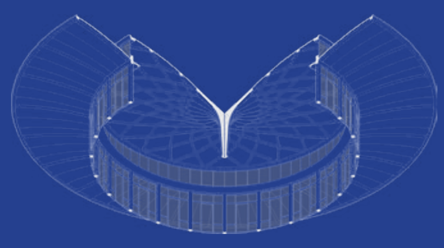
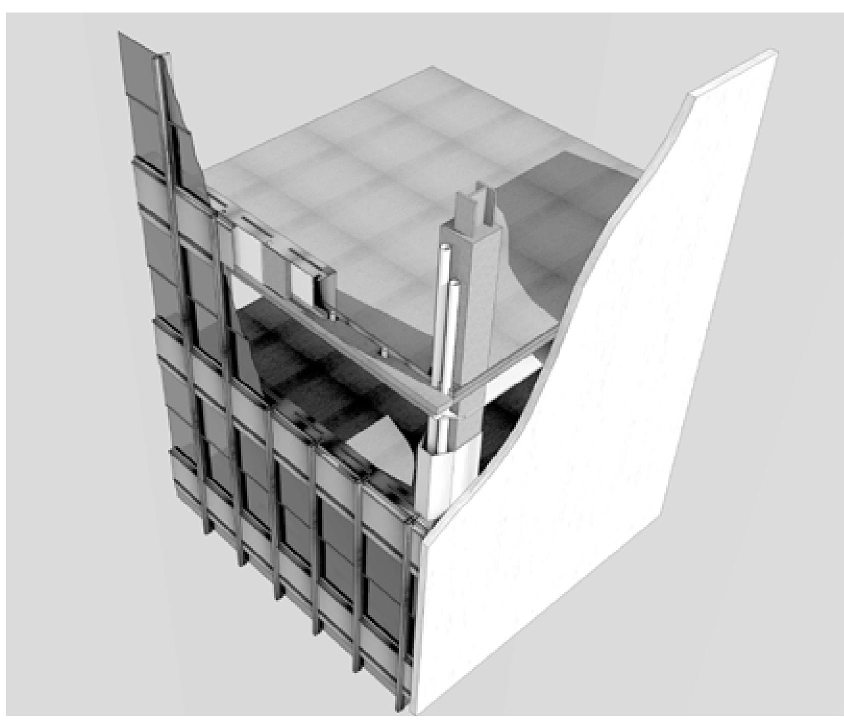
THOMAS LESLIE, FAIA



Teaching and Research Portfolio
Winter, 2023

Pier Luigi Nervi, Tobacco Warehouse, Bologna, Italy, 1951 (left). Harrison and Abramowitz, United Nations Building, 1949, (bottom, curtain wall reconstruction by Saranya Panchaseelan and Paolo Orlando). Pier Luigi Nervi, *Salone B, Torino Esposizione*, 1949.



SCHOLARSHIP--NOUNS AND VERBS

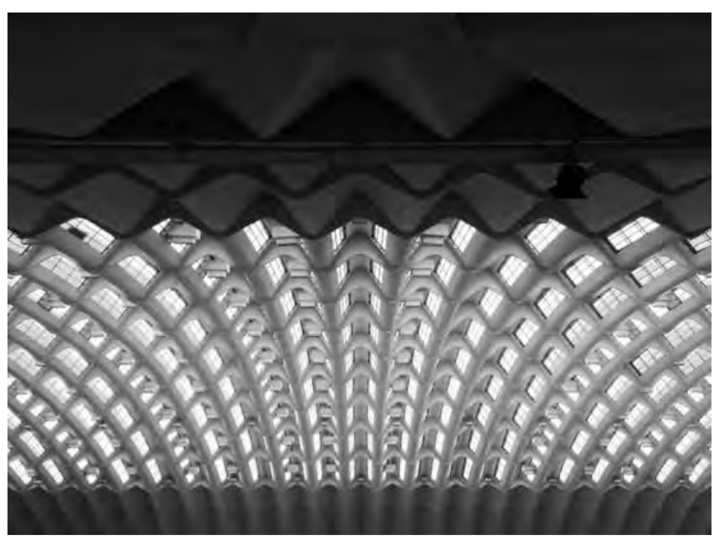
"It is no linguistic accident that 'building,' 'construction,' work,' designate both a process and its finished product. Without the meaning of the verb that of the noun remains blank."

John Dewey, ***Art as Experience***, 1934

I am interested in the relationships between what, why, and how we build. Dewey, in his brilliant aphorism, pointed out that our human production is a complex negotiation between the world as it is and the world as we desire it, that our interactions with that world involve attempts to understand and to modify it, and that this process involves constant experimentation, failure, reconsideration, and iterative attempts to 'fail better,' finding new equilibria between our human needs and an indifferent but malleable nature. This, I believe, is what we do as designers.

Dewey's discussion of nouns and verbs occurred within a broader discussion of the aesthetic realm, and in the seven years since my promotion to Professor I have become more interested in considering the relationship between my traditional realm of 'hard' technical aspects of building and the more subjective realm of beauty. I have researched case studies—buildings, or in some cases whole careers—that suggest links between how buildings perform, how they are constructed, and whether they provide the unique cognitive satisfaction that suggests 'beauty' to us. My research on Pier Luigi Nervi, has shown that, rather than an 'emergent' beauty—a determinant link between performance or efficiency and the satisfaction of our instinct toward beauty—the refinement of design solutions through multiple filters of desired performance and available means merely, in Nervi's words, "suggests" possible routes to architectural aesthetics, and it remains the agency of the designer, who "welcomes the suggestion and models it, emphasizes it, proportions it, in a personal manner which constitutes the artistic element in architecture." This model sees technology not as a determining force, but rather as a collection of grammars—structural, constructional, material, functional, etc.—each of them offering possible meaning. These are often contradictory, and it remains in the very personal realm of the designer to tease out legible narratives from the inevitable tangle of values and suggestions before them. The ability to do so relies on a fluency in each of these grammars, as well as a well-honed 'sensitivity' to possible manifestations or outcomes. My research shows how this combination of knowledge and vision has been applied to problems ranging from art museums to bridges, and how the general public—without expert knowledge but bringing to every interaction with architecture or construction a wealth of lived human experience—responds to lucid presentations or explications of technical principles with genuine engagement. Every time I have led a tour of Nervi's masterful ***Palazzetto dello Sport***, or walked someone past the punctuated structural rhythms of Sullivan's Carson Pirie Scott store in Chicago, I have been touched by the emotional response such refined examples produce, even among those with no background in architecture or engineering. I am interested in discovering how such pragmatically conceived structures can, through their designers' attention to detail and ornament, be transformed into such resonant experiences.

This agenda crosses disciplinary boundaries in ways that are both challenging and rewarding. It has, since my promotion to Professor, been recognized by funding, awards, fellowships, and publications that range across the fields of history, engineering, preservation, and architecture. Most notably, it has produced scholarly books (***Chicago Skyscrapers, 1871-1934*** and ***Beauty's Rigor: Patterns of Production in the Work of Pier Luigi Nervi***) that have won favorable reviews in publications ranging from the ***Journal of the Society of Architectural Historians*** to ***Construction History*** and ***Architectural Record***. Since promotion to Professor, I have also published peer-reviewed articles in highly competitive outlets including the ***Journal of the Society of Architectural Historians***, the ***Journal of Illinois History***, the ***Journal of the International Association of Shell and Spatial Structures***, and the ***Council on Tall Buildings and Urban Habitats Journal***. My scholarship has been recognized with invitations to collaborate with Lord Norman Foster, my former employer, on a design history of the Millau Viaduct in France (2012), to write a catalogue essay for the international traveling exhibition ***Louis I. Kahn: The Power of Architecture*** (2012), and to contribute a long essay on the history of American building technology to ***The Oxford Encyclopedia of the History of American Science, Medicine, and Technology*** (2015). Other essays of mine have been anthologized (***Building Systems: Technology, Design and Society,*** 2012), and translated and published abroad ("Les 'Quatre Causes' de l'Architecture, ou la Réponse de Dankmar Adler au Texte de Louis Sullivan, 'de la Tour de Bureaux Artistiquement Considérée,'" 2012). I was also invited by the family foundation of Pier Luigi Nervi to lead the editing and re-publication of Nervi's 1965 collection of lectures, ***Aesthetics and Technology in Building,*** and I am currently editing, at the invitation of the Society of Architectural Historians, the Iowa entries in their online ***Archipedia***, preparing roughly 35 essays on important buildings myself and coordinating other scholars' efforts on the project.



Research for this work has been supported by competitive, peer-reviewed funding, in particular ***Beauty's Rigor***, which was the result of a six-month fellowship in Historic Preservation at the American Academy in Rome. Publication of this book was assisted by a ***Furthermore*** grant from the J.M. Kaplan Fund. I led a group of graduate research assistants in their successful application for a grant from the Council on Tall Buildings and Urban Habitats, which led to the 2016 publication of "Deep Plan, Thin Skin," a pilot paper for my current research project on postwar high-rise construction. I am also part of a €161,000 grant from the Getty Foundation to prepare a preservation plan for Nervi's Flaminio Stadium in Rome. In addition to funding, my scholarship has been recognized by invitations to appear on major media outlets to discuss historic building construction and contemporary failures: I discussed skyscraper history and the Grenfell Tower disaster as part of a panel on the BBC World Service program ***Forum*** in 2017, and have appeared on radio and TV programs in Chicago (WBEZ, WTTW, WGN) to help explain that city's high-rise legacy. My views on the Council on Tall Buildings and Urban Habitat's ratification of One World Trade Center's height were featured in a ***New York Times*** op-ed piece in 2013, and my class lecture on Chicago skyscrapers was featured on C-SPAN's ***American History TV*** in 2015. Finally, my research has garnered lecture invitations from schools of architecture and engineering throughout the U.S. and Europe. I continue to lecture regularly to docents at the Chicago Architecture Center, have keynoted conferences ranging from state AIA meetings (South Dakota, 2014) to international Construction History gatherings (Chicago, 2015, Cambridge, UK, 2016), and engineering exhibitions (Lehigh, 2018), and served as a Senior Visiting Fellow at the Institute of Advanced Studies at the ***Università di Bologna*** in 2017. In recognition of my eight-year association with Northwestern University's undergraduate program in architectural engineering, I was invited to join the faculty of the McCormick School of Engineering there this year, and currently hold the title of Full Adjunct Professor in their Department of Civil, Construction, and Environmental Engineering jointly with my position at Iowa State. Finally, the most personally meaningful recognition of my work has come from the American Institute of Architects, which elevated me to Fellowship in Spring, 2018.

Going forward, I hope to bring the explanations of building as a culturally, technically, politically, and economically situated activity to broader audiences. My public appearances have been particularly rewarding, and have convinced me that my approach to understanding the relationships between what we build, how we build, and why we build provides fertile ground for broader knowledge about the environments humans have constructed around ourselves for thousands of years. While I have begun work on a new scholarly project—***Chicago Skyscrapers, 1934-1974***—I also hope to turn my seminar class on construction history into a general non-fiction book project. ***Big and Tall*** will be the first comprehensive overview of the relationships between construction, engineering, design, and their socio-cultural contexts, one that promises to tie together many of my interests while showing some of our species' most acknowledged works of architecture and urban design in a new light.

Pier Luigi Nervi, Thompson Arena, Dartmouth College, 1975.

RESEARCH

My research sees architecture as a meeting place between the two cultures of art and engineering.

Few other disciplines offer such clear evidence of the difficulties in shaping the world we desire out of the indifferent resistance that world actually offers. Yet this friction can produce graceful, even poetic artifacts. Much of the awe and joy that we feel when standing in Chartres Cathedral, the Aya Sophia, or the Kimbell Art Museum comes from the connections we make between their spaces and forms and the principles of physics that they evidence. We can know the equations, the shapes, the chemistry that make these structures stand, but--at its most disciplined and eloquent--architecture also makes us feel and intuit these principles. This understanding, the instinctive desire to know how a building stands or works and whether it is up to the tasks we ask of it, is an innate source of visual pleasure. When we find bits of the world that are congruent with and exemplary of our understanding, we feel more satisfied with and sure of our place in that world.

This appreciation for architecture's integration of physical necessity and visual satisfaction comes from my seven years with the office of Norman Foster and Partners, both in their main office in London and as a site architect for a medical research laboratory at Stanford University. The experience of coaxing a design through construction gave me, I thought, a stance from which I could teach, and in 2000 I accepted a position at Iowa State, where I have taught building design, history, and technology since. I was hired primarily for my technical background, and I have enjoyed teaching students the difficult pleasures of structural design and its role in architecture. But my research has sought to frame this knowledge in a broad historic context, to understand how structural and functional desires have always been balanced against real material facts, and how the negotiations between these two realms have—occasionally—been nurtured into formal and spatial poetry. To date, this has resulted in three books, each of which examines how technology and design have challenged and informed one another in three very different building cultures.

My first book, ***Louis I. Kahn: Building Art, Building Science***, was the result of four years of research into Kahn's working methods and his collaborations with engineers and contractors—structural engineer August Komendant in particular. Kahn (1901-1974) has always been known as an architectural poet, and spaces such as the courtyard of the Salk Institute (La Jolla, CA, 1968) continue to inspire and awe visitors today with their seemingly ineffable, silent presence. This book argued that such profound spatial experiences were due to the technical fluency that informed the structures forming them—that Kahn's integration of structure, construction, function, and environmental response was so carefully considered, so thorough, that nothing was left to distract from the purity of his spaces. I noted in particular Kahn's documented influence on the so-called "high-tech" school of the late 20th century (including Norman Foster, but also Renzo Piano and Richard Rogers), and suggested that the resolution and expression of such technical factors in these later architects' work could also be explained by the clarity of the solutions and the language in which they were visually explained. This connection between technology and experience has been cited in studies of Kahn's work by Carter Wiseman, Wendy Lesser, and others since.

While Kahn's work is a neat case study of a single career and its relationships with a handful of trusted collaborators, my 2013 book ***Chicago Skyscrapers, 1871-1934*** (University of Illinois Press, 2013), looked at broader issues of economics, geography, politics, and industry. These came to bear on the development of a building type suited to Chicago's explosive real estate market in the late 19th and early 20th century, and they can be read into the details and forms of the city's tall buildings. This study challenged the traditional historiography of the city's architecture; historians from Siegfried Giedion onward saw Chicago's expressed frames and thin skyscraper skins as prescient signs of 20th century modernism, but in fact these traits grew from onerous financial and material realities. While the mythology of the city sees a period of mercantile classicism from 1913 forward as a decadent betrayal of the city's original principles, my research showed that these heavier buildings were shaped by changing environmental systems, in particular the affordability of electric lighting, which eliminated the need for broad, light-gathering windows. This study also showed that Chicago's building was tightly linked to the industry of the region, and its proximity to sources of glass, iron, and terra cotta made its buildings markedly different from any others.

My latest project, ***Beauty's Rigor: Patterns of Production in the Work of Pier Luigi Nervi*** (University of Illinois Press, 2017), investigates a slightly different balance of engineering, construction, and design. Italian builder Pier Luigi Nervi (1891-1979) was trained as both a structural engineer and a contractor, and he designed and built structures throughout Italy that won praise for their economical designs, rigorously conceived structural forms, and breathtaking spaces. Nervi was a brilliant designer, and his intuitive sense of 'correct' structural form ensured that his buildings for sports palaces, airports, and factories were always grounded in very evident applications of simple physics. Yet his structures were constructed using algorithmic processes that ensured they could be built with his in-house laborers—always a small crew—and affordable hoisting equipment. By breaking down the scale of each project into units that could be manipulated by small groups of workers, Nervi imbued his structures with a visual grain; to stand in his ***Palazetto dello Sport*** is to understand through form and pattern both how the dome stands and how it was built. Nervi's career encompassed two Roman sites—his design office near ***Piazza del Popolo*** and his ***cantiere***, or contractor's yard, south of the city in Magliana. The knowledge gained from experiments at the drawing board and in the fabrication yard can be read into Nervi's forms, but also into the patterns that grace these forms with marks of their own production and assembly.

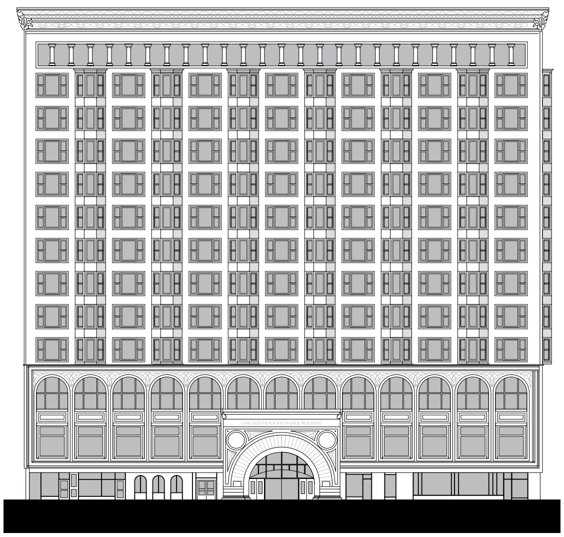
I have two nascent projects that I hope to add to this sequence of books in the next few years. ***Chicago Skyscrapers, 1934-1974*** will look at the evolution of the city's high-rises in the radically changed political, technical, and social climates of the postwar era, showing how mechanical systems and new glass technologies forged new constructive types that played into the city's re-envisioning of its central core. It will also show how these developments downtown were matched by more troubling marriages of building and systems technology to the city's notorious public housing projects; while steel and glass formed a gleaming city center, concrete formed a less successful typology that encoded the city's unspoken but insistent culture of segregation. With a team of graduate students (Saranya Panchaseelan, Shawn Barron, and

Paolo Orlando) and I have published the first reconnaissance paper in this project. "Deep Plan, Thin Skin" looks at the effects of four technologies—air conditioning, insulated glazing and heat-absorbing glass—in the shaping of mid-century high rise floor plates and curtain walls. A more detailed history of insulated glazing is in production with the ***Association for Preservation Technology Journal***, and I have conference papers on the influence of the 1951 Chicago Building Code and the role of fluorescent lighting in the rise of the modular office scheduled for presentation during this academic year. I am in discussions with the University of Illinois Press to turn these early papers into a full monograph.

