

# OVERCOMING OBSTACLES

*Appreciating Old Buildings and Adapting for New Uses*



Ben de Rubertis, Matt Garrett



*“THE IMPEDIMENT  
TO ACTION  
ADVANCES  
ACTION;  
WHAT STANDS  
IN THE WAY  
BECOMES  
THE WAY.”*

— SENECA

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# PATHWAYS TO RENEWAL

Adaptive reuse – repurposing existing buildings for a new use – is one of the most responsible and impactful ways to build. It requires fewer resources and produces lower embodied carbon than a new build of the same scope and size.

Successful adaptive reuse honors the past by showcasing the valuable aspects in old buildings. Adapting, rather than discarding these buildings, creates environments that build upon the established culture of a campus or neighborhood and serve today's needs.

However, anyone who has gone through the process of a home renovation knows it can be scary. The responsibility of transforming an outdated space into something new and better comes with pressure. Uncertainty of the right path forward and fear of failure can make potential obstacles feel daunting.

But a little fear and a little pressure – properly channeled – can be a great motivator. In this booklet, we'll address some common stumbling blocks and how you can use reason to overcome that fear.

The embodied carbon impact of retrofitting an existing structure is

**50%–75%**

lower than the impact of replacing that building with traditional new construction.

*Source: Esau, Reducing Embodied Carbon in Buildings, 2021.*

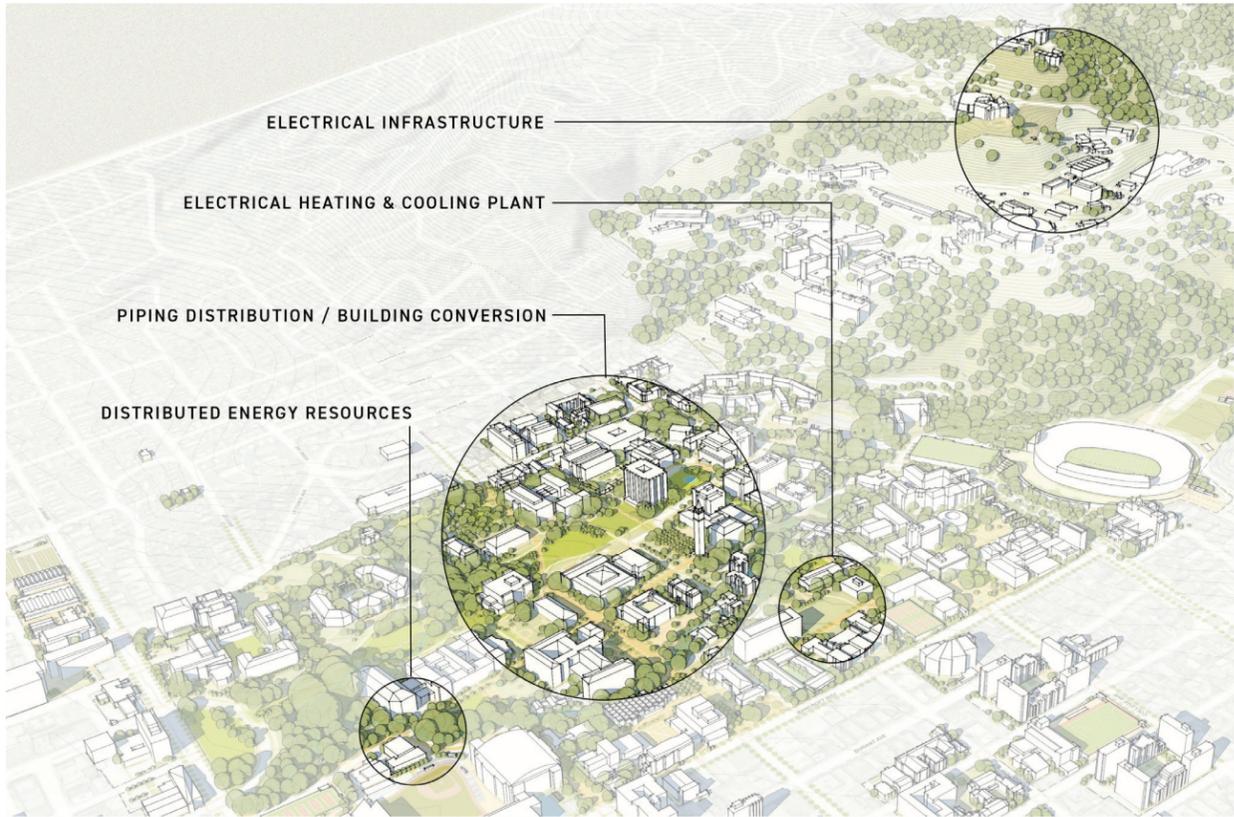
**INCREMENTAL VS.  
HOLISTIC CHANGE.**

Systems age out of relevancy at a different rate than program spaces, which can create difficult decision points around what to keep and what to throw out when reusing a building. We recommend building the strongest case for both approaches and then objectively evaluating how effectively each one meets the desired outcomes for the project. This can help remove some of the emotion from the process and add some rigor to the thinking around utilities and infrastructure.

In a few clear-cut cases, improvements are secondary considerations that support a bigger agenda for renewal. For example, a decarbonization project in the University of California system prioritizes infrastructure replacement and then will adopt programs to suit conversion of existing facilities to all-electric service.

Many projects are not so clear cut. They may come at a time when campus energy or structural conversions have been initiated but will take time to fully roll out. Considering the age of the existing infrastructure and the risk of any new investment into old technology are paramount to arriving at a good decision.

If campus modernization is 15 years to completion, this should discourage investment in soon to be outdated technology. It may also discourage limping along with existing equipment that will be costlier to replace once a new program has been installed in existing spaces.

