MULTIPLICITY in AGGREGATED BUILT FORM

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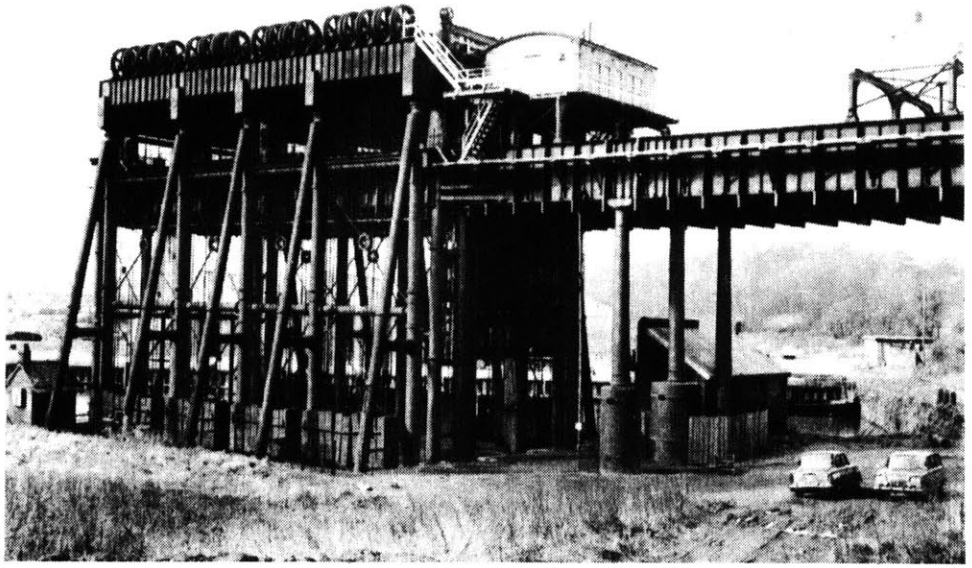

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Chairman
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COVER

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ANDERTON LIFT (immediately north of Northwich, England). To avoid a flight of locks, with their time-consuming passage and loss of water, the Weaver Navigation was connected with the Trent and Mersey Canal by means of this massive lift -- the canal is clearly seen in the trough at top right, and the river is below. Opened in 1875, the lift was originally hydraulically operated, each caisson (of wrought iron, 75 ft x 15 ft 5 in.) being supported by a ram 3 ft in diameter, most of the effort required to raise a boat the 50 ft being derived from overfilling the top caisson relative to the bottom one (one was always at the top in those days when the other was at the bottom). Each tank full of water weighed about 252 tons, and the system worked well for twenty years, until scoring of the rams made replacement necessary. In 1907 the lift was reopened using electric power (with a 30 h.p. motor), most of the weight being counterbalanced by the cast iron weights working over the pulleys shown. The lift is a reasonable alternative to either the flight of perhaps ten locks, which would have been needed instead, or the troublesome transshipment of goods, which had been necessary before it was built.

Multiplicity in Aggregated Built Form

by
Mark DeLaney Smith

Submitted to the Department of Architecture on February 12, 1985 in partial fulfillment of the requirement for the degree of Master of Architecture

abstract

Although the economic efficiency of industrial construction technologies based on long production runs of similar manufactured components is well known, strict dimensional considerations and repeated use of a limited number of formwork types tend to result in "built-modules" of excessive uniformity. With respect to building form, these technologies offer little flexibility in realizing more pluralistic design solutions. The designer's input can be reduced to applying idiosyncratic skin treatments to a building framework which, by its repetitive nature, designed itself before leaving the factory.

If, however, the initial design of these systems is both formally and structurally reconsidered, assembly generating much greater ranges in the aggregate form will be possible. Thus, the input of the designer will be dramatically enhanced. Given this shift in attitude, the rethinking of the structural and formal behavior of the components can help determine the ways in which the systems may be assembled.

Thesis Supervisor: Waclaw Piotr Zalewski
Title: Professor of Structures

ACKNOWLEDGMENTS

It is unfortunately impossible to mention everyone who made this exploration possible, but the following friends cannot go unrecognized.

Waclaw Zalewski · For lending "credibility" to my ideas.

Maurice Smith · For instigating the work embodied here and of course for helping me to overcome my "formal illiteracy."

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1. WHY MULTIPLICITY?

Social [economic and political] problems inevitably affect architecture and design -- producing for the moment a great deal of confusion over design's reasonable purpose and direction. There are swings to a (presumably) more comfortable past -- the whole nostalgia movement in home decorating; there is Post-Modernism, which reduces architecture to supposedly witty and ironic skin treatments; there are manifestations like "Memphis" in furniture and accessories, which I find easier to take than architecture for some reason -- probably because the latter smells of pure fashion, supported by a large infusion of hype from a press starved for news.

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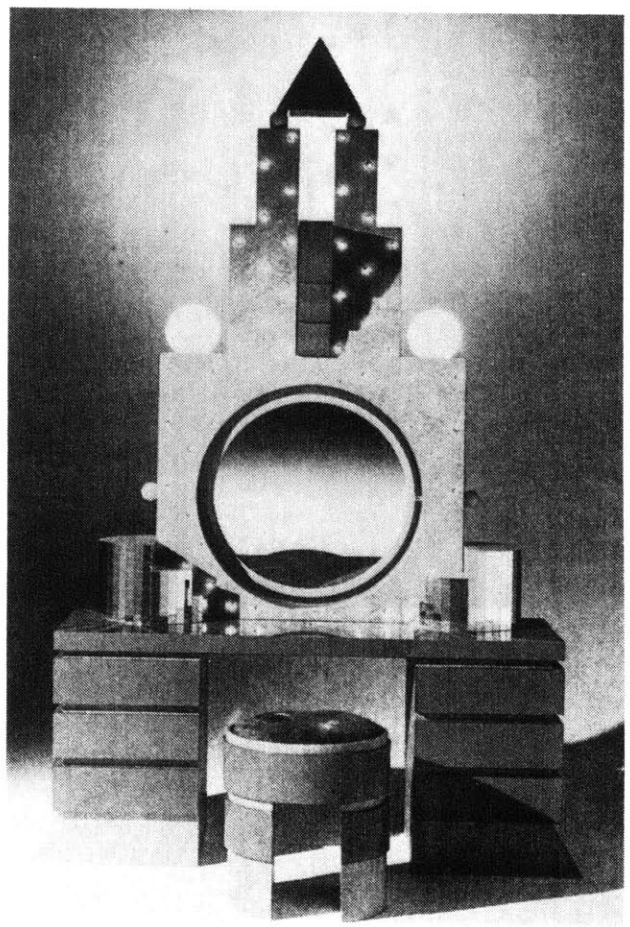
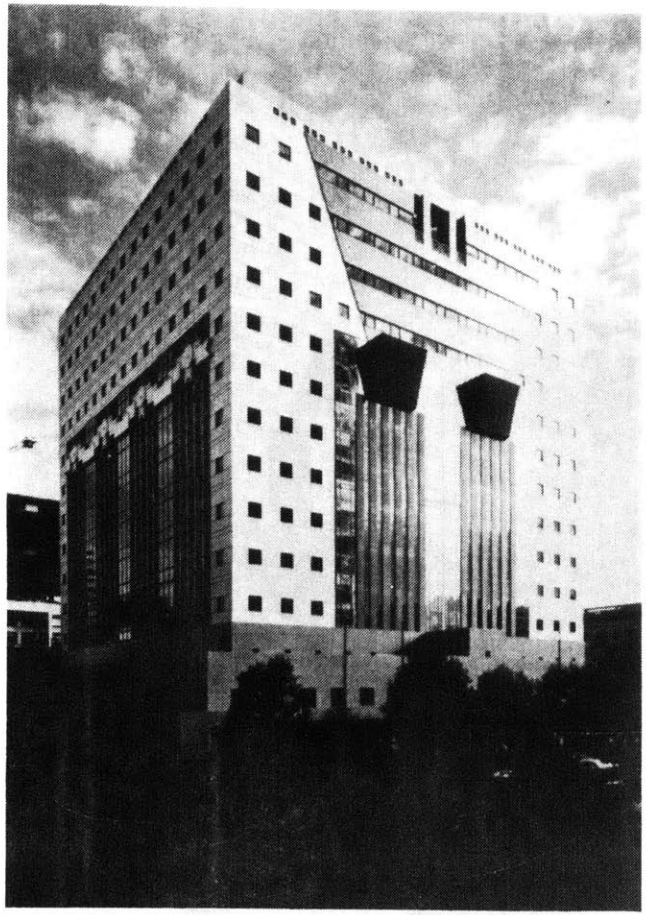


Dressing table designed for the Memphis Furniture Company, Milan by Michael Graves.



The Portland Building, Portland, Oregon.

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George Nelson's dismal perception of current design and architectural practices is unfortunately not far off the mark. However, in defense of Post-Modern's "supposedly witty and ironic skin treatments," one need only review economic and political trends which appear to direct builders and developers toward mundane and superficial solutions to habitable built form. Economy dictates that buildings no longer need function for extended periods of time. It is desirable to receive a payoff from an initial investment as quickly as possible; longer-range planning is out of the question owing to global economic and political fluctuations. Given this fast-paced calendar, what is left to design is a building that is physically, structurally, and formally minimalist. The use of the least material and labor is paramount. What then remains for the architect is only the possibility of some inexpensive and superficial treatment to a predesigned (by supposed economic necessity) box. In many instances, a designer's formal contribution to architecture is merely painted graphics on an object's surface which will probably need to be replaced after a relatively short period (about the same time that the building can be expected to pay

for itself and hopefully be resold). Thus we have disposable architecture, not unlike cheap plastic tableware that is used once and discarded.

EXPERIENTIAL ARCHITECTURE

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Maurice K. Smith residence, Harvard, MA.

What is lacking in that approach to building is any minutely open-ended relationship between buildings and inhabitants that involves a range of perceptual and emotional interactions. Fundamental to the concept of "experiental" architecture is the platform that architectural design decisions be open enough for the inhabitant to become involved with the design, and to make changes and adjustments necessary to fit individual lifestyles without interfering with the integrity of the whole. The architect's real task is the development of processes and systems for decision making. The assemblage of a larger, positive framework able to accommodate a variety of "infill" becomes the overall organizing principle. This fresh approach is clearly a reaction against the neutrality of the International Style and the more recent decoration trends attempting to render the physical environment more human. If it is truly cost which inhibits the approach advocated, more careful attention must be given to low-cost industrial forms and materials.

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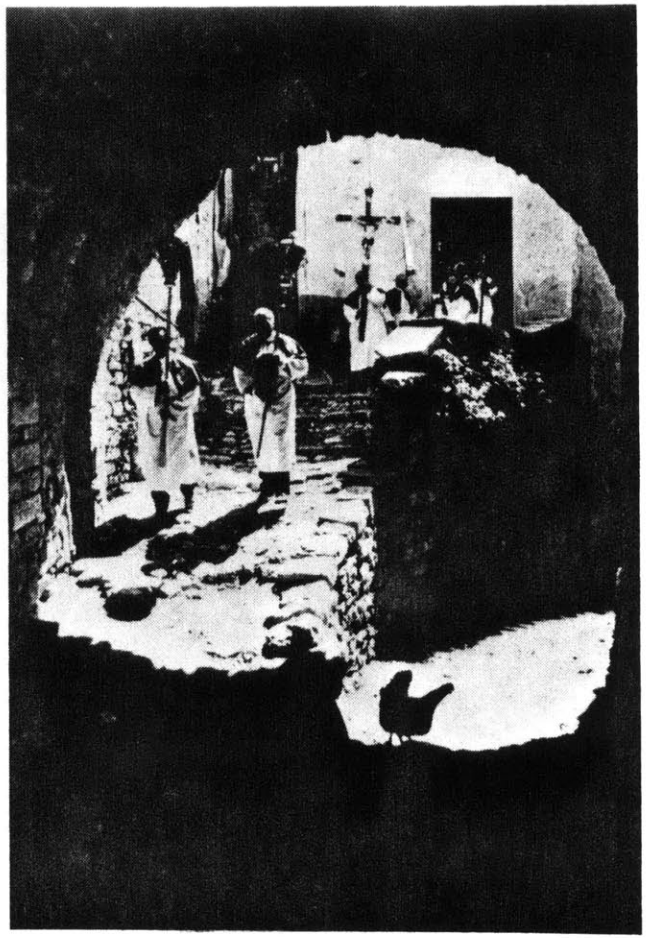
A couple in front of their habitation in Martina Franca.

Although political norms and socio-economic intentions dictate the direction architecture takes, society is not so restrictive as to intentionally close down fresh possibilities of learning about and experiencing the physical environment. The fact is, no two people or situations are alike. Placing a society in an environment of inadequate multiplicities and definitions contradicts the notion that variety and self-identity are important factors in life. It is hoped that the built physical environment may generate a common bond between all individuals within a society, and not merely become a neutral background for it. The built environment may then participate and interact with its users. It can generate a pluralistic order by offering a maximal range of partial definitions and polarities.



Postignano. The start of the annual church procession.

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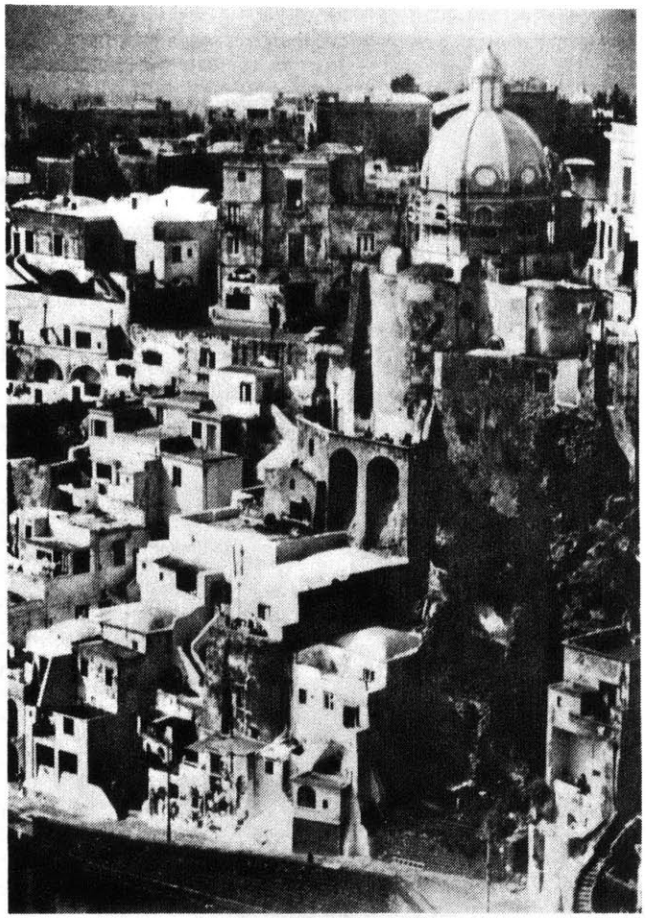

Procida. View from the Marina Corricella.

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If it is possible to generate buildings from a pluralistic range of definitions, the powerful self-identity of each individual may easily be accommodated by the enormous variety and multiplicity in the physical environment. If this assumption is correct, there should be no need to build or repeat a boring singular norm. Moreover, the conventional non-pluralistic approach to design inevitably leads to the nihilistic application of superfluous graphic attempts which generate at best a two-dimensional formal variety.

Maurice K. Smith illustrates the case for pluralistic form in the following excerpt from an interview in The Journal of Architectural Education:

> We can develop a "friendly collage" attitude, which allows respectfully that people are also different and their differences can be built. We don't need to find a reductive common denominator. Once we believe that, we have a critical measure, and it's clearly wrong for a school to have a dozen identical classrooms, because all those people in them -- students, teachers, what they're doing and where they are -- are different. Difference itself becomes a positive virtue. And every possible difference sets up more optional associations...

Once the argument for plurality in the built environment is accepted, the next step is how to arrive at a comprehensive understanding of specific formal qualities that would result in a demonstrably qualitative experience. We must not lose sight of the fact that we are concerned with architectural form, and that some degree of continuity and repetition is essential to the understanding of the end product. What is needed

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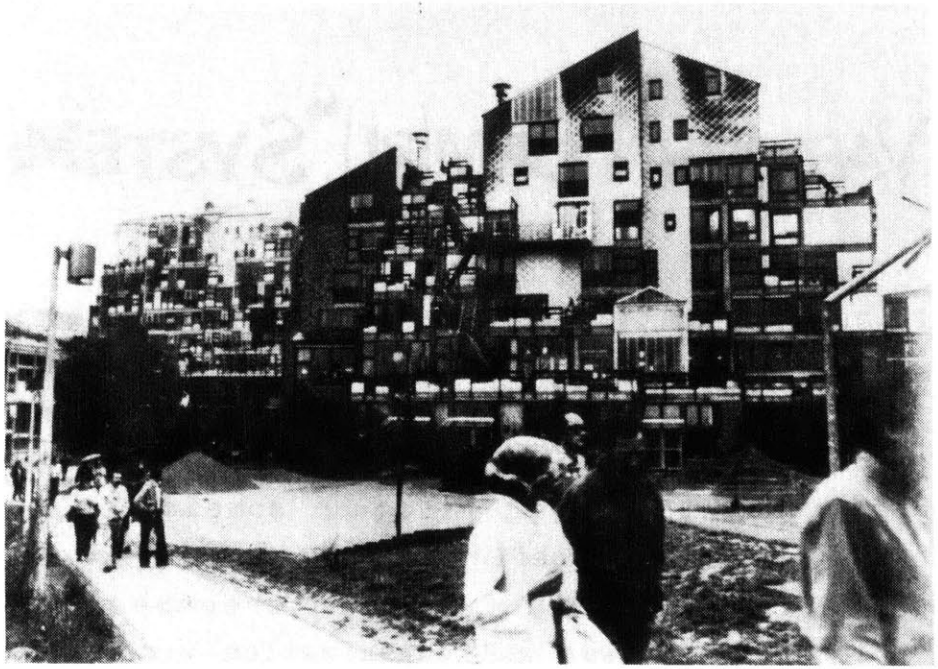

Facilites Medicales a Woluwe-St-Lambert.

is a built physical reference -- (or more literally, a framework) that is the initial round of formal and use definition. This framework would be similar to the armature of a sculptor in that there would be enough strength of form to provide an overall organization but not enough to become heirarchic. This first round of decisions must support subsequent decisions while not overpowering them.

SELF STABILITY of VARIOUS FORM(al) "SYSTEMS"

Primary or initial form decisions are equated with access for practicality's sake. Here it is important to distinguish between access and circulation. Circulation implies a system which operates within a building or some other close built system. By definition, access is more open ended; it allows for the interconnection of independent systems and organization within those systems.

Since access is a primary element of formal organization, it follows that some predictability and repetition must occur if for no other reason than orientation. However, this is not to say that access is a singular system. The access may be built of repetitive elements which, if properly deployed, should add up to an unpredictable whole. Tuscan and Iberian villages are a good example. There are dimensional and formal repetitions in the individual dwellings, yet additive assemblage of the basic units does not lead to a predetermined continuity. There is a flexibility in addition and aggregation which allows larger moves and continuities to remain independent of the rules by which the smaller moves have been made. Thus, while the access is built from smaller repetitive moves, it still retains a distinctly different identity. This concept of allowing individual systems to retain their own unique identities is that of self-stability.

The success of Moshe Safdie's Habitat also depends to some degree on the principles of self-stability and aggregated continuities. The placement of precast dwelling units, which are by definition self-stable, depends on some larger organizing

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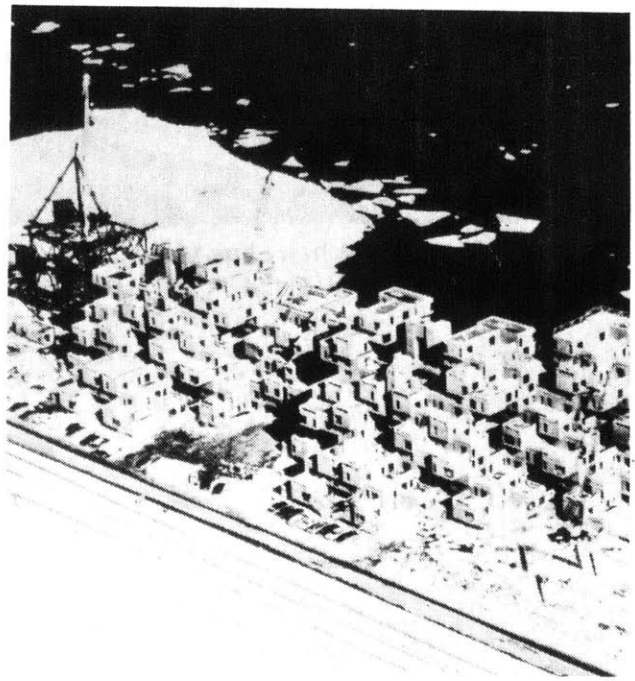

Habitat, Montreal.

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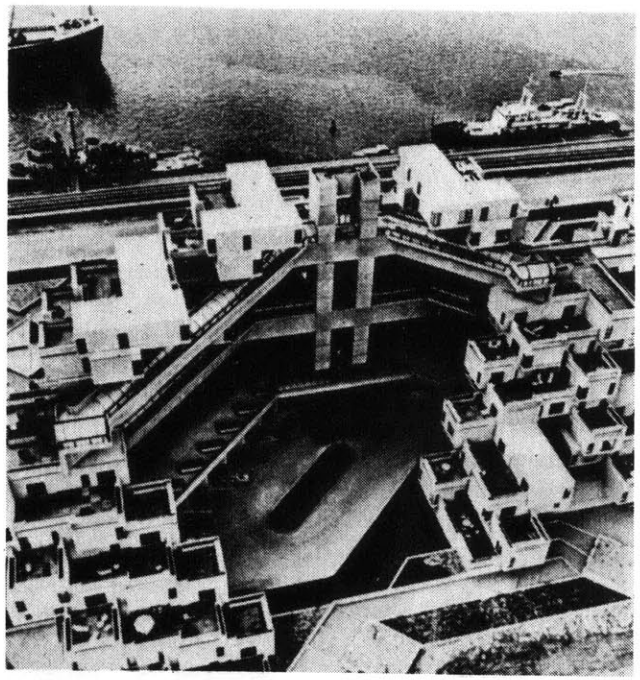


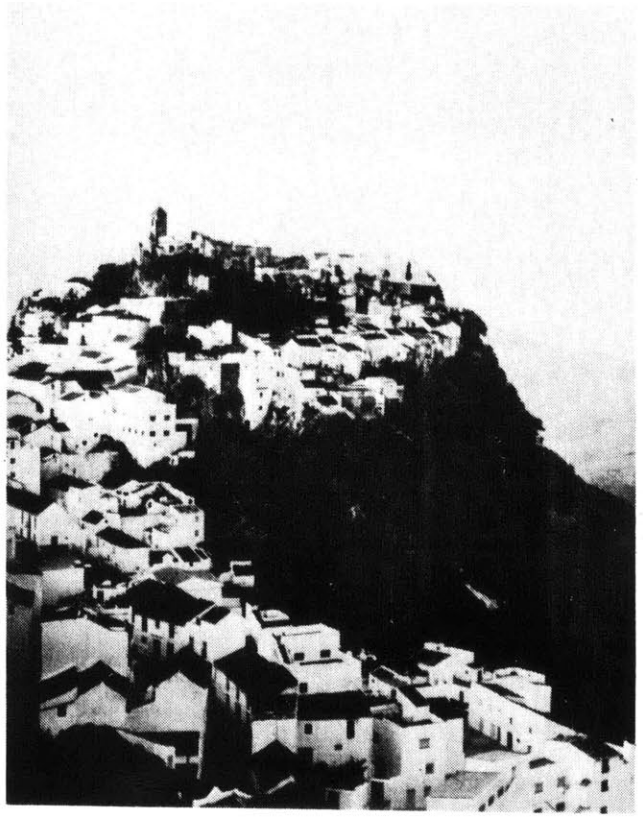
Registration of habitations to the "built-access."

principles (i.e. larger continuities). Safdie has introduced a framework (built access) that apparently conforms to the direction and overall form of the dwelling aggregation. Out of structural necessity, he has created a heirarchic primary system which doubles as access, but is not so formally stable as to become independent of the precast dwelling units, and vice-versa. The result is that the primary access is only intensified by the registration of the precast units. Neither of the two systems are really independent from each other in this respect, and thus a heirarchy has been created: one system is structurally and formally dependent on another. Were either of the systems truly self-stable, this interdependency need only occur at will.

> ... If we are designing ... housing for 500 people, part of the proposition includes enough recognizable definition so that the rest of the built landscape can reciprocate.
>
> **52**

Through the lineal aggregation of self-stable additive growth forms, the designer may create an environment not only rich in formal variety and multiplicity, but one which can have larger, more recognizable continuities as well. Large

definitions* and continuities are crucial for two reasons: (1) Without access continuities, orientation within any habitable structure is difficult. The larger moves prevent the overall aggregation from becoming maze-like. (2) In order to arrive at any sort of interaction with the natural landscape, built or natural, large scale continuities are essential. If the larger definitions are easily recognizable, then they may participate in an additive manner with similarly sized definitions in the landscape.



Cesares.

*Large built definitions are substitutions for "landscape" realities. What remains to be determined is how big is enough?

2. MULTIPLICITY of PROCESS

Of all the primary objectives in this thesis, the emergence of formal variety from inherently repetitive building processes is paramount. The formal failure of many industrialized building technologies does not lie within the physical system per se but with the singular deployment of its parts. Regularity and monotony result from the use of only one process. Many of Mies van der Rohe's buildings are exemplar of this misunderstanding. Although the Mies buildings are very direct, they offer neither the possibility of formal interaction with the environment nor any attempt to create habitations which are more than a single designer's obsession with a singular building system. Mies' glass boxes are just that -- complete object definitions randomly "lowered" onto any landscape.

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900 Esplanade Apartment Buildings (model), Chicago. Mies, 1954.

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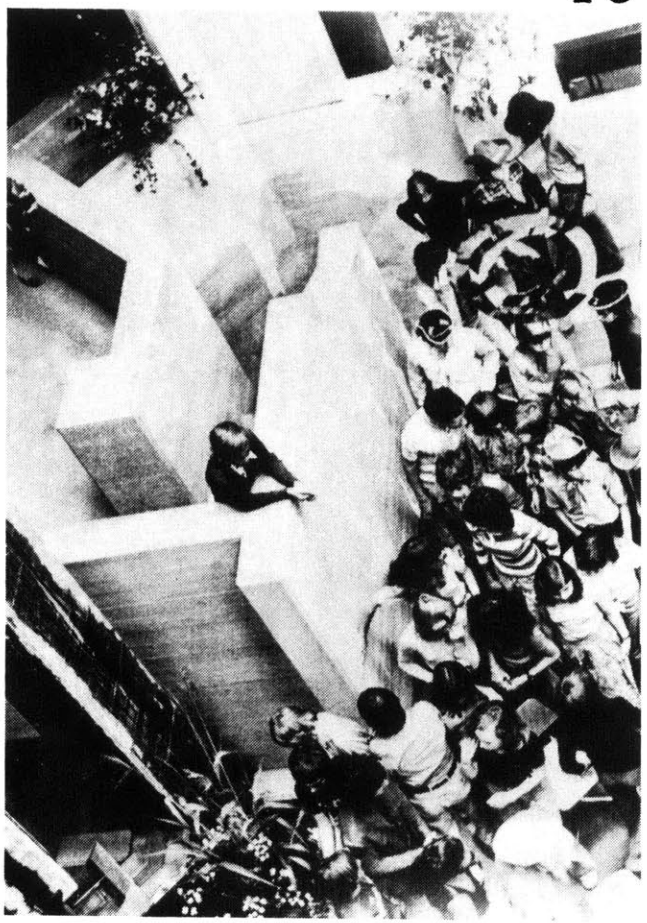
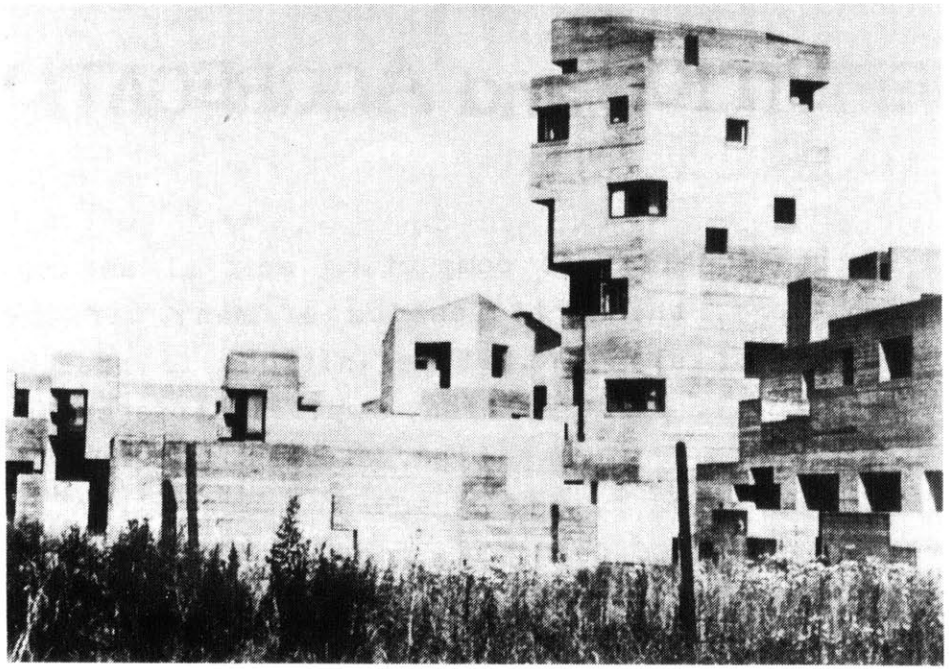


Interior of "Im Grafler" Technical and Higher School at Schaffhausen-Herblingen.

Walter Förderer's folded concrete wall chapels are similar to the Mies buildings in their singularity, with one important exception: they don't always make completed spatial definitions, which allows for the possibility of interaction with other forms. Although the physical form of Förderer's chapels rises from only one material and one process, the intentional incompletion of room-sized definitions allows for and implies that there is more to the building than what is literally cast in concrete. From the exterior, Förderer's buildings appear to be only the beginning of a larger structure. Their formal incompleteness implies that more (or less) could be built. (The Protestant Centre at Monheim resembles a habitable elevator-service core.) On the interior, the recognition of the reciprocal interaction of other self-stable forms (citizens in this case) with the built-form only occurs because of a deliberate non-completion of space on the architect's part. It is this duality of concern that gives the Förderer buildings their life and interaction with the environment.



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Protestant Centre at Monheim, North Rhine-Westphalia.

By taking any singular system and deploying components of that system in a "formally literate" manner, it is not only possible to arrive at pluralistic building form, it is, more importantly, possible to induce participation of the built-form with the environment.

PARTIAL DEFINITION and AGGREGATION

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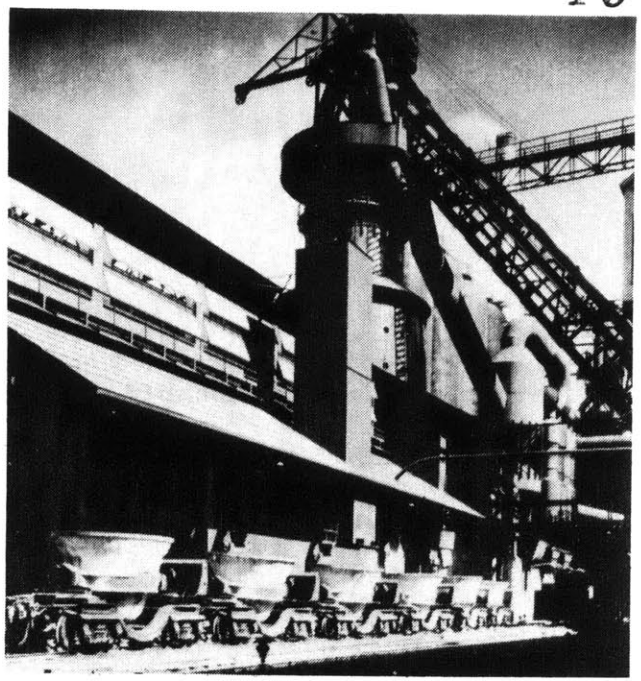

Ford Motor Company Plant in Michigan by Albert Kahn.

By intentionally not completing spatial and built definitions, the participation of many different formally stable partial definitions is possible. Multiplicity, by definition, implies differences -- or at least the condition which allows for the coexistence of manifold and various parts. If multiplicity and plurality in built form are to be achieved, even through the utilization of a single building system, then arrangements of different forms is required. Assuming that each collection of forms in an aggregation is self-stable (existing in its own right), then these forms can best coexist reciprocally. The aggregation of two or more formally dissimilar systems is not a contradiction if they are so deployed. George Nelson writes:

> Western religion lives with the complication of gods living along with devils, and much of Christian theological speculation has been devoted to the question of how God in his infinite goodness can permit the existence of evil.

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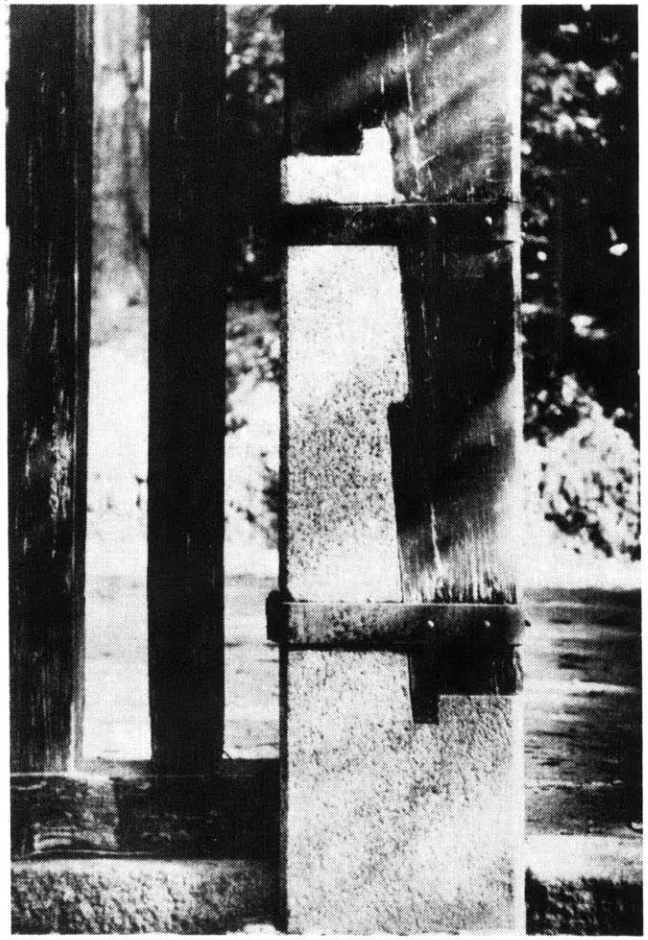
Habitants and users are a subset of "formally stable partial definitions." Eastern religions have attempted to resolve this paradox by accepting the existence of polarities. The idea is that so-called contradictions exist in harmony with each other. Moreover, one cannot survive without the other. The visually reciprocal form of the yin-yang symbol illustrates this relationship.

Both attitudes (East and West) can be applied to the design process. In the West, current trends lead to the expectation that science and technology might be a solution to the ailments of society. Although numerous technological breakthroughs seem to resolve many difficulties, they generally do not come without cost. The side effects of technological milestones create difficulties that are often more severe than the original problem. When corrective action is taken, the process often repeats itself until the problems are so great and many-faceted that a simple solution is no longer possible. As a rule of evolution, the problem moves from simplicity to complexity.



Honen-in. Interlocking joint used to joint wood and stone. Near Ginkaku-ji, Kyoto.

> The present conception of the universe starts with some hydrogen atoms drifting aimlessly in a bottomless void. Some fifteen billion years later these have evolved into 92 elements, planets, about 20 amino acids, art, science, contraceptive pills, Grateful Dead and Ronald Reagan. Our very survival may depend on our ability to deal with these contradictions. **54**

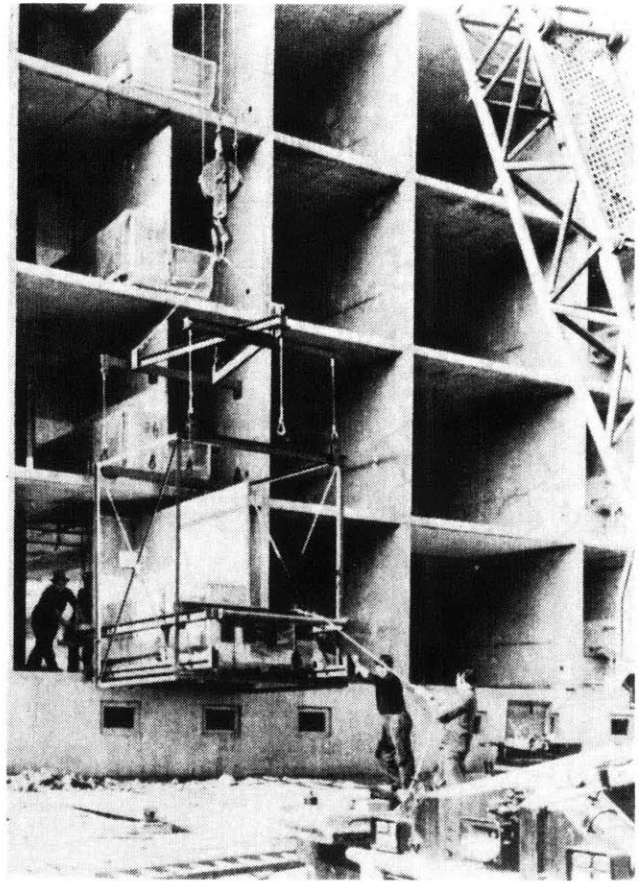
As a design process, "Built Form" addresses the yin-yang principle by allowing different and independent forms to coexist harmoniously in space. Continuities of space help to build the larger definitions which can bring together seemingly polar or contradictory forms. If space between independent forms is organized in a manner allowing reciprocative continuities to unify those forms, then a readable and understandable multiplicity of form is reached. The resultant built form is a continuity of differences that is interacted with by both the environment and the user.

The underlying assumption for this thesis is that formal richness and variety may be achieved through the aggregation of more than one industrialized building technology. It is clear that industrialized building technologies themselves do

not contain enough information to create habitable form. It is not enough to consider only the structural or physical properties of any building process. Habitable form may only be achieved with a comprehensive understanding of form itself.

