

Jacobs Institute for Design Innovation

Project Overview

East elevation from Le Roy Avenue: The public face of the Institute, welcoming students from across the University to a place of creativity and design innovation. - Photo Credit: Tim Griffith

View from the intersection of Le Roy and Ridge Road: The building presents a new threshold to the campus that expresses the values of the Institute and the University. - Photo Credit: Tim Griffith

“Design innovation starts with asking the right questions and ends with changing the world.”
- Jacobs Institute Mission Statement

Founded on the conviction that design can help address some of society’s most pressing challenges, the Jacobs Institute for Design Innovation at UC Berkeley, is devoted to

introducing sustainable design innovation at the center of engineering education and university life. The project was conceived by the College of Engineering as an interdisciplinary hub for students and teachers from across the university who work at the intersection of design and technology. It is designed as both a collaborative, project-based educational space and a symbol to the region of the University's commitment to sustainable innovation.

The tiny corner site, formerly a volleyball court, lies at the northern edge of campus within a dense, diverse context. Two 4-story engineering buildings border the site on the west and south. Single family residences and apartment buildings line the street to the north. An existing two-level basement lies directly beneath 35% of the site.

The program, intended to accommodate up to 2,000 students per semester, includes flexible design studios, project rooms, support spaces and fabrication equipment rooms containing a variety of rapid prototyping tools and equipment.

Location:

253 Ridge Road
Berkeley California 94720
United States

Project Owner:

University of California, Berkeley

Submitting Architect:

Leddy Maytum Stacy Architects

Project Completion Date:

September, 2015

Project Site:

Previously Developed Land

Project Type:

Education – College/University (campus-level)

Project Site Context/Setting:

Urban

Other Building Description:

New

Building or Project Gross Floor Area:

24,035 square feet

BOMA Floor area method used?:

Yes

Hours of Operation:

60 hrs / wk

Design & Innovation

The project models high-density / low-carbon living and learning for students and the broader community. It maximizes the potential of its tiny site, providing light-filled, energy-efficient learning spaces for 2,000 students per semester. - Photo Credit: LMS Architects

North elevation from Ridge Road: The north elevation faces the community with a calmer façade. Large north-facing windows welcome the daylight and reveal the activities within. A narrow landscaped zone along the street frontage filters 100% of roof drainage from the project. - Photo Credit: Tim Griffith

The Jacobs Institute's mission is to expand the role of design in engineering education at all levels, empowering young engineers to create innovative solutions to society's biggest problems. The architecture reflects this mission, modeling high-density / low-carbon living and learning in spaces that support project-based learning, rapid prototyping and fabrication.

- **HIGH DENSITY URBAN INFILL:** The project repurposes an underutilized 11,000 SF site, optimizing learning space within a compact 24,035 GSF building. The efficient design minimizes circulation/service space while maximizing flexible learning space. The structure cantilevers 12 feet southward over an existing basement to create sufficient space for the new building while retaining a south-facing courtyard.
- **MODELING SUSTAINABLE INNOVATION:** The project was envisioned as a striking new

threshold to the campus - a “beacon of innovation” expressing the sustainable values of the Institute and the University. The architecture outwardly demonstrates sustainable design innovation, integrating economic strategies that foster practical and poetic connections between students and the natural world.

- **ADVANCED ENERGY-EFFICIENCY:** The project is designed to exceed the AIA 2030 Commitment target, using 90% less energy than the national median for university buildings. Integrated energy efficiency drives the overall building form and appearance, including simplified massing, high-performance skin and the cantilevered photovoltaic array.

Regional/Community Design

Campus / Community

Connectivity: The building serves as both a new threshold to the University and an “beacon of innovation” attracting students from across the University. - Photo Credit: LMS Architects

South elevation from Soda Hall: The south façade opens to the sun to maximize solar and daylighting benefits while connecting to outdoor courtyards, terraces and University beyond. Integrated sunshades manage internal loads, reflect daylight into the studios, and maintain maximum visual transparency. - Photo Credit:

“The Jacobs Institute is UC Berkeley’s interdisciplinary hub for students, teachers and practitioners who work at the intersection of design and technology.”

