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A REPORT ON THE REFUGEE CAMP AND HOUSING PROGRAMS IN CHOLOMA, HONDURAS, FOR THE REFUGEES OF HURRICANE FIFI: DECEMBER 1974

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INTRODUCTION

On December 26th and 27th, 1974, INTERTECT representatives visited the region of Honduras which was hit by Hurricane Fifi in September of 1974. The purpose of the trip was to inspect the housing programs established by the relief agencies and to prepare a report on the units, this report to provide data for inclusion in the Housing section of the Relief Operations Guidebook as well as the first supplement. Data was also obtained to establish area housing preferences for inclusion in the forthcoming disaster response matrix being developed by INTERTECT and Carnegie-Mellon University.

The city of Choloma was chosen as it suffered the most extensive damage, and the re-housing activities here were typical of the re-housing programs throughout the disaster area.

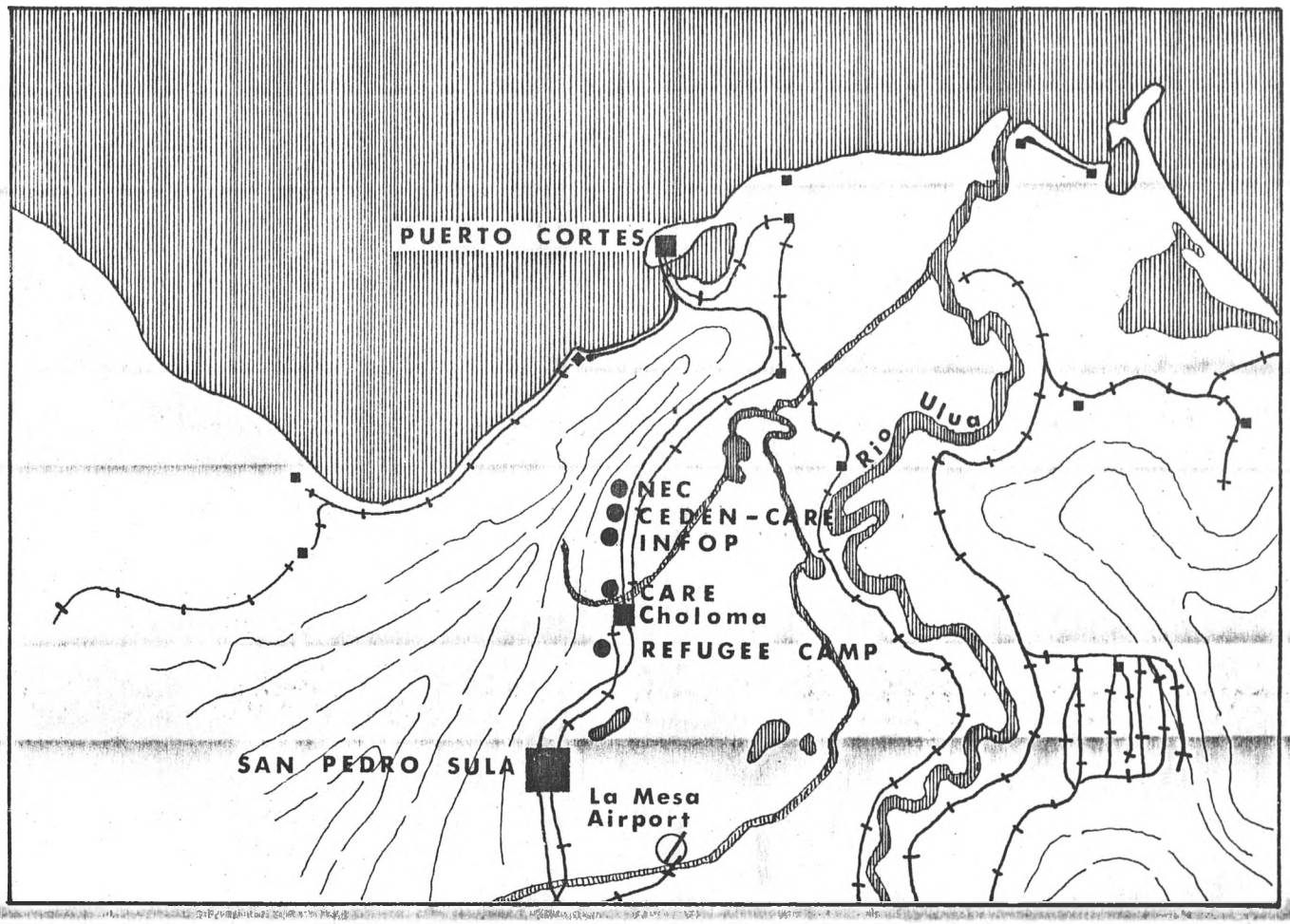
The information contained herein was obtained from interviews with relief agency personnel, administrators of the Choloma Refugee Camp, residents of the camp, construction workers at each of the construction sites mentioned in the report, and future occupants of the housing units under construction. Following the on-site inspection and interviews, a brief aerial survey was conducted.

INTERTECT wishes to thank Rev. Arturo Correa, who provided transportation to the sites and assisted in arranging contacts; Mr. Jim Nash of CARE who provided an overview of the relief operation and assisted with contacts; Senores Pedro Aguirre and Jose Barahona, administrators of the Choloma Refugee Camp who provided much information on the camp and who enabled us to meet and talk with its residents; and the CARITAS field representative who also provided much data.

Thanks are also extended to Mr. Ian Cherrett of the Catholic Institute on International Relations, Tegucigalpa, Honduras, for advice in preparation for the visit.

FIGURE 1

Housing Projects



Disaster Area

PART I: BACKGROUND

The Setting

The city of Choloma is located in the extreme north portion of Honduras in the western part of the north coast. It lies in the valley of the Río Ulua approximately 13 kilometers from the sea. The town sits on the south bank of a tributary of the Ulua which flows directly from a steep mountain ridge immediately west, a ridge which is capped by a 7309' peak less than 35 kilometers away. The city is on the flood plain of this tributary and the majority of its structures are on level ground and laid out in the typical grid of the Latin tradition.

The People

The inhabitants of Choloma are primarily associated with agricultural work and, at heart, most consider themselves rural people. The main crop of the region is bananas, and much of Choloma's population worked in the production and processing, either directly or indirectly, of that crop. The city is sited on the main road from San Pedro Sula to Puerto Cortes, the seaport for the region, and is likewise situated on the main track of the railroad between those cities, thus making the city an integral part of agricultural processing and export activities.

In recent years, the production of the agricultural crops has become more mechanized and, in the process, people living and working for the larger producers have been displaced. Many moved to the immediate area of Choloma looking for work and setting up traditional housing units of either stick and thatch construction or the more popular cement block houses (see Figure 2). The land most readily available and affordable was that adjacent to the river or in its flood plain, 300 meters on either side of the center line of the channel.

Consequences of the Hurricane

When Hurricane Fifi struck the coast, she was accompanied by extremely high rainfall. The mountains surrounding the valley were saturated to such an extent that the topsoil began to slide. With the total rainfall occurring in such a short time, the slides quickly developed into a major avalanche of mud, emptying into the tributary and flowing like a flash flood into the city. This tremendous volume of mud-saturated water forced the waters from the channel and inundated the city. In particular, those living near the channel were swept away, but others living in weak structures were also killed. The same process occurred in other parts of the valley and many additional residents were killed or left homeless by the direct wind and water effects of the storm, especially those living closer to the seacoast and those in more rural areas.

