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A LONGITUDINAL STUDY OF THE 1976 GUATEMALAN EARTHQUAKE

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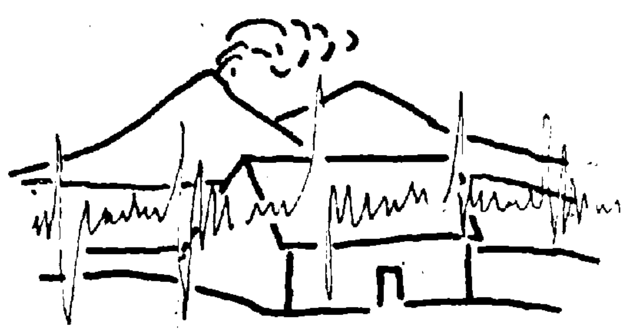

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16. Abstract (Limit: 200 words)
Results are presented of a study of the reconstruction process that followed the earthquake in Guatemala on February 4, 1976. The objectives of the study were to examine the hypothesis that major disasters foster rapid social change and to analyze the effects of reconstruction programs on the recovery of households and communities. This volume addresses housing and general economic changes as well as cultural differences in recovery. Four settlements representing different types of recovery are examined: Roosevelt, a government settlement; Carolingia, a planned permanent settlement; 4th of February, an unplanned squatters' settlement; and New Chinautla, a planned permanent resettlement of people from a previously existing town. The economic situations of settlers in Roosevelt and the 4th of February worsened after the earthquake, while those of settlers in Carolingia and New Chinautla improved. It is concluded that the organization of victims into reconstruction committees, and eventually into a permanent community organization, was extremely important to the continued control of the settlement by the residents.

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A LONGITUDINAL STUDY OF THE 1976 GUATEMALAN EARTHQUAKE

EDITED BY

FREDERICK L. BATES

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Chapter 8

Housing Reconstruction

Frederick L. Bates and Thomas E. Edwards

In most disasters, but especially in earthquakes, damage to man-made structures constitutes the principal method by which the disaster agent impacts upon the social system. Such damage is responsible for most of the lives lost and for most of the injuries suffered. Furthermore, the financial losses suffered by the private as well as the public sector are primarily due to the effects of the disaster agent on man-made structures.

Actually, disasters are social phenomena and occur only when a large scale impact is felt by the social system. Since this system consists of organized human behavior and that behavior depends upon and employs a physical infrastructure to support its continued functioning, a disaster impacts upon society by first disrupting its physical facilities. As a consequence, a disaster is almost always a result of an interaction between some physical disaster agent such as an earthquake and the physical infrastructure which supports the social system.

If the physical infrastructure is resistant to the disaster agent, an earthquake for example, the physical event will not produce a disaster for the social system. It will merely constitute a sudden and disturbing release of vast amounts of energy which is absorbed with little or no damage by the infrastructure. If, however, the physical facilities used to support the social system are not resistant to the disaster agent, heavy damage to the infrastructure itself and to people who occupy and use it can be expected. Large scale loss of life and disruption of human activities in a disaster are therefore evidence that the physical infrastructure exposes the social system to disruption by the disaster agent. A secondary impact of a disaster occurs when efforts to restore the physical infrastructure and to reestablish normal patterns of activity take place. These efforts usually, though not always, both mitigate and exacerbate the effects of the disaster agent. The combined effects of the primary and secondary impact of a disaster almost inevitably lead to change in the physical infrastructure and in the long run to alterations in the social patterns associated with it. This particular research is focused on tracing these effects.

For convenience, damage to physical infrastructure (primary impact) and reconstruction of that structure (secondary impact) in the Guatemalan case will be discussed under two headings. In this and the next three chapters the impact of the disaster on housing will be examined and in a later chapter the impact on community level facilities and services will be explored. In both cases emphasis will be placed on changes in man-made structures produced by the earthquake and by the reconstruction process.

Housing in Guatemala Prior to the Earthquake

Guatemala is a country of great internal contrasts and variability. Like most developing countries, it has one foot in the highly modern westernized world of today with many of its characteristics resembling those found in the United States or Europe. This is especially true in Guatemala City. The other foot, however, is still firmly planted in the traditional past even to the extent that life in many remote villages is not too unlike it was two hundred years ago.

Housing reflected this wide range of variability just before the earthquake. In the city the wealthy and the small but expanding middle class lived in houses with all of the modern conveniences and with structures built of modern materials designed to resist the shock of earthquakes. In the rural countryside, especially in small villages, housing was more traditional, ranging from "informal houses" made of straw, cane and palm built upon light wooden frames of posts and sticks, through bajareque (similar to waddle and daub) and adobe, with an occasional house made of cement block or brick to house more affluent villagers. There was a definite continuum of "modernization" to be observed. This continuum was anchored on one end in the more affluent zones of modernized Guatemala City and at the other in remote aldeas and caserios (villages and hamlets) tucked away in the mountains of the Highlands or the East. In between, but more towards the modernized end, came the more accessible departmental capitals and large municipios.

Change was underway in Guatemala at the time of the earthquake, producing gradual movement, even in the more remote areas of the country, towards modernization. For example, the roof patterns of houses were changing away from traditional materials such as palm, thatch or clay tile, towards the use of corrugated metal roofing (lamina) or corrugated cement and asbestos sheeting (duralita). Where money resources permitted, wall materials were also changing away from traditional materials, especially adobe, towards the use of cement block and brick. Wood was a scarce resource and becoming scarcer. As a consequence, it was used sparingly in the building of houses.

Household facilities and services also varied tremendously prior to the earthquake. Except in the city and in the larger department capitals and municipios, running water in the house was very rare, and electricity even more so. Similarly, municipal sewage systems were infrequent and, where present, did not serve everyone. Furthermore, there was no system for piping gas into homes anywhere in the country. Cooking depended upon wood, charcoal, bottled gas or kerosine, and because of the mildness of the climate, houses were, for the most part, unheated.

Housing in much of Guatemala should not be thought of in the same way that people in the U.S. or Europe think of it. Among the poor in Guatemala, and especially among Indians, housing as a process is frequently accomplished using a combination of separate structures. A household group may occupy several buildings on the same site using some as dormitories, others as "living rooms" and still others as kitchens and storerooms. These various buildings may be built of widely different materials and conform to different designs. As a consequence, when we speak of a house, it is important to realize that it does not conform to many western notions of housing, especially when remote areas are involved.

Policy Issues Arising With Respect to Housing Reconstruction

Immediately following the earthquake, when the extent of damage to housing became known and it became clear that a massive housing program would be necessary, officials within the Guatemalan government, and representatives of foreign agencies, began to think about how to rehouse disaster victims. During this period, which eventually stretched over several months, various issues were debated. Individual agencies, both inside the Guatemalan government and within the foreign agency community, resolved these policy issues in different manners, arriving at plans for housing programs that varied considerably from one organization to the next.

Some of these issues have already been alluded to in the chapter on the Guatemalan government's response but it will be useful here to lay out the more salient ones in a more systematic fashion as a guide to analysis of data. The form that actual housing programs took depended on how individual agencies resolved these questions. In turn, the current distribution of housing types in Guatemala was strongly affected by the way these issues were resolved.

Free Aid Versus Participatory Aid

One of the first issues to arise involved the question of whether housing aid should be given away free or whether victims should be required to contribute either money or labor in return for receiving it. The Guatemalan government, through the Emergency Committee and later the Reconstruction Committee, strongly opposed free aid. There were two reasons for this. First, it was feared that free aid would create dependency either on the government or on foreign agencies, and that as a consequence, long range development would be slowed down. Furthermore, it was regarded as beyond the financial capacity of the government to offer free housing in the future and it would be a bad precedent, creating unattainable rising expectations, if such a practice were followed during reconstruction. Many foreign agencies agreed with this view since they were also against creating any form of dependency and creating unrealistic expectations in the process of distributing aid.

The government, along with these agencies, advocated one of two solutions which were eventually followed in some form by most agencies. Housing aid in the form of materials should either be sold at a subsidized, reduced price, usually half the market value, or people should contribute their labor in housing construction or on community projects to pay for housing assistance. Furthermore, when whole houses were provided, a program of low interest loans, in many cases with housing prices subsidized by an agency, was considered appropriate by the Guatemalan government.

Some foreign agencies, however, felt that the dependency issue was not important and favored the distribution of free housing assistance. They argued that their donors expected them not to charge the people they helped for the assistance they received. It would therefore be a breach of faith with their donors if they did so.

A second reason the Guatemalan government favored victim participation through money payments or labor in the reconstruction process was the additional resources such contributions would make available for meeting the enormous cost of reconstruction. Money collected from the sale of housing materials at subsidized prices could be ploughed back into the reconstruction of community facilities. Labor contributed in return for housing assistance could be used to further housing construction or to reconstruct public buildings and services. Money used to repay housing loans could pay back foreign debt incurred to finance reconstruction.

This official stance of the Guatemalan government was written into contracts signed with individual domestic and foreign agencies in various forms. Some agencies chose the subsidized price option, others the housing assistance for work or the low cost loan option, or a combination of these. In theory, no housing aid was given away absolutely free, but in practice, because rules were relaxed in the field, some victims did actually receive housing assistance without making a personal contribution to their own housing reconstruction.

Permanent Versus Temporary Housing

The earthquake occurred in February during the dry season. In this season the temperatures are relatively mild and of course there is no rain. But by May the rainy season would come and the lack of housing would represent a major threat to the health of people living in the Highlands. The government believed that it had 100 days in which to get roofs over all the victims' heads even though finished houses for everyone could not possibly be supplied in this time. This raised the issue of whether temporary or permanent housing should be supplied.

Temporary housing is distinct from emergency shelter in that it involves more substantial semi-permanent structures expected to serve as housing during the whole period during which permanent reconstruction is taking place. Tents and existing buildings that serve as temporary refugee centers as well as self-constructed huts serve as short term emergency shelters.

Temporary housing, in contrast, comes in several forms. In the most extreme case it consists of complete detached houses that serve one household on its original house site but which are built of temporary materials and intended to last for only a short period, such as a year or two, while permanent housing is being built. There is a provisional quality about this type of housing in that it usually does not offer the same level of amenities that is normally present in permanent housing nor is it intended to remain permanently on the housing site.

A second type of temporary housing consists of barracks-like structures housing multiple households built in temporary refugee style camps. Such housing removes disaster victims from their original housing sites and concentrates them in a temporary form of public housing units. Again these units usually lack the amenities ordinarily present in a permanent house. In particular, privacy is absent and crowding is characteristic. There is usually more sharing of public facilities such as toilets or showers and sometimes cooking and dining facilities.

A third type of temporary housing consists of self-built shacks or shanties constructed of any available material either on the original housing site or in squatters settlements that take on aspects of spontaneously organized refugee camps. Such units start out as temporary shelters but,by gradual impro·ement and elaboration,become temporary houses or, in a longer period, permanent houses.

In the Guatemalan case each of these types of temporary housing occurred in great numbers. For example, The Guatemalan Red Cross, with financial and managerial assistance from The American Red Cross, and construction help from the Mennonites, built over twelve thousand wooden houses with lamina roofs. These houses measured about twelve square meters. They were placed on the recipient's original housing site and were intended to serve for a temporary period while permanent housing programs were being developed.

The Guatemalan government built a number of refugee style temporary housing projects in Guatemala City to house the urban poor displaced by the earthquake. In addition, huge squatters settlements arose in various parts of Guatemala City and in some large municipios in the countryside. In a large number of other cases, individual households built makeshift temporary houses out of scrap material on their own housing sites to serve them until permanent housing could be built.

Right after the earthquake no one really knew how long it would take before permanent houses could be built nor by what method this would be accomplished. There was, however, a great deal of concern over how to get people under a roof before the rainy season. Several options were discussed and eventually agencies chose to go in different directions. Some built temporary houses, others distributed housing materials only and left the decision as to whether these materials would be used on permanent or temporary structures up to the victims. Still others developed large scale permanent housing projects. Later the types of programs will be discussed in more detail.

Materials Versus Whole Houses

Since only a short time was available before the rainy season began, it was obviously impossible to construct permanent housing in order to provide shelter from the rains. The only real question was whether to go all out for building temporary housing, as The Guatemalan Red Cross eventually decided to do, or to provide building materials that the people could use themselves in constructing their own shelter. If reusable materials were provided, they could first be used to construct temporary houses, and later in the construction of permanent ones.

The National Emergency Committee settled on the plan for 100 days as a means of distributing building materials for use in self-construction. These materials consisted of corrugaged, galvanized steel roofing, known in Guatemala as lamina, and of wooden posts, nails, and ridge rolls. These materials were distributed by the National Emergency Committee through local emergency committees.

U. S. AID normally conducts programs through contracts with voluntary agencies acting as a funding agency rather than as an operational organization. In the Guatemalan case an exception to this pattern occurred. AID conducted a building materials program featuring lamina at half price, using personnel hired on temporary contracts. This material which included lamina, posts, nails and ridge rolls, was distributed largely through rural cooperatives, a pattern which had already been developed by OXFAM and World Neighbors for whom the AID contract personnel had worked in the early days of the disaster.

CARE also conducted a building materials program featuring lamina, but instead of charging for it, required recipients to build an aseismic wooden frame for a house as a condition for receiving the lamina free. Once the frame was built and inspected by CARE representatives, the lamina was nailed onto the roof at no charge to the recipients.

In contrast to these building materials programs, The Guatemalan Red Cross mass produced 10,000 board and batton houses of about 3 x 4 meters. These houses had lamina roofs. They were produced in a prefabrication yard located near the housing sites, transported on trucks and erected on the site. Recipients were required to prepare the site and to furnish labor in the prefabrication yard or help to transport and erect the final structures. In all, about 10,000 of these houses were built using green unplaned lumber sawed in Guatemala.

During the period when these programs were being conducted (for the first six months following the earthquake) other agencies were planning permanent housing projects. For the most part, these did not really get underway until at least six months after the disaster. There was a great variety of these programs started and some continued for the next two years.

Paternalism Versus Self-determination

Throughout the reconstruction process a debate continued over the issue of self-determination versus paternalism. One side of the debate strongly favored local participation in all phases of the reconstruction process. They held that such participation would result in a more appropriate and more permanent improvement in housing technology. Furthermore, it was believed that the practice gained in handling local reconstruction problems would provide skills necessary for continuing economic development after the reconstruction process was completed. In contrast, it was argued that paternalism leads to dependency and the loss of adaptive skills and thus would slow down the development process so vital to improvement of life in Guatemala. Also, it was argued that when paternalistic approaches are used by foreigners they introduce inappropriate technology which results in future economic problems based on foreign dependency, to say nothing of disrupting the integrity of local culture.

Although no one spoke out in favor of paternalism as such, a number of groups approached the housing problem independently of local participation. Houses were designed by outside architects, and construction projects conducted using foreign work methods, construction techniques and building materials. Furthermore, many whole projects were managed by foreigners with little or no managerial input at the top level by local citizens or even by highly trained city-based Guatemalans. This resulted in the comment that in Guatemala after the reconstruction, you can see villages that look Swiss, German, Italian, Norwegian or American, but fewer that look Guatemalan than before the earthquake! Although this statement is an exaggeration, it reflects the critic's view that not enough local participation went into the design process, and not enough consideration was given to local cultural values.

Those who tended more toward the paternalistic end of the scale were more concerned about making sure houses were earthquake resistant and less concerned about their cultural appropriateness. Those who tended toward the participation end of the scale seemed to reverse these priorities, being more concerned about cultural integrity and less about aseismicity. Both sides of the debate of course claimed they were concerned about both.

The strongest adherents to local participation chose to engage in housing material distribution, often accompanied by efforts to educate the victim population in matters related to earthquake vulnerability. They attempted to promote the use of indigenous materials and construction methods deemed to be more aseismic. Furthermore, they saw the development of local social and political structure as part of the process.

The agencies who engaged in the building of large scale housing projects which were managed without much local participation saw themselves as developing local skills in the building trades by training people to make cement block, or as masons or carpenters or electricians and plumbers.

Improvement in Aseismicity Versus Cultural Appropriateness

It was immediately apparent to anyone inspecting the earthquake area that structural failure due to the improper use of building materials or to defects in design was responsible for the magnitude of the disaster. In particular, adobe buildings had collapsed, dropping their heavy tile roofs on the bodies of sleeping disaster victims. Also apparent was the fact that some structures made of traditional materials withstood the earthquake. The question naturally arose as to how, in the reconstruction process, to insure future earthquake resistance in housing at a cost affordable by Guatemala and those who came to assist in reconstruction.

At the same time, Guatemalans and foreign agency personnel with long experience in the country were concerned about preserving the integrity of Guatemalan culture. They wished to restore the affected towns and villages so that they would regain their characteristic Guatemalan character. In the minds of most who were concerned with this issue, the answer was to use "appropriate technology." Such technology was defined as employing indigenous materials, designs and construction methods to rebuild housing.

Many people were also concerned over the use of modernized materials and technologies that could insure better earthquake resistance and create structures that appeared much like traditional ones, but which would cost far more for materials and construction than the average pre-earthquake house. To achieve improvement in earthquake resistance and at the same time to remain within cost limitations, it was argued that "appropriate technology" would be necessary.

However, others in favor of a higher technological solution, felt that such an approach would lead to too much delay in reconstruction, and would not necessarily result in the same level of improvement in earthquake vulnerability. In addition, it would not necessarily result in improvement in the standard of housing, especially in the provision of urbanized services such as water, sewage and electric power which would more naturally accompany a general modernization in housing. They wished not just to replace lost housing units, but at the same time to improve the level of living of their occupants.

In general, one pattern of reconstruction was to move towards the use of concrete block reinforced by steel bars, with a light weight roof of lamina or duralita. The other pattern was to provide materials for roofing and for building a frame to support it and the walls and to urge the people to follow aseismic practices in choosing wall materials and in wall construction. By leaving it up to the victim to make the choice, it was felt that appropriate technology would be employed. By attempting to educate, this choice was nudged towards aseismicity.

Throughout the reconstruction process criticisms and counter-criticisms abounded and a tension remained among considerations of cost, earthquake resistance, and appropriate technology. As shall be seen when the figures on housing patterns are examined, the net effect of all reconstruction programs taken together, and of individual efforts, was to radically change the character of housing in the earthquake zone and at the same time to substantially increase its cost and decrease its earthquake vulnerability.

Summary of Issues

The way in which the Guatemalan government, through the Emergency, and later the Reconstruction Committee, resolved or failed to resolve these issues resulted in great variability in housing programs in Guatemala. The most important structural decision of the Reconstruction Committee was to grant relative autonomy to the various foreign and domestic agencies who worked on the reconstruction process. This meant that individual agencies were assigned towns and villages within which to operate. Within guidelines written into contracts with them, they were allowed almost total autonomy to conduct their own programs. They handled their own money, hired and managed their own personnel and developed their own plans with only gentle prodding by the Reconstruction Committee to conform to its guidelines. Wide latitude in what was considered conformity was allowed. The situation was simply too large and too complex and too much was happening at once for any centralized management to work even if the desire were present to do so.

The consequence of this pattern was that individual villages and towns varied considerably in the kinds of housing reconstruction programs going on in them. This means that the Guatemalan Earthquake Reconstruction process offers a unique opportunity to compare different types of programs within the same cultural setting.

Types of Housing Programs

Even though there was great individual variability among agencies and among towns and villages, it is possible to create a housing program typology to guide examination of the housing data obtained in this study. This will be done in the next few pages.

There were three major categories of housing programs: (1) those providing housing materials and supplies, (2) those providing temporary housing and (3) those providing agency built permanent housing. Each of these major types may be further sub-divided into several sub-types.

Housing Materials Programs

Housing materials programs took three basic patterns, depending on the agency involved. It will be easiest to describe these programs by describing briefly each in terms of (a) conditions for receiving materials, (b) educational aspects and (c) community level goals.

OXFAM-World Neighbors Pattern: OXFAM, a British private voluntary agency, acts primarily as a funder and stimulator of development programs. In Guatemala it had a close working relationship with World Neighbors, a church affiliated development agency with headquarters in Oklahoma City, U.S.A. OXFAM's Centeral American regional headquarters was located in Antigua Guatemala at the time of the earthquake. World Neighbors also had its country headquarters there, as did several other voluntary agencies.

Both OXFAM and World Neighbors are strongly committed to a development philosophy that favors appropriate technology, heavy local participation, extension education, and the development of rural cooperatives. Much of their development work focuses on community development and agriculture.

When the earthquake occurred they felt compelled to go into the disaster relief and reconstruction business in the towns and villages where they were conducting programs but of course to enter the housing reconstruction program area in such a way as to conform to their usual development philosophy which was strongly in favor of self help. After surveying the needs of villagers and discussing with them what they thought would be appropriate assistance, they decided upon a lamina program. The people were asking for corrugaged metal roofing as a means to build shelters while they decided upon permanent reconstruction.

In order to conform to their ideas which opposed the "creation of dependency" and also the giving of charity which they believed hurt a person's self-esteem, and at the same time to make the most of available funds, they decided to sell lamina at half price. This would make a half more available as compared to giving it away since the money paid for it could be used to purchase more lamina. Since they had been developing and working through rural cooperatives, it was decided to market the lamina through these channels. This would have the advantage of helping the cooperatives gain practice in managing a local project and at the same time provide an existing institution through which the lamina could be channeled.

If lamina were to be given away on the basis of need, it would be necessary to create an organization and a procedure to do case work to decide on allocation. With the cooperatives,a normal marketing channel was provided and automatic market mechanisms would regulate distribution. Those who could afford to pay $30.00 for ten sheets of lamina would buy them just like any normal transaction in the market. This would be quicker and involve smaller overhead costs than any other method.

In order to manage the purchase and distribution of lamina to cooperatives and to collect and recycle funds obtained from sales, OXFAM-World Neighbors hired several employees temporarily on contract from one of the language schools located in Antigua. These schools were disrupted by the earthquake since they depended on foreign students for their clientele, and they had personnel available with experience in business management and who could speak local languages.

Parallel to the lamina programs OXFAM-World Neighbors developed an educational program to spread information on earthquake resistant construction. World Neighbors had worked for some time on agricultural development programs using people from local villages as extensionists. These Indian men were now trained in conducting educational sessions in the rural countryside using an especially designed flip chart featuring pictorial representations of various information concerning building aseismic structures. These charts were printed on cloth so as to survive the tough field conditions under which they were used. In general, World Neighbors favored the use of appropriate technology in its educational efforts and passed out information on how to build with adobe or using bajareque and at the same time to improve earthquake resistence. They favored "adobe de canto" and wire reinforcement. This means that adobe blocks would be set on their sides to make the wall thinner, and held in place by barbed wire stretched between reinforcing posts and beams. Bajareque, a traditional house construction form, employs a system of posts sunk into the ground with a lattice work of cane or sticks woven between them as cross-bracing with the whole wall filled in with adobe mud.

Extensionists traveled around the countryside holding meetings using these flip charts, answering questions and giving advice. How actual houses were built was left strictly up to local residents. In addition, demonstration houses were built in the four municipios in which they worked using local labor to serve as examples of aseismic construction. These structures were intended in the long run for use as community centers.

U. S. AID Lamina Program: The United States, through the U. S. AID mission in Guatemala, made $25,000,000 available for use in disaster relief and reconstruction activities. Five million dollars of these funds were expended on a housing program that featured the distribution of lamina at subsidized prices. Normally AID operates as a funding agency channeling resources into other organizations to support programs. These programs are actually conducted in the field by these separate voluntary agencies. Initially AID considered channeling its housing aid through CARE or some other voluntary organization but after much debate and discussion, the decision was made to conduct the program directly through AID, using specially hired temporary personnel to manage the program. Several individuals who had worked for OXFAM-World Neighbors were hired to conduct this program along much the same lines that were being used by these agencies.

The AID lamina program featured the distribution of lamina, wooden posts, nails and ridge rolls sold at half price largely through cooperatives. The money collected from sales was placed in community funds for each community involved and was used in conducting labor intensive community reconstruction projects. The idea was to provide a source of income for disaster victims and at the same time to assist in financing such programs as road reconstruction, the repair of water and drainage systems or the reconstruction of community buildings such as schools and government offices.

At the same time, the program offered an opportunity to strengthen local cooperatives by giving them experience in handling a relatively complex program. Cooperatives were paid a small commission on sales to defray their costs. Where cooperatives were not available,other groups were employed to carry out the distribution. The aim was to work through grass roots organizations wherever possible rather than through official government channels.

As in the case of OXFAM-World Neighbors, the idea was that such a program would avoid setting up complex case work machinery by using commercial market arrangements. No new organizations or groups needed to be found and there was no implication of charity and dependency involved in this method.

Originally AID intended to conduct an educational program to parralel its lamina distribution program. It requested voluntary agencies to submit proposals for such an effort, and it attempted over a period of a year to interest the cooperatives or other agencies in becoming interested in such a program. No enthusiasm was shown for such an effort at the grass roots level and no acceptable proposal for conducting such a program was received. As a result, with a good deal of reluctance, the idea of an educational program was dropped.

In all, AID aimed at supplying enough lamina to roof 100,000 structures. It distributed 369,935 sheets of lamina in the Western Highlands, 193,175 sheets in the East and 52,722 in the Verpaz Region, for a total of 615,632. This distribution was carried out in 26 different municipios and their associated villages. In addition, AID offered 40,000 round treated wooden posts for sale at half price, along with nails and ridge rolls to complete the roof.

The reuse of funds collected from subsidized sales contributed to the financing of 465 community work projects. These projects were selected by the local community and conducted under local supervision. Each local group decided on the wage rates to be paid and how labor would be organized and employed on these projects.

CARE Lamina Program: The CARE lamina program differed from the OXFAM-World Neighbors and AID programs in that it did not sell lamina at a subsidized price. It distributed 500,000 sheets of lamina through seven regional distribution centers in the Western Highlands, set up especially for the program, using Guatemalan personnel hired for the purpose.

Recipients were required to prepare a building site and to erect a frame designed according to CARE design principles as a condition for receiving the lamina. Furthermore, recipients were required to organize themselves into groups of five to six families and to work cooperatively on building the house frames.

Small scale models of housing frames were used to demonstrate the proper structural principles and demonstration houses were erected for local people to copy. Once the frame was constructed, the program called for it to be inspected by one of CARE's field staff and then the lamina was delivered and nailed to the roof.

The idea behind this program was to provide a method of insuring aseismic housing design in a short period and to do so in a way that would have an educational effect. CARE policy ruled out charging recipients money for what they received. Since the money used for this program was collected as gifts in the U. S. from voluntary donors, it was felt that it should be given to recipients as a gift.

However, by requiring people to work in groups on their own houses, and by allowing freedom in how the frame was filled in, CARE personnel felt they were living up to the spirit of the Guatemalan government's request that dependency be avoided by requiring people to help themselves.

The CARE program also differed from AID and OXFAM-World Neighbors in that it attempted to base distribution on need rather than to serve everyone, and it operated in the entire Highlands region rather than being centered in selected communities. It, along with The Red Cross and Catholic Relief-CARITAS, constituted one of the three organizations that resisted the Guatemalan Reconstruction Committee's policy of assigning agencies to specific towns and villages. These three organizations operated on a region-wide or country-wide basis.

In all, CARE distributed around 500,000 sheets of lamina along with nails and ridge rolls. Late in the reconstruction process, CARE experimented with the building of whole houses to be financed by low cost government loans. This experiment, however, was undertaken over a year and a half after the earthquake and proved unsuccessful because people could not, or would not, assume the debt necessary to finance the program through mortgage payments.

Other Lamina Programs: The National Reconstruction Committee also conducted a lamina program and distributed around 600,000 sheets through a distribution center in Guatemala City where lamina was sold at half price. The Catholic Relief Service and CARITAS sold 300,000 sheets at subsidized prices at locations throughout the country using parish churches as the distributors. Save the Children also conducted such a program in the Quiche region where it distributed about 100,000 sheets along with nails and ridge rolls at subsidized prices. Participants were allowed to pay for the lamina over a two year period.

Through these various programs, 2,310,000 sheets of lamina were distributed in the disaster area. It was believed that ten sheets were sufficient to build a temporary house and that approximately twenty would be required for a more permanent structure. This meant that 231,000 temporary houses, or 115,500 permanent houses could be roofed as a result of these programs.

The Guatemalan Red Cross Temporary Housing Program

The American Red Cross and the International League of Red Cross Organizations worked through The Guatemalan Red Cross to carry out its relief and reconstruction projects. Other national Red Cross societies, such as the Norwegian and Swiss organizations, chose to conduct separate housing programs on their own.

The Guatemalan Red Cross program focused on the production and distribution of temporary houses. These structures were made of freshly sawed lumber and most used board and batten construction. They measured approximately 3 x 4 meters, had a single door at the front and a window which could be closed by a wooden shutter at each end. The roof featured a double pitch covered by lamina roofing. These structures were set directly on the ground and therefore had dirt floors. Occasionally owners elevated the structures on rock or cement block foundations and added wooden floors.

Guatemalan Red Cross houses were built in centralized construction yards under the supervision of American and Guatemalan Red Cross personnel assisted by American Mennonite volunteer workers. In these construction yards the walls of the house and doors and shutters for the house were prefabricated using the labor of local people who were required to work in order to qualify for a house if they were able to do so. Wall sections were loaded on the trucks and transported to the housing site which had been prepared by the recipients and other volunteers. There,special crews of local volunteers, supervised usually by Minnonite volunteers, erected the walls, built a roof frame and attached the lamina. Around ten thousand of these structures were erected during the first year after the earthquake.

Later the Guatemalan Red Cross, largely on its own, built 2000 more houses which were larger and more permanent in design. These houses had half cement block, half wooden walls with lamina roofs. The upper wall sections were prefabricated and placed on top of the cement block lower walls at the house site.

The distribution of all of these houses was managed by local Red Cross committees on the basis of need. Other than supplying labor in the construction process, people were not required to make any contribution. Widows and the incapacitated were given special consideration.

The estimated cost per house at the beginning of the program was $400 but, according to various informants, rose to close to twice this amount before the program was completed. Such costs represent the amounts charged against Red Cross funds for each unit rather than the actual material, labor and transportation costs involved. This figure is important because it was estimated that the value of the actual houses lost in the earthquake - that is, the pre-earthquake house value - was between $600 and $800 per unit, depending on who was making the estimate.

These Red Cross houses were intended to serve only as temporary houses while permanent reconstruction was being carried out. Being made of wood, it was anticipated that they would deteriorate rapidly from termite damage and other causes and would have to be replaced in around five years. Furthermore, it was recognized that they were different in size, appearance and method of construction than the largely adobe and tile structures they replaced.

The concentration of these houses was in Chimaltenango itself and surrounding municipios and aldeas and in El Progreso and its associated towns and villages, but such houses were distributed in many other towns and villages around the earthquake area.

Examples of Permanent Housing Programs

Bricks for Guatemala Housing Project in Sanarate. The housing reconstruction program conducted in Sanarate, a municipio in the Department of El Progreso, was financed and managed by a private organization, "Bricks for Guatemala," funded by the Jewish community in Guatemala. The basic conception of how the project would be carried out and its initial funding were furnished by an Israeli entrepreneur and philanthropist who proposed a self-help mutual aid project in which the beneficiaries, working cooperatively, would participate in all phases of the house construction. The cost of all materials and other expenses were covered by the sponsoring agency. A private Guatemalan construction company DEINCO, volunteered to provide technical and administrative supervision, obtain materials and furnish some equipment and vehicles. Participants in the project were selected by a local committee on the basis of need as indicated by a socioeconomic and housing survey carried out by a team from the Guatemalan Community Development Agency.

Because of limitations on the availability of materials, equipment and supervision, construction was divided into two phases. The first stage consisted of 23 groups with 10 beneficiaries in each which would build 230 houses as construction teams. The second consisted of only 10 groups of the same size to build an additional 100 houses. There were many more people who needed houses but could not meet the requirements for participation. The composition of the groups varied greatly ranging from adults to teenagers and included both sexes. Members of some groups were co-workers or neighbors while others were strangers before the project.

The following qualifications were placed on participation in the project: (1) the participants must own the property where the house would be built; (2) the property had to be within Sanarate's city limits;

(3) only one member of the pre-quake household could receive a house; (4) only household members or an unpaid substitute could work in the project; (5) all participants had to work in all phases of the construction process. Participants had to work a total of approximately 90 days. Exceptions were made to some of the restrictions, especially the one requiring that no paid worker substitute for members of the participant household.

One requirement that was adhered to strictly was participation in all phases of construction, from the making of the terracreto bricks to the placing of the final roof. Each group of participants had to make approximately 20,000 bricks, which included an extra amount to build a house for someone unable to work. If a person quit working he had to forfeit the bricks he had made up to that point. The requirement that a person had to participate in the construction of all the houses built for all group members was enforced by constructing houses in phases. A particular phase (i.e., the foundation) was completed on all ten houses before the next phase was begun. Thus all houses were completed at about the same time and no one could quit after his own house was complete.

The Bricks for Guatemala project emphasized the construction of permanent aseismic houses. They were modeled after a basic house constructed by DEINCO in their commercial housing developments. The house measured approximately 6 x 6 meters with walls about 2.75 meters high. The walls were constructed entirely of terracreto bricks with reinforced concrete columns in the corners and the center of each wall. There were reinforced concrete horizontal supports at the top and midpoint of the walls and the foundation was of reinforced concrete. The roof had a single pitch and was covered by sheets of pressed concrete and asbestos ("canaleta" or "duralita") measuring 1 x 7 meters. Houses were turned over to the owners with dirt floors and no doors or window coverings.

The beneficiaries did not participate in the design of the house and only a few modifications were accepted in individual cases. Beneficiaries could choose whether to include a small entrance and could, within limits, select the placement of windows and doors. This standardization facilitated construction using untrained workers and limited supervision.

In general, the beneficiaries were satisfied with the houses. The main complaints were about the heat caused by low walls and roof material and poor lighting due to an insufficient number of windows. A more serious complaint was that some of the walls were cracked. The main factors that caused the cracking were poor construction materials and techniques. These were both due to the inexperience of the beneficiaries and the lack of adequate technical supervision.

The beneficiaries, most with little or no house construction experience, built the terracreto blocks and laid them, mixed the concrete, tied the steel reinforcement forms and placed the roofs on the houses. Instructors from the Guatemalan Institute of Technical Training and Promotion taught the beneficiaries basic construction techniques. Masons and a foreman were hired to supervise the groups and assist in their training. This method reduced labor costs, provided the beneficiaries the opportunity to acquire skills and gave them a sense of involvement in the reconstruction. It did result in construction errors and lengthened construction time. It did not strengthen community organization and promote cooperative effort as sponsors had hoped.

The building of the terracreto bricks was one of the most unique aspects of the project. A hand operated machine called a CINVA-RAM was used to compress a mixture of clay soil, sand, cement and water. The bricks that were produced were stacked, cured and eventually transported to the house construction sites. Each group was provided one of these machines and organized in a manner to accomplish the various tasks involved in the brick making process.

A total of 326 houses were constructed in the two phases, 230 in the first phase and 106 in the second. Each phase required about four months, the entire project lasting about eight months. The two phases overlapped. Soon after groups from the first phase had begun constructing their houses, groups from the second phase began making bricks. Construction time varied greatly among the groups, depending on the experience, age, sex and compatibility of the members and availability of materials.

The total cost of the project was estimated at $220,000. This amount does not include the cost of the labor of the beneficiaries and volunteer workers. It also does not include some donated materials and vehicles. Based on the 1977 value of the materials, the price of the houses was estimated at $600 each (CEMAT 1977).

To aid the beneficiaries during the period they were reconstructing their houses, Bricks for Guatemala secured food from the World Food Program. Each participant family received approximately two pounds of rice and one pound of beans weekly. Families were eligible to receive food as long as they participated in the Bricks for Guatemala project. This program began about three weeks after the reconstruction process began and continued until all houses were constructed. The entire project was completed before the end of 1976.

The Permanent Housing Reconstruction Program in Patzún. The agency housing reconstruction program in Patzún was carried out by the Norwegian Red Cross in conjunction with two Guatemalan agencies, the National Institute for Administration of Development (INAD) and the National Agricultural Development Bank (BANDESA). The Norwegian Red Cross provided approximately 65 percent of the total cost of the program. INAD was responsible for the planning, administration and supervision of the program. It also carried out a socioeconomic study that served as the basis for the design of the program and the selection of beneficiaries. BANDESA was responsible for administering housing loans for the beneficiaries. Another Guatemalan agency, the National Institute for Training and Promotion (INTECAP) provided personnel who supervised and trained beneficiaries during house construction. The reconstruction program was multi-dimensional since it included not only the construction of permanent houses, but emphasized community development. Direct participation by the community was encouraged.

The Central Committee that directed the project included the mayor as a representative of Patzún. Beneficiaries participated in the design of the houses and, to a limited extent, the organization of the construction process. Housing was considered not merely as a replacement for the previous house, but a means for altering the life style of the beneficiaries. All houses included sanitation facilities, connections for water, concrete floors and basic electrical installations.

To accommodate different desires, financial situation and family size with respect to beneficiaries, three different house designs were offered.

The three types were as follows:

Type	No.Rooms	No.Windows	Size ($m.^2$)	No.Doors	Approximate Cost
1	2	2	21.4	2	$1,513
2	3	3	25.0	2	$1,913
3	4	4	37.0	4	$2,194

The same materials and construction techniques were used for all three types. Walls, approximately 2.4 meters high, were constructed of concrete block with steel reinforced concrete columns, horizontal reinforcement and foundations. The roofs were double pitch covered by duralita, or asbestos-cement material. All houses included wooden shutters and doors, concrete floors and the facilities mentioned earlier. Approximately 1233 of these houses were constructed.

To participate in the program for these houses, the beneficiaries had to fulfill the following requirements: (1) had his house destroyed by the earthquake; (2) have present a title for the future house site; (3) accept a loan agreement; (4) work a certain number of days and provide some unskilled workers. The program furnished skilled workers.

Loans, administered by BANDESA, varied in amount,according to the cost of the house, up to a maximum of $1,500. The length of payments varied according to the beneficiary's age. Younger beneficiaries had a maximum of twenty years and older beneficiaries had a maximum of five years. The rate for all loans was four percent annually.

An alternative method was offered to accommodate those persons, mostly wealthier Ladinos, who did not like the design of any of the three houses. This method, called the Supervised Auto-Construction Program (PAS), allowed persons to design their own houses and still receive aid in the form of technical assistance, donation of scarce materials and monetary loans at eight percent interest. They also had to prove ownership of the future house site. The approximate cost for each of these houses was $2641. The project also provided houses for persons who had no house site. They purchased land on the edge of Patzún and offered lots measuring 8 x 20 meters and the three house types offered in the regular program. Loans were provided at the same rate and under the same terms as for the regular program. Approximately 110 houses were built in this housing project. Each lot cost approximately $250 and the introduction of water to each cost about $100. The total cost for preparation was approximately $35,500.

Housing construction began about June, 1976, and was completed about two years later in May, 1978. During this time, approximately 1,671 houses were constructed; 1233 were of the site-owned type 1,2 or 3; 328 were from the PAS program and 110 were in the housing project for non-land owners. The approximate cost, excluding the housing project was $2,726,505.

One other component of this integrated development program was the improvement and extension of the water and drainage system for the entire community of Patzún. New springs were added to the gravity fed water system and a new pump was installed. The Norwegian Red Cross donated over 60 percent of the $357,000 estimated cost of this project. The beneficiaries of the housing program were expected to pay approximately 31 percent of this cost. Their contributions paid for the connection of their houses to the system. The remaining amount was paid by the municipal government and INAD.

Housing as a Process

Housing is usually thought of as the actual physical structure occupied by families, rather than as the process through which permanent shelter is provided. This perspective leads naturally to a static view of housing since it focuses on a structure and its characteristics at a given time. Actually, housing may be regarded as the process by which houses are produced, occupied, used and altered through time. This view of housing as a process is particularly suited to the study of post-disaster reconstruction since it captures the dynamic nature of the activities that household groups and public agencies engage in as they attempt to solve the shelter problem.

There are several important issues emphasized by this process point of view. First, it emphasizes the fact that the rehousing of disaster victims requires a social process in which a variety of activities are carried on by a network of individuals and groups in order to solve the housing problem. These activities themselves form a process which needs to be understood if the long range effects of disaster on the housing stock of a community are to be understood.

The housing stock of a community is the result or outcome of the housing process as carried on in that community. It is one of many outputs of the social system and is profoundly affected by the structure of that system and by how it operates in relation to its environment through time. For example, if the community is structured so that it has a highly stratified system of social rank with the great majority of people being poor and powerless, then housing will reflect this fact both as a process and as a physical outcome. Furthermore, if houses are built by their occupants rather than by full time specialists, then the housing process will reflect this fact and so will the outcome of that process in the form of structures.

It is apparent from these examples that the way a community is organized, especially with respect to how houses are built, obtained by people, and used in conjunction with household activities, will affect the form that housing takes as well as the nature of the process employed in providing shelter. For this reason, it is possible to say that housing, both as a process and as a physical outcome, is profoundly affected by structural variables related to the organization of the social system producing it.

Of course, cultural preferences and individual attitudes also enter into housing, both as process and as outcome. These preferences and attitudes are also related to the structure or organization of the community and interact with it to produce the housing process and its resultant structural product, houses. Similarly, the environmental situation which provides the resources used in producing houses, and sets limits on the availability of materials as well as providing the climatic conditions to which housing forms an adaptation, enters into the process of housing and, through it, into the determination of the housing outcome.

Taking a process perspective towards housing inevitably leads the researcher to ask questions about how social organization, cultural factors, individual differences and environmental factors affect that process and produce differing outcomes. It leads, in short, to seeing houses as the natural outcomes of processes governed by social, cultural, psychological and environmental factors.

A second point of view that is taken as a result of using a process perspective is to see houses, not as static structures unchanging through time, but as developing or evolving objects. Houses, in a sense, have lives of their own. They, themselves, go through a process as they change over time.

Everyone is aware of aging and deterioration in housing whereby houses decay and disintegrate over a period of time. But they are less aware of the fact that houses may also grow and change in other ways. Rooms may be added or eliminated. Partitions may be erected or torn down. Walls and roofs may be changed, facilities and services added or removed, adornments and decorations added or changed. Similarly, the use of the whole structure or of parts of it may be altered so that dormitories are transformed into living rooms or kitchens, or part of the structure is changed to use in a business or other enterprise. Finally, houses may be moved from one place to another or two or more entirely separate buildings may be joined to form a single building.

All of these possibilities, as well as others, represent potential events in the "life cycle" of a house. This life cycle is produced by the housing process discussed above but it may be traced separately by focusing on the house itself as an object of study rather than upon the human systems that produce and utilize it. Because different societies differ in culture and social organization, they are characterized by different characteristic life cycles for houses. In some societies houses start as small one-room structures and grow as the household group expands and invests additional resources in the housing process. The same household group will remain on the house site and change the house to suit its needs during different parts of the group's life cycle. In other societies, household groups, usually families, move from one house to another to accommodate the changes in the life cycle of the household group. Thus, in some societies a given house will be occupied by one household group continuously throughout its existence. The group and the house remain intact continuously as generations pass, and individuals are born and die, and as the house evolves through a continuous process of housing related activities. In other societies a given house will be occupied by different family or household groups as one group moves out and another in, each producing an impact on the structure, which gradually decays and eventually is regarded as unusable as housing and is eventually torn down and replaced.

Both the social process of housing and the resultant life cycle of houses are complex phenomena that need careful study, especially in the case of disasters. As already stated, the characteristics of houses at the time of a disaster's impact, coupled with the activities being carried out at the time of impact, largely determine whether a natural phenomenon such as an earthquake will produce a disaster or not. But perhaps more important to the disaster researcher is the fact that the reconstruction process, as it relates to housing, creates a new housing stock and this new stock and the process of reconstruction that produces it may lead to greater or lesser future disaster vulnerability. Furthermore, the process of reconstructing houses may lead to social and cultural changes that are either towards or away from the development aspirations of the society.

Of concern with respect to such matters are questions related to how housing is financed, who designs replacement houses, who manages the process of housing reconstruction and who actually builds the structures, as well as who receives the benefits of the housing process. These questions are important to the issues of disaster vulnerability, dependency, equity, and development.

One way of organizing the housing process may lead to dependency while another promotes development. A given way of producing houses may assure future disaster resistance while another heightens disaster vulnerability. Furthermore, it is possible that the process which best improves earthquake resistance may be the very process which produces dependency and leads to the lowest level of cultural appropriateness!

Disaster relief and reconstruction agencies need to know which way of organizing the housing reconstruction process leads to the best results, given the multiple considerations that must enter into a reconstruction process. Given the best of all possible worlds, such agencies would undoubtedly wish to (1) improve disaster resistance,(2) raise the level of living of disaster victims,(3) avoid dependency,(4) utilize technology appropriate to the level of development of the community,(5) take into account cultural preferences,(6) minimize costs, and (7) through the process of reconstruction,develop the capacity of the local system to carry on further development activities. At present, however, scientifically valid knowledge of which process results in maximizing each of these results does not exist. Most information available on these subjects is based on the ideologies and practical experience of operating agencies.

This study will make a beginning attempt to answer some of these questions by looking at housing as a process and by contrasting and comparing how that process was carried on in different communities by different agencies who used various ways of organizing the reconstruction process. Before looking at the research findings, however, a preliminary view of the housing process needs to be presented as a guide to the analysis of data and their interpretation. One way to conceptualize this process is in terms of time phases. A second way is in terms of the various functions or roles played in the process, and still another way is in terms of the groups and individuals who participate in reconstruction.

Time Phases

The housing process with respect to disaster may be thought of as occurring in a succession of time phases during which different sets of activities are carried out. These phases will be delineated in terms of the kind of physical structures used to perform the shelter function and what is happening with respect to housing activities. The phases to be used in this report are as follows.

Phases in the Housing Process Following Disasters

1. Pre-impact Phase - The house prior to impact and the characteristics of the household in relation to it.
2. Impact Phase - The performance of the house during disaster impact and the damage suffered.
3. Temporary Shelter Phase - Period during which people use highly temporary provisional shelter such as tents and lean-tos.
4. Temporary Housing Phase - Period during which people erect or occupy shelter intended to house them while permanent houses are built or repairs are made on damaged structures.
5. Permanent Housing Construction Phase - Phase during which permanent housing is actually under construction and people are occupying temporary housing.

6. Permanent Housing Occupancy Phase - People move into permanent houses and abandon or destroy temporary shelters.

7. Housing Revision Phase - People begin to modify reconstruction housing and continue to do so into the indefinite future.

Within the same community these phases may overlap for different individuals. Furthermore, there is an obvious overlap while, for example, people occupy temporary houses and are working on permanent ones. Temporary houses are built before permanent ones, nevertheless, and this justifies thinking in terms of two different phases.

Functions Performed in the Housing Process

During various phases of the housing process a number of different functions are performed in order to complete the process. Different phases are characterized by the combination of functions that are concentrated on and by who is active as a participant in the housing process. The following list of functions identifies the various ingredients in the form of activities and their resultant functional output that combine in a definite pattern to comprise the housing process. They are not necessarily listed in the order in which they occur. Furthermore, some functions may be performed several times, for example, with respect to temporary shelter, then temporary housing and finally with respect to permanent housing.

Functions Performed in the Post-disaster Housing Process

1. Provision of housing site.
2. Debris clearance.
3. Planning or designing a structure and its placement on the site relative to other structures.
4. Provision of housebuilding materials and other resources such as tools or machinery.

5. Provision of money resources, or financing.
6. Supervision or management of the construction process.
7. Provision of labor in the construction process.
8. Provision for household services such as water, power, sewage, etc.
9. The actual allocation of a house to a household group who occupies it under some condition of tenure.
10. In cases of housing developments or settlements, the provision of community facilities and community organization.

As can be seen from this list of ten functions, it will depend upon who is engaged in the housing process what form activities to perform the function will take. In the case of self-built houses, constructed without assistance of a public agency, the issue of who occupies the house is moot. Likewise, in the case of individual houses built on the site of a previous earthquake destroyed structure, in an established community, the issue of community facilities and community organization has little application. However, this list of functions is meant to fit the wide variety of cases that were encountered in the Guatemalan situation and so includes points which may not be encountered in every case.

Participation in the Reconstruction Process

A third dimension along which the reconstruction process can be examined is in terms of who participates in the various activities carried on to serve these functions. Different combinations of participants will be found in different phases of the process performing different functions. Below a list of potential participants is offered as a tentative identification of significant categories of individuals and groups who take part in the reconstruction process.

Participants in Reconstruction Process

1. Disaster victims and members of their household (not organized into formal agencies).

2. Relatives and friends of disaster victims (not organized into formal agencies).

3. Other private citizens from the community or society affected by the disaster (not organized into formal agencies).

4. Representatives of the national government of the affected country (including military personnel).

5. Representatives of local government of the community affected.

6. Representatives of local governments in unaffected communites.

7. Representatives of The United Nations.

8. Representatives of foreign governments (including military personnel).

9. Representatives of domestic non-governmental disaster organizations from country affected by the disaster.

10. Representatives of domestic non-governmental development agencies from the country affected by the disaster.

11. Representatives of foreign disaster agencies.

12. Representatives of foreign development agencies.

13. Individual foreigners who come as volunteers attached to no organized group.

14. Private business firms from the affected country.

15. Private business firms from foreign countries.

16. Individual specialists working for wages such as carpenters, masons, brick layers, day laborers.

17. Young groups such as Boy Scouts or Girl Scouts.

18. Churches and church groups not usually in development or emergency relief activities.

19. Groups from schools, colleges or universities who volunteer to assist in any phase of the reconstruction process.

20. Private professional consultants and academicians or technicians from outside the affected community.

21. Public utilities.

From the above list it can be seen that an extremely wide potential cast of players may be involved in the reconstruction process if that process is viewed on a national scale in the case of a large disaster. This list was compiled from data obtained in the Guatemalan case, where it is believed that the disaster related social system reached its maximum degree of complexity. Obviously in the individual local communities, and with respect to construction of individual houses, only a small portion of this list will apply. Even so, the housing process following a disaster such as that which occurred in Guatemala involves this list of actors participating at some stage of the process, in some of the communities involved.

Summary of Housing as Process

A relatively complete picture of the housing process following a disaster could be obtained if data were available which would permit a description of who performed which functions at what stage in the process. Such a description should go a long way in helping us to understand the changes which take place in housing stock as the process unfolds.

It is apparent, however, that keeping track of all of these matters simultaneously is a very complex task. In the analysis which follows, an attempt will be made to follow out at least a major part of this design. However, because of the complexity of the task, and more importantly, because this complexity was not fully realized when data collection instruments were designed, there will be some major gaps in the pattern which can not, regretably, be filled in.

Our pattern will be,first,to look at housing stock at several points in time in terms of what changes have occurred over this period. Next, we will focus on types of housing solutions, starting with temporary shelter and then examining temporary housing and permanent housing. In the case of the latter two, we will examine changes and alterations made in these structures as time has passed since they were built. Finally, at all points we will look at who participated in the process and insofar as possible, how various functions were performed. Along the way, special attention will be given to contrasting various types of agency programs and to comparing agency programs with self-built housing efforts.

When is a House a House ?

Although it seems apparent that even the average person in any society would recognize a house when he sees one, in actuality it is often difficult to do so when conducting an exhaustive study of housing. Many different types of structures serve the housing function in most societies and this makes providing an adequate definition of a house difficult. This is especially true in a country such as Guatemala where there is tremendous variation in housing, running the whole gamut from grass huts to multi-storied apartment houses, and elaborate modern mansions of the rich. Also there is the fact that in rural Guatemala, especially among the poor, housing as a function is performed using a combination of totally separate structures, all of which serve the same household group. In such a case, one building serves as the sleeping and living quarters for the household head, another as a dormitory for older children, and still a different one as a kitchen. Things may become even more complex when two brothers and their wives and children share a common hearth, with separate sleeping quarters but a common kitchen and a common meeting room, each of which are separate structures. It is apparent that the whole set of buildings, although detached, performs the same housing function as a single structure among the middle or upper class in the same society.

In a study such as this where the objective is to focus on what happened to houses in the earthquake, it is important to be sure that data are being collected on a common basis for all respondents. Limitations of resources, however, make it impossible to gather detailed data on every structure encountered on every house site. The data obtained for this study included a detailed survey of the structural characteristics of houses, as well as data on how and by whom the structure was built. In the case of pre-earthquake houses, data were obtained not only on these topics, but on what happened to the house in the earthquake. To obtain such data on all units on the house site would have been prohibitive in both money and time costs. Therefore it was originally decided to gather data only on what was termed the "principal house," and at most, on one additional structure used as a dormitory. Data were also collected which indicate whether or not a separate kitchen was present, but not on the structural characteristics of this unit.

The principal house was defined as the building in which the household head slept. Secondary structures included those used to house other members of the household group. As experience accumulated with the interviewing and a second and third wave of interviews were conducted, data were collected on as many as three separate structures in addition to the pre-earthquake house if these structures had been built after the earthquake. This compounding of the data collection occurred partially to accommodate the fact that upon re-interview some household heads had moved from one structure to another and before the study was completed, some had occupied three different buildings on the same house site, each of which had been built after the earthquake. Since data were collected on the principal house in every interview, this procedure resulted in as many as three different principal houses being recorded.

Furthermore, particular attention was given in this study to examining houses built by agencies. Cases occurred in which a household group built one house themselves and received another from an agency or even received two different agency houses. To make things worse, some household units combined previously separate buildings to create a single structure. In short, everything that could happen did happen, leaving the question of "When is a house a house?" a really serious issue.

Another problem arose in identifying a particular house and following it through time. Suppose a household starts with a structure having walls of adobe and a roof of tile. The earthquake strikes and knocks one wall down and cracks the others, at the same time causing the roof tiles to fall off. The household group pulls down one damaged wall, leaving two standing and puts up two new walls made of scraps of used materials such as wood and scraps of metal and cardboard. They obtain lamina from an agency and put it on the roof. At the time of the first interview they are asked whether they are living in the same house as before the earthquake and answer "yes." Is it the same house or isn't it? New walls and a roof have been added but it is on the exact same spot and part of the old structure is still present. Later the scraps of wall material are replaced by cement block and still later the remaining adobe walls are pulled down and replaced. Is it still the same house? That is, is it one particular house that has undergone change or is it an entirely different house than the one we started with? How, in other words, are we to distinguish between change in housing and difference in housing?

Change amounts to a particular object, which has a continuous history, undergoing transformation. On the other hand, difference refers to two entirely separate objects that have entirely separate histories. Different objects can exist at the same time in different places, or at different times in the same place. For this latter reason an object that has undergone radical change may be mistaken for an entirely different object with a separate history.

This of course is an old philosophical dilemma, but one that is important when studying the reconstruction of housing following a disaster. In the following analysis the objective is to keep track of a given structure called the principal house as it passes through time and is altered by the disaster and the reconstruction process. At the same time, a second objective is to follow the household group as it moves from one structure to another if, in fact, this takes place. So the matter of change versus difference is an important issue in this analysis.

A structure will be regarded as being the same object which has undergone change if a step by step process can be established in which individual structural changes occurred to bring about the transformation; in other words, if an unbroken history can be established for the structure.

Structures will be identified as separate, or different structures, if separate histories can be established for them. This amounts in most cases to saying that they will be regarded as separate if it can be established that one of the following was the case: (1) they both existed at the same time as detached units,or (2) if one was completely destroyed or torn down before the other was built. If, at some time, two structures are combined to form a single unit, then this unit as a whole will be regarded as a new structure but note will be made of the fact that it was created out of older structures that still exist as parts.

To keep track of this complexity the terms (1) principal house, (2) secondary house, (3) tertiary house, and (4) agency house will be employed. These terms are defined as follows:

1. Principal house: The structure in which the head of the household sleeps.
2. Secondary house: A second structure occupied by household members as sleeping quarters.
3. Tertiary house: A third structure occupied by household members as sleeping quarters.
4. Agency house: An entire house built as a whole by a reconstruction agency: can be a primary, secondary or tertiary house, or used for another purpose such as a store.

It is important for the reader to remember, while examining the data on housing that much of this analysis is focused on the so-called principal house. This structure in many cases represents only one of several structures occupied by the household unit. At other times, the analysis will focus on agency houses. Again, these units may represent only a portion of the housing occupied by the members of various households.

The Household Unit

Household units are complex in much the same way as houses. Households vary from those consisting of a single individual to those containing many individuals. Furthermore, they may contain only individuals related by blood or marriage, or they may include unrelated individuals consisting sometimes only of such persons. At times they may include only one generation; at others, three or four generations of related and unrelated persons. Finally, a single family unit may make up a household, or two or more related or unrelated family units may be included.

It is also true that new members may be added to a household or old members may leave. As a consequence, as time goes by the membership of the household may be entirely transformed so that at some point no member who was present in the original group still lives in the household and it is made up of entirely different individuals. The same rule will be followed in distinguishing between change and difference with respect to households that was followed in dealing with houses. If a continuous history can be established for the group in which members come and go, then the group will be regarded as one undergoing change or transformation through time, rather than as a different group. If, however, separate histories can be established for the groups themselves, then the households will be regarded as entirely different groups.

It is obvious that the household and the family refer to entirely different social units. For purposes of this study, the household is the unit of study and not the family. For our purposes, a household is defined as a group of people sharing a common hearth and eating from the same food supply. In this case the hearth is defined as kitchen or cooking facilities. This definition allows people who live in separate buildings, even on separate house sites, to be defined as a household if they eat together from common facilities. Whenever several separate families shared a common hearth, the senior family member who was considered to be the household head was interviewed. This could have been either a male or female, depending upon who was available and willing to be questioned concerning their earthquake reconstruction experience. It was the structure where this individual slept which was recorded as the principal house and whose characteristics and whose history was studied. However, it should be remembered that data were obtained on all other household members during the course of the interview and that data were obtained on as many as three separate buildings occupied by this group after the earthquake as well as on the pre-earthquake principal house.

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Chapter 9

Comparison of Pre and Post-earthquake Housing

Frederick L. Bates and Walter G. Peacock

Before the earthquake there was great variability in housing in Guatemala. Houses ranged from tranditional structures made of cane and palm or thatch to the most modern dwellings built of reinforced concrete. This variability could be seen throughout the country but was most observable in contrasts between Guatemala City and remote rural villages. The pre-earthquake situation was also characterized by a housing shortage, particularly in the larger towns and in Guatemala City to which rural people were migrating at a rapid rate. In the years before the earthquake a process of "modernization" had also been taking place in housing, as traditional styles were abandoned in favor of more modern housing patterns. These more modern structures depended upon the use of industrially produced materials such as steel and concrete rather than upon indigenously produced products.

In this and the following two chapters the impact of the earthquake on housing patterns will be examined. This impact will be considered from two perspectives. First, the actual impact of the physical disaster agent on housing will be explored. Then the effects of the reconstruction process which followed will be analyzed. These topics will be examined using housing characteristics as the primary information to be manipulated. Since walls and roofs are among the most important structural characteristics of houses and because they are highly correlated with other housing features, they will be the housing features around which the analysis of other data will be organized.

Wall Types and Earthquake Damage

Data on the walls used in pre-earthquake houses were obtained from the sample of 1472 households in interviews conducted about two years after the earthquake. Respondents were questioned carefully about the characteristics of the houses they were living in on the day of the earthquake and about the amount of damage suffered by various housing features such as roofs, walls, floors, foundations, and so forth. Damage was rated on a four point scale ranging from 0 for no damage, through 1 for slight damage, 2 for heavy damage, and 3 for completely destroyed. Slight damage was defined as damages requiring only minor repairs, while heavy damage required major repairs before the house could be inhabited. An average score of "0" on this scale would mean no damage occurred in the sample group and a score of "3" would mean that every house in the group was destroyed. Averages in between have a meaning relative to these two extremes.

Table 9-1 gives a tabulation of wall types for the three sample groups studied and shows the average damage suffered by each wall type in each group. Examination of the table will show that adobe houses were the most common form found in all three sample groups. There was, however, a far higher proportion of such houses found in the experimental group area, that is, in the area outside of Guatemala City which was struck hardest by the earthquake. There, around 84 percent of all houses had

Table 9-1

Average Damage to Various Types of Wall Material in Experimental, Control Group and City

Wall Material	Experimental Group				Control Group				City				Total			
	No.	Percent	Mean Damage	St.Dev.	No.	Percent	Mean Damage	St.Dev.	No.	Percent	Mean Damage	St.Dev.	No.	Percent	Mean Damage	St. Dev.
Patchwork	3	0.4	1.33	1.53	2	0.4	1.00	0.00	10	3.1	1.60	0.84	15	0.9	1.47	0.92
Cane, Palm, Poles	31	3.9	1.10	1.27	178	31.1	0.22	0.65	6	1.9	1.83	1.47	215	12.7	0.40	0.90
Bajareque	53	6.6	1.83	1.16	82	14.3	0.48	0.75	3	0.9	1.67	1.15	138	8.1	1.03	1.14
Tapia, Poured Mud	5	0.6	2.20	1.10	2	0.4	0.00	0.00	0	0.0	0.00	0.00	7	0.4	1.57	1.40
Wood	10	1.2	0.50	1.08	41	7.2	0.02	0.16	48	15.0	1.08	0.99	99	5.8	0.59	0.92
Lamina, Duralita	1	0.1	0.00	0.00	2	0.4	0.00	0.00	3	0.9	1.33	0.58	6	0.4	0.67	0.82
Half Adobe	3	0.4	1.00	1.00	4	0.7	0.50	0.58	4	1.2	2.50	1.00	11	0.6	1.36	1.21
Half Block	2	0.3	1.00	0.00	26	4.6	0.17	0.38	2	0.6	1.00	1.41	30	1.8	0.29	0.53
Adobe	677	84.2	2.44	0.83	182	31.8	0.80	0.81	206	64.4	2.44	0.75	1065	62.8	2.17	1.02
Cement Block, Brick or Stone	18	2.2	0.44	0.78	50	8.7	0.19	0.45	35	10.9	0.97	1.07	103	6.0	0.50	0.84
Other	1	0.1	0.00	0.00	3	0.6	0.67	1.15	3	0.9	2.00	0.00	7	0.4	1.14	1.10
TOTAL	804	100.0	2.16	1.24	573	100.0	0.32	0.62	320	100.0	1.80	1.12	1697	100.0	1.62	1.26

adobe walls at the time of the disaster. In contrast, only around 32 percent of the houses in the control group had such walls, while around 64 percent of the city sample occupied such houses before the earthquake. This city sample consisted mostly of people who had rented housing in the older part of the city.

Two other categories, bajareque and cane, palm or poles make up another 10 percent of the remaining houses in the experimental group, leaving less than six percent scattered among other categories of wall types. In the control group an even larger proportion of houses had either bajareque or cane, palm or pole walls. Together, these categories made up 45 percent of all houses so that when added to adobe, about 23 percent was left over to be covered by other wall types, especially cement block (9 percent), wood (7 percent), and half block-half light material such as wood (about 5 percent).

The city sample displays a different pattern. This sample consisted entirely of people who settled in post-earthquake housing developments after the earthquake and is therefore not representative of the city as a whole. It consists mostly of poorer people who had been tenants before the earthquake, most of whom came from somewhere inside Guatemala City. The highest proportion of these people (64 percent) lived in adobe houses before the earthquake. About 26 percent of the remainder lived in either cement block or wooden houses, leaving only ten percent in other categories.

It appears from these distributions that except in the city, the vast majority of respondents in both the experimental and control groups lived in traditional housing. The modern categories of cement block, brick or stone, or of half block-half other materials, and of lamina or duralita were relatively rare. Sawed lumber, which is found in the category "wood" was also used sparingly and must be regarded in most cases as a more or less modern material when compared to adobe or bajareque. It is also apparent that while this same thing is true in the control group, there was a slightly higher proportion of modern structures found there. This was especially the case in the city.

Damage to Walls

When the various wall types are examined in terms of the average damage they suffered, several important, but not unexpected, facts stand out. First, much higher average damage was suffered in the experimental group and city than in the control group. This of course is due to the fact that the control group was deliberately chosen to be outside the zone of severe earthquake damage.* On an average this area suffered damage between "none" and "slight." In contrast, the experimental group on an average suffered damage between "heavy" and "destroyed," as did the city.

Damage, however, was unequally distributed among wall types in all three places. Most important is the fact that adobe, the predominant wall material in the earthquake area, suffered the heaviest damage. Sixty-two percent of all adobe houses studied in the experimental group were destroyed and another 24 percent experienced heavy damage. In the city, 58 percent were destroyed, and 31 percent heavily damaged. Even in the control group,

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* The control group has been weighted in this analysis so that it equals the experimental group in terms of the number of aldeas, municipios and departmental capitals included in each sample. This is the reason why the number of cases appears to be more than those reported in the chapter on methodology which summarizes the number of interviews.

adobe faired worse than other mateials. Of the 10 houses reported as destroyed there, half were made of adobe. Of the 31 houses reported as heavily damaged, 23, or 74 percent, were adobe. Taking all of the houses in all of the groups together, of the 600 reported as destroyed, 544 were made of adobe. In other words, slightly over 90 percent of the houses destroyed were adobe.

Three other wall types involve the use of mud or earth as part of their structure: bajareque, tapia, and half adobe. These categories also suffered relatively high levels of damage, although there are too few examples to draw reliable conclusions except in the case of bajareque. The average bajareque house in the experimental group (high impact area) scored 1.83, or very close to "heavy" damage on an average. This compares to a score of 2.44 for adobe.

Many agency personnel in Guatemala believed that bajareque was a safer material than adobe because it consists of a wooden frame onto which a lattice work of cane or sticks has been woven and then filled in with mud. The wooden frame supplies a form of cross-bracing and was therefore believed to be stronger and more earthquake resistent than adobe without such cross bracing. The figures in Table 9-1 confirm this belief. It is important to realize, however, that rather heavy damage still occurred in bajareque houses as compared to other types. This may be due to the age of many of these structures. They represent an even older more traditional pattern than adobe which is regarded as a higher status material. The internal wooden parts of the structure are subject to rot and termite damage and, with age, may lose their reinforcing capacity.

The lowest damage suffered in the experimental group was in the case of houses constructed of cement block, brick or stone. Most houses falling in this category were made of cement block rather than the other two materials and usually contained some form of steel reinforcement. The average damage to such modern structures was between "none" and "slight." Also relatively safe were houses with walls of cane, palm, or wooden sticks or poles. Their flexibility, when combined with a light weight roof, resulted in damage averaging 1.10,or just above the "slight" category.

Too few cases exist in other categories to yield a reliable estimate of damage. When the control group and city are examined with respect to the wall types with greater than 15 cases, it will be seen that the pattern discussed above remains consistent. This is also revealed in the total figures for all samples. In the case of the total sample, however, it can be cautiously concluded that houses employing cement block in the lower wall and light material in the upper wall, proved even safer than those made entirely of block, brick or stone masonry. It should be noted, however, that very few of these structures were recorded in the heavy impact area outside of Guatemala City.

Before going on to a discussion of roof materials and how they fared in the earthquake, it should be noted that knowledge of wall materials alone is not sufficient to judge the earthquake resistance of houses. Engineers and architects maintain that adobe can be used safely if it is used properly and in conjunction with certain design principles. Among the requisites of a safe adobe house are: (1) proper siting and foundations, (2) adobe blocks made of the correct mixture of materials to prevent easy disintegration, (3) a well integrated bond beam system or solerá at the top of the walls, (4) a light weight roof properly connected to the whole structure, (5) although not absolutely essential, corner posts and cross-bracing can strengthen the structure, (6) the blocks used in construction must be properly bonded to each other by the use of a mud mortar which will not easily disintegrate in response to vibrations, (7) a symetrical design with proper door and window placement.

This is a rather complex set of requirements that obviously was not met in most adobe structures in the high impact area in Guatemala. Of all of the above requirements, the three most important are probably the bond beam system, the light weight roof with proper attachments to the house, and symetrical design. Although most adobe houses in Guatemala had soleras or bond beams, most were not strongly attached to the walls, nor were they integrated into a rigid ring around the walls. Many consisted merely of crude logs lightly attached to each other, and laid without bonding on the top of the walls. Roofs often were made of heavy tile and held to the walls only by their weight resting on the logs used for a solera.

