

7 Louis Kahn: Modernization and the New Monumentality, 1944–1972

In reality the arches, squares, cylinders, skylights, exedrae and symmetrical axes which spring from this architecture in ever richer and more complex ways, give rise, once they are realized, to fragile and powerful simulacra of the discontinuous and the non-homogeneous, of what is ours and at the same time what is not. The clean-cut surfaces of the walls are slim diaphragms, the flexible and unconventional use of which creates a continuous interplay of light and shade,—highly refined and complex filters of the energy field of light; but the light relayed from these surfaces is an unreal light, une lumière 'autre'. The more intelligent and pertinent the use of Design and appropriate the choice of materials, perfect the technique of execution and detail, meticulous the expression of all the static forces involved, the more the measurable enters the realm of the immeasurable, and from what is physically and tangibly present, from surfaces, cracks, holes, and pools of light, it blows like a metaphysical, weightless breeze—without the weight of earthly gravity I mean, but in return, laden with allusions to mnemonic depth and dimension and to everything that this architecture, in its fragile, contingent, physical and almost miraculous equilibrium "is not". . . . In this sense, and almost reversing the terms of the problem, Kahn's architecture recovers the sense of history and re-proposes the basic theme of Sullivan's aesthetics: that of the impact and weight of the language, of its dangerous and incapable semantic burden, with which all creative projects must struggle. But in Sullivan, who had also been strongly attracted towards what "is not" the sense of history and the surrender to the infinite represented only a necessary counterweight, an alternate phase of what "is" and what comes to light; just as the seed must lie in the darkness of the earth before it flowers and vegetates, so the artist must plunge into the depths of life and language before creating something new. . . . But in Kahn, the finite-infinite dichotomy has another meaning which in no way implicates Sullivan's vital dynamism towards a formative end. He, on the contrary, proposes modern cognitive space, in which (after filtering through European rationalism) the subjective and individual can be realized only by limiting, denying, decentralizing itself; but in which, on the other hand, the assumption of subjective finitude with its incessant self questioning as to the myth of the Beginning, in a vital and problematic way brings up for examination once more the synchronous and logical classifications of rationalism, pointing from behind its fragile, immobile, and provisional screen, at the dark and blind forces of change in progress and the inevitable erosion of time.

Maria Bottero, "Organic and Rational Morphology in Louis Kahn," 1967

Modernization and monumentality may be seen as the dialogical theme running throughout the later career of Louis Kahn (1901–1974); the former being the singular processual character of the modern world with which he will struggle throughout his life, the latter being the institutional referent that will form the fundamental focus of his architectural system. Kahn's unique contribution in this regard stems from his conviction that tectonic structure, rather than mass form or type, must be pursued as the first condition of monumental form. To predicate the monument on architectonic expressivity was to take an entirely different approach from the sociopolitical attitude assumed by Sigfried Giedion, José Luis Sert, and Fernand Léger in their seminal and highly influential *Nine Points on Monumentality*, written in America in 1943.¹ Shortly after this revisionist manifesto was first issued, the idea of a new monumentality was generally in the air, and within a year a symposium largely devoted to this theme was staged by Paul Zucker at Columbia University under the somewhat misleading title "The New Architecture and City Planning."² Kahn's contribution to this symposium was to establish the basic thematic of his work. It was also one of the most revealing statements he ever made with regard to his conception of monumental

form. Kahn approached the issue of monumentality in an unusual way, emphasizing the character of the tectonic element above all other considerations.

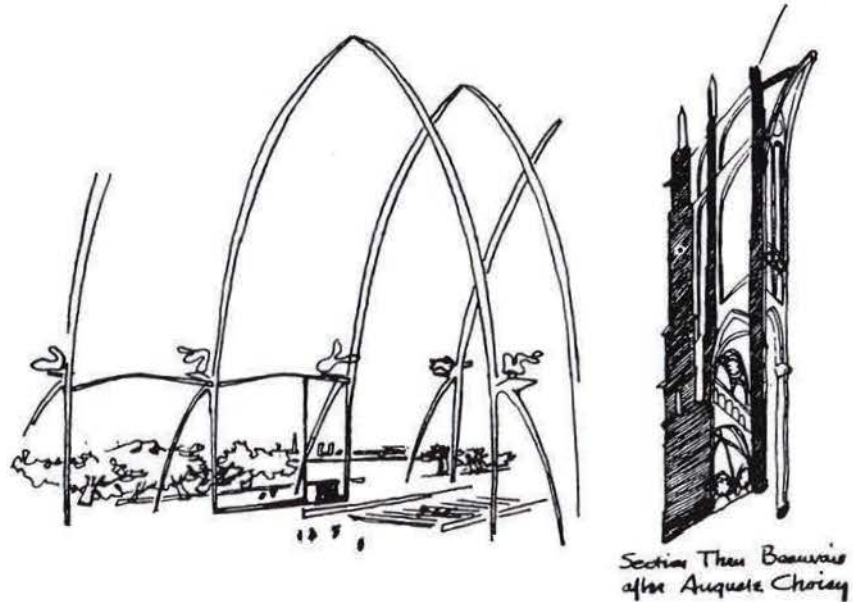
Neither the finest material nor the most advanced technology need enter a work of monumental character for the same reason that the finest ink was not required to draw up the Magna-Carta. . . . In Greek architecture engineering concerned itself fundamentally with materials in compression. Each stone or part forming the structural members was made to bear with accuracy on each other to avoid the tensile action which stone is incapable of enduring. The great cathedral builders regarded the members of the structural skeleton with the same love of perfection and search for clarity of purpose. Out of periods of inexperience and fear when they erected over-massive, core-filled veneered walls, grew a courageous theory of a stone over stone vault skeleton producing a downward and outward thrust, which forces were conducted to a column or a wall provided with the added characteristic of the buttress. . . . The buttress allowed lighter walls between the thrust points and these curtain walls were logically developed for the use of large glass windows. This structural concept, derived from earlier and cruder theories, gave birth to magnificent variations in the attempts to attain loftier heights and greater spans creating a spiritually emotional environment unsurpassed.

The influence of the Roman vault, the dome, the arch, has etched itself in deep furrows across the pages of architectural history. Through Romanesque, Gothic, Renaissance and today, its basic forms and structural ideas have been felt. They will continue to reappear but with added powers made possible by our technology and engineering skill.³

This passage is revealing, for reading between the lines, it is possible to discern not only the specific nature of Kahn's formation, as a student at the University of Pennsylvania under the Beaux-Arts tutelage of Paul Cret, but also the terms in which he was to conceive his own architectural agenda. It says something for his French education that his own point of departure was to recall the long debate surrounding the evolution of the Greco-Gothic idea. This may explain why he would adopt a totally different attitude toward the steel frame than that assumed by Mies van der Rohe, for where Mies readily accepted the rolled steel joist as the structural norm of twentieth-century architecture, Kahn began his thesis on monumentality with an elaborate critique of this universal building element.

The I-beam is an engineering accomplishment deriving its shape from an analysis of the stresses involved in its use. It is designed so that the greater proportion of the area of cross-section is concentrated as far as possible from the center of gravity. The shape adapted itself to ease of rolling and under test it was found that even the fillets, an aid in the rolling process, helped convey the stresses from one section to another in continuity. Safety factors were adopted to cover possible inconsistencies in the composition of the material of manufacture. Large scale machinery and equipment needed in its fabrication lead to standardization.

The combination of safety factors (ignorance factor as one engineer termed it) and standardization narrowed the practice of engineering to the selection of members from handbooks, recommending sections much heavier than calculations would require and further limited the field of engineering expression stifling the creation of the more graceful forms which the stress diagrams indicated.⁴



7.1

Louis I. Kahn, esquisse for a modern cathedral in welded tubular steel, 1944. The accompanying section through Beauvais cathedral is taken from Auguste Choisy's *Histoire de l'architecture*.

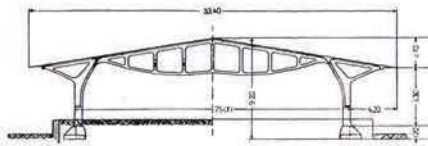
Kahn would follow this critique of standard engineering practice with a rather general advocacy of welded tubular steel construction.

Joint construction in common practice treats every joint as a hinge which makes connections to columns and other members complex and ugly. To attain greater strength with economy, a finer expression in the structural solution of the principle of concentrating the area of cross-section away from the center of gravity is the tubular form, since the greater the moment of inertia, the greater the strength. A bar of a certain area of cross-section rolled into a tube of the same area of cross-section (consequently of a larger diameter) would possess a strength enormously greater than the bar.

The tubular member is not new, but its wide use has been retarded by technological limitations in the construction of joints. Up until very recently, welding has been outlawed by the building codes. In some cases, where it was permitted, it was required to make loading tests for every joint.⁵

The above passages surely testify to the underlying influence of Viollet-le-Duc; above all, the reference to oversectioned members that do not reflect the stress variations to which they are subject and the double allusion to both graceless joints and a failure to consider the frame as a total system. Kahn is critical of the inorganic trabeated rigidity of the standard steel frame and so favors the more organic, one may even say neo-Gothic, potential of welded tubular steel. Kahn was to clarify his position with a number of sketches that illustrate the essay. The first of these is an esquisse for a modern cathedral in welded tubular construction (fig. 7.1). This is directly related, as the drawing indicates, to Auguste Choisy's axonometric of the structure of Beauvais cathedral as this appears in his *Histoire de l'architecture* of 1899. Of this, Kahn wrote:

Beauvais cathedral needed the steel we have. It needed the knowledge we have. Glass would have revealed the sky and become a part of the enclosed space framed by an interplay of exposed tubular ribs, plates and columns of a stainless metal formed true and faired into a continuous flow of lines expressive of their stress patterns. Each member would have been welded to the next to create a



7.2

Robert Maillart, storage shed for S. A. Magazzini Generali, Chiasso, 1924. Section and partial elevation.

7.3

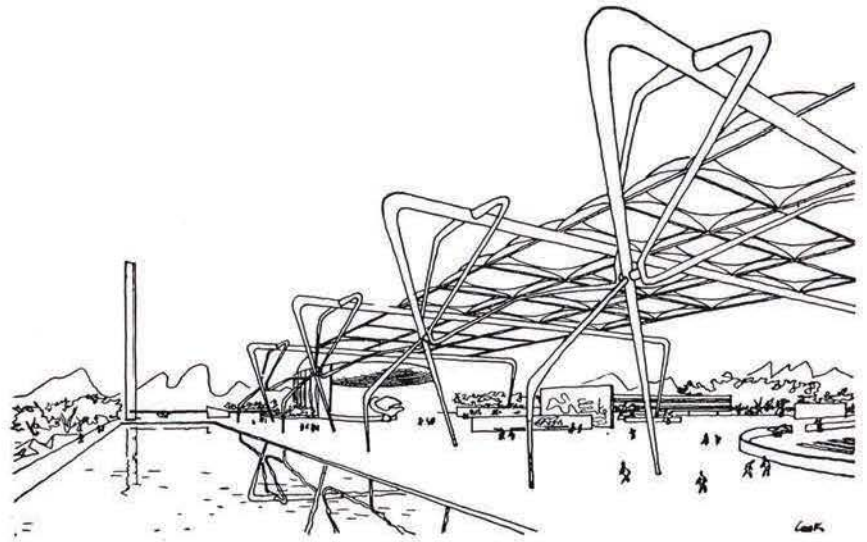
Louis I. Kahn, proposal for a welded tubular steel structure projected for Philadelphia, 1944.

*continuous structural unity worthy of being exposed because its engineering gives no resistance to the laws of beauty having its own aesthetic life.*⁶

The structural rationalist nature of this argument is self-evident, as is its relation to the production and statical limits of the materials involved. It is easy to see, for example, that Kahn's hopes for the future of welded tubular steel are not unlike those that he will later entertain toward reinforced concrete, and this, in turn, will be close to the attitude assumed by Auguste Perret with respect to the same material. It was patently evident to Kahn and Perret alike that reinforced concrete structural members could be easily modified in section in order to accommodate and reflect variations in stress. In this regard, the organic potential of the material had already been amply demonstrated by Eugène Freyssinet in his bowstring factory roofs and by Robert Maillart in the storage shed that he erected in Chiasso in 1924 (fig. 7.2).⁷ One should also mention Pier Luigi Nervi in this connection, to whom Anne Tyng showed the City Tower project that she had designed with Kahn in 1953.⁸

That Kahn did not immediately fix on reinforced concrete as the material of the new monumentality testifies to Kahn's regard for the structural elegance of metal construction. He advocated welded tubular steel largely because of its lightweight modern industrial nature and the apparent ease with which it could be fabricated. In comparison to welded steel, reinforced concrete displayed a number of disadvantages. In the first place, there was the inelegance of having to build one structure in order to cast another; in the second, it possessed a tectonically ambiguous nature inasmuch as it was a "conglomerate": while it appeared to be compressive, it invariably concealed a tensile component. Welded tubular steel came close to Kahn's ideal building material, of which he spoke in later life to the effect that "I dream of space full of wonder. Spaces that rise and envelop flowingly without beginning, without end, of a jointless material white and gold. When I place the first line on paper to capture the dream, the dream becomes less (fig. 7.3).⁹

Although the oriental tone of this vision should not go unnoticed, it is clear that the paradigm evoked has much in common with the Gothic cathedral. The great



advantage of welded tubular steel lay in its potential for achieving an ontological tectonic comparable in its expressive substance to the self-evident continuity of Gothic stonework. What Kahn had in mind was the continuous flow of force that seemingly passes from vault to rib to pier in one and the same material. While this modulated continuity could be achieved in reinforced concrete, as Perret had already demonstrated, concrete lacked for Kahn the intrinsic lightness and clarity of welded tubular steel and was in this sense less modern. Furthermore, it could not be erected as a constructional continuity, since the process of construction did not allow its respective components, above all the steel rods, to *appear* in their final and appointed place.¹⁰ The fact that it was a casting operation rather than an assembly made it categorically inimical to the precepts of structural rationalism.

