OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

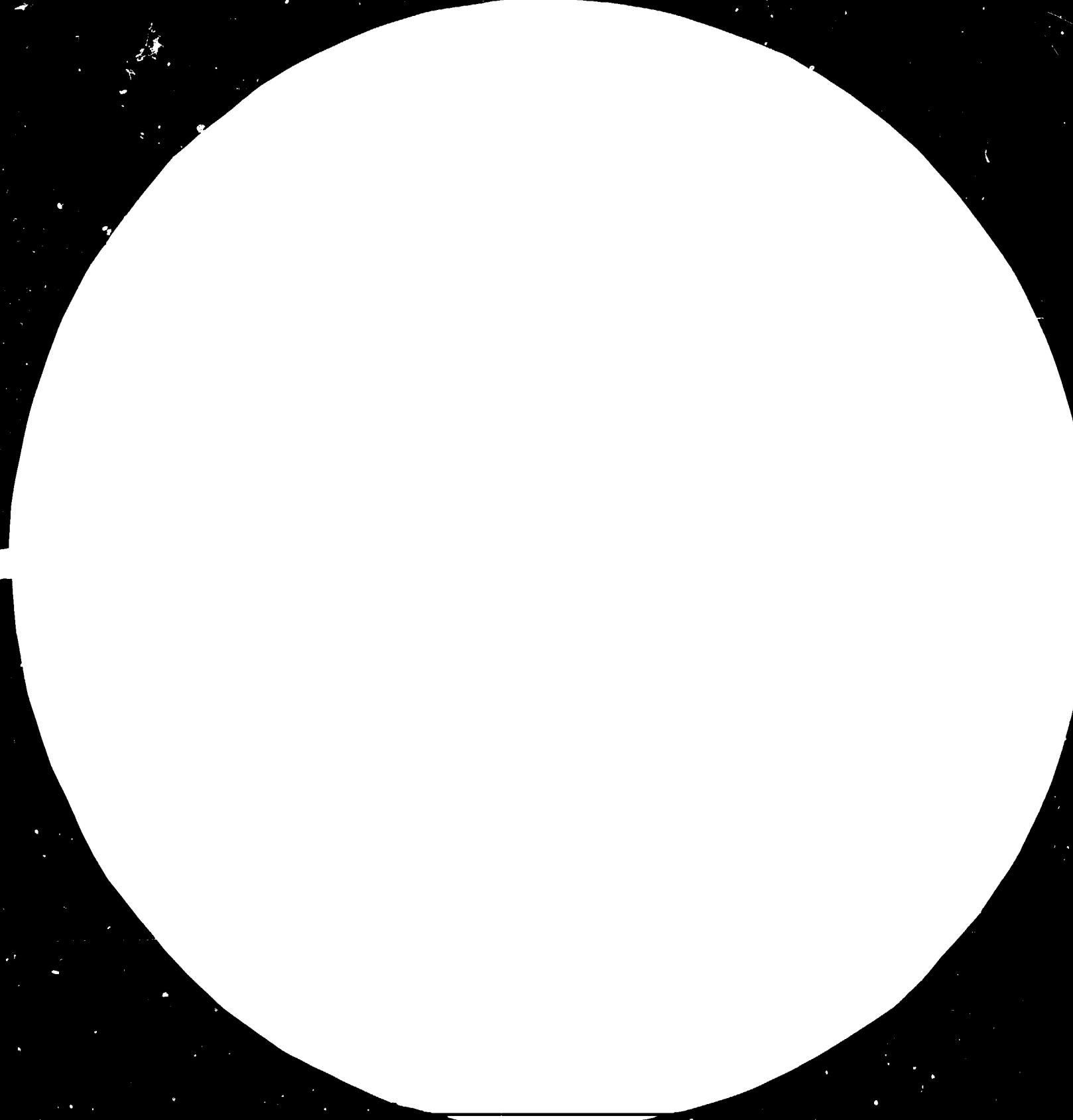
FAIR USE POLICY

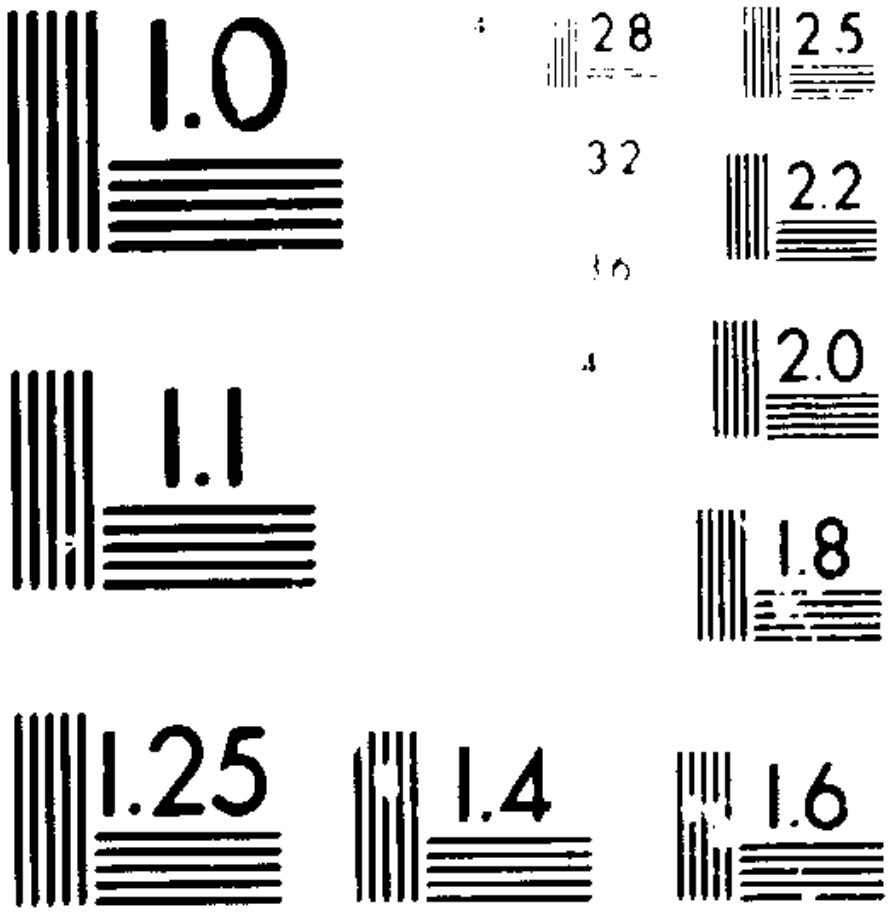
CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org





RESTRICTED

DP/ID/SER.A/565
24 January 1985
ENGLISH

14020

DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW-COST HOUSING

SI/PHI/83/801

PHILIPPINES

Technical report: Design, supervision and certification aspects of the demonstration coconut wood house project*

Prepared for the Government of Philippines
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the woprk of Gregorio G. Santa Maria,
Designing Architect and Consultant

United Nations Industrial Development Organization
Vienna

*Mention of firm names and commercial products does not imply the endorsement of the United Nations. This document has been reproduced without formal editing.

V.85-21317

EXPLANATORY NOTES

The monetary unit of the Republic of the Philippines is the Peso (₱). The current official rate of exchange for the Peso is ₱14.00 - US$1.00.

The following acronyms are used in this Report :

DGLC	-	Davao Gulf Lumber Corporation, Davao City Philippines, participant, lumber processing firm in this Project
FAO	-	Food and Agricultural Organization, United Nations
PCA	-	Philippine Coconut Authority, A Philippine Government agency responsible for the coconut industry.
PCA - ZRC	-	Philippine Coconut Authority - Zamboanga Research Center
SPDA	-	Southern Philippines Development Authority, the Project's implementing agency of the Philippine Government.
UNDP	-	United Nations Development Programme
UNIDO	-	United Nations Industrial Development Organization
SIDFA	-	Senior Industrial Development Field Adviser

A hyphen between numbers (e.g. 1 - 5) indicates the full range involved, including the beginning and end points.

A full stop (.) is used to indicate decimals.

A comma (,) is used to indicate thousands, millions, billions.

The following symbols and/or abbreviations are used in this Report :

US$	-	US Dollars, currency unit of the United States of America
PHP	-	Philippine Peso, currency unit of the Republic of the Philippines
mm	-	millimeter, 1/1000th of a meter
cm	-	centimeter, 1/100th of a meter

ø	- diameter
"	- inches
'	- foot or feet equivalent to 12 inches
2 - 50 mm x 100 mm	- pieces - thickness and width measurements
m	- meter, metric unit of length
cu. m.	- cubic meter, metric unit of volume
pcs.	- pieces, denoting unit of quantity
No.	- number
Man-Hours	- Man-Hours, unit of work performed
%	- per cent, 1/100th part of a whole
coco	- coconut
S4S	- Surfaced on 4 sides, referring to a board whose 4 sides have been planed smooth.
T & G	- Tongue and Groove, a system of joining wood flooring pieces.
V-Cut	- A system of joining wooden walling boards, characterized by beveled edges to form a V-shaped groove at the joined edges.
CCA	- Copper-Chrome-Arsenate, a wood preservative compound
TCT	- Tungsten Carbide Tip, a hard metal alloy used to reinforce the cutting surfaces of tools.
T & B	- Toilet and Bath
L & V	- Light and Vent
L.M.	- Linear Meter
S R	- Simple Rabetted wood joints characterized with L Section
M^3	- cubic meter
M^2	- square meter
PCS.	- pieces

PROF	-	Profiled
P.G.I.	-	Plain galvanized iron sheet
G.I.	-	Galvanized iron
FIN.	-	Abbreviation for finish
Reg. No.	-	Registration Number
TAN	-	Tax Account Number
PTR No.	-	Professional Tax Receipt Number

- - - - - - - - - - - - - - - - - -

Mention of company names and product brands do not imply endorsement by the United Nations Industrial Development Organization (UNIDO).

TABLE OF CONTENTS

DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW COST HOUSING

(UNIDO PROJECT No. SI/PHI/83/801)

I. INTRODUCTION

1.1 PROJECT BACKGROUND

Over the last seven and one half years United Nations Development Program (UNDP) has been supporting an FAO and UNIDO project devoted to research on the processing of coconut wood. The Philippine Coconut Authority (PCA) has been the local implementing agency. A Coconut Wood Processing Centre was established in Zamboanga with equipment donated by the government of New Zealand.

Intensive research and development activities led to the development of technology for the extraction of lumber from coconut trunks. A sawmill was set up with special systems to handle coconut trunks and special blades for smooth cutting. Experimentation was also undertaken on the preservation of coconut wood for use as materials for building construction.

In 1982, UNIDO joined the project to put the developed technology into industrial use, particularly in the construction of low cost housing. To that end, UNIDO undertook as first task formal grading and testing of the lumber and the design of prototypes for low cost housing.

In addition to the grading undertaken in the course of work, special grading and testing has been undertaken at the Forest Products Research and Development Institute. These tests are considered to be of prime importance since they will provide the necessary certification for the quality and durability of coconut wood and also for the proper utilization of lumber extracted from different parts of the trunks. Several coconut houses have already been designed and constructed at the FAO/UNDP Centre in Zamboanga. UNIDO on the basis of this experience proceeded to draw up, through a local firm, architect's plans that would conform to the relevant building regulations and satisfy financing

requirements. The designs were based on several modules which can be assembled into different types and sizes of houses. At the same time an erection manual was prepared to specify the materials and the techniques to be used in the construction of such houses.

1.2 PROJECT CONCEPT

As a result of the coconut wood technology developed in the Philippine Coconut Authority - Zamboanga Research Centre (PCA-ZRC) and the design for low-cost housing developed by UNIDO under Project No. RAS/81/110 the necessary know-how has been made ready for application in commercial construction. Several communities and private builders have expressed interest in building low-cost housing from coconut wood. To make this a reality it was necessary to construct a proto-type house. The Southern Philippines Development Authority (SPDA), an agency of the Philippine government, offered to construct the proto-type house; while the Davao Gulf Lumber Corporation (DGLC) agreed to process the coconut tree trunks into lumber and other housing components. UNIDO provided two consultants who assisted the SPDA and DGLC in the conduct of the various activities of the Project. The final reports to be prepared by the UNIDO consultants will pool together all the generated information in order to draw conclusions regarding the utilization of coconut wood both from the point of view of acceptability to commercial enterprise, government and the consumer on one hand and its economic aspects on the other.

1.3 PROJECT OBJECTIVES

i - Assist SPDA in its intention to promote the use of coconut wood in low-cost housing.

ii - To demonstrate the use of coconut wood as a building material and determine its viability for low-cost housing according to UNIDO designs.

iii - To develop construction techniques and specifications on the use of coconut wood as

a building material and to make any modifications to the plans and erection manual developed by UNIDO if any were needed.

II. ORGANIZATION AND MANPOWER PARTICIPATION

2.1 UNIDO CONSULTANTS ASSIGNED TO THE PROJECT

2.1.1 HORATIO P. BRION — Lumber Processing Technology, Cost analysis and report
Secondary Wood Processing Expert

2.1.2 GREGORIO G. STA. MARIA — For Design, Construction Supervision and Certification
Designing Architect and Consultant

Assisted by:

i - Cesar Caliwara - Structural Engineer Consultant
ii - Ernesto Villaos - Sanitary Engineer Consultant
iii - Jose Enriquez - Electrical Engineer Consultant
iv - Edgar Hidalgo - Assistant to Designing Architect
v - Remigio Nagayo - Documentations and Recorder

2.2 SPDA PROJECT MANAGEMENT TEAM COMPOSITION

2.2.1 PIO J. A. VELASCO — Project Officer-in-Charge
Chief, E&TS Division, OPNS

2.2.2 Oscar Paradero - Lumber Processing Supervisor

2.2.3 Floro Virtuccio - Coconut Logging Supervisor

2.2.4 James Salvador - Timekeeper and Materials Control Officer

2.2.5 Anatolio Alcoberes - Construction Foreman

2.3 SCHEDULE OF VISITS AND INSPECTION OF UNIDO CONSULTANTS ASSIGNED TO THE PROJECT No. SI/PHI/83/801

2.3.1 October 25-26, 1983, SPDA, Davao City, Philippines

Party of three (Designing Architect, UNIDO Consultant and SIDFA, UNDP-MANILA) had a conference with SPDA Administrator and other officials regarding project document and briefing on SPDA activities. Survey of possible site and sources of coconut stems were conducted. Visited different existing sawmills for possible participation in lumber processing.

2.3.2 November 23-26, 1983, SPDA, Davao City, Philippines

Party of two (Designing Architect and Assistant Structural Engineer) had a conference with Project Officer-in-Charge, SPDA, identification of exact site, soil tests and ground breaking activities. Layout, staking and excavation started for all foundations and septic vault.

2.3.3 December 12-13, 1983, SPDA, Davao City, Philippines

Inspection of on-going Phase I of Construction (Concrete and Masonry Works) and a conference with UNIDO Consultant and Project Officer-in-Charge, SPDA, regarding plans and coco wood requirements took place.

2.3.4 February 2-4, 1984, SPDA, Davao City, Philippines

Inspection of on-going Phase II of Construction (Coco Wood Construction Works) and conference with UNIDO Consultant and Project Officer-in-Charge, SPDA, regarding revisions of bill of materials due to difficulties in sawmilling desired sizes of coco wood for specific components were held.

2.3.5 February 14-27, 1984, SPDA, Davao City, Philippines.

Assignment of one (1) Project Inspector representing the Designing Architect to supervise on-going Phase II of Construction was done. He assisted Project Officer-in-Charge in the supervision of coco wood processing and treatment when UNIDO Consultant left for Manila.

2.3.6 March 6-7, 1983, SPDA, Davao City, Philippines

Party of two (Designing Architect and SIDFA UNDP-MANILA) inspected the progress of construction and coco wood processing. They had a briefing and conference with UN Resident Representative and UNDP Head to the Philippines visiting the project and SPDA Administrator and other officials regarding the on-going and future coco wood projects. Ocular inspections of house under construction and coco wood treatment processes.

2.3.7 April 24-25, 1984, SPDA, Davao City, Philippines

Party of two (Designing Architect and SIDFA UNDP-MANILA) inspected the substantial completion and inauguration of coco wood house during the SPDA 9th Anniversary Celebration wherein the inauguration was one of the high-lights of the whole day activities. The inauguration was attended by national and local officials, members of diplomatic corps and businessmen and industrialists in the wood and housing industries.

2.3.8 May 9, 1984, SPDA, Davao City, Philippines

Party of four (Designing Architect, Consulting Structural, Sanitary and Electrical Engineers) inspected the project for certification that the construction was done in accordance with the design and erection manual as well as modifications.

The following were the observations and remedial measures taken:

i - The Designing Architect formally rejected the installed Grade C floor boards and recommended that those be replaced with Grade A. The Project Officer in-Charge was also advised that the rough finishes on flooring, sidings, jambs and blades of jalousies and other coco wood finishes should be sanded to desirable smoothness before final surface finishing.

Finishing schedules of oil and flat varnish were furnished the Officer-in-Charge of the project for future implementation.

ii - The Consulting Structural Engineer inspected and measured floor and roof girt deflections and gave instructions for remedial measures. The slight deflections were reported to be negligible and within tolerance of structural design.

iii - The Consulting Sanitary Engineer checked all sanitary, plumbing and water supply system to be in accordance with the design and government regulations.

iv - The Consulting Electrical Engineer inspected all the control devices, checked the electrical and power supply systems and found them to be in order and done in accordance with the design except for the minor omission of an electric meter which was not necessary in this particular case because SPDA generates its own electric power.

2.3.9 June 13-16, 1984, SPDA, Davao City, Philippines

Party of two (Designing Architect and UNIDO Consultant) inspected the project and held conferences and de-briefing with the SPDA personnel involved in the project.

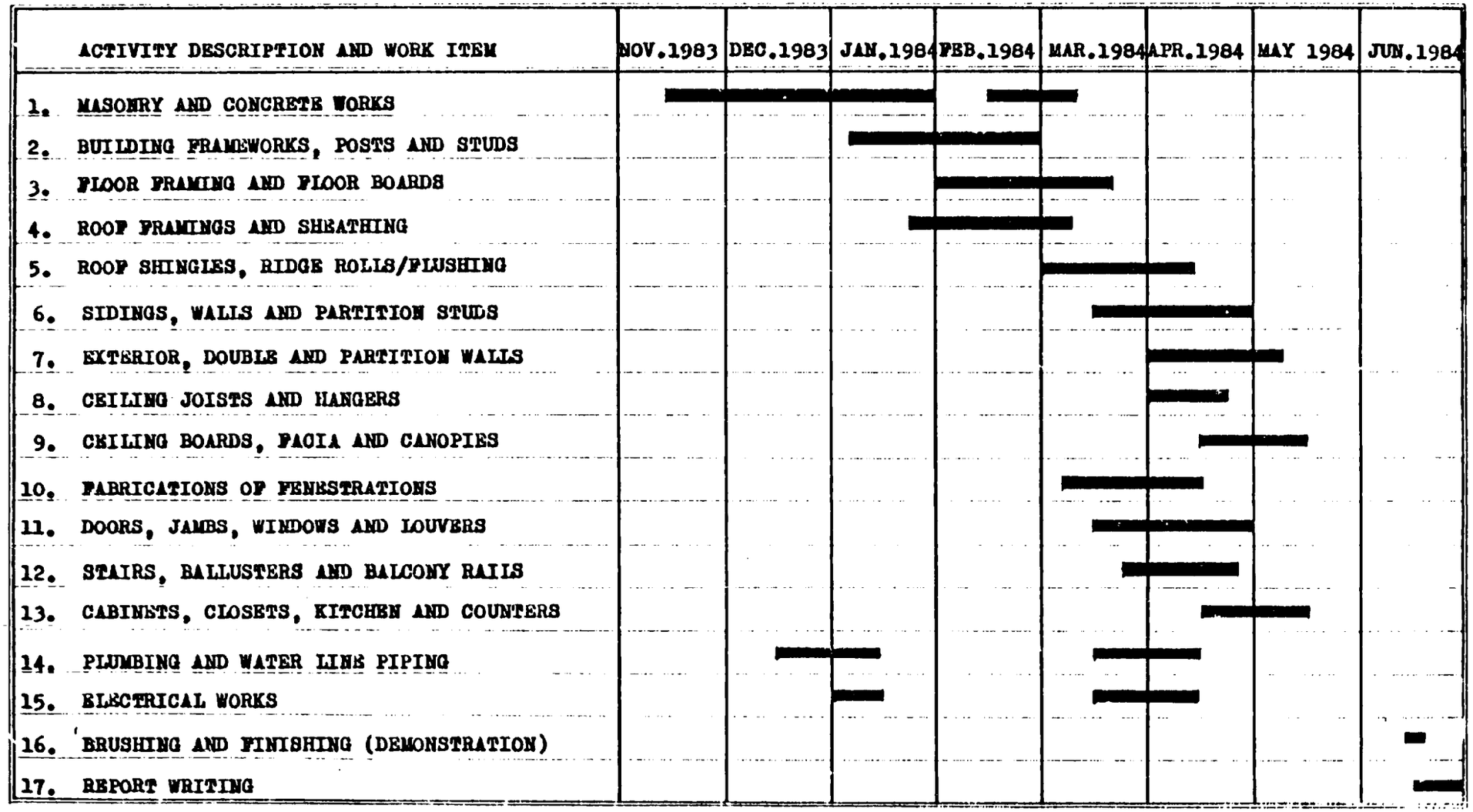
The engineer and foreman were de-briefed by the Designing Architect and the UNIDO Consultant. Notes were taken covering important observations and experiences during the execution of the project. Techniques developed were also noted as well as non-conventional systems using coco wood as material in the construction.

Thorough inspections were done on almost all the coco wood components and recorded by photographs. Sanding and finishing with oil was demonstrated by the UNIDO Consultant on the proper procedure and applications.

Costing records on materials and labor usage were reviewed and summarized for inclusion in the final report.

The sawmilling plant was visited again for an interview with the production engineer regarding the profiling operations which converted coco boards into floor, sidings, and ceiling boards. The interview revealed difficulties experienced in the profiling processes due to the grain characteristics of coco wood and also the profiling blades

2.4 CONSTRUCTION BAR GRAPH SCHEDULE



used in conventional lumber.

The production engineer reported the experiment to reinforce the regular blades with stellite tipping which turned out to be very successful in profiling all the boards. Reinforced blades were shown and recorded by photographs. Profiling, however, of Tongue and Groove (T & G) sections for floor boards were substituted with "L" sections inspite of the stellite tipped blades as the T & G profile developed chipped edges and tongues.

Further studies and techniques were recommended by the UNIDO Consultant on the matter.

The sawmill management reported further their receipt of inquiries on coconut lumber, both from local and foreign buyers, for use as building materials, in manufacturing furniture, wood crafts and other novelties.

III. DESIGN, MANAGEMENT AND SUPERVISION OF CONSTRUCTION ACTIVITIES

3.1 PRE-CONSTRUCTION ACTIVITIES

The United Nations Industrial Development Organization (UNIDO) approved Project No. SI/PHI/83/801 in September, 1983 and a Special Service Agreement was signed on October 18, 1983 in Manila with the architect's firm of Gregorio G. Santa Maria.

The site was selected in Southern Philippine Development Authority (SPDA) Compound in Cataluman Pequeño, Davao City, Philippines by the Designing Architect and approved by the representatives of SPDA and UNIDO.

On October 25, 1983 during the meeting of UNIDO and SPDA representatives held at the SPDA Head Office in Davao City, both parties agreed to test further the flexibility of the design developed under Project No. RAS/81/110, coco house Model A, adaptable for urban and rural use. SPDA, with the concurrence of UNIDO, chose Model A, Duplex Type, to be used as quarters for the visiting members of the Board of Directors. Ground breaking

activities were held in the middle of November, 1983.

The Designing Architect's firm prepared additional plans (Annex I), bill of materials and specifications (Annex II) for the construction of Model A, Duplex Type, coconut wood demonstration house.

An erection manual was prepared based on results of Project SI/PHI/83/801 and was revised as the work progressed (and will be issued separately).

3.2 COCONUT WOOD MATERIAL USAGE AND SURFACING

COMPONENTS	SIZES	GRADES	TREATMENT	REMARKS
Post (built-up)	100mm x 100mm	A S4S AD		
Floor Girt	50mm x 150mm	A S4S AD		
Floor Joint, block and bridging	50mm x 125mm	A S4S AD		
Roof girt and block	50mm x 150mm	A S4S AD		
Rafters and block	50mm x 150mm	A S4S AD		
Purlins and block	50mm x 50mm	A S4S AD		
Shingles	100mm x 400mm	A,B & C	CCA	
Ridge Rolls	180mm x 150mm	A,B & C	CCA	Profiled
Facia Board	12mm x 100mm	A & B KD	CCA	Profiled
Flashing	100mm x 100mm	A & B AD	CCA	Profiled
Floor Board T&G	18mm x 100mm	A & B KD		Profiled
Siding board and ceiling board V-Cut	12mm x 100mm	B &C KD		Profiled
Corbel	50mm x 150mm	A S4S AD		
Door/Window Jambs	50mm x 100mm	A KD		Profiled
Door Frames/Panels	12mm x 100mm	A KD		Profiled
Window Blades/ Zigzag/Louver	12mm x 100mm	A & B KD		Profiled
Stringers/Steps	50mm x 150mm (built-up)	A S4S AD		
Handrails/balusters and railings	50mm x 100mm	A S4S KD		
Studs	50mm x 75mm	B & C S4S AD		
Ceiling joists and Hangers	50mm x 50mm	B & C Rough AD		
Cabinet Frames Finished lumber	mixed sizes	A S4S KD		Profiled
Forms and scaffoldings	mixed sizes	A,B &C Rough AD		

3.3 SCHEDULE OF COCONUT WOOD TREATMENT

3.3.1 General

Dipping in Sodium Pentachlorophenol (NaPCP)

3.3.2 Boiling Soaking

CCA solution for roof shingles, canopy members, facia boards, flashing, ridge rolls, portion of roof girts.

3.3.3 Brushing

Creosote-borne NaPCP (Solignum) for wood in contact with concrete CCA solution for exterior components under roof; boron solution for interior components.

IV. PHASE ONE - CONCRETE AND MASONRY CONSTRUCTION

4.1 STAKING AND EXCAVATION
(Annex II, EP-2, Figure I, Under Separate Cover)

After the ground breaking activities in mid November 1983, site clearing, lay-out and staking, and excavations followed. Chainsawing coco stems to provide stakes, batter boards and scaffolding materials was done near the construction site.

The ground was fairly level. Foundations were staked and batter boards and cross bracings were installed. The top of the batter boards were leveled using straight edge and spirit level. The exact location of excavations were determined by actual measurement on all intersection by strings tied following the layout per excavation and staking plan. A plumb-bob was used to transfer measurements on the string to the ground.

4.2 INSTALLATION OF REBARS FOR COLUMN FOOTING, WALL FOOTING & COLUMNS
(Annex I $\frac{S-1}{3}$ and Annex III, EP-4, Under Separate Cover)

Bottoms of excavated foundations were fairly leveled. Rebars (CF-1 see Bill of Materials, Revised) were installed with tie wires at every intersection and interconnected with wall footing

dowel (DD-2, see Bill of Materials, Revised) and vertical bars of columns in conformity with the dimensions and rebar detail plans. After rebar installation, stone block spacers were provided for clearance between rebars and gravel fill.

4.3 MIXING AND POURING OF CONCRETE FOR FOOTINGS
(Annex III, EP-3, Under Separate Cover)

Class A concrete mix was used : that is, for every bag of cement (50 kilograms), mix 0.057 cubic meter of sand, 0.113 cubic meter of gravel and about 23 to 27 liters of water. Mixture was turned over by shovel until it was evenly mixed for uniform consistancy. Water was added intermittently while mixing until entire mixture was uniform throughout. Concrete mix was placed in final position and compacted immediately.

4.4 PLACING OF FORMS FOR COLUMNS, DOWEL BARS AND STEEL STRAP PLATES
(Annex III, EP-5 , Under Separate Cover)

Forms for columns were fabricated and erected with necessary supports such as stakes, nailers and cross bracings. Afterwards form works, dowels and steel post straps were installed over the finish level of columns, and were secured in their correct positions by means of coco wood. Straps were located as per detail plans and were further secured from displacement during the concrete pouring.

4.5 MIXING AND POURING OF CONCRETE FOR COLUMNS
(Annex III, EP-5, Under Separate Cover)

Class A concrete mix was used for all columns and compacted properly. Electrical and sanitary pipes were embedded in concrete as well as all steel straps on their correct positions. Coco wood forms were removed after seven (7) days.

4.6 PLACING OF SCAFFOLDING, FORMS AND REBARS FOR BALCONY, LIGHT AND VENTILATION SHAFT AND TOILET AND BATH
(Annex III, Figure 3 - 4, Under Separate Cover)

Coco wood scaffoldings and forms were installed for all slabs and

beams. All siding forms were installed after installation of all rebars for all beams and slabs were completed. The balance of the steel post straps and machine bolts requirements were installed as indicated in the plans.

Concreting of beams and slabs were done with the same Class A concrete mix. Same pouring procedures were followed and concrete structural and slab components of the building were completed. Forms were removed after 28 days, except those which supported building components which would be subjected to additional loading during the construction activities.

4.7 LAYING OF CONCRETE HOLLOW BLOCKS (CHB)
(Annex III. Figure - 2, Under Separate Cover)

The mortar mixture for laying CHB required 0.085 cubic meter of sand for every bag of cement (50 kilograms). Mixing was done on a fabricated mixing pad made of coco wood.

Concrete Hollow Blocks (CHB) were laid layer by layer and reinforced as designed and with the required diameter and spacing of rebars. All the empty CHB cells were filled with mortar and tamped until they were fully compacted. Rebars were spliced with three sets of tie wires spaced at a minimum 300mm apart. All vertical bars were extended to protrude to the lintel beams of slabs of the toilet and the light and ventilation shaft areas as shown in the detail plans.

All concrete and masonry finishes were 25mm plain plaster finish, except in the toilet and bath floor and walls, wherein all were tile finish as per plans and specifications.

Specialconstruction featured the reinforced concrete stilts (columns) on which all coco wood posts and girts were mounted as the major structural construction joints of concrete and coco wood to assure acceptability, bankability and resistability to natural calamities such as typhoons, earthquakes and rains. All the design features were expected to keep the house in good condition like any other traditional lumber species used in building and housing construction.

V. PHASE TWO - COCO WOOD FABRICATION AND INSTALLATION

5.1 POSTS, 100 mm x 100 mm Built-up, Grade A, S4S, Air Dried (Annex III, BP-2, Figure 6 Under Separate Cover)

Built-up posts were fabricated on the job site with two pieces of Grade "A", 50 mm x 100 mm boards selected and matched in pairs. Both contact surfaces were applied with "Solignum" brand wood preservative before nailing together with 75 mm common wire nails. All nailings were pre-drilled. Holes were drilled through-and-through the first member and penetrated the second member by about 18 mm using drill bit one size smaller in diameter than the 75 mm nail. Nails were spaced at about 30 mm on both faces and with about 25 mm back clearances between nails.

Built-up posts were installed on the fifteen (15) reinforced column stilts using two 19 mm x 127 mm machine bolts for anchorage to the steel post straps embedded on top of each and every stilt as per detailed plans. All coco wood in contact with concrete were coated with "Solignum", including the concrete portion in contact with the post ends.

All posts were braced for lateral movement by using other coco wood materials available on the site which also served as scaffolding for the installation of other coco wood structural framings. The coco wood posts were hard and heavy to handle and work as compared to other Philippine mahogany species. Difficulties in nailing and cross cutting were experienced by the carpenters specially with Grade "A" coco wood.

It was determined and decided that all nailings shall be pre-drilled and preferably with high grade steel nails because inspite of pre-drilling, to drive the nail another 6 mm to 9 mm into the coco wood required six to nine hammer strokes which sometimes were not still successful. A serious study is necessary to solve this aspect of the problem.

The same problem was true in cutting of coco wood wherein the saw required sharpening after about one third (1/3) normal use in

Philippine mahogany wood species.

Thus, it can be understood that as was experienced even from the very beginning during the lay-out, staking, scaffolding and posts erection phase, the construction work was slow and delays ensued.

5.2 FLOOR GIRTS, Grade A, S4S, Air Dried, 2 - 50 mm x 150 mm (Annex III, EP-2, Figure 6, Under Separate Cover)

Floor girts were installed and connected to all the 15 built-up posts as per plan by means of 16 mm ø x 229 mm machine bolts at all ends. Installation of the others was done at one end by means of 16 mm ø x 229 mm machine bolts and the other ends by means of twisted steel strap with two 19 mm ø x 300 mm anchor bolts and two 19 mm ø x 76 mm ø bolts. Anchorage of floor girt to pheriperal beams of light and vent shaft was by means of anchor bolts. All installation was in accordance with the plans and erection manual.

5.3 FLOOR JOISTS, Grade A, S4S, Air Dried, 50 mm x 125 mm (Annex III, 3P-12, Figure 6, Under Separate Cover)

The floor joists were placed in accordance with the second floor framing plan and temporarily nailed to the floor girts and their positions on the floor girts were marked. To install permanently, every other marked joist was removed to give space for the pre-drilling and nailing of the next joist to the bridging as well as the joists to the floor girt. Pre-drilling were through and through plus about 6 mm to 9 mm to the next member (floor girt or bridging) and nailed using 75 mm x 100 mm long nails. The procedure was repeated until all the joists and two lines of bridging were all permanently installed.

The top level of joists were checked by running a string from one end to the other and by spirit level. All faults were corrected immediately, including the bridgings. After installation, deflections, twists and other unusual occurence were checked and found to be all in order except a very negligible springy vibration or movements when sudden force or pressure was applied.

5.4 ROOF GIRTS, Grade A, S4S, Air Dried, 2 - 50 mm x 150 mm
(Annex III, EP-14, Figure 7, Under Separate Cover)

Scaffoldings and bracings were erected to prepare the installation of roof girts to posts. Roof girts were installed and connected by means of 16 mm x 229 mm machine bolts with washers. Construction joints were per design and details in the erection manual. All connections to the posts were very rigid, leveled, plumbed while positions of all roof girts were checked to receive the interconnection to all rafters.

5.5 RAFTERS, Grade A, S4S, Air Dried, 50 mm x 150 mm
(Annex III, EP-14, Figure 7, Under Separate Cover)

Rafters were installed by interconnecting it to the girts, using twisted steel strap plate at one end with 16 mm ϕ x 76 mm long bolts. Timber blocks were inserted between roof girt and rafter and nailed before the machine bolts were tightened. "Y" steel plate at the other end (roof apex) were used with machine bolts, while timber blocks were inserted and nailed before tightening the bolts. The rafter tops were checked by using a cord string across the rafters from one end of the roof framings to the other end to assure a uniform level among the rafter ends. No deflections, twists or other abnormal behaviour were observed on the rafters.

5.6 PURLINS, Grade A, S4S, Air Dried, 50 mm x 50 mm
(Annex I $\frac{A-4}{6}$; Annex III, Figure 7, Under Separate Cover)

After checking that the rafters were all secured rigidly, purlins were installed with spacing of 150 mm (instead of 125 mm as originally specified), starting from the bottom of the rafters going up to the pitch of the roof framings. The purlins were nailed (pre-drilled) to the rafters, with coco wood blocks in between per design and erection manual. Even level of the top edges of the purlins was checked and assured by running a piece of string across the purlins from one end of the roof framing to the other end.

5.7 TYPE I (MARINE) PLYWOOD SHEATHING 6 mm x 4' x 8' , Grade C (Annex I $\frac{A-4}{6}$) , Under Separate Cover)

Spacing and leveling of purlins were checked to be sure that the purlins were rigidly installed with blocks in place. 6 mm thick marine plywood sheathing was installed for waterproofing. Joints of 6 mm marine plywood sheathing were sealed against rain water leaks by ordinary masking tape instead of epoxy sealant as specified due to non-availability of the latter. Marine plywood sheathing in future construction will be "optional" as it was observed that it is not a must. Deleted also were the 910 mm strip 15 pounds specified roof tar paper waterproofing as it was found not necessary provided the same design and sizes of shingles are adopted.

5.8 COCO WOOD SHINGLES, Grade A, B, and C, Rough, CCA Treated 12 mm x 21 mm x 100 mm x 400 mm (Annex I $\frac{A-4}{6}$) , Under Separate Cover)

Coco wood shingles were installed after complete installation of the plywood sheathing. The shingles were installed over the 6 mm thick marine plywood on 50 mm x 50 mm purlins, in straight single courses, but doubled at all eave edges. The butts of the first course of shingles projected beyond the edge of the roof eaves by 50 mm. Spacing between adjacent shingles (side joints) was adequate for expansion, shrinkage and warping. No joints in any three successive courses were in alignment, thus helping assure better leak-proof properties of the roofing system. Installation started from the lowest end of the eaves going upeach shingle being fastened with two galvanized iron common nails to the purlins. Each nail was placed approximately 19 mm from the side edge of the shingles and not more than 25 mm above the exposure line. All nailings were pre-drilled and nails were driven flush with the shingle surface but not too deep to prevent the nail head from crushing the wood. Installation of wood shingles at the ridge was alternately overlapped to conceal the nails. All pre-drilling were through and through penetrating to the purlins by at least 6 mm.

It was further observed that the shingles may be fabricated longer,

up to a maximum of 60 cm. and the purlins spacing can be 25 cm., thereby reducing the number of purlins and increasing the effective roof coverage of shingles to 200 mm. The shingles shall remain 100 mm wide because of coconut trunk diameter constraints.

The shingles roofing exposure to the weather showed negligible shrinkage after three months. Only slight warping, but no splitting was observed. Coco wood shingle design, fabrication and installation were found to be in good order and condition.

5.9 COCO WOOD RIDGE ROLLS AND FLASHING, Grade A and B CCA Treated, Pre-fabricated

(Annex I $\frac{A-4}{6}$ and $\frac{A-6}{6}$, Under Separate Cover)

Designed and developed by UNIDO Consultant on Coco Wood processing, ridge rolls and eaves flashing were fabricated from quartered solid coconut trunks. The ridge rolls and flashings were installed with 50 mm half lap joints and attached to the roof framings with galvanized iron straps with lead washers on top. Such design and fabrication in the mills open opportunities to design other types of roofing components. The color and texture of the wood shingles were beautiful. This is further enhanced by 100% use of coco wood roofing materials and roofing accessories. Corner pieces similar to the ridge rolls or flashing are recommended for use on corner joints of exterior sidings in the future.

5.10 FACIA BOARD, Grade B and C, Kiln Dried, V-Cut, 12 mm x 100 mm

(Annex I $\frac{A-3}{6}$, Under Separate Cover)

Facia boards were installed along the ends of purlins on 50 mm x 50 mm wood nailers. Pre-drilled facia boards were also nailed along rafter lengths, directly to the ends of the rafters. The rafter ends serve as support of the facia boards.

5.11 INSTALLATION OF SIDING FRAMES FOR EXTERIOR WALLS

Grade B and C, Air Dried, S4S, 50 mm x 75 mm

(Annex III, Figure 9-12, Under Separate Cover)

The erection of studs followed after installation of floor joists. S4S studs were used to provide uniform thickness and even nailing

surface so that exterior and interior double wall boards could be installed properly.

The studs rested on floor joists along the second floor pheriphery and were flashed to the exterior face of built-up posts. One piece was used for all vertical members nailed to the horizontal stud resting on the joists, with the other end nailed to the other horizontal stud on the roof frames. This way, the studs contributed to rigid framing and added structural support. All other horizontal studs were as per design and cutting schedule.

Plumbness and right angle positions were checked from time to time specially for all openings provided for windows and door jambs.

However, in future constructions, window and door jambs should be made available early enough to allow their installation at the same time as the studs. Nailing was from studs to the jambs for clean finish. Wood preservative (Solignum) was applied on all studs in contact with concrete.

It is highly recommended that whenever possible, studs and jambs be installed at the same time. Studs were installed per design and erection manual with very minimal changes.

5.12 <u>INSTALLATION OF FLOOR BOARDS, Grade A and B, Kiln Dried Profiled "L" Section (Simple Rabetted) 19 mm x 100 mm</u>
(Annex I $\frac{S-1}{2}$, Detail A $\frac{J}{S-1}$, Under Separate Cover)

Floor joists and bridgings were checked for uniform level by running a piece of string from one end to the other and leveling uneven portions. Floor joists and bridgings were checked again to assure their rigid installation, particularly to the floor girts, prior to installation of simple rabetted floor boards.

Flooring installation started at the middle of the floor and proceeded towards both ends of the area. The first attempt to nail floor boards the standard way was unsuccessful because the section broke or cracked, inspite of pre-drilling procedures before nailing.

