

the **POWER**
of **COLLABORATION**

*2016
Annual Report*



CHARLES PANKOW
FOUNDATION

President's Message

In 2016, our eleventh year, the Charles Pankow Foundation initiated the **most research grants in a single year and the largest single research grant ever**. The research grants carried out in 2016 were also the most diverse in terms of subject matter.

We attribute this high level of performance to our success in identifying and assembling partners and coalitions to collaborate on a wide breadth of research topics. We know we cannot go it alone if we expect to make a significant impact on the industry.

Approaching research as a coalition offers many benefits to all participants. The ability to leverage the financial contributions of all funding partners spreads these benefits to everyone involved and allows for more and better research projects. A coalition also offers better participation during research execution and enhanced dissemination of research findings when complete. Furthermore, coalition partners are the most likely early adopters, giving new technologies and outcomes a head start in improving design and construction practices.

We're deeply grateful to our industry partners for their 2016 funding contributions toward meaningful research projects, including the ACI Foundation, the American Institute of Steel Construction, the CRSI Foundation, the Construction Industry Institute, the Structural Engineers Association of California, the Structural Engineering Institute of the American Society of Civil Engineers, the American Society of Concrete Contractors, and the International Building Information Modeling for Masonry Initiative.

We'd also like to recognize our 2016 governmental funding partners, the Federal Emergency Management Agency and the State of Oregon Department of Environmental Quality. We're most appreciative of the corporate contributions of Magnusson Klemencic Associates, Webcor, Clark Construction Group, Conco, Bekaert Corporation, Skanska USA Building Inc., Commercial Metals Company, Nucor Corporation, and MMFX.

It's always a challenge to measure the success of research projects. Therefore, it's been very gratifying to see the results of several ongoing research projects put into practice and result in tangible benefits to the industry. For example, in 2016, we launched our ninth and tenth high-strength reinforcing steel grants and expect to launch at least two more in 2017. Results from our past grants are now making their way into the building codes.

This coming year holds great promise with research projects underway in the areas of reinforced concrete, structural steel, BIM tools, construction productivity tools, and sustainability. We'll be releasing several important publications in 2017, available to the industry at no cost.



"This coming year holds great promise"

In evaluating research opportunities, we've learned to focus on opportunities that truly address productivity challenges in our industry. There are no silver bullets to increased productivity but we're proud of the many contributions our research projects have made toward advancing innovation in building design and construction.

Richard M. Kunnath, PE
Charles Pankow Foundation
Board President



CHARLES PANKOW
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“This work... would become one of the largest research programs ever undertaken in the reinforced concrete industry.”

A Partner's Perspective

The Charles Pankow Foundation serves in a unique role in our industry, enabling discussions between researchers and industry experts that share mutual benefits. This dialogue builds consensus early and ensures that all parties are heading toward a common and productive goal.

In one major initiative—with funding from the Charles Pankow Foundation, the Concrete Reinforcing Steel Institute Foundation, and the reinforcing steel industry—a new understanding is being developed of the material requirements and performance of high-strength (100 ksi) steel reinforcing. This extremely beneficial collaboration has spurred major advances in the specification and use of reinforcing steel, with the ultimate goal of incorporating high-strength steel into the ACI 318 building code.

This work began in 2014 with a roadmap to guide what would become one of the largest research programs ever undertaken in the reinforced concrete industry. Collaborative funding has supported several major research projects over the past few years.

The Charles Pankow Foundation has also been instrumental in assisting with BIM Industry Foundation Classes (IFC) data model for reinforcing steel. An IFC is required to enable data sharing between computer programs. The bridge between engineers, contractors, and CRSI-member steel suppliers has been strengthened and streamlined by this collaboration.

Finally, the Pankow Foundation has supported several new approaches to reinforcing steel design, including the evaluation of a novel continuous stirrup system for rectangular beams or columns.

No one organization could have done these monumental projects alone. CRSI is looking forward to collaborating with the Charles Pankow Foundation in the future to bring forward new technologies and materials to the AEC industry..

