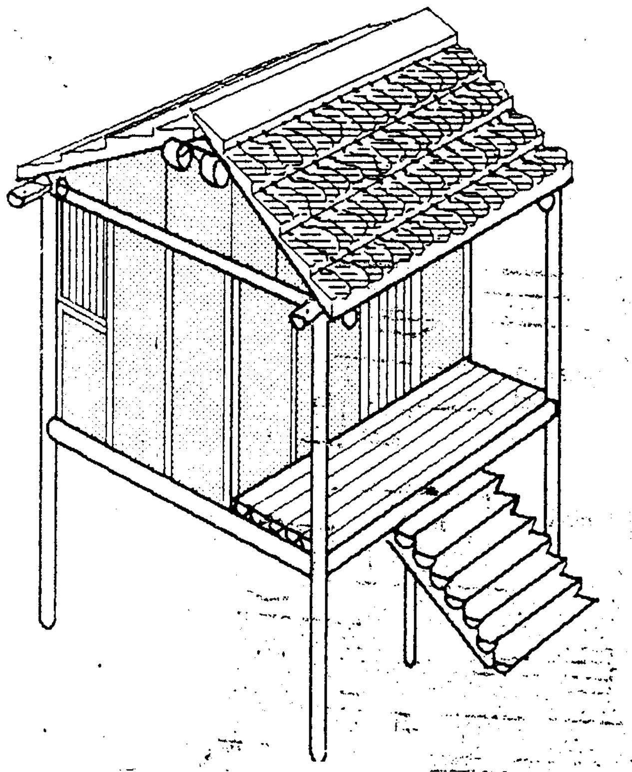
PUERTO CABEZAS INDIGENOUS HOUSING PROJECT



BY

THE CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS
AUSTIN, TEXAS

FOR

C.I.D.C.A.

SPONSORED BY

OXFAM, ENGLAND
TROCAIRE, IRELAND

LETTERS OF INVITATION
AND
WORK ACCEPTANCE

CIDCA
Centro de Investigaciones y Documentación de la Costa Atlántica
Bluefields: 472 - 487 Puerto Cabezas: Tel. Managua, Tel. 70983 - 74541 Aptd. A-189

March 9, 1984

Pliny Fisk
Director
The Center for Maximum
Potential Building
8604 Webber Ville
Austin, TX 78724

Dear compañero,

I am writing to confirm our invitation to you to participate as associate researcher and adviser in a project of the Center for Research and Documentation on the Atlantic Coast (CIDCA), titled: "Development of a Housing Unit for Settlements Using Non-Traditional Materials Appropriate to Ecological, Historic and Social Conditions in Special Zone I," a copy of which is enclosed.

The project in question, coordinated by CIDCA, will begin April 27, 1984, coinciding with your arrival in Nicaragua. The project consists of five phases and your participation as associate researcher and adviser will be for a period of fifteen (15) weeks, corresponding to the first three phases of the project.

Your stay will be subject to extension if you and other members of the project deem it necessary and desirable.

Centro de Investigaciones y Documentación de la Costa Atlántica
Bluefields: 472 - 487 Puerto Cabezas: Tel. Managua, Tel. ~~70023~~ - 74541 Aptd. A-189
CIDCA

I am enclosing a check #1137 drawn on an account at the Chase Manhattan Bank, N.A., United Nations Plaza, 46th Street, New York, New York 10017, for U.S.$2,500.00 (two thousand five hundred dollars) payable to "The Centre for Maximum Potential Building Systems." The check covers the following categories:

1) Salary advance of U.S.$1,000.00 (one thousand dollars)
2) Purchase of materials and equipment, U.S.$1,000.00 (one thousand dollars)
3) Travel and other expenses Austin-Managua-Austin, U.S.$500.00 (five hundred dollars)

TOTAL: U.S.$2,500.00 (two thousand five hundred dollars)

We thank you in advance for your willingness to participate in this project which will directly benefit sectors of our population historically exploited but desirous of participating in the reconstruction and defense of Nicaragua.

Fraternally,

CENTRO DE INVESTIGACIONES Y DOCUMENTACION DE LA COSTA ATLANTICA
DIRECCION
CIDCA

Galio Gurdián L
Director
CIDCA

cc: Archivo
cc: Crono
GGL/jb.

PROYECTO:

"Desarrollo de modelo habitacional y asentamientos humano con materiales no tradicionales y adecuado a las condiciones Ecológicas, Históricas y Sociales de la Z.E.I. "

I. OBJETIVOS GENERALES:

1.1 Desarrollar una tecnología de construcción con materiales nativos de la Zona; el proyecto pretende contribuir a resolver el problema habitacional en la Z.E.I. especialmente en el área de Puerto Cabezas.

1.2 Colaborar con las instancias del Gobierno de Reconstrucción Nacional especialmente MICONS y MINVAH en el diseño de un modelo de asentamiento y estructura física adecuados a las condiciones ecosistémicas, históricas y Culturales de la Z.E.I.

1.3 Colaborar con MICONS y MINVAH en la organización y educación de la población afectada por la carencia de vivienda, a fin de impulsar eventualmente un proyecto masivo de autoconstrucción que responda a las condiciones Socio-Culturales de la Zona.

II. OBJETIVOS ESPECIFICOS:

2.1 Identificación de los yacimientos de material nativo no tradicional a utilizarse en el proyecto.

Dicho material se utilizaría en las fundaciones, paredes, techos, ventanas y pretiles de puertas.

2.2 Diseño del equipo de producción del material de construcción, fabricación del material de construcción, moldes para bloques, sistema de amarrado y diseño de la estructura.

..../

2.3 Construcción de la unidad habitacional proto-tipo, con paredes y techo. La unidad incluiría sistema de agua potable y aguas negras.

2.4 Elaboración de material educativo Audio-Visual sobre las diferentes formas históricas de asentamiento humano en la Z.E.I. y las causas mediatas e inmediatas de la crisis habitacional regional.

2.5 Diseño y desarrollo con MICONS, MINVAH y G.R. Z.E.I. de un seminario de formación integral dirigido a los posibles participantes en un plan piloto de auto construcción.

El seminario incluiría, el análisis histórico del asentamiento humano en la región, asi como técnicas de auto construcción utilizando los materiales no tradicionales desarrollados en el proyecto.

III. INSTITUCIONES PARTICIPANTES:

3.1 Delegación MINVAH Z.E.I.
3.2 Delegación MICONS Z.E.I.
3.3 Gobierno Regional Z.E.I.
3.4 CIDCA Z.E.I.
3.5 "The Center for Maximum Potential Building Systems" ("Centro para la Máxima utilización de Sistemas de Construcción").

IV. ETAPAS DEL TRABAJO Y CRONOGRAMA

4.1 FASE (1):

Identificación de los yacimientos de material nativo = (5 semanas).

4.2 FASE (2):

Diseño del equipo de producción de materiales, construcción

....../

de moldes para bloques, diseño del sistema de amarre y estructura de la unidad habitacional = (5 Semanas).

4.3 FASE (3):

Construcción de la unidad habitacional prototipo, incluyendo paredes y techos así como sistema de agua potable y aguas — negras =(5 Semanas).

4.4 FASE (4):

Investigación Socio-Antropológica de patrones históricos de - asentamiento en la Z.E.I. (4 Semanas).

4.5 FASE (5):

Diseño de asentamiento humano que incorporando nuevas técnicas de construcción, responda a la identidad histórica y cultural de la región = (3 Semanas).

4.6 FASE (6):

Elaboración de materiales educativos Audio-Visuales sobre el - desarrollo histórico del asentamiento humano en la Z.E.I. = - (8 Semanas).

4.7 FASE (7):

Seminario de formación integral para los posibles beneficiarios que incluya la situación histórica y socio-económica de la re - gión así como técnicas de auto-construcción con materiales de construcción no tradicionales = (2 Semanas).

V. Fecha de Inicio del Proyecto:

1ero de Abril de 1984.

VI. Delegados por Institución:

- CIDCA: César Pérez y Judy Butler
- "Centro para el Máximo Aprovechamiento de Sistema de Construcción Pliny Fisk.

- Gobierno Regional Z.E.I:
- MINVAH: Ing. Rolando Lupiac
- MICONS:

VII. PRESUPUESTO:

FASE (1)

Traslado de técnico asesor EE.UU.-NICARAGUA. (Austin (Texas/ - Managua):

Managua):	US	$	460.00
Managua/Pto. Cabezas/Mga.	US	$	100.00
Salario (5) Semanas (US $ 500.- C/Semana).	US	$	2,500.00
Equipo de Laboratorio.	US	$	900.00
Combustible y Lubricantes.	US	$	200.00
Total	US	$	4,160.00

FASE (2)

Salario Técnico-Asesor.	US	$	2,500.00
Gastos de Viaje TX-MGA.	US	$	460.00
Herramientas	US	$	600.00
Combustible y Lubricantes	US	$	200.00
Total	US	$	3,760.00

FASE (3)

Salario Técnico-Asesor	US	$	2,500.00
Gastos de Viaje	US	$	460.00
Combustible y Lubricantes	US	$	200.00
Total	US	$	3,160.00

FASE (4)

- Aporte CIDCA/MINVAH

FASE (5)

- Aporte CIDCA/MINVAH

.....

FASE (6)

Impresión de Materiales		US $ 1,000.00
Materiales de Fotografía y Montaje de Audiovisuales.		US $ 1,500.00
	Total	US $ 2,500.00

FASE (7)

Aporte Gobierno Regional Z.E.I.

Aporte CIDCA

Aporte MINVAH.

Puerto Cabezas, Nic
1 de Marzo de 1984.

/vmv.

TRÓCAIRE The Catholic Agency for World Development

169 Booterstown Ave.,
Co. Dublin, Ireland.
telephone: 885385
telex: 31614 CAPO E1

SO'N/SC

Pliny Fisk
Center for Maximum Potential Building Systems
8604 Weber Ville Road
Austin
Texas 78724
U.S.A.

21 June 1984

Our Ref: LA/NIC/84/3

Dear Mr. Fisk

I am enclosing a copy of a letter in Spanish which we have sent to the Director of CIDCA in Nicaragua concerning a project for low-cost housing which Trocaire has cofinanced with CIDCA. We have just received instructions from CIDCA to transfer part of the funds to your account in the United States and following a conversation yesterday with your office, we have realised that these are urgently required and are forwarding them by the enclosed bank draft. In order to facilitate our Accounts Department we would be grateful if you could please sign and return the enclosed form which will serve our organisation as a receipt.

We hope that your collaboration with this project in Nicaragua will be extremely successful and we look forward to hearing about your activities from CIDCA in due course.

Yours sincerely

Brian McKeown
Director

encls.

please quote our reference no. in all correspondence

TRÓCAIRE The Catholic Agency for World Development

169 Booterstown Ave.,
Co. Dublin, Ireland.
telephone: 885385
telex: 31614 CAPO E1

VR/SC

Pliny Fisk III
Director
Center for Maximum Potential Building Systems
8604 F.M. 969
Austin
Texas 78724
U.S.A.

11 December 1984

Our Ref: LA/NIC/84/3

Dear Pliny Fisk

Thank you for the material you sent us on the Puerto Cabeza Indigenous Housing Project. This is most useful to us in our own reporting back on the progress of the project. Galio may have informed you that we are seeking further governmental funding for the project and it is in connection with this that we are particularly interested in receiving certain specific details on future developments.

While the initial proposal and the reports which we have received from you to date give us a very clear picture of work on the design and introduction of the housing unit, we have been specifically asked for further details on the plans and perspectives for widespread construction of the unit following Phase VII of the design project. From your reports we see that some involvement of the Ministry of Housing shows that there are hopes to introduce the housing unit throughout Zelaya Norte or even to other parts of the Atlantic Coast. However, in order to comply with the requisites of our external funding sources, we require some written evidence that concrete plans are being made to ensure that the project will lead to widespread implementation. We therefore request you to send us a formal letter or short document outlining the aspects of your discussions which focus on this post-design phase. Information such as government institutions involved, plans for implementation, timing of introduction, number of housing units required, etc., would all be relevant if available.

Furthermore, and quite apart from this formal request, we at Trocaire would be interested to maintain contact with you during the next few months regarding your own view of the development of the project. We believe that such a project has a fantastic potential for Nicaragua, but given the difficult circumstances in which it is being developed we can understand that there may be problems in implementing certain aspects. Also, we note that in your document Short-Term Funding Requirements a series of new elements are entering into the budget. While this is not unusual in a project of this sort, we would like you to keep us informed of any changes which occur with the original project description and budget.

We wish you every success with the next phase of the project, and we look forward to hearing from you soon.

Yours sincerely

V. Roche

Val Roche Projects Section

GOBIERNO DE RECONSTRUCCION NACIONAL
MINISTERIO DE DESARROLLO AGROPECUARIO
Y REFORMA AGRARIA
Managua, Nicaragua, C. A.

TO WHOM IT MAY CONCERN :

MIDINRA has reviewed the indigenous housing work developed by Mr. Fisk of the Center for Maximum Potential Building Systems and finds it particularly relevent, for housing the people who are members of our cooperative farming program. The design incoporates the enterprise development and response to Social needs with in the family that we at MIDINRA feel are a part of our overall objective in providing healthy emviromments for the very important food producing members of our society.

We support any effort that Mr. Fisk might undertake to develope his disicoveries and design into a working production facility for housing. We agree that a working prorotype is key in this effort and that detailed instructional materials are needed.

Thank you for helping Nicaragua, sincerely yours

Alvaro Reyes Portocarrero
Ministerial Delegate
MIDINRA, Special Zone No 1.
North Zelaya, Nicaragua.

Desarrollo Agropecuario y Reforma Agraria
Zona Especial I
Zelaya Norte
Delegado Ministerial

cc: Fernando López
File
registrar

ARP/lef

" 1984: A50 AÑOS... SANDINO VIVE "

1983 AÑO DE LUCHA POR LA PAZ Y LA SOBERANIA

DM-567-84

MINISTERIO DE CULTURA DE NICARAGUA

GOBIERNO DE RECONSTRUCCION NACIONAL

Managua, 04 de octubre de 1984

Compañero
PLINY FISK III
Director CMPBS
Puerto Cabezas,
NICARAGUA

Muy estimado compañero Pliny:

Hemos recibido a través del compañero Joel Zamora, Delegado de nuestro Ministerio en la Zona Especial I, el interesante Proyecto de Investigación "Materiales Indígenas para la Construcción", que muy amablemente usted ha enviado al compañero Ministro Ernesto Cardenal.

Al respecto deseo comunicarle que nuestro Ministro se encuentra en estos momentos realizando una gira de trabajo por Europa. Sin embargo, esté seguro que al regresar de esa gira, el Proyecto será puesto en manos de él, y cualquier inquietud del compañero Ministro al respecto, le será informada por la vía del compañero Joel Zamora.

Sin otro particular, le saluda fraternalmente,

Luz Marina Acosta
ASISTENTE DEL MINISTRO

MINISTERIO DE CULTURA
Despacho del Ministro
Managua, Nicaragua

/lrb.

cc: Cro. Joel Zamora
Delegado Ministerial Zona Especial I
Cro. Alberto Legall
Director de Artesanías
archivo
cronol.

CIDCA

Centro de Investigaciones y Documentación de la Costa Atlántica

Bluefields: 472 - 487 Puerto Cabezas. Tel. Managua, Tel 70983 - 74541 Aptd. A-189

Managua, October 16th, 1984

Dear

Pliny Fisk, director of the Center for Maximum Potential Building Systems, has been working with low-cost housing indigenous materials for the last ten years. He has been working in collaboration with us since March 1984. CIDCA is a center for research and documentation about the Atlantic Coast of Nicaragua.

The projects carried out in this time include:
- constructing a laboratory for the analysis of construction materials
- conducting an analysis of local resources with a potential use as building materials
- conducting a survey of human resources and equipment available in the area
- conductinga survey of construction styles and room size in one barrio in Puerto Cabezas
- developing production equipment for prefabricated indigenous building components on a prototype scale.

The results of these projects include:

- the identification of high - grade kaolinite clays in a 14,500 km2 area in Special Zone I (Northern Zelaya) which can be used in the production of masonry products and ceramics
- the development of a low-grade cement, using local clay and rice husk ash, which can be used as mortar
- the development of a prefabricated building panel, using waste wood chips from the local sawmill, which can be used by individual home-owners for the construction and repair of their houses
- the development of an integrated water/waste water system using ferrocement
- the design and initial construction of a model housing unit using these materials.

CIDCA

Centro de Investigaciones y Documentación de la Costa Atlántica

Bluefields: 472 - 487 Puerto Cabezas- Tel. Managua, Tel 70983 - 74541 Aptd. A-189

We believe that these results will be extremely valuable to our effort to solve the critical housing shortage in Puerto Cabezas. Our housing problems are daily becoming more acute, due to the frequent attacks by counterrevolutionaries on outlying Miskito villages and the consequent influx of villagers into the city.

CIDCA with the support of humanitarian NGO's from Europe (OXFAM U.K, TROCAIRE, OFICINA DE CONSEJERIA DE REFUGIADOS C.RICA) has been able to assume the costs for the initial research and construction of the model unit and the preparation of the final report on the project through the month of November 1984, but additional funding will be required to finish construction of the unit. We estimate that the unit can be terminated within 3 months at an approximate cost of $14,000. A rough breakdown of the costs is attached.

We would greatly appreciate any help that you can give to Mr.Fisk so that this project can be successfully terminated.

Sincerely yours,

Galio Gurdián
Director
CIDCA.

CENTRO DE INVESTIGACIONES Y DOCUMENTACION DE LA COSTA ATLANTICA
DIRECCION
CIDCA

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LABORATORY SUMMARY

MIXES HAVE BEEN DETERMINED FOR INDIGENOUS WASTE WOOD PANALS, CEMENT MORTAR, FIRED CLAY PRODUCTS AND A CORRUGATED FIBERCEMENT ROOF PANAL.

PROTOTYPE WOOD CHIP PANALS ARE TURNING OUT BETTER THAN SAWDUST PANALS THUS MORE WORK HAS TO BE DONE ON SAWDUST CEMENT IF THE LARGE QUANTITY OF THIS WASTE MATERIAL IS TO BE USED. THE QUANTITY OF CHIPS IS NOT AS HIGH AS THE AVAILABILITY OF SAW DUST. (SEE MORE DETAIL ON WOOD CHIP PANAL IN THIS REPORT)

MICON HAS FINISHED TESTS ON CLAYS AND HAS CONFIRMED OUR TESTS SHOWING THEM ALL AS KAOLINITES WHICH INDICATES THE CLAYS OVER A 14,500 KM2 AREA ARE GOOD TO EXCELLENT FOR MOST ALL AREAS OF MASONRY AND CERAMIC PRODUCTS.

ALL CLAY SAMPLES HAVE BEEN FIRED AT 1000ºC WITH ALL SAMPLES SHOWING PROMISING STRUCTURAL STRENGTH WITH SOME BEING SUBMERGED IN WATER FOR 2 WEEKS WITH NO DETERIORATION. FINAL TEST CYCLINDERS FOR FIRING IN ORDER TO DO COMPRESSION AND ABSDORPTION TESTS NEED TO STILL BE MADE.

THIS SAME CLAY MATERIAL WHEN BURNED AT 700-800º GROUND AND MIXED WITH GROUND RICE HUSK ASH AND LIME MAKE A DESCENT MORTAR FOR MASONRY MATERIALS. TESTS ON STENGTH STILL MUST BE DONE. THIS METHOD WAS DEVELOPED DUE TO THE REALIZATION THAT BAUXITE TYPE KAOLINITE CLAYS LACK SILICA BECAUSE OF THE CONSTANT RAINS IN THIS TROPICAL ZONE AND THAT WHEN THIS CLAY WAS FIRED AT 800ºC, GROUND AND MIXED WITH THE SILICA AVAILABLE FROM BURNT RICE HUSK ASH AND THE CALCIUM FROM LIME THAT A LOW GRADE MORTAR RESULTED.

SUMMARY
INDIGENOUS HOUSING PROJECT

FINAL TESTING FOR COMPRESSION, WATER ABSORPTION, AND ABRASION MUST STILL BE DONE ON ALL SAMPLES.

SO FAR THE PARTIAL REPLACEMENT OF PORTLAND CEMENT WITH GROUND RICE HUSK ASH HAS NOT BEEN TOTALLY SUCCESSFUL. THIS IS EITHER DUE TO THE LACK OF TEMPERATURE CONTROL USING OUR CRUDE OUTSIDE INCINERATOR OR DUE TO THE LACK OF FINE ENOUGH GRINDING.

HIGH SILICA SAND, THE MISSING INGREDIANT FOR BAUXITE/KAOLINITE CLAYS TO MAKE HIGH QUALITY BRICK, AND AS THE BASIC INGREDIENT FOR GLASS MANUFACTURING HAS BEEN LOCATED BETWEEN SISIN AND TUARA BUT NO SAMPLES HAVE BEEN TAKEN DUE TO A LACK OF TRANSPORTATION.

LIMESTONE, THE BASIC INGREDIENT OF LIME HAS BEEN REPORTED LOCATED WEST OF SISIN BUT NO SAMPLES HAVE BEEN TAKEN DUE TO A LACK OF TRANSPORTATION.

A CAMERA AND CERTAIN ON SITE REPAIR TOOLS SUCH AS A WELDER AND CUTTING TORCH ARE NEEDED BY THE INVESTIGATOR FOR SMALL ON SITE PRODUCION EQUIPMENT REPAIRS. THE CAMERA IS NEEDED TO RECORD SITE LOCATIONS AND PRODUCTION SEQUENCES UNDER THE FACTORY SECTION BELOW.

THE MAIN PROBLEM TECHNICALLY WITH OUR APPROACH TO THE PROJECT IS THAT AN ADEQUATE PORTLAND TYPE CEMENT SEEMS NECESSARY FOR SEVERAL OF THE PROPOSED HOUSING TECHNOLOGIES TO BE FULLY REALIZED AND THAT THIS CEMENT IS NOT AVAILABLE LOCALLY WITHOUT FURTHER RESEARCH. EVEN THOUGH THE CEMENT BASED TECHNOLOGIES USED ARE HIGHLY EFFICIENT IN THEIR MATERIAL USE (IE. FERRO CEMENT CISTERN SEPTIC TANK, FIBER CEMENT CORRUGATED ROOF PANAL AND THE PRESSED WOOD CHIP PANAL UTILIZING CEMENT AS THE ADHESION METHOD).

SUMMARY
INDIGENOUS HOUSING PROJECT

ANOTHER TECHNICAL ISSUE THAT HAS NOT BEEN TOTALLY SOLVED IS THE DEVELOPMENT OF A NONTOXIC WOOD PRESERVATION TECHNIQUE. ALTHOUGH THE ARTIFICIAL PETRIFICATION OF WOOD USING A SEA WATER/ELECTROLYSIS PROCESS SEEMS PROMISING, SUFFICIENT TIME AND RESOURCES TO CARRY OUT THIS WORK HAS NOT BEEN AVAILABLE. EVEN THOUGH THIS RESEARCHER CONSIDERS HIMSELF EXPERIENCED AT MANY LEVELS OF TECHNICAL DEVELOPMENT I WOULD VERY MUCH APPRECIATE SOME KNOWLEDGABLE ADVICE, MEETINGS AND OR INDEPENDANT CRITIQUE FROM SOMEONE BROADLY VERSED IN TECHNICAL, ENVIRONMENTAL AND TECHNICAL TRANSFER ISSUES CONCERNING THIS PROJECT EITHER THROUGH OXFAM OR BY OTHER MEANS.

FACTORY

BOTH THE TEMPORARY GRASS HUT FACTORY AND THE PERMANENT FACTORY ARE STRUCTURALLY FINISHED BUT THE PERMANENT FACTORY STILL LACKS A ROOF. MINVA HAS PROMISED THAT THE ZINC FOR THE PERMANENT FACTORY HAS BEEN ORDERED BUT HAS NOT COME FROM MANAGUA YET.

ALL FABRICATION JIGS HAVE BEEN DESIGNED AND ARE NOW OPERATIONAL AT A SMALL SCALE OF PRODUCTION. THESE INCLUDE THE FOLLOWING:

1) FIBERCRETE CORRIGATED ROOF FORMING SYSTEM AT 100-150 ONE METER SQUARED PANALS PER WEEK USING TWO LABORERS

2)PRESSED WOOD CHIP PANEL SYSTEM FOR WALLS WITH EXTERIOR STUCCO AND INTERIOR PLASTER COMPLETE ON BOTH SIDES. EXPECTED PRODUCTION MAY BE AS MUCH AS 12 TO 10 PANALS 4' BY 3' PER DAY

SUMMARY
INDIGENOUS HOUSING PROJECT

WITH THREE LABORERS.

3) A CYLINDRICAL LIGHTWEIGHT STEEL FORM FOR FABRICATING FERROCEMENT SEPTIC TANKS AND CISTERNSEITHER ON SITE ORWITHIN A SMALL FACTORY HAS BEEN COMPLETED BUT NOT TESTED.

4) A MOLDING SYSTEM FOR FIRED CLAY ROOF TILE AS AN ALTERNATIVE TO THE CORRIGATED FIBERCRETE PANAL IN ORDER TO HELP SOLVE FURTHER ROOFING PROBLEMS WAS COMPLETED.

THE FIRST TIME ON ANY PRODUCTION SEQUENCE REQUIRES THE IRONING OUT OF MANY IMPERFECTIONS BEFORE EVERYTHING RUNS SMOOTHLY. USUALLY THIS TAKES AT LEAST TWO WEEKS ACCORDING TO MY EXPERIENCE IN SMALL FACTORY PRODUCTION USING SIMPLE FABRICATION SYSTEMS. THIS STATEMENT IS INCLUDED DUE TO THE PREVAILING ATTITUDE BY THE GOVERNMENT AND OTHERS THAT MASSIVE SCALE HOUSING EFFORTS USING THESE TECHNIQUES CAN START "TOMARROW".

IT MUST ALSO BE REALIZED THAT THE EQUIPMENT DESIGNED AND FABRICATED FOR A PROTOTPE DEMONSTRATION IS NOT SUFFICIENT TO FOREFILL LARGE SCALE HOUSING NEEDS.

HOUSING PROTOTYPE

THE HOUSING PROTOTYPE HAS BEEN DESIGNED INCLUDING PLANS SECTIONS AND DETAILS.

THE DEMONSTRATION SITE HAS BEEN CHOSEN AND PASSED THROUGH MINVAH.

SUMMARY
INDIGENOUS HOUSING PROJECT

THE WOOD FOR THE FRAME AND TRUSSES HAS BEEN ORDERED AND ARRIVED ON SITE IMMEDIATELY BEFORE LEAVING.

THE SEPTIC TANK AND CISTERN ARE NOT YET STARTED AND MUST BEGIN UPON RETURN.

METHODOLOGY

PHASE I ACTIVITIES AND PROCEEDURAL STEPS TAKEN IN THE PUERTA CABEZAS INDIGENOUS HOUSING PROJECT

This section of the report goes over the general approach to the project and summarizes work carried on in the first four weeks.

The beginning stages of the project were carried out in Texas, with preliminary research involving the investigation of mapped resources known to exist on Nicaragua's Atlantic Coast. Time was then allocated to developing a laboratory and lab manual that could deal with the materials found to exist in the region. Some time was spent talking with anthropologists and social scientists (Jim Nations, human ecologist; Emily Vargas Adams, social anthropologist), as well as with geologist (Steve Musick), chemists (Richard Pruiksma) and people who have worked directly on construction projects in Central America and Nicaragua (John Cloud, Lorena Stove Workshop leader; Dick Clark, architect who worked on construction of 300 homes in Nicaragua under sponsorship of the University of Tennessee).

One week was spent in Managua at the CIDCA office, where further research was completed concerning the social ecology of the region and, in particular, Nieutsmann's book *Between Land and Sea* about traditional Miskitu culture. Further gathering of materials, including mapped materials and soil information was carried out as well.

Puerto Cabezas

The Lab

The laboratory took about four days to set up. It primarily consisted of basic soil classification equipment, including sieve analysis screens with shaker, Atterberg limit device, two (2) weighing scales, oven, salinity tester, pH tester, compression tester, water absorption tester, water spray test, and a five pound earth ramming device to determine optimum soil moisture and strength of rammed earth. It was later found out, after being on-site, that certain equipment could have been better tailored to the conditions in Puerto Cabezas, particularly equipment that would better deal with cement and clay manufacturing processes, i.e. high temperature potter's kiln, high temperature thermometers, liquid limit tests specifically designed for potentially cementatious materials. Other tests require more sophisticated testing using the back-up of larger laboratory facilities to be sure of soil/clay mineral content. The knowledge of clay content is important in order to determine the firing range required to produce cement. These latter-mentioned facilities are not absolutely necessary, but given the time schedule of the project, they would reduce the amount of trial and error involved in testing the materials. Such facilities are being sought after during a two-week break during June.

Of the earthen samples collected, lab tests verified that all earth materials secured contained either too much clay or were too gravelly and sandy. More important than this, it was found that the soil samples had low pH values, verifying our other soil information which had indicated that these soils would be unfit for typical adobe, poured wall or rammed earth construction methods. This is because the high acidity of the entire soil profile would inhibit any normal stabilization practices to be used. Salinity was found to be very low--a positive attribute for soil-based structures. It was also found that these soils were poor for agricultural purposes, but adequate for savanna-type tree farming.

Area Resources

The first and second weeks at Puerto involved becoming familiar with the people and physical resources at the Ministry of Housing (MINVAH), who provided immediate assistance by supplying a complete tour of the region, including Tuapi, Tuara, Sinsin, as well as areas along the Wawa River and Lambolya. Collection of materials began right away, in addition to the initiation of a process of photographic documentation of existing material processes and their uses. Some of these collected materials included fibrous plants for potential reinforcement uses, coral and sea shell deposits, possible high silica sand for glass manufacture, waste rice husks, which were particularly noted along with waste fiber from coconuts. From a visual and field type physical analysis, few soils seemed to lend themselves to usual earthen structures.

People Resources

Personal contacts were made, including with the Governor General of the region and his assistant in the regional government office. Community people were introduced who had particular skills in masonry block manufacturing (cement coming from Managua or Cuba), wood craftsmen, as well as with metal fabricators both in the private and public sectors. Contacts made in the Maintenance Department of the hospital helped in outfitting certain lab components. Personnel at the Ministry of Works were made (particularly Jet) with much junk iron as well as metal-working shops all placed at our disposal. Two individuals met during this period became very helpful; one from the private sector and the other from the public. The former, Juan Peters, ran a metal-working and machine shop still surviving from the days of large sawmill operations. (Puerto Cabezas was home to the largest sawmills in Central America in the 1930's.) Juan immediately became enthused about working on the fabrication of equipment for primary manufacturing facilities for the base materials for housing. Another person, who it was later discovered was a friend of Juan's, Oscar Palmer, showed equal enthusiasm, especially with regards to utilizing particular native woods for certain housing issues and related problems. Oscar Palmer works in the Ministry of Public Works. Both Juan and Oscar are presently working on manufacturing equipment to be described later in this report. Please see the Appendix of this report for more detailed findings of area resources and proposed technologies.

Housing Needs Survey

In an effort to balance the technical with the social concerns of this project, we combined forces with the staff at the Ministry of Housing, who were predominately Miskitu, and jointly put a survey together. At that time it was already known that approximately 600-1000 houses per year were needed, but a user survey regarding spatial needs had never been conducted to anyone's knowledge. The CIDCA staff also joined in on this effort to help establish important issues of housing preferences, including materials, utility needs, heat problems, roofing, and structural concerns. Questions regarding the need and use of social space emerged, specifically questions of size, placement, and the area needed for yards/gardens. The latter turns out to be a major issue, with both Miskitu and Creole populations, since previous government efforts to enforce family plot sizes were found to be too small for gardens, animals, and for general privacy--all important considerations among the local people of Puerto Cabezas. The results of this survey a are reported in a latter section of this report. A social planner from the Ministry of Housing has become the person primarily responsible for the survey's design, application and analysis.

A specific goal of this survey is to produce three-dimensional model components of walls, roofs, steps, porches, etc. related to the dimensional ranges found in the survey, to enable potential users to design their own living spaces (both interior and exterior) using a medium that has proven culturally unbiased and more communicable than line drawings normally used by architects and engineers. (I have personally worked and taught at the university-level with the person who has established this medium as a successful housing communication tool. Some information regarding this process is included in this report--more information is available upon request

Program Identification

By the second and third weeks on-site, it became apparent that there were three (3) components to the program that were necessary to carry out:

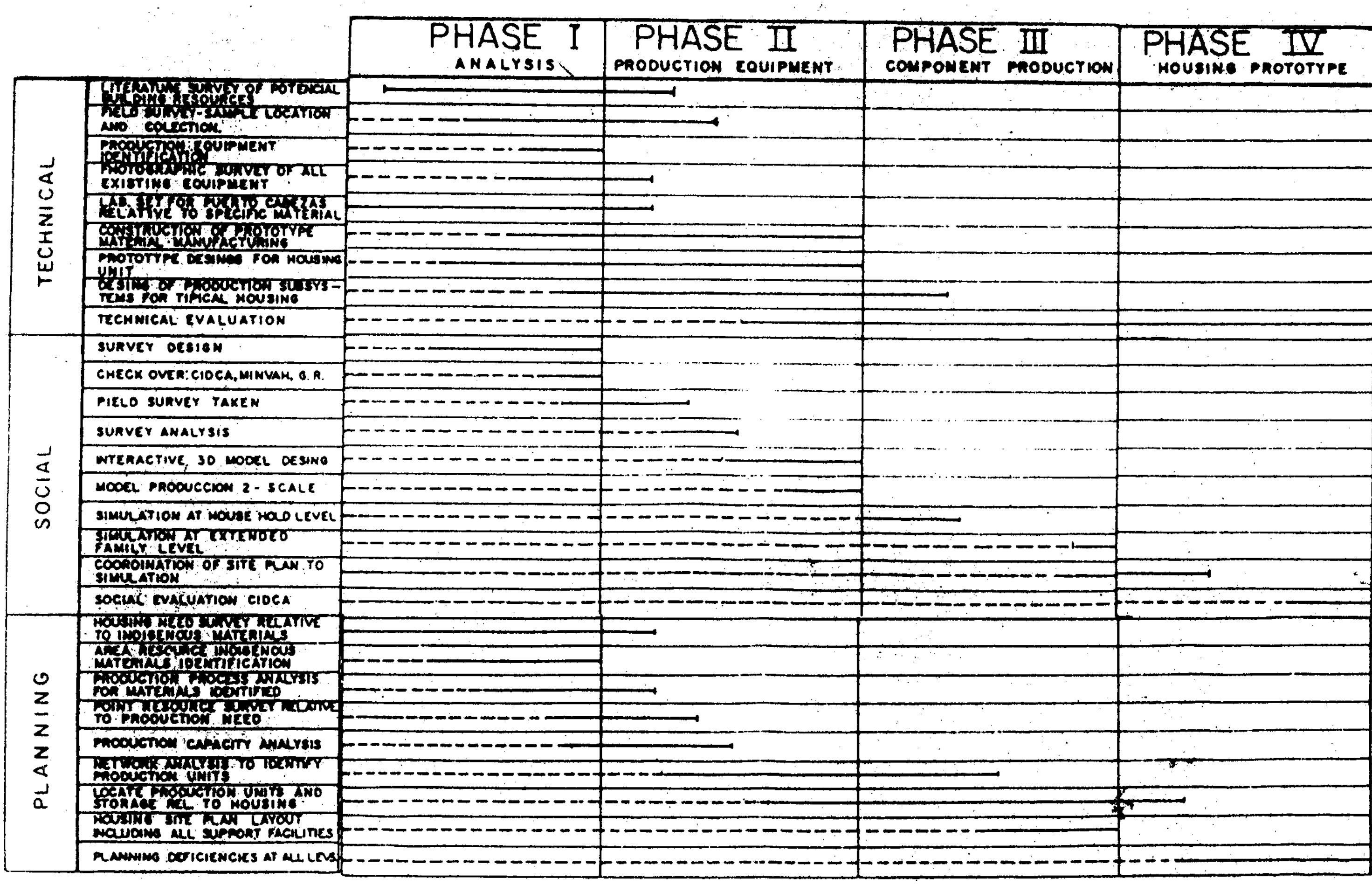
(1) A technical lab for testing agreed-upon material needs using all indigenous sources;

(2) The sociological components described above;

(3) A program of technology and resource planning, so that needs could be assessed against the capability of the region to supply the quantity of raw materials, the equipment and the skills needed to carry out a project based on indigenous values and materials.

The program shown below also added a fourth time phase to the program, which seemed necessary in my opinion to accomplish the integration of the three technical, social, and planning aspects of the project. It should be emphasized that all three components are necessary and are now in full progress, and that even though all detail components within each program may well not be successful, that the overall approach be adapted as a program for housing in the region.

WORK SCHEDULE INDIGENOUS HOUSING PROJECT-PUERTO CABEZAS



<u>The Planning Process</u>

The first two components, the technical (earth lab) and the social (ending with an interactive model as a tool for communication) have already been described. The third component, the planning process, brings together in a procedural manner the various actors and their associated activities as they relate to the existing physical resources within the regionand how physical and human resources can be applied to housing. A procedure was followed which parallels other work done by CMPBS.

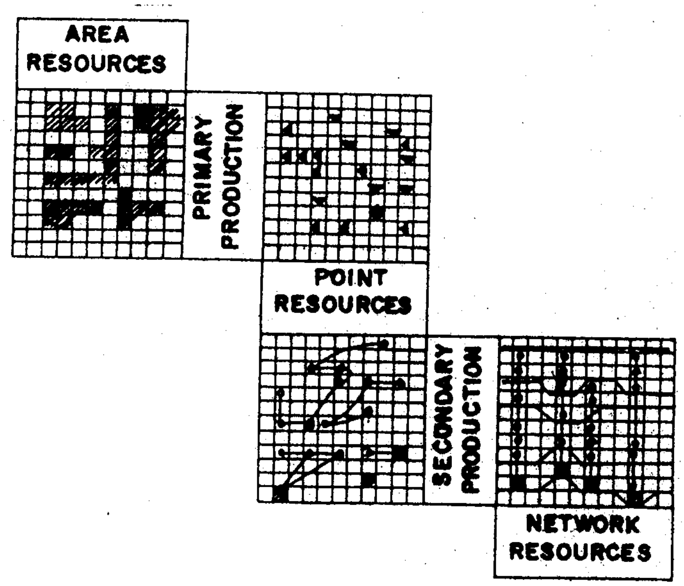
First, three resource components were identified: *Area Resources* (mapped physical resources that could, when processed, fulfill human needs for materials); *Point Resources* (the equipment and skills necessary to transform raw materials into usable products); and *Network Resources* (the recording of already existing lines of activity between one point resource and another in order to produce final housing components). Together, these activities represent examples of how Area Resources and Point Resources can be brought together to represent various levels of product development, all the way to a housing prototype. Essentially, the point resources (skilled people and their associated equipment) act as transformers of energy, materials or information supplied from another point resource or transformation process. The connections between these point resources (or transformation entities) consist of a flow of money, materials, energy or information. Since some of these flows do not exist because the point resources do not exist, we record those non-existent entitites as blank, whereas those which do exist are represented as solid points.