A larger project, ***Big and Tall: A History of Construction from the Pyramids to the Burj*** is a development of my class notes for a seminar on construction history that will form the first thematic study of building arts and sciences over the last 3000 years.

In each of these projects, the relationships between aesthetic or functional desires and the indifference of the material world to those desires are negotiated by designers, builders, and makers fluent in the competing requirements and forces inherent in all three. The histories of the resulting negotiations provide alternatives to the cleaner, traditional histories of architecture based in narratives of style, type, or biography. Histories of construction are necessarily more complex; teasing clear narratives out of efforts to meet difficult needs with resources limited by time, geography, knowledge, and money is inevitably my research aim. This approach, telling history from the drawing board and the job site, has opened connections between architecture and histories of technology, labor, politics, and economics, situating the discipline within rich networks of influence and showing how what we do is often the precipitated result of these acting upon one another.

CHICAGO SKYSCRAPERS 1871-1934



Chicago Stock Exchange. Louis H. Sullivan, 1895.
From *Chicago Skyscrapers, 1871-1934.*

UNIVERSITY OF ILLINOIS PRESS, 2013

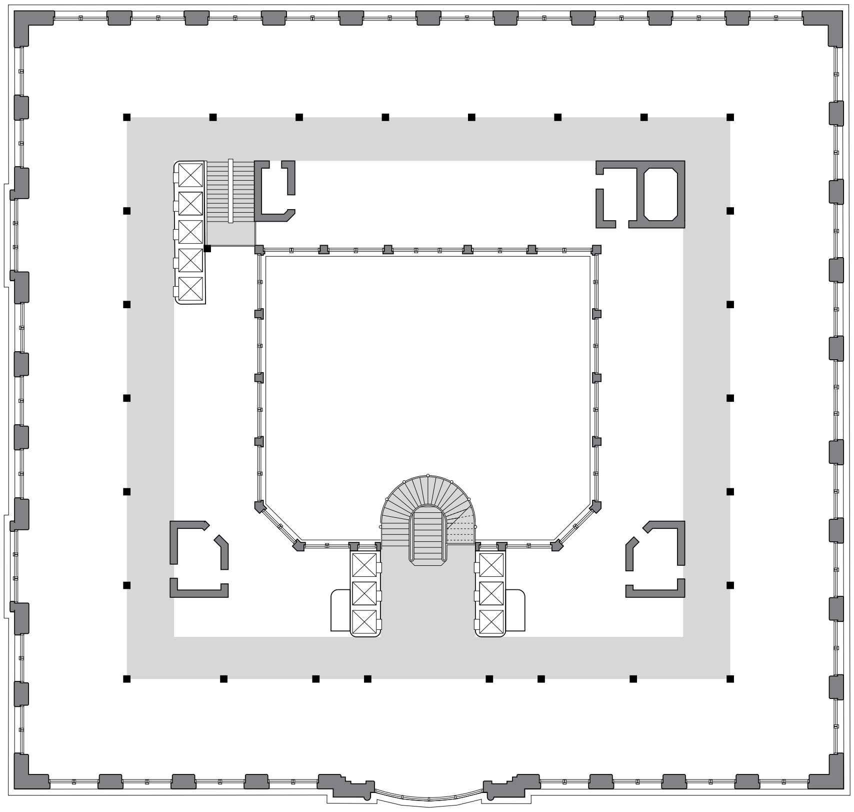
"While imperfect, occasionally contradictory, and never as neat as one might prefer, arranging Chicago's tall commercial structures in terms of architecturally and constructionally distinct types proves useful in elucidating the city's skyscraper evolution from five-story mill construction at the time of the Fire to a type recognizable by 1934 as the basic template for tall building construction throughout the twentieth century. This evolution occurred through both incremental, almost unrecognizably subtle steps and in what evolutionary biologist Steven Jay Gould called "punctuated equilibrium," that is, sudden bursts of new forms or types that were quickly adopted and that sufficed for repeated iterations, until some other change in material availability, code restrictions, or functional necessity emerged. These typologies were all sensitive to their industrial, economic, and cultural contexts, and the fickle nature of the commercial rental market meant that building types were made obsolete with astonishing rapidity as new conveniences or efficiencies emerged in the market. While such an evolutionary model is limited, it was a model that was recognized even at the time, by John Root among others.

"A list of 330 major structures built in Chicago between the Great Fire and the Great Depression and an attempt to describe their technical systems (in particular structural, foundational, and cladding) yields seven overlapping constructive types that dominated at various times, based on material availabilities and costs, structural techniques, code impositions, or changing functional standards. The following study is thus divided into chapters that explore the technical milieu from which each type was distilled and the influence on architectural or structural composition that it suggested or encouraged."

From Chapter 1, "Introduction."

"Leslie reshapes [skyscraper] history with deep scholarship, immaculate prose, highly informative graphics, and the rare understanding of buildings that comes from being both a practitioner and an academic. What sets this volume apart even further from its predecessors, however, is the graphic material: the author's superbly precise floor plans and elevations, accompanied by highly evocative historic photographs, postcard views, and informative digital reconstructions photographs, postcard views, and informative digital reconstructions....Essential." --Choice

Unlike earlier historians who drew deceptive clarity from simplification and myth, Leslie expresses the intertwined realities that designers and builders experience as they strive to solve the technical and formal problems presented by a novel building type. Combining numerous elements-architectural and construction history; cultural, technological, and social history; political, planning, and economic history-Leslie presents a story that rings true as a portrait of professional life in the building world in all its ambition and ambiguity. --*Tom Peters,* Journal of Architectural Historians

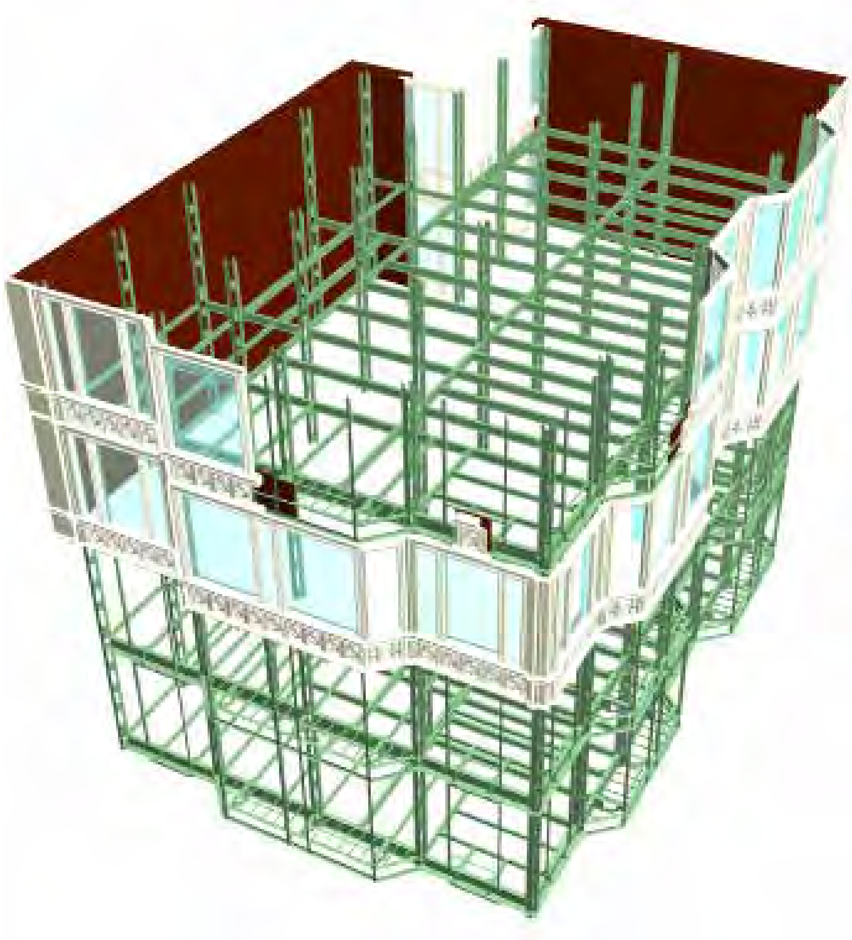


"The Rookery's frame was a gravity-resistant system only; like the Home Insurance, it was supported against lateral forces by a system of belts and hoop-steel that loosely tied iron elements to the mass of the exterior brick walls. Connections between beams, girders, and columns were made with comparatively loose iron straps. But the Rookery's masonry walls were reinforced to create a stiff hybrid frame that combined the strength of iron with the rigidity of brick. "Nowhere is the masonry left to tie itself," noted *The Engineering and Building Record* of the Rookery's structure. "Everywhere it is helped out by iron, and all the members of the building are so thoroughly tied together that it would seem almost impossible for any breaks or structural defects to show themselves."

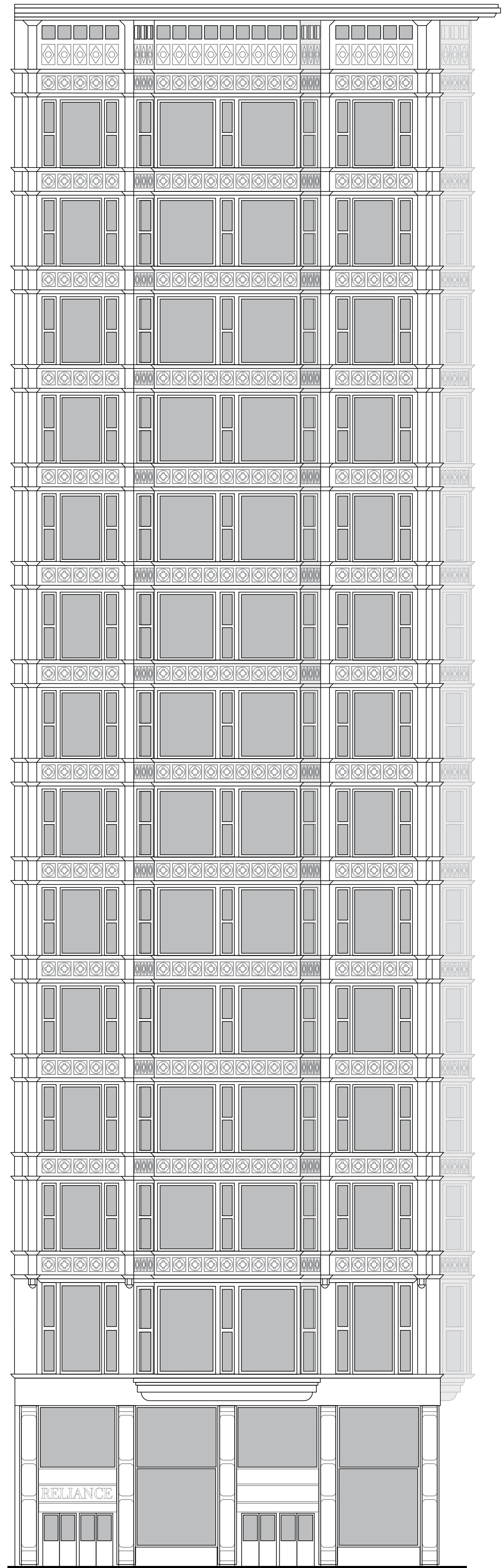
"....Columns and girders were connected by cast lugs bolted to girder webs, and they were protected by standard fireproofing elements of terra cotta flat arches, plaster ceilings, and cement floors by the Pioneer Company. The Rookery and the Home Insurance both featured piers that were composites of iron and brick; both relied on a combination of reinforced iron joints and large swaths of masonry for their wind bracing; and both featured elevations that expressed neither the bulk of masonry nor the attenuated lines of metal, instead offering measured steps away from the spatial and daylighting limitations of bearing masonry though not yet exploiting the full potential of the all-metal frame."

--from Chapter 3, "Iron and Light: The 'Great Architectural Problem' and the Skeleton Frame, 1879-1892."

Rookery Building, Burnham and Root, 1885. Plan (author), view from La Salle and Adams streets (contemporary postcard).

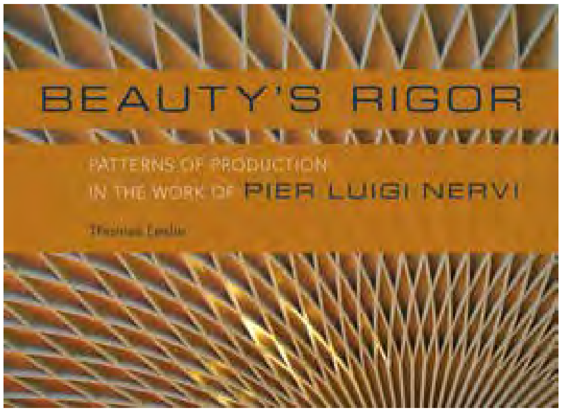


Reliance Building, D.H. Burnham & Co., 1895. Cutaway view (Ryan Risse) and State Street elevation (author).

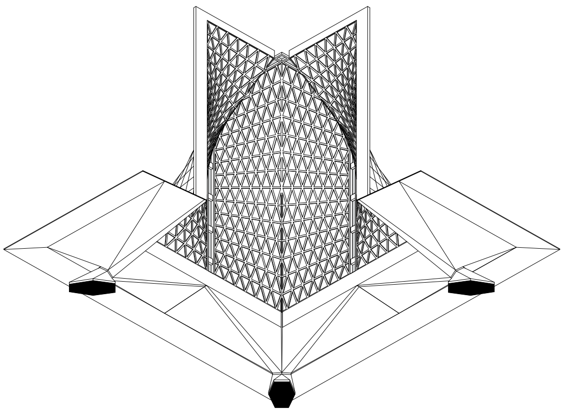


"It has always been tempting to see these curtain wall structures as precursors of their twentieth century counterparts, but these experiments were not as prescient as they might appear. For Burnham, the experiment was momentary; it was only in the 1920s that scholars and architects saw in hindsight the foreshadowing of a new aesthetic in buildings like the Reliance. Burnham abandoned this formulation as soon as it became problematic, first because of revisions to the Chicago Building Code (see Chapter 6), and then because of higher plate glass prices and lower electricity costs. To construct a 'building without walls' in 1896, however, was an important achievement. By positing a skin that was draped over the frame rather than integrated with it, Burnham and Atwood were able to achieve buildings with significantly improved performance relative to structures of only a year or two before, with more glass, lower foundation loads, and more easily achieved height. At the same time, this formulation required a new approach to skyscraper aesthetics, and Atwood rose to this challenge with programs of airy detail, proportions, and even color. Atwood's emphasis on verticality, line and plane, and repetition of ornamental elements reflected these developments in steel frames, enameled terra cotta cladding, and plate glass. While the neo-gothic proportions of the Reliance and the Fisher would quickly be eclipsed by a code- and materials-driven return to bulk and mass, they offered an alternative interpretation of the steel frame as light, glassy constructive type, one that built upon the development of the wind-braced frame's separation of skin and structure."

--from Chapter 5, "Glass and Light: 'Veneers' and Curtain Walls, 1889-1904."



BEAUTY'S RIGOR:
PATTERNS OF PRODUCTION IN THE WORK OF PIER LUIGI NERVI



St. Mary's Cathedral, San Francisco, CA.
Drawing by Lana Zoet, from *Beauty's Rigor: Patterns of Production in the Work of Pier Luigi Nervi*

UNIVERSITY OF ILLINOIS PRESS, 2017

"...Architecture for Nervi was not just a meeting ground between science and art. It was also a dialogue in which the two architectural cultures form impulsive and constraining influences—a desire for emotional or sensory satisfaction and a rigid set of fiscal and technical boundaries within which that desire may be played out. This implies both an energy and a discipline, a creative impetus and an intellectual skepticism, operating at once. Built works that failed to inspire or that failed to stay within their budgetary or functional parameters were invalid under this arduous pair of strictures. For Nervi this defined the role of the designer and forged innovative, compelling work. In his own oeuvre, he could point to over a dozen acclaimed structures that he had constructed not on the basis of their sensational aesthetics but rather on strict competitive tenders. The fact that the Turin Halls or the Palazetto roof were in fact so striking, came not from the willful imagination of the designer, but rather from the distillation of a programmatic solution into its simplest structural scheme and its most cost-effective constructive methods—albeit with an important latitude in how they were finished and detailed that remained in designer's realm of "sensibility."

"Nervi laid out this basic conceptual armature several times in his writings. In his 1963 essay "Some Considerations About Structural Architecture," the last of his essays published by North Carolina State's student design publication he wrote:

"I believe the essential conditions of structural architecture to be as follows:

1. It must give a convincing answer to a real and authentic static necessity and be determined by it.
2. A static constructive scheme should become visible and comprehensible inside and outside.
3. It must express frankly the material with which the structure is executed and find in the technological characteristics of the material itself the sources and ways, as well as the details of its architecture."

