Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961.
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Managing Expectations – Contemporary Design Culture, Conservation and the Transformation of The Richards Laboratories

BY DAVID FIXLER

Louis I. Kahn's Richards Laboratories at the University of Pennsylvania are a paradoxical building. At the same time that they perhaps represent the epitome of Kahn's literal expression of structure and material hierarchy, servant and served spaces and the role of mechanical systems in determining architectural form, these powerful ideas never came together programmatically to enable a fully functional, complete work of architecture. This paper describes the quest to solve the functional conundrum and technical shortcomings of Richards, to bring the architecture and program closer together. Through a synthesis combining transformation – a significant change in use that allowed the opening of the laboratory floors to the unique light and views that were always latent in the promise of Kahn's essential architectural idea – and rehabilitation, where the best aspects of Richards – the glazed, vitrine-like façades and the beautiful logic of the building services distribution, were renovated for enhanced performance, Kahn's original architectural vision and present function were able to be successfully reconciled.

Introduction

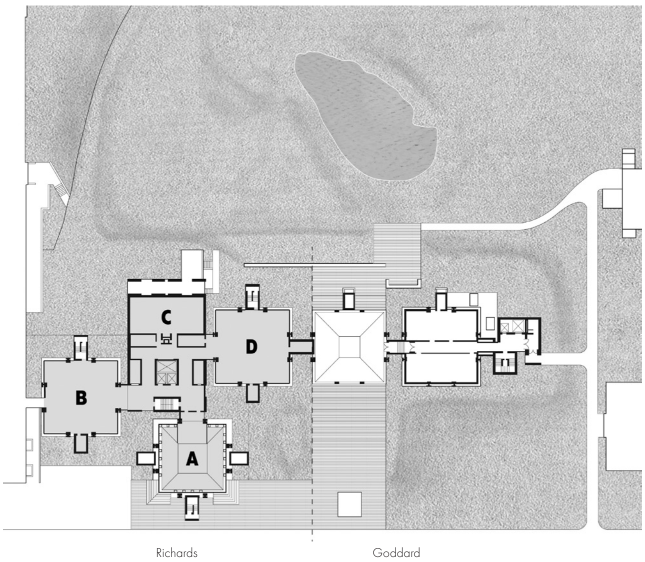
Architectural culture in the 1950s was widely perceived by many architects and scholars as having largely become dominated by formulaic responses to the demands of the commercial market and the embrace of the economic expediencies of curtain wall technology by the construction industry. Reactions to this trend ranged from the "New Formalist" explorations of architects such as Edward Durrell Stone (1902–1978) and Minoru Yamasaki (1912–1986) to the highly diverse geometric explorations of Eero Saarinen (1910–1961), but perhaps the most critical and complex response to these soft intellectual paths came in the deliberate search by Louis I. Kahn for an architecture that would speak directly to its own material and function.

Designed in 1957-58 and with construction substantially complete in 1961, the Alfred Newton Richards Bio-Medical Research Laboratories at the University of Pennsylvania in Philadelphia signal an epochal statement in Kahn's maturation as a designer and more fundamentally, in the direction of architectural discourse in post-WWII America. Two essential principles are particularly in evidence:
1) the laboratories are perhaps the quintessential example in Kahn's oeuvre of the careful treatment of materials to reflect and celebrate their fundamental nature through their tectonic and honorific role in the structure, and 2) no other building of Kahn's (with the possible exception of the Salk Laboratories) more lucidly expresses Kahn's signature concept of the separation of primary use and service functions within the buildings into "servant" and "served" spaces and volumes.

The Richards Building was immediately recognized and widely heralded as signaling a new direction both in American architecture and the trajectory of Modernism. Scholars such as Vincent Scully (1920–2017) proclaimed its genius, and the Museum of Modern Art in New York mounted an entire show on Richards alone in 1961 — prior to its final completion. Curator Wilder Green stated in the exhibition catalog that Richards is "considered by many authorities here and abroad as possibly the most significant example of post-war architecture in the United States… [and] as individually authoritative an act of architecture as exists in this country today"[1]. Though it was sometimes called a Brutalist building due to the honesty of its tectonic expression, Reyner Banham (1922–1988), the original author of the term the "New Brutalism", in fact had problems with the hierarchy of expression in the Richards Building, and consequently did not embrace its design nearly to the degree exhibited by most other contemporary architectural critics, notably among them William Jordy (1917–1997)[2].

It is perhaps fitting that unqualified praise of this magnitude could only be stated prior to Richards becoming fully operational, as the flaws in its functional logic (some pointed out by Reyner Banham) soon became apparent. Kahn at this moment in his career imagined the way in which the scientists would want to work to be analogous to that of the architect — in open, relatively partition free studio spaces. He is alleged to have commented on his design for the lab floors as follows: "No space you can devise can satisfy these requirements. I thought what they should have was a corner for thought, in a word, a studio instead of slices of space"[3]. Due to tragic communications disconnect during the planning process, Kahn failed to fully grasp what was actually desired relative to the spatial configuration and light control requirements in the labs, resulting in a compromised ideal articulated by Kahn's greatest champion Vincent Scully who notes: "They are (...) a town of colleagues, but in a material sense they function not perfectly at all"[4]. The Richards Building is thus a rare if not unique example of a property with iconic, globally recognized architectural status that has been effectively dysfunctional for most of its working life. Fortunately, the chronic, seemingly intractable functional issues that have led to numerous planning studies and piecemeal interior transformations that have compromised the purity of Kahn's vision have not altered the building exteriors (excluding replacement of several lights of glass), thus maintaining the essential integrity that helped it to achieve status as a National Historic Landmark (NHL) in 2009, the highest honor that the United States can confer on a work of architecture.

