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Pole Buildings in Papua New Guinea

by: Peter Lattey

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Papua New Guinea

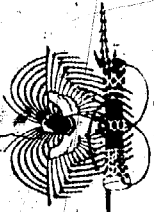
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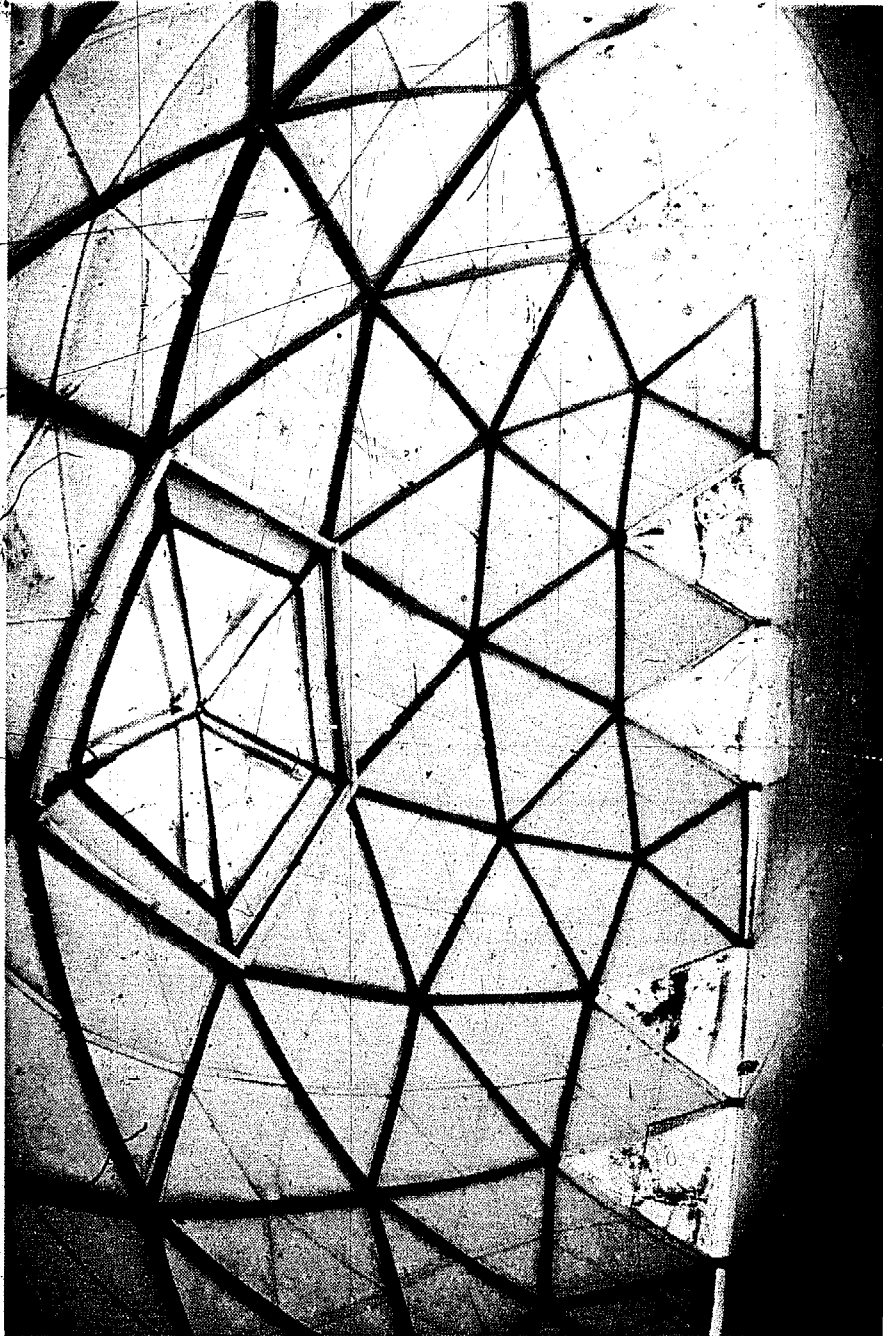
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PAPUA NEW GUINEA
DEPARTMENT OF FORESTS

POLE BUILDINGS IN PAPUA NEW GUINEA

A Review Of Work By Peter Lattey Of F.P.R.C.



PREFACE

For the past 18 months, the F.P.R.C. has had a C.U.S.O. volunteer on their staff who has been working in the field of building research. This booklet is a review of the work done by him in that time. It's purpose is to inform the general public of some of the possibilities that exist in the use of local building materials. It is hoped that this type of work will continue to be carried on. It is also hoped that this booklet will assist those who do carry it on.

ROUND POLE BUILDINGS IN PAPUA NEW GUINEA

Forest Products Research Centre,
Box 1358, BOROKE,
P.N.G.

Peter Lättey

CONTENTS

INTRODUCTION	1
BUILDING DESIGNS	
Round House Shelter	7
Playground Equipment	9
Bus Shelters	11
Market Pavilions	13
Yore House	15
Semina House	17
Octa House	19
Community Centre	21
Geodesic Dome Cultural Centre	23
Forestry Pavilion	25
Rural Aid Post and Health Centre	26
College Recreation Centre	28
BUILDING DETAILS	
Pole Joints	31
Wall Sections	32
OTHER WORK	
Round Pole Scissors Truss	38
Hessian Cement Roof	40
Rural Wood Preservation Manual	43

INTRODUCTION

The use of round timber poles as a building material dates back to the earliest settlement of Papua New Guinea many thousands of years ago. Today, poles remain one of the most widely used building materials. The majority of Papua New Guineans live in villages and, in virtually every village, poles are still one of the most important elements in house construction. These traditional house styles are generally beautifully suited to the local economy, cultural milieu, climate and aesthetics. Naturally enough, they use locally available materials and craftsmanship. In short, they follow closely the architectural axiom, *Form follows function*.

The arrival of western culture over the past century has naturally had an influence on the building techniques and methods of P.N.G. In too many cases this has meant the introduction of a building type that ignores the local situation; it frequently uses solely imported material, imported craftsmanship and imported aesthetics.

At the Forest Products Research Centre we have been trying to develop building techniques using locally produced material with local craftsmanship to produce a better building that is more in keeping with the present-day realities of P.N.G.

We feel that the country should use, as a basis for its further development, its existing skills, culture and technology. Wherever possible, new imported technologies or ideas should be grafted onto existing institutions rather than imposed with little or no relationship to what already exists. This grafting can result in far greater results for less effort.

An example of this might be in a traditional coastal village, where it is decided to improve the livelihood by introducing cattle ranching. With great

effort the project just might succeed, but trying to make cowboys out of sailors would be a difficult job. On the other hand, if improved fishing techniques and equipment were introduced the people could make use of their already extensive knowledge of the sea and fishing. The project would have a greater chance of success with less effort required. This is the type of approach we are trying.

By using preservative treatment we make it possible for the traditional pole buildings to resist rot and insect borers for a much longer time. Instead of lasting only one to eight years, a post in the ground will last 20 years and out of the ground it will last indefinitely. By using improved fastenings we make it possible to use fewer poles and still produce as strong a building.

Thus, by using what is basically the traditional material and the traditional skills, but with a couple of modifications, it is possible to build a more permanent building. This allows the owner to devote less of his time and money to merely keeping a roof over his head and more to his other activities. The direct benefits to the individual of this are obvious, but it also has benefits to P.N.G. as a whole, as it increases the Gross National Product and reduces the amount of imports.

Although in P.N.G. the rush of people from the villages to the urban areas has been slower than in many other countries, it is certainly occurring. Also many of the newly arrived urban dwellers are extremely poor. This combination of urban drift and urban poverty produces the squatter settlements, built of scrap material and scattered around our towns. These settlements demonstrate that the conventional methods of providing urban housing are not good enough. They demonstrate the need for some

new types of urban housing.

In order to be successful this housing must:

1. Have low material cost.
2. Be designed to be erected by the owner/occupier over a period of months but be habitable almost from the very start.
3. Be healthy to live in.
4. Satisfy the important consideration of individual aesthetic preferences and status.

With urbanization and development occurring in P.N.G. there is a need for many new types of buildings; buildings for which no precedent in the Papua New Guineans' tradition exists. Buildings such as market halls, first aid posts, workshops, community centres and Council Chambers are needed. But the tendency has been for these new building types to follow the European pattern. This must be shown to be unnecessary. If a design conforms to local conditions and uses locally produced material, it can be erected at a lower cost and function as well or better. It can also be at least as attractive as one built on the Australian or any other foreign pattern.

Probably one of the most difficult aspects of the problem is prejudice. There is a strong prejudice among both expatriates and Papua New Guineans against the use of 'bush materials'. This is especially true of status buildings such as houses, churches and council chambers where a 'European' building is demanded to satisfy status requirements. However, it also extends to utilitarian buildings such as implement sheds, workshops and warehouses.

It needs to be pointed out again and again that although the locally produced materials (such as

poles or sawn timber) are sometimes considered inferior to imported materials (such as fibro or steel), this is solely a P.N.G. preference. In many nations of the world, notably New Zealand and the Scandinavian countries, the use of poles or sawn timber is considered the preferred way to erect a building.

Our Efforts Towards Solutions.

Although we are not likely to solve the entire housing and building problems in P.N.G., we feel that we have made some effort in that direction. Our activities have been in two areas:

1. Working with the staff of the various building authorities of P.N.G. to make them more aware of the possibilities of using poles. This has resulted in both the Housing Commission and Public Works Dept. giving poles a try out in various applications. The Housing Commission is using them as house stumps and Public Works is using them as a complete house frame.
2. The other area of our activities has been our design programme. We provide a free design service for government bodies and the general public.

In this programme we follow what is a normal client-architect relationship. The procedure is generally as follows:

- (a) A client contacts us either to purchase treated poles or with a request to have a building designed for him.
- (b) After discussing his needs, finances available, site conditions etc., we design a building for him.
- (c) We sell him the poles and where

necessary, provide construction advice.

(d) After the building is finished and in use, we study it. Then with the results of this study and with what we have learnt during construction we can modify and improve the design.

(e) The design then becomes available to future clients and the general public who wish to construct similar buildings.

This method has proven very useful. It means that the buildings we design are not just theoretical exercises but fulfil a real need. The financial and site constraints are also very real and usually provide an example of the type of conditions prevalent in the community.

This method also gives us an opportunity to erect and evaluate a range of building types and a range of building techniques at very little cost to ourselves while providing a worthwhile service to the community. Further, it provides buildings scattered throughout the community for the general public to view. This helps with the vital problem of demonstrating the usefulness of pole buildings.

In the past 18 months we have built eighteen different building types and at present have another ten in various stages of planning/design, and erection. Three of the completed building types have proven doubly successful in that other members of the community have seen them and built the same building in other locations.

We certainly are not convinced that poles are the ultimate solution to the building problems of P.N.G. or probably anywhere else. Similarly, steel, concrete or rammed earth bricks do not represent the ultimate solution to a nations' building problems. Each material has its advantages and its disadvantages and each has its place and application in whatever

building programmes are proposed.

Poles have the basic advantages of being locally produced and readily available at virtually no capital cost, but they also have obvious disadvantages. The ideal solution is not a nation living and working in buildings of a uniform design and building material, but a nation using different designs and materials to fit the particular requirements of a particular situation.

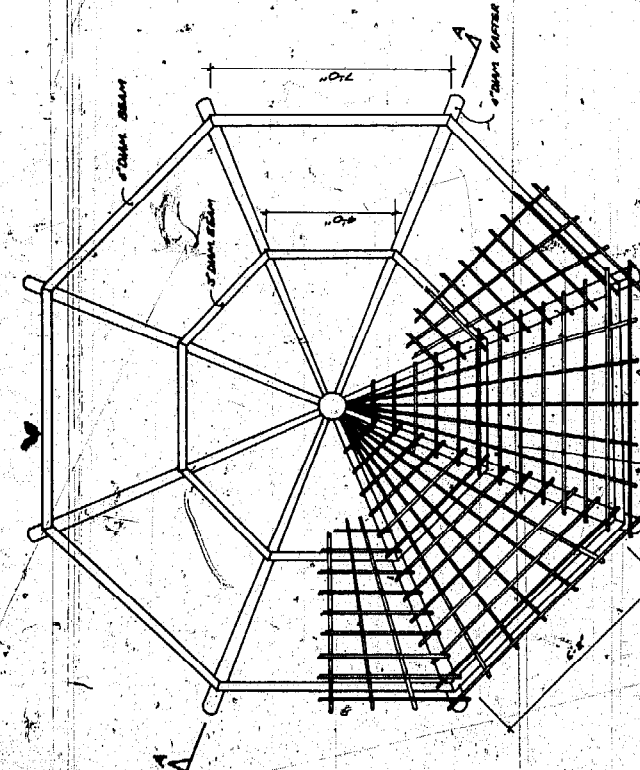
The purpose of this publication is twofold.

It is to make people more aware of the types of buildings possible using permanent bush materials. We hope that this will encourage them to use poles themselves.

It is also to tell the people about the building design advice available from F.P.R.C. All of the plans in this booklet are available from us for K1 per copy. The building design service is available free of cost.

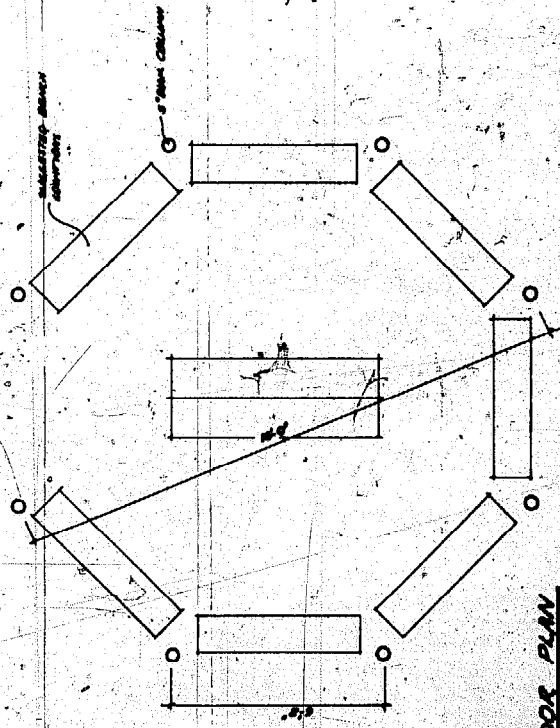
BUILDING DESIGNS

These building designs do not include all that have been done by F.P.R.C. However they are a representative sample. Please note that the costs, where given are for June, 1974.

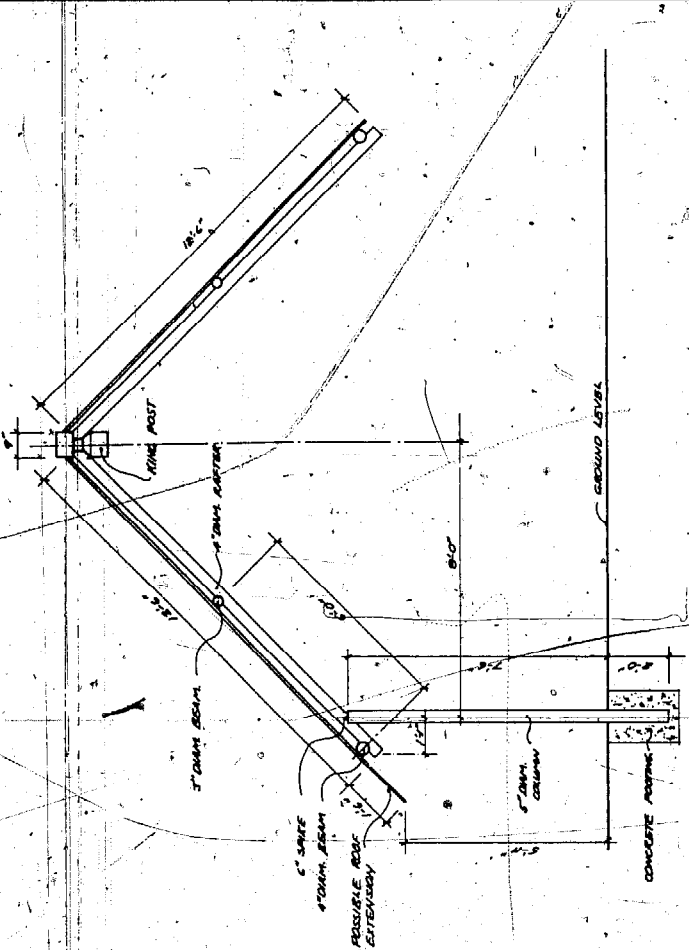


ROOF PLAN

SELF BRACING SYSTEM OF
SHEATHING LATHING IS
APPLIED AT CENTERS
IN BRACING SYSTEM. ROOF IS
GIRD AND INTERNAL LATHING
TOP OF PERIMETRAL LATHING



FLOOR PLAN



SECTION A-A

MATERIAL LIST		QTY	UNIT	REMARKS
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F.P.R.C.
HONOLA, FAHIA NEW GUNNER
ROUND HOUSE SHELTER

DESIGNED BY: [illegible]
CHECKED BY: [illegible]
DATE: [illegible]
SCALE: [illegible]
SHEET NO.: [illegible]
TOTAL SHEETS: [illegible]

This was one of the first designs to come out of the project. The need was to provide a simple, inexpensive shelter, that was adaptable for a variety of uses.