David McDonald, PhD, PE
Concrete Reinforcing Steel Institute (CRSI)
President and CEO

2016 AWARDED RESEARCH GRANTS

\$165,000

University of California Berkeley
Pacific Earthquake Engineering Research Center
Update to performance-based seismic design guidelines for tall buildings

\$165,000

Stanford University
Low-cycle fatigue criteria for the seismic design of concrete structures with high strength reinforcing steel

\$248,083

University of Texas at San Antonio
Acceptable elongations and low-cycle fatigue performance for high-strength reinforcing bars

\$155,000

University of Washington
Practice guide: life cycle assessment (LCA) for low-carbon construction

\$60,000

Urban Fabrick Collaborative
Design professional's practice guide to integrating on-site water use and reuse

\$600,000

Purdue University
Seismic and wind behavior and design of coupled CF-CPSW core walls for steel buildings

\$124,778

Catholic University
Construction industry validation of schedule performance measure

\$25,200

Georgia Tech
Building information modeling for masonry Phase III project: technical oversight for the commercialization of the masonry unit database



Collaborative Research on Coupling Beams

Coupling beams—which typically span openings in reinforced concrete core walls—are often one of a building’s most rebar-congested earthquake-resistant concrete elements. These elements require large diagonal steel bars surrounded by closely-spaced transverse reinforcement to resist the severe demands imposed by a large earthquake, a configuration that’s difficult and costly to construct.

Adding steel fiber reinforcement to concrete enhances the concrete’s ductility and shear strength. In a project sponsored by the Charles Pankow Foundation and collaboration partners, researchers Ángel L. Pérez-Irizarry and Gustavo J. Parra-Montesinos, both at the University of Wisconsin, performed large-scale testing using different fiber types and mix concentrations.

The researchers evaluated whether using fiber-reinforced concrete could lead to a simplified earthquake-resistant coupling beam design that doesn’t rely on diagonal bars. A link was proposed between the performance of the fiber-reinforced

concrete and the deformation capacity and shear strength of coupling beams without diagonal bars.

Research results demonstrate that fiber reinforcing is a viable alternative to the current coupling beam design specified in the 2014 American Concrete Institute Building Code, supporting possible future code changes. **The use of steel fiber reinforced concrete in coupling beams in actual practice has proven that this technology can improve construction productivity and cost efficiency.**

FUNDING COALITION

Charles Pankow Foundation
Bekaert Corporation
ACI Concrete Research Council
American Society of Concrete Contractors

2016 COMPLETED RESEARCH GRANTS

University of Texas at Austin

Wassim Ghannoum, PhD, PE, F.SEI
Setting bar-bending requirements for high-strength steel bars

Georgia Tech

T. Russell Gentry, PhD
Building information modeling for masonry Phase II project: BIM for masonry benchmark

Georgia Tech

T. Russell Gentry, PhD
Building information modeling for masonry Phase II/III project: masonry wall model definition

University of Wisconsin – Madison

Gustavo Parra-Montesinos, PhD
Linking concrete tensile performance and seismic response of fiber reinforced concrete coupling beams



Design-Build Educator Workshop

In August 2016, seventeen faculty from thirteen universities gathered in Denver to take a deep dive into the key principles and best practices of the design-build project delivery methods, and how to effectively incorporate design-build into new and existing curriculum.

Co-sponsored by the Charles Pankow Foundation and the Design-Build Institute of America, the Design-Build Educator Workshop is in its third year. In total, forty-two educators from across the country have been trained via this workshop. In 2016, corporate sponsors generously funded full scholarships for qualified university faculty.

Universities play a major role in exposing students to design-build and its value to the industry. Design-build currently represents about forty percent of the non-residential design and construction market. Design-build enables cost containment, shorter schedules, less litigation, and higher owner satisfaction.

“The workshop’s effect on me was an internalization of the workshop’s design-build principles and attitude, which was reinforced by the jobsite visit and interviewing the jobsite staff. My paradigm on construction management is now inverted.”

—John Hannon, Associate Professor in the School of Construction at the University of Southern Mississippi and 25-year public-works veteran

FUNDING COALITION

Charles Pankow Foundation

Design-Build Institute of America

Brown and Caldwell

Clark Construction Group

Crosby Group Engineering

gkkworks

Haskell

HDR, Inc.

Hensel Phelps

HKS, Inc.

