

Charles Pankow Foundation
2021 Annual Report

Synergize



CHARLES PANKOW
FOUNDATION



President's Letter

Astronomers and physicists believe the universe isn't static, but rather always growing and expanding. Over the past year, I have begun to believe the same may be true of the Charles Pankow Foundation, as growth and expansion abound.

CPF, from its very beginning, has been the beneficiary of generous support. Lately, however, that support has increased to new heights—in the form not only of financial contributions but also in-kind services and materials that greatly offset laboratory expenses, as well as priceless assistance in helping to conceive and monitor our research initiatives. And while it's tempting to account for this support by simply adding the nominal dollars, its actual value is multiples of this amount as the less tangible assistance helps ensure the Foundation is focused on the most meaningful research opportunities and that, when complete, we have a fully prepared cadre of stakeholders to help guarantee the resulting innovations are understood and adopted by the industry.

Part of CPF's expanding universe should come as no surprise. It flows directly from the broadened research domains that we are pursuing. Building envelope standards—including best practices in subcontracting, carbon/energy use, and structural suitability research—will assist both owners and project teams in designing smarter, more efficient structures. This, in addition to our ongoing work in wastewater, technology, and especially structural engineering, has attracted the attention of major corporations, federal and state agencies, and universities who believe in the promise of our work and see the potential direct benefit to them.

For all you who provide the invaluable assistance that extends the impact of the Charles Pankow Foundation, our heartfelt thanks. For those of you just learning of our work, join us as we endeavor to make innovation an expanding reality in the built environment.

Richard M. Kunnath

Richard M. Kunnath, P.E.

