3.4.7 Workable Days

The Government of Solomon Islands adopts a five-day work-week system, but employees of most private companies still work on Saturdays.

In 1989 calendar days, there are 52 sundays and 9 holidays on Guadalcanal. On the average, there are 14 rainy days in a month and 6.4 sunshine hours in a rainy day. This suggests that some rainy days are workable. Assuming that one-third of the rainy days are unworkable, then unworkable rainy days in a year can be calculated as:

$$\frac{14}{30} \times \frac{1}{3} \times 25 \times 12 = 46 \text{days}.$$

Thus, a total of 107 (=52+9+46) days are unworkable. Therefore, the workable day ratio in a year is (365-107)/365=70%, which is approximately similar to the rate in Japan.

(The figures of rainy days and sunshine hours adopted here are based on the meteorological data from Henderson Airport)

3.4.8 Prices and Wages

Most construction materials on Guadalcanal are imported, and the prices are influenced by delays in deliveries.

Government employees get about a 6% yearly pay raise, while the price increase rate is more than 10% every year.

4. CONTENTS OF THE PROJECT

4. CONTENTS OF THE PROJECT

4.1 Objectives of the Project

The objective of the Project is to reconstruct the Lungga Bridge close to the existing bridge in order to improve the load capacity and safety, and to meet the increased traffic.

4.2 Evaluation of the Requested Project

The Lungga Bridge has been in service for about 35 years. It is a one-lane Bailey-type bridge which has deteriorated with the long-term use. At present the bridge has been restricted to a load limit of 15tons.

The risk ratings of this bridge have been judged to be high enough that the required works have to be done. Even if, works such as repainting, scour protection should be done, the load carrying capacity of this bridge would not be improved.

Additionally, the traffic capacity of a single lane bridge cannot meet the present and future traffic volumes.

Consequently, it is recommended to replace the existing bridge and construct a new Lungga Bridge as a 2-lane structure that is structurally safe and able to meet the traffic volume.

4.3 Contents of the Project

4.3.1 Executing Agency

The executing agency of the Project is MTWU. All work related to this Project during its implementation shall be administered under this agency.

The MTWU budget for 1988 and the estimated budget for 1989 are shown in TABLE 4.1. The expenditures of RBA for 1988 and 1989 are shown in TABLE 4.2.

TABLE 4.1 1988 & Estimated, 1989 Budget of MTWU

Unit:1000 SI$

	1988	1989
Headquarters & Administration	368.2	359.5
Works	1,221.2	1,223.3
Electrical & Refrigeration	297.3	335.7
Roads,Bridges & Airfields	850.7	975.3
Architectual	113.3	184.6
Plumbing & Sewerage	249.3	256.9
Water Unit	755.8	927.0
Training	58.3	50.8
Total	3,914.1	4,313.1

(Source:1989 Recurrent Estimate)

TABLE 4.2 Expenditures of RBA

Unit:1000 SI$

	1988	1989
Payroll	310.5	403.7
Materials	120.0	135.0
Maintenance	274.0	275.0
Others	146.2	161.6
Total	850.7	975.3

4.3.2 Construction Site

In addition to the connection to the existing road, the construction site of the new bridge will be confined to the upstream or downstream side of the Lungga Bridge.

As the topographical and geotechnical conditions are assumed to be same, if the new bridge is located on the downstream side of the existing bridge, the following conditions would result:

(a) The bridge length is likely to be longer, because the planned bridge has to cross over the river on the skew in order to connect properly to the existing road.

(b) The piers of a new bridge will be adversely affected by the water flow which is disturbed by the existing piers during flood time if both new and old piers are not set in a straight alignment.

(c) In the improvement plan of the north Guadalcanal Road, the new Lungga Bridge is planned to be located on the upstream side of the existing bridge and will

avoid the problems mentioned above.

Based on the above-mentioned reasons, it is recommended that the construction of the new bridge be on the upstream side of the existing Lungga Bridge.

5. BASIC DESIGN

5. BASIC DESIGN

5.1 Basic Design Principles

The basic design of the new bridge is based on the natural conditions and construction conditions prevailing at the site. The basic design principles are as follows:

(a) Minimum span length is determined by the volume of flow and to avoid blockage of the span by driftwood during flooding. The following formula is used.

Minimum span length=0.005Q+20=33m

Q=Q100=2547cu.m/sec

(b) The clearance of the bridge (free board) is 1.20m above the highest high water level. This value corresponds to d clearance of Q100.

(c) The elevation of the top of the footing laying in the stream bed will be 2.0m below the lowest point of the river bed.

(d) The concrete bridge, having a span length over 40m would be a prestressed concrete box girder. This type of bridge, however, would require construction technology with a high degree of accuracy and a high level of quality control at the site.

Since the above type of work would necessitate a longer construction period than would be required by a steel bridge, the concrete bridge is excluded from consideration in the basic design notwithstanding its durability advantages.

5.2 Basic Design Conditions

The basic design conditions are as follows.

(a) Design speed	80km/hour, except on the east side of the bridge	
(b) Width of roadway	2 lanes 3.75m x 2=7.5m	
(c) Width of footway	1.20m each	
(d) Minimum span length	33.0m	
(e) Clearance	1.20m from H.H.W.L	
(f) Utilities	Water main	260mm W=160kg/m
	Telephone cable	90mm x 2 W= 30kg/m
	Electricity cable	150mm W= 30kg/m

(g) Related specifications

Specification for highway bridges
(JAPAN ROAD ASSOCIATION)

Bridge design specification
(THE NATIONAL ASSOCIATION OF AUSTRALIAN STATE ROAD AUTHORITIES)

General structural design and design loadings for buildings
(STANDARDS ASSOCIATION OF NEW ZEALAND)

5.3 The Comparative Design

5.3.1 Types of Superstructure

Four types of superstructures were selected as the objects of the comparative design.

Plan 1 2 spans (one span steel truss ,one span steel box girder)

Plan 2 3 spans continuous steel girder

Plan 3 3 spans(one span steel box girder and 2 spans continuous steel girder)

Plan 4 2 spans simply supported steel truss

5.3.2 Types of Substructure

(a) Abutment

The type of abutment is the retaining wall type.

(b) Pier

The type of pier adopted is a hammer head concrete pier.

(c) Foundation

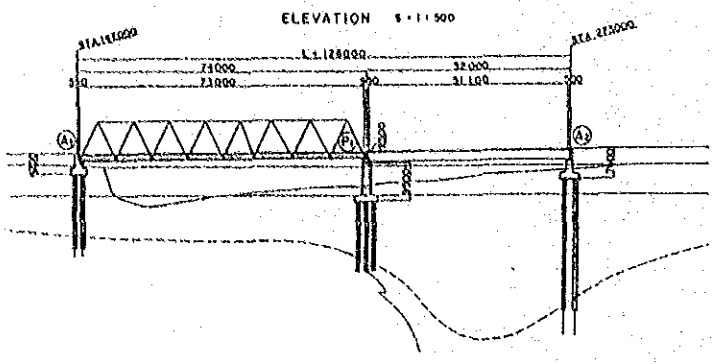
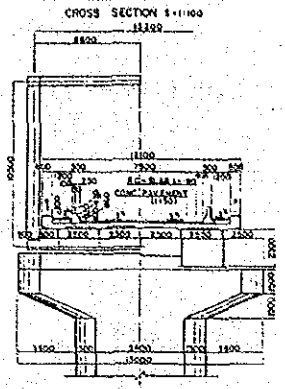
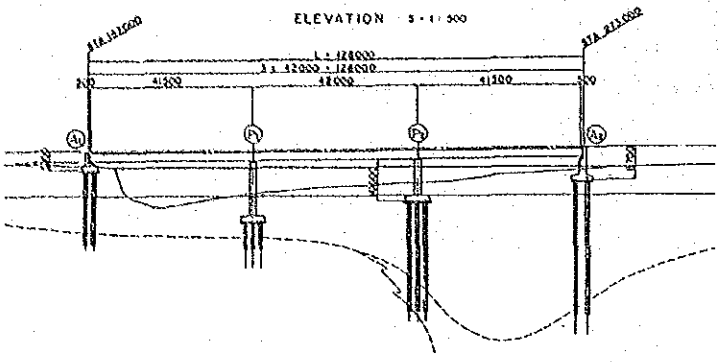
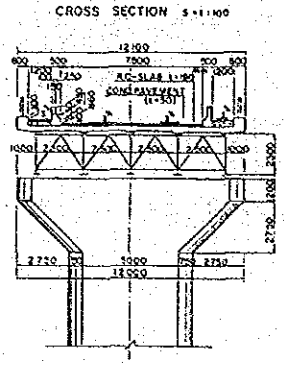
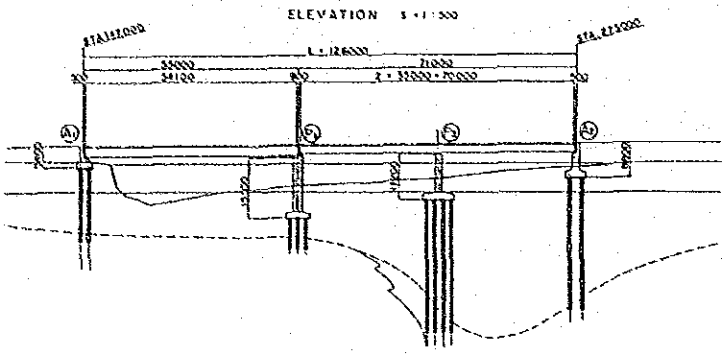
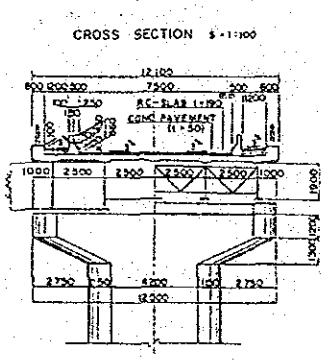
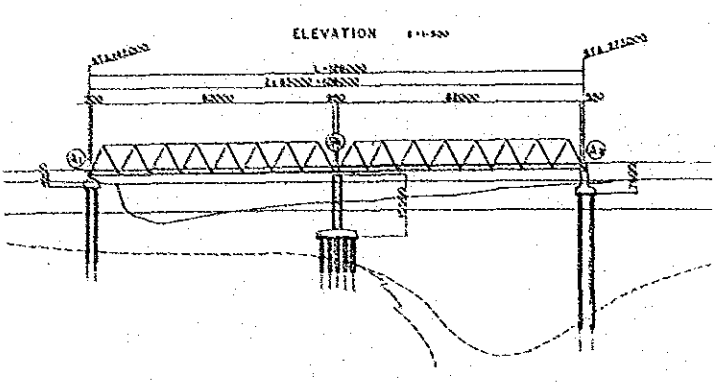
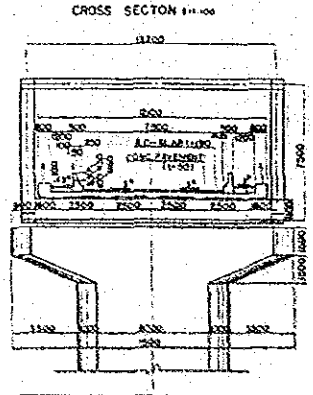
Three (3) sizes of steel pipe piles were considered: 600mm, 800mm and 1000mm in dia.

The type of foundation selected will use 800mm diameter pipe piles.

5.3.3 A Summary of the Comparative Design

A Summary of the Comparative Design is shown in TABLE 5.1.

