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Low Cost Housing: Prefabricated Panel System
Technical Bulletin No. 14

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**LOW COST HOUSING
PREFABRICATED PANEL SYSTEM**

**PAPUA NEW GUINEA
DEPARTMENT OF PUBLIC WORKS
BUILDING RESEARCH STATION**

TECHNICAL BULLETIN No. 14, MARCH, 1974.

LOW COST HOUSING
PREFABRICATED PANEL SYSTEM

PAPUA NEW GUINEA
DEPARTMENT OF PUBLIC WORKS
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TECHNICAL BULLETIN NO. 14
MARCH 1974.

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INTRODUCTION

To assist in providing accommodation for low income earners in Papua New Guinea this Bulletin outlines economies possible by using a prefabricated panel construction technique.

Prefabricated building can maximise returns in material, labour and money.

This Bulletin explains a simple technique through which reductions in materials and construction time can significantly reduce other building costs.

Selected plans utilizing this system are illustrated and relevant detail drawings are available on request.

Compiled by D.W.Brett Technical Assistant

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BOROKO
PAPUA NEW GUINEA.

PANEL SYSTEM

The prefabricated panel system minimises timber used, labour costs and erection time. The timber is basically 2" x 1" rough incorporated into 8' 0" x 4' 0" frames. The cladding comprises two sheets of seldo matting stapled back to back on one side of the timber frame, however there is little variation in cost using plywood, fibro or hardboard.

Panels are externally clad prefabricated sections of walls assembled on site. The walls sit on a conventional floor and are bolted to form an integral part of the building. Three alternative roof designs are included.

Utilizing this system a house may be completed in two weeks.

The four panels used are:

- (1) Wall Panel
- (2) Door Panel
- (3) Single shutter panel
- (4) Double shutter panel

The timber frames being fabricated on a simple jig.

THE JIG

The following procedure should be followed in the construction of the Jig.:

----- The dimensions of the wall panel (reference detail (1)) are scribed on an 8' 0" x 4' 0" sheet of 3/4" plywood.

----- Strips of 2" x 1" are nailed as stops on either side of the lines using the photograph as a guide.

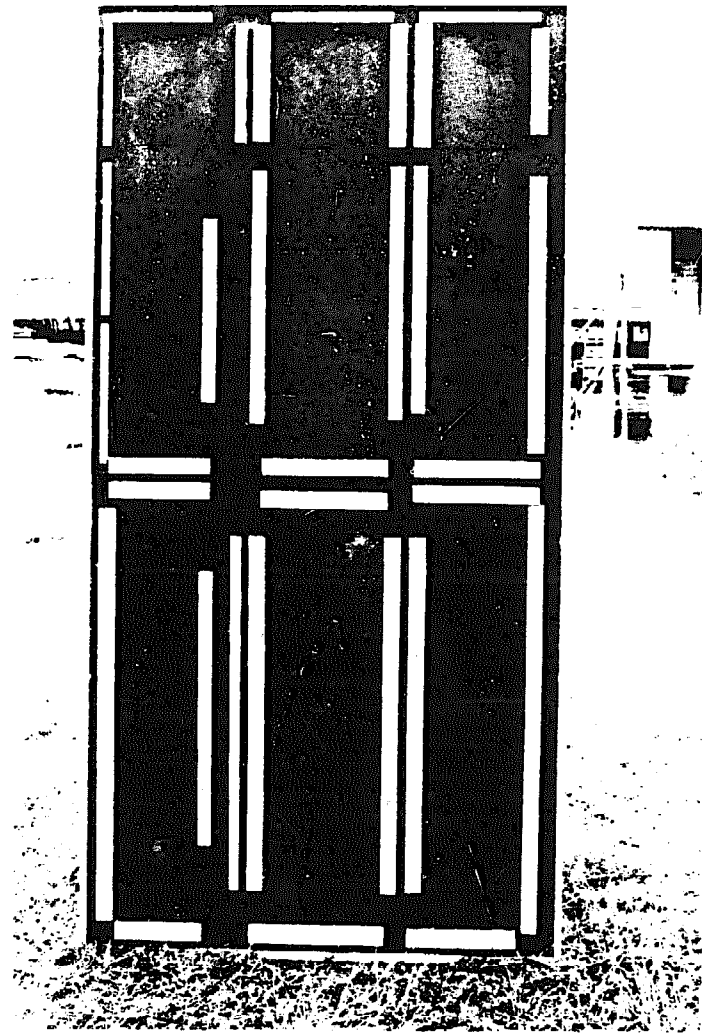
----- The procedure outlined for the wall panel is completed for the other three panels. Reference details (2), (3) and (4).

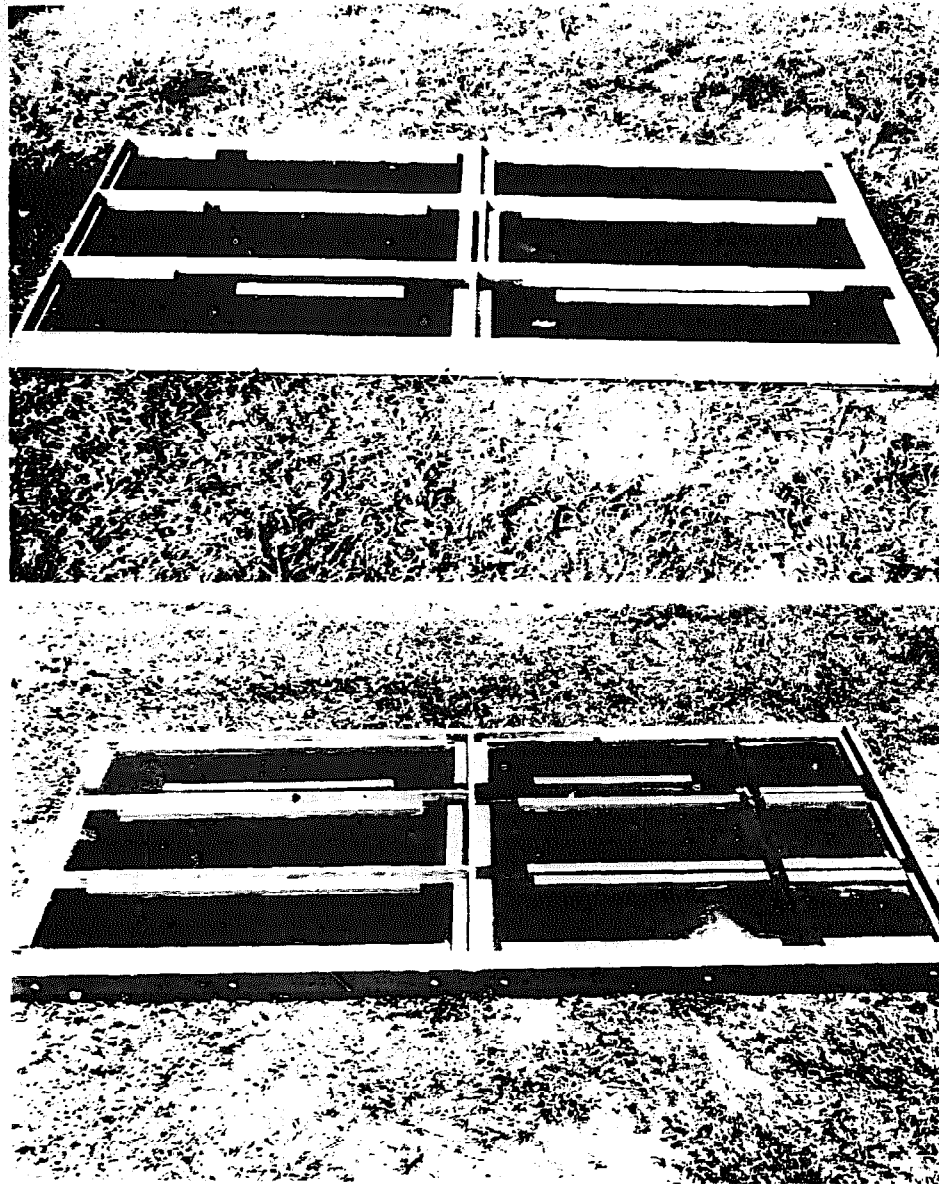
----- The plywood sheet is planed accurately to 8' 0" x 4' 0" lengths of 3" x 1" are nailed around the edge of the sheet so that there is a lip of 3/4" above the plywood surface.

----- To strengthen the Jig, a frame work of 3"x2" is fixed under the plywood sheet.

----- For clarity areas where the timber frames lie should be painted a distinctive colour.

----- Shutters are not fabricated in this jig.





CONSTRUCTION OF FRAME

The Jig is placed flat on an earth or concrete floor or supported on carpenter horses.

Timber is cut to size working from details (1), (2), (3) and (4).

Precut lengths of 2" x 1" are positioned in the jig and nailed to complete a frame .

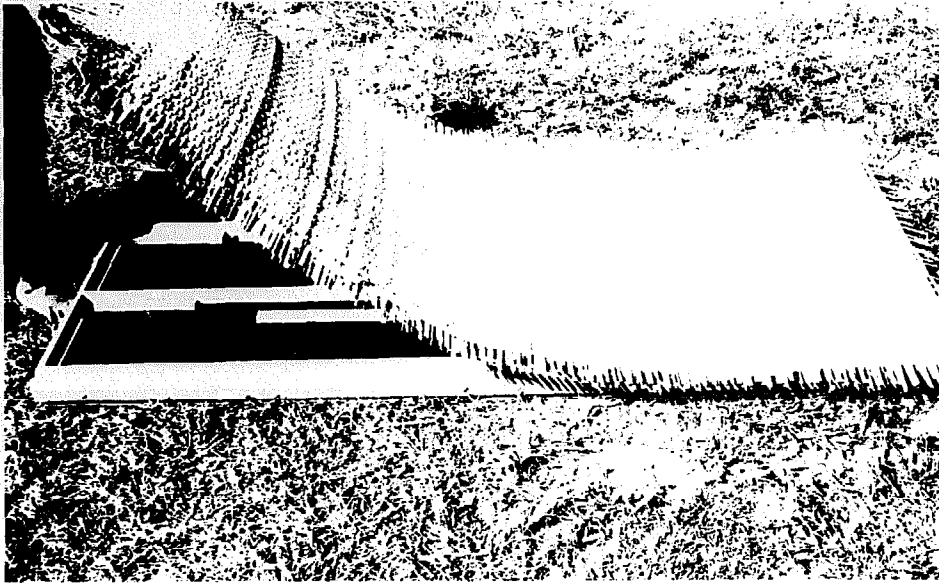
In the fabrication of a wall, panels are bolted to the floor and to each other using 3/8" bolts. To maintain uniformity, template holes are drilled in the jig in positions indicated by the details.

Where any two or more panels meet at right angles (i.e. at all corners), bolts tying the panels require two distinct levels. A calculated number of the variant panels are drilled on the jig using a variant set of holes on one side of the jig.

The Jig has:

- 3 corresponding template holes on either side
- 3 variant templete holes on one side
- 2 template holes in the base.

All template hole positions are noted in the details.



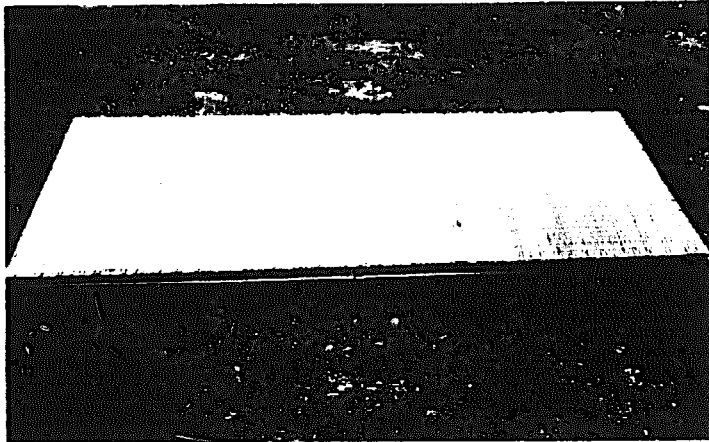
ATTACHMENT OF SELO

Two sheets of selo matting are stapled back to back on one side of the frame. Photographs 4, 5 and 6.

Staples used to fix the selo are $\frac{1}{2}$ " brass or galvanised of a type fitting the bostich stapling machine or similar.

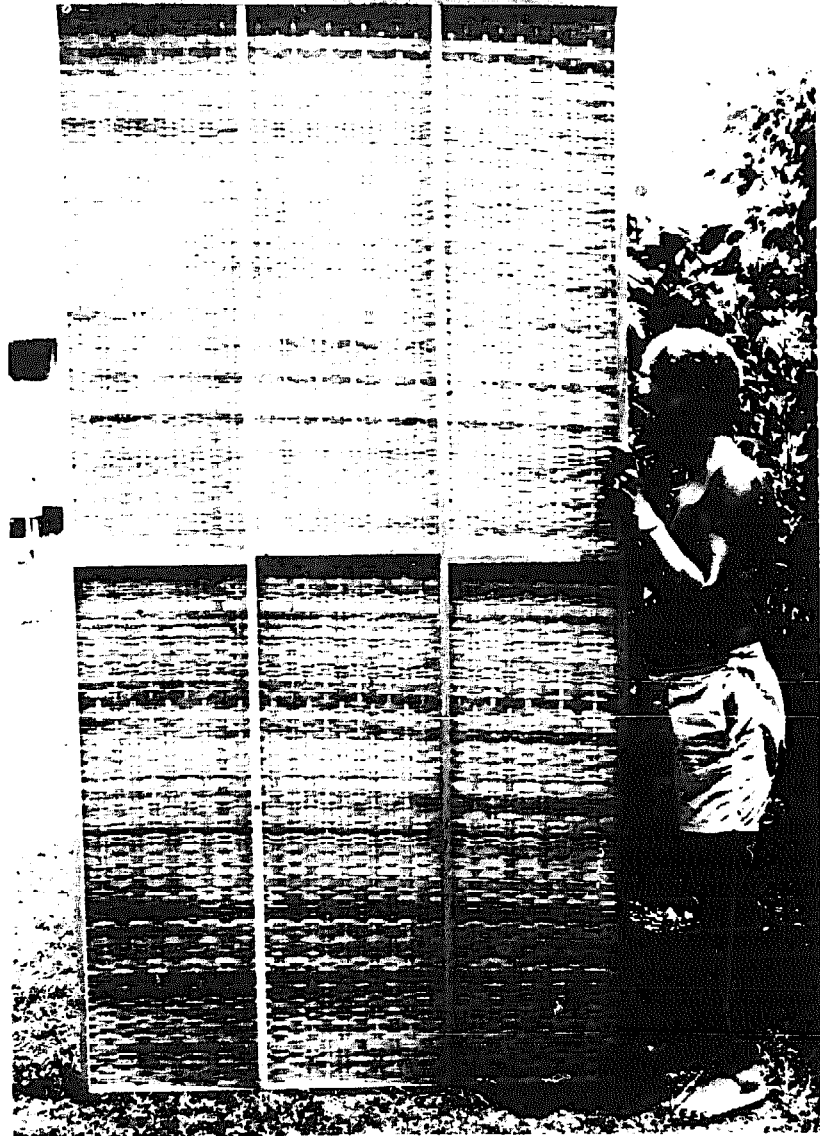
Staples are shot into the frame at regular intervals not more than 6 inches apart. The selo is trimmed flush with the frame. Photograph 7.





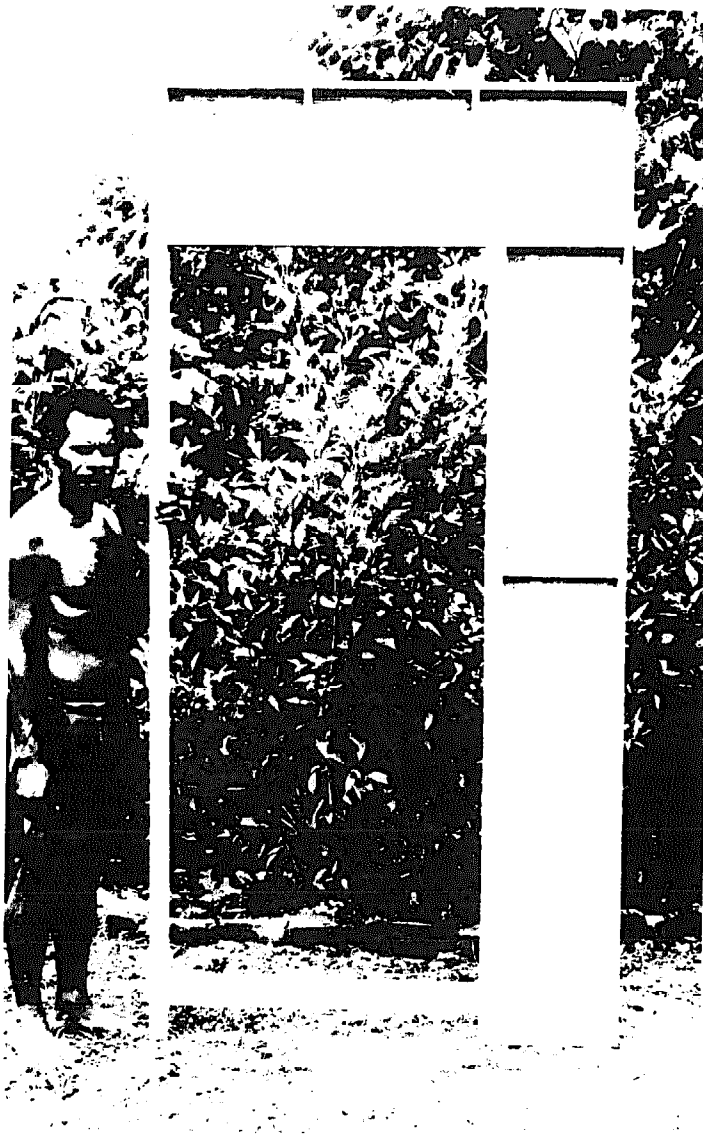
THE WALL PANEL

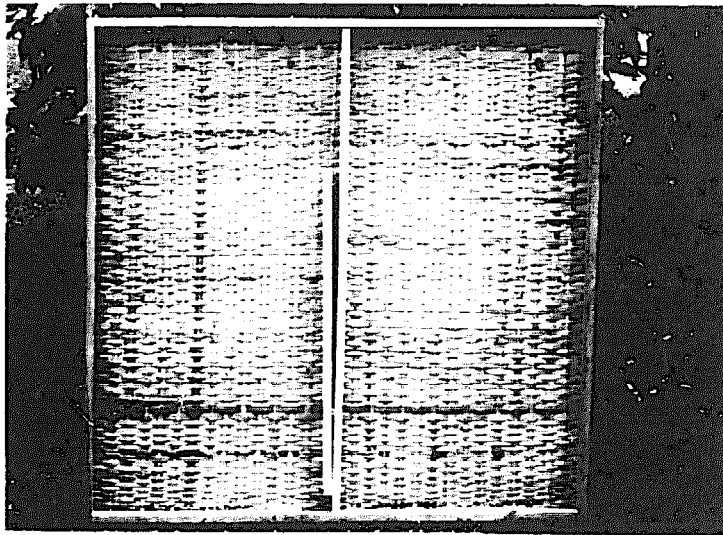
Dimensions are given in
detail (1).