Board President, Charles Pankow Foundation

2021 Active Grant Portfolio

Overview

15 Projects

\$4M Grants

14 Institutions

Industry Partners

31 Project Investors

37 Material Contributors

213 Knowledge Contributors

Results

Go-to Resources

Game-changing Systems

Decision-making Digital Tools

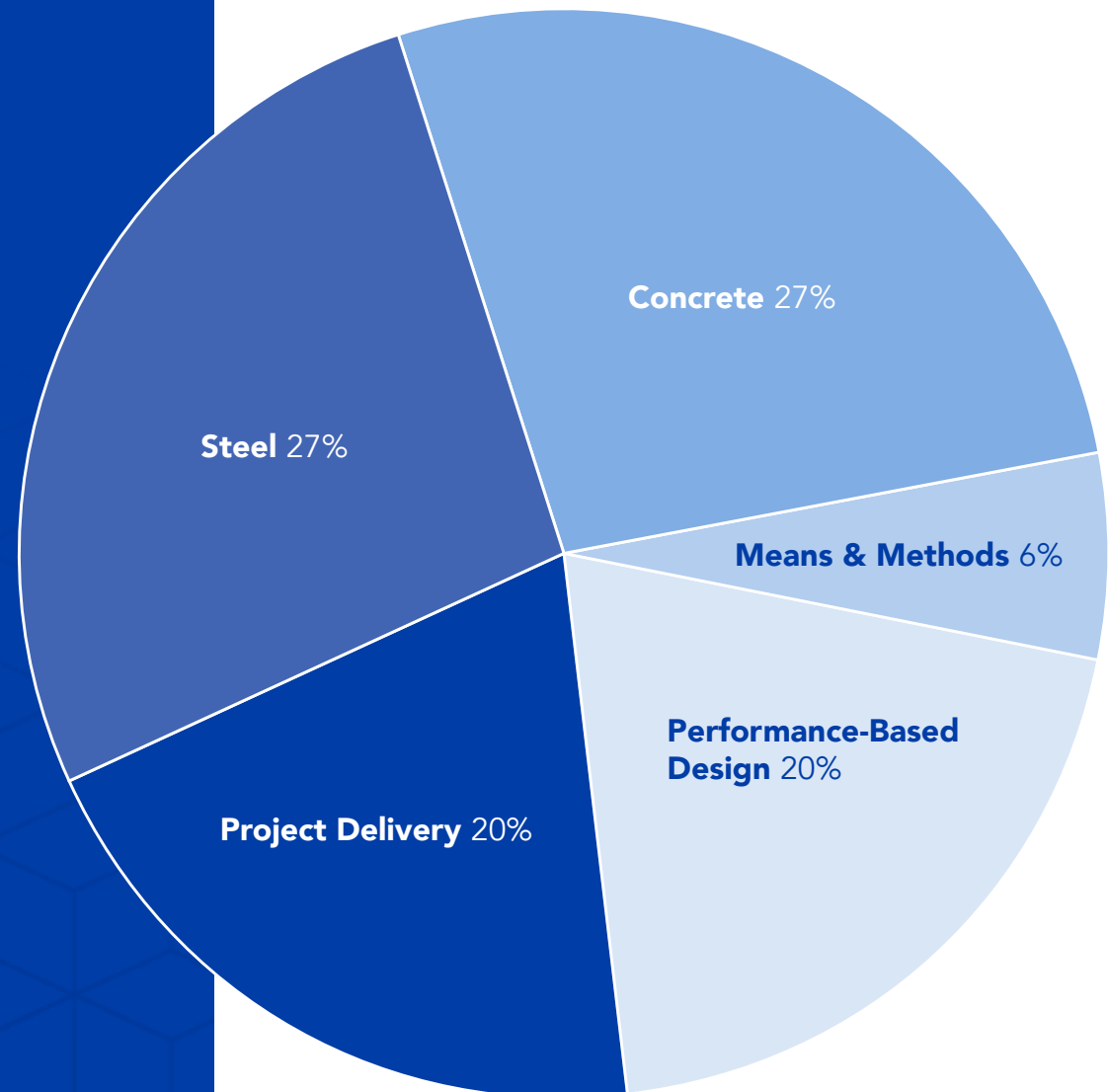
Impact

Safer Construction Conditions

Project Cost and Schedule
Savings and Reliability

Improved Building Performance

Research Projects by Topic



2021 Grant Portfolio Contributors

The Charles Pankow Foundation extends its sincere appreciation to our 2021 grant portfolio contributors. These champions of innovation provide inspired thinking, resources, and the know-how to drive industry best practices forward.

Financial

ACI Foundation
American Institute of Architects
American Institute of Steel
Construction
Association of Drilled Shaft
Contractors - International
Association of Foundation Drilling
Atlas Tube/Zekelman
Chandos Construction
Clark Pacific
Construction Industry Institute
Construction Institute of the ASCE
CRSI Education and Research
Foundation
Design Build Institute of America
DesignIntelligence
Hensel Phelps
Integrated Project Delivery Alliance
Keller Companies
Kiewit
Kraemer NA
Martin/Martin
McCarthy
Metromont
MKA Foundation
Nucor
P1 Consulting
Pankow Builders
Parsons Corporation
Precast/Prestressed Concrete Institute
Process Industry Practices
Schuff Steel
Siefert Associates
Steel Institute of New York
Stellar

2021 Grant Portfolio Contributors

Knowledge

Farid Alfawakhiri
Dylan Allen
Markku Allison
Neal Anderson
Scott Anderson
Christine Angleton
Esteban Anzola
Baabak Ashuri
Kevin Aswegan
Suzanne Aultman
Mantu Baishya
Keith Bauer
Reza Bayat
Jim Bedrick
Glenn Bell
Brian Bennett
Mark Bennier
Stephen Benton
Evan Bentz
Kal Benuska
Margi Bergamini
Robert Berhinig
Mahabir Bhandari
Tanner Blackburn
Geoff Bomba
Scott Bondi
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Jared Brewe
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Vince Cammalleri
Renée Cheng

Rachel Chicchi
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Lisa Choe
Sean Clifton
Michael Collins
Tom Culp
Charlie Čurčija
Dave Darwin
Don Davies
Greg Deierlein
Mark Denavit
Daniel de Oliveira
John Donatelli
Carrie Sturts Dossick
Rick Drake
Jason Duff
Bill Earl
Sam Easterling
Matt Eatherton
Hamed Ebrahimian
Jim Fabinski
Tomasz Falborski
Fanfu Fan
Ray Fassett
Luke Faulkner
David Fields
Erica Fischer
Greg Force
Nazanin Fouladi
Chris Fowler
Chad Fox
Bryan Franz

Tim Fraser
Stephen Fronck
Sean Garrett
Tony Ghodsi
Tony Giansanti
Greg Gidez
Harry Gleich
Subhash Goel
William Green
Daniel Haaland
Mike Haber
Jerry Hajjar
Daniel Hall
Susan Bogus Halter
Ron Hamburger
Dan Hart
Ahmad Hassan
Jeremy Hasselbauer
Neil Hawkins
Robert Heintges
Gary Higbee
Stephane Hoffman
Elie Homs
John Hooper
Devin Huber
Angie Hunter
Will Ikerd
Ahmad Itani
Barbara Jackson
John Jackson
Scott Jacobs
Will Jacobs

