division, a branch of the Ministry of Finance and the price of such goods is uniform throughout the country.

The imported goods initially enter into Tarawa and are then distributed to the other areas of the country. The prices in Tarawa are comparatively high taking into account the transportation of imported goods. The import goods handled by the Supply Division are usually products from Japan, Australia and New Zealand.

Gasoline, kerosene and diesel oil are handled by the Mobil Oil Agency, an semi-government body of the Ministry of Works and Energy. The price for these item varies area by area.

The coral reef near the Project site is abundant in coral sand which can be used as fine aggregate. Aggregate for porland cement concrete and asphalt concrete is produced by the crushing plants of the Public Works Department at Bonriki Airport area and they can be purchased. These aggregates are made of coral rock blocks and their strength is not high. Stone material for wire mesh gabions can also be obtained at the Bonriki Airport area; however, it is difficult to get large quantities due to poor access conditions.

Rainwater stored and supplied through water supply pipe can be used for production of portland cement concrete.

(4) Labor

An abundant labor force is available in Tarawa. Skilled and unskilled labor can be hired through all area of Tarawa. Drivers and operators for common equipment such as bulldozers and maintenance equipment can be employed in the country. However, there are few experienced operator for such equipment as backhoes.

4.4.4 Construction Methods and Material/Equipment Plan

(1) Number of workable hours and workable days

The working conditions in the Project area are affected by the rise and fall of the tide. During certain hours at low tide, equipment can be operated on the surface of the reef in the areas having higher elevations. Based on the records of daily changes in tide levels, the number of workable hours in one day was estimated at 4.5 hours (during daylight period of 6:00 A.M. - 6:00 P.M.) when the tide is lower than DL + 0.80 m. The number of workable days in a month was estimated at 22 days by deducting Sundays and national holidays (which average about 5 days/month) as well as non-workable days due to stormy weather (expected to average 3 days/month).

Table 4-6 Estimated Workable Hours and Workable Days for Major Work Items

Work Item	Workable Hours per Day	Workable Days per Month
Earth	4.5	22
Concrete	8.0	22
Pavement	8.0	22
Channel	4.5/8.0	22
Bridge	8.0	22

(2) Construction Methods for the Causeway

The total length of the causeway shall be divided into 2 sections, the Betio side and the Bairiki side. The spreading and compaction of embankment material shall be executed

from both ends of the causeway to its center in the two sections. The work sequence shall be as follows:

i) Excavation of embankment material from borrow area
ii) Transportation of embankment material to the job site
iii) Placement of sand bags
iv) Spreading and compaction of embankment material
v) Excavation at each toe of embankment
vi) Slope protection
vii) Toe protection using rubble stones
viii) Pavement

Embankment material shall be transported by dump trucks and spread by grader and compacted by rollers. Prior to placing the embankment material, sand bags shall be laid along the toe portions of the embankment to keep the embankment material from being washed away by the tidal currents. Sand bags shall be piled up from the seabed to an elevation of DL + 1.8 m. After completion of the embankment to an elevation of DL + 3.0 m, slope protection consisting of a concrete mat shall be constructed by means of a concrete pump car.

(3) Construction Methods for the Fisheries Channel

The existing ground level along the proposed fisheries channel is at DL + 0.23 m on an average at the ocean side of the causeway and DL + 0.4 m on the lagoon side.

In the area near the causeway embankment which has a higher ground level, the channel excavation shall be executed by backhoe. It is estimated that about two-thirds of the total channel excavation shall be performed by this method. The excavated sand and gravel shall be used as embankment fill material for constructing the causeway.

In the areas having a lower ground level, the remaining one-third of the total volume shall be excavated by using a

clamshell on a pontoon floating on the sea. The excavated sand and gravel obtained from this method shall be wasted in the area adjacent to where channel is being excavated.

The coral rock at the edge of the reef on the ocean and lagoon sides shall be loosened by blasting and then removed by the clamshell method.

In the area where the proposed channel will cross the existing electric cable, telephone cable and water supply pipe, excavation shall be started only after such cables and pipe have been positively marked.

At the bridge site, the excavation of the channel shall be started after the bridge has been constructed.

(4) Construction Methods for the Bridge

Since the bridge site is located in an area covered by water, temporary cofferdam shall be constructed by using steel sheet piles. The cofferdam shall be constructed to an elevation of DL + 3.0 m /1 taking into account setup and wave runup of ocean waves of 1-year probability.

Excavation shall be executed by clamshell with the bottom of the excavated area being sealed by use of sealing concrete in order to prevent intrusion of seawater. Water which accumulates in the cofferdam shall be removed with a submergibly pump. Placing of reinforcement forms scaffolding and concrete inside the cofferdam shall be executed "in the dry". Supports and scaffolding for the deck construction and removal of the cofferdam shall follow, which shall be executed by manpower and equipment including vibrohammer.

/1 High water level + setup + wave runup
= (R.L. + 1.80 m) + 0.24 m + 0.96 m
= R.L. + 3.00

Concrete of the major portion of the bridge, including deck concrete, shall be placed by a concrete pump car which will also be used for concreting the slope protection for the causeway. After curing, all supports and formwork shall be removed.

Concreting of the curb, installation of the concrete railing, backfilling of the abutment and construction of the bridge approaches shall follow.

(5) Materials/Equipment Plan

i) Construction Materials

The quantities of the major consturction materials have been estimated by work item and are shown in Table 4-7.

ii) Construction Equipment

The approximate numbers of major items of equipment to be used are listed in Table 4-8.

Table 4-7 Major Construction Material to be Used

Work Item	Kind of Material	Unit of Q'ty	Estimated Quantity	To be Obtained from
Embankment	Embankment Mat'l.	m^3	144,400	Borrow Area C
	Vinyl Sacks for Sandbags	bag	604,700	Japan
	Sand for Sandbags	m^3	14,700	Borrow Area C
Pavement	Asphalt Cement	ltr.	136,900	Japan
	Aggregate for pavement	m^3	1,350	Bonriki
Concrete Parapet	Portland Cement	ton	730	Japan
	Aggregate Sand	m^3	1,662	Bonriki
	Aggregate Gravel	m^3	1,899	Bonriki
	Timber Form	m^2	11,410	Japan
Fisheries Channel	Dynamite	ton	2.70	Japan
Bridge	Portland Cement	ton	150	Japan
	Concrete Sand	m^3	280	Bonriki
	Aggregate Gravel	m^3	330	Bonriki
	Re-bar	ton	50	Japan
	Form (Plywood board)	m^2	800	Japan
	Pipe support	m^3	570	Japan
	Steel sheet pile	ton	55	Japan
	Gas pipe for Hand Rail	m	90	Japan
	Rubble	m^3	30	Bonriki
Slope Protection	Mat	m^2	44,600	Japan
	Portland Cement	ton	3,260	Japan
	Aggregate Coral Sand	m^3	6,300	Bonriki
	Crushed aggregate	m^3	2,100	Bonriki
	Rubble	m^3	5,900	Channel Excavation, Borrow Area C

Table 4-8 Major Construction Equipment to be Used

C/W : Causeway
CHN : Fisheries Channel
BRG : Bridge

No.	Description	Capacity	Horsepower	Weight (tons)	Nos.	To be used for
1	Bulldozers	15t	150	15.0	2	C/W
2	Backhoe/1	0.6m^3	108	18.7	1	CHN
3	Backhoe	0.8m^3	139	23,4	4	C/W, CHN
4	Wheel Loader	0.6m^3	51	3.9	1	C/W
5	Wheel Loader	1.4m^3	91	8.2	1	C/W
6	Dump Truck	11t	314	9.3	15	C/W
7	Cargo Truck	2t	87	1.9	1	C/W, BRG
8	Cargo Truck	4-4.5t	164	3.4	1	C/W
9	Clamshell	0.8m^3	170	38.3	1	CHN, BRG
10	Truck Crane	20t	230	22.0	1	BRG
11	Vibropile Hammer	35-37t	45(KW)	3.7	1	BRG
12	Leg hammer	30kg	—	0.031	1	C/W, CHN
13	Pt.Air Compressor	10.5m^3	105	2.7	1	C/W, CHN
14	Concrete Mixer	0.5m^3	7.5	2.2	1	BRG, C/W
15	Concrete Pump Car	55-60m^3/hr	170	10	1	BRG, C/W
16	Agitater Cars	2m^3	11(KW)	2.5	4	BRG, C/W
17	Vibrator, Conc.	ϕ45mm	0.75(KW)	0.02	2	BRG, C/W
18	Vibratory Rollers	4t	25	4.0	2	C/W
19	Tire Roller	8-20t	89	8.5-20	1	C/W
20	Motor Grader	3.1m	110	9.5	1	C/W
21	Asphalt Sprayer	30ℓ/min	3.5	0.17	1	C/W
22	Grout Pump	18.5KW	18.5	1,10	1	C/W
23	Grout Mixer	200×2ℓ	2.2	0.21	1	C/W
24	Water Pump	ϕ50mm-10m	0.75(KW)	0.017	1	C/W
25	Generator	75KVA	93	2.0	1	C/W, BRG
26	Generator	45KVA	58	1.5	1	C/W, BRG
27	Generator	15KVA	22	0.62	1	C/W, BRG
28	Crawler Crane	22.5t	96	22.4	1	BRG
29	Pontoons	35t	-	60	2	CHN
30	Tug Boat	-	110	-	1	CHN
31	Concrete Buggies	-	-	-	2	BRG

/1 Attachment Giant Breaker/T1800

4.4.5 Division of Works

In implementing the Project, the work to be covered by the grant from the Government of Japan and the work to be provided by the Government of the Republic of Kiribati shall be divided as follows:

(1) Grant from the Government of Japan:

a) Causeway: Top Width = 11.0 m and Length = 3.4 km

b) Fisheries Channel Width = 10.0 m and Length = 800 m

c) Bridge Width = 10.0 m and Length = 10.0 m

d) Appurtenant works

i) Electric cable: Installation of 11 KVA cable, 3.4 km long

ii) Telephone cable: Material supply and relocation of cable 50 circuits, 4,300 m long

iii) Pavement of access road: 900 m long

(2) Undertakings to be taken by the Government of the Republic of Kiribati

1. To secure lots of land necessary for the Project.

2. To provide and accord necessary permissions, licences and other authorizations required for the execution of the Project.

3. To ensure prompt unloading, customs clearance for the goods imported by the contracted Japanese firms for the Project.

4. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Kiribati with respect to the supply of the products and services under the Verified Contracts.

5. 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 the Republic of Kiribati and stay therein for the performance of their work.

6. To maintain and use properly and effectively the facilities constructed under the Grant.

7. To bear all the expenses other than those to be borne by the Grant.

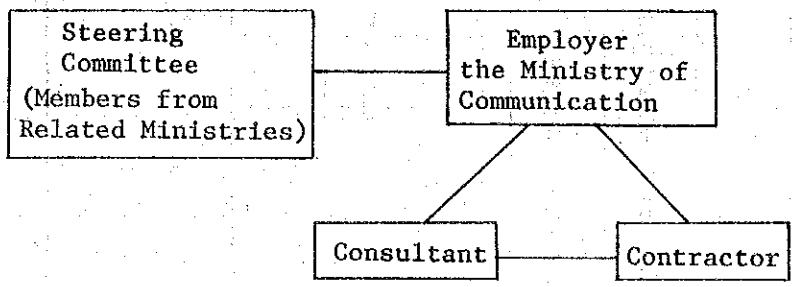
8. To supply under-ground power cable and its joints to be installed in the causeway with adequate length and quality and to carry out cable jointing.

9. To relocate and install water main into the causeway

4.4.6 Project Implementation Organization

The responsible agency of the Government of the Republic of Kiribati for the implementation of the Project is the Ministry of Communication.

For the management of construction, the Ministry of Communication shall organize a steering committee.



4.4.7 Procurement Plan for Materials and Equipment

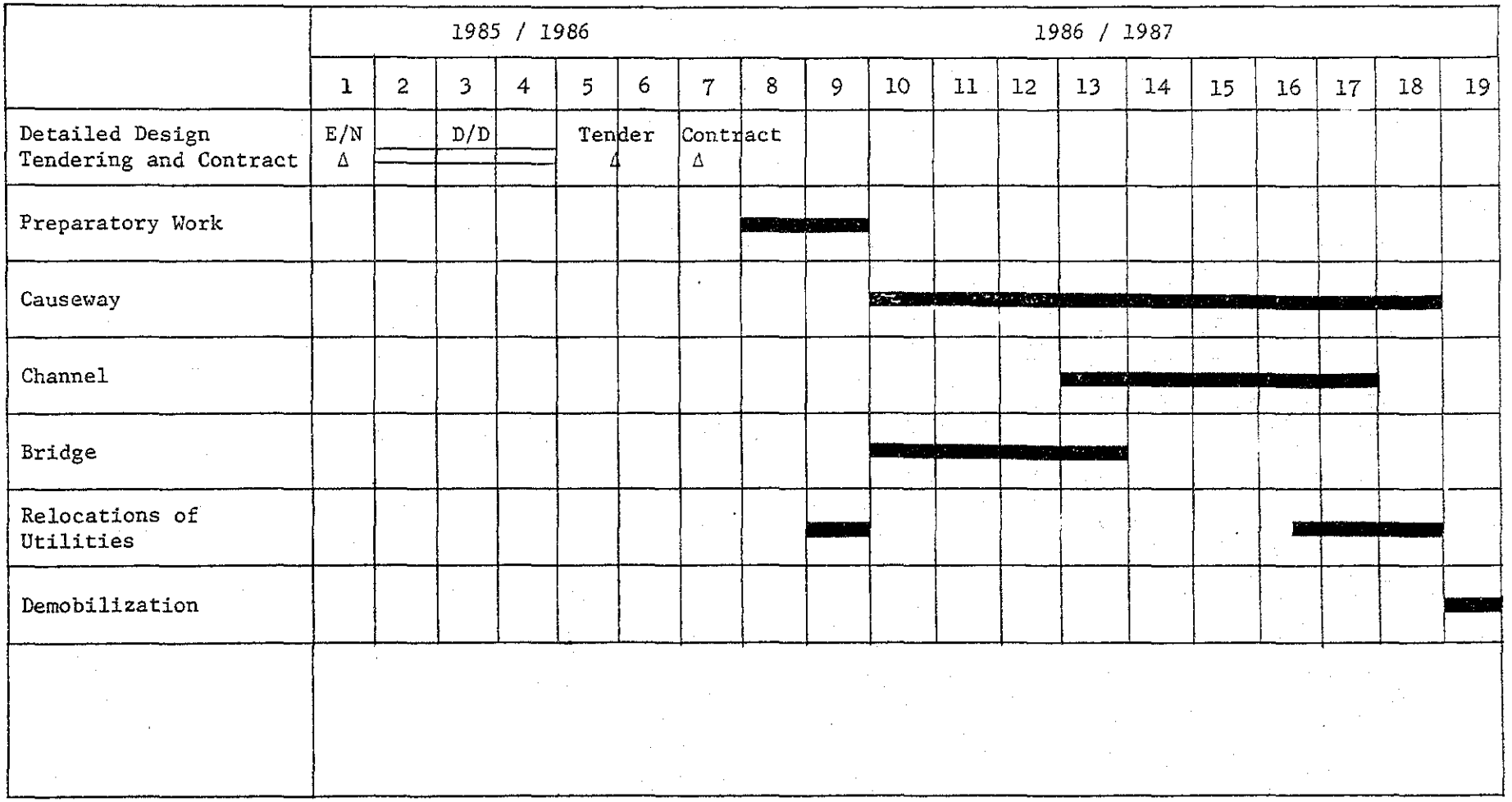
Major materials, except for such locally available material as sand, crushed stone and fuel/lubricants, shall be all imported from Japan. The major import materials shall include Portland cement, vinyl sacks, fabrimat, reinforcing bar, steel pipes, timber and plywood for form work. Fuel and lubricants shall be purchased in Kiribati.