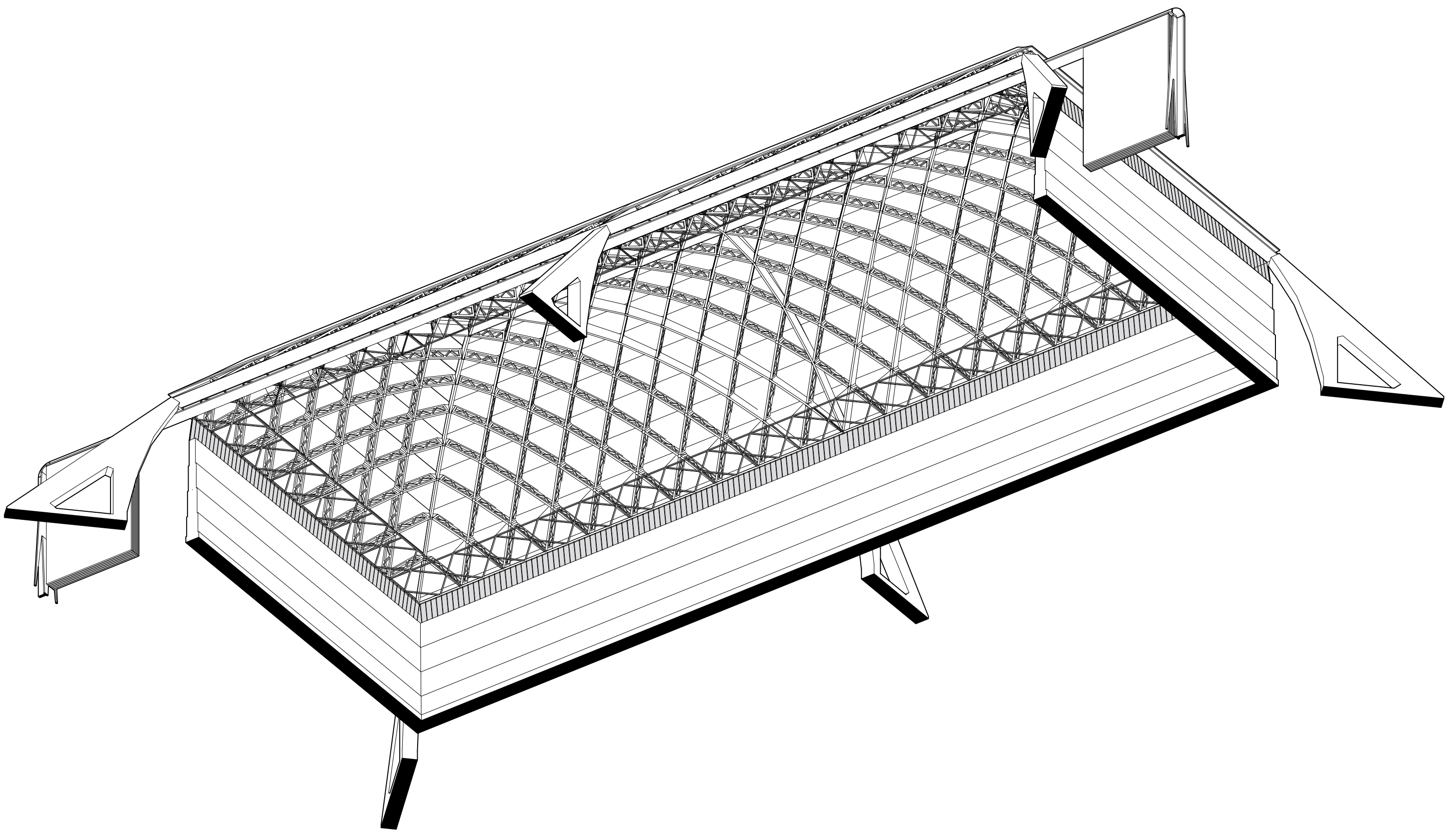
"This tripartite structure resonates with the title of *Aesthetics, Technology, and Building*, emphasizing the intertwining of structure, construction, and expression—itself an engineer's riff on the Vitruvian triad of firmitas, commoditas, and venustas. It can therefore serve as a road map toward teasing consistency out of Nervi's many overlapping publications. Overall, this outline appears again and again in his writing, albeit in different guises and with different phraseology. Nevertheless, Nervi's philosophy hones in on this formula for architettura strutturale: it must be true to the diagram and scale of static forces and be legible in the experience of its occupants and bystanders. Legibility, however, must be coaxed through materiality and detail. In other words, the structural scheme forms the overall meaning; the construction forms the grammar through which this meaning is inscribed and read, and the phrasing of this construction through detail gives the work its style. Engineers are charged with arriving at a logical structural scheme and with finding the means to instantiate this scheme. Beyond this, however, the architect must also find in these complex negotiations moments that can elucidate principles and processes to be legible and appealing."

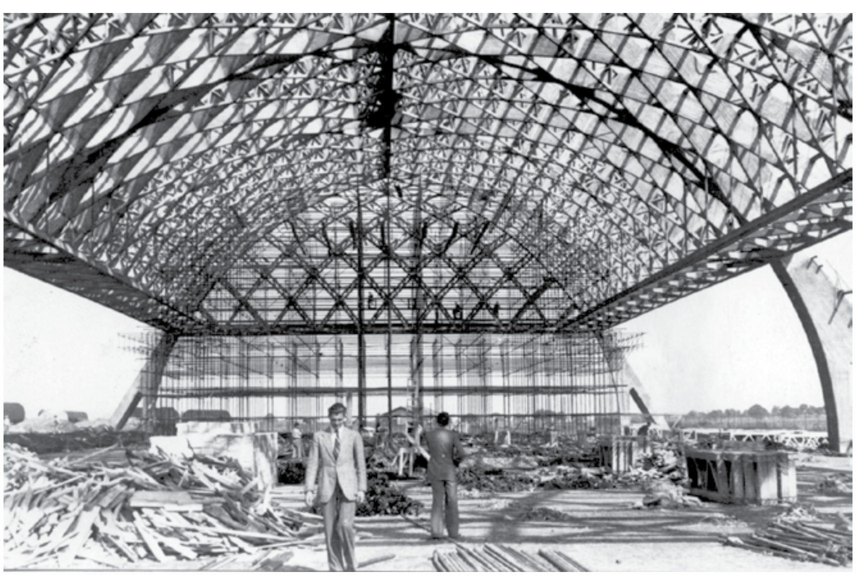
--From "Preface."

"Leslie makes an exploration, both actual and theoretical, of Nervi's life and key works, in nine thematic chapters. This book is not a desktop exercise in colating, summarising and analysing the extensive and diverse catalogue of the great architect/engineer/builder...One of the stand our features and most pedagogically useful aspects of the book are the wonderful drawings by Leslie and colleagues that describe projects in orthographic projection, their geometry and construction sequence....Nikolaus Pevsner writing in The New York Review of Books *in 1966 stated: 'Nervi's greatness is his combination of aesthetic power with structural resourcefulness and honesty.' Thomas Leslie's wonderfully crafted and punchy book is a worthy testament to Pevsner's sentiment..." --Will McLean,* Construction History

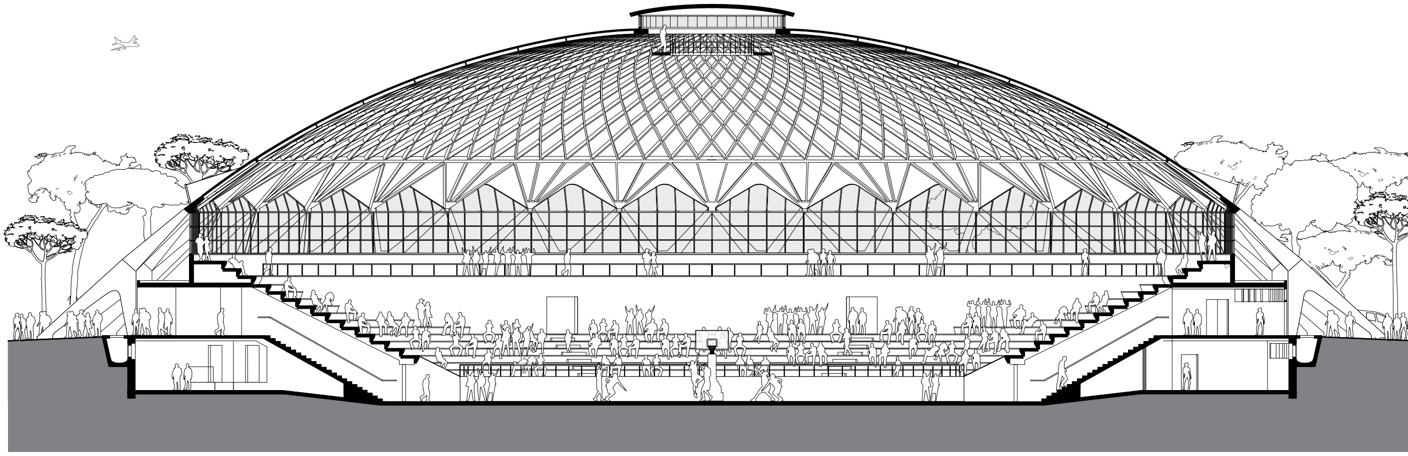
"These new hangars swopped the brute force of the earlier poured-in-place structures for the finesse of a far lighter, more delicate support network. While the geometries of the two were similar, the later hangars stood because of their calibrated equilibrium rather than the heavy, continuous buttressing of the earlier version's side and rear walls. By Nervi's definitions, the Orvieto hangars were Roman—monolithic and massive—while the Orbetelo and Torre del Lago iterations were Gothic, based on equilibrium and tracery. They were light, soaring structures that seemed to just barely stand and to use no more or less material than necessary. Spurred on by more and more stringent economics, Nervi grew more daring, more experimental, his designs grew more audacious and more striking."

--from Chapter 2, "'Repetition of Identical Sections'—Structural Precasting."

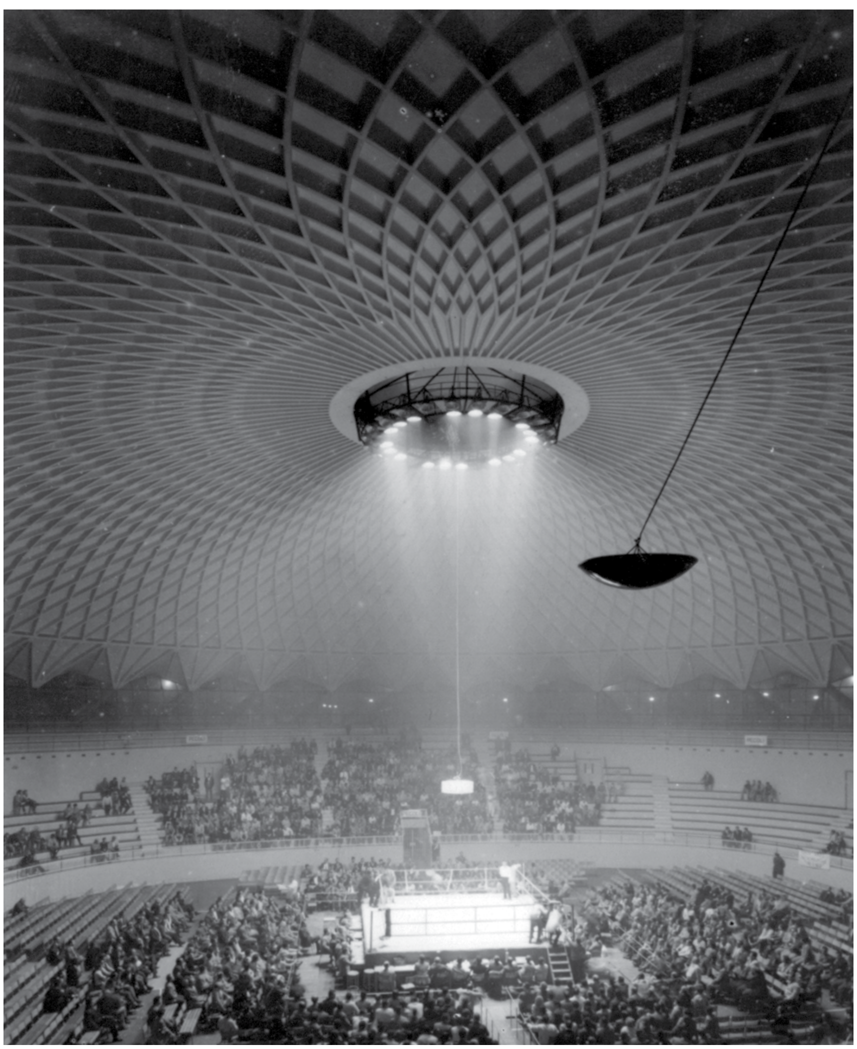




Prefabricated Aircraft Hangars, Orbetello. Experimental prototype of concrete system (top, MAXXI). Worm's eye view of finished hangar. Construction view showing Nervi at front, in tie. (left, MAXXI).



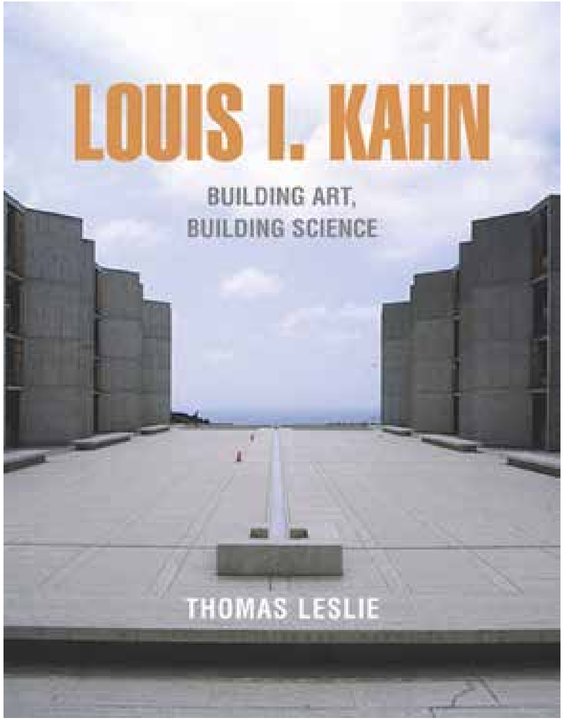
Palazetto dello Sport, Rome, 1957. Section (above). Construction view showing *ferrocemento* formwork pans (right, CSAC Archives, Università di Parma). View during 1960 Olympic boxing competition (below, MAXXI).

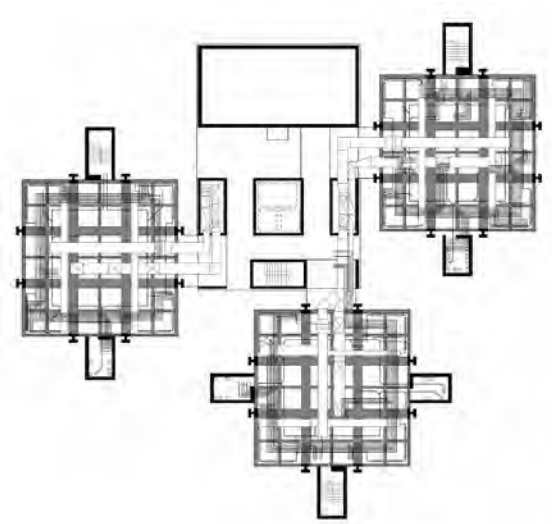


"For Nervi, the intuition of the engineer was matched by a natural intuition in the human mind that evaluates structures in order to determine whether they will support us or not. Whether this is an a priori cognitive ability or whether it is gained through a lifetime of experience, our interaction with the physical world requires us to intuit structural behavior on a daily basis--what is the easiest way to pick this object up, will this chair support us if we stand on it, will this pile of things fall over, and so on. Nervi hinted that this subconscious grasp of structural principles forms its own language, one in which the engineer or architect can speak, can demonstrate, can even argue--but only if the structure and building blocks of the language are legible in the objects we experience and seek to engage. It was, Nervi felt, possible for technically correct solutions to be too sophisticated or too inarticulate to allow comprehension: "How could one express a thought in a poetic language with poorly known words, grammar and syntax? Many architectural difficulties of the moment derive precisely from the fact that the speed of technical progress has overtaken the inevitable slowness of development of the technical skills of the designers." This language can create beauty when we find the structure satisfactory, or ugliness when we feel threatened or unsure."

--from Chapter 8,
"Connecting the Two Cultures of Building."

LOUIS I KAHN:
BUILDING ART, BUILDING SCIENCE





Richards Medical Laboratories, Philadelphia, PA.
Drawing of mechanical and plumbing systems from *Louis I. Kahn: Building Art, Building Science*

GEORGE BRAZILLER, 2005

"If Kahn's conceptions stemmed from his continually developing understanding of building science, how these were made manifest focused on pure expression, on connecting with our minds and our sensibilities as observers. It was not enough for Kahn to simply find an efficient solution, rather, it was paramount that a solution communicate itself visually or tactilely. Throughout Kahn's work, this connection of a building's assembly, its performance, and our perception of these were, again, woven together, solutions inseparable from expressions, details integrated with ornament. In this, Kahn's approach lay somewhere between Fuller, whose complex structures were well beyond the intuitive abilities of most observers, and Mies, whose apparently straightforward expressions of structure and function usually belied or concealed crucial aspects of both. Kahn believed that the ways in which a building's systems, structures and materials were presented—through some combination of distinguishing, balancing and weaving—must ultimately be aimed at, and tested against, the built work's experience itself....

