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REPORT ON THE POST-DISASTER HOUSING TRAINING PROGRAM  
OF CATHOLIC RELIEF SERVICES/DOMINICAN REPUBLIC AND OXFAM

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In the aftermath of Hurricanes David and Frederic (September 1979), OXFAM requested that Fred Cuny of INTERTECT go to the Dominican Republic to make an evaluation of post-disaster housing conditions. That investigation led to the conclusion that OXFAM and Catholic Relief Services (CRS/DR) would become involved in the housing sector during reconstruction.

In late October, I was asked to go to the Dominican Republic also, to work with CRS in the formulation of an approach to post-disaster housing. By the end of October, CRS had decided to implement a double-faceted approach to housing. On the one hand, CRS would provide construction materials to various communities through the counterpart agencies of CARITAS and CEPAE (Centro de Planificación y Acción Ecuμένηca). Most of the funding for this project is expected to come from the U.S. Agency for International Development (USAID) and will be supplemented by funds from other sources, including the European Economic Community (EEC).

The other component of the CRS approach to housing was to develop a program to educate the public as well as builders to the need for building wind resistant structures; to build model houses demonstrating these wind resistant construction techniques; and to use the process of the construction of these model houses as a means of training builders in these techniques. The funding for the educational and training aspects was shared by OXFAM and CRS, while the construction materials for the model houses were purchased with funds from the EEC.

Although INTERTECT worked with CRS in the development of the policy for the materials distribution program, this report deals specifically with the educational/training program.

## TRAINING PROGRAM

INTERTECT and CRS focused on the need to communicate technological information and explored alternative ways of accomplishing this. One consideration was to set up a housing information center that would make this information available to the general public, people in the construction industry, and housing program planners. However, by late October, CEPAE submitted to CRS a request for funds to build fifteen (15) houses in the rural area of southern Baní. INTERTECT then proposed to CEPAE and CRS that this project be used as an opportunity to build a series of model houses.

The initial objective of the model house project was to build three or four houses for each of the existing 4 or 5 traditional housing construction types. The essential characteristics of each type would be preserved, but the new wind resistant construction details would be incorporated into the design and demonstrated. Up to 60 carpenters were to be invited from each of the communities of the three municipalities that CRS identified as its focus of involvement (Baní, Cambita Garabitas, and San Cristóbal).

These initial intentions were not entirely met. The fifteen families selected to receive the houses in the community of Sabana Chiquita were virtually unanimous in their rejection of all housing types except slip-form concrete. Eventually, two families consented to build houses of concrete block.

The other important factor was that initially very few carpenters from outside southern Baní attended the program. Those that did attend typically stayed for only a short period of time. (This issue is discussed in more detail in another section of this report.)

When it became clear that a much larger group of carpenters could participate in the program if model houses were to be built in other communities, it was decided to construct one model house in the northern Baní community of Río Arriba and another near the center of Cambita Garabitas.

### A. Training Materials

A series of materials were produced by INTERTECT to assist in the training process. One thousand (1,000) copies of the pictorial brochure, "Wind-Induced

Failures in Traditional Housing", were made and are being distributed to the general public, as well as to builders.

The same drawings were redrawn in a 24" x 36" format and used as a classroom aid for introducing the concepts of why buildings fail in high winds and how to overcome these failures.

The other two booklets written by INTERTECT -- "Vulnerability Analysis of Traditional Housing in the Dominican Republic" and "Introduction to Wind Resistant Housing Construction: A Guide for Agencies in the Caribbean" -- have been translated into Spanish and will be distributed not only to builders but also to all people at the professional level in the various agencies interested in low-cost housing in the disaster-affected area.

#### B. Classes

At each of the three model house sites, the actual construction was preceded by a class. The 24" x 36" posters of "Wind-Induced Failures in Traditional Housing" were used as the principal teaching aid. The classes were presented by a Dominican architectural student who also prepared the drawings.

The audience of builders always seemed to understand all of the material presented. Very often, they offered their own observations, opinions or experience that repeated or reinforced the new wind resistant construction ideas.

Actually, few of the ideas presented were really new. Rather, they commonly represented sound construction practice that existed in the country; but in the poorest or shoddiest houses, they simply had not been used. Consequently, the builders, who had seen extensive damage to these poorly-built houses, were easily persuaded as to the importance of making these specific improvements.