Without an understanding of some basic formal principles, even an aggregation of self-stable systems cannot be successful. If the designer becomes infatuated solely with building systems and construction processes, then those particular systems or processes will run uncontrolled throughout the resulting structure -- even in those having more than one type of building component. Structural principles and physical components provide only limited clues toward a successful habitation.

For example, consider a habitation built entirely from cast-in-place (cip) tunnel formwork. The process involves placing reinforcing bars around a greased formwork. The concrete is poured, cured, and after twenty-four hours the formwork is slipped out horizontally and set on top of the hardened shell. The process is then repeated. One attempt to break the monotony and inflexibility of the



Cellular construction system, Copenhagen.

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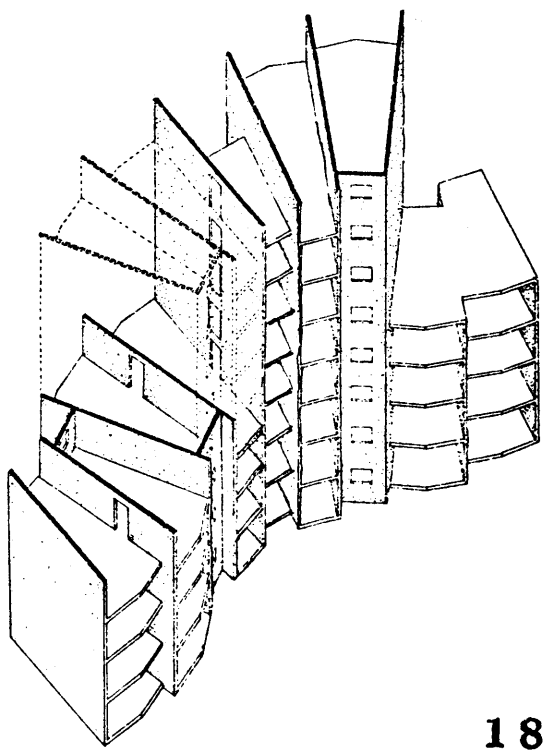

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resulting building is to widen the formwork at one end, which assists in its release from the cured concrete. If this process is exaggerated, the linear aggregation of units will become curved and some variation can thus be induced. However, this does little for the overall building form besides allowing the building to curve, snake-like. Attempts to express this structural modification of a building system only contributes to the construction process and add little or nothing to the building form. Without territorial and directional definition, there can be no useful built form, only a singularly monotonous structure.

Given the availability of a multitude of industrialized building technologies which are repetitive, some form language is required to aggregate the self-stable chunks of building. A formal "vocabulary" and set of rules are outlined in the following sections.

3. FORM BEHAVIOR and RECOGNITION

When working with self-stable building forms, a field organization is always employed. If a conventional grid system is the overall organizer of individual parts, then those parts are subject to a heirarchical arrangement (dependent on subdivision) and subsequently cannot be considered self-stable. Not only is a grid system heirarchic, but the notions of direction, territoriality, and slack (the space between stabilities) cannot be adequately addressed. These concepts embody the fundamental principles which will result in a workable aggregation of self-stable building components.

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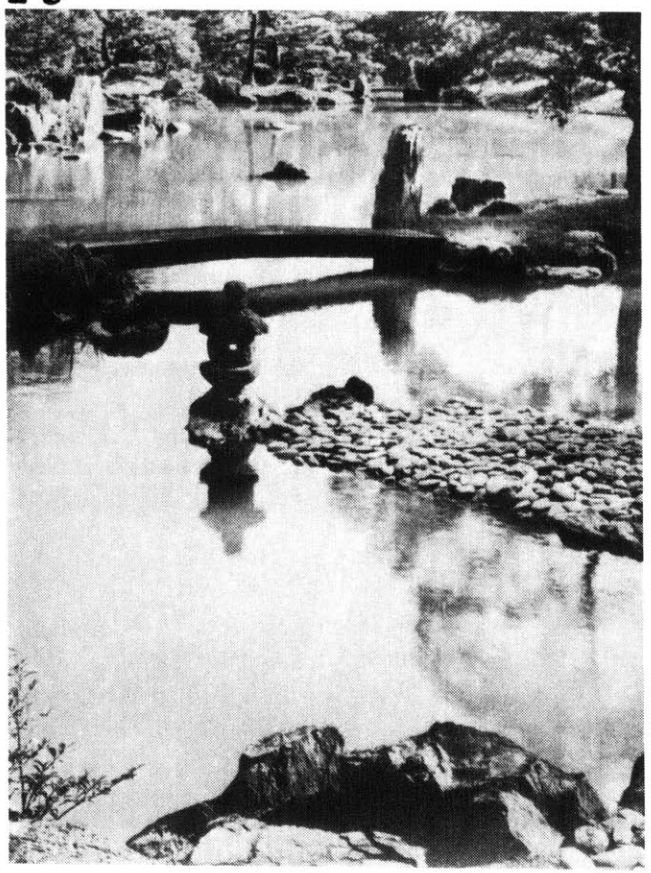

Katsura Palace. Main view of the garden.

DIRECTION in of FIELD ORGANIZATION(S)

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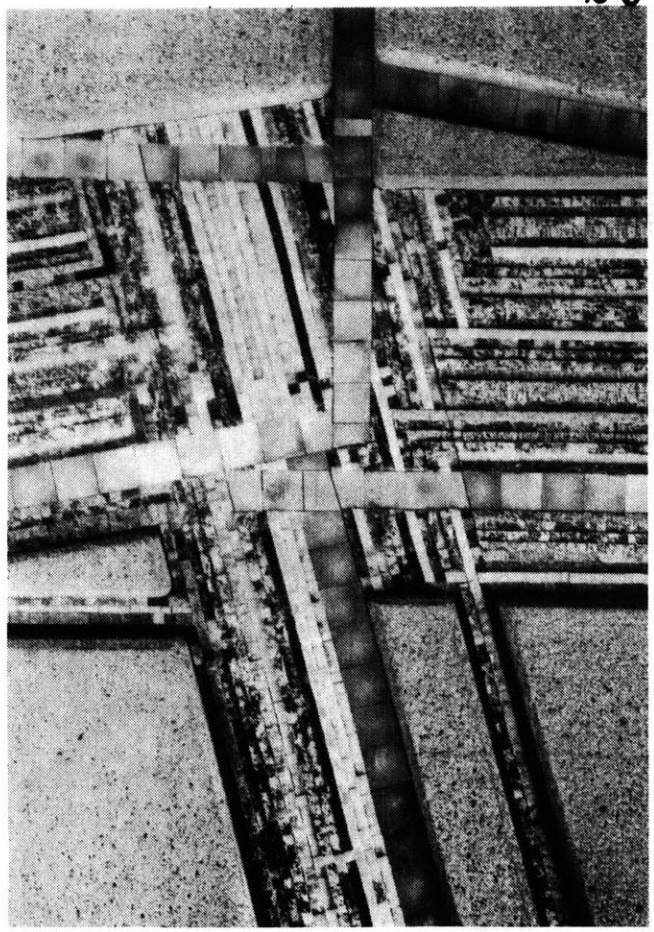
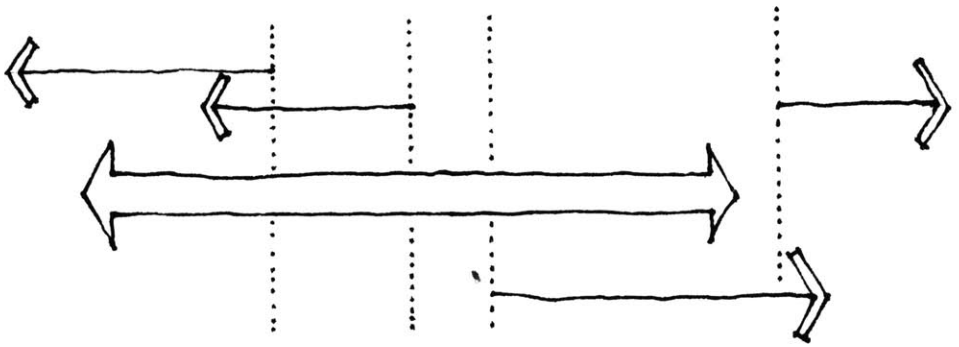


1975 mosaic in Duren by Ludwig Schaffrath.

There exist two distinctly different directional systems: habitable and processional. A processional directional system relies on the building up of a single spatial direction with the addition of relatively parallel components (0 -15) in a neutral field. An intensification of directionality is achieved by allowing the initial components to move at will parallel to the desired direction, i.e., avoiding the registration of components normal to the main direction will reinforce it.

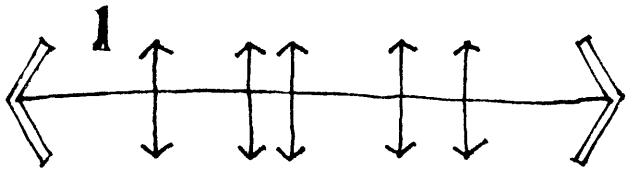


A street or racetrack may be considered examples of processional directionality.

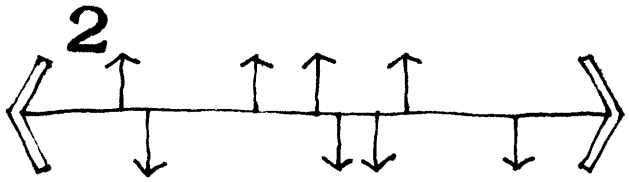
Habitable directional form may be considered an attempt to intensify a primary direction by the registration of perpendicular components to the primary directional component. When working in such a manner it is important not to work against the direction of the established field and thereby allow the perpendicular direction to dominate. If both directions are of equal strength, then there is in effect no direction. In this sense, a directional field's components should be heirarchic. Therefore, to retain or intensify the primary direction with a habitable directional form, the perpendicular components registered to the initial form must "slip" in the same manner that processional "slip" occurred in the first example.

In the omni-directional form diagram, neither direction dominates the other. In the second figure, the vertical components are permitted to break and slide along the primary definition, indicating greater importance and strength of the initial direction.

The slipping action of certain components of any directional field allows the field to retain its



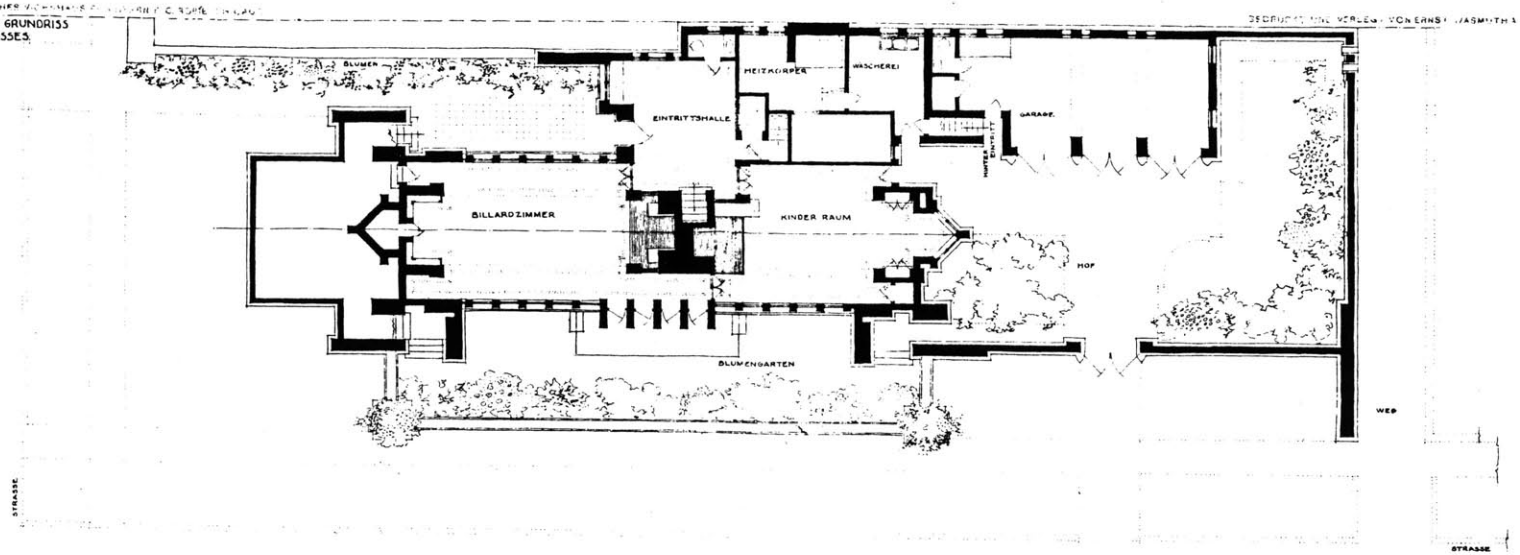
Habitable omni-directional form.

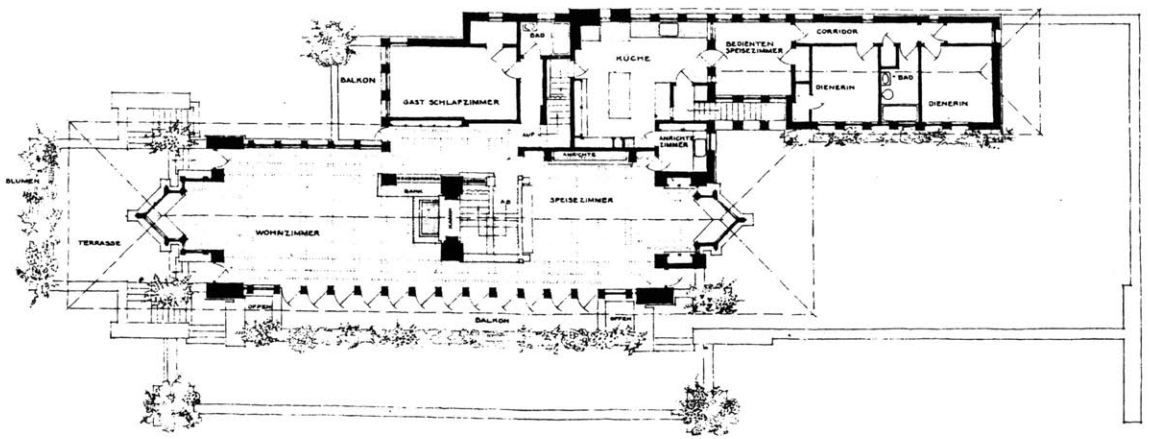


Habitable directional form.

Overleaf: plan of Robie House, Chicago by Frank Lloyd Wright.

LAGEPLAN UND GRUNDRISS
DES ERDGESCHOSSES





GRUNDRISS DES HAUPTGESCHOSSES

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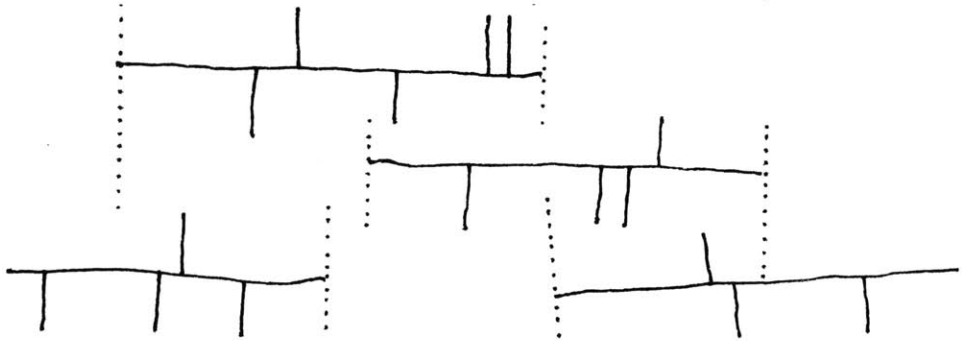
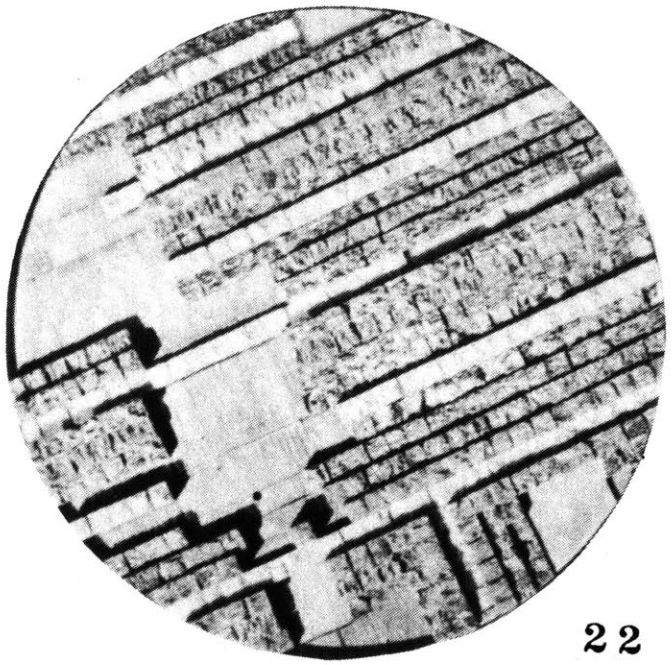
directional integrity (see following figure). Furthermore, the registration of normal components results in the emergence of some partially closed territories and zones. These territories may be considered habitable. They are privacies which may be connected by the directional access system.



TERRITORIALITY

The second principle in developing a working aggregation of self-stable components is that of territoriality or partial containment. A containing form functions in two different spatial modes. First, this element is an "optional" container. It "contains" some space while remaining open enough to allow continuity, or vice-versa, to invite an alternate system to assist in the definition of the territory.



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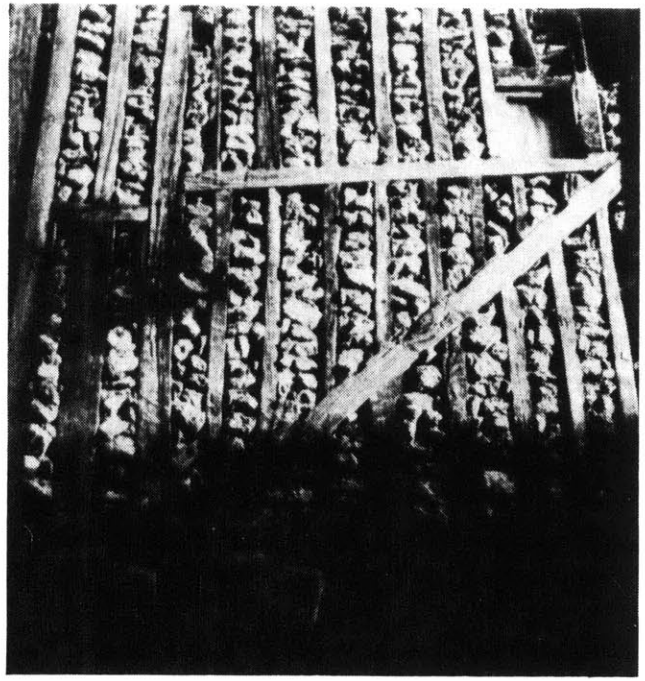
Mosaic study by Schaffrath.



"Packing" of wall form at La Alberca.

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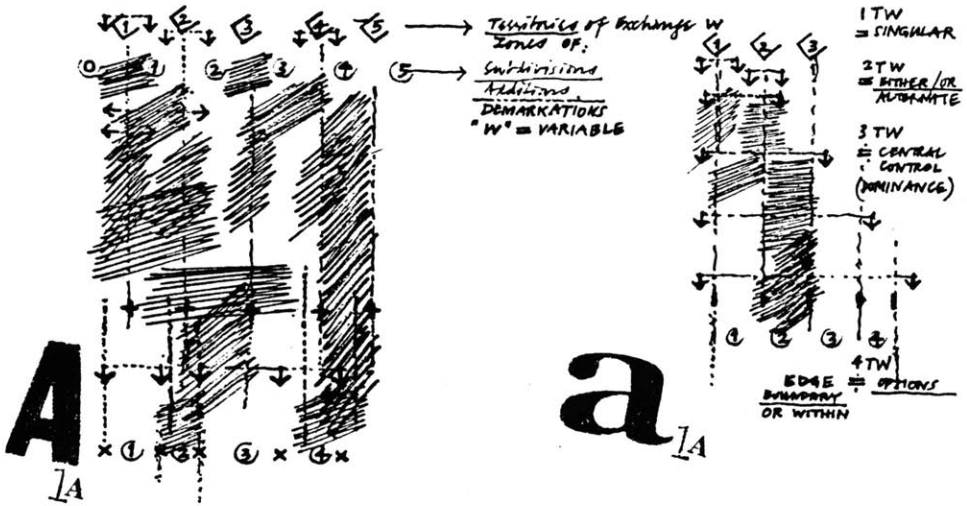
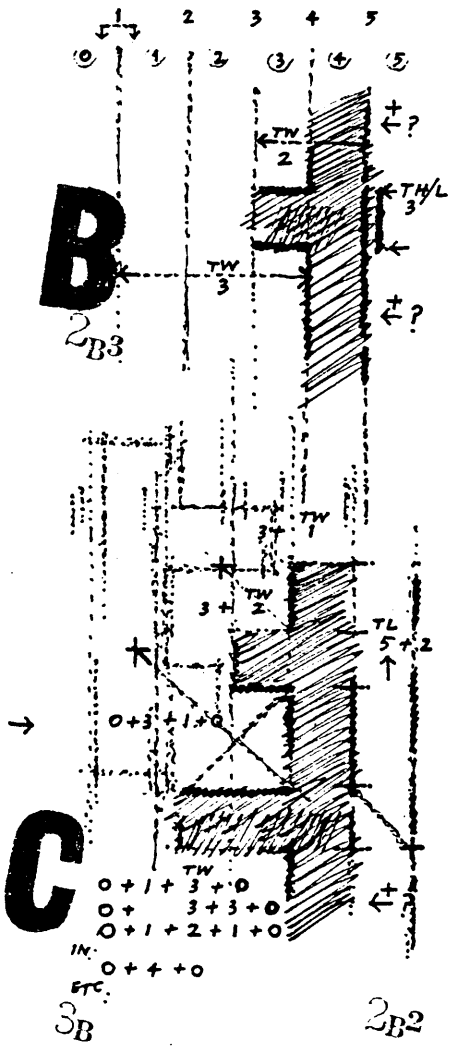
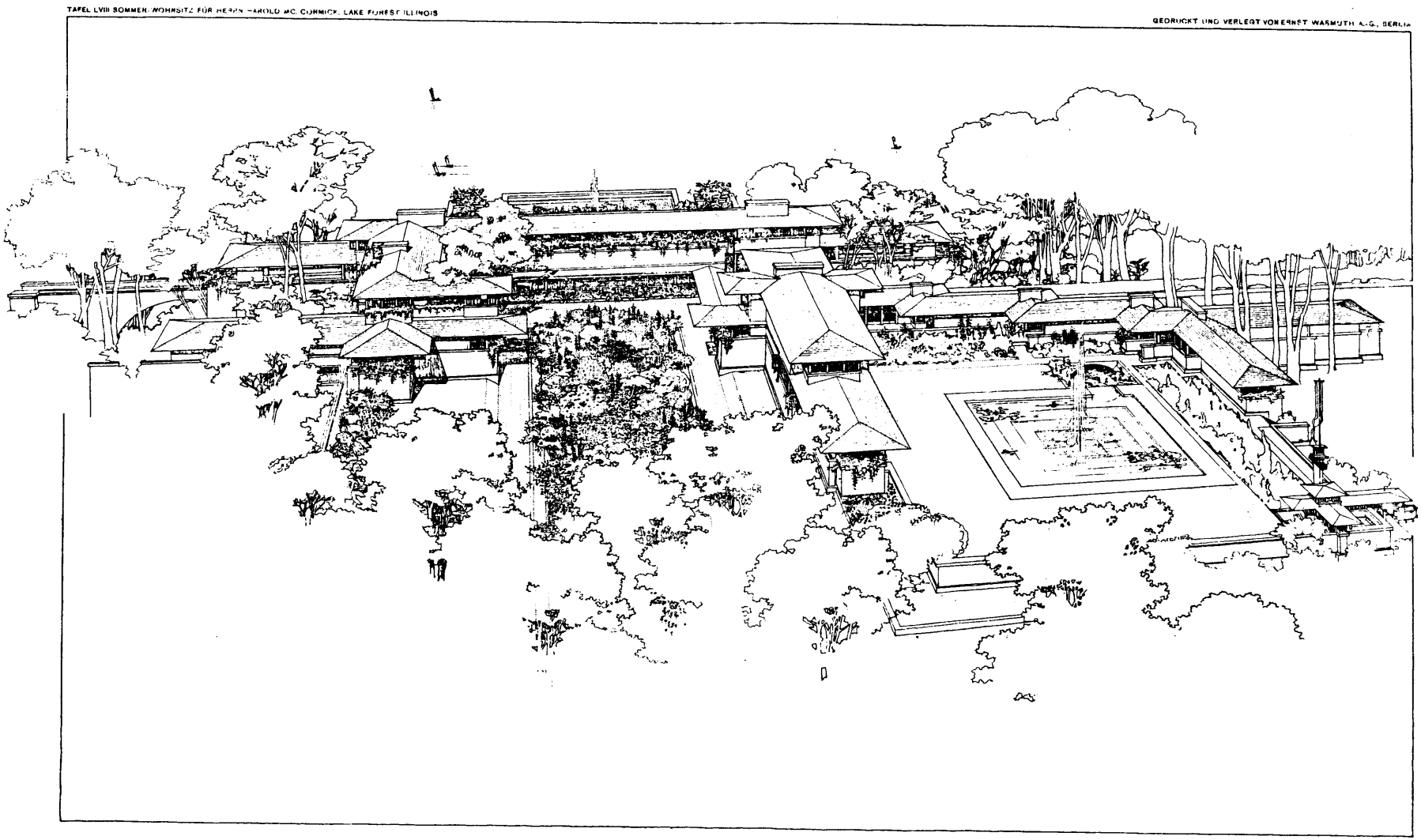
To understand the reciprocal nature of a containment a look at directional field organization is in order. To begin with, a field of four directional zones is established. Were each of the four directional zones built, then this arrangement might be referred to as a "packed" directional field. Packing refers to the interrelation of components, or lack thereof. Without space or slack between the components, no territorial claims can be made. The first step in achieving territoriality is to establish exchange between the initial four zones. This may be done through the lateral displacement of the edge zone in select instances.

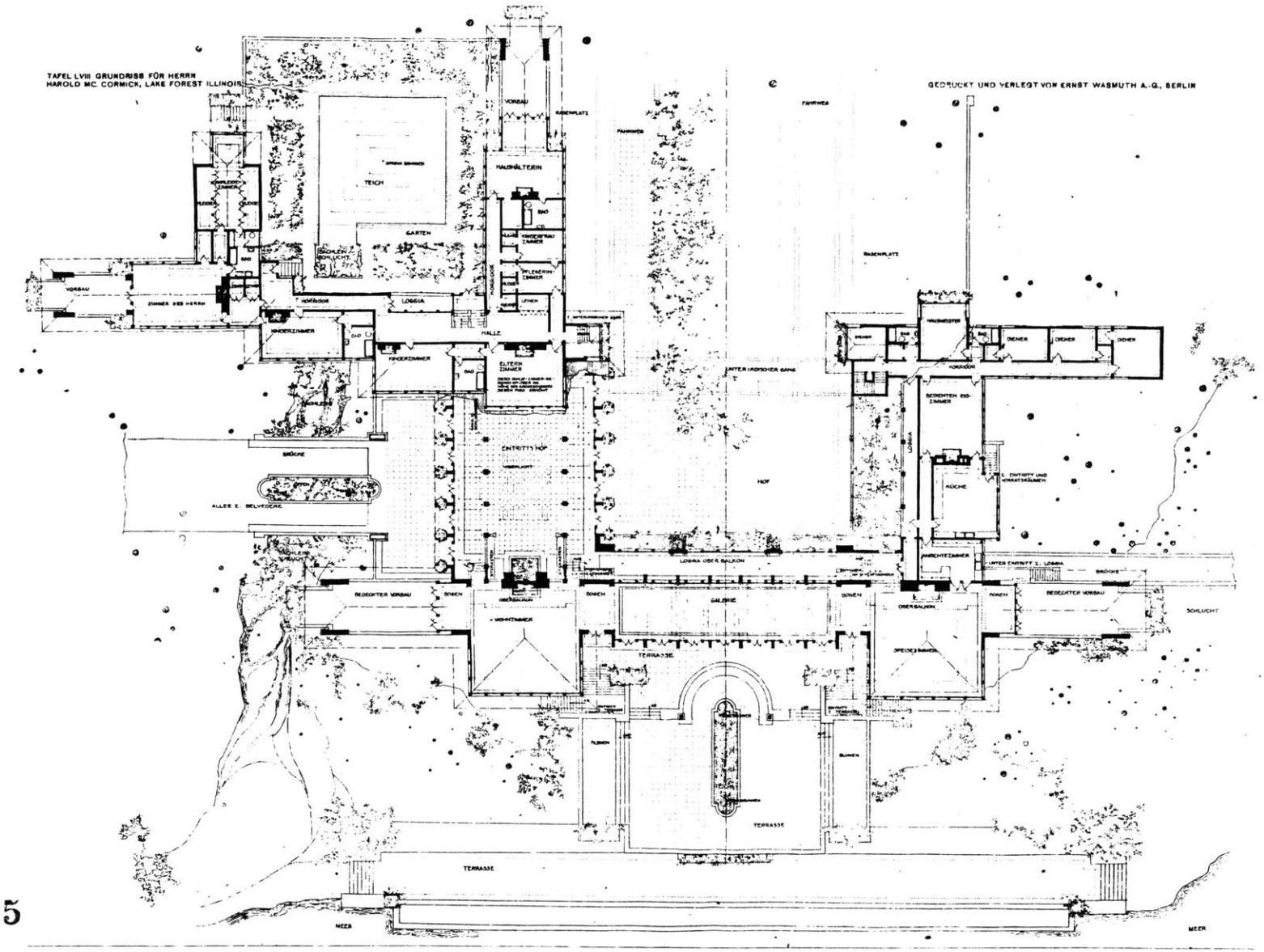


The diagram illustrates a reciprocal exchange between the non-built space in zones (1) through (3) and built form (dark) in zones (3) to (4). By laterally displacing a small portion of the fourth zone, the contact area between the two zones is increased. Note that the built zone still retains its directionality and registration. To create a territorial exchange between two components another lateral displacement is required. Then, its nature being reciprocating and territorial, the "first" primary self-stable form is defined. The form is stable because it stands on its own yet it is engaging with "external" adjacent space. The diagram embodies the rudimentary principles of self-stable form: direction and territorial control.

It is the reciprocal nature of this particular form that allows it to interact with and to partially contain adjacent space. Independent stable form must work in a reciprocal manner. This results in a formal relationship with spatial continuities, linking numerous self-stable building fragments. Hence the importance of the yin-yang principle.




TAFEL LVIII SOMMER-WOHNSITZ FÜR HERRN HAROLD MC. CORMICK, LAKE FOREST ILLINOIS
GEDRUCKT UND VERLEGT VON ERNST WASMUTH A.-G., BERLIN


TAFEL LVIII GRUNDRISS FÜR HERRN
HAROLD MC. CORMICK, LAKE FOREST ILLINOIS
GEDRUCKT UND VERLEGT VON ERNST WASMUTH A.-G., BERLIN
TEICH
GARTEN
VORBAU
HAUSHÄLTERIN
LOGGIA
HALLE
ELTERN ZIMMER
KINDERZIMMER
ENTRITTS HOF
BRÜCKE
ALLEE Z. BELVEDERE
HOF
KÜCHE
GALERIE
OBER BALKON
LOGGIA OBER BALKON
WOHNZIMMER
BEDECKTER VORBAU
TERRASSE
SCHLUCHT
MEER

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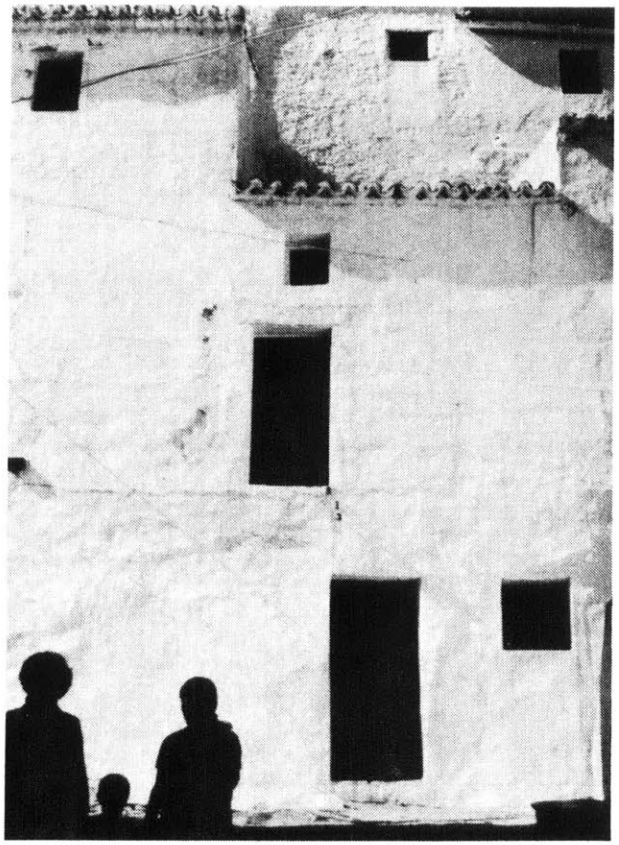
Preceding pages: Harold McCormick house, Lake Forest, IL, by Frank Lloyd Wright.



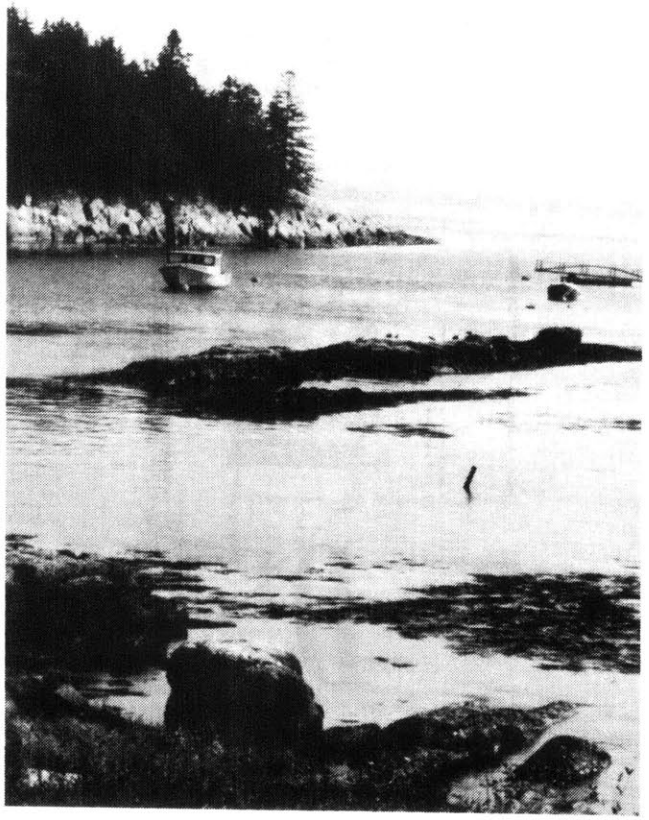
Cesares: Windows and doorways appear as formally stable components within dimensionally stabilized wall zones. Note the repetition of window dimensions between windows.

SpACE and/or SLACK

The intent of the thesis has so far been to arrive at an understanding of formal non-repetition through the use of more than one formally self-stable building system. The second criteria is that these systems rely on repetition of like components for buildability. The issue which has not yet been addressed is that of how space affects the overall form of the project. Although the components of the physical systems may be repetitive, a formally chaotic aggregation could result if the variable building chunks are not deployed in a coherent manner.

Now that the fundamental principles of a physically deployable part have been addressed, the space between parts may now be "built." "Built space" is defined as the formal component existing between or adjacent to deployed, self-stable parts. The Maine coastline illustrates the reciprocal relationship of the physical built form to built spatial form. In this reference, the self-stable "built forms" are the rocks and the water is the space or slack. Although water tends to register to the land in a manner dependent on the rock forms, the overall form of the intersection is actually dependent on the physical form of the water. The form of the intersection changes with the tides. This analogy illustrates a second, more important principle: the reciprocal relationship of the two forms, demonstrated by their interlocking properties.

Although the rocks along the coastline appear to be the initial self-stable forms to which the "slack" or water registers, due to the reciprocal nature of the water's interaction with the mainland, it may also be considered a formally stable element. In this sense, the water's stability is a result of the interlocking behavior of the two forms -- landscape and water.



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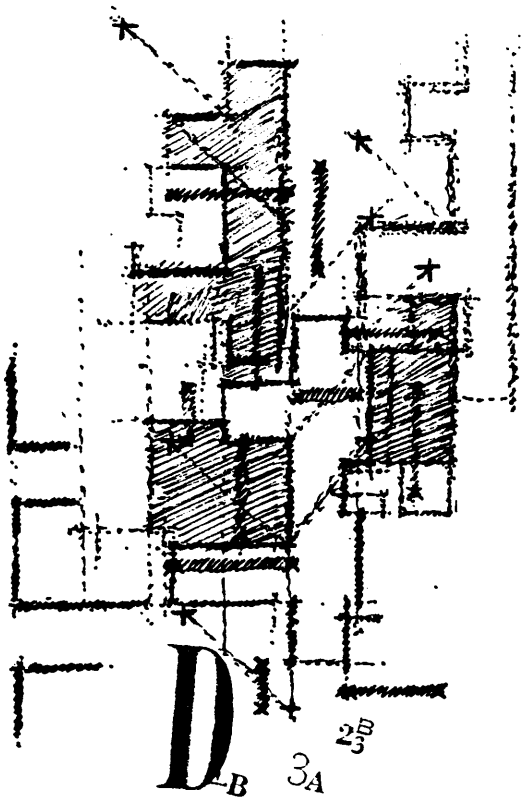


DIMENSION

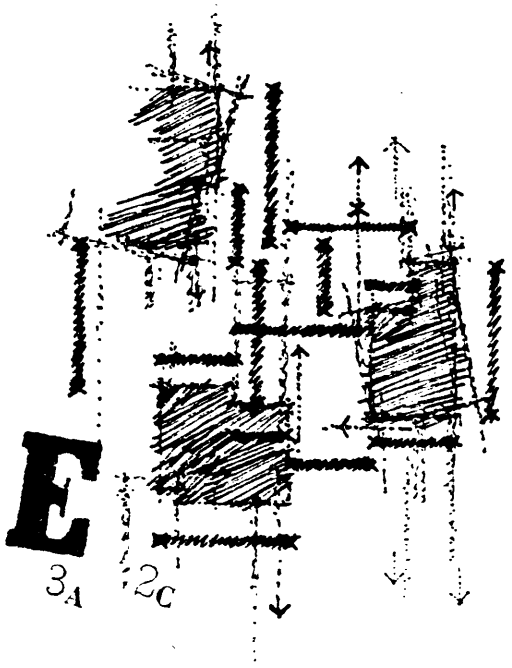
The second principle that produces spatial stability is that of dimensional repetition. The following diagram illustrates the manner in which self-stable elements (dark) may be arranged so that the dimensions and form of the space between them retain similar characteristics to those inherent in the original definitions. The heavy lines indicate the repetition of dimension found in both positive and negative form.

