

SOME CHANGES IN HOUSING CHARACTERISTICS IN GUATEMALA FOLLOWING THE FEBRUARY 1976 EARTHQUAKE AND THEIR IMPLICATIONS FOR FUTURE EARTHQUAKE VULNERABILITY*

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INTRODUCTION

This paper discusses some of the preliminary findings which have emerged during the first year of a three-year longitudinal study of the 1976 Guatemalan earthquake. It focuses on the housing reconstruction process and on changes in house types as they are related to future earthquake vulnerability in Guatemala. While it is concerned with what, at first glance, may appear to be merely a set of physical objects, houses, in reality it deals with the end product of a social process through which these physical objects have been created. In so doing, it examines some of the social and cultural factors which have influenced that process [1].

Housing in any society is a product of the social organization, technology and value

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system incorporated into the structure of that society. It is also a tool or facility which is utilized by the members of society as they play certain vital domestic roles. Houses are not merely physical objects, and therefore of little interest to social scientists, but they are social objects to which important cultural meanings are attached. Furthermore, the methods by which they are constructed, the materials used to build them, and the form that they take have important relationships to the social organization of society and to the life style of its members.

In societies with advanced technological systems which employ high levels of specialization in occupations, houses are produced by a different set of people than those who occupy them. They are often built using materials which are shipped over vast distances, some of which are not even produced in the society in which the finished house is located. Furthermore, they are acquired and traded, much like any other commodity in the market place. In such a society, a house is more an expression of the ideas and tastes

of architects, designers, developers and contractors, coupled with the promoters, advertisers, and media experts who manipulate tastes through the mass media than of the ordinary citizens who occupy and utilize them. In contrast, in folk societies, or in so-called developing countries, houses are more likely to be produced by the very people who occupy them, using simple technologies and employing indigenous materials. Under such circumstances they more closely approximate an expression of the values, tastes and domestic organization of their occupants than houses in technologically advanced societies.

The 1976 Guatemalan earthquake resulted in the deaths of over 25,000 people and in injuries to approximately 75,000 others. These deaths and injuries were partially a result of the fact that the disaster occurred at 3:00 a.m. while people were asleep in their homes, most of which had unreinforced adobe walls with heavy terracotta tile roofs. These roofs were supported by light frames which were not securely attached to the structure. Under the stress of the earthquake, the walls collapsed and the heavy roofs fell in on the sleeping victims. Many were crushed. Others suffocated in the heavy adobe dust which engulfed them.

These houses had been built largely by their owners, assisted by village albañiles (builders) using indigenous materials and following an established traditional pattern. Although this type of house predominated, there were other housing forms in use in Guatemala at the time of the earthquake which proved safer. For example, one traditional pattern used cane or corn stalks for a wall material and straw or palm for the roof, the whole structure being built around a wooden frame. Another pattern combined bajareque walls with either a tile, straw or palm roof. Bajareque uses a set of wooden posts sunk into the ground, across which cane is woven to form a lattice-like wall which is then filled in and plastered over with adobe-like mud. Because

of their flexibility, and because of their cross-braced wooden frame, these houses withstood the earthquake better than the adobe structures. A few houses were made of cement block and used lamina roofs. These also fared better. The cane and palm houses and those of bajareque were generally considered less desirable than adobe before the earthquake and were found primarily in the more remote villages among the poorer people of the community.

REQUIREMENTS OF A NEW HOUSING PROGRAM

Following the earthquake when it became obvious that a massive housing construction effort would be required and at the same time, it was apparent that the traditional adobe house with a tile roof was unsuitable in a seismic zone, the question on everyone's mind was how to encourage the building of earthquake resistant houses and at the same time meet two severe requirements. First, it would be necessary to rehouse the million homeless people in a very short time to prevent further suffering from exposure. Second, houses had to be inexpensive and built with non-hazardous materials. This latter requirement can best be grasped if it is understood that the average house occupied by people in the towns and villages outside of Guatemala City cost under \$ 500 to construct before the earthquake.