Jordan Jarrett
Stan Javernick
Urmilla Jokhu-Sowell
Amit Kanvinde
David Kayll
Paul Kelley
Dominic Kelly
Les Kempers
Sal Khalaf
Kevin Kirkley
Sue Klawans
Danielle Kleinhans
Ronald Klemencic
Kelly Knowles
Walter Korkosz
Lawrence Kruth
Daniel Kuchma
Rik Kunnath
Gino Kurama
Nesseline Kuscu
Tom Kuznik
Katerina Lachinova
Randy Landers
Russell Larson
Ivan Lee
Roberto Leon
Dan Lemieux
Dimitrios Lignos
Brett Lord
Jim Malley
Brad Malmsten
Bonnie Manley

2021 Grant Portfolio Contributors

Rick Marshall
Ann Masek
Therese P. McAllister
Virginia McAllister
Matt K. McCaulley
Mark McClintock
David McCrary
Ian McFarlane
Dudley McFarquhar
Donald Meinheit
Ron Meng
Duane Miller
Jack Moehle
Jon Mohle
Keith Molenaar
Eric Montplaisir
Judi Mosqueda
Chris Motter
Joshua Mouras
Kai Ki Mow
Sean Mulholland
Javeed Munshi
Tim Murphy
John Neary
Ralph Nicastro
Cory Ochsner
Andy Osborn
Laura Osburn
Louise Pannetor
Shailendra Patel
Viral Patel
Mic Patterson

John Peronto
Bill Perry
Jim Perry
Jack Petersen
Justin Ramer
Dan Rawlings
Thomas Rawls
Paul Richards
Eloy Rodriguez
Juliana Rochester
Ken Roko
Mark J. Rothman
Rafael Sabelli
Thomas Sabol
Cheryl Saldanha
Dave Sanders
Helen Sanders
Mike Santarone
Ben Schafer
Bahram Shahrooz
Jennifer Shane
Phil Sheridan
Vincent Siefert
Lyle Sieg
Jon Siu
Robert Solomon
Peter Speier
Laura Stagner
Tabitha Stine
John Straube
Andrew Taylor
Dana Taylor

Mathew Thomas
Peter Timler
Fernando Torrealva
Christina Trotter
Amy Trygestad
Chia Ming Uang
Catherine Valenzano
Allan Van Horn
Amit Varma
Jeff Veilleux
Mason Walters
Lisa Washington
Steve Weinryb
Brad Whitaker
Joe Willich
Joseph C. Windover
David Wright
Dave Zanetell
Farzin Zareian
Wael Zatar
Duff Zimmerman
Joe Zona

Material
Alamillo Rebar
Baker Concrete Construction
Baker Equipment and Materials
BarSplice Products
Cascade Steel
Catalina Pacific, a CalPortland
Company
Cives Steel

Clark Pacific
Commercial Materials Company
Concentric Steel
Contractors Materials Company
Dayton Superior
Geiger and Peters
Harris Rebar / Nucor
Headed Reinforcement Corp.
J.F. Stearns
Janell Concrete and Masonry
Equipment
Level 10 Construction
L&M Industrial Fabrication
Metals Fab
Metromont
Midwest Concrete Materials
Nucor
nVent LENTON
P.J's Rebar
Pacific Earthquake Engineering
Research Center
Pacific Steel Group
Sherwin Williams
Sika
SLS Consulting
Supreme Group
Tate Inc.
Terracon Consultants
The Pressure Grout Company
Tincher's Welding
Turner Construction
Williams Form Engineering

Research Grants Awarded in 2021

\$250,000

UNIVERSITY OF CALIFORNIA, LOS ANGELES

John W. Wallace, Ph.D., P.E.

Performance and Repair of Ordinary Structural Walls Subjected to Wind and Seismic Loading Protocols (RGA #01-21)

\$198,961

STATE UNIVERSITY OF NEW YORK AT BUFFALO

Michel Bruneau, Ph.D., P.Eng.

Bolted Splice Details for Composite Plate Shear Walls—Concrete Filled (RGA #02-21)

\$168,053

UNIVERSITY OF FLORIDA

Bryan W. Franz, Ph.D. with Daniel Hall, Ph.D. of ETH Zürich

Expanded Guides to Managing the Design Phase of Design-Build Projects (RGA #03-21)

\$138,920

IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

Jennifer Shane, Ph.D.