Although dimensional considerations create similarities between positive and negative form, this particular organization is still defined by the five original demarkations discussed earlier. In other words, all forms -- both positive and negative -- are strictly registered to those demarkations. A heirarchy similar to a one-dimensional grid system dominates the organization. Recall that if a heirarchy exists, it is then impossible to have components existing without reliance on another system. As a result, the fierce registration of forms in the preceding

diagram leads to a "packed" directional field organization, even though the forms are dimensionally stable. There is no slack between the forms.

Operational dimensional stability will not only allow the forms to remain free of a heirarchic registration, but will also allow an "open" field organization to occur. In the following figure, the original demarkations are subject to displacement and/or reorientation based on an initial system of dimensional repetition. The field is thus stabilized.

The concepts discussed in this section represent the fundamental principles used to design a field organization comprised of variable self-stable components. The diagrams are not intended to be taken literally -- they illustrate a process which enables a variety of independent forms to be aggregated into a coherent organization.



4. OPERATIVE PRINCIPLES and DEFINITIONS

Given an understanding of the fundamental concepts of formal behavior, an examination of the physical manipulation of those principles is essential. To begin with, form may be classified into four generative categories. Each of these four groups may be subdivided into two opposing behavioral groups, intensification and transformation. Once the initial generative categories have been established, the intensification and transformation aspects of those categories represent the manner in which the designer may influence the basic principles of form.

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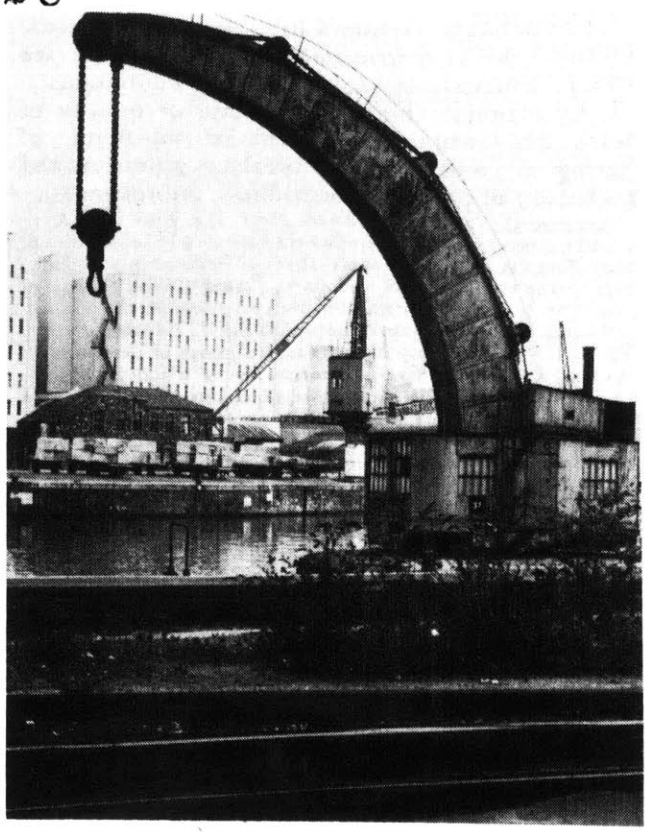


"Fairbairn" steam crane built by Stothert and Pitt about 1875.

GENERATIVE FORM CLASSIFICATION

Continuity

Continuity (kɒntiniū·ĭti). [a. F. *continuité* (16th c.), ad. L. *continuitāt-em*, f. *continu·us*: see -ITY.] The state or quality of being continuous.

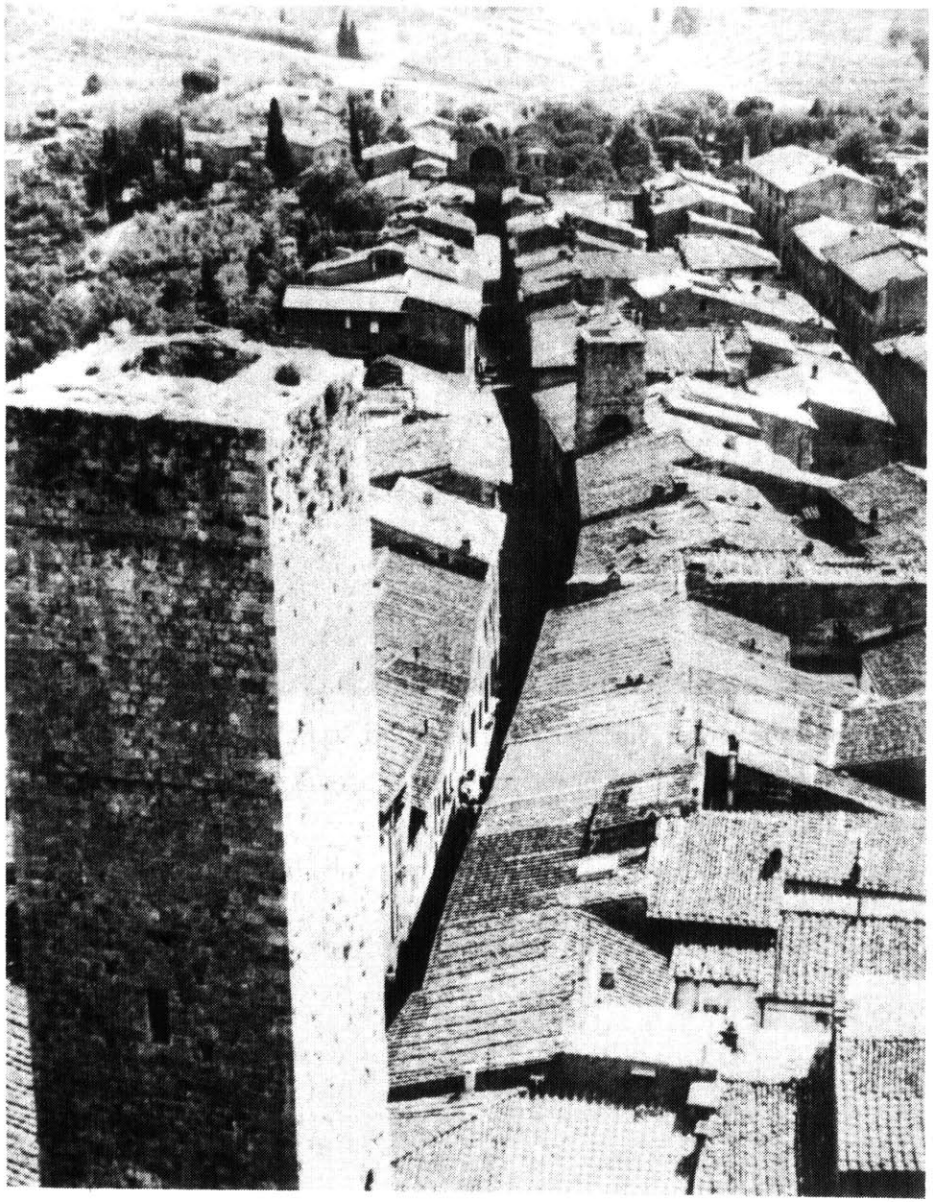
1. Of material things: The state or quality of being uninterrupted in extent or substance, of having no interstices or breaks; uninterrupted connexion of parts: connectedness, unbrokenness.

1543 (see 5). 1570 DEE *Math. Pref.* D j, Fyre and Ayre ..will descend, when..their Continuitie should be dissolued. 1607 TOPSELL *Four-f. Beasts* (1673) 38 Inflaming the body, loosing the continuity of the parts. 1615 CROOKE *Body of Man* 307 Now there is no continuity betweene the vmbilicall veine and the hollow veine. 1646 SIR T. BROWNE *Pseud. Ep.* II. i. 55 Continuity of parts is the cause of perspicuity. 1727-51 CHAMBERS *Cycl., Continuity* is usually defined, among schoolmen, the immediate cohesion of parts in the same quantum. 1804 WELLINGTON in Gurw. *Disp.* III. 59 The continuity of the frontier. 1813 BAKEWELL *Introd. Geol.* (1815) 52 Sometimes the continuity of rocks and strata is.. broken. 1855 BAIN *Senses & Int.* I. ii. § 17 (1864) 46 The continuity of the cord with the brain is necessary.

2. Of immaterial things, actions, processes, etc.: The state or quality of being uninterrupted in sequence or succession, or in essence or idea; connectedness, coherence, unbrokenness.

1603 HOLLAND *Plutarch's Mor.* 1356 All that shall be, hath a stint and dependance of that which is, by a certeine continuitie, which proceedeth from the beginning to the end. 1751 HARRIS *Hermes* vii. (1786) 101 We may gain some idea of Time, by considering it under the notion of a transient continuity. 1820 W. IRVING *Sketch Bk.* I. 10 In travelling by land there is a continuity of scene, a connected succession of incidents that carry on the story of life. 1842 W. GROVE *Corr. Phys. Forces* Pref. (ed. 6) 16 The continuity of attention necessary for the proper evolution of a train of thought.

In architectural terms, continuity represents a large definition -- an aggregation of smaller definitions. Continuity exists as the lineal addition of a number of not necessarily similar or identical parts. These parts, no matter what their physical form, are arranged in a manner perceived as a coherent whole. Continuities in self-stable aggregated building form are essential for the understanding of larger definitions of built form. The notion of continuity is the principle that can interrelate incongruous bits.



San Gimignano.

b. *Law* or *principle of continuity*: the principle that all change, sequence, or series in nature is continuous, and that nothing passes from one state to another *per saltum*.

The phrase originated with Leibnitz. In 1687 he laid down as a general principle, that where there is continuity between data, such that one case continually approaches and at length loses itself in another, there will be a corresponding continuity in results or properties. For example, it is a property of the ellipse that all rays from the one focus are reflected from the curve to the other; in the parabola all such rays reflected at the curve are parallel; if there be given a series of ellipses continually approaching the parabola by the continuous increase of distance between the foci, the focal radii of these will continuously approach the relation of parallelism, so as at length to differ from it by less than any assignable amount. This was according to Leibnitz 'a principle of general order', having its origin in the mathematical infinite, absolutely necessary in Geometry, but holding good also in Physics, because the Sovereign Wisdom, the source of all things, acts as a perfect Geometer, and according to a harmony that admits of no addition. In 1702 he referred to this principle as 'the law of continuity', and claimed that it operates in all natural phenomena; and in his *Nouveaux Essais*, he declared it to be part of his 'Law of Continuity' that everything in nature goes by degrees, and nothing *per saltum*.

[1687 Leibnitz *Lettre à Mr. Bayle* Wks. Erdm. 104. 1690 — *Lettre à Mr. Arnauld* ibid. 107 Chacune de ces substances contient dans sa nature legem continuationis seriei suarum operationum. 1702 — *Repl. aux Refl. de Bayle* ibid. 189/2 Qu'il ne se rencontre jamais rien, où la loi de la continuité (que j'ai introduite, et dont j'ai fait la premiere mention dans les *Nouvelles de la République des Lettres* de Mr. Bayle), et toutes les autres regles les plus exactes des Mathématiques soient violées. *a* 1716 — *Nouv. Ess.* IV. xvi, Tout va par degrés dans la nature et rien par saut, et cette règle, à l'égard des changements est une partie de ma loi de la continuité.] 1753 Chambers *Cycl.* Suppl. s.v., An eminent mathematician has supposed what he calls a law of continuity to obtain in the universe, by which law every thing that is executed or done in nature, is done by infinitely small degrees. 1812-6 Playfair *Nat. Phil.* (1819) I. 271 When bodies, whether solid or fluid, act on one another by impulse or percussion, in such a manner that their action is subject to the law of continuity. 1830 Herschel *Stud. Nat. Phil.* 189 It prevents a breach of the law of continuity between transparent and opake bodies. 1841 J. R. Young *Math. Dissert.* ii. 74 That the angle changes at once from 90° to zero, is to admit so palpable a violation of the principle of continuity..that, etc. 1852 Mulcahy *Mod. Geom.* ed. 2) 1878 Tait & Stewart *Unseen Univ.* (1880) p. xii, We endeavour to show that immortality is strictly in accordance with the principle of Continuity (rightly viewed).

c. *Equation of continuity*, in *Hydrodynamics*: the equation connecting the rate of change of density of a fluid within any closed surface constantly full of fluid with the flow of fluid through the surface.

1836 T. Webster *Equilibr. & Motion of Fluids*. 1880 Haughton *Phys. Geog.* iii. 141. 1882 Minchin *Unipl. Kinemat.* § 93.

3. The state or quality of being continuous in time; uninterrupted duration. *rare.*

1646 Sir T. Browne *Pseud. Ep.* iv. xiii, Wee need not have recourse unto any starre but the Sunne and the continuity of its action. 1840 Mrs. Browning *Drama of Exile* Poems 1850 I. 27 Their stedfast continuity of gaze. 1841 Brewster *Mart. Sc.* ii. iv. (1856) 146 A painful disease, which had its origin in the severity and continuity of his studies.

4. quasi-*concr.* A continuous or connected whole; a continuous or unbroken course or series. (Of material or immaterial things.)

1601 Holland *Pliny* II. 423 Running throughout one continuity without interruption. *a* 1619 Fotherby *Atheom.* ii. ix. § 3 (1622) 296 All magnitudes and continuities are deduced from one originall prick. 1644 Milton *Areop.* (Arb.) 70 When every stone is laid artfully together, it cannot be united into a continuity, it can but be contiguous in this world. 1809–10 Coleridge *Friend* (1865) 219 A chain that ascends in a continuity of links.

b. A part continuous with something else. *rare.*

1809 W. Irving *Knickerb.* (1861) 248 The New-Netherlands .. a continuity of the territory taken possession of .. by the Pilgrims, when they landed on Plymouth Rock.

5. *Solution of continuity*: the fact or condition of being or becoming discontinuous; fracture, rupture, breakage, 'break'. Orig. used of wounds, etc. in an animal body; thence also in other senses.

1543 Traheron tr. *Vigo's Chirurg.* (1550) 12 The heart can not suffer solution of continuitie without death. 1661 Bramhall *Just Vind.* ii. 14 Schisme is an exteriour breach, or a solution of continuity in the body Ecclesiastick. 1707 *Curios. in Husb. & Gard.* 77 The Solution of Continuity may hinder the Juice from mounting. 1790 Burke *Fr. Rev.* 24 With what address this temporary solution of [historical] continuity is kept from the eye. 1877 Tyndall in *Daily News* 2 Oct. 2 5 We are brought without solution of continuity into the presence of problems, which..lie entirely outside the domain of physics.

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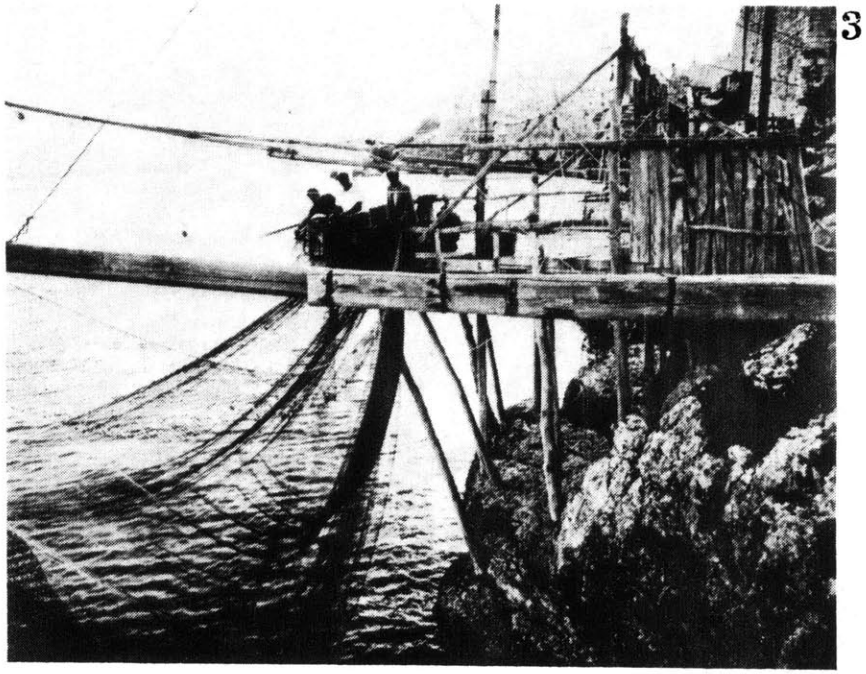

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Horizontal continuity: Vieste at the tip of the Gargano Peninsula.

Containment

The family of forms which gives rise to territoriality is referred to as containment. As a general rule, containments may be independent elements registered to larger continuities. The generic form of containment is the "U". With respect to programmatic function, the "U" form is generally considered as a use territory. Use in this sense can only occur if the contained territory is not overly disturbed by movement or through access. Therefore, "containments" must aggregate to contribute to a larger continuity. The physical form of a single containment invokes a collective attribute, e.g., a gathering place or public zone.

In "Built Form" theory, containments are considered more flexible if not completed. Total completion of any form results in the inability of that form to interact with other forms in its vicinity except by juxtaposition. Completed containments, then, are "isolated" objects.

Containment (kǒntē·nmĕnt). *rare.* [f. as prec. + -MENT. Cf. OF. *contenement.*] The action or fact of containing; holding; restraint; † deportment, behaviour; CONTENEMENT.

1655 FULLER *Ch. Hist.* IX. ix. § 9 A vast summ enough to shatter the conteinment of a rich mans estate. *Time's Storehouse* (L.), A good means of virtuous containment, as well in the days of peace as of warre. 1879 G. MEREDITH *Egoist* II. ii. 40 Revelry in sobriety, containment in exultation.

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Contain (kǒntē·n), *v.* Forms: 3 contein, 4 contenen, contienen, kunteyne, (*pa. pple.* y-contyened, y-contynent), 4-6 contene (chiefly *Sc.* and *north.*), 4-7 conteyne, conteine, 5 *Sc.* conten, 6 contaigne, -teygne, *Sc.* -tein, 6-7 containe, -tayne, 7- contain. [ME. *contein-en, conten-e*, a. OF. *conten-ir* (3rd pers. pres. Norman *conten-t, conten-ent*, subj. *contene, -teigne*) = Pr. *contener, -ir*, Sp. *contener*, It. *contenere* :— L. *continēre*, to hold together, keep together, comprehend, contain, f. *con-* together + *tenēre* to hold.]

I. To have in it, to hold; to comprise, enclose.

1. *trans.* To have in it, to hold. (Said of a vessel, a space, or the like.)

1382 WYCLIF *Jer.* ii. 13 Wastid cisternes, that contenen [1388 holde] watris moun not. *c* 1490 *Promp. Parv.* 91 (MS. K.) *Conteynyn*, hauyn or kepyn wit-innyn. *c* 1576 THYNNE *Ld. Burghley's Crest* in *Animadv.* App. (1865) 115 In brittill glasse is wholsome wyne conteynde. 1673 RAY *Journ. Low C.* 64 The Juices .. conteined in the Veins of the Earth. 1709 POPE *Ess. Crit.* 283 So vast a throng the stage can ne'er contain. 1860 TRENCH *Serm. Westm. Ab.* xx. 225 We were not formed to contain God's truth, but to be contained by it.

b. To be capable of containing; to have capacity for: usually expressed by to HOLD.

1526-34 TINDALE *John* ii. 6 And ther were stondynge theare sixe waterpottes of stone .. contaynynge two or thre fyrkins a pece. And Jesus sayde vnto them: fyll the water pottes with water. 1530 PALSGR. 496 1 This pot contayneth eyght quartes. 1875 URE *Dict. Arts* III. 1120 In the Wear the best coal is put into tubs, these are waggons without wheels, containing each 53 cwts.

IV. xvi. T ij b, Icosaedron is a solide Figure, vnder twentye equall equiangle triangles conteyned. 1594 BLUNDEVIL *Exerc.* I. v. (ed. 7) 17 Aske how many times 9 is contayned in 29. 1660 BARROW *Euclid* I. axiom xiv, Two right lines do not contain a space. *Ibid.* I prop. xlvi. *note*, A Rectangle contained under two right lines given. *Ibid.* XI. def. ix, Like solid figures are such as are contained under like Planes equal in number. 1823 H. J. BROOKE *Introd. Crystallogr.* 123 The new figures would be contained within 24 isosceles triangular planes. 1875 TODHUNTER *Algebra* (ed. 7) lii. § 709 We have to find the highest power of 2 which is contained in $\lfloor\underline{14}$..thus the required power is 11.

† 7. To include, comprehend (in a writing, under a title, division, etc.). *Obs.*

1548 TURNER *Names of Herbes* 74 Many learned men contayne the red Mynt..under Sisymbrio. 1561 T. NORTON *Calvin's Inst.* I. 28 He conteineth both these pointes in his law. 1652 NEEDHAM tr. *Selden's Mare Cl.* 83 The Isles and the Sea it self might bee conteined here, as particular parts of the Government or Province. 1666 EARL ORRERY *State Lett.* (1743) II. 99 The proclamation may also contain, that, if any one fails therein, etc.

II. To hold together; to keep under control, restrain, restrict, confine.

† 8. To hold together; to sustain. *Obs.*

c 1374 CHAUCER *Boeth.* III. xii. 102 Yif þere ne were oon þat contened[e] þat he hab conioigned and ybounde. 1579 FENTON *Guicciard.* 1123 The army was at a maze where to seeke vittells to conteine the bodies which the stroke of diseases had yet left on live.

† 9. To hold (in a certain estimation). *Obs. rare.*

1601 B. JONSON *Poetaster* v. i. 37 The dull detractions Of leaden souls; who..Contain her worthiest prophets in contempt.

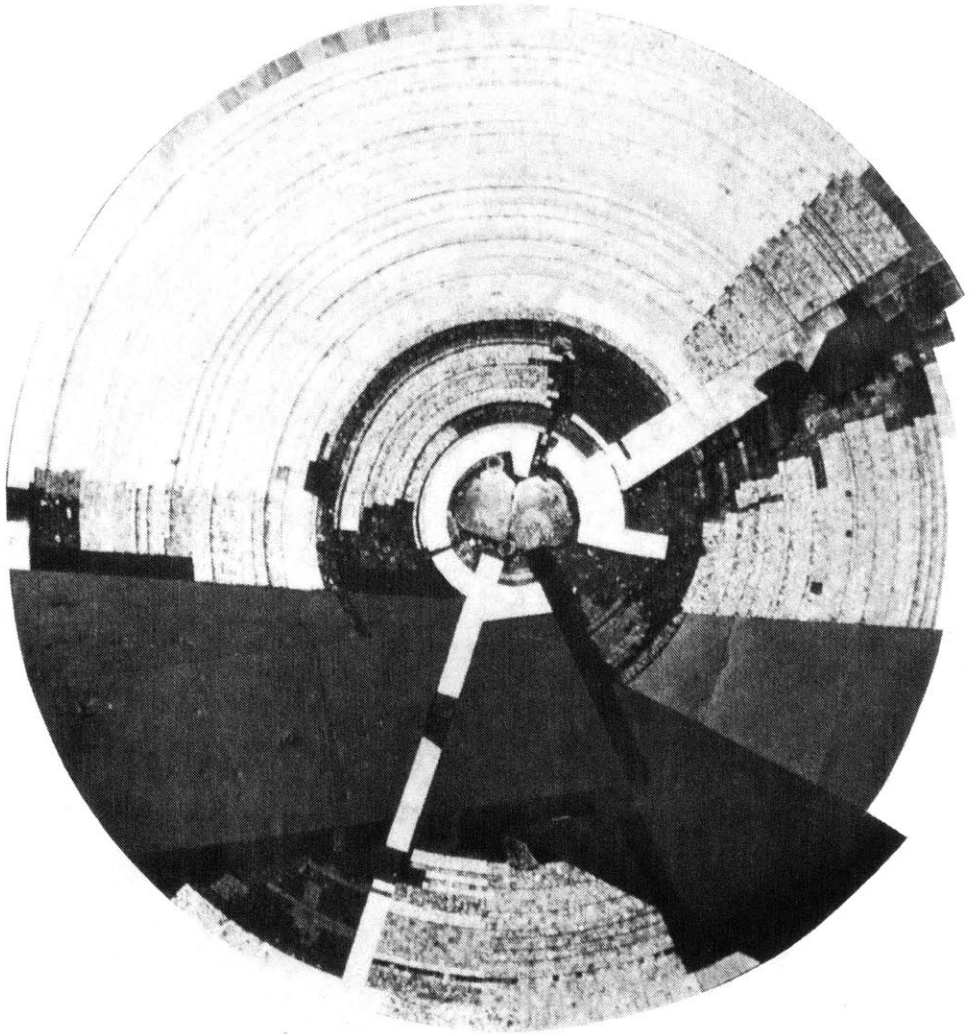
† 10. To keep or retain in a certain state or order, under control, in subjection, etc. *Obs.*

1538 STARKEY *England* I. i. 10 By lyke wysdome they must be conteynyd and kept therin. *Ibid.* I. iv. 110 Al such lawys..wych conteyne the pepul in gud ordur and rule. 1598 BARCKLEY *Felic. Man* I. (1603) 28 That the sight and horror thereof .. might contayne them in modestie. 1649 SELDEN *Laws Eng.* I. xxxviii. (1739) 58 A fair opportunity of containing them for ever under their awe. 1705 STANHOPE *Paraphr.* III. 409 The Ceremonial Law .. was given to contain the Israelites in their Duty. 1776 GIBBON *Decl. & F.* xii. (1792) II. 85 It was almost impossible that he could at once contain in obedience every part of his wide-extended dominions. 1831 SIR W. HAMILTON *Discuss.* (1852) 396 To contain his pupils within statutory regulations.

† 11. To restrain, hold in, keep in check; to hold back, keep back, hinder (*from* an action, etc.) *Obs.*

1523 *St. Papers Hen. VIII*, VI. 119 The same shal do grete good for conteyning of the Swicer. 1596 SPENSER

Market in San Gimignano.



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Mosaic in the entrance hall of the Alsdorf Rathaus by Schaffrath.

Astrol. I. § 8 A degre of a signe contieneth 60 Mynutis. 1611 BIBLE *Ezek.* xlv. 11 That the Bath may containe the tenth part of an Homer. 1875 URE *Dict. Arts* III. 1123 In Ireland the perch contains 7 yards, and the mile 2240. *Mod.* A pound avoirdupois contains 7000 grains.

†4. To take up, occupy. (Cf. COMPRISE 4 c.)

c 1374 CHAUCER *Troylus* III. 453 For þer was som Epistel ..þat walde as seith myn auctour wele contene Neigh half þis boke. 1483 CAXTON *Gold. Leg.* 108/2 Yf I shold here expresse alle the myracles .. It shold conteyne an hole volume. 1598 BARCKLEY *Felic. Man* III. (1603) 150 That matter alone would containe a reasonable volume. 1736 SWIFT *Let.* 15 May, A complete history of the .. absurd proceedings in this kingdom would contain twelve large volumes in folio.

†5. To enclose (so much space, etc.). Said of a boundary line, or of a person. *Obs.*

1490 CAXTON *Eneydos* vii. *heading*, How dydo .. boughte as moche londe..as she myghte conteyne wythin the space of the hide of an oxe. *c* 1500 *Melusine* 44 The grete compace of the ledder [thong], which conteyned wel the space of two mylles of grounde.

b. *pass.* Of a space, region, etc.: To be comprehended, included, or intercepted (within a certain space, *between* certain limits).

c 1391 CHAUCER *Astrol.* II. § 30 The arch meridian þat is conteined or [interjcept by-twixe the cenyth and the equinoxial. 1530 PALSGR. 34 The countreys that be conteygned betwene the ryver of Seyne & the ryver of Loyrre. 1584 POWEL *Lloyd's Cambria* 1 That part conteined betweene the French Seas. 1603 KNOLLES *Hist. Turks* (1638) 184 The kingdome..was contained within the bounds of the lesser Asia. *Mod.* The Asteroids revolve in the space contained between the orbits of Mars and Jupiter.

6. *Math.* a. *Geom.* To enclose, include, form the boundary of (a figure, an angle); in *pass.* formerly *to be contained under.*

A rectangle is still said to be *contained under* the two lines which form its length and breadth; so † *transf.* a composite number was formerly said to be *contained under* its factors.

b. *Arith.* and *Alg.* To have as a factor or submultiple; to be divisible by, without remainder (also, less strictly, with a remainder). In *pass.* (const. *in*): To divide, 'go into' (without, or less strictly with, a remainder).

1570 BILLINGSLEY *Euclid* I. def. ix, If the lines which containe the angle be right lynes, then it is called a right-lyned angle. *Ibid.* def. xv, A circle is a plaine figure conteyned under one line, which is called a circumference. *Ibid.* VII. def. xix. 187 A square number is that .. which is contayned vnder two equall numbers. 1571 DIGGES *Pantom.*

2. To have as part (or the whole) of its contents or substance; to comprise, include.

1340 HAMPOLE *Pr. Consc.* 999 Þe lawer werld .. Contenes haly þe elementes alle. 1340 *Ayenb.* 118 Þe zeue benes þet byeþ y-contyened ine holi pater noster. *c* 1400 MAUNDEV. (Roxb.) xiii. 58 In þis rewme of Surry er many rewmes contende. 1480 CAXTON *Chron. Eng.* ccxxi. 211 He vnclosed the lettre and saw what was conteyned therin. 1509 FISHER *Fun. Serm. Ctess Richmond* Wks. 1876 I. 295 The crowne of our lady .. after the manere of Rome conteyneth lx and thre aues. 1541 BELLENDEN *Cron. Scot.* Tabula sig. D iiij, The table .. contenand the mater of euery buke. 1600 J. HAMILTON (*title*) Facile Traictise, Contenant, first: ane infallible reul..Nixt, a Declaration, etc. 1697 DRYDEN *Virg. Georg.* IV. 305 And Grandsires Grandsons the long List contains. 1863 A. J. HORWOOD *Year-bks.* 30–31 *Edw. I*, Pref. 22 The volume..having once contained many more [pages] than it does now. 1875 JOWETT *Plato* (ed. 2) V. 18 The Laws.. contain a few passages which are very grand and noble.

b. Of a material body or substance: To have in it (as a constituent element, or in combination).

1756 C. LUCAS *Ess. Waters* I. 84 Such waters as contain most air..are found the lightest and purest. 1831 J. DAVIES *Manual Mat. Med.* 273 Some of them contain besides, carbonic acid. 1860 TYNDALL *Glac.* I. xx. 141 The rock .. evidently contains a good deal of iron.

† 3. To include, comprise, extend over, measure (so much space, time, or other magnitude). *Obs.*

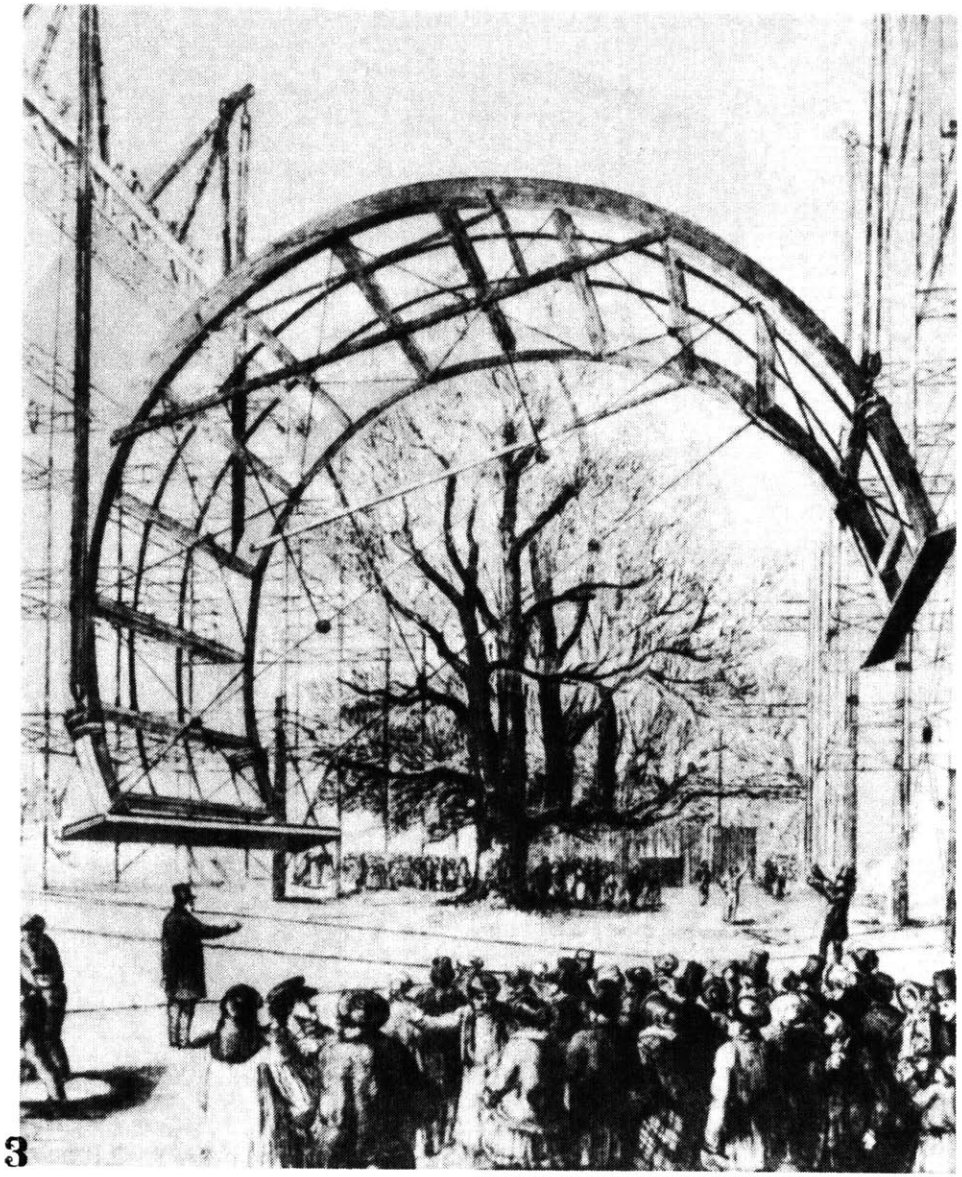
c 1374 CHAUCER *Boeth.* II. vii. 56 As myche space as þe see and [the] mareys contenen and ouergon. *c* 1391 — *Astrol.* I. § 7 The space bytwene contieneth a Mile-wey. 1398 TREVISA *Barth. De P. R.* III. vii. (1495) 53 Of all the fygures of the same lengthe the cercle is moost and most conteynyth. *c* 1425 WYNTOUN *Cron.* III. iii. 171 Þe thryd elde..Contenys nyne hundyr yhere And twa. 1526–34 TINDALE *Acts* i. 12 Then returned they .. from mount-olivete, which is nye to Ierusalem, conteyninge a Saboth dayes iorney. [So 1557 *Geneva.*] 1551 ROBINSON tr. *More's Utop.* II. (Arb.) 72 The Iland of Utopia, conteynethe in breadthe .. cc miles. 1563 SHUTE *Archit.* E iv a, Tuscana conteineth in height .6. Diameters. 1697 POTTER *Antiq. Greece* I. viii. (1715) 42 They were not exact Semicircles, but contain'd the bigger half of the Circle. 1703 MOXON *Mech. Exerc.* 263 That the first Story contain full 10 Foot in height.

† b. *intr.* with *of* = prec. *Obs. rare.*

1660 BLOOME *Archit.* B d, Regula under Astragulus containeth of one part. *Ibid.* C a, The Pillar with all his ornaments, containeth of 10 Diameters.

c. Of a measure or magnitude: To comprise, be equal to (so much or so many of a smaller measure or magnitude, or a certain fraction of a larger).

1387 TREVISA *Higden* (Rolls) II. 235 (Mätz.) A cubite of gemetrie conteyneþ sixe comoun cubites. *c* 1391 CHAUCER



33

Raising a prefabricated wooden transept by horse, block and tackle.

State Irel. Wks. (Globe) 614/1 To contayne the unruly people from a thousand evill occasions. 1625 Bacon *Ess., Anger* (Arb.) 567 To containe Anger from Mischiefe. 1651 Hobbes *Leviath.* II. xviii, Covenants being but words and breath, have no force to oblige, contain, constrain, or protect any man. 1791 Burke *App. Whigs* Wks. VI. 94 The principles and opinions, which have hitherto guided and contained the world.

b. To restrain, put restraint on, repress (one's feelings, passions, etc.).

c 1611 Chapman *Iliad* III. 198 One that was my brother-in-law, when I contain'd my blood, And was more worthy. 1697 Dryden *Virg. Georg.* IV. 97 Scarce can their Limbs, their mighty Souls contain. 1712 Steele *Spect.* No. 438 ¶ 1 To contain the Spirit of Anger.

†12. To restrict, limit, confine. (Also *refl.*) *Obs.*

1579 Lyly *Euphues* (Arb.) 148 Them that haue conteined themselues, within the bandes of reason. 1602 *Hist. Eng.* in *Harl. Misc.* (Malh.) II. 415 My desire to contain the work within some reasonable proportion. 1705 Stanhope *Paraphr.* II. 215 To contain themselves within the limits mark'd out for their Christian Course. 1816 Mackintosh *Bacon & Locke* Wks. I. 336 To excite a fearless spirit of inquiry, and yet to contain it within the boundaries which Nature has prescribed.