The first phase of the project has identified most of the area resources, point resources, and some of the networks necessary for an indigenous housing project to occur in the region. We have also identified all those parts that need to be created in order for complete product development to occur. Phase II will place the information necessary for spatially mapping area and point resources, as well as begin to place quantifiable units on the necessary production and flow capacities required, so that we can measure both existent and non-existent activity against a production goal.

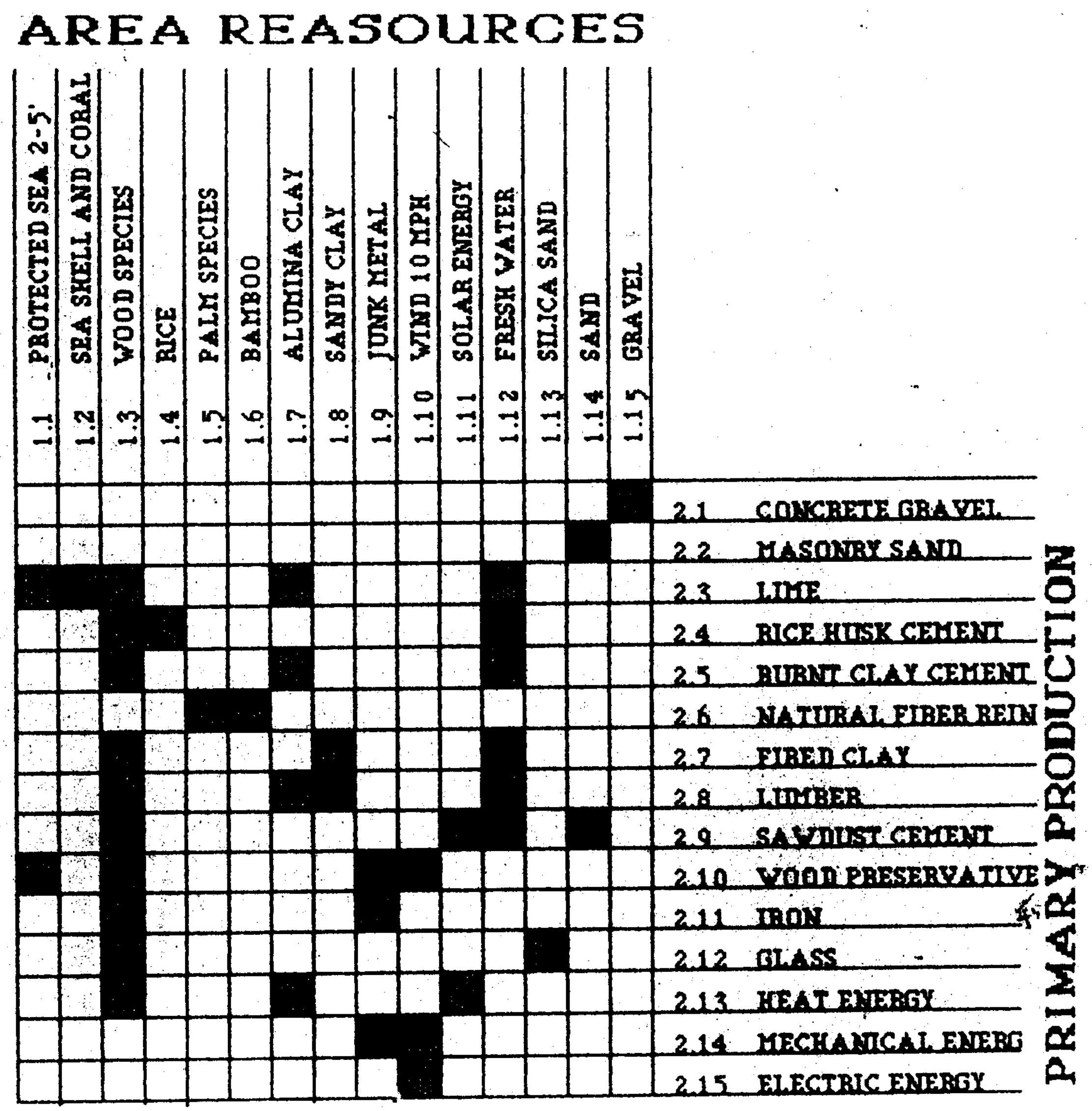
Interactive Field Matrix

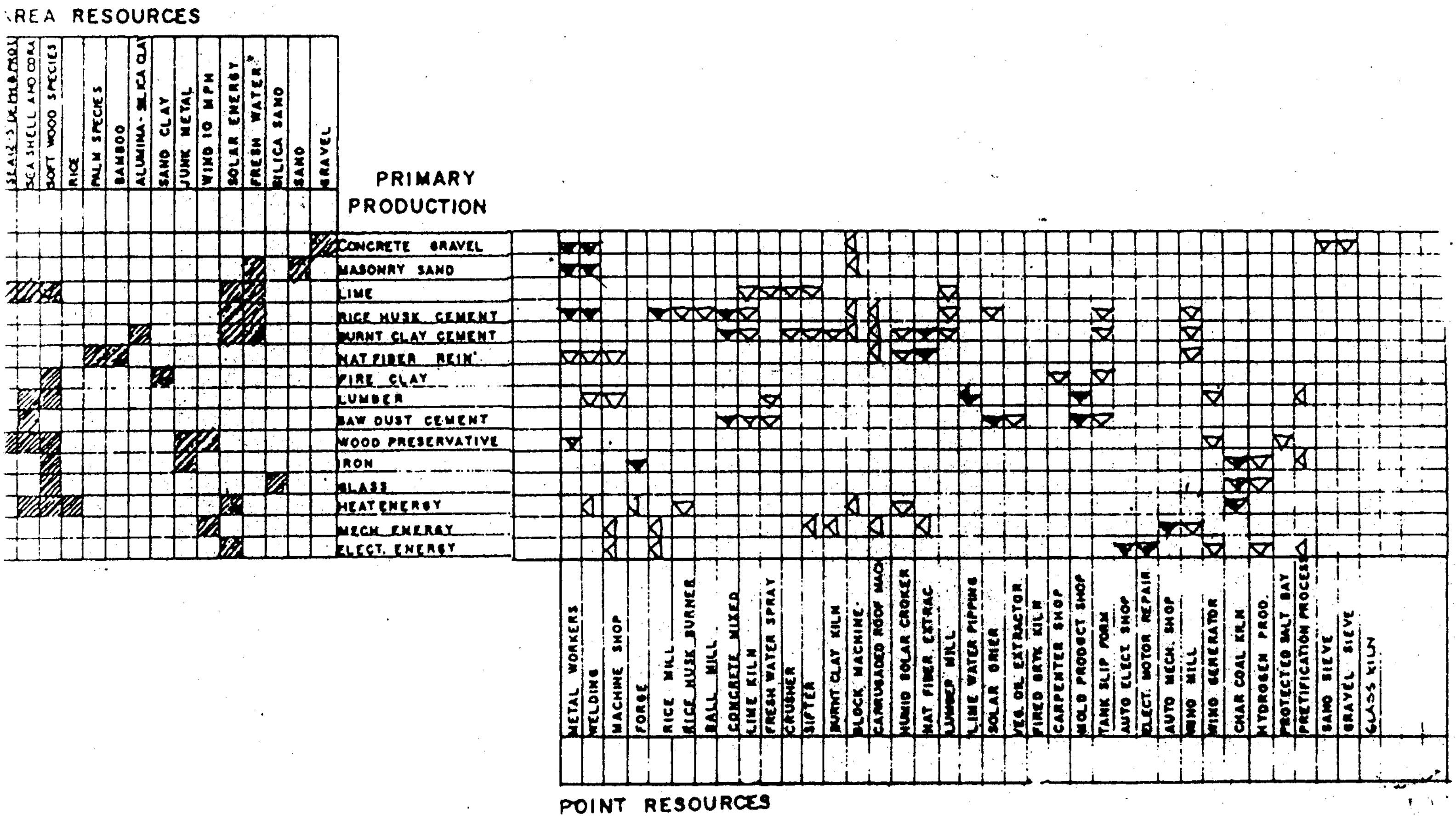
In order to represent the entire process from Area Resource identification through to Networks, we have utilized a management tool called an interactive field matrix which has the ability to relate variables in a continuous process. However, it was necessary to add two important elements to the matrix in order for the continuity between area, point and networks to be understood. These elements were (1) primary production and (2) secondary production.

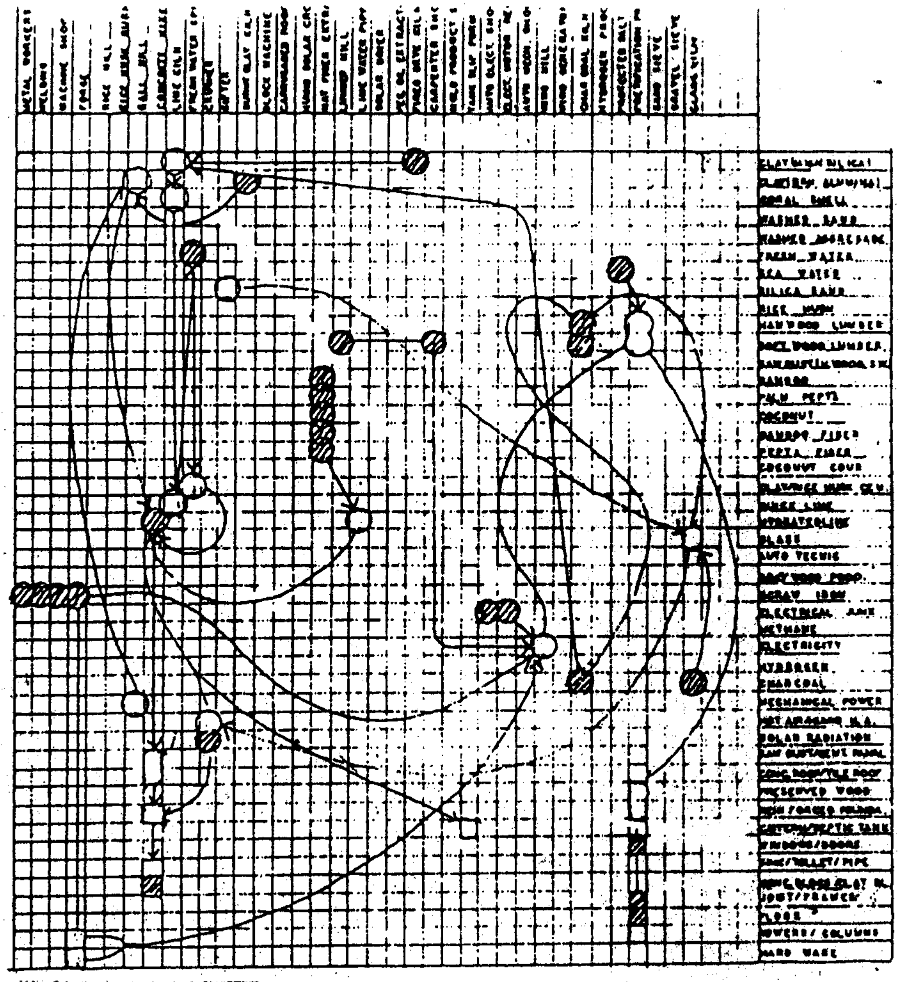
INTERACTION FIELD MATRIX AND RESOURCE PLANNING SUMMARY

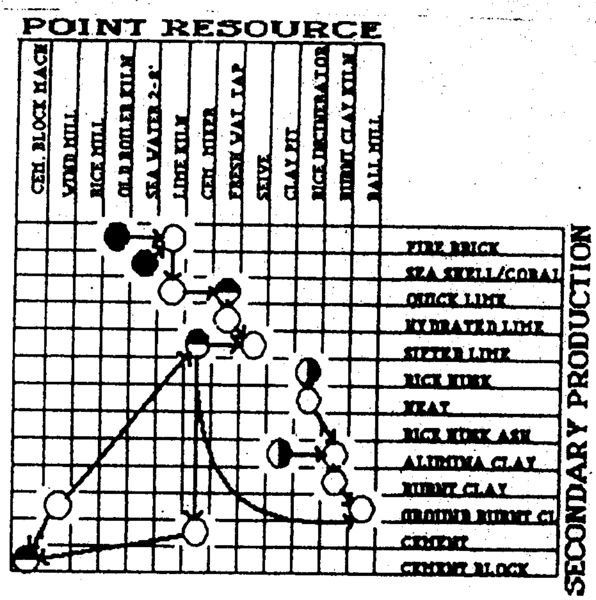


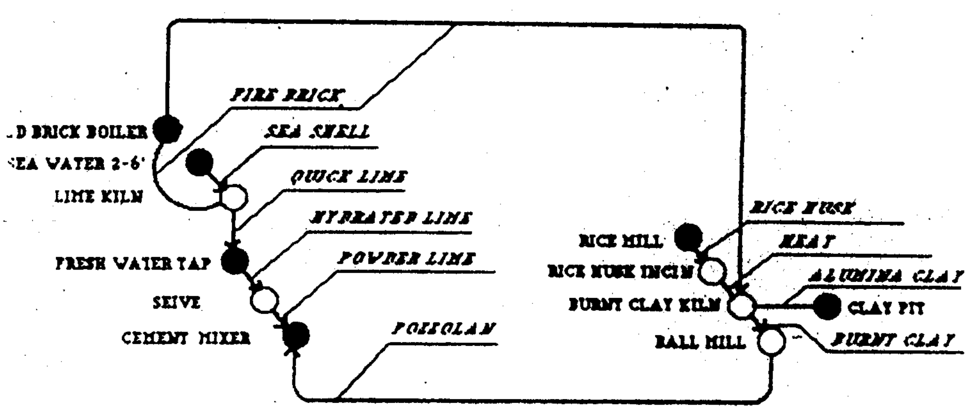
Primary Production can be identified as the primary product resulting from first level processing, i.e. coral into lime or trees into lumber. The *Secondary Production* list includes all primary production categories and adds to it more processed materials, i.e. indigenous cement into concrete block or lumber into building components ready for home construction. Secondary Production, therefore, represents enough steps within the whole production process that when it is correlated to point resource equipment, points can be connected so they represent a diagrammatic representation of transformation processes and flows. A detail of Burnt Clay-Rice Husk Ash Cement is detailed as a more specific demonstration of this procedure.




AREA RESOURCES
SEA SHELL AND CORAL
SOFT WOOD SPECIES
RICE
PALM SPECIES
BAMBOO
ALUMINA-SILICA CLAY
SAND CLAY
JUNK METAL
WIND 10 MPH
SOLAR ENERGY
FRESH WATER
SILICA SAND
SAND
GRAVEL
PRIMARY PRODUCTION
CONCRETE GRAVEL
MASONRY SAND
LIME
RICE HUSK CEMENT
BURNT CLAY CEMENT
NAT FIBER REIN'
FIRE CLAY
LUMBER
SAW DUST CEMENT
WOOD PRESERVATIVE
IRON
GLASS
HEAT ENERGY
MECH ENERGY
ELECT. ENERGY
METAL WORKERS
WELDING
MACHINE SHOP
FORGE
RICE MILL
RICE HUSK BURNER
BALL MILL
CONCRETE MIXED
LIME KILN
FRESH WATER SPRAY
CRUSHER
SIFTER
BURNT CLAY KILN
BLOCK MACHINE
CARRUGADED ROOF MACH
HUMID SOLAR CROKER
NAT FIBER EXTRAC
LUMBER MILL
LIME WATER PIPPING
SOLAR DRIER
VEG. OIL EXTRACTOR
FIRED BRICK KILN
CARPENTER SHOP
MOLD PRODUCT SHOP
TANK SLIP FORM
AUTO ELECT SHOP
ELECT. MOTOR REPAIR
AUTO MECH. SHOP
WIND MILL
WIND GENERATOR
CHAR COAL KILN
HYDROGEN PROD.
PROTECTED SALT BAY
PRETIFICATION PROCESS
SAND SIEVE
GRAVEL SIEVE
GLASS KILN
POINT RESOURCES




POINT RESOURCE
CEM. BLOCK MACH
WIND MILL
RICE MILL
OLD BOILER KILN
SEA WATER 2-6'
LIME KILN
CEM. MIXER
FRESH WAT. TAP
SEIVE
CLAY PIT
RICE INCINERATOR
BURNT CLAY KILN
BALL MILL
FIRE BRICK
SEA SHELL/CORAL
QUICK LIME
HYDRATED LIME
SIFTED LIME
RICE HUSK
HEAT
RICE HUSK ASH
ALUMINA CLAY
BURNT CLAY
GROUND BURNT CL
CEMENT
CEMENT BLOCK
SECONDARY PRODUCTION


FIRE BRICK
SEA SHELL
QUICK LIME
HYDRATED LIME
POWDER LIME
POZZOLAN
SEA WATER 2-6'
LIME KILN
FRESH WATER TAP
SEIVE
CEMENT MIXER
RICE HUSK
HEAT
ALUMINA CLAY
RICE MILL
RICE HUSK INCIN
BURNT CLAY KILN
CLAY PIT
BALL MILL
BURNT CLAY

Network Resources

Network Resources are represented when these flow and transformation processes are identified by labor organizations. For example, cement products manufacturers are linked by common suppliers, resources, and even transportation means. In a similar way, one can identify clay products, lumber products, metal, hardware, sanitation facilities, energy equipment manufacturers, etc. Depending on the stage of development within the social and institutional infrastructure, one can find trade organizations that are organized either around production sequences, i.e. (vertically), concrete product manufacturers associations, or around different stages of end-products, i.e. (horizontally) raw material suppliers, product manufacturers, energy producers, building contractors, etc.

By recognizing both the horizontal and vertical orders of organizations, different types of coordination can be recognized. For example: (vertically) overall production of masonry products, both cement and clay, can be better coordinated to meet the structural wall goals for housing; or (horizontally) worker issues related to working conditions, safety, pay, etc. can be discussed at the different supplier levels, from mining at one level through to subcontractors who together can be represented by worker organizations at that level. Organizations which already exist can aid greatly in these organization efforts. If they do not exist, these different associations might gradually have to be created so that both human production and technical production issues are fully recognized, to foster a home building industry which can function through the long term. Many of these network resources have yet to be identified for the Puerta Pabezas region.

SECONDARY PRODUCTION

NETWORK RESOURCES

	HARD WARE	TOWERS / COLUMNS	FLOOR	JOISTS/FRAMES	CONC. BLOCKS/CLAY BL.	SINK/TOILET/PIPE	WINDOWS/DOORS	CISTERNS/SEPTIC TANK	[illegible] FORCED FOUNDA.	PRESERVED WOOD	CONC. ROOFTILE ROOF	[illegible] PANAL	SOLAR RADIATION	[illegible] ARRANGED H.A.	MECHANICAL POWER	CHARCOAL	HYDROGEN	ELECTRICITY	METHANE	ELECTRICAL JUNK	SCRAP IRON	[illegible] WOOD PROD.	AUTO TECNIC	GLASS	HYDRATED LIME	QUICK LIME	[illegible] CEM.	COCONUT COUR	[illegible]	BAMBOO FIBER	COCONUT	PALM [illegible]	BAMBOO	[illegible] WOOD LUMBER	SOFT WOOD LUMBER	[illegible] WOOD LUMBER	RICE HUSK	SILICA SAND	SEA WATER	FRESH WATER	WASHED ARGREGADE	WASHED SAND	CORAL SHELL	CLAY (ALUMINA)	CLAY (SILICA)
CEMENT MANUFACTURE																																													
BULDG COMP. PRODUC.																																													
" BLOKS MANUF.																																													
" ROOF PANALS MF																																													
" CIST./CEPT. MANUF.																																													
" SINK MANUFACT.																																													
MASONRY CONTRACTOR																																													
BULDING SUBSYSTEM																																													
" FOUNDATION CONST																																													
STRUCTURAL WALLS																																													
ROOF CONST.																																													
PLUMBING INSTALATION																																													
CLAY MANUFACTURING																																													
BUILDING COMPONET																																													
" BRICK MANUFACTU.																																													
" ROOF TILE MANUF.																																													
" PIPE-BAKED CLAY																																													
MASONRY CONTRACT.																																													
BUILDING SUBSYSTEM																																													
" WALL																																													
" ROOF																																													
" UNLINES																																													
LUMBER MANUFACTU.																																													
" PRESERVES																																													
BUILDING COMPONENT.																																													
" DOORS																																													
" WINDOWS																																													
" PANALS																																													
JOISTS/STUDS																																													
FASTEWERS																																													
BUILDING SUBSYSTEM																																													
RIB TRUSS																																													
FLOOR																																													
WALL SYSTEMS																																													
METAL SHAPE FABRIC.																																													
FASTNERS/PLATES																																													
HINGES/HAWPLES																																													
ELECTRODES/TOWERS																																													
BUILDING SUBSYSTEM																																													
ROOF TRUSS/RIB TRUSS																																													
DOORS WINDOWS																																													
UTILITIES MANUFACTU.																																													
SINIC/BATH																																													
LACTRINE																																													
CISTERN/SEPTIC																																													
DRENAGE PIPE																																													
INSTALLERS																																													
UTILITIES MODULE FAB.																																													
SUPPORT SYSTEMS																																													
TOWERS/TANKS																																													
WOOD PROPELLERS																																													
METRUM ROOLING																																													
ELECTRIC SHOPS																																													
ENERGY EQUIP. MANUF.																																													
WIND GENERATOR																																													
WIND MILL																																													
HYDROGEN PRODUCT.																																													
METHANE TANKS																																													
DEHUMIDITERS																																													
LOW TEMP. HEATERS																																													
HIG TEMP. HEATERS																																													
BUILDING SUBSYSTEM																																													
COOKING																																													
LIGHT																																													
REFRIGERATION																																													

REGIONAL AREA RESOURCES

REGIONAL RESOURCE SUMMARY

LATASOL BAUXITE CLAYS FOR A MORTAR GRADE CEMENT, FIRED CLAY BRICK AND TILE, AND CERAMIC PRODUCTS. IS LOCATED OVER 14,500 KM2 IN ZELAYA NORTE AND THEY HAVE BEEN SUCCESSFULLY FIRED AND TESTED AS KAOLINITE CLAYS INCLUDING SEVERAL WEEKS SUBMERSION IN WATER WITH NO DETERIORATION AFTER FIRING.

IT IS IMPORTANT TO NOTE THAT ONE OF THESE KAOLINITES APPEARS TO BE OF HIGH CERAMIC QUALITY GOOD ENOUGH FOR CHINA AND MAY BE IDENTIFIABLE AS A CHINA CLAY. THIS CLAY WAS LOCATED ON A CREEK AT THE MIDPOINT BETWEEN TUAPI AND KAMBLA AND APPEARS TO EXIST IN CONSIDERABLE ABUNDANCE.

COCONUT COIR WHICH DERIVES FROM THE FIBER OF THE OUTER COCONUT SHELL IS AN EXCELLENT REINFORCING MATERIAL ESPECIALLY FOR CEMENT AND LIME BASED PRODUCTS. THERE ARE APPROXIMATELY **EIGHT** SMALL VILLAGES AROUND THE PUERTO CABEZAS REGION AS WELL AS SOME BARRIO AREAS WITHIN TOWN THAT PRODUCE A TOTAL ANNUAL CROP ADEQUATE TO SUPPLY OVER 2000 ROOFS UTILIZING 8MM THICK CEMENT IN CORRIGATED FORM.

PINE CHIPS AND SAWDUST AS A FILLER FOR LIGHTWEIGHT CONCRETE AND CHIPS AS REINFORCING ARE AN ABUNDANT WASTE PRODUCT IN THE PUERTA REGION. THE LATTER HAS BEEN PROVEN BY PRIVATE AND PUBLIC RESEARCH ORGANIZATIONS TO BE ESPECIALLY GOOD AS A REINFORCING PRODUCT WITHIN FIBERBOARD CEMENT PANALS. APPROXIMATELY 15-25 M2/WK IS PRESENTLY PRODUCED.

A **HIGH SILICA SAND** HAS BEEN REDISCOVERED TO EXIST WEST OF THE MAIN ROAD TO SISIN TOWARDS TUARA. THIS SOURCE SEEMS TO BE SEVERAL KILOMETERS SQUARE IN AREA AND WAS REPORTEDLY USED BY AN ITALIAN GLASS MAKER IN JINOTEPE ON THE WEST COAST. THE REPORTED PROBLEM ENCOUNTERED BY THIS MANUFACTURER WAS THE HIGH COST OF TRANSPORTING THE MATERIAL TO MANAGUA. LABORATORY CONFIRMATION OF THE MATERIAL STILL MUST BE MADE.

LIMESTONE HAS ALSO BEEN DISCOVERED WEST OF SISIN AND WHEN SUBJECTED TO THE STRONG HYDROCHLORIC ACID TEST PROVED TO BE OF ADEQUATE CONSISTENCY TO PRODUCE LIME. THIS LIME IS USED TO PRODUCE A LOW TO MEDIUM GRADE CEMENT WHEN MIXED WITH RICE HUSK ASH FINELY GROUND AND MEDIUM GRADE BURNT CLAY CEMENT WHEN MIXED WITH BAUXITE CLAY [ESPECIALLY SAMPLE NUMBER FIVE] AND RICE HUSK ASH IN THE PROPORTION OF 3 LIME 1 1/2 RHA AND BURNT CLAY AT 700ºC 1 PART. THE QUANTITY OF LIMESTONE AT THIS TIME IS UNKNOWN.

RICE HUSK EXISTS IN PLENTIFUL QUANTITY AND IS INCREASING ANNUALLY. IN 1984 A QUANTITY OF APPROXIMATELY 1500 LB/HR 8 HOURS/DAY FOR FOUR MONTHS WAS PRODUCED EQUIVALENT TO ABOUT 170 TONS. IN FUEL VALUE THIS IS EQUIVALENT TO ABOUT 85 TONS OF COAL. IN CEMENT TERMS THIS IS EQUIVALENT TO 34 TONS OF CEMENT. SO FAR LABORATORY TESTS HAVE NOT BEEN SUCCESSFUL ON SITE TO PRODUCE GOOD CEMENT NOR HAS THE ADDITION OF THIS MATERIAL TO PORTLAND CEMENT BEEN

SUBJECT: LIME

SUMMARY:

Lime is the basic ingredient for many building processes including the following: (1) A basic component of all natural cement; (2) a primary part of masonry ; (3) as lime-water, it becomes part of a process to pH stabilize wood products for masonry; and (4) lime can be used as a basic ingredient of paint, especially masonry paint.

CHARACTERISTICS:

Lime for building can be made from limestone, sea shell or coral. Any of these sources must then be fired at 900°C. to 1100°C. The finished product is calcinated lime, and must be handled wiht great care or it can burn the skin when it is touched. (Another name for this lime is *quick lime*. When quick lime is sprinkled with water, it is called *slaking* and much heat is generated during this process. When the quick lime has been reduced to power by slaking, you have slaked juice (or hydrated lime) which is the product used in most all masonry work.

If the sea shell, coral, etc. is mixed with 5-25% clay and this is fired, one makes a hydraulic lime which means that when water is added the lime "sets" and gets hard without the addition of cement. (The kiln temperature required for hydraulic lime is a little higher than that required for quick lime.) The resulting product can be used as mortar. The firing process is also different for sea shells, because there are usually not enough air spaces for the temperature of the fire to reach all the shells. Usually large chunks of coral, about the size of a long bread loaf, are used; however, the use of coral can damage good fishing areas, so some management program must accompany its use. The potential for artificially collecting calcium carbonate from sea water through a low energy, piezzo-electric process is discussed under artificial wood petrification as a method for wood preservation in this report. The process for lime production initially involves obtaining fire brick (brick that can take 1500°C.+). Be sure to check housing in a region before determining there are no fire brick, because these materials have been used in many regions of the world, and very often one might find an old lime kiln. Other materials such as stone, concrete block, adobe, etc. can be used, but usually have to be replaced once a year, because of fire cracking them. Often a mixture of sand and clay is used that becomes fired as the kiln is used, and also enables the bricks to expand and contract with heat.

AVAILABILITY AND PRELIMINARY COST: PUERTO CABEZAS

At this time, the only sources of calcium carbonate is either sea shell or coral, and this has been confirmed through a Miskitu village around Tuapi, north of Puerto by about 15 kilometers. It is also reported that a limestone source may exist west of the Sisin area. The quantity of materials is unknown at this time, but the Miskitus tell us there is no problem in obtaining large quantities through investigation. Further inquiry will have to be done to determine this method of collection. Transport of the material is achieved by leaving a 3M four wheel trailer to be filled and picked up every 6 weeks, at which time another empty trailer is left. The trailer size and method of collection is one limiting factor to the amount of lime that can be produced. Under the production sequence explained in the Burnt Clay section of this report, about 125 tons of material would be needed each year to make burnt clay cement under the kiln conditions described. With a 43 week work year, this quantity would be about three tons per week. At 143 lb/ft(3), and accounting for 50% air space between coral chunks, an estimated 15-20 tons of coral could be collected in one load. These quantities should be well within the capability of a small village population ( ). This could be equivalent to about 1200 lbs. per day of actual collection weight. If 1 cordoba were paid per 2 pounds of coral, our delivered price, including transport, would be the following:

A 2,800 BTU/ton/mile diesel truck
A 164,000 BTU/gal diesel fuel
A cordobas/gal diesel fuel
Labor-1000 cordobas/ton
Transport fuel: 9.3 miles x 2800 Btu/mi = 26,040 BTU/ton
- 26,040 / 164,000 - .16 gal diesel/ton.
-.16 x 26.25 cordobas/gal =
Driver - 1 hour @ 2.5 cordobas/hour 1 hour = 2.5

For preliminary labor costs associated with firing of coral to make lime, please see Burnt Clay section.

SUBJECT: NATURAL FIBERS CATEGORY: PRIMARY PRODUCTION

SUMMARY:

The use of organic fibers to replace Asbestos-fibre cement and glass-fibre is presently being done in a number of countries, both to off-set high costs and to reduce health hazards which can be great within the asbestos industry. Some of these organic fibers considered as alternatives include Sisal, Elephant Grass, Bamboo, Palyra Leaf Fibers, and coir fiber from coconut palms. Among the plants available in the Puerto Cabezas region are Papta Palm stalk fibers and Pine Wood fibers.

CHARACTERISTICS

Experience thus far indicates that regions with soft wood and coconut are good because wood wool (long fibers) and coconut coir (short fibers) together produce an excellent reinforcing binder for corrugated roofing sheet cement panels. Coir is apparently good because, unlike other cellulosic materials, it is free from soluble polyphenols which effect the concrete. The soft wood fibers are extracted with a plane. The fibers are 1mm x 4mm in cross section, and 40mm long. The coconut is shredded with a shredding machine, or by hand. Some researchers have used just coconut coir with good results. In all cases, the panels are pressed from both sides in a corrugated mold with about 280 psi. The mixture of wood wool and coir fiber produced panels using 30% less concrete than with the asbestos panels. Tests on the panels using only coir showed high water absorption, which indicates a need for protective coating when used outside.

Bamboo has a considerable history in its use as a reinforcement, but mostly as reinforcing bar rather than as fiber. Fiber extraction from bamboo and paptá palm has reasonably high potential by using a roller type crusher which flattens the materials and separates the fiber. However, the ability of any fiber to withstand an alkaline environment such as that found in cement products is the key. One method of neutralizing the acids within the wood is to submerge the fibers in a saturated lime water bath. This has been successful for soft wood sawdust when this sawdust is used to make lightweight concrete. A tank of lime water (pH 12.1) is set up with a screen mesh so that fibers can be extracted and, if necessary, dried in the sun for storage. Often with materials such as bamboo, the stalks must be rolled or at least left in water containing a wetting agent (e.g. soap) in order to rid the wood of vegetable oils so that the calcium oxide lime water can be successfully abosrbed. An alternative treatment for the cellulose materials is to bathe them in calcium chloride. But, as far as this researcher knows, this chemical is difficult to produce locally. It has been shown that the best way for these chemicals to be absorbed into the wood is to go from a hot bath to a cool bath where pressures in the wood are relieved, thus making absorption possible.

AVAILABILITY IN PUERTO CABEZAS REGION

Surveys were conducted to estimate the number of coconut palms in the region. Bamboo species and papta palms have not been identified as to quantity. The survey was done to determine the existing production potential. It was estimated that there are 11 rural communities which have cultivated coconut palms for nutritional needs, and in most all of these cases, the coir is discarded. There does not exist any organized coconut oil extraction processes in the region to centrally locate the coir husk. The need to develop parallel industries is obvious in order for coir to be effectively used. It is estimated that each of these 11 communities average 400 trees per year with 50 coconuts each, for a total yield of 220,000 coconuts per year. Each coconut yields approximately 1,125 lbs. of dry weight coir. A 1m(2) roof panel utilizes approximately 1 kg. of fiber, or 2.2

lb. Therefore, 2 coconut shells are required per 1m(2) of roof. A 36m(2) home utilizes about 46m(2) of roof; therefore, 92 coconut coir shells are required per home. These figures would give an annual total of 2,390 roofs supplied if all the coconut coir could be collected.

COST & LIFE EXPECTANCY

Researchers have found that by replacing such materials as asbestos fiber with natural fiber that there is an 80% cost reduction in reinforcement (elephant grass). This work has done using portland cement. It was also found that up to 30% of the cement could be reduced without appreciably affecting the structural strength (Sisal). With elephant grass, absorption of moisture was as good if not better than with asbestos cement panels. The life expectancy of fiber cement combinations have been used without any appreciable sign of deterioration. Therefore, it is reasonable to assume at least a 10-15 year life span, if not more. Actual cost of collection can only be estimated at this time in the Puerto Cabezas region. This researcher has timed experienced coconut palm climbers who can climb, drop 10 coconuts, and be back on the ground in 6 minutes. How many times one can do this per day is not known, but it is reasonable to expect that 10 climbs per day is possible, meaning that 100 coconuts per person per day is possible. At 220,000 coconuts per year, this is 2200 man/days, or 7-8 persons working 300 days per year. At 80 cordobas per day, this is 176,000 cordobas, or approximately 1 cordoba per coconut. Other costs such as transport, extraction and lime water chipping time still need to be tracked in order to determine total costs.

RICE HUSK ASH CEMENT CATEGORY: Primary Production

SUMMARY:

Rice husk cement is produced by burning rice husks to ash, grinding this

ash, and mixing it with lime to produce cement. Most all rice husk in the Puerto Cabezas area is presently thrown into the dump; it has no nutritional value. The only other possible use known at this time is as fuel.

-Rice husk constitutes by weight 20% of the harvested dry rice crop. The ash consists of 20% by weight of this rice husk by-product, or .20 x .20 = .04% by weight of total dry biomass.
-Since rice husks contain about 1/2 the <u>energy</u> value of coal, the cement process can be made energy self-sufficient.
-The <u>heat</u> obtained from the rice husk could be used to make the lime, but the optimum heat requirements are slightly different. (Rice husk ash: 450 - 750°C.; Lime: 900 - 1100°C.)
-Some researchers believe the upper-most temperature for rice husk ash is 600°C.
-The husk ash must turn white-grey in order for it to be considered ready for grinding.
-Grinding should be accomplished in a ball mill and, according to some researchers, ground to a fineness sufficient to pass a #300 sieve.
-Ground material is then mixed 1:3 or 1:3.5 lime to ground ash. (Some researchers say the mixture should be 20-30% by weight of hydrated lime.
-Expected compression ranges from 50-80kg/cm(2) or 715-1144 lb/in(2).
-The energy value of this material is about 13 x 10(6) J/kg.

<u>POTENTIAL QUANTITY: PUERTO CABEZAS:</u>
-Rice husk mill, in town: 1500 lb/hr/8 hr/day/7 days/wk/4 month/yr = 134.2 tons of ash.
-At a mixture of 20-30% lime added, this is equivalent to 161T. of cement.
-At 30 bags for a small house, this is equivalent to 107 houses per year.

SUBJECT: <u>BURNT CLAY CEMENT</u>

<u>SUMMARY:</u>

Burnt Clay Cement has been used for centuries, especially in India and Egypt. Traditional Burnt Clay Cement (BCC) was made from grinding brick bats and over burnt brick from a brick kiln and combining this material with lime, which has a low cementatious activity level. However, specially selected clays, when burned at optimum temperatures, produce a relatively high quality cement which mixed in optimum ratios with lime. The clays identified as possibly fitting the necessary requirements in the Puerto Cabezas area are substantial in quantity, do not conflict with good agricultural land, and can be managed in the extraction process so that tree farms of the pine variety could be planted after excavation. The development of these clays also acts in two ways: (a) as an indigenous cement; and (b) as clay for building brick, roof tile, water and sewer pipe, etc.

TECHNICAL CHARACTERISTICS:

The soil type in general is a *latosol,* which contains high alumina and silica properties. Commercially, such clay could be developed to produce aluminum, but at great expense and energy cost. Therefore, from a mineral standpoint, these soils can be placed in the Bauxite category. The clay is burned at temperatures between 700 to 800'C for about 35 minutes. The energy requirements are therefore less than that needed for traditional portland cement (temperature 1450'C). Because the temperature range is similar to that required (and therefore supplied) by rice husk ash cement, there may be a way of combining these two processes which would also help the rice industry eliminate a troublesome waste by-product. A mixture of 1:3 or 1:35 lime to ground burnt clay is suggested. OUR LAB WORK EVENTUALLY SHOWED THAT A SILICA SOURCE HAD TO BE ADDED SUCH GRO8UND RICE HUSK!

Under ideal conditions, compression strengths of from 1000 to 1750 lb/in(2) are obtainable. To give a relative idea of this strength, adobe block in the USA are accepted under Unified Building Code at 250 to 300 lb/in(2). This compression capability would suggest that hollow-type concrete block may be possible, thus lowering the mass yet retaining the strength of indigenously produced masonry units. This lowering of mass is of extreme importance in tropical zones so that structures do not heat up and retain the heat. Low mass also contributes to the potential for breeze penetration.

