6.3.4 MAINTENANCE PROGRAM

Restored facilities themselves are not necessary to be specially maintained. Daily cleaning of the road surfaces and observation of the bridge and the access road shall be managed by Ministry of Public Works.

The maintenance plan of the facilities consists of the following three inspections.

1) Monthly inspection

The monthly inspection shall consist of ocular observations and shall be carried out on a monthly basis. Items to be inspected are as follows;

a) roadway surface condition
   stains of road surface, cracks in surface asphalt concrete.
b) curb and handrail
   cracks in concrete curb, distortion or damage of handrail
c) expansion joint
   extraordinary sound or vibration when vehicle passes
d) drainage
   curb drains should be functioning properly to evacuate the water
e) lighting equipment
   examine if lighting equipment are operating properly
f) approach road
   condition of face of slope

2) Periodic Inspection

The periodic inspection shall be carried out each five years and shall cover the condition of the following elements, in addition to the monthly one.

a) asphalt pavement
   verify surface wear, cracks in surface pavement
b) girder, cross beam
   cracks of main girder and cross beam
c) shoe
   observation of accumulation of sand or dust
d) substructure
   tilting or settlement of substructure
e) fishing channel
   observation of accumulation of coral sand

3) Special inspection

In addition to monthly or periodic inspection, special inspection shall be carried out when the facilities will be damaged by strong waves caused by typhoon. Items to be inspected are as follows;

a) protective stones
   observation of condition of protective stones
b) fishing channel
   observation of accumulation of coral sand
c) approach road
   observation of face of slope on embankment of the ocean side

Any problems noticed during the inspections and the countermeasures taken should likewise be recorded.

CHAPTER 7

BASIC DESIGN

CHAPTER 7 BASIC DESIGN

7.1 DESIGN CONCEPT

The rehabilitation project for the concerned facilities shall be implemented in accordance with the following principal concept;

1) Necessary repairs to fulfill lifetime of the bridge is carried out.

2) A repair method not to corrupt the existing facilities as much as possible shall be adopted.

3) Water main to realize easy maintenance at the site shall be selected.

4) No suspension during construction for the channel navigation and the bridge traffic is planned. Besides, traffic restriction to ship and vehicles shall be avoided as much as possible.

5) Local procurement of construction materials and machinery except special products is available

6) Construction time shall be within a single fiscal year as this is the repair work and small size

7.2 DESIGN CRITERIA

7.2.1 DIMENSION OF THE CHANNEL

Tidal levels, water depths and clearance are as follows;

1. Tide Levels in the Channel

	Tide Level
H.W.L.	+1.8M
M.W.L.	+0.9M
M.L.L.W.L.	+-0.0

where H.W.L. High Water Level
M.W.L. Mean Water level
M.L.L.W.L. Mean Lower Low Water Level

2. Water Depths

Water depths in the Channel is 2.0m below M.L.L.W.L.

3. Clearance

Following clearance shall be maintained to implement the restoration of the fishery channel and the bridge.

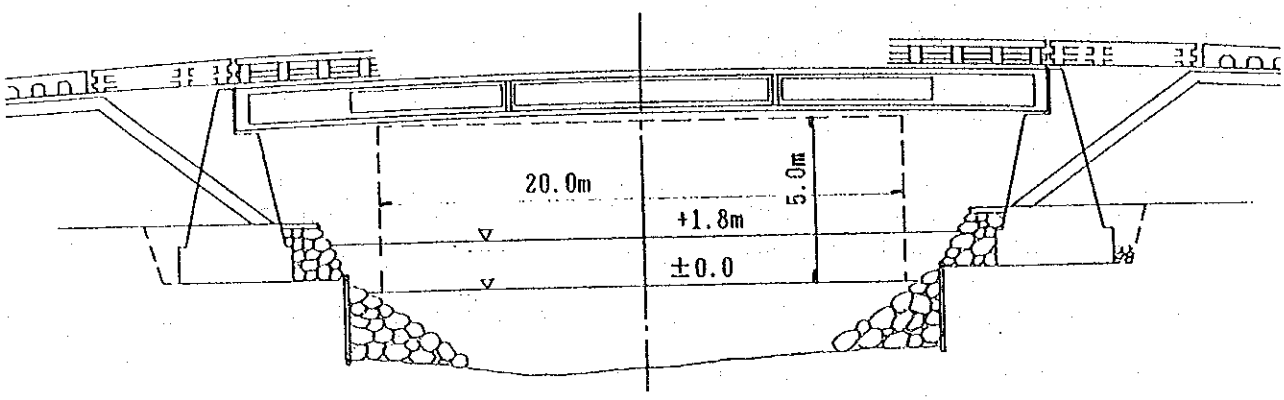


Figure 7.1 Clearance

7.2.2 CROSS SECTION DESIGN

1. Width of the Bridge

Carriageway	3.25m x 2 (lanes)	= 6.50m
Footpath	1.00m x 2 (both sides)	= 2.00m
Verge	0.40m x 2 (both sides)	= 0.80m
Total		9.30m

2. Width of Road

Carriageway	3.25m x 2 (lanes)	= 6.50m
Footpath	1.00m x 2 (both sides)	= 2.00m
Verge	1.00m x 2 (both sides)	= 2.00m
Total		10.50m

7.2.3 GRADE

Longitudinal Grade : max. 5.0%
Transverse Grade : straight grade of 2%

7.2.4 DESIGN STANDARDS

1. Materials Strength

Concrete (28-days strength)	not less than	160 kg/cm2
Mortar Cement	not less than	210 kg/cm2
Reinforced Bar (SS295)	not less than	3,000 kg/cm2
Structural Steel (SS400)	not less than	2,500 kg/cm2
Asphalt concrete		

in accordance with ASTM Standards in case of usage of coral reef rocks

7.3 BASIC PLAN

7.3.1 PORTIONS TO BE RESTORED

The Project pursues restoration of the channel for fishing boats and the bridge in the Marshall islands. The main portions of the restoration shall be as follows:

a) counterplan for outwash protection of bearing stratum for the abutment
b) reform of protective stones for the channel bulkheads
c) repair of face of slope on the embankment at the side and wing of the abutment
d) replacement of water mains for the approach sections
e) road surfacing
f) restoration of footpath, verge and handrails
g) dredging the channel and a counterplan for water control

7.3.2 REPAIR PLAN

1. Outwash Protection

A method of cast-in-place piles (PIP) were selected as the outwash protection work considering composition, thickness of layers surveyed during soil investigation and water depths at construction. The outwash protection work by the PIP method is to excavate the ground with approximately 450mmdia. boring, to install core materials (H-250x125x6x9), and to fill mortarcement. The outwash protection is completed by arranging the PIP piles continuously with an overlap of approx. 5cm.

Protective concrete as a combined use of the bulkhead shall be cast and the pile heads are built in coral rocks. The protective concrete is provided with full of coral rocks in the forms and filled with concrete in between.

A plan view of the outwash protection is trapezoidal enclosing the abutment. Concrete as a combined use of coping is cast in the

upper portion of steel sheet piles to fix the existing sheet piles. Meantime, reinforced bars are placed for a purpose of reinforcement.

2. Reform of Protective Stones

Reform of protective stones come off because of the typhoon and waves shall be carried out.

3. Repair of Slope of Embankment

The embankment around the abutment shall be reformed, and covered by concrete shall be cast.

4. Replacement of Water Main

The existing water main (PVC) settled in the embankment of approach roads shall be replaced with steel pipes coated with vinyl chrolide.

Sections to be replaced are 99m in one side or a total length of 198m. Expandable pipes shall be settled around the back faces of the abutments they are able to correspond to settlement of the embankment and/or angle variation. The expandable pipes are of flange types with closure joints and for high pressure (20kg /cm2).

Crushed stones shall be placed, leveled and compacted underneath water mains and sleeper concrete is cast insitu.

5. Pavement

The existing asphalt pavement of carriageway and sidewolks are removed and new pavement is placed.

The wearing course is paved with cold mixture asphalt concrete. Gutters on both the embankment of approach voads shall be removed. Crushed stones of coral rocks is utilized for the mixture. Sections to be paved shall be in a total length of 260m including the bridge.

Lane marks are provided on the center of roads and chatter bars are settled in every 5m as traffic safety facilities. Chatter bars shall be for right-hand traffic.

Daily and hourly traffic volume around the bridge are 2,000 and 200, respectively, and the volume is increasing to compare with days when constructed. Therefore, the paving work shall be pro-

gressed with allowing oneway traffic, and such care as settlement of traffic signals shall be taken for safety of the traffic.

6. Footpath, Verge and Handrails

Damaged parts of footpath, verge and handrails shall be repaired. Repair sections of footpath and verge shall be approximately 30m on the ocean side of Rita. Only a part of handrails is damaged. It shall be repaired properly at any time when found.

7. Dredge of the Channel and Water Control

1) Dredge of the Channel

Dredging at the shallower part of the ocean and lagoon sides shall be made to ensure a water depth of -2m in the channel. When dredged, guradmen are arranged, full attention shall be paid to safety of ships navigation and notices shall be advertised through navigation signals, boards and radio broadcast.

7.3.3 **BASIC DESIGN DRAWINGS**

The basic design was conducted based on the resuets of reconaissance survey and analysis of collected data, and design concepts.

The drawings of basic design are shown belows;

a) Figure 7.2 General plan of basic design
b) Figure 7.3 Grauting works
c) Figure 7.4 Channel concrete wall works
d) Figure 7.5 Channel protection works
e) Figure 7.6 Water pipe improvement works
f) Figure 7.7 Pavement improvement works