By the first decade of the 21st century however, it had become apparent that a comprehensive re-thinking of the core function and purpose of the Richards Building would be required for it to remain a functionally viable structure. Given its conceptual tectonic purity and the additional protection mandated by its NHL designation, which protects the integrity of the building exterior and key interior spaces visible from the outside, it was determined at an early stage that the resolution of the functional issues could only come through a radical re-thinking and ultimately re-purposing of the building program to accommodate the parameters set by the unique configuration of the building. This paper will describe the ideas, process and mechanics that ultimately enabled a successful transformation to its current use.



01 Richards and Goddard Laboratories. Site Plan. © EYP, 2016.

02 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. Construction photo. © University of Pennsylvania Architectural Archives, 1961.

The building – character defining features

The Richards Building is conceived as a series of reinforced concrete tower structures whose exterior expression is reflective of their interior purpose. The plan consists of three nearly identical "served" laboratory towers (called towers A, B and D) set in a pin-wheel arrangement around a central "servant" tower (tower C) in a designed landscape setting (figure 01). The lab towers are seven stories above grade with a basement level with a clerestory at grade. Each of these is defined by large expanses of glass that rise above brick knee walls on each floor to engage the stepping precast concrete Vierendeel frames (they are not true trusses – despite the frequent use of this term) that support the floor above. The virtually windowless service tower has eight stories plus a mechanical penthouse. Each of the towers is separated by a continuously glazed vertical strip window slot, and the rhythmic verticality of the complex is further accented by smaller, artificially attenuated exterior brick service shafts — originally dubbed "schnorkels" by Kahn — housing exhaust ductwork and fire stairs[5].

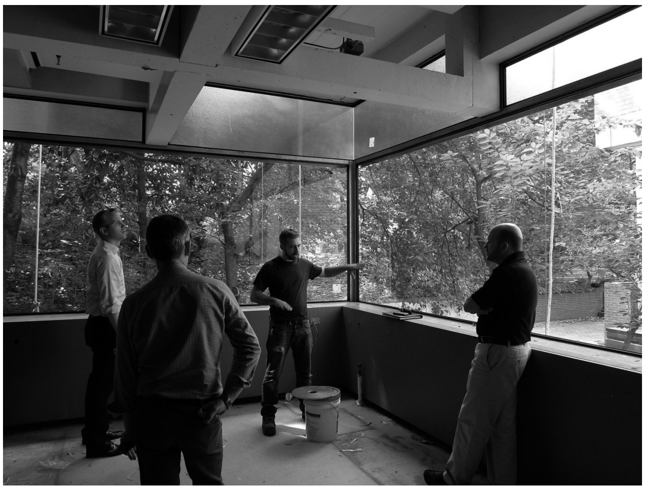
The collective ensemble of a highly articulated structure with clear architectural expression of the separate elements carrying the building services speaks to the fact that the integration of structure and building services was of particular concern to Kahn in this building. He began this quest with his structural explorations with Anne Tyng in the tetrahedral waffle-slab concrete system of the original Yale Art Gallery (which proved to be problematic in terms of building services integration) and next used a primitive Vierendeel frame structure as a way of integrating services and structure in the American Federation of Labor (AF of L) Medical Services Building (1953–55, subsequently demolished) in Philadelphia. Following the AF of L project, Kahn began to work with August Komendant (1906-1992), a structural engineer and visionary in his own right, on a structural system that could better accommodate the heavy building services demands — and need for flexibility — inherent in a laboratory building. The system developed for Richards cantilevers the Vierendeel frames off perimeter columns, creating voids of sufficient depth towards the heart of each floor, to accommodate the necessary services. The design of this system celebrates the architectural expression of structure and services more than any prior or subsequent Kahn building. The exposed concrete frames hung from eight columns placed at the exterior third points (two each side) of each square tower are the primary structure of the served towers, resulting in column-free interior spaces. The concrete structure is sheathed in brick at the servant tower, but there are subtle articulations in the planes of the brick cladding and exposed concrete floor edges that distinguish bearing from infill walls, and thus give clues to how this element is structured as well.