Although they incorporated aseismic design features and proved safe in the earthquake, houses made of cane with palm roof or of bajareque had other drawbacks which discouraged their use as replacement housing. Cane walls offer little protection from the elements and are not secure against intrusion. Bajareque and cane houses were associated with lower economic status than were adobe and concrete block. Few houses employed wood. The need was for a house form which would be cheap, easily produced and acceptable

to the people and, at the same time, safer in an earthquake.

In addition to these practical considerations, a number of less tangible factors entered into the decision-making processes affecting housing. First, a number of consultants to the government and to foreign agencies urged that the aid offered the Guatemalan people should avoid creating dependency on donor agencies. Furthermore, it was urged that housing programs permit people to construct similar houses on their own when relief efforts ended. This meant that both design features and construction method had to be within the economic means and within the capacity of local skills and resources. In short, whatever housing effort was to be carried on by outside agencies would have to fit into the technological and economic base and at the same time be aseismic. This, of course, was a tall order, given the severe economic constraints and limitations of the prevalent local house building technology.

In response to the need for housing and in response to these constraints, a variety of housing programs was instituted under general policies laid down by the Guatemalan government's Emergency Committee and later its Committee on Reconstruction. There were two policies of importance to this paper. First, the government decided to divide up the total job of relief and reconstruction among the various domestic and foreign agencies offering assistance by assigning agencies to specific towns and villages where they would have primary responsibility for relief and reconstruction. This meant that each town or village would have a different type of program, depending on the particular agency assigned to it. Second, the government requested that instead of giving away houses or housing materials and other relief supplies such as food, the people should be required to contribute either money or their own labor to help themselves. The argument given was that this would prevent the creation of de-

pendency and at the same time increase the resources available for reconstruction and speed the recovery process.

Several types of agency housing programs were the result of these various considerations. The variety of housing programs is as follows:

1. One style of program distributed free lamina (corrugated galvanized iron) roofing to families who had first constructed for themselves a wooden frame which employed aseismic cross-bracing features. The idea behind this program was to insure aseismic construction by motivating people with the offer of free roofing. At the same time an educational effort was conducted to apprise people of long-run objectives regarding aseismic housing.
2. A second type of program distributed lamina at half price through local organizations, usually cooperatives, to anyone who could afford it. In most cases, the proceeds were then placed in a community fund which was later used to finance reconstruction programs requiring a high labor input. The intent here was to: avoid imposing a housing pattern on the people; obviate the possibility of creating dependency relationships; provide a versatile building material and generate jobs which would keep money furnished through subsidized sales in the community as well as contribute to the reconstruction effort.
3. A third type of program concentrated on providing short-range housing which would serve the needs of people during a four or five year period while permanent solutions to the housing problems were being worked out. Whole houses built using prefabrication techniques which employed local labor were given to people in return for their work in helping to construct them. The idea behind this program was to furnish temporary shelter quickly and to offer it in such a way as to provide a period of time during which planning for permanent reconstruction could take place.

4. A fourth type of program concentrated on building permanent housing constructed according to an aseismic design, usually of steel reinforced concrete block, and arranging for housing loans which would permit people to pay for their houses over a ten to twenty year period at an affordable price. These houses were usually subsidized by the agency offering them to keep the selling price within the limits thought appropriate for the local economy. Their construction often employed the labor of the eventual occupants in a communal building program.
5. There were other patterns which mixed together features of these four types. However, most of the housing produced used one or the other of the dominant patterns.

In the following pages the results of the overall housing reconstruction process in seven ladino communities will be discussed in terms of changes in housing style which have occurred and the implications of these changes for future earthquake vulnerability. Preliminary tabulations reflecting attitudes and opinions of the aid process will also be examined. Before presenting these results a brief description of the methodology employed is appropriate.

