2019 Annual Report

WSU Integrated Design + Construction Laboratory
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LETTER FROM THE DIRECTOR

JULIA K. DAY, PHD.

Friends of the Integrated Design + Construction Laboratory,

The ID+CL at Washington State University conducts sponsored design and construction research activities under WSU’s School of Design + Construction (SDC) and is administered under the WSU Composite Materials and Engineering Center. The ID+CL seeks to capture energy savings throughout the phases of building design, construction, operation and occupation. Our team targets cutting edge interdisciplinary research to advance building energy savings and occupant comfort through market transformation, education, and innovation. Research topics include but are not limited to occupant comfort, adaptive behaviors, energy efficiency, high performance buildings, and management of human satisfaction and behaviors.

Through various projects, publications from the lab this year include an international review of human-building interfaces, studies where users capture images of their post-occupancy experiences, thermal comfort literature reviews, as well as evaluations of user-preference and satisfaction using differing types of glazing. Many projects from 2019 will be further developed, expanded upon, and presented in the new year.

We have worked alongside numerous local partners on the design and construction of projects providing technical assistance, consultation, program development, and research services. The last year has brought opportunities for lab faculty to work in Spokane under an industry residency, research discoveries to develop a tenant engagement program for the Catalyst Building, initiation of an energy and comfort study for residents of the WSU Pullman campus, as well as many other professional, educational, and service activities that expand the ID+CL’s collective knowledge and experience.

A generous gift from NEEA allowed for a full time project manager to be hired at the beginning of the new school year, who has assisted in management of student employees, producing reports and project deliverables, as well as assisting with lab budgets and administrative tasks. Additionally, 2019 brought 11 student employees who have gained research and professional experience through working on current projects. As more funded contracts bring work to the lab, the ID+CL wants to continue providing educational and research opportunities to students.

The ID+CL has been present at numerous local, regional, and international events in 2019, disseminating and discovering relevant research in the industry. Outside of travel for conferences and expert meetings, ID+CL teams travel frequently to meet with industry partners in order to acquire and maintain working contracts. Additional efforts to maintain and build connections with fellow Cougs is, what we believe, makes our industry connections so strong.

Overall, 2019 has been a great year for the ID+CL in terms of growth, research progress, and vision fulfillment. We look forward to evolution that comes in the new year and opportunities to continue research in the built environment.

Director, Julia K. Day
ABOUT THE ID+CL AND CONTACT INFORMATION

Background
The WSU Integrated Design + Construction Lab (ID+CL) conducts sponsored design and construction research activities under WSU’s Institute for Sustainable Design + Construction, the School of Design + Construction, and is administered under the WSU Composite Materials and Engineering Center. The ID+CL advances innovation in practice as part of an allied regional network of university labs (UO, UW, WSU, UI, MSU) that provides technical assistance and market diffusion services to AECO building teams. The network seeks to transform design, construction, and building operational practices to advance high-performance building designs that are more comfortable for people, require less carbon and energy to construct and maintain, and enhance the health and productivity of occupants.

Goals of the ID+CL

- employ students in cutting edge research activities,
- work on projects that reflect the WSU grand challenges,
- advance energy savings and occupant comfort in high-performance buildings
- educate building occupants and building operators, and
- engage with the community and industry.

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What We Do:

The ID+CL welcomes projects related to high performance buildings, occupant comfort, occupant training and education, building system interfaces, BIM technical assistance, as well as occupant surveys and behavioral studies.

The School of Design + Construction has recognized the ID+CL as a key player in the school-wide research initiative for the following activities:

- engagement of building occupants, building operators, designers, and contractors through research opportunities, training and education;
- engagement of undergraduate & graduate students in research opportunities and scholarly activities through mentorship;
- dissemination of cutting edge research to the architecture, interior design, & construction communities;
- education and resource development for safe and efficient energy management; and
- facilitation of occupant-centric research in emerging tech, building case studies, innovative training for energy codes, standards and more.

The ID+CL hires a team of diversely talented students in the disciplines of Construction Management, Architecture, Interior Design, Civil Engineering, and aspires to seek additional expertise by hiring students in the Mechanical Engineering, Electrical Engineering, Computer Sciences, Environmental Sciences & design fields in the coming year.

Since re-establishment in 2017, the IDCL has hired 13 students

Disciplines employed:
- Construction Management
- Architecture
- Civil Engineering
- Interior Design

Since re-establishment in 2017, the IDCL has hired 13 students
OUTCOME 1:  
DISCOVERY THROUGH RESEARCH + DEVELOPMENT

In many of the ID+CL projects, an extensive research phase is included to ensure a broad analysis is reviewed. Literature reviews of tenant engagement strategies, occupant adaptive behaviors, social behavior interventions, thermal comfort factors, as well as general industry standards and state-of-the-art are conducted by ID+CL researchers. Related projects include the following:

Comfort and Energy

“Snuggies at Work” is a study that describes commercial office building inhabitants and their use of adaptive comfort opportunities, such as adding or removing clothing, as ways of maintaining comfort and reducing energy use from heating and cooling. Stories from building users that describe their methods of achieving visual or thermal comfort are commonly the inspiration of the ID+CL’s research. At the nexus of energy and comfort is the occupant, who may or may not always be factored into high-performing energy profiles.