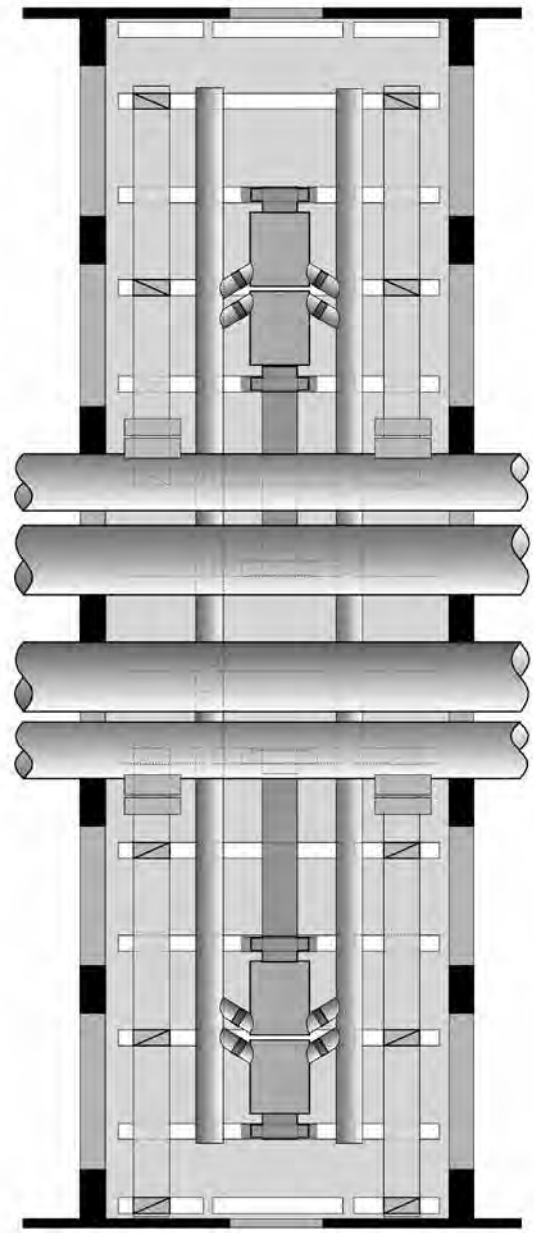
"Expression was, for Kahn, the opportunity to record both the job site's activity and that of the drawing studio. "I think that a building should show how it was made," he wrote shortly before his death, "and should give some idea of the struggle involved in building it." The very purpose of his quest for order was to make a clear, legible statement to us, eliminating everything that would "blur the statement of how a space is made" and confuse our understanding. This recording of the design and construction processes, was not simply to be shouted into the void, nor was it limited in its focus to other architects or engineers. In all of Kahn's work, the intention was to provide a road map to the processes of design and to that of the job site, to record the inherently meaningful activities of design and construction. The details and finishes that Kahn insisted upon were designed to communicate these "struggles" to all, to enable the Kimbell's patron, for example, or the undergraduate at Yale to share the excitement and passion that Kahn himself felt for the universal and contingent truths of each project. What is perhaps most unique about Kahn's work is that however complex the structural, environmental or constructional solution, its expression was always designed to communicate some fundamental principle of its conception in as legible and comprehensible a way as possible. It may be that the "little old lady from Abilene" would not fully appreciate the mathematics of Komendant's post-tensioning cables at the Kimbell, for example. But she would surely recognize the shells' enormous spans, the constant rhythm of the roofs, and the exquisite quality of the silver light flowing off of the raw concrete overhead. Architects and historians may develop deeper thoughts about the Kimbell's various elements and spaces. But these hardly invalidate the simpler, more direct communication that Kahn was keen to establish with a far larger population."

--From Chapter 6, "Conclusions"

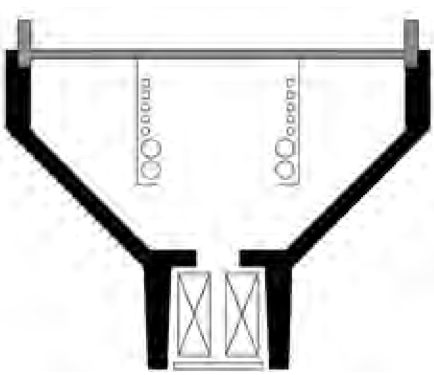
"The message of the book, how a building should speak of the way it was put together (itself a nineteenth-century quest) is important today when things are put together anyway and anyhow. ..A critical assessment of Kahn's contribution to current architecture can be useful for architecture students especially those obsessed with surface-architecture and in desperate need of critical strategies to decode the occasional return of the most archaic in the new. To this end, Leslie's book is a welcoming one." --Design Issues

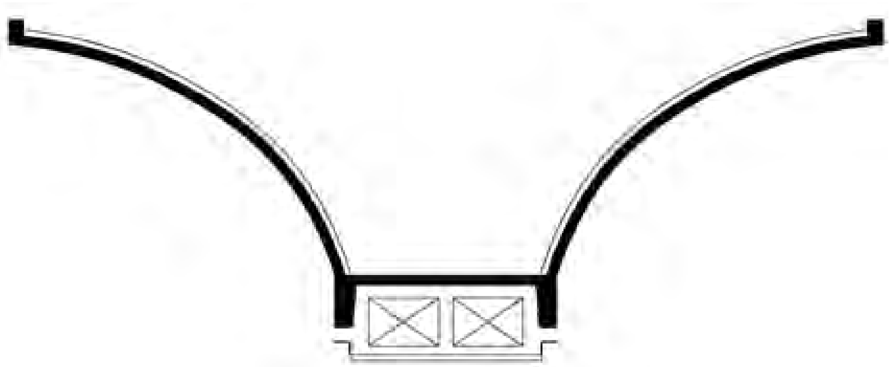
While Komendant's claims of deadlines and changes may not be entirely supportable, there is no doubt that the structural solution he developed from Kahn's sketches was brilliantly executed. Despite his objections that the Vierendeel was a structurally 'incorrect' solution, the Salk remains a textbook example of the potential for this structural type, and it was, perhaps reluctantly, highlighted by Komendant in his monograph on concrete structures published in 1972. The logic behind the Vierendeels in the Salk parallels their use in Richards. Truss construction replaces a beam's solid vertical web with a network of axially loaded members, substituting simple compression and tension for shear. This enables the physical separation between tension and compression chords without the weight of a solid web. Again, as at Richards, Vierendeel trusses reversed the logic of simple trusses' diagonal arrangements, providing robust moment connections between the flange elements and the vertical posts separating them. These posts resist the internal shear in the truss' 'web', which is transmitted by the moment connections into the tension and compression members at the bottom and top of the truss, respectively. While trusses of traditional shape are familiar solutions to clear-span situations, their depth is greater than that of a simple beam, and the provision of services either underneath or above such a truss implies an increased floor-to-floor height. In service-intensive programs such as laboratories, the depth of the mechanical systems is often as great as the required structural depth. There is thus efficiency in combining structure and services in the same section, achieved in the earlier scheme using folded plates with services in the hollows of each member.."

from Chapter 4, "The Salk Institute."



Salk Institute for Biological Studies, La Jolla, Ca.
Typical mechanical module as designed by mechanical engineer Fred Dubin (above). Construction view (left, Architectural Archives, University of Pennsylvania).
Kimbell Art Museum, Fort Worth, TX. Comparison of structure to early Salk Institute scheme (bottom, drawing by the author).





AESTHETICS AND TECHNOLOGY IN BUILDING: THE 21ST CENTURY EDITION

Aesthetics and Technology in Building: The Twenty-First Century Edition (top). Pier Luigi Nervi on the site of the George Washington Bridge Bus Terminal (bottom), from Alberto Bologna, "Pier Luigi Nervi And The Clever Construction Of An Ephemeral Success In The United States, 1951-65," critical essay in *Aesthetics and Technology in Building.*

Co-editor, with Cristiana Chiorino and Elisabetta Nervi
UNIVERSITY OF ILLINOIS PRESS, 2018

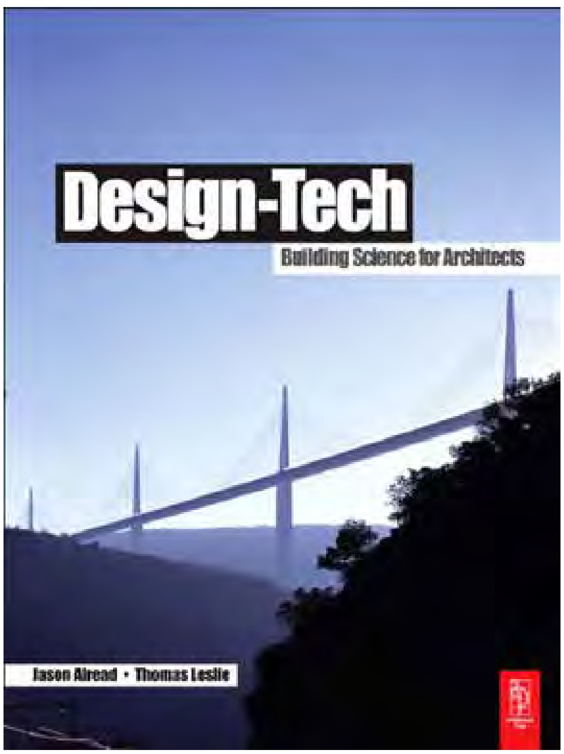
"The "soaring beauty" of Pier Luigi Nervi's visionary designs and buildings changed cityscapes in the twentieth century. His uncanny ingenuity with reinforced concrete, combined with a gift for practical problem solving, revolutionized the use of open internal space in structures like arenas and concert halls.

Aesthetics and Technology in Building: The Twenty-First-Century Edition introduces Nervi's ideas about architecture and engineering to a new generation of students and admirers. More than 200 photographs, details, drawings, and plans show how Nervi put his ideas into practice. Expanding on the seminal 1961 Norton Lectures at Harvard, Nervi analyzes various functional and construction problems. He also explains how precast and cast-in-place concrete can answer demands for economy, technical and functional soundness, and aesthetic perfection. Throughout, he uses his major projects to show how these now-iconic buildings emerged from structural truths and far-sighted construction processes.

This new edition features dozens of added images, a new introduction, and essays by Joseph Abram, Roberto Einaudi, Alberto Bologna, Gabriele Neri, and Hans-Christian Schink on Nervi's life, work, and legacy."

–University of Illinois Press Catalogue Copy.

DESIGN-TECH:
BUILDING SCIENCE FOR ARCHITECTS



Design-Tech: Building Science for Architects. 2nd edition, 2014 (top) and 1st edition, 2006 (bottom).

with Jason Alread and Robert Whitehead
ARCHITECTURAL PRESS, 2006;
ROUTLEDGE, 2014

Design-Tech: Building Science for Architects is based on the course notes and structure we developed for Iowa State's graduate technologies curriculum. When first published, in 2006, it addressed the lack of holistic, introductory building science textbooks by combining structural, environmental, construction, and performance themes into a single, integrated volume. Like our coursework, *Design-Tech's* organization into short chapters on focused subjects allowed us to address topics across these subdisciplines—for instance, showing how steel beam shapes arose from both static and fabricational forces, or discussing how heavy materials such as concrete balance structural and environmental influences. A second edition, published in 2014, includes rewritten sections on structural design and new chapters on high rises, specifications, site design, digital fabrication, and BIM. *Design-Tech* is used in undergraduate and graduate programs in North America, the United Kingdom, and Australia, and was named one of twenty finalists for the Royal Institute of British Architects Book of the Year Award in 2005.

"With Design Tech *we finally have the book that effectively extends building technology (teaching) into design studios and professional practice. A must have for students and young professionals." --Andrzej Zarzycki, Associate Professor at New Jersey Institute of Technology*

"Design-Tech *is how I wish I had learned first principles of building technology: integrated, intuitive, and imaginatively illustrated. " --Ryan E. Smith, Director ITAC, University of Utah*

BUILDING: CONSTRUCTION: WORK A HISTORY OF CONSTRUCTION FROM THE PYRAMIDS TO THE BURJ KHALIFFA

Current Book Proposal

"It is this two-fold generosity that I want to propose as a standard in assessing built works from a technical standpoint: does an object accomplish its function of making our way in the world more effective or more efficient, and does it also leave us with a better understanding of our relationship to that world? This, I think resolves a long-standing debate in engineering and architecture in particular in that it validates the role of aesthetics in design. Too often the expressive aspect of a building or structure is dismissed or explained away as irrelevant, or the coincidental byproduct of an otherwise rigorously economical process. This may well be true, but anyone who has practiced will recognize the urge to tinker with a fully resolved and efficient solution until it seems visually or tactilely satisfying. A well-detailed stair handrail, for instance, or a finely balanced or sculpted knife handle are both well-understood examples of elements that can be solved quickly, but often resolved only with hours or days of study and iteration. While experience may come after more economically or functionally pressing issues have been solved, it is common across a range of design disciplines to subject those solutions to an equally rigorous process of revision, re-examination, and re-design until the senses and intellect are sated.

"*Building: Construction: Work* applies this lens to the history of human building; to see construction as an activity that is intimately tied to the scientific understanding, the material culture, the industrial abilities, and the economic climate of its specific times and its local places, but to also see it as an expressive art in its own right, one that replicates those influences in sensory experiences that in turn reveal and clarify our own relationships to those contexts. Throughout, my emphasis will be on types of building that reflect these temporal and geographic particulars, explaining how these suggested, defined, limited, or inspired particular ways of building and particular forms of architecture. But these will be matched by thinking about how these technically-influenced 'suggestions,' to use Nervi's term, have subsequently been modeled and shaped by much softer vectors, in particular the human desire to explain and to understand. The text will focus not on how buildings look so much as what they are, taking an archaeological approach rather than an art historical one, and exploring the deep fabric of construction along with its public face and attempts by builders, designers, and commentators on how the stuff of building has implied more abstract ideas about how it might best be ordered, engendered with meaning, and in some cases how it could—with enough care and devotion—instantiate the divine. These modes of building—pragmatic, representational, and philosophical—are, of course, intricately related, and it is this conversation between how we build, how we present that activity to the world, and why we invest this particular activity with such meaning that constitutes the following inquiry."

Pompidou Centre, Paris, Rogers and Piano, 1971-77 (top). Reims Cathedral, 1211-1345 (bottom).

Two Skyscraper Legacies: Inland Steel Building, Chicago (SOM, 1955-57, top), Bertrand Goldberg presenting scheme for Hilliard Homes to Mayor Richard J. Daley and member of the Chicago Housing Authority, 1961. (bottom, Chicago History Museum).

CHICAGO SKYSCRAPERS, 1934-1986

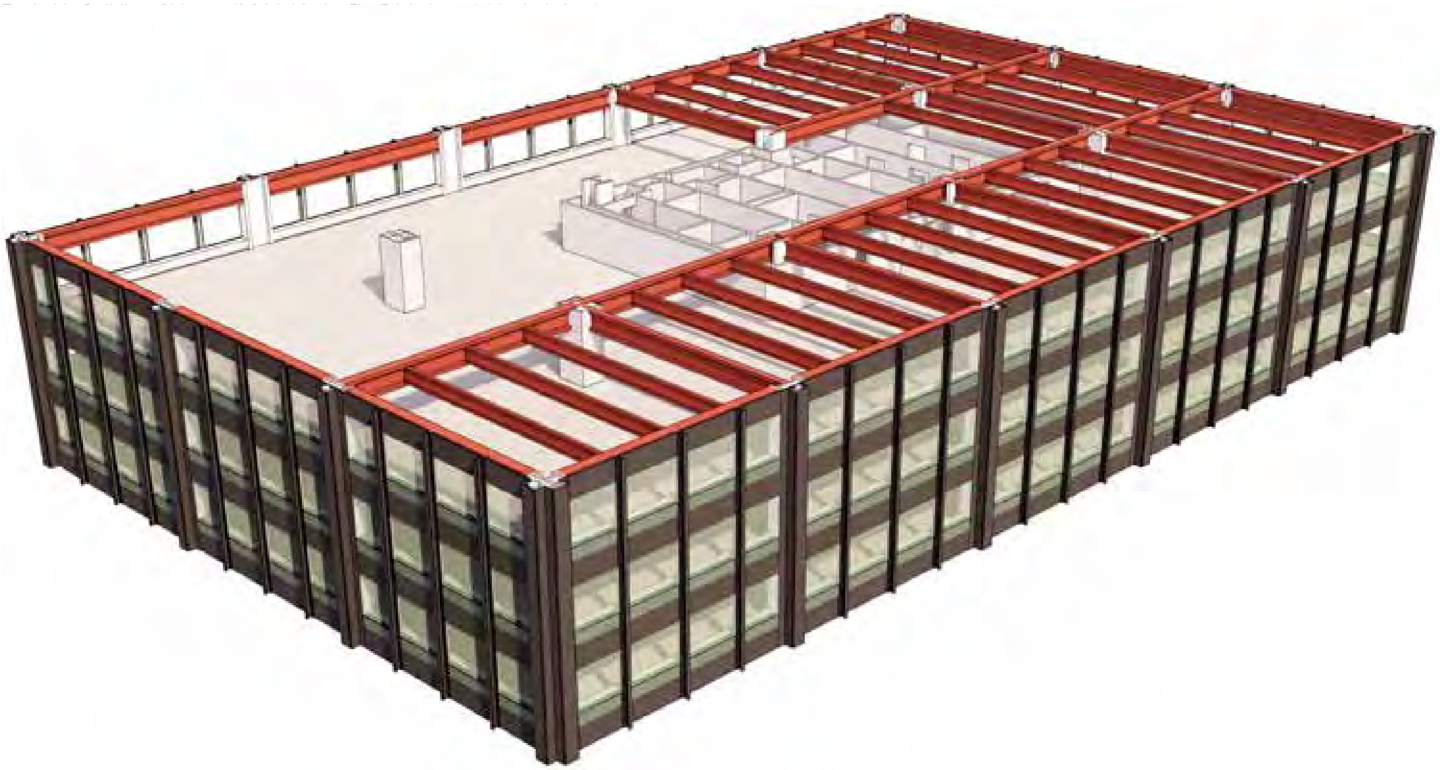
UNIVERSITY OF ILLINOIS PRESS, FORTHCOMING

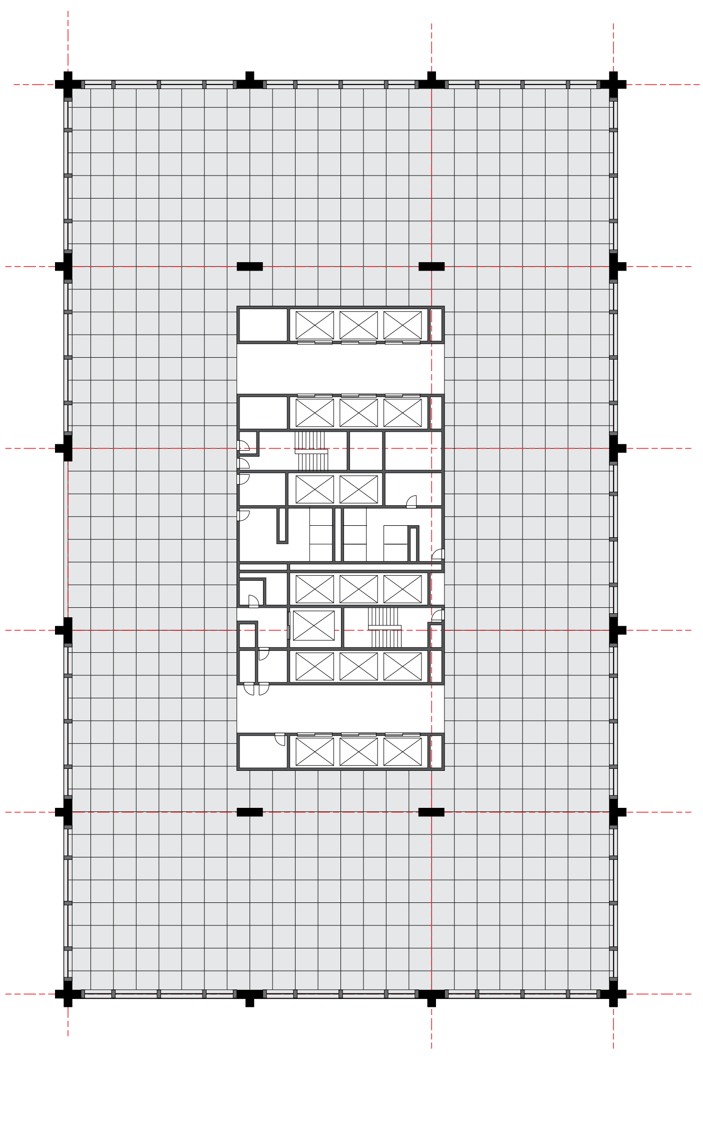
After exuberant overbuilding in the 1920s, Chicago's financial crash was steep and unforgiving; no commercial high rises were built there between the 1934 Field Building and the Prudential, completed in 1955. But over the next two decades Chicago built the tallest, most advanced, and most distinctive skyscrapers in the world. Whether or not Chicago was the 'birthplace' of the skyscraper in the 19th century, it was the leading center for high-rise design and construction in the 20th. Postwar architects and engineers there took advantage of new materials, systems, and techniques to build towers as distinctive as they were innovative. "Big shoulder" towers such as the Sears and the John Hancock Towers resonated with the city's classic skyscrapers, achieving record-breaking heights in a new, technically expressive style. These towers symbolized the city's surging economy—but they also glossed over the demographic and social segregation that was endemic in Chicago
.