†13. To retain, keep, keep in, confine (within limits of space); also *refl.* to confine oneself, remain, 'keep'. *Obs.*

c 1565 Lindesay (*Pitscottie*) *Chron. Scot.* (1728) 9 To pass homeward to Edinburgh, there to contain himself till he was further advised. 1570-6 Lambarde *Peramb. Kent* (1826) 137 William consulted with Lanfranc how he might conteine that treasure within the Realme. 1596 Shaks. *Merch. V.* IV. i. 50 And others, when the bag-pipe sings i'th nose, Cannot containe their Vrine. 1640 H. Hawkins *Youth's behav.* i. § 14 (1663) 3 Wriggle not thyself, as seeming unable to contain thyself within thy skin. *a* 1674 Clarendon *Hist. Rev.* XII. (1843) 740/2 [He] ordered his other small troops to contain themselves in those uncouth quarters. 1703 Moxon *Mech. Exerc.* 243 As the Moderns restrain Water, and contain it.

† b. *intr.* To keep oneself, remain. *Obs.*

c 1400 *Rom. Rose* 4226 That he may, er he hennes pace, Conteyne undir obedience. 1682 Tate *Absal. & Achit.* II. 42 Accusers' infamy is urged in vain, While in the bounds of sense they did contain.

† c. To retain, keep in one's possession or control. *Obs.*

1596 Shaks. *Merch. V.* V. i. 50 If you had knowne the vertue of the Ring .. Or your owne honour to containe the Ring, You would not then haue parted with the Ring. 1651 N. Bacon *Hist. Disc.* xlv. 118 It's true the English stuck close to him; but how they were gained or contained, Writers speak not.

† d. To keep, maintain (in a certain state). *Obs.*

1677 Hale *Prim. Orig. Man.* IV. ii. 297 The Water by heat and rarefaction easily assuming the nature of Air, and ..containing it self in that consistency.

14. To refrain from expressing or yielding to feeling, passion, etc.; to restrain oneself; † to refrain or keep *from* (*obs.*); † *spec.* to be continent, keep oneself in chastity (*obs.*). (Cf. 11 b.)

a. *refl.*

c 1290 *S. Eng. Leg.* I. 108/61 Heo ne coupe no-þing conteini hire ne speken no-þe-mo. 1382 Wyclif 1 *Cor.* vii. 9 For if thei conteynen not hem silf, *or ben not chast*, wed-did be thei. *c* 1450 *Castle Hd. Life St. Cuthb.* (Surtees) 2669 And when fra gretyng sho hir contende. 1590 Sir J. Smyth *Disc. Weapons* Sig.** ij b, Such..can very hardly after be reformed and reduced to containe themselues, and liue vnder any discipline. 1596 Shaks. *Tam. Shr.* Induct. i. 100 Feare not my Lord, we can contain our selues, Were he the veriest anticke in the world. 1778 Bp. Lowth *Transl. Isa.* xlii. 14 Shall I keep silence for ever? Shall I still contain myself? 1887 *Pall Mall G.* 15 Sept. 7/2 Let them contain themselves and quit themselves like men.

b. *intr.* (for *refl.*)

1611 Bible 1 *Cor.* vii. 9 But if they cannot conteine, let them marry. 1621 Burton *Anat. Mel.* I. ii. III. viii. (1651) 103 He could contain no longer, but hasting home, invaded his territories. 1710 Swift *Let.* 21 Sept. (Seager) No wonder she married, when she was so ill at containing. 1719 Young *Paraphr. Job* Wks. 1757 I. 205 Then Job contain'd no more; but curs'd his fate. 1726 Chetwood *Adv. Capt. R. Boyle* 213 All our care was to contain from laughing, which was a very hard Task. 1760 Goldsm. *Cit. W.* iii, I could hardly contain when I saw the Daures dress their heads with horns. 1883 G. Lloyd *Ebb & Flow* II. 205 He .. seemed hardly able to contain.

†15. To bear oneself (well), behave. *Obs.*

a. *refl.*

1297 R. Glouc. (1724) 547 Sir Simound de Mountford conseilede hom vaste, Hou hii ssolde hom conteini, the wule the bataile ilaste. 1375 Barbour *Bruce* XII. 277 Gif ze conteyn zou manfully. *c* 1450 *Merlin* iv. 77 That he sholde contene hym-self myrily. 1481 Caxton *Godfrey* xvii. 45 The good bisshop of Puy..conteyned hym moche wysely and truly. *c* 1500 *Lancelot* 1130 Neuer..was sen No man in feild more knyghtly hyme conten.

b. *intr.* (for *refl.*)

c 1350 *Will. Palerne* 3301 How that komeli knizt kunteyned on his stede.

†16. *intr.* (for *refl.*) To be situated, remain (in place). *Obs.* (cf. 17 b.)

1528 Lyndesay *Dream* 666 Asia contenis in the Orient. 1563 Hyll *Art Garden.* (1593) 144 It doth cleanse the places also where the stones containe.

Completion

Completion (kŏmplī·ʃən). [ad. L. *complētiōnem*, n. of action f. *complēre* to fill up, complete.] The action of completing or making complete; the condition of being completed or perfected.

1657 CROMWELL *Sp.* 21 Apr., They may tend to the completion of the business. *a* 1744 POPE (J.) He makes it the utmost completion of an ill character to bear a malevolence to the best men. 1752 JOHNSON *Rambler* No. 203 ¶ 6 It is necessary to the completion of every good, that it be timely obtained. 1841–4 EMERSON *Ess. Manners* Wks. (Bohn) I. 206 A plentiful fortune is reckoned necessary..to the completion of this man of the world. 1877 MRS. OLIPHANT *Makers of Flor.* v. 137 The past in its..stony completion is always a poor substitute for the present.

b. Accomplishment, fulfilment (of a prophecy, wish, etc.).

1659 HAMMOND *On Ps.* Pref. 16. 1678 CUDWORTH *Intell. Syst.* I. iv. 283 Virgil's forementioned Eclogue; wherein there is .. another completion of them [the Sibylline books] expected. *a* 1716 SOUTH (J.) All the divine predictions, receiving their completion in Christ. 1736 BUTLER *Anal.* II. vii. 353 The apparent completions of prophecy. 1842 TENNYSON *Gardener's D.* 234 That my desire .. By its own energy fulfill'd itself, Merg'd in completion.

† c. (with *pl.*) A perfection, an accomplishment.

1662 BP. GAUDEN, in Chr. Wordsworth *Documentary Suppl.* (1825) 34 Your Lordship, in whom are all those completions which advance men to .. love and high esteeme.

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Complete (kŏmplī·t), *a.* Forms: 4–5 complet, -pleet, 6–7 -pleate, 6–9 -pleat, 4– complete. [ad. L. *complēt-us*, pa. pple. of *complēre* to fill up, finish, fulfil, f. *com-* intensive prefix + **plēre* to fill (cf. *plēnus* full). Cf. F. *complet*, *complète* (in Palsgr. 1530; the earlier OF. word was *compli*, *complie* from the Romanic form of the vb. *comp̃lir*(*e*). About 1600 often accented *co·mplete*, e.g. by Marlowe, Chapman, and Shakspere.]

1. Having all its parts or members; comprising the full number or amount; embracing all the requisite items, details, topics, etc.; entire, full.

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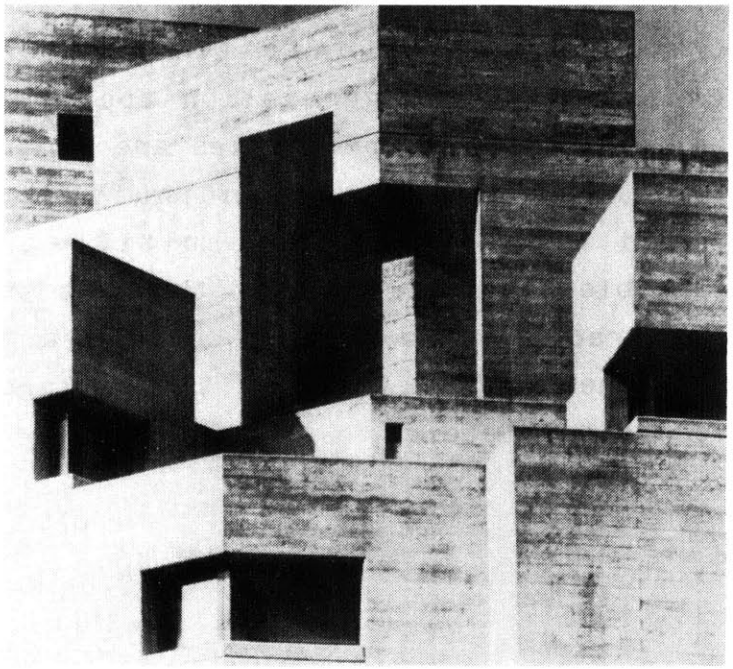
In the language of form, completion refers to the optional completion of a form. The more complete a form is, the more it is isolated and less likely to interact with other forms. When aggregating many independent self-stable forms, their lack of completion can allow reciprocal continuities to occur with and between the separate parts. The question is how much completion can be attained without obviating or denying reciprocity?

Partial "completion" of wall forms at Forderer's St. John's Catholic Church Center in Lucerne-Wurzenbach allows formal interaction between space and built form.



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c 1380 WYCLIF *Sel. Wks.* I. 323 Ech compleet resoun telliþ treuþe þat we shulde trowe. 1586 MARLOWE *1st Pt. Tamburl.* III. iii, Their shoulders broad for complete armour fit. 1597 HOOKER *Eccl. Pol.* v. § 19 (T.) When one doth wait for another coming, till the assembly .. be complete. 1602 SHAKS. *Ham.* I. iv. 52. 1611 BIBLE 2 *Macc.* iii. 25 It seemed that hee that sate vpon the horse, had complete harnesse of golde. 1615 CHAPMAN *Odyss.* VI. 83 A coach .. Stately and complete. 1740 JOHNSON *Life Barretier*, Those, who have received more complete intelligence. 1856 EMERSON *Eng. Traits*, '*Times*' Wks. (Bohn) II. 117 Its information is earliest, completest, and surest. 1871 RUSKIN *Munera P.* (1880) Pref. 24 The preface is complete in itself.

2. Of a period or space of time: That has run its full course, whole. Of action or events in time: Finished, ended, concluded.

c 1386 CHAUCER *Merch. T.* 649 The fourthe day compleet fro noon to noon. — *Nun's Pr. T.* 369 Whan þat the Monthe..That highte March..Was compleet. 1494 FABYAN *Chron.* I. xvi. (R.) By the tyme or space of v. yeres complete. 1606 SHAKS. *Tr. & Cr.* IV. i. 27 Ioue, let Æneas liue ..A thousand compleate courses of the Sunne. 1701 EVELYN *Diary* (1827) III. 393, I was this day 81 complete. 1731 POPE *Ep. Burlington* 78 Behold Villario's ten years toil compleat. 1879 LOCKYER *Elem. Astron.* 319 The Moon's nodes perform a complete revolution in nineteen years.

3. Of an action, state, or quality: Realized in its full extent; entire, thorough.

1645 *Ord. Lords & Com., Susp. fr. Sacram.* 1 Sincerely to endeavour the compleat establishment of Purity and Unity. 1663 GERBIER *Counsel* 19 A man of compleat stature. 1727 DE FOE *Syst. Magic* I. IV. (1840) 115 The greatest and best principles are often illustrated .. by their completest contraries. 1853 KANE *Grinnell Exp.* XXX. (1856) 258 Next came the complete inability to obtain drink without manufacturing it. 1854 RONALDS & RICHARDSON *Chem. Technol.* I. 199 One pound of peat requires for complete combustion ..from 70 to 134 cubic feet of air. 1875 BRYCE *Holy Rom. Emp.* (ed. 5) 443 The triumph of the principle..is complete.

59

COLLAGE [kò-láj'] *s. m.*

[ÉTYM. Dérivé de **coller**, § 78. || 1753. **Colage ou collage**, ENCYCL. Admis ACAD. 1835.]

|| Action de coller. | **1.** Action de faire adhérer avec la colle. **Le — d'une affiche, d'un papier de tenture sur la muraille. Le — d'une pièce de menuiserie.** | **2.** Action d'encoller (le papier, pour l'empêcher de boire). | **3.** Action de clarifier avec de la colle de poisson. **Le — des vins.**

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COLLAGE, subst. masc.

A. — Action de coller des choses quelconques, résultat de cette action. *Un collage rapide, bien fait; le collage des papiers peints, d'une moquette, des pièces d'un meuble :*

1. — Nous avons travaillé ensemble pendant un an. C'étaient mes débuts : **collages** *d'affiches*, distributions de tracts. Frédé était formidable : dix-huit heures de travail par jour, toujours volontaire pour les coups durs.
VAILLAND, *Drôle de jeu*, 1945, p. 10.

SYNT. *Collage des étiquettes sur les bouteilles* (*cf.* BRUNET, *Le Matériel vinicole*, 1925, p. 539). *Collage bout à bout de fragments enregistrés sur bande* (P. SCHAEFFER, *À la recherche d'une mus. concrète*, 1952, p. 205).

— *Spécialement*

1. [P. réf. à l'usage de la colle pour assembler]

a) *CÉRAM.* Fixation de deux pièces au moyen de barbotine épaisse. [*Dans l'opération d'applicage*] *si* [*l'ouvrier*] *n'en met pas assez* [*de la barbotine*] *ou si la barbotine est trop sèche, le collage ne tient pas* (A. BRONGNIART, *Traité des arts céram.*, 1844, p. 169).

b) *PEINT.* Composition surréaliste ou cubiste exécutée au moyen de diverses matières (le plus souvent papiers découpés) collées sur une toile ou intégrées à une partie peinte. *Les collages de la première peinture surréaliste* (*cf.* P. SCHAEFFER, *op. cit.*, p. 47) :

2. Je ne sais si jamais poète a été plus pénétré de ces vérités fondamentales que Max Ernst. Et c'est une première raison, de regarder, d'admirer ce peintre comme un poète très haut. À travers ses **collages**, ses frottages, ses tableaux, s'exerce sans cesse la volonté de confondre formes, événements, couleurs, ...
ÉLUARD, *Donner à voir*, Peintres 1939, p. 97.

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Collage

The key word in this definition is incongruous. Through the addition of incongruous, self-stable bits, a larger whole or continuity may be achieved. Field organizations are usually assembled from a series of collages. Once a continuity is established from an aggregation of smaller parts, that aggregation may become part of a larger definition by interrelating with other same-sized definitions, similar or dissimilar. The same reciprocal and dimensional principles accounting for the initial aggregation apply to larger moves as well. Collage principles are those which embody and organize the continuities, completions, and containments, resulting in formally intelligible aggregations. If there is to be reciprocal interaction between the collage and its environment, then, by definition, the collage itself may never be complete.

Leverkusen-Fettehenne, R.C. parish church, St. Matthias, exterior detail of concrete-glass relief window.

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2. [P. réf. à certaines propriétés des colles]

a) *ŒNOL.* Clarification des vins et des boissons alcooliques à l'aide de diverses matières collantes qui retiennent les particules (blanc d'œuf, gélatine, colle de poisson, etc.). *Des collages défectueux* (E. BOULLANGER, *Malterie, brasserie*, 1934, p. 291).

b) *PAPET.* Action qui consiste à plonger le papier dans une dissolution gommeuse de manière à l'imprégner de colle afin d'éviter les bavures de l'encre lorsqu'on écrit dessus. Synon. *encollage*. *Le collage du papier vergé* (E. LECLERC, *Nouv. Manuel complet de typogr.*, 1932, p. 548). *Le plan du grand Cointet était d'une simplicité formidable. Du premier abord, il jugea le collage en cuve impossible* (BALZAC, *Les Illusions perdues*, 1843, p. 744).

B. — *P. ext.*

1. [P. réf. à A 1 b, en parlant d'un récit, du caractère d'un personnage] Assemblage, juxtaposition d'éléments disparates. *Dire que Mme de Guermantes est Mme Une Telle, c'est absolument faux. Son personnage est fait de recoupements et de collages* (MORAND, *L'Eau sous les ponts*, 1954, p. 53).

2. *Pop.* Situation d'un homme et d'une femme vivant ensemble sans être mariés. Synon. *concubinage :*

> 3. Il y a dans les familles bourgeoises, souvent, un train de refroidissement et de replâtrages intéressés, presque aussi ignoble et sans cœur que dans les **collages** de femme à homme. On se déteste, mais on se craint et chacun met les pouces, parce qu'on pense à mille circonstances où il serait fâcheux d'être brouillés.
> E. et J. DE GONCOURT, *Journal*, 1860, p. 851.

— *Rare* et *p. méton.* Personne avec laquelle on vit en situation de concubinage. — *Et ton collage à propos, tu l'as donc épousé?* (ZOLA, *L'Oeuvre*, 1886, p. 274).

◇◇ **Prononc. et Orth.** : [kɔla:ʒ]. Ds *Ac.* 1835-1932. **Étymol. et Hist.** 1544 *collage du papier* (*Statuts des papetiers* d'apr. Delboulle ds QUEM.). Dér. de *coller** ; suff. *-age**. **Fréq. abs. littér.** : 66. **Bbg.** GUÉRET (J.). La Constr. aéron. *Banque Mots.* 1972, nº 4, p. 178. – SAIN. Arg. 1972 [1907], p. 233; Lang. par. 1920, p. 104.

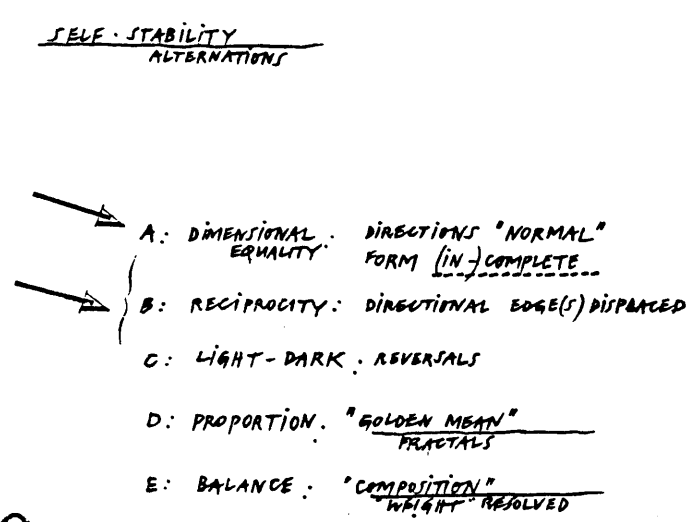
61

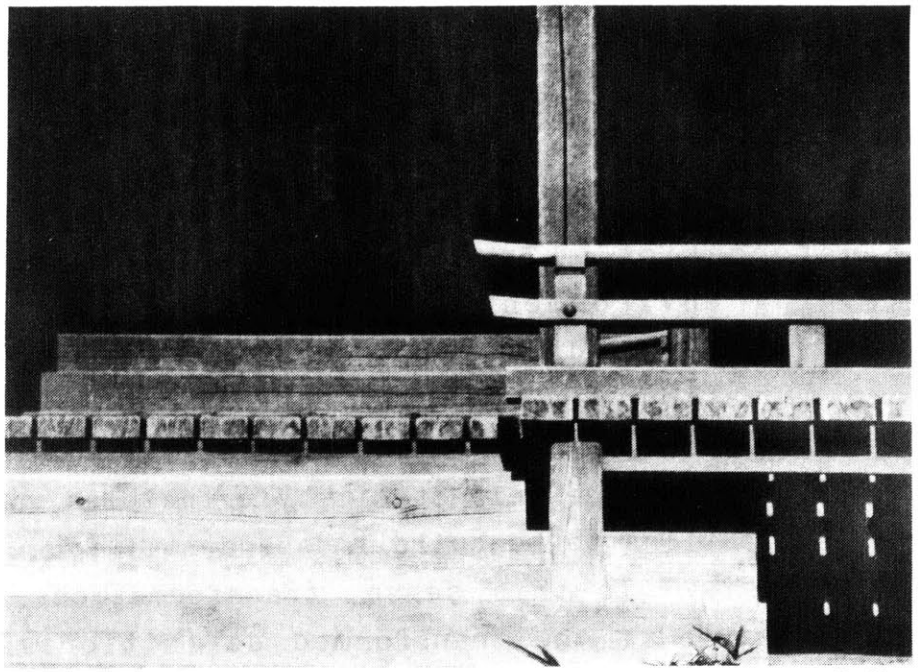
BEHAVIORAL FORM CLASSIFICATION

Each of the form families may be given formal self-stability by the manipulation of their behavioral attributes. Form behavior embodies two polar operational principles: intensification and transformation.

Intensification

Strengthening continuity, or intensification, of any of the generative form groups may be accomplished by the utilization of one or more principles of self-stability. A continuity may be intensified by the repetition and/or registration of similar forms (shape and direction) in the immediate vicinity of that continuity. The form and direction of the continuity must be spatially reinforced by the intensifying elements, creating reciprocity between continuity and adjacent space.





Shrine in front of Yakushi-ji Temple, near Nara. 36

Transformation

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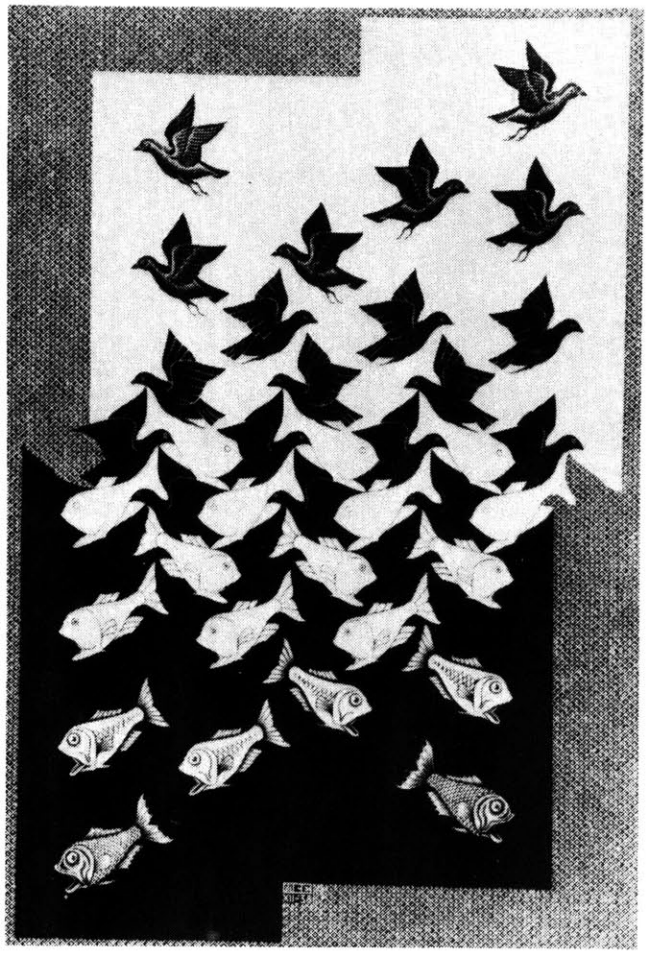

Lucht en Water II, M.C. Escher.

The operative opposite of intensification is transformation. Transformation occurs when existing environmental conditions need to be countered. In a directional field organization, transformation may occur by a reversal or other major alteration in the initial direction. Manipulation of the self-stability principles allow intensifications to be build independently from the environment. In this sense, transformations are only possible if the transformed definitions are self-stable. The relationship between non-transformed and transformed bits is governed by the same self-stability principles outlined in the section on intensification.

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These eight to ten story vertical units at Cuenca add up horizontally to create a larger continuity normal to the initial direction of the vertical units.

5. SELF-STABLE INDUSTRIAL BUILDING SYSTEMS

The general principles of form may be applied to a broad range of construction technologies. Repetitive industrial construction technologies are agents of practicality in the architectural design process. The era of hand-crafted aesthetics has given way to Twentieth Century notions of functionalism and industrialized processes. The need for speed, standardization, and efficiency is so deeply rooted in our culture that flexibility, plurality, and traditional aesthetic considerations are obsolete. What then is the expression of the Twentieth Century? Is it merely a functionalisitic representation of industrialized technology out of control? Is it an attempt to disguise those processes which have created such drastic changes in our culture?

If we recognize a unity in nature and human energy, it follows that science, art, and the humanities are also inseparable. Frank Lloyd Wright addressed this issue in his edict "form is function." These two concepts must exist in a harmonious relationship. As Buckminster Fuller says in Nine Chains to the Moon:

> When there is time perspective on [Henry] Ford equivalent to the 400 year interval between ourselves and Leonardo da Vinci, which enables us to appraise da Vinci as the greatest artist of the Middle Ages, Ford will undoubtably be acclaimed by the people of that latter day as certainly the greatest artist of the 20th century. 62

Given an understanding of the concepts of self-stable form(s) in a field organization, formal and aesthetic issues may be addressed with the use of industrialized building systems. The physical nature of these systems is to be independent of alternate systems. Components are designed with strict operational, structural, and dimensional limitations in mind. These limitations give individual systems character and self-stability. Although some systems tend to work better in particular situations than others, there exists

such a wide range of alternatives and techniques that almost all programmatic and functional requirements may be accommodated.

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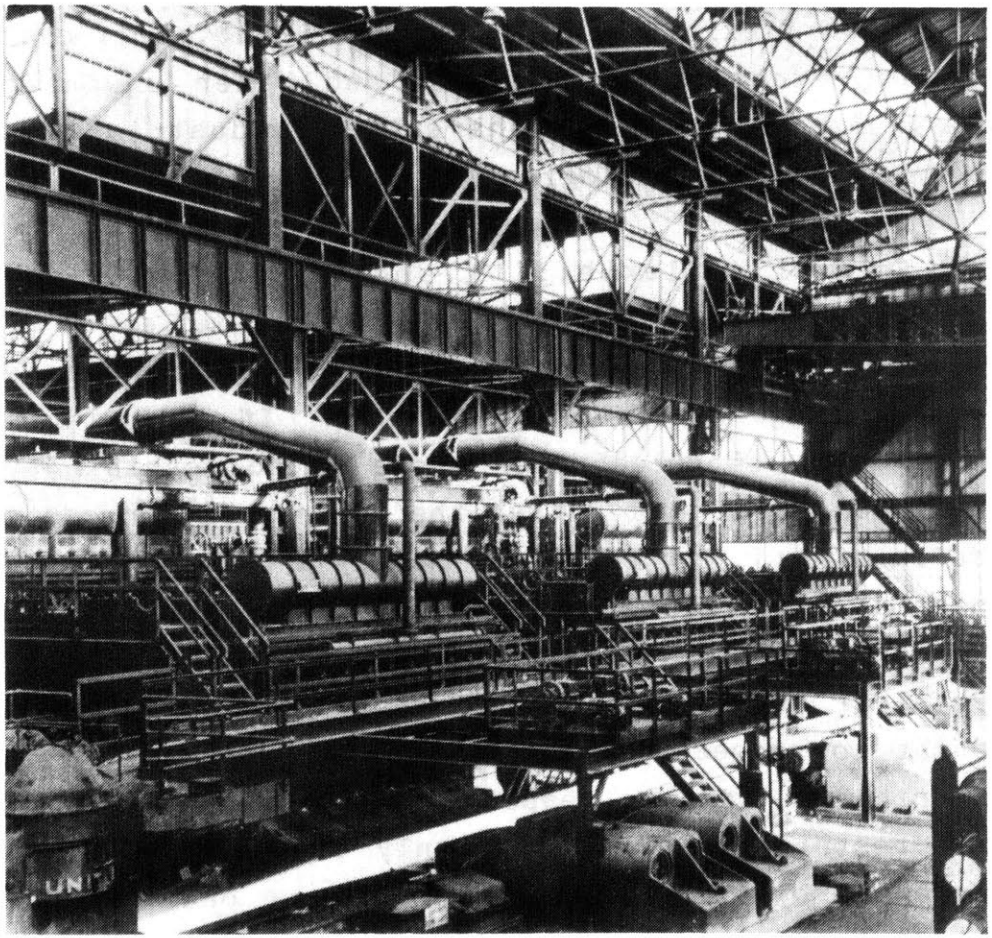
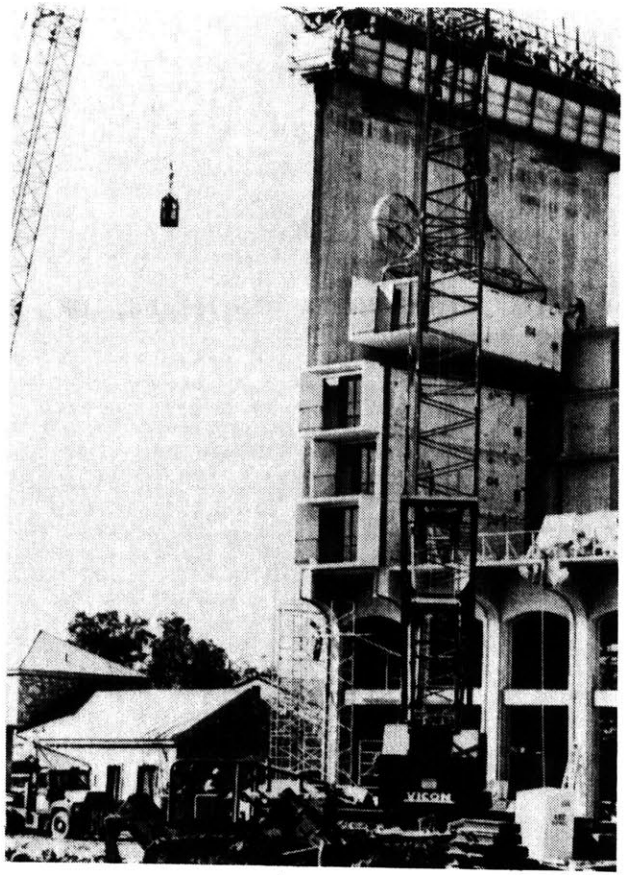


Republic Steel Mill, Cleveland, OH, by Albert Kahn.



Built for the San Antonio Hemisfair, the Zachary system consists of prefabricated boxes stacked against a monolithic slip-formed wall. 40

Environmental and site considerations depend not on the choice or design of a specific industrialized system but on the formally literate deployment of the system's components. If reasonable formal principles are used to generate a coherent aggregation, then there is virtually no limit on flexibility for the architect. In most cases, excessive uniformity and other unwanted environmental effects inherent in industrialized construction technologies may be avoided.

The formal inflexibility and failure of many buildings result from both obsessive completion of the industrialized components and an illiterate overall aggregation of components. If definitions have been completed, then there is no possibility of interaction with either the environment or other definitions. The result is merely a honeycomb-like maze of individually isolated components.

Physical aspects of the primary structural system ought to suggest the beginning of a definition or territory. In this respect, the initial system is not restricted to creating only one type of space governed by the formal properties of one system. Without completion there is an allowance made for

subsequent decisions that may either alter or intensify the original move.

The advantage to designing structural systems by this method is that it not only structurally bonds the building together, but also may begin to define partial containments and continuities of space. The formal expression of physical properties in the structural system then lends a unique character to spaces and territories defined by structure. Different structural systems may have different formal implications, and so specific programmatic and functional criteria may be accomodated by the selective placement and aggregation of individual systems. In this sense, form not only **is** use but use **is** form.

If each system is designed to be structurally and formally self-stable, then the option to deploy different systems with varying formal implications is left to the designer.

42

An unfortunate example of industrial building technology.

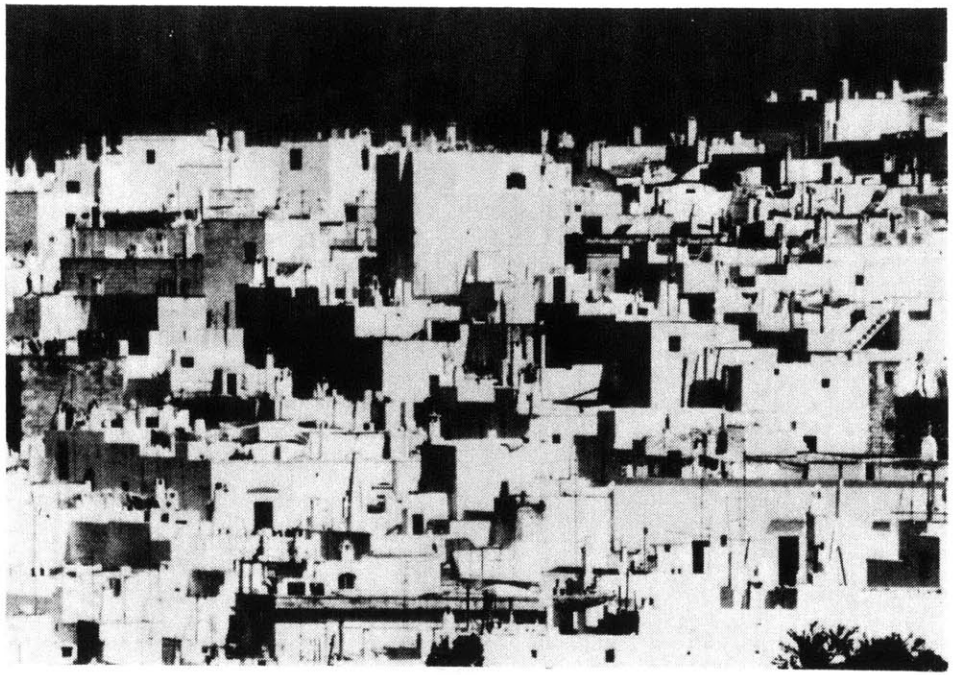
ADDITIVE GROWTH FORM

Since it is possible to build partial territorial definitions with the use of industrial building technologies, the overall form and multiplicity of form in an aggregation of building systems is apparent. It has been demonstrated that larger definitions may be built by the additon of smaller, identical forms. The next step is to build the

larger definition or the addition of bits from non-identical systems. The result would be similar to a model built from Legos, Tinker Toys, and an Erector Set, and even though each modeling medium has its own formal* and structural implications, a coherent whole can be achieved through the use of reciprocal forms and dimensional considerations.

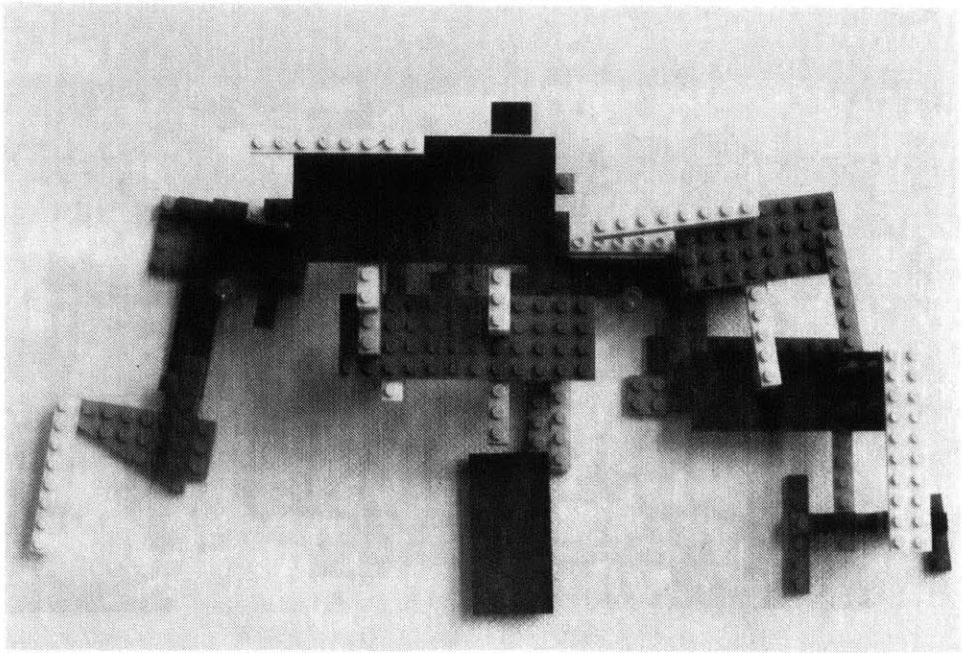
*(The dimensional system need not be only finished parts.)

41



This Southern Italian town is clearly a more humane and interesting aggregation of components than the preceding example.

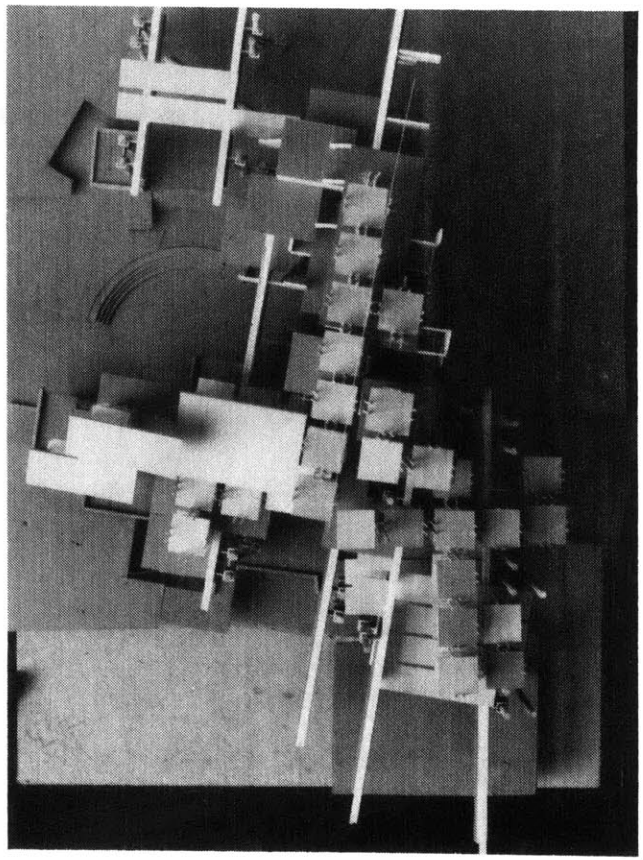
While it is possible to create larger definitions by the addition of dissimilar components, the variety attained by employing several systems is essential to the basic concept of plurality of architectural form. As in the Iberian and Italian hilltowns, the addition of individual definitions results in a non-repetitive and hence transformed whole, even though the construction and organization principles may be very constant. Transformation and the use of multiple self-stable components allows us to achieve plurality and variety in form.