THE DOOR PANEL

Dimensions are given
in detail (2).



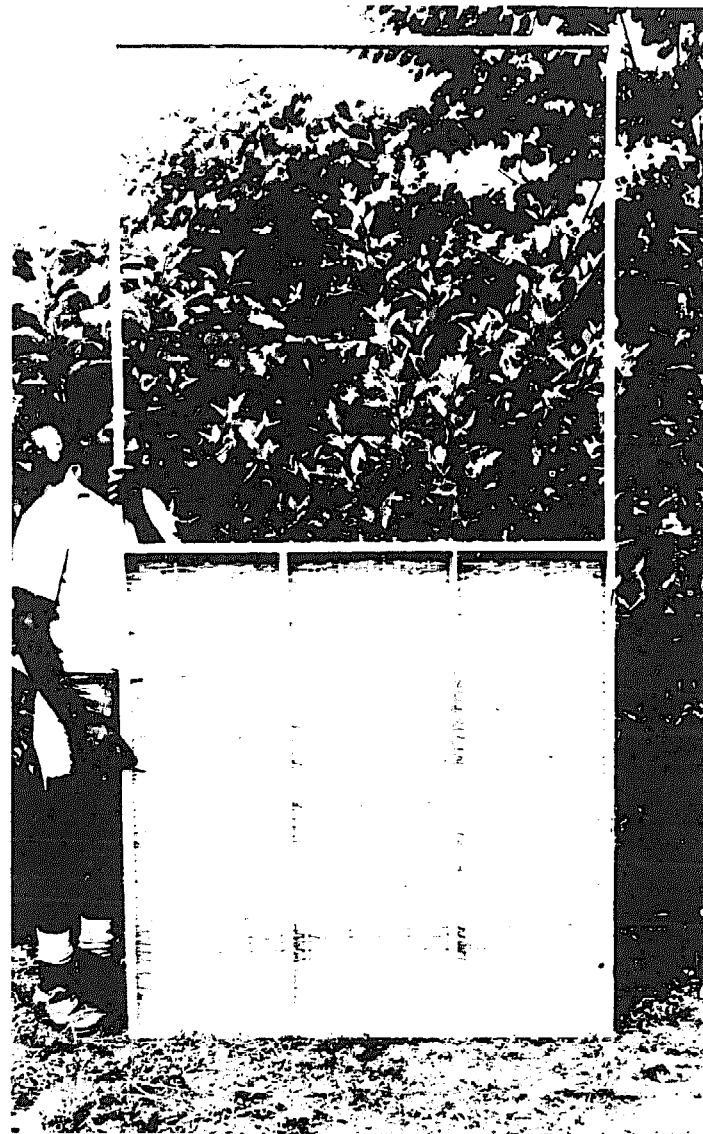


THE SINGLE SHUTTER PANEL

Dimensions are given in detail (3).

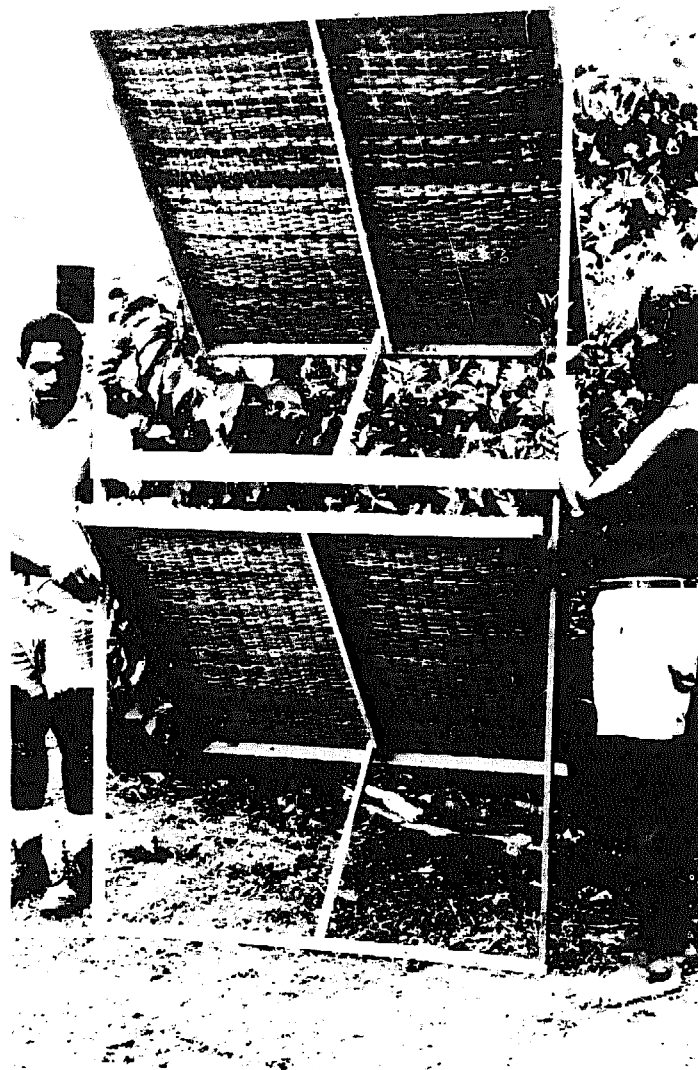
The shutter is assembled to detail (5). The cladding is attached as outlined on page 5. Cover strips are nailed according to the detail.

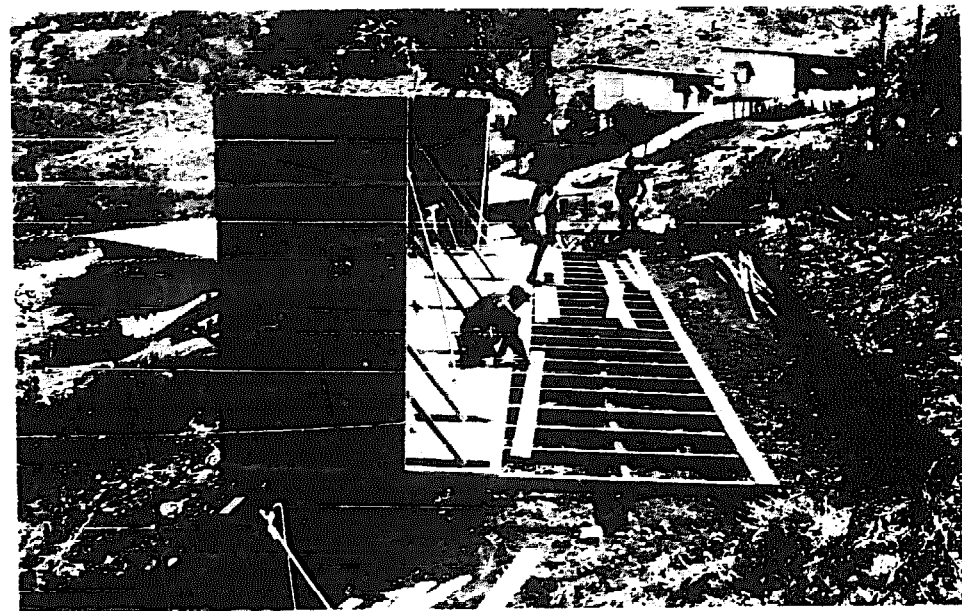
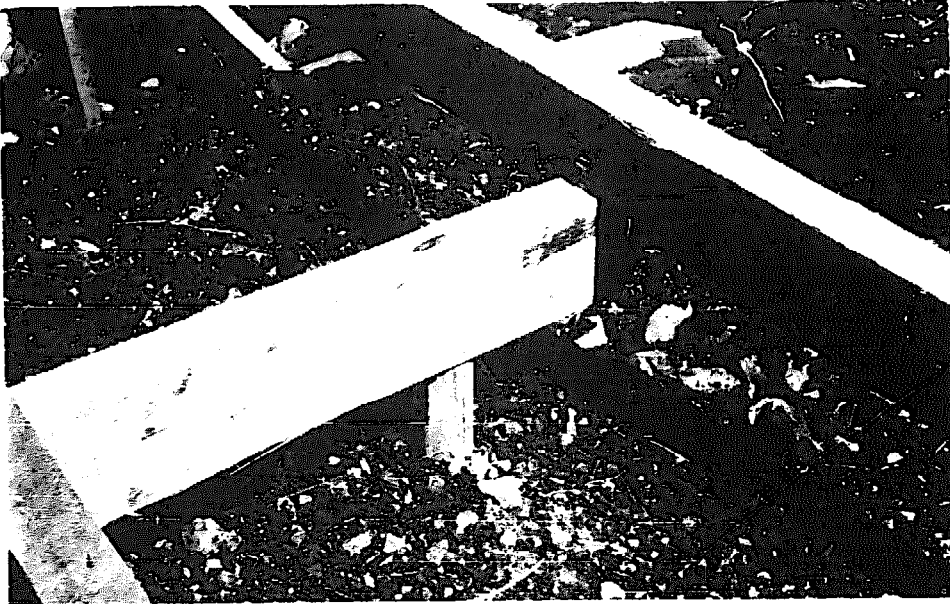
A 2" x 1" stay is cut approximately 2' 6" long and bolted to the centre support of the shutter. The hinged end is rounded and the other shaped to rest on the centre rail when the shutter is open. Photograph 15.



THE DOUBLE SHUTTER PANEL

Dimensions are given
in detail (4).





CONSTRUCTION TECHNIQUES

EXCAVATION is necessary when buildings on a steep site to the extent of 5'0" from the side of the house.

FOUNDATION details are found on appendix 'B' detail (18) refers to the fixing of bearer to stump.

FLOOR JOISTS (at 2'0" centres) are nailed as shown in photograph 16.

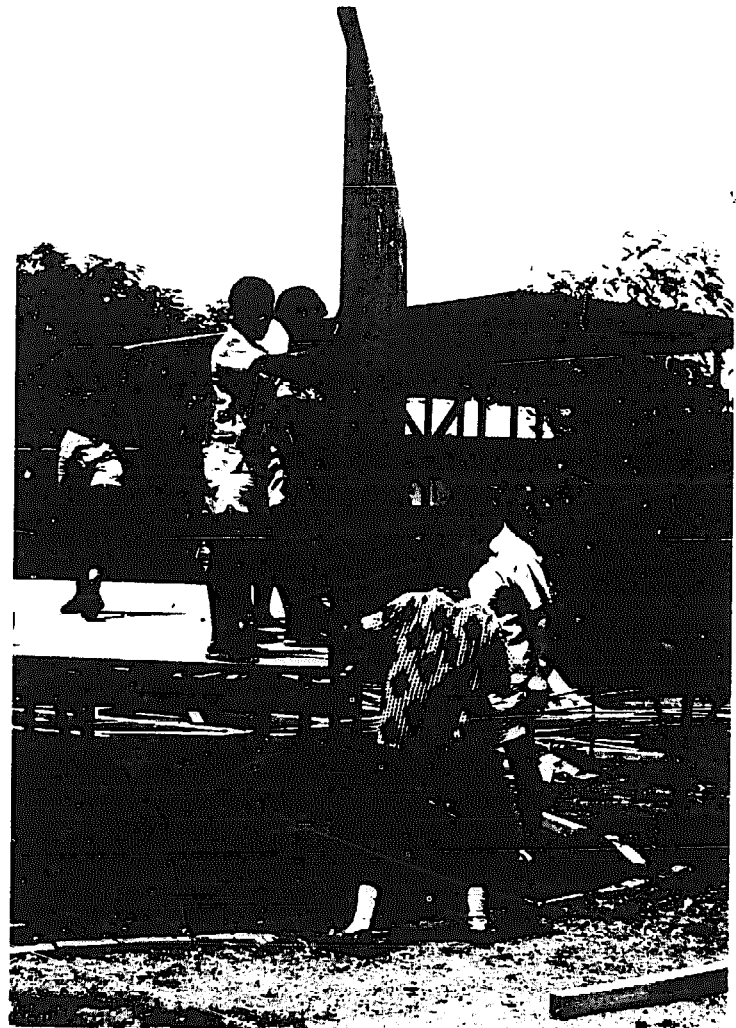
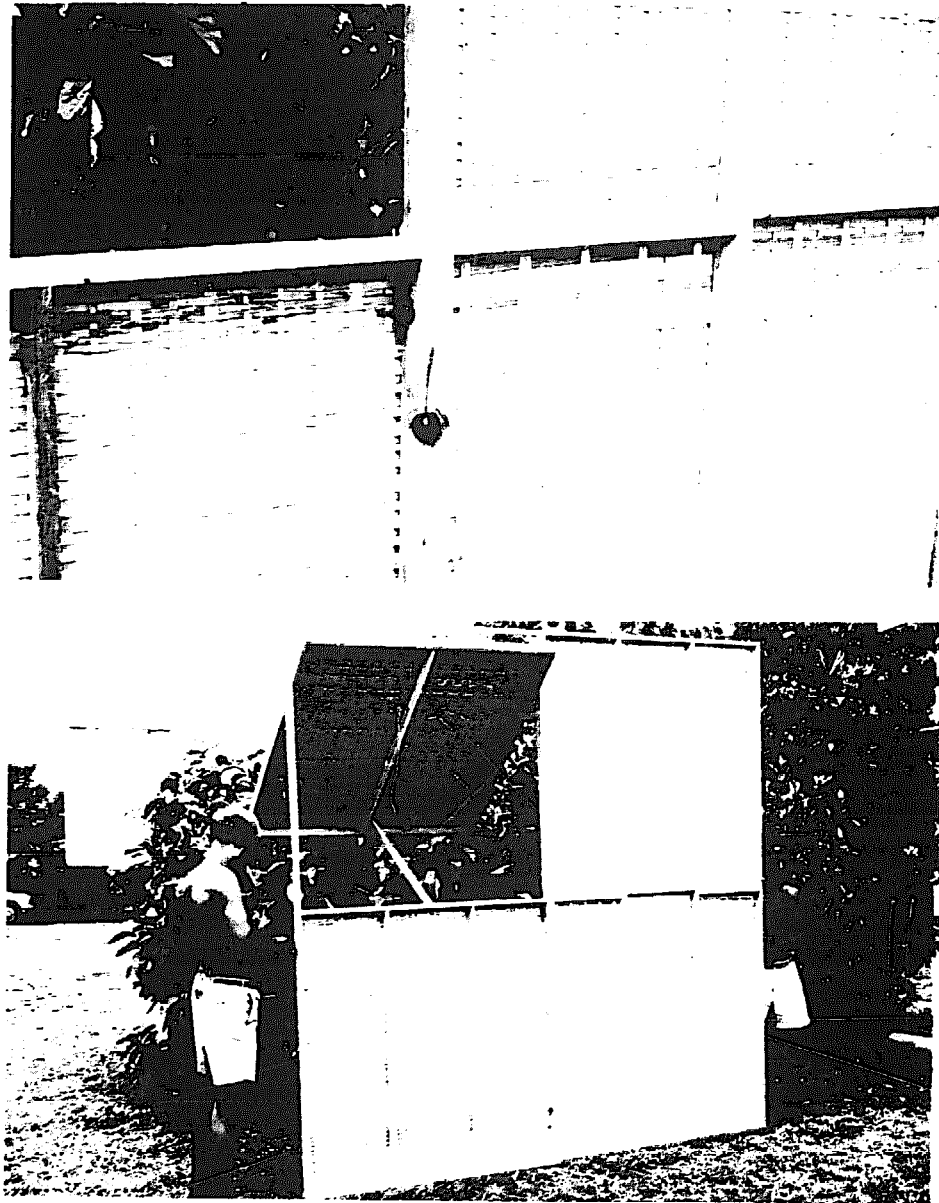
FLOORING (tongue and groove 4" x 1") is fixed prior to the erection of walls as indicated.