– Jacobs Institute Mission Statement

The Institute fosters interdisciplinary engagement across the University, welcoming students from other departments, inventors, tinkerers and over thirty student clubs to an inspiring environment of creativity and innovation.

- **THRESHOLD AND DESTINATION:** Located at the northern edge of campus, the building serves as a new threshold to the University and a “beacon of innovation” attracting students at all hours. A cantilevered photovoltaic array ascends to the north, expressing the aspirational values of the Institute to the University and the public. Glassy stairs project outward, glowing after dark to welcome visitors.
- **TRANSIT-ORIENTED:** The new building provides no parking except for one wheel-chair accessible street parking space. Access to the building is by foot, bicycle and public transit. Walk Score Rating: 86.
- **TRANSPARENCY:** The design emphasizes transparency and overlooks to reveal the hum of creative activity to the University and the community. The south wall opens to the sun for daylighting and passive solar benefit while connecting to outdoor terraces.
- **STABILITY:** The seismic system exceeds the California Building Code for added resilience.

Metrics

Estimated percent of occupants using public transit, cycling or walking:
99%

Land Use & Site Ecology

*Densifying Developed Land:
The project converts a tiny
11,000 SF former volleyball
court into a 24,035 GSF
educational facility devoted to
the exploration of sustainable
design innovation. Site
opportunities are efficiently
exploited on the constricted
site, providing inviting outdoor
spaces and enhancing*

*environmental quality. - Photo
Credit: LMS Architects*

*East entry façade / floorplans
(basement and L1): The
building attracts students well
into the evening,
accommodating over 30
student clubs. The compact
floorplan minimizes circulation
and service space while
optimizing flexible teaching
spaces. - Photo Credit: LMS
Architects*

*East entry detail / floorplans
(L2 and L3): The third floor
studio doubles as a flexible
presentation space for
lectures, presentations and
poster sessions. - Photo
Credit: LMS Architects*

The new building is an urban infill project within a dense campus / community context. It repurposes previously developed land and enhances environmental quality on a constricted site.

- **DENSIFYING DEVELOPED LAND:** The project converts a tiny 11,000 SF site – formerly an underused volleyball court – that is partially underlain by an existing two-story basement. To maximize buildable area on the tight site, the structure cantilevers 12 FT over the existing two story basement. Remaining site resources are arranged efficiently to provide benefits to students and the environment.
- **SOUTH COURT:** The roof of the existing basement is reused as a south-facing courtyard that solves fire separation requirements, enhances solar and natural ventilation access, provides pedestrian access across the site, and creates a sunny outdoor space for classes to use in warm weather.

- **SITE ECOLOGY:** The 1,450 SF landscaped area along the north property line serves several purposes as well. It works with the new building to transition the institutional campus scale to the residential scale of the community. Planted with draught-tolerant landscaping and Incentive Cedars, this area preserves habitat for native birds and other species. It also serves as a bio-swale / rain garden that filters all roof drainage before it enters the storm drainage system.

Bioclimatic Design

The building is oriented for maximum solar and natural ventilation benefit. A high performance envelope with integrated sunshades takes and manages external building loads. - Photo Credit: LMS Architects

Elevations: The four elevations architecturally respond to each orientation. - Photo Credit: LMS Architects

The site is located in the warm, marine climate of the Northern California inland coastal region. Adjacent Soda Hall steps up to the south away from the site, affording excellent solar access. Four story Etcheverry Hall to the west of the site partially shields the site from seasonal winds and the low western sun. The building fully engages this climate and site, benefitting from natural systems while connecting students to the daily rhythms of the sun and the changing seasons unique to their place.

- **ORIENTATION:** The building is oriented on an east-west axis for optimal solar benefit. This creates a wind-protected, sunny courtyard to the south while enhancing building access to passive solar heating, daylighting, natural ventilation and a continuum of indoor / outdoor

spaces at the first floor.