Floor boards were therefore, nailed to the joists on the finished surface. The nail holes were counter sunk. Floor boards were installed in continuous length with few staggered joints, which were concealed along partitions as much as possible. Mixed grade of floor boards were noticed due to selection mistakes at the mill. All "C" grades were rejected to be too soft for flooring. Grade "A" only shall be specified and maintained for all coco wood flooring boards in the future.

5.13 FABRICATION AND INSTALLATION OF WINDOW AND DOOR JAMBS
Grade A, Kiln Dried, S4S, 50 mm x 125 mm
(Annex I $\frac{A-3}{6}$ Details C-F, Under Separate Cover)

All window and door jambs were manually fabricated from S4S boards at the jobsite, because the cost of TCT profiling knives required to cut the specified jamb profiles would have been very prohibitive. Simplified design of sections and moulding system were adopted to allow the use of conventional hand tools. This required three times more man-hours for carpenters to maintain the conventional tools on good cutting condition, as the cutting edges become dull too soon. Carpenters were occasionally hurt by coco wood splinters. Grade "A" kiln-dried coco wood was too tough and hard to work on for manual and conventional ways and therefore uneconomical, impractical and time consuming.

Some windows and door jambs were installed in the assigned stud openings, while the others were installed at the same time as the studs. Plumbness, alignment and perpendicularity of the studs were checked and found acceptable.

5.14 INSTALLATION OF V-CUT SIDINGS, Grade B and C,
Kiln-Dried, S4S, 12 mm x 100 mm
(Annex I $\frac{A-2/3/6}{6}$, Under Separate Cover)

Prior to installation of sidings, door and window jambs were checked to be plumb, aligned and rigidly attached to the studs. Installation started from the bottom going upwards. The sidings were installed horizontally instead of vertically for architectural reasons to follow line directions of ceiling of

from roof eaves using the same materials. V-cut sections were not prominent per design because of mill profiling difficulties to profile acute angles. Boards (all in single lengths) were nailed to the studs, leveled and with right angle cut joints on all corners of the building. All board ends were concealed. The same horizontal levels of V-cut lines were maintained all through-out the aidings areas.

V-cut boards with mixed grades were installed as sidings, thus giving a beautiful contrast of light and dark coco wood exterior wall boards with varying shade, finish and texture. However, Grade"A" is too hard for sidings. Twisting, shrinkage and warping were negligible on all lengths.

Grade "C" boards, which are the light colored boards, showed splinters on profile finish. This requires machine or manual sanding to attain smooth surfaces. Compared to traditional Philippine mahogany species (Lauan and Tanguile), handling coco boards require extra man-hours, roughly three times more.

Horizontal installation required almost the same lengths and volume of boards as compared to vertical installation, because wastage was within tolerance. The choice between vertical or horizontal installation of sidings is the discretion of the owner and architect.

5.15 INSTALLATION OF CEILING JOISTS (NAILERS) AND HANGERS
Grade B and C, Air Dried, Rough, 50 mm x 50 mm
(Annex I $\frac{A-4}{6}$ Under Separate Cover)

Ceiling joists were installed following the pattern and markings on ceiling plans. Continuous ceiling runners were installed along partitions and exterior siding studs. Hangers were connected to the roof frames every 1.20 meters or as often as necessary. All specified sizes of ceiling joists (50 mm x 50 mm) were found to be adequate and were maintained without changes per plans.

The ceiling joists on all roof eaves were installed flush with

and followed the inclination of the rafters in order to cover all roof framings except the end portions of roof girts. V-Cut ceiling boards were also installed according to a pattern which followed the same line and directions of all exterior wall boards for architectural purposes. The level of ceiling joists were checked from time to time and were verified to be all rigidly hang and secured.

5.16 INSTALLATION OF CEILING BOARDS, Grade B and C, Kiln-Dried, Profiled V-Cut, 12 mm x 100 mm (Annex I $\frac{A-4}{6}$, Under Separate Cover)

Ceiling boards were installed before the installation of double wall partition boards. V-cut lines were made parallel to the V-cut wall board partitions all through-out the living-dining-kitchen area. The same technique was done in installing the ceiling in all bedrooms and toilet.

All V-cut ceiling boards were installed at the roof eaves following the lines and directions of the front exterior wall. V-cut boards were installed to include the facia boards as per new design furnished by the architect.

5.17 INSTALLATION OF DOUBLE WALL PARTITION (FRAMES) STUDS Grade B and C, Air Dried, S4S, 50 mm x 75 mm (Annex III, Figure 20, Under Separate Cover)

All studs were installed resting on the flooring. All vertical studs were of one piece lengths and were connected to the bottom and top horizontal studs. They were checked to assure that they are plumbed, aligned and leveled all throughout as per plans and erection manual. Studs were installed to receive both exterior and interior sides composed of V-cut boards set horizontally all throughout the wall areas.

5.18 INSTALLATION OF DOUBLE WALL PARTITION BOARDS Grade B and C, Kiln-Dried, Profiled, 12 mm x 10 mm (Annex I $\frac{A-4}{6}$, Under Separate Cover)

Installation of double wall partitions was done after the installation of all door and window jambs. Boards were

installed horizontally, instead of vertically, to follow the line and direction of ceiling V-cut boards, for better aesthetic considerations. Board ends were fitted clean-cut to door and window jambs, and with right angle joints on all corners to maintain the same leveled lines.

5.19 INSTALLATION OF BALCONY AND LIGHT AND VENT SHAFT RAILINGS Grade A, Kiln-Dried, S4S, 50 mm x 100 mm

(Annex III, Figure 19, Under Separate Cover)

Railings were fabricated at the jobsite manually, using carpenter's conventional hand tools. After preparation of components, installation followed by anchoring the base plates to the concrete with machine bolts, supplemented by concrete nails. Vertical components were first erected to allow extensions of the rafters at three points for additional rigid support. Other components followed as per plans and erection manual.

5.20 INSTALLATION OF MAIN AND SERVICE STAIRS, Grade A, Kiln-Dried, S4S, 50 mm x 200 mm ; 50 mm x 150 mm ; 50 mm x 100 mm

(Annex I $\frac{A-5}{6}$, Under Separate Cover)

Stringers were prepared from two pieces of 50 mm x 200 mm coco wood specially sawn for the purpose. Triangular blocks were cut along one edge of the boards, requiring a 50 mm thick piece to build up the stringers to specified width. The stringers were installed to the anchor plates embedded in the concrete base. Built-up treads were prepared and installed after checking positions, levels and rigid construction. Treads were built-up from 50 mm x 125 mm and 50 mm x 100 mm boards and installed on the stringers as per design and erection manual. Railings and balusters were installed after completion of tread installation. All joints were fastened by common nails, concealed as much as possible, or at inconspicous locations.

The same procedures were applied to the installation of the Service Stairs.

5.21 INSTALLATION OF CLOSET AND ATTACHED PARTITIONS, Grade A, Kiln-Dried, S4S, 50 mm x 100 mm ; 12 mm x 100 V-cut (Annex I $\frac{A-6}{6}$, Under Separate Cover)

Installation of closet was done after complete installation of floor boards, double wall partition boards, ceiling boards and double walling. Framings were fabricated manually at the jobsite using simple sections and the moulding system of installing the V-cut door panels, following basically the plans and erection manual.

All framing joints were glued and nailed and all exposed surfaces were smoothly dressed, ready to receive oil finish or flat varnish.

5.22 INSTALLATION OF KITCHEN CABINETS AND COUNTER, Grade A, Kiln-Dried S4S, 50 mm x 100 mm and 12 mm x 100 mm V-cut; 18 mm x 100 mm "L" Section, Floor Boards

Framings and other components were fabricated at the jobsite. The framings were installed resting on the base plate board as floor supports and vertical framings extended to the ceiling. Kitchen tops were made of L-profiled floor boards, while cabinet doors were made from V-cut siding boards.

Ordinary hinges and catches were installed on the top and bottom of doors. All carpentry works were smoothly finished and sanded.

VI. MODIFICATION OF THE DESIGN AND ERECTION MANUAL

6.1 ROOFING

6.1.1 Purlins spacing should be widened from 127 mm (5") to 150 mm (6") to correct structural over-design, thus reducing the quantity and the total weight of coco wood for purlins, instead of reducing their cross sectional

dimensions.

6.1.2 The exposed portion of shingles should be enlarged to 37.5% (instead of 31.25%), which is 150 mm instead of 125 mm of the shingle length.

6.1.3 Solid wood ridge rolls may be used at the apex of the roof instead of multiple shingle layer at the apex course. Solid wood flashing was also introduced at the roof edge as developed by the consulting wood expert during the milling of the coconut stem.

6.1.4 The use of 12 mm x 100 mm V-cut facia board instead of 25 mm x 150 mm coconut wood boards is acceptable.

6.2 ROOF FRAMING

6.2.1 The use of one instead of two anchor steel straps for every rafter anchorage to the roof girt per instruction of Structural Engineer is acceptable.

6.2.2 The roof girts at the end of gable roof may be extended to give "Malayan" motif of architecture.

6.3 SIDINGS, DOUBLE WALLINGS AND PARTITIONS

6.3.1 The use of horizontal V-cut sidings instead of the original vertical V-cut designs for all exterior walls is acceptable for architectural design reasons.

6.3.2 12 mm x 100 mm V-cut double walling may be installed horizontally instead of vertically for the same architectural design reasons.

6.3.3 Less acute V-cut design in V-cut boards may be adopted to avoid splitting and other difficulties in profiling operations.

6.4 STAIRS

6.4.1 Widening of the stairwell from 0.90 m to 1.00 m is acceptable.

6.4.2 The stair landing at the second floor may be enlarged from 300 mm (as originally designed) to 600 mm.

6.4.3 The use of 50 mm x 125 mm wood for handrailing instead of 30 mm x 150 mm is acceptable.

6.4.4 Floor joists may be chamfered at the approach of the stairs to give more head room due to enlargement of the second floor landing.

6.5 DOORS, WINDOWS AND JAMBS

6.5.1 The use of 12 mm x 100 mm V-cut boards instead of 12 mm x 100 mm T & G boards on all door panels is acceptable for architectural design reasons.

6.5.2 The use of 12 mm x 100 mm V-cut boards instead of 10 mm x 100 mm boards for wood louver blades and wooden jalousy blades is acceptable in case the latter size is not available.

6.5.3 50 mm x 125 mm kiln-dried coco wood may be used for all door and window jambs in case 50 mm x 150 mm boards are not available. Mouldings may also be used on door frames to facilitate installation of door panels.

6.6 CEILING INTERIOR AND EXTERIOR

6.6.1 12 mm x 100 mm V-cut boards may be used for both interior and exterior ceilings instead of 12 mm x 100 mm T & G as originally designed.

6.7 CABINETS AND ATTACHED PARTITIONS

6.7.1 Simplified profiling for all cabinet frames and the use of ordinary wood mouldings to install 12 mm thick V-cut panels may be adopted in case T & G profiling blades ground to cut the originally specified profiles are not available.

6.8 BALCONY RAILINGS

6.8.1 The extension of balcony railing posts to the rafters is allowed provided they are properly anchored to give railing components more rigid connection.

6.9 CANOPIES

6.9.1 Canopies (not included in the original design) may be provided above windows at the left and right side of the coco house for added rain protection of windows far from roof eaves.

6.10 STRUCTURAL

6.10.1 "Although there are visible deflections in some beams and girts, these members are still structurally sound and can safely carry the required loads.

In locations where such deflections may not be aesthetically pleasing, a simple solution is to place brackets which may be architecturally treated."

VII. RECOMMENDED SCHEDULE OF COCO WOOD FINISHES

7.1 INTERIOR FINISHES

7.1.1 Floor Boards

Floor boards shall be properly machine sanded smooth and and ready to receive one coat of sanding sealer. Apply one coat of colorless wax and polish by machine or manually to give desired sheen.

7.1.2 Oil Finish

This is for all interior walls and partitions, interior ceiling, interior of all cabinets and closets.

7.1.3 Flat Varnish Finish

For all door and window jambs, doors, cabinet and closet doors, all closet and cabinet works, handrails of balusters and railings and all finishing coco wood in the interior.

7.1.4 Exterior Oil

For all exterior wall boards, ceiling beards, exposed rafters, exposed girts and all other exposed coconut wood except roofing shingles. Apply at least two coats of exterior finishing oil.

VIII. PLUMBING SYSTEM

8.1 GENERAL SCOPE OF WORK

The work done was the supply and installation of the complete plumbing system to be carried out in compliance with the local rules and regulations on plumbing code, and the specifications, drawings and erection manual prepared by the Project's Designing architect.

SPDA supplied all the pertinent materials and components, the plumbing labor contractor furnished all labour, tools and equipment necessary to complete the installation of the plumbing system in coordination with the other concrete, masonry and carpentry work schedules.

Pipes and fittings embedded in concrete were held firmly in position and protected from damage while the concrete works was being laid. Pipes which were prevented from being accidentally clogged during construction activities were checked and cleaned again before acceptance of the work.

All plumbing fixtures, fittings, accessories, materials and all work necessary to the proper functioning of all installation were provided as shown and indicated on the drawings and materials specifications.

A septic vault was constructed conforming to the dimensions and location indicated in the drawings, and with all the necessary fittings and pipes complete and ready for service. Plumbing specifications and drawings and all plumbing fixtures complied with the American Society for Testing Materials (ASTM), American National Stardards Institute (ANSI) and National Plumbing Code of the Philippines and American Water Works Association (AWWA).

IX. ELECTRICAL SYSTEM

9.1 GENERAL SCOPE OF WORK

The work done involved the furnishing, fabrication, installation and testing of the complete lighting system, including conduit wiring system, lighting fixtures, convenience outlets, power outlets, switches and lighting panel board for the complete electrical system of the house.

Wiring method was in Polyvinyl Chloride conduit and detailed installation was in accordance with the latest edition of the Philippine Electric Code (PEC).

Convenience outlets and switches were all flash type, duplex type and single pole respectively. Switches controlling ceiling outlets totalling less than 300 watts were rated at 5-amperes, 250 volts. Switches controlling outlets totalling 300 watts or over were rated 10-amperes, 250 volts.

Wires and cables used were copper wire, moisture heat resistant thermoplastic, type "TW" and "THW" as shown in the drawings. All condusctors used had insulation rating of 600 volts and were of stranded manufacture for all sizes.

Panel boards and safety switches were installed per design and specifications. Lighting and distribution panel boards were all air circuit breakers, surface mounted type, provided with hinged door with combination catch and lock with key and door trim. Covers were secured with brass screws. Gaskets were provided for boxes located out of doors or in damp locations.

Conduit installations, boxes, fittings and accessories conformed to the requirements of the latest edition of the Philippine Electrical Code (PEC). Each run of conduit between boxes or equipment were electrically continuous. Threads conform to the American Standards for Tapered Pipe threads cut with approved dies.

All electrical devices such as panel boards, convenience and power outlets boxes, fittings and accessories, air-condition units, ranges, stoves, safety switches were properly grounded to the nearest water pipe.

X. CONCLUSIONS AND RECOMMENDATIONS

10.1 The Project was able to demonstrate the utmost utilization of the coconut trunk, particularly in consonance with the building industry. In addition, the move towards the use of indigenous materials for construction and the immediate need for shelter and shelter-components research results were tested.

The demonstration was also able to introduce coconut timber as a new indigenous shelter material to be produced commercially but to be utilized purposively for low-cost/low income housing, henceforth with implications and greater affordability and utility as a supplementary timber source. In the process, it encourages research and development of how best to utilize the coconut stem and its other parts, waste and by-products.

The thrust on production of low-cost indigenous building materials is of vital importance and relevance because at present, shelter materials cost in the Philippines were inflated by either expensive production methods or high foreign exchange costs, thus requiring higher capital investment and other relative costs. Its significance is also reflected in its contribution to the following:

i - The development of alternative building materials and shelter components for low-cost housing;

ii - The encouragement of innovative architectural and structural designs considering optimum use of the unique physical characteristics of coconut wood;

iii - The chance to introduce to the local and international markets a new, attractive and durable product ;

iv - The additional farm income and rural employment it gives to the coconut farmers ; and

v - The elimination or reduction of phytosanitary hazards in the plantation site, which is expected as a potential problem during coconut replanting activities.

The project is a viable business venture with strong economic and social significance. Raw materials are readily available for the production of coconut timber. This is on the assumption that the country has 3,125,000 hectares planted to coconut which yields approximately 100 trunks per hectare the majority of which are already considered senile trees (1980 PCA Studies).

There is a constant demand and need for low-cost housing, shelter and local and international construction.

The government and other international organization like UNIDO has provided incentives and sponsored programmes for the utilization of indigenous materials and non-conventional components. The government also has moved to control the cutting of conventional sources of timber, and has encouraged tapping other supplementary sources.

Coconut lumber as a construction material substitute for traditional wood species (e.g., Lauan, Tanguile, Apitong, etc.) is very promising it being durable, economical and abundant according to PCA estimates. The use of indigenous materials for construction is also being encouraged by both the government and private sectors. However, the following recommendations should be studied for implementation in future construction projects involving coconut wood.

10.1.1 Commercial coco wood sizes should be established and designing architects and engineers should be encouraged to specify and use coconut wood components based on information and guidelines on the economic and practical design of houses and other structures.

Designs therefore will be guided by available commercial

sizes to maximize coco wood usage and at the same time also increase coco wood recovery during coco lumber milling or processing operations.

Light timber structural design system should be encouraged due to expected limitations in thickness and commercial sizes of coco wood.

10.1.2 Construction connection of joints of coco wood should be further studied. Nailing procedures, where extreme difficulties were experienced during the construction of the demonstration coco wood house, deserve special attention in order to avoid pre-drilling activities which are laborious and wasteful. Fastening techniques other than that using common wire nails should be explored. Any improvements thus evolved should be adopted in future construction activities making use of coco wood.

10.1.3 Properly treated coco wood may be used for exterior structural members and components provided wet and dry joints with the same or other materials are minimized. The recommended design of coco wood balcony and toilet and bath components are cited as samples. Please refer to design "Annex I a.".

10.1.4 The possibility for more extensive use of built-up coco wood building structural components such as posts, girts, rafters, joists and others, should be further studied with a view to determining the economical and practical system to be adopted, particularly for rural housing developments where coco wood will be abundant during replanting periods. The use of built-up components will help maximize coco wood u age as well as provide more jobs in rural areas it being labor-intensive.

10.1.5 Coco wood as a substitute for building material components which are heretofore made of traditional wood species like roof shingles, doors, jambs, louvers,

balusters, canopies and others, should be developed for possible use in big scale urban housing developments by both the government and private sectors. It is an excellent way of promoting usage of indigenous construction materials for low and medium cost housing.

GREGORIO G. STA. MARIA & ASSOCIATES
ARCHITECTS • ENGINEERS

34 PITIMINI ST., PALTOK. SAN FRANCISCO DEL MONTE. QUEZON CITY. PHILIPPINES
TELEPHONES: 99-11-71: 99-14-40: 95-12-16: 99-74-77: 98-65-28 & 98-11-34 CABLE: "SANTAMARIA"

June 29, 1984

C E R T I F I C A T I O N

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Project Title: SI/PHI/83/801 Demonstration of Coconut Wood Utilization In Low Cost Housing

This document is the certification that as the Designing Architect and in charge of supervision of the above captioned project, the structure has been designed and constructed in accordance with the Philippine National Building Code which is the basis of all building regulations in the country.

This is to certify further that the Structural Engineer (licensed Civil Engineer), Sanitary Engineer and the Professional Electrical Engineer who designed and inspected the project have certified in writing that their respective design, construction and installation were executed in accordance with the plans, design and erection manual.

Written certifications of Cesar A. Caliwara, Structural Engineer; Ernesto Villaos, Sanitary Engineer; and Jose Enriquez, Professional Electrical Engineer are all attached herewith and formed part of this certification.

Quezon City, Metro Manila
Republic of the Philippines

GREGORIO G. STA. MARIA
Architect
Registration Certificate No. 1541
Professional Tax Receipt (License)
No. 418 B, Dated January 16, 1984
Issued at Quezon City, Metro Manila

TECPHIL
THE ENGINEERS COLLABORATIVE PHILIPPINES
2ND FLOOR, DELTA BUILDING
QUEZON AVE., COR. WEST AVE., QUEZON CITY
PHILIPPINES

ENGINEERING SERVICES:
CIVIL WORKS
STRUCTURAL
MECHANICAL
ELECTRICAL
SANITARY

Southern Phil. Development
Authority Davao Pequeño
May 9, 1984

ARCH. GREGORIO STA.MARIA
34 Pitimini Street, SFDM
Quezon City

Dear Sir:

This is in connection with our inspection trip to the site of the prototype coconut wood house at the Southern Philippine Development Authority Compound Davao Pequeño, on May 9, 1984

We are submitting herewith our observations and comments as follows:

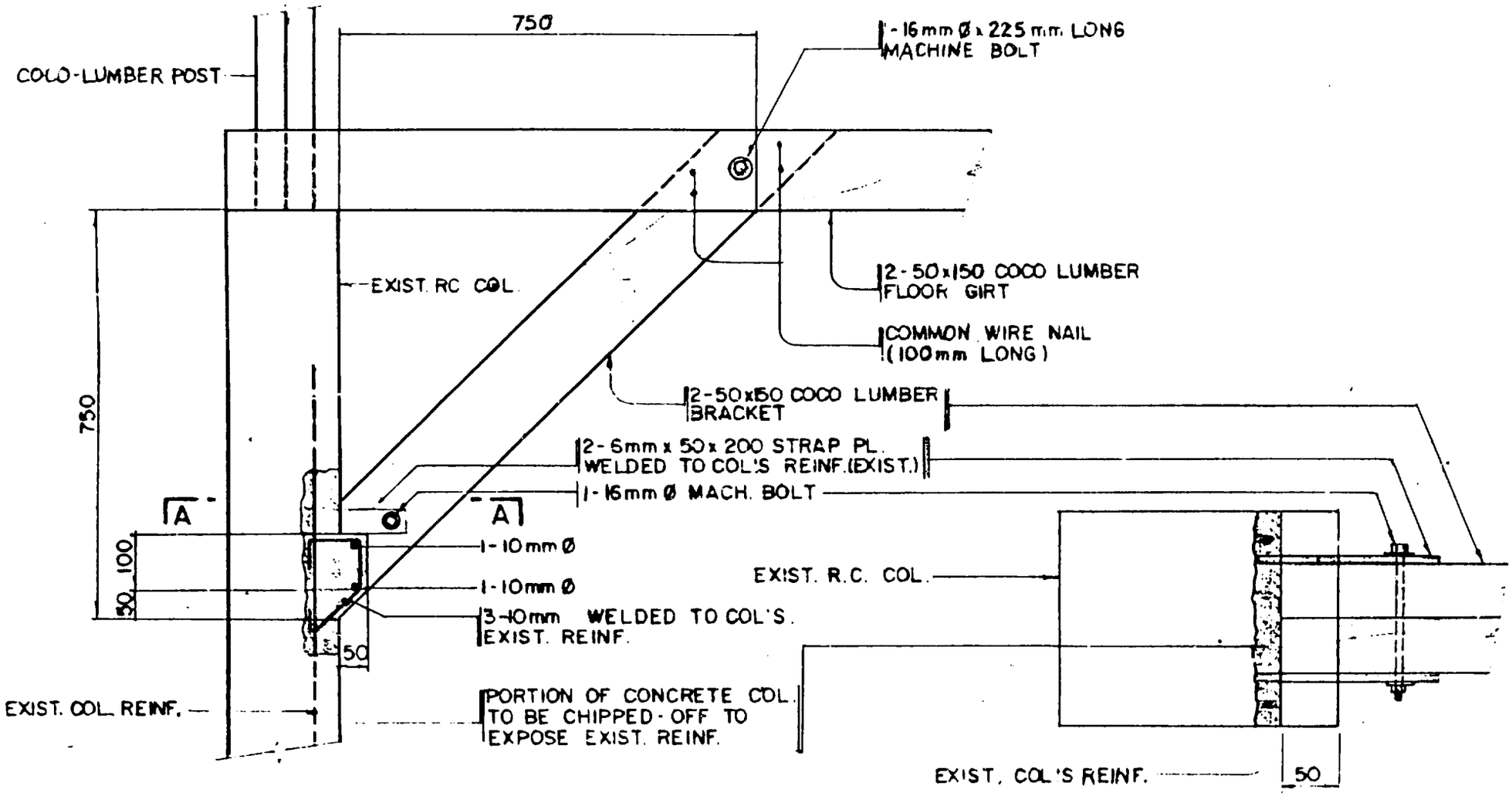
1. The structure has been designed and constructed in accordance with the Philippine National Building Code which is the basis of all building regulations in the country.
2. The visible structural framework made of coconut lumber was built in accordance with the plans.
3. Although there are visible deflections in some beams and girts, these members are still structurally sound and can safely carry the required loads.
4. In locations where such deflection may not be aesthetically pleasing, a simple solution is to place brackets which may be architecturally treated. (See accompanying sketch, Figure 1.) Note: This beam size is just about the maximum obtainable practically, hence the bracket solution.
5. Improved structural details of balcony area are shown in Figures 2 and 3, and may be implemented in succeeding construction.

Should there be any further questions, please do not hesitate to communicate with us.

Yours truly,

CESAR A. CALIWARA
President
PRC Certificate No. 1781 & PTR No. 242
Dated April 12, 1984, Quezon City, MM

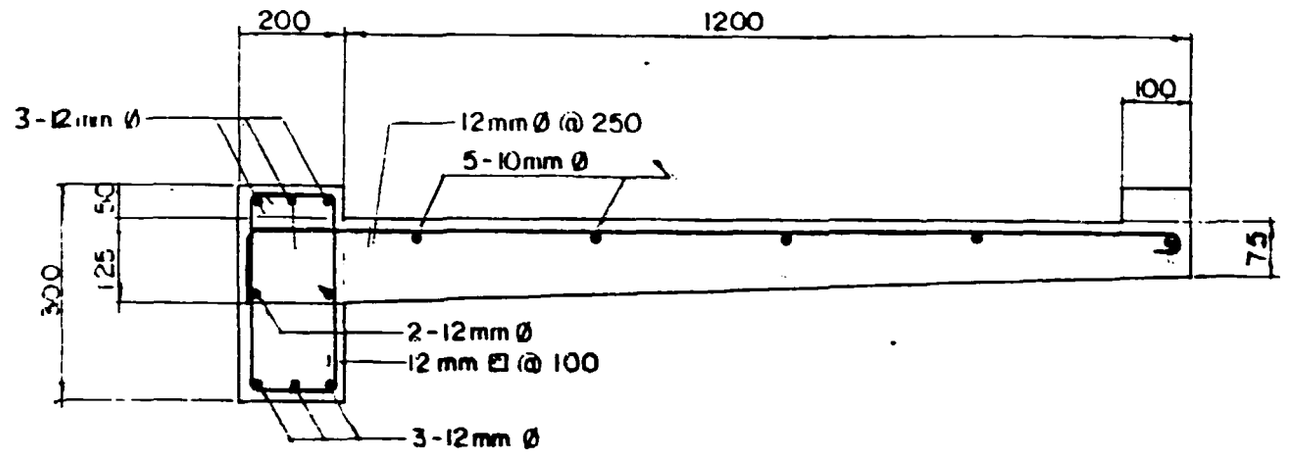
CAC:mip



ELEVATION DETAIL

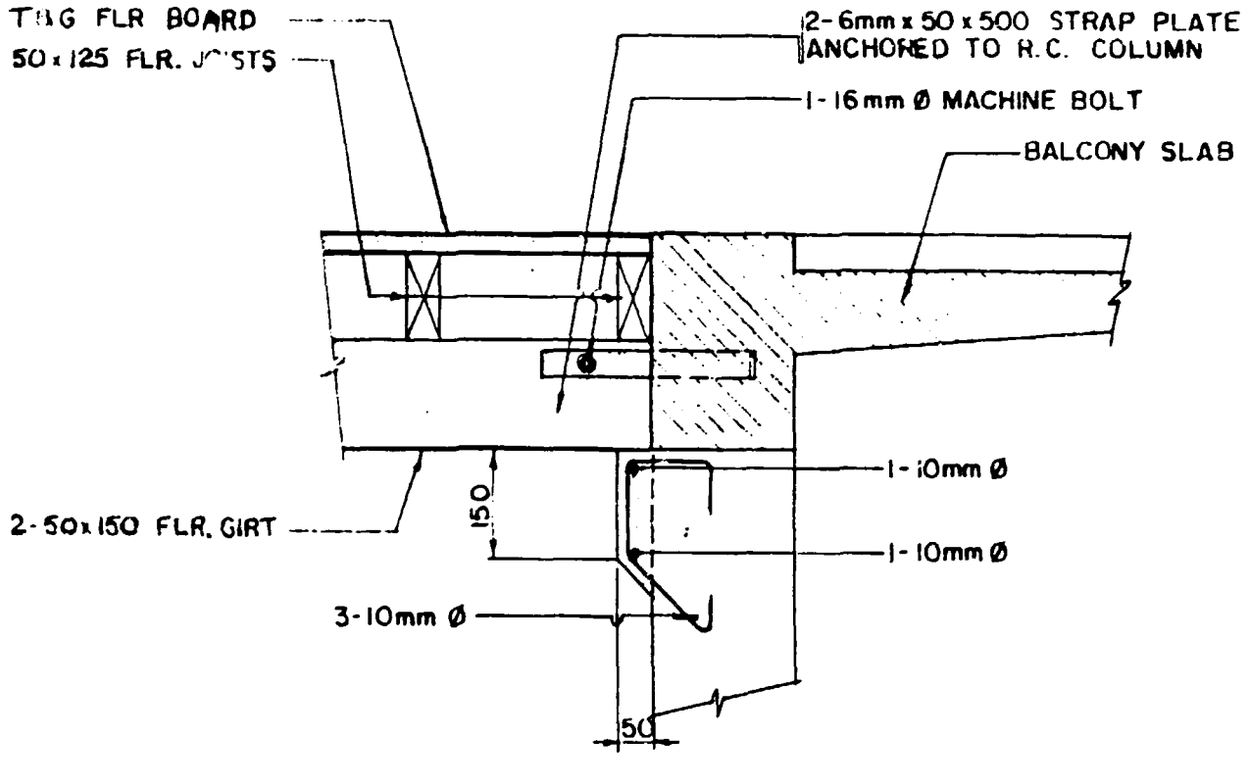
SECTION A-A

FIGURE 1 : STRENGTHENING OF FLOOR GIRTS



TYP. DETAILED SECTION OF BALCONY SLAB

FIGURE 2 : REVISED BALCONY SLAB



CONN. DETAIL OF FLOOR GIRT TO R.C. COL. NEAR BALCONY AREA.

FIGURE 3 : ANCHORAGE DETAIL OF FLOOR GIRTS TO BALCONY'S COLUMN SUPPORTS.

Arch't. Gregorio G. Sta. Maria
34 Pitimini St., Paltok San Francisco
del Monte, Quezon City
Metro Manila

Dear Sir:

This is a letter certification in connection with the inspection of the project Demonstration of Coconut Wood in Low Cost Housing at the Southern Philippines Development Authority compound, Davao City on May 9, 1984, as Consulting Sanitary Engineer.

I am certifying the following:

1. That the Plumbing System has been designed and constructed in accordance and following standards:

   1.a ASTM American Society for Testing and Materials

   1.b ANSI American National Standards Institute
   National Plumbing Code of the Philippines

   1.c AWWA American Water Works Asscciation

2. That the design and construction was done in accordance with the Erection Manual with provisions for future expansion on the ground floor.

This certification was issued as the Consulting Sanitary Engineer of the project of SPDA, UNDP and UNIDO.

Southern Philippines Development Authority
Davao City, Philippines
May 9, 1984

Sincerely yours,

ERNESTO VILLAOS
Sanitary Engineer

Professional Regulation Commission
Certificate No. 657

Professional Tax Receipt (License)
No. 114879 dated February 16,
1984, issued at Quezon City

ARCHITECT GREGORIO G. STA. MARIA
34 Pitimini Street, Paltok, SFDM
Quezon City, Metro Manila

Dear Sir:

This is a certification in connection with the inspection trip to the site of the Demonstration of Coconut Wood in Housing at the Southern Philippines Development Authority Compound, Davao Pequeño Davao City, wherein I am the Consulting Electrical Engineer.

I am submitting herewith my observation and comments as follows:

1. The Electrical System has been designed and installed in accordance with the latest edition of the Philippine Electrical Code (PEC) which is the basis of all electrical regulations in the country.

2. The inspection shows that the electrical works was installed in accordance with the plans and erection manual except provision for electric meter because SPDA supply their own electric power.

3. It was observed however that provisions or spare for future expansion on the ground floor were installed and within the computed design.

This letter certification was issued as one of the requirements being the Consulting Electrical Engineer of the project.

Southern Philippines Development Authority
Davao Pequeño, Davao City
09 May 1984

Very truly yours,

[redacted] VASQUEZ
Professional Electrical Engineer
Professional Regulation Commission
Certificate No. 924

Professional Tax Receipt (License)
No. 914 757 dated January 31,1984
Issued at Quezon City, Metro Manila

B I B L I O G R A P H Y

Decena, A. S., B. J. Penid, F. R. Siriban & F. N. Tamolang. PRODUCTION COST OF COCONUT-LUMBER PRODUCTS I. TREATED STONE-CUT.**

Eala, R. C. & D. G. Quiñones. SAWMILLING OF COCONUT TRUNK.*

Eala, R. C. & F. N. Tamolang. SPECIAL TREATMENT OF SOFT COCONUT LUMBER**

Espiloy, E. B. & F. N. Tamolang. BENDING STRENGTH OF FULL-SIZED COCONUT TRUNK POLES**

Garcia, M. L., A. V. Reyes & F. N. Tamolang. EXPLORATORY TEST ON THE NATURAL SUSCEPTIBILITY OF COCONUT "WOOD" TO TERMITES**

Joson, R. A. LOGGING OF COCONUT PALMS, CWUT 310, PCA-Zamboanga Research Center, Zamboanga City, 1983.

Lauricio, F. M. & F. N. Tamolang. THE STRENGTH AND RELATED PROPERTIES OF COCONUT TRUNK**

Madrazo, R. M. & Joson, R. A. THE PRODUCTION OF COCONUT LUMBER, SAWING AND SAWING FACILITIES, CWUT 103, PCA-Zamboanga Research Center, Zamboanga City, 1983

Medrano, R. N. & F. M Lauricio. SPECIFIC GRAVITY AND SHRINKAGE OF COCONUT PALM TIMBER IN THE PHILIPPINES**

Mendoza, Alfonso M. R. HARVESTING COCONUT STEMS**

Mosteriro, A. P. & F. R. Siriban. COCONUT WOOD PRESERVATION IN THE PHILIPPINES*

Mosteriro, A. P. MACHINING PROPERTIES OF COCONUT WOOD*

Palomar, R. N. PRESERVATION TECHNIQUES FOR COCOWOOD, CWUT 120, PCA-Zamboanga Research Center, Zamboanga City, 1983

Peñamora, L. J. PRODUCTION OF SHINGLES FROM COCOWOOD, CWUT 105, PCA-Zamboanga Research Center, Zamboanga City, 1983

Peñamora, L. J. COCOWOOD HANDICRAFTS, NOVELTIES AND CARVED PRODUCTS, CWUT 130, PCA-Zamboanga Research Center, Zamboanga City,1983

Peñamora, L. J. AIR AND KILN-DRYING OF COCOWOOD, CWUT 310, PCA - Zamboanga Research Center, Zamboanga City, 1983

Sulc, V. K. COCONUT STEM UTILIZATION STUDIES, Philippine Coconut Research Center

Sulc, V. K. MECHANICAL PROPERTIES OF COCONUT PALM WOOD, PCA - Zamboanga Research Center, Zamboanga City, 1983

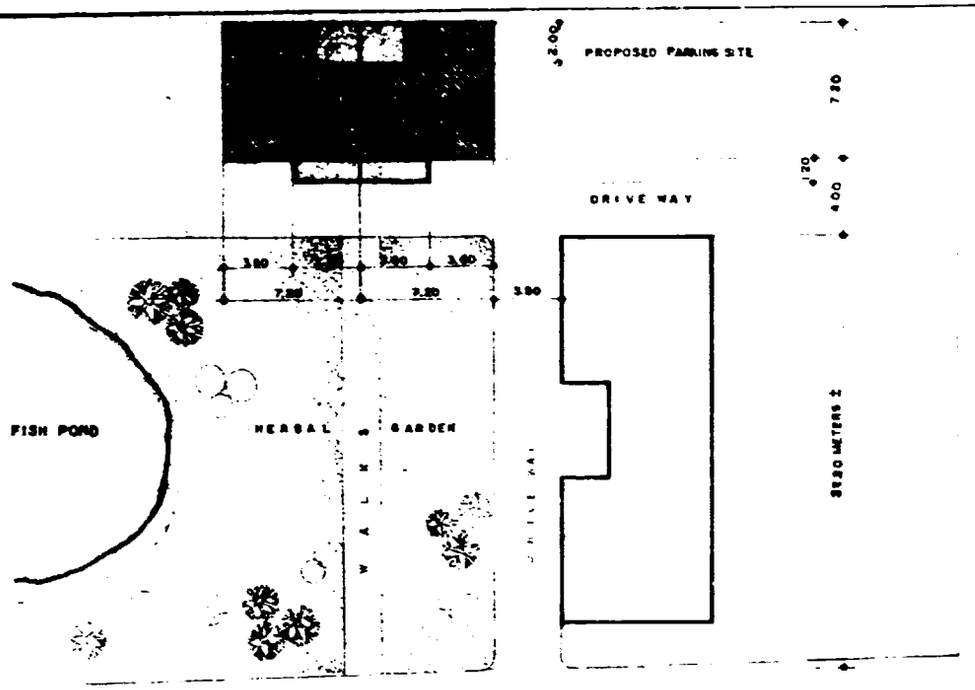
L E G E N D :

* Paper presented during the Meeting on Coconut Wood - 1979, sponsored by the Philippine Coconut Authority, New Zealand, Ministry of Foreign Affairs, and the Asia and Pacific Coconut Community, at Manila and Zamboanga on October 22-27, 1979.

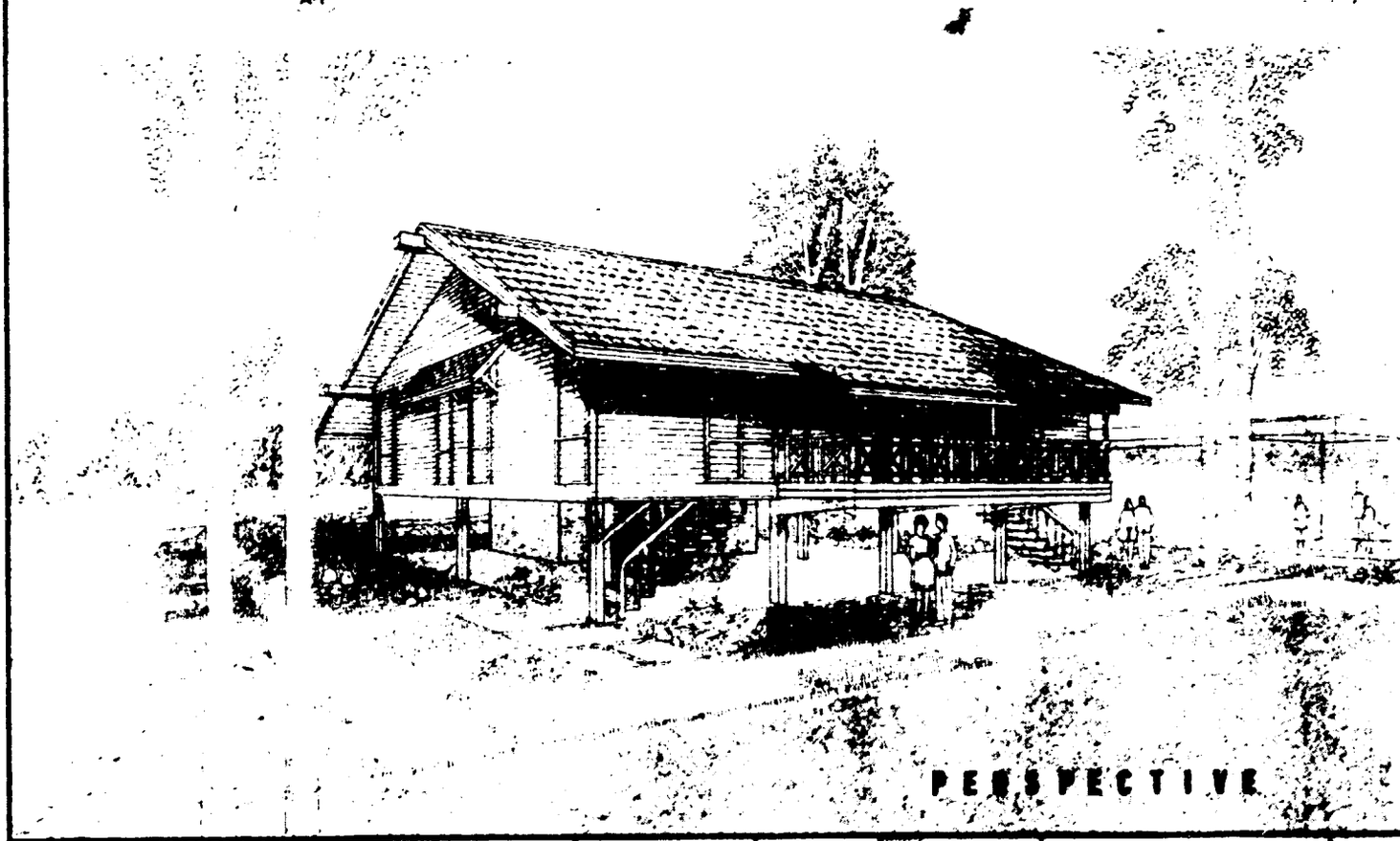
** Paper presented during the Coconut Stem Utilization Seminar, Tonga, October, 1976.