BACKGROUND

The data upon which this article is based are the preliminary results of the first phase of a three-year longitudinal study of the long-term effects of the 1976 Guatemalan earthquake. The research design calls for household survey interviews in twenty-five Indian and ladino communities in both heavily damaged and undamaged areas at two points in time. In addition, interviews with key people (formal and informal leaders) in each community are being conducted. These data are to be supplemented by ethnographic case histories of various communities and interviews and documentary research of selected relief, recon-

struction and development agencies. The ultimate goals of the research are to make intelligible social and economic consequences of a major disaster through time, across cultural environments, and to test various hypotheses regarding the rates and directions of induced and secular social change. In addition, the research seeks to provide information for government and private agency planners and executive personnel that will be useful for future relief and reconstruction efforts.

This paper is based on findings obtained in seven ladino communities. Six of these communities are located in the eastern part of the country in the Department of El Progreso. These include El Progreso (departmental capitol); Sanarate (municipio or county seat); and four relatively isolated villages (aldeas): San Juan, Conacaste, Santo Domingo and Espiritu Santo. The seventh community is the Municipio of Zaragoza, a ladino enclave in the largely Indian-populated region in the midwestern highlands.

HOUSING CHARACTERISTICS BEFORE AND AFTER THE EARTHQUAKE

Prior to the earthquake, the "typical" poor rural ladino house was a modest one or two room structure that generally included a porch of "corredor." Cooking and other food preparation activities were usually conducted either in the corredor, or in a separate structure attached to the main building. The house site frequently had other divisions that served various purposes such as storehouses and additional dormitory facilities. Households are composed of various combinations of kinsmen and non-relative. For the purposes of this study, the household, our basic unit of analysis, is defined as being composed of all individuals who share a common hearth. The house is the principal dwelling on the house site where the household head (self-defined) sleeps and where household activities are centered.

Housing characteristics were determined by two methods, interviews and observation. To obtain information on the pre-earthquake dwelling, interviewers defined terminology and then asked if the house prior to the earthquake had the particular characteristics in question. The respondent was then asked to estimate the damage to each particular characteristic – “none”, “little”, “much”, or “destroyed” [2]. The characteristics of the contemporary dwelling were then recorded, using both interview and observation techniques.

There are only three principal characteristics shared by all houses in this study: walls, roofs, and floors. Other features are expressions of individual variability according to economic resources and preference. Further, the structural significance (presence or absence) of some features such as corner posts, varies with the characteristics of the three principal components.

CHANGES IN PRIMARY HOUSING FEATURES: WALLS, ROOF AND FLOOR TYPE

The type of wall and roof employed in house construction has important implications for earthquake vulnerability. It also has a significant relationship to local tastes and values related to social status and to customary housebuilding economics and technology. As noted earlier, most pre-earthquake houses were built with adobe walls and a tile roof. Indeed 80 per cent of those interviewed lived in houses with adobe walls prior to the earthquake. Sixty-four per cent of all houses had tile roofs. The combination of adobe walls and a tile roof was found in 58 per cent of all houses at that time. Before the earthquake 16 per cent of the households studied lived in houses with either cane or bajareque walls. Other wall types such as wood or concrete and various other types accounted for only 3.5 per cent of all houses. While tile was the most common roofing material being

used (64.1 per cent), lamina was found on 23 per cent of the houses and another 12 per cent had straw or palms.

Considerable change has occurred since the earthquake in the materials being used for walls and roofs. The most striking changes are in the use of adobe for walls and tile for roofing. While 80 per cent of the houses studied had adobe walls before the earthquake, only 17 per cent have such walls at present. The proportion of houses with tile roofs has decreased from 64 per cent before the earthquake to around 23 per cent at present. Furthermore, the combination of adobe walls and tile roof which proved so dangerous in the 1976 earthquake has changed from 58 per cent of all houses before the earthquake to 23 per cent at present [3].

An examination of data on damage to housing revealed that most existing houses with adobe walls and a tile roof have survived the earthquake and have either remained inhabitable or could be made so with minor repairs. Few new houses constructed from these materials have been built. Instead, there are marked increases in the use of all other materials such as wood and concrete blocks in making walls and half adobe or half concrete and half other light weight upper wall material [4]. The use of bajareque has remained constant and cane and a patchwork of salvaged materials has increased.

