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Why Does It Cost So Much?

Understanding the High Cost of Building a Better University

By Donald Guckert and Jeri Ripley King

Planning, design, and construction organizations in higher education perform our services on the forward-edge of an ever-changing world. We provide increasingly complex facilities under shortening timelines and proliferating code and regulatory requirements, while we address emerging technologies, expanding concerns about indoor air quality, and growing demands for the use of sustainable design and construction practices. Underpinning our efforts to meet these challenges, we continue to hear the same question echoed by our governing boards, administration and customers: "Why does is cost so much?

The answer is found in the myriad of details and choices that flow from the institution's vision, values, strategic plan, stewardship responsibilities, total-cost-of-ownership analysis, risk tolerance, and the health and safety of the community.

A Sense of Place

Building designs are viewed as a way to enhance and preserve our institutional heritage, while providing an attractive environment in which to learn, discover and live. We do not just build or renovate structures; we create a "sense of place." The sense of place is what connects us emotionally to our institutions.

Our universities use the appearance of the campus and the experiential opportunities that the facilities offer as a competitive edge to attract the diminishing pool of incoming students, and faculty and staff. The appearance of the buildings and grounds influences prospective students and other visitors to campus and is used in on-line and other marketing efforts. Research from Washington State University discovered that prospective students reach their decisions within the first 10 minutes of walking on campus.

The appearance of our campus comes at a cost. In constructing a new building for the campus environment, we seek architectural designs that convey emotions and create reactions which may range from stimulating debates over the architecture to conveying notions of continuity and timelessness. Often the designs include prominent building entrances, buried utilities in tunnels and chases, hidden downspouts in interior walls, screened waste receptacles, discrete access for service vehicles, and extensive landscaping, courtyards and wayfinding. These little extras add a lot to the quality of the built campus environment.

Land must be used carefully, balancing the need for buildings with gathering places, green spaces and circulation. This drives us to optimize building footprints by building upward to conserve precious campus real estate. The resulting multiple stories require more costly foundations and structures designed to meet seismic and wind loading standards. Stair towers and elevators consume project resources and decrease the percentage of assignable space. All these factors lead to a higher cost per square foot.

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Codes, Regulations and Standards

Code requirements have a tremendous impact on cost. The type of occupancy determines the applicable code requirements. The large assemblies found in most university facilities dictate the highest level of life safety design, including stair towers, fire rated corridors, fireproofing on structural members, fire alarm systems, sprinklers, and smoke evacuation systems. Even the grade of carpeting in a university facility is selected to minimize concerns about flame spread.

In addition to codes, building design and construction must meet numerous legislative mandates, standards, and regulations. The list reads like alphabet soup: ADA, EPA, OSHA, ASHRAE, and the list continues. These requirements govern building designs, accessibility, removal of hazardous waste, asbestos, lead paint, storm water runoff, construction dust control, noise control, and more. Then there are the building and occupancy permits, construction contracts, consulting agreements, testing and commissioning services, and requirements by donors and funding agencies that must be met and managed.

The type of facility and its occupancy also drives ventilation requirements. Labs require more ventilation than classrooms; classrooms require more ventilation than offices. Increased ventilation leads to upsizing HVAC systems, because outside air must be heated or cooled prior to being delivered to the finished space. Indoor air quality concerns and awareness, which were heightened during the pandemic, is driving investments in better air filtration systems and increased ventilation rates. The cost of these improvements has been profoundly felt on renovation project budgets, where much of the budget is consumed by HVAC costs.

Institutional and Statutory Requirements

Institutional and statutory requirements can drive up costs, too. Contractors are generally required to provide the highest industry coverage for insurance and bonding, and construct in accordance with industry standards. Architects are required to furnish professional liability insurance. Public owners must follow state procurement statutes, which generally increase design and bidding costs, and often constrain the use of more cost-effective delivery approaches. Many institutions require contractors pay prevailing wages, equating to union-scale.

An often-overlooked impact on cost is the institutional expectation that construction activities will be conducted with minimal disruption to campus life. The campus is a protected environment that accommodates learning, social interaction, discovery, living, dining, recreation and public service. As invited guests into this haven, contractors are required to conduct their activities in a manner that minimizes the impact on the institution's primary missions. Functioning campuses are not ideal construction sites. Project costs go up dramatically when universities restrict access to building sites; limit space for staging; require off-campus parking; enforce jobsite cleanliness; add fencing and protection; restrict construction vehicle movement; limit noise and hours of operation; and impose complex phasing schemes to accommodate academic calendars.