TABLE5・1 A summary of the comparative design

GENERAL VIEW	CROSS SECTION
	
Plan 1 2 spans(one span steel truss, one span steel box girder)	Ratio of the construction cost 1.175
	
Plan 2 3spans continuous steel girder	Ratio of the construction cost 1.000
	
Plan 3 3spans(one span steel box girder and 2 spans continuous steel girder)	Ratio of the construction cost 1.100
	
Plan 4 2spans Simply supported steel truss	Ratio of the construction cost 1.124

5.3.4 Selection of the Most Suitable Bridgetypes.

Estimates of construction cost, structural characteristics, ease of erection, comfort of driving, esthetics and maintenance for each plan are given below in TABLE 5.2.

TABLE 5.2 General Estimation

Item	(1)	(2)	(3)	(4)	(5)	(6)	Total	Rank
Weighted values	50	5	20	5	10	10	100	
Plan 1	43	5	16	3	6	9	82	4
2	50	5	20	5	10	10	100	1
3	46	5	18	4	8	10	91	2
4	45	5	14	3	6	8	81	3

	Weighted values*
(1) construction cost	50
(2) structural characteristics	5
(3) ease of erection	20
(4) comfort of driving(less expansion joint)	5
(5) esthetics	10
(6) maintenance	10
	100

*The weighted values are determined from experience in bridge design and construction and are subjective. Those items that are heavily cost related are given more weight.

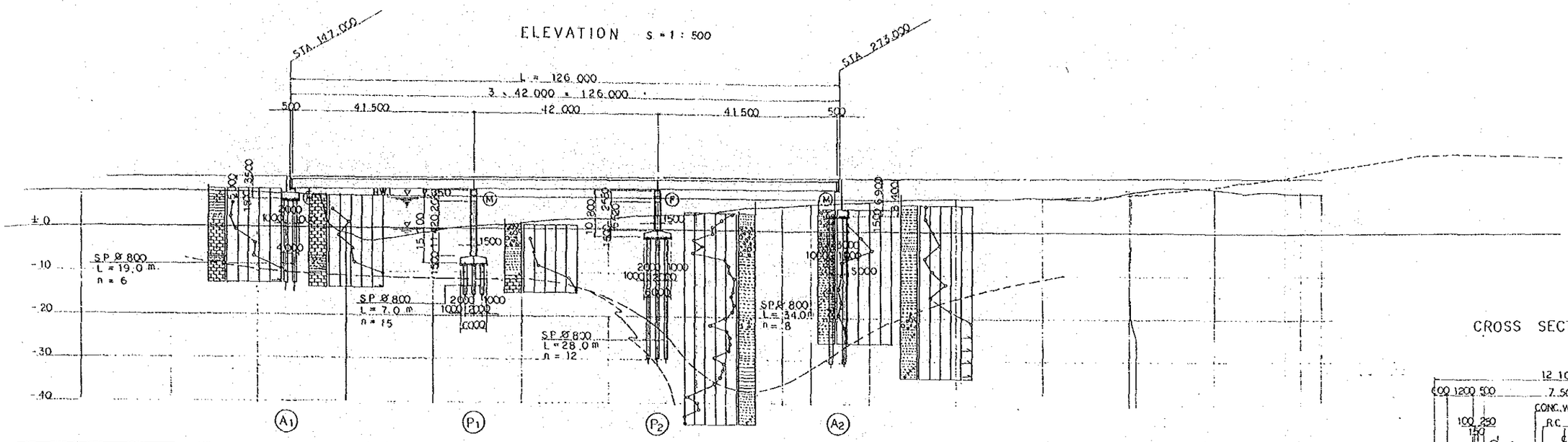
Plan 2, consequently, was selected as the most suitable bridge type.

5.4 Results of Basic Design

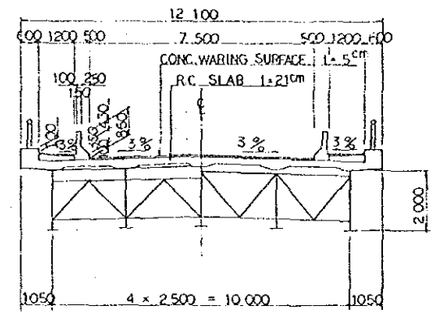
5.4.1 Dimension of Superstructure

5.4.2 Dimension of Substructure

ELEVATION S = 1 : 500

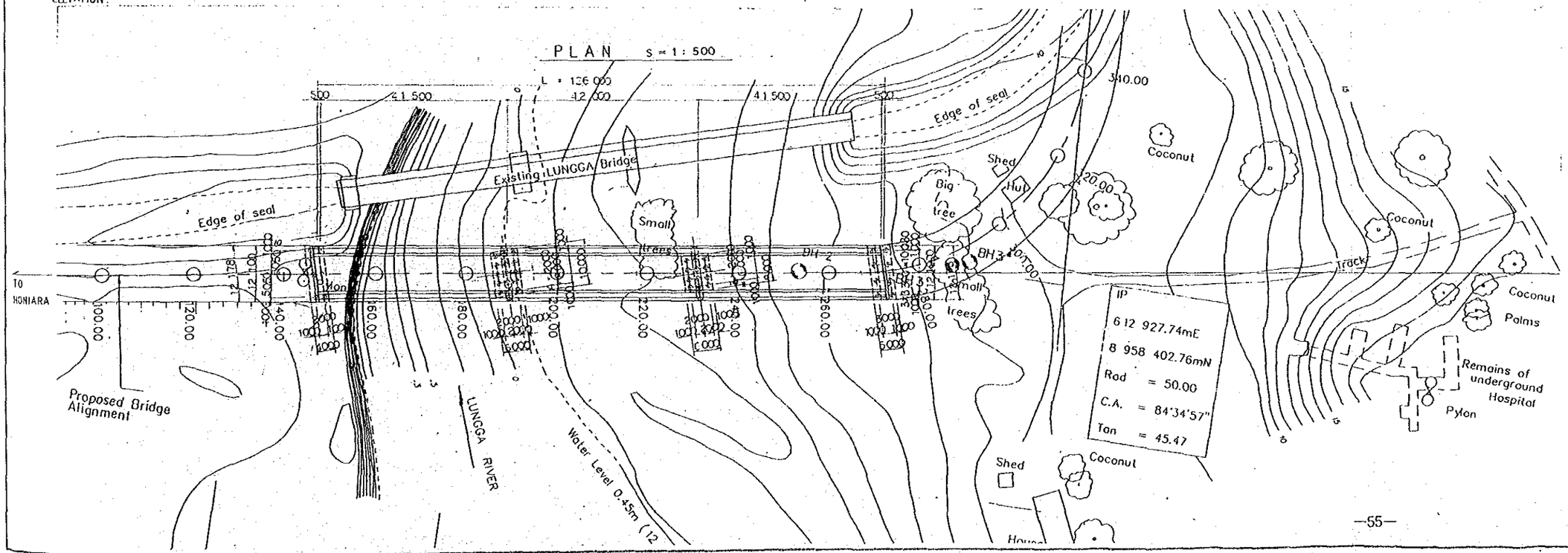


CROSS SECTION S = 1 : 100

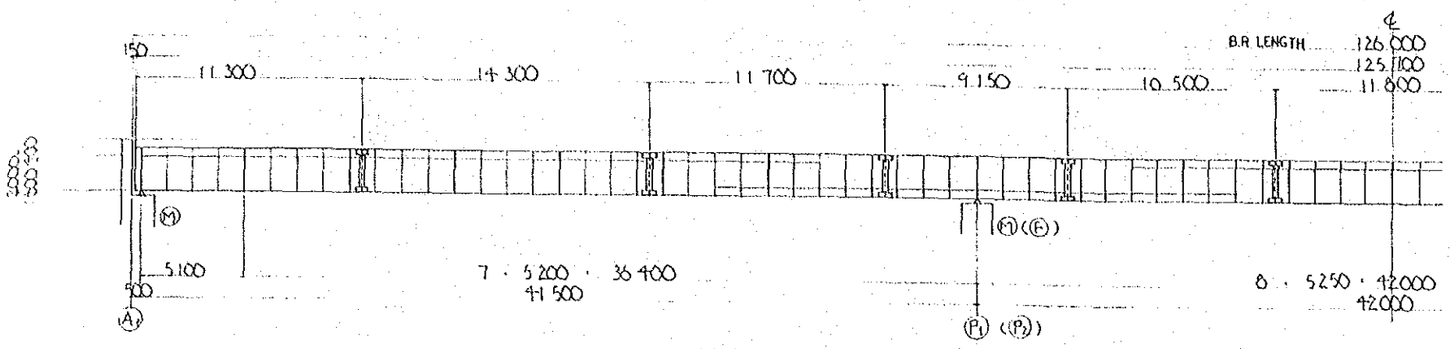


VERTICAL ALIGNMENT	i = 0.5 %
PROPOSED HIGHT	12.365 — 11.465 — 11.500 — 11.565 — 11.665 — 11.710 — 11.765 — 11.865 — 11.920 — 11.965 — 12.065 — 12.098 — 12.130 — 12.165 — 12.265 — 12.365 — 12.465 — 12.408 — 12.565 — 12.505 — 12.689
GROUND HIGHT	8.03 — 7.76 — 7.45 — 0.83 — 0.995 — 1.955 — 3.170 — 5.070 — 5.525 — 6.265 — 7.135 — 7.450 — 8.785 — 8.845 — 9.755 — 9.015 — 9.000
STATION (℄ CHAINAGE)	120. — 140. — (A1) 147. — 160. — 180. — (P1) 189. — 200. — 220. — (P2) 231. — 240. — 260. — 265.50 — (A2) 273. — 280. — 300. — 320. — 340. — 340.36 — 360. — 380. — 384.80
PLANOMETRIC ALIGNMENT	
SUPER ELEVATION	