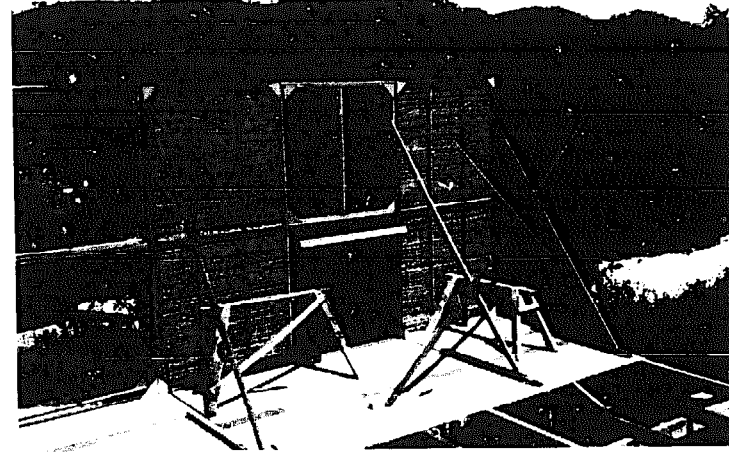
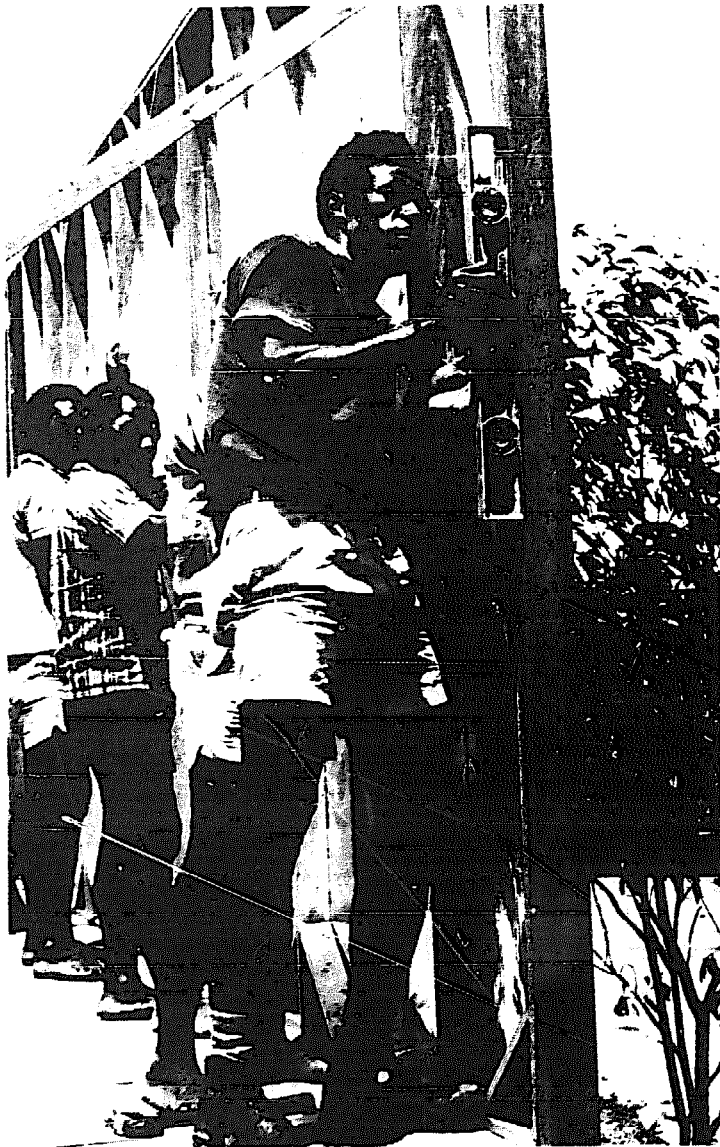
WALL PANELS, SHUTTER PANELS AND DOOR PANELS comprising a single wall are positioned side by side on the floor. The panels are butted together and bolted. Photographs 18 and 19.

CORNER POSTS (2"x2") are bolted on either end of the wall.

SHUTTERS are hinged on the bolts that fix adjacent panels. Where shutter panels butt, 5" bolts are required.

BOLT POSITIONS (reference page 4) are detailed showing the recessing of bolt heads and outs where required.





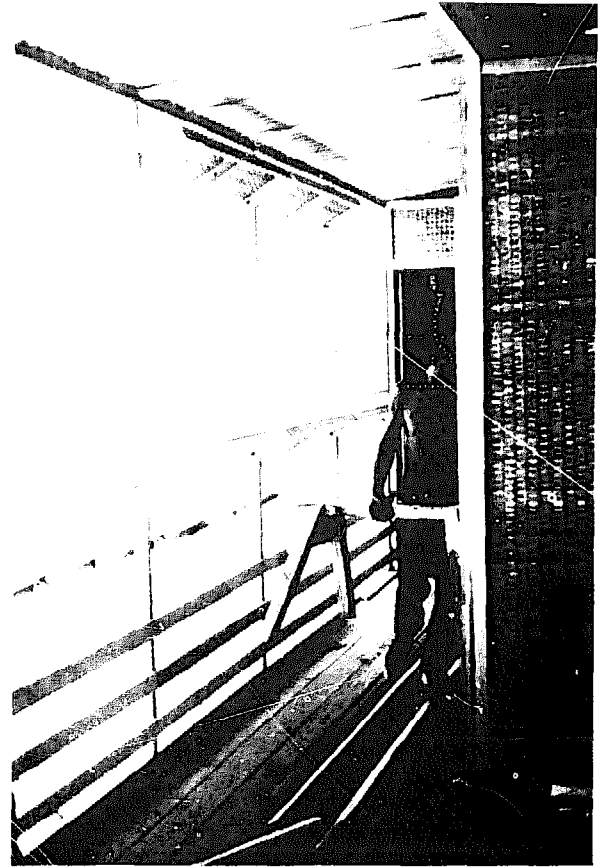
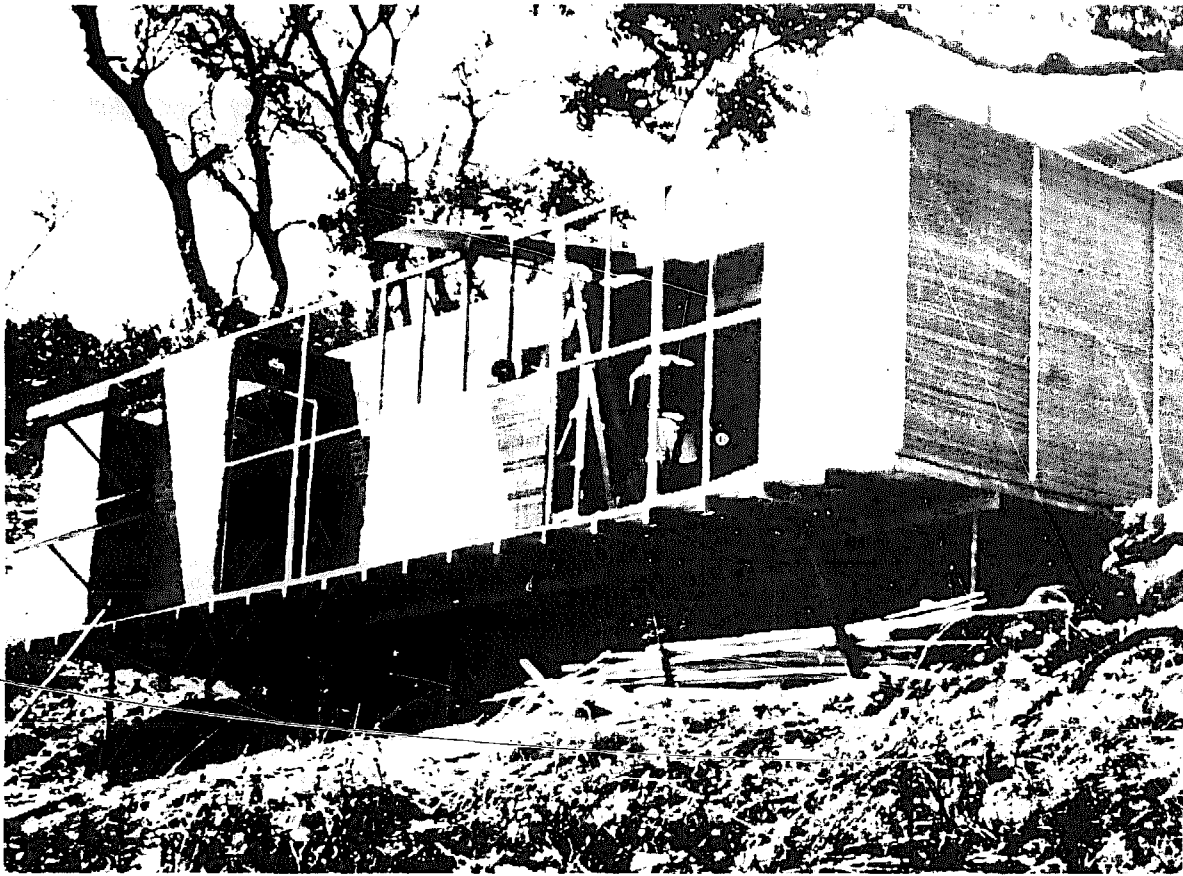
CONSTRUCTION TECHNIQUES (CONT.)

TOP PLATES (2"x1") are nailed along the top of the wall sections.

THE WALL is lifted up into position and bolted through the floor. Photograph 20.

TEMPORARY BRACES are employed until all the walls are upright. Photograph 22.

A LEVEL CHECK is carried out as the bracing is nailed. Photograph 21.



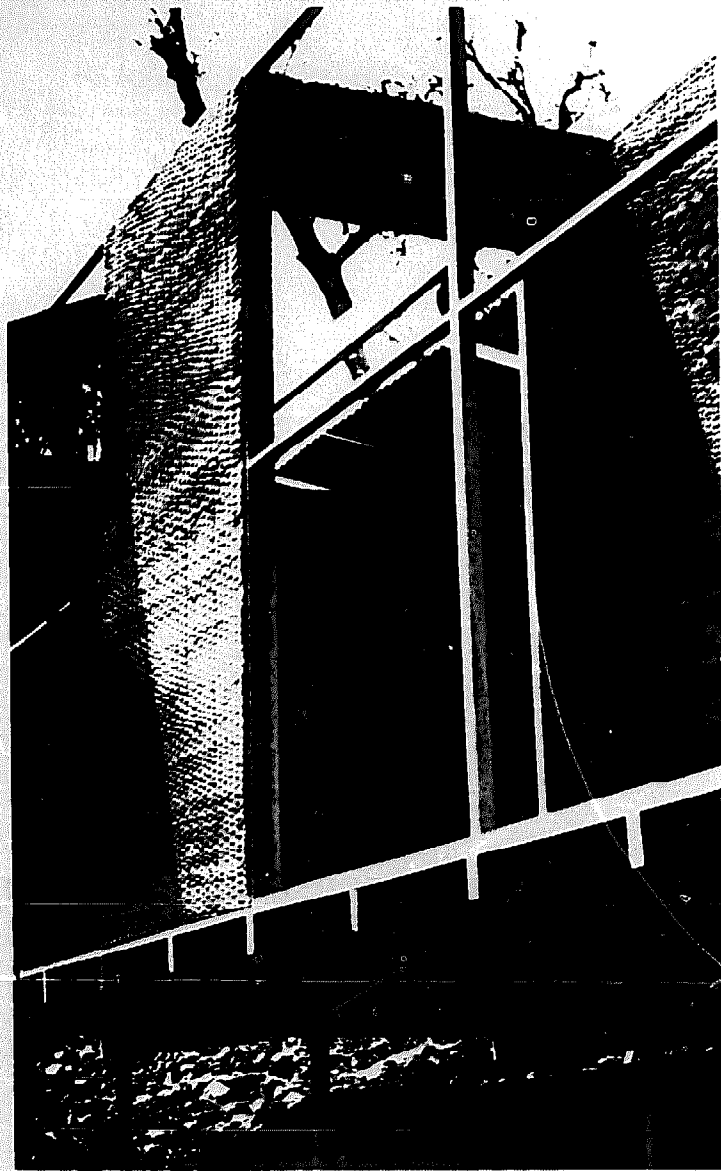
CONSTRUCTION TECHNIQUES (CONT.)

CLADDING (Seio matting) is applied to the framework before erection unless the material is unavailable at that time.

COVER BATTENS are nailed where seio sheets meet, after the panels have been bolted.

3 SAFETY RAILS run the length of the shuttered wall of R5 19 A 62. Photograph 24.





CONSTRUCTION TECHNIQUES (CONT.)

INTERIOR PARTITIONS are bolted in position as required.

COVER STRIPS are secured on all interior partitions.

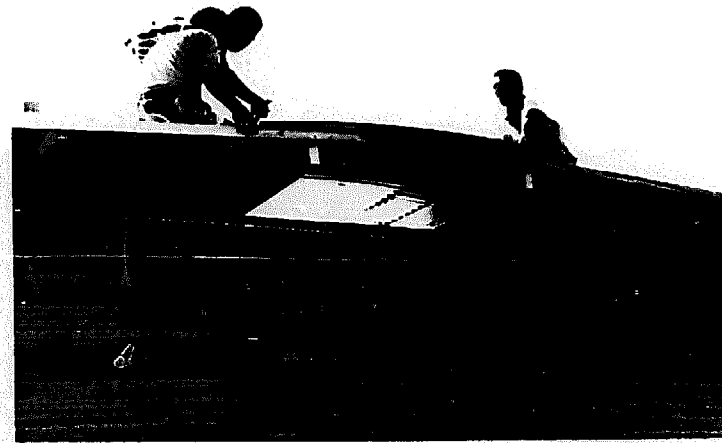
PURLINS are run the length of internal walls where possible. Photograph 26.

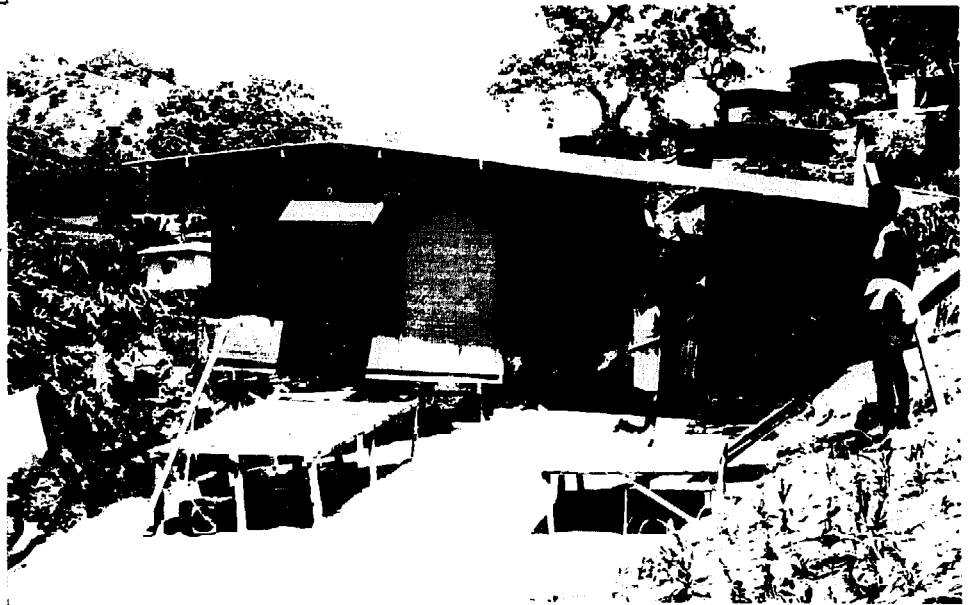
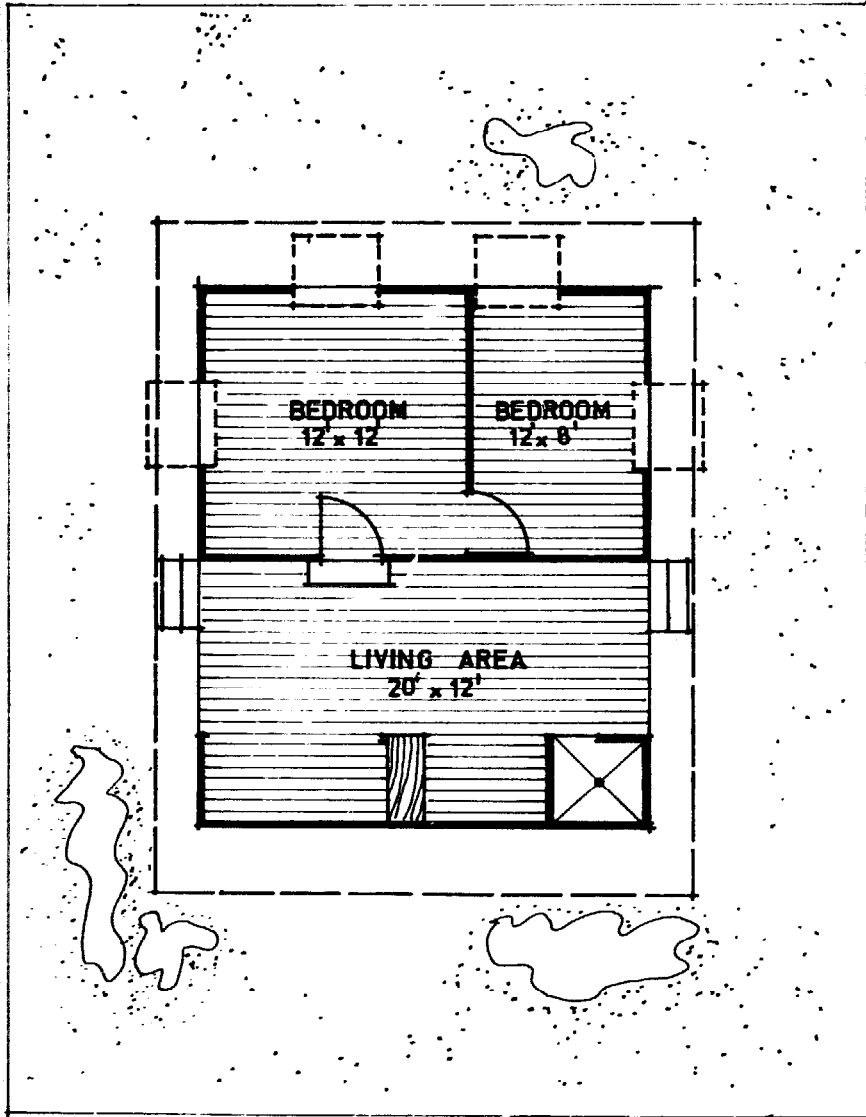
SISALATION is nailed to the purlins.