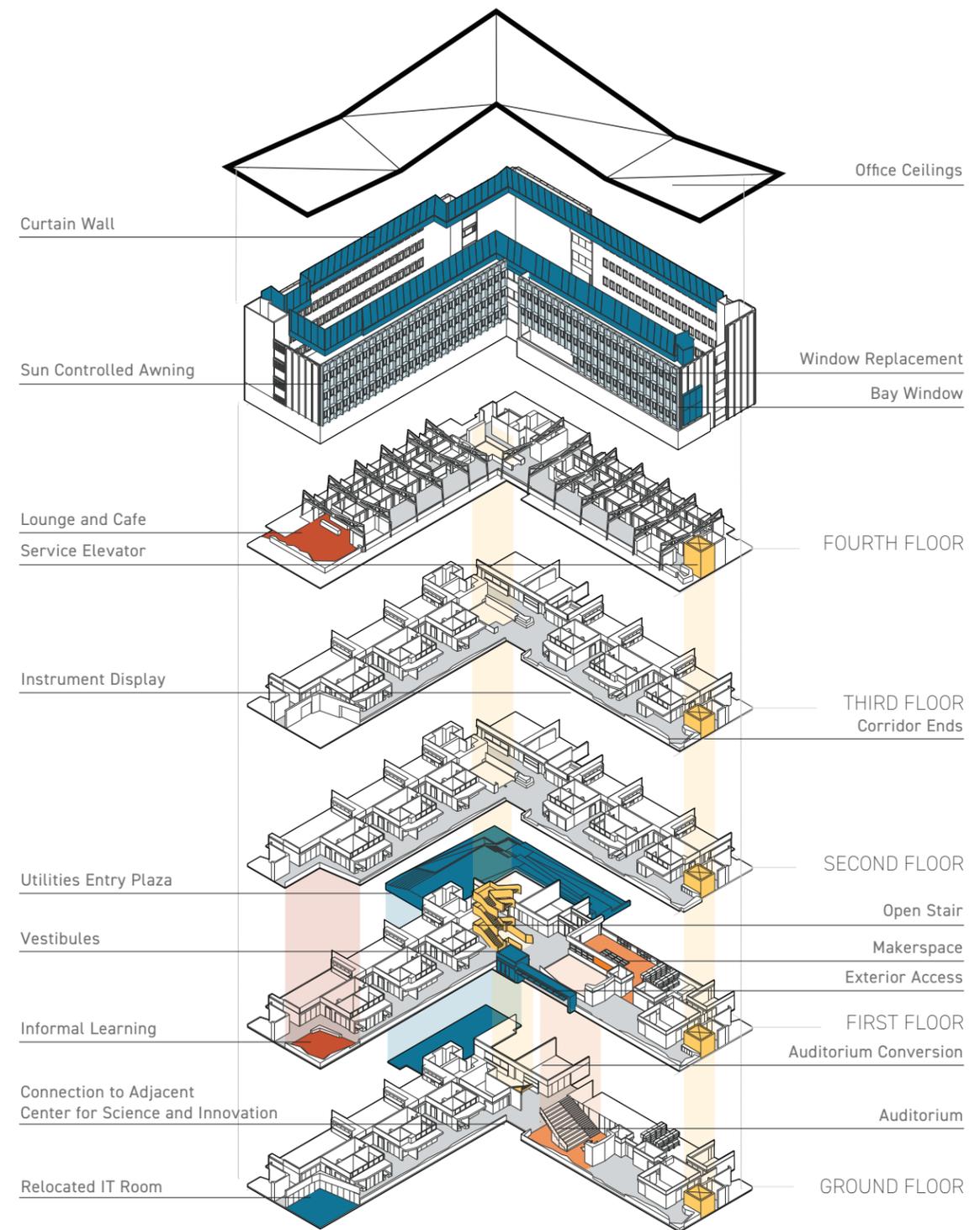


Building codes often support an incremental approach to rehabilitation, but that carries risks as well. Is it an acceptable risk to string together many small improvements that avoid seismic upgrades or compliance with model energy codes? The financial and risk impacts need to be understood together so that the strategy and finished product are coherent.

Building programs also have a tricky way of conforming to the logic established by the original structure. You'll need to understand and plan for placemaking and culture across a realistic timeline – we recommend 15-20 years – that spans several sequences of potential renovations or program improvements.

While a piecemeal approach is possible, the challenge is that the existing utilities layouts and circulation of a structure tend to passively direct possibilities toward the path of least resistance. This can block the kind of transformative change that would be expected if the facility were upgraded all at once.

Microphasing can be a key to unlock this network of overlapping challenges, but as evidenced in the case of placemaking and culture, can also introduce challenges of its own. The flexibility that comes from being able to plan improvements over time is substantial. However, it requires a plan to preserve institutional memory, prioritize culture, and commit resources to the key elements of design that will unlock potential and transform the building into a truly relevant asset.



## WHAT DOES THIS MEAN FOR SCIENCE?

### SCIENCE TEACHING AND LEARNING.

As universities and colleges embrace interdisciplinary work and extra departmental focus on grand challenges, flexibility is a major key for infrastructure. On its own, this can often be enough to tip considerations around infrastructure toward a more holistic approach.

The learning environment is often an informal student creation, the product of many hands coming together at a moment in time. The tools and resources needed to support informal learning must be ready to hand and differ greatly from the features of workplace and industry. Luckily, existing buildings can offer an inherent flexibility that cookie-cutter programs or new construction often struggle to create.

And it is notable how sticky analog technology has been on the collaborative side of science learning. Today's phone cameras have largely replaced the smart board, just as conferencing protocols have lagged behind the in-person meeting. Academic science learning will hopefully continue to be adapted and changed by learners themselves and less reliant on institutional relics.



## ACADEMIC RESEARCH.

For academic research environments, technology is moving at such speed that a one-size-fits-all concept for learning will likely not be shelf stable.

Planning considerations may not be synonymous with bench equipment, just as dry science may not be synonymous with singular workstations and dedicated faculty offices. Helping an older laboratory step into this future requires revisiting benchmarks and methodology.

We recommend choreographing the science as it is presently understood, so opportunities to share resources, especially high-volume processing equipment that can become redundant in an academic setting, as well as controlled ventilation that drives cost and complication.

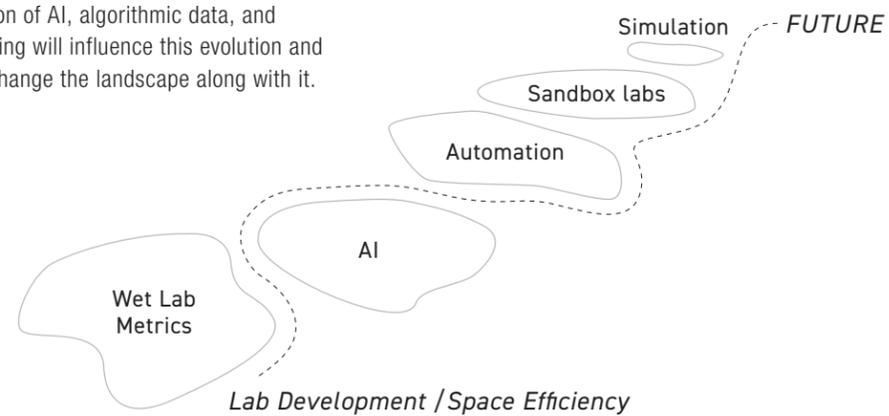
How people come together is more important than ever. This is especially true as computational work becomes more necessary to protein identification, small molecule research, and large data set interpretation.

The intersection of AI, algorithmic data, and machine learning will influence this evolution and undoubtedly change the landscape along with it.

People will always be the gate check of research. So, now it is more important than ever to pattern the research environment with opportunities to inject humanistic concerns and oversight.

In other words, all science projects at universities are adaptive reuse projects because today the cultural imprint of science research and education has never been more crucial to fair and just outcomes.

The concept of learning only as a preparation for industry has been the default mode. But learning is more than that. Young engineers and chemists do not begin their moral lives at the mature age of 50. They arrive with the skills ready to begin and should expect a lifetime of steady application as they innovate a sustainable future for all of us.



## GETTING STARTED: COMMON QUESTIONS.

**How do you decide whether an old building is worth keeping or if it's time to build something new?**

One obvious answer is to calculate it. It's always a good idea to take stock of building capacity, structural soundness, and adaptability to a new use. These are table stakes. After meeting that litmus test, calculate the carbon cost to landfill the existing structure compared to the carbon cost of building from scratch.