#### C. Model Houses

After the class, work commenced on each of the model houses. We emphasized that any of the basic house types could be made wind resistant and that most of the principles and construction details executed in one house type applied to the others.

At the first model house site of Sabana Chiquita, we began by building a

house of slip-form concrete. The details that were emphasized were:

1. Steel-reinforced continuous footing;
2. A keyed joint between wall and footing;
3. Preservative-treated 4x4 posts at 4'0" on center buried approximately 24" with gravel under the post bottom;
4. Heavy use of 14-gauge barbed wire as concrete reinforcement;
5. Use of 4'x8' plywood concrete forms which allowed the casting of entire wall panels in one pour and, therefore, eliminated the numerous cold pour joints found when a few horizontal boards are used;
6. Several anchor rods to hold down the continuous top sill plate;
7. A roof structure constructed of a system of complete trusses located at about 3'0" on center;
8. Anchoring the trusses to the top sill plate with metal tie-down straps;
9. Use of wood shutters for the windows;
10. Enclosing the eaves with a soffit;
11. Use of (lightweight) wood siding to enclose the gable ends instead of using concrete;
12. Use of a 30° roof pitch.

We strongly urged that the families also use the hip roof instead of the gable, but because of certain disadvantages, we did not insist on it. Two of the fifteen families agreed to its use. The basic disadvantages of the hip roof are that it is difficult to build on additions to a house with this type of roof and that it is more difficult, more time-consuming and slightly more costly to construct. It was also observed that the more extensive area of zinc roofing and absence of gable end vents would produce a hotter house interior.

The concrete block model houses of Sabana Chiquita emphasized the following details:

1. Steel-reinforced continuous footing;
2. Vertical steel reinforcing with grout-filled cores 3' on center and at doors and windows;

3. Continuous steel-reinforced beams at the mid-point and top of the walls;
4. Use of several steel anchors to hold down a continuous wood top sill plate;
5. Same roof, truss, shutter and soffit details as presented in the slip-form concrete house.

The second model house site is at Río Arriba where another slip-form concrete house was built.

At the third model house site, Cambita Garabitas, a wood frame house with palm board siding was constructed. This form of construction represents the great majority of existing housing in that area. The improvements in the construction techniques include the following:

1. Continuous steel-reinforced concrete footing;
2. Concrete block foundation wall with vertical steel reinforcing 3'0" on center which also holds down the bottom sill plate; this form of foundation wall eliminates the traditional use of the post buried in the ground;
3. Walls constructed with diagonal bracing at all corners;
4. Roof, truss, shutter and soffit details of the previous houses are again repeated.

The owners of both the Río Arriba and the Cambita Garabitas houses agreed to a hip roof construction.

#### D. Participation

The training of carpenters has so far produced mixed results. In terms of actual numbers, at least 75 carpenters from 22 different communities had participated in the construction and classes as of December 12, 1979. The great majority (51) visited Sabana Chiquita, the site of fifteen houses. Twelve carpenters helped build the house at Cambita, and 14 assisted at Río Arriba (two of whom are from Cambita).

It was apparent from my observations that many carpenters felt they were learning some new and valuable ideas. Their motivation for participating seemed to include a belief that they would be more in demand, in terms of being hired as carpenters in their own community, because of their new expertise. They consequently became the potential carriers of news of the program to their community.

It seems possible to divide the carpenters who participated in the program into two categories: those who were otherwise unemployed, and those who were in effect following the "orders" of their parish priest to participate. This division applies more to Río Arriba and Cambita than to Sabana Chiquita. However, at Sabana Chiquita, some men were basically fulfilling a pledge to their agricultural association to contribute a day of labor toward the construction of the houses.

This means that, for the most part, the program did not always work with the best and the brightest carpenters of their community. However, as a means of attracting these men to the program, they were paid three dollars (\$3) per day and given lunch.

#### E. Problems Encountered in the Training Program

One of the major problems encountered in the carpenter training program was that the participants often did not stay long enough to go through the entire construction process of a single house. Thus, they did not gain a complete exposure to the integrated design.

