



*Investigations at the intersection of form and performance: research, design, make, teach, publish, repeat.*

## EDUCATION

### **Master of Architecture, University of North Carolina Charlotte.**

3.9 GPA, Tau Sigma Delta, Alpha Rho Chi Medal, Boardman Fellowship, USGBC Rob Eggers Scholarship, UNCC SOA Alumni Scholarship, SOA Excellence in Technology Award.

### **B.A., Plan II (honors liberal arts), University of Texas at Austin.**

3.9+GPA, summa cum laude, Phi Beta Kappa.

## PROFESSIONAL EXPERIENCE

### **Assistant Professor, Product Architecture Engineering, Stevens Institute of Technology. 2015 - present.**

Developing a multi-disciplinary lab investigating the interplay between sustainability and resiliency through research, design, making, teaching, and publication.

### **Project Faculty, The SUREHOUSE, Stevens Institute of Technology. 2014 - 2015.**

Member of faculty team for SIT's entry in the 2015 Solar Decathlon, conceived as both a sustainable and resilient response to climate change. Worked with students and professionals to research, design, build, disassemble, transport, reassemble, and operate a high performance, technologically advanced, solar-powered house. The project won 1st place in 7 contests, including both Architecture and Engineering, and 1st place **overall**.

### **Project Manager, UrbanEden Project, UNC Charlotte. 2011 - 2014.**

Oversight of student design and construction team on the 2013 Solar Decathlon entry that won the People's Choice Award and 3rd in Engineering. Ran team that developed high performance precast wall system with integrated thermal transfer; first geopolymer cement concrete building in the world. Master's thesis on thermal performance of concretes in building envelopes.

### **Researcher, Laboratory for Innovative Housing, UNC Charlotte. 2011 - 2013.**

Part of team working with DOE grants to develop new residential weatherization system for low income housing and high performance precast concrete wall system with integrated hydronics.

### **Teaching Assistant, UNC Charlotte. 2012 - 2014.**

Involved in teaching architectural undergraduate materials science course and graduate design methodologies for thesis preparation.

### **Managing Director, The Nauhaus Institute. 2009 - 2011.**

Created and ran non-profit tasked with development of residential carbon neutral design/build systems. NHI designed and built what might be the most energy efficient (Passivhaus standard) "natural" (site produced materials, hempcrete wall system) building in the world.



**Adjunct Professor, UNC Asheville. 2009.**

Developed and taught “Green Building” elective course in undergraduate Environmental Studies department.

**Principal, Think Green Building. 2005 - 2009.**

Ran consulting and design firm that specialized in “hyper green” residential projects. Services included site analysis, Passivhaus modeling, and turn-key design.

**Author. 2002 - present.**

Freelance writer, photographer, and presenter on high performance, low-embodied energy design and building techniques for residential construction. Three books, approximately 40 articles, and 1,000+ photos published to date.

**Builder, Self-employed. 1994 - 2005.**

Wide variety of experience in the construction trades including concrete, masonry, wood, and steel applications. Specialization in alternative construction materials, methods, and systems.

**Builder, Center For Maximum Potential Building Systems. 1993 - 1994.**

On the construction team that built the “Advanced Green Building Demonstration Building”.

## PUBLICATIONS

### BOOKS

Snell, Clarke, and Tim Callahan. *Building Green: A Complete How-to Guide to Alternate Building Methods : Earth Plaster, Straw Bale, Cordwood, Cob, Living Roofs.* New York: Lark Books, 2009.

Snell, Clarke. *Building Storage with Style: 20 Great-Looking Projects from Off-the-Shelf Lumber.* New York: Lark Books, 2006.

Snell, Clarke. *The Good House Book: A Common-Sense Guide to Alternative Homebuilding.* New York: Lark Books, 2004.

### THESIS

Snell, Farley Clarke. “Optimizing Thermal Performance of Concrete in Building Envelopes: A Comparison of Portland Cement and Geopolymer Cement Concrete Mixes.” Charlotte: UNC Charlotte, 2014.

### CONFERENCE PAPERS

May, Edward, Clarke Snell, Christopher Stefens, Christopher Hamm, and AJ Eliot. “The SURE HOUSE: A Sustainable + Resilient Coastal Prototype.” Greenbuild 2015. Washing, DC, 2015.