The existing tugboat and pontoon in Kiribati shall be made available on lease basis. The other major items of equipment such as backhoes, bulldozers, wheel loaders, tucks, etc. shall be imported from Japan.

4.5 Implementation Plan

A contractor from an approved list of prequalified contractor shall be selected through a competitive bidding for performing the work. It is estimated that the detailed design by the consultant will take 3 months and that the construction will take 12 months.

The proposed implementation schedule is shown in Fig. 4-8.



Note : E/N = Exchange of Note

Figure 4-8 Proposed Implementation Schedule

4.6 Maintenance Work

Maintenance Works for Causeway

The Public Works Division, Ministry of Works & Energy, being responsible for executing maintenance works for the causeway is required to carry out periodic and routine maintenance work properly without any delay so as to keep the project facilities in good condition.

The periodic and routine maintenance works should include the following:

(1) Routine maintenance
- Repair of any damaged portions of the parapets
- Cleaning of drainage system
- Repair of any damaged section of the pavement
- Repair of concrete slope protection
- Repair of guide post and handrail of the bridge

(2) Periodic maintenance
- Overlay of the pavement about every 5 years, say in 1992, 1997, 2002 and 2007.

Maintenance Works for Fisheries Channel

The Marine Division, Ministry of Communication, will be responsible for executing maintenance works for fisheries channel. The periodic dredging is required to keep and maintain the required vertical clearance of the fisheries channel.

Maintenance Costs Required for the Proposed Causeway and Fisheries Channel

Annual maintenance costs for the existing roads and causeways spent by the Government of Kiribati in 1984 are as follows:

Maintenance Cost for Existing Road (Trund Road = 40 km)

A$70,700/year or A$1,800/km year

Maintenance Cost for Existing Causeway (about 1.5 km in total)

A$2,500/year or A$1,700/kg year

It is recommended that the annual maintenance costs per km to be spent for the proposed causeway including road surface and shoulder should not be lowered than that of the existing roads and causeways. Maintenance cost for the fisheries channel is also required for executing dredging work. Total maintenance costs required for the proposed causeway and fisheries channel are estimated as follows:

Maintenance Cost for Proposed Causeway and Road Surface

(A$1,800 + A$1,700)/km year x 3.4 km = A$11,900/year

Maintenance Cost for Fisheries Channel

= A$3,100/year

Total Maintenance Cost A$15,000/year

In addition to the above annual maintenance costs the Government of Kiribati is required to spent the cost for overlaying the road surface every 5 years. This overlay work should be done in 1992, 1997, 2002 and 2007 and estimated cost for the overlay is as follows:

A$8.50/$m^2$ x 6.0 m x 3,400 m x 70%

= A$121,380 (say A$120,000)

CHAPTER 5

PROJECT EVALUATION

CHAPTER 5 PROJECT EVALUATION

The construction of the causeway and fisheries channel would create various kinds of economic benefits to the country as shown below:

Direct Tangible Economic Benefits
- Benefits for diverted traffic from the ferry
- Benefits for induced traffic
- Benefits for fisheries boat

Indirect Benefits
- Savings in infrastructures construction
- Social impact and effect

An economic evaluation was conducted comparing the direct tangible economic benefits and the economic costs through computation of economic internal rate of return (EIRR). However, the economic feasibility of the project should be tested considering not only the direct economic benefits but also the indirect benefits which were not included in the calculation of the economic evaluation due to the difficulty of quantification.

The economic benefits were estimated by comparing the "With Project" and "Without Project" conditions, as follows:

With Project:

The case where the construction of the causeway and fisheries channel are implemented.

Without Project:

The case where no causeway and fisheries channel are constructed and the existing ferry system continues to function as it now does.

The evaluation period for calculating the project benefit and costs was set at 20 years.

5.1 Project Benefits

5.1.1 *Benefits for Diverted Traffic from the Ferry*

(1) Estimate of future traffic demand in the "Without Project" case

The future traffic demand between Betio and Bairiki was estimated based on the projected natural increase in traffic in the absence of the causeway, as shown below in Table 5.1.

Table 5-1 Estimate of Future Traffic Demand between Betio and Bairiki Islands

Year	Passenger Traffic Volume (persons)	Vehicle Traffic Volume (vehicles)	Cargo Transport Volume (tons)		
			By Ferry	By Lighter	Total
1984	394,117	8,221	3,496	3,570	7,066
1987	420,705	9,036	3,842	3,924	7,766
1992	465,400	10,577	4,497	4,593	9,090
1997	508,821	12,381	5,265	5,377	10,642
2002	556,293	14,493	6,163	6,294	12,457
2007	608,195	16,965	7,214	7,367	14,581

The increase in the rate of ferry passenger per year was assumed to be the same as the increment of population in South Tarawa as follows (refer to Chapter 2):

1984 - 1990	2.2% per annum
after 1991	1.8% per annum

The growth rate of cargo traffic was estimated at 3.2% per annum by applying the rate of increase of the GDP (refer to Chapeter 2).

(2) Diverted traffic volume from the ferry

The existing ferry system was assumed to be abolished after completion of the causeway. As the result, the passengers, vehicles and cargo now carried by the present ferry system being be transferred to the vehicle traffic system on the causeway after it is opened to the public. Details pertaining to this are as follows:

(i) Traffic volume diverted from the ferry passengers:

The future traffic demand of passengers estimated in Table 5.1 was converted to the vehicle numbers based on the vehicle type as well as the average number of passenger in the vehicle as shown in Table 5.2, assuming the following conditions:

- the present bus service systems in both Betio and Bairiki Islands will be re-organized and operated after completion of causeway, and
- the type of vehicles will be the same as for the present.

Table 5-2 Type of Vehicles and Average Number of Passengers

	Type of Vehicle (%)	Average No. of Passengers (person/vehicle)
Motorcycles	16	1.2
Passenger Cars	14	2.0
Mini Buses	45	14.1
Trucks	25	3.2

Table 5-3 shows the forecasted annual traffic volume on the causeway which will be diverted from ferries.

Table 5-3 Forecasted Annual Traffic Volume on the Causeway Diverted from Ferry Passenger

(Unit: vehicle/year)

Year	Motor-Cycles	Passenger Cars	Mini Buses	Trucks	Total	(%)
1987	56,094	29,449	13,427	32,868	131,838	(100)
1992	62,053	32,578	14,853	36,359	145,844	(111)
1997	67,843	35,617	16,239	39,752	159,451	(122)
2002	74,172	38,941	17,754	43,460	174,327	(135)
2007	81,093	42,574	19,410	47,515	190,592	(148)

(ii) Traffic volume of vehicles and cargo diverted from ferried

Vehicles

The vehicles ferried by the existing services consist of 80% of motorcycles while the remaining 20% are trucks. It was assumed that these vehicles will travel on the causeway without any changes concerning the above constitution.

Cargo

All cargo being ferried by the existing services are assumed to be carried by 2-ton trucks and have been converted to the equivalent number of trucks, the results of which are shown in Table 5.4 below:

Table 5-4 Forecasted Annual Traffic Volume on the Causeway Diverted from Ferries and Lighters

(Unit: vehicle/year)

Year	Motor-cycles	Passenger Cars	Mini Buses	Trucks	Total
1987	7,229	-	-	5,690	12,919
1992	8,462	-	-	6,661	15,123
1997	9,905	-	-	7,797	17,702
2002	11,594	-	-	9,127	20,721
2007	13,572	-	-	10,684	24,256

(iii) Forecasted Total Volume of Diverted Traffic

The total forecasted traffic volume diverted from ferry passengers as well as vehicles and cargo are listed in Table 5.5 below:

Table 5-5 Total Forecasted Annual Traffic Volume on the Causeway (Diverted Traffic)

(Unit: vehicle/year)

Year	Motor-cycles	Passenger Cars	Mini Buses	Trucks	Total
1987	63,323	29,449	13,427	38,558	144,757
1992	70,515	32,578	14,853	43,020	160,966
1997	77,748	35,617	16,239	47,549	177,153
2002	85,767	38,941	17,754	52,587	195,049
2007	94,665	42,574	19,410	58,199	214,848

(3) Benefits from traffic diverted from the ferry

Benefits from traffic diverted from the ferry are derived from transport costs and time savings comparing the ferry system in the "Without Project" case and vehicle traffic in the "With Project" case.

Basic Assumption for Comparison Purpose

- Frequency of the ferry runs per day would be unchanged but the capacity of the ferry boats would be increased by 50% at the time of purchasing new boats, in order to cope with the increased traffic volume.
- New boats would be purchased in 1987 (two boats) and 1988 (one boat).
- Service life of ferry boat is assumed to be 15 years.
- New ferry terminal would be constructed at Takoronga, eastern end of Betio island, which is presently scheduled to be started in 1986 and completed in 1987.
- Travelling time by the new boats between the new ferry terminal at Betio and the existing terminal at Bairiki would be 30 minutes, which is 15 minutes shorter than that used by the present ferry servies.

(i) Benefits derived from transport cost savings:

a) Ferry operating costs:

- Operation and maintenance costs of the existing ferry system including staff costs, fuel and lubricants, operating expenses, maintenance & repair and miscellaneous.
- Ferry investment cost for new ferry boats and new ferry terminal facilities, including maintenance and administration costs.

Details pertaining to the above costs are shown in the Appendix 5-1. The annual operating costs of the ferry system were estimated until the target year of 2007, as summarized in Table 5-6 (next page).

b) Vehicle operating costs

Vehicle operating costs per km consists of fuel, lubricants oil, tires & tubes, depreciation and interest, repair and maintenance, driver's costs and administration costs (buses commercial vehicles and trucks only). Operating cost per km by type of vehicle are presented in Table 5-7 (next page).

Yearly vehicle operating cost was calculated by the following equation, the results of which are summarized in Table 5-8 below:

$$VOCi = U \times L \times TDi$$

where

VOCi = Vehicle operating cost in the year i

U = Unit cost of vehicle operating cost (A$ cent per km)

L = Running distance between Betio and Bairiki island (km)

TDi = Estimated deverted traffic in the year i

Table 5-8 Estimated Annual Operating Cost of Vehicles Using the Causeway (Diverted Traffic)

(A$)

Year	Motor-cycles	Passenger Cars	Mini Buses	Trucks	Total
1987	10,588	13,771	20,172	31,833	76,364
1992	11,790	15,233	22,315	35,518	84,856
1997	12,999	16,655	24,397	39,256	93,308
2002	14,340	18,209	26,674	43,416	102,639
2007	15,828	19,907	29,162	48,049	112,947

Table 5-6 Estimated Future Transport Costs for Operating Ferry

(1000 A$)

Year	New Port Construction Cost	Port Maintenance Cost	Ferry Investment Cost	Staff Costs	Ferry Maintenance and Repair Costs	Ferry Fuel and Lubricants Costs	Lighter Operating Costs	Total Ferry Transport Costs
1986	526	-	-	-	-	-	-	526
1987	0	1	1,170	94	37	76	19	1,397
1988	0	1	585	94	37	76	19	812
1989	0	1	0	94	37	76	20	228
1990	0	1	0	94	37	76	20	228
1991	0	1	0	94	37	76	21	229
1992	0	1	0	94	37	76	21	229
1993	0	1	0	94	37	76	22	230
1994	0	1	0	94	37	76	22	230
1995	0	1	0	94	37	76	22	230
1996	0	1	0	94	37	76	23	231
1997	0	1	0	94	37	76	23	231
1998	0	1	0	94	37	76	24	232
1999	0	1	0	94	37	76	24	232
2000	0	1	0	94	37	76	25	233
2001	0	1	0	94	37	76	25	233
2002	0	1	1,404	94	37	76	26	1,638
2003	0	1	702	94	37	76	26	936
2004	0	1	0	94	37	76	27	235
2005	0	1	0	94	37	76	27	235
2006	0	1	0	94	37	76	28	236
2007	0	1	0	94	37	76	28	236
Salvaged Value			-1,498					-1,498
Total	526	21	2,363		777	1,596	492	7,749

Table 5-7 Operating Costs for Type of Vehicles

(A¢/kM)

	Fuel Cost	Oil Cost	Tire and Tube Cost	Depreciation and Intrest Costs	Repair and Maintenance Costs	Operator and Overhead Costs	Total
Motorcycles	2.2	.05	.04	1.73	.16	0	4.18
Passenger Cars	4.4	.09	.35	6	.85	0	11.69
Mini Buses	6.9	.15	.98	12.96	5.17	11.4	37.56
Trucks	6.2	.13	.89	6.7	2.62	4.1	20.64

c) Benefits derived from transport cost savings

Benefits from traffic diverted from the ferry is computed comparing the ferry operating costs and vehicle operating cost obtained in the above items a) and b), respectively.

Table 5-9 shows the summary of the benefits derived from transport cost saving.

Table 5-9 Projected Annual Transport Costs and Savings Benefits

(1000A$)

YEAR	Without Project (1) Transport Cost by Ferry	With Project (2) Vehicle Operating Cost	(1)-(2) Transport Cost Savings with Causeway
1986	526	-	526
1987	1,397	76	1,321
1988	812	78	734
1989	228	80	148
1990	228	81	147
1991	229	83	146
1992	229	85	144
1993	230	87	144
1994	230	88	142
1995	230	90	140
1996	231	92	139
1997	231	93	138
1998	232	95	137
1999	232	97	135
2000	233	99	134
2001	233	101	132
2002	1,638	103	1,535
2003	936	105	831
2004	235	107	128
2005	235	109	126
2006	236	111	125
2007	236	113	123
SALVAGE VALUE	-1,498	-	-1,498
TOTAL	7,749	1,972	5,777

(ii) Benefits derived from savings in transport time

In addition to the transport cost savings, the construction of the proposed causeway would also contribute to the saving of travel time. Saving time is computed comparing the travel time between the ferry system in the "Without Project" case and the vehicle traffic on the causeway in the "With Project" case, as follows:

A. Travel time by the ferry system (Without Project case) is estimated at 45 min. per trip including 30 min. of travelling time on the ferry and 15 min. of passenger's getting on and off the ferry.

B. Travel time by vehicle (With Project case) is estimated at 6 min. per one-way trip assuming the average speed of 40 km/hr on a road distance of 4.0 km.

C. Estimated time savings per trip: 45 min - 6 min. = 39 min.

The benefits derived from the time savings were quantified for the passengers, excluding vehicles and ferried cargo. Students and the unemployed were also excluded from the quantification of time savings because they would not make profitable use of the time saved.

The average time value of the passengers is estimated at A$1.20/hr based on the wages of the government officials belonging to the middle class of society, who make up about 40% of the total persons employed in the country (refer to Appendix 5-2).