Some agency personnel were concerned about the tendency of foreigners to introduce modern materials into house construction in order to achieve earthquake resistence because they felt that this would be too expensive for most people and because it would create dependency on foreign materials and on urban centers. They looked for ways to improve adobe construction or to promote bajareque as a substitute. As shall be seen, however, the people distrusted adobe, and disliked bajareque because it was considered a "poor man's" house.

Roof Materials and Roof Damage

Data on roof materials and roof damage were obtained in the same manner and at the same time as information on walls. Table 9-2 shows a tabulation of these data. In the experimental group the most common roofing materials were tile (54.7 percent), and lamina or corrugated metal roofing (35.9 percent). These two materials accounted for 90.6 percent of all houses. The only other roofing material used by appreciable numbers was thatch or palm which accounted for 7.5 percent of the remainder. In the control group, lamina was by far the most commonly used material (61.1 percent), followed by palm or thatch (22.1 percent), and tile (15.6 percent). The city figures show that lamina was by far the most often used material,accounting for 85.9 percent of all roofs. Tile (7.8 percent) was used sparingly there, as were the more rural thatch and palm (less than one percent).

Attention needs to be called to tile and lamina in particular since these materials figure prominantly in the decisions made on reconstruction. It was believed by most witnesses to the earthquake that the greatest killer was the tile from roofs. Such tile roofs are extremely heavy and were supported by relatively light weight wooden frames. In the shock of the earthquake, tiles fell in on sleeping inhabitants and caused injury and death. This can be seen by looking at the average damage suffered by tile roofs in the experimental group, 2.20, which is slightly above heavy damage. Surprisingly, however, lamina roofs also suffered relatively heavy damage, averaging 2.03. Both of these high figures are due to the preponderance of adobe as a wall material. When the walls of

Table 9-2

Average Damage to Roofs of Various Materials in the Experimental, Control Group and City

	Experimental Group				Control Group				City				Total			
Roof Material	No.	%	Mean Damage	St. Dev.	No.	%	Mean Damage	St. Dev.	No.	%	Mean Damage	St. Dev.	No.	%	Mean Damage	St.Dev
Thatch, Palm	60	7.5	1.20	1.34	127	22.1	0.25	0.68	3	0.9	0.00	0.00	190	11.2	0.71	1.11
Wood	2	0.2	1.50	2.12	0	0.0	0.00	0.00	0	0.0	0.00	0.00	2	0.1	2.50	0.71
Tile	440	54.7	2.20	1.03	89	15.6	0.83	0.90	25	7.8	2.28	0.89	554	32.7	2.08	1.06
Lamina	289	35.9	2.03	1.29	350	61.1	0.40	0.66	275	85.9	1.60	1.31	914	53.9	1.54	1.25
Duralita	7	0.9	2.29	1.11	1	0.2	0.00	0.00	10	3.1	0.60	1.07	18	1.1	1.44	1.34
Cement Slab	4	0.5	0.00	0.00	5	0.9	0.00	0.00	5	1.6	0.60	0.89	14	0.8	0.21	0.58
Patchwork	1	0.1	0.00	0.00	1	0.2	0.00	0.00	2	0.6	0.00	0.00	4	0.2	2.50	0.50
No Information	1	0.1	0.00	0.00	0	0.0	0.00	0.00	0	0.0	0.00	0.00	1	0.1	2.00	0.00
TOTAL	804	100.0	-	-	573	100.0	-	-	320	100.0	-	-	1697	100.0		

houses collapsed, the roofs were quite naturally heavily damaged. Most would have been rated as "destroyed" except for the fact that the materials themselves survived. Individual tiles were intact for the most part and sheets of lamina also survived. The reason, therefore, that roofs appear to have suffered less than walls lies in the fact that adobe blocks were themselves not reusable, while tile and lamina were. This fact seems to have presented a conceptual problem to some respondents whose roofs fell in but the roofing material survived and was not itself destroyed.

This is very important in judging what happened in reconstruction. People who survived could have reused both materials in building new houses. As shall be seen, however, they avoided the use of tile because of its reputation as a killer. While lamina roofs fell in and were "heavily damaged" they did not cause the same number of injuries and deaths as tile.

It is interesting to note that in the control group and city, lamina appears to have performed better than in the experimental group. In the control group its damage score is 0.40 as compared to 0.83 for tile. In the city the comparable figures are 1.60 for lamina and 2.28 for tile. This is undoubtedly due to the fact that there were fewer adobe houses in these two groups.

One other material needs to be discussed since it will appear later as one that was often used in reconstruction. Duralita is the trade name of a material made of cement and asbestos into corrugated roofing sheets, much like lamina. It is heavier, however, being about a quarter inch thick. It is also very brittle. When colored red or orange, however, it resembles tile and was believed by some involved in reconstruction to be more "culturally appropriate" because of its vague resemblance to the more "traditional" tile. This material, if evidence taken from the few cases in the experimental group is of any value, suffered the heaviest damage of all roof materials in the earthquake. Being relatively light weight in comparison with tile, it was however, less likely to cause fatalities.

House Types and Damage

Using combinations of wall and roof material,a housing typology was created. Table 9-3 shows the distribution of housing types in the three sample groups being discussed. It also gives figures on average house damage. These were created by averaging wall and roof damage for each house to arrive at a household score. These scores were then averaged to obtain a sample group score.

The most common house type found in the experimental group had adobe walls and a tile roof, accounting for 51 percent of all houses studied in the high impact area. The second most common had adobe walls with a lamina or corrugated metal roof (31.7 percent). No other house type accounted for as many as five percent of the cases.

In the control group or low impact area, housing types were more varied in distribution. The most common type was adobe and lamina, with 19.7 percent of the cases; next came cane, palm, or pole walls and a palm or thatch roof (17.9 percent), and then houses with similar walls and a lamina or duralita roof (12.9 percent). Finally, 11.6 percent

Table 9-3

Distribution of House Types Showing Average Damage to Each for the Experimental, Control Group and City

House Types (Wall x Roof)	Experimental Group			Control Group			City			Total		
	No.	%	Mean Damage	No.	%	Mean Damage	No.	%	Mean Damage	No.	%	Mean Damage
Adobe - Tile	410	51.0	2.29	66	11.6	0.85	20	6.2	2.52	496	29.2	2.11
Adobe - Lamina	255	31.7	2.41	113	19.7	0.42	186	58.1	2.17	554	32.6	1.93
Wood - Lamina or Duralita	6	0.8	0.00	39	6.8	0.01	46	14.4	1.01	91	5.3	0.52
Block - Lamina or Duralita	14	1.7	0.39	43	7.4	0.11	27	8.4	0.70	84	4.9	0.35
Bajareque - Thatch or Palm	34	4.2	1.44	19	3.3	0.29	1	0.3	0.50	54	3.2	1.05
Bajareque - Tile	13	1.6	1.81	11	1.9	0.50	1	0.3	3.00	25	1.5	1.28
Cane, Palm, Pole - Palm, Thatch	14	1.7	0.46	102	17.9	0.21	1	0.3	0.00	117	6.9	0.24
Cane, Palm, Pole - Lamina, Duralita	8	1.0	1.81	74	12.9	0.12	5	1.6	2.20	87	5.1	0.41
Patchwork - Any Roof	3	0.4	1.33	2	0.4	0.50	10	3.1	1.20	15	0.9	1.13
Half Block or Adobe - Lamina - Duralita	3	0.4	1.00	28	4.9	0.12	6	1.9	1.92	37	2.2	0.50
Other	44	5.5	1.66	77	13.4	0.33	17	5.3	0.97	138	8.1	0.84
Total	804	100.0	2.16	573	100.0	0.31	320	100.0	1.80	1697	100.0	1.49

of the houses had adobe walls and a tile roof. Housing using block or wood for walls and lamina or duralita for roofs were found in 7.4 percent and 6.8 percent of the cases respectively.

As would be expected from examination of the tables on walls and roofs, the city sample differs considerably from either the control or experimental group. The predominant pre-earthquake house type was adobe with a lamina roof (58.1 percent). The next most frequent, however, was wood and lamina or duralita (14.4 percent), followed by block and lamina or duralita (8.4 percent). Except for block and lamina (6.2 percent), no other house type accounts for as many as five percent of the cases in the city. Most of the adobe houses occupied by people in the city sample were large older houses in which families rented one or two rooms and shared kitchen and toilet facilities.

Traditional and Modern House Types

Pre-earthquake house types can be classified according to whether they employed traditional or modern materials in the construction of their roofs and walls. Traditional wall materials consist of adobe, bajareque, tapia, cane, palm, poles or corn stalks. Modern materials include cement block, brick, stone, sawed lumber, sheet metal or asbestos. With respect to roofs, the traditional pattern includes tile, thatch, palm or wooden shingles, while the modern category consists of lamina, duralita or cement slabs. If a house uses only modern material it is classified as modern and if only traditional material, it is classified as traditional. It is classified as mixed if a combination of modern and traditional materials was used. This classification is based on wall and roof characteristics of individual houses rather than on grouping house types together.

A second classification of house types will prove useful. Houses with walls made of adobe, bajareque or tapia will be classified as earthen structures. Those with walls made of wood, cane, palm, thatch, lamina or duralita, or with the upper wall of these materials, will be classified as "light" walls. Finally, those with walls completely made of cement block, brick or stone, will be called "masonry."

Tables 9-4 and 9-5 use these classifications to compare houses in terms of the amount of damage they suffered in the earthquake for the control and experimental groups. These tables show clearly that traditional structures suffered more heavily in the earthquake than modern ones. Since most traditional structures consisted of two types, (1) earthen structures made of adobe, bajareque or tapia, and (2) light structures made of cane, palm, thatch, or cornstalks, the comparisons between earthen and light weight structures are important. Also important are those between earthen structures and those made of masonry.

These comparisons show that earthen structures suffered much more heavily than either masonry or light weight structures. They show also that masonry performed better than light weight traditional buildings. Finally, Table 9-4 shows that buildings that mixed modern and traditional materials fared worse than either modern structures or traditional ones. All of these differences are statistically significant.

The same comparisons were made in the control group where the amount of damage was on the average very light. Even there, however, the findings discussed above hold up, with one exception. In the control group area,

Table 9-4

Differences in Earthquake Damage for Various Categories of House Types in the Experimental Group

Categories of House Types Compared Using "F" Tests	N	Mean Damage	Stand. Dev.	F*	Prob. of F
Traditional	496	2.15	0.98	143.43	.0001
Modern	27	0.24	0.59		
Traditional	496	2.15	0.98	17.96	.0001
Mixed	281	2.34	0.96		
Mixed	281	2.34	0.96	190.07	.0001
Modern	27	0.24	0.59		
Earthen	738	2.28	0.93	131.4	.0001
Masonry	20	0.32	0.67		
Earthen	738	2.28	0.93	128.25	.0001
Light	41	0.98	1.22		
Light	41	0.98	1.22	8.01	.0055
Masonry	20	0.32	0.67		

*F test for one way ANOVA, Difference Between Means.

Table 9-5

Difference in Earthquake Damage for Various Categories of House Types in the Control Group

Categories of House Types Compared Using "F" Tests	N	Mean Damage	Stand. Dev.	F*	Prob. of F
Traditional	188	0.47	0.80	25.73	.0001
Modern	106	0.07	0.21		
Traditional	188	0.47	0.80	5.97	.0150
Mixed	250	0.31	0.53		
Mixed	250	0.31	0.53	21.06	.0001
Modern	106	0.07	0.21		
Earthen	264	0.50	0.69	22.52	.0001
Masonry	72	0.10	0.26		
Earthen	264	0.50	0.69	33.82	.0001
Light	201	0.15	0.54		
Light	201	0.15	0.54	0.57	.4528
Masonry	72	0.10	0.26		

*F test for one-way ANOVA, Difference Between Means.

houses of light weight materials suffered about the same amount of damage as those made of masonry.

These data demonstrate that traditional structures made of earth proved to be much more dangerous than either more modern structures made of masonry or traditional structures made of light weight materials. They also contain a hint that mixing modern and traditional materials may at times be more dangerous than sticking entirely with one or the other.

In interpreting these findings it is important to remember that they are entirely concerned with structural damage and do not deal directly with the issue of injury or death. This is especially important in assessing the difference between lightweight traditional structures and earthen or masonry buildings. A cane or palm roof or wall may collapse without causing fatalities to those inside. This is far less likely with buildings made of heavier materials. In addition, adobe pulverizes into dust under extreme earthquake shock and there is the risk of suffication from dust in addition to the risk of physical injury.

It is also important to realize that these data relate to construction patterns in actual use in the villages studied rather than to the potentially best performance that could be expected from a given type of structure that employed the ideal engineering principles and construction methods. Furthermore, there is the problem of obsolescence. The houses studied varied in age, many being well over 50 years old. Deterioration of original structural features, or alterations made haphazardly in design by the occupants over time may be as responsible for the failure of buildings as the materials employed in construction.

A complex problem in designing housing programs is presented by these facts and others which will be discussed later. Traditional housing patterns using earthen construction experienced a high rate of failure in this 7.5 Richter scale earthquake, while relatively modern housing types performed much better. Modern patterns are much more costly, however, and are beyond the financial reach of many of Guatemala's poor. Furthermore, these more modern patterns foster dependence on industrial production, a money economy and on foreign sources of supply. At the same time, safer traditional patterns such as the use of cane, palm, poles and thatch or bajareque are regarded as signs of poverty and are therefore not prefered as housing patterns by many Guatemalans.

Furthermore, serious questions arise as to how fast and how effectively educational programs can be effectively mounted to improve the use of adobe or to promote the use of bajareque under conditions where housing reconstruction is essential and the time period for completion is short. Another question arises as to whether housing aid should be made conditional upon conformity to aseismic practices in the use of the materials and aid supplied. All of these issues arose as the Guatemalan government and foreign relief agencies considered the types of housing programs that would be appropriate in the Guatemalan context.

One fact which shows up clearly in Tables 9-2 and 9-3 is the fact that lamina roofing was a very common material at the time of the earthquake. This is important to the forthcoming discussion of housing reconstruction programs since some of these programs focused entirely on lamina distribution. Some critics felt that the use of lamina introduced or reinforced a modernization trend in housing and that this trend would result in greater dependency of rural peasants on an industrialized economy, and on foreign sources of supply. Since Guatemala produces no steel, this criticism is undoubtedly valid at some level. Nevertheless it is apparent that this trend was already well advanced at the time of the earthquake. Other data from this study, to be given careful examination later, show that lamina was a preferred roof material in rural Guatemala, and was believed by the majority to be safer in an earthquake than tile.

Another point which bears upon the upcoming discussion of reconstruction programs is the fact that houses made of cement block, with lamina or duralita roofs, performed better than any other type in the experimental group, shown in Table 9-3. On an average they suffered a good bit less than light damage, scoring 0.39 in the experimental group on a scale where 0 means no damage and 1.00 means slight. Since most agencies who constructed whole permanent houses for distribution to victims used these materials, this is an important fact to keep in mind.

Temporary Shelter

Because so many houses were destroyed or heavily damaged in the earthquake and because strong aftershocks continued to occur for many weeks afterward, victims sought temporary shelter for their safety and for protection against the elements. Data on temporary shelter were collected at the time of the first interview with 1472 households.*

*The control group figures have been weighted to equal the number of department capitals, municipios and aldeas in the experimental group. This results in a new total number of observations of 1695.

These data will be discussed below.

There are a number of facts which need to be recognized in evaluating this information. The first is concerned with the extensiveness of the disaster. Its destructive force decimated a vast area stretching from the Atlantic Coast to Solola, a distance of around 200 miles. Its effects were felt in a band over 50 miles wide at some points. This meant that hundreds of towns and villages were destroyed or heavily damaged. The area of heavy impact also included the capital, Guatemala City. As a result, victims could not easily flee to a nearby area where conditions might be better and they would be relatively more safe. The next town was as bad off, or perhaps worse, than their own. Furthermore, communications and transportation facilities were severely affected and travel was difficult or impossible for several days after the disaster. This must be added to the fact that most Guatemalans depend upon buses rather than on personal vehicles for transportation and public transportation was temporarily interrupted by the earthquake. All of this means that temporary shelter had to be sought or, more properly, created locally.

A second factor must be recognized when assessing temporary shelter. Except at the highest altitudes in the rainy season the climate of Guatemala is moderate in the area struck by the earthquake. The disaster occurred during the dry season at a time when the rains were not expected for about 100 days. This meant that temporary shelter of a substantial sort was not manditory for at least three months following the event. Rather flimsy structures could easily serve during this period but more substantial shelters would be needed when the rains began.

A third factor involves the nature of Guatemalan culture, especially in rural areas, and among the poor who make up the bulk of the population. Many Guatemalans are accustomed to putting together informal structures out of scrap materials available in their immediate environment. Farmers build their own lean-tos or "champas" in their fields or on their house sites. Poor city dwellers create shacks on vacant lots or in their back yards in the same way. The know-how to create informal, temporary structures was therefore present.. It can easily be argued that such know-how is really present in every society, but what is important in the Guatemalan case is that such structures were more acceptable by many people, perhaps because their ordinary housing was not that much better. In short, they knew how to survive under such conditions, and immediately set out to do so without suffering the same degree of loss in status or self esteem as might be the case with the middle class or the affluent in a more developed society.

Immediately following the earthquake, when sufficient time had elapsed for people to recover from the shock and care for the injured and the dead, temporary shelters began to appear. For those who owned their own land and housing sites these, or the streets in front of them, were used. For urban dwellers who were landless, streets, parks, the median strips between boulevards, and vacant public and private land was used. As discussed in Chapter 3, squatters settlements arose, and eventually had to be dealt with. The eventual fate of some of these people will be discussed in Chapter 12.

During the first interview respondents were asked two questions concerning temporary shelter which shed some light on the subject.

First, they were asked the characteristics of the first place with a roof they slept in after the earthquake, and then they were asked how long they stayed in temporary shelters. Table 9-6 gives the characteristics of the first shelter for the experimental, control groups and city.

Only around four percent of the people in the experimental group reported that they remained in their pre-earthquake houses all of the time after the earthquake. In the city around five percent did so. This compares to around 40 percent in the control group. The remainder either constructed some other sort of shelter themselves, were supplied shelter by others, or used some less dangerous structure on their house site. Even those who "remained" in their original houses slept outside for a period of time while severe aftershocks were still being felt.

One of the first things to note in this table is that even in the control group people moved out of their houses and into temporary shelter considered to be safer. The earthquake was felt in all three areas covered in this study although it did not produce heavy damage in the control group area. Furthermore, strong aftershocks continued for weeks in some areas. People did not know whether an even greater earthquake might follow the February 4th disaster. Therefore, they moved out of structures they considered dangerous and slept elsewhere.

Hastily constructed shacks made of canvas, cardboard, scrap lumber or metal roofing were thrown up in 86 percent of the cases in the experimental group and in 88 percent of the cases in the city. In the control group 51 percent used this solution. What is perhaps most important, only around three percent in the experimental group, five percent in the city and two percent in the control group were sheltered

Table 9-6

Types of Temporary Shelter Used Right After the Earthquake in the Experimental, Control Group and City

Types of Temporary Shelter	Experimental Group		Control Group		City		Total	
	No.	%	No.	%	No.	%	No.	%
Same House	31	3.87	230	40.20	16	5.00	277	16.36
Tarp - Cardboard	482	60.10	244	42.58	244	76.25	970	57.23
Wood - Tin Shack	210	26.18	51	8.84	38	11.88	299	17.62
Tent	27	3.37	8	1.40	16	5.00	51	3.01
Provisional Shelter	29	3.62	23	3.96	0	0.00	52	3.05
Friend's House	18	2.24	14	2.50	3	0.94	35	2.08
Other	4	0.50	3	0.52	3	0.94	10	0.59
No Information	1	0.12	0	0.0	0	0.00	1	0.06
TOTAL	802*	100.0	573	100.0	320	100.0	1695*	100.0

*Two Missing Cases.

in tents supplied by relief agencies. By the time tents arrived most people had already provided shelter for themselves. The question upon which these data are based asks only what the first place with a roof people slept in was like and therefore can not help determine whether other types of shelter were used later. Some undoubtedly moved into agency supplied tents. What this table does show is that by the time tents arrived people had already created some form of temporary shelter for themselves.

The category provisional shelter, which appears in the table, applies to more substantial structures intended to serve for a long period while the housing problem was being permanently solved. Some of these provisional shelters could have been additional buildings already on the house site which were lightly built and therefore considered safer and others could have been built out of more substantial salvaged materials available to a few people.

Finally, only a relatively few people called upon relatives or friends for temporary shelter. This is probably due to two factors. First, most of the relatives of victims lived nearby and were also victims, and secondly, people wanted to remain near their housing site, and did not wish to migrate even temporarily to seek shelter. Public shelters were virtually non-existant, since public buildings were few in most small places and because they too had been damaged and were dangerous in most heavily damaged towns where they existed.

Table 9-7 shows the length of time people reported spending in temporary shelters. All but ten households out of those studied reported spending at least some time sleeping outside their pre-earthquake houses.

Table 9-7

Length of Time Respondents Stayed in Temporary Shelter Following the February 4, 1976 Earthquake

Length of Time	Experimental Group No.	Experimental Group %	Control Group No.	Control Group %	City No.	City %	Total No.	Total %
1-2 nights	6	0.75	17	2.97	6	1.88	29	1.72
2-5 nights	24	3.02	31	5.41	11	3.45	66	3.91
5-15 nights	95	11.93	82	14.37	87	27.27	264	15.66
2-4 weeks	142	17.84	78	13.61	62	19.44	282	16.71
1-2 months	169	21.23	69	12.10	51	15.99	289	17.14
2-4 months	183	22.99	44	7.74	51	15.99	278	16.49
4-12 months	135	16.96	52	9.02	46	14.42	233	13.78
Still There*	25	3.14	146	25.48	0	0.00	171	10.13
Other	3	0.38	29	5.06	0	0.00	32	1.90
No Information	14	1.76	24	4.25	5	1.57	43	2.57
Total	796	100.0	573	100.0	319	100.0	1688	100.0
Missing	8		0		1		9	

*This category includes people who never left their houses and those who have never moved out of the temporary shelter they built after Feb. 4th in the experimental group and the two can not be separated. In the control group all of these cases represent people who never built a temporary shelter and remained in their pre-earthquake houses except for sleeping outside a few nights.

These 10 are shown as "missing" at the bottom of this table. This included those whose houses were undamaged and who reported still living in the same house when interviewed two years after the earthquake. Some of these slept outside for only a short period but are included in this table showing how many days they spent outside.

About 55 percent spent less than two months in temporary shelters in the experimental group area and about 74 percent did so in the control group. In the city about 68 percent remained in temporary shelters for less than two months but this figure reflects a special sample in which people had moved into houses built by agencies by the end of the first year or in which they had built more permanent houses in squatters settlements for themselves.

Even in the control group where damage was relatively low virtually everyone sought safer shelter for a period of time. Almost everyone was back inside more substantial houses by about four months after the earthquake. The 25 percent reported as "still there" in the control group are persons who remained in their original houses that really suffered no damage to begin with, but slept outside at night for a few days only.

The housing process occurred in several stages. For the first few weeks, or in some cases months, after the disaster people moved outside into very flimsy temporary shelters but as time passed for those whose houses were destroyed, more substantial provisional housing was built to last until permanent housing was provided. This was often done by gradually improving the original temporary hut started within days or hours after impact. The above tables relate only to the first stage in this process and not to the second. Unfortunately no questions were asked on this second stage housing because it was originally assumed, when the interviews were designed, that people moved directly from temporary shelter to permanent housing and that this would be discovered by looking at the type of house occupied when the person was interviewed. By two years after the earthquake a majority of respondents were located in permanent housing of some sort or in housing provided by an agency to serve a provisional purpose. The characteristics of interim provisional housing for those who had already moved into permanent structures by the time of the first interview were, however, missed by this procedure. In the city in particular, three out of four of the sample units began as squatters settlements where typical squatter housing was created and later replaced by agency built permanent housing.

Differences in Housing Before and After the Earthquake

The characteristics of houses before and after the earthquake can be compared using housing data collected in three interviews. This comparison will be made before attempting to account for the differences which arose between time periods. Later, houses constructed by the people themselves will be compared to agency built houses in order to assess the role of agency programs in producing housing change. Before answering the question of how agency programs contributed to housing change, however, it will be useful to examine differences in housing at three points in time (pre-earthquake, 1975, post-earthquake, 1978, post-earthquake 1980) in order to arrive at an overall picture of the trends following the disaster.

Table 9-8 shows the wall materials used on houses at these three time periods. Tabulations are given separately for the experimental, control group and city samples. It will be remembered that 84 percent of all houses had adobe walls in the experimental group before the earthquake and that most of these were either destroyed or heavily damaged. This table shows that by two years after the earthquake only 11 percent of the houses people were living in had adobe walls. By then substantial increases had taken place in the use of other materials, especially cement block which had gone from two percent to almost 20 percent, and in wood which had increased from around one percent to around 25 percent.

Other noteworthy changes had occurred in the use of cane, palm and poles, and in the use of patchwork walls. Both of these categories represent poorer, less substantial housing material and reflect a loss of housing quality due to the earthquake.

In addition there was a substantial increase in houses with walls made of adobe in the lower half and of some light weight material such as cane, corn stalks, wood or lamina in the upper half. Such houses were often the result of heavy damage to existing adobe walls. People cut down the damaged wall to about a meter from the ground and added light weight material above. Similar new structures were built using cement block for the lower wall material. These two sorts of structures increased from less than one percent before the earthquake to about 18 percent two years later. This was a type of wall construction recommended by some agencies as safe in an earthquake.

The overall picture obtained from examining changes in the experimental

Table 9-8

Wall Characteristics Before and After the Earthquake in the Control, Experimental Group and City

Wall Material	Experimental Group						Control Group						City					
	Pre-E.Q. House		Post-E.Q. House 1978		Post-E.Q. House 1980		Pre-E.Q. House		Post-E.Q. House 1978		Post-E.Q. House 1980		Pre-E.Q. House		Post-E.Q. House 1978		Post-E.Q. House 1980	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Patchwork	3	0.37	63	7.84	39	5.77	2	0.35	13	2.21	4	0.79	10	3.13	45	14.06	40	14.93
Cane, Palm, Poles	37	3.86	82	10.20	65	9.62	178	31.12	143	24.96	111	22.10	6	1.88	0	0.00	0	0.00
Bajareque	53	6.59	47	5.85	30	4.44	82	14.31	65	11.34	57	11.38	3	0.94	0	0.00	0	0.00
Tapia - Poured Mud	5	0.62	1	0.12	1	0.15	2	0.35	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	10	1.24	205	25.50	159	23.52	41	7.16	66	11.46	52	10.39	48	15.00	101	31.56	87	32.46
Lamina - Duralita	1	0.12	11	1.37	6	0.89	2	0.35	2	0.35	3	0.60	3	0.94	17	5.31	12	4.48
Half Adobe*	3	0.37	104	12.94	81	11.98	4	0.70	11	1.92	11	2.25	4	1.25	0	0.00	0	0.00
Half Block*	2	0.25	42	5.22	44	6.51	26	4.60	29	5.12	30	5.89	2	0.63	0	0.00	0	0.00
Adobe	677	84.20	91	11.32	77	11.39	182	31.82	143	24.90	118	23.49	206	64.38	0	0.00	0	0.00
Cement Block	18	2.24	157	19.53	173	25.59	50	8.67	90	15.71	109	21.71	35	10.94	150	46.88	129	48.13
Other	1	0.12	1	0.12	1	0.15	3	0.58	12	2.04	7	1.39	3	0.94	7	2.19***	0	0.00
TOTAL	804	100.0	804	100.0	676**	100.0	573	100.0	573	100.0	504**	100.0	320	100.0	320	100.0	268	100.0

* Upper walls made of some light weight material such as wood, lamina, cane, etc.

** 128 cases were unavailable for interview during the last round of interviews for an attrition rate of 15.9%; 42 were lost from the control group, or 12.1%. 52 cases were lost in the city due to attrition, or 16.25%.

*** Six of these cases are houses with "cardboard walls" made from packing boxes.

group is one in which adobe and other earthen wall materials were abandoned and wood or cement block were adopted in their place. As shall be seen later, this change was largely a result of agency housing programs which featured these materials.

When the 1980 figures are examined for the experimental group this overall trend is even more obvious. By then about 49 percent of all houses either had wooden or cement block walls. The increase, however, was primarily in the use of cement block, while wooden walls were being used by slightly fewer people than two years earlier. This slight change in wooden walls could be due to sampling error, however, since 222 cases were lost through attrition in the interview process during the interval between 1978-1980. Slight, but statistically insignificant, declines had taken place in the use of patchwork, cane, palm and poles and bajareque by this time. Otherwise little difference appears in the figures for wall types between 1978-1980. Clearly the major change in housing came during the first two years after the earthquake. During that time a strong trend away from adobe and towards the use of cement block and wood as substitutes was established.

The figures on the control group are also interesting since they reflect trends not directly related to the actual destruction of houses which had to be replaced. In control areas, there were fewer adobe houses before the earthquake than in the experimental area (32 percent). This possibly indicates a trend away from the use of adobe in these areas which had been taking place before the earthquake. By 1978 even in this area where few houses were heavily damaged, adobe had dropped by about seven percent to 25 percent of all walls. Two years later the figure had reached around 23 percent. Thus adobe was being abandoned as a wall material in the control group also.

In the control area there was a trend similar to that in the experimental group towards an increase in the use of cement block. Between 1978 and 1980 it rose from around nine percent to slightly over 22 percent. Wooden walls also registered an increase of about three percent in this period. Parallel to these changes was a steady reduction in the use of cane, palm and poles and a weak trend downward in the use of bajareque.

All of these changes add up to a trend away from traditional materials towards more modern ones and away from housing forms associated with poverty towards more costly housing. There is an obvious possibility of a "spill-over" effect from the experimental or heavily damaged area to the control or lightly damaged area. Agencies did not build houses in the control area. Therefore, these changes were not produced directly by their activities. However, the reputation of adobe as a dangerous material undoubtedly spread into the control area and may have influenced people to be wary of using it as housing. Furthermore, agency houses of block or of wood may have served to stimulate the use of wood and block in house construction even in low damage areas.

The city figures, as usual, need special interpretation. Only four types of walls are recorded in the 1978 and 1980 figures. This is due to the nature of the four settlements studied, all of which were built after the earthquake. Two, Carolingia and New Chinautla, consisted entirely of agency built houses of cement block with lamina roofs. One, Asentiamento Roosevelt, consisted entirely of wooden barracks with lamina roofs. Finally, The Fourth of February consisted of self-built houses made largely of scrap material, called patchwork walls in this study. Sometimes these houses used lamina for a wall as well as a roof material. It is for these reasons that this table appears to show a complete abandonment of adobe in the city and a substitution of wood, block and patchwork for it. Although these trends are similar to those in the experimental group, they must be interpreted differently. While experimental and control group figures come from a random sample of those areas, and are reasonably representative of them, the city figures do not represent Guatemala City as a whole, but only the four special housing areas studied. Three of these were built by agencies and the other was a squatters settlement.

Roof Materials Before and After the Earthquake

Table 9-9 gives a tabulation showing the roof materials used on housing before the earthquake, in 1978 and 1980 for the control, experimental group and city. There is one dominant trend apparent in these figures. People have moved away from the use of tile for roofing and towards the use of lamina and duralita. It is also apparent that this change occurred primarily in the first two years following the earthquake. This is not surprising since there were massive lamina distribution programs conducted by AID, OXFAM-World Neighbors, CARE, Catholic Relief and the National Emergency Committee during this time period. In addition, most agency built houses used lamina or duralita as roofing materials. The only other trend seen in this table worthy of note is

Table 9-9

Roof Material Used in Pre and Post-earthquake Houses in Experimental, Control Group and Guatemala City

	Experimental Group						Control Group						Guatemala City					
	Pre-E.Q. House		Post-E.Q. House 1978		Post-E.Q. House 1980		Pre-E.Q. House		Post-E.Q. House 1978		Post-E.Q. House 1980		Pre-E.Q. House		Post-E.Q. House 1978		Post-E.Q. House 1980	
Roof Material	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Thatch, Palm	60	7.46	37	4.60	26	3.85	127	22.11	89	15.59	64	12.64	3	0.94	0	0.00	0	0.00
Wood	2	0.25	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Tile	440	54.73	94	11.69	76	11.24	89	15.59	51	8.90	40	7.94	25	7.81	0	0.00	0	0.00
Tile over Lamina	0	0.00	4	0.50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Lamina	289	35.95	564	70.15	475	70.27	350	61.08	425	74.11	394	78.23	275	85.94	320	100.00	268	100.00
Duralita	7	0.87	85	10.57	87	12.87	1	0.17	3	0.52	3	0.60	10	3.12	0	0.00	0	0.00
Cement Slab	4	0.50	6	0.75	6	0.89	5	0.87	5	0.87	3	0.60	5	1.56	0	0.00	0	0.00
Patchwork	1	0.12	14	1.74	6	0.89	1	0.17	0	0.00	0	0.00	2	0.62	0	0.00	0	0.00
No Information	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL	804	100.0	804	100.0	676	100.0	573	100.0	573	100.0	504	100.0	320	100.0	320	100.0	268	100.0

the reduction in the use of thatch or palm. This too is undoubtedly a result of the easy availability of lamina as a substitute.

The control group exhibits the same trends but to a lesser degree. For example, while the use of lamina doubled in the experimental group, it increased by only about 17 percent in the control group. Similarly the use of thatch and palm went down in the control group.

Although lamina programs were confined to the experimental group and city areas, there is the distinct possibility that some of it ended up being traded or sold by its original recipients in the control group area, thus accounting for the relatively sharp increase in its use there. It is also probable that in both experimental and control areas people were acutely conscious of the lethal effects tile had during the earthquake and therefore sought a safer substitute.

The city figures show that every house studied had a lamina roof after the earthquake. This is again a result of the special nature of this sample. Lamina was distributed to the squatters in the 4th of February and all of the houses in the three other settlements were built by agencies using lamina for roofing.

House Types Before and After the Earthquake

By using a combination of wall and roof materials it is possible to arrive at a limited number of house types found in the samples for this research. Table 9-10 gives a tabulation showing the frequency of various houses at the three points in time discussed above for the three sample groups.

Ninety to ninety-two percent of all houses fell into ten wall-roof combinations. The remaining eight to ten percent were scattered among

Table 9-10

House Types Before and After the Earthquake in the Experimental, Control Group and City

House Type (Wall × Roof)	Toral Sample: Pre-E.Q. House No.	%	Post-E.Q. House 1978 No.	%	Post-E.Q. House 1980 No.	%	Experimental Group: Pre-E.Q. House No.	%	Post-E.Q. House 1978 No.	%	Post-E.Q. House 1980 No.	%
Adobe - Tile	496	29.2	85	5.0	76	5.2	410	51.0	53	6.6	49	7.2
Adobe - Lamina	554	32.6	140	8.2	114	7.9	255	31.7	34	4.2	27	4.0
Wood - Lamina or Duralita	91	5.4	365	21.5	294	20.3	6	0.7	201	25.0	157	23.2
Block - Lamina or Duralita	84	4.9	380	22.4	399	27.6	14	1.7	151	18.8	167	24.7
Bajareque - Thatch, Palm	54	3.2	20	1.2	16	1.1	34	4.2	11	1.4	7	1.0
Bajareque - Tile	25	1.5	26	1.5	15	1.0	13	1.6	16	2.0	10	1.5
Cane, Palm, Poles - Palm, Thatch	117	6.9	86	5.1	58	4.0	14	1.7	17	2.1	13	1.9
Cane, Palm, Poles - Lamina, Duralita	87	5.1	128	7.5	110	7.6	8	1.0	54	6.7	44	6.5
Patchwork - Any roof	15	0.9	121	7.1	83	5.7	3	0.4	63	7.8	39	5.8
Half Block or Adobe - Lamina, Duralita	37	2.2	165	9.7	150	10.4	3	0.4	129	16.0	114	16.9
Other	138	8.1	182	10.7	132	9.1	44	5.5	75	9.3	49	7.2
TOTAL	1697	100.0	1697	100.0	1448	100.0	804	100.0	804	100.0	676	100.0

House Type (Wall × Roof)	Control Group: Pre-E.Q. House No.	%	Post-E.Q. House 1978 No.	%	Post-E.Q. House 1980 No.	%	City: Pre-E.Q. House No.	%	Post-E.Q. House 1978 No.	%	Post-E.Q. House 1980 No.	%
Adobe - Tile	66	11.6	32	5.5	27	5.3	20	6.2	0	0.0	0	0.0
Adobe - Lamina	113	19.7	106	18.6	87	17.3	186	58.1	0	0.0	0	0.0
Wood - Lamina or Duralita	39	6.8	63	11.0	50	9.9	46	14.4	101	31.6	87	32.4
Block - Lamina or Duralita	43	7.4	79	13.7	103	20.5	27	8.4	150	46.9	129	48.1
Bajareque - Thatch, Palm	19	3.3	9	1.6	9	1.8	1	0.3	0	0.0	0	0.0
Bajareque - Tile	11	1.9	10	1.8	5	1.0	1	0.3	0	0.0	0	0.0
Cane, Palm, Poles - Palm, Thatch	102	17.9	69	12.0	45	9.0	1	0.3	0	0.0	0	0.0
Cane, Palm, Poles - Lamina, Duralita	74	12.9	74	13.0	66	13.1	5	1.6	0	0.0	0	0.0
Patchwork - Any roof	2	0.4	13	2.2	4	0.8	10	3.1	45	14.1	40	14.9
Half Block or Adobe - Lamina, Duralita	28	4.9	36	6.2	36	7.2	6	1.9	0	0.0	0	0.0
Other	77	13.4	83	14.4	71	14.1	17	5.3	24	7.5	12	4.5
TOTAL	573	100.0	573	100.0	504	100.0	320	100.0	320	100.0	268	100.0

a wide variety of infrequent combinations. The most frequent pre-earthquake house in the entire sample had adobe walls and a lamina roof (32.6 percent) and the next most frequent had adobe walls and a tile roof (29.2 percent). In the experimental group these two types were also the most frequent, but adobe and tile was more more frequent (51 percent) than adobe and lamina (31.7 percent). Only two other house types accounted for more than five percent of the cases (cane, palm and poles with thatch or plam roof, 6.9 and cane, palm and poles with lamina roof, 5.1).

Four years after the earthquake (1980) the total sample contained only 13.1 percent adobe houses, and the experimental group contained only 11.2 percent. As seen in the discussion of walls and roofs separately, the distribution of house types after the earthquake became more diverse but was dominated by three types: block and lamina or duralita (27.6 percent), wood and lamina or duralita (20.3 percent) and half block or adobe and lamina or duralita (10.4 percent) for the whole sample with proportionately similar figures for the experimental group.

In the control group things were different. There adobe houses with either a lamina, duralita or tile roof were still the most frequent house type four years after the earthquake (22.6 percent), followed closely by block and lamina or duralita (20.5 percent). Cane, palm or poles with a lamina or duralita roof is in third place, with 13.1 percent, and wood with lamina or duralita in fourth place, with 9.9 percent, followed closely by cane, palm and poles with a palm or thatch roof, 9.0 percent. In other words, although before the earthquake the control group contained slightly more housing using "modern," as opposed to traditional materials, than the experimental group, following the earthquake this was not true. The experimental group has been "modernized" with respect to housing in the four year period covered in these tables.

This is shown clearly in Table 9-11 which classifies house types at the three points in time, first into traditional mixed and modern structures, and then into those whose walls are earthen, lightweight or masonry. Traditional structures in the experimental group have dropped dramatically from around 62 percent before the earthquake to around 13 percent four years later. Even structures which mixed traditional and modern materials have decreased slightly during this period, from 35 percent before the earthquake, to 32 percent four years later. In contrast, modern structures increased from three percent before the earthquake to 55 percent in 1980. This represents a dramatic change in housing patterns in the experimental group area.

A similar, but less pronounced, trend is observed in the control group. This trend in the control area can be interpreted in several ways. First, it is probably true that a trend in the direction of modernization was underway before the earthquake and the changes observed in the control group are an expression of that trend. A second, and very strong possibility, is that the control group was also influenced by the earthquake and this influence is registered in the housing changes observed there. This could have come about in two ways. First, there was spillover of information from the experimental group into the control area, encouraging people there to avoid adobe and tile as building

Table 9-11

Change in House Types After the 1976 Earthquake

House Type	Experimental Group						Control Group					
	Pre-E.Q. 1975		Post-E.Q.1978		Post-E.Q.1980		Pre-E.Q. 1975		Post-E.Q. 1978		Post-E.Q. 1980	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Traditional	496	61.7	111	13.8	89	13.2	204	35.6	124	21.6	91	18.0
Mixed	281	35.0	289	36.0	214	31.7	259	45.1	277	48.4	231	45.8
Modern	27	3.4	404	50.2	373	55.2	110	19.3	172	30.0	182	36.2
Total	804	100.0	804	100.0	676	100.0	573	100.0	573	100.0	504	100.0
Earthen	738	92.5	243	33.3	189	30.0	270	47.8	219	40.0	187	38.2
Light	40	5.0	287	39.4	224	35.6	219	38.8	209	38.2	164	33.4
Masonry	20	2.5	199	27.3	217	34.4	76	13.4	119	21.8	139	28.4
Total	798	100.0	729	100.0	630	100.0	566	100.0	547	100.0	490	100.0

("Other" and "Patchwork" categories not included in this table) materials. Secondly, although agencies did not distribute building materials in the control area, except in a few cases in Solola, some materials found their way into this area through "informal" channels.

A third, and probably the best explanation, is that both of the possibilities mentioned above occurred. In any case there is no way to determine from the data which of these possibilities is the correct interpretation. It needs to be noted, however, that if there was a trend towards "modernization" already underway at the time of the earthquake, and there almost certainly was one going on, then part of the change in the experimental group must also be attributed to a continuation of this trend, and not to the special effects of the earthquake and the agency influenced reconstruction process. In other words, some change would have occurred in the experimental group even if the earthquake had not taken place. The difference in percentage change between the control group and experimental group somewhat corrects for this predisaster trend effect since that trend is included in both the control and experimental group figures. This means that the difference between the control and experimental group is probably associated with their differential experience with the earthquake.

When Table 9-11 is examined it will be seen that the experimental group increased from 3.4 percent to 55.2 percent modern structures, a percentage difference of 51.8 percent. This amounts to a percentage change of 1524 percent between 1975 and 1980 in the experimental group. In the control group modern structures increased from 19.3 percent to 36.2 percent. In terms of percentage change this amounts to 88 percent.

This comparison demonstrates, not unexpectedly, that the experimental group changed to a far greater extent than the control group, indicating that earthquake related factors accelerated an already existing trend towards modernization.

Similar dramatic changes are shown in Table 9-11 with respect to earthen structures which decreased from 92.5 percent of all structures in the experimental group before the earthquake to only 30 percent four years later. This change was accompanied by growth in the use of lightweight materials, especially wood, and in masonry made primarily of cement block.

Summary

The data presented above demonstrate that dramatic changes occurred in housing patterns following the earthquake. Housing in the experimental group area was transformed from predominantly traditional housing patterns to housing closer to the modern end of the continuum. They also point to a strong modernization trend in the control group area which was only lightly affected by the earthquake. If this control group trend is taken as evidence of a modernization process that was already transpiring in Guatemala when the earthquake struck, then it must be concluded that the earthquake did not produce innovations in housing, but instead, accelerated a process that was already underway. In all likelihood this acceleration affected both the control and experimental groups so that the contrast which is seen in the figures presented above between the two groups actually underestimates the effects of the disaster on housing modernization. In other words, the changes observed in the control group probably exaggerate the rate of change which was taking place before the earthquake in the towns and villages studied in this research. Since this is probably so, then the observed differences between changes in the experimental group and the control group are smaller than they would have been if the control group had been totally isolated from the experimental group, unaffected by the earthquake or by information about its effects on housing.

In the next two chapters, different types of housing programs will be examined to determine how they were related to these changes. In these chapters the question of whether the trends noted above actually represent recovery from the earthquake in the experimental group and city will be carefully considered. Furthermore, statistical procedures will be used to test the significance of differences observed between various sub-samples including the experimental and control groups.

Chapter 10

An Evaluation of Lamina Programs

Frederick L. Bates and Charles D. Killian

When the Guatemalan National Emergency Committee, U. S. AID and various voluntary agencies considered what should be done to furnish housing to disaster victims, they considered many alternatives. One that surfaced early was the possibility of lamina distribution. There was a widespread feeling that something had to be done quickly about shelter before the rainy season. Only 100 days were left before the rains would begin and there was a need for tens of thousands of houses to replace those destroyed or badly damaged in the earthquake.

It was apparent that housing programs designed to build whole houses could not be mounted on a sufficient scale in the time available. Even if they could be organized quickly, sufficient funds were not on hand to build whole houses by the tens of thousands, and furthermore, there were serious questions in the minds of many concerning dependency and cultural appropriateness in connection with such programs. If government housing programs were started in order to build whole houses, the time and money required would be excessive and they might be built according to hastily made plans that might result in increased dependency of rural people on the government and on products produced in the city or in foreign countries. In the long run, if houses were sold even at subsidies, this might result in a drain of economic resources from the countryside where poverty was already the rule. If housing programs were undertaken by private voluntary agencies the same objections pertained but with the additional possibility that foreign influences might result in even greater cultural inappropriateness in unrealistically rising expectations, and in dependency on foreign sources of supply.

Because of many of these objections, a substantial group of agencies which included the Guatemalan Emergency Committee, U. S. AID, CARE, OXFAM-World Neighbors and Catholic Relief chose to distribute corrugated, galvanized sheet steel roofing called lamina. The argument in favor of doing this was that such material could be quickly used to construct temporary houses, and could be reused later in the construction of more permanent structures. Its distribution, therefore, required a minimum financial outlay and a minimum housing design commitment. Besides this, lamina was preferred by the people from destroyed towns who began almost immediately to ask PVOs and the Guatemalan government to help them to obtain it. Furthermore, it was believed by disaster victims and agency personnel alike to be a relatively safe material to use for roofing in an earthquake prone area. It therefore had the additional appeal of improving earthquake resistance in housing.

As pointed out in the introductory chapter on housing, a debate developed over whether lamina should be distributed free or at a subsidized price. Those advocating the subsidized sale of lamina believed that giving it away would promote dependency and loss of self-esteem. It would also contribute to rising expectations for future public assistance. On the other hand, selling it would provide additional funds to plough back into reconstruction. It would also require the creation of a less cumbersome distribution system since cooperatives could be used to distribute it.

Ultimately some agencies chose to give lamina away, while others used a subsidized price system or combined lamina distribution with public works programs. Through all systems of distribution at least 2,310,000 sheets of lamina were eventually distributed by agencies as building materials.

In this chapter data gathered in household interviews pertaining to lamina distribution will be examined. At the same time the question of how the lamina which was distributed was actually used in connection with housing will be examined. In addition, attitudes towards the reconstruction process and their relationship to lamina programs will be explored.

Lamina Distribution

During the first interview conducted an average of two years after the earthquake, household heads were asked how they obtained the various materials used in the construction of their houses. Pre-test interviews had been used to obtain an inventory of possible responses to this question and these were provided as precoded categories to interviewers. A respondent could answer with as many as three different sources from which a given building material was obtained.

Table 10-1 shows the responses to this question for lamina for the experimental, control group and city samples. There are eight different specific means by which lamina was obtained shown in this table along with a "no information" and an "undetermined source" category. This last category was used only in the city where a problem arose over how to code agency houses with lamina roofs. Ordinarily if a person had received a whole house from an agency and that house employed a lamina

Table 10-1

Sources From Which Lamina was Obtained by Households After the Earthquake

Source of Lamina	Experimental Group			Control Group			City			Total		
	No.	% Respondents Receiving Lamina	% of All Respondents	No.	% Respondents Receiving Lamina	% of All Respondents	No.	% Respondents Receiving Lamina	% of All Respondents	No.	% Respondents Receiving Lamina	% of All Respondents
Given to Respondent	208	31.7	25.9	11	5.4	1.9	21	7.7	6.6	240	21.2	14.1
Bought at Market Price	269	40.9	33.5	129	65.0	22.5	133	48.7	41.6	531	47.0	31.3
Bought at Subsidized Price	202	30.7	25.1	34	17.3	5.9	63	23.1	19.7	299	26.5	17.6
Traded	8	1.2	1.0	2	1.0	0.3	0	0.0	0.0	10	0.9	0.6
Owned Already	7	1.1	0.9	3	1.5	0.5	4	1.5	1.2	14	1.2	0.8
Salvaged From Past House	166	25.3	20.6	21	10.8	3.7	14	5.1	4.4	201	17.8	11.8
Salvaged From Agency House	2	0.3	0.2	0	0.0	0.0	0	0.0	0.0	2	0.2	0.1
Borrowed	3	0.5	0.4	4	2.2	0.7	3	1.1	0.9	10	0.9	0.6
Undetermined	0	0.0	0.0	0	0.0	0.0	147	53.8	45.9	147	13.0	8.7
No Information	7	1.1	0.9	8	3.9	1.4	7	2.6	2.2	22	1.9	1.3
TOTAL RESPONSES	872	132.7	81.7	212	108.9	37.0	392	143.6	122.5	1476	130.9	87.0
No. of Respondents	657	100.0	804*	198	100.0	573*	273	100.0	320*	1128	100.0	1697*

* Base of the percentages in column.

roof, then the conditions under which the house was received were used as the "means of obtaining lamina." For example, if the house was given to the person, then the source of lamina was coded as "given" and if he "bought" the house, it was coded as bought either at full price or discount price, depending on the nature of the agency program involved. In the city, however, some people occupied agency houses over which there was a dispute concerning whether the tenants would pay for them or not. In this case the source of lamina was coded as "undetermined."

It is important to realize in interpreting this table that people could obtain lamina as a building material separately from obtaining it as a part of an already constructed house, for example, through one of the lamina distribution programs discussed earlier. Besides obtaining it as a separate material, it could be obtained as a part of an already built house. Both types of cases show up in Table 10-1. The figures in this table also include multiple responses, in cases where respondents obtained lamina by several methods.

The percentages given are figured using two different bases. The percentages given in columns 2,5,7 and 9 are based on the number of different respondents who reported receiving lamina from some source. Thus, in the experimental group 657 households reported receiving lamina. This was out of 804 households in this sub-sample, meaning that 81.7 percent of the households in the experimental group received lamina from one or more sources. In the control group, only 212 households reported receiving lamina out of a total of 573 for 37.0 percent. In the city 273 households out of 320 (85.3 percent) were lamina recipients. In columns 2,5,7,9, the base of the percentages is the number of lamina recipients. For example, column two uses 657 as the percentage base.

The second way of computing percentages is based on the total number of respondents, regardless of whether they received lamina or not. Such percentages occur in columns 3,6,9,12 of the table. For example, column 3 is based on the 804 cases in the experimental group. The first set of percentages shows what percentage of people <u>who received lamina</u> were given it, bought it at full price, or at a subsidized price, and so forth. The second set shows what percentage of <u>all of the people questioned</u> were given lamina or bought it at full price, etc.

Examination of this table will show that around 26 percent of the households in the experimental group, as compared to two percent in the control group, were given lamina free of any charge or condition. Unfortunately there is no information available on who actually gave the lamina or on how much was given to any one person. In most cases it undoubtedly came originally from an agency program but some people may have obtained lamina as gifts from third parties such as relatives or friends. In the city the comparable figure is around seven percent.

Many agency programs provided lamina at a subsidized price, usually at half its ordinary cost to the agency. In the experimental group 25 percent of the respondents report receiving lamina under these conditions as compared to around six percent in the control group and close to 20 percent in the city.

Several things need to be noted about these comparisons. First, in the experimental group about as many people report receiving lamina free as receiving it at a subsidized price. This is surprising since far more was distributed using the subsidy system than the free distribution system according to data collected from other sources (see Chapter 6). A second fact that stands out is that about three times as many people in the control group (6 percent) claimed buying lamina at a subsidized price as receiving it free (2 percent). In the city a similar ratio prevails. This seems to indicate that free distribution was more effectively restricted to the earthquake affected area than was subsidized sales. This might be expected since subsidized sales programs resembled ordinary commercial transactions and people from the control area may have found a way of buying lamina at the favorable price offered by agencies even though they lived outside the earthquake area. Later in this chapter the question of how distribution of free and subsidized lamina programs relate to the amount of damage houses suffered in the earthquake will be examined. This will provide a basis for determining whether lamina went to victims or non-victims.

Now, however, a look needs to be taken at lamina sold at full market price. Table 10-1 shows that almost 34 percent of the people in the experimental group claim they paid full price for lamina. Around 23 percent in the control and 42 percent in the city say they bought at full price. In other words, in every group more households report paying full price than either receiving lamina free or buying it half price. This is astounding, if true, since agencies together either sold at subsidy or gave away over 2,310,000 sheets in lamina programs alone. Perhaps another 250,000 sheets were used in the building of whole houses which were later distributed to people. The lamina distributed in strictly building materials programs is estimated to have been enough to roof a minimum of 100,000, and perhaps as many as 150,000 houses such as those occupied by the average disaster victim at the time of this study. Laid end to end, this amount of lamina would make a strip 30 inches wide and over 5,000 miles long.

There are two possible explanations of these figures on full price sales. The first is that the data are inaccurate and that respondents were confused over the difference between a subsidized and a full price. Many therefore may have reported paying a full price when they really obtained lamina at half price. A second possibility is that a great deal of the lamina distributed either free or at subsidized prices was distributed to people who didn't use it and it found its way into the market were it was bought and sold at or near the market price to others who had a use for it. This could happen if a large number of the original recipients actually did not need the material and were willing to sell it to another householder, or to a middleman. This could also happen if lamina were stolen during the shipping and distribution process and then resold. It would appear reasonable to suspect this happened, however, only if distribution programs missed a large number of people who needed the material and at the same time furnished it to others who did not need it.

Accounts by agency personnel of how they obtained the lamina they distributed agree that within a short time after the earthquake the international market (in nearby countries) was depleted. This would seem to mean that ordinary commercial sources could not obtain lamina for a period of several months to distribute through normal commercial channels. If lamina were sold at full price during the first six months following the earthquake, it would therefore either have to come from stores on hand at the time of the earthquake, or it would have to be obtained from people who got it from agency sources. After the first six months, most of the lamina being given away or sold at subsidy had been distributed however, and after that,commercial sales took over.

To anyone familiar with Guatemala it is difficult to believe that respondents did not know the difference between full and half price lamina. Guatemalans are price conscious, and are very much aware of the market value of the commodities they consume, many of which are bought in markets where bargaining over prices is the rule of the game. Men and women alike become "price conscious" becuase so many products do not have fixed prices but the actual price charged is determined by the skill of the buyer and seller in bargaining. This bargaining process rests on both parties knowing the approximate market value of the commodity.

It is of course possible that errors entered into responses to this question because respondents answered in a way they thought the interviewer wanted them to answer, but such a practice would appear to have deflated rather than inflated the figures for lamina sales at full price. Furthermore, control-experimental group differences in the relative number who bought at full price compared to other means of obtaining lamina appear to be in the direction expected if respondents understood the question. It would be expected that more would buy at full price in the control group and less at subsidized price than in the experimental group. This is exactly what the figures show. Given all of this, it appears more reasonable to assume that a good deal of lamina resale took place than to assume mistakes in answers to the question.

Taken together, free lamina and subsidized lamina were obtained in approximately 51 percent of the cases in the experimental group as compared to 33 percent for full price sales. In the control group, around 8 percent was obtained from what appear in most cases to be direct agency sources as compared to 24 percent obtained from full price sales. This lamina, sold at full price in the control group, could well have come indirectly from agency sources in the experimental group area. It even appears likely that this was the case since the normal supply of lamina available to commercial outlets was depleted by agency purchases as noted above.

If the second way of figuring percentages is examined, it will be seen that of those who obtained lamina in the experimental group, 41 percent bought it compared to about 65 percent in the control group. This reflects a difference in impact of agency programs in the two areas. Agency sources were far more important in the experimental group and city, where earthquake damage was great, than in the control group. There is definite evidence of spillover from the earthquake area to the area not affected by the earthquake in the data, however.

There are three ways to test the hypothesis that lamina was resold by its recipients, no one of which can settle the issue. First, it is possible to look at how many respondents received lamina both free and at a subsidized price, or received it free and bought it, etc. If a large number received it free and at subsidy, but did not buy any, it is possible that these double recipients had lamina to sell. This is especially pertinent since the question does not show how much was received free or was bought at subsidy. A single respondent could have received several sets of 10 sheets free or bought several at a subsidized price and would be counted only once in this table for each source. There were reports by on the scene observers that some households had received as many as sixty sheets of lamina from agency sources! This would be enough to roof four or five typical houses.

A second method of getting at this question is to look at house damages for those who received lamina. Those persons with little or no roof damage can be at least suspected of not needing the lamina they received, especially if their pre-earthquake house had a lamina roof. They may therefore have been prone to sell what they received to others.

A third method is to look at whether those people who received lamina free or bought it at a subsidized price built houses with lamina roofs after the earthquake or received such houses from agencies. If the lamina received was not used, then perhaps it was sold to someone else.

Before looking at these possibilities, note should be taken of the one other source of lamina with a significant number of responses in Table 10-1. Around 21 percent of all respondents in the experimental group say they salvaged lamina from their old houses for reuse in their present ones. In the control group and city this source is relatively unimportant. It should be recalled, however, that little damage occurred in the control group and there was no reason for salvage. In the city most respondents did not own the houses they lived in before the earthquake and therefore had no right to "salvage" roofing materials from them. This relatively high salvage rate in the experimental group, not surprisingly, confirms the notion held by lamina advocates that lamina,as a material, survives earthquake damage. It also means that as many as

21 percent of the disaster victims already had reusable lamina at their disposal when lamina distribution programs began. Agencies could therefore have over-estimated the need for this material. The pre-earthquake housing data from the last chapter shows that over a third of all houses in the earthquake area had lamina roofs at the time of the disaster. Most of this material probably survived and was either salvaged and reused or remained on houses which were not destroyed.

Lamina Programs and House Damage

One way to examine the question of whether lamina programs delivered housing materials to households who needed it as a consequence of the earthquake is to examine the distribution of lamina according to how much damage was suffered by the roof of the house in the earthquake. Table 10-2 presents data on this subject. It must be remembered in examining this table that a household could report receiving lamina in three different ways. This means that the percentage of the respondents receiving it by all methods adds up to more than 100 percent. This table shows that for the whole sample, including experimental, control group and city, 1128 (66.5 percent) reported obtaining lamina in one or more ways. In contrast, 569 (33.5) of the 1697 households studied did not obtain lamina after the earthquake from any source.*

Of those obtaining lamina through any method, 350 (31.0 percent) had no damage to the roofs of their houses, 100 (8.9 percent) had slight

*These tables use figures in which the control group sample has been reweighted to equal the experimental group sample in terms of the number of departmental capitals, municipios and aldeas included. This raises the size of the sample from 1472 to 1697.

Table 10-2

Method of Receiving Lamina For Those Who Received it Classified by Damage Suffered by the Roof of the Pre-earthquake House in the Experimental, Control Group and City

Source of Lamina	Damage Suffered by Roof of Pre-earthquake House									
	No Damage		Slight Damage		Heavy Damage		Destroyed		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Given to Respondent	50	14.4	29	29.0	52	30.4	108	21.3	240	21.2
Bought at Full Price	185	52.9	47	47.0	77	45.0	221	43.6	531	47.0
Bought at Discount Price	70	20.1	21	21.0	43	25.1	165	32.5	299	26.5
Other	114	32.6	31	31.0	54	31.6	207	40.8	406	36.0
No. of Respondents (Base of Percentages)	350	100.0	100	100.0	171	100.0	507	100.0	1128	100.0

damage, 171 (15.2 percent) heavy damage and 507 (44.9 percent) reported their roofs being destroyed. There was therefore a greater tendency for people who received lamina to report no damage or destroyed than either light or heavy damage.

When the type of source is examined it will be seen that people with no damage, and therefore no earthquake related need, represent 31.0 percent of all cases who received lamina. These households report receiving free lamina in 14.4 percent of the cases and of buying it at a discount price in 20 percent of the cases. Around 53 percent report paying market value for it. To these cases where no earthquake related need seems to have existed, if damage estimates are accurate, must be added another 8.9 percent who had only slight damage. If these cases also represent households not in need of lamina, 29.0 percent were given lamina and did not need it and 21.0 percent were sold it at a discount price. It is important to note, however, that these percentages can not be directly added together because some of the same people may be recorded twice. Nevertheless, this table suggests the possibility that a fairly large percentage of the sample really not in great need of lamina for roofing received it from agencies if need is assumed to be measured by damage. Before these data have a clear meaning it is necessary to break them down into control and experimental group figures and to look at the data from several angles.

Table 10-3 classifies methods of obtaining lamina by roof damage categories and by control and experimental group. Percentages are computed as follows. The number in the experimental group or the control group (depending on which is being computed) who received lamina from a

Table 10-3

Comparison of Lamina Sources With Extent of Damage Using Total Received From a Given Source as the Base of Percentages

Source of Lamina	Slight or No Roof Damage				Roof Heavily Damaged or Destroyed				Total			
	Experimental		Control		Experimental		Control		Experimental		Control	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Given	61	29.3	8	71.9	147	70.7	3	28.1	208	100.0	11	100.0
Bought at Discount	31	15.3	25	73.8	171	84.7	9	26.2	202	100.0	34	100.0
Bought at Full Price	63	23.4	108	83.7	206	76.6	21	16.3	269	100.0	129	100.0
Other	30	15.5	37	97.4	163	84.5	1	2.6	193	100.0	38	100.0
No. of Responses	185	21.2	178	84.0	687	78.8	34	16.0	872	100.0	212	100.0
No. of Respondents Receiving Lamina	152	23.1	168	84.8	505	76.9	30	15.2	657	100.0	198	100.0
Sources Per Respondent Receiving Lamina	1.22	-	1.06	-	1.56	-	1.13	-	1.33	-	1.07	-

particular source, "given" for example, is used as a base for computing percentages for those who had slight or no damage and then for those who had heavy damage or whose roofs were destroyed. Thus in the experimental group there were 208 households who were given lamina. Of these 61, or 29.3 percent, had "slight or no damage" to their roofs and 147,or 70.7 percent had heavily damaged or destroyed roofs. This same procedure is followed for the control group and for all sources of lamina. Again this table only deals with people who received lamina from some source and excludes those who received none.

Some interesting observations can be made about these figures. First, 29 percent of the people given lamina in the experimental group may not really have needed it because of earthquake damage. Similarly, about 23 percent who were sold lamina at half price by agencies fall in this same category. In contrast, only 15 percent of those who bought lamina at full price had light or no damage to their roofs, while 85 percent who paid full price, had roofs which were heavily damaged or destroyed.

Although the control group figures are presented, there are too few cases in the "given" and discount price categories to draw valid conclusions. In the case of full price sales, however, most cases of buying lamina (84 percent) fall in the low damage category. This is to be expected because there were really only a few cases of heavy damage in the control group and most people who obtained lamina necessarily came from the low damage group.

There is still a third way to compute percentages for these same figures. That is to use the total number of households that experienced light or no damage and then those whose roofs were heavily damaged or destroyed and compute how many obtained lamina from each source. This is done in Table 10-4. Column 1 of this table shows that 61 households with light damage were given lamina in the experimental group. Altogether there were 234 experimental group households with slight or no damage. This means that 26.1 percent of all households in the experimental group were given lamina even though they had relatively light roof damage. In contrast, only about half as many (13.2 percent) bought lamina at a subsidized price from agencies. This seems to show that subsidized sales have the effect of reducing the number of people receiving aid who do not need it. This is probably the case because recipients are required to spend their own money to obtain it and those not in need are not as likely to do this as they are to seek free aid if it is available.

Another possible meaning of these observations is that there were 92 cases in the experimental group in which people received lamina under favorable conditions when they may not have needed it out of a total of 804 households, or 11.4 percent. These families may have sold the lamina they received for a profit and may account for some of the lamina available for sale at full price.

Another set of observations stands out in this table. If only the 570 households with heavy damage in the experimental group are considered, then again around 26 percent were given lamina, the same percentage who received it and had light damage.

Table 10-4

Comparison of Lamina Sources With Extent of Damage to the Roof Basing Percentages on Total Sample

	Slight or No Damage to Roof				Roof Heavily Damaged or Destroyed			
	Experimental		Control		Experimental		Control	
Source of Lamina	No.	%	No.	%	No.	%	No.	%
Given Free	61	26.1	8	1.7	147	25.8	3	3.4
Bought at Discount	31	13.2	25	5.2	171	30.0	9	10.1
Bought at Full Price	63	26.9	108	22.3	206	36.1	21	23.6
Other	30	12.8	37	7.6	163	28.6	1	1.1
Received No Lamina, Any Source	82	35.0	316	63.2	65	11.4	59	66.3
No. of Respondents Receiving Lamina	152	65.0	168	34.7	505	88.6	30	33.7
No. of Respondents in Sample	234	100.0	484	100.0	570	100.0	89	100.0

On the other hand, subsidized sales were made to 30 percent of the households with high damage as compared to only 13 percent to people with low damage. Again it appears that the subsidized sales method is more successful in discriminating between those in need and those not in need than programs that give building materials away. Full price sales have similar, but less pronounced, characteristics in the experimental group. This is expected, however, since buying at full price does not give the buyer an economic advantage. A person may take free lamina even if he doesn't need it because he is receiving something with a resale value. He might even do so with a subsidized price but a full price promises no particular possibility of profit from resale.

Comparison of Free Lamina Distribution with Distribution Using Subsidized Prices

It will be useful to examine free lamina and subsidized priced lamina distribution separately in terms of how successful they were in reaching their target populations. It is assumed that the target population for both types of distribution consisted of households whose houses had suffered heavy damage or were destroyed in the earthquake, and who needed roofing material to rebuild with. Furthermore, it is assumed that neither type of program was intended to supply lamina to a household that also received it from another source.

Using these assumptions Table 10-5 was constructed for free lamina distribution. Those needing lamina are households whose houses were heavily damaged or destroyed, and who did not salvage lamina from their previous houses or buy it at a subsidized price. All other households

Table 10-5

Relationship Between Need for Roofing Material and Receiving Roofing Free

Received Free Lamina	Need Roofing Material				Total	
	No		Yes			
	No.	%	No.	%	No.	%
No	409	79.4	187	64.7	596	74.1
Yes	106	20.6	102	35.3	208	25.9
TOTAL	515	100.0	289	100.0	804	100.0

are classified as not needing lamina. Households are then classified by whether they received free lamina or not.

The target population for free lamina distribution according to this table consisted of 289 households, comprising around 36 percent of the experimental group population. Of this 289, 35 percent received free lamina and 65 percent did not. It is important to realize that the 65 percent who did not receive lamina free, also did not obtain it by subsidized sales. From this perspective the free lamina programs were only 35 percent effective. Another interesting fact may be obtained from this table which is not immediately apparent. Table 10-4 shows that, in all, 570 households suffered heavy damage or were destroyed. Here it is seen that 289 fell in this category and had neither salvaged lamina nor bought it at a subsidy. This means that 281 of the households in the high damage categories either salvaged lamina from a previous house, or bought it at a subsidized price. Thus,almost half of all households with heavy damage are classified in this table as not needing lamina because they already had it from another source. In a sense, they were double lamina recipients and could be a source from which full price sales came.

There is still another way to look at Table 10-5. It shows that 515 cases did not need lamina according to the critieria being used. Nevertheless, 106, or 21 percent of them received lamina free. In other words, around a fifth of the people who had slight or no damage, or who had heavy damage but received lamina some other way,* were nevertheless given lamina.

One way to compute a success rate from this table is to consider the distribution a success when (1) it gives aid to people in need and (2) when it <u>does not</u> give aid to persons who <u>don't</u> need it. In other words, there is a positive and negative form of success. The success rate equals the percentage of total cases falling into these two categories. In Table 10-5 this rate is 63.6 percent for cases of free lamina distribution (409 + 102/804 x 100). Of this 63.6 percent, however, only 12.7 percent are positive successes (102/804 x 100) and the remaining 50.9 percent are negative successes (409/804 x 100).