As a result of the hurricane, 100% of the structures of Choloma were damaged to some extent with 80% of the housing units suffering major structural damage.* Thus, the re-housing of the refugees became a major program in the relief operation.

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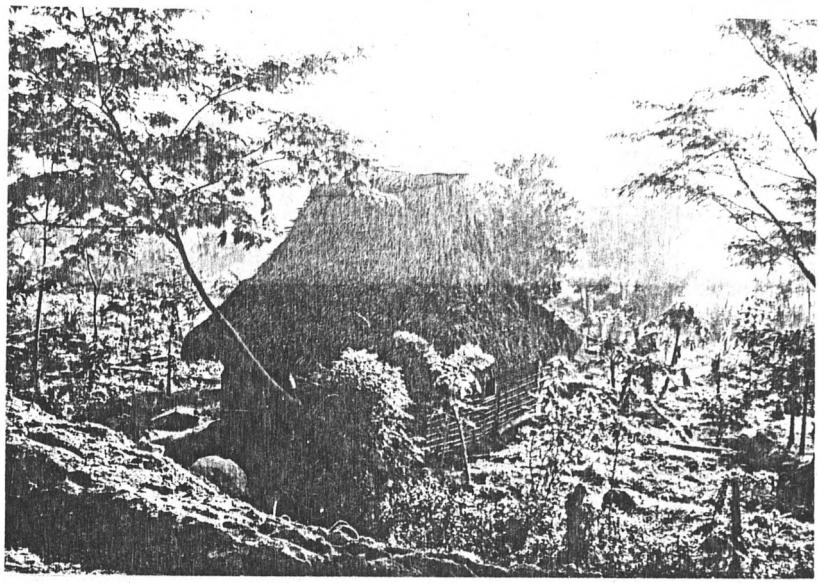
* Source: Government of Honduras

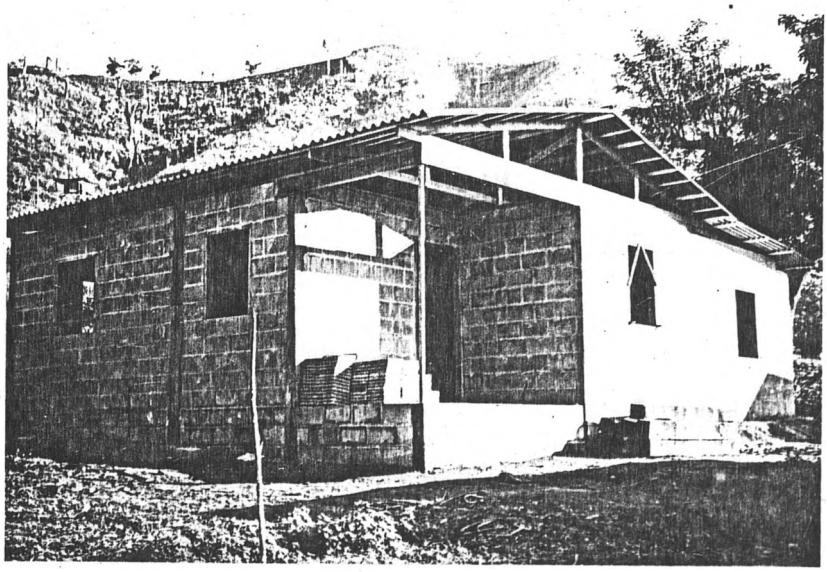
FIGURE 2:

TYPICAL HOUSING IN THE CHOLOMA AREA



2a

Rural Housing
(Stick and Thatch)



2b

Urban Housing
(Cement Block with
Zinc Roof)

PART II: THE CHOLOMA REFUGEE CAMP

(Campamentos Venezuela y Canadá)

Background Data

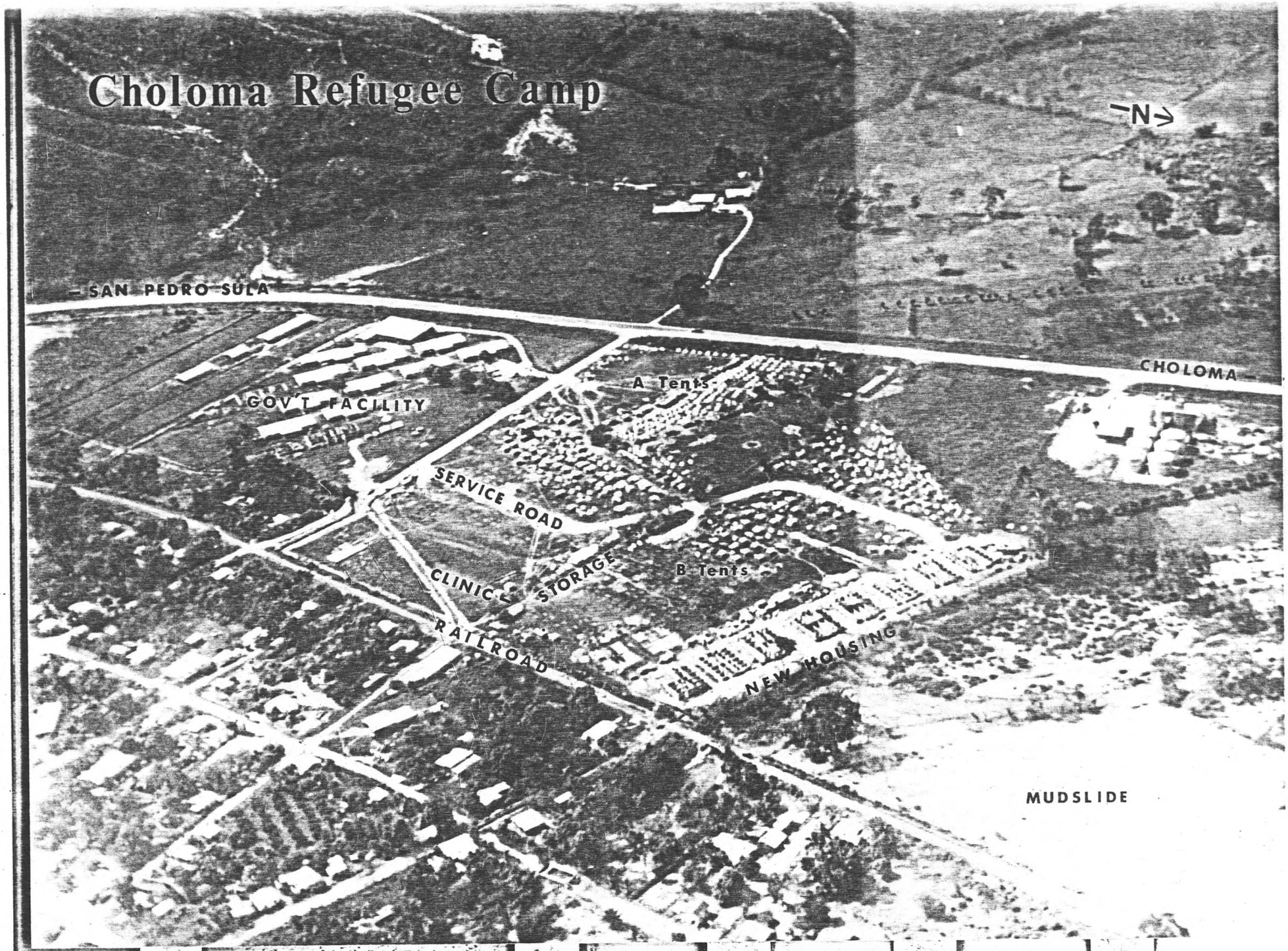
In the days immediately following the hurricane, the only activity in the relief operation geared toward re-housing the refugees was the establishment of a series of refugee camps and temporary shelters for the homeless. The largest of these camps was established adjacent to the San Pedro Sula-Puerto Cortes Road, one kilometer south of Choloma. This camp houses 318 families (1,831 persons).

