

# AN ELEMENTARY AND HIGH SCHOOL COMPLEX FOR LEXINGTON, MA: AN EXPLORATION IN DESIGNING FOR THE WALDORF CURRICULUM

by  
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Bachelor of Science in Architectural Studies  
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May, 1987

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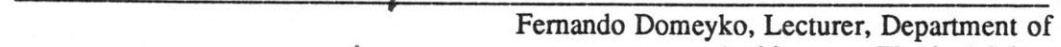
AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
June, 1990

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16 March 1990

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Architecture, Thesis Advisor

Accepted by

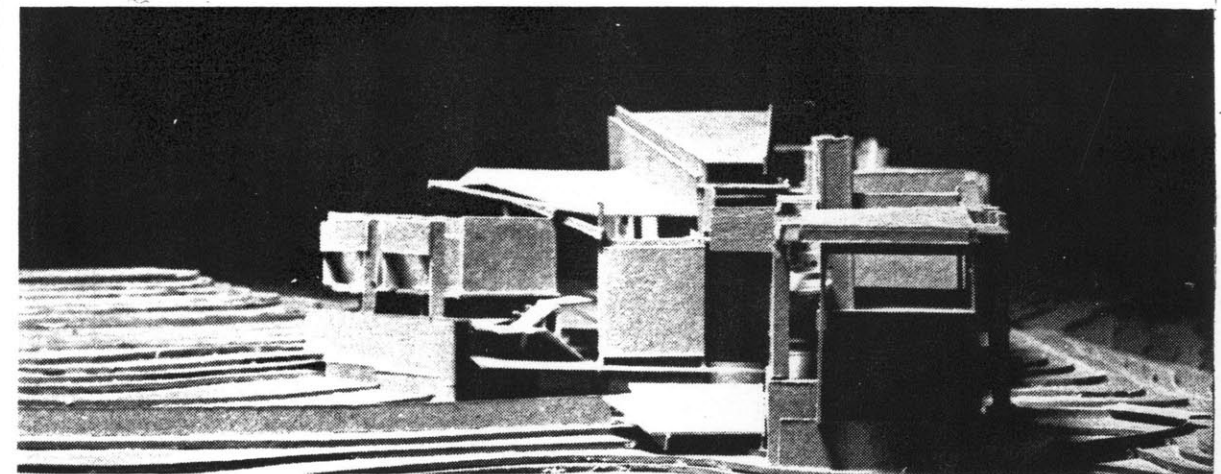
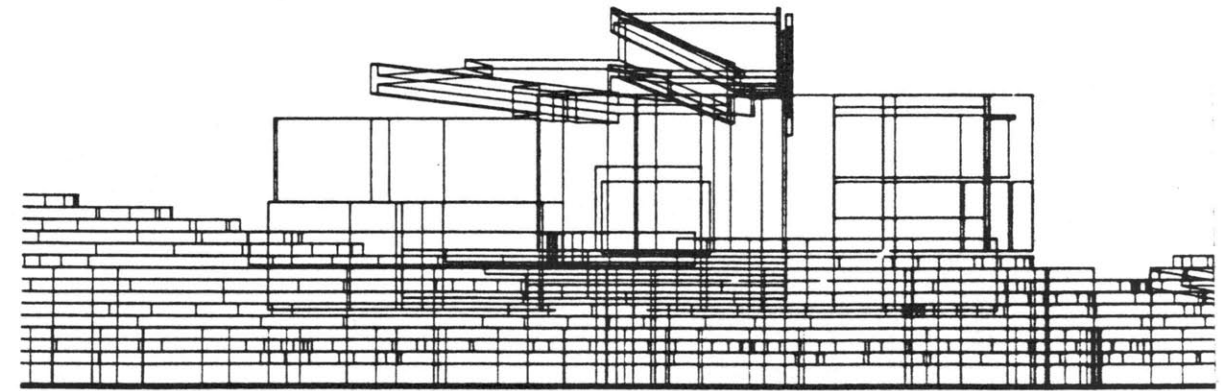
  
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William Porter, Chairperson,  
Department Committee for Graduate Students

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Submitted to the Department of Architecture on March 28, 1989 in partial fulfillment of the requirements of the degree Master of Architecture.

**ABSTRACT**

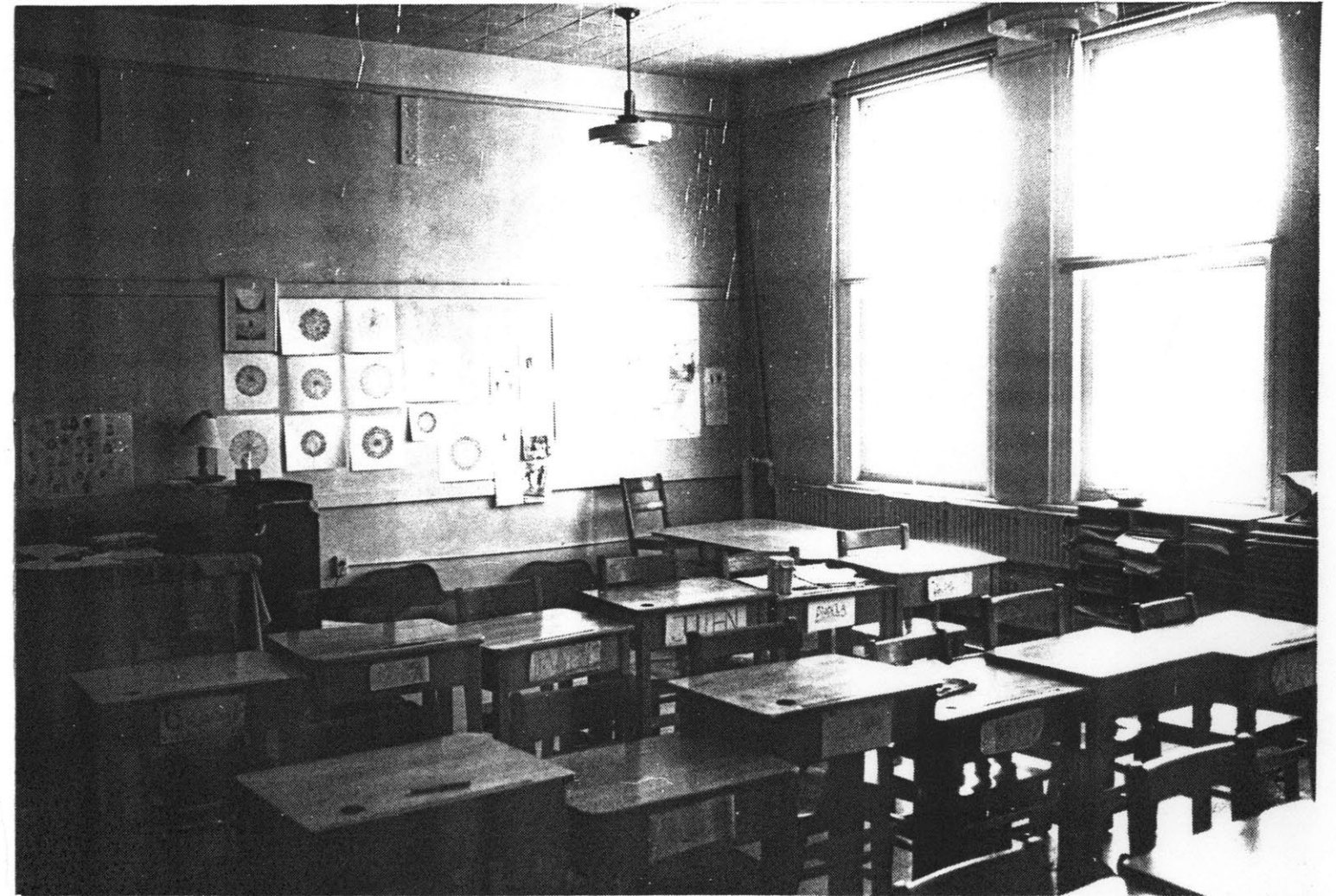
## **AN ELEMENTARY AND HIGH SCHOOL COMPLEX FOR LEXINGTON, MA:**

**AN EXPLORATION IN DESIGNING FOR THE WALDORF CURRICULUM**

by Scott David Newton

This thesis is an examination of how elementary and high school education within the context of the Waldorf School Curriculum manifests itself in the physical form of its built environment. This project is therefore the documentation of a design process that accommodates the Waldorf School curriculum and a proposal for a school complex intended to embody the many unique characteristics of this educational system.

Documentation of the design process includes recording all the various methods of representation employed during the development of the final design. In this thesis emphasis is placed on the role of computer aided design and representation in the transformation of a concept into architecture. Documentation of the design process is intended to show the manner in which the various methods of representation facilitate a better understanding of both the concept and the final solution for this project.



Thesis Supervisor:

**Fernando Domeyko**  
Lecturer  
Department of Architecture





*For my family*



## ACKNOWLEDGEMENTS

To:

Fernando Domeyko

Mathew

David

Ronna

Bill

Eric

Marzio

Caroline

the Droege Studio

and a very *special* thanks to Vella Chan

For their ceaseless patience, attention, encouragement, and laughter.



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## THE WALDORF CURRICULUM



The following paragraphs give some insight into the Waldorf school curriculum and organization at the elementary level. The purpose of this thesis is not to endorse, evaluate, or critique the curriculum in any way. This is merely a summary of the Waldorf curriculum as it exists; it also includes some of the ideas and values that helped generate it.

The most prominent and unique feature of the Waldorf curriculum is the relationship that develops between the Waldorf teacher and the student throughout the elementary education. From first grade to eighth grade a student will be instructed by the same teacher for most of their courses. The location of an instructor's class is changed within the school building from year to year but the students remain with the same teacher for eight years. Unlike most conventional schools a Waldorf teacher is not associated with a particular subject or location within the school.

Much of the early education at the Waldorf School is based on the Waldorf educator's belief that children are primarily a "sense organ" before the age of seven. The body, soul, and spirit exist as a unity. After the age of seven the child needs the teacher as "artist" to help the child assimilate and understand new concepts on an intellectual level rather than the simple memorization of lists and facts.

Waldorf educators believe that superficial facts and knowledge are forgotten, at least as far as instant recall is concerned. But the subjects taught in "blocks" are those in which the goal is to instill



concepts, processes, and thought--not to produce factfilled computers. In addition the process of "forgetting" is part of the process of assimilating the material, of sorting out the "facts" from the deeper knowledge. And since the curriculum is cumulative and comprehensive, the children return to each "block" later on. Subjects such as English, arithmetic, foreign languages require constant exercise, and these are taken up continuously rather than in blocks.

Art is the keystone of the Waldorf education, as the following aphorism suggests:

*The child who learns to work with the hands becomes a laborer;  
The child who learns to work with the hands and the brain becomes a craftsman;  
The child who learns to work with the hands, the brain and the heart becomes an artist.*

The child's most deeply ingrained habits and behavior patterns form very early, when he or she is at the "copying" stage of development. At this time, artistic expression is more suitable than any other form of activity for cultivating positive habits and patterns in children, and especially for insuring that they are able later in life to take a perceptive interest in the world about them. It is the Waldorf educator's belief that artistic activities permit the child to give outward expression to impulses which come from the inner life. This process puts the child's inner nature in touch with his or her physical being, and thus work in art has an important influence even on physical growth and development. This intensive bond between body and "soul" is an

especially characteristic quality of childhood, and is seen early in the child's instinct to give physical expression to feelings and emotions. When children are allowed to work out these feelings through artistic activities, their deepest needs can be most fully and clearly and satisfyingly expressed.

Within the Waldorf curriculum these artistic activities are not merely "expressive"; they are also formative. Thus, artistic activities are woven into the entirety of the Waldorf curriculum.

In addition to the curriculum already described, attention to the child's physical body is a fundamental part of the Waldorf curriculum. Simple circle games are played in the early grades, leading to around the third year to team sports, track and field games, and "Bothmer" gymnastics. Adventure stories can be acted out on gymnastic apparatus and on the playing field. By the sixth year, attention to the physical body is taken up with even greater consciousness; for instance, the children will begin to perceive the relationships between their gymnastics exercises and the geometric patterns they are constructing at their desks.

Even in the earliest years, work on a balance beam and exercises with beanbags and copper rods are developing poise and self-assurance, and are enabling young children to achieve conscious harmony with the space in which they live.

A prerequisite to "achieving harmony with the space in which one lives" is an understanding of the

"nature" and origin of elements that make up a particular environment. According to the teachers at the Waldorf school, children at a young age receive too much of what they learn in an "abstracted" form. Examples of this include; a misunderstanding of distances due the extensive use of the automobile, confusion over the origin of prepackaged food found in stores, and the distorted view of adult life available on television. It is the belief of Waldorf school educators that these "man-made" interventions create a serious problem in reference to a child's perception of their environment and their own orientation within it. It is one of the primary goals of the Waldorf curriculum to give young children an understanding of the process by which their surroundings were made. A clear understanding of how things get from "point A" to "point B" is necessary for a successful association with the natural and man-made world.

## THE SITE



Above is existing school building  
to be demolished

View over looking dry lake bed and existing playing fields

The site is located in Lexington, Massachusetts approximately twenty miles northwest of the city of Boston and one half mile south of Lexington's Historic district. The site is angled twenty degrees west of the north axis. It is bounded by Massachusetts Avenue on the west and south, a low density residential neighborhood on the north, and the Boston and Maine Railroad on the east. The site as well as the town of Lexington in general can be characterized as a low density, picturesque community with gently, rolling hills and moderately wooded areas.

The site includes a dry lake bed approximately sixteen feet below the level of the school building. The dry lake bed serves as the site of the playing fields for the school and is located on the northeastern side of the site. There are two small hills; the tallest of which rises twelve feet above the first floor level of the school. The proposed school is located on an axis formed between the two hills and along the crest of the shoreline of the dry lake bed.





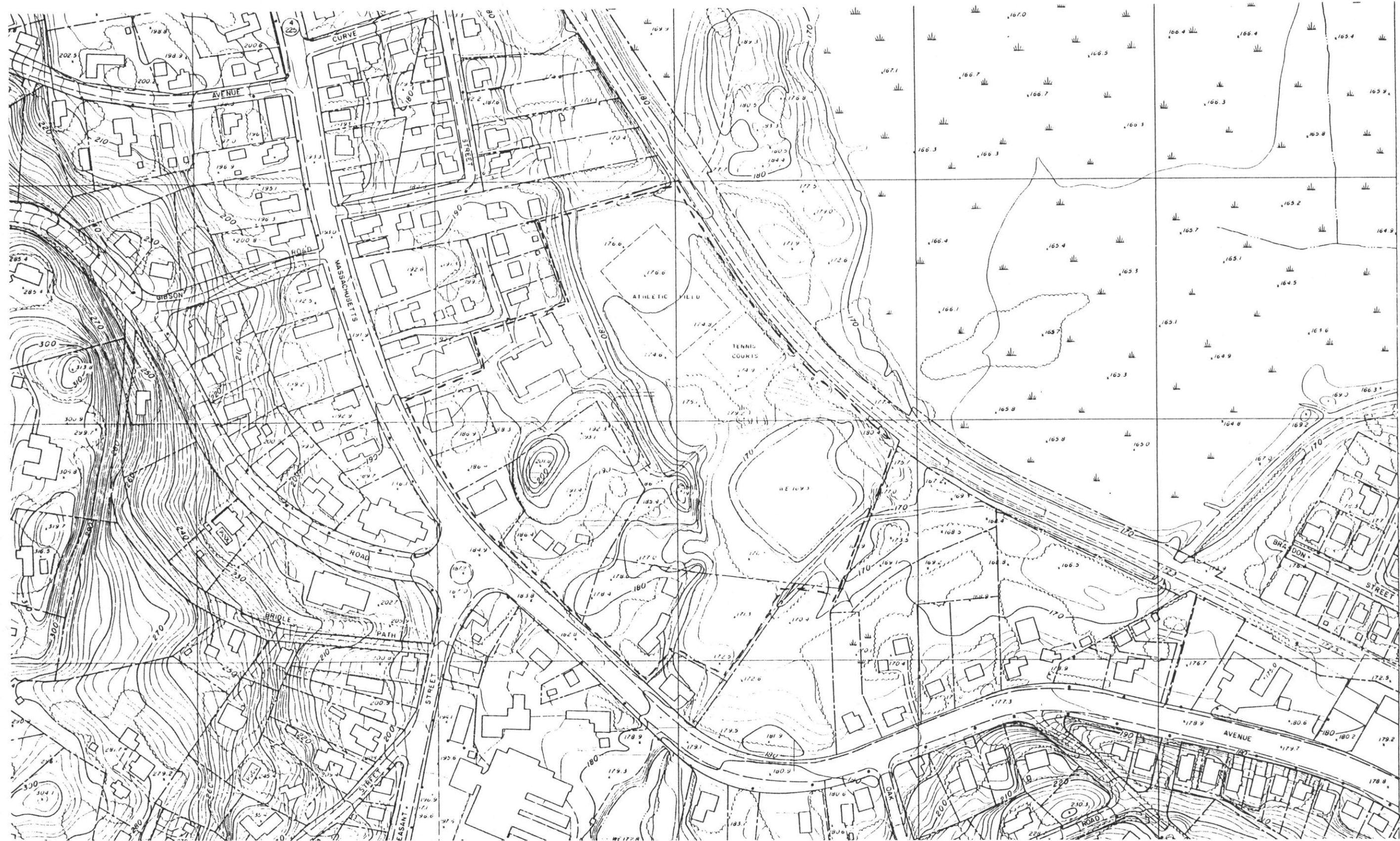
View looking south



View looking towards Massachusetts Avenue, Lexington





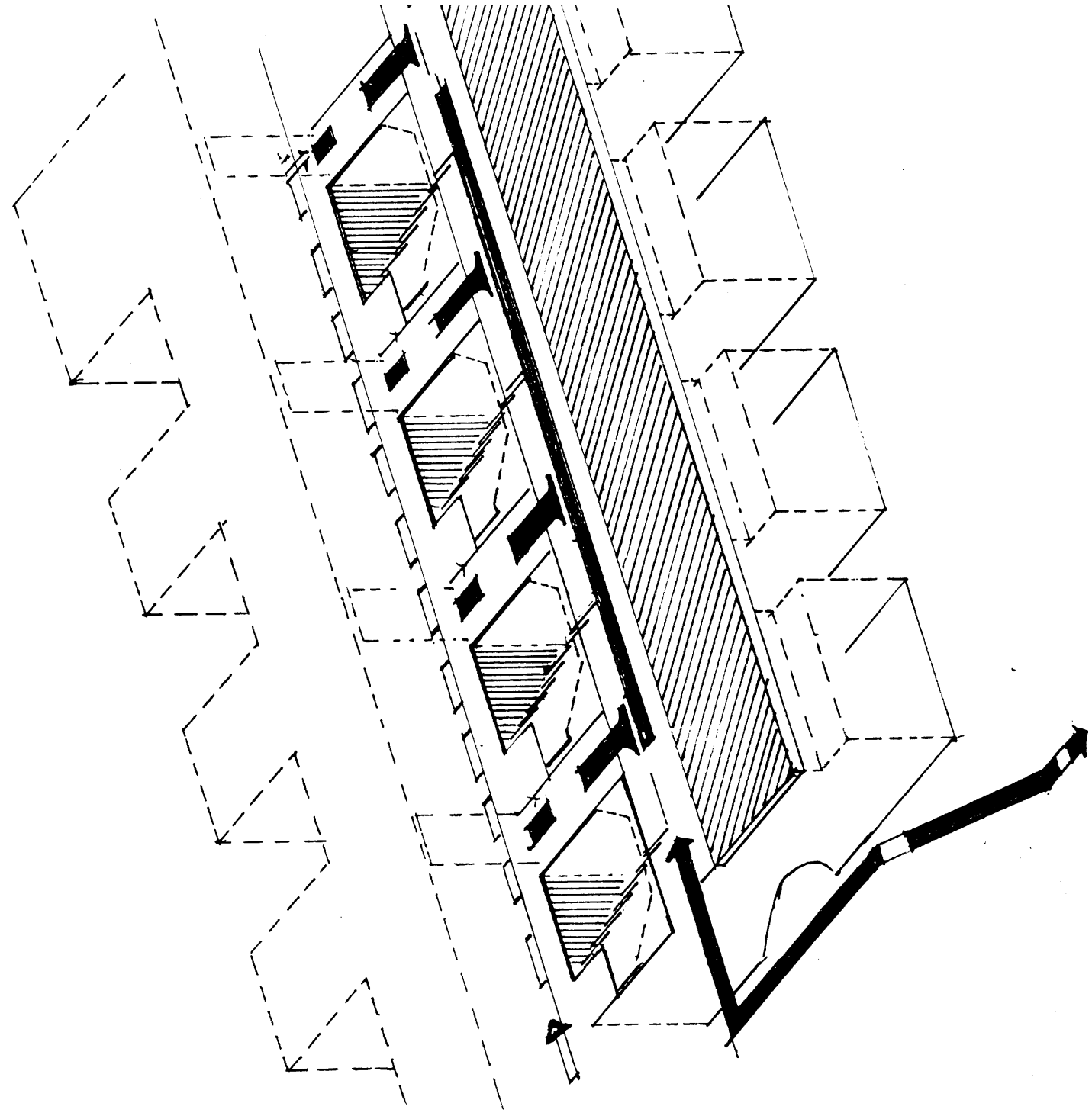




## THE BUILDING CONCEPT

The concept for the school was developed with three major issues in mind: the organization of the school, curriculum requirements, and movement about the site. Before developing a concept several organizational references of institutional buildings were analyzed. These were narrowed down to three different organizations. These three organizations have one important feature in common; they all develop a relationship between a large collective space and smaller private spaces. In most of the references the private spaces define the large collective space and the large collective space incorporates or includes the primary access. The final concept for the school borrows from these organizational references.