When a Chi Square test of significance was run on the data in Table 10-5, a significant relationship was found between need and free lamina distribution. This relationship is furthermore in the positive direction, meaning that people needing lamina were more likely to receive it free than those not needing it. This is illustrated by the fact that 35 percent who needed it received lamina but only 21 percent of those who did not need it, nevertheless, were given lamina. Even though

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* Either at a subsidized price or by salvaging it.

these results indicate that free distribution did take need into account, the success rate of only 64 percent indicates that in at least 36 percent of the cases such a distribution system failed to fit distribution to need.

The same sort of analysis is offered in the case of subsidized lamina distribution in Table 10-6. This table shows that there were 295 cases of need usable in this analysis. This means that about 37 percent

Table 10-6

Relationship Between Need for Roofing Material and Buying Lamina at a Subsidy

Bought Lamina at Subsidy	Need Roofing Material				Total	
	No		Yes			
	No.	%	No.	%	No.	%
No	415	81.5	187	63.4	602	74.9
Yes	94	18.5	108	36.6	202	25.1
TOTAL	509	100.0	295	100.0	804	100.0

of the cases studied had experienced damage in the heavy or destroyed category and had neither salvaged lamina nor received it free. Of these 295 cases only 108, or 37 percent, were sold lamina at a subsidized price. The remaining 63 percent received no lamina from any agency source. On the negative side, there were 509 households defined as not needing lamina of which 94, or 18 percent, nevertheless bought lamina at a subsidized price.

The success rate for subsidized sales computed in the same manner as for free distribution was 65.0 percent (415 + 108/804 x 100). In other words, it was slightly higher than for free aid distribution whose success rate was 63.6 percent. Subsidized sales had a slightly higher positive success rate of 13.4 percent (108/804 x 100) than free aid (12.7 percent). It also had a slightly higher negative success rate (51.6 percent) than free lamina (50.9 percent). These differences are not large enough to be significant, however.

When Chi Square was applied to Table 10-6, a significant relationship was found between need and subsidized sales. The relationship is again in the positive direction, indicating that people needing lamina, according to the definition of need being used, were more likely to receive it than those who did not need it.

From this analysis it appears that there was little difference between free and subsidized lamina distribution in terms of their effectiveness in distributing lamina to people in need. This analysis, however, assumes a rather stringent set of criteria for need. To be classified as in need, a household had to have experienced heavy damage or had their roofs destroyed and, in addition to that, they could not have salvaged lamina from their prior house, or have received it from another agency. Such criteria do not measure the extent of need in a given household, nor do the distribution figures show how much lamina was received, either free or at subsidized prices. On the need side, a household may have required more lamina than was being distributed by an agency, or more than they were able to salvage, and if they had received it from two sources or had salvaged it, they would be classified as not in need in the above tables.

Since the same criteria have been applied to free and subsidized lamina distribution, the comparisons made between these two systems relative to one another should be fair, even though both might over or under estimate success rates. It was anticipated that subsidized sales would tend to rule out distributing aid to people who did not need it more effectively than free distribution. The reasoning was that by charging something for it, those not really in need would be discouraged from obtaining it. There is a slight difference in this direction indicated in Tables 10-5 and 10-6, but the difference is too small to be significant.

Free and Subsidized Lamina Distribution and Economic Need

One criticism of subsidized sales made by those who favored free distribution was that such a system would penalize the very poor who could not even afford the small price being charged by those programs distributing at a subsidized price. Table 10-7 will shed some light on this issue. It compares free and subsidized lamina recipients in terms of their domestic assets scores. These scores measure the relative socio-economic status of households. A detailed discussion of the domestic assets scale is presented in a later chapter of this report and therefore will not be presented here.

Using the domestic assets scale, each household was given a score representing its economic status. For Table 10-7 these scores were

Table 10-7

Relationship Between Socioeconomic Status and Receiving Lamina Free or at a Subsidized Price

Socioeconomic Status	Received Lamina from an Agency					
	Free Only		Subsidy Only		Total	
	No.	%	No.	%	No.	%
Low > 1 St.Dev.	26	15.1	4	2.4	30	8.9
Middle ± 1 St.Dev.	132	76.7	146	88.0	278	82.2
High < 1 St.Dev.	14	8.1	16	9.6	30	8.9
TOTAL	172	100.0	166	100.0	338	100.0

Chi Square = 16.871
Probability = .0002
Phi = 0.223

divided into three categories, using the standard deviation of all scores as a method of doing so. The middle group consists of families whose scores were within plus or minus one standard deviation unit of the mean. The upper group then consists of those households whose score is more than plus one standard deviation from the mean and the lower group more than minus one unit away.

This table shows that subsidized lamina distribution did in fact distribute lamina less frequently to the lower socioeconomic group. Of the 166 households to which lamina was sold at a subsidized price, only 2.4 percent fell into the lower group. This group constituded 8.9 percent of the population being studied so that it would be expected that if subsidized sales were unbiased economically, around this percent would have bought lamina at a subsidized price instead of the 2.4 percent who actually did.

The comparable figure for free distribution is 15.1 percent. In other words, the percent of the people who received free lamina in the lower group was 6.2 percent higher than would have been expected using the population percentage (8.6 percent) as the expected figure. Other figures in this table show that free distribution tended to favor the poor while subsidized sales tended to favor those who were better off and had the money to make a purchase.

The Chi Square for this table indicates a highly significant statistical relationship between economic status and how lamina was obtained. This difference is in the direction described above. If a household was poor it was more likely than expected to receive lamina free and less likely to buy it at a sibsidized price.

It is important to qualify these findings since the subsidized sales system was not as rigid as it might appear from the above discussion. Provisions were made for the very poor in most cases of subsidized sales, and according to agency interviews, they were "given lamina" under certain circumstances. More often they were allowed to work for wages on community projects which were sponsored through funds obtained through subsidized lamina sales. These wages could then be used to buy at a subsidized price. Notwithstanding these qualifications however, it still must be concluded that a strictly subsidized sales system will miss serving the very poor and must be combined with "free delivery" or with a program such as "lamina for work" if it is to serve this group.

Discussion of Success and Failure Rates

One very important finding stands out in the tables on both free and subsidized lamina distribution, namely that around 35 percent of the cases represent failures in both distribution systems. Of these failures about 12 percent are due to distributing lamina to people who probably didn't need it because of the earthquake and around 25 percent represent not distributing it to people in need. In other words, there were about twice as many positive failures as negative ones.

In an ideal distribution system, which of course can never be mounted in an emergency where urgency coupled with a highly disorganized situation dominates, aid would only be given to those in need. A judgment on the adequacy of the 65 percent success rate can only be made in comparative terms by examining its relationship to other disaster cases, which are unfortunately unavailable at present. The question of course is, "Is the cup of success two-thirds full, or one-third empty? Is a cup two-thirds full more or less than should be expected by the victims of a disaster and the agencies that serve them?" This question can only be answered in the long run by comparing many different cases of disaster.

Another point needs to be made. If there were around 23 percent of all households in need of roofing material and they did not obtain it from agencies, where did they obtain it? Table 10-1 suggests that most of them bought it at full price or salvaged it from previous structures. A further possibility suggested, but by no means proven by these data, is that the 12 percent who obtained lamina, but did not need it, could have been a source from which it was bought at full price. Even if all of these people did sell at full price, it would not be sufficient to for all of those who bought at market price. A mystery remains, unresolvable from these data, as to where all of that full price lamina came from.

There is an additional perspective which needs to be taken with respect to lamina distribution. Need was undoubtedly not the only criterion used as a basis for both free and subsidized lamina distribution systems. Underlying both was a desire to do something with respect to the housing situation which would improve earthquake resistence. It was believed that by substituting lamina for tile as a roofing material, a substantial improvement would take place, even if nothing else were done. Such roofs are lighter and much less likely than tile, the dominant pre-earthquake material, to cause injury in an earthquake, even if they collapse.

If this is assumed to be true, and it very definitely appears to be, then promoting the substitution of lamina for tile, even on houses which had light or no damage to their roofs, could be counted as a form of success. This would mean that the success rate of lamina distribution programs should be measured in terms of how many houses changed to this material from a more dangerous one. The data in Table 9-9 show that the use of tile decreased in the experimental group from 55 percent before the earthquake to around 12 percent two years later when lamina programs had ended, and at the same time lamina roofs rose from 36 percent to 70 percent. This indicates a large shift in roofing patterns promoted by agency programs in the direction intended by their designers.

There is still another point that needs to be taken into account in evaluating lamina distribution programs, either free or subsidized.

Both represent economic transfers. Recipients gain economically in the process by receiving something which has a market value. It can be argued that since the earthquake increased economic need, and since the households in the affected villages on an average were poor, then even if they sold the materials they obtained, there was a positive effect on the reconstruction process by providing income usable for other purposes. Such money could be used to defray other disaster caused expenses, or to assist people in need merely because of their normal conditions of poverty. Such an argument can be used along with the argument that lamina distribution resulted in improvements in aseismicity, even in households with little damage, to say that those cases where earthquake caused need did not justify distribution are not really cases of failure in the distribution system, but really successes of a different type. If this argument is accepted, the success rate of lamina programs must be raised to around 77 percent since only those cases in which need existed, but nothing was received, are left to be counted as failures. There were around 23 percent such cases. In the long run each agency must examine the figures presented here and decide what they mean in terms of the success of its program as compared to others. There is no absolute standard against which to measure success and failure which can be used in all cases. It depends upon the goals and objectives set for the particular program involved.

Before leaving this topic altogether, it will be helpful to look at figures which show whether the lamina obtained through agency programs actually shows up on the roofs of houses examined in this study.

The Use of Lamina Obtained From Agencies

There were three different ways people could obtain lamina from agency sources. First, they could receive an agency house and that house could have a lamina roof. If so, it was recorded in the answers to questions pertaining to sources of lamina as "given," "bought at subsidy" or "bought at full price," depending on how the house was obtained. A second way was to be given lamina free of charge by a relief agency and the third way was to pay an agency half price for it when purchasing it through a cooperative or other outlet used by an agency. All other methods of obtaining lamina pertain to non-agency sources.

In order to evaluate lamina programs which were not connected to the distribution of whole houses in terms of how the lamina they distributed was used, it is necessary to differentiate between agency and non-agency houses and then to look at whether lamina which was given to a respondent, or bought by a respondent at a subsidy was actually used by them for roofing their houses. This is done in Table 10-8 which shows people who were given lamina only, or bought lamina at a subsidy only and those which were both given and bought at a subsidy separately in terms of whether lamina is found on either an agency or non-agency house. This table takes into account up to two houses for each respondent if, in fact, they used two different structures to house household members.

There were 657 cases of households who received lamina, and out of these, 172 were given it by an agency. Of these 172, 70 or 40.7 percent, have lamina on the roof of a non-agency house, 68 or 39.5 percent have lamina on the roof of an agency house, and 34 or 19.8 percent do not have lamina on any house recorded in the survey even though they were given lamina by an agency.

Table 10-8

Use or Non-use of Lamina Received From Agencies on Houses Recorded For People Receiving Lamina in the Experimental Groups

Source of Lamina	Lamina on Non-Agency House		Lamina on Agency House		Lamina Not on Any House		Total	
	No.	%	No.	%	No.	%	No.	%
Given Free	70	40.7	68	39.5	34	19.8	172	100.0
Both Given and Bought at Subsidy	20	55.6	14	38.9	2	5.6	36	100.0
Bought at Subsidy	96	57.8	57	34.3	13	7.8	166	100.0
Other Means	210	74.2	18	6.4	55	19.4	283	100.0
TOTAL	396	60.3	157	23.9	104	15.9	657	100.0

Chi Square = 98.443
Probability = .0001
Phi = 0.387

If the 68 cases who have lamina on an agency house are eliminated, the 104 cases left are households who received lamina free from some agency as a separate building material. Of these 104 cases, 34 or 32.6 percent,did not show up in the survey as having lamina on the roof of the houses they occupied. In other words, about one third of the lamina given away in the experimental group in the towns studied was not used on the recipients' primary or secondary houses. It could have been used on other structures on the house site, such as storage houses or separate kitchens or animal shelters but the types of roofs used on these structures were not recorded in the interview. It also could have been sold or traded or given away to someone else.

Examination of the row referring to subsidized price shows that of the 166 cases recorded, 96 or 57.8 percent had lamina on a non-agency house, 57 or 34.3 percent on an agency house, and only 13 or 7.8 percent do not have lamina on any house recorded in the survey. Of the 109 cases of lamina recipients, not involving agency houses, 13 or 11.9 percent do not seem to have used it to roof the houses they live in. Of those who were both given lamina and bought at a subsidy, 2 out of 22 cases did not use it for housing. This amounts to 9 percent.

The row of the table referring to other sources shows 55 cases out of 265 non-agency house lamina recipients who did not use the lamina on houses they occupied. This amounts to 20.7 percent of the cases for "other" sources.

When "other sources" is broken down into particular ways of receiving lamina, "bought at full price" and "salvaged" make up 266 of the 283 cases.

In the case of full price lamina, 30 of 152 lamina recipients who received it as a material, not as a house, did not use it on houses. This is equal to 19.7 percent. For salvaged lamina the figure not using it on a house was 24 out of one hundred, or 24 percent.

The percentages for obtaining lamina but not using it on a house recorded in the survey for each source discussed above are as follows:

	Percent Not Using Lamina on a House
Given	32.6
Salvaged	24.0
Market Price	19.7
Subsidized Price	11.9
Subsidized and Given	9.1

It appears from these figures that people who were given lamina were less likely to employ it on their principal or secondary house than people who received lamina any other way. Those who bought it at a subsidized price were almost three times less likely not to use it on a house than those who were given it. This seems to indicate that subsidized price distribution came closer to matching need than did give-away programs. When Chi Square was applied to Table 10-8, a highly significant statistical relationship was found between use of lamina and the means by which it was obtained, indicating that there is a difference between subsidized price programs and free distribution programs in how the lamina distributed was used.

There is an indication in these figures that people who salvaged lamina or bought at full price may have used much of it for other purposes than roofing houses. For example, they may have used it on other structures on the housing site such as storehouses, kitchens or animal pens. This may well give an indication of where some of the unused free and subsidized lamina went. It is also clear, however, that far more who bought at full price or salvaged did not received an agency house and used the lamina on a non-agency house than the other types of recipients discussed. In Table 10-8 it will be seen that only 6.4 percent had an agency house with lamina on it. This is an indication that these people were bypassed by both lamina and agency house programs.

It seems relatively clear that if the objective of lamina programs was to provide roofing for houses occupied by people as dwellings, rather than for out buildings, perhaps as much as a third that was given away and over a tenth that was sold at a subsidy served other purposes entirely. This probably means that a good deal more lamina than needed for housing purposes alone, not considering other uses, was distributed after the earthquake.

Attitudes Towards and Perceptions of Building Materials

During the second year of field work for this study, a sub-sample of 256 households in the experimental group was reinterviewed to obtain additional data on certain topics which required more in-depth study. Among the topics covered in this interview were attitudes towards various aspects of housing. This information was collected in order to shed light on cultural preferences which could be used to judge the appropriateness of aid.

The sample of interviewees was not chosen on a strictly random basis but interviewees were chosen from the original sample of 804 experimental group households on the basis fo their willingness to cooperate in a rather abstract, tedious interview and on the basis of their ability to articulate their opinions. While this procedure was underway, difficulties developed in Chimaltenango which led to this departmental capital being left out of the final sample of 256 cases. These difficulties were associated with the fact that over 50 interview studies had been conducted in this town during the previous two years and the people were becoming hostile toward interviewers. Since a third interview was planned for this area in connection with this study, it was decided to allow interviewees a "rest" before asking for their further cooperation. Except for Chimaltenango, the interviewees for this segment of the study came from the same communities used in the experimental group in the first interview.

Each of the 256 household heads was asked, among other things, to name wall and roof material they considered to be:

1. The prettiest or most attractive
2. The least attractive, or ugliest
3. The safest in an earthquake
4. The most dangerous in an earthquake
5. That are most often used by poor people
6. That are most often used by rich people
7. Which were best to have on your house

Tables 10-9 and 10-10 show the number of times the respondents gave each answer to each of these questions. They were allowed to name two different wall and roof materials for each question. Because of this, percentages, which are based on the number of respondents rather than on

Table 10-9

Perception of Various Wall Materials in Terms of Beauty, Safety and Status

Wall Materials	Beauty				Safety				Social Status				Overall	
	Wall Materials that are Prettiest		Wall Materials that are Least Pretty		Wall Materials that are Safest		Wall Materials that are Most Dangerous		Wall Materials that are Used by Poor		Wall Materials that are Used by Rich		Wall Materials that are Best	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Cane	5	1.95	65	25.39	44	17.19	0	0	82	32.03	0	0	14	5.47
Palm	2	.78	50	19.53	18	7.03	3	1.17	36	14.06	0	0	5	1.95
Poles	3	1.17	46	17.97	26	10.16	2	.78	38	14.84	0	0	6	2.34
Straw	1	.39	54	21.09	17	6.64	5	1.95	33	12.89	0	0	0	0
Bajareque	9	3.52	31	12.11	47	18.36	5	1.95	83	32.42	1	.39	34	13.28
Tapia	3	1.17	3	1.17	4	1.56	18	7.03	3	1.17	0	0	8	3.13
Wood	14	5.47	29	11.33	65	25.39	4	1.56	70	27.34	7	2.73	43	16.80
Lamina-Duralita	12	4.69	16	6.25	21	8.20	3	1.17	12	4.69	1	.39	18	7.03
Adobe	14	5.47	29	11.33	1	.39	207	80.86	63	24.61	9	3.52	21	8.20
Stone	28	10.94	4	1.56	21	8.20	47	18.36	0	0	39	15.23	70	27.34
Block	180	70.31	2	.78	94	36.72	72	28.13	14	5.47	200	78.13	208	81.25
Bricks	192	75.00	0	0	95	37.11	33	12.89	1	.39	210	82.03	199	77.73
Terrecreta	27	10.55	2	.78	14	5.47	12	4.69	1	.39	10	3.91	32	12.50
Plywood	11	4.30	8	3.13	8	2.13	0	0	5	1.95	4	1.56	14	5.47
Nylon	0	0	24	9.38	3	1.17	0	0	1	2.73	0	0	2	.78
Cloth-Plastic	0	0	5	1.95	2	.78	0	0	1	.39	0	0	0	0
Cardboard	1	.39	26	10.16	5	1.95	0	0	16	6.25	0	0	2	.78
Tin	0	0	10	3.91	3	1.17	0	0	5	1.95	0	0	0	0
Other	0	0	0	0	2	.78	0	0	0	0	0	0	0	0
No Information*	10	3.91	108	42.19	23	8.98	101	39.45	42	16.41	31	12.11	92	35.94
Base of Percentages	-	256	-	256	-	256	-	256	-	256	-	256	-	256

*Number who failed to give two answers

Table 10-10

Perception of Various Roof Materials in Terms of Beauty, Safety and Status

Roof Materials	Beauty				Safety				Social Status				Overall	
	Roof Materials that are Prettiest		Roof Materials that are Least Pretty		Roof Materials that are Safest		Roof Materials that are Most Dangerous		Roof Materials that are Used by Poor		Roof Materials that are Used by Rich		Roof Materials that are Best	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Straw	21	8.20	145	56.54	98	38.28	8	3.13	125	48.83	0	0	16	6.25
Palm	19	7.42	125	48.83	87	33.98	9	3.52	114	44.53	0	0	15	5.86
Treated Wood	14	5.47	35	13.67	20	7.81	14	5.47	9	3.52	10	3.91	15	5.86
Tile	44	17.19	56	21.88	4	1.56	226	88.28	74	28.91	21	8.20	18	7.03
Lamina	145	56.64	11	4.30	140	54.69	15	5.86	112	43.75	93	36.33	176	68.75
Duralita	153	59.77	16	6.25	66	25.78	95	37.12	6	2.34	182	71.09	128	50.00
Flat Concrete	88	34.38	7	2.73	52	20.31	58	22.66	0	0	156	60.94	98	38.28
No Information	28	10.94	117	45.70	45	17.58	87	33.98	72	28.13	50	19.53	46	17.97
Base of Percentage		256		256		256		256		256		256		256

the number of responses, add up to more than 100 percent in these tables.

In general these data demonstrate that the types of wall materials most often mentioned as being pretty, safe, associated with rich people and to be best overall, are cement block or brick. Stone walls are also mentioned relatively often, considering they are rarely used in Guatemala and not familiar to many people. Subjects had to volunteer their responses without prompting and therefore had to know about a material and think of it in connection with the question to give an answer. All of the most often named materials may be classified as "masonry." In Interview Number One they were all coded into a common category, which appears in some of the earlier tables as "block" because no stone or brick houses actually were observed in certain sub-samples.

The materials which appear to be least favored, are generally those falling into the traditional category. For example, with respect to unattractiveness, cane, palm and straw lead the list. Adobe and bajareque are very seldom mentioned as pretty materials, and are mentioned about twice as often as being unattractive. Since one large agency built wooden houses, it is interesting that wood is also in this same category. Quite naturally, cardboard and nylon are also mentioned by nearly ten percent as being ugly. This perhaps reflects the sudden increase in the use of these materials in temporary shelters which were seen everywhere for a few months following the earthquake.

It is also important that virtually no one named block, brick or stone as being unattractive materials. When this is added to the fact that they are most often named as being attractive, a clear aesthetic preference for these materials emerges.

With respect to social status the materials most often named as being associated with the poor are, in order of frequency, (1) bajareque, 32.4 percent (2) cane, 32.0 percent, (3) wood, 27.3 percent, (4) adobe, 24.6 percent. Next come palm, poles and straw. In other words, all of the traditional, indigenous materials are thought of as being associated with the poor. At the same time, they are seen as being unattractive by substantial numbers of respondents.

The questions on wall safety in earthquakes present a slightly more complex picture. It is clear that the majority (81 percent) voluntarily mentioned adobe as a dangerous material and that substantial numbers believe that cement block (28 percent), stone (18 percent), and brick (13 percent) are also unsafe. Thus, there is recognition on the part of a substantial minority that masonry buildings, although attractive and high in status, can be unsafe in an earthquake prone area. This ambivalence towards safety, however, does not prevent most respondents from naming block and brick as the "best" wall materials. This may mean that some people do not believe anything is safe. Some respondents did, in fact, answer "only God knows" to this question. They occur in the no information category in this table.

On the positive side of the safety issue, there are also some contradictions. The type of houses named most often as safe are cement block or brick. Masonry is therefore seen as safe by some people and as dangerous by others. Nevertheless, the largest numbers classify it as safe. In general, light weight materials are also recognized as being safe. Wood, cane, palm, poles, straw fall into this category. While they are thought of as being safe, however, they are perceived as being unattractive and low in status.

In the case of roof materials there is a clear preference for lamina when the "best material" preference is expressed. This is followed by duralita and flat concrete. All other roofs were mentioned by less than ten percent of the sample. Since they could mention two materials, this has even greater meaning. Lamina was also mentioned frequently as being pretty (57 percent) and safe (55 percent). It was, however, seen as being associated with the poor and rich alike. In contrast, duralita was perceived by slightly more as being pretty and rich but by many fewer as being safe. Since duralita is heavier and tends to break up in an earthquake it is apparently seen as being less safe than lamina even though it is thought to be prettier and higher in status.

Tile and other traditional materials such as straw and palm are clearly less favored. With respect to straw and palm, they are seen as being unattractive, relatively safe and low in status by most respondents. Tile is seen as being unattractive by more people than see it as attractive and as being dangerous by a large number. Tile is also thought of more as being associated with the poor than the rich. Wood, which is relatively rare as a roofing material, seems to be viewed in an inconsistent fashion.

Flat concrete roofs are named by a fair number of respondents as being "attractive," "rich" and "best" but by about the same number as being safe and unsafe. Such roofs are found on only the most expensive houses in most communities and require reinforced masonry structures to support them. They are, however, out of the financial reach of most people.

These data show a clear preference for lamina and duralita as roofing materials with the possible exception that duralita is distrusted by many because it is believed to be dangerous. This preference is important because most agency programs involved with housing used these two materials. Agency decisions to do so therefore appear to fit local preferences well even though the materials distributed are modern as opposed to traditional.

Table 10-11 reclassifies the data given in Tables 10-9 and 10-10 into traditional and modern categories for each preference dimension. This table shows a clear preference by the majority of respondents for modern materials for both the walls and the roofs of their houses. This preference is most strongly expressed with respect to the appearance and status dimensions and also with respect to which category of material was considered "best."

Over 92 percent of all responses named modern wall materials as being pretty, while over 75 percent named traditional materials as being unattractive. Almost 98 percent of all responses named modern materials as being rich, while almost 72 percent said traditional materials were associated with the poor.

The only preference dimension upon which there is substantial disagreement involves safety in an earthquake. Even here, however, the clear majority favors modern materials. These findings hold for both roof and wall materials with only slightly less agreement on roofs.

In short, the preferences of the people examined in this sub-sample are in the direction of favoring those materials most often chosen by agencies engaged in housing programs. Materials distribution programs distributed "modern materials" such as lamina, and occasionally cement block or duralita. Programs which built permanent houses most often built

Table 10-11

Attitudes Toward Traditional and Modern Wall and Roof Materials

	Appearance				Safety				Status				Overall Preference	
	Pretty		Ugly		Safe		Unsafe		Poor		Rich		Best	
Wall Materials	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Traditional	37	7.6	278	75.5	151	31.3	240	58.4	338	71.9	10	2.1	88	13.0
Modern	451	92.4	90	24.5	331	68.7	171	41.6	132	28.1	471	97.9	588	87.0
Total	488	100.0	368	100.0	482	100.0	411	100.0	470	100.0	481	100.0	676	100.0
Roof Materials														
Traditional	98	20.2	361	91.4	209	40.8	257	60.5	322	73.2	31	6.7	64	13.7
Modern	386	79.8	34	8.6	303	59.2	168	39.5	118	26.8	431	93.3	402	86.3
Total	484	100.0	395	100.0	512	100.0	425	100.0	440	100.0	462	100.0	466	100.0

them of cement block and put either lamina or duralita roofs on them.

Only in the case of wood is there a serious question concerning the correspondence of aid with preferences. Wood was not a very popularly perceived material by those questioned in this survey. More saw it as ugly than pretty, and as poor than rich. Its only advantage was that it was seen as relatively safe. It was named by only around 17 percent as one of the best materials as compared to 81 percent who named cement block and 77 percent who named brick. Since one large temporary housing program used wood for walls there is a question concerning its correspondence with expressed preferences. This will be examined later.

These data quite naturally raise the question of what is meant by cultural appropriateness. One interpretation of appropriateness, often expressed by field workers in Guatemala, is based on the actual prevalence of a pattern in the country. For example, if most houses are made of adobe with a tile roof, then it is assumed that such a pattern is part of the "culture." Why else would the majority of people build such houses? Another interpretation depends on opinion or preference data. In order to determine what is culturally appropriate it is necessary, from this perspective, to find out how people in the society think or feel about alternative ways of doing things. The majority opinion then becomes the expression of cultural patterns. In other words, one strategy depends on practices and the other on preferences.

There are various reasons that the actual practices followed in a society may not correspond to preferences and therefore that conceptions of cultural appropriateness based on these two may disagree with one another. Most important among these reasons are those associated with economic resources. Practices may be compromises with patterns of preference forced by the limitation of economic resources. Most people may live in adobe houses, not because there is a deep cultural preference for them, but because they can not afford to do otherwise. If given the opportunity, they might very well change to another housing pattern more to their liking.

This appears to be the case with respect to the data discussed above and in the last chapter. Preferences appear to be strongly away from the traditional materials which dominated the housing scene before the earthquake, and towards modernized patterns such as those followed by reconstruction agencies. It is impossible to tell when this pattern of preference came into being. It is possible that it did not exist to the same degree before the earthquake and that preferences changed as a consequence of the disaster experience and the actions of agencies in the reconstruction process. For example, a preference for adobe could have existed and been reversed when people saw so many such houses collapse and harm their occupants. It is also possible that agency programs which featured modern materials had the effect of changing preferences. There is evidence, however, for a pre-earthquake trend in this direction found in the data themselves. These data show that more modern materials were used in the larger cities and towns than in the remote villages, indicating a possible modernization trend. There is also a difference between the control and experimental group. The control group in some respects appears to be further along in a modernization trend than the experimental group. It is likely, therefore, that a shift in preferences had already taken place before the earthquake and that at most, the earthquake experience reinforced and sped up this trend. No matter what the origin for preferences for modern materials, they are definitely there and they correspond to the changes which have actually occurred in housing patterns.

The cultural appropriateness issue should not be left resting entirely on preferences, however. There are two other sides to the issue which need to be taken into account. First, there is the question of long-range dependency and the long-range capacity to sustain the modernization trend. It remains true that modernized housing patterns depend upon industrially manufactured products, many of which come from foreign sources. This means that monetary resources must be expended to sustain such patterns and part of these resources will flow out of the country. If such patterns are followed at the village level, such resources will flow from rural areas towards the industrialized city, thus having the effect of making villages more economically dependent on outside resources from within the country as well as from outside. It is impossible at present to evaluate the long-range economic effects of these changes at the village or even the country level, but they can not be ignored.

A second respect in which the appropriateness issue enters is in terms of the presence or absence of local skills and know-how to produce modernized structures. Adobe technology was and is definitely a part of the local culture, even though it appears that preferences may be in a different direction. The building of modernized structures requires the introduction of a newer technology and the development of new skills. This had apparently taken place to some degree before the earthquake, and probably to a greater degree after it, since thousands of houses have been built during the reconstruction process using modern patterns. Much of what was done during reconstruction however, was done under foreign supervision and management and a question remains as to how independent local communities are of such managerial resources in terms of continuing these patterns in the future. Nothing in the data for this research can answer this question.

It is apparent from this discussion that the issues of cultural appropriateness and dependency can not be easily separated. It suggests, however, that if appropriateness is defined in terms of preferences, then it is possible for preference patterns to promote dependency. If the people prefer modernized housing and modernized housing depends on foreign imports or in rural areas, upon urban products, then such preferences will lead to dependency if they are followed in actual practice. It would appear, therefore, necessary either to change preferences, or to ignore them to avoid increased dependency under circumstances where preferences are in the direction of modernization which requires "foreign" resources.

The Relationship Between Lamina Distribution Systems and Attitudes Toward Aid

The various interviews conducted with respondents contained questions concerning their attitudes toward the aid delivered in their towns. Responses to these questions can be used to evaluate how various forms of lamina distribution are related to people's attitudes towards the aid process in their respective villages. These attitude questions were asked about the aid process in general and not about lamina programs in particular. They therefore represent general assessments of the aid process and not specific evaluations of lamina programs. Since most towns received various forms of aid ranging from emergency food, medical assistance, clothing and blankets, through building materials to whole houses, these attitudes must be regarded as the result of all of these forms of aid taken together.

One opinion question asked, "What did you think about the assistance given to this town to help recover from the effects of the earthquake?" Respondents could answer "very poor," "poor," "medium," "good" or "very good." Answers cross-classified by the method by which respondents obtained lamina are given in Table 10-12. This question was asked, on an average, two years after the earthquake in experimental group communities.

First, the data show that around 86 percent of experimental group respondents felt that aid was either good or very good. Because there is a tendency for respondents to avoid expressing negative opinions in Guatemala, the medium category was combined with the poor and very poor response categories. This table shows a tendency for opinions to be more positive the more favorable the conditions were under which lamina was obtained. The most unfavorable condition is buying at full price, next comes subsidized price and finally, free aid. The "other" category contains mostly people who salvaged lamina. Over 91 percent of the

Table 10-12

Opinion of Aid Received by this Town

Source of Lamina	Poor or Very Poor, Medium No.	%	Good or Very Good No.	%	Total	Percent
Given to Respondent	17	8.7	178	91.3	195	100.00
Bought at Full Price	36	17.1	174	82.9	210	100.00
Bought at Discount	24	13.4	155	86.6	179	100.00
Other	24	15.4	132	84.6	156	100.00
No. of Respondents	77	13.9	477	86.1	554	100.00

No significant difference between given and discount.
No significant difference between given and all other sources.
No significant difference between discount and all other sources.
No significant difference between full price and all other sources.

household heads who received free lamina were positive towards aid as compared to 87 percent for subsidized price and 84 percent for full price lamina sales. These differences, however, do not prove to be statistically significant when tested using Chi Square. However, as shall be seen in the case of other attitudes where significant differences are found, they probably indicate greater satisfaction with free aid than other forms.

A second question asked respondents was, "In your opinion, was the amount of assistance given to this town fair (or just), considering the amount of damage suffered here?" This question was meant to get respondents to compare their town with others in terms of the amount of assistance received there. Responses were coded "yes" or "no," meaning aid was sufficient or insufficient, considering earthquake damage. Table 10-13 gives a tabulation of these results for various categories of lamina recipients. Again, most respondents (around 65 percent) expressed a positive opinion. This time, however, more people who bought at a subsidized price than either at a full price or were given lamina expressed a negative opinion. There is, however, no significant statistical difference between discount recipients and those who were given lamina in how positive or negative they were about the amount of aid delivered.

A third question does show significant statistical differences between types of recipients. When respondents were asked, "What do you think about the way in which relief assistance was distributed to disaster victims in this town?" significantly more people who bought at discount said it was unfair than those who received it free (see Table 10-14). The same is true of full price recipients. More of them think distribution was unfair than those who were given lamina free of charge.

Another important point raised in Table 10-14 is that over half of all respondents (51.5 percent) said they thought aid distribution was unfair. As would be expected, full price buyers were most unfavorable, followed closely by discount buyers. Of those who received lamina free, 45 percent nevertheless said overall aid distribution was unfair.

The picture which emerges from these tables is one in which the respondents seem to feel that the amount and type of aid delivered was "good" and "sufficient" given the needs. On the other hand aid was perceived by at least half as being unfairly distributed or managed. This

Table 10-13

Did This Town Receive Enough Aid Compared to Others?

Source of Lamina	No		Yes		No Information		Total	
	No.	%	No.	%	No.	%	No.	%
Given to Respondent	53	25.5	146	70.2	9	4.3	208	100.0
Bought at Full Price	66	24.6	175	65.3	27	10.1	268	100.0
Bought at Discount	63	31.2	122	60.4	17	8.4	202	100.0
Other	56	29.0	119	61.7	18	9.3	193	100.0
No. of Respondents	177	27.0	425	64.8	54	8.2	656	100.0

No significant difference between given and discount.
No significant difference between given and all other sources.
No significant difference between discount and all other sources.
No significant difference between full price and all other sources.

Table 10-14

Was Aid Distribution Fair or Just?
(1978)

Source of Lamina	Unfair		Fair		No Answer		Total	
	No.	%	No.	%	No.	%	No.	%
Given to Respondent	93	44.7	107	51.4	8	3.8	208	100.0
Bought at Full Price	149	56.2	96	36.2	20	7.5	265	100.0
Bought at Discount	112	55.4	72	35.6	18	8.9	202	100.0
Other	107	55.4	72	37.3	14	7.3	193	100.0
No. of Respondents	336	51.5	268	41.0	49	7.5	653	100.0

Significant difference between given and discount at .01 level.
Significant difference between given and all other sources at .02.
Significant difference between discount and all other sources at .019.
Significant difference between full price and all other sources at .004.

feeling is probably due to the mixture of distribution systems being used in the country. It was well known that some people were receiving lamina and other aid free, while others were being required to pay for it, even though at a nominal price. Some were required to work to receive certain types of aid, while others were not. This mixture of distribution systems was bound to produce negative attitudes in those who felt that they were being discriminated against. For the most part, distribution systems were more consistent within towns than between them. Nevertheless, people knew what was going on elsewhere. The rumor mill worked full-time. Because lamina was being given away free by some agencies and being sold nearby at a subsidized price by others, those having to pay formed negative attitudes. This should not be taken as the degree to which they would have been satisfied if only a subsidized sales system had been used throughout the country.

When this same question was asked respondents a second time two years after the first interview, and by then four years after the earthquake, the differences observed in Table 10-14 still persisted (see Table 10-15). At that time 52 percent of those buying lamina at a subsidized price still felt aid distribution was unfair. This compared to 45 percent who had been given lamina, and 50 percent who had paid full price for it.

In all of the above attitudinal tables people who bought at full price have more negative attitudes than those who received lamina free. When compared to those buying at a subsidized price, full price buyers appear to be similar. There is one additional question available which was asked of the sub-sample of respondents interviewed three years after the earthquake. This question asked, "Do you think that the reconstruction work in this community was well managed?" The results of this question, cross-classified by ways lamina was obtained, is given in Table 10-16. This table contains only respondents who received lamina and who expressed an opinion on this question.

More people who received lamina free gave a negative response to this question than any other category. Almost 31 percent disagree with the statement that aid distribution was well managed. This compares with 27 percent of those who bought at a discount and even more dramatically with around 18 percent who bought at full price. Because of the small number of cases these differences are not significantly different statistically but they present the tantalizing possibility that free aid distribution results in a greater perception of mismanagement than selling it at a subsidy or at full price. There appears to be less criticism of aid management by those who bought at full price than by any other group. This presents an hypothesis worth testing in future research. That hypothesis could be stated as follows: "The less the recipient has to pay for the aid he receives, the more likely he is to be critical of aid management."

The reason for criticizing the management of free aid is believed to lie in the procedures used to obtain it. In the Guatemalan case recipients of free aid often had to stand in long lines waiting to be served. In order to receive aid they had to answer numerous questions concerning their qualifications. This was not true of course of those who bought building materials for full price, since they used normal commercial channels. It was also not true of those who bought at subsidized prices.

Table 10-15

Was Aid Distribution Fair or Just?
(1980)

Source of Lamina	Unfair No.	Unfair %	Fair No.	Fair %	No Answer No.	No Answer %	Total No.	Total %
Given to Respondent	85	45.0	93	49.2	11	5.8	189	100.0
Bought at Full Price	116	50.4	82	35.7	32	13.9	230	100.0
Bought at Discount	89	52.0	63	36.8	19	11.1	171	100.0
Other	87	53.4	53	32.5	23	14.1	163	100.0
No. of Respondents	271	48.0	229	40.5	65	11.5	565	100.0

Significant difference between given and discount at .05 level.

Table 10-16

Reconstruction was Well Managed in this Town
(Time 4:1979)

Source of Lamina	Disagree and Strongly Disagree No.	Disagree and Strongly Disagree %	Agree and Strongly Agree No.	Agree and Strongly Agree %	Total No.	Total %
Given to Respondent	21	31.8	45	68.2	66	100.0
Bought at Full Price	9	17.6	42	82.4	51	100.0
Bought at Discount	14	27.5	37	72.5	51	100.0
Other	9	25.7	26	74.3	35	100.0
No. of Respondents	40	26.7	110	73.3	150	100.0

No significant difference between given and discount.

It is believed that the criticism of free aid stems from the bureaucratization of the procedures this method employs. This is probably why respondents who receive free aid more often think of it as being fair or just than those who have to pay for it but, at the same time, tend to be critical of the process of managing the aid. It might be said that victims prefer free aid distributed without bureaucratic procedures. This interpretation is supported by other data collected on the reasons people gave for saying aid was unfair or that it was mismanaged. The results of this study, however, can not be employed to test this hypothesis fully because of the way the various questions were asked and the size of the sample involved.

Chapter 11

An Evaluation of Agency Housing Programs

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Definition of an Agency House

There were scores of housing programs conducted in Guatemala after the earthquake by both Guatemalan and foreign agencies. Many agencies chose to distribute building materials and to conduct educational programs along with them. Others focused instead on building whole houses which were either given or sold to disaster victims. Often such programs constructed hundreds of houses in the same town in an attempt to rehouse everyone in need. In many cases housing programs were accompanied by the building or repair of water and sewage systems, or by electrification and the building of schools, health posts and other community facilities and services. In addition, some were accompanied by community development activities.

In this chapter, households who received houses constructed through housing programs which built whole houses will be examined and compared to households who built houses by other means. For purposes of this discussion, an agency house will be defined as a complete structure intended to serve as a residence which was built as a unit by means of an agency controlled program. In contrast, a house built by household members, their relatives or friends or by people hired by the household such as contractors, will be regarded as non-agency houses, even if they used materials such as lamina which were originally obtained from an agency lamina program.

This classification is intended to include,under the agency house category, only houses built according to a common agency design using agency related personnel as managers or coordinators of the building process. In many cases agencies built houses using the unpaid labor of their eventual occupants or of other people from the community where the program was conducted working in groups in the construction process on each others' houses. This means that the term "self constructed" needs to be used carefully because both agency and non-agency houses were often built using the labor of disaster victims.

At times it was difficult for field workers to tell an agency house from a non-agency house because of this fact. When respondents were asked "Who built this house?" a question it was thought would reveal whether it was built by an agency or by others, respondents frequently said they did, even when it was known that the house was definitely a product of a standardized agency program. Another reason it was difficult at times to identify agency houses lies in the fact that many changes and alterations were made in agency buildings once they were turned over to disaster victims. Four years later some were not easily identifiable by a field worker even though in their original form they would have been easy to classify as an agency house. A third reason that some difficulty existed in identifying such houses was that some agencies gave definite instructions on how to build a house, or conducted educational programs aimed at promoting certain design principles. These same agencies also sold half-price building materials or gave them to disaster victims. When asked, "Did you receive a house from an agency?" or "Who designed this house?" and related questions, some respondents answered as if the house had been built by an agency, when actually the household had only received building material and advice from them.

For these reasons, it is believed that there have been some errors involved in correctly identifying all agency houses according to the above definition. There are probably no more than 10 or 15 cases out of the 804 households in the original experimental group sample where this has taken place, however. The error amounts to identifying a house built using agency supplied materials and agency advice as an agency house although it was not built as part of an agency house building program which supplied whole houses to people as intended by the classification scheme.

The Number of Agency and Non-agency Houses Found in the Experimental Group

The interview schedule employed to obtain data on housing two years after the earthquake provided space to record the characteristics of up to two houses occupied by a given household. In addition to this, a direct question asked respondents if they had received a house from an agency. From these two sources it is possible to determine the number of agency houses distributed and to examine who received them, their characteristics and how they are being used.

Table 11-1 gives data on the number of occupied and unoccupied agency and non-agency houses recorded in the first survey done two years after the earthquake. Altogether there were 342 agency houses on which housing characteristics were recorded. Of these, 303 were being occupied as

Table 11-1

Agency and Non-agency Houses Upon Which Data Were Recorded Showing the Number of Households with One and Two Houses and Whether They are Occupied or Not

Number who reported receiving an agency house	331
Number who received only one agency house and occupy that house as a primary house	224
Number who received only one agency house and occupy that house as a secondary house	47
Number who received two agency houses and occupy both of them	16
Total number of households with at least one occupied agency house	287
Total number of occupied agency houses	303
Number of unoccupied agency houses	39
Total number of agency houses recorded	342
Estimated number of agency houses bought or rented from or lent by someone other than an agency	5
Number who have one non-agency house occupied as primary house	510
Number who have one non-agency house occupied as secondary house	27
Number who have two occupied non-agency houses	54
Total number of households with at least one non-agency house	591
Total number of occupied non-agency houses	645
Number of unoccupied non-agency houses	10
Total number of non-agency houses	655

dwellings at the time of the survey, and 39 were unoccupied. Most of these unoccupied agency houses were in the final stages of construction and had not yet been occupied. Only one agency house was recorded for 271 households, 224 of which used it as the principal or primary house and 47 of which used it as a secondary house. In 16 cases households had two agency houses and used one as a principal house and the other as a secondary house. The number of households in the experimental group that had received at least one agency house and still had it at the time of the interview was 326 (271 with one occupied house + 16 with two occupied houses + 39 with unoccupied houses).

The number of respondents who reported in response to a direct question that they had received an agency house at some time before the interview was 331, amounting to 41.2 percent of the 804 households in the experimental group. Of those reporting receiving an agency house, five reported either buying or renting them from someone else. This means that when these five are added to the 326 upon which data were obtained, there is agreement in the number of agency houses present in the experimental group from two different sources in the interview. There were apparently 342 such houses obtained by the 804 households in this study, including five received from a source other than an agency. These five are not counted in most tables because they did not come directly from agency programs.

These data show that around two percent of the households in the experimental group received two agency houses. They also show that of the people studied, 144 had two houses which were occupied at the time of interview, for 17.9 percent of the sample. Another 49 had unoccupied secondary houses,amounting to 6.1 percent of the sample. This means that 193 households (24.0 percent) had two houses and the remaining 611 (76.0 percent) had only one house. Of the 193 cases with two houses, at least one came from an agency, in 63 cases amounting to 7.8 percent of all households in the experimental group.

In the case of non-agency houses, a total of 655 such structures were recorded altogether. Of these, 645 were occupied and 10 were unoccupied. Table 11-1 shows that 54 households had two such houses and another 27 had one agency house and one non-agency house. Together, this amounts to 10.0 percent of the sample.

Taking the two types of structures together,there were 997 different houses recorded in the experimental group. Of these, 342 (34.3 percent) came from agencies and 655 (65.7 percent) were non-agency houses. This means that on an average there were 1.24 houses per household in the experimental group. No agency houses were found in the control group.

In the first few tabulations which follow, where the characteristics of agency and non-agency houses are compared, only one house of each type will be examined per household. This means that when a household has two agency houses, only the principal house will be examined and when they have two non-agency houses the same will be true. If a household has one of each, however, both will be counted. This is done so that a given household will not be counted twice in the agency house category or in the non-agency house category and the base of percentages for each type of housing will remain the number of households rather than the number of houses.

Characteristics of Agency and Non-agency Houses

Table 11-2 shows the wall types used in agency and non-agency houses. Only one house of each type is included in this table for each household. Since some households had one house of each type, a given household may occur twice in this table, once in the agency and once in the non-agency house columns.

The data show that there is considerable difference between the frequency of different wall types between these two groups. Agency houses were mostly constructed of wood or cement block. These two categories account for 89.5 percent of all agency houses examined in this table. Houses with half and half walls of either adobe or block account for another 8.3 percent, leaving only 2.2 percent in other wall types. All of these but one are made of adobe.

Self-constructed or non-agency houses display considerably more variability in wall types. Only 15.1 percent are concrete block and 11.5 percent wood, adding up to 26.6 percent of all non-agency houses. This compares to 89.5 percent in these two categories for agency structures. In contrast, traditional materials such as adobe, bajareque or cane, thatch or palm were used in a far larger proportion of cases in non-agency houses. These three categories account for 37.8 percent of non-agency houses as compared to 2.0 percent for agency structures.

What is perhaps more important is the fact that 33.2 percent of all non-agency houses employed adobe either for the whole wall or for the lower half of it. Only 3.4 percent of the agency houses fall into this category. It is suspected that the five cases of adobe agency houses are

Table 11-2

Comparison of Wall Types Used on Agency and Non-agency Houses

Wall Types	Agency Houses* No.	Agency Houses* %	Non-Agency Houses* No.	Non-Agency Houses* %
Patchwork	1	0.3	65	11.0
Cane, Palm, Thatch	0	0.0	85	14.4
Bajareque	0	0.0	46	8.1
Tapia	0	0.0	1	0.2
Wood	172	59.9	68	11.5
Lamina-Duralita	0	0.0	12	2.0
Half Adobe	5	1.7	107	18.1
Half Block	19	6.6	26	4.4
Adobe	5	1.7	89	15.1
Concrete Block	85	29.6	89	15.1
Other	0	0.0	1	0.2
Total	287	100.0	591	100.0

*Only one house counted per household -
Could be either principal or secondary

really misclassified. They are probably houses which followed the recommendations of an agency, and used roofs and other materials bought at half price from that agency, but were actually built by their occupants or by a builder hired by their occupants. There is also one house in the table called "patchwork" which is obviously misclassified since no agency built houses using salvaged scrap materials.

The houses classified as half block and half adobe conform to a pattern used by a few agencies and therefore appear to be correctly identified. In this table there are therefore perhaps as many as six cases out of the total of 287,or around 2.0 percent, that are probably misclassified as agency houses when they should be included in the non-agency category. There occupants nevertheless reported that they had been built by an agency.

Similar differences between agency and non-agency houses appear in Table 11-3 which gives a tabulation of the roof materials used. Over 69 percent of all agency houses had lamina roofs and an additional 28.9 percent had roofs of duralita, accounting for 98.2 percent of all agency houses. The remaining five houses used thatch or palm roofs. These five agency houses occurred in one municipio where a foreign agency built houses using such roofs.

The dominant material on non-agency houses is lamina (71.2 percent), an even higher percentage than on agency houses. Most of this material was undoubtedly supplied through the agency lamina programs discussed in the last chapter. It will be realled, however, that when a house was built by its occupants or by people they hired, even though it used

Table 11-3

Comparison of Roof Materials Used on Agency and Non-Agency Houses

Roof Material	Agency Houses		Non-agency Houses	
	No.	%	No.	%
Thatch, Palm	5	1.7	33	5.6
Tile	0	0.0	98	16.6
Tile Over Lamina	0	0.0	4	0.7
Lamina	199	69.3	421	71.2
Duralita	83	28.9	15	2.5
Cement Slab	0	0.0	6	1.0
Patchwork	0	0.0	14	2.4
Total	287	100.0	591	100.0

materials obtained from an agency, it was classified as a non-agency house.

Duralita, a material frequently used in agency programs, was not used very frequently by people in building their own houses. It accounts for only 2.5 percent of the non-agency roofs. In contrast, more traditional materials such as tile (16.6 percent) and thatch or palm (5.6 percent) were used on non-agency houses. Patchwork roofs also occurred more frequently (2.4 percent). Such roofs are made of scraps of many different materials and occur on structures which might best be called "shacks."

When roof-wall combinations were classified into house types, the data given in Table 11-4 were obtained. This table shows that the dominant

Table 11-4

Comparison of Agency and Non-Agency House Types

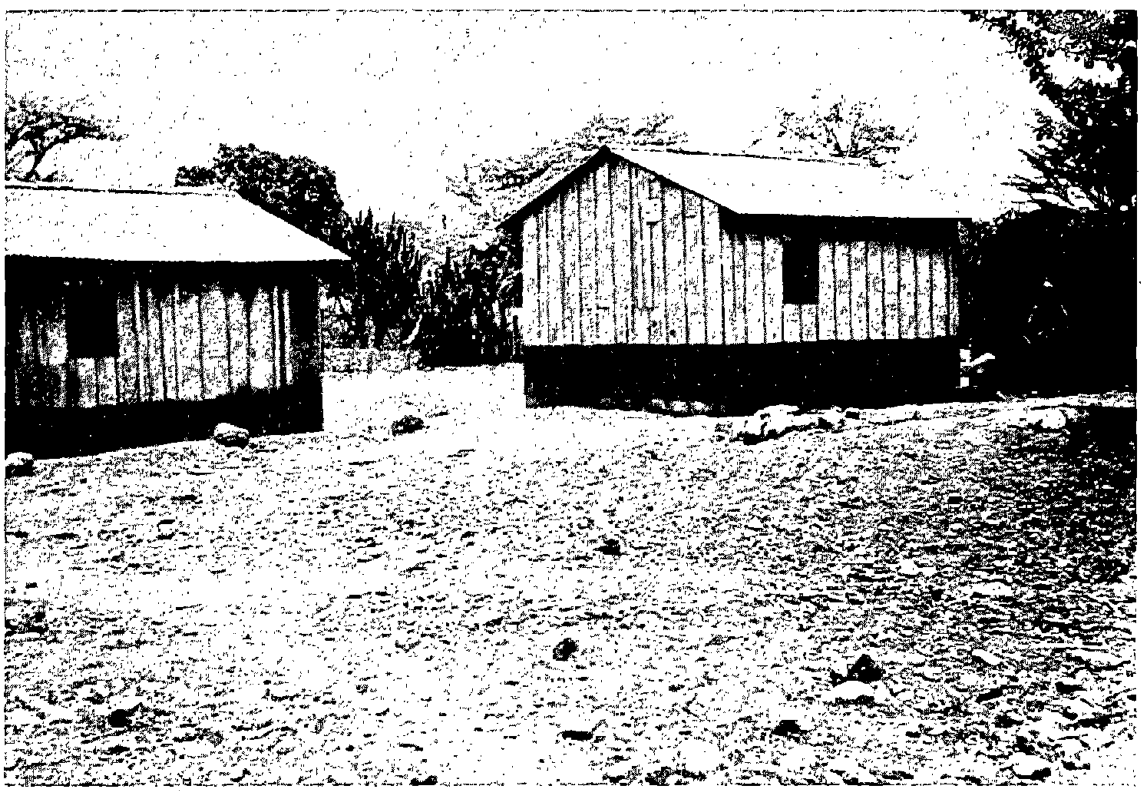
House Type (Wall x Roof)	Agency Houses No.	Agency Houses %	Non-agency Houses No.	Non-agency Houses %
Adobe - Tile	0	0.0	54	9.1
Adobe - Lamina or Duralita	5	1.7	31	5.2
Wood - Lamina or Duralita	172	59.9	64	10.8
Block - Lamina or Duralita	85	29.6	82	13.9
Bajareque - Thatch	0	0.0	11	1.9
Bajareque - Tile	0	0.0	16	2.7
Cane, Palm, Poles - Palm,Thatch	0	0.0	17	2.9
Cane, Palm, Poles - Lamina, Duralita	0	0.0	57	9.6
Patchwork - Any Roof	1	0.3	65	11.0
Half Adobe or Block - Lamina, Duralita	19	6.6	121	20.5
Other	5	1.7	73	12.4
Total	287	100.0	591	100.0

agency house type found in the experimental group for this study was made of wood and lamina or duralita (59.9 percent). Most of these houses were built by the Guatemalan Red Cross and occurred in both of the departmental capitals studied, Chimaltenango and El Progreso, one municipio, San Martin Jilotepeque, and one aldea in the East, Espiritu Santo. This program built over 10,000 such houses, in the departments of Chimaltenango and El Progreso primarily. All had wooden walls and a lamina roof and were placed directly on the ground, or where a pre-earthquake floor survived on a house site, on that floor (see Pictures 1 and 2).

The second most common agency house type was constructed of block with a lamina or duralita roof (29.6 percent). This category also includes houses built of terracreto, a material made by mixing earth with cement and then pressing it into a brick or block. This material is hard like block or brick, rather than being soft like adobe. Most of the block houses in this table came from Patzun, an Indian municipio in the Highlands, where the Norwegian Red Cross constructed houses using these materials. Those of terracreto all come from Sanarate, a Ladino municipio in the East where the Jewish community of Guatemala City constructed houses in the program called "Bricks for Guatemala" which was described earlier. There are scattered cases in the category of block from other communities in the sample as well (see Pictures 3 and 4).

The third most common agency house type consists of 19 houses (6.6 percent) with walls which are half block at the base with light weight material, usually wood or lamina, filling in the upper half. These houses have either a lamina or duralita roof. In this study, most of

1



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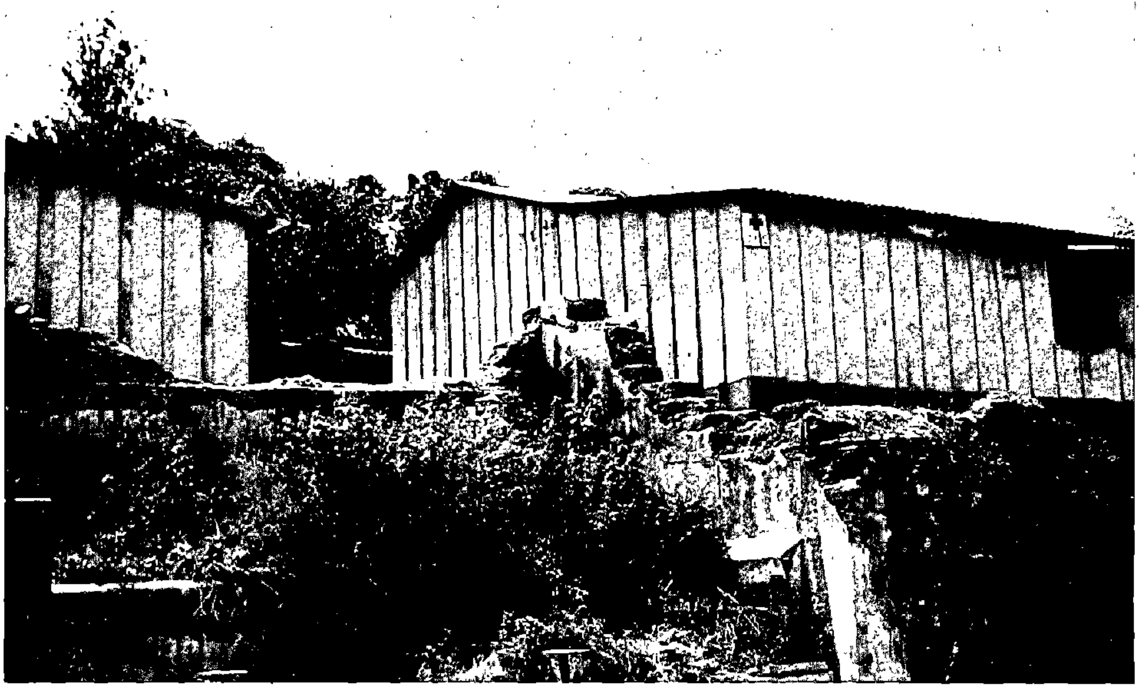
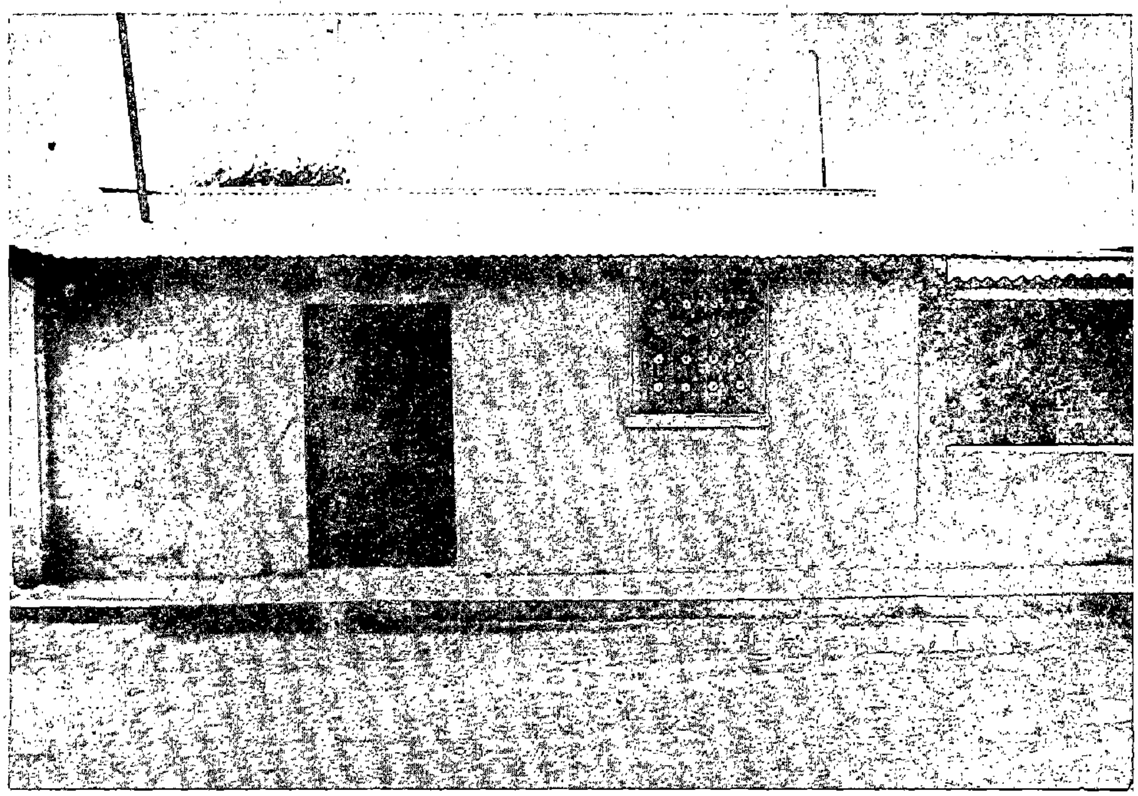


Picture 1. Red Cross House in El Progreso Area.

Picture 2. Red Cross House in San Martin Jilotepeque.

3

4



Picture 3. Terracreto House with Duralita Roof in Sanarate.

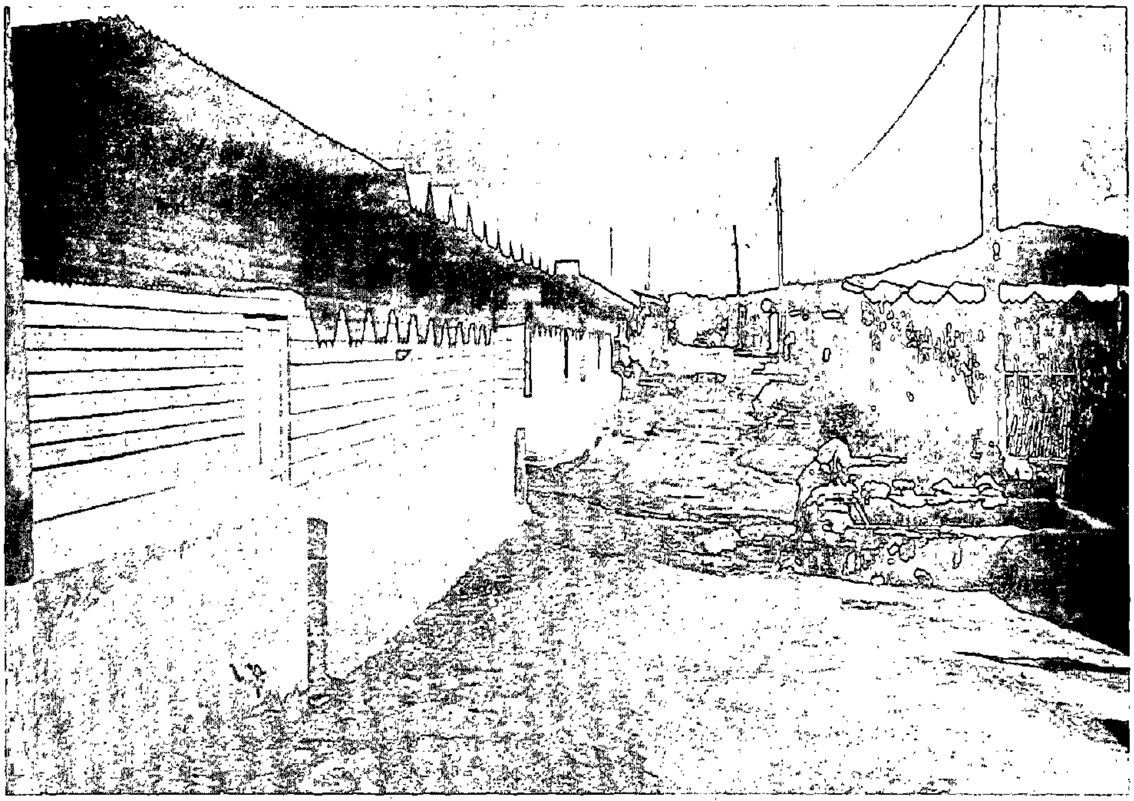
Picture 4. Cement Block House with Lamina Roof in Patzun.

these cases come from one Indian aldea in the Highlands, Santa Maria Cauque, where the Mennonites constructed such houses (see Pictures 5 and 6).

Besides the types discussed, there are only 11 other cases, five falling into the adobe-lamina-duralita category, five into the "other" category and one into the patchwork. There is a good possibility, as pointed out above, that about half of these are really misclassified and should be regarded as non-agency houses.

The dominant non-agency house type is half and half with a lamina or duralita roof. This type, however, only accounts for 20.5 percent of the cases. Such houses conform to some of the recommendations made by one agency working in the central highlands. Many are the result of people cutting down the damaged walls of pre-earthquake houses to the height of about one meter from ground level and then filling in the upper wall with a light weight material such as wood, lamina, or sometimes cane or corn stalks (See Picture 6). The upper wall provides a wooden frame to support the roof and is usually attached to posts sunk into the ground. Furthermore, some of the adobe houses found in the non-agency house category are made of adobe de canto rather than regular adobe (see Picture 7). This construction pattern lays the adobe block on its narrow edge, creating a thinner wall than in regular adobe structures. The blocks are then held in place by wire stretched between support posts so that they will not easily fall out in an earthquake. This pattern of construction was promoted particularly by OXFAM and World Neighbors in the San Martin Jilotepeque area. Unfortunately the coding system used for this study does not differentiate between regular adobe and adobe de canto. Therefore the exact number of such structures encountered can not be given. (Pictures 9 and 10 show a traditional adobe house, and a newly constructed bajareque house.)

5



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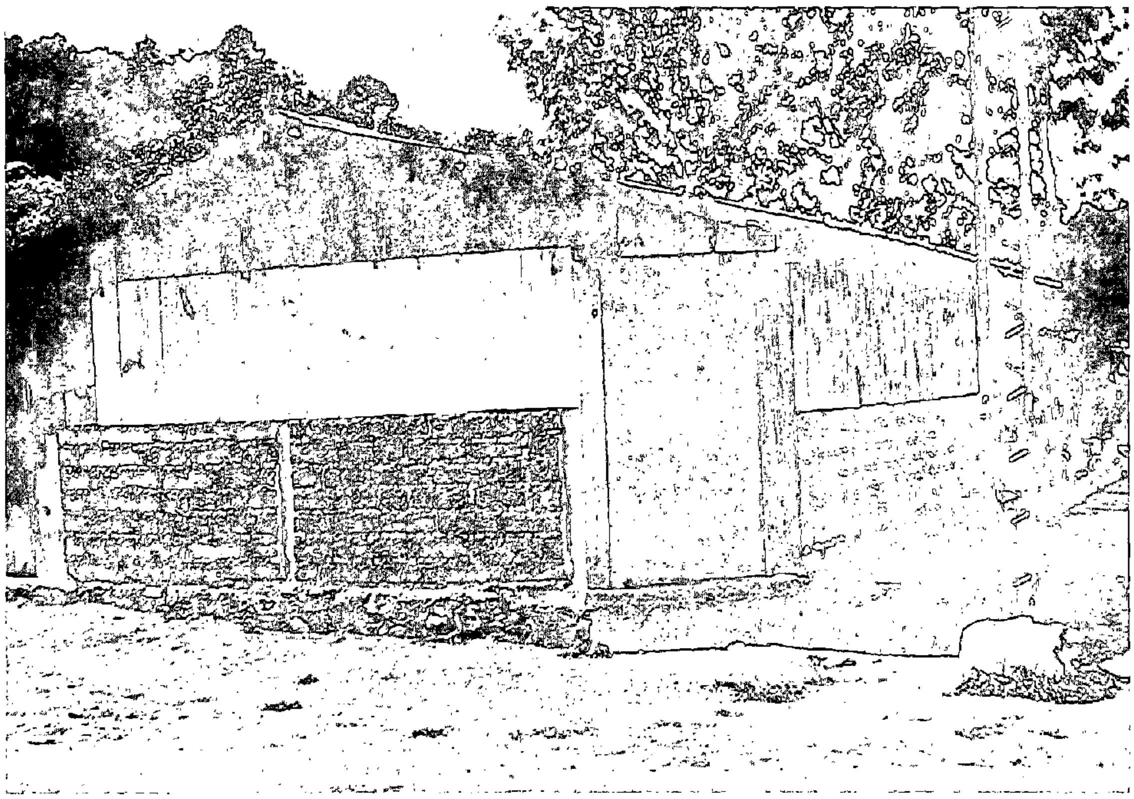
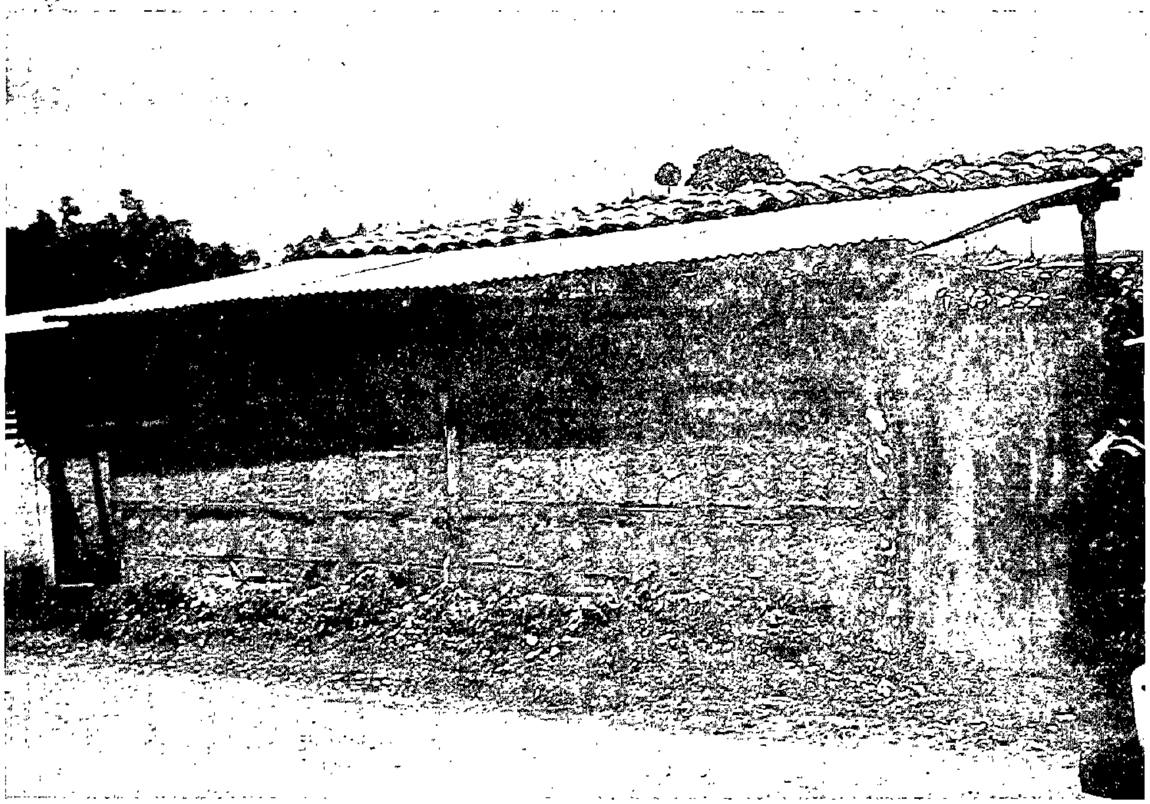


Picture 5. Half Block - Half Wood Walls with Duralita Roof in Santa Maria Cauque.

