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Disaster Resistant Housing

Published by:
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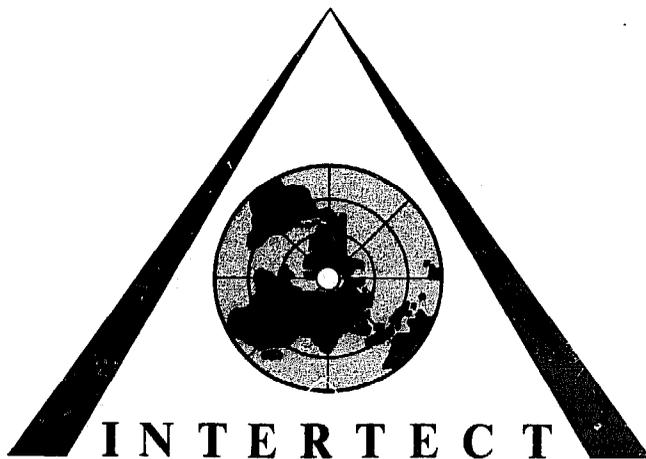
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**Program Planning Options
For the Reconstruction of Disaster Resistant Housing**



PROGRAM PLANNING OPTIONS
FOR THE RECONSTRUCTION OF DISASTER RESISTANT HOUSING

A primary objective of post-disaster reconstruction programs is to produce housing which is safer than that which failed in the disaster. An additional objective is to maximize the resources that are available so that the greatest possible number of people can be served.

With these objectives in mind, there are generally six program options available for the reconstruction of safer housing: conventional housing projects; prefabricated housing; materials distribution programs; housing education programs; core housing; and in-house shelters.

A. Conventional Housing Projects

Conventional housing projects offer the best means of ensuring that the homeowner receives a safe, well-engineered, disaster resistant house. An architect and/or engineer designs the house and it is then produced by a construction team under the supervision of a trained building tradesman. Only when the structure is complete is the building turned over to the occupant.

The advantages of this type of project are that complete control can be maintained over the quality of the construction and that, as long as quality control is continued in building maintenance, safety can be ensured.

There are, however, several disadvantages which must be taken into consideration before initiating this type of project, including:

1. Cost: This type of project is the most expensive; thus, the number of people served is limited.

2. Time: Conventional housing projects take a relatively long period of time to plan and execute.
3. Low Owner Involvement: Because of the nature of the design process, owner/occupant input is usually fairly low. Due to the cost of preparing a design, variations are relatively few.
4. Site: This type of project does not lend itself easily to construction on scattered sites. Thus, conventional housing projects are normally built in clusters on large sites, increasing the task of land acquisition.

Because a conventional housing project takes time to plan and execute, it offers the additional disadvantage of providing nothing for the homeless during the emergency period. If this option is selected, it may be necessary to develop an emergency shelter or transitional program to provide temporary shelter until the housing project is completed.

B. Prefabricated Housing

During the 1960's and early 1970's, a number of reconstruction programs chose to develop and provide prefabricated housing units for disaster victims. In most cases, the prefab units were of panel construction with corrugated metal or cement roofing sheets. The success of these programs varied considerably, often depending upon the sophistication of the design, its size, and its suitability to the particular community and environment. In most cases, the units were not popular, and occupants considered the houses to be only a temporary or intermediate measure. Researchers have pointed out that the advantages (including speed of construction, reduced cost, and speed of delivery) were advantages viewed from the perspective of the agency providing the houses and not of the disaster victims.

When surveyed, disaster victims noted the following disadvantages:*

1. Prefabricated houses represented only a small margin of economy compared to more desirable forms of housing.
2. Prefabricated houses were more expensive than traditional houses.
3. Mass-produced prefabricated houses had the disadvantage of uniform architecture.
4. The resale market was very restricted, resulting in a high number of abandoned houses.
5. Prefabricated housing projects located in rural areas incurred very high construction costs because of the difficulty and high cost of transportation.
6. Because the units were designed for mass production, individual homeowners complained that they had no input into the overall design and, therefore, they were often unhappy with the configuration.

