TECTONICS IN ARCHITECTURE:

From the Physical to the Meta-Physical

by

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Submitted to the Department of Architecture in May 9, 1986 in partial fulfillment of the requirements for the Degree of Master of Architecture

ABSTRACT

Tectonics in architecture is defined as "the science or art of construction, both in relation to use and artistic design." It refers not just to the "activity of making the materially requisite construction that answers certain needs, but rather to the activity that raises this constuction to an art form." It is concerned with the modeling of material to bring the material into presence: from the physical into the meta-physical world.

The topic is, in part, a reaction to some contemporary trends in architecture. Part one discusses two current trends perceived to be negative: the effacement of history, both in an architectural and a temporal sense; and the tendency toward scenographic representation.

Part two discusses the external references and internal references of buildings. These references are developed in two ways: a building's inter-consciousness and inner-consciousness. The former is concerned with the general circumstances of a building, (physical, social, political, economic), or in Heidegger's terms, the way in which it "gathers the fourfold," and the latter is concerned with the intrinsic properties of a building. The two are completely interdependent, however, this thesis is primarily concerned with a building's inner-consciousness.

Part three defines tectonics first by discusssing its relation with meta-physics; second by tracing an abbreviated lineage of nineteenth century German practitioners and theorists; third by describing different kinds of tectonic expression and finally by outlining only a few "subjects" of tectonic architecture.

Part four examines two examples in detail -- the 25bis Rue Franklin Apartment Building by August Perret, and the Richards Medical Research Laboratories by Louis Kahn. These are intended to give concrete examples of some of the issues and subjects discussed previously in the thesis.

Tectonics is primarily concerned with the making of architecture in a modern world. Its value is seen as being a partial strategy for an architecture rooted in time and place, as well as an architecture of "depth." In bringing the physical into the meta-physical, tectonics begins to talk of a poetic of construction.

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part one:

INTRODUCTION

This thesis seeks to explore tectonics in architecture– its relevance, and definitions with respect to some aspects of building. It is a topic which, in part, is in reaction to some current trends. It is an approach to architecture which, at the outset, hoped to coalesce some ideas that might have the capacity to resist the seemingly negative influences of these trends.

Tectonics is defined as "the science or art of construction, both in relation to use and artistic design."[1] It refers not just to the "activity of making the materially requisite construction that answers certain needs, but rather to the activity that raises this construction to an art form."[2] It is transcending the banality of mere building by the modeling of a physical thing which reveals a conscious attempt by the architect to "tell a story": bringing the physical into the meta-physical world. Tectonic expression concerns itself with the narrative capacity of a building, primarily with respect to itself, but also as part of a more general circumstance (physical, social, political, economic etc.).

Specifically, it is hoped in this thesis to demonstrate that a building, as a bearer of intrinsic properties, can tell its *own* story. The physical qualities of a building -- structure, materials, organization, services, detail, as well as its process of assembly and constructional technique -- can be brought into meta-physical presence: that a building be thought of as a "thing" rather than a "sign." In short, tectonics is primarily concerned with the apparent self-consciousness of a building with respect to its construction.

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[1] Webster's Dictionary

[2] Anderson, *Modern Architecture and Industry: Peter Behrens, the AEG, and Industrial Design,* p. 83

More generally, a tectonic approach hopes to address the possibility of there ever being an architecture rooted in time and place. It is hoped that tectonics has the capacity for a kind of "depth-ness"-- a depth that would result from the the implicit or even vague "story" told by tectonic expression. The implicit message would allow for varying personal interpretation; the acquisition of meaning or symbolism over time, as well as the possibility of that meaning changing with time. So, it may be productive, or easier, to see tectonics in contrast to architecture that relies on the explicit messages of "signs."[1] Before discussing tectonics, it is helpful to identify several aspects of our present societal condition and their architectural manifestation.

Sometime just after World War II a whole new type of society emerged, referred to by Ernest Mandel as "late-capitalism,"[2] which is sometimes referred to as post-industrialism, consumer society, media society, multi-national society or a postmodern culture.[3] For Jameson the present architectural climate, societal condition, and culture are inextricably bound up with the development of Late-Capitalism. He states, "...every position on postmodernism in culture -- whether apologic or stigmatization -- is also at one and the same time and *necessarily* an implicitly or explicitly political stance on the nature

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[1] Not necessarily in opposition to postmodernism, as that term will be used in the most general sense. It is hoped, as will be discussed, that postmodernism is not seen as a style, but rather as a cultural manifestation which allows for the presence and coexistence of a range of very different features, and which is seen as a positive aspect of our condition- one which doesn't place tectonics and other important aspects of architecture in contradiction.

[2] The general thesis of the book states that there have been three fundamental moments in capitalism: the market capitalism; the monopoly stage or the stage of imperialism; and our own-- multi-national capital or Late-Capitalism. He feels it is the purest form of capitalism yet to have emerged since it has expanded into previously "uncommodified" areas-- the destruction of precapitalist third world agriculture, and the rise of the media and the advertising industry.

[3] Jameson, *Postmodernism and Consumer Society,* p. 113

of multi-national capitalism today."[1] It is characterized by

> *"planned obsolescence; an ever more rapid rhythm of fashion changes; the penetration of advertising, television and the media to an unparralleled degree throughout society; the replacement of the old tension between city and country, center and province, by the suburb and by universal standardization; the growth of the great networks of superhighways and the arrival of automobile culture."*[2]

It is a society which is becoming increasingly intoxicated with the self-perpetuating cycle of consumption and production; the continuing erosion of the traditional boundaries between high-culture and pop-culture; and the incapacity of our society to retain its own past.

Two aspects of the postmodern condition, which are a result of the general reduction of architecture to a commodity, I find particularly regressive: the effacement of history, and the tendency toward scenographic representation. This is not intended to be an exhaustive discussion of these, but rather, to introduce only two which were formative in addressing tectonics.

The effacement of history happens at two different levels-- the breakdown of the signifying chain and the indiscriminant cannibalization of the historical past. The breakdown of the signifying chain is primarily a question of temporal organization, one which is essential to the idea of *anything* being rooted in time or place. The interlocking relationship of signifier to signifier is ruptured, leaving a rubble of distinct and autonomous signifiers: a series of pure and unrelated presents in time.

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[1] Jameson, *Postmodernism or The Cultural Logic of Late-Capitalism,* p. 55. For more discussion on the postmodern condition see *The Anti-Aesthetic: Essays on Postmodern Culture* edited by Hal Foster and *Mapping The Postmodern* by Andreas Huyssen.

[2] Jameson, *Postmodernism and Consumer Society,* pp. 124-5

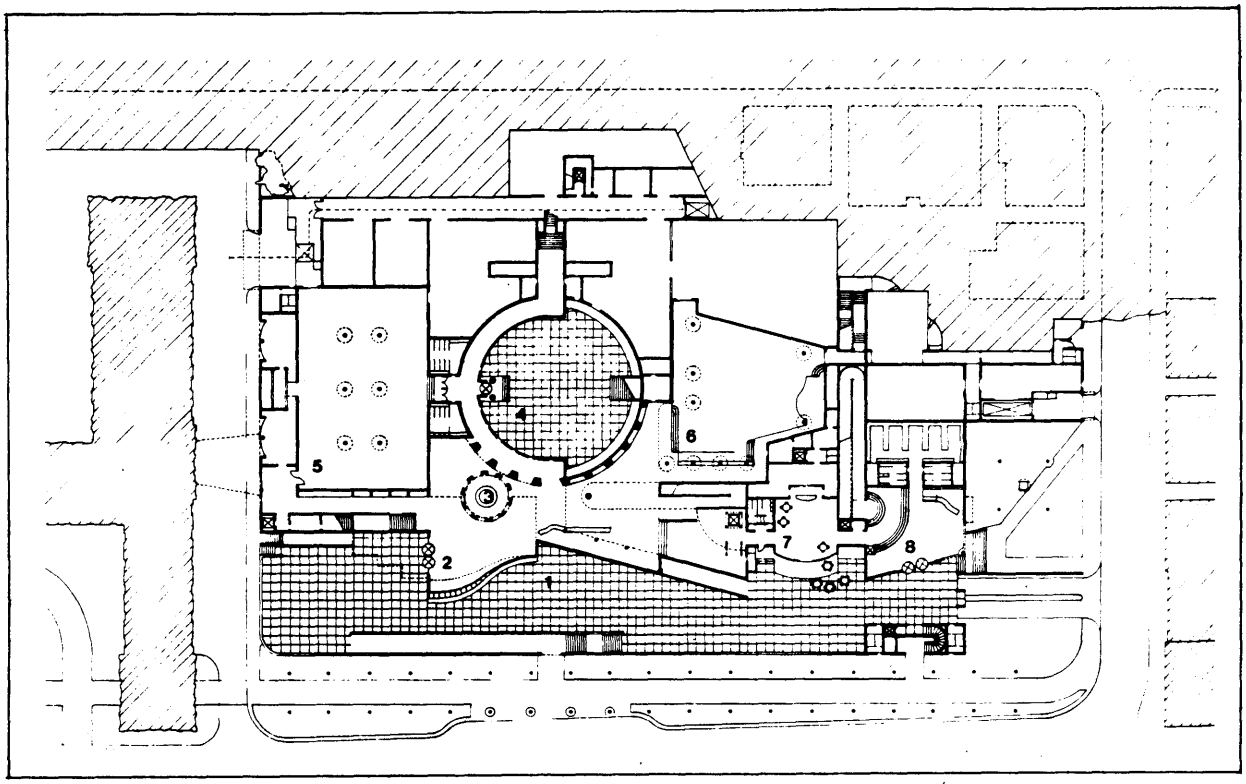

Fig. 1.1 : Plan of Neue Staatsgalerie, *Stuttgart. Stirling. 1973-83*

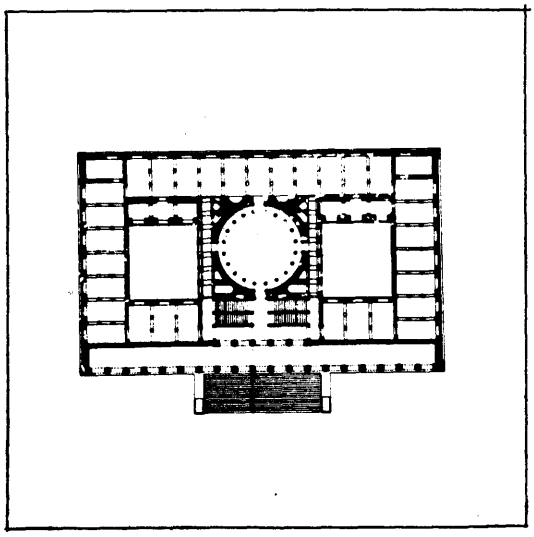

Fig. 1.2 : Plan of Altes Museum, *Berlin. Schinkel. 1824-28*

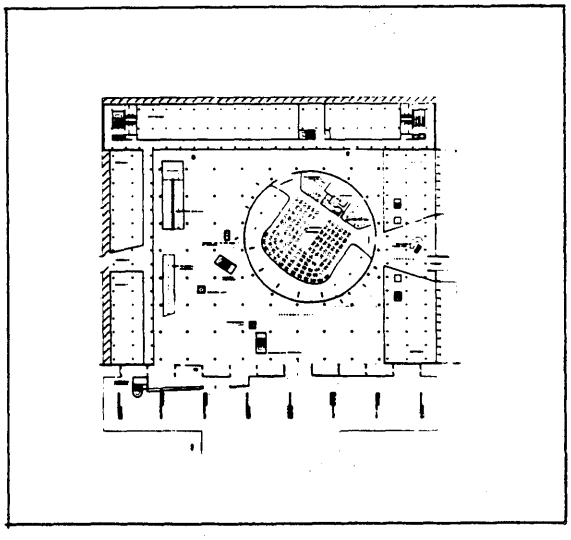

Fig. 1.3 : Plan of Parliament buildings, Chandigarh. Le Corbusier. 1953-65

One has only to think of the "distance" between now and the space shuttle explosion or between now and the hostage crisis. This phenomenon might first be demonstrated by text, where the signifier is reduced to a sentence (or at least several words), by the postmodern recording artists, the *Talking Heads.* On "Stop Making Sense" (the title itself is indicative), they state:

> *"Men like pastries, women like custards. Scientists have invented a love drug, but it only works on bugs. Animals* like *earthquakes, tornadoes and volcanic activity. Nuclear weapons can wipe out life on earth, if used properly. Cats like houses better than people. Dolphins find people amusing, but they don't want to talk to them. People look ridiculous when they're in ecstasy. Schools are for training people how to listen to other people. Body odor is the window to the soul. Sound is worth money."*

To "make sense" of this, I think, is difficult except maybe for the common thread of "life", and thus it illustrates that there is a loss of meaning when the relationship between past, present, and future is not established.

The indiscriminant use of history happens in two ways. It happens in a more temporal sense; history as time, where it becomes difficult to determine, as Lynch has said, "what time is this place." Also, it happens more directly in a physical way (which is inextricably linked with the first, yet different), where motifs are used independent of the conditions under which they were produced. In architecture the first tends to happen because of the second. It is historicism; the temporal and physical senses of effacement are linked and mixed. Buildings become an arbitrary assemblage of discrete and unrelated referents or signifiers. A good example is James Stirling's *Neue Staatsgalerie* in Stuttgart. One can distinguish, besides the general dialectical references to classicism and modernism, no less than four distinct signifiers of questionable relationship: the plan, referring no doubt to the Altes Museum by

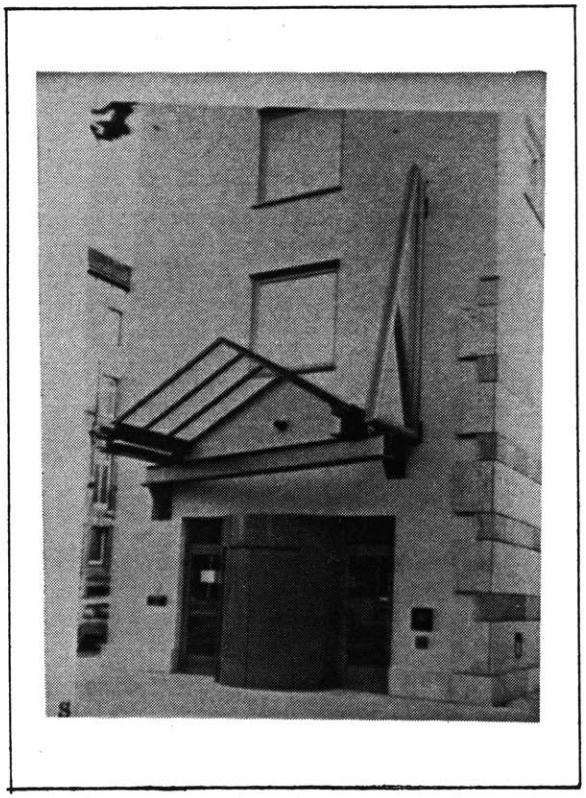

Fig. 1.4 : Entrance awning of Neue Staatsgalerie.

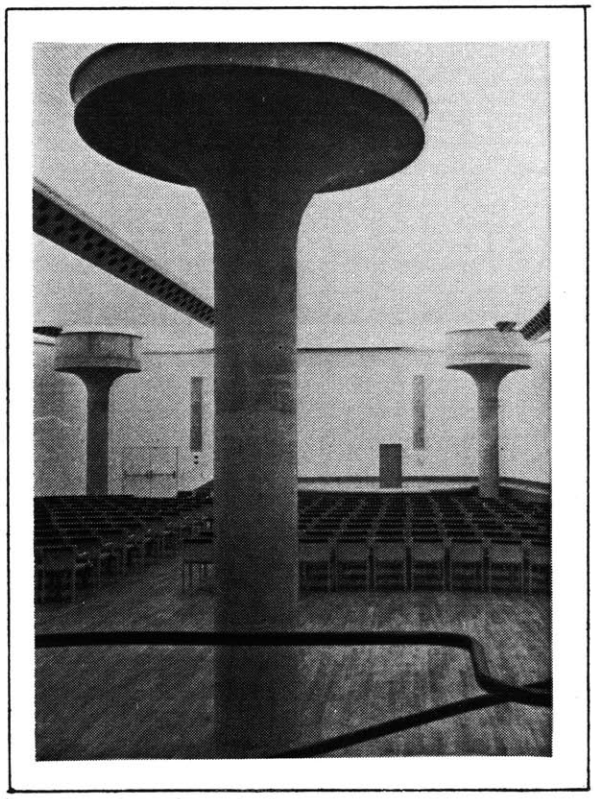

Fig. 1.5 : Lecture room of Neue Staatsgalerie.

Karl Friedrich Schinkel (Fig. 1.1 & 1.2), or perhaps to the Parliament Buildings by Le Corbusier (Fig. 1.3); the awnings, which have definite constructivist overtones (Fig. 1.4); the columns in the lecture room referring to the columns of the Johnson Wax building by Wright (Fig. 1.5). All of these referents stand as separate entities with no relationship to the whole. As Wright stated:

> *"Everything has a related articulation in relation to the whole and all belongs together: looks well together because all together are speaking the same language. If one part of your building spoke Choctaw, another French, another English and another some sort of gibberish, you would have what you mostly have now -- not a very beautiful result."*[1]

Buildings of this genre become a "bricolage" of recognizable figures: a kind of pastiche or blank, empty parody. The architecture becomes totally impotent without the meaning resulting from the continuous signifying chain. It is an architecture with no discourse– simply quotations, parenthesis, and brackets. Or, as Jameson says, "...the past as referent finds itself gradually bracketed, and then effaced altogether, leaving us nothing but text."[2] It is, I think, precisely because of the nature of the sign that allows for its disposition, and the degeneration of its limited initial potency into something that "Stops Making Sense."

The other aspect of the postmodern condition which may help to set up tectonics is the general tendency to reduce architecture to a commodity, specifically to reduce all "reality" to images. This is facilitated by the separation of the inner substance (construction) from the outer form (image). The economic urgency of the self–perpetuating cycle of consumption and production, where ever–new items are created, is pervading

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[1] Curtis, *Principle vs. Pastiche,* p. 20

[2] Jameson, *Postmodernism or The Cultural Logic of Late-Capitalism,* p. 66

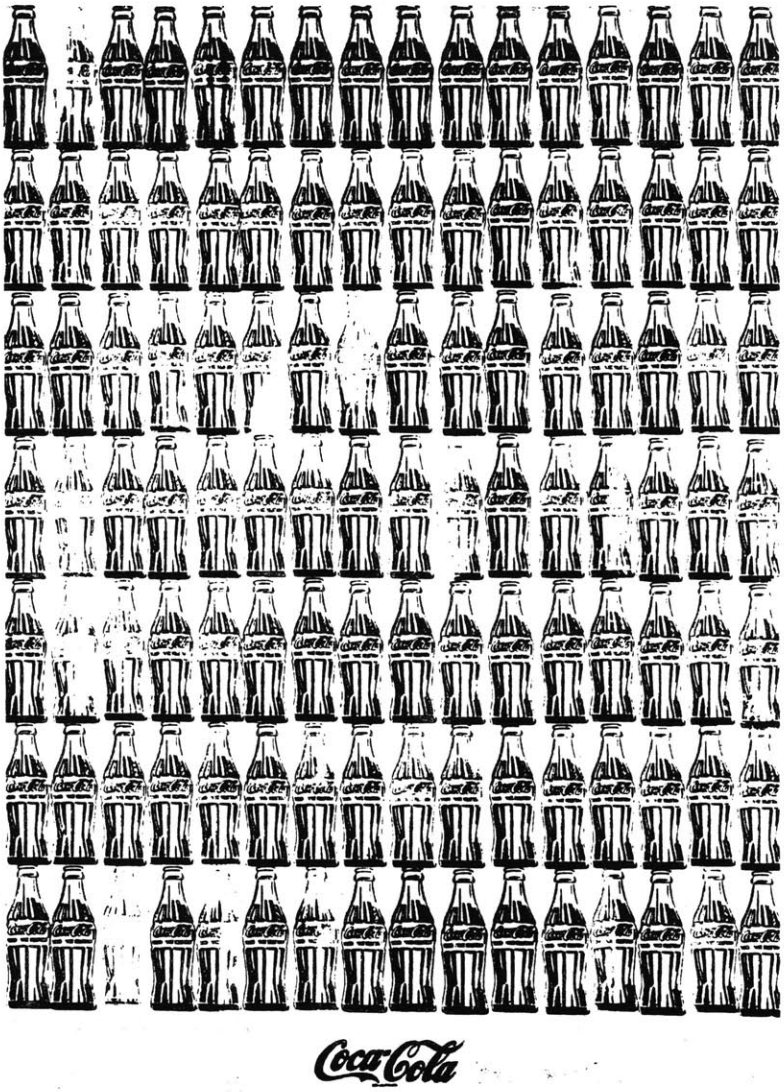

Fig. 1.6: Green Coca-Cola Bottles. Warhol. 1962

aesthetic fields to an increasing degree. One only has to think of Andy Warhol, whose "production" of art as a commodity (even where a commodity is the subject of the art-- the Coca-Cola bottles) and appeal to "pop" culture is undeniably the basis for his success (Fig. 1.6). But architecture is perhaps the art most directly related to economic considerations and it is not surprising that the primary impetus for the maturation of this condition is multi-national business. The effects of the "commodification" of architecture are far-reaching, but it is important to point out the degree to which it depends on visual means-- on the image. The fundamental similarities between advertising and architecture point to this fact.[1] The innovation of photography, television and video-tape have had a profound impact on the way we understand the life-world. The ubiquity of the image leads to a condition described by Plato's conception of "simulacrum"-- the reproduction of an image to the point that it seems no original ever existed. Again, in art any of Andy Warhol's work serves as a good example.[2]

The disproportionate importance placed on the visual aspects of architecture has partly resulted in a fundamental schism between the inner substance of a building and the outer form. As Colquhoun states, "...architectural meaning withdraws into the realm of pure visibility; the substance of the building does not form a part of the ideal world imagined by the architect. Structure becomes pure representation."[3] On the one hand we are constantly groping with the dialectic of semantically mute elements of industrial

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[1] See Prangnell, *On Authenticity*

[2] This is not to say that the multiple images of the Coca-Cola bottles does not "mean" anything. The interest in Warhol's work is in the very fact that the meaning derived is on another level-- a kind of hyper-meaning. Or think of the way in which Robert Stern uses the column or rustication. It is a kind of simulacrum dependent on image where the original no longer exists, or is even important.

[3] Colquhoun, *Essays in Architectural Criticism,* p. 187

DUCK

DECORATED SHED

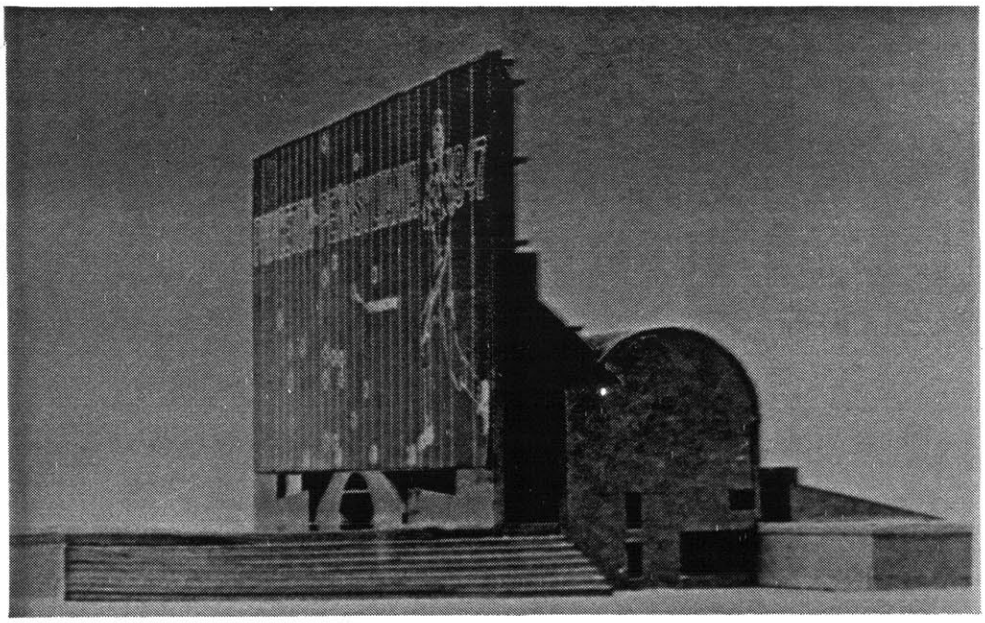

Fig. 1.7: The duck and the decorated shed. Venturi

Model of National Football Hall of Fame Competition entry. Venturi and Rauch. 1967

production handed down from modernism and, on the other, semantically expendable historicist signs. This condition is not only a result of the predilection for scenographic representation, but it has been proposed as a positive architectural design strategy, most notably in Robert Venturi's formulation of the "decorated shed" (Fig. 1.7). He states;

> *"Where systems of space and structure are directly at the service of the program, and ornament is applied independent of them. This we call the decorated shed."*[1]

This theory provides the conceptual basis for the discrimination of construction and image and for safeguarding against the reorganization of the building industry that any integration of them would have necessitated. Moreover, three layers of architecture — pragmatics, technics, and semantics — had their own individual budgets which could be shifted for their most effective use at minimum cost. The architectural act no longer aimed at an integrated aesthetic object, and the architect should abjure "architectural qualities of space and structure" and concentrate instead on symbolic content.

It is a condition which essentially drives the architect to the exterior of the building where he is simply responsible for its packaging. As Helmut Jahn stated, "let's face it, I'm in the packaging industry, I'm paid to make it different."[2] Colquhoun summed up the situation succinctly:

> *"The implications of the notion of the decorated shed are...far-reaching. They lead to the assertion that architectural meaning has become irretrievably separated from its substance. Architects are impotent in the face of a society whose values have made this split inevitable. It is not by the*

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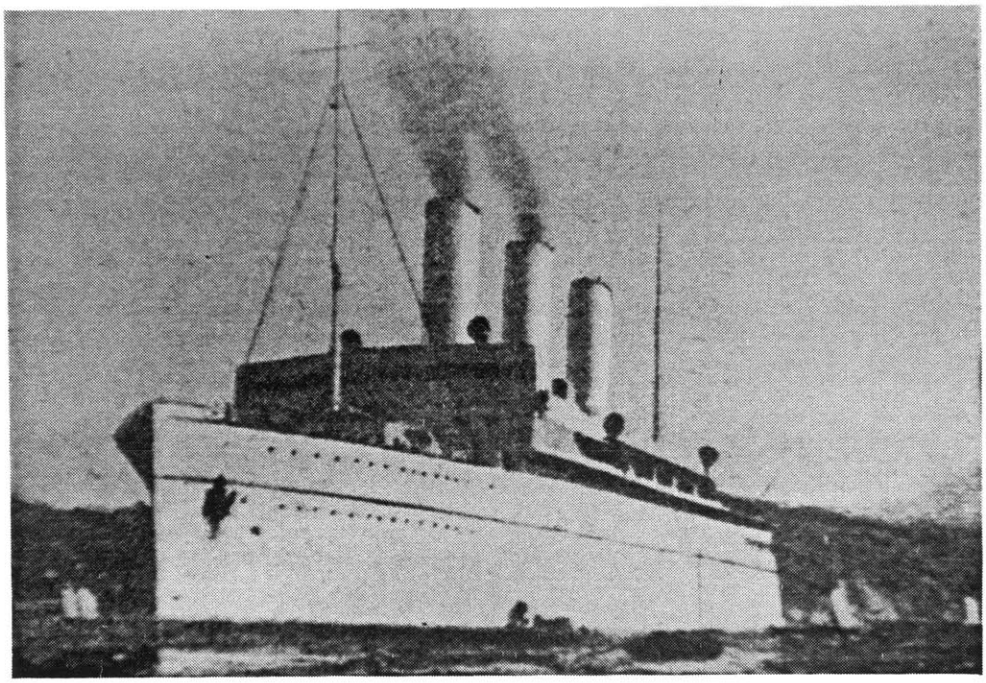
[1] Venturi, Scott Brown, Izenour, *Learning From Las Vegas,* p. 87

[2] Frampton, Interview at Columbia University



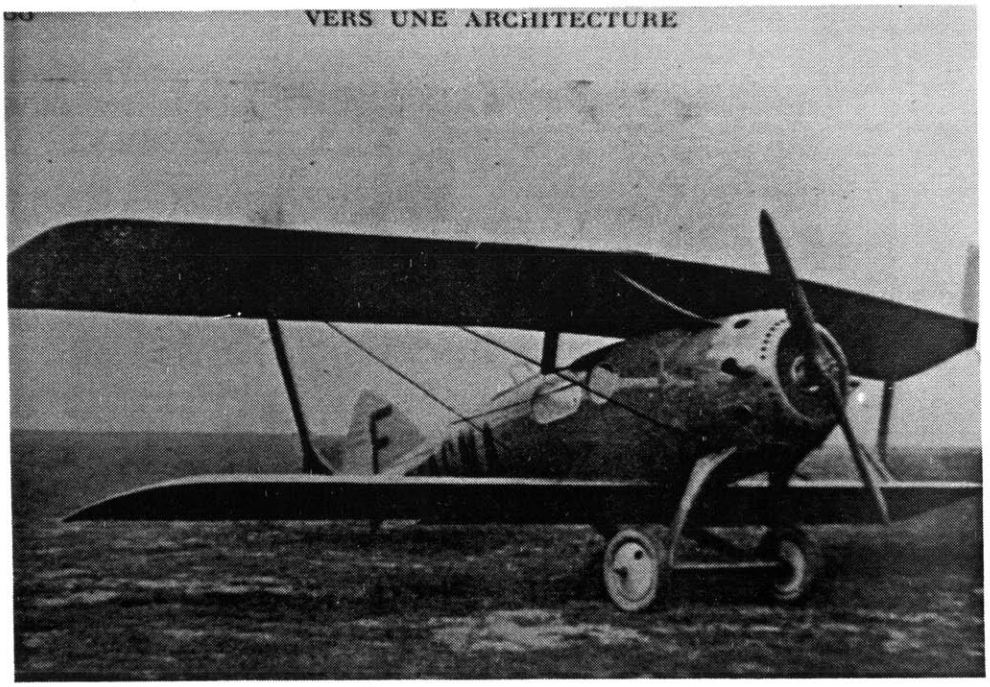


Fig. 1.8 *: Steamliner from* Vers Une Architecture. *Le Corbusier. 1923*
Plane from Vers Une Architecture.

vision of an alternative architecture that these values can be criticized but only by the manipulation of its surface appearance, and then only by means of an equivocal irony in which these values are alternately condoned and exposed. The architect, like the fool in Shakespeare, uses his subservient role to flatter the king and, at the same time, to tell him a few home truths."

Perhaps it is due to the fact that contemporary technology no longer has the capacity for representation. Modernist technology (the machine) provided tangibility and figuration, whereas today's technology doesn't have the capacity to "tell a story" of itself. As is well known, the inspiration of steamliners, cars and industrial machines in general provided a model from which Le Corbusier and other worked; it was a process of aesthetizing the machine. Today, technology is no longer conveyor belts, streamlines trains or smokestacks, but rather the computer and the television. Neither of these has the capacity for the engaging experience of its kinetic function (Fig. 1.8). The inner substance and outer form is as independent as in the decorated shed model.

It is hoped that the tectonic position can resist some of the perceived negative aspects of our general societal condition: that the possibility of an architecture rooted in time and place still should be an objective; that the notion of ornament or motif should be related plastically and iconographically to the "real" building, whose structural form is thought of as an integral part of its meaning; that architecture can retain or attain meaning simply by establishing a relationship between the general concept and its parts -- the ornament and its structure and spatial theme.

part two:

INTERNAL AND EXTERNAL REFERENCES IN ARCHITECTURE

The purpose of part two is to place the tectonic position within a larger framework. It attempts to develop the idea of a building as a thing, rather than a sign; the manifestation of a presence rather a substitution for an absence. Many people have written about "things" in many different ways, but here the idea of an architectural thing will be developed in two ways: first, its *inter-consciousness,* that is the building's position within its own surroundings -- physical, social, political, economic -- in Heidegger's terms, the way in which it "gathers the fourfold"; and second, its *inner-consciousness,* that is, the building itself as a bearer of properties. On both levels, it is concerned with *particularity.*

Tectonics is generally concerned with the inner-consciousness of a building, and therefore the majority of the thesis deals primarily with this aspect. However, the inter-consciousness of a building does have a determining effect on tectonics and it is this larger issue that will be briefly discussed before embarking on the specifics of tectonics.

> *"...the temples and subsidiary buildings of [Greek] sanctuaries were so formed in themselves and so placed in relation to the landscape and to each other as to enhance, develop, complement and sometimes to even contradict the basic meaning that was felt in the land. From this it follows that the temples and other buildings are only part of what may be called architecture of any given site...But in order to act to the full, it too had to become on embodiment, not merely a construction, or an abstractly perfect shape, or a pictorial element."*[1]

As will become apparent, Greek architecture can serve as a model for much of this discussion. A building's relationship with the site was crucial for the meaning and

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[1] Scully, *The Earth, The Temple and The Gods,* p. 3

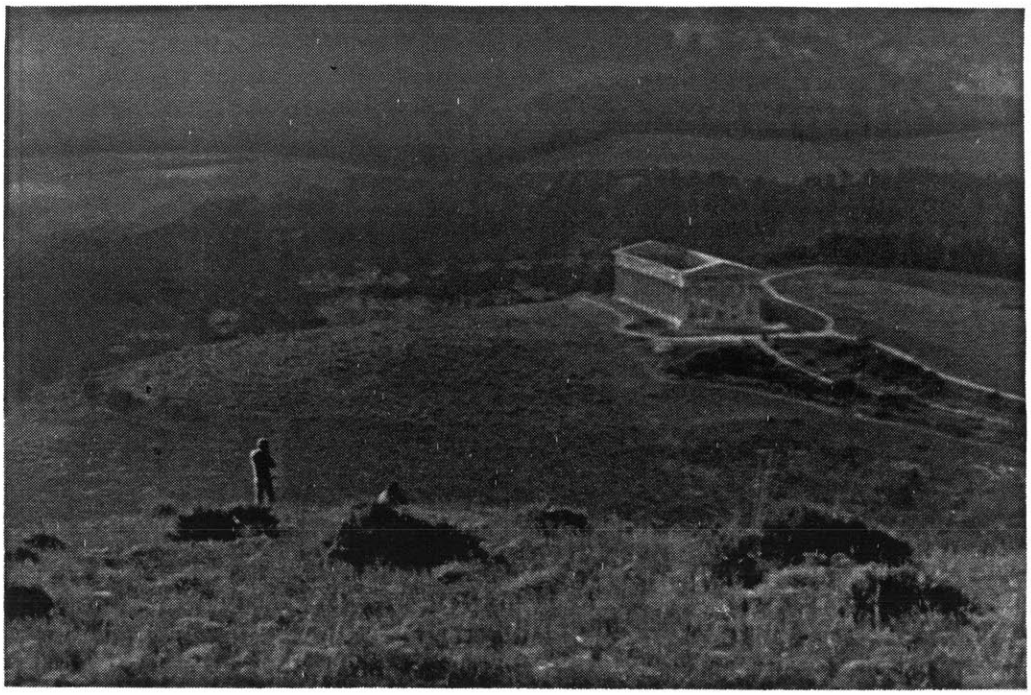

Fig. 2.1 : Doric temple, Segesta. Late 15th cent. B.C.

Fig. 2.2 : Notre Dame du Haut. *Ronchamp. Le Corbusier. 1953-55*

significance of the Greek temple. It is the combination of landscape and building together which form the architectural whole. In fact, it could be said that the formal elements of any Greek sanctuary are, first, its setting and second, the building that is placed within it. As Edith Hamilton stated:

> *"To the Greek architect the setting of his temple was all-important. He planned seeing it in clear outline against sea or sky, determining its size by its situation on plain or hilltop or the wide plateau of an acropolis...He did not think of it in and for itself, as just the building he was making; he conceived of it in relation to the hills and the seas and the arch of the sky."*[1]

Anyone who has visited Segesta or the Acropolis has experienced the intimate relationship of building and setting. Or perhaps Ronchamp serves as a good contemporary example (Fig. 2.1 & 2.2).

Heidegger writes similarly in "Building, Dwelling, and Thinking." The essay is concerned with the relationship between "building" and "dwelling" and the kind of "thinking" that results from attention to that relation. But most importantly to this part, the essay appears to advance thought on the metaphysical question of "being"-- a topic that Heidegger was concerned with, in many different forms, for most of his life. The subjects of what I am calling the inter-conscious relationship -- that is the building's relationship with its historical circumstance (physical, social, political, economic etc.) -- are presented by Heidegger as "the fourfold." He states that the existence of mortals is "on the earth" which means simultaneously "under the sky" while "remaining before the divinities" and "belonging to men's being with one another." These four -- the earth, the sky, divinities, and mortals -- are the fourfold.

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[1] Hamilton, *The Greek Way,* pp. 201-2

"Earth is the serving bearer, blossing and fruiting, spreading out in rock and water, rising up into plant and animal. When we say earth, we are already thinking of the other three along with it, but we give no thought to the simple oneness of the four.

The sky is the vaulting path of the sun, the course of the changing moon, the wandering glitter of the stars, the year's seasons and their changes, the light and dusk of day, the gloom and glow of night, the clemency and inclemency of the weather, drifting clouds and blue depth of the water. When we say sky, we are already thinking of the other three along with it, but we give no thought to the simple oneness of the four.

The divinities are the beckoning messengers of the godhead. Out of the holy sway of the godhead, the god appears in his presence or withdraws into his concealment. When we speak of the divinities, we are already thinking of the other three along with them, but we give no thought to the simple oneness of the four.

The mortals are the human beings. They are called mortals because they can die. To die means to be capable of death as death. Only man dies, and indeed continually, as long as he remains on earth, under the sky, before the divinities. When we speak of mortals, we are already thinking of the other three along with them, but we give no thought to the simple oneness of the four. [1]

The relationship between the fourfold and thinking of architecture as a thing is that the meaning of things consists in what they gather-- their world. A building (as a thing) is the manifestation of the fourfold. It is easy to see the implications this simple concept has as a starting point for an architecture that establishes its relationship with its surroundings-- its inter-consciousness.

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[1] Heidegger, *Basic Writings,* pp. 327-8

Of course it is equally easy to see that in dealing with our present physical environment, "gathering the fourfold" is rather idealistic and is of limited use. In many cities, Heidegger's "house of being" is no longer nature but rather vacant lots, superhighways, strip developments, and condos. But this condition does not completely invalidate the model. It means that the *particularity* of the surroundings (again, physical and social and economic etc.) has an effect on the building as a thing. The vacant lot under the highway, for instance, has particular aspects as a site and these are what should be "enhanced, developed, complimented, or even contradicted." Here, the idea of landscape given in the Greek model takes on new meaning. It is the landscape of the megopolis. But there are many things that make a site particular: light, climate, topography, vegetation, adjacent streets and buildings, etc. Respect for and response to these (and others) all help to make one place different from another. Which leads to the last point regarding the inter-consciousness of a building-- the idea of place.

> *What the word for space,* raum, *designates is said by its ancient meaning.* Raum, rum, *means a place cleared or freed for settlement and lodging. A space is something that has been made room for, something that is cleared and free, namely, within a boundary, Greek* peras. *A boundary is not that at which something stops, but as the Greeks recognized, the boundary is that from which something begins its essential unfolding... Accordingly, spaces receive their essential being from locations and not from "space."*[1]

The concept of place, although an ubiquitous topic today is not new. Ancient man saw it as being very important to deal with the *genius* of the locality where his life takes place.[2] Places have served as the location where man is at peace with what he

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[1] *Ibid.*, p. 332

[2] Norberg-Schulz, *Genius Loci*, p. 18

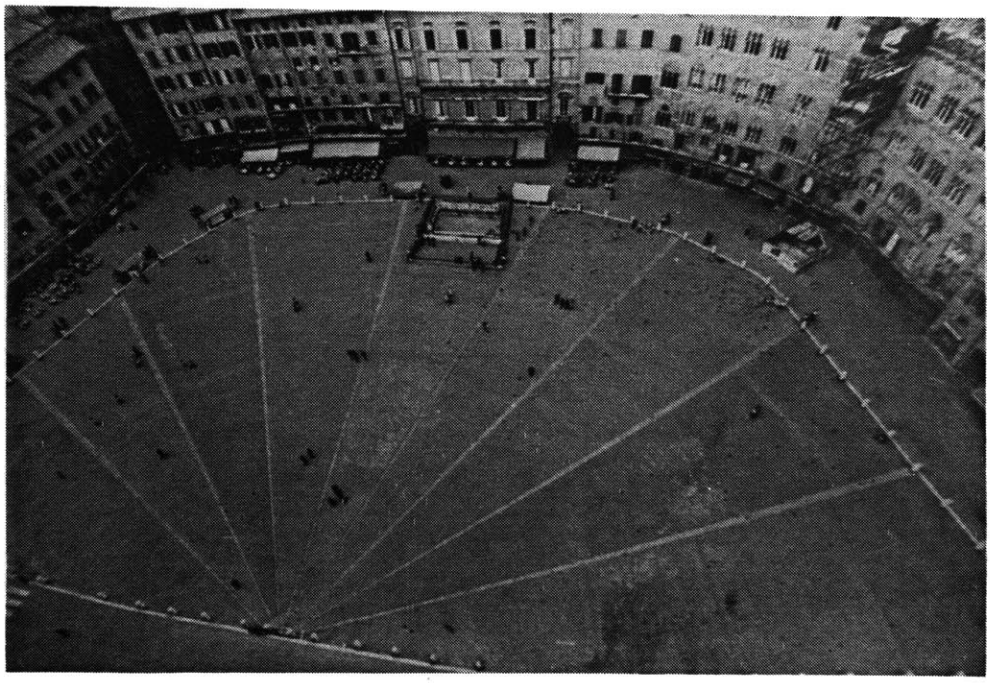

Fig. 2.3 *:* Il Campo, *Siena.*

knows as exhibited by the common root of the words, *habit, habitat,* and *habitation.*

It could be said that another purpose of architecture is to make a site become a place, to bring into presence the meanings potentially present in the given environment. A building's resonance depends on its stability (as things we *inhabit),* and on the appropriateness and richness of the socio-cultural experience it offers.

Perhaps the most general attribute of place is the way in which it gathers the particulars of its surroundings. It gathers them with a concrete presence. The particular way in which a location gathers its surroundings-- the circumstantial condition of locality and building task-- gives it identity, and its "place-ness."

The structure of place can be broken into two aspects: space and character. Space, in this respect, refers to the way in which it is organized-- central, linear, clustered etc. This meaning should not be confused with space as three-dimensional geometry and mathematical descriptions but rather it is space as perceptual field resulting in "concrete space."[1] Both the enlightenment category of "spatium in extensio," (or limit-less space), and the notion of architectural space are being challenged by the notion of place. Our incapacity to deal with it is evident in persistent use of the word "space" instead of place. The preference for place over space, in this thesis, is legitimized by the capacity of place to deal with the public sphere, which the abstract notion of space cannot do. Place has the irreducible capability of embodying the collective-- both representationally and physically. "Its sole legitimacy stems, as it must, from the social constituency it accommodates and represents" (Fig. 2.3).[2]

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[1] *Ibid.,* p. 11

[2] Frampton, *On Reading Heidegger,* p. 3

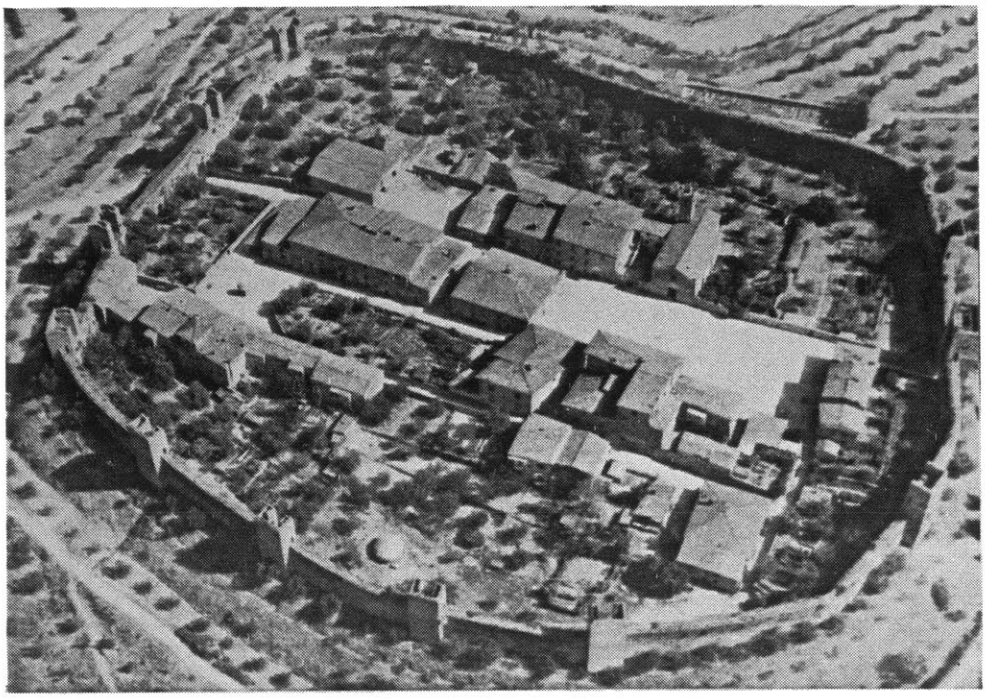

Fig. 2.4 : Monteriggioni, Toscana

Space has extension and enclosure and it is enclosure that is important to place. Enclosure implies both boundary and threshold. As Heidegger stated, "a boundary is not at which something stops, but as the Greeks recognized, the boundary is that from which something begins its presencing."[1] A place is determined by its boundary as an enclosure and as its presence. Architecture occurs in the boundary as an embodiment of the world. The notion of boundary quickly implies threshold as an embodiment of *difference.* Threshold embodies the dialectic of unity/difference of world and the thing. As a real thing in a building or place the threshold simultaneously unites and divides the realm of the place from that of the world: what is alien from what is habitual (Fig. 2.4).[2]

The character of place is determined by its articulation; how does the building(s) stand on the ground and rise to the sky. It depends on *how* things are made, their material and formal constitution as a manifestation of concrete phenomenon of their everyday life-world. It is determined by the kind of construction used; whether it is skeletal, open and transparent or massive and enclosed, and secondly, by the making as such; the way in which it is erected, joined etc. These processes express how the character of place comes to us as a "thing."