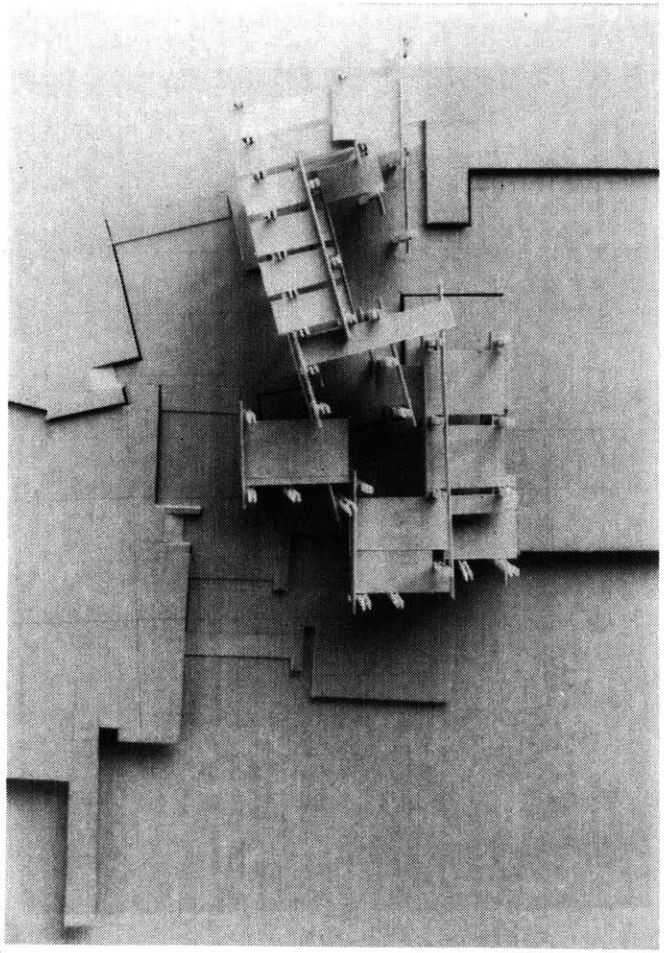


6. CONCLUSION/MODELS

When designing with self-stable industrial building forms, it is restrictive to work 2-dimensionally. To begin with, continuities must be treated in a "lineal" manner (as opposed to "linear" which implies 2-dimensionality). Space is by its nature 3-dimensional and the only effective way to understand it is to model it in three dimensions. Further, given the 3-dimensionality of the various building systems involved, it is impossible to arrive at an understanding of the spatial relationship between self-stable components without modeling them in three dimensions.

The modeling process also lends itself to working additively. Individual components can be amassed and then aggregated in a manner appropriate to the basic principles ("facts") of form already discussed.

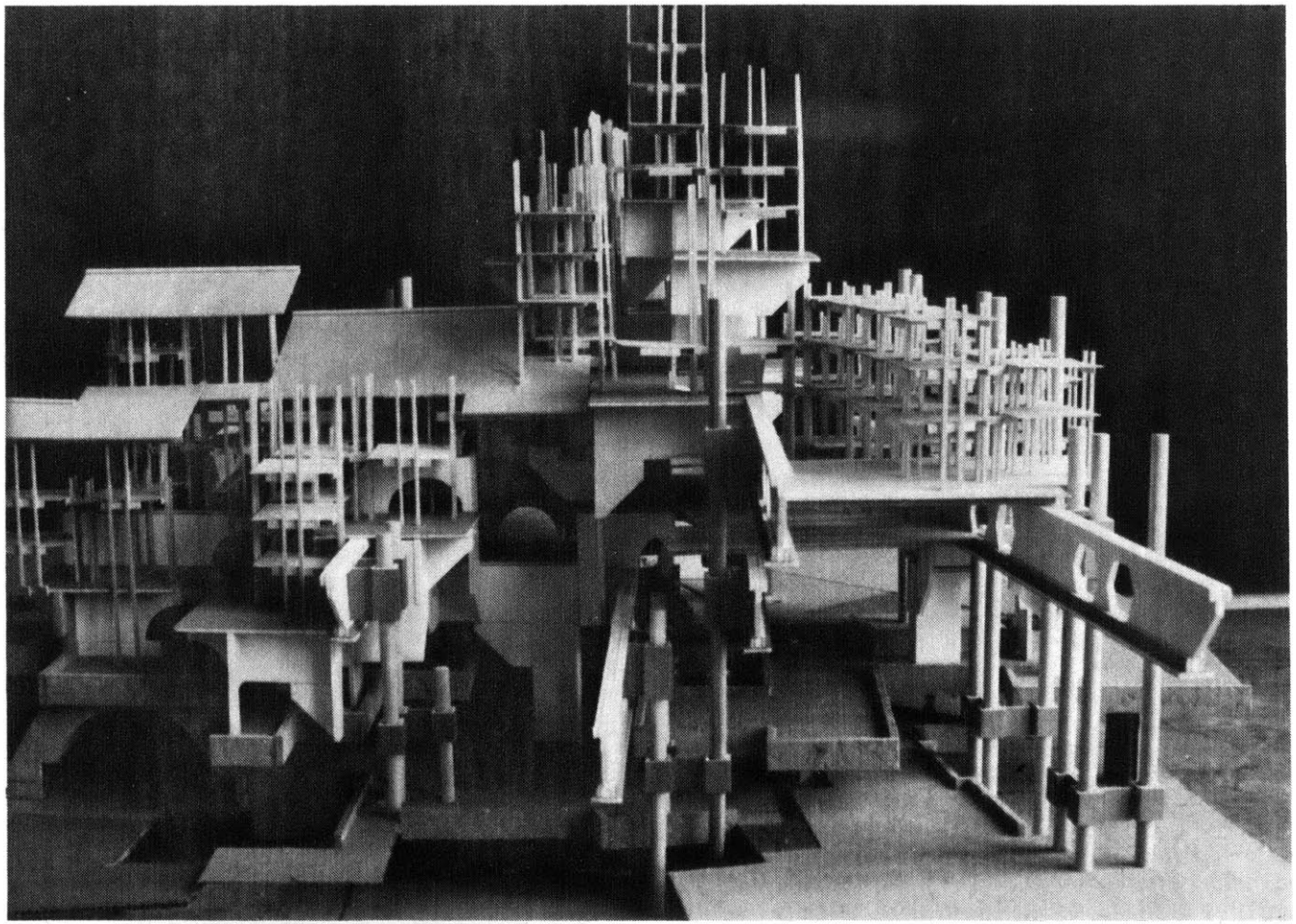


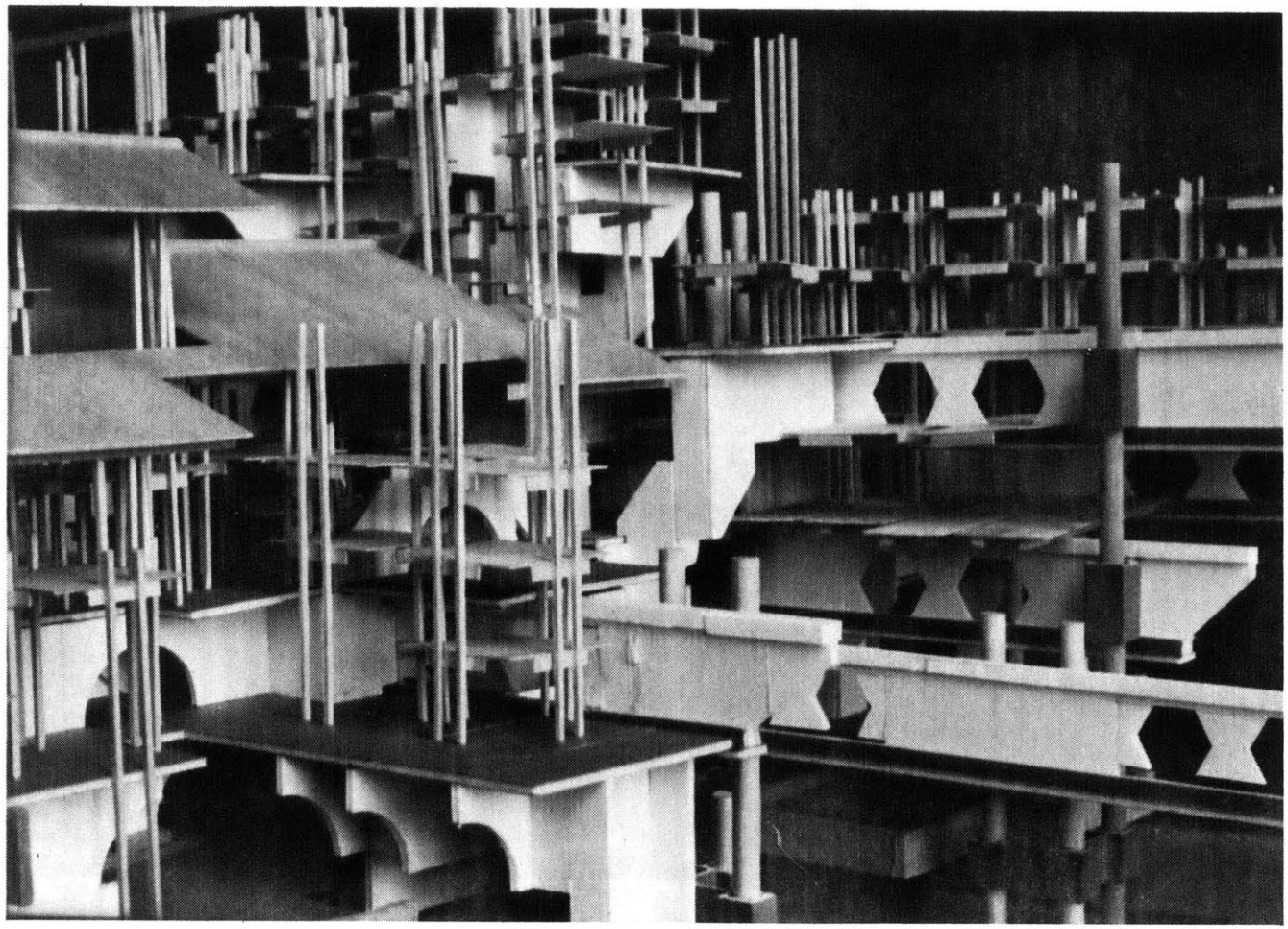


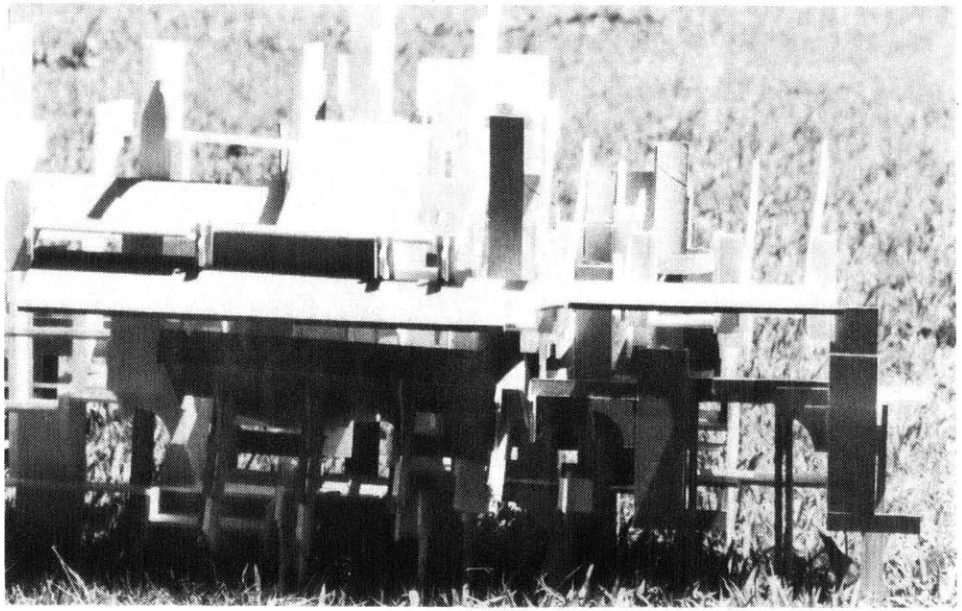
Several study models assisted in the design of individual industrial building systems. Although many different conventional industrial building systems exist, careful selection and modification of those systems was important in order to arrive at formally workable definitions. In particular, the folding skeletal wall system had to be carefully designed to achieve the desired physical, structural, and formal properties while not obviating its repetitive construction attributes. Once the systems were seen in 3-dimensional space, their unique physical and formal properties could be identified and explored.

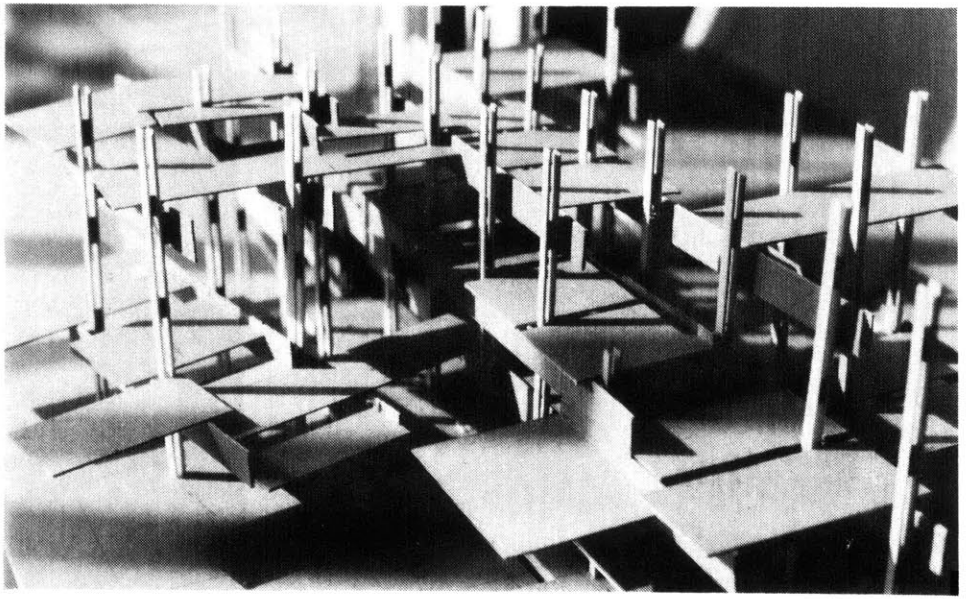
Although it is hoped the systems developed in this thesis may be applied to a variety of use situations, the selection of a specific site (Government Center Plaza, Boston) assisted in the aggregation and design process. Site and use considerations must determine the juxtaposition and dimension of individual spaces in any reasonable building design. Choosing a specific site provided clues to the initial round of form decisions at the urban scale as well as the organization of different sized individual habitable territories and zones. Although site and use issues are

crucial to the design of any building, these considerations were given less than the usual attention. It was considered most important for this exploration to deal with industrial construction technologies and generic architectural form principles.









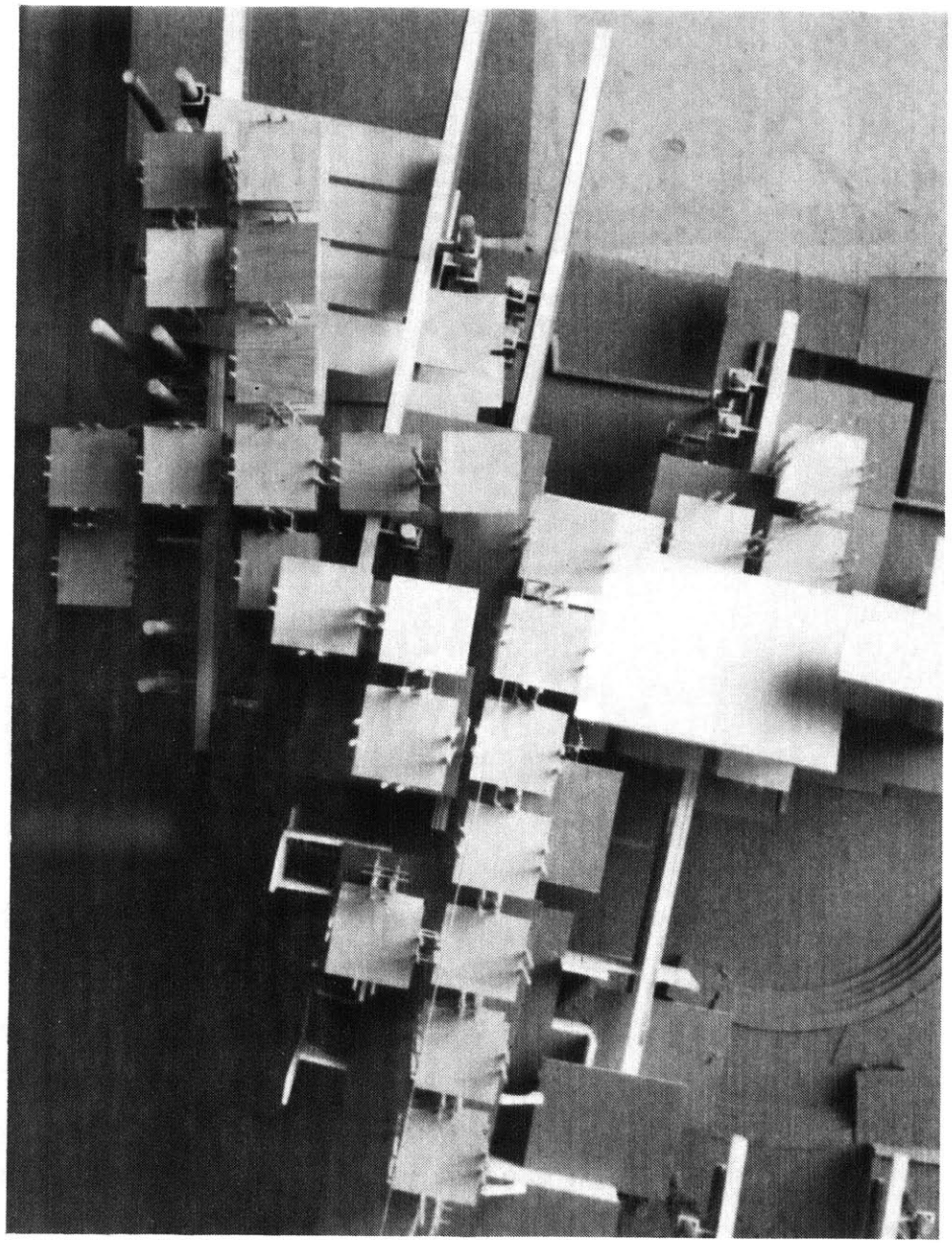
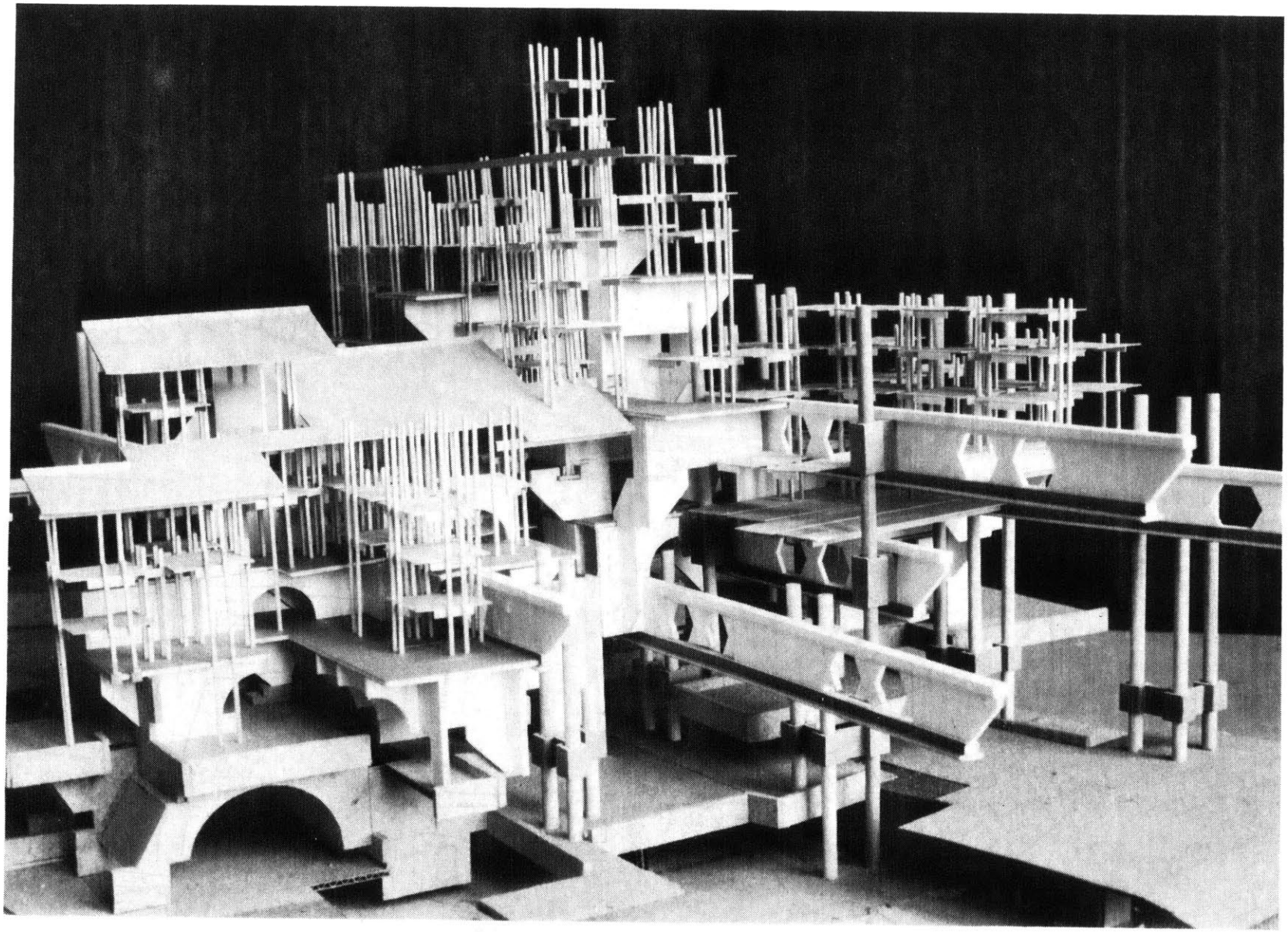
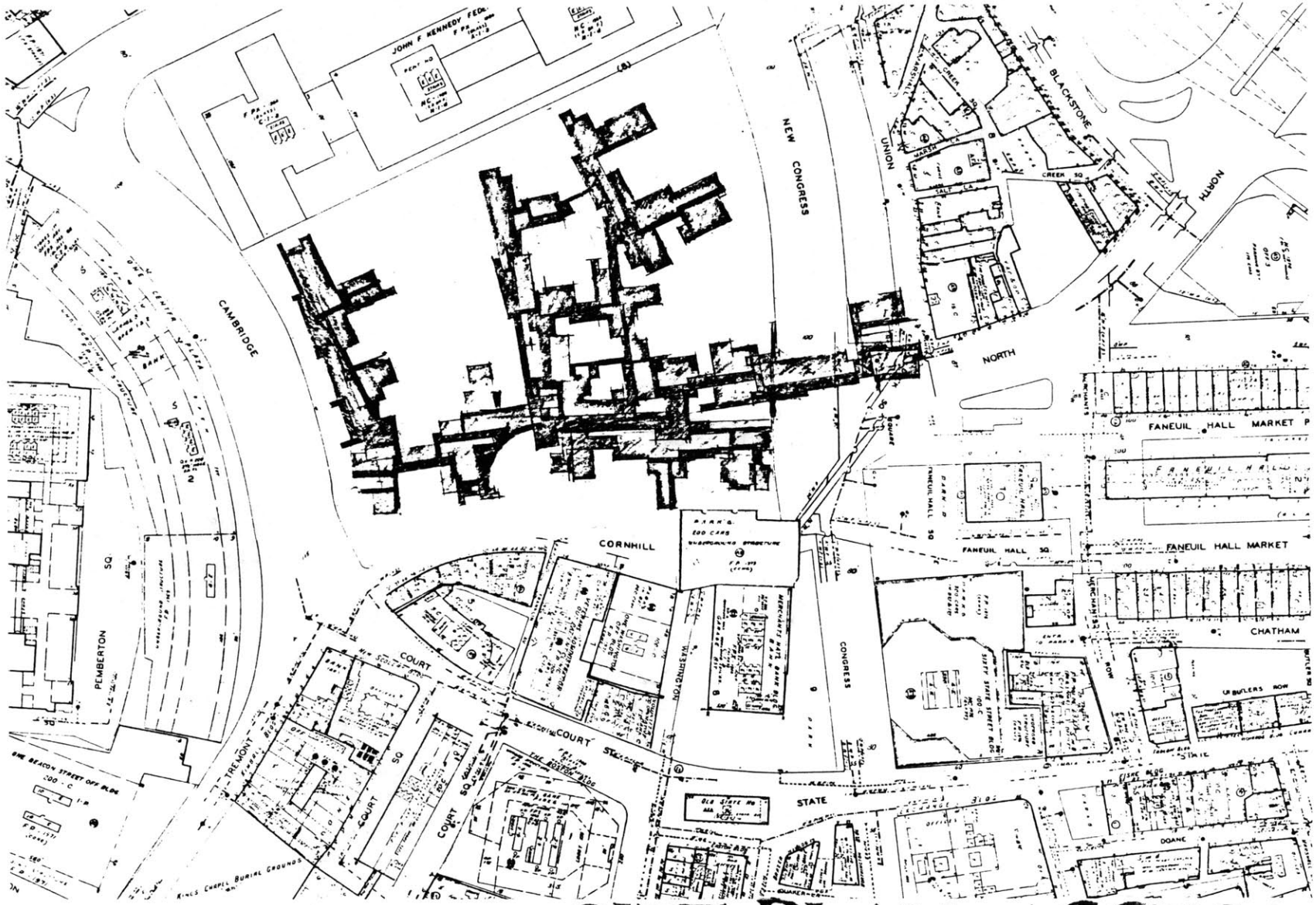


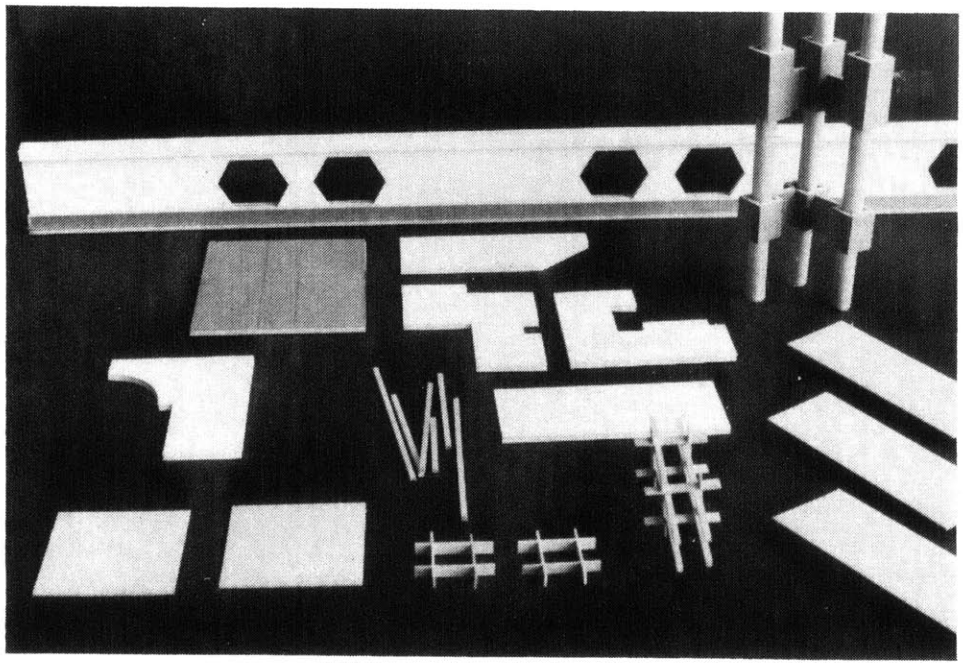
Plate 70





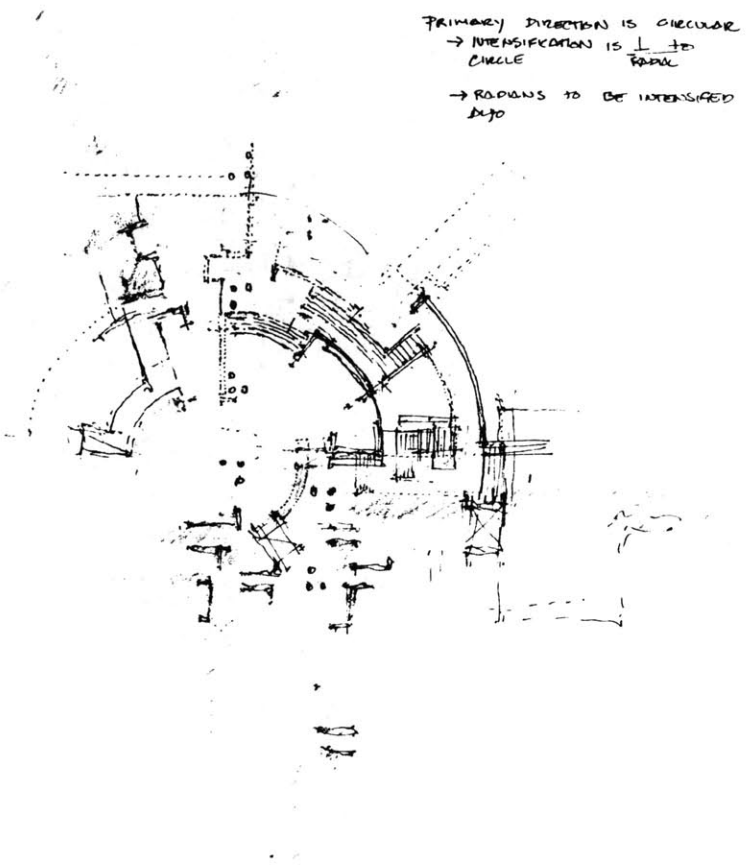
SITE PLAN - ACCESS

APPENDICES



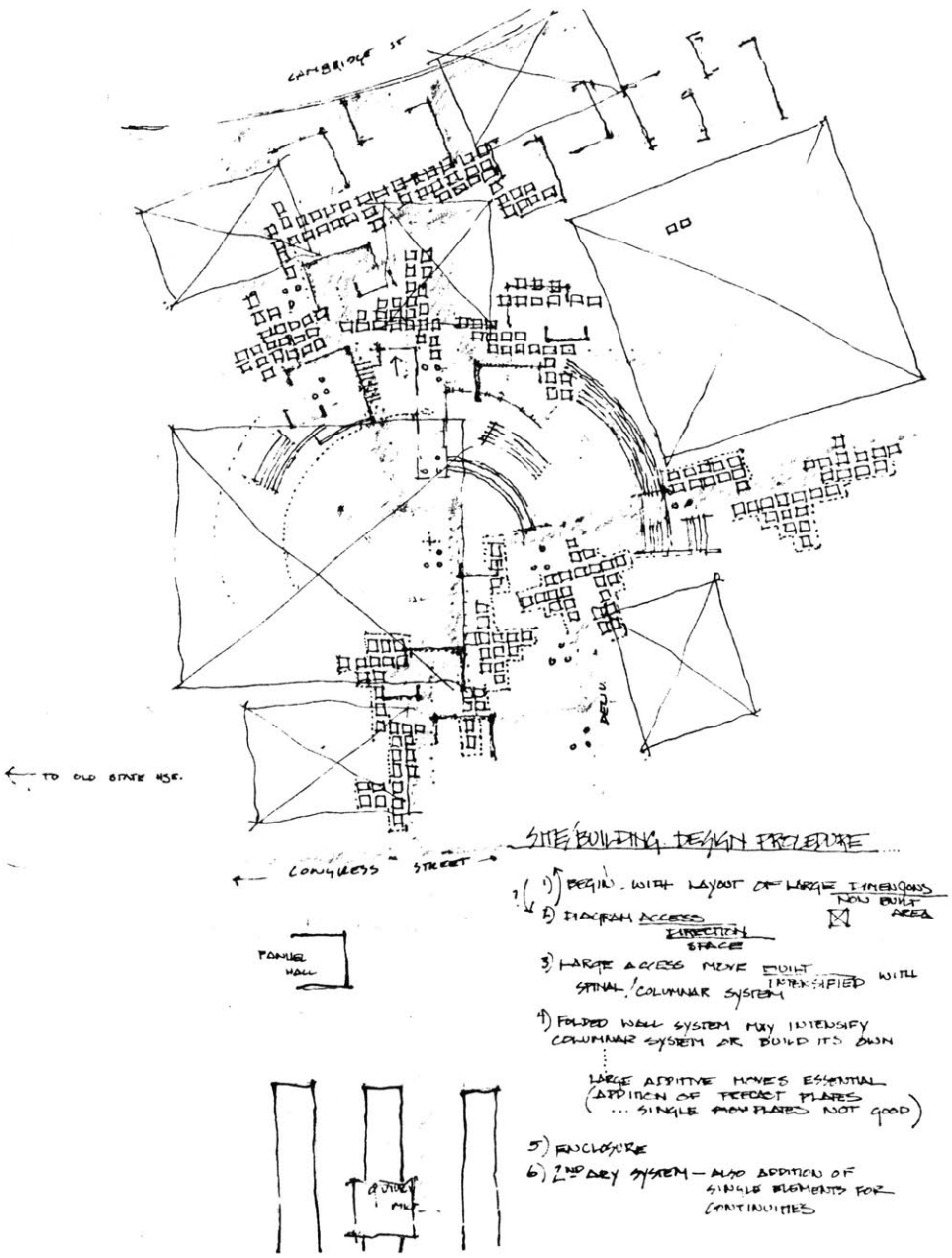
APPENDIX a.

DISPLACED SURFACE GROUNDFORM



Displaced surface forms are concerned with foundations and site-related issues. In formal terms, the idea is to displace areas of existing ground form by elevating them to allow access continuities to be established between the displaced surfaces and the underlying zones. In plan, displaced edges take on the form of partial containments and establish large scale continuities. Territorial definitions of this nature and scale suggest large public gathering areas such as plazas and ceremonial places.

Because the displaced surface is identified with public use, it is desirable to build vertical access and service cores from its components. If this is possible, then not only does the system allow intensification of ground forms, but it also builds reciprocity between the ground forms and the upper building.