With respect to roofing, the primary shift has been away from tile to lamina. Tile has decreased from 64 per cent to 23 per cent, while lamina and duralita has risen from 23 per cent to 66 per cent. It is interesting to note also that the straw and palm for roofing have declined from 12 per cent to 6 per cent, while the application of “other” materials increased from 1 per cent to about 5 per cent above prequake levels.

This change in housing materials has reduced the earthquake vulnerability of the average house being occupied by the persons interviewed. The substitution of lamina and

duralita for heavy tile roofing and of wood and concrete for walls means that on a whole, houses are safer now than they were before the earthquake simply because the materials used in constructing them, on an average, present less of a threat to life.

This change has taken place partially as a result of agency housing programs that constructed complete houses which were then supplied the citizens of a community and partially as a result of the efforts of individuals who rebuilt their own homes. The houses with wooden walls and lamina roofs are built by one large agency which gave them to earthquake victims in return for their labor in the reconstruction process. These houses were intended to serve as temporary dwellings during a four or five year period and are expected to deteriorate and to be replaced by more permanent shelters. It is possible, therefore, that when the occupants of these houses begin to rebuild more permanent structures, they will return to the use of traditional materials and traditional building methods. The concrete block houses, most of which employed a duralita roof, were produced by another agency program in a different town. These houses have steel reinforcement and were given people in return for their work in the construction process. While the houses are permanent structures, they were built according to an agency plan under agency supervision and therefore do not represent local ideas about aseismic construction. A third type of house, is one which uses walls that employ either adobe or concrete block for the lower portion and a lightweight material such as wood, lamina or duralita for the upper wall. This type of construction was promoted by an agency working in one community in the sample as a more aseismic design than either full adobe or full concrete block walls.

The question arises as to whether the people living in these communities, if they were to rebuild their houses on their own without the

guidance of agency personnel, would choose more quake resistant wall and roof material. An answer to this question may shed some light on what is likely to happen, once agency programs are terminated and people go back to building houses on their own. A tabulation was made which compares people who constructed their own houses with those who were assisted in some way by an agency.

The tabulation shows that individuals unassisted by agencies avoided the use of adobe nearly as often as those who were assisted by agencies. Only 19 per cent of those building or repairing their own homes used adobe for walls as compared to 14 per cent of those assisted by agencies. The differences are not statistically significant.

With respect to the use of tile for roofing, the picture is slightly different. When unassisted by agencies, 28 per cent of the people used tile for roofing, as compared to 18 per cent of those who were agency assisted. This difference is statistically significant. Nevertheless, both categories of people show a marked reduction in the use of tile for roofing as compared to before the earthquake, when 64 per cent of all houses had tile roofs. These figures indicate that the improvement in the aseismic qualities of housing noted earlier is due to both individual and agency efforts, but that agency programs produce slightly greater results in this direction. It should be noted that agency housing programs may have served as models for individual house construction and have had an educational effect on individual builders.

Much of the change in housing features mentioned above is a result of highly organized agency housing programs. The more permanent structures, those of concrete block and lamina, were often heavily subsidized by a relief agency and were built under the supervision of agency representatives to design specifications which often were predetermined by agency personnel. Further, such houses employ a combination of locally manufactured

materials, such as cement and imported material such as lamina and steel reinforcing rods, all of which are relatively expensive. As a consequence, the question arises as to the economic ability of poor rural Guatemalans to build such houses on their own.

Another shift in housing patterns is away from the more traditional indigenous materials that can be fabricated locally and inexpensively. The trend is towards the use of industrially processed materials. The relationship between house type and the before-after time periods is highly significant, both statistically and in terms of its meaning for future earthquake vulnerability.

Floor Types

Floor types have altered slightly since the earthquake, but these changes have little significance for earthquake vulnerability. The number of houses with dirt floors has increased from 53.8 per cent before the earthquake to 63.6 per cent at present. The number of houses with brick or tile floors dropped from 14.9 to 6.2 per cent. The use of concrete for floor material has remained about constant. Before the earthquake 30.2 per cent of the houses studied had concrete floors, while 27.1 per cent have such floors now. The principal change so far has been from the use of brick or tile to dirt floors. This reflects in part the existence of the wood and lamina houses built as temporary shelters, all of which have dirt floors. When these houses are replaced by more permanent structures, tile flooring will probably increase because it is culturally preferred.