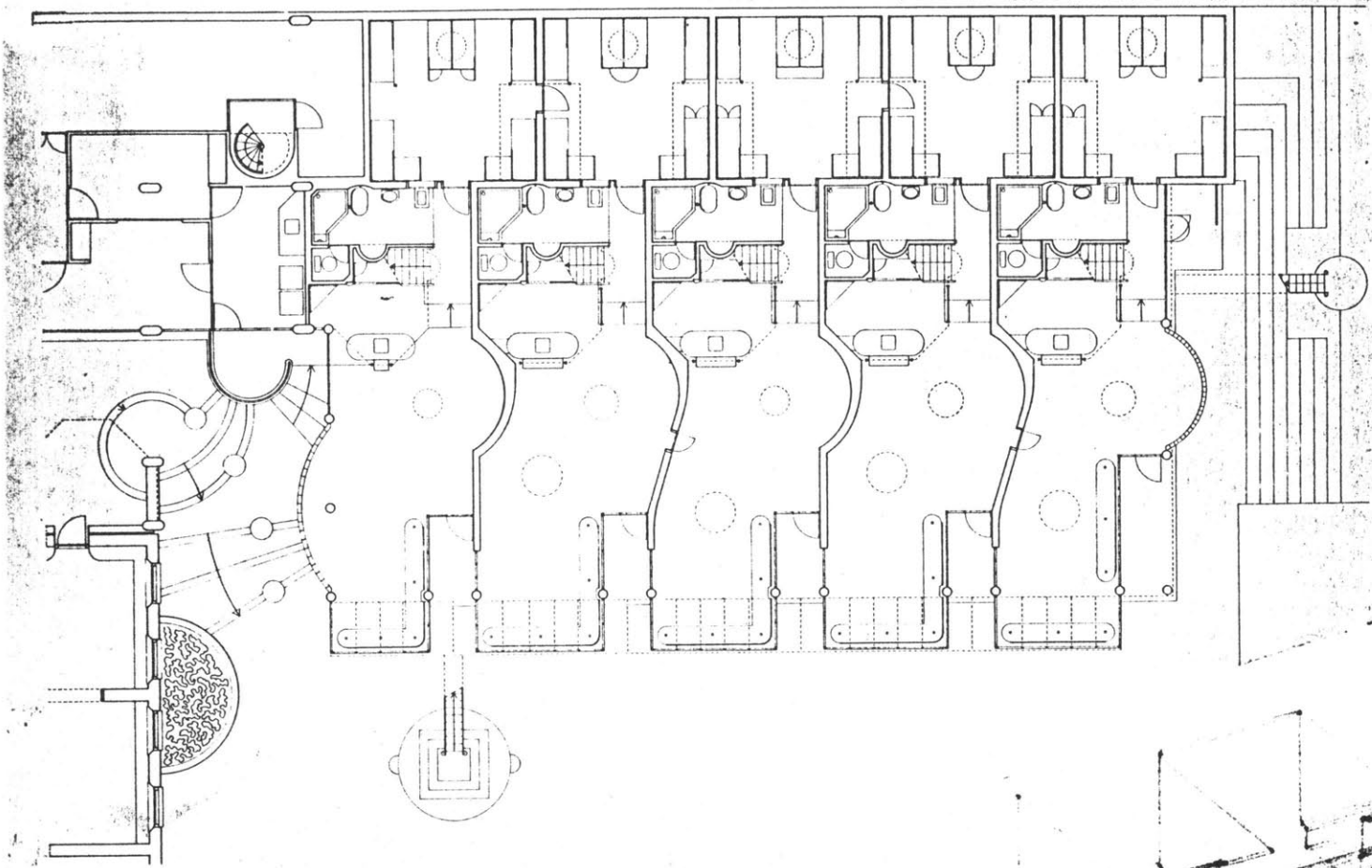
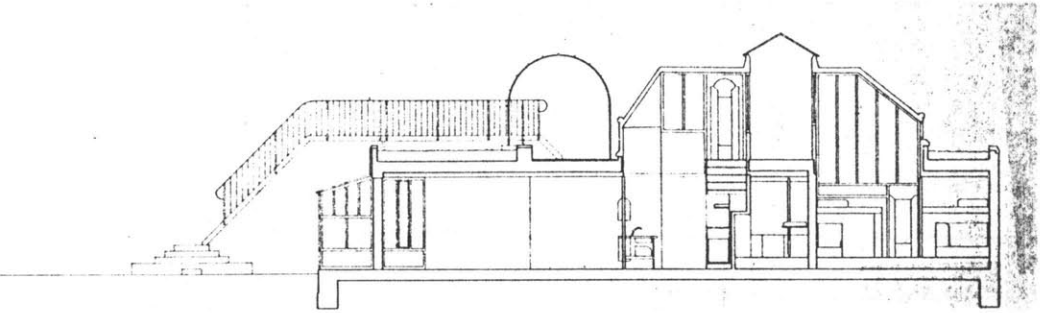
The following pages diagram the references used in developing the concept.



*Computer generate*



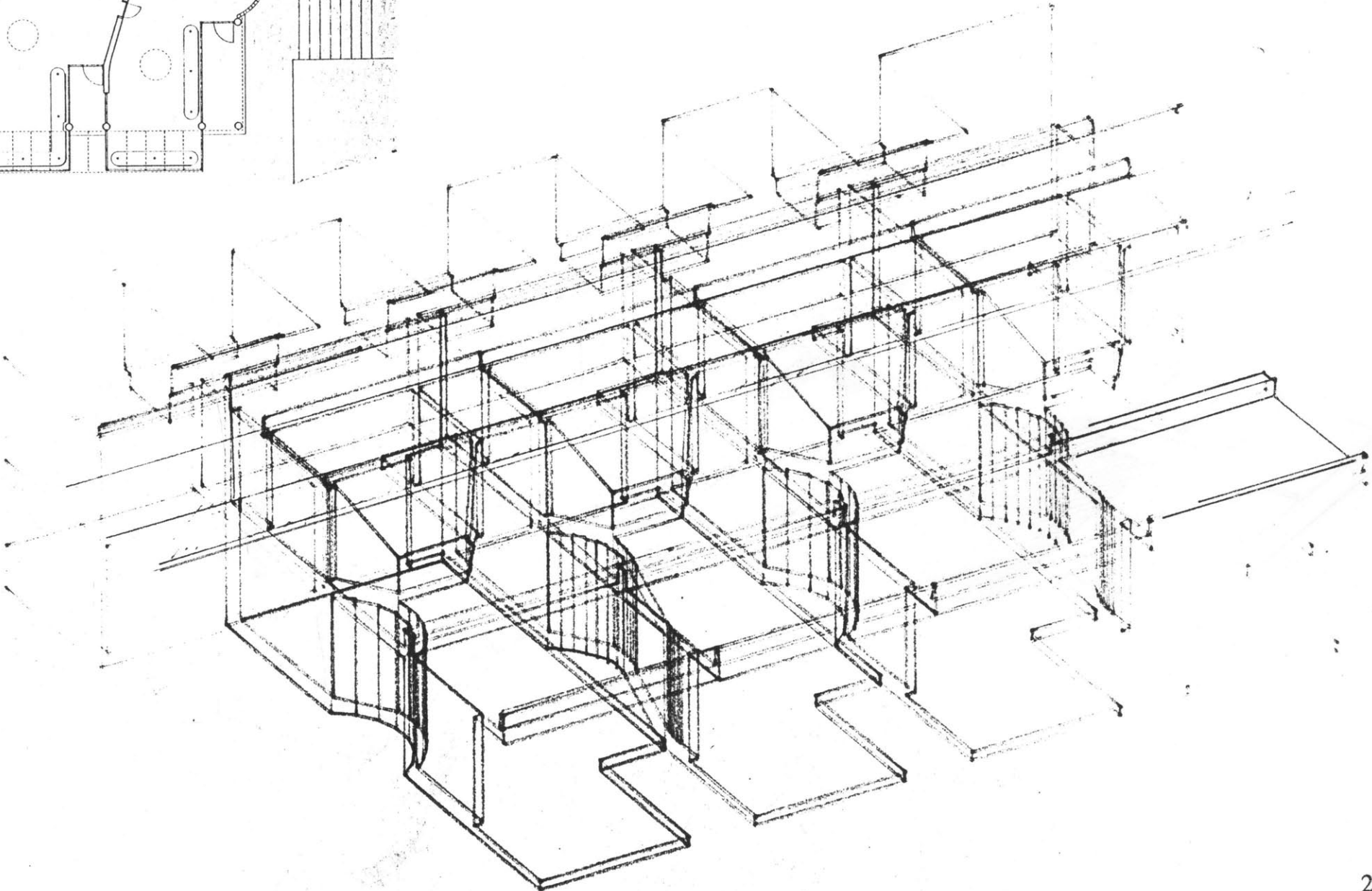
**CONCEPT REFERENCES**



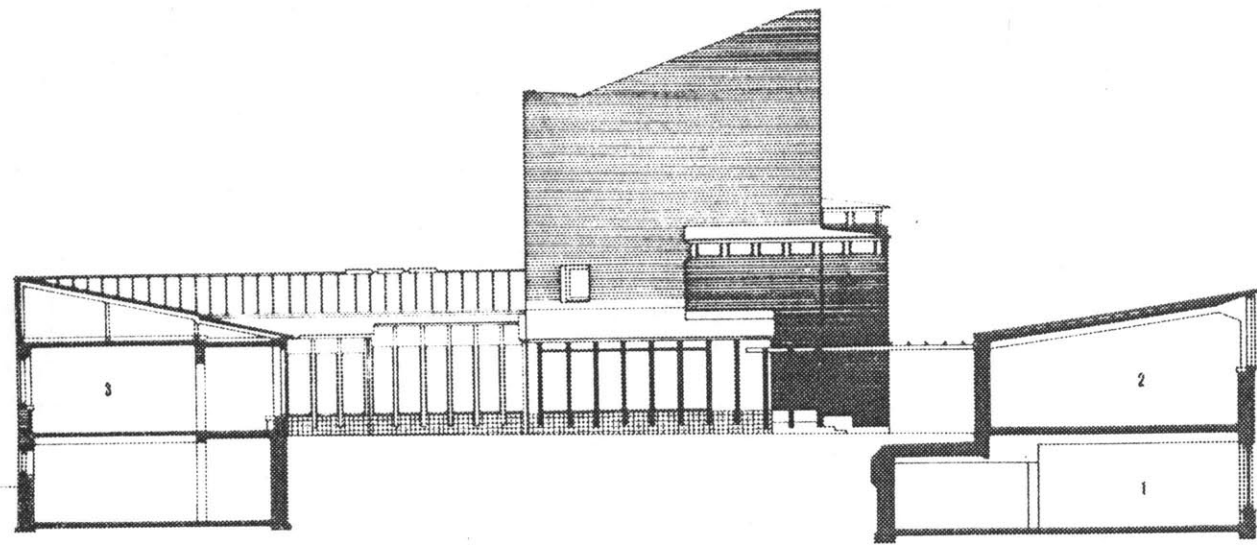
**HOME FOR SINGLE PARENT FAMILIES**

by Aldo van Eyck

The primary access and collective space are both located above the private spaces. Each private apartment is accessed by its own stair leading down to the first floor. Each apartment contains its own smaller collective defined by the curved wall on the first floor.



*Computer generated diagram*

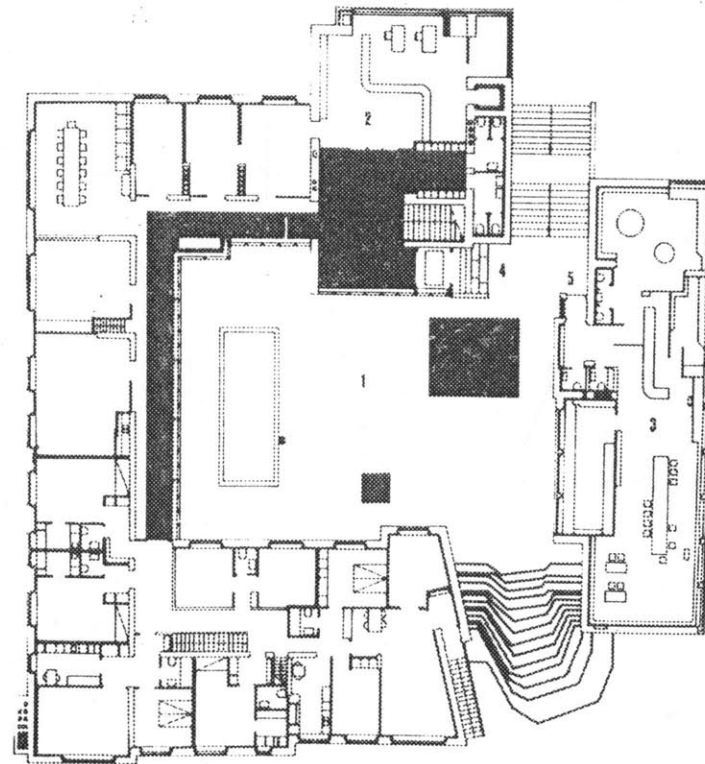
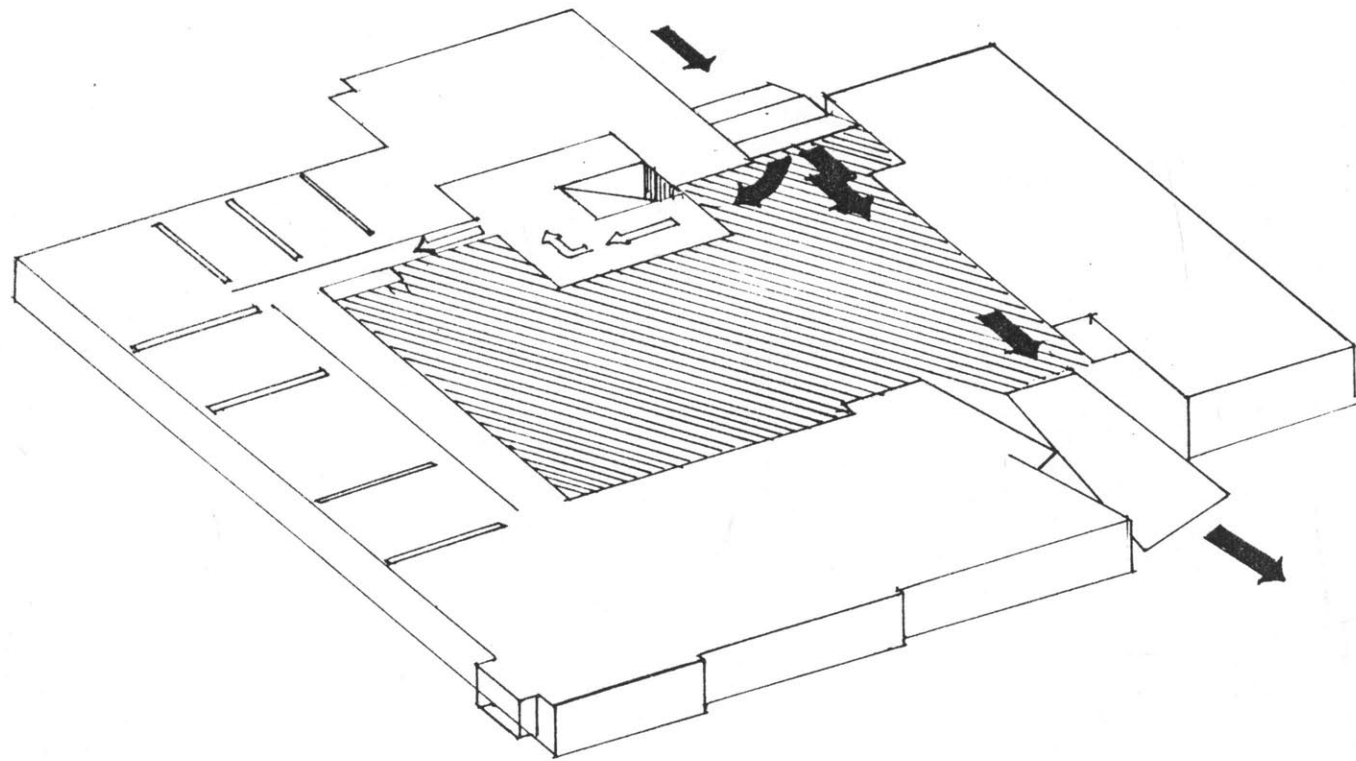


**CONCEPT REFERENCE:**

**TOWN-HALL, SAYNATSALO, FINLAND**

by Alvar Alto

The collective space is defined on all four sides by the private spaces. Interaction between the large collective space and private spaces is limited to one floor. The primary access surrounds the collective space with the option to bypass on one side of the collective. The large collective which is outdoors in this particular reference is differentiated by having been elevated approximately eight feet above the level of the site.