> *"Character cannot possibly be separated from the process of making...The technical revolution of the lat hundred years is therefore more than a technical revolution. In fact, modern technology does not only serve to solve quantitative and economic problems, but, if properly understood, may help us to substitute for the devalued motifs of historicism forms which give our environment character, and thereby make it become a real place."*[3]

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[1] Heidegger, *op. cit.,* p. 32

[2] Norberg-Schulz, *Heidegger's Thinking on Architecture,* p. 66

[3] Norberg-Schulz, from Frampton, *Modern Architecture: A Critical History,* p. 312

These two elements form a basis from which we can begin to define our environment in terms of places rather than the alienation of placelessness.

In short, it is a location which gathers the surroundings and involves a concentration (due to boundary) of experience and meaningful events of our existence. Locations are set apart from the surroundings, yet are part of it at the same time. So places are a basic element in the ordering of our environment; one cannot experience placeness in chaos. Places are the object of our association, which constitutes the vital source for individual and cultural identity and serve as a way we orient ourselves in the world. They are characterized by the kind of space defined by buildings of particular character. It is with the character of a building that one can talk about the inner-consciousness of a thing.

The inner-consciousness of a building, as it suggests, is primarily concerned with the building *itself* as a thing. Of course both aspects of a thing are interdependent, but a building has intrinsic properties; it is a bearer of properties.

> *"...a thing is always something that has such and such properties, always something that is constituted in such and such a way. This something is the bearer of properties; the something, as it were, underlies the qualities. This something is what endures."*[1]

It is the story the building tells us about its own life— how it was made, how it stands, its uses, its assembly process with respect to available technology and labour etc. Structure, materials, services, (HVAC, plumbing, communication, electrical etc.), are all intrinsic properties of a building. They are the physical things that make up a

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[1] Heidegger, *What Is a Thing?* p. 33

building. Tectonics enters when these physical things are brought into presence; when the physical becomes meta-physical.

Tectonics depends on how buildings are made which is, in turn, determined by the kind of construction and by the making (binding, erecting, joining etc.). The remainder of the thesis deals primarily with these issues.

To think of architecture as a thing is a hope for the possibility of an architecture rooted in time and place. The function of things is to concretize or reveal life in its various forms, whereby they tell stories about their own making and about the historical circumstances by which they are made. As a thing, a building's relationships -- its inter-consciousness, as an extended relationship with its surroundings and its inner-consciousness, as a bearer of properties -- are an attempt toward rootedness, where a building has a capacity for the realization of man here and now.

part three:

TECTONICS

Etymological Implications

Tectonic theory and architecture are inextricably linked. The etymology of the words demonstrates this. The term tectonics is Greek in origin coming from *tektonikos,* which pertains to building and *tekton* meaning carpenter or builder. From this comes the Latin *architectus* derived from *archi* meaning a person of authority and again *tekton* giving us our present day word-- architect. Also, the word *techne* is indicative. As Heidegger states:

> *"The word* techne, *technique, belongs to the verb's root* tec. *To the Greeks* techne *means neither art nor handicraft but rather, to make something appear, within what is present, as this or that, in this way or that way. The Greeks conceived of* techne, *producing, in terms of letting appear.* Techne *thus conceived has been concealed in the tectonics of architecture since ancient times."*[1]

Techne is fundamentally linked to knowledge and to creating in the sense of a deliberate act of production. Here one can begin to talk about the relationship between tectonics and metaphysics.

Tectonics and Metaphysics

As mentioned in the thesis title and briefly in part one, the notion of metaphysics in a specific sense is central to tectonics. It is not my intention to digress into a long discussion of the question of metaphysics. It has been used in many different ways and its meaning has changed constantly since the time of the Greeks and Aristotle.

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[1] Heidegger, *Basic Writings,* p. 337

The original Greek usage of *physis* denoted self-blossoming emergence, being itself, by virtue of which essents become and remain observable. It meant the power to emerge but also to endure. They called the essent as a whole *physis.* But since it was primarily experienced through what we perceive, the definition of *physis* was subsequently narrowed to mean natural phenomena. It was narrowed to what we know of as "physics" or the physical nature of things. Yet when asking about the realm of being one cannot remain in the world of nature and of materiality. As Aristotle stated:

> *"...the underlying subject itself does not cause itself to change. What I mean, for example, is this: neither the wood nor the bronze causes itself to change; the wood does not make a bed, nor the bronze a statue, but some other thing is the cause of the change. Now to seek this is to seek another principle, namely, as we might say, the source which begins motion."*[1]

It is the inquiry into the being of the essent, where it is irreducibly dependent on "physics." Aristotle's makes a distinction between *matter* and *form.* He says that matter is the essential subject upon which the origin and essential existence depends. Form, on the other hand, falls into the problems of "basic philosophy" (metaphysics).

The essence of metaphysics became the "disclosure of being." This is very similar to the meaning of *techne,* as making something appear, and begins to establish an etymological relationship between the Greek verb root *tec* and *techne,* metaphysics and tectonics. So, with the Greek prefix *meta,* meaning "beyond something" and *physis,* again meaning physical, we have *metaphysics* or "beyond the physical" and the definition of meta-physical as used in this thesis.

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[1] Apostle, *Aristotle's Metaphysics,* 984a23-27

"It should be sufficiently clear by now that what we are seeking are the initiating principles and determining factors of whatever is, considered solely under the abstract aspect of its being. Health and physical condition have their determining factors, and generally speaking every science that is intellectual or in any way involves intellect must take account of determining factors and initiating principles, whether in a precise or in a rough-and-ready way. But each of these sciences picks out some entity or class of entities and confines its attention to that. It does not deal with Being in its most general aspect, Being qua Being, nor does it offer any logical account of Essence; rather, starting from some preconception of what essence is, whether as a datum of sense-perception or as a postulate arbitrarily set up, it proceeds to demonstrate with more or less cogency the essential attributes of the class of things it is dealing with. Such a procedure obviously yields no real demonstration of the essential thinghood and whatness of anything..."[1]

The German Tectonic Lineage

Although the term's first English appearance is in a glossary dating to 1656, nearly a hundred years after the first use of the term *architect* in 1563, it is with the transfer of French Enlightenment thought to Germany that the term first appears in the modern period.[2] It is this abbreviated lineage of the development of tectonic theory that I would like to trace as a means to define it. This is not to say that tectonic theory was not being propounded in other parts of the world.[3]

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[1] Wheelwright, *Aristotle,* p. 80

[2] Frampton, unpublished lecture transcripts

[3] Certainly Pugin's writings, first in *Contrasts* and later in *The True Principles of Pointed or Christian Architecture* have strong tectonic implications as, for example, the statement, *"...that there should be no features about a building which are not necessary for convenience, construction or propriety"* and *"that all ornament should consist of enrichment of the essential construction of the building,"* indicates. Of course Viollet-Le- Duc spent his whole life developing

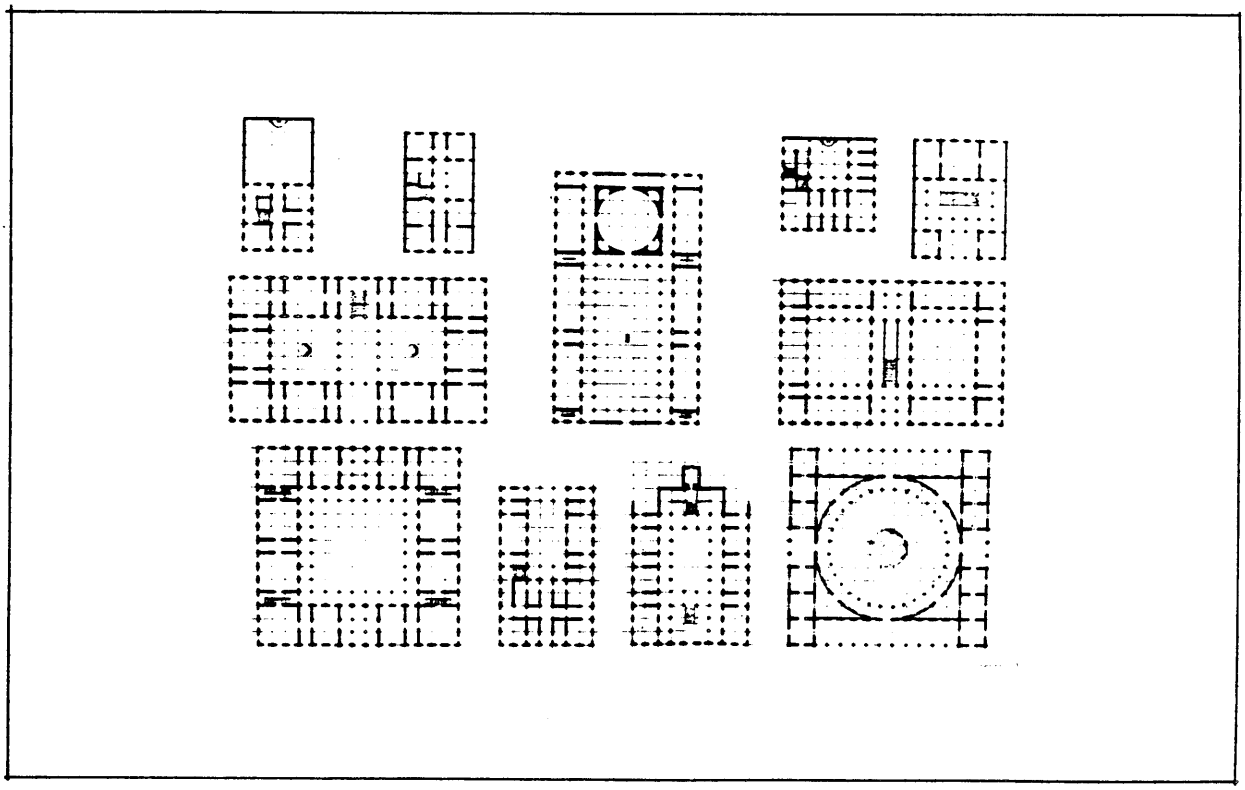

Fig. 3.1 *:* Precis des Lecons d'Architecture. *J.N.L. Durand. 1809*

The connection between French Enlightenment thought and Germany took place primarily through the office of David Gilly and the founding of the Royal School of Architecture (later known as the Bauschule), where both David Gilly's son Friedrich and Alois Hirt were to become influential instructors. A coherent line of tectonic thought can be traced in Germany from David Gilly through his son Friedrich, Karl Friedrich Schinkel and Karl Botticher and perhaps culminating, as a formulated theory, by Gottfried Semper.

The general transformation of building technique is perhaps the most significant transference of French Enlightenment thought to Germany. French constructional prowess exercised a major influence on the *Bauschule,* both in terms of wood and iron. The eloquence of the French trussed wooden roof system was studied by both Friedrich Gilly and Schinkel during their respective visits to France. In fact, David Gilly was to build an adaptation of the system in a military gymnasium dating from 1800. Rondelet's systematic documentation of the state of the art, in his *"Traits Theorique et Pratique de l'Art de Batir,"* works emphasized the tectonically expressive potential of structural assemblies. Also, J.N.L. Durand's publication, *"Precis des Lecons Donnes a L'Ecole Polytechnique,"* insisted on fitness and economy as the prime causes of beauty (Fig. 3.1). These two sources (amoung others), helped established fertile ground in which the precepts of the *Bauschule* and the emergence of tectonics were based.

Schinkel became the most prolific practitioner of the *Bauschule.* Although he tempered his stance on the universality of Durand's fitness and economy with

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theories, which, although not referred to as such, are sympathetic with tectonic theory.

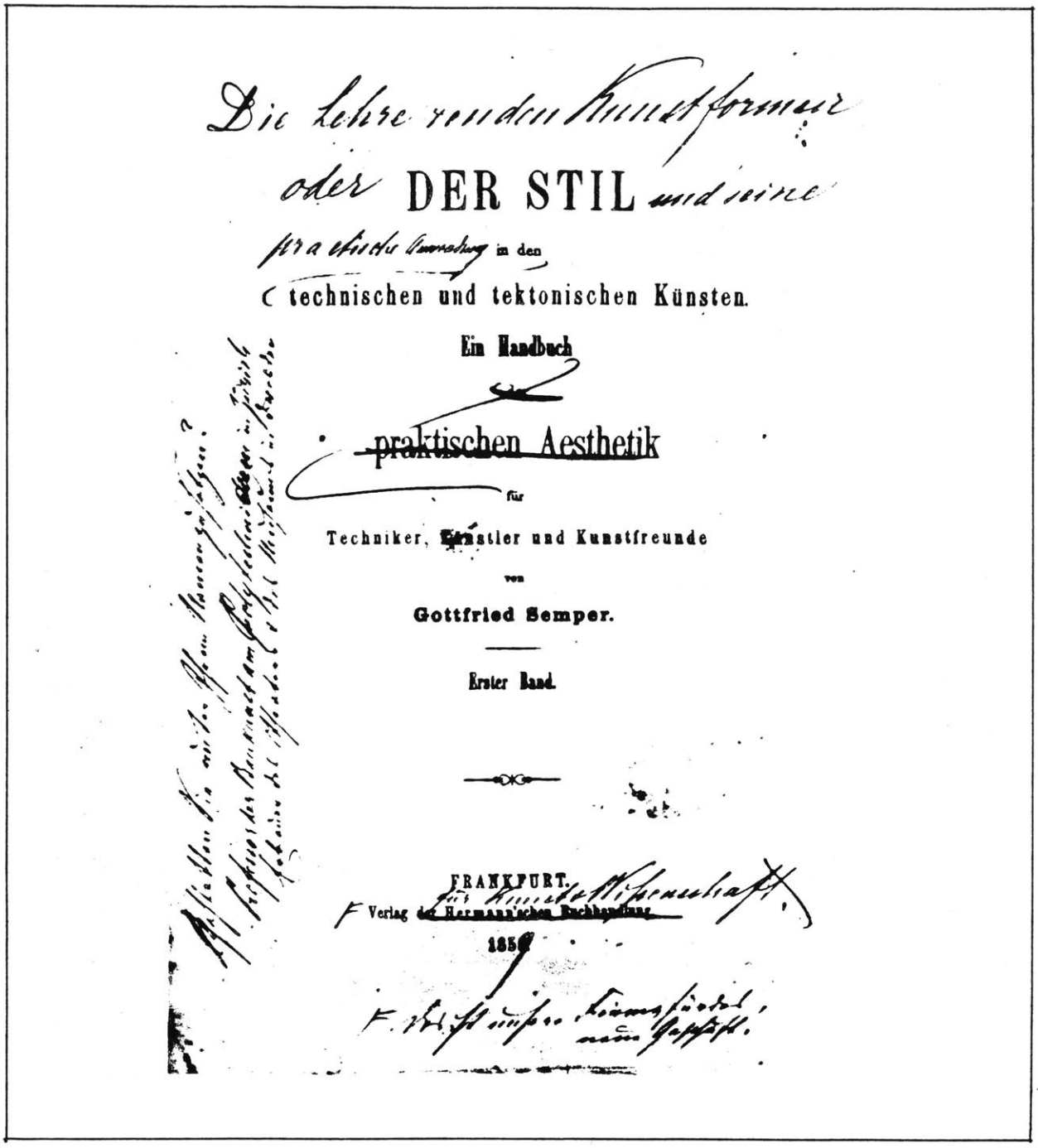

Fig. 3.2: Design for title page of Der Stil. *Semper. 1860*

somewhat regional overtones,[1] he remained indebted to Durand and Vitruvius for the influence of these concepts on his work. He wrote:

> *"The material edifice which always presupposes the spiritual, is here the subject of my consideration. The fitness of every building may be considered from three main points of view, these are: a) fitness of space distribution or plan (which depends on utmost economy of space, utmost order in distribution and utmost convenience in accommodation); b) fitness of construction, (which is derived from the best possible materials, best possible treatment of and fitting together of materials, and most visible indication of the best materials, best workmanship and use of materials); and c) fitness of ornament or decoration."*[2]

Perhaps the most prolific reinterpretation of Greek culture and hence explicity of tectonic theory came with the publishing of Karl Botticher's *"Die Tektonik der Hellenen"* and Gottfried Semper's *"Die Vier Elemente der Baukunst"* and later *"Der Stil in den Technischen und Tektonischen Kunsten oder Praktische Aestik"* (Fig. 3.2).

In 1843 Botticher published *Die Tektonik,* a book whose motto -- "the form of the body is the mirror of its essence! Master it and the seal of the riddle is broken" -- begins to allude to the relationship between form, universal law, and technical considerations.[3] He explained that *Tektonik* referred "not just to the activity of making the materially requisite construction that answers to certain needs, but rather to

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[1] "Architecture should be mediated by the customs and requirements of the country and the conditions of the region of the site," Frampton, unpublished lecture transcripts

[2] Frampton, unpublished lecture transcripts

[3] Anderson, *Modern Architecture and Industry: Peter Behrens, the AEG and Industrial Design,* p. 83

the activity that raises this construction to an art form. That is, every element of a building -- a column, for example -- has an actual technical function, but this function may not be fully apparent. The functionally adequate form must be adapted so as to give expression to its function. The sense of bearing provided by the entasis of Greek columns became the touchstone of this concept of *tektonik*." His interpretation of Greek temples was a composite of functionally expressive members where the form of the body was the embodiment or plastic representation of its essence. "Form gave to the construction material the expression of its fulfillment of function."[1]

Botticher's work on *Die Tektonik* in many ways anticipated Semper's subsequent literary work-- *Der Stil*. Yet Semper, negligent in his literary research, was not aware of *Die Tektonik* until 1852, and was shocked to read views he considered to be his own intellectual property which were published nearly ten years earlier.[2] Disappointed with his negligence, he lashed out at Botticher calling him "the vicious little mystagogue from Berlin, the founder of a new era in architecture, the Pythagoras of the nineteenth century revealing the secrets of tectonics, and the rediscoverer of the 'Analoga,' before whom and his trismegistos Schinkel the world had groped in the dark and had no idea of Greek architecture or of architecture in general."[3] Semper, realizing he had to make his position clear, later responded in a more rational manner.

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[1] *Ibid.*, p. 83

[2] Semper read of Botticher's eulogy of the hearth from which "the whole layout of the house originated"; that woven carpets "served at all times and everywhere in their capacity as space-creating surfaces, be it as cover, enclosure or floor." These views were very similar to the ideas Semper had just formulated in *Die Vier Elemente* discussed below. Herrmann, *Gottfried Semper: In Search of Architecture*, p. 140

[3] *Ibid.*, p. 141

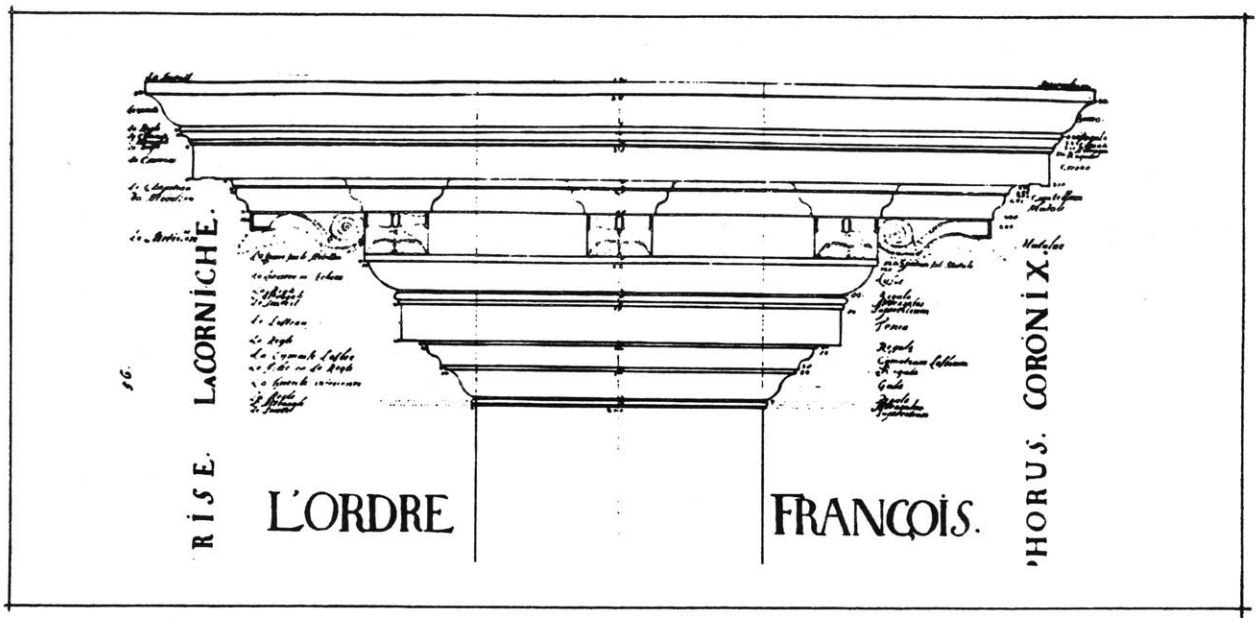

Fig. 3.3: The French Order exhibiting a cyma. Colbert. 1672

Both men believed the Greeks had achieved the highest form of tectonic expression; that the elements of Greek architecture were closely connected with its construction and that their purpose was to express symbolically the mechanical functions of the structural parts— giving support, carrying load, countering pressure. As Semper stated:

> *"The cyma is the uppermost crowning member of a structural and dynamically functional part; it gives expression to both the concept of crowning and the measure of the existing conflict" (Fig.3.3).*[1]

Die Tektonik influenced Semper in many ways, the most significant of which, with respect to this thesis, is the use of the term *tectonics,* which did not originally belong to his vocabulary. Only after he became acquainted with *Die Tektonik* did it appear in his own work— after which it played a significant role. In the introduction to *Theory of Formal Beauty* he gives a definition of tectonics as,

> *"...an art, the model and ideal of which takes nature as a model -- not nature's concrete phenomena but the uniformity and the rules by which she exists and creates...the sphere of tectonics is the world of phenomena...Tectonics is truly a cosmic art; the Greek word....., which has no equivalent in any living language, signifies cosmic order and adornment alike. To be in harmony with the law of nature makes the adornment of an art object; where man adorns, all he does more or less consciously is to make the law of nature evident in the object he adorns."*
>
> *"Tectonics deals with the product of human skill, not with its utilitarian aspects but solely with that part that reveals a conscious attempt by the artisan to express cosmic laws and cosmic order when molding the material."*[2]

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[1] *Ibid.,* p. 144

[2] *Ibid.,* p. 151

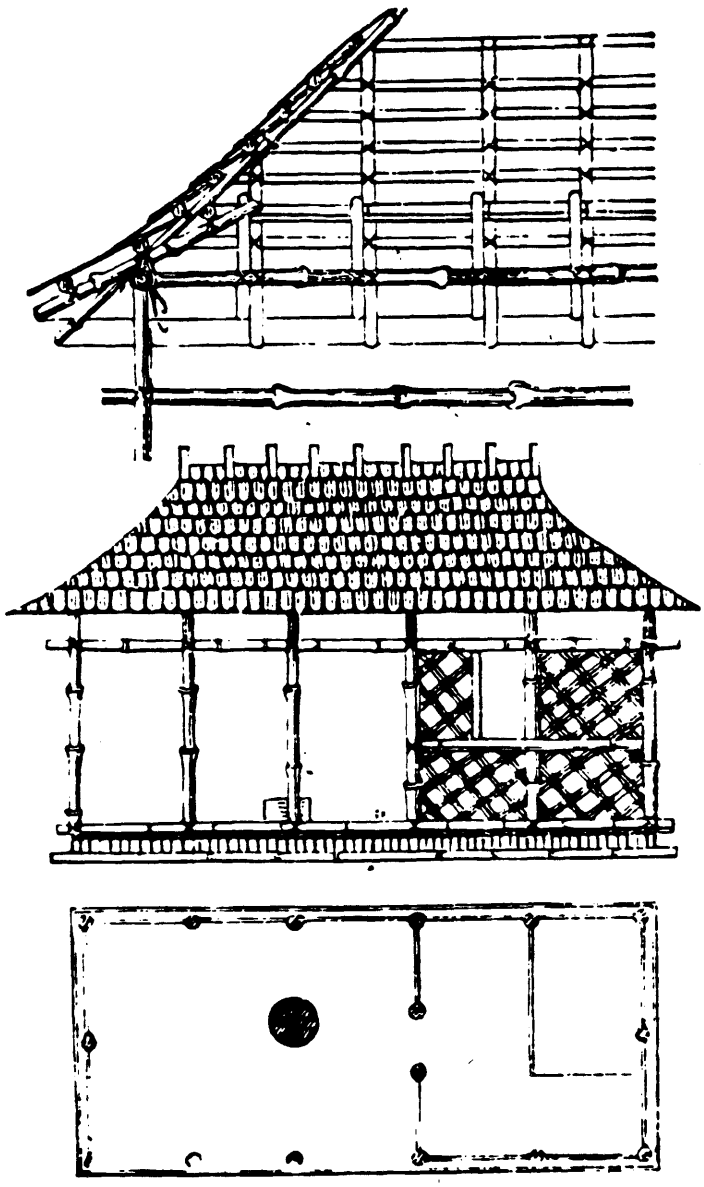

Fig. 3.4: Carribean hut exemplifying the "Four Elements of Architecture".

Botticher's influence on Semper is without question. It is this polemical relationship that forces Semper to clarify his position, in so doing adopting the contributions that Botticher made. It is with the publication of *Die Vier Elemente* and *Der Stil* that the final elaborations of tectonic theory are made. A comprehensive discussion of these two pieces is beyond the scope of this thesis; however, there is a major distinction to be made-- the definition of tectonics became yet more precise.

In *Die Vier Elemente,* spurred by observations of a Carribean hut he saw at the Crystal Palace, Semper proposed that there are four elements of architecture: the hearth, the terrace, the roof and supporting structure and the enclosure (Fig. 3.4).[1] Semper's first notion of tectonics comprised all of the technical arts; only later in *Der Stil* did he more narrowly define it as the third of the four technical arts-- carpentry.[2]

Semper elaborated further by making a distinction between *tektonik* and *stereotomic:* between constructs of articulated elements (skeletal structures, timber and metal frame) and more inert assemblies (masonry walls). Tectonic structures were composed of members; stereotomic structures were composed of similar pieces. The stereotomic pieces all had the same function -- that of resistance to compression. Tectonic pieces (this is where the definition differs from the previous distinction), could be made of stone, but most importantly each member was articulated with respect to its action.[3]

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[1] These four corresponded to four ways of making (not material): moulding for the hearth, which produces ceramics; weaving and platting to the enclosure, which produces textiles; carpentry and joining to the roof; and masonry for the terrace. Rykwert, Semper and the Conception of Style, p. 75

[2] Herrmann, *op. cit.,* p. 152

[3] Anderson, *op. cit.,* p. 86

It could be said that with *Der Stil* the formulation of tectonic theory becomes complete. Although these contributions should be seen in light of the nineteenth century sensibility, their contemporary significance and relevance in understanding tectonic theory is undeniable.

The Range of Tectonic Expression

The term *tectonics* is used in many different ways and is most commonly confused with the term *technological,* or more generally with architectonics. It is possible to distinguish three different conditions of objects which help to further define tectonics: first, the "scenographic object," which concerns itself with the representation of an image and not at all with technical reality; second, the "technological object," which comes from invention in response to certain quantifiable requirements; and third, what this thesis is concerned with, the tectonic object.

The range of tectonic expression can be thought of in terms of the interplay of *structure* and *enclosure,* where on one hand the structure's presence is represented by the modulation of the enclosure and, on the other, when the modeled structure stands unconcealed and visible. What follows is a discussion of some of this range.

Representation in tectonics is concerned with the relation of the *idea* of construction and the construction itself. It is concerned with the relation of signification. As Panofsky states:

> *"...to perceive the relation of signification is to separate the idea of the concept to be expressed from the means of expression. And to perceive*

the relation of construction is to separate the idea of the function to be fulfilled from the means of fulfilling it."[1]

This separation of the idea of construction from the actual construction itself was the basis for the comparison between Botticher and Semper. It was a polemic relationship usually centered around the axiomatic differentiation between core- and art-form *(Kern und Kunstform).* Botticher formulated the relationship as follows:

> *"a concept of each part* [*which*] *can be thought of as being realized by two elements: the core-form and the art-form. The core-form of each part is the mechanically necessary and statically functional structure; the art-form, on the other hand, is only the characterization by which the mechanical-statical functional is made apparent."*[2]

Although both men wrote and in effect refuted each other, their views were very similar; both emphasized repeatedly that a close correlation between core and art form was necessary to rescue the application of decoration arbitrarily to structural parts. He wrote:

> *"It is in the nature of things that this simple law will restrain any subjective and arbitrary desire to cover the core-form haphazardly with symbols...The essence and idea of a structural part prohibit arbitrary decoration and do not allow one to deal with the decorative elements as one pleases."*[3]

It is this range of synthesis and the role of representation that is important and it is in light of this argument that the relation of signification should be seen. This type of representation is easily illustrated by the Classical tradition. Porphyrios, in his argument that "Classicism is not a Style," defines architecture as the mimetic

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[1] Billington, *"Meaning in Maillart,"* p. 39

[2] Herrmann, *op. cit.,* p. 141

[3] Herrmann, *op. cit.,* p. 144

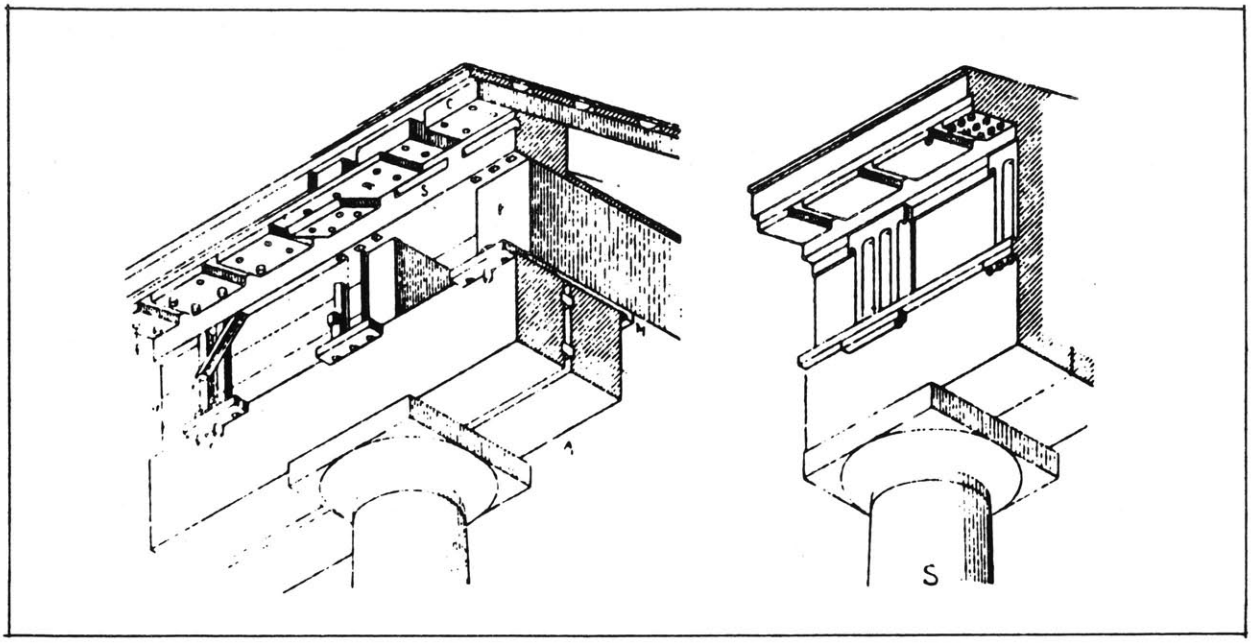

Fig. 3.5 : Stone and timber origin of Doric order. Choisy.

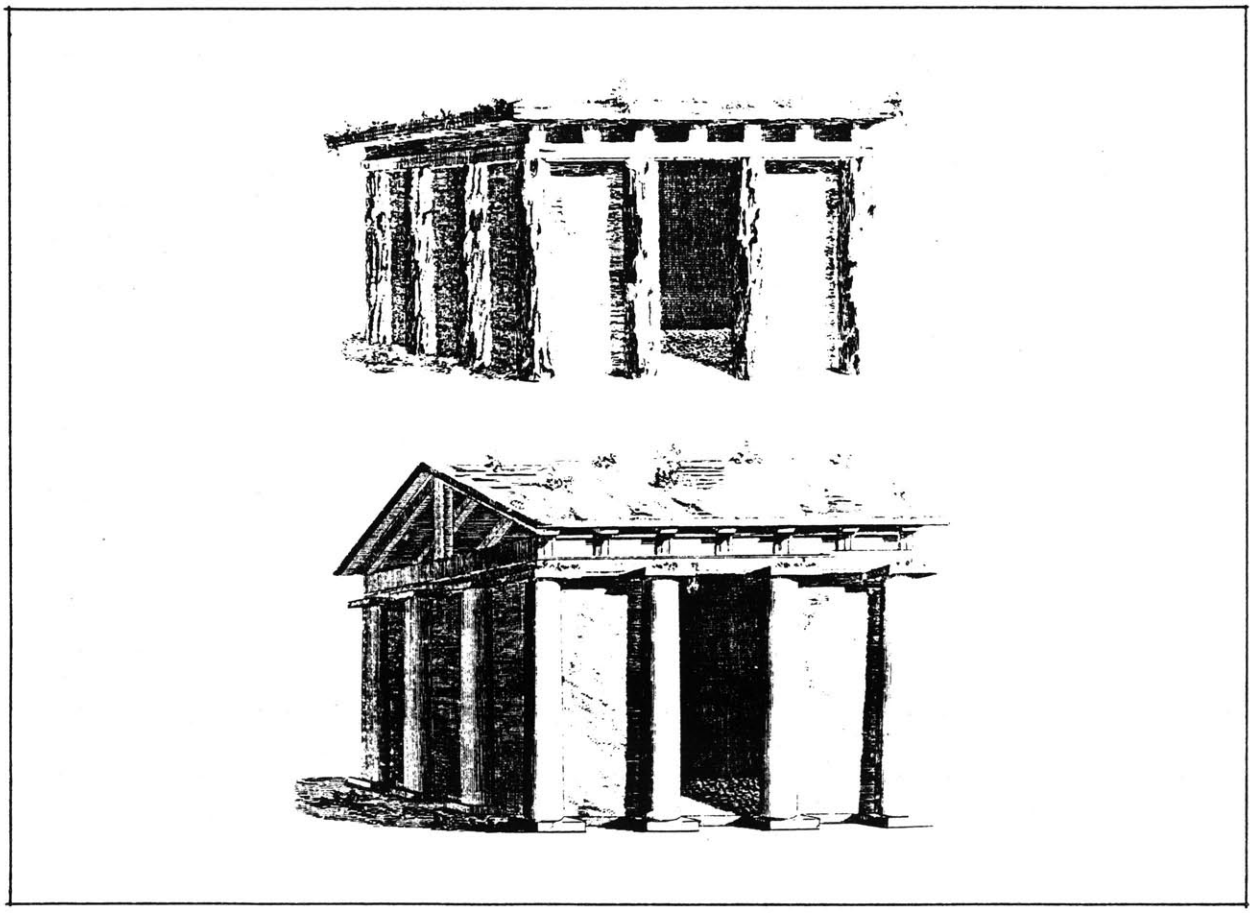

Fig. 3.6 : Primitive huts and the origin of architecture. Chambers.

elaboration of the constructional logic of the vernacular; he maintains that classicism constructs a tectonic fiction out of the productive act of building (Fig. 3.5 & 3.6). Architecture attains its cultural status and significance over building by the mythification of a set of *a prioris.* The *a prioris* are: the *load-bearing* and the *load-borne,* manifested in the column and lintel; horizontal and vertical *enclosure,* manifested in the roof and the wall; and lastly, since construction is by means of finite elements, the act of *demarcation,* manifested in beginning and ending.[1] He states:

> *"...classicism -- as a sensibility and not a style -- naturalizes the constructional* a prioris *of shelter by turning them into myth: the demarcation of beginning and ending are commemorated as base and capitol; the experience of load-bearing is made perceptible through the entasis in the shaft of the column; the chief beam, binding the columns together and imposing on them a common load, becomes the architrave; the syncopation of the transversal beams resting on the architrave is rendered visible in the figures of the triglyphs and metopes of the frieze; the projecting rafters of the roof, supported by the frieze, appear in the shape of the cornice; finally -- and most significantly -- the whole tectonic assemblage of column, architrave, frieze and cornice become the ultimate object of classical contemplation in the idea of the Order. The Order sets form over the necessities of shelter; it sets myth of the tectonic over the contingencies of construction."* [2]

His idea of the "mythification" of building elements serves as a way to think of representational tectonic, but it is essential that the representation retain its direct relationship with the reason for its being; there must be a convergence of the real

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[1] These *a prioris* give rise to a set of constructional relationships of syntactic and figurative status, "the gable as the sectional end of the building indicates the experience of entry; the pilasters indicates a relationship between load-bearing and enclosure; window and door which interrupt enclosure in order to pass; colonnade which demarcates a boundary..." Porphyrios, *Classicism is not a Style,* p. 56

[2] *Ibid.,* p. 57

Fig. 3.7: Les Espaces d'Abraxas, Marne-la-Valle. Bofill. 1979-83

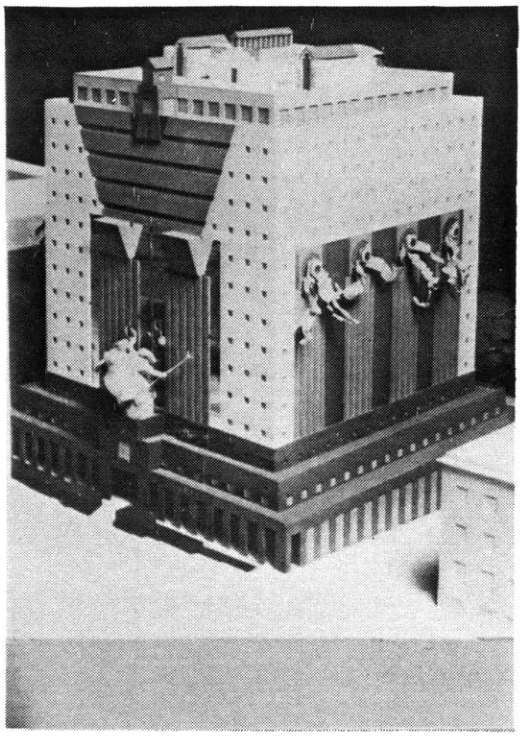

Fig. 3.8: The Portland Building, Portland, Oregon. Graves. 1979-82

and the fictive so that, in some way, the real is redeemed, because in the act of representing (since there is a separation of the tectonic expression and the structure), its degeneration into scenography is possible. This can be clearly illustrated in the later work of Ricardo Bofill. The housing project *Les Espaces d'Abraxas* at Marne-la-Vallee certainly is the mythification of building elements-- all the requisite classical elements are there. However, the Abraxas housing cannot be considered a representation of a tectonic element because of the severe schism between the inner substance and the outer form (Fig. 3.7). Another example of the degeneration of representation into scenography is the Portland Building by Michael Graves. Here there is absolutely no relationship between the core-form and the art-form. None of the building motifs -- the large four story keystone, the fluted columns and capitols -- which are traditionally elements with real static roles, bear no relationship to the actual way in which the building stands *or* the use divisions within the building. It is a quintessential decorated shed (Fig. 3.8).

Conversely, when the structure stands unconcealed, the *idea* of construction and the construction itself are one and the same. It is the actual constructional element that is modeled to bring itself into presence. The enclosure either is subordinate to the structure at key structural points or is kept completely independent. But, in this case, it is essential that the actual structural members are modeled is some way to bring them into presence.

In the Vredenburg Music Center in Utrecht, by Herman Hertzberger, the enclosure of the building is definitely subordinate to the structure; it "bows" at almost every meeting. Here both the structure and enclosure are tectonic in and of themselves, as well as interactively tectonic. The columns are revealed solely by the modulation of the enclosure. Yet the columns themselves have overly large square column heads and

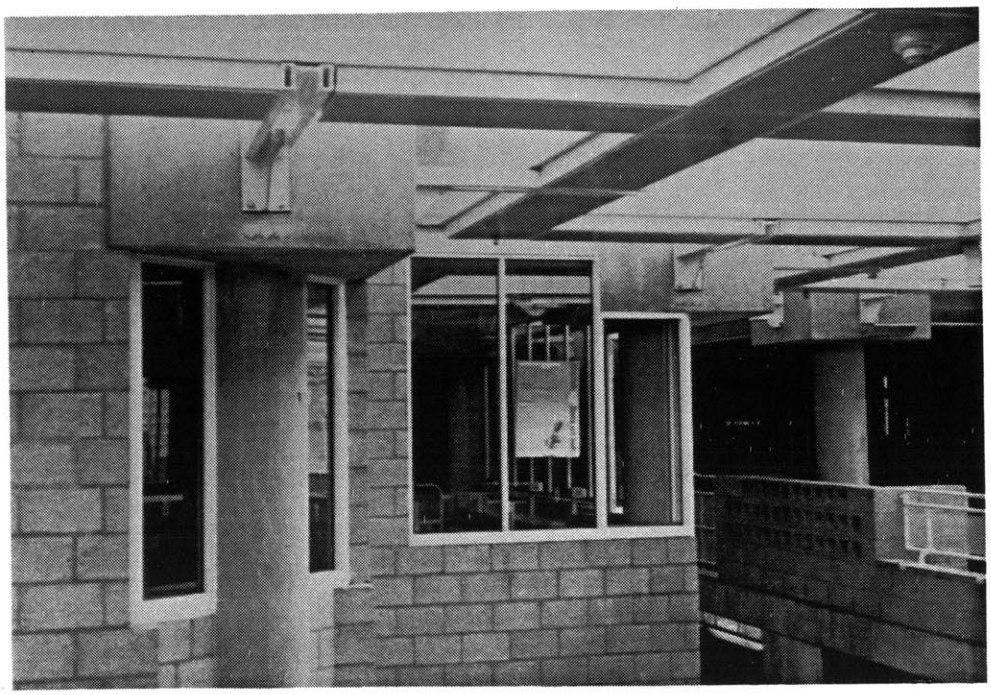

Fig. 3.9: Vredenburg Music Center, Utrecht. Hertzberger.

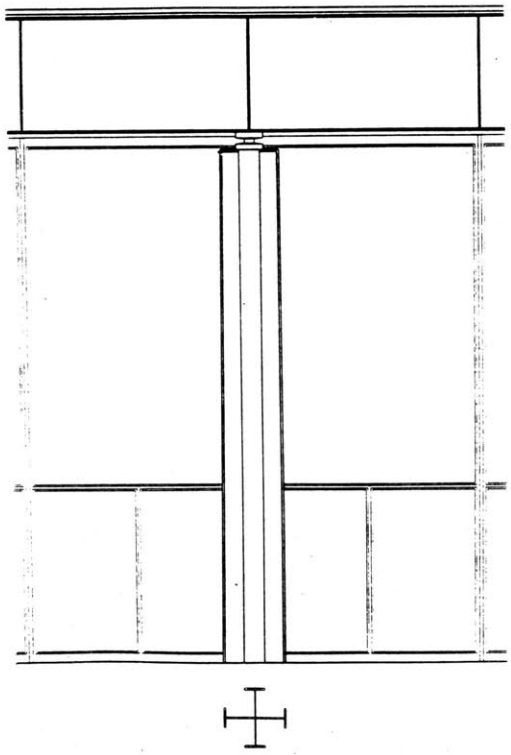

Fig. 3.10: Columns of Neue Nationalgalerie, *Berlin. Mies. 1962-68*

in this way attain their presence. The capitols, by being aligned all in one direction, allow for ceilings to be joined at different heights, but most importantly, they hold the enclosure away, (by joining with glass, or by going around) let the columns come into existence (Fig. 3.9).

At the New National Gallery in Berlin, by Mies van der Rohe, the enclosure is kept entirely free of the structure. The structure is revealed by its absolute independence from the enclosure. The columns attain their presence by their physical modeling in reference to classicism (Fig.3.10). They are, in a way, a reinterpretation of classical language in a modern idiom. The four "T" sections welded together recall Greek architecture, where the multiple vertical lines allude to fluting and the hinged column head serves as a metaphorical capitol -- as the transition between load-borne and load-bearing, between vertical and horizontal.