SINGLE SHEETS OF C.G.I. (corrugated galvanised iron) are spanned across the building and nailed to purlins and top plates.

AN ALTERNATIVE ROOF STRUCTURE (1) is detailed on Appendix 'A'

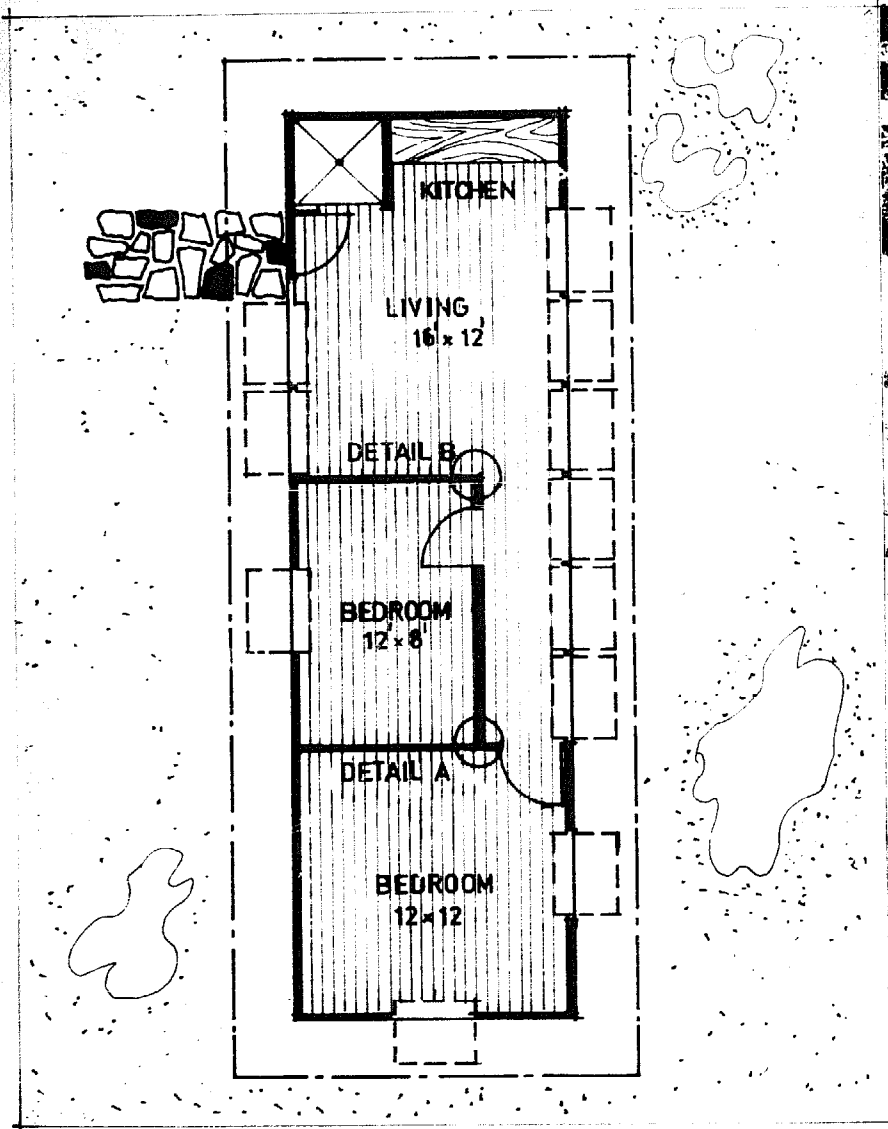
AN ALTERNATIVE ROOF (2) is illustrated below. Photograph 27.





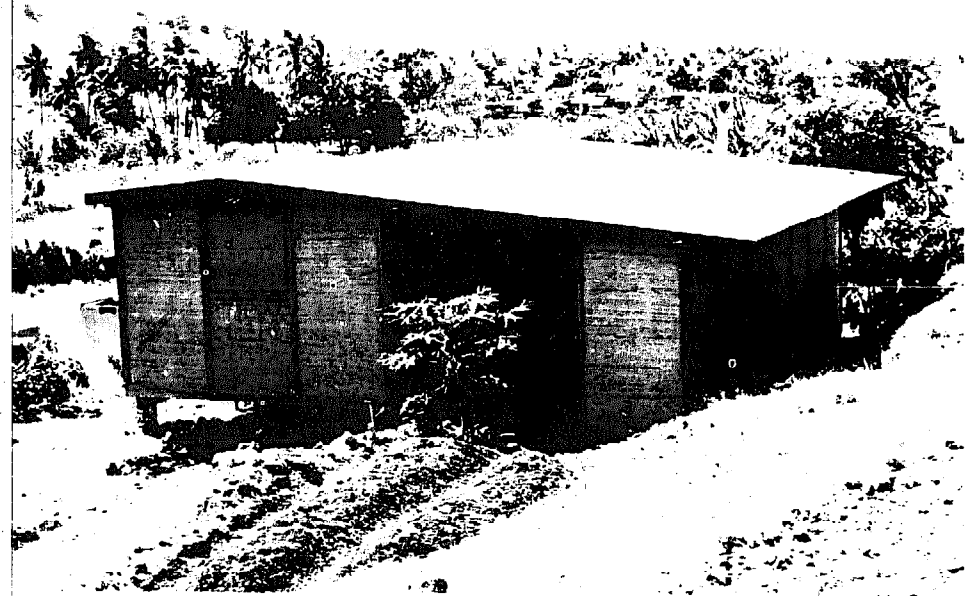
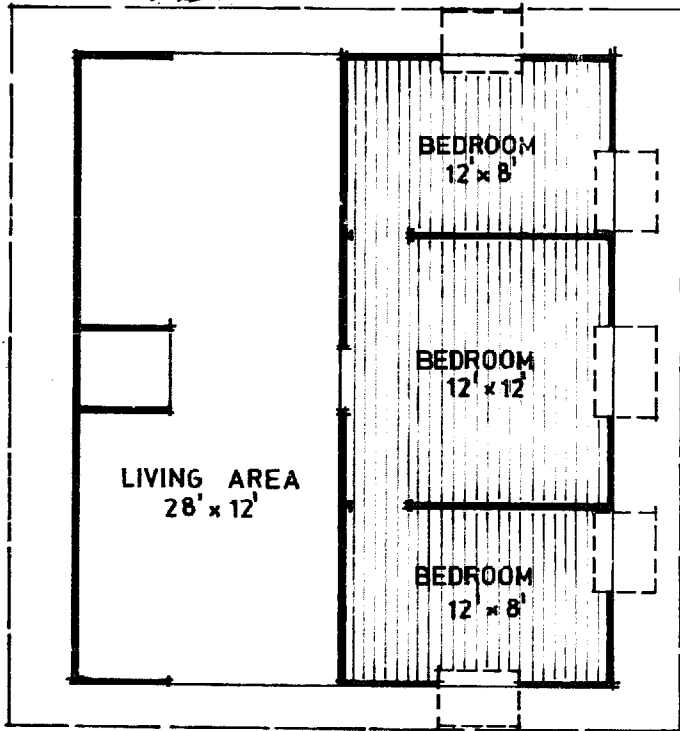
RS 19A/56
AREA 490 SQUARE FEET

1



RS 19 A/62
AREA 506 SQUARE FEET

2



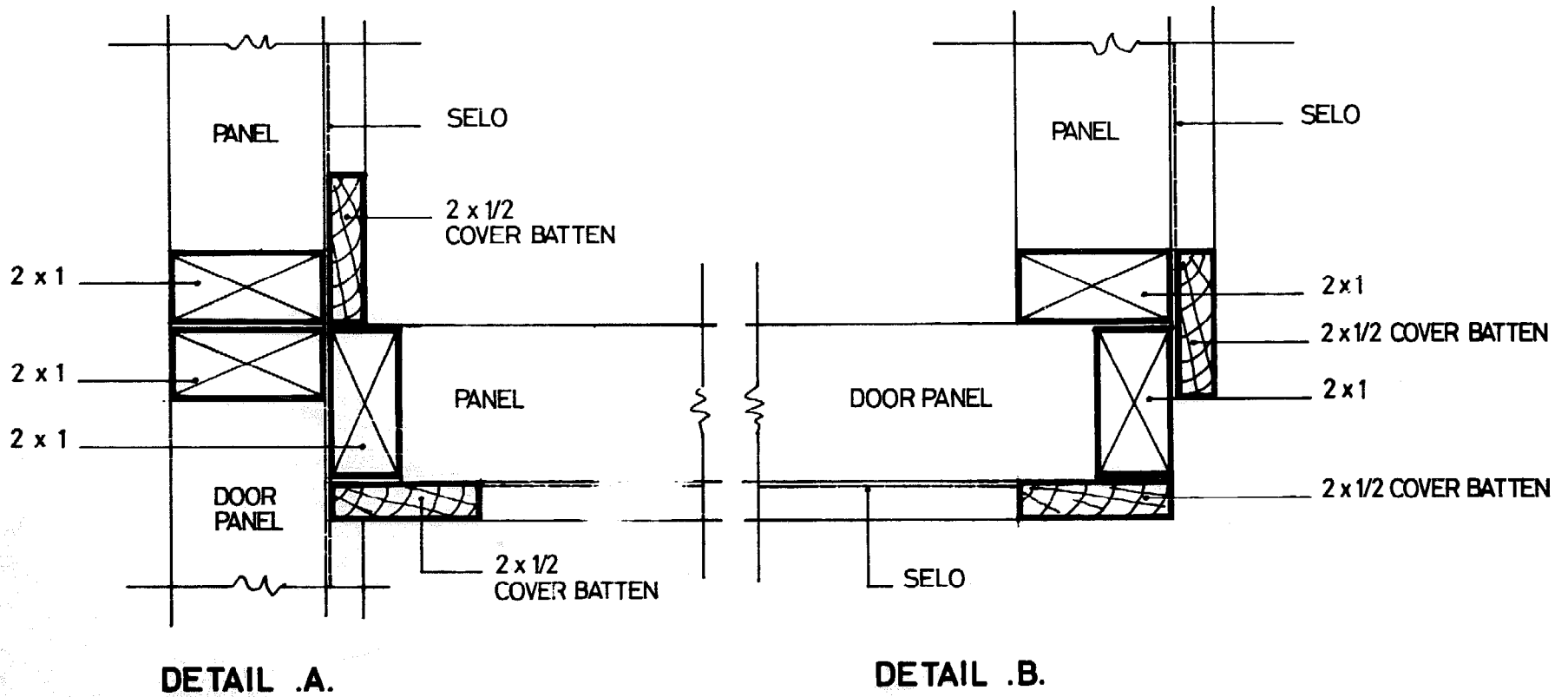
RS 19A/63
AREA 690 SQUARE FEET

3

LIMITATIONS OF SYSTEM

Though not a true module system, the technique detailed here can be used freely for the 3 house designs included with one exception:

- RS 19 A 62
- Smaller bedroom
- The wall containing a door panel is modified as shown below in the two details. The details correspond where shown on the plan, page 16.

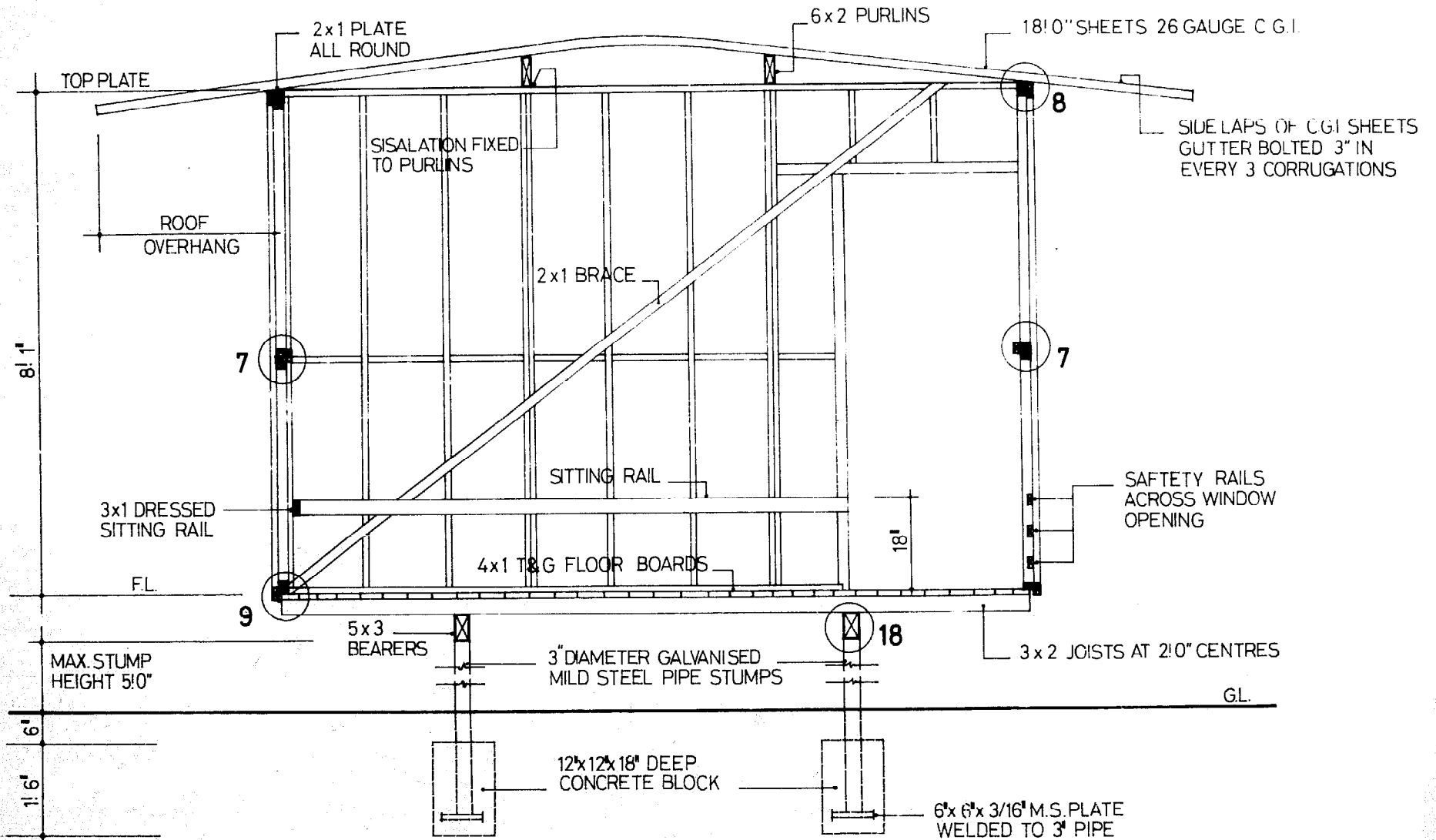


Comparative Costing of RS 19 A 62
 Comparing the prefabricated panel
 system with conventional construc-
 tion. Cost in dollars.

	CONVENTIONAL			PANEL SYSTEM			REMARKS
	MATERIALS	WITH LABOUR	PER SQ.	MATERIALS	WITH LABOUR	PER SQ.	
Floors (5 square)	213.50	427.00	85.40	213.80	374.60	74.92	Conventional: 4"x3" Bearers at 5'0"centres 3"x2" Joists at 2'0" centres 3 rows of 2" pipe piers.
Walls (132 Lineal Feet)	287.00	574.00	4.35 per L.F.	246.00	328.00	2.48	About \$30 in material costs is saved if flat asbestos cement sheeting is used. Labour in constructing panels is not included however should not be more than \$25.
Roof (5 square)	160.00	320.00	64.00	160.00	320.00	64.00	An alternative roof structure is given on page 21, when requires more timber and greater labour costs.
TOTAL	660.50	1321.00	264.20	619.80	1022.60	204.52	NOTE: Timber cost \$18/100 super ft. H.W.rough no overhead costs or sitework costs are included

TYPICAL CROSS SECTION

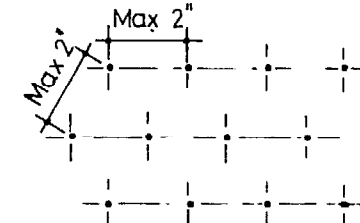
APPENDIX .A.



ALTERNATIVE ROOF STRUCTURE NAILED TIMBER TRUSS

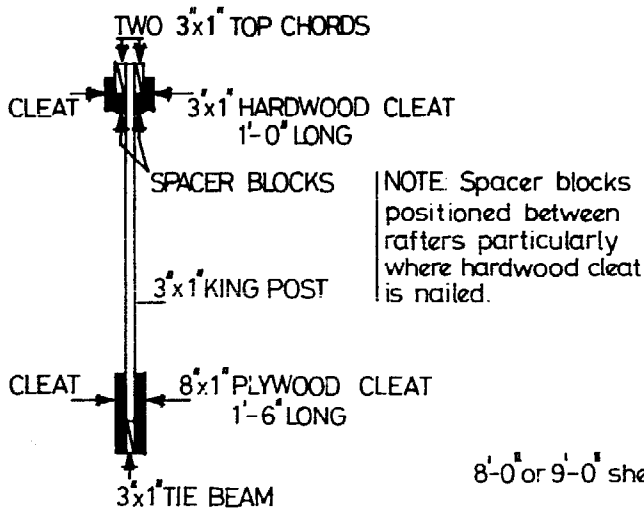
APPENDIX A.