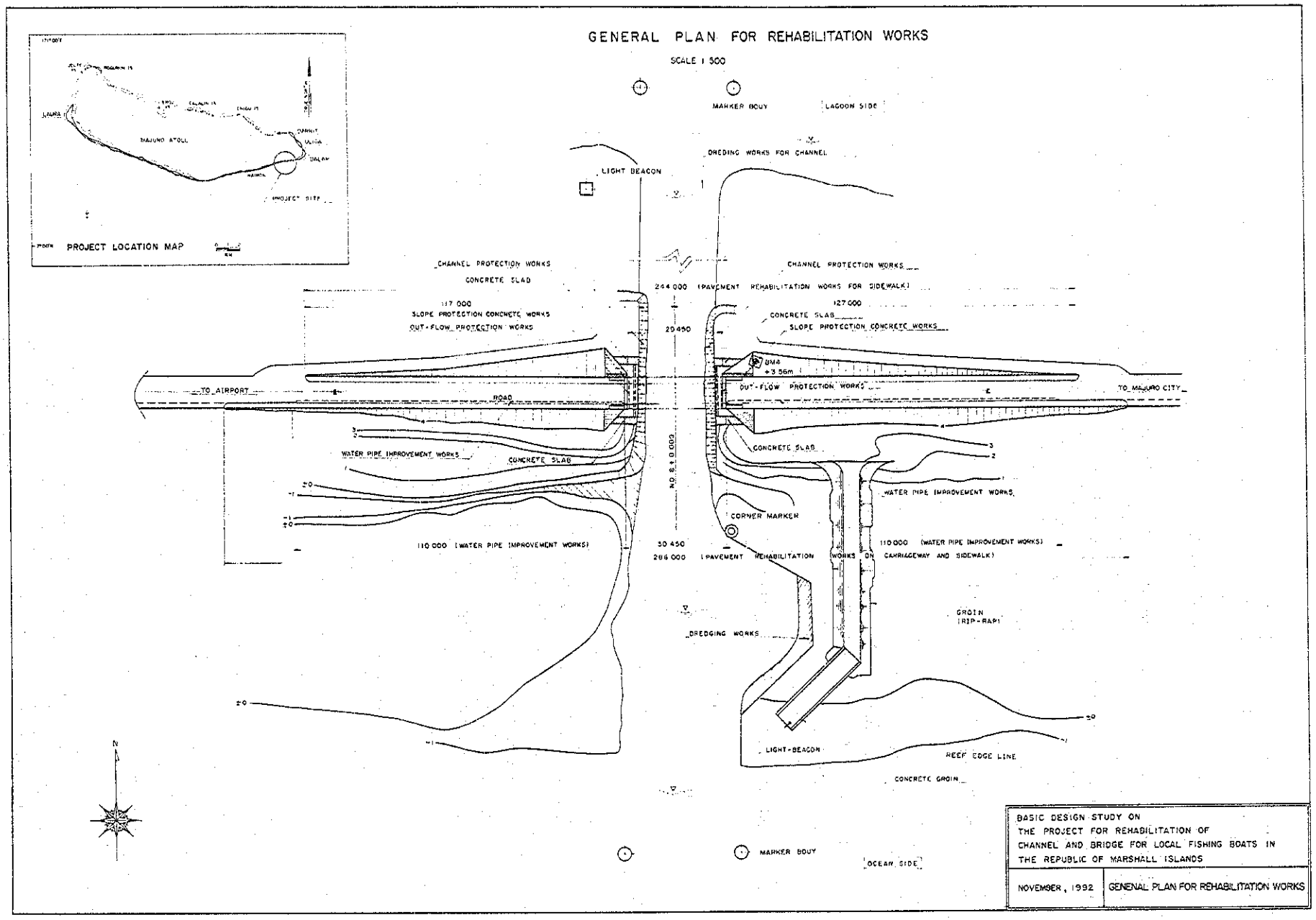


Fig. 7.2 General Plan of Basic Design

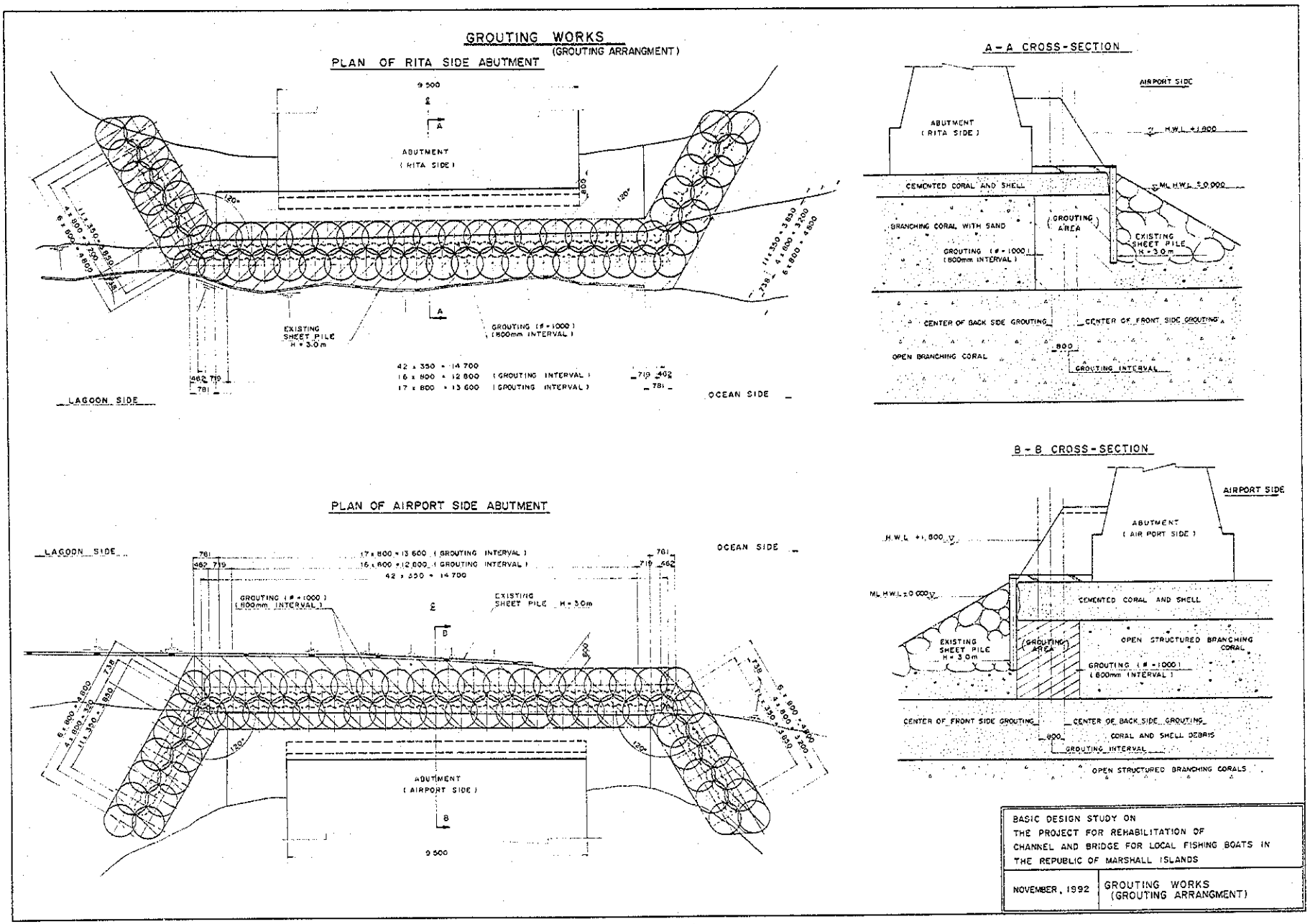


Fig. 7.3 Grauting Works

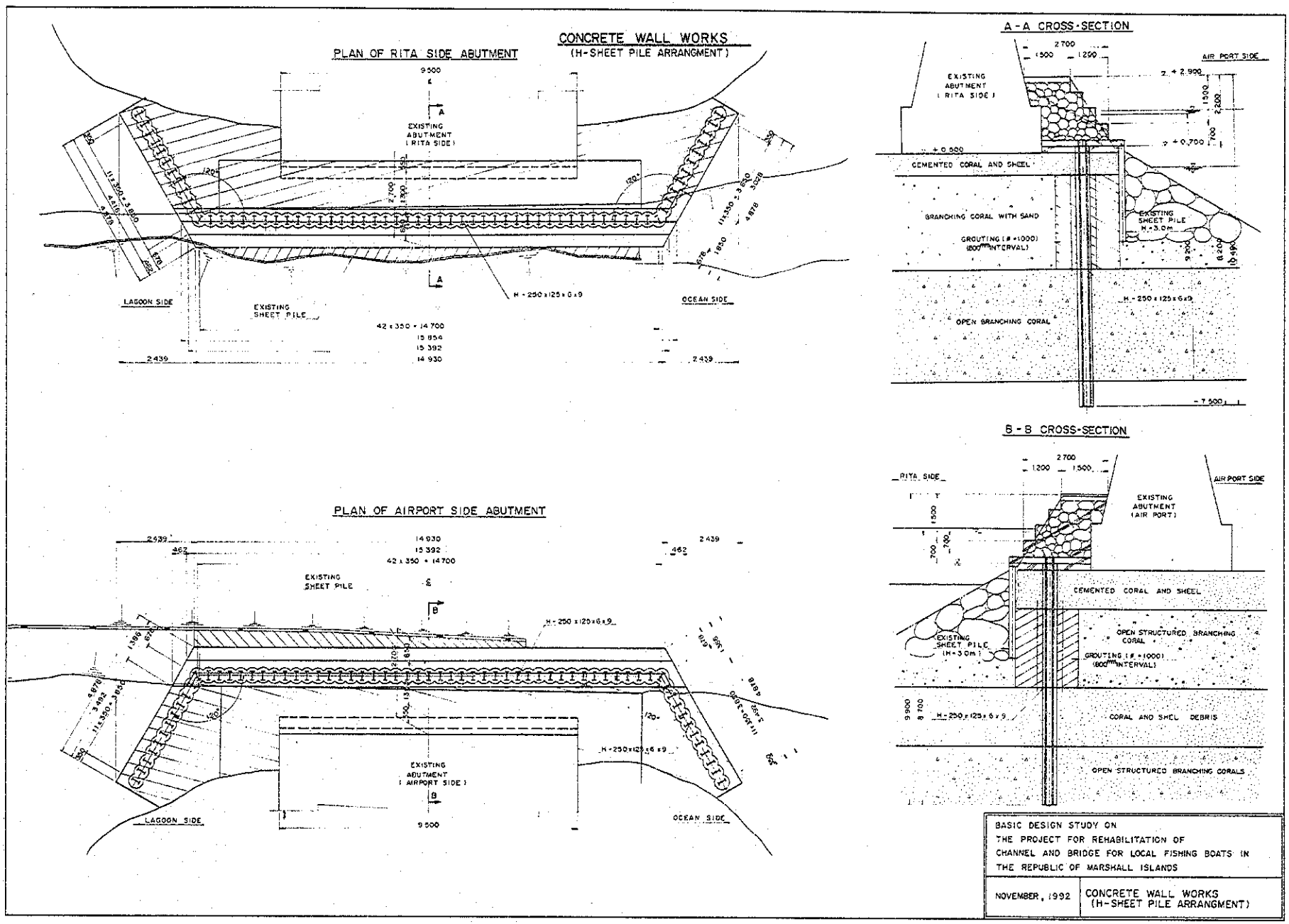


Fig. 7.4 Channel Concrete Wall Works

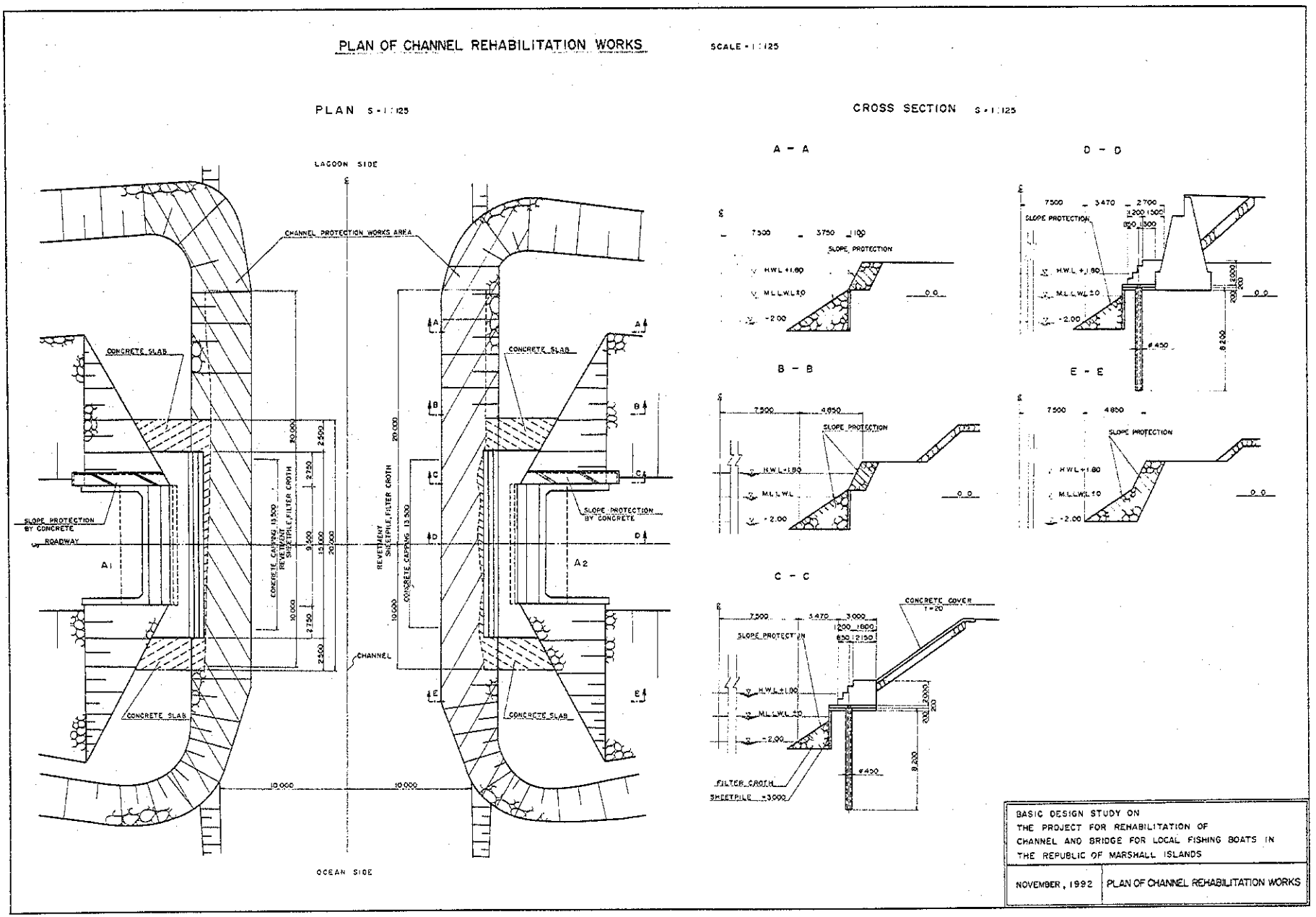
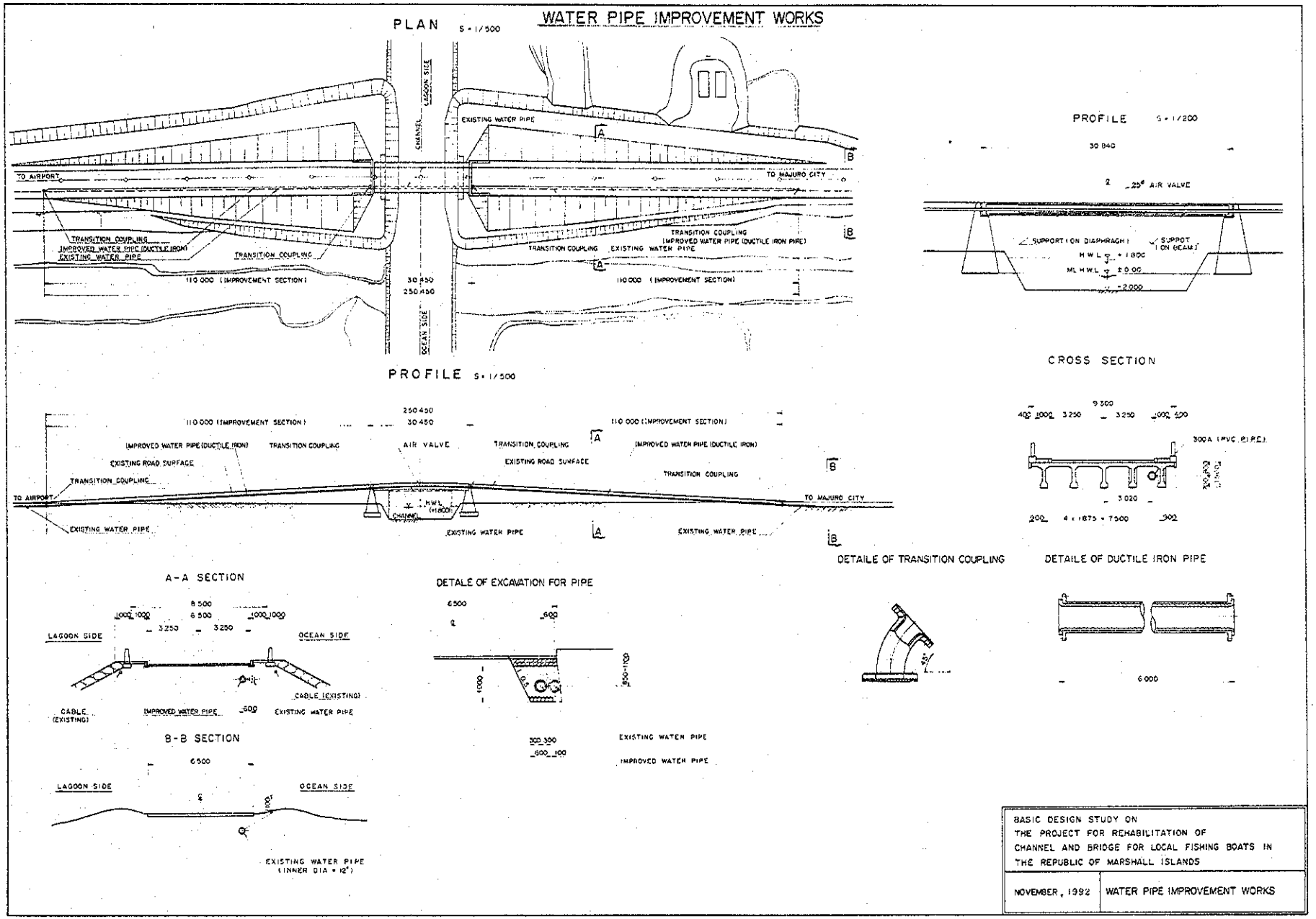


Fig. 7.5 Channel Protection Works



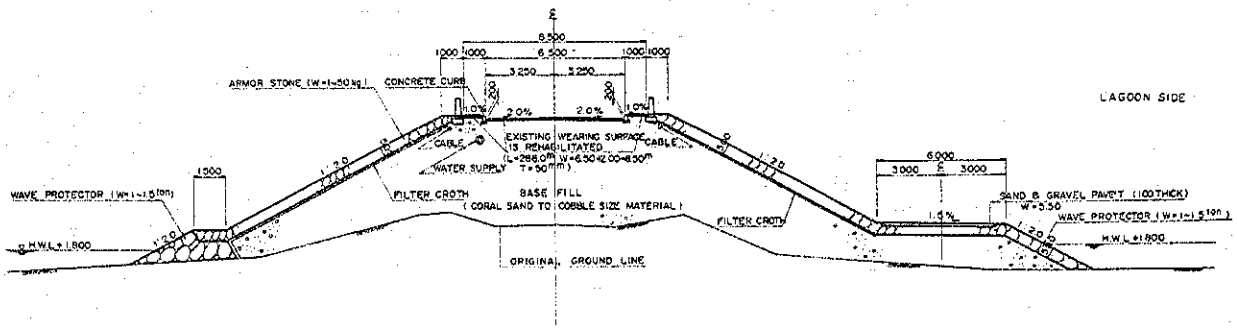
BASIC DESIGN STUDY ON
THE PROJECT FOR REHABILITATION OF
CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN
THE REPUBLIC OF MARSHALL ISLANDS

NOVEMBER, 1992	WATER PIPE IMPROVEMENT WORKS

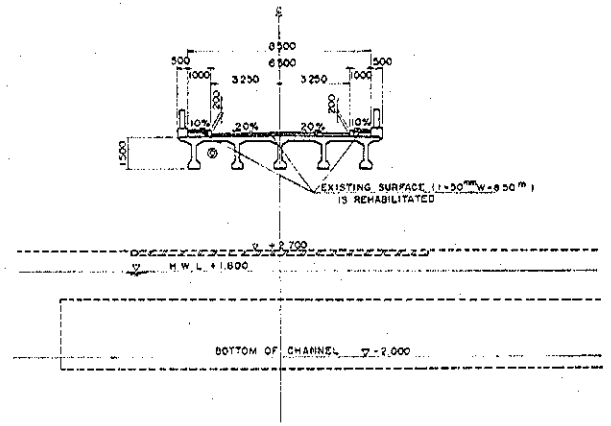
Fig. 7.6 Water Pipe Improvement Works

PAVEMENT REHABILITATION WORKS

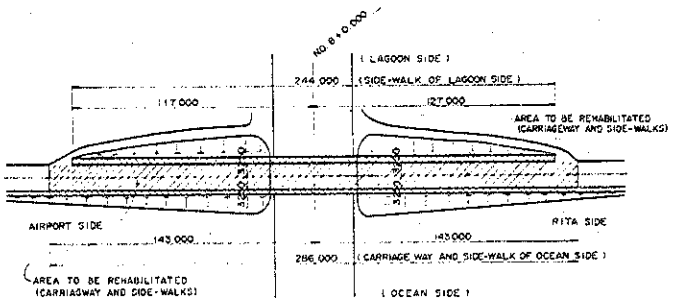
EMBANKMENT SECTION



BRIDGE SECTION



LOCATION OF PAVEMENT REHABILITATION WORKS



NOTES :

THE CONSTRUCTION PROCEDURE OF THE PAVEMENT RIHABILITATION WORKS ARE AS FOLLOWS

1) THE EXISTING WEARING SURFACE OF CARRIAGEWAY AND SIDE WALK (t = 50mm , W = 6.50+2.00 = 8.50m) ARE TAKED OFF.
2) THE LENGTH OF RIHABILITATION WORKS ARE 286.0m ON CARRIAGEWAY AND SIDEWALKS.
3) THE SURFACE OF THE BASE COUESE (UNDER THE RE-MOVED WEARING SURFACE) SHOULD BE ARRANGED BY CORAL SAND TO KEEP A FLOT AND BE FULLY CONPACTED.
4) NEWLY WEARING SURFACE IS PAVED BY COLD ASPHALT CONCRETE WITH 50mm THICKNESS.

BASIC DESIGN STUDY ON THE PROJECT FOR REHABILITATION OF CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN THE REPUBLIC OF MARSHALL ISLANDS	
NOVEMBER, 1992	PAVEMENT REHABILITATION WORKS

Fig. 7.7 Pavement Impronement Works

7.4 IMPLEMENTATION PROGRAM

7.4.1 ORGANIZATION OF THE PROJECT IMPLEMENTATION

Ministry of Public Works shall be responsible for implementation of the project. Prior to implementation of the project, Exchange of Notes shall be concluded between Governments of Japan and the Marshall Islands. Detail design and construction management of the project is executed by a Japanese consulting firm, and construction is carried out by a Japanese general contractor upon concluding the contract with the Government of the Marshall Islands, respectively. The consultant contract and construction contract will be valid upon verification by the Japanese Government. MPW will take necessary actions to smoothly proceed and complete the project, with gaining cooperation from other Ministry including an agency of environment protection.

7.4.2 PRINCIPLES OF CONSTRUCTION

1. Principles on Natural Conditions

Natural conditions will affect on construction for a) construction time and b) construction method. Out of these, rain and wind (wave) are named as factors to influence construction time. In accordance with weather data for 24-months before May 1992, followings can be concluded:

a) According to the rainfall survey result made during 9:00AM to 6:00PM in Majuro, only 0.7days per month rained full time during survey hours were observed and 7.2 days per month that rainfall exceeds 10mm were observed. Judging from this, rainfall in Majuro is a shower to have plenty of rain in a short time and accordingly, only 1-offday due to rain is sufficient to include.

b) Windy days to exceed 10m/sec in 24-months in Majuro was only 1-day when the typhoon arrived. Therefore, the offday due to strong wind is not necessary to anticipate. Mean time, 2.4 days per month when max. wind speed of 1-minute exceeded 10m/sec was recorded. However, since this is momentary strong wind, no influence on construction is anticipated.

