BAKERSFIELD COLLEGE

SCIENCE AND ENGINEERING BUILDING

EXECUTIVE SUMMARY

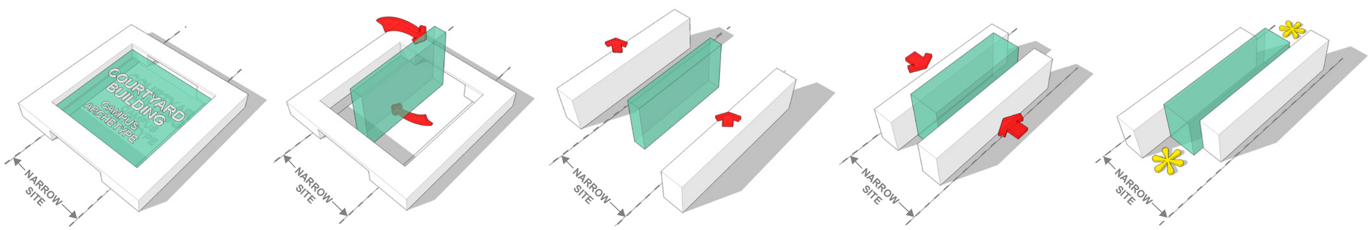
The new Science and Engineering Building reinvents the courtyard archetype of the historic campus into a vertical atrium, a beacon for scientific observation, discovery, and learning. Envisioned as the new hub for the STEM program on campus, the design puts the science labs, classrooms, and activities on display, raising the profile of the STEM programs not just on campus but also the larger community. This showcase building gives students pride in their academic program and in the larger institution. Students learn skills and work on equipment with real world applications. Specialized facilities from the Robotics Lab to the Makers Space directly benefit students academically but also offer opportunities for partnerships with local businesses fostering connections between students and future careers. We designed the facility as a place to see things differently, choreographing the unfolding of knowledge in space centered around the vertical "courtyard" atrium, designed to maximize the narrow site with simple lines reminiscent of the original Mid-century Modern campus buildings. This interior atrium serves as an incubator, a space for study, learning, observation, and interaction making the building itself an instrument of scientific study. Working with the Dean, scientific concepts have informed the design process from brick patterns based on the atomic energy levels around a nucleus, to an exterior façade panelized based on the Fibonacci sequence. The building is a place to learn to see things differently, discover how things work, and discover the natural world through science and engineering.

SCOPE OF WORK AND BUDGET

- **Institutional/Education:** Bakersfield College, Kern Community College District
- **Location of Project:** Bakersfield, CA
- 3-story Science and Engineering Laboratory Building
- **Building Area (sf):** 69,988 GSF
- **Construction Cost:** $53,000,000
- **Completion Date:** Completed August 2022
- **Cost:** $757/sf

"The challenge was to design a STEM learning building not a STEM instructional building. That is what your team accomplished. Learning is built into the building by design."

-Dr. Stephen Waller, Dean of Instruction,
Math, Science, and Engineering



"Courtyard" Atrium Massing Diagram

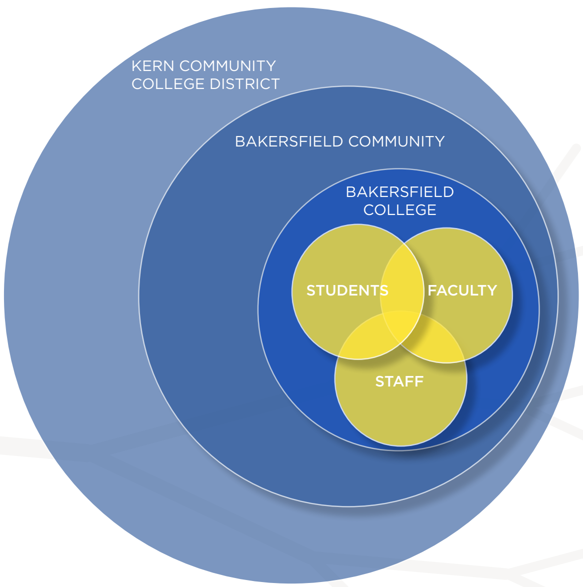
SCHOOL & COMMUNITY
DESCRIBE THE COMMUNITY

Bakersfield College, one of the nation's oldest continually operating community colleges serves 33,000 students annually, providing opportunities for students from diverse economic, cultural, and educational backgrounds to attain Associate and Baccalaureate degrees, certificates, and workplace skills. The student-focused rigorous and supportive learning environment promotes equity and fosters students' abilities to think critically, communicate effectively, and demonstrate competencies and skills to engage productively in their community and the world.