Curing times of BCC's are longer than for portland cement. BCC's are aided in their curing process by being in a humid environment. Slightly higher temperatures in a humid environment help the curing process (i.e. clear plastic over a curing brick pile in the sun--never without cover in the sun.) Relative curing times for speeded up laboratory testing is as follows, each equivalent to 3 months curing at 20°C:

20°C @ 3 months = 3 months
30°C @ 6 weeks = 3 months
40°C @ 3 weeks = 3 months
50°C @ 1.5 weeks = 3 months
60°C @ 5 days = 3 months
70°C @ 2.5 days = 3 months
80°C @ 36 hours = 3 months

**Curing time is therefore about 3 times that of portland cement.

According to some researchers, the material should pass the 75mm sieve, but be retained on the 53mm sieve.

PRELIMINARY COST OF BURNT CLAY CEMENT

Burnt clay cement will vary in cost according to the energy sources available, with labor and maintenance remaining constant. As was already mentioned, the ideal combustion temperature of rice husk, 750°C., possibly fits the requirement of the 700 to 800°C of burnt clay. A possible technical means of accomplishing this could be with the use of a corkscrew-type metal conveyor feeding the fire with rice husks from a hopper. This method should utilize a variable speed motor in order to adjust the amount of fuel according to heating needs. The possibility, then, of utilizing the rice husk ash in combination with the burnt clay mixed and ground together in the ball mill offers a possible high production from a small cement factory. The only limiting factor energy-wise, then, becomes the energy need for the lime that needs to be mixed with the cement. Since this lime quantity would make up 20 to 30% of the energy cost, and since lime requires 900 to 1100°C., or approximately 3 times the energy requirement of the burnt clay, when rice husk waste is used as fuel for the clay, almost all our energy costs are associated with the lime. However, it has been shown that lime can be produced with waste wood or charcoal, and since there are relatively large quantities of waste log sides from the saw mill in the Puerto Cabezas region, a possible fuel source exists that only requires a small amount of transporation and labor. It should be noted, however, that this waste wood is presently used as fencing material for people's yards.

Burnt clay takes 35 minutes to produce the firing process, and probably takes 6 times that for loading and unloading a kiln. A 10' x 108 c 5'6" kiln produces about 450 tons of burnt clay per year. The same size kiln produces 250 tons of hydrated lime per year. Two tons of waste timber fuel are required per ton of lime, and approximately 1/3 this quantity is needed per ton of burnt clay. Ten workers are required for 300 days per year to produce this quantity. One half the kilns were used for lime production, and the other half for burnt clay. With a suitably insulated wall between, we would obtain 225T. of BCC, approximately 450T. of rice husk ash, and 125T. of lime, giving a ratio of 675T. pozzolana and 125T. lime, or approximately 20% lime which is the required amount for the mix. Thus, 675T. of cement could be produced by 10 workers 300 days per year. At an average cost of 100 cordobas/day for 9 persons and 350 cordobas per day for 1 person, this quantity of cement would cost approximately 375,000 cordobas in labor, or 555 cordobas per ton. At 20 bags per ton, this is equivalent to 27.77 cordobas per 100 lbs. in labor cost alone, excluding the labor time required for either the excavation or delivery of either the clay or the coral/shell for lime.

POTENTIAL QUANTITY IN PUERTO CABEZAS REGION:

Two types of soils with clay in them show high descriptive potential for use in BCC's. These soil types are derived from correlating work done for the Ministry of Planning by Tahal Consulting Engineers Ltd., Tel Aviv, Israel, and the sources sited above. These two soils are *Plintha-Quic Tropudults* (UPT) and *Plinthil Orthoxic Tropults* (UPH). These soils are of the class called *Ultisols*, suborder *Udults*, great group *Tropudults*. Both have high alumina content and thus poor fertility from an agricultural standpoint, but are good for pine lumbering. Both soils, according to Lea, are *latosols* or Bauxites which is corroborated in a paper *Land Potential of the Puerto Cabezas-Rio Coco Area*, June 1957. The relative quantity of *Plinthaguic Tropudults* is 16.5% of 8949 km(2), or 1476.6 Km(2) at approximately 1 foot depth. The relative quantity of *Plinthic Orthoxic tropudults* is 11% of 5931 km(2), or 6524 Km(2) at approximately 1 foot depth.

SUBJECT; WOOD PRESERVATION
UTILIZING SEA WATER
OR CALCIUM CHLORIDE

SUMMARY:

Wood, especially soft woods, can be treated using the minerals contained in sea water through the use of a simple electrolysis technique. The technique involves setting up a positive and a negative pole within the sea water by injecting electrical current through two pieces of metal. The piece of metal attached to the negative pole attracts minerals out of the sea water onto its surface. If this negatively charged piece of metal is surrounded by wood the wood itself absorbs the minerals and the cells of wood are filled with solid materials so that the wood is able to withstand insect and fungus decomposition. Over time (approximately 3 months) the wood attains a concrete quality which, in addition to preserving the wood, eanables the wood to obtain a high degree of structural strength.

TECHNICAL CHARACTERISTICS;

Wood preservation by electolysis in sea water, although very simple techniquely, was only recently invented and put to use by the Marine Resources Co. of Galvestion, Texas, U.S.A. Most of the experiments done up until this time have involved purely metal and metal wire mesh positive and negative poles. Ideally the anode (the positive pole) should be carbon or lead but it has also been shown that steel used at both poles works adequately enough 'if the attendants on the job make sure that the anode does not get covered with minerals itself which it gradually can moreso than by utilizing carbon, When accretion (the building up of these minerals on the cathode) occures on wire mesh over an extended period (of six to eight months) a very hard material approximately half again the compression strength of concrete developes. Although actual test data is not available, the Marine Resources Company has shown that when wood surrounds a cathode in the shape of a bar, that similar type strengths occure. An easy way of preserving wood that is already located in the sea such as with wooden docks or boat hauls is to wrap the wood with a 1/8 to 1/2" inch screen mesh like hardware cloth.

Several observation resulting from experiments done thus far are as follows:

1) Accretion in small tanks can be achieved producing a soft material.

2) Rapid accretion results in a soft material. There is some possibility that rapid accretion products can be scraped and used as a lime source once fired.

3) Slow accretion, e. g. 5-100 mA per square foot of cathode area produces a harder material.

4) Energy requirements are fairly low compared to producing the samre product out of concrete e. g. .4 - 2kW per 1kg. of accreted mass.

5) Water bodies that are constantly replenished by the sea or sea water that is little affected by fresh water runoff from the land or from a river are the best source for accretion because of good concentrations.

6) Both iron and steel rapidly disintegrate as anode materials where as carbon or graphite show very little deterioration. However since the former is usually much more available this should not deter one from prodeeding.

7) Low voltage (6-12 volts) should be used with heavy guage *6 wire as the leads.

8) The connection between the cable and the anode has to be very well protected using silicone or a heavy application of tar and the end of the wire should be well bedded or set into the material.

9) Unlike most wood preservatives being used the electrolytic preservation of wood in sea water is completely nontoxic both to marine life during the process, and to humans while the product is in use within buildings. Recently in the U.S. there were up to 10,000 cases reported of families suffering from the use of Penta type wood preservative.

10) The name we will refer to from now on for the preservation of wood by the electrolysis process in sea water will be WOODCRETE

WOOD PRESERVATIVE USING CALCIUM CHLORIDE

SUMMARY:

A similar nontoxic process for preserving wood to that of sea water preservation is the use of calcium chloride at a concentration of 60% specific gravity in fresh water. The advantage of this technique over the electrolysis process is that smaller more delicate plants such as those used for thatch roofs or various bamboo products such as window screens or baskets can be artifically petrified. Although the process has not been used extensively out of doors, a decorative plant company in the U.S. has been using it for years as a house plant preservative so Americans no longer have to water there decorative house plants. The process is simply one of adding the chemical , which is very inexpensive,(in the U.S. it is used to salt roads ;in the winter time to prevent ice build up so one can imagine how inexpensive it is) to fresh water and testing the water with a hydrometer until the proper concentration is obtained. Some plants since they contain alot of natural waxes like bamboo should be boiled or soaked for some time in order to dissolve the wax before submersing the plant for preservation purposes. Boiling the plant itself in the calcium chloride solution also helps the plant absorbe the calcium. The end result is a plant whose cells are taken up with calcium in a similar way that woodcrete is made with the sea water process.

IT IS NECESSARY TO REALIZE THAT A SALT BASED TECHNIQUE PROBABLY SHOULD NOT BE SUBJECTED TO RAINFALL BECAUSE OF GRADUAL DESOLVING OF THE SALT FROM THE WOOD. THEREFORE THIS METHOD SHOULD BE INCORPORATED ONLY WHERE DIRECT RAIN OR REPEATED WATER EXPOSURE IS NOT A PROBLEM!

NOTE: The company in the united states which uses the calcium chloride plant preservation method is The Tropical Island Preserved Plant Institute located Ft. Lauderdale Florida, P.O. Box 21496, Dept. O Tel. 305 566-2395

SOCIAL SURVEY

THE SURVEY STARTED IN PHASE 1 FOR BARRIO COCAL WAS COMPLETED. THE RESIDENCE FROM THIS BARRIO ARE GOING TO BE THE PRIMARY HOUSING USERS FOR THE INDIGENOUS HOUSING PROJECT. THE SURVEY ALSO INCLUDED MEASURED DRAWINGS OF TWELVE EXISTING HOUSES ROOM BY ROOM INCLUDING LOT SIZES. SINCE MANY OF THESE FAMILIES LIVE IN VERY TRADITIONAL WAYS IT WAS FELT IMPERATIVE TO BE ABLE TO REPRESENT ANY SOCIAL SPACE AND FUNCTIONS AS CLOSELY AS POSSIBLE IF NEW HOUSING OR THE REPAIR OF EXISTING HOUSING WERE TO BE ACCOMPLISHED. A COMPLETE SUMMARY OF THIS SURVEY IS INCLUDED IN THIS PHASE TWO REPORT IN SPANISH. A BRIEF SUMMARY OF THIS REPORT IN ENGLISH FOLLOWS.

-33 FAMILIES WERE INTERVIEWED OF A TOTAL BETWEEN 170 TO 200NORMALLY 15% IS CONSIDERED ADEQUATE FOR A SURVEY

-THERE SEEMED TO BE AN INCREASE IN FAMILY SIZE OVER A FIVE YEAR PERIOD FROM 7.1 PERSONS PER HOUSE HOLD TO 8.5 PERSONS

-225 PERSONS OF 280 LIVED IN THE SAME HOUSE OVER THE LAST 4 YEARS AND 20 OF 33 PERSONS HAVE LIVED IN BARRIO COCAL FOR MORE THAN 10 YEARS INDICATING A FAIRLY STABLE WELL ESTABLISHED COMMUNITY.

- 23 OF 33 FAMILIES QUESTIONED PREFERRED TO STAY IN THEIR OWN HOUSE EVEN THOUGH 29 OF 33 FAMILIES CONSIDERED THEIR HOUSE TOO SMALL

-CONSIDERING THAT FOOD IS A PROBLEM IN PUERTA COMBINED WITH THE FACT THAT THE GOVERNMENT IS TRYING TO DECREASE LOT SIZE PER FAMILY IN ORDER TO GIVE MORE FAMILIES ACCESS TO UTILITIES ALL 33 FAMILIES INDICATED THEY WOULD LIKE TO HAVE THEIR OWN GARDEN WHERAS ONLY 12 OUT OF 33 ACTUALLY HAD THEIR OWN GARDEN.

-22 FAMILIES WANTED MORE SHADE INDICATING A POSSIBLE COMBINATION OF FRUITING TRESS AND SHADE

-MATERIAL AND STRUCTURAL PROBLEMS WERE DOMINENT IN ROOF AREA AND STEPS. UNFORTUNATELY FLOORS FAILED TO GET INTO THE QUESTIONAIRE AND MIGHT BE CONSIDERED TO BE PART OF THE HIGH RESPONSE IN THE CATAGORY CALL OTHER.

A SURVY WAS NEARLY FINISHED AT THE TIME OF THIS REPORTING THAT WILL SUMMARIZE TYPICAL RANGES OF EXISTING SPACIAL SIZES FOR 12 FAMILIES OF THE 33 SURVEYED. THIS WAS DONE NOT ONLY FOR EACH SPACE USE IN THE HOME BUT WILL ALSO INCLUDE TYPIAL LOT SIZES NOW EXISTING IN THE COMMUNITY. IT IS HOPED THAT THIS STUDY CAN BECOME A MAJOR DETERMANENT IN MODULAR SIZES PROPOSED IN NEW COMPONENTS FOR HOUSING. A POSSIBLE PANAL TYPE MADE FROM WASTE SAW DUST THAT CAN IN TURN BE SAWN TO FIT OLD STRUCTURES BUT WHOSE MODULAR SIZE FITS A DIMENSIONAL INCREMENT RESULTING FROM THE ABOVE STUDY IN ORDER TO FIT NEW STRUCTURES, IS THE MAIN OBJECTIVE.

COCAL SURVEY

1. Family name.________

2. Family adress.________

3. How many years you have living in this area?________
4. How many people were living hear since four years?________
5. Were they living in the same building? Yes____ No____
6. Where were they living before they came to live hear?________
7. Number of persons who lives in the same building.________

Name	Sex	Age	Relationship

8. Family names of related family members within neighborhood

Name	Sex	Age	Relationship

9. What do you share among other members of the family that lives in the same are?

		Yes	No
You Share:	Food	–	–
	Animals	–	–
	Garden	–	–
A) you Share:	Building task	–	–
B) " "	Building materials	–	–
C) " "	Water	–	–
D) " "	Kitchen	–	–
E) " "	Bathroom	–	–
F) " "	Land	–	–
G) " "	Latrine	–	–

H) Others________
(Specify)

10. Which is most important for your family to share among other family members. A, B, C, D, E, F, G, H.

11. Which would you like not to share if you had the choice.
________________.

12. Do you presently own land together with other family member in this neighborhood? Yes_____ No_____

13. How much land do you feel is yours. (Interviewer identify actual markings).________________

14. FACILITIES.

Climate:

-Do you feel as though you have enough breeze from the wind?
Yes_____ No_____

-Which direction do you get the best breeze from?
N, NE, E, SE, S, SW, W, NW.

-Do you have good window?

-Do you feel that you could use more shade trees?

-How do you cool yourself when it is too hot?

Sleep in shade	take shower
Go swimming	Others________________ (Specify)
Drink	

-What part of your house is hotest, and why?

Water:

	Yes	No
Do you get water from: Well	-	-
Cistern	-	-
tanks	-	-
Asbesto/cement tanks	-	-
Pipe water	-	-

-Do you feel that your water is of good quality? Yes_____ No____

-If it is not good, do you feel it is:

	Yes	No
- Dirty	-	-
- Doesn't tast go d	-	-
- Has insects in it	-	-
- Dead animals	-	-
- Green algae	-	-
Others________________ (Specify)		

15. Sewage:

Type:

	Yes	No
-No personal toilet	-	-
-Out house	-	-
-Toilet with septic field	-	-
- City sewer	-	-

-Drainage

16. Health and sickness in the family.

	Frecuent	Not frecuent	Never
Diarya	-	-	-
Colds	-	-	-
Stomach	-	-	-
Headach	-	-	-
Skin/hair/feet	-	-	-
Bits: mosquito	-	-	-
Spider	-	-	-
Scorpion	-	-	-
Snakes	-	-	-

17. Do you produce any foodstuff? Yes____ No______

- Do you own animals? Yes_____ No ______
- Would you like to own animals? Yes____ No____
- Type:

  Chickens ducks
  pigs Rabbit
  Cows turkey

  Others__________________
  (Specify)
- Have you ever owned animals Yes_____ NO______.

Garden

- Do you own a garden? Yes_____ No______
- Would you like to own a garden__________________
- What do you grow?______________,__________________.
- Whato do you like to grow.______________________
  (Specify)

Food Storage:

	Yes	NO
- dried	-	-
- Salted	-	-
- fresh from garden	-	-
- refrigerator	-	-

How do you protect food from ants, roaches, rats, etc.

	Yes	No
-Food cooking	Yes	No
a) Wood	–	–
b) butahe gas	–	–
c) kerosene	–	–
d) electricity	–	–
e) Saw dust/rice husk	–	–
f) charcoal	–	–

- What kind of cooking technique do you prefer?
  a, b, c, d, e, f,

18. Materials

Problems:

a) structure-posts
b) Roof 1 aks? (Interviewer marks down what type of roof)
c) Steps
d) Doors
e) screen (insect)
f) furniture
g) Other________________
(specify)

- Which is the most important? a, b, c, d, e, f, g,
- Why?________________
- Which is the most costly for me to repair?
  a, b, c, d, e, f, g.

19. Distribuition of the building:

- How many rooms it have?
- Bedrooms________ Hall________ kitchen________ Others________.
- Do you feel your house is small? Yes____ No____
- Would you like to make bigger? Yes ____ No____
- Which room would you like to make bigger? ____________
- Would you like to change to a nother house? Yes_____ No____
- Why?________________.

20. Space Use:

Draw plan of house including al spaces,(including storage),all windows, doors, furniture, measure all spaces.

21. Draw measured plan of yard, including; animals pens, gardens, storage, dimensions of whole lot, dimensions of shaned space, with other family members, position of house, position of road and paths.

22. General plan of extended family neighbor hood, including: relative position of house, sheds paths, roads; mutually owned or used space.

Foot note:

- Use one page for each point mention above.
- Make enphasis on:

Lot area

use of the are

service

Social use of are.

ENCUESTA DEL BARRIO " EL COCAL."

PROYECTO DE MATERIALES NO TRADICIONALES.
(CIDCA-MINVAH 1984)

Boleta No.__________

1. Nombre de la familia____

2. Dirección exacta de la casa__________________________________

3. Cuántos años tiene de vivir aquí? ____________________________

4. Cuántas personas vivían en su casa hace 4 años?_________________

5. Estaban en la misma casa? Sí___ No___

6. Dónde vivían antes de venir a esta casa?_______________________

7. Número de personas que viven en la casa._______________________

Nombre	Sexo	Edad	Parentezco

8. Otros familiares que también viven en Barrio El Cocal

Nombre	Sexo	Edad	Parentezco

9. Qué comparte Ud. con los demás miembros de la familia que tambien viven en el barrio?

Comparte:

	SI	NO
Alimento	-	-
Animales	-	-
Huerto	-	-
A)Comparte: Trabajos de construcción	-	-
B)Comparte: Materiales de "	-	-
C)Comparte: Agua	-	-
D)Comparte: Cocina	-	-
E)Comparte: Baño	-	-
F)Comparte: Terreno	-	-
G)Comparte: Letrina	-	-

H)Otros_______________________________
(Especificar)

10. Cuál es más importante para tu familia de compartir con los otros miembros de la familia, que tambien viven en el barrio?
A,B,C,D,E,F, G,H.

11. De los elementos señalados, si pudieras elegír cuál no te gustaría compartir?________________________

12. Tiene usted un terreno que comparte con otros miembros de la familia que tambien viven en el barrio? Si____ No_____

13. Qué extensión de terreno cree que posee? (El entrevistador identifica los límites del solar)____________________

14. FACILIDADES:

Clima:

- Cree Ud. que recibe suficiente aire? SI_____ NO_____
- De que dirección reciba más aire fresco?
  N, NE, E, SE, S, SO, O, NO.
- Tiene Ud. una buena ventana?
- Tiene Ud. buenas puertas?
- Cree que puede usar más sombra de los árboles?
- Cómo se refresca Ud. cuando hace mucho calor?

Duerme bajo sombra	Se baña
Va a Nadar	Otros________________
Toma agua	(Especificar)

- Qué parte de tu casa es más calurosa y porqué?

Agua:

-De dónde toma el agua?

Pozo ________

Cisterna ________

Barriles ________

Tanques de asbestos/cemento. ________

Agua por tubería. ________

- Cree Ud. que su agua es de buena calidad? Si___ No__
- Si cree que no es bueno, cree entonces que es:

Sucio ________

No tiene buen sabor ________

Contiene insectos ________

Animales muertos ________

Algas ________

Otros ________________
(Especificar)

15. SERVICIO:

Tipo:

- Inodoro dentro de la casa ______
- Fuera de casa ______
- Letrina individual ______
- Letrina colectiva ______
- No tiene servicio ______
- Dónde tira el agua?
  - Drenaje ______
  - Fosa aséptica ______
  - Superficial ______

16. SALUD Y ENFERMEDADES EN LA FAMILIA.

	Frecuente	No frecuente	Nunca
-Diarrea	----	----	---
-Catarro	----	----	---

- Dolor de estómago ---- ---- ----
- Piel/pelo/pies ---- ---- ----
- Picaduras de:
  - Zancudo ---- ---- ----
  - Araña ---- ---- ----
  - Escorpión ---- ---- ----
  - Culebras ---- ---- ----

17. Produce algún alimento en su casa? Si____ No____

-Posee Ud. animales? Si____ No___ Cuáles________

-Tipo de animales que le gustaría tener:

-Gallinas	---	Patos	---
-Cerdos	---	Conejos	---
-Vacas	---	Chompipe	---

-Otros____________________
(Especificar)

- Le gustaría tener animales? ---
-Ha tenido animales alguna vez ---

<u>Huerto</u>:

-Tiene Ud. un huerto? Si___ No___
-Qué siembra?________________,__________________.
-Le gustaría tener un huerto? Si____ No____
-Qué le gustaría sembrar?_________ ______________
(Especificar)

Almacenamiento de alimentos:	SI	NO
- Secado	-	-
- Salado	-	-
- Recién cosechado	-	-
- refrigerador	-	-

- Cómo protege su alimento de las: Hormigas, cucarachas, ratones, etc.?

Cocina su comida con: SI NO

a) Leña
b) Kerosene
c) Electricidad
d) Aserrín/cáscara de arroz.
e) Carbón
f) Gas butano-propano.

-Qué tipo de cocina prefiere?
a, b, c, d, , f,

18. MATERIALES:

Problemas:

a) Estructura del poste.
b) Gotea el techo (El entrevistador anota qué tipo de techo es: de metal, otros. etc)
c) Gradas
d) Puertas
e) Malla o cedazo
f) Muebles
g) Otros____________________
(especificar)

- Cuál es el más importante: a, b, c, d, e, f, g,
- Porqué?________________
- Cuál es el más costoso de reparar: a, b, c,d,e, f,g

19. Distribución de la casa.

- Cuántos cuartos tiene?

Dormitorios__________ Sala __________ Cocina__________
Otros __________

- Le parece que la casa es pequeña Si____ No____
- Quisiera ampliarla? Si____ No____

Cuál de los cuartos?____________________

-Preferiría cambiarse a otra casa? Si____ NO____

- Por qúé?________________

20. Trazar el plano de la casa incluyendo todos los espacios para almacén, ventanas, puertas, muebles, medir todos los espacios.

21. Trazar el plano del patio incluyendo espacios para el huerto, almacén, dimensiones de todo el lote, espacio compartido con otros miembros de la familia, posición de la casa, posición de caminos y calles.

22. Trazar plano general de un extenso vecindario incluyendo, posición relativa de viviendas o cobertizos, calles y caminos de uso común, o espacio usado.

Enfásis:

a) Area del Loto
b) Utilización de ésta
c) Servicios
d) Utilización social del área.

NOTA: Dedicar una página para cada plano solicitado en los puntos 20, 21, 22.

" MUESTREO REALIZADO EN EL BARRIO EL COCAL-ASPECTO SOCIO-ECONOMICO

PARA EL (PROYECTO DE MATERIALES - CIDCA- NIDWAN) PUERTO CAB. "

Años de vivir en el barrio el Cocal	Personas que vivian en su casa hace 4 años	Estaba en la misma casa	Procedencia	Personas que viven en su casa actualmente
2 años ó menos = 6 2 a 4 años = 1 5 a 10 años = 6 10 años ó más = 20	225	Si = 28 No = 5	Krukira = 6 Pto. Cab. = 10 [illegible] = 1 [illegible] = 1 Sandy-Bay = 2 Cukalaya = 1 Boom-Sirpi = 2 Cabo Gracias = 1 Krukira = 1	280

Que comparte usted con los demás miembros de familia viven en el barrio	Comparte	No Comparte	Lo más [illegible]	Recibe suficiente aire	Dirección donde recibe más aire
Alimento	10		1	Si = 10 No = 1 No resp. 2 Total 13	N, NE, E, SE, S, SO, O, NO 4, 14, 14, 12, 1
Animales	1				
Huerto	2				
Trabajo de Construccion	2				
Material de "			1		
Agua	6	1	5		
Cocina	6				
Baño	3	1	3		
Letrinas	5		1		
Otros	1				
total	40	2	13		

	Tiene buena huerta	Puede usar más sombra de los árboles	Como se refresca usted cuando hace mucho calor	Que parte de la casa es mas calurosa
Si =11 No =22 Total=33	Si =10 No =23 Total=33	Si = 22 No = 6 No Resp. 5 Total 33	Duerme bajo sombra = 10 Va a nadar = 2 Toma agua = 2 Se baña = 21 Otros = 9 Total 44	Cocina = 7 Habitación 10 Total 17

		Cree usted que su agua es de buena calidad?	Servicio	Donde tira el agua?
Pozo Cisternas Barriles Tanque de bustos /c Agua por	1 2 = 30 l= 33	Si = 31 No = No resp= 2 Total 33	Inodoro dentro de la casa Fuera de la casa = 4 Letrina individual = 8 Letrina colectiva = 10 No tiene servicio = 11 Total 33	Drenaje Fosa Aséptica Superficial 33 Total 33

I	dad	Produce algun alimento en su casa?	POsee usted animales	Tipo de animales
 Catarro Dolor de Estómago Piel/piel/pelo	Frecuente / No Frecuente 15 / 8 18 / 8 5 / 2 1 / 1	Si = 14 No = 17 No.Resp= 2 Total 33	Si = 10 No = 21 No. Resp = 2 Total 33	Gallina = 28 Cerdo = 12 Vacas = 2 Patos = 12 Conejos = 0

..../..../...

Le gustaría tener animales?

Sí	30
No	3
Tot.	33

Ha tenido animales alguna vez?

Sí	13
No	20
Tot.	33

Tiene usted un huerto

Sí	12
No	20
No Resp.	1
Tot.	33

Le gustaría tener un huerto?

Sí	33
Tot.	33

Almacenamiento de alimento

secado	20
salado	26
refrigerador	1
recien cosechado,	11
	[illegible]
Tot.	58

Como protege usted los alimentos de las hórmigas, cucarachas etc.

Tapado	11
enlatado	11
sacos	2
cajas	1
barriles	2
taperes	1
plasticos	1
mesa	8
no responde	1
TOTAL	58

Cocina su comida con: y que tipo de cocina prefiere?

	Cocina Con:	Tipo de cocina prefiere?
Leña	32	6
Kerosene	5	17
Eléctrico		2
Carbon	2	7
Gas butano,		5
propano	30	31
	Tot. 30	Total 31

Problemas de Materiales

a) estructura del poste	5
b) goteo el techo	16
c) gradas	12
d) puertas	10
e) malla o cedazo	1
f) muebles	7
g) otros	15
Total	66

Cual es el más importante?

a)	10
b)	20
c)	6
d)	3
e)	2
f)	4
g)	11
Tot.	56

Cual es el mas costoso de reparar?

a)	10
b)	21
c)	4
d)	3
e)	1
f)	3
g)	9
Tot.	51

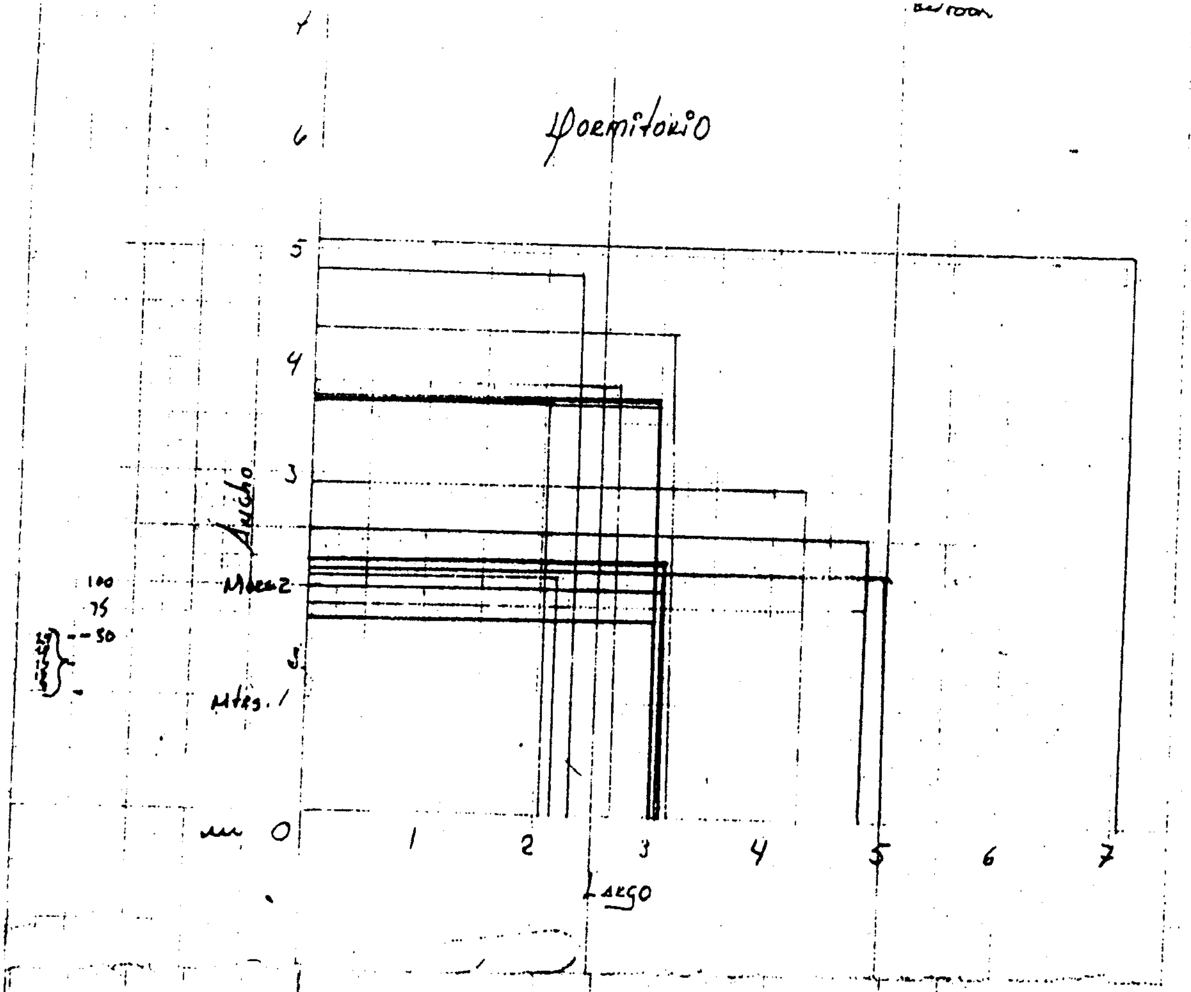
Cuantos cuartos tiene?

1	Espacio	31
3	Habitación	2
	Total	33

PASA AL REVERSO DE ESTA HOJA, CON?

Quisiera ampliarla	Preferería cambiar de casa ? *change.*	Extensión de terreno que posee:
Sí = 30 No = No Resp. = 3 Total 33	Sí = 8 No = 23 No Resp. = 2 Tot. 33	Promedio = 556 m^2 Mediana = 375 m^2 NOTA: Solo se cuenta con información del 50% de los casos. No se reportaron las desmembraciones

Le parece que la casa es pequeña? *small.*
Sí = 29 No = 2 No resp. = 2 Tot. 33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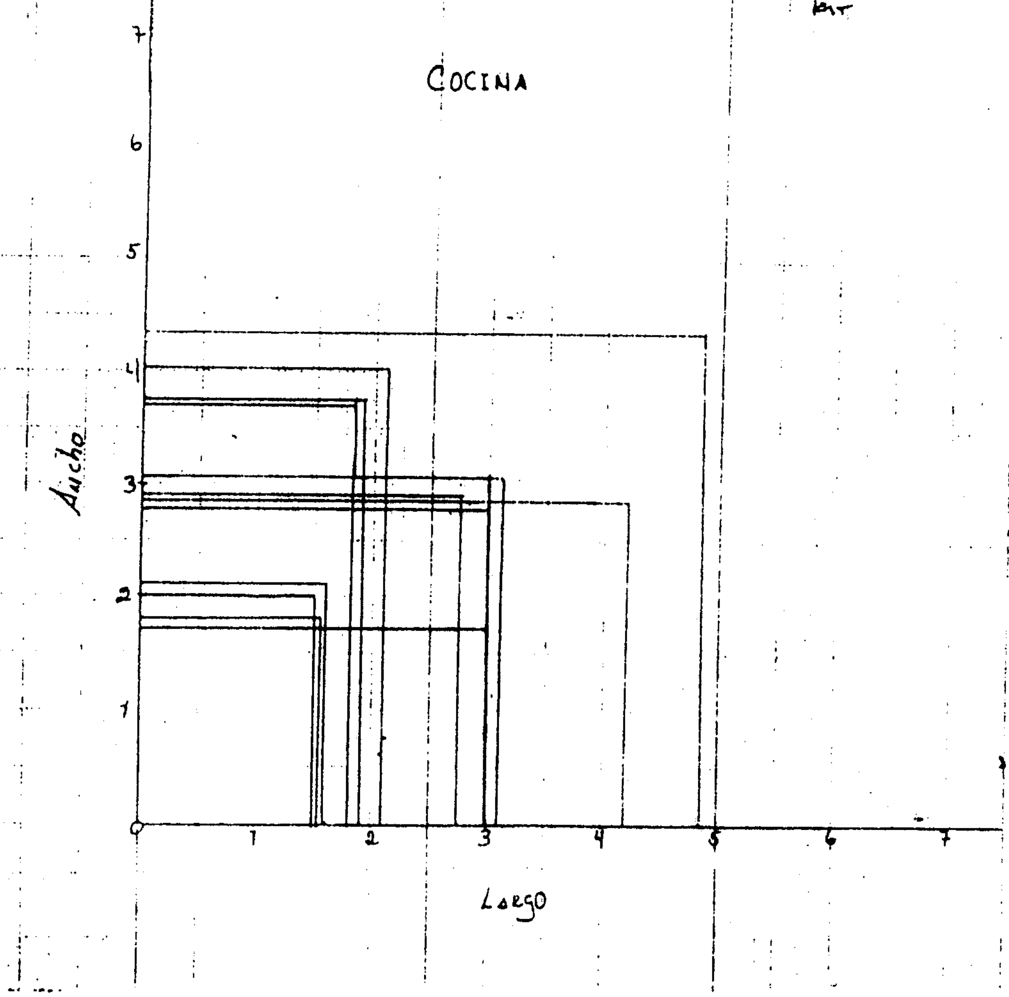
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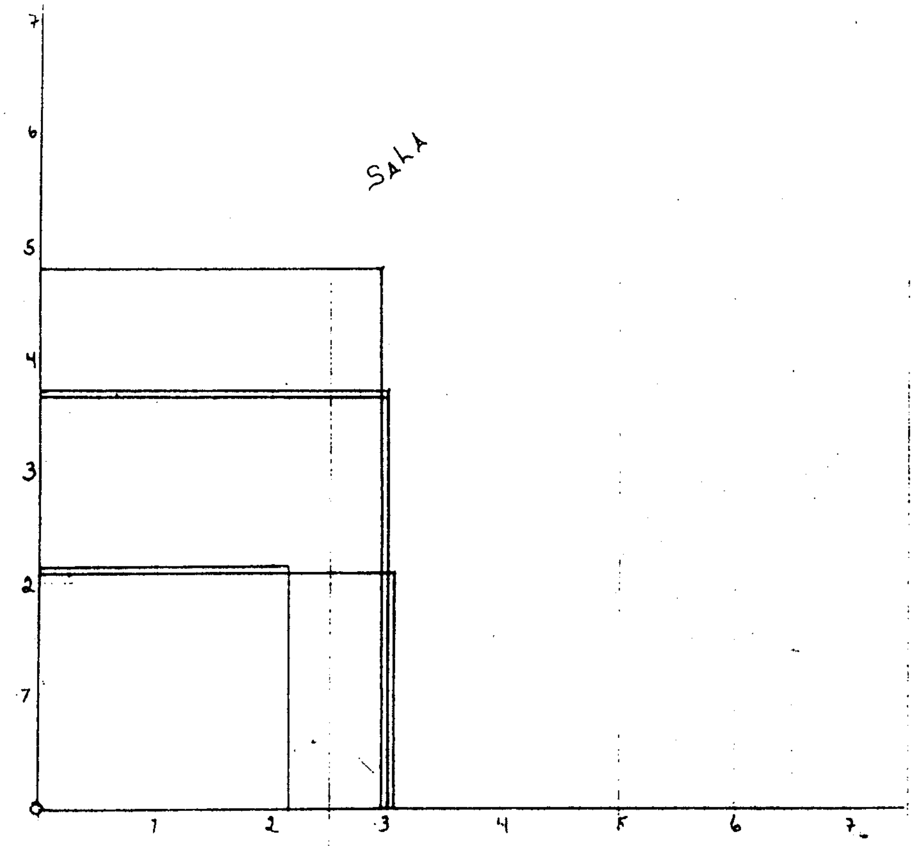
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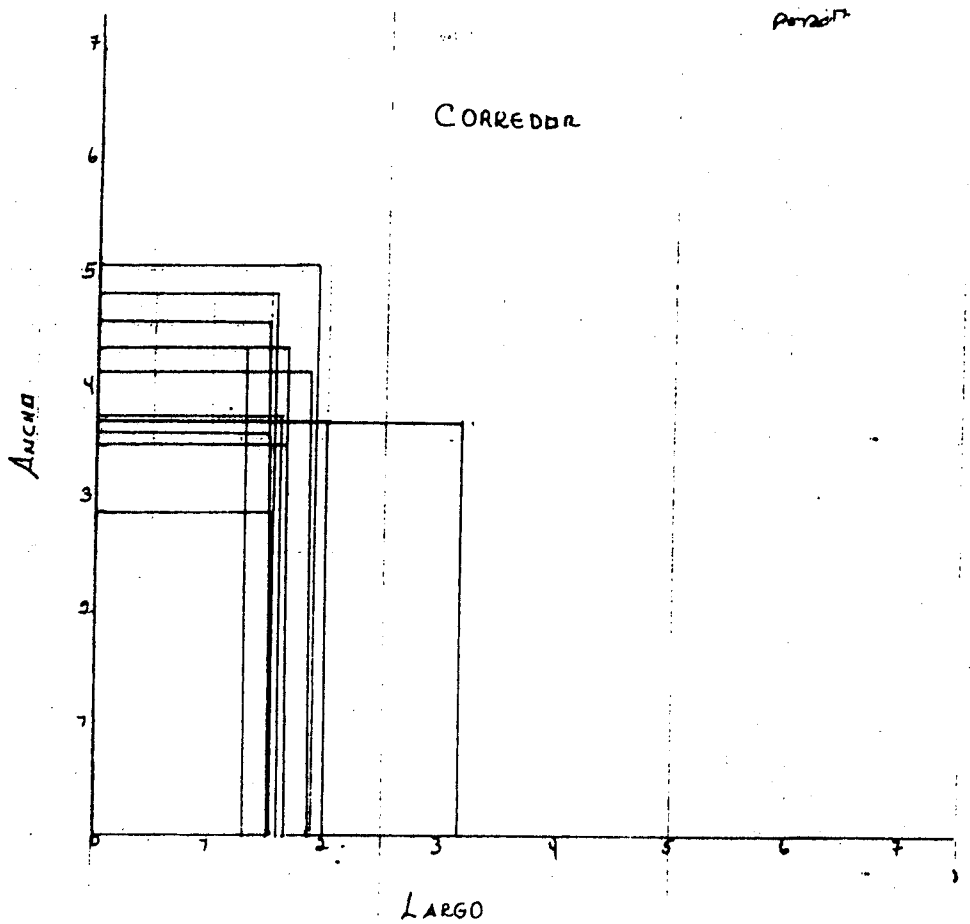

CORREDOR
ANCHO
LARGO

LABORATORY REPORT

CERAMIC SUMMARY

VARIOUS GRADES OF KAOLINITE CLAYS MOSTLY IN THE FORM OF BAUXITE CLAYS HAVE BEEN CONFIRMED TO EXIST IN MAJOR QUANTITIES WITHIN ZELAYA NORTE ZONA ESPECIAL 1 (CONFIRMATION BY TWO SEPARATE LABORATORY FACILITIES). THESE FINDINGS ALTHOUGH GENERALLY KNOWN TO EXIST HAVE NOT PREVIOUSLY BEEN SUBJECT TO ACTUAL TEST.. FIVE SAMPLES OF CLAYS WITHIN 30 KM OF PUERTA CABEZAS WERE SUBJECTED TO PHYSICAL/HYDRAULOGIC AND REFRACTORY (1000 DEG. C.) CLASSIFICATION PROCEDURES. ALL TESTS SHOWED POSITIVE RESULTS. THE FIRED CLAY PRODUCTS HAVE ALSO BEEN SUBJECTED TO SUBMERGENCE IN WATER FOR MORE THAN 1 WEEK WITH NO DETERIORATION THUS SHOWING POTENTIAL BRICK QUALITY. THESE CLAYS SEEM TO HAVE IMPORTANT SIGNIFICANCE IN BOTH THE CERAMICS BUILDING INDUSTRY AND CERAMICS ARTS AND CRAFT INDUSTRY AND THEY REPRESENT CLAYS COVERING 14,880.4 KM2 OF THE REGION.