It is not a radical departure from existing building styles and methods, nor was it meant to be. It was meant to be a building that was built in traditional style with traditional material but with improved techniques. At this, it was a success.

It was also meant to demonstrate to the public how easy this type of building improvement could be.

So far this design has been used for bus shelters, market halls, garden shelters and spectator shelters at a football field.

It probably has other uses as well that we do not know about. It has been one of the most successful designs.

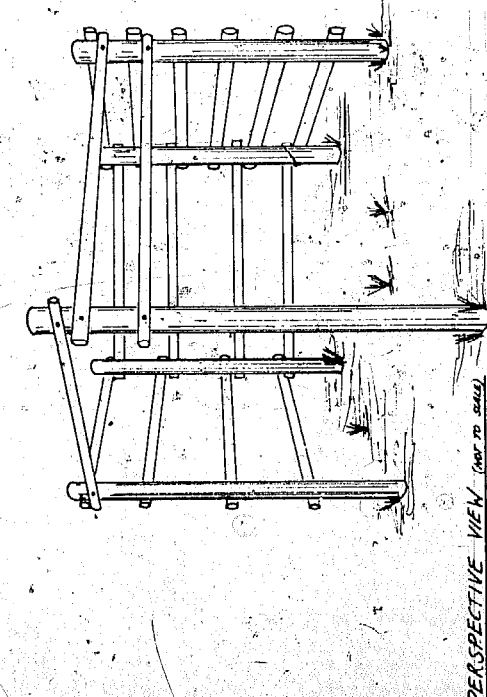
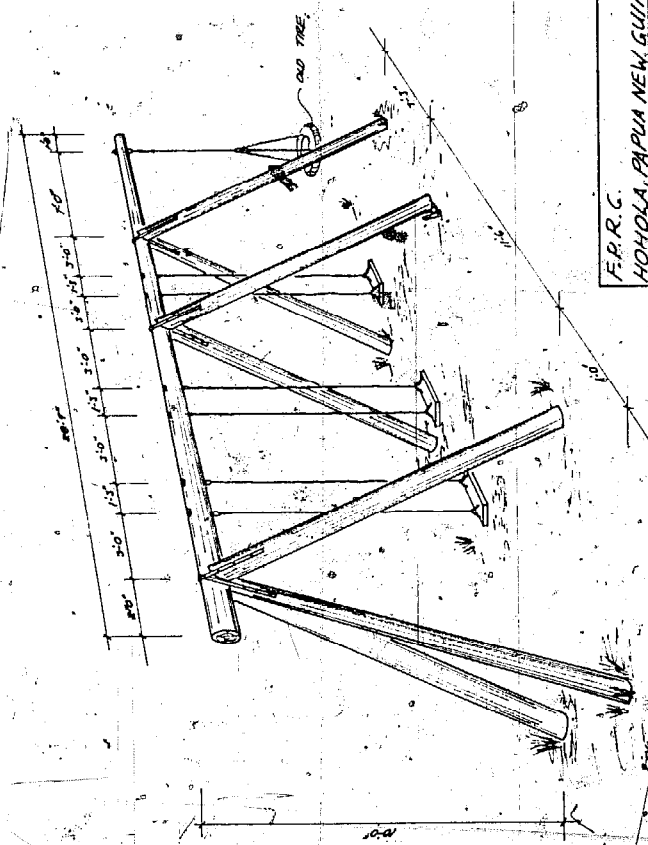
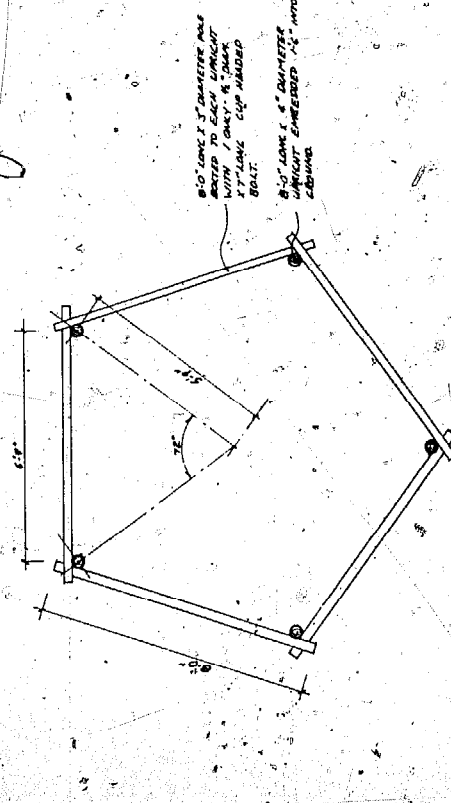


ROUND HOUSE SHELTERS

Cost - Material	\$ 70	Area	18.7m ² (201 ft. ²)
Labour	\$140		
Total	\$210		

NOTES

- ① POLES ARE 2" DIA. MINIMUM OR HULLA OR LOAD OF EQUIPMENT SWAGGERS
- ② POLES ARE INTERSPACED 2'-0" INTO THE GROUND
- ③ JOINTS OF POLES ARE 1/2" 1/4" NEW BAND ATTACHED TO POLES BY LAM SCREWS.
- ④ SWINGS ARE 12" X 12" HUNG BY LIGHT IRON FROM EYE BOLTS ROATED THROUGH POLES
- ⑤ SWINGS ARE HUNG 1/2" ABOVE GROUND



MATERIAL LIST

QUANTITY	DESCRIPTION	SIZE	NOTE
5	POLES	2" DIA.	MINIMUM
1	SWING SET	12" X 12"	HUNG BY LIGHT IRON

F.P.R.C.
HOHOLA, PAPUA NEW GUINEA
PLAYGROUND FURNITURE
PENTAGON CLIMBING FRAME
SWING SET

DESIGNER	DATE	SCALE	PROJECT NO.
PLATTY	10/1/50	A1	71-50
APPROVED BY			

PENTAGON CLIMBING FRAME

We have had frequent requests from pre-schools, service groups and private individuals for different pieces of equipment. In response to these requests, we now have a range of designs for see saws, swings, slides, crawling tunnels and climbing frames.

Some, such as these shown in the photograph were designed by others, some we designed.

All of the equipment is simple, sturdy and inexpensive. All is suitable for the abuse that children can give such equipment.



PLAYGROUND EQUIPMENT

MATERIALS LIST

- POLES
 2 NO. 120" x 4" COLUMNS
 2 NO. 120" x 4" PULLING
 2 NO. 70" x 2" SUPPRT.
 2 NO. 510" x 4" SUPPRT.
 1 NO. 120" x 4" x 2"
 2 NO. 60" x 4" x 2"
 2 NO. 60" x 4" x 2"
 2 NO. 120" x 2" x 2" CAL. CAL. FROM
 1 NO. 2" x 4" x 6" COP HEADED BOLTS
 2 NO. 1/2" DIA. x 1" QUANTITY OF NAILS AND CONCRETE

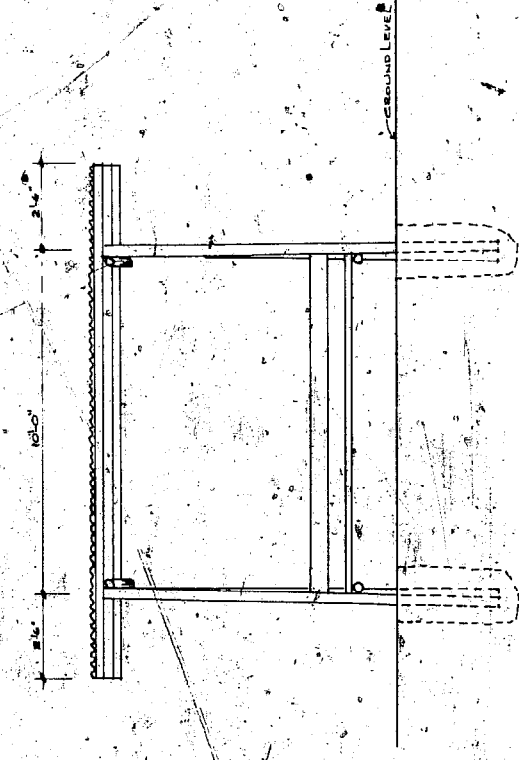
NOTES FOR BOTH SHELTERS
 DIMENSIONS ARE EXTENSIBLE IN UNITS OF 10.0
 ALL TIMBER AND POLES MUST BE PRESERVE
 TREATED WITH PRESERVATIVES
 ALL JOINTS ARE BOLTED WITH 1/2" COP HEADED BOLTS

MATERIALS LIST

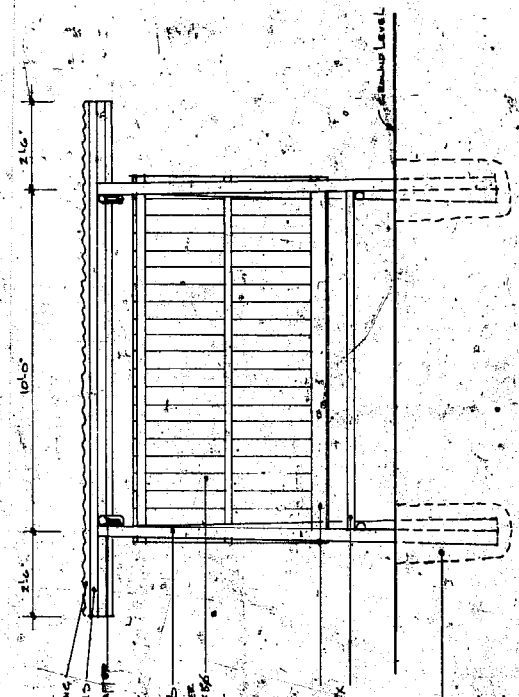
- POLES
 4 NO. 120" x 4" COLUMNS
 2 NO. 120" x 4" PULLING
 2 NO. 70" x 2" SUPPRT.
 3 NO. 100" x 3" SUPPRT.
 1 NO. 120" x 4" x 2"
 2 NO. 60" x 4" x 2"
 70 LFT. 2" x 4" x 6" TYPICAL WEATH. PL.
 10 NO. 1/2" DIA. x 6" COP HEADED BOLTS
 22 NO. 1/2" DIA. x 7" " " " " " "
 18 NO. 1/2" DIA. x 6" " " " " " " " " " "
 2 NO. 1/2" DIA. x 2" " " " " " " " " " "
 QUANTITY OF NAILS AND CONCRETE

F.P.R.C. BOX # 1358
 BOROKO P.M.G.
 BUS SHELTERS

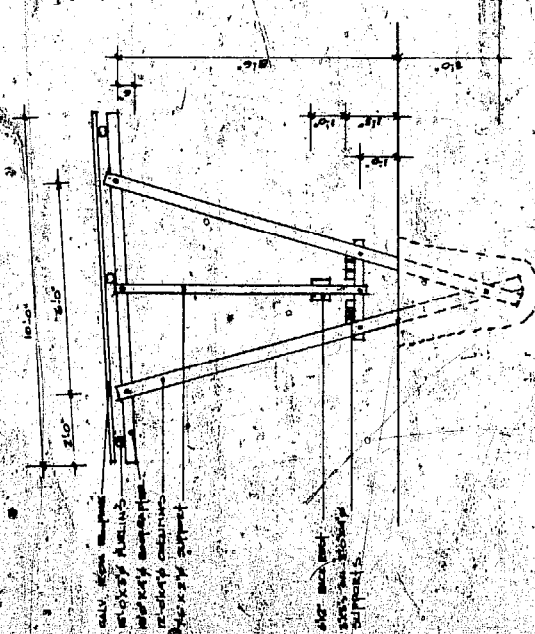
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PROJECT: [signature]	NO. [signature]



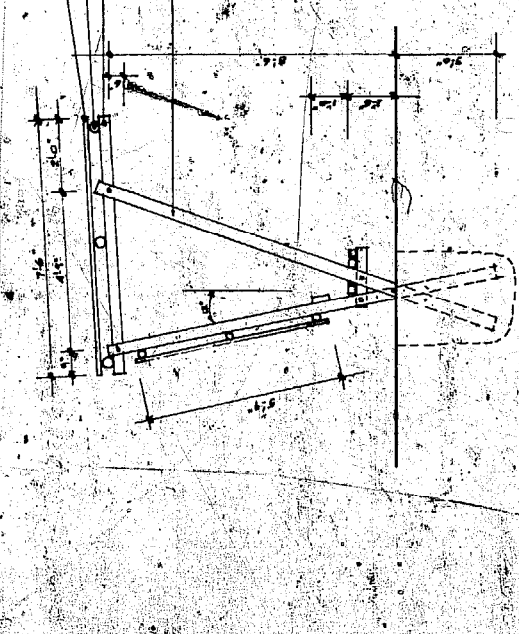
FRONT ELEVATION



FRONT ELEVATION



END ELEVATION



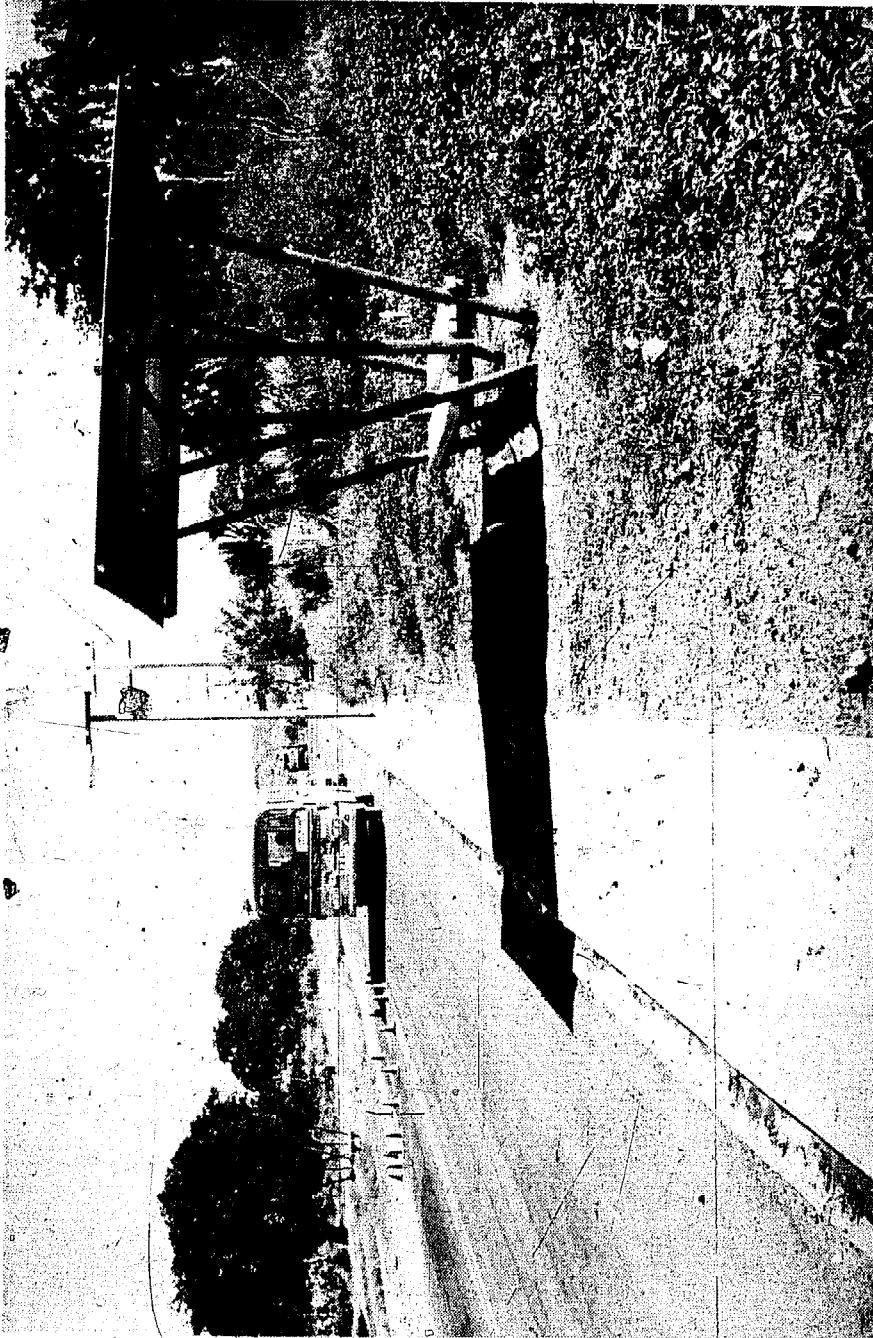
END ELEVATION

DOUBLE SEAT

SINGLE SEAT

Port Morésby City Council has, until recently, provided bus shelters made entirely from imported iron pipe. The cost of the structure was not important as the iron pipe shelters were already quite inexpensive. However the city engineer felt that an improvement could be made both aesthetically and from an import substitution viewpoint.