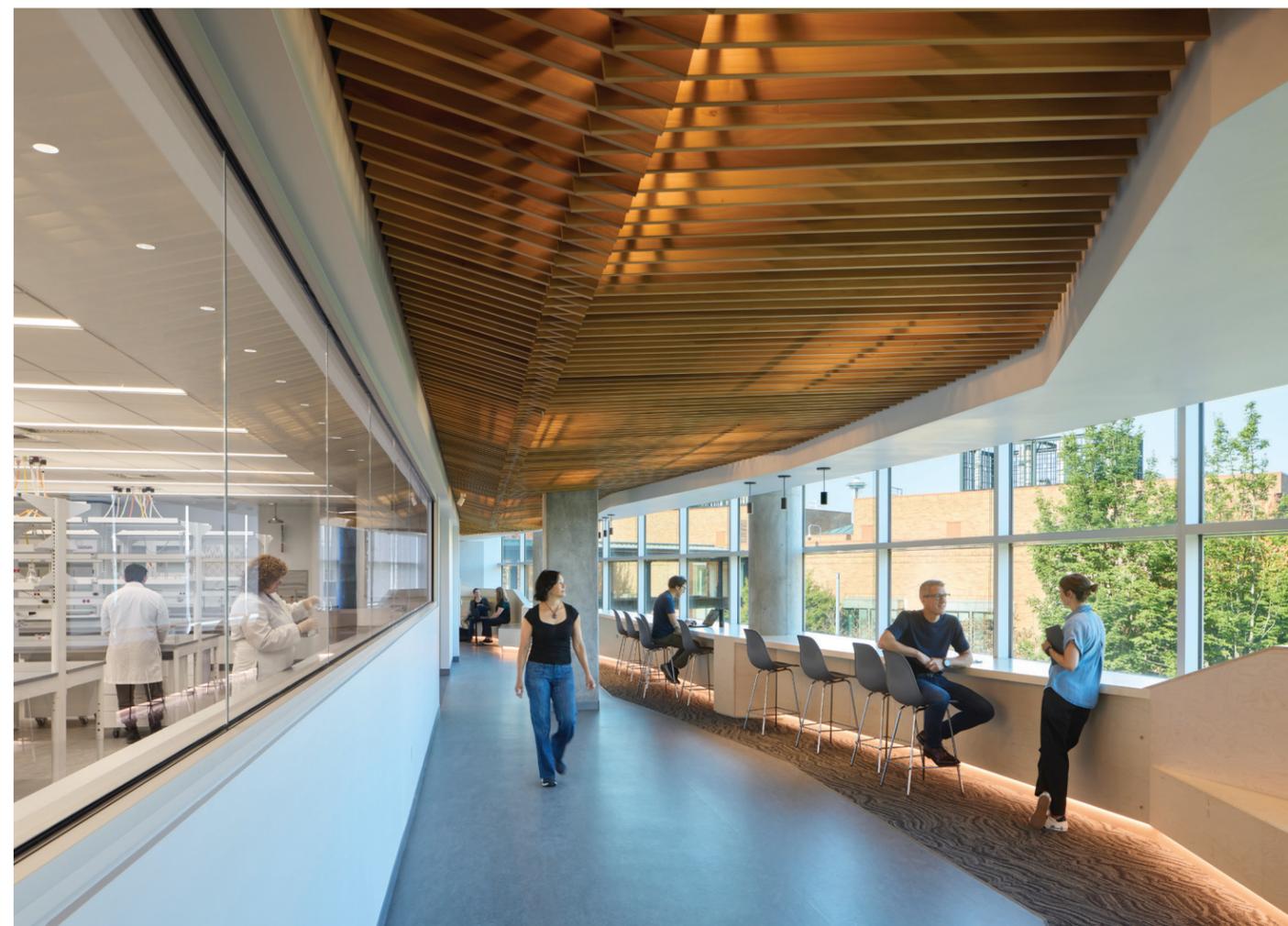
A not-so-obvious answer: consider what our economic system prioritizes. There are multiple industrial concerns, from design, to manufacturing, to fabrication, that incentivize and encourage the razing of the old and building new. Prestige architectural commissions on campuses routinely look further and further afield to find a small stable of designers who will add millions of airline travel miles to project carbon footprints.

**What are other unique considerations for the reuse of old laboratory buildings?**

For starters, the age of the current state of the facility will dictate everything from the building infrastructure to the ability to lay out a coherent planning module for research and learning. Structure will greatly affect the potential for the building to house precise instrumentation: ENMR, optics, and microscopy require low vibration and resonance. It will also affect the ability to store hazardous materials and establish control areas for liquid handling.

Chasing down impacts to academic research is even more demanding; research park projects that create partnerships with industry may require more substantive services and higher performance criteria.

On the bright side, a renovation can bring newer, cleaner, and more culturally engaging science to an academic center.



**OFFER YOUR BUILDING AGENCY AND HELP IT FEEL SEEN.**

Most buildings, like most people, do not want to be other than themselves. To think of existing buildings as pure resources is to miss the point of what advantages and defects of character can result from the way they are treated. The following is a loose taxonomy of the kinds of existing buildings we have encountered.



**You Don't Get to Pick Your Family**

Any of the thousands of campus structures that are architecturally and functionally out of date, but which have the key and redeeming asset of being immediately available and not spoken for by another campus program.



**Building Gifts**

Buildings are home to cultural legacies and local histories that can become more vivid through selective remodeling. Does everything from a past occupancy need to be painted and paved over or are there elements of the past that should find expression in the present?



**Path of Most Resistance**

The right building in the wrong place, assessing structures that offer more flexibility and immediacy than a new building. Buildings that need to be taken down to their structure because they have great bones and can accelerate the rate of change. Conversely, buildings with structural constraints that requires a complete replacement, but which have iconic exterior architecture that should be preserved.



**Deferred Maintenance**

Buildings so old that the infrastructure will need to be replaced entirely offer the opportunity to think a bit more radically about what will catalyze the sense of place. Inevitably it is important for the new "place" to offer some perspective into the history of use and the era of the original building that helps catalyze the new program occupying it.

**Location, Location, Location**

The considerations around tenant improvements for campuses that desperately need to expand their teaching and research platforms in leased buildings. Often, these resources represent critical adjacencies for a campus, proximity of health sciences to teaching hospitals are but one example.



**Good Neighbors**

A design should factor in many considerations when local permitting and jurisdictional issues favor re-use over building new. It is key to remember that the rate of change in cities affects institutions and the neighborhoods in which they reside.



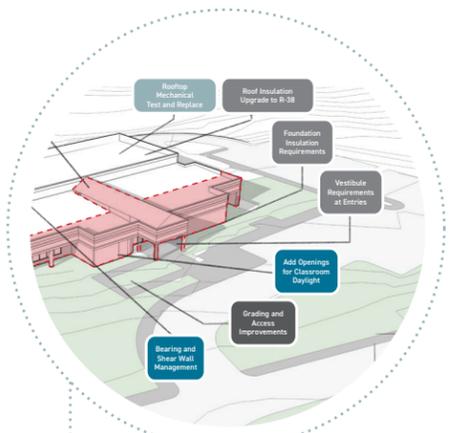
# ADAPTIVE REUSE FRAMEWORK

Think of CULTURE FIRST in any existing structure.

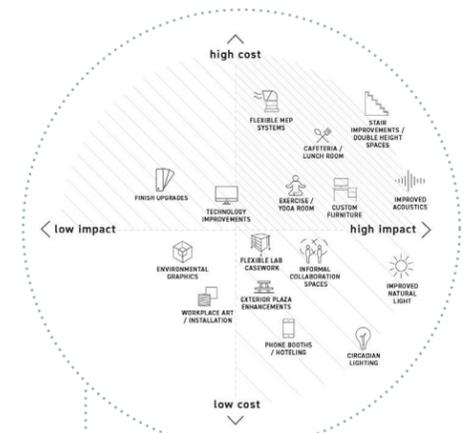
How is the building best suited to deliver on its potential? The chapter headings comprising any assessment or planning study are developed to consider impacts to culture across a variety of categories. Buildings all differ, and placemaking is an organic process, so there are no hard and fast rules about how to evaluate the fit between an existing building and its future use. However, there are a few tried and tested subroutines that have relevance in most projects.



