# Charles Pankow Foundation 2024 Annual Report

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CHARLES PANKOW FOUNDATION

### **PRESIDENT'S LETTER**



It is with a feeling of gratitude and satisfaction that these comments are written for this year's annual report.

Where to begin? First and foremost, I'd like to offer a big thank you to all in the AEC community that have helped Charles Pankow Foundation experience a great 2024. Your time, talent, and treasure were put to productive use in the work we completed with your invaluable help.

In addition to our normal activities, the board undertook a project to update its slide deck that describes the foundation to audiences who may not be familiar with our work or are fuzzy on the details. Such endeavors always produce some deeper thinking concerning both our mission and how we want to present ourselves to the public.

There were two primary takeaways. First, CPF is in the business of converting ideas into change. This seemingly simple insight highlighted the importance of recruiting special individuals who understand what innovations (ideas) have significant industry impact (positive change), and who have the drive, determination, and influence to see these become adopted.

The other observation is that the process of converting ideas into change—while 20 years on and still evolving — is well-established. It consists of taking an idea and applying the right ingredients of funding, collaboration, and research to make lasting change. These critical components—funding, collaboration, and research—are the not-so-secret sauce of the CPF cookbook.

Other notable happenings in 2024 include closing out a total of seven research projects, which are featured in this report. CPF also significantly broadened our scope of industry initiatives to include exciting work in thermal loss through building envelope components. This work connected us with the Federal Department of Energy, which provided significant assistance in helping us achieve our research goals. Other new fields of endeavor include extending the Design Management in a Design Build Environment to non-vertical markets such as water, waste water, and aviation.

We start 2025 with energy, high hopes, and an ever-increasing portfolio of active research projects. If you see yourself as someone impatient for change and willing to help make it happen, you belong here.

Richard M. Kunnath

Richard M. Kunnath, P.E. Board President, Charles Pankow Foundation

### **RESEARCH GRANTS AWARDED IN 2024**

### RGA #01-24 Improving the Safety of Rebar Cages by Using Innovative Connectors (Phase 2) —Failure Prevention of Below and Above Ground Rebar Cages

Hamed Ebrahimian, Ph.D., P.E., et al. University of Nevada, Reno

### RGA #02-24 Guide to Equitable Risk Allocation in Design-Build Projects

Keith Molenaar, Ph.D., et al. University of Colorado Boulder

### RGA #03-24 Owner Readiness Assessment Tool for Design-Build Projects

Carrie Sturts Dossick, Ph.D., P.E. University of Washington

### RGA #04-24 Owner Readiness Assessment Tool for Design-Build Projects

Bryan Franz, Ph.D. University of Florida

### RGA #05-24 Safe and Sustainable Parking Garage Live Loads in the Age of the Electric Vehicle

Ross B. Corotis, Ph.D., P.E. University of Colorado Boulder

### RGA #01-19 Foundation Mats with High-Strength Steel Reinforcement

Jack Moehle, Ph.D. University of California, Berkeley

The Charles Pankow Foundation has led a coordinated research program to advance the use of high-strength reinforcement in buildings assigned to all seismic design categories. The goal of this research project was to develop recommendations for the safe, efficient design of thick foundation mats using high-strength reinforcement. These elements are critical to the performance of many buildings. They are also elements where high-strength reinforcement is likely to see extensive use. Previous tests have demonstrated that shear strength is sensitive to thickness of the structural member (the so-called size effect) and flexural tension strain and crack width. Foundation mats with high-strength reinforcement typically are thick and will have higher average tensile strains and crack widths than foundation mats using Grade 60 reinforcement, leading to questions about available shear strength. This research conducted tests on two deep, one-way beams to explore shear strength and minimum shear reinforcement requirements for deep foundation elements using high-strength reinforcement.





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

Michel Bruneau, Ph.D., P.Eng. University at Buffalo

The goal of this project was to provide experimentally-verified bolted splice details for Composite Plate Shear Walls—Concrete Filled (C-PSW/CF) for use across the nation in those regions where field-bolted splices are preferred over welded ones. This includes non-seismic regions, regions of moderate seismicity, and where wind demands exceed elastic seismic demands and govern splice design. Composite Plate Shear Walls—Concrete Filled consist of two steel faceplates with concrete infill sandwiched between them. This research investigated bolted splice details for C-PSW/CF to facilitate their use in such regions. Objectives included assessing the applicability of existing AISC strength equations, comparing splice details, evaluating stiffness equations, understanding ultimate behavior, and validating numerical models. The research demonstrated the satisfactory inelastic behavior of a bolted C-PSW/CF under axial and cyclic lateral loads that can be obtained when the bolts in horizontal splices are governed by bearing strength and the bolts in vertical splices are governed by slip-critical resistance.