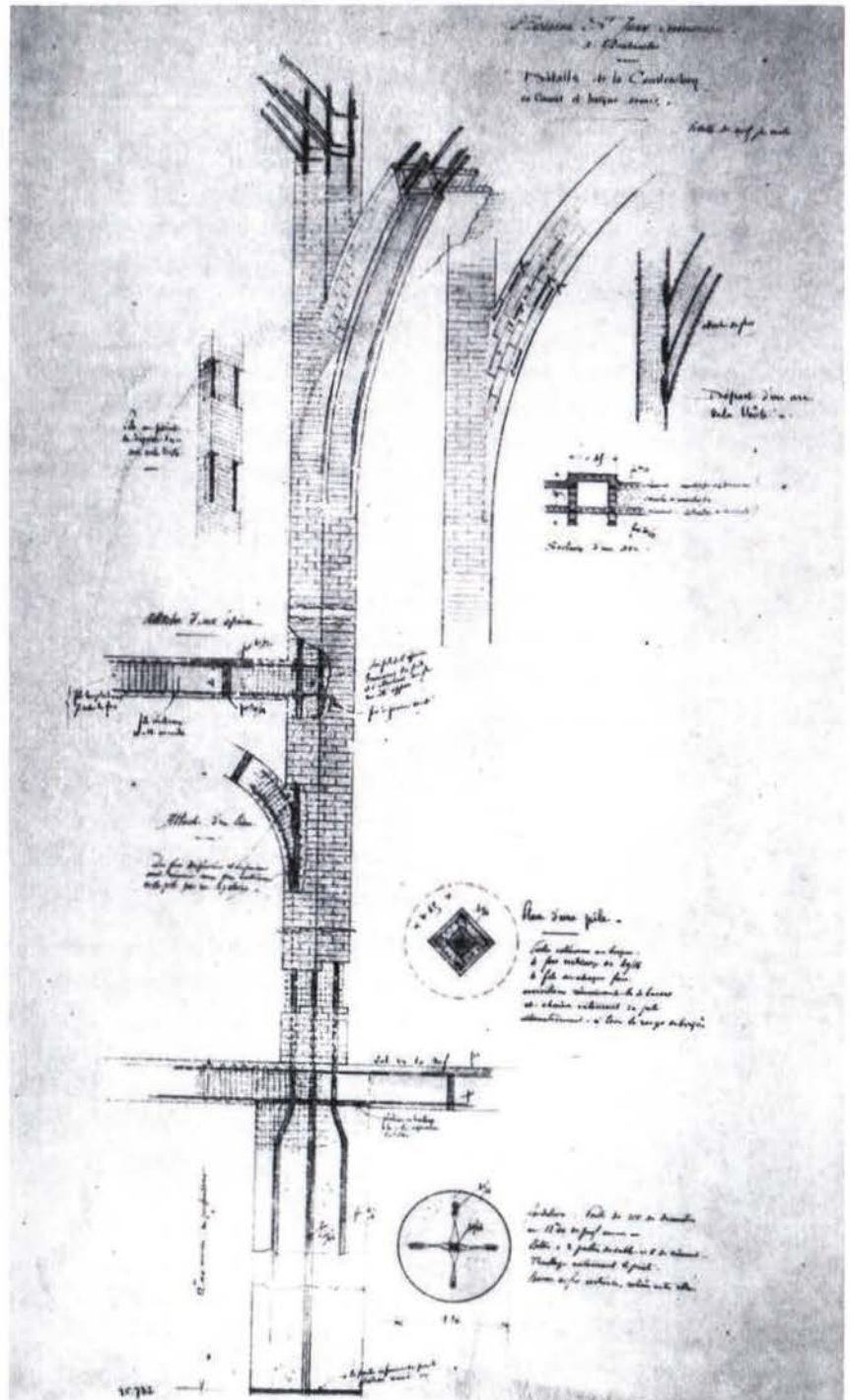
The shortcomings of reinforced concrete from a tectonic standpoint had long been perceived by Viollet-le-Duc's prime pupil Anatole de Baudot, above all in his church St.-Jean de Montmartre, under construction in Paris from 1894 to 1904. As we have already seen, de Baudot, educated by both Henri Labrouste and Viollet-le-Duc, carried the legacy of structural rationalism into the twentieth century. St.-Jean de Montmartre (figs. 2.27, 2.28), completed when de Baudot was seventy, was the most significant work of his life. No two works, ostensibly both deriving from the precepts of Viollet-le-Duc, could be more opposed than Perret's 25 bis rue Franklin apartments and de Baudot's church in Montmartre. Where the one embraced the Hennebique system, the other categorically rejected it, not only because, unlike Gothic architecture, it failed to reveal the patterns of stress induced in its structural members, but also because it was incapable of generating an architectonic syntax arising out of the constructional process. As we have seen, it was for this reason that de Baudot's church was built out of a unique system of reinforced brick and concrete construction, developed in collaboration with the engineer Paul Cottancin and proposed under the name of *ciment armé*, in order to distinguish it from Hennebique's *béton armé*. To this end, de Baudot and Cottancin deployed cement-reinforced, perforated-brick arches, walls, and piers. These lean components were held in place by reinforcing wires that were painstakingly inserted into the perforated masonry; the interstices were thereafter charged with cement (fig. 7.4). Here Semper's textile revetment became transposed, as it were, into the substance of the building rather than its cladding. De Baudot employed a building system that resulted in a monolithic but articulate assembly, compounded of structurally taut and expressive elements comparable to those of Gothic architecture. These elements could be perceived as being determined to an equal degree by both gravity and the act of construction.

While Kahn never alluded to de Baudot, it is almost certain that he would have been aware of his work through his teacher, Paul Cret. Cret gave his own public assessment of de Baudot in his famous and influential essay "The Architect as Collaborator of the Engineer," published in 1927, three years after Kahn's graduation.¹¹ Although Cret takes pains in this essay to distance himself from de Baudot and to reassert the primacy of imitative form, structural rationalism nonetheless remained an important and seminal reference for him, and from this standpoint de Baudot may be adduced as a possible influence on Kahn. The case is further strengthened by the space-framed, vaulted roof structure in *ciment armé* that de Baudot projected during the last decade of his life. Kahn's tubular-steel-framed exhibition pavilion, with which he illustrated his 1944 essay

on monumentality (fig. 7.3), is indicative of his structural naivete in that, unlike cast-iron tubing, it is impossible to extrude steel tubing with a continuously diminishing diameter. Nevertheless, the didactic intent of the proposal is obvious. The tapered components recall the tapered cast-iron members of Viollet-le-Duc's great hall featured in the *Entretiens*, where similar hypothetical variations in stress were to find reflection in the comparable varying diameter of the cast-iron tubular cross section.¹² Moreover, Kahn's account of space frame construction leaves one in no doubt as to his feeling for the difference between the *stereotomics* of the earthwork and the *tectonics* of the frame. More importantly, perhaps, this essay, dedicated to monumentality, concludes with an inventory of modern materials that reads, paradoxically enough, as though it had been compiled by a prewar functionalist.¹³

7.4

Anatole de Baudot, St.-Jean de Montmartre, Paris, 1894–1904. Construction details. This drawing shows the positioning of the reinforcing rods passing through the reinforced brickwork.

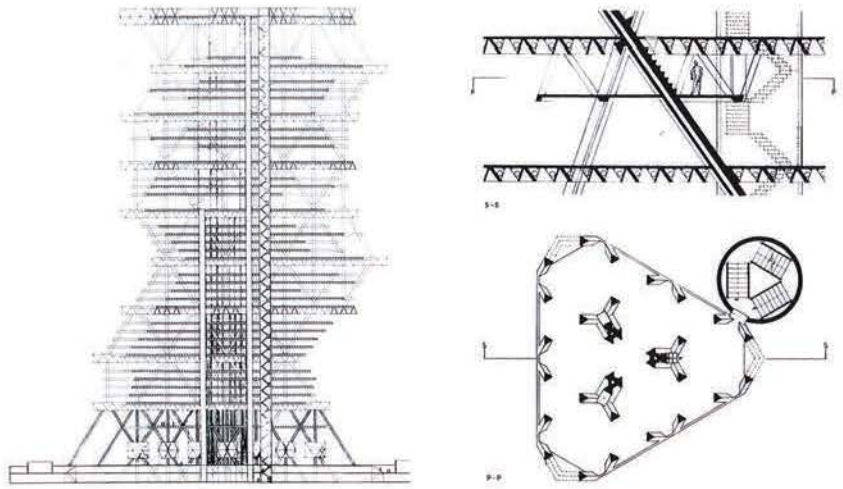


Steel, the lighter metals, concrete, glass, laminated woods, asbestos, rubber, and plastics, are emerging as the prime building materials of today. Riveting is being replaced by welding, reinforced concrete is emerging from infancy with pre-stressed reinforced concrete, vibration and controlled mixing, promising to aid in its ultimate refinement. Laminated wood is rapidly replacing lumber and is equally friendly to the eye, and plastics are so vast in their potentialities that already numerous journals and periodicals devoted solely to their many outlets are read with interest and hope. The untested characteristics of these materials are being analyzed, old formulas are being discarded. New alloys of steel, shatter proof and thermal glass and synthetics of innumerable types, together with the materials already mentioned, make up the new palette of the designer. . . . Standardization, pre-fabrication, controlled experiments . . . are not monsters to be avoided by the delicate sensitiveness of the artist. They are merely the modern means of controlling vast potentialities of materials for living, by chemistry, physics, engineering, production and assembly, which lead to the necessary knowledge the artist must have to expel fear in their use, broaden his creative instinct, give him new courage and thereby lead him to the adventures of unexplored places. His work will then be part of his age and will afford delight and service for his contemporaries.¹⁴

It is remarkable that Kahn's first theoretical statement would turn on a hypothetical synthesis between structural form and modern material technique, although he was to insist in conclusion that he did not wish to imply that monumentality could be attained scientifically or that it could be simply derived from the application of engineering methods. Viollet-le-Duc was nonetheless an influence on the remarkable space frame tower structure that Kahn and Anne Tyng were to project for Philadelphia in a number of different versions between 1952 and 1957 (figs. 7.5, 7.6, 7.7). The architects would describe the first version of their proposal in terms that the French master of structural rationalism would have appreciated.

*In Gothic times, architects built in solid stones. Now we can build with hollow stones. The spaces defined by the members of a structure are as important as the members. These spaces range in scale from the voids of an insulation panel, voids for air, lighting and heat to circulate, to spaces big enough to walk through or live in. The desire to express voids positively in the design of structure is evidenced by the growing interest and work in the development of space frames. The forms being experimented with come from a closer knowledge of nature and the outgrowth of the constant search for order. Design habits leading to the concealment of structure have no place in this implied order. . . . I believe that in architecture, as in all art, the artist instinctively keep the marks which reveal how a thing was done. . . . Structures should be devised which can harbor the mechanical needs of rooms and spaces. . . . It would follow that the pasting over of the construction, of lighting and acoustical material, the burying of tortured, unwanted ducts, conduits, and pipe lines, would become intolerable. The desire to express how it is done would filter through the entire society of building, to architect, engineer, builder and craftsman.*¹⁵

The influence of structural rationalism is revealed by the first sentence, while the degree of Kahn's involvement with modernization is indicated by his unprecedented attitude toward mechanical services. He becomes preoccupied at this juncture with the idea that services should be accorded the same tectonic sta-



7.5

Louis I. Kahn, City Tower project ("Tomorrow's City Hall"), Philadelphia, 1957. Section through tower. Kahn's caption reads: "The concrete struts forming the triangulated frame come to a point every 66' with 9 of these sections occurring in a total height of 616'. The column capitals at these intersections, 11' deep, are spaces for service needs."

7.6

Louis I. Kahn, City Tower, detail plan and section.

tus as structural form. It is hard to overestimate the radical nature of this concern, for prior to Kahn's formulation of the theoretical opposition of "servant and served," contemporary architecture had failed to address the problems posed by the increase in the amount of services being installed in buildings in the second half of the twentieth century. Centralized air-conditioning imposed a quantum leap in this regard, but, unlike Mies, Kahn could not accept the suspended ceiling as a normative method for the accommodation of ducts in the servicing of open floor space, largely because a false ceiling inevitably conceals the basic floor structure. As far as Kahn was concerned, the fundamental structure of a building had to be made manifest both inside and out.

A transcendental strain is detectable in Kahn's thought at this juncture, a mode of beholding in which he appears to have become preoccupied with the latent order of nature as this had been revealed through scientific research. This is partly what he has in mind when he writes in 1944 of the purity of engineering form which has "no resistance to the laws of beauty having its own aesthetic life,"¹⁶ or in 1952 of forms that "come from a closer knowledge of nature."

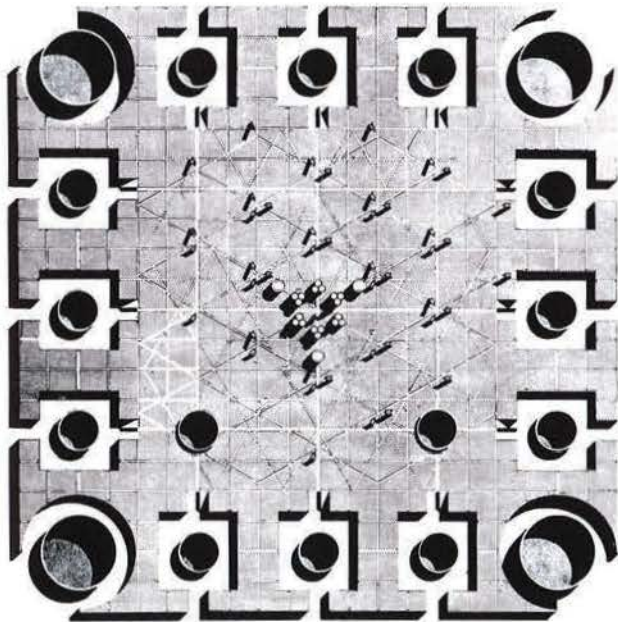
Tyng (who first worked with Kahn in 1945, in the office of Stonorov and Kahn, and then, after 1947, in Kahn's own practice) clearly exercised a major influence on Kahn's development, introducing him to D'Arcy Thompson's *On Growth and Form* in 1952. Between 1951 and 1953, Tyng designed two independent works employing octatetrahedron geometry, a prototypical school and a house for her parents realized on the eastern Maryland shore in 1953. This triangulated space frame building, left open for habitation, was of the same order as Kahn's Yale University Art Gallery design of virtually the same date, although by now Kahn was also familiar with the work of Richard Buckminster Fuller, whom he had met while teaching in the architectural school at Yale. While Tyng played a major role in initiating the City Tower project, both Kahn and Tyng were influenced by the then recent realization that certain molecular structures were ordered according to tetrahedral geometry and by Fuller's development of the Octet (octahedron/tetrahedron) truss principle, a demonstration version of which was erected in 1959.¹⁷ The tripartite tetrahedral ordering principle of the final version of the tower was thus imagined by Kahn and Tyng as a Transcendental construction, all but identical in its form with natural crystalline structure. Kahn would first em-

ploy this geometry in combination with the interstitial mechanical services in his Yale Art Gallery, under construction in New Haven between 1951 and 1953. In the final version of the City Tower, the term "servant space" would apply not only to the volume within the triagrid floors and the tetrahedral capitals, used for the accommodation of lavatories, but also to the provision of catwalks for the purpose of maintenance and for the horizontal transfer of ducts and pipes (fig. 7.6). At this point, the structuralist principle of giving primacy to the joint and the transmission of stress is no longer solely a matter of careful detailing but is further amplified through geometry to include the provision of hierarchic space as well. In this way a clear separation was maintained between the secondary "servant" spaces, such as the elevators, service cores, lavatories, etc., and primary "served" volumes. As Kahn put it later, with regard to his penchant for interstitial servicing elements, "I do not like ducts; I do not like pipes. I hate them really thoroughly, but because I hate them so thoroughly, I feel they have to be given their place. If I just hated them and took no care, I think they would invade the building and completely destroy it."¹⁸

Unlike either Perret or Viollet-le-Duc, Kahn will repudiate any direct relation to historical form, be it Classic or Gothic. And yet while he will distance himself from historicism he will nonetheless gravitate toward a transhistorical evocation that is modern without being utopian and referential without becoming eclectic. Thus certain analogical allusions abound in Kahn's work, evoking Roman, Romanesque, neoclassical, and above all Gothic paradigms, particularly with his advocacy of "keeping the marks which reveal how the thing was done." Equally Gothic in the City Tower proposal are the 11-foot-deep tetrahedral capitals or nodes provided not only to absorb the shear stress but also to accommodate services, lavatories, etc. This light yet monumental tetrahedral frame is conceptually dematerialized in contrast to the heavy treatment of its podium and masonry undercroft, with its massive cylindrical light wells and circular ramps. The Roman allusions in this instance are obvious, and yet Kahn's description of the sun control system projected for the surface of its crystalline curtain wall makes his commitment to modern technology equally evident.

7.7

Louis I. Kahn, City Tower, plaza-level plan.