KAOLINS OFFER A CONSIDERABLE RANGE OF USES FROM SEWER PIPE, FLOOR AND ROOF TILE, BUILDING BRICKS OF VARIOUS TYPES, AND SOME OF THE FINEST CHINA CLAYS FOR POTTERY. THE LATTER IS SIGNIFICANT ALSO FROM AN HISTORICAL VIEWPOINT SINCE THE ARCHEOLOGICAL FINDINGS IN AND AROUND THE SANTA FE/KILGNA AREA SHOWED POTTER BEING USED HISTORICALLY WITHIN THE MISKITO CULTURE ALONG THE RIO COCO.

SINCE BAUXITIC TYPE CLAYS IN HIGH RAINFALL ZONES EXIBIT CERTAIN DEFICENCIES THAT WOULD NORMALLY LIMIT THE USE OF THESE CLAYS, IT IS SIGNIFICANT THAT THE PRINCIPAL LIMITING INGREDIENT THAT OF SILICA CAN ALSO BE FOUND IN THE REGION FROM OTHER SOURCES MAINLY THAT OF HIGH SILICA SAND AND RICE HUSK FROM THE AGRICULTURAL INDUSTRY. THIS DICOVERY NOT ONLY INCREASES THE RANGE IN THE USE OF CERAMIC PURPOSES BUT GIVES AN ADDITIONAL USE TO THESE CLAYS MAINLY IN THE FORM OF BURNT CLAY TYPE INDIGENOUS CEMENTS FOR MORTAR AND OTHER USES. THE EXISTENCE OF HIGH SILICA SAND ITSELF (ALTHOUGH STILL REQUIRING LABORATORY CONFIRMATION) ALSO INTRODUCES THE POSSIBILITY OF A GLASS INDUSTRY.

CEMENT SUMMARY

ALTHOUGH A LITERATURE SURVEY TOLD US THAT BURNT BAUXITE CLAYS ONCE GROUND AND MIXED WITH LIME HAVE FORMED CEMENT LIKE MATERIALS (LE CHATELIER INVESTIGATION ON THE RUINS AT LES BAUX IN THE RHONE VALLEY) IT IS GENERALLY AGREED THAT FURTHER WORK ON THIS PARTICULAR TYPE BURNT CLAY CEMENT MUST BE DONE. THE PROBLEM USUALLY ASSOCIATED WITH BAUXITE CLAYS IS THEIR LACK OF THE SILACOUS MATERIAL NECESSARY FOR PROPER POZZOLANIC ACTIVITY TO TAKE PLACE. IT IS THEREFORE IMPORTANT IN THE DEVELOPEMENT OF CEMENTATOUS MATERIALS IN TROPICAL CLIMATES FOR THE PROPER PROPORTION OF SILICA TO BE FOUND LOCALLY AND COMBINED WITH THESE CLAYS FOR CEMENT PRODUCTION.

OUR LABORATORY PROCEDURE THEREFORE BECAME ONE OF EXPERIMENTING WITH THE ADDITION OF OTHER SILICA BASED MATERIALS FROM THE REGION MIXED WITH THE BAUXITE CLAYS WHICH THEMSELVES WHEN MIXED ONLY WITH LIME PROVED NOT SUFFICIENT AS CEMENT. SO FAR THIS WORK HAS ONLY INVOLVED THE USE OF RICE HUSK, WHICH WHEN BURNED OFFERS A PRODUCT FROM 80 TO 90 PERCENT PURE IN SILICA. THE RESULTS HAVE SO FAR BEEN ENCOURAGING. SAMPLES AFTER CURING PROVIDED AN ESTIMATED 500PSI (PLUS) COMPRESSION STRENTH AND DID NOT DISINTEGRATE WHEN SUBJECTED TO BOILING WATER FOR A TWENTY FOUR HOUR PERIOD IN FACT INCREASED IN STRENGTH. LIME, THE THIRD INGEDIENT IN THESE TYPE CEMENTS IS PRESENTLY AN ONGOING INDUSTRY IN THE ROSETTA AREA BUT THIS ACTIVITY WOULD HAVE TO BE INCREASED AND DECENTRALIZED POSSIBLY WITH THE USE OF SEA SHELLS OR LIME STONE SOURCES NEAR SISIN AS A LIME SOURCE.

GLASS SUMMARY

GLASS IS FORMED BY SUBJECTING HIGH SILICA BASED SANDS TO 2600 DEG. F. TEMPERATURE AFTER MIXING WITH POTASH, SODA, AND LIME. THIS PRODUCT CAN BE REMOLDED AND SHAPED UPON REHEATING THE

RESULTING MATERIAL TO 1100 DEG. F. AT THE TIME OF WRITING THIS SUMMARY A POTENTIAL SOURCE FOR THIS SAND HAS BEEN PRELIMARILY IDENTIFIED AND MAKES UP SEVERAL SQUARE KILOMETERS OF AREA BETWEEN SISIN AND TUARA. NO ATTEMPTS YET HAVE BEEN MADE AT MIXING THESE SANDS WITH THE KAOLINITE CLAYS NOR HAS THERE BEEN ANY ATTEMPT AT THE ACTUAL PRODUCTION OR GLASS.

ONE OF TWO NONCOMMERCALLY VALUABLE LUMBER SPECIES WAS CUT IN THE FOREST WITHIN 30 KM. OF TOWN TO BE SET UP FOR THE ELECTROLYSIS PROCESS OF PRESERVATION IN SEA WATER. A DESIGN FOR CUTTING THIS LUMBER WAS CHOSEN THAT BOTH ENABLES THE ELECTROLYSIS PRESERVATION TECHNIQUE TO OCCURE ON A PRODUCTION TYPE BASIS AND TO MINIMIZE CUTTING AT THE MILL AND THUS LOWERING ENERGY USE AND WASTE SAWDUST AT THE MILL COMPARED TO EXISTING SAW MILLING PRACTICES. THE TWO SPECIES CHOSEN FOR PRESERVATION WERE ZEPOLETA AND DURANGOBECAUSE THEY WERE STRAIGHT AND SOFT WOODS THAT WERE NORMALLY UNSUITABLE STRUCTURALLY FOR HOUSING. SINCE THE PETRIFICATION PROCESS HARDENS THE WOOD TO A HIGH COMPRESSION SRENGTH AND THE WOOD CAN ALSO RETAIN SOME TENSILE CAPACITY DEPENDING ON THE LENGTH OF TIME IN THE SEA WATER, IT WAS DECIDED TO SET THE WOOD IN THE WATER FOR THREE MONTHS.

A WIND GENERATOR AND BATTERY CHARGER WERE SET UP ON THE MUNICIPAL DOCK TO BEGIN THE ELECTROLYSIS PRESERVATION PROCESS ON AT LEAST ONE OF THE LUMBERED WOOD PIECES. TWO DIFFERENT POWER SOURCES WERE CHOSEN BECAUSE BOTH GOOD WINDS AND CITY ELECTRICITY WERE AVAILABLE ON THE DOCK AREA AND ONE COULD PROVIDE BACKUP FOR THE OTHER IN CASE OF FAILURE. UNFORTUNATERLY THIS STRATEGY PAID OFF QUITE SOON AS A TROPICAL SQUAL WITH 40 TO 50 MPH WINDS CAUGHT US AT THE WRONG TIME AND THE WIND GENERATOR PROPELLER FAILED ON SATURDAY JULY 14. HOPEFULLY ANOTHER FAILURE, THAT OF THE BATTERY CHARGER, WILL NOT PLACE THIS PART OF THE PROJECT IN JEOPARDY.

SEA PRESERVATION EXPERIMENT FAILED DUE TO HEAVY WAVE ACTION. IT HAS BEEN DECIDED THAT PETRIFICATION TANKS ARE ADVISABLE AND THAT SEA WATER NEEDS TO BE RENEWED TWICE PER WEEK. ALBERO FROM CIDCA WAS OF TREMENDOUS HELP WITH ALL SEA RELATED ACTIVITIES OVER THE PAST TWO WEEKS. ALSO ING. NOEL RODRIGUEZ OF GEO TECNIC FROM MANAGUA IS PROVING TO BE OF GREAT HELP IN THE EARTH LAB AND WOULD BE A LIKELY PERSON TO TAKE OVER THAT ROLE AT SOME LATTER DATE. HE IS THE SAME PERSON WHO WILL BE DOING THE DOCK EXPERIMENT WITH CMPBS.

November 1, 1984

EVALUATION OF WOOD CHIP PANAL

WOOD CHIP PANALS, REFERRED TO STRUCTURALLY AS LAMINAR COMPOSITES, ARE MADE UP OF TWO THIN HARD, STRONG, STIFF, AND DENSE FACINGS COMBINED WITH A RELATIVELY THICK, LIGHT WEIGHT, LOWER STRENGTH, LOWER DENSITY CORE TO PROVIDE A COMBINATION POSSESSING STRENGTH AND STIFFNESS WITH LOW WEIGHT. THIS PANAL ALSO HAS A GOOD INSULATING VALUE.

LABORATORY

THE APPROACH TAKEN ON THE PUERTO CABEZAS INDIGENOUS HOUSING PROJECT WAS TO COMBINE THIN (APP. 1/16 TO 1/8 IN.) COCONUT FIBER REINFOROED CEMENT SURFACES (2% by wt. COCONUT FIBER WITH 1:3 CEMENT TO SAND MIXTURE) AND WOOD CHIPS (MEASURING APPROXIMATELY 1/2"X 1" X 1/16") AS THEY COME FROM THE PLAINER AS A WASTE PRODUCT THE LATTER BECAME THE LIGHT WEIGHT MATERIAL BETWEEN THESE TWO SURFACES. THE WOOD CHIPS ARE WETTED TO THE EXTENT THAT THEY ARE BARELY DRIPPING AND THEN DRY, PURE PORTLAND CEMENT IS SPRINKLED ONTO THEM. THE WATER USED CONTAINES APPROXIMATELY 1 TABLESPOON OF POWDERED SOAP PER GALLON BOTH AS A WETTING AGENT TO BETTER SPREAD THE CEMENT OVER THE WOOD PARTICLES AND TO MAKE UP FOR THE ORGANICS THAT DISSOLVE IN THE WATER (THE LATTER WOULD NORMALLY MAKE THIS WATER UNSUITABLE TO MIX WITH CEMENT).

THE RATIO OF CEMENT TO CHIPS VARIED IN THE LABORATORY FROM 1.25 TIMES THE WEIGHT OF CHIPS TO .66 TIMES THE WEIGHT OF CHIPS. ALL SAMPLES WERE PRESSED WITH 1 PSI OF WEIGHT AND LEFT ABOUT 4 HOURS, RELEASED FROM THE MOLD AND SURFACED. A MORE PRATICAL METHOD WAS FOUND BY FIRST PLACING THE FIBER CEMENT INTO THE MOLD AND THEN THE WOOD CHIPS SO THAT ONE SURFACE WAS COMPLETEDBEFORE PROCEEDING. THE ONE SAMPLE THAT WAS NOT PRESSED TO THE 1 PSI WAS AN OBVIOUS FAILURE WITHIN 24 HOURS. THE 1.25 SAMPLE APPEARED TOO DENSE AND THEREFORE TOO HEAVY. THE

RATIO .66 SEEMED RELATIVELY LIGHT AND STRONG IN THE LABORATORY BUT NO BENDING OF SHEAR TESTS WERE ABLE TO BE MADE DUE TO LACK OF EQUIPMENT. (THESE TESTS ARE USUALLY PRESCRIBED FOR SANDWICH TYPE PANALS).

THE QUANTITY OF CEMENT USED WAS COMPARED TO THAT USED IN A CONCRETE BLOCK WALL (SINCE PORTLAND CEMENT IS A RARE COMMODITY IN PUERTO CABEZAS). THE 4" WALL CHOSEN FOR COMPARISON WAS A COMMERCIALLY MADE BLOCK WALL WITH THE LOWEST POSSIBLE CEMENT TO SAND RATIO (1:7.5). A WALL 3'X4' USED VERY NEARLY 12 BLOCKS. INCLUDING MORTAR (AT 15 LB CEMENT PER 25' OF MORTAR JOINT) THE WALL USED 44.85 LBS OF CEMENT. IN THE LABORATORY A 1" THICK SAMPLE COVERING 32 SQ. IN. UTILIZED 100 GRAMS OF CEMENT OR 3.125 GR./IN3. THIS WOULD MEAN THAT A 2IN THICK 3'X4' PANAL WOULD CONTAIN 10800 GRAMS OF CEMENT OR 23 LBS. IT IS ESTIMATED THAT THE SURFACING MATERIAL AT 1/8 IN THICK CONTAINS 2.93 LBS OF CEMENT. THE LABORATORY PANAL ALSO CONTAINED 140 GRAMS OF CHIPS PER 32 IN3 OR 33LBS OF CHIPS PER 3'X4' PANAL. THUS SUCH A PANAL WOULD WEIGH APPROXIMATELY 80 LBS (INCLUDING 18 LBS OF MORTAR SAND ON BOTH SURFACES). THIS PANAL WOULD BE NEARLY LIGHT ENOUGH TO HANDLE AND SAVE ABOUT 16 LBS OF CEMENT PER 12 SQ. FT. OF WALL AREA COMPARED TO THE THINNEST AND LEAST STRONG CONCRETE BLOCK WALL AVAILABLE ON THE MARKET. HOWEVER A BUILDING PANAL WEIGHING 80 LBS IS DIFFICULT FOR A SINGLE PERSON TO MANUEVER. THEREFORE A 2'-8" X 4' PANAL WAS CHOSEN THUS SAVING ON WEIGHT AND CEMENT BY 10%. THIS ENABLED THE PANAL TO NOW WEIGH 72 LBS. IT WAS DECIDED THAT THIS PANAL WAS GOOD FOR LOWER AREAS BUT EAVES AND OTHER HIGHER AREAS SHOULD HAVE A SMALLER LIGHTER PANAL. A 1'-8' X 4' PANAL WAS CHOSEN SINCE IT ALSO FIT INTO OUR BUILDING MODULE AS AN ALTERNATIVE BUILDING MEMBER. THIS REDUCED THE WEIGHT TO LESS THAN HALF THE ORIGINAL 80 LBS DOWN NOW TO 38LBS.

FIELD EXPERIMENT

THE FIRST APPARENT DISCREPANCIES BETWEEN THE LABORATORY AND

THE FIELD WERE THAT MORE CEMENT WAS BEING USED IN THE FIELD AND THAT TOO MANY WOOD CHIPS WERE PREVENTING THE PRESSURE PLATE FROM PRODUCING THE REQUIRED 2" THICK PANAL.

THE AMOUNT OF CEMENT REQUIRED IN THE FIELD WAS DETERMINED BY WHETHER ALL THE WOOD CHIPS APPEARED THE SAME COLOR AFTER MIXING. THIS COLOR WAS ABOUT THE SAME AS THAT FOUND IN THE LABORATORY. THE APPARENT DESCREPANCY I BELIEVE WAS DUE TO SEVERAL FACTORS:

1) NEW MORTAR TROUGHS USED UP SOME CEMENT TO INITIALLY COAT THEMSELVES.

2) SINCE WE WERE IN AN OPEN AND BREEZY AREA AND SINCE WE SIFTED THE CEMENT BEFORE MIXING, WE LOST SOME MATERIAL BEFORE IT WAS ABLE TO GET MIXED.

3) MIXING BY HAND WAS NOT AS THOROUGH AS MIXING MECHANICALLY.

WE ALSO FOUND THAT WHEN WE REDUCED THE CHIPS BY 1/4 WHILE LEAVING THE QUANTITY OF CEMENT THE SAME, THIS MADE THE PANAL THE NECESSARY THICKNESS. UNFORTUNATELY BETWEEN TESTING PROTOTYPE EQUIPMENT WHILE AT THE SAME TIME TRYING TO TRANSFER THE CORRECT MIX FROM THE LABORATORY TO THE FIELD, THESE DISCOVERIES TOOK SEVERAL DAYS. THESE WERE THE LAST EXPERIMENTS DONE BEFORE DEPARTURE.

RECOMENDATIONS

1) SINCE THESE PANALS TAKE A LONG TIME TO DRY ONE MUST LEAVE THEM CURE FOR PERHAPS AS MUOH AS TWO WEEKS OR MORE. IN ORDER TO SPEED UP THE CURING PROCESS I SUGGEST THAT THE FINAL FIBERCEMENT COATING BE LEFT OFF WHILE THE DRYING PROCESS TAKES PLACE. THIS WILL EXPOSE THE ORGANIC FIBERS TO THE AIR AND SINCE ORGANIC FIBERS ARE KNOWN TO DISTRIBUTE MOISTURE EVENLY WITHIN A MATRIX THAT THEIR EXPOSURE TO AIR WILL ENABLE THE ENTIRE

PANAL TO DRY MORE QUICKLY.

2) THESE PANALS WILL REMAIN QUITE HEAVY UNTIL FULLY CURED. THIS MIGHT TAKE AS LONG AS ONE MONTH. THIS ALSO MIGHT MEAN THAT THEIR STRENGTH IS NOT SUFFICENT UNTIL THIS DRYING PROCESS IS COMPLETE. I WOULD MOVE THE DEMONSTRATION PANALS NO SOONER THAN OCT 25 AND THE LAST ONE MADE PERHAPS NOT UNTIL THE 1ST OF NOVEMBER.

3) MAKE MORE PLATFORMS AS A RESPONSE TO THE-LENGTH OF CURING TIME AND THE DAILY PRODUCTION RATE.

4) ALWAYS MAKE SURE ALL CHIPS HAVE THE SAME COLOR WHILE MIXING BEFORE PLACING INTO THE MOLD.

5) MAKE SURE THE PRESS IS DOWN ALL THE WAY WHEN PRESSURE IS APPLIED.

6) DON'T LET PANALS GET WET FROM THE RAIN.

7) A POSSIBLE MEANS OF MAKING THESE PANALS EVEN LIGHTER WOULD BE TO LET THEM DRY WITHOUT ANY SURFACING ON BOTH SIDES AND THEN TO MAKE SURE THAT THEY ARE STRONG ENOUGH TO WITHSTAND BUILDING ABUSE ON THE BUILDING SITE. AFTER THEY ARE IN PLACE IN THE BUILDING ONE WOULD PUT ON THE SURFACING.

FACTORY

AT THIS TIME THE SHELL OF A 2000 SQ. FT. PRODUCTION FACTORY HAS BEEN CONSTRUCTED FOR THE PURPOSE OF INDIGENOUS MATERIAL DEVELOPEMENT FOR HOUSING AND OTHER HOUSE RELATED PRODUCTION ACTIVITIES IN THE PUERTA REGION. THIS FACILITY IS TO ACT AS A SEED FOR FURTHER, MORE DECENTRALIZED FACILITIES TO BE LOCATED WITHIN INDIVIDUAL COMMUNITIES AND NEIGHBORHOODS AND THEREFORE WILL ACT PRIMARILY AS A PRODUCTION, RESEARCH AND TRAINING FACILITY. THE EQUIPMENT WITHIN THIS FACILITY IS THEREFORE CHOSEN TO ACT AT FIRST IN A DIRECT PRODUCTION MANNER WHILE GRADUALLY BECOMING MORE OF SEEDING BASE FOR CREATING DECENTRALIZED COMMUNITY BASED PRODUCION FACILITIES. THIS EQUIPMENT MUST EVENTUALLY BE LOOKED AT AS POSSESSING MULTIPURPOSE FUNCTIONS. THIS FACILITY IS LOCATED APPROXIMATELY 1000 FEET FROM THE EXISTING VOCATIONAL SCHOOL.

SKILLS AND EQUIPMENT

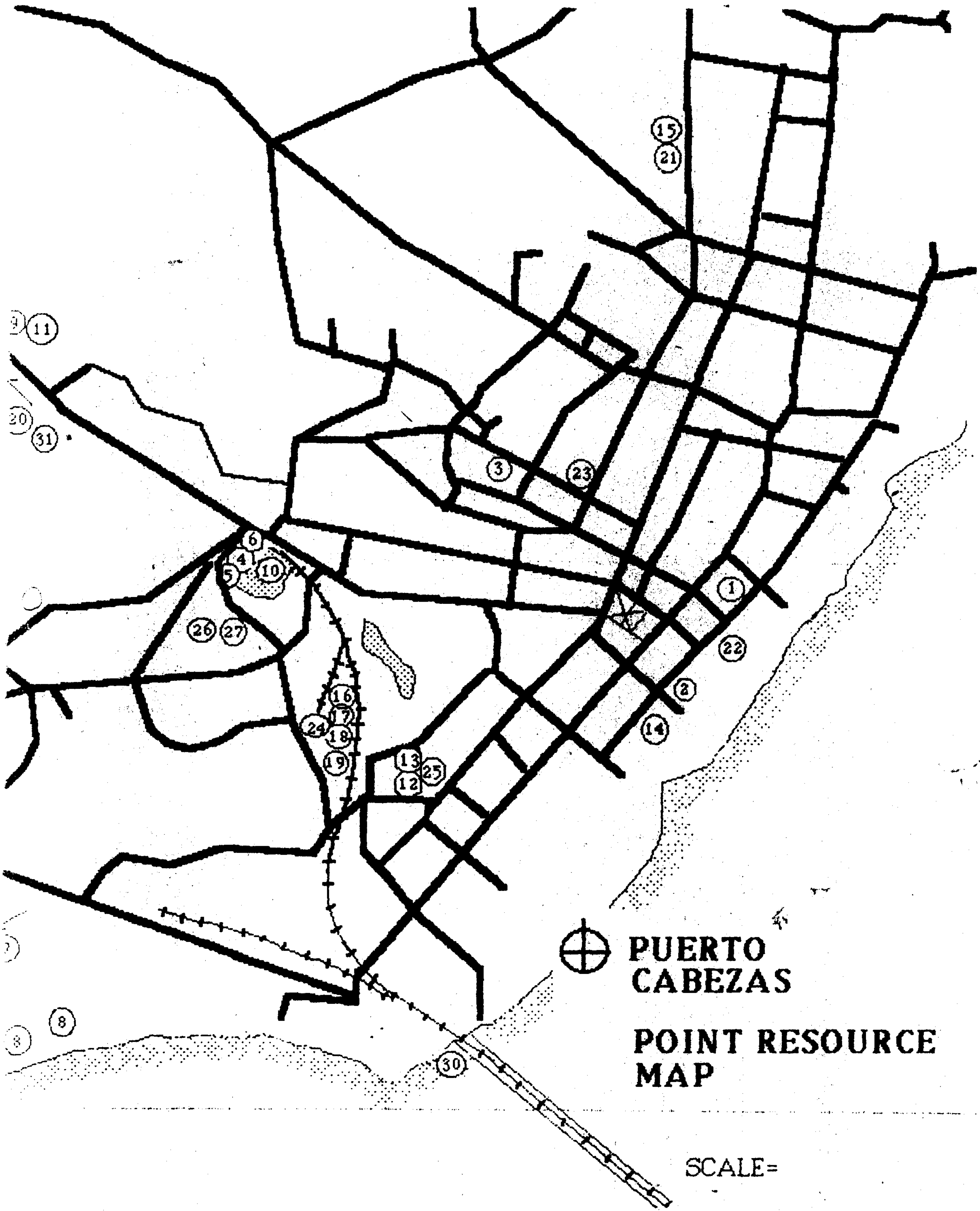
APPROXIMATELY 35 SKILL AND EQUIPMENT SOURCES HAVE BEEN IDENTIFIED WITHIN AND IMMEDIATELY AROUND THE PUERTA CABEZAS TOWN PROPER. THE FOLLOWING SKILL AREAS WERE IDENTIFIED;

MASONRY BLOCK AND MASONRY SINK PRODUCION,/ WELDING AND MACHINING,/ THATCH ROOF AND CORRIGATED ROOF INSTALLATION,/ LUMBERING, SAWMILLING AND PLANEING,/ BAKING WITH BRICK OVENS,/ SMALL BOAT FABRICATION,/ GASOLINE ENGINE REPAIR [ALL SIZES]./ BACK YARD GARDENING INCLUDING MANY EDIBLE NATIVE PLANTS,/ BASIC CISTERN AND HOUSE PLUMBING,/ SEPTIC TANK MANUFACTURING,/ HEAVY EQUIPMENT AND ROAD SCRAPEING CAPACITY,/ CARPENTRY,/ SHEET METAL FABRICATION,/AND THE USE OF FORGES.

IN MOST ALL OF THE ABOVE CASES INADEQUATE BACK UP EQUIPMENT EXISTED OR EQUIPMENT THAT WAS IN SERIOUS NEED OF REPAIR. AN EXCEPTION TO THIS WAS THE OVERABUNDANCE OF ELECTRIC WELDING MACHINES ESPECIALLY IN THE VOCATIONAL SCHOOL WERE NO WELDING ROD EXISTS. THE REPAIR AND MAINTENANCE OF SAWMILLING EQUIPMENT WAS WELL COVERED.

PUERTO CABEZAS POINT RESOURCE LIST

1 SAN PEDRO CONCRETE BL. YARD
2 SAN PEDRO CONCRETE SINK YARD
3 ABANDONED CONCRETE BL. YARD
4 RD. PAVING CONCRETE BL. MACH.
5 RICE HUSK MILL
6 OLD KILN FIRE BRICK
7 CHARCOAL KILNS
8 2-6' NAT. SALT WATER TUBS
9 CEMENT MIXERS
10 FRESH WATER POND
11 SAND AND GRAVEL SEIVES
12 RICE HUSK INCINERATOR
13 BALL MILL COMPONENTS
14 ROLLER FOR FIBER SEPARATION
15 OSCAR PALMER ROLLER FOR FIB. SEP.
16 SHEET METAL WORKING
17 WELDING
18 MACHINE SHOP
19 FORGE
20 LUMBER MILL
21 OS. PALMER CARPENTRY SHOP
22 CHURCH CARPENTRY SHOP
23 AUTO ELECT. SHOP
24 ELECT. MOTOR REPAIR
25 WELDING EQUIPMENT
26 WELDING SCHOOL
27 WOOD WORKING SCHOOL
28 SHEET METAL SCHOOL
29 TANKS FOR PRES. PROCESS
30 ELECT. AT SALT WATER EDGE
31 SAWDUST PILES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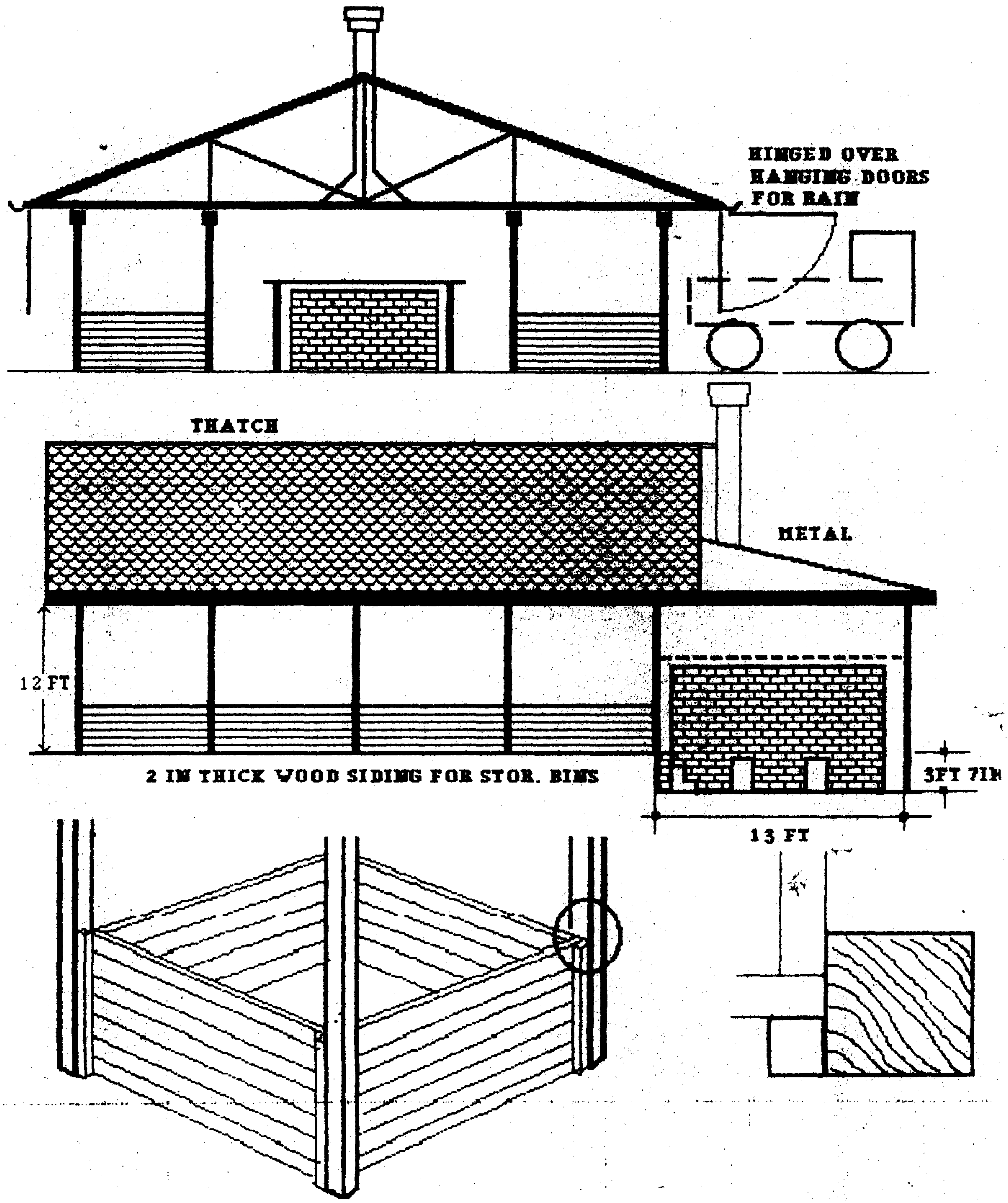
INDIGENIOUS MATERIALS FACTORY

CEMENT FACTORY
SECTION AND BIN DETAIL



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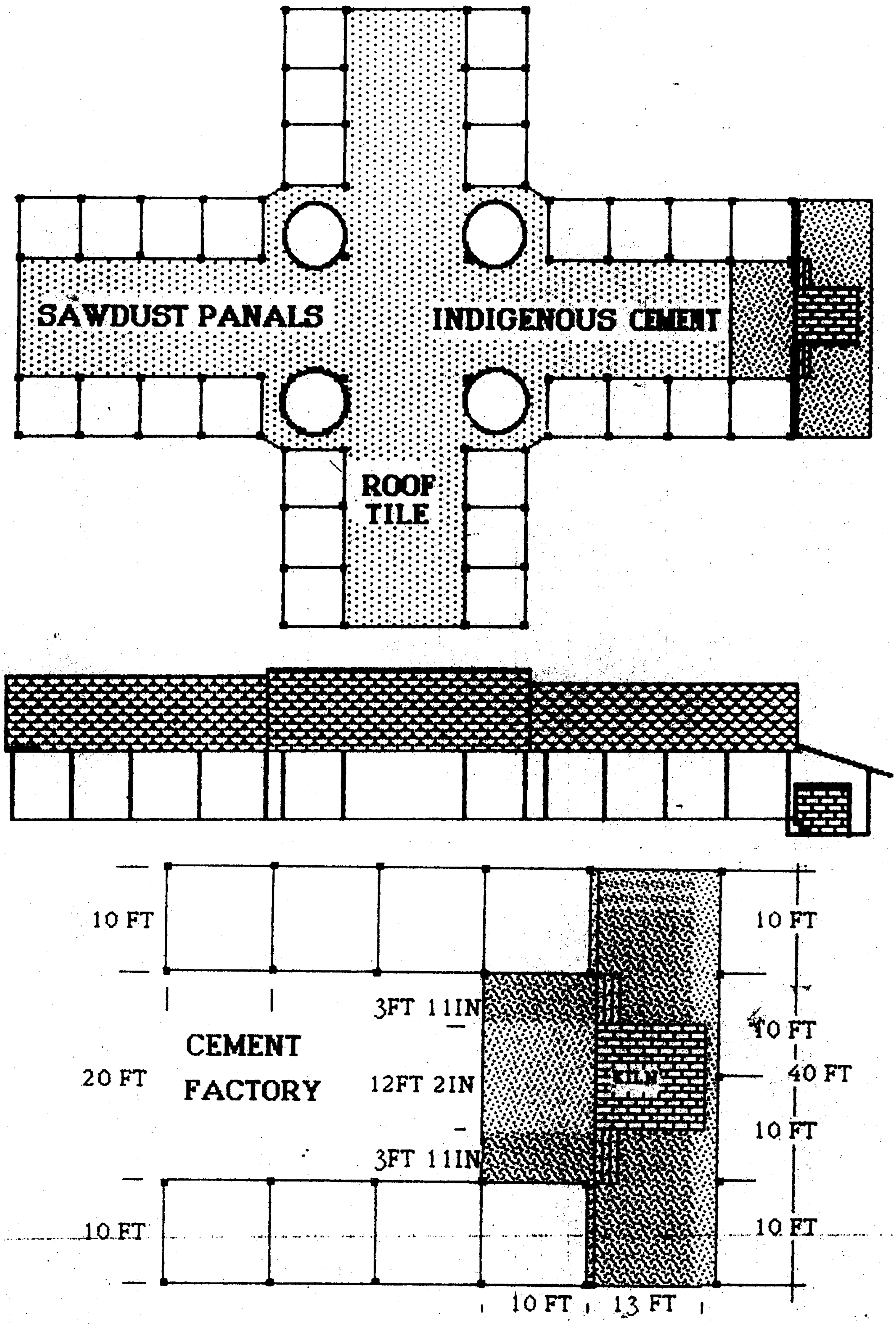
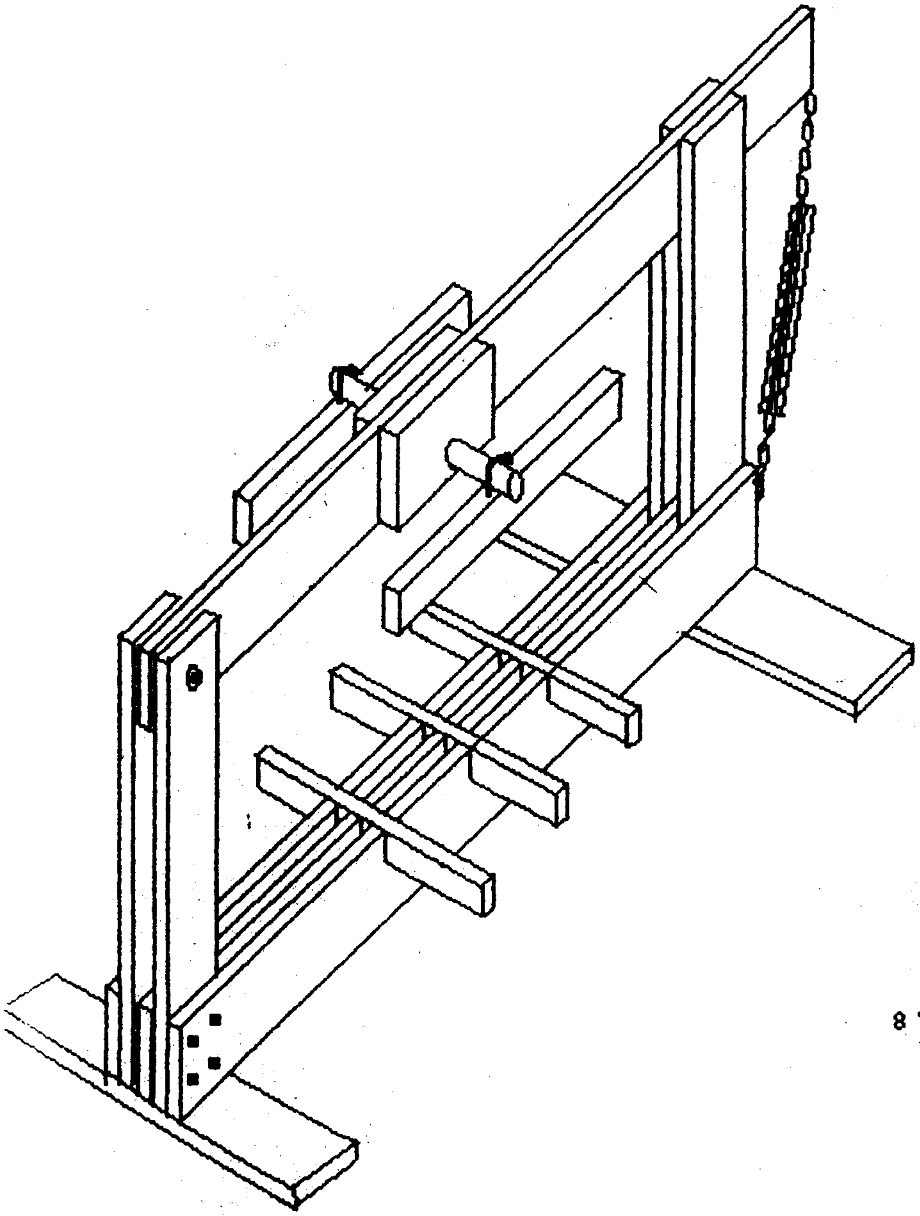
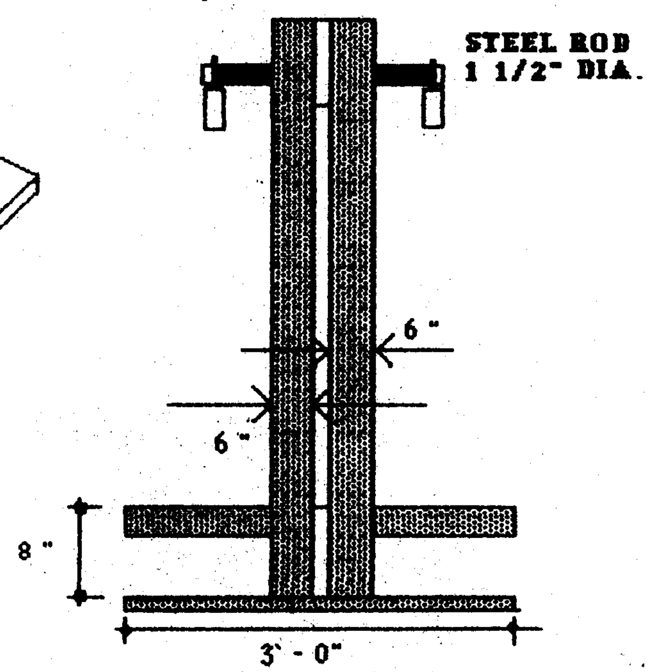