The site selected is a large, unoccupied tract belonging to a small cement company. The land is flat, with a coastal grass vegetation and little tree cover, save one line of small deciduous trees -- running in line, east to west, through the center of the camp -- which are not large enough to provide either shade or a windbreak. The site is bounded on the north by a small stream; on the east by the railroad; on the south by a service road which separates the site from a government project; and on the west by the San Pedro Sula Road. In the northwest corner is the cement company property. One interior service road has recently been built and is covered with gravel and caliche. As there is no uniform slope to the tract, several depressions of no more than ½ meter variation from the mean level occur but are not naturally nor artificially drained, thus allowing water to stand in large portions of the tract. (See Figure 3, Aerial Photo of Choloma Refugee Camp.)

Responsibility for the construction and servicing of the camp was undertaken by a consortium of agencies. The housing element was carried out by two major contingents; the first phase of camp development was under the direction of the Venezuelan Army, the second by the Canadian Army several weeks later. The two units provided two different types of tents and laid out their segments in separate groups; thus today the groups are referred to and identified by the residents as two camps, Venezuela and Canadá, and are formally organized and administered by the residents as two separate groups.

Non-housing relief activities were undertaken by a number of organizations, most notably CARITAS which provided food and protein supplements. In the months since the disaster, relief supplies and services have tapered off until today only a few major activities are carried out. One nurse operates a daily out-patient clinic; CARITAS still provides food; and state-certified social workers provide a variety of services on an individual case basis.

When the camp was established, the tents were laid out in blocks using the typical grid pattern and on line with the road built to service the camp. No consideration for terrain was given except to avoid obvious areas of standing water; likewise, no consideration for social integration or spatial orientation was given. Tents in many cases are only 1-2 meters


Choloma Refugee Camp
N
SAN PEDRO SULA
CHOLOMA
GOV'T FACILITY
A Tents
SERVICE ROAD
CLINIC
STORAGE
B Tents
RAILROAD
NEW HOUSING
MUDSLIDE

apart and no concern for group living is expressed in the siting. Subsequent additions to the camp also neglected these considerations. (See Figure 3.)

Based on established criteria, the camp qualifies as a Phase I Refugee Camp.*

Facilities

Initial housing in the camp consisted entirely of tents provided in the early construction phases. At the north end of the site, permanent housing is being built which will house a portion of the residents (this new construction will be discussed subsequently). The tents are of two types, illustrated on page 8, which are designated types A and B for the purpose of this report. Both are designed for camping in a temperate environment, not for long-term occupancy in a refugee camp, and both types show considerable wear and patching (see Figure 5). Major problems include: holes in the ground cloth; tears in the roof and walls; malfunctions of the zippers; deterioration of the guy lines; and breakage of the aluminum ridge poles. Residents have noted that type A is too small for family living and does not allow many personal goods to be stored. They have also remarked that type A is less comfortable than type B. Type B, however, is more susceptible to wind damage and deterioration of the roof.

Sanitation facilities at the camp consist of open latrines and one complex of covered latrines over a ditch cut near the south central block of tents. No arrangements have been made to treat the sewage or to reduce the odors. The camp administrators report that users are those nearest the facility; others usually do not bother to walk to the complex. Solid waste is disposed of in an open pit that was originally cut to provide an additional latrine. Occasionally, earth is placed over the trash to reduce odors, but no routine has been established in this regard.

Water has been obtained from a storage tank nearby and is carried to three established water points in the camp by a 3" water hose. The water is treated in the reservoir and is theoretically sanitary when it reaches the taps; however, in fact, the hose has many cuts and could become contaminated at a number of places. It is unclear what, if any, water rationing system is used, but adequate water is available for cooking and drinking. (Water was once cut off by the supplier due to the leakages but was quickly restored following patching of the hose.)

Service facilities in the camp consist of one out-patient clinic which is operated on a regular basis; a storage complex consisting of a fenced-in open area for construction materials and a bodega (warehouse) built of wood with a zinc roof. A number of zinc-covered, open-air structures built to house community activities such as school, public meetings, etc., have been built in the central portion of the camp (see Figure 6). Electricity has been provided to the major installations of the camp, and a small number of light standards have been installed throughout the camp. There are no telephones or other means of communication in the camp and no vehicles are assigned on a permanent basis.

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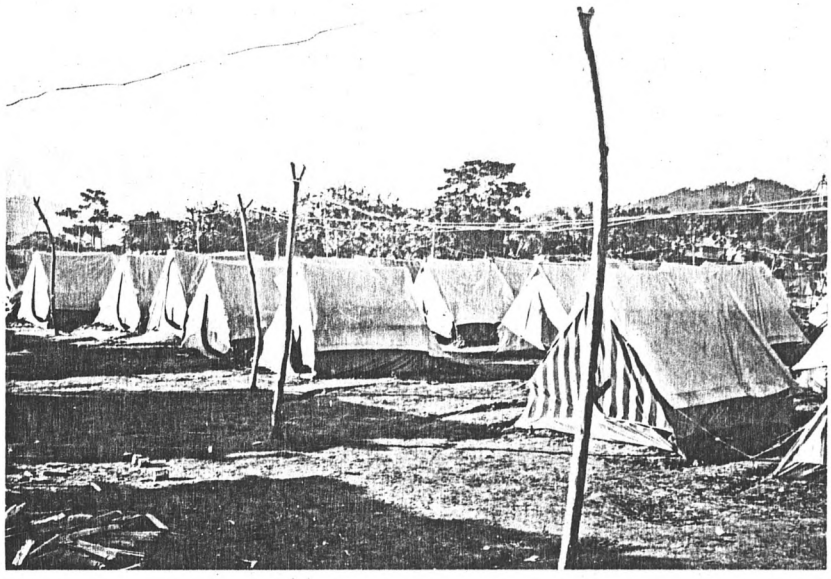
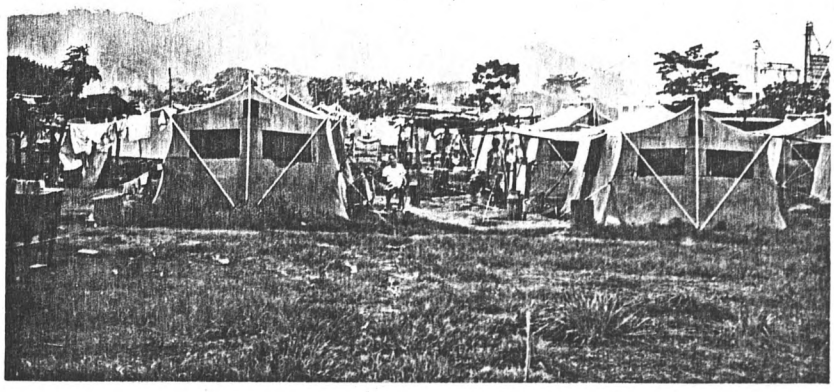
*See Refugee Camps & Camp Planning, Report I: Base Studies, F.C. Cuny & Associates - INTERTECT, Dallas, Texas, 1971.