(TRUSSES ARE ERECTED AT 8'-0" INTERVALS)

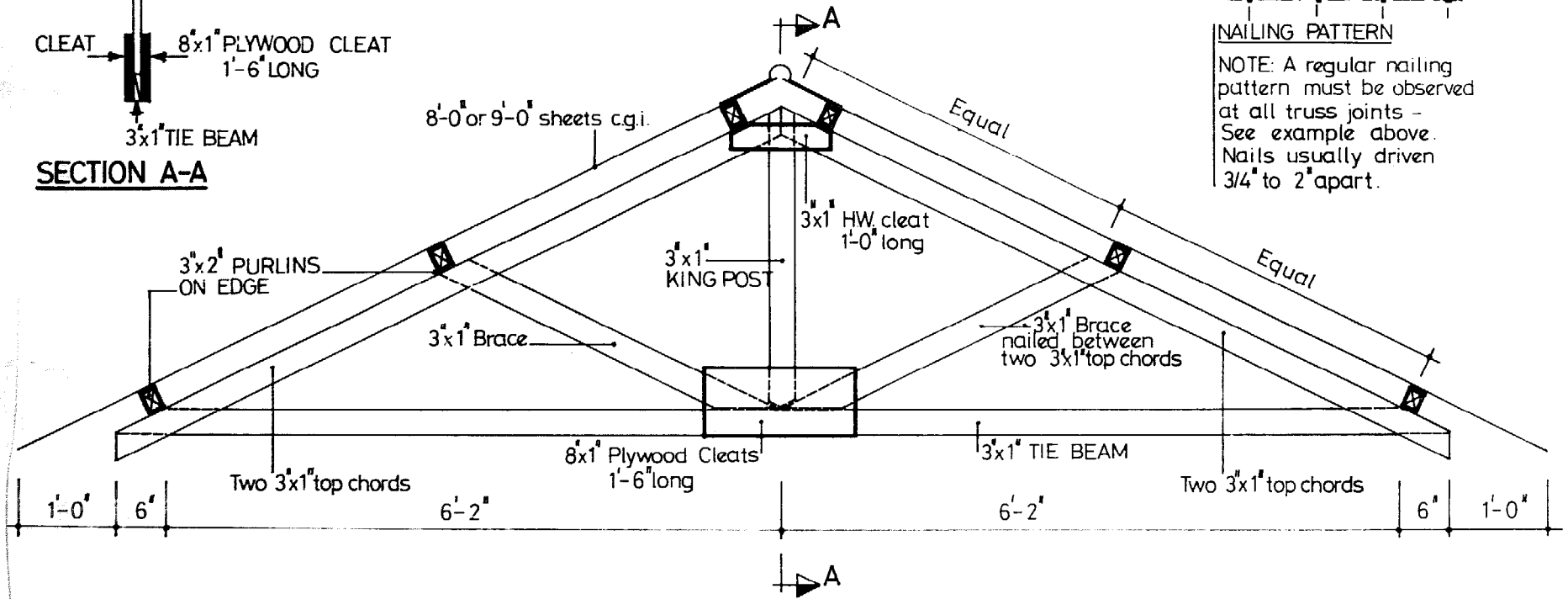


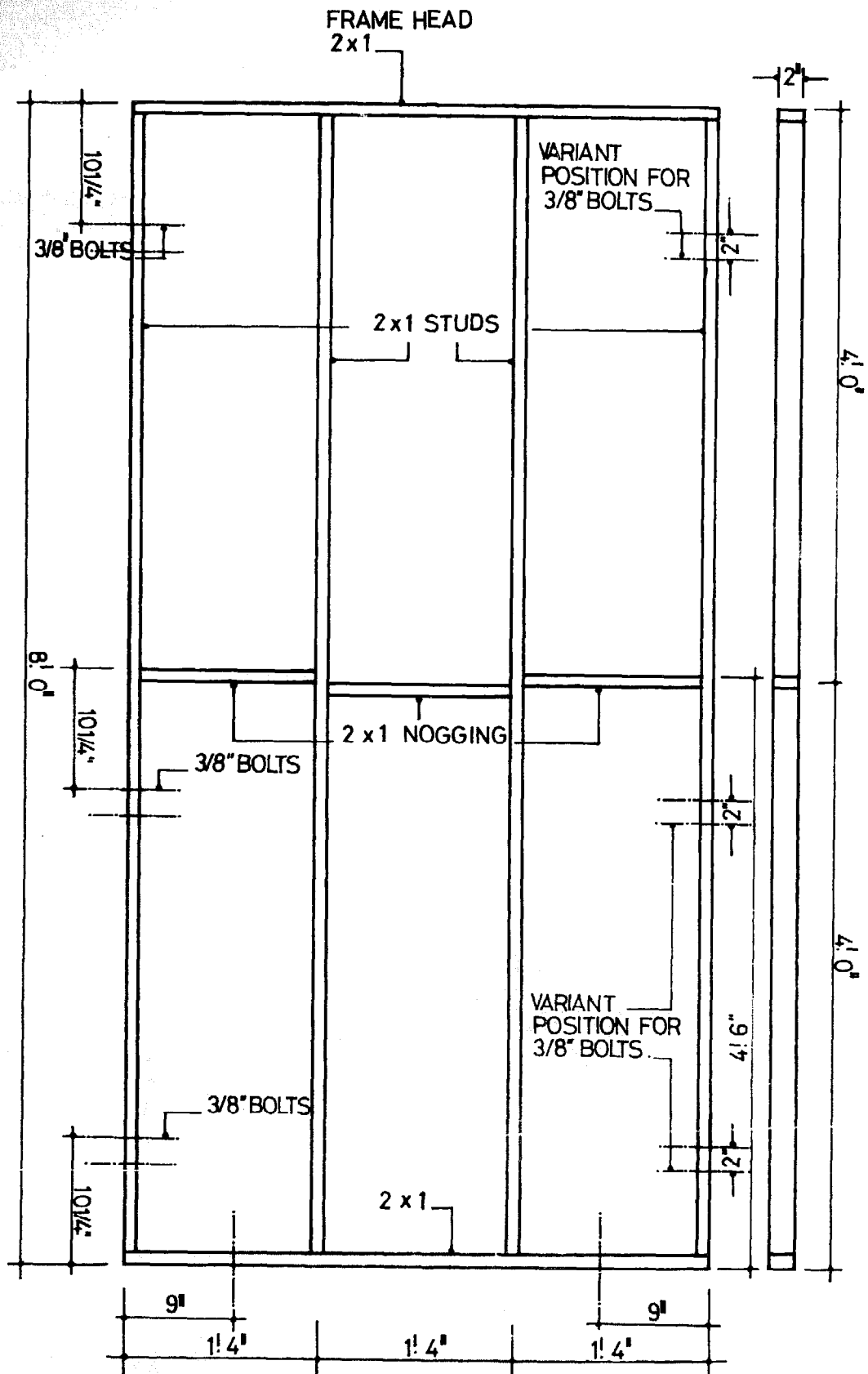
NAILING PATTERN

NOTE: A regular nailing pattern must be observed at all truss joints - See example above. Nails usually driven 3/4" to 2" apart.



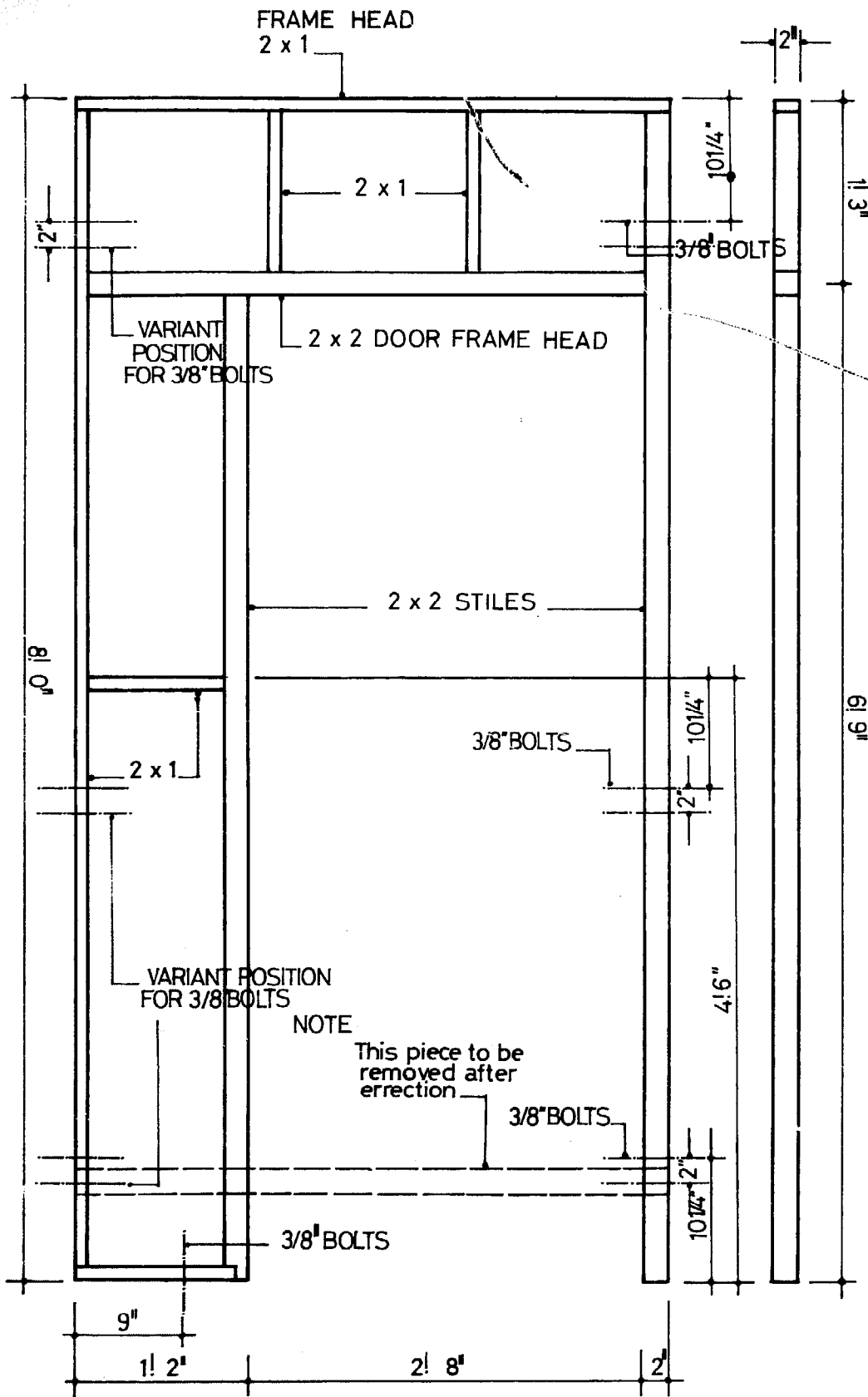
SECTION A-A





APPENDIX B.

WALL PANEL	Scale: 1 inch = 1' 0"	DETAIL NO. 1
	Drawn: B. Nagau	

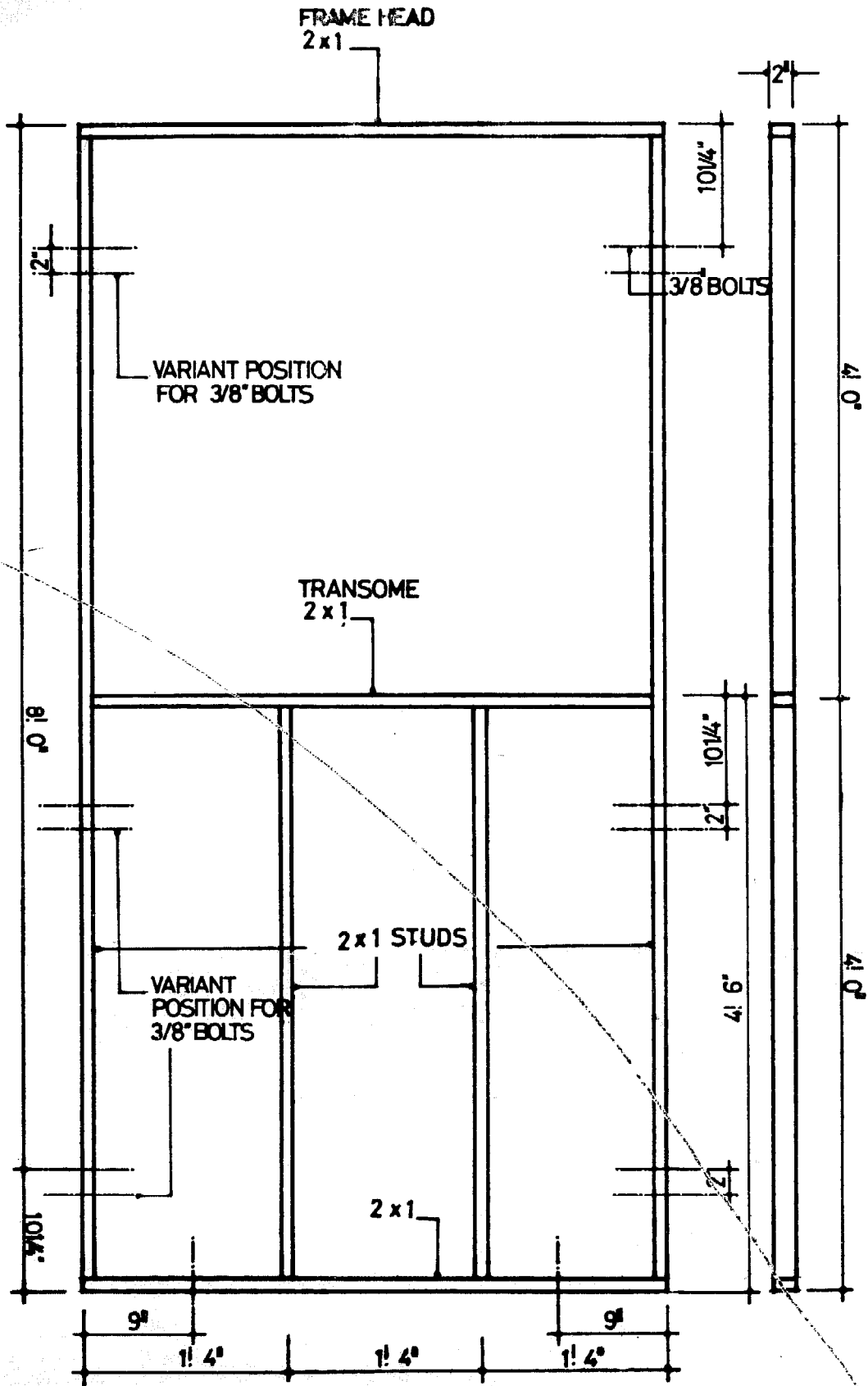


DOOR PANEL

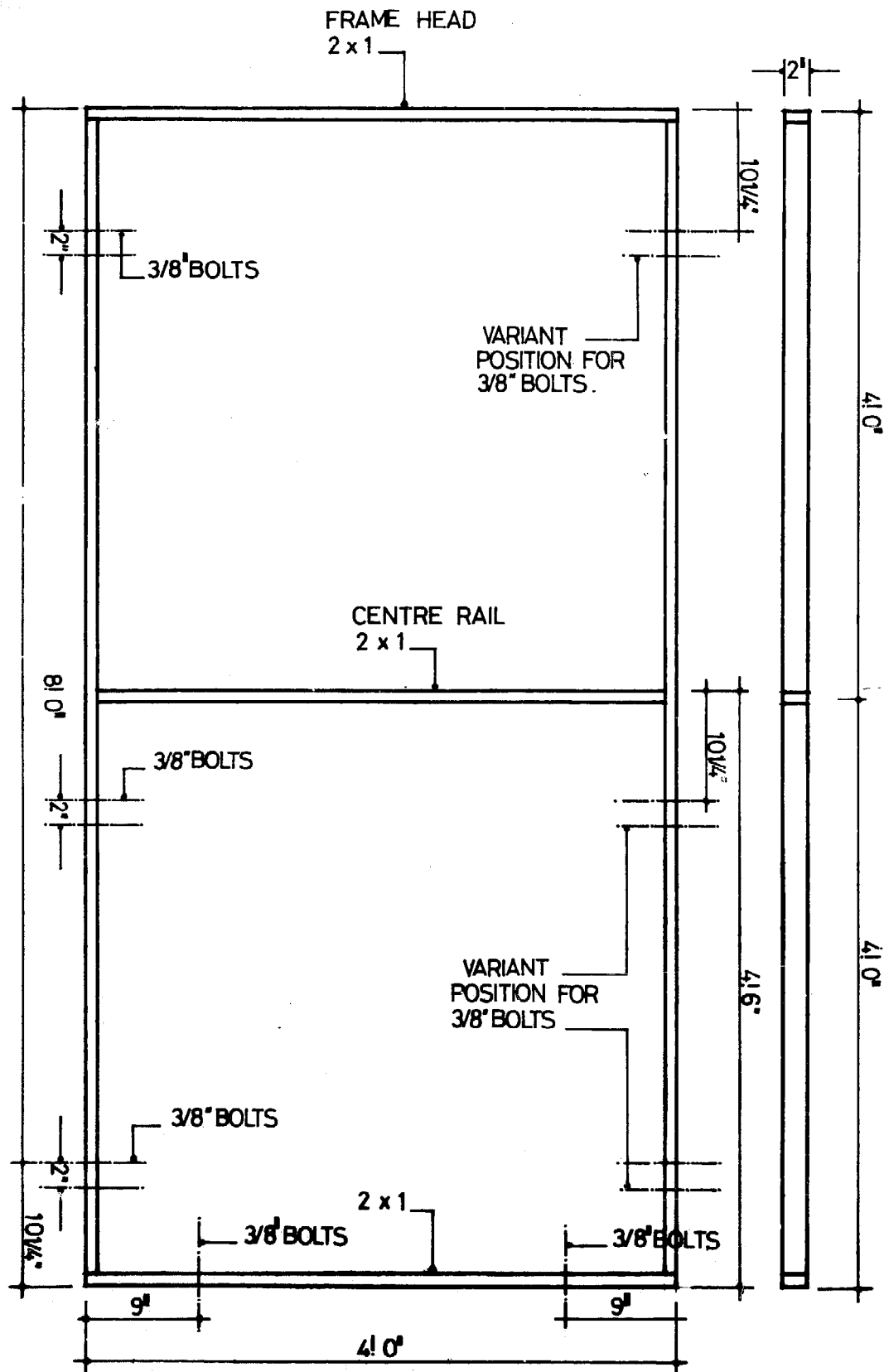
Scale:
1 inch = 1'0"