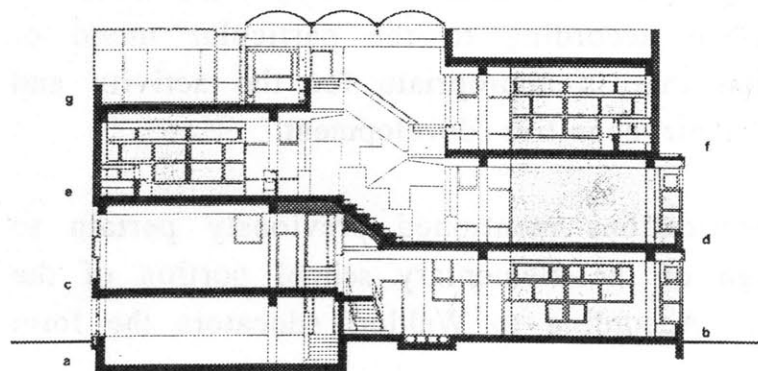
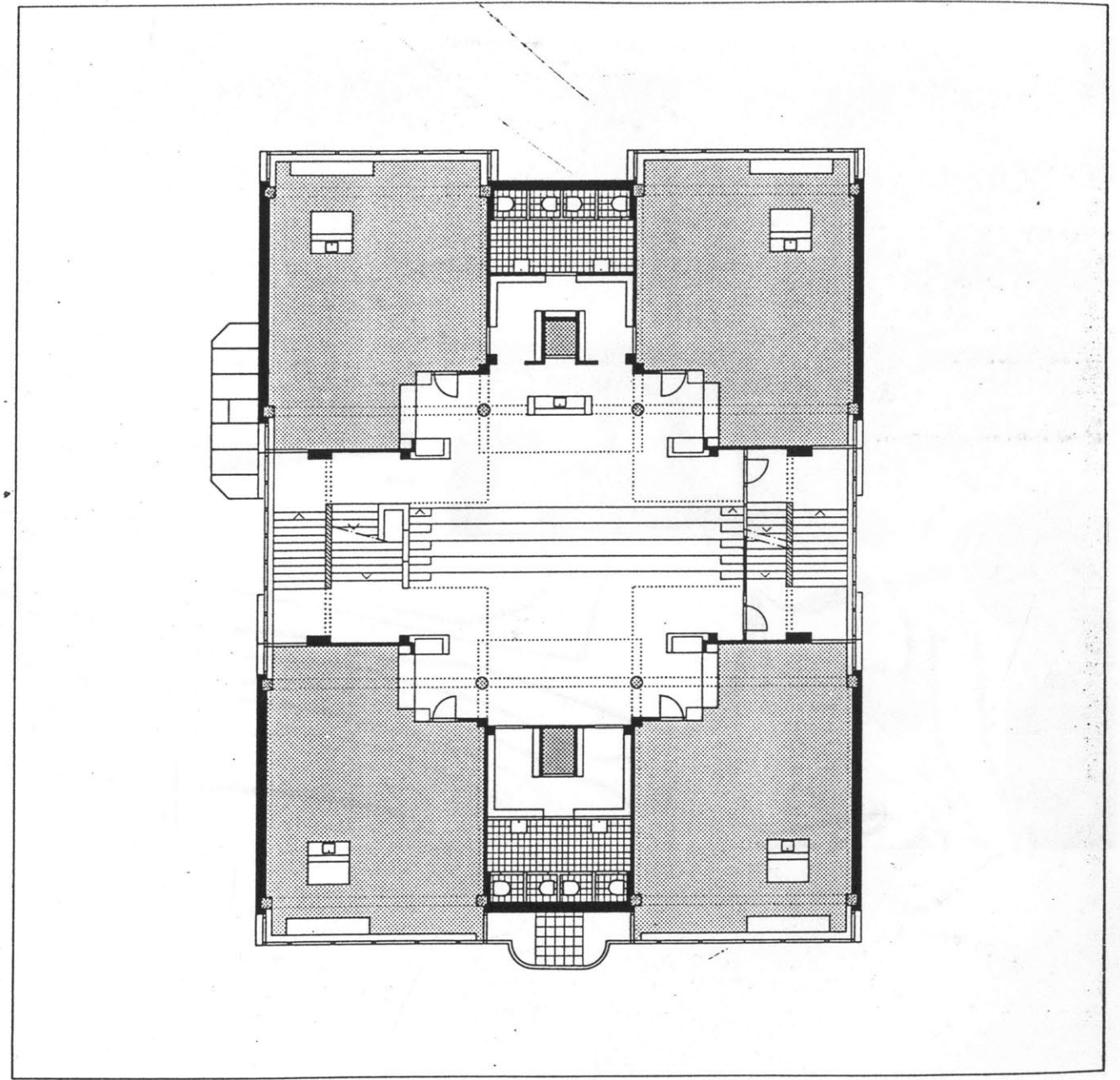
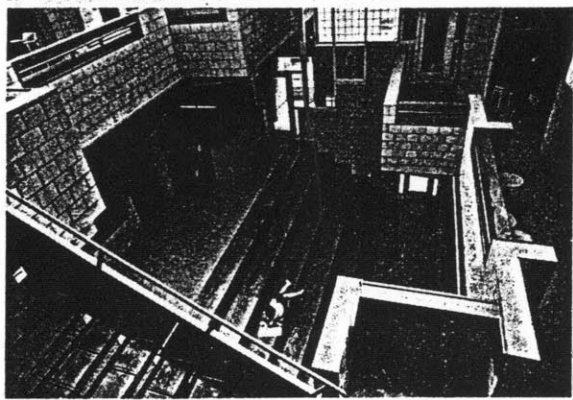
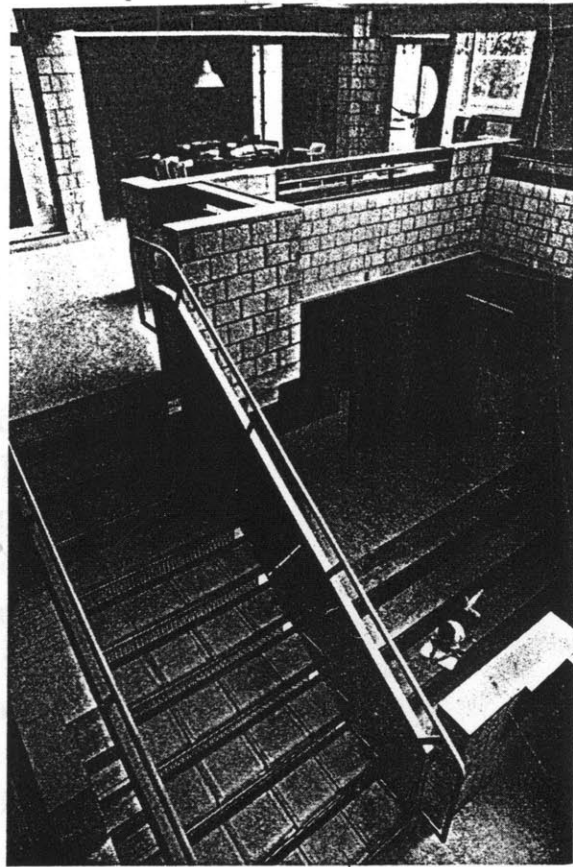
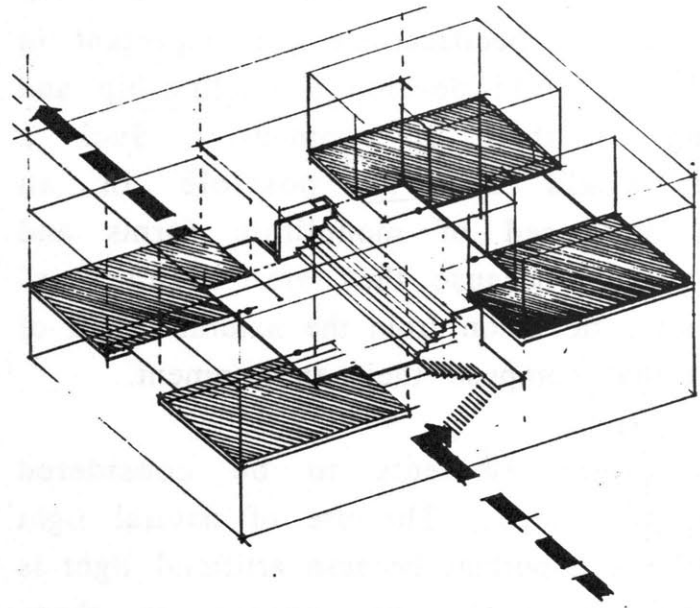




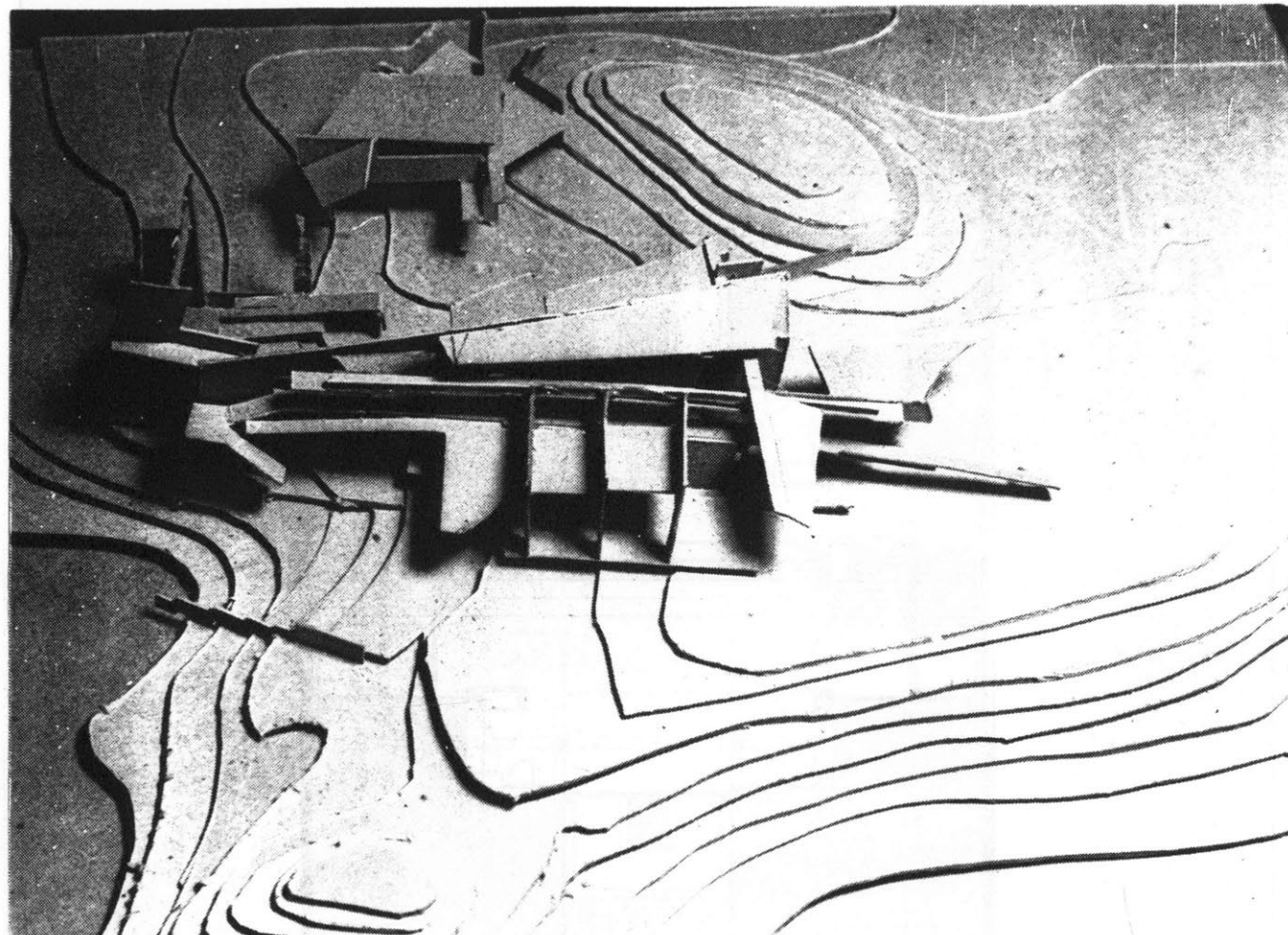
**CONCEPT REFERENCE:**  
**APOLLO MONTESSORRI**

by Herman Hertzberger

The private spaces are located on both the first and second floors. The primary access is defined by a series of stairs and balconies that service the classrooms and contribute to defining an intermediate zone between the classrooms and the collective spaces.



## THE BUILDING CONCEPT



The structure and substance of the Waldorf curriculum has an obvious effect on the forms and materials used to design and construct a building to house such a school. Issues relating to form, surfaces, and movement are important concerns to Waldorf educators with respect to the orientation and education of the child in the Waldorf curriculum. The physical form of the school should conform to the natural contours of the site as much as possible. Access and movement through the school should be in a clear direction to help establish orientation. These specifications are important in order to help the child develop a relationship and understanding of their environment. Such a relationship would not be possible in an environment composed of monolithic forms and synthetic materials because they are "abstractions" and too severe a deviation from the natural origin of the elements that compose their environment.

Other architectural elements to be considered include light and color. The use of natural light where possible is important because artificial light is an abstraction in the same manner as those mentioned above. Color is important in the Waldorf school because of the effect it has on the child's mood. The walls of classrooms and work areas are color coded according to the particular mood or disposition that is appropriate for the activity and stage in their cognitive development.

The specifications mentioned previously pertain to the design of the elementary school portion of the complex. According to Waldorf educators the form



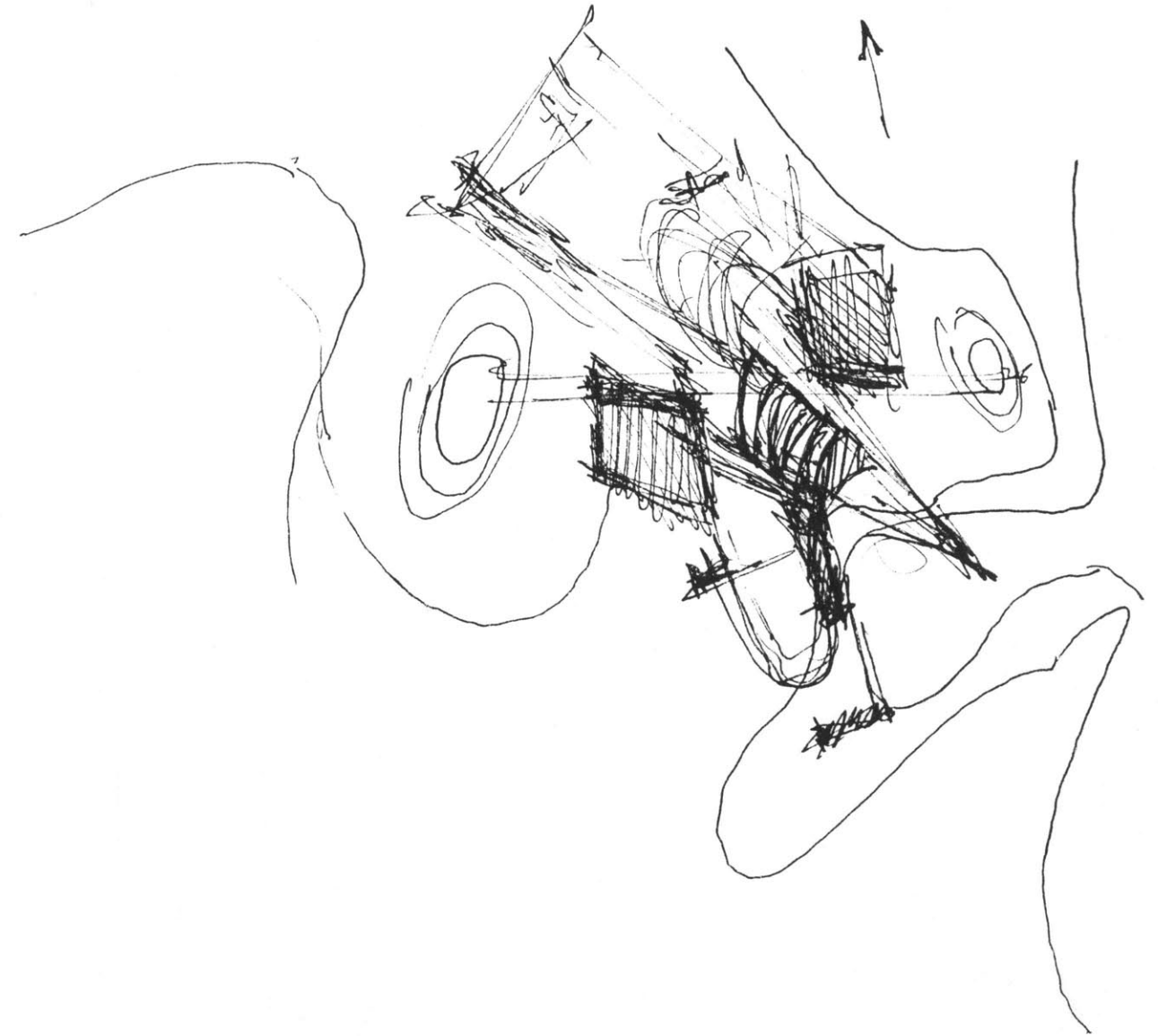
of the high school portion of the complex need not follow all of the specifications listed above because the child has matured enough to understand and relate to abstract forms by the time they reach the high school level. Therefore there is considerably more freedom regarding the design of the high school within the complex.

Each of the attitudes listed above regarding the architectural form of the elementary school serve to make the school's environment a less distracting, more understandable and orienting place in which to learn by eliminating the abstracted elements until the children are capable of understanding the origin of such elements.

The concept diagrammatically gives form to the issues listed previously. The issue of the relationship between collective and private spaces is resolved by establishing an axis between the two hills of the site and parallel to Massachusetts Avenue. This primary access axis also follows the contours of the site as they slowly descend down toward the level of the dry lake bed.

Another axis that runs along the shoreline of the dry lake bed is the organizing element for a majority of the classrooms. The two axis together form a wedge around which the classrooms are situated. The organizing axis remains at one level providing a reference level. The primary access axis descends down with the land and bypasses the former by traveling eight

feet underneath the reference level. Within the wedge is the location of the large collective space that descends down with the primary access. The large collective space is where the auditorium of the complex is located. The two axis define movement through the building and the smaller, private spaces define the large collective space or auditorium.