Number of Rooms

The number of rooms in a house is an indicator of the social status and affluence of the family occupying the dwelling. Most houses in the surveyed communities had either one or two rooms before the earth-

quake (50.7 per cent had one room while 28.7 per cent had two rooms). Only 10.3 per cent had four or more rooms. Since the earthquake there has been a 16.3 per cent increase in the number of one-room houses and a decrease in houses with all other numbers of rooms. The greatest decrease is in the number of houses with four or more rooms. In short, it appears that people on an average are living under more crowded conditions than before the earthquake and that their current houses are smaller and equivalent to houses of slightly lower socio-economic status than before the disaster. Again, this is partially accounted for by the relatively large number of temporary wood and lamina structures built by the agency mentioned earlier. There were 92 such houses in our sample, all of which were built as one-room dwellings although some have been expanded since their construction by the agency.

Porches or Corridores

Another housing feature related both to living space and cultural preference is the porch or corridor. This feature expands the living space available in the home by offering additional room for family activities. As noted earlier, the corridor is often used for a kitchen as well as for storage or even additional sleeping space in mild weather. Before the earthquake 81 per cent of all houses had corridors in contrast to the 44.7 per cent that currently do. This is another indicator of loss of living space and of increased crowding. Furthermore, it represents a major shift away from a long established cultural practice. Most of the agency houses built within the sample communities lacked corridors, although small porches were present in a few cases. The reduction in the number of houses with this feature is therefore a result of agency design which excluded it.

Other Housing Features

Questions were asked concerning the presence or absence of certain housing features related to earthquake resistance. In particular, respondents were asked whether their pre- and post-earthquake houses had: (1) corner posts, (2) beams, (3) cross bracing in the walls, and (4) a solera (a wooden frame made of heavy timbers which is joined to the top of the walls and supports the roof). Responses were mixed regarding earthquake resistance in housing.

There was a substantial increase in the use of corner posts (from 23.8 to 82.8 per cent) indicating an improvement in aseismic qualities. Some of these posts were of wood and others of concrete and steel, depending on the type of walls being used in the house. In contrast, the use of beams diminished slightly (99.5 per cent before, 92.9 per cent after), cross bracing (7.6 per cent before, and 3.8 per cent after), and solera (82.2 per cent before and 79.9 per cent after). Both cross-bracing and a solera are associated more often with adobe construction and so these figures suggest a reduction in the use of this material for walls. On balance, it appears that a slight improvement in the aseismic qualities of houses has occurred because of the increased use of corner posts. This was a feature emphasized by several large agencies. Cross-bracing, also emphasized, actually decreased slightly though it was deemed necessary for adobe construction.

WHERE RESPONDENTS ARE LIVING NOW

In order to determine whether respondents are living in the same location as before the earthquake we asked them where they lived when the earthquake took place. This question is useful in determining how many households are living in the same house as before the earthquake, and therefore serves to indicate whether their houses survived. It

was revealed that 19.5 per cent of the 370 persons interviewed are living in exactly the same house that they lived in before the earthquake. This shows that approximately this percentage of houses survived and were inhabitable after the disaster. Of those who lived in different houses, 60.8 per cent live in a different house located on the same site as their pre-earthquake dwelling and 14.9 per cent live in a different house on a different site in the same town or village where they resided before the earthquake. The remainder of the respondents (5 per cent) have migrated to their current location from a town either in the same or a different department. Because only persons present in the village two years after the earthquake were interviewed, it is impossible to say at the moment how many persons migrated out of the village as a result of the disaster. Later, a detailed analysis of family composition before and after the earthquake will permit migration estimates.