One of the signature elements of the Richards Building is the remarkably detailed vitrine-like exterior envelope of the glazed served towers where all elements – exposed concrete structure, monumental lights of monolithic glazing set in minimal stainless-steel frames, and brick knee-wall between the sill of the windows and the slab – are absolutely co-planar (figure 02). The glazing system that enables this expression is of particular significance and merits special examination as a unique component assembly. Originally conceived by Kahn as a technical exploration that he began with the 1953–55 AF of L Building referenced above, following a less than satisfying experience with the conventional steel window system employed at the first Yale Art Gallery, Kahn continued to develop and refine this idea throughout his career — reaching its final and most complex iteration in the Yale University Center for British Art that was completed after his death in 1974. The essence of Kahn's idea is that existing metal glazing systems — whether rolled steel or extruded aluminum – were not available in assemblies that would yield the ideal combination of strength and an absolutely minimal "truthful" appearance desired by Kahn. The basic component of the system is heavy gauge (c. 3.20 mm) matte finish sheet stainless steel bent on a brake-form into a U-shaped profile with an upturned leg (for a glazing stop) that produces sharp corners and a deep reveal, forming a shadow line that makes most of the frame appear as a void. It also has the benefit of being a material that can easily be employed in its natural state, as was Kahn's preference – no coating system is required as would be the case for carbon steel, which would require paint, or most aluminum systems, requiring paint or anodization. The result is a unique, incredibly simple and highly elegant glazing system (figure 04).

The character-defining features of the interior are the original material palette of the walls and ceilings and the architectural alignment and organization of the original building systems. In order to retain a "sacred zone" between the sill and the head of the monumental windows (between approximately 90 cm and 2.60 m above finish floor) free of services or devices, Kahn's team developed a hierarchy for the placement and distribution of systems throughout the floor (figure 07). Of less significance was the plan subdivision of the laboratory floors; although these were also given an organizing system by which partitions would be placed along the lines of the 9-square primary planning grid dictated by the overhead exposed trusses, and secondary 4-square grids set within each of the primary bays (figure 05).

Renovation drivers

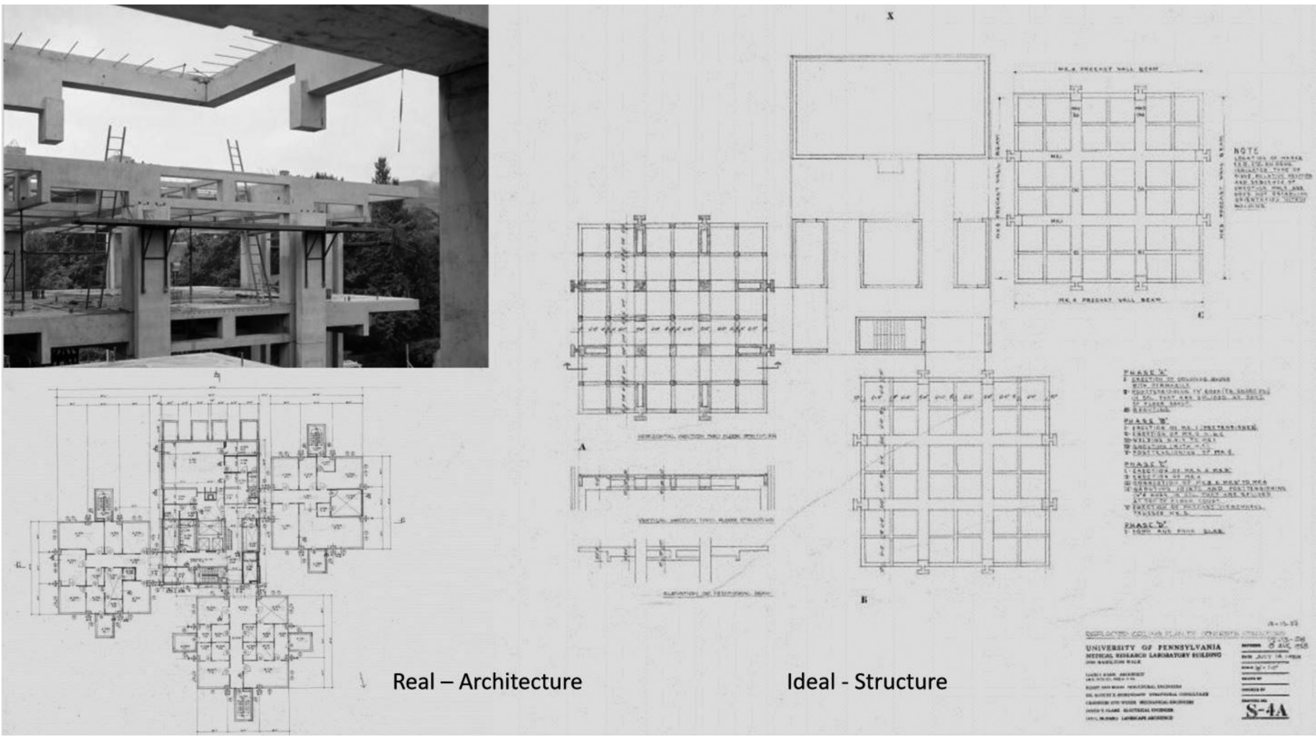
In the early 2000s, faced with increasing dissatisfaction over the ability of the Richards Labs to meet program need, the University of Pennsylvania (Penn) began to formulate a methodical plan with the ultimate goal of keeping the essential character-defining qualities of the building intact while making the changes necessary — in program, services, and where necessary to the structure of



03 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. Photo of mockup of W-1 and W-2 lights *in-situ*, with project team members. © David Fixler, 2014.

04 Louis Kahn, Richards Laboratories, Philadelphia, USA, 1957–1961. View between two towers showing stainless steel glazing frames. © Mildred Schmertz Photograph, University of Pennsylvania Architectural Archives, 1961.