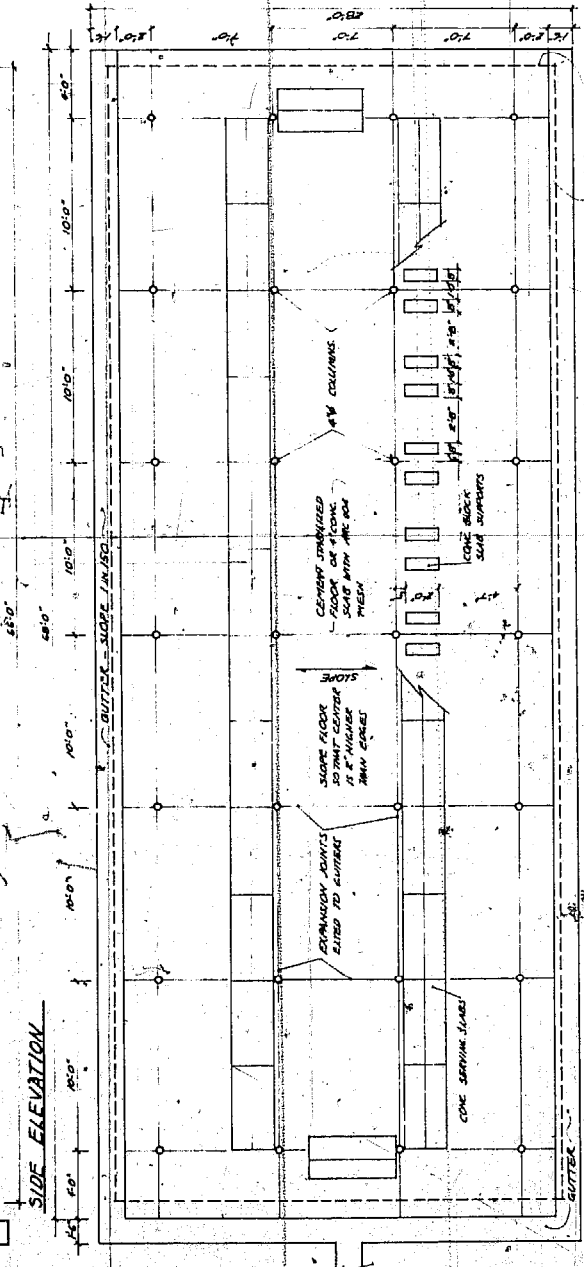
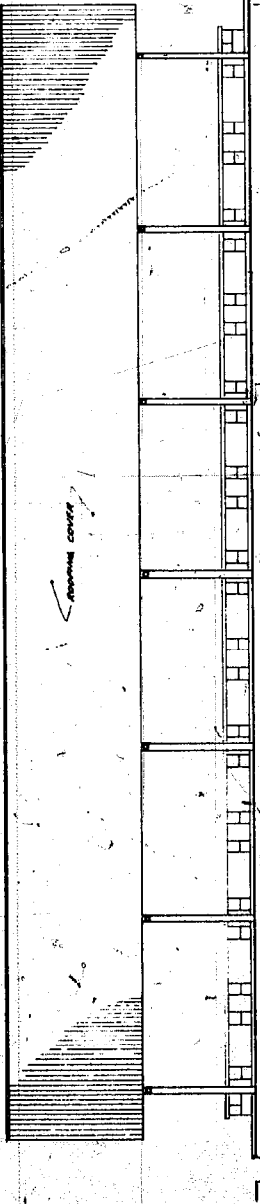
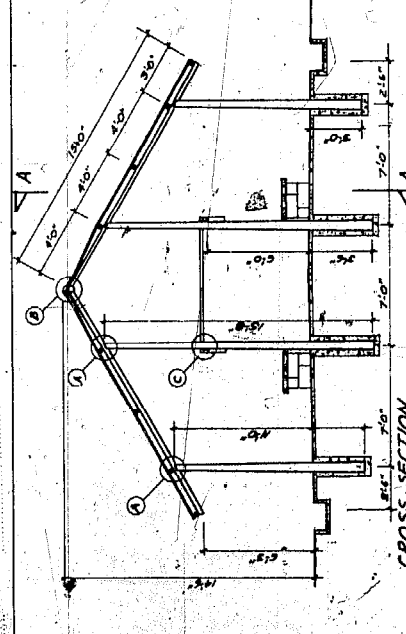
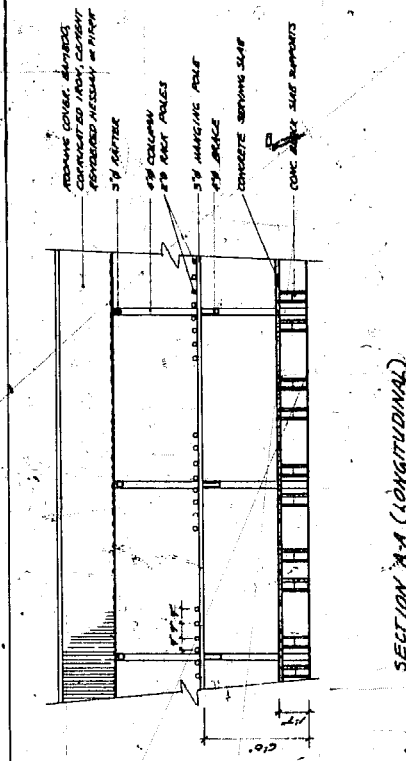
This was the result. There was incidentally, some cost saving as well.



BUS SHELTERS

NOTES

- A ROOF GOLF IS TO BE PROVIDED TO PROTECT THE ROOF FROM WEATHER.
- WINDPROOF CURBS FOR RAFTERS ARE TO BE SUPPLIED.
- ALL TRUSSES IS TO BE PRESERVE TREATED.
- THE PART OF THE CEILING WHICH COMES UNDER THE ROOF IS TO BE FINISHED WITH MIT FOR.
- THE GYPSUM STRENGTHENED PLASTER IS TO BE FINISHED WITH WHITE WASH OR PAINT COLORED WITH CEMENT ON TOP OF WELL CALIBRATED SAND.
- ALL JOINTS OF RAFTERS TO CALCIUM HYDROXIDE AND TO CONCRETE SURFACE TO BE PAINTED WITH ANTI-RUST PAINT. ALL RAFTERS WHICH ARE EXPOSED TO BE PAINTED WITH ANTI-RUST PAINT.



F.P.R.C.	
HONOLULU, PAPAUA NEW GUINEA	
MARKET HALL	
PLAN & ELEVATIONS	
DESIGNED BY	ROYAL HOLLAND
DRAWN BY	W. J. RAY
SCALE	1/4" = 1'-0"
DATE	12/11/27

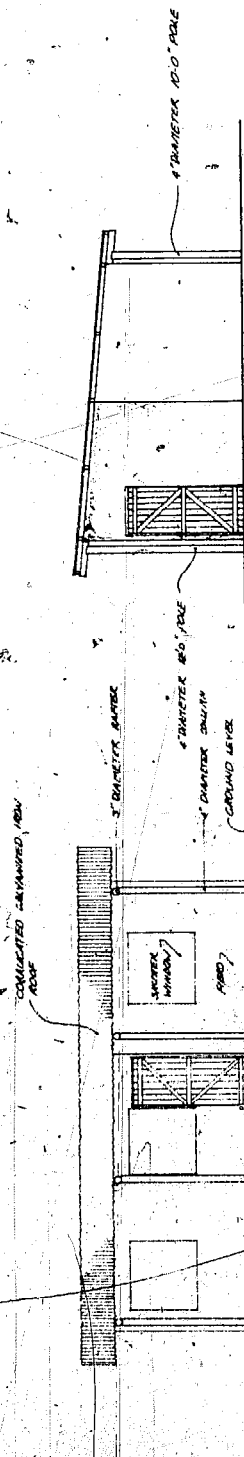
Until recently in Port Moresby, the market places were very limited. Outside of Koki Market there were a few places where people sat in the dust selling a few wilted and dirty vegetables, but nowhere, was there a reasonable shelter that would encourage buyers and sellers to congregate. The City Council embarked on a program of building markets in the various suburbs. This market Pavilion was developed as their standard market hall.

In every location where they have been erected, the volume of goods sold, has increased greatly, as much as 700% or 800%, within weeks of the building being completed. This has greatly increased the availability of fresh fruits and vegetables in the city. The result is more money going into the nearby villages and a lower cost of living for the city dwellers.



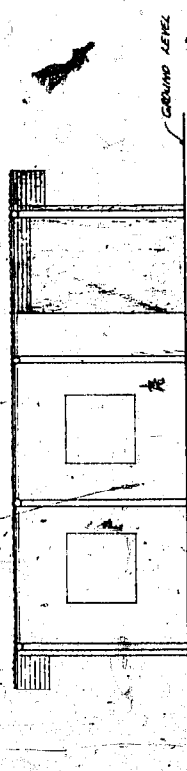
MARKET PAVILIONS

Cost - Materials	\$2400	Area	139m ² (1500 ft. ²)
Labour	1200		
Total	\$3600		



BACK SIDE ELEVATION 1/8" = 1'-0"

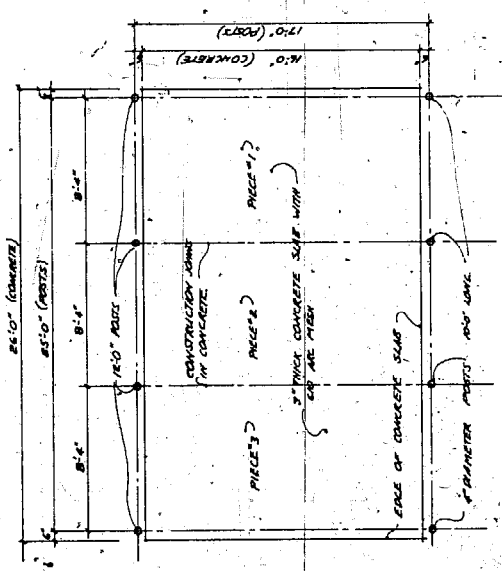
END ELEVATION 1/8" = 1'-0"



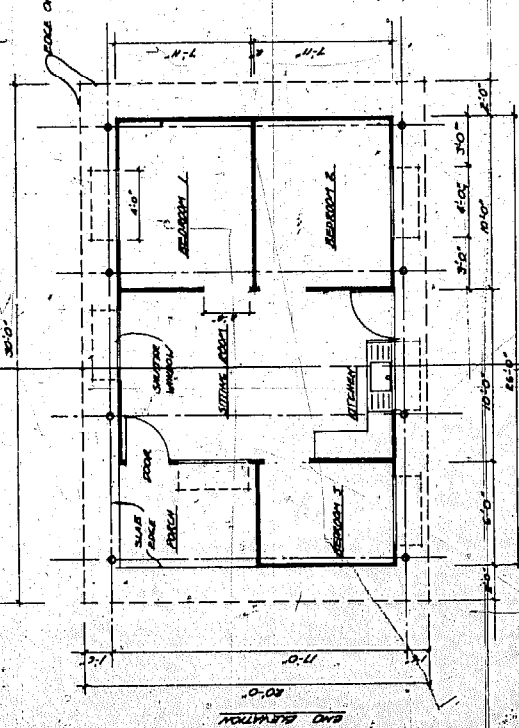
FRONT SIDE ELEVATION 1/8" = 1'-0"

MATERIALS LIST			
TREATED POLES	SIZE	LENGTH	QTY
4	2" DIA.	10'-0"	PLATES
4	4" DIA.	10'-0"	COLUMNS
4	4" DIA.	10'-0"	COLUMNS
ROOFING IRON			
24 PIECES 24 GA GALVANIZED IRON 10'-0" LONG			
CEMENT			
22 BAGS			
SALVAGE TIMBER			
3 1/2" ROOF PURLINS (830 CM/PI)			
10 1/2"			

F. R. C.
 HOHOLA, PAPUA NEW GUINEA.
 YORE RESIDENCE
 PLANS AND ELEVATIONS
 DRAWING NO. 030
 DRAWING BY: PLATES DRAWN: PLATES
 DATE: JUNE 1970 SCALE: 1/8" = 1'-0"
 SHEET NO. 2/2 DRAWING / 1/2"



FOUNDATION PLAN 1/4" = 1'-0"



FLOOR PLAN 1/4" = 1'-0"

SECTION A

SECTION A

This house was designed for Yore Inave, a retired policeman living in the Morata suburb of Port Moresby.

Because of his very limited cash he would be living in a temporary house on the site until this house was liveable. He would then be living in part of the house and finishing off the rest.

The entire process from start to finish would take up to 9 months. This is quite a normal situation in the urban centres of P.N.G. where housing is in short supply.

In order to accommodate this process, the house was designed to be built in steps. The roof is independent of the floor and walls, so that it could go up first. Next he could pour as much of the floor slab as he liked and put walls around as much as he could afford at the time.

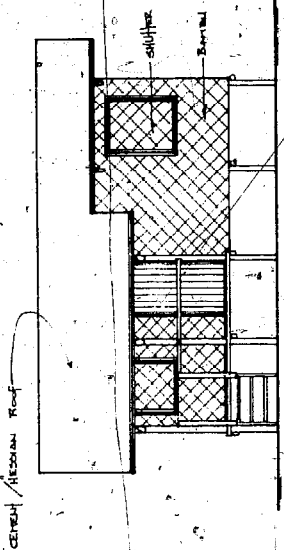
Throughout this house the walls are of woven, treated bamboo. This material is very strong and resilient. Also, because it is a few inches above the ground and has been treated, it should last many years.