At IIT in Chicago, the presence of the structure and thus its tectonic quality is heightened by the juxtaposition of the two conditions described-- the enclosure and structure work simultaneously and where the enclosure envelops the structure. In the fourth period of his career[1] when he preferred *Baukunst* over *Architur,* he succeeds in monumentalizing the steel frame. His preference for a frame/infill genre of building is made markedly more difficult by the requirement of the major columns to be fireproofed, but, ultimately, it is this combination that, perhaps, results in a very

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[1] Johnson, in his monograph on Mies, divides Mies' career into five distinct periods: 1886-1919 characterized by his still strong commitment to the *Schinkelschule;* 1919-1925, when he is affected by the radical "isms" of the European avant-garde; 1925-1937, when his work is perhaps the most complex in terms of the struggle between tectonics and avant-gardism and makes the transition from the steretomics of brick construction to the tectonic potential of glass and steel; 1937-1947, when he seems to favour the German distinction of *Baukunst* over *Architur;* and lastly 1948-1960, when his career culminates in Crown Hall, the Seagrams building and finally the New Gallery in Berlin.

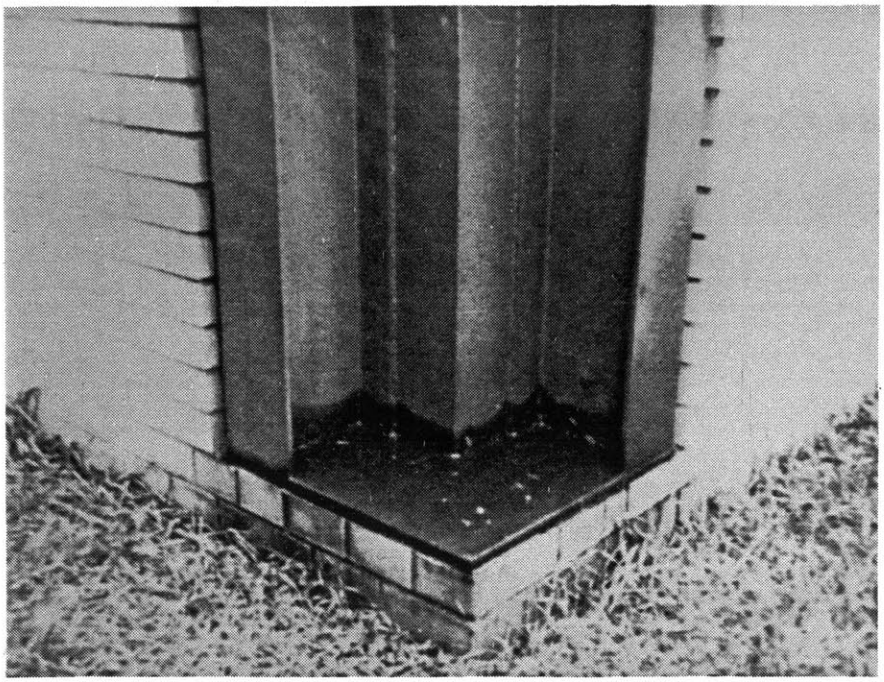

Fig. 3.11 *: Building corner detail at IIT, Chicago. Mies. 1945*

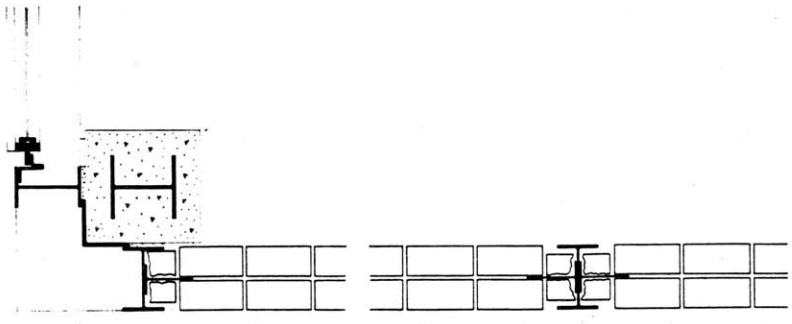

Fig. 3.11 *: Plan of corner detail at IIT.*

eloquent detail (Fig.3.11).[1] The presence of the main column is represented by the metal cladding placed over the corner and develops the continuity of the corner from one mullion around to the other mullion. The juxtaposition of the "I" beams and the metal cladding at once articulate the corner, and reveal the presence of both parts-- the major structural element and the secondary infill panels. Here the structure and enclosure are "presented" as working simultaneously where the reading of both at once is possible. However, at the base of the building, the brick enclosure envelops the structure and runs past it and around the corner, which is in accordance with the nature of it as a skin-- a kind of wrapping. The juxtaposition of these two conditions heightens the presence of the structure of the building. It is an eloquent interplay of enclosure and structure, each asserting its own nature, yet working as a whole, where by juxtaposition the existence of both is brought into presence.

The "Subjects" of Tectonic

When looking at buildings as "things," and more specifically at their inner-consciousness as the major (though not exclusive) focus of tectonics where the physical modeling of a substance is key, what are the typical "subjects" of this physical modeling? The next section attempts to outline several of these (among many) before applying them to two specific examples in part four. They are in general, the things with which tectonics is concerned. They are the building's relation to the following issues: structure and enclosure; services; joining and detail; materials and techniques; and natural forces. These subjects are not prescriptive-- the ways in which tectonic practitioners manipulate these attributes is very different. Moreover, (as will be discussed later), the

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[1] As opposed to the corner detail of "860" where because there is no brick infill, the column is pushed out to the corner and relies solely on the placement of the I beams on the outsides of the column to articulate the corner.

Fig. 3.12 : *Glass Block House, Osaka. Ando. 1978*

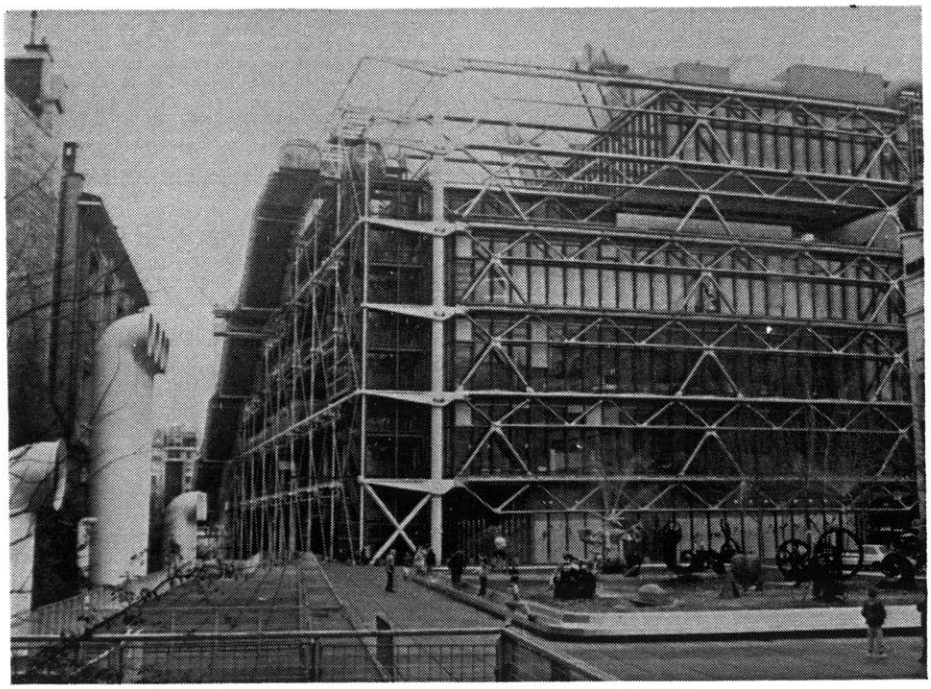

Fig. 3.13 : *Beaubourg, Paris. Piano and Rogers. 1972-77*

attributes can be contradictory as well as validated by their opposite. What follows does not pretend to be complete (neither as a list of subjects or within each subject), but rather only an outline of a few possible points with which to discuss the examples.

Probably the most common subject of tectonic expression is the structure and enclosure of a building. Much of this was covered in discussing the range of tectonic expression, but several points should be made. Unlike the Semparian definition of tectonics,[1] the use of the word tectonics in this thesis includes all structural systems, and is used in a more general sense. This does not change the essential nature of the tectonic idea, but rather is meant to be more encompassing in the sense that one could talk about a stereotomic structure of "similar pieces" as also being tectonic. The work of Tadao Ando, for instance, would have to (and should) be considered tectonic under the guise of this thesis. Most of his work is not composed of articulated elements, but rather, as in the "Glass Block House", is poured-in-place concrete (Fig. 3.12). Another well known example is the Beaubourg in Paris designed by Renzo Piano and Richard Rogers. Although it is a rather ostentatious display of structure (and by no means does tectonic architecture in general have to be quite so demonstrative), it undeniably uses structure as a intrinsic part of the building's image. The presence of the building depends on the structure (Fig. 3.13). In short, tectonics as used here includes all structural systems: tensile, frame, pneumatic, bearing etc.

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[1] As discussed previously, Semper narrowed his definition of tectonics in *Der Stil* to correspond to the third of the four technical arts-- carpentry. As opposed to stereotomic structures, which he defined as being assembled with identical or similar pieces (inert assemblies, tectonic structures were composed of articulated members (elastic skeletal structures).

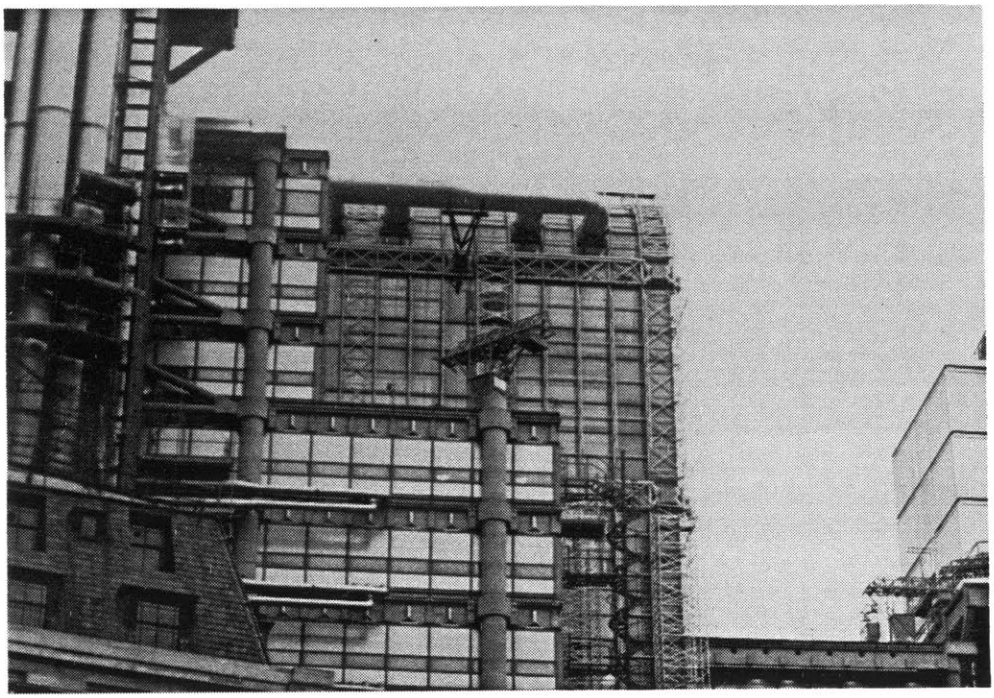
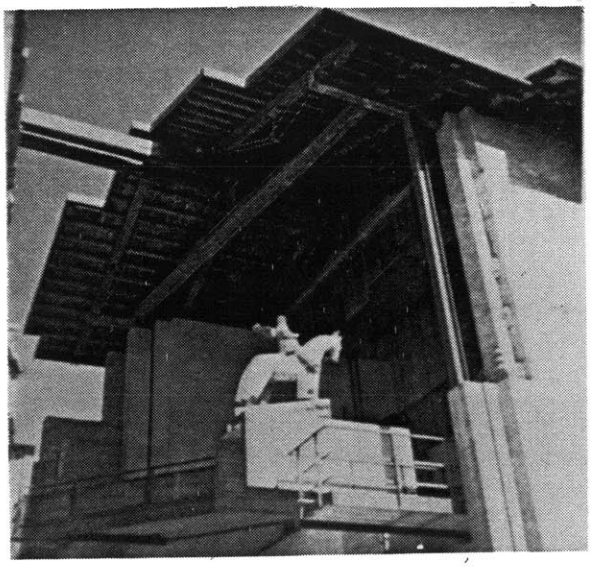


Fig. 3.14: Lloyds, London. Rogers. 1983-86



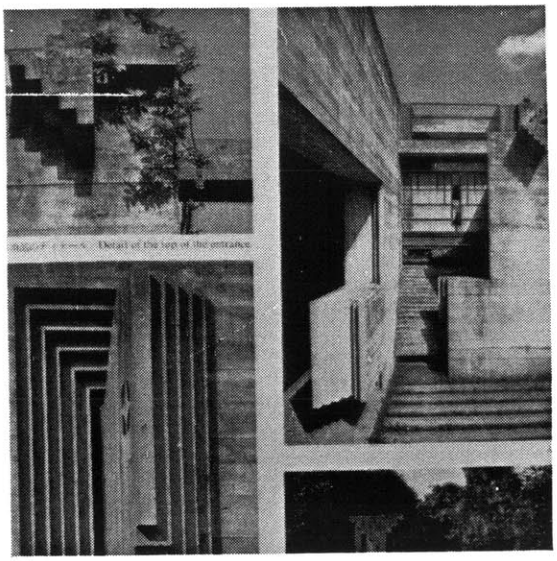


Fig. 3.15: Ziggurat motif
Castelvecchio, Verona.
Scarpa.

Brion Family Cemetery,
S. Vito d'Altivole.

Many times the service components of a building -- HVAC, plumbing, lighting, access -- are revealed as part of the building. The Lloyds of London building designed by Richard Rogers fully displays its services (Fig. 3.14). The vertical access, HVAC ducts and plumbing soar vertically extending far beyond the major use spaces of the building. In this respect it is very similar, as will be discussed later, to the Richards Labs by Louis Kahn. The expression of services is a relatively recent phenomenon, which arose with the increased complexity of building systems and services. The tectonic position accepts this undeniable fact and acknowledges it, by some architectural gesture. There are, of course, many examples of the expression of service in a building less radical than Beaubourg, and it is important to note that these can be considered tectonic as well.

The joining of materials together and the celebration of that joint as a detail have been for many the most important aspect of architecture.[1] The ziggurat motif at the Castelvecchio in Verona (Fig. 3.15) is used to terminate the layers of the wall of the facade to show the virtual joint between the original walls and the wall constructed in 1924. It is a simple way of revealing the layers: telling the story of the whole (building) through the part (detail). The archeological layers are "peeled" backed to bring into presence the building's past life. The Ziggurat at the Brion-Vega Cemetery is used in a different way. It tells the story of its making (cast-in-place concrete) as well as the story of the cemetery. The "ruined" form alludes to past times and memories enriching the story of a cemetery as whole. It should be noted that the narrative capacity of the joint should be understood at all sizes-- at the size of a

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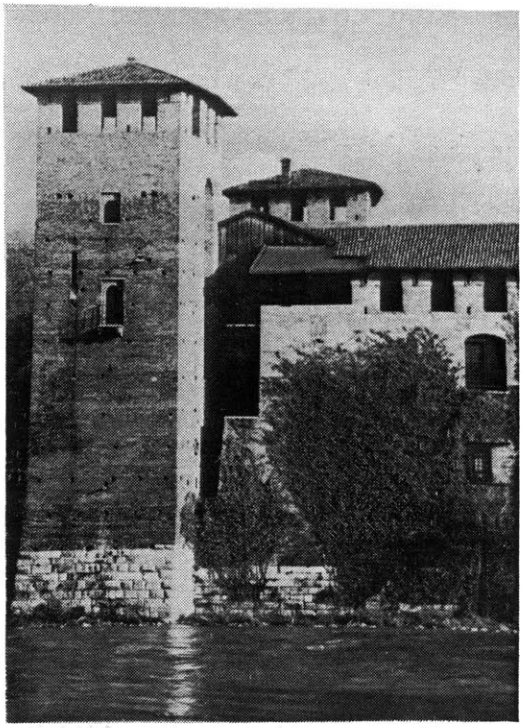
[1] Semper made the curious etymological connection between knot, *(die Knoten)*, and joint *(die Naht)*, describing the knot as "perhaps the oldest technical symbol and the expression of the first cosmogonic ideas which arose among the peoples." For Semper the ultimate element of architecture was the joint. Rykwert, *The Necessity of Artifice*, p. 124



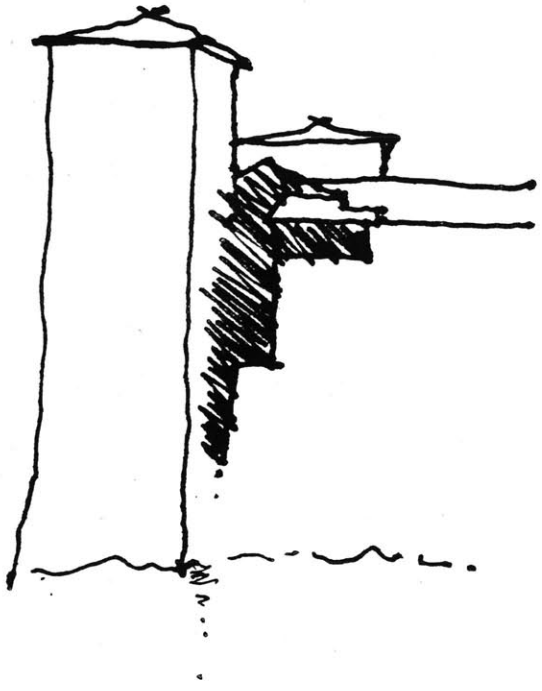


Fig. 3.16: Castelvecchio, Verona. Scarpa. 1956-

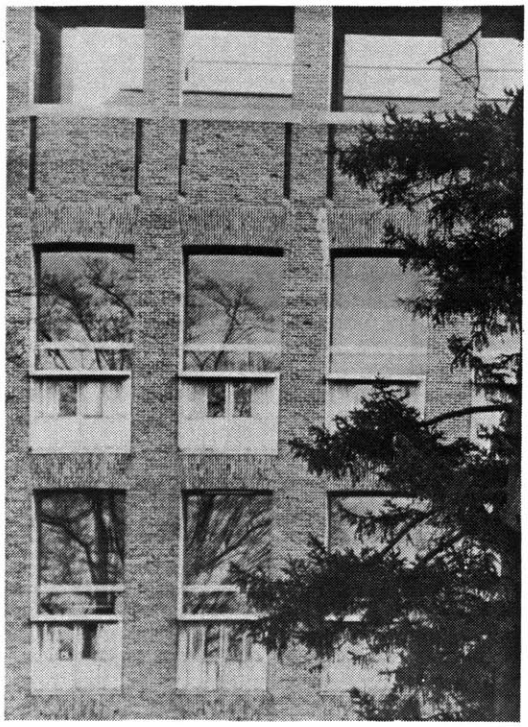


Fig. 3.17: Exeter Library, Exeter. Kahn. 1967-72

building as well as the size of the detail. At Castelvecchio, Scarpa uses a spatial joint at building size to link the buildings together (Fig. 3.16). In all cases the joint has great narrative capacity: to tell the viewer of its purpose, both making and signification.

Tectonics is almost invariably concerned with modern materials and building techniques. Once again, Semper's "four elements" of architecture can serve as a conceptual model. They corresponded to four ways of operating (and not to four materials as is often mistakenly thought): moulding for the hearth, which produces ceramics; weaving for the walls, producing textiles; carpentry and joinery to the roof and supporting structure; and lastly, masonry to the terrace. The value of this model is not in the specific processes themselves, but rather, in the importance placed on constructional processes and materials. The "death" of the craftsman as well as the constant development of new building materials since the nineteenth century created a new condition for the architect, for which there is no precedent. Tectonics tries to take advantage of these developments. The question is not so much whether one uses readily available materials and building techniques, but rather how one makes a virture of what are the typical modes of production.

How does the building stand on the ground and rise to the sky? That is the question that best characterizes the final attribute of tectonic architecture discussed here— the revealing of natural law and, in particular, gravity. Buildings reveal the natural forces of our existence on the earth in two ways: the acknowledgment and defiance of its force. In the Exeter Library designed by Louis Kahn, natural forces are revealed and acknowledged by the diminution of the width of the brick piers. The building rests firmly on the ground and rises to the sky, gradually becoming more ephemeral and light. This modeling of the material heightens the brick's essential characteristic as a bearing material and brings natural forces into presence (Fig. 3.17). Natural law can

Fig. 3.18 : Skating rink, Saint-Ouen, France. Chemetov. 1973-80

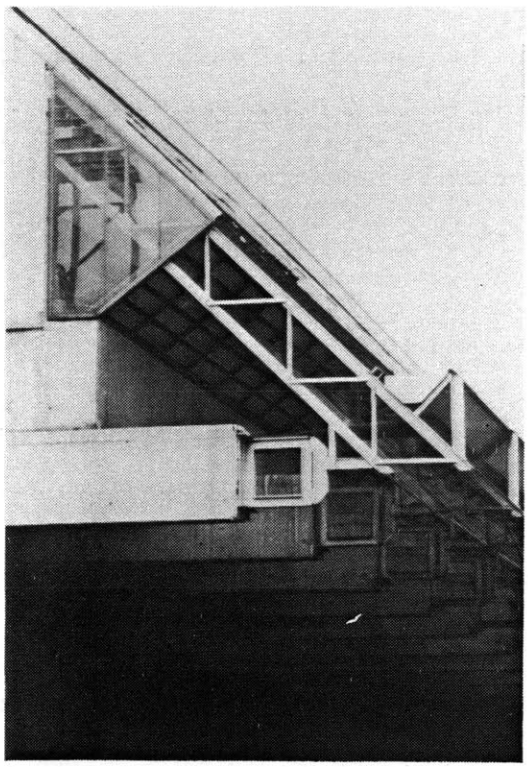


Fig. 3.19 : Skating rink, Saint-Ouen.

also be revealed by defying its force. This is done primarily by cantilever, where because space is all around the element, its defiance of natural law is emphasized. The skating rink in the Paris suburb of Saint-Ouen, by Paul Chemetov, (Fig. 3.18), cantilevers the rink out over the road (Fig. 3.19). Natural forces are brought into presence by the space around the building elements and in this case emphasized by vehicular movement directly underneath.

Not all tectonic works can be described by these subjects alone. It was intended that this brief discussion would begin to introduce a few of the issues common to tectonic buildings. They were derived from analysis of many buildings; the following part uses some of these issues as a basic framework for analysis of 25bis Rue Franklin and the Richards Medical Laboratories.

It is hoped that these descriptions give an idea of tectonics. In short, it could be described as the narrative capacity of architecture; an architecture inseparable from construction. It is the modeling of the physical things of a building -- the structure, the enclosure, materials, organization -- bringing it into the meta-physical world. It reveals a conscious attempt by the designer to tell stories about the the building itself; how it is made, how it stands, its assembly process etc. More generally it tells stories about the historical circumstances by which buildings were made. It is meant to concretize and reveal life in its various forms. With this general definition in mind, part four gives two examples.

part four:

TWO EXAMPLES

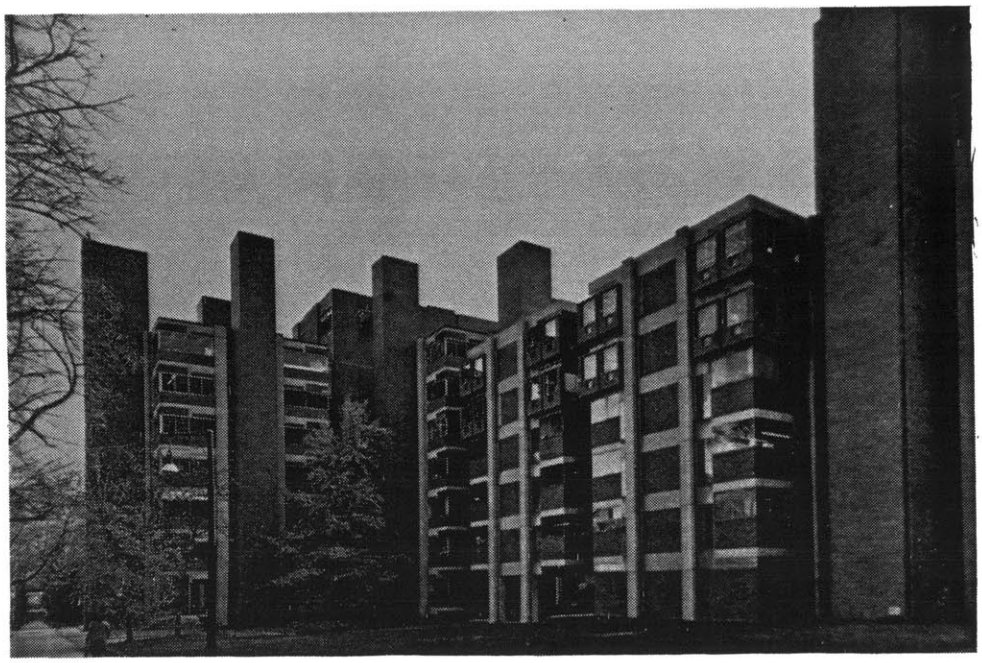


Fig. 4.1 : Richards Medical Laboratories, Philadelphia, Kahn. 1957

Fig. 4.2 : 25bis Rue Franklin, Paris. Perret. 1903

There are many examples that one could use in discussing tectonic architecture. The two chosen examples -- the apartment building at 25bis Rue Franklin in Paris by August Perret (Fig. 4.2), and the Richards Medical and Biology Laboratories in Philadelphia by Louis I. Kahn (Fig. 4.1) -- are not intended to represent my choice of two quintessential tectonic buildings. The following criteria were used.

First, the two examples seemed, at the outset, exemplary. As a conscious act, the designer had placed significance on at least some of the tectonic "subjects" discussed in part three. Second, the choices were limited to buildings where the main structural system was concrete, so that the issues would be similar and the examples would demonstrate varying ways of dealing with those issues. It follows that the examples allow one to see some development of the material from 25bis Rue Franklin, which is commonly considered to be the first emplyment of ferro-concrete as a medium for architectural expression,[1] to the Richards Labs, which exhibited newly developed techniques of post and pre-tensioned members. Third, there is a range of socio-cultural climate in which the buildings were constructed. Lastly, they are buildings which I perceive to be progessive pieces of architecture: in many ways they are seminal buildings.

Introductory Comparison of Tectonic Subjects

As an introduction to the more detailed sections, this one discusses the two examples comparatively with respect to the previously outlined tectonic subjects.

At 25b the structure is completely clothed by the enclosure. The enclosure wraps the whole facade and the structure is represented by the tiles (Fig. 4.26). At the Richards

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[1] Collins, *Concrete,* p. 173

Labs, on the other hand, the actual structure is allowed to stand unconcealed as part of the exterior surface of the building. The enclosure and actual structure work simultaneously as part of the exterior surface of the building. Here, the structure is not the "bones" with its conforming "skin" (as at 25b), but rather structure that permeates the whole (Fig. 4.50).

Both buildings are, concrete frame buildings, and both use the concrete frame to delimit the spaces. However, 25b delimits the space by "staking out" the spaces with columns. The columns always occur as part of a partition wall where the wall itself almost envelops the columns. The columns serve as punctuation points, and in conjunction with the partition wall, set up the spaces (Fig. 4.23). The structure at the Richards Labs, on the other hand, delimits in a spatial way. As opposed to the lineal structure of solid members, (25b), the Vierendeel trusses at Richards Labs generate a zone of space allowing for services. Also, the Vierendeel trusses at the Richards Labs delimit the well lighted "studio" spaces from the darker spaces used mostly for access (Fig. 4.36).

Both buildings express some aspect of their services. At 25b, the area of services, comprised of the stairways and kitchens in the typical apartments, and the *concierge* apartment at the street level, is expressed clearly as one component of the facade composition (Fig. 4.31). It was unusual at this time, especially considering Perret's Beaux Arts training, that the service had "life" at all. Typically, service was tucked away in areas left over after the more honorific definitions were made. Certainly, service was not part of a building's expression, especially not the facade. Although the service can still be read as the *poche,* it nevertheless is expressed on the facade of the building. This is significant as a starting point for the full expression of services as is later demonstrated at the Richards Labs (Fig. 4.53). Kahn's axiomatic distinction of "served" and "servant" spaces provided a conceptual basis that made a building's

services an integral part of its "life." The soaring towers of the Richards Labs endows the building with a sculptural quality that almost monumentalizes the services contained within. Kahn recognized that with the rising complexity of services in modern buildings, the architect had to accommodate and give expression to them so as not to relinquish any form-determining factors to others (for instance, the mechanical engineer). It was, to use Semper's primary rule of art: "making a virture of necessity."[1]

Perhaps one area in which 25b does not demonstrate tectonic qualities is with respect to the issue of joining and detail. In fact the representation of the junction between the major building elements (frame/infill) tends to negate any relationship. The floral pattern tile infill can be seen as almost dematerializing: having no characteristics akin to a building component (Fig. 4.26). The dialogue of adjoining materials is mute. Perhaps the only place where there is any sense of elements joining is the corners of some rooms (Fig. 4.25), which are articulated by the concrete column and the partition wall. But in general, any tectonic quality attained from the syntactic elequence of building elements is not developed. The Richards Labs, on the other hand, demonstrates the "adoration of the joint" in many ways-- with intricate fit, juxtaposition and light. The way in which the Vierendeel trusses "talk to each other" clearly expresses the pieces and the viewer can see how it was assembled (Fig. 4.59). The intricacy and precision of their fit are akin to the syntactic elequence of wood joinery. The different materials used -- the different kinds of concrete (poured-in-place, pre-cast, block), brick, glass -- are used together where the expression of joinery is by juxtaposition (Fig. 4.58). The use of light as a joint, for Kahn, is something that began at the Richards Labs and subsequently developed more fully. The concrete

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[1] Rykwert, *The Necessity of Artifice,* p. 125

structural column and the service towers are joined not by a physical thing but rather by light and space. Here, the idea of joining and detail takes on a new meaning.

Both buildings are seminal with respect to materials and building techniques. The use of concrete for domestic purposes was unusual in Paris at the time. Concrete technology had evolved with the work of Hennibique (Fig. 44) and others to the point where it was feasible to build domestic buildings. But most importantly, Perret saw it as the material of the future: the material capable of making the architecture of the twentieth century. When looking at the two projects it is easy to see how quickly concrete technology had evolved. The frame of the 25b, unfit for visibility, had evolved to the perfectly finished precision pieces of the Richards Labs, capable of unconcealed presence. With the help of Dr. Komondant, Kahn was one of the first architects to employ a system of casting the concrete elements off-site, where they were either pre-tensioned or post-tensioned later on-site. The process of assembly was facilitated by a relatively new tool — the crane, which, in conjunction with the detail of the pieces, allowed the structural pieces to be simply lifted up and slipped into place. The new structural system and process of assembly demonstrate a respect for technological advance while at the same time concern for the their own life and the story they tell.

The last subject outlined in part three was the building's relationship with natural forces. Providing a sense of bearing (as in the brick piers at Exeter Library), or the defiance of natural force (as in the Chemetov skating rink), was not seen as part of the story of either the 25b or the Richards Labs.

25bis Rue Franklin

Auguste Perret maintains a transitional position in the history of architecture and therefore his work is very difficult to classify. His career spans an unusually long period-- some sixty years until his death in 1954. Trained at the *Ecole des Beaux Arts,* his career endured the rise and maturation of modernism almost to the point of its demise in the fifties. The difficulty of his placement in history is made more difficult by two different concerns which stayed with him throughout his career-- the "continuation"[1] of the Graeco-Gothic ideal and the development of concrete building technology: a legacy dating back to the eighteenth-century theorists Cordemoy and Laugier, and to Francois Hennebique's concrete frame system patented in 1892 (Fig. 4.3 & 4.4).

His ideas on architecture were primarily fostered by three men; Gaudet, who was his teacher at the *Ecole;* his father, a building contractor with a strong and uncompromising temperament; and Choissy, whose history of architecture, which is essentially a history of construction, was his constant guide.[2]

Gaudet's *Theory of Architecture* is, even today, an important source. Its influence on generations of architects, especially in France, is well known. His doctrine could be summarized as a hybrid of the French Classical tradition and the Structural Rationalism of Viollet-Le-Duc and LaBrouste.[3] It was Gaudet's atelier, until his appointment as Professor of Theory in 1894, that Perret was a part of.

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[1] Le Corbusier once remarked reproachfully that Auguste Perret was not a revolutionary but a continuator and that his entire personality was to be found in the continuation of the great, noble and elegant truths of French architecture. Collins, *Concrete,* p. 153

[2] Collins, *The Doctrine of August Perret,* p. 92

[3] He had, in fact, followed in the footsteps of LaBrouste. Both men were essentially

Fig. 4.3 : The primitive hut, after Laugier. 1765

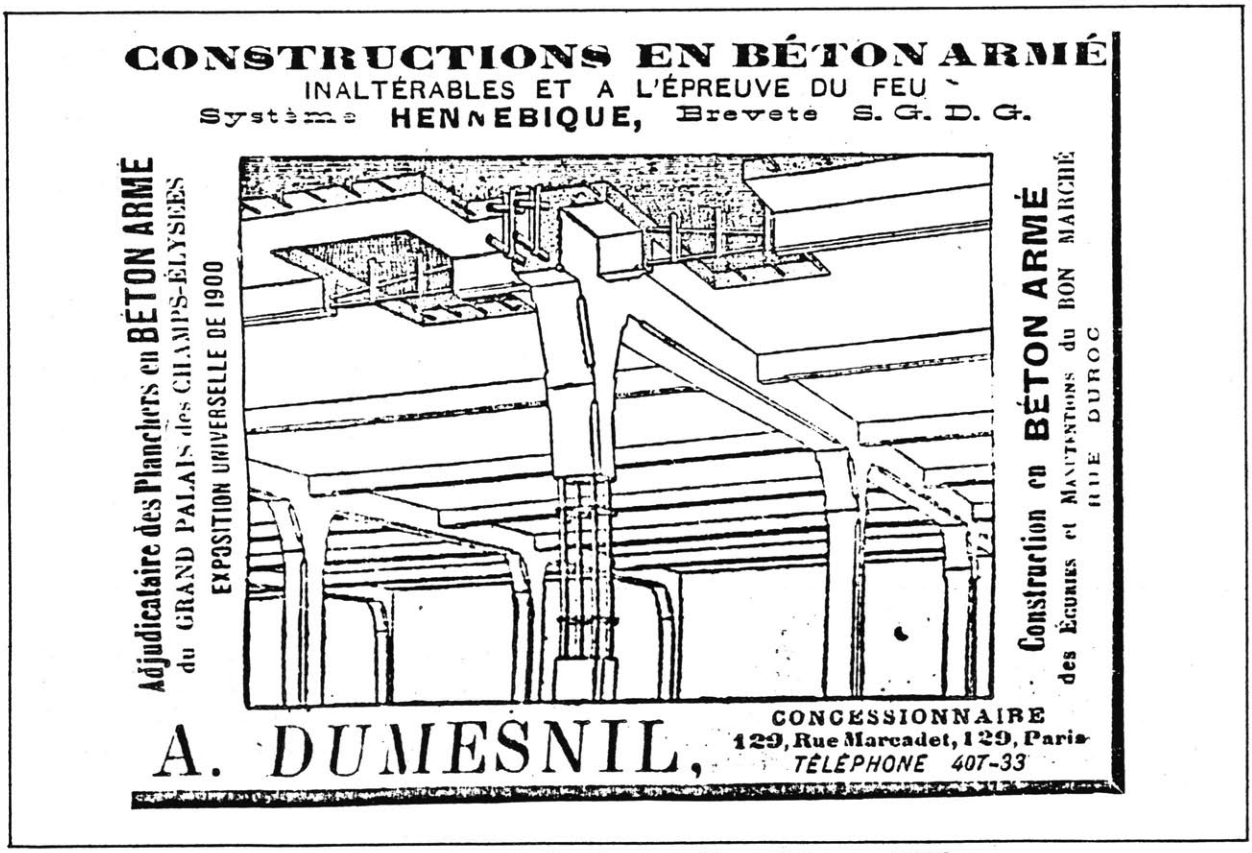

Fig. 4.4 : Le Beton arme et ses applications. *Hennibique. 1902*

The way in which Perret (and his brother Gustave) conducted their studies within the atelier broke with tradition. Although Perret developed a close relationship with Gaudet's son and four other students,[1] they did not get along well with the atelier as a whole. His refusal to submit to "slavery" for the senior students, was apparently tolerated due to his maturity and knowledge of construction. He never worked on designs at the *Ecole,* partly because of the time demanded of him by his father and partly because of his distaste for the whole system. He never submitted his designs for review by the whole atelier, which could only have been reviewed privately at Gaudet's home. Nevertheless, he had an excellent academic record, completing fifty-four accepted projects (when only ten were required), to qualify for permission to submit a thesis. However, he never bothered to get his diploma, which it has been argued was intentional so as not to legally bar himself from acting as a building contractor.

Gaudet's teaching is known to us today through the publication of his lectures. They are characterized by the presentation of classic principles of composition and proportion, all leading to the main point— the analysis of a particular building type. His approach was diplomatic as he always considered the question of how a new architecture or new structural forms should develop, yet did not use any examples from his contempories. Collins characterized him by emphasizing "...his deep feeling for architectural integrity, his sense of the intimate bond between plan, section and facade, and of the obligation to ensure the constructability of every academic project."

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products of the *Ecole,* won the Prix de Rome, had a prominent role in the erection of a major nineteenth-century architectural landmark (LaBrouste with the design of the Biblioteque Ste. Genevieve, and Gaudet, the construction supervision of Garnier's Paris Opera House), and later taught at the *Ecole,* influencing a generation of significant architects thereafter.

[1] Lebret, Degeorges, Tzakini and Turtan, Collins, *Concrete,* p. 159

Fig. 4.5 : Claude, Gustave and Auguste Perret. 1951

But, perhaps it was the importance placed on construction by Gaudet, complemented by his family background, that allowed an affinity with Perret to develop. Although Gaudet did not teach construction, it was always part of his message. As he equated truth and beauty, it was clear the most important truth was derived from expression of construction. He often warned his students of the danger of neglecting or falsifying constructional laws and defined architecture as the "execution of constructional elements to satisfy material and emotional needs: no construction, no architecture."[1]

Perret's career must always be seen in light of the family business-- *A. & G. Perret Constructeurs* (Fig. 4.5). It was his father, Claude-Marie Perret, who was the undisputed authority of the firm and who in many ways respects formulated Auguste's career. Throughout his life, when confronted with the choice of pursuing his independent career as an architect or the prosperity of the family enterprise, Auguste always opted for the latter. It was his father's decision to return to Paris[2] that had the most deeply rooted influence on Perret-- his initiation into the general milieu of French Classical architecture. As a young boy he was well-versed in construction; as soon as he could hold a pencil he worked in the family firm. The practical knowledge was complemented by some knowledge of history and theory since at age ten he had found a copy of Viollet's *Dictionnaire;* and already by the age of sixteen he had designed and built a house for his mother. It is clear that Claude-Marie had always wanted his son to be an architect for as soon as he was old enough to start academic studies, he began making designs for admission into the *Ecole.* His influence on Auguste's career was probably not due to any romantic ideal of a master

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[1] Collins, *Concrete* p. 162

[2] The family was exiled in Ixelles (near Brussels) for Claude-Marie's part during the Communard uprising of 1871. But after the French government declared general amnesty for all political offenders, his desire to live in Paris again overwhelmed the benefits of his established roots in Ixelles and the family returned to Paris.

Fig. 4.6 : Auguste Choisy.

builder family lineage, but rather to circumvent the typical process and relationship of contractor and architect. As Collins states, "...the idea suggests itself mainly as an ingenious device for underbidding his competitors, whereby architect's fees could be included in tenders for building contracts, and private architects circumvented whenever he constructed speculative buildings of his own." It seems likely that Claude-Marie did not want his son to complete his studies at the *Ecole,* since with the official title of "architect" he would not be able to act as a building contractor. So it was as a builder's draftsman in the family firm that Perret started his career fresh out of the *Ecole.* At a time when architecture was synonomous with Fine Arts it seemed like an unfavorable start; yet it proved to be a salvation, for he gained knowledge of one particular aspect of building buildings (which no theoretical or academic speculations could do) which would become significant in the development of twentieth-century architecture in general and concrete technology specifically-- the influence exerted by economy on the evolution of architectural form.[1]

Auguste Choissy's writings, in particular the *Histoire de l'Architecture* of 1899, constitute the third of the major influences of Perret's career. His significance is in complete accordance with the academic experience of Gaudet's influence, and the practical experience of his father's influence-- namely the concern for construction. The theme pervades all of his work, equating good architecture and good construction as the same thing (Fig. 4.6). Choissy's *Histoire* is basically a history of construction and in many ways crystalizes a historical justification for the Rationalist theory of design. Its most influential chapter was that of Greek architecture, as the chapter on

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[1] It should be noted that the opertion of the Perret firm displays yet another way in which it would anticipate subsequent architecture. The fusion of developer, designer and builder was unusual at the time (even today), yet it provides a model for a way in which the architecture field can resist its separation from, on the one hand, the building aspects of construction and, on the other, the economic aspects that seem to be so effectively dominating the architectural profession.

mediavel construction did not really contribute anything beyond what Viollet-Le-Duc had propounded previously. His study of Greek architecture sought to demonstrate the complete structural integrity of Greek temple design and thus vindicate the claims of the Classical Rationalists over the French Gothic Rationalist school; that "the exterior form must be the translation of the interior structure."[1] But it was perhaps the acceptance of the method of the *Histoire* that served as a model for Perret's research. Although it was an inverse task from Choissy's,[2] the criteria were the same. Perret believed if he could be as objective in his own work, it would have complete integrity and possess the same fundamentals of great architecture of the past and thus the same stature.

The influence of Viollet-Le-Duc on Perret is significant as well (especially with respect to the 25bis Rue Franklin building). Viollet's *Dictionnaire* proved to be constant inspiration throughout Perret's career. In fact, he stated at one point, "Viollet-Le-Duc was my real master...it was he who enabled me to resist the influence of the *Ecole des Beaux Arts."* [3] His primary influence had to do with structural integrity. However, one could say that over the whole of his career, Perret followed more closely the teachings of Guadet. Unlike Viollet, he saw structure only as a means to an end; it evolved not only from the force of its own logic, but also from the fulfillment of certain practical needs (governed by planning) and emotional needs (governed by proportions), thus repudiating any sort of solely structural determinacy. Perret, while building on the rationalist doctrines of Viollet, constantly showed how

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[1] Collins, *Concrete,* p. 198

[2] Choissy deduced from existing form what the constructional methods might have been, Perret had to determine the most appropriate form from familiar building techniques.

[3] Collins, *Concrete,* p.155

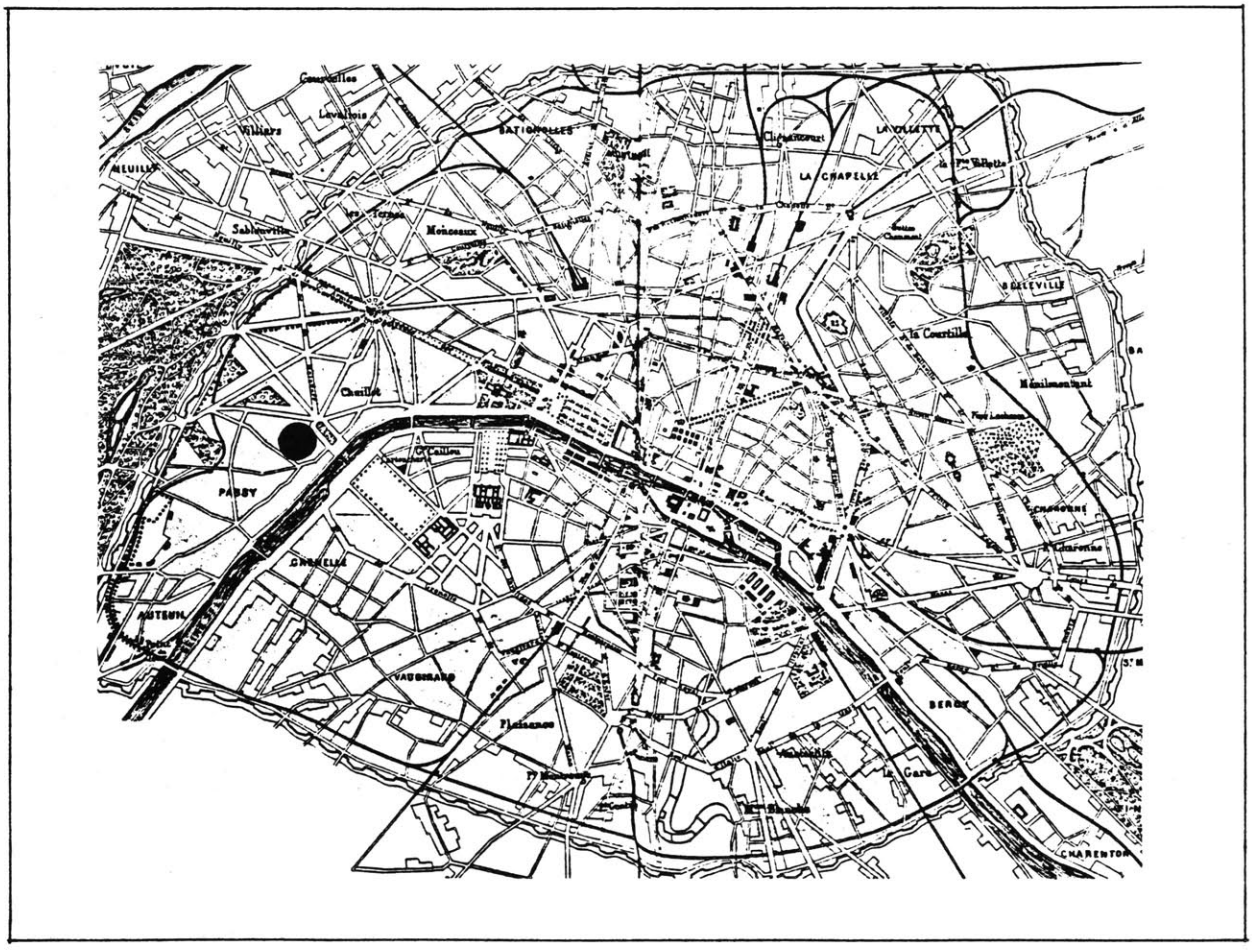

Fig. 4.7 : Map of Paris.

they could be expressed in a much wider range of tectonic form by constant refinement of the structure in favor of proportion and planning, thus indicating the more profound influence of Gaudet. With that introduction to Perret and his significant influences, what follows is a brief look at the 25bis Rue Franklin apartment building.