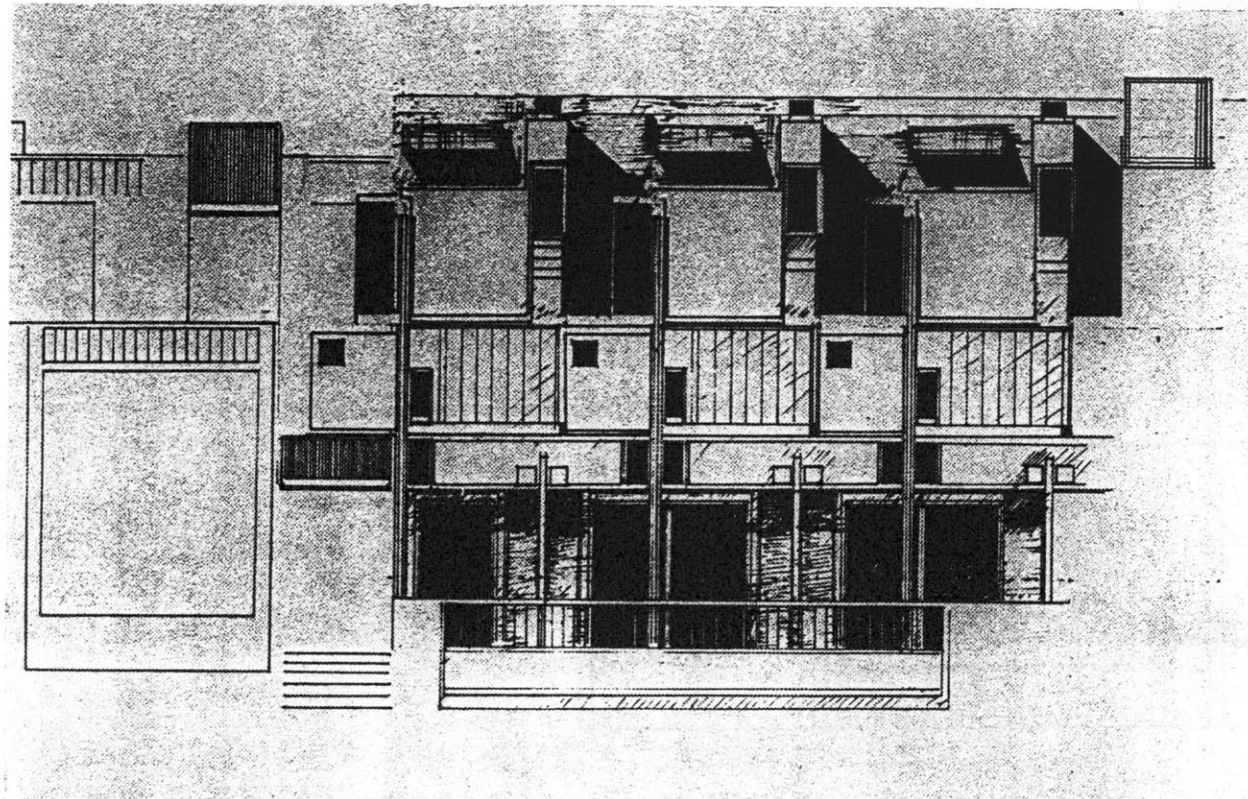
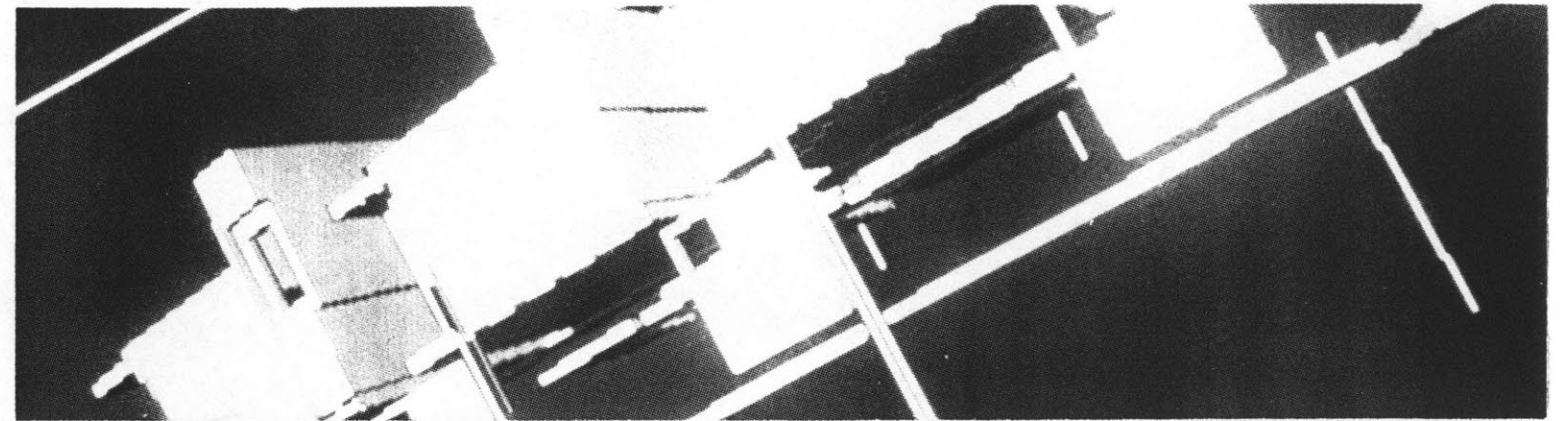




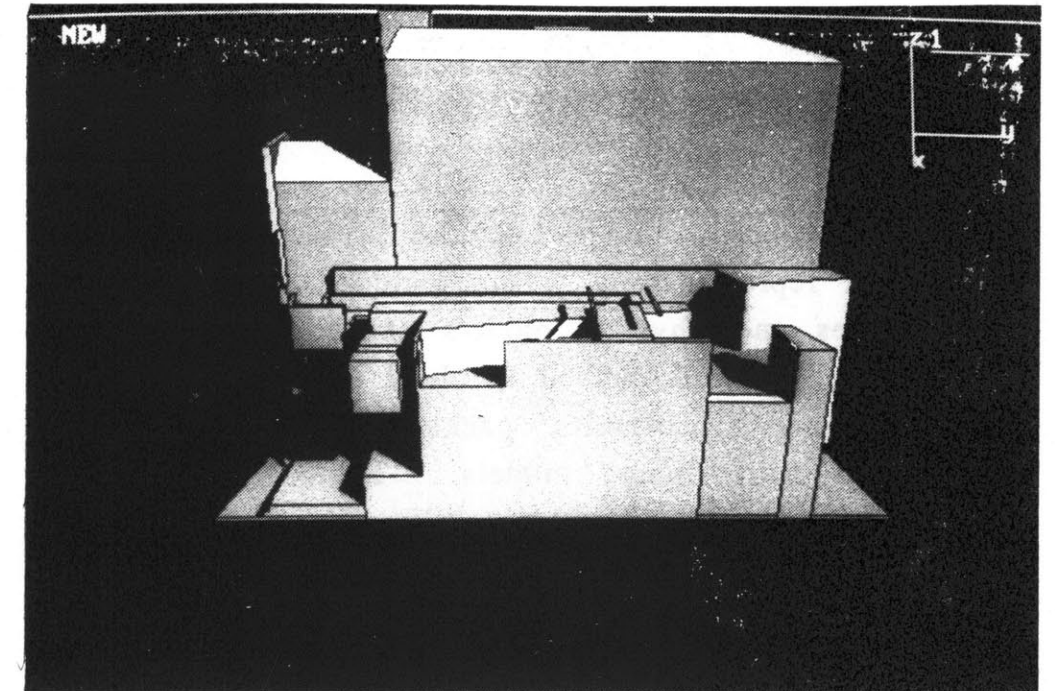
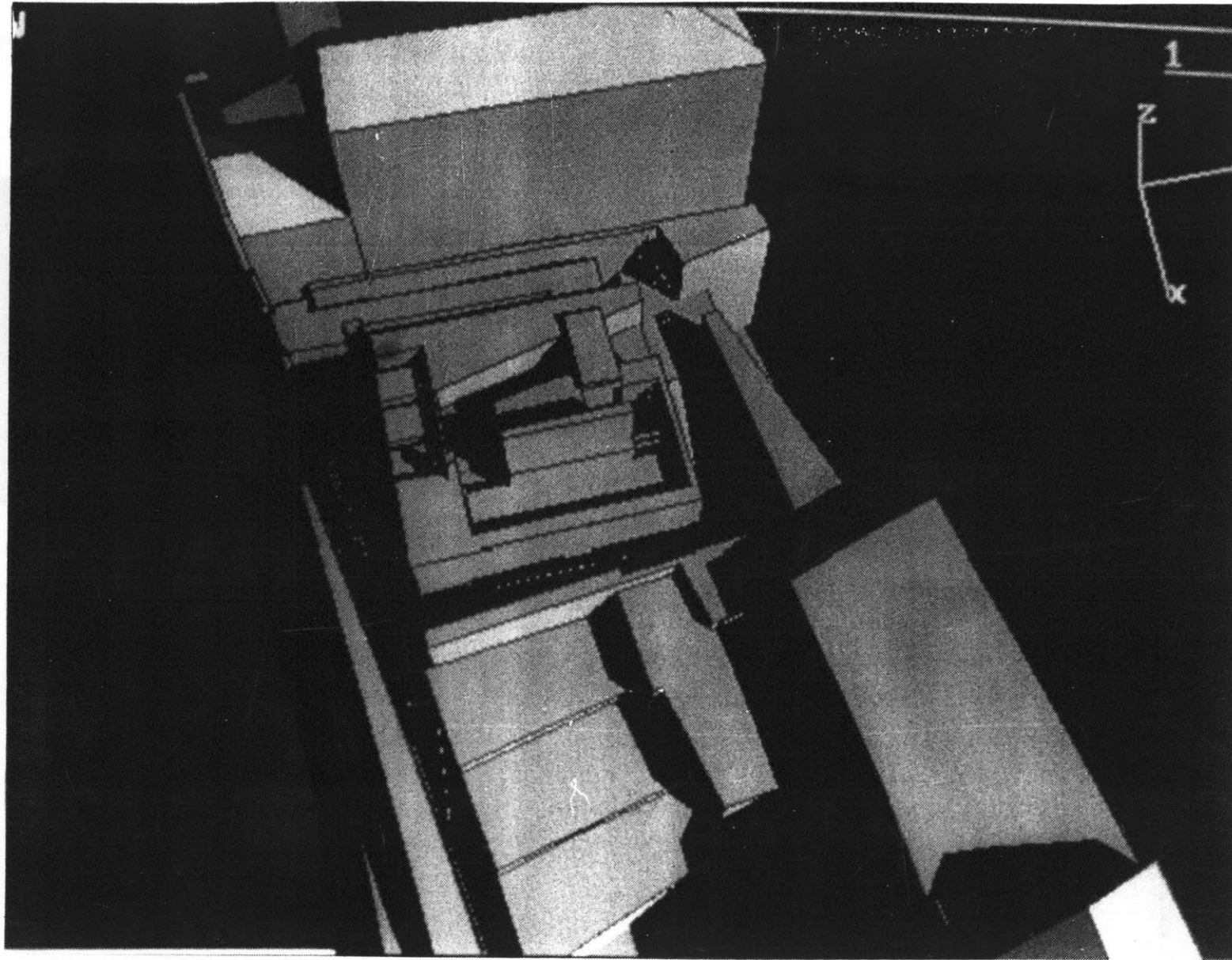
### TRANSFORMATION OF THE CONCEPT

Making the concept into architecture involved three methods of representation. This included drawings and sketches and physical models of the building and site. The third method involved the use of a computer and a software package capable of constructing solid image models. The computer representations allowed for quick and multiple views of the building as a whole or any individual piece as selected. By putting to use the additive and subtractive design capabilities of the software in addition to the physical models and sketches, a more comprehensive understanding of the architecture and the concept that drives it was possible.

The following process references provide a more elaborate display of the interaction between various methods of representation.





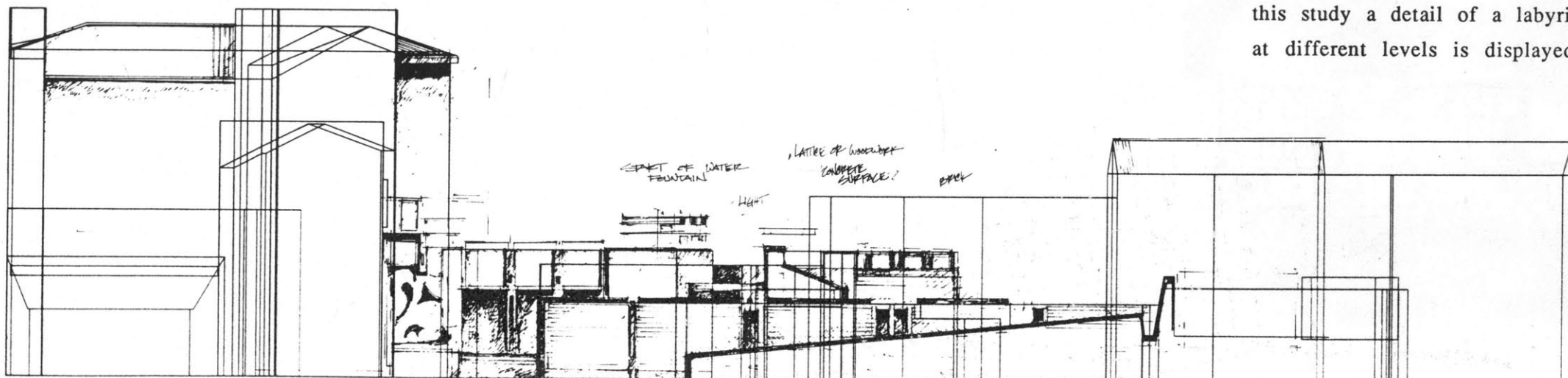


**COMPUTER REFERENCE #1**  
**GARDEN LABYRINTH AND OUTDOOR DISPLAY FOR**  
**THE TOWN OF SALUZZO, ITALY**

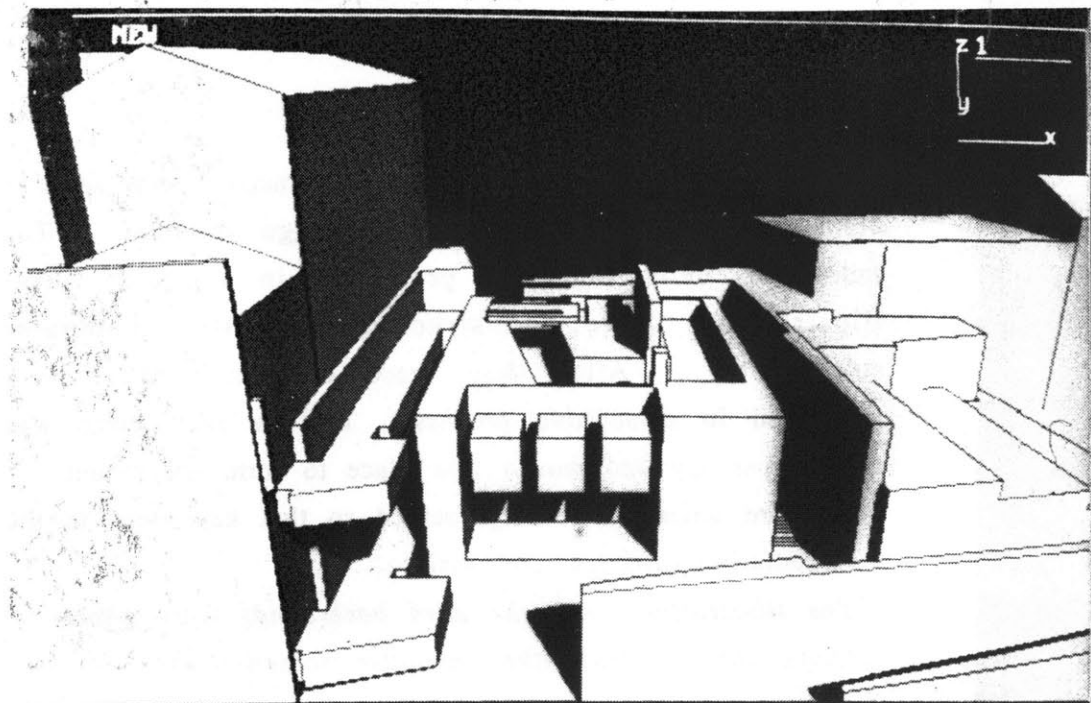
by Scott Newton 1987

Enzo Testa, Visiting Critic, M.I.T.

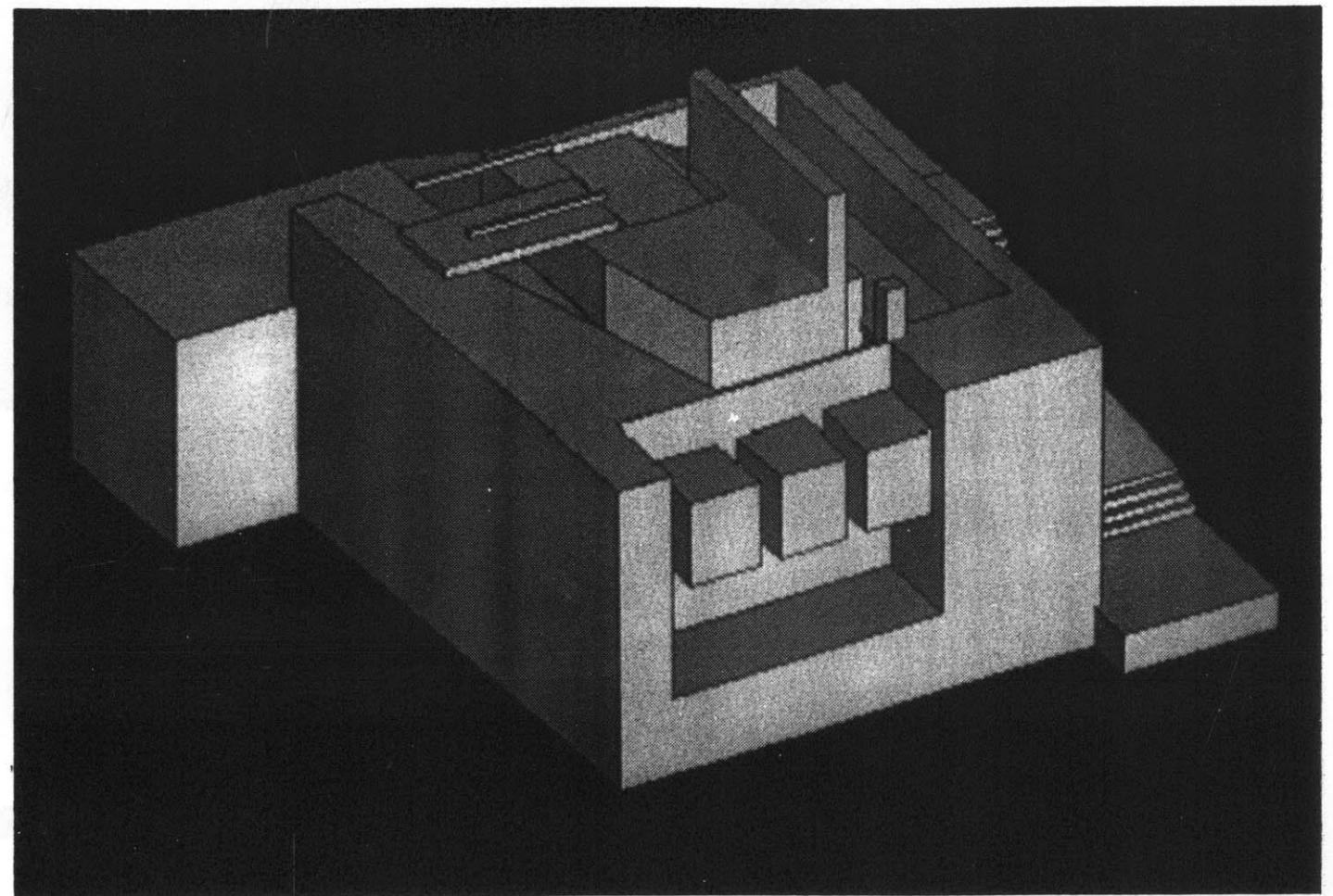
This is an example of a subtractive design assembly as constructed on the solid image modeler. The image on the computer begins as a large block or cube from which are "carved out" or subtracted various spaces of any size or dimension. This is particularly useful in representing continuous surface forms such as concrete or masonry. In this study a detail of a labyrinth linking two streets that are at different levels is displayed.