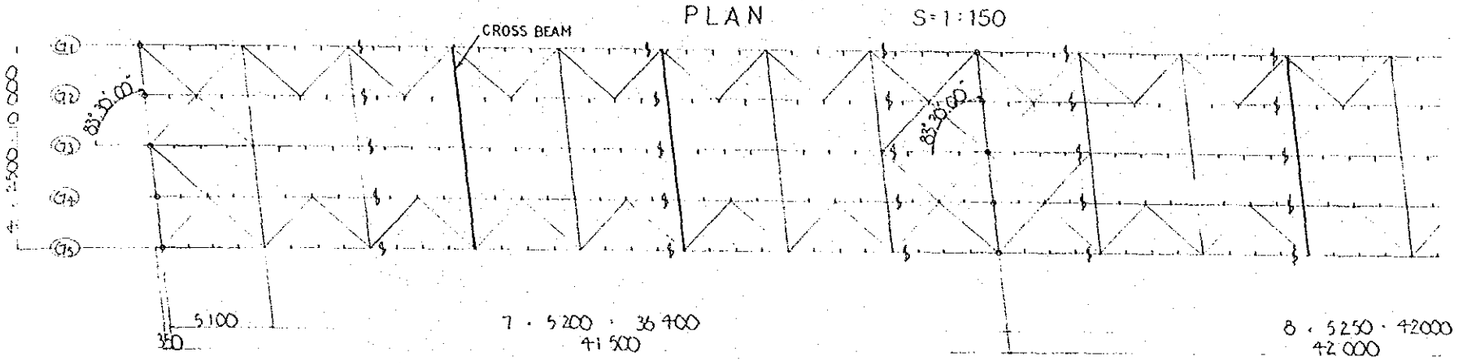
PLAN S = 1 : 500



ELEVATION S=1:150

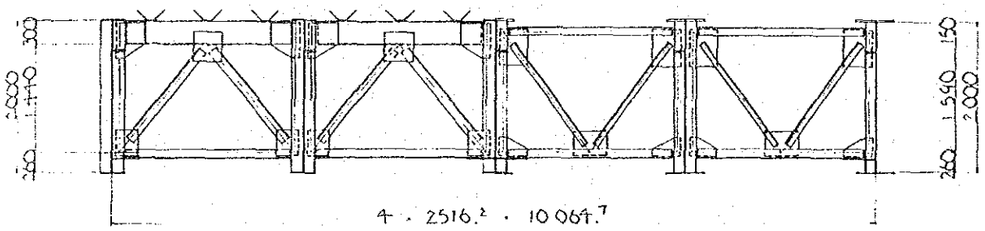


PLAN S=1:150



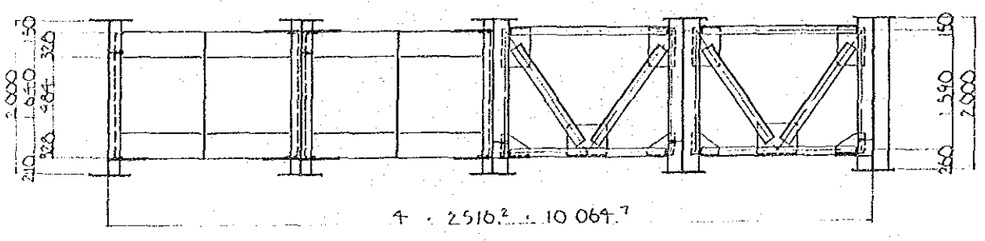
CROSS BEAM SYSTEM S=1:40

S.B ON ABUT



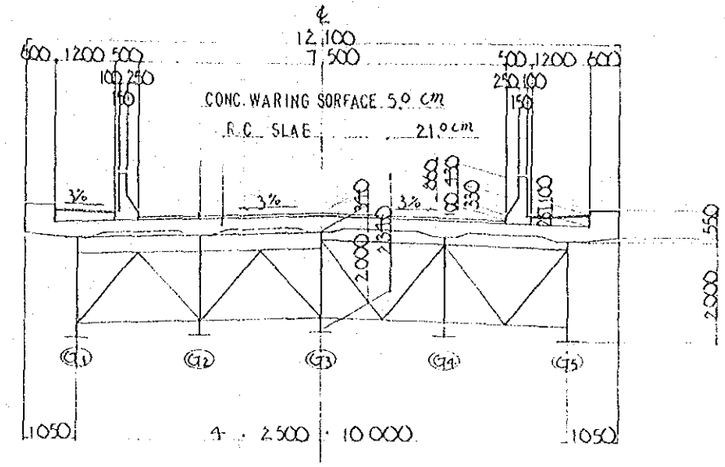
S.B BETWEEN SUPPORS

CROSS BEAM S.B ON PIER

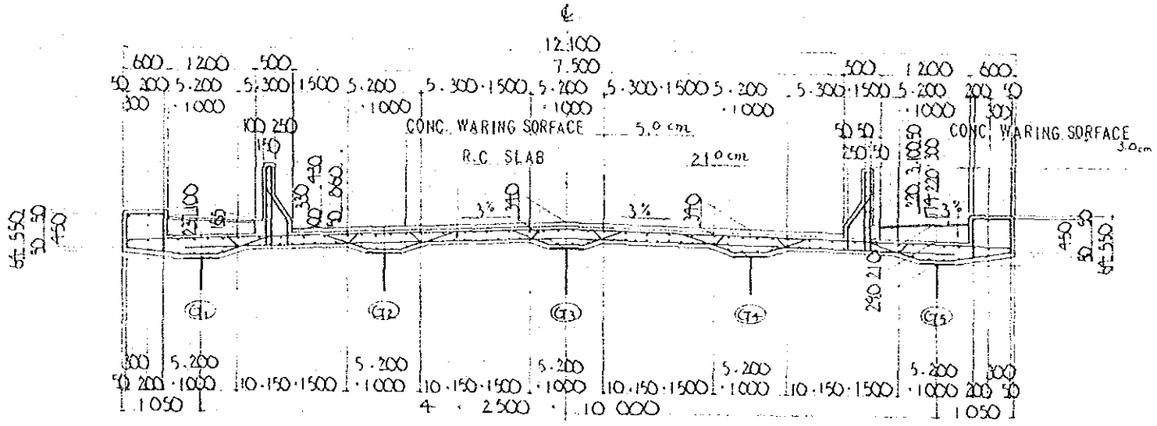


NOTE : S.B STUNDS FOR SWAY BRACING.

CROSS SECTION S=1:60

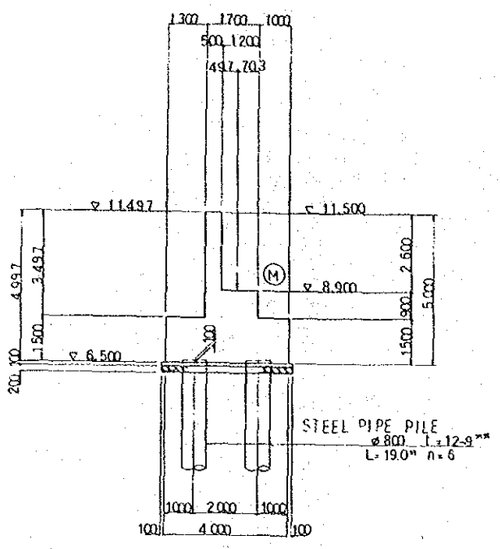


DETAILED CROSS SECTION S=1:40

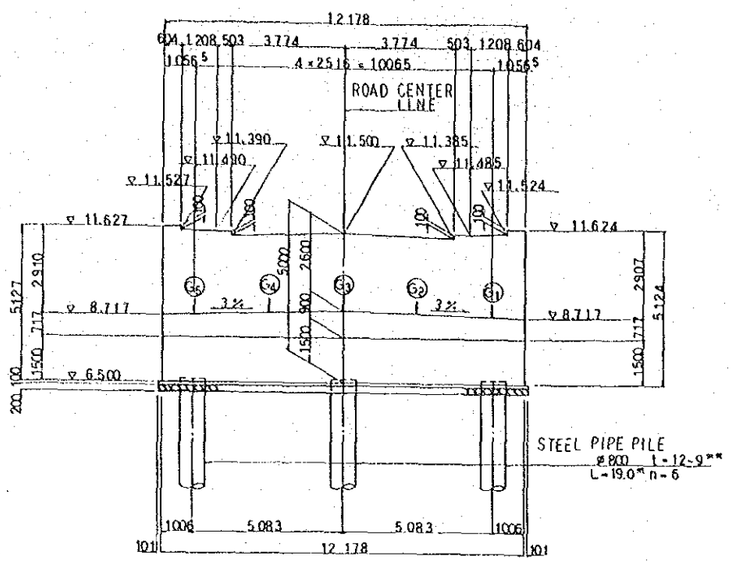


A1 ABUTMENT S=1:100

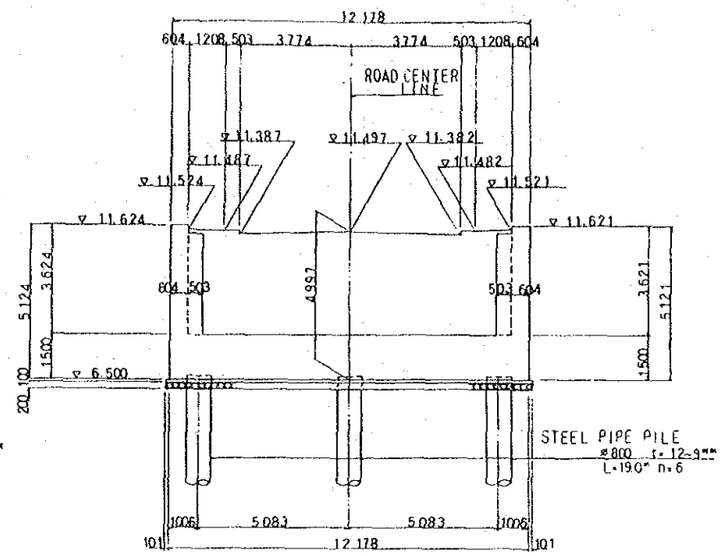
1 – 1



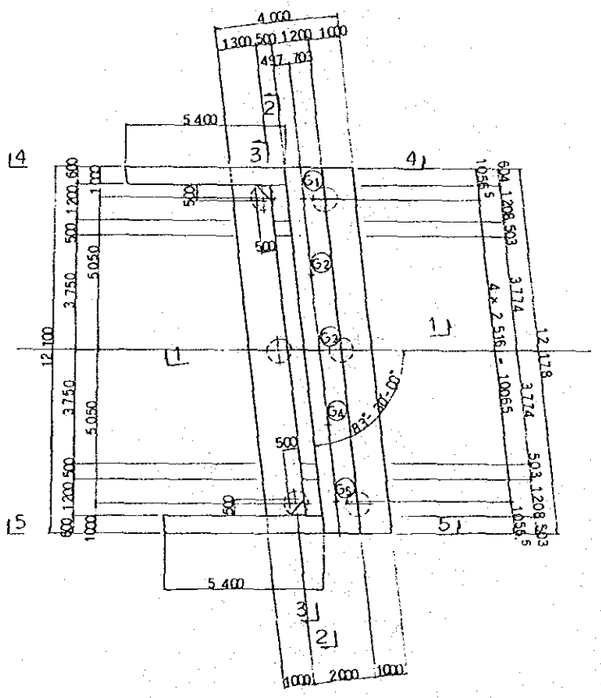
2 – 2 (FRONT ELEVATION)



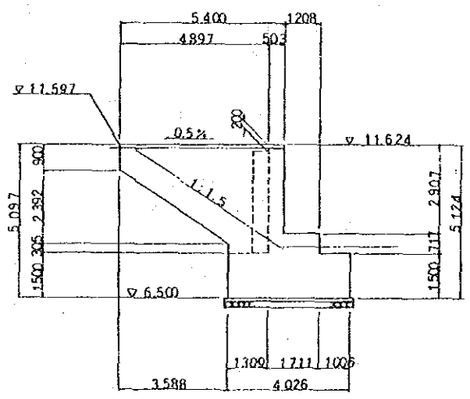
3 – 3 (BACK ELEVATION)