Although Perret was thirty and he had designed no less than six buildings, of which three were significant enough to be published in *La Construction Moderne,* it was the design and construction of 25b that is considered the starting point of his career. Its determination as such is due to several reasons: first, its concrete frame. As mentioned previously, the development of concrete technology was synonomous with Perret's career. Second, it was designed as the headquarters for both the family enterprise and the architectural office of "A. & G. Perret" and thus it had not only to convey the skills of the construction firm but also to state clearly Perret's architectural convictions. It was, in a sense, a promotional piece where the embodiment of personal doctrine is displayed.

There is no surviving document that gives any indication why Perret bought that particular site, but it turned out to have a significant determination on the building form. It is on top of the small hill of Passy within the city limits of 1860 and part of the XVI district (Fig. 4.7). Yet its character was much different than the city center; akin to the flavor of a small village district away from the congestion of central Paris. It was an upper class residential neighborhood without much commercial activity and no industry. The site's physical characteristics were all positive attributes: westerly winds;[1] permeable ground that drained easily; and one of the highest places in Paris.

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[1] Western quarters of nineteenth-century European cities were generally considered the

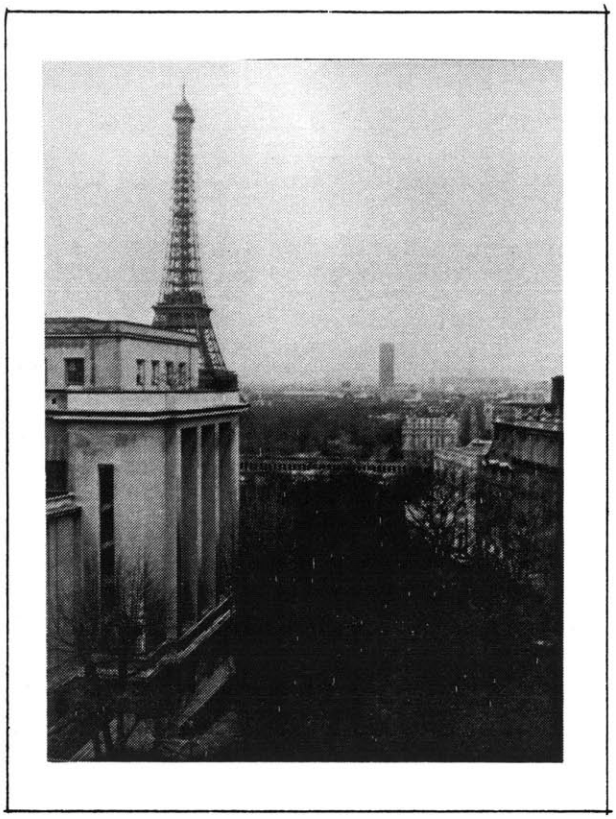

Fig. 4.8 : View from 6th floor apartment.

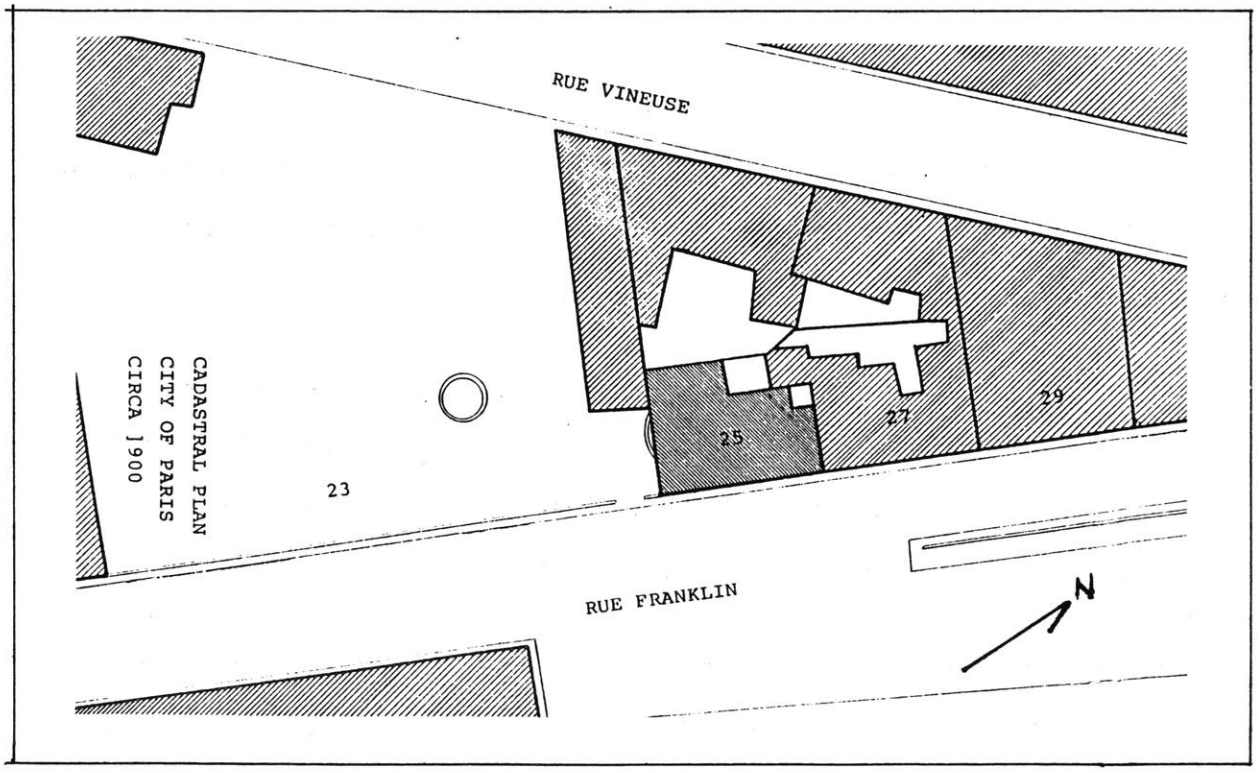

Fig. 4.9 : Site Diagram. circa 1900

Rue Franklin was largely built up be the turn of the century. It served as a main artery between the carrefour de Passy and the Place de Trocadero with tram service to central Paris.

The significance of the site was heightened by the Trocadero Gardens directly across the street and by the Champs-de-Mars across the Seine. They had been the sites of major exhibitions; thus Perret's building would face directly towards the place where major architectural monuments of the nineteenth century stood-- one of which is, of course, the Eiffel Tower (Fig. 4.8). Its direct affrontation to the exhibition grounds and to the whole of Paris, as two important symbols of modern times,' implies his contribution to the continuation of that tradition as a twentieth-century equivalent in terms of concrete and modern engineering.[1] More specifically he may have bought the site because it was so exiguous (Fig. 4.9) that its low cost would make a good real estate investment. But it seems more likely that there were more personal reasons. His father was getting older (he died in 1905) and its south-east orientation and the Trocadero Gardens across the street were well suited for a retirement residence. The tramline on Rue Franklin made the trip into Paris fast and easy and certainly was good for the family business. It was probably a combination of these personal reasons as well as the significance of the site that made it so attractive.

Another factor which had a major influence on the form of the building was the by-laws of 1902. The way in which Perret manipulated the laws was rather ingenious. The middle portion of the building sits back and allows all rooms a window on the street thus obviating the need for an interior court yard. According to the laws of

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more desirable since most had westerly winds and the pollution would not affect the air but rather flow in the other direction

[1] Bressani, *Rationalism and the Organic Analogy in Fin-de-Siecle Paris,* p. 62

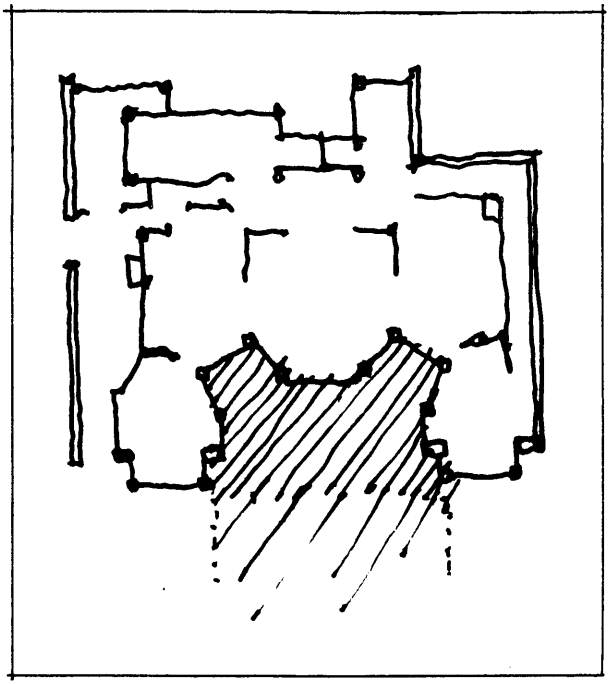

Fig. 4.10: Virtual courtyard in front of building.

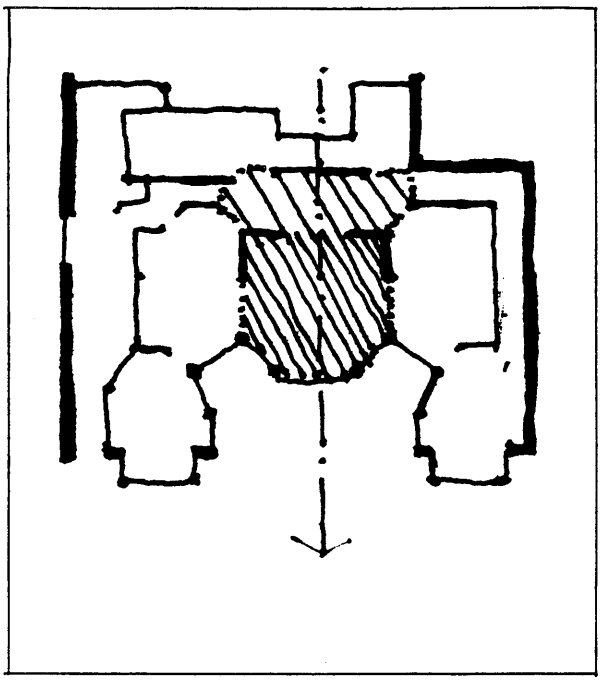

Fig. 4.11: Diagram of the salon *and its relationship with the city.*

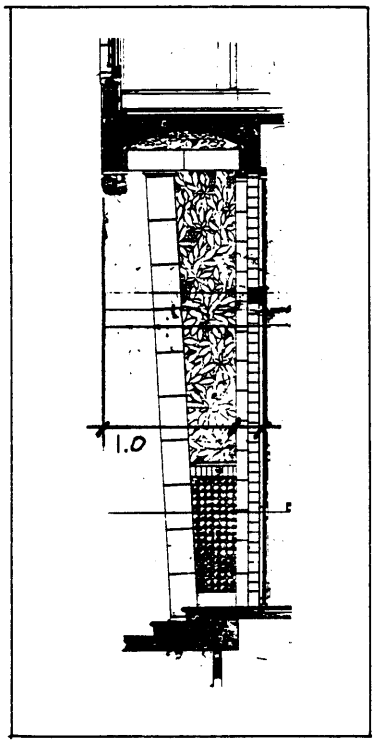

Fig. 4.12: Section at Gabarit superieur.

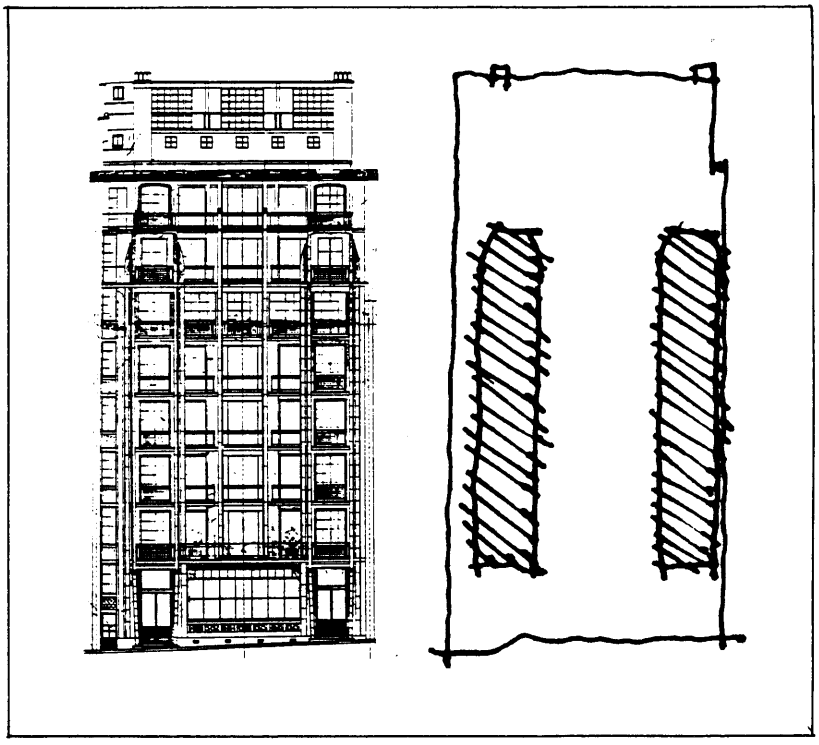

Fig. 4.13: Projecting bays as 1/3 of elevation.

1902, the courtyard couldn't have been any smaller than 56.66 square meters. On a site which is only 196 square meters that was a significant portion. By essentially placing the courtyard at the front, which measures only 18 square meters, he saved nearly 40 square meters *per floor* (Fig. 4.10). Consequently, the most important room of the apartment -- the salon -- takes on a completely different position with respect to the typical floor arrangement. It no longer is locked into the center of the flat, but rather sits on axis with the city, while harboring itself with the projecting bays on either side (Fig. 4.11). Article 22 allowed, on streets that were 20 meters in width, that at the *gabarit inferieur* (the lower portion of the building up to four meters from the ground), the main entrance was not to exceed .5 meters and above the *gabarit inferieur* no more than 1 meter; both of which Perret followed exactly. The slanted portion of the entry goes to exactly .5 meters and the bays project exactly 1 meter (Fig. 4.12)[1]

Article 22 specifies that the surface of the building which projected beyond the *gabarit superieur* was limited to 1/3 of the total area of the upper portion of the elevation. The two projecting bays constitute exactly 1/3 of the total (Fig. 4.13). But he had to limit the projection of the left bay because article 22 decreed that "laterally and at the extremities of buildings, projections shall be limited by a vertical plane at 45 degrees to the plane of the alignment and starting at 25 cm. from the party line, a measure taken at the alignment."[2]

The building's section follows closely to the specified projection and heights. As Bressani states, "The legal building line -- in a section drawn at the top of the building -- which was determined by a half circle of a radius of half the width of

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[1] *Ibid.*, p. 80

[2] *Ibid.*, p. 80

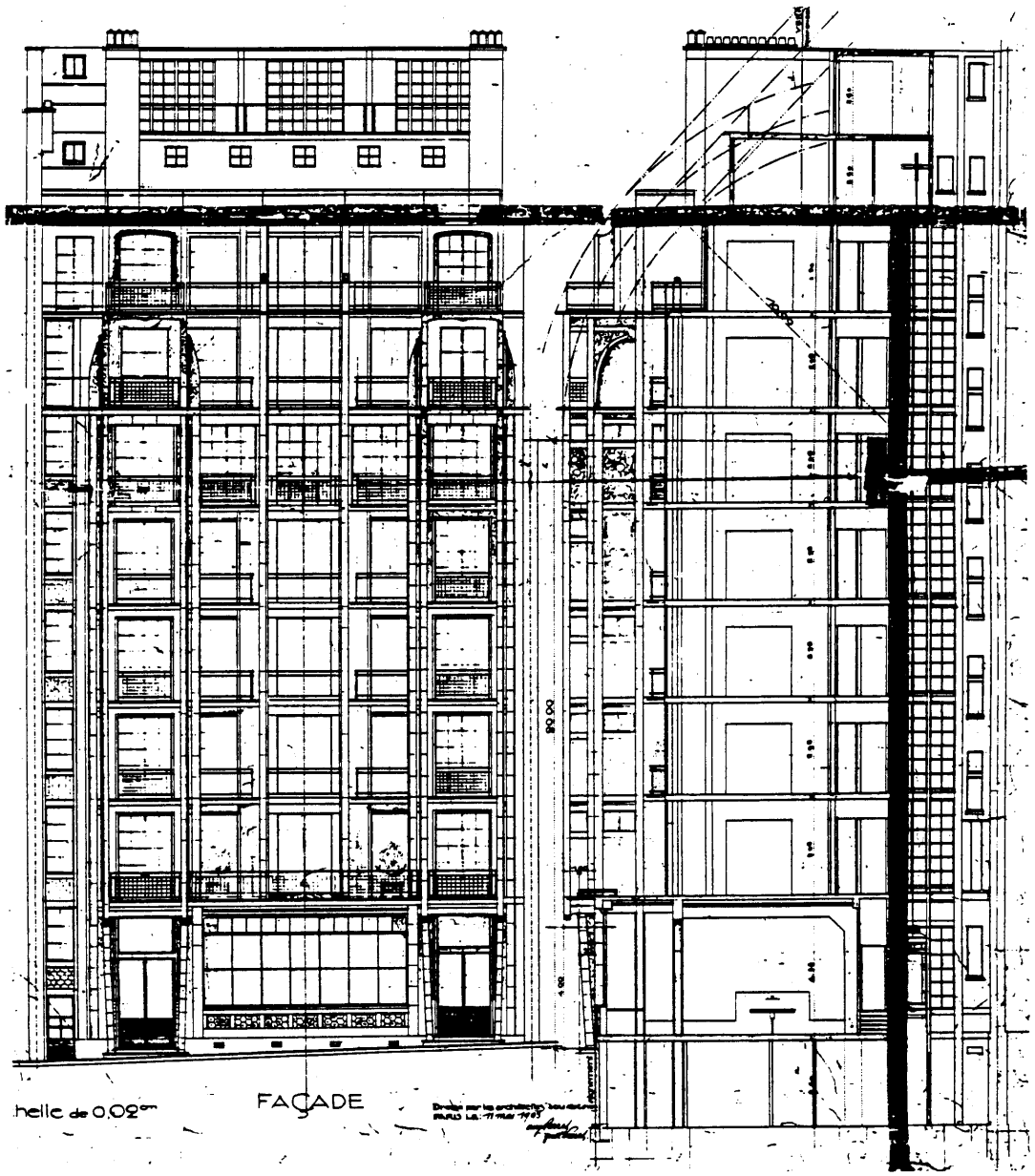

Fig. 4.14: Elevation and section showing 1902 by-law limits.

the street, starting at a height equal to the width of the street. Fig. 4.14 shows that the curved section at either side of the bays on the sixth floor follow the curvature of the building line exactly. The sixth-floor loggias are also in close accordance with the building line, since only a non-enclosed structure could be rejected in line with the bay below. The exterior wall of the building itself had to be recessed following the limit set be a half circle projecting 1 meter further than the main building line. Similarily, the limit for the decorative projections at the top of the bays followed a third half circle, projecting 2 meters further out from the main building line, starting at the point of junction between the curve and a vertical line projecting from the outer edge of the bay (Fig. 4.14).[1] From Fig. 4.14 one can see that the eighth and ninth floors projected illegally outside the building line. Originally they were not part of the design, or at least not part of the design submitted for building permit application. But at the request of the city hall, drawings were submitted to the city inspectors, but only after the penthouse was already built. It seems that Perret had been covering up all along and had not wanted the city to block the erection of the building. The consequences were small as he was granted a variance and paid the small fine of sixteen francs.[2]

Partially dictated by the by-laws, the terraces became, for Perret, an important part of the whole. They were a relatively new architectural element as a way of enjoying the city: it was, in a way, the dawning of a new part of buildings in a post-elevator age (Fig. 4.15).[3]

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[1] *Ibid.*, p. 81

[2] *Ibid.*

[3] After the invention of the elevator, the tops of buildings (because of light, air, and views) became the most desirable places to live.

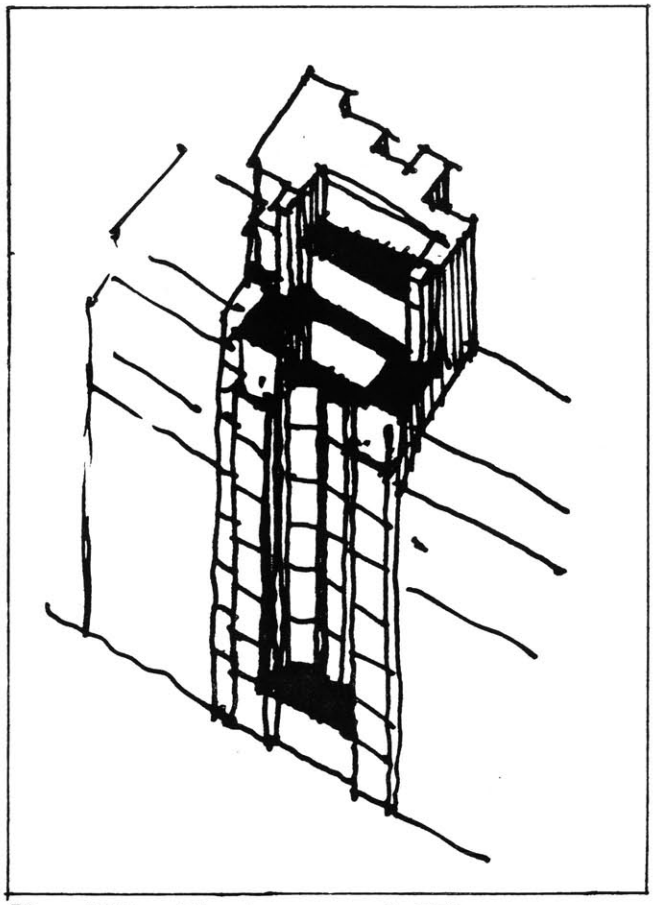

Fig. 4.15 : The terraces of 25b.

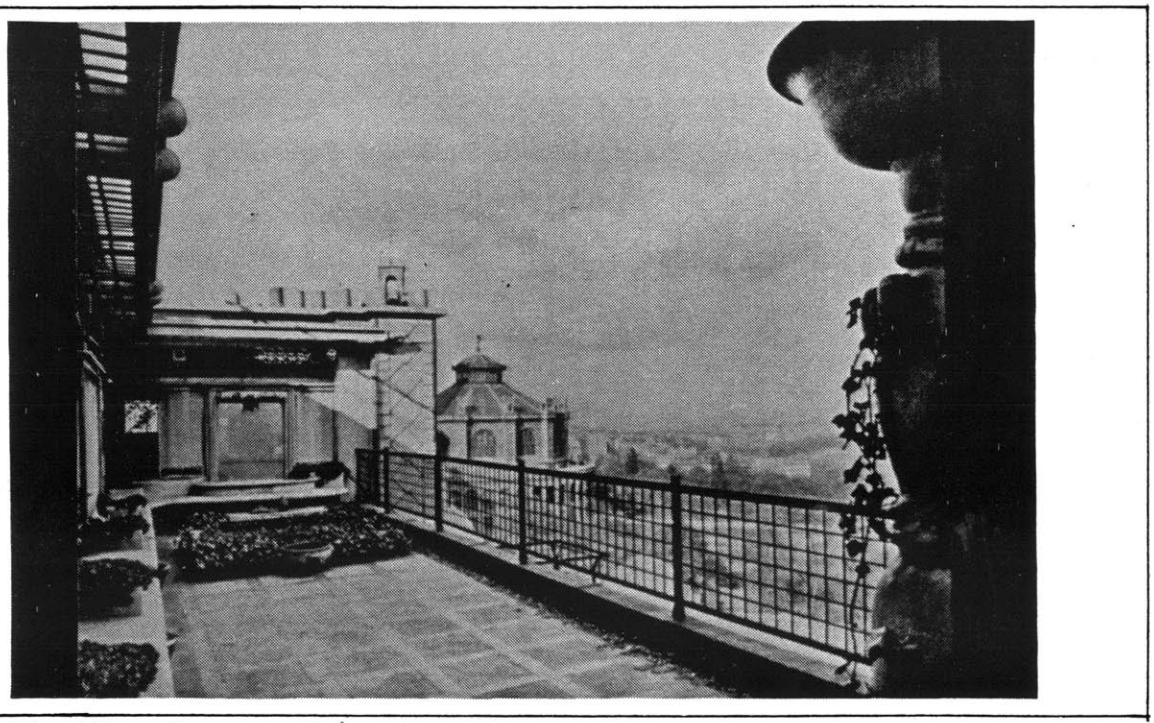

Fig. 4.15 : View from penthouse terrace.

It is these two factors -- the unique characteristics of the site and the by-laws of 1902 -- that Perret recognized, and in a way, exploited. His response to them makes the building particular to that specific place and deeply roots the building in time and place.

The project was designed by April or May of 1903. Construction was started the in summer of 1903 and ended in the first half of 1904, with occupation sometime in 1905. As finally designed it had eleven distinct levels from the basement to the ninth floor penthouse, measuring 33 meters above the ground. Seven stories immediately above the ground floor were used for apartments-- one apartment per floor. All are typical except the sixth and seventh floor which were recessed to respect the legal building line (Fig. 4.14).

The building tells one story by offering an understanding of its parts and uses by way of surface modulation, and repetition/change of its vocabulary. The repetition of the vocabulary from the first through sixth floors tells the viewer that they are of a similar configuration and therefore probably of similar use. The change at the ground floor, to a maintained street line and much larger area of glass indicate a commercial space. The two uses of the building -- residential and commercial -- are reinforced by the two main doors. The eighth and ninth floors, although it is debatable whether they are part of the original design, are completely different in terms of both vocabulary and configuration from that of the typical apartments below; the eigth floor was servant's quarters and the ninth floor penthouse was designed to be maintained within the Perret family. This tripartite division gives the building an implied classicist character (although fundamentally different from the typical apartment buildings of that time in Paris). However, these parts are by no means separate. They can be read in many different ways. Fig. 4.16 shows the overlap of various readings

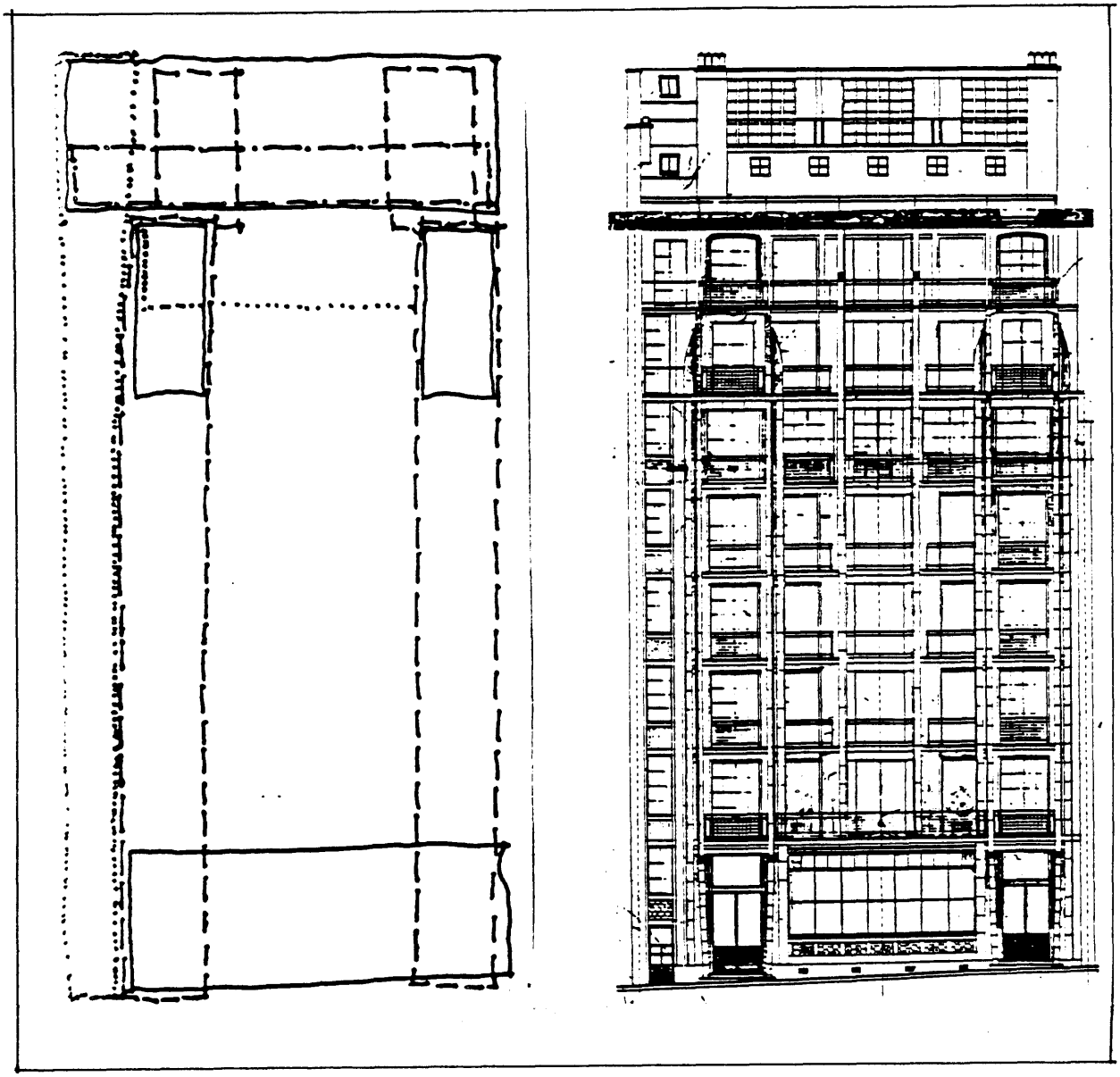

Fig. 4.16 : Overlap of various readings of elevation.

possible. So, although the parts tell their own story, they are somewhat separate where different people can see them in different ways or various relationships simultaneously.

The debate surrounding French Rationalist theory of the nineteenth century is the milieu that, in many ways, the 25b embodies. It was a difference in attitude represented simply by the *Ecole* and its emphasis on composition on the one hand, and a group of more radical architects concerned with the reform of architecture through consideration of modern techniques on the other. It is significant that Perret was exposed to both positions, through Gaudet and Viollet-Le-Duc. Guadet's influence on Perret has already been discussed and its significance should not be diminished, but on closer inspection it becomes clear that it was Viollet-Le-Duc and the "ultra-rationalist" branch of theory that had the most formative impact on 25b.[1]

As Bressani points out there are three aspects that align the 25b with the "ultra-rationalist" position: first, Perret's choice of concrete is clearly an attempt to embrace modern materials and technique in a reformist manner, one which would not be possible with the "conservative" attitude of the *Ecole;* second, the absence of any classical motifs, (the Orders, cornices, mouldings etc.), was a break from Guadet's doctrine (although it should be pointed out that the elevation and organization are classical in an implicit way); and third, the elevational expression was a manifestation of one of Viollet's most central ideas-- that the building should present a structural argument.[2] The affinities with Viollet are particularly strong in the case of the 25b. The expressed frame is directly related to Choissy's characterization of Gothic as an architecture of rib-work and infill. The attenuated articulation of the columns gives a

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[1] Collins, *Concrete,* p. 155

[2] Bressani, *Op Cit.,* p. 171

vertically soaring feeling akin to that of Gothic structures and in particular, the small bosses pendent at the entrance way all sway the fine balance of Perret's position, in this particular case, to Viollet-Le-Duc.

The French Rationalist tradition and its embodiment of the Graeco-Gothic ideal dates back as far as the seventeenth century, the common thread through the subsequent years being the role of structure in architecture. Without digressing into a long discussion of French Rationalism and the Graeco-Gothic ideal, and at the risk of oversimplification, it will suffice to say that with Perret's role as a continuator of this tradition, he adopted the frame as a synthesis of the Gothic and Classical traditions. The articulation of structural support from the enclosing infill became the touchstone of his career.[1] He firmly believed in the formative qualities of structure over the arbitrary nature of abstract form and thus once again realigns himself with Viollet-Le-Duc in a general way. As Collin states, "It was Auguste Perret's great achievement to perceive that it could only be by proportioning and refining *structure,* as opposed to arbitrary and alien veneers, that a true architecture of concrete could be created..."[2] For Perret it was on the ultimate primacy of structure that his entire doctrine is based. He felt that unless the frame was ordered, fully expressed and articulated the essential tectonic qualities of architecture would be lost. He states:

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[1] It is interesting to note that technology similar to that of reinforced concrete was developed to carry out the precepts of Laugier at Ste. Genevieve. "...the key monuments of the Graeco-Gothic ideal in the eighteenth-century, such as Perrault's eastern facade for the Louvre, and Mansart's chapel at Versailles, or Gabriel's *Hotel de la Marine* had incorporated similar systems of reinforced masonry. It is as if the emergence of the French rational tradition had been concurrent with the first germ of the idea of reinforced concrete." *Ibid.,* p. 144

[2] Collins, *Concrete,* p. 185

Fig. 4.17 : Commercial shop at street level.

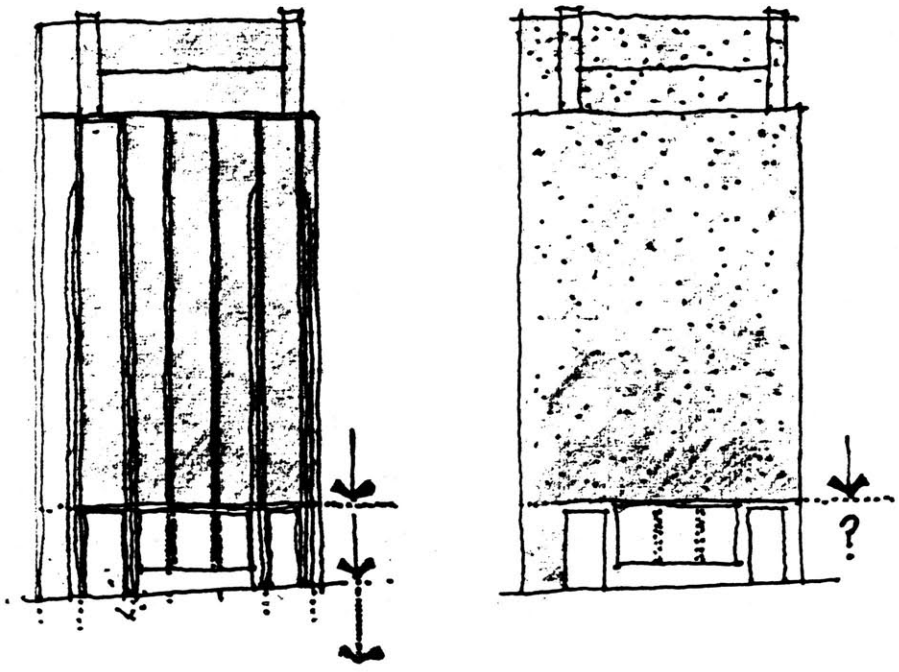

Fig. 4.18 : Transfer of forces: stone veneer and frame.

"The skeleton of a building is similar in function to that of an animal. Just as the animal's rhythmed, balanced and symmetrical skeleton contains and supports organs of diverse form and arrangement, so the skeleton of a building should also be rhythmed, balanced, composed and even symmetrical and should be capable of containing all the various organs demanded by the program. This is the very basis for architecture. If the structure is not worthy to remain visible, the architect has badly fulfilled his mission."[1]

Viollet's advocacy of the Gothic was based in its logic of structure. Its validity was its "expression of function dialectically-- to offer a visible argument to the viewer"; where the expression of function means the clear presentation of the structural means, and the visible argument thus becomes a structural argument. This is very similar to the "telling of a story" referred to throughout this thesis.

The reason why Perret expressed the structural frame by way of the enclosure probably has to do with the rationalist tendencies of providing a structural argument: the building telling its own structural story. The articulation of the frame on the exterior by the tiles indicates how the building stands: one can sense the transfer of forces to the ground. The structural argument is even indicated by the alignment of the window mullions with the structural frame (Fig. 4.18). In this way, Perret resolves the fundamental narrative contradiction of a stone veneer building hovering over a largely glazed commercial shop (Fig. 4.17). As it divided into a middle section of typical residential units, upper penthouse units and one main commercial level, the argument had to be offered on the exterior if it was to offer an understanding of the whole. Also Perret might have expressed the frame on the exterior in order to make known his use of concrete. Perret continually tried to identify himself as one of the

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[1] *Ibid.*, p. 213

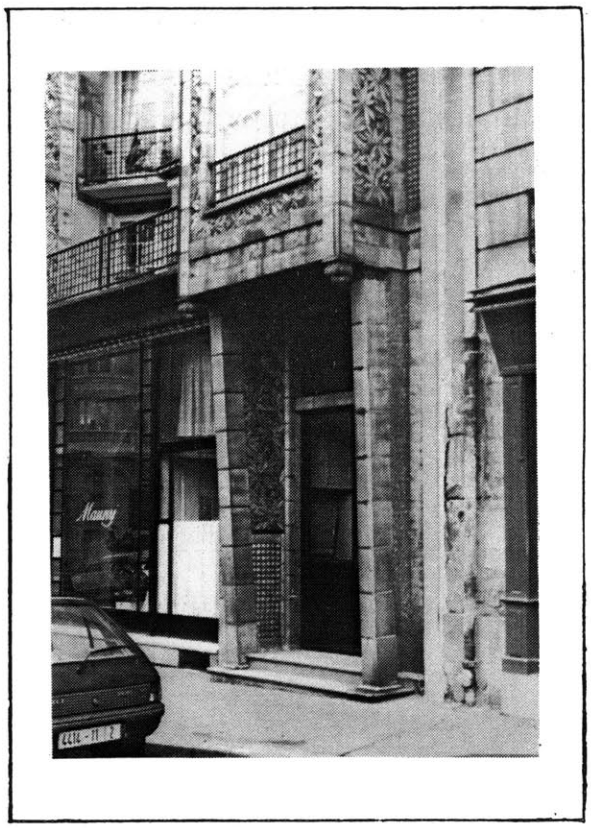

Fig. 4.19 : Entry at 25b.

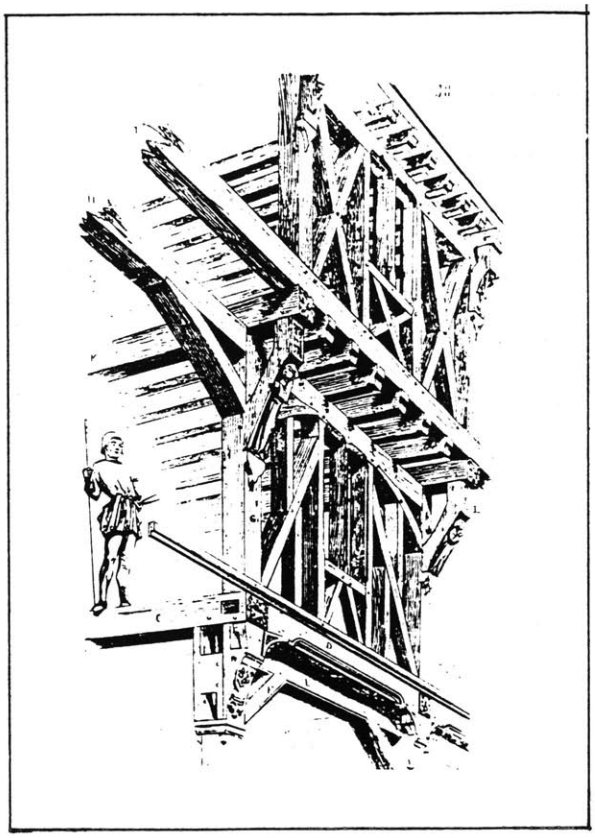

Fig. 4.20: Medieval half-timber urban house. Viollet-le-Duc. 1863

first to use concrete architecturally and if the building had been a veneer, this would not have been apparent.

Perret's source for the frame-infill system originated in the theoretical discussions of the eighteenth-century, in which the development of reinforced concrete was immanent. The frame had an inherent rationality regardless of context. It is most important to understand that, for Perret, the frame-infill system was a model for architecture that transcended the material used. In fact, the affinites between wood and concrete were immediately apparent to Perret. His term for a frame -- *charpente* -- is directly related to the French word for carpenter -- *charpentier.*[1] In fact, much of the vocabulary of the building is derived from wood buildings. Although the concrete beams had the capacity to cantilever, the two inclined members visually support the projecting bay above; the pendent bosses projecting down from the corner of each projecting bay allude to traditional wood details. Both examples allude directly to similar forms in medeival architecture (Fig. 4.19 & 4.20). Perret believed that concrete gained its qualities from that by which it is formed. The use of wooden formwork gave the appearance of a timber frame and thus also related its final form and appearance to the constructional process. Moreover, it could be said that it has similar qualities to wood in that it can resist tensile stress and has a fibrous nature (due to reinforcing).

The structural frame of the building, as demarcated on the building's surface by the tiles, presents an argument even more emphatically where at the sixth floor loggia the basic structural unit becomes completly disengaged from the building. The dialectic of frame-infill is emphasized by the juxtaposition of the only two curvalinear forms of

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[1] It is interesting to note that in Semper's *Vier Elements,* one of the elements being the roof and supporting structure, corresponds to the trade of carpentry and the more narrow defintion of tectonics.

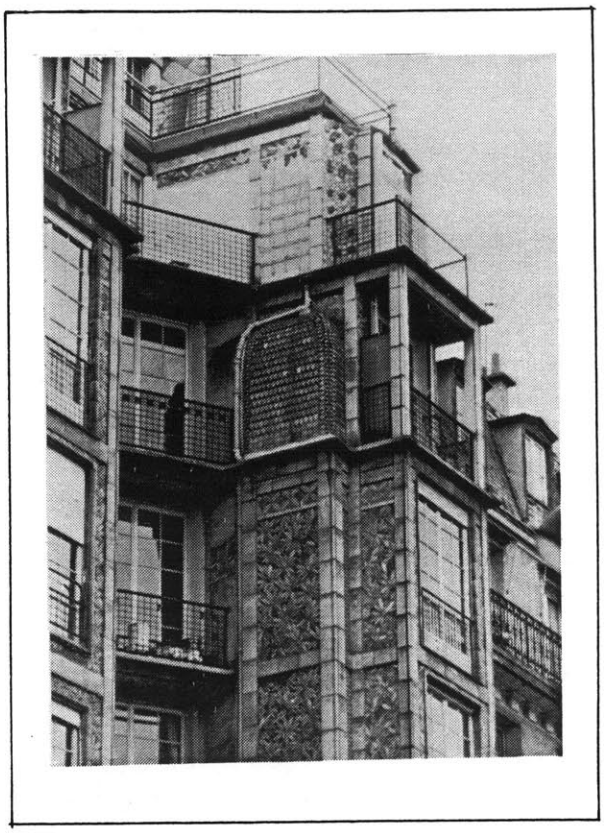

Fig. 4.21 : Projecting bay at 5th, 6th and 7th floors of 25b.