Jacobs

M.C. Dean

Skanska

Sundt

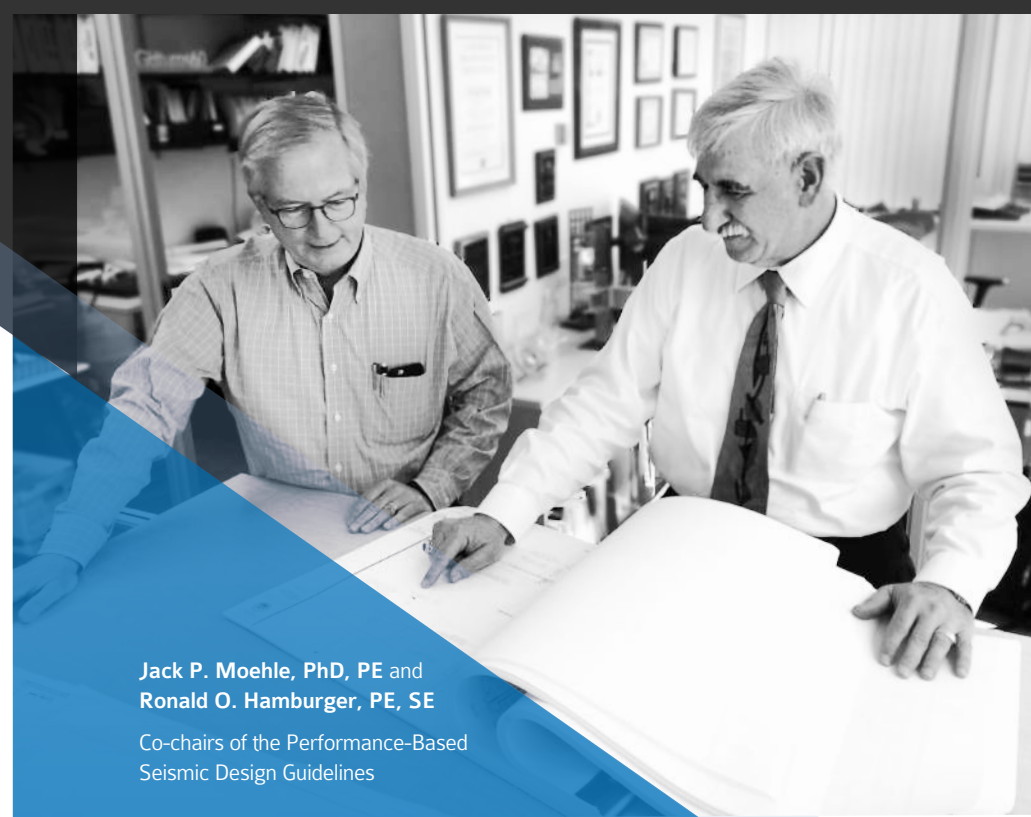


Seismic Design Guidelines Update

When published in 2010, *Guidelines for Performance-Based Seismic Design of Tall Buildings* presented a revolutionary alternative to prescriptive design procedures contained in standards such as ASCE 7 and the International Building Code (IBC). The Charles Pankow Foundation and its collaboration partners provided funding for Version 1.0.

Recognizing that the guidelines had become partially out of date due to rapidly developing engineering advances, the Charles Pankow Foundation and collaborators funded the development of Version 2.0 to reflect current knowledge and approaches.

For example, guidelines have been expanded to reflect building occupancy Risk Categories III and IV, and near-fault building sites and sites with significant hazards from multiple sources. Guidelines are now consistent with ASCE 7-16, "Minimum Design Loads and Associated Criteria for Buildings and Other Structures," which also produces greater consistency with ACI 318, AISC 341, and AISC 360. The Guidelines will be published in 2017.



Jack P. Moehle, PhD, PE and
Ronald O. Hamburger, PE, SE

Co-chairs of the Performance-Based
Seismic Design Guidelines

FUNDING COALITION

Charles Pankow Foundation
Federal Emergency Management Agency
ACI Foundation
American Institute of Steel Construction
Structural Engineers Association of California
Structural Engineering Institute of the American
Society of Civil Engineers

The Charles Pankow Foundations wishes to thank our valued partners:

RESEARCH AFFILIATIONS




RESEARCH UNIVERSITIES

Catholic University of America
Georgia Tech University
Lehigh University
Northeastern University
Oregon State University
Penn State University
Purdue University

San Diego State University
San Jose State University
Stanford University
University of Arizona
University of California, Berkeley
University of California, Davis
University of California, Los Angeles

University of California, San Diego
University of Cincinnati
University of Colorado
University of Florida
University of Illinois
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University of Michigan

University of Nebraska
University of Notre Dame
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University of Washington
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Leading the way for positive change in the
AEC industry with thoughtful research and
collaboration.



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