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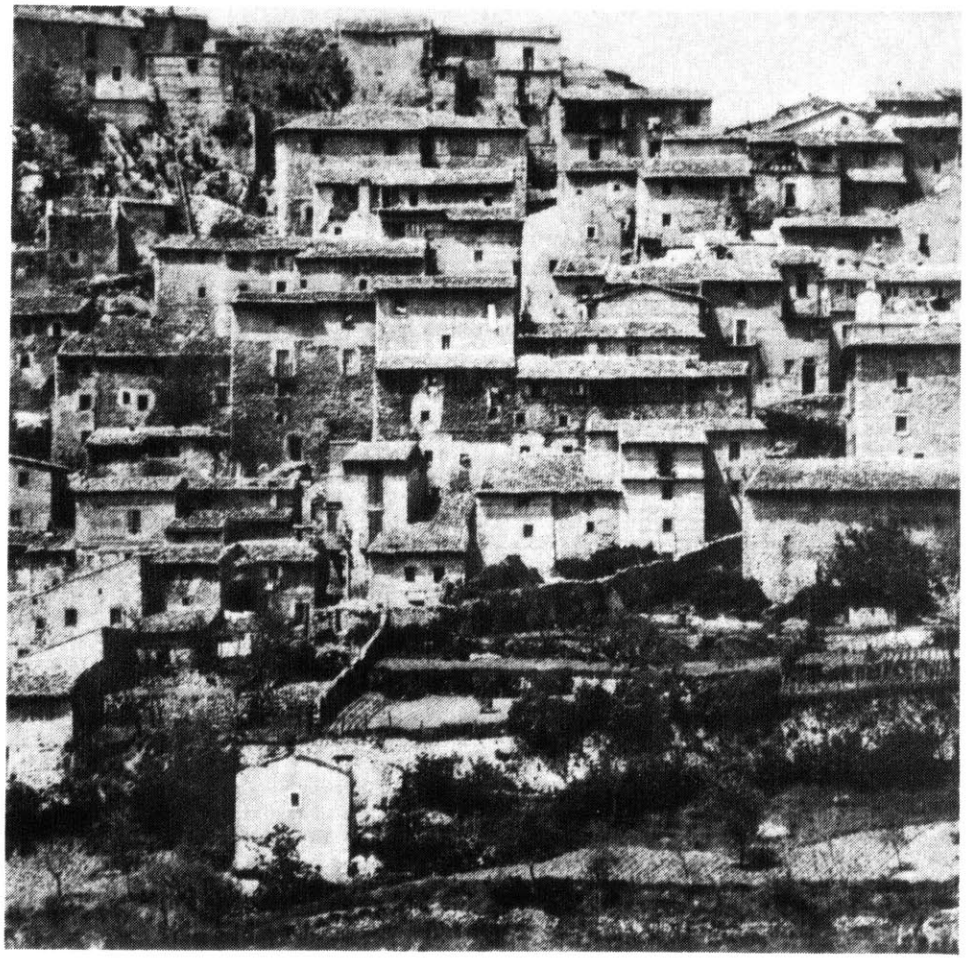
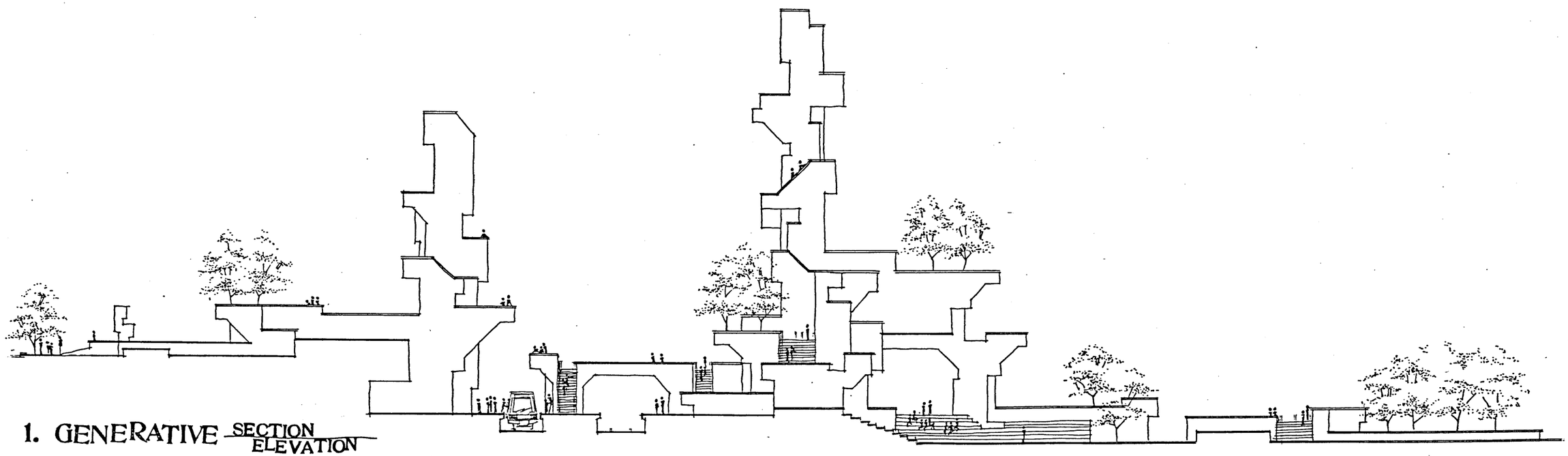


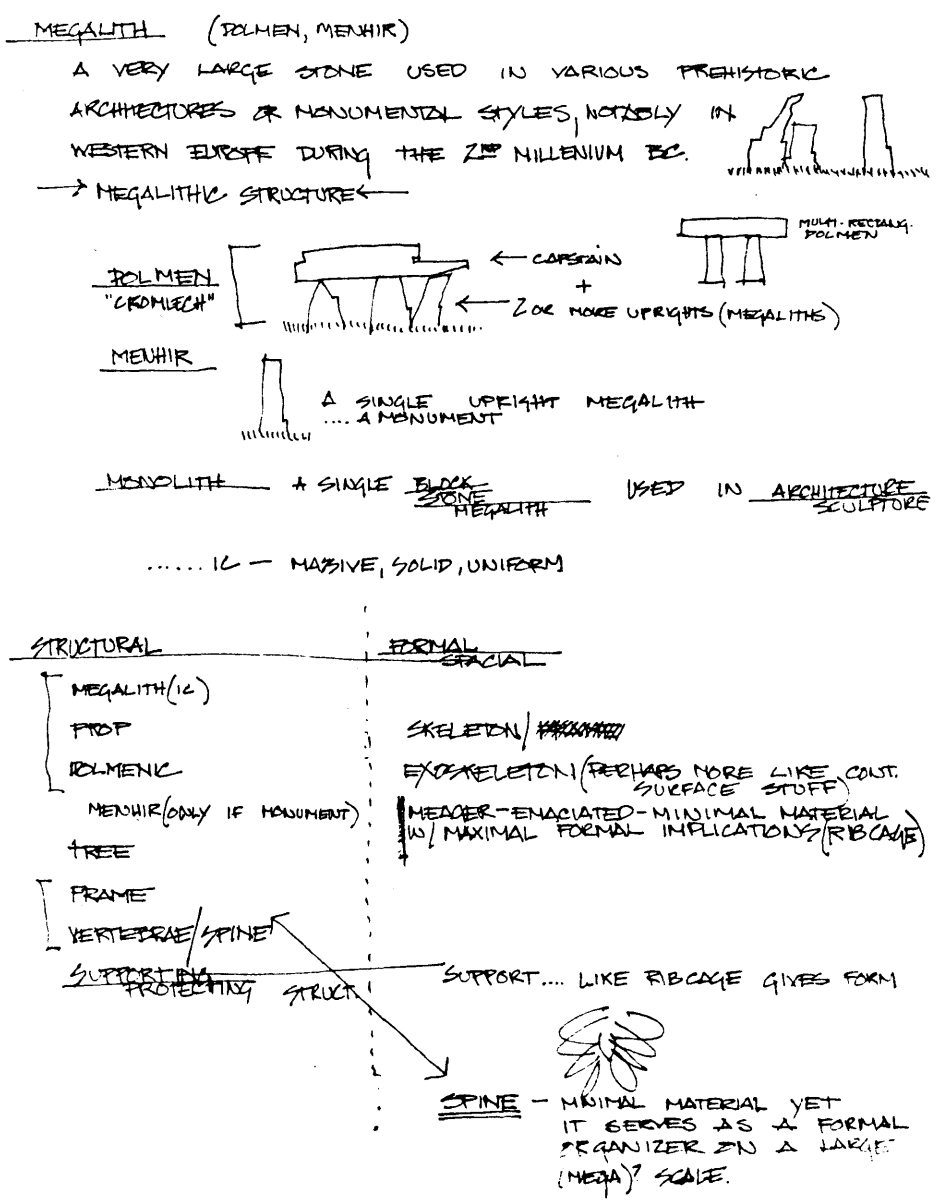
In addition to the vertical displacement of ground forms, displaced surfaces may be "floated" horizontally. Treating surface forms in this manner leads to a directional intensification of the horizontal. It also implies that the region between raised form and the ground may be established as an access continuity. This notion of continuity creates reciprocity between the two regions.

Horizontal surfaces (ground/roofs) are displaced by this village's closure.



1. GENERATIVE SECTION ELEVATION

1" - 40'

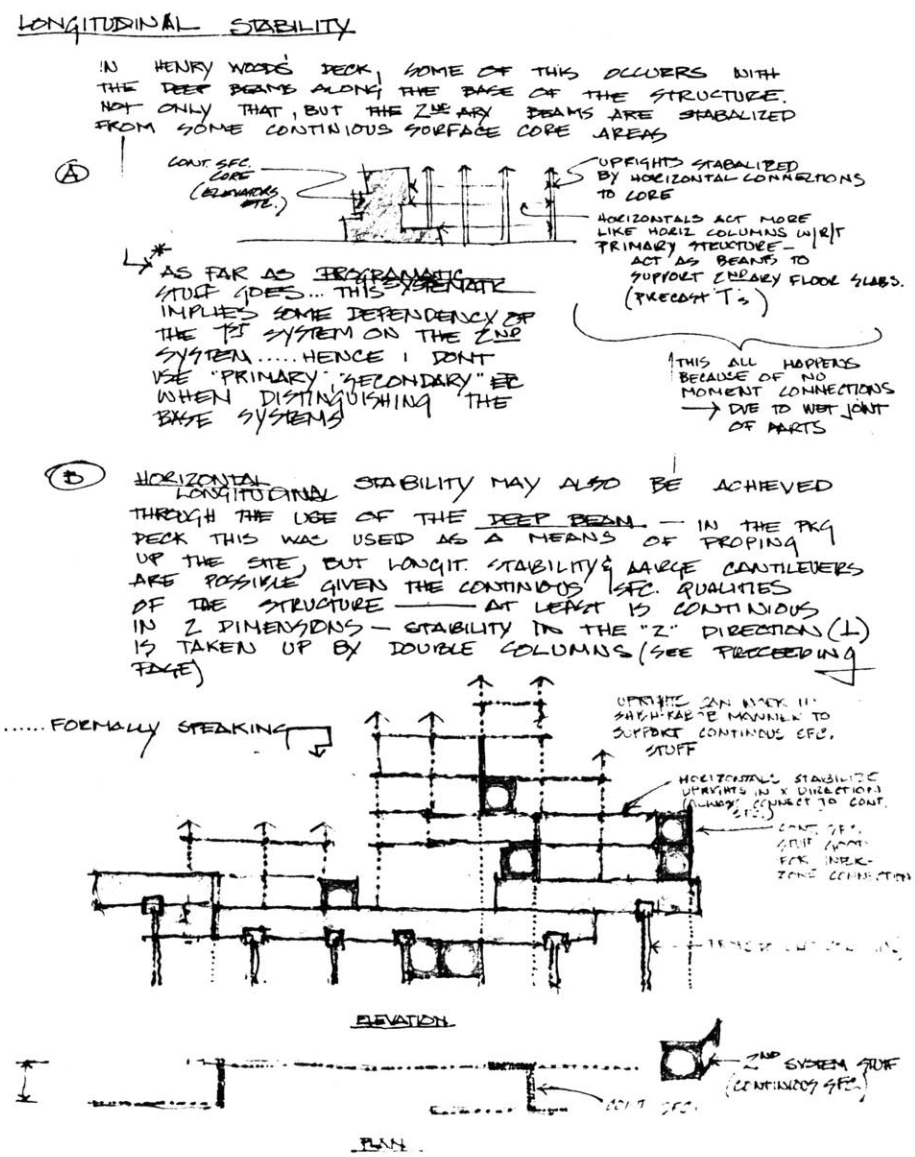


APPENDIX b.

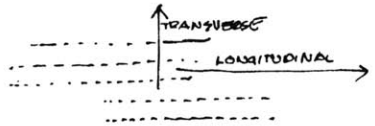
MEGALITHIC SPINE

The formal intent of the megalithic spine is to build large scale continuities. These provide workable definitions large enough to reciprocate with the overall urban fabric of a large city, yet small enough to be recognized as building-sized definitions. By creating urban-sized continuities, the megalithic spine system works in a manner similar to the backbone of an animal. The backbone is the common component to which appendages are registered.

In order for any building system to be considered formally stable, basic dimensional and reciprocal criteria must be met. In this instance, dimensional considerations are resolved through the use of multiple precast components. Territorial and reciprocal considerations lead to the use of a triple column arrangement and the cantilevered spandrel beams. All components are 100% precast with the exception of the two-hundred foot spandrel beams. The lower precast portion of the spandrel beams are hoisted into place and secured, and the upper section and webbing are poured in place. The precast bottom portion is a support for formwork while the upper half is poured. By allowing the webbing and top of the beams to be cast-in-place, homogeneous structural connections to the cip folding



PHYSICAL STABILITIES - STRUCTURAL ISSUES

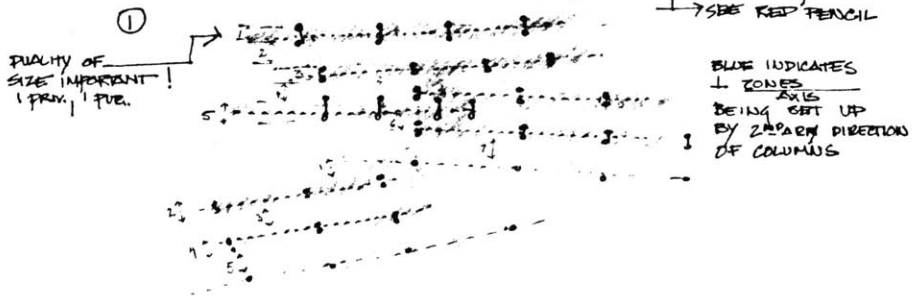


TRANSVERSAL STABILITY

THIS WILL BE ACHIEVED THROUGH A VERTICAL TRUSS ARRAINGEMENT — PROBABLY VIERENDEEL — 2 COLUMNS CONNECTED AT APPROPRIATE INTERVALS BY MOMENT CONNECTIONS (OR TRIANGULATION) STRUCTURALLY
↑ 2ND ARY
WILL BE ANCHORED TO THE GROUND W/ RIGID FOOTINGS.....
(HERE IS THE PRIMARY MOMENT CONNECTION. SOLID
↳ FORMALLY SPEAKING.....

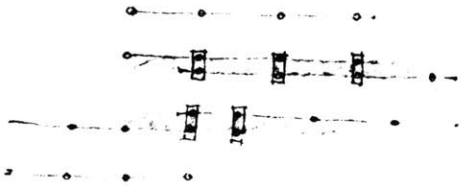
THIS SEEMS TO JUSTIFY THE DOUBLE COLUMN ARRAWNGMENT
WHAT WILL HAPPEN IS THAT THESE DOUBLE COLUMNS WILL MARCH ALONG WITH THE PRIMARY DIRECTION (SEE DOTED LINES) & THE IN-BETWEEN ZONE CAN BECOME THE (AREA OF SLIP) YET A ZONE OF ITS OWN (EDGE INTENSIFICATION ?)
↳ SEE RED PENCIL

①



②

THE DOUBLE COLUMN MAY BE THE INSTRUMENT OF "SLIP" DIRECTIONALITY AS COULD EASILY HAVE BEEN THE CASE IN THE HENRY WOODS' PARKING GARAGE AT GOVT. CENTER



THE "SLIP" HERE IS ACTUALLY BUILT BY THE "BETWEEN ZONE" ZONES IN CONTRAST TO PART ① WHERE THE SLIP OCCURS BETWEEN EVERY OTHER ZONE

skeletal wall system may occur.

Columns

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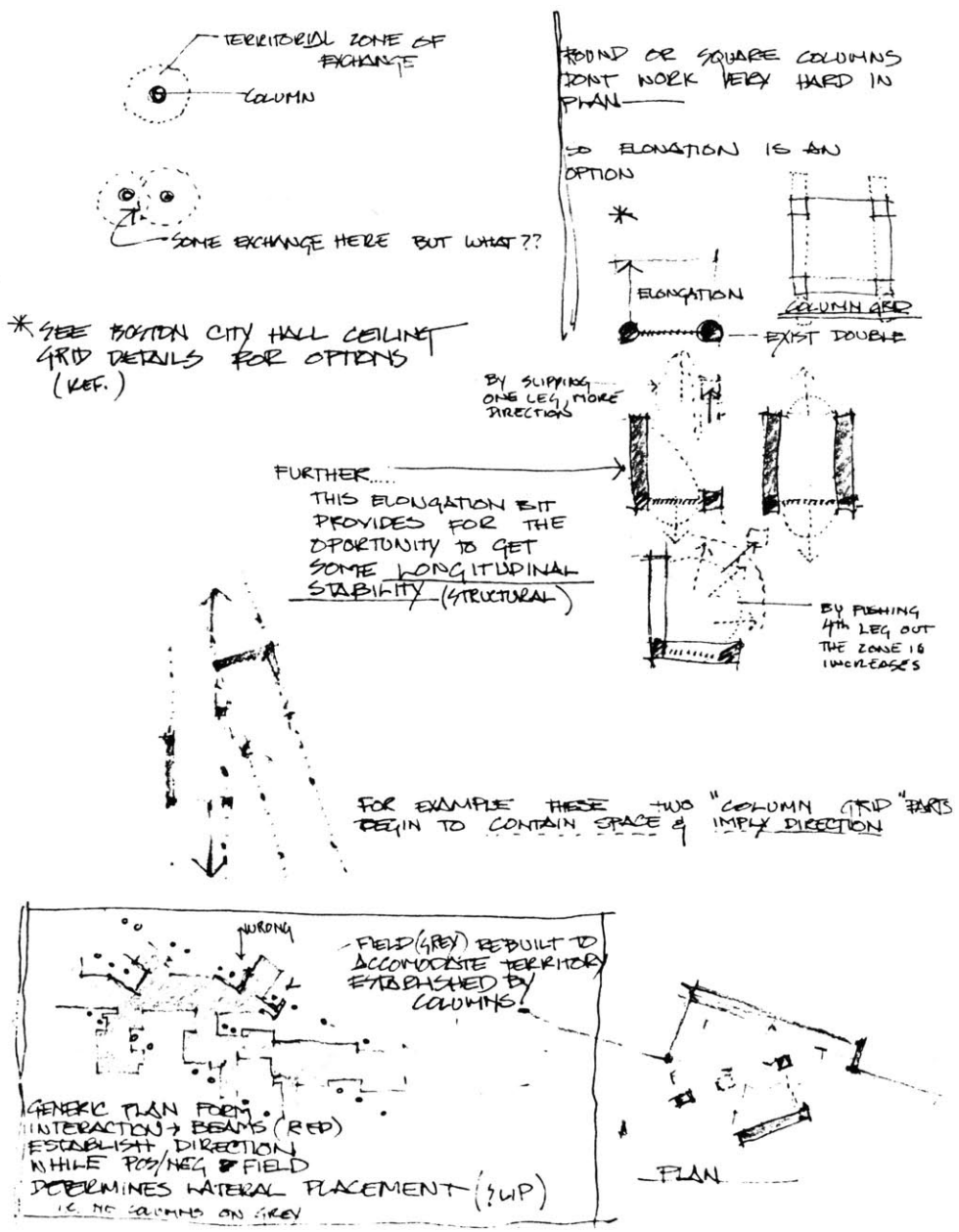
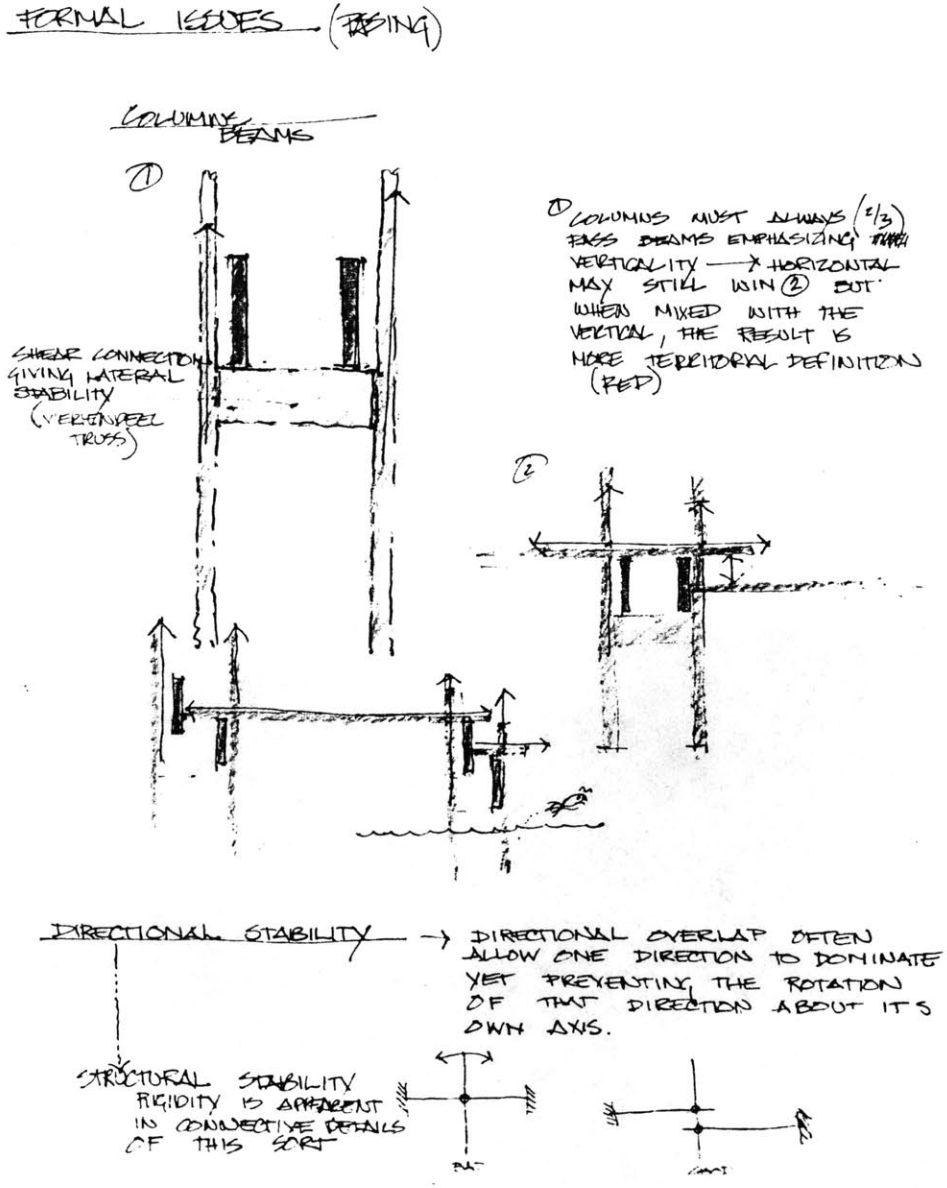
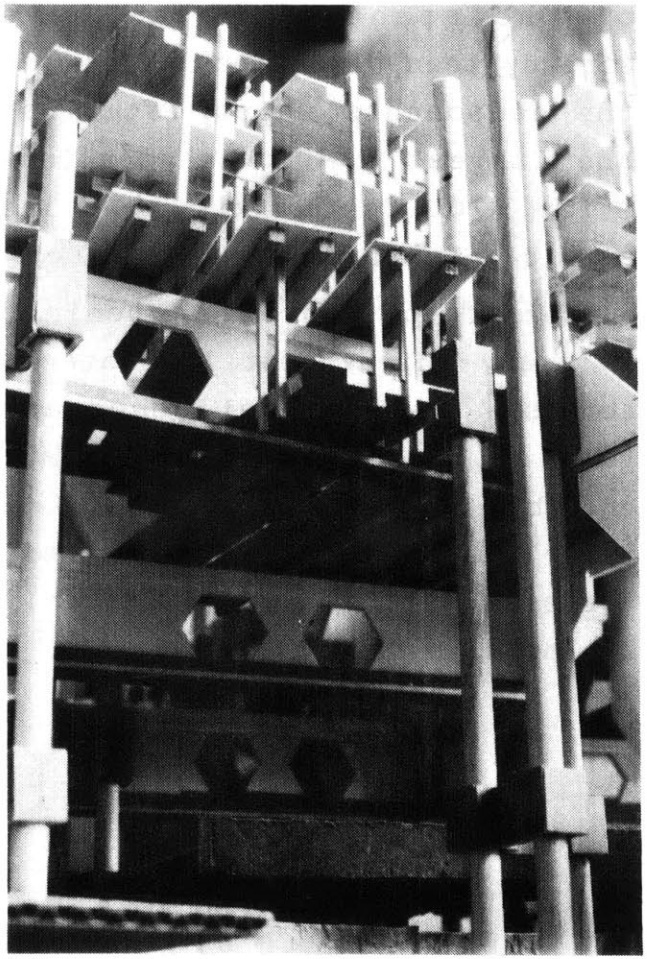
Formally, the clustering of three or more columns is intended to: (1) create the beginnings of territorial definitions at the column base with the possibility of an intensification of that territory through the use of an alternate formal system (probably ground forms); and (2) with the notion of cantilevering spandrel beams, to create major vertical continuities.

Each column is a precast cylindrical form. Column sections are connected to a precast spatial tree. The precast tree enables an inter-column connection to occur, thus providing some lateral stability to the columns by inducing a moment connection. In this sense, the column cluster resolves some horizontal loading situations by working like a vertical cantilevered beam. The interconnections react as shear





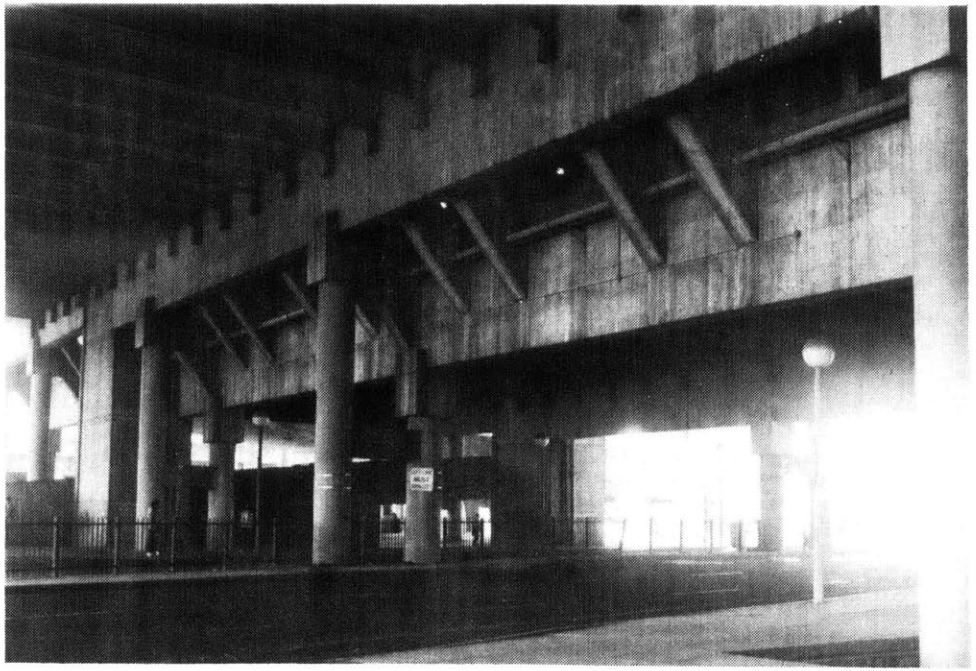
inhibitors in a manner similar to the action of webbing on a horizontal beam.



Spandrel Beams

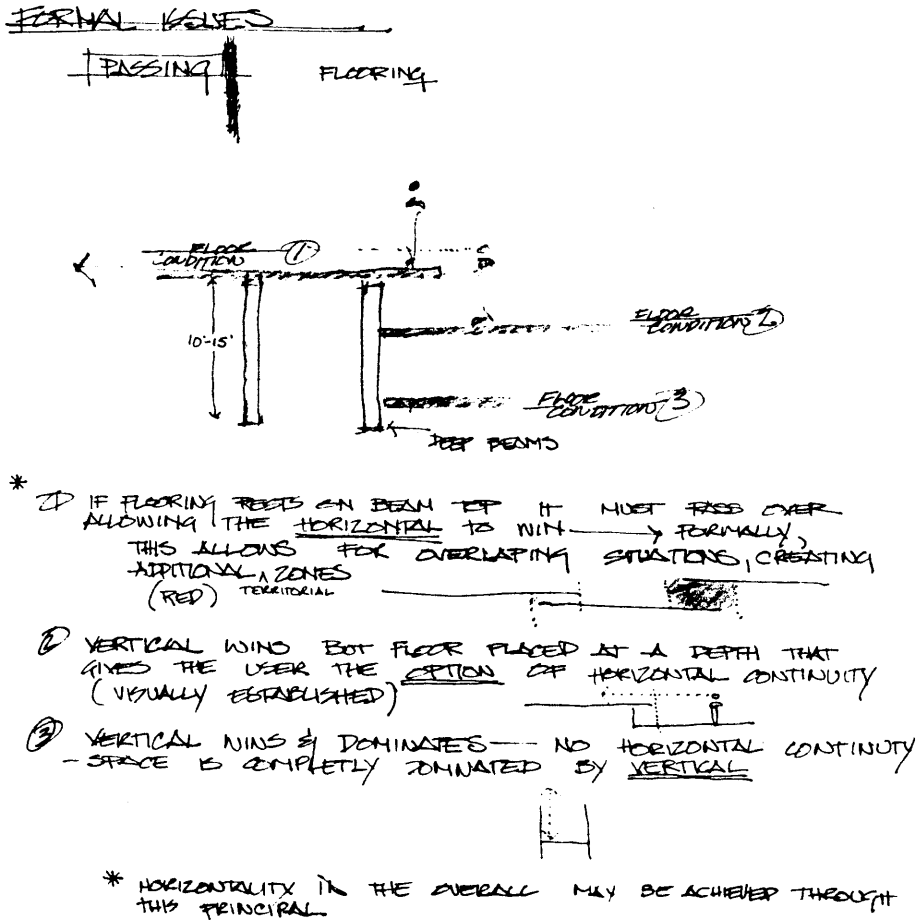
The basic structural implications of the spandrel beams have already been discussed. They are the components which establish the largest horizontal continuities (200 feet maximum). The spandrels are approximately sixteen feet deep with openings at every thirty feet for lateral access. The spandrel beams are vertically located at a minimum of thirty feet, establishing major access continuities. These access levels function similarly to those in Habitat.

45



Spandrel beams in the Government Center parking garage, Boston.

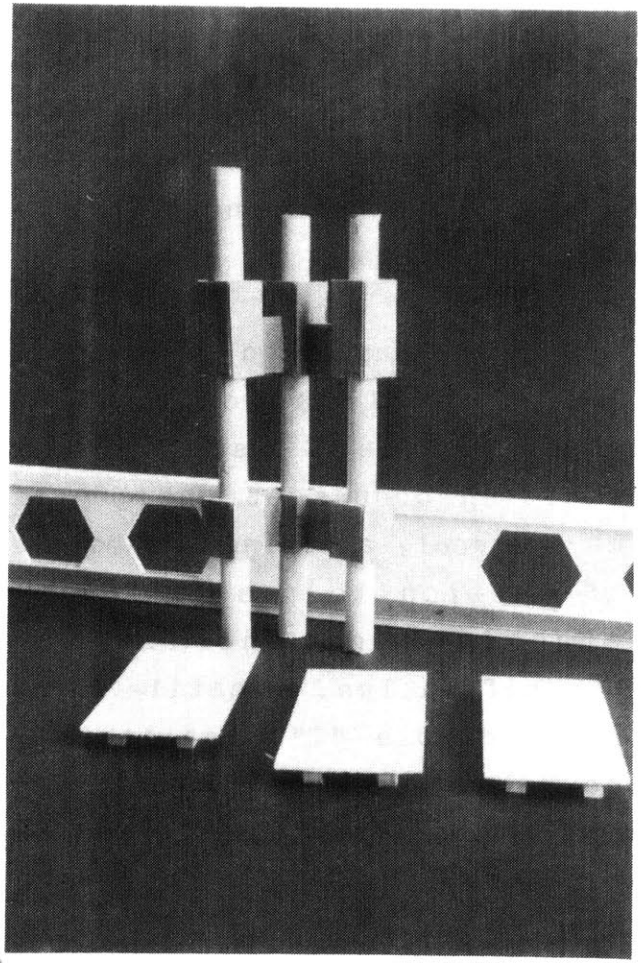
Precast Flooring



Primary access continuities are built from precast double "T" sections. The maximum allowable span is sixty feet with the possibility of up to a fifteen foot cantilever. A general rule for cantilevers is that they can be no greater than one-fourth of the initial span.

Flooring is supported directly by the spandrels at one of two points. The first loading condition occurs at the top of the spandrel, allowing the double "T" section to pass over and establish some horizontal intensification. Cantilevering of the double "T" section only occurs at this position. The second support condition occurs at the base of the spandrel.

Here the double "T" rests on the original precast component of the spandrel and is supported in the same manner as is the cip formwork for the upper section of the spandrel.



MEGALITHIC — > LARGE ELEMENTS USED IN A VERTICAL FASHION

SPINE —> MAIN ORGANIZING ELEMENT OF A SKELETAL SYSTEM. SPINAL ACCESS. 'BACKBONE' OF THE SYSTEM.

CONNECTION DETAILS [PASSING]

1. THE UNDERLYING APPROACH HERE IS BASICALLY THAT WHEN TWO ITEMS COME TO AN INTERSECTION, IF THEY ARE ALLOWED TO 'PASS' EACH OTHER, THAT INTERSECTION MAY NOT ONLY BECOME PHYSICALLY STABLE, BUT MOST IMPORTANT, "SPACIAL"

↓

AT THIS SCALE THE "SPACIAL" QUALITIES OF THE INTERSECTIONS NEED NOT BE HABITABLE — (ALTHOUGH THEY WELL MAY...)

SIMPLY SPACIAL IS ENOUGH! →

↳ THIS LEADS TO SOME VISUAL INTEREST AND FORMAL BALANCE OF THE CONNECTIONS

↳ F.B. THE 'SPACIAL' QUALITIES OF THE INTERSECTIONS GENERATE DIMENSIONS WHICH MAY THEN BE USED IN A DIMENSIONALLY STABLE MANNER

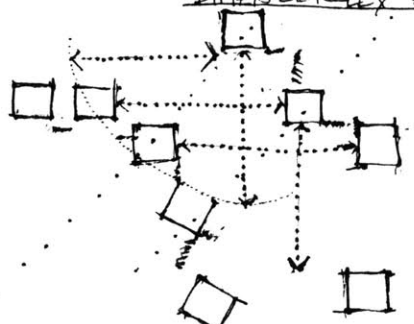


DIAGRAM — YOU CAN TREAT THE BOXES (CONNECTIONS) AS PART OF THE DIMENSIONALLY STABLE SYSTEM

2. ASSUMING THAT THE PASSING THING IS GOOD, LETS EMBRACE THE PASS... BUILD IT.... WHATEVER

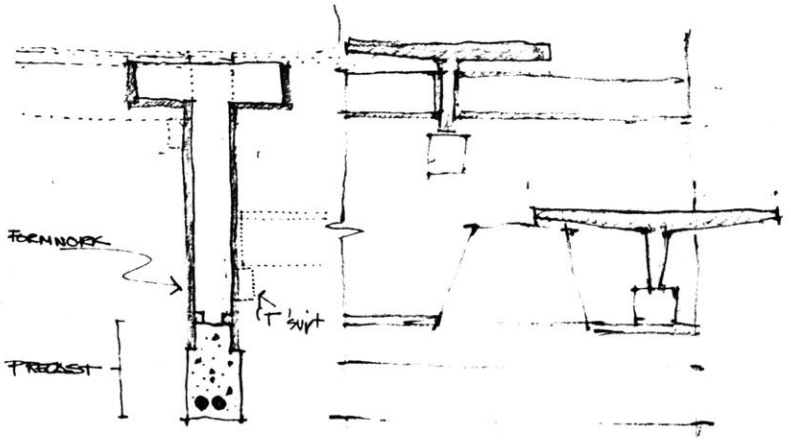
→ THUS SET BEAM AWAY FROM COLUMN

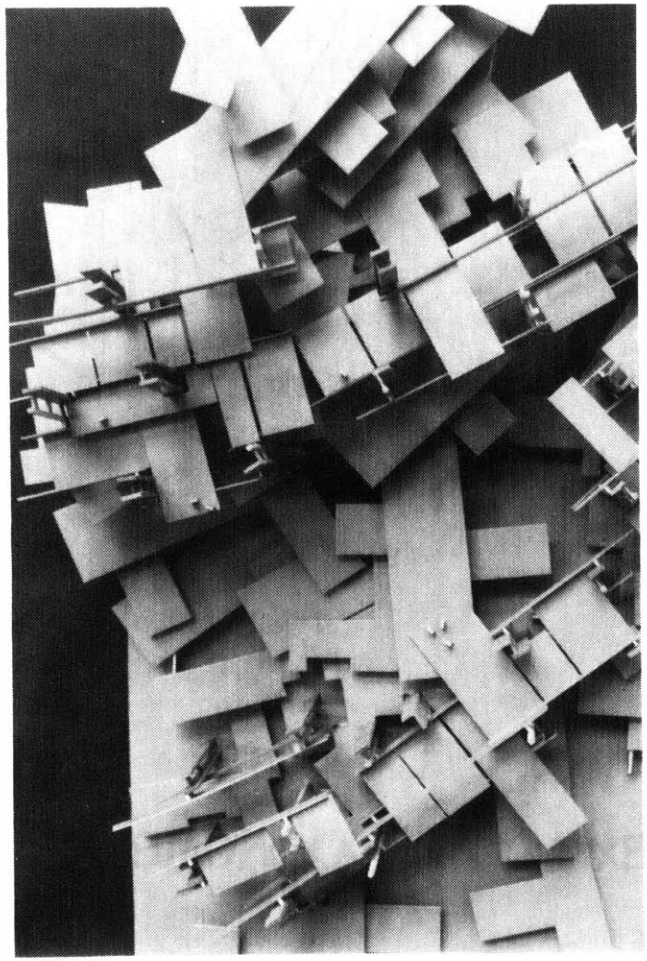
STRUCTURAL ISSUES
CONSTRUCT.

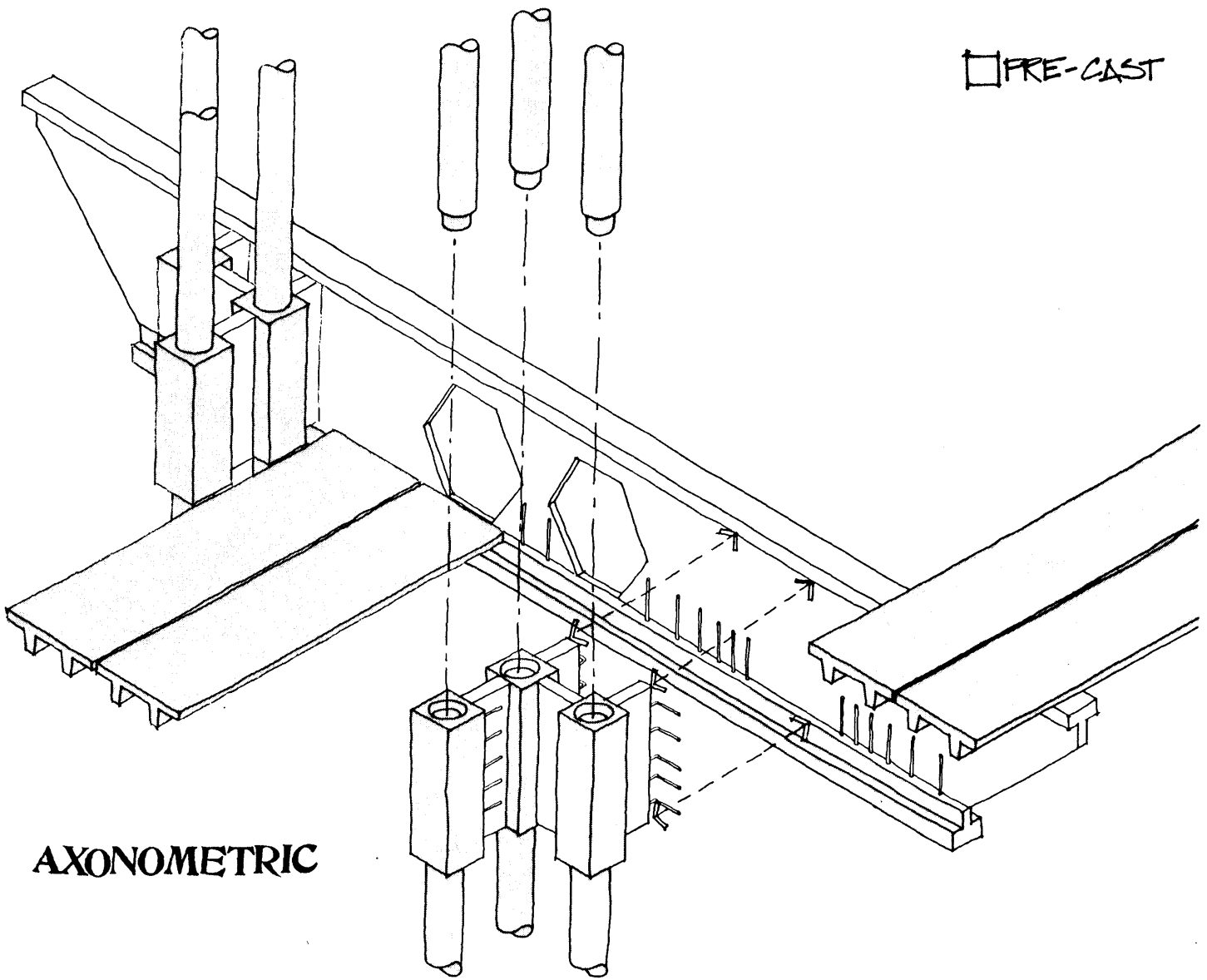
1). WRT / ~~DEEP BEAMS~~ PROPPED LANDSCAPE — TOO DEEP (15' → 15') TO TRANSPORT IF PRECAST SO, BY ONLY CASTING THE BOTTOM SECTION, THE TOP MAY BE CAST LATER → IF NECESSARY THIS WOULD ALLOW PRECAST 'T's TO BE SET ON TOP OF THE BOTTOM ELEMENT (PRECAST) AND THEN CAST IN PLACE WHILE THE TOP HALF OF THE BEAM IS POURED → THIS WOULD (?) RESULT IN A MOMENT CONNECTION BETWEEN THE 'T's AND THE BEAMS. ...FOR THE TOP OF THE BEAM & FLOOR COULD BE INTEGRALLY CAST, & RESULTING IN SOME MOMENT CONNECTION.