- **COMPACT MASS:** A compact building mass with an efficient skin-to-floor area ratio helps to reduce thermal transfer. A narrow, 55 ft. deep floorplate and 14 ft. ceilings, promote excellent natural ventilation and daylight penetration.
- **HIGH-PERFORMANCE ENVELOPE:** A highly insulated envelope, with exterior insulation, rain screen cladding and integrated sun-shading on three exposures, manages external building loads. Energy Star-rated cool roofing and high-albedo paving help to further reduce cooling loads in warm weather.

Light & Air

*100% of instructional spaces
above the basement level
enjoy abundant daylight,
natural ventilation and views
to the exterior. - Photo Credit:
Photos: Tim Griffith; Graphics:
LMS Architects*

*Typical studio interior: Flexible
studios support design, rapid
prototyping and fabrication. -
Photo Credit: Tim Griffith*

*East Lobby at Le Roy
Avenue: Daylight enlivens*

public spaces throughout the day. - Photo Credit: Tim Griffith

The design emphasizes simple solutions that maximize energy efficiency, user comfort and biophilic connections to nature while reducing first cost and long-term maintenance.

- **DAYLIGHT:** The narrow building floorplate presents a shaded façade to the south for optimum daylight harvesting. Large north-facing windows and interior glazing help to reduce internal glare. 100% of instructional spaces above the basement and 85% of all regularly occupied spaces are day-lit.
- **BIOPHILIC BENEFITS:** The biophilic benefits of daylight were also considered in the design, ensuring that public spaces are enlivened throughout the day.
- **VIEWS:** Transparency is a key strategy used to promote a healthy learning community and individual well-being. 100% of instructional spaces above the basement and 85% of all regularly occupied spaces enjoy views to the outdoors.
- **AIR:** The building opens to the prevailing winds, allowing 100% of instructional spaces above the basement level and 85% of all regularly occupied spaces to be naturally ventilated. Mechanical ventilation provides added fresh air when windows are closed, providing 30% additional outside air above code requirements. Material selection, including no-VOC paints, adhesives and sealers, formaldehyde-free materials, etc., ensures healthy indoor air quality. IAQ Management Plans were implemented during the construction and pre-occupancy periods.

Metrics

Daylighting at levels that allow lights to be off during daylight hours:

85%

Views to the Outdoors:

85%

Within 15 feet of an operable window:

85%

Water Cycle

100% of roof drainage is piped from the south to a 1,400 SF landscaped bio-swale and rain garden on the north side of the tight urban site, slowing and bio-filtering stormwater before entering

the city storm sewer. - Photo

Credit: LMS Architects

Located in a semi-arid climate that experiences periodic droughts, the project reduces total potable water use by 50% and treats 100% of roof drainage on the small, constricted site.

- **BUILDING WATER USE:** Ultra-low flow fixtures reduce building water consumption by 50% from baseline.
- **LANDSCAPE WATER USE:** Drought-tolerant landscaping, sub-surface drip irrigation systems and advanced, weather-based irrigation controllers combine to reduce landscape water use by 50% from baseline. The small size of the site's landscaped area makes efficient use of available land while further reducing water consumption for landscaping.
- **STORM WATER MANAGEMENT:** 100% of the project's roof drainage is piped from the south to the small, 1,400 SF northern landscaped area, where it is delayed, absorbed and filtered by a bio-swale and rain garden. Excess filtered stormwater is delivered to the city storm sewer.

Metrics

Percent reduction of regulated potable water:

50%

Is potable water used for irrigation:

Yes

Percent of rainwater from maximum anticipated 24 hour, 2-year storm event that can be managed onsite:

0%

Energy Flows & Energy Future

*The project exceeds the AIA
2030 Commitment target,
using 90% less energy than
the national median for
university buildings per EPA
Target Finder. - Photo Credit:
LMS Architects*

The project exceeds the AIA 2030 Commitment target, using 90% less energy than the national median for university buildings per EPA Target Finder.

- **HIGH-PERFORMANCE ENVELOPE:** The thermally-broken envelope integrates added insulation, sun shading, cool roof, high-performance glazing and daylighting to reduce

heating, cooling, and lighting loads.

