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**Construction manual for
earthquake-resistant houses
built of earth**

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Kassel, December 2001
Gernot Minke

Introduction

The solutions proposed in this manual concentrate on low-cost single-story houses, built from earth in rural areas of earthquake-prone zones. They are based on research projects carried out at the Forschungslabor für Experimentelles Bauen (Building Research Laboratory) of the University of Kassel, Germany, on the analysis of earthquake damage in Latin America, on studying relevant literature and on the implementation of several test structures in Germany and prototype houses in Guatemala, Ecuador and Chile.

Using locally available building materials as well as the skills of local craftsmen should be considered for the design of seismic-resistant (earthquake-proof) houses and it should be proved that the solutions are accepted by the users.

Earth as a building material has lost its credibility mainly because of the fact that most modern houses with earth walls could not withstand earthquakes, and also since earth is considered as the building material for the poor. In this context it is worth mentioning that a census conducted by the Salvadorian Government after the earthquake in January and February 2001 states that adobe houses were not worse affected than other houses.

In many areas of the Andes regions building with adobe (unburned, unstabilized handmade soil blocks) is forbidden nowadays. Nevertheless, the majority of the rural population still builds with this building material, as it cannot afford to build with bricks or concrete blocks.

When designing low-cost houses for rural areas it should be taken into account that structural failures as a consequence of an earthquake have to be avoided, whereas minor damage like small cracks must be tolerated if it can be easily restored.

For more information about the different building techniques with earth, the physical and structural characteristics of earth and the possibilities of improving them, reference is made to the "Earth Construction Handbook" by the author, published at WIT Press, Southampton, UK 2000, or to the "Manual de Construcción en 'Tierra'", publicadora Nordan, Montevideo, Uruguay 2001.