Resilient Design Symposium:
State of the Art & Emerging Issues for the Built Environment
College of Architecture and Environmental Design, Cal Poly; February 22-23, 2018

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Those of us that study, observe, and work in built environment professions have been challenged in the last decade by the emergence of the resiliency as a conceptual tool. Definitions generally fall into three main clusters: engineering, socio-economic, and environmental. None of these however directly address issues of the built environment and how to design through a resilience lens. We asked ourselves, what is resilient design? Who is doing it? How does it work, and what might be included in the curriculum of a college focusing on the education of future professionals of the built environment?

These questions formed the basis for the College of Architecture and Environmental Design's (CAED) symposium *Resilient Design: State of the Art and Emerging Issues for the Built Environment*. A symposium steering committee was formed by CAED faculty in the Fall of 2017, and it functioned as clearinghouse and operations group. The Steering Committee members included Bill Siembieda (CRP) and Margot McDonald (ARCH), as co-chairs, and department representatives Dale Clifford (Arch), Ellen Burke (Larch), Amir Hasrasouliha (CRP), Vicente del Rio (CRP), and Anahid Behrouzi (ArchE).

The symposium was held during the whole days of February 22 and 23, 2018 at the CAED. Approximately 275 people attended each day of which 90 had registered on the web beforehand

and 178 people signed in at the door. Students and faculty from all the CAED departments attend, as well as from the College of Science and Math and the College of Agriculture Food and Environmental Science. There were 16 private practice and consulting firms and three public agencies represented, as well as one attendee from Stanford University and one from UC Berkeley. The event was supported by the American Planning Association and the American Institute of Architects, who sent representatives and offered continuing education credits for participating professionals.

Having Heidi Harmon, Mayor of San Luis Obispo, and Christine Theodoropulos, Dean of Cal Poly's CAED, providing the welcoming addresses, the symposium brought together sixteen professionals with experience in what they considered resiliency practice to present work examples and talk about emerging issues. The professionals ranged from Laurie Johnson, a single practitioner working on hazard mitigation, to Josh Sawislak, the head resilience officer of AECOM, a global consultancy. There were no presentations from academics; all were grounded in experience.

Focused on how practice is presently done and how it will evolve over the next two decades, the symposium informed on the state of practice and the benefits of resilient design. The format supported debate on the issues and advanced the understanding of what is needed to be included in the curricula of disciplines dealing with the built environment.

Four themes provided a framework for the symposium: New ways to think about resilient design; Emerging ways to use resilience thinking; New thinking for big projects; and Building Regional Resiliency. This format resulted in a diverse set of presentations, and a list of attributes related to resiliency in the built environment, and more importantly, allowed for a definition of resilient design to emerge. Water, dominated the practice work presented, with five speakers focusing on how to design with water not against it. Surprisingly, making the business case for resiliency clearly found a place in practice,

demonstrating the long-term financial benefits of resilience design work is an emerging feature of practice. We also heard that "stationarity is dead" from more than one presenter. This emphasizes a movement from predictive models based on experience to the use of "adaptive dynamic plans."

From an initial attribute list derived from the presentations and the debates, a definition has emerged:

> "Resilient Design is an intentional action that enables a system, in whole or part, to meet the challenges posed by changing, or unstable, conditions, to absorb a shock or disturbance while maintaining its identity and functionality through adaptive recovery."

This definition adds a new domain of resilience definitions to those described by Quilan et al. (2016), as seen in Table 1. The major conceptual breakthrough in the definition is the expression "intentional action." This brings to the forefront the systems thinking process, choosing an appropriate scale, accepting change, and working on parts of a whole. Actually, the engineering resilience approach that relies on the systems speed (time) of return to equilibrium must rely on intentional action to become operational.

For resilience design, the keys are identity maintenance and functionality (which are socio-economic factors). Resilience does not have an aesthetic quality per se. Instead, it combines functionality by solving real-world problems with design quality that improves the human condition. Adaptation is a critical component in the definition recognizing that the system components need to be responsive to change, sometimes quickly so that the built environment does not suffer cross a threshold of irreparable repair or recovery. Also, in California, adaptation is a term used widely and across disciplines as it accepted as a grounded basis for design actions. We call the symposium presenters "informed urbanists" because they have gone beyond the constraints of conventional professional training and emerge as system thinkers who are trying to take action informed by nature and the socio-economic system.