There appear to be a number of reasons for this. Perhaps the most obvious is that any carpenter worth his salt is out earning from eight to twelve dollars (\$8-12) per day. The ODC (Oficina de Desarrollo Comunitario) is paying \$8 per day for people who can handle a hammer. Consequently, the program's \$3 per day is not competitive.

Another reason has been the need for some carpenters who are also farmers to attend to their farm work.

My own speculation suggests that, after as little as half a day or as much as two days, the carpenter feels that he has seen or experienced enough to

understand the intention of the program (i.e., the new methods of construction). Or he may not agree with the concept. In either case, he would be little disposed to help build a stranger's house if he felt he had nothing more to gain from the experience.

One of the unexpected results of the project at Sabana Chiquita, however, was the evolution of a very effective self-help housing project. As stated, it had been anticipated that the project would largely be built through the efforts of visiting carpenters. Since fewer carpenters participated for a shorter period of time, the responsibility for completing the construction fell to the fifteen families themselves. By the time the second house was nearly complete, the workers were familiar enough to break down into small but efficient work teams. These teams were divided according to the skills of the individuals, each team becoming somewhat specialized. Leaders emerged to take charge of organizing and directing the construction.

Although it was unintended, a very valuable by-product of the project at Sabana Chiquita will be its model of self-help construction. The program staff should be able to communicate this experience to other communities. As they receive their construction materials, perhaps they can also be organized to rebuild their houses in a similar fashion.

#### F. Program Staff

As part of his responsibility for the overall housing program, Miguel Mahfoud is the director of the training program as well.

Approximately November 10th, the program hired Santiago Tejada for the position of artist. He is an architectural student who is scheduled to complete his thesis work this month and obtain his degree. His thesis work relates to the issue of how to improve the quality of low-income housing. His interest in the project, his clearly demonstrated capabilities for making the drawings for the educational materials, conducting the classes, relating well with carpenters and families, suggest that he will be able to take on an expanded role in the administration and supervision of the housing program.

Another young Dominican architect hired by the program, Cesar de la Cruz,



demonstrates similar capabilities, as well as more field experience in construction. Both men will assume supervision of the implementation of the housing program in the field. This will include training the "master builders" to enable them to give the basic classes, providing technical assistance to the "master builders" on matters of construction techniques, and administrative details that need to be attended to in the field.

Two "master builders" have been identified and hired to date: one in southern Baní and the other in northern Baní. It is intended that they be the primary promoters of the program, advocating implementation of the improved construction techniques throughout their region, offering advice to individuals as to how to implement these techniques, and providing limited construction supervision of their houses. The greatest impact, however, could be effected when the master builder works directly with a local carpenter who will be involved in the construction of several houses.

Two more "master builders" are to be hired: one for Cambita and the other for San Cristóbal. The priests in each parish have made recommendations for people to fill the positions, but in both cases I feel they are not capable of fulfilling the job description. This has illustrated that requesting the priests to identify competent people for the job is not always dependable. They perhaps do not clearly understand the qualities that are necessary for a person to perform the job, and they also seem to place too high an emphasis on the person being loyal to the priest.

## MATERIALS/METHODS OF CONSTRUCTION

The construction materials and methods used in the model houses were largely determined by the factors of user preferences, availability, cost of both materials and required labor, and suitability in terms of climate and safety.

### A. User Preferences

As illustrated in the analysis of rural housing types completed by INTERTECT in October, the basic forms of housing construction include wattle-and-daub, slip-form concrete, wood frame, concrete block, and even a combination of these. In some geographic areas, all of these can be found; while in others, one or two types predominate.

In the Baní area, where all forms can be found, there is a definite preference for new construction to be slip-form concrete. The reasons for this preference were cited as follows:

1. It was seen as the safest form of construction;
2. It was the most economical.

Without a campesino explicitly expressing it to me, I also conclude from my observations that slip-form concrete is preferred because it has higher status (more like an urban dwelling) than wood or wattle-and-daub, and because the people are generally acquainted with and at ease with the method of construction.

The reasons expressed for not selecting the other house types varied. The mere mention of using wattle-and-daub was met with derision. It clearly holds very low status, would perhaps be viewed as a significant step backward, and is regarded as hazardous (i.e., sparks could set the thatch roof on fire). Obtaining enough wood for the framing and siding of a wood house was generally regarded as too difficult or too costly. Many concrete block houses failed in the hurricane in the Baní area; consequently, this was cited as a principal reason for rejecting this house type.