**FRAMEWORK SUBROUTINES:**



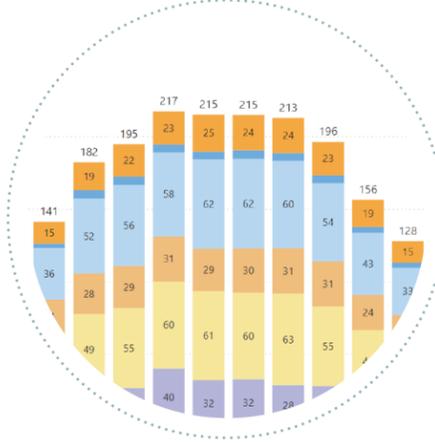
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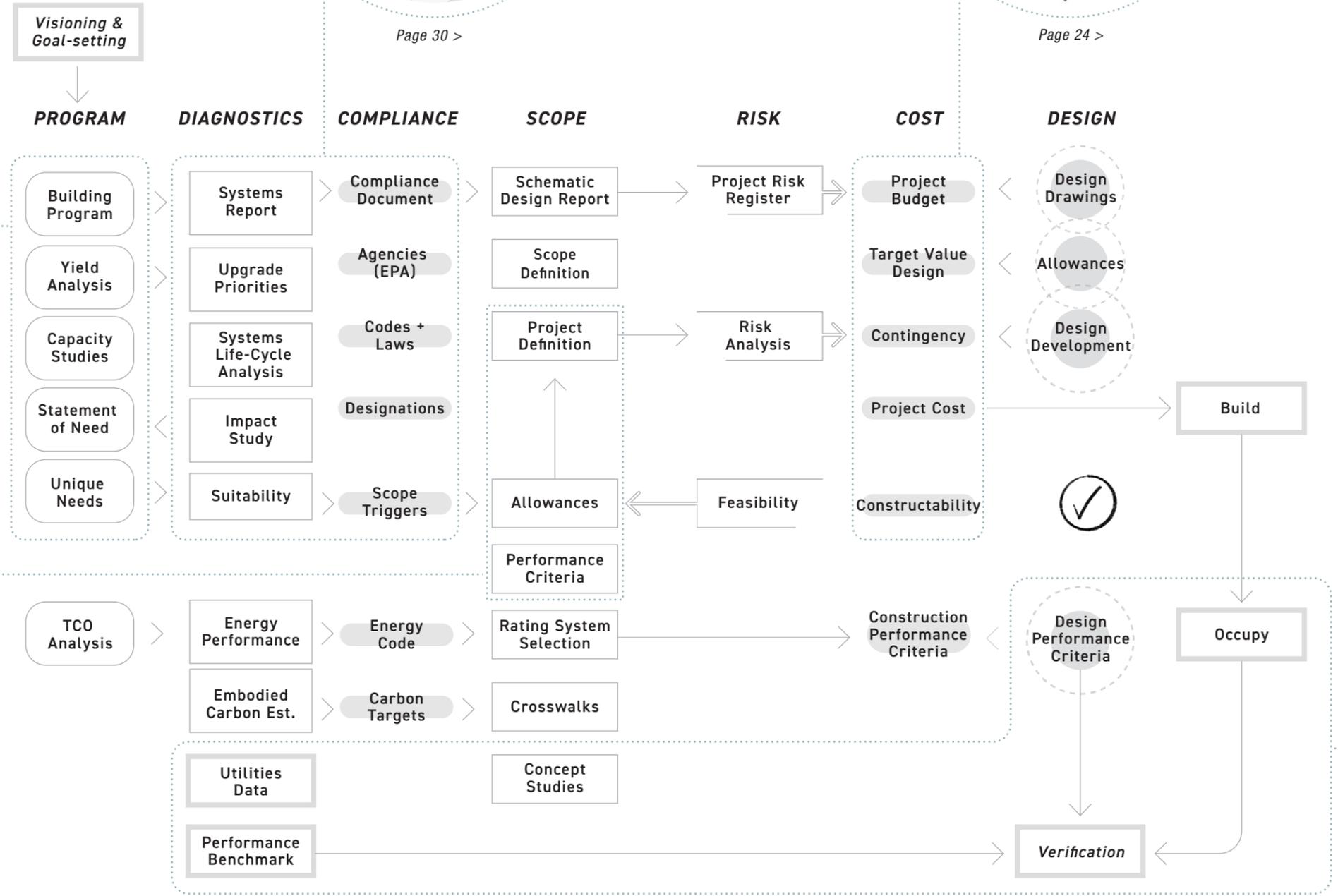


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Performance Criteria

The expected use of a building should undertake a project definition that includes criteria such as; building population, acoustical baselining, thermal comfort, views and daylight, as well as critical baselining for health and well-being, sustainable food sourcing, and belonging.



*Verification - Value over Time*  
Utilizing benchmarking data, conduct a detailed analysis to understand two key things: expected operational cost and verified operational performance.

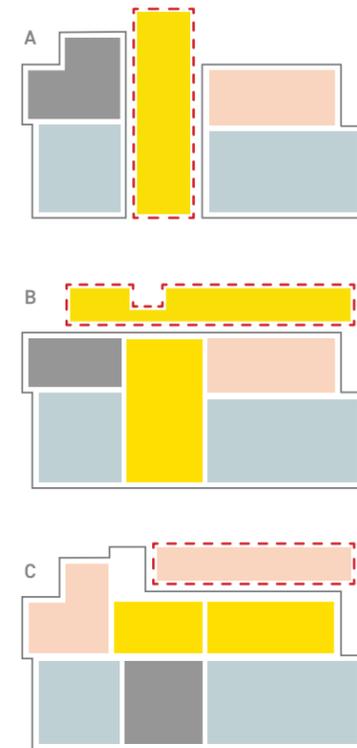
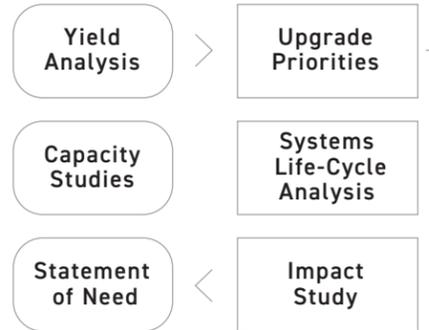


### DON'T TRY TO DO TOO MUCH.

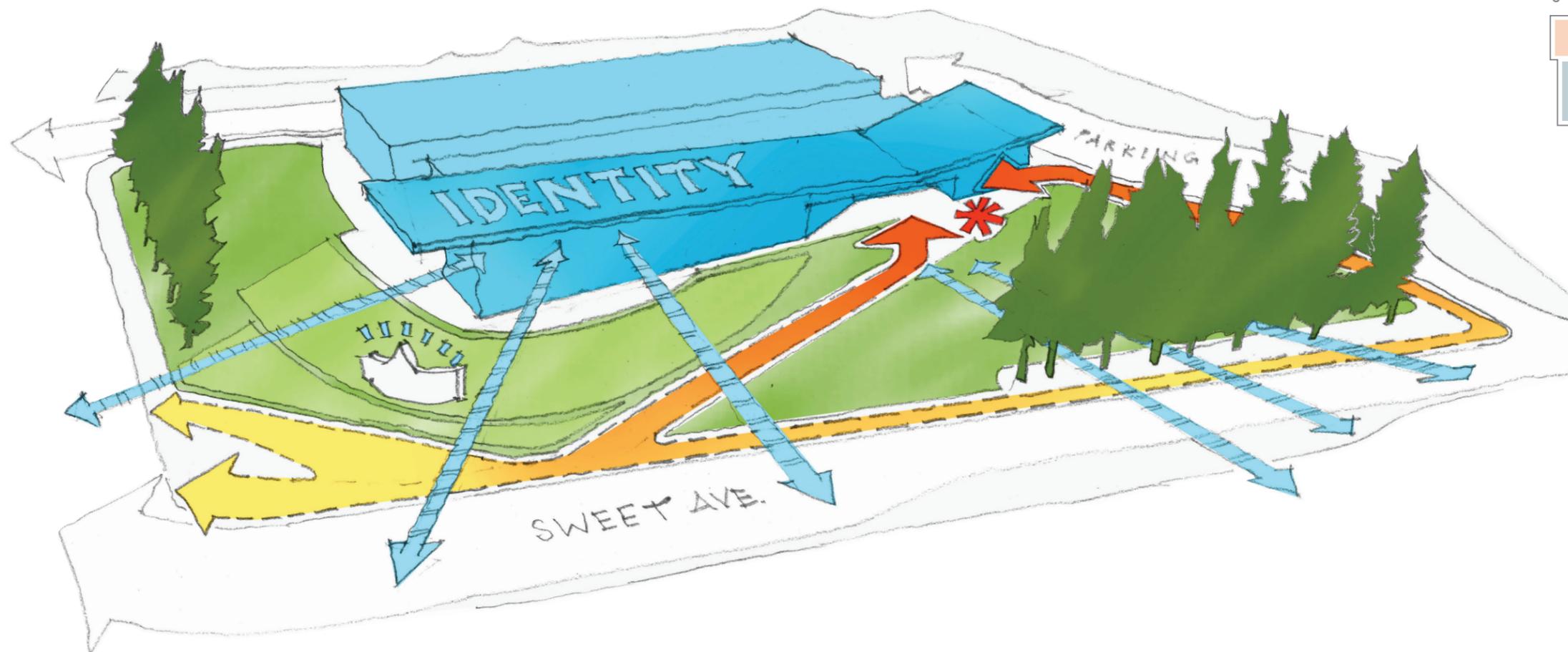
Your first instinct may be to replace nearly everything in an outdated building. Don't do it. Even if the ultimate goal is transformational change, no building should be 100 percent updated. In addition to stripping an existing building of its character, replacing too many elements will overpack the space with a program the structural system may not be able to support.