SAWDUST PANEL PRESS TABLE





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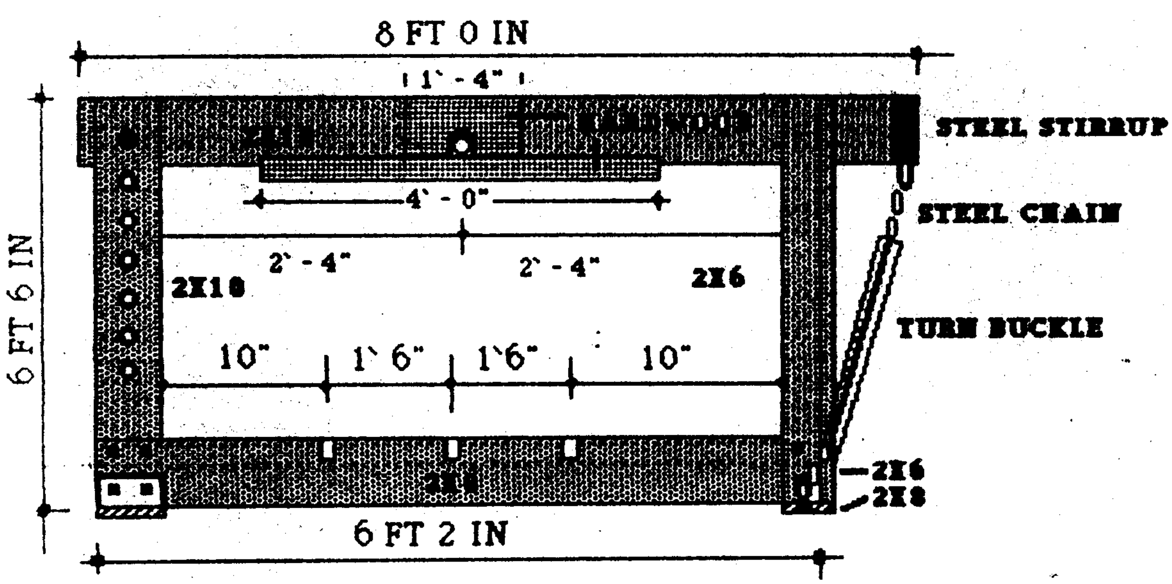
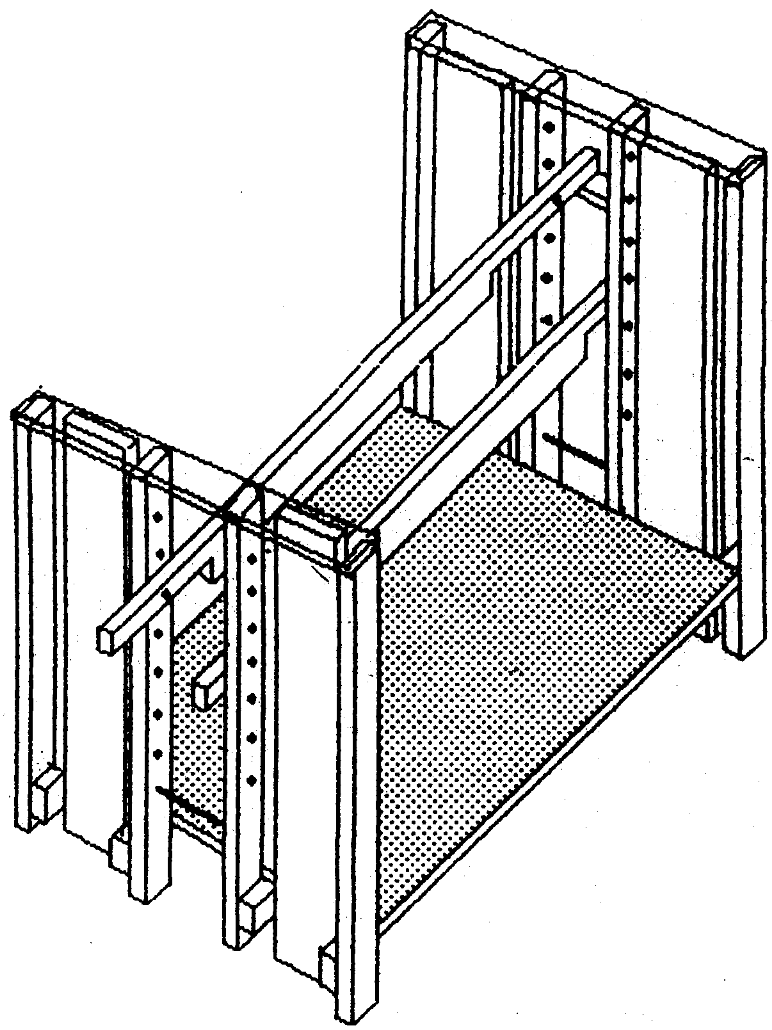
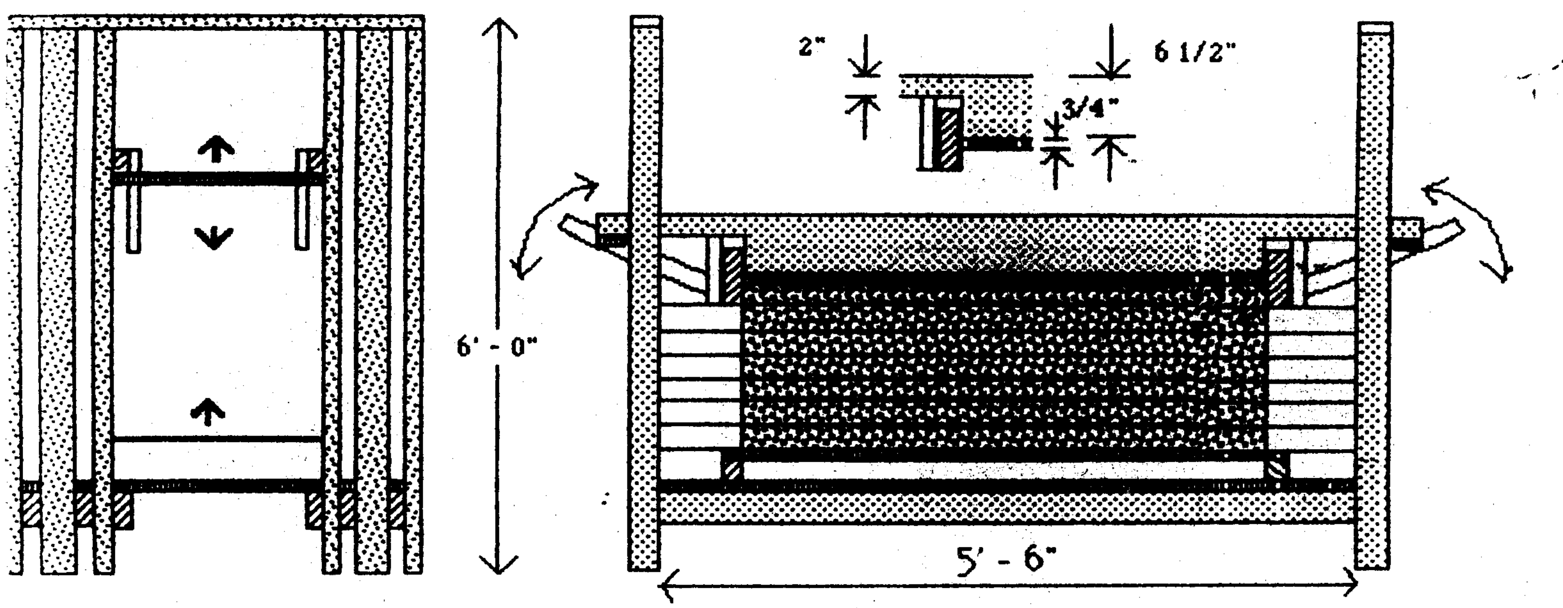


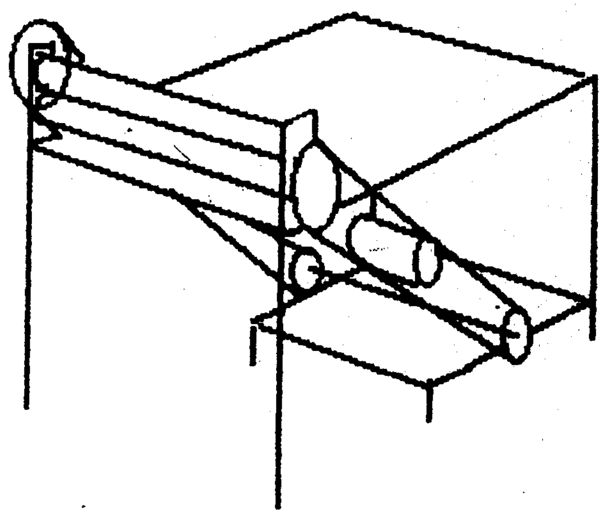
SAWDUST PANEL RELEASE TABLE



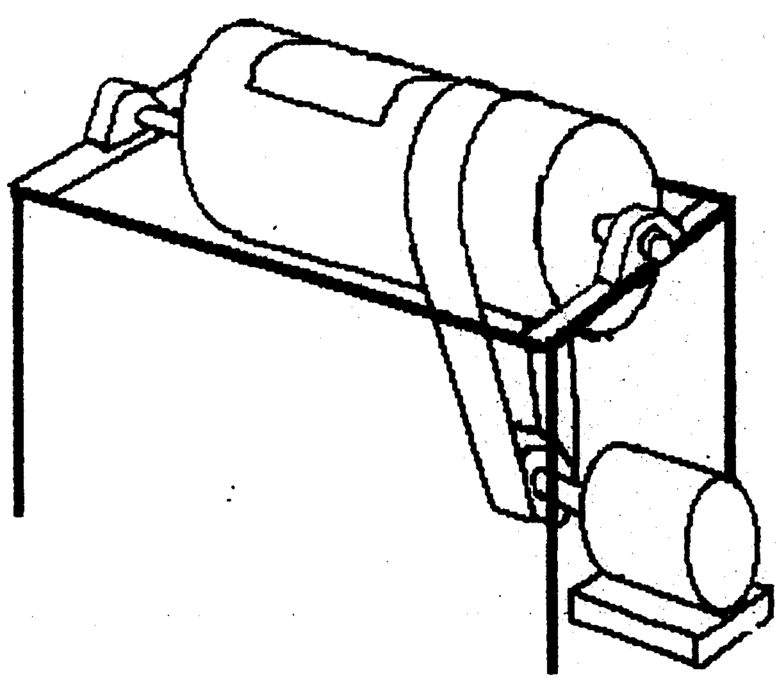


EQUIPMENT - MECHANICAL

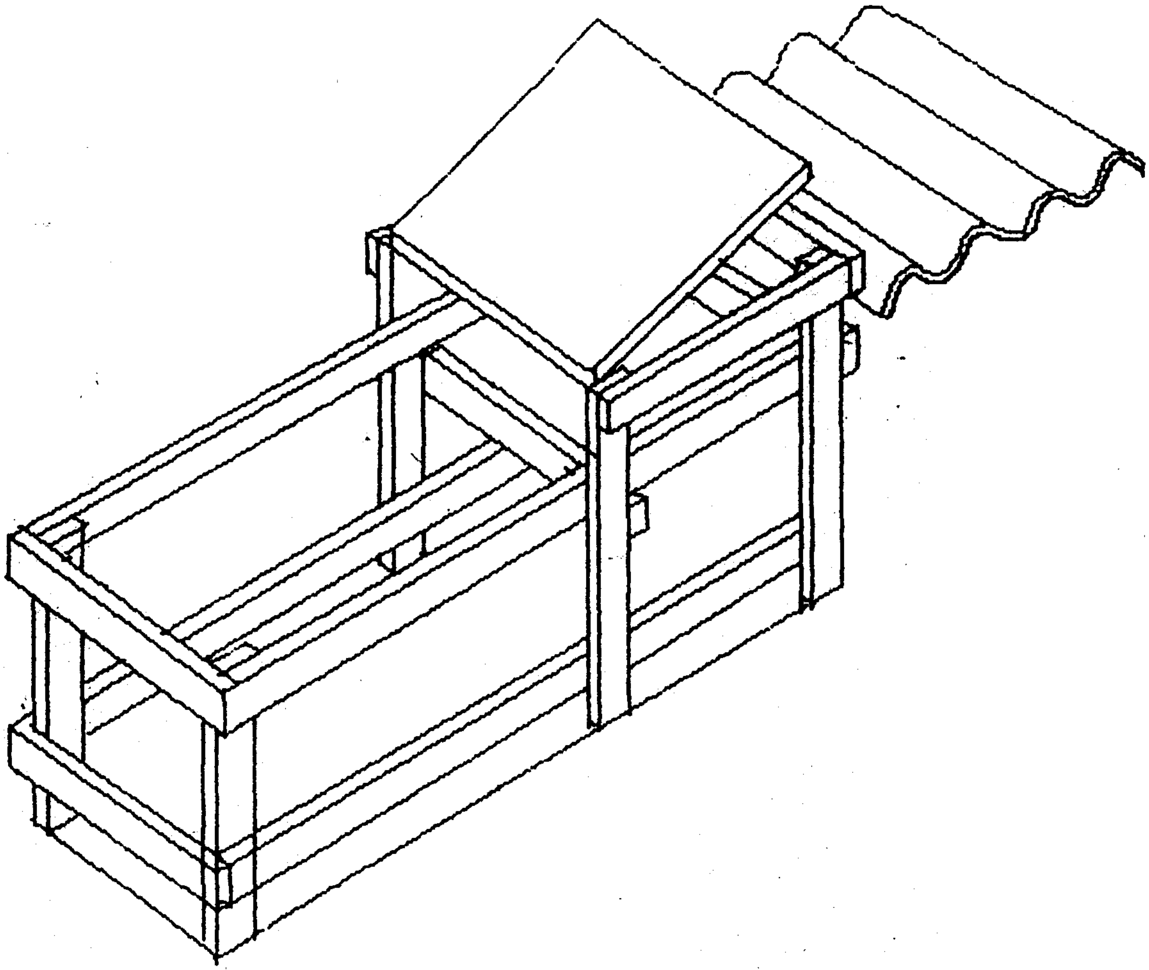
NATURAL FIBER SEPARATOR



BALL MILL CEMENT PULVERIZER

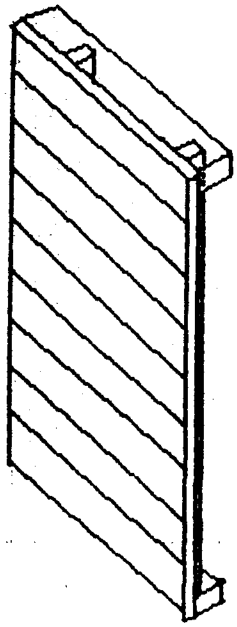


FIBERCRETE CORRUGATED ROOFING

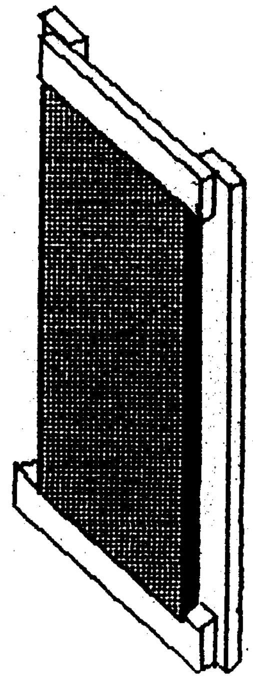


WALL-CONVENTIONAL V.S. SAWDUST PANAL

LOWEST COST
PUERTA LUMBERED
WALL



SAWDUST CEMENT PANAL
WALL USING WASTE
SAWDUST FROM MILL



BOARD FOOT WALL ONLY
640 FT2 BUILDING
INCLUDING PARTITIONS

1182 | 411

INCLUDING INSIDE
OUTSIDE WOOD SURF.
1812

COST EXCLUDING NAILS, PAINT, LABOR [C$8.5/BD FT.]

NO TONG. @ GROOVE

C$10,047

WITH INSIDE AND OUT-
SIDE WOOD SURFACE

C$15,402

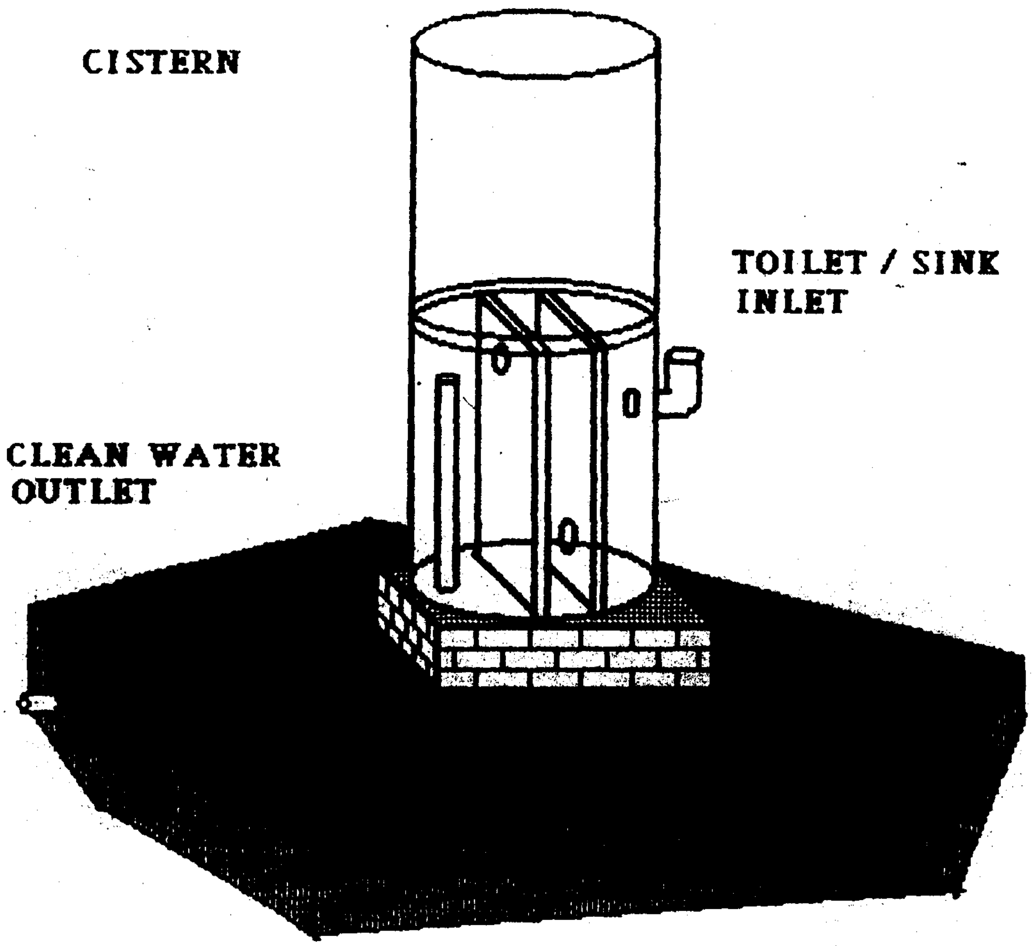
NO GAS/ CEMENT C$200 /BG

C$8329

CEMENT INDIG.@ C$60/BG.

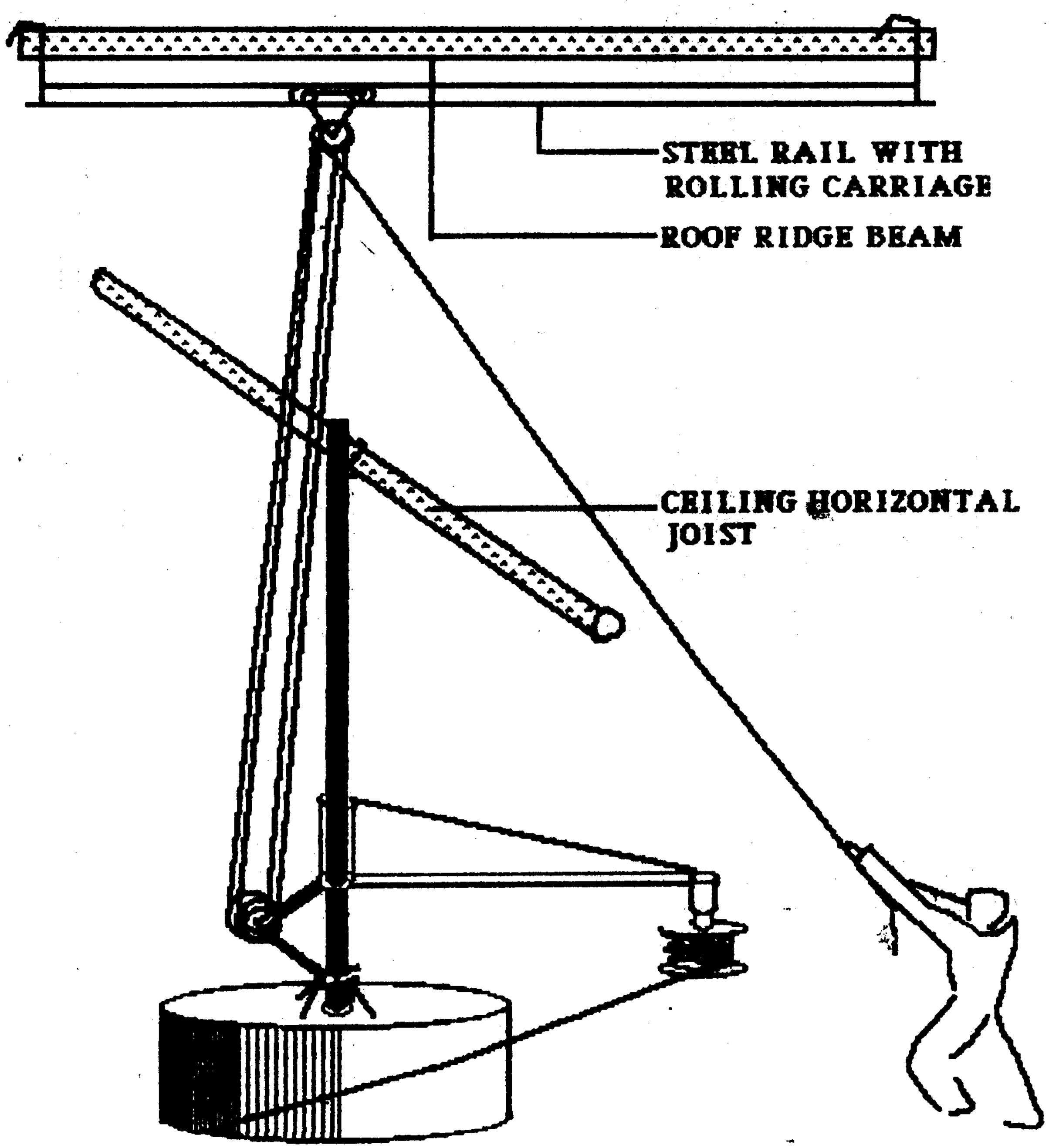
C$5904

COMBINED CISTERN/SEPTIC TANK

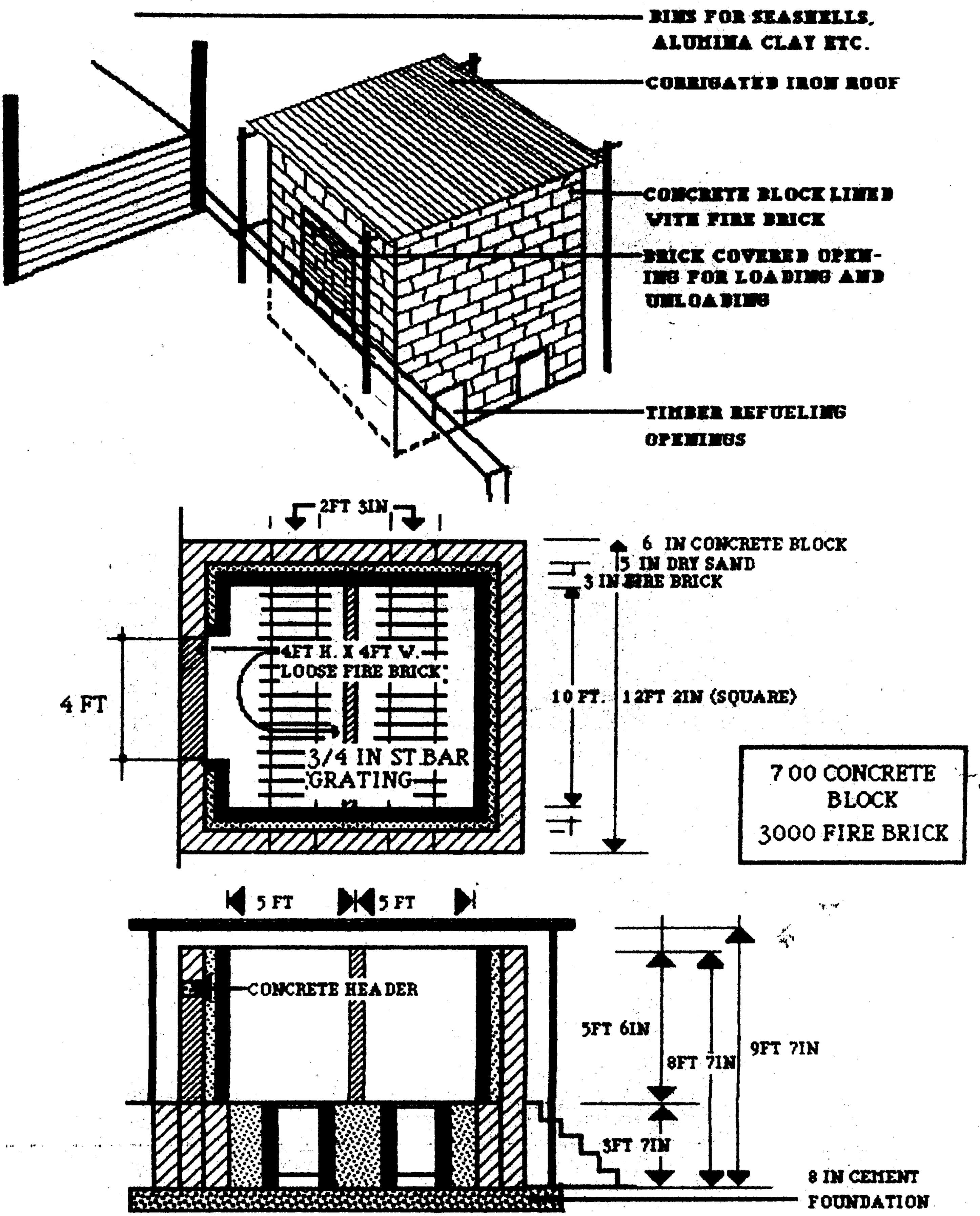


EQUIPMENT- MECHANICAL

SLIP FORM FOR SEPTIC TANK /CISTERN

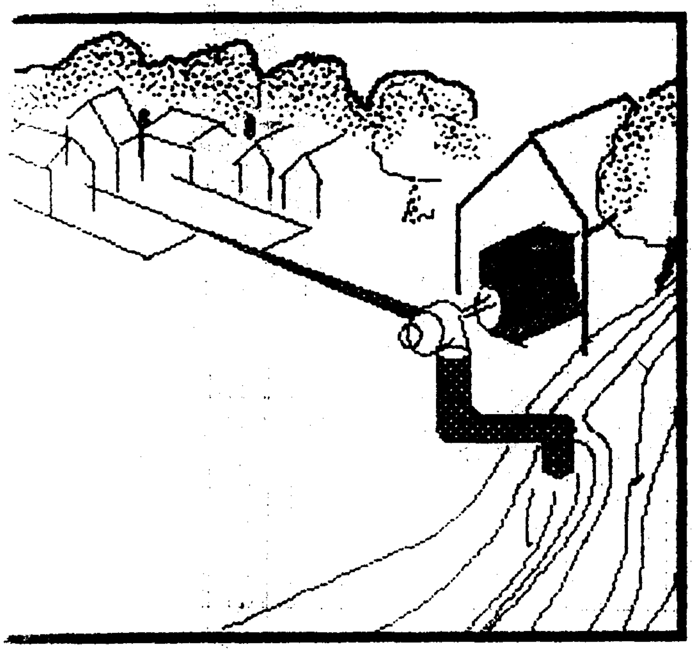


EQUIPMENT - KILN

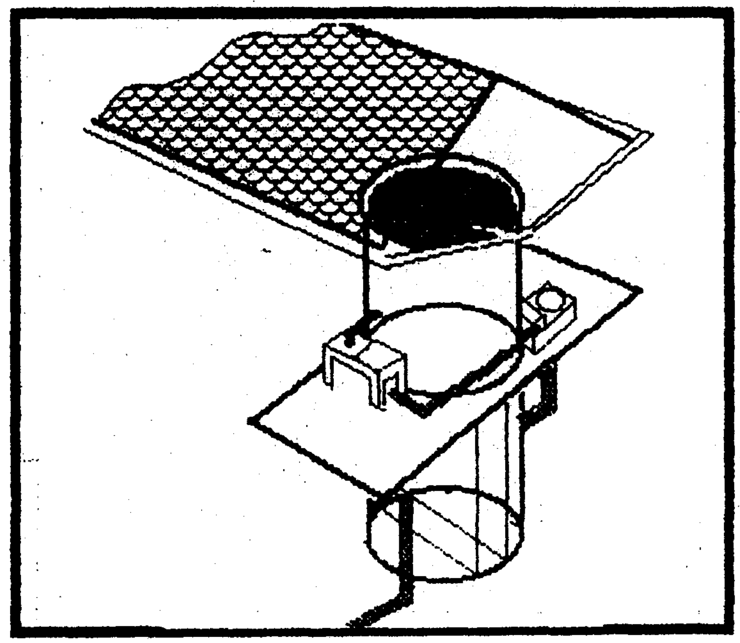


WATER - WASTE WATER

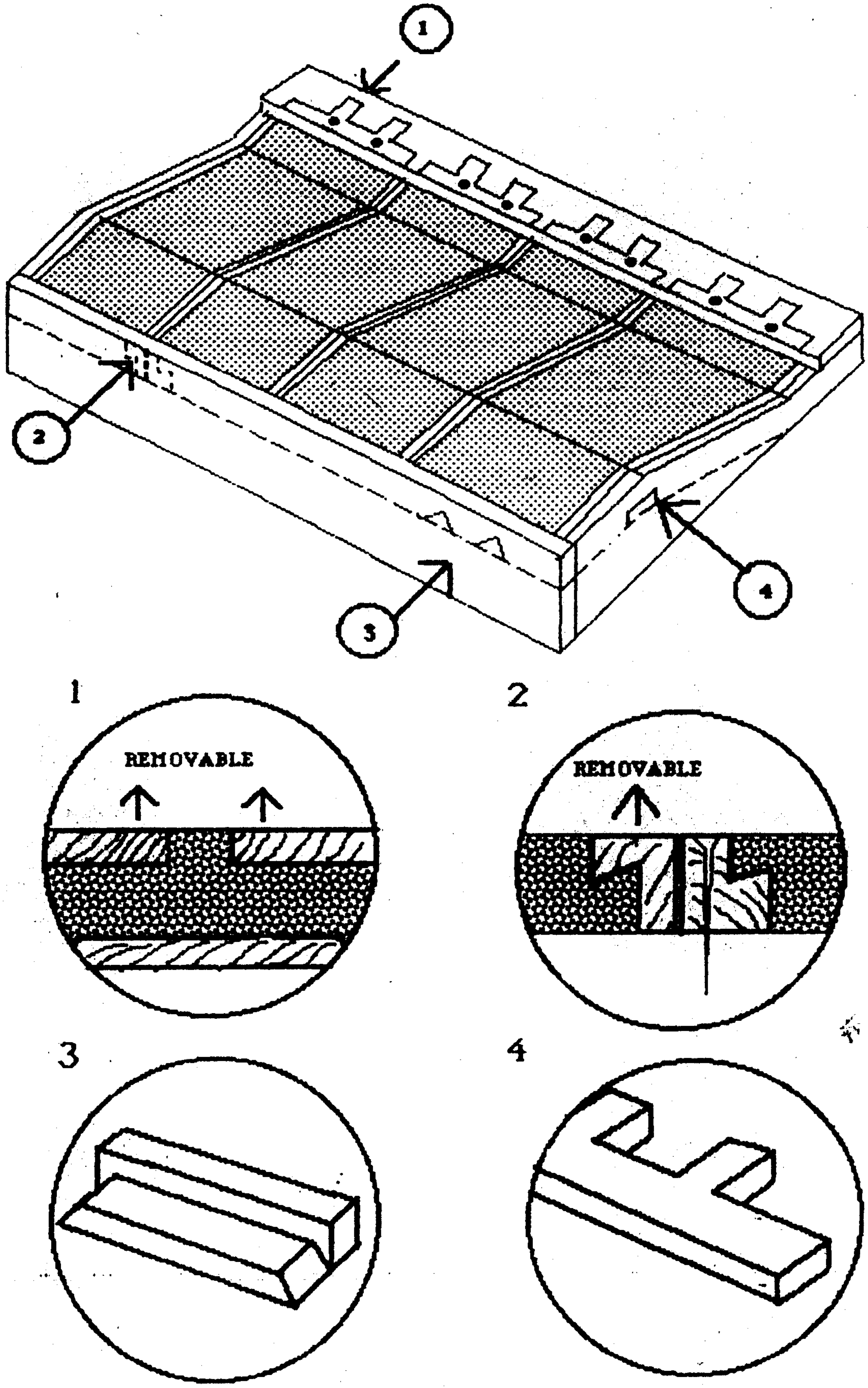
CENTRALIZED



DECENTRALIZED

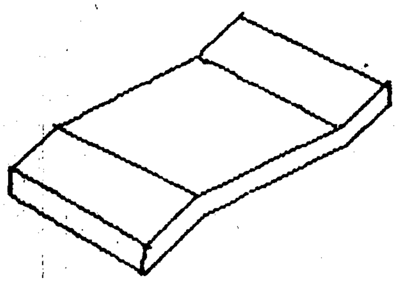


EQUIPMENT-PALM TILE MOLD

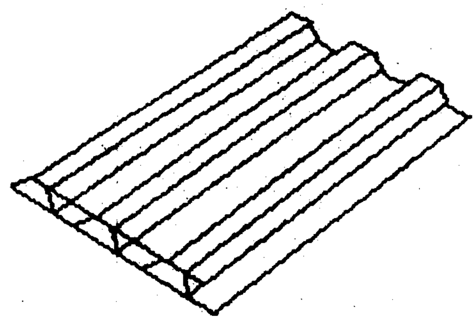


ROOF - INDIGENOUS V.S. IMPORTED STEEL

INDIGENOUS
CEMENT PALM TILE



IMPORTED
CORRIGATED STEEL



ROOF COST 640 FT 2 HOUSE

MANAGUA CEMENT

19.250 MAT.
10,000 LAB.

C$29,250

COSTA RICA IMPORT

C$ 48,000

PUERTA CEMENT @ 60/BG.

C$18,750

HOUSING
PROTOTYPE

THE PUERTO CABEZAS INDIGENOUS HOUSE

SUMMARY

THE PUERTO CABEZAS INDIGENOUS HOUSE TRIES TO BE A DIRECT RESPONSE TO HOW PEOPLE LIVE AND WORK IN THE REGION AND HOW BY BUILDING IN CERTAIN WAYS THAT THE REGIONS NATURAL AND HUMAN RESOURCES CAN BE PROPERLY USED AS THE BASIS OF A MEANINGFUL HOUSING SYSTEM. BECAUSE IT UTILIZES TOTALLY INDIGENOUS MATER IALS AND METHODS IT PROVIDES MANY MORE LOCAL JOBS THAN IMPORTED BUILDING TECHNIQUES AND THESE JOBS ARE OF THE TYPE AND SCALE THAT SUPPORTS EXISTING COMMUNITY BASED ENTERPRISES. IT IS TRULY A HOUSING SYSTEM NOT ONLY BECAUSE IT SUPPORTS MANY COMMUNITY BASED ACTIVITIES BUT BECAUSE IT ALMOST TOTALLY RESPONDES TO DIFFERENT FAMILIES VARIED GROWTH REQUIREMENTS AND VARIED ECONOMIC CONDITIONS. THE BASIC UNIT CAN BE EASILY EXPANDED INCREMENTALLY AND CAN BE PURCHASED AT ALMOST ANY LEVEL OF COMPLETION SO THAT HOUSING LOANS ARE USUALLY NOT REQUIRED THUS MATCHING AS DIRECTLY AS POSSIBLE THE FAMILIES ABILITY TO PAY AS THEY GO AND ONLY FOR WHAT THEY REALLY NEED.