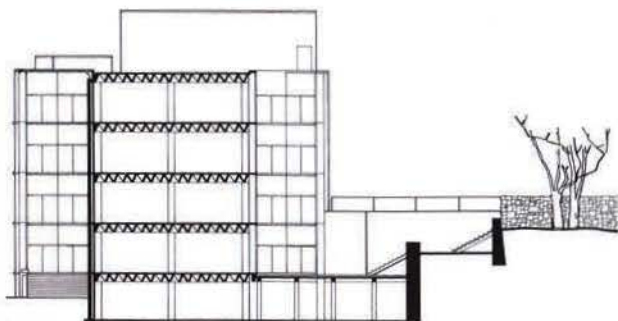
To shade the building from the sun and to hold its panels of glass, a permanent scaffolding of aluminum is planned to cover the entire exterior. From a distance windows per se, would not be apparent. A lacey network of metal reflecting the color of the light and its complementary color of shadow would be seen by the passer-by.¹⁹

Inasmuch as this project established an opposition between the tectonic of the skeleton frame and its skin and the stereotomic base of the earthwork, it may be seen as exemplifying Semper's *Four Elements of Architecture* of 1851. Close to a feeling for the Gothic, as this was embodied in Bruno Taut's concept of the city crown in his book *Die Stadtkrone* of 1919, we may interpret Kahn's City Tower as a dematerialized crystal set above an all-material base.²⁰

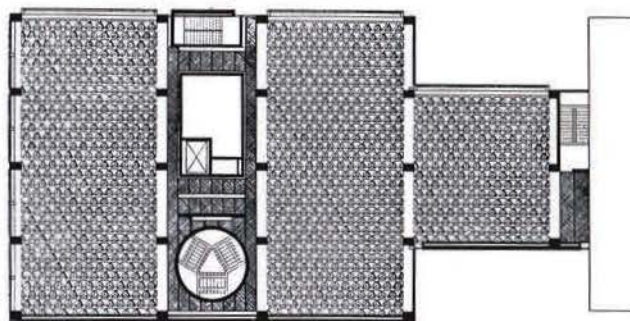
Although tubular steel gave way to concrete in all of the versions of the City Tower and indeed in all of his work thereafter, the precept of a hollow structural form would remain a perennial theme throughout his career. This, plus the tactile presence of subordinate components such as the generic arch, window, and door would become irreducible elements for Kahn, because he saw them as deriving from the geometrical essences of archetypal, universal forms. For him they would stand as the ultimate morphemes of building culture without which one cannot create anything. And yet Kahn's overall notion of tectonic authenticity went beyond this necessary articulation and inflection of components to consider the experiential impact of the work on the subject. This much is implied in a statement that he made about the tactility of the Yale Art Gallery. He clearly saw the pseudo-Brutalist interior of this work as embodying a kind of psycho-ethical challenge. Thus he wrote: "One might feel that only persons who are in flight from themselves, who need plaster and wallpaper for their emotional security, can be uncomfortable in this building."²¹ Despite this rather patronizing, all but trivial attitude, Kahn is nonetheless close in this work to the principles embodied in Perret's plaster-free Musée des Travaux Publics and to Perret's equally tectonic concern for the integration of services into the hollow interstitial structure of the building.

The way in which Kahn comes to terms with orthogonal geometry in the Yale Art Gallery will be decisive for the rest of his development (fig. 7.8), as will the manner in which its reinforced concrete skeleton is both revealed and concealed by the continuity and discontinuity of its cladding. The solution adopted recalls the tectonic/stereotomic interplay in Kahn's City Tower proposal, for here, in contrast to the homogeneity of the principal street elevation in brick, the return curtain wall in glass is subdivided so as to read as a tessellated, translucent skin. In order to express the common hermetic nature of both, Kahn alternates the manner of the structural expression between the northern and southern faces, so that where the curtain-walled facade, on the northwest and northeast elevations, serves to conceal the concrete floor and to reveal the columns, the converse applies on the main Chapel Street front, where the columns are suppressed except at the returns and where the floors read continuously throughout. These last are represented by horizontal stringcourses in stone, which are made of the same depth as the concrete ribs projecting from the tetrahedral floors. These stringcourses are of a similar tectonic order as the metal facing plates that cover and represent the floors in the fully glazed facades.

Within this play, the triagrid floor functions both as a structural network and as a distributive membrane, with tubular air ducts and electrical raceways running



断面图. Cross section.



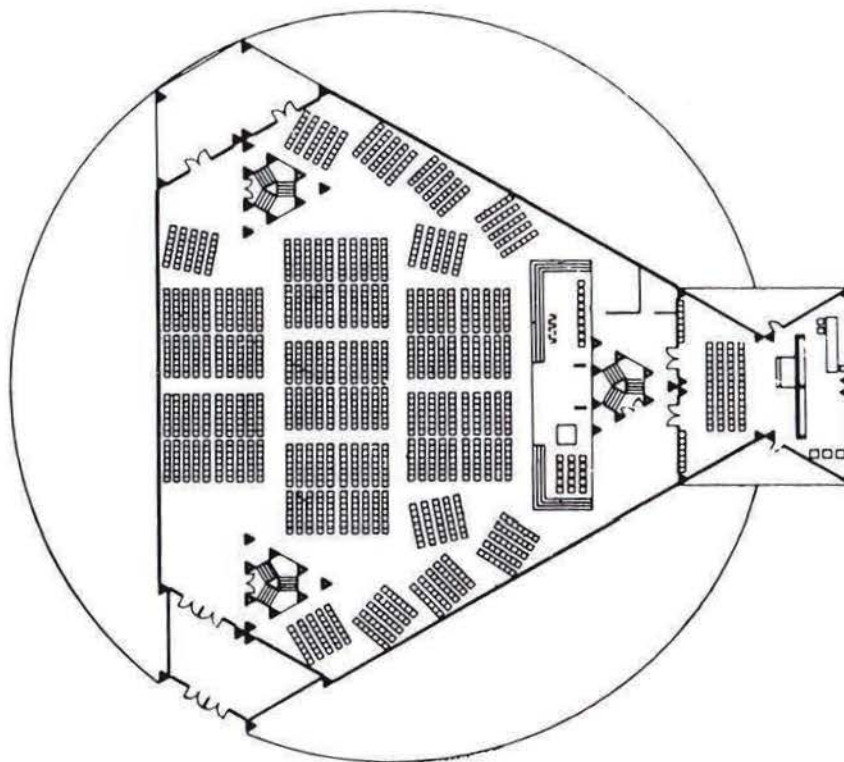
7.8

Louis I. Kahn, Yale University Art Gallery, New Haven, 1951–1953. Cross section and reflected ceiling plan.

in the interstitial space of the monolithic but hollow concrete tetrahedrons that make up the three-foot floor depth (figs. 7.9, 7.10). The fact that these triagrid floors had, in the end, to be calculated as inclined structural beams, due to the kind of calculations required by the city building code, hardly discredits the inventiveness and inherent probity of the design. One needs to note in this regard that each octahedron space within the tetrahedron network is four times greater in volume than the space of the tetrahedron itself. The ontological character of this geometry no doubt accounts for the autocritical sketch that Kahn made after the completion of the museum. As in the space frame proposed for the floor and roof of the Adath Jeshurun Synagogue projected for Elkins Park, Pennsylvania, in 1954–1955, this post-facto sketch proposes to support the tetrahedral floors of the gallery on a number of inclined tetrahedral pylons (fig. 7.11). This hypothetical idealized gallery appears in two versions, first as a square and then as an octagonal plan, fed in each instance by freestanding cylindrical services cores. Against this sketch, Kahn would append the note, “a tetrahedral concrete floor asks for a column of the same structure.”²² This may be read as a direct indication of the way in which his tectonic preconceptions would be at variance, at times, with the spatial and structural requirements of the work in hand.

Kahn’s sketch of an alternative tetrahedral structure for the Yale Art Gallery may derive from the fact that the floor as built was about 60 percent heavier than what would have been required for a normal 40-foot span, and while the finished ceiling possessed all the ethical and aesthetic attributes that Kahn desired, the revealed structure was not, as we have noted, designed as initially envisaged. The tetrahedral unit, as designed by Kahn and the engineer H. A. Pfisterer, was to have been a two-foot-high pyramid having 3½-inch-thick sides, cast integrally with a 4-inch concrete floor. While this made for a heavy floor, the overall ingenuity of the concept lay in the integration of the mechanical services running within the depth of the tetrahedrons.

Kahn’s “servant versus served” theme is further articulated particularly where the floor of the middle servant bay is distinguished from the honorific volumes it serves by being made of flat concrete plank construction rather than being cast in the form of the triagrid floors. This narrower structural bay accommodates at the next level of detail three servant elements: a cylindrical tripartite stair, an elevator/bathroom core, and a standard dogleg escape stair. Of these, the first is the main public stair, and this accounts for its honorific format comprising an equilateral triangular stair housed in a cylinder, as previously employed by Kahn



7.9
opposite, top

Louis I. Kahn, Yale University Art Gallery, isometric drawing showing integration of structural and air distribution systems.

7.10
opposite, center

Louis I. Kahn, Yale University Art Gallery, detail plan and section of floor structure.

7.11
opposite, bottom

Louis I. Kahn, Yale University Art Gallery, section sketch made after completion of the building (1954). Appended caption reads: "A tetrahedral concrete floor asks for a column of the same structure."

7.12
Louis I. Kahn, project for Adath Jeshurun Synagogue, Elkins Park, Pennsylvania, 1954. Second-floor plan.

in the City Tower design. The same honorific stair will appear in the plan for the Adath Jeshurun Synagogue projected for Elkins Park in 1954 (fig. 7.12). Meanwhile at Yale a second servant bay, accommodating another escape stair adjacent to the existing neo-Gothic Weir Hall, will also be simply rendered in concrete plank construction.

That Kahn was always concerned with the specific appearance of the constructional elements employed is evident from the care with which the Yale Art Gallery was detailed. This is confirmed by William Huff's memoir dealing with the construction of the gallery, particularly in the light of Kahn's concern for the quality of microtectonic elements.

In addition to his innovative handling of the basic concrete structural system, into which he deftly integrated the mechanical systems, and to the concrete's consequent exposure as one of the primary architectural finishes at the Yale Gallery addition, other major materials, such as the gallery floors and special concrete block, both of which played against the rugged concrete, evidenced his innate urge for the sensual. Other architects were using polished brick pavers or rubber tile or something like that for their floors. But in his free-searching survey of an inventory of imaginable, albeit viable, products, Lou stumbled upon the gymnasium floor, made up of carefully matched end-grain maple-strips—a wonderfully rich, as well as wonderfully comfortable and durable, material. And, saying that nothing looked more like a concrete block than the common 8 × 16 block, he had special 4 × 5 blocks manufactured, whose dimensions and proportions gave the walls wonderful scale and texture.²³

Elsewhere, in the same memoir, Huff remarks on the recessed shadow joint adopted in the paneling of all of Kahn's interior cabinetwork: "Lou's detailing of

character of its institutions, sanctioned through how sensitive they are to renewed agreement and desire for new agreement, not through need, because it comes from what already is.²⁷

By this date, twenty years after his initial essay on monumentality, the manifest destiny of monumental form had become amplified, that is to say it had evolved from an initial focus on the tectonic expressivity of built form to include within its scope the seminal character of the civic institution. Kahn was well aware that all traditional institutions were threatened by the processal aspects of late metropolitan development. Thus, his concern for the continuity of the city as an assembly of institutions is paralleled by his efforts to accommodate and overcome the contrary demands being made upon the traditional city by the ever-changing dynamics of modern locomotion. This much is clear from the way he was to conceive of the automobile in relation to the city. Thus, we find him writing in 1961:

The circumstantial demands of the car, of parking and so forth, will eat away all the spaces that exist now and pretty soon you have no identifying traces of what I call loyalties—the landmarks. Remember, when you think of your city, you think immediately of certain places which identify the city, as you enter it. If they're gone, your feeling for the city is lost and gone. . . . If because of the demands of the motorcar, we stiffen and harden the city—omitting water, omitting the green world—the city will be destroyed. Therefore the car, because of its destructive value, must start us rethinking the city in terms of the green world, in terms of the world of water, and of air, and of locomotion.²⁸

From the scale of the tectonic element to the scale of mega-urban form, Kahn constantly attempted to introduce into the fundamental structure both the essential services and the character of the served place-form in order to neutralize the destructive aspects of twentieth-century technology. Thus, his efforts to interpret modern space frame construction in the light of principles derived from structural rationalism were to be paralleled by attempts to transform the elevated freeway into a new form of civic architecture. This preoccupation lay behind Kahn's paradoxical aphorism that "the street wants to become a building" and his later projection of what he disingenuously referred to as "viaduct architecture."²⁹ This was also the primary impulse behind his 1957 plan for midtown Philadelphia (fig. 7.14), above all his so-called Civic Center Forum, surrounded by parking silos, of which he wrote:

This strategic positioning around the city center would present a logical image of protection against the destruction of the city by the motor car. In a sense the problem of the car and the city is war, and the planning for the new growth of cities is not a complacent act but an act of emergency. The distinction between the two architectures, the architecture of the viaduct and the architecture of the acts of man's activities, could bring about a logic of growth and a sound positioning of enterprise.³⁰

The ambivalent tension in Kahn's work between modernization and monumentality is perhaps never more evident than in the evolution of the cylindrical parking towers by which the city center was to have been surrounded (fig. 7.15). In his first version of these "wound-up streets" it is clear that Kahn cannot quite decide as to whether they should be treated as monuments or utilitarian semiotic elements. Thus, we find him writing in 1953:

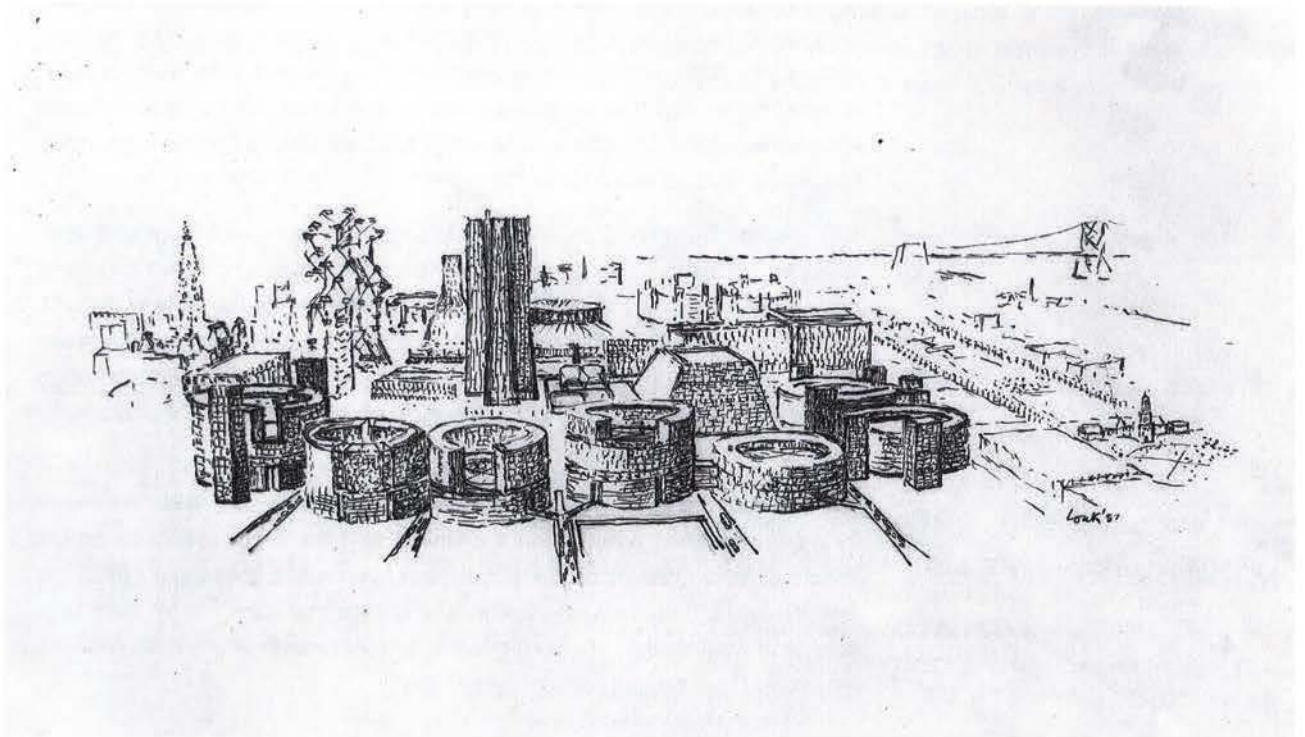
The tower entrances and interchanges, wound-up parking terminals, suggest a new stimulus to unity in urban architecture, one which would find expression from the order of movement. The location and design of these entrances are an integral part of the design of the expressway. . . . At night we know these towers by their illumination in color. These yellow, red, green, blue and white towers tell us the sector we are entering, and along the approach, light is used to see by and give us direction in ideas of lighting in rhythm with our speed. From these entrances a system of canals or interior streets feed the various activities of center city life.³¹