The structural and material advances of the so-called "Second Chicago School" have been well studied, as have the complex economic, racial, and political dynamics of Chicago's postwar era. But these histories have never been adequately related to one another. The Sears Tower is just the most visible example of this split. Engineer Fazlur Khan's tall steel frame of nine 'bundled tubes' has been celebrated as a brilliant development, for instance, but such innovation was only necessary to match the city's energetic political efforts to keep corporations from leaving the city by encouraging dense, tall construction. The city's famous downtown towers were also not the only skyscrapers being constructed in postwar Chicago. Outside the Loop, the Chicago Housing Authority constructed over 100 high-rise housing projects—of concrete, not steel—designed by the same firms, often built by the same contractors, and subject to the same political and technical influences as tall construction downtown. Towers like the now-demolished Robert Taylor Homes or Cabrini-Green deserve to have their stories told in concert with those in the Loop. They are as revealing as any of Chicago's more recognized commercial towers about the political and social values behind the era's high-rise architecture.

This project will re-examine the city's postwar towers in two ways. First, it will explain the material and technical developments that re-shaped the city's commercial and residential high-rises. Some of these were globally influential—welded steel, electronically controlled elevators, air conditioning, and efficient insulated glazing, for instance. But others were unique to Chicago's climate or economic geography—the city was the nation's earliest and most enthusiastic adopter of air conditioning in the mid-1930s, for instance. Second, the study will examine how these advances were embedded within broader contexts of finance, city and national politics, labor relations, and economic geography, and how they helped Chicago's political and corporate interests reshape the city's social, economic, and cultural fabric. It will expand our understanding of the "Second Chicago School" to show that the city's iconic steel frames were matched by residential high rises in concrete that dwarfed downtown construction in scope if not in height, and that advances outside of the Loop were as important to the city's technical and urban development as those inside.

Chicago Skyscrapers, 1934-1974 will be the first comprehensive, critical study of Chicago's second generation of high-rise innovation. It will extend my arguments about earlier skyscrapers in Chicago—how new materials, innovative structural techniques, local politics, and regional economics forged new architectural and construction types—into new chronological and interdisciplinary territory. It will explore the roles of organized labor, real estate, social attitudes, and machine politics in motivating these projects as well as the importance of industry and engineering in realizing them. It will explain how these forces came together to build skyscrapers that explicitly reveal their function and their construction—and that implicitly evidence the complex networks of finance, power, and culture in which they were conceived and constructed.





(top) Lawless Gardens, 35th and King Dr., Chicago. Dubin, Dubin, Black, and Moutoussamy, 1966-70. (center) Sandburg Village, unbuilt competition scheme by Harry Weese and Loewenberg & Loewenberg (1961). (bottom). Lake Meadows, SOM, 1950-1957. From *Ebony*, 1960.

"*Ebony* praised Lake Meadows on its opening in 1960:

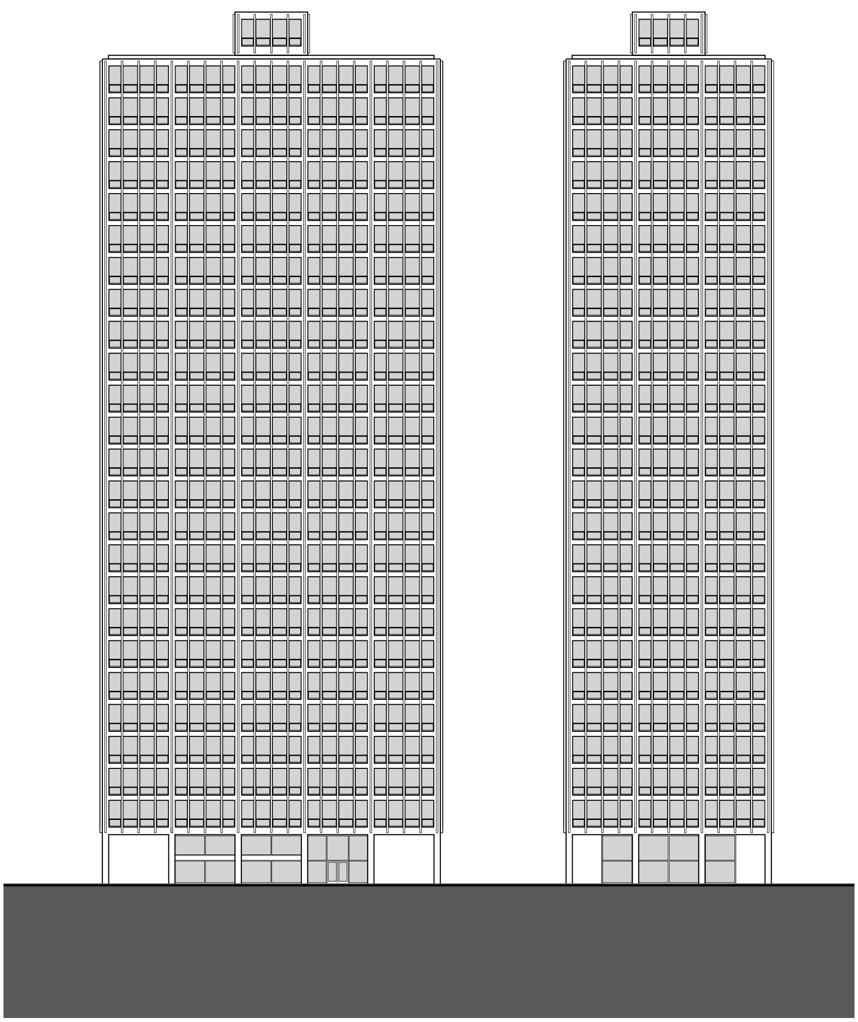
"Some 7000 Chicagoans enjoy the spaciousness of suburban living, though only three miles from the teeming Loop. Active participants in the nation's biggest and most successful venture in high-grade interracial housing, they are the envied residents of Lake Meadows—Chicago's futuristic South Side development near Lake Michigan's shores."

But the project's long saga drew critics who contrasted its extraordinary costs with its limited achievement. Even the Land Clearance Commission's chairman, Phil Doyle, admitted that the ultimate cost to the city in clearance, infrastructure, and tax losses while the land sat fallow had been between $55 and $60 million, or $30,000 per unit, making Lake Meadows more heavily subsidized than the city's public housing. The Defender's Doc Young lamented that while "the rich and middle class" lived "side by side" there "were no poor" in Lake Meadows; its "country-like spaciousness" was possible only because the city moved more than 7000 residents out and replaced them with just 4000. Architectural Forum, on the other hand, thought that Lake Meadows had not done enough. At the project's outset, New York Life estimated there were 19,000 families on the South side that could afford its rents; as massive as it was, Lake Meadows accommodated just 10% of them."

--from Chapter 3, "Progressive Housing Movements in the 1950s."

the Daley administration sped passage of new zoning regulations (see Harris Bank, below) adding incentives that encouraged civic amenities. It passed vigorous restrictions on billboards and gave inspectors greater latitude in enforcing and punishing zoning violations on dilapidated properties. Grant Park's underground garage was expanded, and the Federal and Civic Center projects were both launched, though they would take years longer than anticipated (see Chapter 7). Encouraged by all this public investment, more than $600 million in privately financed construction followed within five years, "a greater change," then-CCAC chairman Harold Moore thought, "than has ever taken place in any 10 years of the city's history." In 1962, Chicago counted almost forty new, private building projects downtown. Most Chicagoans would see only peripheral benefits from the Plan's sweeping vision, and many would end up displaced by urban renewal or priced out of neighborhoods that saw soaring rents along with new construction. The tensions that underlay the city's housing fights in the 1950s remained as the Plan took effect. Daley's wholehearted support for the Loop did, however, spark a wholesale reinvestment in the center city that rippled through housing markets and energized the city's economy. In that sense, Tribune critic Paul Gapp thought, looking back at the mixed legacy of the Central Area Plan in 1983, Daley achieved his urban and civic goals. Without the influx of commercial and residential construction and its attendant population, Gapp wrote, citing unironically one of the precedents that inspired Daley's energetic embrace of urban renewal, "Chicago's core would by now probably be as exciting as downtown Pittsburgh."

--from Chapter 5, "Daley's City."



(left) 860-880 Lake Shore Drive. Mies van der Rohe; PACE Associates; and Holsman, Holsman, Kleklamp, and Taylor, 1947-52.
(above) Continental Insurance, Wabash and Jackson Sts. C.F. Murphy Associates, Jacques Brownson, lead designer. 1960-62.

"At some point, the distinction between a skeleton of columns and beams blurred into structurally solid walls pierced with window openings that could work as a giant, tubular cantilever beam sticking out of the ground. The resulting shape was an imperfect beam (with two webs instead of the I-beam's one), an imperfect shear wall (perforated with dozens of window openings), and an imperfect architectural solution (window walls interrupted by columns larger than mullions)—but taken together these individual elements formed an efficient overall structure.

"Thinking about the entire building as a cantilever was a paradigm shift. Hand calculations were limited to tracing loads through a structure, looking at individual elements' capacities to resist loads and deflection. Such an elemental approach, engineers knew, provided conservative results—studies on the 55-story 1000 Lake Shore Plaza showed that its shear wall and column structure deflected only 37% as far its designers had calculated due to wind. This may have been reassuring, but it was a waste of materials. Khan's sense of the building structure as a holistic—almost organic—system marked a new approach. Understanding the flow of forces through a monolithic network required more computing power than hand calculation could provide. But the redundancies that made such structures difficult to calculate also made them efficient— 'hyperstatic,' dispersing forces throughout building frames in multiple, simultaneous load paths, in this case through a "shear shell" or "tube."

--from Chapter 8, "Tubes and High Rises."

(right) John Hancock Tower, SOM, 1964-69. (below) Sears Tower (SOM, 1969-74) and Standard Oil (Perkins and Will/Edward Durrell Stone, 1972-74) under construction. Both (c) Chicago History Museum.

TEACHING

I was hired by Iowa State in 2000 from practice—and without academic experience—as a "utility infielder," in other words, someone who could do an adequate job wherever a gap existed in the Department's curricular coverage. With strong design and technical backgrounds as an Associate and site architect for Foster and Partners, my initial assignments tended toward studio and technology classes, in particular structures, but I have also taught in our three other primary curricular areas: communications, history/theory, and practice.

Such a range of assignments implies breadth rather than depth, but I have found that this has allowed me to range more freely through the traditional pedagogical silos, and I have developed coursework that has found its home not within design, history/theory, or technology, but rather in the interstitial spaces between them. In particular, colleagues and I have developed an approach to Integrated Design studio that incorporates not only technical aspects, but also cultural and social forces. I have also developed technology and history courses that overlap, using history to build understanding of the materials, techniques, and systems that have evolved into contemporary building practice, and teaching history courses that are supported by technical analysis of examples ranging from Roman vaults to insulated glass curtain walls. Throughout, my aim is to coach students into understanding baseline skills and knowledge within cultural, social, and historical contexts. My teaching has been recognized by Iowa State for its effectiveness and its links to practice (Polster Teaching Award, Morrill Professorship), by the AIA and the U.S. Green Building Council for its integration of structural, design, and environmental topics (AIA Education Award, AIA Iowa Educator Award, U.S. Green Building Council Education Award), and by the ACSA for its innovation across sub-disciplines (three collaborative Creative Achievement Awards, and a New Faculty Teaching Award).

<u>Integrated Design—Technology within Context</u>

My studio teaching has provided a center of gravity for many of these developments. Since 2002 I have co-coordinated and developed studio coursework designed to address NAAB criteria for "Comprehensive" and "Integrated" Design. Iowa State has been one of the leaders in establishing these as design-forward classes. We began by insisting that "Comprehensive" be seen as a literal charge to consider the broadest possible influences on architectural design. We have intentionally selected challenging urban sites (downtown Montreal, the Boston waterfront, an historic rail district in Seattle, and a reclaimed military base at the mouth of the Panama Canal) that imply environmental and cultural responses. At the same time, our programs have combined demanding technical requirements with powerful civic themes—a ***mediatheque***, a performing arts center, an amateur sports complex, and an ecologically responsive conference hotel. Students must thus negotiate between problem solving and expressive design. These studios universally develop conversations about how constraints can distill ideas into clear, legible schemes that can, in turn, provide the basis for development and refinement that elucidates the complex range of responses contained within.

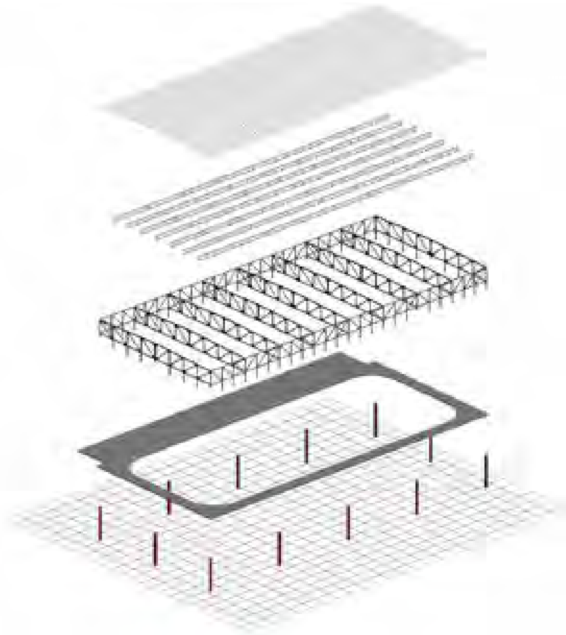
<u>SCI-TECH—Technology and Pedagogy</u>

From 2003-2014 I taught an integrated technologies sequence geared toward our graduate program, along with colleagues Jason Alread and, later, Rob Whitehead. Our M.Arch. program has its roots as a first professional degree, and we were charged with developing courses that could accommodate the wide range of backgrounds among our new students. The resulting classes focused on concepts, vocabulary, and simplified calculations to build a foundational grammar of structure, environment, materials, and systems that paralleled early studio coursework. Our classes rotated between history and theory, application, and hands-on laboratories. I used history in particular to show how our understanding of structural principles has evolved—showing how Aristotle's realization that a beam can be understood in terms of mechanical levers, for instance, was gradually improved by Leonardo, Galileo, Navier, and Fairbairn, among others, to conceive the modern W-shape. In laboratories, students built and tested structures, performed on-site solar and thermal comfort studies, assessed accessible routes on campus by traversing them in borrowed wheelchairs, and fabricated full-scale pneumatic classrooms within tight time constraints, among others. These haptic learning opportunities became signature elements within the curriculum, and we found that they evened out our students' understanding of the topics to hand—while those with more technical backgrounds thrived on numerical examples, students with fine arts backgrounds in particular found laboratories more effective. Beginning in 2009, these experiments formed the basis for an overhaul of our undergraduate technologies curriculum, and in 2015 we integrated this area of our graduate and undergraduate programs.

<u>Construction History</u>

In parallel with this required teaching, I have taught courses in the history of construction. "Physics and Form" (2001-2008) looked at structural and material expression in modern architecture and design, while "Big and Tall" (2013-present) is an overview of the past three millennia of human construction, focusing on the importance of regional materials and climate in developing constructive typologies. In addition to standard lectures, students are assigned weekly discussion questions and a semester-long project in 'building anatomy,' in which they are asked to pick an example from the course, construct a digital or physical model, and use this to show how its builders negotiated functional or structural aspirations with the realities of available materials and building techniques.