Based on the above assumption, the unit time value per hour by type of vehicle is computed as shown in Table 5-10 below:

Table 5-10 Calculation of Time Value per Vehicle

	Motor-Cycle	Passenger Car	Mini Bus	Truck
(1) Average Occupancy (Persons/Vehicle)	1.2	2	14.1	3.2
(2) Employed Persons per Vehicle/1 (1)*0.4	0.48	0.80	5.64	1.28
(3) Passenger Time Value (A$/Vehicle)/2	0.58	0.96	6.77	1.54

/1 Estimated to be 40% of total occupant per vehicle

/2 Estimated to be A$1.20 per hour

Benefit derived from the time savings are obtained by multiplying the above value per hour by type of vehicle times the saved time (39 min.) and the diverted traffic volume shown in Table 5-3. Based on this, the estimated time saving benefit by type of vehicle are as shown below in Table 5-11:

Table 5-11 Projected Annual Benefit of Time Saving by Type of Vehicle (Diverted Traffic)

(A$ 1000)

Year	Motor-cycles	Passenger Cars	Mini Buses	Trucks	Total
1987	21	18	59	33	132
1992	23	20	65	36	145
1997	26	22	71	40	159
2002	28	24	78	44	174
2007	31	27	85	48	190

5.1.2 Benefits for Induced Traffic

(1) Forcast of Induced Traffic

In addition to diverted traffic from the ferry, induced traffic is expected due to the reduced transport costs and travel time after causeway has been constructed.

Induced traffic is usually derived from passenger trips and transported cargos however, in this case, traffic induced from transported cargo was neglected because of the difficulty in its quantification.

It is assumed that the main factor of traffic induced from passenger trips is the decrease of the travelling cost between Betio and Bairiki Islands.

Induced traffic volume is estimated by the following equation:

$$IT = IR \times NT$$

where,

IT = Induced traffic volume

NT = Normal traffic volume (in this case, the traffic volume on the causeway which has been diverted from the ferry passengers)

IR = Induction Rate

$$= \left(\frac{FC}{CC} - 1 \right) \times DE$$

FC = Tariff on ferry passengers (A$0.70/person)

CC = Average transport cost using the causeway (A$ 0.40/person)

DE = Demand elasticity

The average transport cost is estimated at A$0.40/person assuming that present bus services in each island will be reorganized and that new bus services will be operated on the causeway after completion of the causeway.

It is assumed that the demand elasticity (DE) is 1.0, considering the magnitude of economy in Kiribati. This results in an induction rate (IR) of 0.75.

Normal traffic volume was measured as only 40% of the traffic volume diverted from ferry passengers as shown in Table 5-3. This is because it is only businessmen who will actually benefit from time savings after completion of the causeway and they make up only 40% of the total passengers ferried while the remaining 60% are students and commuters. It was assumed that induced traffic is to increase at the same growth rate as diverted traffic does. Following are the results of the estimated induced traffic volume after the causeway is open to the public.

Table 5-12 Forecasted Annual Traffic Volume Using the Causeway (Induced Traffic)

(Unit: vehicle/year)

Year	Motor-cycles	Passenger Cars	Mini Buses	Trucks	Total
1987	16,828	8,835	4,028	9,860	39,551
1992	18,616	9,773	4,456	10,908	43,753
1997	20,353	10,685	4,872	11,925	47,835
2002	22,252	11,682	5,326	13,038	52,298
2007	24,328	12,772	5,823	14,255	57,178

(2) Benefits from Induced Traffic

Benefits from induced traffic were quantified by using the same method as for the diverted traffic, but 50% of it was counted as economic benefits in the usual manner. Table 5-13 shows the results of expected benefits from induced traffic.

Table 5-13 Projected Annual Transport Cost and Time Saving Benefits (Induced Traffic)

(A$1000)

Year	Cost Saving Benefits	Time Saving Benefits	Total
1987	34	20	54
1988	35	20	55
1989	36	21	57
1990	36	21	57
1991	37	22	59
1992	38	22	60
1993	39	22	61
1994	39	23	62
1995	40	23	63
1996	41	23	64
1997	41	24	65
1998	42	24	66
1999	43	25	68
2000	43	25	68
2001	44	26	70
2002	45	26	71
2003	46	26	72
2004	47	27	74
2005	47	27	74
2006	48	28	76
2007	49	29	78
TOTAL	870	504	1,374

5.1.3 Benefits from the Fisheries Channel

The following two items are counted as direct tangible benefits associated with the construction of the fisheries channel:

- Operating cost savings of fishing boats
- Increase of fisheries product associated with reducing travel time to the fishing banks,

Fishing operations are now being conducted under the following conditions:

- Nos. of fishing boats across the strait between Betio and Bairiki Islands:
  - . Fishing boats at Betio Isl. : 20 vessels
  - . Fishing boats at South Tarawa Isl. : 17 vessels

- Travelling from residence to fish banks for
  - . Fishing boat at Betio isl.
    - * travelling across the strait: 22 days/month
    - * Using the strait's bypass route: 4 days/month
  - . Fishing boats at South Tarawa Isl.
    - * travelling across the strait: 22 days/month
    - * No operation at low spring tide: 4 days/month

- Distance from residence to fish banks
  - . fishing boat at Betio Isl.
    - * travelling across the strait: 14.0 miles
    - * Using the strait's bypass route: 19.5 miles
  - . Fishing boat at South Tarawa Isl. : 14.0 miles

- Travelling time : 5.0 hr/round trip

- Waiting time at low spring tide :
  1.0 hr/trip x 8 days/month

- Fishing boat
  - * Skiffs, 40 HP
  - * Consumption of fuel
    1 lit/mile x A$ 0.77/lit = A$ 0.77/mile
  - * Speed 13 mile/hr.

- Time spent for bypassing per round trip

  (19.5 - 14.0) mile ÷ 13.0 mile/hr x 2

  = 0.85 hr/round trip

- Operating hours in the case of travelling across the strait

  5 hrs - [14.0 mile ÷ 13 mile/hr x 2]

  = 2.85 hrs.

- Operating hours in the case of travelling the strait's bypass:

  2.85 - 0.85 = 2.0 hrs

(1) Benefits derived from cost savings of fishing boat operations

Fishing boats stationed at South Tarawa Islands are usually not operated at low spring tide. Therefore, the benefits derived from the cost saving of such fishing boat operations are quantified only from the fishing boats located at Betio Island, estimated as follows:

So = (19.5 mile - 14.0 mile) x 2 round trip x A$ 0.77/mile x 4 days/month x 12 months/year x 20 vessels

= A$8,131/year

(2) Benefits derived from time savings

Construction of the fisheries channel would save the travelling time of fishing boats going to the fishing banks it would eliminate the waiting time at the entrance of the channel when it is at low water spring tide.

It is assumed that time saved by the construction of the fisheries channel would be spent for fishing.

An increase of the fishing catch could be expected due to longer time available fishing and this can be treated as a direct tangible benefits.

(i) Time Savings

a) Time savings of fishing boats at Betio Isl.
= (Time saving of travel to the fishing banks
+ time saving due to eliminating the waiting time)
= 0.85 hr/trip x 4 trip/m x 12 mns/yr. + 1.0 hr/trip
x 8 trip/mn x 12 mns/yr.
= 136.8 hrs/year/vessel

b) Time savings of fishing boat at South Tarawa Isl.
= (Time savings due to eliminating the waiting time
+ increase of day of operation)
= 1.0 hr/trip x 8 trip/m x 12 mns/yr. + 2.85 hr/trip
x 4 trip/m x 12 mns/yr.
= 184.8 hrs/year/vessel

(ii) Fish Catch per Hour

Fishing operation including travelling time from the residence to the fishing banks is limited to a maximum of 5 hours in order to keep the fish fresh. Therefore, the net fishing operation per trip is only 2.85 hours (2.0 hours in the case of travelling a shallow sea's bypass).

Therefore, the net operating hours of a fishing boat per year is estimated as follows:

Net operating hours of fishing boats (20 vessels) at Betio Isl. = 842 hrs/year/vessel

Net operating hours of fishing boats (17 vessels) at South Tarawa Isl. = 752 hrs/year/vessel

The annual fish catch by fishing boats from Betio Island and South Tarawa Islands was 800 tons/year and 530 tons/year in 1984, respectively. Fish catch per hour, therefore, can be calculated as follows:

a) Fish catch per hour of the Betio fishing boats (20 vessels) is:
   800 tons/year ÷ 842 hrs/year ÷ 20 vessels
   = 0.048 tons/hr./vessel
b) Fish catch per hour of the South Tarawa fishing boats (17 vessels) is:
   530 tons/year ÷ 752 hrs/year ÷ 17 vessels
   = 0.041 tons/hr./vessel

(iii) Benefits Derived from Time Saving

Time saving in travelling would increase the fishering catch, which can be treated as the direct tangible benefits, as follows:

Annual increse of fish catch

Betio (20 vessels) :	136.6 hr./year x 0.048 tons/hr./vessel x 20 vessels = 131 tons/year
South Tarawa (17 vessels):	184.8 hr/year x 0.041 tons/hr./vessel x 17 vessels = 129 tons/year
Total:	260 tons/year

It is assumed that only 50% of the increased fish catch would be the bought by Te Mautari Ltd. in the first year considering the relatively small fisheries market in the

country. After that, selling of fish products is assumed to increase in proportion to that of economic growth. The average purchase price of fish by Te Mautari Ltd. is estimated at A$ 0.66/kg.

Benefits derived from the increase of fish product is computed as summarized below:

1987	260 ton x ½ x A$ 660/ton	= A$ 85,800
1992	Increase at 3.2% per annum	= A$100,435
1997		= A$117,567
2002		= A$137,620
2007		= A$161,095

5.1.4 Other Benefits (Indirect Benefits)

In addition to the direct tangible benefit stated in the foregoing paragraphs 5.1.1 to 5.1.3, the following indirect benefits could be expected:

(1) Savings by being able to make better use of certain public facilities which now exist separately in both Betio and Bairiki Islands.

(2) Benefits to the public by providing easy access to such public facilities as the police station, hospital and schools.

(3) Savings due to the improved administration and management of government, corporations and private businesses.

(4) Savings due to a lessening of the congestion at Betio harbour, thus allowing the port handling facilities to be utilized by others and enabling Bairiki ferry harbour to be used by the local fishing boats.

(5) Decreasing the congestion now existing throughout Betio Island.

These indirect benefits, however, were not included in the economic evaluation by the Internal Rate of Return because of the difficulty in their quantification.

5.2 Project Evaluation

The economic feasibility of the Project was examined by the conventional criteria of the EIRR (Economic Internal Rate of Return). The project life was set at 20 years considering the expected lifetime of the major causeway facilities. The annual benefits and costs were converted to the value in 1986.

In estimating the project cost, tax is excluded and price escalation is also excluded.

The economic analysis comparing economic construction cost and economic direct tangible benefit obtained in the foregoing paragraph 5.1 and tabulated in Table 5-14 (next page) resulted in an EIRR of 7.9%.

An EIRR of 7.9% may seem to be slightly low comparing it with other similar projects; however, if indirect benefits, such as cost saving of infrastructures and social impact and effect, etc. are taken into account, the econimic feasibility of the Project will be further enhanced in the context of the Kiribati national economy.

The economic feasibility, therefore, is judged sufficient enough to justify the implementation of the Project.

Table 5-14 Projected Annual Economic Costs and Benefits

(A$1,000)

Year	Economic Cost			Economic Benefit							
				Diverted Traffic		Induced Traffic		Fishery			
	Construction Cost of Causeway	Maintenance Cost of Causeway	(1) Total Cost	Cost Savings	Travel Time Savings	Cost Savings	Travel Time Savings	Cost Savings	Time Savings	(2) Total Benefits	(2)-(1) Net Cash Flow
1986	6836	-	6836	526	-	-	-	-	-	526	6310
1987	0	15	15	1321	132	34	20	8	86	1601	1586
1988	0	15	15	734	134	35	20	8	89	1020	1005
1989	0	15	15	148	137	36	21	8	92	442	427
1990	0	15	15	147	139	36	21	8	95	446	431
1991	0	15	15	146	142	37	22	8	98	453	438
1992	0	135	135	144	144	38	22	8	101	457	322
1993	0	15	15	144	147	39	22	8	104	464	449
1994	0	15	15	142	150	39	23	8	107	469	454
1995	0	15	15	140	153	40	23	8	111	475	460
1996	0	15	15	139	155	41	23	8	114	480	465
1997	0	135	135	138	158	41	24	8	118	487	352
1998	0	15	15	137	161	42	24	8	122	494	479
1999	0	15	15	135	164	43	25	8	126	501	486
2000	0	15	15	134	167	43	25	8	130	507	492
2001	0	15	15	132	170	44	26	8	134	514	499
2002	0	135	135	1535	173	45	26	8	138	1925	1790
2003	0	15	15	831	176	46	26	8	142	1229	1214
2004	0	15	15	128	179	47	27	8	147	536	521
2005	0	15	15	126	183	47	27	8	152	543	528
2006	0	15	15	125	186	48	28	8	156	551	536
2007	0	135	135	123	189	49	29	8	161	559	424
Salvage Value	-	-	-	-1498	-	-		-	-	-1498	-1498
Total	6836	795	7631	5777	3339	870	504	168	2523	13181	5550

Economic Internal Rate of Return was calculated at 7.9%.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

CHAPTER 6 CONCLUSION AND RECOMMENDATION

Betio & Bairiki Islands in South Tarawa form the capital area of the Republic of Kiribati. Bairiki Island is the administrative center of the country while Betio Island is the economic center as well as the base of the fisheries industry with the fishery port. Plans to connect these two major islands (which are separated by a shallow sea) with a causeway have been envisaged over and over. At long last, the actual construction of a causeway was started in 1978, after financial support was obtained from the ADB, but it was not completed due to the technical difficulties.

A JICA survey team has studied the project to construct the above-mentioned causeway, as well as the excavation of a fisheries channel to cross it, which the Government of Kiribati has requested the Government of Japan's assistance in. As a result of this study, it is judged that the Project will have a major impact on the fisheries industry and the vitalization of the economic and social activities of the Republic of Kiribati, which has been attempting to promote the fisheries development and to improve the socio-economic conditions of the country after the phosphate ore was exhausted in 1979. The survey team also judged that the causeway and fisheries channel can be constructed and maintained, providing careful attention is paid to the technical problems concerning tidal currents and waves.

Based on the above judgements, the survey team came to the conclusion that the Project is highly eligible for a Grant Aid Assistance Project by the Government of Japan and looks forward to a prompt implementation of it.

In this regard, the survey team would like to make the following recommendations to the Government of the Republic of Kiribati to ensure that the causeway and fisheries channel is operated in a safe and effective way after the Project has been constructed.

(1) The roadway on the causeway has good alignment which will allow high-speed traffic; however, in order to avoid accidents, it is recommended to enforce a maximum speed limit of 65 km/hr speed limit.

(2) Appropriate and timely maintenance will be required for the causeway, road and fisheries channel, in order to be able to keep its intended function once the project is completed. As such, it is recommended to establish a maintenance system, including the preparation of a maintenance manual which specifies check items, inspection frequencies, repair methods, etc.

(3) Since the causeway is basically constructed in the sea thereby making it difficult to be re-built if it is ever destroyed, prompt remedial works will be required when damage is found and before it develops into a more serious condition. Based on this, the Government is recommended to pay constant and careful attention toward the maintenance of the causeway by making appropriate financial arrangements for it.