THE PUERTO CABAZES INDIGENOUS HOUSE ALSO SAVES ON PRECIOUS RESOURCES IN TERMS OF MATERIALS, WATER AND ENERGY. THE WALLS, FOR EXAMPLE ARE MADE FROM WASTE WOOD CHIPS AND SAWDUST PRESSED TOGETHER AND GLUED WITH CEMENT USING UNSOPHISTICATED EQUIPMENT. THE RESULTING PANALS ARE LIGHT IN WEIGHT AND ARE USEFUL BOTH FOR INSIDE AND OUTSIDE WALLS. BY UTILIZING DISCARDED WOOD PRODUCTS SOME OF THE 45% WASTE USUSALLY ASSOCIATED WITH THE REGIONS SAWMILLS IS CONSIDERABLY REDUCED. USING INDIGENOUS CLAY AND CEMENT PRODUCTS REINFORCED WITH NATURAL FIBERS

THE PUERTO CABEZAS INDIGENOUS HOUSE

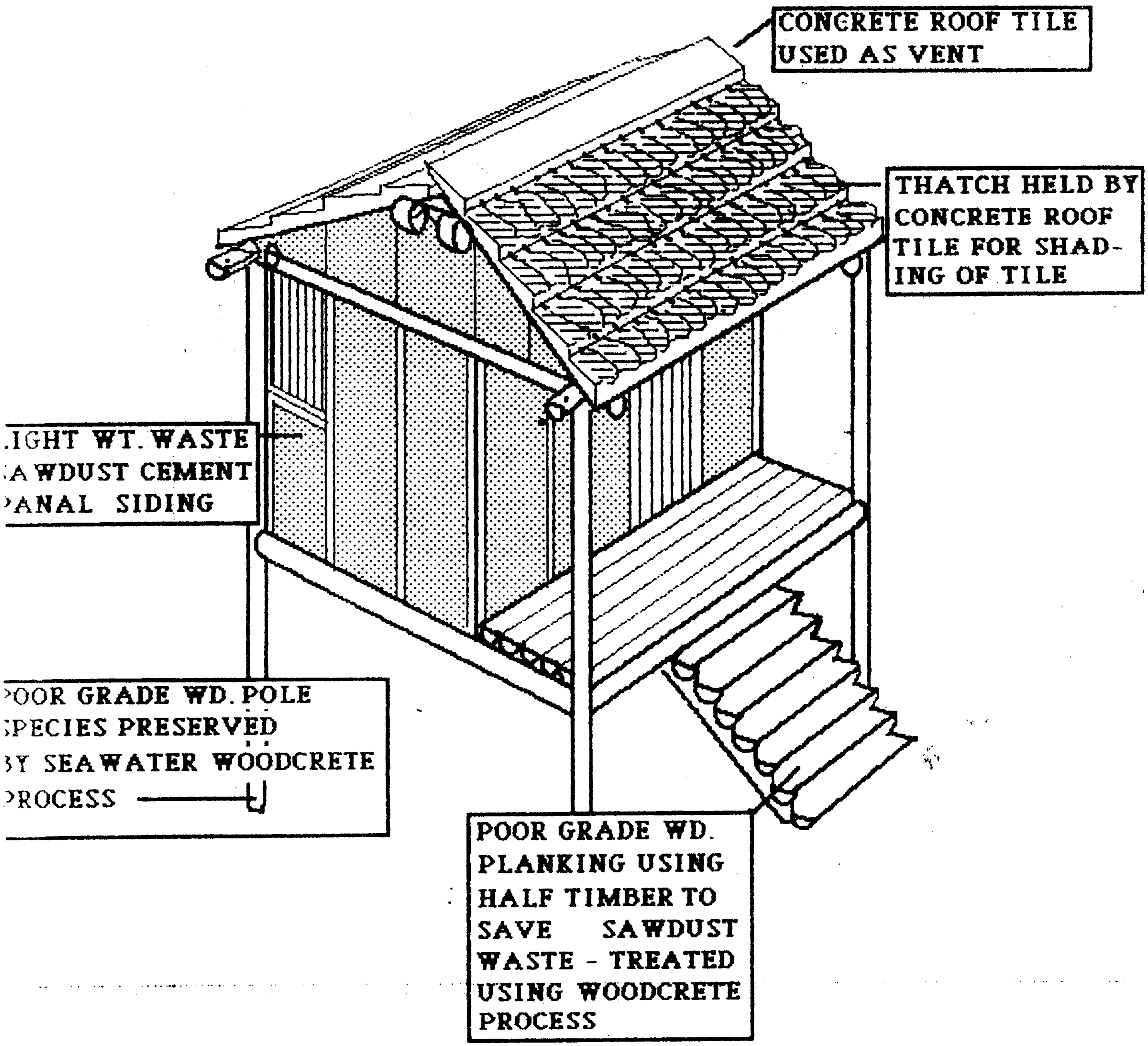
INSTEAD OF USING GALVANIZED STEEL FOR ROOFING NOT ONLY SAVES ON THE IMPORTATION OF A MAJOR HOUSING COMPONENT BUT ALSO PROVIDES A SAFE SURFACE FOR COLLECTING DRINKING WATER, THUS RAIN WATER ANOTHER BENEVOLENT RESOURCE IN A TOPICAL CLIMATE CAN GIVE MORE THAN ENOUGH FRESH CLEAN DRINKING WATER. NEEDLESS TO SAY THAT THESE AND MANY MORE ATTRIBUTES BROUGHT TOGETHER IN THIS HOUSING SYSTEM GIVE THE COMMUNITY TWO TO FIVE TIMES THE NUMBER OF JOBS EACH TIME AN INDIGENOUS MATERIAL AND FABRICATION TECNIQUE IS USED.

ENERGY SAVING ARE TAKEN INTO CONSIDERATION BOTH WITHIN THE HOUSE AS WELL AS WITHIN THE TECHNOLOGIES THAT PRODUCE THE HOUSING COMPONENTS THEMSELVES. FIRST, WOOD IS USED AS A PRIMARY STRUCURAL MATERIAL DUE TO THE FACT THAT IT USES THE LEAST ENERGY PER UNIT WEIGHT OF THE COMMON BUILDING MATERIALS. THE WASTE FROM MILLING PROCESSES ARE INCORPORATED INTO THE BUILDING ACTUALLY IN TWO WAYS, **ONE** IN THE BUILDING PANALS ALREADY DESCRIBED WHICH OFFER TRIPLE THE INSULATING VALUE OF A PURELY CONCRETE BLOCK WALL AND **TWO** AS A FUEL SOURCE IN THE KITCHEN STOVE. [THE SAME STOVE IS ALSO USED WITH RICE HUSK AS FUEL.] THE CONCRETE OR CLAY TILE ROOF ALSO SAVES ENERGY AND ACCOMPLISHES THIS IN THREE WAYS; **ONE** BY KEEPING THE OCCUPANTS COOLER THUS REQUIRING LESS MECHANICAL COOLING, **TWO** BY USING A LESS ENERGY INTENSIVE MATERIAL THAN ZINC METAL WHICH IS A VERY ENERGY EXPENSIVE PROCESS IN FABRICATION AND **THREE** SAVING GREATLY ON THE ENERGY COST OF TRANSPORTATION SINCE IT IS LOCALLY PRODUCED. OTHER FEATURES OF THE HOUSE INCLUDE SUCH ITEMS AS PLACING THE WATER CISTERN ON THE INSIDE OF THE BUILDING INSTEAD OF ON THE OUTSIDE THUS

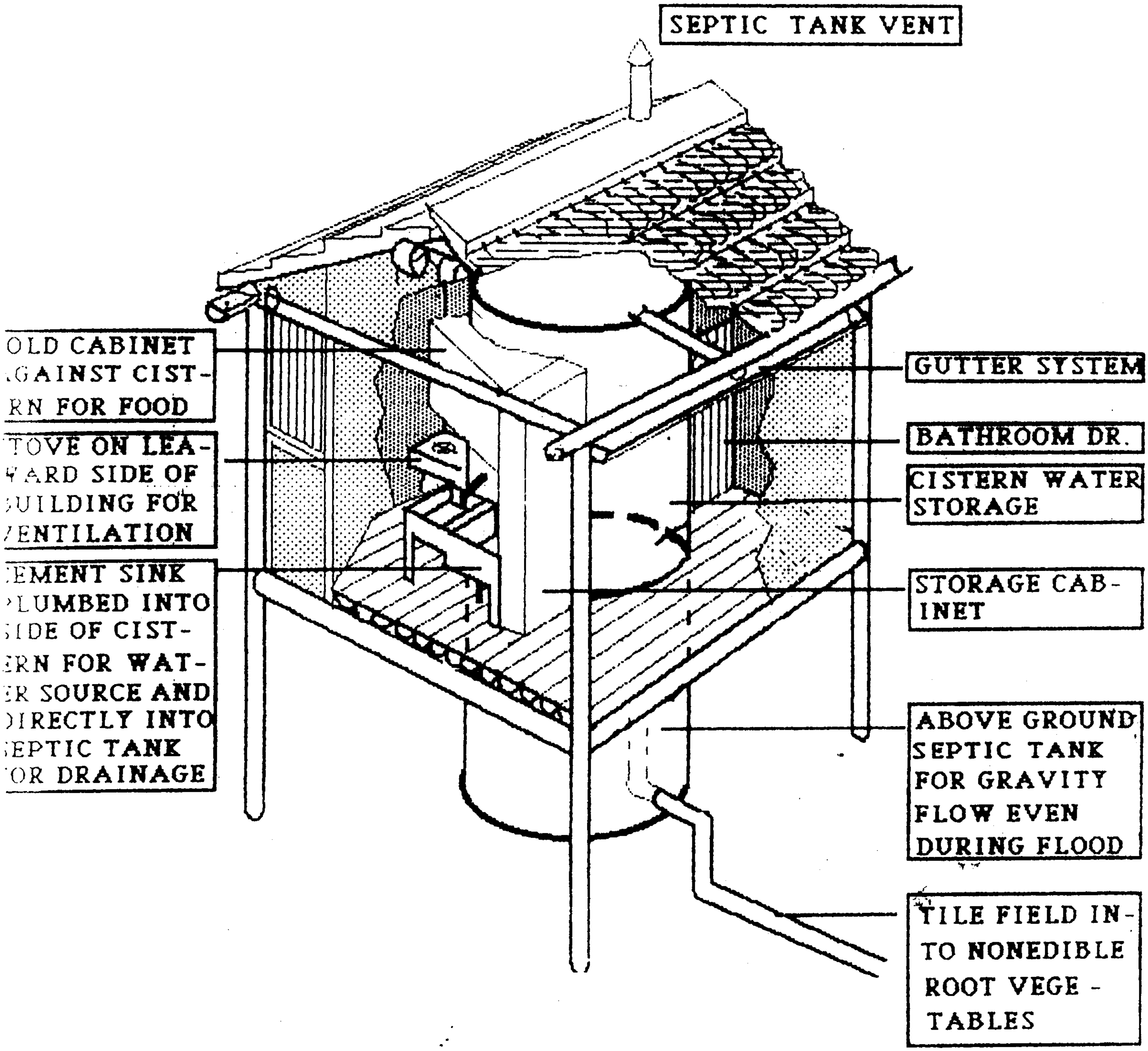
THE PUERTO CABEZAS INDIGENOUS HOUSE

UTILIZING THE COOL SURFACE FOR KEEPING THE KITCHEN COOLER BUT ALSO AS A SURFACE UPON WHICH A COOL CHEST CABINET IS PLACED TO KEEP FOOD TEMPERATURE AT LEAST BELOW AVERAGE AMBIENT AIR TEMPERATURE.

MODULAR LIVING UNIT

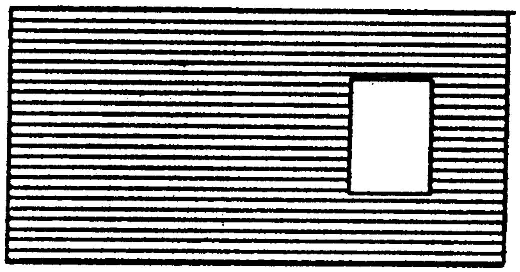


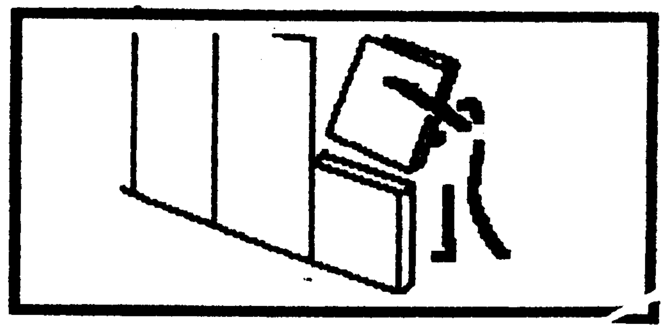
UTILITY UNIT



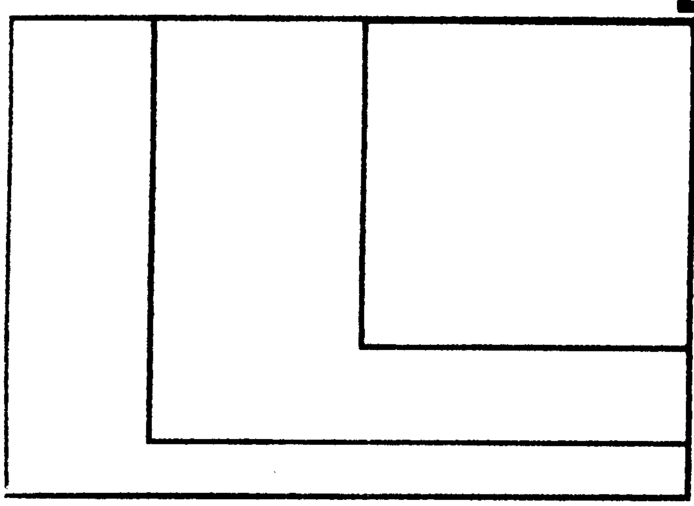
SPACE SIZE ADAPTABILITY

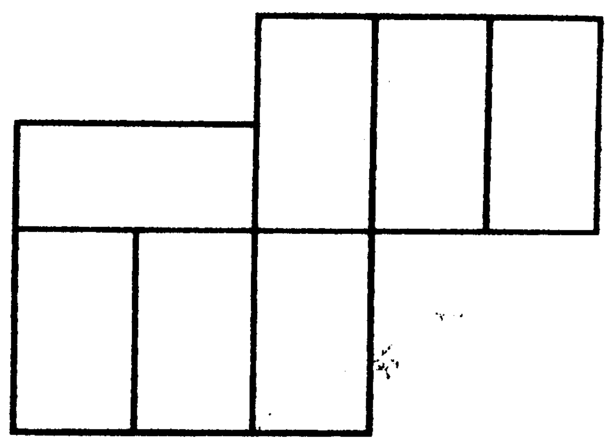
WALL SECTION

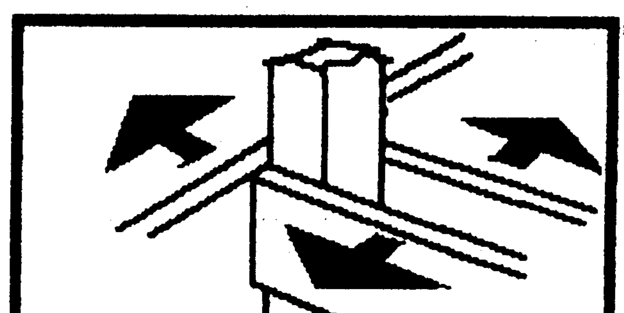




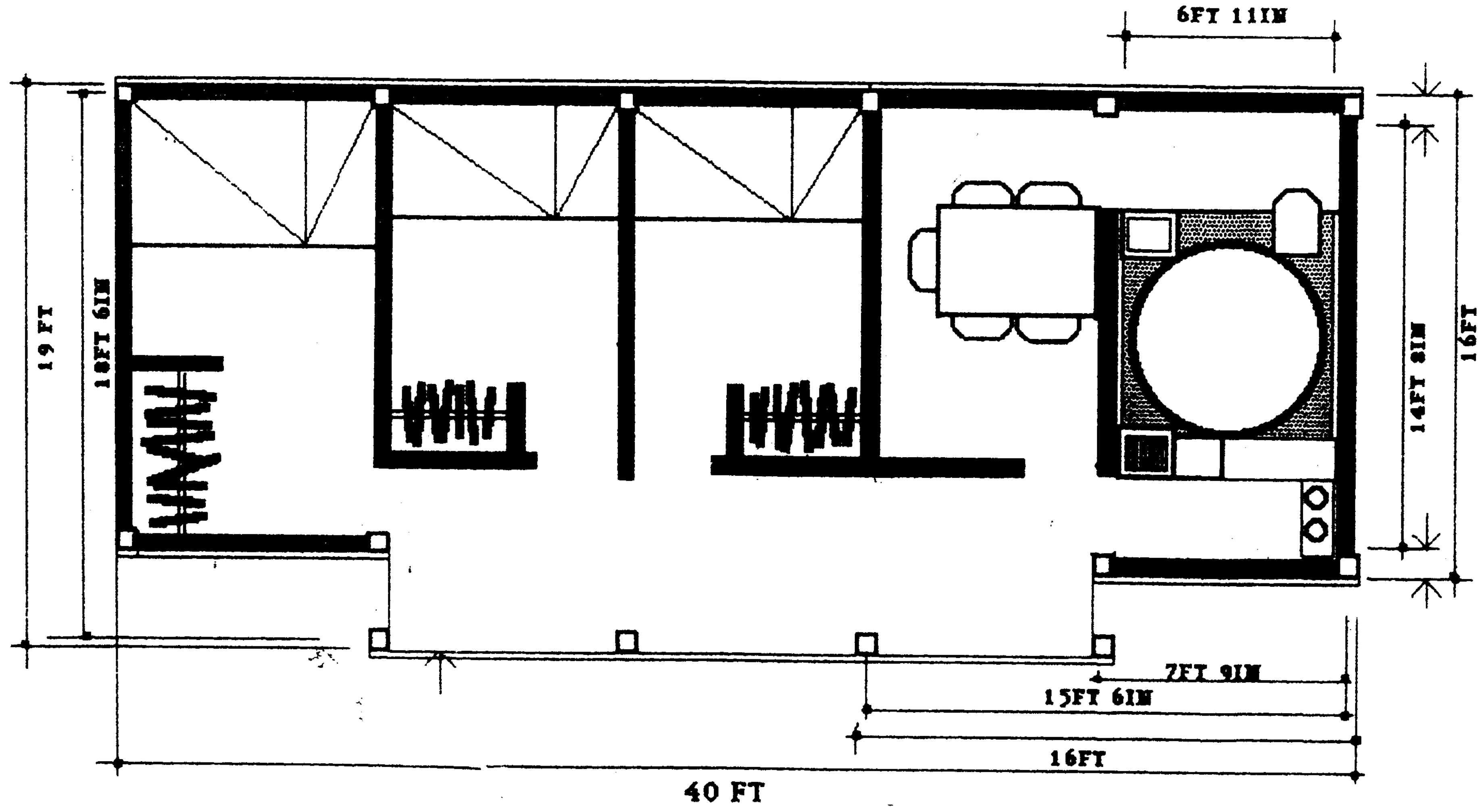
PLAN

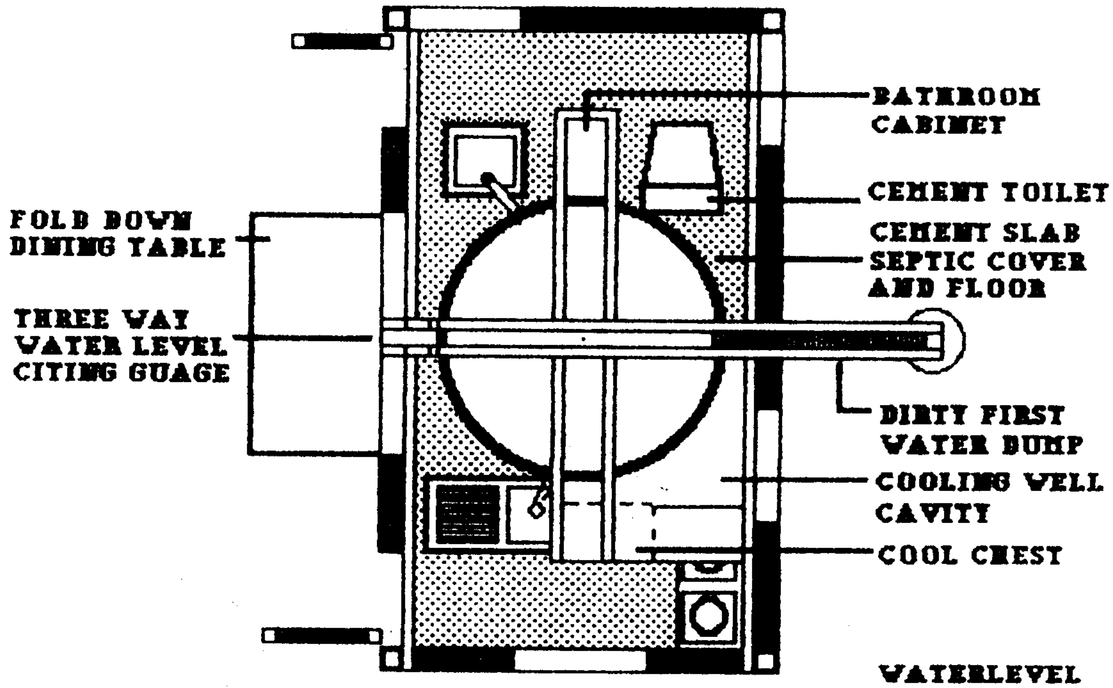


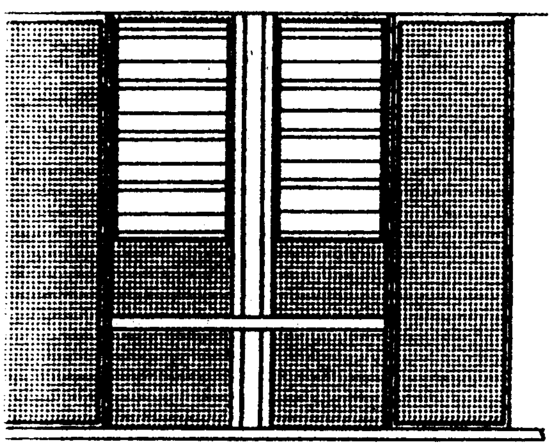




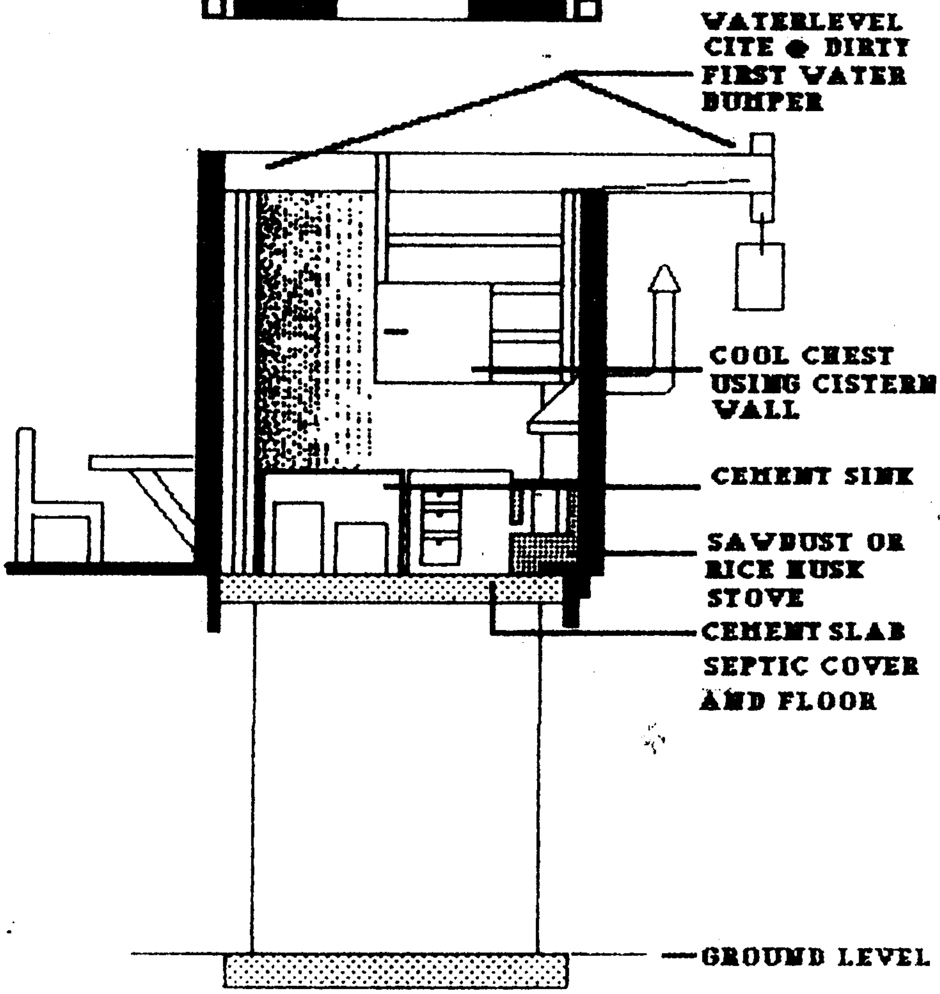
PLAN


6FT 11IN
19 FT
18FT 6IN
14FT 8IN
16FT
7FT 9IN
15FT 6IN
16FT
40 FT

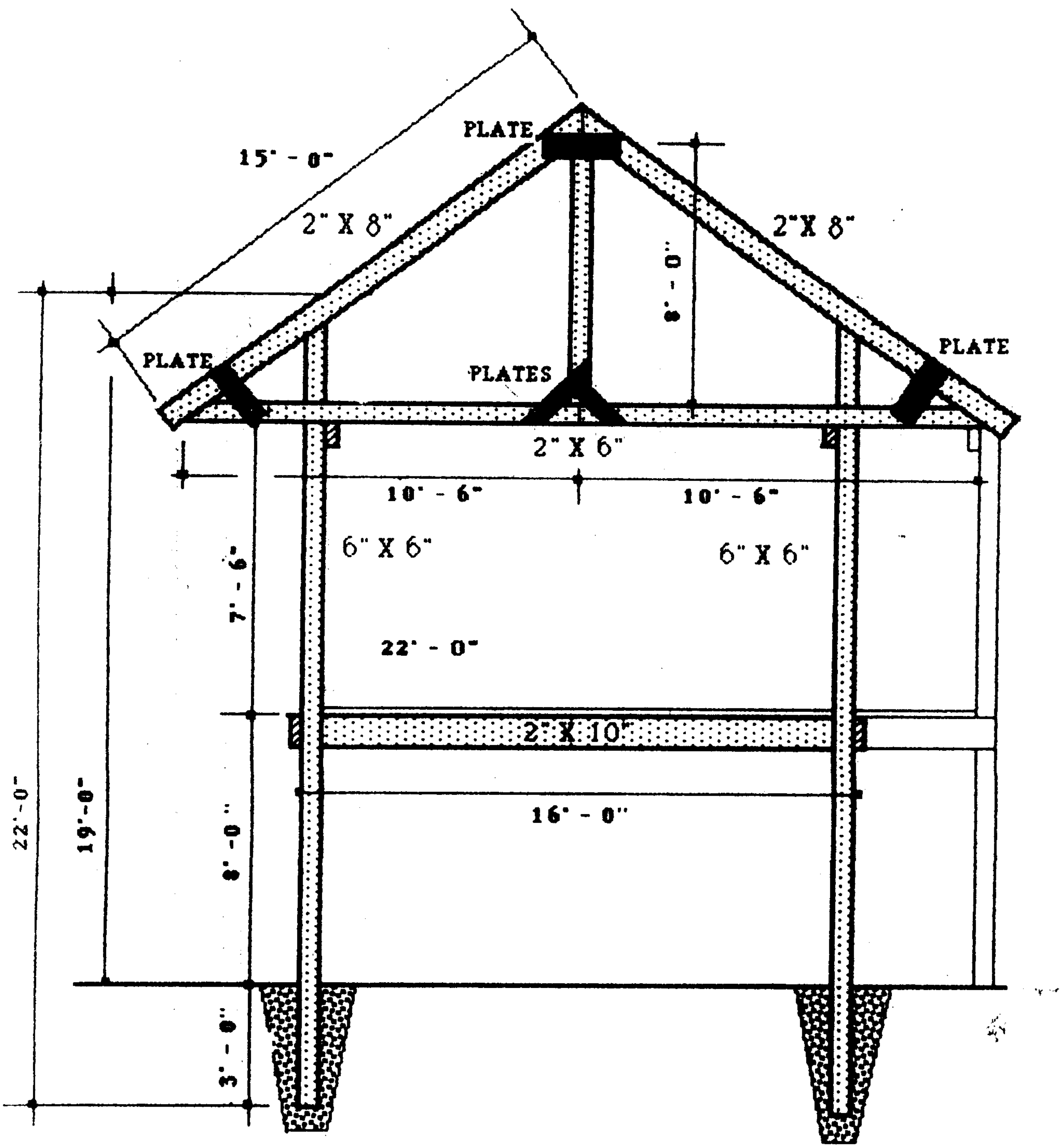




DINING R. WALL ELEVATION [W] FOLD DOWN TABLE



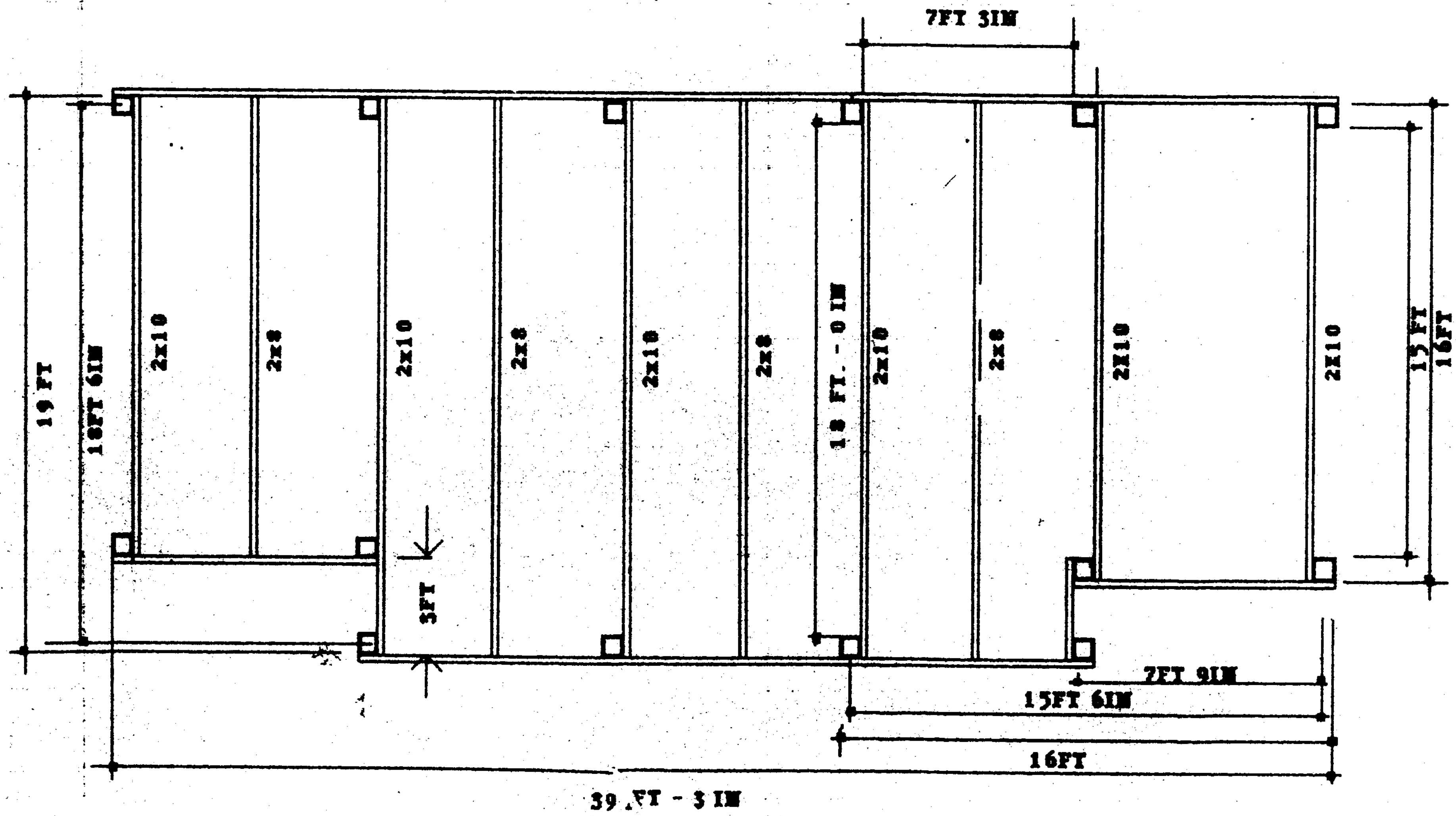
RIB TRUSS



15' - 0"
PLATE
2" X 8"
2"X 8"
8' - 0"
PLATE
PLATES
PLATE
2" X 6"
10' - 6"
10' - 6"
6" X 6"
6" X 6"
7' - 6"
22' - 0"
2" X 10"
16' - 0"
22'-0"
19'-0"
8'-0"
3'-0"

