Fig. 23 (a) Overview

Fig. 23 (b) Close-up showing pullout of friction pile

Fig. 23 1985 MEXICO EQ: PHOTOS ILLUSTRATING THE COLLAPSE OF A BUILDING DUE TO FOUNDATION FAILURE

Separation of Adjacent Buildings [25]. Many buildings in Mexico suffered serious damage (Fig. 24) owing to the hammering of adjacent buildings because of lack of proper separation, despite the significantly stricter requirement of the 1976 Mexican Code compared to that of the 1982 UBC interstory drift index, IDI, which computed through an elastic analysis considering the specified seismic forces. The building separations recommended by the UBC are inadequate. This has been confirmed by the significant damage that occurred due to hammering during the 1989 Loma Prieta EQ The ATC has already recognized this inadequacy, and has recommended that the lateral deflection induced by the specified design seismic forces, which are determined through elastic analysis which considers the building to be fixed at the base, be increased by multiplying these seismic forces by a deflection amplification factor C_d. Although the 1988 SEAOC and the 1988 UBC specify a story drift index limitation similar to that of the 1982 UBC ($\leq 0.04/R_w$ or ≤ 0.005), it is further recommended that separations between adjacent buildings should allow for $(3/8)R_w$ times the displacement due to the design seismic forces. The rationale for this choice of amplification factor is not clear, since it appears that structures designed just to comply with the limitation of $0.04/R_w$ under specified design seismic forces will undergo deflections larger than $(3/8)R_w$ times the displacement under the specified design forces when subjected to major EQ ground-shaking.

A revision of UBC regulations regarding acceptable IDI and building separation is urgently needed. To avoid the effects of the hammering of adjacent tall buildings, the separation that would be required could lead to serious problems in the economical use of usually very expensive real estate. Thus, it appears that in order to avoid damage between adjacent buildings it will be necessary to develop other regulations or requirements besides just the specification of adequate separation, such as the inclusion in the design and detailing of adjacent buildings of the possibility of such hammering. One such regulation should be that for two adjacent buildings with inadequate separation, the floor systems of the two buildings should be at the same level.

The problems of identifying realistically acceptable values of IDI at different limit states and defining proper separation between adjacent buildings urgently require a better solution than those offered in our current codes. Economical solutions for retrofitting existing adjacent buildings which do not have adequate separation should be researched immediately.

Fig. 24 COLLAPSE OF TWO INTERMEDIATE STORIES DUE TO HAMMERING OF ADJACENT BUILDINGS

THE 10 OCTOBER 1986 SAN SALVADOR EARTHQUAKE [26]. Although this was an EQ of moderate magnitude (M_s=5 4), because of its proximity to the city of San Salvador (practically at the southern edge of the city) and its shallow focus (about 7 km), this EQ produced extensive damage and caused a relatively high number of casualties: approximately 1,200 dead and nearly 10,000 injured For the economy of the country, already