At Cambita, the housing type preference issue seemed simpler. The overwhelming majority of the houses there are of wood. In fact, I did not hear or participate in a discussion of possible alternatives. As it was very important to our program to demonstrate a construction type other than concrete block or slip-form concrete, we did not pursue any real user preference inquiry.

B. Availability of Materials

Of the building materials in common use before the hurricane, all were generally available afterwards. There were some important differences, however.

The continued use of corrugated zinc for roofing seems to have been universally taken for granted. The issue essentially became one of which gauge was acceptable and of locating a source with stock on hand. The most available during the period of my involvement in the program was 30-gauge. Thirty-five gauge was also on the market. The higher quality 26-gauge and 28-gauge were relatively scarce.

It was my position, however, that a model house that purported to demonstrate wind resistant construction techniques could not do so with the 30- or 35-gauge zinc. Consequently, the program advocated the use of 26- and 28-gauge zinc. We purchased 26-gauge zinc for the model houses when it came on the market.

The availability of wood was a fairly complex issue and varied among the communities. The hurricane blew down a great number of trees, especially palm trees. Although there was governmental control over the salvaging of these trees and laws against deforestation, this was not of much effect in the rural areas. In rural communities where these trees (both felled and standing) are found, much wood was cut for wood houses, roof structures, posts for slip-form concrete houses, and siding.

A considerable amount of wood was also salvaged from the destroyed houses.

C. Material and Construction Costs

The feasibility of a particular housing type is certainly a function of the cost to build it. Consequently, we studied the market value of the materials

used in the various methods of construction. A general comparison of material costs for building a 20' x 20' house (6m x 6m) illustrates the range. (The house is only a shell complete with floor, doors, wood windows, and employing wind resistant techniques).

1. Slip-form Concrete	\$1,100
2. Concrete Block	\$1,200
3. Wood Frame	\$1,600

For a family that would need to hire a mason to build a house of concrete block, but could perhaps do most of their own work on the slip-form concrete or wood house, the concrete block house would then be the most expensive in terms of total cost.

At the other extreme, it is conceivable that a family who built a wattle-and-daub house, purchasing only roofing and hardware on the market, could build their house for about \$250. Yet, as has been previously noted, there was no interest indicated in this solution.

In fact, the high cost of construction materials relative to the rural families' average income is one of the more difficult aspects of the housing program. Some relief agencies (most notably USAID) did not seem to understand that the minimum cost to build minimum houses was substantially higher in the Dominican Republic than in other Latin American countries which recently suffered a disaster. For example, a similarly-sized adobe house in Guatemala would have cost about \$300 in 1976, and the materials for a wood house in Honduras cost about \$400 in 1974.

## FUTURE PROGRAM IMPLEMENTATION AND RECOMMENDATIONS

The future of the training program lies in two areas. It needs to be integrated with the CRS/CEPAE and CRS/CARITAS housing programs, and it needs to communicate and share its information with other agencies.

### A. Classes

To date, the classes that have been given have only been for builders. They should also be offered to the general public in each community. This is very important for two reasons:

1. Many families will build or repair their houses without the assistance of a builder and, therefore, they should have direct access to the wind resistant construction technology.
2. By increasing the awareness on the part of the family of the need for improved construction techniques, the demand for builders/carpenters who know these techniques will also be increased.

A recommendable time to introduce the classes would be when the housing program first brings the building materials to the community. This would therefore be coordinated with the families' ability to implement the new construction techniques.

On the other hand, some communities began the process of reconstruction long ago and, for them, the sooner they are exposed to the ideas, the better. Obviously, the time to present the classes will have to be coordinated with the demands on the program staff and the needs of the community.

The classes themselves can be developed a little further than they are at present. Especially with the carpenters, each of the methods of construction can be discussed in detail, perhaps modifying the basic set of recommendations to accommodate the unique conditions of each community.

B. Educational Materials

The three educational materials prepared by INTERTECT have been previously mentioned. As they are being distributed, the program staff should continually check (at least informally) to see whether the information contained in the materials is clearly presented and understood by the users.