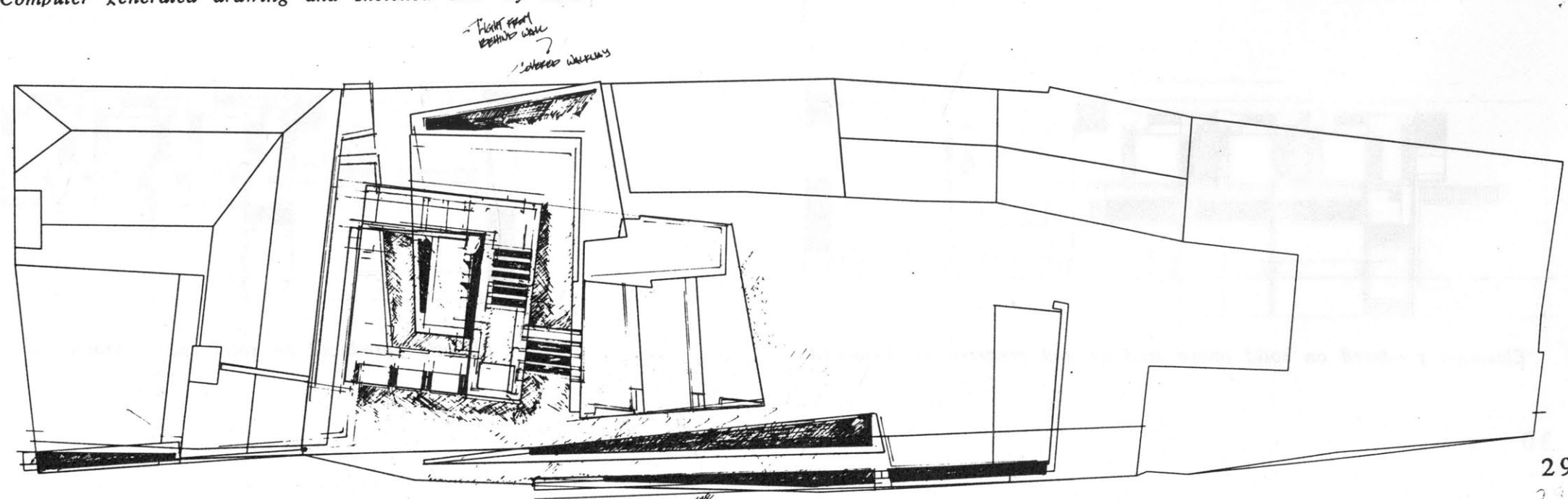


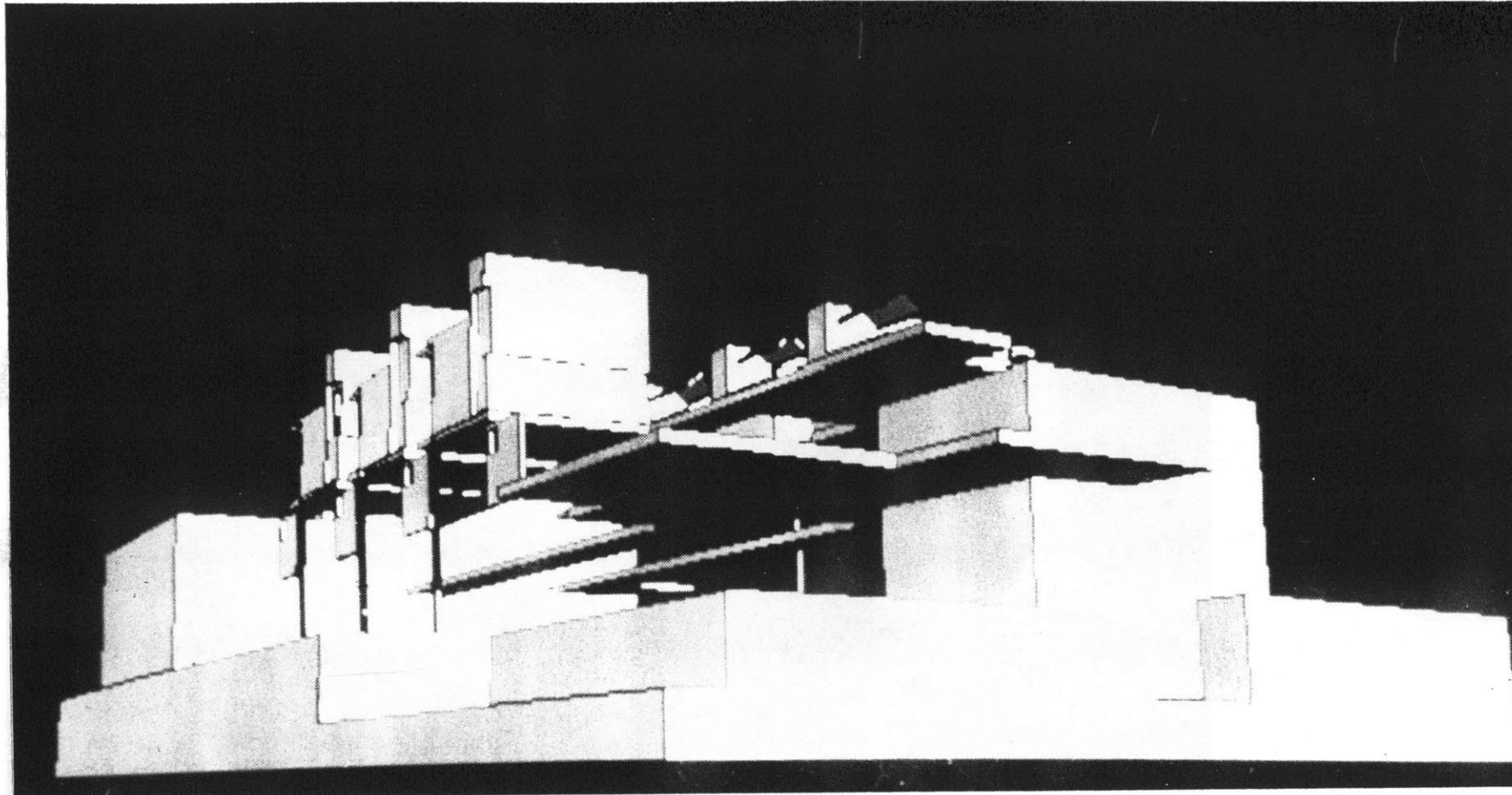


Computer image taken from screen



Computer generated drawing and sketched over by hand





*Computer image taken from screen*

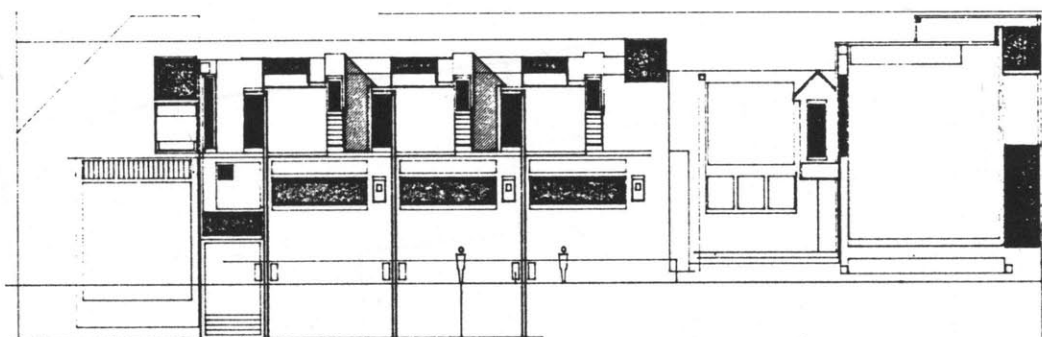
**COMPUTER PROCESS REFERENCE #2  
TRANSITIONAL HOUSING FOR THE HOMELESS**

By Scott Newton

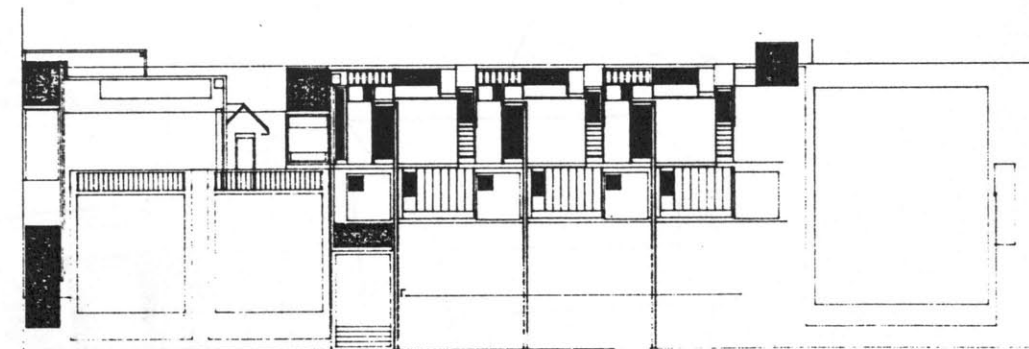
Fernando Domeyko, Design Critic

This is an example of both the subtractive and additive display capabilities of the solid image modeler. The individual units that are prominent in each of these illustrations were constructed on the computer subtractively. After they were completed they were assembled in a additive process. That is each piece was made seperately and moved into place to form the model. The entire model is not represented so that key steps in the representative process are visible.

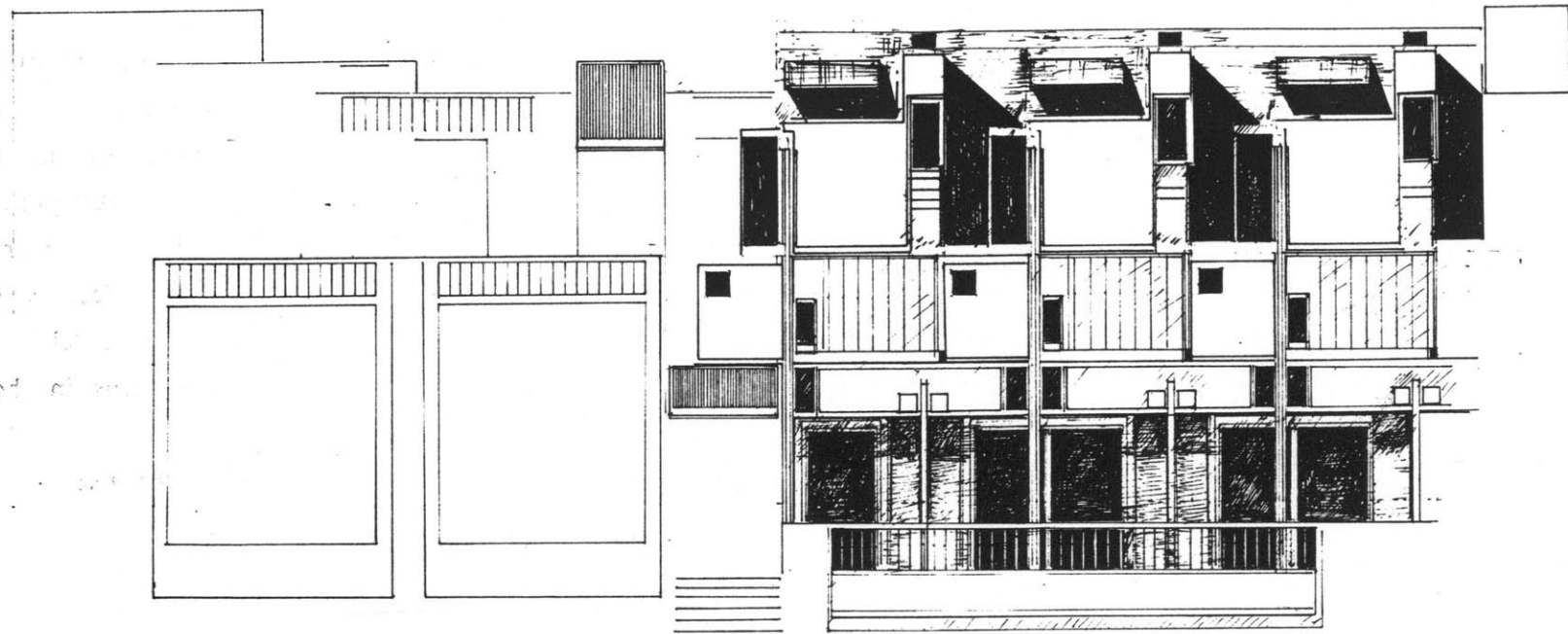
*( The illustrations with the dark backgrounds were photographed directly from the computer screen.)*



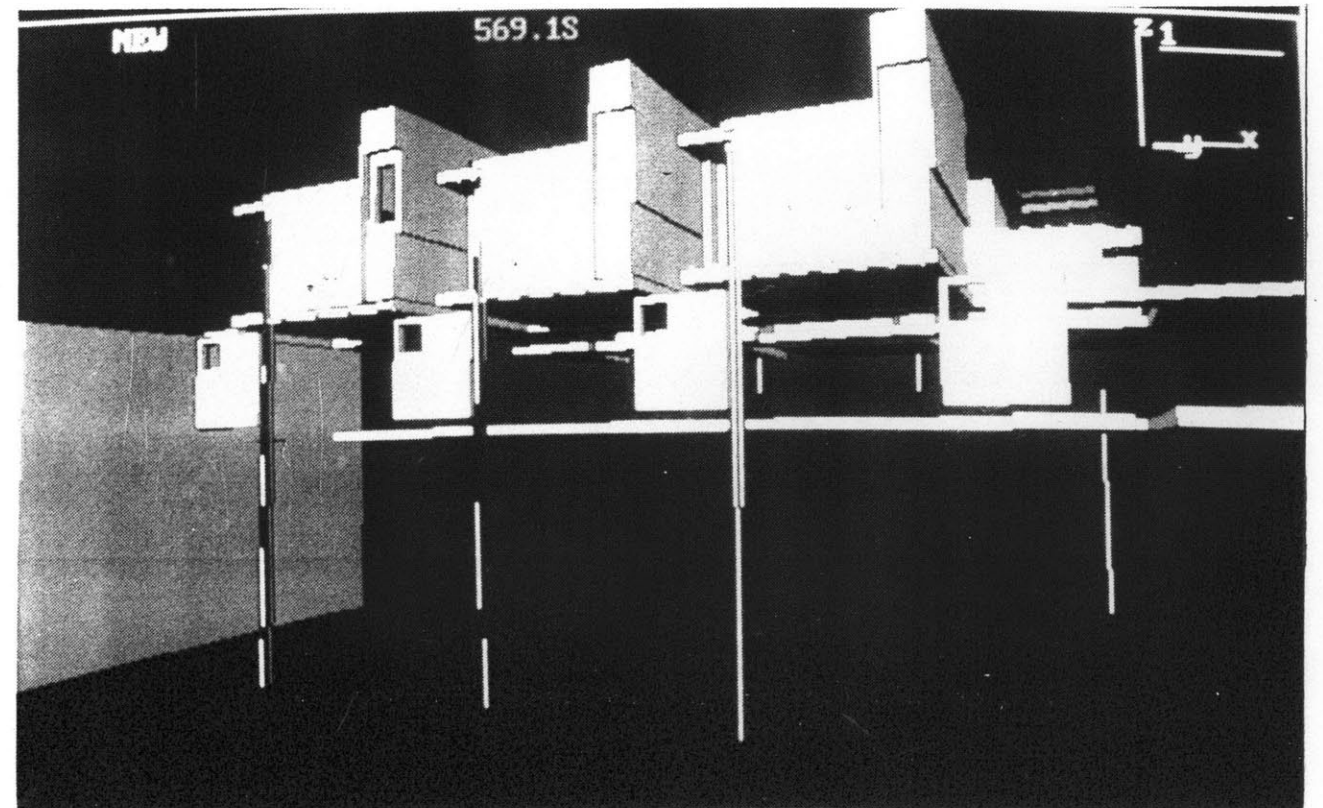
*Elevation produced on solid image modeler and rendered on Autoocad*