Time is Money

Demanding schedules are an inherent part of higher education design and construction efforts. More often than not, we aggressively work toward the inflexible dates of academic calendars, residence hall occupancies, and athletic event schedules. In research environments, the need to be up-and-running is paramount, and faculty recruitment start-up agreements too often overpromise on the timing of lab and office renovations. When the higher education environment demands design and construction projects to be delivered on increasingly shorter timelines, this drives up the cost of university projects.

In general, shortening the allotted time for construction will drive up costs. A five-month renovation will be unaffordable if it has to be completed during the summer break. When bidding an aggressive schedule, contractors

will increase their bids to reflect overtime payments to workers, incentive payments to vendors, reduced worker productivities, and contingencies to cover the risks of completing late.

Conversely, easing the five-month schedule to six months will yield savings. When there is extra time in the schedule, the contractor's risk is reduced because it facilitates effective coordination among subcontractors, provides sufficient time for fabrication and delivery of materials and equipment, and other accommodations that result in a more cost-effective project delivery. This is especially true when market conditions are experiencing disruptive supply chain conditions and shortages of available contractors and skilled trades workers.

Complexity

We build state-of-the-art research facilities, high-occupancy performance and athletic venues, heavily trafficked and technological learning environments, and living and social environments that must facilitate and heighten the user experience. The facilities we build are among the most challenging in the building construction industry.

Program activities dictate the need for classrooms, laboratories, meeting rooms and offices. While grouping one type of activity per facility would reduce costs, our buildings rarely house only one type of activity. In addition, program activities must meet the functional requirements of the campus environment. For example, our classrooms and auditoriums, which demand larger column-free spans, are usually on the lower levels of a building. The lower levels may then have to support upper floors that are designed to accommodate heavy floor loadings for books, furnishings, and lab equipment. Inverting these spaces, by placing the column-free classrooms on the upper floors and the heavy load-bearing spaces on the lower floors, would be more cost effective, but less functional in a campus setting.

Our facilities must provide healthy environments with adequate ventilation and filtration systems while accommodating a mix of functions and heavy traffic. To manage this, we install technically controlled complex building systems. These systems are designed for extreme conditions: the hottest and coldest temperatures, the highest and lowest humidity, with the strictest climate control for the highest occupancy. In addition, we recognize that the design of a mechanical system represents the greatest opportunity for energy conservation and carbon reduction. Incremental investments in energy efficient mechanical systems will yield a lower stream of future utility costs, so we pay a little more now to save a lot later.

Maintainability, Sustainability, Reliability and Longevity

Higher education, more than any other built community and commercial environment, constructs buildings to last beyond our lifetimes. Every institution envisions itself in existence into perpetuity. Making long-term investment choices separates higher education from the vast array of other building environments.

With many people using university facilities in frequent cycles throughout the course of extended daily operating hours, the components of our facilities must be of a quality to withstand heavy use and abuse. Our requirements for durability raises the price of doors, door hardware, carpeting, entranceways, floor tile, and restroom fixtures, but it lowers the future cyclical costs of maintaining and replacing lower quality, less durable products.

The way we use our facilities demands that we construct utility systems to high reliability standards. This often results in paying for system redundancies, back-up generators, UPS systems, and connecting to central utility systems.

Sustainability is another factor impacting construction costs within higher education. Facilities are being designed and constructed under governing sustainable design principles using materials certified as manufactured from

renewable sources and building and system designs that utilize progressive methods and technologies to conserve energy and reduce waste streams. Pursuing LEED certification brings positive recognition and validation sought by many institutions seeking to demonstrate their commitment to sustainability. However, this comes at a higher incremental cost.

In large part, our universities choose to make these initial investments, because of the benefits they will make in driving down the institution's total-cost-of-ownership over the life of the building.

Technology, Security & Inclusion

Advances in technology, increasing concerns about security, and efforts to provide more inclusive environments have emerged in recent years as contributors to the high cost of campus construction.

Institutions have moved from simply complying with the requirements of Americans with Disabilities Act (ADA) to embracing universal design and inclusivity. Examples of going beyond legal and code requirements include adding hearing loops in public assembly spaces and providing gender-neutral restrooms and prayer rooms.

