CALL FOR SEED RESEARCH PROPOSALS BY THE CENTER FOR INTEGRATED FACILITY ENGINEERING (CIFE)

SUBMISSION DEADLINES:
-- revised for virtual meeting --
Summary page: April 7, 2020, 9:00 AM PDT
Full proposal: April 21, 2020, 9:00 AM PDT

The CIFE community aims to improve the planning, design, construction, and operation of the built environment across all sectors and scales, including buildings, industrial plants, urban districts, manufacturing facilities, infrastructure, and even whole cities. The research endeavors to develop and test engineering and management methods that allow the industry to move beyond the notion of minimizing the negative impacts of the built environment, but instead move the industry towards a more resilient and sustainable built environment with measurable improvements across these broad categories:

- Addresses the climate crisis and improves the natural environment
- Improves efficiency of energy and resource use
- Builds technical, social, and community resilience
- Improves the quality of life for society, communities, and people
- Fosters business and the local, regional, or global economy
- Enhances the experience with the built environment for all involved stakeholders – from architects to engineers, builders, users, and operators

CIFE is seeking seed proposals that outline a potential contribution in at least one of these broad categories. Proposals must be led by a Stanford academic council member and should last one year with an expected budget in the range of $70k to $100k. The intent of these seed grants is to enable a small research team to explore the feasibility of a larger research effort. The following topics illustrate focus areas that have been identified by CIFE’s Industry Advisory Board as particularly critical. However, proposals can cut across these topics or address other topics in the broad research area outlined above.

- **Vision for the Future of Urban Districts** – *How do districts or communities of buildings interact to produce higher quality of life, lower resource use, and more efficient operation of technical and social systems?* Research could:
  - Showcase how project management recognizing multiple community stakeholder issues might be more successful in project permitting and construction
  - Explore rapid development and automatic evaluation of multivariate project alternatives

- **Vision for the Future of Building Users** – *How can buildings and combinations of buildings be created that do more good for their users (rather than minimizing negative impacts), e.g., buildings that communicate with each other and the infrastructure, respond to the people inside, create engagement, and bring people joy?* Research could:
Demonstrate how to transcend the notion that humans feel the building and begin to enable the buildings to feel, respond, and improve the human experience.

Address issues around human wellness, the built environment and responsiveness to society at-large, metrics and measurement, predictive tools, and dynamic strategies to improve the benefits derived from the built environment for today and tomorrow, and for individuals and the community.

- **Automation** – How can automation and robotics in construction be deployed to enable better jobs for humans, to improve project safety, to address labor shortages, to improve business performance, and to effectively integrate with a modern workforce? Research in this area could:
  - Demonstrate the value propositions for automation and robotics deployed throughout construction projects, including metrics to define the success, metrics to evaluate which stakeholders will benefit, and metrics to evaluate associated risk.
  - Identify the biggest opportunities for automation (both for off-site and on-site construction).
  - Identify data created from this automation and how it might be used.
  - Define and mitigate risks in the deployment of automation.
  - Outline strategies to navigate technical, cultural, and institutional barriers to the adoption of automation and robotics in AEC.

- **Design for Fabrication** – How can products for the built environment be prefabricated automatically without shop drawings, RFIs, cost and schedule overruns, paper, or PDFs? Research could:
  - Demonstrate how to define inputs and constraints that enable designers to create designs for prefabrication.
  - Explore process improvements, algorithmic approaches, metrics, KPIs, and feedback loops to measure and enable the deployment of completely automated high-performance projects.
  - Develop strategies to deploy automation and prefabrication demonstrating measurable improvements for communities, natural resources, and people.

- **Team Collaboration** – How can a new business paradigm be enabled where projects are defragmented and the use of Virtual Design and Construction enables measurable improvements in delivery? Research could:
  - Outline solutions that seek to break down the business, legal, and policy barriers to collaborative project delivery.
  - Create strategies that reduce fragmentation across the architecture, engineering, construction industry and seek to better understand how to promote industry-wide learning and innovation.
  - Explore strategies, projects, and business models that will deliver measurable improvements in product quality, and result in more resilient and sustainable communities.