*Elevation produced on solid image modeler and rendered on Autocad*



*Above is an elevation generated by computer and sketched over by hand.*

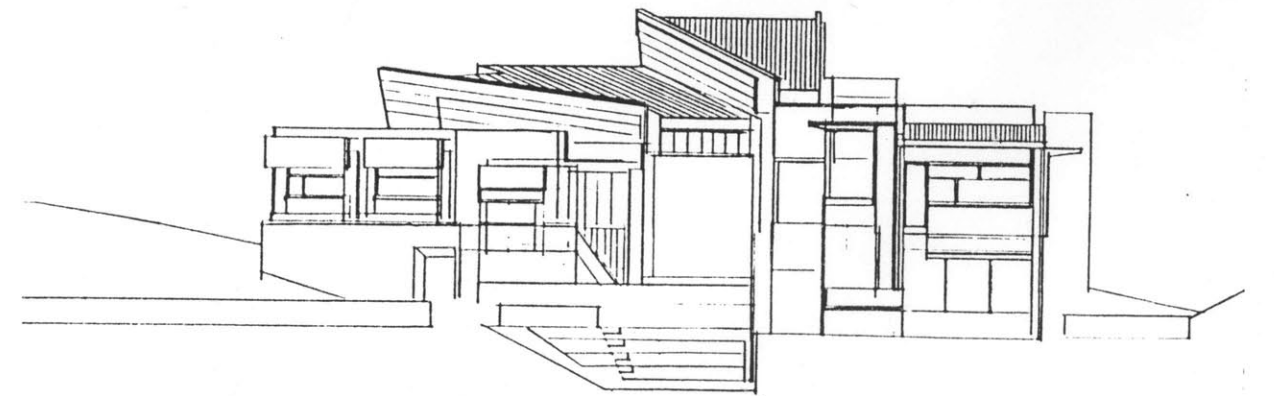
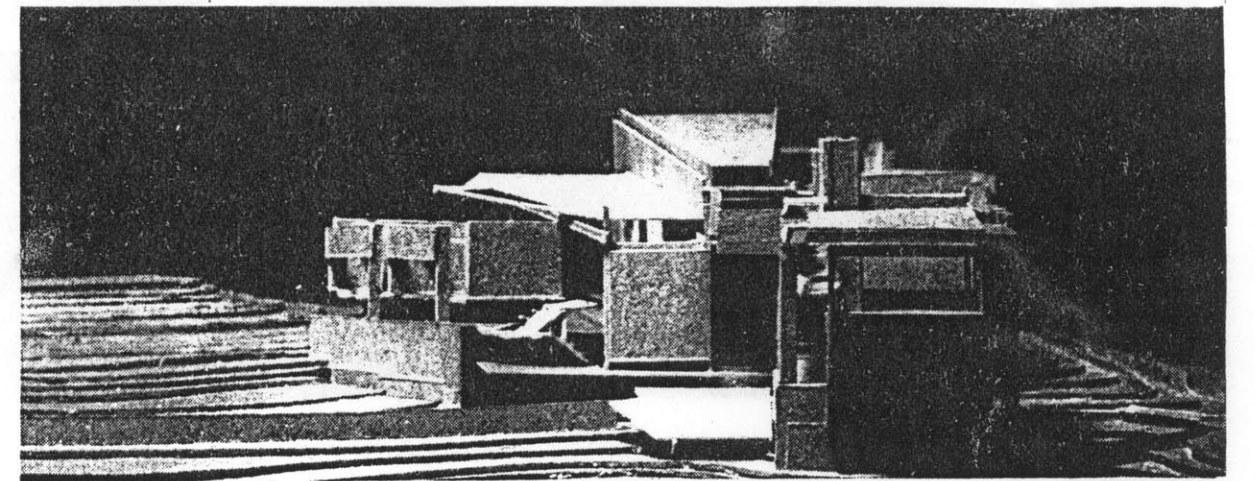
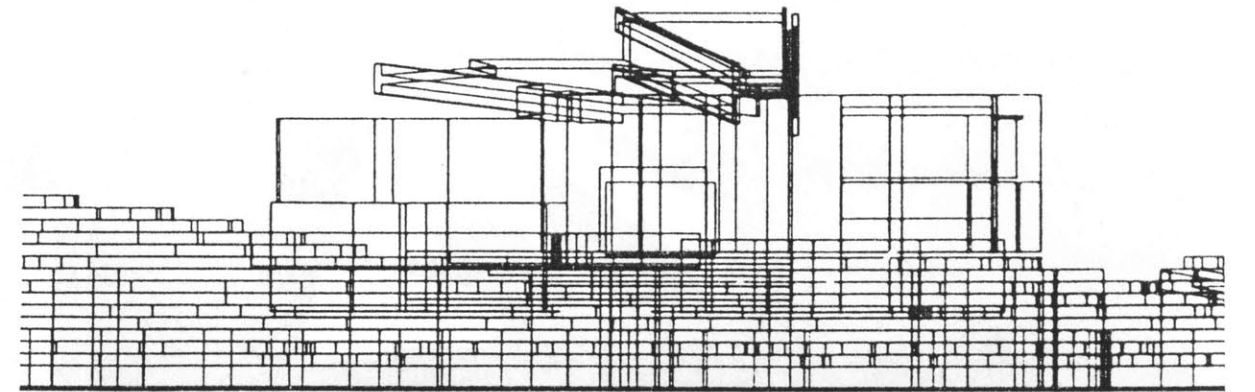


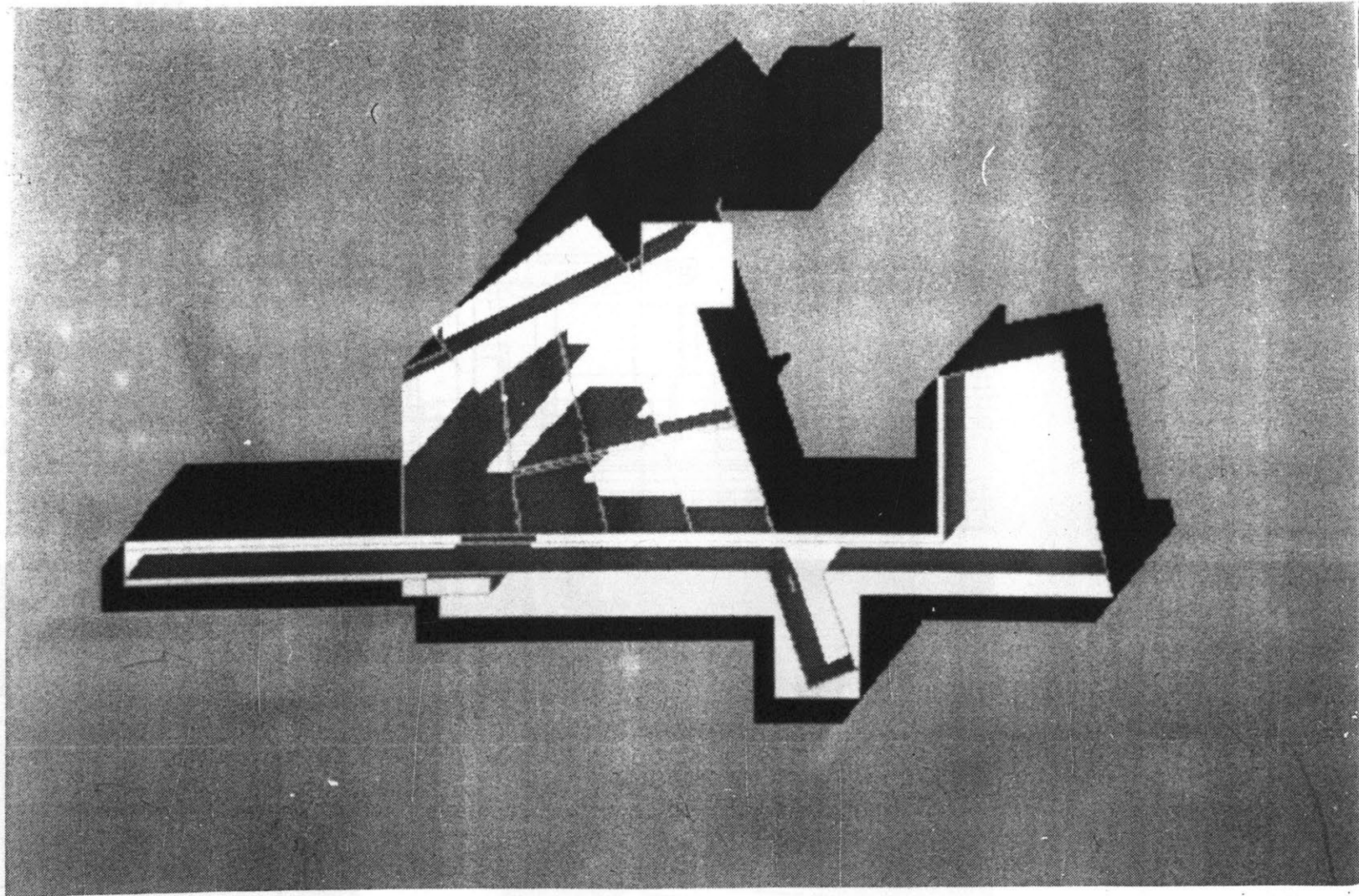
*Computer image taken from screen*



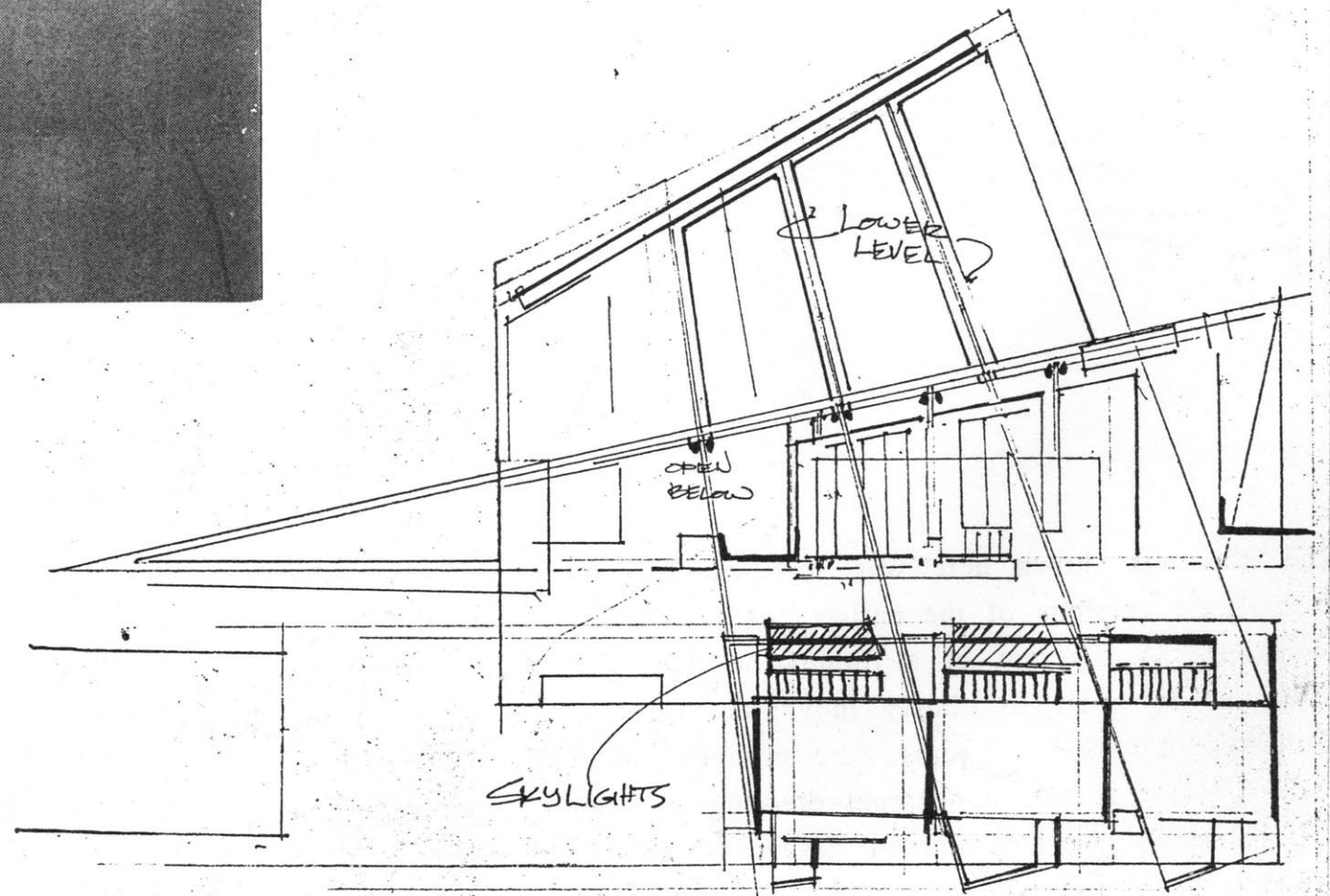


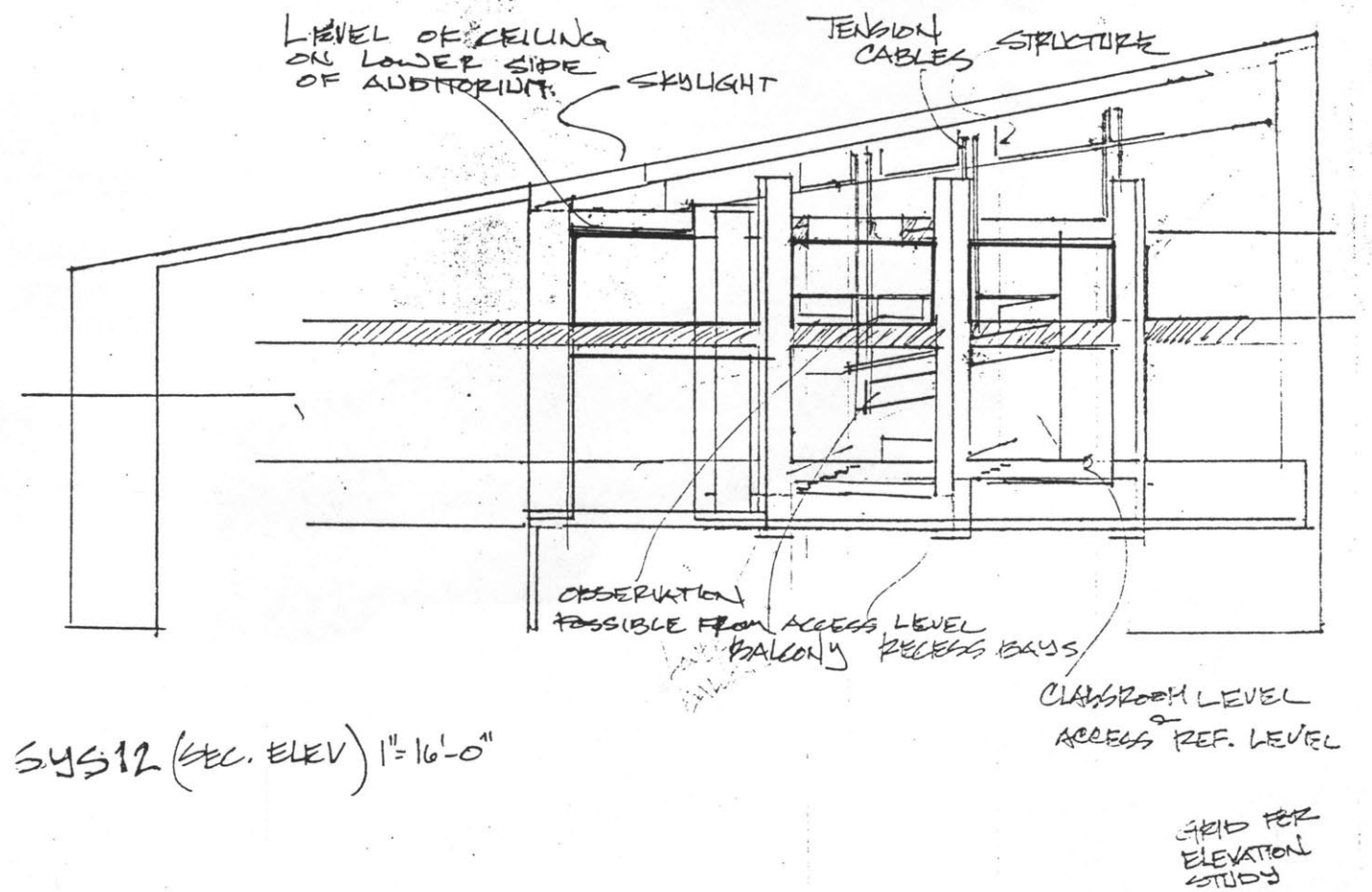
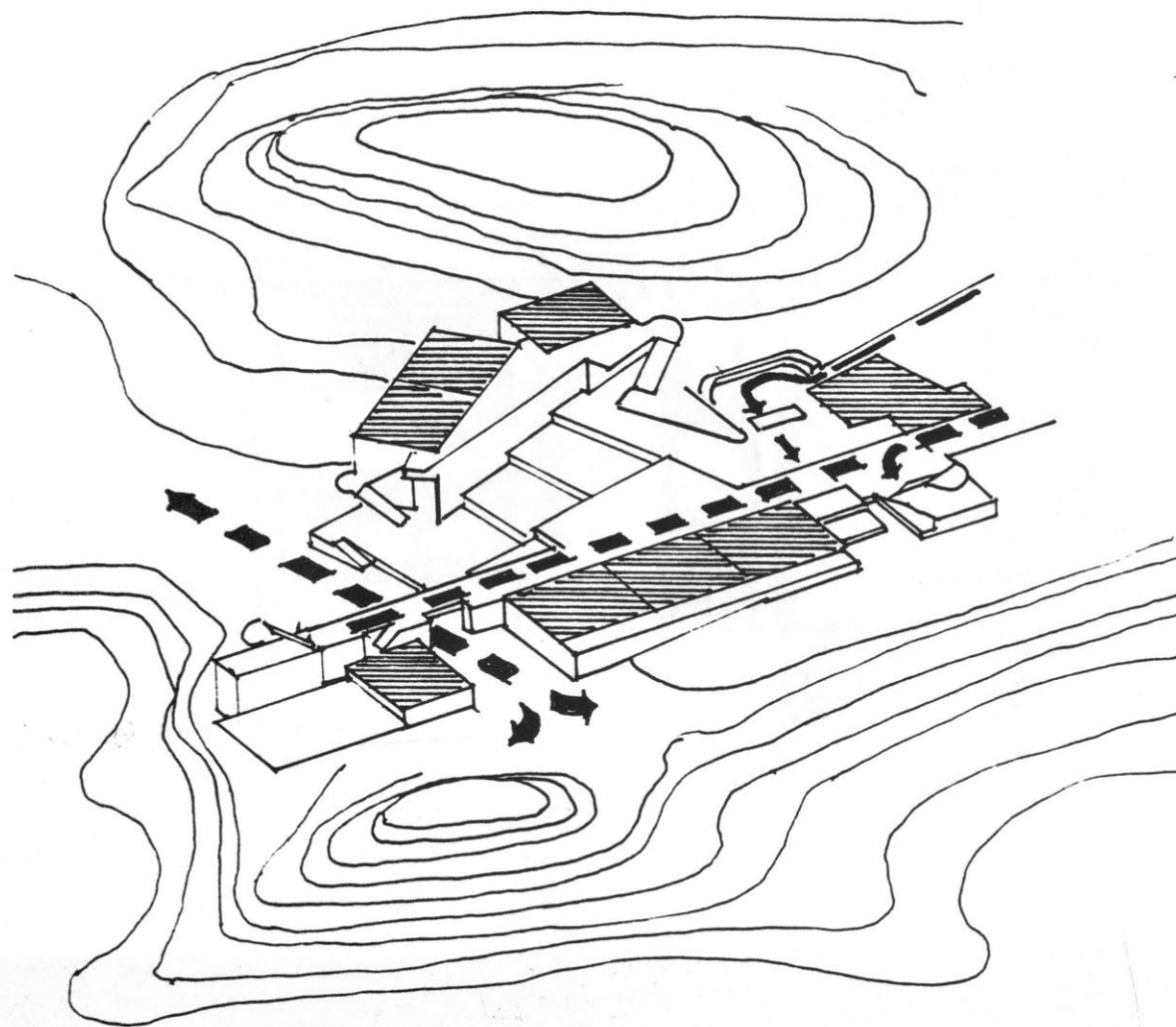
# THE DESIGN PROCESS