For the most part, prefab housing programs cannot provide emergency shelter except in urban areas or regions which are adequately served by roads. Thus, if a prefab scheme is contemplated, some form of emergency or temporary shelter may have to be developed for areas with limited access.

C. Materials Distribution

Materials distribution programs are a method by which a degree of safer construction can be effected. For example, in earthquake-prone

*Tarja Cranberg, "Social Factors Which Influence the Advance of Housing Technology", Design, Siting and Construction of Low-Cost Housing and Community Buildings to Better Withstand Earthquakes and Wind Storms, National Bureau of Standards, BSS 48, Washington, D.C., 1974.

regions where heavy tile roofs contribute to the mode of failure in traditional housing, lightweight roofing sheets (such as corrugated metal or fiber-reinforced cement) can be provided as an alternative to tile. In areas where roofing is particularly vulnerable to uplift during high winds, fasteners and anchors can be provided. Other disaster resistant components that could be considered include:

- Concrete posts for disaster resistant frames
- Braces or reinforcing material
- Wood preservatives
- Reinforcing bars for cement reconstruction
- Stabilizing materials for earthen construction
- Nails, screws or other fasteners to improve building joint

Advantages of materials distribution programs include:

1. A large number of people can be assisted at a relatively low cost.
2. Distribution is relatively easier than for complete prefabricated units.
3. Materials can be delivered quickly (for example, as compared to a complete prefab unit).
4. The program places the burden of decision-making regarding design, size, etc., on the homeowner.

Disadvantages include:

1. Without guidance or technical assistance, there is no assurance that the materials being distributed will be used in the manner intended or in a safe way.
2. In those cases where the material being distributed is not indigenous nor available in normal periods, the intro-

duction of the material may create a demand which cannot be satisfied after reconstruction activities cease. Furthermore, introduction of the material may require changes in the basic design of the housing which, unless proper technical assistance is provided, may prove to be unsafe.

Many relief and reconstruction agencies are finding that materials distribution programs are an attractive option following widespread disasters, as they enable a large number of people to receive at least some degree of benefit. An additional advantage is that materials distribution schemes can be initiated during the emergency period, and certain materials (such as roofing sheets and other components) can be used first to provide emergency shelter and later be incorporated into a more permanent dwelling.

D. Housing Education Programs

The term "housing education" refers to the provision of technical assistance and training to homeowners and building tradesmen on ways to improve traditional housing to make it more disaster resistant. Housing education may simply be a teaching/education effort or it may be a component of one of the other types of programs described herein. Most often, housing education is offered in conjunction with materials distribution and self-help programs.

Housing education programs are difficult to initiate and conduct as the training staff must be familiar not only with the technical aspects of construction but also with the means of conveying this information to different groups of people. Attention must be given to the development of appropriate media for presenting the information and the structuring of sessions where building tradesmen can receive "hands on" as well as theoretical training.*

* Nancy Lehman Fritch and Jinx Parker, A System for Planning Educational Materials with Specific Reference to Their Use in Seismic Resistant Housing Programs, INTERTECT, Dallas, Texas, 1979.

Despite the difficulties of initiating a housing education program, without some effort in this field, long-term acceptance of disaster resistant construction methods is not likely to occur.

The advantages of a housing education program are:

1. Long-term change in construction techniques can be effected.
2. If properly designed, large numbers of people can receive benefits at relatively low cost. (Initial costs may be rather high in terms of the development of the training aids, exploration of training methods, and training of initial staff. However, longer-term operational costs are relatively minor.)
3. Housing education programs place the burden of decision-making about the style, shape and materials of the house on the homebuilder and occupant, thus ensuring a high degree of citizen participation and involvement in the program.

