ATC-13-1

Commentary on the Use of ATC-13 Earthquake Damage Evaluation Data for Probable Maximum Loss Studies of California Buildings

by

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Preface

In 1985 the Applied Technology Council (ATC) completed and published the ATC-13 report, *Earthquake Damage Evaluation Data for California*. Funded by the Federal Emergency Management Agency (FEMA), the ATC-13 report was developed to provide expert-opinion earthquake damage and loss methodology and data for use in estimating local, regional, and national economic impacts from earthquakes in California. The ATC-13 report includes: (1) expert-opinion motion-damage relationships, presented in the form of damage probability matrices, for 78 classes of structures, including buildings (40 classes) and lifeline structures (electrical, water, sanitary sewer, natural gas and telephone components and systems); (2) methods and data for estimating damage and loss resulting from collateral hazards, including fault rupture, ground failure, inundation, and fire; (3) estimates of the time required to restore damaged buildings and lifeline structures to their pre-earthquake functionality; (4) inventory methodology to estimate the type, distribution, and number of man-made facilities throughout California; and (5) methodology and data for estimating deaths and injuries.

The ATC-13 data and methodology were explicitly developed for evaluating the expected performance of average California construction. The report explicitly states that "the damage estimation procedures set forth in this report are most applicable for a statistically large number of facilities and should not be applied to individual facilities directly" (ATC, 1985, p. 307).

Since publication in 1985, the ATC-13 earthquake damage and loss estimation methodology and data have been widely used for a variety of purposes, including (1) ranking the seismic vulnerability of California buildings for hazard evaluation and mitigation decision making (e.g., as in the case of selecting buildings to be instrumented under the California Strong-Motion Instrumentation Program); (2) developing a scoring system for rapid visual screening of buildings for potential seismic hazards (as in the case of the FEMA 154 report, *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook* (first edition); (3) classifying buildings and other structures by their earthquake resisting characteristics; and (4) portfolio analysis by companies that provide earthquake insurance for dwellings and commercial buildings.

While never intended for use in estimating the expected performance of individual buildings or structures, the ATC-13 methodology and data have also been used by practicing structural engineering professionals to estimate the probable maximum loss (PML) of individual structures for insurance and investment decisions. The widespread use of ATC-13 for PML studies prompted a decision by the ATC Board of Directors to develop this *Commentary*, the purpose of which is to enable users of the ATC-13 report to understand how these data were developed, the limitations of the data, and issues associated with using the data for PML studies.

The main body of this *Commentary* contains a discussion of the scope and results of the ATC-13 project, a description of the most common type of PML study, a discussion and some examples of how ATC-13 is typically used as a basis for a PML study, and recommended improvements to the ATC-13 data. Also included are three appendices containing information and data not included in the original ATC-13 report (ATC, 1985): (1) ATC-13 model building type descriptions, including methodology for estimating the expected performance of standard, nonstandard, and special construction; (2) ATC-13 Beta damage distribution parameters for model building types; and (3) PML values for ATC-13 model building types.

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