FIGURE 4:

TENTS USED AT CHOLOMA



Type A



Type B

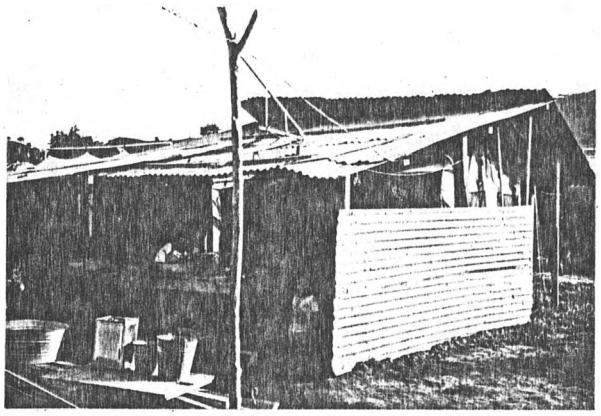


FIGURE 5:

TENT "HOUSED" BY SHELTER
TO PROLONG USE OF TENT

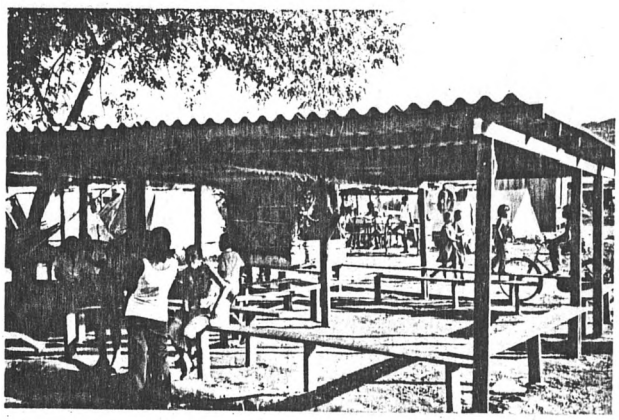


FIGURE 6:

BUILDING USED FOR SCHOOL,
RECREATION AND MEETINGS

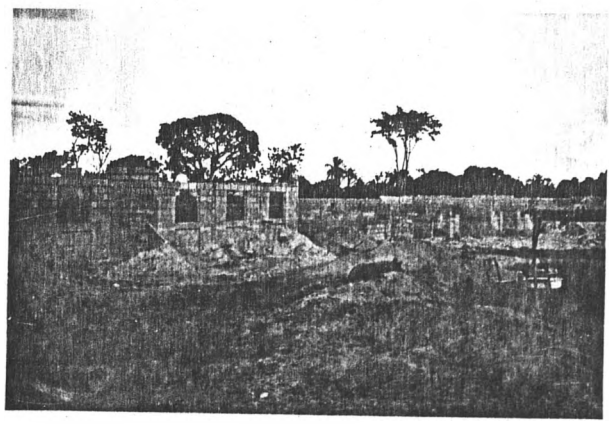


FIGURE 7:

NEW HOUSING UNITS AT CAMP

Administration

When the camp was built, no formal administration was established. After some time, the CARITAS staff attempted to establish a resident organization, but efforts generally were only partially successful. Finally, two leaders were elected, mainly through their own efforts, to represent each "camp". These two men now serve as the camp administrators and handle all transactions between the residents and relief and governmental agencies. An informal relationship exists between the two and they appear to work well together for the common good of all the residents.

It is assumed that a council also exists which helps formulate policy, but its membership and workings are not clear at this writing.

During early conversations with the administrators, an interesting point was made concerning their ability to organize the residents (though this was later disputed by the CARITAS representative). Their observation was that while the camp was still laid out in the grid, it was difficult to organize the people for self-help projects. Later, they observed people beginning to move their tents and group them with friends. The regrouping was further increased as the new permanent units were begun and people were forced to relocate to other areas of the site. It was during and after this regrouping that the resident organization was founded, and the administrators felt that it was the new "communities" that facilitated working together toward common goals. Today, these communities are clearly recognizable by the spatial separation from others, the orientation of the tents toward a common ground, and by the obvious group activities that are conducted in each area. Thus, it is felt that these initial observations were correct.

Long-term Housing

The refugee camp is currently in the process of becoming a long-term housing project. Funds have been appropriated by a local source to purchase the land from the cement company and build a complex of 45 units of multi-family housing. The units, constructed of cinder blocks, are grouped into clusters of four units per structure and are placed on line with the stream on the northern boundary of the camp (see Figure 7).

These units have been a source of much controversy within the refugee camp due to the fact that the residents were not consulted at any stage of the development program -- including site selection and design or layout -- nor are they being used for the construction. There is also no clear idea as to how much the units will cost or how they will be financed. Another problem which will arise is deciding who will get the units, as there are not enough structures to rehouse the entire camp.

To the INTERTECT team, the site selection seems to have been a poor choice; the units are lower than other parts of the site and are adjacent to the stream. While the residents noted that the site was one of the few areas which did not flood during the hurricane, an admittedly superficial aerial inspection of the stream indicated that this may have been

due to a temporary diversionary damming of the stream by mudslides upstream rather than by any inherent capability of the channel to accomodate a high flow.

It is obvious that all these problems could have been worked out by establishing a dialogue between the benefactor and the recipients; and this points out the need for increased citizen participation using the established organization of the camp in the future housing programs.

PART III: RE-HOUSING PROJECTS

There are four major re-housing projects currently under way in the immediate Choloma area which illustrate the different housing techniques being used in the Honduran relief program. Each of these is sponsored by a relief or church-related organization, and each has approached the problem from a different perspective. The units and sites are identified below according to the sponsoring organization.

National Evangelist Committee Project (Tilt-up Concrete)

Fifteen to twenty single-family housing units are currently being erected on a site approximately 6 kilometers north of Choloma adjacent to the Puerto Cortes Road. The units, constructed with funds from the National Evangelist Committee, are made with a tilt-up concrete process. This type of construction is accomplished by casting complete walls on frames built on a level platform on the ground. Once the concrete has set, the walls are tilted upright by a metal erector and fastened into place with a turnbuckle attached to loops set in the corners of each panel. The roof is corrogated zinc, placed on wooden beams set on top of the panels. The resulting unit is a shell only, with no interior walls or partitions (see Figure 8). The process takes approximately 7-10 days to build one unit which measures approximately 5 x 6 meters.

The people who will be occupying the structures have participated in the construction process and this participation has reduced the overall cost. It is not clear how the balance will be financed nor what the final cost per unit will be. Residents did not participate in the selection of the construction process.

Comments on the structures by the future residents concerned two objections. First, the residents had reservations about the overall process, for they felt that the structure could not be expanded. In particular, they did not like having only one door at the front and pointed out that to add another door after the unit was erected would entail demolishing the wall or re-erecting that side.