ANNEX 1

D R A W I N G S



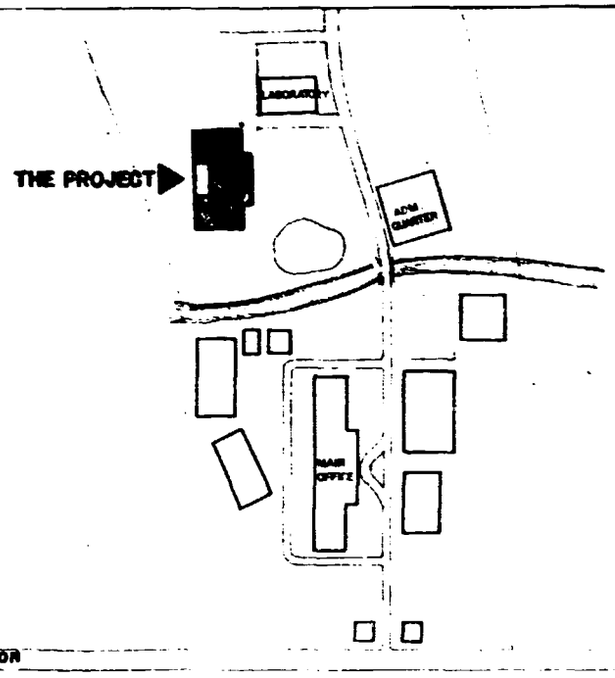
1 SITE DEVELOPMENT PLAN
A-1 SCALE 1:200 MTS



PERSPECTIVE

GREGORIO G. STA MARIA ARCHITECT · PLANNER · CONSULTANT 14 PITIMINI ST SAN FRANCISCO DEL MONTE QUEZON CITY METRO MANILA PHILIPPINES TEL NO 99144(99117	REG. NO. 1341 PTR 418 8 DATE 1-10-84 PLACE Q.C. TAN 53565 L 1737 A-4	PREPARED BY: GREGORIO G. STA MARIA ARCHITECT	APPROVED BY UNITED NATIONS UNIDO, UNDP	PROJECT DEM UTI - SI

SECTION 1



2 VICINITY / LOCATION PLAN
A-1 NOT TO SCALE

REPUBLIC OF THE PHILIPPINES
MINISTRY OF PUBLIC WORKS
TRANSPORTATION & COMMUNICATION

OFFICE OF BUILDING OFFICIALS

DISTRICT / CITY / MUNICIPALITY

LAND USE & ZONING

LINE & GRADE

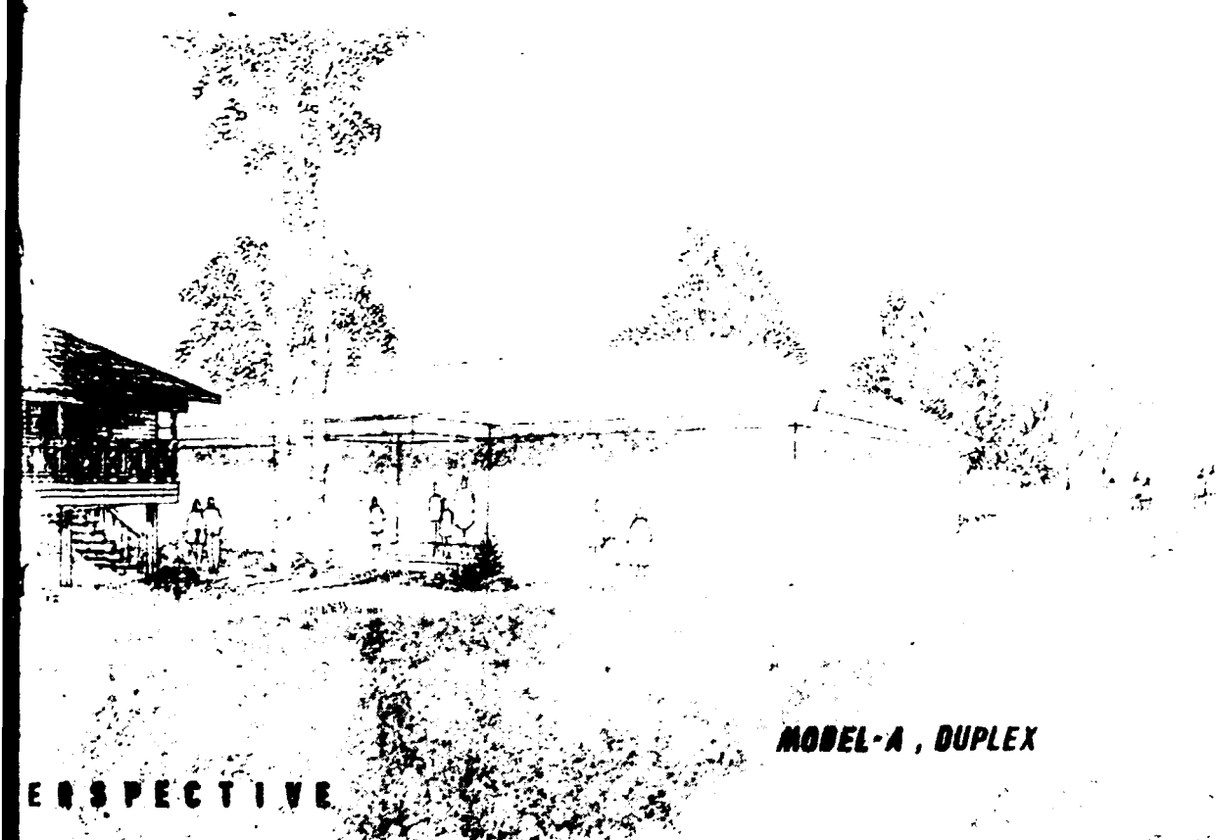
ARCHITECTURAL

STRUCTURAL

SANITARY

ELECTRICAL

MECHANICAL

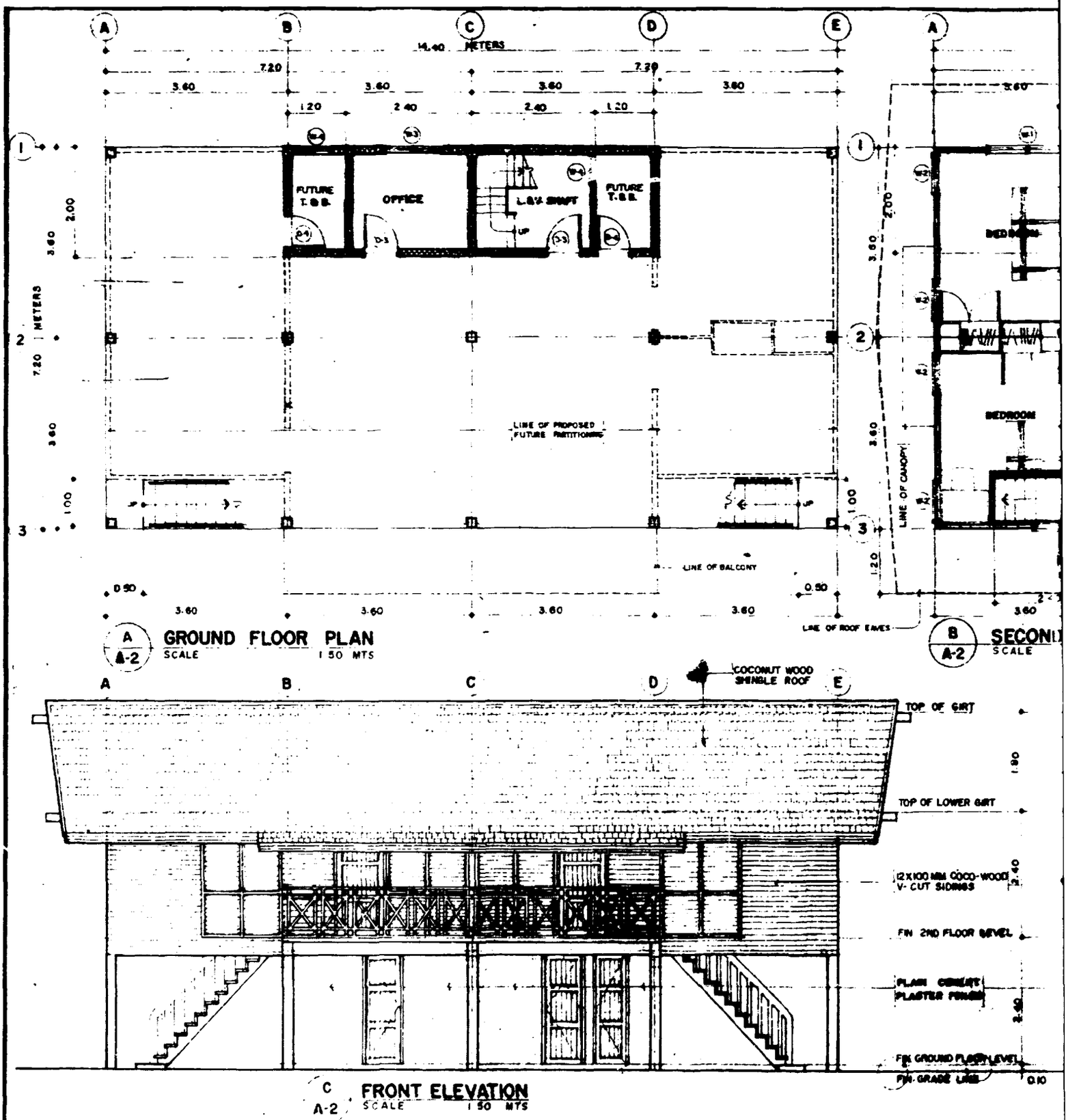


MODEL-A , DUPLEX

ERSPECTIVE

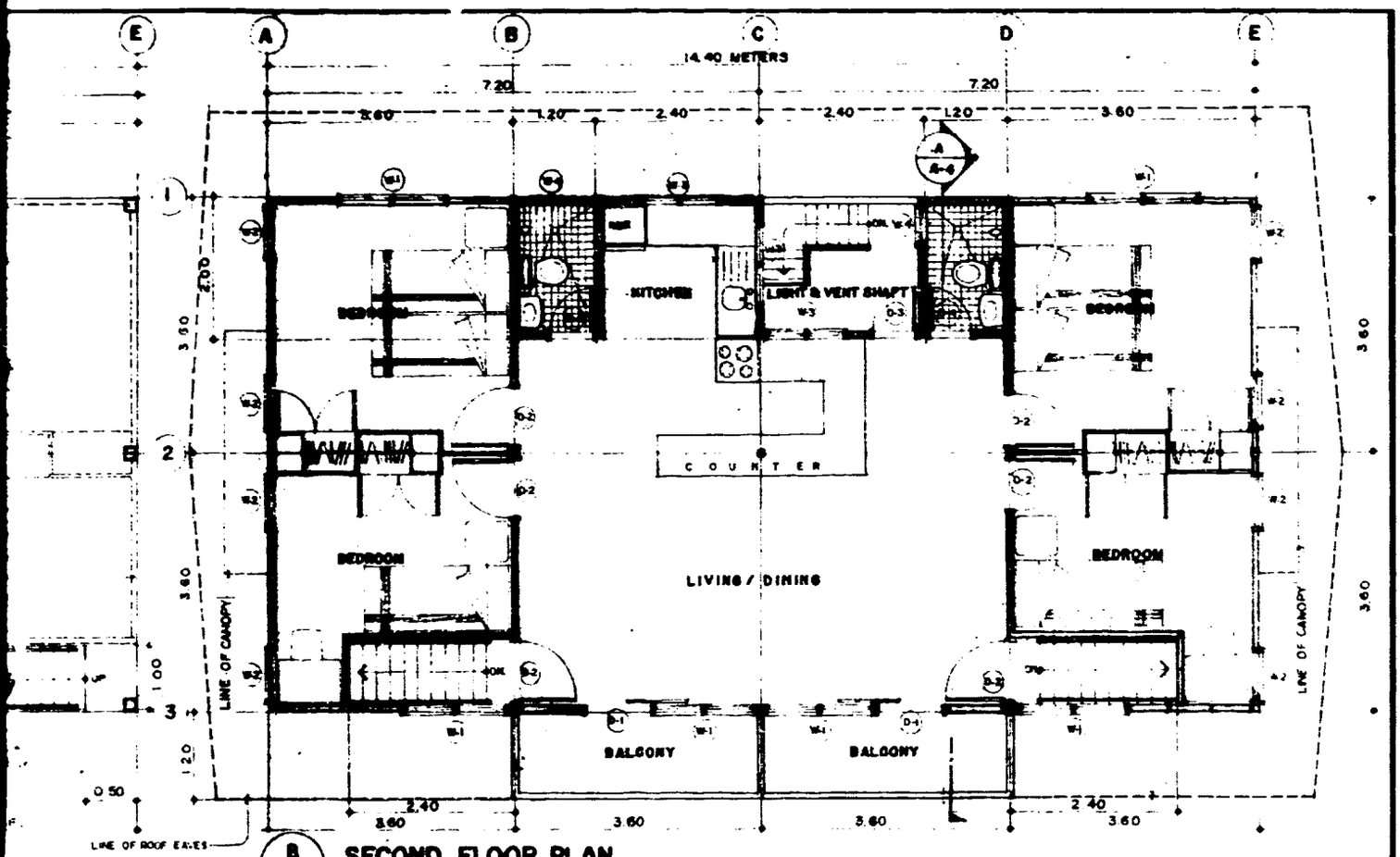
	APPROVED BY: UNITED NATIONS UNIDO, UNDP	PROJECT TITLE: DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW COST HOUSING - SI/PHI/83/801 (AS BUILT PLAN)	REGNO 1781 FILE 242 DATE 4-12-84 PLACE Q.C. TAN C-46721-H1621A-4	CESAR A. CALIWARA CIVIL ENGINEER	SHEET NO. A-1 6 MODEL-A DUPLEX

SECTION 1

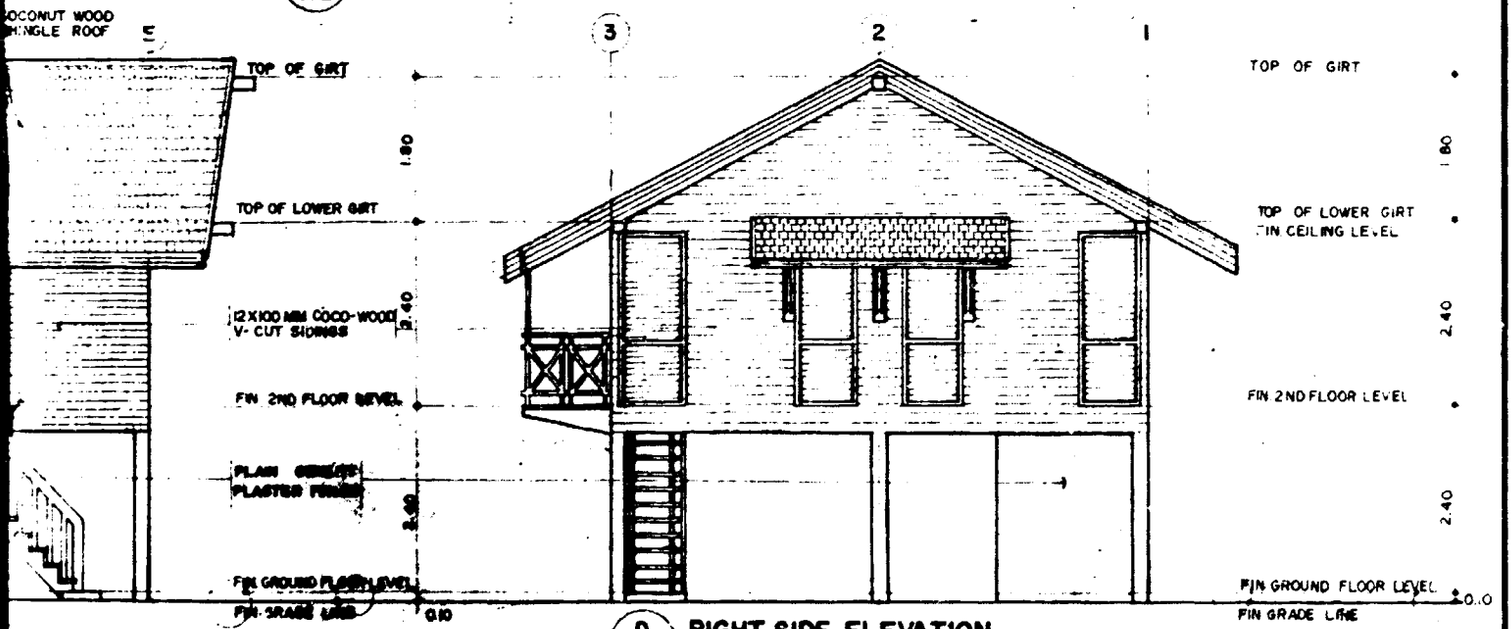


GREGORIO G. STA MARIA ARCHITECT • PLANNER • CONSULTANT 24 PITIMINI ST., SAN FRANCISCO DEL MONTE QUEZON CITY METRO MANILA PHILIPPINES TEL NO 991440 9911 71	REG NO 1341 PTR 446 B DATE 1-18-84 PLACE Q.C. TAN 53688 L 1737 A-6
PREPARED BY GREGORIO G. STA MARIA ARCHITECT	APPROVED BY UNITED NATIONS UNIDO, UNDP
PROJECT TITLE DEMONSTR UTILIZATIO -SI/PHI/8	

SECTION 1



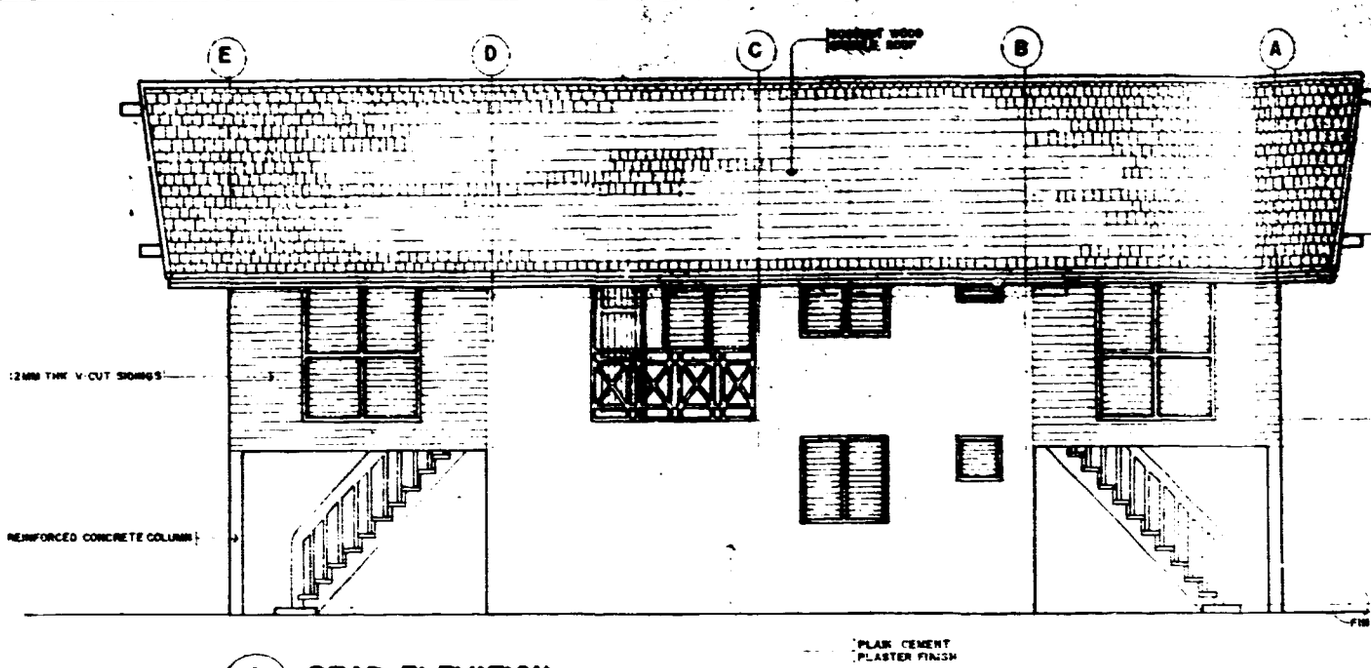
B / A-2 **SECOND FLOOR PLAN**
SCALE 1:50 MTS.



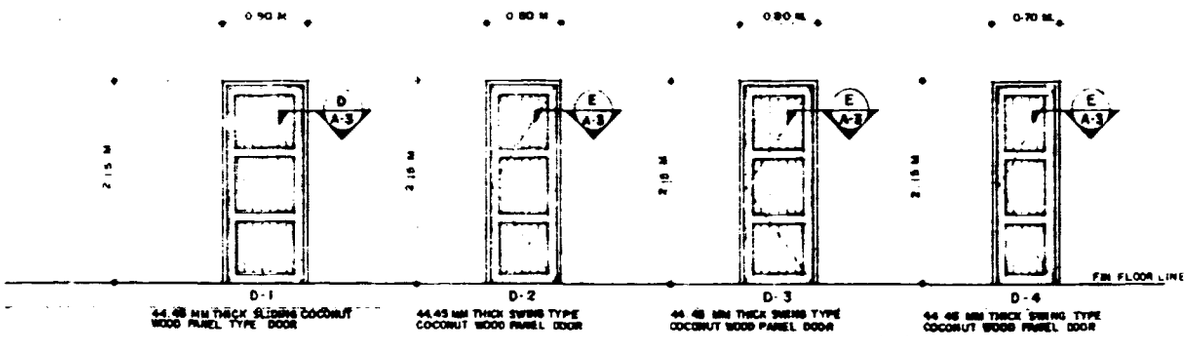
D / A-2 **RIGHT SIDE ELEVATION**
SCALE 1:50 MTS

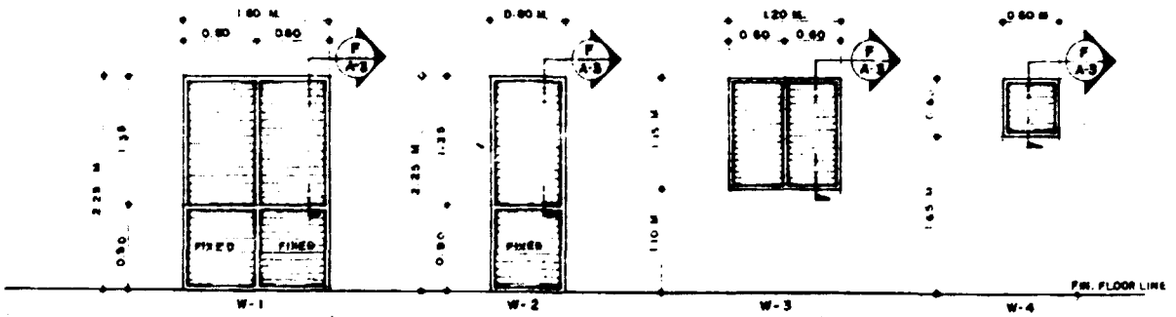
APPROVED BY: UNITED NATIONS UNIDO, UNDP	PROJECT TITLE: DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW COST HOUSING - SI/PHI/83/801 (AS BUILT PLAN)	REG. NO 1781 PTR NO. 348 DATE 4-12-84 PLACE Q.C. TIN C0021-H0021-A-6	CONSULTING STRUCTURAL ENGINEER CESAR A. CALIWARA CIVIL ENGINEER	SHEET NO. A-2 / 6 MODEL-A DUPLEX

SECTION 2



A / A-3 **REAR ELEVATION**
SCALE 1:50 MTS





C / A-3 **SCHEDULE OF DOORS & WINDOWS**
SCALE 1:40 MTS

12 MM THK. V-CUT

FROM 25 X 50 MM WOOD

FROM 50 X 75 MM WOOD

FROM 50 X 100 MM WOOD

D / A-3 SLI
HALF

FROM 25 X 50 MM. WOOD MOULDINGS

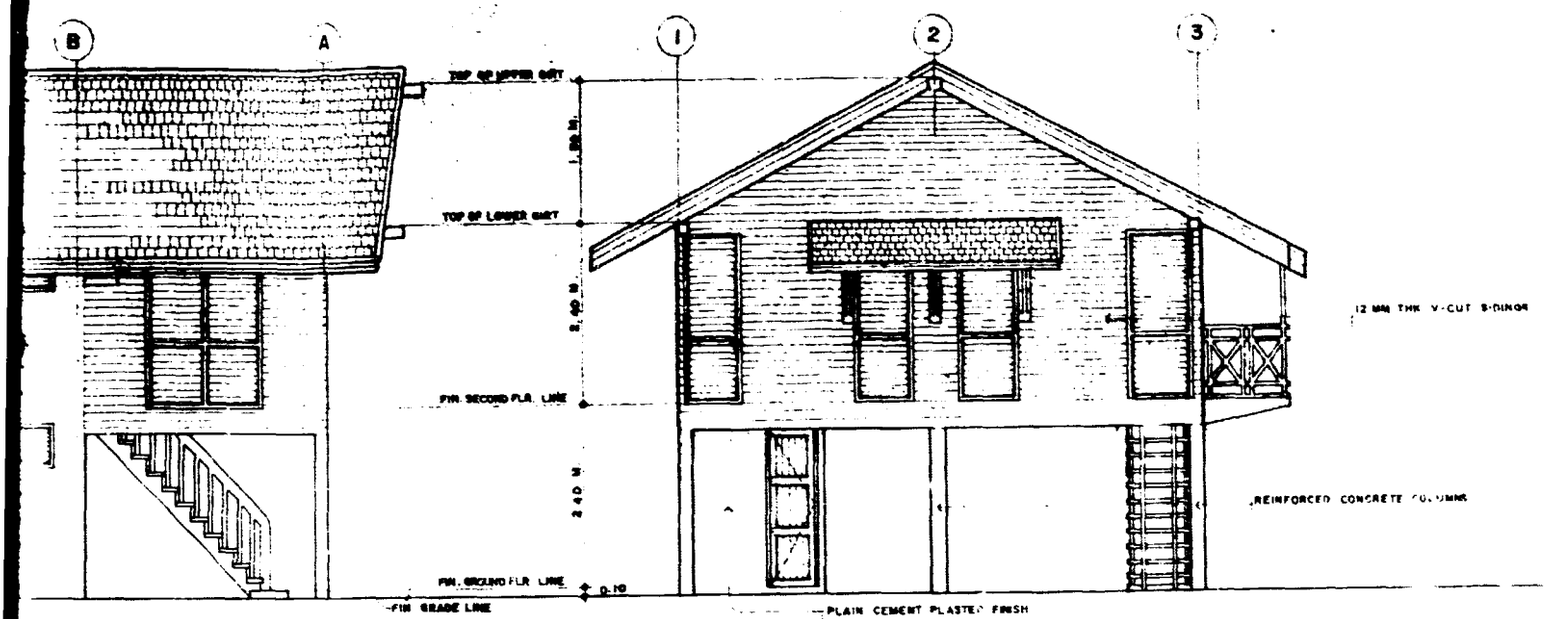
FROM 50 X 100 MM W

FROM 50 X 125 MM W

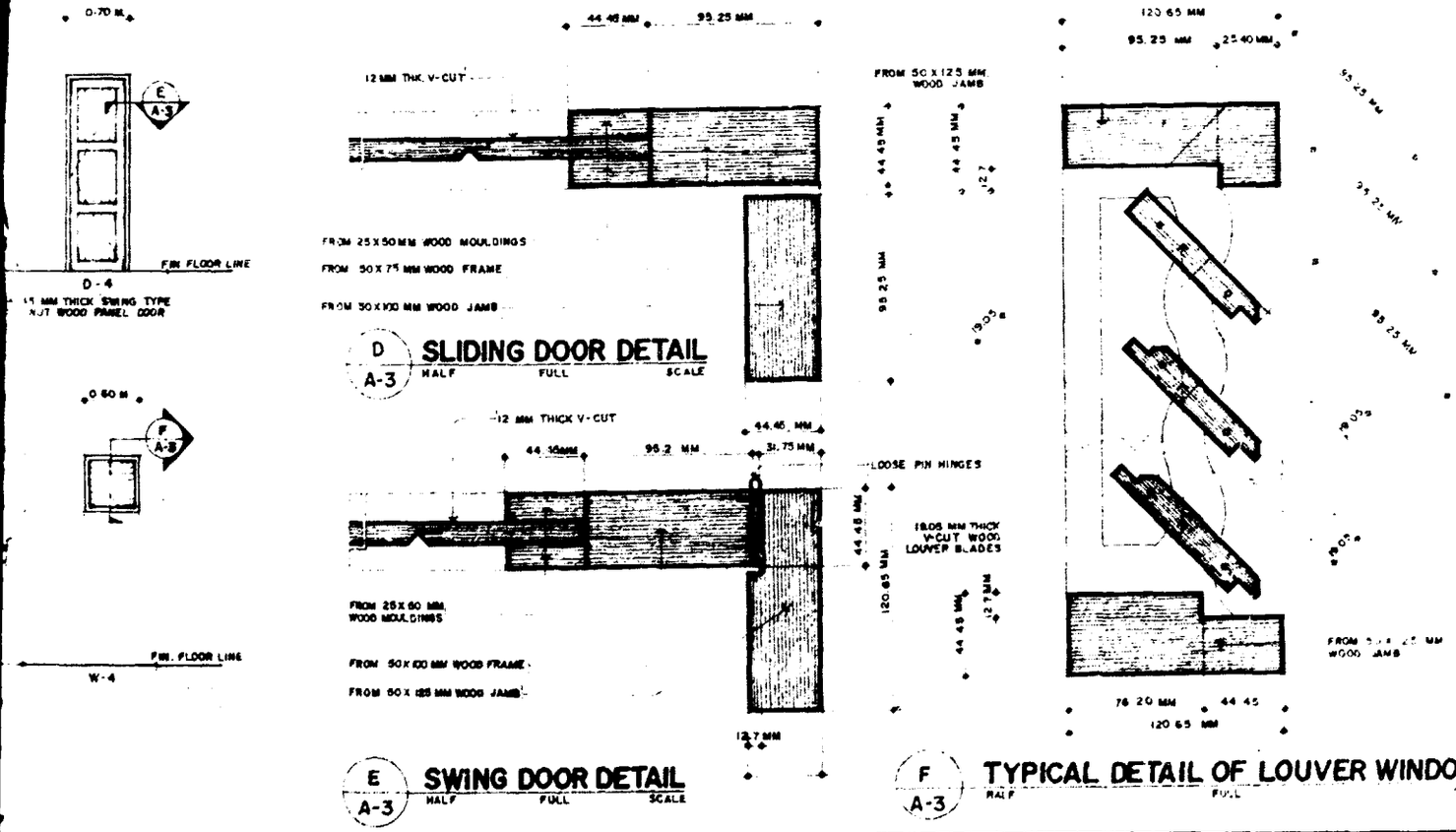
E / A-3 SW
HALF

GREGORIO G. STA MARIA ARCHITECT • PLANNER • CONSULTANT 94 PITIMINI ST. SAN FRANCISCO DEL MONTE QUEZON CITY METRO MANILA PHILIPPINES TEL NO. 991449 991171	REG NO 1341 PTR 4108 DATE 1-10-84 PLACE Q.C. TAN 03985 L (737-A-6	PREPARED BY GREGORIO G. STA MARIA ARCHITECT	APPROVED BY UNITED NATIONS UNIDO, UNDP	PROJECT DEM UTIL - SI/

SECTION 1



B / A-3 **LEFT SIDE ELEVATION** SCALE 50 MTS



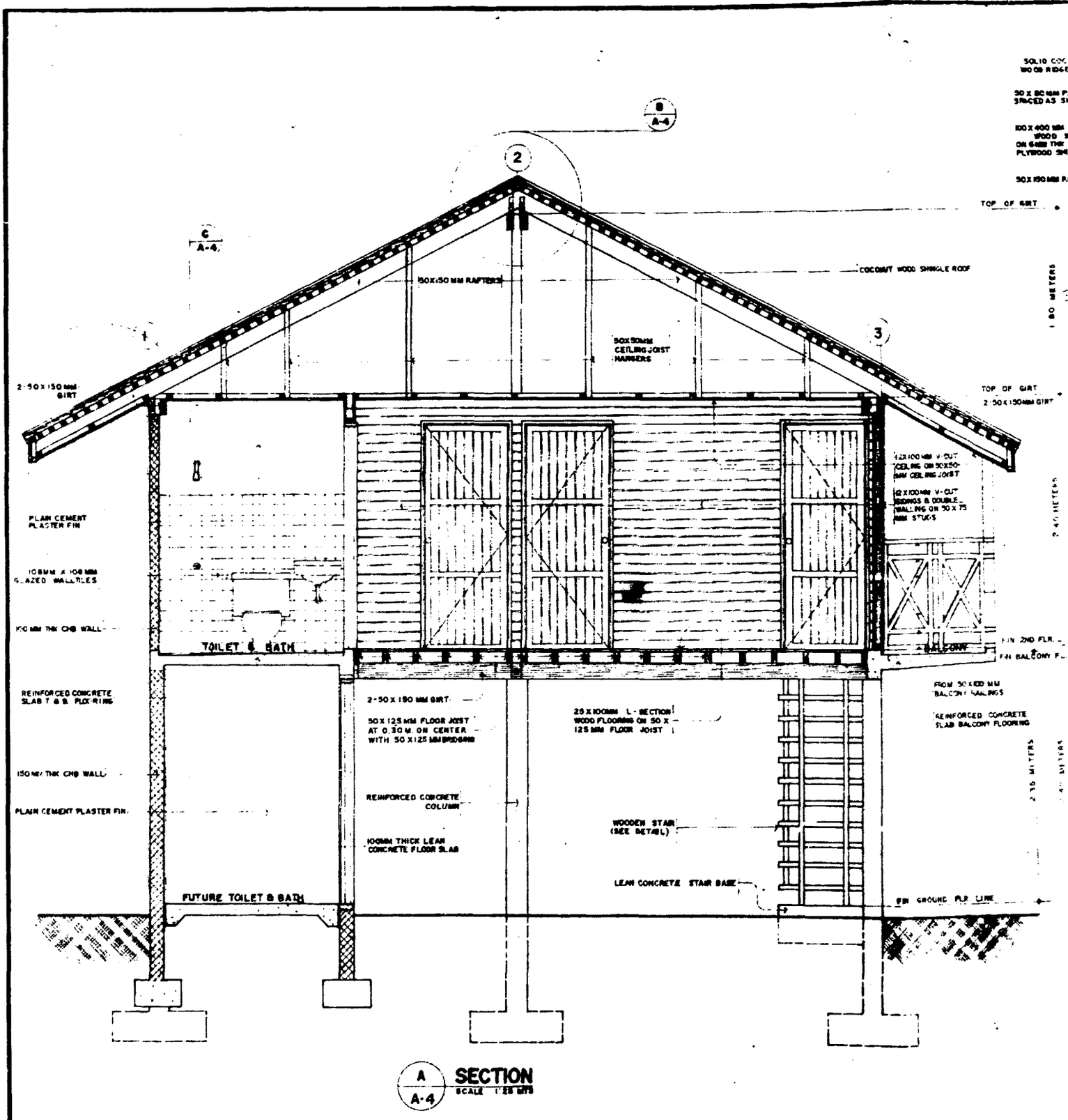
D / A-3 **SLIDING DOOR DETAIL** HALF FULL SCALE

E / A-3 **SWING DOOR DETAIL** HALF FULL SCALE

F / A-3 **TYPICAL DETAIL OF LOUVER WINDOWS** HALF FULL SCALE

	APPROVED BY: UNITED NATIONS UNIDO, UNDP	PROJECT TITLE: DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW COST HOUSING - SI/PHI/83/801 (AS BUILT PLAN)	REG NO 1781 PTR NO 242 DATE 4-12-84 PLACE Q.C. TAR C4621-H1621-A-4	CONSULTING STRUCTURAL ENGINEER: CESAR A. CALIWARA, CIVIL ENGINEER	SHEET NO: A-3, 6, MODEL-A

SECTION 2



GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT
84 PITIMINI ST. SAN FRANCISCO DEL MONTE
QUEZON CITY METRO MANILA PHILIPPINES
TEL NO. 991440 991171

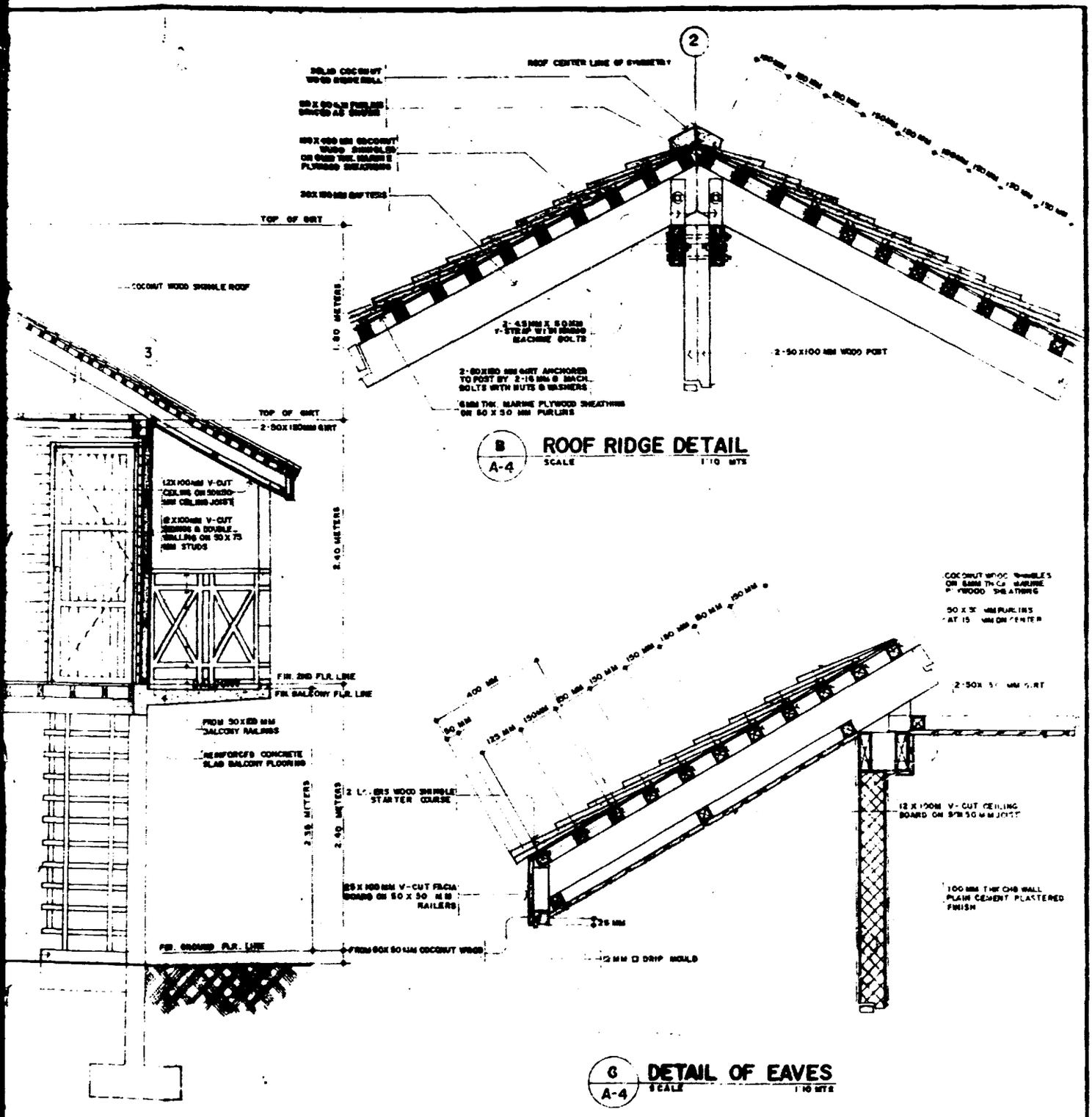
REG. NO. 1341
PTR 410 B
DATE 1-16-84
PLACE Q C
TAN 3365L 1737 A-6