Throughout, my initial charge to draw connections and to fill gaps between our program's well-developed poles of History/Theory, Design, and Technology has led to coursework that crosses sub-disciplinary boundaries, broadening students' understanding of not only what they are required to know and to do as architects, but also why these matter, and how they relate to one another. This prepares them not only for practice, but also as design thinkers, better able to see connections between what we make, how we make it, and why.



ARCH 541, 543, 643, 644.

What should the role of architectural technology education be in a discipline where both resources and performance requirements for buildings are undergoing radical change? How do we teach a new generation of students whose interests in architecture are increasingly based on concerns for environmental issues, and who are enthusiastically embracing new digital design and fabrication tools? And, perhaps most importantly, does the opportunity to rethink traditional methods and strategies offered by these new vectors also give us the chance to address long-standing concerns with the insularity and specialization that have marked technology education in architecture schools over the last generation?

SCI-TECH is one of three major curricular elements in a re-designed and overhauled M.Arch. curriculum that seeks to address these fundamental questions. In 2003, we were charged with developing an agile, responsive technology sequence as part of this effort. The new program had at its base a concern for integration and outreach; issues of social and ecological sustainability were to permeate and inform all areas of the new curriculum, and we envisaged each of the program's three 'legs' as being balanced and mutually supportive. Design studio, history/theory seminars, and SCI-TECH were each to be equally weighted and emphasized, and we were asked to find ways in which these traditionally insular components could carry on a dialogue with one another, reinforcing in our students a holistic understanding of architecture's aesthetic, technical, social, and cultural aspects.

The resulting technology sequence—SCI-TECH—consists of four required courses, each of which covers portions of four broad themes: structural design, building materials, environmental response, and human factors. These themes are woven through the sequence, rather than being separated into individual course 'silos'. Materials such as steel and concrete can, therefore, be brought up in the context of beam and column design, while glass and aluminum can be introduced alongside topics on thermal insulation, daylighting, and curtain wall design. Such a thematic approach can also be tuned to support, build upon, and influence studio projects and parallel seminar topics.

Our goal in delivering this material is to emphasize how these topics inform and inflect architectural design, rather than focusing on each as an autonomous sub-discipline. This reflects our own experiences with engineers, contractors, and consultants, where technology and design seemed to be engaged in a constant, daily process of negotiation. Theoretical basics are, therefore, introduced primarily as fundamentals, from which we build practical, applicable knowledge. Structures, for example, is taught as structural design, and we focus on the physical ramifications of material choices, span, shape and scale, rather than on deriving formulae. Since our program is a first professional degree, our students come from a wide range of backgrounds, including art, engineering, business, interior design, and medicine. Our daily class sessions, therefore, are designed to appeal to a range of learning styles and abilities.

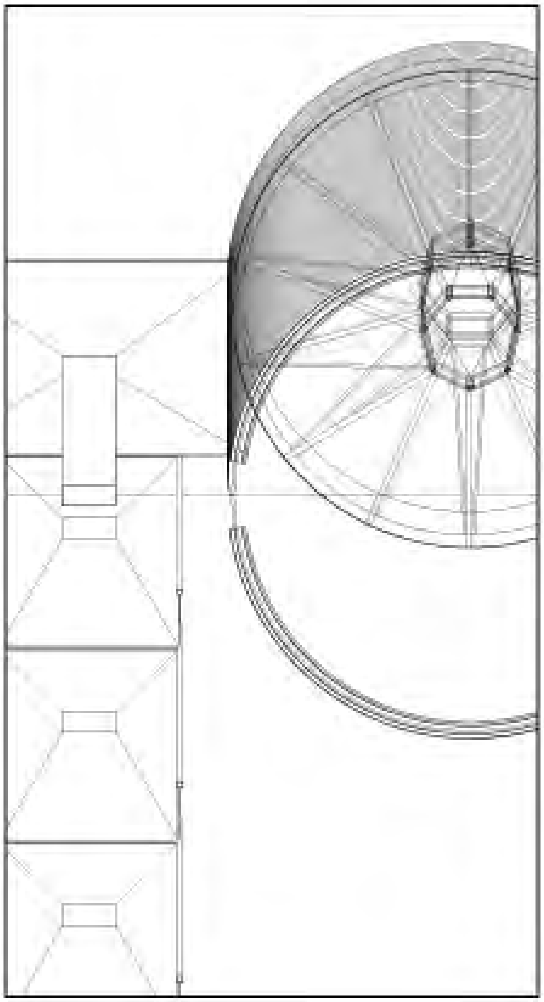
"I feel that this course was extremely helpful, and was especially well done for students that come from a variety of backgrounds. I really enjoyed the myth busters approach to testing & designing..."

--Iowa State University Course Evaluations

SCI-TECH Analytical Projects:
Lied Recreation Center, DLR Group. Model by Gregory Freeman and Mohammed Bassam
John Deere Headquarters, Eero Saarinen & Associates. Model by Ryan Risse and Jen Lehmkuhl

Hands-on SCI-TECH Laboratories. Clockwise from upper left: Frames, Cardboard Beams, Long Span, Pneumatic Classroom, Slabs,

TEACHING:
PERFECT WORKS OF ARCHITECTURE: CONSTRUCTING AND CONSTRUING



Re: Detailing. Oreon Scott Chapel, Drake University (Eero Saarinen, 1947). Ali Brunn.

ARCH 507 SUMMER STUDIO

"This studio is designed to explore the productive tension between making and meaning and between building and conception. It will deal, unapologetically, with the abstract and the concrete, often at the same time. You will be asked to explore, document, explain, and reconfigure both the reality and the meaning of an existing "perfect" work of architecture in our region. Along the way, we will revisit and refine some of what you've learned in the first two semesters of the graduate program: representation, construction, structure, history, and theory.

"Our summer will be inspired and provoked by two texts that deal with architecture as a primordial act. The first reading, from Mircea Eliade's book The Sacred and the Profane, argues for space-making as an act of division between the unordered (profane) and the ordered (sacred) realms. We make these divisions in order to connect with the divine, he argues, to sacralize parts of our world, and thus, by extension, to sacralize the entire world. The second reading, Kenneth Frampton's Rappel l'Ordre: The Case for the Tectonic, makes a subtly different argument, namely that we embed meaning into our buildings by the act of making, in particular by the act of connecting experience with intention through materials and attentive craft. Both of these readings have been controversial, and the studio will attempt to avoid any taking of sides. However, you will be asked to consider, as you study, document, and reconsider your chosen "perfect work," how these two notions of connection between the ideal and the real might define your approach.

"In short, we are out to ask an impossible question: how does architecture mean anything? Does this meaning reside in the intentions of its makers? Or in the fabric of its making? Does the ideal suffer by its translation into the real? Or do the contingencies of materials, techniques, and use themselves offer gateways from our profane world to something more enlightening? As we consider these questions, we will also work on refining the skills you've picked up in your first two studios, both representational and technical. You will be asked to propose a "gate house" to your chosen work (how do you add on to perfection?), and to demonstrate the structure and construction of both the existing work and your proposal.."

--ARCH 507 Syllabus

TEACHING: DESIGN STUDIOS

Performing Arts Center, Du Sable Park, Chicago.
Rachel Cuthbert and Ming Duan;
Transit Hotel, Seattle. Kyle Vansice and James Elliott..

ARCH 403/603

Comprehensive Design relates directly to the NAAB requirement for a single studio that demonstrates "ability to produce a comprehensive architectural project that demonstrates each student's capacity to make design decisions across scales" while integrating student performance criteria ranging from Historical Traditions and Global Culture to Structural and Environmental Systems. We have always taken a broad view of this requirement, and have attached it to an evolving program for a Digital Media Library that asks students to consider issues of urban design, civic representation, and public space. We have set the studio in Montreal, Boston, and Seattle, cities that offer contrasts to the gridded cityscapes of the Midwest while offering important historic and urban contexts. In 2008 we facilitated a switch of this studio from fourth to fifth year by offering a pilot studio that focused on smaller urban scale and single-story structures, asking students to design a Glass Arts Center near downtown Seattle. The results in the subsequent fifth year studio showed a remarkable leap in integrative and technical abilities, and we believe this sets the stage for a more thorough overhaul of the comprehensive studio going forward.

Since 2012 I have coordinated the graduate program's Comprehensive Design (now Integrated Design) studio. This has built on our work in the undergraduate program, with progams for the Downtown Symphony Center and, more recently, a similar theatre proposal for an abandoned industrial site at the mouth of the Chicago River. The current studio includes options for students to pursue longspan or highrise structures in Boston or Panama City, Panama.

DSN S 446/546, ARCH 590

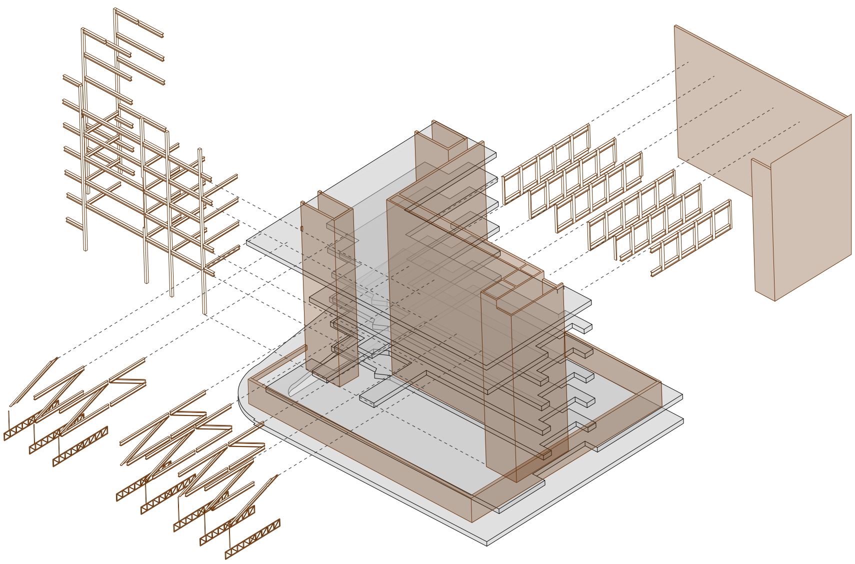
The College of Design offers interdisciplinary studios in the spring semester to students in the final year of their degree coursework. I have taught studios that emphasize the role of technology in such holistic design projects, often bringing engineering teams or crtiics to the table to show how environmental science, structural design, and material development all underlay disciplines throughout the building world.

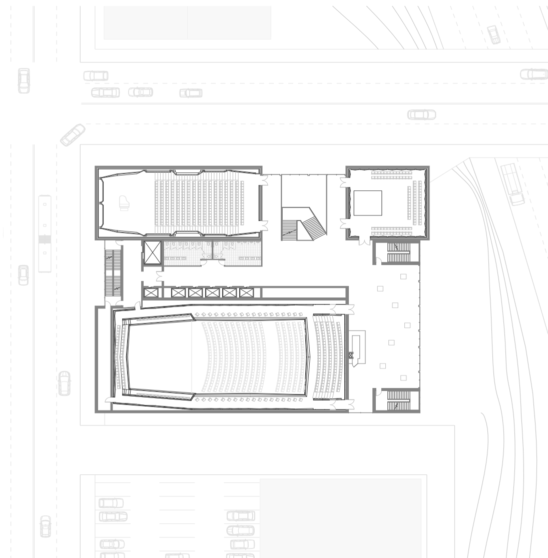
Our projects have included high rise hotels and office buildings in Chicago, a Museum of Steel on a brownfield site near Pittsburgh, and a gliding center outside of San Francisco. Students in these studios have occasionally pursued graduate study in other discipilnes (architecture to interior design, landscape architecture to architecture, etc.), which I believe is the ultimate proof that such interdisciplinary work is a crucial part of our mission as a Design College.

I also regularly sponsor independent student work at the graduate and undergraduate levels, which has led to successful competition entries and proposals for technical exploration at scales ranging from a small boathouse and lodge on a suburban lake in Minneapolis to a new underground headquarters for the London Futures Exchange in Spitalfields.

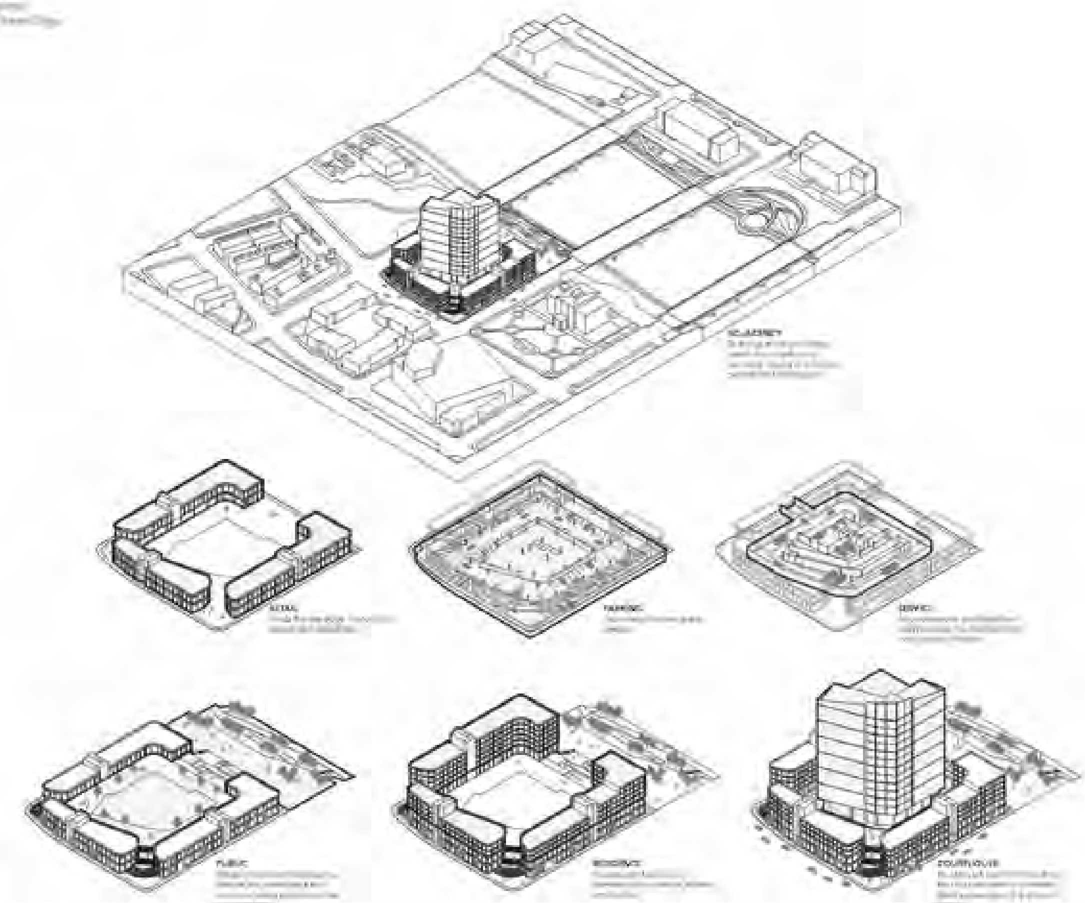
This page: Center for Contemporary Music, West Loop, Chicago. Emma Henry, Brandon Maxey, and David Tucker.

Facing page: Federal Courthouse, Des Moines, IA, Jennifer Hakala, Shawn Barron, and Kyla Peterson.

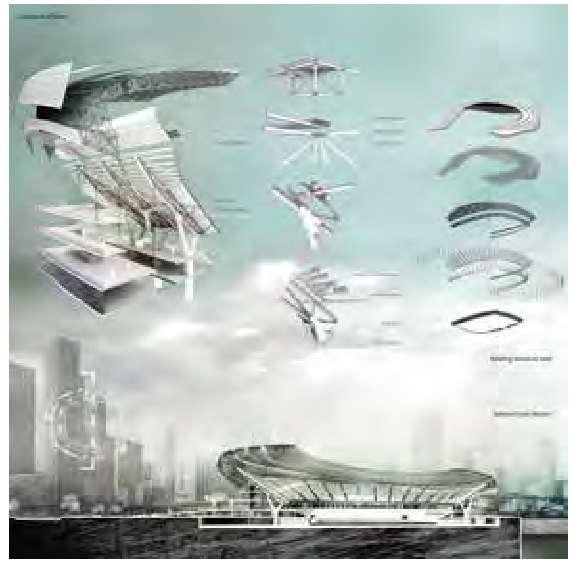





Central Court Project
River View




North/South Section looking East

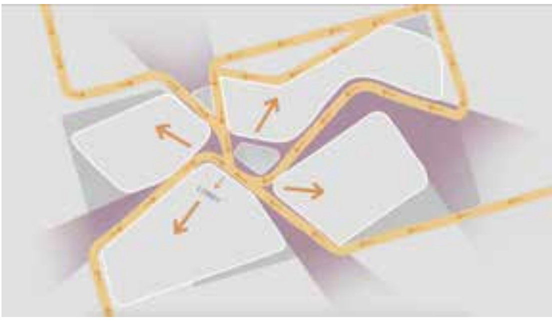


Facing page: Federal Courthouse, Des Moines, IA, Babafemi Ade Aina, Hang Gao, and Zheyu Zhang.

