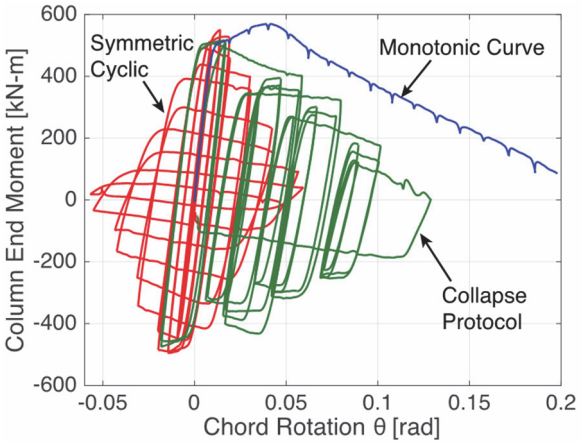
NIST GCR 17-917-45



Recommended Modeling Parameters and Acceptance Criteria for Nonlinear Analysis in Support of Seismic Evaluation, Retrofit, and Design

Applied Technology Council

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Cover image – Steel moment frame assembly subjected to alternative loading protocols (Suzuki and Lignos, 2015).

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Preface

In September 2014, the Applied Technology Council (ATC) commenced a task order project under National Institute of Standards and Technology (NIST) Contract SB1341-13-CQ-0009 to conduct comprehensive review of the generalized component models published in the current ASCE/SEI standard and relevant research, and develop recommendations for improvement (ATC-114 Project). The need for defining parameters for nonlinear force-deformation models for components, elements, or assemblies is identified as a high-priority research and development topic in NIST GCR 14-917-27 report, *Nonlinear Analysis Study and Development Program for Performance-Based Seismic Engineering*, (NIST, 2013b) which outlines a research and development program for addressing the gap between state-of-the-art academic research and state-of-practice engineering applications for nonlinear structural analysis, analytical structural modeling, and computer simulation in support of performance-based seismic engineering.

The current standard, ASCE/SEI 41-13, *Seismic Evaluation and Retrofit of Existing Buildings* (ASCE, 2014), is widely used by designers for evaluating and upgrading existing buildings. The component models in the current standard were developed for use in existing building analysis, but they have also become widely employed in new building analysis. The purpose of this report is to recommend broad improvements to seismic nonlinear modeling and acceptance criteria requirements for different structural systems.

This report was developed by the members of the ATC-114 Phase 1 project team. ATC is indebted to the leadership of Ron Hamburger, who served as Project Director. The Project Technical Committee, consisting of Greg Deierlein, Dawn Lehman, Dimitrios Lignos, Laura Lowes, Robert Pekelnicky, Benson Shing, Peter Somers, and John van de Lindt monitored and guided the technical efforts of the Project Working Groups, which included Jianyu Cheng, Ahmed Elkady, Siamak Epackachi, Alexander Hartloper, Maria Koliou, Daniel Sloat, and Andrew Whittaker. The Project Review Panel, consisting of Martin Button, Charlie Carter, Kelly Cobeen, Philip Line, Justin Marshall, Lawrence Novak, Graham Powell, Michael Schuller, Wiliam Tremayne, and Kent Yu (ATC Board Contact), provided technical advice and consultation over the duration of the work. The report also greatly benefited from the work of the ATC-114 Phase 2 and 3 projects, completed under the direction of Greg Deierlein and Curt Haselton. The names and affiliations of all who contributed to this report are provided in the list of Project Participants.

ATC also gratefully acknowledges Steven L. McCabe (Contracting Officer's Representative), Jay Harris, Siamak Sattar, Matthew Speicher, and Kevin K.F. Wong for their input and guidance throughout the project development process. ATC staff members Veronica Cedillos and Carrie Perna provided project management support and report production services, respectively.

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