05 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957-1961. Original structural and architectural plans and construction photo of concrete frame erection. © Marshall Meyers, University of Pennsylvania Architectural Archives.



the building itself, that would enable it to be fully adapted to accommodate the rigors of 21st century science. As the building aged and attempts had been made at mitigating some of the chronic acute issues, it became increasingly apparent that the building was unable to support the type of science for which it was originally designed. Structural movement resulting from creep of the cantilevered concrete elements, expansion of the brick veneer and subsequent distortion of the window frames had weakened the glazing gaskets. The windows leaked and were easily broken in high winds as the size of the larger units also stretched their structural capacity. Finally, the exquisite, carefully articulated exposed concrete and cinder block walls and ceilings inside the building had become so soiled and damaged in many areas that they had been covered up or painted — further diminishing the material qualities of the interior.

Over time, as piecemeal renovations were undertaken within individual labs, the logic of Kahn's original organizing principles for routing systems and architectural interventions was lost, and supplemental or replacement systems, materials and devices failed to meet the standards originally developed for the building. Program issues were further compounded by the difficulty of subdividing the laboratory floors into appropriately sized spaces because of the dictates of locating partitions only along the lines of the overhead structure. This resulted in some spaces — in particular the corner offices in each served tower — being too large and flooded with an overabundance of light from the oversized windows, and others being undersized, with inadequate access to natural light.

The original building systems were outdated and inefficient from an energy use standpoint, hindering Penn's goals of achieving high energy performance standards across its entire physical plant. In addition, two key factors were driving the need to maximize the project's sustainability quotient. The first of these is that Penn has joined hundreds of other institutions in signing on to the American College and University Presidents Climate Commitment to meet specific carbon reduction targets by 2030[6]. The second is that the project was funded by a Century Bond Initiative whose primary mandate is to underwrite energy/sustainability upgrade projects.

A key decision then was made to change the use from a wet-bench bio-medical, HVAC intensive series of laboratories to a computational based Center for Cognitive Neuroscience, thereby eliminating the need for fume hoods and the volume of associated ductwork for the HVAC system. This also made it possible to explore more sustainably aggressive alternatives to the traditional variable air volume system that had been employed, to further optimize energy conservation.

Interventions

The primary project drivers were thus energy performance, envelope failures and an imperfect program fit. The charge to the project team was to craft a design that would effectively accommodate the repurposed dry lab, computational program to the structural, material and spatial qualities of the building. In the fall of 2010, the Facilities and Real Estate Services (FRES) group of the University of Pennsylvania in conjunction with the Perelman School of Medicine released a Request for Proposals (RFP) to define the scope and nature of the renovations, and in the spring of 2011, EYP Architecture and Engineering was retained to lead a team of consultants and experts through first the production of a Feasibility Study and then to create a design that could be used both in the initial and subsequent phases of construction.

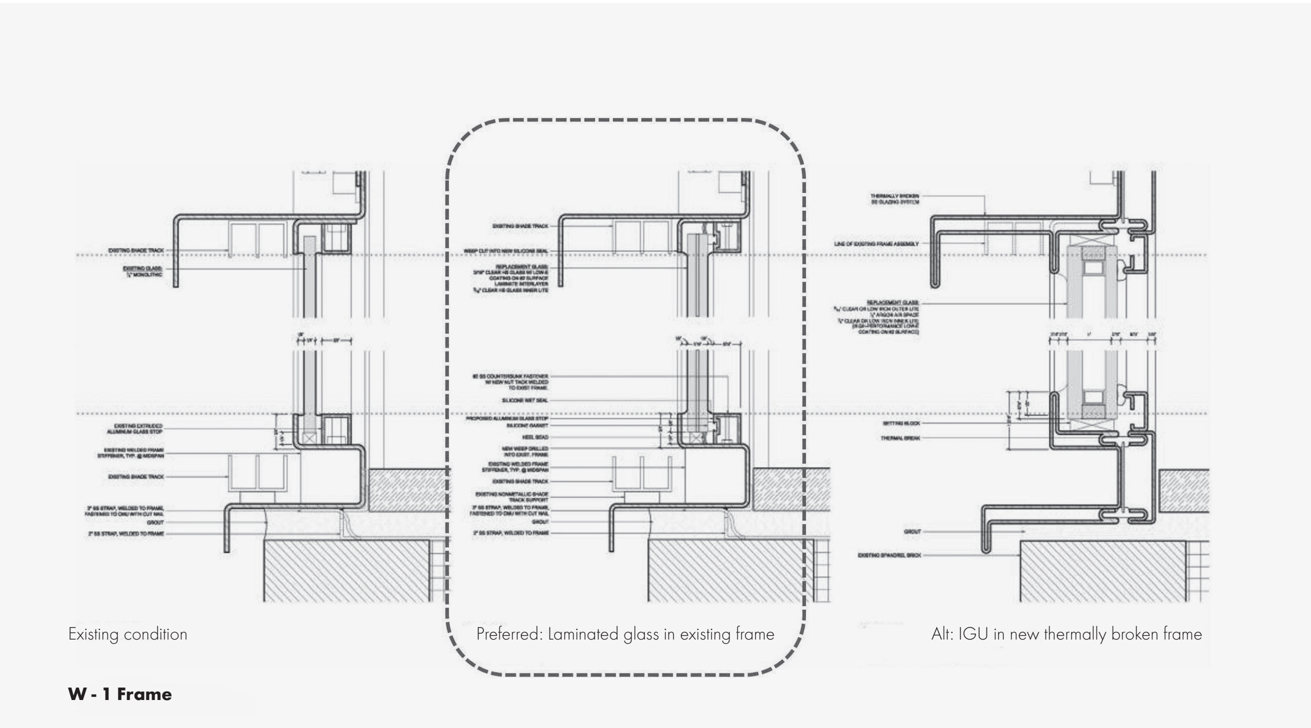
An initial study was undertaken to develop program and planning strategies through an understanding of the history, design and tectonic logic of the building. Design principles were identified that enabled the team to develop a kit of parts capable of responding to a range of possible programs now and in the future. The key technical drivers were glazing and the building systems. In order to accommodate the mandate to balance conservation with performance, the team created an energy model to use as a guide in testing different glazing and system combinations to arrive at an "energy frugal" solution (taken from Penn's RFP for the renovation project) that best balances conservation and performance.