One of the symposium objectives was to establish the "state of the art" for resilient design in practical terms to transform professional education for planners, designers, engineers, and constructors of the built environment. This was accomplished by the presentations and debate shared by the presenters and the moderators. Resilient design involves the professional the opportunity to elect the standard of performance rather than be limited by what the local code suggests.

Choosing performance standards requires a deep understanding of context, time, and the manner in which disturbances influence urban and natural systems. In some ways, it is "intentional" as stated in the definition, but in more ways, it is reflective of the longer-term changes at different scales and our

Table 1: The Nine Domains of Resilience.

The Domains of Resilience	Definition
1. Engineering resilience	System's speed of return to equilibrium following a shock.
2. Ecological resilience	Ability of a system to withstand shock and maintain critical relationships and functions.
3. Social-ecological resilience	(i) Amount of disturbance a system can absorb and remain within a domain of attraction; (ii) capacity for learning and adaptation (iii) degree to which the system is capable of self- organizing.
4. Social resilience	Ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change.
5. Development resilience	Capacity of a person, household or other aggregate unit to avoid poverty in the face of various stressors and in the wake of myriad shocks over time.
6. Socioeconomic resilience	Socioeconomic resilience refers to the policy- induced ability of an economy to recover from or adjust to the negative impacts of adverse exogenous shocks and to benefit from positive shocks.
7. Community resilience	A process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance.
8. Psychological resilience	An individual's ability to adapt to stress and adversity. Resilience is a process and can be learned by anyone using positive emotions.
9. Resilient Design**	An intentional action that enables a system, in whole or part, to meet the challenges posed by changing, or unstable, conditions, to absorb a shock or disturbance while maintaining its identity and functionality through adaptive recovery.

Obs: Domains 1 to 8 from Quilan et al. (2016). Domain 9 concluded from Cal Poly's 2018 Resilient Design Symposium.

NAME	FIRM	TITLE/ROLE
David Waggonner	Waggoner & Ball	Principal
Doug Pierce	Perkins + Will	Lead Designer
Gerdo Aquino	The SWA Group	CEO
Josh Sawislak	AECOM	Global Resiliency Director
Gunnar Hand	SOM	Planner
Yana Waldman	ARUP	Senior Project Manager
Laurie Johnson	Laurie Johnson Consulting	Principal
Geoffrey Neumayr	San Francisco Airport	Chief Development Officer
Paul Hutton	Cuningham Group	Chief Sustainability Officer
David Tickle	Hassell	Urban Design Lead
Amanda Brown Stevens	Bay Area Resilient Design Challenge	Managing Director
Steve Moddemeyer	CollinsWoerman	Principal

Symposium Presenters

NAME	ORGANIZATION	PROFESSION
Stacey While	Cal Poly, Architecture.	Architect
João Pedro Costa	Universidade Técnica de Lisboa	Urban Designer
Alicia Daniels Uhlig	Living Community Challenge	Architect
Brian Seamer	LPA	Structural Engineer

Symposium Moderators

understanding of the changes. Presenter Geoffrey Neumayr's example of the San Francisco Airport Control Tower demonstrates the use of a chosen performance standard. This is specified resilient, focusing on a single hazard. The tower will withstand any projected level of a seismic event in the Bay Area, and continue to function with no interruption. This means the airport can serve its function as a transportation hub without interruption in service.

The choosing a standard of performance concept was validated in October 2018 by the "Sand Palace" house in Mexico Beach, Florida that withstood the 155 miles an hour winds and a storm surge of Hurricane Michael. The Sand Palace was the only house standing in a six-block area of the town. It was built to withstand 165-hour winds, far above the local code requirement of 120 miles per hour.

The way we need to invest in resilience is to look at it sideways because an investment in a structure or a physical piece might be a one-time investment. However, investment in resilience for people or economies is ongoing. So, when we think about resilient planning or resilient strategies, we have to be thinking about it with a mix of tools, investments, and approaches.