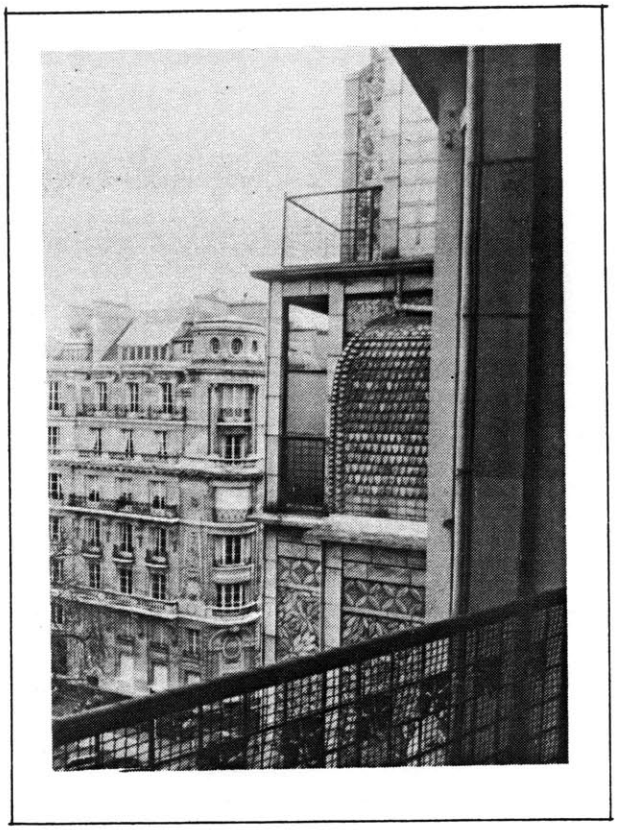

Fig. 4.22 : View out salon *of 6th floor apartment.*

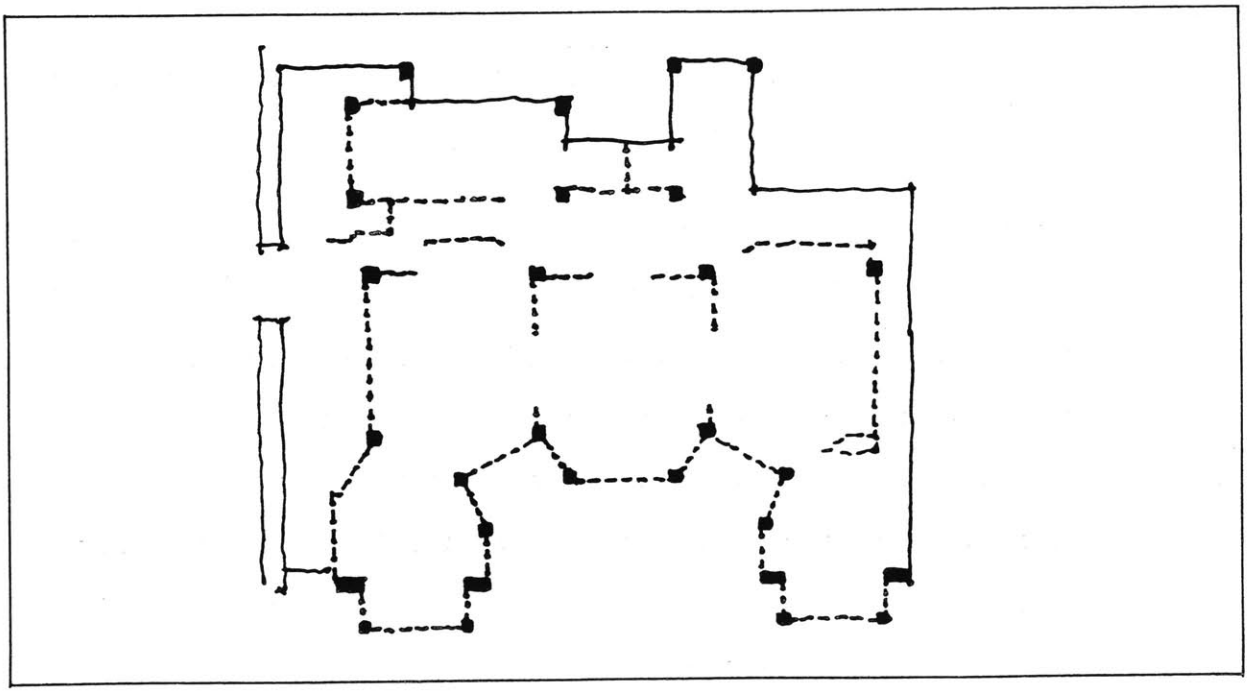

Fig. 4.23 : Columns as space definers.

the building with the frame, at the very point where the frame disengages. The curvalinear section on the seventh floor directly above the sixth floor loggia, as well as the bulbous forms emerging from the sides of the sixth floor projecting bays, clearly assert their own quality distinct from that of the frame (Fig. 4.21 & 4.22).

It is with the fundamental change of attitude toward structure due to the capabilities of concrete -- the change from load bearing wall to point-support columns allowing the independence of structure and enclosure -- that the building attains tectonic significance. The columns, on the interior, are used to define the spaces: at the corner of each space there is a column (Fig. 4.23). In a way, they "stake out" the space, and the partition walls run from one column to the next as needed for definition. Although the columns never stand in isolation and always occur as part of a partition wall, they nevertheless are present. It is important to note exactly how the partition walls come into the columns. Perret uses this very basic syntactic relationship as a means to express the inside/outside relationship of the use spaces. The wall always adjoins the column with the outside edge flush, creating an inside and an outside where on the inside the columns are visible as well as articulating the corner (Fig. 4.24 & 4.25).

The application of stoneware tiles is, in this case, the presentation of the building's argument. Their use and differentiation are perhaps a quintessential example of representation in tectonics. As stated earlier Perret's father had little faith in the material; consequently the execution of the frame was placed in the hands of a sub-contractor. Being in the unusual position of designing a building which someone else would build and unsure of concrete's ability to resist moisture penetration, Perret decided to sheath the entire building with stoneware tiles assuring two things: a high quality presentable building finish; and the maintained integrity of the reinforcing bars,

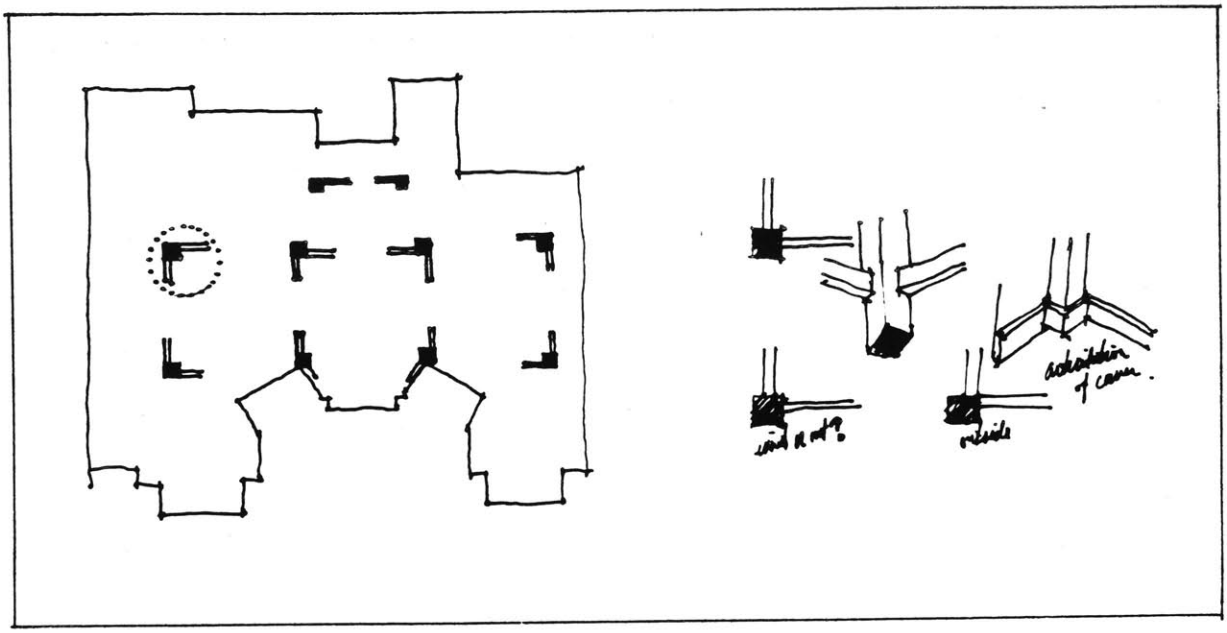

Fig. 4.24 : Column/wall relationship indicating inside/outside of the more important rooms and articulation of the corner.

Fig. 4.25 : View of salon *in 6th floor apartment showing corner articulation.*

which with poor workmanship or permeable concrete might otherwise have decayed.[1] Using stoneware tiles to face a building is not of particular importance in and of itself as it was nearly common practice at that time,[2] but the importance in this case is that they were not used as a kind of wrapping paper enveloping the whole building, but rather as an element that could help present the structural argument of the building. He used two types of tile, each meant to express the tectonic function of what it was to clothe. One was a plain flat tile which was applied only to the lines of the concrete structural skeleton; the other an organic pattern of chestnut leaves, (designed by Perret), to only those surfaces which were a-structural infill of the frame (Fig. 4.26).

The presentation of the structure in tile as frame-infill does not mean that there is a kind of transparency through which the structural layout is revealed in totality. Since Perret was covering the whole surface with tile it allowed him to disregard the great disparities of structural sizes. The standardized size of the plain tiles lent a certain homogeneity and coherence to the whole which if otherwise represented literally would appear less cohesive. However, when there was a great disparity between the structural member and the size of the representing tile, in several places he introduced a third type of tile, geometrically more abstract yet not plain, to differentiate it from the simple infill (Fig. 4.27 & 4.28). So Perret is, in effect, clothing the structure, and when he can't represent it as an exact reflection of the true size he does provide some understanding of the differences-- the presentation of the argument from which to read the structural layout.

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[1] Collins, *Concrete,* p. 181

[2] It goes back to at least 1874 where they were used as form liners. *Ibid.,* p. 103

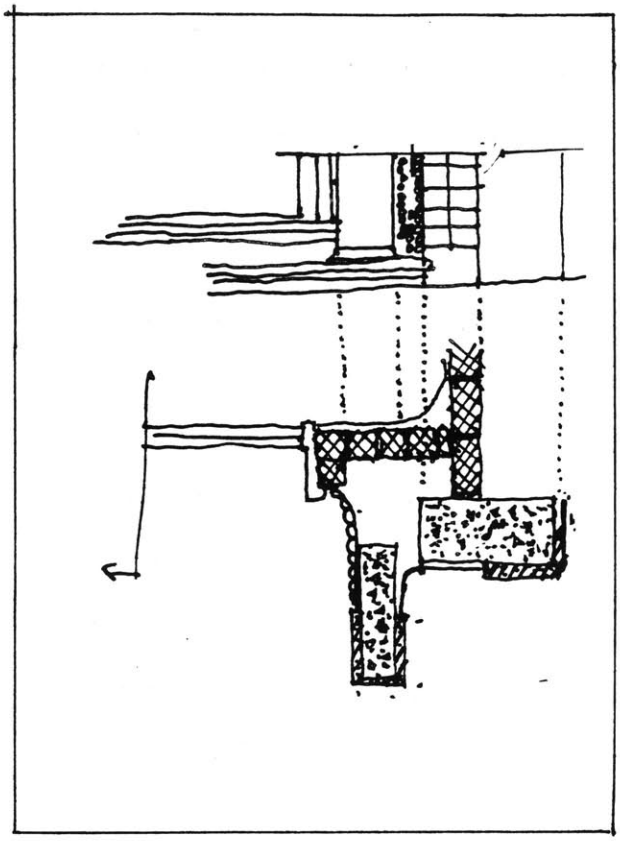

Fig. 4.27:

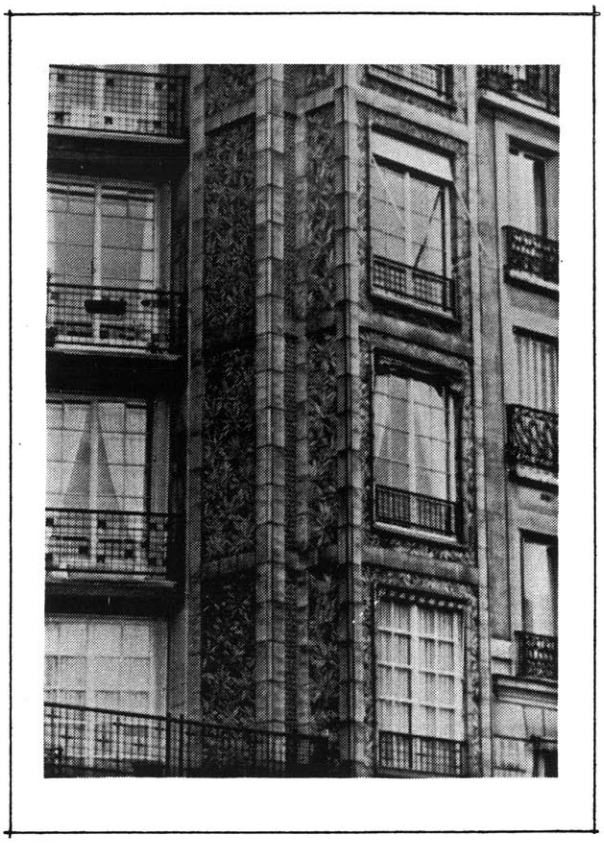

Fig. 4.26 : Representation of frame-infill by stoneware tile.

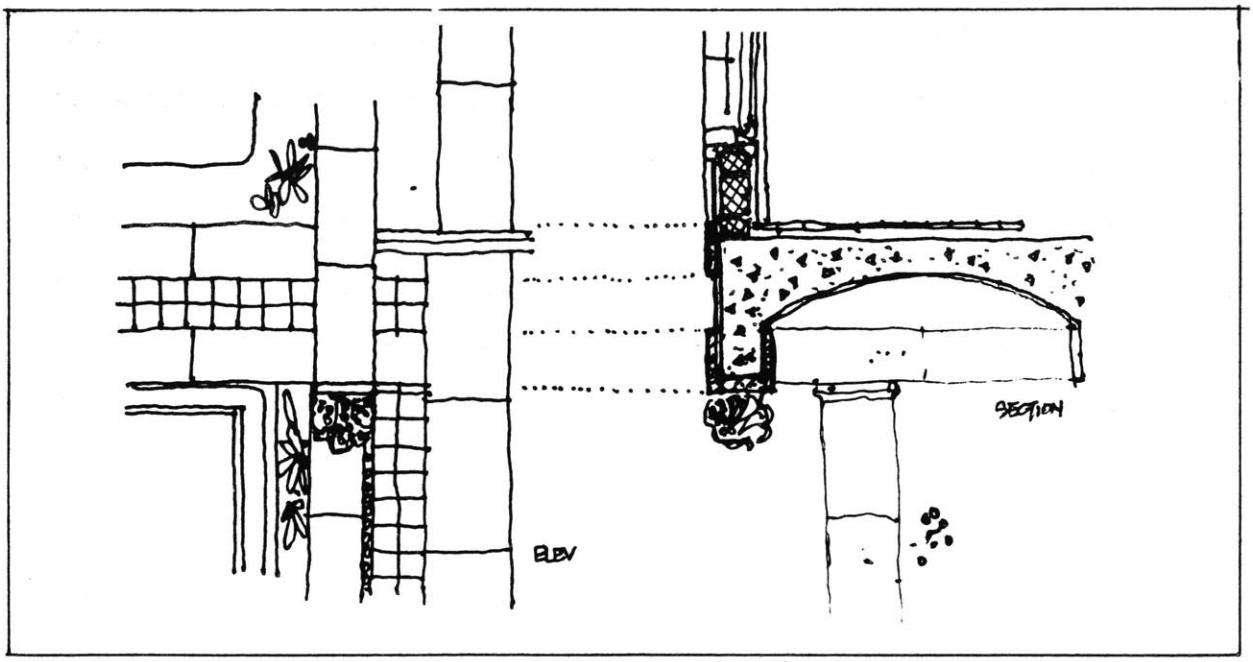

Fig. 4.28 : Diagrams of structure and various types of tiles.

Perhaps, one of the most interesting aspects of the building is the relationship between its services and the use spaces. In a way, it anticipates the full expression of services as will be discussed with the Richards Labs, yet still retains an organization which is classical in nature. This is indicative of Perret's position in history: he, at once, coalesces many nineteenth-century concerns as well as being a kind of springboard for the twentieth century. The more honorific spaces -- foyer, salon, side rooms and bedrooms -- are arranged symetrically, and inserted into the plan form. The services, are in effect, the *poche* between the two (Fig. 4.29). This places extreme importance on the foyer as the link between the two: the place from which the whole layout of the living spaces unfolds (Fig. 4.30). But, in terms of services, it is significant that the service zone -- stairs, kitchens, *concierge* apartment -- is expressed on the facade at all. Although one could say it is not really an integral part of the elevational composition, it nevertheless is clearly expressed (Fig. 4.31).

The debate surrounding concrete had raged for over thirty years by the time Perret used it at 25b.[1] A new age had dawned partly due to new structural methods, the industrial revolution and the prevailing anti-academic attitude, and somehow a new architecture was needed to express it. The question of what concrete's qualities are and what form it should take was a central issue and, one could say, is still an issue even today. The debate gradually changed from its relation to technique to its inherent aesthetic problems. Thomas Potter in his book on concrete technology of 1877 stated:

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[1] For a more complete discussion of the development of concrete see Collins, *Concrete.*

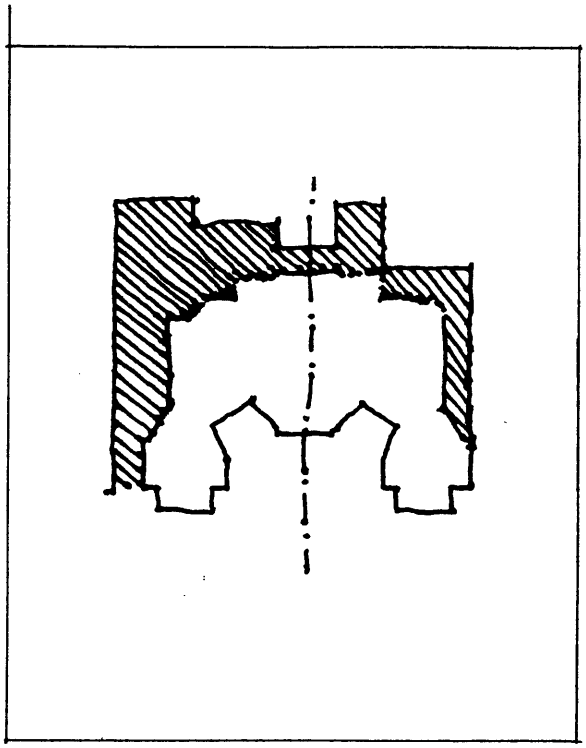

Fig. 4.29 : Service as poche.

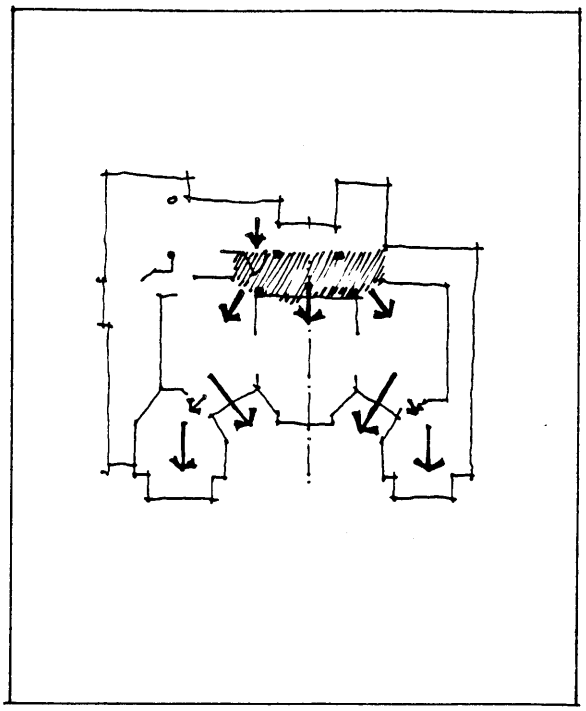

Fig. 4.30 : Apartment layout unfolds from foyer.

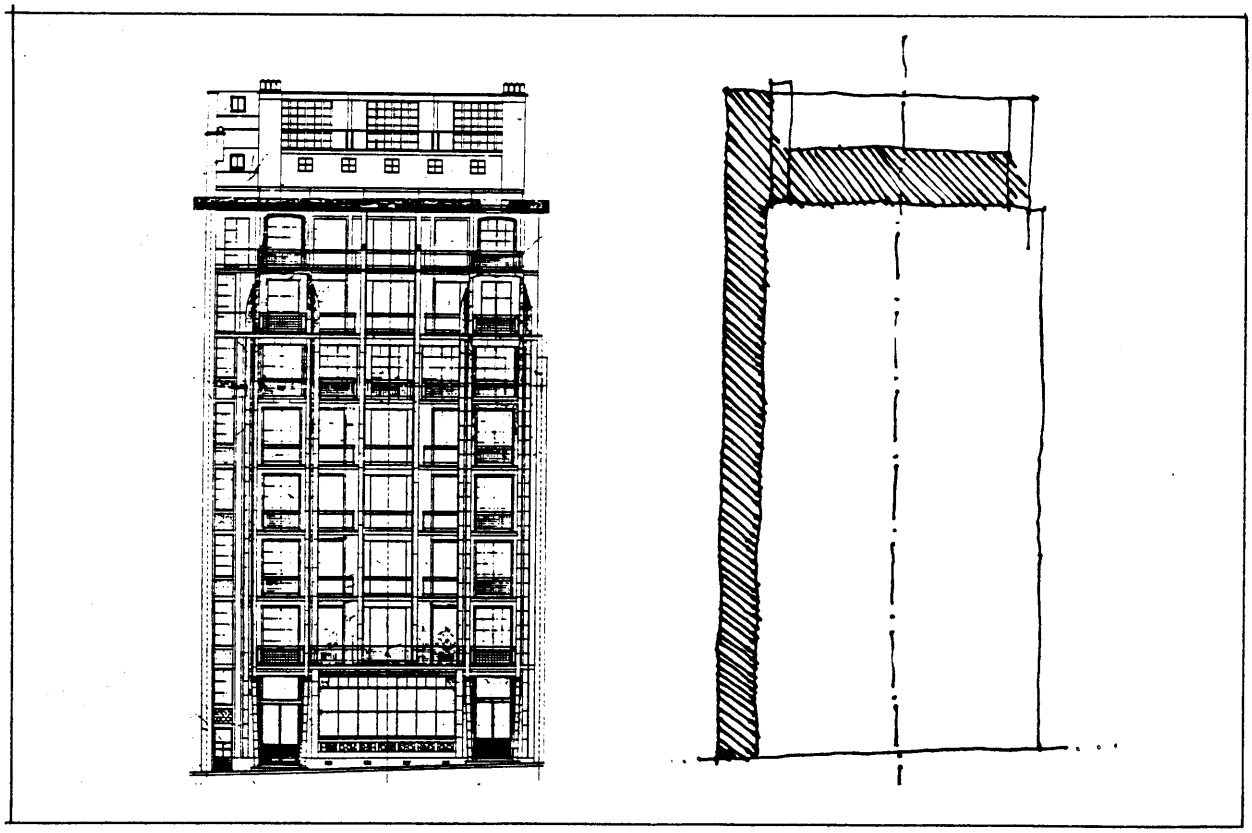

Fig. 4.31 : Service as part of the facade.

"the later opposition to the use of concrete has resolved itself almost entirely into the question of aesthetics. The doubts about strength, durability, and other essential qualities have given way to nearly the only remaining important difficulty, viz., how to treat it in such a way that shall be reasonable and consistent, without imitating any other material, and without pretense of being something totally different from what it really is."[1]

Ruskin and his colleagues were equally indeterminant; "as material was to be made to look like any other material and although the critics had not the slightest idea as to what concrete should look like, they were unhesitant in condemning anyone who make it look like anything at all."[2] The fact that concrete is a conglomerant, and that its inherent qualities were only the relative slenderness of construction, monolithic continuity and its natural texture, made it difficult to discuss in aesthetic terms. The problem then was not to discover, but to determine the appropriate architectural expression for concrete.

In general it seemed to follow that since concrete had no specific inherent qualities, its form and characteristics should be derived from its mold, for it takes its shape only after it is poured into form work. For Perret, as discussed before, the recognition of the formwork as the generator of its form dictated a framed structure akin to wood. The concrete frame is so commonplace today, that Perret's determination that its true structural form was the frame (as a synthesis of Classicism and Gothic traditions) seems not so revolutionary. But it must be considered with respect to the turn of the century sensibility-- a time when theorists continued to talk of it either

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[1] Potter, *Concrete,* p. 5

[2] Collins, *Concrete,* p. 100

as a substitute for masonry or as a material capable of anything.[1] Two sources were influential in determining the appropriateness of the frame: Choissy's *Histoire* and Paul Christopher's book on the Hennibique system, *Le Beton* (Fig. 4.4).[2] The first provided the precedents of classicism and the second provided the technical information required to make such a form in concrete feasible.[3]

Why Perret decided to use concrete at 25b is not entirely clear. Perret seemed to be fascinated with the material and its possibilites, as he had wanted to build the casino at Saint-Malo (1899) entirely out of reinforced concrete.[4] But it seems that his father, having little sympathy for the material, did not allow it as it would require collaboration with a sub-contractor for most of the structural work. The constriction of the site may have been a factor, but it probably had to do more with Perret's interest in the new material, as concrete was seen by many as the material of the coming age. Beyond these general implications, the most important specific one, with respect to the effect of concrete on the building's form, is the internal structural system: the substitution of slender point supports for massive load-bearing walls. For Perret it seemed a logical extension of the structural system, with the advantages of

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[1] The confusion is exemplified by the fact that in Paris in 1902 there were no less than five well known ways of using concrete: "conventional," which did not call attention to its novelty; "futuristic," which was an ostentatious display of concrete's unusual potentials especially those that had never been seen before; "skeletal," in which the nature of the material was shown by way of a reinforced concrete frame; "plastic," used by designers who had succumbed to the *Art Nouveau* aesthetic; and lastly "veneered," which covered the facade with another material. Collins, *Concrete,* p. 179

[2] Frampton, *Modern Architecture: A Critical History,* p. 105

[3] The influence of Choissy has been discussed. Hennebique's development of concrete technology was an essential prerequisite to Perret's work. He had experimented with columns, beams and slabs. With the introduction of iron stirrups as a bonding agent of the top and bottom of the beam, and the bending up of iron rods at the point of supports, he developed a comprehensive system which was patented in 1892.

[4] Collins, *Concrete,* p. 175

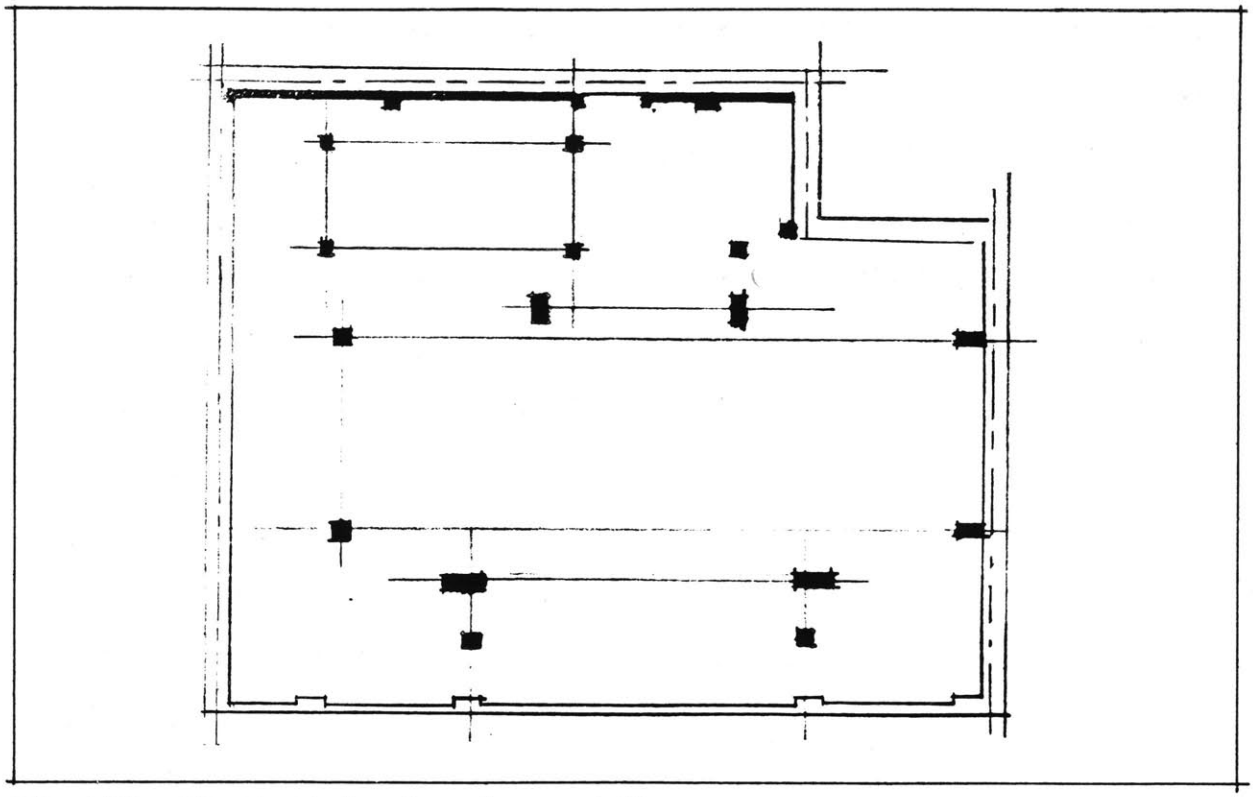

Fig. 4.32: Structural drawing of ground floor.

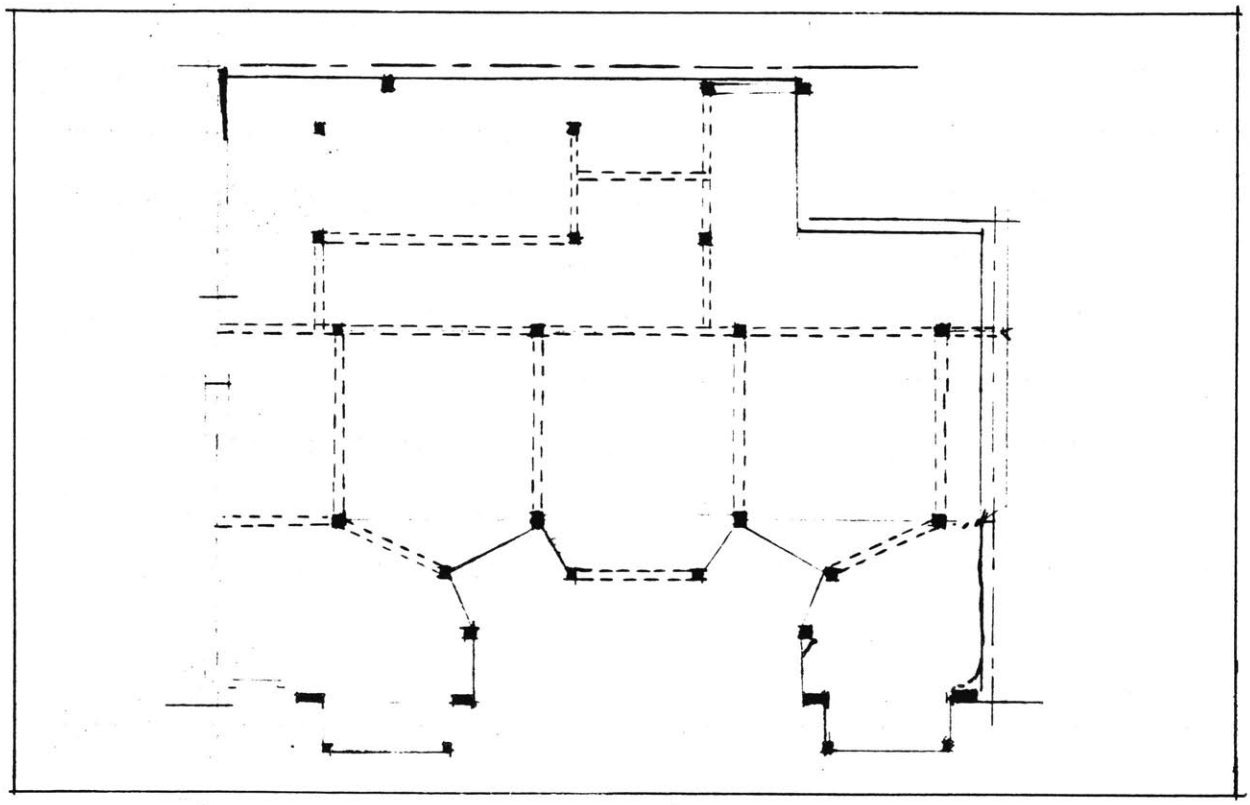

Fig. 4.33: Structural drawing of upper floor.

increased floor area, easier intercommunication between rooms and the freedom to move impermanent, thin screens around independently of the structure. For the up and coming generation of architects, it proved to be the genesis of a completely new spatial order which resulted from the freedom gained by the independence of the partition and structure.[1] This is exemplified by the way Perret changes the structural module from widely spaced piers at the bottom two levels, to a more slender, closely spaced structural module corresponding to the basic configuration of the apartment rooms (Fig. 4.32 & 4.33). The wider piers at the bottom allow for maximum uninterrupted floor area, presumably for maximum flexibility of the ground floor shop to adapt and change use as required. Where the configuration was more determinant and the use more stable, closely spaced columns allowed for smaller dimensions and a closer fit with the probable position of the partitions and thus a less obtrusive presence.

The 25bis Rue Franklin clearly embodies many tectonic attributes. The emphasis on structure, the use of contemporary materials and construction processes, the clear expression of the parts of the building, all add up to a highly tectonic piece of architecture. The building serves as a good example of a piece of architecture defined as a "thing." As stated before, "things tell stories; they tell about their own making, they tell about the historical circumstances by which they were made." Most certainly 25b is telling a story: one understands its making as a frame of articulated elements with infill panels between; that the acceptable levels of propriety and the quality of concrete technology were such that would not allow direct exposure of the concrete

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[1] *Ibid.*, p. 183

frame; that the tile was applied afterward, as was often done then, yet maintining some relationship with what it covers.

As the thing-ness of a thing is determined by what it gathers, it is evident that the 25b is deeply rooted to its time and place. The building is clearly conscious of itself and its circumstance. Its characteristics are inherent to either itself or the place. The surface modulation of the facade is specific to constrictions of the site and the by-laws of the time; the affrontational quality of the building form stands on the hill at Passy looking out over the city; the break-down of the building mass at the top allows for a newly discovered element from which to view the whole city-- the terrace; the expression of the structural frame is a self-referential quality emphatically stating its own structural story; the use of the chestnut leaf motif in the infill panels is an obvious reference to the chestnut trees of the Trocadero Gardens directly across the street; the varying vocabularies refer to its own life in terms of use; the materials of concrete and stoneware tiles are indicative of the time the building was built-- as the threshold between an accepted veneer vocabulary and a newly emerging material not yet ready for full exposure. In these points it is easy to see how the building as a thing gathers its world. It talks to us revealing and concretizing its own general circumstances as well as its own qualities making a particular thing.

It is clear that Perret was trying to establish the integrity of the building in a rational manner through a strongly imposed order. Simultaneously he was trying to establish a relationship between the building and its context-- physical, social, political, economic etc. In this respect its significance resides in its deeply rooted relation to itself and historical circumstance.

Certainly the Graeco-Gothic ideal, and subsequently the French Rationalist legacy he inherited seemed to almost dictate projects of particular tectonic significance; however,

through the whole of his own career, it was his engagement with the act of *construction* and his belief in the future of concrete that combined to result in such tectonically significant architecture.

The Richards Medical Research Laboratories

The architecture of Louis I. Kahn can be seen as a synthesis of the principles of the *Beaux Arts* tradition on the one hand, and modernity on the other. It is perhaps because of the struggle with, and integration of these two aspects that he attained such significance, albeit late, in the development of twentieth-century architecture. His reference and use of history was always distilled: it was never surface appearance or superficial application. Yet at the same time his work not only comes to grips with, but utilizes modernity through the process of its own integral realization. The influences of his *Beaux Arts* training can be seen primarily in the spatial hierarchy and the geometrically controlled building organizations; while modernity can be seen revolving around constructional issues, both of which are synthesized into a kind of modern monumentality.

Kahn was trained at the University of Pennsylvania which, at the time, was considered the best Architecture School of the French *Beaux Arts* tradition.[1] His training, like Perret, was based on the theories of Viollet-Le-Duc, Choissy and Gaudet, where a masonry architecture of palpable structure was typical. It was Paul P. Cret, who was trained at the French *Ecole* and came to the States in 1905, whom Kahn considered his master. Kahn was apparently a conscientious student who had, by comparison, learned the academic lessons well. He traced and adopted forms from the archetypical academic books: Letarouilly, D'Espouy, Gaudet.[2] The teaching method was based primarily on that of Choissy where the spaces are highly symmetrical and defined by solid structure, the influence of which can be seen throughout his career.

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[1] Scully, *Louis I. Kahn,* p. 12

[2] *Ibid.*

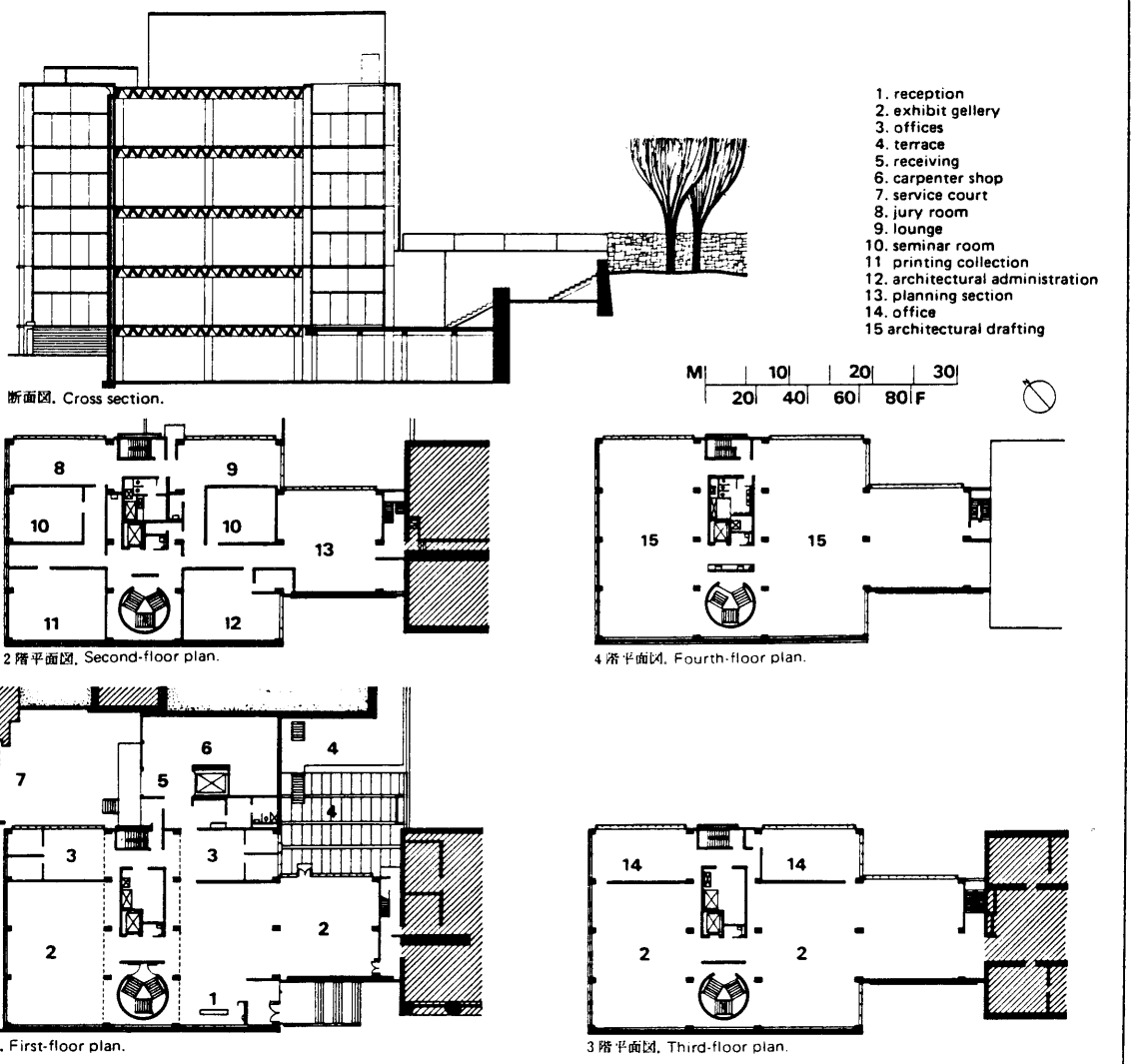

Fig. 4.34 : Plan of Yale Art Gallery, New Haven. Kahn. 1951

It was probably this academic training that prevented Kahn from being a more significant figure earlier in his career. In 1924 he had entered an architectural milieu that was not sympathetic to the lessons he had learned. What was later to be labeled "The International Style" by Johnson and Hitchcock, promised to be the architecture of the future; issues of lightness, maximum thin-ness in the solids, fluid spaces and non-structural enclosure were foreign to the *Beaux Arts* sensibility. For over twenty years he struggled with those concerns. He was known only to his colleagues and his students at Yale and it wasn't until he was over fifty that he was able to reconcile his own convictions and the architectural milieu with, one could say, the construction of the Yale University Art Gallery in 1951 (Fig. 4.34).

He emerged at a time when architecture was ripe for such an integration-- the objectivity and break from historical precedent of the modernist era was proving to be illusory, yet modern structural systems, materials and constructional processes were here to stay. His temperament and training provided a potent combination that enabled him to struggle successfully with one of the most profound issues of the modern era-- the reconciliation of a building's image as a cultural object and its construction with modern building materials and techniques.

The whole of Kahn's career could be characterized, at the risk of oversimplification, by his dogged search for intrinsic order. For him it was a complex search that embodied both the physical and meta-physical; ranging from the explicit order of structure, to the order of being; the rational and irrational; tangible and intangible; measurable and unmeasuarable. He believed that order is intrinsic and not primarily a product of the subjective human perspective, yet allowing for unimaginable variation. He states:

"Order is not repetition. It is a central idea. An architect's sense of order is like a composer's sense of music; it has nothing to do with counterpoint or orchestration. It is something underneath and beyond these elements of style. It is something beyond design. *The elephant and man are different designs. But the same order created them."*

He stressed, however, that the realization of order does not dictate beauty; using the examples of the dwarf and Adonis illustrated that the same order had created very different things.

At a meeting on education at Princeton in December 1953 he advanced what he called his "order-design" thesis. It was, at that point, an undeveloped thought describing a linear design process from the abstract to the concrete. It was the basic law of nature, (human nature also), on which the whole world was based. He spent the next several years trying to define order more explicitly until finally in 1955 he stated with confidence and simplicity that *Order is.* He states:

Order is
Design is form-making in order
Form emerges out of a system of construction
Growth is a construction
In order is creative force
In design is the means -- where with what when with how much
The nature of space reflects what it wants to be
Is the auditorium a Stradivarious
or is it an ear
Is the auditorium a creative instrument
keyed to Bach or Bartok
played by the conductor
or is it a convention hall
In the nature of space is the spirit and the will to exist a certain way
Design must closely follow that will
Therefore a stripe painted horse is not a zebra.