The stainless-steel frames, though an important part of the character-defining historic fabric, lack the thermal break typically employed in contemporary construction, which places limits on maximizing energy performance. This issue was carefully considered, and preliminary studies undertaken to determine the feasibility of replacing the frames showed that replacement would be very expensive and disruptive to the surrounding building fabric, and that in the end the frames would have a heavier appearance than the original units, which was deemed unacceptable. Our energy model also determined though that the potential energy loss was mitigated by the minimal profile of the frames.

The glass itself however had to be replaced for reasons both of energy performance and safety. Typically, replacement glazing in a Northern climate involves the use of insulated glass units (IGUs) to maximize performance. This solution was tested and ultimately considered unacceptable due to 1) the inability of the existing frames to properly accommodate the thickness and weight of the glazing unit and 2) the fact that in windows as large as the typical corner units (roughly 4.20 m × 1.70 m), there tends to be distortion caused by the pressure differential between the airspace between the layers of glass and the surrounding environment, which would not have been visually acceptable (the original windows were polished plate glass with exceptional flatness and clarity). It should also be noted that IGUs have a long-term life-cycle problem, which is that when the seals that hold the two layers of glass apart begin to fail, moisture enters the internal airspace and the units fog up. At this time there is no way to correct this without replacing the unit, which means that within some 20–30 years, much of the glazing would need to be discarded and replaced, which naturally adversely affects the overall life cycle cost of taking this route. Monolithic tempered glass was also ruled out because of the roller wave distortion that is inherent in its manufacturing process — also visually unacceptable — and because the coating that was necessary to ensure improved glare and heat gain control would be left unprotected from potential damage (whether employed on the interior or exterior).

The team therefore tested, mocked up and ultimately employed high-performance laminated glass – identical in appearance to the original lights – with a coating on the number two (interior of outer layer of glass) surface adjacent to the PVB interlayer, that yielded the optimal energy performance possible without the use of an IGU, and was able to be properly fixed within the restored bespoke stainless-steel brake-metal frames. This final design

06 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. Comparative W-1 Glazing Options, Plan – ¼″ Plate, 9/16″ Laminated Glass, IGU. © Diagrams by R. A Heintges, 2012.



was successfully developed and implemented through close collaboration between the design team, owner, glass manufacturer and the glazing installer (figure 03). Ultimately this enabled the envelope performance to improve sufficiently due to 1) the computer scanned laser cut fit of the new glass which was precisely scribed to the distorted openings, which enabled a far tighter seal against resistance to air infiltration and 2) the ability of the glass to resist solar heat gain. Together these factors improved the envelope performance sufficiently to permit the installation of new HVAC that moves from a conventional VAV system to chilled beams, which use far less energy. Through these measures, and by changing all of the lighting to LED sourced fixtures, the team was able to achieve about 80% of the maximum energy savings possible in the renovation, yielding the optimal "energy frugal" structure sought by Penn without compromising Richards' integrity as a work of significant modern heritage (figure 08). Like all of the building systems, these elements are exposed within the space between the bottom of the Vierendeel frame and the underside of the slab above, which means that they are both carefully chosen for their aesthetic as well as performance features and carefully worked into the hierarchy of ductwork, conduit and piping components running within the open frames.

The adaptive reuse of any historic structure will inevitably require substantial change to the interior layout and furnishings, and it is here that creative architectural design and conservation must arrive at an optimal balance that brings out the essence of the original building while enabling the functional and often aesthetic improvements that are necessary to maintain the work as a viable institutional resource. In dealing with a building and an architect of this importance, it also becomes critical to develop a material palette and design language that complement the original work without being overtly mimetic; they must have their own design integrity. Research on the whole of Kahn's oeuvre reveals a consistency of material and detail that give clues as to what could then be appropriately adapted in developing a "kit of parts" for the fitting out of Richards' interior.