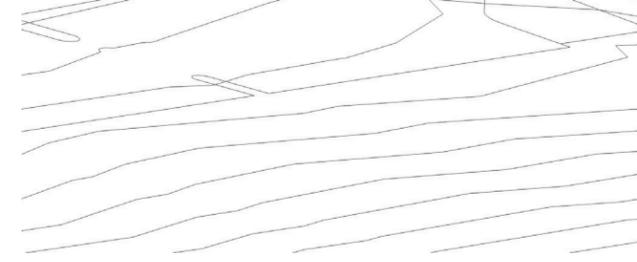
Instead of starting with a fully fleshed out space program, we recommend developing the building program concurrently with building diagnostics. This more agile approach allows the design team to test out multiple options and configurations to find the best fit.

#### PROGRAM      DIAGNOSTICS



Visioning & Goal-setting

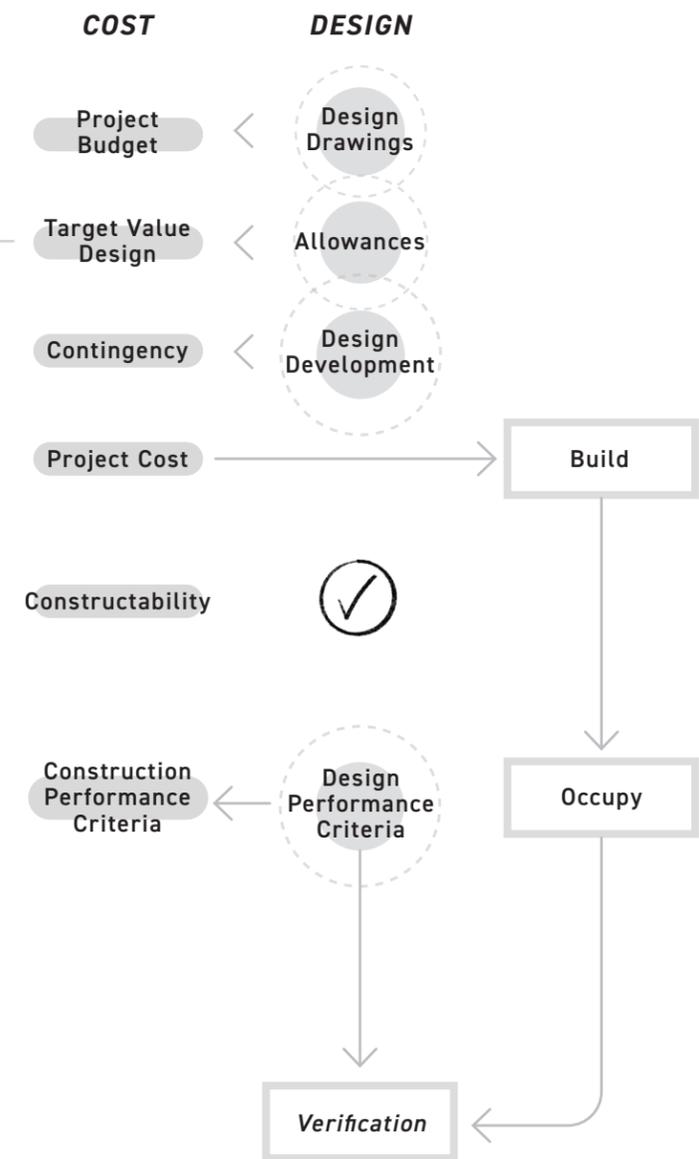
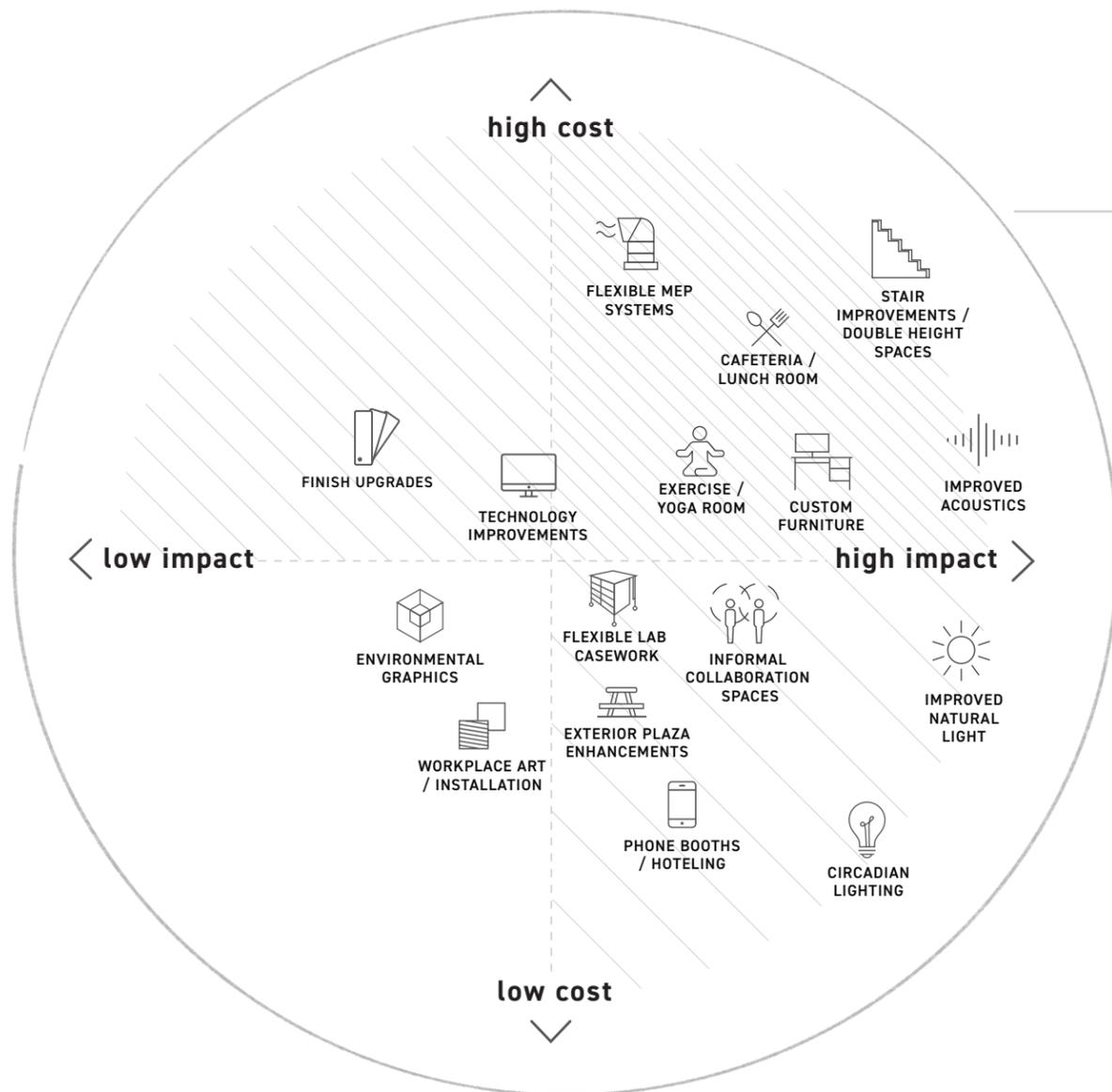




**DESIGN TO COST.**

Think of adaptive reuse as a competition for resources. What wins, what loses, and what can remain contingent until more is known? How will the design team evaluate differences between an air handler with twenty years of service life and ten years remaining versus one in very poor condition that is relatively new?

This is relatively straightforward, but how can a team compare reusing an old roof to providing active daylight harvesting? As the comparisons diverge, the challenges increase. We recommend evaluating cost against impact on a straightforward grid. This has the benefit of being a combination of objective and subjective, being both evidence and preference, which is the only effective way to design to cost.