On the other hand, topography, geology, and wave and tide current around the channel and the bridge are factors concerning construction method. Topographical survey, soil investigation, and observation of tide level and current were implemented during the second field survey and following principles were determined:

a) Resulting from topographic survey and soil investigation, outwash protection of coral sand and gravel layer shall be made by continuous wall method in the ground using cast-in-place pile columns.

b) Normal tide current is not more than 2 knots. However, control of the tide current from a standpoint of construc tion is extremely difficult and under water construction is thought to be also difficult. Therefore, all works shall be performed from the land and cover stones at the front faces of the abutment shall be removed to assure the operation yard.

c) Platforms shall be settled for operation machines in order for the machines not to sink in water even at the time of high tide.

2. Design Principles on Social Aspects

1) Law Conditions

In the Republic of the Marshall Islands, the law regarding environmental protection (Earthmoving Regulations) was promulgated in 1989 by the Republic of the Marshall Islands Environmental Protection Authority. Construction must be in compliance with this regulation.

2) Traffic Conditions

In the Republic of the Marshall Islands, traffic volume in these years are increasing accompanied with increase of No. of vehicles. As a counterplan for traffic safety during the construction was thought to be necessary, traffic survey was carried out at the bridge site and DUD district. Since the survey found 12-hours traffic volume at the bridge site to be approx. 2,000 on oneway, it was determined, from a standpoint of traffic safety, to settle traffic signals during paving work for both the bridge and the embankment as well as replacing work of water mains.

3) Days to Cease Works

National holidays to affect on construction time was checked. It was found that the nation ordains by law 5-working days system besides 10-national holidays. When calculating the working ratio, these holidays and offdays shall be considered, however, 6-working days are counted to plan the construction. Meanwhile, the working day ratio including one non-working day per month due to wind and rain as previously mentioned turns to

be 80% as a total of non-working days will be 74 days.

3. Local Contractors and Utilization of Local Materials

1) Construction Firms

There are two construction firms in Majuro named Pacific International Inc. (hereinafter called PII) and MAKO. PII has been in operation for a long time and receives variety of works inside the Atoll as a local contractor. MAKO is a relatively new firm owned by Korean.

2) Works under Construction

At present, architectural construction such as government office building and hotels are under construction in Majuro. And construction of fishery bases in the surrounding islands (3-sites) is planned under Grant Aid programs by the Japanese Government. Dredge works in the channel and terracing with stones of the bulkhead are similar types of construction to the Project. However, such works as cast-in-place piles and chemical grouting to be applied to the outwash protection are not being carried out and no referential information was obtained.

3) Ability of Local Firms and Labor Conditions

General civil works such as concrete works, embankment works to use crushed coral reef as well as recent architectural works are carried out by local firms. But, special operations represented by chemical grouting and pile construction are thought to be dependent on foreign countries. Replacement of the water main and reform of slope of face on the Project are able to be subcontracted to them. On the other hand, all skilled labor is demanded for overseas, and mainly people from Philippine come to work. American and New Zealander are central forces of engineers and local labor is merely expected to do simpler works.

4) Utilization of Construction Materials

General use heavy equipment can be supplied by Ministry of Public Works (MPW) and PII. But, such special machines as boring machines to use for excavation of cast-in-place piles are not able to procure locally and have to be transported from foreign country.

Construction materials such as cement, re-bar, wooden forms, and timber are available by PII and MJCC, a local materials dealer. But, as all materials except aggregates are imported from Japan, the United States, Korea, Taiwan and New Zealand, their prices

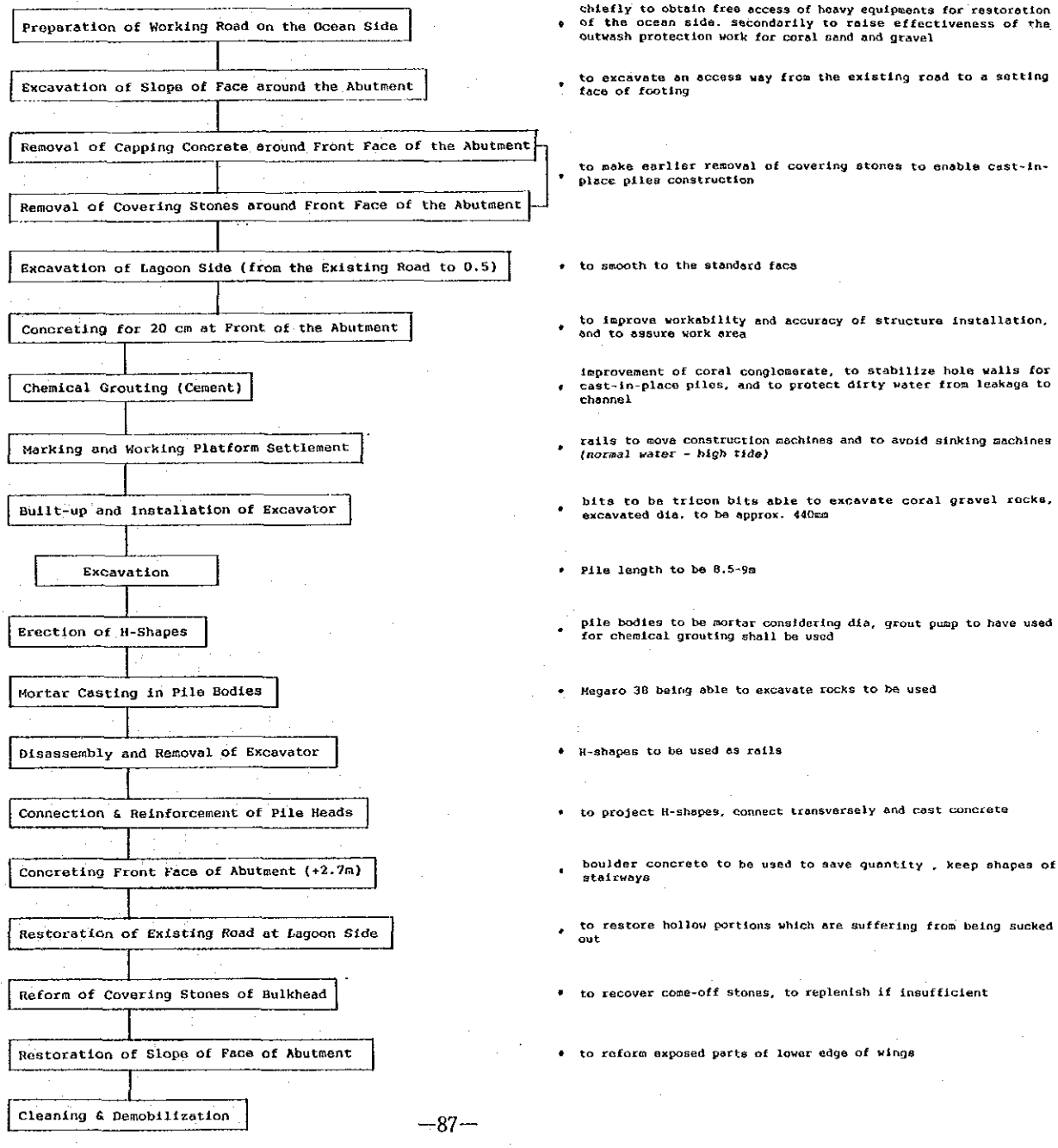
are high. As chemical grouting is involved in the Project, these materials shall be transferred from Japan. An advance check of locally available materials must be made as a stock is limited or sometimes no stock is happened.

7.4.3 CONSTRUCTION PLAN AND PROCEDURE

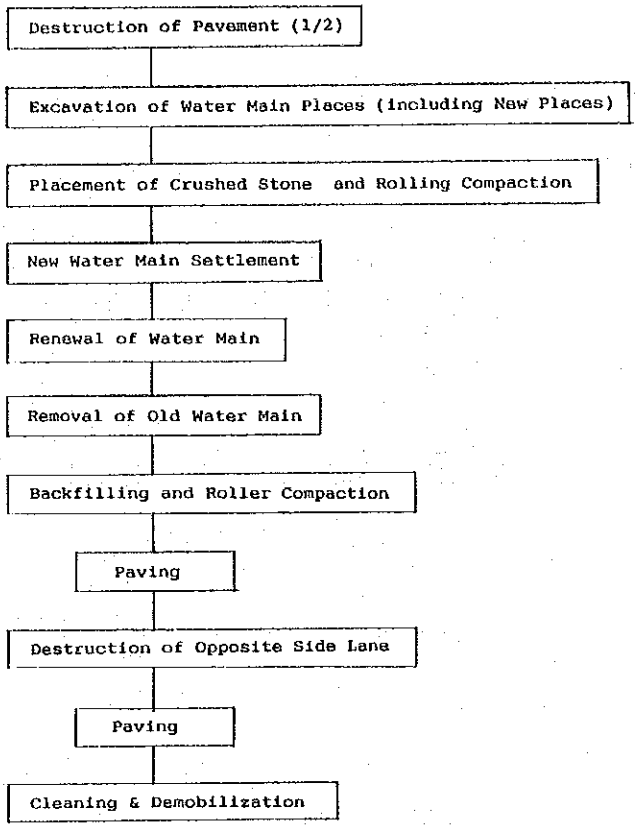
1. Flow Chart of Restoration Works

A flow chart and work description are indicated as to the restoration of the bridge and the channel, replacement of the water main and the pavement, which are considered to be sizable.

1) Restoration of the Bridge and the Channel for Fishing Boat



2) Replacement and Pavement

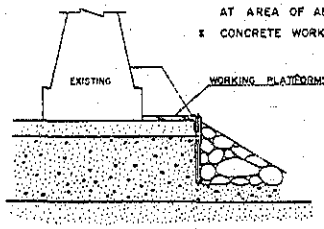


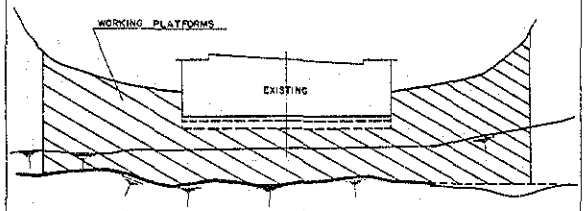
- to confine to oneway traffic (settle traffic signals)
- to exchange watermains only at the embankment
- to use lining steel pipes of vinyl chrolide
- to employ cold mixture asphalting
- to settle chatter bars (for right hand traffic)

WORKING PROCEDURE FOR CHANNEL CONCRETE WALL

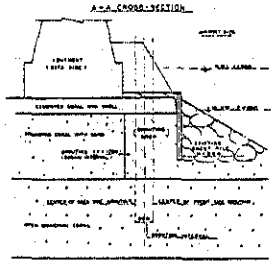
① PREPARATORY WORKS
CONCRETE WORKS OF WORKING PLATFORMS

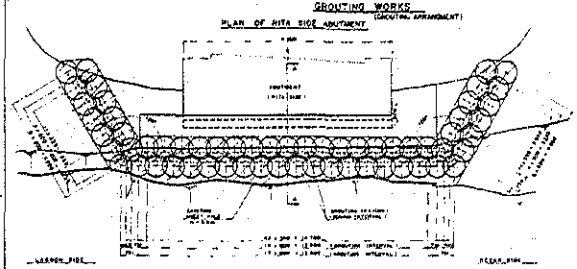
x REMOVAL OF ARMOR STONES AT AREA OF ABUTMENTS
x CONCRETE WORKING PLATFORMS



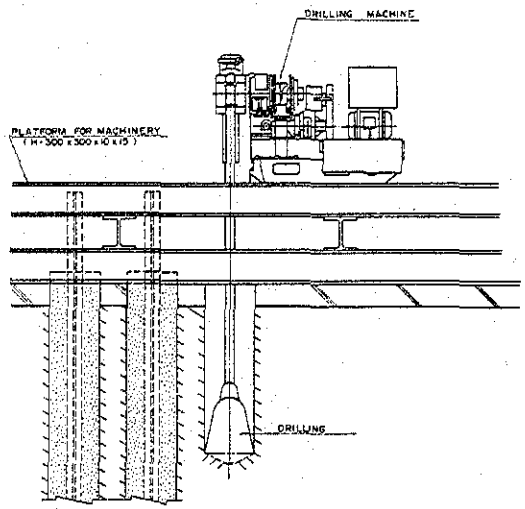


② PRIMARY GROUTING

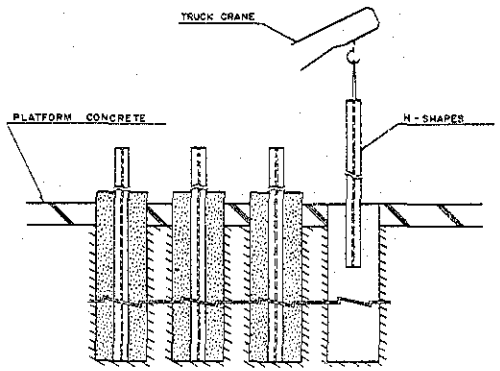


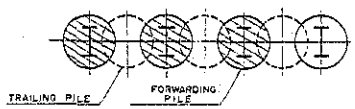


③ EXCAVATION

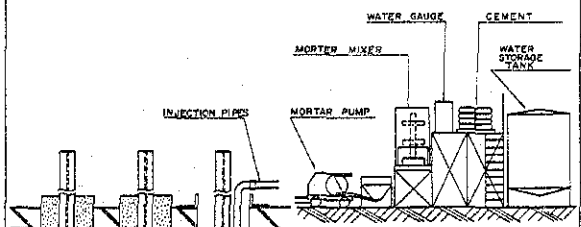


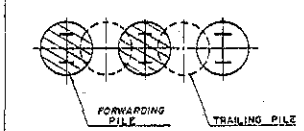
④ PILING WORKS (SETTLEMENT OF H-SHAPES)



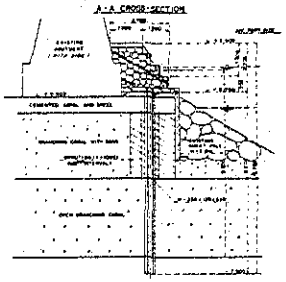


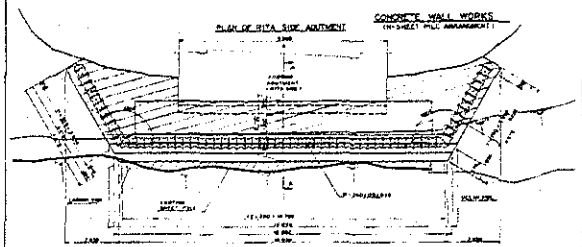
⑤ MORTAR PLACEMENT





⑥ CHANNEL CONCRETE WALL WORKS





7.4.4 PROCUREMENT PLAN OF MATERIALS AND MACHINE PARTS

1. Locally Available Construction Machines

General purpose heavy equipments are available locally as MPW and PII are able to furnish. Special machines such as a set of machines for cast-in-place piles, a set of machines for chemical grouting and a mixer for asphalt mixture need to be ocean transported from foreign county.

2. Locally Available Construction Materials and Their Price

Only cement, aggregate, ready to mix concrete, timber and plywood for forms are locally available, and other required materials such as steel, a set of chemicals for chemical grouting and asphalt emulsion are to be ocean transported from foreign country.

7.4.5 WORKING SCHEDULE

Implementation schedule for the Project shall be separated into 3-phases of detail design, bidding and restoration works.

1. Detail Design

Bid documents are worked out based on detail design. They contain, specifications, structural computation and budget estimation. At the initial, middle and final steps of the detail design, close discussion will be held with the concerned authority of the Marshall Islands. Upon approval of final documents, it is progressed to the bidding phase.

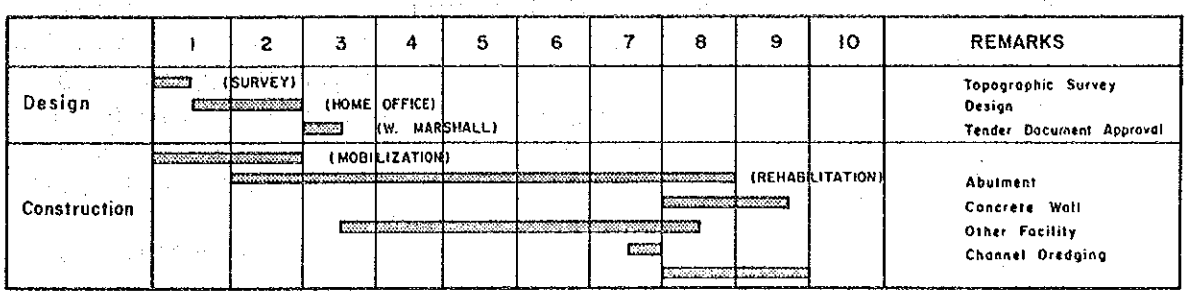
2. Bidding

Upon completion of the detail design, prequalification notice is announced to public in Japan. The implementing organization will invite candidate construction firms and conduct the bid in witness of the concerned parties. The least expensive bidder will be successful unless the contents of their bid is not evaluated as appropriate. The successful bidder will reserve the right to make the construction contract with the Government of the Marshall Islands.

3. Restoration Work

The successful bidder shall commence the work after the contract is verified by the Japanese Government. Working schedule shall be determined with full consideration of real process, temporary structure/facility plan, materials procurement and costs.