### RGA #01-22 Fast Floor (Phase 1): Behavior of Modular Steel Plate Floor Assemblies

Jerome F. Hajjar, Ph.D., et al. Northeastern University

This research conducted an investigation of a new, modular steel floor framing and diaphragm system for commercial building structures with broad applicability, including high seismic zones. The proposed system has key benefits of increasing the speed of construction, including eliminating the pouring of a concrete deck. This type of system is key to achieving the goals of the AISC Need for Speed initiative to reduce the time from conception to occupancy for steel building structures. Phase 1 activities included conceptualizing initial development of the modular floor system, finalizing initial prototype structures and specimen designs for vibration and acoustic tests, and conducting analyses of prototypes to document behavior. This involved initiating the design, analysis and execution of subassemblage tests of modular floor system for serviceability, as well as initiating design and analysis on experiments of modular floor system for gravity strength and ductility.





### RGA #05-22 Introduction to Performance-Based Structural Fire Design (PBSFD) for Authority Having Jurisdiction (AHJ) Officials

Amit Varma, Ph.D., et al. Purdue University

Current building codes, provisions, and specifications such as AISC (2016), ASCE7 (2022), NFPA 5000 (2021), and IBC (2021) provide requirements for designing building structures under fire loading. The developed approaches include prescriptive and performance-based design methods. Prescriptive design methods have been around for several decades and are well known to architects, engineers, and Authority Having Jurisdiction (AHJ). However, performance-based structural fire design (PBSFD) is relatively new and somewhat unknown to architects, engineers, and AHJ. This project developed educational and training materials to introduce authorities having jurisdiction to the topic of performance-based structural fire design. These materials will assist AHJ to gain an understanding of the goals, objectives, fire scenarios, and thermal and structural analyses for PBSFD. After completing the training, AHJ will be able to coordinate the review of PBSFD designs along with their assumptions, limitations, and caveats. They will be able to effectively manage relationships between the engineering team and the peer review panel and make final decisions based on building codes for steel, concrete masonry, and wood structures.



#### RGA #03-21

The Design-Builder's Guide to Design Management: A Playbook for the Industrial Sector

# The Design-Builder's Guide to Design Management: A Playbook for the Federal Sector

Bryan Franz, Ph.D., et al. University of Florida

The Professional's Guide to Managing the Design Phase of a Design-Build Project has been the go-to resource for design-build (DB) professionals for a decade and is utilized in company, university, and DBIA training. The newly published third edition, titled The Design-Builder's Guide to Design Management, has been updated and expanded to reflect the state-of-practice and a path forward, with common principles that apply to all DB projects and market sectors, and specific guidance for the building sector. The guide is intended to help owners, designers, and builders of design-build projects achieve greater success by understanding and fully leveraging the unique role of the design integration manager. The new edition comes with five additional new "playbooks" that provide targeted design management guidance to assist professionals in navigating the differences in procurement processes, project scope, team composition, BIM-readiness, and more. Dr. Bryan Franz produced two of the five playbooks: A Playbook for the Industrial Sector, which provides detailed information specific to the design integration manager's role in the industrial sector; and A Playbook for the Federal Sector, which details the specific tasks and competencies necessary for design integration managers working on federal projects. This project was done in collaboration with Iowa State University (RGA #04-21) and University of New Mexico (RGA #05-21).