- **VENTILATION:** The building is naturally ventilated, augmented by code-required mechanical ventilation in internal areas and the basement. 30% more outdoor air than ASHRAE standards is provided to enhance indoor air quality when windows are closed.
- **THERMAL COMFORT:** Space heating is provided by hydronic radiators, augmented by tempered mechanical ventilation air. Cooling is provided by natural ventilation and ceiling fans, augmented by “bump cooling” delivered by the mechanical system.
- **ENERGY PIGGYBACK:** The building utilizes surplus hot and chilled water for space conditioning from adjacent Soda Hall, saving the cost, embodied energy and space required to generate these resources onsite.
- **LIGHTING:** Although the University required higher than normal interior light levels of 50 foot-candles due to the fine-scaled work occurring in the spaces, total lighting loads were managed through the use of efficient fixtures and controls.
- **RENEWABLE ENERGY:** A cantilevered 74kW photovoltaic array, celebrated as a signature architectural element, provides 58% of the building’s energy requirement.

Metrics

Total pEUI:

29 kBtu/sf/yr

Net pEUI:

12 kBtu/sf/yr

Percent Reduction from National Median EUI for Building Type (predicted):

90%

Lighting Power Density:

0.80 watts/sf

Upload Energy Data Attachment:

[EAp2 Min Energy Performance_EAc2 Renewable Energy.pdf](#)

Materials & Construction

Design strategies and materials were selected for economy, durability and resource efficiency. - Photo Credit: Photo: Tim Griffith; Graphics: LMS Architects

Multiple design strategies model respect for natural resources.

- **RESOURCE REDUCTION:** The building and site work were “right-sized” to fit on the tight

urban site. Material use was reduced through the design of simple forms using a straightforward structural system and conventional manufacturing dimensions.

- **MATERIALS:** Materials were selected for economy, durability, and resource efficiency. 17% of all building materials are recycled, including 50% fly ash content in foundation concrete and floor slabs, carpet, and steel. Aluminum was required to have 50% recycled content. 12% of all materials were regionally harvested and manufactured to reduce embodied energy and carbon footprint associated with shipping. 75% of all wood products are FSC-certified. Rapidly renewable materials include rubber flooring and base, linoleum flooring, and agrifiber door cores.
- **HEALTH:** Materials were researched and selected to ensure healthy indoor environments, including no-VOC, vinyl-free and formaldehyde-free products. IAQ Management Plans were implemented during the construction and pre-occupancy periods, including a two-week building flush-out.
- **WASTE REDUCTION:** 1,595 tons (97%) of site and construction debris was recycled and diverted from landfills. Recycling and composting stations throughout the building promote ongoing waste management.

Long Life, Loose Fit

The steel and concrete building was designed for a minimum useful life of 100 years.

- **RESILIENCE:** Located in a seismically active region, the building was designed to meet University seismic requirements that exceed the California Building Code in order to enhance life safety and minimize damage in a seismic event. Strategies included the use of simple, self-bracing building forms and high-efficiency seismic systems.
- **DURABILITY:** Major finishes were selected for durability, low maintenance and fire resistance. The primary exterior finishes are concrete and metal panels. Primary interior finishes - polished concrete floors and painted drywall - are easily maintained with light cleaning and paint.
- **FLEXIBILITY:** The building was designed to provide flexibility in both short and long terms. In the short term, teaching spaces are easily adaptable to evolving curricula and technologies. To the greatest extent possible given the specialized nature of the program, spaces were generalized to allow for future adaptation to unforeseen alternative uses in the long term.
- **ADAPTABILITY:** If the College of Engineering decides to relocate at some point in the future, the building could easily be converted to another use beneficial to the University. .

Collective Wisdom & Feedback Loops

- **DESIGN DIALOGUE:** The Design Team engaged the College of Engineering and University representatives in focused workshops addressing sustainability, comfort, operability and maintenance throughout the design phases. This helped to solidify low-energy strategies early in design while also managing occupant expectations.
- **ENERGY MODELING:** A project goal of exceeding the AIA 2030 Commitment target was established at the first owner and consultant meetings. The energy model was updated frequently throughout the design phases to confirm compliance with this goal.
- **RENEWABLE ENERGY:** Due to budget constraints, the renewable energy system was held

out of the base project scope and funded late in construction solely due to the efforts of the Assistant Dean of the College of Engineering.