Snell, Clarke, Thomas Gentry, and Brett Tempest. “Optimizing Concrete Mix Design for Thermal Characteristics in a High Performance Wall Assembly.” PLEA 2014 Sustainable Habitat for Developing Societies: Choosing the Way Forward. Ahmedabad, India, 2014.





Snell, Clarke. "Having Our Concrete and Eating It Too: A Carbon Reduction Success Story." Carolinas Climate Resilience Conference. Charlotte, North Carolina, 2014.

Snell, Clarke. "'Natural Building' Meets the Passivhaus Standard: The Nauhaus Prototype." 4th Annual North American Passive House Conference. Duluth, Minnesota, 2009.

Snell, Clarke. "Hemp in the USA: A Model for High Performance 'Natural' Building." 1st International Hemp Building Symposium. Kenmare, Ireland, 2009.

Snell, Clarke. "Urban Homestead." 2009 Mountain Green Sustainability Conference. Asheville, North Carolina, 2009.

Snell, Clarke. "Building Healthy in the Real World." 2008 Building Biology Conference. Nashville, Tennessee, 2008.

Snell, Clarke. "Filling the Void: Insulation Alternatives for Timber Frames" in Timber Framers' Guild Eastern Conference. Roanoke, Virginia, 2006.

### **PEER-REVIEWED ARTICLES**

Snell, C., Tempest, B., Gentry, T. "Comparison of the Thermal Characteristics of Portland Cement And Geopolymer Cement Concrete Mixes. Submitted to ASCE Journal of Architectural Engineering.

Tempest, B., Snell, C., Gentry, T., Trejo, M., Isherwood, K. "Manufacture of full scale precast geopolymer cement concrete components: a case study to highlight opportunities and challenges." PCI Journal 60, no.6 (December 2015).

### **ARTICLES**

Snell, Clarke. "Building Earthen Homes Using the Original DIY Material - Adobe, Cob, Compressed Earth Blocks and Clay-Straw Building Methods Are Labor-Intensive but Tremendously Rewarding." Mother Earth News, August/September (2012).

Snell, Clarke. "The Nauhaus Chronicles: Don't Throw the Igloo Out with the Bathwater." New Life Journal: Carolina Edition 10, no. 9 (November 2009).

Snell, Clarke. "The Nauhaus Chronicles: Building with Hemp." New Life Journal: Carolina Edition 10, no. 8 (October 2009).

Snell, Clarke. "The Nauhaus Chronicles: Anatomy of a Passive House." New Life Journal: Carolina Edition 10, no. 8 (September 2009): 26–27.

Snell, Clarke. "Making Sustainable Happen." New Life Journal: Carolina Edition 10, no. 7 (August 2009): 26–26.

Snell, Clarke. "What Goes Up Must Come Down." New Life Journal: Carolina Edition 10, no. 6 (July 2009): 26–27.

Snell, Clarke. "Footloose and Carbon Free: The Passive House Standard." New Life Journal: Carolina Edition 10, no. 5 (June 2009).