Expanded Guides to Managing the Design Phase of Design-Build Projects (RGA #04-21)

\$87,031

UNIVERSITY OF NEW MEXICO

Susan Bogus Halter, PE, Ph.D.

Expanded Guides to Managing the Design Phase of Design-Build Projects (RGA #05-21)

\$11,898

PURDUE UNIVERSITY

Amit H. Varma, Ph.D.

Seismic and Wind Behavior and Design of Coupled CF-CPSW Core Walls for Steel Buildings (Amendment to RGA #06-16)



Test specimen for “Improving the Safety of Rebar Cages by Using Innovative Connectors” research conducted at University of Nevada, Reno in conjunction with the ASCE Construction Institute.

Creating the Foundation for Synergy

syn·er·gize

/ˈsɪnərˌdʒɪz/

verb

to combine or coordinate the activity of (two or more agents) to produce a joint effect greater than the sum of their separate effects.

Traditionally, the construction industry has operated in a fragmented manner—with project developers discretely engaging architects, designers, engineers, and contractors. While team members may each have a clear idea of their specific role within a project, they might not have the vision of the larger project itself in mind—nor of how their work impacts that of others on the project team. This disconnect can lead to inefficiencies, conflicts, and an end product that is not fully optimized for the building occupant. And it stymies innovation.

The Charles Pankow Foundation (CPF) supports research and industry activities that seek to integrate and streamline the design and construction processes and deliver structures optimized for building performance. We bring together the best minds from across the AEC industry to develop synergistic solutions that improve financial, environmental, and social outcomes for all project participants. The fruits of our labor are practical guides and tools for use by designers and builders everywhere.



The Foundation is now making these assets freely available to practitioners and the public alike on our revamped website. Our new [Library of Resources](#) compiles CPF-supported research reports, design recommendations, case studies, user guides, pre-standards, and more—all searchable by deliverable type and/or subject matter. Topics include building information modeling, concrete, exterior wall systems, performance-based design, project delivery, steel, and sustainability.



Forging Synergies

Knowledge is not created in a vacuum—but rather through the exchange of ideas and the testing of hypotheses. Creative collaboration, properly focused, can provide critical insights into solving design challenges that transcend even those of the most discerning individual in a given group. CPF's synergistic approach identifies a challenge, assembles cross-disciplinary experts to analyze and address the relevant issues from diverse perspectives, and drives team members to produce workable solutions.

A primary tool that the Foundation uses to generate these synergies is focus group workshops—in which expert opinions are surveyed; data is collected and analyzed; and solutions are developed for the challenges identified. Over the past year, CPF has held workshops with stakeholders from around the industry—including architects, engineers, academicians, manufacturers, and others—on two topics: curtain walls and managing the design phase of a design-build project.

Workshop on Curtain Wall Research

Thirteen industry leaders were convened for a focus group on curtain wall research that centered on four general themes:

- Guidance to clarify roles, responsibilities, and processes involved in curtain wall systems;
- Technical/performance of such systems addressed through research;
- Innovation/materials and systems to deliver better performance; and
- Workforce/education skill and knowledge programs.

Takeaways from the workshop include engaging in research to understand thermal performance of curtain wall systems to inform design execution and ultimately improve energy performance of buildings. A second area of focus going forward will be the development of guidance to foster better collaboration across the industry to define roles, responsibilities, and workflows—and to cultivate a curtain wall-smart workforce to improve the procurement, design, execution, and maintenance of building curtain wall systems.



Forging Synergies

Workshop on Managing the Design Phase of a Design-Build Project

Eleven leaders from across the AEC industry participated in a workshop to consider the current Design Management Guide (DMG) and potential future editions. A number of opportunities were identified to update and extend the guide's knowledge and best practices throughout the industry and to support project success through the management of the design phase of a design-build project. Recommendations from the workshop included the development of:

- A new over-arching, universally applicable (i.e., market sector/client/project size-agnostic) principles-based guide;
- Multiple market-sector and client-specific guides (e.g., buildings, aviation, federal, specialty trades); and
- An updated DMG to reflect current state-of-practice models sector guides, organized by project phase and with additional content to include entries on topics such as BIM execution plan, design delegation, how to raise performance topics, and checklists of deeds to be addressed.