PREPARED BY
GREGORIO G STA MARIA
ARCHITECT

APPROVED BY
UNITED NATIONS
UNIDO, UNDP

PROJECT TITLE
DEMONSTI
UTILIZATI
-SI/PHI/

SECTION 1

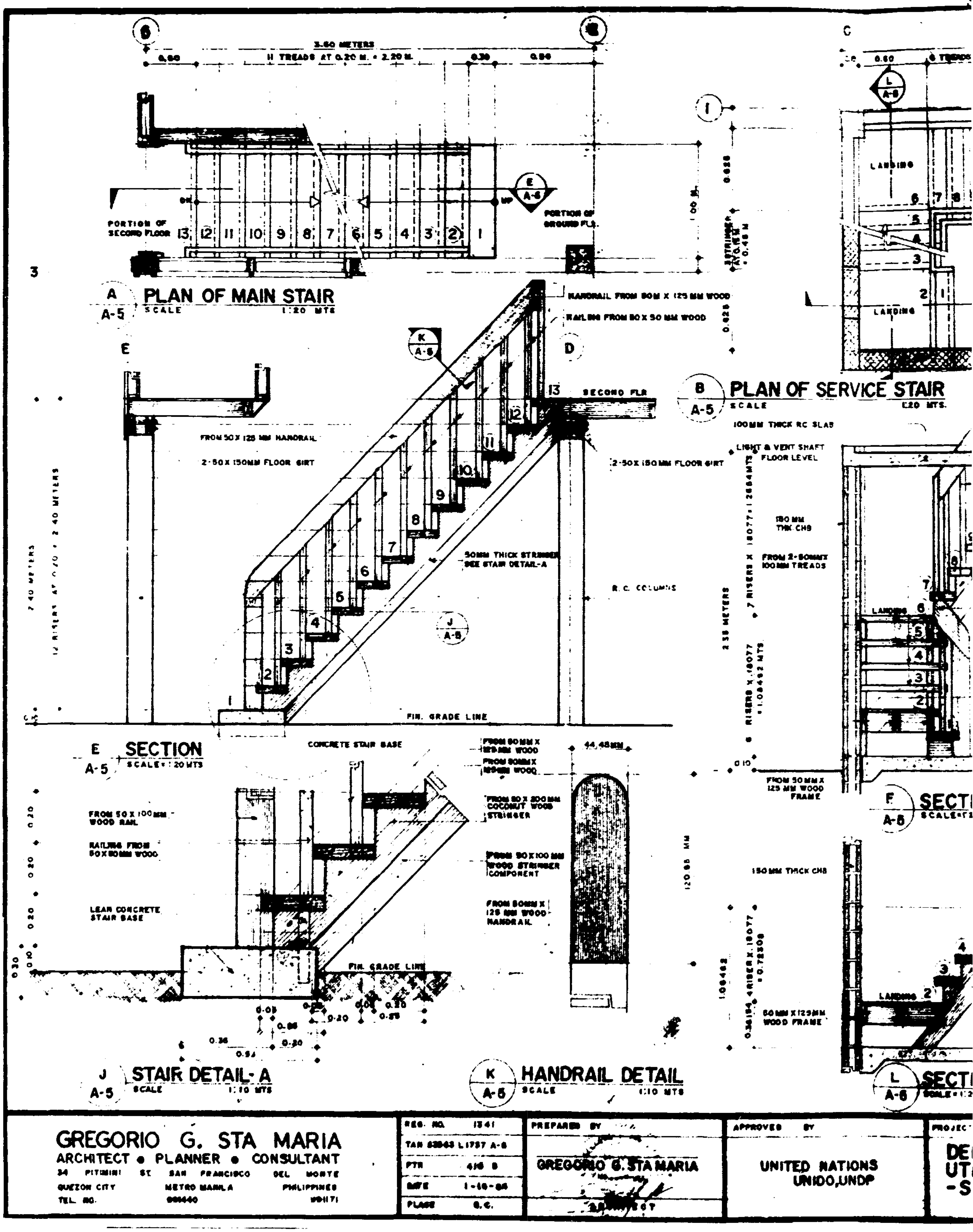


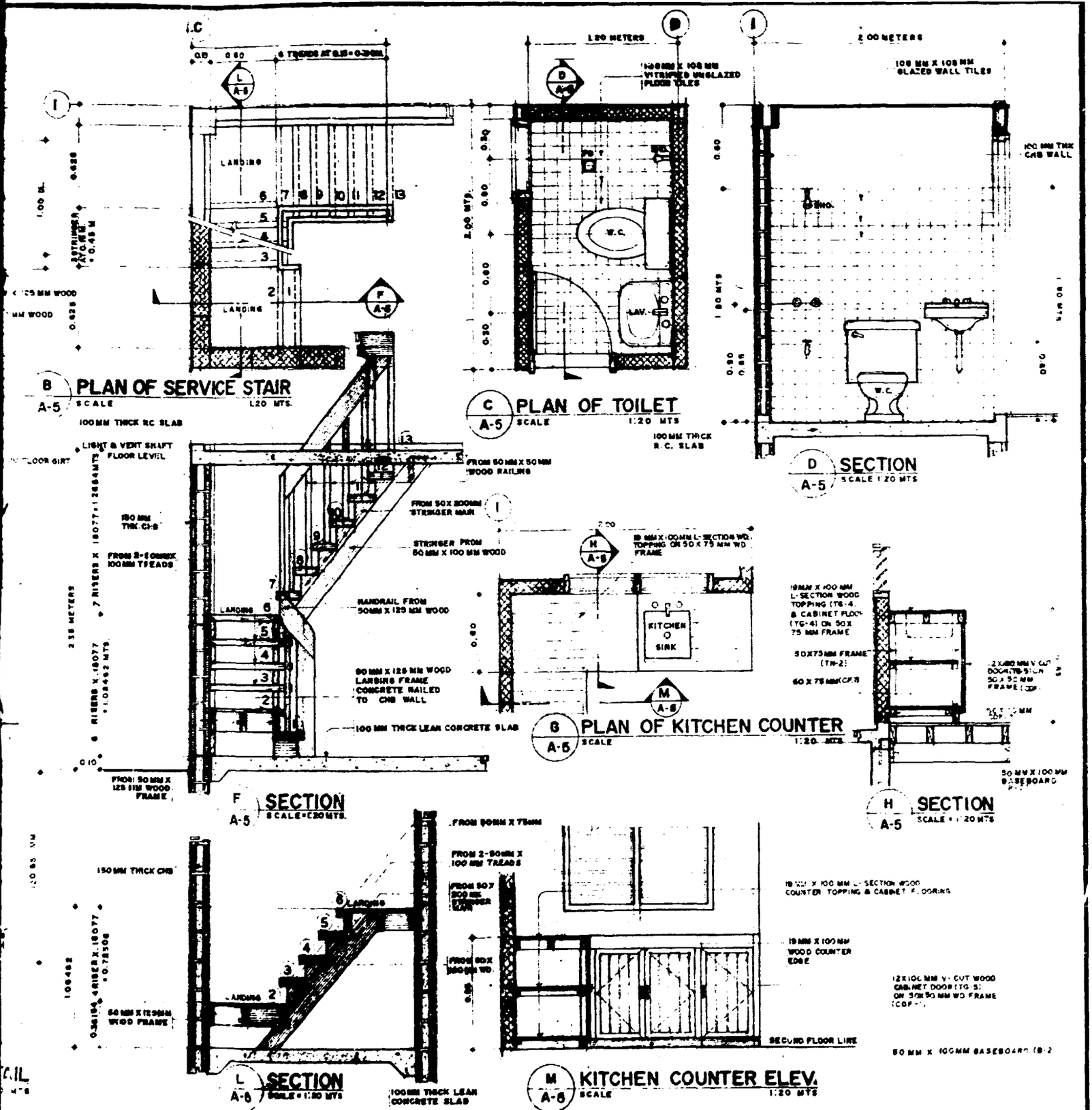
B / A-4 ROOF RIDGE DETAIL
SCALE 1:10 MTS

G / A-4 DETAIL OF EAVES
SCALE 1:10 MTS

APPROVED BY: UNITED NATIONS UNIDO, UNDP	PROJECT TITLE: DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW COST HOUSING -SI/PHI/83/801 (AS BUILT PLAN)	REG. NO 1781 PTR NO 242 DATE 4-12-84 PLACE G.C. TAR C4681-M6821-A-4	CONSULTING STRUCTURAL ENGINEER: CESAR A. CALIWARA, ENGINEER	SHEET NO A-4 / 6 MODEL - A DUPLEX

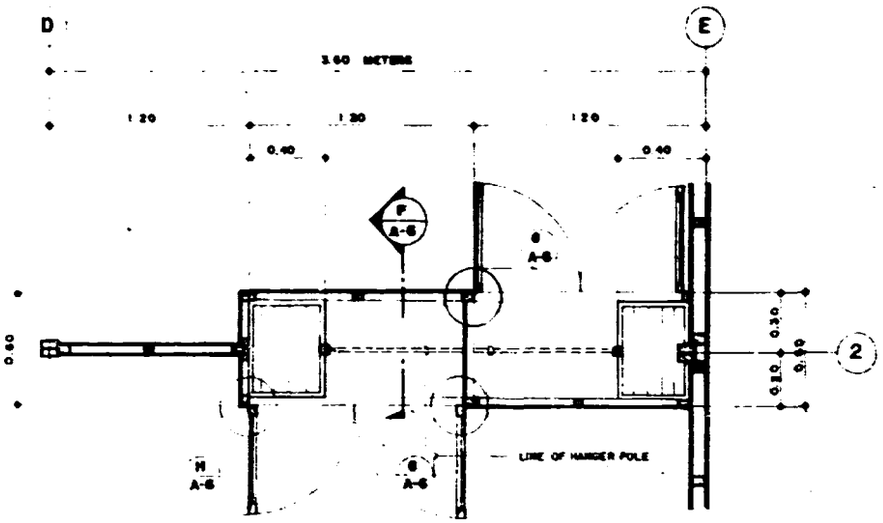
SECTION 2


3.60 METERS
11 TREADS AT 0.20 M. = 2.20 M.
PORTION OF SECOND FLOOR
PORTION OF GROUND FLR.
A PLAN OF MAIN STAIR A-5 SCALE 1:20 MTS
HANDRAIL FROM 50M X 125 MM WOOD
RAILING FROM 50 X 50 MM WOOD
SECOND FLR
FROM 50 X 125 MM HANDRAIL
2-50X 150MM FLOOR GIRT
50MM THICK STRINGER SEE STAIR DETAIL-A
R. C. COLUMNS
FIN. GRADE LINE
E SECTION A-5 SCALE 1:20 MTS
CONCRETE STAIR BASE
B PLAN OF SERVICE STAIR A-5 SCALE 1:20 MTS.
100MM THICK RC SLAB
LIGHT & VENT SHAFT
FLOOR LEVEL
150 MM THK CHB
FROM 2-50MMX 100MM TREADS
LANDING
FROM 50 X 100 MM WOOD RAIL
RAILING FROM 50 X 50MM WOOD
LEAN CONCRETE STAIR BASE
J STAIR DETAIL-A A-5 SCALE 1:10 MTS
FROM 50 X 200 MM COCONUT WOOD STRINGER
FROM 50X100 MM WOOD STRINGER COMPONENT
FROM 50MM X 125 MM WOOD HANDRAIL
44.45MM
K HANDRAIL DETAIL A-5 SCALE 1:10 MTS
FROM 50 MM X 125 MM WOOD FRAME
150MM THICK CHB
50 MM X 125MM WOOD FRAME
F SECTI
L SECTI
GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT
QUEZON CITY
METRO MANILA
PHILIPPINES
PREPARED BY
GREGORIO G. STA MARIA
APPROVED BY
UNITED NATIONS
UNIDO,UNDP

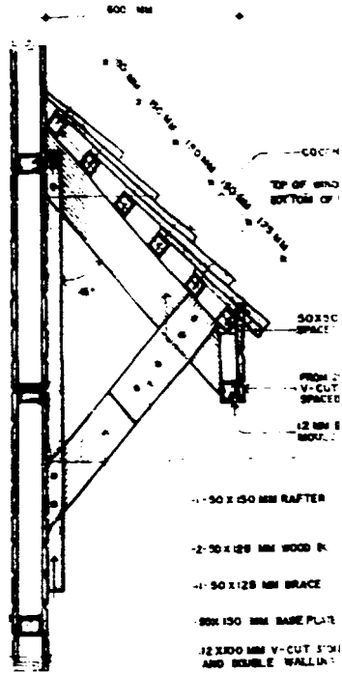


APPROVED BY: UNITED NATIONS UNIDO, UNDP	PROJECT TITLE: DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW COST HOUSING -SI/PHI/83/801 (AS BUILT PLAN)	REG NO. 1781 PTR NO. 248 DATE 4-12-84 PLACE D.C.	CONSULTING STRUCTURAL ENGINEER: CESAR A. CALIWARA, CIVIL ENGINEER	SHEET NO. A-5 / 6	MODEL-4 DUPLEX

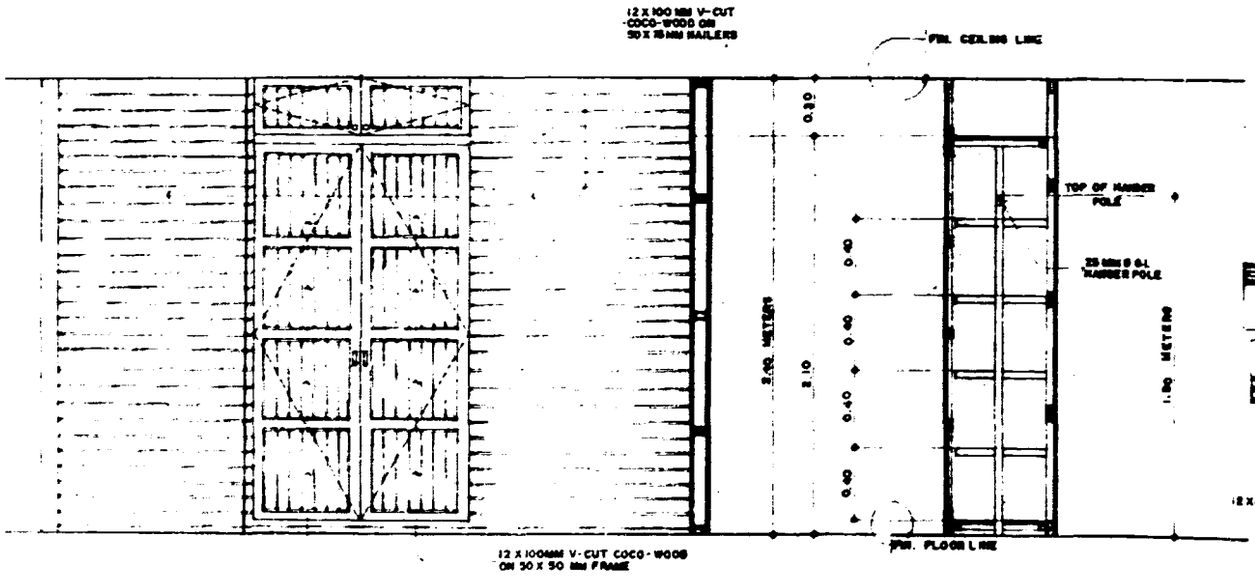
SECTION 2



A / A-6 **TYPICAL PLAN OF CLOSET**
SCALE 1.20 MTS

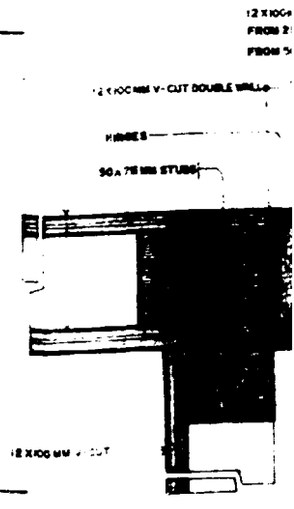


B / A-6 **DETAIL OF CANOP**
SCALE



F / A-6 **TYPICAL ELEVATION OF CLOSET**
SCALE 1.20 MTS

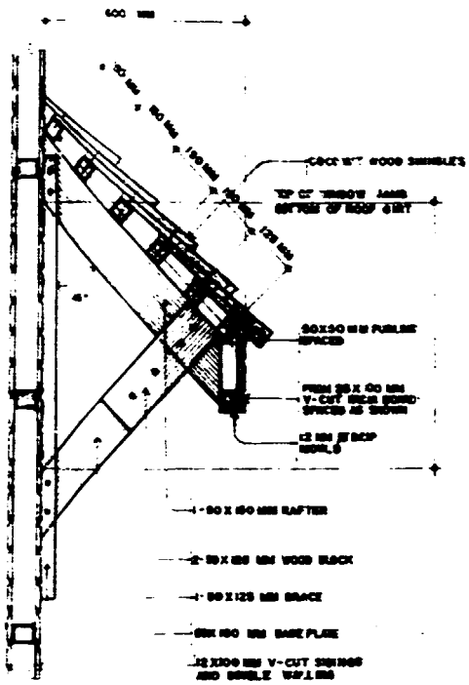
F / A-6 **SECTION**
SCALE 1.20 MTS



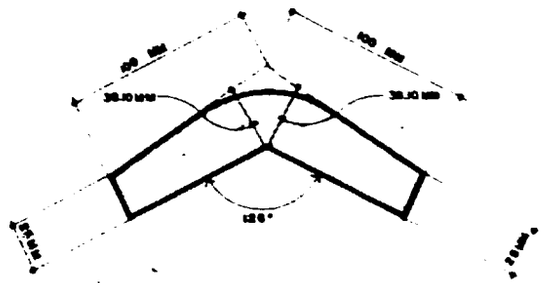
G / A-6 **DETAIL-A**
HALF FULL SCALE

GREGORIO G. STA MARIA ARCHITECT • PLANNER • CONSULTANT 34 PITHIHIM ST SAN FRANCISCO DEL MONTE QUEZON CITY METRO MANILA PHILIPPINES TEL. NO. 991440 991171	REG NO 1341 PTR 418 B DATE 1-16-84 PLACE Q.C TAN 53563 L 1737 A-6
PREPARED BY: GREGORIO G. STA MARIA ARCHITECT	APPROVED BY: UNITED NATIONS UNIDO, UNDP
PROJECT TITLE DEMONSTRA UTILIZATIO • SI / PHI / 8	

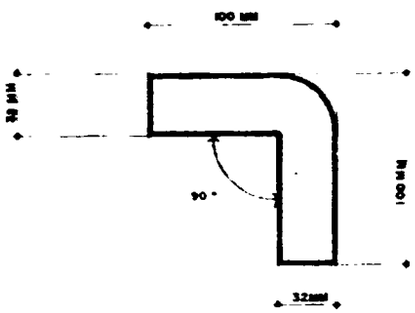
SECTION 1



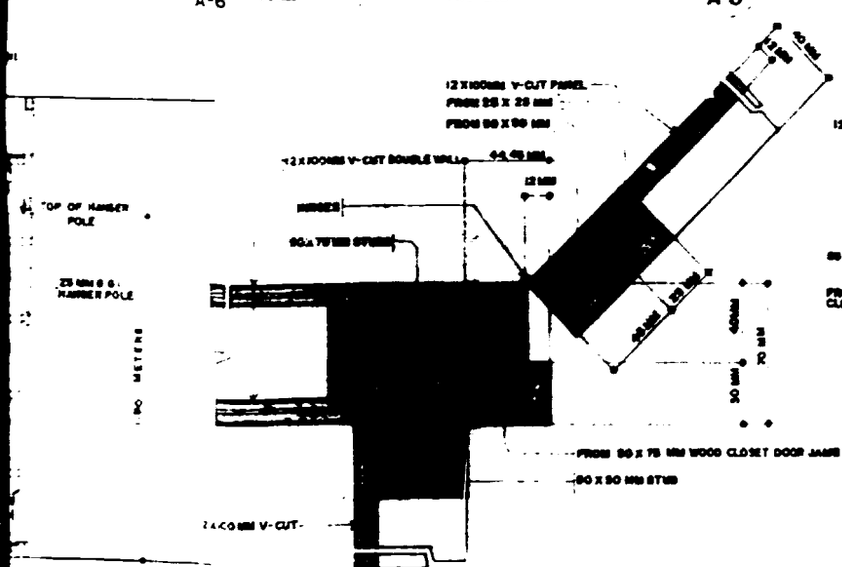
B A-6 **DETAIL OF CANOPY**
SCALE 1:10 MTS.



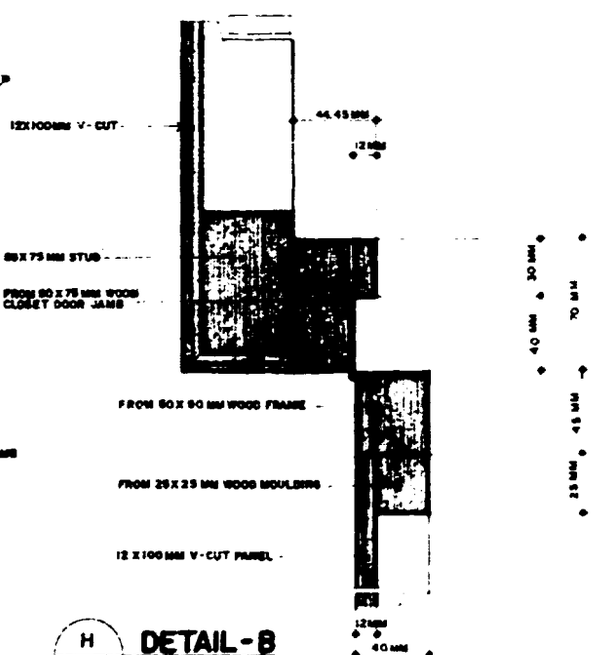
C A-6 **WOOD RIDGE ROLL DETAIL**
SCALE 1:00 MTS



D A-6 **WOOD FLASHING DETAIL**
SCALE 1:00 MTS



G A-6 **DETAIL-A**
HALF FULL SCALE

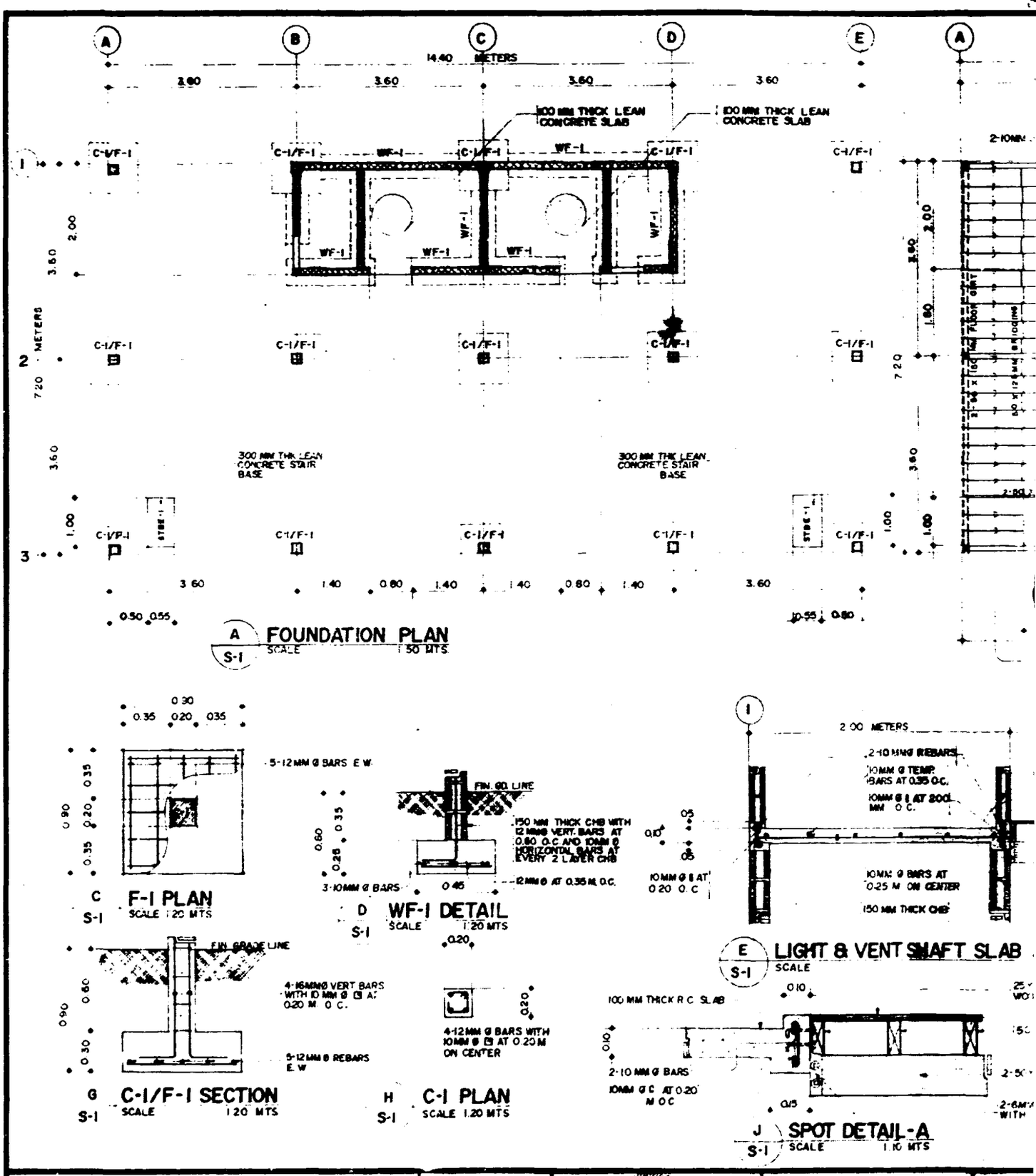


H A-6 **DETAIL-B**
HALF FULL SCALE

APPROVED BY: UNITED NATIONS UNIDO, UNDP	PROJECT TITLE: DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW COST HOUSING - SI/PHI/83/801 (AS BUILT PLAN)	REG NO 1781 PTR NO 242 DATE 4-12-84 PLACE [illegible]	CONSULTING STRUCTURAL ENGINEER CESAR A. CALIWARA CIVIL ENGINEER

SHEET NO. A-6 / 6

SECTION 2



A S-1 FOUNDATION PLAN SCALE 1:50 MTS

C S-1 F-1 PLAN SCALE 1:20 MTS

D S-1 WF-1 DETAIL SCALE 1:20 MTS

E S-1 LIGHT & VENT SHAFT SLAB SCALE

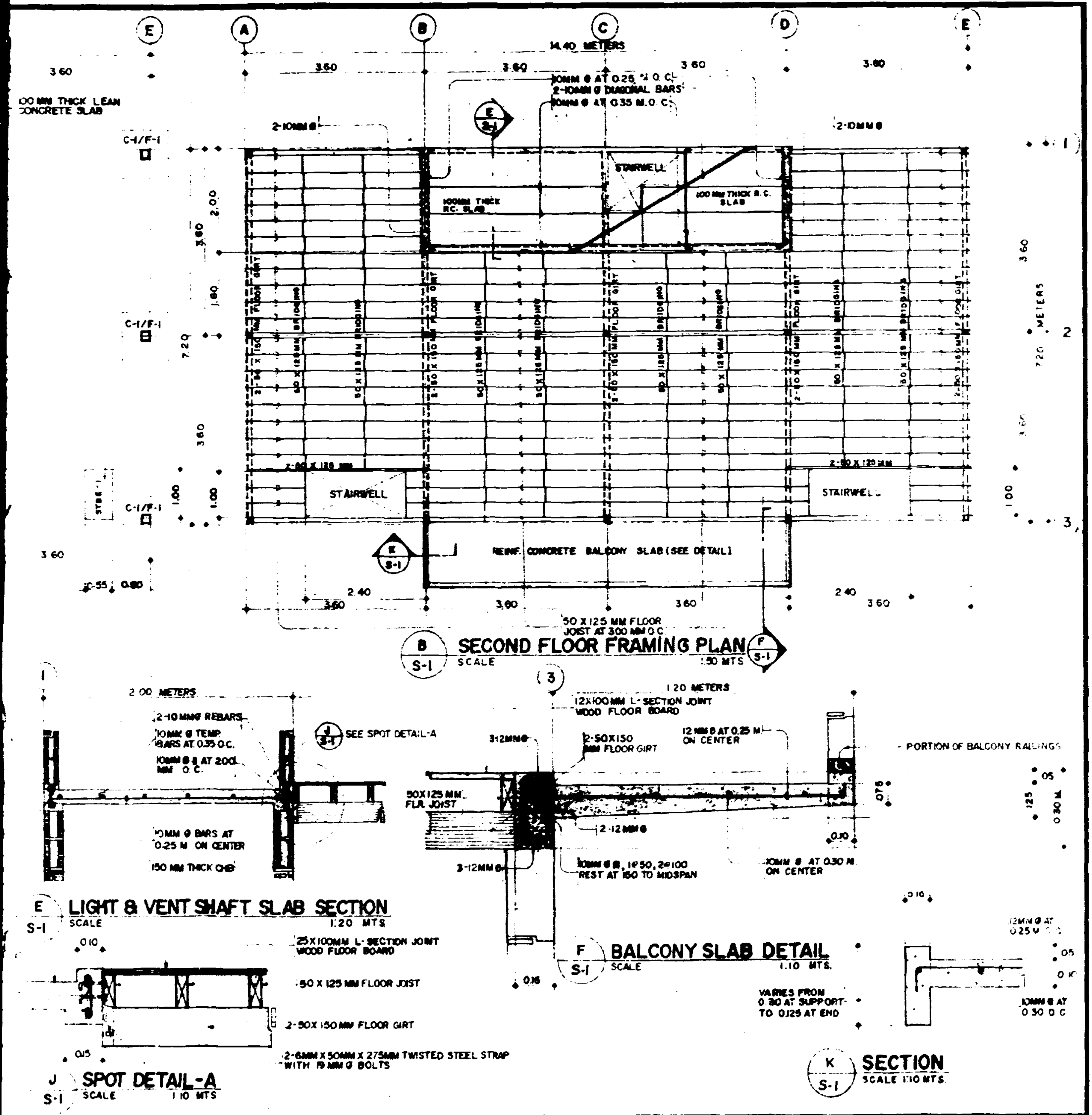
G S-1 C-1/F-1 SECTION SCALE 1:20 MTS

H S-1 C-1 PLAN SCALE 1:20 MTS

J S-1 SPOT DETAIL-A SCALE 1:10 MTS

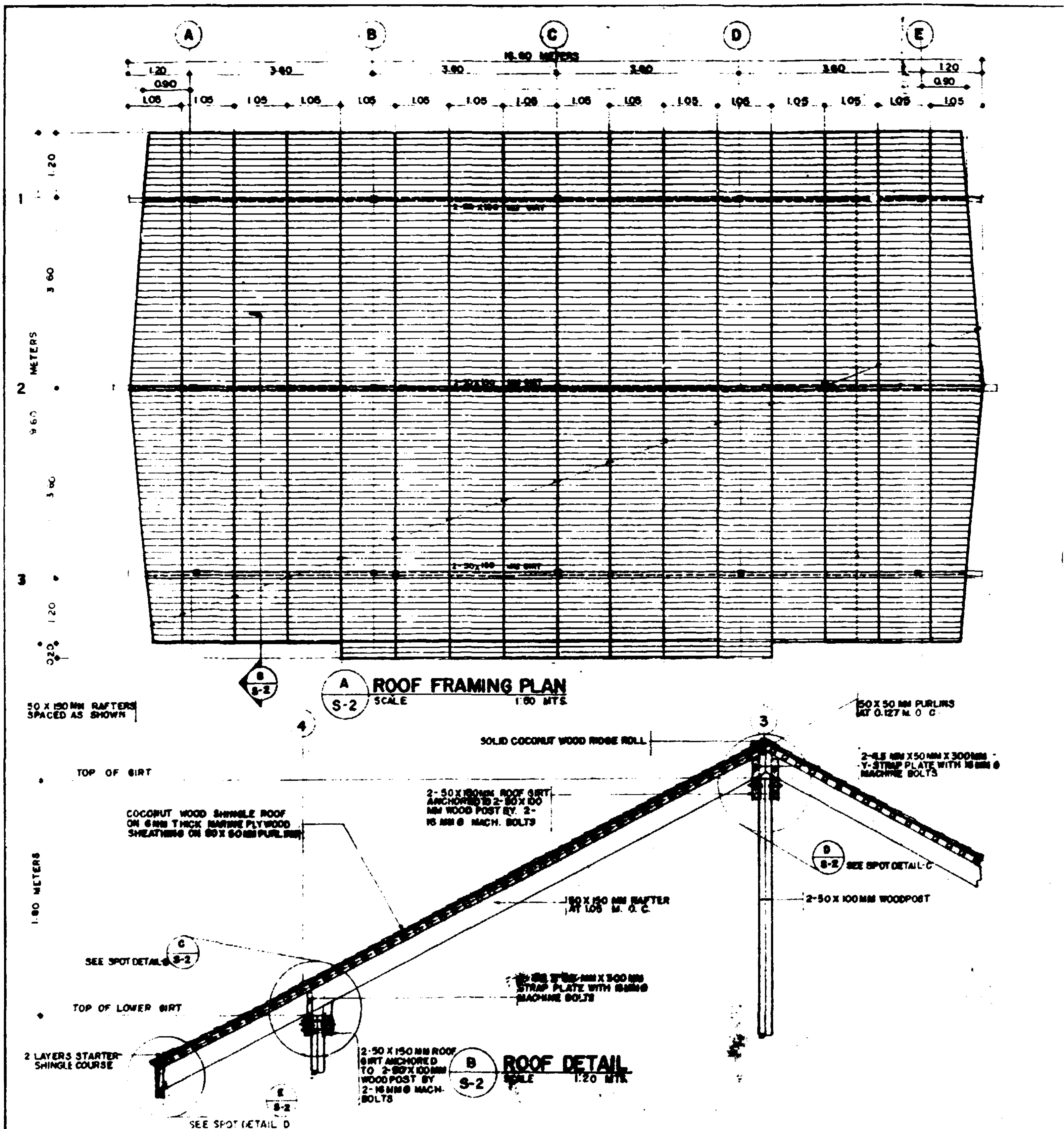
GREGORIO G. STA MARIA ARCHITECT • PLANNER • CONSULTANT 84 PITTSBURH ST., SAN FRANCISCO DEL MONTE QUEZON CITY METRO MANILA PHILIPPINES TEL NO. 994440 99171	REG NO. 1341 PTR 4188 DATE 1-16-84 PLACE Q.C. TIN 50000-1787 A-6
PREPARED BY GREGORIO G. STA MARIA SIGNATURE	APPROVED BY UNITED NATIONS UNIDO/UNDP
PROJECT DEM UTIL -SI/	

SECTION 1



APPROVED BY	PROJECT TITLE		CONSULTING STRUCTURAL ENGINEER	SHEET NO.
UNITED NATIONS UNIDO/UNDP	DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW COST HOUSING -SI/PHI/83/801 (AS BUILT PLAN)	REG NO 1781; PTR NO 848; DATE 4-12-84; PLACE Q.C.	CESAR A. CALIWARA, CIVIL ENGINEER	S-1 2 MODEL-A DUPLEX

SECTION 2

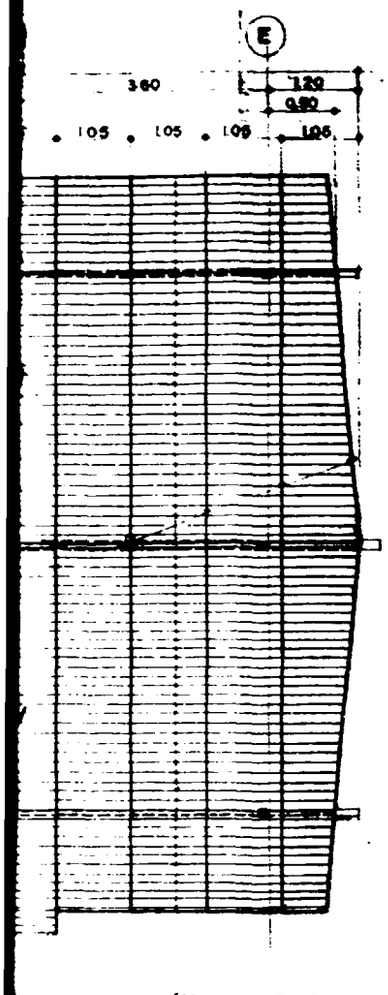


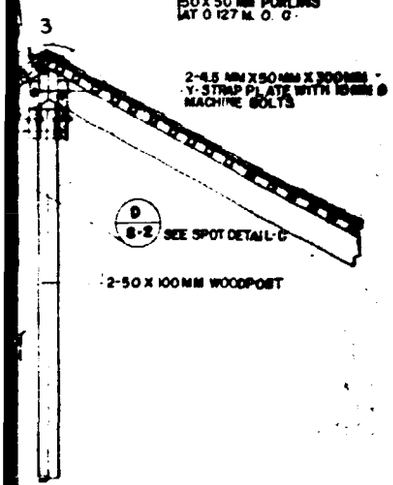
GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT

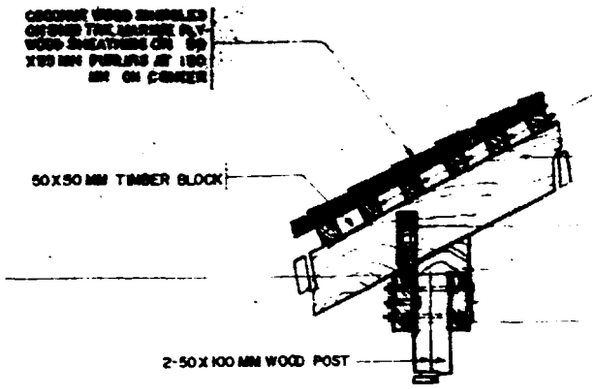
REG NO	1341	PREPARED BY	APPROVED BY
PTR		GREGORIO G. STA MARIA	UNITED NATIONS UNIDO/UNDP
DATE			
PLACE	Q.C.		

PROJECT TITLE: DEMONST[RATION] UTILIZATI[ON] - SI/PHI/

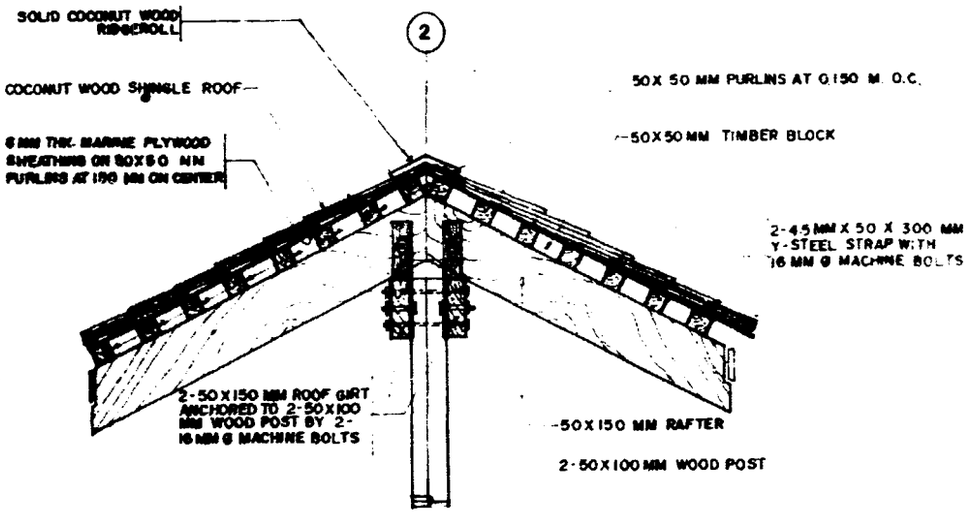
SECTION 1



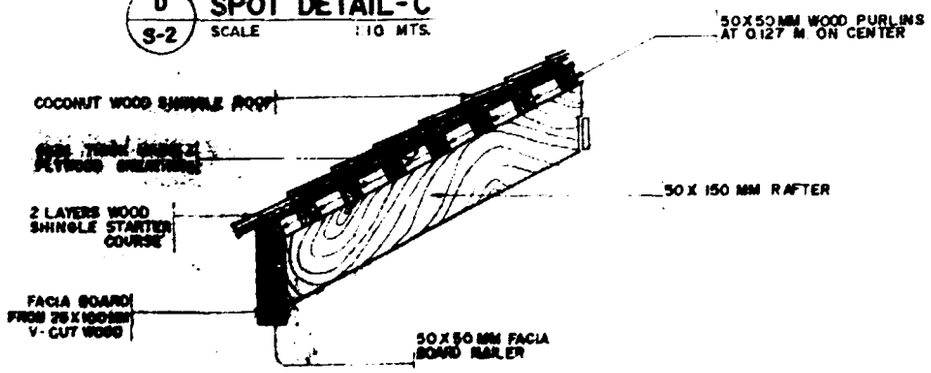




C S-2 SPOT DETAIL-B
SCALE 1:10 MTS.