Before a railroad station is a building
it wants to be a street
it grows out of the needs of street
out of the order of movement
A meeting of contours englazed.
Thru the nature -- why
Thru the order -- what
Thru design -- how
A form emerges from the structural elements inherent in the form.
A dome is not conceived when questions arise how to build it.
Nervi grows an arch
Fuller grows a dome
Mozart's compositions are designs
They are exercises of order -- intuitive
Design encourages more designs
Designs derive their imagery from order
Imagery is the memory -- The Form
Style is an adopted order
The same order created the elephant and created man
They are different designs
Begun from different aspirations
Shaped from different circumstances
Order does not imply Beauty
The same order created the dwarf and Adonis
Design is not making Beauty
Beauty emerges from selection
affinities
integration
love
Art is a form making life in order -- psychic
Order is intangible
It is a level of creative consciousness
forever becoming higher in level
The higher the order the more diversity in design
Order supports integration
From what the space wants to be the unfamiliar may be revealed

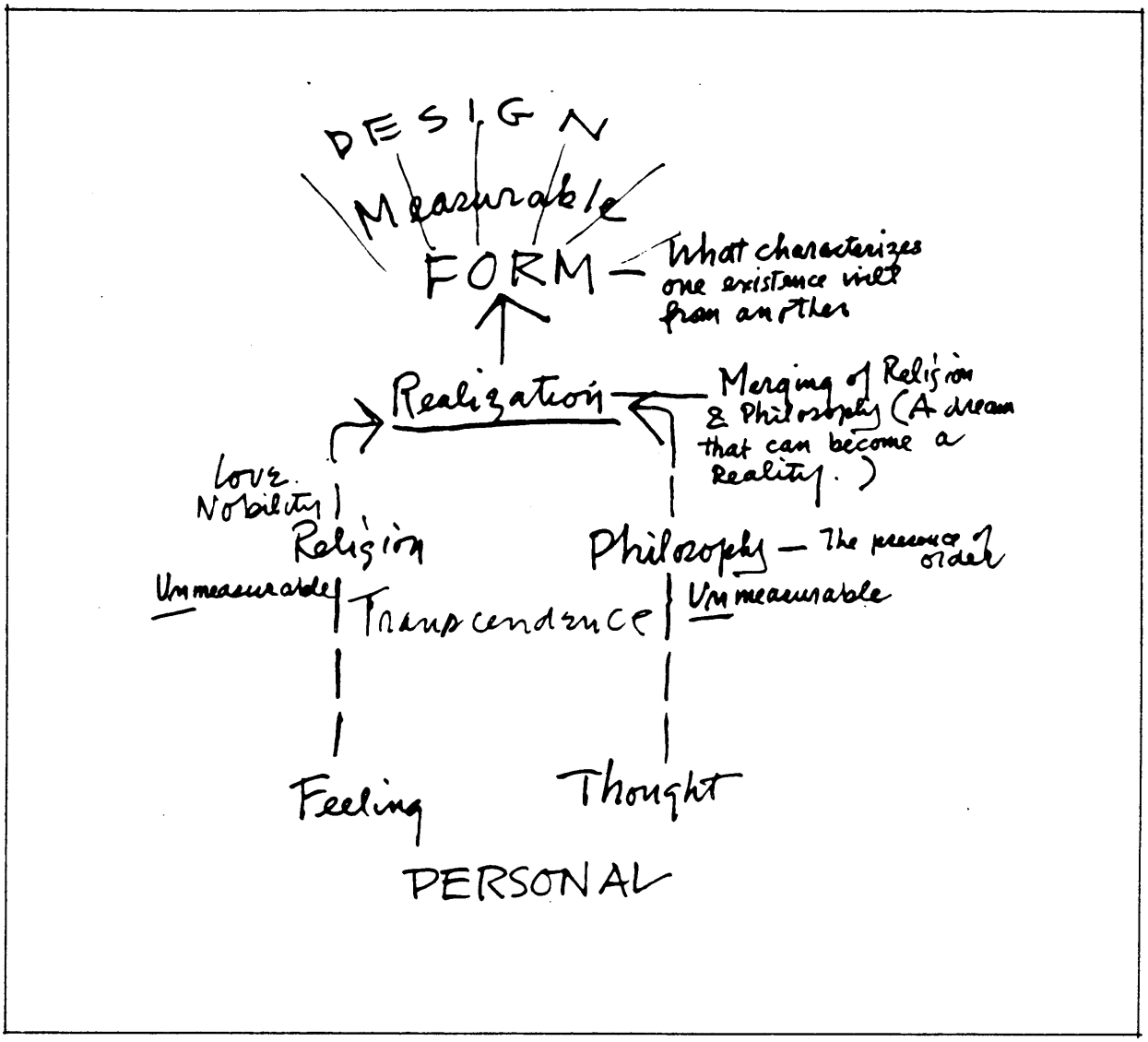

Fig. 4.35: Kahn's sketch of form *and* design. *1960*

to the architect.
From order he will derive creative force and power of self-criticism
to give form to this unfamiliar.
Beauty will evolve.

But Kahn's ideas on the design process and the art of realization came to maturity in 1959 with the introduction of the idea of *form.* The term, up to this point, had been used nebulously and without specific meaning. Although he merely substituted the word *form* for order in some passages, the two words were not congruent; the definition of order became more precise. Order, as the maker of all existence, has no existence will. Form is the realization of the existence will. So with the emergence of form coupled with his idea of design, a mature concept had evolved. (Fig. 4.35). What follows is a short discussion of his definition of *form* and *design* as they have significant tectonic implications: the tangible manifestation of intangible qualities.

> *"Existence will,* man, *become existence, through nature's law and evolution. The results are always less than the spirit of existence."*[1]

In Kahn's terms, *form* is a realization that distinguishes one thing from another. The realization is recognition of a sense of order and a sense of dream. The realization of form occurs when Philosophy (thought) and Religion (feeling) come together. In the closest rapport between thought and feeling -- the mind and the psyche -- is the source of "what a building wants to be." The realization of form has no specifics, it is a timeless conception at the deepest level of unconsciousness. It is coming to a deep revealing understanding of a sense of order and of dream. It is the realization of nature having no presence and exists only in the mind.

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[1] Tyng, *Beginnings,* p. 72

This particular part of Kahn's philosophy was probably based on Schopenhauer:

> *Every glance at the world, to explain which is the task of the philosopher, confirms and proves that* will to live *far from being an arbitrary hypostasis or an empty word, is the only true expression of its innermost nature. Everything presses and strives towards* existence, *if possible* organized existence, *i.e.* life *and after that to the highest possible grade of it. In animal nature it then becomes apparent that* will to live *is the keynote of its being, its one unchangeable and unconditioned quality."*[1]

It is important to understand that to Kahn form was intangible and impersonal. For any form diagram there are many design possibilities; through the permutations of a design, the form diagram may remain the same. It is the "what" of architecture and is primarily concerned with the metaphysical issues of existence.

Design, on the other hand, Kahn considered to be the "how" of architecture. It is the tangible presence of form, concerning itself with the physical nature of things; the specifics of shape, size, material. It is circumstantial in that it deals with the building site, budgets, clients, architect etc. In short, it is the *presencing* of *existence;* the means by which one brings something into being which the form seems to indicate. On the relation between the two, Kahn states:

> *To begin is the time of belief in form.*
> *Design is the maker that serves this belief.*
> *To build is action from a sense of order.*
> *When the work is completed the beginning must be felt.*
> *Form is the realization of inseparable characteristics.*
> *Form has no existence in material, shape or dimension.*

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[1] Schopenhauer, *The World as Will and Idea,* Vol. III p. 107

A design is but a single spark out of form;
It is hard to talk about a work when it is done.
You feel its incompleteness.
I recall the beginning as Belief.
It is feeling as religion, and thought as philosophy.
Then there is no material no shape no dimension.
And then I recall the adventure of design when dream-inspired
Form must answer to the laws of order so as to be.
One feels the work of another in transcendence -- in an aura
of common-ness and in Belief.[1]

The potency of this relationship between form and design is the combination of the physical nature and meta-physical nature of a thing -- its existence and presence -- as two aspects inextricably synthesized. Kahn describes it, in the art of building, as a transformation from the unmeasurable (determination of the form), to the measurable (design), to the unmeasurable (their synthesis). He states:

> *"A geat building, in my opinion, must begin with the unmeasurable, must go through measurable means when it is being designed and in the end must be unmeasurable. The design, the making of things is a measurable act. In fact at that point, you are like physical nature itself because in physical nature everything is measurable, even that which is yet unmeasurable, like the most distant stars which we can assume will be eventually measured. But what is unmeasurable is the psychic spirit...a building has to start in the unmeasurable aura and go through the measurable to be accomplished. It is the only way you can build, the only way you can get it into being is when the building becomes part of living it evokes measurable qualities. The design involving quantities of brick, method of construction, engineering is over and the spirit of its existence takes over...*[2]

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[1] Tyng, *op. cit.*, p. 68

[2] *ibid.*, p. 72

This is the essential nature of tectonics; the elevation of mere physicality to something invoking a state of mind, (understanding, engagement, etc.). This is not say that with this transformation, the physical qualities are lost; on the contrary, it is by way of the physical that the meta-physical is brought into existence-- without existence there is no presence.

The relationship between Kahn's "Order, Form and Design" concept, and the discussion in part two on the revealing of the inner- and inter-consciousness of a building is interesting. Although they do not exist in a direct relationship, they are clearly concerned with the same idea-- how does one determine the characteristics of a building? The statement, "what it wants to be" implies both aspects of a "thing", that is its inner and inter-consciousness. The word "it" indicates self-consciousness, and "wants to be" (or will) indicates some level of external determination. But most importantly for the following discussion, it is how (as in "design") the inner-consciousness of a building is revealed; construction as perceptible law.

> *"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. Such habits retard the development of art. I believe that in architecture, as in all art, the artist instinctively keeps the marks which reveal how a thing was done."*[1]

The form determination of the Richards Labs seems to have resulted from two premises: first, the best place for a scientist to work was in a "studio" environment. The studio analogy resulted from a careful consideration of how scientists work -- either alone or in a small group -- yet, they need periodic contact with other colleagues. However, it is important to note that the "studio" idea was not solely

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[1] *Ibid.*, p. 59

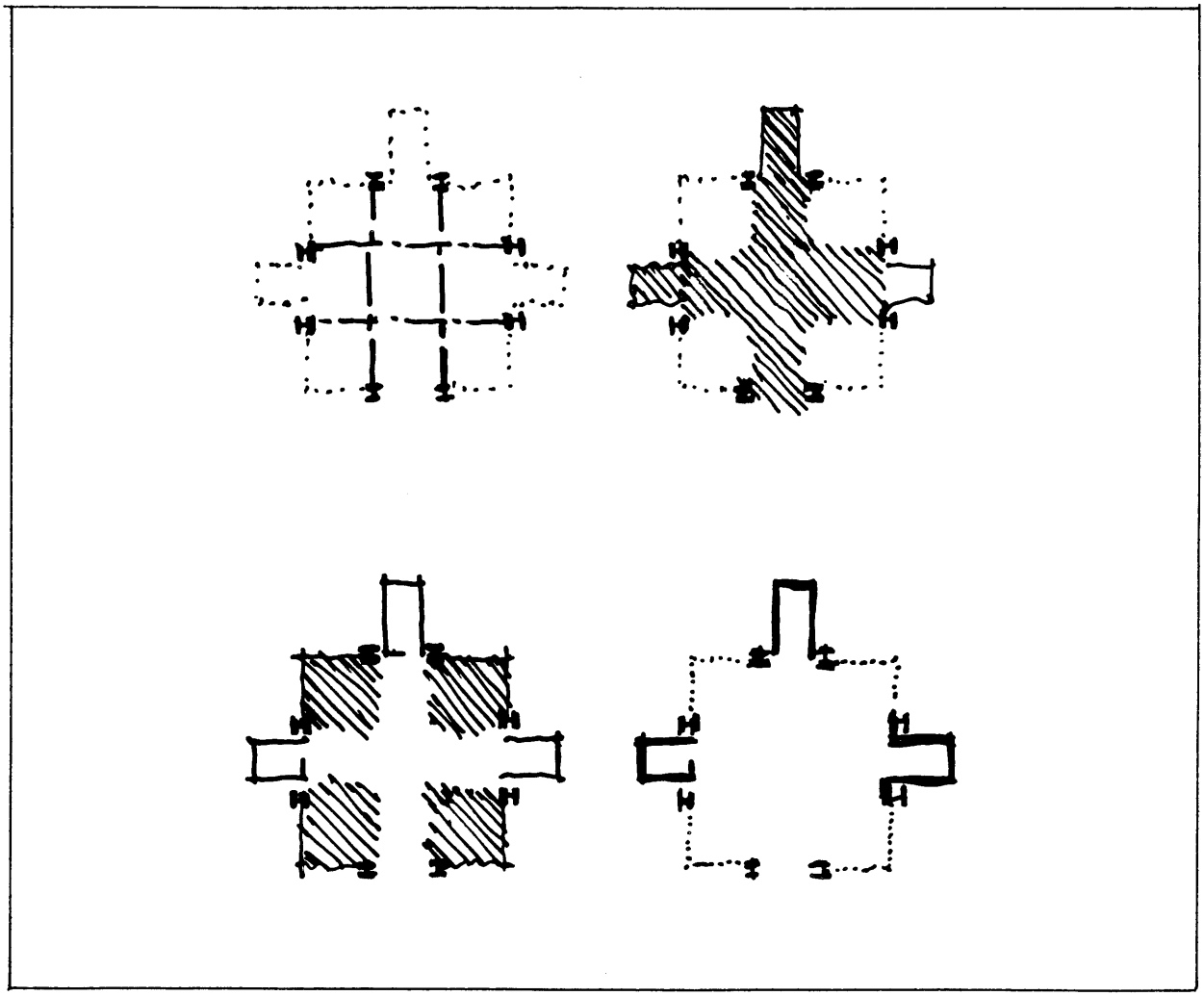

Fig. 4.36: Harmony of systems and of harmony of spaces: (1) structure; (2) light/dark; (3) use/access; (4) served/servant.

determined by form. This division of the program (and indeed invention of the program) was formed out of and was to some extent, the reason for the frame of the building. The "studio" form added force to structure, to frame and to the elements of its making, which in turn added force to the "form." This exemplifies the way in which Kahn linked form and design: not as a linear process but rather where form and design were constantly re-informing each other. Second, scientists work in a potentially dangerous environment and the services for that environment should not interfere with its use. The elimination of noxious fumes became, for Kahn, paramount. It was, in a sense, the idea of a building as an organism inhaling down low toward the more natural part of the site and exhaling high up far away from the intake. Perhaps a third form determinant was the long narrow site which by being surrounded by other existing buildings almost dictated a vertical building.[1]

The interplay of space, structure and service was also an obvious concern. The building is conceived as a revealed "harmony of systems and a harmony of spaces" (Fig. 4.20). It is the separation, coordination, and interplay of these, creating the building as a whole of discrete parts. The issue of the discreteness of parts and their relation to the whole, is one which pervades all of Kahn's career. It is important to mention the issue of the discreteness of the parts and their interplay that pervades the whole of Kahn's career.

Synthesis is a word that often is used to describe Kahn's work. Space/structure, use/service, history/modernity are said to be integrated. It is with the Richards Labs that one can see the influence of three great modern masters-- Wright, LeCorbusier, and Mies. The influence of LeCorbusier is seen, if not in the building's sculptural quality, most certainly in the compartmentalization of use as in the *Unite d'Habitation*

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[1] Anon., *Logic and Art in Precast Concrete,* p. 233

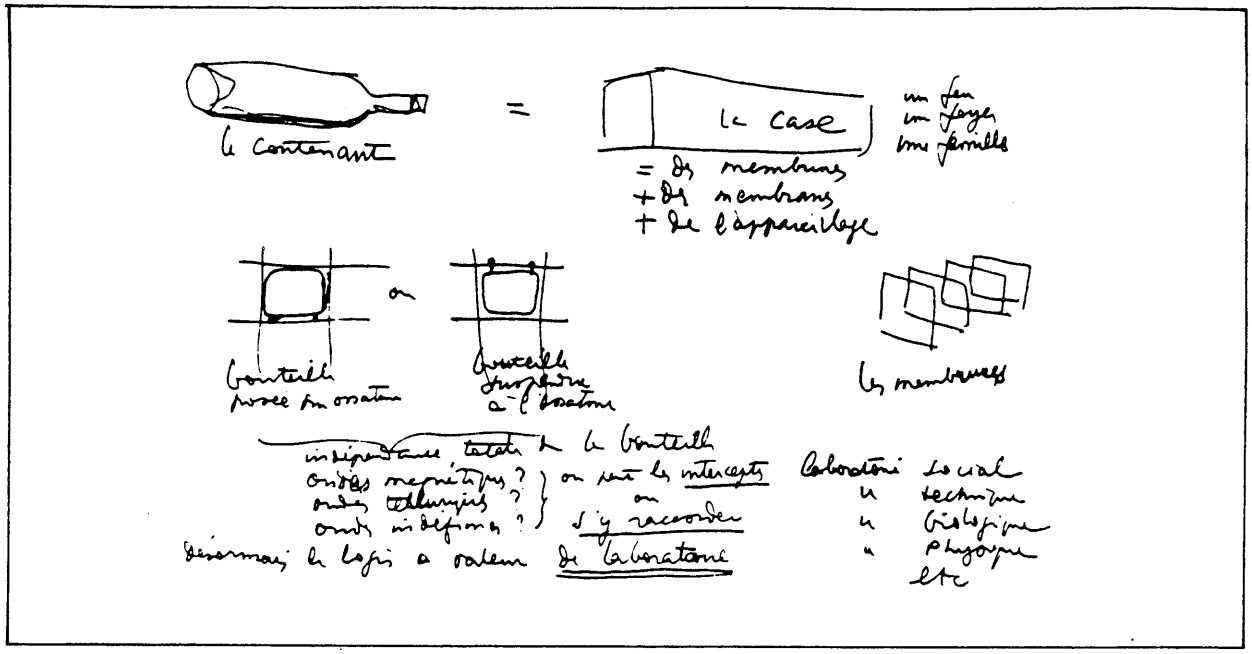

Fig. 4.37: Apartment as wine bottles in a rack. Unite d'Habitation. *Le Corbusier*

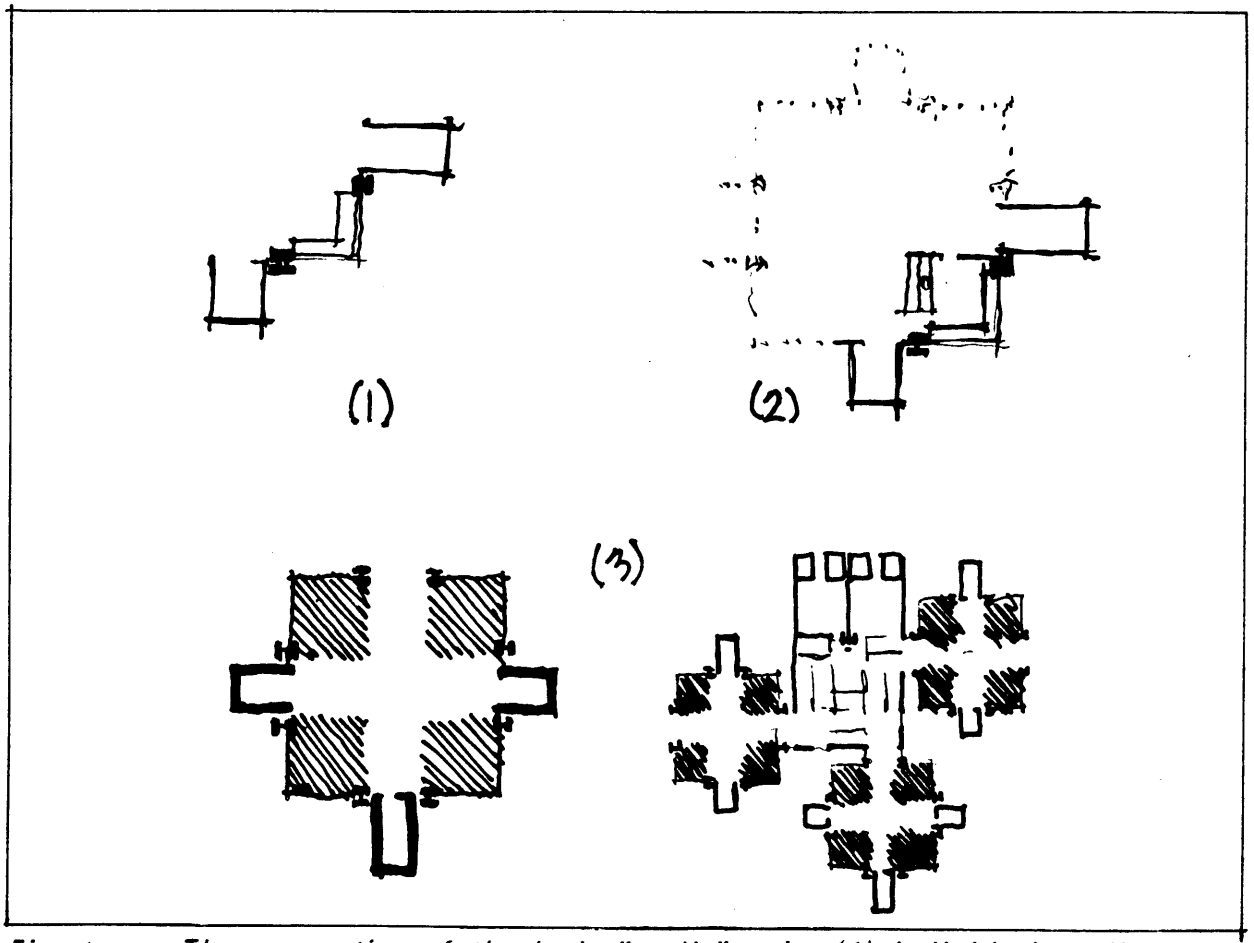

Fig. 4.38: The aggregation of the basic "studio" unit: (1) individual studio; (2) floor of studios; (3) building of floors of studios.

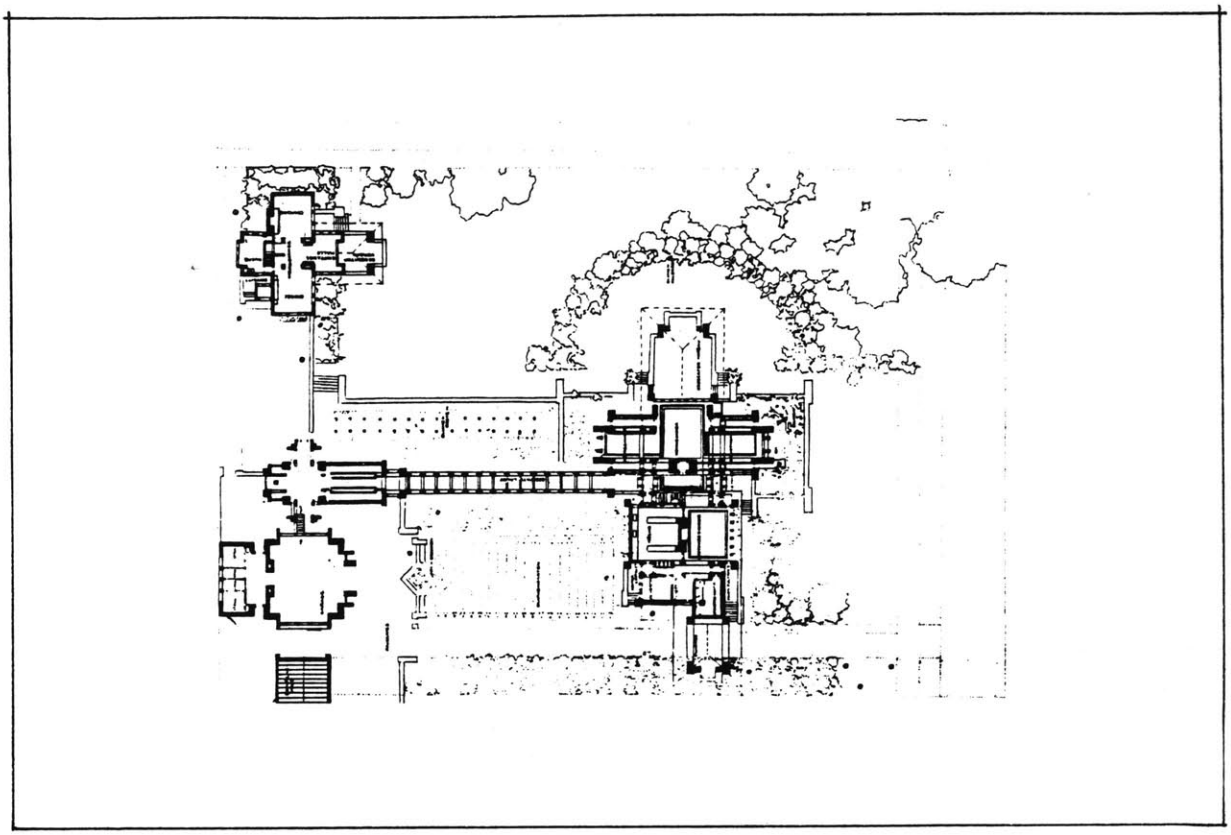

Fig. 4.39: Plan of Martin House, Buffalo. Frank Lloyd Wright. 1904

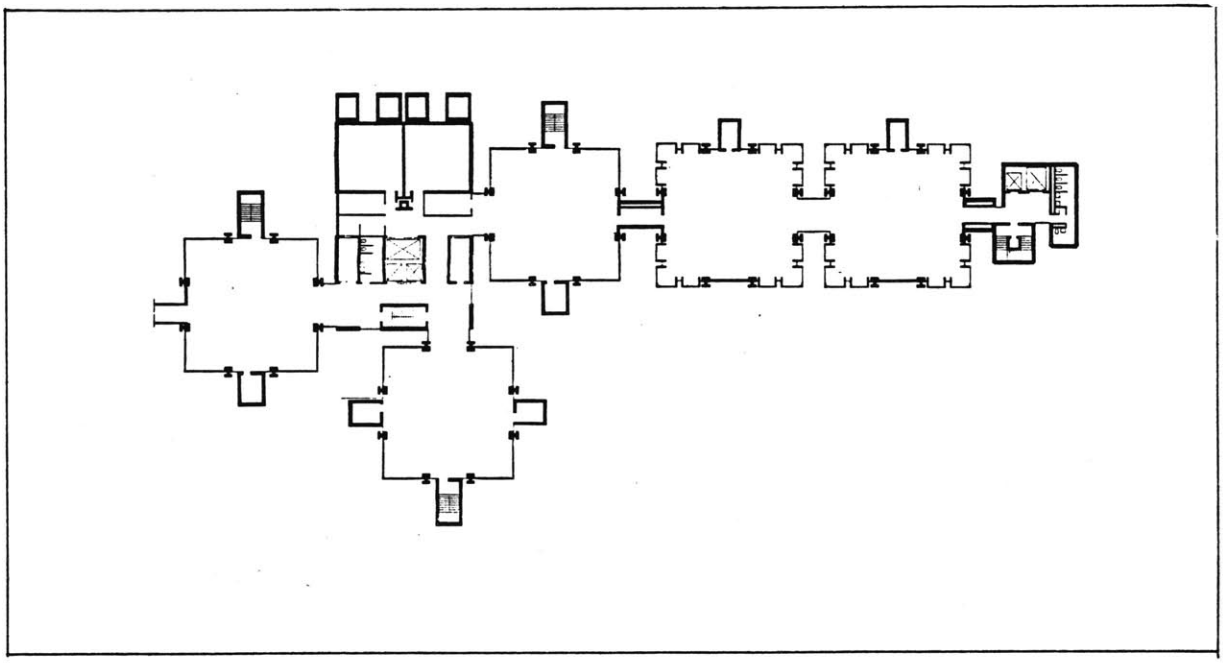

Fig. 4.40: Second floor plan of Richards Labs and Biology Building.

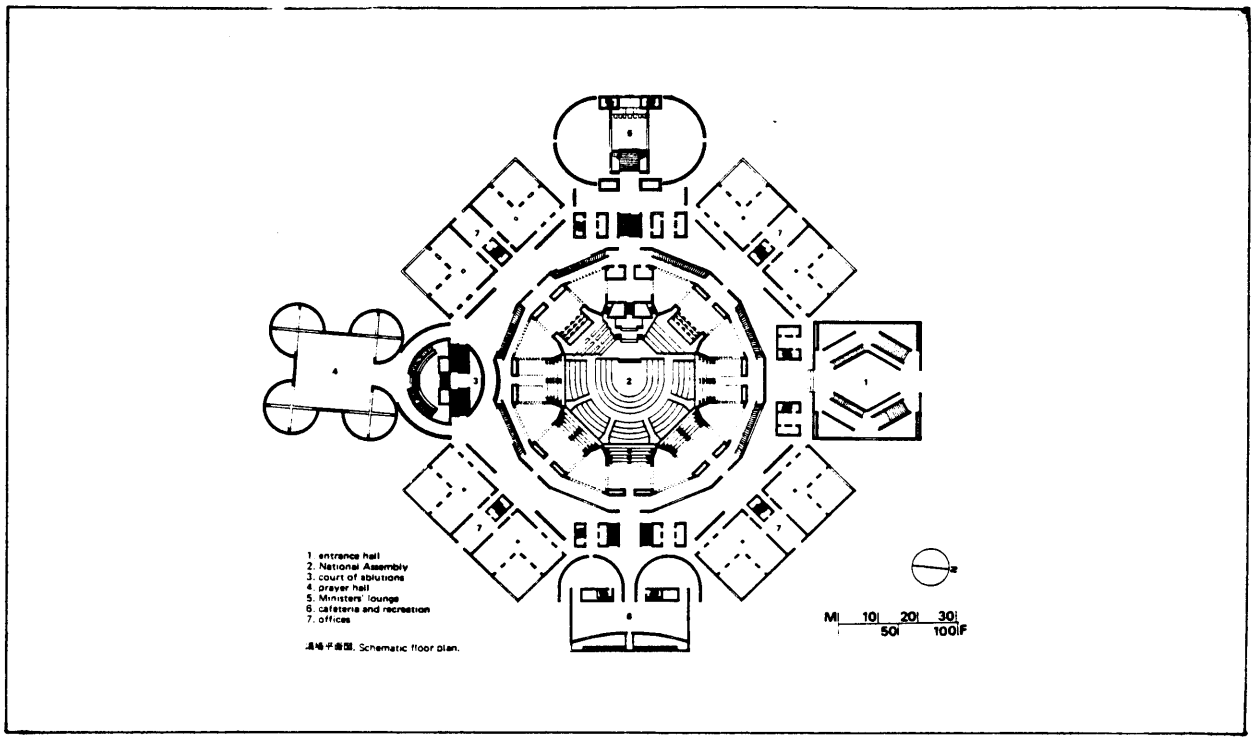

Fig. 4.41: Floor plan of Sher-E-Banglanagar *National Assembly Hall. Dacca. Kahn 1962-74*

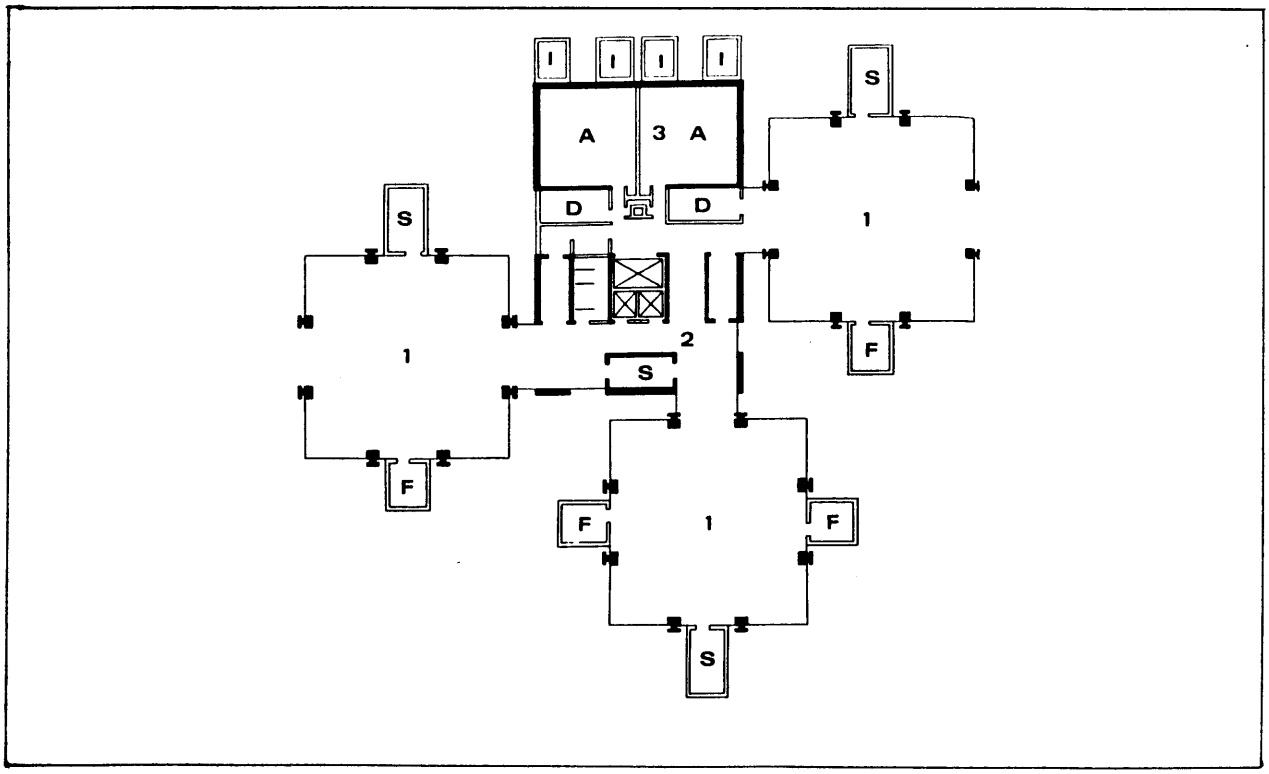

Fig. 4.42: Plan of Richards Labs: (1) studio laboratory towers, (2) corridors and vertical circulation, (3) animal quarters, (I) shafts for outside air intake, (A) animal rooms, (D) shafts for the distribution of conditioned air, (F) fume exhaust and vertical utility runs, (S) peripheral fire stairs.

at Marseilles of 1946-52 where the apartment units are conceived as wine bottles which fit into the rack (the apartment block) (Fig. 4.37). So too does Kahn try to break up the whole into humanized compartments; the "studios" are the basic unit which is then combined with other studios in an additive manner (Fig. 4.38). The crystalline, jointed nature of their aggregation brings to mind early Wright (Fig. 4.39). But unlike Wright, the growth of the Richards Labs is less organic and tends to grow "as a building" in a very conscious way (Fig. 4.40). The manipulation of, and strict adherence to plan geometries in an almost ornamental way is a common characteristic of both their work, becoming more intense for Kahn later in his career, especially at Dacca (Fig. 4.41). The objectivity of the building, especially in the initial stages (its form determination) is akin to Mies' "almost nothing." Both display a certain passivity in the initial stages of a project. But perhaps the most important parallel between Mies and Kahn, and the most significant with respect to this thesis, is their respective definitions of architecture in a structural sense, where the completed whole is an assemblage of discrete parts of which the building is made. In both cases the discreteness of the parts is emphatically stated by their blunt juxtaposition. Both men have different positions on what kind of structure and material is most appropriate, but nevertheless the primacy of structure is common.

Before talking about some specifically tectonic elements, it would be helpful to briefly describe the building. It can be understood as a service tower with three studio towers relating in a pin-wheel fashion (Fig. 4.42). The service tower consists of elevators, principle stairs, air distribution shafts, and animal quarters. The three studio towers consist of studio/lab spaces, fume exhaust and vertical utility runs and peripheral fire stairs. It was the first time pre-stressed and pre-cast elements were used; this

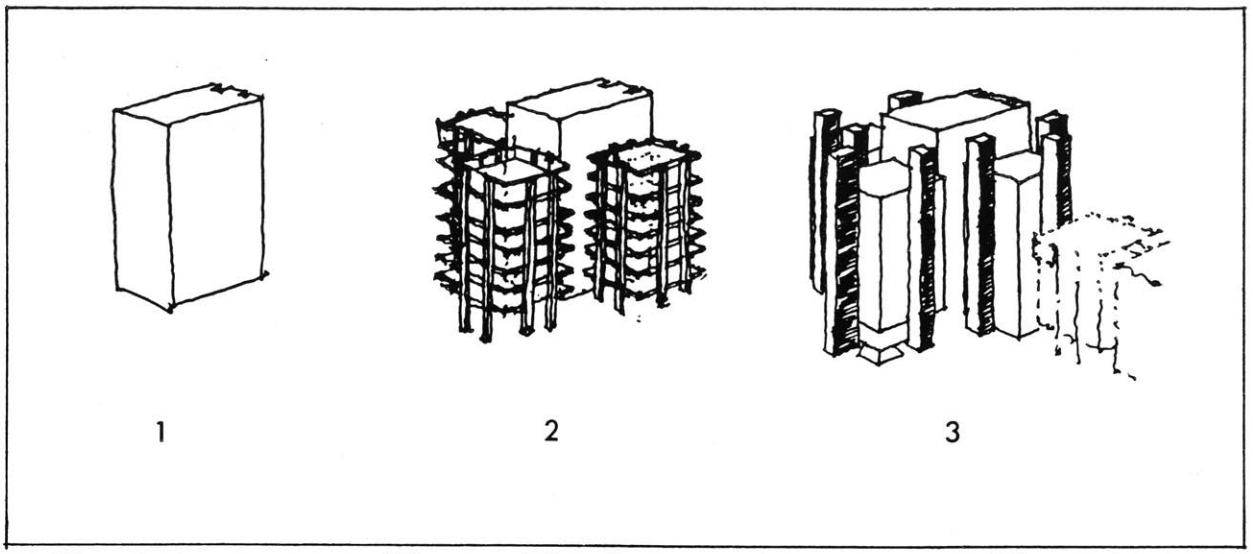

Fig. 4.43 : 3 stage process: (1) poured-in-place central service core; (2) pre-fabricated concrete frame; (3) poured-in-place peripheral cores.

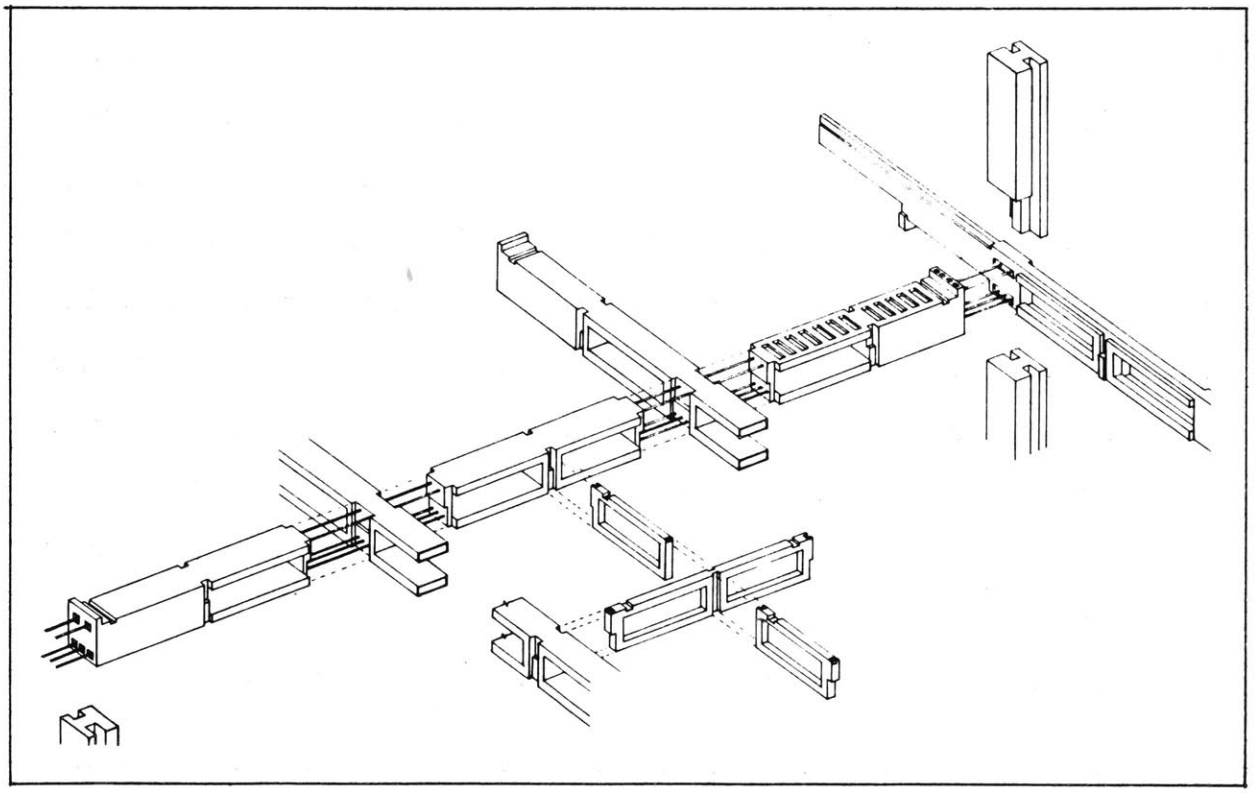

Fig. 4.44: Assembly of precast concrete frame.

innovation made it difficult to find a contractor and get a building permit.[1] Basically it was a three stage process: first, poured-in-place utility cores in the central service tower; second, the placing of pre-cast concrete skeleton framing in the laboratory towers; and third, poured-in-place service cores at the periphery of the laboratory towers.

The primary structural system of the central service tower is poured-in-place concrete comprised of five rectangular cores within the body of the tower and four poured-in-place concrete cores hanging on the outside with poured-in-place floor slabs. This tower was constructed first, then served as a central scaffolding and storehouse for the erection of the framing of the laboratory stacks (Fig. 4.43).

The structural framing for the laboratory towers is comprised of pre-fabricated, pre-tensioned and post-tensioned elements. The primary support of each tower is eight pre-fabricated concrete columns; two on each side, spaced at third points. They were set into place floor by floor each stage notched to accept their adjacent section (Fig. 4.45). The notching of the inside flange of the main columns provides a seat for the pre-tensioned Vierendeel trusses,[2] which span between the two columns (Fig. 4.44). The pair of trusses crossing at right angles to these were dropped into place as three pieces and post-tensioned. The mechanical tensioning of the principal reinforced concrete structural trusses permitted a clear span of 45 feet and thus unbroken floor area for the studio spaces. The pre-cast, pre-tensioned perimeter cantilever beams were then set into place and together with the Vierendeel trusses form a kind of space frame. The nine squares of the main Vierendeel trusses then became 36 squares

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[1] Komendant, *op. cit.*, p. 12

[2] A Vierendeel truss resembles a ladder turned sideways. It is not a "true"truss in the sense that it lacks the requisite triangulation.

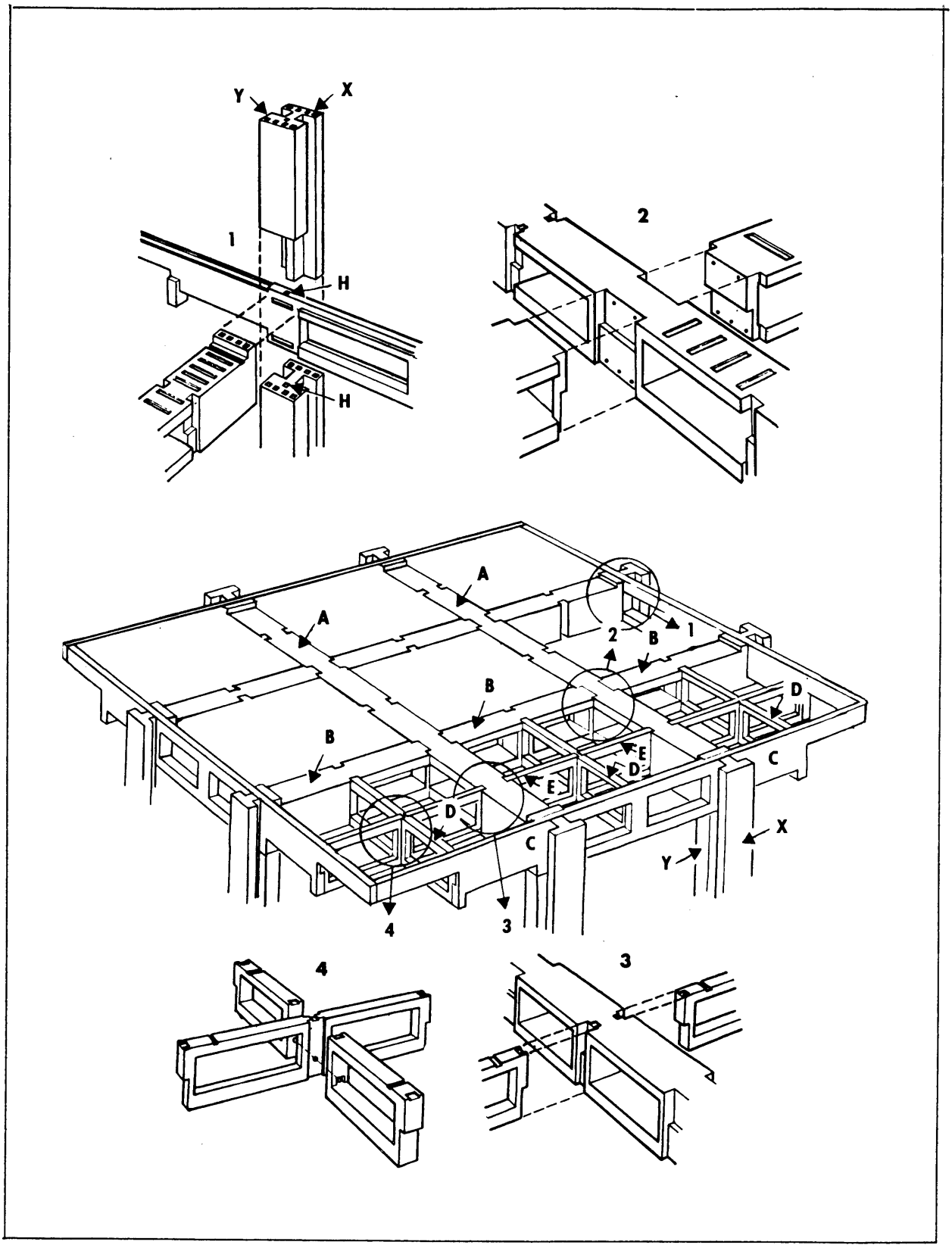

Fig. 4.45: Full floor framing diagram.

as a secondary set was placed within each square, where once again one member spans the whole square and the other member fits in two pieces.[1] As the columns rose floor by floor reinforcing rods were threaded into them and through the ends of the trusses and when the building was topped-out jacks post-tensioned the whole assembly into a tight fit. The utility cores were then poured-in-place.

It is hoped that the digression into this description will give a general understanding of the building's organization and structural system. With that, what follows is a discussion of the structural aspects of the building.

> *"The elements and their shapes, like the structure they form evolve so logically from the architectural requirements that* structure *and building cannot be separated, the one evolves the other."*[2]

Although Kahn might have determined the quality of a piece of architecture by its degree of "unmeasurability" in the end, he nevertheless recognized the symbiotic relationship between the measurable and unmeasurable; tangible and intangible; physical and meta-physical. He stressed that as people who *make* things, the means by which we realize the "unmeasurable" was with the "measurable." For Kahn structure was the primary tool for architects. Later in his career (and most emphatically at the Kimball Art Museum), he developed this symbiotic relationship to an even more metaphysical level by stating that "structure is the giver of light," where light was the source of all being.[3] Kahn constantly strove to bring the fundamental structure of a building into

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[1] This secondary set of trusses only stiffens the whole frame and allows the floor slabs to be poured without additional shoring. Later, in the design of the Biology Building, they were eliminated as the whole system was made more simple.