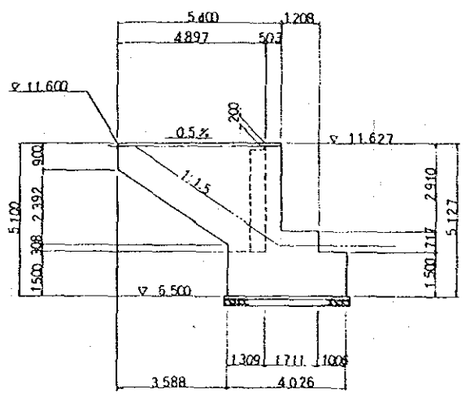
PLAN



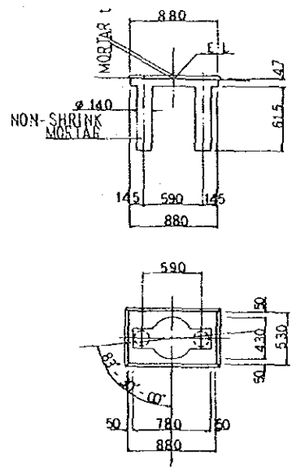
4 – 4



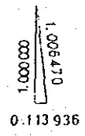
5 – 5



DETAIL OF MORTAR LAYER AND BOLT HOLES S=1:30



TRIGOMETRIC RATIO

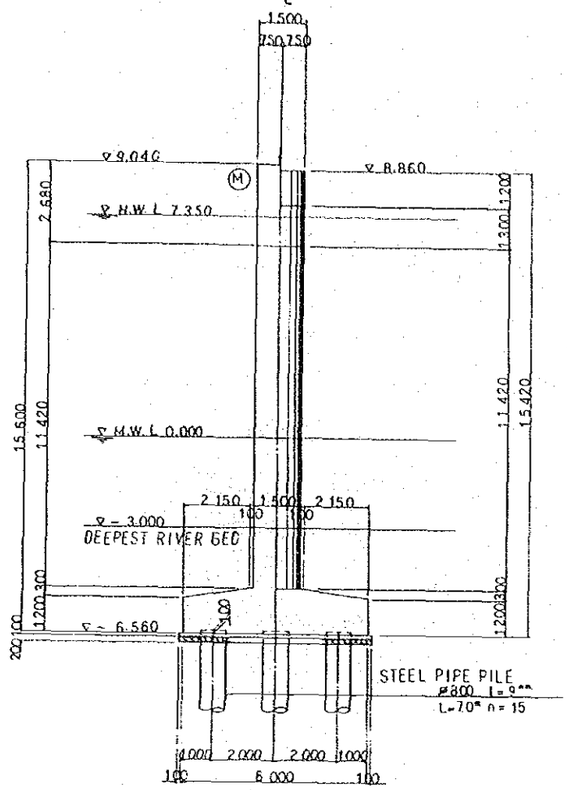


DIMENSION OF MORTAR LAYER

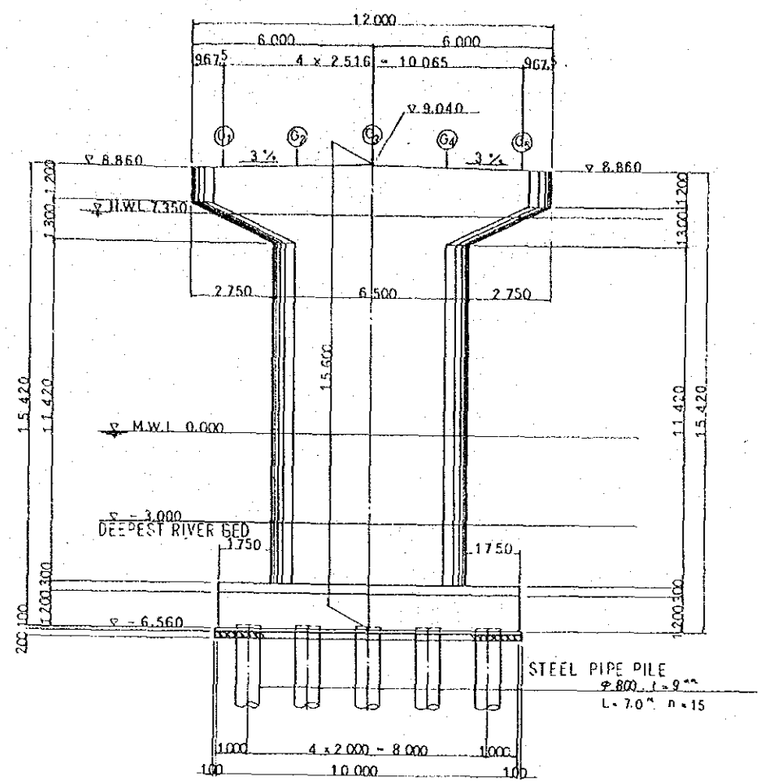
	G1	G2	G3	G4	G5
MORTAR t (mm)	53	54	56	57	58
E.L	8.750	8.825	8.900	8.825	8.750

P1 PIER S = 1 : 100

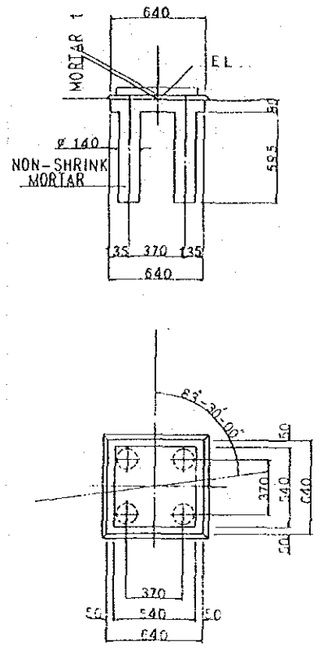
SIDE ELEVATION 1 – 1 ℄ 2 – 2



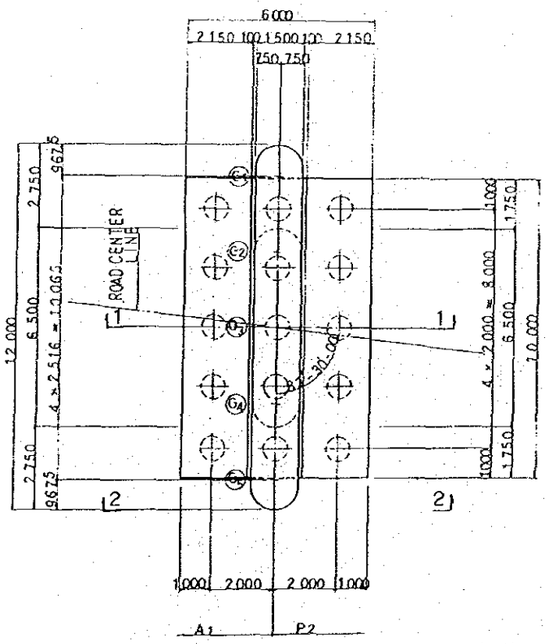
FRONT ELEVATION



DETAIL OF MORTAR LAYER AND BOLT HOLES S = 1 : 20



PLAN



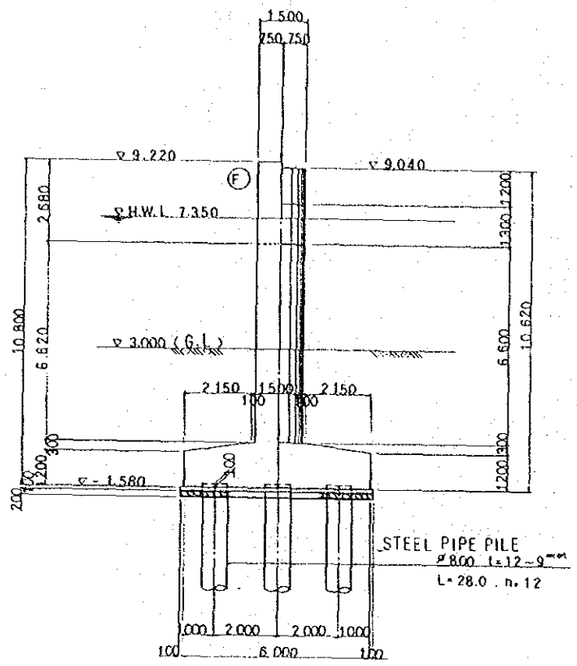
DIMENSION OF MORTAR LAYER

	G_1	G_2	G_3	G_4	G_5
MORTAR 1 (cm)	30	36	37	39	36
EL	8.890	8.965	9.040	8.965	8.890

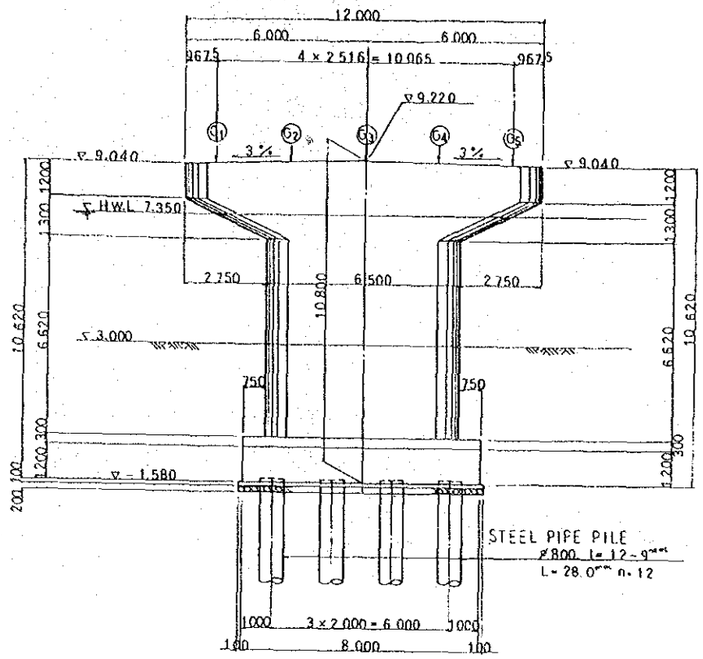
P2 PIER S = 1 : 100

SIDE ELEVATION

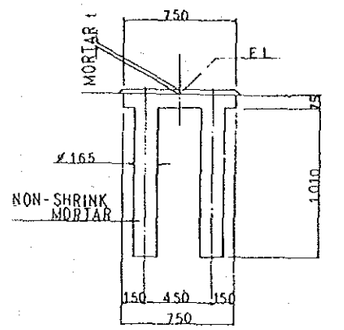
1 – 1　　2 – 2

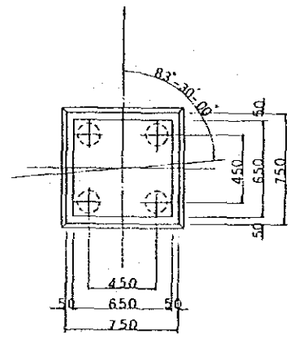


FRONT ELEVATION



DETIL OF MORTAR LAYER AND BOLT HOLES S = 1 : 20

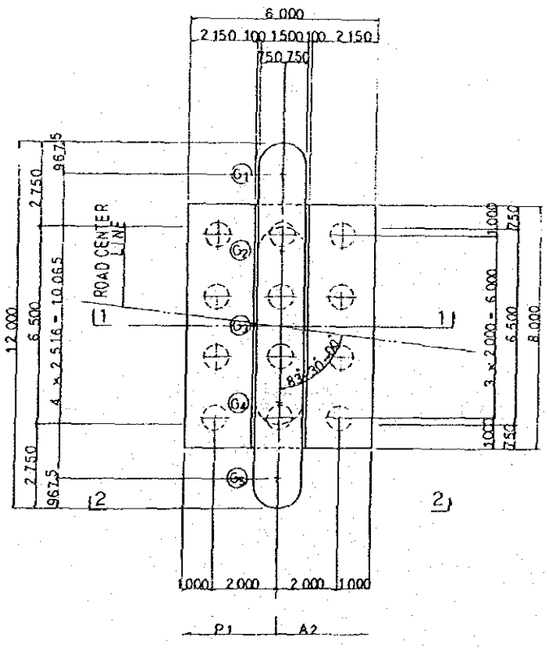




DEMENSION OF MORTAR LAYER

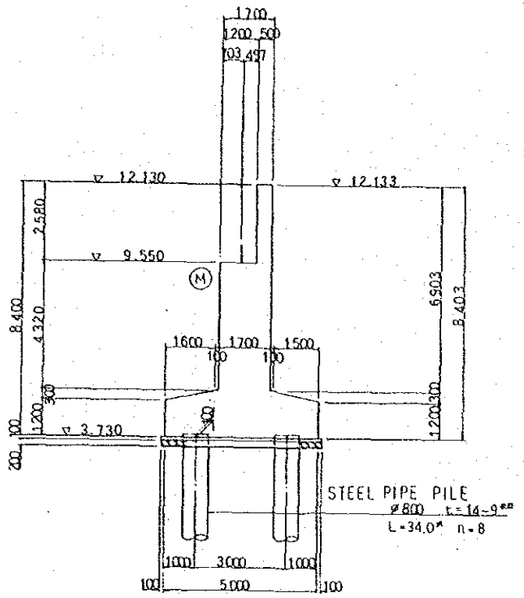
	G1	G2	G3	G4	G5
MORTAR t(mm)	35	41	42	43	41
E.L	9.070	9.145	9.220	9.145	9.070