SCHOOL & COMMUNITY
IDENTIFY STAKEHOLDERS

The primary stakeholders were the students, staff, and faculty, each with their own set of needs and priorities. Students and teachers both needed 21st century classroom and lab spaces, with abundant daylight and modern equipment. Beyond that students needed places outside of class to collaborate and study with their peers. Faculty needed to be accessible to students. The administration also wanted a facility that would celebrate their science and engineering program, showcasing it for both those on campus and in the surrounding community.

SCIENCE AND ENGINEERING STAKEHOLDERS



"This is a building built for all our students and it's built for learning."

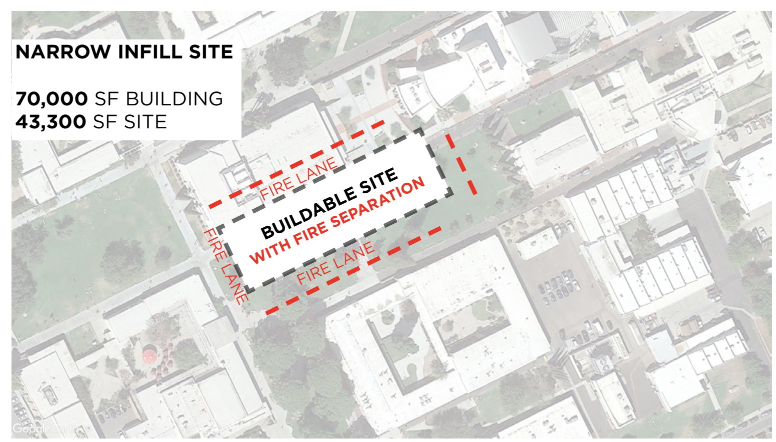
-Dr. Stephen Waller, Dean of Instruction, Math, Science, and Engineering

Amphitheater Stair

SCHOOL & COMMUNITY
NAME CHALLENGES

The project site posed the biggest challenge. The site is both narrow and has a 12' grade change along it's length. To maintain a feeling of open space and fire separations from nearby buildings a three-story building was necessary, which can make collaboration more difficult due to the separations between floors and departments. The solution was the vertical atrium space interconnecting the floors, with each seen as a neighborhood. Engineering and Physics on the first, Life Sciences on the second, and Chemistry on the third. The project takes further advantage of the atrium to take advantage of the grade change with users from the East parking entering directly into the second floor at the top of the lobby Amphitheater gathering space. This eliminated any below grade level program spaces.

The other notable challenge was faced during construction with material shortages caused by COVID-19, particularly the specified brick and metal lathe for the plaster system. The design team and contractor brought solutions to address these issues as they arose that benefited the client and mitigated schedule issues to bring the project to a timely completion.



DESCRIBE AVAILABLE ASSETS

The new Science and Engineering Building's main entry plaza is directly off of the existing Science Building allowing for collaboration between old and new.

Situated in the historic core of campus, the college stakeholders wanted the new Science Building to fit in harmony with the context, with similar materials and simple rectilinear forms.

VALUE OF PROCESS AND PROJECT TO COMMUNITY AT LARGE

The new Science and Engineering building gives students a path to contribute back to their community. Students learn skills and work on equipment with real world applications. Specialized facilities from the Robotics Lab to the Makers Space offer opportunities for partnerships with local industry fostering connections between students and future careers. Serving 33,000 students annually, Bakersfield College is one of only 15 community colleges offering bachelor's degrees as part of a pilot program. The Industrial Automation program now housed in the new Robotics Lab is one of those degrees, a program which according to the Dean **"100-percent get job offers at local companies before they wind up graduating."**

EDUCATIONAL ENVIRONMENT DESIGN
EXPLAIN THE EDUCATIONAL VISION AND GOALS OF THE SCHOOL & HOW DESIGNED ENVIRONMENT SUPPORTS THE CURRICULUM

The college envisioned a flexible building that would complement the Mid-century Modern campus and celebrate the STEM program, giving it an elevated presence and providing students with a modern facility to learn skills and work on equipment with real world applications. The program the building supports creates opportunities for partnerships with local industry fostering connections between students and their future careers.