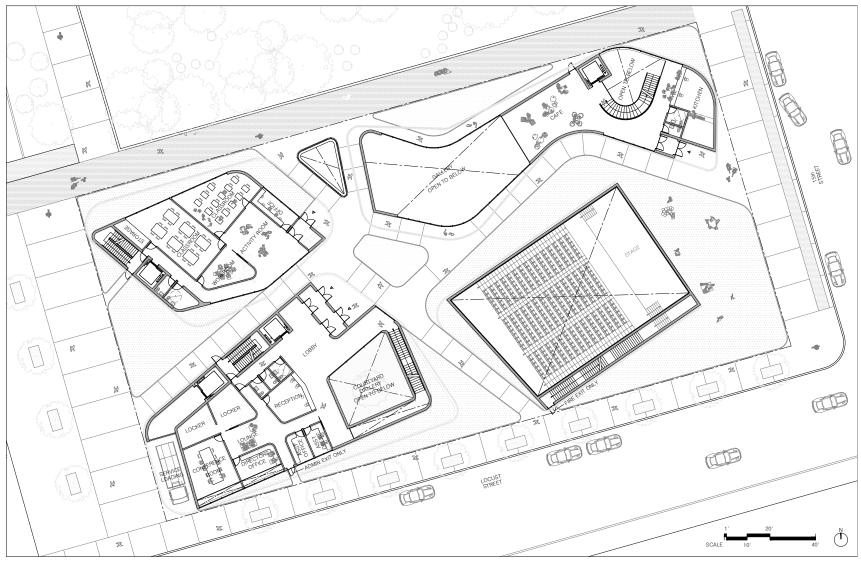
This page: Soccer Stadium, Miami, FL. Hanwei Fan, Xian Wang, and Yifeng Guo (2nd Place, ACSA/AISC Steel Competition); Eco/Convention Hotel, Amador Peninsula, Panama. Anastasia Sysoeva and Weiching Chen (1st Place, Hospitality Design Student Competition).

This page: Hôtel Eiffel, Paris, France
Hang Gao, Tianlin Xu, Wan Wei, and Zhouqi Xu.
1st place, Hospitality Design Student Competition.

Facing page: Des Moines Art Center Downtown Campus
Brenna Fransen & Jihoon Kim

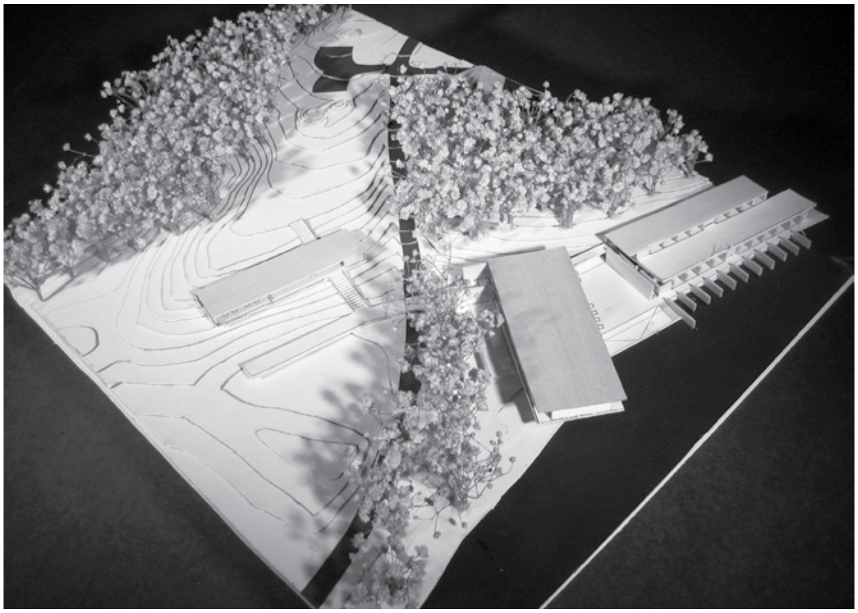


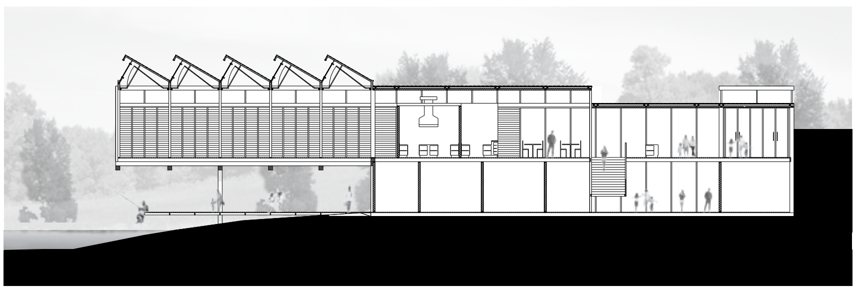

PROPOSED DESIGN
PEDESTRIAN PATH

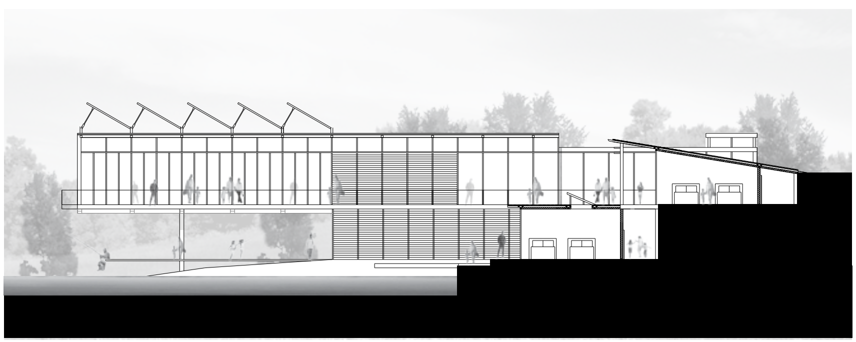

CLASSROOM
CLASSROOM
OFFICE
STORAGE
ACTIVITY ROOM
WORKROOM
GALLERY
OPEN TO BELOW
CAFE
OPEN TO BELOW
KITCHEN
STAGE
LOBBY
COURTYARD
GALLERY
OPEN TO BELOW
RECEPTION
LOCKER
LOCKER
LOUNGE
CONFERENCE
ROOM
DIRECTORS
OFFICE
ASST
OFFICE
ASST
OFFICE
SERVICE
LOADING
ADMIN EXIT ONLY
FIRE EXIT ONLY
LOCUST
STREET
15th
STREET
SCALE
1'
10'
20'
40'
N

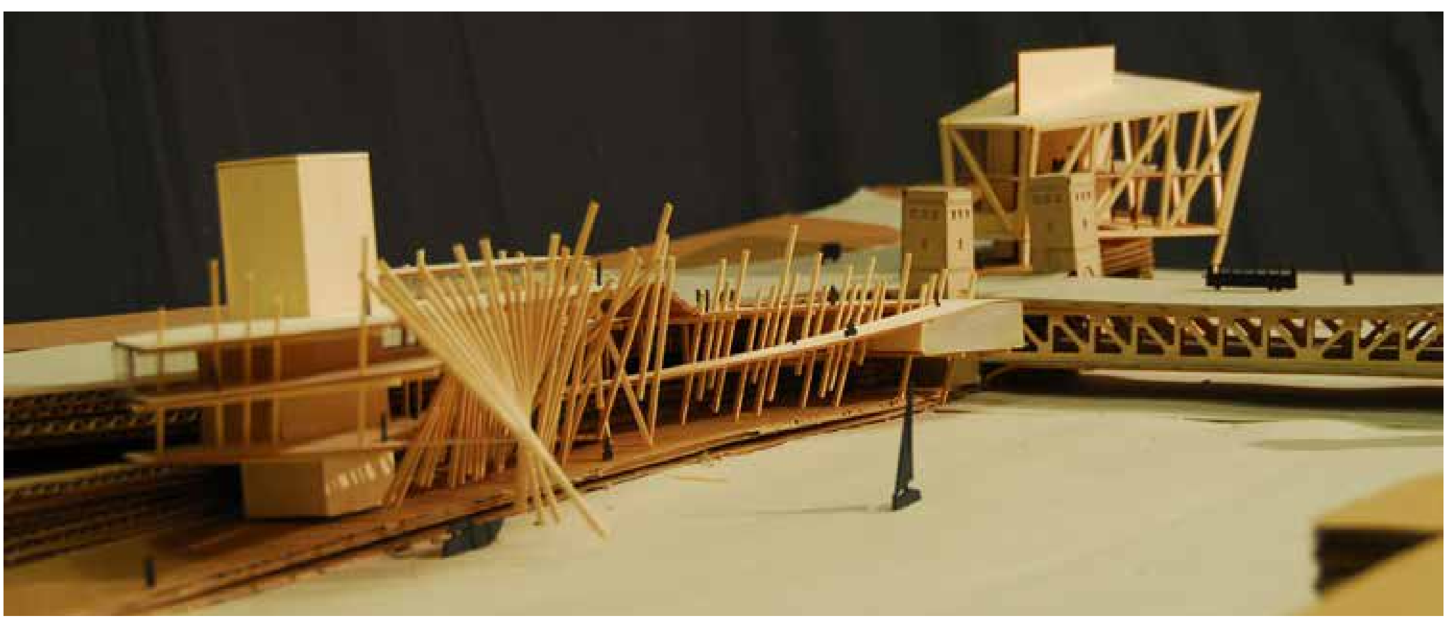
Riverfront Hotel, Chicago, IL.
Adrienne Nelson and Inna Kulyk (above);
Sarah Schultz & John Dykstra (right).

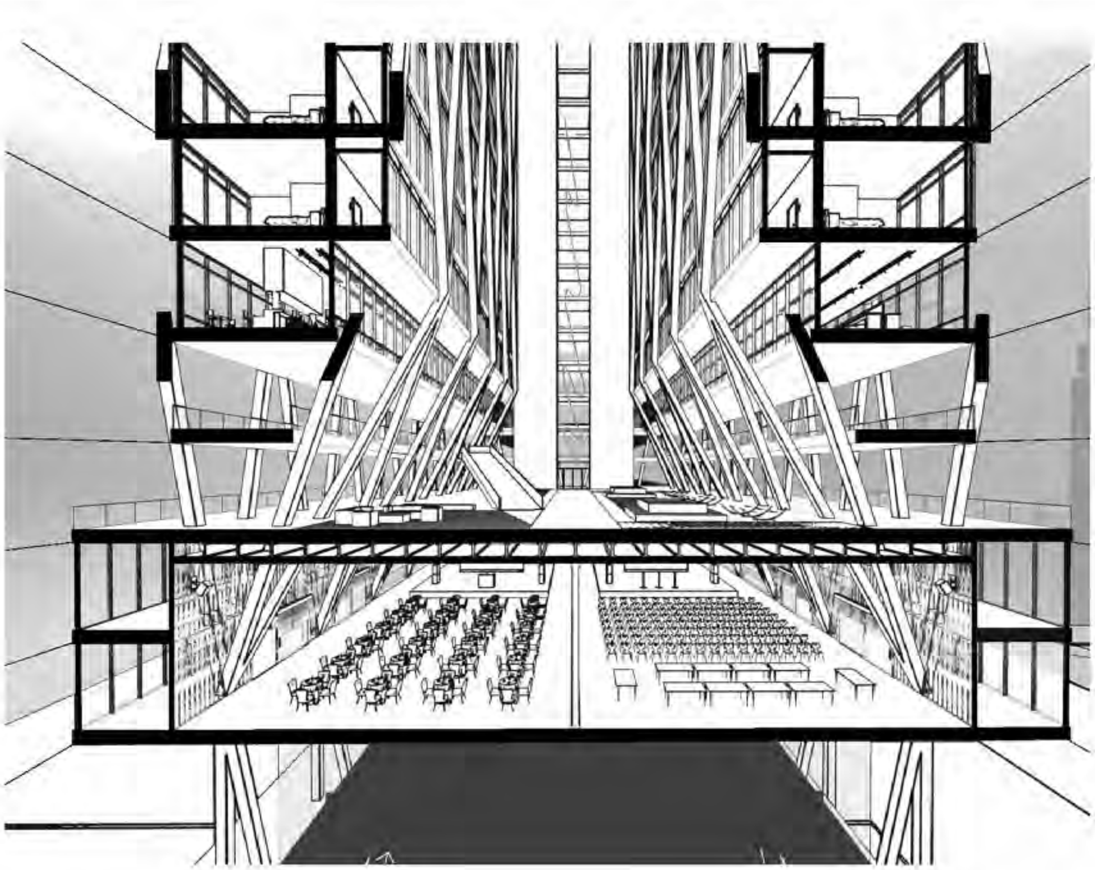
Independent Study/Thesis:
Kristi Krueger, Lakefront Recreation Center, Minneapolis, MN
Nathan Potratz and Chris Carotta, Chapel, New Ulm, MN
Jenni Whitney, Riverwalk, Chicago, IL





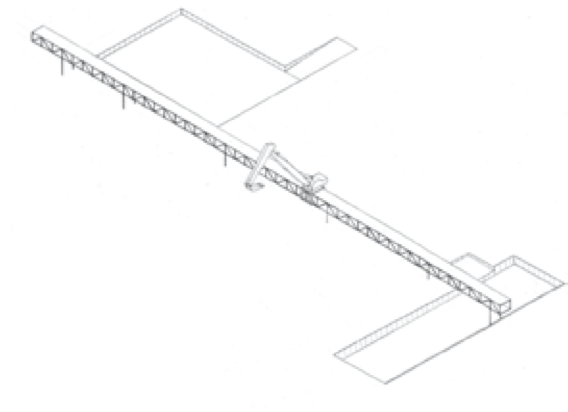


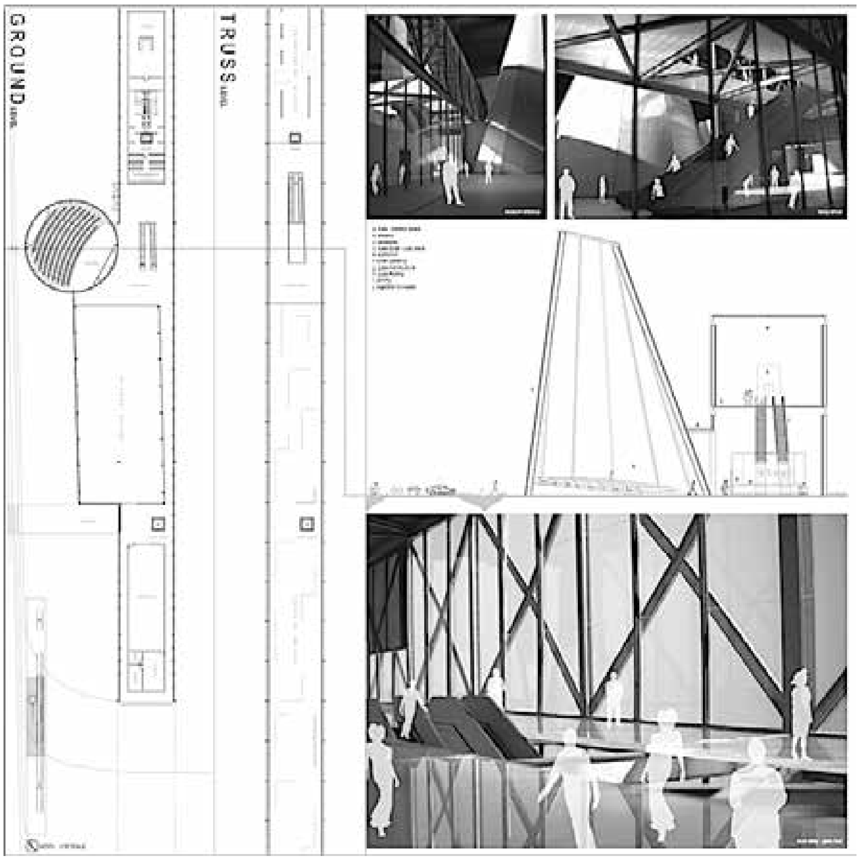


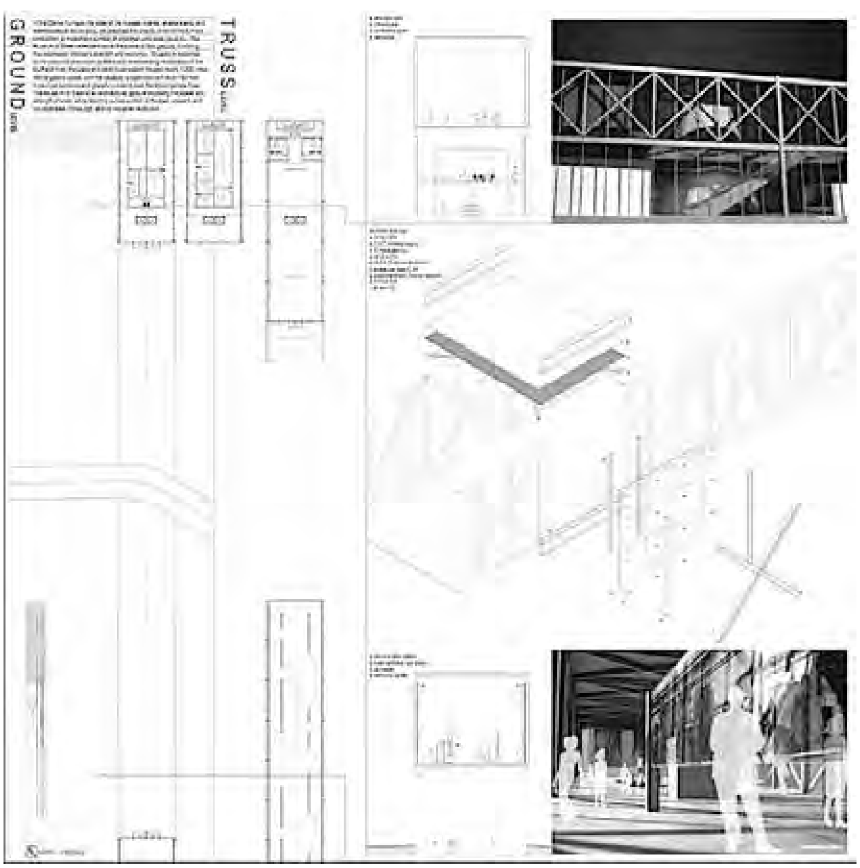


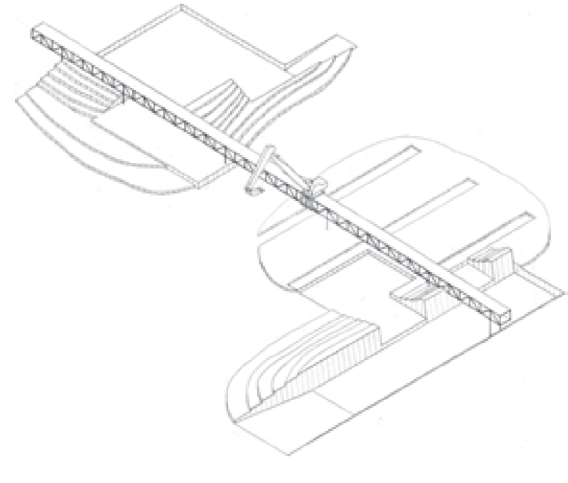
Transit Hotel, Seattle. Bryan Johnson, Nate Peters, and Thomas Thatcher.

