URBAN GEOLOGIC PROBLEMS ASSOCIATED WITH THE MIXCO FAULT ZONE

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INTRODUCTION

Portions of the rapidly expanding urban development in and west of Guatemala City were extensively ruptured by secondary faulting along the Mixco fault on February 4th and 6th, 1976. The physical effects of the earthquake included ground shaking, fault rupture, and ground failure. The purpose of the research described here is twofold, 1) to identify the major deterrents to the implementation of a seismic hazard reduction program in the Guatemala City - Mixco area, and 2) to demonstrate the use of existing geotechnical information for the compilation of a potential seismic hazards map and for site-specific seismic hazard abatement.

Research for this study involved three phases. The first phase consisted of approximately three weeks of field mapping in March 1976 to identify and map the fault traces and ground ruptures in and north of Mixco. The second phase involved an evaluation conducted in October 1977 to see if any programs for seismic hazard abatement had been implemented. Interviews with architects, engineers, developers, and governmental officials were conducted, and areas of special interest were field checked. The third phase consisted of compilation of a potential seismic hazards map and implementation of a seismic hazard abatement plan to two development plans.

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EARTHQUAKE EFFECTS

On February 4, 1976, the Motagua fault ruptured in a left lateral strike-slip fashion along 240 km of its length, generating an earthquake of surface wave Magnitude (Ms) 7.5. Simultaneous rupturing occurred along 20 km of the Mixco fault (Plafker, 1976). The main earthquake and its aftershocks claimed more than 24,000 lives, injured more than 77,000 people, and left 1,000,000 people homeless. It is estimated that damages exceeded $1 billion. Ground shaking was the major cause of damage and death; however, the ground ruptures from the Mixco fault caused extensive damage locally.

One of the first programs the Guatemalan Government instituted, through the Emergency Committee and the Instituto Geografico Nacional, was the mapping of the fractures in and around Guatemala City and Mixco (Figure 1). The Mixco fault had been mapped prior to the earthquake and appeared on most modern published maps of the region as a 35 km long series of en echelon fault segments trending generally north-south. This fault bounds the western side of the Guatemala City graben and exhibits normal dip-slip fault displacements with the east side down (Bonis, et al., 1970). The Mixco fault is of particular interest from a seismic hazard standpoint because of its proximity to the highly urbanized areas of Mixco and Guatemala City.

Ground rupture along the Mixco fault generally was expressed by vertically oriented, nearly linear, extensional cracks 2 to 7 cm wide. The cracks typically appeared as single, well defined features, but splaying was locally expressed by branching or braided patterns of smaller fissures over ground widths of 10 to 20 meters. Vertical displacements up to 15 cm were