Drawn:
B. Nagau

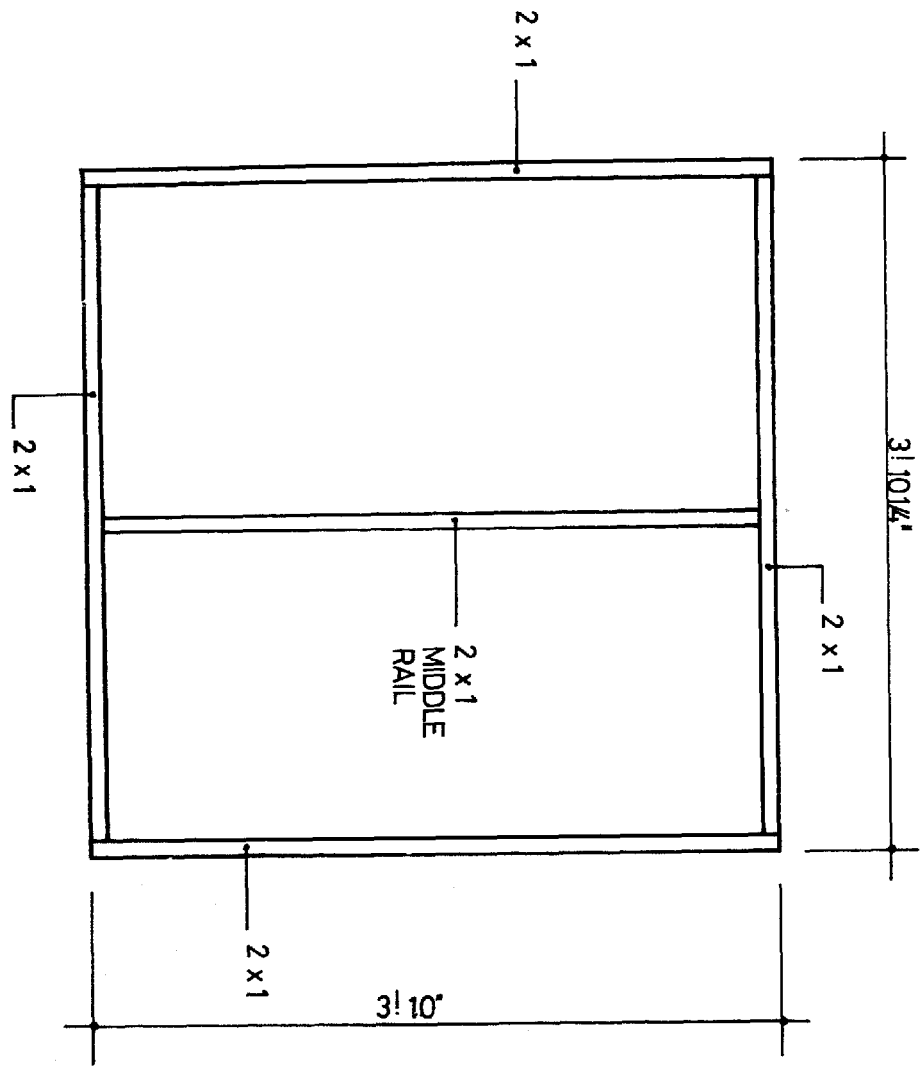
DETAIL NO. 2



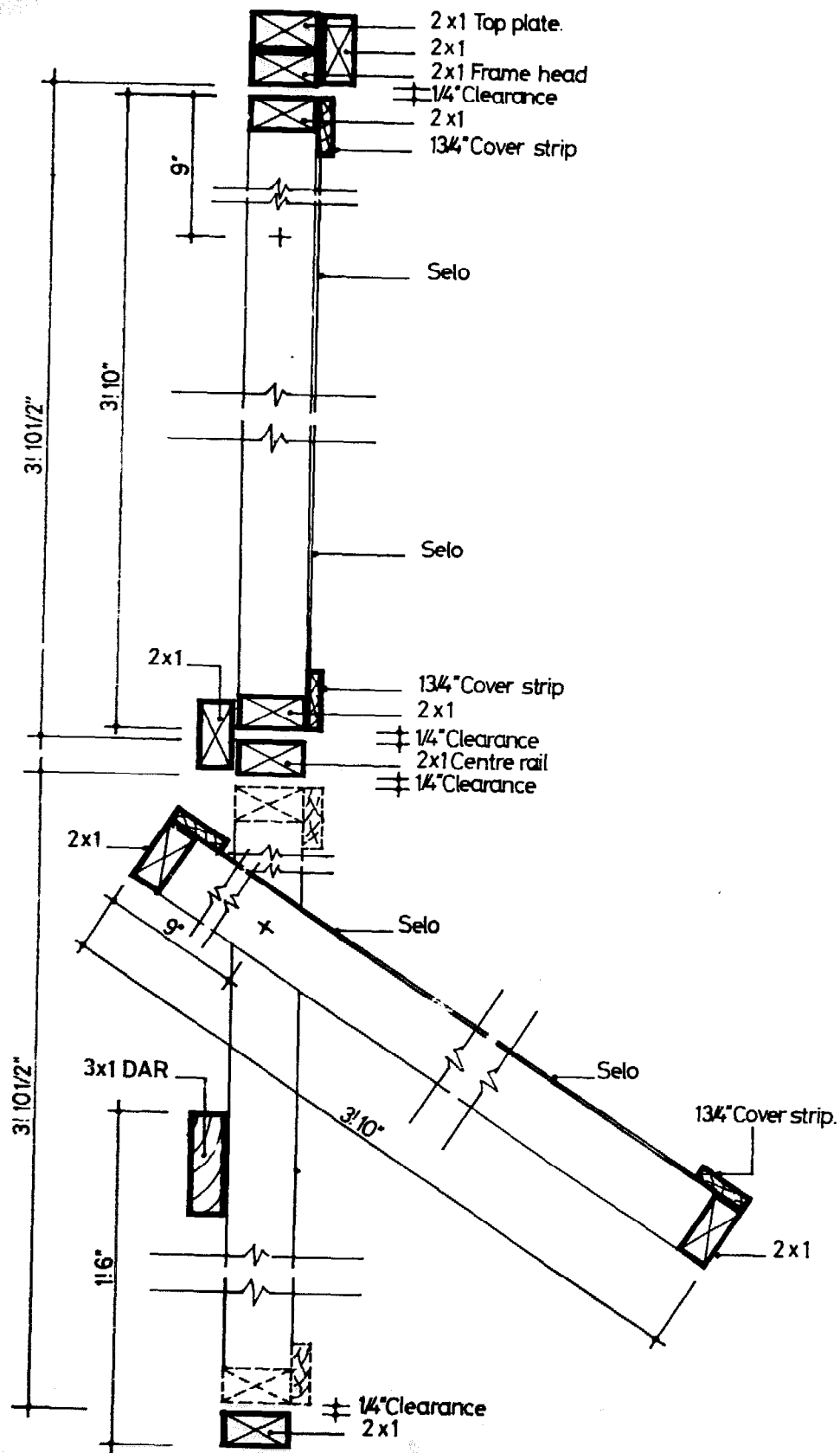
SINGLE SHUTTER PANEL	Scale: 1 inch = 1' 0"	DETAIL NO. 3
	Drawn: B. Nagau	



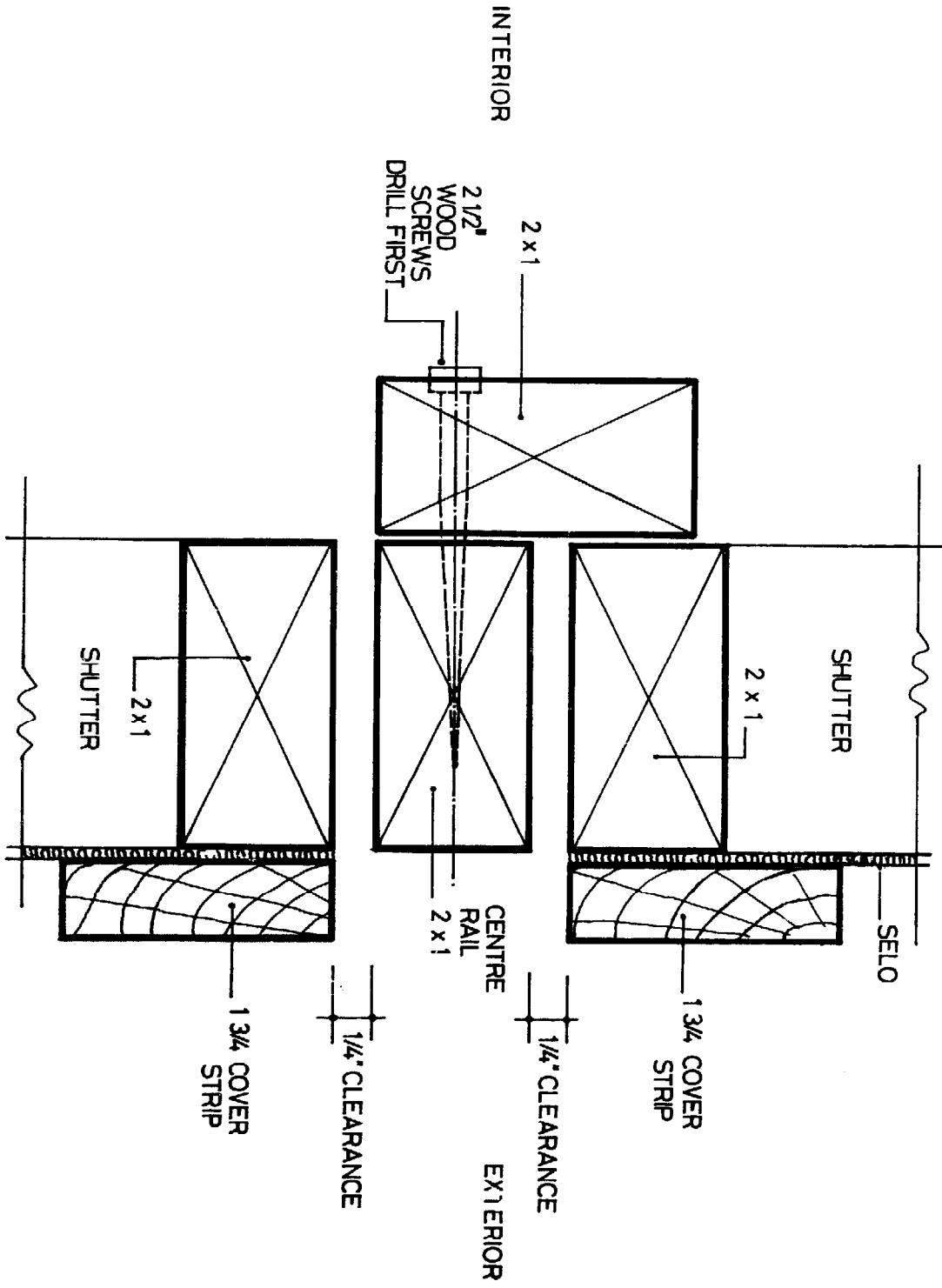
DOUBLE SHUTTER PANEL	Scale: 1 inch = 1' 0"	DETAIL NO. 4
	Drawn: B. Nagau	



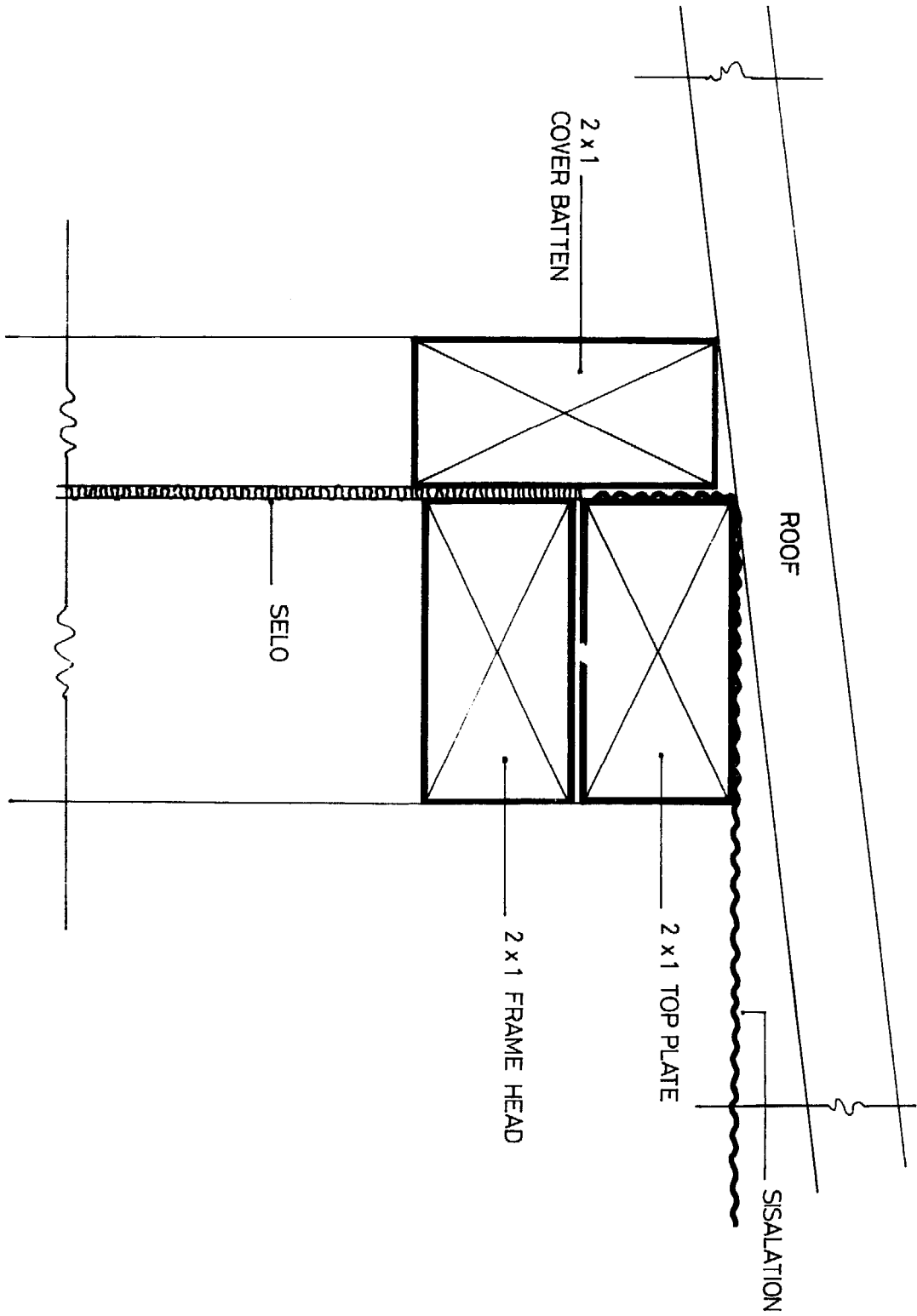
SHUTTER	Scale: 1 inch = 1' 0"	DETAIL NO. 5
	Drawn: B. Nagau	



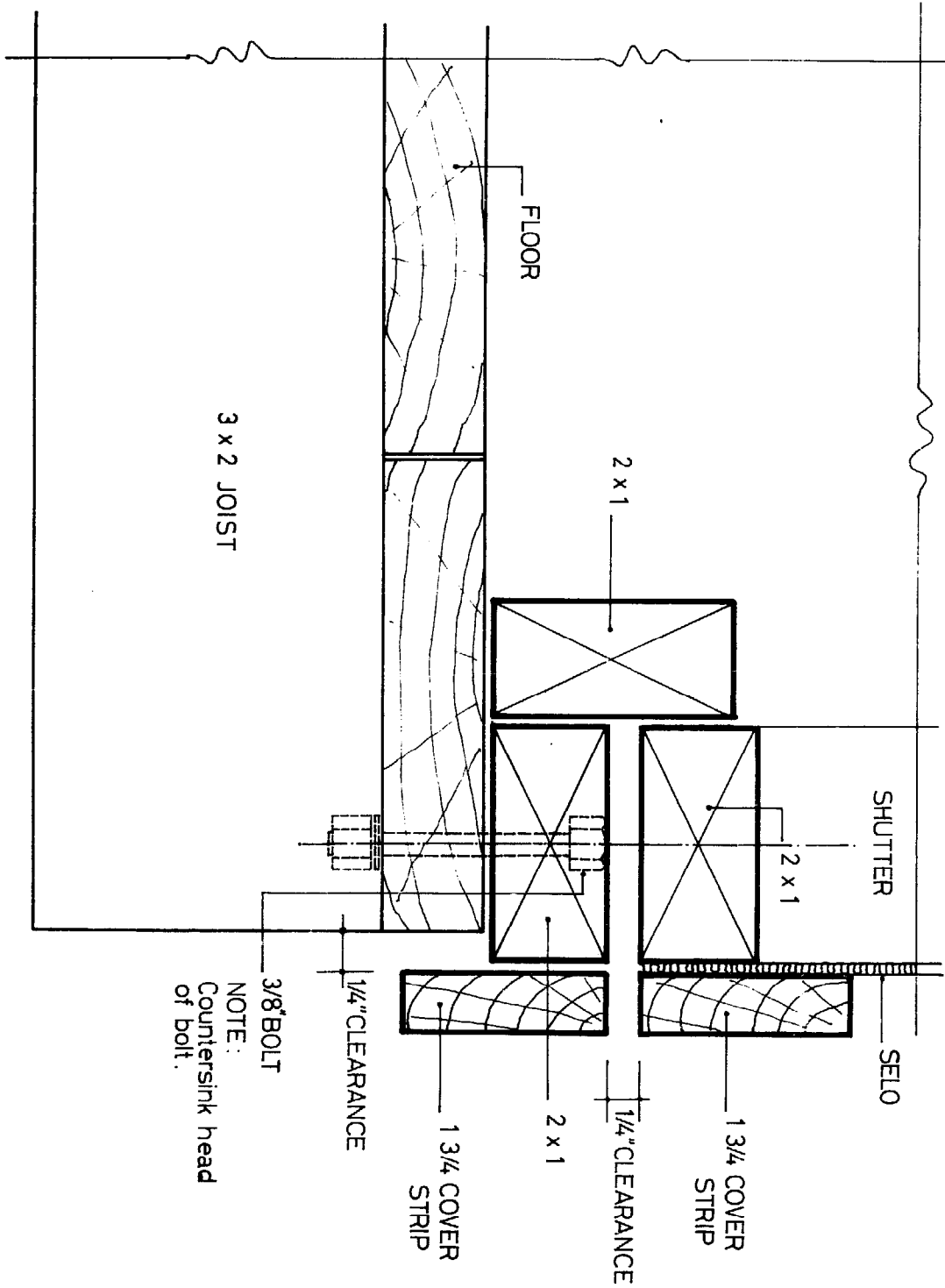
CROSS SECTION/DOUBLE SHUTTER	Scale: Not to scale	DETAIL NO. 6
	Drawn: B. Nagau.	