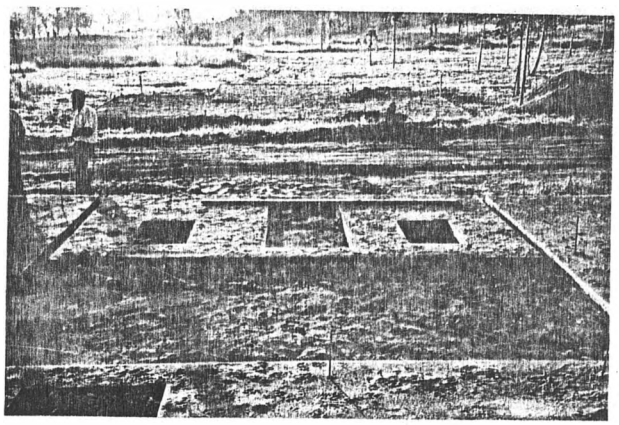
Another objection was that the process was too long and was not of the style common to that area, i.e. not of concrete block construction which they view as superior and quicker to erect (though, in fact, the total time is actually about the same).

Three units were erected which have a single plane, sloping roof. Following this, the residents suggested a change in the design to accomodate a conventional peaked roof, and this change has been incorporated in the remainder of the units.

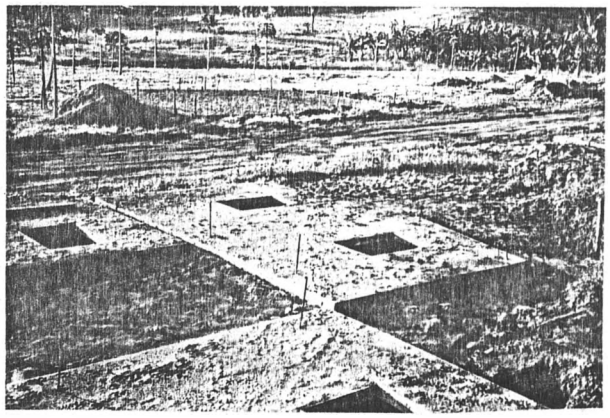
The site selected for the structures appears to be an excellent choice. Aerial inspection shows no indication of danger from slides in the hills nearby and the site is in no danger of flooding. A natural slope will adequately handle drainage and, if adequate ground cover is allowed to grow, the site should be a fairly nice place to live.

FIGURE 8:

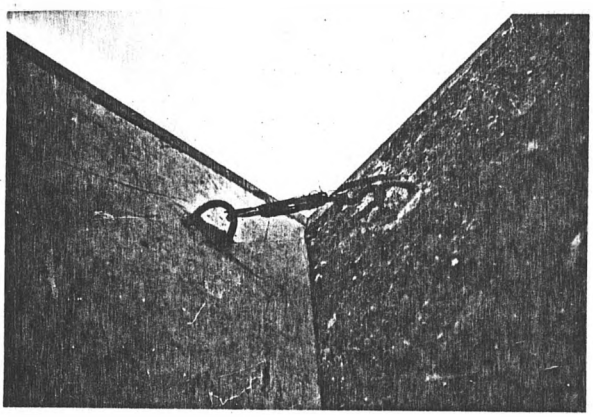
CONSTRUCTION SEQUENCE FOR TILT-UP CONCRETE HOUSING



8a: Front Panel in Mold

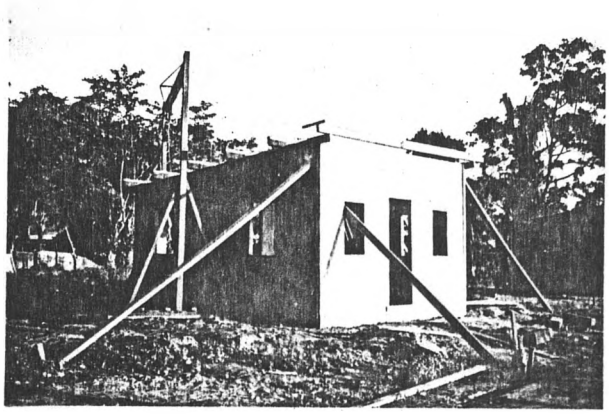


8b: Side Panels in Mold

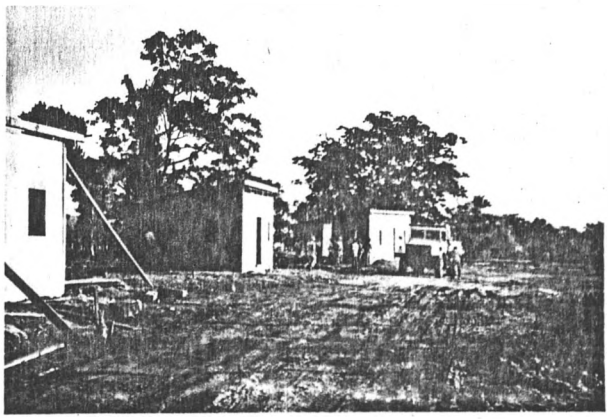


8c: Turnbuckle Holding Sides Together

8d: Roof Joists



8e: Erected and Joined Panels



8f: Completed Units

The layout was given only minor consideration in the overall plan, but siting of individual structures is good. All have access to the service road and separation between units is good. At this writing, no plans for sanitation have been made and it is not clear how water will be provided.

CARE-CEDEN Project (Concrete Block Housing)

Between 20-30 units of single-family housing are being built as a joint CARE-CEDEN project. The site is approximately 4 kilometers north of Choloma, immediately west of the Puerto Cortes Road on a sloping plane at the base of a foothill to the mountain ridge. The site has extensive tree coverage and ground vegetation, and the slope is insufficient to cause erosion problems if localized drainage channels are provided around units and service roads.

The units are constructed of concrete blocks which are formed and set off-site, taking approximately 3 days to set. The blocks are then trucked to the site and used to build the units, which are approximately 5 x 5 meters and have a conventional peaked roof (see Figure 9). Again, the unit is only a shell with no interior partitions. Construction time on site is 8 days.

It appears that a good deal of thought has gone into the entire process of setting up this project. Minor details such as incorporating simple patterns like diamonds into the blocks have added a distinctive touch to the units. Likewise, the site plan provides clusters of housing, which is socially desirable, as well as individual access to roads. One privy facility for each four units has been planned. It is not clear at this writing how water will be furnished.

Comments by the workers, many of whom will be occupying the units, indicate a good deal of pride in the units and acceptability is high. Overall costs are not known at this time.