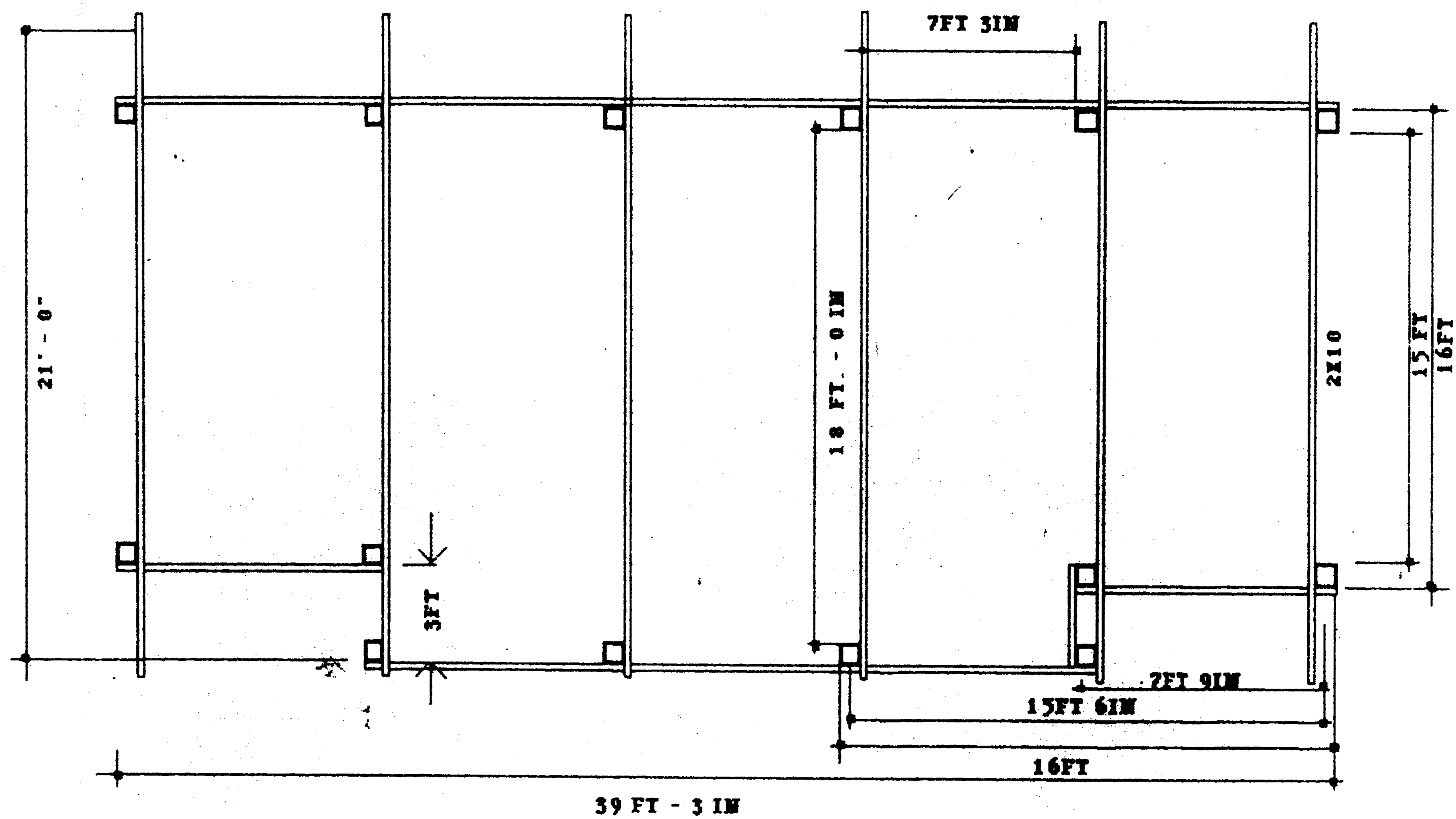
FRAMING PLAN

SEA

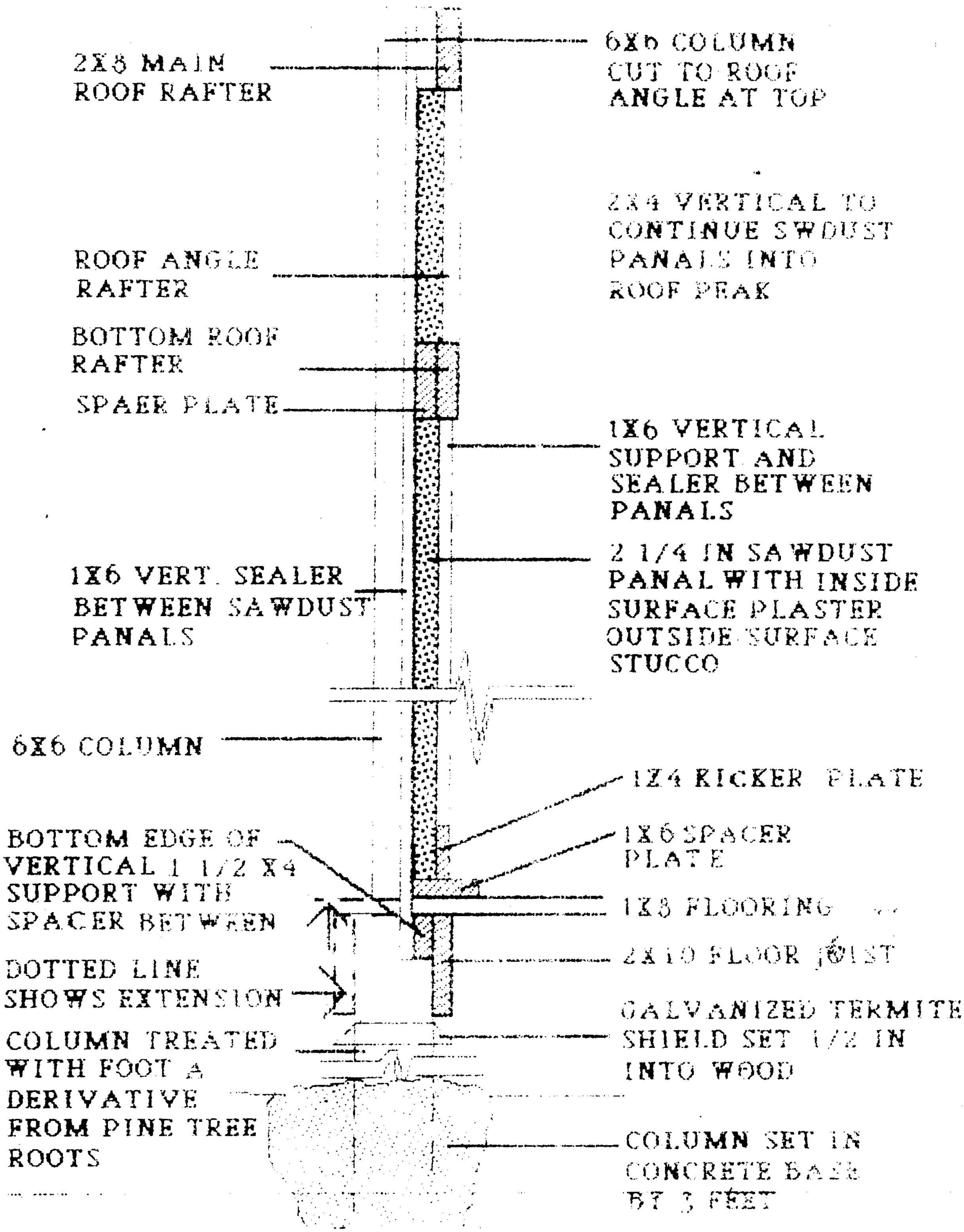


ROOF FRAMING PLAN

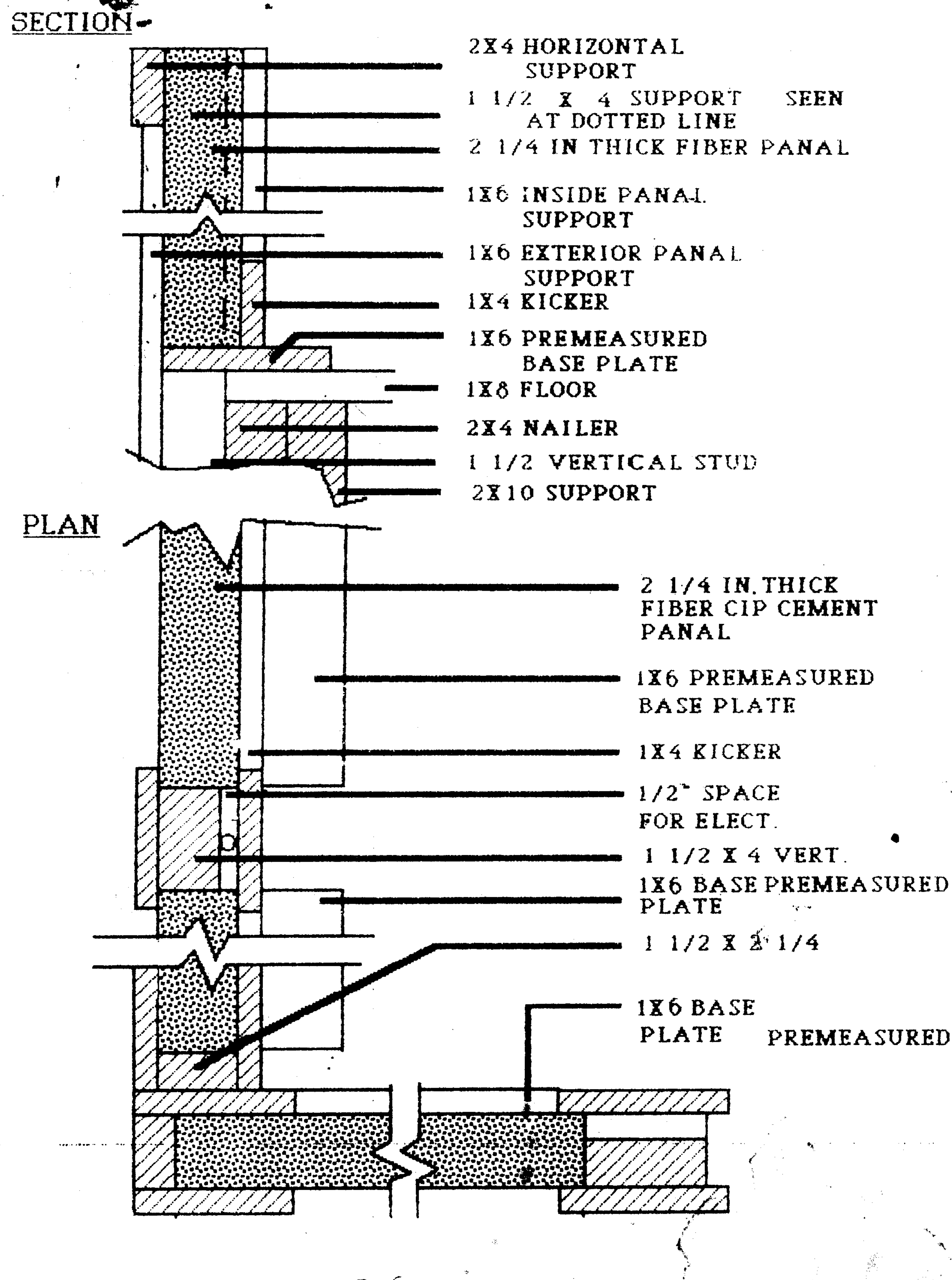
SEA SIDE



TYPICAL END WALL SECTION AND PARTITION AT TRUSS

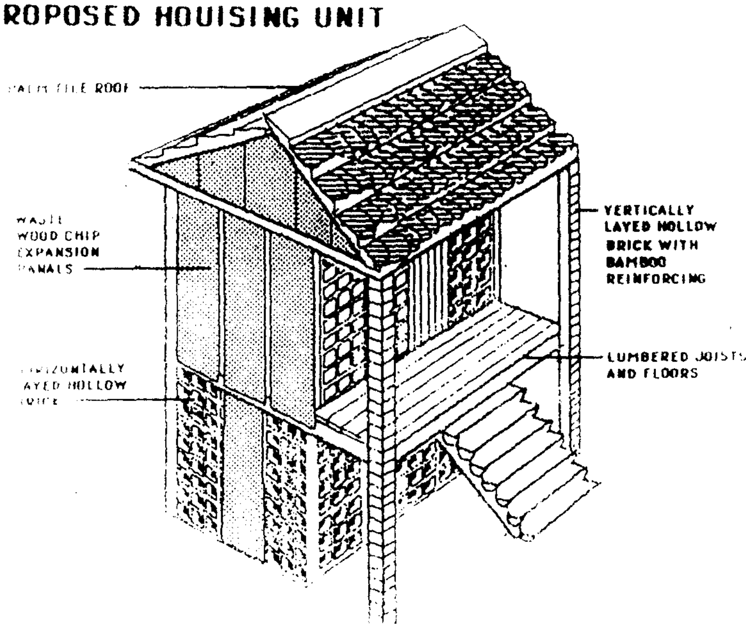


TYPICAL WALL DETAIL

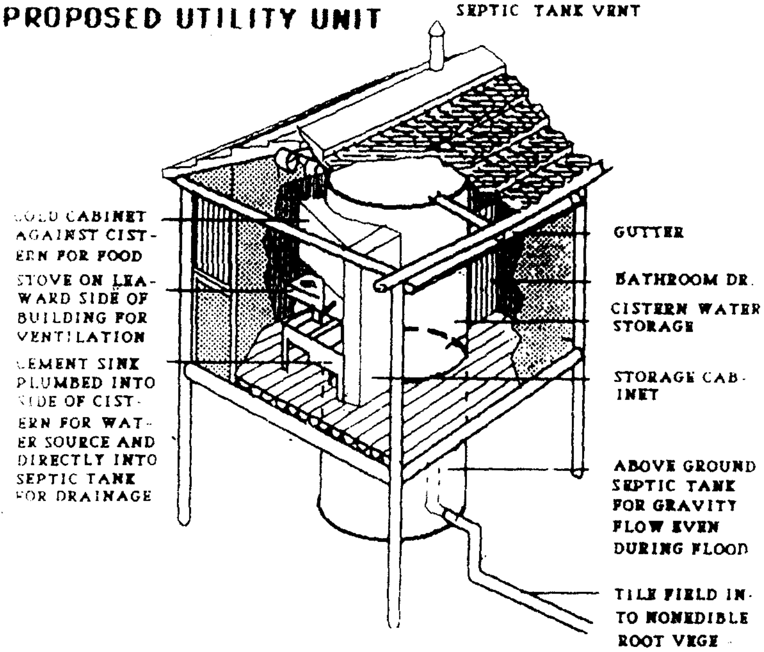


INDIGENOUS HOUSE

PROPOSED HOUISING UNIT



PROPOSED UTILITY UNIT



SEMI
INTERNAC
Ecotécnicas aplic
a la vivie

INTERNATION
CONFERENC
Passive and low
energy ecotechniques
applied to housing

PLEA 84
MEXICO

SECRETARIA DE
DESARROLLO
URBANO Y
ECOLOGIA
SEDUE

INSTITUTO DEL
FONDO NACIONAL
DE LA VIVIENDA
PARA LOS TRABAJADORES
INFONAVIT

A BRIEF RESUME ON BIOREGIONS/BIOTECHNOLOGIES:
Planning & Communication Tools for Indigenous Populations and Third World Countries

Pliny Fisk III

Center for Maximum Potential Building Systems
8604 F.M. 969
Austin, Texas 78724
U.S.A.

Pergamon Press 1984

PLENARY PAPER

BIOREGIONAL PLANNING AND APPROPRIATE TECHNOLOGY FOR NICARAGUA'S MISKITO INDIANS

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Gail D.A. Vittori

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8604 F.M. 969
Austin, Texas 78724

This paper has been presented in part or in whole at various national and international conferences including a plenary presentation in Mexico City.

BIOREGIONAL PLANNING AND APPROPRIATE TECHNOLOGY FOR NICARAGUA'S MISKITO INDIANS

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Austin, Texas 78724 U.S.A.

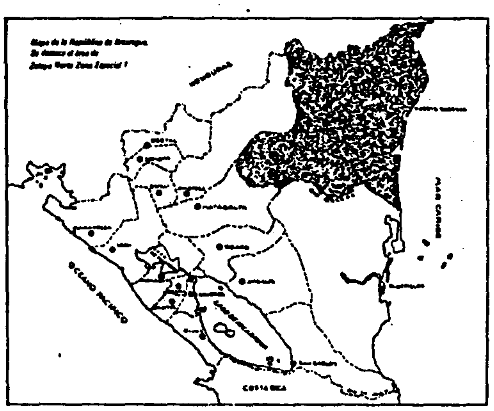
Keywords: Nicaraguan Indians, Miskito, Bioregional Planning Methodology, Appropriate Technology, Appropriate Building Materials, Latisol Soil Brick, Cistern/Privy System

ABSTRACT

The presentation describes in brief the research and organizational procedure undertaken by the Center for Maximum Potential Building Systems to set into motion a large scale indigenous housing program under the sponsorship of the Center for Investigation and Documentation of the Atlantic Coast (CIDCA), an autonomous Nicaraguan research organization. The project was funded by The Rubin Foundation (US), OXFAM (England), and TROCAIRE (Ireland). This project responds to an awesome housing shortage among the Miskito and other indigenous peoples of Nicaragua's Atlantic Coast, which is exacerbated daily as people are driven from their homes and villages to seek refuge from attack. The housing is specifically adapted to the culture and traditions of the Miskito, and corresponds to the availability of skills and materials within the region.

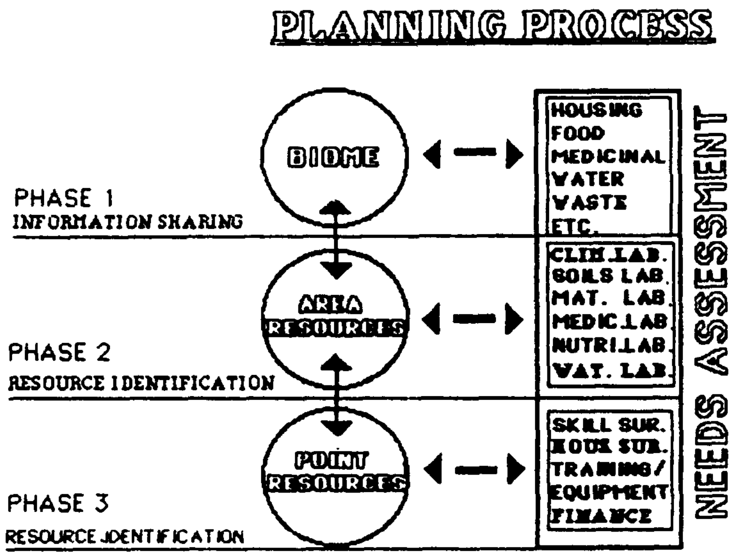
The presentation goes through the methodology used by the Center so that one may obtain the background needed to develop a region's indigenous potential from a natural and human resource standpoint. The procedure includes two principal parts: A) the <u>Planning Methodology</u> and B) the <u>Development Procedure</u>. The first part is an identification process beginning at the macro level of the global biome that shows other world regions which share similar resource attributes as Nicaragua's East Coast, enabling the sharing of human experiences in dealing with similar resource conditions. The process ends with the identification of the human resource participants in the project. Part B shows how all physical and human resources, once found, are brought together into an integrated step-by-step procedure for the development of an appropriate housing system.

It is important to realize that the housing project is just in the beginning stages since only 18 weeks have been spent on-site by the Project Coordinator. This, however, was enough time to do the planning, most of the materials testing, and the design for a building system that could accomodate the 400+ homes in the project's initial phase.



PART A - PLANNING METHODOLOGY

The planning methodology used for this project consists of three (3) phases: 1) information sharing at the biome level as described later; 2) area resource identification involving the identification of potentially useful natural resources within the project area (for housing in this instance); and 3) the point resource identification phase which consists of identifying the available human resources, including equipment, that are being used or may be used to develop the area resources in the project area. Phase Three also includes a housing survey and training program. These phases are diagrammed below:



PHASE 1: BIOME IDENTIFICATION

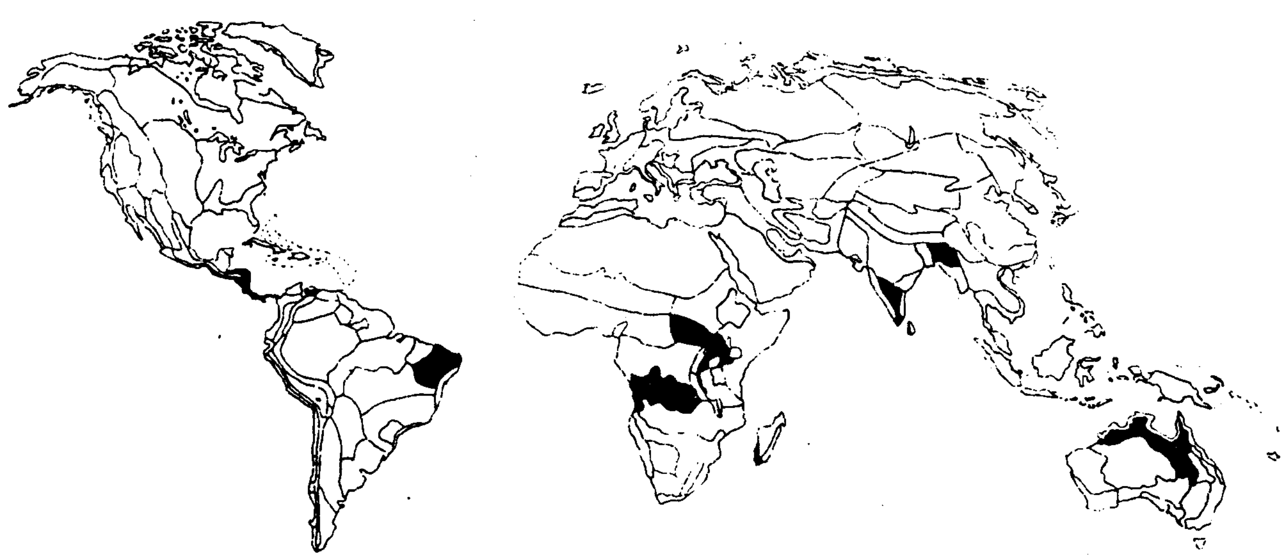
In the Project's first phase, preliminary work was done to identify the broad spectrum of experiences responding to the combination of resource conditions commonly found in this type of Tropical Savanna and other closely associated biomes, on-site and in other parts of the world. This biogeographic information base is a development of the Center for Maximum Potential Building Systems, and is used to familiarize ourselves and our clients with the problems and potentials that similar regions throughout the world have experienced under similar physical conditions related, in this case, to housing. This is done in order to supply the project with the most complete historical and up-to-date information available.

The procedure begins by utilizing the biogeographic map developed by M.D.F. Udvardy for the International Union for Conservation of Nature and Natural Resources (I.U.C.N.) prepared under contract with U.N.E.S.C.O.'s Man and the Biosphere Program. This resource map shows where similar plant and animal life appear. For our purposes, this resource map, containing 15 different biomes, also becomes an indicator of similar patterns of soil, climate, hydrology, etc. subsystems within each biome pattern.

Along with plant and animal types, these subsystems become the basis upon which many indigenous technologies depend. We then combine this map with an inventory list of private and public institutions around the world which deal with a particular topic being researched. If, for example, we are dealing with indigenous materials, we bring out our constantly expanding list of institutions that have been using or researching indigenous materials in their particular geographic location. We then literally overlay this list with all geographic locations of all these indigenous materials institutions with the biogeographical map and send off a series of search questions dealing with various major housing components to those institutions which correlate geographically with the biome under consideration.

In the case of Nicaragua's East Coast, we find ourselves sharing similar resource conditions with nine (9) other areas of the world that are within our particular Tropical Grassland and Savanna biome. As we check out our list of institutions, including building research laboratories, grass roots non-profit appropriate technology groups, private laboratories, and individuals, we send off our search request. This direct search is also paralleled by searches into various data bases in the U.S. through keyword and geographic town/country indexes that already are contained in some of these data banks that we can cross-reference into our biome areas. Our own data base of institutions cross-referenced to the I.U.C.N. map identified 47 groups doing indigenous materials work in our global biome of Tropical Grasslands and Savannas, which is spatially mapped below. It was from this type of search that such diverse topics as coconut coir reinforcement, laterite clay cement and laterite clay low temperature brickmaking were discovered.

At times our investigation went beyond the biome in certain sub-category areas such as soils. For example, it was found by investigating building research in general regarding latisol-type soils which exist both within and outside the biome boundaries (into sister biomes), that some very low energy use latisol block fabrication techniques have been discovered in relation to laterite soils in Ghana in a sister biome* called Tropic and Humid Forests. It was found that soils from that area have produced a lime stabilized block under pressure of 300 Kg/cm(2) and cured at only 208°F. with a resulting compression strength of 1523 PSI. These will be more fully described under the section called **Area Resources**.



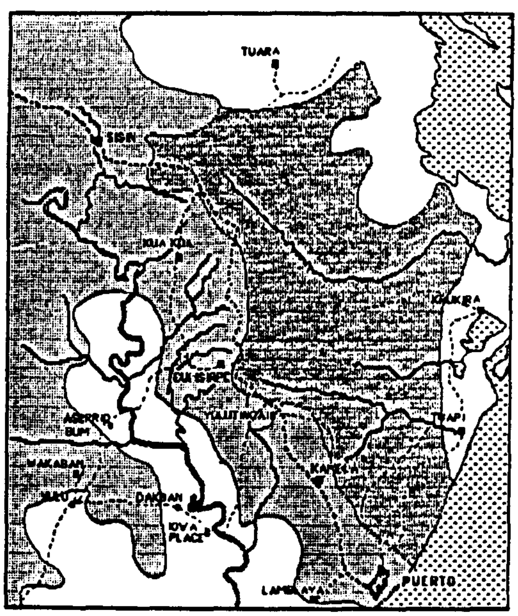
*Sister biomes are spatially adjacent to the parent biome being used as point of reference. They often share one or more characteristics with the parent biome; in the case of the Tropical Humid Forest Biome, it shares parent soil types, mean annual precipitation, and climatic zone.

PHASE 2 - AREA RESOURCE IDENTIFICATION

By using the investigatory processes outlined in Phase I, we are better able to understand and ask the necessary questions regarding the potential resources that we may find on-site. This is an important procedure for the following reasons:

(1) We may better ask local people the necessary questions so that we can better understand available building options.
(2) There may be no pre-recorded use of certain available resources that could be of use to the local population if the skills required to develop them meet the local skill standards.
(3) We may use biome criteria to design and choose the necessary equipment within a building material testing laboratory.

Ideally, the area resource identification process therefore occurs through two different means: one, at the larger scale of the biome which sets the standard as to further searching the possible range that one should expect to find at the on-site bioregion level; the other at the micro scale of identification using a laboratory. Combined, these two levels of identification become a kind of learning system that is almost self-critical at one end by showing what is hypothetically possible and what should be looked for, while at the other end what actually tests out identification-wise to be present and whether those materials that do exist are useful for building. Some of the accompanying area resource maps for the Puerto Cabezas Project follow.

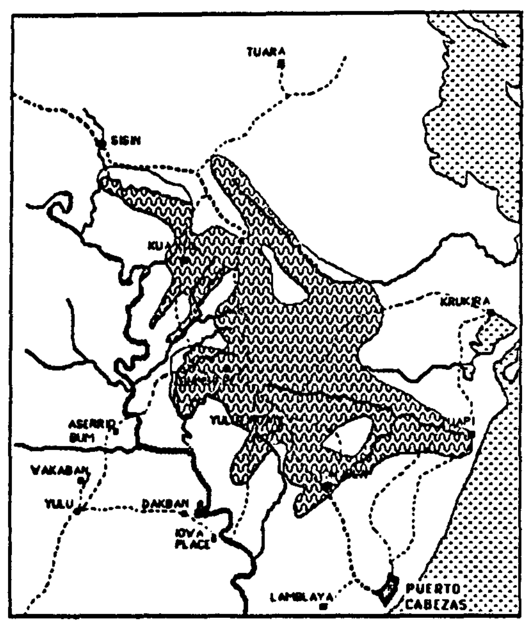


0 5 10
SCALE: MILES

PUERTO CABEZAS INDIGENOUS HOUSING PROJECT

PLINTHAQUIC TROPUDULTS
PLINTHIC ORTHOXIC TROPUDULTS

AREA RESOURCE MAP
HIGH ALUMINA CLAY KAOLINITE SOILS FOR FIRED CLAY & CEMENT
SOURCE: ISRAELI STUDIES

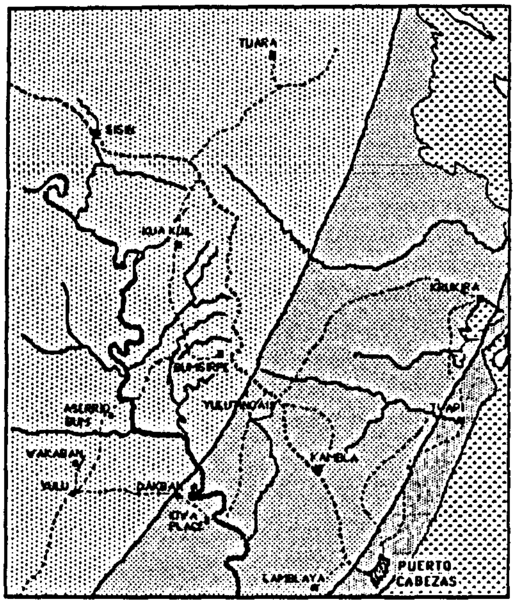


0 5 10
SCALE: MILES

PUERTO CABEZAS INDIGENOUS HOUSING PROJECT

SCATTERED SOURCES OF OVER LUMBERED PINE FORESTS

AREA RESOURCE MAP
PINE WOOD FOR LUMBER, WOOD CHIPS, FIBER, SAWDUST



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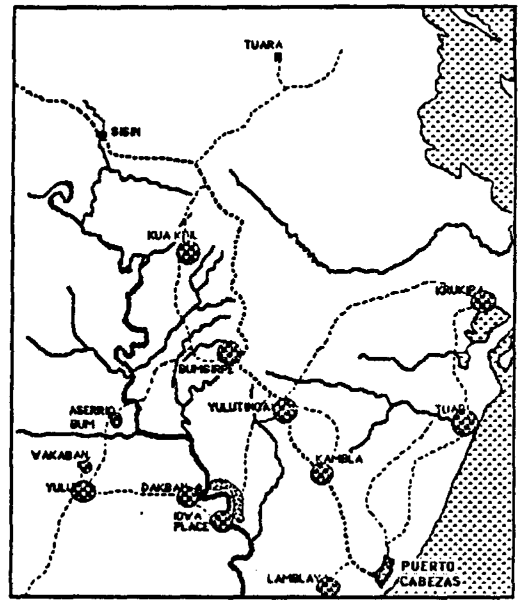
SCALE: MILES

PUERTO CABEZAS
INDIGENOUS HOUSING
PROJECT

135-130 INCHES/YEAR
125-130 INCHES/YEAR
120-125 INCHES/YEAR

AREA RESOURCE MAP
PRECIPITATION QUANTITIES
FOR USE AS ON SITE CISTERN
WATER SOURCE



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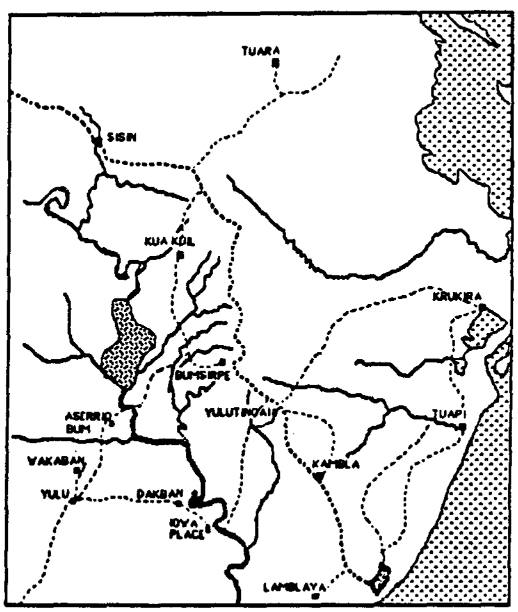
SCALE: MILES

PUERTO CABEZAS
INDIGENOUS HOUSING
PROJECT

COCONUT PALM
BAMBOO

AREA RESOURCE MAP
FIBROUS MATERIAL FOR
REINFORCING



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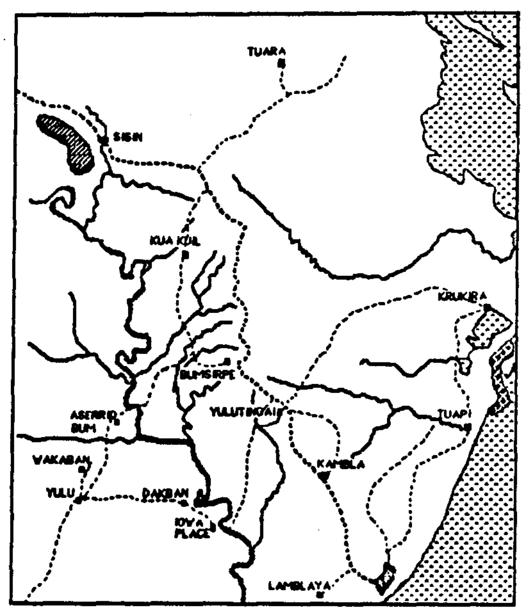
SCALE: MILES

PUERTO CABEZAS
INDIGENOUS HOUSING
PROJECT

RICE PADDIES

AREA RESOURCE MAP
RICE AS SOURCE FOR RICE
HUSK USED IN CEMENT
MANUFACTURING



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SCALE: MILES

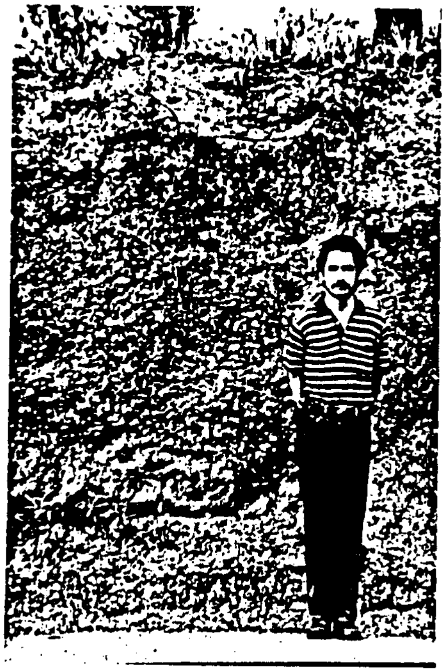
PUERTO CABEZAS
INDIGENOUS HOUSING
PROJECT

LIMESTONE
SEA SHELL

AREA RESOURCE MAP
LIME SOURCES FOR MASONRY
AND CEMENT

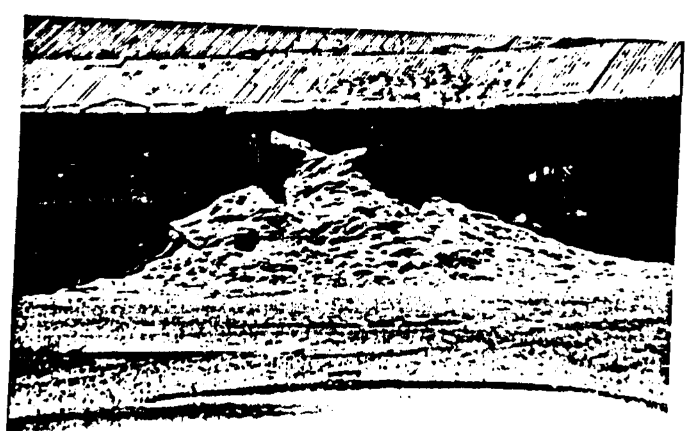
SOURCE: WORD OF MOUTH

KAOLINITE HIGH ALUMINA CLAY



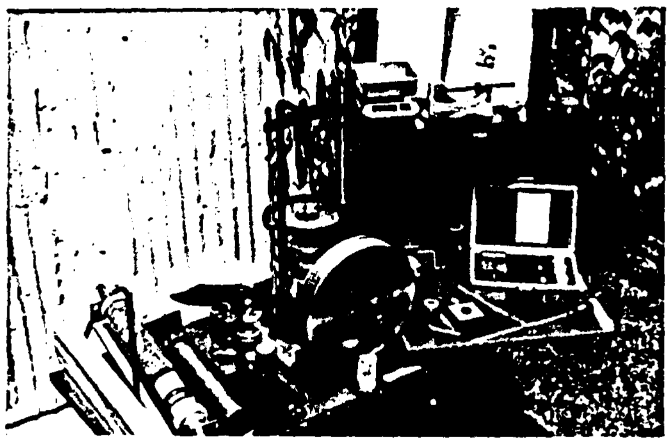
WASTE PINE SAWDUST AND WOODCHIPS

WASTE RICE HUSK



The laboratory design derives from this investigatory procedure. Its equipment contents and laboratory procedures lean toward what might be expected to be found not only around the information that exists on the site itself. Often, however, this approach is cost prohibitive and one must settle for a close approximation to what is known in the regional site conditions.

Our laboratory included the following: basic soil classification equipment, including sieve analysis screens with shaker; Atterberg limit device; two weighing scales; oven; salinity tester; pH tester; compression tester; water absorption tester; water spray test; five pound earth ramming device to determine optimum soil moisture and strength of rammed earth; high temperature potter's kiln; high temperature thermometers; and liquid limit tests specifically designed for potentially cementatious materials.



A summary of findings from this combined research can be divided into five (5) general areas. These include: 1) compression materials; 2) reinforcing; 3) materials useful for combined compression and tension; 4) preservatives and paints; and 5) insulative and transparent materials.

Compressive materials include indigenous cement, fired clay materials, and stabilized earth. More specifially we found cement type possibilities to be derived from waste rice husk, burnt kaolinite clay, and lime based materials. Portland type cement also seems probable. The quantities of these materials was found to be extremely plentiful including 34 tons of rice husk ash cement wasted within Puerto Cabezas each year, 14,800 sq. km. of kaolinite clay useful for possible cement production when fired and mixed with lime, and 5-10 sq. km. of lime based materials which can be fired and mixed with clay for portland cement production. As a fired clay material, the 14,800 sq. km. of kaolinite clay also contained perhaps as much as 20 sq. km. of high grade china quality clay material. Together, these clays, when fired, could produce many housing components including sewer drainage pipe, sinks and lavatories, brick, floor tile and roof tiles. Last, earth materials that are not fired include pressed laterite soils utilizing a lime admixture. This latter material processing technique could have the potential of utilizing the kaolinite which is a latisol thus placing this building technology at merely equal to the 14,800 sq. km. base material category.

In the category of reinforcing materials we found six (6) prospective materials with a history of processing and use existing in other geographic biomes. These include: coconut fiber, pepta palm fiber, pine fibers, various bamboo species, and elephant grass. Of these, the coconut fiber and pine fiber have had the most use and experience where a high degree of success has resulted from their use with concrete type reinforcing applications.

Materials useful for compression and tension in the form of roof joists, columns, and lintels, etc. were the wood species. This category included native species such as pine, zopelota, bamboo, leucaena, and eucalyptus. The unique attribute about building materials based on plant species is that relevant species derived from the Tropical Grassland and Savanna Biome can be transplanted from other geographic areas. However, this is also a delicate process because certain very tolerant species can dominate and upset the potential for the proper propagation of regional species. Species that therefore looked like potential candidates for an experimental and controlled introduction procedure were looked at particularly if their growth rates and environmental tolerance were attractive. Due to the fact that this Savanna was nearly all lumbered by U.S. companies, candidates which tolerated the poor soil, high clay and high flooding conditions of this tropical location were the following: Australian pine (ironwood), Australian acadia, gumbar, India blackberry, and Indian almod, a Trema species from Madagascar, and *Eucalyptus grandis* from Brazil.

Preservatives and paints can be derived from combinations of plant and mineral based materials. A preservative called fout, for example, is derived from the trunk and roots of the pine tree species in the project area. Resinous materials that are the basis for shellacs, varnishes, lacquers and paints are derived from a series of plants referred to as Copals, a number of which could be grown or already grow in the region. There is the possibility that the well-known Nim tree from India could be introduced for purposes of producing a safe pesticide for other less tolerant but more plentiful wood species.

Insulative and transparent materials could be derived from a combination of waste wood from sawmills in the form of chips and sawdust combined with cement to make building panels that are self-supporting and moderately insulating. This well-proven technology can also incorporate rice husk in place of wood, according to one building research group in India, discovered through our computer data base searches of groups in this biome. Approximately 20 sq. km. of a high grade silica sand for glass manufacturing was found about 30 km. northwest of Puerto Cabezas.

PHASE 3 - POINT RESOURCE IDENTIFICATION

The third phase of the planning process involves the identification of the human resources found within the project area. The human resources are identified as the skills relative to the prime area resources within the region and the tool and equipment capability of the local population relative to the development of the region's resources. The financial requirements result from the deficiencies of the above combined survey.

The skills, equipment, and other facilities required are most often only partially fulfilled when we compare the ideal point resource combination necessary to develop the region's resources to what actually exists at the present time. This need gap results when a local population has become dependent for one reason or another on external political and economic forces that have resulted in a skills and equipment shift that no longer fully relates to the capabilities of the region. This gap between what is presently used and what could be utilized from within the region itself is reflected in housing deficiencies, skill deficiencies, and equipment mismatches which in the end culminates in an identifiable economic deficit in the region. The latter occurs because the region had been forced more and more to depend on outside goods and services at the expense of developing its own productivity potential in order to remain internally stable or develop into a small scale exporter of certain goods not found in other neighboring regions.

The survey that was made in Puerto Cabezas and the surrounding region was therefore designed to help identify this gap; first in housing, then in skills and equipment. Once this information is compiled, the biotechnology/bioregional planning team helps to formulate the **development process** described in a following section. Ideally, this final development process step follows a line of least resistance; i.e. incorporating the maximum number of existing skills without retraining, using the maximum amount of existing equipment and facilities without importing more, while subtly transforming the whole into a regional manufacturing entity. This procedure does not at all imply that a regional manufacturing facility should result, but more likely that individual skills and family enterprises are reinforced by better connecting one small business to the other and to a regional material base that can better guarantee long term stability. The following paragraph describes briefly some of the discoveries made in our survey with the indigenous people of Eastern Nicaragua.

HOUSING SURVEY

General:

(1) Nearly all families who had a home wanted to have it repaired; if they did not have a home, they wanted a home similar to their traditional housing.

(2) Nearly all families wanted to have their own backyard garden. They also desired fences to keep out stray animals.

(3) Most families wanted their small backyard businesses, if they had one, reinforced through economic or other support.

Building Related:

(1) Nearly all metal roofing was found to be in disrepair, usually leaking (with 120 in. rainfall per year) and too hot in the tropical sun.

(2) Better sanitary facilities including the availability of private water supply, latrines, and safer waste water disposal.

(3) Better cooking facilities that depended on inexpensive fuel sources, although kerosene stoves were preferred; also in this category was the need for better food storage facilities.