4. Overall Schedule



7.4.6 SHARE OF RESPONSIBILITY FOR THE PROJECT

Scope of works for the Project is separated into Japan and Marshall and listed below:

Scope of Works	Japan	Marshall
1. Construction and Repair of the Facilities		
1) Outwash Protection	O	
2) Replacement of Water Main	O	
3) Pavement	O	
4) Dredging the Channel	O	
5) Repair of Bulkhead of the Channel	O	
6) Restoration of Handrails, Footpath and Verge	O	
2. Remittance of B/A Commission to Japanese Bank		O
3. Procedures of Import and Custom Clearance		
1) Transportation to Marshall	O	
2) Duty Exemption and Custom Clearance		O
3) Domestic Transportation in Marshall	O	
4. Offer of Convenience on Procedures of Leaving from, Arriving at and Staying in Marshall		O
5. Proper and Effective Operation and Maintenance of Grant Aided Facilities and Machine Parts		O
6. Procedures of Construction Permission		O

CHAPTER 8

PROJECT EVALUATION AND CONCLUSION

CHAPTER 8 PROJECT EVALUATION AND CONCLUSION

The concerned facilities, after completion by the Japanese Grant Aid in 1983, contributed to purify the Lagoon water in Majuro, to make an access to fishing ground by Majuro fisherman more convenient, and to improve acsess for public of Arno atoll. Besides, fishery development in Arno atoll with cooperation of OECF is being progressed, and future importance of the channel for fishing boats is becoming higher.

On the other hand, the rows of houses are recently extending toward the airport in Majuro, and development of Long Island is progressed. Traffic volume is increased by years and 500 vehicles are hourly passing on the Bridge. according to recent traffic survey.

Under such a circumstance, the facilities, 10 years old after construction, was damaged by the typhoon on January, 1992. The Bridge, upon opening of the channel, is the sole connecting route to link the city center and the airport side, hence, a loss of the bridge will be an enormous economical loss, deprive citizens of their transportation and threaten their daily life as living water source is relied on the airport.

The bridge itself has not been damaged by the typhoon, but a protective portion for the bridge had damages. Therefore, immediate destruction is not anticipated at all. However, if it is left, an enormous damage may be taken place in some day. Consequently, an urgent rehabilitation is imperative viewing importance of the facilities. Majuro is normally under calm and mild environment, but protection against disasters is extremely weak. In such a circumstance, it will be great contribution to stabilization of public welfare to assure safety of the bridge that is a most remarkable structure in Majuro.

In above context, the Project was concluded to be appropriate as the Japan's Grant Aid.

APPENDICES

A. 1 STUDY TEAM MEMBER

Table-1 Members of the Team

Name	Speciality	Present Status
First Stage Field Survey;		
Mr. Yutaka Yokoi	Team Leader	Deputy Director, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs
Mr. Futoshi Takahashi	Grant Aid	Grant Aid Division Ministry of Foreign Affairs
Mr. shuji Ono	Project Coordinator	Second Basic Design and Study Division, Grant Aid Study & Design Department, JICA
Mr. Katsuyuki Hioki	Rehabilitation Planner	Chodai Co., Ltd
Mr. Tsutomu Maekawa	Civil Engineer	Chodai Co., Ltd
Mr. Iwao Yokogawa	Geotechnical Engineer	Chodai Co., Ltd

Second Stage Field Survey;

Mr. Takeru Kato	Team Leader	Technical Officer, Construction Division Fishing Port Department, Fisheries Agency
Mt. katsuyuki Hioki	Rehabilitation Planner	Chodai Co., Ltd
Mr. Yoshinori Abe	Construction Planner	Chodai Co., Ltd
Mr. Tsutomu Maekawa	Civil Engineer	Chodai Co., Ltd
Mr. Tsunehiko Yoshii	Geotechnical Engineer	Chodai Co., Ltd

Third Stage Field Survey;

Mr. Takeru Kato	Team Leader	Fisheries Agency
Mr. Satoshi Chikami	Project Coordinator	Fishing Cooperation Division, JICA
Mr. Katsuyuki Hioki	Rehabilitation Planner	Chodai Co., Ltd
Mr. Tsutomu Maekawa	Civil Engineer	Chodai Co., Ltd

A. 2 STUDY SCHEDULE

Table 3-1 Schedule for the First Field Survey

NO	DATE	DAY	CITY OF STAY	CONTENTS OF STUDY		
				A	B	C
1	Jun.17	Tue	Hono-lulu			
2	18	Wed	Majuro	Ar. Majuro Courtesy Call on the Government of Marshall Islands and Meeting with Ministry of Foreign Affairs and Ministry of Public Works		
3	19	Thu	"	Field Survey Signing of Minutes of Discussins		Ar. Majuro
4	20	Fri	"	Field Survey		
5	21	Sun	"	Teem Meeting		
6	22		"	to Guam Visiting on Consulate General in Agana	Field Survey	
7	23	Tue	"		Field Survey	
8	24	Wed	"		Field Survey	
9	25	Thu	"		Field Survey	
10	26	Fri	"		Meeting with Ministry of Public Works	
11	27	Sat	Guam		to Guam	
12	28	Sun	"		Teem Meeting	
13	29	Mon			Visiting on Consulate General in Agana	

A: Grant Aid B: Coordinator

C: Technical member

Table 3-2 Schedule for the Second Field Survey

NO	DATE	DAY	CITY OF STAY	CONTENTS OF STUDY		
				A	B	C
1	Aug.04	Tue	Guam	Visiting on consulate General in Agana		
2	05	Wed	Majuro	Ar. Majuro		
3	06	Thu	"	Courtesy Call on the Government of Marshall Islands		
4	07	Fri	"	Submtting of Interim Report and Meeting with Ministry of Public Works (MOP)		
5	08	Sat	"	Field Survey		
6	09	Sun	"	Teem Meeting		
7	10	Mon	"	Meeting with MOP and Signing of Minutes of Discussins		
8	11	Tue	"	Ar. Guam	Field Survey	
9	12	Wed	"	Visiting on Consulate General in Agana	Field Survey	
10	13	Thu	"		Field Survey	
\	\	\	\		\	
15	18	Fri	"			
16	19	Wed	"		Meeting with MOP	
17	20	Thu	"		Ar. Guam	Field Survey
18	21	Fri			Visiting on Consulate General in Agana	Field Survey
19	22	Sat	"			Geological Survey
\	\	\	\			\
37	Sep.09	Wed	"			
38	10	Thu	Guam			Ar.Guam

A: Team Leader B&C: Technical Member

Table 3-3 Schedule for the Third Field Survey

NO	DATE	DAY	CITY OF STAY	CONTENTS OF STUDY
1	Oct.11	Sun	Hono-lulu	
2	12	Mon	Majuro	Ar. Majuro Arrengement of Schedule
3	13	Tue	"	Courtesy Call on the Government of Marshall Islands
4	14	Wed	"	Submitting of Draft Report Site Survey and Data Collection
5	15	Thu	"	Meeting with the Government of the Marshall Islands and Signing of Minutes of Discussions
6	16	Fri	"	Additional Data Collection
7	17	Sat	"	Site Survey on Arno Fishing Base
8	18	Sun	"	Team Meeting
9	19	Mon		to Guam Visiting on Consulate General in Agana

A. 3 MEMBER OF GOVERNMENT OF MARSHALL ISLANDS

Table -2 Related Parties of the MarshallIslands

	Name	Present Title
1	Honarable Antonio Eliu	Minister of Public Works
2	Honarable Kinja Andrike	Ambassador of Tokyo Embassy
3	Mr. Rien Morris	Secretary of Public Works
4	Mr. Jiba Kabua	Secretary of Foreign affairs
5	Mr. Thomas Z. Kijiner Jr.	Under Secretary for International Affairs
6	Mr. Reginald White	Public Works Stuff
7	Mr. John Kaiko	Public Works Stuff
8	Mr. Fritz Capelle	Pubric Works Stuff
9	Mr. Spoon Aster	Public Works Stuff
10	Mr. Kasuo Helgenberger	General Manager Environmental Protection Authority
11	Mr. John Bungitak	Deputy Directer Marshall Islands Marine Resourse Authrity
12	Mr. Robert L. Bryant	Technical Adviser of MOP
13	Mr. James Aberaothy	Technical Adviser of MOP
14	Jerry Kramer	Technical Adviser of MOP
15	Mr. Bernard Cotter	Manager Majuro Water & Sewer Company

A. 4 MINUTES

MINUTES OF DISCUSSION
BASIC DESIGN STUDY
ON
THE PROJECT FOR REHABILITATION OF CHANNEL AND BRIDGE
FOR LOCAL FISHING BOATS
IN THE REPUBLIC OF THE MARSHALL ISLANDS

In response to a request of the Government of the Republic of the Marshall Islands, the Government of Japan decided to conducted a Basic Design Study on the Project for Rehabilitation of Channel and Bridge for Local Fishing Boat(hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of the Marshall Islands a study team headed by Mr. Yutaka Yokoi, Deputy Director, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, and is scheduled to stay in the country from June 18th to June 27th, 1992.

The Team held discussions with the officials concerned of the Government of the Marshalls Islands and conducted field surveys at the study area.

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

Majuro, June 19, 1992

横井 裕

Yutaka Yokoi
Leader,
Basic Design Study Team,
(JICA)

for Hon. Antonio Eliu
Minister of Public Works
The Government of the
Marshall Islands

ATTACHMENT

1. Objective of the Project

The objective of the Project is to rehabilitate the Channel and Bridge which was built under the Japanese Grant Aid several years ago. The foundation of the bridge was heavily damaged and dislocated by the typhoon Axel at the beginning of this year.

2. Project site

The site of the Project is located at Majuro island; which connects the west and the east islands.
(Project area and site map are attached as Annex - 1.)

3. Executing Agency

Responsible Agency : Ministry of Public Works

4. Items requested by the Government of Marshall Islands

The following items were requested.
The Government of the Marshall Islands request the Basic Study Team to rehabilitate the bridge and channel.
The discussion on the technical measures for the project will be continued between the Government of the Marshall Islands and the Basic Design team.
The result of that discussion will be confirmed with a memorandum by both parties.

However, items for the Project may be differed depend upon the result of the Study and will be finalized at Draft Report discussion.

5. Japan's Grant Aid Program

(1) The Government of Marshall Islands has understood the system of Japanese Grant Aid explained by the team.

(2) The Government of Marshall Islands will take necessary measures, described in ANNEX II, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

6. Schedule of the study

(1) The consultants will proceed to further studies in Marshall Islands until June 29th, 1992.

(2) JICA will prepare the Interim report in English and despatch second mission in order to submit the report and explain the result of the first field survey and conduct the second field survey including natural condition survey around middle of August, 1992.
After studying of the results of the field surveys and designing of the details of the Project, JICA will prepare the draft final report in English and dispatch a mission and explain its contents.

(3) In case that the contents of the report is accepted in principle by the Government of Marshall, JICA will complete the final report and send it to the Government of Marshall Islands by November, 1992.

ANNEX -II

Necessary measures to be taken by the Government of the Marshall Islands are as follows;

1. To secure the ownership and/or the right to use the Project site.
2. To clear, level and reclaim the Project site, when needed, prior to commencement of the Project.
3. To construct wall and fences around the Project site.
4. To improve the access road to the Project site.
5. To provide facilities for the distribution of the electricity, water supply, drainage, telephone line and other incidental facilities.
6. To bear adivisng commission of the Authorization to pay (A/P) and Payment commission to the Japanese Foreign exchange bank for banking services based upon the Banking Arrangement (B/A).
7. To ensure prompt unloading, tax exemption, and custom clearance of the goods for the Project at Port of disembarkation.
8. To accord Japanese nations whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Marshall Islands and stay therein for the performance of their work.
9. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Marshall island with respect to the supply of the products and services under the verified contracts.
10. To maintain and use properly and effectively the facilities constructed and equipment under the verified contracts.
11. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.
12. To coordinate and solve any matters related which may arise with third party and inhabitants living in the Project area during implementation of the Project.

June 26, 1992

MEMORANDUM OF MEETING

BASIC DESIGN STUDY

ON

THE PROJECT FOR REHABILITATION OF CHANNEL AND BRIDGE

FOR LOCAL FISHING BOATS

IN

THE REPUBLIC OF THE MARSHALL ISLANDS

Ministry of Public Works (hereinafter referred to as "PW") and the basic design study team held meetings at the Office of Public Works on June 22 and 26, 1992.

The study team, in commencement of the study, submitted Inception Report to Public Works and explained the contents.

The study team also submitted a brief report to Public Works and stated their technical views from the results of site inspection.

Main items agreed upon by both parties are as follows;

1. The Inception Report which is prepared by the study team is accepted in general by Public Works.

2. Public Works provides the counterpart personnel according to study schedule for smooth implementation of the study.

3. The rehabilitation of channel sides in the bridge area which have been armoured by reef rocks is the the most important. The study team will work out to carefully investigate the present conditions of the channel sides accordingly.

4. Public Works requests that the rehabilitation of main water pipe should be done as a part of the Project, for the reason that water pipe in the fill embankments of both side of bridge deck had been repaired several times since 1984.

5. Public Works noted that the speed of the current/low speed through the channel is very swift for the boats and has caused numerous sinkings. Public Works has requested that the engineers look at the possibility of deepening and/or widening the channel to reduce current speed through the boat channel.

Katsuyuki Hioki
Basic Design Study Team
(JICA)

Hon. Antonio Eliu
Minister of Public Works
The Government of the Marshall Islands

MINUTES OF DISCUSSION

BASIC DESIGN STUDY

ON

THE PROJECT FOR REHABILITATION OF CHANNEL AND BRIDGE

FOR LOCAL FISHING BOATS

IN THE REPUBLIC OF THE MARSHALL ISLANDS

In response to a request of the Government of the Republic of Marshall Islands, the Government of Japan decided to conducted a Basic Design Study on the Project for Rehabilitation of Channel and Bridge for Local Fishing Boat(hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of the Marshall Islands a study team headed by Mr. Takeru Kato, Technical Officer, Construction Division, Fishing Port Department Fisheries Agency, and is scheduled to stay in the country from August 5th to September 10th, 1992.

The Team held discussions with the officials concerned of the Government of Marshall Islands and conducted field surveys at the study area.

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

Signed and Dated this 7th day of August, 1992 at Majuro, Republic of the Marshall Islands.

加藤 武留

Takeru Kato
Leader, Basic Design Study Team
(JICA)

Hon. Antonio Eliu
Minister of Public Works

ATTACHMENT

1. Objectives of the Project

The objective of the Project is to rehabilitate the Channel and Bridge which was built under the Japanese Grant Aid several years ago. The foundation of the bridge was heavily damaged and dislocated by Typhoon Axel at the beginning of this year.

2. Project Site

The site of the Project is located at Majuro Island; which connects the west and the east islands. (Project area and site map are attached as ANNEX - 1.)

3. Executing Agency

Responsible Agency : Ministry of Public Works

4. Items requested by the Government of Marshall Islands

The following items were requested by the Republic of the Marshall Islands Government:

(1) Rehabilitation of the sides of the channel in the bridge area which have been armoured by reef rocks.

(2) Replacement of water main in the fill embankments.

(3) Rehabilitation of the pavement on the bridge deck and the approaching embankments.

(4) Rehabilitation to protect the sloping face of embankments alongside the abutments.

(5) Dredging of debris build-up on the bed of the channel, if any.

5. Japan's Grant Aid Program

(1) The Government of the Republic of the Marshall Islands understands the system of Japanese Grant Aid as explained by the team.

(2) The Government of Marshall Islands will take necessary measures, described in ANNEX II, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

J.K

6. Schedule of the study

(1) The consultants will proceed to further studies in Marshall Islands until September 10th, 1992.

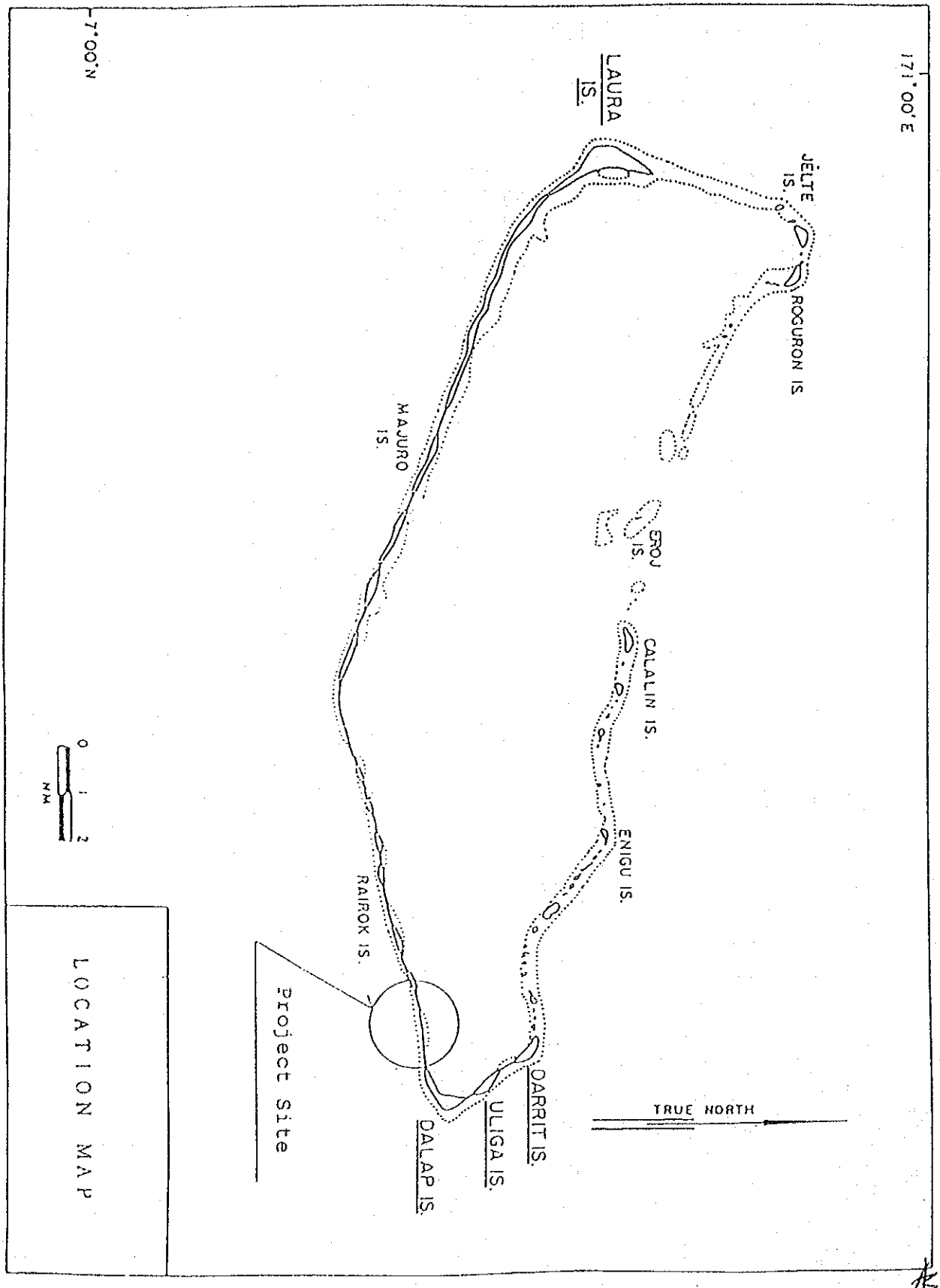
(2) JICA will prepare the draft report in English and dispatch a mission in order to explain its contents in the middle of October, 1992.