[2] Komendant, *18 Years With Louis Kahn,* p. 19

[3] Lobell, *Between Silence and Light,* p. 34

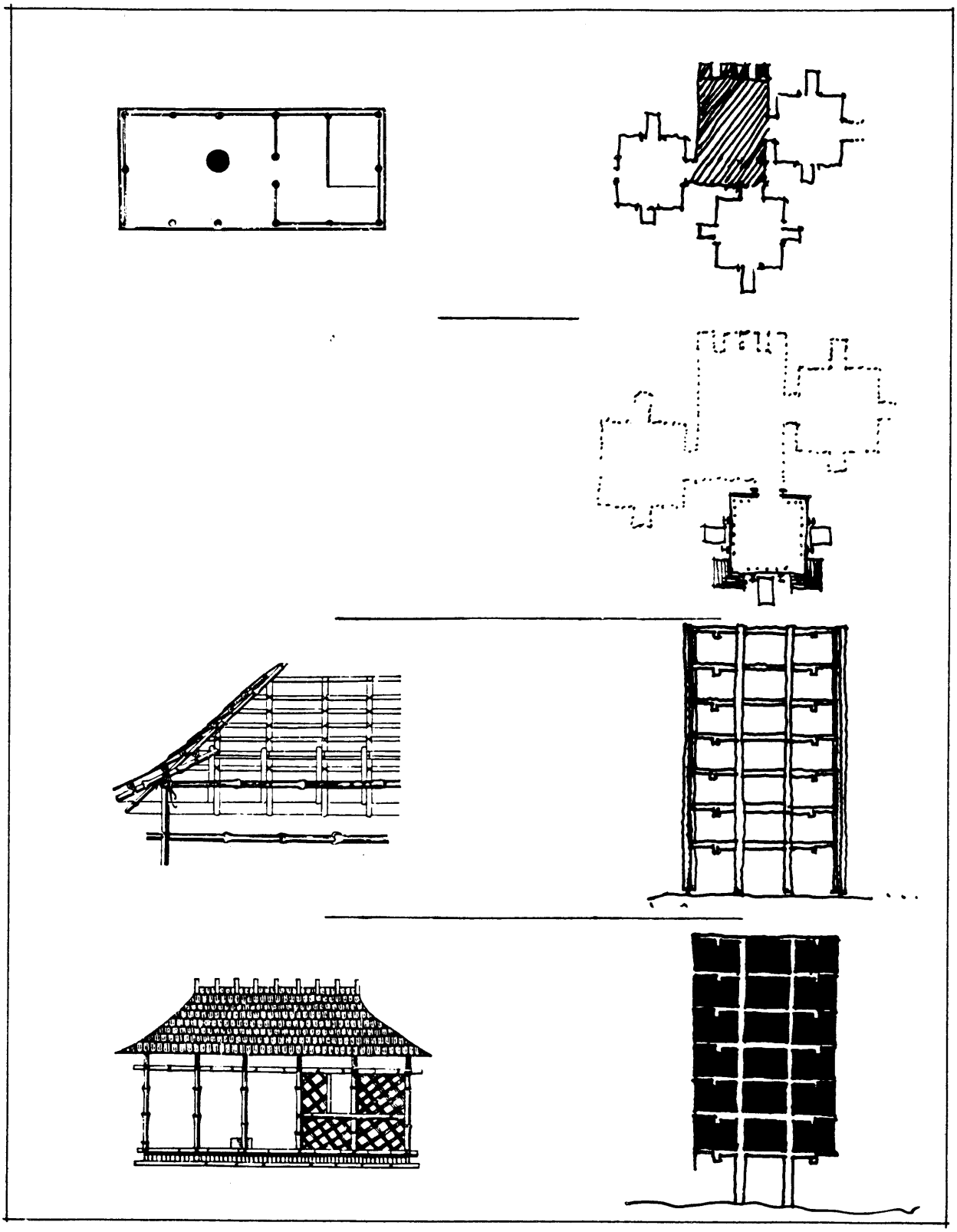

Fig. 4.46: Semper's Carribean hut and the Richards Labs: (1) the hearth; (2) the terrace; (3) supporting structure; and (4) the enclosure.

being and revealing it both inside and out. This constant concern places all of his work as being highly tectonic and reminds one once again of the Greek word *techne.*

The parallels between Semper's Carribean hut model and the Richards Labs is interesting. Generally the Richards Labs displays Semper's four elements: the central service core as the hearth; the front entry portico and steps as the terrace; the primary structural system as supporting structure for the roof; and the brick infill and glass as the enclosure (Fig. 4.40). In fact, the tectonic significance of the structural frame is in its most specific form. As previously discussed, Semper's more narrow definition of tectonics, in *Der Stil,* defines it as the roof and supporting structure characterized by separate articulated elements, which are linked to its mode of production-- carpentry. The primary structural system of the Richards Labs is directly comparable to the supporting frame of Semper's model and, as will be discussed, the frame takes on qualities as though it was made by carpentry.

The structure of the building is extremely important and becomes fully tangible in three ways: first, it is fully revealed, inside and out, as the support of the building; second, it delimits the space, not only as enclosure but also it differentiates use and circulation on each floor;[1] third, it provides the building with an integral sculptural embellishment which Kahn felt was only possible with concrete, once again evoking thoughts of LeCorbusier.

The main structural supports for the building -- the post-tensioned columns -- are highly tectonic elements. Although one could easily criticize their form as being more commonly associated with steel than reinforced concrete (even reminiscent of Mies' 860

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[1] This attempt was not successful as many of the interior partitions are now set-up irregardless of structural lines.

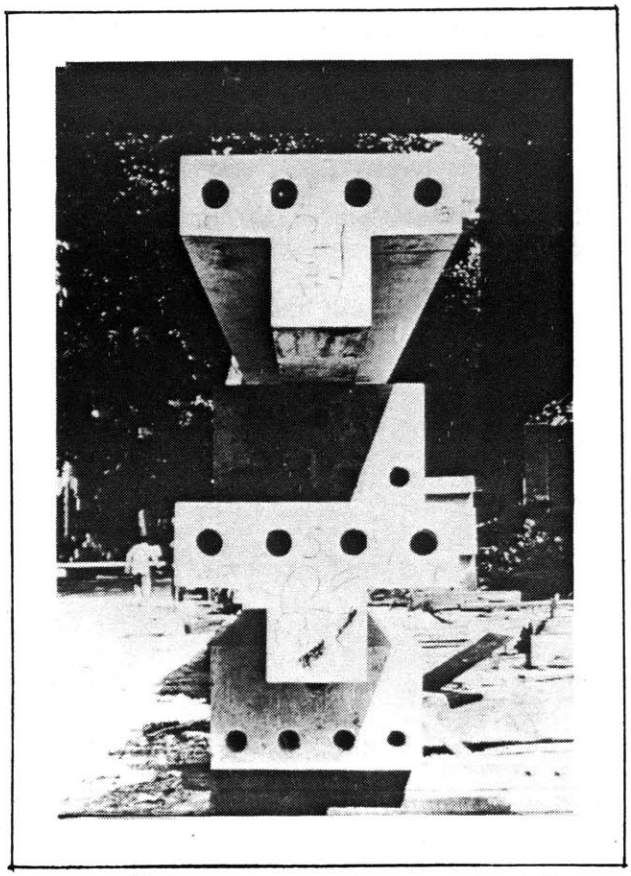

Fig. 4.47: Primary pre-cast concrete columns

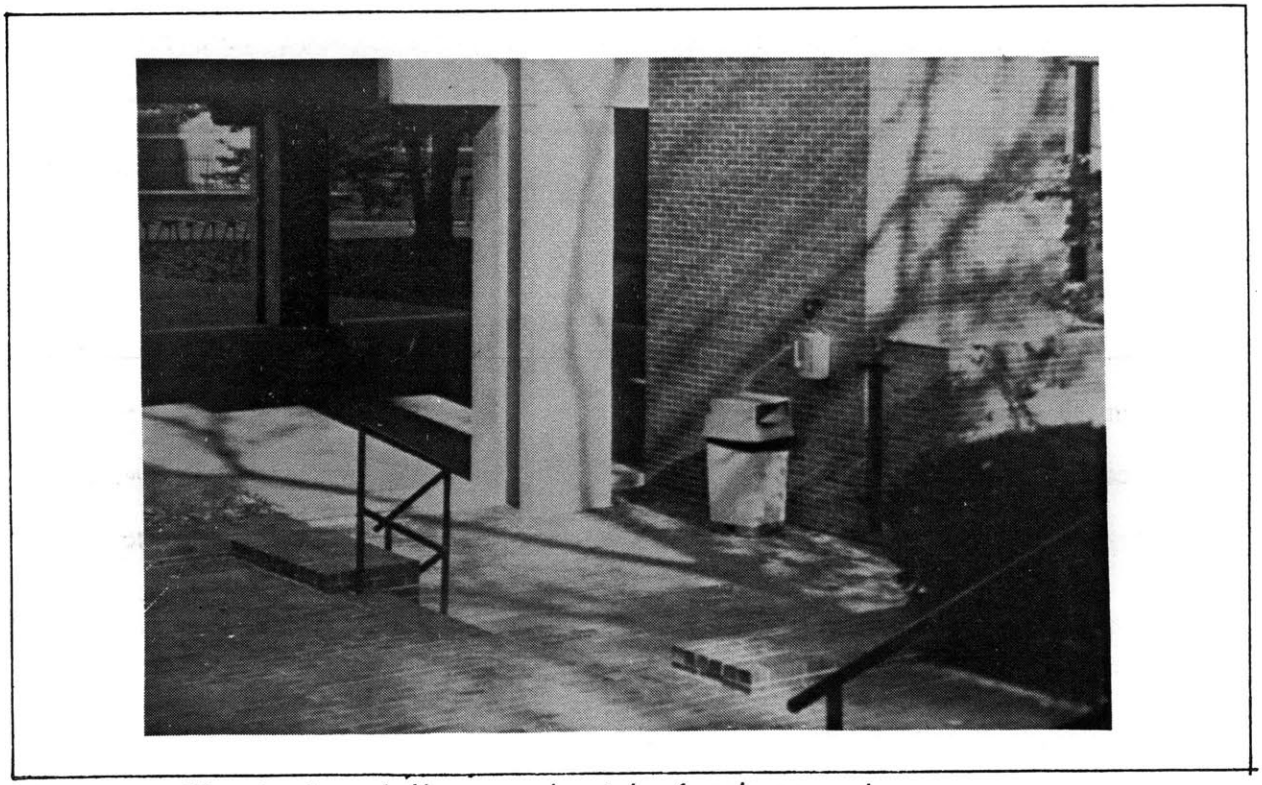

Fig. 4.48: Visual play of flange and notch of primary column

Lakeshore Dr. buildings), it is through the physical modeling of this element with visual and symbolic intentions, that it attains its tectonic significance and transcends the banality of mere structural or functional requirements (Fig. 4.47). The notch has symbolic significance in that it celebrates the jointed nature that Kahn always sought in his architecture. The side toward the inside picks up the bearing of the Vierendeel trusses and perimeter cantilever beam while the outside flange develops the continuity of the column as a vertical element from floor to floor. Certainly Kahn could have satisfied the mere physical requirements of the trusses, beams and columns meeting with a simple rectangular section, but the notch begins to tell a story and brings the column into presence which a rectangular section would not have the capacity to do.

The visual effect of the notch in the column reinforces similar concerns. It causes a shadow line, an alternation of light (flange), dark (notch), light (flange), that certainly reinforces a classical reading of Kahn's work and also accentuates the symbolic significance discussed previously (Fig. 4.48). This rather small modulation of light and surface have an intensity that brings the presence of the column into the realm of the much more massive, less intense service stacks that they are, in some ways, competing with. The visual mass of the column is greatly reduced from what it would otherwise be; as Kahn judged it would be overly bulky if left rectangular. Also the modeling has structural reasons as well. Loading of the column is eccentric (from the Vierendeel trusses and perimeter cantilevered beams bearing on the inside of the column, it wants to bend outward), and by placing as much of the material to the outside as far away as possible from the central axis, it counteracts the eccentricity of the loading as efficiently as possible. But it should be noted that its tectonic significance is the visual and symbolic quality resulting from the *physical modeling of the structure,* and not primarily from the satisfaction of mere structural requirements.

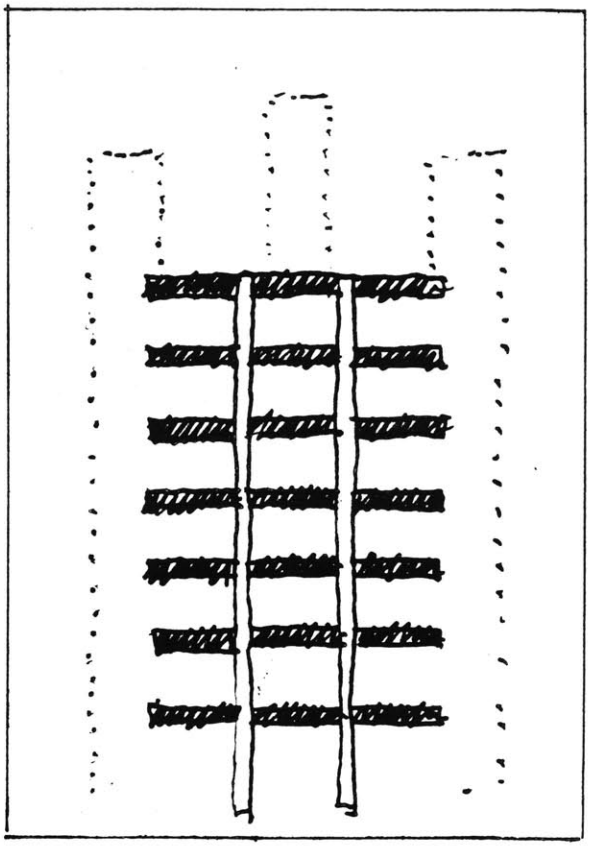

Fig. 4.49 : Section indicating the area

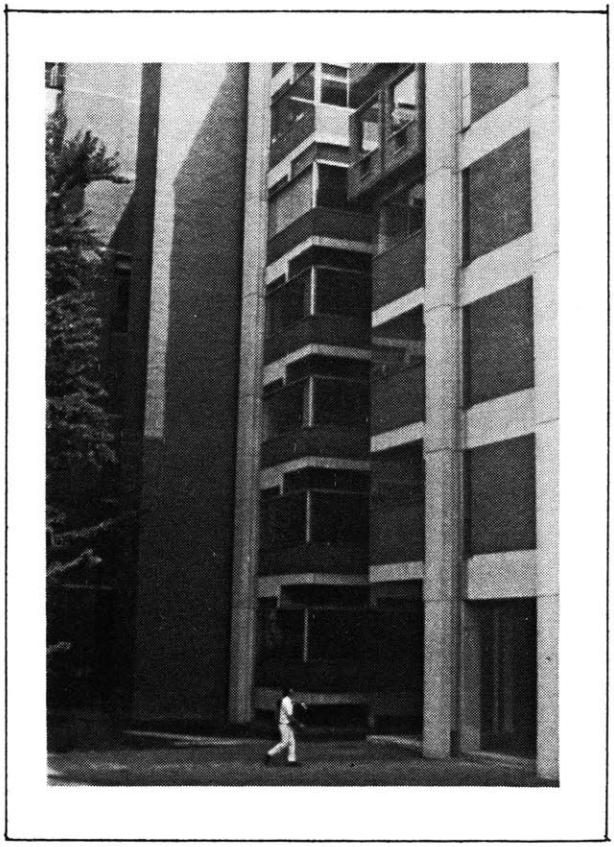

Fig. 4.50 : Fully visible structural frame

Perhaps the most interesting part of the building is the concrete floor framing. As described previously they are both pre-stressed and post-tensioned pieces and apparently one of the first, if not the first, applications of pre-fabricated pieces in buildings largely due to the collaboration of Kahn with Dr. August Komendant.

The design takes on spatial characteristics where structure begins to occupy an *area* and no longer relates in a linear relationship as in a standard frame (Fig. 4.49). The generation of this space allows for a symbiotic relationship between structure and utilities and therefore both can be revealed as part of the building's life, telling the viewer a story. It is also significant that an understanding of the structural frame is possible both inside and outside the building; where, on the inside the space frame floor structure is fully revealed and permeates to the exterior as an integral part of the building's elevation (Fig. 4.50).

The form of the cantilever beam indicates several things. Its diminished depth as it gets to the corner reflects the stresses a cantilevered beam undergoes-- more bending near the supports. The small piece projecting downward accepts the secondary Vierendeel trusses on the inside while giving the indication of its presence from the outside. The spatial combination of the two perimeter beams coming together tells the viewer the importance of the corner: it is the prime place to work. Here one can talk about the reconciliation of the building's construction and image. The main structural elements tell many stories with respect to themselves. They are intrinsic elements with a capacity to engage the viewer with their own "life." The elements are open to individual interpretation and thus have a kind of depth and a capacity for interpretive change over time.

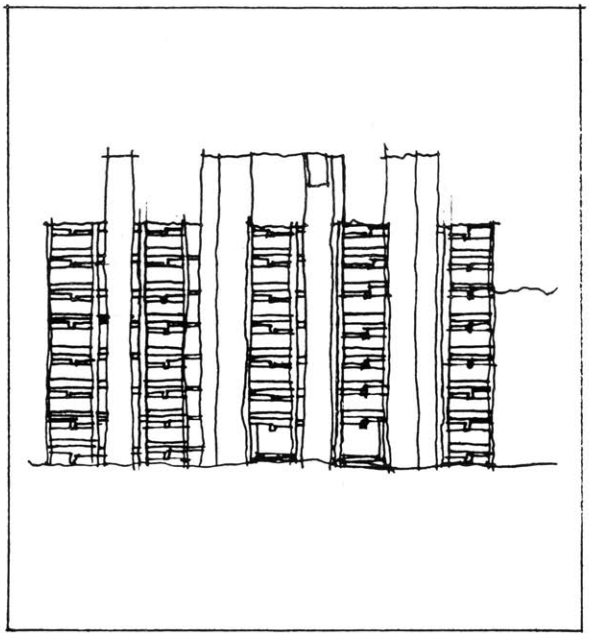

Fig. 4.57 : Dialectic of served and servant: horizontal for served; vertical for servant.

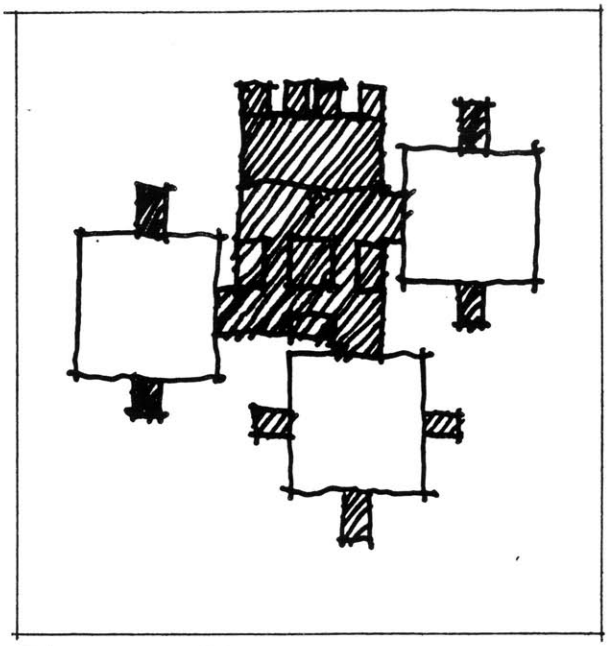

Fig. 4.52 : Diagram of served and servant. (servant shaded).

Fig. 4.53: Richards Labs from the Botanical Garden.

Kahn's constant search for order inherent in living things resulted in the famous formulation of *servant* and *served* spaces, the model of which was a tree; the way in which the trunk and branches brought nourishment to the leaves; one as important as the other. It was an innovation in spatial organization, certainly a break with the spatial conception of his training, and became very influential for subsequent architecture.

It is with the design of the Richards Labs that one sees the mature formulation of served and servant order. The building design displays a strong dialectic of served and servant; the horizontality of the windowed studio spaces and the verticality of the blind mechanical cores (Fig. 4.51). The separation of the labs from the service systems reveals the building's natural order, "just as lungs are not next to one's brain and our elimination points are not next to our intake points" (Fig. 4.52).[1]

The service cores are significant in that no other building had exploited the mechanical aspects of a building to such a monumental and expressive extent (Fig. 4.53 & 4.55). The image of the building relates to its services, not to its more "important" spaces. In Kahn's terms, this was a comprehensive demonstration of the life of the building.

Kahn recognized that since modern technology had made the service aspects of a building more and more complex, especially in a medical research laboratory, they needed to be provided for in an *architectural* manner, otherwise the architect would relinquish control over the design process to the mechanical engineer. He felt the services should be revealed as part of the building and they should appear as they are. Rather than trying to fit services into remaining *poche* after designing major use

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[1] *Ibid.*, p. 31

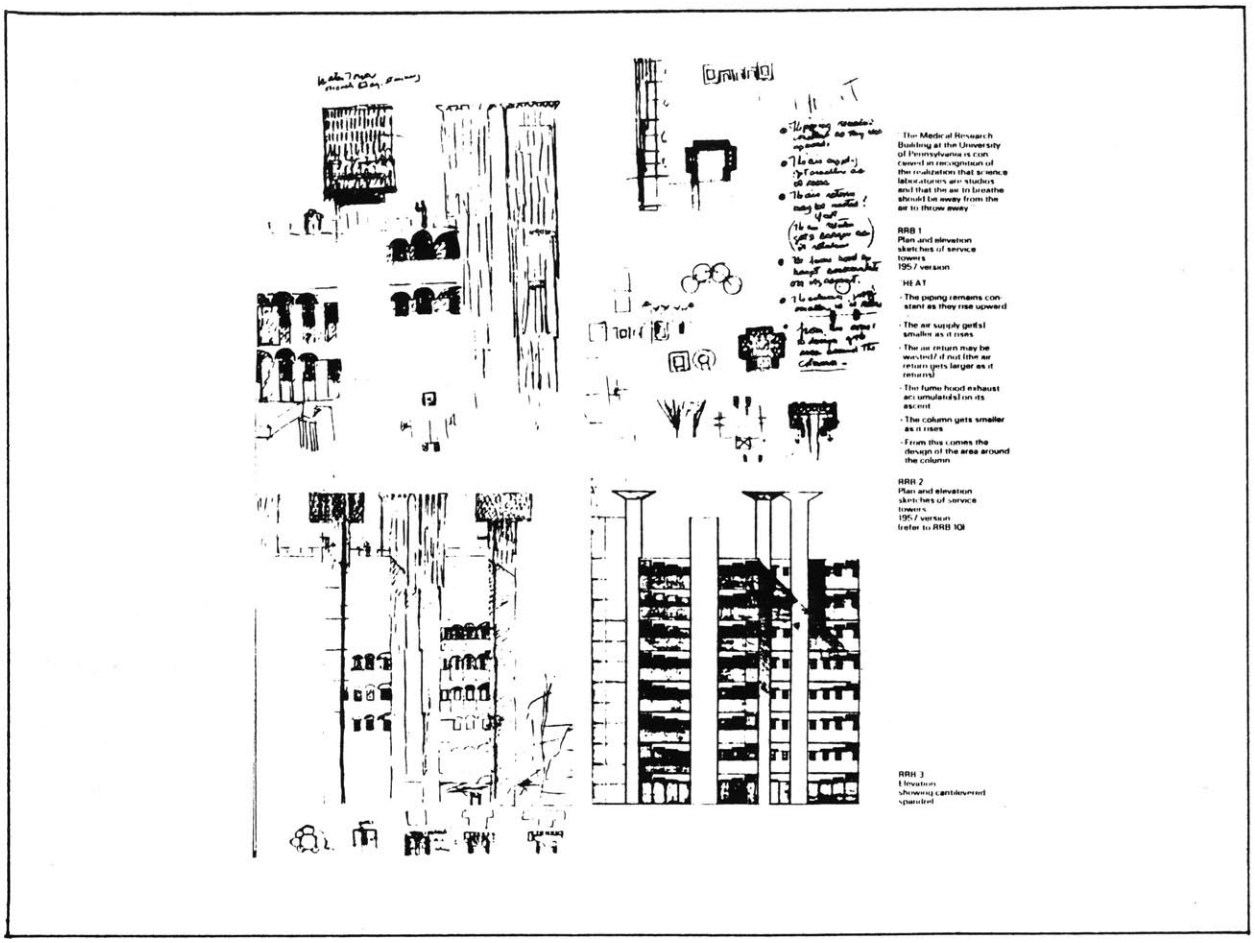

Fig. 4.54 : Kahn's sketches of service towers. 1957

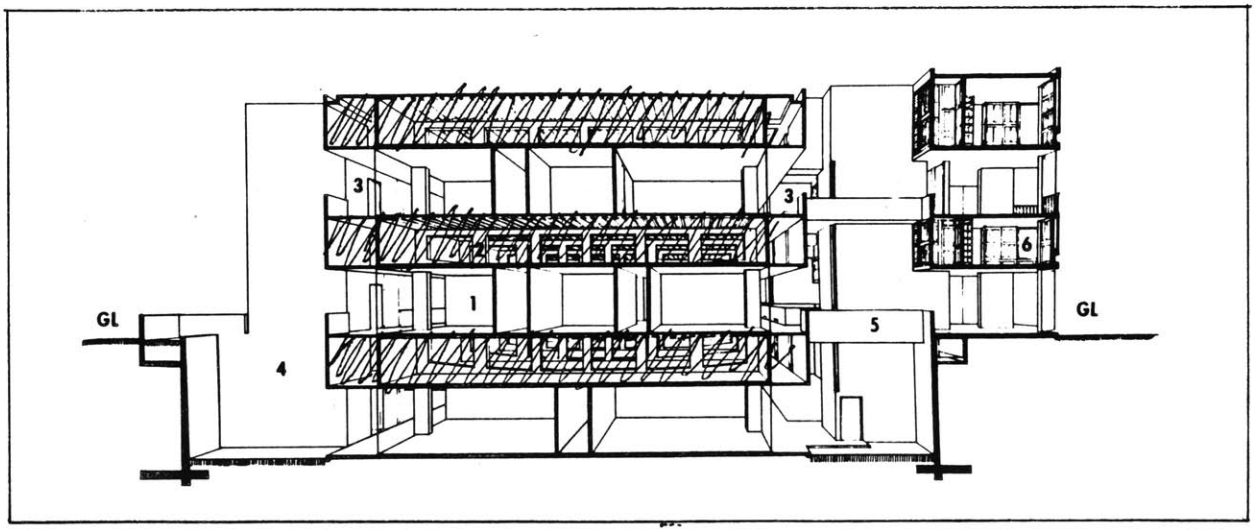

Fig. 4.55: Section of "pipe laboratories and people laboratories" of Salk Institute. Kahn. 1959-1965

spaces, Kahn's solution was to generate space for the services. He thought if walls and columns could become hollow it would provide the space so that the services could become an integral part of the building's design and presence. He felt that space was an order inherent to modern building materials. We no longer build with solid masses, as hollow masses are a natural outgrowth of concrete and steel. The generation of a three-dimensional spatial area of floor structure was one result of this idea, exemplified by the Salk Institute in California where the services were thought of as a full floor nine feet tall and referred to by Kahn as "pipe laboratories" in between "people laboratories" (Fig. 4.55).

Another result of this generation of space for service is the "hollow column." It pervades all of Kahn's major works, but perhaps it is first seen in a sophisticated form at the Trenton Bath Houses, 1955-56, where the hollow columns at each corner supported the pyramidal roof above. But more importantly they had grown to a habitable size where they served as entrances to dressing rooms and small rooms for plumbing and storage (Fig. 4.56). Here the realization of habitable columns was the beginning of the served/servant formulation, but it wasn't until the design of the Richards Labs that it became more clear; spaces designed for service were not thought of as just void but rather as rooms thus attaining importance equal to that of the use spaces.

> *"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."*

At the Richards Labs, the service cores are seen as huge hollow columns containing the utilities, as hollow "bones" accepting the "marrow" of the services Fig. 4.57). In

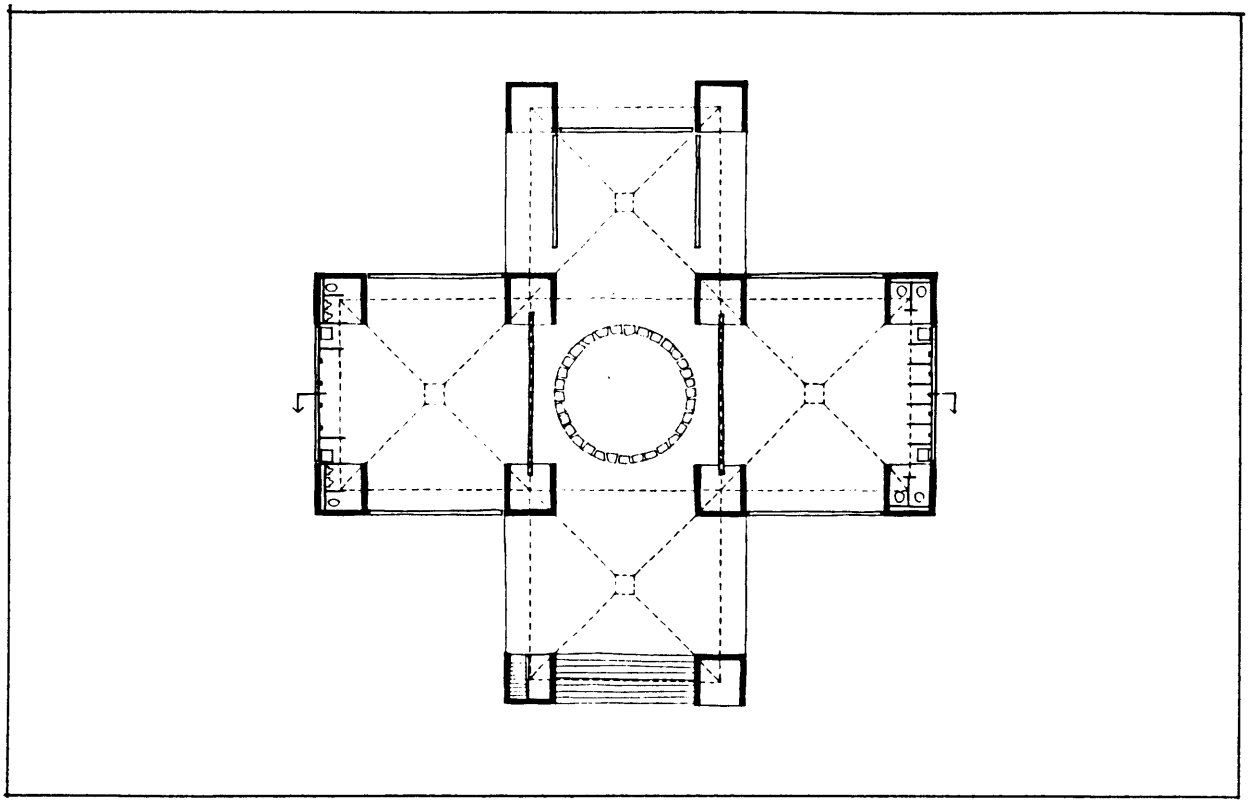

Fig. 4.56: Plan of Trenton Bath House showing habitable columns.

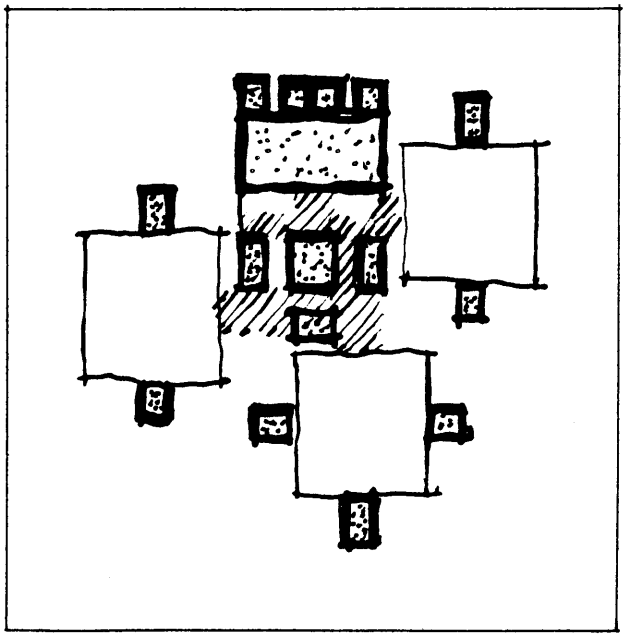

Fig. 4.57: Hollow columns at Richards Labs.

fact at one time Kahn had intended to support the floor slabs with them whereby they would function as actual columns. The relationship between load-borne and column still exists. The "columns" are supporting the labs not in a structural sense, but in terms of use and visual perception.

This idea is particularly innovative. It indicates Kahn's recognition of twentieth-century conditions, in a tectonic sense, as a generator of architecture and perhaps for the first time, we see the services of a building monumentally expressed.

The construction process of the Richards Labs is of interest for two reasons: the use of pre-fabricated structural elements and the use of the crane in their assembly. The pre-fabrication of the main structural elements has already been discussed previously, but it should be noted that because the fabrication process was within a highly controlled environment, extreme precision and high quality were possible. The elements were designed with notches and seats that made the erection process on site unusually fast and accurate, much more so than would have been possible if welded plates or cast-in-place sections were used at the joints. As a result, the lab floors were being put together at the rate of three per week.[1] The eloquence of the solution could only have been possible with the parts being pre-fabricated.

The crane was a tool for construction whose potential was only beginning to be realized in the middle of this century. In many ways it has transformed the way in which buildings are conceived with respect to their construction process. Its potential was something Kahn realized very slowly. He stated:

> *"One day I visited the site during the erection of the pre-fabricated frame of the building. The crane's 200 ft. boom picked up 25 ton*

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[1] Anon., *Logic and Art in Pre-Cast Concrete,* p. 238

members and swung them into place like matchsticks moved by the hand. I resented the garishly painted crane, this monster which humiliated my building [by its scale]. I watched the crane go through its many movements all the time calculating how many more days this "thing" was to dominate the site and building before a flattering photograph of the building could be made.

Now I am glad of this experience because it made me aware of the meaning of the crane in design, for it is merely the extension of the arm like a hammer. Now I began to think of members 100 tons in weight lifted by bigger cranes...Now the crane was a friend and the stimulus in the realization of a new form."

It is clear that without the crane to lift the pieces into place pre-fabrication would have been impossible and the structural design would have been much different.

Certainly one of the most important attributes of tectonic architecture is the concern for joining; as a *maker* of things we should be concerned about *how* things are joined and thus the celebration of joining-- detail. For Kahn, as for Semper, the joint became the touchstone of tectonic and was inextricably linked to the process of its making. Rather than paraphrase, Kahn states:

"A building is like a human. An architect has the opportunity of erecting life. The way the knuckles and joints come together make each had interesting and beautiful. In a building, details should not be put in a mitten and hidden. Space is architectural when the evidence of how it is made is seen and comprehended.

The feeling that our present day architecture needs embellishment stems in part from our tendency to fair joints out of sight, to conceal how parts are put together...If we were to train ourselves to draw as we build, from the bottom up, when we do, stopping our pencil to make a

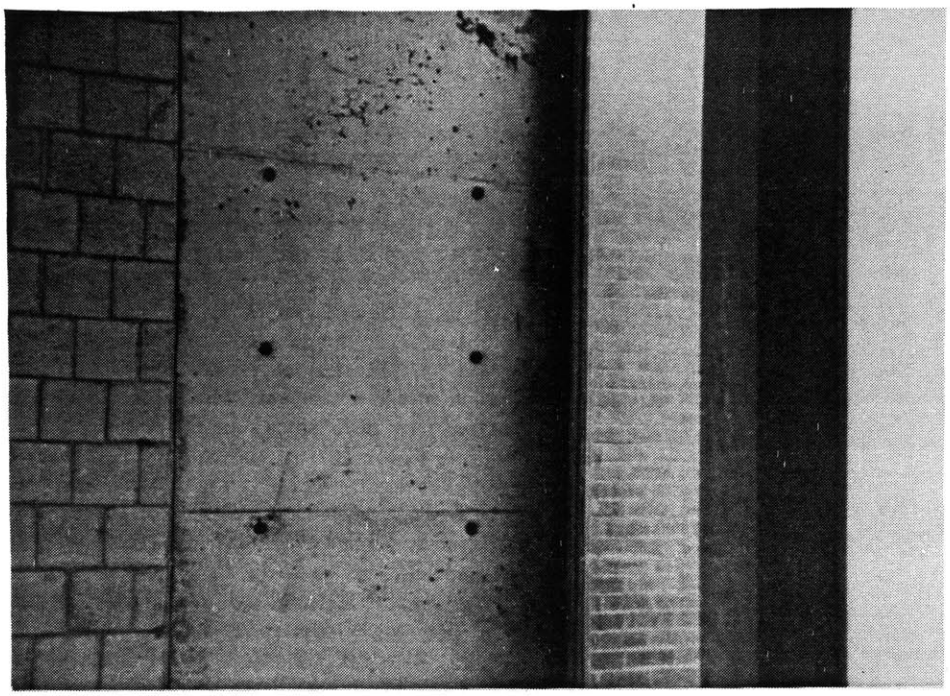

Fig. 4.58: Juxtaposition of materials.

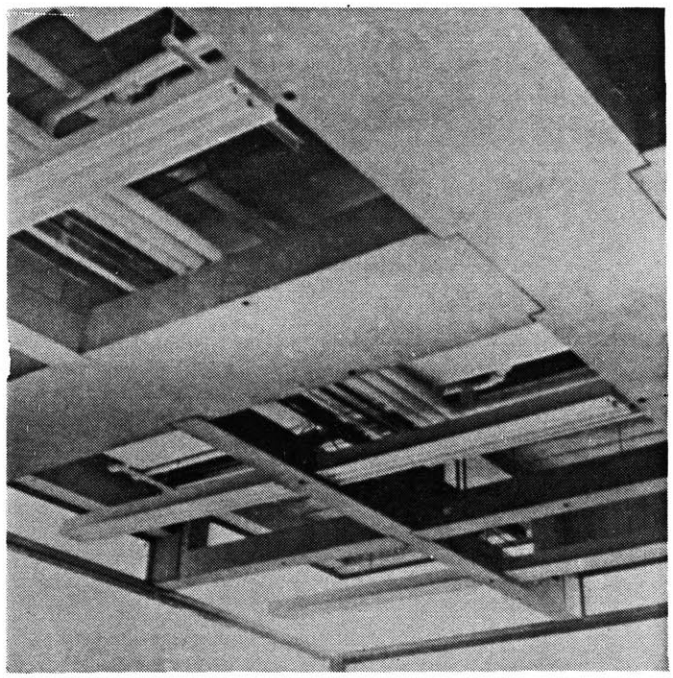

Fig. 4.59: Intricate joining of concrete framing members.

mark at the joints of pouring or erecting, ornament would grow out of our love for the expression of method."

For Kahn joint-making was the beginning of ornament, as distinguished from decoration as being merely applied.

The building takes on a particular narrative capacity by the juxtaposition of its materials (Fig. 4.58). The way they come together teaches the "build" of the building where the inherent surface of the various materials is fully revealed. Factory made concrete block is next to site-poured concrete, which is next to pre-cast elements where the relentless similarity of the concrete blocks tells of their industrial production; the pitted quality of the poured-in-place concrete, the holes from the form-ties and the wood grain from the forms are left deliberately unpatched telling of the method of site-poured concrete as well as the imperfections,compared with the precise, hard edges of the pre-fabricated members. This juxtaposition also tells of the hierarchy of fabrication: the standard "off-the-shelf" nature of concrete block as infill; the site specific poured-in-place elements housing the services; and the custom designed, precision pieces made under factory control for the primary structural frame.

At a smaller size, adoration for the joint occurs, as discussed previously, in the floor framing. As with Perret and Semper before, Kahn seems to have determined that the characteristics of the frame are derived from wood. The intricate joinery and precise tolerances are more akin to wooden Japanese joinery than one would expect in concrete construction (Fig. 4.59. Kahn's insistence on such fine craftsmanship and precision seems more typical for carpentry. The joints themselves are so precise that they are emphasized by tooling them out to depth of 1/4 in.

Also, one begins to see, in anticipation of Kahn's later formulation of metaphysical light, a way of joining in which space and light are the joint. The main structural

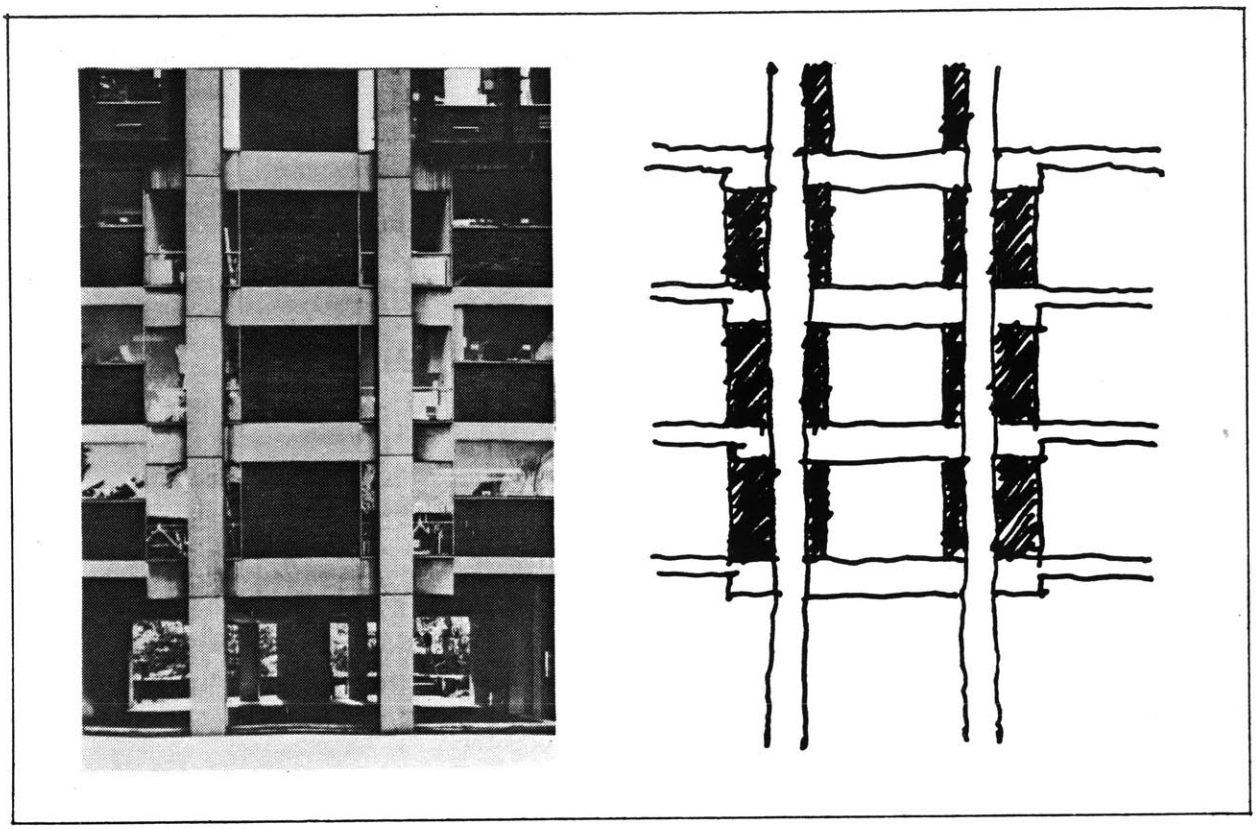

Fig. 4.60: Light as a joint.