"The challenge was to design a STEM learning building not a STEM instructional building. That is what your team accomplished. Learning is built into the building by design."

-Dr. Stephen Waller, Dean of Instruction, Math, Science, and Engineering

Robotics and Industrial Automation Lab

EDUCATIONAL ENVIRONMENT DESIGN
DEPICT & ILLUSTRATE HOW THE DESIGNED ENVIRONMENT SUPPORTS A VARIETY OF LEARNING & TEACHING STYLES


Hands on Learning


Laboratory and Classroom Learning


Collaborative Group Study

EDUCATIONAL ENVIRONMENT DESIGN
HOW THE ENVIRONMENT IS ADAPTABLE AND FLEXIBLE

The planning was based on a 44’ lab module, organized and stacked in simple linear bars to maximize efficiency and future adaptability. The straightforward organization paired with high floor-to-floor heights provides flexibility for the future, groups the labs into scientific neighborhoods, and allows the interior “courtyard” atrium to be a place of interest and collaboration, with overlooks, views, seating, and daylight for students and faculty. Moveable furniture and a variety of collaborative seating spaces from quiet laptop bar for individuals to group seating areas and white boards for small group study provide students with the opportunity to adapt the space to their needs. Engineering spaces such as the Robotics Lab and Makerspace are highly reconfigurable with features such as overhead power umbilicals and a mix of instructional and hands-on space.

RESULTS OF THE PROCESS & PROJECT

DESCRIBE & ILLUSTRATE HOW THE PROJECT ACHIEVES EDUCATIONAL GOALS AND OBJECTIVES

"When you walk the space of this beautiful science and engineering building it is clear that it is made for us. It was built for learning and student collaboration and it was designed to intentionally inspire curiosity and STEM based careers of the future. This building is going to be a game changer for us."

-Shehrazad Barraj, Student Trustee, President of Bakersfield College student government association

Confined by a narrow site, the new Science and Engineering Building reinvents the courtyard archetype of the historic campus into a vertical atrium, a beacon for scientific observation, discovery, and learning. Envisioned as the new hub for the STEM program on campus, the design puts the science labs, classrooms, and activities on display, raising the profile of the STEM programs not just on campus but also in the larger community. This showcase building gives students pride in their academic program and in the larger institution. Students learn skills and work on equipment with real world applications. Specialized facilities from the Robotics Lab to the Makers Space directly benefit students academically but also offer opportunities for partnerships with local industry fostering connections between students and future careers.

EDUCATIONAL ENVIRONMENT DESIGN
DESCRIBE & ILLUSTRATE HOW THE PROJECT ACHIEVES SCHOOL DISTRICT GOALS

1 Develop an inclusive and diverse workforce that is reflective of our community and is cohesive and productive.

2 Improve access to inclusive, equitable, and high quality education

"This building is a demonstration of BC's growth and forward thinking. It is innovative, collaborative, creative, inspirational, and focused on the latest technology in science which we all know will help us create the healthy futures we all aim for."

-Shehrazad Barraj, Student Trustee, President of Bakersfield College student government association

3 Deliver proactive, data-driven leadership that actively seeks out and encourages diverse perspectives.

EDUCATIONAL ENVIRONMENT DESIGN
DESCRIBE & ILLUSTRATE HOW THE PROJECT ACHIEVES COMMUNITY GOALS

According to District Board President Romeo Agbalog,

"If Kern County was going to continue to lead, we needed to do things differently in order to prepare the workforce. So here we are... Nearly 50% of the jobs in metropolitan Bakersfield were subject to automation and about 90% of those jobs in the areas of production were subject to automation. That really challenged us to think big and to be innovative and do things a little bit different if Kern County was going to continue to lead we needed to do things differently to prepare the workforce of the future."