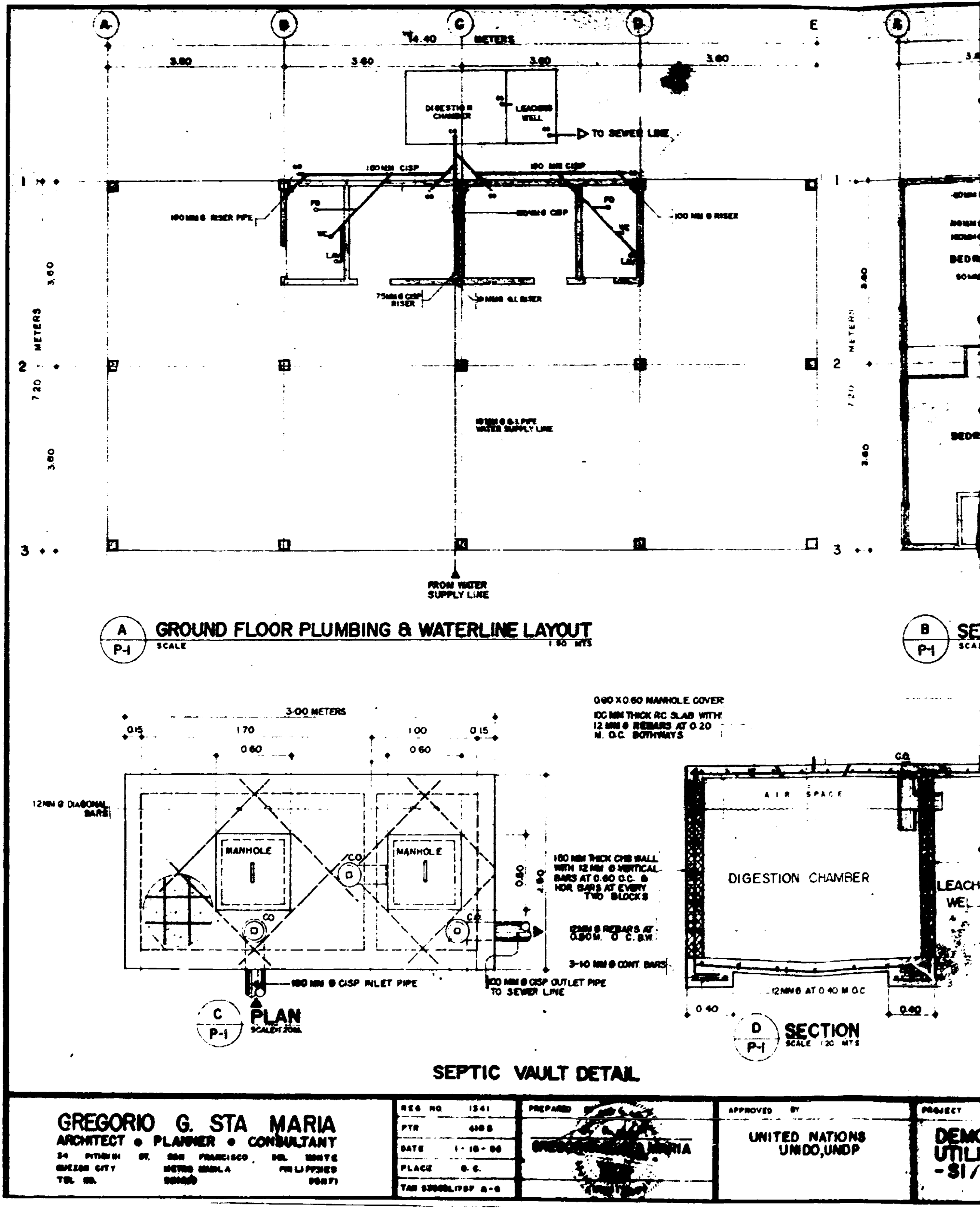


D S-2 SPOT DETAIL-C
SCALE 1:10 MTS.

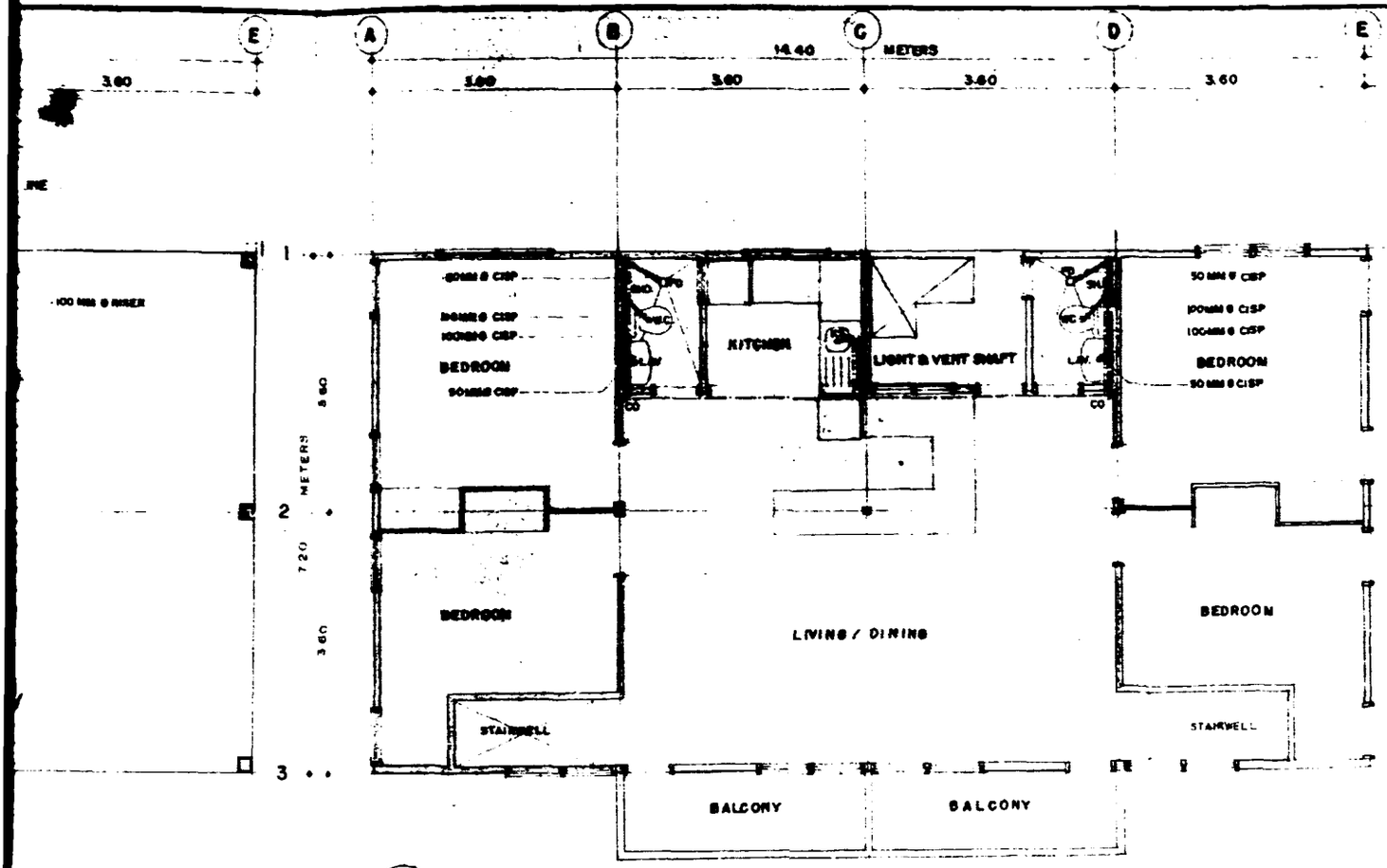


E S-2 SPOT DETAIL-D
SCALE 1:10 MTS.

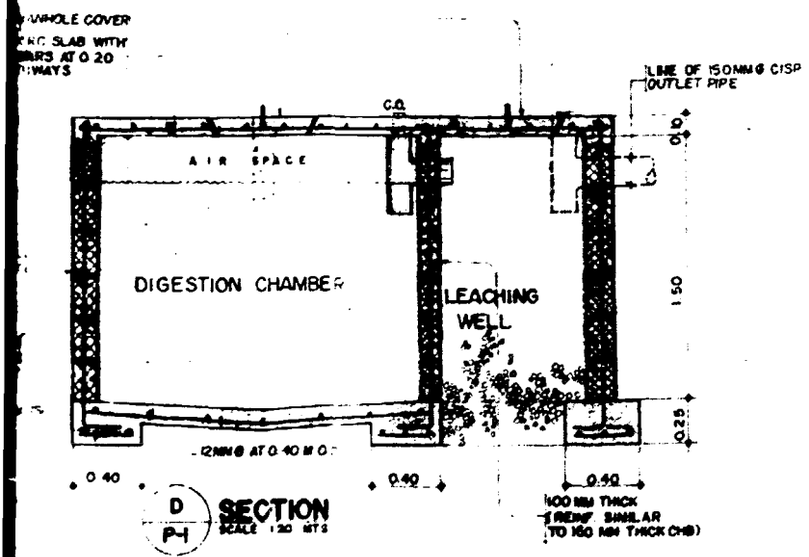
APPROVED BY	PROJECT TITLE	DRG. NO. 1701	CONSULTING STRUCTURAL ENGINEER	SHEET NO.
UNITED NATIONS UNIDO/UNDP	DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW COST HOUSING - SI/PHI/85/801 (AS BUILT PLAN)	DRG. NO. 3424	CESAR A. CALIWARA	S-2 / 2
		DATE 6-10-84		
		SCALE 0.C.		MODEL-A DUPLEX
			CIVIL ENGINEER	


DIGESTION CHAMBER
LEACHING WELL
TO SEWER LINE
100 MM CISP
100 MM Ø RISER PIPE
100 MM Ø RISER
75 MM Ø CISP RISER
FROM WATER SUPPLY LINE
METERS
A P-1 GROUND FLOOR PLUMBING & WATERLINE LAYOUT
SCALE 1:50 MTS
B P-1
3.00 METERS
0.60 X 0.60 MANHOLE COVER
100 MM THICK RC SLAB WITH 12 MM Ø REBARS AT 0.20 M. O.C. BOTHWAYS
12 MM Ø DIAGONAL BARS
MANHOLE
CO
150 MM THICK CHB WALL WITH 12 MM Ø VERTICAL BARS AT 0.60 O.C. & HOR BARS AT EVERY TWO BLOCKS
3-10 MM Ø CONT. BARS
100 MM Ø CISP INLET PIPE
100 MM Ø CISP OUTLET PIPE TO SEWER LINE
C P-1 PLAN
AIR SPACE
DIGESTION CHAMBER
12 MM Ø AT 0.40 M O.C.
D P-1 SECTION
SCALE 1:20 MTS
SEPTIC VAULT DETAIL
GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT
METRO MANILA
PHILIPPINES
REG NO
PTR
DATE
PLACE
PREPARED BY
APPROVED BY
UNITED NATIONS
UNIDO,UNDP
PROJECT

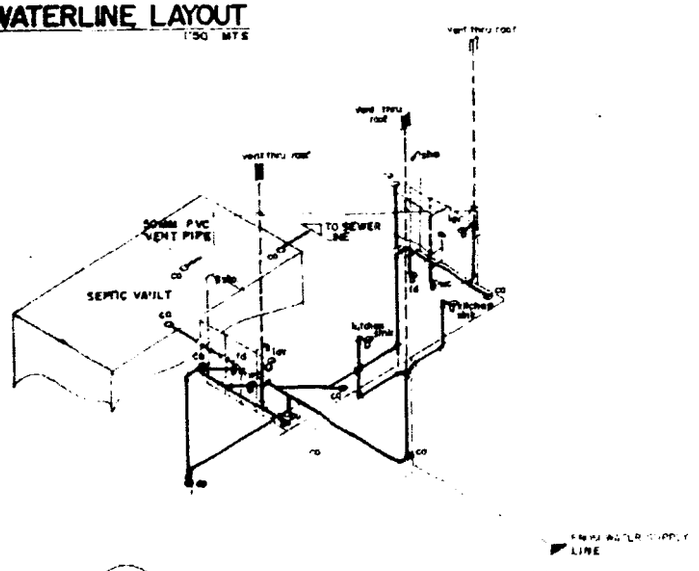
SECTION 1



B / P-1 SECOND FLOOR PLUMBING & WATERLINE LAYOUT
SCALE 1:50 MTS



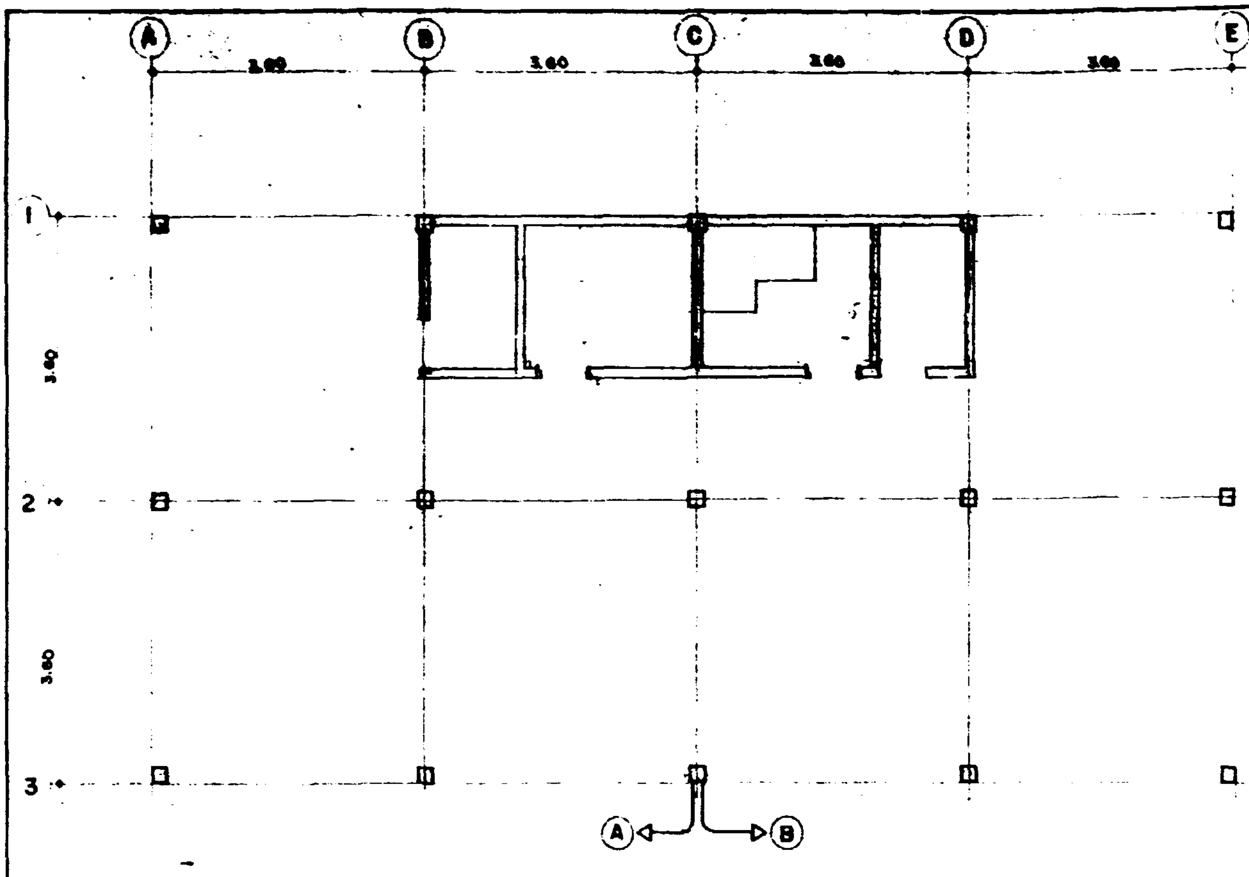
D / P-1 SECTION
SCALE 1:20 MTS



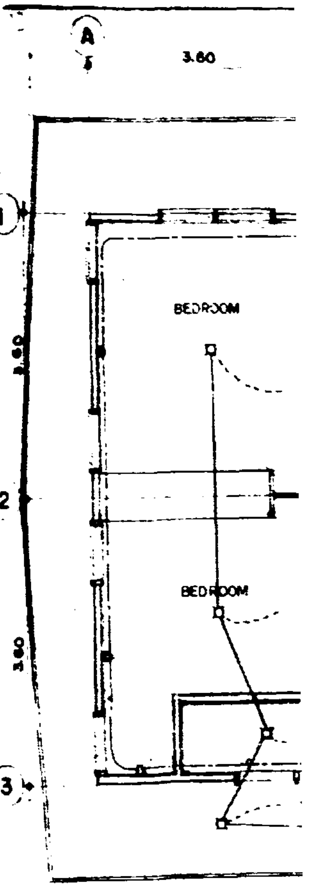
E / P-1 PLUMBING & WATERLINE ISOMETRIC
NOT TO SCALE

ARIA	APPROVED BY: UNITED NATIONS UNIDO, UNDP	PROJECT TITLE: DEMONSTRATION OF COCONUT WOOD UTILIZATION IN LOW COST HOUSING -SI/PHI/83/801 (AS BUILT PLAN)	REG NO 657 PTR NO 155568 DATE 2-9-83 PLACE QC TAX 8816-694-E	ERNESTO V. VILLAOS SANITARY ENGINEER	SHEET NO P-1	MODEL - A DUPLEX

SECTION 2



A / E-1 **GROUND FLOOR ELECTRICAL LAYOUT**
SCALE 1:50 MTS.



A / E-1 **SECOND**
SCALE

ELECTRICAL LEGEND:

- LIGHT OUTLET
- CONVENIENCE OUTLET
- S_1 SINGLE POLE SWITCH
- S_2 TWO POLE SWITCH
- S_3 THREE POLE SWITCH
- RA RANGE OUTLET
- RE REFRIGERATOR OUTLET
- PANEL BOX

SCHEDULE OF LOAD "A" (TYPICAL TO LOAD "B")

CKT. NO.	LOAD DESCRIPTION	NO. OF OUTLET PER CKT.	TOTAL WATTS/CKT	AMP/CKT.	BRANCH PROTECTION AT	POLE	AF	BRANCH RACEWAY SIZE OF WIRES IN CONDUITS
1	INCANDESCENT OUTLET	10-100 WATTS	1000 WATTS	4.54 AMP	20 AT	2 P	50AF	2 # 3.5MM² T.W. WIRE IN 15 MM [illegible] PVC PIPE
2	REFRIGERATOR OUTLET	1-400 WATTS	400 WATTS	1.81 AMP.	20 AT	2 P	50 AF	- DO -
3	RANGE OUTLET	1-8.8 KW	[illegible]00 WATTS	40 AMP	40 AT	2P	50 AF	2 # 8MM² THW WIRE IN 20 MM Ø PVC P[illegible]
4	CONVENIENCE OUTLET	8-200 W[illegible]	[illegible]00 WATTS	7.27 AMP	20 AT	2P	50AF	2 # 3.5MM² TW WIRE IN 20 MM Ø PVC P[illegible]
5	SPARE	5-100 W[illegible]	[illegible]00 WATTS	4.54 AMP	20 AT	2P	50AF	EMPTY
6	SPARE		1000 WATTS	4.54 AMP	20AT	2P	50 AF	EMPTY
TOTAL			13800 WATTS	62.70				

COMPUTATION:

$$I_L = \frac{10{,}000}{220} \times 100\% + \frac{3800}{220} \times 80\%$$

$$= 45.45 + 17.27$$

$$= 62.72 \text{ AMPS.}$$

FOR WIRES:

USE: 2 # 22 MM² THW IN 32 MM Ø RSC CONDUIT

FOR BREAKERS:

MAIN: 100 AT, 2P, 100 AF
BRANCHES: 5 - 20 AT, 2P, 50 AF
1 - 40 AT, 2P, 50 AF

GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT
[illegible] PITIMINI ST., SAN FRANCISCO DEL MONTE
[illegible] CITY METRO MANILA PHILIPPINES

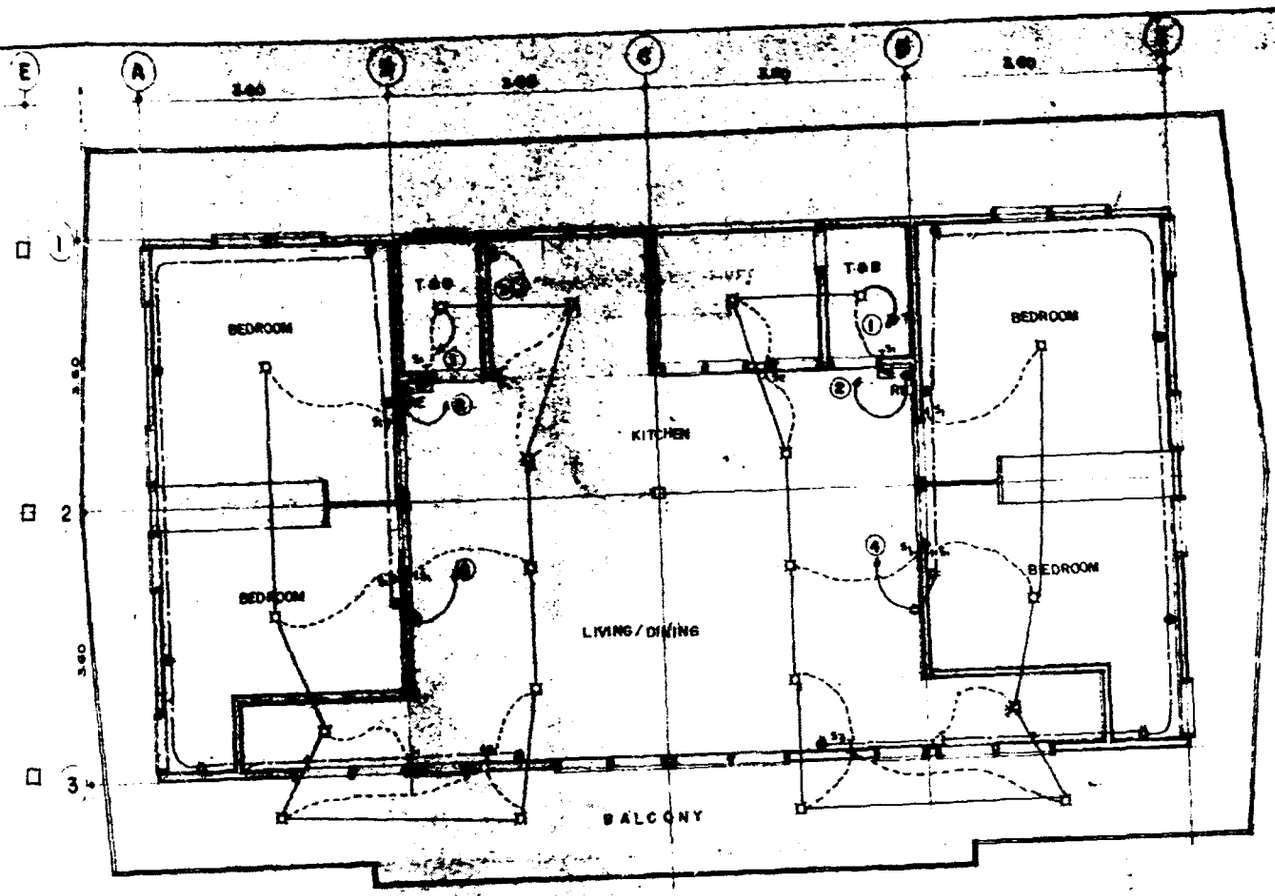
REG. NO.	5841
PTR	[illegible]
DATE	[illegible]
PLACE	[illegible]

PREPARED BY: GREGORIO G. STA MARIA

APPROVED BY: UNITED NATIONS UNIDO, UNDP

PROJECT TITLE: DEMONSTR[...] UTILIZATIO[...] - SI / PHI / [...]

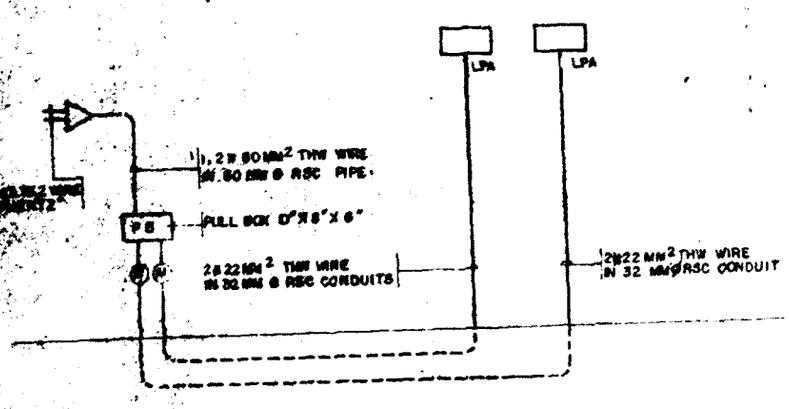
SECTION 1



A / E-1 SECOND FLOOR ELECTRICAL LAYOUT
SCALE 1:50 MTS.

(TYPICAL TO LOAD "B")

AMP/CKT.	BRANCH PROTECTION AT	POLE	AF	BRANCH ASSEMBLY SIZE OF WIRES IN CONDUITS
4.54 AMP	20 AT	2 P	50AF	2# 5.5mm² T.W. WIRE IN 19 mm Ø PVC PIPE
91 AMP	20 AT	2 P	50AF	-DO-
40AMP	40AT	2P	50 AF	2# 8mm² THW WIRE IN 25mm PVC PIPE
7.27AMP	20 AT	2 P	50AF	2#2.5mm² TW WIRE IN 20 mm PVC PIPE
4.54AMP	20AT	2P	50AF	EMPTY
1.54 AMP	20AT	2P	50AF	EMPTY
2.70				



RISER DIAGRAM

FOR WIRES:
USE. 2 # 22 MM² THW IN 32 MM Ø RSC CONDUIT

FOR BREAKERS:
MAIN: 100 AT, 2P, 100 AF
BRANCHES: 5 - 20 AT, 2P, 50 AF
1 - 40 AT, 2P, 50 AF

APPROVED BY
UNITED NATIONS
UNIDO, UNDP

PROJECT TITLE
DEMONSTRATION OF COOKING WOOD UTILIZATION IN LOW COST HOUSING - [illegible] (AS BUILT PLAN)

SHEET NO. E-1 / 1

SECTION 2

PERSPECTIVE

GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT
SAN FRANCISCO DEL MONTE
PHILIPPINES

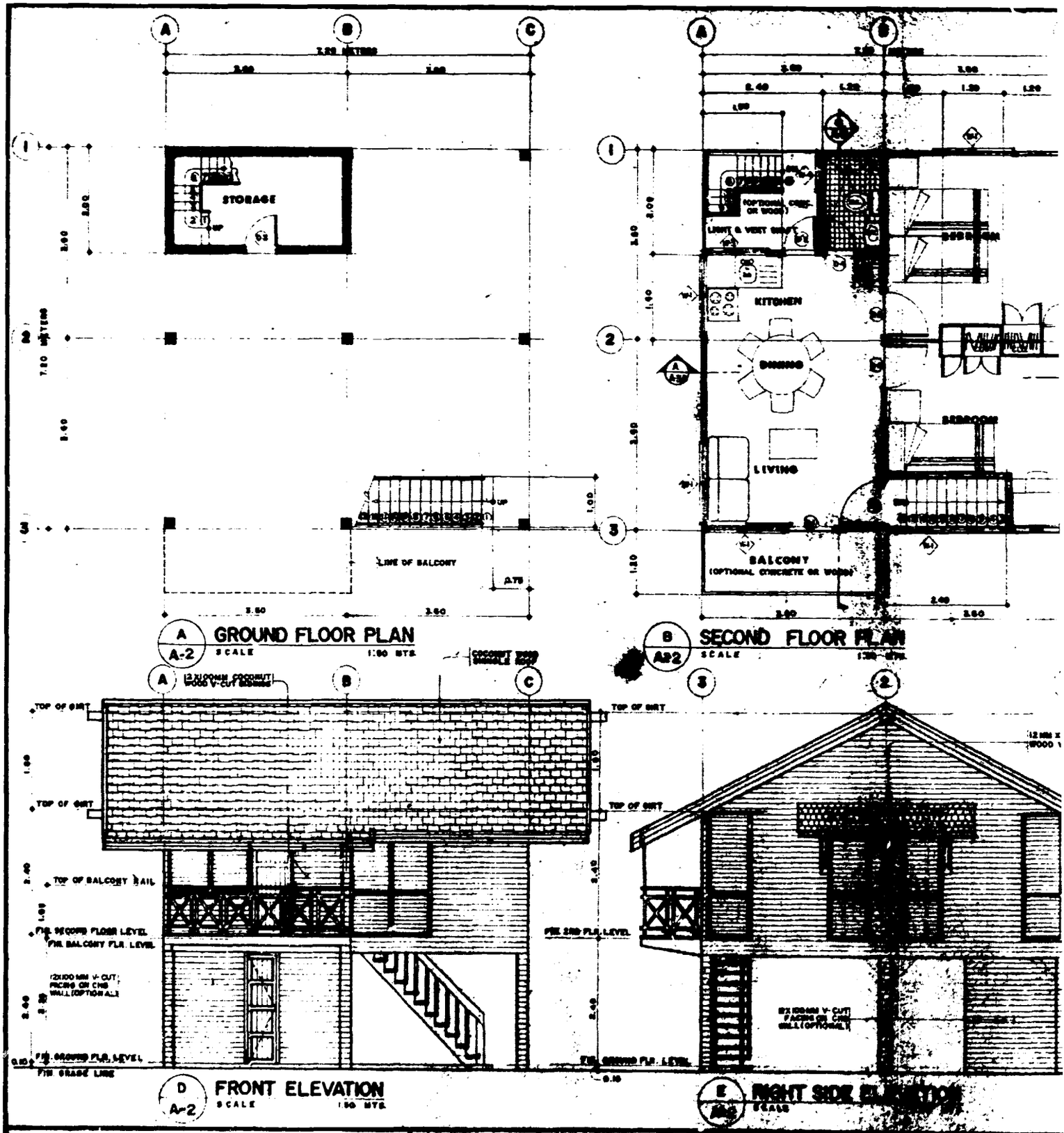
REG. NO. 1361
PTR 440-9
PREPARED BY
APPROVED BY
UNITED NATIONS

SECTION 1

ECTIVE

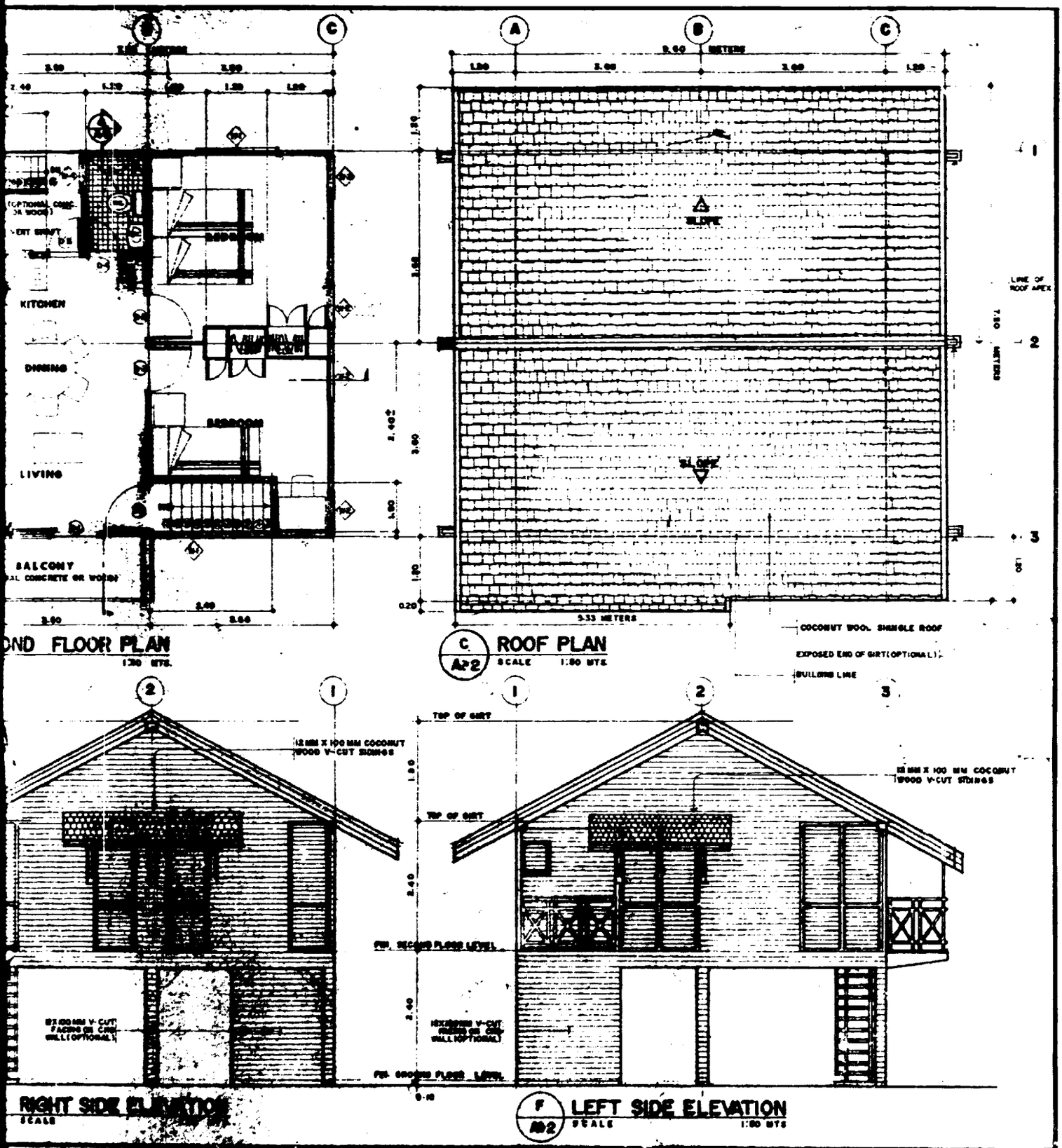
ARIA	APPROVED BY UNITED NATIONS			CONSULTING STRUCTURAL ENGINEERS CESAR A. CALMARA	SHEET NO AM 9

SECTION 2



GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT
74 PITARRI ST SAN FRANCISCO DEL MONTE
QUEZON CITY METRO MANILA PHILIPPINES
TEL. NO 3004-00 3004

SECTION 1



ND FLOOR PLAN

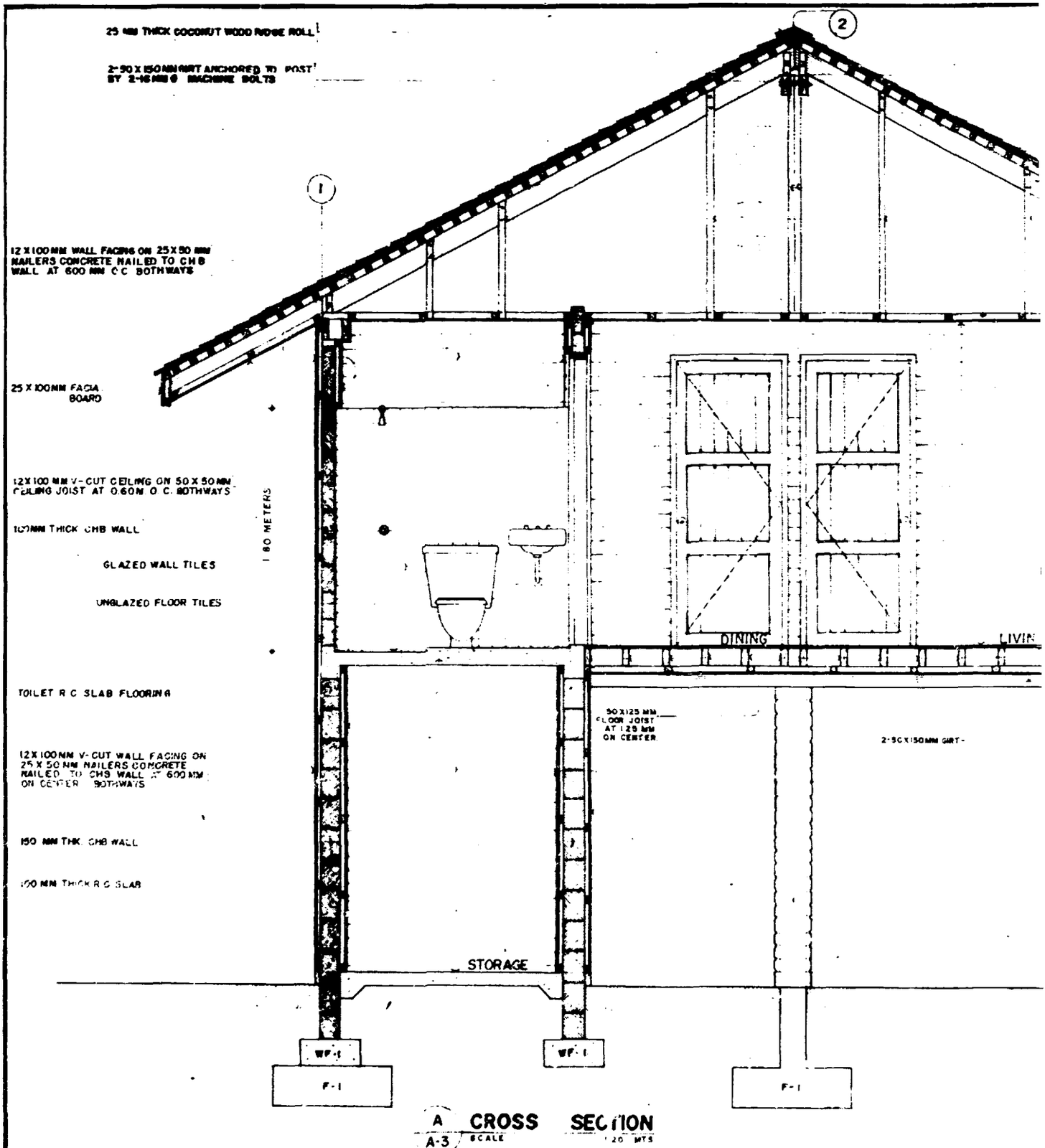
C / A-2 ROOF PLAN
SCALE 1:50 MTS

RIGHT SIDE ELEVATION
SCALE

F / A-2 LEFT SIDE ELEVATION
SCALE 1:50 MTS

APPROVED BY	PROJECT TITLE	CONSULTING STRUCTURAL ENGINEER	SHEET NO.
UNITED NATIONS DEVELOPMENT PROGRAMME	[illegible] OF PROJECT	CESAR A. CALIWARA, CIVIL ENGINEER	A-2 / 7
			MODEL-A

