ATC-50-1

Seismic Rehabilitation Guidelines for Detached, Single-Family, Wood-Frame Dwellings

by

APPLIED TECHNOLOGY COUNCIL
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Preface

In September 1998 the Applied Technology Council (ATC) was awarded a contract by the City of Los Angeles, Department of Building and Safety, to develop and test a series of standardized procedures for the voluntary seismic evaluation and rehabilitation of detached single-family wood-frame dwellings (ATC-50 project). The project was prompted by high economic losses resulting from damage to single-family wood-frame dwellings during the 1994 Northridge earthquake. The concept for the project was conceived by the Financial Services Subcommittee of the City of Los Angeles Mayor's Blue Ribbon Panel for Seismic Hazard Reduction, which included representation from the banking and insurance industries.

The project contract called for ATC to: (1) develop and test a seismic performance grading system for detached single-family wood-frame dwellings that reflected expected economic losses in future damaging earthquakes; (2) develop and test seismic rehabilitation guidelines for detached single-family wood-frame dwellings that would enable a homeowner to improve the seismic grade; (3) prepare a set of examinations for certification of home inspectors, contractors, and design professionals who have been trained to implement the procedures developed under the project, and (4) plan and conduct a seminar to introduce the ATC-50 project products to inspectors, contractors, and design professionals in the Los Angeles area. As part of the project, ATC was also asked to provide guidance on how to develop and implement a market-driven, incentives-based program to encourage homeowner use of the seismic assessment and seismic rehabilitation procedures developed under the project.

This report, ATC-50-1, *Seismic Rehabilitation Guidelines for Detached, Single-Family, Wood-Frame Dwellings*, contains prescriptive methods, simplified engineering methods, and fully engineered methods that, if implemented, allow a homeowner to improve the seismic grade assigned using the companion ATC-50 Simplified Seismic Assessment Form (see companion ATC-50 report). The ATC-50-1 document includes specific guidance for rehabilitating a dwelling's seismic deficiencies identified using the Simplified Seismic Assessment Form, and illustrates in detail the procedures required by the Los Angeles Department of Building and Safety for cripple-wall strengthening. The report development effort included a pilot testing program whereby 50 dwellings in the City of Los Angeles were rehabilitated using a preliminary version of the ATC-50-1 *Seismic Rehabilitation Guidelines*. The purpose of the Pilot Seismic Rehabilitation Testing Program was to evaluate the utility and ease-of-use of the seismic rehabilitation procedures, and results from the pilot program were used to clarify and improve the procedures.

The companion ATC-50 report, *Simplified Seismic Assessment of Detached, Single-Family, Wood-Frame Dwellings*, provides inspection procedures and a four-page Simplified Seismic Assessment Form to evaluate detached, single-family, wood-frame dwellings, and to assign to each a Seismic Performance Grade. The procedure considers the potential for damage or collapse in a manner that is useful to owners, purchasers, insurers, lenders, contractors, design professionals, and regulatory officials. Another companion report, the ATC-50-2 report, *Safer at Home in Earthquakes: A Proposed Earthquake Safety Program*, provides recommendations for the development and implementation of a market-driven, incentives-based program to encourage homeowners to have their homes evaluated, and rehabilitated if necessary, using the procedures developed under the ATC-50 project.

Funding for the ATC-50-1 report and the Pilot Seismic Rehabilitation Program was provided by the City of Los Angeles, by a Federal Emergency Management Agency Hazards Mitigation Grant from the California Office of Emergency Services, and by a grant from the Department of Housing and Urban Development.

The ATC-50-1 report was developed under the direction of Ronald T. Eguchi, who served as ATC-50 Project Director. Wiss Janney Elstner Associates, Inc., a national structural and earthquake engineering firm with experience in seismic evaluation and rehabilitation of buildings, served as the ATC-50-1 Report Development Subcontractor. Robert A. Bruce authored the report, and Kent Sasaki, James Mahaney, and Brian Kehoe served as peer reviewers. The Pilot Seismic Rehabilitation Testing Program was carried out by personnel from four construction contractor firms: Avalin Design Construction Company, Sinai Construction Inc., Stern's Construction,

and Tremor Ready. Overview and guidance were provided by an advisory Project Engineering Panel, consisting of John Coil, Edward F. Diekmann, Susan Dowty (Steering Committee representative), Laurence M. Kornfield, Onder Kustu, Timothy McCormick, Doc X. Nghiem, James Russell, Robin Shepherd, and John G. Shipp (ATC Board representative). Nancy Sauer served as technical editor, and Gerald Brady, Peter Mork, Bernadette Mosby, and Michelle Schwartzbach were responsible for final editing and report production. The affiliations of these individuals and the list of personnel who led the Pilot Seismic Assessment Testing Program are provided in the Project Participants List.

ATC gratefully acknowledges the patience, input and guidance provided by Nick Delli Quadri, who served as Project Officer for the Department of Building and Safety, City of Los Angeles. ATC also acknowledges the encouragement and assistance provided by other City of Los Angeles personnel, including Scott McGill (Department of Building and Safety) and Perry Singerman (Mayor's Office), who nurtured the project from the outset, and Thomas Grant and Ann Ormiston, who guided ATC through the Department of Building and Safety's contractual requirements. The support of Andrew Adelman, General Manager of the Department of Building and Safety, is also gratefully acknowledged.

Special thanks also go to the members of the Steering Committee who provided overarching guidance for the ATC-50 project: Susan Dowty, (Chair), S.K. Ghosh Associates, Inc.; John Brown, California Real Estate Inspection Association; Dave Carey, Fannie Mae (Washington DC); Kenneth Cooley, State Farm Insurance; Karl Deppe (retired), Los Angeles Department of Building and Safety; Mike Edwards, California Department of Insurance; Mike Grottkau, California Earthquake Authority; Do Kim, Institute for Business and Home Safety; Eugene Lecomte (deceased), Insurance Industry Consultant; Richard McCarthy, California Seismic Safety Commission; Tim McCormick, City of Santa Monica; Duane McCutcheon, California Real Estate Inspection Association; Dave Nelson, International Conference of Building Officials; Jeff Paggi, Farmers Insurance; William Petak, University of Southern California; Patricia Schumate, Freddie Mac; Earl Schwartz, Structural Engineers Association of California; and Barbara Zeidman, Fannie Mae (Los Angeles).

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