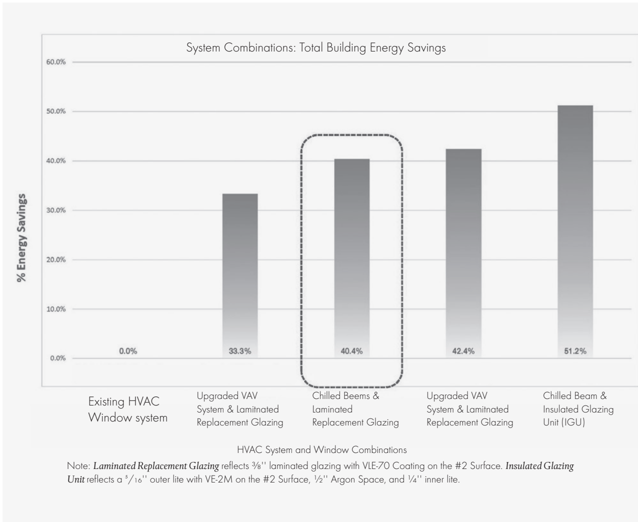
The primary planning issue concerned the right-sizing and equalization of the offices and the attendant opening up of the typical laboratory floor to enable better access to natural light and an ability to perceive the space as it was originally intended by Kahn. In order to accomplish this, the team had to fully understand – and then break — the rules. The typical partitions within the labs were constructed of Concrete Masonry Units (CMU) and, as noted, followed the lines of the overhead structure. This both blocked access to natural light and created very large offices in each of the corners — offices that exceeded the university's space standards and yielded inadequate adjacent interior offices. Careful examination of the original Richards construction documents uncovered a detail that demonstrated a way to create a line of partitions that did not conform to the structural grid, but enabled an offset through the use of an infill ceiling panel flush with the bottom of the overhead concrete frame (figure 10). This detail was updated (the original included use of an asbestos acoustic panel that was changed to perforated matte finish aluminum) and utilized to both increase the dimension of the central open area on each floor and to adjust and right-size each of the perimeter offices. The right-sizing of the offices also involved the introduction of an interior glass corner placed just inside of the exterior glazing to borrow light from the oversized windows. These units employ a special non-glare glass that minimizes reflection and thus is virtually invisible when perceived from the exterior. An important planning decision was also made to always leave at least one corner open on each floor to maximize natural light and views, and to enable the full appreciation of the power of Kahn's own vision for a sort of universal space.

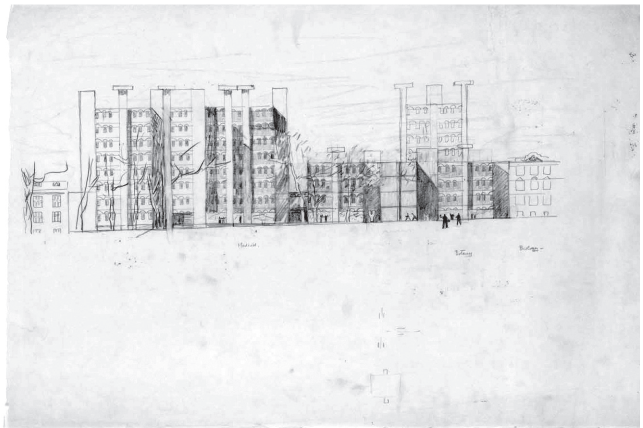
The other major change in the walls was the change from masonry to flush full-height panels of wood and glass to allow light and views to fully penetrate the floors. The interior architectural elements include a partition system utilizing a minimal bent steel frame that is the closest commercially available equivalent that could be found to the original system proposed by Kahn for the building (changed late in the design and never executed) and to the exterior window frames. It incorporates full height (to bottom of overhead structure) flush panels of Kahn's favorite red oak wood and a combination of clear and obscure glass (for privacy reasons), and perforated horizontal metal ceiling closure panels, all of which are chosen as a sympathetic counterpoint to the concrete frame. The ceiling closure detail lends additional flexibility in enabling partition placement off the lines of the structural grid where necessary to accommodate program. This system then builds upon Kahn's material palette and language, both in this building and as he consistently developed it in subsequent work, but is clearly meant to be understood as a contemporary intervention. It was tested, evaluated through a series of mock-ups, and finally implemented in the first phases of construction. The result opens up the center and one full quadrant of each of the laboratory floors and realizes Kahn's original idea of being able to experience the full extent of each glazed volume (figure 15). At the perimeter knee wall in the served towers, previous building renovation had sometimes incorporated a full height floor-sill metal enclosure to protect the perimeter fin-tube radiation units. The design team refined this idea, taking advantage of the space within the unit to add conduit for power and data conduit and moved the heating element (within the enclosure) closer to the window above for greater efficiency and to minimize the potential for condensation (figure 16).

The windowless servant (C) tower was repurposed to hold service, testing and conference spaces. Here as elsewhere within the interiors, conservation issues primarily focused on removing paint and cleaning exposed concrete. The design team worked with conservators from Penn and the industry to ensure the lightest possible touch in cleaning the concrete. The results still exhibit many of the more serious stains and imperfections that have accumulated through the years, but the overall effect is nonetheless transformational, as the cleaning has revealed the degree to which the concrete has

07 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. Interior construction showing routing of systems. © University of Pennsylvania Architectural Archives, 1961.