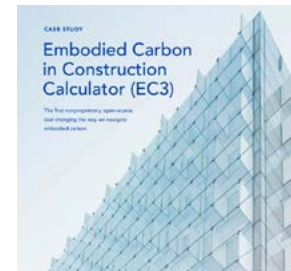
Profiles in Synergy

While forging synergies among diverse parties in the value chain is key to creating new industry knowledge, distilling this insight into actionable recommendations—and sharing them with both industry professionals and the wider public—are essential to driving industry practice forward.

For this reason, the Foundation chronicles its success in pushing research into the field via the publication of [case studies](#). Each case study outlines a challenge faced by designers and builders, the solution pursued, and the result/deliverable that followed. Written and illustrated for both laymen and industry professionals alike, the case studies document how the power of synergy can reimagine and drive best practices in building design and construction.

Following are synopses of the first seven case studies published.

Embodied Carbon in Construction Calculator



Catalytic investment by the Charles Pankow Foundation and over 30 future-focused organizations supported the collaborative development of the [Embodied Carbon in Construction Calculator](#) (EC3) tool. This open-access digital tool allows designers and contractors to assess and compare the embedded carbon in different building materials, helping them to choose more sustainable options during the design, material specification, and procurement processes.

Profiles in Synergy

Managing the Design Phase of a Design-Build Project



CPF recognized the need to centralize best practices for design-build and develop better approaches to design and construction project delivery. Convening leaders from across the AEC industry, the Foundation funded the creation of the [Professional's Guide to Managing the Design Phase of a Design-Build Project](#), which aims to help owners, designers, and builders of design-build projects achieve success by utilizing a design phase manager.

Tall Building Initiative - Performance-Based Seismic Design



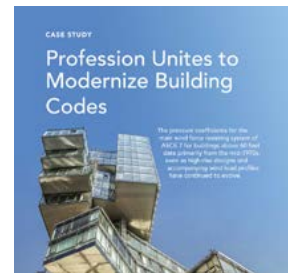
Lack of a common approach to performance-based seismic design of tall buildings has traditionally led to excessive delays in permitting projects, particularly in earthquake-prone regions. CPF funding helped forge development of a new [performance-based design methodology](#) allowing the use of conventional framing systems at greater heights that has cut permit review and approval times from 1-2 years down to 6-10 months.

SpeedCore Modular Framing System



With the objective of bringing greater efficiency to high-rise construction projects, the Charles Pankow Foundation, in collaboration with industry partners, supported key experimental tests to inform the design of a novel wall system. Dubbed [SpeedCore](#), the system is constructed of prefabricated modular steel sandwich panels, stacked onsite and field-filled with concrete. Eliminating the need for temporary formwork and reinforcing steel cages simplifies onsite trade and material management, saving time and potentially lives.

Modernizing Building Codes for Wind



Prescriptive building codes established in the 1970s hadn't kept up with the trend toward ever-taller, more complex 21st-century buildings. The ASCE 7 Wind Loads Subcommittee recognized the need for [updated wind load design methodologies](#) applicable to modern buildings of varying shapes and sizes. With grant funding from CPF and industry partners including NCSEA, wind tunnel testing provided the aerodynamic data required for the launch of a project that can form the basis for establishing a common methodology for the wind load design provisions in ASCE 7.

Profiles in Synergy

Building Code Requirements for High-Strength Reinforcing Steel



For almost half a century, Grade 60 steel remained the industry standard for rebar in structural concrete—even as larger structures were designed and built. The Charles Pankow Foundation identified the research and testing that would be required to support the use of [higher-strength reinforcement in concrete](#). Subsequent testing, supported by CPF with industry partners ACI Foundation and CRSI Foundation, led to the inclusion in the ACI 318 Building Code of specifications greatly expanding the use of higher-strength steel reinforcement in concrete.

Prestandard for Performance-Based Wind Design



Traditionally prescriptive approaches to building design limited their ability to be engineered for efficient material usage, post-event building functionality, and reduced economic losses due to hazards such as high winds—particularly as buildings have grown in height and complexity of shape. With CPF and industry funding, structural engineering leaders convened and developed a 21st-century approach to the design of buildings for wind loads detailed in the ASCE publication [Prestandard for Performance-Based Wind Design](#).

Charles Pankow Foundation Leadership Team



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Board President



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FIStructE**
Board Director



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Board Director



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Executive Director



CHARLES PANKOW
FOUNDATION

Charles Pankow Foundation
1390 Chain Bridge Road, Suite 700
McLean, Virginia 22101-3904

Tel: (360) 326-3767
info@pankowfoundation.org
www.pankowfoundation.org