- Snell, Clarke. "Local Paint in a Local Space." *New Life Journal: Carolina Edition* 10, no. 4 (May 2009): 28–31.
- Snell, Clarke. "Energy Efficiency Geek-out: Anatomy of Windows and Doors Part II." *New Life Journal: Carolina Edition* 10, no. 3 (April 2009).
- Snell, Clarke. "Energy Efficiency Geek-out: Anatomy of Windows and Doors Part I." *New Life Journal: Carolina Edition* 10, no. 2 (March 2009).
- Snell, Clarke. "Building "Green" Beyond the Home." *New Life Journal: Carolina Edition* 10, no. 1 (February 2009).
- Snell, Clarke. "Green Building, Today." *New Life Journal: Carolina Edition* 9, no. 11 (December/January 12, 2008): 32–37.
- Snell, Clarke. "Good (& Green) Neighbor Guide Revisited." *New Life Journal: Carolina Edition* 9, no. 10 (November 2008): 14–16.
- Snell, Clarke. "What Is Greening?" *New Life Journal: Carolina Edition* 9, no. 10 (November 2008): 32–35.
- Snell, Clarke. "Renewable Energy: A Green Building Fundamental." *New Life Journal: Carolina Edition* 9, no. 9 (October 2008): 36–39.
- Snell, Clarke. "Certifiably Green." *New Life Journal: Carolina Edition* 9, no. 8 (September 2008): 36–39.
- Snell, Clarke. "Engineering: A Green Building Fundamental" *New Life Journal: Carolina Edition* 9, no. 7 (August 2008).
- Snell, Clarke. "Holistic Health: Mind, Body and Building?" *New Life Journal: Carolina Edition* 9, no. 6 (July 2008): 36–39.
- Snell, Clarke. "To Deck or Not to Deck: Floors for Outdoor Rooms." *New Life Journal: Carolina Edition* 9, no. 5 (June 2008).
- Snell, Clarke. "Outdoor Rooms: Save the World With a Smile on Your Face." *New Life Journal: Carolina Edition* 9, no. 4 (May 2008).
- Snell, Clarke. "Firewood: Don't Burn It, Build With It." *New Life Journal: Carolina Edition* 9, no. 3 (April 2008).
- Snell, Clarke. "Choosing Land." *New Life Journal: Carolina Edition* 9, no. 2 (March 2008).
- Snell, Clarke. "Is Wood Good?" *New Life Journal: Carolina Edition* 9, no. 1 (February 2008).
- Snell, Clarke. "Reflections on Warmth: Cooperate with the Sun and Move Up the Evolutionary Bench." *New Life Journal: Carolina Edition* 8, no. 11 (January 2008): 31-32.
- Snell, Clarke. "GO SOLAR and Save Big!" *Mother Earth News* 2007, no. 221A (2007).
- Snell, Clarke. "Wherever You Go, There You Are: My Experience with Community." *New Life Journal: Carolina Edition* 8, no. 10 (November 2007).
- Snell, Clarke. "Notes from the Green Building Trenches: Should You Build Your Own House?" *New Life*





Journal: Carolina Edition 8, no. 9 (October 2007): 33-34.

Snell, Clarke. "Thwart the Diabolical Extraterrestrials: Buy Local Paint." *New Life Journal: Carolina Edition 8*, no. 8 (September 2007).

Snell, Clarke. "Phased Design or the Tao of Air Conditioning." *New Life Journal: Carolina Edition 8*, no. 7 (August 2007).

Snell, Clarke. "What is Natural Building, Or 'Do I Have to Wear Dreadlocks to Build with Straw Bales?'" *New Life Journal: Carolina Edition 8*, no. 6 (July 2007).

Snell, Clarke. "A Treatise on Dirt." *New Life Journal: Carolina Edition 8*, no. 5 (June 2007).

Snell, Clarke. "Straw vs. Our Climate." *New Life Journal: Carolina Edition 8*, no. 4 (May 2007): 29-31.

Snell, Clarke. "Think Globally, Build Locally." *New Life Journal: Carolina Edition 8*, no. 3 (April 2007).

Snell, Clarke. "When Is a House a Home?." *New Life Journal: Carolina Edition 8*, no. 2 (March 2007).

Snell, Clarke. "Plan for Tomorrow, Change Your Light Bulbs Today." *New Life Journal: Carolina Edition 8*, no. 1 (February 2007).

Snell, Clarke. "Using the Sun: Passive Solar 101." *New Life Journal: Carolina Edition 7*, no. 12 (January 2007).

Snell, Clarke. "Green: Still Not Easy." *Library Journal* 131, no. 10 (2006).

Snell, Clarke. "Plan for Tomorrow, Change Your Light Bulbs Today." *New Life Journal: Carolina Edition 8*, no. 1 (February 2007).

Snell, Clarke. "The Five Elements of Green Building." *New Life Journal: Carolina Edition 7*, no. 11 (November 2006): 29-29.

Snell, Clarke. "Your Green Dream Home: First Things to Consider." *Mother Earth News* 2006, no. 215A (2006).

Snell, Clarke. "How to Build Your Own Home." *Natural Home Magazine*, 2004.