(3) In case that the contents of the report is accepted in principle by the Government of Marshall , JICA will complete the final report and send it to the Government of the Marshall Islands by November, 1992.

J.K

ANNEX 1

Project Area and Site Location Map



J.K

ANNEX-II

Necessary measures to be taken by the Government of the Republic of the Marshall Islands are as follows:

1. To secure the ownership and/or the right to use the Project site.

2. To clear, level and reclaim the Project site, when needed, prior to the commencement of the Project.

3. To construct temporary wall and fences around the Project site, if necessary.

4. To improve the access road to the Project site, if necessary.

5. To provide facilities for the distribution of the electricity, water supply, drainage, telephone line and other incidental facilities, if necessary.

6. To bear advising commission of the Authorization to Pay (A/P) and Payment commission to the Japanese foreign exchange bank for banking services based upon the Banking Arrangement (B/A).

7. To ensure prompt unloading, tax exemption, and custom clearance of the goods for the Project at port of disembarkation.

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

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

10. To maintain and use properly and effectively the facilities constructed and equipment under the verified contracts.

11. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.

12. To coordinate and solve any matters related which may arise with third party and inhabitants living in the Project area during implementation of the Project.

J.K

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY
ON
THE PROJECT FOR REHABILITATION OF CHANNEL AND BRIDGE
FOR LOCAL FISHING BOATS
IN THE REPUBLIC OF THE MARSHALL ISLANDS
(CONSULTATION ON THE DRAFT REPORT)

In June 1992, the Japan International Cooperation Agency (JICA) dispatched the Basic Design team on the Project for Rehabilitation of Channel and Bridge for Local Fishing Boats (hereinafter referred to as "the Project"), to the Republic of the Marshall Islands, and through discussions, field survey and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult the Marshallese side on the components of the draft report, JICA sent to the Marshall Islands a study team, which is headed by Mr. Takeru Kato, Technical Officer, Construction Division, Fishing Port Department, Fisheries Agency, and is scheduled to stay in the country from Octorber 13rd to 18th, 1992.

As a result of discussions, both parties confirmed the main items described on the attached sheet. This consultation was held by and between the JICA mission, Ministry of Public Works and Ministry of Foreign Affairs of the Republic of the Marshall Islands.

Majuro, Octorber 15th, 1992

Takeru Kato
Leader
Draft Report Explanation Team
JICA

Hon. Antonio Eliu
Minister
Ministry of Public Works
Republic of the Marshall Islands

ATTACHMENT

1. Components of Draft Report

The Governmet of the Republic of the Marshall Islands has agreed and accepted in principle the components of the Draft Report proposed by the team.

The main items of rehabilitation shall be as follows;

1) construction of concrete walls to prevent from outwash of bearing stratum for the abutments,
2) reform of armor stones and concrete covering in front of the abutments and rearrangement of wall stones in some part of the channel,
3) repair of armor stones on the slope of embankment at the side of the abutments,
4) replacement of the water main in the approach embankment sections,
5) pavement of the bridge deck and approach embankments,
6) repair of the footpath and curb stones, and
7) dredging of the area adjacent to the mouth of the channel.

2. Japan's Grant Aid Program

(1) The Government of the Republic of the Marshall Islands has understood the system of Japan Grant Aid explained by the team.

(2) The Government of the Republic of the Marshall Islands will take necessary measures, described in ANNEX Ⅰ, for smooth implementation of the Project on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

3. Further Schedule

The team will make the Final Report in accordance with the confirmed items, and send it to the Governmend of the Republic of the Marshall Islands by the end of December 1992.

J. K

ANNEX I

Necessary measures to be taken by the Government of the Republic of the Marshall Islands in case Japan's Grant Aid is extended.

1. To secure the ownership and/or the right of the site for the Project.
2. To clear, level and reclaim the site, prior to the commencement of the Project.
3. To undertake incidental outdoor works such as fencing, gates and exterior lighting in and around the site.
4. To improve the access road to the Project site, prior to the commencement of the Project.
5. To provide facilities for the distribution of the electricity, water supply, telephone line and other incidental facilities to the Project site.
6. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.
7. To exempt taxes and to take necessary measures for customs clearance of the materials and equipment brought for the Project at port of disembarkation.
8. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Majuro and stay therein for the performance of their work.
9. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant.
10. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.
11. To coodinate and solve any matters related which may arise with third party and inhabitants living in the Project area during implementation of the Project.

J.K Yamaguchi

A. 5 LIST OF COLLECTED DATA

List of Collection Data

1. SECOND FIVE YEAR DEVELOPMENT PLAN 1991/92 - 1995/96
   REPUBLIC OF THE MARSHALL ISLANDS

2 Informations of Typhoon Axel

3. Tidal Record at Majuro Lagoon -Wether Station

4. Drilling Investigation: Majuro Bridge Foundation

5. Repairing Record for Water main Across Majuro Bridge
   MWSC

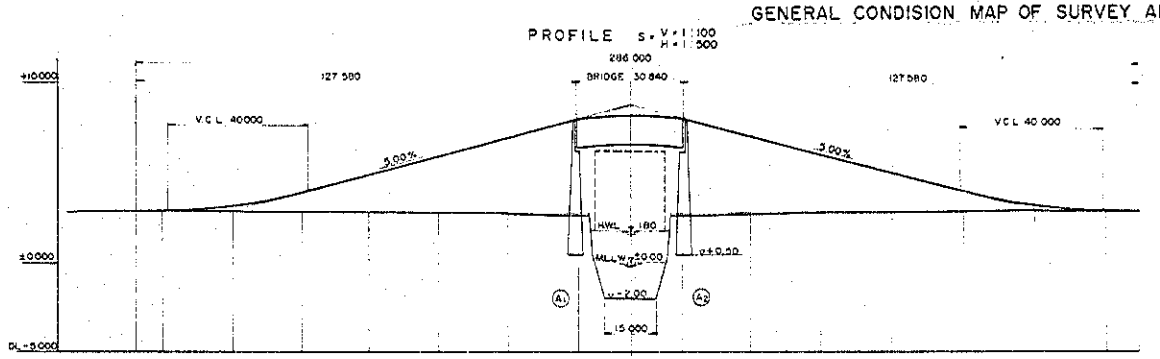
6. Register Vehicle Number in Majuro - Police Station

7. Organization Chart of ministry of Public Works

8. Data of Catch of Fish in Arno Atoll - MIMRA

A. 6 DATA FOR BASIC DESIGN STUDY

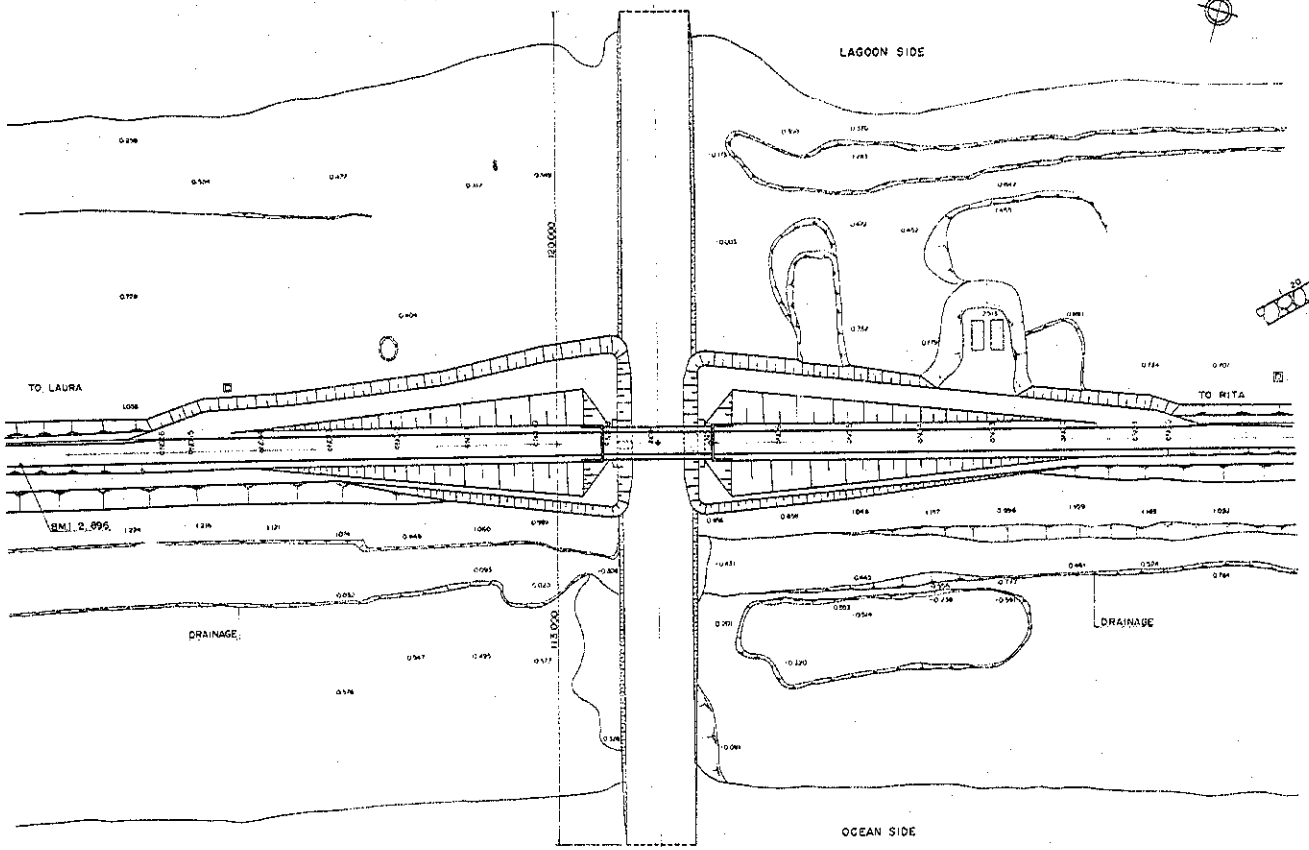
GENERAL CONDISION MAP OF SURVEY AREA



GEOMETRIC DESIGN STANDARDS

DESIGN SPEED		40 km/h
WIDTH OF CARRAGE WAY		6.50 m
WIDTH OF SIDE WALK		1.00 m
WIDTH OF SHOULDER		1.00 m
MAXIMUM GRADIENT		5.0%
MINIMUM VERTICAL RADIUS		450 m
NAVIGATION CLEARANCE	WIDTH	20 m (15 m)
	HIGHT ABOVE H.W.L.	5.00 m

PLAN S=1:500



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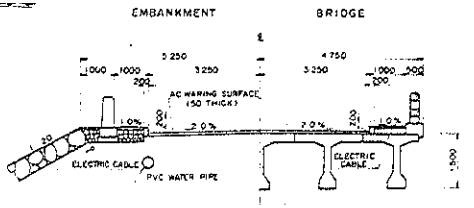
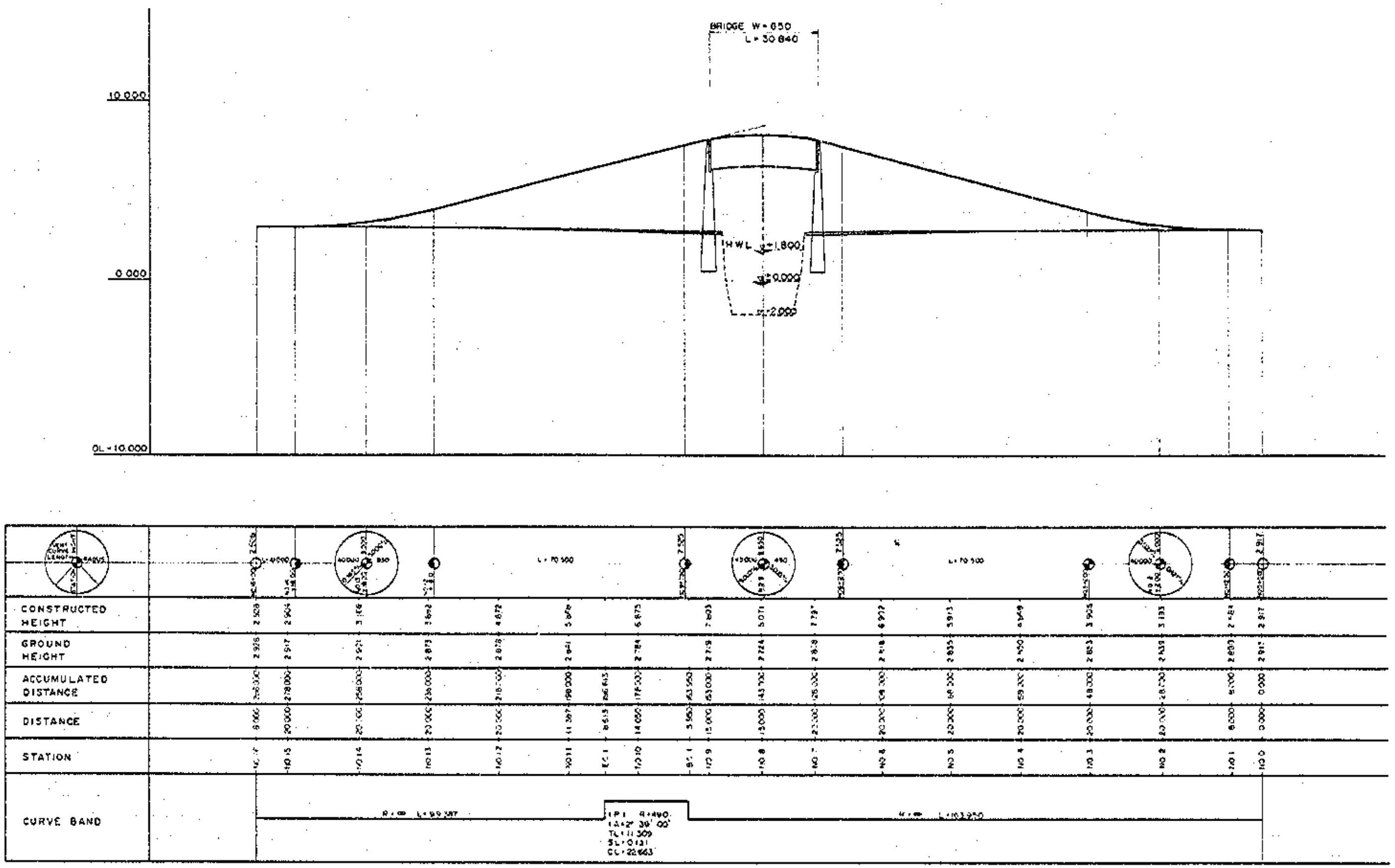


BASIC DESIGN STUDY ON
THE PROJECT FOR REHABILITATION OF
CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN
THE REPUBLIC OF MARSHALL ISLANDS