INFOP Housing Project (Wooden Houses)

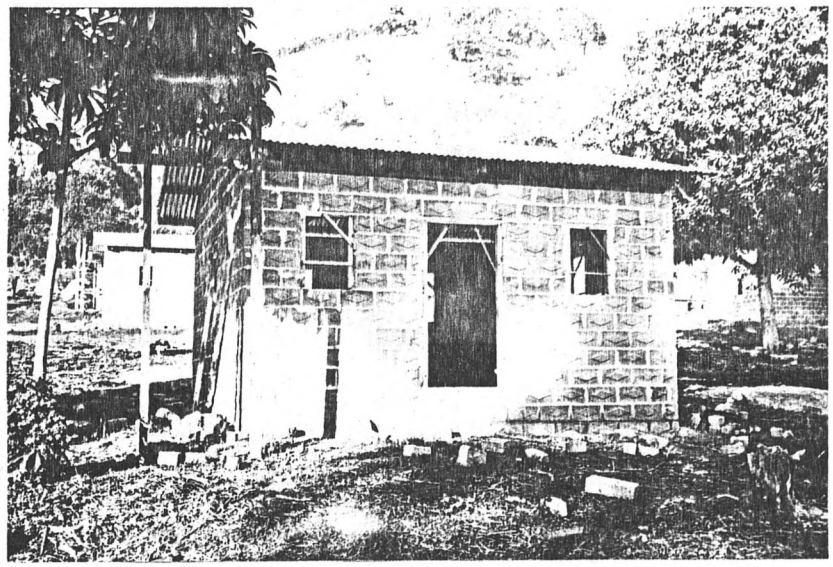
On a site approximately 2½ kilometers north of Choloma, adjacent to and west of the Puerto Cortes Road, about 15 units of single-family housing are being built by INFOP. The units are built of wooden boards covered with a zinc roof. The units are approximately 5 x 6 meters at the base and consist of two designs, one with a single-plane sloping roof, the other with the more traditional peaked roof. The first units are unique in that they have an added-on area for use as a kitchen. Each unit has two individual exterior water outlets, one adjacent to the kitchen and the other on the opposite corner designed to be used as a shower (see Figure 10).

The unit cost of each is projected to be $400 - $500 (U.S.). It is not clear how these will be financed.

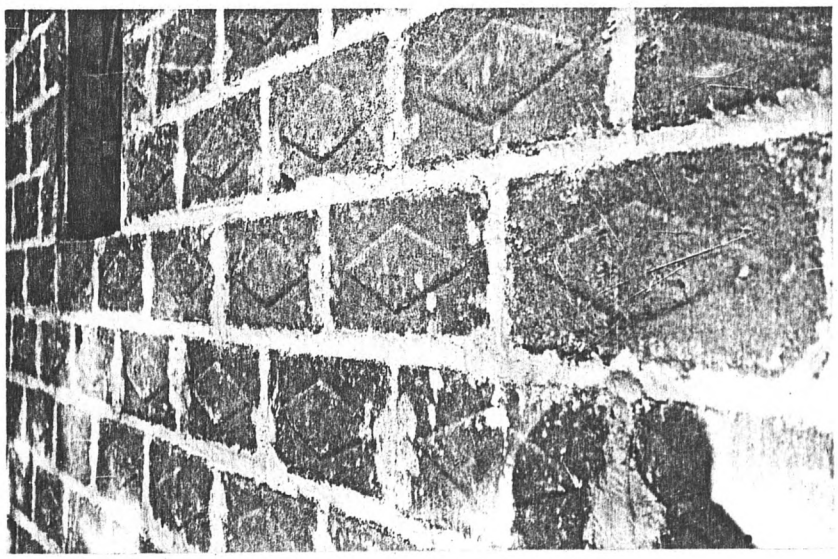
The site selected is fairly barren, a gentle slope with no tree cover. However, if adequate grasses are allowed to grow and if localized

FIGURE 9:

CONCRETE BLOCK HOUSING



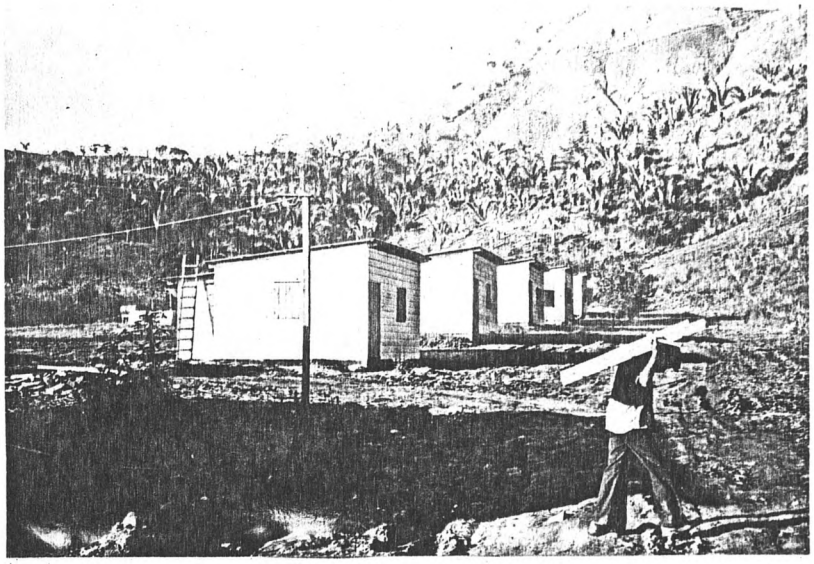
9a
Completed Unit



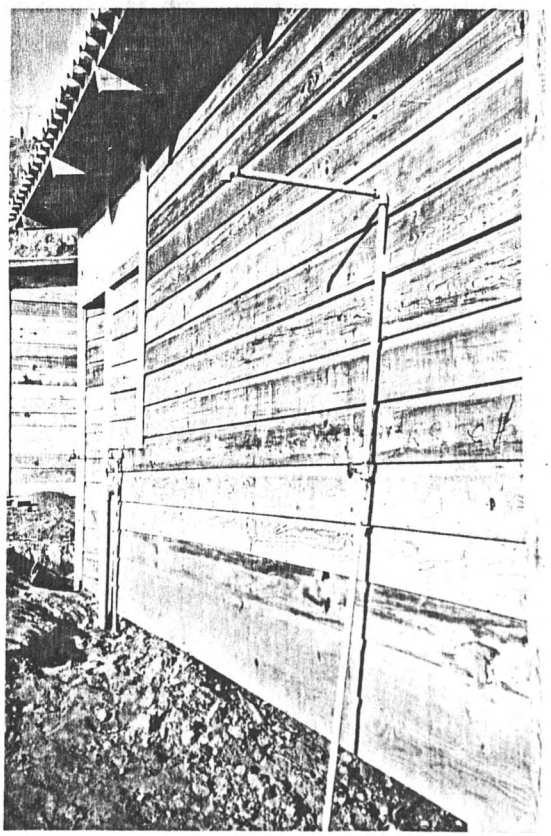
9b
Pattern in Blocks

FIGURE 10:

WOODEN HOUSING



10a
Typical Units



10b
Water Outlets

drainage is constructed around each unit, no erosion problems should be encountered. The site is above any flood level and the hill directly west provides an effective barrier to mudslides from the ridge behind it.

Layout is not brilliant, with each unit in line with a service road running perpendicular to the Puerto Cortes Road; but it does afford individual access to each house. One feature, however, deserves praise: each unit has been allowed sufficient ground behind it to establish a garden and the water points of each unit are located in the rear to help facilitate irrigating the ground. Also commendable are the privy and shower installations which are planned for the site.

Comments by future residents were not enthusiastic, and most indicated that they preferred concrete block units. Indeed, 8 units of two-family, concrete block structures are being built on a site directly adjacent to the INFOP project and the workers pointed these out as being superior to the wooden casitas, despite the fact that they are not single-family units. (These units are similar to the design preferred by the residents of the refugee camp as opposed to the design now being built for long-term housing at the camp.)