We are coming to accept reality: cities break. They break for different reasons including natural hazards, economic hazards, and slowly for climate change. The question before us is how we can make the built environment safer through resilient practice? Doug Pierce champions RELi (a rating a project rating system similar to LEED®), that is basically a new consensus standard, and it fills the gap on resilience relative to the other standards that are in use, such as LEED.

Conclusion: Actions that Inform Practice

Certain actions inform practice. The following elements can be included in contemporary "resilient design."

(1) Choose the design standard that meets the desired resiliency threshold (a system limit).

(2) Work at the appropriate scale to address the defined system problem. Scale matters.

(3) Design to a future time that fits the built environment use. Time does matter.

4) Embrace the need to make the business case (understand how does it benefit the client or user).

(5) Utilize nature's reality to inform a design solution(i.e. designing with water).

(6) Understand that change becomes the constant, and less emphasis is placed on historical information, what means stationarity is dead.

(7) Use threshold analysis, as a part of the decision-making process.

(8) Improve risk management through risk transfer (improved built environment performance, mitigation, acceptance, or insurance).

(9) Improve the information base required for this work by engaging in inter and multidisciplinary approach.

(10) Avoid the single designer approach, as it does not yield resilient design. As David Waggonner, FAIA, says "we work across disciples."

(11) Design for desired outcomes, not the present code prescription. This is performance-based design.

Conclusion: Curriculum Advancement

Informing curriculum development for resilient design was a symposium objective. The prime directive of the presenters was to engage and emphasize interdisciplinary studies. Broaden the traditional design curriculum to allow the student to see and engage in the world more holistically. Learning to work with others, and learn from their perspectives is another curriculum lesson, so spanning departments and disciplines are needed (Smith et al., 2018). There is still much to learn about how to build this into the curriculum, although we do it in the CAED through single interdisciplinary studios (which are a good start) and through environmental design studies courses that work on a different scale. When students learn the benefits of interdisciplinary thinking, they take the first step in becoming what we call "informed urbanists". We need more informed urbanists, and also informed activists such as Harold Hay to use nature as a partner in creating a safer and energy conserving built environment (McDonald & Dayer, 2019).

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References

Quinlan, A., Berbes-Blazquez, M., Haider, L. J., & Peterson, G.D. (2016). Measuring and assessing resilience: broadening understanding through multiple disciplinary perspectives. *Journal of Applied Ecology, 53*, 677–687.

McDonald, Margot and Carolina Dayer (Eds.).(2018). *Activism in Architecture: Bright Dreams of Passive Energy Design.* London: Routledge.

Smith, G. et al. (2018). Recommendations of the Resilient Design Education in the United States: Current and Emerging Curricula in Colleges and Universities. Coastal Resilience Center, University of North Carolina.

Presenters Laurie Johnson (above) and Geoffrey Neumayr (below).
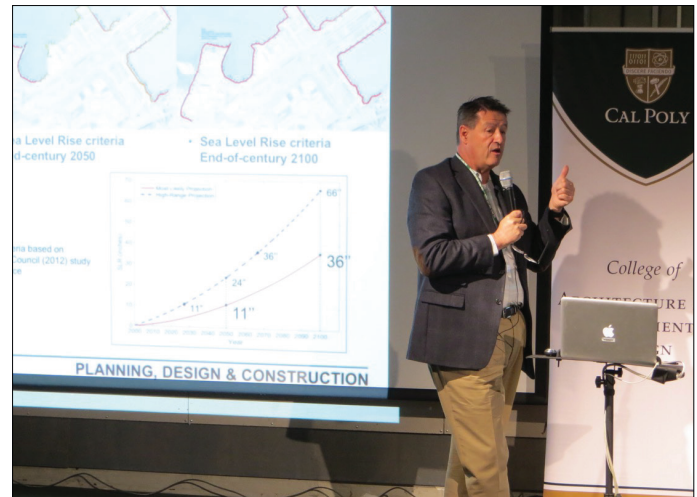
From left to right: Margot McDonald and William Siembieda (co-chairs), Byan Seamer (moderator), Yana Waldman, Gunnar Hand, David Waggonner, Josh Sawislak (presenters, and Stacey White (moderator).