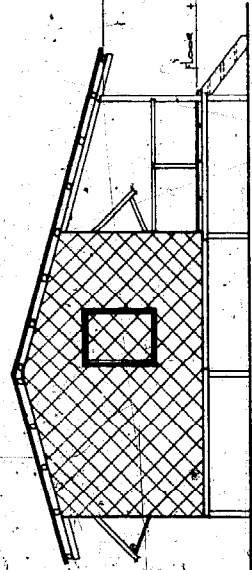
YORE HOUSE

Labour - 1 man part-time
for 9 months

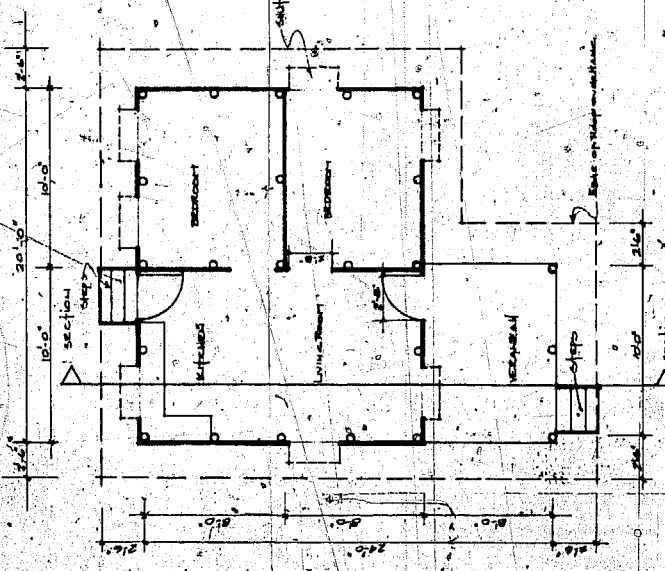
Area $37,2m^2$ (400 ft.²)



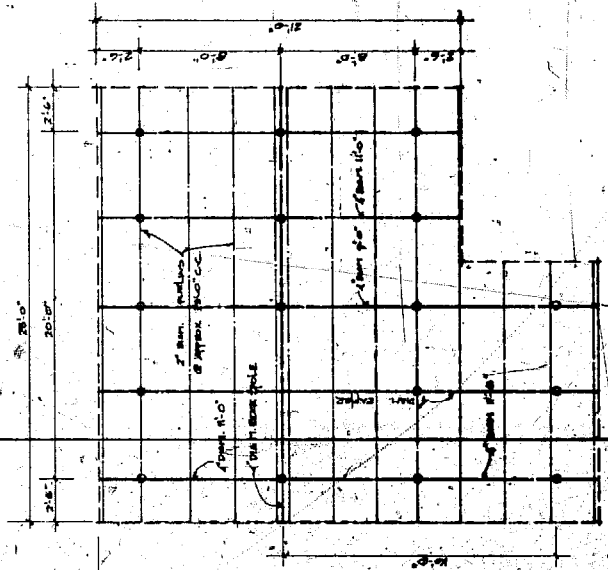
② FRONT ELEVATION



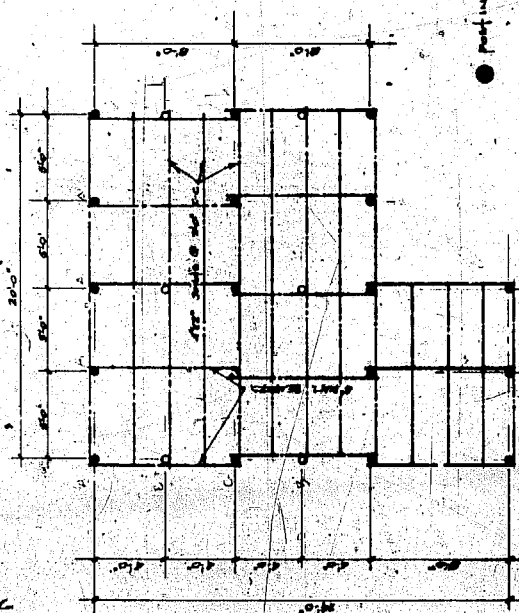
① SIDE ELEVATION



FLOOR PLAN 1/4"=1'-0"



Roof Plan 1/4"=1'-0"



Floor Structure 1/4"=1'-0"

● roof in ceiling
○ roof not in ceiling contact

FP.R.C.	BOX 1358
BOKORO	PANAMA
SEMINA HOUSE	
PLANS & ELEVATIONS	
DRAWN BY: D.H.	SEMINA HOUSE
DESIGNED BY: S.M.	SEMINA HOUSE
DATE: 11-1-51	SEMINA HOUSE

This house was designed for Semina Apove who works as a Labourer in Port Morésby.

Like Yore Inave, he has very limited cash and would be living in a temporary house while building.

The house is more of a coastal house, with the floor up off the ground for coolness. Unlike normal construction, the house stumps do not stop at the floor. Instead they continue up to form the walls and to support the roof. This is a simpler, stronger method of erecting a house. As soon as the poles are in the ground, the roof can be put on. Then the rest of the work goes on, sheltered from the sun and rain.

The main structure of the house is made of round poles. Only the floor joists and flooring need be of sawn timber. However Semina had some 70 mm x 50 mm's (3" x 2") available and so he used them for the roof purlins.

The house took him 8 months from start of work until he moved in.

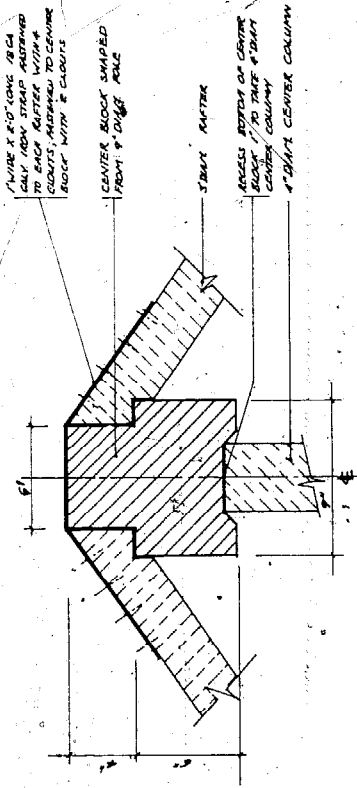


SEMINA HOUSE

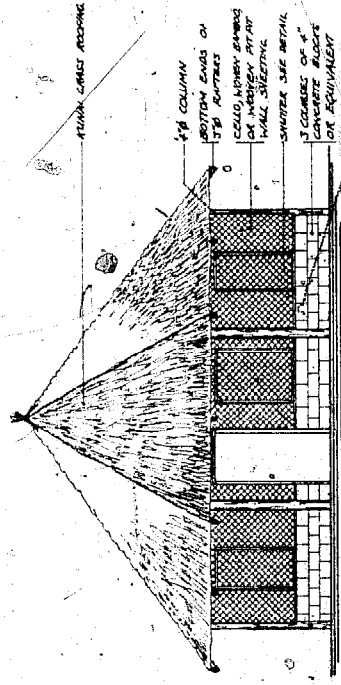
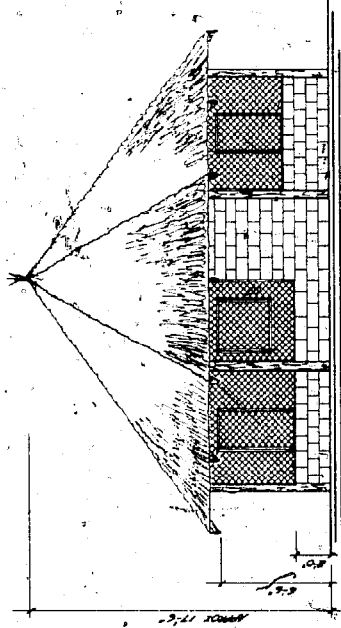
Cost - Materials \$203

Labour - 1 man, part-time
for 8 months

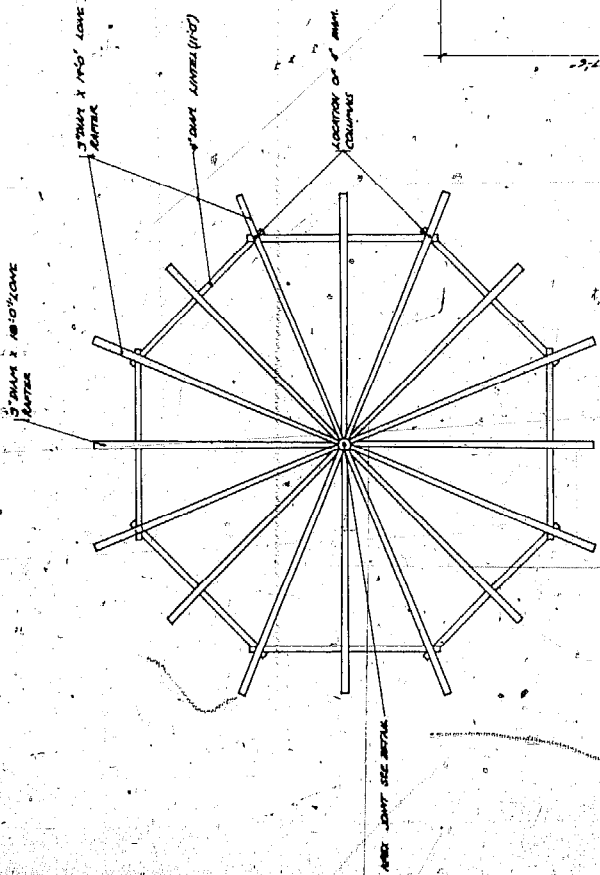
Area 37.2m² (400 ft.²)



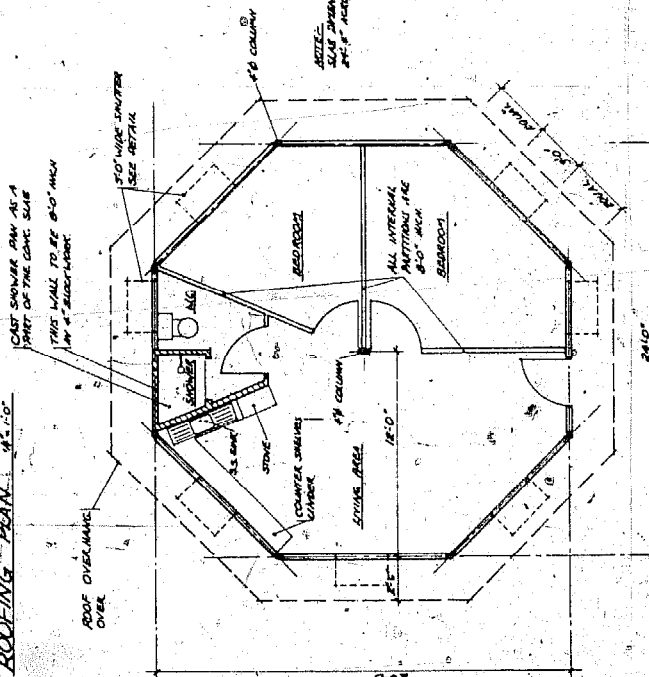
APEX JOINT DETAIL 1/4" WALL SIZE (3'-0" x 3'-0")



FRONT ELEVATION 1/4" x 10"



ROOFING PLAN 1/4" x 10"



NOTES

1. ALL ROOFING IS TO BE SHIPPED WITH BRACKET
ON ALL RAFTERS NOT SHIPPED.

2. THE SLAB IS TO BE GRADED WITH 4 CONTINENT
BY JOINTS. RAFTERS ARE TO BE GRADUALLY CUT TO 4"
THE 1/2" WIRE MESH COLUMNS.

3. ALL JOINTS AND CONNECTIONS ARE TO BE MADE WITH
ALL JOINTS AND CONNECTIONS ARE TO BE MADE WITH
PAINTED WITH TIMBER PRESERVATIVE.

F.R.C.
HOHOLA, PAPUA NEW GUINEA
OCTA-HOUSE I 478 sq ft

PLANS, ELEVATIONS, DETAIL

DESIGNER: P. R. C.	DRAWING: P. R. C.
DATE: 10/15/73	SCALE: 1/4" = 1'-0"
JOB NO: 73-2	PRINTING: 10-2

This house has a number of features which make it unusual.

It is a round (actually octagonal) house built on a concrete slab.

In order to keep the inside drier and to protect the woven bamboo walls from rot and from being kicked about, there are 3 courses of concrete blocks around the perimeter.

The interior walls do not support the roof. Because of this they can be built later by the owner to save money. Also he can put them wherever he likes.

It has a hessian/chicken wire/cement roof. This is explained on page 40.

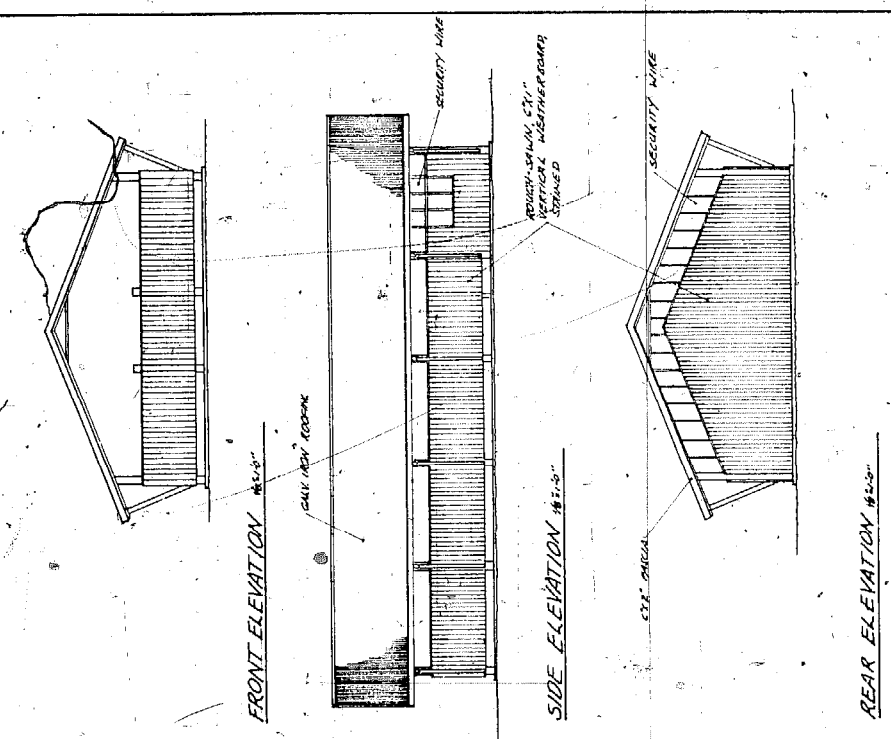
The walls and roof are built out of treated round poles and the woven bamboo is also treated.



OCTA - HOUSE

Cost - Materials	\$600	Area	44.6m ² (480 ft. ²)
Labour	390		
Total	\$990		

- MEMBERS**
- 1 1/4" x 1/4" x 10'-0" POLE
 - 2 1/4" x 1/4" x 10'-0" POLE
 - 3 1/4" x 1/4" x 10'-0" POLE
 - 4 1/4" x 1/4" x 10'-0" POLE
 - 5 1/4" x 1/4" x 10'-0" POLE
 - 6 1/4" x 1/4" x 10'-0" POLE



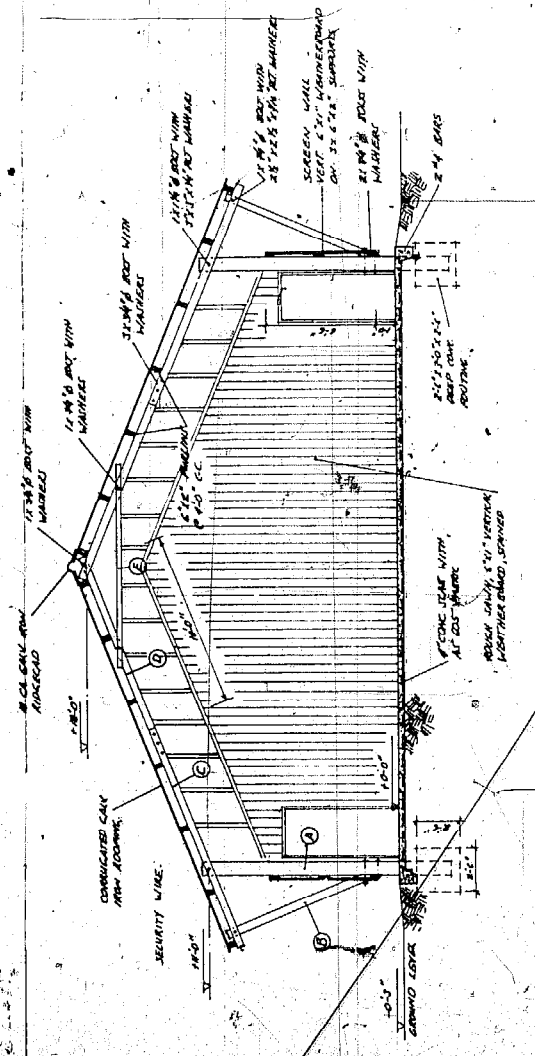
STAGE I

- CLEAR AND LEVEL SITE
- ERECT STRUCTURE AND ROOF
- POUR CONCRETE IN WALLS AND SLAB ONLY
- BUILD WALLS FOR CHASE AND CLIMB ONLY
- INSTALL 1/4" x 1/4" x 10'-0" POLES
- ERECT 100' ST. WEATHER

STAGE II

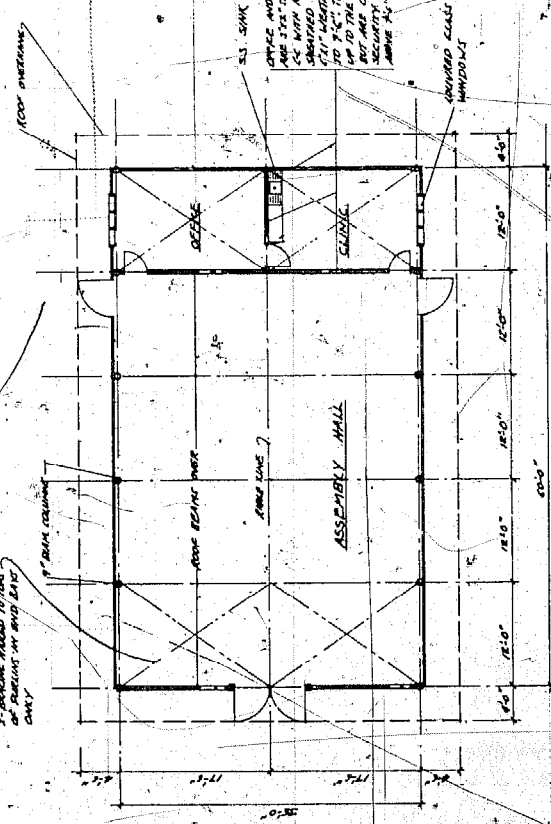
- POUR CONCRETE FOR FOUNDATION
- ERECT SCREEN WALL

F.P.R.C.	
HONOLA P.A.G.	
YUNE VALLEY COMMUNITY CENTER	
R.A.M. SECTION ELEVATIONS	
DRAWING NO. 013	DESIGNED BY RICHIE
DATE - FEB. 11, 1973	SCALE - AS SHOWN
JOB NO. 71-16	DRAWING / 101