CARE Project (Wooden Structures)

Forty-four units of wooden housing structurally similar to the INFOP housing have been built by CARE on a site ½ kilometer north of the city. Most aspects of the construction are similar to the INFOP units, except that each house has a cement floor and outside kitchen, and they were designed with the thought that families would add on to their core structure. (CARE reports that this adding on of extra rooms is going on now.) The attitudes of the people now occupying the units are also similar, with the exception that as these were the first units available, the people occupying them are less critical of the materials used in the buildings.

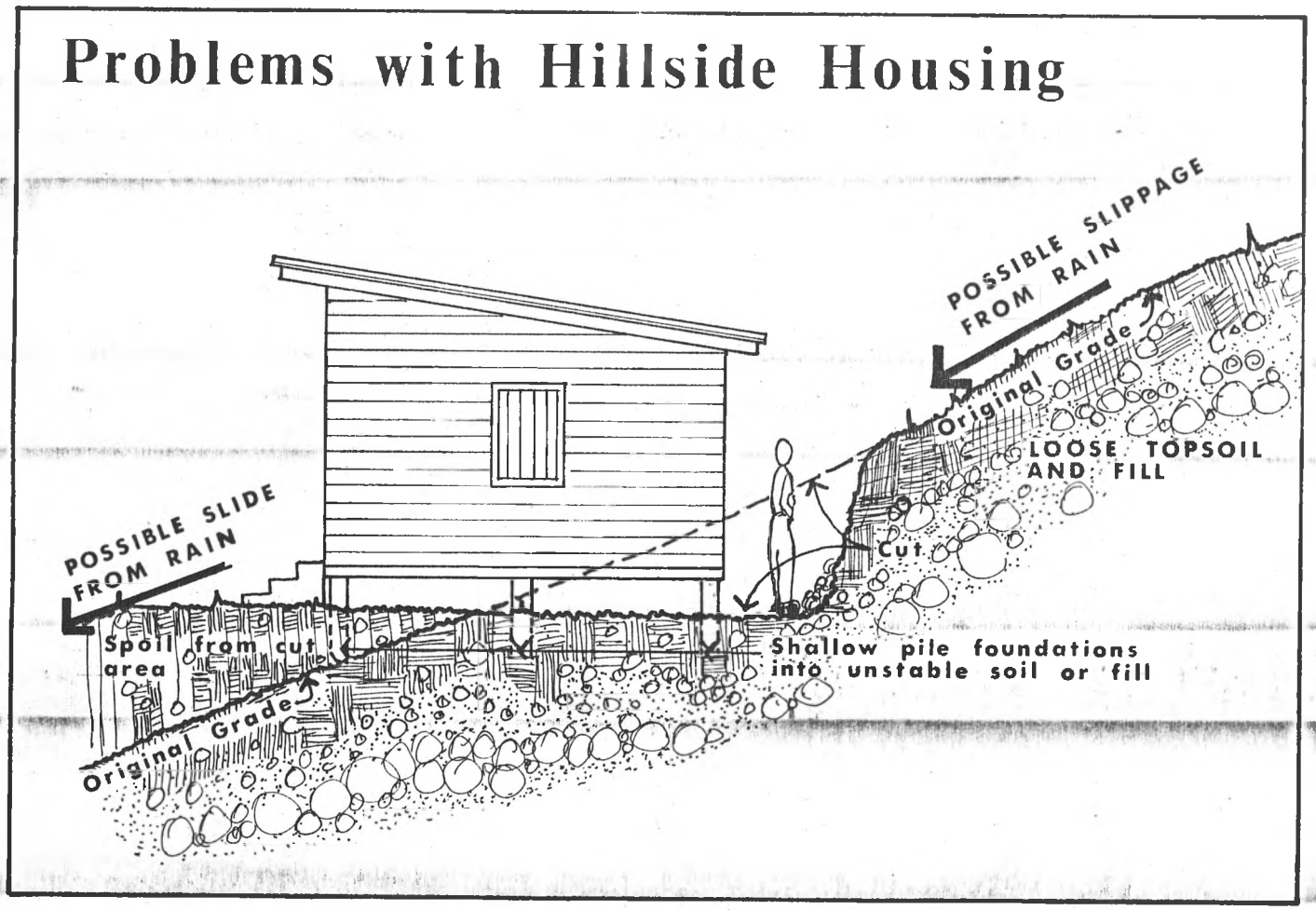
The CARE project started less than 10 days after the hurricane ravaged Choloma, and it was completed within 60 days. It was the first permanent replacement housing project inaugurated after the hurricane. The new colony was provided with street lights, individual family latrines, and an on-site water system. The site was bulldozed, roads were ballasted, culverts installed, and the site laid-out in the shape of an obtuse triangle, thus allowing space for a park or public buildings which could be constructed later. Fruit and ornamental trees were planted for shade, beauty and economic benefit of the community. CARE arranged for donations of the land, electrical lines, land-clearing and bulldozing, and trees at no cost to CARE or to the new community residents.

Wood was used for the houses because the only cement factory in the country was flooded at the time and was not in operation. Cement supply was uncertain, wood was a cheap material, and as wood is a principal export, it was available in sufficient quantity to accomplish the construction program. The wood was treated with a preservative and Mr. Jim Lewis of CARE reported in March 1975 that no signs of deterioration had yet

set in. Residents participated in both the planning and execution, including providing all skilled labor and manual labor for the project.

A major problem, however, is the lack of regulation on the site. After CARE completed the original construction, a missionary group moved onto adjacent areas and a small number of units were built on the sides of fairly steep hills. These sites have been cut into the hill and a level platform made by the spoil from the cut. The house is then set on piles driven into the ground. While the view must be nice, a visual inspection indicates that the piles are not long enough to penetrate the solid earth below the slag, and the structures are susceptible to sliding following a heavy rain (see Figure 11). No control over these constructions has been exercised to date.

FIGURE 11



If it is not possible to relocate the units to a safe site on level ground, the following actions should be carried out to stabilize the structures:

1. Piles should be driven until they reach firm ground in the hillside (minimum 3 meters).
2. Deep root grasses and shrubs should be planted around the entire area and uphill from the site.
3. Build a back door escape hatch into the units.
4. Stabilize earth around structure, especially spoil, with concrete, lime or by compaction.
5. Terrace cut behind structures and spoil in front, and install a retaining wall at each level (wall can be made of debris from disaster).
6. Build drainage channels around sites starting at least 20 meters uphill.

PART IV: OBSERVATIONS

From the visit by the INTERTECT staff, it is apparent that re-housing efforts in and around Choloma are typical of the types of re-housing activities that have been used in recent relief operations in Central America. The activities here showed no major innovations in the delivery techniques, the design of units, the use of new materials or the organization of self-help programs on the part of agencies, churches or government. It is especially disappointing that lessons learned in other operations have not been applied in Choloma and that some materials and housing units which have proved unpopular or have shown low or moderate success have been used here. However, it is rewarding to note that some of the more blatantly ineffectual housing units (such as the polyurethane domes) and the excessively expensive units (such as stack-sack houses) were not used in this area.

A few major points should be made, however, regarding techniques and units. The first and most important is the overall lack of citizen (refugee) participation in the rebuilding process. In man-made disasters, it may be acceptable to deny refugees access to the decision-making processes for a number of reasons; and if they are dependent on a neighboring government for shelter, they must often take what they can get in the way of housing. But in the aftermath of a natural disaster, where a reconstruction effort is called for, the refugees have a high stake in the relief program as they will be living with the results for many years. Thus, to neglect them in any stage -- planning, design, site selection or construction -- is to invite dissatisfaction and disaffection.