LIST OF TABLES AND FIGURES

LIST OF TABLES AND FIGURES

APPENDICES

LIST OF APPENDICES

SURVEY SCHEDULE OF JICA TEAM

Order	Month	Date		Description
1	April	5th	Fri	Departure from Narita by JL-775 at 21:55 for Nadi
2		6th	Sat	Arrival at Nadi at 09:15
3		7th	Sun	Off duty
4		8th	Mon	Departure from Nadi by DK-301 at 9:00 and arrival at Tarawa at 16:00
5		9th	Tue	Courtesy call to the concerned Authorities of the Government of Kiribati
6		10th	Wed	Meeting with the representatives of the Authorities concerned regarding survey schedule and assisstance to be given by the Authorities
7		11th	Thu	Interviews and data correcting with Authorities concerned
8		12th	Fri	Ditto
9		13th	Sat	Site survey
10		14th	Sun	Unexploded ordnance and tidal current surveys
11		15th	Mon	Exchange of opinions with the engineers of the Public Works Division, Ministry of Works and the Energy
12		16th	Tue	Study on design conditions
13		17th	Wed	Meeting with Inter-Ministerial Committee of the Government of the Republic of Kiribati and preparation of Guide Lines for Basic Design
14		18th	Thu	Borrow pits and tidal current surveys
15		19th	Fri	Meeting of the team and signing of the Minutes of Meeting for Basic Design between Secretary of Ministry of Communication of the Republic of Kiribati and the Team Leader

16	April	20th	Sat	Unexploded ordnance survey
17		21st	Sun	Off duty
18		22nd	Mon	Meeting of the team
19		23rd	Tue	Preparation for traffic counting, tide and tidal current surveys
20		24th	Wed	12-hour traffic counting, tide and tidal current surveys. Mr T. Kawagushi, Mr K. Kurihara and Mr H. Yoshitake left Kiribati for Tokyo
21		25th	Thu	Interviews with the Public Corporations concerned and tidal current survey
22		26th	Fri	Data correcting at the Public Corporations concerned
23		27th	Sat	Meeting of the team Mr T. Kawaguchi, Mr K. Kurihara and Mr H. Yoshitake arrived at Tokyo
24		28th	Sun	Off Duty
25		29th	Mon	Centerline and tidal current surveys
26		30th	Tue	Preparation for return to Japan
27	May	1st	Wed	Departure from Tarawa by ON-301 at 10:00 and arrival at Suva at 18:00 via Nauru
28		2nd	Thu	Courtesy call to Embassy of Japan in Fiji and JICA Office, departure from Suva by bus at 13:00 and arrival at Nadi at 16:30, departure from Nadi by QF-094 at 17:35 and arrival at Sydney at 21:10
29		3rd	Fri	Departure from Sydney by QF-021 at 21:45 for Tokyo
30		4th	Sat	Arrival at Narita at 6:10

LIST OF PERSONS INTERVIEWED (From 5 Apr 1985 To 4 May 1985)

Ministry of Communications

Minister	Hon. Taomati T Iuta
Secretary	Mr John I Tonganibeia
Senior Assistant Secretary	Mr Inatoa Tebania
Marine Superintendent, Marine Division	Capt Beiaiti Highland
Senior Customs Officer	Mr Patric Barey

Ministry of Works and Energy

Secretary	Mr Koraubara Tetabea
Chief Engineer, Public Works Division	Mr Bill Young
Senior Assistant Secretary, Mobil Oil Agency	Mr Tekire Tamuera

Ministry of Foreign Affairs

Acting Secretary	Mr Peter T Timeon

Ministry of Finance

Secretary	Mr Beniamina Tinga
Economist	Mr Peter Poulsen
Chief Supplies Officer, Supply Division	Mr Temoai Tuakai
Stock Controller, Supply Division	Mr Raurenti Taake
Senior Storekeeper, Supply Division	Mr Teinai
Chief Statistics Office	Mr Charles McFadden

Ministry of Natural Resource Development

Secretary	Mr Teken C Tokatake
Chief Fisheries Officer	Mr Bareret Onorio
Senior Fisheries Officer	Mr Teekabu Tiikai
Assistant Fisheries Officer	Mr Maruia Kamatie
Boat Builder, Fisheries Office at Tanaea	Mr Nelson Reiti

Ministry of Home Affairs	
Chief Lands Officer	Mr N Papps
Betio Town Council	
Town Clerk	Mr Rubetake Taburuea
Teinaninano Urban Council	
Urban Clerk	Mr David Yee-Ting
Plant and Vehicle Unit	
Manager	Mr Manraoi Kaiea
Public Utilities Board	
General Manager	Mr Nataara T Biribo
Te Mautari Ltd	
General Manager	Mr Brendan Dalley
Fishing Master	Mr Pikia Tiroba
Police	
Commissioner	Mr P J Somerville
Betio Hospital	
Doctor	Dr Eritane Kamatie

E NO: W.17/30, C5/1/1 SUBMISSION DATE: 8/11/84
E NO.MF: DP 26/2 PLANNING OFFICE CONTACT: C.P.O.

DEVELOPMENT PROJECT FUNDING SUBMISSION

1. TITLE OF PROJECT: Betio-Bairiki Causeway - Fisheries Channel Project.
2. LOCATION: South Tarawa
3. IMPLEMENTING AUTHORITY: Ministry of Works and Energy
   Public Works Division
4. PROJECT COORDINATOR: PWD. Chief Engineer
5. PROFESSIONAL ADVICE: PWD Chief Engineer
   Previous consultant's reports
6. OBJECTIVES OF PROJECT:
   (i) the local construction of a permanent causeway between the island of Betio and the rest of South Tarawa; (Full technical details are given in Appendix I)
   (ii) to ease access and communication within the capital of Kiribati;
   (iii) to greatly reduce the recurrent costs of linking Betio and the rest of South Tarawa;
   (iv) to aid the consolidation of government, other public and private sector services;
   (v) to aid the administration and management of all South Tarawa institutions; and
   (vi) to construct a channel over the reef connecting the lagoon with the ocean to allow fish and fishermen's access.

This project has been given a very high priority by Cabinet as stated in the current National Development Plan (Further details are given in Appendix IV).

7. BACKGROUND:

The project has a long and unfortunate history, details of which are given in Appendix II.

All preparatory work has been completed i.e. surveys, cost studies and feasibility studies and technical documents are held by the PWD Chief Engineer.

Other projects and public investments are dependent on this project. These are listed in Appendix III.

8. BENEFITS:
   (i) Cost savings due to the displacement of the Ferry and Lighterage services;
   (ii) Removal of the need for a new Ferry Terminal at Takoronga;
   (iii) Cost savings due to the improved administration and management of all sectors of the economy;
   (iv) Cost savings due to a lessening of congestion on Betio;

(v) Time savings and social benefits due to more convenient communications within South Tarawa;

(vi) Time and cost savings as the local fishermen's access to the ocean is greatly enhanced; and

(vii) The maintenance of the marine ecology.

Further details are given in the Appendix covering Economic Viability - Appendix IV.

APPENDIX I : TECHNICAL PROPOSALS

Following the failure of the first attempt to construct a causeway between Betio and Bairiki various alternative designs were put forward by the contractor, consultant engineer and the Asian Development Bank consultant.

These suggestions were under consideration when the idea of a causeway/runway was put forward and they were subsequently discarded in favour of the causeway/runway. The causeway/runway suggestion was also rejected, on the grounds of excessive costs in late 1982 and the project has not moved any further forward since then.

The Public Works Division (PWD) believe that the suggestion for a minimum capital cost causeway put forward by Mr. B. D. Robertson of Sinclair Knight and partners Pty Ltd. for the Asian Development Bank had merit and could be accepted by us in a slightly modified form. The construction of this causeway could be carried out by the P.W.D. using our existing equipment.

The dimensions of this minimum causeway are taken as crest Elevation R.L. + 3.0metres crest width 10 metres, beach slope on the lagoon side of 1 in 8 and beach slope on the ocean side of 1 in 15. The quantity of material required for this embankment is 285,000 cubic metres. The Bridge over the Fisheries channel would be 10 metre wide and have a span of 5m. The approximate deck level would be R.L. +4.0 metres.

There is an estimated quantity of 90,000 cubic metres of material occurring naturally on the reef flat in the form of relatively stable sandbanks. This material can be pushed into the causeway shape by construction plant working at low tide. This leaves a deficiency of 195,000 cubic metres which would be excavated from the reef flat wo on the lagoon side between Bairiki and Betio Harbour.

It is envisaged that the 90,000 cubic metres of sand at present on the causeway location could be pushed up into the causeway cross section using a Bulldozer operating at low tides. The material to be excavated from the reef flat would be pushed into stockpiles by a Bulldozer and would then be loaded by two loaders into 5 No. Nissan 5.5 cubic metre capacity tipper trucks and one 19.6 cubic metre Dumptruck. These trucks would then haul the material approximately 3.2.km to the causeway site where it would be spread by a Bulldozer and a Motor Grader.

To facilitate the continuance of the present ecological movement of fish and other marine life between ocean and lagoon and to allow small local craft to reach their fishing grounds from their lagoon moorings an opening between the two islands has to be maintained.

The type of works required would be a channel across the reef which is 5 metres wide and has a minimum depth of 0.3 metres below a spring low tide (say - 0.4 metres). The roadway would have to bridge that gap and the structure recommended for that is a single span bridge of concrete encased steel beams with a reinforced concrete deck. The abutments of the bridge are to be 5 metres apart, the approximate clearance under the bridge should be 1.5 metres above a spring high tide. Suggest underside of Bridge beams to be at 3.5 metres..

All excavation work for the channell can be carried out using locally available equipment.

Design

The design is very much a combination of some of the designs already put forward. The crest elevation of 3.0 metres above chart datum has been chosen by Wilton and Bell for their Causeway/Runway proposal and also by B.D. Robertson of Sinclair Knight and Partners in their report of March 1980. This height compares with Nanikai-Teaoraereke causeway of +3.05m and Ambo-Taborio causeway of +2.65. The road on the present sandspit has an elevation of +2.6 metres and looks perfectly adequate. The finished height of the causeway is not the significant factor in assessing safety from storm damage.

The crest width of 10m is considered to be the minimum desirable width to accommodate a road of 5½ metres together with footpaths and an area for services, and also maintain a small margin for safety. It is anticipated that some acretion will occur on the northern side of the causeway, mainly caused by the deposition of lime muds which at present are held in suspension and then lost on the ebb tide to the ocean. It is not considered necessary to construct the road surfacing immediately following completion of the causeway.

The lagoon beach slope of 1 in 8 and the ocean beach slope of 1 in 15 allows for a run-up on one day in 100 years but for no beach flattening. It is not anticipated that any beach flattening will occur as the particle size of the fill is expected to be well in excess of 1.0mm grain size, the vast bulk being coral rubble.

Borrow Area

Previous advice has been against the removal of material from the coral reef. Holmes in his report of 1976 states "Removal of significant amounts of material from a reef would modify the refraction of waves over the reef and would change their direction of incidence on the Island's shore. Potentially disastrous erosion of the narrow land could occur".

It is considered that this statement is ill advised and unsubstantiate Temaiku Bund, Ambo-Taborio, Nanikai-Teaoraereke and Nanikai-Bairiki causeways have all been constructed by excavating material from the lagoon reef flats and there have been no serious after effects.

The rosive effect of the reef excavation can be kept to a minimum by shallow dredging over large areas in sections of similar width, parallel to the shoreline. This reduces the reflection of incident waves and restricts any changes to the ends of the excavation. The proposed site for excavation is on the lagoon flat between Bairiki Harbour and the Marine Training School (M.T.S.) channel on Betio and it is intended to excavate a long wide section of reef to a depth of 250mm to provide the causeway fill. (see sketch). With an excavation of this shape the vulnerable areas will be at the ends and at any change in the excavation width. The eastern end is the Bairiki Harbour mole and the new causeway itself. The Bairiki harbour mole could not be eroded and the new causeway will have a high degree of resistance to erosion due to the particle size of the fill. The western end which could be affected is the area between the M.T.S. channel and Betio harbour east mole. It is not anticipated that any material will be lost from this section as the sand beaches are "locked in" by the M.T.S. Jetty and the harbour mole, but some movement may take place. It is anticipated that any erosion that occurs could be dealt with quite easily by conventional methods (sand replacement, stone wall or gabion baskets.)

Resources

The Public Works Division has at present cadre very experienced and highly skilled plant operators who have proved their capabilities on the Outer Islands Airfield construction and the Outer Island Road upgrading projects. These men are at present employed on South Tarawa by P.W.D. but not necessarily on tasks commensurate with their skills. They can be made available to work under the direction of the contractor appointed by the donor.

The Plant and Vehicle Unit has all the necessary equipment for the construction of the causeway in its possession. This equipment is at present being under-utilised. The plant should be utilised by the contractor appointed to do the work.

The existing management of P.W.D. Civil Engineering Section could manage and carry out the work provided funding is made available.

APPENDIX II : SUMMARY OF BACKGROUND INFORMATION TO 1984

1966 and 1969	Reports on proposed Betio-Bairiki causeway. Wilton and Bell, Consulting Engineers, Sydney
1969	Borehole and probe survey of the proposed adjacent lagoon bed as a possible source of embankment fill material. George Wimpey & Co. Australia (Full report and cores etc. with Wilton and Bell.)
1974	Evaluation of causeway project by UNDP Advisory Team (B. Injac. Suva).
1976 (March)	Wilton and Bell engaged as consulting engineer.
1976 (July/aug)	Asian Development Bank pre-appraisal/appraisal mission to site.
1976 (Aug/Oct)	Wilton and Bell asked to carry out further coastal engineering studies etc.
1976 (Oct)	Wilton and Bell asked to proceed with pre-qualification of interested contractors.
1976 (Nov)	ADB approval
1977 (Feb)	Wilton and Bell design report issued
1977 (March)	Report by Wilton and Bell on pre-qualification of contractors.
1977 (March)	ADB and Kiribati Government sign loan agreement.
1977 (Aug)	Pre-tender conference on site and issue of tender documents.
1977 (Oct)	Wilton and Bell advise K.G. on lowest tender bid.
1977 (Nov)	Contract awarded by K.G. to P.D.C. Ltd. Value A$1.936 million.
1978 (Jan)	Contractor on site. Dredging due to start May 1978 and estimated completion of dredging August 1978.
1978 (Aug)	Dredging started.
1978 (Dec)	Dredging stopped. Contractor claimed extra costs due to shortage of dredgeable material and or material being more compacted "than might reasonably have been anticipated".
1979 (March)	K.G. brought in independent Dutch dredging expert for report on P.D.C. dredger and recommendation.
1979 (April)	Report - Analysis of Dredging Works at Tarawa by J.H. Van Koeverigne of Royal Volker Stevin. P.D.C. dredger condemned - impossible to complete contract.

1979	Protracted negotiations and discussions between K.G., Consultant, P.D.C. and their legal advisers.
1979 (July)	Contractor (P.D.C.) expelled from site by K.G. on advice of Consultant.
1979 (Dec)	P.D.C. Initiated arbitration proceedings.
1980 (July)	Agreement between K.G. and P.D.C. resolving distribution of site plant and equipment and postponing arbitration proceedings.
1980 (Dec)	A.D.B. (Robertson) Technical Assistance report on proposed further Geotechnical Investigations for the causeway project. Proposal for "minimum dimension" single causeway.
1981 (Oct)	ADB Report TANo 383 KIR - "Kiribati Causeway Geotechnical Investigations" - John Connell. Consulting Engineers, Melbourne, Australia Report covers borehole and probe investigations of A) original borrow area in lagoon bed B) borrow area along centre line of causeway C) borrow area on lagoon reef flat N.E. of Betio D) borrow area on lagoon reef flat near Bonriki runway and confirmed adequate quantity of material suitable for dredging available in original area.
1982 (July)	Report on feasibility of constructing a proposed Betio-Bairiki Causeway/Runway by dredged fill embankment. (John Connell). The proposal was to combine the requirement for a new and bigger runway with the causeway to justify the mobilisation/demobilisation costs of a medium large cutter/suction dredger. The report indicated the costs would be excessive.
1982	KG gave up Causeway/Runway proposal and decided to proceed with dual causeway project enquiries.
1983	Arbitration proceedings between P.D.C. and K.G. abandoned by mutual agreement.
1984	PWD proposal for "minimum dimension" - Causeway - Fisheries Channel Project

APPENDIX III : RELATED PROJECTS/EXERCISES

Consolidation of Supplies Division

Consolidation of Plant and Vehilce Unit

The PVU have identified the following benefits which would arise from the construction of a causeway:

(i) closure of Bairiki Mechanical Workshop;
(ii) centralisation of vehicle hiring on Bairiki;
(iii) centralisation of government fuel outlet on Bairiki;
(iv) easing of repairs to heavy equipment on Betio;

These "benefits" would realise savings in vehicles, staff, spares and electricity;

Consolidation of Kiribati Housing Corporation

Tarawa Water Supply Project - Betio-Bairiki pipe Laying.