NOVEMBER, 1992	GENERAL CONDISION MAP OF SURVEY AREA

LONGITUDINAL PROFILE OF EXISTING ROAD

PROFILE SCALE V = 1 : 100, S = 1 : 500



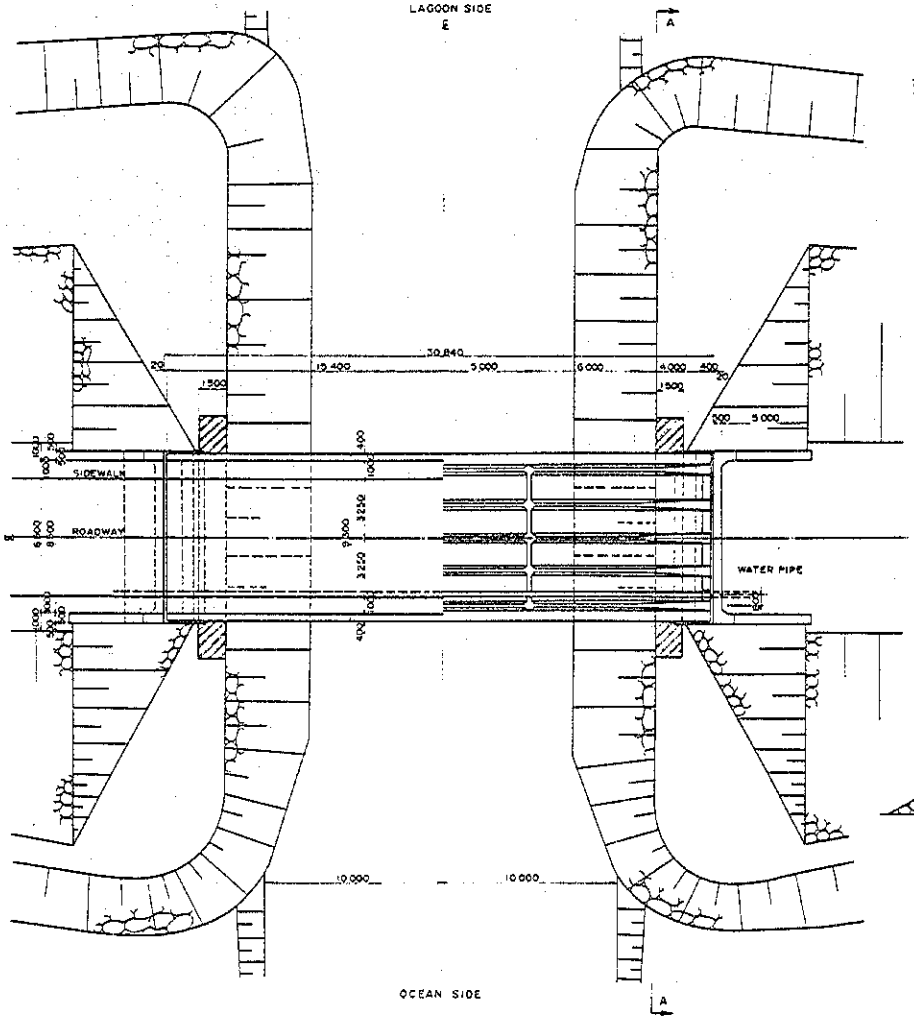
NOTE
BENCH-MARK IS B.M.1 (2m 869)

BASIC DESIGN STUDY ON
THE PROJECT FOR REHABILITATION OF
CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN
THE REPUBLIC OF MARSHALL ISLANDS

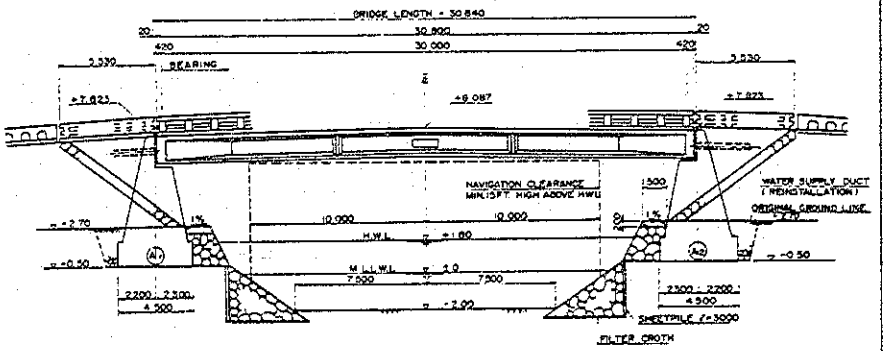
NOVEMBER, 1992 | LONGITUDINAL PROFILE OF EXISTING ROAD

GENERAL VIEW OF EXISTING BRIDGE

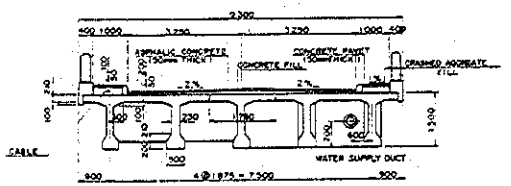
PLAN S=1/100



CROSS SECTION S=1/100



CROSS SECTION S=1/50



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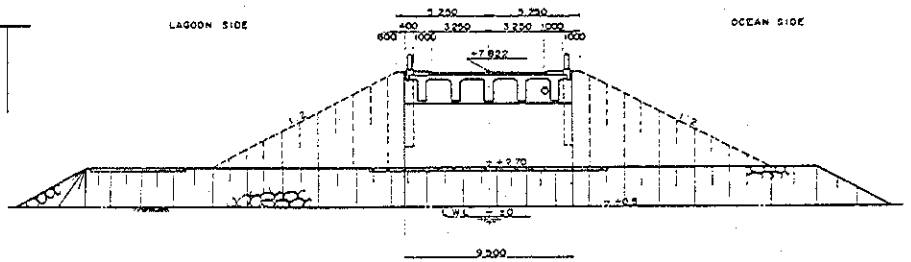
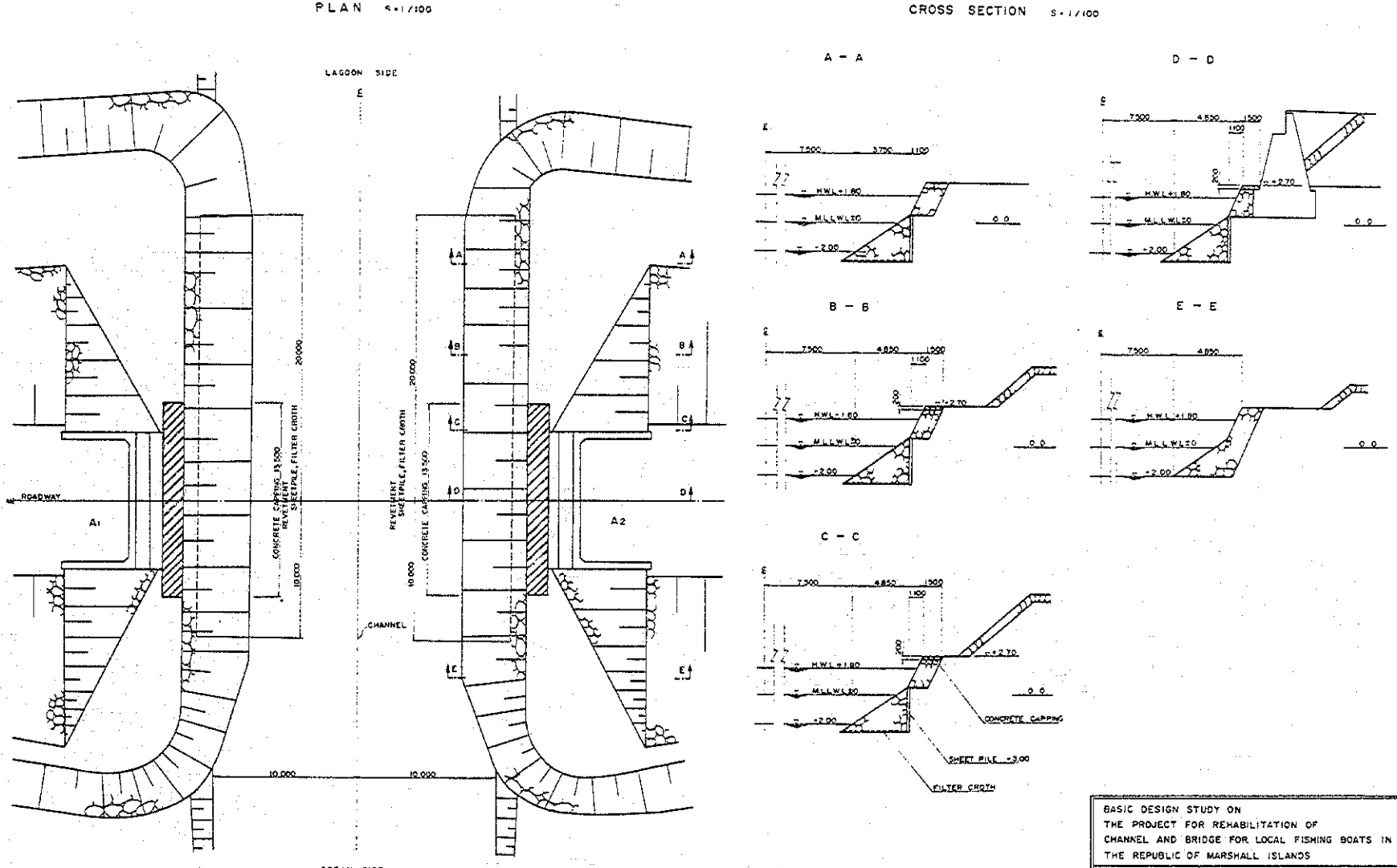
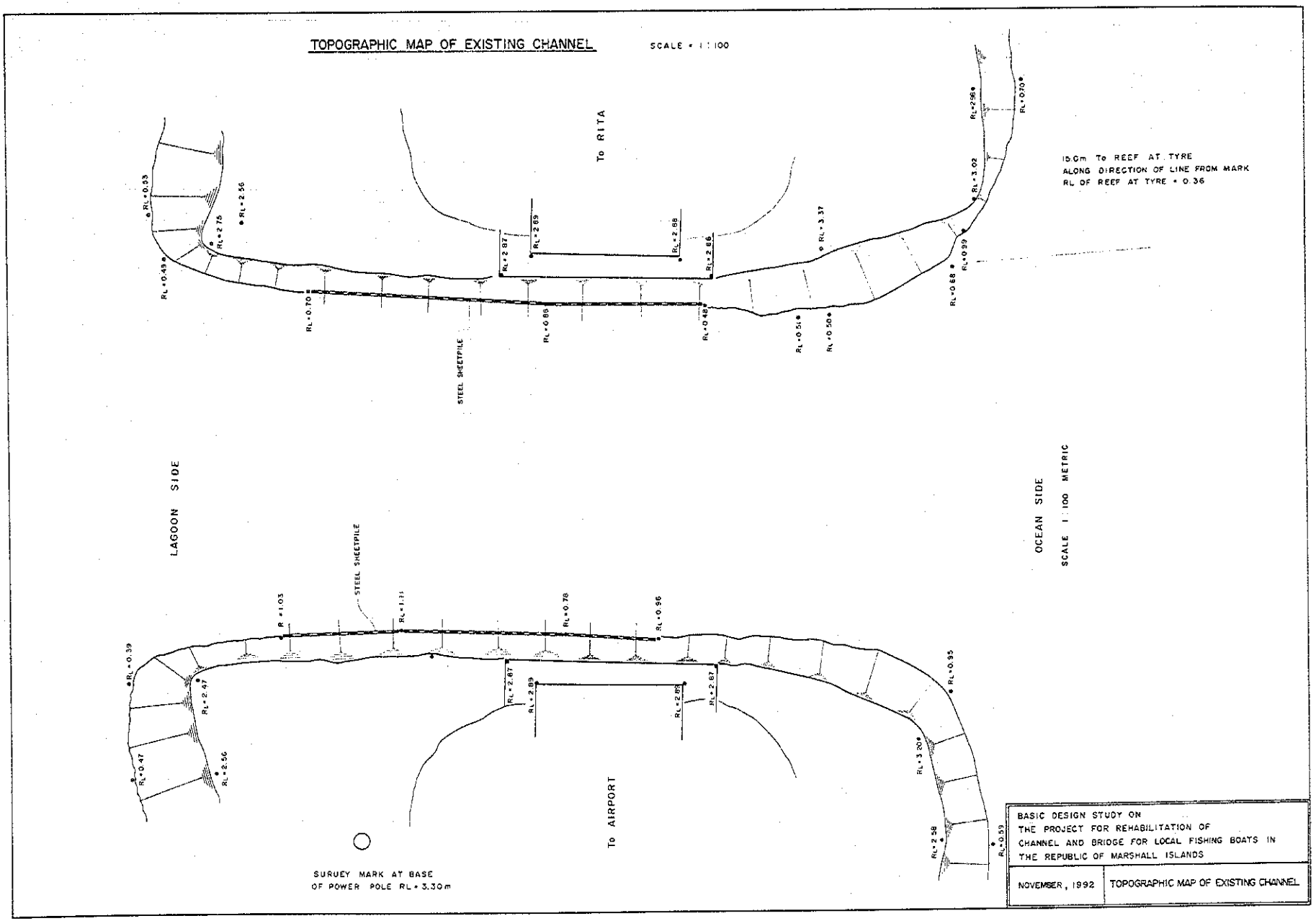


BASIC DESIGN STUDY ON THE PROJECT FOR REHABILITATION OF CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN THE REPUBLIC OF MARSHALL ISLANDS	
NOVEMBER, 1992	GENERAL VIEW OF EXISTING BRIDGE

DIMENSIONS OF EXISTING CHANNEL STRUCTURE

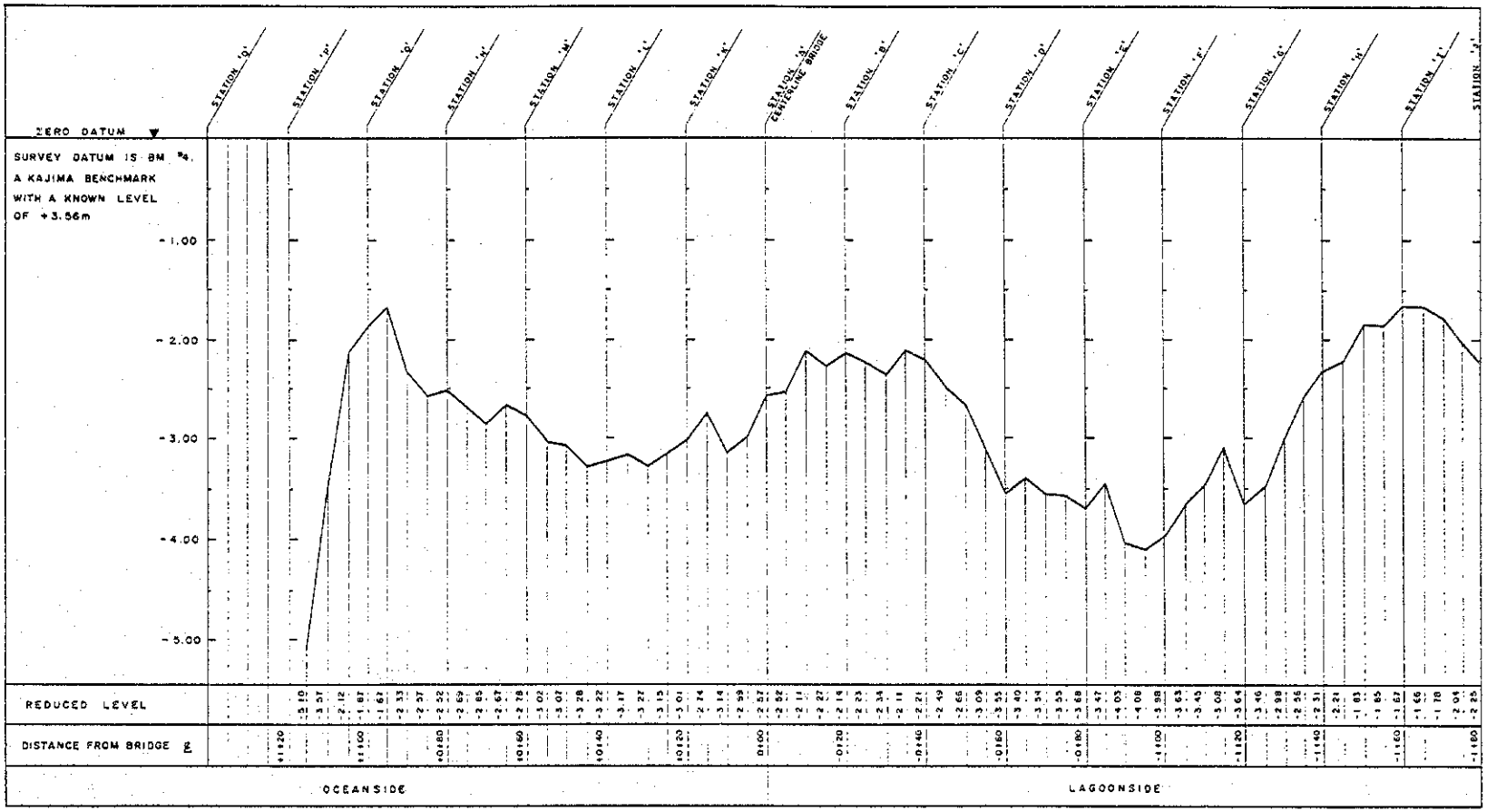


BASIC DESIGN STUDY ON THE PROJECT FOR REHABILITATION OF CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN THE REPUBLIC OF MARSHALL ISLANDS	
NOVEMBER, 1992	DIMENSIONS OF EXISTING CHANNEL STRUCTURE