#### RGA #04-21

## The Design-Builder's Guide to Design Management: A Playbook for the Aviation Sector

# The Design-Builder's Guide to Design Management: A Playbook for the Highway Sector

Jennifer Shane, Ph.D., et al. Iowa State University

The Professional's Guide to Managing the Design Phase of a Design-Build Project has been the go-to resource for design-build (DB) professionals for a decade and is utilized in company, university, and DBIA training. The newly published third edition, titled The Design-Builder's Guide to Design Management, has been updated and expanded to reflect the state-of-practice and a path forward, with common principles that apply to all DB projects and market sectors, and specific guidance for the building sector. The guide is intended to help owners, designers, and builders of design-build projects achieve greater success by understanding and fully leveraging the unique role of the design integration manager. The new edition comes with five additional new "playbooks" that provide targeted design management guidance to assist professionals in navigating the differences in procurement processes, project scope, team composition, BIM-readiness, and more. Dr. Jennifer Shane produced three of the five playbooks: A Playbook for the Aviation Sector, which offers guidance tailored to the characteristics of design-build project delivery in the aviation sector for professionals who have been tasked with the role of design integration manager; A Playbook for the Highway Sector, which provides detailed information specific to the design integration manager's role in the highway sector; and A Playbook for the Water/Wastewater Sector. This project was done in collaboration with University of Florida (RGA #03-21) and University of New Mexico (RGA #05-21).

THE DESIGN-Builder's Guide To Design Management: A Playbook for the Water/Wastewater Sector



#### RGA #05-21

The Design-Builder's Guide to Design Management: A Playbook for the Aviation Sector

### The Design-Builder's Guide to Design Management: A Playbook for the Highway Sector

### The Design-Builder's Guide to Design Management: A Playbook for the Water/Wastewater Sector

Susan Bogus Halter, Ph.D., P.E., et al. University of New Mexico

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### **ON-GOING RESEARCH GRANTS IN 2024**

#### RGA #03-19

### Seismic Precast Concrete Wall and Frame Structures with Short-Grouted Ductile Rebar Connections

Yahya (Gino) Kurama, Ph.D., P.E. University of Notre Dame

#### RGA #01-21

#### Performance and Repair of Ordinary Structural Walls Subjected to Wind and Seismic Loading Protocols

John W. Wallace, Ph.D., P.E., Professor, F. ACI, F. ASCE University of California, Los Angeles

#### RGA #03-22

### Design Requirements for Mechanically Spliced High-Strength Reinforcing Bars in Hinge Regions

Wassim Ghannoum, Ph.D., P.E. University of Texas, San Antonio

#### RGA #01-23

### Thermal Performance of Spandrel Assemblies in Glazing Systems Research Roadmap (Phase 2)

Wei Lam (RDH), et al. RDH Building Science Inc.

### RGA #02-23

### FEMA P695 Study on Post-tensioned Mass Timber Rocking Wall Lateral Systems

Shiling Pei, Ph.D., P.E., Associate Professor, Department of Civil and Environmental Engineering Colorado School of Mines

#### RGA #03-23

### Fast Floor: Behavior of Modular Steel Plate Floor Assemblies (Phase 2)

Jerome F. Hajjar, Ph.D., P.E., et al. Northeastern University

#### RGA #04-23

# Steel/Mass Timber Hybrid Diaphragms and Vibration

Erica Fischer, Ph.D., P.E., et al. Oregon State University

### **2024 FUNDING PARTNERS**

AIA Building Performance Knowledge Community (AIA-BPKC) American Concrete Institute Foundation (ACIF) American Council of Engineering Companies (ACEC) American Institute of Steel Construction (AISC) American Society of Civil Engineers (ASCE) ARUP Atlas Tube **Cives Steel** Clark Construction Concrete Reinforcing Steel Institute (CRSI) Concrete Reinforcing Steel Institute Foundation (CRSIF) Construction Industry Institute (CII) **DCI Engineers** Design-Build Institute of America (DBIA) DeSimone Glass Coatings and Concepts (GCC) Haskell Construction **Hensel Phelps** Herrick Steel HMC Architects Holmes Structural & Fire Engineering International Association of Foundation Drilling (ADSC-IAFD) International Institute of Building Enclosure Consultants (IIBEC) Jones Design Studio Kiewit

**KL&A Engineers and Builders KPFF** Consulting Engineers Lease Crutcher Lewis Maffei Engineering Magnusson Klemencic Associates Foundation (MKAF) Martin / Martin Metals Fabrication National Glass Association NUCOR **Owen Steel** Pankow Builders Parking Consultants Council (PCC) Parsons Process Industry Practices (PIP) Rimkus Schuff Steel Siefert Associates Simpson Gumpertz & Heger (SGH) Softwood Lumber Board Structural Engineering Association of New York (SEAoNY) StructureCraft TimberLab Vanir Walter P. Moore Wiss, Janney, Elstner Associates (WJE)

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Charles Pankow Foundation 5501 Merchants View Square, Suite 114 Haymarket, Virginia 20169 Tel: (360) 326-3767 info@pankowfoundation.org www.pankowfoundation.org