Takoronga Ferry Terminal - unnecessary of Causeway proceeds.

Replacement Ferries - unnecessary if Causeway proceeds.

Repositioning of Betio-Bairiki Submarine electricity cable.

Public Service Review.

APPENDIX IV : ECONOMIC VIABILITY

This project has been agreed by the Kiribati Government and accepted as a top priority project. The Ministry of Finance has been asked to pursue finance.

The alternative to the Causeway/Fisheries Channel is to continue and try to improve the existing ferry service. A new ferry terminal at Takoronga, Betio has been proposed by the Ministry of Communications at a cost estimate of A$605,000. An alternative ferry terminal on Betio will prove all the more necessary once the Betio fisheries jetty is constructed. The Causeway and the ferry terminal are mutually exclusive projects. National development must be seen to be far better served by a Causeway. The initial investment costs and negligible maintenance costs of a Causeway/Fisheries Channel must be preferred to the annual and increasing operating costs of a ferry service.

Demand

Statistics of ferry traffic are presented below in Tables 1 and 2. A total of 8,115 motorcycles and 2,191 other vehicles were also ferried between Betio and Bairiki in 1983. There is obviously a high demand for traffic between Betio and Bairiki which is quite

*number travelling from Betio to Bairiki and Bairiki to Betio.

TABLE 1

FERRY PASSENGERS *

1973	219,000
1974	260,000
1975	314,500
1976	356,000
1979	411,784
1980	371,025
1981	411,077
1982	409,462
1983	379,611

likely to substantially increase with the construction of a more convenient causeway/Fisheries Channel.

TABLE 2

CARGO LIGHTERED (TONS)

	BETIO/BAIRIKI	BAIRIKI/BETIO	TOTAL
1977	3331.5	1351.7	4683.2
1978	2961.8	976.7	3938.5
1979	5323.0	832.3	6155.3
1980	4072.3	646.1	4718.4
1981	2977.8	545.8	3523.6
1982	3847.0	606.7	4453.7
1983			

Economic Costs

The original ADB economic appraisal and subsequent reappraisals described the Causeway Economic costs as:

(i) Capital
(ii) Maintenance
(iii) Additional Vehicle Operating Costs

If locally constructed, capital costs are estimated to total A$920,000 only, this represents a great reduction over previous estimates.

Maintenance costs were set by ADB in 1976 at A$15,000 then A$30,000. These are a gross over-estimate, even for 1984, and exceed PWD's total South Tarawa causeway maintenance allowance of A$2,500 for 1985. An annual allowance of A$2,000 would be more realistic. The additional vehicle operating costs are also unrealistic, as such costs would be more than outweighed by the vehicle operating costs-savings, due to reductions in the size of both the public and private vehicle fleets. These are partially duplicated at present because of the lack of a permanent roadlink between Betio and Bairiki.

Economic Benefits

Economic benefits can be listed as follows:

(i) Cost savings due to the displacement of the Ferry and Lighterage services (including fuel transportation), and the removal of the need for a new ferry Terminal at Takoronga, resulting in lower costs of imports;

(ii) Costs savings due to the consolidation of government services avoiding the present duplication of some government staff, buildings as well as vehicles. PVU and Supplies Division could be reorganised;

(iii) Cost savings due to the improved administration and management of Government, Corporations and private businesses;

(iv) Cost savings due to a lessening of the congestion at Betio harbour, easing the port handling of other users, and enabling Bairiki harbour to be used by Local fishing boats; and

(v) Time and Cost savings associated with the local fishermen's easier access to the ocean.

The permanent roadlink would also be of great social benefit to the pupulations of Betio and the rest of South Tarawa easing their respective access to: the hospital; airport; TTC; Hotel; for Betio and the harbour; TTI; and High Court for the rest of South Tarawa. The Causeway/Fisheries Channels would ease Betio's dense population. The Causeway would undoubtedly lead to a large increase in the traffic between Betio and the rest of South Tarawa.

Unfortunately few of the above benefits are directly and immediately quantifiable. Also, the ADB appraisal over-estimated the benefits due to the Causeway by entering Ferry Cost savings from project year 1, (and possibly double accounting ferry depreciation). These are more realistically entered after completion of construction.

Rate of Return

An economic analysis should be based on the careful assessment of social, as opposed to financial, prices. To date, hardly any work has been undertaken to assess social (shadow or accountancy) prices for Kiribati. The Kiribati economy is however fairly open, using an international currency with next to no foreign exchange control, and few other controls other than domestic taxes. The economy is however artificially stimulated by aid. On balance Kiribati social prices and financial or market prices should be close. Causeway costs and benefits (cost savings) are similar - i.e. machinery, fuel, labour and any price distortions could be assumed to effect both costs and benefits equally.

The Causeway/fisheries Channel project is undoubtedly economic with a repayment of capital costs within two years and an estimated internal rate of return of over 50%. This can be illustrated by the following cost comparison:

CAUSEWAY

COSTS	A$	BENEFITS	A$
Construction (1)	920,000	Ferry cost savings (3)	477,754
Annual maintenance:	2,000	Lighterage cost savings	22,246
			500,000
		Salvage value (4)	81,359

There is little if any need for a "what if" analysis of sensitivity. However if:

(i) construction costs are doubled and spread over two years which allows for the importation of equipment;

(ii) net cost-savings are reduced to A$290,000 which equates to the 1982 Shipping Corporation Accounts cost estimates for the ferry service

With these two major cost/benefit adjustments the project still returns an IRR of 15%.

---

(1) All in 1984 prices

(2) Estimated total construction cost of A$920,000 in 1984 prices - (See Appendix V for details)

(3) Revision of December 1982 Management Report data by a factor of 10% to allow for inflation to 1984

	A$
Staff Costs	177,972
Maintenance and slipping	66,932
Fuel	96,000
Insurance	6,006
Depreciation	163,000
Other	27,844
	477,754

Additional A$22,246 for savings in lighterage operations

= A$500,000

Note

Ferry replacement and major overhaul costs included under depreciation and maintenance and slipping cost elements of ferry operation.

(4) Salvage Value at 10% of capital investment.

On the benefits side of the equation, we have not as yet been able to provide quantification of the further benefits due to the construction of a causeway/fisheries channel i.e.:

(i) cost savings due to the consolidation of government services avoiding the present duplication of some government staff, buildings and vehicles. PWD, FVU and Supplies Division could be reorganised;

(ii) Cost savings due to the improved administration and management of government, Corporations and private business;

(iii) cost savings due to a lessening of the congestion at Betio harbour, easing the port handling of other users; and

(iv) cost savings due to improved fishermen's access to the ocean.

MINUTES OF DISCUSSION
ON
BASIC DESIGN STUDY
FOR
BATIO - BAIRIKI CAUSEWAY , FISHERIES CHANNEL PROJECT
IN
THE REPUBLIC OF KIRIBATI

In response to a request made by the Government of the Republic of Kiribati, the Government of Japan through Japan International Cooperation Agency(JICA), the governmental agency responsible for implementation of economic &technical cooperation programme of the Government of Japan, dispatched the Basic Design Study Team on Betio - Bairiki Causeway, Fisheries Channel Project.
The Team headed by Mr.Takeshi KAWAGUCHI, Fisheries Agency, Ministry of Agriculture, Forestry & Fisheries, has carried out a field survey, held a series discussions and exchanged views with Kiribati government officials concernd from 8th to 28th April, 1985.
Both parties confirmed following points mentioned in attachment.

April 19, 1985
Betio

Mr. Takeshi KAWAGUCHI
Team Leader
Basic Design Study Team on Betio-Bairiki Causeway, Fisheries Channel Project
Japan International Cooperation Agency

Mr. John Ikakeau Tonganibeia
Secretary
Ministry of Communications
The Republic of Kiribati

ATTACHMENT

1. The objective of the Japanese Grant Aid required for the Project is to construct a causeway between Betio and Bairiki islands, a navigation channel for local small fishing boats and a bridge at the crossing of the causeway and the channel.

2. Executing Authority of the Project in the Republic of Kiribati :
Ministry of Communications

3. The Basic Design Study shall be completed in line with the Design Guidline attached in ANNEX 1., which was agreed to between the Team and the Inter-Ministerial Committee of the Government of the Republic of Kiribati.

4. The result of the Basic Design Study shall be compiled as a draft of the Basic Design Study Report, which shall be submitted and explained to the Government of the Republic of Kiribati by JICA mission to be dispatched at the beginning of July, 1985.

5. The Kiribati side has understood Japan's Grant Aid System explained by the Team which includes a principle of use a Japanese consultant firm and a Japanese general contractor.

6. The Government of the Republic of Kiribati will take necessary measures listed in ANNEX 2. on condition that the Grant Aid by the Government of Japan will be extended to the Project.

ATTACHMENT TO THE MINUTES

ANNEX I - DESIGN GUIDELINE FOR THE BASIC DESIGN STUDY ON BETIO-BAIRIKI CAUSEWAY AND FISHERIES CHANNEL PROJECT

I-1 Project Length (See Figure No. 1)

Beginning point:	STA 0+00 near junction with existing road at Bairiki
Ending point:	STA 30+00 near the eastern end of Betio
Causeway length:	3,000 m

I-2 Alignment of Causeway

Horizontal alignment:	As proposed by PWD
Vertical alignment	
Causeway:	Level
Approach to the bridge:	2.5%

I-3 Design Speed: 50 km/hr

I-4 Typical Cross Section of Causeway

(1) Crest elevation: RL + 3.0 (lowest)

(2) Crest width: 10.0m

(3) Roadway with pavement: 6.0m

(4) Alternatives of causeway embankment to be studied.

Type	Slope of Embankment: Ocean side	Lagoon side
Type 1	1 : 15	1 : 8
Type 2/2	1 : 2 1 : 3/1	1 : 8
Type 3/2	1 : 2 1 : 3/1	1 : 2 1 : 3/1

Note/1: Slope Protection

Slope protection with grout filled fabric mat or other suitable measures will be provided on the fill slope of causeway.

Note 2: Alternative cross sections (Type 2 and Type 3) are established by the Study Team to:

(1) minimize erosion of fill slope

(2) maintain durability of embankment

(3) minimize environmental problems which might be caused by excavating fill material from the lagoon reef flat.

L-5 Fisheries Channel

(1) Approximate location of channel to be constructed : STA 19 + 00

(2) Width of channel: 10.0m

(3) Depth of channel: 1.0m below a MLWS or R.L - 1.0m

L-6 Bridge across channel

(1) Clear span: 10.0m

(2) Width of bridge: 10.0m

(3) Clearance from MHWS: 3.6m

(4) Deck elevation: R.L + 5.

(5) Type of Bridge: Reinforced [illegible]

L-7 Borrow Area

Borrow areas for excavation proposed by the Study Team

(i) the l[illegible]of flat within Borrow area 2

(ii) the [illegible]t on the ocean side near Bo[illegible]ki

L-8 Quarry Site

Coral ro[illegible]e used for aggregate of concrete structure and pavemen[illegible]e obtained from the quarry on the ocean side of Bon[illegible]oral rubble for slope protection will also be obtaine[illegible]m there.

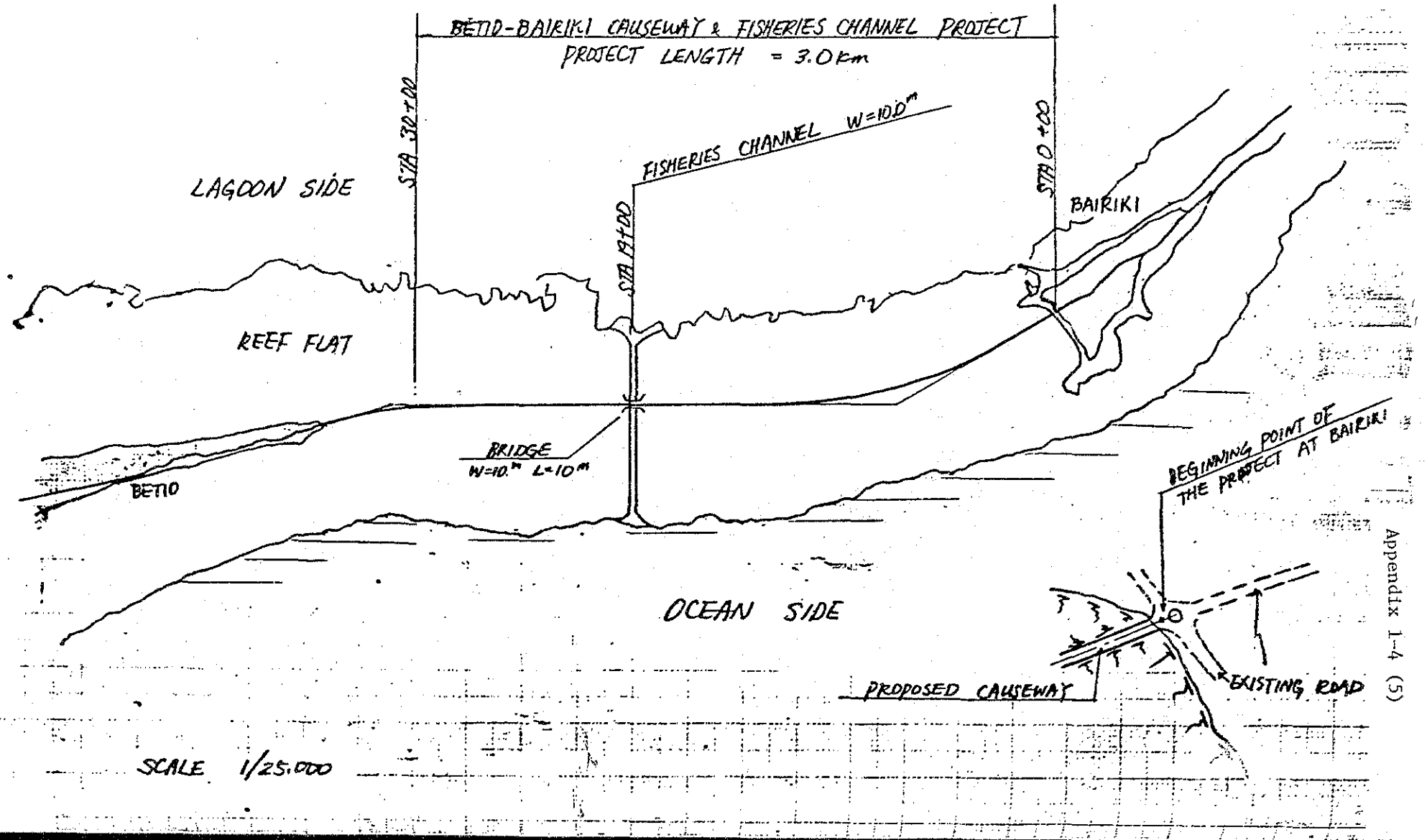
Comments:

The followi[illegible] comments are raised by the Government of Kiribati in connecti[illegible] with the design guideline:

(1) the necessity of additional opening be studied taking into consideration marine life in the lagoon

(2) Slope protection of the causeway might be necessary if borrow area for the excavation are selected near to the causeway.