(THIS WILL ALSO ALLOW SUPPORTS BAR (T) TO BE CAST ONLY WHEN REQ'D)

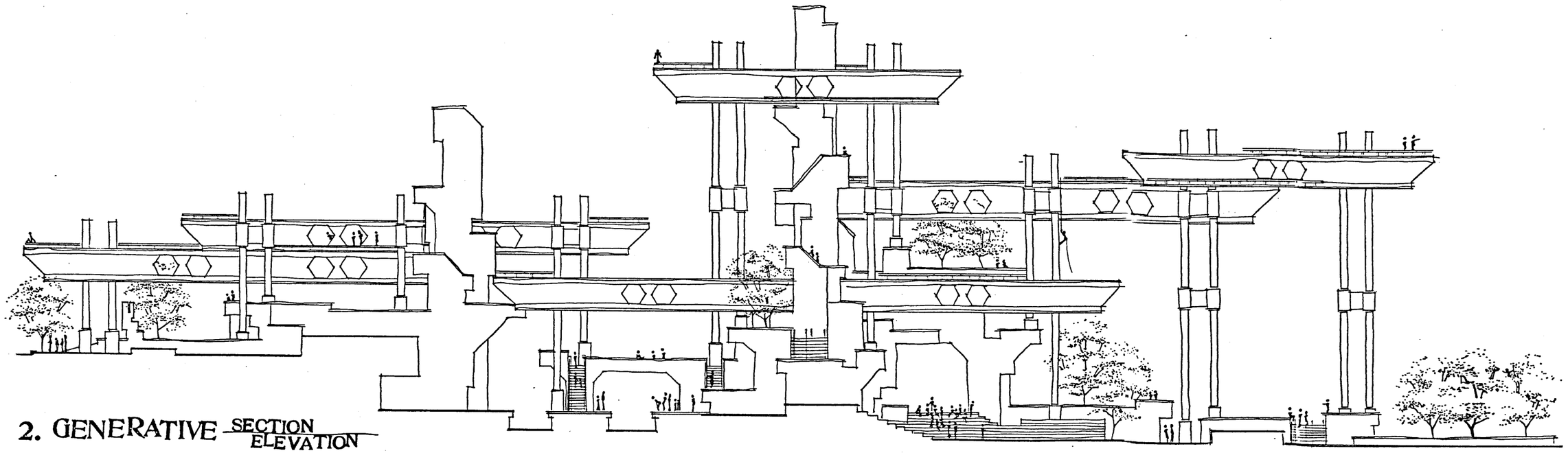
2. WATCH OUT FOR SHEAR PROBLEMS!
AS THE JOINT BETWEEN CAST & PRECAST LIES ALONG THE SHEAR AXIS, A SAW-TOOTH CONNECTION IS VITAL HERE.







EXPLODED AXONOMETRIC

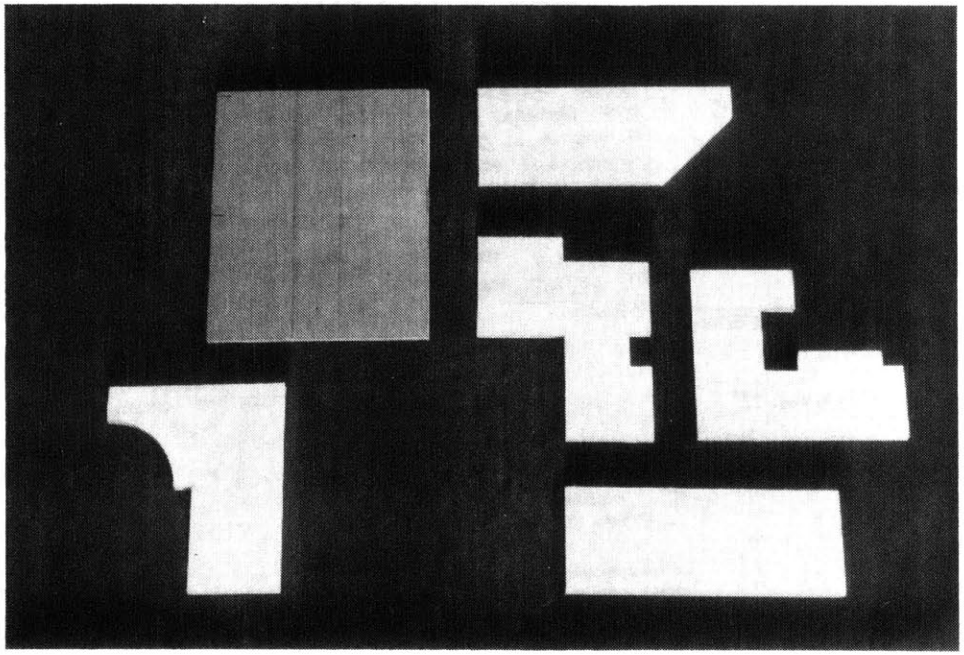


2. GENERATIVE SECTION ELEVATION

1" - 40'

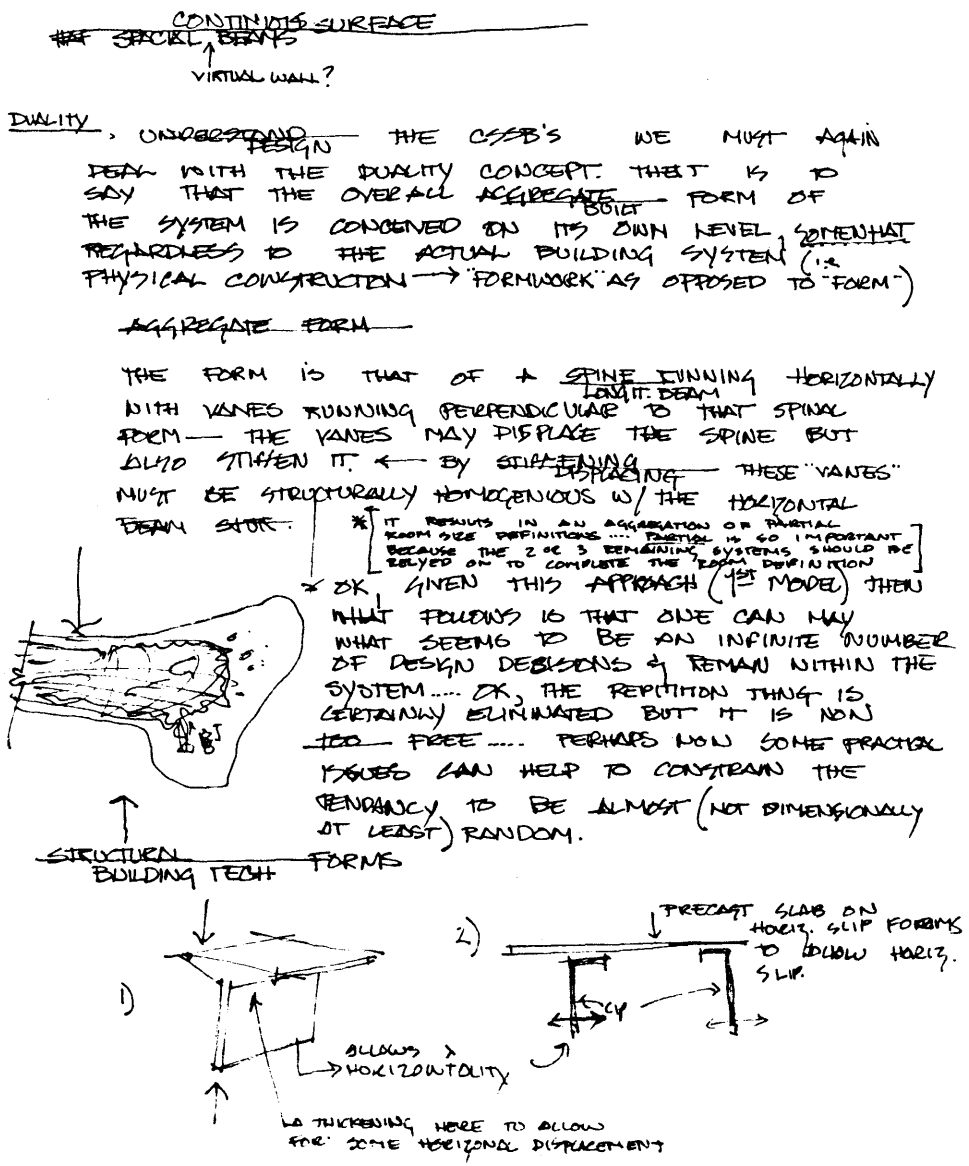
APPENDIX C.

CONTINUOUS SURFACE SKELETAL WALL

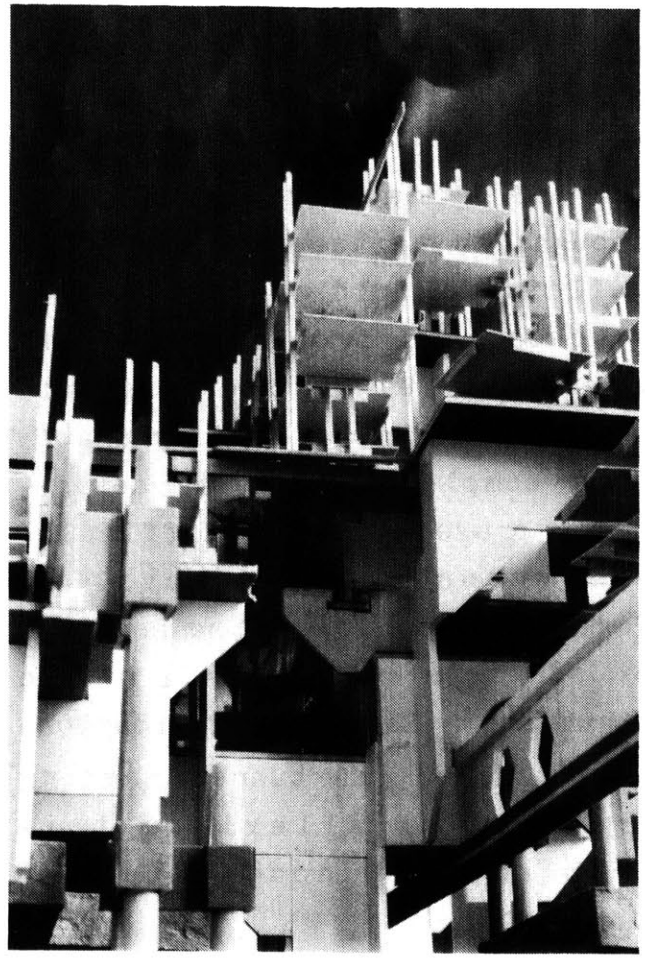


Although the folding wall system is the most difficult system to design, build, and define, its formal attributes are the most rewarding of all the building systems. To begin with, a continuous surface structural wall system not only serves as a major structural element, but its flexible formal and folded surface qualities are ideal for building partial containments and room-sized definitions.

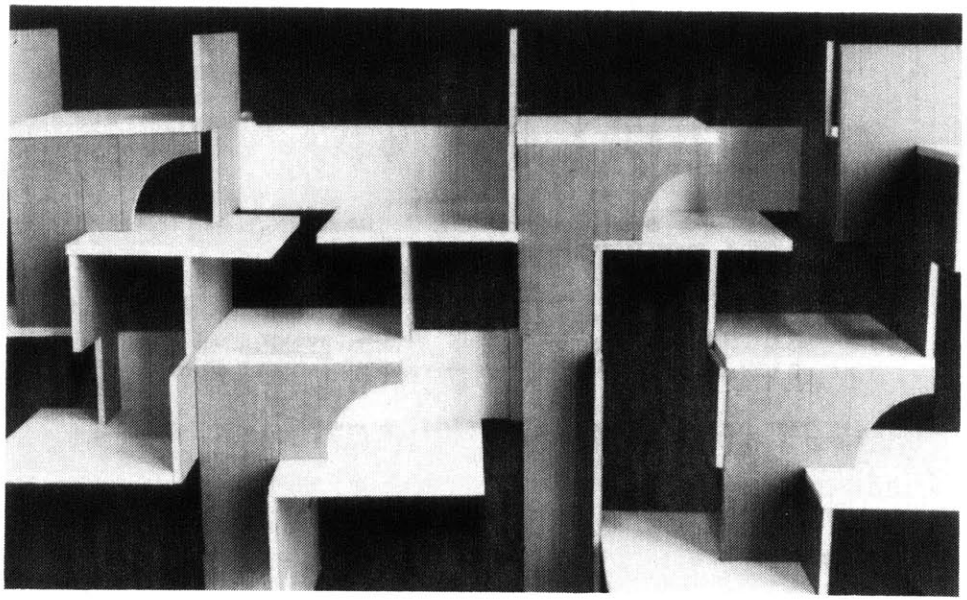
Formal properties of the folding skeletal wall system imply deployment in a manner intensifying main built continuities (such as spandrel beams), even though large definitions may be created by the selective addition of registered built wall zones. Individual bits of wall or wall zones may be considered habitable because they are spatial. In other words, the folding properties of the wall system allow numerous partial territorial definitions to occur. These definitions may or may not be intensified or transformed by the use of another building system (usually a secondary system). The overall form of the folded wall system resembles that of bone marrow. The homogeneous addition of many different surfaces results in the creation of multiple small spatial definitions; the lineal

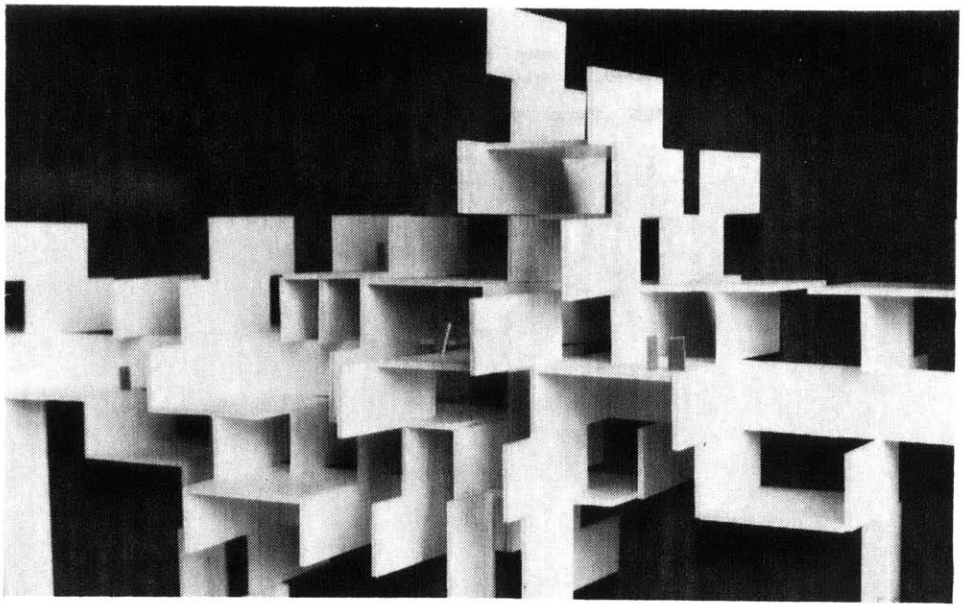


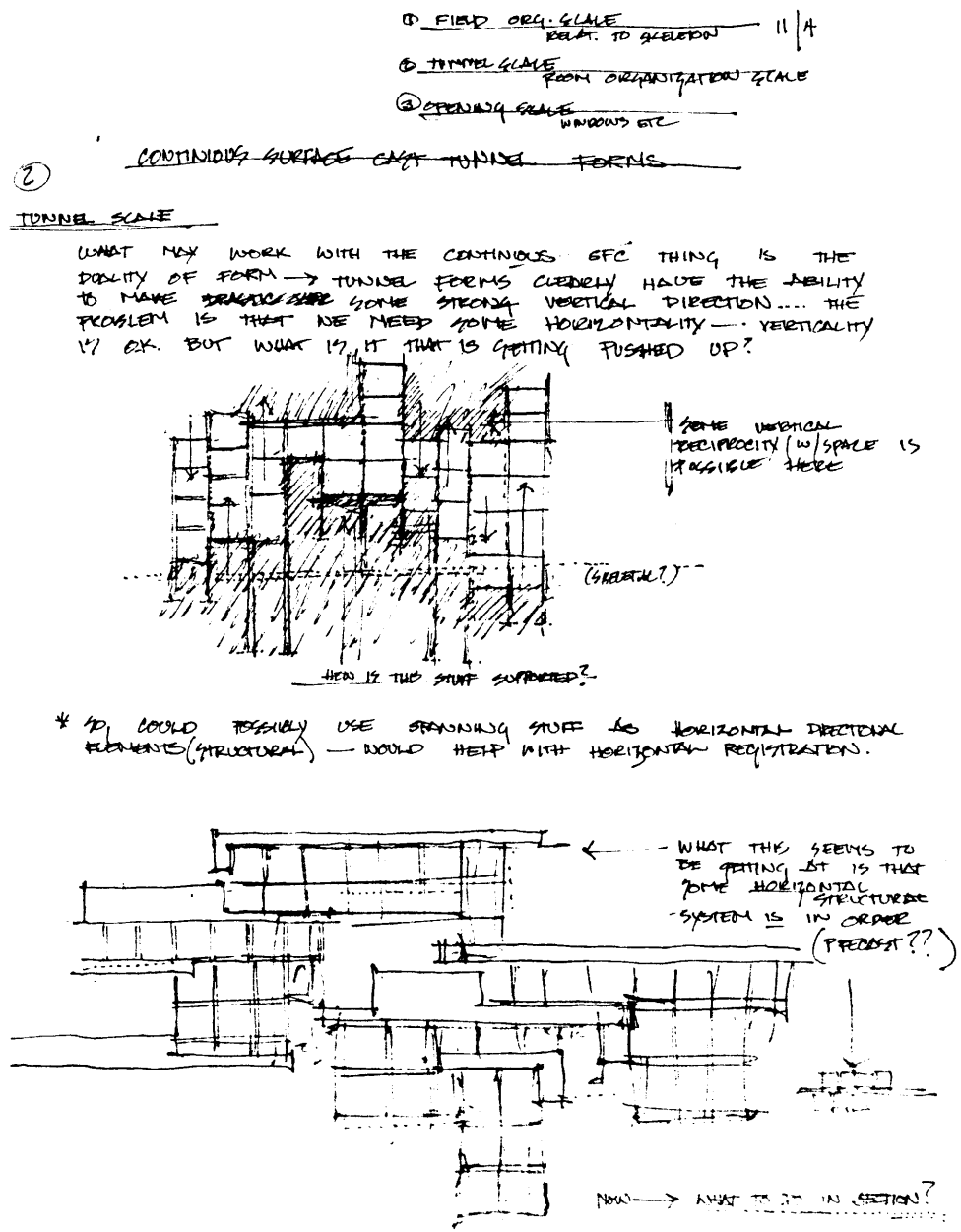
addition of numerous spatial bits creates a great deal of flexibility in overall form definition.



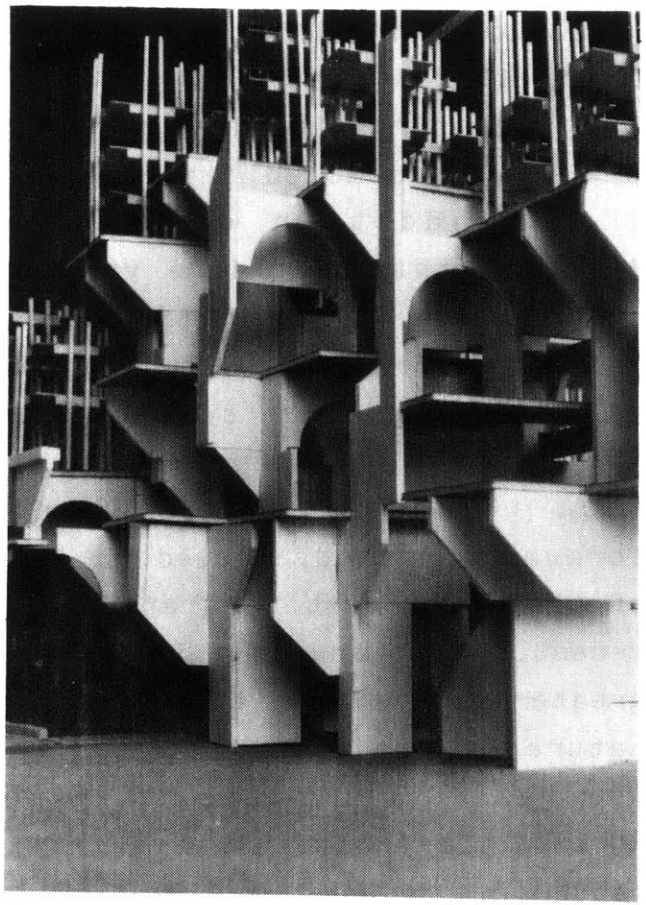
One of the greatest difficulties in designing with a system allowing so much formal freedom is that additive continuities (especially horizontal) are a bit problematic. This dilemma became apparent during the first three or four attempts to model the system. Initially, a modified tunnel formwork system was thought to be the best method of building a folding wall system. However, two problems with the smaller territorial scale occurred. First, breaking away from completed cellular definitions proved to be a difficulty and second, the removal of formwork disallowed the casting of surfaces on the face of the structure. Several modifications were made to the tunnel casting process to alleviate this problem, but none was very successful.





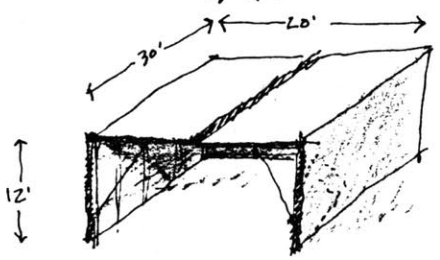


Horizontal continuities were the most difficult to build. Initially, it was thought that larger horizontal definitions could be assembled through the lineal addition of cells. Although this technique yielded some success, the approach seemed to be contradictory to the nature of the design of the system. The tunnel casting system works best when the form is cast, the formwork removed, placed on top of the newly cast part and then recast. This sequence implies a greater emphasis on the vertical nature of the overall form. To get the tunnel forms to read horizontally, one must fight the nature of the system. For this reason, the tunnel casting method was abandoned.



CONTINUOUS SURFACE TUNNEL FORM

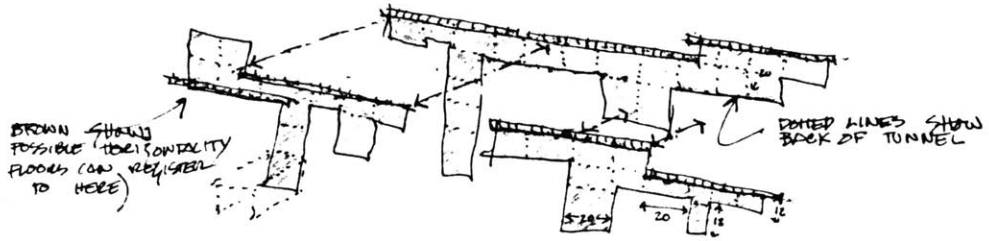
THE IDEA IS TO CREATE A MEGAFORM CONSISTING OF THE ADDITION OF A SERIES OF PARTIAL ROOM SIZED DEFINITIONS ——— THE KEY TO SUCCESS IN MODELLING SEEMS TO BE NOT TO COMPLETE ANY OF THE TUNNELS ..... MAY BE COMPLETED BY 3RD SYSTEM?? or not....



OK → SO THESE PARTIAL ROOM SIZED DEFINITIONS MUST WORK IN SOME UNDERSTANDABLE FORMAL AGGREGATION

THERE ARE TWO BASIC TYPES
1. HORIZONTAL
2. VERTICAL

1) HORIZONTAL REGISTRATION MAY BE CONTROLLED BY THE BACKSURFACES BACKPLATES → THESE ALSO GIVE 3 DIMENSIONALITY 30'-60'-90' / 45°-75° OR DEPTH DIMENSION TO THE 4D CALLED HABITABLE AGGREGATION OF PARTIAL DEFINITIONS THAT IS ACTUALLY A VIRTUAL WALL.... oh brother...

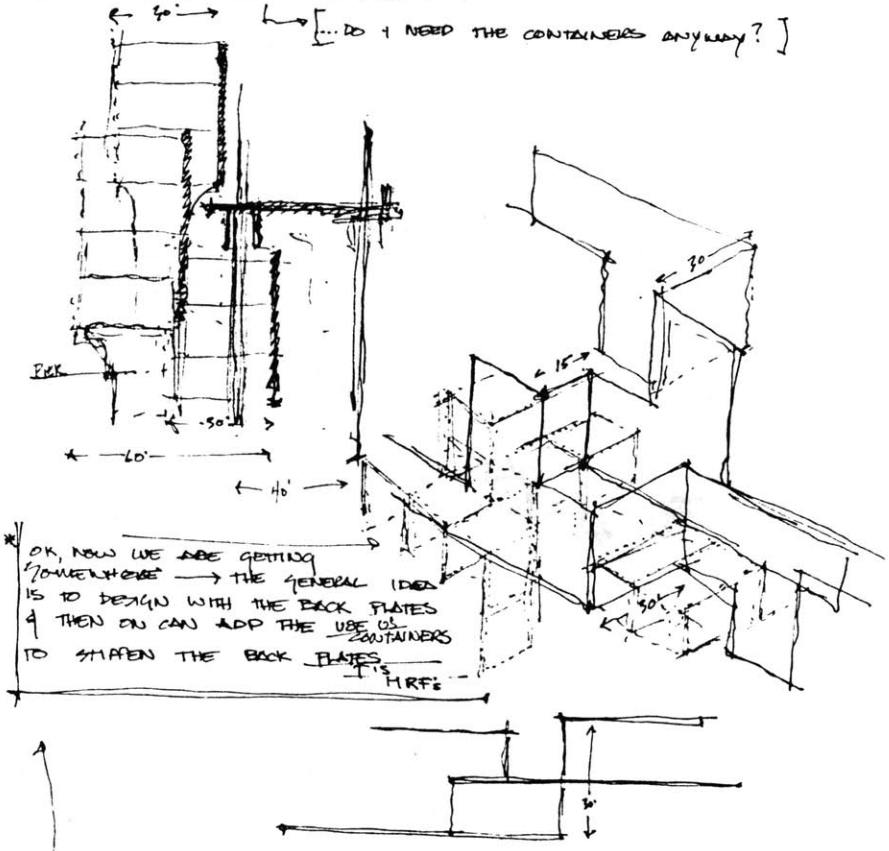


(2)

TO GET SECTIONAL DEPTH OUT OF THIS STUFF IT MAY BE ENOUGH TO BUILD THE BACK WALL & CONSIDER IT ENOUGH —

THE BACK WALL WOULD (COULD) INSIDE ESSENTIALLY BE A FRAME FOR THE CONTAINERS TO CANTILEVER FROM.

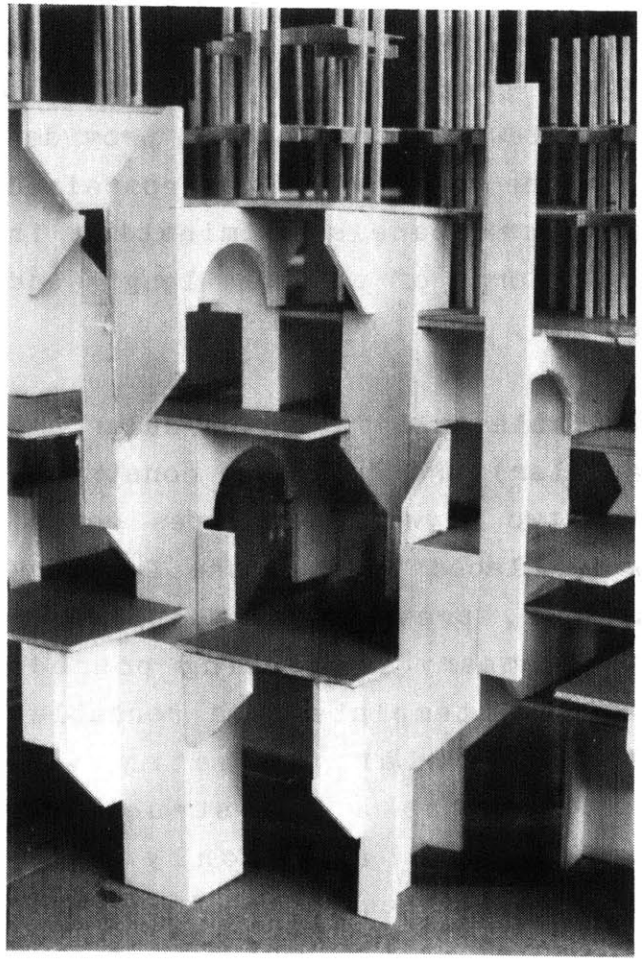
← 30' → [... DO I NEED THE CONTAINERS ANYWAY?]



OK, NOW WE ARE GETTING SOMEWHERE → THE GENERAL IDEA IS TO DESIGN WITH THE BACK PLATES & THEN ON CAN ADD THE USE OF CONTAINERS TO STIFFEN THE BACK PLATES

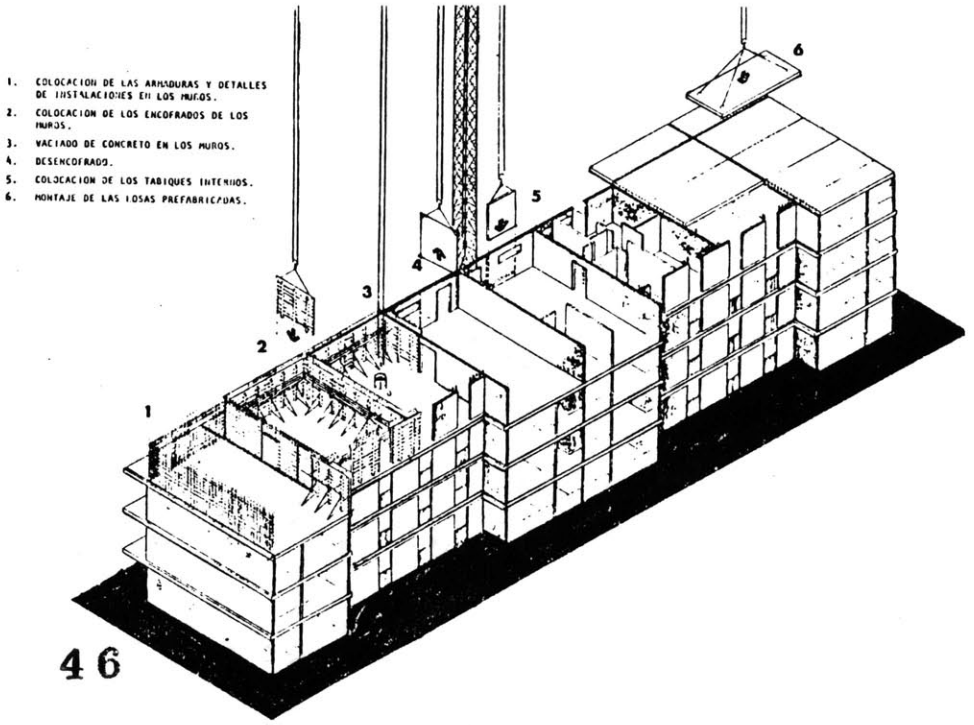
MRFs

50, CONT. SEC STUDY MODEL @ ½" OR 1/16

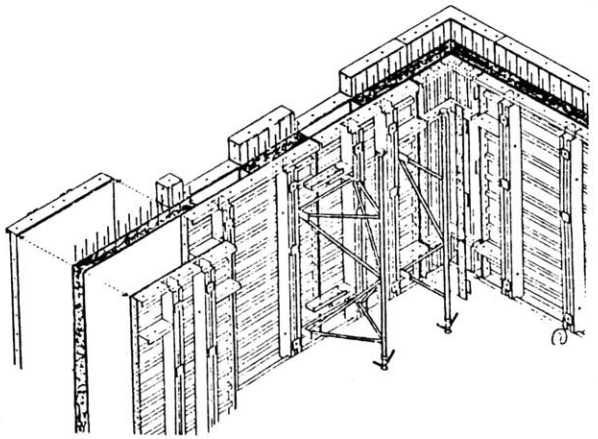


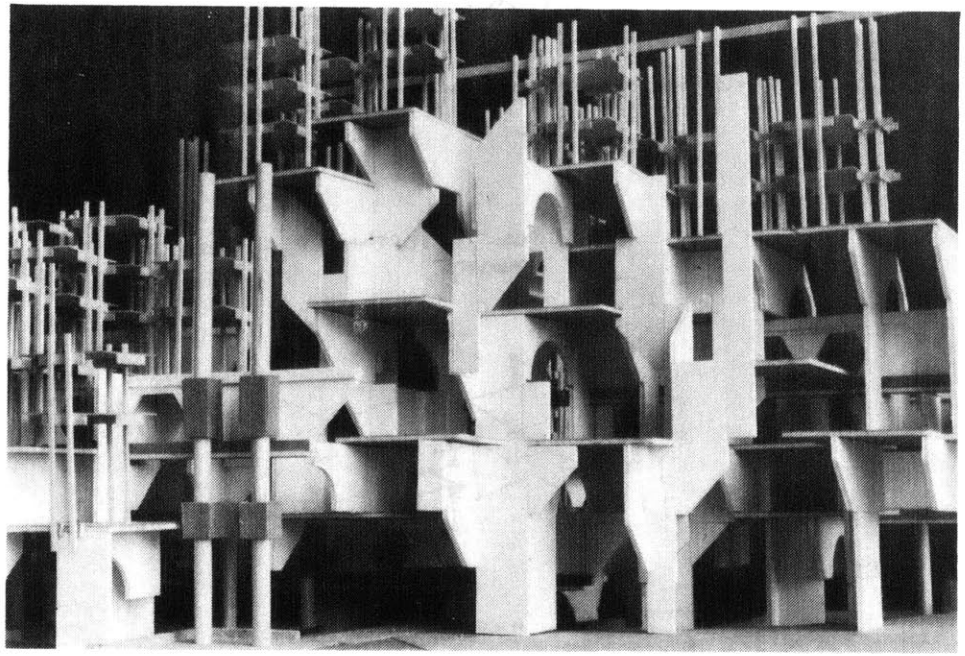
A systematic method of casting with reusable formwork panels was then developed. While overall formal goals do not vary from initial intentions, the methods used in achieving those goals has been altered. Similar to the SIMIX system developed by Waclaw P. Zalewski, this system provides for the addition of standardized formwork panels culminating in wall forms of variable length and height.

Variable wall forms (circular and angular) are built by constructing two plywood templates which, when placed between the formwork panels, prevent a specific area or geometry from being poured. The two templates are reusable. The circular geometry was intended as a non-structural definition used only when movement or access is hindered by excessive wall material.