PLAN

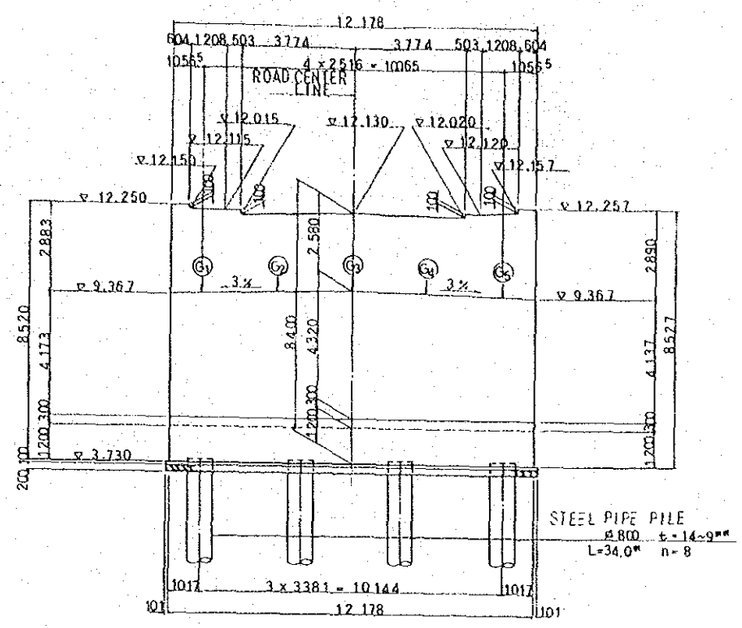


A2 ABUTMENT S=1:100

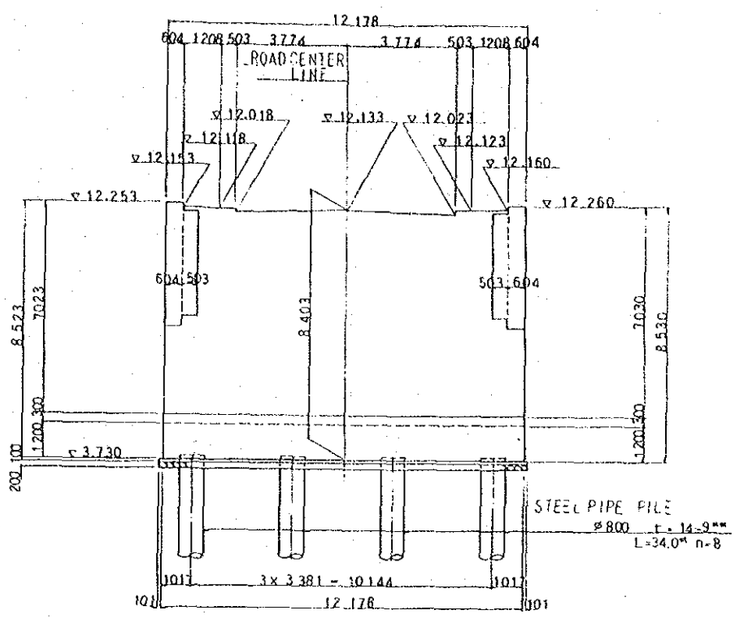
1 – 1



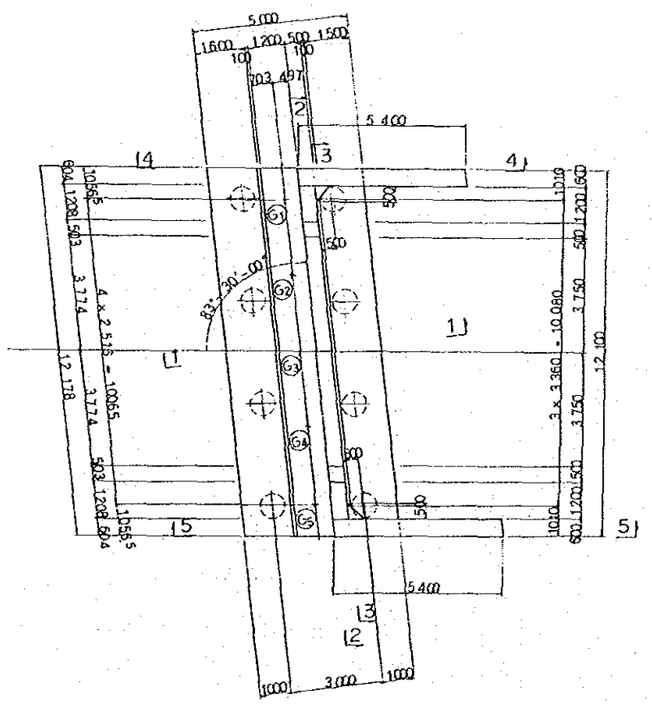
2 – 2 (FRONT ELEVATION)



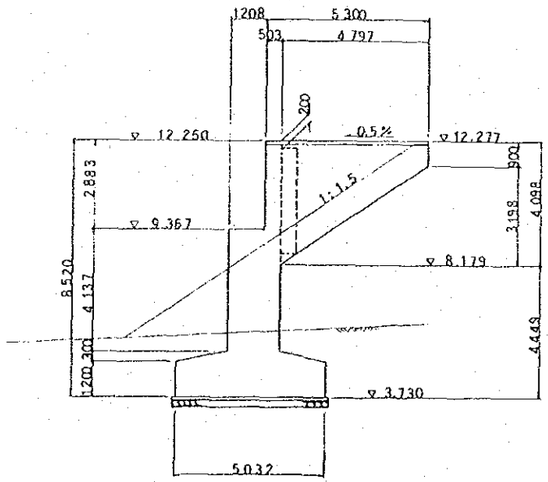
3 – 3 (BACK ELEVATION)



PLAN



4 – 4



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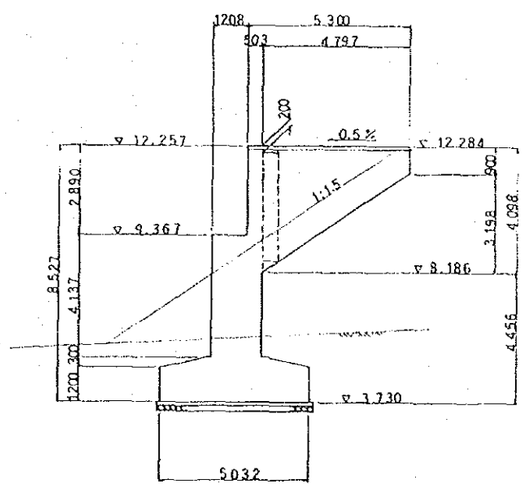
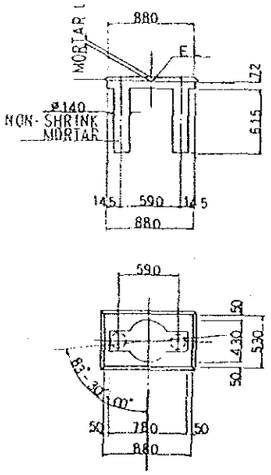
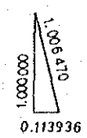


DETAIL OF MORTAR LAYER AND BOLT HOLES S=1:30



TRIGOMETRIC RATIO



DEMENSION OF MORTAR LAYER

	G1	G2	G3	G4	G5
MORTAR t (mm)	28	30	31	32	34
EL	9.400	9.475	9.550	9.475	9.400

5.4.3 Materials Quantity of Superstructure

(1) Steel weight

1) Girders

Main girder	247.8
Cross beam	25.7
Bracing	12.6
Lateral bracing	10.8
Shoe	8.7
Subtotal	305.6 tons

2) Accessories

Expansion Joint	5.0
Drainage	0.7
Handrail	6.8
Others	3.8
Subtotal	16.3 tons

3) Total weight 321.9 tons

(2) Pavement

Area of pavement	roadway	943 sq.m
	footway	302 sq.m

(3) Slab

Concrete volume	463 qu.m
Area of form	2097 sq.m
Reinforcement	131 tons

(4) Area of painting 5.430 sq.m

5.4.4 Materials Quantity of Substructure

(1) Concrete volumes		
	180 kg/sq.cm	721.0 qu.m
	160 kg/sq.cm	21.0 qu.m
(2) Forms		
	Ordinary	817.4 sq.m
	Circular	125.1 sq.m
(3) Cobblestone		42.0 qu.m
(4) Scaffold		1178.1 qu.m
(5) Staging		191.2 qu.m
(6) Reinforcement		45.6 tons
(7) Excavation		1622.0 qu.m
(8) Refilling		1158.0 qu.m
(9) Steel pipe (800dia.)		156.7 tons
(10) H-shape steel		31.3 tons
(11) Steel sheet pile (S.P.III)		84.0 tons

6. IMPLEMENTATION PLAN OF THE PROJECT

6. IMPLEMENTATION PLAN OF THE PROJECT

6.1 Organization for Implementation of the Project.

The Ministry of Transport, Works and Utilities shall be responsible for the implementation of this Project.

Preceding the implementation of the Project, the Government of Japan and the Government of Solomon Islands will sign an Exchange of Notes.

The detailed design and the supervision of the construction will be undertaken by a Japanese consultant and the construction work will be undertaken by a Japanese construction firm on contract with the Government of Solomon Islands. The contract of consultants and constructor will be verified by the Japanese Government prior to the commencement of the Project.

MTWU shall arrange matters in order to smoothly implement and complete the Project in cooperation with Economic Planning Agency, Ministry of Natural Resources, and other authorities of the Government of Solomon Islands.

6.2 Undertakings of Both Governments

The undertakings of the Government of Japan and the Government of Solomon Islands for the construction work of this Project are indicated below in TABLE 6.1.

TABLE 6.1 Major Undertakings

No.	Items	Japan	Solomon Islands
1.	To secure land		●
2.	To clear, level and reclaim the site when needed		●
3.	To construct gates and fences in and around the site		●
4.	To construct roads		
	1) Within the site	●	
	2) Outside the site		●
5.	To construct new Lungga Bridge and its approach road (at both ends)	●	
6.	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1) Electricity		
	a. The distributing line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
7.	To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the banking arrengement		
	1) Advising commission of authorization to pay		●
	2) Payment commission		●
8.	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	
9.	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contact such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		●
10.	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.		●
11.	To maintain and use properly and effectively the facilities constructed and equipment provided undre the Grant.		●
12.	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.		●
13.	Demolition and Removal of the pier of the existing bridge		●

6.3 Construction Plan

6.3.1 Construction Principles

The construction principles are as follows.

(a) In order to shorten the construction period, the work on both abutments shall be done during the rainy season, as both abutments are situated at a comparatively high elevation, and from the past records of the water flow, the water level during the rainy season will not reach the level of the abutments. During cyclone Namu in May 1986, the flood water did not reach to the level of the proposed abutments.

(b) The work on pier P1 situated in the running water shall be done in the dry season (from May to October) using a cofferdam constructed with steel sheet piles.
In this cofferdam, the construction of the footing shall be done under dry conditions which are obtained by pumping out the underground water.

(c) Concurrent with this work, the work on the approach roads shall be done. The roads shall be used also to carry the members of the superstructure into the site.

(d) The superstructure shall be erected by a crawler crane using the steel bent falsework. This work shall be done in the late dry season in order to install the bent in the running water using a temporary steel platform as necessary.

(e) The major construction equipment such as pile-hammer, crawler crane, backhoe and so on, shall be used efficiently to set up a reasonable construction period.

6.3.2 Items to be Considered in the Construction

The following items for construction should be considered.

(1) measurement of the rebounds of the driven steel piles

(2) damage to the pile head

(3) moving and inclination of the pile

(4) deficiency in reaching pile bearing capacity

(5) field joint of steel pile

(6) quality control of the ready mixed concrete

(7) safety of the timbering and scaffolding

(8) safety of the foundation of the bent and the staging

(9) special works in case of cyclone

6.3.3 Supervision Plan

(a) Supervision Plan

The following considerations are to be taken for the supervision plan.

1) Substructure work

A supervisor shall be dispatched to supervise the pile-driving for abutment A2 and pier P2.