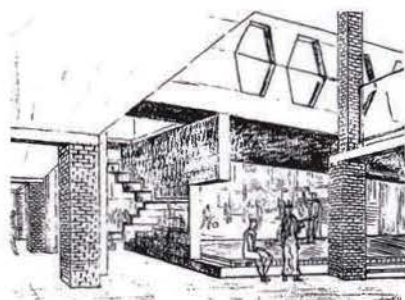
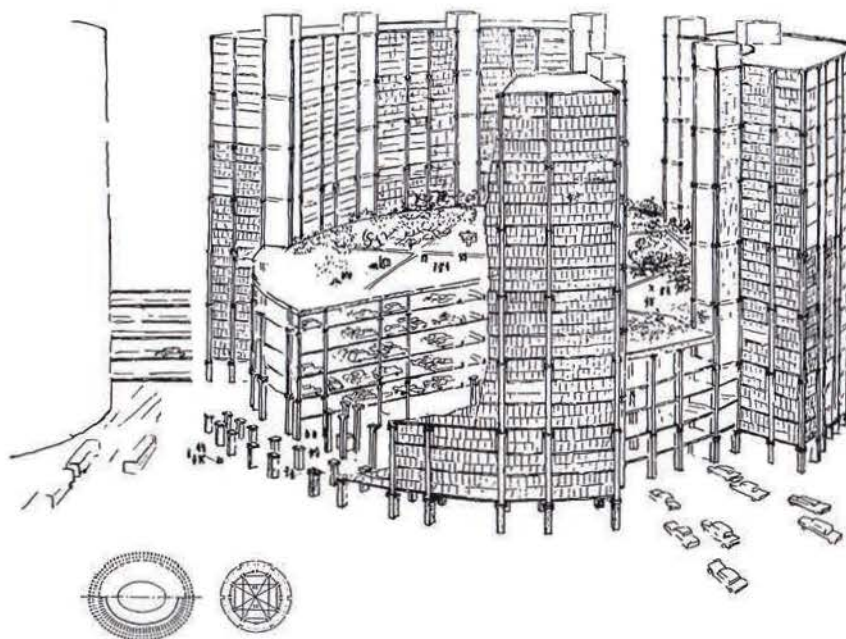
Apart from the reference to "canals," this reads like a prescription for identifying urban sectors according to a color code. However this seemingly semiotic approach to the ordering of urban space is immediately followed by a typical Kahnian metaphor in which the proposed access system breaks down into rivers, harbors, canals, and docks, that is to say into an all but mythical, analogical world, wherein expressways are seen as "rivers," streets as "canals," parking towers as "harbors," and the cul-de-sacs as "docks"; these last finally giving onto building entrances and car-free pedestrian zones. The provision by which some vehicles would park in harbor towers while others would penetrate into canals and cul-de-sacs is never made fully explicit in any of Kahn's Philadelphia studies. The familiar "stop and go" street plan does not seem to account for the fine-grain distribution of the traffic. Moreover, in all of his Philadelphia plans the parking silos are invariably seen as the equivalent of bastions, while the bounding freeway is regarded as a twentieth-century version of the medieval city wall. Of this last Kahn would write:

Carcassonne was designed from an order of defense. A modern city will renew itself from its order concept of movement which is a defense against its destruction by the automobile. . . . Great vehicular harbors or municipal entrance towers

7.14

Louis I. Kahn, plan for midtown Philadelphia, 1957. Perspective; north view from Spruce Street. The existing City Hall is shown on the extreme left.





7.15

Louis I. Kahn, plan for midtown Philadelphia: sketch of parking tower and a plan diagram of parking tower or "dock" set against a plan of the Roman Colosseum.

7.16

Louis I. Kahn, Jewish Community Center, Trenton, 1954–1959. Perspective sketch of game room and gymnasium (1957). Note the concrete Vierendeel trusses.

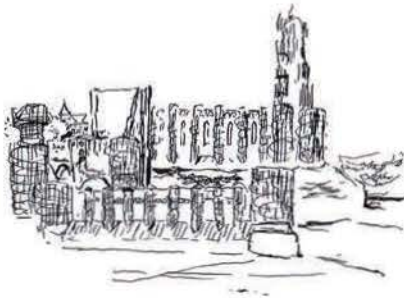
will surround the innermost center of the city. They will be the gateways, the landmarks, the first images that greet the visitor. . . . The main body of the tower gateways between the outer perimeter and the inner core will be the wound-up street of vehicular arrival and stopping.³²

Kahn's preoccupation with the idea of a hollow structure—"now we can build with hollow stones"—was to unify his thinking at both an architectural and an urban level. And where the former announced itself, in various ways, in the triagrid floors of the Yale Art Gallery, in the Vierendeel trusses projected for the Trenton Jewish Community Center (1954–1959) (fig. 7.16), and finally in the hollow floor beams of the Richards Medical Research Building of 1957, the latter was to manifest itself as a viaduct architecture of his last urban proposal for Philadelphia, dating from 1962. Of this last, Alexandra Tyng has written:

Viaduct literally means a "carrying street." Kahn extended its original Roman meaning to signify a complex consisting of levels for pedestrian traffic, automobile traffic, mass transportation systems, and rooms under the street for piped services, which could then be repaired without interruption of traffic. The viaduct is actually a hollow column turned on its side, channelling the energy flow of the city.³³

If on one level the monumental for Kahn was contingent upon the institution and the city, on another, as we have already seen, it turned upon the structure and the joint. These two poles were related to each other by natural light, that is to say, by the way in which light, as revealed by structure, was capable of imparting a specific character to a given institution or a civic element. Kahn would even see light as a divine transforming essence, as something that could make solid structures translucent, even transparent in their material consistency, as is suggested in his famous sketch of Albi cathedral (fig. 7.17).

As Kahn's career advanced, he became increasingly antithetical to open-planned, loft space and more concerned with the irreducible character of the

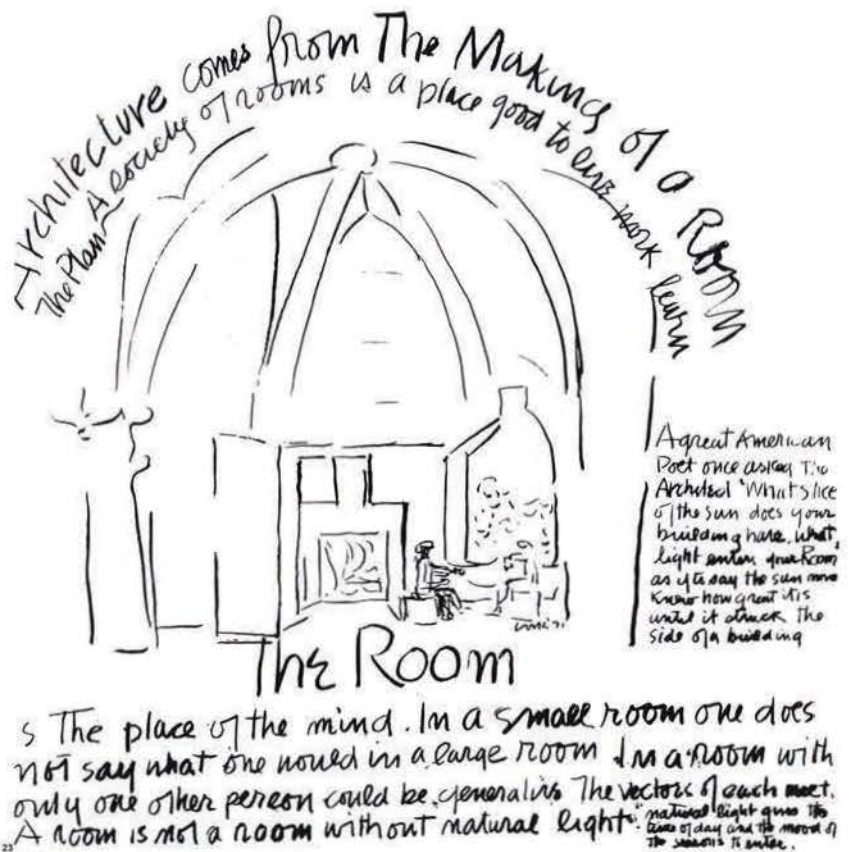


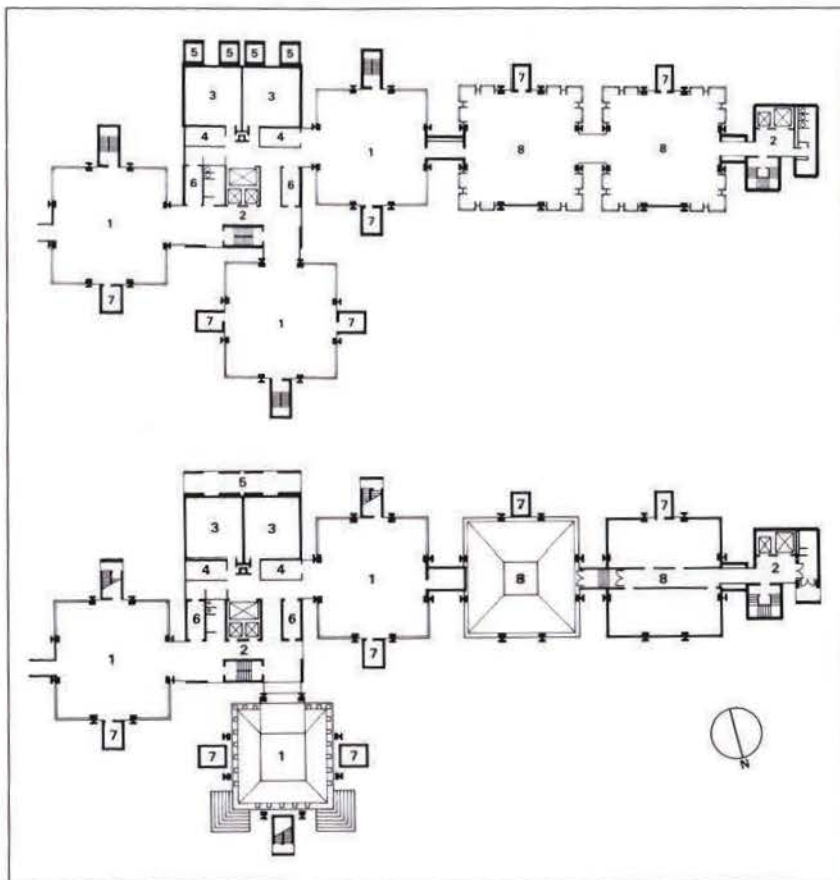
room in se. For him, the quality of light made manifest through its interaction with a specific structural volume was the essential determinant of its character (fig. 7.18). Hence, he would write:

Architecture comes from the Making of a Room. . . . The Room is the place of the mind. In a small room one does not say what one would in a large room. In a room with only one other person . . . the vectors of each meet. A room is not a room without natural light. Natural light gives the time of day and [allows] the mood of the seasons to enter.³⁴

In a similar vein, Kahn wrote of the penetration of light into the multilevel free-way viaducts that he proposed for midtown Philadelphia in the early 1960s in terms of allowing a sliver of light to enter into the darkest room; to penetrate even into a cinema in order to reveal how dark it is.³⁵ The windowless, climate-controlled box was a total anathema to Kahn, as was the indifferently assembled, underdetailed modern building so often found in commercial architecture. Thus, as far as he was concerned, the joint, as revealed by light, was the tangible proof of the constructional probity of the work in much the same way as it had been the touchstone of tectonic form in the writings of Viollet-le-Duc and Semper.

Kahn's emphasis on the joint naturally leads to a comparison with Mies van der Rohe and to the drawing of certain parallels between their respective achievements. This is particularly true of their mature work, and above all of their comparable essays in reinforced concrete construction. Thus, one may compare





7.17

Louis I. Kahn, sketch of St. Cécile cathedral, Albi, France, 1959. Note the representing of the cylindrical elements as "wind-up" forms.

7.18

Louis I. Kahn, "Architecture comes from the Making of a Room . . .," 1971.

7.19

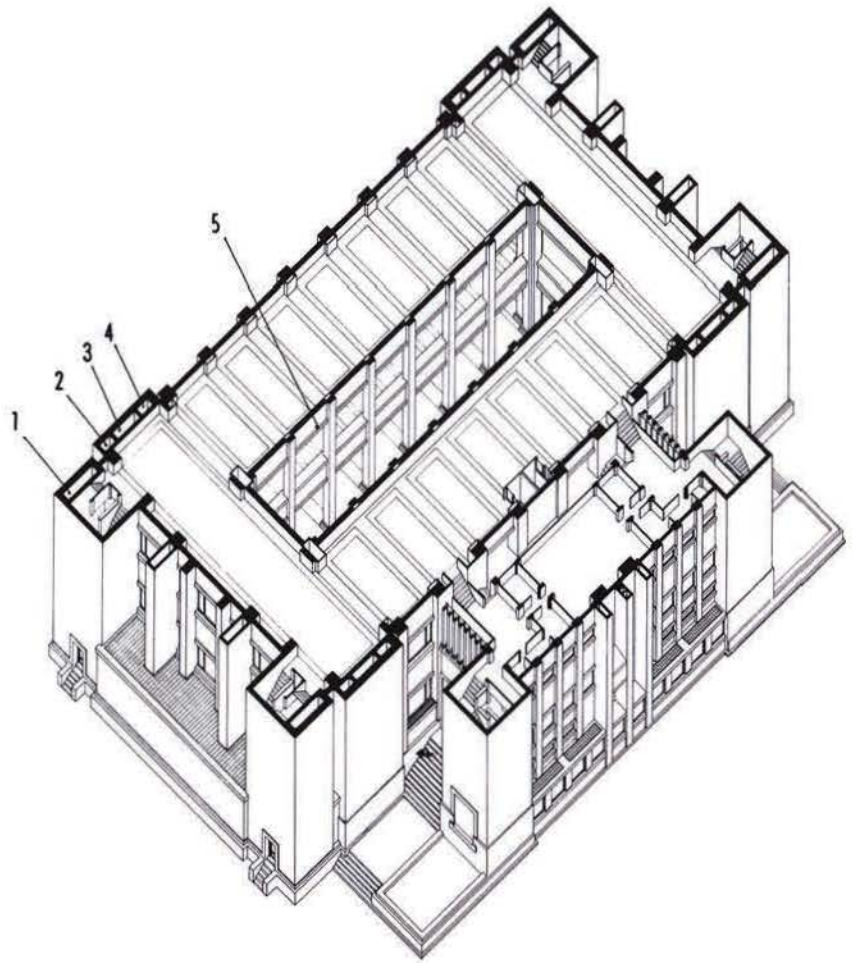
Louis I. Kahn, Richards Medical Research Laboratories, University of Pennsylvania, Philadelphia, 1957–1961. Typical floor plan (above) and first-floor plan (below):

1. studio towers
2. elevators and stairways
3. animal quarters
4. animal service rooms
5. fresh air intake stacks
6. air distribution shafts
7. fume and exhaust stacks
8. biology building towers

Mies's Promontory Apartments of 1949 to Kahn's cylindrical parking/office silos, first published in 1953 as part of the midtown Philadelphia plan. An exposed tra-beated reinforced concrete frame is the primary expressive element in each instance. Moreover, the structural frame is similarly articulated in each case; that is to say, the perimeter concrete columns, carrying the spandrels, diminish in section as they rise upward due to a decrease in compressive stress. Aside from this singular case, however, their preferred generic columns could hardly have been more different, with Mies favoring a standard rolled steel stanchion and Kahn preferring a hollow or solid concrete pier.

Kahn's preoccupation with hollow structure reaches its apotheosis with the Richards Medical Laboratories realized for the University of Pennsylvania between 1957 and 1961 (fig. 7.19). As others have remarked, this building synthesizes for the first time the multifarious aspects of his tectonic approach: the use of hollow structure at every conceivable scale, the articulation of servant and served spaces, the full integration of mechanical services, and not least the dialogical "gravitational/levitational" expression of static weight and gaseous exhaust. From this point onward, Kahn treats the structure as the potential generator of space, that is, as a hollow diaphragm from which the volume itself emerges by extension. At the same time, the articulation of the joint assumes an organic character; thus he was to write:

A building is like a human. An architect has the opportunity of creating life. It's like a human body—like your hand. The way the knuckles and joints come to-



7.20

Frank Lloyd Wright, Larkin Building, Buffalo, 1904. Axonometric at third-floor level. Note the service ducts built into the walls of the stair shafts. Numbers indicate built-in services according to the following key:

1. fresh air intake
2. utilities
3. foul air exhaust
4. miscellaneous ducts and services
5. tempered air outlets under balcony fronts and ceiling beams

7.21

Louis I. Kahn, Richards Medical Research Laboratories, perspective sketch from the southwest, 1957 version showing cantilevered and ribbed exhaust stacks.

7.22

Louis I. Kahn, Richards Medical Research Laboratories, early plan.