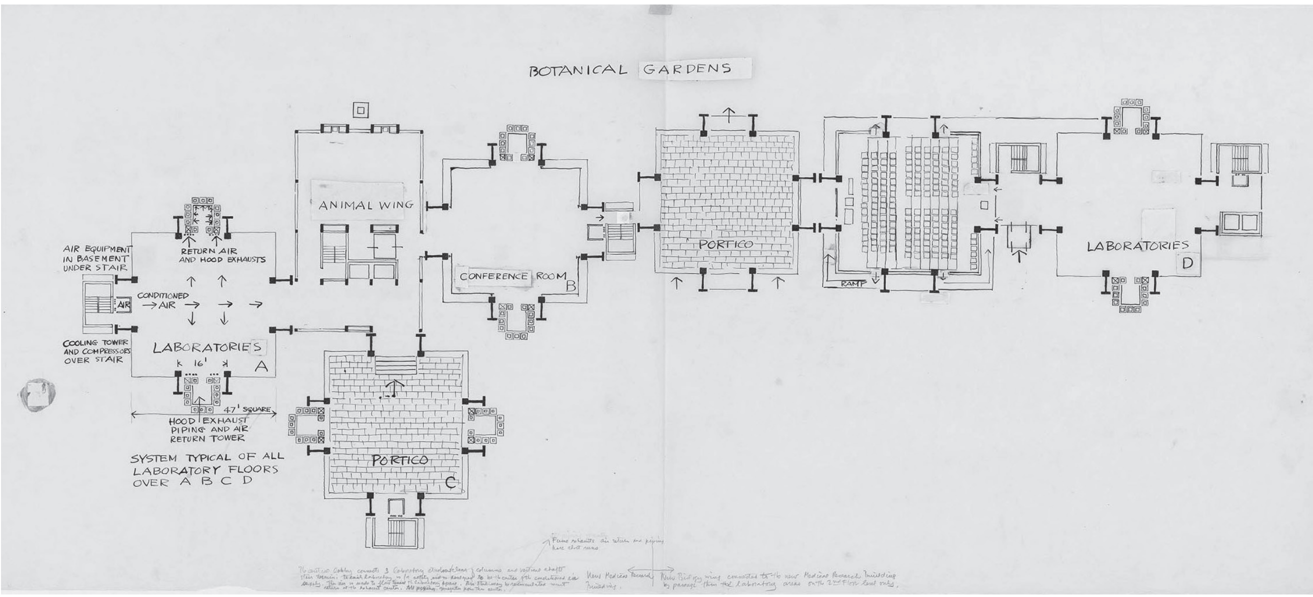
08 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. Energy performance comparison with different HVAC and glazing system combinations. © R. A. Heintges Architects & Urban Engineers, 2014.



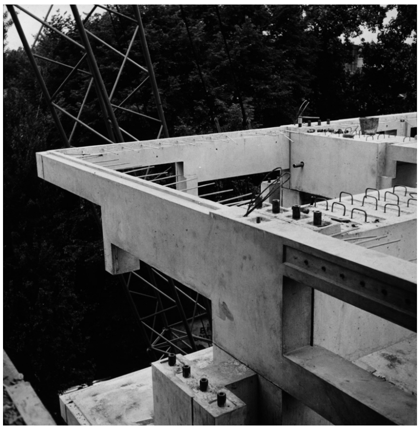


09 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. © Louis I. Kahn Collection, University of Pennsylvania and the Pennsylvania Historical and Museum Commission.

10 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. Completed 6th floor Tower D workspace prior to furnishing, showing full height glass and wood partitions offset from grid with infill ceiling. © Jeff Goldberg, ESTO, 2015.

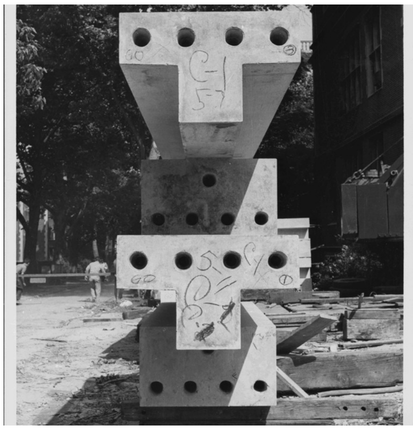


11 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. Preliminary plan with early schemes for structure and systems. © Louis I. Kahn Collection, University of Pennsylvania and the Pennsylvania Historical and Museum Commission.



12 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. © Marshall D. Meyers Collection, The Architectural Archives, University of Pennsylvania.

13 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. © Marshall D. Meyers Collection, The Architectural Archives, University of Pennsylvania.



14 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. © Louis I. Kahn Collection, University of Pennsylvania and the Pennsylvania Historical and Museum Commission.

15 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. Tower D, 6th floor plan before and after renovation. © EYP Architecture and Engineering, 2015.

16 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957–1961. Typical renovated corner office showing knee-wall enclosure and interior glazing along offset line. © Halkin Mason, 2015.

17 Louis Kahn, Richards Bio-Medical Research Laboratories, University of Pennsylvania, Philadelphia, USA, 1957-1961. Exterior from West. © Halkin Mason, 2015.

warmed in tone and acquired a genuine and pleasing patina through the process of carbonation.