Picture 6. Half Adobe - Half Wood Walls and Lamina Roof in San Martin Jilotepeque.

7



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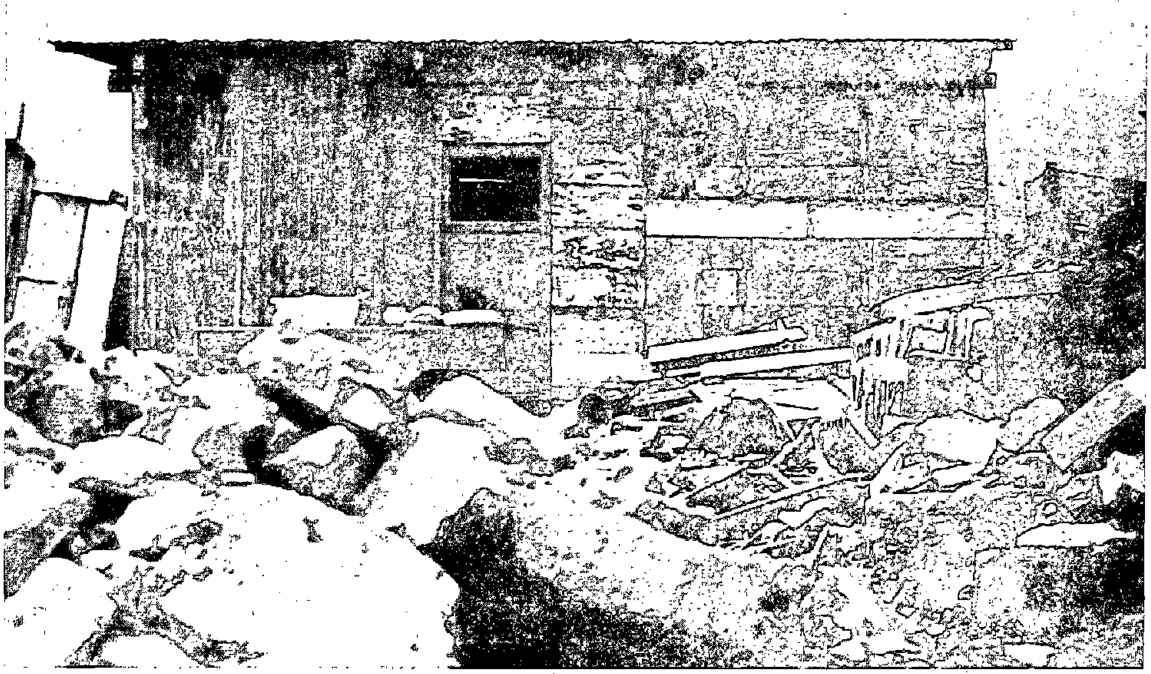
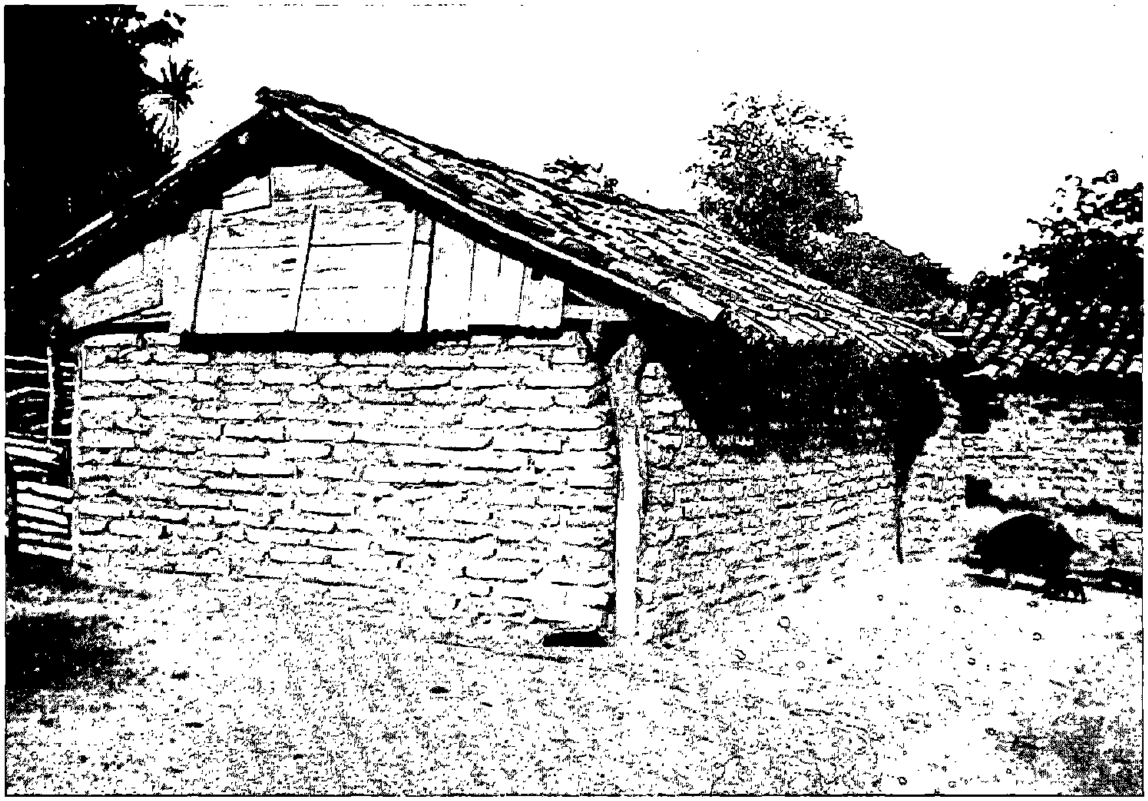


Picture 7. Adobe DeCanto Walls with Tile Over Lamina Roof.

Picture 8. Patchwork Walls with Lamina Roof.

9



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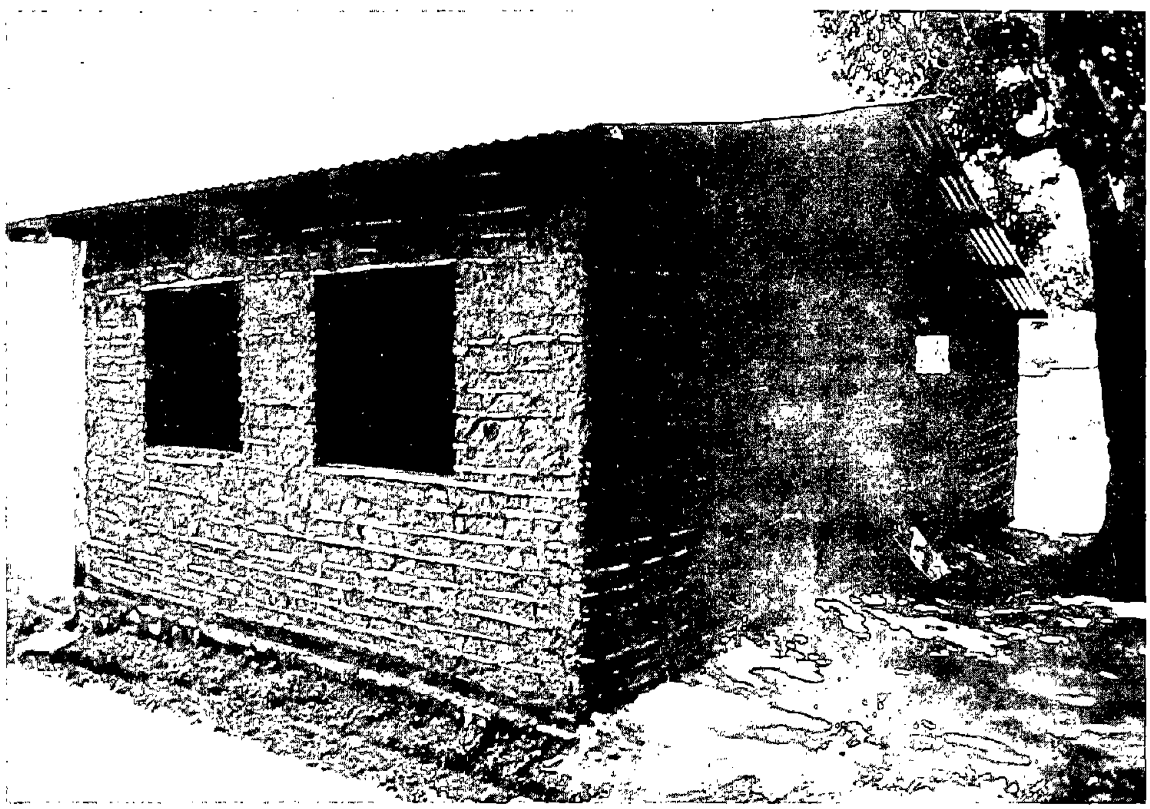

Picture 9. Adobe Walls with Tile Roof. Picture 10. Bajareque Walls with Lamina Roof.

All of the agency houses shown in Table 11-4 were constructed after the earthquake because by definition they were produced by earthquake related reconstruction programs. In the non-agency house category there are a few houses which survived the earthquake and therefore reflect pre-earthquake housing trends rather than those produced by the interplay of the earthquake, and the disaster related sociocultural system. In particular, there appear to be 89 such houses altogether, constituting 15 percent of the non-agency house sample. Of these, 43 employed adobe walls, 30 with a tile roof, 13 with a lamina roof. On the basis of these figures it is possible to estimate that about 42 new adobe houses were constructed after the earthquake in the experimental group area by households in the sample for this study. This amounts to 5.2 percent of the households in the experimental group. Of these, 24 had tile roofs and 18 had lamina or duralita roofs. There is a very high probability that most of these 18 were adobe de canto.

Modernization of Housing

In an earlier chapter, house types were classified into traditional, modern and mixed categories according to the types of materials they used in their walls and roofs. This same classification can be used to compare agency with non-agency houses. Table 11-5 shows the number of principal houses falling into each of these categories for agency and non-agency houses before and after the earthquake. This table shows that there has been a substantial change from traditional to modern house types since the disaster. People who occupied agency houses as their principal house in 1978, two years after the disaster, lived primarily

Table 11-5

Classification of Agency and Non-agency Principal Houses According to Traditional-Modern Continuum

Classification	Agency Houses				Non-agency Houses			
	Before E.Q.*		1978		Before E.Q.		1978	
	No.	%	No.	%	No.	%	No.	%
Traditional	144	60.0	1	0.4	352	62.4	110	19.5
Mixed	92	38.3	12	5.0	189	33.5	277	49.1
Modern	4	1.7	227	94.6	23	4.1	177	31.4
TOTAL	240	100.0	240	100.0	564	100.0	564	100.0

*These are the characteristics of houses occupied before the earthquake by recipients of agency houses. They are all non-agency pre-earthquake houses.

in modern house types supplied by agencies (94.6 percent). Before the earthquake, however, only 1.7 percent of present agency house occupants had lived in such structures. Instead, before the disaster, sixty percent had lived in traditional housing. This difference represents a dramatic reversal in housing patterns for the agency house group.

Perhaps more interesting is the fact that more of those who were living in non-agency houses in 1978 were also living in modern structures than before the earthquake. Here the pre-earthquake figure was made up of 4.1 percent modern structures as compared to 31.4 percent in 1978. In the same time period, traditional housing had decreased from 62.4

percent to 19.5 percent.

The table also shows that the recipients of agency houses and those who lived in non-agency houses had been more or less alike in housing characteristics before the earthquake. After the reconstruction process had changed their housing patterns, however, they differed considerably. Agency housing recipients had moved more completely into the modern category than had non-agency house people. Even more important, however, is the fact that those with non-agency houses had also moved heavily away from traditional toward modern housing. This means that when victims made their own decisions as to housing patterns, most tended to move in the direction of modernization.

It is possible to determine how many households changed in the direction of more modern structures, how many moved in the direction of more traditional structures and how many remained in structures with the same classification in the two year period following the earthquake. These figures are given in Table 11-6.

Table 11-6

Direction of Change in Housing Pattern 1975-1978 for Agency and Non-agency House Occupants

Type of Housing Change	Type of House Occupied 1978			
	Agency		Non-agency	
	No.	%	No.	%
From Traditional Toward Modern	229	95.4	312	55.3
From Modern Toward Traditional	1	0.4	4	0.7
Remained in the Same Category	10	4.2	248	45.7
TOTAL	240	100.0	564	100.0

These data show that 95 percent of agency house holders moved in the direction of modernization in housing as compared to 55 percent for non-agency house holders. In addition to this, less than one percent in either category moved toward the traditional end of the continuum. The big difference between the groups lies in the number of non-agency householders who remained in the same category of housing. It is clear that the trend towards modernization was strong in either case.

Similar figures are available for the period between 1975 and 1980 and are given in Table 11-7.

Table 11-7

Direction of Change in Housing Patterns 1975-1980 for Agency and Non-agency House Occupants

Direction of Change 1975-1980	Type of House Occupied 1980			
	Agency		Non-agency	
	No.	%	No.	%
From Traditional Toward Modern	220	96.1	269	60.2
From Modern Toward Traditional	0	0.0	5	1.1
Remained in Same Category	9	3.9	173	38.7
TOTAL	229	100.0	447	100.0

Between 1978 and 1980, 128 out of 804 households dropped out of the experimental group sample due to nonavailability for reinterview. The remaining 676 are shown in this table. These data show that there was a slight increase in the number who had moved toward modern housing in the agency house category between 1978-1980 with the figure now showing that 96.1 percent of all agency house occupants had moved towards modernity. The remaining 3.9 percent had remained in the same category. In the case of non-agency house occupants the percent who had moved in the direction of modernity had increased from 55.3 to 60.2 percent. This shift came primarily out of the category "remained the same."

These data show a strong and continuing trend towards modernized housing in both groups but what is most important is the fact that those households who built their own houses, or hired someone else to build them, moved rather rapidly in this direction also. In the case of non-agency houses the trend is produced by choices made by Guatemalan disaster victims themselves and not by agencies, although these choices were undoubtedly influenced by agency programs.

Comparison of Control Experimental Differences in Housing Modernization

It is apparent that a rather large shift toward modernization occurred in housing following the earthquake in the experimental group and that this trend was strongest in the group of households receiving agency houses. The question arises, "How does this compare to what would have happened if there had been no earthquake?" A comparison of changes between the experimental and control groups will offer some help in answering this question.

Table 11-8 shows the percent with traditional mixed and modern housing at three points in time, 1975, 1978 and 1980 in the experimental and control groups. At all three time periods the control and experimental groups are significantly different from each other, but the direction of difference changes after the earthquake. In late 1975, 19.3 percent of

Table 11-8

Traditional, Mixed and Modern House Types in the Control and Experimental Groups Before and After the Earthquake

	1975						1978						1980						Difference 1975-1980	
	Control		Experimental		Total		Control		Experimental		Total		Control		Experimental		Total		Control	Experimental
House Type	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Traditional	204	35.6	496	61.7	700	50.8	124	21.6	111	13.8	235	17.07	91	18.0	89	13.2	180	15.2	-17.6	-48.5
Mixed	253	45.1	281	35.0	540	39.2	277	48.4	289	36.0	566	41.1	231	45.8	214	31.7	445	37.7	+ 0.7	- 3.3
Modern	110	19.3	27	3.4	137	10.0	172	30.0	404	50.2	576	41.8	182	36.2	373	55.2	555	47.1	+16.9	+51.8
Total	573	100.0	804	100.0	1377	100.0	573	100.0	804	100.0	1377	100.0	504	100.0	676	100.0	1180	100.0	0.0	0.0

1975		1978		1980	
Chi Square	= 139.44	Chi Square	= 57.596	Chi Square	= 41.820
Probability	= 0.0001	Probability	= 0.0001	Probability	= 0.0001
Phi	= 0.317	Phi	= 0.205	Phi	= 0.188

the housing in the control group fell in the modern category as compared to only 3.4 percent in the experimental group. The control group was also ahead in mixed housing. These figures indicate that before the earthquake, the control group was further along in modernization than the experimental group.

By two years later (in 1978*) this difference is reversed. Now the experimental group is 50.2 percent modern as compared to 30.0 percent for the control group. By 1980 both groups have continued to modernize and now have reached 36.2 percent modern for the control group and 55.2 percent modern for the experimental group. In the four year period the control group has added 16.9 percent to the proportion of modern houses for an 87.6 percentage gain in this category, but the experimental group has added even more, 51.8 percent, for an amazing percentage increase in modern housing of 1523.5 percent!

These figures make it clear that there was a general trend towards modernization in housing taking place in the country as a whole, evidenced by the 87.6 percentage increase in this category in the control group. They likewise demonstrate that the earthquake and the reconstruction process in the experimental group multiplied the effects of this trend in the experimental group,producing a dramatic shift towards modern housing forms far beyond what occurred in the control group and therefore presumably beyond what would have occurred without the earthquake.

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*The year 1975 is used throughout this manuscript to indicate the pre-earthquake period. In actuality, the housing characteristics represent those of the houses occupied by respondents on the day of the earthquake, Feb. 4, 1976. Thus 1978 is "two years" after the earthquake.

In all liklihood, some of the modernization in the control group was also produced by events associated with the earthquake. This means that the control group figures over-estimate what the modernization trend was like in the country as a whole before the earthquake. As a consequence, the above figures probably underestimate the difference between the pre-earthquake trend and the trend produced by the earthquake and reconstruction process. In actuality the earthquake and reconstruction process probably produced an even greater boost to modernization in housing than is shown by comparing the control and experimental groups. The earlier examination of figures for households who received agency houses and those who did not clearly indicate that organized housing programs were primarily responsible for this shift,although there was a strong movement in the direction even when people built their own houses.

Urbanized Services

Modernization in housing can also be measured by examining the availability of such modernized services as running water, modern human waste disposal systems and electricity in households who were involved with agency housing programs as compared to those who were not. Table 11-9 gives data on such services and on land and house tenure for households in the experimental group who received an agency house from any source, in comparison to households who did not receive an agency house from any source.

This table shows that in 1978, two years into the reconstruction process, agency house recipients differed from non-recipients with respect to running water and electricity but were like them with respect to

Table 11-9

Modern Urban Services in 1980 for Households Receiving and Not Receiving Agency Houses

	Either House is An Agency House		Neither House is An Agency House		Total		Statistics	
	No.	%	No.	%	No.	%		
Running Water								
No	179	55.6	318	66.0	497	61.8	Chi Square	= 8.820
							Probability	= 0.0030
Yes	143	44.4	164	34.0	307	38.2	Phi	= 0.105
Total	322	100.0	482	100.0	804	100.0		
Flush Toilet or Modern Latrine								
No	256	79.5	390	80.9	646	80.4	Chi Square	= 0.243
							Probability	= 0.6221
Yes	66	20.5	92	19.1	158	19.6	Phi	= 0.017
Total	322	100.0	482	100.0	804	100.0		
Electricity in House								
No	164	50.9	297	61.6	461	57.3	Chi Square	= 9.012
							Probability	= 0.0027
Yes	158	49.1	185	38.4	343	42.7	Phi	= 0.106
Total	322	100.0	482	100.0	804	100.0		
Owned House Site								
No	48	14.9	111	23.0	159	19.8	Chi Square	= 8.027
							Probability	= 0.0046
Yes	274	85.1	371	77.0	645	80.2	Phi	= 0.100
Total	322	100.0	482	100.0	804	100.0		
Owned House								
No	9	2.8	48	10.0	57	7.1	Chi Square	=15.039
							Probability	= 0.0001
Yes	313	97.2	434	90.0	747	92.9	Phi	= 0.137
Total	322	100.0	482	100.0	804	100.0		

human waste disposal systems. Slightly over 44 percent of the agency house recipients had running water either piped onto their housing sites or into their houses as compared to 34 percent of non-agency house people. In the case of electricity, 49 percent of the agency house group had electricity in their houses while the non-agency house group had this service in only 38 percent of theirs. On the possession of a modern flush toilet or sanitary latrine, the two groups were almost identical (20.5 as compared to 19.1 percent). With respect to the indicators of water and electricity, the agency house group appears more modern in 1978 than the non-agency house group.

It is possible, however, that this difference is due to pre-earthquake differences and not to the differential effects of reconstruction programs on the two groups. The important question is how much change took place in these characteristics for the two groups after the earthquake and how they compare to the control group. Table 11-10 presents figures showing the percentages of each group who had each modern service in 1975,* the year before the earthquake, in 1978 and in 1980. Table 11-11 shows the percentage of households that declined, improved or remained the same on these services. "Declined" is defined as going from the modern to non-modern category and "improved" is defined in the opposite fashion. The results of statistical tests are also given in these tabulations.

Before the earthquake, agency house recipients started with 34.5 percent having running water and by 1980, 50.2 had this service. In comparison, the non-agency house group went from 26.6 percent in 1975 to

* 1975 is used to represent the housing situation just before the earthquake which occurred on Feb. 4, 1976. Whenever 1975 is used in any of these tables it means the immediate pre-earthquake situation. The time period covered by the data is approximately four years since the final interviews were conducted in the Spring of 1980.

Table 11-10

Changes in Water, Electricity and Sewage 1975-1980
Classified by Households Receiving an Agency House
and Not Receiving an Agency House

	1975	1978	1980	Percentage Change 1975-1978	Percentage Change 1975-1980
Running Water					
Agency	34.5	44.4	50.2	28.9	41.4**
Non-agency	26.6	34.0	36.0	27.8	41.7
Total	29.7*	38.2*	41.9*	28.6	41.7
Electricity in House					
Agency	41.0	49.1	54.8	19.8	32.2
Non-agency	30.7	38.4	44.6	25.1	49.5
Total	34.8*	42.7*	48.8*	22.7	41.1
Flush Toilet or Modern Latrine					
Agency	18.6	20.5	25.6	10.2	38.6
Non-agency	19.5	19.1	19.0	-2.1	9.2
Total	19.2	19.6	21.8*	2.1	20.8
Owned House Site					
Agency	73.9	85.1	85.4	15.2	16.4
Non-agency	71.8	77.0	81.8	7.2	12.4
Total	72.6	80.2*	83.3	10.5	14.0
Owned House					
Agency	78.9	97.2	96.1	23.2	21.7
Non-agency	78.8	90.0	92.9	10.2	17.9
Total	78.9	92.9*	94.2	17.7	19.4

* Significant difference between agency and non-agency.

** These percentages are computed using only the 676 cases that were present in the sample in both 1975 and 1980. Since 128 cases dropped out of the sample during this time interval, the percentage changes computed on differences using the whole sample at $Time_1$ will not be the same.

Table 11-11

Changes in the Percent Who Have Running Water, Electricity and Modern Sewage for Agency House Occupants and Those Who Did Not Receive Agency Houses for Three Time Periods

Sample Group	1975-1978							1978-1980							1975-1980						
	Change Category							Change Category							Change Category						
	Declined (-1) %	No Change (0) %	Improved (+1) %	Total No.	Total %	Mean	Net % Impr.	Declined (-1) %	No Change (0) %	Improved (+1) %	Total No.	Total %	Mean	Net % Impr.	Declined (-1) %	No Change (0) %	Improved (+1) %	Total No.	Total %	Mean	Net % Impr.
Running Water																					
Non-Agency	1.9	88.8	9.3	482	100.0	.075	7.4	1.3	94.2	4.6	395	100.0	.033	3.3	1.3	86.3	12.4	395	100.0	.111	11.1
Agency	4.0	82.0	14.0	322	100.0	.099	10.0	1.4	92.9	5.7	281	100.0	.043	4.3	3.9	77.9	18.2	281	100.0	.142	14.3
Total	2.7	86.1	11.2	804	100.0	.085	8.5	1.3	93.6	5.0	676	100.0	.037	3.7	2.4	82.8	14.8	676	100.0	.124	12.4
	Chi Square = 8.07, Probability = .0177, Phi = 0.100 T = -0.901, Probability = 0.3682							Chi Square = 0.482, Probability = 0.7858 Phi = 0.027 T = -0.502, Probability = .6156							Chi Square = 9.926, Prob. = .0070, Phi = 0.121 T = -0.964, Prob. = .3355						
Electricity																					
Non-Agency	2.9	86.5	10.6	482	100.0	.077	7.7	0.5	91.4	8.1	395	100.0	.076	7.6	2.0	80.8	17.2	395	100.0	.152	15.2
Agency	6.5	78.9	14.6	322	100.0	.081	8.1	1.4	93.2	5.3	281	100.0	.039	3.9	5.0	76.9	18.2	281	100.0	.132	13.2
Total	4.4	83.5	12.2	804	100.0	.078	7.8	0.9	92.2	7.0	676	100.0	.061	6.1	3.3	79.1	17.6	676	100.0	.143	14.3
	Chi Square = 9.703, Probability = .0078, Phi = 0.110 T = 0.132, Probability = .8948							Chi Square = 3.420, Probability = .1809, Phi = 0.071 T = 1.726, Probability = 0.0847							Chi Square = 4.807, Prob. = 0.0904, Phi = 0.084 T = 0.585, Prob. = 0.5586						
Sewage																					
Non-Agency	3.5	93.4	3.1	482	100.0	-.004	-0.4	2.3	93.4	4.3	395	100.0	.020	2.0	3.8	90.6	5.6	395	100.0	.018	1.8
Agency	4.7	88.8	6.5	322	100.0	.019	1.8	3.9	87.2	8.9	281	100.0	.050	5.0	6.0	80.8	13.2	281	100.0	.072	7.2
Total	4.0	91.5	4.5	804	100.0	.005	0.5	3.0	90.8	6.2	676	100.0	.032	3.2	4.7	86.5	8.7	676	100.0	.040	4.0
	Chi Square = 6.068, Prob. = 0.0481, Phi = 0.087 T = -1.034, Prob. = 0.3014							Chi Square = 7.762, Prob. = 0.0206, Phi = 0.107 T = -1.193, Prob. = 0.2336							Chi Square = 14.460, Prob. = 0.0007, Phi = 0.146 T = -1.777, Prob. = 0.0763						

to 36.0 percent in 1980. Chi Square tests were run on the distributions from which these figures were taken and the results are indicated by an asterisk next to the totals in each column. An asterisk means the two groups were significantly different at better than the .05 level of statistical significance. (In most cases significance levels are far greater.)

In the case of running water, the two groups were statistically different at all three time periods with the group receiving agency houses always being more modernized. The important question is which group changed the most after the earthquake. This question is answered by the figures in Table 11-11 which show declines and improvements between 1975 and 1978, 1978 and 1980, and between 1975 and 1980. These data indicate that between 1975 and 1978, 14 percent of the agency house group improved and four percent declined for a net positive gain of 10 percent in the number of houses with running water, as compared to 9.3 percent who improved and 1.9 percent who declined for the non-agency house group for a net positive change of 7.4 percent. When the means* of this distribution of gain and loss for each group are considered, the difference between them is not statistically significant although it is in favor of the agency house group. When, however, the amount of change which took place in the two groups is considered it is apparent that the agency house groups had a greater amount of change take place. Not only did more households improve by gaining running water, but more also declined by

*A mean of "0" would mean that everyone remained the same, a mean of -1 would indicate that everyone declined and a mean of +1 that everyone improved. These means therefore represent the proportion of gain or loss. If they are multiplied by 100, the net percent who gained or lost, depending on sign, results. Thus a mean of .250 amounts to saying that 25 percent more households gained than lost the service.

losing it in this group. This can be easily seen by looking at the figures which show what proportion of the households remained the same (88.8 for the non-agency and 82.0 for the agency). This is why the Chi Square for this distribution is significant. It shows there is a significant relationship between sample group and amount of change. Even though more changes took place in the agency group, the amount of improvement it made as a group is not statistically different than that made by the non-agency house group. The figures for change from 1975 to 1980 also show this trend,but to a slightly more pronounced degree. Overall, more households changed in the agency house group either up or down during this four year period but the amount of change in terms of net improvement for the groups as a whole was not statistically different between the two groups.

The fact that the two groups improved to about the same degree can be seen most easily by examining the percentage improvement made by the two groups over the four year period in terms of percentage increase from their respective starting points. The agency house group started with 34.5 percent of the households with running water, and registered a total positive group gain of 14.3 percent which amounts to a 41.4 percent increase in the number of households with running water as compared to the group's starting point. In comparison, the non-agency house group started with 26.6 percent with this service and a net improvement of 11.1 percent occurred for this group, amounting to a 41.7 percentage gain, a figure almost identical to the agency house group. During the period 1978 to 1980, neither the volume of change nor the amount of improvement achieved by the two groups measure significantly different. If all time periods are considered, it can be seen that the agency house group changed slightly more during the first two years after the earthquake, which is to be expected since it was during this time period that agencies did most of their work. After that, the agency and non-agency house people were both more or less on their own and changed about the same amount.

The figures for both groups are rather dramatic, all things considered, and represent a rapid rate of improvement in this urbanized service in both agency and non-agency house groups. It will be necessary to compare the experimental group figures to control group figures before it is possible to say whether this improvement is due to earthquake effects within the earthquake affected area. Before this is done, however, it will be useful to look at the other urbanized services given in this table.

As can be seen, the results for electricity are, in some respects, similar to those for water. The agency house group registered higher percentages of houses with electricity at all time periods and made significantly more positive and negative changes between 1975 and 1978. Between 1975 and 1980, however, the non-agency house group made the largest positive gain,indicating that it began to catch up with the agency house group between 1978 and 1980. This results in no significant difference in the amount of overall change or improvement in the two groups for the four year time period. Neither the "t" tests for difference in mean improvement nor the Chi Square,which tests for differences in volume of change,show any difference between the two groups except in the volume of change for the agency house group between 1975-1978. There was, nevertheless, a four year positive percentage gain in the number of houses with electricity for the non-agency house group of 49.5 percent as compared to a 32.2 percentage gain for the agency house group.

The conclusion that can be drawn from this discussion is that modernization in electricity was about the same in terms of absolute percentage gain between 1975 and 1980 for the two groups when measured by the net proportion of families that benefitted (13.2 agency, 15.2 non-agency). The agency house group, however, started from a higher base and its percentage gain was therefore substantially lower than the non-agency house group because a similar absolute amount of improvement results in a greater percentage change for the lower group. These results seem to indicate that in the long run modernization in electricity had very little to do with the presence or absence of agency housing programs. Although improvements seem to have come more quickly for the agency house group, the non-agency house people improved proportionately more but at a slightly later period.

Human waste disposal systems appear to have a different pattern than water and electricity. First, the agency and non-agency house group were alike on the possession or non-possession of flush toilets or modern latrines in both 1975 and 1978, as indicated by a lack of significant statistical difference between them. It was only after 1978 that the agency house group shows a significantly higher proportion of people in the modern category on this service. During both the 1975-1978 and the 1975-1980 time periods, the agency house group shows a higher amount of positive and negative change with the greatest shift in the modern direction coming after 1978. Ultimately there was a 7.2 percent absolute improvement for agency house people as compared to a 1.8 percent improvement for non-agency house occupants in this service. This represents a 38.7 percentage increase for the former group and a 9.2 percentage improvement for the latter, relative to their starting points, which were similar in this case. The Chi Square tests for differences in amount of change show that the two groups differed during each time interval. There were both more positive and negative changes taking place in the agency house group. The "t" tests which measure the average change for each group show that at each time period the average improvement was the same. A mean of zero would indicate that improvements and declines exactly equal each other, while a score of plus one would mean that everyone improved and minus one that everyone declined. These means are proportional to the difference in the percent who improved and declined. It appears therefore that there is no significant difference between the groups in this percentage difference with respect to the absolute amount of change. There is, however, a difference in terms of what the percentage difference means in terms of relative improvement, considering the starting points of the two groups.

The general conclusions to be drawn from this examination of three urban services is that there was surprisingly little difference between the agency and non-agency house groups in the amount of absolute improvement that took place in the two groups. In no case were the means representing improvement statistically different. This is a result of the fact that the agency group had both higher percentages of declines and higher percentages of improvements on all services than the non-agency house group.

When higher declines are subtracted from higher gains they result in about the same mean absolute improvement for the two groups. The fact that the agency house group always shows a greater amount of change indicates that these programs altered the relative access of people to urban services more than non-agency housing efforts. In other words, more people who had services lost them and more who did not, gained them. This amounts to a substantial shift in access of individual families to services, even when the average access for the whole group is the same as for the non-agency house group.

Because the two groups started from different levels, the percentage gains represented by these figures differ,depending on service. The non-agency house group made the higher percentage gain in electricity, while the agency house group showed a higher percentage gain in human waste disposal. The two groups were alike in the gains they made in water. This pattern seems to indicate that there was little relationship between being associated with an agency house program and having an advantage in obtaining urban services. Instead, such services seem to have been more or less distributed without reference to housing program participation. Their presence in a household is more highly dependent on which community the household is found in than on their association with an agency program within that community. There is still a possibility,however, that different types of agency programs produced different results with respect to urban services. This possibility will be examined below.

One point that should not be lost sight of is the fact that these data demonstrate a rather strong trend toward improvement in modern services for both agency and non-agency house people. For the two groups taken together, there was a 41.8 percentage change in the positive direction in running water, a 44.3 positive percentage change in electricity and a 20.8 percentage gain in modern human waste disposal systems in the four year period between the time of the earthquake and 1980. This demonstrates a dramatic modernization trend.

Control-Experimental Group Differences in Urban Services

The question remains as to whether these improvements differ from what occurred in the control group, and therefore can be attributed to earthquake relief activities. Table 11-12 gives a comparison of the control and experimental groups with respect to the three urban service items. It shows that in the case of water and sewage, the control group and the experimental group were alike at every time period, indicating that they were about the same in modernization, if these services are used as a measure. Electricity shows a different picture. At every time period the control group has a higher proportion of households with this service.

Change in the direction of modernization took place in both groups following the earthquake but in the case of every service the experimental group changed slightly more. The difference in amount of change is only statistically significant in the case of electricity, however. In terms of percentage change, during the interval between 1975 and 1980, the greater change rate for the experimental group is particularly noticeable. The following tabulation (Table 11-13) shows the difference in percentage change in the control and experimental groups for this four year period.

It appears that although the contrast in amount of change within time periods between the control and experimental groups is small and insignificant

Table 11-12

Changes in Water, Electricity and Sewage, 1975-1980, For the Control and Experimental Groups

	1975				1978				1980				Total Change, 1975-1980	
	Control Group		Experimental Group		Control Group		Experimental Group		Control Group		Experimental Group		Control	Exper.
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Running Water														
No	377	65.8	565	70.3	329	57.4	497	61.8	278	55.2	393	58.1	-10.6	-12.2
Yes	196	34.2	239	29.7	244	42.6	307	38.2	226	44.8	283	41.9	+10.6	+12.2
Total	573	100.0	804	100.0	573	100.0	804	100.0	504	100.0	676	100.0	-	-
	Chi Square = 3.107, Prob. 0.0780				Chi Square = 2.768, Prob. 0.0961				Chi Square = 1.018, Prob. = 0.3130					
Flush Toilet or Modern Latrine														
No	460	80.3	650	80.8	450	78.5	646	80.4	396	78.7	529	78.2	- 1.6	- 2.6
Yes	113	19.7	154	19.2	123	21.5	158	19.6	107	21.3	147	21.8	+ 1.6	+ 2.6
Total	573	100.0	804	100.0	573	100.0	804	100.0	504	100.0	676	100.0	-	-
	Chi Square = 0.069, Prob. 0.7932				Chi Square = 0.678, Prob. 0.4103				Chi Square = 0.032, Prob.=0.8574					
Electricity														
No	317	55.4	524	65.2	267	46.7	461	57.3	214	42.4	346	51.2	13.0	-14.0
Yes	256	44.6	280	34.8	306	53.3	343	42.7	290	57.6	330	48.8	+13.0	+14.0
Total	573	100.0	804	100.0	573	100.0	804	100.0	504	100.0	676	100.0	-	-
	Chi Square = 13.500, Prob. = 0.0002				Chi Square = 15.325, Prob. 0.0001				Chi Square = 8.885, Prob. = 0.0029					

in terms of absolute percentage differences, there are greater differences in the rate of change in the two groups when their starting points are taken into account. Data not presented here indicate that there were more people who both gained and lost in urban services in the experimental group, but when net gains are considered, the two groups were very similar although the experimental group, because of its lower starting point, made higher percentage gains in proportion out of the same amount of absolute increase.

Table 11-13

Percentage Change in Urban Services 1975-1980 in the Control Group and Experimental Group

Urban Service	Percentage Change - 1975-1980	
	Control	Experimental
Running Water	31.0	41.1
Flush Toilet or Modern Latrine	8.1	13.5
Electricity	29.1	40.2

Percentage change = %1980-%1975/%1975 x 100

The lack of significant differences in improvement between the experimental and control groups means that the general trend toward improvement in urban services can not be attributed to special earthquake related influences in the experimental group that were not present in the control group. In particular, they can not be attributed to programs being carried on there. Nevertheless, one must not lose track of the fact that both the experimental and control groups made significant gains in running water and electricity and more modest ones in human waste disposal, showing a strong general trend towards modernization in the country as a whole. This trend itself may be partially attributable to the effects of the earthquake on the country as a whole through the boost it gave to economic activity in general and to public programs related to urbanized services.

Differences Among Program Types in Urban Services

If the urban services found in particular households are examined in terms of the type of reconstruction program they were associated with, insight can be gained into which types of programs were associated with the greatest amounts of change. This is done in Table 11-14 which demonstrates that for every time period there was a relationship between type of housing program and the percent who had modern water or electricity. There was, however, no relationship between program type and percent with modern sewage at any of the time periods.

The program types used can be defined as follows:

1. No Program: Households who did not receive either lamina or an agency house, either temporary or permanent.
2. Lamina Programs: Households who received lamina either free or at a subsidized price but did not receive either a temporary or permanent house.
3. Temporary Housing: Households who received a temporary house of wood and lamina built by an agency, but did not receive a permanent house.

Table 11-14A

Modern and Non-modern Water Supply by Program Type
(Modern = Faucet in House or on the Housing Site)

	1975						1978						1980						Total Improvement	
	Not Modern		Modern		Total		Not Modern		Modern		Total		Not Modern		Modern		Total		% Dif-	%
Program Type	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	ference	Change
No Program	225	71.4	90	28.6	315	100.0	196	62.2	119	37.8	315	100.0	143	57.7	105	42.3	248	100.0	+13.7	+47.9
Lamina Program	137	76.1	43	23.9	180	100.0	130	72.2	50	27.8	180	100.0	117	73.6	42	26.4	159	100.0	+ 2.5	+10.5
Temporary Housing	108	57.4	80	42.6	188	100.0	96	51.1	92	48.9	188	100.0	76	46.6	87	53.4	163	100.0	+10.8	+25.4
Permanent Housing	95	78.5	26	21.5	121	100.0	75	62.0	46	38.0	121	100.0	57	53.8	49	46.2	106	100.0	+24.7	+114.9
Total	565	70.3	239	29.7	804	100.0	497	61.8	307	38.2	804	100.0	393	58.1	283	41.9	676	100.0	+12.2	+41.1

	1975	1978	1980
Chi Square	= 21.876	= 17.490	= 25.317
Probability	= 0.0001	= 0.0006	= 0.0001
Phi	= 0.165	= 0.147	= 0.194

Table 11-14B

Modern and Non-Modern Source of Light; Electricity or No Electricity by Program Type

	1975						1978						1980						Total Improvement	
	No Electricity		Electricity		Total		No Electricity		Electricity		Total		No Electricity		Electricity		Total		% Dif-	%
Program Type	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	ference	Change
No Program	200	63.5	115	36.5	315	100.0	178	56.5	137	43.5	315	100.0	123	49.6	125	50.4	248	100.0	+14.0	+38.4
Lamina Program	142	78.9	38	21.1	180	100.0	127	70.6	53	29.4	180	100.0	103	64.8	56	35.2	159	100.0	+14.1	+66.8
Temporary Housing	108	57.4	80	42.6	188	100.0	104	55.3	84	44.7	188	100.0	71	43.6	92	56.4	163	100.0	+13.8	+32.4
Permanent Housing	74	61.2	47	38.8	121	100.0	52	43.0	69	57.0	121	100.0	49	46.2	57	53.8	106	100.0	+15.0	+38.7
Total	524	65.2	280	34.8	804	100.0	461	57.3	343	42.7	804	100.0	346	51.2	330	48.8	676	100.0	+14.0	+40.2

	1975	1978	1980
Chi Square	= 21.115	= 23.462	= 16.849
Prob.	= 0.0001	= 0.0001	= 0.0008
Phi	= 0.162	= 0.171	= 0.158

Table 11-14C

Modern and Non-modern Human Waste Disposal Systems by Program Type
(Modern = Flush Toilet or Modern Latrine)

	1975						1978						1980						Total Improvement	
	Not Modern		Modern		Total		Not Modern		Modern		Total		Not Modern		Modern		Total		% Dif-	%
Program Type	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	ference	Change
No Program	246	78.1	69	21.9	315	100.0	252	80.0	63	20.0	315	100.0	194	78.2	54	21.8	248	100.0	-0.1	-0.5
Lamina Program	154	85.6	26	14.4	180	100.0	149	82.8	31	17.2	180	100.0	135	84.9	24	15.1	159	100.0	+0.7	+4.9
Temporary Housing	148	78.7	40	21.3	188	100.0	150	79.8	38	20.2	188	100.0	124	76.1	39	23.9	163	100.0	+2.6	+12.2
Permanent Housing	102	84.3	19	15.7	121	100.0	95	78.5	26	21.5	121	100.0	76	71.7	30	28.3	106	100.0	+12.6	+80.2
Total	650	80.8	154	19.2	804	100.0	646	80.4	158	19.6	804	100.0	529	78.2	147	21.8	676	100.0	+2.3	+11.8

1975		1978		1980	
Chi Square	= 5.595	Chi Square	= 0.993	Chi Square	= 7.267
Prob.	= 0.1331	Prob.	= 0.8030	Prob.	= 0.0639
Phi	= 0.083	Phi	= 0.035	Phi	= 0.104

4. Permanent House: Households who received a permanent house of block and lamina or duralita, or half block and lamina or duralita or of block and thatch from an agency.

If a household received several types of aid they are classified according to the highest level of aid they received, with none being considered lowest and permanent housing being considered the highest. Level in this case is considered to be a reflection of the monetary value of the aid offered.

The data presented in Table 11-14 show that in the case of water supply, temporary housing recipients show a higher proportion of people with modern water supplies at all time periods. It furthermore shows that people associated with permanent housing started out with the lowest proportion in the modern category, but ended up second after temporary housing people. The group which improved least are those who were associated with lamina programs. These data are illustrated graphically in Figure 11-1.

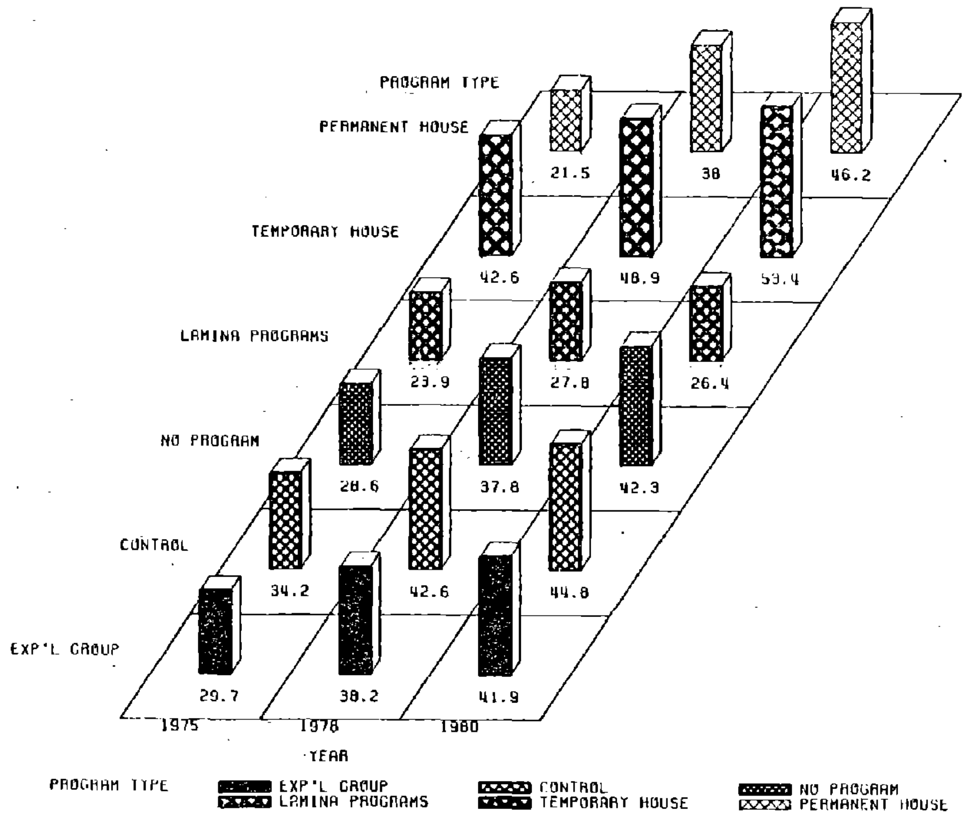
When the percentage change column is examined it becomes apparent that the greatest change took place in the permanent housing category which improved by 114.9 percent in the four years after the earthquake. Next came people who were associated with no organized housing program who improved by 47.9 percent. Lamina program and temporary housing program households improved 10.5 and 25.4 percent respectively. These figures show that being associated with a permanent housing program was definitely associated with the greatest improvement in water supply and being associated with no program at all came next.

With respect to lighting, the lamina program people made the greatest percentage improvements (66.8 percent) and the temporary housing

FIGURE 11-1

PROGRAM TYPE & MODERNIZATION
PER CENT WITH MODERN WATER

BLOCK CHART OF WATER

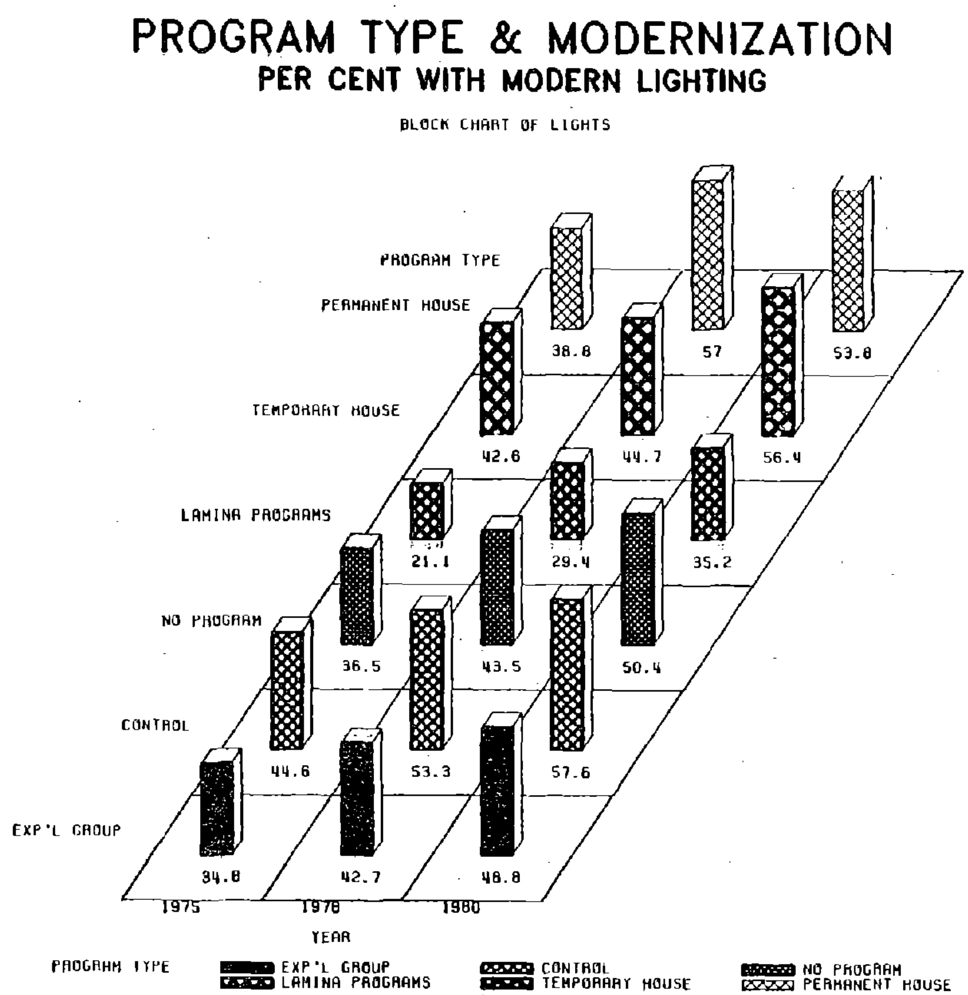


people made the least (32.4 percent). The other two groups, permanent housing (38.7 percent) and no program (38.4 percent) were about equal. (See Figure 11-2.) On sewage, the permanent house group again showed the greatest percentage improvement (80.2 percent), but this time the temporary house group was second (12.2 percent), the lamina program group third (4.9 percent), and the no program people last (-0.5 percent), actually registering a slight decrease. (See Figure 11-3.)

How are these data to be interpreted? They show that in the case of two modern services, water and electricity, program type is definitely associated with significant differences at each time period, but which program type is associated with the highest degree of modernization depends on the service being considered. In all cases, however, the relationship is positive. This means that higher modernization is associated with the programs which offered housing assistance with the higher dollar values, that is, temporary and permanent housing programs.

The data on urban services in 1975 are particularly interesting. They show that there were systematic pre-earthquake differences between the groups who were later served by various types of programs, in their possession of modern services. In general, the group which eventually received temporary houses was the most modern before the earthquake and those who only received lamina were the least modern. The permanent housing group and the no program group were very similar and in the middle. These differences are probably the result of the association of program type with type of community on the one hand and the association of type of community and modernization on the other. Temporary housing programs in this sample were concentrated in the departmental capitals

FIGURE 11-2

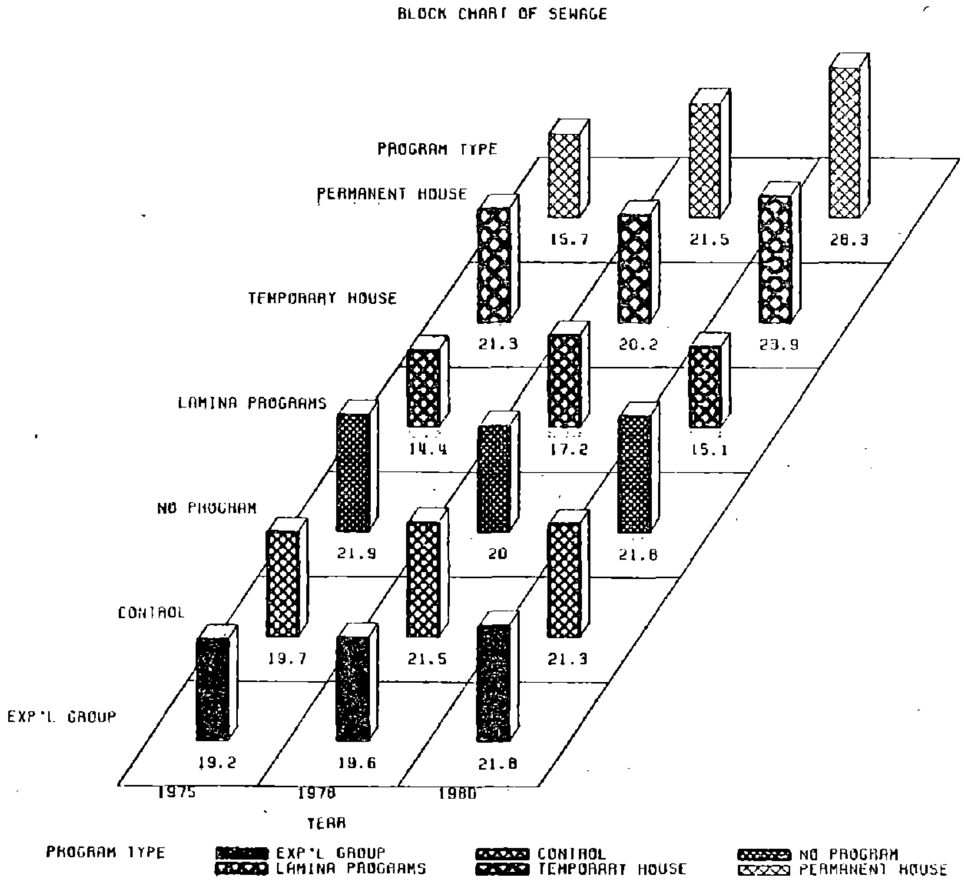


541

FIGURE 11-3

PROGRAM TYPE & MODERNIZATION

PER CENT WITH MODERN SEWAGE



of El Progreso and Chimaltenango,while lamina programs were more likely to be found in smaller places and permanent agency house building projects in the municipios. Those not affected by programs came from all units. Table 11-15 shows this relationship.

Modernized services were quite naturally distributed according to type of community, as shown in Table 11-16. As a consequence of these two relationships there was an association between program type and modernization at the beginning of the reconstruction process.

Table 11-16

Percent with Modern Urban Services Classified by Community Type

Type of Community	Percent with Modern Water	Percent with Electricity	Percent with Modern Sewage
Department Capitals	59.5	53.6	33.8
Municipios	21.9	34.7	16.0
Aldeas	10.2	11.4	8.0
Total	29.7	34.8	19.2
Chi Square	137.824	77.174	47.531
Probability	0.0001	0.0001	0.0001
Phi	0.414	0.310	0.243

For example, temporary housing programs were concentrated in the department capitals where modernization was already high, and lamina programs tended to be found in the smaller places where it was low. In every

Table 11-15

Program Types Cross Classified by Community Types

	Housing Program Types									
	No Housing Program		Lamina Program		Temporary Housing		Permanent Housing		Total All Types	
Type of Community	No.	%	No.	%	No.	%	No.	%	No.	%
Departmental Capital	78	35.1	33	14.9	104	46.8	7	3.2	222	100.0
Municipio	196	48.3	68	16.8	35	8.6	107	26.4	406	100.0
Aldea	41	23.3	79	44.9	49	27.8	7	4.0	176	100.0
Total	315	39.2	180	22.4	188	23.4	121	15.0	804	100.0

Chi Square = 233.302
Probability = 0.0001
Phi = 0.538

community there were people who did not receive any housing aid and therefore fell into the "no program" category. As will be seen later in this chapter, these people tended to come from the lowest and the highest socioeconomic groups in their communities. Organized housing programs tended to serve the middle group in the Highlands, and the upper group in the East.

The amount of change observed in urban services for households in the experimental group after the earthquake can be seen as a function of program type, but in interpreting the differences between programs it is necessary to keep constantly in mind the fact that there were different starting points for change for each program, and in addition to this, there were different community contexts operating on each program type throughout the process of reconstruction.

Changes and Differences in House and Site Tenure

It is important to compare agency and non-agency house occupants on home ownership and on ownership of housing sites in order to see how much agency programs changed the economic circumstances of families. Tables 11-10 and 11-17 contain data relevant to this subject. These two tabulations reveal the following facts.

First, Table 11-10 shows that agency house recipients and those who did not receive agency houses were alike in both house and site tenure before the earthquake. Although there is a small difference in favor of agency house people in ownership of the site itself (73.9 as compared to 71.8 percent), the difference is not significant. During the next two years a gap opened between agency and non-agency house people and a

Table 11-17

Changes in the Ownership of Houses and Housing Sites, 1975-1980

1975-1978

Sample Group	Change Category: Declined (-1) %	No Change (0) %	Improved (+1) %	Total No.	Total %	Mean	Net % Impr.
Site Ownership							
Non-agency	3.5	87.8	8.7	482	100.0	.052	5.2
Agency	3.1	82.6	14.3	322	100.0	.112	11.2
Total	3.4	85.7	11.0	804	100.0	.076	7.6
	Chi Square = 6.175						
	Probability = 0.0456						
	Phi = 0.088						
	T = -2.186						
	Prob. = 0.0292						
House Ownership							
Non-agency	2.3	84.2	13.5	482	100.0	.112	11.2
Agency	0.9	79.8	19.3	322	100.0	.183	18.3
Total	1.7	82.5	15.8	804	100.0	.141	14.1
	Chi Square = 6.546						
	Probability = 0.0379						
	Phi = 0.090						
	T = -2.514						
	Prob. = 0.0121						

1978-1980

Sample Group	Change Category: Declined (-1) %	No Change (0) %	Improved (+1) %	Total No.	Total %	Mean	Net % Impr.
Site Ownership							
Non-agency	0.5	95.7	3.8	395	100.0	.033	3.3
Agency	1.1	97.5	1.4	281	100.0	.004	0.3
Total	0.7	96.5	2.8	676	100.0	.021	2.1
	Chi Square = 4.048						
	Probability = 0.1321						
	Phi = 0.077						
	T = 2.100						
	Prob. = 0.0361						
House Ownership							
Non-agency	1.5	96.7	1.8	395	100.0	.003	0.3
Agency	2.1	97.5	0.4	281	100.0	-.018	-1.8
Total	1.8	97.0	1.2	676	100.0	-.060	-6.0
	Chi Square = 3.145						
	Probability = 0.2075						
	Phi = 0.068						
	T = 1.553						
	Prob. = 0.1210						

1975-1980

Sample Group	Change Category: Declined (-1) %	No Change (0) %	Improved (+1) %	Total No.	Total %	Mean	Net % Impr.
Site Ownership							
Non-agency	2.5	86.1	11.4	395	100.0	.089	8.9
Agency	3.2	81.5	15.3	281	100.0	.121	12.1
Total	2.8	84.2	13.0	676	100.0	.102	10.2
	Chi Square = 2.601						
	Probability = 0.2724						
	Phi = 0.062						
	T = -1.055						
	Prob. = 0.2918						
House Ownership							
Non-agency	1.5	84.8	13.7	395	100.0	.122	12.2
Agency	1.1	80.4	18.5	281	100.0	.174	17.4
Total	1.3	83.0	15.7	676	100.0	.143	14.4
	Chi Square = 3.079						
	Probability = 0.2145						
	Phi = 0.067						
	T = -1.753						
	Prob. = 0.0801						

significant difference emerged. This resulted in 85.1 percent site ownership for agency house people and 77.0 percent ownership for non-agency house residents in 1978, as shown in the detailed tabulations given in Table 11-9. A similar, but slightly smaller, difference is found in house ownership at that time.

In the next time period however (1978-1980), the non-agency house group achieved a greater improvement than the agency house group and they were no longer different statistically. The figures given in Table 11-17 show declines and improvements in site and house tenure and also give means, Chi Squares and "t" tests for each service at each time period. These figures show that there was a greater volume of change for the agency house group during the 1975-1978 time period. In short, more households either declined or improved and fewer remained the same. In the case of site tenure, the agency house group gained a statistically significantly greater amount, (11.2 percent as compared to 5.2 percent). A similar result is obtained for house tenure where the agency house group gained 18.3 percent as compared to 11.2 percent for the non-agency group.

During the next time interval there is no significant difference in the volume of change between the groups but the non-agency group gained significantly more in site tenure and about the same amount in house tenure. The difference in gain in site tenure between the two groups, although statistically significant, is quite small (3.0 percent for the non-agency group and 0.3 percent for the agency group).

During the four year time period between the end of 1975 and 1980, the two groups turn out to be equal both in the volume of change as measured by both improvements and declines, and tested by Chi Square, and in the amount of net improvement as measured by the means and "t" tests. In other words, the two groups started out alike in site and house tenure and ended up alike four years later. In between, however, temporary differences had emerged during the first two years following the disaster when it seemed that agency house recipients were forging ahead of those who did not receive this kind of assistance. When the figures in Table 11-10 are examined, it will appear that the agency house group actually gained more in the four year period but statistical tests indicate that the observed difference is not statistically significant.

Again it is necessary to contrast these changes to those occurring in the control group before a judgement can be made as to whether they are related to earthquake reconstruction in the experimental group area. Table 11-18 gives such a comparison. It shows that there were differences between the control and experimental group at all points in time on both site and house tenure,with the experimental group showing more ownership of both houses and housing sites. However, when the two groups are compared with respect to the percentage changes which occurred after the earthquake, they are similar. The experimental group improved 10.7 percent in site tenure as compared to 10.0 percent for the control group, a difference of only 0.7 percent in absolute improvement, and it improved 15.3 percent on house ownership as compared to 13.2 for the control group, a 2.1 percent difference in the amount of change.

These figures for both groups reveal a rather large and rapid improvement in home ownership during the four year period between the earthquake and 1980. The percentage change in site ownership for the

Table 11-18

Changes in Site and House Tenure for Experimental and Control Groups Between 1975 and 1980

	1975				1978				1980				Total Dif.1975-1980		% Change	
	Control Group		Experimental Gp.		Control Group		Experimental Gp.		Control Group		Experimental		Control	Exper.	Control	Exper.
Owned Housing Site	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%				
No	204	35.6	220	27.4	176	30.7	159	19.8	129	25.6	112	16.7	-10.0	-10.7	-15.5	-14.7
Yes	369	64.4	584	72.6	397	69.3	645	80.2	375	74.4	563	83.3	+10.0	+10.7	+15.5	+14.7
Total	573	100.0	804	100.0	573	100.0	804	100.0	504	100.0	675	100.0	-	-	-	-
	Chi Square = 10.657				Chi Square = 21.532				Chi Square = 13.815							
	Prob. = 0.0011				Prob. = 0.0001				Prob. = 0.0002							
	Phi = 0.088				Phi = 0.125				Phi = 0.108							
Owned House																
No	158	27.5	170	21.1	109	19.0	57	7.1	72	14.3	39	5.8	-13.2	-15.3	-18.2	-19.4
Yes	415	72.5	634	78.9	464	81.0	747	92.9	432	85.7	637	94.2	+13.2	+15.3	+18.2	+19.4
Total	573	100.0	804	100.0	573	100.0	804	100.0	504	100.0	676	100.0	-	-	-	-
	Chi Square = 7.491				Chi Square = 44.577				Chi Square = 24.613							
	Prob. = 0.0062				Prob. = 0.0001				Prob. = 0.0001							
	Phi = 0.074				Phi = 0.180				Phi = 0.144							

control and experimental groups combined was 10.3 percent in four years. This is especially large considering the fact that the improvement came on top of an already relatively high base of around 70 percent. In ownership of houses, the percentage of absolute improvement for the two groups combined was 14.4 percent, starting from an even higher base of 76.2 percent. This amounts to a rather remarkable 18.9 percentage increase in house ownership. These figures demonstrate a strong trend toward improved socioeconomic status at the household level in Guatemala in general during the four year period following the disaster. This trend may well be the result of the infusion of money into the economy following the earthquake in both groups. The slightly higher rate of change in the experimental group suggests, however, that reconstruction efforts may have strengthened this trend in that region beyond the trend observed in the control group. The difference, however, is too small to be statistically significant, given the size of the sample.

Comparison of Program Types and Tenure

When site and house tenancy are classified by housing program types and by time periods, the results in Table 11-19 are obtained. These results show the relative impact of different types of housing programs on house and site tenure. In the pre-earthquake period there was no significant difference between program types with respect to either site or house tenure. Two years later, after housing programs had time to operate, a significant difference between program types emerged on both house and site tenure. The difference is in the direction indicating that the more aid a household received, the more tenure status improved. The

Table 11-19

Changes in the Ownership of Houses and House Types, 1975 to 1980
Classified by Program Type

House Site

Program Type	1975 Not Owned No.	%	1975 Owned No.	%	1975 Total No.	%	1978 Not Owned No.	%	1978 Owned No.	%	1978 Total No.	%	1980 Not Owned No.	%	1980 Owned No.	%	1980 Total No.	%	Total 1975-1980 % Difference	% Change
No Program	88	27.9	227	72.1	315	100.0	77	24.4	238	75.6	315	100.0	45	18.2	203	81.8	248	100.0	+ 9.7	13.5
Lamina Program	52	28.9	128	71.1	180	100.0	36	20.0	144	80.0	180	100.0	30	18.9	129	81.1	159	100.0	+10.0	14.1
Temporary House	55	29.3	133	70.7	188	100.0	36	19.2	152	80.8	188	100.0	30	18.4	133	81.6	163	100.0	+10.9	15.4
Permanent House	25	20.7	96	79.3	121	100.0	10	8.3	111	91.7	121	100.0	8	7.6	98	92.4	106	100.0	+13.1	16.5
Total	220	27.4	584	72.6	804	100.0	159	19.8	645	80.2	804	100.0	113	16.7	563	83.3	676	100.0	+10.8	14.9

	1975	1978	1980
Chi Square	= 3.336	= 14.486	= 7.628
Probability	= 0.3427	= 0.0023	= 0.0544
Phi	= 0.064	= 0.134	= 0.106

House Tenure*

Program Type	1975 Not Owned No.	%	1975 Owned No.	%	1975 Total No.	%	1978 Not Owned No.	%	1978 Owned No.	%	1978 Total No.	%	1980 Not Owned No.	%	1980 Owned No.	%	1980 Total No.	%	Total 1975-1980 % Difference	% Change
No Program	67	21.3	248	78.7	315	100.0	44	14.0	271	86.0	315	100.0	22	8.9	226	91.1	248	100.0	+12.4	15.8
Lamina Program	38	21.1	142	78.9	180	100.0	4	2.2	176	97.8	180	100.0	7	4.4	152	95.6	159	100.0	+16.7	21.2
Temporary House	46	24.5	142	75.5	188	100.0	7	3.7	181	96.3	188	100.0	9	5.5	154	94.5	163	100.0	+19.0	25.2
Permanent House	19	15.7	102	84.3	121	100.0	2	1.6	119	98.4	121	100.0	1	0.9	105	99.1	106	100.0	+14.8	17.6
Total	170	21.1	634	78.9	804	100.0	57	7.1	747	92.9	804	100.0	39	5.8	637	94.2	676	100.0	+15.3	19.4

* Only tenure of principal house was known in 1975. For 1978 or 1980, if household owned either the principal or secondary house they were counted as an owner. This only shifted four cases to the owned category from what would have been the case if principal house ownership was used.