*gether make each hand interesting and beautiful. In a building these details should not be put in a mitten and hidden. You should make the most of them. Space is architectural when the evidence of how it is made is seen and comprehended.*³⁶

This anthropomorphic conception of the joint is to be given a more tectonic rendering in his homage to Carlo Scarpa, made shortly before his own death:

Design consults Nature

to give presence to the elements.

A work of art makes manifest the wholeness of 'Form', the symphony of the selected shapes of the elements.

In the elements

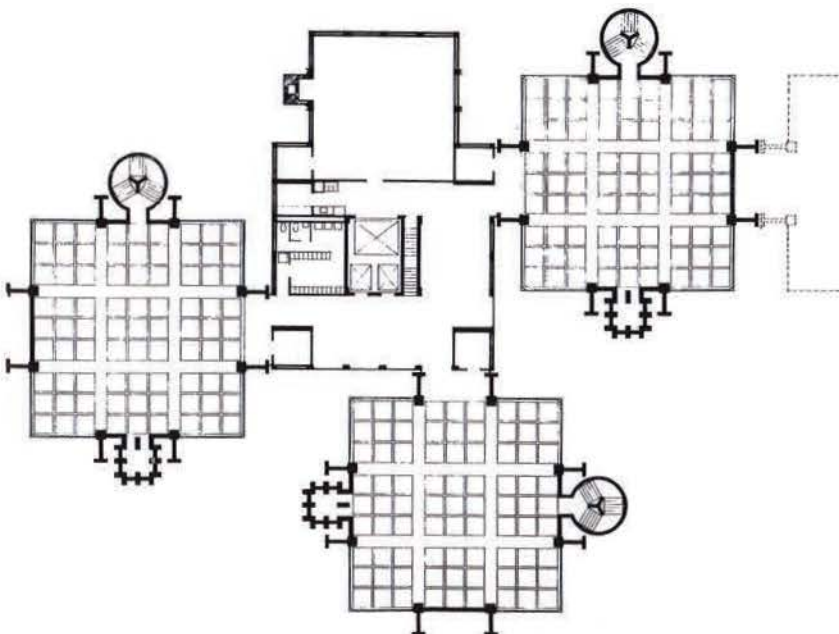
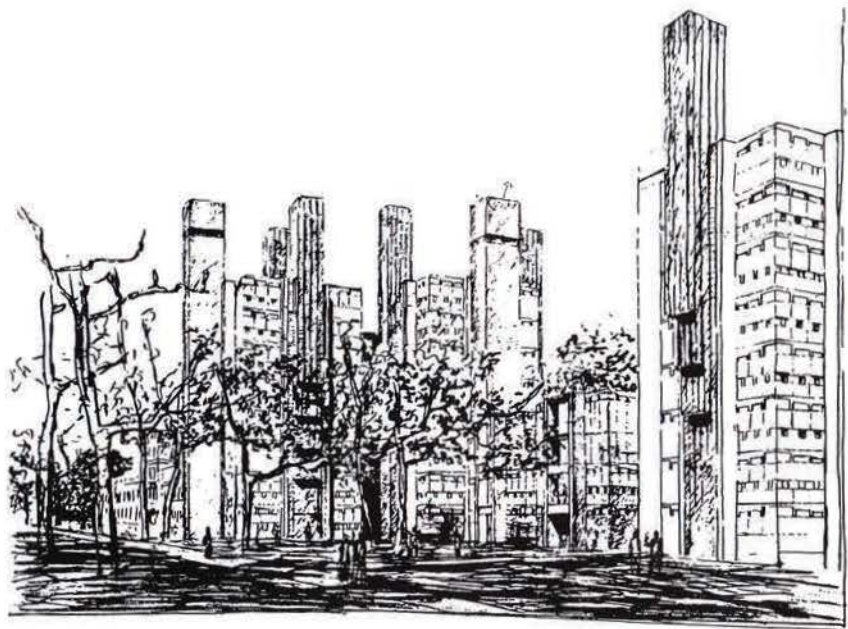
the joint inspires ornament, its celebration.

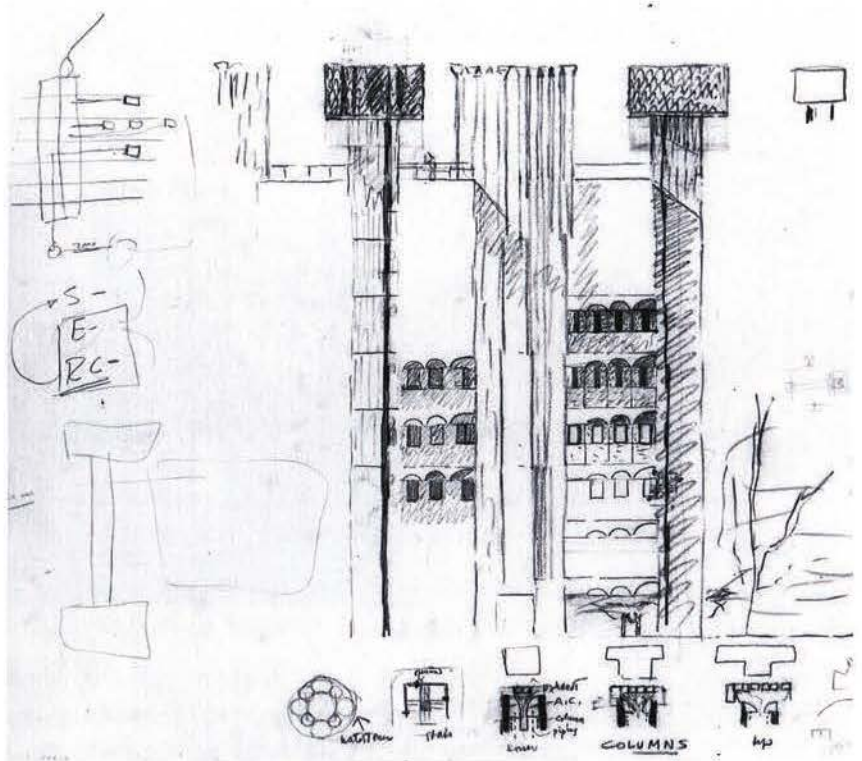
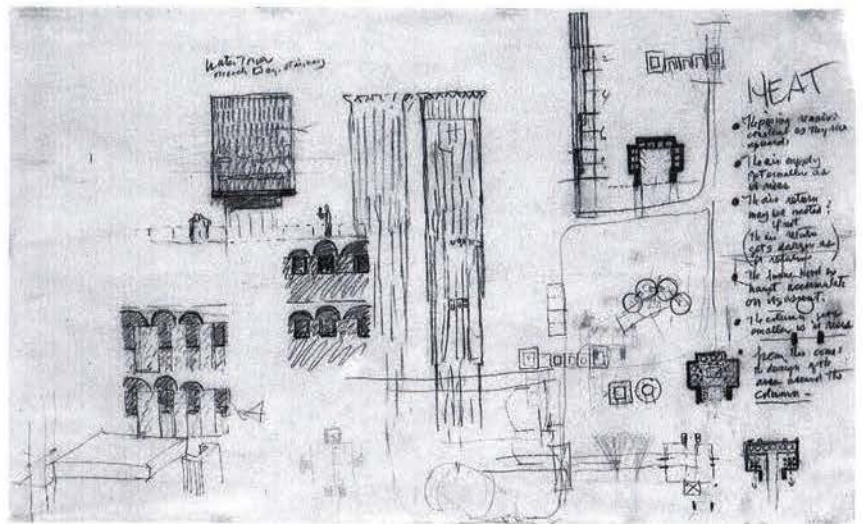
*The detail is the adoration of nature.*³⁷

This feeling for the organic surely derives in large measure from Frank Lloyd Wright. Wright is, in any event, still an insufficiently acknowledged influence on Kahn, not only in the Richards Medical Laboratories but throughout his career. And while many earlier twentieth-century architects were inspired by Wright's domestic architecture, including, of course, Hendrik Petrus Berlage and Ludwig Mies van der Rohe, few if any were able to develop the introspective concatenations of hierarchic form that characterized Wright's public buildings. In a round-about way, this legacy fell to Kahn. The totally blank exterior of the hollow

service towers in the Richards Laboratories and the division of the parti into servant and served spaces are all surely incipient in Wright's Larkin Building, Buffalo, of 1904 (fig. 7.20), and a similar relationship clearly obtains between the Richards Laboratories and the S. C. Johnson Administration complex built at Racine, Wisconsin, in 1937. It is significant that Wright's own 1945 description of the S. C. Johnson Building has much about it that could have been from the hand of Kahn:

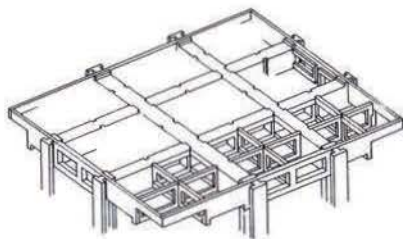
Laid out upon a horizontal unit system twenty feet on centers both ways, rising into the air on a vertical unity system of three and half inches: one especially large brick course. Glass was not used as bricks in this structure. Bricks were bricks. The building itself became—by way of long glass tubing—crystal where crystal either transparent or translucent was felt to be most appropriate. In order to make the structure monolithic, the exterior enclosing wall material appeared inside wherever it was sensible.³⁸





7.23
Louis I. Kahn, Richards Medical Research
Laboratories, plan and elevation sketches of
service towers, 1957 version.

In much the same spirit Kahn wrote of his laboratories as being "conceived in recognition of the realization that science laboratories are studios and that the air to breathe should be away from the air to throw away."³⁹ Here once again the hollow column comes into play, particularly in the initial sketches for the exhaust and air intake towers (figs. 7.21, 7.22, 7.23) against which Kahn would jot down the following notes: "The air supply gets smaller as it rises . . . the air return gets larger as it returns. The fume hood exhaust accumulates on its ascent. The column gets smaller as it rises. From this comes the design of the area around the column."⁴⁰ These ventilation manifolds, built out of corbeled masonry and dialectically conceived as opposing the ascent of gas to the descent

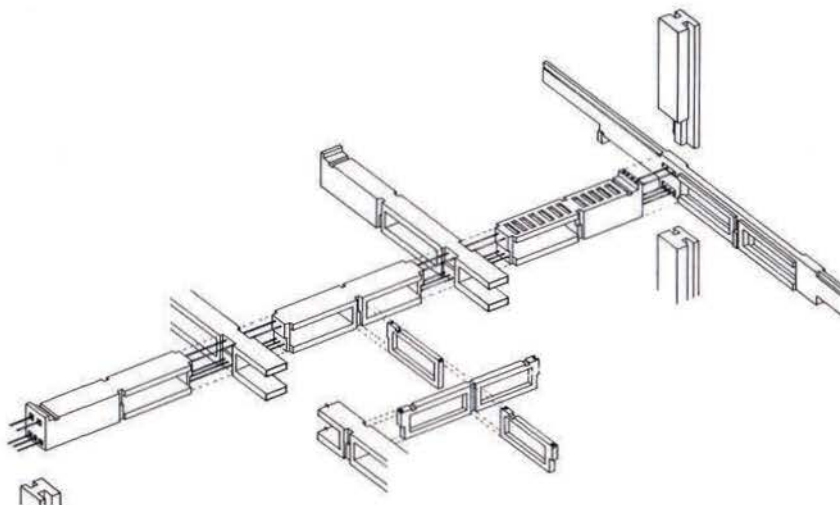


7.24

Louis I. Kahn, Richards Medical Research Laboratories, isometric drawing of precast concrete floor system.

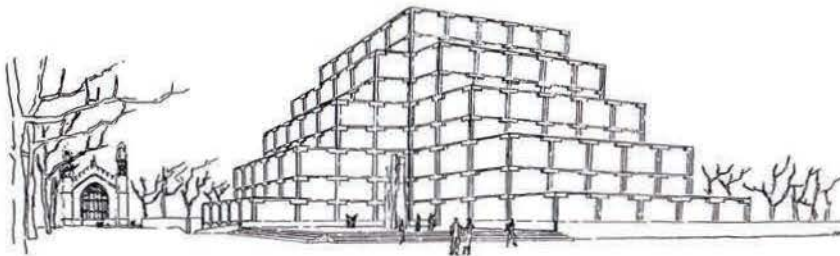
7.25

Louis I. Kahn, project for Washington University Library, St. Louis, 1956.



of gravitational force, had eventually to be abandoned in favor of simpler boxlike sections for the process of air intake and foul exhaust. Nevertheless, as in the original sketches, a clear division was maintained between the stereotomics of the ventilation system built in brick and the tectonics of the columnar structure cast in concrete. As in the Yale Art Gallery, Kahn was able to integrate the horizontal distribution of services within the post-tensioned diagrid, two-way cantilevering floors of the laboratories, the structural depth being reduced toward the corners as the bending stress diminished. It is to the great credit of Kahn's engineer August Kommendant, with whom he would work continuously from 1956 to the end of his career, that this cantilevered Vierendeel was executed entirely of prefabricated concrete (fig. 7.24). Unlike the dialectic between ascendant air and descendant gravity, this horizontal interweaving of the services into the "space frame" of the flow structure was maintained throughout.

In one design after another, Kahn constantly strove to reveal the structural skeleton, together with its cross-sectional reduction in area as the load diminished. However, Kahn's project for the Washington University Library of 1956 (fig. 7.25) was his last didactically tectonic essay in this regard, for thereafter masonry would play a more decisive role in his work, either rendered as a screen wall or treated as a kind of stressed-skin construction, as in the calculated load-bearing concrete blockwork of the Tribune Review newspaper building erected in Greensburg, Pennsylvania, in 1961 (fig. 7.26). Where the masonry was not structural it was handled as though it were a representative shell or "ruin," that is to say, as though it were a screen running outside the structural and institu-



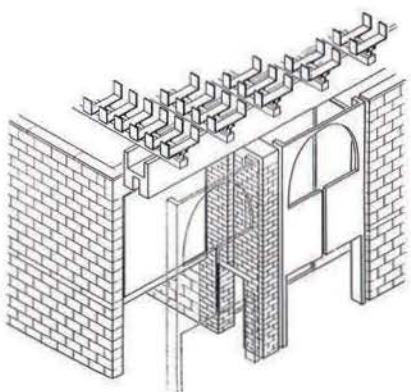
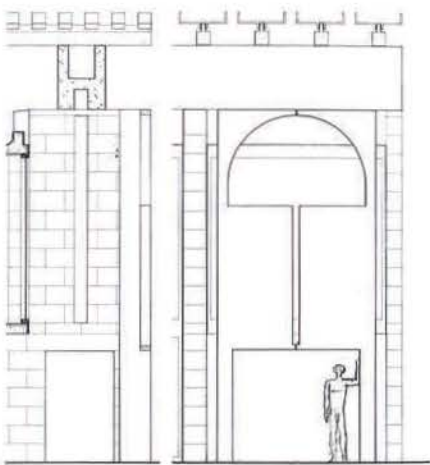


7.26

Louis I. Kahn, Tribune Review Building,
Greensburg, Pennsylvania, 1958–1961.