2) Superstructure work

A supervisor will carry out the inspection of the pre-assembled fabricated elements at the plant prior to shipping. The same supervisor shall supervise the field erection.

3) Approach road

The supervisor, in charge of the substructure work will inspect concurrently two-thirds of the work of the approach roads and the supervisor of the superstructure will supervise the rest of the approach road work prior to supervision of the erection of the girders.

6.3.4 Procurement of Construction Equipment and Materials

Construction equipment and materials required for this Project and their transportation method are shown below in TABLE 6.1.

TABLE 6.1 Procurement Plan

NA:not available in Solomon Islands

Items	Solomon Islands	Japan	Transport Method	Remarks
1.Machinery(Major)				
1)crawler crane 35ton		○	ship	NA
2)diesel hammer		○	ship	NA
3)vibration hammer		○	ship	NA
4)backhoe		○	ship	NA
5)bulldozer	○			
6)dump truck	○			
7)loader	○			
8)generator	○			
9)welder	○			
2.Materials				
1)sheet pile		○	ship	NA
2)pipe pile		○	ship	NA
3)reinforcement		○	ship	NA
4)ready-mixed concrete	○			
5)sand	○			
6)gravel	○			
7)wooden form	○			
8)metal form		○	ship	NA
9)steel bent		○	ship	NA
10)steel staging		○	ship	NA
11)gascline	○			
12)diesel oil	○			

6.4 Implementation Schedule

The implementation schedule is divided into three phases: detail design, tender, and construction of water and land facilities.

6.4.1 Detail design

Tender documents will be formulated based on the basic design which consists of documents on detail design, technical specifications, structure design, budgetary schedule, etc. Discussion on the detail design shall be held closely with the concerned agency of the Government of Solomon Islands at the initial, intermediate and final stages, respectively. The final documents shall be used with the tender after verification by the Government of Solomon Islands.

6.4.2 Tender

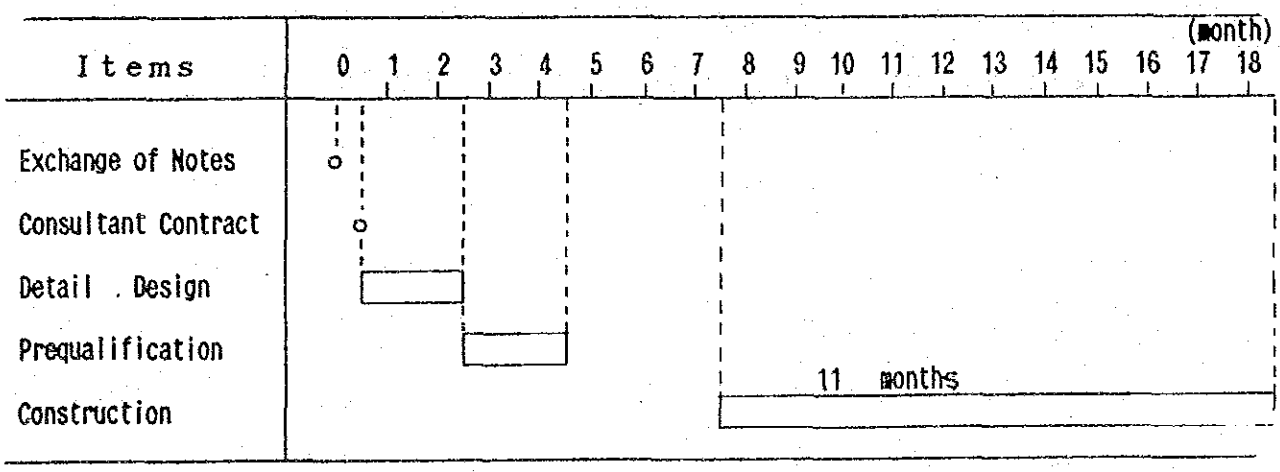
After the detail design work, the pre-qualification of tender participants will be conducted through the announcement of the tender in Japan. The executing agency shall invite participating firms for the tender based on the results of the prequalification and conduct tendering in the presence of witnesses. The lowest tenderer will be the successful bidder and will sign a contract for the construction with the Government of Solomon Islands, if the firm's tender is judged to be appropriate.

6.4.3 Construction work

The construction work will commence after the signing of the construction contract and its verification by the Government of Japan. The optimum construction schedule will be set up by examining the actual schedule, temporary work, procurement of materials and construction cost, etc., of each construction work item.

The implementation schedule is provided below in FIGURE 6.2.

FIGURE 6.2 Implementation Schedule



6.5 Portion of Project Cost by Government of Solomon Islands

The portion of the construction cost to be borne by the Government of Solomon Islands is estimated to be 900SIS.

7. MAINTENANCE PLAN

7. MAINTENANCE PLAN

7.1 Maintenance Organization

The ROADS, BRIDGES AND AIRFIELDS Division (RBA) of MTWU is responsible for maintenance of the existing Lungga Bridge. Consequently, RBA, will also be responsible for the maintenance of new the Lungga Bridge.

7.2 Maintenance Plan

The maintenance of any bridge follows the process of inspection. In the case of the Lungga Bridge, it is recommended that inspections be conducted periodically and wherever damage or defects are noticed. A thorough examination should be made and a report prepared detailing the actual problem(s). A thorough investigation should be conducted as necessary and recommendations for repairs should follow. The repairs should be made in a timely fashion as it is important to keep the function of the bridge.

The maintenance plan of the new Lungga Bridge consists of the following three inspections.

(1) monthly inspection
(2) periodic inspection
(3) special inspection

7.2.1 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 :

(1) roadway surface condition

stains of road surface, cracks of surface concrete

(2) handrail and curb

distortion or damage of handrail, cracks in concrete curb

(3) waterway obstruction

debris brought by flood waters should be cleared

(4) expansion joint

extraordinary sound or vibration when vehicle passes

(5) drainage

curb drains should be functioning properly to evacuate the water

(6) behind of abutment

settlement of the approach roadway

(7) lighting equipment

If electric poles and lights are installed, examine if they are operating properly

(8) others

illegally occupied portions, obstructions

7.2.2 Periodic Inspection

The periodic inspection shall be carried out each five years and shall cover the condition of the following elements.

(1) roadway surface

verify surface wear and cracks of surface concrete

(2) handrail and curb

damage or deformation

(3) slab concrete

observation of cracks in the concrete slab from underside of the bridge

(4) expansion joint

damage or deformation of the welded connections, joints, etc.

(5) shoe

observation of accumulation of sand or dust, corrosion of members, relaxation of anchor bolt, cracks in the concrete substructure under the shoes

(6) condition of steel members such as main girder, cross beam, bracing, lateral bracing

1) deformation, torsion

2) paint-changes, color deterioration , swelling stripping, rust

3) cracks

(7) field joint

loosening, relaxation or rust of high tensile bolt, welding cracks

(8) substructure

settlement, tilting, scour, river-bed shifting

7.2.3 Special Inspection

The special inspection shall be done when serious deformation or damages are noticed during monthly or periodic inspections. In addition to this, special inspections shall be made under the following cirumstances.

a) floods caused by cyclones or a heavy rainfalls

b) earthquakes

All items to be inspected are described in paragraph 7.2.2, and especially as described below.

(1) In case of flooding

Settlement or tilting(leaning) of piers and/or abutments by scour, river-bed shifting, etc.

(2) In case of earthquakes

Settlement or tilting of foundation due to earthquakes. The superstructure, especially the shoes and beam seats connected to the substructure should be thoroughly inspected.

7.2.4 Records of Inspections

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

All records of inspections shall be kept including reports of the inspections, observations and repairs made as a result of the inspections.

8. EVALUATION OF THE PROJECT

8. EVALUATION OF THE PROJECT

8.1 Project Benefits

According to the 1986 census, the population along the north Guadalcanal road and east of the Lungga Bridge is 79,500.

Major products in this district are agricultural including copra, and palm-oil. Forestry products are generated from the hinterland in the mountainous area.

Viewed from the standpoint ofroad transportaion, however, forest production is not affected directly, because the logs are cut in the hinterland and carried directly on mountain trails to the coast to be loaded on cargo-ships off the shore.

The socioeconomic benefits to be gained from the replacement of the Lungga Bridge are as follows.

(a) Direct benefits

- -Passenger time savings
- -Bridge maintenance cost savings (including the cost of improving the existing bridge)
- -Removel of restrictions on vehicle axle load

(b) Indirect benefits

- -Improvement of traffic safety
- -Increase of vehicle operating efficiency
- -Promotion of regional unity
- -Promotion of secondary industry reconstruction, such as mining and forestry

9. CONCLUSIONS AND RECOMMENDATIONS

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

The Lungga Bridge is located about 10 km east of Honiara, capital of the Solomon Islands, on the north Guadalcanal road which traverses the Guadalcanal Plains where most of the island's agricultural products are grown. This road ranks as the most important trunk road as there is no alternative one on Guadalcanal Island. The existing Lungga Bridge is a single-lane Bailey bridge.

There are two problems associated with the existing bridge:

9.1.1 The deterioration caused by long-term use. Although the bridge was opened for traffic under a limited load capacity of 15.0 tons, as indicated in paragraph 2.5.3(C), there is no technical means to increase the load carrying capacity.

9.1.2 It is a single-lane bridge. Due to increased traffic, traffic congestion has been occurring lately during the peak hours in the morning and evening at both ends of the bridge. The two problems can be resolved at the same time by the implementation of this Project.

Consequently, it is considered justifiable for the Government of Japan to implement the Project under Japanese grant aid.

9.2 Recommendations

In order to operate the maintenance smoothly and effuciently after the completion of the Project, it is recommended that the Government of Solomon Islands arrange to undertake the following:

9.2.1 Preserve the records of the inspections.

All matters noted and/or observed during the periodic or special inspections must be properly recorded and documented. All actions and countermeasures should likewise be recorded.

Experience has shown that unless records are properly kept and maintenance properly executed, more serious consequences may result.

9.2.2 Demolition and removal of the pier of the existing Lungga Bridge.

The river piers of the new and existing Lungga Bridge are not in a straight line or parallel to the river flow. Therefore, the heavy water flow during flood periods caused by a cyclone or by heavy rainfall, will become a problem and the pier of the existing bridge is likely to scour. The scour hole in the river-bed created by the scour at the downstream end of the piers of the existing bridge will contribute to the lowering of the river bed around the new piers. It is therefore expected that the piers of the existing bridge, at least the west side pier (river pier), be removed following the construction of the new bridge.

APPENDIX

APPENDIX

APPENDIX 1

1.1 Members of the Basic Design Study Team

(1) Basic design study

Name	Speciality(Present Department)
1) Kazunori YUKI	Team Leader (Deputy Chief,First Engineering Section, Engineering Division,Hanshin Expressway Public Corporation)
2) Takayuki NAKAYA	Grant Aid Cooperation (Grant Aid Division,Economic Cooperation Bureau,Ministry of Foreign Affairs)
3) Mikio HIGAI	Bridge Planner (Chodai Co.,Ltd.)
4) Katuyuki HIOKI	Bridge Designer (Chodai Co.,Ltd.)
5) Iwao CHIKARAISHI	Construction Planner (Chodai Co.,Ltd.)
6) Kazumi KAMIJO	Geotechnical Engineer (Chodai Co.,Ltd.)
7) Takahiro TSURUMI	Cost Estimator (Chodai Co.,Ltd.)

(2) Draft report explanation

Name	Speciality(Present Department)
1) Kazunori YUKI	Team Leader (Deputy Chief, First Engineering Section, Engineering Division, Hanshin Expressway Public Corporation)
2) Akira HARASHIMA	Grant Aid Cooperation (Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs)
3) Mikio HIGAI	Bridge Planner (Chodai Co., Ltd.)
4) Iwao CHIKARAISHI	Construction Planner (Chodai Co., Ltd.)