## LICENCES AND CERTIFICATIONS

**Certified Passive House Consultant.** Passive House Institute US. 2009 - *present*.

**Building Analyst.** Building Performance Institute. 2012 - *present*.

**Construction Safety Certification.** Occupational Safety and Health Institute. United States Department of Labor. 2013 - *present*.

## DESIGN PROJECTS EXECUTED (SAMPLES)

*The projects listed below are all completed, inhabited buildings for which I was involved from the beginning of the design process through construction. Design projects not built and many smaller design/build projects are not included here:*





**The SURE HOUSE Project. Hoboken, NJ. Project Faculty/ Construction Manager. 2014 - 2015.** Winner of the 2015 Solar Decathlon including first place in Architecture, Engineering, Market Appeal, Communications, Homelife, Appliances, and Commuting.

#### Architecture:

Superstorm Sandy devastated many neighborhoods along the Jersey Shore. FEMA's response was to mandate elevating structures up to 13' feet above grade out of the flood plane. Though wellmeaning, this move cut at the core of the appeal of shore living: a direct connection to the outdoors. In fact, traditional shore neighborhoods are built on an interplay between indoor and outdoor spaces that allow for lifestyle patterns that fluctuate with the seasons. The SURE HOUSE was a response to a specific social question: how do we rebuild these established neighborhoods without destroying them. The result was a design prototype that combined flood-proofing to allow buildings to stay on grade with simple formal layering of spaces that supported seasonal lifestyle flexibility. Careful integration of a familiar material pallet and up-dated conventional construction techniques brought substantial technological advances within reach of the motivated local contractor.

#### Engineering:

The holy grail of sustainability in architecture in recent years has been buildings that produce more energy than they use, the excess making up for grid inefficiencies and other carbon emissions associated with project lifecycle. But even the most efficient building cannot be considered sustainable if it will not survive the next storm. In an era of climate change, sustainable has to mean resilient. In this vein, the SURE HOUSE was conceived as a sustainable and resilient prototype for coastal housing. The organizing sustainability strategy was a drastic reduction in heating, cooling, and hot water loads through careful application of Passivhaus principles. Tiny energy demands allowed practical on-site photovoltaic energy production well in excess of demand through typical use. Resilience to coastal storms was provided by an integrated flood-proofing system that protected wall, floor, and fenestration up to 5 feet above grade, including innovative bi-fold composite shutters that doubled as solar shades and flood-proofing for the floor to ceiling glass comprising the southern façade. A photovoltaic system that provided both direct DC water heating and "islanding" that allowed for continued energy production even during a grid failure rounded out the resiliency strategies. In the event of a power outage, electricity was routed to critical circuits, including a charging hub outside the house that could supply small amounts of power to the neighborhood for charging phones, flashlights, and other necessities.

**UrbanEden Project.** Charlotte, NC. Project Manager, Concrete R&D Team Lead. 2011 - 2014.

UNC Charlotte's entry in the 2013 Solar Decathlon, UrbanEden was a design/build project with a \$1.3 million budget that included a number of technological innovations. The wall system was a continuously insulated precast concrete panel with embedded hydronics plumbed to heat exchangers capable of heating or cooling the wall mass through passive heat exchange. The concrete used was a geopolymers cement mix developed by the team that represented a significant reduction in carbon footprint over portland cement and was the first application of its kind in the world. A 7.5KW photovoltaic array produced all required electricity on site and was mounted on a movable rack that provided adjustable shade to the outdoor rooms with living walls that comprised the south side the house.



**Nauhaus Prototype.** Asheville, NC. Design and Construction Team Leader. 2009 - 2010.

One of the most energy efficient “natural” buildings in the world, this house was designed to the Passivhaus standard with the intent of reaching carbon neutrality. From a building science standpoint the goal was to combine state of the art performance with the advantages of many historical hygroscopic envelope systems. Features included: 16” thick lime/hemp wall infill, quadruple pane fenestration, passive ground loop to adjust temp of incoming air to ERV, small indoor footprint through extensive outdoor room design, site-made materials including compressed earth blocks for floors and interior walls and a variety of earth plasters.

**Friedwald-Melz Homestead.** Bat Cave, NC. Design Team Leader. 2009.

Off-grid homestead design including extensive land analysis to utilize on-site resources including sun (passive space heating, solar hot water, and photovoltaics), water (gravity fed spring for domestic potable water and small-scale hydro power), and wood (all framing harvested on site or locally). The house envelope system consisted of a larsen truss framing system with cellulose infill and an earthplaster finish.