A check of the difference between the large and small communities shows that in the small places (aldeas of Santo Domingo, Conacaste, Espiritu Santo and San Juan) 42, or 40.4 per cent of the people interviewed live in the same house as before the earthquake. In contrast, in the large places (Sanarate, Zaragoza and El Progreso) 30, or 11.3 per cent live in the same house. This reflects a higher damage rate in the two types of communities. On an average, about 60 per cent of the houses were destroyed in the small aldeas, while 80 per cent on an average were destroyed in the larger towns. This difference in rate of destruction is associated with the type of houses employed in the two types of locations. The aldeas contained more houses made of straw, palm and bajareque than did the larger places. In Zaragoza, for example, virtually all of the houses were made of adobe. Not a single respondent in Zaragoza is living in the same house he occupied before the earthquake. In

contrast, in Conacaste and San Juan almost half of the individuals interviewed are living in the same house they occupied before the disaster.

CURRENT USE OF AGENCY HOUSES

Of the 370 respondents interviewed, 137, or 37 per cent, received a house from some agency either in return for work or on some other basis. These persons were concentrated in El Progreso, Sanarate, Zaragoza and Espiritu Santo. Eighty-three per cent of such houses are still being used as residences. Some have been converted into businesses, others are being used for storage or are uninhabited, or have been dismantled and recycled as building materials. Only one house in our sample has been sold and two are currently being rented. Perhaps the most important fact here is that 11, or 8 per cent, of those encountered in our survey were uninhabited at the time of the interviews.

One of the agencies which supplied houses in return for work intended these structures as temporary shelters good for a period of 3 or 4 years. This organization anticipated that these structures might be torn apart and used for building materials or added on to or converted to other uses. So far, only three individuals have used their agency houses as a source of building material. However, 35 per cent have made alterations and additions to the houses they received.

SECOND RECONSTRUCTED HOUSES

During the pretesting it was discovered that a number of individuals had either built or received more than a single house since the earthquake. As a consequence it was necessary to record characteristics of both the first and second house reconstructed and to determine the source of the second house. In all, 86 out of 370 persons interviewed reported either building or receiving a second struc-

ture. As far as can be determined, by cross-tabulating the source of the first house and the source of the second house, only 5 individuals received two agency houses.

WHO REPAIRED OR RECONSTRUCTED THE HOUSE

In the case of every agency program in the area studied, family members were required to participate in work programs associated with house building in order to receive a house from the agency. As a consequence, families perceived themselves as participating in the process of house building with Guatemalan and foreign agencies even when the agency house was built according to agency plans and specifications using agency materials. Nearly 56 per cent of all respondents reported building or repairing their own houses. It is apparent, however, that some respondents saw themselves as building the house by themselves, even when agencies provided the materials and supervised the work according to their plans. If all of the responses which mention agency assistance are added together, only 31 per cent of the families remember an agency's involvement in house building. When asked whether they received an agency house or not, 36.6 per cent said they got one in return for work or rented, borrowed or bought one. In short, 22 per cent of all persons who received an agency house reported that the family built it, rather than reporting that they had been assisted in the building by the agency.

ATTITUDES AND OPINIONS TOWARDS THE RECONSTRUCTION PROCESS

In the course of the interviews, a number of attitude and opinion questions were asked. One series dealt with respondents' opinions concerning how aid was distributed. Another asked respondents' suggestions

for how aid could be improved. The responses to these questions are discussed below.

Evaluations of the Aid Process

Taking all respondents together, 54.3 per cent felt that aid was distributed fairly within the communities in which they lived, while 38.6 per cent felt that aid was distributed unjustly. The remainder gave no answers to this question. There is a striking difference between the small and large communities and their evaluations of the fairness of aid distribution. In the four small communities, Santo Domingo, Conacaste, Espiritu Santo and San Juan, the great majority of respondents said that aid was distributed justly. In these four communities the program consisted primarily of the distribution of free lamina after residents had constructed an aseismic frame upon which to place the roof. In addition, food distribution was carried on in return for work. In one of the small communities, Espiritu Santo, wooden houses with lamina roofs were distributed to 60 per cent of the interviewees in return for work.