1.2 Survey Itinerary of the Study Team

(1) Basic design study

No.	Date	Activities
1.	June 25(Sun)	Lv.Tokyo
2.	26(Mon)	Ar.Honiara,courtesy call to Embassy of Japan
3.	27(Tue)	Courtesy call to Ministry of Fareign Affairs and Ministry of Transports, Works and Utilities. Explanation and Discussion of Inception report and Questionnaire
4.	28(Wed)	Discussion of Minutes. Site survey (the Lungga Bridge)
5.	29(Thu)	Signing of Minutes
6.	30(Fri)	Site survey(East of Honiara)
7.	July 1(Sat)	Site survey(West of Honiara)
8.	2(Sun)	Meeting of team members
9.	3(Mon)	Mr.Yuki and Mr.Nakaya lv. Honiara Meeting with MTWU
10.	4(Tue)	Collection of data (Natural Resouces)
11.	5(Wed)	do
12.	6(Thu)	Collection of data(MTWU) Mr.Hioki ar. Honiara
13.	7(Fri)	Holiday the 11 Independence Day
14.	8(Sat)	Analysis of data
15.	9(Sun)	Meeting of team members

No.	Date	Activities
16.	10(Mon)	Collection of data(Economic Planning Division)
17.	11(Tue)	Collection of data(Port Authorities)
18.	July 12(Wed)	Collection of data(Construction Firms)
19.	13(Thu)	do
20.	14(Fri)	Collection of data(Consultants)
21.	15(Sat)	Investigation of bridges(Honiara — Aola)
22.	16(Sun)	Meeting of team members
23.	17(Mon)	Analysis of data(MTWU)
24.	18(Tue)	do
25.	19(Wed)	do
26.	20(Thu)	do
27.	21(Fri)	do
28.	22(Sat)	Investigation of bridges(Honiara — Lambi)
29.	23(Sun)	Meeting of team members
30.	24(Mon)	Analysis of data
31.	25(Tue)	Conference with MTWU
32.	26(Wed)	Courtesy call to MTWU and Embassy of Japan
33.	27(Thu)	Lv.Honiara
24.	28(Fri)	Ar.Tokyo

(2) Draft report explanation

No	Date	Activities
1.	Sept.27(Wed)	Lv. Tokyo
2.	28(Thu)	Ar. Honiara
3.	29(Fri)	Courtesy call to Embassy of Japan, Ministry of Foreign Affairs,Ministry of Provincial Government,Ministry of Transport, Works and Utilities. Explanation of draft report
4.	30(Sat)	Meeting of team members
5.	Oct. 1(Sun)	Meeting of team members
6.	2(Mon)	Discussion of draft report Discussion of Minutes
7.	3(Tue)	Signing of Minutes
8.	4(Wed)	Lv. Honiara, Ar. Port Moresby
9.	5(Thu)	Courtesy call to Embassy of Japan, and JICA
10.	6(Fri)	Lv. Port Moresby, Ar. Sydney
11.	7(Sat)	Lv. Sydney, Ar. Tokyo

1.3 Name of Members Contacted

(1) Basic design study

Name	Position	Organization
1.Related Japanese Personnel in Solomon Islands		
MASASHI IKEO	AMBASSADOR	EMBASSY OF JAPAN
ZENICHI KINOSHITA	FIRST SECRETARY	DO
ICHIRO KOBAYASHI	SECOND SECRETARY	DO
2.Authorities Concerned in Solomon Islands		
MICHAEL MAENA	MINISTER	MTWU
DANIEL BUTO	PERMANENT SECRETARY	MTWU
C.I.MACKAY	UNDER SECRETARY	MTWU
A.M.MILLERSHIP	CHIEF CIVIL ENGINEER	MTWU
MARTIN WATTS	CHIEF CIVIL ENGINEER	MTWU
KEN MUNRO B.Sc.	SENIOR CIVIL ENGINEER	MTWU
D.R.MAKINI	SENIOR CIVIL ENGINEER	MTWU
S.FANEGA	UNDER SECRETARY	MFP (MINISTRY OF FINANCE&ECONOMIC PLANNING)
J.FUGUI	POLICY EVALUATOR	PRIME MINISTER OFFICE
DERRICI DEPLEDGE	WATER RESOURCES ADVISOR	MINISTRY OF NATURAL RESOURCES
TIM BISMIRE	CHIEF ENGINEER	SOLOMON ISLANDS PORTS AUTHORITY
3.Private Firms and Consultants in Honiara		
COLIN BROEKES	MANAGER	FLETCHER KWAIMANI J.V.
HENK SIJNJA	MANAGER/ENGINEER	EARTH MOVERS SOLOMONS LTD
ALAN PILSWORTH	MANAGER	SHORNCLIFFE(S.I)LTD
ALAN BOSO	MANAGER	CONCRETE INDUSTRIES LTD (A SUBSIDIARY OF SIIL)
LAWRENCE HOWELL	ENGINEER/MANAGER	MURRAY-NORTH(S.I)LTD
WOJTEK ZBOROWSKI	MANAGER	CAMERON McNAMARA
DARRYL B. SHELLEY	MANAGING DIRECTOR	SULLIVANS(S.I)LTD
NICK ROGERERS	ENGINEER/MANAGER	TONKIN & TAYLOR LTD
DAVID McCOMISH	ENGINEER	DO
LIAN ARUNDEL	ENGINEER	DO

(2)Draft report explanation

Name	Position	Organization
1.Related Japanese Personnel in Solomon Islands		
MASASHI IKENO	Ambassador	Embassy of Japan
2.Authorities Concerned in Solomon Islands		
MICHAEL MAENA	MINISTER	MTWU
C.I. MACKAY	UNDER SECRETARY	MTWU
MILNOR TOZAKA	PERMANENT SECRETARY	F.A
M.B.SIBISOPERE	PERMANENT SECRETARY	MINISTRY OF PROVINCIAL GOVERNMENT
S.FANEGA	UNDER SECRETARY	MFP
J.FUGUI	POLICY EVALUATOR	PRIME MINISTER OFFICE

1.4 Minutes of Discussions

(1) Basic design study

THE MINUTES OF DISUCUSSIONS ON THE BASIC DESIGN STUDY ON THE PROJECT FOR RECONSTRUCTING THE LUNGGA BRIDGE IN SOLOMON ISLANDS

In response to the request of the Government of Solomon Islands, the Government of Japan decided to conduct a basic design study on the Project for Reconstructing the Lungga Bridge (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA"). JICA sent the basic design study team headed by Mr. Kazunori Yuki, Deputy Chief, First Engineering Section, Engineering Division, Hanshin Expressway Public Corporation, to carry out the study from June 26th to July 27th, 1989.

The Japanese team had an initial series of discussions during the first week of the study on the Project with the officials concerned of Solomon Islands, and conducted a preliminary field survey at the Project site.

As a result of the preliminary discussion, both parties agreed to recommend to their respective Government authorities that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

June 29th 1989

Mr. KAZUNORI YUKI
Leader,
The Basic Design Study Team,
JICA

Mr. DANIEL BUTO M.B.E.
Permanent Secretary,
Ministry of Transport,
Works and Utilities

ATTACHMENT

1. Objective of the Project

The objective of the Project is to reconstruct the Lungga Bridge close to the existing bridge in order to improve the safety and to meet the increased traffic.

2. Implementing Body

"Ministry of Transport, Works and Utilities" is responsible for the implementation of the Project.

3. Construction site of the Project

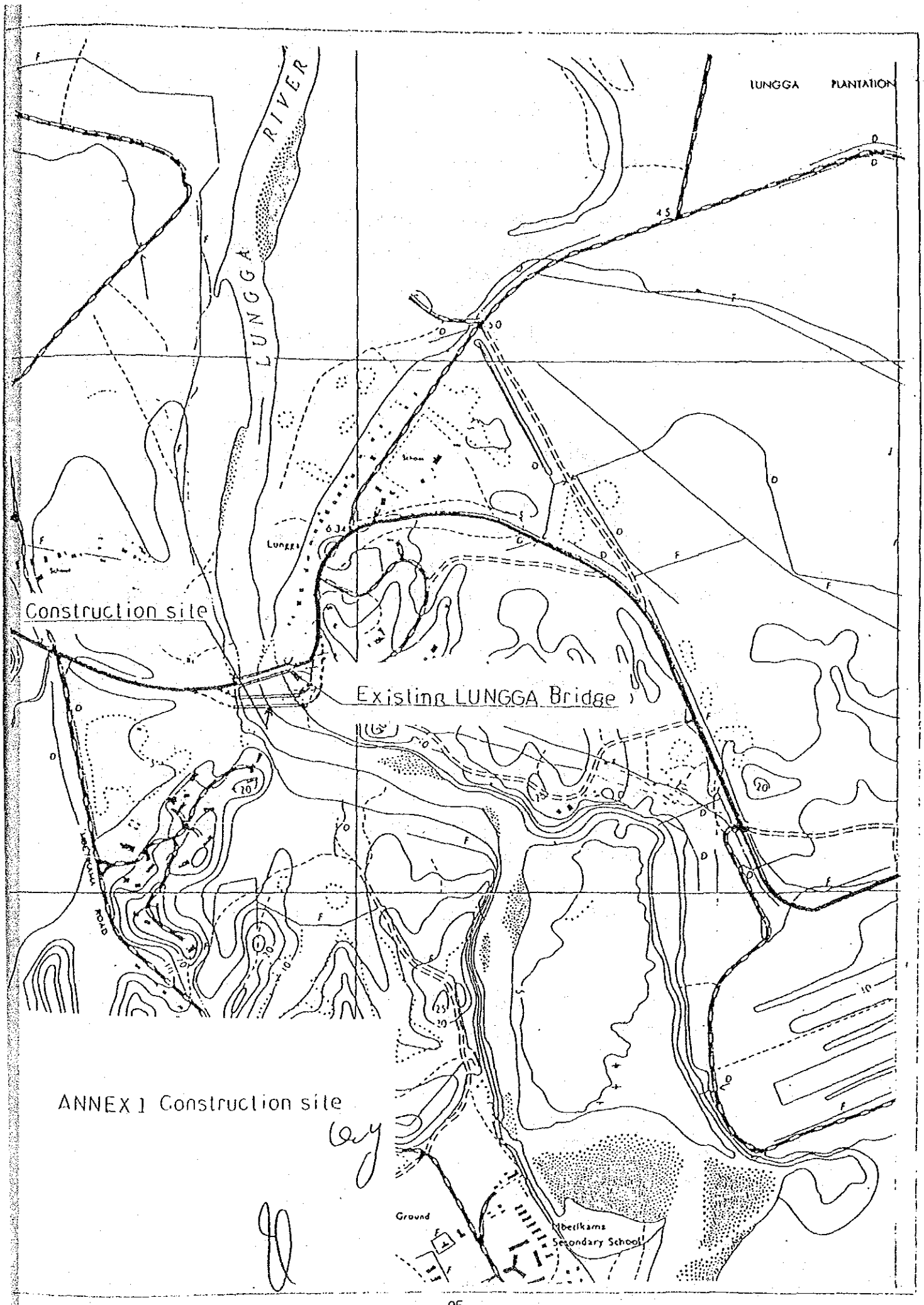
The construction site of the Project is upstream side of the existing Lungga Bridge as shown in Annex I.

4. Outline of the Project is as follows:

(1) New Lungga Bridge
Carriage way; two lanes with pedestrian way
(2) Approach road ;connencting the new Lungga Bridge with existing road

5. The Government of Solomon Islands will take the necessary measures listed in Annex II on condition that the Grant Aid by the Government of Japan is extended to the Project.

6. Both sides confirmed that Japanese study team explained the Japanese Grant Aid Program and Solomon side understood it.