	1975	1978	1980
Chi Square	= 3.398	= 37.765	= 9.494
Probability	= 0.3343	= 0.0001	= 0.0234
Phi	= 0.065	= 0.217	= 0.119

lowest ownership percentage is associated with the no-program group and the highest with those who received permanent houses. This improvement is also greater with respect to houses than to house sites. These data are illustrated in Figures 11-4 and 11-5.

When percentage change is considered, a slightly different picture emerges on site tenure. The least change is registered by the "no program" group and the most by the permanent housing group, but the difference is only 3.0 percent. When house tenure is considered, the greatest percentage change occurred in the temporary house group (25.2 percent) and the least in the no-program group (15.8 percent). The permanent housing group, however, made only 17.6 percentage improvement, just slightly above the no-program group. The reason for this is that this group started from a higher base of 84.3 percent and added 14.8 percent house ownership, while the temporary housing group began with 75.5 percent ownership and added 19.0 percent to its base, thus achieving a much higher percentage change. When figures on gain and loss, such as those given earlier for modern services and for tenure in comparisons between the agency and non-agency houses are obtained for each program type and the mean improvements are compared between each pair of program types, the following results are obtained. During the four year period between the end of 1975 and 1980, there are no differences in the amount of net improvement in site tenure between any pair of program types. With respect to house tenure, the results show that both permanent and temporary housing programs resulted in greater net improvement in house ownership than the "no program" group. Otherwise the groups are alike in net improvement.

FIGURE 11-4

PROGRAM TYPE & MODERNIZATION
PER CENT OWNING SITE

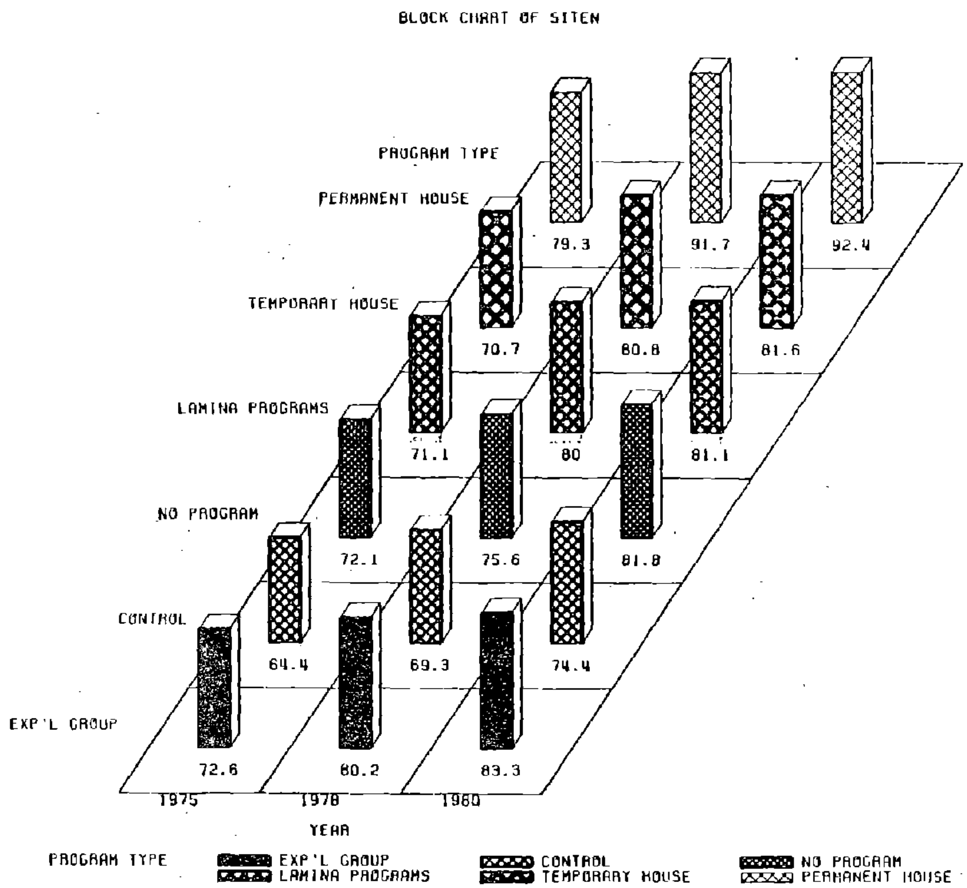
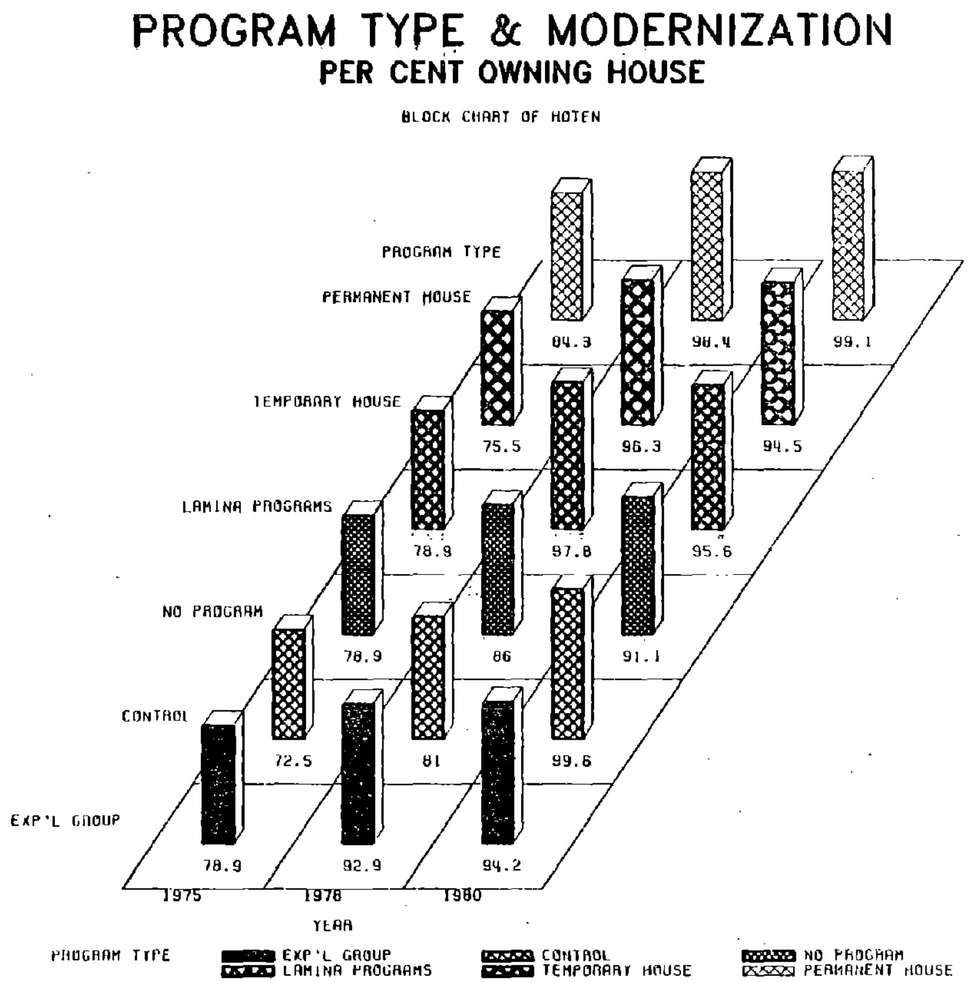


FIGURE 11-5



PROGRAM TYPE & MODERNIZATION
PER CENT OWNING HOUSE
BLOCK CHART OF HOTEN
PROGRAM TYPE
PERMANENT HOUSE
TEMPORARY HOUSE
LAMINA PROGRAMS
NO PROGRAM
CONTROL
EXP'L GROUP
84.3
98.4
99.1
75.5
96.3
94.5
78.9
97.8
95.6
78.9
86
91.1
72.5
81
99.6
78.9
92.9
94.2
1975
1978
1980
YEAR
PROGRAM TYPE
EXP'L GROUP
LAMINA PROGRAMS
CONTROL
TEMPORARY HOUSE
NO PROGRAM
PERMANENT HOUSE

These figures also indicate that both permanent and temporary housing programs were likely to supply houses to people who did not already own houses. However, the temporary housing programs were more likely than permanent housing programs to do so. As a matter of fact they were 7.6 percent more likely to do so. The people who were not associated with any program improved the least during this time period.

It will be recalled that the control group improved by 15.5 percent in site tenure, and 18.2 percent in house tenure over this same four year period. Now it is seen that people who received no aid in housing improved 13.5 percent in site tenure and 15.8 percent in house tenure, a slightly smaller amount than in the control group. The difference, however, is not statistically different. This seems to indicate that the greater improvement of other program types in both site and house tenure is due to program inputs, or to the selection of households for participation in such a manner that they differed in resources related to tenure improvement. Later, when the question of how programs matched their distribution of assistance to need is examined, this question of differential selection of households for participation will be given a thorough look. For the present it is reasonable to conclude at least tentatively that program type affected improvements in tenure and the greatest improvements occurred for temporary house people, and next came permanent house occupants.

Changes in House Value: Agency Houses

During the course of this study data were obtained to allow an estimate of the monetary value of houses and household equipment and facilities. These data make it possible to estimate the value of each house occupied by each respondent at each time period. The estimates are based on figures obtained from Guatemalan architects who supplied cost figures for building a standard sized one or two room structure, 4 x 5 meters, using each type of building material.

For example, these figures tell what it would cost in 1978 prices to build adobe walls, or walls of block or wood, or to put up a lamina roof or a tile one. Figures are available for the cost of walls, roofs and floors as well as other housing features. A house value was computed for each house by adding together the cost of the walls, roof and floor and then by increasing the value for each additional room above two by a factor of .25. The resultant figure is only an estimate of the value of a house measured by estimated construction costs towards the end of the reconstruction process. For each time period the same values are used for a house constructed of the same materials and of equal size. No attempt was made to inflate values according to rising prices but instead, to hold inflation constant by using a constant value for a given type of house. There are obvious weaknesses in this procedure and actual estimates of market value made by an expert assessor would be superior. Such data were not available, however, and this procedure supplies the only feasible substitute. The estimates are probably fairly good when dealing with averages for house types with a high frequency, although in individual cases they are not necessarily as accurate.

Tables 11-20 and 11-21 present figures on house value for agency and non-agency houses for three time periods for each house type discussed earlier. These figures are to be interpreted as the mean dollar value of houses occupied by households at the three time periods indicated.

Table 11-20

Principal House Values Before and After the Earthquake For Agency House Recipients Showing Gain and Loss Between 1975 and 1980

	N	1975 House Value	N	1978 House Value	N	1980 House Value	Gain 1975-78	Gain 1975-80	Gain 1978-80
Adobe - Tile	0	-	-	-	-	-	-	-	-
Adobe - Lamina Duralita	5	928	5	939	5	1032	+11	+104	+93
Wood - Lamina Duralita	172	982	172	367	147	601	-615	-381	+234
Block - Lamina Duralita	85	975	85	1742	73	1623	+767	+648	-119
Bajareque - Thatch	0	-	-	-	-	-	-	-	-
Bajareque - Tile	0	-	-	-	-	-	-	-	-
Cane - Thatch	0	-	-	-	-	-	-	-	-
Cane - Lamina Duralita	0	-	-	-	-	-	-	-	-
Patchwork - Any Roof	1	1575	1	475	1	475	-1100	-1100	0
Half Block or Adobe - Lamina Duralita	19	924	19	1157	18	1463	+233	+539	+306
Other	5	675	5	872	5	1105	+197	+430	+233
Total	287	972	287	846	249	981	-126	+ 9	+135

Table 11-21

Principal House Values Before and After the Earthquake For Non-agency House Residents Showing Gain and Loss Between 1975 and 1980

	N	1975 House Value	N	1978 House Value	N	1980 House Value	Gain 1975-78	Gain 1975-80	Gain 1978-80
Adobe - Tile	54	920	54	919	45	999	- 1	+ 79	+ 80
Adobe - Lamina Duralita	31	1013	31	957	21	1043	- 56	+ 30	+ 86
Wood - Lamina Duralita	64	1065	64	391	52	761	-674	-304	+370
Block - Lamina Duralita	82	1444	82	1934	63	2044	+490	+600	+110
Bajareque - Thatch	11	497	11	369	10	373	-128	-124	+ 4
Bajareque - Tile	16	662	16	551	14	753	-111	+ 91	+202
Cane - Thatch	17	427	17	101	16	306	-326	-121	+205
Cane - Lamina Duralita	57	789	57	262	52	410	-527	-379	+148
Patchwork - Any Roof	65	928	65	240	55	574	-688	-354	+334
Half Block or Adobe-Lamina Duralita	121	1067	121	862	103	1075	-205	+ 8	+213
Other	73	950	73	764	62	1015	-186	+ 65	+251
Total	591	1007	1084	792	493	976	-215	- 31	+184

It is important to note, however, that households are classified in terms of the type of house they were occupying in 1978 two years after the earthquake, and only one house is counted in the agency and non-agency group for each household where multiple houses exist. This was done in order to separate people who occupied an agency structure in 1978 from those who did not and to look at the relative value of their pre-earthquake houses and the houses they occupied two years later in 1980.

These tables reveal that the average 1978 agency house was valued at $846 as compared to $792 for non-agency houses. This small difference of $54 in house value indicates that non-agency houses were about six percent less valuable than agency houses, not enough difference to warrant a conclusion that agency house recipients, on an average, were that much better off than others. This is especially true when the figures on difference in value between 1975 and 1980 are examined. These figures show that agency house occupants gained $9.00 in house value on an average over their pre-earthquake houses, while non-agency house occupants lost $31, not a particularly dramatic difference.

There are, however, substantial differences between house types that need close examination. For example, the house value for wood and lamina structures built by agencies was estimated to be $367 on an average in 1978, while the value of block and lamina or duralita structures was estimated at $1742. These two types make up the majority of agency houses and therefore deserve close scrutiny.

The figures given for 1975 estimate the average value of houses occupied by people before the earthquake in the house type category, determined by the houses they occupied in 1978. For example, 172 households lived in wood and lamina houses supplied principally by The Red Cross in 1978. These people could have lived in any type of house before the earthquake. The value of whatever house they occupied is used to arrive at the average for this category in 1975. Most, as earlier data indicate, lived in adobe structures. The pre-earthquake average house value for 1978 wood and lamina house occupants was $982. This means that their post-earthquake 1978 agency house was worth $615 less than their pre-earthquake houses on an average. In contrast, the 85 households living in block and lamina or duralita houses in 1978 gained $767 since their pre-earthquake houses were worth an average of $975, and their post-earthquake 1978 agency houses were worth $1742. By 1980 the wood and lamina people had gained $234 in house value and were now only $381 less well off than they had been before the earthquake. The block and lamina households had actually lost $119 in house value between 1978 and 1980 and now were only $648 better off than before the earthquake.

It is important to realize how these 1978 to 1980 changes could have taken place. This table deals only with occupied houses and a given household may occupy both an agency and a non-agency house, and therefore be included twice in the table. Between 1978 and 1980, 222 households dropped out of the sample. If those who dropped out of the sample occupied more valuable houses on an average than those who remained in, the average house value for the category they came from would decline. Obviously this could work in the opposite direction also. A second way house value could change would be by adding rooms to the house or by taking rooms off or by changing the floor, walls or roof of the house. The reduction in the value of houses occupied by block and lamina agency house dwellers in 1978-1980 is due either to differential drop out rates or to households moving from one house to another between 1978 and 1980, rather than to decrease in the value of particular houses.

The only other category of agency houses with enough cases to make anywhere near a reliable estimate of house value is the one including houses made of half and half adobe or block with lamina or duralita roofs. It will be seen that such households lived in houses worth an average of $924 before the earthquake, $1157 in 1978, and $1463 in 1980. They gained $539 in house value, an increase of 58.3 percent as compared to a 66.5 percent increase in house value over the four year period for block and lamina house people and a loss of 38.8 percent for the wood and lamina house occupants of 1978.

It is quite obvious that how a family fared in post-earthquake housing was a matter of which type of agency program they were associated with. Those who received Red Cross temporary houses made of wood and lamina had not recovered in house value by 1980,but those who received block and lamina houses, or those who received half and half houses, more than recovered. They actually improved their housing position, if the value of the house they occupied is considered.

There is another problem to consider, however. That is the problem of ownership and indebtedness. This will be discussed after the value of non-agency houses has been explored and after differences in program type have been considered.

Non-agency House Value

Non-agency house values similar to those given for agency houses appear in Table 11-21. The first point that needs to be noted is the fact that in every housing category upon which a comparison can be made except "patchwork," pre-earthquake house values were higher for the non-agency house group than for the agency house group. On an average, however, the two groups are very similar with respect to the values of their pre-earthquake dwellings ($972 for agency house residents and $1007 for non-agency house residents). As noted earlier, a lot more non-agency house residents lived in houses made of traditional less expensive materials such as bajareque, or cane and plam. It is these houses that bring the average non-agency house value down to an amount close to that for agency houses. If only wood and lamina, block and lamina and half and half houses are considered, the types which predominate in the agency house category, non-agency house occupants, register a higher pre-earthquake house value of $1182 as compared to $976. This means that the value of non-agency house people's pre-earthquake house, for comparable categories of houses was about 21 percent higher than those of agency house residents. This appears to mean that agency houses were distributed to people who were slightly poorer than those who provided their own houses of a comparable sort. It must be remembered, however, that a substantial number of non-agency house recipients were even poorer and lived in houses with low house values. Given these facts, it appears that agency housing programs reached the middle socio-economic group while non-agency houses were more common in the upper and lower groups as measured by house value. More evidence of this trend will be presented later.

Table 11-21 shows that non-agency house people who provided themselves with wood and lamina houses after the earthquake had an average house value of $391 in 1978, $674 lower than their pre-earthquake house value. By 1980, their value had risen to $761 so that they now remained only $304 behind their pre-earthquake status. This is comparable to the similar figures for wood and lamina agency houses and similar change figures are observed. Further examination of the table will show that those who built block and lamina or duralita houses for themselves had lived in the most expensive houses before the earthquake ($1444 average value) and ended up four years later with the highest house value of any group, either agency or non-agency ($2044). The group living in the least valuable houses before the earthquake were those who occupied cane, palm or pole houses with thatch roofs after the earthquake. Their pre-earthquake house value averaged only $427 and their 1978 post-earthquake self-provided houses were worth only $101. They also remained the lowest group four years after the earthquake.

In general this table shows that there was a direct relationship between the pre-earthquake house value, and the value of the post-earthquake house constructed by or for non-agency house people. This is of course what would be expected since house construction depended upon a household's own resources rather than upon agency aid, except for the small amount of help in the form of lamina distribution. Lamina distribution programs could add no more than $50 to the value of a house.

If the house values of households before the earthquake are correlated against their post-earthquake house values, an estimate of how closely reconstruction reproduced the pre-earthquake housing situation can be obtained. This was done for the whole experimental group sample and for the agency and non-agency house sample separately,using zero order correlations. The results are as follows:

Table 11-22

Correlations Between Pre and Post-earthquake Principal House Values for Agency Recipients and Non-recipients

Samples and Time Periods	No.	Correlation Coefficient	Probability Greater Than Zero
Total Sample			
1975-1978	804	0.4472	0.0001
1975-1980	676	0.4806	0.0001
Received Agency House			
1975-1978	325	0.2616	0.0001
1975-1980	285	0.3299	0.0001
Did Not Receive Agency House			
1975-1978	479	0.5674	0.0001
1975-1980	391	0.5852	0.0001

First,it is apparent that there is a positive relationship between the value of the pre-earthquake houses occupied as principal houses by the whole experimental group sample and those they occupied after the earthquake at both 1978 and 1980. This is reflected by the moderately high correlations of .4472 and .4806 for these periods. In other words, there was a tendency for people with relatively expensive houses before the earthquake to occupy relatively expensive ones after and for those with low cost houses to do the same. The relationship is far from perfect, however, indicating considerable shift in relative house values after the earthquake.

When people who received agency houses and those who did not are used as separate samples and these same correlations run, considerable difference emerges in this relationship. The correlations are much higher for the non-agency house group than for the agency house category.

Both, however, are positive and significantly different than zero, indicating that there was a relationship between pre and post-earthquake house value at both time periods for both groups. It is apparent, however, that when people built their own houses, or hired someone to do so, as was the case in the non-agency house group, there was greater correspondence in pre and post-earthquake house values than when agencies supplied the post-earthquake house.

This means that agencies were much more likely to supply a high value post-earthquake house to households with a low value pre-earthquake house, or to supply a low value post-earthquake house to a household with a high value pre-earthquake house, than was the case when people built their own houses. In short, agency housing programs produced a good bit of shifting in relative house value among households after the earthquake as compared to what happened when people built their own houses.

Changes in House Value and Program Type

In evaluating housing programs, the question arises, "How did different types of housing programs affect the value of the houses disaster victims eventually occupied after the earthquake?" Did all programs yield the same benefit to disaster victims or were there significant differences among them? Table 11-23 presents data related to these questions by classifying house value for the principal house occupied by each household at four time periods by the type of housing program the household was associated with during reconstruction. The figures given in the table are dollar values for principal houses computed on the basis discussed earlier. These data are illustrated graphically in Figure 11-6.

It is important to realize that although households are classified according to what type of program they were associated with, the principal house can be either an agency or a non-agency house, even when a household received a house from an agency. This is because the principal house is defined as the house the household head sleeps in. If the family has an agency house and it is not used as the principal house, its value will not be included in these tables. The data therefore measure how much a household benefitted in the value of their principal house, by being associated with a certain type of housing program, regardless of how the agency house is used. In most cases the agency house is used as the principal house and therefore these values come close to representing the values of those houses for the agency house groups.

The first thing to be noted about the figures in Table 11-23 is the fact that pre-earthquake principal house values were nearly equal for the various groups. Table 11-24 presents the results of statistical tests run between mean house values for each pair of program types for each time period and will help in interpreting differences found in this table.

Table 11-23

Comparison of Program Types in Terms of House Values for the Principal House at Various Time Periods

Program Type	Pre-earthquake 1975			Value Day After Earthquake, Feb. 1976			House Value 1978			House Value 1980			Gain or Loss		% Lost	% Re-covered	% Re-covered
	N	Mean	St.Dev.	N	Mean	St.Dev.	N	Mean	St.Dev.	N	Mean	St.Dev.	1975-78	1975-80	1975-76	1978	1980
No Program (1)	315	1038	613	315	434	640	315	856	742	248	1022	875	-182	- 16	-58.2	82.5	98.5
Lamina Program (2)	180	904	380	180	275	312	180	691	566	159	849	688	-213	- 55	-69.6	76.4	93.9
Temporary House (3)	188	986	506	188	172	388	188	486	484	163	660	707	-500	-326	-82.6	49.3	66.9
Permanent House (4)	121	1007	340	121	207	248	121	1410	583	106	1554	597	+403	+547	-79.4	140.0	154.3
Total Experimental	804	991	509	804	303	488	804	816	689	676	977	805	-175	- 14	-69.4	82.3	98.6

FIGURE 11-6

DAMAGE & RECOVERY
MEASURED BY PRINCIPAL HOUSE VALUE

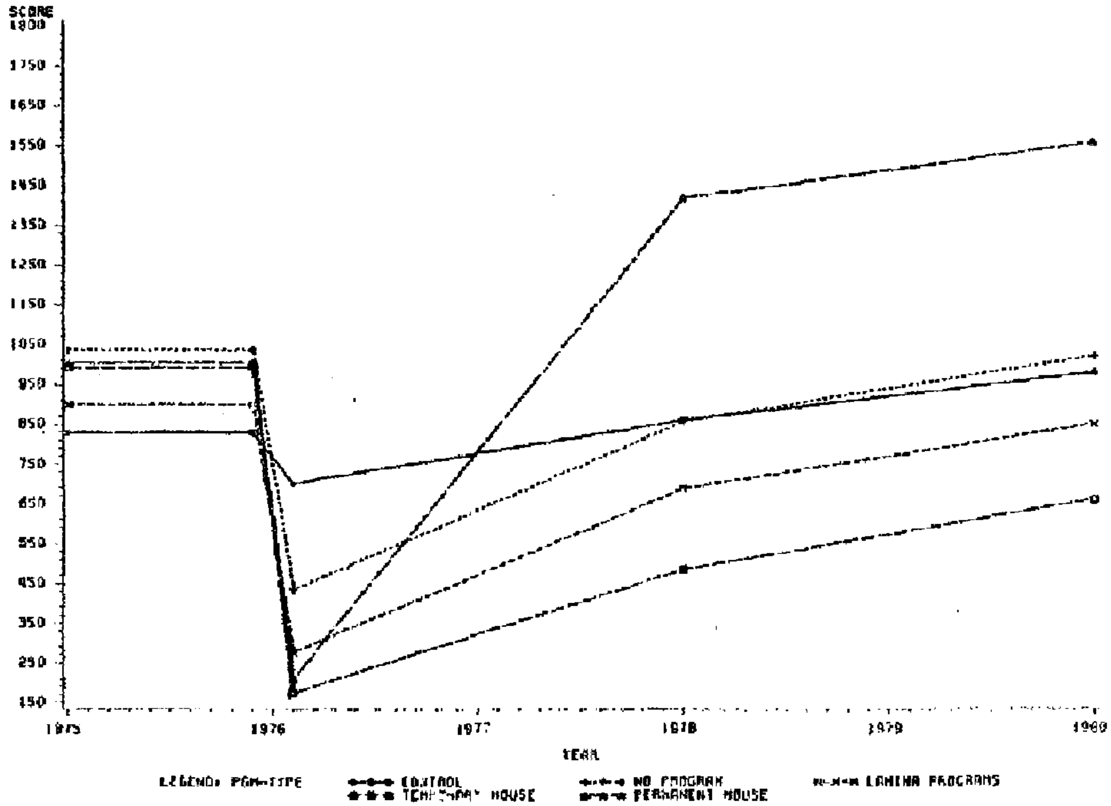


Table 11-24

Probabilities That Observed Differences Could Have Occurred by Chance Computed for T Tests Between Means for House Value at Four Time Periods

	Pre-earthquake 1975				Right After Earthquake 1976				Earthquake +2, 1978				Earthquake +4, 1980			
	No Program	Lamina	Temp.	Perm.	No Program	Lamina	Temp.	Perm.	No Program	Lamina	Temp.	Perm.	No Program	Lamina	Temp.	Perm.
		T_1				T_2				T_3				T_5		
	(1)	(2)	(3)	(4)												
No Program (1)	–	.0029	.3016	.5057	–	.0002	.0001	.0001	–	.0056	.0001	.0001	–	.0266	.0001	.0001
Lamina (2)		–	.0809	.0148		–	.0051	.0355		–	.0002	.0001		–	.0156	.0001
Temporary (3)			–	.6371			–	.3348			–	.0001			–	.0001
Permanent (4)				–				–				–				–

It shows that only two significant differences occurred. The first was between the value of pre-earthquake houses occupied by "no program" households and households who participated in "lamina programs." The difference of $134 is statistically significant. These two groups represent the extremes in the distribution of housing value in the pre-earthquake period. Before the earthquake, the "no program" people lived in the most valuable houses on an average, and the people who eventually received lamina lived in the least valuable ones. The second significant difference is between those who received lamina and those who received permanent houses. Here the difference of $103 is also significant. This also indicates that the permanent house group ranked second in the value of their pre-earthquake houses but were not statistically different from either the no program group or the temporary house group.

It is interesting that "no program" households and those receiving temporary housing or permanent housing display no pre-earthquake difference in housing value. They were only a few dollars apart on the average before the earthquake. What will become apparent by examining the table is the fact that by four years after the earthquake, large significant differences had emerged between these groups in the values of their principal houses. Table 11-24, for example, shows that for the last time period, 1980, every program type is significantly different in house value from every other one. Whereas the range of average house values was from $904 to $1038, a difference of $134 in the pre-earthquake period, the range in 1980 was from $660 to $1554, a difference of $894,which is 6.7 times as great as the pre-earthquake difference.

This table also shows the value of houses occupied by disaster victims after they have been depreciated for earthquake damage. These are the figures given for 1976. They are derived by reducing the pre-earthquake house value by the proportion of damage suffered. They therefore give an estimate of the monetary impact of the earthquake on housing. They show, for example, that on an average for all groups taken together, house value was reduced from $991 to $303 by the earthquake, a loss of 69.4 percent.

The households associated with different programs suffered different amounts of loss. Table 11-25 shows, for example, that people who received temporary houses suffered the greatest loss, 82.4 percent of their average pre-earthquake house value, and those who received "no housing" suffered the least, 58.2 percent on an average. If Table 11-24 is consulted, it will be seen that there were significant differences in average house values after loss between all pairs of groups except the permanent and temporary house groups, both of whom have high losses recorded in Table 11-25.

Table 11-25

Percentage Differences in House Values for the Principal House Between Various Time Periods

Program Type	Percent Loss 1975-1976	Percent Re-covered 1978	Percent Re-covered 1980	Percent Change 1976-1980
No Program	-58.2	82.5	98.5	+ 97.2
Lamina Program	-69.6	76.4	93.9	+151.3
Temporary House	-82.4	49.3	66.9	+182.6
Permanent House	-79.4	140.0	154.3	+581.2
Total	-69.4	82.3	98.6	+222.4

This differential effect of the earthquake on people associated with different program types meant not only that some lost more than others, but that there were different amounts of effort and monetary input necessary to bring them back to their pre-earthquake level of housing value. Since different programs actually expended different amounts of effort and money to help disaster victims and employed different strategies and offered different housing types, it is no wonder that significant differences emerged in principal house values among all groups by 1978, two years after the disaster. By 1980, these differences had become even greater.

This fact can be clearly seen by noting first that Table 11-24 shows significant differences between all pairs of program types in both 1978 and 1980, and then by looking back at Table 11-23 at the actual dollar amounts involved. The total dollar gain or loss between 1975 and 1980 for each program type is as follows:

Program Type	1980-1975 (gain or loss)
No Program	-$ 16.00
Lamina Programs	-$ 55.00
Temporary Housing	-$326.00
Permanent Housing	+$547.00
All Types	-$ 14.00

These figures seem to indicate that on an average, only one group had actually regained the equivalent of the full value of their pre-earthquake principal house by 1980, the permanent housing group. This group had actually made a $547.00 gain equal to 154 percent of recovery. For all practical purposes the no program and lamina program households had recovered in principal house value by 1980, being only a few dollars behind their pre-earthquake situation. It is the temporary housing group which shows the greatest distance to go to attain recovery. It is $326.00 behind its pre-earthquake principal house value. This is equivalent to a 33.1 percentage loss in comparison to its pre-earthquake value and therefore represents only 66.9 percent of recovery.

Table 11-25 offers information useful in interpreting these differences in program type. First, it shows that the temporary house group suffered the greatest percentage loss in the disaster, 82.4 percent. If the changes in house value between 1975 (when the value was 82.4 percent less than pre-earthquake because of damage) and 1980 are examined, it will be found that temporary housing people gained 182.6 percent in house value during the reconstruction process up to 1980,over the value of their earthquake damaged houses, that is, where they stood the day after the earthquake. This is a greater percentage gain towards recovery than for either the "no program," or "lamina program" group. They end up, however, being farther away from recovery than these two groups because they had farther to go to reach that point. While the "no program" group is 98.5 percent recovered in 1980, and the lamina program is 93.9 percent recovered, temporary house people are still only 66.9 percent of the way back to their pre-earthquake house value. This of course assumes that principal house value can be used as a measure of recovery.

Of course the glaring exception in the opposite direction is the permanent housing category. It gained 581.2 percent between its low value after the damage and recovered by 154.3 percent Even though this group also suffered a heavy loss (79.4 percent of its pre-earthquake house value), the value of the houses received from agencies was far greater than that for other groups.

One of the most interesting aspects of these findings relates to the "no program" people. These households received no housing assistance in either the form of lamina distribution, temporary or permanent housing. Yet, by 1980 they were 98.5 percent recovered, ahead of either the lamina recipient group or the temporary house group. It will be recalled that when their house types were examined it appeared that they had built houses comparable in type and value to those they had occupied before the earthquake. The question to be considered now is, "How could they have recovered as fast as the groups receiving more aid?" One answer is that they experienced less loss than any other group (58.2 percent). Another answer is that by and large this group was better off economically, as shown by their pre-earthquake house value which was higher than any but the permanent house group. In short, many households in this group probably had more private resources upon which to depend in reconstruction. But there is a possible third answer. More of them may have borrowed money in order to finance their own personal reconstruction projects. It is necessary therefore to examine borrowing and housing related debt before these figures on relative housing recovery can be assessed fairly. For example, the temporary house people may be $326 behind in house value but at the same time, they may have accumulated less debt or the "no program" people may be only $16 behind full recovery, but be deeply in debt as a result of the disaster.

Before this is done, however, another complexity in the data has to be considered. It will be recalled that 193 of the households in the sample actually had two houses rather than one. Sixteen of these had even received two houses from an agency. In the above discussion only one house, the principal house, was considered for each household and other houses occupied by the household were ignored. This made it possible to compare pre and post-earthquake houses in terms of house value on a common definitional basis. Because of the fact that only the principal house was recorded for the pre-earthquake period, and damage was reported on this house only, when comparisons are made with the pre-earthquake period it is necessary to focus on the principal house because it is the only one recorded during all time periods. Actually, some households may have occupied more than one house before the earthquake, but no data was collected for the pre-earthquake period for secondary structures.

Starting with the year 1978, up to two houses were recorded for each household where they existed and were occupied as dwellings. This makes it possible to compare program types for 1978 and 1980, using the total value of the two houses taken together for households that own two.

Table 11-26 shows the value of the principal house for each program type for each time period and, for 1978 and 1980 it also furnishes the total house value for households in each category allowing all the houses they occupied to be included in their total house value. In addition, it gives the number and percentage of households who had two houses. The first thing to note about this table is the large differences between "no program" and "lamina program" households on the one hand and "temporary"

Table 11-26

Comparison of Principal House Value With Total House Value as they Relate to Different Program Types, for Three Time Periods

Program Type	Principal House Value N*	Principal House Value 1975	Principal House Value 1976	Principal House Value 1978	Principal House Value N	Principal House Value 1980	No. With 2 Houses 1978	% With 2 Houses 1978	No. With 2 Houses 1980	% With 2 Houses 1980	Total House Value N	Total House Value 1978	Total House Value N	Total House Value 1980	Percent Recovered Using Principal House Value	Percent Recovered Using Total House Value
No Program	315	1038	434	856	248	1022	38	12.1	35	14.1	315	956	248	1155	98.4	111.3
Lamina Program	180	904	275	691	159	849	29	16.1	16	10.1	180	840	159	934	93.9	103.3
Temporary House	188	986	172	486	163	659	79	42.0	46	28.2	188	712	163	864	66.8	87.6
Permanent House	121	1007	206	1410	106	1554	47	38.8	21	19.8	121	1951	106	1791	154.3	177.9
Total	804	991	303	816	676	977	193	24.0	118	17.4	804	1022	676	1132	98.6	114.2

* "N" is the same for 1975,1976, and 1978. There are significant differences between each pair of program types, using principal house value, but there are not significant differences between no program and lamina programs, and lamina programs and temporary housing programs in 1978, and none between temporary housing and lamina programs in 1980 on total house value.

and "permanent housing" households on the other in terms of the percent who have two houses in 1978. The table shows that 42 percent of the temporary housing people have two houses, and almost 39 percent of the permanent housing people do also, but only 12 percent of the no program and 16 percent of the lamina program people have two houses. This appears to mean that housing programs which supplied whole houses were more likely to result in a household having two houses than when people constructed their own houses as was the case in both "no program" and "lamina program" households. This difference between program types in the number of households with two houses is statistically significant at both the 1978 and 1980 time periods as measured by Chi Square. (Chi Square, 1978 = 78.825, Prob. = .0001; Chi Square 1980 = 21.493, Prob. = .0001.)

When average total house values for 1978 and 1980 are compared to principal house values, it will be seen that the average house value for each program type is increased. Because there are different proportions of two house families in the various groups, however, the total house values do not remain exactly proportional to principal house value across programs. As a result, slightly different conclusions are obtained from comparing program types using total house value than when using principal house value.

First, when only principal house values are used, there is a significant difference between the mean principal house values, between the "no program" and "lamina" group, with the no program group being higher. When total house values are employed, this difference disappears. This is probably due to the fact that four percent more lamina program people owned second houses, and the inclusion of these houses in average house value increased their average value more than was the case in the no program group. This reduces the amount of difference between the two groups below the statistical significance level. The second contrast between results obtained from using only the principal house and using both houses is that no difference occurs between "lamina" and "temporary house" people when both houses are used, but there was a difference when only the principal house was considered. Again, this is probably due to the much greater percentage of temporary house people who had two houses, thus raising their total house value proportionately more for that group so that it comes close to equaling the lamina program average. For example, total house value is $149 more on an average for the lamina group, but $226 more for the temporary house group. This difference closes the gap in house value between the two groups that seemed to exist when only principal house value is considered.

The final difference in result again relates to comparisons between these two groups in the 1980 time period. The principal house comparisons show that the "lamina group" is significantly higher in house value than the "temporary house group" but when total house value is considered they are statistically similar.

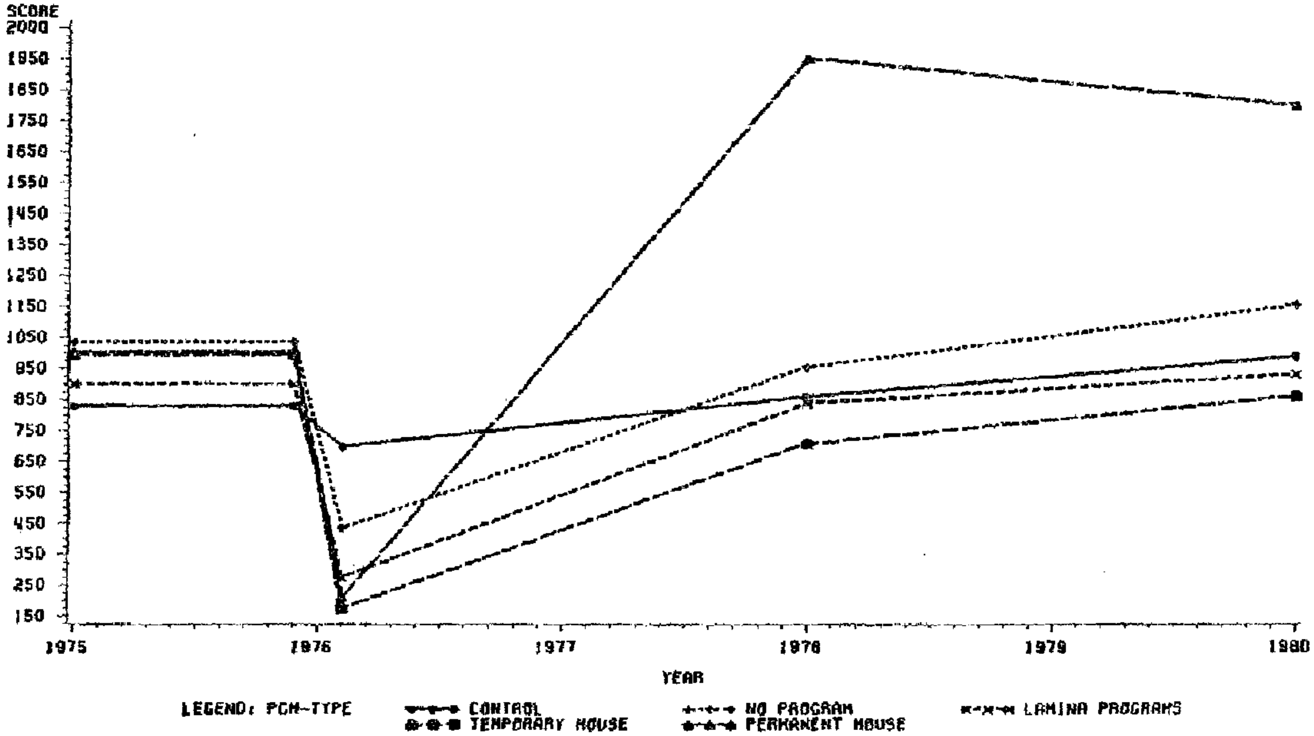
These differences in results obtained using total house value rather than principal house value really do very little to change the interpretation to be made of the basic data. There are significant differences in house value in favor of the group receiving the most expensive form of aid, permanent housing. Furthermore, the no program group remains statistically different from the temporary house group and the lamina group in 1980. Also, the order in which the groups fall in terms of house value does not change. The group with the highest value is permanent housing and the one with the lowest is temporary housing even when two houses are counted. In addition, people who received no housing aid at all remain second in total house value just as they were for principal house value.

The major difference between the two methods is that the range of values between highest and lowest has narrowed,and as a consequence, differences between house types which rank next to each other in house value have narrowed sometimes below the significance level. On principal house value, the lowest category is 42.4 percent of the highest, but on total house value it is 48.2 percent of that value. This means that there is slightly less difference between temporary house people and the others than shows up in previous tables. Figures 11-6 and 11-7 graphically represent the results obtained from each of these methods and present a picture of what happened to house values through time. Recovery on these graphs would amount to the trend line reaching the level it started from in 1975.

One apparent anomaly needs to be cleared up with respect to the data in Table 11-26. Close examination of the table will show that although 193 households had two houses in 1978, only 118 were recorded in 1980. This reduction is due to the operation of two factors. First, some households dropped out of the sample between 1978 and 1980. The drop-out rate for households who had two houses, however, was similar to that for one house families and therefore drop-out rate does not appear to bias the results. The other reason there are fewer two household families is that some households who had two houses in 1978 had disposed of them by 1980 in one way or another. One way was to join together two separate

FIGURE 11-7

DAMAGE & RECOVERY
MEASURED BY TOTAL HOUSE VALUE



580

structures to create one house. If this was done, house value was increased for the single structure remaining because it now had more rooms and its value was accordingly inflated. Another way was to sell the house or to tear it down, or to convert it into an animal shelter or a commercial establishment. If any of these things occurred it disappeared from the sample "as a house" and was therefore not recorded in the final time period.

In other words, the figures on total house value only count houses occupied as dwellings and exclude any structures used for other purposes. It is possible,because of this unavoidable anomaly,in the data that total house values for the temporary and permanent house groups are underestimated, especially for 1980, if it is assumed that any structure received from an agency or built by the family, regardless of its use, should have been counted. For example, some Red Cross houses were converted into stores or shops and these are not being counted in house value. The above discussion focuses on improvement in housing and not on improvement in economic status, even though the data used involves the value of houses. In a later chapter the question of economic benefit will be considered.

Housing Loans and the Amount of Debt Associated with Program Types

Data were also collected on the amount of money borrowed by households for purposes of housing reconstruction. A summary of these data is presented in Table 11-27 which deals with the problem of how loans affect the equity people have in their post-earthquake houses. Housing loans were virtually non-existent in rural areas in Guatemala before the earthquake. After the disaster the Guatemalan government made money

Table 11-27

Relationship Between Housing Loans and Housing Programs and the Impact of Loans on Recovery Measured by House Value

Category of Information	No Program	Lamina Program	Temporary Housing	Permanent Housing
1. Number of cases, 1978	315	180	188	121
2. Number who received loans	59	31	32	60
3. Percent with loans	18.7	17.2	17.0	49.6
4. Average amount borrowed for those receiving loans	1416	1360	923	634
5. Average net equity for those with loans (1978 principal house value - loan amount)	315	288	465	1348
6. Average house value 1978 (principal house)	856	691	486	1410
7. Average loan value for all respondents including those who didn't receive loans as "0."	265	234	157	314
8. Average net equity for sample as whole	591	456	329	1096
9. Pre-earthquake house value	1038	904	986	1007
10. Percent recovered 1978 after loans have been deducted, i.e., using net equity	56.9	50.4	33.4	108.8
11. Percent recovered 1980 after loans have been deducted, i.e., using net equity	72.3	69.6	48.9	124.0
12. Number of cases counted in 1980	248	159	163	106
13. House value 1980 without loan deducted	1022	849	660	1554
14. Percent recovered 1980 using principal house value without loan deductions.	98.5	93.9	66.9	154.3

for housing loans available through BANDESA, the Rural Development Bank, and earthquake victims could borrow money for housing construction at five percent interest for up to twenty years. Many people in rural villages and towns were afraid to borrow money because they feared they might not be able to pay it back and would then lose their land and houses. However, a substantial number of people took advantage of this opportunity, either on their own or were more or less forced to do so in connection with agency permanent housing programs. Table 11-27 shows that 182 out of the 804 households in the experimental group took out loans,amounting to 22.6 percent of the sample. The percentage taking out loans was nearly the same for the no program, lamina program and temporary housing program groups (between 17 to 19 percent). In the case of the permanent housing group, however, 49.6 percent had loans on their houses. This was required in the housing program in Patzun, but even in places such as Sanarate and Santa Maria Cauque, where no loans were required to receive an agency house, some households borrowed money for housing purposes. This could occur to make additions to the agency house or to build a second house on the housing site,or for reasons unrelated to housing.

The average amount borrowed for those who took out loans is also shown in Table 11-27. The largest average loan amount occurred in the no program group and the next largest in the lamina program category. Actually lamina programs only offered people a $50 contribution at most, in the form of free or subsidized lamina and the major cost of rehousing themselves had to be obtained some other way. In other words, with respect to the need for cash to finance reconstruction, they were almost like the no program group. What is most surprising in these data is the fact that the permanent housing group took out relatively small loans compared to all of the others, yet the houses they obtained were considerably more costly. This indicates a large subsidy by agencies, even where loans were required,and this occurred in only a few places.

Despite the fact that the temporary housing people who consisted primarily of those receiving houses from The Guatemalan Red Cross did not have to pay anything for their houses, seventeen percent took out housing loans averaging $923. This amount is over twice the value of the wood and lamina houses they received from agencies. Such loans could have been used for additions and modifications to their houses, or to build a second house, but the data indicate that in 1980 the house they were living in as a principal house was still only worth $660, according to estimates based on data from architects. This appears to mean that the money obtained from loans was spent on things other than housing. Reports from field observation seem to support this contention. Such reports indicate that some people took advantage of the liberal loan policies to borrow money to buy automobiles or to invest in business.

It is obvious from this table that the less aid a household received in the form of physical building materials or houses, the more they borrowed (see Line 4, Table 11-27). This borrowed money can be subtracted from the value of their houses and a new estimate of the degree to which they recovered in net housing assets or equity can be determined. This is done for the whole sample in each program type in Lines 8 and 10 of Table 11-27. When net equity is compared to pre-earthquake house value, a percentage recovery can be computed on this basis. These figures are given in Lines 11 and 12 of the same table. These figures show that there is no change from earlier tables in the order in which program types come in terms of recovery, but the percent of recovery achieved is a good bit lower than when principal house value without deducting loans is considered. The following tabulation summarizes pertinent data.

	Percent Recovered 1980	
	Using Principal House Value	Using Net Equity
No Program	98.5	72.3
Lamina Program	93.9	69.6
Temporary Housing	66.9	48.9
Permanent Housing	154.3	124.0

It can be seen that by deducting loan value, "no program," "lamina program" and "temporary housing programs" are about equally affected. Permanent housing programs are affected least, considering the percentage difference between the principal house value undecremented by loans as compared to that same value after loans have been deducted. Conclusions concerning the relative standing of program types are not therefore substantially affected. Figures 11-8 and 11-9 illustrate these data and should be compared to Figures 11-6 and 11-7 to obtain an impression of how conceptions of recovery are affected by the methods employed to measure it.

Conclusions Concerning Program Types

All of the data presented so far concerning different housing programs leave the clear impression that temporary housing programs had the effect of slowing down, perhaps even preventing, recovery in housing. Such

FIGURE 11-8

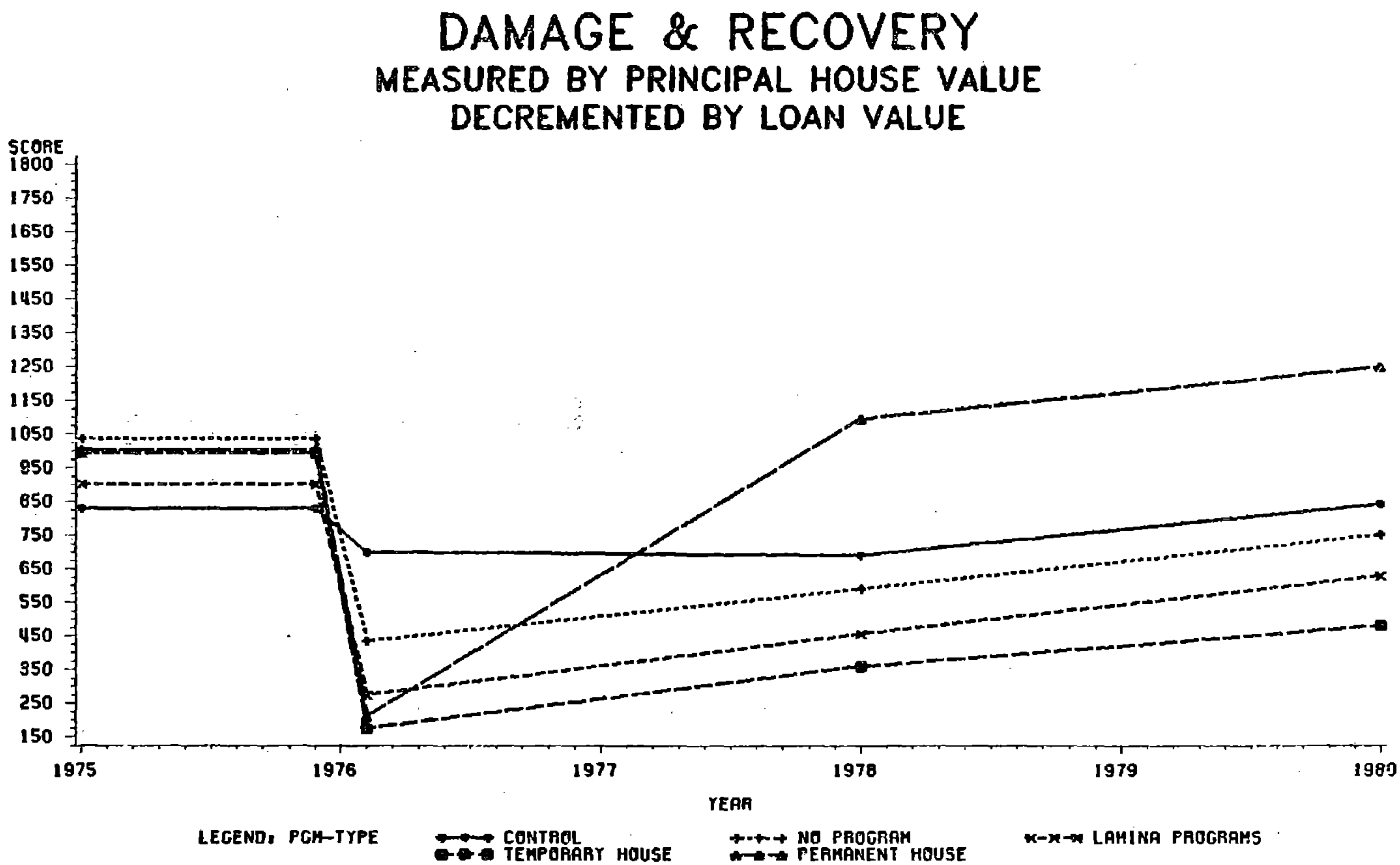
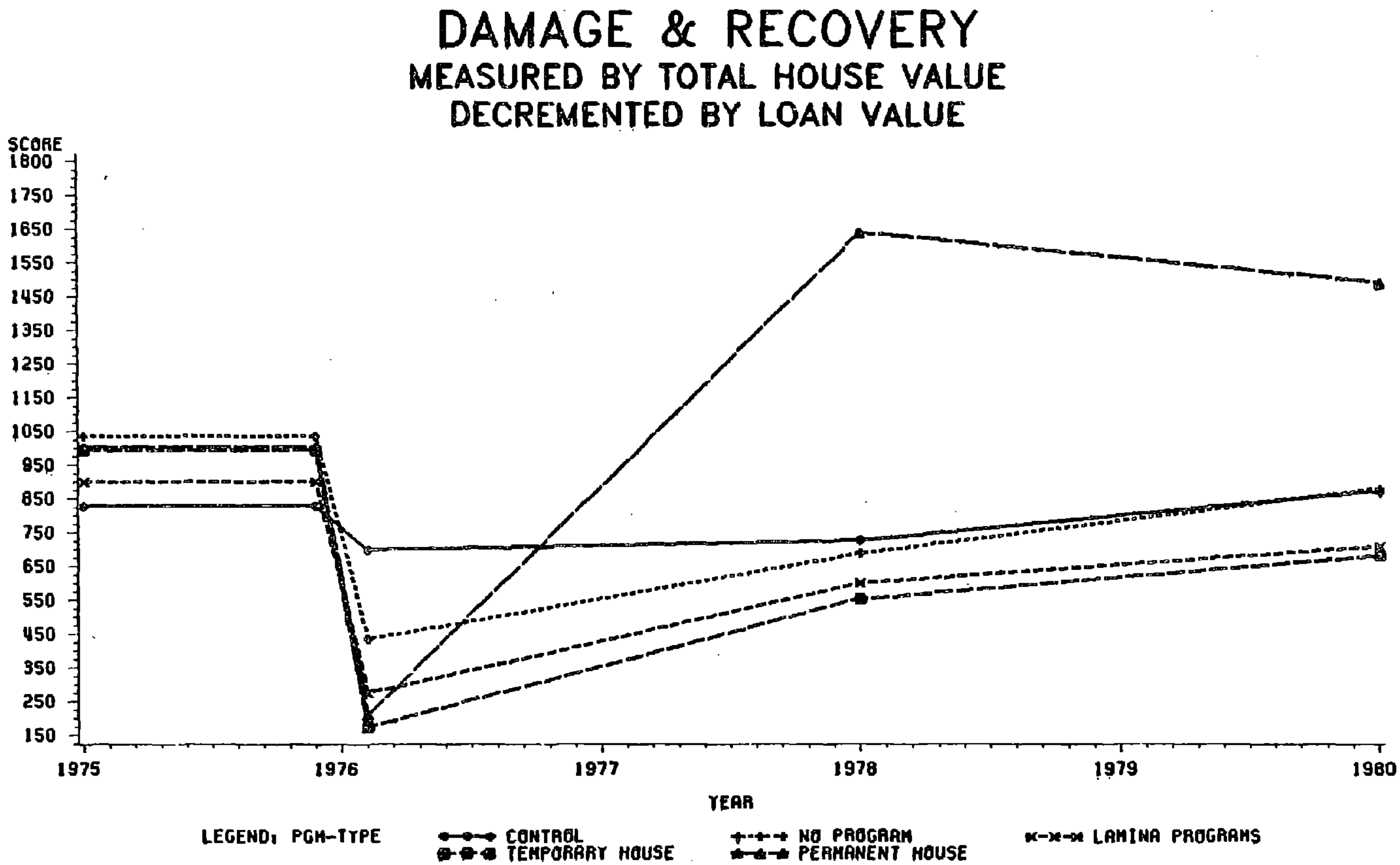

DAMAGE & RECOVERY
MEASURED BY PRINCIPAL HOUSE VALUE
DECREMENTED BY LOAN VALUE
SCORE
1800
1750
1650
1550
1450
1350
1250
1150
1050
950
850
750
650
550
450
350
250
150
1975
1976
1977
1978
1979
1980
YEAR
LEGEND: PGM-TYPE
CONTROL
NO PROGRAM
LAMINA PROGRAMS
TEMPORARY HOUSE
PERMANENT HOUSE

FIGURE 11-9


DAMAGE & RECOVERY
MEASURED BY TOTAL HOUSE VALUE
DECREMENTED BY LOAN VALUE
SCORE
1800
1750
1650
1550
1450
1350
1250
1150
1050
950
850
750
650
550
450
350
250
150
1975
1976
1977
1978
1979
1980
YEAR
LEGEND: PGM-TYPE
CONTROL
NO PROGRAM
LAMINA PROGRAMS
TEMPORARY HOUSE
PERMANENT HOUSE

programs provided a shelter that was adequate to meet people's needs for several years and people receiving them seem to have delayed constructing more permanent houses. In the meanwhile, inflation has increased housing costs faster than incomes, and in addition, political violence in the countryside has brought governmental and agency assistance to a standstill, especially in the Highlands region. Because of these intervening factors, it is difficult to predict what would have happened to these temporary house people under "normal circumstances." It was clear in 1980, however, that they were lagging behind other groups in the recovery process. All things considered, it appears that they would have ended up better off in 1980,had they been associated with any other category of program shown in the tables examined above.

Comparison of Changes in House Value Between the Control and Experimental Groups

It is now necessary to compare changes in house value between the control and experimental groups in order to determine the relative extent to which reconstruction programs produced benefits beyond the trend toward improvement in housing taking place in the country due to normal development processes.

Table 11-28 shows the mean principal house values for the control and experimental groups at four points in time and gives the results of statistical tests for differences between means.* These data show that before the earthquake, principal houses in the experimental group were worth an average of $242 more than in the control group. These values were 132.3 percent higher for the experimental group and are statistically significant.

*Two-way analysis of variance procedures were used for this purpose.

Table 11-28

Comparison of Experimental and Control Groups on Mean House Values at Four Time Periods

	Control (weighted)		Experimental	Difference (C - E)	Ratio Between Control and Experimental E/C 100
Pre-earthquake Mean House Value	$749		$991	-242	132.3
Standard Deviation	$624		$509	+115	-
Number of Cases	544		804	-375	-
Prob.of no difference in means (from ANOVA)		0.0001			
1976 Mean House Value (house value after depreciation for damage)	$649		$303	+346	46.7
Standard Deviation	$592		$488	+104	-
Number of Cases	544		804	-375	-
Prob. of no difference in means (from ANOVA)		0.0001			
1978 Mean House Value	$800		$816	- 16	102.0
Standard Deviation	$626		$689	- 63	-
Number of Cases	544		804	-375	-
Prob. of no difference in means (from ANOVA)		0.6706			
1980 Mean House Value	$922		$977	- 55	106.0
Standard Deviation	$725		$805	- 80	
Number of Cases	479		676	-197	
Prob. of no difference in means (from ANOVA)		0.2296			

In 1976,at the time of the earthquake, the experimental group dropped the equivalent of $688 in house value as compared to $100 for the control group due to earthquake damage. Now the experimental group house values, instead of being 134.3 percent of control group values, are only 46.7 percent of those values. By 1978, however, they have risen to 102.0 percent of control group values and by 1980, to 106.0 percent of those values.

In the case of both groups, house values increased after 1976. This must be taken into account in measuring recovery. For example, between 1975 and 1980 the control group increased $173 in house value, which amounts to a 23.1 percentage increase over the four year period. During this same period the experimental group went from an average house value of $991 in 1975 to $977 in 1980, a decrease of $14, or of 1.4 percent.

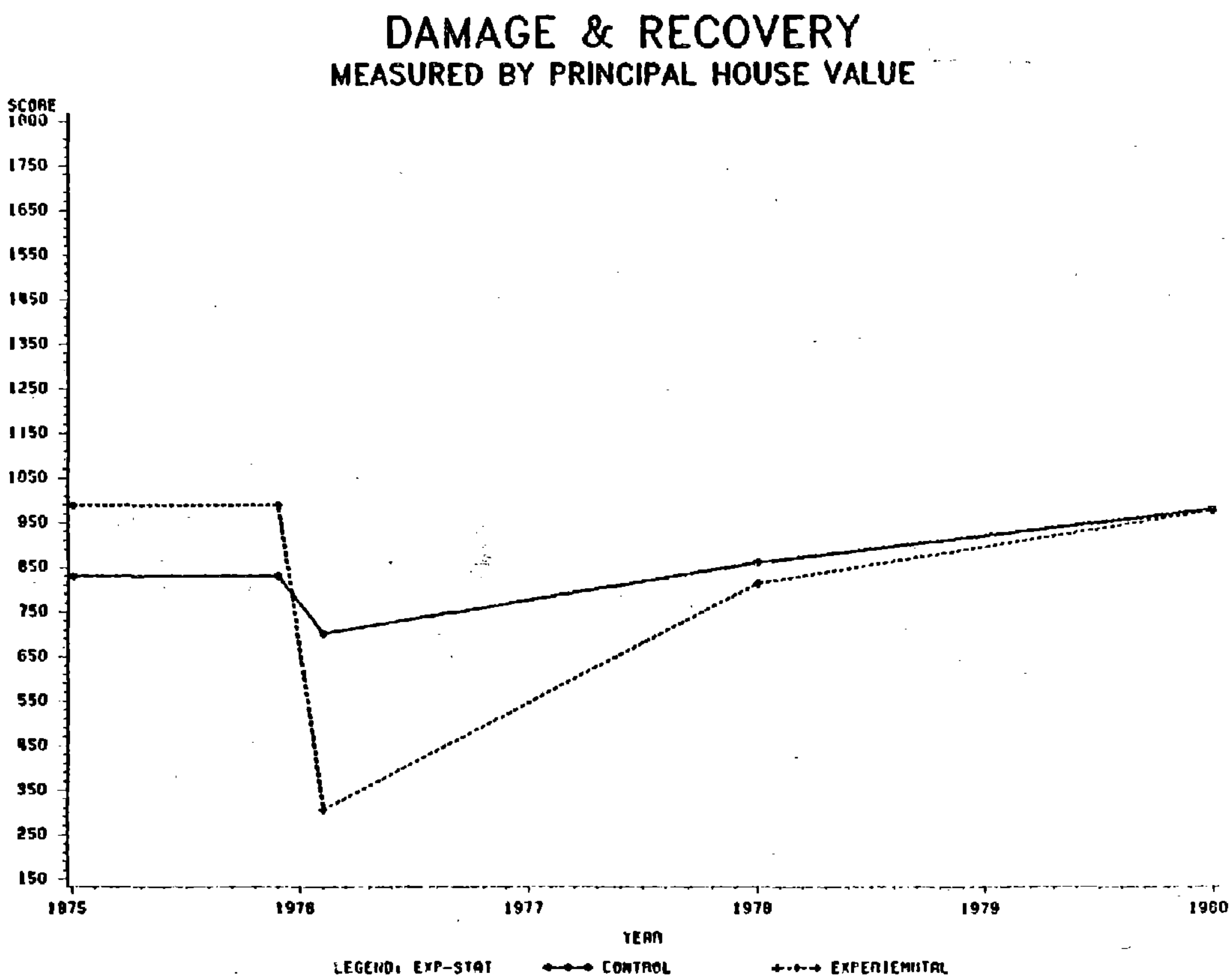
Since the control group had gained 23.1 percent during the post-earthquake period and the experimental group had lost 1.4 percent in the same period, it is apparent that the experimental group has fallen behind the general economic trend during this period and is now about 24.5 percent behind what it would have been without the earthquake. Of course this assumes that the percentage change in the control group represents a general economic trend in Guatemala, which is not necessarily earthquake related.

Another way to put this same argument is to say that the experimental group had houses worth 132.3 percent of those in the control group before the earthquake. To recover from their low point of 46.7 percent of the control group value (which resulted from earthquake losses), they had to again achieve a ratio in value of 1 to 1.323. By 1980, however, this ratio had reached only 1 to 1.060. In order to be fully recovered, the experimental group would have to increase its housing value up to the ratio equal to the pre-earthquake ratio in relationship to the control group. This requires a 24.8 percentage increase over their present level. The difference between the 24.5 arrived at earlier, and 24.8 is due to rounding errors.

Using this reasoning, it appears that the experimental group was about 80 percent recovered by 1980. This estimate is derived from taking the percentage that 106.0 is of 132.3 (106.0/132.3 x 100 = 80.1). This figure (80.1 percent) is 19.9 percent away from recovery. It requires a percentage increase in house value of 24.8 percent to reach 100 percent recovered (19.9/80.1 x 100 = 24.8). Thus, except for rounding error, it appears that between 24 and 25 percentage increase in housing value is required to bring the experimental group back into its pre-earthquake relationship in housing value to the control group. The situation is even worse if principal house value is decremented by loan amounts. (These data are illustrated graphically in Figures 11-10 and 11-11.)

It must be emphasized that this argument assumes that the trend observed in the control group represents what would have happened in the experimental group without either an earthquake or a reconstruction process taking place. In all probability, the earthquake and reconstruction process produced part of the increase in house value in the control group. This group improved in principal house value by 23.1 percent over the four year period, a rather rapid increase in the value of housing,

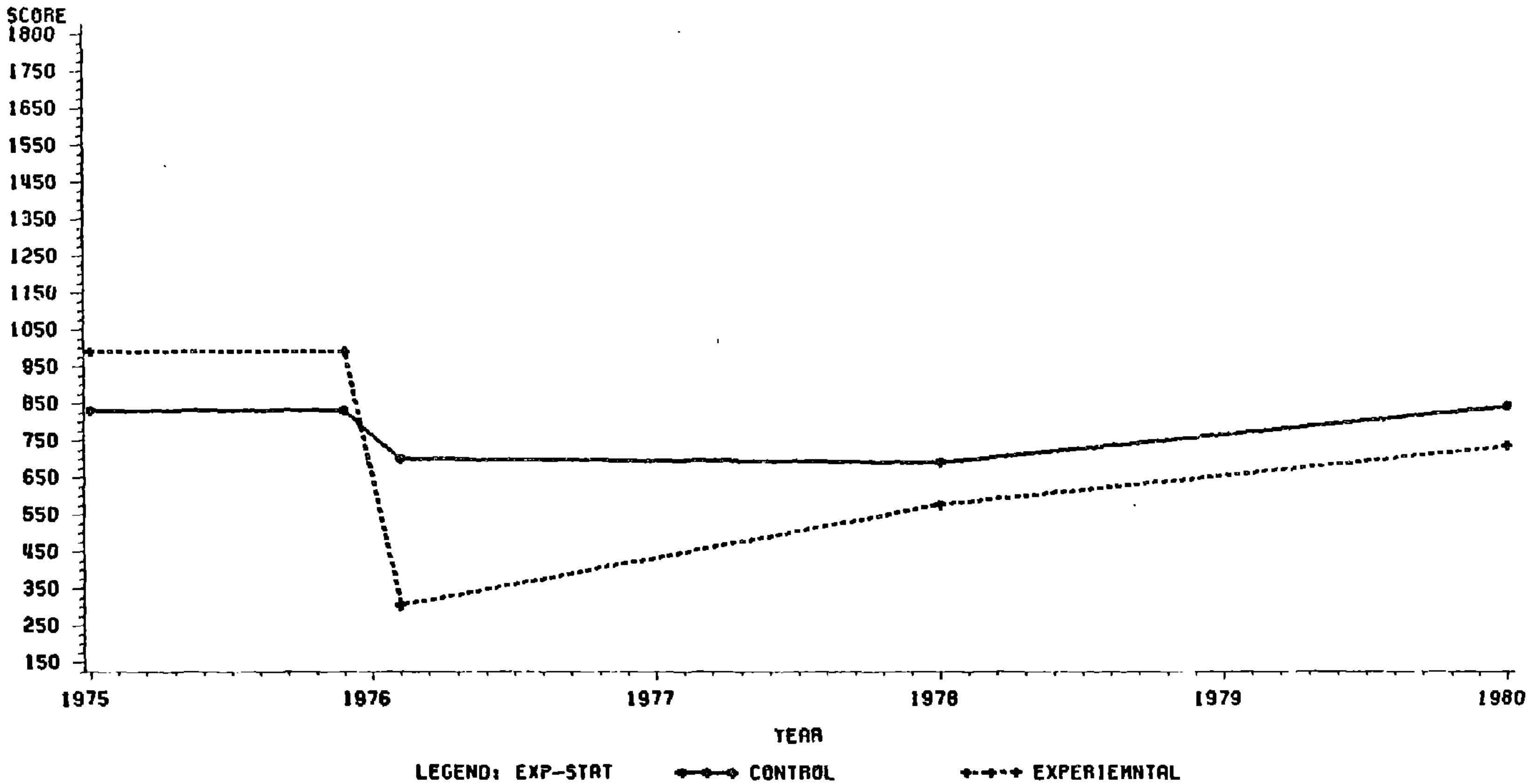
FIGURE 11-10



DAMAGE & RECOVERY
MEASURED BY PRINCIPAL HOUSE VALUE
SCORE
1850
1750
1650
1550
1450
1350
1250
1150
1050
950
850
750
650
550
450
350
250
150
1975
1976
1977
1978
1979
1980
YEAR
LEGEND: EXP-STAT
CONTROL
EXPERIEMNTAL

FIGURE 11-11

DAMAGE & RECOVERY
MEASURED BY PRINCIPAL HOUSE VALUE DECREMENTED BY LOAN VALUE



especially when it is recalled that the method being used to compute these values holds inflationary effects constant.