DETAIL OF 6 - AT CENTRE RAIL	Scale: Full size	DETAIL NO. 7
	Drawn: B. Nagau	

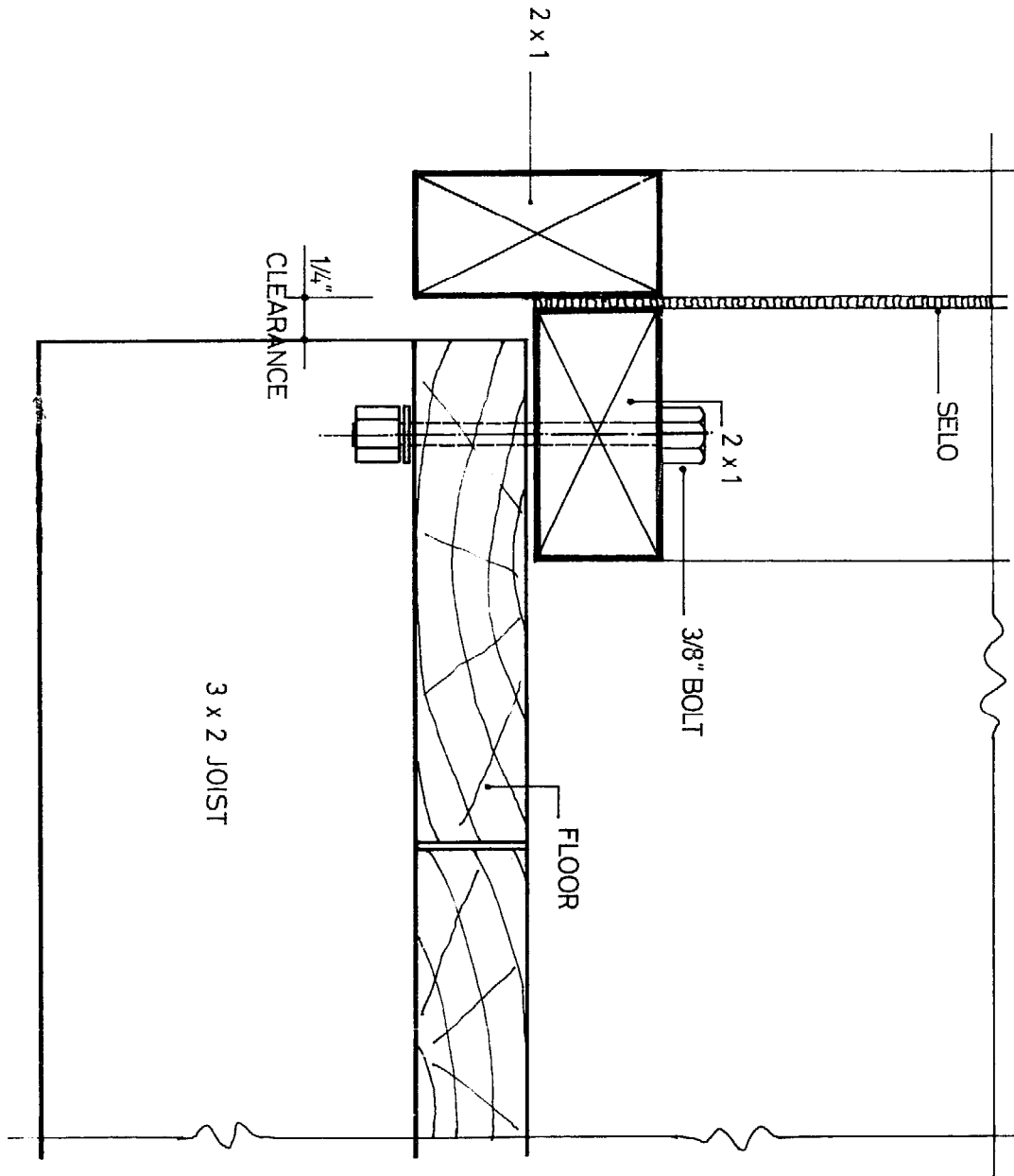


ROOF FIXING DETAIL	Scale: Full size	DETAIL NO. 8
	Drawn: B. Nagau	

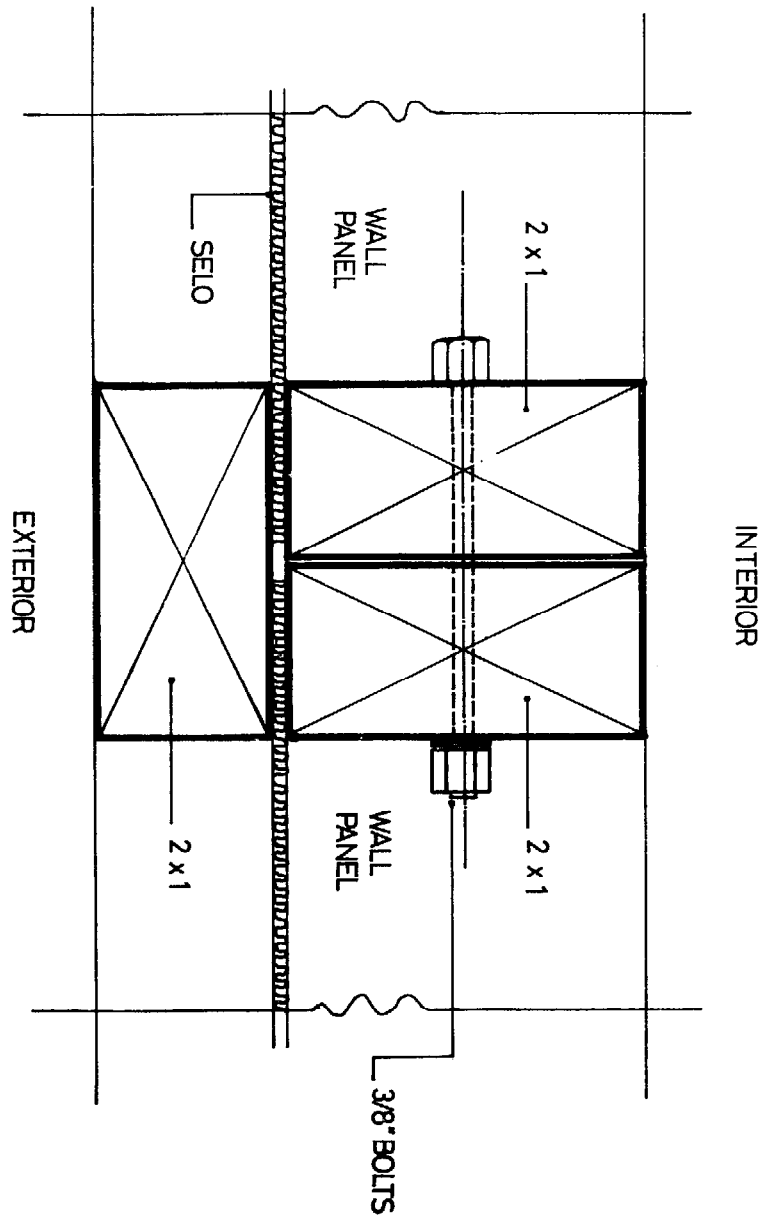


NOTE:
Countersink head
of bolt.

SHUTTER PANEL / FLOOR	Scale: 3/4" = 1'-0"	DETAIL NO. 9
	Drawn: B. Nagau	



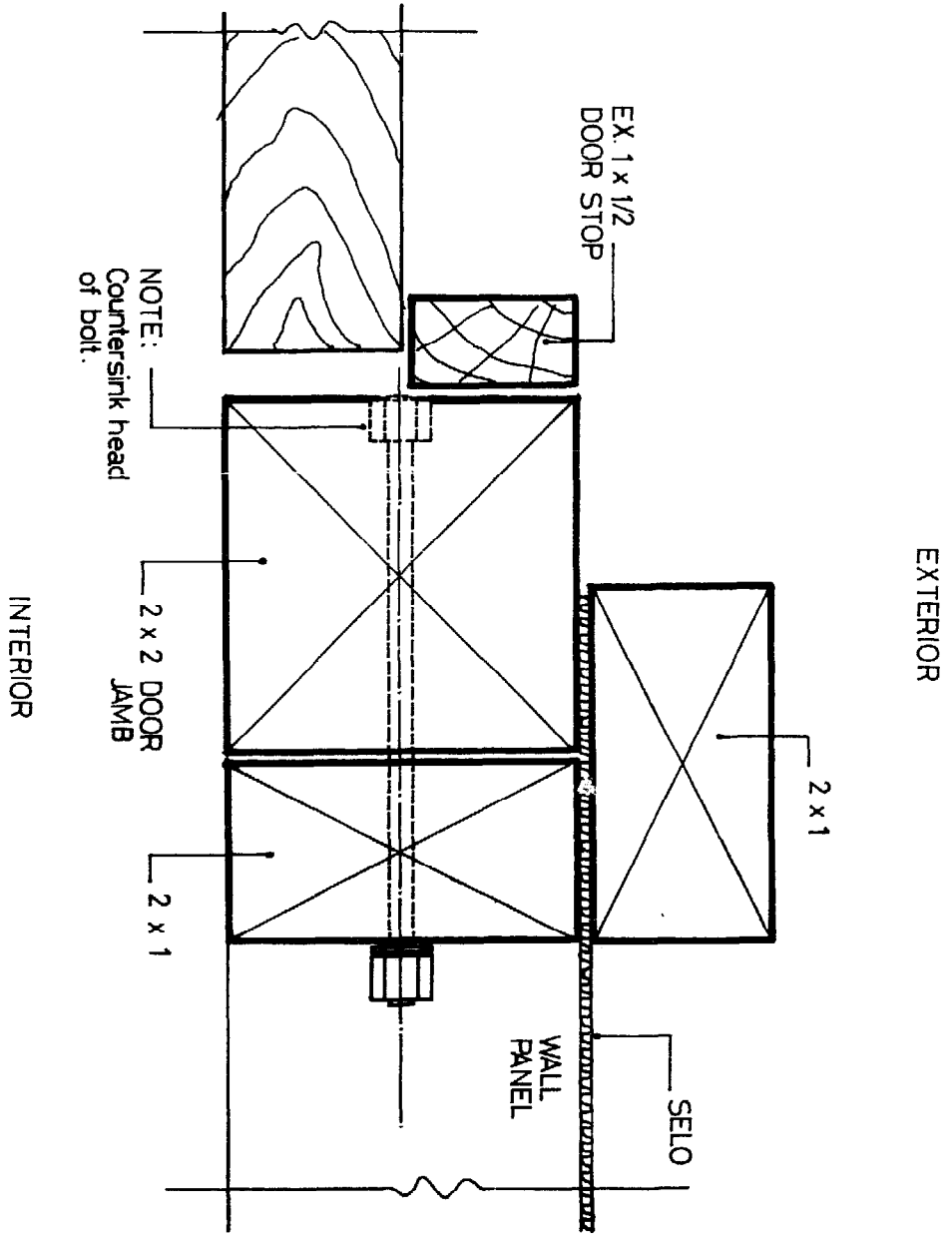
WALL PANEL / FLOOR	Scale: 3/4" = 1'-0"	DETAIL NO. 10
	Drawn: B. Nagau	