In Sanarate, Zaragoza and El Progreso, less than half of the respondents said aid was distributed justly within the community. In Sanarate the housing program constructed cement block or *terrecreta* houses, most often with *duralita* roofs, using the labor of community members. El Progreso's housing program consisted of the distribution of wooden houses with lamina roofs in return for work. Compared to El Progreso and Sanarate, Zaragoza received relatively little aid with respect to housing reconstruction. Eighty-seven per cent of the respondents from this town reported that they had not received an agency house. It will be noted in Zaragoza the highest percentage of persons regard the aid distribution as being unjust.

When asked whether aid to the community was adequate, considering the damage suf-

fered, the majority of respondents in all communities responded "Yes." Again, however, there is a higher level of satisfaction with the aid process, as indicated by this question, in the smaller communities than in the larger ones. These questions seem to indicate that people feel that the aid offered within the community was "sufficient" or "adequate" considering levels of damage and loss. However, in the large communities they seem to feel that the distribution process could have been improved. In short, it was not what was offered in the way of aid but how it was distributed that is a source of some dissatisfaction among respondents.

It should be noted that in contrast to most of our survey questions an appreciable number of respondents gave no answers to these questions. In Sanarate 13.8 per cent failed to answer the question, "Was aid distributed fairly in the community?", and 11.9 per cent failed to answer the question, "Was aid to the community adequate considering damage?" In San Juan 17.4 per cent failed to answer the first question. It is unlikely that these "no answers" would divide evenly between the positive and negative categories if answers had been forced. They probably represent people with negative opinions who did not wish to go on record as expressing them.

A cross-tabulation was made between these two questions to determine whether answers to them were related. This cross-tabulation demonstrated that there is a significant positive statistical relationship between the answers to the two questions. Those people who said aid was unjust tend, in higher proportions, to say that aid to the community was not sufficient (64.1 per cent) while those who say it was just tend to say aid to the community was sufficient (65.2 per cent).

A third attitudinal question was asked regarding aid. This question asked, "In general, what do you think about the aid received by the community?" The answer

categories used in coding were "very bad," "bad," "average," "good," or "very good." Eighty-six per cent of the respondents, when asked this general question, said aid was "good" or "very good" and only 4.9 per cent said it was "bad" or "very bad."

Taking the results of this question and the other two discussed earlier, it seems that especially in the larger communities, subjects were satisfied with the kind and amount of aid but not with the way in which it was managed or distributed. This conclusion is supported by answers to the question, "How could aid be improved?"

Ways Subjects Thought Aid Could Be Improved

Subjects were asked the general question, "How could aid have been improved in this community?" During pretesting in which 300 interviews were done, a set of answer categories expressing their opinions was developed. A total of 113 or 34 per cent of those who answered this question said aid was adequate as it was. By and large, these individuals gave no further answers to this question. The most frequent answers given to the question by others are found in the categories "Should be distributed according to need," "Should be distributed equally to all," "Should be distributed house to house," and "Should be better controlled."

The category "Should be distributed house to house" needs some explanation. This answer category was used when subjects said people offering aid should come to disaster victims at their own homes and offer aid rather than having them stand in line or go through bureaucratic procedures to receive it. Subjects literally answered, "People distributing aid should go from house to house distributing it." When probes were used to discover the meaning of this answer, it was found that they were objecting to having to wait in lines and contend with formal dis-

tribution procedures. The two answers, "According to need," and "Equally to all" indicate that subjects feel a different plan of distribution than utilized should have been employed in distributing the aid. The answer, "Should be better controlled" probably indicates that the respondent felt aid was being given to undeserving persons or being wasted. It might also indicate that they disagreed on the equity principle upon which aid was being distributed.

The answers, "According to need," "Equally to all," "House to house" and "Better control," taken together, are related to the underlying basis upon which aid was distributed rather than to the type of aid or who distributed it. It will be noted that few subjects mentioned what was distributed as a way to improve aid. Only 3.4 per cent said more materials should have been distributed and 1.2 per cent said loans should be provided. All other answers are related either to the organization of aid or to the manner of its distribution. Of particular interest is the fact that 31 persons, or 9.5 per cent of those interviewed, said that aid should have been distributed directly by the outside agency without an intervening committee, local or otherwise. Only one subject mentioned that aid should be distributed by a local committee and six said no committee should be involved at all.