Figures 11-10 and 11-11 graphically represent the control and experimental group comparisons discussed above and show the general upward trend in housing values for both groups. It employs only principal house values, and can therefore be compared to Figure 11-2,which employs the same basis for comparing program types. It must be remembered that the total experimental group contained people who were associated with various types of programs. When they are averaged together, the above results are obtained. When, however, they are separated into program types, it becomes obvious that those associated with permanent housing programs were far better off than this average, and those associated with temporary housing programs were worse off.

The Relationship Between Need and the Delivery of Agency Houses

If it is assumed that agency housing programs were directed toward rehousing earthquake victims rather than meeting the need for housing which stemmed from socioeconomic conditions prior to the earthquake, then it is possible to evaluate the successfulness of agency programs by comparing earthquake produced need with the delivery of agency houses. In doing this it must be remembered that the building materials programs discussed in the last chapter were also carried out, many times in the same communities where agency housing programs were being conducted.

For purposes of measuring need, it will be assumed that those households whose houses were destroyed or experienced heavy damage constituted the target population for agency housing programs. Those with slight or no housing damage will be classified as not needing earthquake related housing assistance in the form of whole houses, although they very well could have needed housing assistance for other reasons.

Table 11-29 shows the number and percentage of households in the experimental group living in the Highlands and the East with low and high damage, who received and did not receive agency houses. This table is accompanied by Chi Square statistics. It shows that for both regions and for the whole experimental group sample, there was a significant relationship between need as measured by damage and receiving an agency house. For example, for the whole experimental group sample, 47 percent of those with high damage received such a house as compared to 19 percent for those with low damage. It should be noted, however, that this relationship was much stronger in the sample taken in the El Progreso area (East) than in the Chimaltenango area (Highland). The Phi statistic shows this difference clearly. In the East, Phi, which corresponds roughly to a correlation coefficient, was 0.399 as compared to 0.152 for the Highlands.

The Eastern region of the country is entirely inhabited by Ladinos and there are no Indians present in any of the towns included in the sample. In contrast, the Highlands consist primarily of communities that are mixed in ethnic composition, most being primarily Indian. Damage on an average was much higher in the Highland region, where 83 percent fell in the high damage category, than in the East where only 65 percent were heavily damaged. This difference is probably reflected in the contrast in the proportion of people with high damage who did not receive

Table 11-29

Relationship Between Damage and Receiving an Agency House in the Experimental Group Classified by Region

Received Agency House	East						Highlands						Total Experimental Group					
	Damage				Total		Damage				Total		Damage				Total	
	Low		High				Low		High				Low		High			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
No	87	84.5	82	43.2	169	57.7	67	77.0	243	57.3	310	60.7	154	81.0	325	52.9	479	59.6
Yes	16	15.5	108	56.8	124	42.3	20	23.0	181	42.7	201	39.3	36	19.0	289	47.1	325	40.4
Total	103	100.0	190	100.0	293	100.0	87	100.0	424	100.0	511	100.0	527	100.0	614	100.0	804	100.0

East:
Chi Square = 46.690
Prob. = 0.0001
Phi = 0.399

Highlands:
Chi Square = 11.741
Prob. = 0.0006
Phi = 0.152

Total Experimental Group:
Chi Square = 47.645
Prob. = 0.0001
Phi = 0.243

agency houses in the two regions. There were 57.3 percent in this category in the Highlands and 43.2 percent in the East. The task of reconstruction was much larger in the Highlands region and as a consequence proportionately fewer households received agency houses. This means that the relationship between region and damage must be taken into account before a conclusion can be drawn about the relative effectiveness of programs in meeting need in different parts of the country.

It is possible,with the figures in Table 11-29, to calculate a success rate for all agency housing programs taken together in matching the delivery of houses with need. As in the case of lamina programs, it is necessary to think in terms of positive and negative success and failure. Positive success amounts to supplying houses to people in need, while negative success is not supplying houses to people who don't need them. Positive failure means providing houses to people who don't need them, while negative failure means not supplying houses to people in need. Table 11-30 summarizes these success and failure figures for the data supplied in Table 11-29.

This table shows that the positive success rate in the distribution of agency houses was 35.9 percent, while the negative success rate was 19.2 percent, yielding a total rate of 55.1 percent for the experimental group area as a whole. Another way to look at these data is that about 47.1 percent of the households needing housing because of earthquake damage received them. This compares to 19 percent of those who did not need them but nevertheless obtained agency houses. The success rates for the East and Highlands are different. When similar calculations are made for these groups, the results in Table 11-31 are obtained.

Table 11-30

Success and Failure in the Distribution of Agency Houses in the Experimental Group

Received Agency House from Some Agency	Need for Housing Because of Earthquake: No (Low Damage) No.	%	Yes (High Damage) No.	%	Total No.	%
	Negative Success		Negative Failure			
No	154	19.2	325	40.4	479	59.6
	Positive Failure		Positive Success			
Yes	36	4.5	289	35.9	325	40.4
Total	190	23.4	614	76.4	804	100.0

Total Success Rate = 19.15 + 35.9 = 55.1

Table 11-31

Success and Failure Rates for the East and Highlands

Success Category	East	Highlands
Positive Success	36.9	35.4
Negative Success	29.7	13.1
Total Success	66.6	48.5
Positive Failure	5.5	3.9
Negative Failure	28.0	47.6
Total Failure	33.5	51.5

This tabulation shows a much higher success rate for the East than the Highlands. Most of the difference between the two regions lies in the higher rate of negative successes in the East or, to put it the other way, the higher rate of negative failures in the Highlands. This means that there were proportionately fewer cases in the Highlands where people not in need were not given houses and on the other hand, more cases in need also who were not given houses. This occurred despite the fact that close to the same proportions of people in the two regions were supplied houses (57.7 percent in the East and 60.7 percent in the Highlands). The difference lies in the difference in amount of need mentioned earlier, which was much higher in the Highlands than the East (East 64.9 percent in need, Highlands 83.0 percent in need). It can be seen that the same proportion receiving houses in the two regions would lead to a difference in success rate in favor of the Eastern region.

It will also be useful to look at how the distribution of agency houses matched need as measured by socioeconomic status. It is assumed that the poorest people would have the greatest difficulty providing adequate housing for themselves following a disaster. They might of course be able to provide themselves with marginal housing by building shacks as easy as anyone else. But if it is assumed that agency housing programs were intended to be nondiscriminatory with respect to socioeconomic status, then success can be measured by whether housing was distributed equally to all social classes.

Table 11-32 supplies figures showing how many households in each of four socioeconomic categories received agency houses. The four categories were determined by use of the Domestic Assets Scale mentioned

Table 11-32

Relationship Between Socioeconomic Status and Receiving an Agency House for the Experimental Group, Broken Down by Regions

		East						Highlands						Total Experimental Group					
		Received Agency House				Total		Received Agency House				Total		Received Agency House				Total	
Socioeconomic Status as		No		Yes				No		Yes				No		Yes			
Measured by Domestic Assets		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Low	Over +1 St.Dev.	23	65.7	12	34.3	35	100.0	19	79.2	5	20.8	24	100.0	42	71.2	17	28.8	59	100.0
Lower Middle	0 to +1 St. Dev.	111	71.6	45	28.9	156	100.0	189	59.6	128	40.4	317	100.0	300	63.4	173	36.6	473	100.0
Upper Middle	0 to -1 St.Dev.	23	34.9	43	65.2	66	100.0	64	53.8	55	46.2	119	100.0	87	47.0	98	53.0	185	100.0
High	Over -1 St.Dev.	12	33.3	24	66.7	36	100.0	38	74.5	13	25.5	51	100.0	50	57.5	37	42.5	87	100.0
Total		169	57.7	124	42.3	293	100.0	310	60.7	201	39.3	511	100.0	479	59.6	325	40.4	804	100.0

East	Highlands	Total Experimental Group
Chi Square = 35.364	Chi Square = 10.047	Chi Square = 18.469
Prob. = 0.0001	Prob. = 0.0182	Prob. = 0.0004
Phi = 0.347	Phi = 0.140	Phi = 0.152

earlier. (For a detailed discussion of this scale, see Chapter 13.) The four groups were obtained by dividing up the distribution of domestic assets, using the standard deviation as shown in the table. The upper group is one or more standard deviation units above the mean domestic assets score for the whole sample, and the upper middle group consists of people between the mean and plus one standard deviation. The lower groups are computed in a similar fashion but in the opposite direction. This table is accompanied by Chi Squares and related statistics.

It shows that there was a significant positive relationship between socioeconomic status and receiving an agency house. In short, families in the two upper groups were much more likely to receive an agency house than those in the lower groups when the whole experimental group is considered or, for that matter, when it is broken down by regions.

For the moment, it will be best to focus on the whole experimental group. The table shows that the upper middle group faired best in housing distribution since 53 percent received an agency house. The upper group came next, where 42.5 percent received houses. This compares to 36.6 percent for the lower middle and 28.8 percent for the lower group. In other words, if only the lower and upper halves of the distribution are considered, 49.6 percent received houses in the upper group and 35.7 percent for the lower group. It is clear from this table that the very lowest group received less help than any group and the upper middle group received the most aid when the whole sample is considered.

There are, however, regional differences in this pattern. It is most pronounced in the Highlands where only 20.8 percent of the lowest group received agency houses as compared to 46.2 percent of the upper middle group. In the Highlands the upper group also fell behind either of the two middle groups to a degree almost equal to the lower one. In the Highlands,aid was clearly concentrated in the middle of the socioeconomic distribution.

In the East, it was just as clearly focused on the upper end of the distribution, where over 65 percent received agency houses. There, however, the lower group did slightly better than the lower middle. It should be noted that the lower middle was the largest group in both regions. Also, it should be realized that all of these groups represent relatively poor people. The upper groups are merely "less poor," rather than being well to do.

Again, there is the fact that the regions differed in damage and there is the further probability that the socioeconomic groups did also. This relationship between social class and receiving an agency house may be partially or wholly a product of these differences rather than socioeconomic discrimination in the distribution of aid. This too will be examined below.

Before this, however, it is necessary to look at how the type of community affected the distribution of agency houses. This is done in Table 11-33. It will be recalled that there were three types of communities included in the experimental group: department capitals, municipios and aldeas. These different categories differ with respect to size and complexity of social organization, and degree of isolation; with the department capitals being largest and most complex and least isolated, and the aldeas being the opposite with municipios in between.

Table 11-33

Relationship Between Type of Community and Receiving an Agency House, Classified by Regions

	East						Highlands						Total Experimental Group					
	Received Agency House				Total		Received Agency House				Total		Received Agency House				Total	
	No		Yes				No		Yes				No		Yes			
Type of Place	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Department Capitals	12	15.2	67	84.8	79	100.0	99	69.2	44	30.8	143	100.0	111	50.0	111	50.0	222	100.0
Municipios	74	67.3	36	32.7	110	100.0	176	59.5	120	40.5	296	100.0	250	61.6	156	38.4	406	100.0
Aldeas	83	79.8	21	20.2	104	100.0	35	48.6	37	51.4	72	100.0	118	67.0	58	33.0	176	100.0
Total	169	57.7	124	42.3	293	100.0	310	60.7	201	39.3	511	100.0	479	59.6	325	40.4	804	100.0

East		Highlands		Total Experimental Group	
Chi Square	= 83.437	Chi Square	= 8.961	Chi Square	= 13.205
Prob.	= 0.0001	Prob.	= 0.0113	Prob.	= 0.0014
Phi	= 0.534	Phi	= -0.132	Phi	= 0.128

The delivery of aid should therefore vary with type of place since they vary in isolation and social infrastructure. Table 11-33 shows clearly that it did. There is a significant positive relationship between size, complexity, and accessibility and the proportion who received agency houses for the whole sample from the experimental group. The larger and less isolated the community, the higher the proportion of households receiving agency houses.

There are, however, regional differences in these relationships. In the East there is a very strong positive relationship between size of place or degree of isolation and receiving an agency house. Over 84 percent received them in El Progreso, the departmental capital, but only 20 percent received them in the aldeas studied. This is probably due to differential damage rates in different sized places in this region more than to discrimination against the smaller places. Other data show that there is a strong positive relationship in this direction. There is therefore a need to control for damage before drawing conclusions about this region.

In the Highlands the relationship between size of place and isolation and receiving an agency house was in the opposite direction. Proportionately more people in aldeas received a house than in the departmental capital of Chimaltenango. Again, however, other data indicate that there was a relationship between damage and type of community. In this case the municipios suffered the greatest damage (86.5 percent high damage) while aldeas were next, with 84.7 percent in the high category and the department capital last, with 74.8 percent in the heavy damage category.

In the case of the Highlands, the relationship between size,isolation and receiving an agency house,as measured by Phi,was 0.132 as compared to 0.534 for the East. In other words, the relationship is not nearly as strong and is in the opposite direction,with the smaller places receiving the most aid. Again, it will be necessary to control for damage before conclusions can be drawn.

Ethnicity and Receiving an Agency House

Since all of the Indians included in the experimental group come from the Highlands region, only this region will be considered in examining the relationship between ethnicity and the delivery of agency houses. Table 11-34 gives figures for these data. They demonstrate that there was a greater probability of receiving an agency house if the household was Indian (46.5 percent) than if they were Ladino (27.9 percent).

Table 11-34

Relationship Between Receiving an Agency House and Ethnicity for the Highland Region (Including Zaragoza, an Entirely Ladino Town)

	Ethnic Group					
	Indian		Ladino		Total	
Received Agency House	No.	%	No.	%	No.	%
No	168	53.5	142	72.1	310	100.0
Yes	146	46.5	55	27.9	201	100.0
Total	314	61.4	197	38.6	511	100.0

Chi Square = 17.509
Probability = 0.0001
Phi = - 0.185
Contingency Coef.= 0.182

The relationship between ethnicity and receiving an agency house is highly significant statistically. These data appear to indicate that agency programs in the Highlands favored Indians.

Because Table 11-34 contains one municipio, Zaragoza, which is an entirely Ladino town located in the middle of an essentially Indian region, there is a chance that its presence in the sample affects the relationship between ethnicity and receiving an agency house. It was therefore removed from the sample to create Table 11-35, which contains only towns and villages with both Indians and Ladinos in their population. This is a fairer test of whether ethnicity affected housing distribution. This table still shows that Indians were more likely to receive an agency house than Ladinos (52.9 percent as compared to 41.8 percent) but the relationship is weaker.

Table 11-35

Relationship Between Receiving an Agency House and Ethnicity for the Highlands - Excluding Zaragoza

	Ethnic Group					
	Indian		Ladino			
Received Agency House	No.	%	No.	%	No.	%
No	128	47.1	238	58.2	366	53.7
Yes	144	52.9	171	41.8	315	46.3
Total	272	100.0	409	100.0	681	100.0

Chi Square = 8.143
Probability = 0.0043
Phi = -0.109
Congingency Coefficient = 0.109

Program Type and Need Measured by Damage

Program types may be compared in terms of what proportion of their participants suffered high and low damage. If high damage is used as an indicator of need, then this comparison reveals the effectiveness of a program in distinguishing between those who needed aid and those who did not have an earthquake related need for it, at least to the same degree.

Table 11-36 gives a tabulation that will serve this purpose. It shows the number and percentage of households on each program type who had high and low damage. There is a definite relationship between damage category and program type. This relationship is positive, that is, the higher the monetary value of the type of housing aid offered the household, the higher the damage suffered by that category of households. This is shown by the fact that only around 65 percent of the no program people had high damage, and therefore could be considered in need of housing assistance, especially for whole houses. In contrast, almost 90 percent of the temporary house people fell in the high damage category and slightly more than 88 percent of the permanent house group. The lamina program group contained about 74 percent with high damage.

It is apparent that proportionately more of those who received whole houses, whether permanent or temporary, were in greater need of them as measured by damage than those who did not, but instead, either received lamina or no aid at all. On the negative side of the ledger is the fact that 10 to 12 percent of those who received either temporary or permanent houses had low damage, and presumably needed, at best, minor repairs rather than replacement by whole houses. This represents

Table 11-36

Relationship of Program Type to Need as Measured by Housing Damage

	Low Damage (no need)		High Damage (need)		Total	
	No.	%	No.	%	No.	%
No Program	110	34.9	205	65.1	315	100.0
Lamina Program	47	26.1	133	73.9	180	100.0
Temporary House	19	10.1	169	89.9	188	100.0
Permanent House	14	11.6	107	88.4	121	100.0
Total	190	23.6	614	76.37	804	100.0

Chi Square = 51.667
Prob. = 0.0001
Phi = 0.254

the positive failure category examined in earlier discussions of food and lamina.

In a sense, those in the "no program" category who suffered heavy damage, and perhaps even those in the lamina category also with heavy damage, should be considered a population in need of agency houses. If this is done, then 338 households out of 804, or 42 percent, represent negative failures for either or both of the temporary and permanent housing programs if it is assumed that such programs should have served these groups also. Using the same reasoning with respect to the absence of need, 157 households had low damage and did not receive either form of agency house, for a 19.5 negative success rate. The difficulty in interpreting these various figures is that the percentages use different bases for computing positive success and positive failure on the one hand and negative success and negative failure on the other and therefore can not be added together to obtain a total success or failure rate.

In order to arrive at a common base for computing success and failure rates, it is necessary to deal separately with temporary and permanent housing programs and to define need and lack of need differently than in Table 11-36, which uses high and low damage to define need. For temporary housing programs, need for housing assistance may be defined as occurring when a household had heavy damage to their pre-earthquake house, and when they did not receive a permanent house from any source. If the household had either received a permanent house, or had experienced low damage, then they are defined as not needing housing assistance as far as temporary housing programs are concerned. This means, in effect, that all of those cases falling into the high damage category for "no program" and "lamina programs" in Table 11-36 are defined as "needing" but not receiving temporary housing assistance for purposes of evaluating temporary housing programs. There are 338 such cases.

All those who fall into the low damage category for both "no program," or "lamina programs," as well as all of those who received a permanent house, are defined as "not needing" and "not receiving" a temporary house. There are 278 such cases. The results of using these definitions on the data in Table 11-36 are given in Table 11-37. Similar procedures were employed to construct Table 11-38, which pertains to permanent housing programs. The only difference is that in this table, households who received temporary houses are counted as "not needing" permanent ones, along with those with low damage.

These two new tables show that in the case of temporary housing programs, 21.0 percent of the cases were positive successes in that people needing houses received them and 34.6 percent are negative successes in that households not in need were not supplied houses. This yields a total success rate of 55.6 percent. In comparison, the success rate for permanent housing programs is 56.2 percent, made up of 15.0 percent positive successes and 42.9 negative ones.

While the overall success rates of temporary and permanent housing programs are almost identical, there are differences in their positive and negative success rates. The temporary housing programs have a higher positive and lower negative success rate than the permanent programs. In other words, temporary housing programs tended to supply people in need with houses at a higher rate (21.0 percent) than did

Table 11-37

Success Rate for Temporary Housing Programs

	No Need		Need		Total	
	No.	%	No.	%	No.	%
Did Not Receive Temporary House or Permanent House	278	34.6	338	42.0	616	76.6
Received Temporary House	19	2.4	169	21.0	188	23.4
Total	297	36.9	507	63.1	804	100.0

Table 11-38

Success Rate for Permanent Housing Programs

	No Need		Need		Total	
	No.	%	No.	%	No.	%
Did Not Receive Permanent House or Temporary House	345	42.9	338	42.0	683	85.0
Received Permanent House	14	1.7	107	13.3	121	15.0
Total	359	44.7	445	55.3	804	100.0

permanent housing programs (15.0 percent). This is accompanied by a higher negative success rate for permanent programs, and a lower one for temporary programs.

There are some problems in interpreting these results related to the assumption that a person receiving a temporary house did not need a permanent one. Obviously,in the long run this can not be true. For purposes of comparisons between these program types in the short run period of four years, this assumption makes a little more sense since it rests on the notion that one family probably should not have been supplied both a temporary and a permanent house, when there were large numbers of other people who had received neither.

The reason for the higher positive success rate of temporary housing programs lies in the size of such programs relative to permanent housing projects. The Guatemalan Red Cross alone built 10,000 of these houses in the area being studied in the first year after the earthquake. In comparison, in the towns covered by the sample for this research and in nearby areas, probably about two-thirds this many permanent houses were built.

Before leaving this discussion, it is important to note that the positive failure rates for both types of programs were very low. In other words, very few people who did not need houses were supplied them by either temporary or permanent housing programs (2.4 percent for temporary housing and 1.7 percent for permanent housing). This means that housing programs which supplied whole houses did not indiscriminately supply them to people, regardless of earthquake related need. A glance back at Table 11-35 will show that most of the houses supplied by both types of programs were furnished to households with high damage and therefore earthquake related need (90 percent for temporary houses and 88 percent for permanent ones).

Housing Program Types and Socioeconomic Status

Another measure of need is socioeconomic status. Presumably the poorest people would need the most assistance to reconstruct their homes. Table 11-39 gives program type classified by socioeconomic status, using the same definitions used in earlier tables. These data show that there is a significant positive relationship between socioeconomic status and program type, meaning that the higher a household's socioeconomic status, the more likely they were to receive a permanent agency house. The relationship, however, is far from perfect. For example, it can be seen that proportionately more people who received temporary houses were in the upper group (12.8 percent) than was the case with permanent houses (7.4 percent). In addition, more no porgram people were in the upper group than in any other program types (13.0 percent). The big difference in favor of higher socioeconomic status shows up in the two middle groups. This can be seen clearly in Table 11-40.

Close examination of Tables 11-39 and 11-40 will show that permanent housing programs favored the middle of the socioeconomic range, while lamina programs focused on the lower end of the scale more heavily and temporary housing was more heavily slanted toward the upper end of the range.

Table 11-39 presents figures showing the percentage of those who had high damage that fell into each socioeconomic group in the last

Table 11-39

Relationship Between Program Type and Socioeconomic Status as Measured by Domestic Assets

Program Type	Socioeconomic Status as Measured by Domestic Assets: Lower No.	Lower %	Lower Middle No.	Lower Middle %	Upper Middle No.	Upper Middle %	Upper No.	Upper %	Total No.	Total %
No Program	24	7.6	185	58.7	65	20.6	41	13.0	315	100.0
Lamina Program	18	10.0	121	67.2	28	15.6	13	7.2	180	100.0
Temporary House	15	8.0	97	51.6	52	27.7	24	12.8	188	100.0
Permanent House	2	1.7	70	57.9	40	33.1	9	7.4	121	100.0
Total	59	7.3	473	58.8	185	23.0	87	10.8	804	100.0
Percent with High Damage	-	3.6	-	61.9	-	24.6	-	10.8	-	-

Chi Square = 28.742
Prob. = 0.0007
Phi = 0.189

Table 11-40

Number and Percent of Households in the Middle Socioeconomic Groups Associated with Each Type of Program

Program Type	Middle Socioeconomic Groups No.	Percent	Base of Percentage
No Program	250	79.4	315
Lamina Program	149	82.8	180
Temporary House	149	79.3	188
Permanent House	110	90.9	121
Total	658	81.8	804

line of the table. If damage is used as a measure of need, and it is assumed that programs were intended to meet such needs, then these percentages represent the proportion in each socioeconomic category who should have received that form of aid, assuming all programs operated in communities equally exposed to damage. For example, 3.6 percent of those with heavy damage were in the lower socioeconomic group. It is assumed therefore that 3.6 percent of the cases in the permanent and temporary housing categories should have been in this group. In fact, however, 8.0 of the temporary housing people were in the lower group, more than expected due to their representation in the heavily damaged population. This means that some people in the lower group who received temporary houses had to have experienced low damage.

In the case of permanent housing, the lower group is under-represented.

Only 1.7 percent of those who received permanent agency houses, but 3.6 percent of those in the heavy damage category, came from this group. Fewer lower socioeconomic households got permanent houses than were warrented by damage within this category.

The lower middle group makes up the largest number of households (58.8 percent) but they made up 61.9 percent of the households that were heavily damaged and therefore in need of housing assistance. Yet, only 57.9 percent of the permanent houses went to this group and 51.6 percent of the temporary ones. In other words, the lower middle socioeconomic group were under-served by both permanent and temporary housing programs. In contrast, they were over-served by lamina programs. More importantly, 58.7 percent of those who got no aid came from this group, exactly its proportion in the population. The lower middle group therefore seems to have disproportionately associated with lamina programs, and not with programs offering whole houses.

It will be interesting to look at the proportion of houses from each socioeconomic group that received no housing aid and are listed in the no program group. This is done in Table 11-41.

These figures show that the upper middle socioeconomic group fared best in receiving housing aid and the upper group was least served by these programs but since they were probably better able to help themselves, this is not potentially as important to the measurement of the relation of housing aid to need as the fact that the lower and lower middle socioeconomic groups were served next most infrequently.

In order to resolve the question of how housing aid matched need, it is necessary to measure need simultaneously in terms of damage and

Table 11-41

Relationship of No Aid to Socioeconomic Status

	Program Types					
	No Program		All Other Program Types		Total	
Socioeconomic Group	No.	%	No.	%	No.	%
Lower	24	40.7	35	59.3	59	100.0
Lower Middle	185	39.1	288	60.1	473	100.0
Upper Middle	65	35.1	120	64.9	185	100.0
Upper	41	47.1	46	52.9	87	100.0
Total	315	39.2	489	60.8	804	100.0

social class, rather than as the preceding tables have done, using one of these criteria at a time.

One way to do this is to look at the relationship between socioeconomic status and program type, holding damage category constant. This is done in Tables 11-42 and 11-43, one of which looks at the 614 households with high damage who were believed to need assistance in totally rebuilding their house, and the other looks at those with light damage in terms of program affiliation and socioeconomic status.

Table 11-42 shows a statistically significant positive relationship between program type and socioeconomic status, even when damage is held constant and therefore need for housing assistance is equated. The relationship is complex, however. The strongest impression conveyed by

Table 11-42

Households With High Damage Classified by Program Type and Socioeconomic Status

	Socioeconomic Status Measured by Domestic Assets									
	Lower		Lower Middle		Upper Middle		Upper		Total	
Program Type	No.	%	No.	%	No.	%	No.	%	No.	%
No Program	6	2.9	135	65.8	45	22.0	19	9.3	205	100.0
Lamina Program	7	5.3	94	70.7	22	16.5	10	7.5	133	100.0
Temporary House	7	4.1	89	52.7	50	29.6	23	13.6	169	100.0
Permanent House	2	1.9	62	57.9	34	31.8	9	8.4	107	100.0
Total	22	3.6	380	61.9	151	24.6	61	9.9	614	100.0

Chi Square = 18.558
Prob. = 0.0292
Phi = 0.174

Table 11-43

Households With Low Damage, Classified by Program Type and Socioeconomic Status

	Socioeconomic Status Measured by Domestic Assets									
	Lower		Lower Middle		Upper Middle		Upper		Total	
Program Type	No.	%	No.	%	No.	%	No.	%	No.	%
No Program	18	16.4	50	45.4	20	18.2	22	20.0	110	100.0
Lamina Program	11	23.4	27	57.4	6	12.8	3	6.4	47	100.0
Temporary House	8	42.1	8	42.1	2	10.5	1	5.3	19	100.0
Permanent House	0	0.0	8	57.1	6	42.9	0	0.0	14	100.0
Total	37	19.5	93	49.0	34	17.9	26	13.7	190	100.0

Chi Square = 24.070*
Prob. = 0.0042
Phi = 0.356

* Chi Square has more than 20% of cells with less than 5 expected cases and may be invalid.

these data is that the lower middle group received the least attention from permanent and temporary housing programs, in proportion to their number and their need. Almost 62 percent of the high damaged households fall into this category but they only got 57.9 percent of the permanent houses and 52.7 percent of the temporary ones. In contrast, 70.7 percent of the lamina was given to this group and 65.9 received nothing. The second impression is that the upper middle group made out best of all since it represented 24.6 percent of the cases, but received 31.8 percent of the permanent houses and 29.6 percent of the temporary ones. They were furthermore under-represented in the no aid and lamina program category. Finally, the upper and lower groups are quite similar in many respects. Both received fewer than expected permanent houses, although the lower group was worse off in this respect, and both received more than the expected number of temporary houses. Also, both were slightly under-represented in the no program category. The only substantial difference between the upper and lower groups is found in the lamina program category which favored the lower group and under-represented the upper one.

Table 11-43 gives figures for households with low damage and therefore low need classified by program type and socioeconomic status. It shows first of all that lamina programs went disportionately in the low need category to the two lowest socioeconomic groups. A strong tendency to favor the very lowest group is present for temporary housing programs. While there were only 19.5 percent of the cases on no-need in the lower group, this group received 42.1 percent of the temporary houses given to low earthquake need people. Their need, in other words, was economic rather than earthquake related. Exactly the same proportion of temporary houses given to low need households went to the lower middle group, but this group represented 49.0 percent of the low need households. Again, the lower middle group did not fare as well as some of the other groups. The upper middle group represented 17.9 percent of the low earthquake need households, but it received 42.9 percent of the permanent houses given to low need people. Again, the upper middle group was favored in permanent housing. They, however, received less than the expected number of temporary houses and lamina and were nearly correctly represented in the no-program category, given their proportion in the population.

Finally, almost all of the upper group with low need fell into the no-program category and only one received a temporary house. This indicates that the upper group was effectively kept from receiving housing aid when they did not need it either for earthquake related damage reasons or for socioeconomic status reasons.

Summary of Need and Program Type

What does all of this discussion of need and housing programs amount to in the long run? First, it shows that there was a strong relationship between program type and two measures of need, damage and socioeconomic status. Housing programs definitely tended to give aid more to people who had high than low damage. This is true of lamina, temporary and permanent housing programs.

But there is also a relationship between program type and socioeconomic status which is generally in the direction of people with higher socioeconomic status receiving more valuable forms of aid. The relationship is complex, however. In general, the group receiving the least attention from housing programs was the lower middle group and that faring best was the upper middle group, with the lower and upper ends of the socioeconomic distribution receiving the least attention. When separate programs are considered, lamina seems to have served the poorest group more effectively. Temporary housing seems more focused on the upper two groups and least on the lower middle, while permanent housing programs favored the upper middle group.

In future housing programs more attention needs to be focused on the lower middle income group, which is actually the largest category in the sample for this research. This group in the Guatemalan case was very poor, and not much more able to help themselves than the lower one. Yet they seem to have fared the worst in the reconstruction process. Earlier in the chapter it was noted that the upper group is disproportionately represented in the self-construction category, and also shows higher levels of housing loans. Many in this group obviously preferred to build their own houses, using borrowed money, especially considering the fact that permanent agency houses often required mortgages anyway. It is probably also true that they considered the wood and lamina houses offered by The Red Cross and others inappropriate for their status. In other words, the apparent effectiveness of housing programs in not favoring the higher group is not altogether due to their being screened out by program managers, but much of it is due to self-selection by this group.

The same may be said for permanent housing and the very poor. They may have selected themselves out of such programs when they required them to borrow money which had to be paid back in the form of monthly payments which they could not afford. In addition, such programs often required ownership of a housing site. These may be the reasons that the poorer end of the socioeconomic scale ends up being associated with lamina programs and,in some cases, with temporary housing programs which offered housing free.

Change in Earthquake Vulnerability

On the basis of damage figures collected from households after the earthquake, it is possible to arrive at an estimate of earthquake vulnerability for housing stock in the experimental and control groups at various points in time. To do so it is necessary to assume that the amount of damage experienced by a given house type in the 1976 earthquake (which measured 7.5 on the Richter Scale) would occur to the same house type in a future disaster of the same magnitude. This assumes that the same design principles and construction methods were employed at each point in time.

Estimates of future earthquake damage can be arrived at by taking the average damage to each house type in the 1976 earthquake and multiplying it by the number of houses of that type at some later time period, and then accumulating the scores and dividing by the total number of houses. This procedure results in a predicted weighted average damage score. One of the difficulties with this method lies in the fact that some of the mean damage estimates employed for certain house types are based on many fewer cases than others. It would be desirable to give more weight to those estimates in which we have greater confidence, namely those based on less variable estimates. One way of doing this is to weight the mean damage estimates for house types in terms of their standard deviations. The best procedure is to give more weight to those means that have the lowest standard deviations. This can be done by using the reciprocal of the standard deviation as a weight for the mean. The formula for doing this is as follows:

$$\frac{f_1 \bar{X}_1/s_1 + f_2 \bar{X}_2/s_2 - - - - - - + f_n \bar{X}_n/s_n}{f_1/s_1 + f_2/s_2 - - - - - - - - - - + f_n/s_n} = \text{predicted damage}$$

Where f_i = the number of cases of a given house type, $\bar{X}_i$ = the mean damage experienced by that house type in 1976 and s_i = the standard deviation of damage for that house type.

Table 11-44 gives the results of this procedure for the experimental, control group and city samples, and for agency and non-agency houses in the experimental group for the time periods 1975, 1978 and 1980. Column one of the table gives the actual mean damage suffered in the earthquake of 1976, along with the standard deviation for damage. Colums 2, 3 and 4 give weighted damage estimates using the above method of calculation.

The first thing that needs to be noted is that column two weights the vulnerability of the pre-earthquake housing stock by giving more weight to the categories of housing with the lowest standard deviation of damage. This results in slightly different figures than the ones appearing in column one for actual damage. This is particularly noticeable for the control group. The interpretation of this difference is as follows. If an earthquake of 7.5 had occurred in the control group

Table 11-44

Changes in Earthquake Vulnerability,1975-1980, For Control, Experimental Groups and City and for Agency and Non-Agency Houses

Sample Group	Actual Damage 1978	Expected Damage 1975	Expected Damage 1978	Expected Damage 1980	% Change 1975-1980
Experimental Group	2.16 (S=1.03)	2.15 (N=804)	1.24 (N=804)	1.21 (N=676)	43.7
Non-Agency	2.01 (S=1.09)	2.13 (N=564)	1.49 (N=564)	1.40 (N=447)	34.3
Agency	2.50 (S=.80)	2.19 (N=240)	0.87 (N-240)	0.86 (N=229)	60.7
Control Group	0.31 (S=.62)	1.49 (N=573)	1.40 (N=573)	1.37 (N=504)	8.0
City	1.80 (S=1.12)	1.86 (N=320)	0.83 (N=320)	0.82 (N=268)	55.9

in 1976, it is predicted that the average damage there would have been 1.49 on a scale where 0 = no damage, 1 = slight damage, 2 = heavy damage and 3 = destroyed. In comparison, the control group actually suffered damage equal to 0.31, indicating that the earthquake was much lighter there.

When the predicted 1975 control group figure is compared to the experimental group for the same time period, it is seen that it was considerably less vulnerable before the earthquake (1.49 as compared to 2.15). It would have experienced average damage between slight and heavy, while the predicted value for the experimental group was slightly above "heave damage" on an average. This is due to the difference in housing stock in the two areas. The control group, it will be recalled, had fewer adobe houses, especially with tile roofs, and more houses of cane, palm or poles on the one hand, and more of concrete block on the other. Both of these last types have low damage scores in comparison to adobe. It is the difference in the percentage of adobe houses therefore that makes the difference between the control and experimental groups. The same explanation applies to the difference between the city and the experimental group.

When people who were living in agency as compared to non-agency houses in 1978 are examined in terms of the pre-earthquake vulnerability of their houses, it is seen that they were almost exactly alike before the earthquake. After the disaster, because of differential changes in house types for the two groups, they became quite different in level of vulnerability. Both groups improved considerably, but the agency house group made by far the greatest improvement. Their vulnerability dropped from a pre-earthquake high of 2.19 (greater than heavy expected damage) to 0.86 (below slight damage) on an average. This represent a 61 percent decrease in earthquake vulnerability as compared to a 34 percent decrease for the non-agency house group.

The experimental group as a whole dropped from a score of 2.15 to one of 1.21, representing a decrease of 44 percent in vulnerability. During the same period, the control group went from 1.49 to 1.37, a decrease of only 8.0 percent. This indicates that actions taken by agencies considerably improved the earthquake vulnerability situation for people in the experimental group. Along with these efforts, people who built their own houses also improved considerably, resulting in an overall improvement in the experimental group significantly larger than in the control group. Even in the control group, however, things improved by eight percent in the short period of four years.

All of this seems to show that if an earthquake such as that of February 4, 1976 should occur again, it will produce less severe damage to housing and probably will result in fewer casualties. In interpreting these data, however, it must be remembered that they assume that houses of a given type as classified by wall-roof combinations, which were built after the earthquake, were essentially similar in design and construction to those same types before the earthquake. If improvements were made in construction or design, then our estimates over-estimate the amount of damage that will occur in a future earthquake. Of course if construction methods and designs have moved in the opposite direction, the estimates show less predicted damage than would occur. The method employed uses a strictly "actuarial" basis for predicting future damage, that is, it predicts that what happened in the past to a certain type of house, adobe and tile for example, will happen to the same type of house in the future, assuming that it was constructed in the same way.

Summary and Conclusions

The data presented in the last three chapters show that significant changes took place in housing patterns in Guatemala following the 1976 earthquake. These changes were in the direction of modernization as traditional housing patterns and materials were abandoned for more modern, industrially produced ones. The trend was strong in both the earthquake affected area and in the region surrounding it where earthquake damages were light. It appears, therefore, that when the disaster occurred, a general movement towards modernization was already underway in the country as a whole, and this trend was magnified by the effects of the disaster which dramatized the vulnerability of adobe structures and added weight to an already established preference for more modern housing patterns.

Even though a strong general trend was observed, even in the control group area, change was much more pronounced in the heavily damaged communities of the experimental group. There the object lesson learned from the earthquake combined with already established trends and was augmented by housing programs mounted by relief and reconstruction agencies to produce a dramatic transition in housing patterns. Strong evidence exists that when people built their own houses the movement toward modernization was not nearly so rapid and complete as when they were supplied houses by agencies. Thus it is clear that agency housing programs were primarily responsible for the extensiveness of housing modernization in the disaster area after the earthquake.

This modernization trend must be evaluated, in the long run, against several criteria. First, it is evident that modern structures performed better in the earthquake and therefore the housing transition which has taken place has undoubtedly lowered earthquake vulnerability. At the same time, however, it has increased the cost of housing and has led to the use of industrially produced materials that frequently must be obtained outside Guatemala. This appears to mean that the improvement in safety has been obtained at the cost of increased dependency. With the data available, it is impossible to evaluate the long-range economic effects of this trade-off between safety and dependency, but it can not be ignored in future research. The dependency relationship between rural villages and Guatemala City has probably been strengthened, especially if the increased cost of housing is considered, and the introduction of mortgage financing is taken into account.

Another point needs to be made concerning the modernization trend. Data on housing preferences show rather clearly that this trend is in the direction desired by the people themselves. Traditional materials are regarded by many Guatemalans as being less desirable along several preference dimensions, including safety, appearance and status. This seems to mean that agency programs which built permanent houses or supplied lamina moved in the direction preferred by disaster victims. Such a conclusion is also supported by the fact that in the control group where agency programs were absent, and among people who built their own houses, modernization also took place. While this change in self-built housing could have been stimulated by the example set by agencies, and by statements made on the mass media, when the preference data is taken into account it is more reasonable to assume that the people themselves wanted to move in this direction.

If this modernization trend and its accompanying increase in dependency is to be moderated, it will be necessary for massive educational programs to be carried out to teach those who actually design and build houses in Guatemala to utilize indigenous materials in a way that is, at the same time, earthquake resistant, acceptable in terms of the aesthetic preferences, and acceptable in terms of housing amenities and social status. It is evident that along with a desire to be safer, the people wish to live better, and to achieve higher economic status.

Not only do the data on house construction demonstrate a modernization trend but so do those related to urban services. It is evident that during the four years following the earthquake, substantial improvements occurred in both the earthquake affected and unaffected areas in water systems and electricifcation. Lesser improvements occurred with respect to human waste disposal systems. Except in a few cases of permanent housing, these changes seem to be more or less evenly spread over the agency and non-agency house groups and do not seem to be heavily associated with agency housing programs. They nevertheless add further weight to the general trend towards modernization in the country as a whole. In addition, these data seem to show that agency housing programs tended to select people for participation who were slightly better off than others,as measured by their house values before the earthquake.

When program types are compared in terms of their contribution to recovery, the following results stand out. Households who received a permanent agency house ended up with houses worth considerably more than their pre-earthquake houses, even when the value of the house is decremented by the amount of the housing loan reported by their owners. This means that permanent house recipients more than recovered if house value is taken as a measure of recovery. In contrast, those who received temporary houses made of wood and lamina ended up with houses below the values of their pre-earthquake residences even when loans were not deducted. They appear on this basis not to have recovered as far as housing is concerned in the four-year period following the earthquake, It appears that receiving a temporary agency house had the effect of delaying efforts to obtain permanent housing and resulted in a slowdown in the recovery process.

This interpretation is reinforced by the fact that those households who received no aid at all (with the exception of housing loans in some cases) achieved a higher level of recovery than temporary house people. This group represents people who either built their own houses or hired someone to do so. Their house values in 1980 came very close,on an average,to the values of their pre-earthquake houses and they appear to be within five to ten percent of achieving recovery measured this way. Lamina recipients appear to be very similar to those who received no aid as far as recovery is concerned, but they appear to have been poorer on an average and to have experienced slightly more loss.

There are differences between program types in two variables that are related to need that must be taken into account in evaluating the above discussion. First, those who received temporary houses suffered the most damage in the earthquake. They were closely followed in level of damage by those who received permanent houses. In contrast, those who received no aid suffered the lowest damage and those receiving lamina were only slightly higher in damage level. This means that temporary and permanent housing programs served the groups most in need, if damage is taken as an indicator. Statistical analysis supports this conclusion, showing that there was a positive relationship between receiving an agency house and level of damage.

Using damage as a measure of need, success rates were computed for temporary and permanent housing programs. Temporary programs achieved a 55.6 percent success rate as compared to 56.2 for permanent housing programs. However, the former was more successful in getting houses to people in high need than the latter which was more successful in avoiding supplying them to people with low need.

It is evident from these figures and others that there were substantial numbers of people in the earthquake area who needed housing assistance and did not receive it. While some of these were served by lamina programs, many were left with no assistance. It is undoubtedly true that many people voluntarily chose not to associate themselves with housing programs because they did not wish to work in groups on housing construction or to take out housing loans. It is also evident that the criterion used for program participation ruled others out. For example, to receive an agency house frequently required land ownership. To buy lamina, required money.

Data on the socioeconomic status of housing recipients show that on an average, there was a positive relationship between the level of domestic assets of a household and receiving an agency house. This means that people with more economic resources were more likely to be served by these programs. The relationship, however, is not strong and programs differ in terms of their bias in terms of economic status. Permanent housing programs were more likely to serve the upper middle socioeconomic group, while temporary programs were more focused on the upper and lower groups. Lamina programs seem to have been more focused on the lower socioeconomic group, while the no program group is comprised disproportionately of those from the upper and lower groups. The upper and lower groups either chose not to associate with housing programs or were ruled out by criteria used to select participants. This left the lower middle group as the one least often served by whole housing programs.

It should be emphasized that this relationship between aid and socioeconomic status is rather weak and despite its existence, each program type served each economic group to some extent.

It is apparent from the complex set of data presented that the degree to which a household recovered from the earthquake in the four year period covered by this study depends heavily upon a combination of interrelated factors. Probably the most important is related to the community they happened to live in, since different types of aid programs were carried out in different communities, and in addition, communities differed in how extensively they were damaged. In a later chapter a multivariate analysis will be presented in an attempt to determine how various factors contributed to the recovery process at the household level.

Chapter 12

Reconstruction in Four Urban Post-Disaster Settlements

JoAnn K. Glittenberg

Guatemala City, capital of the Republic of Guatemala, is located in the Valley of La Ermita, in the volcanic central highlands of the country. Ancient Mayan trade routes once criss-crossed this area, meeting in the noted Mayan center, Kaminaljuyu, where ancient ruins are still visible along a busy freeway of the modern city. This valley was chosen as the best site for building the capital of Guatemala in 1776 when earthquakes and volcanic eruptions virtually destroyed the earlier capital, Antigua Guatemala.

In 1917, an earthquake again almost completely destroyed the Capital City of Guatemala. It was, however, rebuilt on the same site, using basically the same plan as the old city. By 1950, its growing population had swollen to 577,120 (El Problema:54). This growth took place primarily on the flat terrain surrounding the center of the city. In the period just before the 1976 earthquake, its area had continued to expand and the density of its population had increased. At the time of the 1976 disaster the city of nearly a million inhabitants was one of great social contrasts, between highrise modern office buildings and hotels, expensive modern dwellings, deteriorating adobe houses and primitive shacks of scrap material.

A majority of the people who increased the city population during the preceding twenty-five years were from the rural areas and they were very poor. They had few choices of where to build homes and few options concerning the materials to be used or how they were to be employed. Consequently, shacks of scrap lumber and cardboard or tin were built along the sides of the available free land in the deep ravines that cut across the city. These areas nevertheless had the convenience of public water sources nearby as well as public transportation.

The largest influx of rural population came after World War II when small industry began to spring up in the city. Wages, however, were low and the workers had few financial resources. Thus a rent free house, no matter how primitive, became a critical means by which household consumption could be maximized. Jobs held by adult males were primarily as manual laborers in the construction industry or in small factories. For poor families inhabiting the sub-standard housing of the city, household incomes were maximized when many members worked at some form of wage labor. Adult females washed clothes, worked as maids in homes of the wealthy, and were industrious sellers of foods, clothing and services. Children also brought in some cash through running errands, washing or guarding cars, selling newspapers or shining shoes in the parks or streets.

Housing of course is a necessity, but when economic resources are limited, the type of shelter is less important than the function it serves (Mangin and Turner 1972). Because of this fact, the poor of Guatemala City housed themselves in the many steep ravines that cut into the level area of the city where they could maximize convenience in terms of location and find available jobs, but still have a very small output in the cost of housing. Close social networks were maintained with rural relatives and friends, and the urban house of one rural migrant became a way-station for many other new urban migrants. The rate of growth of the urban population in 1982 was 3.0 percent a year (El Problema:23). The growth occurred intermittently, however. For instance, the urban rate of growth was 5.4 in the 1950-64 period, then dropped to 4.3 in the 1964-73 period, and finally to 3.0 in the 1974-82 period. Table 12-1, which shows changes in rural and urban population, shows the shift in population in Guatemala from rural to urban areas.

Table 12-1

Rural and Urban Population (in thousands)
1950-1973

	1950	Percent	1964	Percent	1973	Percent
Rural	2,094	75	2,846	66	3,282	64
Urban	697	25	1,442	34	1,878	36

These figures support the popular belief that there has been rapid rural migration to the capital, but show that migrations to cities had been slowing down prior to the 1976 earthquake (El Problema:19).

Marginal Settlements

The special study of urban settlements to be discussed below deals with urban areas containing economically marginal populations. A review of literature on such areas indicates there are two major opinions regarding the nature of such settlements and their place in the development process. Delgado (1971) believes the settlements are misnamed. Rather than being marginal they are really an inherent part of the accelerated process of urbanization, and in fact are positive factors significant in the internal migratory currents on a national basis (Delgado 1971:272). He further notes that migration performs a vital function for national development. In contrast, most writings categorize the settlements in negative terms as a sort of social cancer needing eradication and as places lacking positive social functions.

Many elements are important to consider in understanding the development of the various types of "marginal" urban settlements, including space limitations, ownership of the land, gradual versus rapid development of the site and the political situation at the time of the development (Delgado 1971:285). Some general characteristics that are usually found in all such economically marginal settlements are: (1) the residents are poor, (2) the housing is substandard, (3) they are crowded, and also (4) there is a lack of property rights and urban services. There is, however, always a highly diversified working center nearby that has a capacity for absorbing unskilled labor on a continuous, intensive basis (Delgado 1971:288).

Delgado identifies five steps necessary to alleviate many of the problems of these crowded settlements. They are: (1) abandon the paternalistic notion that the settlements can not solve their housing problems when starting from a determined and definite basis, (2) increase active government participation in providing a solution to the problem of adequate space and legal ownership of the land, (3) channel local resources to housing in accordance with guidelines derived from the settlers' active participation in planning, (4) determine new standards of housing, (5) give aid and technical assistance in the construction of new housing to their eventual residents, and (6) provide basic infrastructural services for the community before executing a housing program (Delgado 1971:295).

The 1976 earthquake offered the Guatemalan government an opportunity to act upon several of these recommendations by providing space and legal ownership of the land, maintaining active settler's participation, developing new standards of housing, and also by offering technical assistance in constructing new houses as well as by providing basic infrastructural services such as sewers, water supplies and electricity before the building began.

Housing Prior to the Earthquake

The character of urban housing reflects Guatemala's broader economic problems. The economic base of Guatemala is agricultural and small individual landowners are the major producers of food in the nation. For most people, the margin of profit from agriculture is only slightly above the subsistence level (El Problema:25). Small scale industrialization, which began to increase in 1960 due to the Common Market of Central America, has developed under severe restrictions on expansion because of the limited buying power of the population. As a consequence, industrial development has proceeded slowly and Guatemala City is considered to be an example of a growing urban center without major industrial development (El Problema:36).

Prior to the 1976 earthquake, a study was made of the housing situation of the poor in Guatemala City. This study furnishes useful background material for the current research. It consisted of a random sample of 5,300 houses in the metropolitan area which were carefully studied in the 1973 census. There was interest at that time in trying to eliminate sub-standard housing in Guatemala City, and in particular in removing the squatters shacks in the deep ravines within the city. At the same time there were plans to provide better housing for all. Four national and international groups were involved in the 1973 housing study. They were: CIVDU (Centro de Investigaciones en Vivienda y Desarrollo Urbano), CHD (Central Internacional de Investigaciones para el Desarrollo), SIAP (Sociedad Interamericana de Plantificación) and IDESAC (Instituto para el Desarrõllo Economico y Social de Amērica Central). The major finding of the 1973 study was that for 30 years the quantity and quality of housing in the urban center had been gradually deteriorating. Not only were there not enough houses, one of the basic rights of each individual according to the Constitution of the Republic of Guatemala, but many of the old houses, especially those of adobe, were in poor repair.

One objective of the study was to develop a typology of "poor housing" called vivienda popular. The types eventually identified fell into five groups, three of which are applicable to the 1976 earthquake resettlement study. Not only were the house types studied, but also the socioeconomic status of the residents was investigated. The three types of housing that apply to the settlements studied in the Guatemalan Earthquake Study were as follows:

> Type I: This house type is constructed of discarded materials, chiefly cardboard, old wood, tin, discarded metals, etc. The house is built on steep inclines (more than 45 degree grade), and consequently it is difficult to provide with water, sewage and electricity. The house is generally inhabited by one family with an average of seven persons living there. Water has to be carried from a stream or other source. There usually is no electricity. There may be doors, but seldom windows. The total monthly family income was less than $51 in 1973. Members of the family, in particular the heads of households, are underemployed. Prior to the 1976 earthquake these types of houses were located in Zone 3 (San Jose Buena Vista, La Isla, La Joya, Oralia, La Ruedita) and Zone 5 (La Limonada) as well as in Zone 6 (La Reinita, Tecun Uman, Joyas de Senahu and San Juan de Dios). Others were in La Bethania in Zone 7 and El Milagro in the Municipio of Mixco (El Problema:79).
>
> Type II. This house type is markedly deteriorated due to lack of repair. These houses are chiefly of adobe with earthen floors and no windows. They are dispersed throughout the metropolitan area not being restricted to only one or two zones. The average monthly income of the family is limited, usually between $50 and $120. These houses are also found in Old Chinautla where land erosion has added to the precarious condition of the house.
>
> Type III. This house type is large, but it provides shelter for many families. The multiple family house is easily adapted to the coming and going of migrants. Generally, several families share one house; they may have one social room and one kitchen, but primarily the house is composed of separate bedrooms. The collective costs are minimal; the advantage is that the house is usually located in the middle of commercial activity. One house found by the study group in 1973 housed up to 64 families. The average monthly income per family was $50 to $120.
>
> The house types also were called by other names; for instance, Type I could be called "tugurios;" Type II - "deteriorated;" and Type III - "palomares."

Economic Status of the Residents - The 1973 Census which studied the economic status of the residents of poor housing (vivienda popular) indicated that 35.5 percent of the residents received less than $50 (U. S. dollars) per month as family income, 43.8 percent received between

$50 and $120(U.S. dollars);and finally only 20.6 percent received a little more than $120 (U.S. dollars) income a month. The poverty of these people was a strong indication of how limited they were in improving their living standards.

Data from Table 12-2 indicate that the inhabitants of the shared housing (Type III) had the highest monthly household income,probably due to the increased opportunity for maximizing the production of each member as well as easy access to high density populations and thus a steady, available labor market.

Table 12-2

Monthly Income as Indicated by House Type

	Less than $50	$50 - $120	$120 plus	
Type I	74.6	21.5	3.9	100%
Type II	36.2	55.2	8.6	100
Type III	22.3	46.8	30.9	100

(El Problema:93)

Income came primarily from salaries or wages as indicated in Table 12-3. This table shows how important wages are to those of low economic status. The boss (or patron) relationship has been gradually on the wane in developing countries for the past fifty years, and self-employed income is primarily generated from low-paying odd jobs in the informal labor market, such as guarding automobiles, washing cars, selling lottery tickets, cigarettes, and other items on the streets. Wages, thus, make up the major source of income, even for the lowest group (El Problema:95).

Table 12-3

Origin of Income

Income	Boss	Self	Wages
$50 or less	0.5	27.8	64.1
$50 - $120	4.3	19.9	70.7
$120 plus	4.3	22.4	63.7

Education as found in the 1973 Census data, was limited,especially for those living in Type I housing, where 51.1 percent had not finished the first three years of primary education and 24.2 percent were considered illiterate. Those living in Type I housing also were the new migrants to the city. Of those living in the Type I houses, a total of 57 percent were considered migrants; that is, they were not born in the Department of Guatemala. According to the 1973 Census, 40 percent of all the people living in the city were migrants by this definition (El Problema:98). Also, according to the Census, using figures from PEA (Poblacion Economicamente Activa) there was a twenty percent rate of unemployment.

Data from this pre-earthquake study indicate that the type of income source was not different for migrants and non-migrants in Type I housing except for the slight difference (29.6 percent migrant/ 19.1 percent non-migrant) in construction employment (El Problema:98).

Unemployment and sub-employment affected migrants as well as non-migrants.

The cost of living in the Type I, II, or III houses was minimal as found in the pre-earthquake study (1973 Census). As shown in Table 12-4, those living in Type I paid the least for housing.

Table 12-4

Monthly Cost of Living in Low Housing

	About $11	$11 - $30	+$30	Total
Type I	84.3%	11.7%	3.9%	99.9
Type II	53.8	41.2	4.8	99.8
Type III	38.1	38.6	23.3	100.0

The majority of houses damaged from the earthquake were those of the low economic level, falling into Types I and III. In particular, the houses that were made of adobe were destroyed, especially if they were old and in poor repair. As noted earlier, most Type I houses were found in the deep barrancos (ravines) around the city. The 45 degree inclines were unstable foundations for the flimsy houses. Also, many were of adobe, the construction material that was found to be most easily destroyed. Table 12-5 shows the wall construction of pre-earthquake houses - number and percent destroyed and seriously damaged in the 1976 earthquake.

Cost of the housing units was calculated for the 5,300 houses in the 1973 Census. By using the cost of living figures at the time of the earthquake (1976) the selling price of the Type I house was $400; Type II was $1800 when the earthquake struck. There were no figures for Type III houses useful at the family level because the cost could not be divided according to the number of families living within the compound since the number varied from month to month (El Problema:9).

The total number of dwellings falling under the heading of "poor housing," vivienda popular, before the earthquake was astonishing. According to the study done on 1973 Census data, the housing deficit in Guatemala City was severe, as shown in Table 12-6 which estimates that 130,810 houses were needed in the city alone.

The 1973 Urban Census Study shows clearly that housing was a critical issue at the time of the earthquake, and the disaster situation was made even more devastating by the overwhelming need for the poor to generate capital in order to modify or correct their living conditions. With 70 percent of the population needing some critical housing improvements before the earthquake, the disaster further increased the number in need.

The earthquake, however, brought in outside aid. The aid and assistance delivered by over one hundred foreign agencies brought with it, not only some of the needed capital, but the impetus and expertise to change some of these conditions.

Table 12-5

Number and Percent of Houses Destroyed and Seriously Damaged by Materials of Wall Construction, Guatemala City, February 1976

	Houses Destroyed and Seriously Damaged									
			Material of the Walls							
	Total		Adobe		Brick and/or Block		Wood		Palo,Bajareque and Other	
Zone	No.	%	No.	%	No.	%	No.	%	No.	%
1	5,928	100.0	5,456	92.0	237	4.0	17	0.3	218	3.7
2	1,131	100.0	951	84.1	131	11.6	11	1.0	38	3.3
3	5,882	100.0	4,703	80.0	234	4.0	320	5.4	625	10.6
4	459	100.0	425	92.6	26	5.7	1	0.2	7	1.5
5	4,995	100.0	4,272	85.5	315	6.3	151	3.0	257	5.2
6	6,774	100.0	5,332	78.7	449	6.6	354	5.2	639	9.5
7	5,461	100.0	4,945	90.6	192	3.5	324	5.9	-	-
8	1,816	100.0	1,742	95.9	25	1.4	6	0.3	43	2.4
9	109	100.0	52	47.7	45	41.3	7	0.4	5	4.6
10	554	100.0	460	83.0	38	6.9	8	1.4	48	8.7
11	1,589	100.0	1,255	79.0	193	12.1	14	0.9	127	8.0
12	2,775	100.0	2,406	86.7	81	2.9	27	1.0	261	9.4
13	1,049	100.0	878	83.7	34	3.2	19	1.8	118	11.3
14	648	100.0	496	76.6	137	21.1	2	0.3	13	2.0
15	137	100.0	84	61.3	47	34.3	1	0.7	5	3.7
16	398	100.0	338	84.9	4	1.0	56	14.1	-	-
17	497	100.0	388	78.1	76	15.3	8	1.6	25	5.0
18	2,822	100.0	2,396	84.9	76	2.7	49	1.7	301	10.7
19	1,688	100.0	1,573	93.2	14	0.8	23	1.4	78	4.6
22	434	100.0	408	94.1	16	3.7	5	1.1	5	1.1
23	642	100.0	628	97.8	1	0.2	4	0.6	9	1.4
24	591	100.0	524	88.7	9	1.5	6	1.0	52	8.8
Total	46,379	100.0	39,712	85.6	2,380	5.1	1,413	3.1	2,874	6.2

Source: Dirección General de Estadística, Ministerio de Economía, Guatemala Investigación de campo sobre los daños ocasionados en las viviendas por el sismo del 4 de Febrero de 1976, la Edicion, Marzo de 1976.

Table 12-6

Estimate of Housing Deficit in the Metropolitan Area of Guatemala

Type of House	Population No.	Population %	No.of Person/House	Houses No.	Houses %
I.Tugurio	109,915	9.7	9.4	11,693	7.42
II.Deteriorada	434,894	38.38	7.33	59,330	37.64
III.Palomares	106,740	9.42	31.57	3,381	2.14
IV.Sub-urbana	74,447	6.57	6.45	11,542	7.33
V.Periferica	67,196	5.93	10.09	6,659	4.23
Total	793,192	70.00	8.57	92,605	58.76

Type of House	Houses Destroyed	Housing Shortage (No. of Houses)
I. Tugurio	2,144	15,702
II. Deteriorada	46,230	72,173
III. Palamares	3,381	20,929
IV. Sub-urbana	2,145	12,407
V. Periferica	6,659	9,599
Total	60,557	130,810
Total of the Metropolitan Area (including suburbs) -------------		209,282

Source: Cuardo 1:1
El Problema de la Vivienda Popular, 1978:3.

The Effects of the Earthquake in Guatemala City

After the earthquake destroyed or severely damaged their homes, more than 200,000 urban dwellers struggled to find some type of shelter. This struggle in the capital extended long after the disaster had occurred. Tents, cardboard boxes, plastic materials, sheets of metal roofing, and discarded wood in almost any conceivable combination, were used to construct shelter for many well into the first year. Water supplies and sewers were interrupted and food supplies were limited. Two major bridges spanning deep ravines and connecting critical parts of the city were destroyed. Many freeways and major throughfares buckled under the strain and were impassible. Numerous business places, office buildings and hotels were either destroyed or severely damaged. The major national buildings such as the Office of Finance, the National Palace and the President's home were intact, however, and no national leader, such as member of the Congress, Vice-president or President was killed.

Some telephone and telegraph services were in operation right after the earthquake in spite of moderate damages. Buses were serviceable within the first few days after rubble was removed from the major highways and streets. The Central Market, vital for commerce, was destroyed. Marketing then continued from streets, sidewalks and open spaces. Banks continued to exchange monies and made other transactions, many using tables on the sidewalks. The destruction or severe damage to ancient cathedrals (some dating to times of the Conquest) was extensive. These cathedrals were, however, soon marked for early restoration as national monuments.

Surviving hospitals continued to overflow with sick and dying well into the second half of the year, partially due to the complete destruction of the large general hospital, San Juan de Dios. Roosevelt Hospital received the largest number of injured, and it was here that a special unit was built to handle the numerous spinal cord injuries. Specialists in handling quadriplegics and hemiplegics were brought in to help with the number of paralyzed victims. Orphanages filled, as many abandoned or orphaned infants and children of all ages were brought to the centers.

Even under these conditions, by the end of the first year a bustling city was again in full operation. Life was different, however, especially for the numerous earthquake victims who were now living in new, post-earthquake settlements.

Number and Percent of Houses Destroyed and Damaged in Guatemala City

Table 12-7 indicates the number (46,379) and percent (34 percent) of houses that were destroyed or seriously damaged in Guatemala City. As can be seen, several of the zones had from 49 to 82 percent of the houses destroyed or damaged, while two high-income level zones had only seven percent destruction. Table 12-5 above, reveals the fragility of adobe. The range of destruction of this wall type was from 47.7 percent in Zone 9 to 97.8 percent in Zone 23. Brick and block construction proved to be the most secure materials. Because of the deteriorated condition of many of the houses within the area, many were not completely destroyed, but damaged to the extent that they were uninhabitable or extremely dangerous. Counting earthquake losses, and the deficit which

Table 12-7

Number and Percent of Houses Destroyed and Seriously Damaged in the Municipal Zones of the Capital City, February, 1976

Zone	Houses Destroyed and Seriously Damaged	%
1	5,928	34
2	1,131	25
3	5,882	49
4	459	41
5	4,995	30
6	6,774	46
7	5,461	32
8	1,816	32
9	109	7
10	554	15
11	1,589	17
12	2,775	31
13	1,049	31
14	648	21
15	137	7
16	398	49
17	497	41
18	2,822	49
19	1,688	37
22	434	16
24	642	79
25	591	82
Total	46,379	34

Source: Direccion General de Estadistica, Ministerio de Economica Guatemala Investigacion de campo sobre los danos ocasionados en las viviendas por el sismo del 4 de Febrero de 1976, la Edicion, Marzo de 1976.

existed at the time it struck, a total of 131,420 houses were immediately needed in the city following the disaster (El Problema:1).

Approximately 120 disaster victim settlements sprang up throughout the city as an initial spontaneous response to this need. Victims who lived in these makeshift settlements were, for the most part, renters prior to the earthquake and now found themselves without a roof over their heads and a landowner incapable of rebuilding. They sought shelter in the best way they could and organized themselves around available land and resources.

The Urban Settlements Studied in this Research

Among the 120 settlements that formed following the earthquake, a variation in the process of recovery could be observed. Consequently, four settlements representing different types of recovery were chosen for study in this research: Roosevelt (a government refugee style settlement), Carolingia (a planned permanent settlement), 4th of February (an unplanned squatters settlement) and New Chinautla (a planned permanent resettlement of people from a previously existing town). Each of the settlements was built in a uniquely different location. Roosevelt was located in the middle of a very busy, active central part of the city and housed people who had lived in Housing Types II and III at the time of the disaster. Carolingia was built on a spacious treeless area on the periphery of the city to serve people from Type I housing, and The Fourth of February sprang up on the very sides of the busiest freeway in town. Its residents also came primarily from Type I housing. In contrast, New Chinautla was built in the area on the plateau above the destroyed town it replaced and near the commercial center of the city, but yet on the periphery of the densely settled area. New Chinautla also was unique in that a large percentage of the new settlers were Indian, whereas the other three settlements had only a few Indians located in them. The sample sites were chosen to be approximately equal in terms of the following criteria: size (approximately 10,000 inhabitants), similar local governments (elected officials and appointed committees), losses (all had completely lost their pre-earthquake homes) and each family was low or very low in terms of household income.

The sampling of households within these communities was carried out in the manner described in Chapter 2. However, since none of the settlements had existed before the earthquake, completely new maps had to be drawn. Each settlement was divided into sectors of approximately the same number of inhabitants. Sectors were chosen from a random table of numbers, and households identified in the same sampling system as previously described. A pre-test, using the same questionnaire as used throughout the household survey for this research, was conducted in a similar settlement, Plaza del Toros, in Zone 13. From this pre-test it was found that a few of the questions needed rewording to make them applicable to the urban center, but for all practical purposes the same interview schedule used in towns and villages outside Guatemala City was used in the city sample.

The first wave of interviews was conducted in January and February, 1978, and the second wave was completed in June, 1980. The sample size and attrition rate are given in Chapter 2.

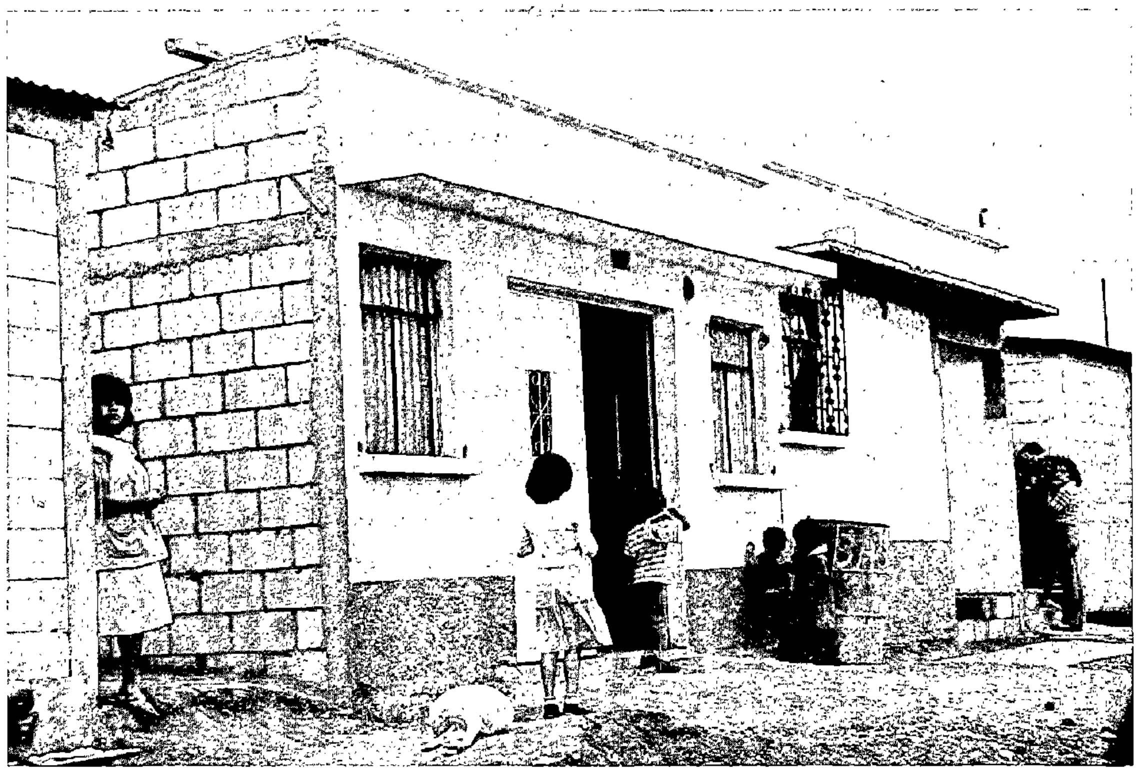
In addition to the household survey, key leaders were interviewed and participant observation was an ongoing process in each settlement. One of the senior research staff lived for a period of time in each settlement except New Chinautla. One of the research assistants worked, on a daily basis, for over three years in that settlement, however. The ethnographic data obtained from informal interviewing and participant observation cover a period of time from June, 1977 through January 10, 1982.