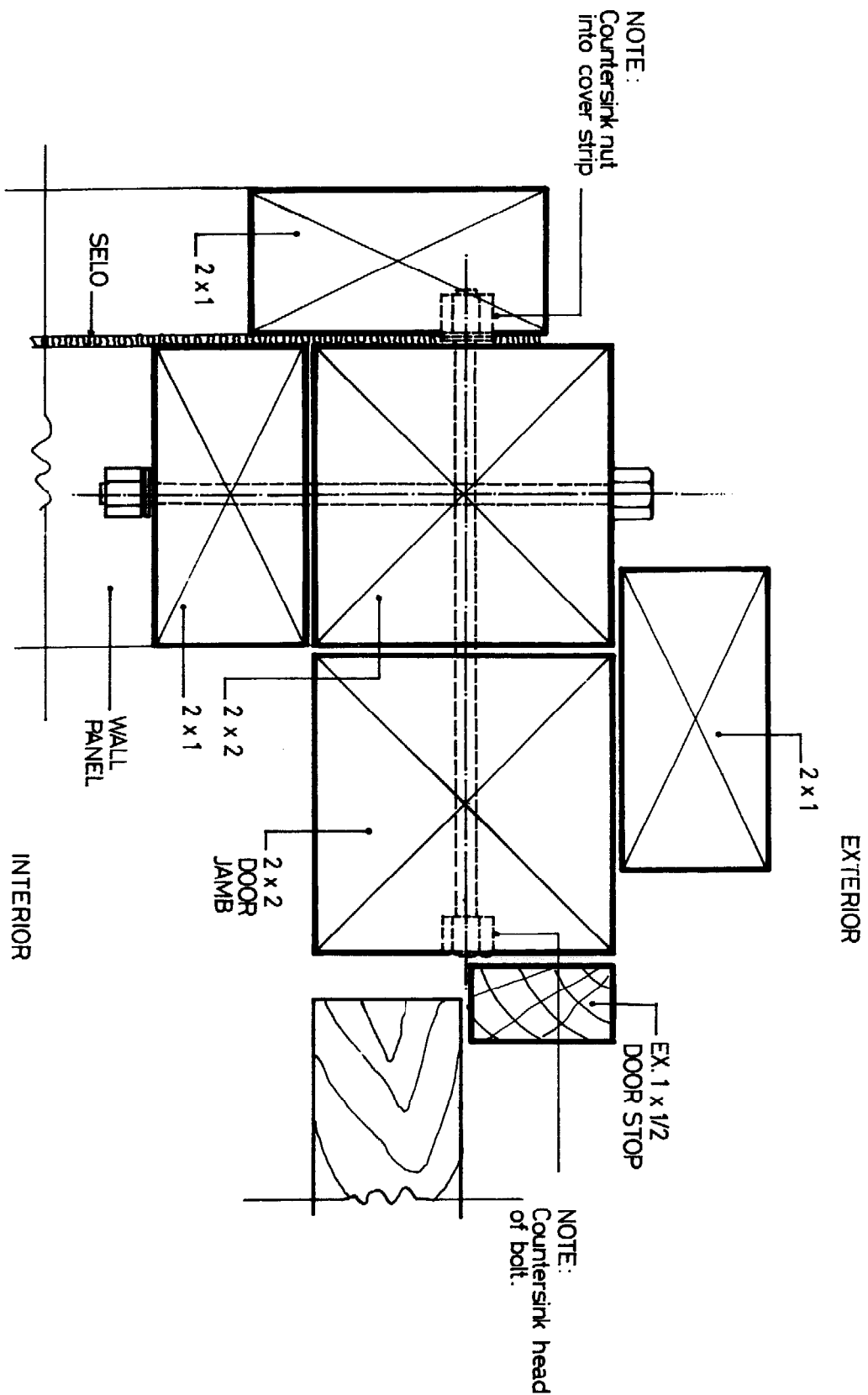
WALL BUTTS WALL

Scale:
 Full size
 Drawn:
 B.Nagau

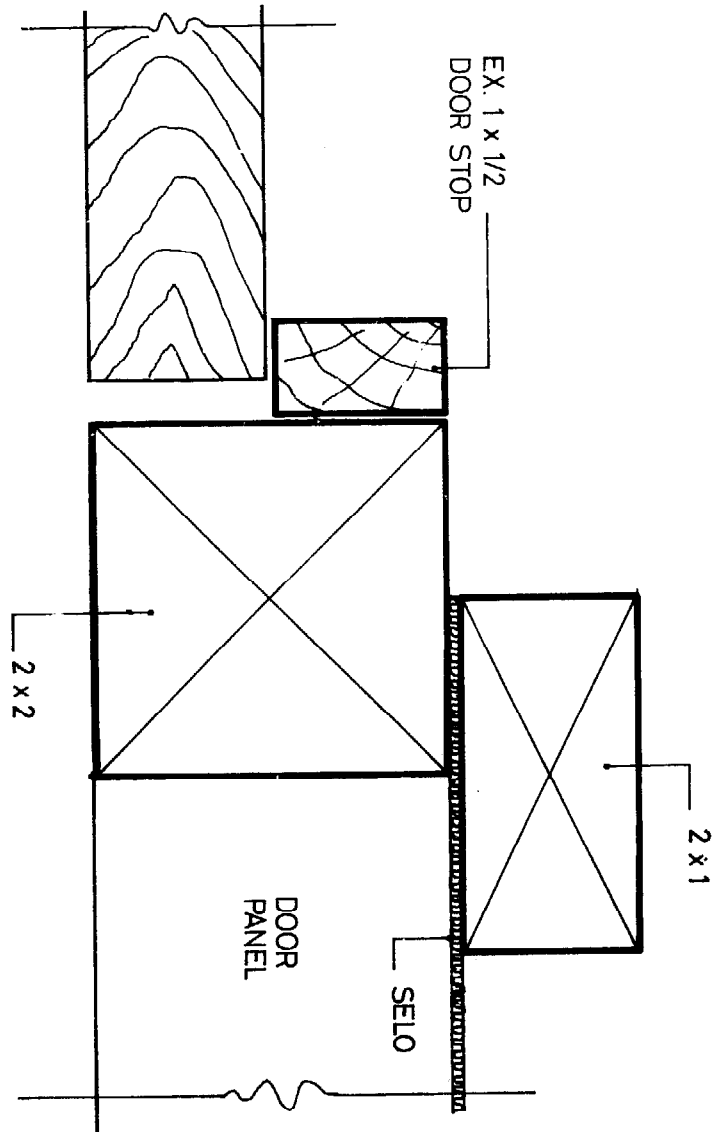
DETAIL NO. 11



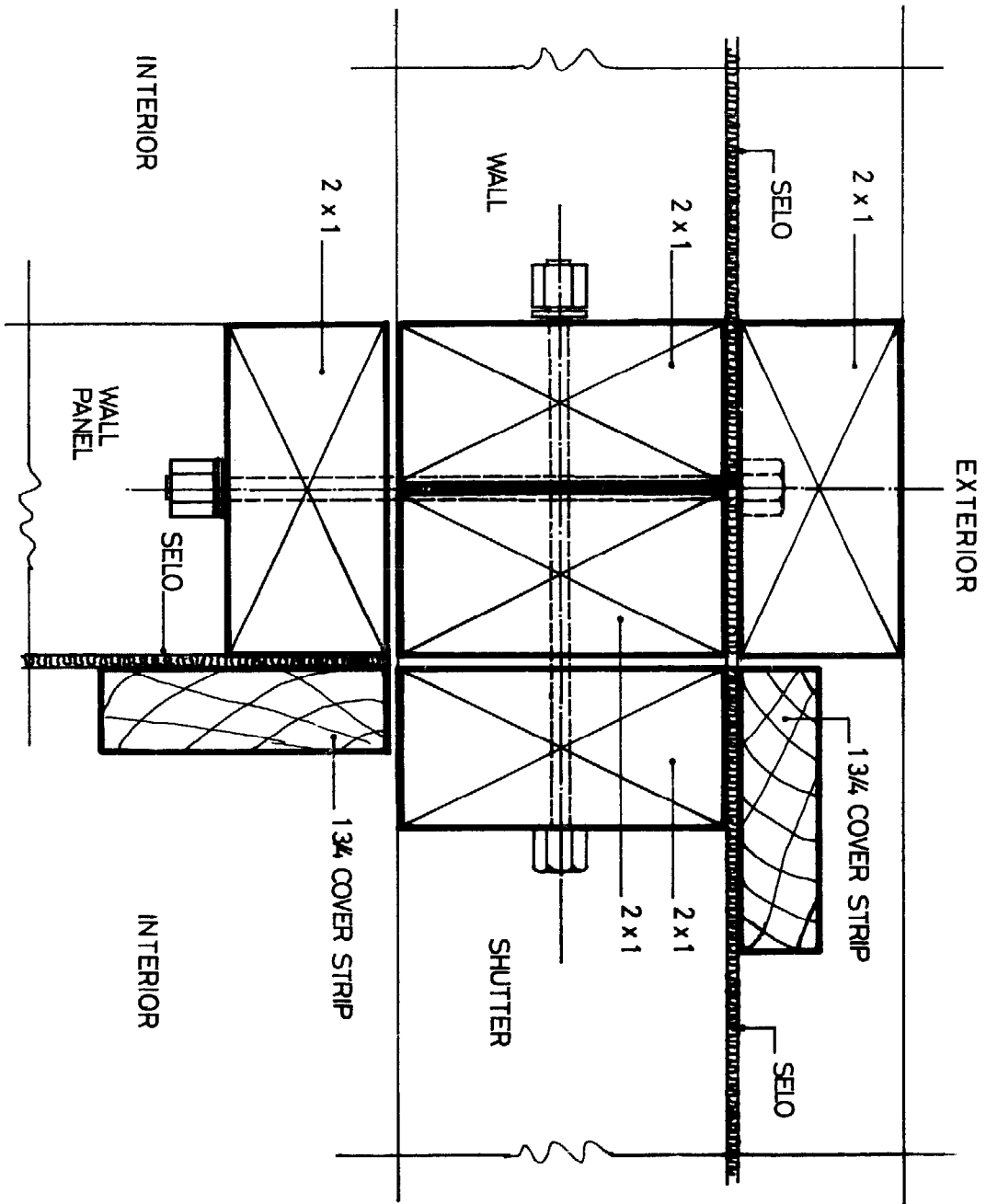
WALL BUTTS DOOR	Scale: Full size	DETAIL NO. 12
	Drawn: B. Nagau	



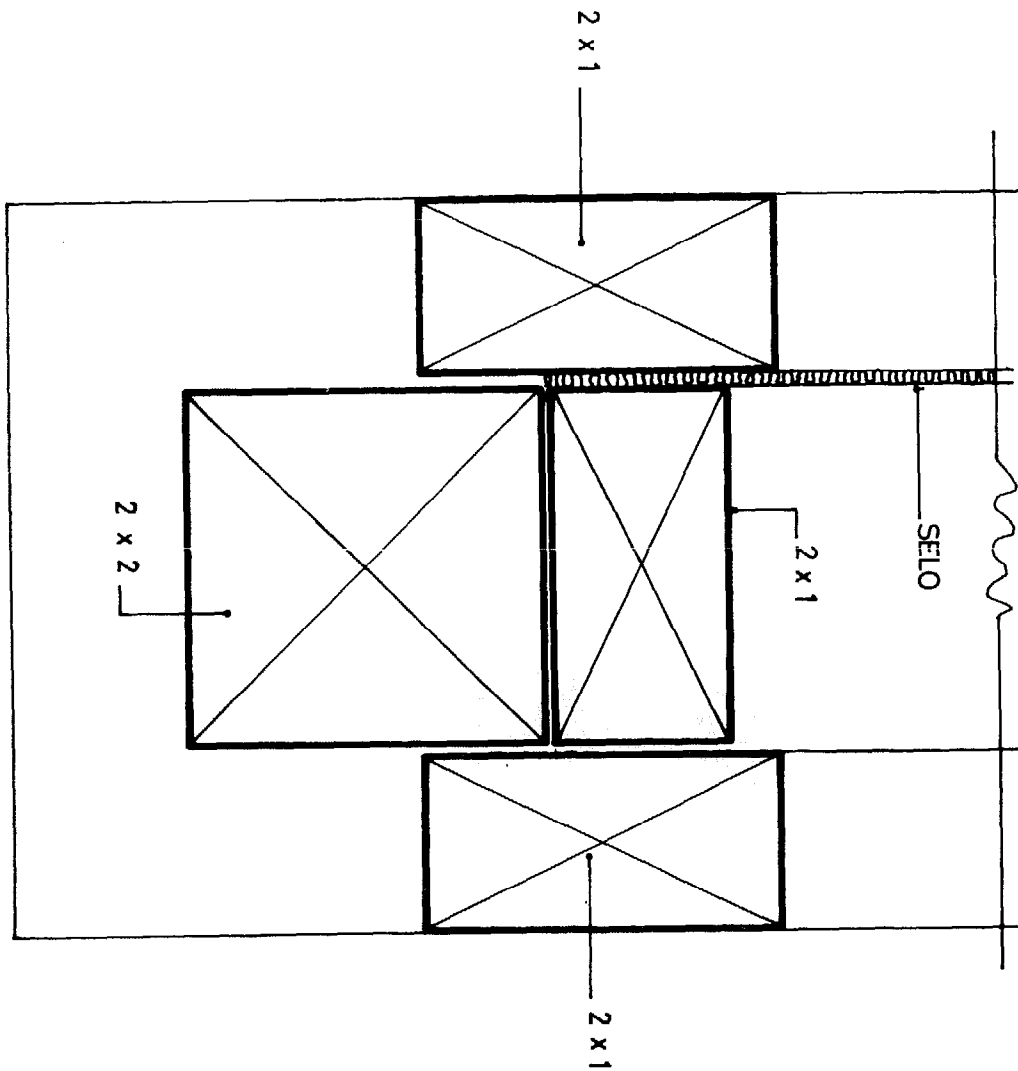
WALL / CORNER / DOOR	Scale: Full size	DETAIL NO. 13
	Drawn: B. Nagau	



DOOR PANEL / DOOR	Scale:	DETAIL NO. 14
	Full size:	
	Drawn:	
	B. Nagau	



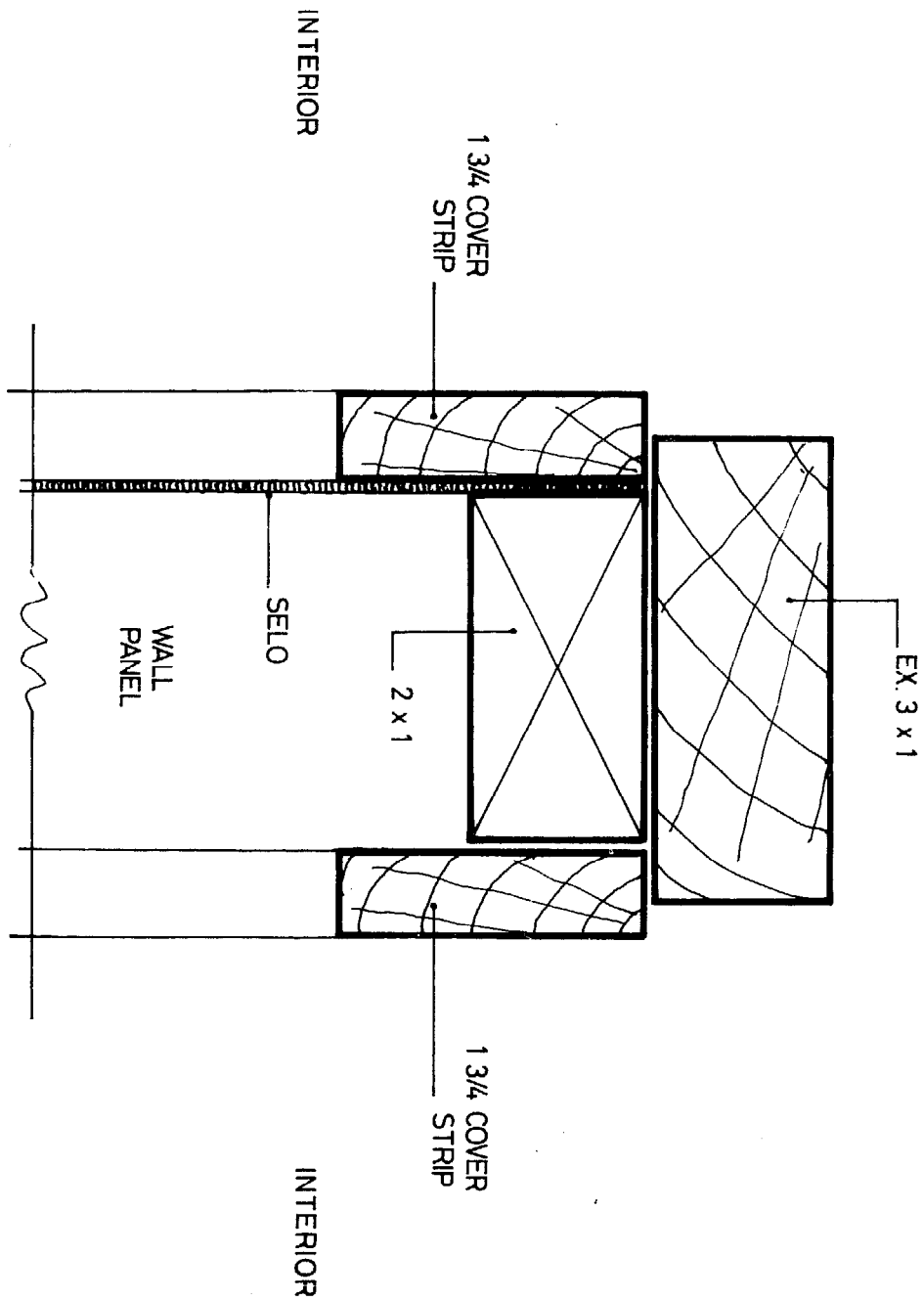
WALL / WALL / SHUTTER	Scale: Full size	DETAIL NO. 15
	Drawn: B. Nagau	



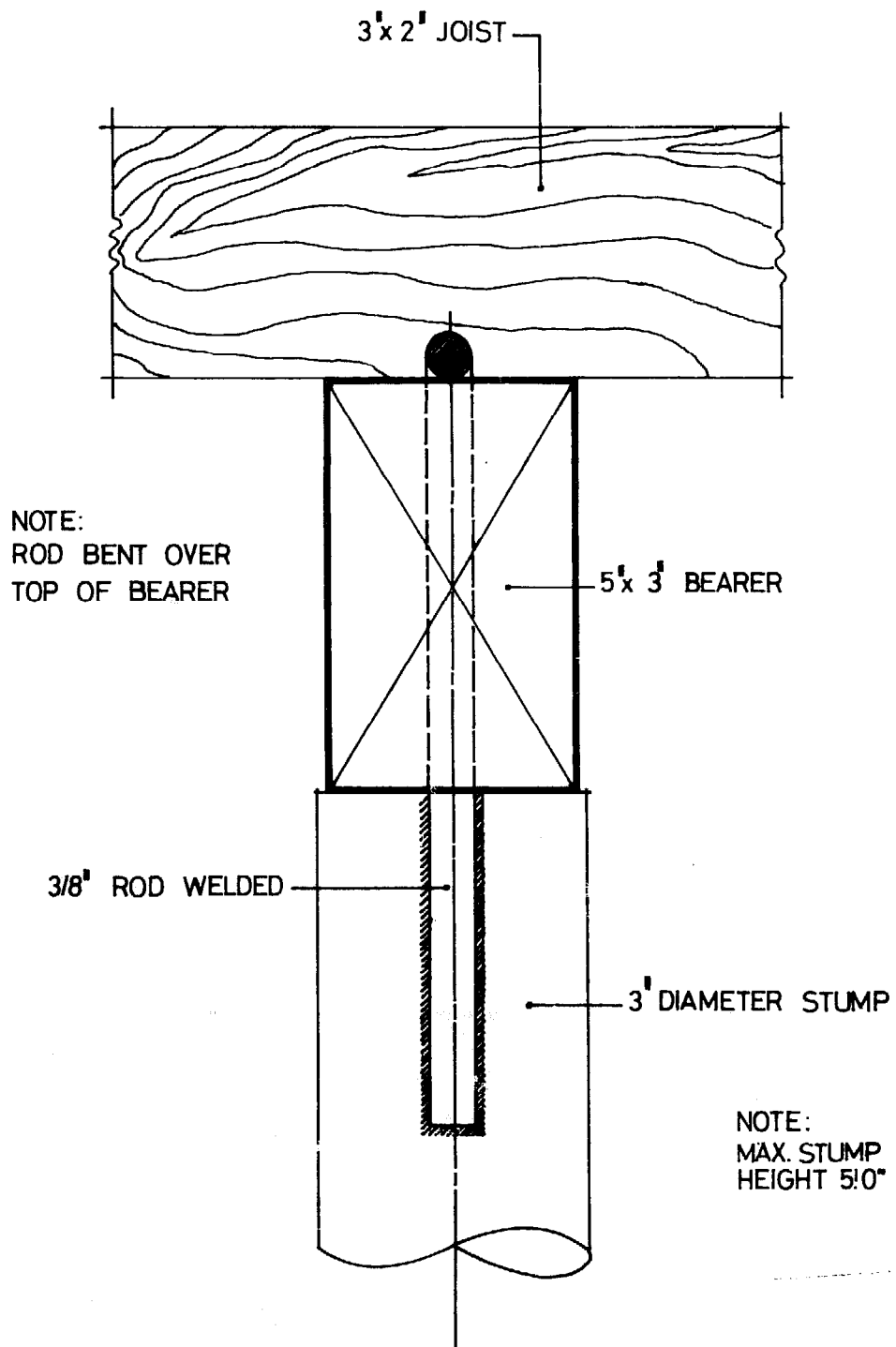
END OF WALL EXTERIOR

Scale:
Full size
Drawn:
B. Nagau

DETAIL NO. 16



END OF WALL INTERIOR	Scale: Full size	DETAIL NO. 17
	Drawn: B. Nagau	



JOIST / BEARER / STUMP

Scale:
1/2 Full size
Drawn:
B. Nagau

DETAIL NO. 18

Port Moresby: G. Dadi, Acting Government Printer - 8523/1,000 - 6.74.