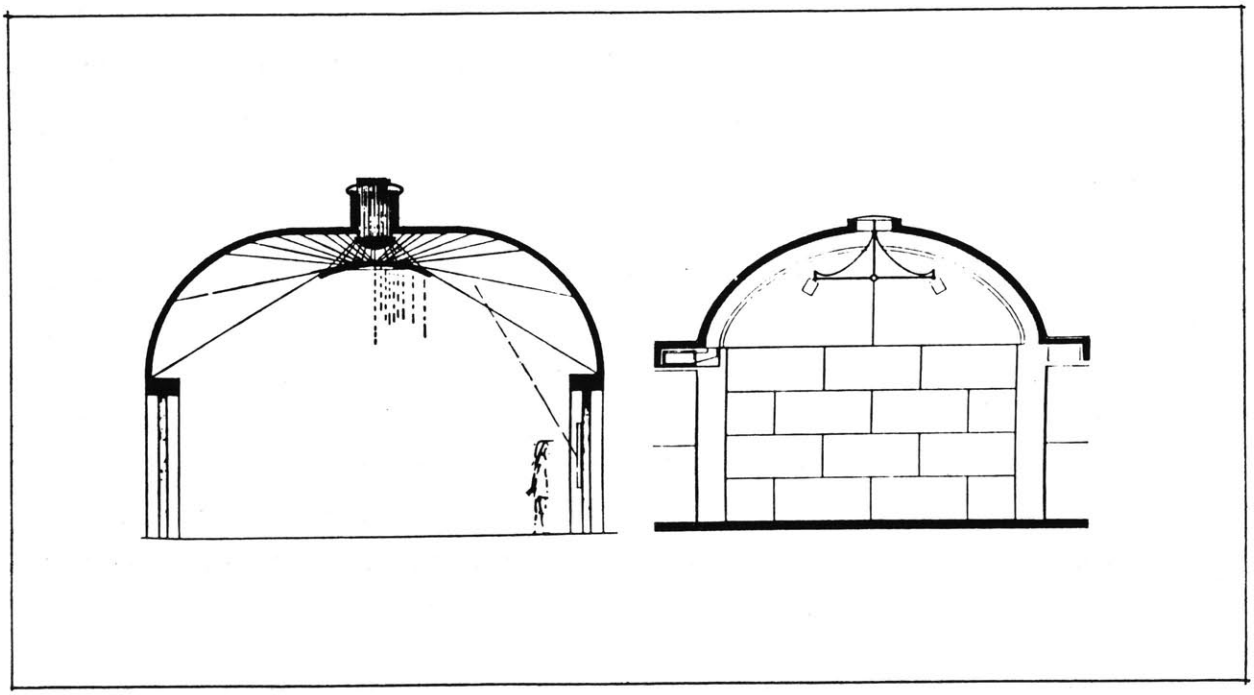

Fig. 4.61: Light as a joint in the pseudo-vaults at the Kimball Art Museum,

columns and the service cores are joined by glass, and thus the space is the "light" and the joint attains its metaphysical presence (Fig. 4.60). This is an idea that was enabled by twentieth-century structural developments and pervades much of Kahn's work, most emphatically demonstrated by the pseudo-vaults of the Kimball Art Museum (Fig. 4.61), where exactly at the point where one would expect physical material, Kahn introduces light. Although one can see only the germ of the full development of this idea at Richards Labs, it nevertheless is there and it must be pointed out as it is a whole new way of conceiving of the joint.

The Richards Labs is a building that exists as an assemblage of discrete parts. It is a complex mass comprised of particularate spaces that declare their specific functions. The discreteness of parts is accentuated by adjacencies as discussed previously. The architecture is literally broken down into its A-B-C's and assembled so that unit A abuts unit B and it abuts unit C (Fig. 4.62). This kind of "independence" is certainly reminiscent of the Graeco-Gothic ideal of the beginning of the eighteenth-century, especially Cordemoy and his call for the *degagement* of architectural elements. However, this is not to say that parts exist as total autonomous objects. On the contrary, although parts are discrete, they are interdependent. Kahn states:

> *"For if you sense something which is a coming of a now-accepted thing in man's way of life, which is expressed in a realm of spaces or in a form which is different from any other form, once that happens you cannot take parts away because every part is answerable to the other. Form is of that nature. Form is that which deals with inseparable parts. If you take one thing away, you don't have the whole thing, and nothing is even really fully answerable to that which man wants to accept as part of his way of life unless all its parts are together."*[1]

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[1] Tyng, *op. cit.*, p. 117

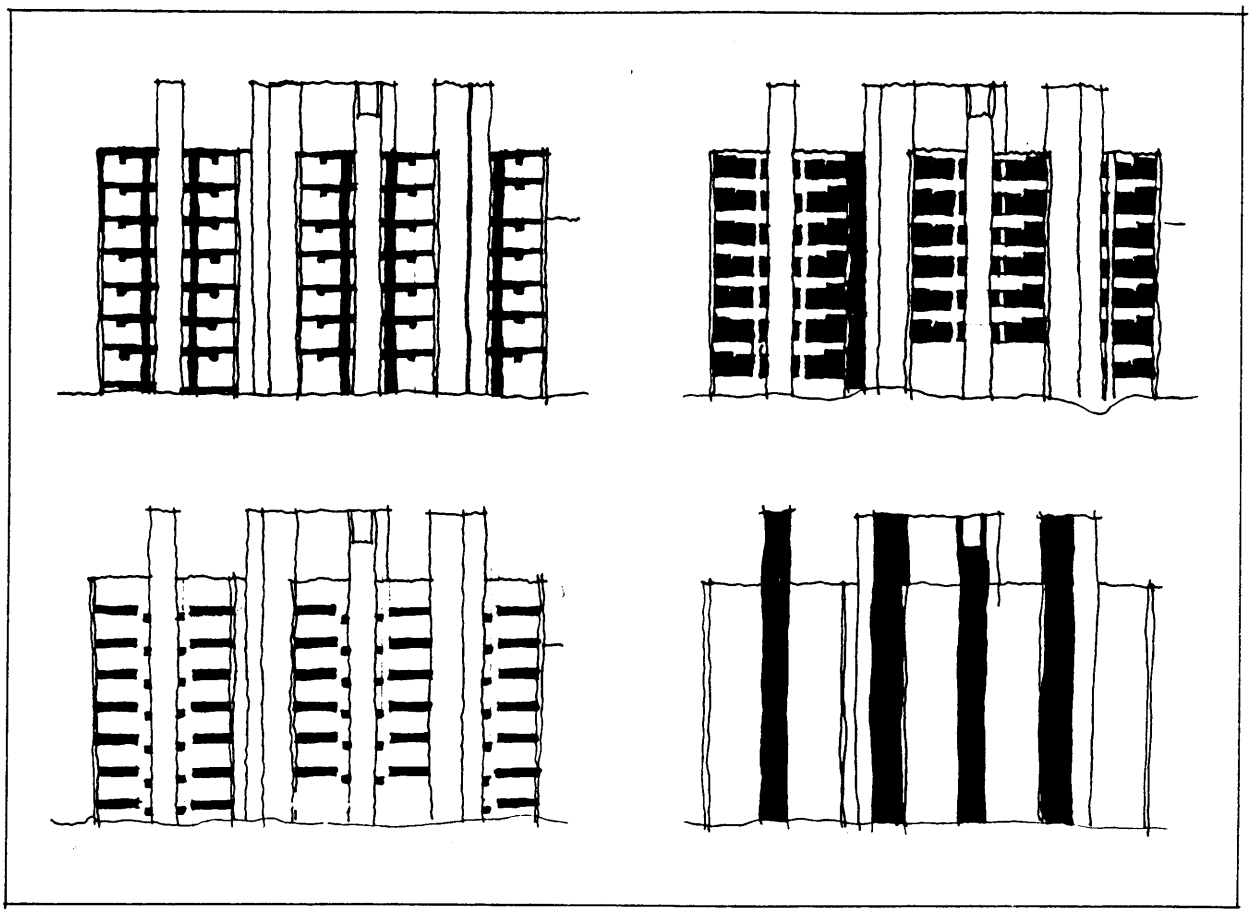

Fig. 4.62: The A-B-C's of the Richards Labs: (1) concrete structural frame; glazing; (3) brick infill; (4) brick service cores.

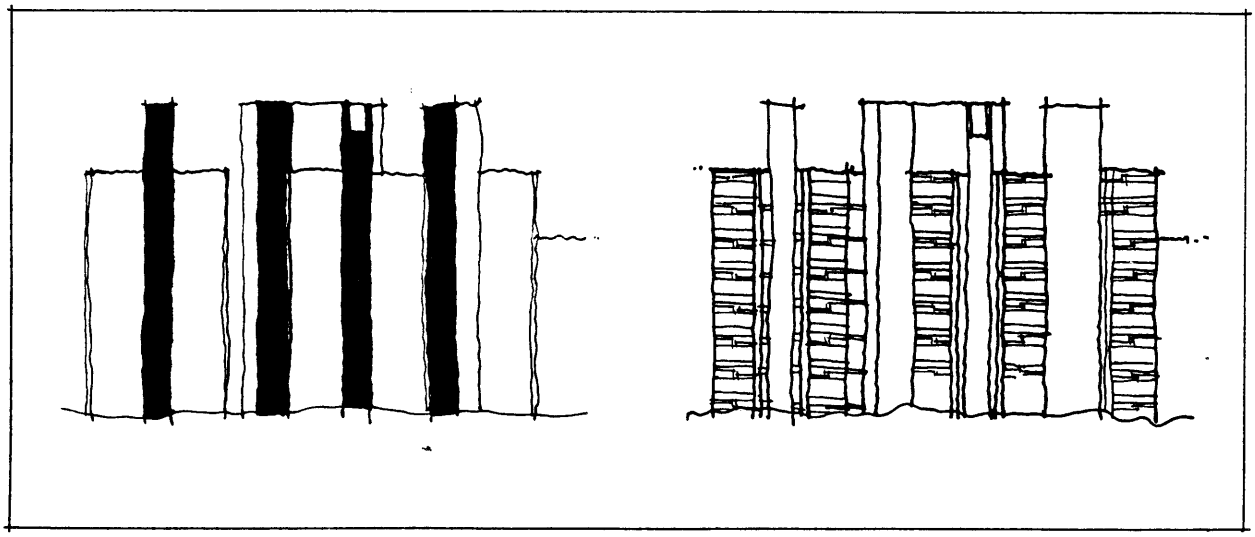

Fig. 4.63: The Dialectic of faceless service cores and talkative studio spaces.

The interplay of the parts and the whole also pervades the compositional aspects of the building's exterior presentation. Generally the viewer is struck by two parts of the building: the faceless, vertical assertion of the service cores; and the talkative, blocky static-ness of the laboratory towers. The relative balance of the parts is established by both mass and intensity; the service cores are more visually massive and relatively blank, while the laboratory portions are seemingly less massive, but the intensity of the visual interest equalizes their presence. This dialectic allows the building to tell its stories at different sizes and scales. The service cores are talking to the viewer on the other side of campus, while the fine details of the lab tower fenestration talk to the up-close user. It is a kind of physical depth that is important to tectonic architecture. The overall glazing area in conjunction with its association with the sky prevents the voids from visually losing out. But the dialectic is psychic as well. The understanding of the corners as use spaces is opposed to the mute quality of the service cores. In short, the physically positive, yet psychically negative elements of the service cores oppose the physically negative yet psychically positive elements of the studio spaces (Fig. 4.63). In this way, no part of the building "loses." All elements, whether they be structure, enclosure, services or the smallest detail, contribute to the building telling its story.

It becomes clear that not to participate in the "life of the building" is very difficult. The whole of the building can be read from its parts. As one stands in the studio spaces, the building presents itself as that space but also, one can see the exterior of the other towers (in most cases) (Fig. 4.64). This simultaneous presentation facilitates the reading of the life of the building significantly. One is aware not only of the activity of the adjoining towers, but also of the constant presence of the architecture.

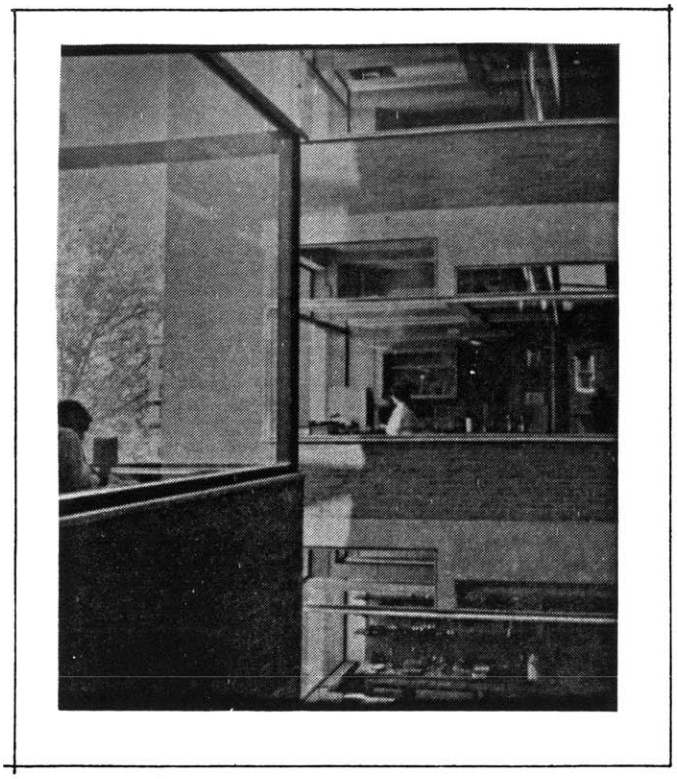

Fig. 4.64: The simultaneous presentation of the building.

In conclusion, the tectonic significance of the Richards Labs resides partially in the three major attributes discussed: the importance placed on structure as an intrinsic, potentially expressive and interpretive element; the monumental expression of services; the concern for joining as a way to tell the story of its making.

The discrete display of the parts of a building is an important aspect of Kahn's work. However, due either to the immature state of the attitude at the time of Richards Labs or the influence of his training, the relationship between the discrete building parts is always a close fit. The delimitations made by structure and enclosure/light are not only integrated-- they are the same. The structure marks its territory and the enclosure falls into the same line and thus the spatial modulation and exchange (outside/inside, use/use etc.) are minimal. Perhaps if the parts were not only discrete but independent as well, they might have told an even more engaging "story." The building even has a kind of rough, naive quality; an unrefined quality as in something newly developed. Its significance may be more in the buildings it subsequently inspired (Hertzberger's Centraal Beheer, for instance) than in itself as an isolated finished product. In this respect, one could say its place in the development of contemporary architecture is clear: it is deeply rooted in time.

More generally, the building as a "thing" presents itself as undeniably self-conscious; it has a certain inner-consciousness that emanates. But the question (in fact a valid question of this whole topic) is whether the frank presentation of a building in a narrative way is of any consequence at all to those "not-in-the-know" (who are the vast majority).

Its inter-consciousness, although largely not of tectonic significance, on the other hand, does not seem to be rooted in that specific place. Despite the references to neighboring buildings -- brick with cut stone trim (Kahn's building is concrete), and

the similarity of complex and broken roof lines -- it responds very timidly to particularities of the site. The building is not rooted in its place for, perhaps, two reasons: Kahn's "form" generating principles dealt primarily with the building (the inner-conscious) and its use/program instead of a combination of the inner and inter-consciousness of its "form"; second, the system (square laboratory towers with services on each side's centerline) has little capacity, at the building size, to respond to differences. The result is an aggregation of a characteristically unresponsive system.

part five:

CONCLUSION

In addressing tectonics, I hoped to increase my understanding of an architecture that is rooted in time and place as well as an architecture with a rich and diverse set of cultural readings. At the most modest level, I was concerned with the making of architecture in the modern world.

The rooting of architecture in time and place depends on the external and internal references of building where by way of its inter-consciousness a building's inner-consciousness is released. Not disregarding the former, which is equally important in a rooted architecture, the intrinsic properties of a building -- structure/enclosure, services, joining/detail, materials/technique, and natural forces, etc. -- are the subjects of tectonics. As part of the cognizance of the fundamental attitudes of a place, the tectonic subjects are the things with which a building can root itself. Tectonic buildings manifest the character of a place as part of the continuum of history. To build tectonically is to realize our existence on the earth here and now with respect to the particular phenomenon of a place.

Architecture as a set of rich and diverse cultural readings is another objective of tectonics. Its consequence is twofold: the possibility of different interpretations of the same tectonic object: and a kind of "depthness." The non-explicit "story" of tectonic expression allows for varying readings where architecture can attain, retain or change significance as cultural circumstances dictate. This change of significance can occur over a long period of time, as from one culture to another, but also is possible simultaneously whereby two people looking at the same object would "see" two different things. It is a kind of ambiguous form allowing different, yet precise, readings.

The "loss of nearness", to use Heidegger's terminology, has resulted in a general condition of "depthlessness" described in part one. Here "depth" is being used in its

most physical sense where it refers to how a building reveals itself. A tectonics building, by being concerned with materials, detail and joining, would have the capacity to reward a user at the smallest detail: where the detail could be a microcosm in itself telling the story of the whole building. The relationship between the whole and the parts is key to the meta-physical importance of the subjects of tectonics.

In either case -- through the possibility of varied interpretation and of depth -- a building would constantly reward the user and have the possibility of engagement in terms of its own making and general circumstances.

In addressing tectonics many more questions are raised than are answered; a kind of epistemological "pandora's box" seems inevitable and leads one to challenge the validity or effectiveness of a tectonic approach altogether. Does one resign himself to seemingly regressive current trends under the guise of historical inevitability, or is it possible to operationally resist them? More specifically, does a tectonic approach have value only to architects, who by profession are, (or at least should be), interested in how buildings go together? Or does the layperson as well feel the meta-physical presence of a building's properties, contributing to a meaningful experience?

By outlining a partial set of concerns, I think it is possible to resist certain current trends. I think architecture is fundamentally different from the other arts. Buildings are not a re-presentation whereby the objects are eventually reduces to a commodity, but rather relatively permanent things that we inhabit as part of our life-world: they satisfy dreams as well as needs. Thus, in trying to resist some general current trends in a society intoxicated with the self-perpetuating cycle of production and consumption, I think a tectonic approach touches on deeper, more enduring values.

At the very least, tectonics is concerned with the *making* of buildings and how their making is made apparent. In bringing the physical into the meta-physical, one can begin to talk of tectonics as a poetic of construction.

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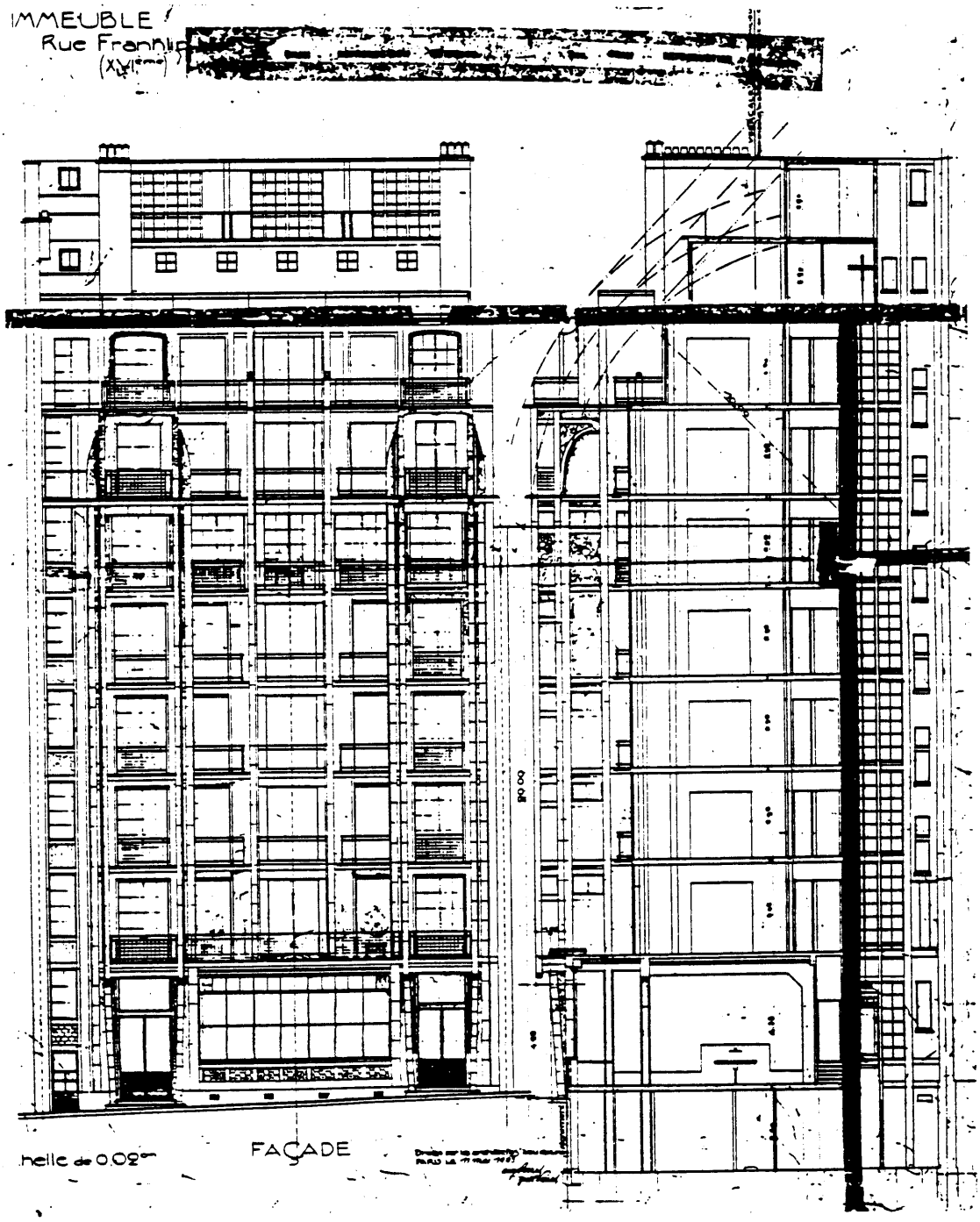
APPENDIX



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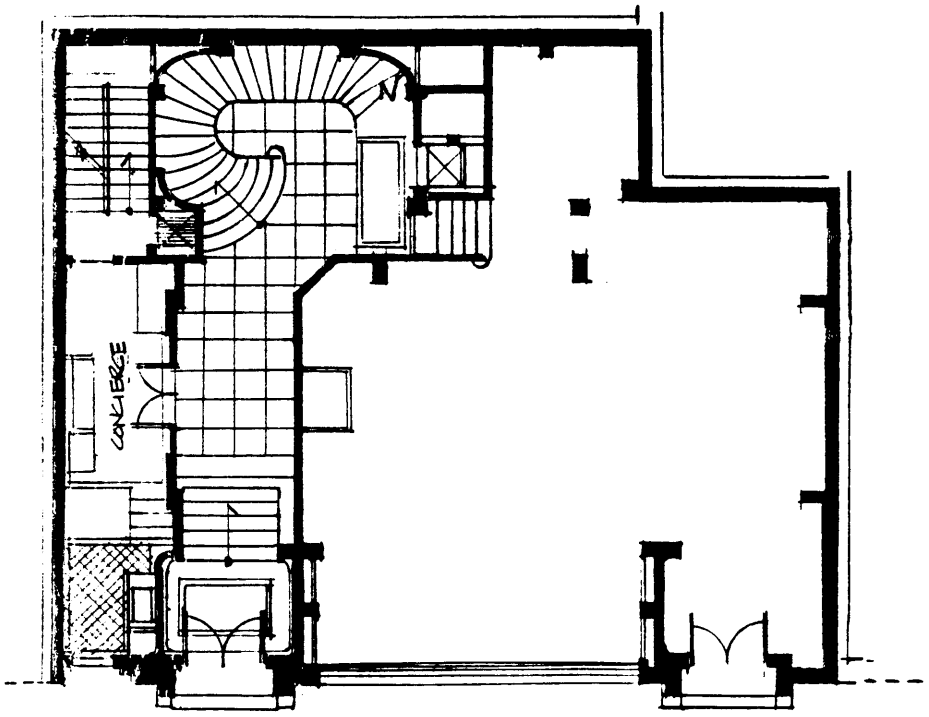

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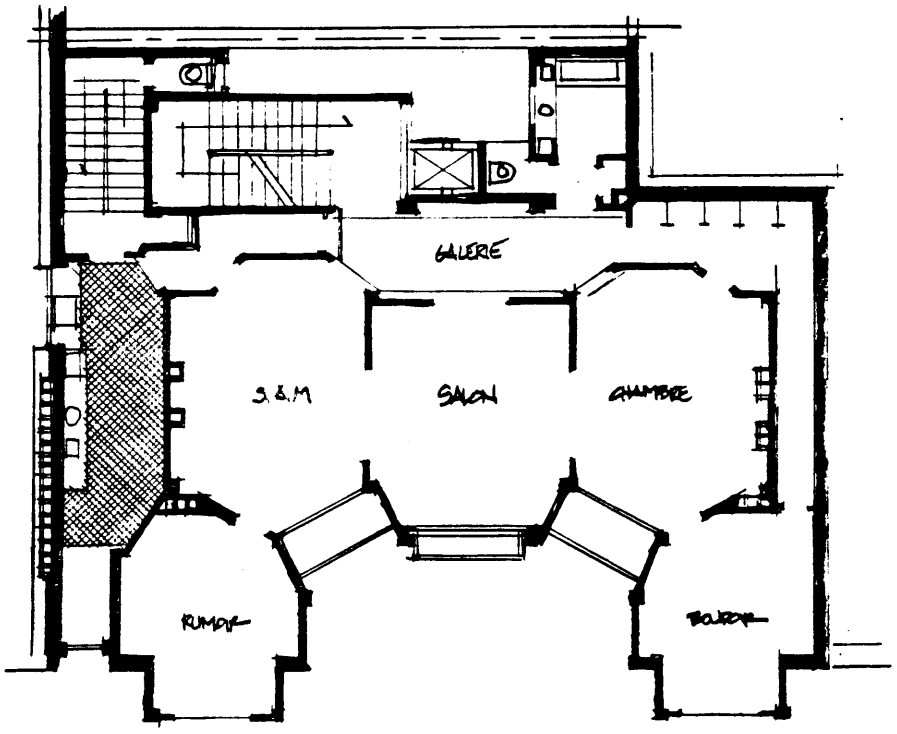
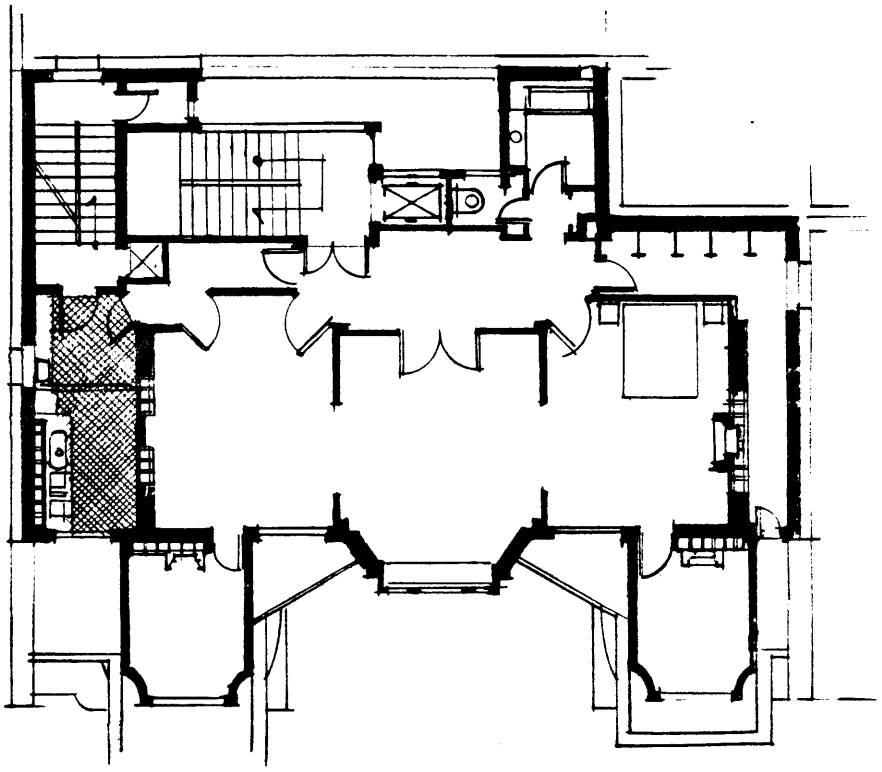
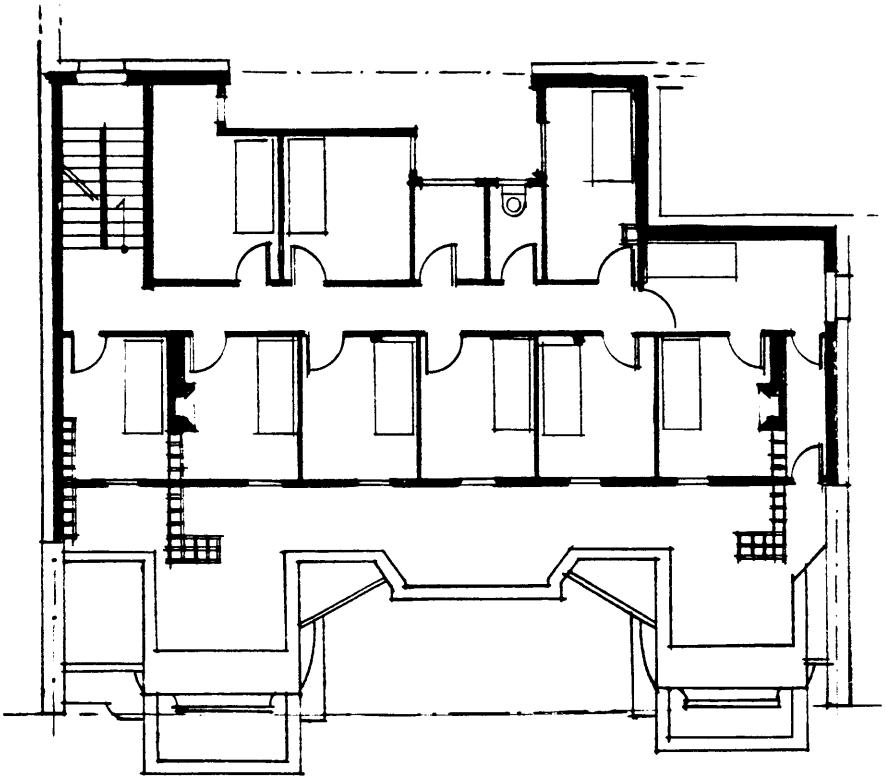


Typical apartment floor plan. Rue Franklin



7th floor plan. Rue Franklin



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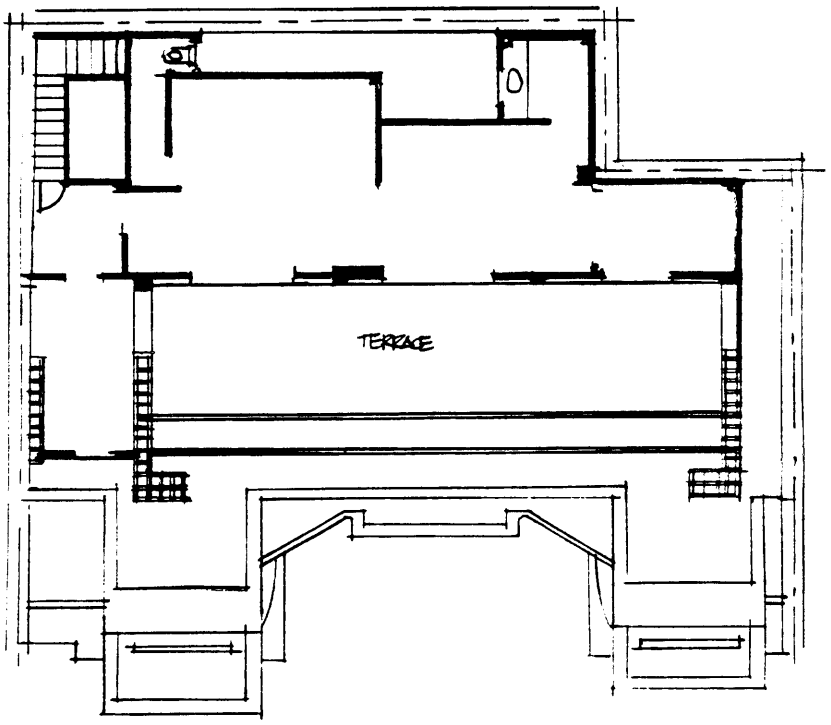

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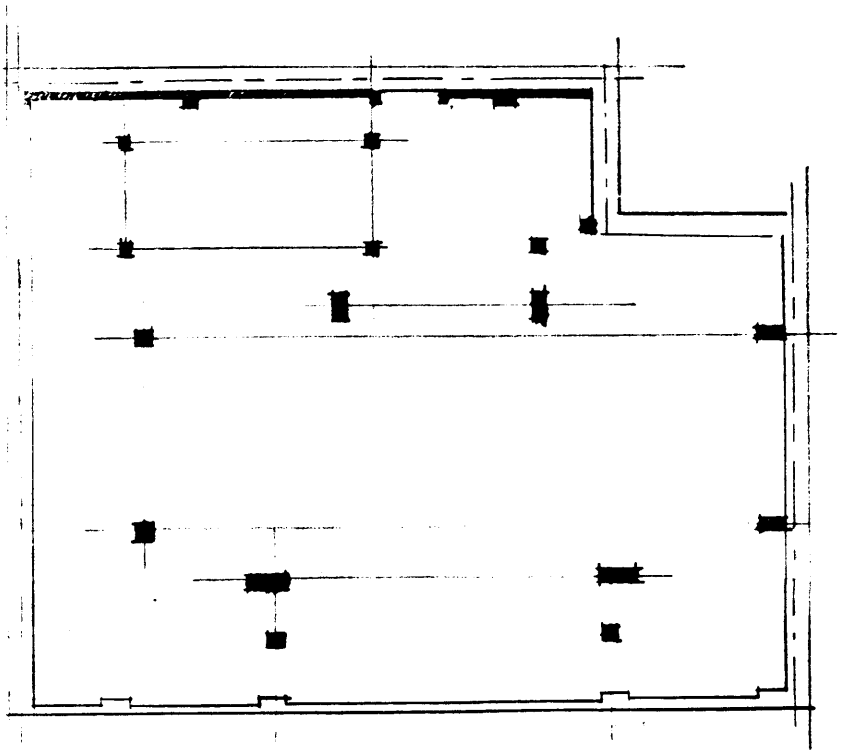

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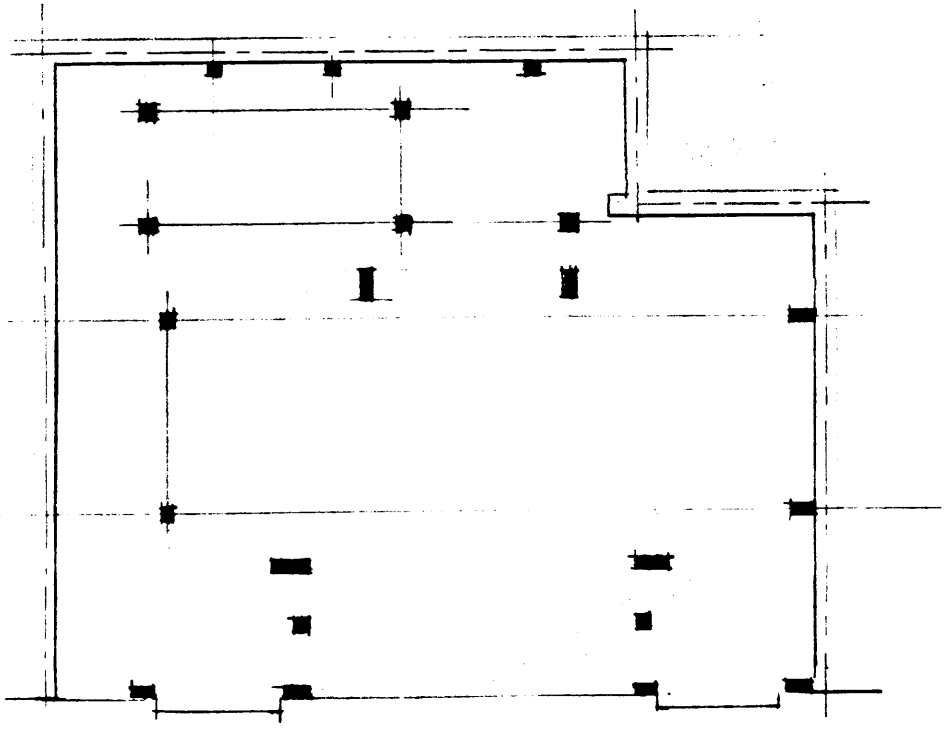

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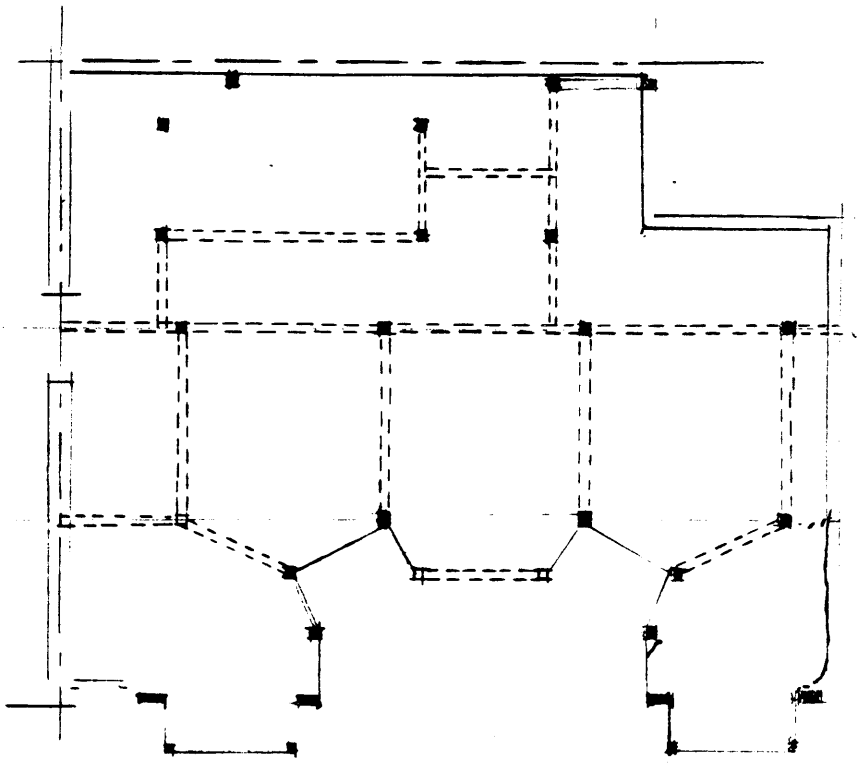

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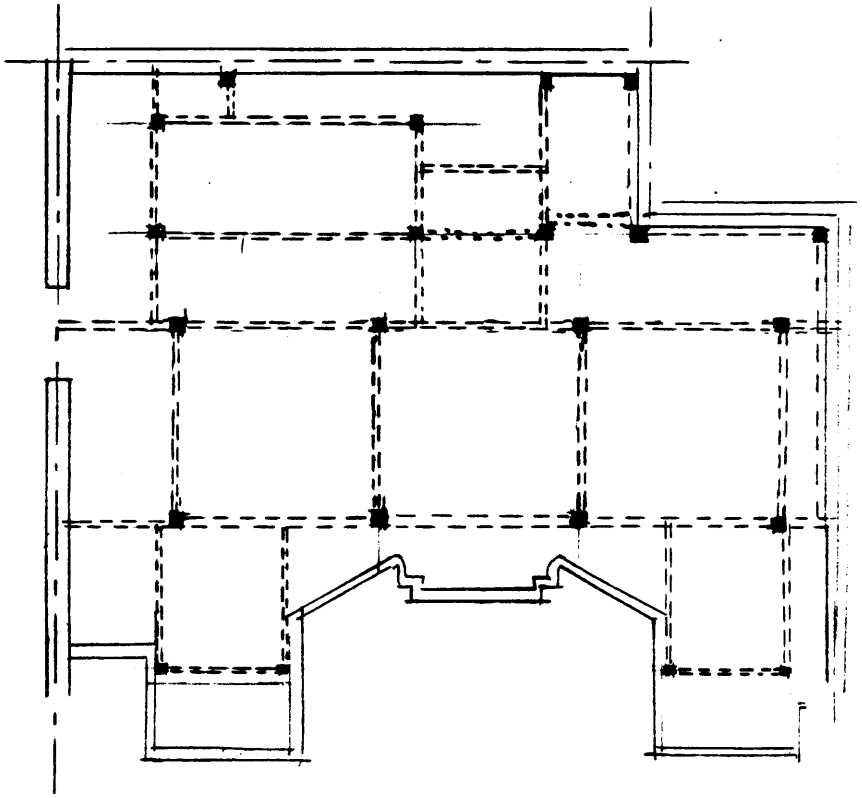

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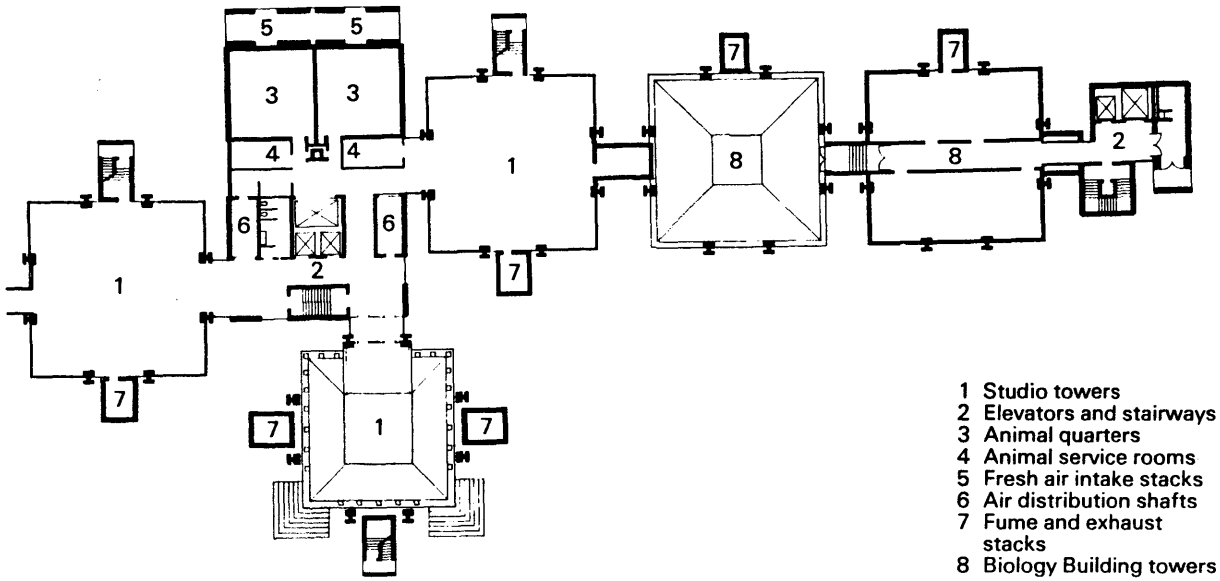
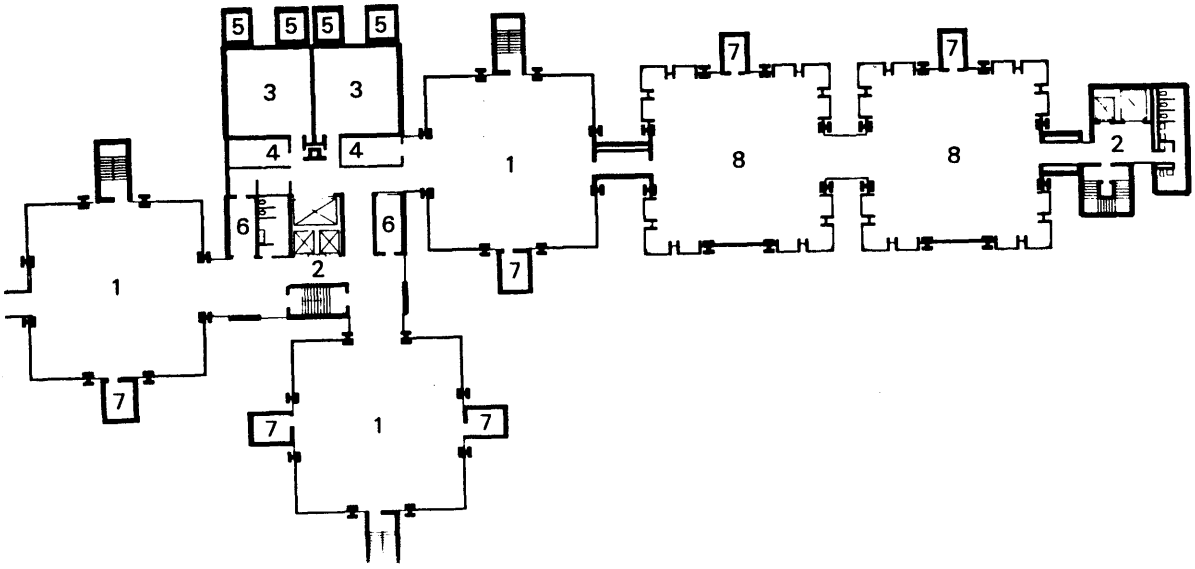
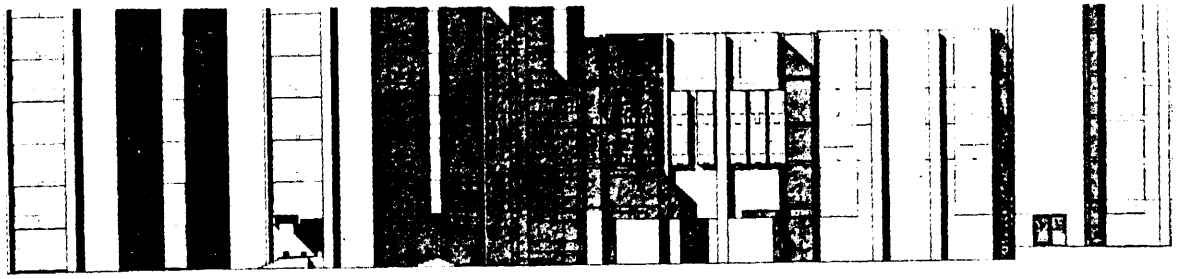


Ground floor plan. Richards Labs



Typical floor plan. Richards Labs



North elevation. Richards Labs