Fig. No.1 LAYOUT OF THE PROJECT



Annex 2

Major undertakings to be taken by the Government of the Republic of Kiribati

1. To secure lots of land necessary for the Project.

2. To provide and accord necessary permissions, licences and other authorizations required for the execution of the Project.

3. To ensure prompt unloading, customs clearance for the goods imported by the contracted Japanese firms for the Project.

4. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Kiribati with respect to the supply of the products and services under the Verified Contracts.

5. 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 the Republic of Kiribati and stay therein for the performance of their work.

6. To maintain and use properly and effectively the facilities constructed under the Grant.

7. To bear all the expenses other than those to be borne by the Grant.

MINUTES OF MEETING

The Basic Design Study Team of Japan International Cooperation Agency on Betio - Bairiki Causeway, Fisheries Channel Project and the Inter-Ministerial Committee of the Government of the Republic of Kiribati held a meeting on 17th April,1985.

At the meeting, a draft of the Design Guidline for the Basic Design on the Project was submitted and explained by the Team based on findings of reviewing the existing data & information and of the preliminary field survey.

As a result of discussion, the Design Guidline was confirmed by both parties as per attached in Annex 1..

Meanwhile, Kiribati side made an additional request that supplementary works relating to the Project would be covered in the scope of the Japanese grant aid requested.
(The contents of the additional request is shown in Annex 2. herein attached.)

While pointing out the difficulty to satisfy the request on account of the demarcation principle on works of the Japanese grant aid system, the Team expressed its intention, in consideration of Kiribati side's ardent hope for the request, to convey the request to the Government of Japan and to make efforts toward realization of the request.

At the end of the meeting, the Team expressed its appreciation and paid its respect for the effort taken by Mr.Inatoa TEBANIA to organize and chair the meeting.

April 17, 1985
Betio

Mr. Takeshi KAWAGUCHI
Team Leader
Basic Design Study Team on Betio-Bairiki
Causeway, Fisheries Channel Project
Japan International Cooperation Agency

Mr. Inatoa TEBANIA
Senior Assistant Secretary
Ministry of Communication
Chairman of Inter-Ministerial
Committee of the Government
of the Republic of Kiribati

ATTACHMENT TO THE MINUTES

ANNEX I - DESIGN GUIDELINE FOR THE BASIC DESIGN STUDY ON BETIO-BAIRIKI CAUSEWAY AND FISHERIES CHANNEL PROJECT

I-1 Project Length (See Figure No. 1)

Beginning point:	STA 0+00 near junction with existing road at Bairiki
Ending point:	STA 30+00 near the eastern end of Betio
Causeway length:	3,000 m

I-2 Alignment of Causeway

Horizontal alignment:	As proposed by PWD
Vertical alignment	
Causeway:	Level
Approach to the bridge:	2.5%

I-3 Design Speed: 50 km/hr

I-4 Typical Cross Section of Causeway

(1) Crest elevation: RL + 3.0 (lowest)

(2) Crest width: 10.0m

(3) Roadway with pavement: 6.0m

(4) Alternatives of causeway embankment to be studied.

Type	Slope of Embankment: Ocean side	Lagoon side
Type 1	1 : 15	1 : 8
Type 2 /2	1 : 2 1 : 3 /1	1 : 8
Type 3 /2	1 : 2 1 : 3 /1	1 : 2 1 : 3 /1

Note/1: Slope Protection

Slope protection with grout filled fabric mat or other suitable measures will be provided on the fill slope of causeway.

Note 2: Alternative cross sections (Type 2 and Type 3) are established by the Study Team to:

(1) minimize erosion of fill slope

(2) maintain durability of embankment

(3) minimize environmental problems which might be caused by excavating fill material from the lagoon reef flat.

L-5 Fisheries Channel

(1) Approximate location of channel to be constructed : STA 19 + 00

(2) Width of channel: 10.0m

(3) Depth of channel: 1.0m below a MLWS or R.L - 1.0m

L-6 Bridge across channel

(1) Clear span: 10.0m

(2) Width of bridge: 10.0m

(3) Clearance from MHWS: 2.6m

(4) Deck elevation: R.L + 5.

(5) Type of Bridge: Reinforced [illegible]

L-7 Borrow Area

Borrow areas for excavation proposed by the Study Team

(i) the l[illegible]of flat within Borrow area 2
(ii) the r[illegible]h on the ocean side near Bo[illegible]ki

L-8 Quarry Site

Coral ro[illegible]e used for aggregate of concrete structures and pavemen[illegible]e obtained from the quarry on the ocean side of Bon[illegible]oral rubble for slope protection will also be obtaine[illegible]n there.

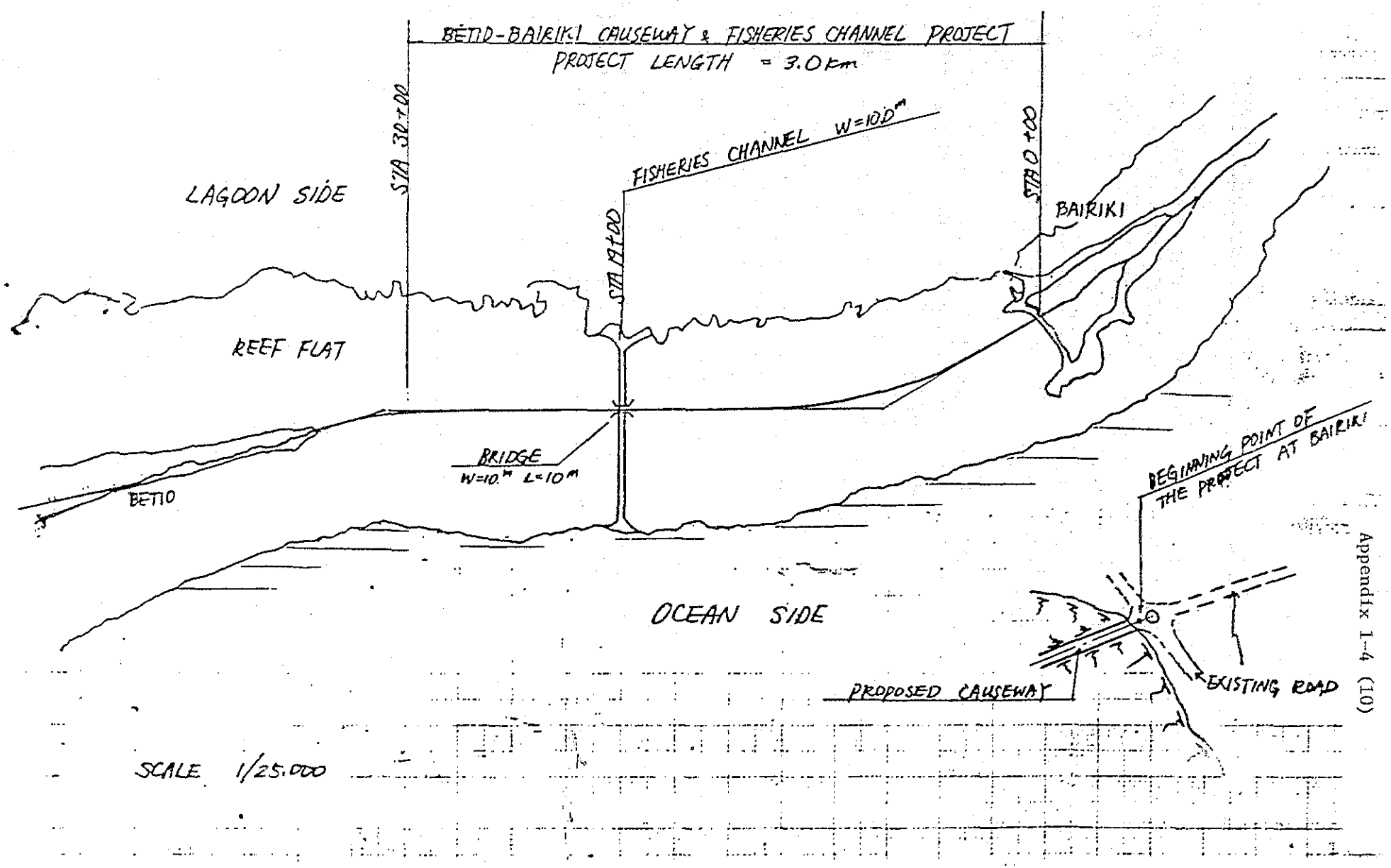
Comments:

The followi[illegible]comments are raised by the Government of Kiribati in connecti[illegible]with the design guideline:

(1) the necessity of additional opening be studied taking into consideration marine life in the lagoon

(2) Slope protection of the causeway might be necessary if borrow area for the excavation are selected near to the causeway.

Fig. No.1 LAYOUT OF THE PROJECT



ANNEX 2

BETIO-BAIRIKI CAUSEWAY AND FISHERIES CHANNEL PROJECT

MEETING HELD ON 17 APRIL 1985 BETWEEN THE BASIC DESIGN SURVEY STUDY TEAM OF JAPAN INTERNATIONAL COOPERATION AGENCY AND THE INTER MINISTERIAL COMMITTEE OF THE GOVERNMENT OF KIRIBATI

The following additional works are requested by Kiribati Government:

(1) That both the causeway and approach roads be surfaced with Double Bituminous Surface Treatment. (Total length approximately 4,200m)

(2) That two parking lots be provided, one on each side of the proposed bridge

(3) That removal of unexploded ordnance over the area of the causeway and borrow areas be included

(4) That the existing power cable be relocated in the proposed causeway.

(5) That a new 50 pr/0.93mm telephone cable is provided over the causeway and approach roads between the relevant junction boxes (total length 4,500m approximately).

BACKGROUND INFORMATION TO ADDITIONAL WORK REQUESTS

1) The sealing of the road over the length of the causeway proper (Sta 0+00 to Sta 30+00) has always been considered as part and panel of the causeway project. The access roads should also be considered part of the project.

At present the sealed road on Betio terminates outside Takoronga Primary School and there is a rough track from this point to the end of the island, a distance of 1,050 metres. More than half of this distance is land that was reclaimed by the first causeway attempt in 1978.

On the Bairiki side the main road at present goes to the wharf and there is an unsurfaced road 170m from Bairiki Police Station to the point where the proposed causeway will commence.

Kiribati Government will be adjusting the alignment of both these road sections and will construct the roads up to the underside of final surfacing level. It is considered that the final surfacing should be done by one contractor as this will give a uniform appearance to the work and will reduce the costs.

The level of road surfacing skills at present available within P.W.D. is not not very high.

2) The Parking Lots (lay-by's) are to be provided so that vehicles do not stop on the highway. It is intended to make the causeway a Clearway but some provision must be made for breakdown and also vehicles who want to stop on the causeway for fishing or site seeing.

3) Kiribati Governments expertise with unexploded ordnance is limited to identifying the probable risk and disposing of the smaller material by hand over the reef. Large or potentially dangerous shells are disposed of by overseas experts. No equipment or expertise for locating ordnance is available locally.

The detonation of shells in-situ is not recommended as the present across-reef water pipeline is in poor condition. The work of locating and disposing of unexploded ordnance on the line of the works, borrow pits and haul roads should be carried out at a pre-contract stage.

4. There are two 11K.V.A. power cables running across the reef. One has extensive damage to it and is located on the line of the proposed causeway, the cable will be recovered by P.U.B. prior to the commencement of the contract. The other cable carries the main power supply from the power house on Betio to the other urban centres of South Tarawa.

   Owing to its position on the reef this cable is constantly at risk. Kiribati Government would like this cable to be relocated in the proposed causeway where it will be adequately protected. If the cable is not relocated it has to be lowered and protected over the width of the channel.

5. At present all junction telephone circuits, telex and telegraph circuits between Betio and Bairiki/Bikenibau are carried by the 20/0.9 submarine cable. To increase its capacity phantom circuits have been derived giving us a total capacity of 28 circuits. All 28 circuits are in use.

   With the anticipated completion of the Radio System this year the junction telephone circuits will be transferred to it. However, it is not possible to transfer the telex and telegraph circuits. Also associated with the anticipated completion of the Automatic Telephone Exchanges and Subscribers Private Exchange a demand has arisen for private circuits between Betio and Bairiki/Bikenibau. This demand will increase over the next 10 years.

   Based on the above and our current requests for private circuits a 20/0.9 cable is insufficient, recommended that a 50/0.9 cable be installed.

SURVEY SCHEDULE (2ND VISIT)

Order	Month	Date		Description
1	July	16th	Tue	Departure from Narita by CO-564 at 11:00 for Nauru via Guam
2		17th	Wed	Departure from Nauru by ON-320 and arrival at Tarawa at 9:10
3		18th	Thu	Courtesy call to the Authorities concerned of the Government of the Republic of Kiribati
4		19th	Fri	Presenting and explaining the draft final report to the members of the Inter-Ministerial Committee of the Republic of Kiribati
5		20th	Sat	Internal meeting of the team
6		21st	Sun	Holiday
7		22nd	Mon	Discussion with the Inter-Ministerial Committee of the Republic of Kiribati
8		23rd	Tue	Signing of the Minutes of Meeting between secretary of Ministry of Communication of the Government of the Republic of Kiribati and the Team Leader
9		24th	Wed	Left Tarawa by ON-319 for Suva via Nauru and arrival at Suva by ON-921 at 16:45
10		25th	Thu	Courtesy call to Embassy of Japan in Fiji and JICA office, departure from Suva by FJ-113 at 16:00 for Nadi, departure from Nadi by QF-094 at 17:35 and arrival at Sydney at 20:10
11		26th	Fri	Departure from Sydney by CX-100 at 14:45 and arrival at Hong Kong at 21:45
12		27th	Sat	Departure from Hong Kong by CX-500 and arrival at Narita at 21:30

LIST OF PERSONS INTERVIEWED (From 16 July 1985 To 27 July 1985)

Ministry of Communications

Minister	Hon. Taomati T Iuta
Secretary	Mr John I Tonganibeia
Senior Assistant Secretary	Mr Inatoa Tebania

Ministry of Works and Energy

Chief Engineer, Public Works Division	Mr Bill Young

Ministry of Foreign Affairs

Acting Secretary	Mr Peter T Timeon

Ministry of Finance

Secretary	Mr Beniamina Tinga
Economist	Mr Peter Poulsen

Ministry of Natural Resource Development

Secretary	Mr Teken C Tokatake
Chief Fisheries Officer	Mr Barerei Onorio

Ministry of Home Affairs

Lands Officer	Mr Paul Taylor

Public Utilities Board

General Manager	Mr Nataara T Biribo

MINUTES OF DISCUSSIONS ON THE DRAFT FINAL REPORT OF THE BASIC DESIGN STUDY ON BETIO-BAIRIKI CAUSEWAY-FISHERIES CHANNEL PROJECT IN THE REPUBLIC OF KIRIBATI

Japan International Cooperation Agency (J.I.C.A.) sent a study team to the Republic of Kiribati from July 17th to 24th July 1985 for the purpose of presenting and explaining the Draft Final Report of the Basic Design Study (the Report) on Betio-Bairiki Causeway-Fisheries Channel Project.

The team held meetings with the Inter-Ministerial Committee of the Government of Kiribati chaired by Mr Inatoa Tebania, Senior Assistant Secretary, Ministry of Communications. As a result of discussions, both parties confirmed the following points attached herewith.