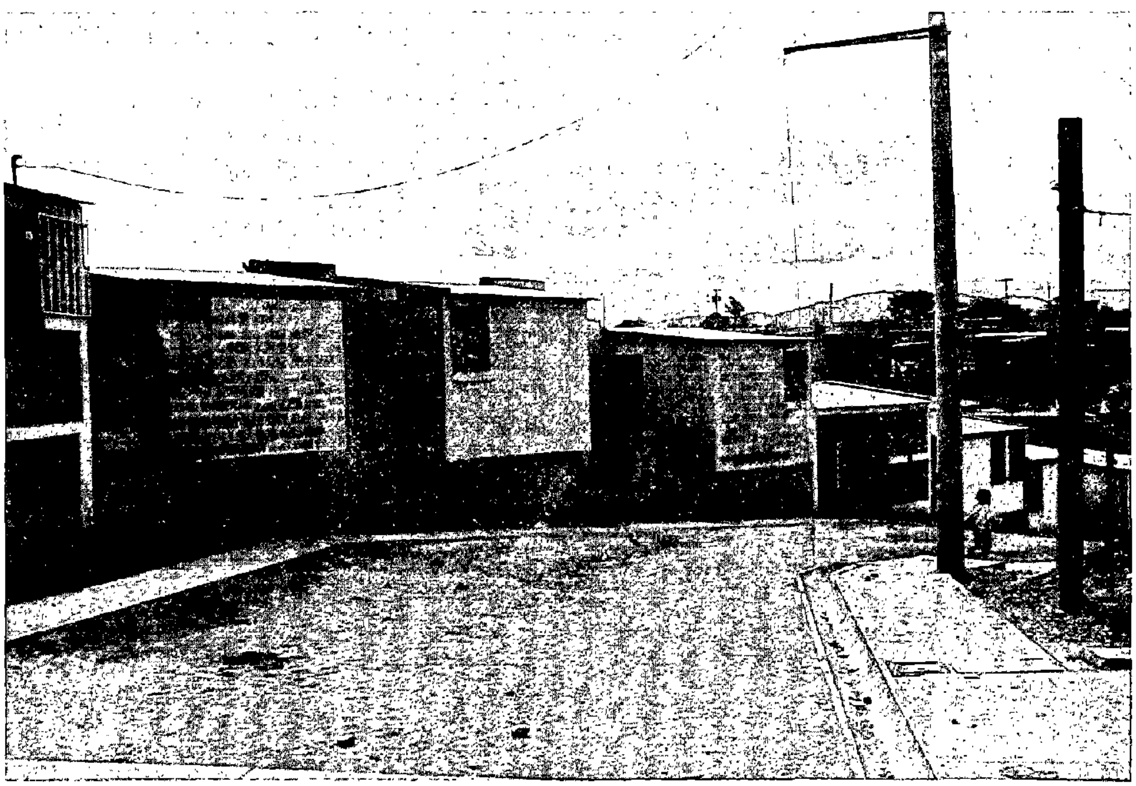
Description of Settlements

Roosevelt: A government built refugee style settlement. On January 10, 1982 you could find the residents of the original settlement, Roosevelt, living in new houses along asphalted streets with lighted street corners. Each house, made of cement block, with glass windows and sturdy metal doors, has two rooms and a small back yard. Electric lights and private bathrooms with flush toilets and showers are added comforts for those who lived for over four years in barracks-like houses in Zone 11 near the Roosevelt Hospital. In 1982, the residents seemed filled with excitement, hope and energy. A new school building in progress had a sign that reflected community spirit, "Education - Hope for Tomorrow." Various stores along the roadway were active in trading. Residents were decorating their houses and eagerly invited the researcher in to see their new homes.

The new settlement in Zone 6 is named Quintanal, and it is located far from reminders of the four years in near hopeless despair in Asentamiento Roosevelt in Zone 11. The residents were eager to tell the researcher that they were buying their own houses with their own land for a cost of between $1,000 and $5,000. This opportunity, as they viewed it, was made possible by the persistence of the people and the help of BANVI (Banco Nacional de la Vivienda). Perhaps most surprising was the news that single women with families could purchase a home just as could those with male heads of households. This change in the BANVI rule is significant since it had been a major stumbling block for women acquiring a home. In Roosevelt, approximately one-third of the household heads were single females. Houses are owned under strict rules and can not be sold but only passed on as inheritance to survivors of the head of household. (See Picture 1, Quintanal 1982)

History of the Development - The attitude of the people toward Quintanal was in stark contrast to the way they saw the settlement from which they came. Asentamiento Roosevelt was viewed with despair and hopelessness by its residents,as each year the long wooden barracks-like houses became more dilapidated and the rubbish piles surrounding the area became higher. The people themselves became disenchanted and nearly lost hope that their lives would ever change. The 10,000 earthquake victims that lived on the flat, barren land behind the Roosevelt Hospital had been economically poor people before the earthquake. For the most part, they had lived dispersed throughout the city. Many had lived in Type III houses called palomares, houses where many families live and share a common kitchen. When the earthquake destroyed these homes, the owners were unable or unwilling to rebuild, and the occupants found shelter under cardboard boxes and pieces of plastic and scraps of wood and metal. A few (2,000) lived in pup tents donated by The German Red Cross. Some of these homeless people lived under such





Picture 1. Quintanal (Roosevelt) 1982

conditions for a year following the disaster. They tell of the difficulties of securing safe water and maintaining sanitation. "Cooking outside was the hardest ordeal...especially in the heavy rains," was the response of one mother. "The tents were't waterproof and after awhile, everything was wet," replied another.

Shelters were placed mostly along public streets. People were dispersed around various parts of the city and natural social networks were disrupted.

The residents of Roosevelt had been among these street dwellers after the disaster. The majority (over 60 percent) had spent between four months and a year living in cardboard, tin shacks or in pup tents. When the galeras which constituted Roosevelt were completed, approximately three months after the disaster, many of the street dwellers were moved into the Settlement of Roosevelt. A second type of housing was built on the same site approximately five months later. It consisted of small prefabricated houses, casitas, with lamina walls and roofs. The dimensions were 10 feet by 10 feet. The galeras, or wooden barracks type, consisted of long wooden buildings with sections containing 54 households. The household units were 15 feet by 23 feet each, and they were separated by a thin wall. Kitchens were separate three-sided sheds attached to the galera. The long galeras were divided into five sectors containing 1700 households, and the small prefabricated houses numbered 300. Some of these small houses were creatively connected by a constructed "walkway" of tin and wood that hid from the view of officials the illegal connections, making it possible for one family to occupy two units as piles of old tires, boxes and other distractors were used to hide the connections.

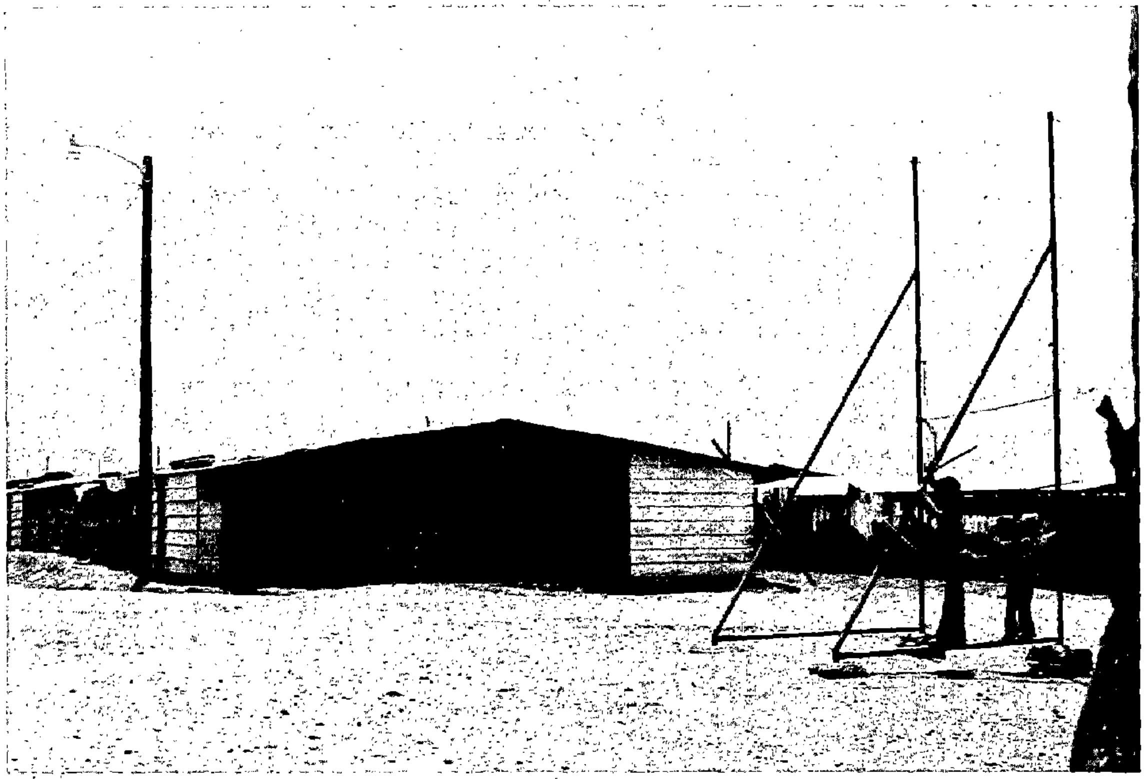
The 10,000 inhabitants of this four-block area known as The Asentamiento Roosevelt experienced many discomforts. For instance, the dirt streets had no curbs and the rushing waters from rain and sewage eroded most of the street. During the rainy season it was almost impossible to drive a car through the settlement. The stagnant water and mud were sanitary hazards any time of the year. The darkness of the streets was bothersome and made them dangerous at night. Electricity was not brought into the settlement until the second year (1978) and then the lines were only to the main streets which were dimly lit. Even then, individual houses had no electricity, thus visiting the settlement at night demanded a good flashlight and a stalwart soul. The crime rate in the settlement was extremely high, in part related to the problem of lighting.

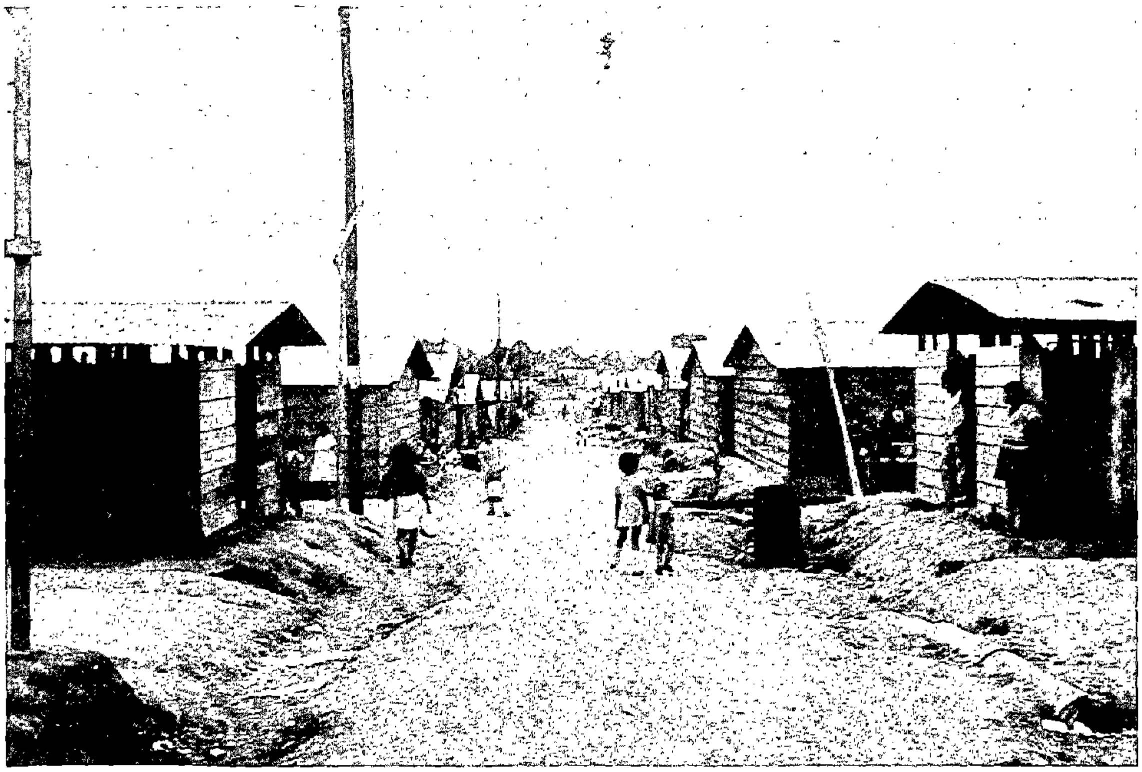
Water was the other chief problem, as it was not only very scarce but also unsafe. Potable water was in shortage even during the rainy season. It was supplied by faucets located in two centers in each of the five sectors. There were 12 faucets per 1,000 people and water was not always available in these outlets. In fact, the water mains were opened on a rotating basis. It was common to take two hours just to have enough water to fill one tub in order to do a load of wash. This problem was compounded by the fact that many of the women in the settlement made a meager salary by "taking in laundry." Spending a day doing such work would earn a woman about 65¢ if she was lucky enough to obtain the water.

The sanitary facilities, toilets and showers, were primitive. Each sector, containing about 2,000 people, had two areas of 16 latrines and 16 showers for each sex. The women's latrines and showers were pink, and the men's were blue. Privacy was nearly impossible as the sheds were poorly constructed and the doors were very short. Women complained about being harassed by "peeping toms" or being propositioned, or even being forced to pay a small sum of money before being allowed to enter a latrine or shower.

Trash and garbage collection for a population of this size is problematic. There were just two centers for collection and each of these collection centers was poorly constructed. In order to dump trash or garbage, a person had to lean over and toss garbage as best he could without having it all fall back upon him. Twice a week the garbage was picked up. Children and animals were drawn to the collection centers as an area of play and "treasure hunting." In July, 1980, a large fence was constructed around the centers to prevent the wind from blowing everything around. The long lines of unpainted sheds were dismal. Few individuals put out flowers or in any way attempted to personalize these sheds. A feeling of hopelessness pervaded the settlement. (See Picture 2, Roosevelt 1978.)

The family institution was the strongest social institution in Asentamiento Roosevelt. Common-law marriages were the most common (43.2%) and about one-third of the household heads were detached women either divorced, widowed or single. A majority (73.6 percent) of the families were Catholic and 26.4 percent stated they were Protestant. There was no church in the settlement. One small Protestant chapel was located in one of the prefabricated houses. Frequently evangelists





Picture 2. Roosevelt 1977 and 1979

would make visits to groups or individuals within the settlement. Funerals, baptisms, and weddings took place outside.

The political structure of Roosevelt was similar to that found in the other settlements. Sixty representatives were elected to serve as part of a committee of reconstruction. These elected representatives were from each sector, and they had two representatives to the National Committee of Reconstruction. A government-employed receptionist worked in the settlement for four hours daily and there was also a secretary who kept records. The locally elected representatives met weekly at the local community building. Five subcommittees dealt with problems of the community including health, water, drainage, education, social justice and reconstruction.

Local representatives and governmental appointees were not always in accord. Most often the local people expressed feelings of helplessness and hopelessness. Now that the group has been resettled, they speak of hope and of the future. Before the move, it was said that "BANVI always promises but never delivers...I'll be here 'til I die." Now they were saying, "It's like a miracle. I didn't believe it would ever happen."

Education before the move was provided in two public schools where about 800 children were enrolled. The boys attended in the morning session, and the girls in the afternoon. The average classroom had about 70 pupils and one teacher. Teachers said, "We're saddened because we have nothing to teach with....no pencils, paper, nor books." Attendance was sporadic and it seemed that little learning took place. For instance, one fourth grade teacher claimed 150 children enrolled in her class, but when it was time for the final examinations for promotion, only 17 children took the examination. In the new settlement, El Quintanal, the new slogan, "Education-Hope for Tomorrow," is a major change in attitude. Adult education was provided in other settlements in the form of literacy classes, sewing, typing, etc., but because of a lack of electricity there were no adult education classes in Roosevelt.

Health care was not a major problem in Roosevelt because of the easy access to the large next door Roosevelt Hospital. There also was a small health clinic staffed by a medical student and a nursing student. The clinic hours were only in the morning. The poor sanitation conditions,as referred to earlier,have now been radically corrected in the new settlement. Trash cans abound and the streets and houses appear exceptionally neat. In the old settlement there were a number of traditional healers, including four inyeccionistas, and a woman known to practice brujeria (witchcraft). There were no signs of such in the new settlement which is very close to many pharmacies.

The economy of the old settlement was generally based on wage labor, sales and services. There were small businesses such as tiny stores, shoe repair shops, tailors and laundresses. The commercial life of the people was obviously outside the boundaries of the settlement. In Quintanal the same observation can be made since there are no major stores or services, but the new settlement is near Calle Marti, one of the busy commercial streets in Guatemala City.

Law and order were very visible in the old settlement. The police station was in a prominent place, and policemen frequently patrolled the streets. No police action was noticed during the study, however. The people reported that the crime rate was high, especially crimes against persons, e.g., assault, murder and rape. In the new settlement there were no police visible and no police station. In the old settlement neighbors spoke of not trusting one another, and of going to the bathrooms and water fountains armed with knives. Today in the new settlement there appears to be a feeling of cooperation and compassion.

Interviews with the Leaders About the Emergency and Reconstruction Process

The four leaders interviewed in Roosevelt before the move to the new settlement had taken place had similar accounts of the emergency and reconstruction process. The emergency period was difficult because scarce food and water were not equally distributed. President Laugerud was viewed by all four as a strong, positive leader "who took charge" and "set a moral frame for responding to everyone's needs." "He even had a television program that you could call in to and talk to him directly. He cried for the pueblo! He was everywhere!"

Emergency actions included putting up shelters in the streets, organizing a formal camp for the homeless, and organizing people into committees. "No one had previous experience and we all had to learn the fundamentals. Some became good leaders and some were plain thieves."

The leaders reported much corruption on the part of government workers, and they had little confidence in many political leaders. Before moving to the new settlement, Quintanal, these leaders said, "They offered much, but completed nothing." Persons who were mentioned as being positive and influential during the reconstruction process were:

President Laugerud, Padre Jose Maria Ruiz Furlan, and Deputy Oscar Enrique Guerra. Each was viewed as being interested in and dedicated to the survivors and especially to those of Asentamiento Roosevelt.

The leaders also believed that foreigners did not often know what the local people needed and therefore made mistakes. They felt that the best plan would be to have a team prepared to handle emergencies and to organize communities. "That's what the National Emergency Committee was supposed to do." The leaders also agreed that aid should be given as directly as possible to the communities and "not to any intermediary." They also felt that aid should not be given out free, but should be worked for. They said that agencies should also work together and not compete. They viewed the work in Carolingia as being a good example of where agencies cooperated and thus had the best results.

In the leaders' opinions it is better to have only one agency working within one community. They cited The Red Cross as being one of the best agencies "because it did a lot of work and in many places." The leaders also mentioned the aid that came from the United States was good.

At the time of the last interview in 1980, leaders felt that the reconstruction process would continue anywhere from five to twenty-five more years. Two years later their opinions would probably have been different after the move to Quintanal. The agencies that worked in particular in Roosevelt were BANVI and the National Reconstruction Committee. In 1980 the leaders were convinced that the leaders of BANVI would never move the settlement, but as was evidenced from the interviews in 1982 with the residents of the new settlement Quintanal, BANVI had been able to reconstruct the settlement and they saw this movement as being highly successful.

Household Interviews

Household heads interviewed both in 1978 and 1980 ranged in age from 18 to 78 years of age, with the average age of 38 years; 29.55 percent being "single" and 26.42 percent being married. The majority of the families (94 percent) were Ladino and only six percent considered themselves Indian.

One question which interested everyone was, "Where did the residents of Roosevelt come from?" The interview data show that 98 percent came from the same zone. It is clear, however, from other data that some came first from various other zones such as Cerro del Carmen (near the Iglesia Candelaria), Santa Domingo in Zone 1, and Cerro de Sandose in Zone 3. Victims came from those zones and subsequently erected temporary shelters such as cardboard and old wooden shacks or pup tents along-side of Roosevelt Hospital. It is clear from the data that the residents of the Asentamiento did not migrate from the rural area, but rather they were victims of houses that had been lost and were not going to be reconstructed by their owners. It is also clear from the ethnographic data that the settlers had no common geographical backgrounds nor common social experiences. Housing choices were not available to them and they were moved off the streets and into the galeras of Asentamiento Roosevelt by The Reconstruction Committee.

According to 86 percent of the respondents, other parts of their lives,such as family relations,remained the same in Roosevelt as before the earthquake. Their relations with local authorities also remained the same, according to 93 percent. These opinions were held in spite of the fact that 54 percent believed their personal economic situation was worse than before the disaster. Forty-six percent also believed their houses were worse than before the earthquake, but 56.6 percent believed that their present wooden house was safer than the previous house because it was not adobe.

The food shortage was severe according to 73.6 percent of the respondents and this shortage lasted for the greatest number (38.5 percent) for two to four weeks, and for an additional 23.1 percent the shortage lasted up to two months and for still another 17 percent the shortage lasted beyond two to three months. The foods listed as being in the shortest supply were: beans, corn, rice, bread, the basics of the Guatemalan diet. A majority of respondents (67.9 percent) received donated food, and very little of the food was unfamiliar (32.4 percent). The unfamiliar foods were primarily canned vegetables and meats. No one believed they received food unnecessarily, and only 7.6 percent received food for work.

Other free aid received was clothing (32 percent), blankets (38 percent) and medical care (42 percent). A sum of 35 percent of the residents believed the agency aid was fine, while 20.8 percent believed the agencies could have had better control of the aid and one way to improve the distribution, according to 18.9 percent, would be to distribute the aid house-to-house, presumably instead of having people stand in lines.

There was no ongoing food program in the settlement, according to the residents. Few could name any agency that helped in the emergency or recovery process. The most often mentioned were government of Mexico and the Guatemalan government. When asked how long it would be before the settlement recovered, the responses were chiefly, 39.62 percent, more than four years, and 15.09 percent believed it would never happen.

In sum, before the residents moved to the new settlement in Zone 6 they believed they were economically more deprived than before the earthquake, but that their houses were now safer. They agreed that they needed the food received during a period up to 3-4 months following the disaster.

During the first four years following the earthquake their lack of hope for the future centered more on the unfulfilled promises of the Guatemalan government (BANVI) than it did on the agency aid actually received. With the change in location, a new life began for most of the residents. There appeared to be greater hope, enthusiasm, energy and direction for the former residents of Asentamiento Roosevelt.

The plan, as actualized, was according to the recommendations that had come from the various studies and groups mentioned earlier in this chapter(CIVDU, CHD, SIAP AND INDESAC). Those recommendations included establishing sufficient space, a legal access to the land and housing tenure, and the establishment of physical infrastructure for the settlement before the houses were built. The residents were involved in the planning of their individual homes after the sewers, lights, and water supplies were established and an equitable credit plan was initiated, with even single women given an opportunity to purchase their homes.
It appears from the process of recovery that the settlement of Roosevelt, although beginning in a much slower and somewhat painful process than

some others, has been able to obtain the same standard of rehabilitation as have the other three settlements. However, if this study had not been longitudinal in nature, the total process of recovery in this particular settlement would have been inaccurately assessed.

Carolingia: A Planned Settlement. On January 10, 1982 the streets of Carolingia were busy with bus loads of people hurrying off to the center of commercial and services activities in Guatemala City. The streets were filled with automobiles, carts and walking people. The bustling activities, the diversity of the many business establishments, the trees grown tall since the earthquake, the roof tops now rusted and gray, the ruts in the streets, the sidewalks being torn up as new sewer lines were being laid down were impressive. There were new churches and some old houses had been torn down. The high school now had a high fence around it and the building looked in need of a new coat of paint. There were more bars and the residential houses looked faintly worn. New quarters were added to the backyards and a few houses had sprouted second stories. Pausing to reflect the first views of this settlement in 1977, when the sewers were being first laid down and the mortar was still wet on the walls of 1500 new houses, it was evident to the researcher that time had passed (Picture 3. Carolingia, 1980 and 1982).

History of the Development - Before the 1976 earthquake, the lower class communities of San Francisco, El Milagro and La Florida in Zone 19 and Mixco on the rim of the capital were the center of workers who lived in small, deteriorated adobe houses closely confined to a few narrow streets. More rural and urban-urban migrants continued to come

Picture 3. Carolingia 1980 and 1982

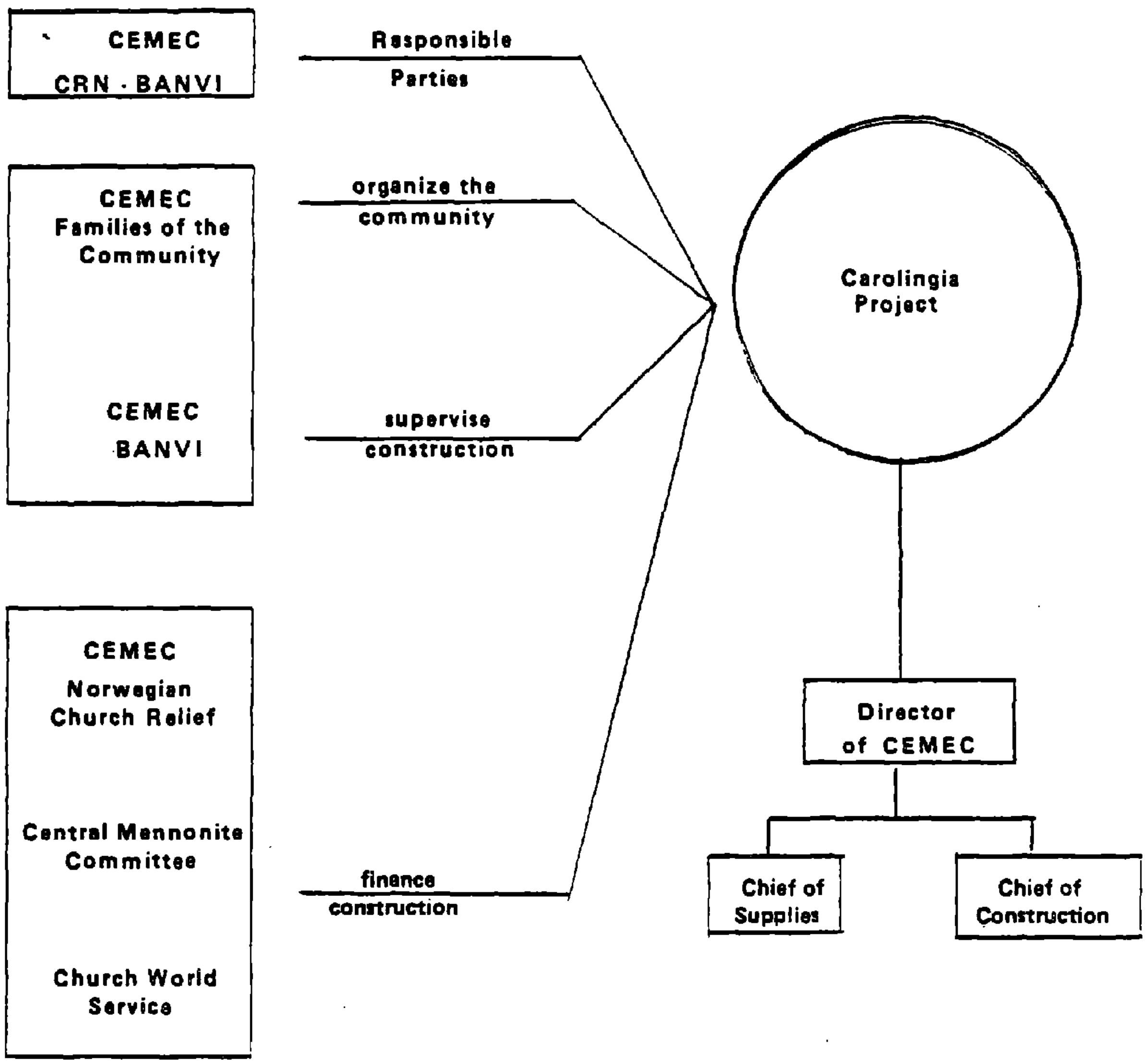
to the area so that more substandard Type I housing was built along the sides of the deep ravines. These substandard houses collapsed during the earthquake, and the residents (chiefly renters) were unable and unwilling to rebuild on unstable ground. Across the ravines where houses had also collapsed were sparsely settled lands. The area was reasonably flat and with little timber. Thus the disaster made possible an invasion of desirable land.

The land invasion was spearheaded by two American missionaries who had the support of members of the Calvary Temple Church. The recovery process also was initiated by a group of students from San Carlos University who formed neighborhood committees of victims from the area of El Milagro and La Florida. The students, headed also by a local man, canvassed the area of victims sheltered in tents and cardboard boxes and took a census of the homeless, particularly those who were renters. The plan of action was to invade an unused area of land (105,000 square meters) with the idea of using it as a squatter settlement. The invasion of over 1,000 families took place only days after the earthquake.

The National Reconstruction Committee, pressured by the San Carlos students, as well as the 1,000 families, requested that BANVI buy the land and offer it for sale to the squatters. This action was carried out. The colony, originally named El Domingo de Ramos de 1976, was renamed "Carolingia" in appreciation of the University students. The campus of the San Carlos University is often called Carolingia. Calvary Church remained active in the organization and recovery of the new settlement. CEMEC, The Emergency Committee of the Calvary Church, was assigned the responsibility for carrying on the development of the Colonia Carolingia. (See Fig.12-1 - Organization Chart for the Execution of the Project.)

Figure 12-1

ORGANIZATIONAL CHART FOR THE EXECUTION OF THE PROJECT:



CEMEC had participated in 14 housing projects previously in rural areas of Guatemala. The objective of this private agency was to raise human social and material quality of life through problem solving in the field of social work. The CEMEC project was to design a New Model of Human Settlement. The design was agreed upon by both the Calvary Church and the Guatemalan government (NRC and BANVI). CEMEC agreed to: construct 1500 houses (26 square meters), a health station, a 10-room primary school, a market, a church, a park, an animal slaughter area, a first aid station, a fire station, purchase land for the park and for the church and to conduct a program in reforestation.

The National Reconstruction Committee (NRC) agreed to provide some of the construction materials, vehicles and equipment, to administer title to the lots, and to facilitate buying building materials. The responsibilities of BANVI were: to urbanize each lot, to lay out and gravel the streets, and to help provide electricity, potable water and drainage. The residents also had responsibilities. They were: to participate in all decisions of the project, to provide three weeks labor on their individual houses, and to make a minimum of $8.00 to $10.00 per month house payment. Two-thirds of the payment would pay BANVI for the land and urbanization, and one-third would pay CEMEC for community development programs in Carolingia as directed by elected community representatives under the direction of the National Reconstruction Committee. The benefitted families were to have begun their payments of $8.00-$10.00 per month in July, 1976. The houses were to have been assigned to the families as users for a period of one year.

At the end of one year, when proof was given that the house was being cared for and used properly as a home for the family, the property rights were then to be given to the family. If there was improper use of the house (e.g. selling it or renting it) the family would forfeit all rights to the land and housing.

However, the projected time plan and cost for reconstruction were inaccurate. Materials such as cement were in great shortage and a lack of funding halted the construction of many buildings. The school was dedicated in November 1978, although it was incomplete. Later, funds came from the Girl Guides of Norway through Norwegian Relief Aid and the school and health center were completed. Lack of funding also halted the construction of the market, the fire station and the slaughter area. The park was constructed from funds from UNICEF and from community participation. (Picture 4. Carolingia 1977 and 1978)

The Process of Emergency Aid - Immediately following the earthquake, the victims living in the ravines of El Milagro and La Florida assessed their damages which appeared to be great. The homeless set up shelters of cardboard and scrap wood and plastic. These temporary shelters and makeshift tents were huddled closely together. According to informants, many infants and young children died during the cold, rainy months that followed, and some were even swept away in rushing waters that cut through unprotected areas. Infectious diseases such as bronchitis, pneumonia and diarrhea took many lives. The leaders of the community were eager to organize and to work closely with leaders of CEMEC and BANVI to begin the housing project. Unity among the neighbors became a strong wedge against slow progress and mishandling of the recovery process.

Picture 4. Carolingia 1977 and 1978

Interviews with Leaders About the Emergency and Reconstruction Process

Carolingia is known as one of the most aggressive, tightly organized settlements in Guatemala. The residents, coming from low income disenfranchised areas, now had found an opportunity to change the quality of their lives. Under the leadership of a strong, eloquent leader, Oscar Paiz, groups and committees were formed early in the emergency period. The organizational skills of the students of San Carlos University (Psychology Department) plus the leaders of CEMEC all converged to be supportive and aggressive. Women found strong leadership roles as well. Partly this was due to the fact that the settlement was on the periphery of the city and the working men of the household were gone into the city for employment much of the day. Because of this the women had to be left in charge of the settlement. The actual physical labor of digging the drainage ditches as well as part of the construction of the houses was done by women.

The entire settlement was laid out and lots assigned by a lottery system. Representatives were elected and committees appointed <u>before</u> any construction began. Most of the elected positions were held by men, but a large number of women were also elected and appointed; so many, in fact, that some said Carolingia was "run by women." The democratic process was the model. Individuals and families were encouraged to speak directly to the "block" representatives. The weekly meetings of committees were well attended and debates and discussions were very lively.

Through these organized activities much was accomplished. Many activities made the national newspapers. For instance, in 1977, while construction was underway, the promised electricity was still not installed and there was a high rate of crime in the streets. Leaders of Carolingia and the settlers marched on the Electric Company and demanded that electric lines be installed. They were installed in one week. Later demonstrations were held against BANVI for unfulfilled promises. Sometimes the protests were violent and at one point gunfire was exchanged with police. Tear gas bombs were thrown and at least one child was killed.

In spite of the protests and counter attacks, problems still remain regarding the title of the land and the issue of paying for the houses as late as 1982. In general, however, the leaders believe the organization of the model community was sound and that the plan was carried forward with faith and good support, especially from community members. The community structure remains closely organized and powerful six years after the earthquake.

The leaders who were interviewed agreed that the most influential groups who worked with the recovery process were: The University of San Carlos students, The National Reconstruction Committee, CEMEC, Church World Service, The Mennonite Central Committee, Faith and Job, UNICEF. Of the groups mentioned, the work of all the agencies was viewed very favorably except that of Church World Service. This agency worked closely with CEMEC on the urbanization projects and in organizing leadership. The chief complaint against the agency was that "they made many promises but fulfilled very few." On the other hand the Mennonite

Central Committee, who arrived in April 1976, and furnished labor for the construction of the houses, was held in very high esteem by all the leaders because "these workers lived right in the community and conformed to the way of life in Carolingia, not like the Church World Service people who just came and went as they pleased."

Household Interviews

Household interviews were conducted on a random sample of 101 households in 1978 and the same sample, down to 84, in 1980. It was found that 58.4 percent of the people were Catholic and 38.6 percent were Protestant, a higher percent than in any of the other settlements. Ethnically 85.5 percent were Ladinos and 14.5 percent Indian. The average age of the head of the household was 36 years, and the range was from 18 to 74 years of age. Thirty-nine percent of the informants were married, 42 percent were in common law relationships, and only 18 percent were single (e.g., divorced, widowed or unmarried).

During the emergency period, 90 percent had slept in temporary shelter of cardboard, wooden shacks or tents for periods of two months to one year. Food shortages were reported by 84 percent, lasting for 79 percent of them from two weeks to two months. The shortage was in staples such as beans, rice, corn, bread, and sugar. Few respondents had received unfamiliar food such as canned vegetables and meats. Food, again, was the item most respondents said they had needed. Few reported needing clothing, blankets or medical care.

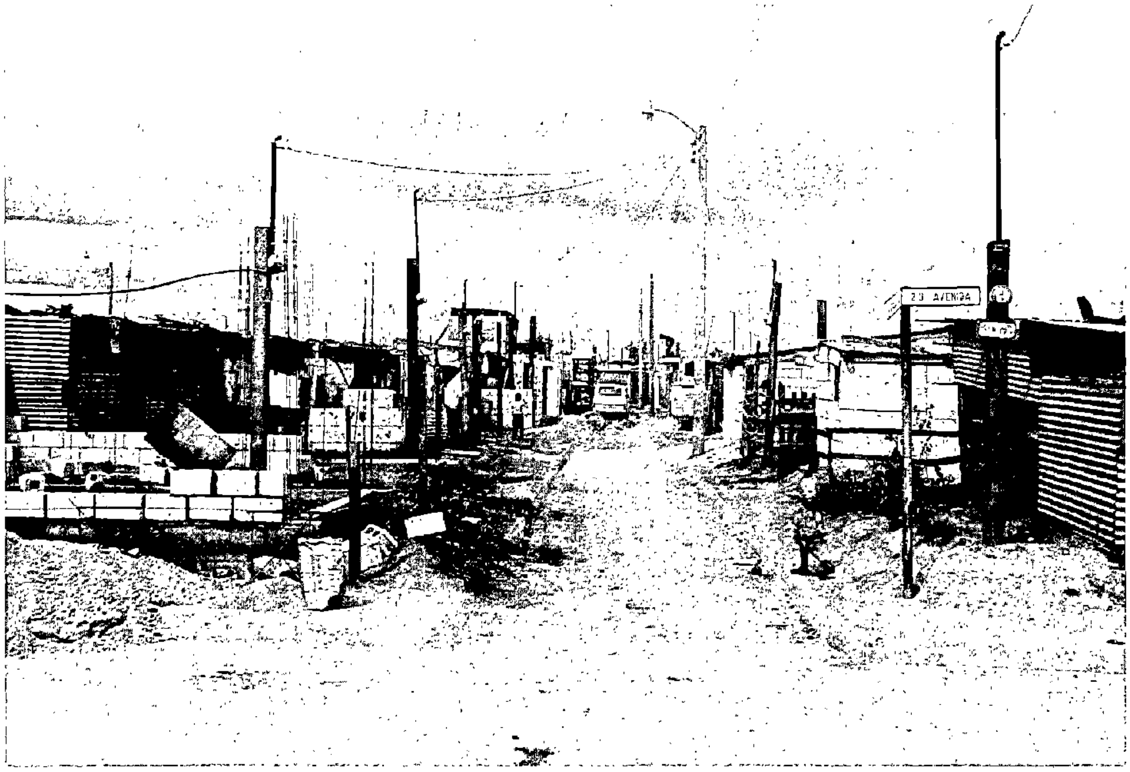
They, as a group, believed the distribution of food had been fair, unbiased and well directed, but if they were to do it again the respondents believed it should be from house to house and with better control. Few could remember from whom they received food and other items. They named the local Emergency Committee, the Episcopal Church of the United States and the Armed Forces of Guatemala. Eighty-nine percent believed that the food prices had increased after the earthquake. Ninety-five percent had received free food and only five percent had worked for food.

Where did the new residents come from? Dispelling myths about rapid influx of rural populations, 98 percent of them said they came from the same zone, that is, from the surrounding ravines and deteriorated neighborhoods. Forty percent believed their economic situation was better; 23 percent felt it was equal, and only 37 percent believed their economic situation was worse than before the earthquake. Family and social relationships were equal or better,according to 99 percent of the respondents and 98 percent believed their relationships with local authorities were the same or better. A large majority (88 percent) believed their houses were better in safety and appearance than before the earthquake. Thirty percent of the sample believed it would take the settlement four years to recover, and only 13 percent (the smallest percent in the four settlements) believed it would never recover.

In summary, it seems that the residents believe that they needed the aid they received, especially the food and housing, and that the process of recovery had improved their own family relations as well as their relations with local authorities. Clearly their lives had improved since living in the ravines of the surrounding areas. The stimulus of the disaster, however, had increased their expectations and subsequently had encouraged a higher level of personal and political unrest in some.

Fourth of February: An Unplanned Settlement. On January 10, 1982, an observer walking along the sidewalks and seeing the curbed, asphalted streets with young teenagers playing soccer on a well defined field while glimpsing the activities of an organized open market would observe a scene in stark contrast to the jumble of shacks and pathways that had twisted through a general area of about four city blocks called the 4th of February just five and a half years before. Individual houses were of many colors. Some were two stories high with attached garages. Windows had ornamental embellishments. There were iron and metal doors with name plates in contrast to the once cane thatched huts and wooden shacks that had been homes for about 15,000 squatters. Street names, according to the usual numbering system of zones gave the area a sense of permanency. (See Picture 5. 4th of February 1982.)

The water tank trucks with the long lines of people carrying their plastic tubs had now been replaced by private water faucets in each house. A concrete block school was being finished in the center of the settlement. A few reminders of the old settlement were the tiny Catholic chapel with salvaged statues of saints and the rugged, eroded entry way into the settlement. To one side of the settlement along the freeway were still the familiar shacks and bustling families in open corridors as they awaited their private land to be urbanized, so that they, too, could begin their own construction. People were busy everywhere working with panes of glass and puddles of cement as they constructed more and more private homes. As densely populated as the settlement now appears, it is only half the number that had once lived on the invaded land. Half the population had followed the leader,Emilio,to a similar settlement in Zone 18 where the open spaces and some timber were more inviting



Picture 5. 4th of February 1982

for their private homes.

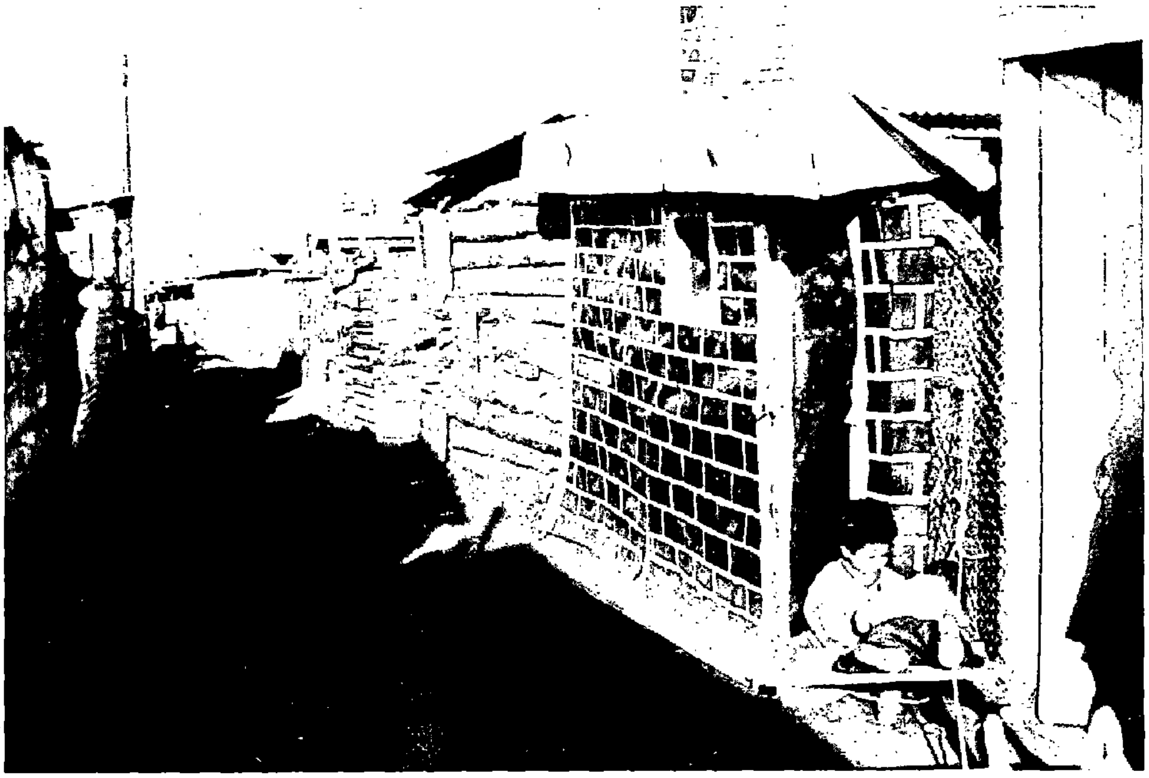
How did these changes take place and what was the process of recovery that was now evident in 1982? The process will be discussed in the following section.

History of Development -

The morning after the earthquake, thousands of survivors from the ravines below invaded the flat area along the sides of a freeway that crossed the city. Ninety-three percent of them had lived in the same zone, Zone 7, four percent had come from other zones and only three percent came from other departments, again dispelling the myth of the influx from rural areas of migrants after the earthquake. These survivers were the poor who had lived in their own shacks along the ravines of the city, or had rented deteriorated adobe homes from owners who could not rebuild after the disaster. The survivers sought flat lands that were open and not timbered in order to set up their shacks of cardboard, tin, and discarded wood. The first settlement was without plan. Only a few small footpaths marked divisions between property lines, and sanitation was without organization. But, slowly the groups began to get organized. Persons who prior to the earthquake had had leadership roles, began setting up meetings. Families had often come with other neighbors and extended families. Networks that had previously been in place were reestablished. Natural geographic markers such as a hill or stream or tree became accepted boundary lines for settlements that began to name themselves. Each settlement had a population of approximately 10,000. Names of the colonies often reflected some aspect of the disaster such as Laugerud (for the President), Helena (his wife), and Fourth of February (the date of the disaster). This study focuses on the Fourth of February.

The first families who invaded the land of Fourth of February came from the same zone. By September 1976, the terrain was filled with about 2,000 shacks of wood and cardboard. Three censuses were taken by the Emergency and Reconstruction Committees, but the actual number of residents was questionable. The early footpaths gradually widened so that within four years several major streets crossed the settlement and automobiles were maneuvering about the area amongst thousands of people. Parts of the shacks were continually being replaced and some added windows and a second story. The appearance remained haphazard. The heavy rains of June to November made it a dangerous spot as contaminated water flowed freely along shallow surface drains throughout the settlement. (See Picture 6, 4th of February 1978 and 1979.)

From the beginning of the land invasion there were legal problems. The land had belonged to the son of the former President Carlos Arana Osorio (1970-74). Legal loopholes were found by enterprizing squatters as the actual ownership of the land was questioned. BANVI initially attempted to move the squatters, then attempted a "temporary" solution by curbing the highway and providing latrines and bringing in tanks of water for personal use and establishing a system of piped in water. A public school for 600 was built and a clinic and police station were added in 1978. The settlement began to take on the appearance of a permanent, yet haphazard suburb. Electricity was not provided by the government, yet enterprising residents illegally "tapped" into the power lines that were along the freeway and they began to "sell" the illegal energy to



Picture 6. 4th of February 1977 and 1978

add-ons. The government did not act on these illegal activities.

Two major committees began to organize the 10,000 to 15,000 residents. They were the Progress Committee, headed by Emilio Cebollos and the Committee for Improvement, headed by Manuel Gutierrez. Each committee had its loyal followers. The Progress Committee had backing also from some American missionaries, while the Committee for Improvement had backing from external social groups in Guatemala City such as the Bomberos (city firemen). The Progress Committee had a large feeding program, financed by foreign missionary groups from the U. S. and Germany. This feeding program fed approximately 500 children daily. A smaller feeding program was personally financed by a missionary from the United States who managed not to be aligned directly with either group.

The individual groups each had about 800 families of followers. The Committee for Improvement (headed by Manuel Gutierrez) seemed the stronger in relation to national ties. This Committee held weekly meetings for elected representatives from each of the seven sections in the settlement. On Thursdays all the representatives (150) met. On Wednesdays the Board of Directors met, and on Mondays an open meeting was held for any resident to bring forward to the representatives personal problems as well as concerns about the settlement.

The Board of Directors consisted of a President, Vice President, Secretary, and one representative from each section. These officers were elected by secret ballot in July for a two-year term. The Board had vast functions including: handling internal and external complaints, making political decisions, supervising promoters and volunteers in each section.

There were ten volunteers for each section who supervised all the volunteer work done by the residents on Saturdays and Sundays. Some of the volunteer work consisted of cleaning the streets, making cement blocks and building some houses. The Board of Directors also acted as a volunteer fire department, supervised burying the dead, taking the sick to hospitals and negotiating family feuds. They acted as an unofficial judicial system. As one member said, "If we took every crime to the officials, they would just get their pockets full of bribe money and the crimes would continue." The unofficial judicial system operated on the principle of hearing both sides of a disagreement followed by a decision of guilt or innocence. Retribution for crimes was swift. For instance, a situation arose involving a dispute between neighbors. After judging the guilt of both parties,the punishment rendered was that one party donate 10 pounds of nails to the settlement and the other 10 pounds of cement. Another act of justice for a thief was that he had to spend two days cleaning the streets. Each of these acts of justice was recorded in a ledger kept by the secretary. As the settlement grew, the police did add a small holding room as a type of jail. The crime rate was reported to be very low.

With the emergence of a more formalized settlement, the school's enrollment increased to 800. Each teacher had between 70-100 students between the grades of 1-6 with the sessions lasting four hours a day. Lacking chalk, paper and pencils, the classes were largely a verbal exchange between the teacher and the students. A private school for 260 children (kindergarten through 4th grade) had Christian church support. There were four teachers for this school and the students were given more individual attention. Enrollment in the school was made by choice of the director, a female missionary from the United States. The students were given a strong religious orientation in their education. Informal education, especially for women, was directed through support from the national government. The focus was largely on nutrition and family planning. Some literacy classes were held as well as classes in sewing and cooking. Vocational training programs by INTECAP were not present in the settlement, but many residents attended night school in various areas throughout the city.

Seventy-six percent of the residents considered themselves Catholic and 24 percent were Protestant. The Protestant groups were more zealous with lay ministers frequently speaking from street corners. The Catholic church had a chapel at the entrance of the settlement. It contained only a few benches and some salvaged, dilapidated status of saints. Religious holidays were not celebrated in the settlement. The dead were interred in the General Cemetery.

This bustling settlement was an example of the development of free enterprise as small businesses arose and competed on every corner. An open market lined both main streets and the range of produce was similar to that found in any market: fresh fruits, vegetables, meats, eggs and flowers. The quality of the produce seemed lower than at the central market, but so were the prices. No small manufacturing was found in the area, but auto mechanics, tailors, electricians and shoe repairmen were abundant. Recreation was limited to local fairs and a "creative" community building where free fights and old movies were shown for a nominal price. The family seemed to be a strong social institution.

There was also a close knit community network to care for those who lived alone. Policemen also seemed to be an integral part of the community carrying on friendly conversations with children and family members, and walking about the community quite informally. There was a small health clinic with medical students on duty during the day dispensing a few medicines. Other competing clinics sprang up around the settlement offering injections and examinations. Most emergency services, food supplies, and some recreation could be found in the settlement after the first year.

Interviews With the Leaders

The leaders who were interviewed in the Fourth of February were those on the Board of Directors as well as a few business people and religious leaders. The leaders agreed that the Guatemalan Red Cross was the most significant early agency to help the survivors. They gave emergency food, medical care, clothes and blankets. The evaluation of their work was high. The Evangelical Mission of Holland was also one of the first foreign agencies to help with goods and clothing. This group experienced some loss of credibility from an overzealous missionary, but after a period of about three years the relationship improved. This group was instrumental in helping half the population to move to the new settlement in Zone 18. Charlotte Lindgren, an independent American missionary whose husband died of cancer during the recovery process, continued her work in the missionary school and feeding program. She established a medical and dental clinic before the national government did. Her contributions were generally rated as being very high. Some leaders, however, claimed she did not collaborate with other agencies.

The work of the Church World Service was low-keyed and not mentioned by many of the leaders. The focus of this agency's work was primarily on women's education related to nutrition and consciousness raising. The Guatemalan government (especially BANVI) received a low rating by the leaders primarily because of the slowness with which they worked, the favoritism they practiced, and the red tape it took to work through them.

The resettlement plan, however, was directed by BANVI. A plebicite vote in April 1979, decided the fate of the settlement, as one-half of the residents (800 families) chose to move to Zone 18 to land bought by BANVI and to houses to be purchased through BANDESA (government housing organization). The cost of each house was approximately $4,000 and the loans were extended for 10-15 years.

The dismantling and rebuilding of houses for these 800 families who moved away from the Fourth of February began in January 1980. In July 1980, land was cleared for new houses to be built in The Fourth of February itself to house those who remained. Water and sewer systems were installed. Each person interviewed seemed pleased with the ongoing resettlement plans. Some, however, were concerned about paying $10-$15 a month for a house since they had never paid anything all of their lives on a regular basis.

Household Interviews

Household interviews were conducted on a random sample of 117 households in 1978, and the same sample down to 95 in 1980. It was found that 76 percent were Catholic and 24 percent Protestant. The average age of the head of household was 38 years old and the range was from 17 to 75 years of age. The marital status was 24 percent married, 52 percent common law, and 23 percent separated, widowed or single. The ethnic composition was 85 percent Ladino and 15 percent Indian. Ninety-three percent said they had come from Zone 7 (the same zone), while four percent were from different zones and three percent from different Departments.

Describing the emergency period, 91 percent said they slept in cardboard shelters and tents at first and that 80 percent stayed in these shelters for periods from one week until two months. The greatest need they saw was for food. Sixty-seven percent stated they lacked basic food. For 76 percent, this food shortage lasted from one to three months. Ninety-five percent received free food and only five percent received food for work. The foods they lacked the most were corn, beans, sugar, rice, bread and milk. There were a few new foods received, chiefly canned meats and vegetables. Fifty-nine percent believed the food program in the settlement was helpful. A total of 90 percent believed that the food prices had increased since the earthquake.

The aid they had received they believed was just or fair "because it was equal and unbiased," but that if things were to be improved they would suggest better control. Because, before the resettlement, many of their houses were the same, 60 percent didn't see any difference in their housing. Since there had been little housing assistance before the resettlement, the residents could not name any agency that had been of any help in the recovery process. Consequently, most (84 percent) of the households believed that life was equal to before the earthquake. Only seven percent believed life in general was worse. However, 22 percent believed that their economic situation was better, but 43 percent believed it was worse, while 34 percent believed it was about the same. The majority (84 percent) believed their family relationships were the same, and 89 percent believed their relationships with local authorities were the same.

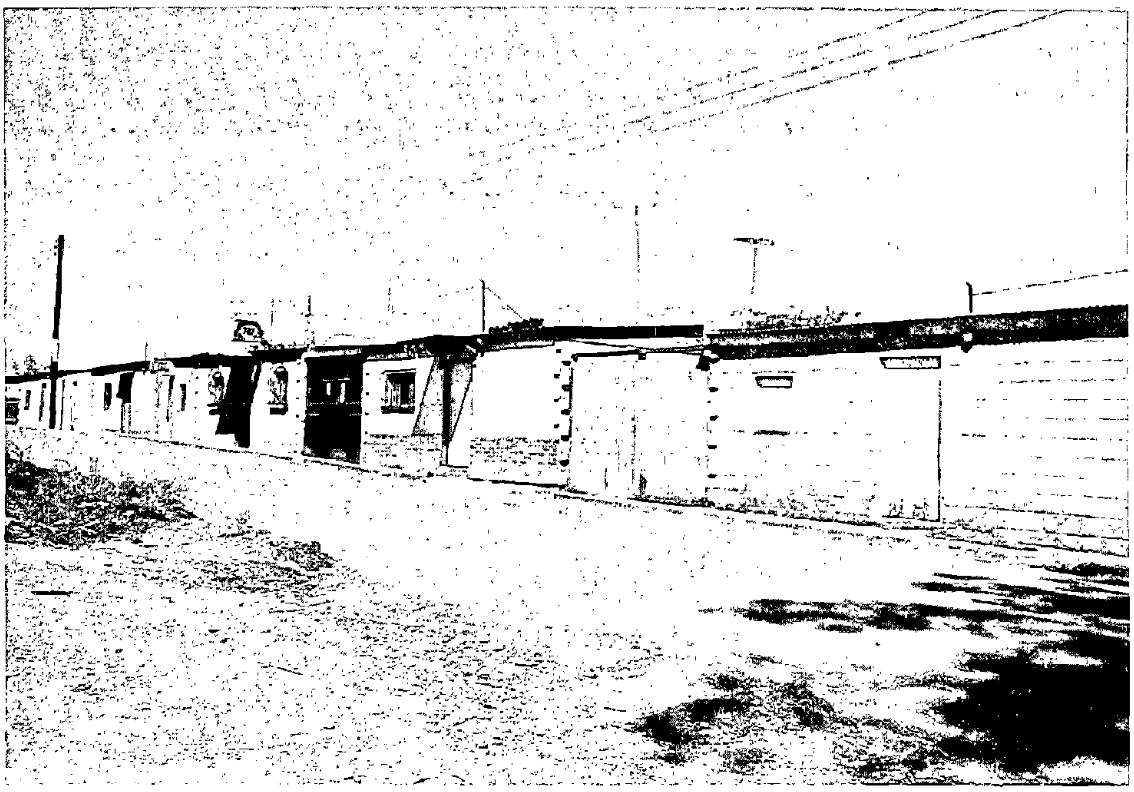
It would be of interest to study the response of the residents now that the settlement has changed so drastically. However from the data available, it seems that without outside intervention, these economically poor people never would have been able to rise above their poverty. It eventually took monumental future-oriented governmental financial support to better the standard of housing and improve other aspects of their lives and to enable them to help themselves.

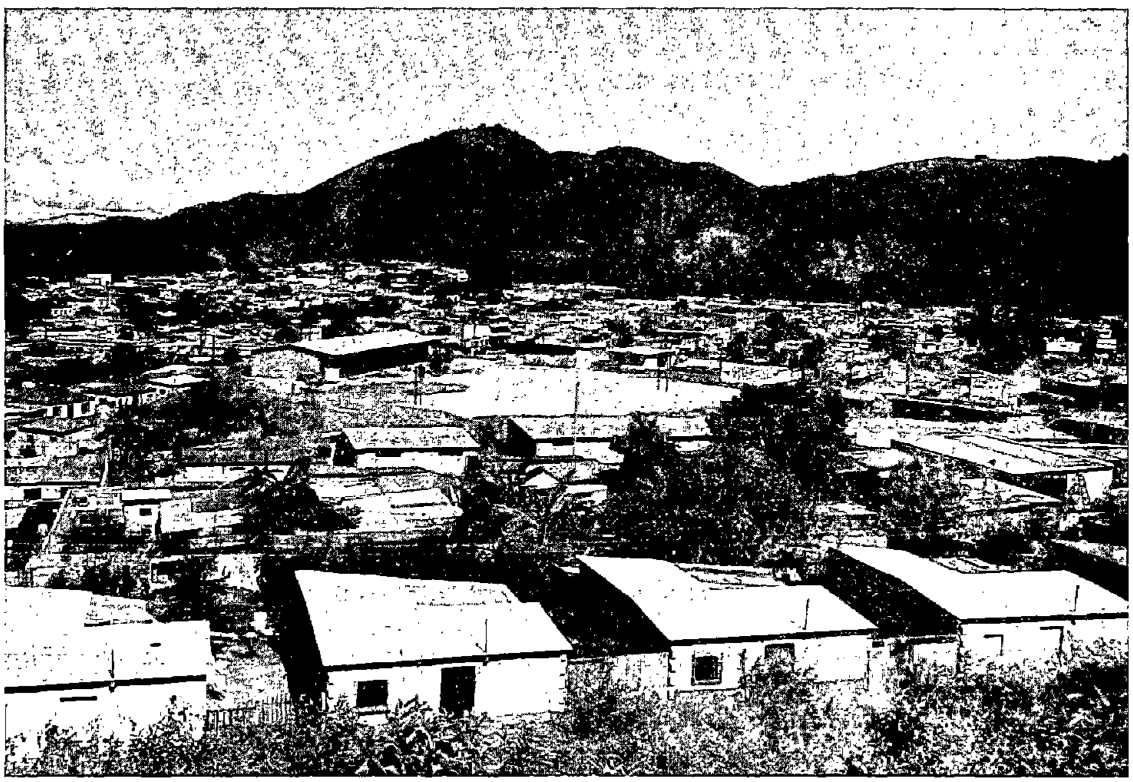
Lessons can be learned nevertheless from looking at this settlement as an example of the natural process of coping with a disaster without formal organizations to supplement the struggles of the poor. The natural organization of the community that arose was extremely effective in coping with the aftermath of the disaster even though at the margins of poverty. Major improvements such as urbanization and improvement in housing and community services, however, required major amounts of outside assistance.

New Chinautla: A Planned Resettlement. January 10, 1982 was an ordinary day in New Chinautla. School vacation enabled the children to run the streets and to play soccer in the playing field. Mothers were busy clearing their houses of left-over Christmas decorations and talking over plans for the day. Husbands were working at their various jobs throughout the city. The Pokomam Indian women were busy catching up on their cermaic work after the long holiday month. They were firing clay pots since the rainy season was still several months off and these were their busiest months. Even small children in the Indian households were busy making small doves, angels and vases. The health clinic had a few patients assembled with colds and the "grippe." The streets during the day appeared like any other busy suburb. Trees had grown quite tall since the earthquake and the backyards were filled with vegetation of several years growth. The house where the construction workers from the Mennonite Central Committee had lived was now a community center, and the open space where tractors, bulldozers and cement block makers had sat was now the plaza that led to a magnificant Catholic church. The lines of ethnic distinction between Indians and Ladinos that had existed for the first four years seemed no longer important. As one resident said, "We had one big fight last year and decided that if we were going to live....we were going to have to learn to live together." The history of the settlement was long and strained relationships had existed between factions even before the Earthquake of 1976. (Picture 7 - New Chinautla 1978 and 1982.)

History of the Development

Unlike the other settlements, New Chinautla had a long history of being an intact, vital community before the earthquake. Residents of New Chinautla came in part from Old Chinautla, one of the earliest and most important cities of Guatemala, also known as Santa Cruz Chinautla. The colonial chronicler, Francisco Fuentes y Guzman, recorded events concerning the capital of the Pokomam Empire, Old Mixco, in the year 1525. At that time there were between 8,000-9,000 Pokomam Indian inhabitants of the Xilotepec Valley. In 1526 Don Pedro de Alvarado tried to conquer entrenched rebel groups. The Spanish Conquistadores finally were





Picture 7. New Chinautla 1978 and 1980

victorious, having killed 200 of the best Pokomam warriors. The town of Chinautla, a dependency of Mixco, was also destroyed, and even today there exist vestiges of the "ruins" of Chinautla, such as a part of an old wall and small fragments of clay covered with a special glaze of red and black, different from that used after the Conquest.

The rebuilt town on the river known as Chinautla River or Rio Las Vacas was a pleasant, quiet retreat that became the subject for many poems as well as a resort for wealthy Ladinos from the city. The land changed ownership many times through the years, but Chinautla was considered a township almost 100 years before the independence of the country in 1821. At that time the central town had a population of 1672 (95.8 percent Indian).

The fame of the town came from the special pottery unique to its clay and its processing in an open fire. The skill has been passed on through the women since before the Conquest. However, the special white clay found in that area was from extremely porous land. Landslides and land erosion soon became a danger to the inhabitants of the area as the population of Guatemala City grew and the river became known as Aguas Negras because of the sewage spilling into the area. The instability of the land caused great national concern, and in 1973 the then president, Carlos Arana, offered the town four million dollars to transfer the whole town to a safer area on a finca (plantation) nearby called Julian Jocotales. Much confusion resulted as rumors spread that the Chinautecos would lose title to their lands.

After much dispute and voting, the natives remained on their rapidly eroding land in Old Chinautla. The earthquake, however, destroyed too much of the remaining town for it to be easily rebuilt. Considerable damage was done to the deteriorating adobe houses that remained. The town's Emergency Committee, led by Jose Montoya, requested help from President Laugerud. Great dissention broke out between the townspeople who wanted to leave and those who wanted to stay. In the final count, approximately half of the townspeople left Old Chinautla to begin a new settlement on the flat area of the finca of San Julian Jocotales.

On February 26, 1976, three weeks after the earthquake, the formal decision of a group of 113 families was made to take possession of the land. They set up encampments on the edges of the Finca in Zone 6. On May 10, 1976, after living three months and eighteen days on the border of the finca, the families decided to invade and take possession. The group, still led by Jose Montoya, President of the local Committee of Reconstruction (formerly the Emergency Committee) invaded the land. The families had intentions of paying for the 140 acres at the going rate of $10,000 per acre. The invaders had confidence that they would be allowed to remain on the land based upon the negotiations of the former President Arana in 1973.

The government had also been negotiating, along with BANVI, to buy this land from its private owner. Consequently the finca was sold to BANVI for an undisclosed amount. Clearing the land was difficult because it had a large amount of timber growing there, but the timber had been stripped by the previous owner, leaving only the stumps of trees to be removed by bare hand. The families prepared temporary shelters and continued to work on their land in Old Chinautla as well as continuing to battle for the title to the new property. In August 1976, Church World Service was given the authority under The National Reconstruction Committee to be responsible for constructing New Chinautla. The agreement was to build 400 houses according to the guidelines of an organized local group of citizens. Although the intent seemed appropriate, many promises between The National Reconstruction Committee, BANVI, and Church World Service seemed not to have been kept. Consequently in 1978, approximately 35 families moved back to Old Chinautla.

Each lot in New Chinautla was to cost $1,000 and the house $600. Payments were to be made at a cost of $3.00 per week with a portion of the payment going for community improvements. Lots were opened up to other families than those from Old Chinautla. This action caused great stress. A lottery system was used to assign houses, but much confusion resulted and owning houses in both Chinautlas became common. A community group called Grupo Organizador began to deal with community issues such as health, education, economy and social matters. Many of their efforts were thwarted by the leader of The Reconstruction Committee, a man called Don Chepe (Jose Montoya). This leader finally resigned and left for the States. Church World Service, through their contacts with social and health workers, seemed to have had a positive effect upon the development of the community.

The Mennonite Central Committee construction workers lived within the community working alongside of the residents. In evaluating their own work, the supervisor stated, "I wish we would have laid out the whole settlement first; that is, put the sewers in and everything. We started both at once, houses and sewers. We tried to hurry and get everyone into a house. In the daytime we'd lay out the property lines and at night the people would move the strings all over. It was awful. So we ended up putting the walls of their houses right on the edge of the streets. They don't have room for a blade of grass in front. If we would have planned it all first it would have been better." The Mennonites tried to really teach the residents new methods of construction as well as putting up sturdier homes. Out of a group of twenty-five to whom they were teaching construction skills while they were building homes at the time of the interview in 1977, twenty had taken new jobs in construction.

Several cooperatives were begun, a community center was organized, a health clinic and youth groups formed. Such activities as sports, theater, excursions and fund raising parties took place in the community. One school, grades 1-6,had 500 students. A police station was built at the entrance to the settlement. In terms of future economic development, New Chinautla is ideally situated between the busy commercial section of the city near Calle Marti and the clay cliffs and agricultural fields of Old Chinautla.

In sum, the development of the settlement was marked by strong opposing leaders and uncertainty on the part of the new settlers concerning ethnic devisiveness. In spite of these differences, the location and the ingenuity and the industriousness of the residents made this one of the most productive, progressive of the four settlements being studied.

Interviews with Leaders

The leaders who were interviewed represented both ethnic groups in the community. As a whole, they were dedicated leaders with strong emotional ties to their groups. Working cooperatively was not possible at first. Many of the issues of social concern were violently opposed by each side. Special interest groups impaired the progress of the community until the schism was so severe in 1981 that the groups were at near war with one another. Finally, the issues were resolved partially by arbitration set in motion by Church World Service personnel and partially by the emergence of younger new leaders.

The old leaders did believe that the work done by Church World Service was significant. "They were honest people, and the construction men from the Mennonite Central Committee lived right with us and taught us many things about building strong houses." Many of the women spoke positively of the work of the social worker and public health nurse who had taught them many classes and were "real friends." Most of the leaders had little faith in BANVI since "they change their policies frequently and they don't keep their word." Most of the leaders seemed aware of the strong personality problems of the various interest groups and that although they couldn't see a way around this stumbling block, they did believe the problems would diminish.