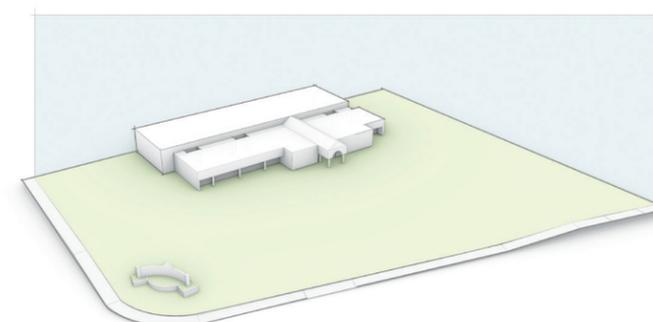
ONE SIZE DOES  
NOT FIT ALL



## HARVEST THE FULL POTENTIAL OF EXISTING BUILDINGS.

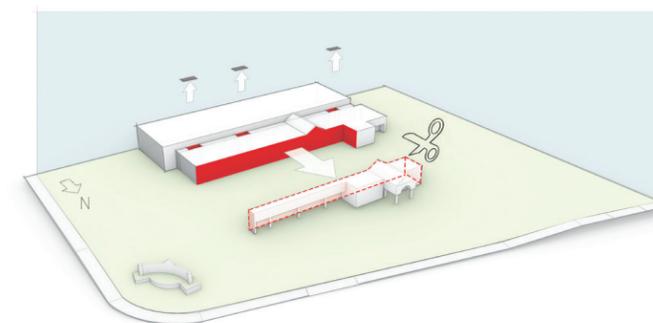
At the University of Idaho, an old wood-framed tech incubator building was identified as the future home of the WWAMI\* medical education building. The existing building formed a bleak skyline directly adjacent to one of the four historic campus gateways – not an auspicious front door to a regional institution. The design team conducted a vigorous and comprehensive analysis of the existing envelope while simultaneously evaluating the new program for fit. Vision-level exercises were also conducted with university leadership to identify the key features that would benefit the program, attract donations, and create a visual resource at this key campus intersection.

*\*WWAMI is a program dedicated to providing access to publicly supported, community-based medical education across five states (Washington, Wyoming, Alaska, Montana, Idaho) for students in their first two years of medical school.*



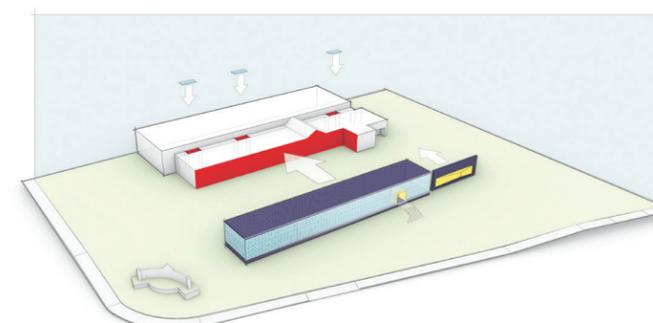
### Target problem areas

An initial assessment identified lawn space west of the building as a potential location for a faculty offices addition. As illustrated on page 31, many of the issues with the existing structure were along the north wall of the building.



### Remove and replace

Removing most of the north wall's existing envelope allowed for replacing non-conforming issues: legacy wall detailing, weather barrier discontinuity, single-glazing, uninsulated exterior soffits, and the non-compliant ADA entry.



### Address the site

Abandoning the building addition at the lawn, the team instead removed the most compromised portion of façade and added a large common area. By developing building program and diagnostics concurrently, the addition was sized for what the structure and site could absorb.



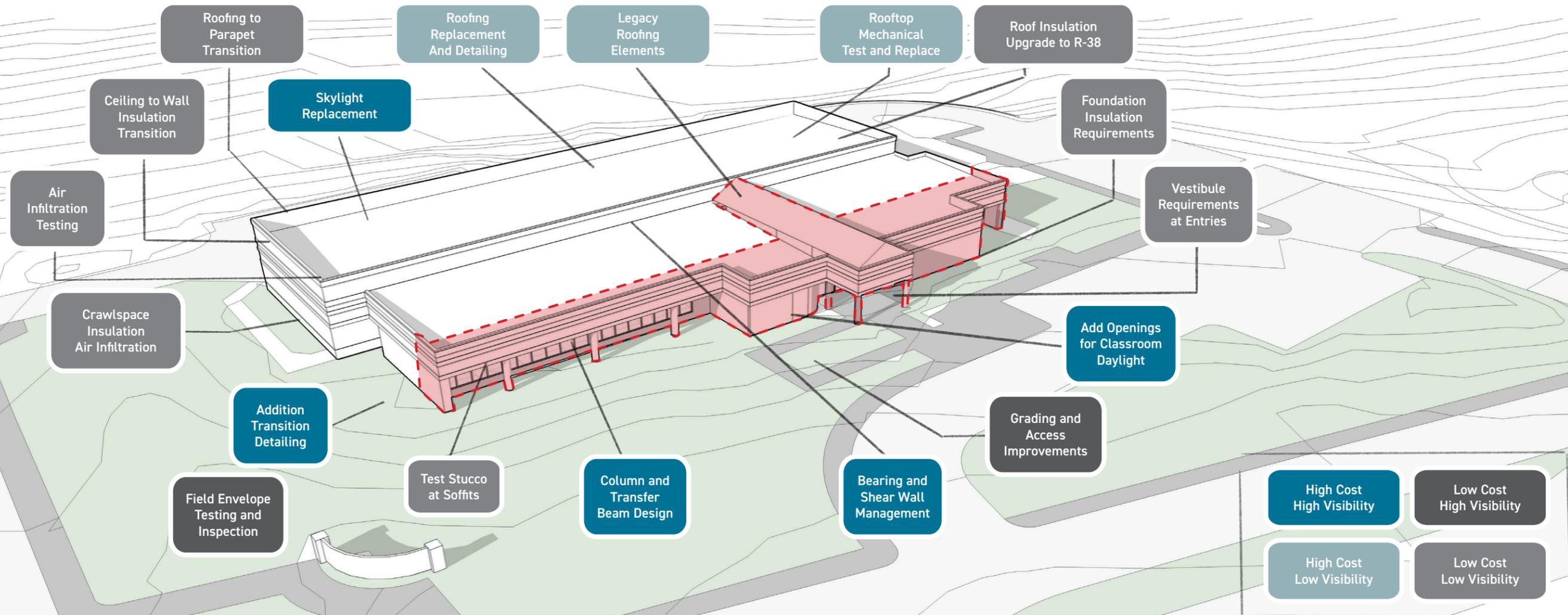
### Express the culture

Along with a new entrance, building sign, and grading, the addition projects a new identity for this highly visible program and creates a cultural amenity that could not have been achieved any other way.

**DIAGNOSTICS.**

A building's capacities are half the story. The other half is the liabilities: outdated systems, deferred maintenance, code compliance issues, and legacy detailing issues. Developing a future program for a building based only on its strengths is impossible – we need the full story. However, what we have found is that sometimes liabilities are clustered around a set of common factors such that, by remedying one zone, we are able to address multiple liabilities at the same time. This can make the process more efficient and preserve more aspects of design that contribute to culture.

*U of I's BTI building told a story. Most of its weak points had accumulated in the north wall of the building, which offered a way for the team to address many of the building issues with a single strategy.*





The team maximized the volume of the common area to help harvest daylight and views to the north. What had been a meager, older building the new program now shares with students from other departments who want to spend the day studying and taking in the views of Paradise Creek.

Cross-laminated timber (CLT) construction was selected as the structural system for the building addition. The post-and-beam construction allowed the team to create more openings between the existing building and the common area so that offices and small group learning areas would help activate and energize the space. The warmth of the wood created a beautiful interior without the added expense of wood paneling.