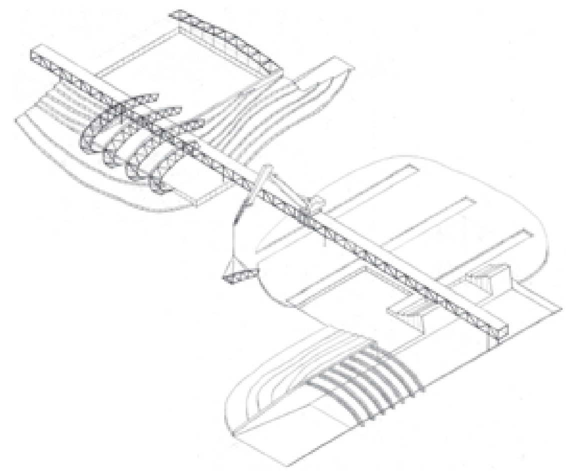
Museum of Steel, Pittsburgh, PA.
Nguyen Hoang & Beau Johnson (below);
Clay Gish and Brian Ogle (right)

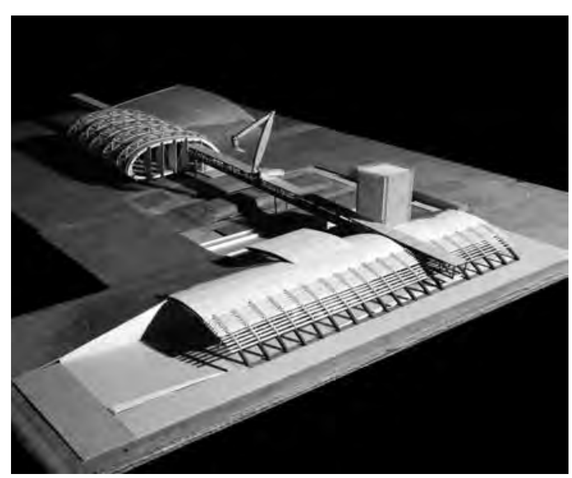


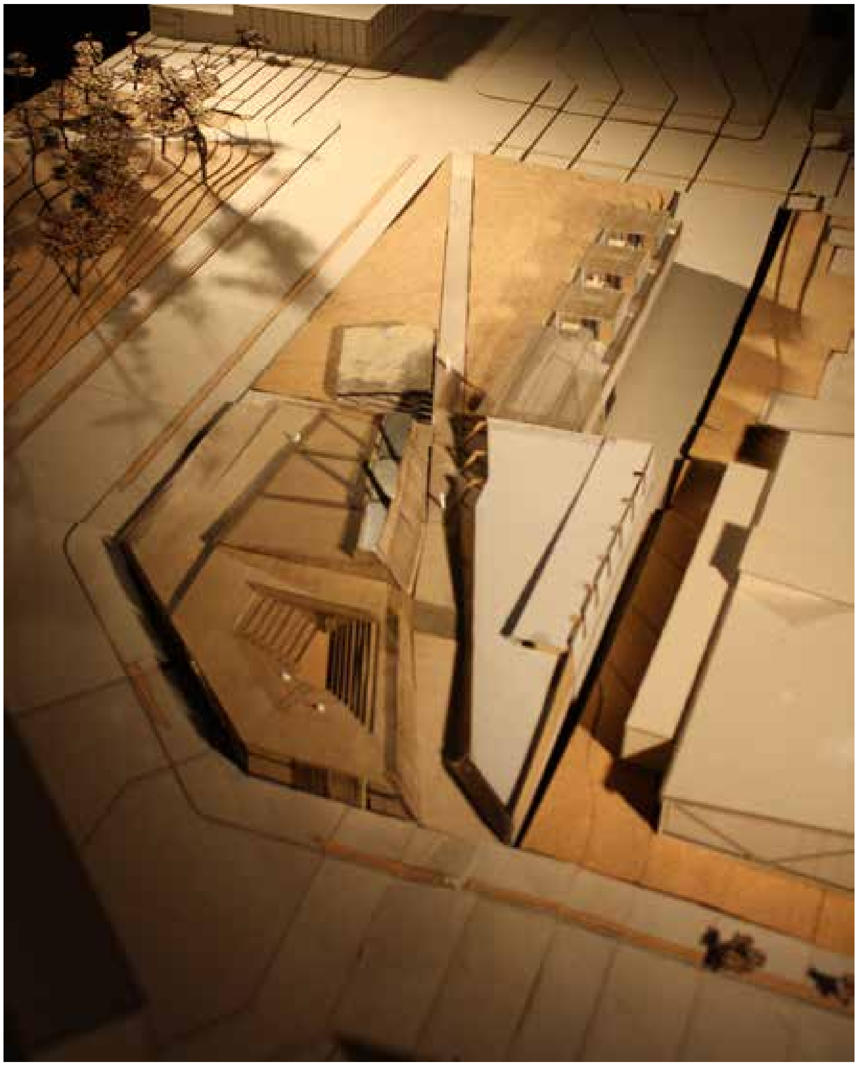


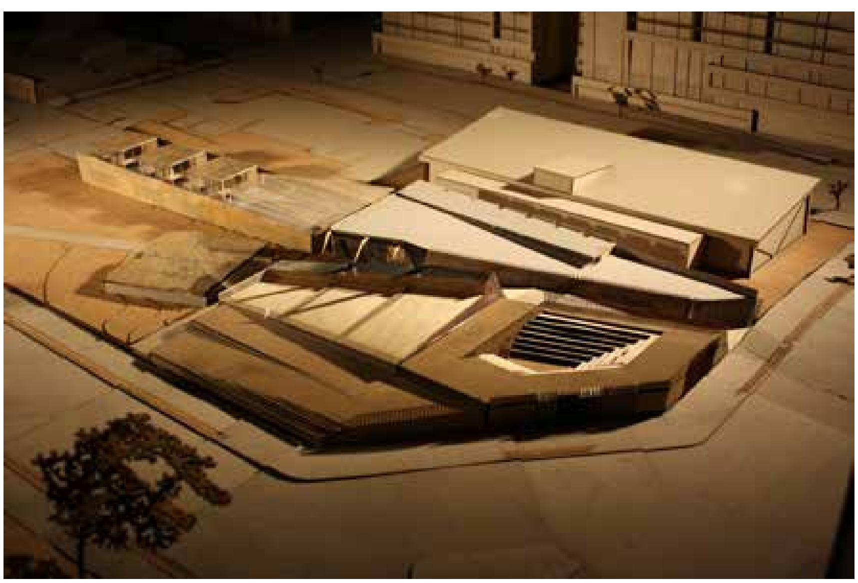












Glass Arts Center, Seattle, WA.
Alex Hale and Kevin Wagner (left),
Bonnie Reynolds and Mandy MacCulley (above).

TEACHING: BIG AND TALL

ARCH 517

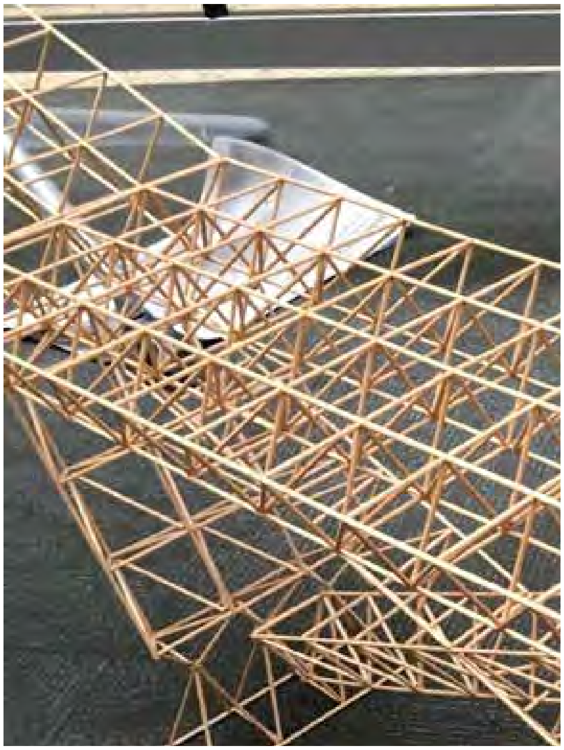
"This course examines the relationship between buildings and the physical forces acting upon and shaping them over the past 3000 years. While often seen as limiting the free reign of the designer, the constraints provided by statics, environmental performance, fabrication and assembly have also greatly increased architecture's formal vocabulary and its expressive potential. In examining an alternative history of architecture based on technical and scientific principles and their expression, we will seek both a complement to the more established fine arts tradition of architectural history, and an intellectual grounding for understanding the role of techne in design, perception, and experience.

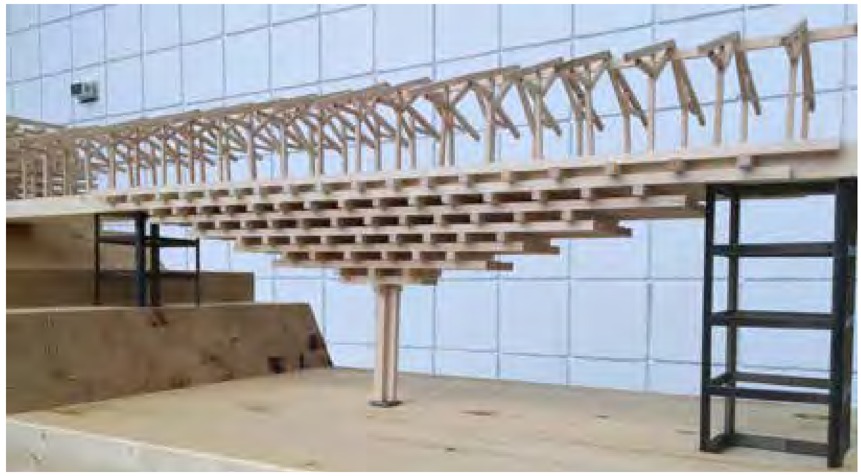
"We will seek out a particular category of these connective events that we recognize as 'true' or 'beautiful,' namely those that speak to our intuitive satisfaction with structures that are effectively or efficiently formed, and with constructions that are safely and robustly built. We are instinctively primed to recognize both of these—a tree limb that will easily support us, for example, or a shelter that will effectively keep us warm or dry. These instincts are the hard-earned results of our evolution from hunter-gatherer origins where a timely tree may have meant the difference between being consumed or living another day; for a bipedal species markedly slower than many of those seeking us for food, the physical environment and what it afforded us in terms of shelter or escape would have been a constant subject of our attention. Such ingrained preferences for objects and environments that are robust—and that invite us to use them through our perception—have not been extinguished by the three thousand years or so of communal building. Even safely removed from the dangers of the savanna, our minds remain satisfied by structures and shelters that allow themselves to be read and suggest to us how we might use them without requiring too much effort or cognitive friction. In short: we appreciate objects that explain their potential function and their production. We may be thrilled by structures that seem to defy gravity just as we are thrilled by the sublime effects of a Turner landscape, but this is a very different experience than the satisfactions offered by structures that reassure us by conforming to or enriching our instinctive understanding of how the world works and how we might better relate to it. A Turner landscape is enjoyable when surrounded by the safety of a gallery—witnessing such a storm unfiltered in the wild brings forth a far different mood.

"Revealing purpose, revealing affordance, and revealing composition thus form a program for technical expression in building; collectively, these are a way to satisfy our senses and our desire to make our way in the world alongside the problems of actually making buildings that balance ends and means. Architecture reveals something of itself and of our surroundings to us, some actionable knowledge that leaves us wiser to the world, or at least capably instructed in how this designed part of the world can help us along. Beauty may be the "splendor of truth," but rather than being a mystical connection to greater universal realms, beauty often arises from the most basic of quotidian 'truths.' and the most elemental of satisfactions."

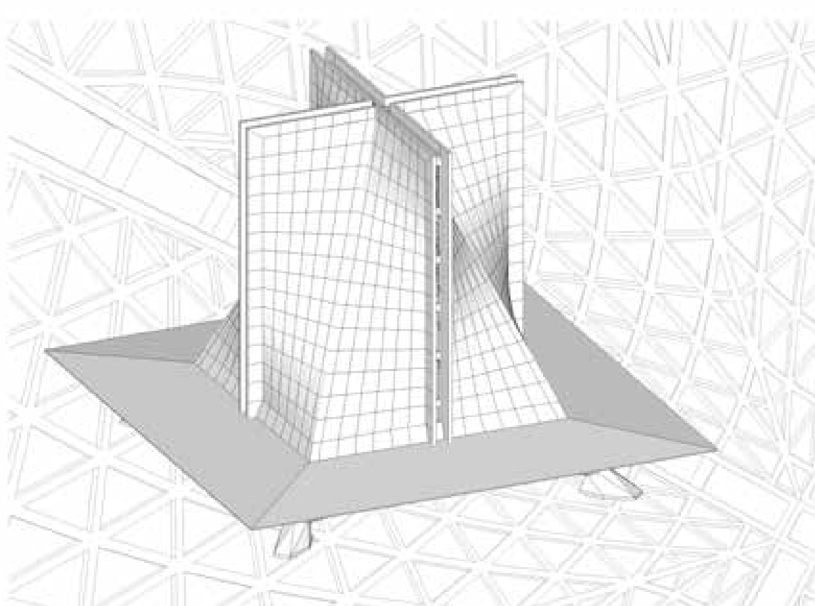
Menil Collection, Renzo Piano Building Workshop. Process Model by Ming Duan. Clifford Styll Museum, Denver, Allied Works Architects. Experimental Concrete models by Paolo Orlando.

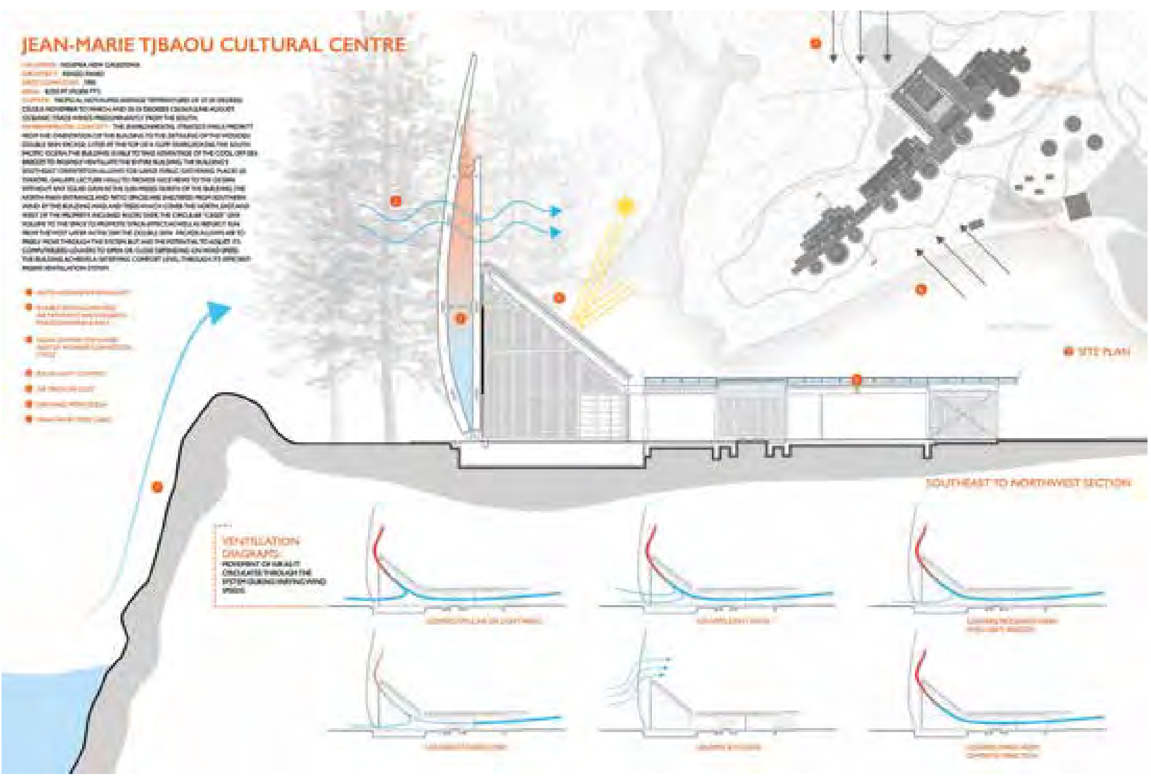
ARCH 517, "Big and Tall," Introduction.





Experimental Hangars, Konrad Wachsmann. Model by Zhaoyu Zhu and Zhenhua Yin; Yusuhara Wooden Bridge Museum, Kengo Kuma, Model by Graham Hanson and Ben Kruse; St. Mary's Cathedral, San Francisco, Pietro Belluschi and Pier Luigi Nervi, digital model by Lana Zoet; New Caledonian Cultural Center, Renzo Piano, diagrams by Zhahn Bose.





t. Mary's Catehdral, San Francisco, Pietro Belluschi and Pier Luigi Nervi, digital model by Lana Zoet;