**Fiordilisi-Harris Homestead.** Design Team Leader. 2009.

40 acre homestead design included long-term infrastructure and land use plan, barn remodel into common space and small apartment, and design of passive solar, high performance SIPS assembly client home.

**Harpoottian Residence.** Design Team Leader. 2008.

Client wanted a true half-timber Tudor timber frame. We worked with an English company to design the building and shipped components to the US, then oversaw the construction process. Envelope system was timber infilled with foam insulation and covered in a lime-based plaster.

**Taylor Residence.** Design Team Leader. 2008.

Rural home for single retiree. Most notable feature of this home was the delicate sitework design and the double stud frame wall system we implemented to reduce thermal bridging. We bought and learned how to use a Total Station surveyor for this project and laid out the complex foundation ourselves.

**Hartbarger Residence.** Design Team Leader. 2007.

Design for a family that built the house themselves. Locally harvested timber frame with SIPS wrap. As with all our projects of the time the house was passive solar with renewable energy/resource systems, in this case solar thermal and rain catchment.

**Zim Zam Residence.** Design Team Leader. 2007.

Experiment in designing for a tiny budget. The project was 800sf with a very simple roof line. Outdoor rooms created with simple extension of roof line to create inexpensive extension of footprint. Wall system was autoclaved aerated concrete block.

**McConville Residence.** Design Team Leader. 2006.

Retrofit of old brick bank building into residence, office, studio space. Roof accessed to double apartment living space. New slab poured on ground floor for hydronic heat. Extensive energy modeling performed to size





hydronics and decide on design/feasibility of applied insulation to existing envelope.

**“Building Green” Cottage.** Project Manager and Design Team Lead. 2003 - 2004.

This project was conceived as research toward answering the question of whether we access the considerable archive of building knowledge represented by indigenous enclosure systems and apply them to our contemporary context? The approach was to apply site-made, local, and recycled materials and passive systems appropriately based on building science principles to create a tiny, flexible, efficient, and beautiful fully functional living space. Different building methods were compared based on performance in relation to a specific microclimate. For example, earthen materials (cob and clay-slip straw) were used on the south face of the building to take advantage of thermal mass to collect solar heat in the winter while straw bales were used on the north face because of their high thermal resistance. The project was conceived as a teaching tool and was designed and built to be documented as a book, “Building Green: A Complete Guide to Alternative Building Methods” published in 2005.

**Snandle Homestead.** Design Team Lead, Project Manager, Builder.

Design/Build homestead project on 3 acres in a 100 acre intentional community. Detailed experiment in the application of “Pattern Language” principles. Partially bermed passive solar house, office, performance space. Low-tech sustainability: Finish masonry wood stove, sawdust composting toilets, gravity fed spring water, site-made batch solar hot water.

## CONSULTING PROJECTS EXECUTED (SAMPLES)

*The projects listed below are a small sample of the consulting jobs completed over the past 10 years, chosen to represent a range of topics considered:*

**Gebhard Residence.** Lead Consultant. 2010.

Client was building a SIPS home and wanted to optimize performance toward the Passivhaus standard. PHPP (Passivhaus Planning Package) was used to model the project and determine optimum configuration of envelope including insulation levels, fenestration specifications, and construction detailing to reduce thermal bridging.

**Snowbird Community.** Lead Consultant. 2006-2009.

Longterm plan for intentional community including infrastructure, planting, house siting, and initial design of community common house and retirement “pods”.

**NBD (Natural Building Development).** Lead Consultant. 2008.

Feasibility study for developer looking to build using site and locally harvested materials. Developed prototype design with square foot pricing using non-traditional materials

**Equinection Facility.** Lead Consultant. 2008.

Varied consulting for therapy and retreat center that included site planning, construction and weatherization







consultation on existing buildings, and energy efficiency and systems design/detailing on new construction for the facility.

**Denny Property.** Lead Consultant. 2007.

Detailed land analysis for client looking to build on large rural parcel. Natural resource inventory including harvestable building materials as well as solar, water, and wind resources. Definition of potential building sites in the context of the resource inventory.

