

# RISE

UC BERKELEY / UNIVERSITY OF DENVER

University of California, Berkeley / University of Denver  
U.S. Department of Energy Solar Decathlon 2017  
Jury Narrative Submission  
August 10, 2017

## PRIMARY FACULTY CONTACT

Eric A. Holt, PhD.  
Franklin L. Burns School of Real Estate & Construction  
Management  
Daniels College of Business | University of Denver  
Denver, Colorado  
eric.holt@du.edu

## STUDENT TEAM LEADERS

**President:** Sam Durkin  
**Head of Design:** Brenton Kreiger  
**Head of Construction:**  
Ruth McGee, Joan Gibbons  
**University of Denver Leads:**  
W. Christensen, D. Joffey, C. Landsinger,  
J. Ross, K. Tyson



# Innovation Narrative

## The Concept II “I” is for Innovation

At the very core of its concept, RISE home is an innovative competition entry. Modular, stackable, and designed for urban settings, this creative approach is far from the usual Solar Decathlon competition spread and more applicable to our end location. To define the specificities of our concept, we plan to break the home into two 12 ft. x 40 ft. modules. A wet and a dry module define our livable space which is “stackable” in the sense that each unit’s post and beam structure easily scales to accommodate one, three, or five homes resulting in one, two, or three stories. Unlike usual residential construction, RISE home is not a stick build. Forces flow horizontally across each



Source – Team Photos

individual flat roof and floor to columns that pick up loads from each story and drive them right to the foundation. Not only does this make for an efficient structure, but as units move and rotate within the configuration the exterior walls are negotiable.

Before the Solar Decathlon team at UC Berkeley/DU became RISE, extensive guidance and thorough prototyping

governed our spiral design process. Beginning with team building and multiple design charrettes with willing local firms, our ultimate iterative event came down to a designathon in early 2016. Six teams came together for a weekend, led by an industry

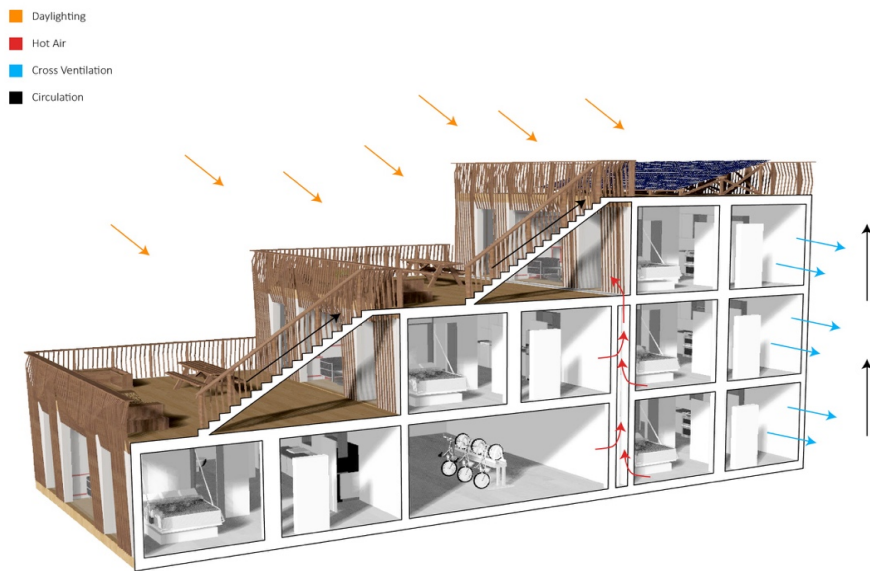


Source – Team Photos

professional, culminating in a presentation of ideas in which we voted and took our favorite pieces. This was the beginning of a collaborative design process and the birth of Design Innovation 190, a student-led class that alternated between professional guest lectures and weekly lab sections in which the entire team came together in one room to work on design tasks. Given the constant conversation and interdisciplinary communication, we quickly began to realize how important a successful project depended on a collaborative effort between majors, interests, and skillsets.

## Practicality II Innovation with a Purpose

Designing for a 3 to 4-person household living near the poverty line in the transitioning suburbs of Richmond, CA, our pervading philosophy throughout this process was “innovation with a purpose.”



Source – Team Renderings

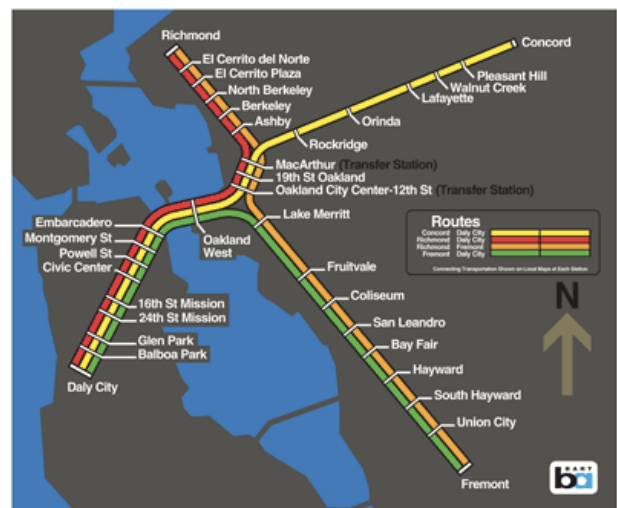
Striving to thoroughly flush out every proposed solution, we compared everything to realistic, marketed options available in Richmond. The idea here was to cater to the positive growth predicted in the city for coming years. With 31 miles of coastline, temperate weather, and two Bay Area Rapid Transit (BART) stops, its potential is evident.