When the relationship between suggestions for how to improve aid and answers to the question, "Was aid distributed fairly?" are compared, it will be seen that a higher percentage of persons who said it was unjust gave answers related to the principles underlying aid distribution or its organization. The most common answers for those who thought it was unjust are the answers, "It should be distributed equally" and "It should be distributed house to house" which, in a sense, mean about the same thing. In short, it seems likely that the persons dissatisfied with the aid process feel that it should be distributed equally to all, perhaps regardless

of need. It should be noted, however, that those who said aid was just also gave these answers in higher proportions than any answer except "Aid was adequate."

SUMMARY AND CONCLUSIONS

The data discussed in this paper show that considerable change has taken place in housing characteristics in Guatemala since the 1976 earthquake. In the two years following that event, houses have changed from the typical adobe structure with a tile roof, characteristic in ladino communities in the East before 1976, to houses made of materials considered by most people to be safer in an earthquake. Roofs are lighter, using lamina or duralita instead of tile, and walls are made of materials such as wood, concrete block, tercreta or a combination of these and other lighter, more flexible materials.

This substitution of other materials for adobe and tile has undoubtedly improved the safety of houses in an earthquake. It must be recognized, however, that the way materials are used to create an integrated structure is perhaps more important to earthquake resistance in housing than the materials used. At this stage of analysis, no firm conclusions can be drawn concerning improvements in structural integrity. It can be stated, however, that in the case of houses offered by reconstruction agencies, care has been exercised to provide an aseismic design and to carry through with aseismic construction techniques. Since the reconstruction process is still in progress, and since shear obsolescence in housing, coupled with population growth, will lead to continual house construction, it is impossible to say at present whether this trend towards the use of more earthquake resistant housing will continue indefinitely.

The changes which have occurred in housing are the result of a combination of individual efforts and agency programs. Individuals seem to be moving away from tradi-

tional house forms towards the use of less life threatening materials even when not directly assisted by agencies. This movement is away from indigenously produced local materials towards materials requiring industrial manufacture. Thus there appears to be an increase in the dependence of local communities on outside sources of supply and on a money economy in house building than before the earthquake.

Without more sophisticated statistical analysis than is possible at present, it is difficult to summarize the attitudes of the people interviewed in this study towards the reconstruction process. On the one hand they seem to be pleased with the amount and type of aid they received. On the other, they seem to be dissatisfied with some of the procedures and organizational patterns employed to render assistance to them. There also appear to be differences of opinion as to the underlying equity principle employed as a basis for distribution. Finally, the amount of satisfaction or dissatisfaction with aid seems clearly to be associated with the type of community (small or large) and perhaps with the type of agency program utilized in that community.

NOTES

- 1 For a description of the disaster and the immediate post-disaster period, including early damage estimates and death rates, see Robert A. Olson and Richard Stuart Olson, 1977.
- 2 Gross housing characteristics before the earthquake are given in *Vol. III, Censo de Vivienda, 26 de Marzo de 1973: Vivendos Particulares, Materiales de Construccion, Tipo de Local*: Direccion General de Estadistica, Ministerio de Economia, Guatemala, C.A. The figures for wall types used in houses were checked against our sample estimates based on the memories of respondents. There was close correspondence between our figures for pre-earthquake wall types in the villages studied and those given in this volume.
- 3 For a discussion of injuries and deaths related to house construction see Roger I. Glass, et al., 1977.
- 4 The category "concrete block" includes brick and a material called tercreta, which is made of a mixture of earth and cement pressed into a block by the hand-operated cinvaram machine. Most houses in this category were constructed of cement block or tercreta.

REFERENCES

Glass, R.I. et al. (1977) "Earthquake injuries related to housing in a Guatemalan village: aseismic construction techniques may diminish the toll of deaths and serious injuries," *Science*, August 17.

Olson, Robert A. and Olson, Richard Stuart (1977). "The Guatemala earthquake of 4 February 1976. Social science observations and research suggestions," *Mass Emergencies*, 2: 69-81.