Betio, July 23rd 1985

Mr Takeshi KAWAGUCHI
Team Leader
JICA Study Team

Mr John Ikakeat TONGANIBEIA
Secretary
Ministry of Communications
The Republic of Kiribati

Witness

Mr Inatoa TEBANIA
Senior Assistant Secretary
Ministry of Communications
Chairman of the Inter-Ministerial
Committee of the Government
of the Republic of Kiribati

ATTACHMENT

1. The Kiribati side has agreed to the Basic Design proposal in the Draft Final Report.

2. The Final Report (10 copies in English) on the Project shall be submitted to the Kiribati side by the end of September 1985.

3. The Kiribati side understood the system of Japan's Grant Aid Programme and the arrangement to be taken by the Kiribati side which includes undertakings to secure the necessary quarry site and the necessary infrastructural facilities such as distribution of electricity, water supply, etc. for the Japanese contractor.

4. Kiribati side will secure the provision of underground power cable to be installed in the causeway with adequate length and quality as mentioned in the Annex.

ANNEX Appendix 1-7 (3)

Telegrams: MINCOM, TARAWA

MINISTRY OF COMMUNICATIONS
P.O.Box 487
Betio, Tarawa
Republic of Kiribati

(In reply please quote)
CS/6/2

Date.....

23 July 1985

Mr T Kawaguchi
BETIO

Dear Sir

Attached is the formal request from the Public Utilities Board relating to the installation of the ground cable for electricity to be included in the construction of the causeway.

The request receives the support of the Ministry of Communications for the kind consideration of the Japanese Government.

Yours faithfully

I TEBANIA
for Secretary for Communications

Encl

T.K

Public Utilities Board

Appendix 1-7 (4)

ESTABLISHED 1st JULY 1977

CABLES: P.U.B. TARAWA

SERVICES
ELECTRICITY SUPPLY
WATER SUPPLY &
SEWAGE DISPOSAL

PHONE: 743 & 749

P.O. BOX 443
BETIO, TARAWA
REPUBLIC OF KIRIBATI
CENTRAL PACIFIC

OUR REF. PUB 4/44

DATE 23/7/85

Secretary
Ministry of Communications
Betio

Dear Sir (Attn: Project Co-ordinator)

RE: CABLE FOR CAUSEWAY

Following our letter even referenced to the Chief Engineer and subsequently to our discussion Tebania/Biribo. We would again confirm that:

PUB has enough underground cable 11KV (8 drums, each 500m total 4.0km) to go into the causeway and has responsibility of cable quality thereof.

Six joints for cable and cable jointing would also be provided by PUB including delivery of cable to site.

We request that installation of cable in the causeway be carried out by Government of Japan through their site engineers during construction of the causeway.

Yours faithfully

NATAARA T. BIRIBO
General Manager

TBL

AREA AND POPULATION OF KIRIBATI BY ISLAND

Area	Area in km^2	Population		
		Dec. 1978 (Census)	Dec. 1982 (Estimated)	per km^2
The Gilbert Group				
Banaba	6.2	2,201	73	11.6
Makin	7.9	1,419	1,555	196.8
Butaritari	13.5	3,149	3,470	257.0
Marakei	14.1	2,335	2,580	183.0
Abaiang	17.5	3,447	3,775	215.7
North Tarawa	15.3	2,227	2,450	160.1
South Tarawa (Urban area)	15.7	17,921	20,050	1,277.1
Maiana	16.5	1,688	1,900	113.8
Abemama	27.4	2,411	2,710	98.9
Kuria	15.5	803	900	58.1
Aranuka	11.6	850	1,005	86.6
Nonouti	19.9	2,284	2710	136.2
North Tabiteuea	25.8	2,975	3,320	128.7
South Tabieuea	11.8	1,182	1,315	111.4
Beru	17.6	2,212	2,480	140.9
Nikunau	19.1	1,829	2,100	109.9
Onotoa	15.6	2,034	2,310	148.1
Tamaroa	4.7	1,349	1,585	337.2
Arorae	9.5	1.527	1,735	182.6
The Line Group				
Washington	9.6	416	450	46.9
Phaninog	33.7	434	470	13.9
Christmas	388.4	1,265	1,360	3.5
The Phoenix Group				
Canton, Phenox & others				
Others (estimated)		255		
T O T A L	717.1	56,213	60,302	84.1

Source: Ministry of Finance

Note: The population in Bonaba Isl. is decreasing sharply due to the exhaustion of the phosphate ore in 1979

TREND IN POPULATION AND NUMBER OF HOUSEHOLDS

	1931	1947	1963	1968	1973	1978	1982
Male	15,395	15,762	21,460	23,748	25,606	27,726	
Female	14,356	15,751	21,876	23,987	26,320	28,487	
Total	29,751	31,513	43,336	47,735	51,926	56,213	60,302
Number of households		7,144	7,770	8,187	8,518	9,068	
Average number of persons per household		4.41	5.58	5.83	6.10	6.20	
Growth rate of population, %		0.4	2.0	1.9	1.7	1.6	2.0
Growth rate of household, %			0.5	1.0	0.8	1.3	
Growth rate of number of persons per household, %			1.5	0.9	0.9	0.3	

COMPOSITION OF POPULATION BY AGE

Age	1973		1978	
	Male	Female	Male	Female
0 ∿ 4	3,787	3,704	3,900	3,876
5 ∿ 9	4,151	3,916	3,670	3,488
10 ∿ 14	3,771	3,571	4,216	3,935
15 ∿ 19	2,484	2,674	3,337	3,397
20 ∿ 24	2,036	2,370	2,318	2,600
25 ∿ 29	1,626	1,669	1,976	2,172
30 ∿ 34	1,458	1,567	1,626	1,614
35 ∿ 39	1,249	1,294	1,451	1,508
40 ∿ 44	1,212	1,139	1,057	1,180
45 ∿ 49	1,026	1,077	1,203	1,129
50 ∿ 54	832	872	863	986
55 ∿ 59	562	659	693	744
60 ∿ 64	551	627	550	688
65 ∿ 69	338	423	393	488
70 and more	523	758	473	682
Total	25,606	26,320	27,726	28,487

Source: 1978 Census of Population

ECONOMICALLY ACTIVE POPULATION (NATIVE PEOPLE)

(Unit: person)

	Total	Male	Female
Population older than 15 years of age	32,858	15,776	17,082
Economically active population	28,859 (100%)	13,769 (100%)	15,090 (100%)
Monentary economic sector	7,375 (25.6%)	5,882 (42.7%)	1,493 (9.9%)
Employer	60	52	8
Employee	6,296	4,963	1,333
Private Concern	184	127	57
Unemployed	835	740	95
Non-monentary economic sector	21,484 (74.4%)	7,887 (57.3%)	13,597 (90.1%)
Non-economically active population	3,999	2,007	1,992

Source: Report on the 1978 Census of Population and Housing

EMPLOYMENT POPULATION BY INDUSTRY (NATIVE PEOPLE)

(Unit: Person)

Industry	Total	Male	Female
	6,432	5,045	1,387
Agriculture & Fisheries	480	464	16
Agriculture	(375)	(365)	(10)
Fisheries	(105)	(99)	(6)
Mining	293	281	12
Manufacturing Industry	183	131	52
Food	(58)	(20)	(38)
Textile	(5)	(1)	(4)
Furniture	(15)	(15)	(0)
Printing	(23)	(15)	(8)
Ship Building	(82)	(80)	(2)
Welfare	192	185	7
Construction	954	917	37
Commerce & Service	902	607	295
Wholesale	(148)	(127)	(21)
Retail Trade	(599)	(405)	(194)
Hotel & Restaurant	(155)	(75)	(80)
Transport & Communication	662	590	72
Transport	(518)	(474)	(44)
Communication	(144)	(116)	(28)
Financial Business	28	21	7
Public Service	2,730	1,844	886
Administration	(994)	(824)	(170)
Education	(639)	(381)	(258)
Others	(1,097)	(639)	(458)
Indefinite	8	5	3

Source : Report on the 1978 Census of Population and Housing

TREND OF COMPOSITION OF FOREIGN TRADE BY ITEM

(Unit: 1,000 A$, %)

Year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Amount of Export (Ratio of increase to previous year, %)	24,054 (+10.57)	27,734 (+15.3)	18,147 (-34.6)	18,212 (+0.4)	21,396 (-17.5)	21,209 (-0.9)	2,426 (-89.6)	3,534 (+45.7)	1,934	3,661	6,978
Ogisogate ore	79.4	96.4	94.5	86.4	88.3	84.7					
Copra	20.3	3.4	5.3	13.3	11.6	14.5	89.2	74.6	75.1	58.9	
Fish						0.7	9.9	19.7	15.7	35.0	
Shark's Fin				0.1	0.1	0.1	0.8				
Handcraft	0.1	0.2	0.2	0.2			0.1	5.7	6.1		
Others	0.2										
Amount of Import (Ratio of increase to previous year, %)	7,546 (+10.7)	9,281 (+23.0)	10,062 (+8.4)	11,692 (+16.2)	14,115 (+20.7)	15,545 (+10.1)	18,263 (+8.4)	22,830 (+18.2)	22,508	19,807	
Food	38.7	32.7	29.2	27.4	27.2	30.2	32.3	24.9	23.1	27.6	
Beverage & Tobacco	5.6	5.8	6.6	6.3	6.3	9.7	7.7	5.6	5.2	6.0	
Raw Materials	3.0	1.5	2.1	1.7	2.0	1.7	1.8	2.0	1.7	2.7	
Fuels	7.0	10.1	13.5	18.1	10.5	14.5	10.8	12.0	14.1	11.1	
Chemicals	6.6	5.4	6.4	5.2	5.3	5.5	5.3	2.0	4.1	4.0	
Industrial Products*	16.8	13.9	11.9	15.5	19.2	11.6	13.7	12.5	12.6	17.5	
Machinery, Transport Equipment & Vehicles	12.5	17.7	19.2	15.6	18.6	16.8	17.2	32.8	27.9	23.1	
Sundries	9.6	11.2	9.9	9.2	10.0	9.3	9.7	8.0	10.5	7.4	
Others	0.1	1.5	1.0	0.9	0.8	0.6	1.4	0.1	0.6	0.5	
Balance of Foreign Trade	16,508	18,453	8,085	6,520	7,281	5,664	-14,422	-16,378	-20,574	-16,146	

* Except Machinery, Transport Equipment & Vehicles.

Source : Ministry of Finance

TREND OF FINANCIAL INCOME AND EXPENDITURE

(Unit: 1,000 A$)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Ordinary Revenues	26,356	14,660	14,751	14,462	17,649	16,769	17,040	16,302	15,303	16,723
Taxes	25,232	12,844	12,028	11,682	13,727	6,755	5,672	4,467	4,509	5,763
Income Tax	547	699	885	927	1,309	1,359	1,020	919	1,020	1,080
Export Tax	1,761	2,460	2,431	2,439	3,315	3,380	3,483	3,428	3,195	3,800
Import Tax	128	109	387	6	47	77	4	2	15	
Phosphate Ore Tax	22,783	9,566	8,301	8,029	8,354	1,669				
Others	1,142	1,816	2,726	3,041	4,536	10,665	10,978	11,274	11,272	
Charge for Fishing			3	261	614	616	1,255			875
Trucking Station					154	241	204	316		183
RERF Interest						4,250	5,751	4,750	5,500	5,050
Postal Stamps			255	383	457	489	590	1,047	49	850
Financial Aid from UK						2,000	2,017	1,000	3,500	2,750
Ordinary Expenditures	30,405	12,251	13,442	13,270	16,687	14,362	16,235	15,889	15,389	16,722
Education & Welfare	2,755	2,503	2,907	3,152	3,760	4,513	4,812	4,803	4,599	
Natural Resources, Trade & Labour	2,304	824	155 646	433 64	686 1,774	740 167	608 341	1,099 446	1,362 734	
Communications, Energy &	2,310	2,153	2,237	4,586	3,464	4,137	4,438	4,481	3,454	
RERF Contribution	19,526	2,705	1,555		245					
Development Fund Contribution	549	512	1,517	1,434	1,976	593				
Balance	-4,049	2,409	1,309	1,192	962	2,407	805	413	86	1

Source : Ministry of Finance

TREND OF GROSS DOMESTIC PRODUCT (EXPENDITURE BASIS IN MARKET PRICE)

(Unit: 1,000 A$)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Private Consumption	8,934	11,202	11,896	15,742	15,946	17,122	20,208	20,988	19,386	20,999
Governmental Consumption	4,396	5,979	5,760	7,574	8,511	9,435	7,603	7,890	7,592	8,211
Total Investment in Fixed Assets	1,281	1,778	1,460	2,020	2,220	2,236	8,154	8,196	9,173	10,373
Increase in Stock	458	311	730							
Export (goods & service)	6,973	11,691	25,324	28,444	18,973	19,498	21,626	21,218	2,434	2,990
Import (goods & service)	6,230	8,735	8,685	11,703	12,010	13,348	18,199	19,993	17,784	19,573
GDP in Market Price	15,812	22,226	36,490	42,077	33,641	34,943	39,392	38,300	20,800	23,000

Source : A D B, Key Indicators of Developing Countries, 1983

Note : GDP in Added Value Basis is not consolidated into Statistics.

