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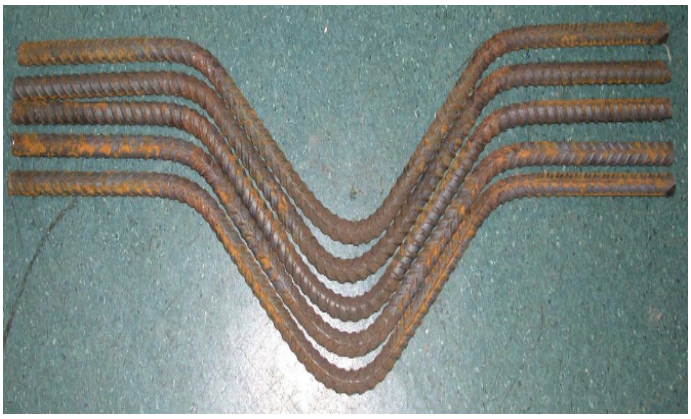

Use of High-Strength Reinforcement in Earthquake-Resistant Concrete Structures

NEHRP Consultants Joint Venture
A partnership of the Applied Technology Council and the Consortium of Universities for Research in Earthquake Engineering

National Institute of Standards and Technology
U.S. Department of Commerce

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Cover image – Example bend-rebend test specimens from New Zealand (Hopkins and Poole, 2005, image courtesy of the New Zealand Department of Building and Housing, now part of the Ministry of Business Innovation and Employment).

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Prepared for
U.S. Department of Commerce
National Institute of Standards and Technology
Engineering Laboratory
Gaithersburg, MD 20899

By
NEHRP Consultants Joint Venture
A partnership of the Applied Technology Council and the Consortium of Universities for Research in Earthquake Engineering

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Preface

In 2007, the National Institute of Standards and Technology (NIST) awarded the NEHRP Consultants Joint Venture, a partnership of the Applied Technology Council (ATC) and the Consortium of Universities for Research in Earthquake Engineering (CUREE), a National Earthquake Hazards Reduction Program (NEHRP) "Earthquake Structural and Engineering Research" task order contract (SB1341-07-CQ-0019) to conduct a variety of tasks. In 2011, NIST initiated Task Order 11305, entitled "Use of High-Strength Flexural Reinforcement in Reinforced Concrete Seismic Design." The objective of this project was to study and make recommendations concerning the utilization of high-strength steel reinforcing bars in concrete structures subjected to earthquake ground motion.

This work grew out of the ATC-57 report, *The Missing Piece: Improving Seismic Design and Construction Practices* (ATC, 2003), which defines a roadmap for the NIST problem-focused research and development program in earthquake engineering. The ATC-57 report recommended that NIST examine new technologies that can improve construction productivity, such as high-strength reinforcement.

The NEHRP Consultants Joint Venture is indebted to the leadership of Dominic J. Kelly, Project Director, and to the members of the Project Technical Committee, consisting of Andres Lepage, David Mar, José I. Restrepo, Joseph C. Sanders, and Andrew W. Taylor, for their contributions in developing this report and the resulting recommendations. The Working Groups, including Abby Enscoe and Aprit Nema, conducted problem-focused studies. The Project Review Panel, consisting of Tony Ghodsi, James O. Jirsa, Conrad Paulson, Mete Sozen, and Loring A. Wyllie, Jr., provided technical review and commentary at key developmental milestones during the project. A workshop of invited experts was convened to obtain feedback on the preliminary findings and recommendations. The names and affiliations of all who contributed to this report are provided in the list of Project Participants.

The NEHRP Consultants Joint Venture also gratefully acknowledges André Barbosa, Joel P. Conte, David Darwin, and Matthew J. Schoettler for their technical input, Jack Hayes (NEHRP Director) and Steve McCabe (NEHRP Deputy Director) for their input and guidance in the preparation of this report, Laura Samant and Thomas McLane for ATC project management, Ayse Hortacsu, Amber Houchen, Jon Kiland, and Peter N. Mork for ATC report production services.

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