ABSTRACT

Tan, Aditya. M.S.C.E., Purdue University, May 2012. Study of the Building Damage Caused by the 1994 Northridge Earthquake. Major Professor: Ayhan Irfanoglu.

Analysis of building damage due to strong earthquake ground motions is complex. Various earthquake intensity scales, such as the field survey-based Modified Mercalli Intensity (MMI) scale and the instrument-based Instrumental Modified Mercalli Intensity (Imm) scale, are used to describe the strength of ground shaking during an earthquake. If ground motion recording stations are available in the affected area, the current approach employed by the United States Geological Survey (USGS) to estimate the shaking intensity of an earthquake, the automated I_{mm} approach, uses the peak values of ground motion, such as peak ground acceleration and peak ground velocity. As rapid as it is, this instrument-only based approach does not account for the structural characteristics of buildings and, therefore, may not provide useful information about the damage state of the built environment following an earthquake.

Studies have shown that the current method in estimating degree of building damage from the shaking intensity ratings is not accurate. The inaccuracy can be attributed mainly to the following: (1) shaking intensity is an ambiguous representation of building damage, and (2) structural damage does not solely depend on the ground motion but also on the characteristics of the buildings.

This research focuses on finding reliable building damage indicators using the inspection records of 104,025 buildings surveyed in the aftermath of the 17 January 1994 Northridge, California earthquake. In this study, damage will be represented using damage severity levels as prescribed by the inspectors. Each structure is associated with the ground motion parameters obtained from the closest ground motion recording station or the closest grid point provided by the USGS. As the nature of the dependent and some of the independent variables are ordered and integer, besides the regular statistical correlation analysis, a random parameter ordered probit statistical model is considered in the study. A critical evaluation of parameters that have strong influence on building damage will be presented. The impact of distance to recording station on observed correlations is also presented.