Issues with campus safety and security has risen over time to rank at or near the top of the list of concerns that parents have. In addition, research labs are requiring tighter security from a variety of threats. To help manage the safety and security of campus facilities, common campus security systems include card and biometric access, programmable locking systems, security cameras, motion sensors, and other technologies.

Technological investments in our built environments are bringing artificial intelligence, machine learning, and data analytics benefits to the operation of our facilities. Emerging and matured smart building systems are mitigating operational risks, enabling predictive maintenance practices, lowering energy consumption, and providing improved user experiences. Although the first costs are higher, the benefits from these technologies are providing a very attractive return on investment.

Why does it Cost so Much?

Construction costs mirror the values and aspirations of the institution. The initial cost of construction or renovation is but a small fraction of the total investment our institutions will make in staffing, operating, and conducting our mission within these facilities. The resulting high cost of construction is caused by the accumulation of investments in all of the hundreds of incremental decisions that go into building a durable, productive and stimulating environment that creates safe, healthy, enriching and inspiring experiences for our faculty, staff, and generations of students.

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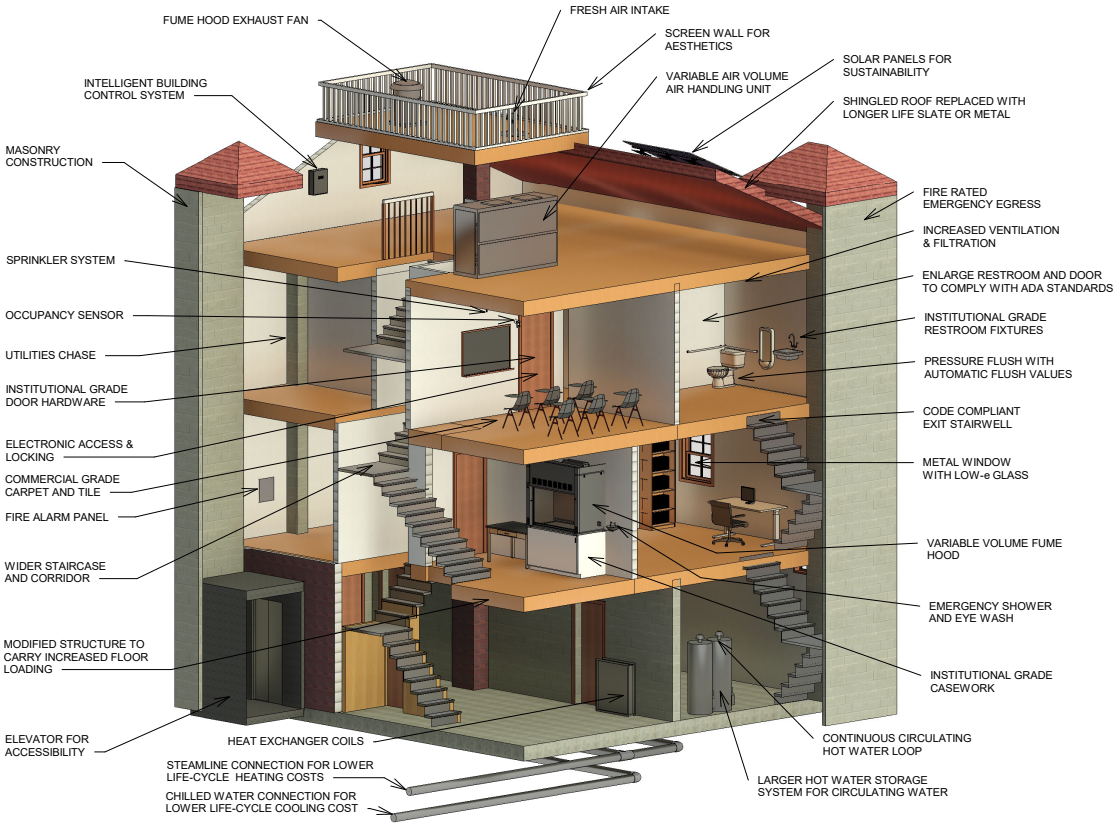
Your House on Campus

By Donald Guckert and Jeri Ripley King

"You've got to be kidding! I could build a nice house for that amount!!"