The new Science and Engineering building was an investment from the community in the college via a bond program. Not just an investment in the college, but more importantly an investment in the students and their futures. The building and Bakersfield College's STEM program helps students prepare for that future, giving them the tools they need to succeed in the 21st Century.

DESCRIBE & ILLUSTRATE ANY UNINTENDED RESULTS AND ACHIEVEMENTS OF THE PROCESS & PROJECT

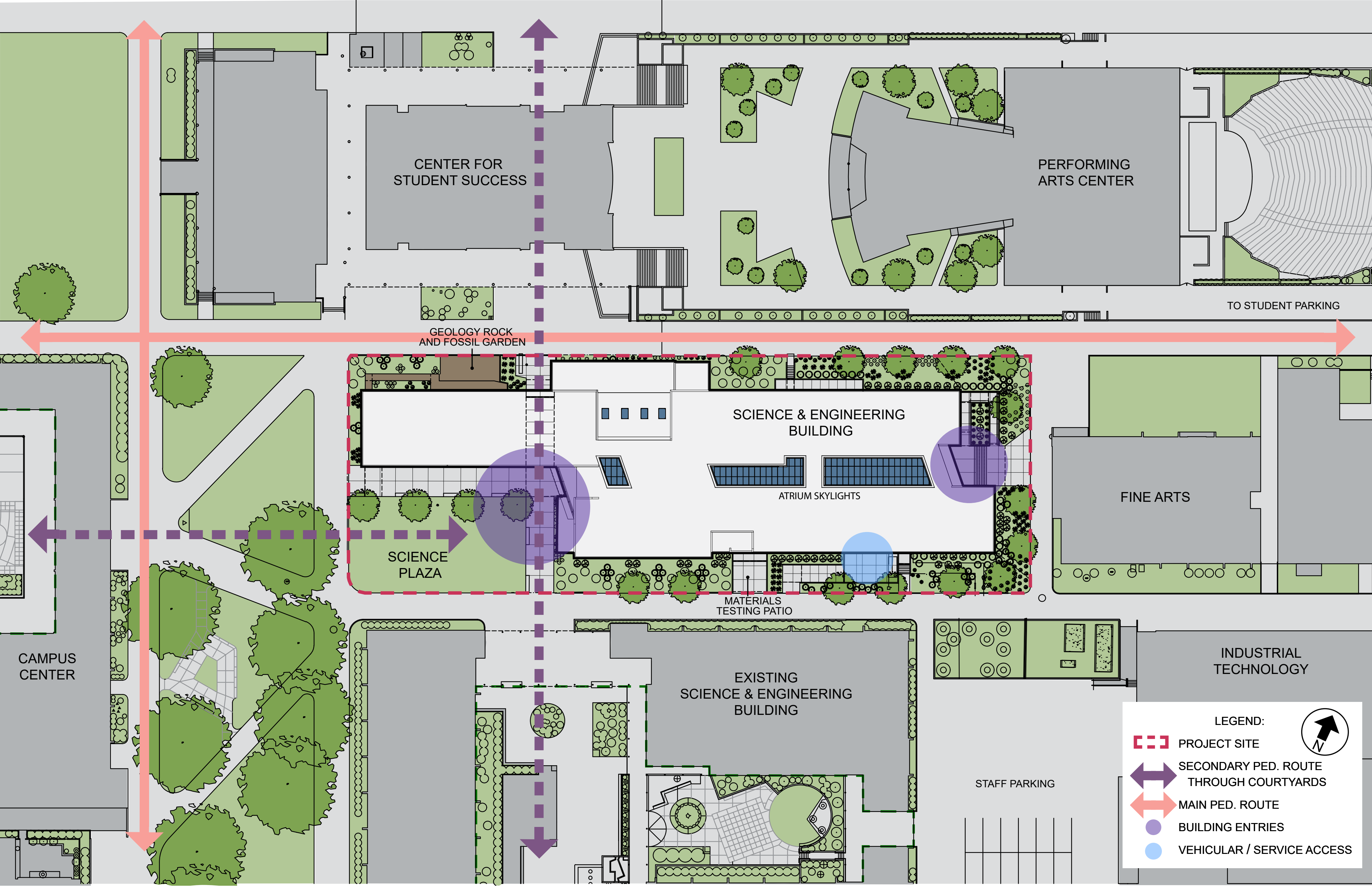
The students and faculty are making the building their own! The best outcome has been the unexpected uses the faculty, students, and Dean are inventing for the new building and spaces to both celebrate STEM learning and create learning opportunities. Envisioning the building as an instrument for learning, the Dean is collaborating with other departments to celebrate Science in the building, using the amphitheater stair seating for a STEM-inspired play, curating a STEM art show in the atrium, and creating an indoor exercise route for the football team that will always be 72 degrees. The high volume spaces of the atrium and Robotics lab may become drone testing aerial racetracks. A post-occupancy walkthrough with the Dean revealed that the students are making the building their own, from paper airplane competitions, collaborating in the hallways, using the white boards, and finding quiet places to study between classes and labs.