ANNEX 1 Construction site

ANNEX II

Necessary measures to be taken by the Government of Solomon Islands:

1. To secure the land necessary for the execution of the Project and provide enough space for such construction as temporary offices, working area, stockyard and others.

2. To ensure that the river area necessary for the construction of the facilities be freely accessible.

3. To provide necessary facilities for the execution of the Project such as electricity, water supply, telephone and other incidental facilities to the Project site.

4. To ensure prompt unloading, tax exemption, customs clearance at ports of disembarkation in Solomon Islands and prompt internal transportation therein of the products purchased under the Grant.

5. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Solomon Islands with respect to the supply of the products and services under the verified contract.

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

7. To maintain and use properly and effectively the facilities provided under the Grant.

8. To remove all existing buildings inside the Project site and clean the site prior to the commencement of the Project.

(2) Draft report explanation

THE MINUTES OF DISCUSSIONS ON THE BASIC DESIGN STUDY ON THE PROJECT FOR RECONSTRUCTING THE LUNGGA BRIDGE IN SOLOMON ISLANDS

In response to the request of the Government of Solomon Islands, the Government of Japan decided to conduct a basic design study on the Project for Reconstructing the Lungga Bridge (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA"). JICA sent the basic design study team headed by Mr. Kazunori Yuki, Deputy Chief, First Engineering Section, Engineering Division, Hanshin Expressway Public Corporation, to carry out the study from June 26th to July 27th, 1989.

As a result of the study, JICA prepared a draft report and dispatched a team headed by Mr. Kazunori Yuki to explain and discuss it from September 28th to October 4th, 1989.

Both parties had a series of discussions on the report and agreed to recommend to their respective Governments that the major points of understandings reached between them on October 3rd, 1989, attached herewith, should be examined towards the realization of the Project.

October 3rd, 1989

Mr. KAZUNORI YUKI
Leader
The Basic Design Study Team
JICA

Mr. COINNEACH I. MACKAY
Under Secretary
for Permanent Secretary
Ministry of Transport,
Works and Utilities

ATTACHMENT

1. The Government of Solomon Islands agreed in principle to the basic design proposed in the Draft Final Report.

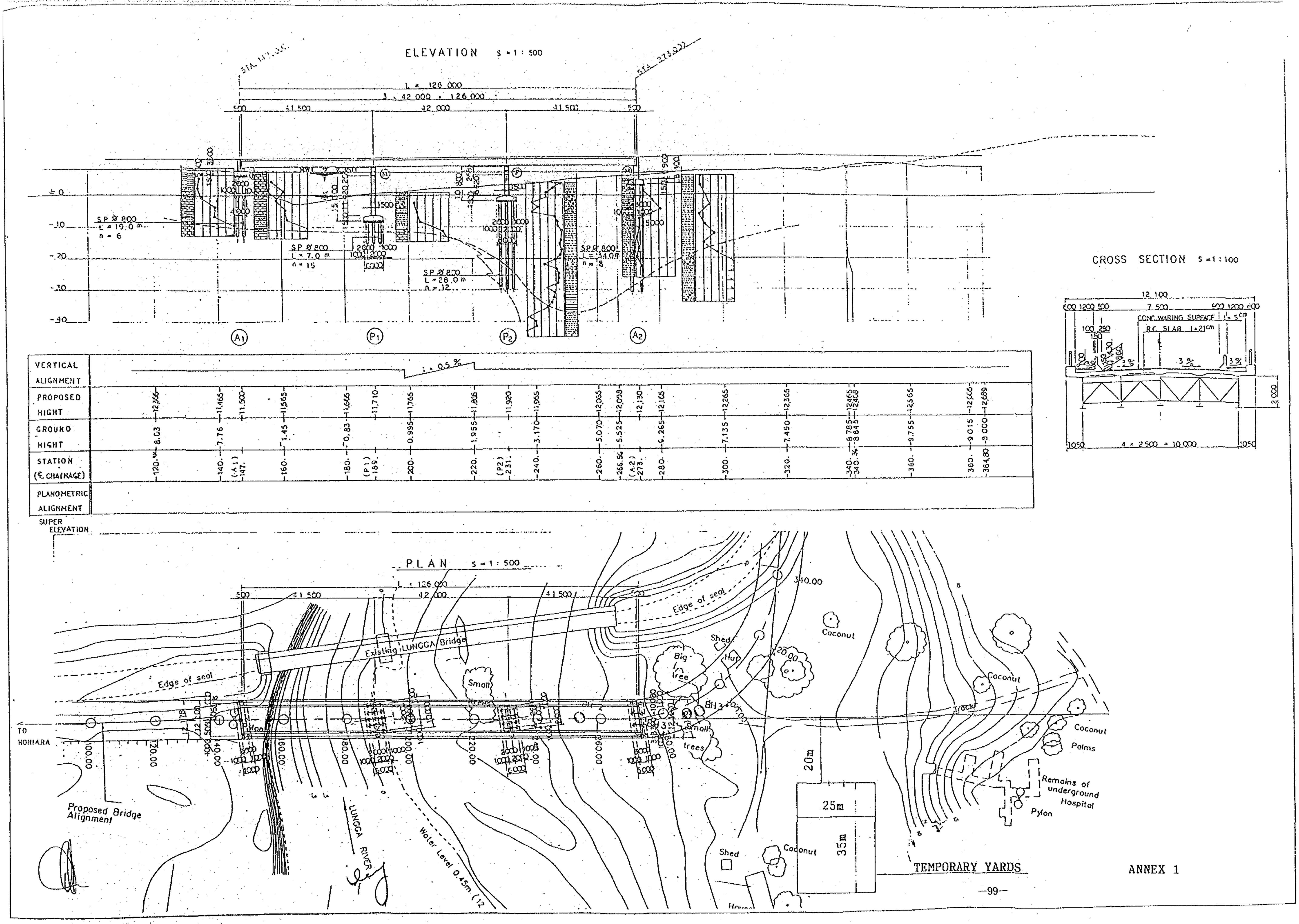
2. The Government of Solomon Islands has reconfirmed the Minutes of Discussion signed on June 29th, 1989.

3. The Government of Solomon Islands assured the provision of the necessary budget for the adequate works such as site clearance, replacement of pylon, etc., for the project execution and the personnel services, maintenance and operation expenses for the new bridge.

4. The Government of Solomon Islands has agreed to be responsible for the provision of site for temporary yards already levelled as shown in Annex 1 and Annex 2.

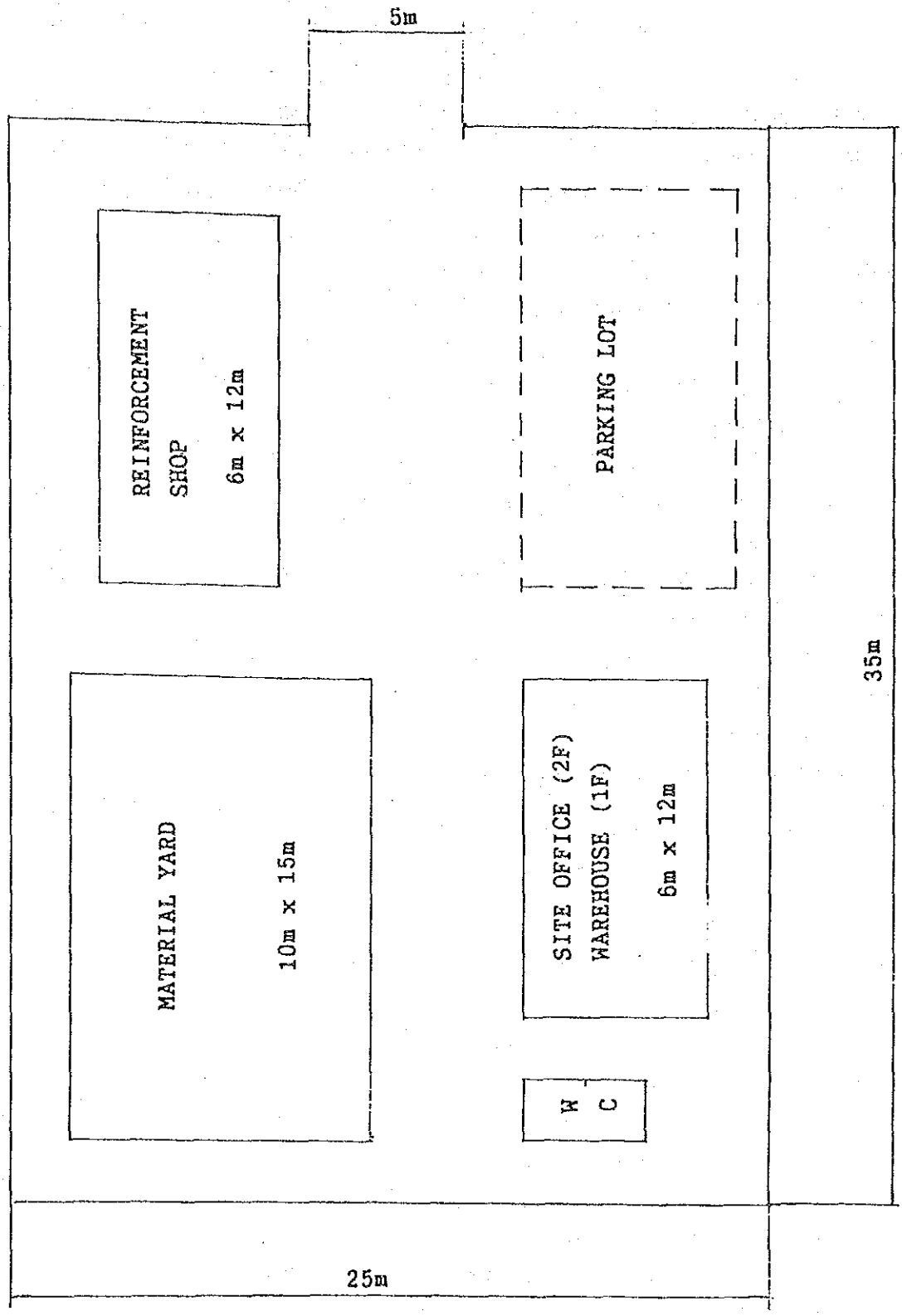
5. The Government of Solomon Islands has agreed to obtain the right-of-way for the Project and report the situation to the Embassy of Japan by the end of March, 1990.

6. The Final Report (10 copies in English) will be submitted to the Government of Solomon Islands in November 1989.



ELEVATION S = 1 : 500
L = 126 000
3 x 42 000 = 126 000
500
41 500
42 000
41 500
500
SP Ø 800
L = 19.0 m
n = 6
SP Ø 800
L = 7.0 m
n = 15
SP Ø 800
L = 28.0 m
n = 12
SP Ø 800
L = 34.0 m
n = 8
± 0
- 10
- 20
- 30
- 40
A1
P1
P2
A2
VERTICAL ALIGNMENT
i = 0.5 %
PROPOSED HIGHT
GROUND HIGHT
STATION (℄ CHAINAGE)
PLANOMETRIC ALIGNMENT
SUPER ELEVATION
CROSS SECTION S = 1 : 100
12 100
600 1200 500
7 500
500 1200 600
CONC. WARING SURFACE
R.C. SLAB
3 %
2 000
1050
4 x 2 500 = 10 000
1050
PLAN S = 1 : 500
L = 126 000
Existing LUNGGA Bridge
Edge of seal
TO HONIARA
Proposed Bridge Alignment
LUNGGA RIVER
Water Level 0.45m
Small
Big Tree
Shed
Hut
Small trees
BH3
Coconut
Track
Palms
Remains of underground Hospital
Pylon
House
20m
25m
35m
TEMPORARY YARDS

ANNEX 1



ANNEX 2 TEMPORARY YARDS