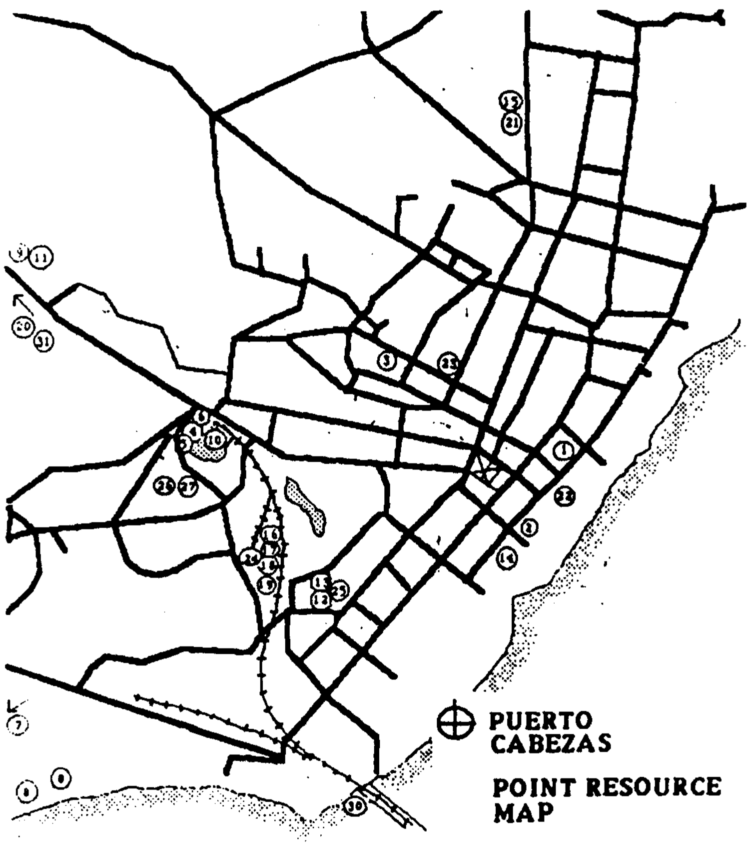
(4) Since most all structures are elevated for purposes of receiving good breeze and protection from animals, good floor structures were required but usually in disrepair as were steps.

SKILLS AND EQUIPMENT SURVEY

Apoproximately 25 skills and equipment sources have been identified within and immediately around the Puerto Cabezas town proper. The following skills areas were identified:

Masonry Block and Masonry Sink Production; Welding and Machining; Thatch Roof and Corrugated Roof Installation; Lumbering, Sawmilling and Planing; Baking with Brick Ovens; Small Boat Fabrication; Gasoline Engine Repair (all sizes); Backyard Gardening, including many edible native plants; Basic Cistern and House Plumbing; Septic Tank Manufacturing; Heavy Equipment and Road Scraping Capacity; Carpentry; Sheet Metal Fabrication; the Use of Forges.

In most all of the above cases, inadequate back-up equipment existed or equipment that was in serious need of repair. An exception to this was the overabundance of electric welding machines, especially in the vocational school, where no welding rod exists. The repair and maintenance of sawmilling equipment was well covered.



PUERTO CABEZAS POINT RESOURCE LIST

1. SAN PEDRO CONCRETE BL. YARD
2. SAN PEDRO CONCRETE SINK YARD
3. ABANDONED CONCRETE BL. YARD
4. RD. PAVING CONCRETE BL. MACH.
5. RICE HUSK MILL
6. OLD KILN FIRE BRICK
7. CHARCOAL KILNS
8. 2-6' MAT. SALT WATER TUBS
9. CEMENT MIXERS
10. FRESH WATER POND
11. SAND AND GRAVEL SEIVES
12. RICE HUSK INCINERATOR
13. BALL MILL COMPONENTS
14. ROLLER FOR FIBER SEPARATION
15. OSCAR PALMER ROLLER FOR FIB. SEP.
16. SHEET METAL WORKING
17. WELDING
18. MACHINE SHOP
19. FORGE
20. LUMBER MILL
21. OS. PALMER CARPENTRY SHOP
22. CHURCH CARPENTRY SHOP
23. AUTO ELECT. SHOP
24. ELECT. MOTOR REPAIR
25. WELDING EQUIPMENT
26. WELDING SCHOOL
27. WOOD WORKING SCHOOL
28. SHEET METAL SCHOOL
29. TANKS FOR PRES. PROCESS
30. ELECT. AT SALT WATER EDGE
31. SAWDUST PILES

PART B - THE DEVELOPMENT PROCESS

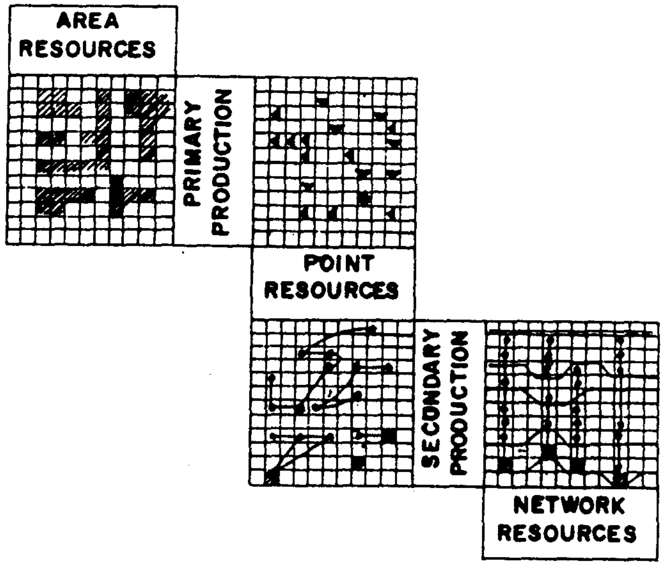
The Development Process brings together into a development sequence the various natural and human resources that have been identified in the Planning Process as they relate to the existing conditions in order to supply the requisite housing for this Project.

First, three resource components were identified: *Area Resources* (useful mapped physical resources that could, when processed, fulfill human needs for materials); *Point Resources* (the equipment and skills necessary to transform these raw materials into usable products); and *Network Resources* (the recording of already existing lines of activity from raw material to final housing components). Together, these activities represent examples of how Area Resources and Point Resources can be brought together to represent various levels of product development, all the way to a housing prototype. Essentially, the Point Resources (skilled people and their associated equipment) act as transformers of energy, materials or information supplied from another Point Resource or transformation process. The connections between these Point Resources (or transformation entities) consist of a flow of money, materials, energy or information. As you will soon recognize, since some of these flows do not exist because the point resources do not exist, we outline optional development alternatives in order to compare the number of non-existent and existent point resources represented in one development sequence vs. another.

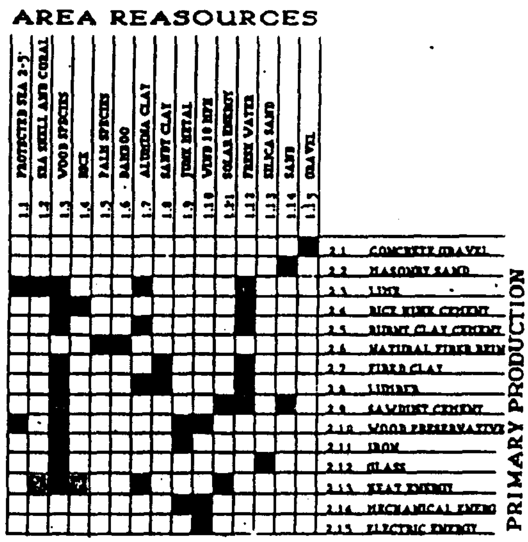
The first phase of the project has identified most of the area resources, point resources, and some of the networks necessary for an indigenous housing project to occur in the region. We have also identified all those parts that need to be created in order for complete product development to occur. Phase II will place quantifiable units on the necessary production and flow capacities required, so that we can measure both existent and non-existent activity against a production goal.

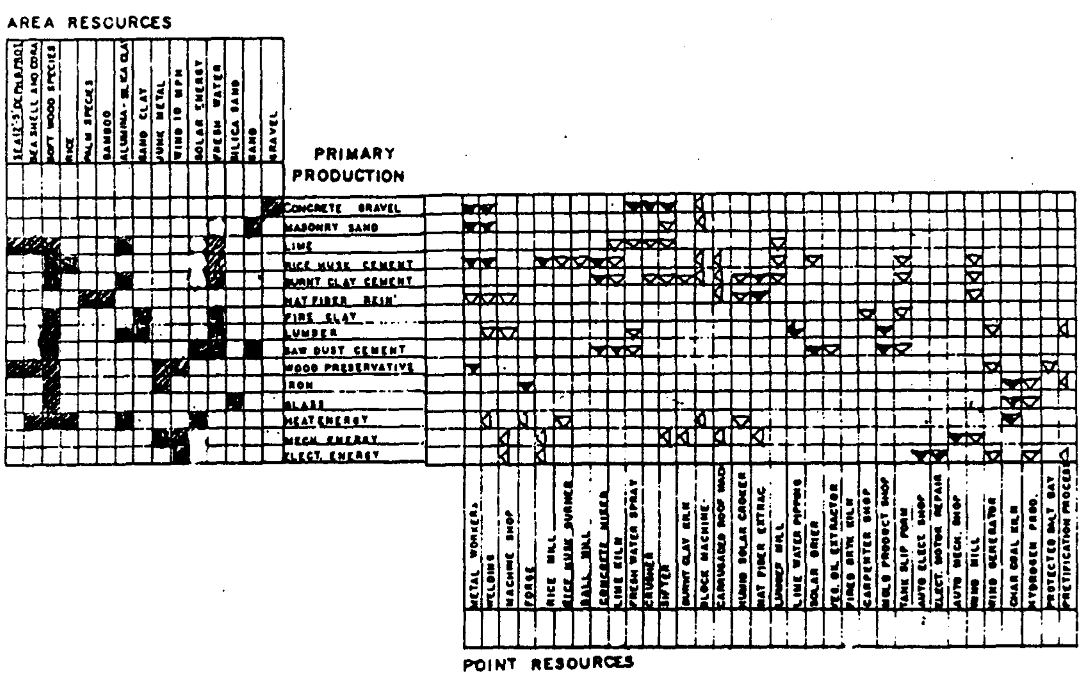
INTERACTIVE FIELD MATRIX

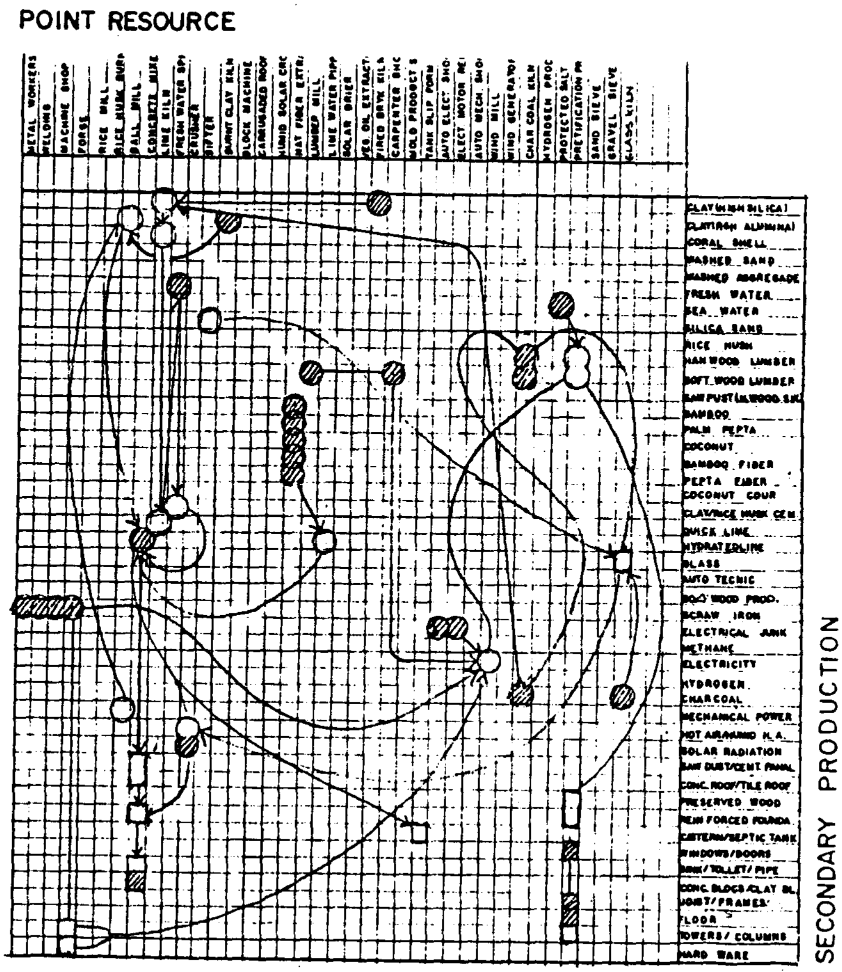
In order to represent the entire process from Area Resource identification through to Network, we have utilized a management tool called an interactive field matrix which has the ability to relate variables in a continuous manner. However, it was necessary to add two important elements to the matrix in order for the continuity between area, point and networks to be understood. These elements were: 1) primary production and 2) secondary production.



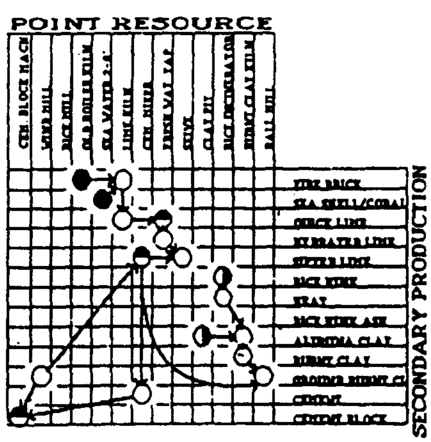
Primary Production can be identified as the primary product resulting from first level processing; i.e. coral into lime or trees into lumber. The *Secondary Production* list includes all primary production categories and adds to it more finished materials; i.e. indigenous clay sources into bricks or roof tile, or lumber into building components ready for home construction. Secondary Production, therefore, represents enough steps within the whole production process that when it is correlated to point resource equipment and skills, points can be connected so they show a diagrammatic representation of the entire production process.

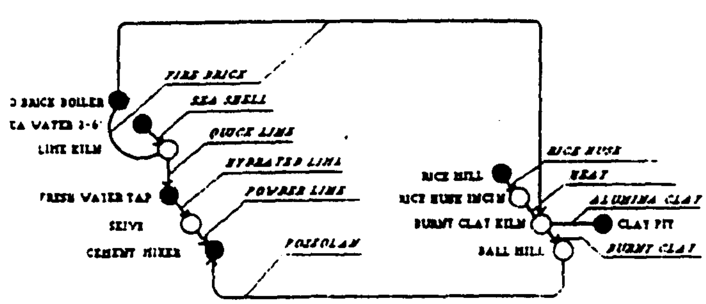






A detail of Burnt Clay-Rice Husk Ash Cement is detailed as a more specific demonstration of this procedure.





NETWORK RESOURCES

Network Resources are represented when these flow and transformation processes are identified by labor organizations. For example, cement products manufacturers are linked by common suppliers, resources, and even transportation means. In a similar way, one can identify clay products, lumber products, metal, hardware, sanitation facilities, energy equipment manufacturers, etc. Depending on the stage of development within the social and institutional infrastructure, one can find trade organizations that are organized either around production sequences, i.e. (vertically), concrete product manufacturers associations, or around different stages of end-products, ie. (horizontally) raw material suppliers, product manufacturers, energy producers, building contractors, etc.

By recognizing both the horizontal and vertical orders of organizations, different types of coordination can be recognized. For example: (vertically) overall production of masonry products, both cement and clay, can be better coordinated to meet the structural wall goals for housing; or (horizontally) worker issues related to working conditions, safety, pay, etc. can be discussed at the different supplier levels, from mining at one level through to subcontractors who together can be represented by worker organizations at another level. Organizations which already exist can aid greatly in these organization efforts. If they do not exist, these different associations might gradually have to be created so that both human production and technical production issues are fully recognized to foster a home building industry which can function through the long term. Many of these network resources have yet to be identified for the Puerto Cabezas region.

CHOOSING A DEVELOPMENT STRATEGY

The final housing development process is chosen by considering a combination of factors that try to fit the need for the number of required homes into the simplest strategy of utilizing the existing natural and human resources, recognizing environmental and sustainability parameters. This strategy is chosen from a variety of development alternatives that cover each major part of the physical housing environment. Six major housing components were chosen . These include: Materials (roof, walls, floor, foundation); Climatic System; Water System; Sanitation; Food Preservation; and Insect Issues (human and material requirements).

Each of these physical components with their individual alternatives were diagrammed in a similar analysis, as was the rice husk ash cement shown earlier. A simplified version of the materials component in form of (1) walls and foundation; (2) roof; (3) water and sanitation is shown below in order to give some concept of the work procedure.

Each development strategy covering major building components was critiqued using an appropriate technology assessment procedure sheet, as briefly outlined below. This critique approach assesses the skills and equipment used in a given development strategy against two major parameters: (A) Ecological Constraints and (B) Network Resources. The Network Resources in turn deal with the four primary network flows of information, money, materials, and energy. Depending on the depth to which a project can be taken, this critique process can become as quantitative as necessary. For example, it can be shown that if a cement development strategy were chosen, that per dollar increase in output, the cement industry is one of the highest users of energy and one of the lowest users of labor. On the other hand, clay fired products and wood products show much better ratios regarding both energy expenditure and use of more local labor skills. Other factors affecting choice of production means was the accessibility and quality of prime materials such as wood vs. masonry products. Since the Savanna was over-lumbered, wood products are now more difficult to acquire whereas clay and cement products are closer to the area of Puerto Cabezas.

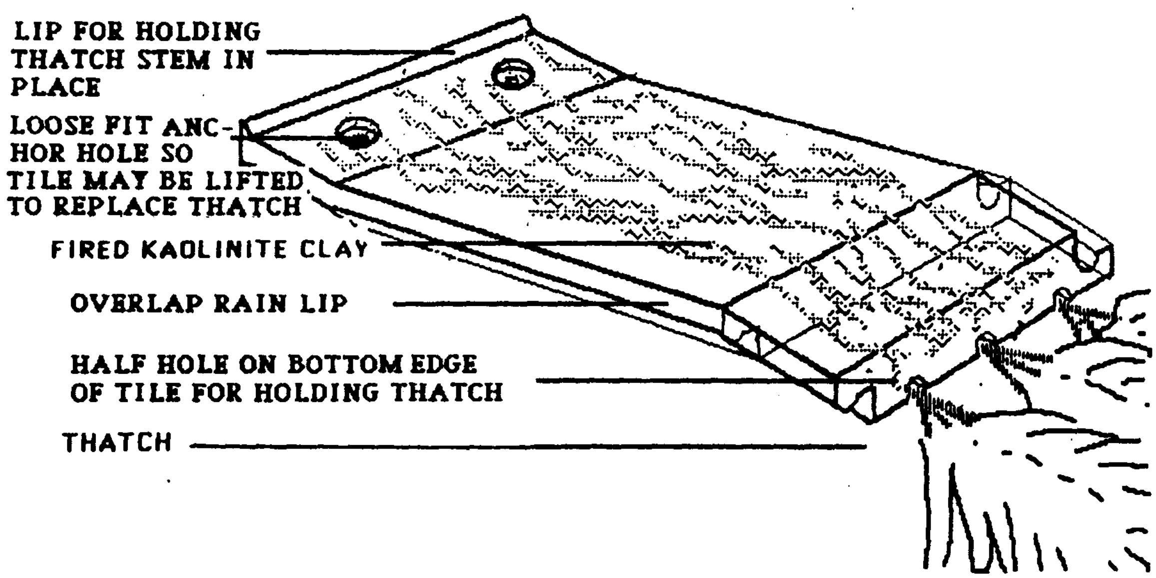
The final housing component choices are diagrammed below and are in response to this type investigation. Some back-up photographs are supplied to show where the project stood several months ago in Nicaragua. More detailed reports are available upon request. Please send for our publication list or inquire directly about this indigenous housing project.

This paper originally appeared in **Earth Systems Reporter**, No. 6, Fall '85 (Earth Systems Development Institute, Robert Proctor, Editor, 7921 E. Horseshoe, Scottsdale, AZ 85253).

ONE EXAMPLE OF STUDIES DONE SHOWING THE USE OF LOCAL SKILLS AND LABOR COMBINED WITH AN IMPROVED PRODUCT STILL TOTALLY BASED ON INDIGENOUS MATERIALS. IN THIS CASE A CLAY ROOF TILE USING A TYPE CLAY HISTORICALLY USED FOR POTTERY BY MISKITO INDIANS INCORPORATED INTO A SPECIALLY DESIGNED TILE THAT USES ANOTHER TRADITIONAL MATERIAL, THE PALM TO KEEP THE SUN OFF THE ROOF. THE PALMS CAN BE REPLACED SIMPLY BY LIFTING THE TILE FROM INSIDE THE DWELLING AND PLACING NEW STEMS AND LEAVES (EVEN TIED IN THE TRADIONAL MANNER). THE PROPOSED ROOF WOULD THEREFORE BE FIRE PROOF FROM WITHIN AND COOL DUE TO THE SHADING AND JUST AS IMPORTANTLY INCLUDE A MORE ADVANCED COMBINATION OF INDIGENOUS SKILLS.

FIRED CLAY PALM TILE

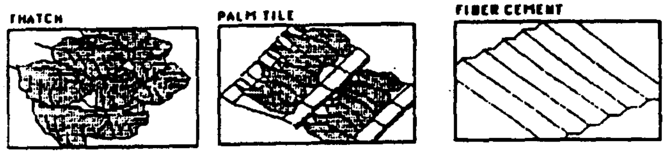
(THATCH IS REPLACABLE AND IS HELD IN PLACE BY WEIGHT OF TILE)



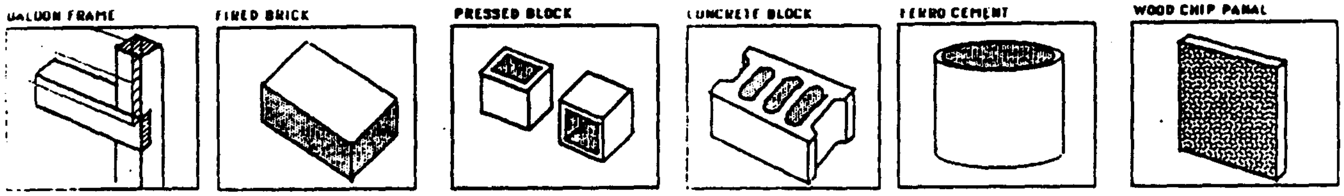
15. Pliny Fisk/Gail Vittori

ALTERNATIVE DEVELOPMENT STRATEGIES

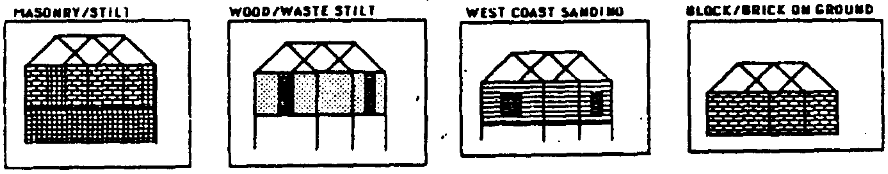
ROOF



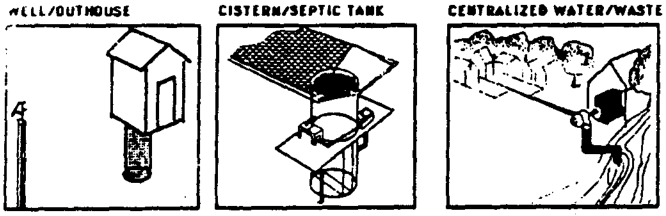
STRUCTURE



CLIMATE SYSTEM



WATER/WASTE WATER



DEVELOPEMENT ALTERNATIVES

STRUCTURAL

WOOD FRAME
- WOOD
- TRANSPORT
- SAWMILL
- FUEL
- SIZING MILL
- FASTENERS
- PRESERVATIVES

FIRED BRICK
- KAOLINITE
- TRANSPORT
- SEPARATOR
- MOLDER
- KILN
- FUEL
- BRICK LAYERS

PRESSED BLOCK
- KAOLINITE V.AL.
- TRANSPORT
- PRESS
- LOW TEMP HEAT
- BRICK LAYERS

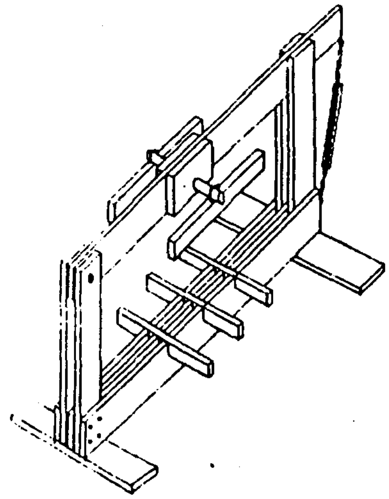
CEMENT BLOCK
- LIME/CLAY
- TRANSPORT
- KILN
- FUEL
- BALL MILL
- BAGGING/STOR.
- SAND/GRAVEL
- TRANSPORT
- WASHERS/SEIVES
- MIXING
- MOLDING
- BLOCK LAYERS

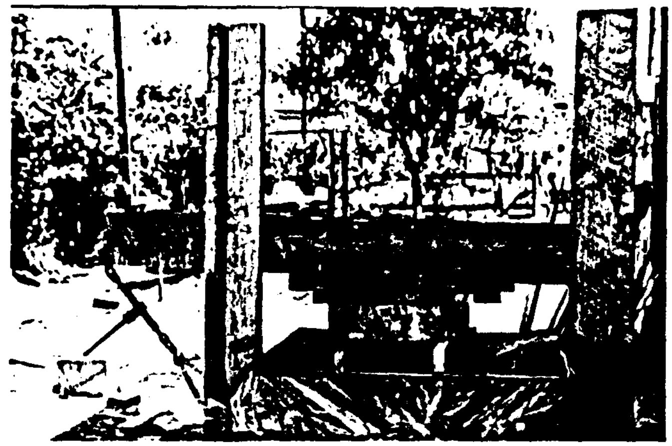
FERRO-CEMENT
- LIME/CLAY
- TRANSPORT
- KILN
- FUEL
- BALL MILL
- BAGGING
- SAND/GRAVEL
- TRANSPORT
- WASHERS/SEIVES
- COCONUT FIBER
- FIBER EXTRACT
- FORMING

WOOD CHIP PANAL
- LIME/CLAY
- TRANSPORT
- KILN
- FUEL
- BALL MILL
- BAGGING
- SAND/GRAVEL
- TRANSPORT
- WOODCHIP WASTE
- MIXING
- FORMING

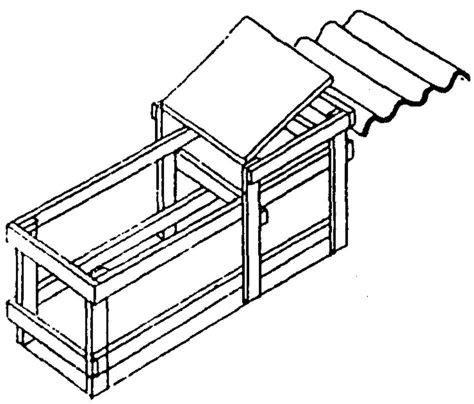
SOME FABRICATION EQUIPMENT BEING TESTED

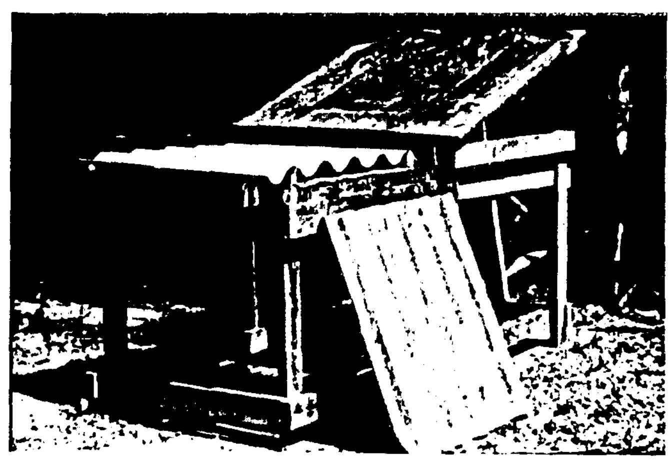
SAWDUST PANEL PRESS TABLE



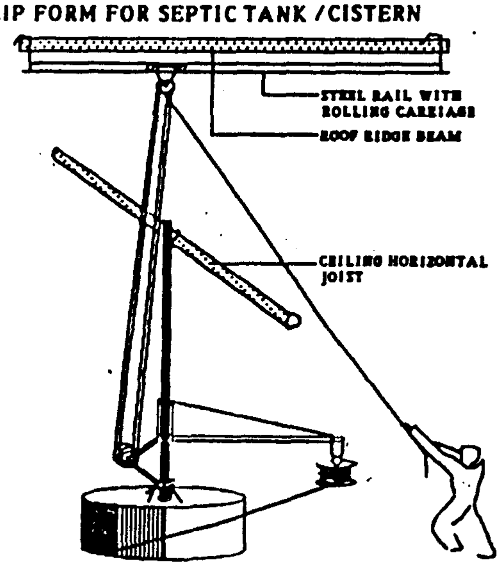


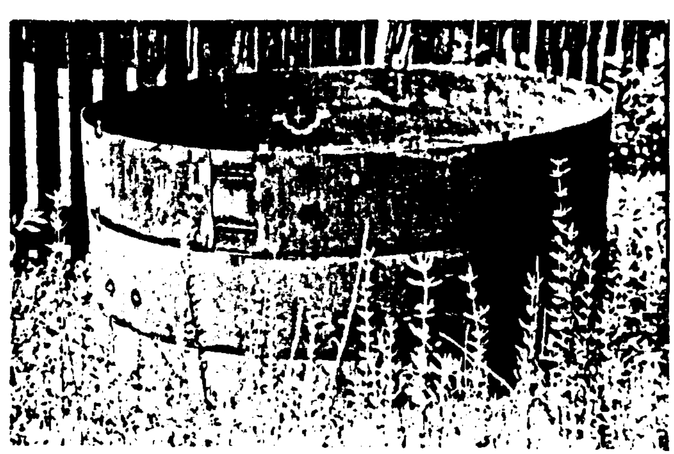
FIBERCRETE CORRUGATED ROOFING





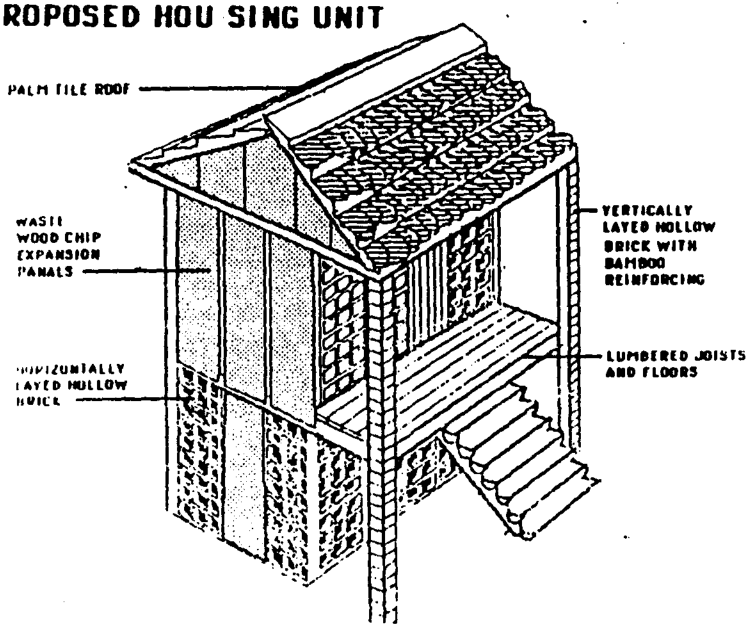
SLIP FORM FOR SEPTIC TANK /CISTERN



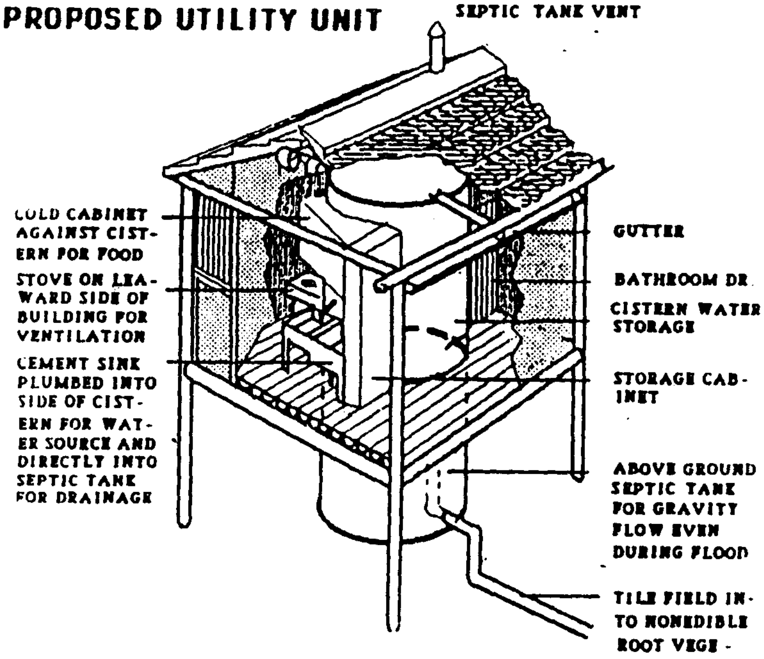


INDIGENOUS HOUSE

PROPOSED HOU SING UNIT



PROPOSED UTILITY UNIT



NEW PERSPECTIVES IN PLANNING IN THE WEST

ARIZONA STATE UNIVERSITY
MARCH 1985

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2. **Title:** A PLANNING PROCEDURE FOR BIOTECHNOLOGIES IN THE BIOREGIONAL CONTEXT

3. **Abstract:** THIS PAPER RESPONDS TO REQUESTS EXPRESSING INTEREST IN OUR ORGANIZATION TO WRITE A GENERAL, STEP-BY-STEP DESCRIPTION OF HOW A REGION AND ITS PEOPLE CAN REESTABLISH BIOREGIONAL IDENTITY. ALTHOUGH STILL DEVELOPMENTAL IN NATURE, WE HAVE USED SUCH A PROCESS IN SEVERAL THIRD WORLD HOUSING AND INDIGENOUS CULTURE PLANNING PROJECTS FOR THE PURPOSE OF HELPING TO REESTABLISH A SUSTAINABLE RESOURCE BASE FORTHE FUTURE. THE PROCEDURE DESCRIBED CONTAINS PLANNING AND TECHNICAL ASSESSMENT PROCEDURES , AS WELL AS COMMUNITY ORGANIZING COMPONENTS WHICH, TOGETHER, CAN ACT AS TRANSITION TOOLS TO TRIGGER THE NECESSARY REGIONAL SELF IDENTITY NECESSARY FOR SUCH AN APPROACH TO BECOME PROPERLY ESTABLISHED. THE PROCEDURE FINDS RELEVANCE ESPECIALLY AMONG CULTURES PRESSED TO MAKE MAJOR DESCISIONS AS TO THEIR DEVELOPMENT FUTURES AND IN PARTICULAR DECISIONS ON WHETHER THESE FUTURES SHOULD BECOME GLOBALLY DEPENDENT OR DEVELOP AN AUTONOMY BASED ON THE PRACTICAL LIMITS OF WHAT THAT CULTURE CAN PREDICTABLY DEPEND ON IN A SELF GOVERNING MANNER.

IN PREVIOUS PUBLICATIONS WE HAVE DEMONSTRATED THE OVERALL OBJECTIVE AND GENERAL METHOD FOR IDENTIFYING A BIOREGION THROUGH ITS GEOGRAPHIC (SPATIAL) AND (INFORMATIONAL) HUMAN KNOWLEDGE LEVELS. WE HAVE ALSO DEMONSTRATED THE BASIS FOR AN INFORMATION SHARING SYSTEM UTILIZING SPATIAL PARAMETERS FOR INFORMATION EXCHANGE AS THE THE "KEYWORD" SYSTEM FOR A DATA BASE. THE LATER IS ACCOMPLISHED BY BREAKING DOWN THE IDENTIFICATION OF THE BIOM (PATTERNS OF SIMILAR FLORA AND FAUNA THROUGHOUT THE WORLD AS PROPOSED BY DASMANN AND OTHERS) INTO THEIR SUBSYSTEMS OF SOILS, HYDROLOGY, CLIMATE ETC. STATISTICAL SIMILARITY BETWEEN THESE SUBSYSTEMS IS IMPORTANT TO ESTABLISH THE NECESSARY LINKS TO EIGHT (8) SUBCATAGORIES OF HUMAN BIOLOGICAL NEED.

SINCE THESE HUMAN NEEDS CAN BE EXPRESSED BY A RANGE OF REGIONALLY APPROPRIATE TECHNOLOGIES WHICH IN TURN ARE BASED ON INDIGENOUS RESOURCES, WE FIND THAT PHYSICAL PLANNING UTILIZING SPATIAL ANALYSIS IS POSSIBLE.

HUMAN RESOURCES (SKILLS, KNOWLEGE, EQUIPMENT, TOOLS AND OTHER ARTIFACTS EITHER HISTORICAL OR PRESENT) MAY ALSO BE CRITIQUED AND ORGANIZED INTO PRODUCTIVE UNITS BASED ON A REGIONS SUPPORTIVE CAPACITY. COMMUNITY ORGANIZING, THEREFORE, BECOMES GOAL ORIENTED BUT PRAGMATIC AS THAT PROCESS RELATES TO PRESENT CONDITIONS OF CULTURAL, ECONOMIC AND POLITICAL REALISM.

THE PAPER WILL PRESENT THE ABOVE FROM THE STAND POINT OF A GIVEN REGION. THE REGION CHOSEN IS ZELAYA NORTE, OR SPECIAL ZONE ONE IT IN NORTHEASTERN NICARAGUA WHERE OUR ORGANIZATION HAS BEEN HIRED BY THE SANDINISTA GOVERNMENT TO DEVELOPE AN INDIGENOUS HOUSING PROGRAM WITH THE MISKITU INDIANS. IT IS IMPORTANT TO NOTE THAT THE THE METHODOLOGY SPECIFICALLY CONCENTRATES ON PLACING SO CALLED SOFT OR APPROPRIATE TECHNOLOGIES INTO THE CRITICAL FRAMEWORK OF REGIONAL SUSTAINABILITY AND ECOLOGICAL BALANCE.