Quiet Spaces


Collaboration


Atrium Drone Flight


Flexible Work Spaces



PHYSICAL ENVIRONMENT DESIGN

DEPICT & ILLUSTRATE
THE SITE PLAN

Site Circulation

The new Science and Engineering building site is ideally situated on campus at the nexus of primary pedestrian paths. It conveniently bookends the North side of the Science and Engineering quadrant becoming the new public face for the science departments in this prominent location adjacent to the Center for Student Success and the Campus Center.

The site is also centered on two secondary courtyard axes, allowing students to pass through courtyards and buildings for shortcuts around campus. This characteristic is unique to the campus so the building planning is intended to preserve and add to these "courtyard" shortcuts.

Landscape

The twelve-foot elevation change across the site combined with the need to match up new walkways with existing creates a variety of challenges. Solving this involved coordination between the design team to locate ramps and walks to accommodate an accessible path, while developing planting areas to soften the retaining walls and disguise the elevation drops.

The southwest corner of the site connects to an existing green space outside the Campus Center. We are continuing this green space onto the site and are also using the green area as a low point to capture runoff from the main entry walks at the southwest corner of the building, reducing the number of drain inlets. The entry walks have built-in benches with gaps to allow for water to sheet flow to the turf. The remainder of the landscape includes low water use plants and shade trees with efficient irrigation to reduce water consumption.

Scientific Neighborhoods Within the Vertical "Courtyard"

Department Legend

- CORE
- ENGINEERING AND ROBOTICS LABS
- FACULTY OFFICES
- ATRIUM “COURTYARD”
- PHYSICS LABS
- STORAGE
- ANATOMY LABS
- BIOLOGY LABS
- ORGANIC CHEMISTRY
- CHEMISTRY LABS
- GENERAL CLASSROOMS
- COMPUTER CLASSROOM

PHYSICAL ENVIRONMENT DESIGN
DEPICT & ILLUSTRATE THE PHYSICAL ATTRIBUTES OF THE ENVIRONMENT

The context of the Bakersfield College campus and more importantly of the immediate project site has a strong consistent language pulling from its mid-century modernism. The historical campus architecture, built in 1956, has a longevity due to the simple yet powerful forms and select material palette of primarily brick, concrete, and plaster.

The historical campus' greatest strength is it's consistency. Understanding the context and it's core attributes is extremely important as the project site is situated in the very core of the original historical campus buildings.

PHYSICAL ENVIRONMENT DESIGN

DEPICT & ILLUSTRATE HOW THE FACILITY FITS WITHIN THE LARGER CONTEXT OF THE COMMUNITY

It was critical that the new Science and Engineering Building honor the campus buildings around it. The design compliments the Mid-Century context without blindly copying it, a new 21st century building fitting into a campus with decades of history.