46

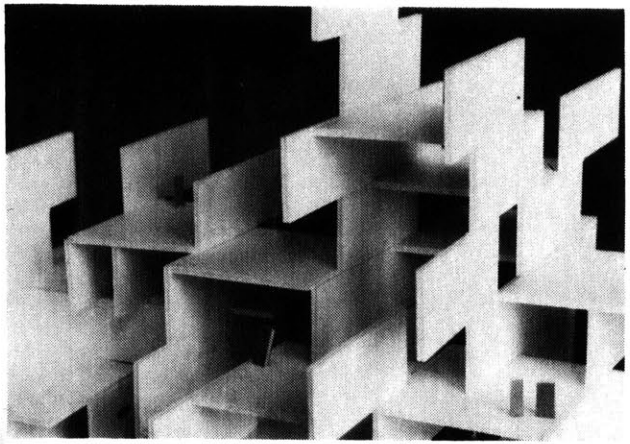

47

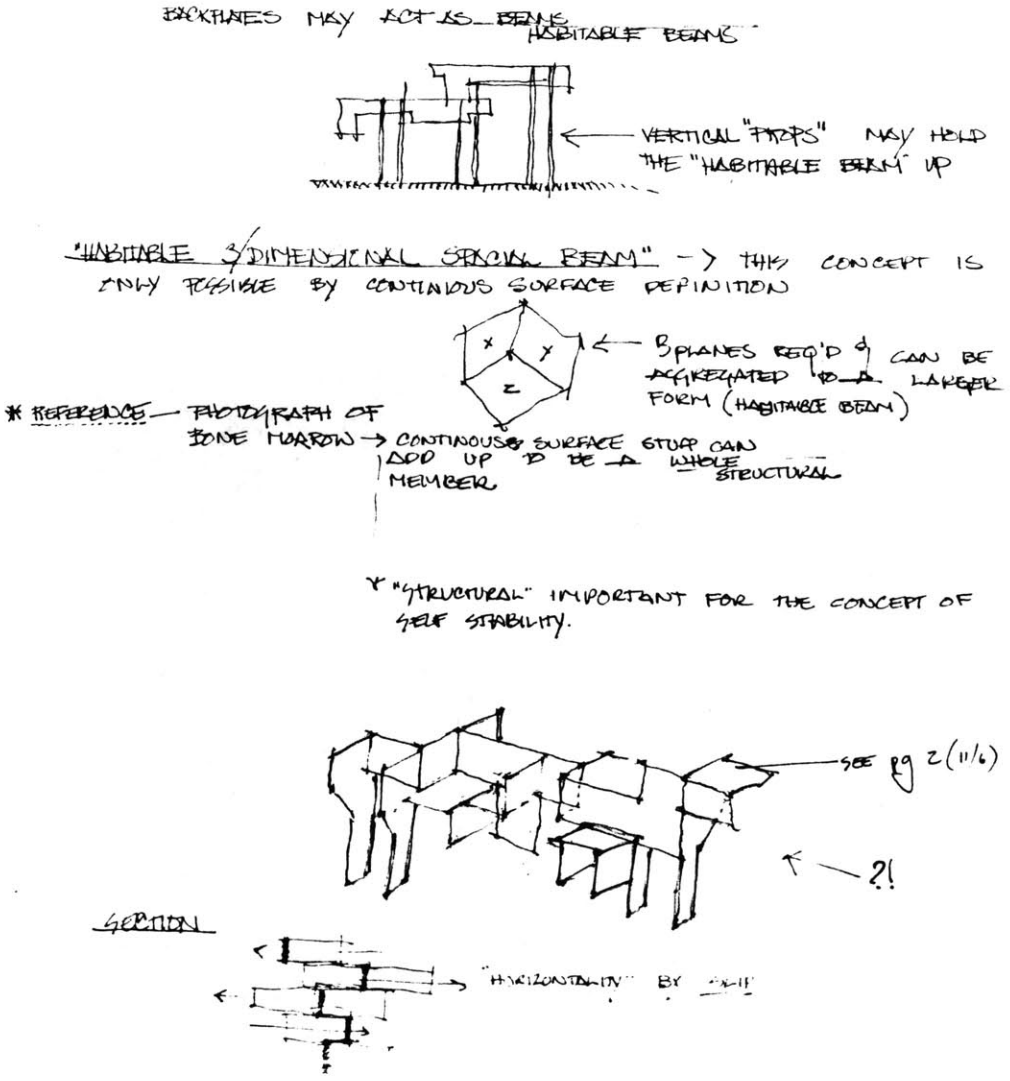


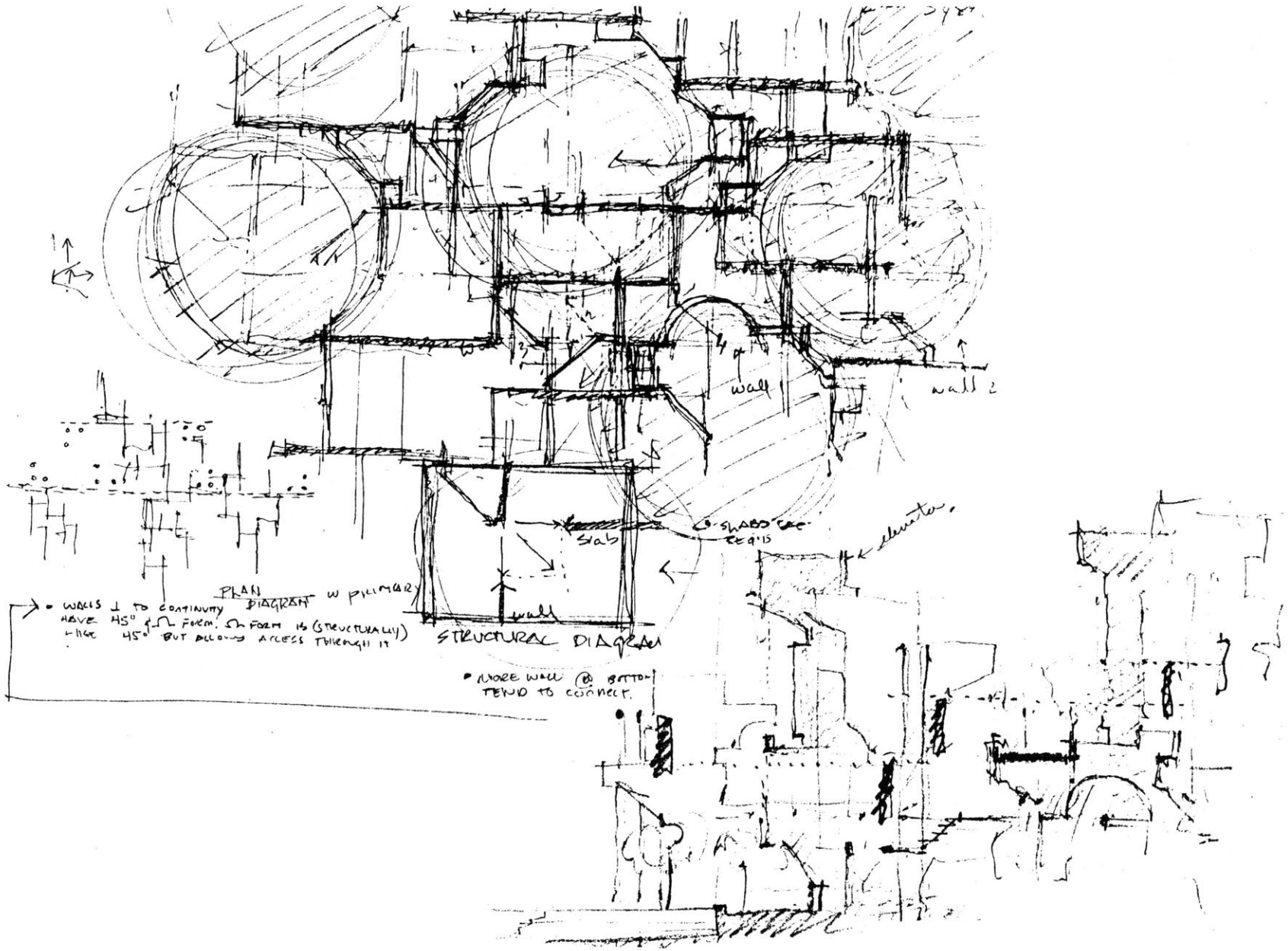
The angular (45°) geometry has more extensive ramifications. To begin with, the angle is used when formal criteria indicate that a lateral shift in the vertical flow of forces induced by the structure's weight is necessary. Shifting vertical loads in this manner gives the folding wall system a certain amount of horizontal movement. The 45 shift also allows chunks of built wall zone to define large continuities and territories which are distinctly different in character from the smaller definitions.

Precast Flooring

Floor slabs are the only precast components in the skeletal wall system. They measure twenty five by thirty feet in length, and linear perforations at selected intervals along the length accommodate reinforcing bars from the cast-in-place walls. It is important that a rigid connection be established between the floor slab and walls for structural reasons.



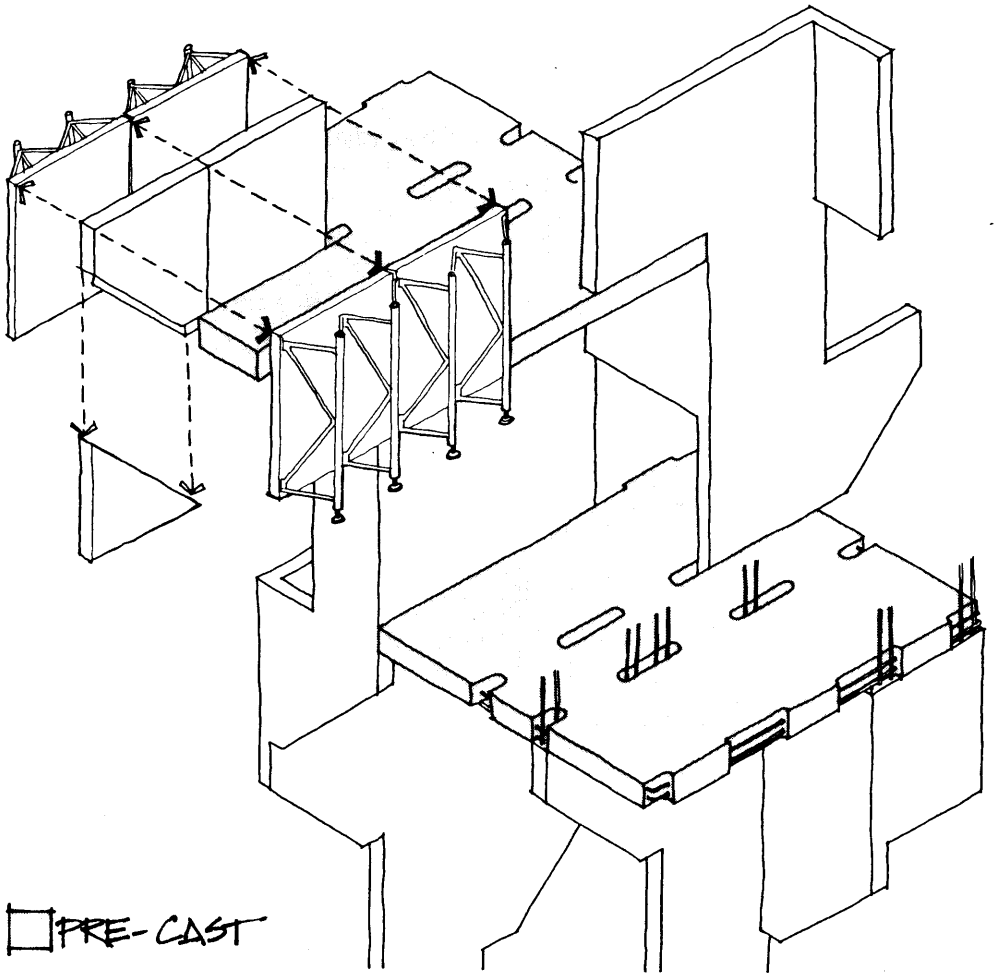



wall
wall 2
slab
wall
elevator
PLAN DIAGRAM W PILLAR
• WALLS ⊥ TO CONTINUITY HAVE 45° FORM. FORM IS (STRUCTURALLY) LIKE 45° BUT ALLOWS ACCESS THROUGH IT
STRUCTURAL DIAGRAM
• MORE WALL @ BOTTOM TEND TO CONNECT.

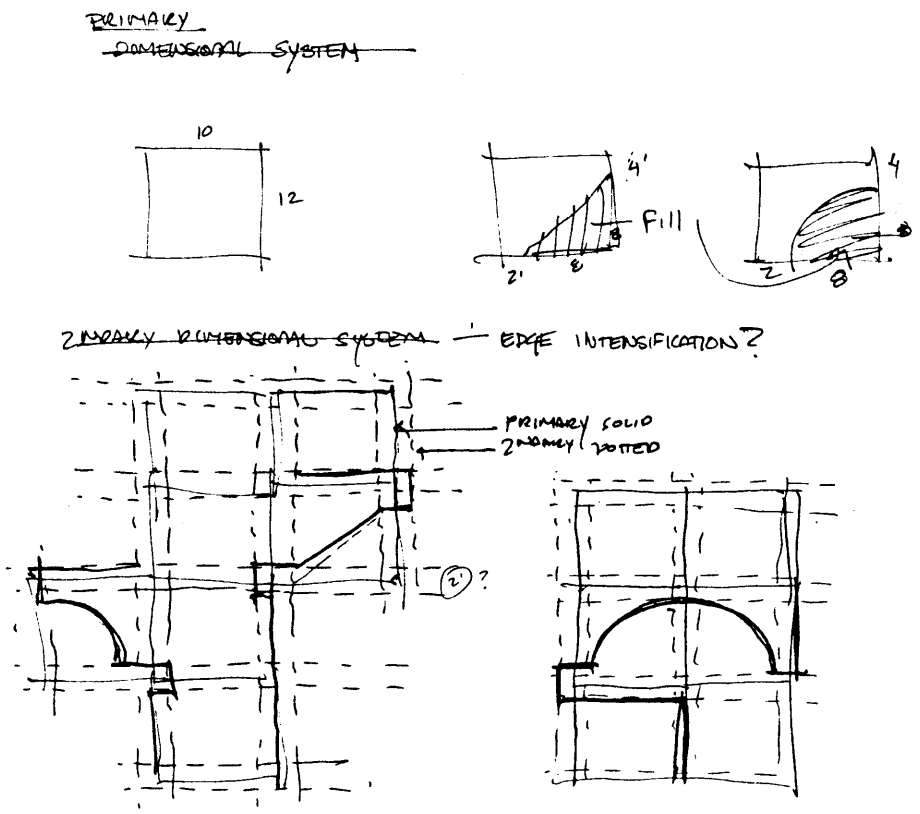
Formwork

The standard formwork panel measures ten feet in width and twelve feet high. Horizontal addition of three panels equals the length of a precast flooring component. The twelve foot height dimension also works as a multiple of three. Reference levels occur at thirty-six foot intervals. The secondary system proposed in Appendix D registers to the wall system only at thirty-six foot intervals, requiring four levels to match the thirty-six foot dimension built with the wall system.

EXPLODED AXONOMETRIC

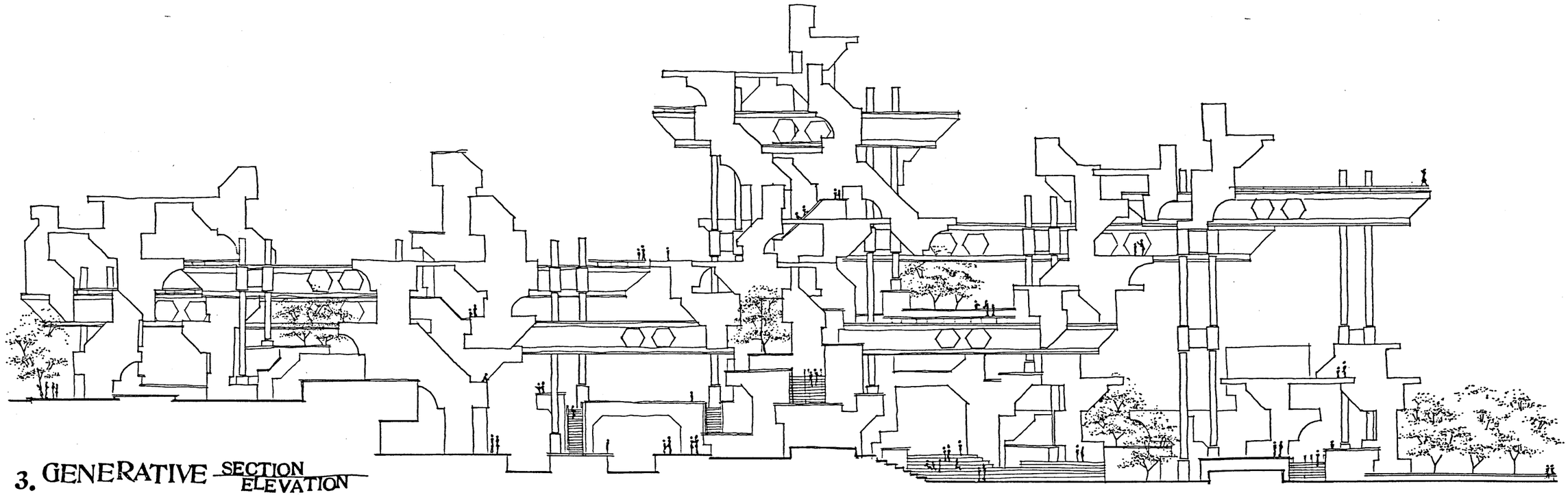


Structural Issues



The relationship between wall and floor components is critical to the overall structural integrity of the additive wall form. By introducing a 45° geometry into the primary structural system, a resolution of the horizontal and vertical components of the 45° thrust is required. Wall sections adequately manage the vertical components, but the precast floor slab is designed to resolve horizontal forces. The overall wall system can be stabilized only in this manner, indicating that floor placement is somewhat more than random. This relationship establishes the formal principle of "continuous surfaceness." For the wall system to be structurally stable, a homogeneous three-dimensional planar aggregation is required.

PLAN DIAGRAM Component Aggregation

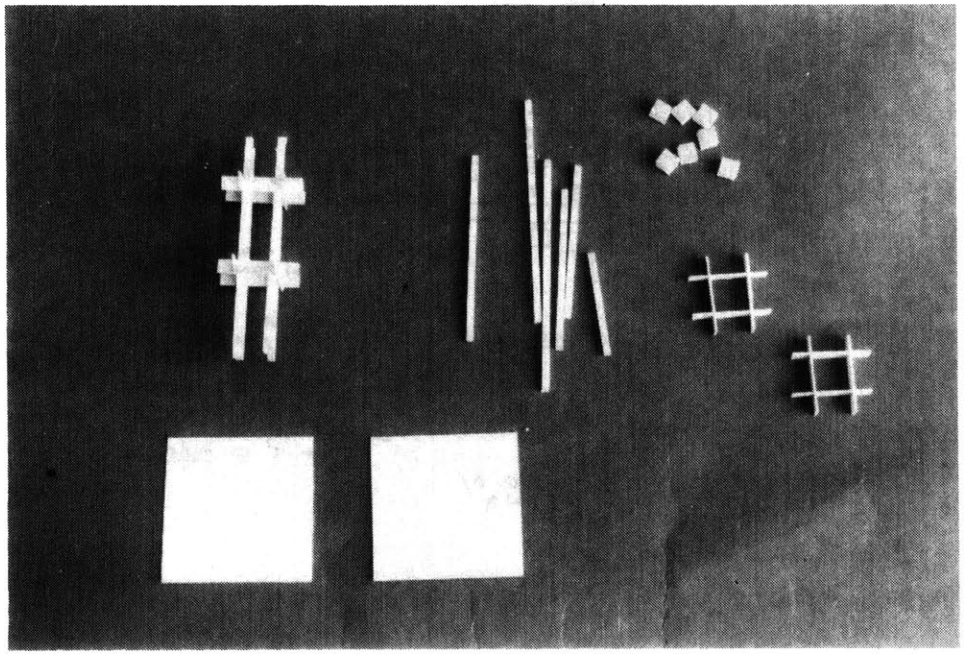


3. GENERATIVE SECTION ELEVATION

1" – 40'

APPENDIX d.

SECONDARY HABITATION AND CLOSURE



The concept of the secondary system is quite simple. The base unit is a propped-up sixteen foot square plate. A square geometry was chosen because it has no dominant directionality. Non-directional form is especially suited to the secondary system because it does not, formally speaking, embody movement. A territory without movement or access may be considered a private, habitable unit. The office and administration buildings designed by Herman Hertzberger in Apeldoorn, Netherlands are the primary reference for this system.

Interior of Hermann Hertzberger's office building in Apeldoorn, Netherlands.

DESIGN

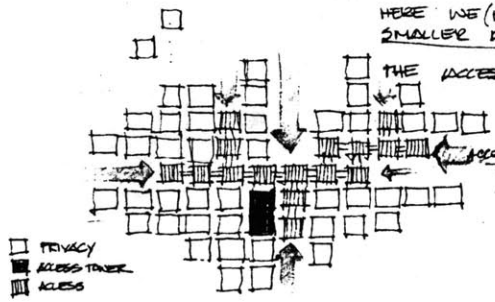
THE ~~ABSOLUTE~~ APPROACH THAT HERMANN HERTZBERGER USES FOR THE OFFICE BUILDING CENTER IN APELDOORN NL IS THAT OF BEGINNING WITH THE PRIVACIES, ~~BUILDING~~ REPEATING THEM UP TO ACHIEVE DIRECTIONALITY

↓

FORM COMES FROM BUILDING UP THE ACCESS OF LIKE COMPONENTS AS PRIVACIES

APPROACH: A REVERSAL OF THE APPROACH FOR THE PRIMARY SYSTEMS WHERE ACCESS IS BUILT & LEFTOVER BECOMES PRIVACY.... OUR ACCESS IS MAIN MOVE AND ⊥ MOVES THAT REGISTERS TO ~~THE~~ INTENSIFIES THE MAIN MOVE.

HERE WE (HERMANN) BEGINS WITH THE SMALLER DEFINITIONS PRIVACIES & BUILDS UP THE ACCESS BY INTENTIONAL REPITITION DIRECTION



2NDARY SYSTEM AGGREGATION DIAGRAM

① NOTE HOW ACCESS IS "BUILT" FROM PRIVATE STUFF

HOWEVER IT DIFFERS FROM HERMY IN THAT AS MUCH ACCESS AS POSSIBLE IS EXPOSED TO OUTSIDE [RECIPROCITY]

② A SQUARE BASED SYSTEM IS USED AS IT IS MULTI DIRECTIONAL

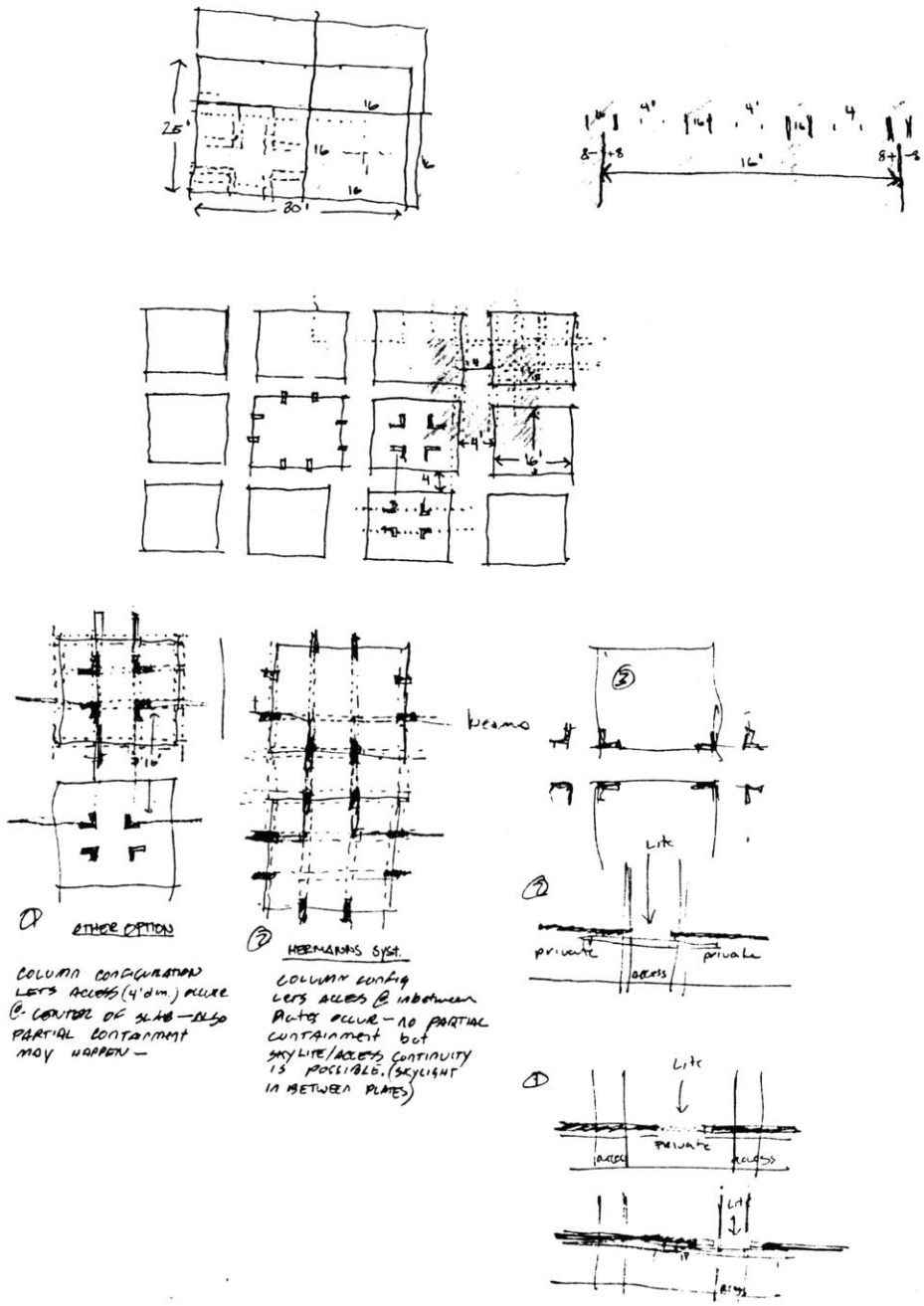
~~SELF SIMILAR~~ STRUCTURES -

① RECIPROCITY — RECIPROCITIES CREATED BY MANNER OF ADDITION & AGGREGATION

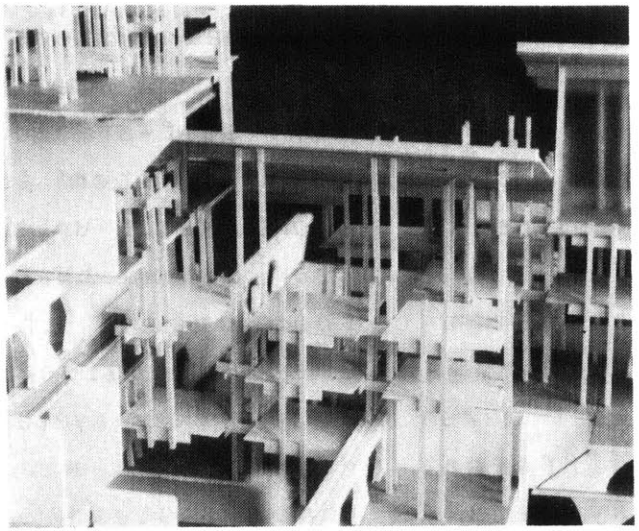
② DIMENSIONAL - OBVIOUS

③ LITE/DARK

④ ~~PROPORTION~~ BALANCE GRID SYSTEM → FIELD ORGANIZATION.... pg 2



Like the previously mentioned structural and formal systems, the secondary system is formally and structurally self-stable. Structurally, the system is designed to support itself up to four levels high. Beyond that, assistance from one of the primary systems is required. What makes the secondary system different from the primary systems is that, instead of beginning with large continuities and allowing their structural and formal characteristics to define smaller partial containments, the privacies are defined first. The sixteen foot increment is considered a typical private use space dimension. Larger continuities may be reached by adding the individual components in a coherent manner.

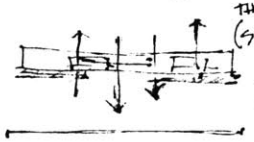


THE PRIMARY PURPOSE OF THE SECONDARY SYSTEM IS TO BEGIN TO ~~COMPLETE~~ CONNECT SOME OF THE PARTIAL DEFINITIONS BEGUN BY THE 1ST 2 SYSTEMS. FOR THE MOST PART, THIS IS A 3-D SCREEN SYSTEM THAT SERVES AS A SUPPORT FOR FLOORING (HORIZONTAL PLANES) & CLOSURE (VERTICAL PLANES).

SCREEN SYSTEM (SELF STABLE

1/ CONTINUITIES INTENSIFICATION MUST 1ST BE (A) RECOGNIZED OR (B) BUILT

(A) IN THE CASE OF THE ACCESS SYSTEM (SPANDREL)



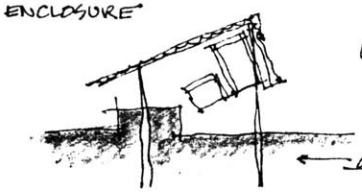
THEN DISCONTINUITIES NEED TO BE "BUILT"

(B) IN THE CASE OF THE ADDITION OF A PARTIALLY DEFINED SYSTEM (CONT. SPC.)

BUILT" eg ROOF LINE ETC — IT GIVES THE DISCONTINUITIES SOMETHING TO REGISTER TO/FROM

3/ VERTICAL CONTINUITIES ESTABLISHED BY COLUMNS & ~~BLACK~~ SPACE
HORIZONTAL CONTINUITIES BY FLOORING & ENCLOSURE

SELF STABILITIES BY ENCLOSURE



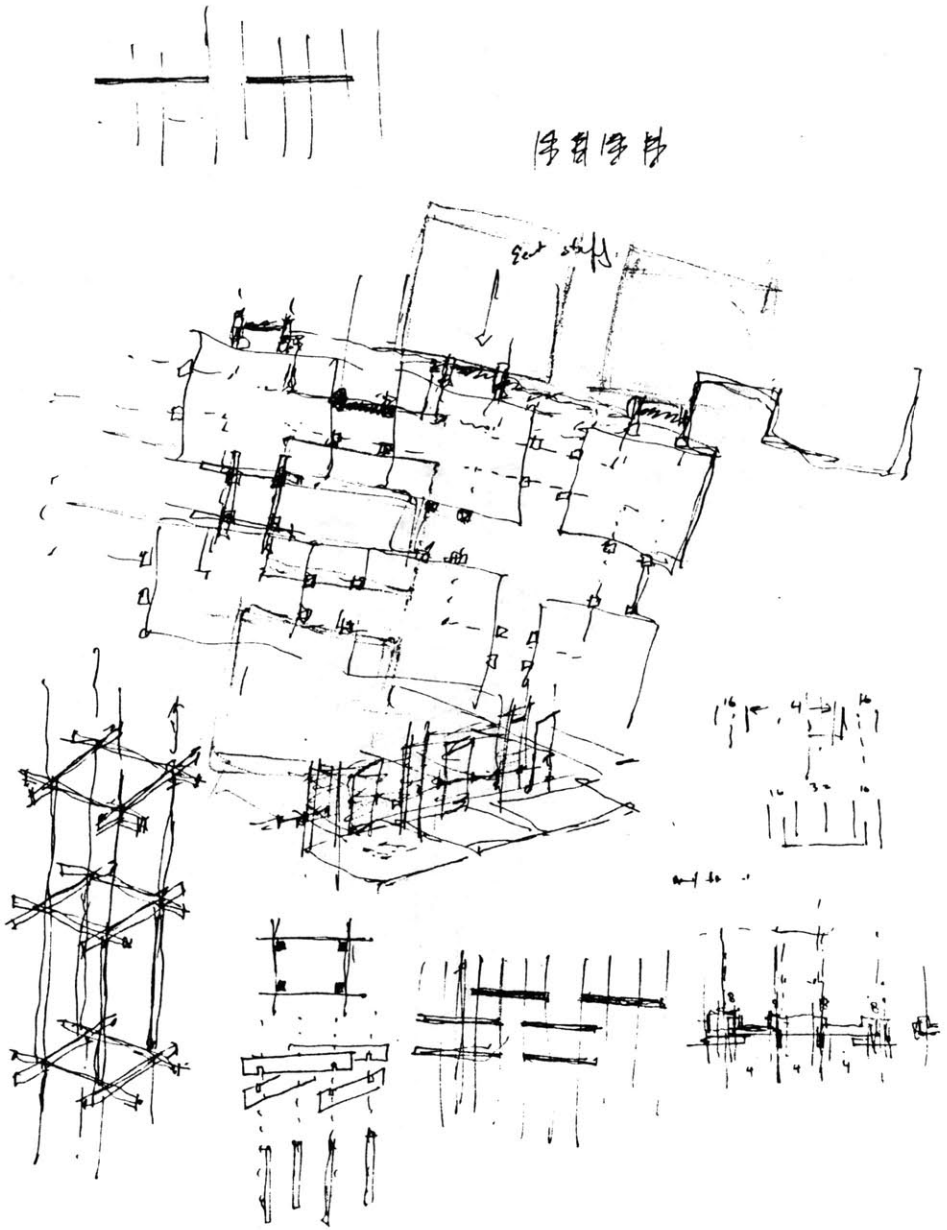
2/ ONCE ~~INTENSIFICATION~~ TRANSFORMATION BEHAVIOR IS RECOGNIZED, THEN THE SCREEN SYSTEM MAY ~~CONT~~ BE BUILT → MUST BE 3-DIMENSIONAL → SELF STABLE.

2NDARY PRIMARY CONNECTIVE DETAILS

2NDARY STUFF IS LIKE FURNITURE ----- IT MAY BE PLACED IN ANY FASHION & NOT REGISTERED TO THE PRIMARY

..... LOOK AT HERZBURGER ..... ADDITION OF SQUARES

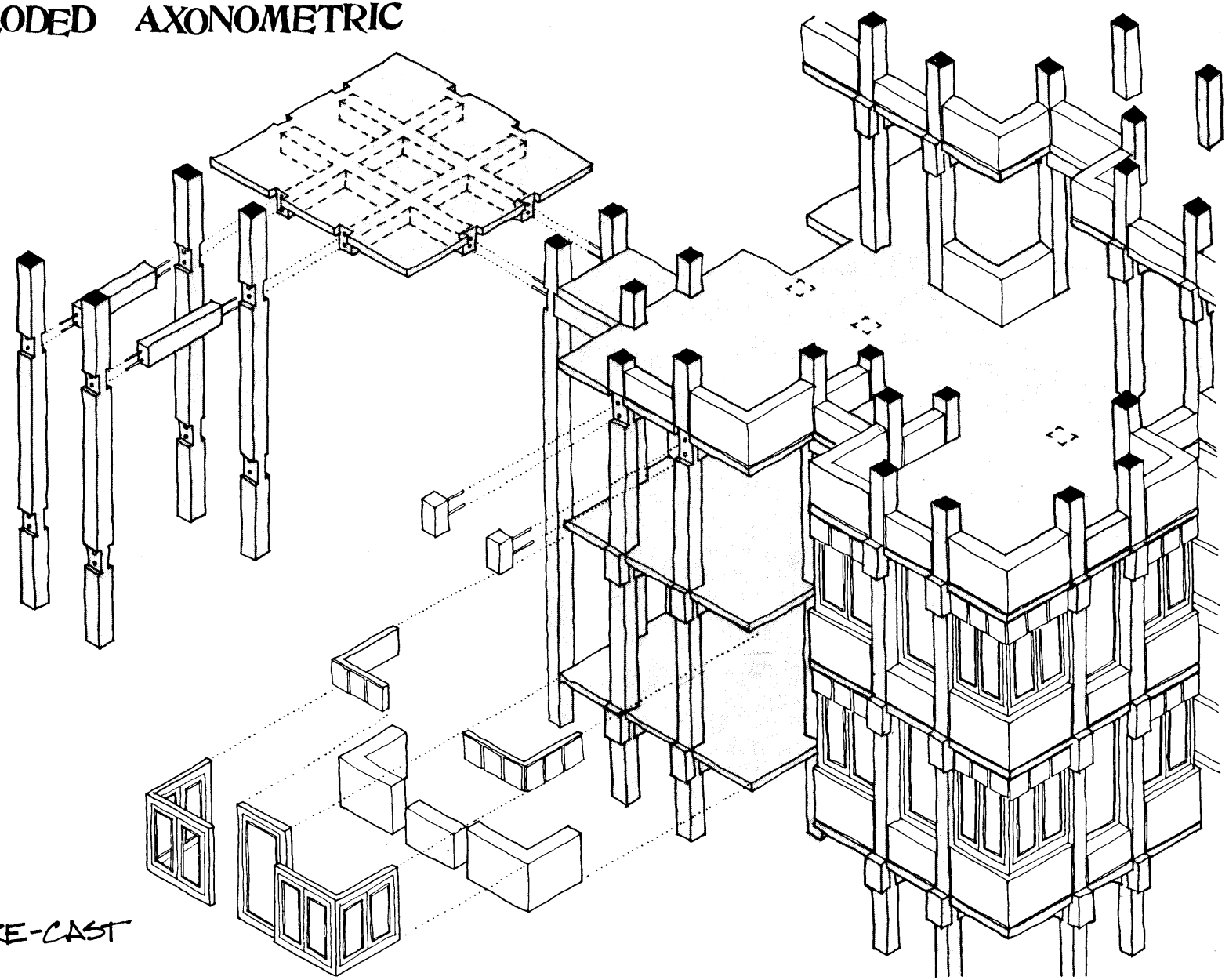
SQUARES BECAUSE THEY ARE OMNI DIRECTIONAL



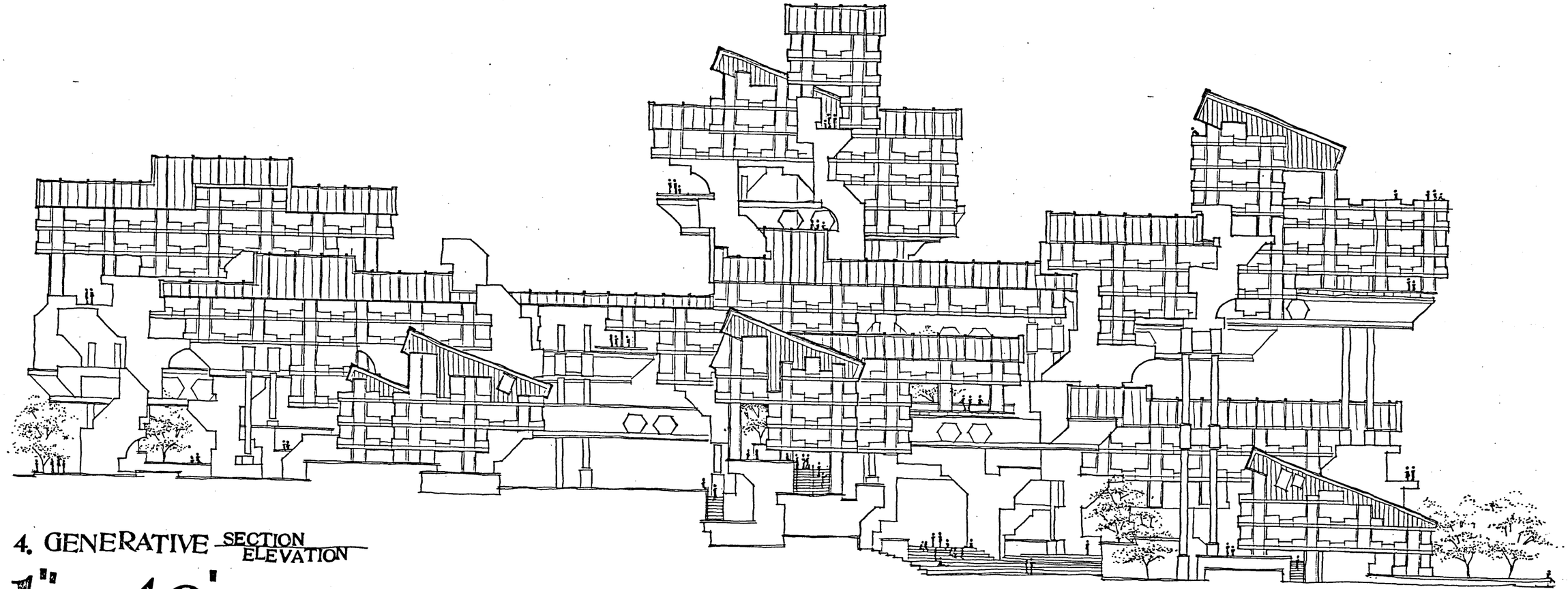
Closure

Closure consists simply of building a flat weather screen that registers to the exterior of the secondary system. Building large continuities in the secondary is accomplished by first designing the larger form of the closure and then registering the three-dimensional secondary system to the enclosure. Larger continuities of form may then be build from a system of self-contained privacies. It is expected that forms and subdivisions of the closure will meet the basic formal and dimensional principles outlined in the preceding sections.

EXPLODED AXONOMETRIC



☐PRE-CAST



4. GENERATIVE SECTION / ELEVATION

1" – 40'

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27 Author

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