NAME OF FISH IN KIRIBATI

Kiribati	Scientific	English
Ati	Katsuwonus pelamis	Skipjack
Aua	Mugilidae	Mullet (Adult)
Auamaran	Valamugil seheli	Bluetail mullet
Auataba	Liza vaigiensis	Diamondscale mullet
Awai	Aprion virescens	Green jobfish
Auan	Spratelloides delicatulus	Blue sprat
Arataba	Etelis carbunculus	Red snapper
Aonga	Caranx lugubris	Black trevally
Awatai	Chanos chanos	Milkfish
Baiura	Thunnus albacares	Yellowfin tuna
Bakoa	Triaenodon obesus	Shark
Bureinawa	Holocentrus violanceus	Violet sqirrel fish
Baara	Acanthocybium solandri	Wahoo, Kingfish
Baua	Valamugil seheli	Bluespot mullet
Bawe	Lutjanus fulvus	Redtail snapper
Barebu	Caranx sexfasciatus	Dusky trevally
Buki iaro	Pristipomoides auricilla	Yellowtail snapper
Bukinrin	Aphareus rutilans	Jobfish
Buari	Gymnosarda	Dogtooth tuna
Barinua	Sphyraena barracuda	Great barracuda
Baiburoro	Carcharhinus melanopterus	Blacktip reefshark
Ingimea	Thunnus albacares	Yellowfin tuna
Ikanibeka	Ruvettus pretiosus	Coster oil fish
Ikanenea	Ruvettus pretiosus	Coster oil fish
Ikari	Albula vulpes	Bonefish
Ikabauea	Sphyraena	Forsters seapike
Ikanibong	Lutjanus gibbus	Humpback red snapper
Ingo	Lutjanus bohar	Red bass, two-spot red snapper
Ikanarina	Trachinotus bailloni	Black-spotted swallow tail
Imnai	Siganus argenteus	Silver spinefoot
Inai	Scarus ghobban	Five banded parrot fish

Kiribati	Scientific	English
Ikamatoa	Lethrinus elongatus	Longnose emperor
Ikamaikeke	Dussumieria sp.	Rainbow sardine
Kemaa	Elagatis bipinnulata	Rainbow lunar
Kika	Octopus unlgarris	Octopus
Kìmokimo	Grammatorcynus bilineatus	Scad
Kabubu	Hyporhawphus	Garfish
Koinawa	Acanthurus triostegus	Convict surgeonfish
Kiroro	Gymnothorax fimbriatus	Green jobfish
Kuaubani	Epinephelus maculatus	Marbled rock cod
Kuau	Epinephelus merra	Honeycomb rock cod
Maebo	Upenous taenopterus	Bar-tailed goatfish
Matabareka	Carangoides orthogrammus	Gold-spot trevally
Mako	Acanthurus xanthopterus	Yellowfin surgeonfish
Matakore	Monotaxis grandoculis	Large-eyed bream
Morikoi	Lethrinus nebulosus	Spangled emperor
Ninimai	Gerres oyena	Silver biddy
Nari	Scomberoides lysan	Queenfish
Neia	Gnathodentex aurolineatus	Gold-line bream
Nimako	Cephalopholis urodelus	Flagtail rock cod
Nimanang	Cephalopholis argus	Peacock rock cod
Onauti	Cypselurus sp.	Flying fish
Okaoka	Lethrinus remak	Orange striped emperor
Rereba	Caranx melampygus	Bluefin travelly
Rou	Lethrinus miniatus	Long-faced emperor
Ree	Gnathanodom speciosus	Golden trevally
Rounaneawa	Lethrinus variegatus	Variegated emperor
Rakuriri	Istiophorus platypterus	Sail fish
Temon	Holocentridae	Squirrel fish
Tarabuti	Harengula ovalis	Sardines
Tau	Tyrosurus crocodilus	Longtom
Taa	Adioryx spinifer	Scarlet squirrel fish
Tiatiiu	Sardinella sirm	Blue sardine
Tawatawa	Euthynnus affinis	Mackerel tuna
Takua	Coryphaena hippurus	Dolphin fish
Tewe	Mulloidichthys	Goat fish
Urua	Caranx ignobilis	Great travelly

DETAILS OF MONTHLY PURCHASE OF FISH CATCHES
BY TE MAUTARI LTD. (1984)

1. Bonito and Tuna Fish

Month	Receiving Days	Receiving Number of boats	Purchase Quantity (kg)	Purchase Amount (A$)	Average Unit Price (A¢)	Purchase Q'ty per Boat (kg)	Purchase Amount per Boat (A$)
1	28	292	38,967	25,738	66.1	133.4	88.1
2	29	286	55,178	36,341	65.9	192.9	127.1
3	30	247	28,780	19,034	66.1	116.5	77.1
4	28	148	17,123	11,312	66.1	115.7	76.4
5	31	272	30,168	19,952	66.1	110.9	73.4
6	28	213	29,501	19,513	66.1	138.5	91.6
7	29	166	22,693	16,595	73.1	136.7	100.0
8	30	233	27,524	19,543	67.4	118.1	79.6
9	27	180	21,662	14,355	66.3	120.3	79.8
10	31	195	26,275	15,848	60.3	134.7	81.3
11	30	330	43,374	28,352	65.4	131.4	85.9
12	29	331	40,349	27,905	69.2	121.9	84.3
Total	350	2,893	381,594	253,489	66.4	131.9	87.6

2. Reef Fish

Month	Receiving Days	Receiving Number of Boats	Purchase Quantity (kg)	Purchase Amount (A$)	Average Unit Price (A¢)	Purchase Q'ty per Boat (kg)	Purchase Amount per Boat (A$)
9	4	6	133	132	99.2	22.1	22.0
10	19	54	2,551	2,530	99.2	47.2	46.9
11	24	52	2,773	2,751	99.2	53.3	52.9
12	10	12	1,423	1,412	99.2	118.6	117.7
Total	57	124	6,880	6,825	99.2	55.5	55.1

3. Total

Receiving Number of Boats	Purchase Quantity (kg)	Purchase Amount (A$)
3,017	388,474	260,314

Note: The figures in this table were consolidated from those in the Daily Purchase Report.

CHARACTERISTICS OF WATER IN LAGOON

The waters at the sea bottom were sampled at the following points and analyzed: 3 points in the ocean, 3 points offshore the lagoon, 10 points along the reefs around South Tarawa Main Isls., 8 points at the proposed site and along the reefs around Betio Isl. and 3 points in Betio Harbour totaling 27 points.

The characteristics were analyzed as mentioned below:

Area	Temperature at base	Specific gravity	Content of chlorine (‰)	Salt concentration (‰)	pH
Ocean	27.6	25.47	19.02	34.37	8.3
Offshore Lagoon	28.4	26.03	19.41	35.06	8.3
Main Isls. Reefs	29.0	26.62	19.83	35.82	8.3
Betio Reefs	29.1	26.47	19.72	35.63	8.3
In Betio Harbour	29.3	26.80	20.01	36.15	8.3
Average in Total	28.8	26.41	19.68	35.56	8.3

The characteristics seems to be that the temperature and specific gravity are lower in the ocean, and they come to be higher, the nearer the points are to the shoreline of the lagoon.

The hydrogen ion concentration index is of the standard type found in a tropical zone, and no tendency of water pollution was found. A tidal current was observed at the entrance of the sea route in the western reef, but only a slow flow of water toward the west along the edge of reefs was found in the lagoon.

OBSERVED MARINE METEOROLOGICAL DATA

Date	Time	Location No.	Depth (m)	Temperature at Base (°C)	Current Speed (kt)	Specific Gravity	Content of Chlorine (‰)	Salt Concentration (‰)	pH	Tide			Weather	Wind Direction & Speed
4/23	10.05	1	1.73	29.0	W'ly 0.20	1.02705	20.14	36.38	8.3	-	H.W 05.36	1.6m	Fine	E 3 m/sec
	10.30	2	4.30	28.8	SW 0.34	1.02698	20.09	36.29	8.3	-	L.W 12.00	0.5m		
	10.48	3	3.57	28.6	SW 0.36	1.02722	20.26	36.60	8.2	-	H.W 18.00	1.3m		
	11.18	4	5.14	28.9	SW 0.23	1.02702	20.12	36.34	8.3	-	L.W 23.48	0.6m		
	11.48	5	4.55	29.0	W'ly 0.20	1.02690	20.03	36.18	8.2	L				
	12.08	6	3.50	29.2	WSW 0.27	1.02765	20.57	37.16	8.3	L				
	13.01	7	3.28	29.4	WSW 0.17	1.02668	19.87	35.90	8.3	+				
	13.20	8	3.80	27.4	Nil	1.02702	20.12	36.34	8.3	+				
	13.43	9	6.00	29.0	W'ly 0.10	1.02655	19.78	35.73	8.3	+				
	13.56	10	4.00	29.4	W'ly 0.10	1.02700	20.10	36.31	8.3	+				
	14.15	11	4.75	29.2	W'ly 0.18	1.02692	20.04	36.21	8.3	+				
	14.35	12	5.40	29.2	W;ly 0.19	1.02710	20.17	36.44	8.3	+				
4/24	08.40	13	2.00	29.2		1.02662	19.83	35.82	8.3	-	H.W 06.06	1.5m	Fine	E 4.5m/sec
	08.45	14	1.40	29.2		1.02712	20.19	36.47	8.3	-	L.W 12.30	0.6m		
	12.48	15	9.60	27.6		1.02610	19.45	35.14	8.3	+	H.W 18.30	1.2m		
	14.15	16	10.50	27.9		1.02587	19.29	34.84	8.2	+				
4/25	13.17	17	5.60	27.6		1.02518	18.79	33.95	8.3	L	L.W 00.18	0.7m	Fine	
	14.15	18	10.60	27.8		1.02524	18.83	34.02	8.3	+	H.W 06.36	1.4m		
	15.05	19	13.00	28.3		1.02567	19.16	34.61	8.3	+	L.W 13.12	0.7m		
											H.W 19.12	1.1m		
4/26	07.35	20	4.06	29.6		1.02688	20.01	36.16	8.3	H	L.W 01.00	0.8m	Fine	E 1~2m/sec
	07.45	21	5.60	27.0	W 0.13	1.02577	19.22	34.71	8.3	H	H.W 07.30	1.3m		
	07.58	22	3.90	29.0	W'ly 0.11	1.02597	19.36	34.98	8.2	H	L.W 14.18	0.7m		
	08.18	23	1.10	28.0	WSW 0.35	1.02535	18.91	34.17	8.2	-	H.W 20.30	1.0m		
	08.37	24	4.20	28.8	W 0.29	1.02585	19.27	34.82	8.2	-				
	08.54	25	1.10	29.0	W'ly 0.23	1.02592	19.32	34.91	8.3	-				
	09.07	26	1.40	29.5	W'ly 0.23	1.02568	19.15	34.60	8.3	-				
	09.22	27	1.50	29.0	WSW 0.30	1.02592	19.32	34.91	8.3	-				
Average				28.8		1.02641	19.68	35.56	8.3					

SHIPPING CORPORATION OF KIRIBATI

CURRENT FERRY SCHEDULES

MONDAY TO FRIDAY

BETIO DEPARTURES	BAIRIKI DEPARTURES
0615 hrs. Mobil Tanker and Passengers from Bairiki	0700 hrs.
0700 hrs. Ferry Run	0800 hrs.
0800 hrs. Ferry Run and BP Tanker	0900 hrs.
0900 hrs. Ferry Run	1000 hrs.
1100 hrs. Ferry Run	1200 hrs.
1200 hrs. BP Tanker and School Children from Bairiki	1300 hrs.
1300 hrs. Ferry Run	1400 hrs.
1500 hrs. Ferry Run	1630 hrs.
1630 hrs. Ferry Run	1715 hrs.
1715 hrs. Ferry Run	1800 hrs.
1900 hrs. Ferry Run	2000 hrs.
2100 hrs. Ferry Run	2200 hrs.

Satuaday

0700 hrs. Ferry Run	0800 hrs.
0900 hrs. Ferry Run	1000 hrs.
1100 hrs. Ferry Run	1200 hrs.
1300 hrs. Ferry Run	1400 hrs.
1500 hrs. Ferry Run	1600 hrs.
1700 hrs. Ferry Run	1800 hrs.
1900 hrs. Ferry Run	2000 hrs.
2100 hrs. Ferry Run	2200 hrs.
2300 hrs. Ferry Run	2400 hrs.

Sunday

0700 hrs. Ferry Run	0800 hrs.
1100 hrs. Ferry Run	1200 hrs.
1500 hrs. Ferry Run	1600 hrs.
1900 hrs. Ferry Run	2000 hrs.

SHIPPING CORPORATION OF KIRIBATI

FERRY DIVISION

TRAFFIC STATISTICS

	YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
PASSENGERS	1982	33,113	34,634	35,347	34,441	37,371	35,857	37,436	32,058	32,547	33,259	29,253	33,533	408,849
	1983	29,329	28,884	30,131	33,064	32,999	33,100	34,936	32,319	31,336	31,888	30,032	31,591	379,609
	1984	30,465	33,663	34.188	32,140	34,413	32,759	34,716	33,898	32,872	32,834	33,781	28,388	394,117
VEHICLES	1982	1387	998	1108	1107	1279	800	956	858	861	717	504	1021	11,596
	1983	1008	794	767	794	638	759	916	1031	881	898	754	868	10,108
	1984	856	729	633	643	693	707	688	642	573	646	656	755	8,221
GENERAL CARGO (M^3)	1982	281	216	265	57	341	271	121	226	549	358	406	370	3,461
	1983	332	234	558	383	764	190	107	1146	105	167	327	145	4,458
	1984	442	162	198	194	194	268	765	167	335	61	474	199	3,459

K. Tabwebweiti
Financial Controller

SHIPPING CORPORATION OF KIRIBATI

TARAWA LAGOON FREIGHT RATES ON FERRIES

ITEMS		
Personal Baggage in excess of one piece	:	3.00 per cubic metre. (Minimum)
Animals	:	1.30 each
Chickens	:	.30 each
Timber	:	45.50 per cubic metre
Bicycle	:	0.80 each
Motor Cycle	:	1.50 each
Tractors Road, Rollers, Fork Lift and small mobil crane	:	12.50 each
Large Crane & Excavators	:	59.30 each
Empty 44 gallons drums	:	6.50 each
Full or part full 4 gals. drums	:	13.00 each
General freight rate per cubic metre	:	32.50
Special freight rate for films	:	0.60 each

Between Betio and Bairiki	Unladen	Full or Part Laden
Cars, truck, trailer Utilities and boats not exceeding 3.5 metres	6.00	10.00
exceeding 3.5 metres but not exceeding 4.5 metres	10.00	19.00
" 4.5 " " " " 6 "	13.00	24.00
" 6 " " " " 7.5 "	14.00	28.00
" 7.5 " " " " 9 "	24.00	47.00
Mobil Truck & B.P. Tankers	35.00	70.00
Over 9 metres - by special arrangement		

NOTE:

1. The above rate covers carriage only: Loading and discharging should be arranged separately by the Shipper or consignee.
2. Freight on vehicles does not include fares for drivers. It should be charged separately.

Charter Rates

Nei Auti	-	$20.00 per hour
Tabakea	-	$40.00 per hour
Nei Tebaa	-	$40.00 per hour

Plus 1½ hours overtime of $10 during non-working hours. (1½ hours is the time tallen for a trip from Betio/Bairiki/Betio).

Fares

Between Betio and Bairiki	-	0.70 per adult
	-	0.35 per child
Concession fare for students	-	$16.00 per term

Questionaire Sheet (English Version)
INTERVIEWS WITH PASSENGERS IN FERRY BOAT BETWEEN BETIO AND BAIRIKI ISLANDS

PERSON TRIP SURVEY IN THE FEERY BOAT BETWEEN B & B

1. ☐ Male ☐ Female	2. Age ☐ Years old
3. Purpose of the trip to Betio 4. ☐ 1. Commuting 2. Business 3. Temporary Visit	
4. What is your present status? 1. Student 2. Gov. Official 3. Employee 4. Fisherman 5. ☐ 6. Jobless	
5. How did you get to the Bairiki ferry terminal from your residence? 1. Walking 2. Bus 3. Passenger Car 4. Truck 5. Motorcycle 6. Bicycle 7. ☐	
6. How do you get to the destination from Betio ferry terminal? 1. Walking 2. Bus 3. Passenger Car 4. Truck 5. Motorcycle 6. Bicycle 7. ☐	
7. Which transport do you intend to use after the completion of causeway between Betio and Bairiki? 1. Bus 2. Passenger Car 3. Motorcycle 4. Bicycle 5. ☐ 6. Walking	

Questionaire Sheet (Kiribati Version)

TE MAMANANGA N TE MEERI BAIRIKI - BETIO

1. ☐ Mane ☐ Aine ☒

2. Roronga ☐ Te Ririki ☒

3. Bukin manangana nako Betio 1. Kakakibotu
2. Kaean te makuri 3. Karaoan te bitineti

4. Tera ae ko kakaraoia?
1. Ataein te reirei 2. Te tia makuri 3. Te tia akawa.
4. ☐ 5. Akea au makuri

5. Ko Kanga n roko nte Tabo Ni Meeri I-Bairiki man am Auti?
1. Rianna 2. N te Bati 3. N te Ka 4. N te Truck
5. N te rebwerebwe 6. N te Batika 7. ☐

6. Tera Baom ae Ko na toka iai ma I Tabon Te Uabu I Betio nakon te tabo ane ko na Kawaria?
1. Te Rianna 2. N te Bati 3. Te Rebwerebwe 4. Te Batika
5. ☐

7. Tera te bao ae ko Kani Kamanena imwin tian te Kotiwei?
1. Te Bati 2. Te Ka 3. Te Rebwerebwe 4. Te Batika
5. Te Rianna 6. ☐

W/mmk.