(*Credit*. Kapereli Voiotias, *Athens*)

This masonry house in Corinth, Greece, was badly damaged in the earthquake of March 1981. Inadequate bracking of stones, and the use of mud mortar were two reasons for the failure. Techniques can be communicated to local craftsmen on a seismic building techniques

The willingness of groups providing technical assistance to remain active in a given area, with sustained support and encouragement to the surviving community beyond the relief period.

Technology transfer

Following disasters where the structural failure of houses has been a major cause of death, assisting groups involved in housing reconstruction have attempted to introduce improved building methods. Many groups, however, do not have technical staff experienced in undertaking structural analyses of indigenous structures, from which to develop an appropriate reconstruction process Therefore, they develop prototype designs of their own and attempt to provide enough units for those in need. These units are built as models for those who are not direct beneficiaries of the scheme. A second approach has been to develop intensive educational programmes and teach new building methods to the disaster-affected population.

The record of both approaches in transferring technology has been disappointing. The weakness of the first approach is cost of construction and maintenance, and the long-term scarcity of building materials (often imported)—factors rarely considered in programme planning. Secondly, the hastily designed techniques of crash programmes are not always the most readily understood or rational for those being trained

Concerning the second approach, incentives have been required to get people to accept new building techniques. The best incentive has been the provision of building materials. However, the ability to transfer technology is dependent upon the continued availability of the selected materials· many techniques to improve structural performance in earthquakes, for example, require the use of lightweight, industrially manufactured materials. These materials, plus the improved building techniques, may be too costly for the majority of survivors.

In several instances, agencies involved in emergency shelter operations have attempted to introduce new technology in the hope that, when they re-entered the "normal" building process, the survivors would carry with them these improved techniques, and incorporate them into their new structures. But there is no evidence that this approach has worked, the primary obstacle being that the people do not equate their emergency shelters with permanent housing.

Training for improved construction

To date the best approach has proven to be combined programmes of building demonstration houses, and training in improved construction techniques. This work is still in its infancy, however, and much research and development are needed.

Training for the management of reconstruction programmes

In addition to training needs at the grass-roots level, there remains the need for training in the management of post-disaster housing programmes.

There are two general classifications of assisting groups active in disaster relief and reconstruction: *development organizations*, working for long-term objectives; and *relief organizations*, working principally in emergency situations. The primary difference between the two is that the development organization will have on-going programmes in the country, and can reallocate the existing staff's time to meet emergency needs; whereas the relief agency will have only a skeleton staff in the country, bringing in personnel from outside to conduct their relief operation for a relatively short-term period.

A survey of both the development and relief organizations (conducted through the American Council of Voluntary Agencies and the International Council of Voluntary Agencies) reveals that among development organizations, little time is spent on training the staff in disaster preparedness or in managing post-disaster programmes Few training aids exist within the organizations, other than their written standard operating procedures. Nevertheless, four of the largest development organizations have appointed officers at headquarters, responsible for preparing disaster operations guidelines, and maintaining liaison with other agencies/organizations Training for field staff or volunteers on the planning and management of relief operations is virtually absent. As the majority of developing countries are disaster-prone, this lack of training represents a serious omission on the part of the development agencies, for there is the likelihood that their staff will be confronted with a disaster during their tour of duty.

In the relief organizations there is, of course, more emphasis on planning and managing disaster programmes. However, the nature of relief organizations tends to limit training to the higher, permanent echelons In reviewing the training programmes of a sample of major relief organizations, it was found that few train their field staff on emergency shelter programmes, and especially on how to set objectives and choose options. Surveys of the libraries of two important relief organizations revealed little or no information on housing or emergency shelter, other than tent catalogues and several manuals on setting up tent encampments.

The apparent lack of staff training in the major development and relief organizations on emergency shelter and post-disaster housing must be remedied, for experience has shown that these areas constitute a substantial proportion of relief and reconstruction activities, both materially and financially.

Technical improvements

1. *The roofing problem*

Most research on emergency shelter and post-disaster housing has concentrated on the development of either whole structural units, or improved materials for use in the walls (e.g. stabilized adobe). Field experience has shown, however, that the majority of the problems encountered relate to the roof and roofing materials.

(Credit LRCS Geneva)

Housing with heavy earthen roofs supported on unreinforced, dried mud (adobe) walls is one of the most vulnerable types of construction in seismic areas. This is indicated in an example of failure, with high loss of life, from an earthquake at Golbuf, Iran, in 1980