However, Richmond bears a past of high crime, poor air quality in fringe communities (due to industrial facilities), and food deserts. Dropping from 784 in 2003 to 472

in 2014, the crime index is still much higher than the US average (290.5). With 16% of people living in poverty and 82% of students qualifying for free lunch, housing is the last thing this community needs to be worrying about. However, all the while, the price of housing has skyrocketed to a median price

of over \$400,000. We took this as a challenge - the goal was to find innovations with a purpose that both accentuate the promising future and solve the darker problems in this place.

More specifically, our novelty begins with the competition itself. Designing a simple, low maintenance home for an urban setting is not your typical Solar Decathlon home. With only one

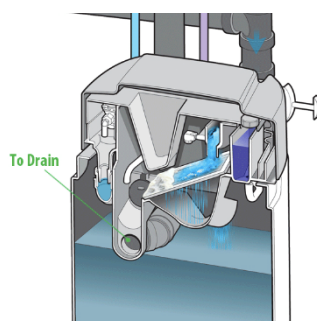


Source – BART Maps

facade of openings (south), stairs, and a covered corridor on the east side, this different design has a purpose. Planning for 'shotgun' infill lots of 40'x100', the RISE home will be adjacent to other buildings up to three stories. As a meeting with the Richmond Mayor's Office and Planning Commission evolved into teaching a class in Richmond High School and a multitude of presentations to over 6 neighborhood councils, we gained insight on what the residents of Richmond, California would like to see. Our innovations need to work around privacy and safety concerns, address food deserts, and fit into the historic neighborhoods. With a stepped back stacked configuration, roof space can be utilized to create green spaces. Wooden stairs blatantly placed in the home provide vertical circulation while fostering community interaction via intersecting pathways.

## Implementation II Systems and Concepts that Work

In addition to innovative design, our team made sure to find groundbreaking products



Source – Bio-Microbics

and technologies that are equally as practical and suitable for our Richmond target client.

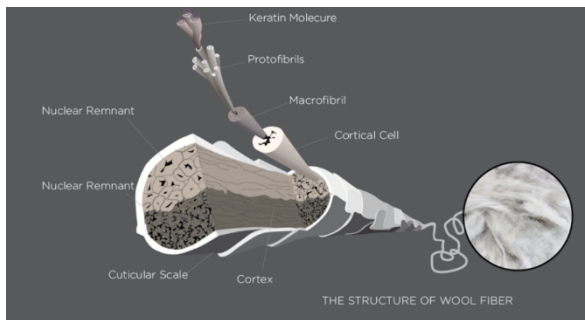


Source – Alpen High Performance Products

For our window doors, we went with Alpen High Performance Products. This passive house certified component is the first commercially available R-10 window, and paired with the new R-16 Tyrol series frame we have a stellar fenestration assembly. Not only does this product perform technically, but the slightly tinted window and thick door frame address the Richmond Neighborhood Council design requests to have strong locking doors and preserve privacy for inhabitants.

While technically Northern California recently pulled out of the drought in 2015, it is a notoriously dry place with convoluted water politics and rampant water scarcity. With climate change imminent, the droughts will only get worse, and re-use is the key to the future. Avoiding spacious, large scale full treatment systems that would better suit a rural setting, we chose to use the Bio Microbics Recover System in our urban set home. Taking water from the

shower and reusing it in the toilet, this low maintenance technology with a self-cleaning filter saves water from one of the most water intensive fixtures in a home (the shower) while only taking up a 3 sqft. footprint in the home.



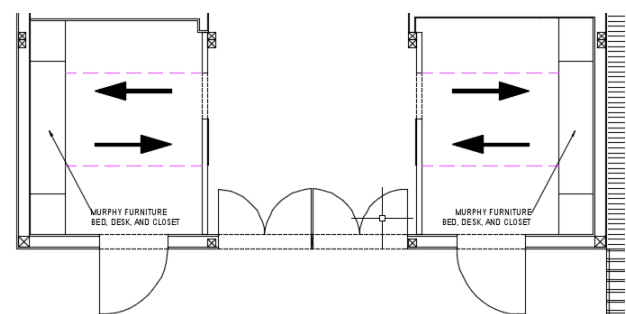
Source – Havelock Wool

An important part of our home includes providing a both affordable and safe, quality solution for our target client. Havelock Wool insulation provides an efficient, sustainable, and non-toxic replacement for the industry standard foam. At R-3.6 per inch for batts and R-4.2 per inch for loose fill, this long-lasting product is far more natural and sustainable than the norm. Free from VOCs and miniscule fiberglass particulate matter, this product provides better indoor air quality for the inhabitants without any mechanized assistance.