In the Choloma re-housing projects, refugee participation ranged from none to minor involvement. Refugees were most used in the construction phase, and in several instances, the refugees played a part in site selection and the negotiations for land acquisition. Many of the problems which are being expressed by the people are actually minor ones which can be worked out if the agencies will establish an effective mechanism to stimulate dialogue; all of those problems which have already arisen could have been worked out earlier had the dialogue already been established. In most cases, the resulting housing units would have been virtually the same as costs, material availability, etc., are always items which dictate the trade-offs. The difference, however, would be that everyone understood why the decisions were made and how the program was going to work. And most importantly, the people would feel that they had a part in the outcome.

The failure of citizen involvement has led to one major fault in each of the programs, that is the uncertainty over the cost and financing arrangements of each project. In talking with future occupants and workers at the various sites, we understood that no one knew how the units were to be paid for, when, or under what conditions. It is probable that these procedures have already been worked out; but from the viewpoint of the residents, it is not at all clear, and many express doubts as to whether they can afford the units.

Whatever the financing arrangements, the housing -- especially the concrete and cinder block units -- is costly to both the residents and the agencies providing the materials. In future operations in this area, it would be wise to consider techniques and materials which would reduce overall costs. For example, the provision of individual water supplies to each unit is very desirable; however, it may be too costly for low income residents (especially if the current high unemployment continues). In this case, community water points established throughout the sites serving a group of units and maintained by an association of the residents might have been more in line with the residents' ability to pay.

Regarding the refugee camp, several points should be made. First, the government of Honduras appears to have been negligent in not appointing a camp administrator to work with the relief agencies and the citizens from the very beginning. The result was the delivery of materials and services with little or no coordination. It was not until recently that a census was taken. The two administrators who finally were selected should be commended for their efforts, as should CARITAS for attempting to organize the camp at an earlier time; but the fact that no coordinator or administrator was assigned initially is still a sign of poor responsibility on the part of the government.

A second point which needs to be made concerning the camp is the lack of imagination shown in the layout of tents. The grid system which was used has been a constant failure in the past and studies by several agencies and planners, including INTERTECT, have shown that the grid is the worst layout for refugee camps.* The site at Choloma would have been suitable for a number of innovative designs which would have been environmentally and socially supportive of the residents.**

The fact that the refugee camp is now undergoing a transition to a permanent housing site illustrates another point for future camp planners, the point being that most refugee camps tend to become permanent installations. Thus the need for adequate planning in site selection assumes as important a role as does site selection for any other re-housing project.

A number of observations concerning future housing operations in this area can be made based on this study. The first concerns the overall acceptability of the structures built with concrete or cinder blocks. These materials are acceptable to people of this region and only the variations of the design and interior floor space are questioned. Given this acceptability, structures made with the CINVA-RAM may also be suitable for this area, as may be units constructed of earth blocks made with chemically stabilized earth. These may, in fact, be cheaper in the long run to both residents and donor agencies.

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* Davis, Ian, The Provision of Shelter in the Aftermath of Natural Disasters: Report on Housing Strategy, December 1972-September 1973 (Managua, Nicaragua), OXFAM, Oxford, U.K., 1974, pp. 34, 47, 157.

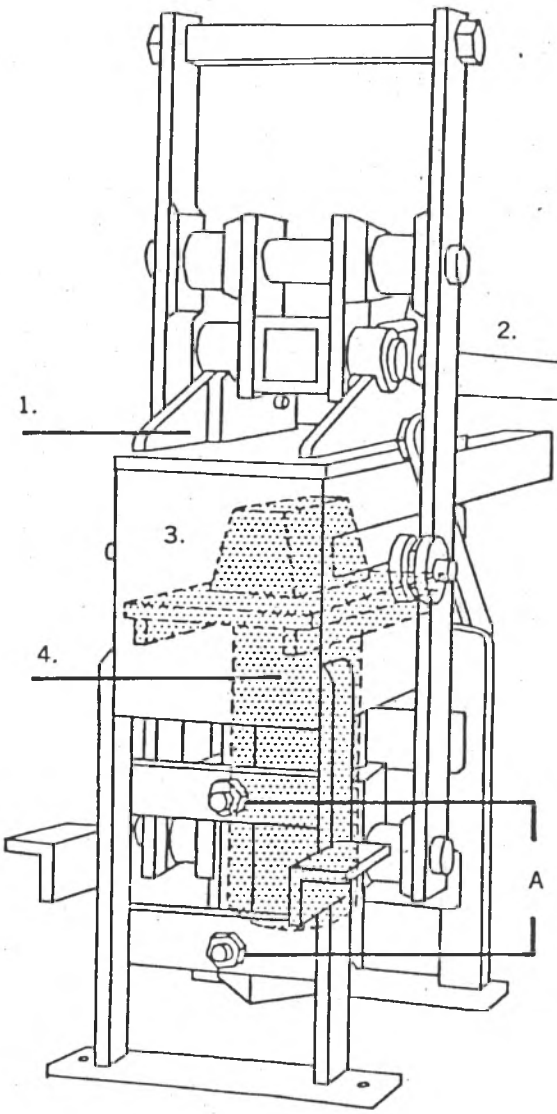
** op.cit., F.C. Cuny, Report IV: Camp Layouts.

Just as the various concrete block structures are well-received, the wooden units are the least acceptable, both from the residents' point of view and from an environmental standpoint. The units are not popular here, nor have similar units been popular in other Central American relief projects. Many of the units built at Choloma, though only two months old, already showed signs of deterioration due to rain and humidity. In effect, the use of these units has produced only an intermediate solution to the housing problem.

Finally, Choloma's re-housing programs (as well as recent re-housing operations in other parts of Central America, such as Managua) point out the changing nature of housing relief in this region; that is, the increasing need to respond with urban-style units in both semi-urban and rural areas. The significance is that relief must not just rebuild; it must provide a step up or improvement over structures in which many of the refugees may have lived before the disaster. The significance for relief agencies is that the demonstrated popularity of certain designs and materials facilitates the formulation of general housing contingency plans and allows the agencies to initiate research and development of procedures, materials and equipment to respond to future disasters in this region with low-cost relief housing acceptable to the people.

FIGURE 12:

CINVA-RAM



1. The COVER. A rectangle of metal, joined to the box by two movable rods at the side to allow it to slide open and to close. Above it are two brackets to house one of the upper shafts of the lever's connecting rods.

2. The LEVER. Consists of a set of connecting rods, operated by hand, which set the piston in motion.

3. The BOX. A metal mould supported by four angular iron legs, constituting the frame of the whole mechanism.

4. The PISTON. Consists of a cylinder, guided between two adjustable angles and ending in a rectangular plate which serves as a compression plunger. To this plate is screwed a piece of wood, the function of which is to stamp the blocks. If solid blocks are wanted, the wooden piece can be taken off by removing the screws and filling the holes left in the plate with small screws.

A. SCREWS FOR LOOSENING THE PISTON GUIDES. Are used to loosen the piston if it fits too tightly between the guides, or vice versa.