7.27

Louis I. Kahn, project for U.S. Consulate, Lu-
anda, Angola, 1959–1961. Detail section, ele-
vation, and isometric.



tional substance of the building (cf. Schinkel's Friedrich Werder Church, Berlin, of 1830). The interior face of this screen was invariably treated as a "space between," wherein the play of light could reveal the difference between the inner substance of a building and the outer surface of its appearance. This masonry encasement is first unequivocally adopted by Kahn in his project for a U.S. Consulate in Luanda, Angola, dating from 1959, wherein the outer envelope of the structure is partially covered by screens for the purpose of sun control (fig. 7.27). Of this provision Kahn would write:

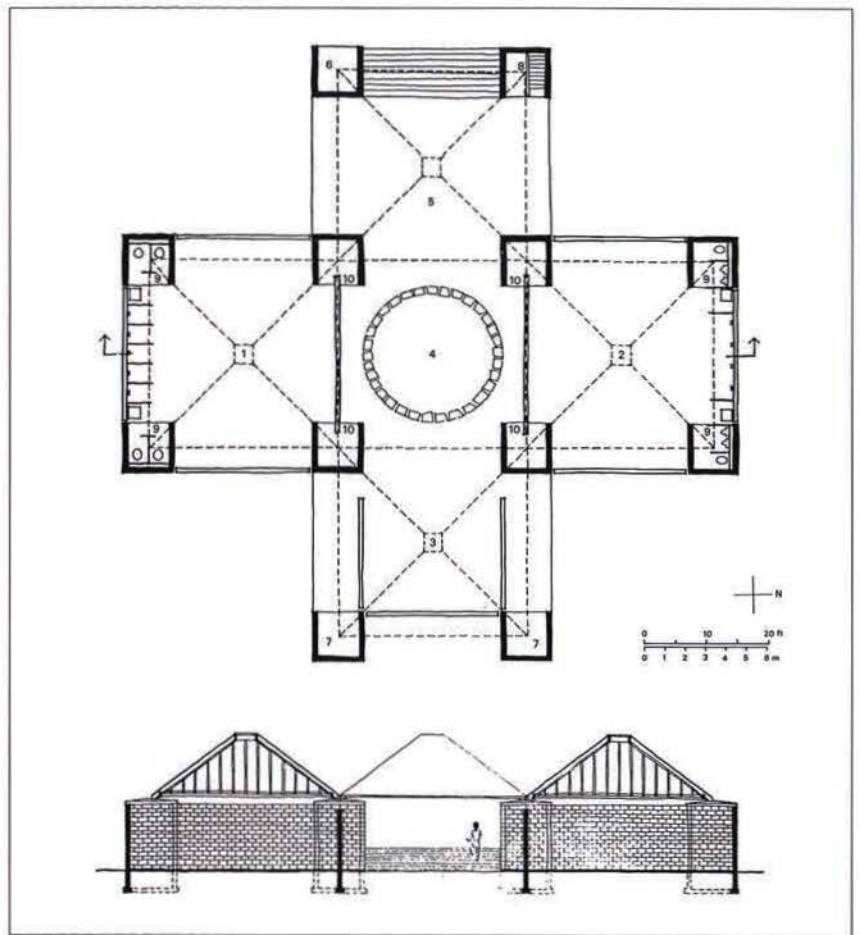
I came to the realization that every window should have a free wall to face. This wall receiving the light of day would have a bold opening to the sky. The glare is modified by the lighted wall and the view is not shut off. In this way the contrast made by separated patterns of glare, which skylight grilles close to the window make, is avoided. Another realization came from the effectiveness of the use of breeze for insulation by the making of a loose sun roof independently supported and separated from the rainroof by a head room of 6 feet. Notice also that the piers that hold the main girders for the sun roof are completely independent of the rain roof. The rain roof is never pierced.⁴¹

This tectonic response to extreme climatic conditions had, however, its representational aspect, for both the cut-out frontal screen and the tessellated sun canopy on the roof evidently served to represent the honorific status of the building. Kahn was fully aware of this fact: "Considering the type of building it is, one should have the feeling of entrance and reception *not* by way of a sign but by its very character."⁴² Kahn seems to have posited the idea of structure at two interlocking levels, first a general spatial structuring to be effected by the octatetrahedral system that, like Buckminster Fuller, he identified with the basic molecular order of the universe, and second a detailed structural order that employed the time-honored tropes of building culture: the cantilever, the catenary, the arch, the vault, the buttress, and the bridge. On occasion these primary and secondary levels—the spatial and the structural—would be conflated into one, as in the towers of the Richards Laboratories or the pseudo-vaults of the Kimbell Art Museum or the octagonal staggered cellular units initially envisaged for the structure of Eleanor Donnelly Erdman Hall at Bryn Mawr College in 1960. In all these instances, the resulting cellular space demonstrated his belated rediscovery that "a bay system is a room system," as he wrote in his notebook of 1955, in a passing reference to the Palladian plan.⁴³ This short pronouncement about the spatial implications of the generic structural bay was the main way in which Kahn distanced himself from the free plan or *plan libre* of the prewar European avant-garde. Influenced by Rudolf Wittkower's 1949 reappraisal of Palladianism, in which rooms were to be designated by their proportion and not according to their use, Kahn invariably projected clearly defined spaces, open to varying modes of appropriation. As we have already noted, he would eventually impose over structure and space a third corporeal order that we may identify as

encasement, after the masonry-encased metal armatures to be found in the work of Labrouste and Viollet-le-Duc. While this third order was first justified by Kahn as a means of shielding the core of the building from glare, in his late monumental works such as the posthumously realized Bangladesh Parliament, the Sher-e-Bangla Nagar completed in Dacca in 1982, these three levels of structuring—the cellular, the structural, and the encasement—become fused, in certain sequences, into a single in situ concrete fabric engendering an all but infinite concatenation of interstitial space. In this instance it is significant, from a Semperian standpoint, that Kahn would elect to represent the concrete case of the building as a woven screen, the concrete being subdivided vertically by inlaid bands of stone. Within his entire oeuvre, Exeter Library (1967–1972) appears as the sole work in which the three levels of structuring become so compounded as to cancel each other out. Thus the brick piers sustaining the perimeter carrel wall running around all four sides of the library are totally at variance with the reinforced concrete column system holding up the book stacks. At the same time this overstructuring of the building has nothing whatever to do with the masklike facade that exploits its stepped-back brick piers, diminishing toward the top, to make a nostalgic allusion to the warehouse and mill vernacular of the eighteenth and nineteenth centuries, while the structure within has little to do with this tectonic tradition. Nothing could be further, one might note, from the tectonic fidelity of Schinkel's Bauakademie in this regard.

Kahn felt that the processes of modernization had a debilitating effect on received architectural forms, and even more importantly on the sociocultural essence of the institutions they once housed. As a result, he felt that modern institutions could no longer be predicated on historically derived types. For Kahn, these forms had either to be assembled piece by piece out of structurally articulate components, developed from the interaction of construction, gravity, ventilation, services, and light, or they had to be evoked as institutions, through employing geometrically determined forms or Platonic solids, that is to say, through the use of absolute plan forms derived from circles, triangles, squares, or other regular polygons. Kahn's intuition in this regard linked him to the rational Cartesian doubt that had dominated French thought since the end of the seventeenth century. As Marcello Angrisani has shown in his 1965 essay "Louis Kahn and History,"⁴⁴ Kahn welcomed the reappearance of the arbitrary architectural paradigms of the French Enlightenment, the massive, largely blank cubes, spheres, and pyramids and their various intersecting permutations that make up the visionary repertoire of Claude-Nicolas Ledoux and Étienne Boullée. At the end of the eighteenth century these architects were already to suggest a way for accommodating and representing the utopian (not to say apocalyptic) institutions of the unprecedented bourgeois, industrial world. In this regard Emil Kaufman's *Three Revolutionary Architects: Boullée, Ledoux and Lequeu*, published in Philadelphia in 1952, had a certain influence on Kahn, as is suggested by the Yale Art Gallery, the Trenton Bath House (fig. 7.28), and the Elkins Park synagogue, all dating from this period. Unlike Boullée and Ledoux, however, Kahn rarely used the primary forms in isolation, but always as the elemental parts of more complex assemblies.

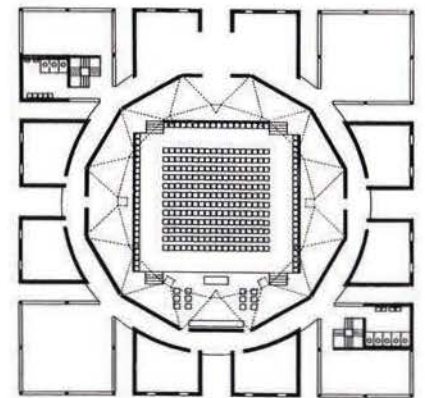
In the Rochester Unitarian Church of 1959, Kahn will make his first didactic demonstration in this vein, that is to say the representation of the *what* of the institution, as opposed to the articulation of the *how* of its structure. As in the equilateral triangular plan adopted for the Elkins Park synagogue but never fully



7.28

Louis I. Kahn, Jewish Community Center,
Bath House, Trenton, 1955–1956. First-floor
plan and section through dressing rooms:

1. women's dressing room
2. men's dressing room
3. basket room
4. atrium
5. entry
6. pool director's kiosk
7. storage
8. entrance to chlorinating equipment
9. toilets
10. wall baffled entrances

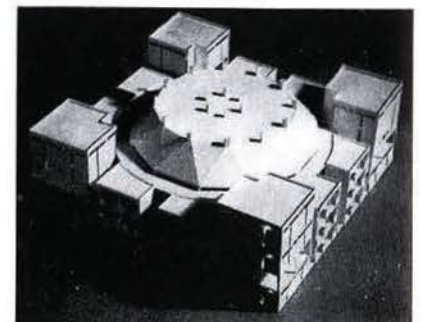


7.29

Louis I. Kahn, Unitarian Church, Rochester,
1959–1967. First-floor plan, 1959 version.

7.30

Louis I. Kahn, Unitarian Church, Rochester:
model, 1959 version.



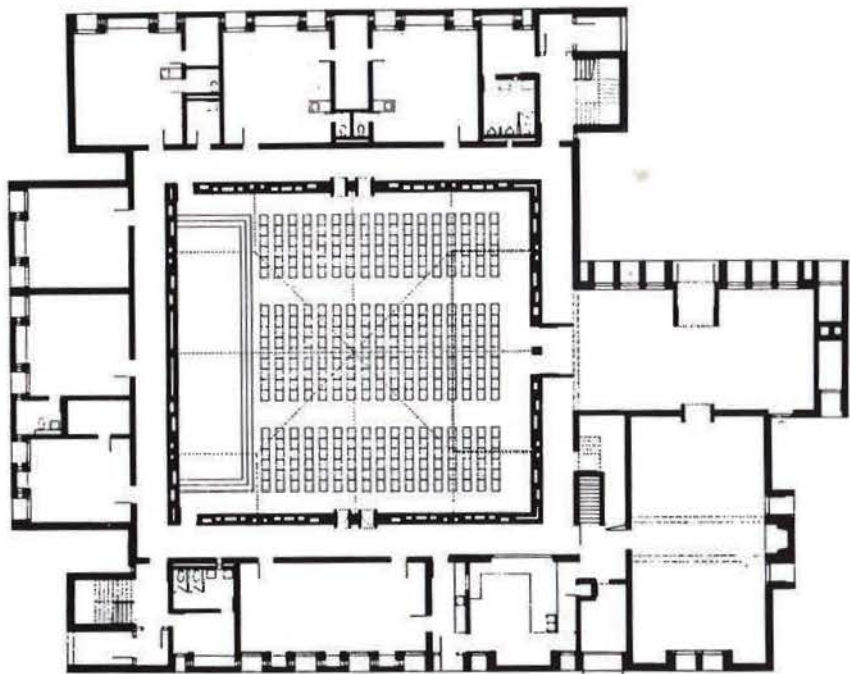
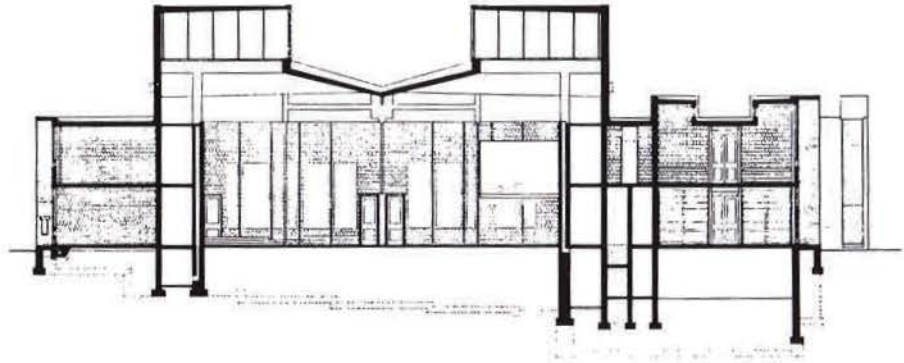
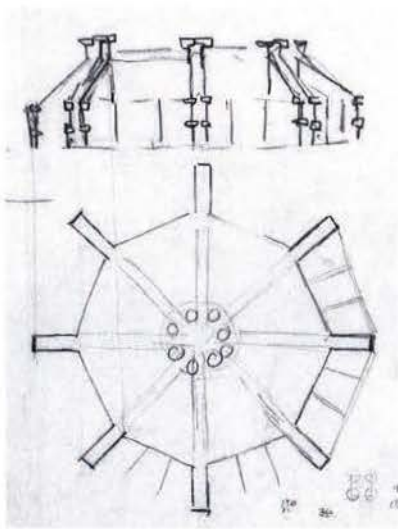
postulated as a mass form, Kahn will assume a regular polygon for the body of the church. This is first projected as a structural octagon set within a square inside a decahedron that in its turn is further inscribed within a circle and an outer square (figs. 7.29, 7.30). An earlier version shows the church as a freestanding octagonal structure, with its roof held in place by buttress-like, reinforced concrete members running in pairs around the periphery (fig. 7.31). The fact that the Rochester church would finally be realized as an empirical, additive form, due to programmatic demands, in no way detracts from Kahn's institutional concerns, as we may judge from the symbolic symmetry of the inner sanctum with its four corner monitor lights and shell concrete roof. The full spirituality of this church as an institution is expressed in the roof section, from which a mysterious light enters into the four cubic corners of the meeting room, highlighting the flying tie beams that serve to sustain the stability of its quadripartite shell form (fig. 7.32). As Kahn was to put it: "It's very Gothic isn't it? Does that bother you? I like it myself."⁴⁵

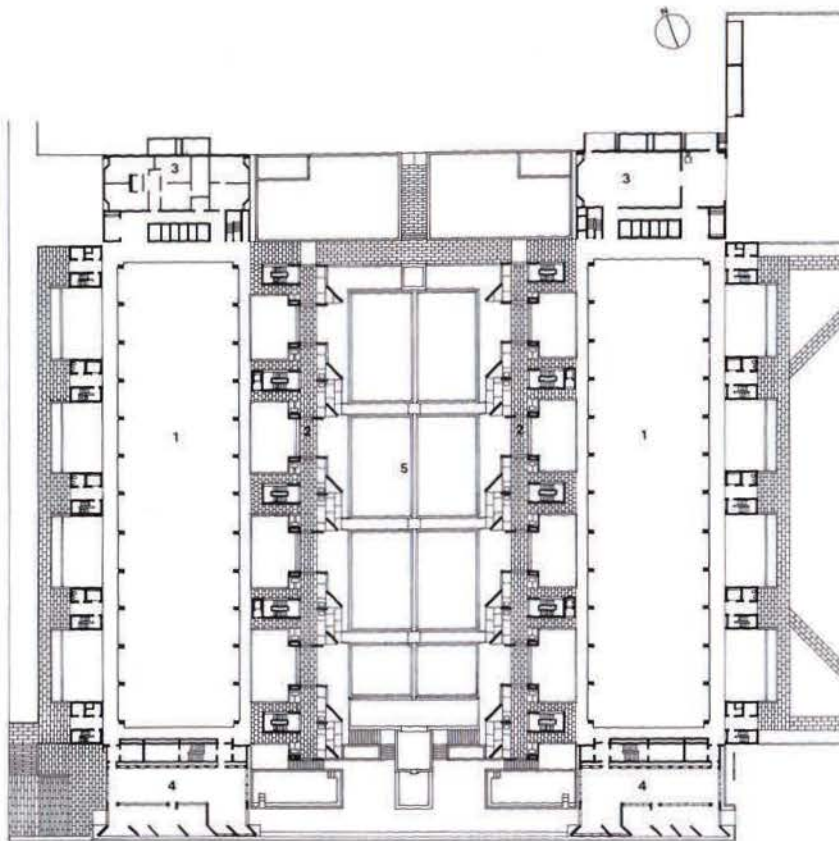
7.31

Louis I. Kahn, Unitarian Church, Rochester, plan and elevation sketches, 1959 version.

7.32

Louis I. Kahn, Unitarian Church, Rochester, longitudinal section and first-floor plan, final (fifth) version.