The one important exterior change that will ultimately be required for the Richards Building is to provide a gracious accessible entrance to the building. Presently individuals with disabilities must enter through the adjacent Johnson Building because the entry platform for Richards is about a meter above surrounding grade. When the final renovations are complete, there will be a limited use/limited access lift placed within the brick service tower to the east of the entry pavilion (tower A) that has become redundant with the reconfiguration and modernization of the building services. This has been designed to enable access from the surrounding plaza in a manner that will not be visible from the public way as a change to the historic appearance of the building. The lighting at this entry platform will also be subtly improved to create a safer and more welcoming entrance to the complex. Future conservation efforts will be required for the exterior concrete frame, which is already showing signs of wear, and this is being monitored closely by both FRES and the School of Medicine to ensure the safety and integrity of the building (figure 17).

Conclusion

The transformation of Kahn's Richards Laboratories demonstrates both the possible successes and limitations inherent in working with significant modern buildings — especially those that have had chronic functional or performance difficulties throughout their history — and starts to point a way towards how to achieve the best possible results in creating a successful renovation. At the top of the success list, one of the key tenets of conservation practice is that wherever possible a building should maintain something of its original function or use value through the process of transformation.

Although Richards has lost its wet benches it very much remains a building for scientific research, after early thoughts of possibly converting it to housing or even a new home for Penn's school of architecture. Second, the retention and enhancement of the essential exterior material palette ensures that the historic public appearance of the building will be retained, even through the course of future possible renovations, with the only limitation being that the envelope will never be completely as robust from an energy standpoint as would be possible with contemporary construction.

The interior transformation speaks conceptually to Kahn's idea for the building but the interventions are for reasons of both desire and necessity completely different from the original interior elements (aside from the reinforced concrete walls and some of the CMU partitions). In this sense they represent a subjective, creative act — one arrived at through an iterative, consensus-based process with a large group of stakeholders, that is meant to reveal, enhance and engage the best qualities of Kahn's material and spatial idea for Richards without ever trying to upstage it. As I stated in the conclusion of a companion article in the proceedings of the *14th International **docomomo** Conference* in Lisbon:

> *It is never possible to fully anticipate the consequences of the transformation of any building. Though it was predictable that the opening of the floors would enable the appreciation of the full impact of the space; what has also become apparent is the degree to which the stark, weathered quality of the building structure has re-asserted its autonomous architectural power in contrast to the elegant steel precision of the new partition system. This is an appropriate outcome, as Kahn's building is in the end an expression of tectonics, systems and space as something decoupled from though not entirely independent of function, and the clarity of this distinction has never been more apparent than at present*[7].

This is a delicate balance; the solution may not be perfect — there will always be room for differing opinions — but it works; the new users of the building are generally satisfied from the point of view both of function and ambiance. As the later phases of the renovation approach completion it is hoped that the Design Guidelines that were crafted near the outset of the project and have continued to evolve throughout the course of design and construction will also continue to both maintain consistency of approach and help guide the inevitable change that future users will bring to the building. For this time however we take comfort in Inga Saffron's assessment "that the building has for the first time become what Kahn wanted it to be"[8].

Notes

The project team roles and responsibilities were as follows. Owner: University of Pennsylvania (Department of Facilities and Real Estate Services (FRES); Perelman School of Medicine); Lead Architect, Design and Phase I Execution: EYP Architecture and Engineering; MEP/FP Engineer: Urban Engineers; Structural Engineer: Keast and Hood; Glazing/Window-wall: R. A. Heintges Architects; Materials Conservation: Building Conservation Associates; Executive Architect: Phases II-IV – Atkin, Olshin, Schade.

1 Wilder Green (curator), *Richards Medical Research Building, Louis Kahn, Architect*, New York, Museum of Modern Art, 1961, p. 1 of the press release.

2 Both Banham and Jordy wrote extensively about Richards at the time of its construction. Jordy writes lyrically and in great depth in an article first published in *Architectural Review* in 1961, and then expanded for inclusion in the *American Buildings and Their Architects* series in 1972. Banham noted in particular in his 1962 article for the *Architectural Review* and his 1966 update to "The New Brutalism" that despite the claims of others to the contrary, Richards did not move architectural discourse beyond where Le Corbusier had left it 30 years earlier.

3 Quote attributed to Louis Kahn, source uncertain.

4 Vincent Scully, *American Architecture and Urbanism,* London, Thames and Hudson, 1969, 215

5 Thomas Leslie, *Louis Kahn Building Art Building Science,* New York, George Braziller, 2005, 121.

6 American College and University Presidents 2030 Climate Commitment: this group seeks a 30% reduction in carbon emissions from their institutions by 2030.

7 David Fixler, "Transforming an Icon on its own Terms: repurposing Kahn's Richards Building" in Ana Tostões and Zara Ferreira (ed.), *Adaptive Reuse. The Modern Movement towards the Future. 14th International Docomomo Conference Proceedings,* Lisbon, Docomomo International/ Casa da Arquitectura, 2016, 940.

8 Inga Saffron, Changing Skyline, "Turning Richards Labs into the Building Louis Kahn Wanted it to Be", Philadelphia Inquirer 9 January 2016 [http://articles.philly.com/2016-01-09/entertainment/69618013_1_louis-kahn-towers-my-architect].