Disadvantages include:

1. Housing education programs take considerable time to initiate.
2. Impact may be negligible in areas where tradition or resistance to change is strong.
3. The ability to change housing according to the techniques being taught often depends upon the availability of materials or components needed for the change.
4. Housing education programs often require many years of program inputs before the methods being taught "catch on" and become incorporated into vernacular housing. Thus an agency initiating this type of program must plan to stay on site for a number of years or until reconstruction is well under way.

With proper advance planning, housing education programs can be initiated immediately following a disaster. When conducted in conjunction with materials distribution programs, they can provide a resource for emergency shelter while at the same time laying the groundwork for later reconstruction activities.

E. Core Housing

An option for providing both emergency shelter and permanent housing, which is being increasingly used by reconstruction agencies, is the "core housing" approach. During the emergency or rehabilitation phase, an agency provides a simple structural frame which can be utilized as an emergency shelter or temporary structure. The frame and roof are designed to be disaster-resistant and permanent. The occupants fill in the walls with whatever materials are available and progressively upgrade the structure. Initially, the walls may be infilled with material salvaged from the rubble, then later this material may be replaced with more suitable or aesthetic materials as the structure evolves into a more formal house.

The advantages of core housing schemes are:

1. The programs are relatively low-cost and allow the agency to provide incremental assistance. The frame and roof can be provided during the emergency period, for instance, with materials for the wall and interior at a later date.
2. Because the frame is designed to be disaster resistant, a degree of control over the end product is established.
3. The components necessary to build the frame and roof can be provided fairly quickly (relatively faster than a complete housing unit).
4. This approach can be used immediately following a disaster to provide emergency or temporary shelter, thus maximizing expenditures.

5. The program can work on a scattered-site basis.
6. The homeowner makes a significant input to the final product and is given a degree of choice as to what materials to use and how the final house will be finished.

Disadvantages are:

1. Without continuing technical assistance or a housing education component, people may infill the walls in an unsafe manner.
2. The program will only work where people own the land or have long-term tenure.

Core housing schemes require a degree of sophistication in order to be successfully implemented. It is especially important that traditional housing be thoroughly understood, as well as disaster-resistant construction techniques. Also implicit is a high degree of pre-disaster decision-making.

F. In-House Shelters

The establishment of in-house shelters is an approach used in industrialized countries which has great potential as a safety measure in developing countries where housing costs are relatively high.

There are two approaches to in-house shelters. The first is to install a disaster-resistant shelter in a house. This could be a closet or small area of the building that can be reinforced and made safe from collapse. During a disaster threat, the occupants would move into the shelter for safety.

The second approach is to design or strengthen one room of the house so that it is disaster resistant. Normally this would be the room in which all or most of the occupants spend the majority

of their time during the day or night (e.g., a bedroom or kitchen). Again, during a disaster threat, the occupants would seek safety in this room.

Usually in-house shelters are designed for use in areas prone to high wind storms, because the occupants have time to move into the shelter after receiving the warnings. The second alternative (strengthening one room of the house) could be used in earthquake-prone areas, although in all probability the only room which would justify extensive modification would be a bedroom.

To date, there are no known examples of the use of in-house shelter reconstruction programs, although the method has been utilized in traditional housing in various disaster-prone areas.

The projected advantages for a reconstruction program of this type would be:

1. Costs of disaster-resistant construction would be reduced.
2. Extensive modification of traditional designs would not be necessary.

The primary disadvantage is that in-house shelters have little overall effect on reducing the vulnerability of the houses.

Each of the aforementioned safe housing options can be coupled with a particular land-use strategy to form the basis for a housing reconstruction program. In a widespread disaster, normally more than one approach would be taken. For example, a materials distribution scheme might be initiated as part of an emergency shelter strategy for all groups. Next a core housing program could be started for people in urban areas; while in the rural areas, the materials distribution scheme could be expanded and combined with a housing education program. For landless victims in urban areas, large sites can be acquired for conventional housing projects with a range of housing types and styles. And in smaller outlying towns,

smaller conventional housing projects of 30-40 houses could be developed on smaller sites.

The point to remember is that a variety of programs can be put together in a well-balanced mix which often works better than one standard approach.