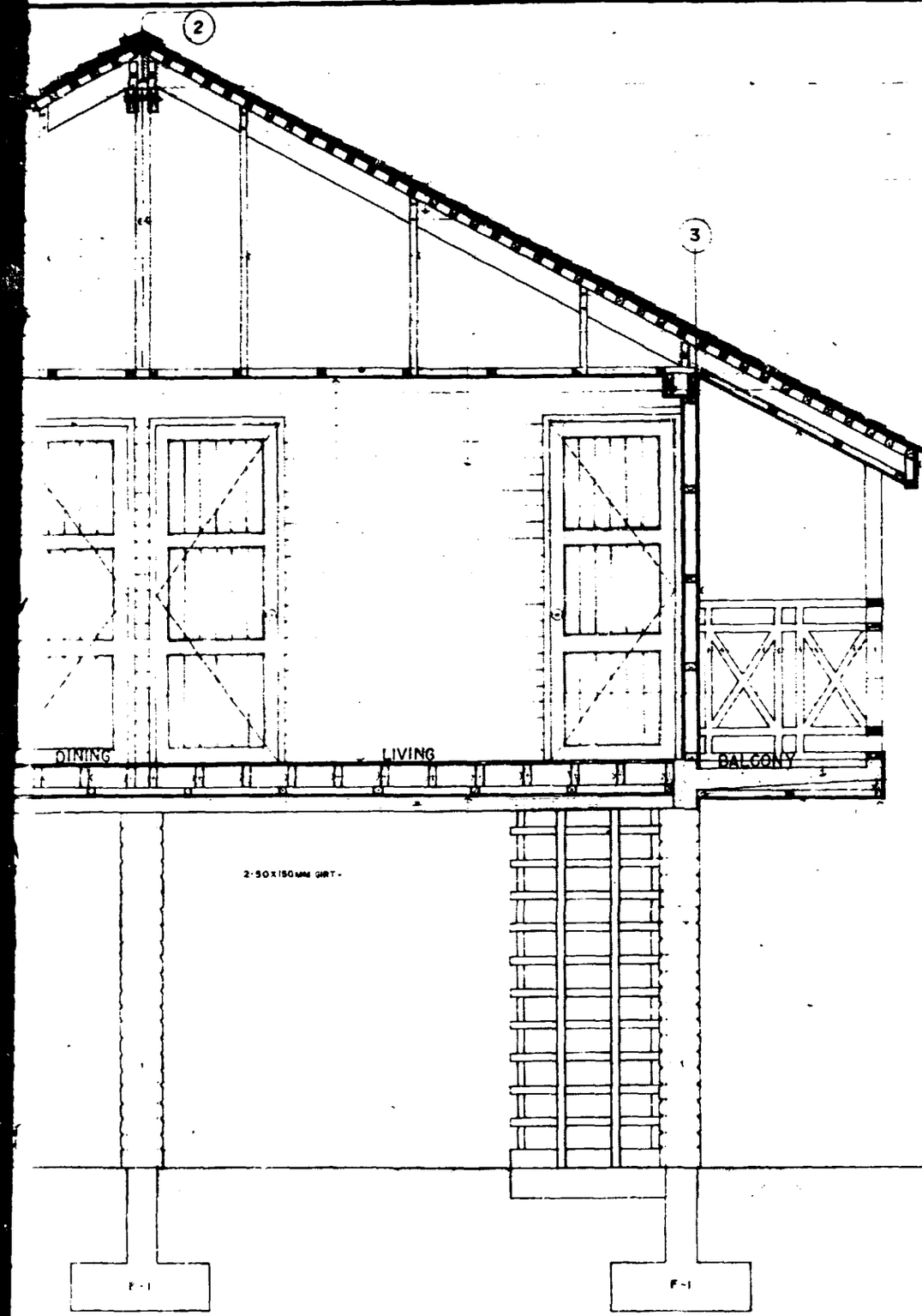
SECTION 2



A CROSS SECTION
A-3 SCALE 1:20 MTS

GREGORIO G. STA MARIA ARCHITECT • PLANNER • CONSULTANT 54 PITIMINI ST. SAN FRANCISCO DEL MONTE QUEZON CITY METRO MANILA PHILIPPINES TEL. NO. 991440 991171	REG NO 1341 PTR 418-B DATE 1-16-84 PLACE Q.C. TIN 83563 L1737 A-6	PREPARED BY GREGORIO G. STA MARIA ARCHITECT	APPROVED BY UNITED NATIONS UNIDO, UNDP	PROJECT RAS/8

SECTION 1



TOP OF GIRT

100 X 400 MM COCONUT WOOD SHINGLE ROOF NAILED DIRECTLY TO PURLINS

50X150 MM RAFTER

2-50 X 100MM WOOD POST

50 X 50 MM CEILING HANGERS

50X50 MM CEILING JOIST AT 0.60 M. ON CENTER BOTHWAYS

12X100 MM V-CUT HORIZONTAL SIDING

TOP OF LOWER GIRT

2-50X150MM GIRT ANCHORED TO POST BY 2-16MM Ø MACHINE BOLTS

25 X100 MM V-CUT FACIA BOARD

12 X 100 MM V-CUT CEILING ON 50X50MM CEILING JOIST AT 0.60 M. ON CENTER BOTHWAYS

12X100MM V-CUT DOUBLE SIDING ON 50 X 75 MM STUDS AT 0.60 M ON CENTER BOTHWAYS

FROM 50 X 100 MM BALCONY RAILINGS

25 X 100 MM L-SECTION JOINT WOOD FLOOR BOARD ON 50 X 125 MM FLOOR JOIST

BALCONY CONCRETE SLAB FLOORING (OPTIONAL)

FIN. SECOND FLOOR LINE

12X100 MM V-CUT FACIA BOARD (OPTIONAL)

12 MM Ø DRIP MOULD

50X100 MM NAILER

12 X 100 MM V-CUT CEILING ON 50X50MM CEILING JOIST AT 0.60 M ON CENTER BOTHWAYS (BALCONY CEILING OPTIONAL)

12 X 100 MM V-CUT FACING ON 25 X 50MM NAILERS CONCRETE NAILED TO REINFORCED CONCRETE COLUMNS

FIN GROUND FLOOR LINE

FIN GRADE LEVEL

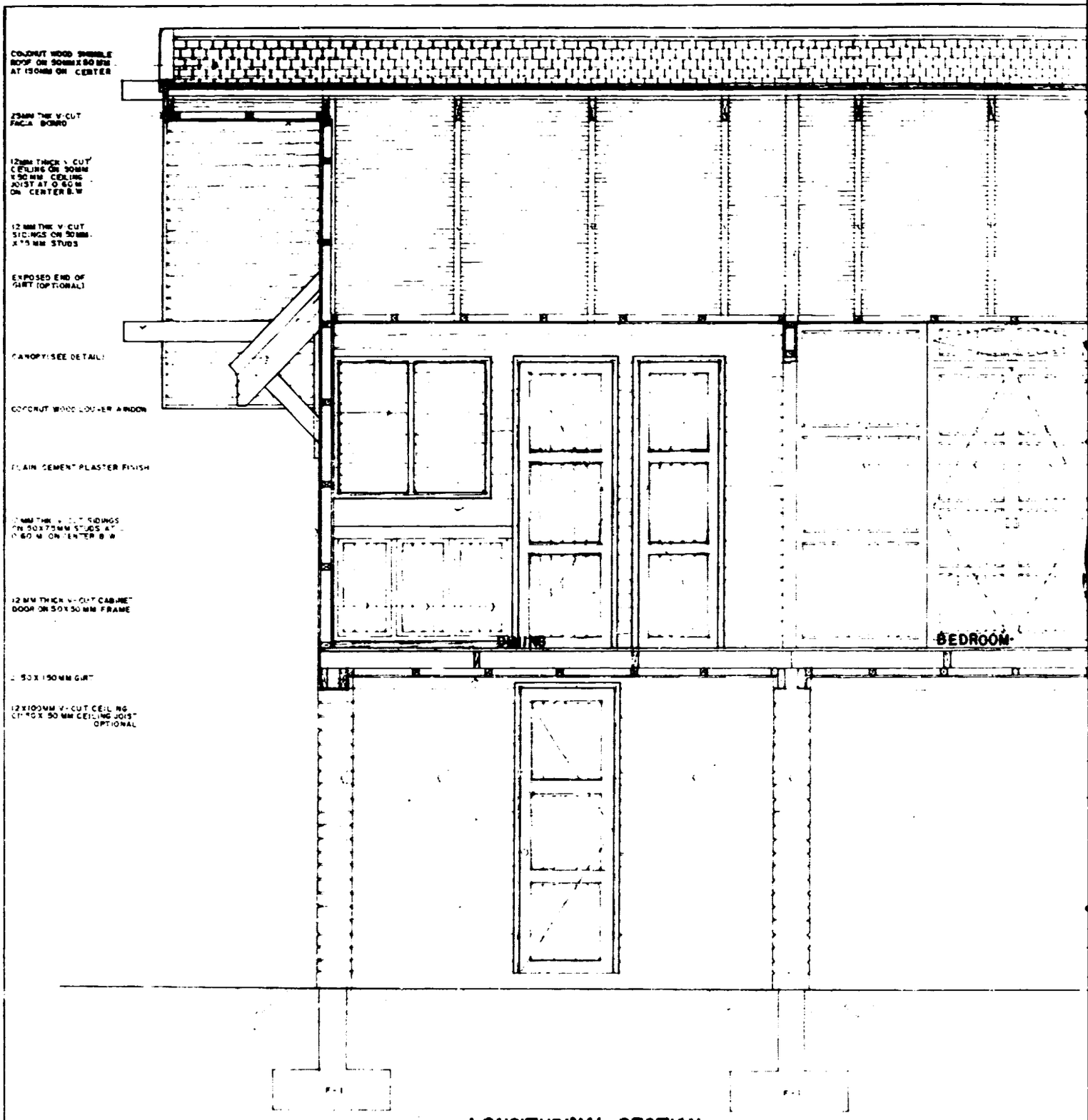
1.80 METERS

2.40 METERS

2.40 METERS

MARIA	APPROVED BY: UNITED NATIONS UNIDO, UNDP	PROJECT TITLE: RAS/81/110 - REGIONAL COCONUT WOOD TRAINING PROGRAMME -LOW COST HOUSING DESIGN (REVISED BASED ON RESULTS OF PROJECT NO - 91/PKI/83/801)	REG NO: 1781 PTR NO: DATE: PLACE: TAN C4621 - H1621 - A - 4	CONSULTING STRUCTURAL ENGINEER: CESAR A. CALIWARA, CIVIL ENGINEER	SHEET NO: A-3 / 7 MODEL - A

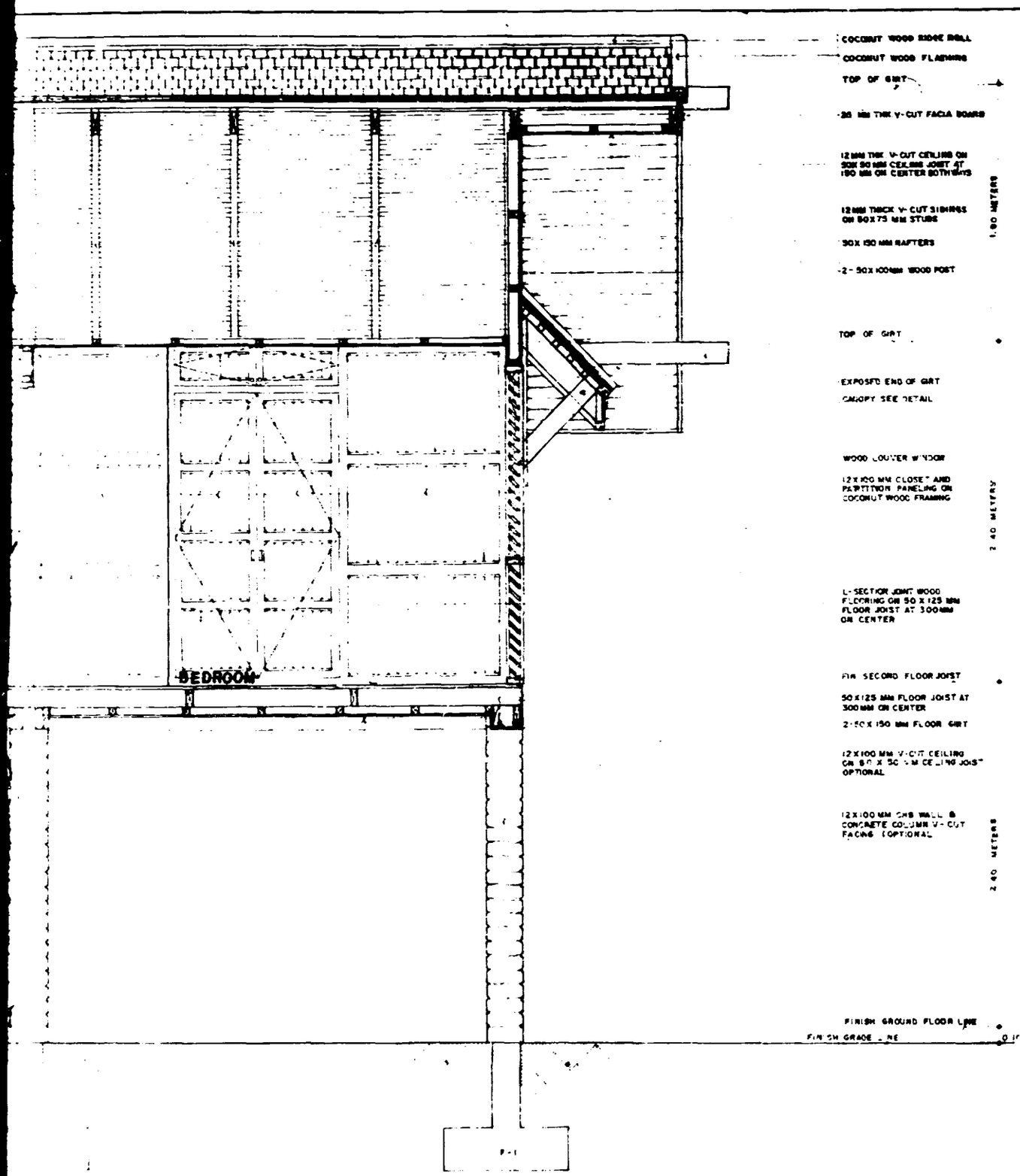
SECTION 2



A LONGITUDINAL SECTION
A-3A SCALE 1:20 MTS

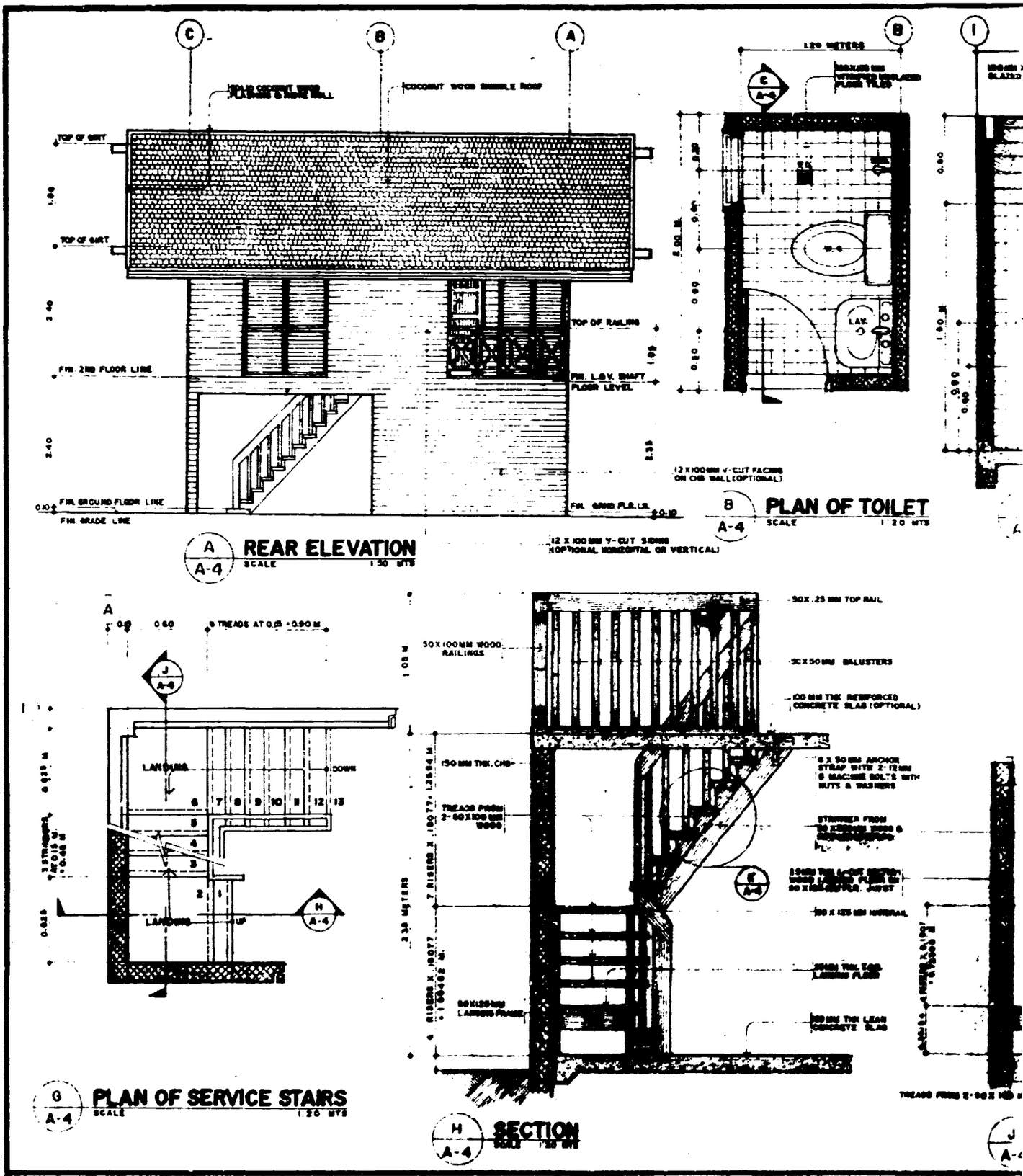
GREGORIO G. STA MARIA ARCHITECT • PLANNER • CONSULTANT 54 PITIMINI ST. SAN FRANCISCO DEL MONTE QUEZON CITY METRO MANILA PHILIPPINES TEL NO 99 1440 80 11 71	REG NO 1341 PTR 418 B DATE 1-16-84 PLACE Q.C TAN 33563L 1737 A-6	PREPARED BY GREGORIO G STA MARIA ARCHITECT	APPROVED BY UNITED NATIONS UNIDO, UNDP	PROJECT TITLE RAS/81/110

SECTION 1



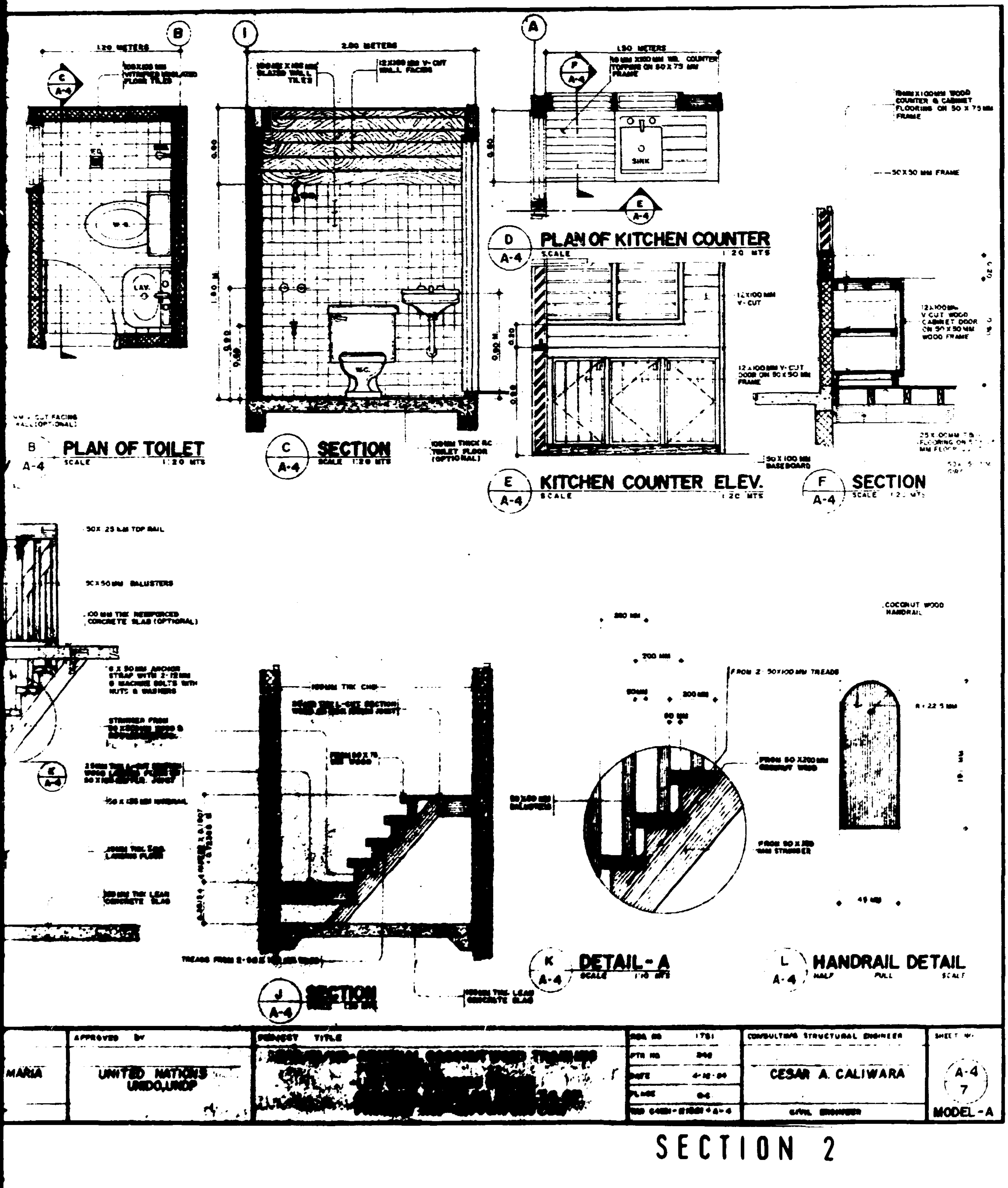
PROVED BY UNITED NATIONS UNIDO, UNDP	PROJECT TITLE RAS/81/110-REGIONAL COCONUT WOOD TRAINING PROGRAMME -LOW COST HOUSING DESIGN (REVISED BASED ON RESULTS OF PROJECT NO. 81/PHI/83/801	REG NO 1781 PTR NO 242 DATE 4-12-84 PLACE D.C. TAN C4621-H1661-A-4	CONSULTING STRUCTURAL ENGINEER CESAR A. CALIVARA CIVIL ENGINEER	SHEET NO A-3A 7 MODEL-A

SECTION 2

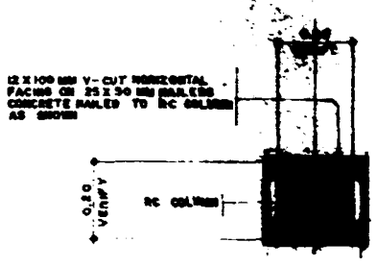


GREGORIO G. STA MARIA ARCHITECT • PLANNER • CONSULTANT 34 PETUNIA ST. SAN FRANCISCO DEL MONTE QUEZON CITY METRO MANILA PHILIPPINES TEL. NO. 921-440 3-91171	REQ. NO. 1544 PTR 419-0 DATE 1-16-84 PLACE D.C. THIS DRAWING/SHEET A-4
PREPARED BY GREGORIO G. STA MARIA ARCHITECT	APPROVED BY UNITED NATIONS UNDO/UNDP

SECTION 1

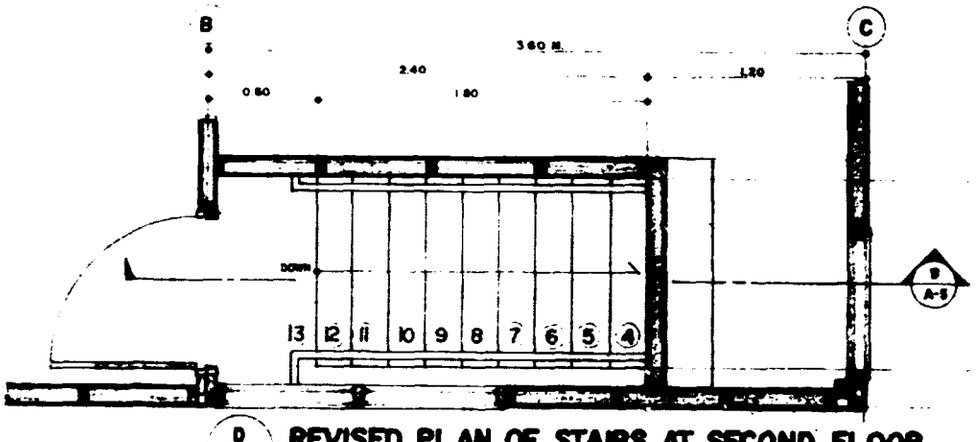

1.20 METERS
2.80 METERS
1.50 METERS
PLAN OF TOILET
SCALE 1:20 MTS
SECTION
SCALE 1:20 MTS
PLAN OF KITCHEN COUNTER
SCALE 1:20 MTS
50 X 50 MM FRAME
KITCHEN COUNTER ELEV.
SECTION
50X 25 MM TOP RAIL
50X50 MM BALUSTERS
COCONUT WOOD HANDRAIL
DETAIL-A
HANDRAIL DETAIL
APPROVED BY
MARIA
UNITED NATIONS
UNIDO,UNDP
SUBJECT TITLE
CONSULTING STRUCTURAL ENGINEER
CESAR A. CALIWARA
CIVIL ENGINEER
SHEET NO.
A-4
7
MODEL-A

SECTION 2

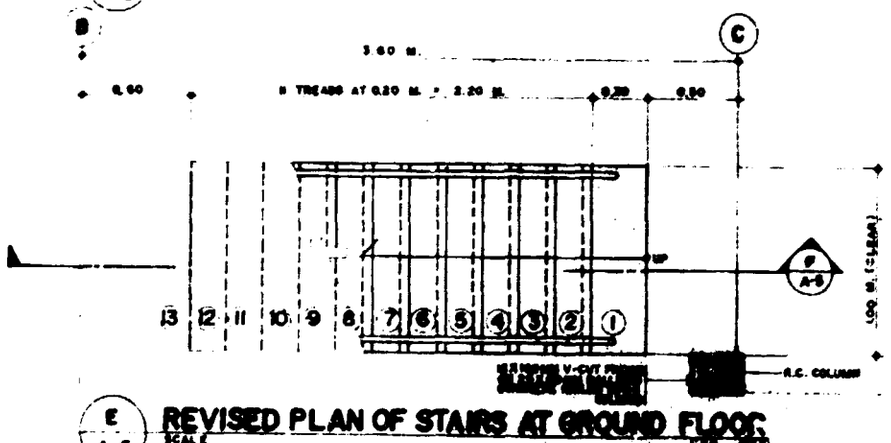


A / A-5 DETAIL OF CONCRETE COLUMN V-CUT FACING
SCALE

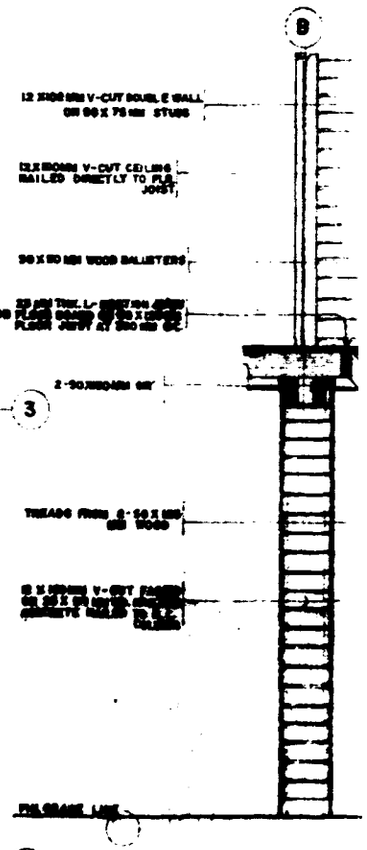
B / A-5 HANDRA
HALF



D / A-5 REVISED PLAN OF STAIRS AT SECOND FLOOR
SCALE

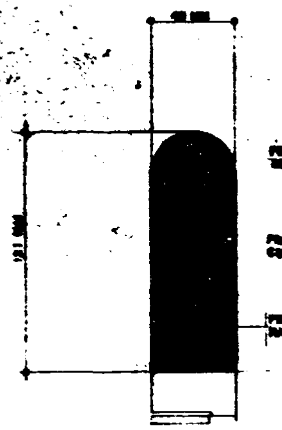


E / A-5 REVISED PLAN OF STAIRS AT GROUND FLOOR
SCALE

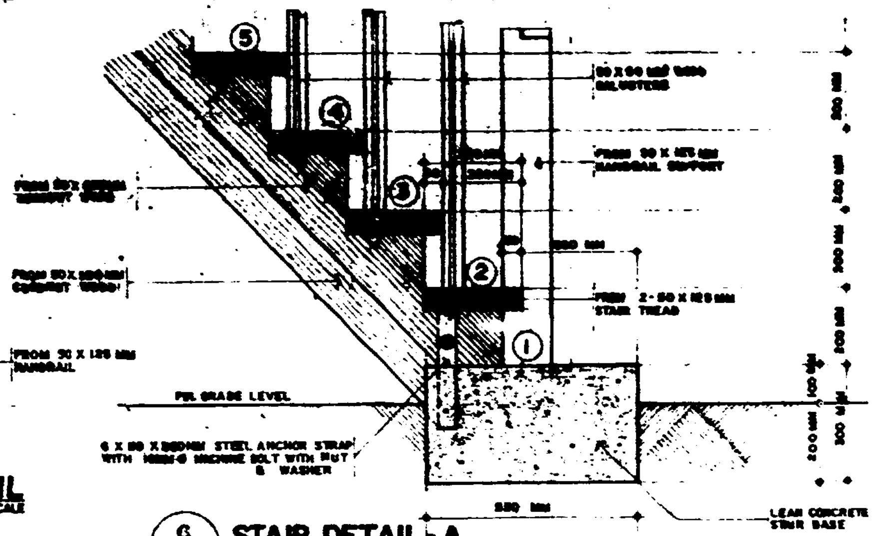


GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT

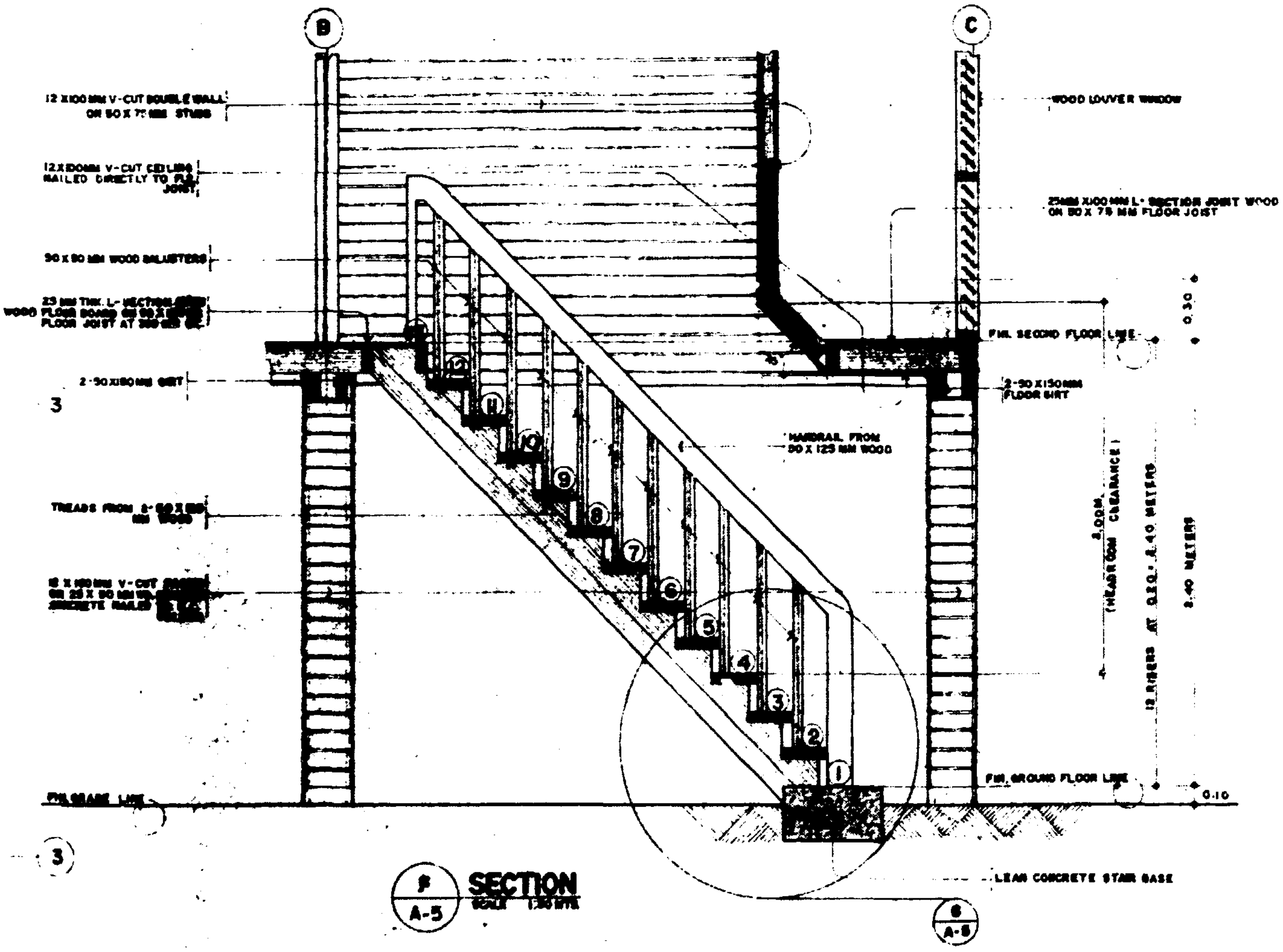
SECTION 1



B / A-5 **HANDRAIL DETAIL**
HALF FULL SCALE



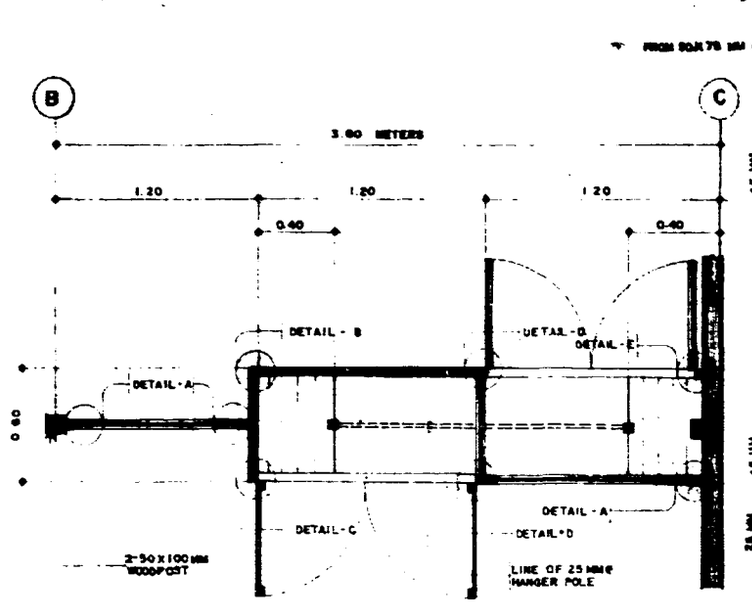
G / A-5 **STAIR DETAIL-A**
SCALE 1:10 MTS



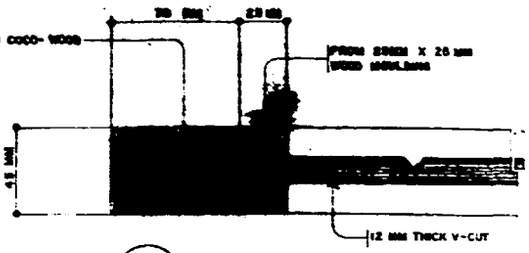
F / A-5 **SECTION**
SCALE 1:50 MTS

APPROVED BY	PROJECT TITLE			CONSULTING STRUCTURAL ENGINEER	SHEET NO.
UNITED NATIONS UNDP	[illegible]	REG. NO.	1781	CESAR A. CALIWARA	A-5 / 7
		PTR NO.	242		
		DATE	4-12-84		
		PLACE	[illegible]		
		[illegible]		CIVIL ENGINEER	MODEL-A

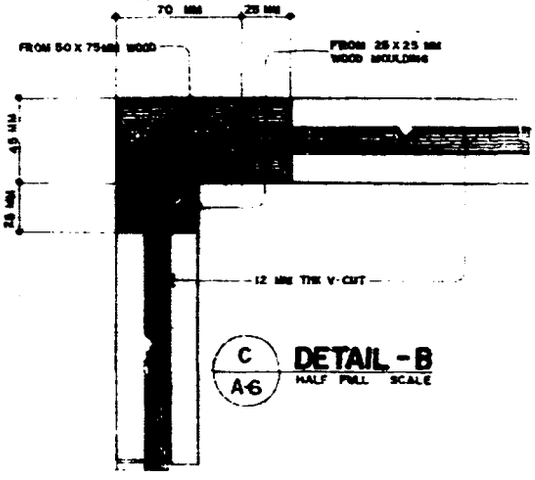
SECTION 2



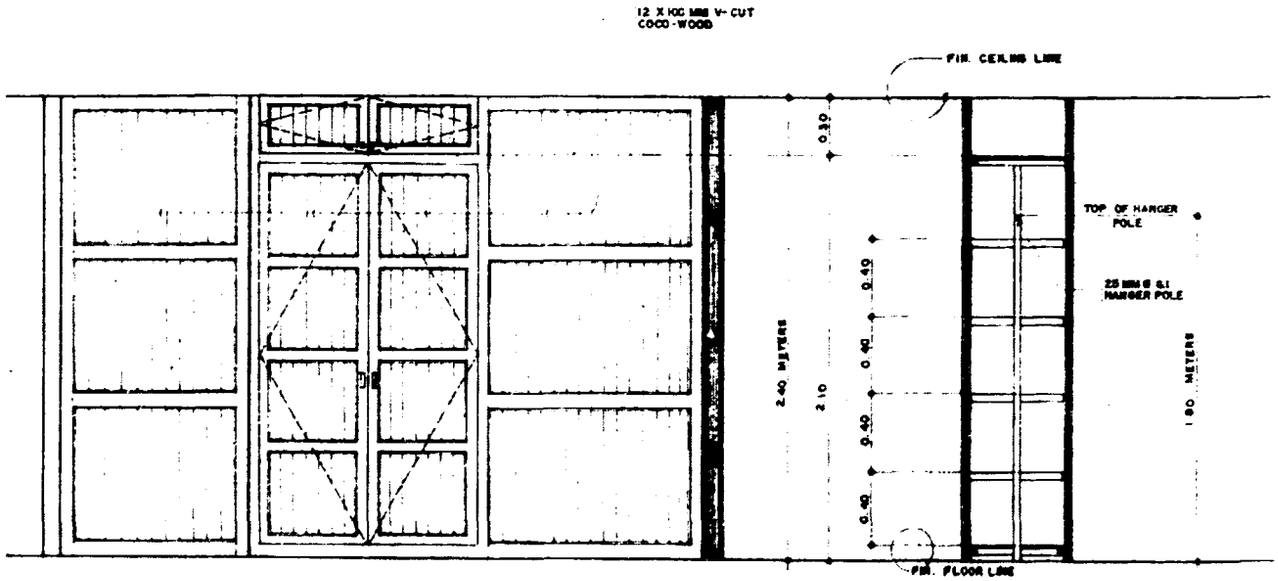
A / A-6 **PLAN OF CLOSET**
SCALE 1.20 MTS