Source – Team Photos

Using scrap optical fibers from Wiedamark Optics we created a “light wall” in two places to (1) accentuate the flow of natural lighting in the house and (2) increase natural lighting in the house. With the west facade as our test subject, 4” elbowed pvc pipe penetrations adjacent to the plumbing vents through the plumbing chase will contain bundled fibers plaster-casted to remain water, and air-tight. With a sealed and caulked boundary, the PVC entering into the home will end and the fibers distributed throughout a transom on the west side of the bathroom wall to transmit light throughout the day. In addition, another transom installed in the east bathroom wall will lack the PVC conduit yet still manage to transmit ambient light from the living room into the bathroom set into the wood interior wall. This entire process was executed using various stages of prototyping, one of the later stages pictured in the photo above.



Source – Team Drawings

In discussion with the Richmond City Council, their desires diverged from the more specific safety and privacy driven requests of the neighborhood collectives. Looking for a long-lasting, transition-ready design, we wanted to create a flexible floor plan for our target clients. With 2 bedrooms,



we didn't want precious space to be wasted if the residents needed more room in their living room area for special occasions or would rather only use a single bedroom on a regular basis. Therefore, we added murphy bed furniture designed by Smart Spaces against the exterior east and west walls that includes beds, cabinets, and a desk. On the interior side of the room a 2x4 interior wall on tracks was designed to slide and lock into place in a both open and closed position for inhabitants to have multiple different floor plan options that extend their living room space. This wall was designed to be thin, light, and low maintenance for ease of use by the residents.



Source – Moss Acres

Coming back to the idea of innovation with a purpose, our team found that, realistically, living walls take extensive maintenance and are usually subject to failure from neglect. Due to our urban setting and generally lower air quality, we chose to work with

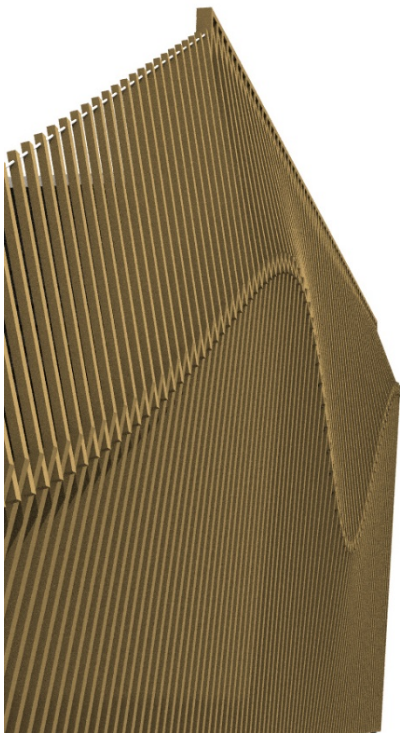
Moss Acres to develop a panelized moss mat to fill our entire north facade. The minimal watering needed in Denver will be provided by rainwater running from the slightly sloped roof onto the north facade, and in Richmond the fog and natural moisture will keep this moss alive and self-sufficient. Both beautiful and sustainable, this material will provide extra insulating value, sequester carbon, and increase air quality. Although not carried out by our team personally, testing carried out in Stuttgart, Germany proved that even a generic moss wall installation can significantly improve air quality. These findings helped encourage us to pursue this option and they are linked here: <http://www.dw.com/en/stuttgart-builds-moss-covered-wall-to-fight-air-pollution/a-37866760?maca=en-Facebook-sharing>.



Source – Team Photos

For our flooring product, we remained as conscious as possible about our material selection. Going with a Shaw hardwood, this specific product uses 50% less wood than normal hardwood by employing a layer of compressed industrial sawdust in the middle. Not only is this more sustainable, but it keeps the wood from expanding and contracting with heat and moisture. Additionally, we used a low VOC glue to adhere the floorboards to further keep our environmental impact down.

acetylated lumber product can but cut and altered while maintaining its amazing strength and resistance properties and go without replacement for 50+ years. This is important due to the complexity of our design so that it will not need replacement. For the actual textured design, this was completed in Rhinoceros, a 3D modeling program, and Grasshopper, a graphical algorithm editor for parametric modeling. The wave that circumnavigates the building was originally designed as a Sine wave, and then later exaggerated to form a more dynamic wave. The transition from the lower deck railing to the façade system was also considered, with the wave emerging in plain view from the wall as a Bezier curve before reaching its final protrusion distance of 7". The wave is manipulated on the south façade to imply archways over the fenestration.



Source – Team Renderings

In order to beautify our rectangular structure, we explored methods in which we could add depth and texture to this otherwise box. Balancing cost and reliability, we chose to go with Accoya. This