TOPOGRAPHIC MAP OF EXISTING CHANNEL
SCALE = 1:100
To RITA
15.0m To REEF AT TYRE
ALONG DIRECTION OF LINE FROM MARK
RL OF REEF AT TYRE = 0.36
RL=0.53
RL=2.56
RL=2.75
RL=0.49
RL=0.70
STEEL SHEETPILE
RL=2.87
RL=2.89
RL=2.88
RL=2.85
RL=0.85
RL=0.48
RL=3.37
RL=0.56
RL=0.50
RL=2.98
RL=0.70
RL=3.02
RL=0.99
RL=0.88
LAGOON SIDE
OCEAN SIDE
SCALE 1:100 METRIC
STEEL SHEETPILE
R=1.03
RL=1.31
RL=0.78
RL=0.96
RL=0.39
RL=2.47
RL=0.47
RL=2.56
RL=2.87
RL=2.89
RL=2.88
RL=2.87
RL=0.95
RL=3.20
RL=2.58
RL=0.59
To AIRPORT
SURUEY MARK AT BASE
OF POWER POLE RL=3.30m
BASIC DESIGN STUDY ON
THE PROJECT FOR REHABILITATION OF
CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN
THE REPUBLIC OF MARSHALL ISLANDS
NOVEMBER, 1992
TOPOGRAPHIC MAP OF EXISTING CHANNEL

LONGITUDINAL PROFEL OF EXISTING CHANNEL

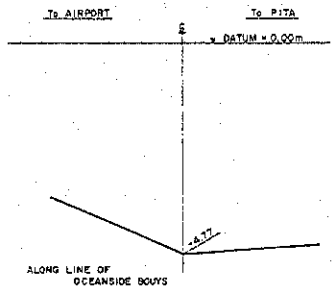
SCALE : H = 1:500, V = 1:20



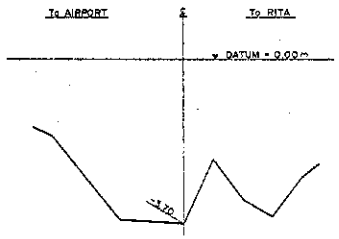
BASIC DESIGN STUDY ON THE PROJECT FOR REHABILITATION OF CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN THE REPUBLIC OF MARSHALL ISLANDS	
NOVEMBER, 1992	LONGITUDINAL PROFEL OF EXISTING CHANNEL

CROSS-SECTION OF EXISTING CHANNEL (1)

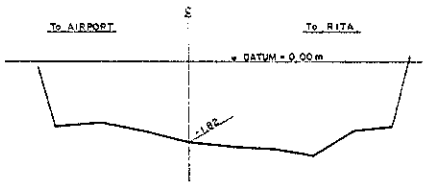
SCALE : H=1:250 , V=1:50



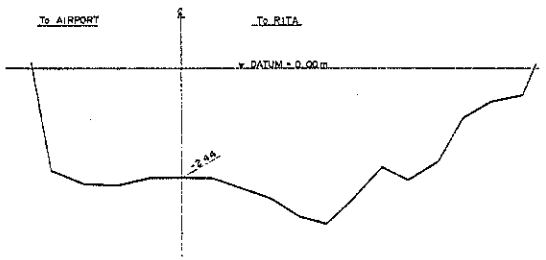
STATION 'Q' 1+40



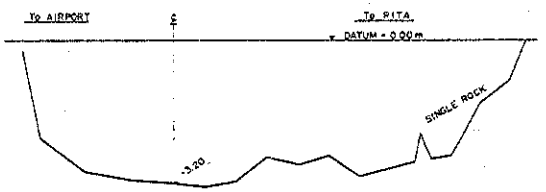
STATION 'P' 1+20



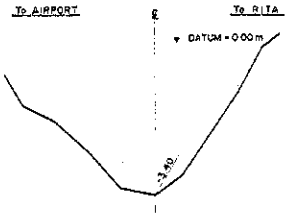
STATION 'O' 1+00



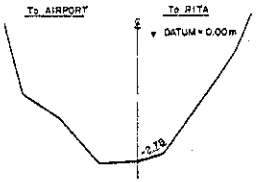
STATION 'N' +80



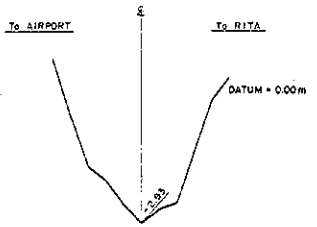
STATION 'M' 0+60



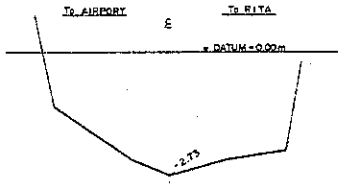
STATION 'L' 0+40



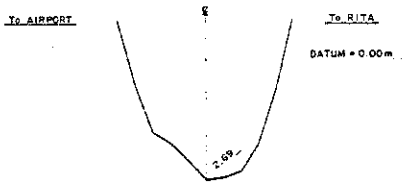
STATION 'K' 0+20



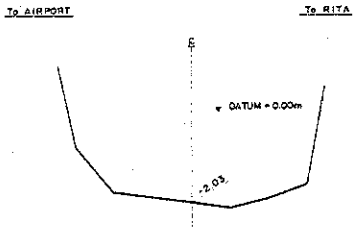
STATION 'A' +0+5



STATION 'A' 0+00



STATION 'A'-0+5



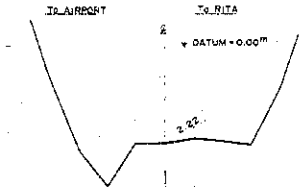
STATION 'B'-0+20

BASIC DESIGN STUDY ON
THE PROJECT FOR REHABILITATION OF
CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN
THE REPUBLIC OF MARSHALL ISLANDS

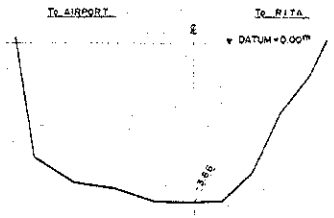
NOVEMBER, 1992	CROSS-SECTION OF EXISTING CHANNEL (1)

CROSS-SECTION OF EXISTING CHANNEL (2)

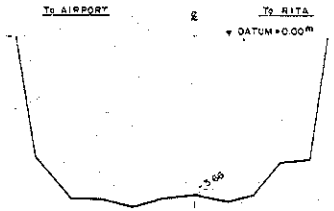
SCALE : H = 1 : 250, V = 1 : 50



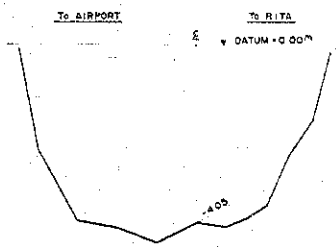
STATION 'C'-0+40



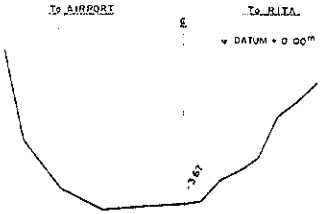
STATION 'D'-0+60



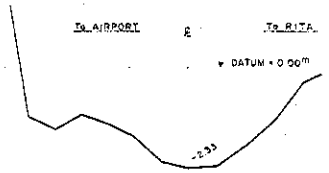
STATION 'E'-0+80



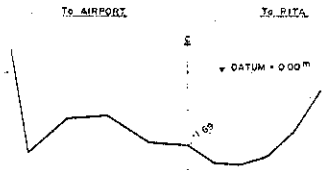
STATION 'F'-1+00



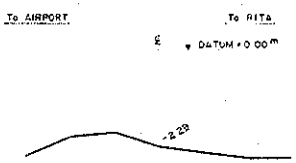
STATION 'G'-1+20



STATION 'H'-1+40

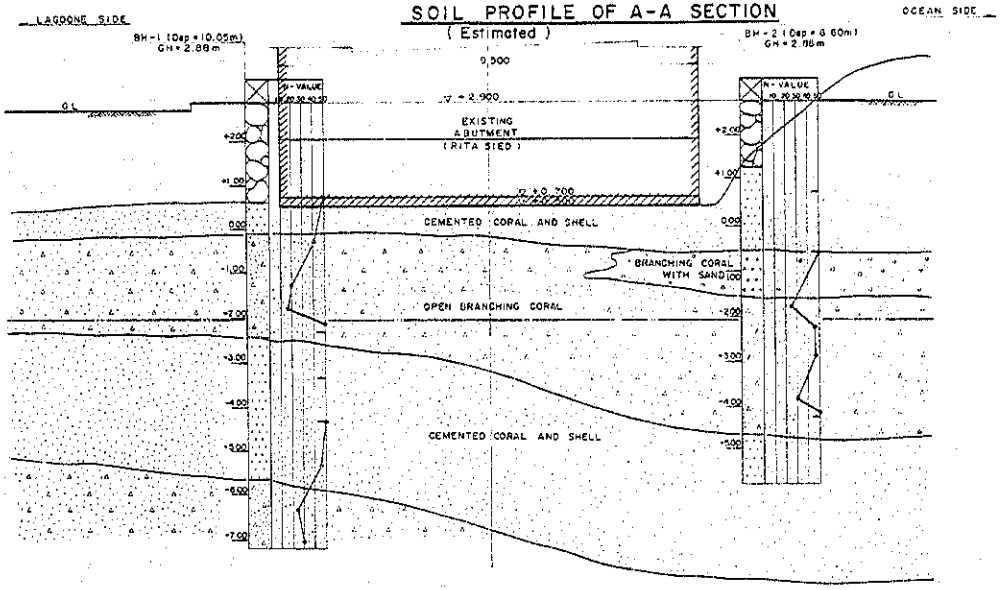


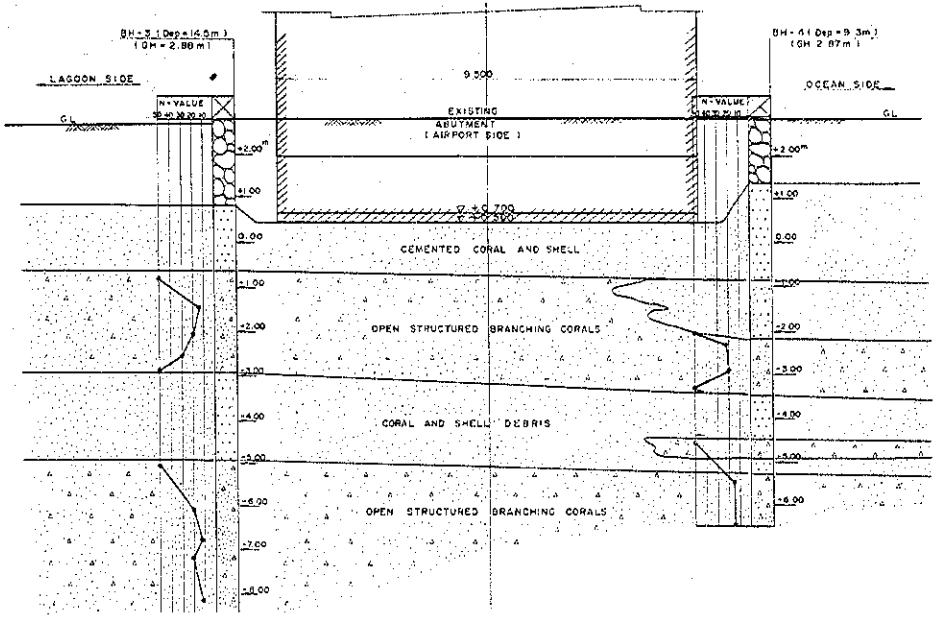
STATION 'I'-1+60

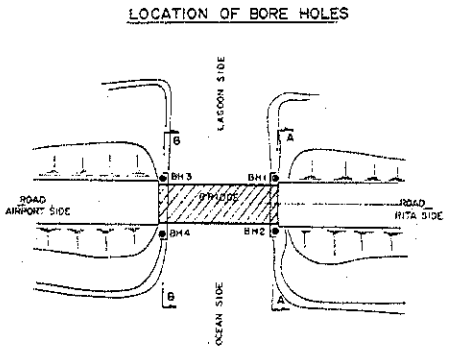


STATION 'J'-1+80

BASIC DESIGN STUDY ON THE PROJECT FOR REHABILITATION OF CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN THE REPUBLIC OF MARSHALL ISLANDS	
NOVEMBER, 1992	CROSS-SECTION OF EXISTING CHANNEL (2)







BASIC DESIGN STUDY ON THE PROJECT FOR REHABILITATION OF CHANNEL AND BRIDGE FOR LOCAL FISHING BOATS IN THE REPUBLIC OF MARSHALL ISLANDS	
NOVEMBER, 1992	SOIL PROFILE OF A-A SECTION

UNCONFINED COMPRESSION TEST FOR CORAL CONGLOMERATE (BEACH ROCK)

Unconfined compression tests was conducted with using bored cores. Results of the tests are summarized in Table-1.

Table-1 Results of Unconfined Compression Tests

DEPTH(GL-m)	COMPRESSIVE STRENGTH	VOLUME PER WEIGHT
3.03-3.18	756	2.56
4.03-4.11	66.3	2.18
8.00-8.10	33.8	1.96

According to the boring results, outer surfaces of coral conglomerates were relatively dense and hard in most areas. Lower parts were, on contrary, porlous and showed low consolidity.(Refer to Photos of bored cores in the attachment) Reflecting these rock conditions, the test results show extremely different strength between GL-3m and lower parts. Besides, in coral conglomerates, porlous rocks tend to have smaller volume per weight and lower

strength.

The unconfined compression tests are applicable only when bar and short column shaped cores were sampled, and the test results is thought to show strengths of good rock portions. Accordingly, it is appropriate to consider that figures given are very near to the upper limits of the concerned rocks, 60kg/cm2 of the compressive strength for the upper coral conglomerate (CR2) is to be adopted with due consideration of ununiformity of the whole. And 30kg/cm2 is proper for the lower coral conglomerate (CR1).

PHYSICAL TESTS FOR CORAL CONGLOMERATE

For a purpose to understand such rock characteristics of coral conglomerate as permeability etc, physical tests with using samples taken by standard penetration tests were conducted.Test results are shown in Table-1.

Table-1 Results of Physical Tests

SAMPLE NO	DEPTH (GL-m)	SPECIFIC GRAVITY	GRADATION (%)			MOISTURE (%)
			GRAVEL	SAND	SILT／CLAY	
1	5.15~5.45	2.83	49	38	13	16.2
2	4.15~4.45	2.83	53	38	9	14.7
3	3.15~3.45	2.82	55	39	6	15.8

SPECIFIC GRAVITY

Relatively larger figures of some 2.83 are gained in any cases. An

example of the measurement for typical soil in Japan is shown in Table-2 for reference.

Table-2 Examples of Density (Gravity) of Soil Fraction

Soil Name	Density (g/cm3)	Soil Name	Density (g/cm3)
alluvium clay	2.65	Kanto loam	2.78
sand	2.70		2.60
diluvium clay	2.67		2.38
sand	2.65	pit sand	2.79
Toyosu st'd sand	2.64	peat	1.60

GRADATION

Gradation is 50% of gravel, 40% of sand and 10% of fine grain and is majored by gravel. Here, fragile coral and shell are majority of gravels. As sampling is done by impact penetration, sampled materials are possibly to have been crashed. Therefore, it shall be considered that content of coarse materials in natural soils is higher than samples.

Results of permeability coefficient estimated by Craiger method as indicated in Table-4 are shown in Table-3. Though a value of k=10 -10 cm/sec is appering in accordance with the results, a value of 10 - 10 cm/sec shall be appropriate for the permeability

coefficient as natural soils are to be more coarse.

Table-3 Estimation of Permeability Coefficient by D20

SAMPLE NO	DEPTH (GL-m)	D20 (mm)	PERMEABILITY COEFFICIENT (cm/sec)
1	5.15-5.45	0.15	5.0×10^{-3}
2	5.15-5.45	0.30	2.2×10^{-2}
3	3.15-3.45	0.53	7.5×10^{-2}

Table-4 D20 and Permeability coefficient by Craiger

(1) Traffic Volume survey

In order to understand traffic volume to use for traffic control during construction and asphalt design, traffic volume survey at both locations of the downtown museum and the bridge area was implemented on August 18, 1992. Simultaneously, number of ships to pass the channel was also surveyed.

Daily traffic in downtown was 3700 from north to south and 4200 from south to north. Analysing vehicle types, it was found a share of sedan and jeep was 50%, while pickup and mini-pickup to be 35-40%. The remainder was buses, trucks and scooters. Daily truck volume around the bridge was totally 150 and same on both upward and dwonward lanes.

Hourly traffic volume in downtown was max. 500, and mean hourly volume was 307 from north to south and 346 from south to north. Around the bridge, the maximum volume was 229, while mean volume hourly was 164 in upward and 152 in downward.
Traffic volume is greatly increased comparing to days of construction.
Daily ships to pass the channel for fishing boats were 33, and low speed boats were only 2out of them. Hourly traffic volume is shown in Figs. 9-1 through 9-5, and traffic survey results is

shown in Tables 9-1 through 9-5.