7.33

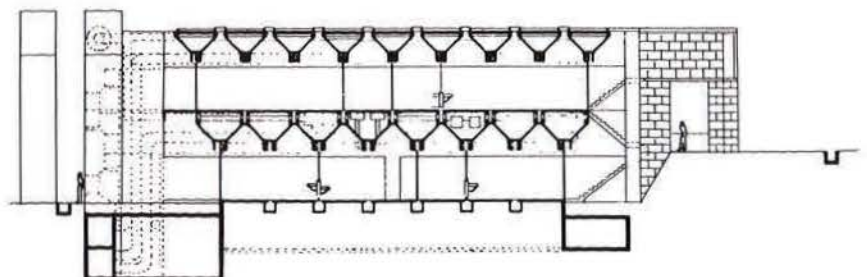
Louis I. Kahn, Salk Institute Laboratories, La Jolla, 1959–1965. Plan of laboratories, final version:

- 1. laboratory
- 2. loggia
- 3. office
- 4. library
- 5. central court

7.34

Louis I. Kahn, Salk Institute Laboratories, typical cross section through laboratory, second version. "In the first scheme for the Salk Laboratory, crawl space was provided in a generously deep folded plate construction. This gave an awkward but possible accessibility as well as an integral enclosure."

Kahn's penchant for embodying institutions in arbitrarily geometric plan forms had its limits, however, as is evident from the Richards Medical building where it became clear that a biological laboratory was something more processual than Kahn's overly idealistic conception of a "science studio." And indeed he took this lesson to heart in the design of the Salk Institute Laboratories at La Jolla, California, first projected in 1959 and finally completed in 1965 (fig. 7.33). He was able to persuade his client, Dr. Jonas Salk, that it was necessary to provide separate physical environments for the conceptual realm of the intellect and the processual realm of empirical research, the former being housed in well-appointed study cells facing onto a common internal court, the latter being accommodated in well-served loft space. Kahn still attempted to render the clear span over this last in accordance with the precepts of structural rationalism, with interstitial man-height service spaces being integrated within the depth of the 100-foot box-truss girders. This triangular-sectioned space would occupy the depth of 50-foot prestressed folded plates spanning the opposite dimension. While this arrangement would have yielded a folded-plate ceiling running between the box trusses for the entire length of the laboratory (figs. 7.34, 7.35),

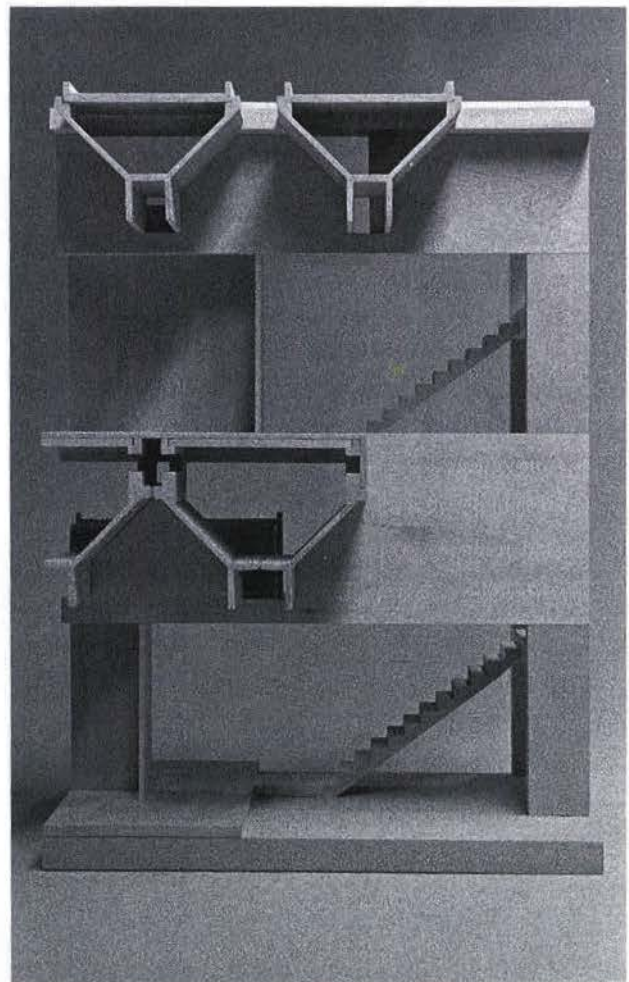
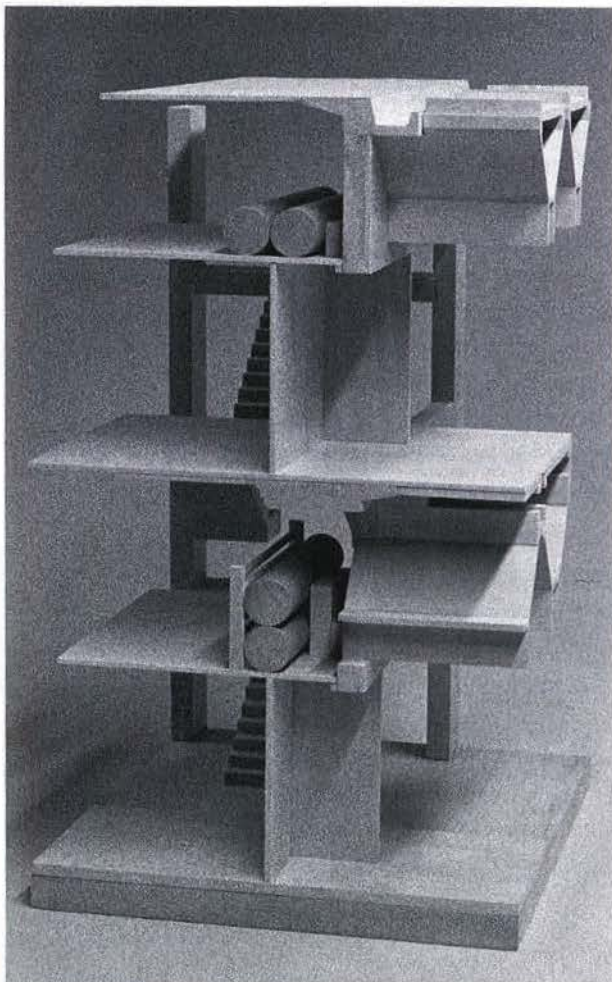


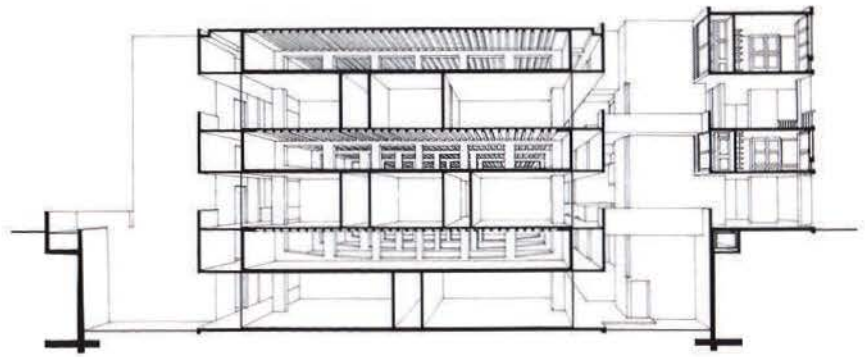
it seems that this provision was eventually rejected in the interests of lowering costs and shortening the construction time.⁴⁶ It was thus decided to achieve the transverse span with inverted post-tensioned concrete Viereckel trusses occupying the full depth of the interstitial space, with a 10-inch concrete slab above and a suspended, 8-inch hollow core slab beneath. Permanent slots were cast at frequent intervals in the lower slab so as to allow the services to be dropped through at virtually any location above the loft laboratory space (fig. 7.36).

Salk is the first occasion on which Kahn integrates the undercroft of the building into the overall domain of the site; indeed one might say that he "builds the site" in Mario Botta's sense, for its symmetrical form, comprising two laboratory wings flanked by study cells facing onto a central court, is raised clear of the undulating clifftop site by the use of a concrete substructure. This earthwork is rendered as a kind of templum, clad throughout in travertine, in which every upstand edge or reveal accommodates in one way or another a point of access or a joint; an iron-framed gateway here, a shallow flight of steps there, or simply a recessed seam between the vertical face of the building and its undercroft. Many of these narrower seams are treated as stormwater gulleys, as though the entire stereotomic foundation was subject to seasonal flooding. This metaphorical opposition between explicit earthwork and implicit waterwork is finally consummated, so to speak, by a shallow water channel running down the central axis of the podium toward the sea. It is surely not without some transcultural significance that the Mexican architect Luis Barragán would play a decisive role in determining the final form of the space, deeming it to be a civic plaza rather

7.35

Louis I. Kahn, Salk Institute Laboratories, views of laboratory study model.





7.36

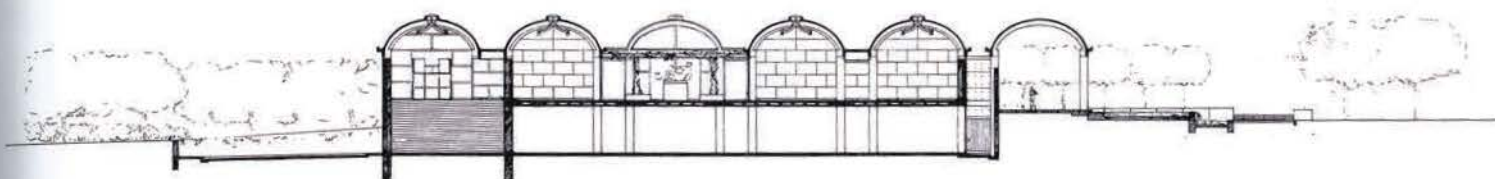
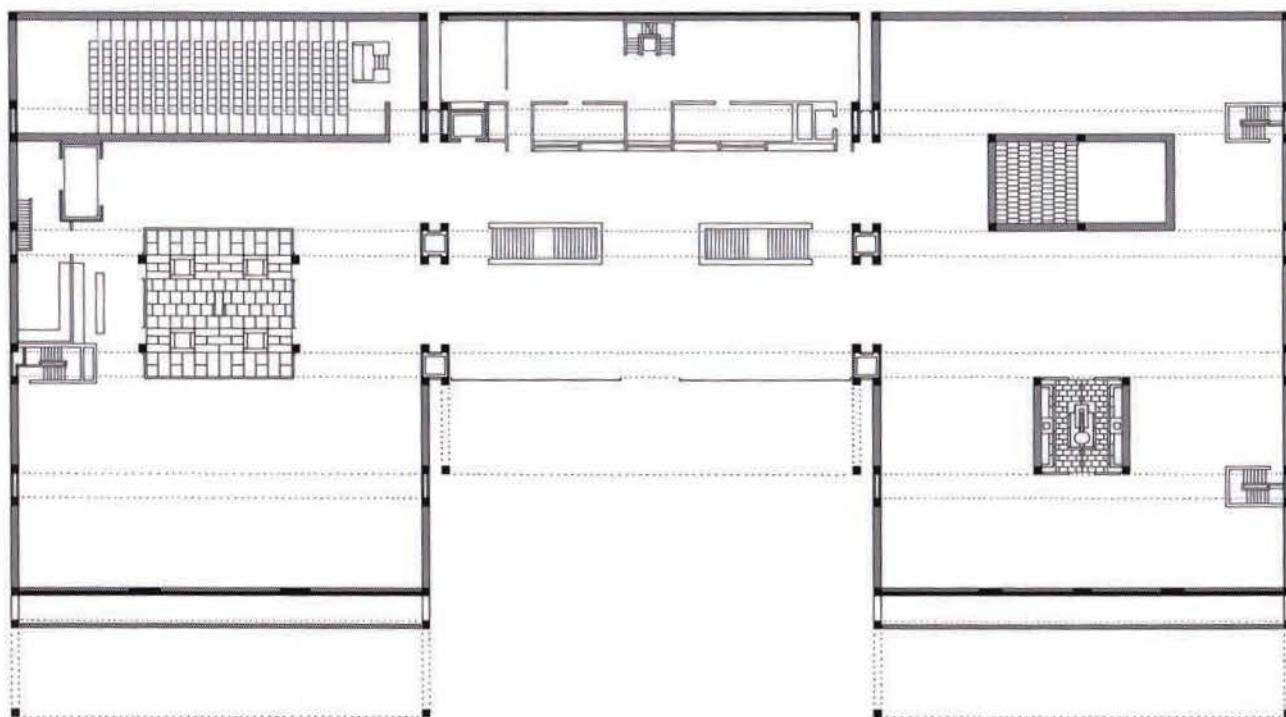
Louis I. Kahn, Salk Institute Laboratories, section through laboratory wing, final version as built.

than a garden court and thus suggesting that it should be left without any planting whatsoever. Kahn's account of the way this decision was made reveals a great deal about the spirit in which the entire work was achieved.

I asked Barragan to come to La Jolla and help me in the choice of the planting for the garden to the studies of the Salk Laboratory. When he entered the space he went to the concrete walls and touched them and expressed his love for them, and then said as he looked across the space and towards the sea, "I would not put a tree or blade of grass in this space. This should be a plaza of stone, not a garden." I looked at Dr. Salk and he at me and we both felt this was deeply right. Feeling our approval, he added joyously, "If you make this a plaza, you will gain a facade—a facade to the sky."⁴⁷

Aside from the overall Mozarabic character of this provision, the specific nature of its detailing is Kahnian throughout. This much is evident from the way in which the watercourse is handled as a reciprocally symbolic system, with fountainhead and gargoyle rendered as the alpha and the omega of a self-contained microcosmos. The fountain is contained within an upstand cube, faced in travertine, in which three slots, set around three sides of a square basin, discharge their flow across shallow weirs, thereby forming a perfectly mitered, three-part trajectory of water cascading into the channel beneath. The symbolic and geometrical counterform to this source is the equally cubic gargoyle that, faced in the same travertine, discharges its flow into a monumental stone cistern set below the surface of the podium, in front of the sea. Since the rate of discharge requires a certain hydraulic pressure, the flow from the source is allowed to accumulate in two holding tanks, each one paralleled by a stone bench, before finally discharging into the cistern below. This entire assembly, court, water, and cistern, is held conjointly in a state of suspension before the undulating contours of a clifftop panorama, while the whole is preceded by an irregular grove of eucalyptus trees that deftly screen the court and the view of the ocean from the landward side.⁴⁸

These primordial elements, as offset by the interplay between tectonic form and changing light, were to be integrated in an equally sublime way in the Kimbell Art Museum at Fort Worth, Texas, first projected by Kahn in 1966 and finally completed in 1972, two years before his death (fig. 7.37). The Kimbell may be seen as the apotheosis of his career, above all for the way in which one dominant tectonic element, namely a barrel vault, determines the overall character of the piece. The other determining factor is once again a stereotomic earthwork, here the manifest integration of the building into its site. And where the former, the split and articulated structure of a pseudo-vault, is the provider of light, the



7.37

Louis I. Kahn, Kimbell Art Museum, Fort Worth, 1966–1972. Upper-floor plan and cross section.

latter is to evoke the presence of nature in a more telluric aspect. Thus while light is the ubiquitous natural element par excellence, Kahn was to inscribe the Kimbell into its site in such a way as to establish a categoric “clearing” and to endow the resultant precinct with a particular presence. In this respect, the Kimbell seems to demonstrate the importance that Martin Heidegger would attach to the boundary in his seminal essay “Building, Dwelling, Thinking” of 1954: “A boundary (*peras*) is not that at which something stops but, as the Greeks recognized, the boundary is that from which something begins its presenting.”⁴⁹ Thus the implantation of the Kimbell amounted to the establishment of an earthwork in every conceivable sense, from the travertine revetment of its elevated podium to the acoustics of its graveled forecourt, from the solemnity of the Yaupon holly grove that crowns the entrance from the park to the more distant, low-slung deciduous planting of the park itself (fig. 7.38).