- **ENERGY PERFORMANCE:** Based upon the University's online energy performance monitor, the building has performed consistently with predictions for the first 4 months of occupancy.
- **POST-OCCUPANCY EVALUATION:** The project has been operational for 4 months. A POE through UC Berkeley's Center for the Built Environment is planned for the near future.

LESSONS LEARNED:

- Establish and document energy goals and performance expectations early in design
- Integrate energy and thermal comfort modeling closely with the design process
- Committed individuals can have a profound impact on project success!
- Extended post-occupancy monitoring and system adjustment is critical to meeting advanced energy goals.

Other Information

Cost and Payback Analysis:

The Owner wished to maximize sustainable design benefits while using readily-available, simple and cost-effective methods. A cost and payback analysis was not required.

Process and Results:

The project process comprehensively engaged all design team members and the community in all phases.

PRE-DESIGN:

- The design team undertook a detailed analysis of the site micro-climate and historic ecologies prior to the start of design.
- Design workshops with school administration and user groups identified energy-efficiency, thermal comfort, resource-efficiency and building health goals.

DESIGN:

- Focused student and faculty design discussions were held at key project milestones.
- A detailed Building Performance Narrative was prepared and presented to the Owner for approval early in the design phase. This document defined project energy and resource efficiency goals, as well as the anticipated thermal comfort ranges, helping to confirm user buy-in and future expectation.

MEASUREMENT & VERIFICATION / POST-OCCUPANCY EVALUATION

- The project has been occupied for five months and Post Occupancy Evaluation is on-going. Thus far it has included interviews with faculty and facility staff, as well as preliminary review of initial energy use data.

Additional Images

North elevation from Ridge
Road - Photo Credit: Tim
Griffith

Project Team and Contact Information

Primary Submission Contact:

William Leddy, FAIA

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677 Harrison Street

San Francisco California 94107

United States

Project Team:

Role on Team	First Name	Last Name	Company	Location
Owner's Representative	Ken	Defiebre	KSD Group	Concord , CA
Structural Engineer	Mason	Walters	Forell/Elsesser	San Francisco, CA
Landscape Architect	Cliff	Lowe	Cliff Lowe Associates	San Francisco, CA
Mechanical, Plumbing, Fire Protection Engineer (Basis of Design)	Tyler	Bradshaw	Integral Group Engineers	Oakland, CA
Electrical Engineer (Basis of Design)	David	Kaneda	Integral Group Engineers	San Jose, CA
Civil Engineer	John	Lamon	BKF	Pleasanton, CA
Acoustical Consultant	Charles	Salter	Charles M. Salter Associates	San Francisco, CA
Decorative Panel Design Concept	Anne	Thompson	UC Berkeley Student	Berkeley, CA
Specifications Consultant	Richard	Fiory	Topflight Specs	San Francisco, CA
Lighting Consultant	David	Malman	Architectural Lighting Design	San Francisco, CA

Surveyor	Walter	Stemberga	BKF	Pleasanton, CA
Telecommunications Consultant	Justin	Mehtlan	McMillan Data Communications	San Francisco, CA
Security Consultant	Manny	Monje	Siemens Industry, Inc.	Hayward, CA
Waterproofing Consultant	Ken	Klein	Simpson Gumpertz & Heger	San Francisco, CA
Cost Estimator	David	Cobb	Davis Langdon / AECOM	San Francisco, CA
Arborist	Jim	Clark	HortScience	Pleasanton, CA
Code Consultant	Jared	Mattern	Rolf Jensen	Walnut Creek, CA
Commissioning	Darren	Goody	Facility Dynamics Engineering	Happy Valley, OR
Contractor and Construction Manager	Pat	Callahan	Hathaway Dinwiddie	San Francisco, CA

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