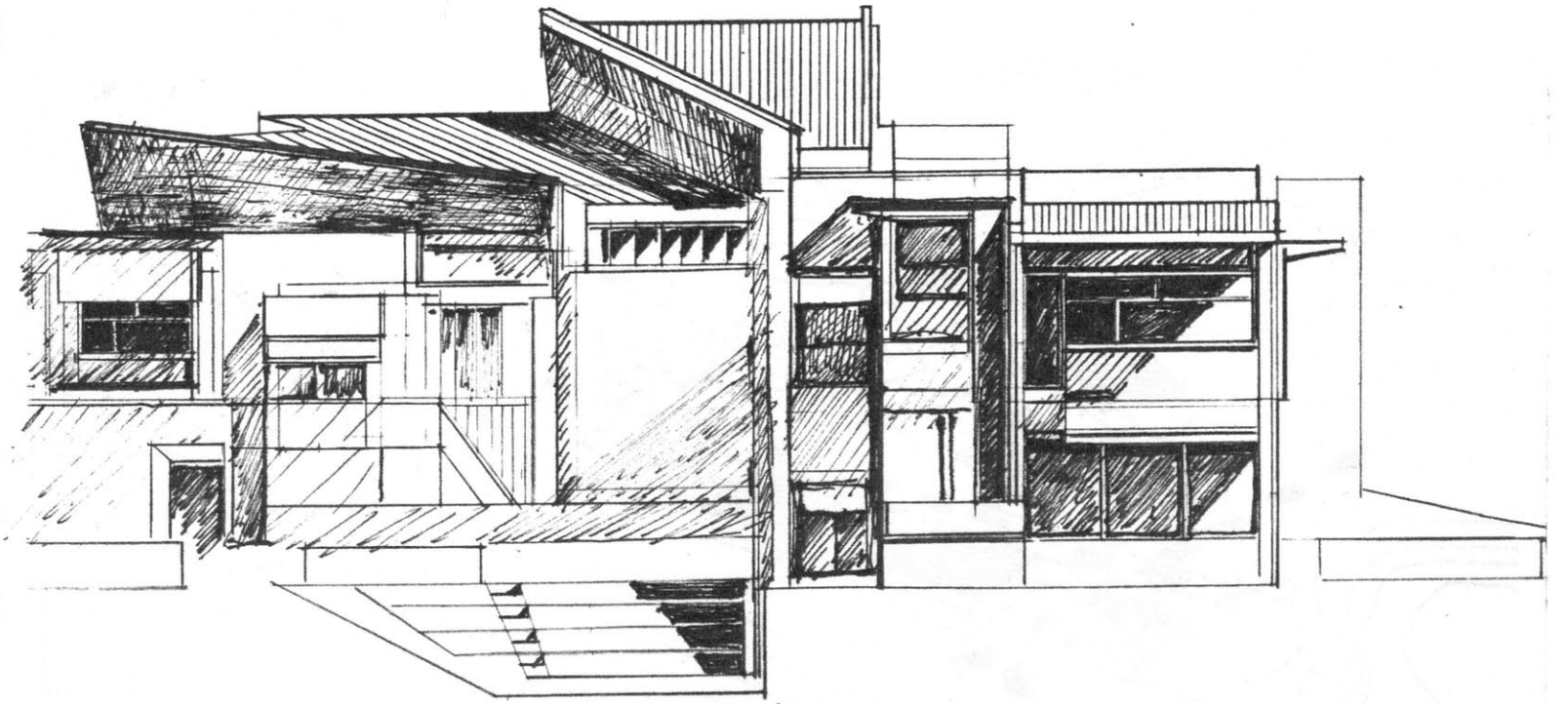
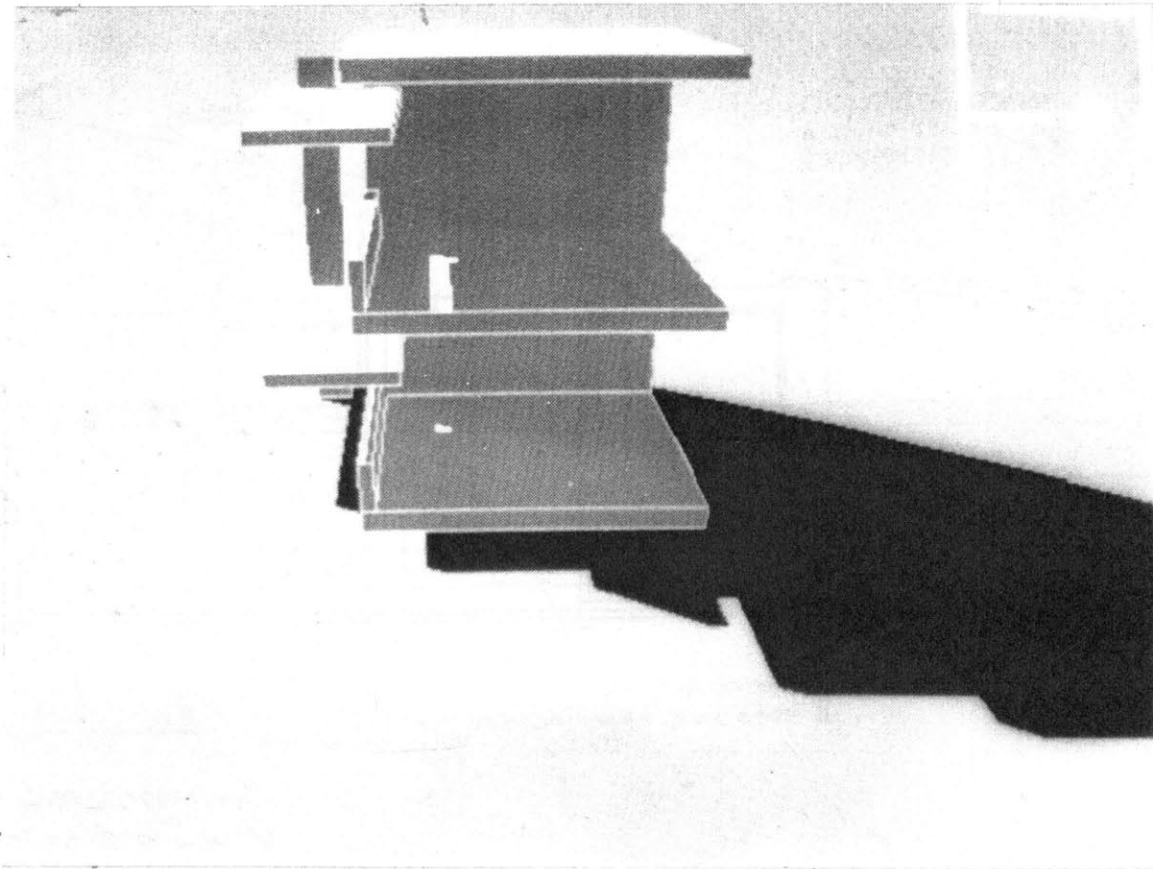
*Computer generated drawing and sketched over by hand*



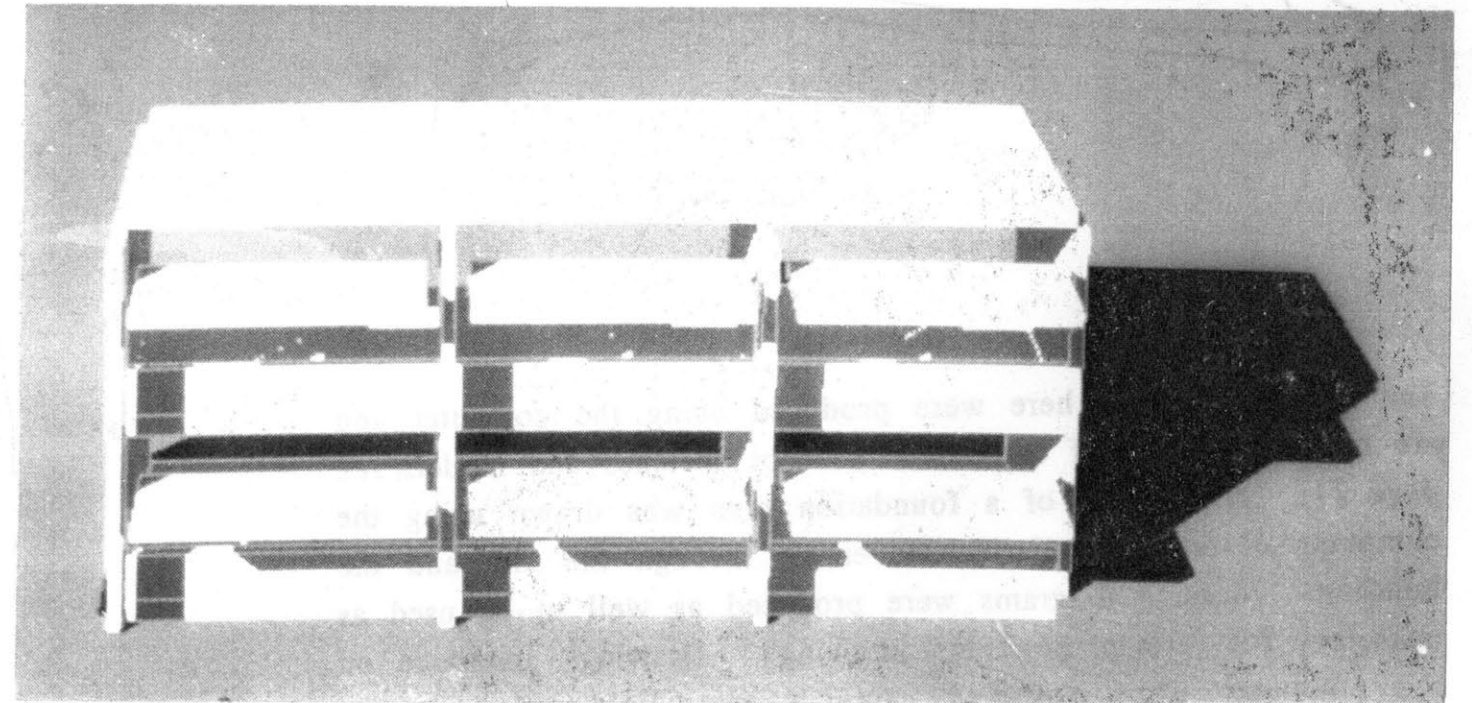


The drawings shown here were produced using the computer and are refined versions of the earlier concept sketches and models (see page 24). A diagram of a foundation plan was drawn using the computer in order to clarify movement through the site and the building. Massing diagrams were produced as well to be used as underlays for further conceptual drawings. Drawings generated on the computer were produced using a very light color pen to prevent distraction while sketches were made on overlays.



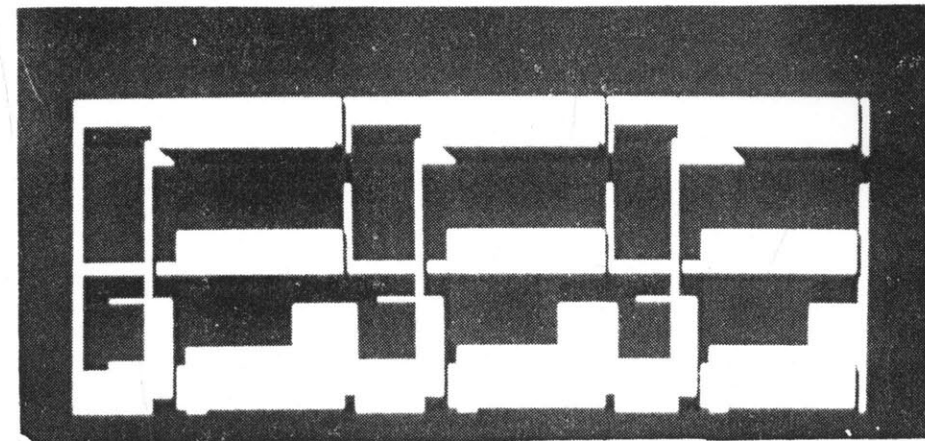
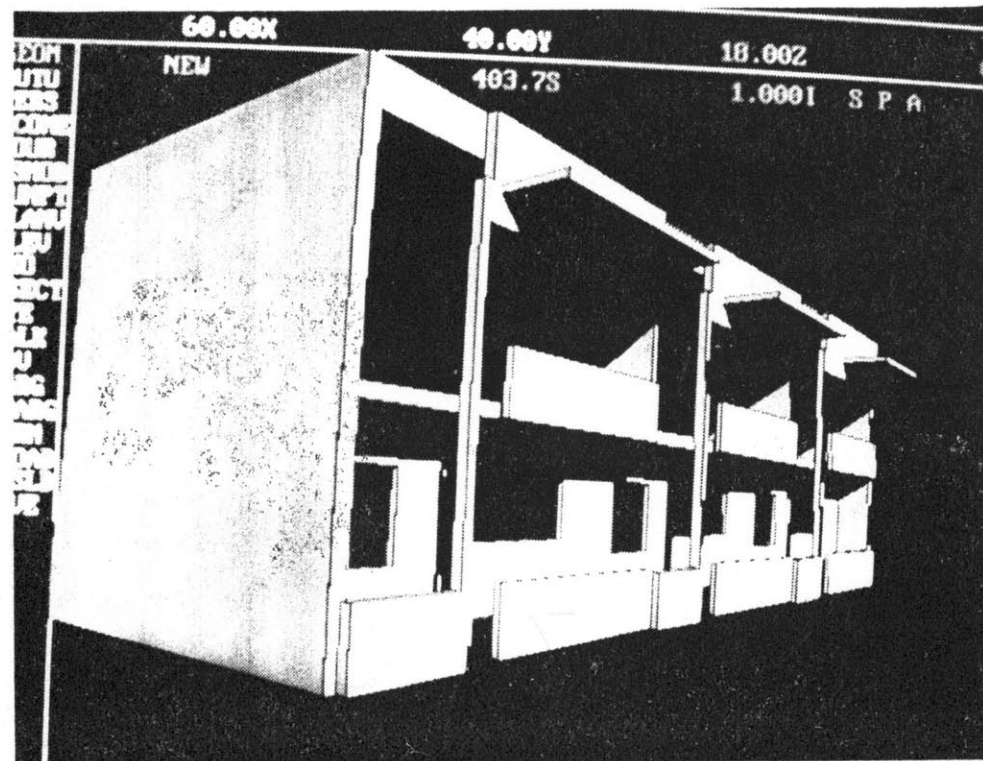
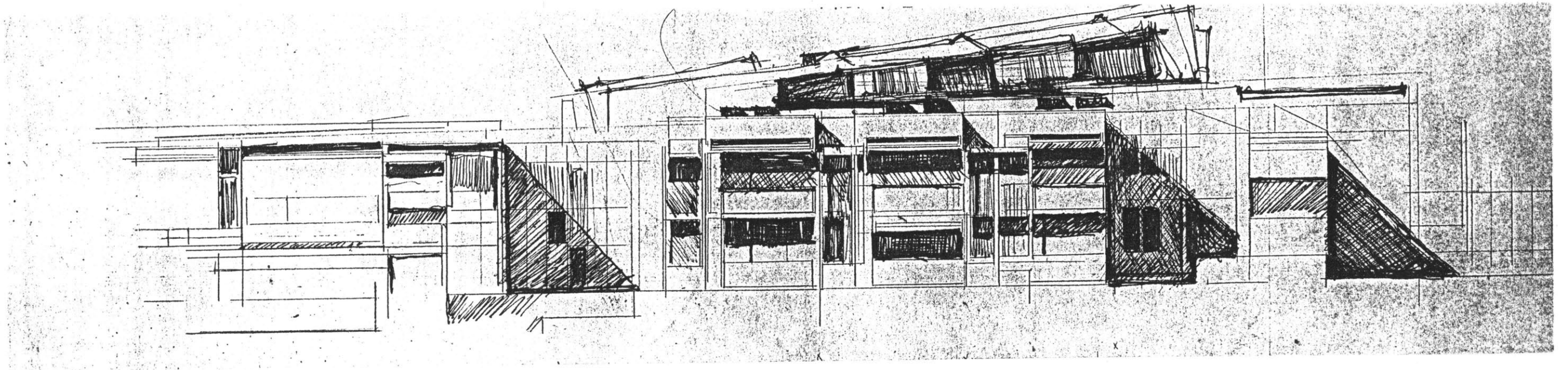


This series of images is part of an elevation study for the southeast side of the school. The computer was used to diagram several configurations in order to study sun angles on several different days. The goal was to maximize the view of the playing fields and beyond while reducing the amount of direct light in the classroom. The computer allowed for quick diagrammatic views and base drawing for further development of the design.