CROSS SECTION 14'-0"

10'-0" x 1/4" x 10'-0" POLES AT 10'-0" ON CENTER TO THE EXTERIOR OF THE WALL ONLY



FLOOR PLAN 14'-0"

ROOF OVERHANGS ARE TO BE PROVIDED GENERALLY

SCREEN WALL WITH 2x4 STUDS AND 1/4" x 1/4" x 10'-0" POLES AT 10'-0" ON CENTER TO THE EXTERIOR OF THE WALL ONLY

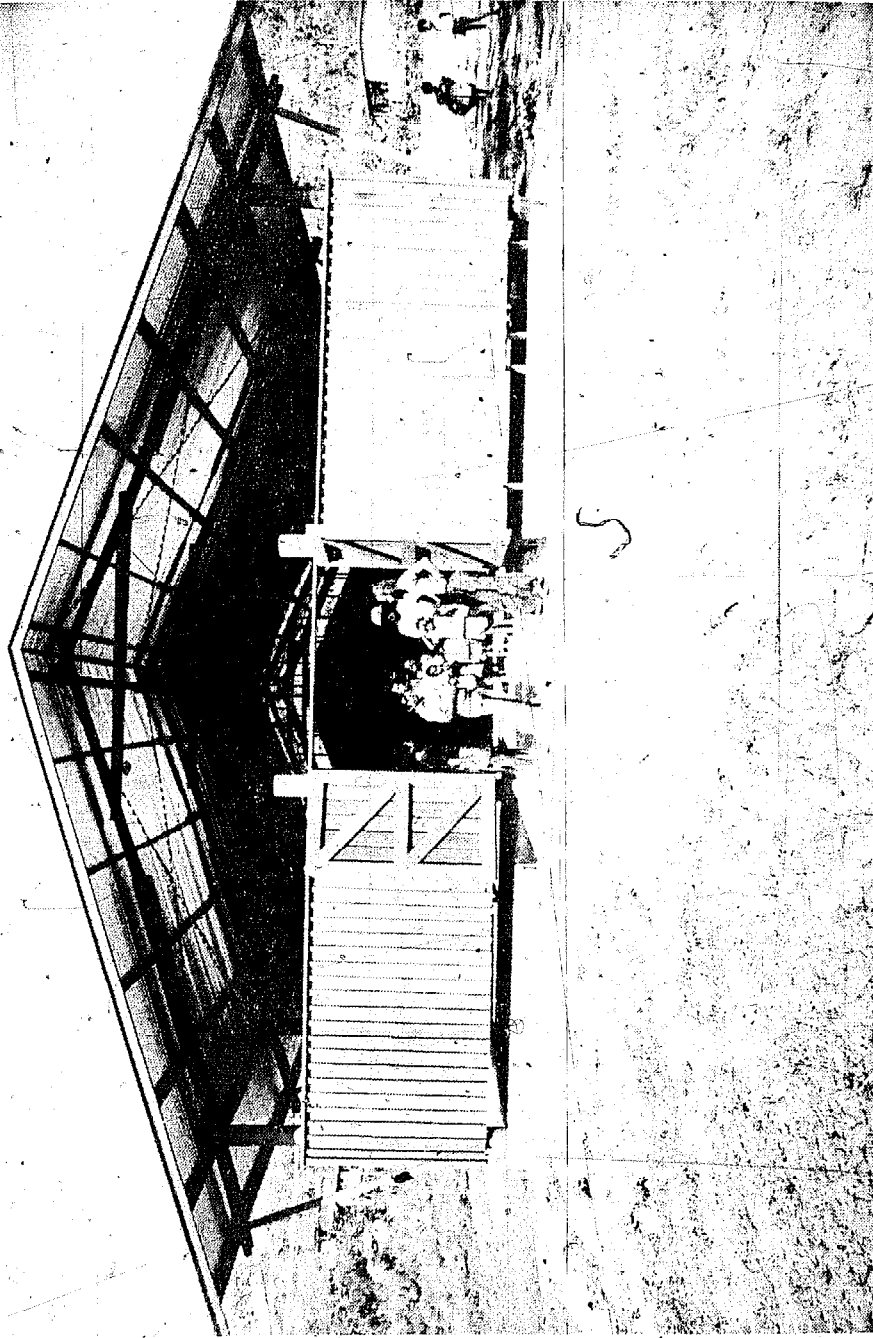
ROOF OVERHANGS ARE TO BE PROVIDED GENERALLY

The June Valley Citizens wanted a large hall to act as the focal centre of the community activities. Although its greatest daily use would be as a clinic, it has to be able to accommodate large gatherings for films, dances, church services and the like.

We accommodated this double use by using the large hall as a clinic waiting room. Thus the clinic could be much smaller and the large hall would not be sitting idle all day.

The building structure is basically a portal frame made of round poles. After the carpenters went through the initial adjustments to using round poles instead of sawn timber, the construction went well.

The building was erected by the City Council for the Citizens of June Valley.

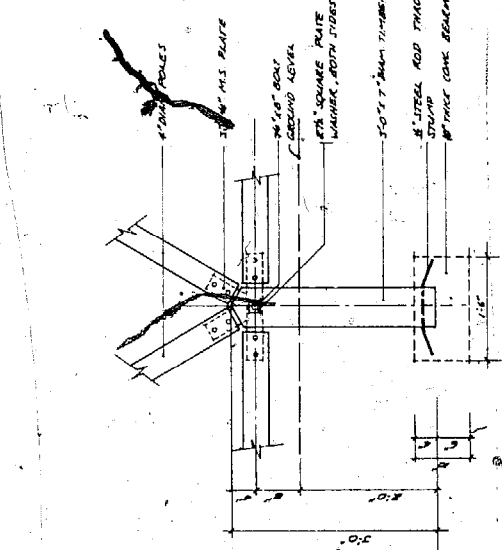


COMMUNITY CENTRE

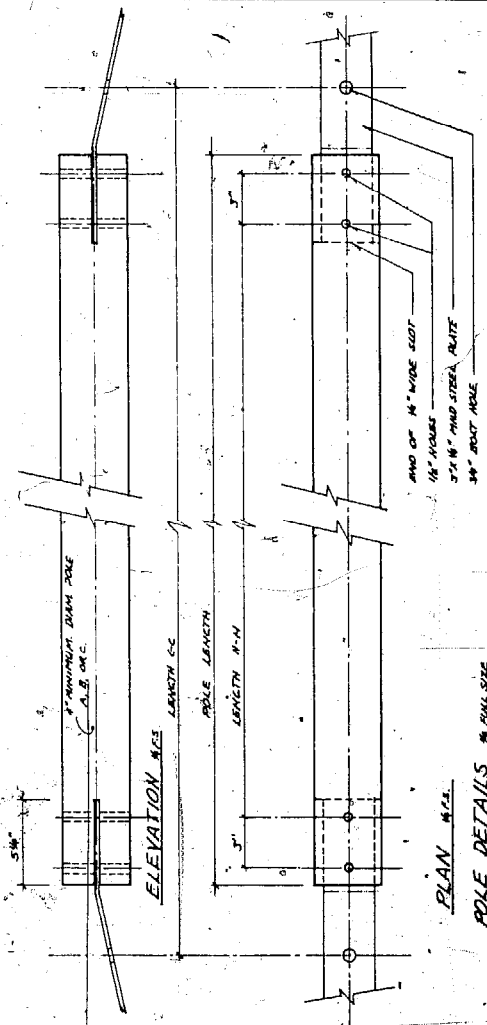
Cost - Materials	\$4480	Area	195m ² (2100 ft. ²)
Labour	4120		
Equipment	460		
Total	\$8060		

NOTES

1. ALL POLES TO BE PRESERVE TREATED WITH C.C.A. SALES TO PREVENT ROTATION IN THE TREATABLE WOOD
2. POLES TO BE TEAK (STRENGTH GROUP 2)
3. PROTECTIVE SKIP JOIST TO BE PROPERLY POSITIONED IN ACCORDANCE WITH AS PANS



FOUNDATION DETAIL 1/2"=10"



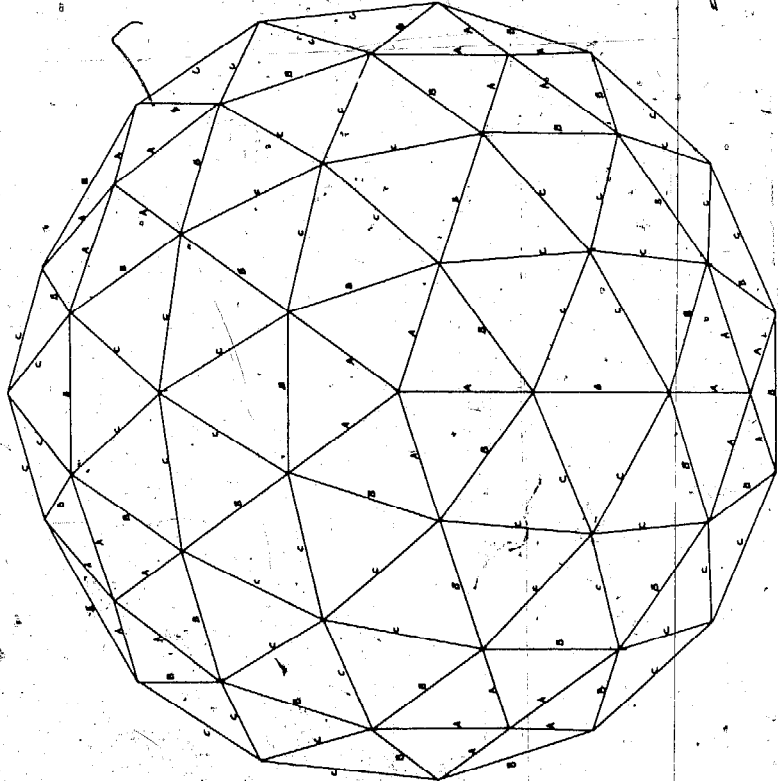
ELEVATION VIEW

PLAN VIEW

POLE DETAILS 3/8" POLE SIZE

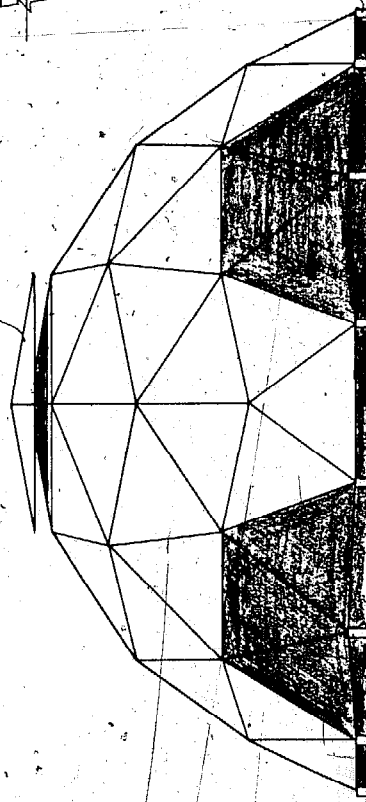
NOTES:
SELECT NUMBER OF POLES, MARKED FOR THE USE OF THE POLE TABLE IS 20'-10" (10' x 20'-10")

POLE DATA			
NAME	LENGTH	POLE USE	QUANTITY
A	74'-0"	C-10"	35
B	81'-0"	7'-0"	45
C	81'-0"	7'-0"	50



ROOF PLAN

TRANSPARENT PLASTIC VENTS AND STAINLESS STEEL.



ELEVATION

28" DIA. 2x10" (2x10) TREATED WOOD JOISTS

F.R.C. HOHOLA, PAPUA NEW GUINEA
42' GEODESIC DOME
PLAN & ELEVATION DETAILS

DESIGNED BY	DR. H. H. HATTY
DRAWN BY	SCALE: 1/8"=1'-0"
DATE	MAY 1972
JOB NO.	10-72-1
DESIGNED BY	DR. H. H. HATTY
DRAWN BY	SCALE: 1/8"=1'-0"
DATE	MAY 1972
JOB NO.	10-72-1

Badihagwa High School wanted a distinctive building that would be inexpensive and erectable by the students. As the school lacks an assembly hall, they wanted what would be a small assembly hall, not big enough for the entire school body, but large enough for 200 or so people. It was hoped that this could be a centre for different school and Community activities, films, dances, traditional dancing practice, extraordinary classes and so on. To date it is getting frequent use for a wide range of these activities.

The structure is of treated poles with a joint connection developed by F.P.R.C. working with the engineers at the Public Works Department, in fact all of the structural calculations were done by P.W.D.

The cladding material is hessian/cement. (This is explained on page 40). This type of structure is extremely rigid and strong. Due to the rigidity the hessian/cement worked very well. It could of course be covered with many other materials instead, kunai grass, pit pit, leaf sak sak or plywood to name a few.

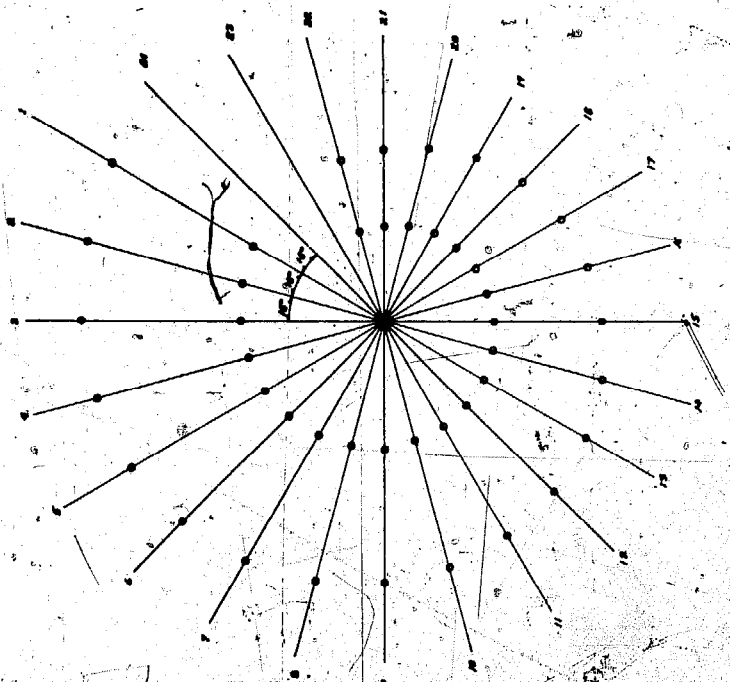
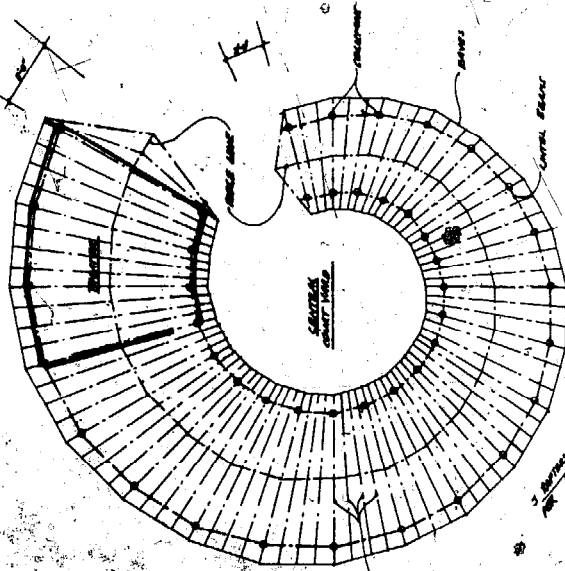
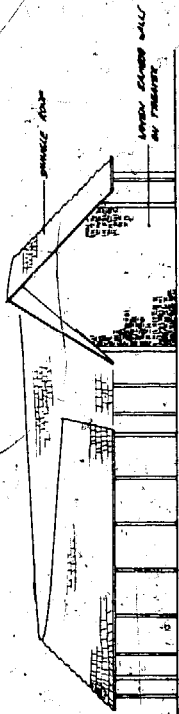
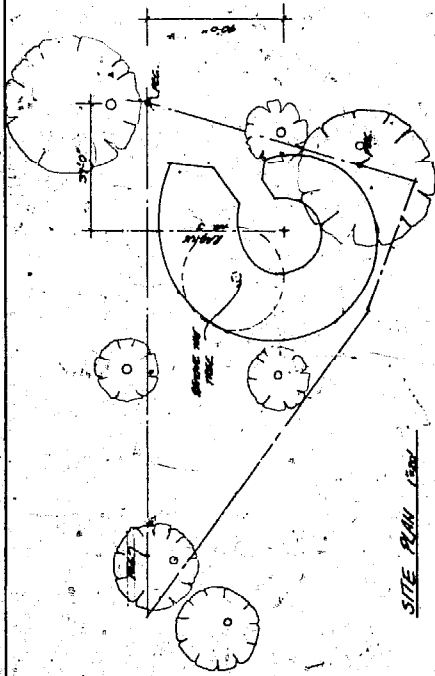
The Geodesic dome may not have wide application here in P.N.G., but where an exciting, inexpensive building with a clear span of greater than 10 meters is needed it can be a good solution.