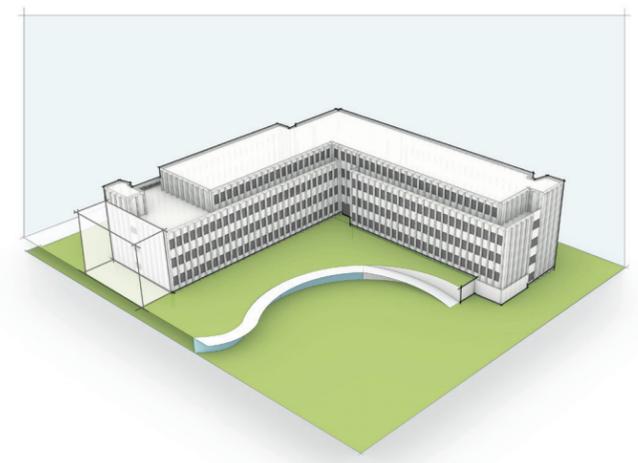




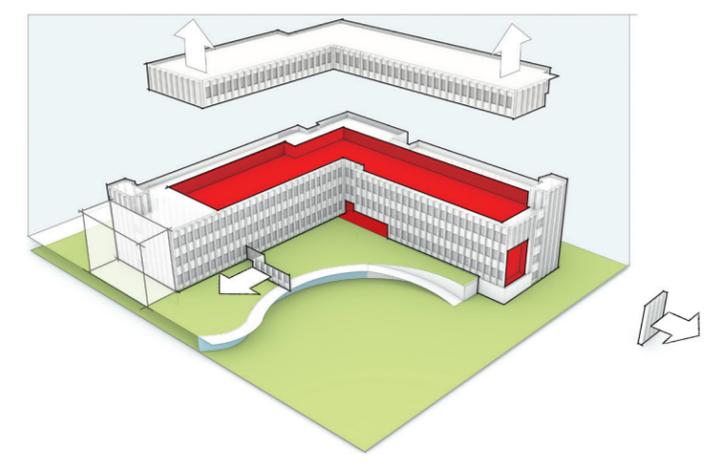
# CREATE CULTURE AND VIBRANCY

The University of San Francisco's Harney Science Center dates to a familiar era – the 1960s – which ushered in a building boom in many campuses consisting of cast and pre-cast concrete structures with simple forms of quite durable construction. So much so, that the challenge with these buildings today comes more from how to adapt them effectively for the more dynamic cultures that are created with today's teaching methodologies. At USF, students are bridging academic departments to focus on their project work in teams, all with the hopes of helping to meet the grand challenges of our present day, from clean energy, to carbon reduction, to food safety, to design equity. How could the restrained 1960s architecture reveal this inner vitality?

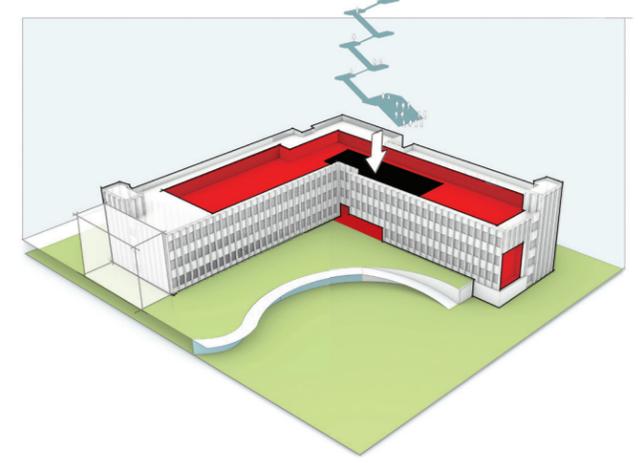
STEP 1. Examine existing facility



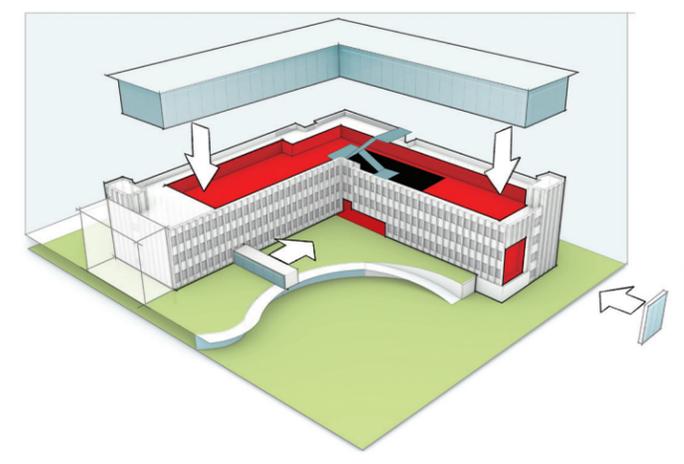
2. Remove Liabilities



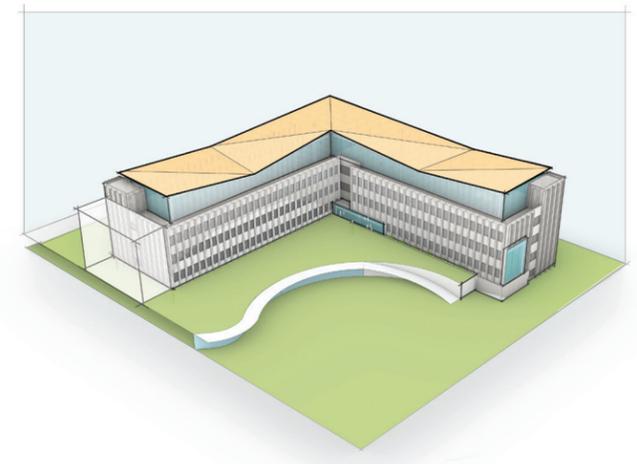
3. Establish connections



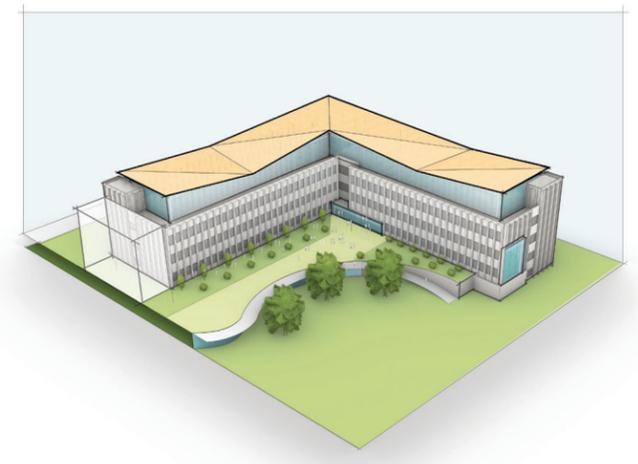
4. New Educational and Cultural Program



5. Crinkle the roof



6. Enhance the landscape



**DECISION CLUSTERS.**

With 90+ metric tons of embodied carbon in the superstructure, the existing building shell and core represents a carbon sink that would more than offset the embodied carbon of all materials required to set it up for its next 50 years of service life.

Consistent with this point is the re-use of the structure from a neighborhood and permitting standpoint – the residential area likes the current building and its slenderness and human scale, and building re-use will allow the project to select sustainable pathways within the city’s regulatory framework.

Overlapping with these two strategies are the decisions around removing elements of the existing structure that are deteriorated or where the cost to cure is prohibitive. This includes a fifth building level that was added on to the structure in the 1970s. It was never fully waterproofed or thermally insulated and is greatly out of compliance with existing codes.

## 21ST CENTURY TEACHING AND LEARNING.

The new building program is designed to help students and faculty confront Grand Challenges, consistent with the university mission, conceiving of research as just another learning method, and allowing students and faculty to come together to evaluate solutions together in a variety of group sizes, from the all-hands presentation to the doorknob lecture.

Designed for Phased Implementation. The team worked to establish a phased approach to improvements, knowing that a single phase of construction may not be possible. Trigger points for the replacement of mechanical service elements and conversion to an all-electric building were established within the phased improvements.