Form

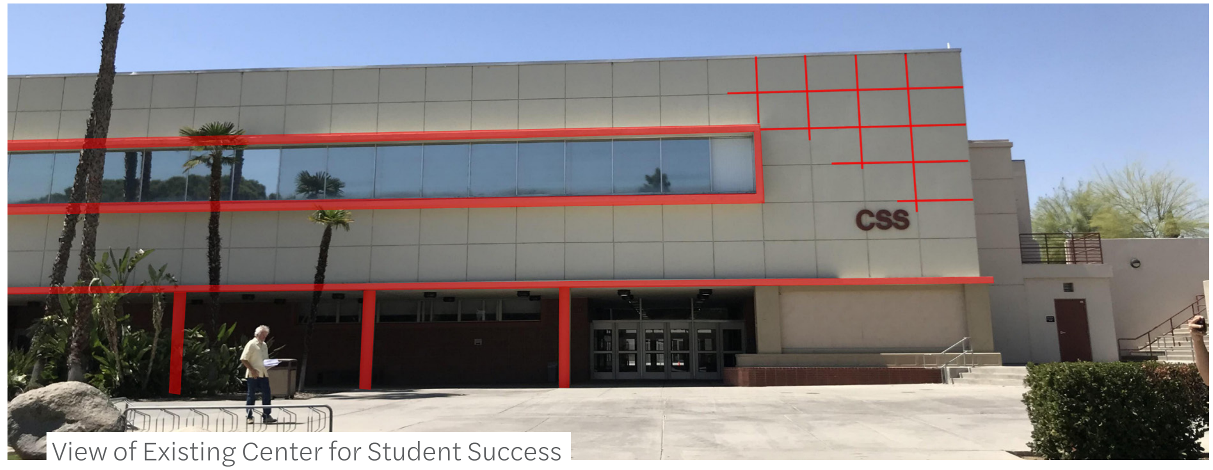
The exterior campus buildings tend towards an honest simplicity achieved by rectilinear forms. There is a clear use of the same language of form from building to building. And like a spoken language, this language of shapes, while simple, can create variety between buildings yet still be understandable and consistent.

- Courtyard spaces reinvented to be an interior atrium
- Simple rectilinear forms
- Horizontal brick base
- Strong horizontality
- Floating volumes and planes

Material

The exteriors of the existing campus buildings are simple and straightforward. This combined with the material palette limited to a handful of materials has helped lend the campus a consistent and modern simplicity.

- Simple white volumes of plaster and concrete
- Flat planar surfaces
- Orthagonal grid patterns
- Red brick in a stacked bond pattern accentuating the horizontality



View of Existing Center for Student Success


View of Existing Science and Engineering Building


View of Existing Campus Center

PHYSICAL ENVIRONMENT DESIGN
DESCRIBE & ILLUSTRATE HOW THE PROJECT INSPIRES AND MOTIVATES

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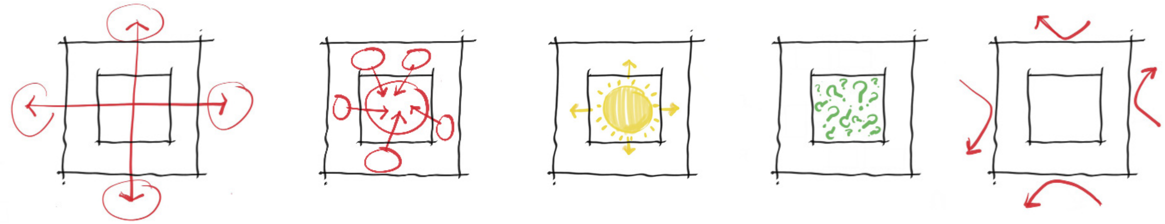
A SPACE MEANT FOR STUDENT COLLABORATION AND INSPIRATION



LINK TO CAMPUS — CONNECTIONS TO CAMPUS AND STEM QUAD

A PLACE TO BE — OPPORTUNITIES FOR CONNECTIONS BETWEEN STUDENTS AND TEACHERS

LIGHT AND AIRY — BRINGING IN DAYLIGHT AND VIEWS FOR HEALTH AND WELLNESS

ENGAGING AND COMFORTABLE — A PLACE FOR YOUR MIND TO WANDER

INCUBATOR SPACE — A RETREAT, SHELTERED FROM DISTRACTION

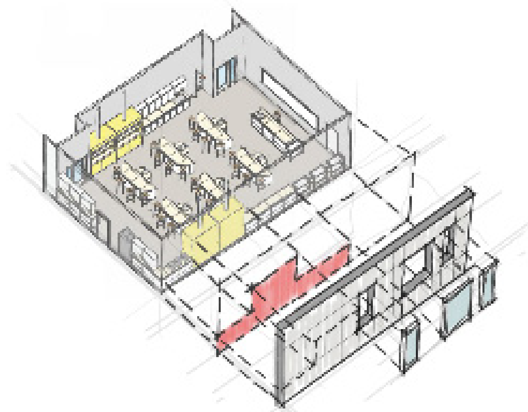
Diagramatic representations such as this help scientists visualize abstract concepts like the electronic configuration within atoms.