GEODESIC DOME - CULTURAL CENTRE

Cost - Material \$2,000

Area 130m² (1400 ft.²)



Column No.	Column Location	Column Size	Column Material	Column Height
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
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24
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30

F.P.A.C. BOX 1358
 BORDO P.A.C.
 FORESTRY PAVILION
 PORT MESSY SHOW

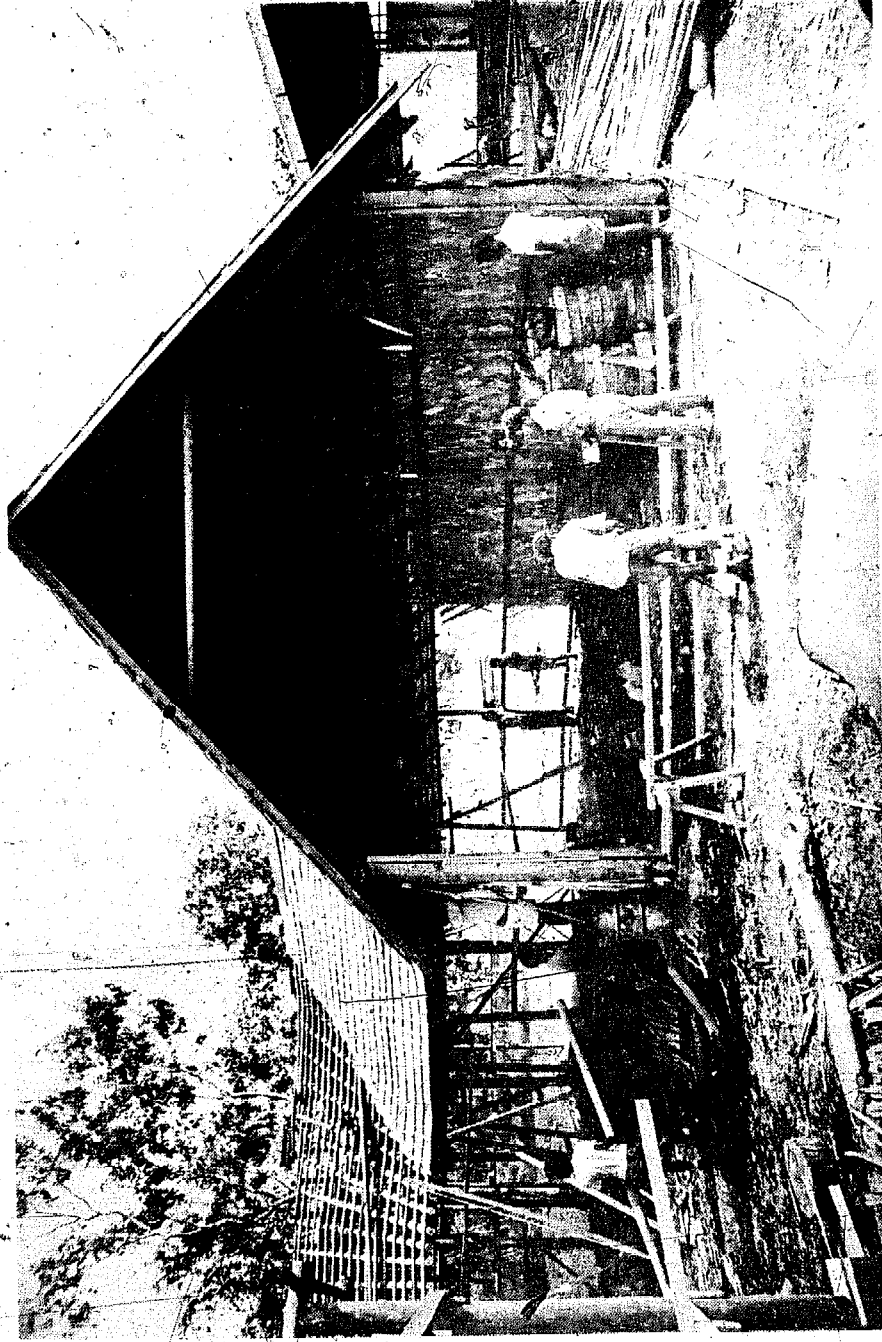
ARCHITECT: ...
 DRAWN BY: ...
 DATE: ...
 SCALE: ...

The establishment of a new showgrounds near Port Moresby meant that a new, permanent, building was needed. It was decided that this building should, in itself, demonstrate what could be done by using the materials from the forests of P.N.G. The structure is of treated poles, the roof of wooden shingles, the floor is flat paving discs of wood and the wall cladding is woven bamboo. All the materials are preservative treated to make this a permanent building.

The building itself is in the shape of a sea shell, spiralling down from large to small. It encloses a small courtyard.

The building was erected just in time for the first show at the new grounds in June 1974.

During the show it received many comments and queries about both the design and the materials used.



FORESTRY PAVILION AT PORT MORESBY SHOW

RURAL HEALTH CENTRE

The Public Health Department requested this design. They wanted a building that could be built anywhere in the country using locally available materials. By using the simple wood preservation technique explained in the Handbook of Rural Wood Preservation, this is possible.

Besides being built of local materials, the P.H.D. also wanted a building that could be expanded easily. This one can. It starts as an Aid Post, with out-patients facilities and a small ward. Then by extending it on both sides it becomes a Sub Centre. This has greater out-patient facilities, maternity and child care clinic, office, storeroom, maternity ward, delivery room and a small ward. Finally it can be extended to be a Health Centre. All of the Sub Centre stays the same with an operating room simply added on. Also at this stage separate wards would be built. Although we do not show plans for them here, we do have plans for these wards. The construction of them is very similar.

These plans are recommended by the Public Health Department as the standard for rural Aid Posts, and Health Centres.

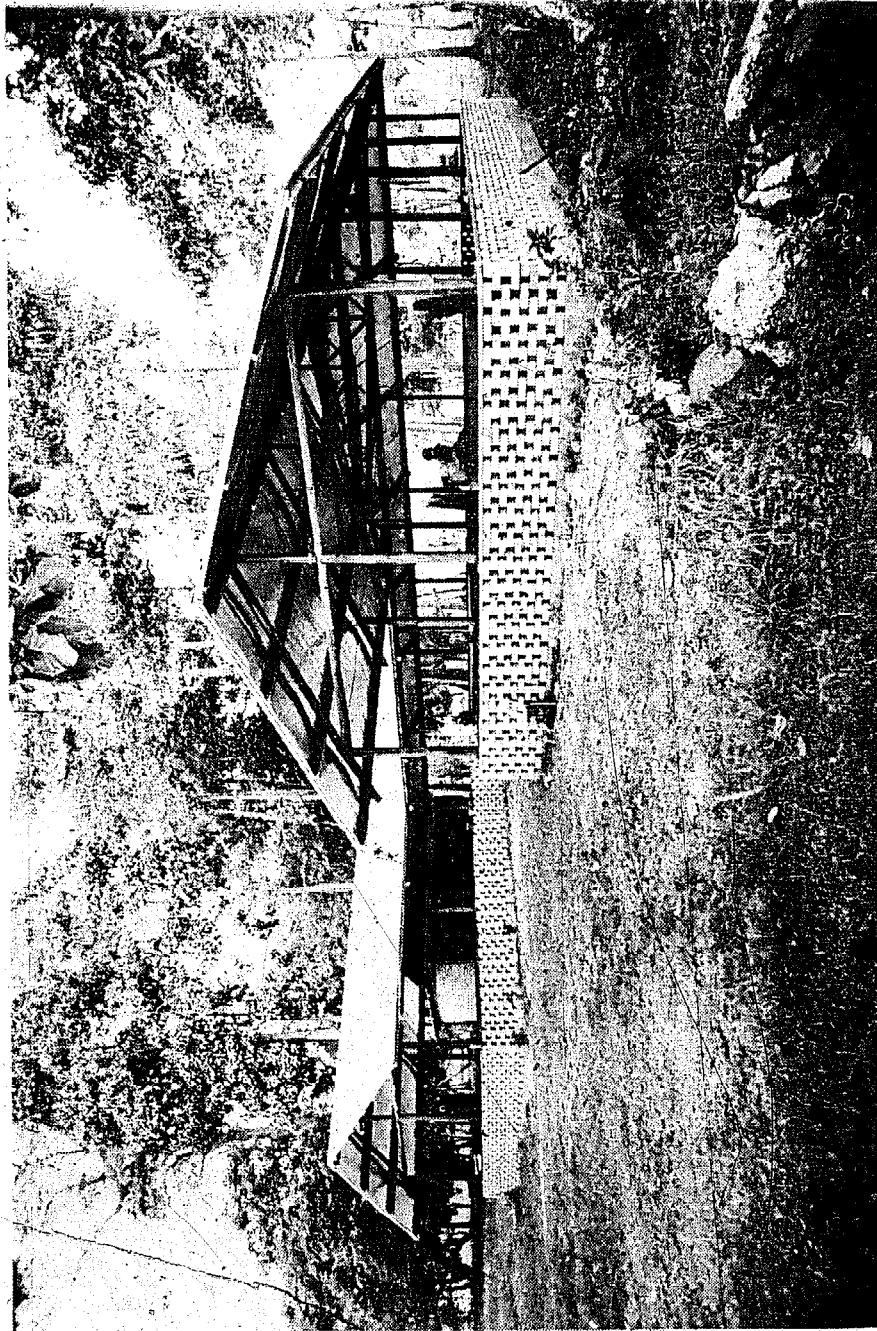
The requirement for this building for the Laloki Co-op College were:

- a large open building that would suit well in the rural setting of the College.
- suitable for films, dances, and parties.
- suitable for daily use as a place for the students to relax.
- be simply constructed so that the students could help build it.

The 'U' shaped plan was chosen. This was partly to keep the roof spans short and economical. It was also to break up what was otherwise to be a very large open space. This makes it more suitable for daily use as well as allowing it to be used for large gatherings.

The floor is concrete slab and the bricks are concrete, made at the college.

It is a successful building in almost constant use.



COLLEGE RECREATION CENTRE

Cost - Materials	\$2300	Area	195m ² (2100 ft. ²)
Labour	1400		
Total	\$3700		

BUILDING DETAILS

Much of the work involved in design of any building is the design of details. Naturally enough, much of the work we have done is in developing suitable details. These are meant to give an idea of what we think are good details.

There are many ways of fastening two poles together. Normal village practice is to tie them together with bush rope or to nail them together. Neither of these is entirely satisfactory.

To be really good a method of jointing two poles must:

- be at least as durable as the poles themselves.
- give a strength comparable to the strength of the poles.
- be inexpensive in materials and easy to use. If it is not relatively easy then the carpenters will just forget it and go their own way.

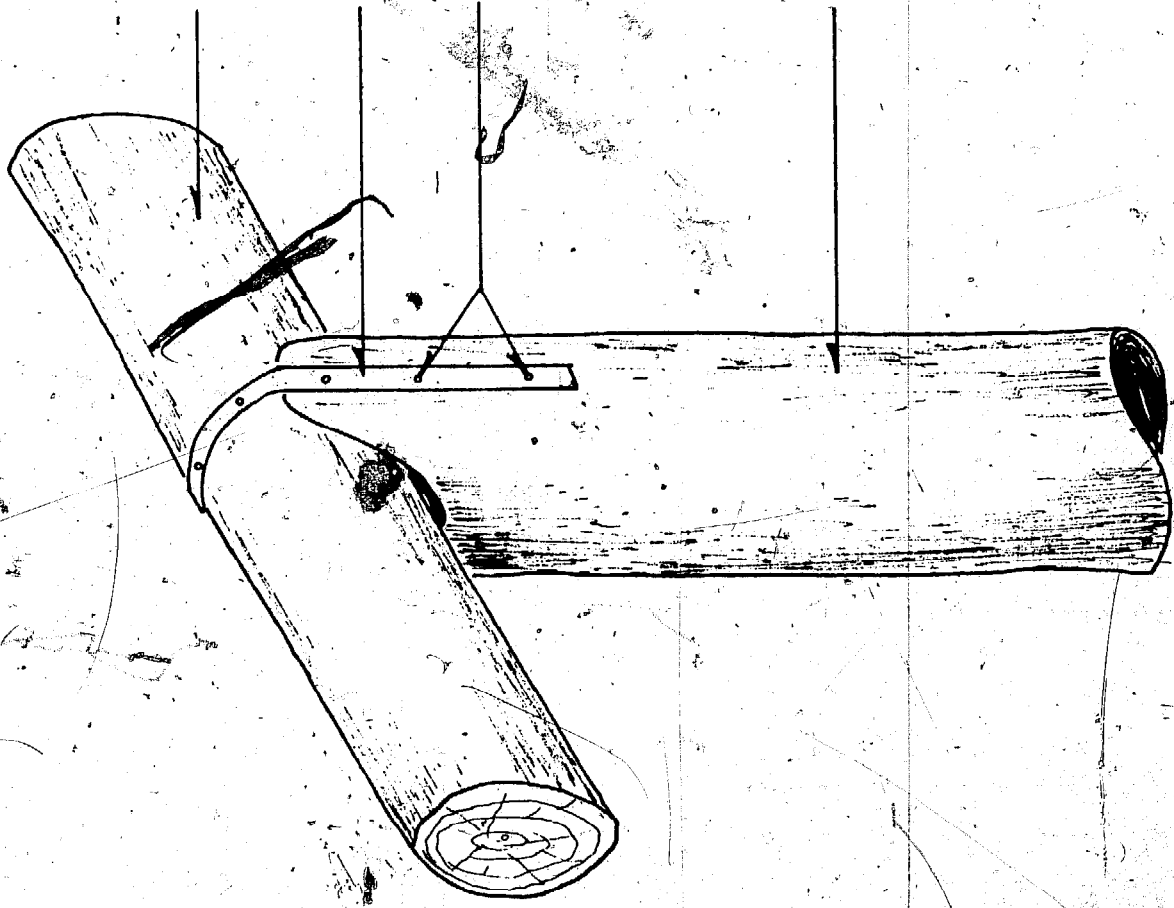
We have found two methods to be satisfactory.

1. Bolting

This is useful for joints such as a floor bearer to a column, where the one pole sits beside another one. The poles are simply lined up, a hole drilled and the bolt inserted and tightened.

2. Hoop Iron

This is useful where one pole is sitting on top of another one. A strip of galvanized iron is wrapped around the two poles. It is then nailed to both poles by galvanized flat-headed nails. This is shown in the drawing.



POLE JOINTS

BUILDING ON GRADE

In a building that is built with an earth or concrete floor that is approximately level with the surrounding ground, the lower 600 to 900mm (2ft. to 3 ft.) of the wall produces the most problems. It is this area that is most subject to the rot and insect attack. It is also this area, close to the ground, that gets the most physical damage. People kick it, bump it, splash water on it etc.