B / A-6 **DETAIL - A**
HALF FULL SCALE



C / A-6 **DETAIL - B**
HALF FULL SCALE

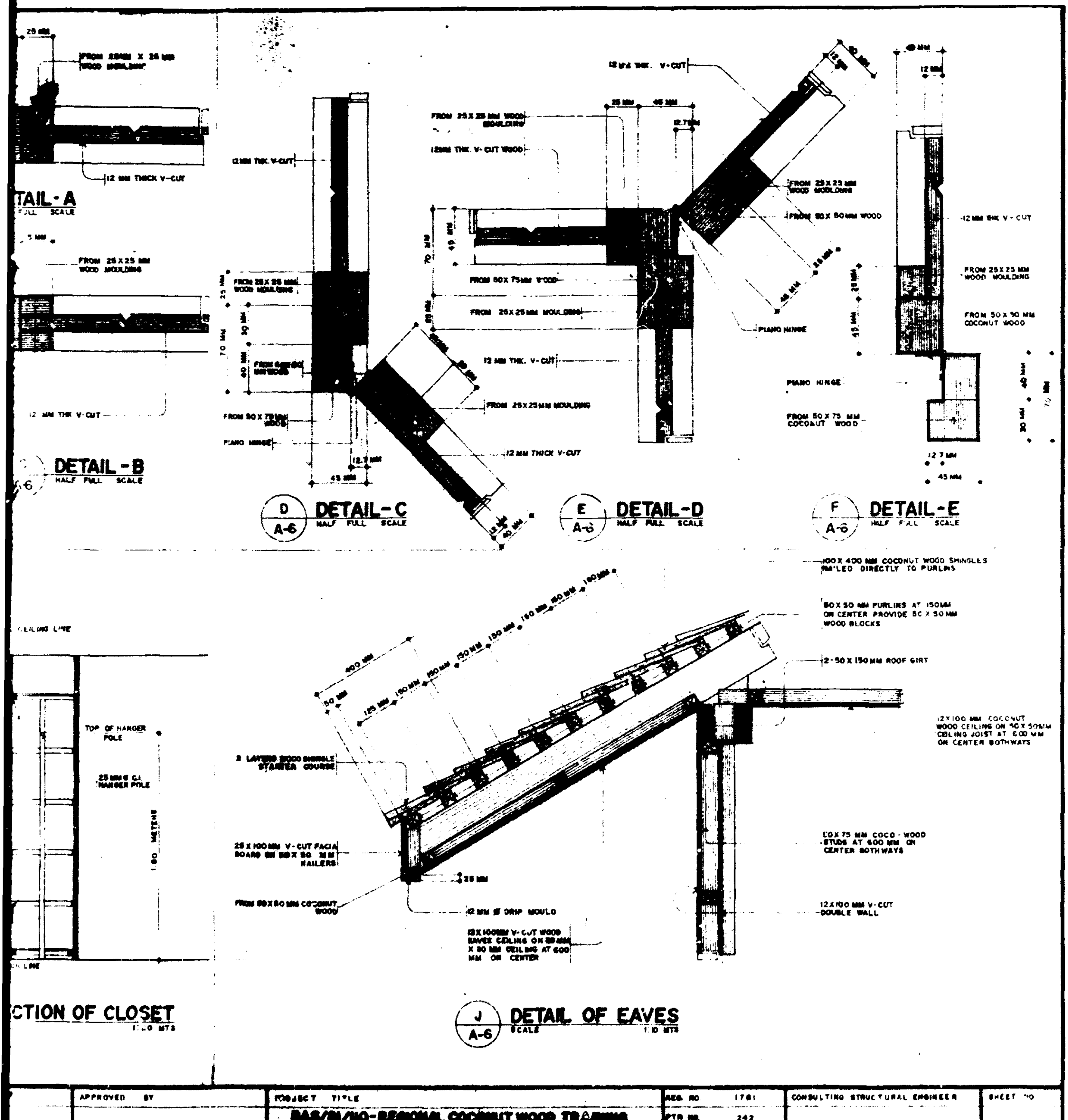


G / A-6 **ELEVATION OF CLOSET**
SCALE 1.20 MTS

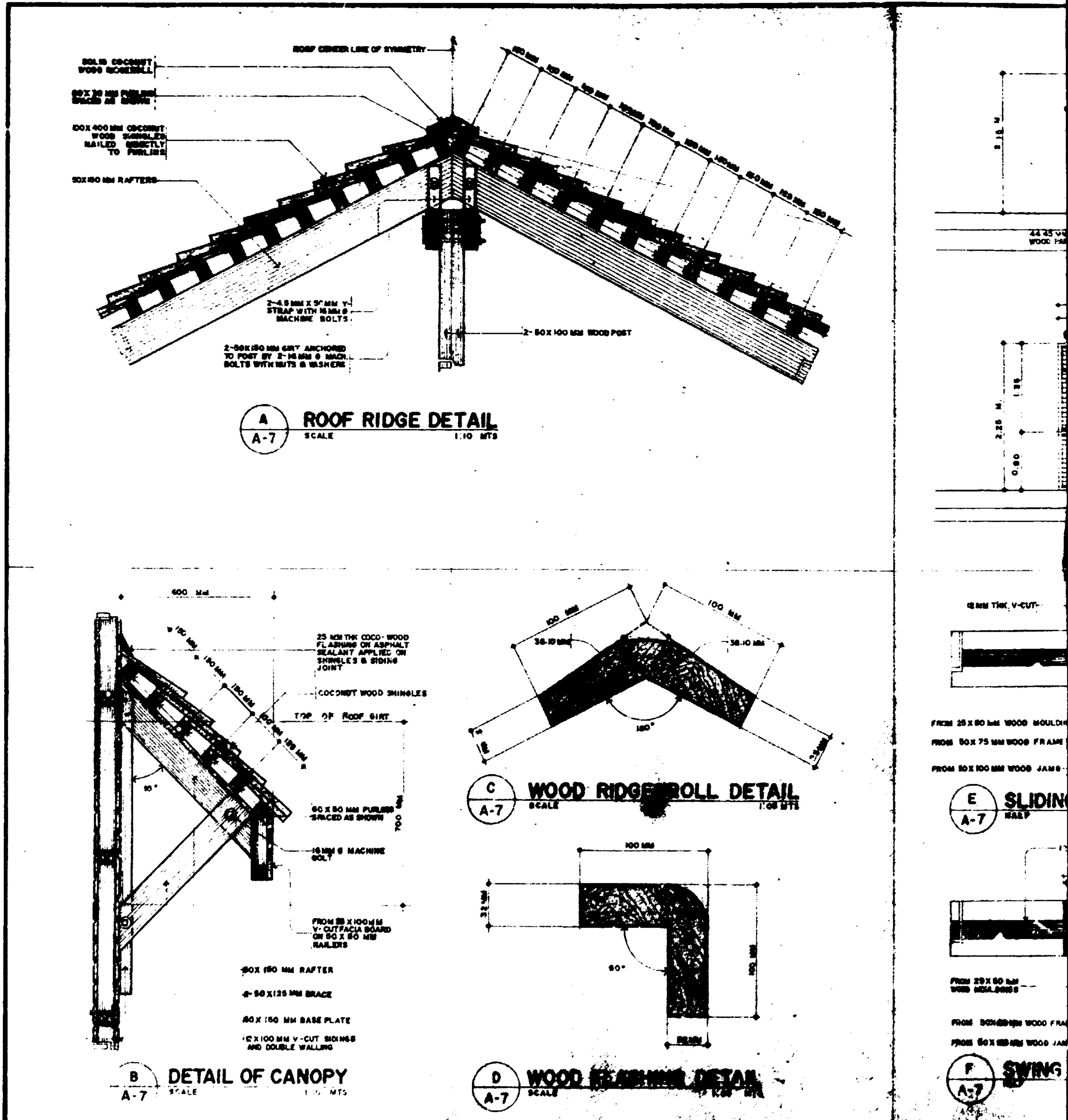
H / A-6 **SECTION OF CLOSET**
SCALE 1:20 MTS

GREGORIO G. STA MARIA ARCHITECT • PLANNER • CONSULTANT 34 MITHRIL ST. SAN FRANCISCO DEL MONTE QUEZON CITY METRO MANILA PHILIPPINES TEL. NO. 994440 9011?1	REG. NO. 1244 PTR 418-8 DATE 1-16-84 PLACE Q.C.	PREPARED BY GREGORIO G. STA MARIA ARCHITECT	APPROVED BY UNITED NATIONS UNIDO, UNDP

SECTION 1

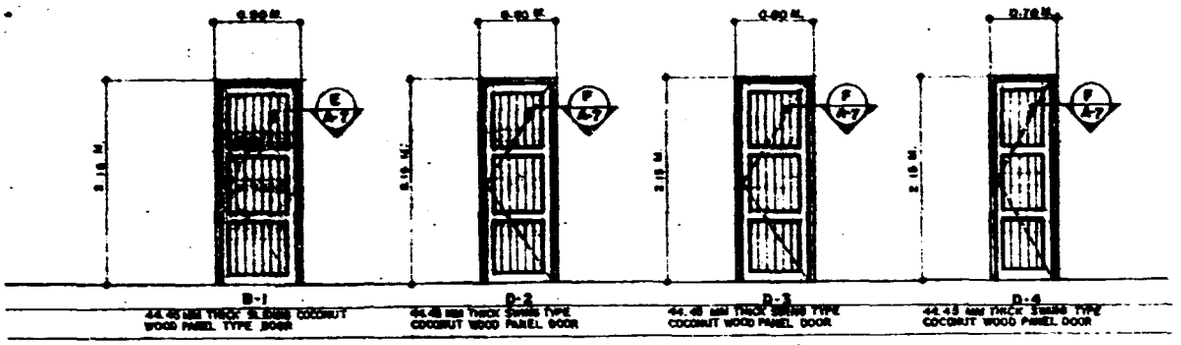

TAIL - A
FULL SCALE
DETAIL - B
HALF FULL SCALE
DETAIL - C
HALF FULL SCALE
DETAIL - D
HALF FULL SCALE
DETAIL - E
HALF FULL SCALE
CTION OF CLOSET
DETAIL OF EAVES
12 MM THICK V-CUT
FROM 25 X 25 MM WOOD MOULDING
FROM 50 X 75 MM WOOD
PIANO HINGE
FROM 50 X 50 MM COCONUT WOOD
FROM 50 X 75 MM COCONUT WOOD
100 X 400 MM COCONUT WOOD SHINGLES NAILED DIRECTLY TO PURLINS
50 X 50 MM PURLINS AT 150MM ON CENTER PROVIDE 50 X 50 MM WOOD BLOCKS
2-50 X 150 MM ROOF GIRT
12 X 100 MM COCONUT WOOD CEILING ON 50 X 50 MM CEILING JOIST AT 600 MM ON CENTER BOTHWAYS
50 X 75 MM COCO-WOOD STUDS AT 600 MM ON CENTER BOTHWAYS
12 X 100 MM V-CUT DOUBLE WALL
12 MM DRIP MOULD
TOP OF HANGER POLE
25 MM Ø G.I. HANGER POLE
1.80 METERS
APPROVED BY
UNITED NATIONS
UNIDO, UNDP
PROJECT TITLE
CONSULTING STRUCTURAL ENGINEER
CESAR A. CALIWARA
CIVIL ENGINEER
SHEET NO
A-6
7
MODEL - A

SECTION 2

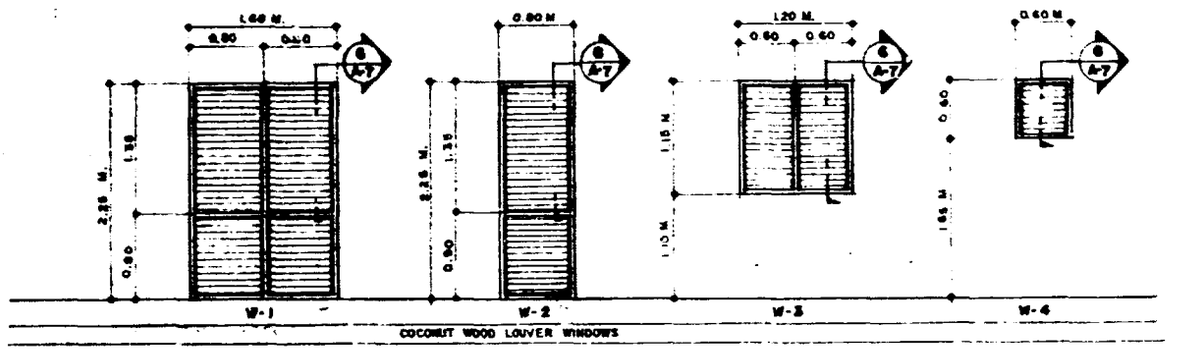


GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT
34 PITIMINI ST SAN FRANCISCO DEL MONTE
QUEZON CITY METRO MANILA PHILIPPINES
TEL. NO. 991440 991171

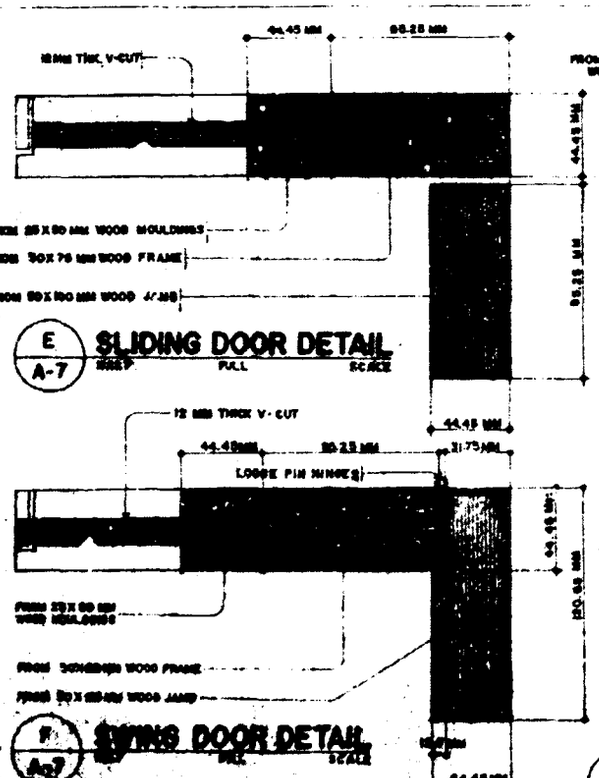
SECTION 1



SCHEDULE OF DOORS

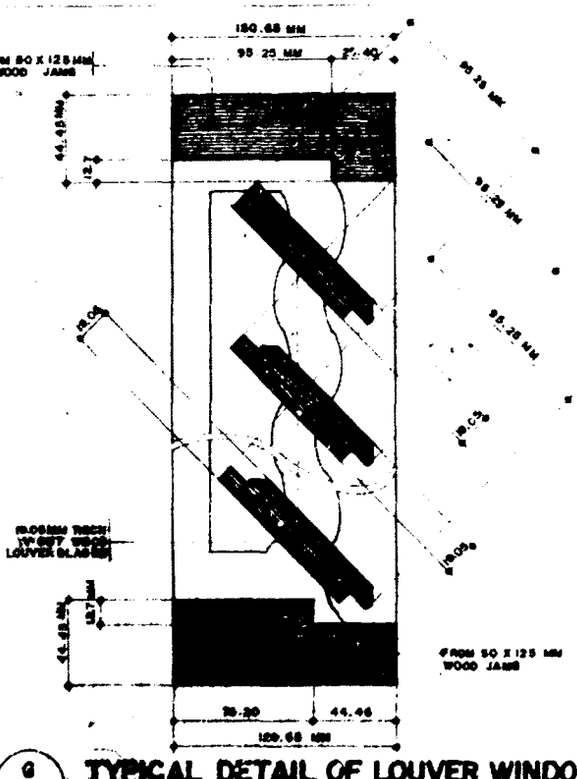


SCHEDULE OF WINDOWS



E / A-7 SLIDING DOOR DETAIL — HALF FULL SCALE

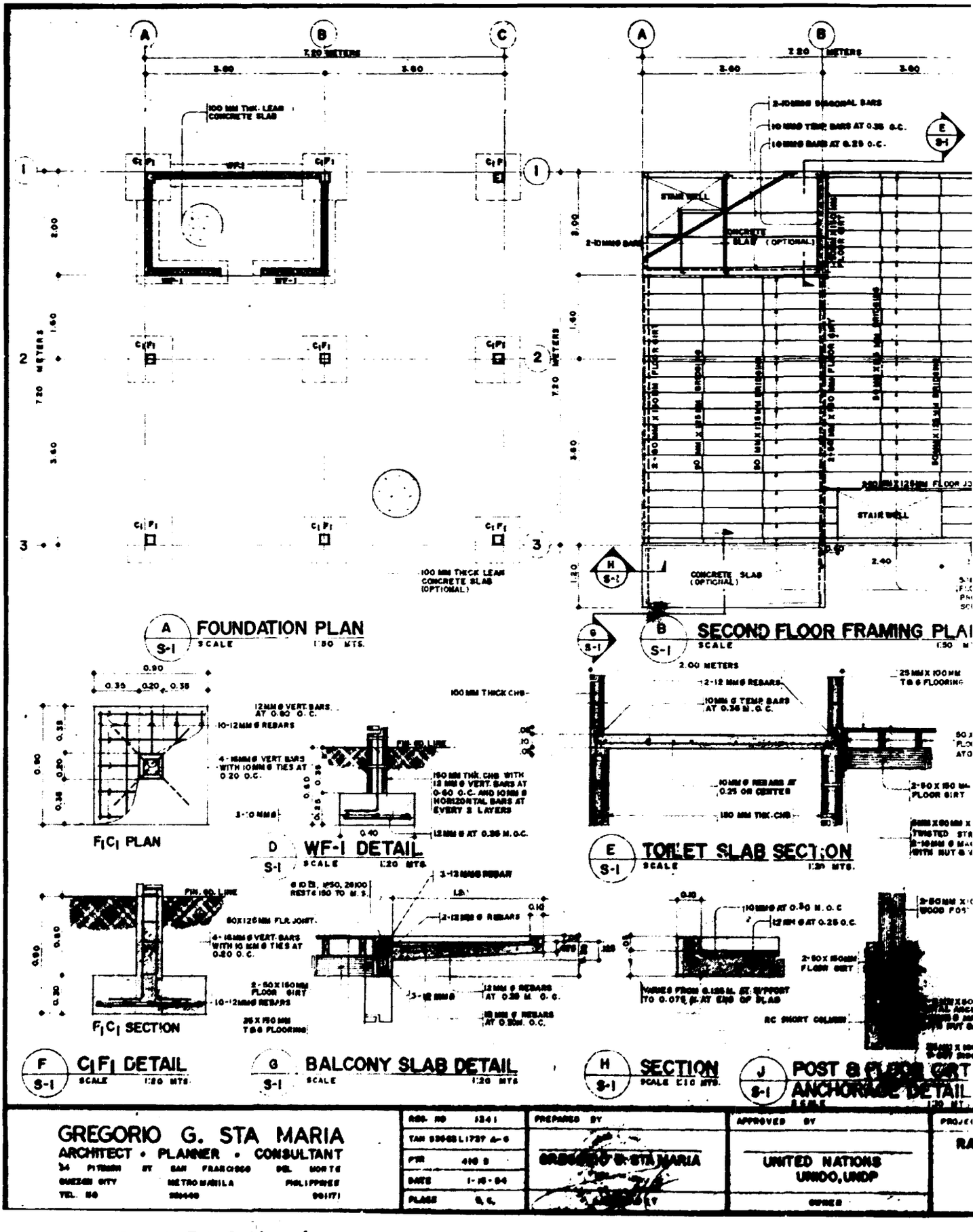
F / A-7 SWING DOOR DETAIL — FULL SCALE



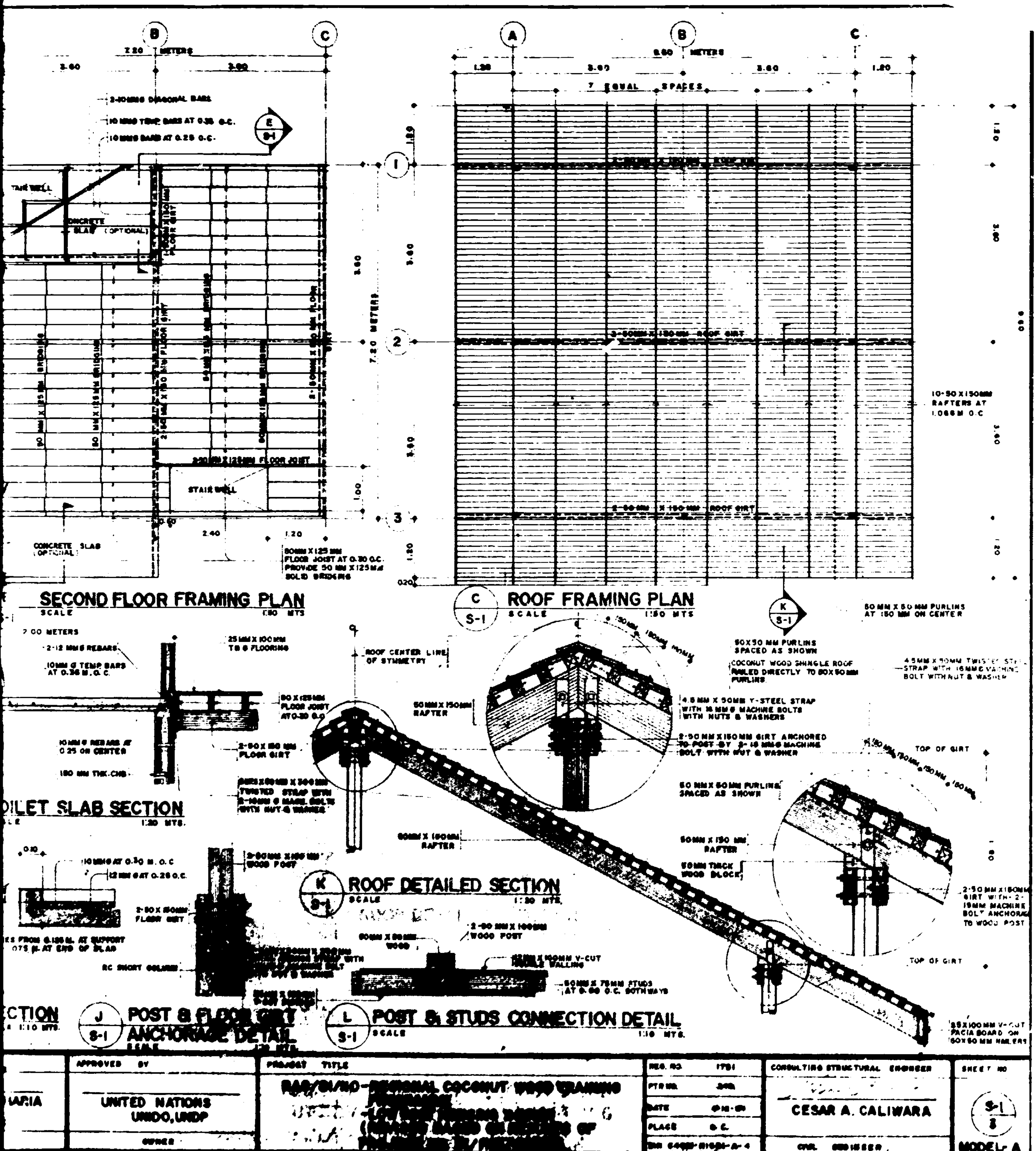
G / A-7 TYPICAL DETAIL OF LOUVER WINDOWS — FULL SCALE

APPROVED BY: UNITED NATIONS UNDP, UNIDO	COCONUT WOOD TRADING	CONSULTING STRUCTURAL ENGINEER: CESAR A CALIWARA	SHEET NO: A-7 / 7
			MODEL - A

SECTION 2

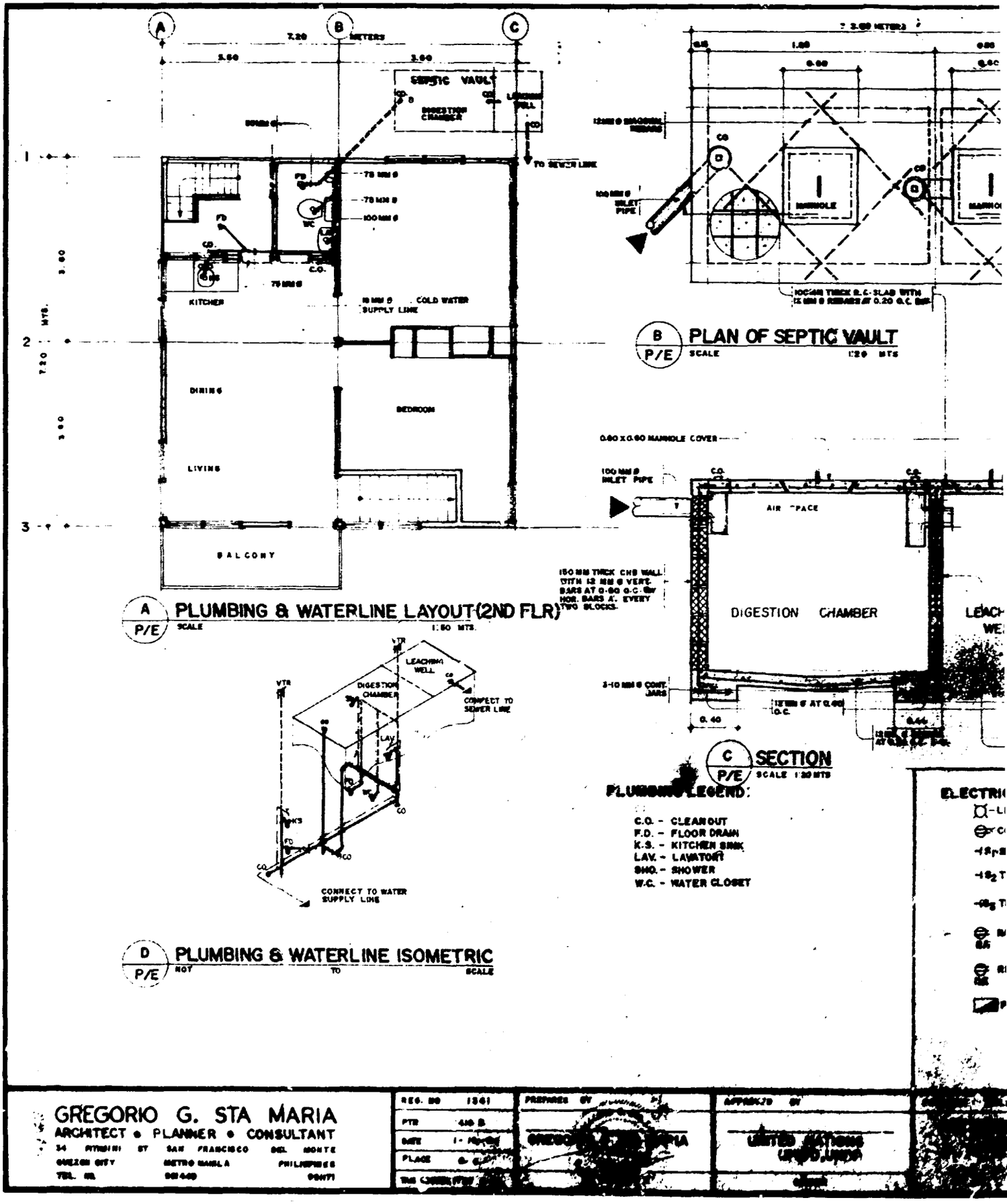

A FOUNDATION PLAN S-1 SCALE 1:50 MTS.
B SECOND FLOOR FRAMING PLAN S-1 SCALE 1:50 MTS.
F1C1 PLAN
D WF-1 DETAIL S-1 SCALE 1:20 MTS.
E TOILET SLAB SECTION S-1 SCALE 1:20 MTS.
F1C1 SECTION
F C1F1 DETAIL S-1 SCALE 1:20 MTS.
G BALCONY SLAB DETAIL S-1 SCALE 1:20 MTS.
H SECTION S-1 SCALE 1:10 MTS.
J POST & FLOOR GIRT ANCHORAGE DETAIL S-1 SCALE 1:20 MTS.
100 MM THK. LEAN CONCRETE SLAB
100 MM THICK LEAN CONCRETE SLAB (OPTIONAL)
STAIR WELL
CONCRETE SLAB (OPTIONAL)
2.00 METERS
2-12 MM Ø REBARS
10MM Ø TEMP BARS AT 0.35 M. O.C.
10 MM Ø REBARS AT 0.25 ON CENTER
150 MM THK. CHB
25 MM X 100 MM T&G FLOORING
2-50 X 150 MM FLOOR GIRT
12MM Ø VERT. BARS AT 0.60 O.C.
10-12MM Ø REBARS
4-16MM Ø VERT. BARS WITH 10MM Ø TIES AT 0.20 O.C.
150 MM THK. CHB WITH 12 MM Ø VERT. BARS AT 0.60 O.C. AND 10MM Ø HORIZONTAL BARS AT EVERY 3 LAYERS
12 MM Ø AT 0.35 M. O.C.
3-12 MM Ø REBAR
50X125MM FLR. JOINT
2-12 MM Ø REBARS
12 MM Ø REBARS AT 0.35 M. O.C.
10 MM Ø REBARS AT 0.30M. O.C.
10MM Ø AT 0.30 M. O.C
12 MM Ø AT 0.25 O.C.
RC SHORT COLUMN
GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT
UNITED NATIONS UNDCO, UNDP

SECTION 1



SECOND FLOOR FRAMING PLAN
C S-1 ROOF FRAMING PLAN
TOILET SLAB SECTION
K S-1 ROOF DETAILED SECTION
J S-1 POST & FLOOR GIRT ANCHORAGE DETAIL
L S-1 POST & STUDS CONNECTION DETAIL
CONCRETE SLAB (OPTIONAL)
STAIR WELL
10-50 X 150MM RAFTERS AT 1.066M O.C.
50 MM X 50 MM PURLINS AT 150 MM ON CENTER
COCONUT WOOD SHINGLE ROOF NAILED DIRECTLY TO 50X50 MM PURLINS
ROOF CENTER LINE OF SYMMETRY
TOP OF GIRT
APPROVED BY
UNITED NATIONS
UNIDO, UNDP
OWNER
PROJECT TITLE
CONSULTING STRUCTURAL ENGINEER
CESAR A. CALIWARA
CIVIL ENGINEER
SHEET NO
S-1
MODEL-A

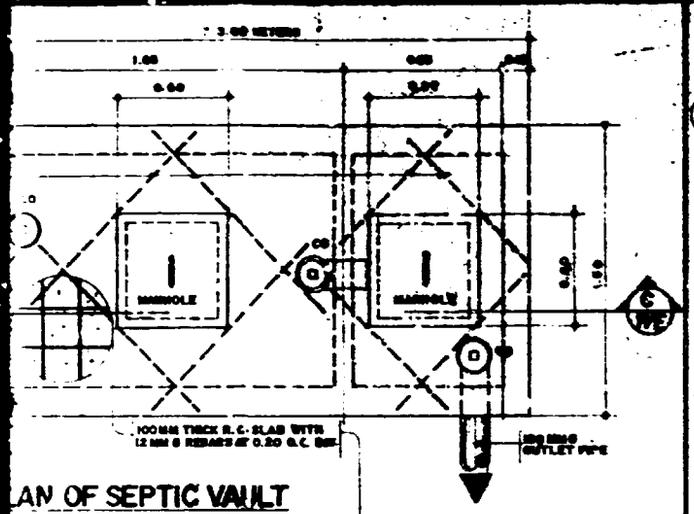
SECTION 2



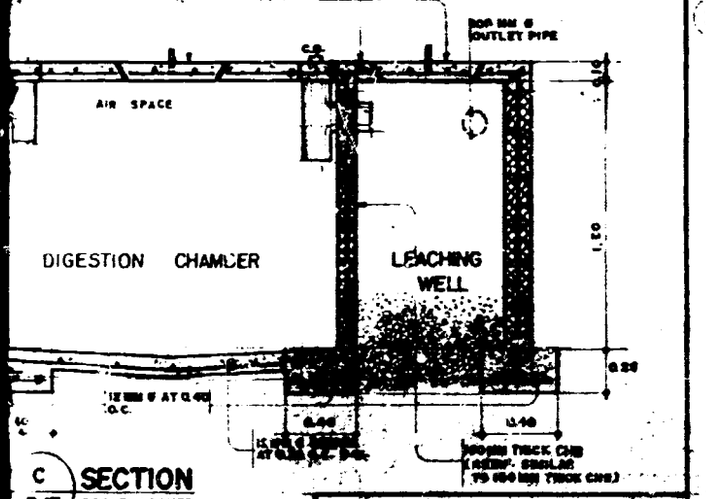
GREGORIO G. STA MARIA
ARCHITECT • PLANNER • CONSULTANT
34 ATISHIN ST SAN FRANCISCO DEL MONTE
QUEZON CITY METRO MANILA PHILIPPINES
TEL. NO. 920420 90471

REG. NO. 1561
PTR 440 B
DATE 1-
PLACE
PREPARED BY
APPROVED BY
LICENSED ARCHITECT

SECTION 1



AN OF SEPTIC VAULT

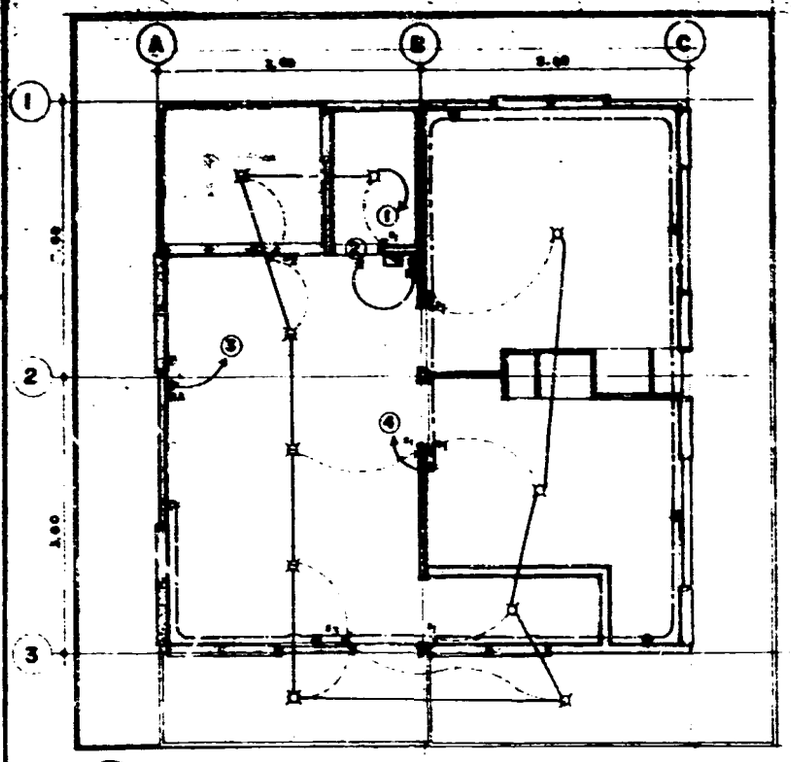


C P/E SECTION

SCALE

GEND:

UT
RAIN
K SINK
RY
Z
CLOSET



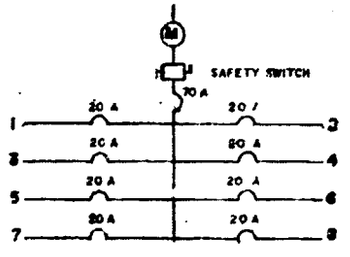
E P/E SECOND FLOOR ELECTRICAL LAYOUT

SCALE

SCHEDULE OF LOADS & COMPUTATIONS							
CKT. NO.	CKT. RATING VOLT	CKT. RATING AMP	LOAD DESCRIPTION LIGHT	C.O.	OTHERS	AMP. LOAD	SIZE OF WIRE
1	220	0.50	10			5.0	3.0 mm²
2	220	1.50			REF	1.5	2.0 "
3	220	9.20			PUMP	9.2	3.5 "
4	220	0.75		8		6.0	3.5 "
5	220	SPARE				5.0	3.0 "
6	220	SPARE				1.5	2.0 "
7	220	SPARE				9.2	3.5 "
8	220	SPARE				6.0	3.5 "
		TOTAL				43.40	

ELECTRICAL LEGEND:

- LIGHT OUTLET
- CONVENIENCE OUTLET
- SINGLE POLE SWITCH
- TWO POLE SWITCH
- THREE POLE SWITCH
- RANGE OUTLET
- REFRIGERATOR
- PANEL BOX



F P/E RISER DIAGRAM

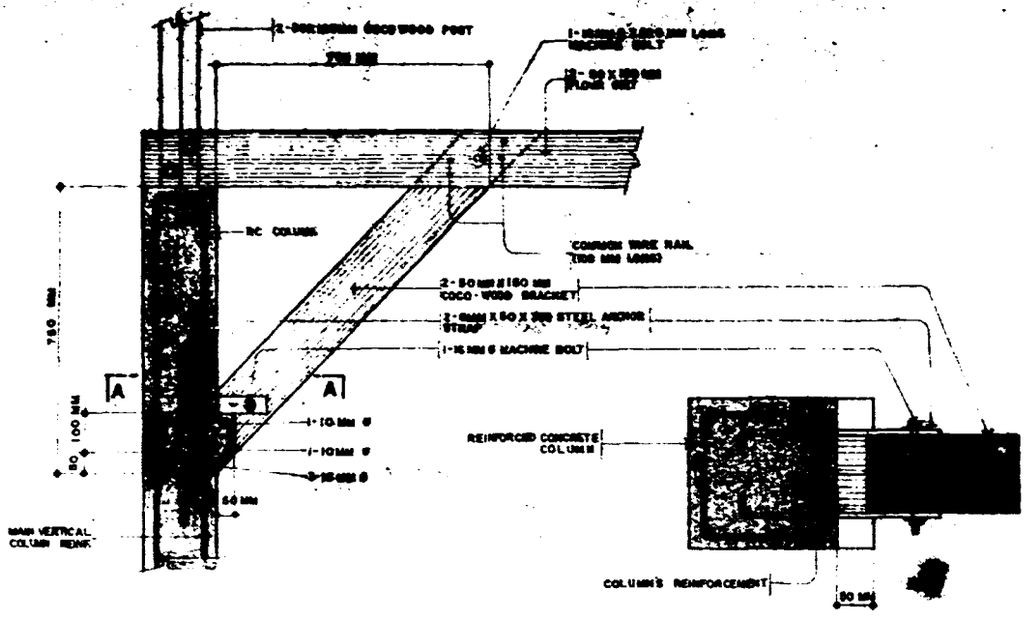
SCALE

APPROVED BY

UNITED NATIONS
UNESCO, UNDP

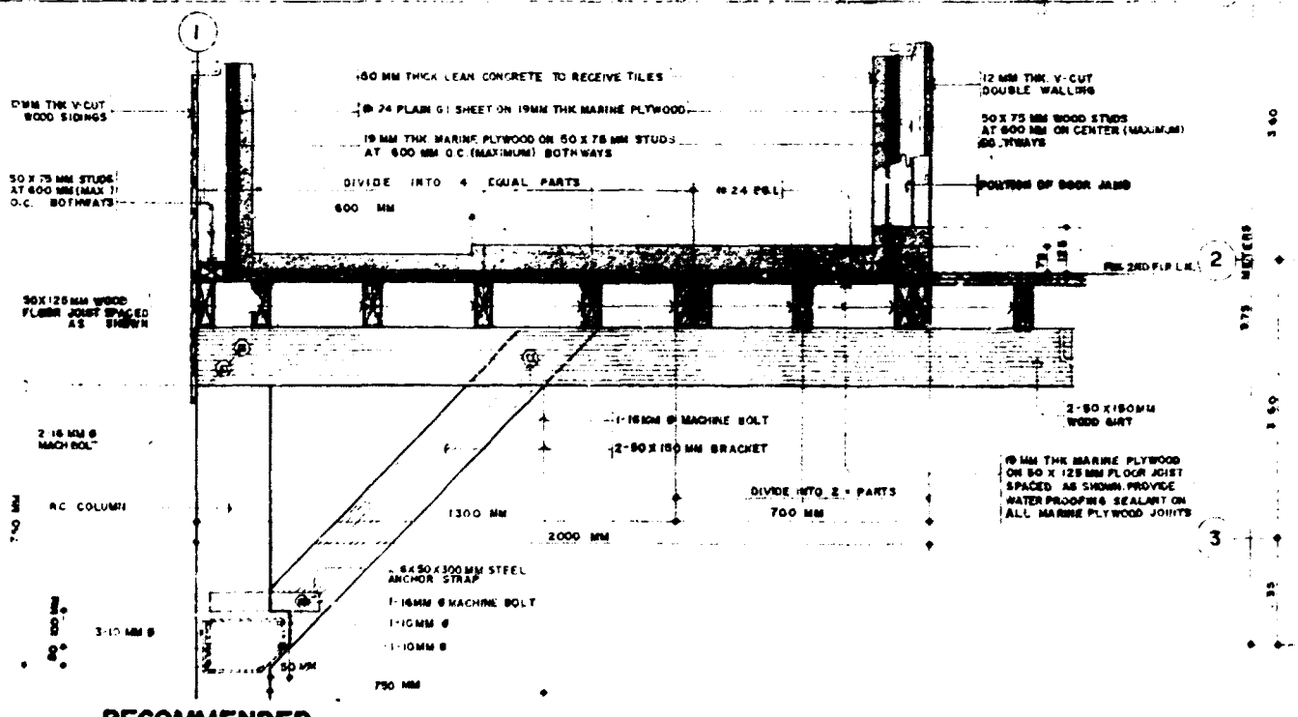
MODEL-A

SECTION 2



A / S-2 **DETAIL OF FLOOR GIRT BRACKET**
SCALE AS SHOWN

NOTE: FOR FLOOR GIRT ALONG TOILET WITH RECOMMENDED WOODEN FLOOR FRAMING.