- **Project Collaboration** – How can projects be engineered such that there is extreme transparency for the owner, participation across all stakeholder groups, and projects that clearly define and measure risk across multiple stakeholders? Research could:
  - Seek to better understand the mindsets that enable (or inhibit) successful deployment of Virtual Design and Construction (VDC) and other innovations across projects.
Help build the understanding of the role(s) of technology in enabling better project collaboration as well as develop the tools (legal, policy, and technology) required to promote more equitable risk sharing across project organizations.

**Feedback in Construction – How can projects use real-time, spatial, and contextual feedback more fully?** Research could:

- Develop technologies and strategies that enable better tracking of planned versus actual performance
- Explore opportunities to more efficiently use resources while delivering measurable improvements in product quality
- Create feedback loops to adjust sequencing and planning in real-time
- Provide accurate and measurable job-site feedback
- Effectively measure and define the impacts of AR/VR technologies in construction

Several industrial members of the CIFE community have expressed interest in working with Stanford research teams to further define the research opportunities outlined above. Contact CIFE Executive Director, Andrew Peterman (apeterman@stanford.edu) if you would like to be put in touch with a CIFE member for a particular topic.

**Timetable and requirements for projects for funding during AY 2020-21**

| March 9 | Call for proposals available to the Stanford and CIFE communities. |
| April 7 Budget request | Last day to request the budget for your proposal from Engineering Research Administration for departments in the School of Engineering or your local research administration staff for other Stanford departments. Note that the majority of the requested funding should normally be allocated to research students. |
| April 7 9:00 AM PDT Summary page | Submit the **summary page** and request a proposal number from Teddie Guenzer at CIFE (cife-email@stanford.edu). |
| April 21 9:00 AM PDT Full proposal, budget, presentation, & video | Submit your proposal in .docx, or .pdf format including the budget to cife-email@stanford.edu. Use the proposal template posted at [https://cife.stanford.edu/CFP2020](https://cife.stanford.edu/CFP2020). Submit the slides you plan to use for the presentation at the Technical Advisory Committee (TAC) meeting in .pptx format to cife-email@stanford.edu. Use the template posted at [https://cife.stanford.edu/CFP2020](https://cife.stanford.edu/CFP2020). Submit the video link of your presentation, up to 8 minutes in length to cife-email@stanford.edu. |
| April 28 TAC Q&A | Join the TAC by video conference at your proposal’s time for an 8-10 minute Q&A session with the committee. |

- June 1 CIFE award decisions announced.
- July 1 Earliest start date for the proposed research – PI needs to request.
- Oct. 1 Typical start date.
- Jan. 1, 2021 Latest research start date.

**Note:** At the requested funding time, CIFE will request that your research team complete a summary outline of the research, adhering to the template that will be provided by CIFE. Continued funding for the second half of the project is contingent on periodic updates to this research summary in accordance with the milestones listed in the proposal. The research summary and updates should provide access to at least
the following information: (1) A practical scenario illustrating the engineering or business problem addressed by the research and highlighting the potential impact of the research on practice and academia, (2) the original proposal (except the budget), (3) explanations of test cases used for the project, (4) presentations developed for this project, (5) industry or academic partners, and (6) research keywords.

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<tr>
<th>Note:</th>
<th>Throughout AY 2020/21, PI(s) and RA(s) on funded seed projects are expected to be available occasionally to present the research at CIFE seminars and workshops or to visiting academics or industry professionals.</th>
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<tr>
<td>Sept. 30, 2021</td>
<td>Latest date for research completion unless a no-cost extension is requested.</td>
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**Intellectual Property Rights**

The research carried out through the CIFE Seed Research program is governed by the research and intellectual property guidelines and rules in effect at Stanford University.