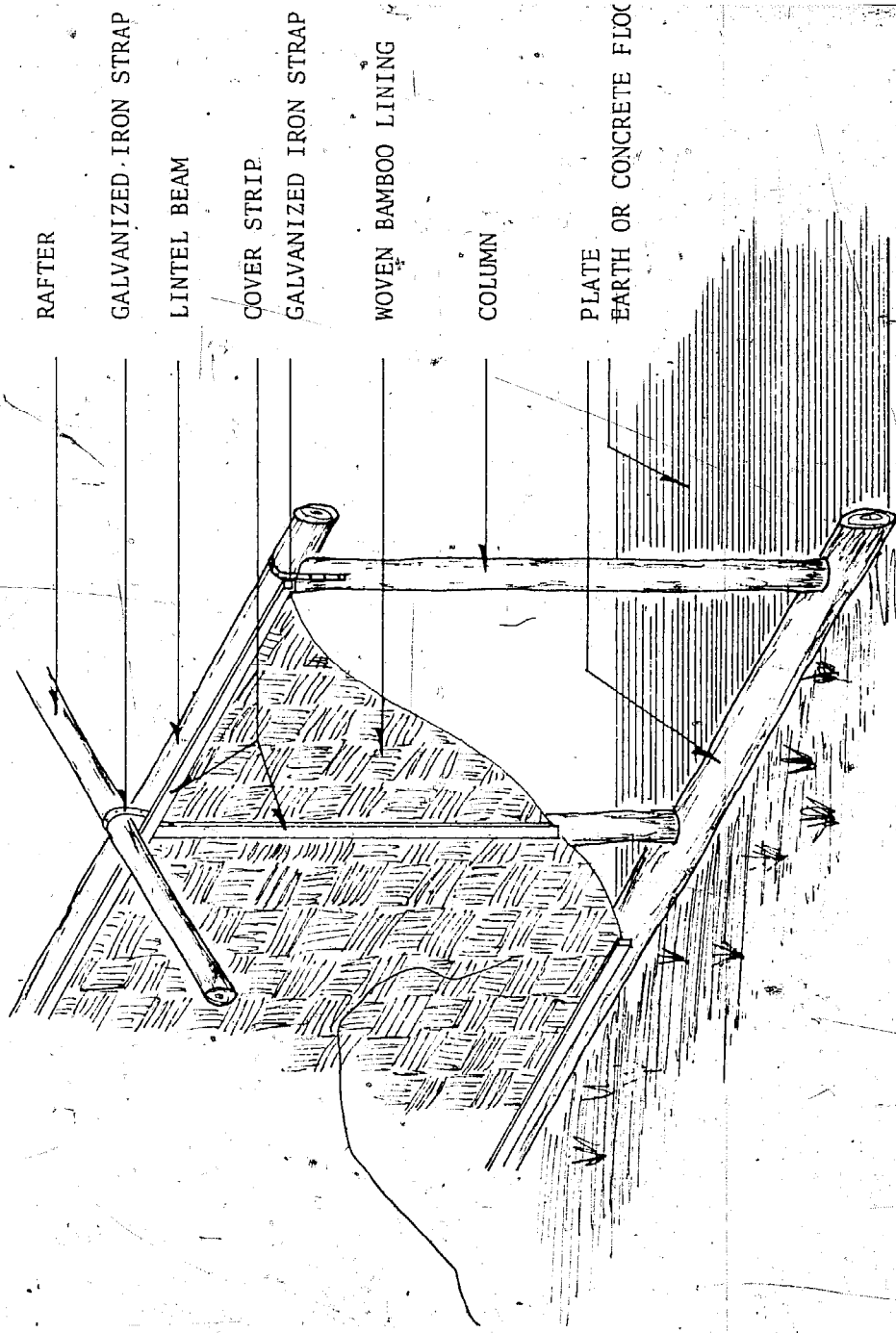
When a wall deteriorates so that it must be replaced, it may often be quite sound up under the eaves but completely destroyed down close to the ground. This area then needs as much protection as it can get.

We can suggest two ways of giving this protection.

The first, and simplest, way is to simply lay a preservative treated log on the ground and to build the wall on top of it.

It is important that the log be treated with preservative or else be of a type of wood that is naturally durable.

This method makes the bottom 200mm (8 in.) or so of the wall quite solid. In some parts of P.N.G., such as New Ireland this method is already used.



RAFTER

GALVANIZED IRON STRAP

LINTEL BEAM

COVER STRIPS

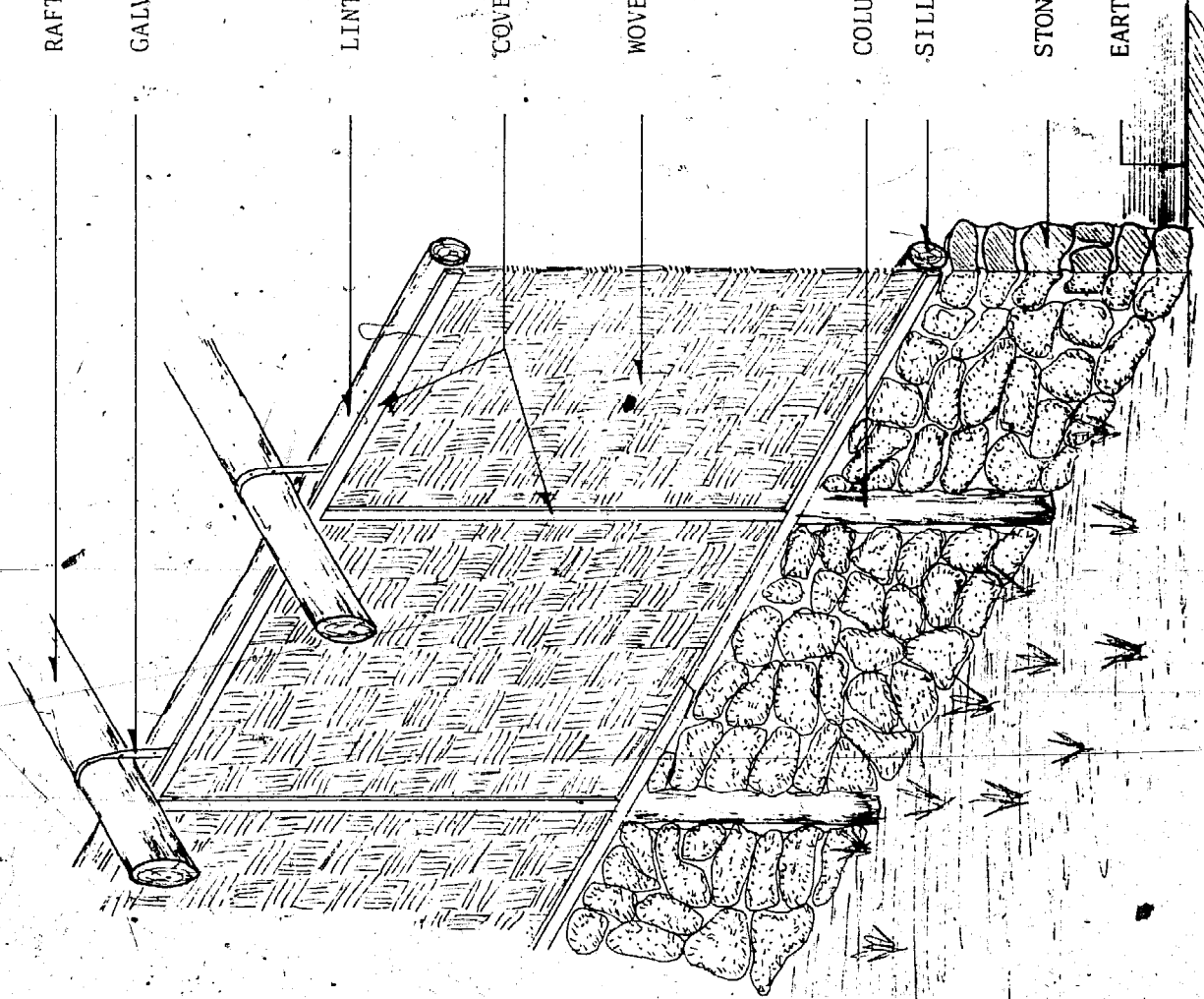
WOVEN BAMBOO LINING

COLUMN

STILL BEAM

STONE OR BRICK WALL

EARTH OR CONCRETE FLOOR



The second method that we recommend is to build the lower 600mm to 900mm (2 ft. to 3 ft.) of the wall out of stones or bricks. This is better than simply putting a log down but it is more work and more expensive. There is no need to build the stone wall any higher than this. Having timber above the stone wall has advantages over having a stone or brick wall all the way to the roof -

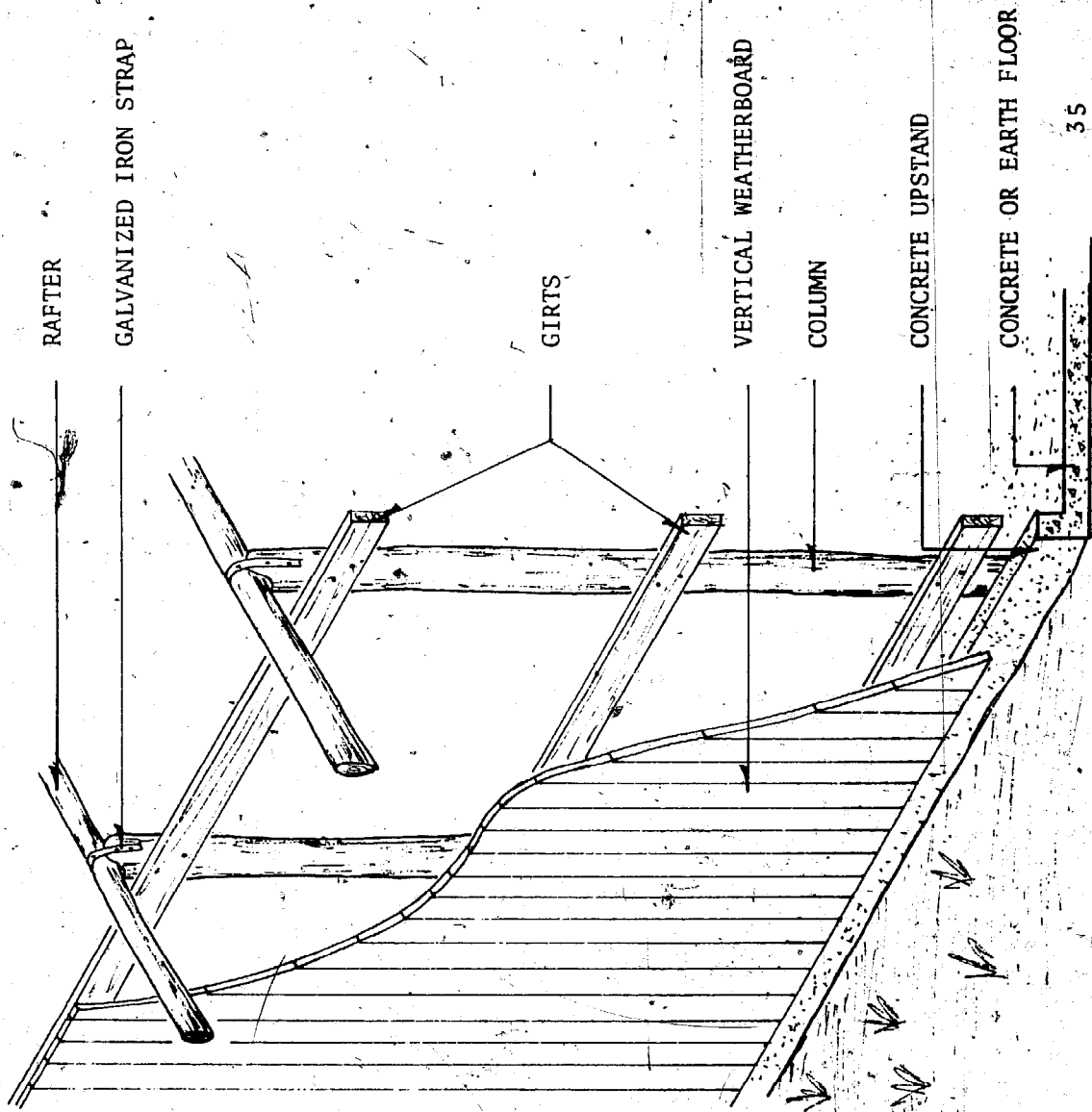
- it is easier to build and cheaper.
- it is cooler.
- it is much safer in earthquakes.

WEATHERBOARD SIDING

We have had many queries from people about putting weatherboard, fibro or other flat sheeting materials onto pole buildings. Some people have used poles to hold the roof up and then put in studs and noggins to nail the sheeting to. This is just a waste of effort in most cases.

What we have found best is to simply nail girts to the columns. These may need a bit of packing or a bit of cutting into the columns to make them straight. However, if the columns are set out true this should not be a problem. The siding, be it weatherboards, fibro, plywood or whatever, is then simply nailed to the girts.

The drawing shows this done on a building with a concrete floor. However this can be done just as well on a building raised up on stumps.