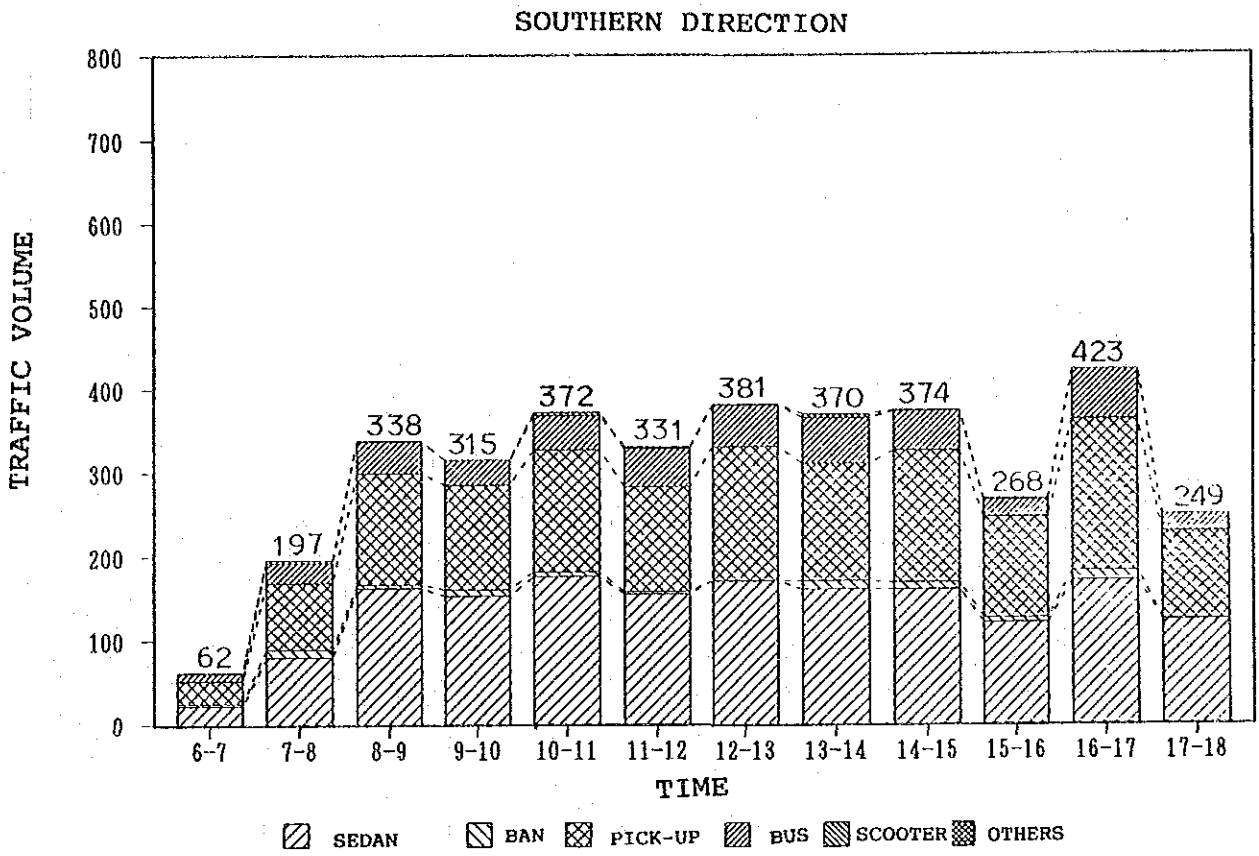


Fig. 9-1 Traffic Volume per Hour in Town

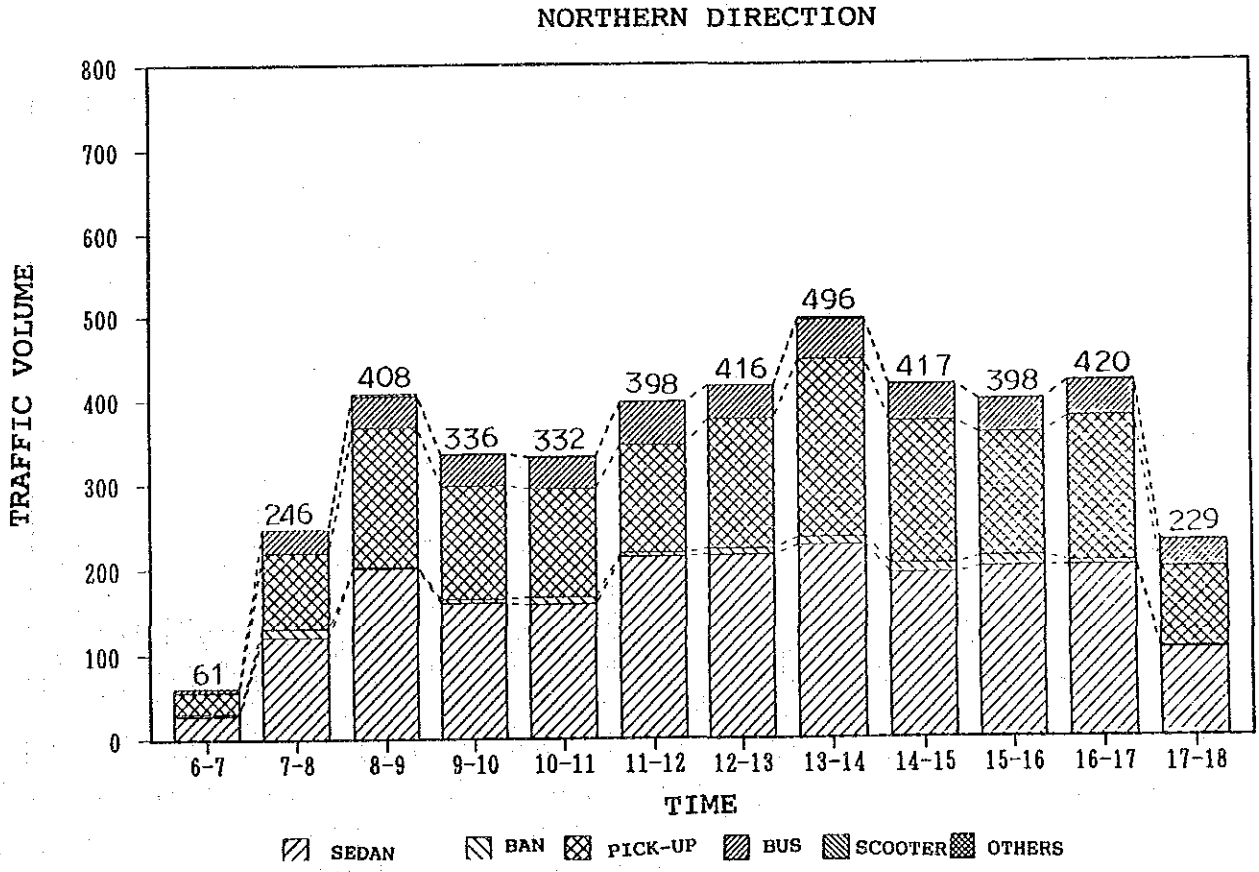


Fig. 9-2 Traffic Volume per Hour in Town

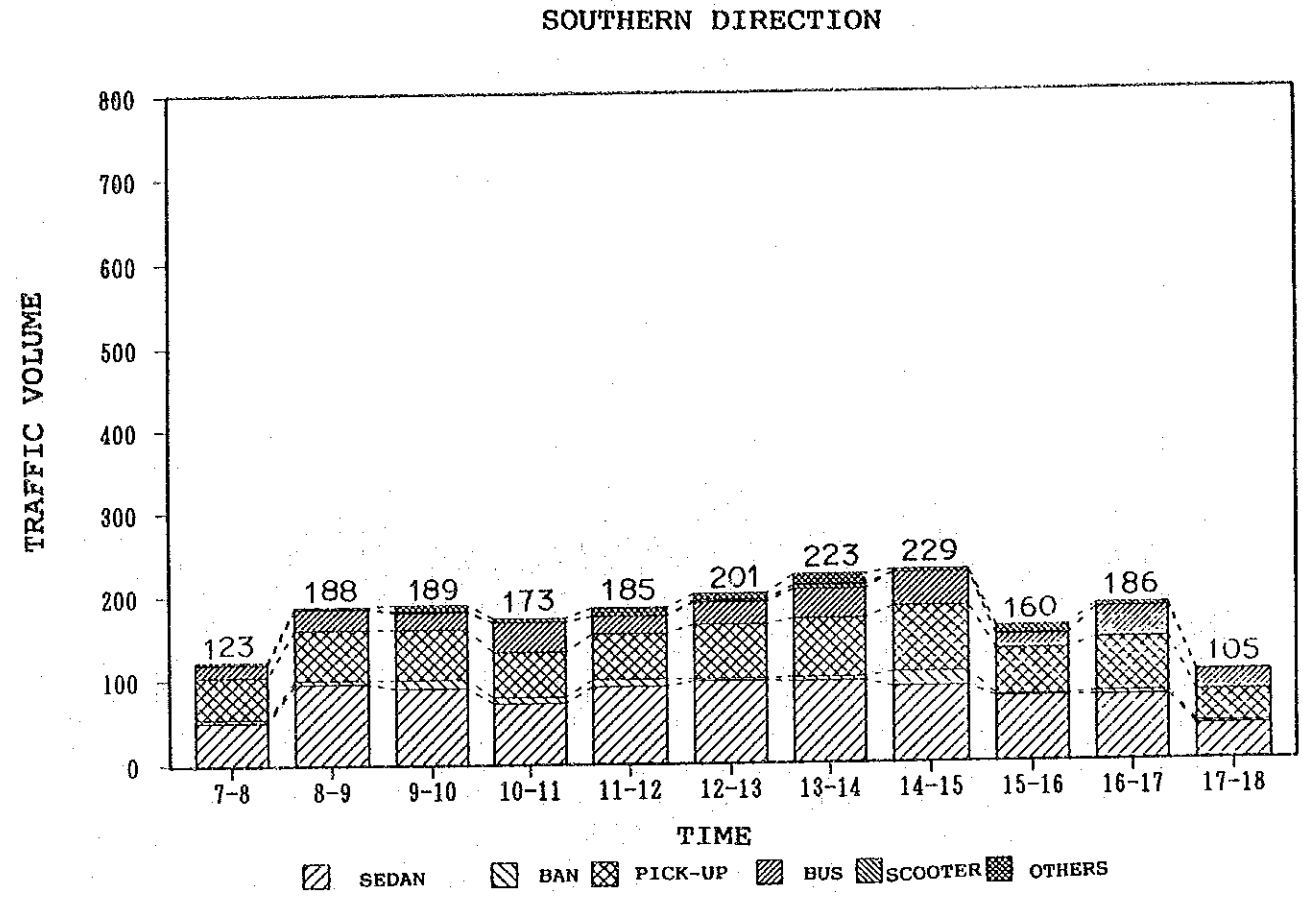


Fig. 9-3 Traffic Volume per Hour at Bridge

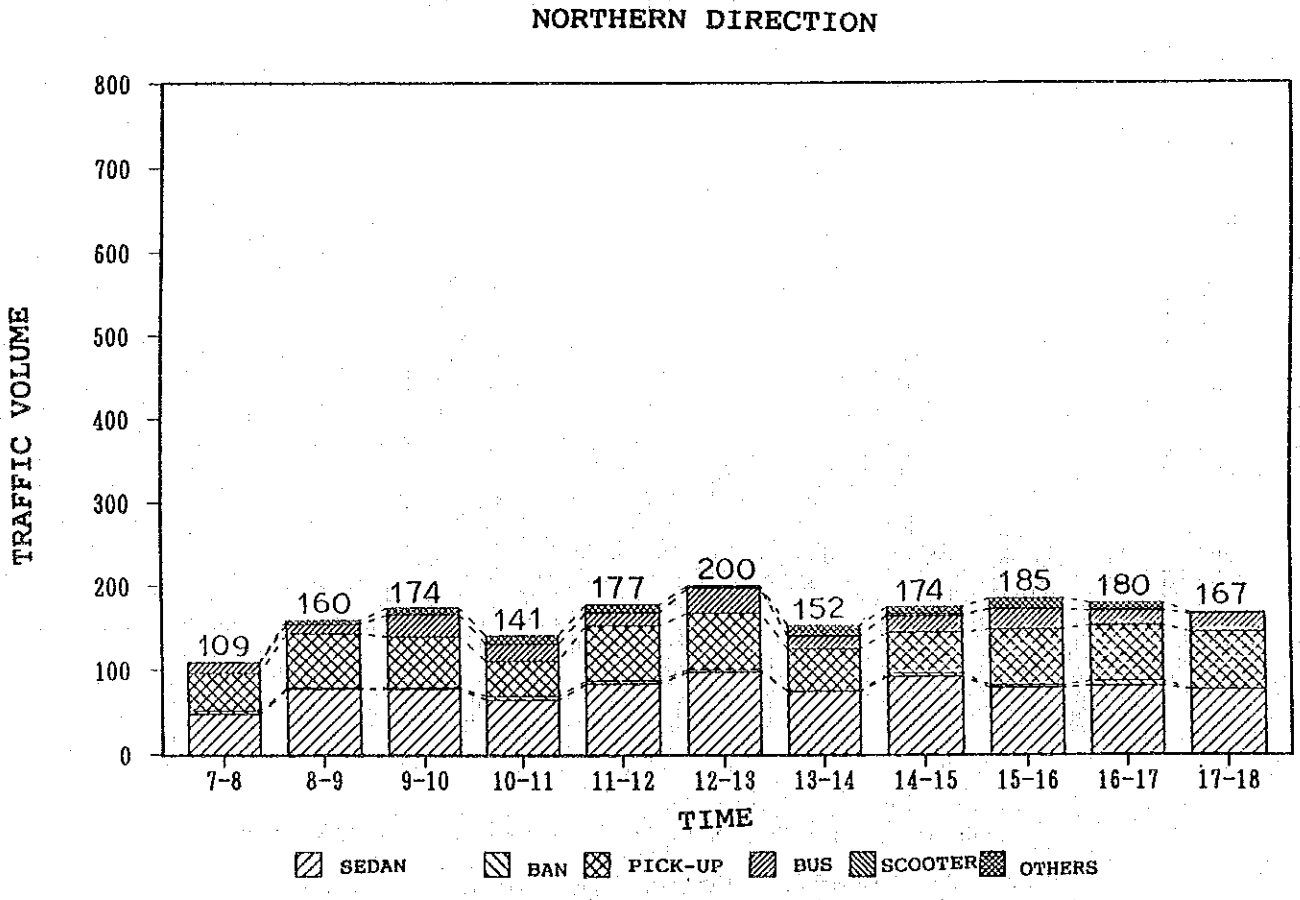


Fig. 9-4 Traffic Volume per Hour at Bridge

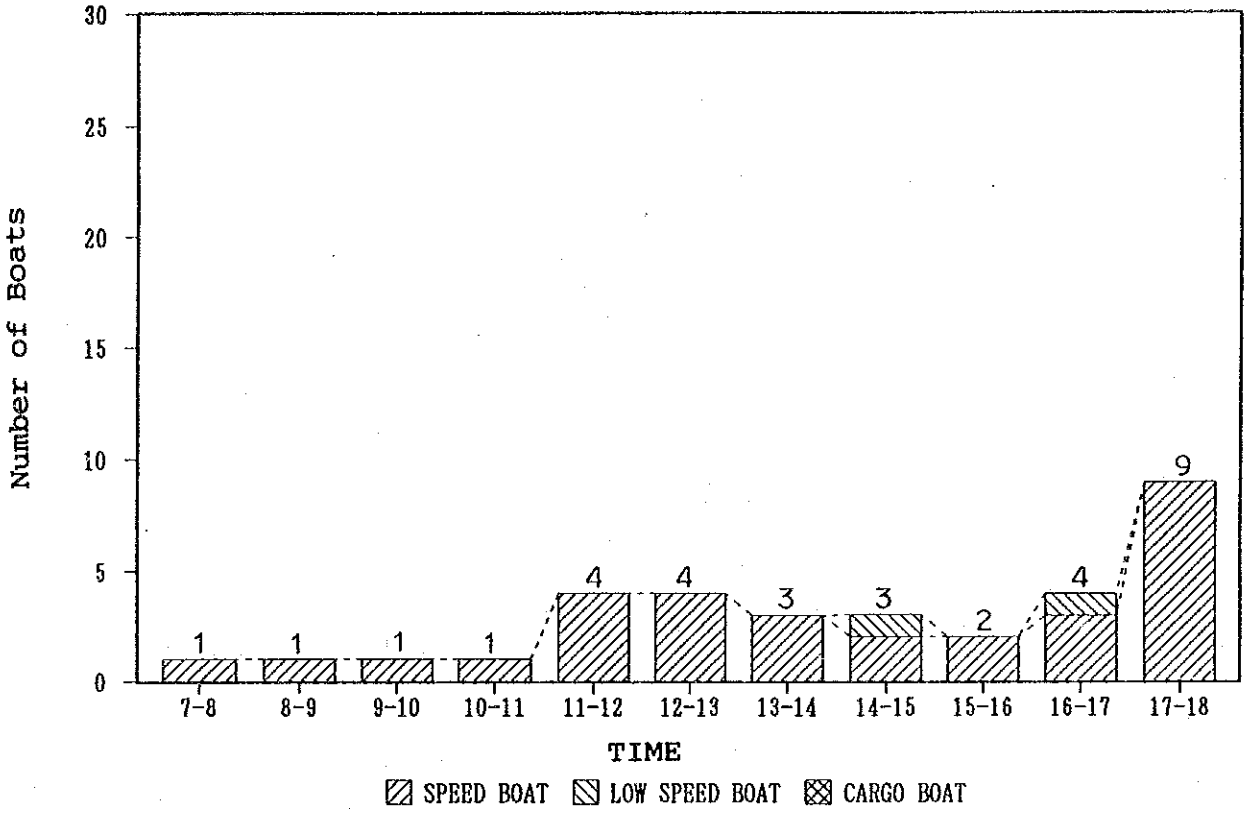


Fig. 9-5 Number of Boats on Passing Through Channel