**Windhorse Project.** Lead Consultant. 2006-2007.

Extensive consultation on dorm and common building design for Buddhist retreat center including creating several iterations of schematic designs for buildings, comparative study of several “alternative” wall systems, as well as a variety of ad hoc problem solving exercises throughout the design and construction process.

**Hanf Residence.** Lead Consultant. 2006.

Client had built and “earthship” (bermed rammed earth tire wall system) that was leaking. This system is designed for dry/arid New Mexico and therefore was leaking in the wet mountains of North Carolina. We devised successful retrofit details to stop the leaks and create a more climatically appropriate approach to this building methodology.

**Schierbaum Remodel.** Lead Consultant. 2006.

Energy retrofit analysis and design for client wanting to extensively upgrade existing house to close to Passivhaus standard. House was site-measured and then modeled in ArchiCad to allow for quantification of energy loads and exacting take-offs of proposed retrofits. In addition to typical insulation, fenestration, and air sealing, the design focused on reducing loads through creating outdoor rooms that adjusted microclimate conditions and allowed for more extensive outdoor (and therefore low-energy) living.

**Peabody School.** Subcontracted Consultant. 2006.

Worked with TOPIA Design in LEED consulting on public school addition. In charge of all LEED documentation, oversight of construction specs, and facilitation of design coordination between design team members.

## MISCELLANEOUS PRESENTATIONS (SAMPLES)

*The presentations listed below are a sample set from a large collection of public presentations chosen to display variety and a span of time:*

**Snell, Clarke and Brett Tempest.** “Geopolymer Cement Concrete and the UrbanEden Wall System.” Duke Power. Charlotte, NC, 2014. *Presentation to 250 employees of Duke Power.*

**Snell, Clarke.** “The UrbanEden Project.” Construction Specifications Institute. Charlotte, NC, 2014. *Presentation to monthly meeting of Charlotte chapter.*

**Snell, Clarke.** “Cementing a More Sustainable Future.” Quest: The Science of Sustainability. Public





Broadcasting System, 2013. *Segment for PBS series. <http://science.kqed.org/quest/video/cementing-a-more-sustainable-future/>*

**Snell, Clarke.** “**UNC Charlotte Solar Decathlon and Energy Efficiency Innovation.**” Charlotte Talks. National Public Radio. 2013. *Interview on local NPR affiliate. <http://wfae.org/post/unc-charlotte-solar-decathlon-energy-efficiency-innovation>*

**Snell, Clarke, Thomas Gentry, Brett Thomas, and Maria Trejo.** “**A New Approach to Precast Concrete.**” Precast Concrete Institute Regional Members Meeting. Hilton Head, NC, 2013. *Presentation at annual members meeting.*

**Snell, Clarke.** “**Anatomy of the Passichanical Wall System.**” School of Architecture, University of North Carolina. Charlotte, NC, 2012. *Public presentation.*

**Snell, Clarke.** “**Why the Solar Decathlon?**” Charlotte Green Initiative. Charlotte, NC, 2011. *Public presentation.*

**Snell, Clarke and Sarah Brinker.** “**Anatomy of a Living Roof.**” Organic Grower’s School. Asheville, NC, 2010. *Public presentation.*

**Snell, Clarke,** “**The Nauhaus: Toward a Carbon Neutral Built Environment.**” Appalachian State University, Boone, NC, 2009. *Public presentation.*

**Snell, Clarke, Jennifer Bennett, and Mark Hanf.** “**Passive Solar Design.**” Geometry of Nature. Asheville, NC. 2009. *Video segment as part of educational series. <http://vimeo.com/30100731>*

**Snell, Clarke.** “**What is Green Building and Can It Save the World?**” Youth Energy Summit. UNC Asheville, Asheville, NC, 2008. *Public presentation.*

**Snell, Clarke,** “**Natural Building 101.**” Asheville-Buncombe Community College. Asheville, NC, 2007. *Lecture series for WNC Green Building Council.*

**Snell, Clarke.** “**Constructing and Detailing a Cordwood Wall.**” Berea College. Berea, Kentucky, 2006. *Public lecture and workshop.*