Household Interviews

Household interviews were conducted on a random sample of 49 households in 1978 and 45 of the same sample in 1980. There was a small loss in the sample, indicating the relative stability of this settlement as compared with the other three. It was found that 61 percent of the sample were Ladinos and 39 percent Indian. The average age of the head of household was 36 years and the range was from 19 to 77 years. A large proportion of the sample was either married (60 percent) or living in common law marriage (31 percent). The single population was smaller than in the other settlements (nine percent). A large portion of the sample had migrated from other zones (29 percent) and 71 percent had come from Old Chinautla.

Respondents reported that there was a severe shortage of basic foods: beans, rice, corn, milk and bread, for 69 percent of them. This shortage lasted for 26 percent of them for over three months (the longest of the settlements). Eighty-eight percent believed that the food prices increased following the earthquake. Ninety-four percent received donated food free and only six percent received it for work. In this settlement 69 percent believed food programs were necessary. The help they reported needing most in the recovery period was housing and food. They believed for the most part that the aid given was just and equally distributed. The residents slept in makeshift shelters from a week to a year (81 percent). This may have been because the land and houses were in dispute for a long period of time with BANVI and The Reconstruction Committee.

The sample could only identify one source of emergency help which was that of the Armed Forces of Guatemala, although they did recognize that foreign countries also helped. The sample indicated that 80 percent had better homes than before, especially with respect to appearance, size, location and number of rooms. They also believed their former homes were poor because they were adobe and had weak walls and beams in the ceilings. Economically,33 percent believed that they were better off, while 27 percent believed they were equal. Even so, 40 percent believed that they were worse off than before the earthquake. However, 31 percent believed that their family relations were better and 67 percent believed they were equal.

In spite of the unrest among their leaders, 13 percent (the largest among the settlements) believed that their relations with authorities were better than before the disaster. When speculating concerning when the settlement would be fully recovered, 10 percent believed it would take longer than four years and 45 percent believed Chinautla would never recover. This figure was by far the largest expressed in any of the settlements and is probably due to the continuing deterioration of the Old Chinautla lands.

Changes in Domestic Assets as Measures of Recovery

During the course of this research a domestic assets score was created to measure the approximate value of the house and basic household equipment owned by each family. This score can also be used to measure the amount of loss suffered in the earthquake by each family and the value of their assets two and four years afterwards. The nature of the scale is discussed in detail in a later chapter and need not be discussed here.

Table 12-8 gives these scores for the four city settlements for four points in time and shows the percentage gain or loss between time periods. The data in this table are illustrated graphically in Figure 12-2. The first important thing to note about this table and the accompanying graph is the fact that the people who lived in Roosevelt in government built barracks-style housing had a higher level of domestic assets before the earthquake than the people from any of the other settlements. This difference is highly significant statistically and probably reflects the fact that most of

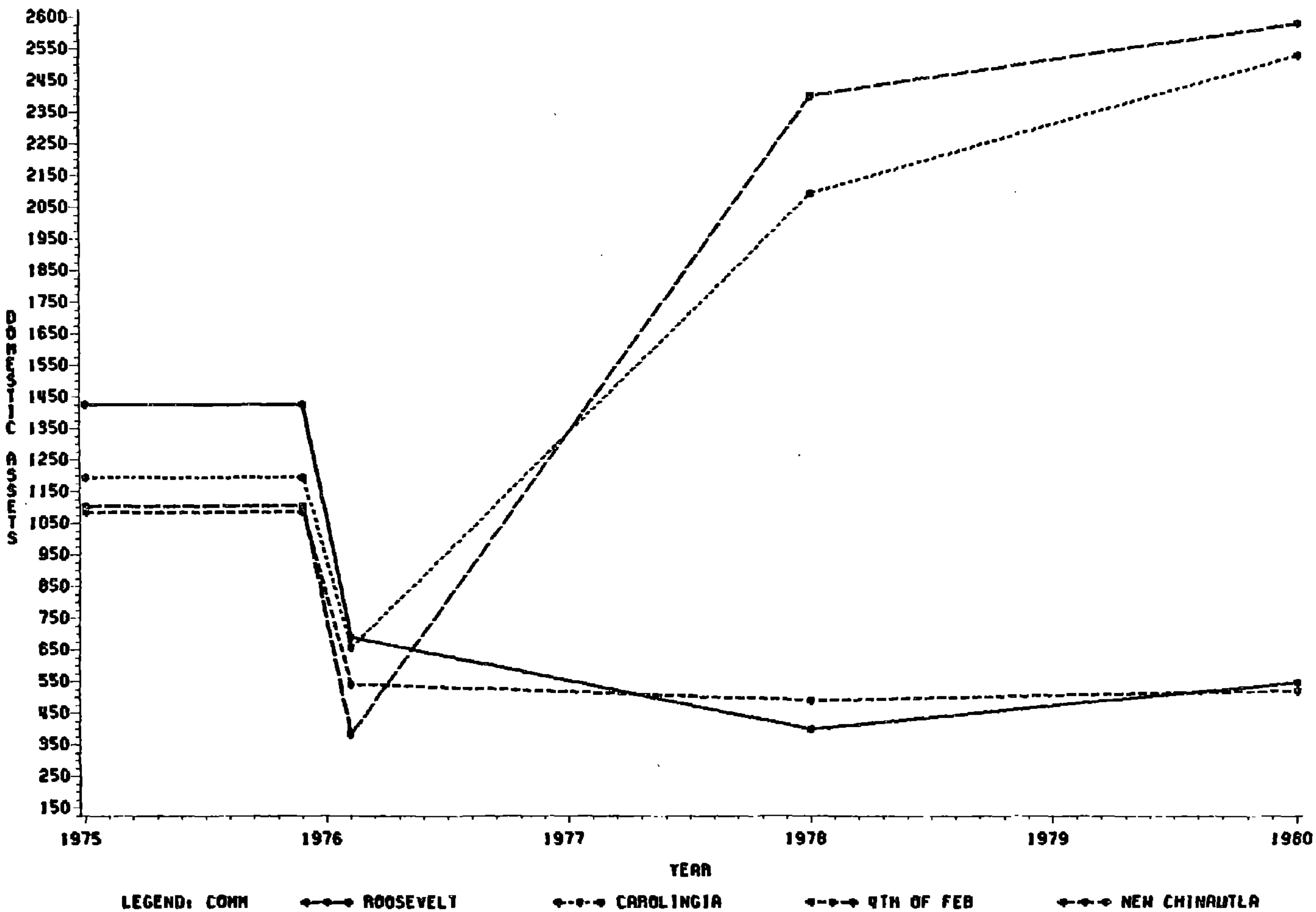
Table 12-8

Change in Domestic Assets Following the 1976 Earthquake in Four Urban Settlements

	Domestic Assets Score in Dollars				% Loss	% Gain	% Gain	% Gain
	1975	1976	1978	1980	1975-1976	1976-1978	1978-1980	1976-1980
Roosevelt	1425	691	398	548	-51.5	-42.2	+37.7	-61.5
Carolingia	1196	655	2090	2532	-45.2	+219.1	+21.1	+111.7
Fourth of February	1085	500	488	522	-50.2	-2.4	+7.0	-51.9
New Chinautla	1107	381	2395	2595	-65.5	+528.6	+8.4	+134.4

FIGURE 12-2

DAMAGE & RECOVERY IN GUATEMALA CITY
MEASURED BY DOMESTIC ASSETS



these families came from the center of the city where they lived in Type II or Type III housing. Earlier tables show that the people who lived in these types of housing had slightly higher incomes than those from the Type I housing backgrounds. The other three settlements measured about the same on domestic assets before the earthquake. It will be recalled that most of these households came from Type I housing.

The domestic assets figure for 1976 measures the value of assets after the earthquake damage. Column five of this table shows the percentage loss suffered in domestic assets as a result of the earthquake by people from each settlement. Two facts stand out from this part of the table. First, most of the people in the four study areas lost over half of their domestic assets in the earthquake. This loss can of course be accounted for principally by the loss of the house itself. The second fact is that the people studied in New Chinautla suffered the greatest loss of any of the populations being studied. This is especially true if it is considered that much of the land itself was lost in Old Chinautla to the extent that it could not be reoccupied.

The figures shown for 1978 and 1980 give the value of domestic assets two years and four years after the earthquake. These figures are heavily affected by the value of the house occupied at these time periods. These houses have been discussed in detail above.

A number of important observations stand out in the figures for these time periods. The first is that domestic assets were even lower in 1978 for Roosevelt and The Fourth of February than they were right after the earthquake in 1976. This is a reflection of the fact that the houses occupied by these people were of less value and offered fewer amenities than those they occupied before the earthquake. This is especially true of the people of Roosevelt.

For the people of Carolingia and New Chinautla, however, things had improved far beyond even their pre-earthquake situation. By 1980, domestic assets had increased by 111.7 percent over pre-earthquake assets for the residents of Carolingia, and by an astounding 134.4 percent for those of New Chinautla. By 1980, however, the people of Roosevelt were still 61.5 percent below their pre-earthquake level and the residents of The Fourth of February, 51.9 percent below theirs. At their worst, these settlements had dropped to 72.0 percent below pre-earthquake level for Roosevelt and 55.0 percent for The Fourth of February.

In interpreting these figures, it is important to realize that this is how the situation stood in the Spring of 1980, when the last formal interviews with household heads were conducted for this study. At that time, the movement of people out of The Fourth of February was just being undertaken by the Guatemalan authorities and Roosevelt remained as it had always been, except in a more dilapidated state.

It is apparent that those people who were fortunate enough to become a part of an organized housing program conducted by reconstruction agencies, had fared very well, even by two years after the disaster. Their domestic assets had risen dramatically and the services offered in their communities had similarly improved. Those who found themselves in the refugee style housing offered by Roosevelt, not only lost the most in the earthquake, but had to wait the longest for assistance in recovery. No doubt if they were measured on the domestic asset scale today they would rival their fellows from Carolingia and New Chinautla, but it took nearly five years as compared to less than two to do so.

One of the lessons these data teach is that those who invaded private or public land, and then organized to keep possession of it and to demand housing assistance, made very rational choices in terms of their long-range economic welfare. In the long run, this applies even to The Fourth of February although it took a longer period for the benefits to be realized. This furnishes another bit of evidence that land invasions by the urban poor in Latin America are important adaptive mechanisms associated with urban growth and that they serve an important development function for their residents.

Another possible interpretation of these data, and of the discussion of the settlements that preceded them, relates to the negative functions of refugee style housing, especially with respect to producing dependency. Refugee housing such as that offered by Roosevelt removes disaster victims from their former places of residence and places them in centers where they are intended to remain only for a temporary period while a long range solution is found for their housing problems. The refugees can not therefore go to work rebuilding their own houses, even as squatters on someone else's land. They are totally dependent on the authorities running the refugee center for rehousing.

In squatters settlements, originating from land invasions, the people immediately set about building their own houses, no matter how flimsy and unattractive they may turn out to be. Later, when offered the opportunity to participate in planning and working on their own houses, they are eager to do so. Furthermore, they are almost always close to the place where the new houses are to be erected and can work more easily on them. This points to the advantage of allowing disaster victims to remain close to the land their post-earthquake houses will occupy, if possible on their eventual house sites, so that they can participate actively in reconstruction rather than becoming a dependent population, becoming more embittered as they wait for someone else to solve their problems.

Housing the people living in self-constructed shacks on the housing site creates frustrations for agency personnel who must contend at times with people getting in the way of what is considered efficient operation. This is particularly true in providing water lines and other infrastructure when houses must be moved in order to complete projects. There is an advantage, however, in being able to utilize the labor and ingenuity of the victims in the completion of projects, thereby avoiding dependency and insuring a higher degree of cultural appropriateness. Furthermore, there are spin-off advantages in the form of vocational training that assist some victims in attaining skills that are useful in future employment.

Another related lesson taught by these case studies is that there is a great deal that disaster victims can and will do for themselves if the opportunity is provided for them to do so. While The Fourth of February may have appeared to be a disorderly jumble of shacks to the American or European eye, it also represented the peoples' ability to adapt to a situation of poverty, and to make a small amount of progress against tremendous odds. The housing therefore was not unlike a great deal of pre-earthquake housing and the fact that in cooperation with the Guatemalan government and foreign voluntary agencies, this settlement and others like it were converted into more substantial and better organized communities, is real evidence of the developmental effects of the disaster. If nothing else, it demonstrated that an alliance between government agencies, private volunteer organizations and disaster victims can produce substantial gains in the levels of living for the urban poor.

Future of the Settlements and Lessons Learned for Future Disasters

As noted by the 1982 ethnographic data, it appears that all four settlements now are approximately equal in the recovery process. Residents now have permanent, well-constructed housing with legal access to property. Each also has electricity, water, sewage and asphalted roads. It is not certain that the present-day residents are the same disaster victims who settled there in 1976 and 1977, but the 1980 Household Survey shows that 84 percent of the 1978 urban household residents were still in the same location.

It can be argued that the housing found in The Fourth of February was not unlike their pre-disaster housing as depicted from the 1973 census study. What has changed for all the residents as of 1982 is that their housing is more valuable, safer from subsequent earthquakes and privately owned. Each settlement should continue to improve since each has access to a labor market as well as progressive social institutions such as education and health facilities. The economic future should therefore be better in each settlement.

Five major points summarize what has been learned from the post-disaster recovery and reconstruction process in these four urban settlements.

(1) Economically poor people with limited income need outside financial, organizational, and legal assistance to recover from a major disaster. Left without assistance such persons remain at a much lower level of living than pre-disaster. A paternalistic attitude, however, (as seen in Roosevelt) has a destructive post-disaster effect. The people lost hope and despaired.

(2) Shared decision making seems essential to get the most out of productive resources (as seen in Carolingia and New Chinautla). Roosevelt victims had little participation in decisions and although they had a higher level of living than any of the other victims before the disaster, they remained on a lower level much longer. This seems to show that how the aid is delivered is as important as how much is offered.

(3) The way reconstruction agencies participated in community affairs clearly had an impact on the satisfaction of victims with the aid given. The most praised agencies were those whose personnel became part of the community and lived and worked there.

(4) It seems that all aid given was regarded by victims as important, but over time, permanent, safe housing had the greatest impact on the way of life of the people.

(5) The organization of victims into reconstruction committees, and therefore eventually into a permanent community organization,

was extremely important to the continued control of the settlement by the residents. This organization makes for a long-term commitment to community development.

In summary, comparing the reconstruction process of four urban settlements revealed some patterns of recovery not present in some of the rural sites. The concentration of the people, the easy access to services and resources as well as the baseline knowledge that each had started from a condition of "no housing," gave this aspect of the study an intensity and clarity with respect to the dynamics of the recovery process not attainable in the other sites studied. Also, because of the added ethnographic data in 1982, the value of a longitudinal study design is again reinforced. Without knowing about the final reconstruction of Roosevelt and The Fourth of February, totally different conclusions would have been reached with respect to the eventual fate of these settlements.

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Chapter 13

Geographic Distribution of Housing Loss and Human Casualties Following the 1976 Guatemalan Earthquake

Luis A. Ferraté and Lucy Arimany

Background

Among other things, the 1976 Guatemalan earthquake damaged the social and physical infrastructure of the country and negatively affected certain characteristics of renewable natural resource systems in the central-western volcanic highlands and the Middle Motagua Valley. The type, intensity and level of damage were partially recorded by the NEC, NRC and other institutions of the Guatemalan government and by some foreign agencies such as the USGS. The data supplied by these sources were based on field inventories conducted to estimate the magnitude and relative importance of damage produced by the impact of the earthquake on the social, economic and ecological systems of the earthquake area.

As a result of these inventories, a great variety of geological, seismological, geomorphological, and other earthquake related data were collected. In addition, information about the number of casualties, and the number of houses, schools, bridges, health centers, public buildings, basic services and other infrastructure that were destroyed or damaged was compiled.

In spite of this vast amount of information, there have been very few attempts to link the number of casualties and types of houses destroyed with the isoseismical intensity of the earthquake in a spatial-geographic sense.

In this chapter an attempt will be made to present a general view of the relationship between the percentage of existing adobe houses previous to the earthquake, the wall-roof damage generated by seismic activity to these houses, and how damage was related to the number of casualties.

Methodology

The three main sources of information used to analyze these relationships are (1) data collected by interview methods as part of the study reported in earlier chapters in this report, (2) data furnished by the NRC and the GSNCEP, and (3) USGS Professional Paper 1002, 1976. The first source supplies quantitative information about wall-roof damage to adobe houses and the number of adobe houses previous to the earthquake in 26 communities - 13 Indian, 13 Ladino, 5 of which are in the metropolitan area of Guatemala City. These 26 communities represent only 40 percent of the area affected by the earthquake and due to this limitation, the data they supply can not be interpolated outside their geographic limits.

The second set of data used comes from a document called "Evaluación de los Daños Causados por el Terremoto, su Impacto Sobre el Desarrollo Económico y Social y Lineamientos para un Programa Inmediato de Reconstrucción," originated by the GSNCEP in 1976. The information in this document covers about 95 percent of the area affected by the earthquake and presents general quantitative information about the number of houses destroyed and/or cracked, the number of casualties (dead and injured) and other physical and social infrastructure losses by municipality. The third set of data is furnished by a reconnaissance map showing the Modified

Mercalli Intensity Isoseismical Distribution of the 1976 Guatemala Earthquake of the 4th of February, developed by the USGS (Professional Paper 1002).

The data from the three sources was analyzed and mapped in order to develop geographical models that might allow a comparison of the intensity of the quake with the number of casualties and adobe houses destroyed and/or damaged, and how this relationship is further correlated with the number of adobe houses existing previous to the seismic phenomenon.

Due to the specific criteria used to collect the data and to the different purposes of the inventories, it was necessary to reconcile the information in order to have a reference point for making rational judgments. This was difficult in some cases due to the spatial distribution of the samples and to the interpretation given to answers in the questionnaires employed and especially to the degree of accuracy of the field observations of the second and third sources.

These limitations were difficult to overcome but an attempt was made to compare the products of the three studies by mapping the data onto seven (7) maps and establishing a mapping scale that would diminish spatial errors.

Findings and Conclusions

The first map, drawn at the scale of 1:500,000, is called, "Percentage of Adobe Houses Previous to the 1976 Guatemalan Earthquake." The data used came from tabulations such as those presented in Chapter 9, which presented information about the 26 communities studied in the research reported in this monograph. This information (see Map No. 13-1) locates in percentages (isolines in twentieths, i.e. 5 percent gradations) the number of adobe houses in the central area of the earthquake zone. It suggests that larger percentages of adobe houses are found in areas of higher elevation, clayish soils, pumice deposits, accelerated erosion, stepped slopes, milpa and other subsistence grain crops, while a smaller percentage of adobe houses corresponds to lower elevations, sandy soils, coluvio-aluvial materials, normal erosion, gentler slopes and more permanent and cash crops.

It seems that there is a relationship between the Indian settlements of the volcanic highlands and the percentage of adobe houses. Most of the Indian settlements in the earthquake area have at least 70 percent adobe houses and in some places like the Cackchiquel area, the percentage is more than 85 percent.

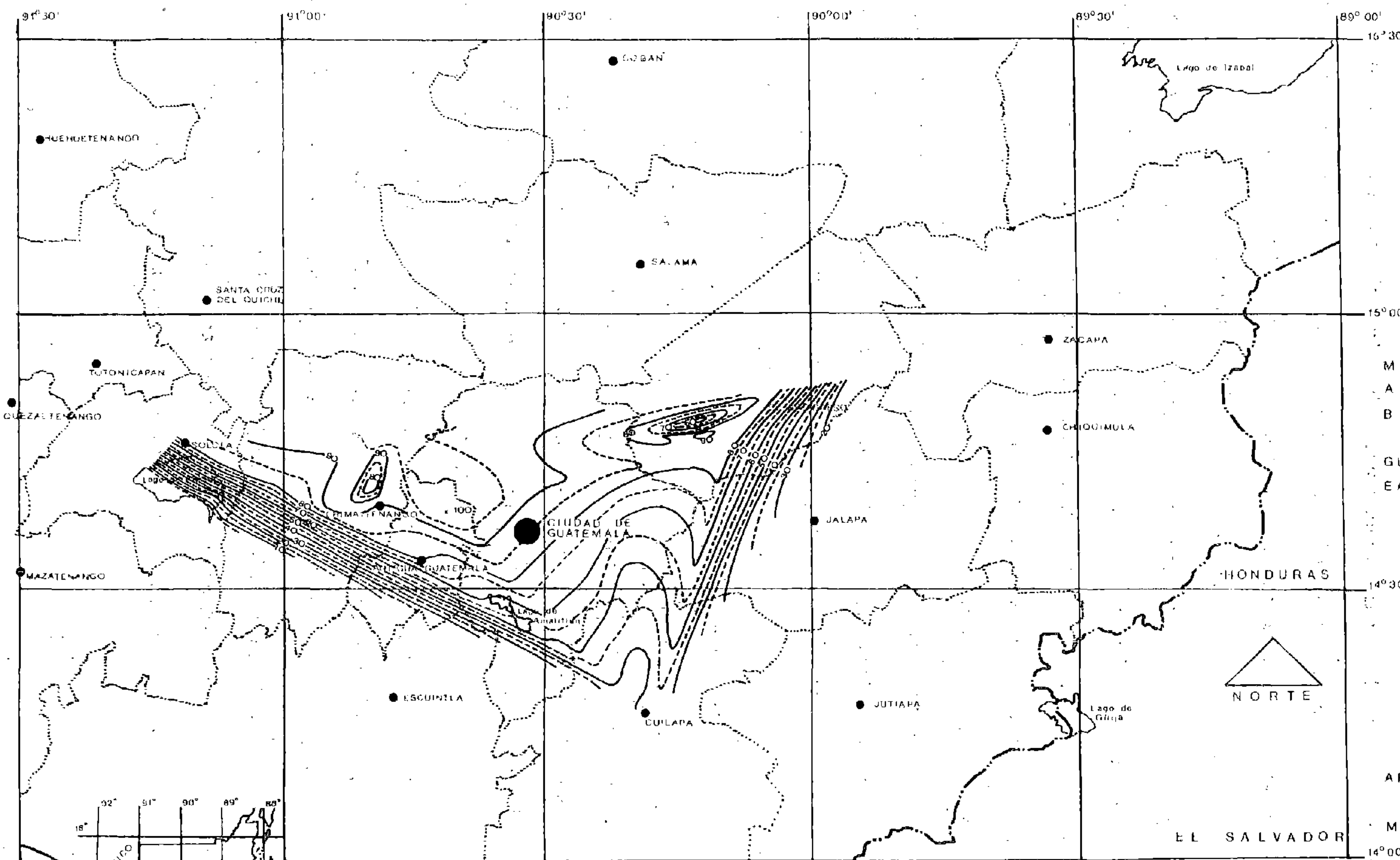
It appears that in certain instances, there is an interdependence between accessibility to natural resources, especially soil, water and vegetation, and economic resources such as jobs and the percentage of adobe houses. The less the resources, the higher the percentage of adobe and vice versa. This conclusion can be drawn from the data from areas around El Progreso, Sanarate, Sansare, Magdalena Milpas Altas, Patzicia, Patzún and other towns. At the regional level, this map shows that adobe diminishes toward the Southeast and the South, but due to the lack of data this generalization might not be valid for the Southeast. There is empirical evidence, however, that this judgment is correct in the South, due to the scarcity of clays, the availability of other materials,

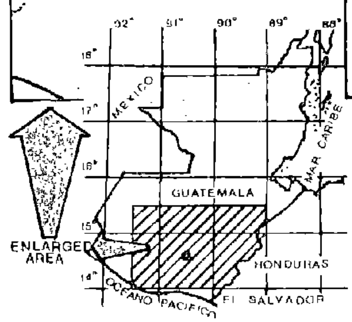
MAP Nº

1

MAIN AREA AFFECTED BY THE 1976 GUATEMALAN EARTHQUAKE

712





PERCENTAGE OF ADOBE HOUSES PREVIOUS TO THE 1976 GUATEMALAN EARTHQUAKES
EXPERIMENTAL AND CONTROL COMMUNITIES

Contour Lines Every Five Percent

— 20,30,40,50,60,70,80,90,100 percent
--- 25,35,45,55,65,75,85,95 percent

Source: SAS
FT 11 F00 1
A 222, 4 October 1981

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MAY 1982
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LUCY ARIMANY

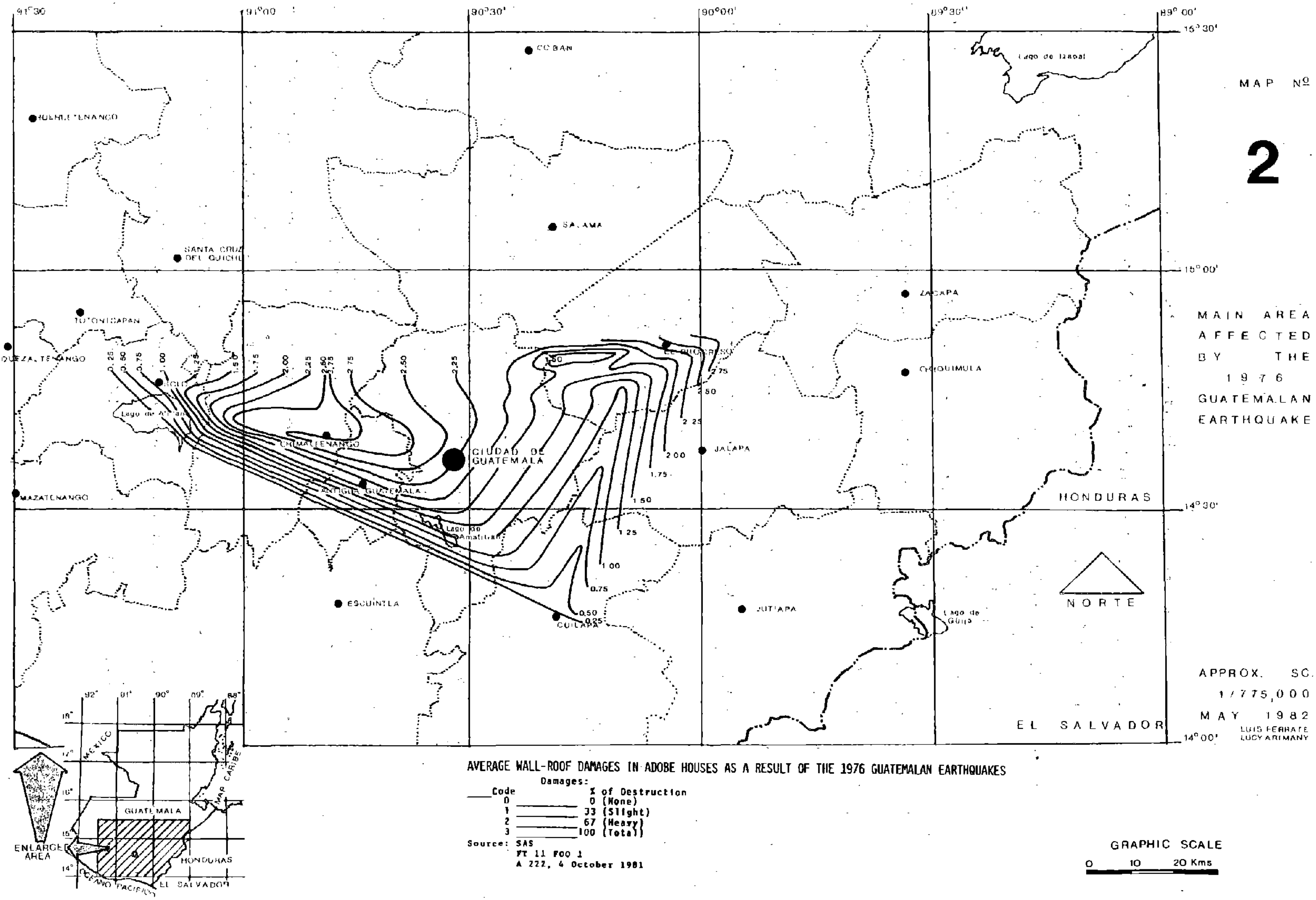
GRAPHIC SCALE
0 10 20 Kms

the increasing incidence of latifundia and other social structures.

The second map prepared (Map No. 13-2) reflects the average wall-roof damage in adobe houses as a result of the 1976 Guatemalan earthquake. The scale, area covered and the data used are similar and from the same source as Map. No. 13-1.

The information expressed in this map shows the magnitude of wall-roof damage derived from interview information collected as part of the study reported in this monograph where damages are rated as follows: 0 = none; 1 = slight (33%); 2 = heavy (67%), and 3 = total (100%). Isolines every twenty-fifth (.25) are used to determine accuracy at the scale 1:500,000. Therefore, to be precise about the importance and magnitude of wall-roof damage, the following ratio can be made with percent damage: 0 = 0%; .25 = ±8%; .50 = ± 17%; .75 = 25%; 1.00 = ± 33%; 1.25 = ± 41%; 1.50 = 50%; 1.75 = ± 59%; 2.00 = ± 67%; 2.25 = 75%; 2.50 = ± 84%; 2.75 = ± 92% and 3.00 = 100%.

The graphic representation attempts to plot damage by interpolating isolines every twenty-fifth (.25) and the results seem to be quite remarkable. If the isoline 2.50 (more than 84 percent of wall-roof damage in adobe houses) is taken to define a heavily stricken area by the earthquake, it can be seen that the map identifies human settlements that are known on the basis of other information to have been almost leveled (San Juan Sacatepequez, San Lucas and San Pedro Sacatepequez, Mixco, Sumpango, Santiago Sacatepequez, Zaragoza, Parramos, Chimaltenango, El Tejar and San Martin Jilotepeque, just to mention some towns). In addition, it can be seen that the area of El Progreso, Las Ovejas, El



AVERAGE WALL-ROOF DAMAGES IN ADOBE HOUSES AS A RESULT OF THE 1976 GUATEMALAN EARTHQUAKES

Damages:

Code	% of Destruction
0	0 (None)
1	33 (Slight)
2	67 (Heavy)
3	100 (Total)

Source: SAS
FT 11 F00 1
A 222, 4 October 1981

Paso de los Tilapas and other surrounding towns and villages show a similar impact.

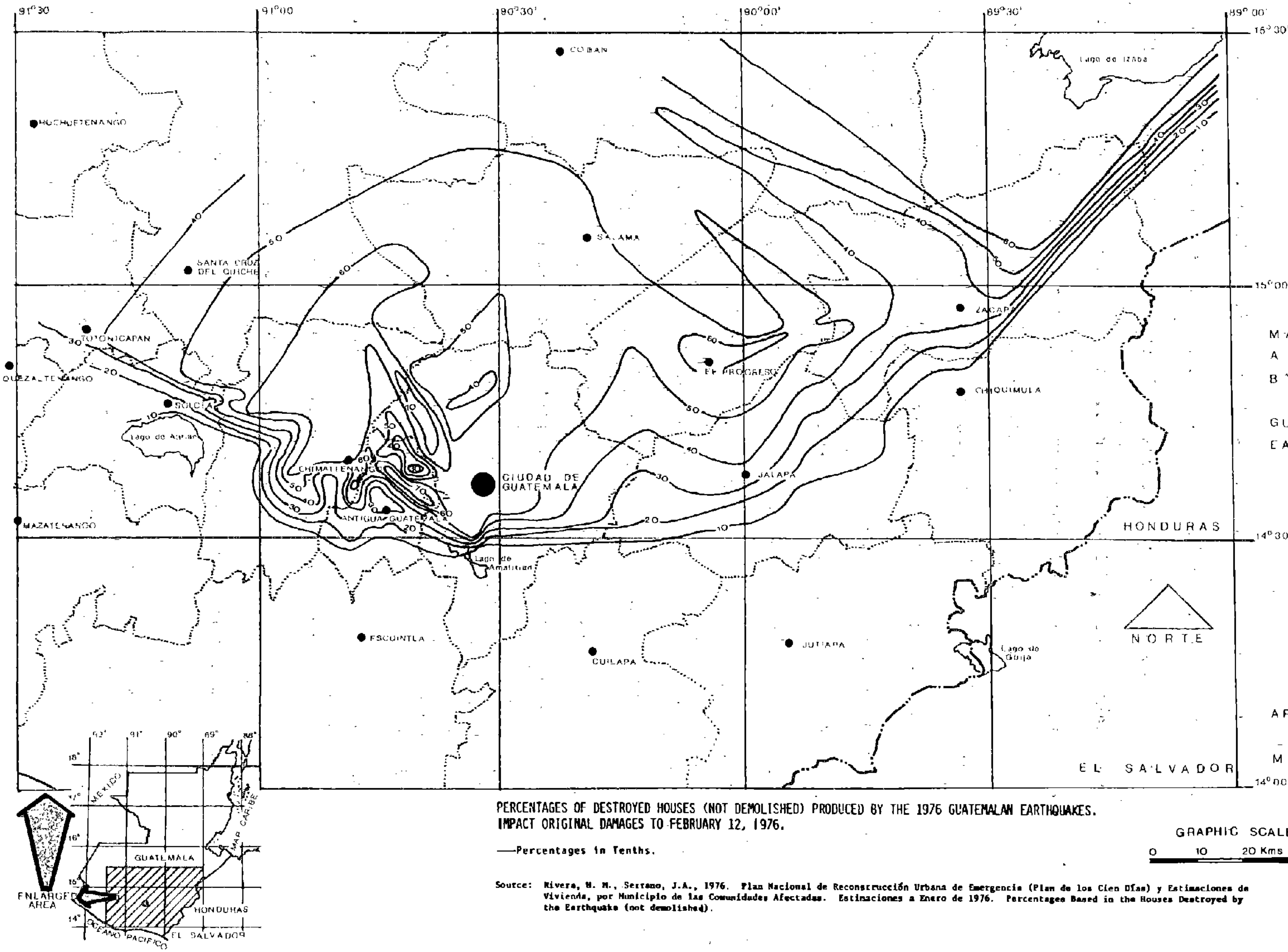
At the lower end of the scale, the isoline 0.75 (less than 25 percent of total wall-roof damage) shows areas where the impact of the earthquake was diminished by the distance from the epicenters as well as by a change in housing construction materials - wood, thatch roofs, concrete and so forth - as well as by better structures.

In summary, heavy to total wall-roof damage in adobe houses corresponds to greater and more intense use of adobe in different geographic areas of the earthquake zone. There seems to be a definite relationship between a higher percentage of adobe houses and wall-roof damage (see Maps No. 13-1 and 13-2). If a point is defined by crossing an isoline of Map No. 13-1 (Isoline 90 percent of adobe houses)with an isoline on Map. No. 13-2 (Isoline 2.75 - ± 92 percent wall-roof damage), an estimation of the number of damaged houses will result. If this is done, approximately 85 percent destruction will occur, as is observed in the cases of the towns of El Tejar, Zaragoza, Sumpango and others. The same conclusions seem to be valid for other areas, such as El Progreso where there were at least 80 percent adobe houses and 84 percent wall-roof damage - ± 67 percent of the houses were destroyed; Tecpán Guatemala, where more than 90 percent of the houses were adobe and 67 wall-roof damage - ± 60 percent of houses destroyed; Mataquescuintla, with approximately 60 percent of adobe houses and about 33 percent of wall-roof damage - ± 20 percent of houses destroyed or cracked. The advantage of this map is that house destruction can be estimated for any given point with a certain degree of accuracy, understanding house destruction as the severe wall-roof damage generated by the direct impact of the earthquake of February 1976.

This map also seems to show the areas where seismic epicenters occurred by associating the shape of the isolines by magnitude. It is important to notice that one of the most important results of this comparison is that it makes it possible to estimate, in order of magnitude, damage to adobe houses in towns that were not surveyed during field research for the current study and allows us to interpolate and therefore to compare data with other studies carried out by the GSNCEP and the U. S. Geological Survey.

The data used for these maps (No. 13-1 and No. 13-2) cover the towns of Chimaltenango, Patzun, San Martin Jilotepeque, Las Lomas, San Marcos (de Puerto Rico) Pacoc, Sta. Maria Cauque, Solola, San Lucas Toliman, Cerro de Oro, San Marcos La Laguna, El Progreso, Sanarate, Conacaste, Sto. Domingo los Ocotes, Espiritu Santo, San Juan, Zaragoza, Cuilapa, Barberena, El Junquillo and the "Asentamientos" and "Colonias" of Carolingia, Roosevelt, 4 de Febero, Chinautla and Nueva Chinautla, the last five located in Guatemala City.

Map No. 13-3 is based upon information described in the "Plan Nacional de Reconstruccion Urbana de Emergencia (Plan de los 100 Dias) y Estimaciones de Vivienda, por Municipio de los Communidades Afectadas" from H. M. Rivera and J. A. Serrano, published in April 1976. The number of houses previous to the 1976 earthquake was estimated to January, 1976 by municipality. For constructing this map, only information at the municipality level was used because it was the only reliable data available.



MAP Nº

3

MAIN AREA AFFECTED BY THE 1976 GUATEMALAN EARTHQUAKE

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PERCENTAGES OF DESTROYED HOUSES (NOT DEMOLISHED) PRODUCED BY THE 1976 GUATEMALAN EARTHQUAKES.
IMPACT ORIGINAL DAMAGES TO FEBRUARY 12, 1976.

——Percentages in Tenths.

Source: Rivera, M. M., Serrano, J.A., 1976. Plan Nacional de Reconstrucción Urbana de Emergencia (Plan de los Cien Días) y Estimaciones de Vivienda, por Municipio de las Comunidades Afectadas. Estimaciones a Enero de 1976. Percentages Based in the Houses Destroyed by the Earthquake (not demolished).

The objective of this map is to show the percentage of houses destroyed (not demolished*) by the seismic events of 1976, using isolines in tenths (10 percent gradations) and covering the whole area of the earthquake. The specific data used is at the level of "cabecera municipal" and smaller individual towns were not taken into account. Damage can be interpolated to these places and it is possible to obtain an estimation of the number of houses destroyed within ± 15 percent of error.

The map shows that the most severe direct damage occurred along the Motagua fault, where about 60 percent of houses were destroyed in the areas of El Jicaro, Las Ovegas, El Progreso, Joyabaj, San Jose Poaquil, Sta. Apolonia, Tecpan Guatemala, Comalapa, Sta. Cruz Balanya, Chimaltenango, Parramos, Pastores, San Bartolome Milpas Altas and Mixco. Damage up to 70 percent is located in San Juan and San Pedro Sacatepequez, while damage of less than 30 percent is located in San Pedro Pinula, Mataquescuintla, Villa Canales and Altotenango.

It seems that there is a direct relationship between direct damage and the percentage of adobe houses in the northern part of the Departments of Chimaltenango, Quiche and El Progreso, Baja Verapza, Guatemala, Jalapa and Zacapa, but due to the lack of accurate regional data, it appears that the towns of southern Solola and Chimaltenango have a high degree of uncertainty. Finally, the possibility exists that the direct impact of the earthquake cracked the walls of many houses but the houses remained standing. Therefore, it is necessary to create

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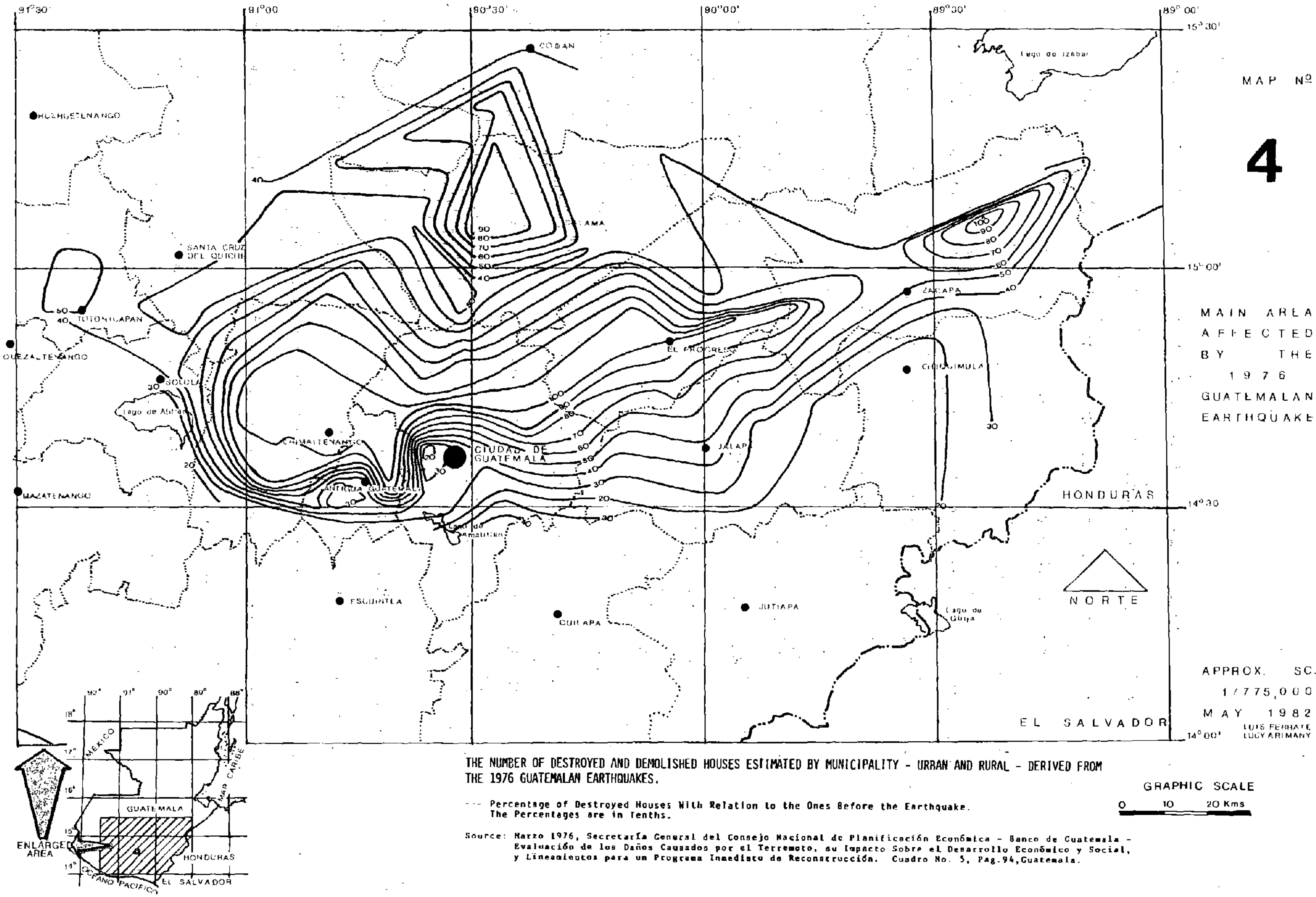
*Demolished refers to houses so badly damaged that they had to be torn down because they could not be repaired. This map only deals with houses that were destroyed by the earthquake itself and therefore with the heaviest damage.

another map that shows the total number of houses destroyed directly or indirectly by the earthquake.*

Map No. 13-4 is an effort to estimate by municipality, the number of houses destroyed directly by the earthquake as well as the ones that had to be demolished due to severe wall-roof damage. The information for this analysis comes from the report called "Evaluacion de los Danos Cousados por el Terremoto, su Impacto sobre el Desarrollo Economico y Social, y Lineamientos para un Programma Inmediato de Reconstruccion," presented by the GSNCEP in March, 1976. Data at the level of municipality were used to draw the isolines in tenths (10 percent gradations), locating data points geographically in the "cabecera municipal." This action introduced a spatial error but, due to the scale of Maps No. 13-3 and No. 13-4 (1:500,000), this error is diminished considerably and other methodology could not be applied due to the fact that the data are at the level of municipality as a political unit.

The results of this analysis generally show that the most devastated area (± 100 percent of total destruction) corresponds to human settlements with 85 percent adobe houses. There are two exceptions to this rule; one to the northeast of El Progreso - El Jicaro, Paso de los Jalapas, Las Ovejas, where the data show as little as 30 percent adobe houses but where the destruction was nevertheless total. The explanation might be that these towns were along the Motagua fault and the earthquake intensity

*Directly means the house collapsed in the earthquake itself. Indirectly means that the house was so badly damaged that it had to be torn down or "demolished."



THE NUMBER OF DESTROYED AND DEMOLISHED HOUSES ESTIMATED BY MUNICIPALITY - URBAN AND RURAL - DERIVED FROM THE 1976 GUATEMALAN EARTHQUAKES.

--- Percentage of Destroyed Houses With Relation to the Ones Before the Earthquake. The Percentages are in Tenths.

Source: Marzo 1976, Secretaría General del Consejo Nacional de Planificación Económica - Banco de Guatemala - Evaluación de los Daños Causados por el Terremoto, su Impacto Sobre el Desarrollo Económico y Social, y Lineamientos para un Programa Inmediato de Reconstrucción. Cuadro No. 5, Pag.94, Guatemala.

there was IX and X (Modified Mercalli) and even bajareque, concrete, wood and other structures were damaged. Another possible exception is that this area is located outside the territory of the towns studied in the research reported on in this monograph and therefore the interpolation of data has a high degree of uncertainty.

The other area with 100 percent destruction, even though there were only about 60 percent adobe houses, is located north of Sanarate where damage was possibly due to the fact that most of the towns are on the Motagua fault and there were epicenters underneath.

In a regional perspective, this map is accurate and correlates infrastructural damage with the percentage of adobe houses in a direct way (the higher the damage, the higher the percentage of adobe houses), but there are exceptions such as those mentioned above.

A general trend is found between the data of Maps No. 13-2 and No. 13-4. The isolines of total and heavy average wall-roof damage to adobe houses correspond to the isolines of 90 percent and more of destroyed and demolished houses. This is especially true in Chimaltenango, Solola, Guatemala and El Progreso, but in the other affected areas, the trends are less conspicious. These maps present a general view of the magnitude, intensity and spatial distribution of damage to houses, especially adobe, and it is possible to interpolate potential damage to human settlements that were not surveyed, as well as to compare this damage with the number of casualties.

Data on approximately 82 municipalities were used to plot the contours of this map and the accuracy of the map is high (90 percent) from the

40 percent to 100 percent isolines and medium (70 percent) with the ones from 20 percent to 40 percent damage.

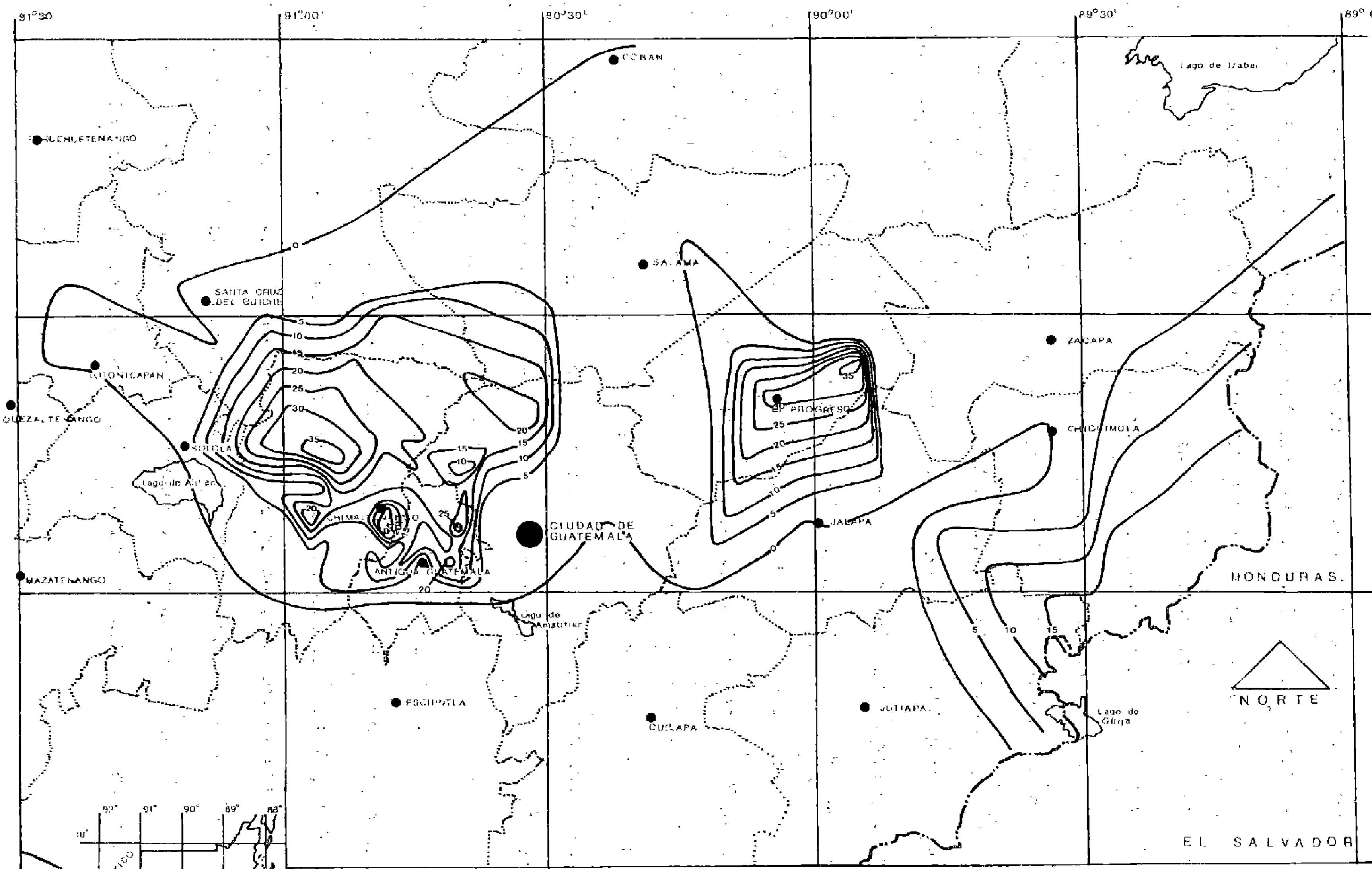
Map No. 13-5 reflects the different percentages (in 5 percent gradations) of deaths produced by the 1976 earthquakes and how these percentages are related to the total estimated population by municipality. There seems to be a strong correlation between the number of destroyed and demolished houses and the percentage of casualties. The isolines of more than 80 percent house destruction (Map No. 13-4) relate rather precisely to the isolines that delineate areas where the human losses were between 25 and 30 percent, especially in the municipalities of Morazan, San Cristobal, Acasaguastlan, El Jicaro, El Progreso, San Juan, San Lucas and San Pedro Sacatepequez, Parramos, Comalapa, Sta. Cruz Balanya, Tecpan Guatemala, Sta. Apolonia and San Jose Poaquil, just to mention some towns.

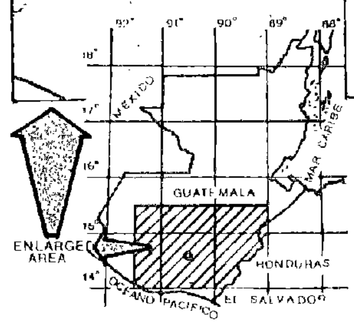
There are other relationships that can be observed between the number of destroyed and demolished houses and the number of casualties. In general it is observed that the larger the percentage of house destruction, the larger the percentage of casualties and vice versa. There is an exception to be seen in a big gap located in Palencia, Canalitos, Suquinay, San Antonio La Paz, Sanarate, San Jose del Golfo, and other towns. The reason for this lack of correspondence between house damage and deaths might be that there is less pumiceous material and therefore, less mass movement of earth. Another explanation might be differences in building construction patterns between this and surrounding areas (the use of bajareque as well as more wooden structures).

MAP Nº

5

MAIN AREA AFFECTED BY THE 1976 GUATEMALAN EARTHQUAKE





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MAY 1982

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PERCENTAGES OF CASUALTIES PRODUCED BY THE 1976 GUATEMALAN EARTHQUAKES - THE PERCENTAGES ARE RELATED TO THE TOTAL ESTIMATED POPULATION BY MUNICIPALITY, TO JANUARY 1976 -

— Percentages in Fifths.

GRAPHIC SCALE

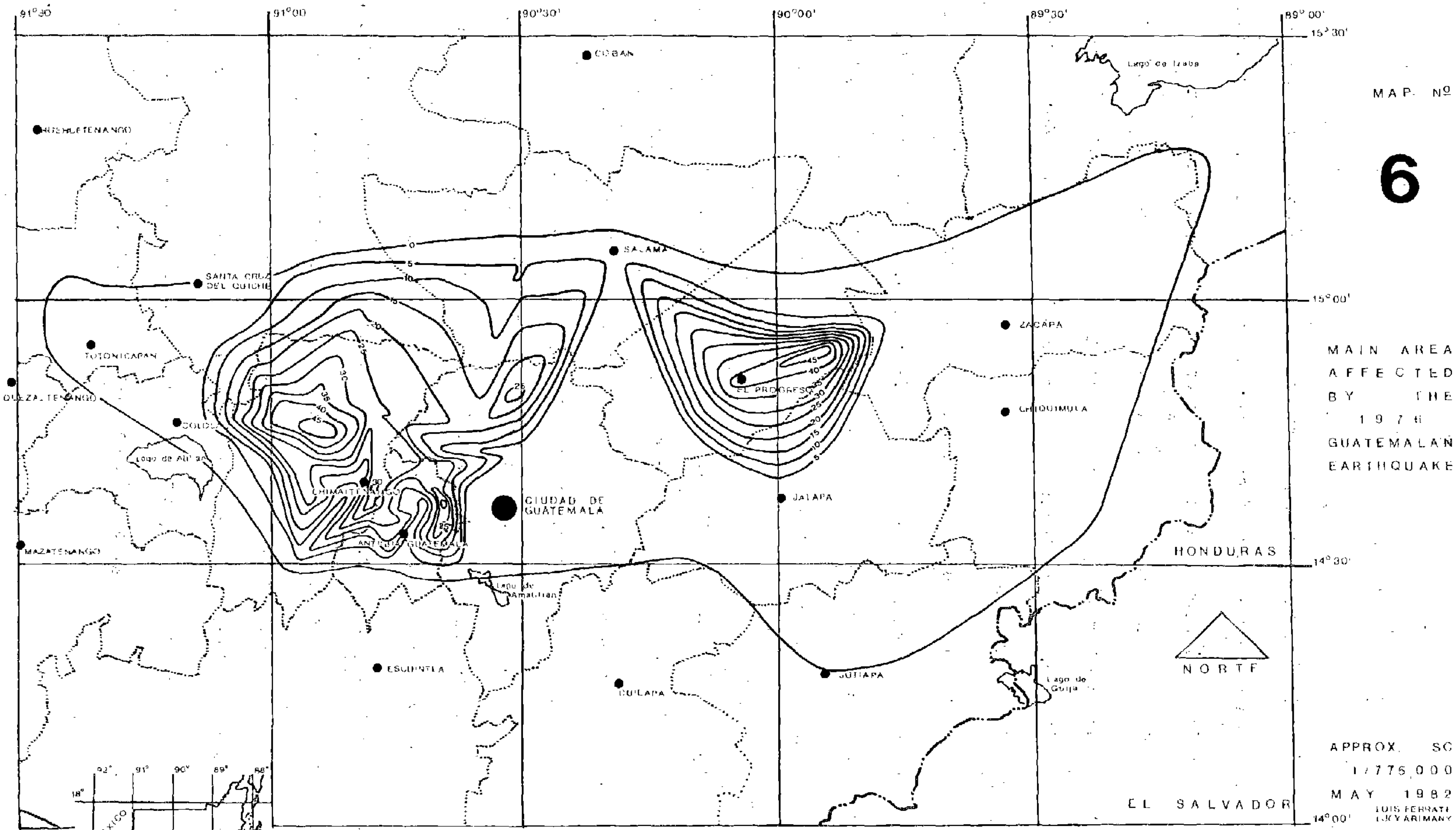
0 10 20 Kms

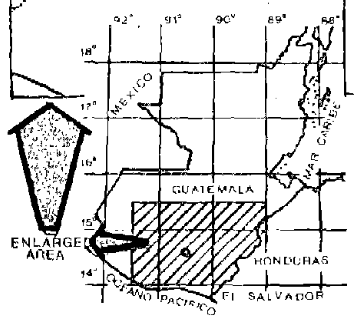
Source: Marzo 1976. Secretaría General del Consejo Nacional de Planificación Económica - Banco de Guatemala - Evaluación de los Daños Causados por el Terremoto, su Impacto Sobre el Desarrollo Económico y Social, Lineamientos para un Programa Inmediato de Reconstrucción, Cuadro No. 4, Pag 89-91, Guatemala.

This map suggests also a correspondence between the depth of pumiceous grabens in the volcanic highlands and increasing percentages of casualties, as well as a relation between the location of epicenters and greater loss of life, or a combination of the aforementioned factors. These potential relationships can be seen in Comalapa, Tecpan, Parramos, San Lucas Sacatepequez, Patzicia, El Progreso, El Jicaro and other areas located in pumiceous grabens (See Map No. 13-5).

In the area of Sansirisay - San Agustin Acasaguastlan, the casualties do not correlate with the percentage of adobe houses and wall-roof damage, probably due to the greater intensities of the earthquakes there and the structural design of the houses employed in the area.

Map No. 13-6, in spite of a different data source ("Applying the Lessons Learned in the 1976 Guatemalan Earthquake to Earthquake Hazard-zoning Problems in Guatemala," by A. F. Espinoza et al, 1978) is very similar to Map No. 13-5 and expresses in five percent gradations the casualties produced by the 1976 Guatemalan earthquake. The main difference stems from census data employed pertaining to the population of municipalities in the disaster area. While Map No. 13-5 uses a population projection to January 1976, Map No. 13-6 uses the hard data of the 1973 census. Another important difference is that Map. No. 13-6 shows isolines with a greater number of percentages of casualties - up to 45 percent of the total population within the municipality - while Map. No. 13-5 shows isolines with values only up to 35 percent. Due to these facts it is not possible to draw very accurate local conclusions, but at the regional level, the information shows specific trends of destruction and human losses that relate to the number of houses destroyed and demolished, but





725

PERCENTAGES OF CASUALTIES PRODUCED BY THE 1976 GUATEMALAN EARTHQUAKES - THE PERCENTAGES ARE RELATED TO THE TOTAL ESTIMATED POPULATION BY MUNICIPALITY, TO JANUARY 1976 -

—— Percentages in Fifths.

GRAPHIC SCALE

0 10 20 Kms

Source: Espinosa, A. F. et al, 1978. Applying the Lessons Learned in the 1976 Guatemalan Earthquake to Earthquake-Hazard-Zoning Problems in Guatemala. Proceedings, International Symposium on the February 4th, 1976 Guatemalan Earthquake and the Reconstruction Process. Guatemala. Table No. 1.

has a low relationship with the percentage of adobe houses and wall-roof damage, with the exception of the human settlements in the Cackchiquel area.

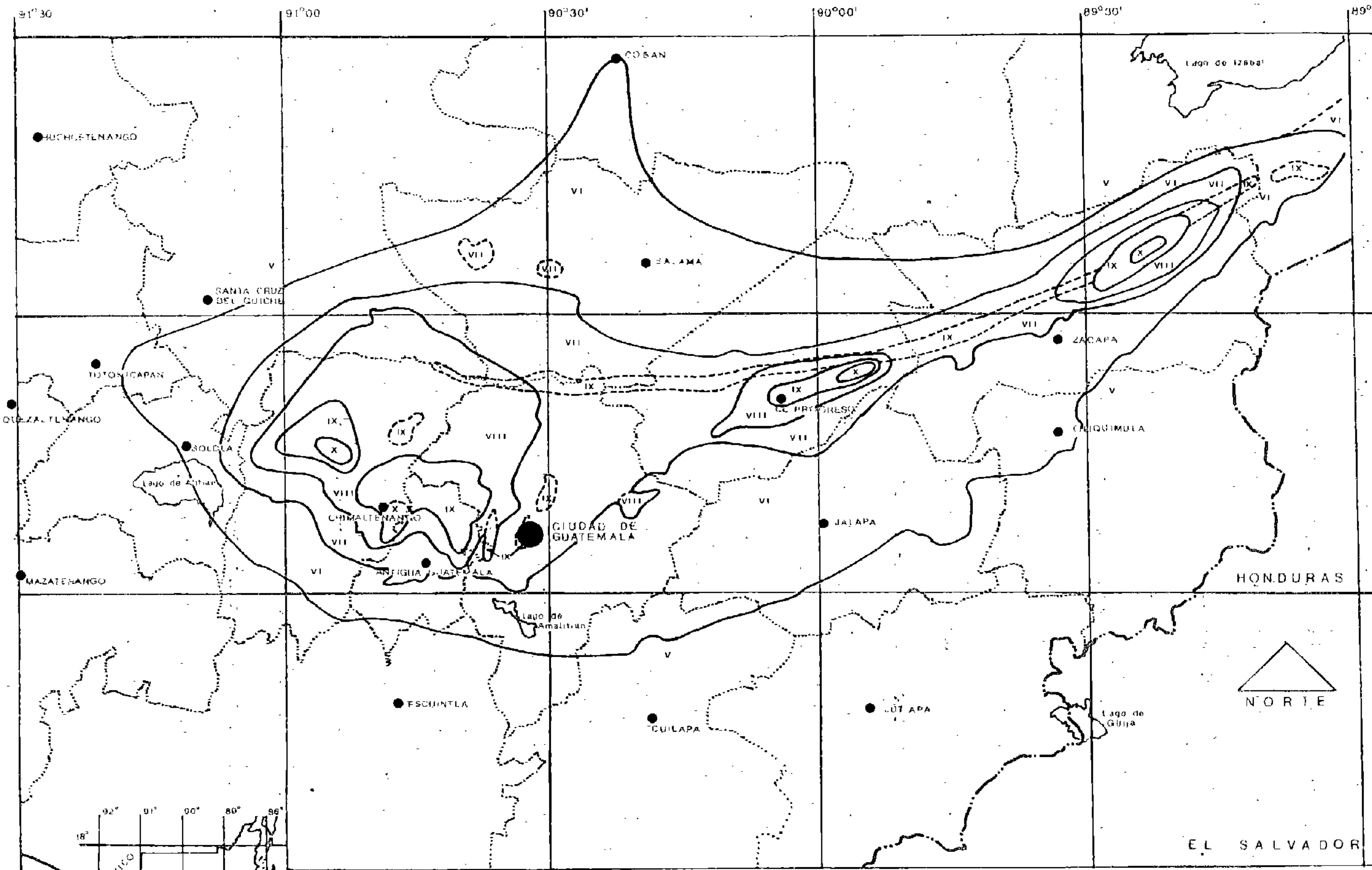
Map No. 13-7 shows the distribution of isoseismic intensities,using the Modified Mercalli Scale. This map attempts to integrate two indicators - one, the percentage of adobe houses destroyed and the other, the percentage of casualties in each municipality - in order to allow the delineation of isoseismic intensities.

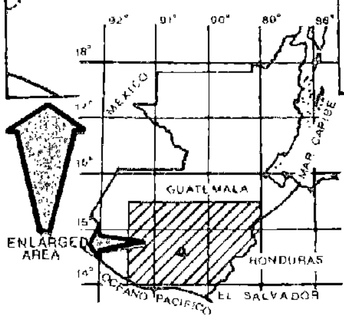
Due to the fact that the source parameters were based upon field observations and data processed by L. Ferrate at the University of Georgia, this map allows a comparison of data collected by F. Bates and associates and the Guatemalan government - especially the GSNCEP and the 100 Days Group.

Map No. 13-7 shows that the intensities varied from V to X, being V at the whole pheriphery of the disaster area and X in the most devastated places, like Comalapa, El Tejar, Parramos, El Jicaro and Gualan. Isoseismic line VI incloses an area where the infrastructure and human losses were light and the other isoseismic lines VII, VIII and IX show how the infrastructure and human losses increased, but in concentrated areas. In other words, the map shows a concentration of damage that seems to be related to the percentages of adobe houses previous to the earthquake, as is the case of the isolines of 90 percent and more of adobe houses that correlate with the isoseismic intensities of VIII, IX and X in the Departments of Chimaltenango, Sacatepequez, Guatemala and some areas of El Progreso. In this last Department, in spite of having less adobe houses at the northeast of the Capital, El Progreso, damage was high, possibly due to the presence

MAP Nº

7





MAIN AREA AFFECTED BY THE 1976 GUATEMALAN EARTHQUAKE

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MODIFIED MERCALLI INTENSITY ISOSEISMAL DISTRIBUTION OF FEBRUARY 4, 1976 GUATEMALAN EARTHQUAKE. INTENSITIES ARE BASED ON THE NUMBER OF ADOBE HOUSES DESTROYED (PERCENTAGE) AND ON THE NUMBER OF CASUALTIES (PERCENTAGE).

GRAPHIC SCALE

0 10 20 Kms

—— Approximate Boundaries -
--- Estimated Boundaries.

Sources: 1 - Espinosa, A.F., et al. Intensity Distribution and Source Parameters from Field Observations. The Guatemalan Earthquake of February 4, 1976, A Preliminary Report. USGS Professional Paper 1002. 1976.
2 - Ferraté, L. A., Processed Data from the Guatemalan Earthquake Study. Dept. of Sociology, Univ. of Georgia, Athens, Ga. Oct. 1981.

NOTE The basic data used are from the information obtain by Bates, F. et al. in the study of the Guatemalan earthquake of February 1976
Other data come from the National Reconstruction Committee (unpublished information) USGS pp 1002 is used for conceptual purposes

of epicenters and the fact that some towns are located directly on the Motagua fault system. Intensities of about VII are associated with isolines of 75 percent up to 90 percent adobe houses, especially in the Department of Guatemala.

The relationship between intensities, isolines and percentages of wall-roof damage also seems to be present. Intensities of VIII to XI are generally associated with wall-roof damage of more than 59 percent in adobe houses, but in a more specific manner intensities of XI and X are associated with damage of 75 to 92 percent, showing that this concept is valid for most of the disaster area.

Another relationship that can be picked up is one that shows the percentage of houses destroyed (not demolished) with the intensity of the earthquake. Isoseismicity of VIII to X is commonly related to isolines of 40-70 percent of the houses being destroyed, but Mercalli intensities of IX and X are mainly correlated with 50-60 percent house destruction in the areas of Tecpan Guatemala, Comalapa, San Jose Poaquil, San Martin Jilotepeque, Chimaltenango, Parramos, Chinautla, Mixco, El Progreso, El Jicaro and Gualan. Isoseismic values of VI and VII are associated with contours of 40 percent and less of houses destroyed.

If we compare Maps Nos. 13-4 and 13-7, other relationships can be observed. One is that higher percentages of houses destroyed and demolished are related to the higher isoseismic intensities. This is especially noticeable with percentages from 80 to 100 percent being associated with the intensities of VIII, IX and X. It is further noted that there is a relationship between 100 percent destruction and intensities of Value X. These generalizations are valid for areas affected by the Motagua faults and other areas associated with them when seismic movements were created in the Central Western volcanic highlands and in the areas of El Progreso and Gualan.

There are some areas where the damage was high - up to 80 percent, but the isoseismic intensity low - VII - such as in Rabinal Cubulco and Palencia, but these are exceptions and not the rule, and probably due to the fact that pumiceous deposits magnified the intensities of the quakes.

The comparisons between Map Nos. 13-5 and 13-6 with Map No. 13-7 allows us to deduce some other relationships between the number of casualties (in percentages) and the isoseismicity. A Mercalli intensity of X is associated with the largest number of casualties in Comalapa, El Tejar, Parramos and El Jicaro where adobe predominated, but not in Gualan, where the housing materials were not adobe but wood, and a higher casualties toll was avoided. The same pattern seems to occur with smaller percentages of casualties and intensities, as can be seen all over Map. No. 13-7.

Conclusions

These maps demonstrate that there was a close relationship between the type of housing located in an area and the proportion of houses destroyed in the earthquake. Destruction was generally high where adobe houses predominated. They also demonstrate that the number of human casualties is associated on the one hand with housing loss, and on the other, with the use of adobe as a building material.

Another conclusion that can be drawn from this analysis pertains to the accuracy of damage data, and data on house types collected in the research upon which this monograph is based. These maps show a close correspondence between data collected especially for this study and data collected by other groups for other purposes.