SCIENCE ON DISPLAY

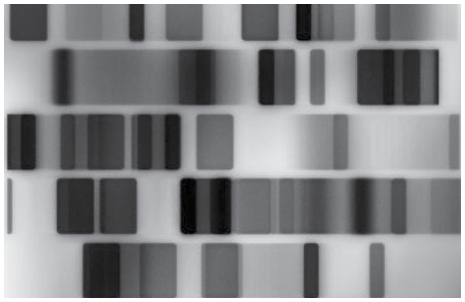
Electrons within an atom are arranged according to energy levels as indicated to the left. Orbital levels with lower energies are filled before those with higher levels according to the Aufbau Principle. This pattern is hidden in the main entries brick pattern detailing.

THE BUILDINGS "DNA"

The building windows act almost like the "DNA" of the laboratories. Rather than force the labs to fit a window pattern, this approach starts inside and lets the lab function and equipment dictate window placement. This creates an interesting DNA-like pattern, a seemingly random window arrangement that in actuality is **driven by function.**



Lab Equipment Informs Window Placement



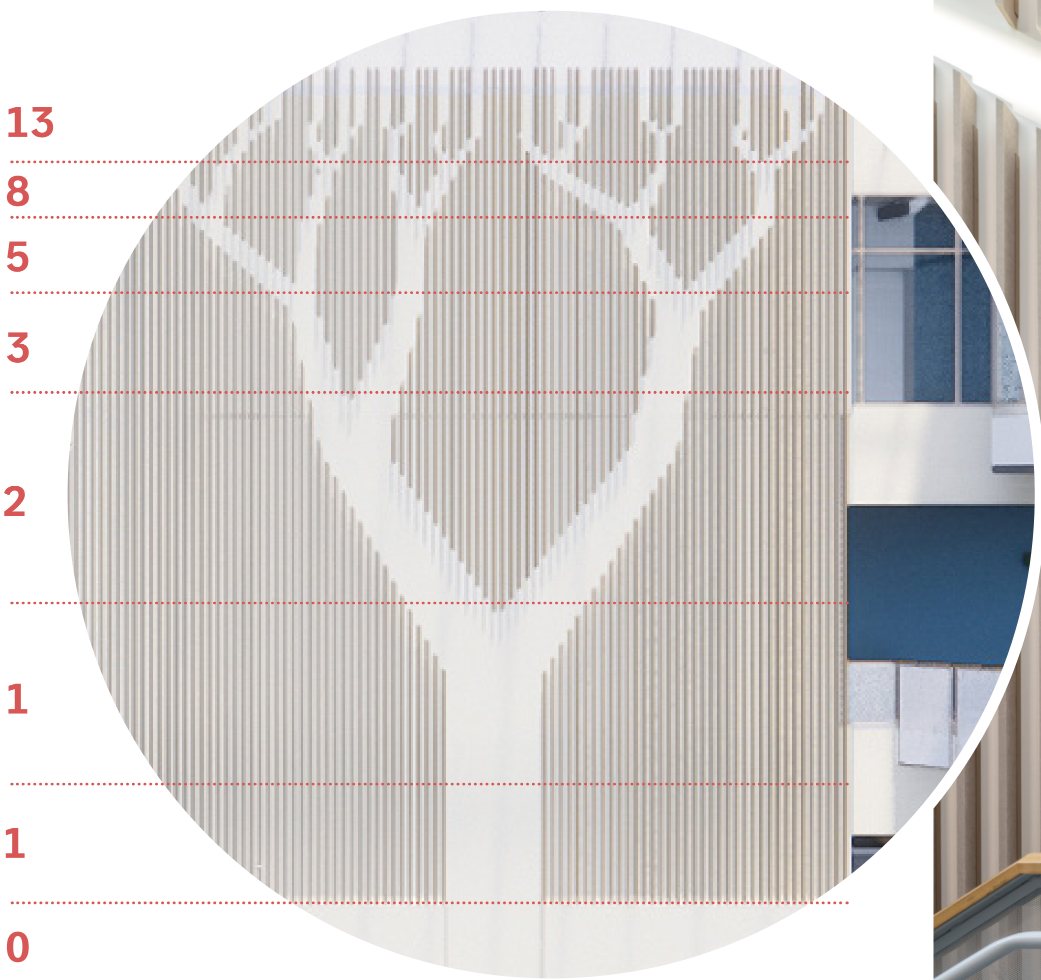
At times scientific evidence appears random yet has an underlying order that has yet to be discovered.