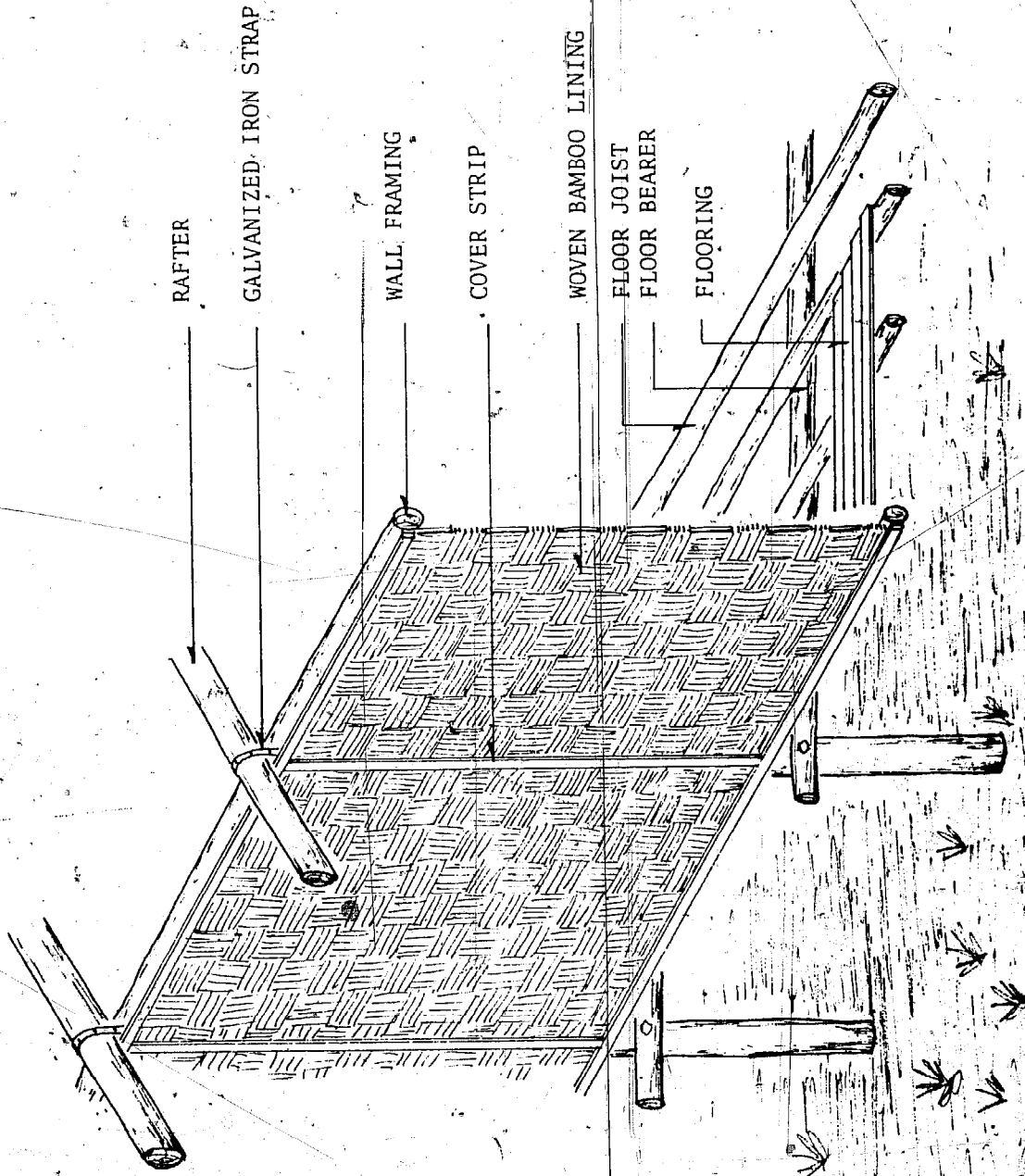


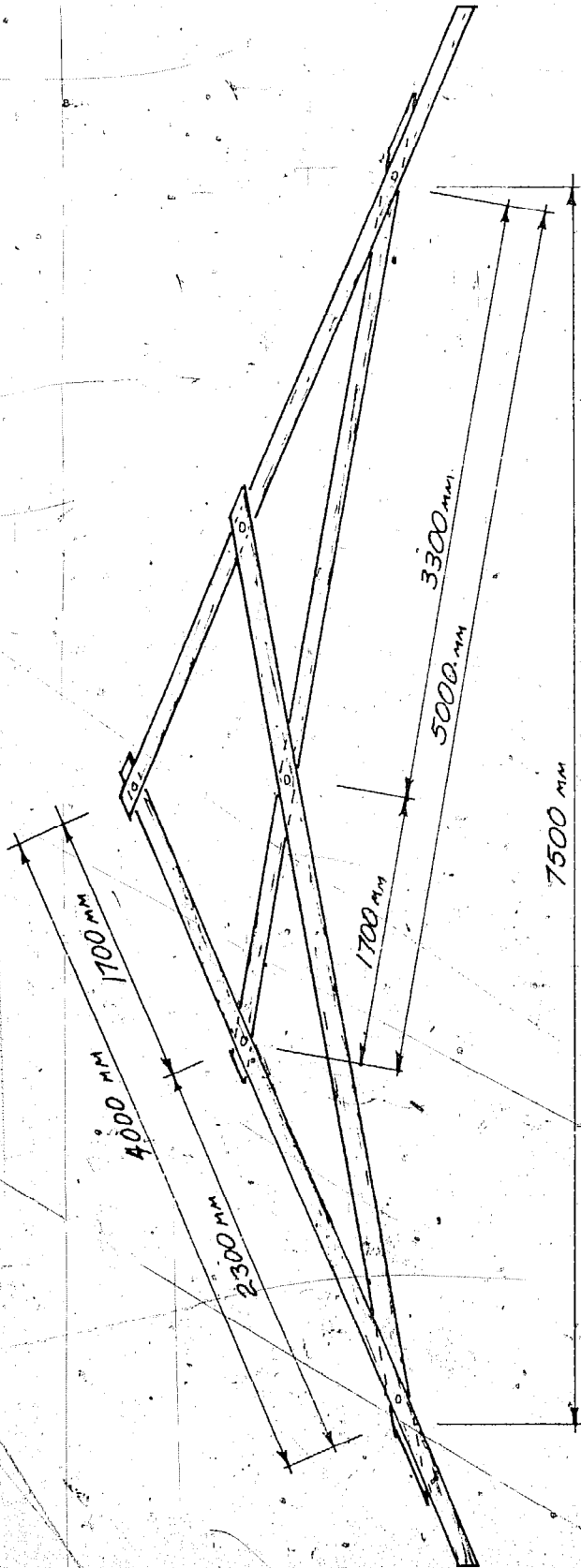
BUILDING WITH RAISED TIMBER-FLOOR

This is the traditional way that many of the houses in the coastal areas of P.N.G. are built. As far as we can see it is a very good way. The only changes that we would suggest are:

- (1) Bring the columns all the way from the ground to the roof. This gives a stronger building with less work.
- (2) Use galvanized iron strapping to fasten the poles together.
- (3) Bolt the floor bearers to the sides of the columns.
- (4) Use preservative treated materials throughout the building.

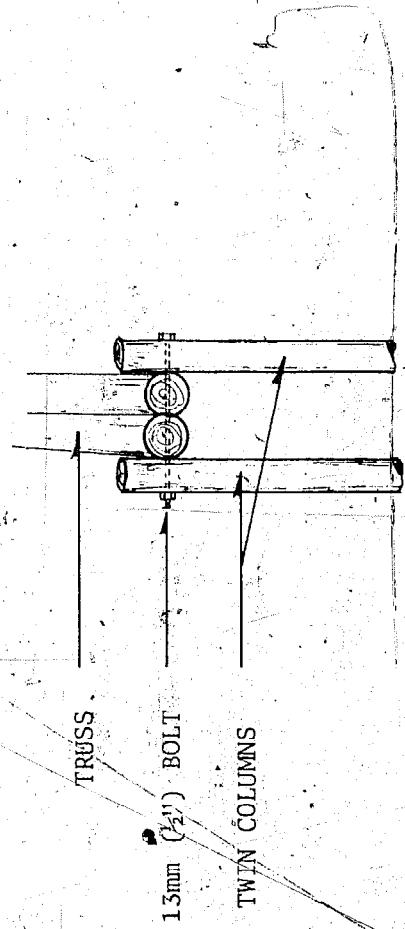
These suggestions, except for preservative treatment are shown in the drawing.





NOTES

- All poles are 100mm minimum diameter.
- Carry all poles at least 100mm past the bolt before cutting them off.



COLUMN DETAIL

SCISSORS TRUSS

We set out to produce a truss that would fit the following criteria:

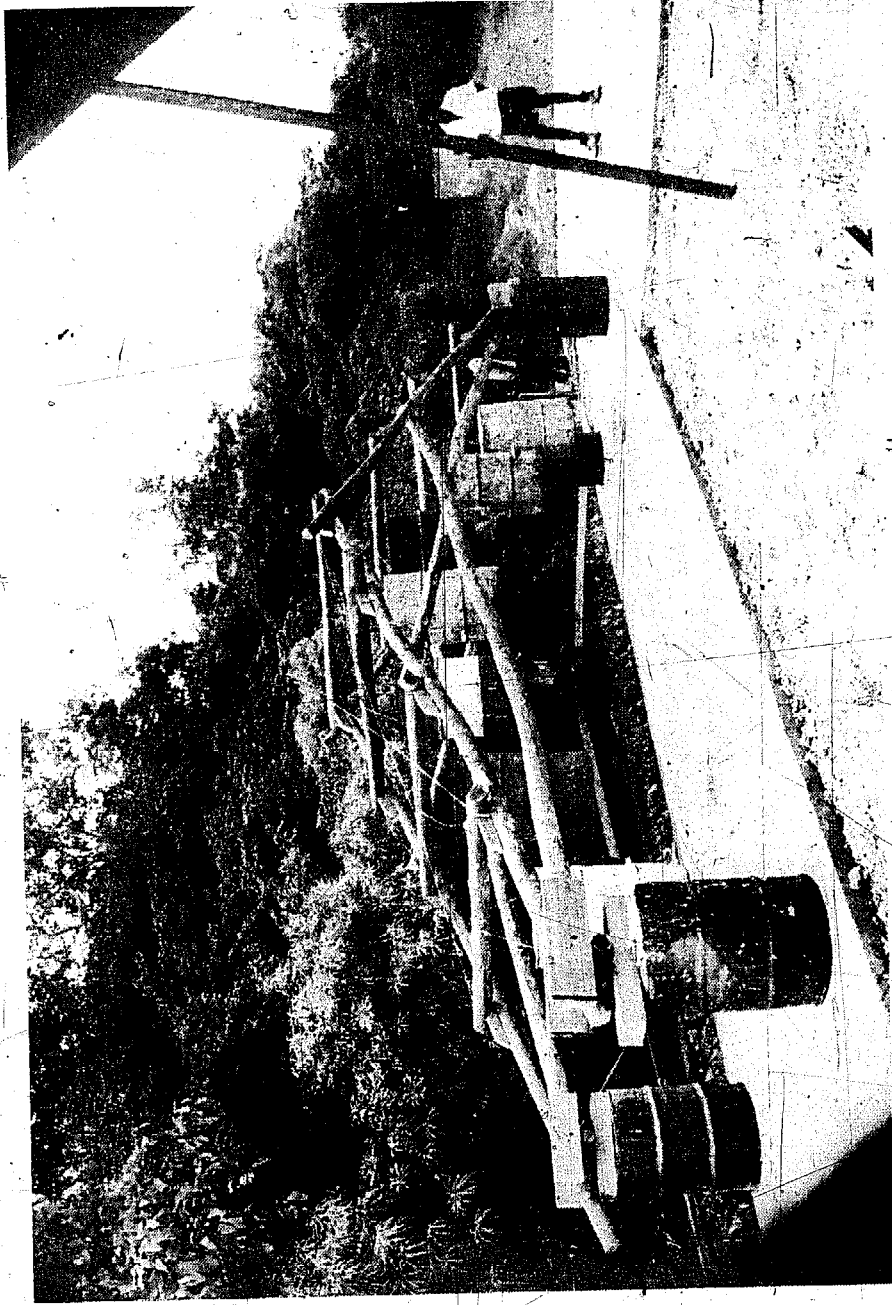
1. Utilize round poles with a minimum of hardware.
2. Be simple to fabricate and erect.
3. Span about 7.5 meters (25 ft.)
4. Carry a combined live and dead load of at least 4.4 kg/m^2 (9 lb/ft^2) when used at a spacing of 2.5m (8 ft.)

Our procedure was to build two trusses and erect them as shown in the photo. We then filled the drums with water and measured the deflection as the drums were filled.

The first two trusses collapsed at a loading equivalent to 39 kg/m^2 (8 lb/ft^2) at 2.5m (8 ft) spacing.

We made another two trusses using larger poles and tested them. They showed quite acceptable deflection and full loading. These are the trusses described in the drawing.

We would like to point out the importance of cross bracing in a structure using this type of truss (in fact in all structures). The truss itself may be very strong, but if it is not properly cross braced it will simply collapse sideways.



ROUND-POLE SCISSORS TRUSS

CEMENT HESSIAN ROOF

This is a method of making a permanent roof that is less expensive and in some ways better than an iron roof. It has advantages, but it has disadvantages as well. The biggest advantage is that the material that you have to buy costs much less than an iron roof. Another advantage is that it is a natural insulator. This means that the house will be cooler down on the coast and warmer up in the highlands. Because it must be painted with a special paint you can choose what colour roof you want, white, gold, green or brown. But there are disadvantages also. The roof is heavy and can crack, so the building must be stronger and more rigid. A steep slope on the roof will help to overcome this. Also there is the work involved. It is more work to put a hessian/ cement roof on than an iron roof. But if you are hiring someone, then his wages stay in P.N.G. whereas with iron, most of the cost leaves the country.

How to build the roof

1. The roof can be put onto round poles, sawn timber, pipe or almost anything else. Just build the house as you normally would, except for three details:
 - (a) The slope must be fairly steep. It should be no less than 30° (7 in 12). The slope of a kunai or pitpit roof is suitable.
 - (b) Because the roof needs to be more rigid, the rafters should be slightly larger than normal. Instead of 2" diameter poles, use 2½", instead of 4" x 2" use 5" x 2" and so on.
 - (c) The purlins should be at no more than 3' - 0" spacing. This is also to make the roof more rigid.

2. After you have the rafters and purlins up, the next thing is the strapping. These are small pieces of wood that run down the slope of the roof on top of the purlins. They can be small poles 1" to 2" diameter, 2" x 1", arc mesh; or whatever. Whatever they are, they must be firmly attached to the purlins.

3. The next step is to stretch hessian tightly over the roof and staple or tie it to the strapping. Where two pieces of hessian meet, they must be stitched together. A needle for sewing up copra bags is good for this.

4. Next a layer of ½" mesh chicken wire is stretched over the hessian and also stapled or fastened to the strapping.

5. Now you are ready for the cement. Mix up 2 parts of sand to 1 part of cement with enough water to make the mix like thick soup. You should add some waterproofing chemical such as NON PORITE to the water. Follow the direction on the tin. When you have the sand, cement, water and NON PORITE well mixed, then paint it onto the roof. A large white-washing brush is best for this.

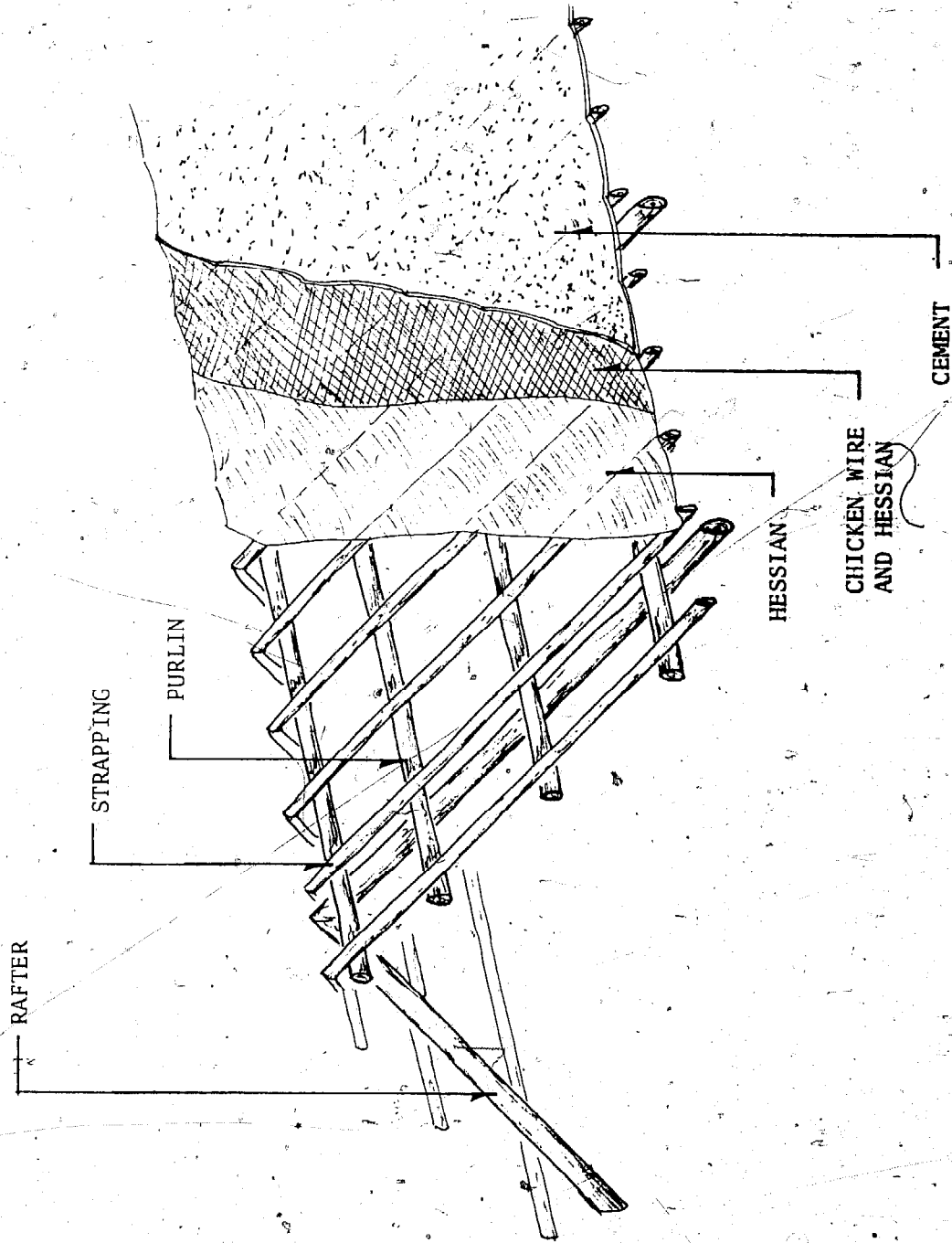
6. You will need to put on 5 or 6 coats of this cement, until the roof is about ¾" thick. Wait between putting on each coat until the last one has hardened for a few hours. It is very important that the roof be kept damp all of this time. Cement needs water to harden properly, if it is allowed to dry out, it will be very weak. As you are working, when some part of the roof starts to dry out, you must sprinkle some water on it to keep it damp.

7. After you have finished putting the cement on

the roof, you must still keep it damp for 4 more days. You can do this by spraying it with water, or you can cover it with grass and spray the grass. But it is important to keep it damp for at least 4 days.

8. Now the last step. As a final seal to keep the water out of the roof it must be painted. You should use a special cement paint for this. One of these is called BONGCOTE. You can buy it from MONIER CEMENT CO. They have several different colours so that you can pick the one you like.

9. That is all there is to it. If you do get any holes or leaks, you can patch them with more cement mixed up as before and then painted over with more BONGCOTE.



CEMENT HESSIAN ROOF

MANUAL OF RURAL WOOD PRESERVATION

This is a booklet which makes wood preservation available to the rural areas of P.N.G. It gives explicit instructions in a number of simple wood preservation techniques. All the methods described require only the sort of equipment available in rural areas, old fuel drums, rubber hoses and the like.

The chemicals required are also inexpensive and readily obtainable in Papua New Guinea.

This handbook is available from:

Forest Products Research Centre,
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