Occupant Behavior

With the goals of reducing energy use and maintaining user comfort, behavioral studies are a large part of understanding the human-building interface. The ID+CL specializes in developing post-occupancy surveys that capture useful information regarding occupant self-reported behaviors, access to control, and overall satisfaction. Many of 2019’s publications include methodologies that use smart-phone based surveys to capture photographs of user experiences and interfaces.

Building Culture

Tenant engagement strategies should be selected and implemented based on the qualities of the users, their space, and their needs. The concepts of using the psychology of competition, incentives, and social feedback are all methods of fostering a culture of efficiency in a high performance building. The ID+CL is actively working with research partners to study the effectiveness of various strategies and competition-based tenant engagement programs in multi-tenanted settings.
OUTCOME 2: EDUCATION + MENTORSHIP THAT TRANSCENDS ACADEMIA

Tenant Engagement

The ID+CL is developing a comprehensive tenant engagement program for the new multi-tenanted Catalyst building in Spokane that considers social interaction, occupant health, and building energy performance to reach the project’s net-zero goals. Technical assistance is provided on this project through research services, design consultation, program development assistance, and recommendation of best practices. Future work includes the implementation of the designed tenant engagement program.

Educational Content for Integrated Design

With ongoing support from WSU Undergraduate education programs, the School of Design and Construction, and the Construction Management program, the ID+CL has been working to virtually tour high-performance buildings and construction sites. This video project seeks to capture the functions of building systems, explain the processes that make the built environment operate and help viewers (college students and industry professionals) further understand the implications of occupant comfort of their work. The videos and pedagogical publications produced from this effort will be further expanded in 2020.

International Outreach

The ID+CL collaborates with international peers through several energy efficiency efforts including the International Energy Agency, Energy in Buildings and Communities Programme, Annex 66: a past international effort to define and simulate occupant behavior in buildings. The ID+CL is also currently involved in the IEA EBC Annex 79: Occupant behavior-centric building design and operation. The lab director is additionally involved in leadership roles through the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Technical Committees, the American Society of Mechanical Engineers (ASME), National Science Foundation Research Coordination Network of Sustainable Human-Building Ecosystems (SHBE), as well as reviews several international publications.
OUTCOME 3: SUPPORTING THE BUILT ENVIRONMENT + PEOPLE

Through industry sponsored research, the ID+CL team has experience working in residential, commercial, educational, and institutional settings through all phases of development, through construction and post-occupancy. Assisting our partners with technical innovations, equipment recommendations, market research, program design and post occupancy evaluations further supports our goals of advancing energy savings and occupant comfort in high performance buildings.

Energy and Comfort Perceptions in University Housing, WSU Pullman, WA

For many universities with quickly aging residential facilities and unpredictable building occupants, making wise infrastructure upgrades can become challenging, and operational costs can increase. With research sponsorship through the WSU Faculty Seed Grant, the ID+CL has been working with the WSU Housing and Residence Life and Facilities to study campus resident ability to achieve comfort and energy behaviors. A smart-phone based survey was developed to gather self-reported comfort and energy use data, and additionally catalog building interfaces through user-submitted photographs. This mixed methods study seeks to better understand the human-building interface, resulting energy use implications in buildings, and potential areas for interface and capital design improvements.

Catalyst Building, South Landing Spokane, WA

The WSU ID+CL has partnered with McKinstry to research, develop, and implement a multi-tenant engagement program to help achieve net-zero and strict energy budgets in tenant contracts. With ongoing support and occupant training, facilitating user preferences and environmental quality standards can be achieved through research to support building, neighborhood grid, and regional energy management.

The study of architectural elements like HVAC systems, glazing, and shading structures that create a more sustainable building offers the development of a progressively efficient building standard. The ID+CL has built relationships with many strong relationships in the A/E/C/O industry in the Spokane, Seattle, and Portland areas. Our work focuses on energy efficient buildings that include the occupant, as opposed to automating them out of the picture. We believe the best way to mediate behaviors that could potentially harm the building’s performance is to allow the occupant to have control and teach them why and how to achieve the set energy goals. We hope to influence the design, construction and operation of buildings so all parties involved are satisfied.
SELECTED PUBLICATIONS + RECENT WORKS

Journal articles


Technical reports:


Peer reviewed conference proceedings and papers:


News/press releases:


Support us

Are you or your company interested in sponsoring a study or pursuing new avenues of research? Your support could help drive significant and timely change in the built environment. Our team targets cutting edge interdisciplinary research to advance building energy savings and occupant comfort through market transformation, education, and innovation. To begin a partnership or discuss potential projects, please email the ID+CL Director at julia_day@wsu.edu.