HIDDEN SCIENCE CONCEPTS TO DISCOVER

Fibonacci Acoustical Tree

0, 1, 1, 2, 3, 5, 8, 13, 21...the **Fibonacci Sequence** occurs both in mathematics and biology. Starting at 0 and 1, each number in the sequence is the sum of the two preceding numbers.

The branching of a tree is an example of the Fibonacci sequence occuring in nature.



SUSTAINABILITY AND WELLNESS

DESCRIBE & ILLUSTRATE THE ENERGY-EFFICIENCY WITHIN THE SOLUTION

Laboratories are inherently energy intensive projects, but through the practical design strategies below, the building is projected to achieve a **74% EUI reduction** from the benchmark EUI for a lab building.

1. Drought-tolerant landscaping conserves water and outdoor Geology rock and mineral garden along promenade

2. Prominent Robotics Lab and Makerspace helps showcase the engineering program

3. Building organized on an efficient repeating 44’ module of stacked labs to simplify construction

4. Cool Roof

5. Main Entry from Quad

6. Industrial Automation Robotics Lab offers a Bachelor’s degree, making students immediately marketable to local employers

7. Low-water plumbing fixtures

8. LED lighting throughout

9. Variety of seating options and collaboration spaces

10. Exposed steel structure and polished concrete slabs minimize material use

11. Secondary Entry from Parking

Inspired by **the idea of discovery**, the workings and structure of the building are exposed

Quiet **study bridge**

Acoustical **Fibonacci tree** controls noise

Daylit storage and prep rooms

Prominent Makerspace location showcases the engineering program

Robotics **Lab overlook**

“Courtyard” atrium with skylights

Bright **spacious labs**

Seating stair, with projector and screen for events

SUSTAINABILITY AND WELLNESS
DESCRIBE & ILLUSTRATE DURABLE AND GREEN MATERIALS RELATING TO MAINTENANCE

To maximize the lifespan of the building it was important to have a straight-forward material palette, leaning towards clean simplicity over anything faddish or complex. On the exterior brick, like other buildings on campus, is used at the base of the building where it sees the most traffic and contact from users and maintenance staff. Going inside, the design intentionally highlights the structure and function of the building to celebrate the nature of Science and Engineering. Steel columns and framing are exposed and durable concrete floor slabs are sealed and polished eliminating the need for additional finish materials. Perforated metal is used as a recurring material in rails, suspended ceiling panels, and stair risers. Rather than add extraneous finishes that have to be maintained, things like the acoustical lobby treatment have been turned into decorative elements communicating fundamental science concepts such as the Fibonacci Sequence.

SUSTAINABILITY AND WELLNESS
DESCRIBE & ILLUSTRATE THE HEALTHY ENVIRONMENTAL ASPECTS

To enhance the physical environment for students and faculty, we borrowed from the principles of Biophilic Design:

- **Visual connection with nature** - windows and views out onto campus
- **Dynamic and diffused light** – daylighting analysis was used to evaluate light penetration in the atrium from skylight to first floor
- **Biomorphic forms and patterns** featured throughout, including use of wood for warmth, a branching tree pattern in the lobby, and construction modules based on the Fibonacci sequence
- **The space is meant to be explored** with the 3 stories unfolding and opening up new views as students move through the building
- **A variety of seating options and study clusters** in the atrium create a sense of comfort and well-being for students, whether when studying alone quietly or hanging-out with their peers going over what they learned in lab
- **High performance air filtration**
- **The acoustical "tree" feature** in the lobby maintains comfortable noise levels