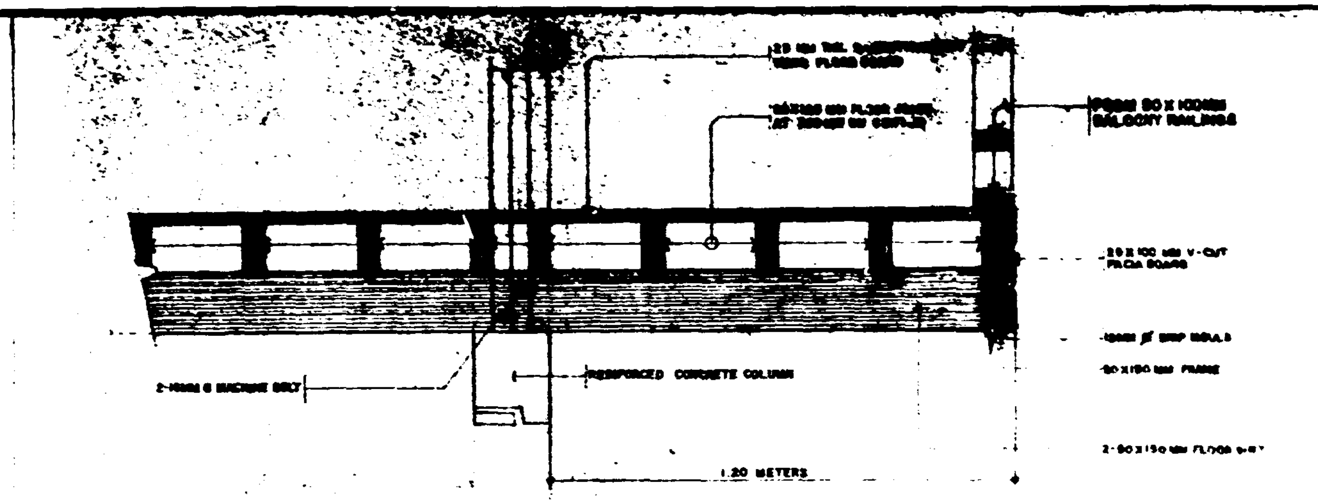
C / S-2 **RECOMMENDED TOILET WOODEN FLOOR FRAME ALTERNATE DETAIL**
SCALE 1:10 MTS

GREGORIO G. STA MARIA	REG. NO. 1261
ARCHITECT PLANNER CONSULTANT	PTR 416-8
34 PITMIMI ST. SAN FRANCISCO DEL MONTE	DATE 1-16-84
QUEZON CITY METRO MANILA PHILIPPINES	PLACE Q.C.
TEL. NO. 281440 991171	TIN 93968-L1791 A-9

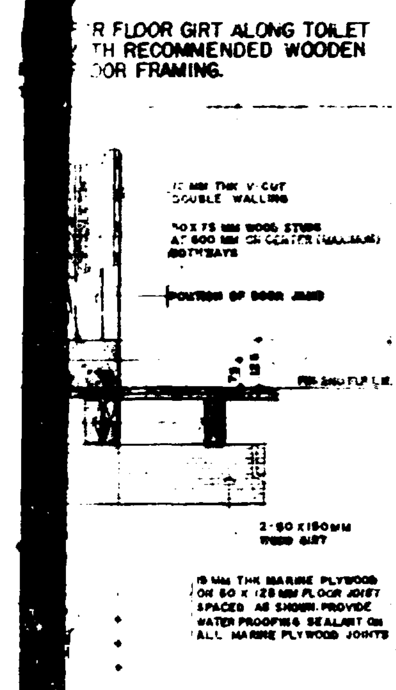
PREPARED BY: GREGORIO G. STA MARIA, ARCHITECT

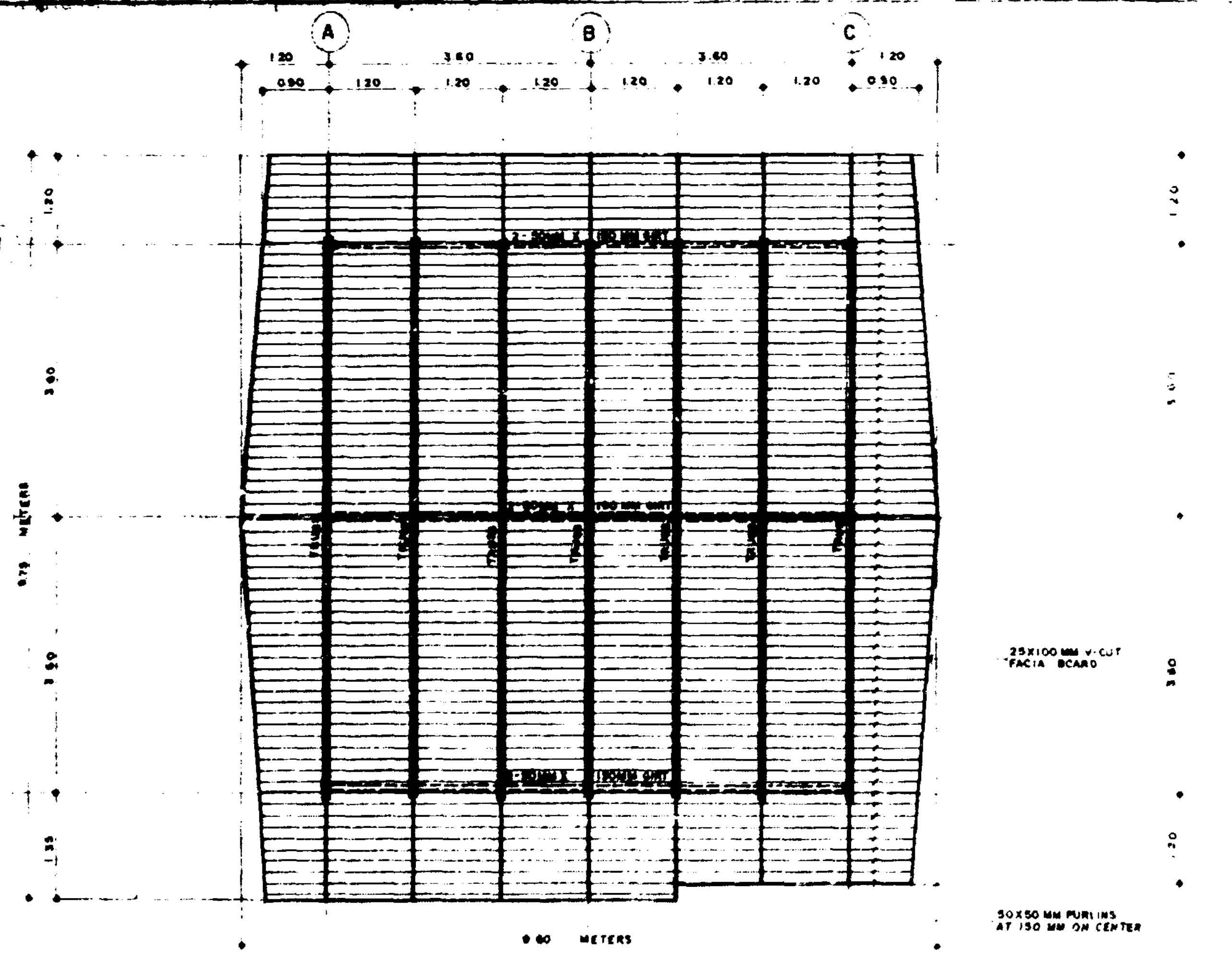
APPROVED BY: UNITED NATIONS UNIDO, UNDP

SECTION 1



B / S-2 RECOMENDED BALCONY WOODEN FLOOR ALTERNATE DETAIL

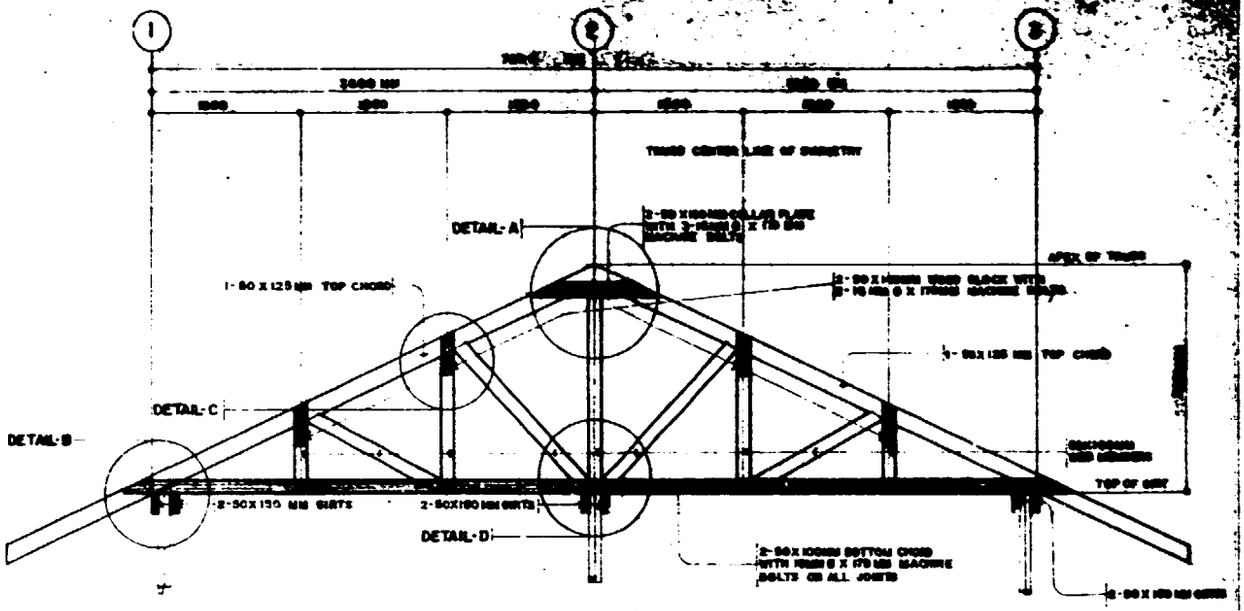




D / 3-2 RECOMMENDED TRUSS SYSTEM ROOF FRAMING PLAN

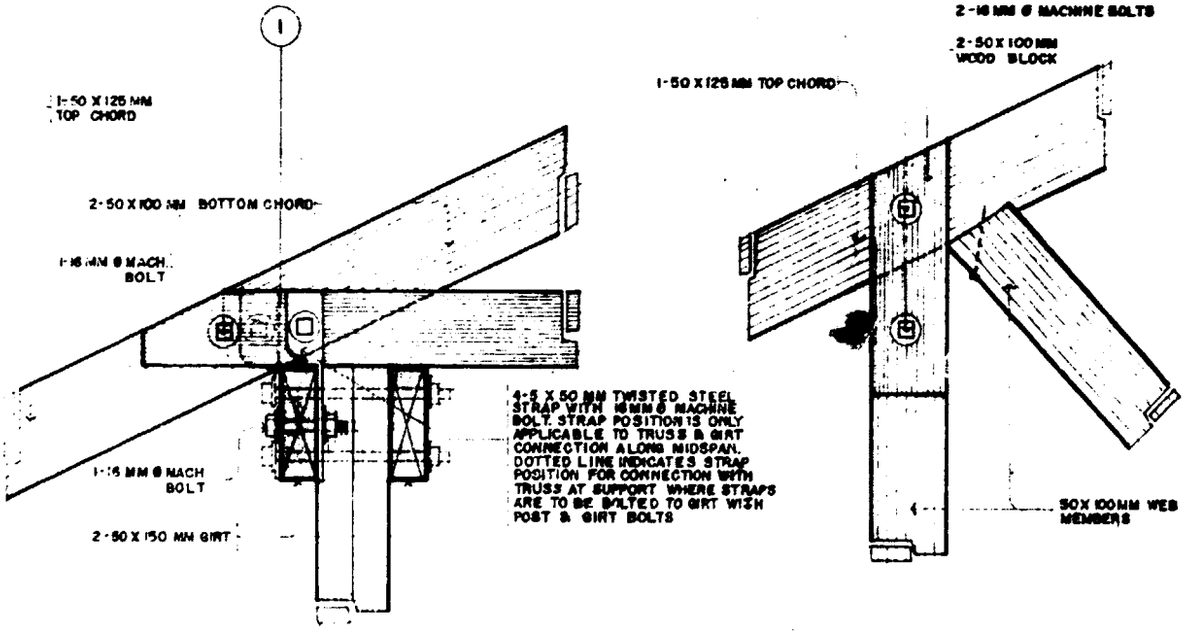
MARIA	APPROVED BY UNITED NATIONS UNIDC, UNDP	PROJECT TITLE	DATE 4-12-84	CONSULTING STRUCTURAL ENGINEER CESAR A. CALIWARA CIVIL ENGINEER	SHEET NO. S-2 3 MODEL - A

SECTION 2



TRUSS SPACING = 1200 MM ON CENTER

A / S-3 **ALTERNATE TRUSS ROOF FRAMING DETAIL**
SCALE 1:50 MTS

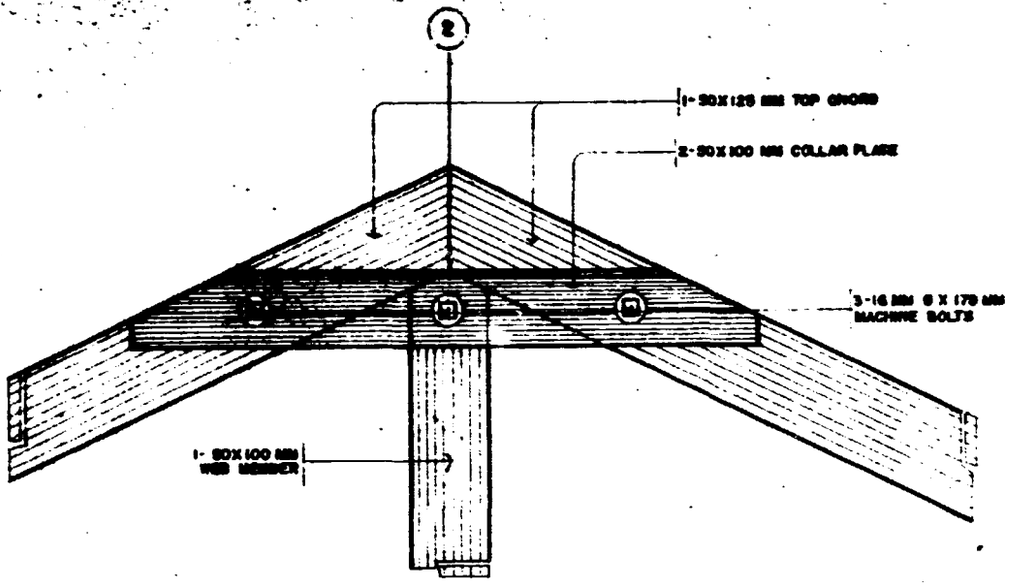


C / S-3 **DETAIL-B**
SCALE 2 MTS

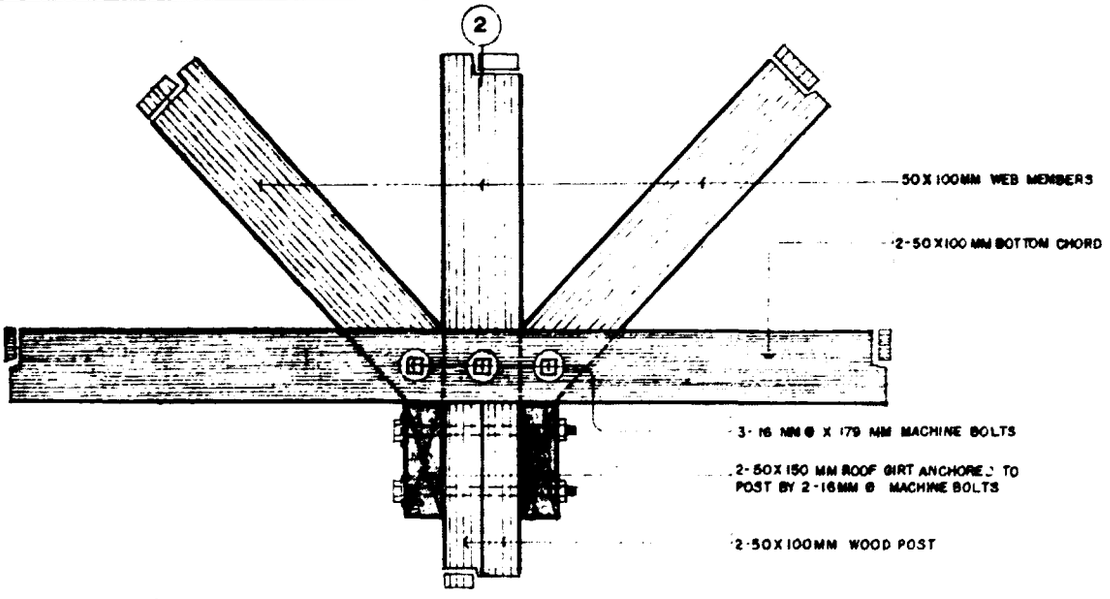
D / S-3 **DETAIL-C**
SCALE 1:2.5 MTS

GREGORIO G. STA MARIA ARCHITECT PLANNER CONSULTANT 34 PITMINI ST SAN FRANCISCO DEL MONTE QUEZON CITY METRO MANILA PHILIPPINES TEL NO 99-1440 99171	REG NO 13-91 PTR 418-8 DATE 1-10-84 PLACE D.C.	PREPARED BY GREGORIO G. STA MARIA ARCHITECT	APPROVED BY UNITED NATIONS UNIDO, UNDP	PROJECT TITLE [illegible]

SECTION 1



8/S-3 DETAIL - A
SCALE 1:2.5 MTS



E/S-3 DETAIL-D
SCALE 1:2.5 MTS

APPROVED BY: UNITED NATIONS UNIDO, UNDP	PROJECT TITLE: [illegible] REGIONAL COCONUT WOOD TRAINING [illegible] HOUSING DESIGN BASED ON RESULTS OF [illegible]	REG NO. 1781	CONSULTING STRUCTURAL ENGINEER: CESAR A. CALIWARA, ENGINEER	SHEET NO: S-3/3
		PTR NO. 242		
		DATE 4-12-84		
		PLACE Q.C.		
		TAN C-0881-81081-A-4		MODEL - A

SECTION 2

ANNEX 2

BILL OF MATERIALS AND SPECIFICATIONS

MODEL A - DUPLEX

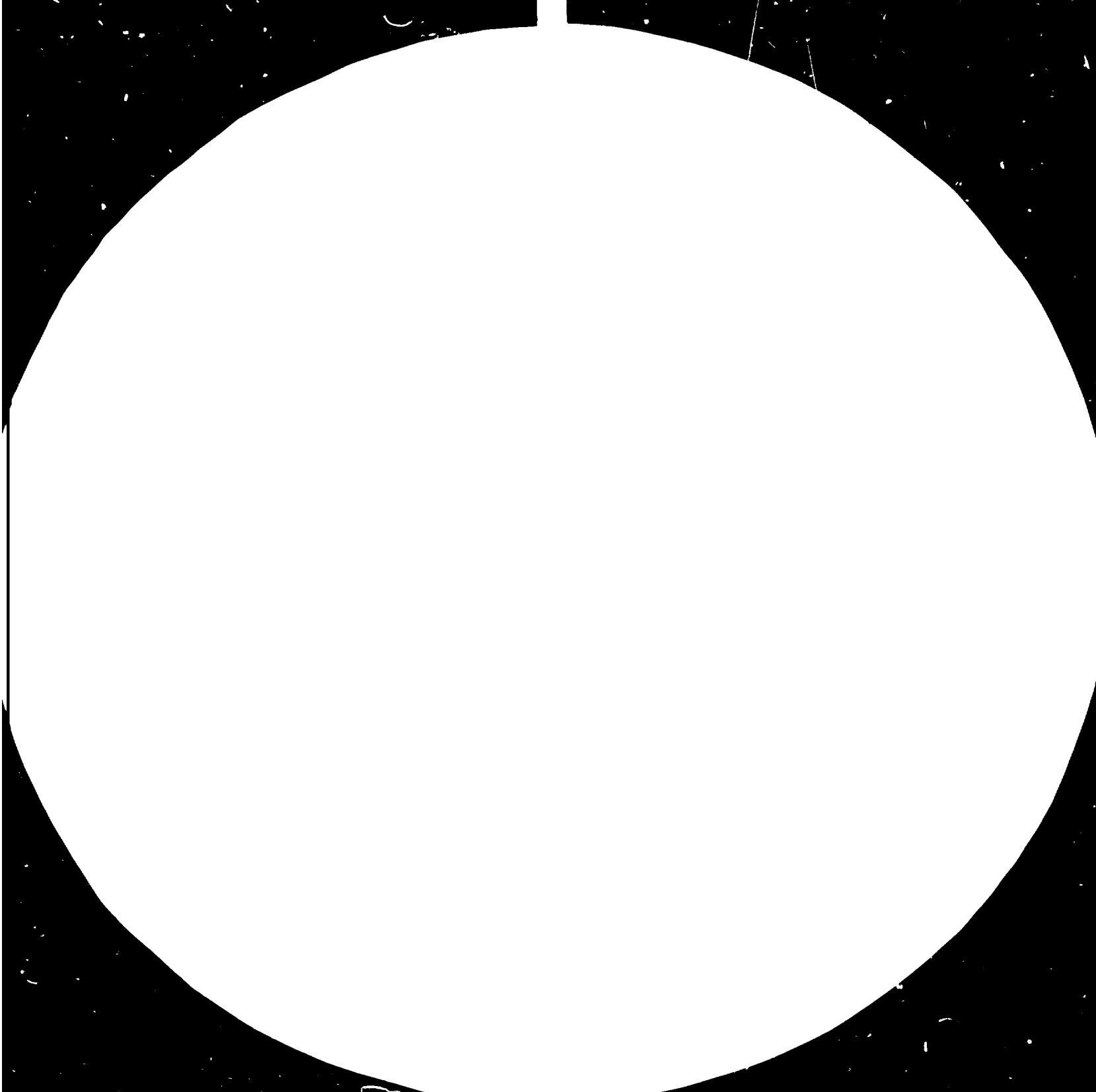
SCHEDULE OF COCONUT WOOD MATERIALS AND SPECIFICATIONS

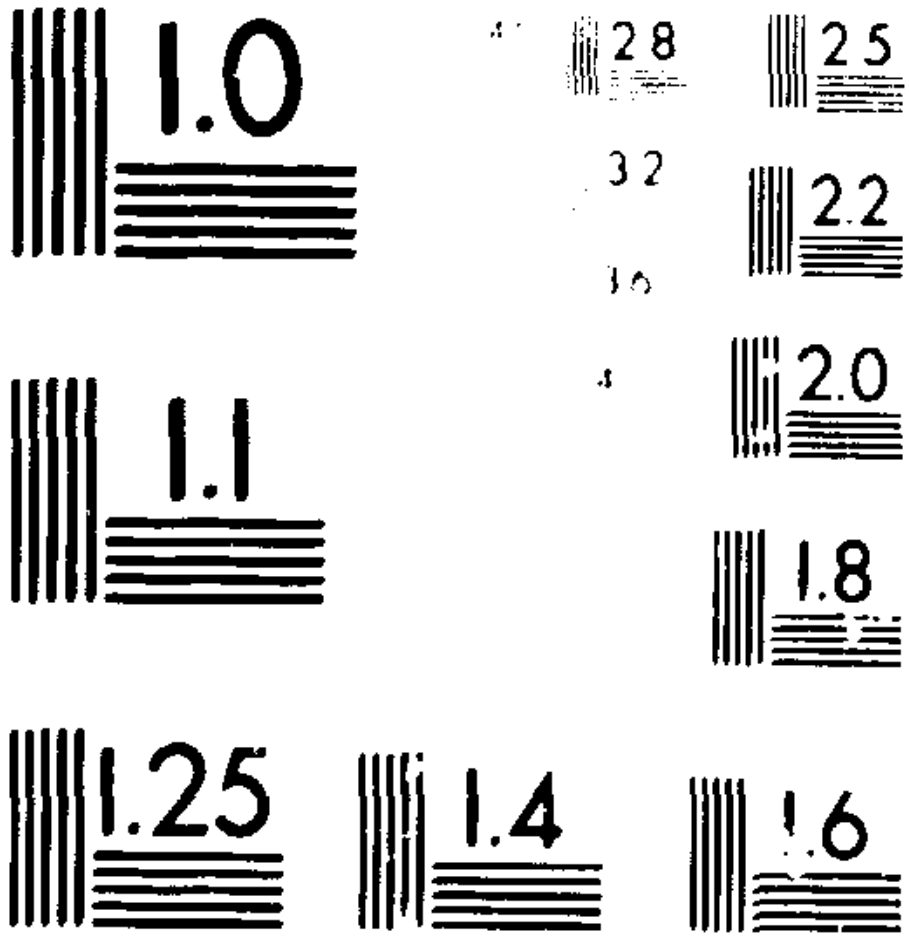
ITEM NO.	DESCRIPTION	UNIT	QUANTITY
1.0	STAKES/BATTER BOARDS/FORMS		
	25 x 50 x 1830	PIECES	16
	25 x 50 x 2430	PIECES	43
	25 x 50 x 4270	PIECES	16
	25 x 100 x 1230	PIECES	94
	25 x 100 x 2430	PIECES	42
	25 x 100 x 4880	PIECES	4
	25 x 150 x 4880	PIECES	16
	50 x 50 x 1830	PIECES	102
	50 x 50 x 2430	PIECES	106
	50 x 50 x 3660	PIECES	4
	50 x 75 x 2430	PIECES	11
	50 x 75 x 3050	PIECES	28
	50 x 75 x 3660	PIECES	4
	50 x 100 x 1830	PIECES	20
	50 x 100 x 2430	PIECES	34
	50 x 100 x 3050	PIECES	90
	50 x 125 x 3050	PIECES	216

CUTTING SCHEDULE

MARKINGS	GRADE	REMARKS
CB-2	GREEN	ROUGH, CHAIN SAWED
S-1,CB-1	GREEN	- do -
BB-1	GREEN	- do -
FM-3, FW-9	GREEN	- do -
FW-2, FW-6	GREEN	- do -
FW-3	GREEN	- do -
SCF-6, FW-1	GREEN	- do -
CB-3	GREEN	- do -
S-2, S-3, N-2, FW-5	GREEN	- do -
FW-4	GREEN	- do -
SCF-10,SCF-11	GREEN	- do -
SCF-3, SCF-4	GREEN	- do -
SCF-9	GREEN	- do -
SCF-8	GREEN	- do -
SCF-7, FW-8	GREEN	- do -
FM-1, SCF-1, SCF-2	GREEN	- do -
N-1, FM-2	GREEN	- do -


85.05.22
AD.86.07





ITEM NO.	DESCRIPTION	UNIT	QUANTITY	CUTTING SCHEDULE MARKINGS	GRADE	REMARKS
2.0	CARPENTRY WORKS					
2.1	WOODEN POSTS					
	50 x 100 x 4880	PIECES	10	P-1	A	S4S, AIR DRIED
	50 x 100 x 3050	PIECES	20	P-2	A	- do -
2.2	FLOOR GIRTS					
	50 x 150 x 4270	PIECES	14	FG-1	A	S4S, AIR DRIED
	50 x 150 x 1830	PIECES	6	FG-2	A	- do -
	50 x 150 x 2430	PIECES	2	FG-3	A	- do -
2.3	FLOOR JOISTS & BRIDGINGS					
	50 x 125 x 4270	PIECES	8	FJ-3	A	S4S, AIR DRIED
	50 x 125 x 3660	PIECES	82	FJ-1	A	-do-
	50 x 125 x 3050	PIECES	18	FJ-2, FJ-4, BRG.	A	-do-
2.4	FLOOR BOARD (L-SECTION JOINT WOOD) SIMPLE RABETTED CUT (SR)					
	25 x 100 x 3660	PIECES	300	WFB-1	A & B	PROFILED, KILN DRIED
2.5	TIMBER CORBEL					
	50 x 150 x 2430	PIECES	1	TC	A	S4S, AIR DRIED
2.6	ROOF GIRTS					
	50 x 150 x 6100	PIECES	12	RG-1	A	S4S, AIR DRIED
	50 x 150 x 4270	PIECES	12	RG-2	A	S4S, AIR DRIED
2.7	RAFTERS AND TIMBER BLOCKS					
	50 x 150 x 6100	PIECES	34	RF-1, RF-2	A	S4S, AIR DRIED

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
2.8	PURLINS AND TIMBER BLOCKS		
	50 x 50 x 4270	PIECES	300
	50 x 50 x 3050	PIECES	68
2.9	WOOD SHINGLES		
	100 x 400mm WOOD SHINGLES	PIECES	14,500
2.10	WOOD FLASHING	L.M.	22.5
2.11	WOOD RIDGE ROLL	L.M.	16.80
2.12	FACIA BOARD AND NAILERS		
	25 x 100 x 3050 V-CUT	PIECES	24
	25 x 100 x 4880 V-CUT	PIECES	24
	50 x 50 x 4880	PIECES	24
	50 x 50 x 3050	PIECES	13
2.13	FRAMING VERTICAL STUDS		
	50 x 75 x 1830	PIECES	13
	50 x 75 x 2430	PIECES	49
	50 x 75 x 3050	PIECES	4
	50 x 75 x 3660	PIECES	16
	50 x 75 x 4270	PIECES	4
	50 x 75 x 4880	PIECES	4

CUTTING SCHEDULE MARKINGS	GRADE	REMARKS
P-3	A	S4S, AIR DRIED
TB-2	A	-do-
WS-1	A, B & C	ROUGH, CCA TREATED, AIR DRIED
CWF	A & B	S4S, CCA TREATED, AIR DRIED
RR	A & B	-do-
FB-1	B & C	PROFILED, KILN DRIED
FB-2	B & C	-do-
FBN-2	B & C	ROUGH, AIR DRIED
FBN-1	B & C	-do-
VS-3, VS-9, VS-13 &14	B & C	S4S, AIR DRIED
VS-1, VS-4, VS-15	B & C	-do-
VS-2	B & C	-do-
VS-5, VS-6, VS-7, VS-12	B & C	-do-
VS-10	B & C	-do-
VS-8	B & C	-do-

ITEM NO	DESCRIPTION	UNIT	QUANTITY
2.14	FRAMING HORIZONTAL STUDS		
	50 x 75 x 1830	PIECES	87
	50 x 75 x 2430	PIECES	16
2.15	FRAMING DIAGONAL STUDS		
	50 x 75 x 4270	PIECES	4
2.16	SIDINGS		
	12 x 100 x 1830 V-CUT	PIECES	102
	12x 100,x 2430 V-CUT	PIECES	88
	12 x 100 x 3050 V-CUT	PIECES	154
	12 x 100 x 3660 V-CUT	PIECES	28
	12,x 100 x 4270 V-CUT	PIECES	60
2.17	DOUBLE WALLING		
	12 x 100 x 1830 V-CUT	PIECES	26
	12 x 100 x 2430 V-CUT	PIECES	404
	12 x 100 x 3050 V-CUT	PIECES	193
	12 x 100 x 3660 V-CUT	PIECES	4
2.18	PARTITION VERTICAL STUDS		
	50 x 75 x 1830	PIECES	12
	50 x 75 x 2430	PIECES	10

CUTTING SCHEDULE MARKING	GRADE	REMARKS
HS-2,HS-3,HS-4,HS-5 HS-6,HS-7,HS-8,HS-9 HS-10,HS-15, HS-16	B & C	S4S, AIR DRIED
HS-1,HS-11,HS-12, HS-14, HS-17, HS-18	B & C	S4S, AIR DRIED
DS-1	B & C	S4S, AIR DRIED
VC-2,VC-3,VC-5,VC-6	B & C	PROFILED, KILN DRIED
VC-13,VC-14,VC-17	B & C	-do-
VC-1, VC-4, VC-12	B & C	-do-
VC-16	B & C	-do-
VC-15	B & C	-do-
DW-21	B & C	PROFILED, KILN DRIED
DW-1, DW-10	B & C	-do-
DW-2,DW-3,DW-7	B & C	-do-
DW-15	B & C	-do-
VPS-1,VPS-4,VPS-5	B & C	S4S, AIR DRIED
VPS-6,VPS-7,VPS-9	B & C	-do-

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
	50 x 75 x 3050	PIECES	7
	50 x 75 x 3660	PIECES	10
2.19	PARTITION HORIZONTAL STUDS		
	50 x 75 x 1830	PIECES	16
	50 x 75 x 2430	PIECES	15
	50 x 75 x 3050	PIECES	7
	50 x 75 x 3660	PIECES	2
2.20	PARTITION DIAGONAL STUDS		
	50 x 75 x 2430	PIECES	3
2.21	CEILING JOIST		
	50 x 50 x 1830	PIECES	88
	50 x 50 x 2430	PIECES	13
	50 x 50 x 3050	PIECES	16
	50 x 50 x 3660	PIECES	40
2.22	CEILING BOARDS		
	12 x 100 x 1830 V-CUT	PIECES	592
	12 x 100 x 2430 V-CUT	PIECES	102
	12 x 100 x 3660 V-CUT	PIECES	300
	12 x 100 x 4270 V-CUT	PIECES	64

CUTTING SCHEDULE MARKINGS	GRADE	REMARKS
VPS-11, VPS-12, VPS-13, VPS-2, VPS-8	B & C	S4S, AIR DRIED
VPS-10	B & C	S4S, AIR DRIED
HPS-1, HPS-6, HPS-7 HPS-14, HPS-12, HPS-9	B & C	S4S, AIR DRIED
HPS-2, HPS-4, HPS-8 HPS-10, HPS-11	B & C	-do-
HPS-5	B & C	-do-
HPS-13	B & C	-do-
DPS-1, DPS-4	B & C	-do-
CJ-2, CJ-9, CJ-13, CJ-3 CJ-14,	B & C	-do-
CJ-6, CJ-8, CJ-11	B & C	-do-
CJ-12, CJ-4	B & C	-do-
CJ-1	B & C	-do-
WC-2	A, B & C	PROFILED, KILN DRIED
WC-3, WC-4, WC-6	A, B & C	-do-
WC-1	A, B & C	-do-
WC-5	A, B & C	-do-

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
2.23	BALCONY AND LIGHT AND VENT RAILINGS		
	50 x 100 x 1830	PIECES	23
	50 x 100 x 2430	PIECES	75
	50 x 100 x 3050	PIECES	2
	50 x 100 x 3660	PIECES	4
2.24	MAIN STAIRS		
	STRINGER		
	50 x 200 x 3660	PIECES	4
	50 x 100 x 3660	PIECES	4
	TREADS		
	50 x 125 x 3050	PIECES	16
	BALUSTERS		
	50 x 50 x 3660	PIECES	11
	HANDRAIL		
	50 x 125 x 3660	PIECES	5
	BALUSTERS		
	50 x 125 x 4270	PIECES	1
2.25	SERVICE STAIRS		
	STRINGER		
	50 x 100 x 2430	PIECES	4
	50 x 100 x 1830	PIECES	4

CUTTING SCHEDULE MARKINGS	GRADE	REMARKS
HR-2,HR-6,HR-8,DR-2	A & B	S4S, KILN DRIED
HR-3,HR-4, HR-5, HR-7, VF-1, DR-1 DR-3, MUR-1	A & B	-do-
HR-9	A & B	-do-
HR-1	A & B	-do-
ST-1	A	S4S, KILN DRIED
ST-2	A	-do-
TR-1	A	-do-
BAL-1	B	-do-
HR-1, HR-2	B	-do-
BAL-2	B	-do-
ST-3	A	S4S, KILN DRIED
ST-4	A	-do-

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
	50 x 200 x 2430	PIECES	4
	50 x 200 x 1830	PIECES	4
	TREADS		
	50 x 100 x 2430	PIECES	16
	BALUSTERS		
	50 x 50 x 360	PIECES	10
	LANDING FRAME		
	50 x 125 x 2430	PIECES	7
	50 x 125 x 4270	PIECES	1
	HANDRAIL AND RAILINGS		
	50 x 150 x 1830	PIECES	4
	50 x 150 x 2430	PIECES	3
	LANDING FLOOR(L-SECTION JOINT WOOD		
	25 x 100 x 2430	PIECES	14
2.26	KITCHEN COUNTER & CABINET		
	BASEBOARD		
	50 x 150 x 3050	PIECES	1
	FRAMES		
	50 x 75 x 3050	PIECES	9
	50 x 75 x 2430	PIECES	18
	CABINET FLOOR & DOOR (L-SECTION JOINT WOOD) (SR)		
	19 x100 x 3050	PIECES	19
	12 x 100 x 2430	PIECES	12

CUTTING SCHEDULE MARKINGS	GRADE	REMARKS
ST-5	A	S4S, KILN DRIED
ST-5	A	-do-
TR-3	A	-do-
BAL-1	B	-do-
LF-1	A	-do-
LF-2	A	-do-
R-1, R-3, HR-1	B	-do-
R-2, HR-2, HR-3	B	-do-
WFB-2	B	PROFILED, KILN DRIED
B-2	A	S4S, KILN DRIED
TN-1, FN-1	A	-do-
TN-2, FN-3, FN-2, TN-3	A	-do-
TG-3, TG-4	A	PROFILED KILN DRIED
TG-5	A	-do-

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	CUTTING SCHEDULE MARKINGS	GRADE	REMARKS
	DOOR FRAME					
	50 x 50 x 2430	PIECES	4	CDF-1	A	S4S, KILN DRIED
	50 x 50 x 3050	PIECES	2	CDF-1	A	-do-
	FRAME					
	50 x 75 x 3050	PIECES	1	CF-7	A	S4S, KILN DRIED
	50 x 75 x 3050	PIECES	2	CDF-3	A	-do-
2.27	CLOSET AND ATTACHED PARTITION					
	FRAMES					
	50 x 75 x 2430	PIECES	28	VF-1, VF-2, VF-3	A	S4S, KILN DRIED
	50 x 50 x 2430	PIECES	58	VF-4, VF-5, PS-1, VF-6 VF-7	A	-do-
	MOULDINGS					
	25 x 25 x 2430	PIECES	96	WM-1	A	-do-
	PANELS					
	12 x 100 x 2430 V-CUT	PIECES	230	WP-1, WP-2	A	PROFILED KILN DRIED
2.28	CANOPY					
	BASE PLATE					
	50 x 150 x 3050	PIECES	3	BP-1	A	S4S, AIR DRIED
	BRACE					
	50 x 125 x 3050	PIECES	4	BR-7	A	-do-
	RAFTER					
	50 x 150 x 3050	PIECES	2	RF-7	A	-do-

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
	PURLINS		
	50 x 50 x 3660	PIECES	16
	FACIA BOARD		
	25 x 100 x 3660 V-CUT	PIECES	2
	25 x 100 x 4270 V-CUT	PIECES	1
	WOOD SHINGLES		
	100 x 400mm	PIECES	900
2.29	DOORS AND WINDOWS		
	DOOR JAMBS		
	50 x 125 x 2430	PIECES	28
	50 x 125 x 1830	PIECES	7
	DOOR FRAMES		
	50 x 100 x 2430	PIECES	56
	50 x 100 x 3660	PIECES	14
	DOOR MOULDINGS		
	25 x 50 x 2430	PIECES	56
	25 x 50 x 3600	PIECES	56
	DOOR PANELS		
	12 x 100 x 2430 V-CUT	PIECES	140
	WINDOW JAMBS		
	50 x 125 x 2430	PIECES	48
	50 x 125 x 4880	PIECES	6

CUTTING SCHEDULE MARKINGS	GRADE	REMARKS
P-7	A	S4S, AIR DRIED
FB-3	B & C	PROFILED KILN DRIED
FB-4	B & C	-do-
WS-2	A,B & C	ROUGH, CCA TREATED,AIR DRIED
	A	S4S, KILN DRIED
	A	-do-
	A	-do-
	A	-do-
	A	-do-
	A & B	PROFILED KILN DRIED
	A	S4S, KILN DRIED
	A	-do-

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
	WINDOW LOUVER BLADES		
	12 x 100 x 1830 V-CUT	PIECES	193
	12 x 100 x 2430 V-CUT	PIECES	106
	LOUVERS ZIGZAG		
	25 x 75mm x 2430	PIECES	45

PREPARED BY:

GREGORIO G. STA. MARIA
Designing Architect and Consultant

REG. NO. : 1341
PTR : 418-B
DATE : 1 -16 - 84
PLACE : QUEZON CITY
TAN : S-3563-L-1737-A-6

CUTTING SCHEDULE MARKINGS	GRADE	REMARKS
	A & B	PROFILED KILN DRIED
	A & B	-do-
	A & B	PROFILED, KILN DRIED