Plans have been made for the preparation of additional educational materials. These will be brief handbooks illustrating the key factors necessary to build safe houses for each of the common construction methods. The English translations of the titles have been established as:

1. "How to Build Safe Slip-form Concrete Houses" (this handbook was nearly complete as of December 14, 1979);
2. "How to Build Safe Wood Frame Houses";
3. "How to Build Safe Concrete Block Houses";
4. "How to Repair a Wind-Damaged House".

The last item (#4) is perhaps the most important. In most communities, the majority of the houses were not destroyed but only partially damaged. Many of these have not yet been repaired, most probably because of the lack of construction materials or money to buy them. There may also be a reluctance on the part of some families to repair a structure that nearly failed in the hurricane. The handbook on the repair of houses should encourage families to proceed with repair of their homes, but to do it as safely and economically as possible.

The extent of the distribution of these educational materials should be as widespread as possible. It would be desirable if every family involved in reconstruction in the areas of the CRS program would receive two handbooks. All should receive "Wind-Induced Failures in Traditional Housing", and each family should also receive a handbook that is designed for the type of construction they will use or the handbook on repair.

CRS should also make the handbooks available to other agencies (at their cost) to distribute in the regions where they are working.

### C. Model Houses

The model houses already built at the first three communities need to be clearly identified as such with a sign. They should also continue to be used as a teaching tool, by showing interested people the important construction features.

The program should look for ways to continue the model house concept. I do not suggest repeating the procedure of CRS making a special purchase of construction materials, assigning an architect to supervise construction for one or two weeks, and paying a large number of carpenters. Rather, it may be possible in several communities for a program staff member to identify a family who is ready to start construction and is willing to implement the new techniques. With the limited support of the program staff member, essentially this house can be built employing the characteristics of a model house. It would only remain to communicate to the rest of the community the fact that this house has been built differently and in what way.

### D. Incentives

Attending a class and having a master builder available for free advice may not be enough to motivate a family to adopt the new techniques. For the poorest of families, the additional cost of a continuous steel reinforced concrete footing, or the extra wood required to construct a complete truss, may be too much for the family to afford. An additional but low-cost incentive might be for the housing program to give each family enough galvanized tie-down straps to safely secure all of the trusses in the house. This would be approximately twenty to thirty-five 1½" x 24" 26-gauge straps. At a cost of about twelve cents (12¢) each, this additional \$2.50-\$4.00 cost per house could well be the best investment the program could make.

Another potential contribution toward the substantial improvement of slip-form concrete construction is to make available on a loan basis two or four sheets of 4' x 8' plywood for the forms. One of the weakest aspects of the traditional method of construction of these concrete houses is the multitude of horizontal pour joints produced by moving the form up the wall one board-width at a time. By casting an entire wall section in one pour, these joints are obviously eliminated. The use of the plywood for forms also virtually assures a maximum distance of four feet between posts, another significant improvement.

E. Term of Program

It is expected that the training program will last the length of the CRS housing programs. Currently, that is expected to be six months. There will, no doubt, be a shift in emphasis from the preparation of educational materials and giving classes to more direct supervision of the construction of houses. There should be a continuous effort to seek out the carpenters in each community and assist them in understanding and applying the new construction techniques.

F. Evaluation

At the approximate mid-point of the training/housing program, a self-evaluation should be conducted. By making a deliberate and focused effort to examine the workings and effectiveness of the program, weaknesses or inappropriate use of resources can be detected and corrected.

It would also be very important to CRS, as well as CEPAE and CARITAS, to know the overall results of the program. At the end of one year, a final evaluation should be undertaken. That evaluation should determine approximately how effective each of the components of the training program have been, i.e., preparation, distribution and usefulness of the educational materials; appropriateness and usefulness of the model houses as teaching tools for both builders and families; effectiveness of the classes as a means of communicating the ideas; effectiveness of communicating the program's objectives to other agencies involved in housing; etc. Certainly, the most important measure of the program's success would be the number of houses that employed some of the construction techniques advocated by the program. The other important factor would be to know how many and how well trained are the builders who participated in the program.

The establishment of this information will probably affect future programming at CRS, by helping them determine whether this approach to post-disaster housing should be applied to a future situation and in what ways it could be improved.