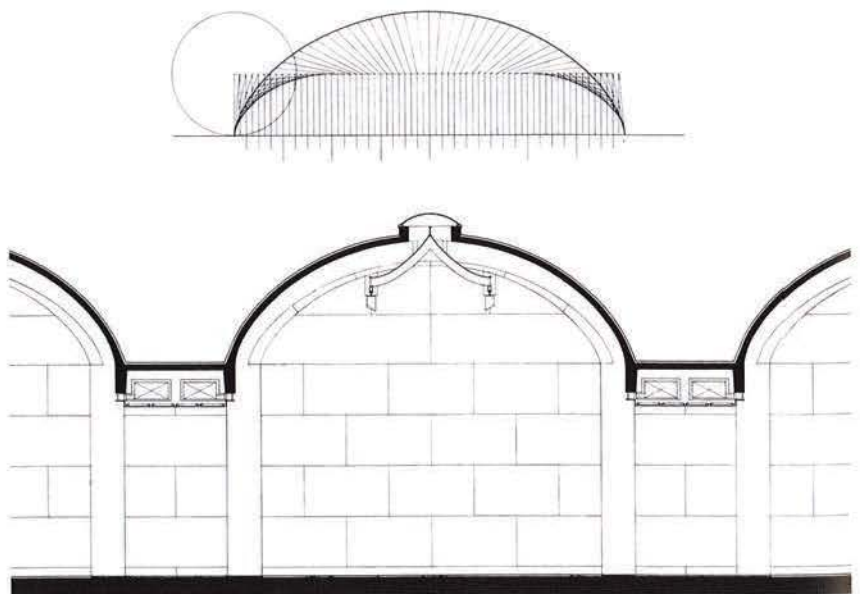
In the laconic remarks that accompany the presentation of the Kimbell, Kahn reveals, as nowhere else, the cosmological intent of his entire approach. Thus, of light he was to write: “We were born of light. The seasons are felt through light. We only know the world as it is evoked by light. To me, natural light is the only light because it has mood—it provides a ground of common agreement for

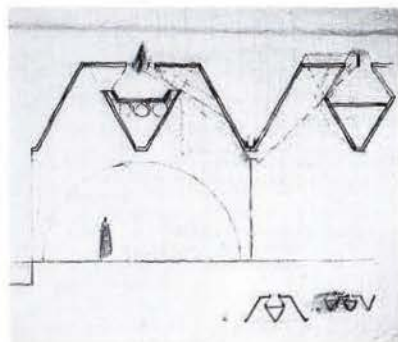
plane, but, there is invariably bleeding of the concrete at the junctures. Here, vertical and horizontal projecting vee joints were formed by controlled tolerances, which allowed the bleeding to be molded into relief elements. The central vertical joint is an indented, poured joint, also plugged with lead.⁵⁶

At the Kimbell, as in the Salk Laboratories, Kahn introduced a certain amount of volcanic ash or *pozzolana* into the concrete mix in order to give the concrete when cast and cured a brownish hue. As it happens, the *pozzolana* had the effect of reducing the expansion of the concrete in casting, although it produced dust and made a high finish more difficult to obtain. As at Salk, the tie cones for the formwork at the Kimbell were plugged with lead after the removal of the molds, and the gaps between the panels produced thin upstand seams on the surface of the finished concrete.⁵⁷

Mention must be made of the way in which services are integrated into the galleries at Kimbell, not only the reflecting light baffles and lighting consoles below the crown of the vault, but also the service channels that run between the downstand beams under the springing (fig. 7.41). These metal service boxes, together with the moving partitions that are bracketed off longitudinal tracks let into their form, enabled Kahn to orient the space of the museum into two countervailing and ideologically distinct directions; on the one hand, the traditional gallery as a discrete room, running in the same direction as the vault, on the other, the lateral expanse of space running across the vault, capable of providing a flexible, open floor area appropriate to a wide range of exhibition formats.

The Kimbell Art Museum is a work that has been subjected to a great deal of controversy on both tectonic and technical grounds, not the least of which has been the character of the 104-foot-by-23-foot "false" vaults by which the building is covered. The roof of the museum reiterates in many ways the dilemma and the aspirations of the Greco-Gothic ideal, for in its evolution two conflicting impulses can be identified. On the one hand, there is the folded-plate, factory-like, concrete roof that Kahn projected in his spring 1967 design for the mu-





7.41
Louis I. Kahn, Kimbell Art Museum, section of
cycloid, final version.

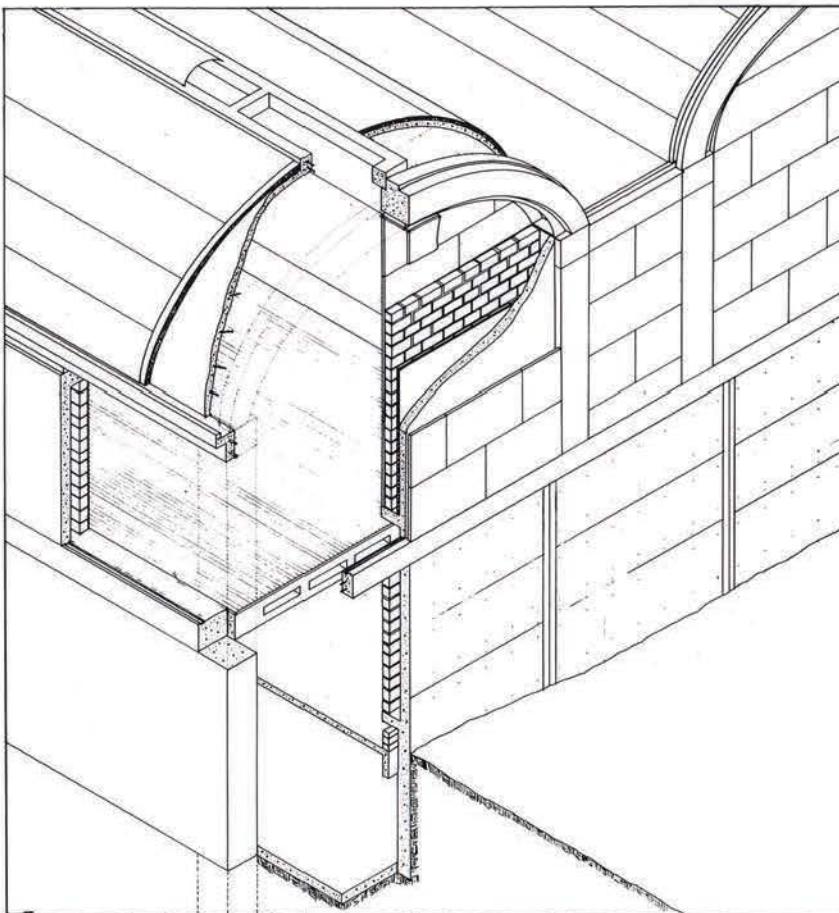
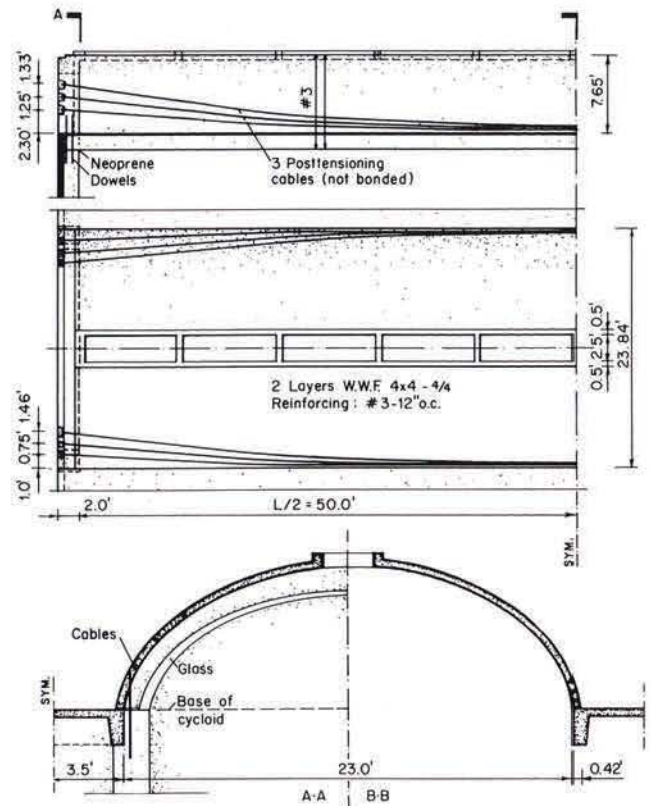
7.42
Louis I. Kahn, Kimbell Art Museum, early
sketch of folded-plate roof structure.

seum (fig. 7.42), a design that clearly anticipated the folded-plate structure to be used in the final work. On the other hand, there are the semicircular, purely vaulted galleries projected by Kahn and his assistant Marshall Meyers in autumn of 1967, when Kahn proposed vaults having a 12-foot radius, set on top of a 12-foot-high beam line supported by columns at 24-foot centers. Nothing surely could have been more Platonic and monumental than this double-square gallery section, and this seems to have been why it was rejected by the client, namely, for being too magisterial, since the director Richard Brown wanted a villa for his museum rather than a palace. This pertinent critique was answered, so to speak, by the cycloid vault section that Meyers happened upon in Fred Angerer's book *Surface Structures in Architecture* (1961). The introduction of the cycloid and the decision to pierce its apex with a continuous light slot brought the structure back to its original folded plate form, even if lateral ties were introduced across the slot, in order to permit the structure to act in both directions. The root of *vault* in the Latin verb *volvere*—meaning literally to revolve across—is particularly apt in the case of the cycloid vault, since the profile arises out of the rotation of a point on the circumference of a circle rolling along a line. There is a further incidental analogy between the roll of the vault and the curvature of the fountain flow that parallels the vaulted porticoes on either side of the main entry. To this cycloid section August Kommendant imparted certain engineering refinements: the deepening of the upstand beams around the slot, the thickening of the cycloid wall toward its base, in order to facilitate pouring, the casting of the cycloid as a second pour above the downstand beams, and finally the post-tensioning of the cycloids in the long direction in order to attain a clear span of 104 feet (figs. 7.43, 7.44). This hidden catenary cable network gave an uplift to the cycloid beams so as to counteract their inevitable deflection. Kommendant needed a diaphragm of a certain depth at the return ends of the vaults, and this led to a circumferential light slot of varying depth, let into the end wall of the section (fig. 7.45). In the final development of this form one might say that Kahn was neo-Gothic to the degree that he followed the precepts of Viollet-le-Duc and Greco-Gothic to the degree that he strove for the purity of the form, once the empirical engineering requirements were satisfied.

Doug Suisman's critical appraisal of the Kimbell highlights once again Kahn's familiar ambivalence toward the automobile, for by the time Kahn turned to the Kimbell he had already been struggling to integrate the automobile into his work for well over two decades (fig. 7.46). By this date we may say that the fundamental dilemma posed by the car had defeated him, and in this of course he was by no means alone. The fundamental hostility of the automobile to architecture and to urban civilization as a whole is surely a treatise that is waiting to be written. In any event, there is no doubt whatsoever that the conception of the Kimbell is basically antithetical to the car, or to put it conversely, the ideal way to enter this museum is hardly from its parking lot. Thus, as Suisman writes:

The first impression of the Kimbell parking lot facade is its blankness—no recognizable windows, unbroken panels of concrete and travertine, a dark horizontal gash for an entryway. . . . Passing into the recess of the entry your eyes have no time to adjust before entering the lobby, so your initial impression of the interior is a gloomy one indeed.

The ideal entrance is by way of the pedestrian approach from the park, but this is relatively unused:



7.43

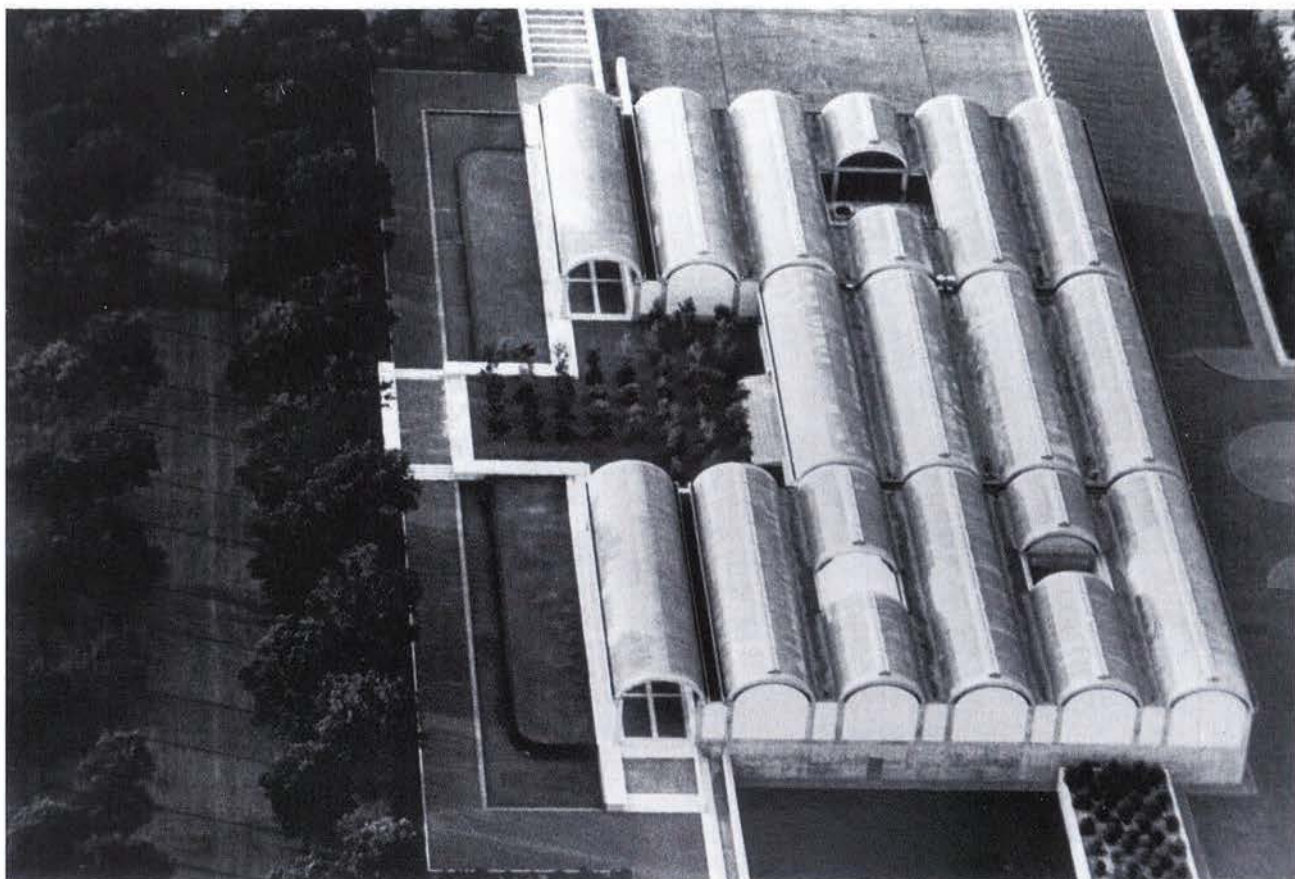
Louis I. Kahn, Kimbell Art Museum: side elevation of shells with post-tensioning cables; plan, post-tensioning cables, and skylight; cross section of shell-end arch, with glass separation between end arch and walls.

7.44

Louis I. Kahn, Kimbell Art Museum, isometric drawing of the elements of construction.



7.45
Kahn in the Kimbell auditorium.



7.46

Louis I. Kahn, Kimbell Art Museum, view of entrance.

It's only later that you learn that a mere 15 per cent of all museum visitors actually enter through this so-called entrance where Kahn expected them; the other 85 per cent arrive by car, park in the lot, and enter through the basement. Could Kahn's reported failure to obtain a driver's license possibly explain this flagrant miscalculation of suburban habits?⁵⁸

It is nonetheless clear that the traditional occidental monument, together with the institution it embodies, demands that one should arrive on foot and enter via a threshold in order to undergo an appropriate rite of passage between the representational portico of the monument and its internal space of public appearance, the very transition that is compromised everywhere today by the universal aporia of the automobile. For Kahn this was particularly distressing inasmuch as he had striven throughout his life for the full integration of modern technology with the substance of institutional form. As we have remarked, this rite of passage is ideally achieved at Kimbell in the approach from the park, where, passing under the foreground canopy of trees, one crosses a stepped threshold between the cascading fountains before entering the museum proper via a gravelled forecourt and a grove of diminutive trees. Once upon this axis, one finds oneself in a green labyrinth, where the gravel underfoot is destabilizing and where the corresponding sound of one's footfall is overlaid by the continual rush of the water. In such a setting, perhaps more fitting for a temple than a museum, we find ourselves returned to the tactility of the tectonic in all its aspects; to a meeting between the essence of things and the existence of beings, to that pre-Socratic moment, lying outside time, that is at once both modern and antique.