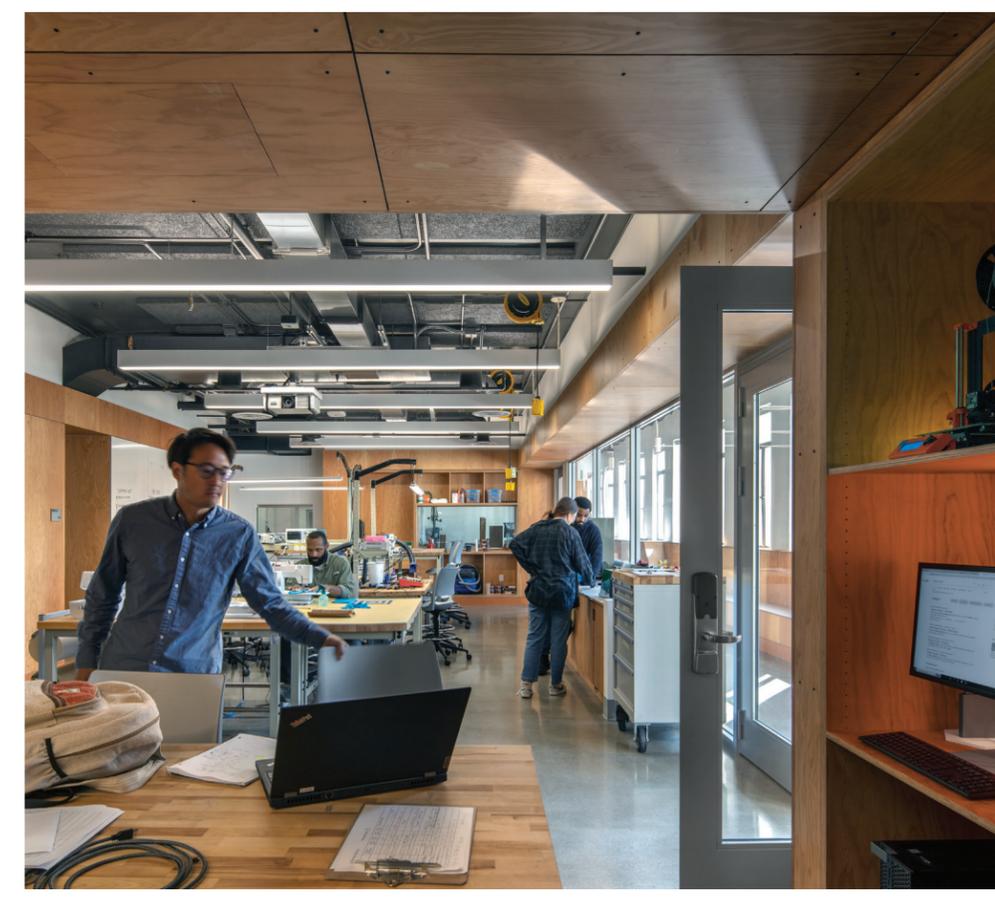
First Phase – Applied Engineering Program. The launch of the school’s first formal program of study in engineering coincided with the first phase of building improvements for the science center. Envisioned as a series of collaborative makerspaces, including a wood shop, materials testing shop, and digital fabrication studio, the new program also forms a new front door within the building, bringing all

students and visitors into the heart of a vibrant and dynamic learning environment. A new large-format hangar door was designed to help bring that vitality to the building’s south courtyard during good weather, and a forum space for students to test their ideas with each other replaces a warren of hallways and faculty offices that greeted visitors prior to the improvements.





Even the student lockers serve a dual purpose as perch space for informal meetings and focused work. The goal was to create a space where students would decorate with their projects and ideas throughout the term, but which could be reset so that the next semester's students would feel the space welcoming to their ideas and their challenges.

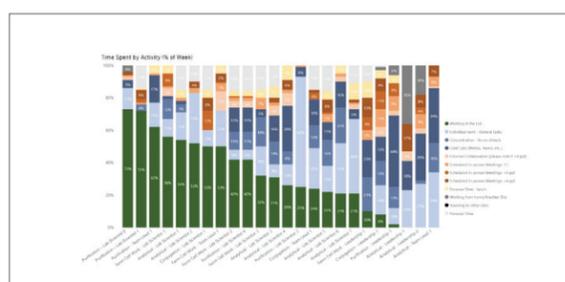
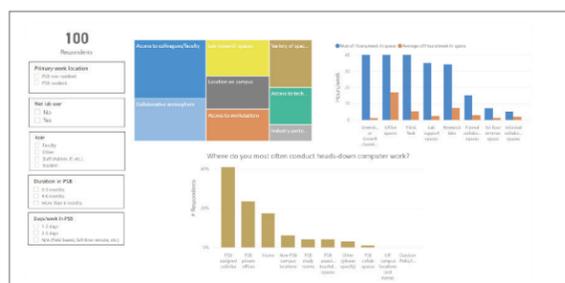
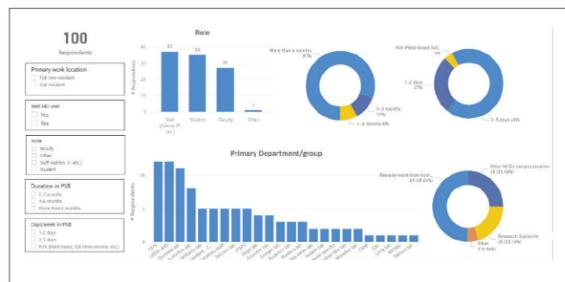


**DIGITAL TOOLS.** ↗

The digital fabrication studio faces the hallway and is active 24/7 with students working on projects of all scales. Activating both the entry and the circulation space, this side of the makerspace brings in a ton of daylight and curious eyes through the glass walls to the south.

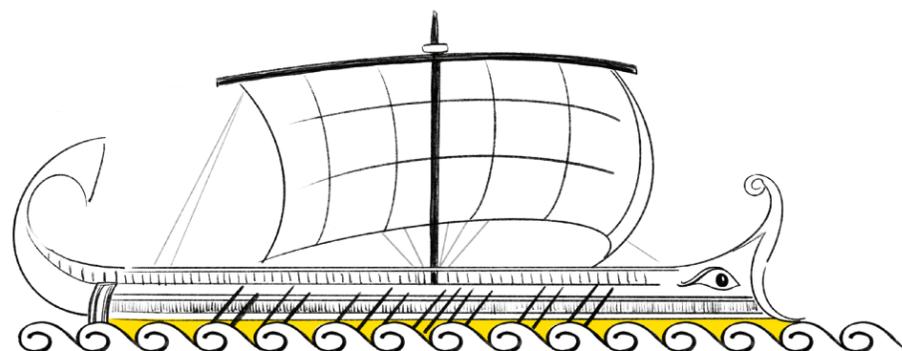
### VALUE OVER TIME.

Once a project is complete, a detailed analysis with benchmarking data will help with understanding actual operational performance compared to expected results. Typically performed a year after project completion, these post occupancy evaluations include existing data analysis, internet of things (IoT) sensor technology, on-site observations and interviews, and electronic surveys. These assessments promote a culture of continuous improvement and identify opportunities for improvement to inform future phases or future projects.



# THE SHIP OF THESEUS

Legend has it that Theseus, the founder of Athens, used a ship to escape after his adventures, and that this ship was preserved and sailed every year to commemorate his travels. Philosophers of ancient Greece wondered whether, after so many years and so many elements replaced on the ship, whether it was still the same ship, or whether it was something new, something altogether different.



One could ask the same question of our buildings. After so many years of replacing old and outdated elements, are the buildings that we live and work in still the same thing, or are they something new, something altogether different?

We propose the answer is yes.

There can be no today without yesterday's dreams, and no tomorrow worth having without today's. As a culture we have grown far too accustomed to discarding what has outlived its needs.

It is not important whether this is a failure of our ability to imagine new life in old places or whether we think the future can only be reached with new places. What is important is that what we have today does have value and probably can, with some imagination, help us meet our needs today. It also benefits us by not adding to the already daunting challenges of climate change. It also serves as a metaphor for renewal that we should seek to embody as individuals: that we can change our own configurations, meet new demands, and flex in ways that surprise us. We aren't dead yet, and we don't need to be put out to pasture.

Thinking of our world as already having value today is a direct reflection of how most of us would like to be seen. So, we should reuse our buildings as often as we can, and be as adaptive, and amazing at it, as our imaginations will allow.

## ABOUT FLAD

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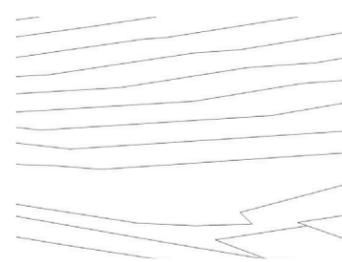
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