How many times have we heard that the cost of a "simple" renovation would buy a high-end home in a nice neighborhood? Customers typically react with sticker shock over the cost of a campus renovation when they receive the initial project estimate. This is the point at which worlds collide, where the *institutional* construction world of the project manager meets the customer's *residential* construction frame-of-reference.

Trying to justify the costs of institutional construction within a residential frame of reference is not easy. These two types of construction are a world apart. However, just for the fun of it, we wondered what would it take to renovate your house into a campus facility? Let's suppose this facility is located on campus and you request that we renovate the living room into a classroom, the kitchen into a lab, and the bedroom into an office. Let's take a walk through your house to see what we will need to do.



Credit: Facilities Innovations, LLC

To begin with, we'll need to make the facility safe and accessible. We'll add an elevator to the second floor, and an exit stair tower connecting all floors to the outside. To make this building look like it belongs on our campus, we'll arrange for matching towers and give the building an identifiable look. Unfortunately, this will add

considerable cost and space to the building, while not adding any space for program needs. After we widen the interior hallways and stairways for increased traffic and install a utility chase from the basement to the attic, we will actually reduce the amount of assignable space.

As a university facility, the house will fall under a different classification as far building codes are concerned. This means we'll need to replace the $20 battery-operated smoke detectors with a $20,000 fire protection system. This system, which includes a fire alarm panel, wired sensors, and sprinkler system, meets all of the requirements of the local fire marshal. To inhibit the spread of flames and smoke from one room to another, we have to reconstruct the walls that separate the rooms from the hallway and make them fire-rated walls. This is not cheap! Neither are the solid doors mounted to the metal doorframes that we'll use to replace the house's hollow doors and wooden frames. For durability we'll need to upgrade all the door hardware. Installing a new card access system will bring us into compliance with institutional policies pertaining to safety and security.

We know the budget for this renovation is limited. Before the money runs out, we need to look at the mechanical systems. By code, our lab, classroom, office and restroom spaces require controlled outside ventilation that your house doesn't have. The small air conditioning unit and gas furnace will have to go. With the big increase in filtered airflow, it wouldn't keep up after the first five minutes. Our house will need dependable and code-compliant mechanical systems. For redundancy and efficiency, we'll connect to chilled water and steam from our central utilities plant.

Finally, we move to the kitchen. To convert it to a lab, we'll take out the $800 kitchen stove and hood, and replace it with a $35,000 variable flow fume hood. Fortunately, we won't need a strobic air fan for that hood; you don't even want to think about that cost. Those kitchen cabinets will come out to allow for the built-in lab casework. The refrigerator will have to go, too. In its place will be a $15,000 environmental chamber.

We'll open up the walls when we install the lab gases, electrical conduits, and corrosion-resistant plumbing. While we are in the walls, let's replace the wooden studs with more durable metal studs that resist fire and termite damage. To complete this "kitchen remodeling," we'll replace the vinyl flooring with an $10,000 epoxy floor, and the Formica counters with epoxy resin.

We're going to need to remove the ceilings in order to increase the number of floor joist necessary to handle the increased weight of office, lab and classroom furnishings and equipment. While the ceiling is open, we'll install the circulating hot water system, designed to serve the lab and restroom, and we'll upsize the mechanical ductwork to meet the new airflow requirements. Speaking of airflow, that "whooshing" sound will be distracting in the classroom so we will need to put in sound attenuation devices.

To meet institutional standards, the wooden windows will need to be replaced with metal, commercial grade windows that have energy-efficient glazing. Similarly, the roof shingles will need to be replaced with slate, due to concerns about life cycle maintenance and architectural consistency. While we're on the roof, let's screen the unsightly mechanical systems. Oh yeah, we can't forget to do something about the pigeons.

Let's look at the outside again, just for a minute. Only the front façade was bricked when your house was originally constructed, so we'll need to install bricks on the other three sides. After all, your house is now on campus and our university is trying to project a certain sense of place.

At this point, we have more scope than budget. Money is running out, and there are more things we need to do to bring your house into compliance with our institutional standards.

What happened here? In trying to comply with the more stringent codes, reduce future operating costs, address aesthetic requirements, and meet programmatic needs we exceeded the funds available for this renovation. For the money this renovation will cost, you really could build a nice house. But, not on our campus!