TOWARD AN AUTOMATED POST-EARTHQUAKE BUILDING SAFETY EVALUATION SYSTEM BASED ON THE TSMIP RECORD

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ABSTRACT

Recent advances in computer technology have led to the development of a PC -based strong-motion instrumentation system that has already been applied in Taiwan under the Taiwan Strong-Motion Instrumentation Program of the Central Weather Bureau. The installation of this new system in building opens the possibility of automated post-earthquake analysis that ultimately could lead to damage detection and safety evaluation. It would be very desirable to utilize this new system for automated post-earthquake safety evaluation that could offer appropriate safety assessment decisions as to whether the building is safe or unsafe to occupy or requires further inspection. Such decisions should be madeina relatively short period of time after an earthquake event, say in a matter of minutes. If this becomes a reality, the benefit to society in the aftermath of a major earthquake could be significant and owners of many important buildings would be more than willing to install such a system.

The current study is to explore the feasibility of such a post-earthquake safety evaluation system. Central to this study is the question whether structural damage can be detected at all from seismic records alone. To answer this question the record of a building damaged in anearthquake is examined in different ways. Through a system identification study, the time variation of the building periods, the time history of the base shear and overturning moment, and the time history of story drift are recreated. If a range of damage threshold is pre-set for each of this quantities,then a safety evaluation could be done. An inspection of the uncorrected record also reveals abnormal high-frequency noises at a time the story drift was large and the change of building period occurred. Thus, it is concluded that while each individual criterion of damage may not be definitive, the simultaneous violation of several criteria may be indicative of structural damage.

To make the analysis automatic, it is also necessary to have a computer program that could detect malfunctioning of sensors and establish the system

identification model automatically. Furthermore, abnormal noises that can be identified easily by eye inspection must be detected by the computer.These and other issues related to the eventual development of a working system are to be discussed during the presentation.

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