THE YUNNAN, CHINA EARTHQUAKE
OF NOVEMBER 6, 1988

Hu Qingchang, Beijing Institute of Architectural Design and Chung Yicun, Earthquake Engineering Research Institute, Academy of Building Science Research

Introduction

Strong earthquakes of magnitude 7.6 and 7.2 struck the Lancang and Gengma areas of southwestern Yunnan Province at 9:03 and 9:15 p.m., respectively, on November 6, 1988. (The USGS FDE reports Nov 6, 13:03, 17.1 s, Gat; 22.808 N, 99.765 E, MB 6.1, Ms 7.0 (BBK) and Nov 6, 13:15, 43.4 s, 23.213 N, 99.533 E, MB 6.4, no Ms.) The depths of foci were found to be 13 km and 8 km respectively.

Earthquake intensity near the epicenter was estimated to be 9 and up to 10 at a few localities. The scale is China's earthquake intensity scale, with maximum value 12, and, in the 8 to 10 range, very close to MMI. On November 30, Lancang county was hit again by a strong aftershock of M=6.7.

Earthquake disaster effects covered 20 counties in the southwestern part of Yunnan Province, among them 3 counties seriously damaged. The most serious effects were scattered among villages of Gengma county: Yansoi, Tuanji, Mengseng, Sepaishan, Muga, Zutang, and Zanmapo, amongst others. People affected by the disaster numbered 5.16 million, deaths totalled 748, 3759 seriously injured and 3992 lightly injured. The number of rooms in collapsed houses was 1,308,000; 934,800 rooms were damaged.

Over 4000 schools and medical service buildings were damaged. More than one million cubic meters of rock slide caused damage of highways and blocked river transportation.

In comparing earthquakes in China within past 25 years, the direct economical loss estimated is second to that of the Tangshan earthquake of 1976.

Figure 1. Lancang Gengma Earthquake. Contour-line of earthquake intensity.
Photo 1. Yansoi Village houses, after earthquake shaking of intensity 9.


Building Performance

Most village houses were constructed with adobe-filled wooden framing and bundled straw roofing (photo 1). Many office buildings and warehouses were constructed with brick walls, adobe walls and reinforced concrete floors (photo 2). Brick walls laid with lime-mud or lime-sand mortar were badly damaged (photos 3, 4). Collapse and serious damage of 3- to 5-storied reinforced concrete frame buildings which were poorly designed and constructed with low strength concrete and incorrect detailing of reinforcement were observed (photos 5-8).

Most buildings in this area were constructed without...
consideration of earthquake resistance. However, several buildings exhibiting adequate seismic behavior were designed or strengthened for earthquake resistance, for example the Gengma cinema building, designed for seismic intensity 8, suffered no evident damage from the earthquake's intensity 8. The ward building of Lancang county hospital was strengthened for earthquake resistance just before the earthquake; no significant damage can be observed after the earthquake. In contrast, the clinic building, a similar masonry structure but not strengthened, suffered heavy damage after the earthquake. It has had to be demolished and rebuilt. In Yansoi, Gengma county, a masonry residential
building strengthened by reinforced concrete tied columns and tied beams was completed just before earthquake. It sustained shaking of intensity 9 without any damage (photo 9).


Figure 2. Distribution of epicenters, Lancang Gengma Earthquake.