STUDIES OF SOUTHEAST ELEVATION

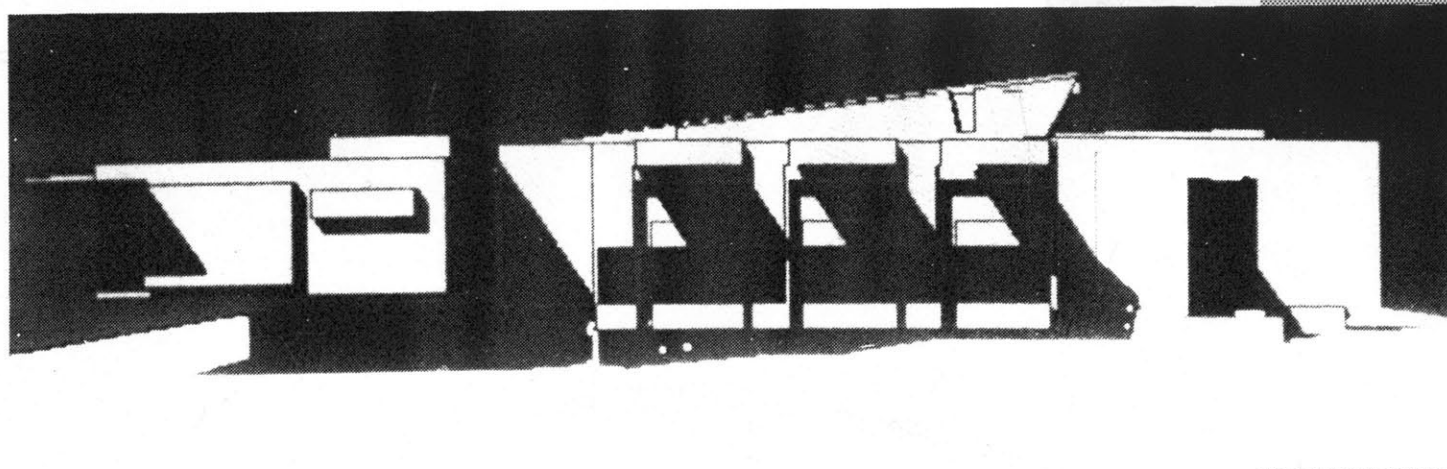
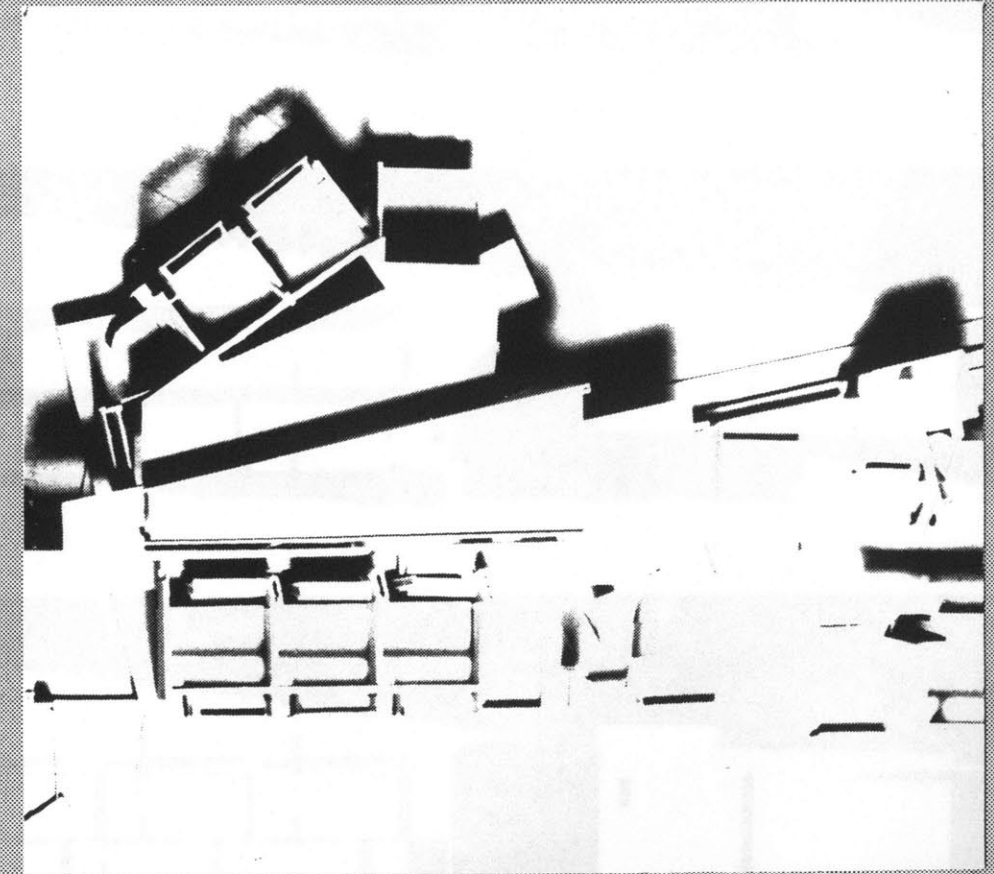




## SHADE AND SHADOW STUDIES

*“With him (Le Corbusier) representation becomes an exploration rather than a conclusive and authoritative depiction.”*

-Sibel Bozdogan



April 11, 11:00am

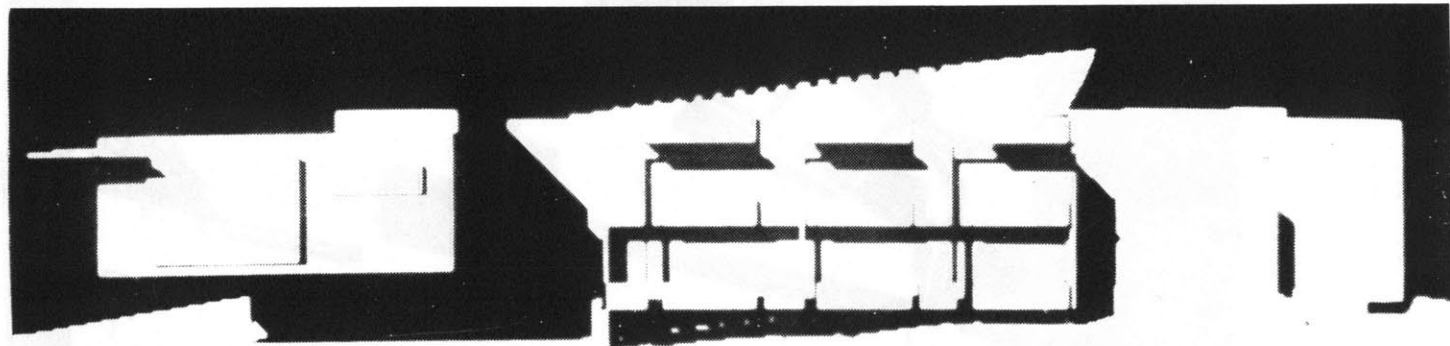
PROFILE ANGLE 56 BEARING FROM SOUTH 27





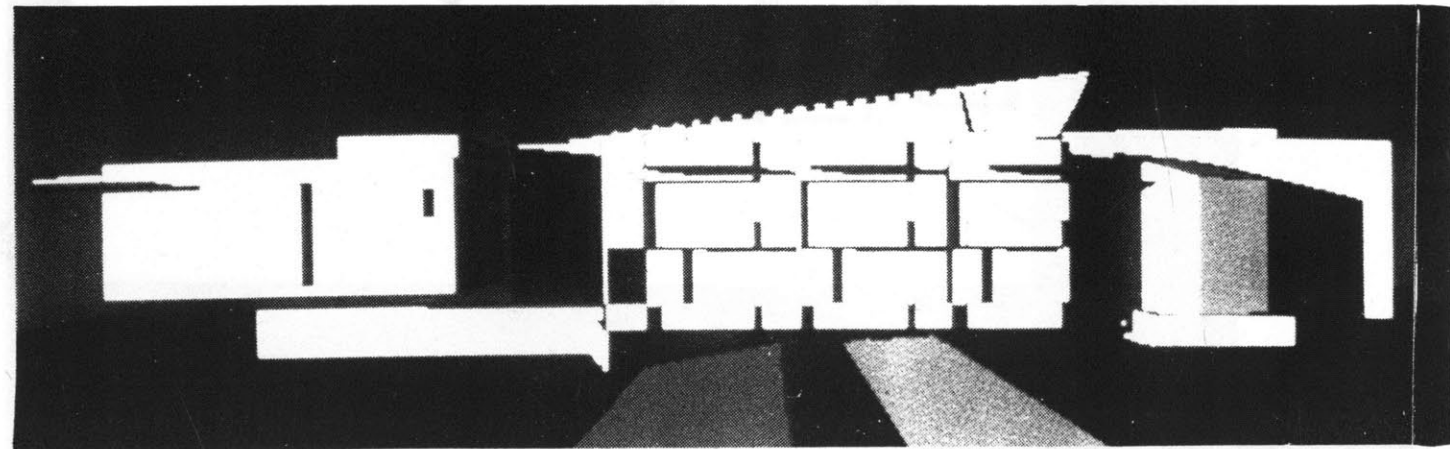
June 21,

PROFILE ANGLE 66 BEARING FROM SOUTH 71



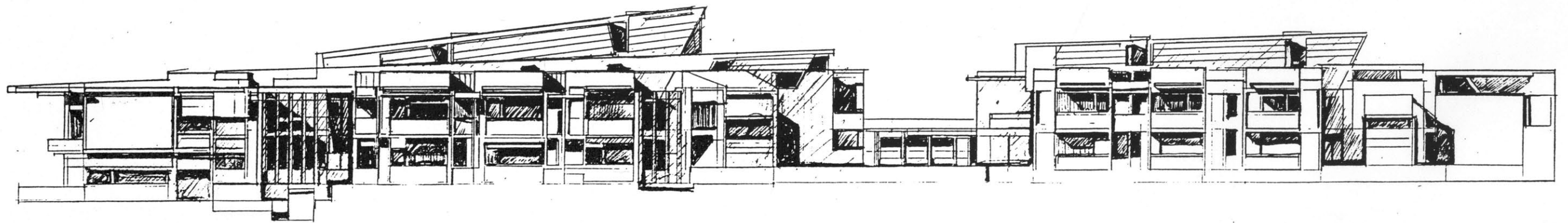
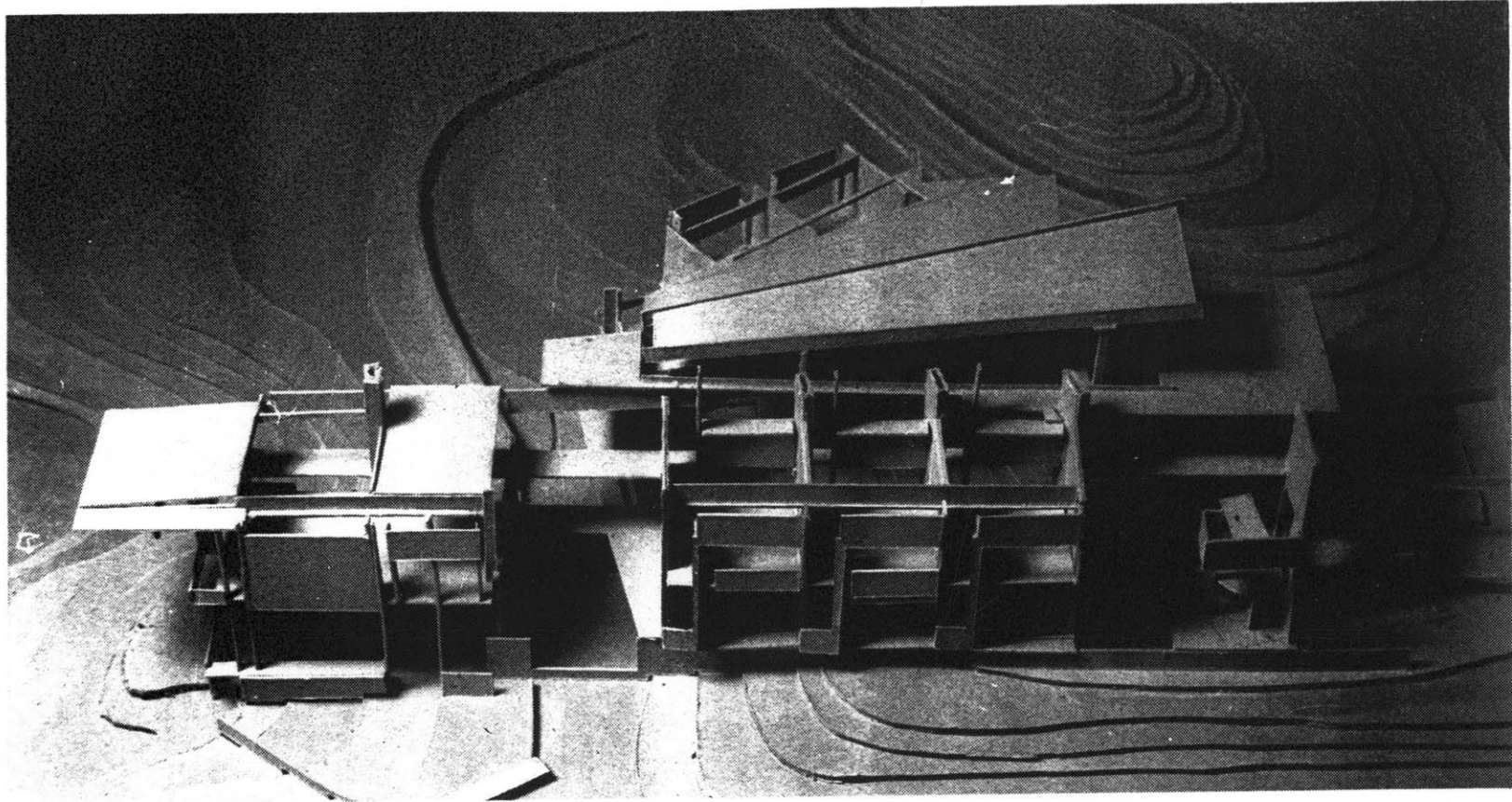
September 1.

PROFILE ANGLE 44 BEARING FROM SOUTH 77



December 1,

PROFILE ANGLE 6 BEARING FROM SOUTH 53

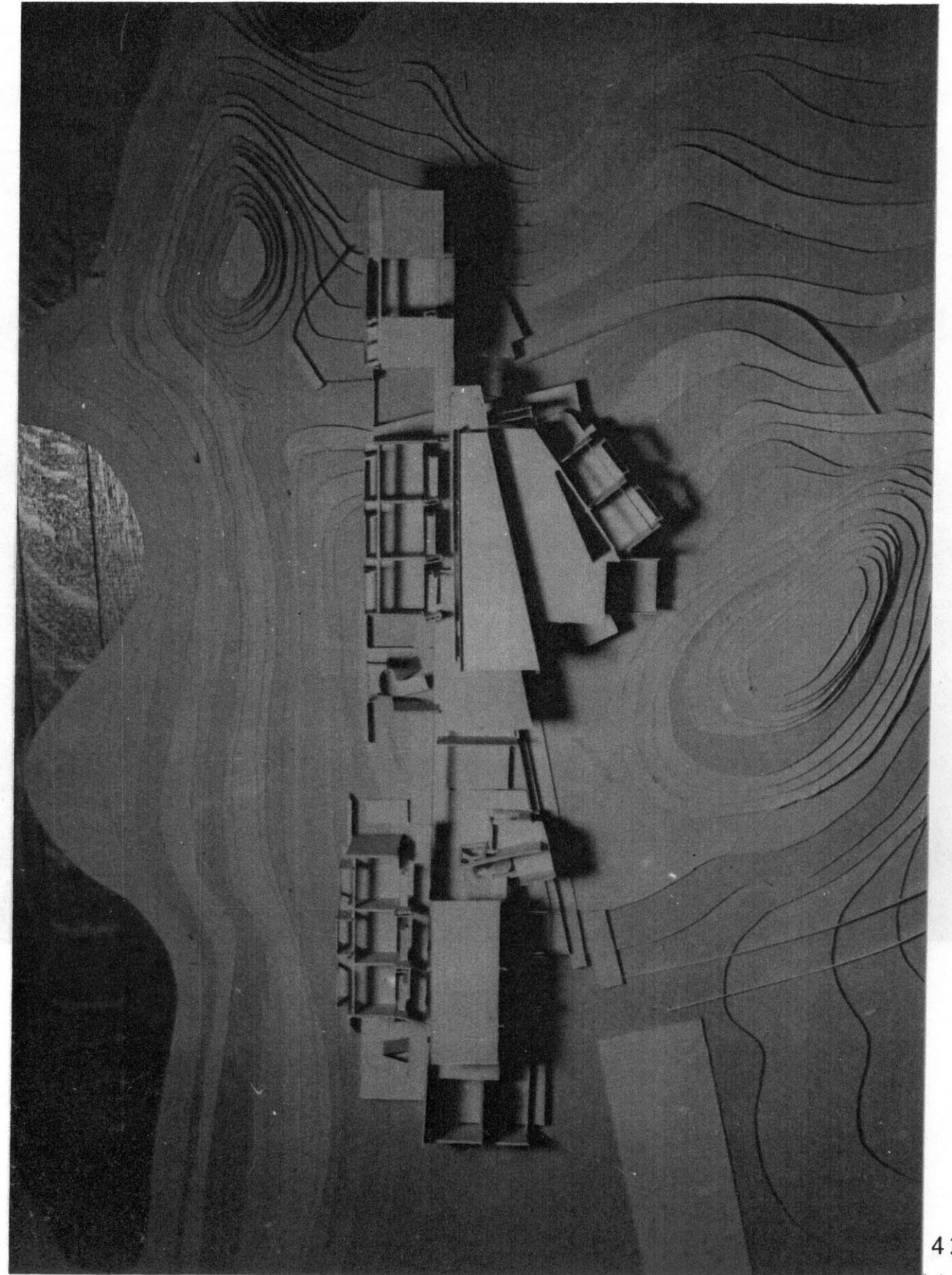


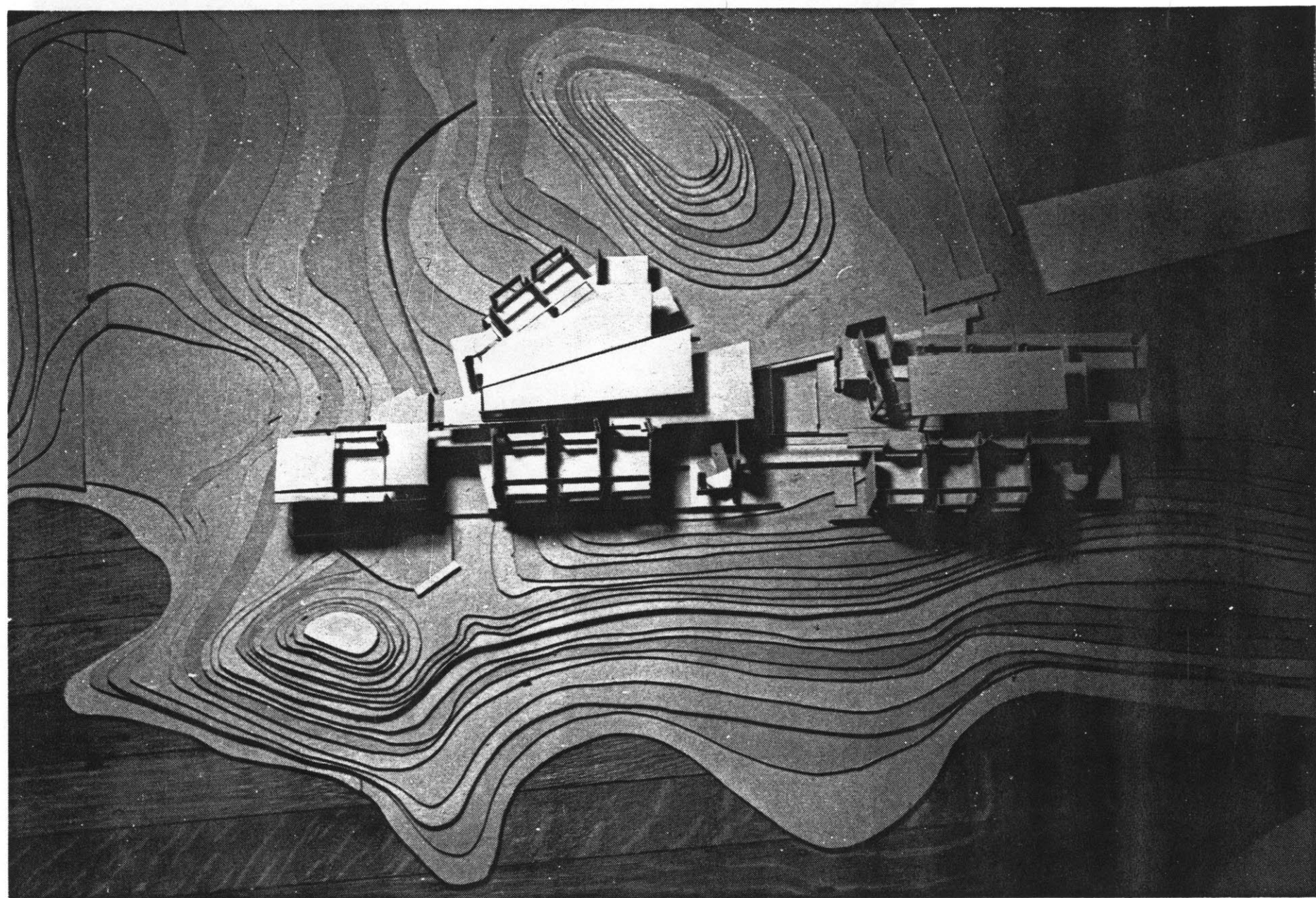
SOUTHEAST ELEVATION





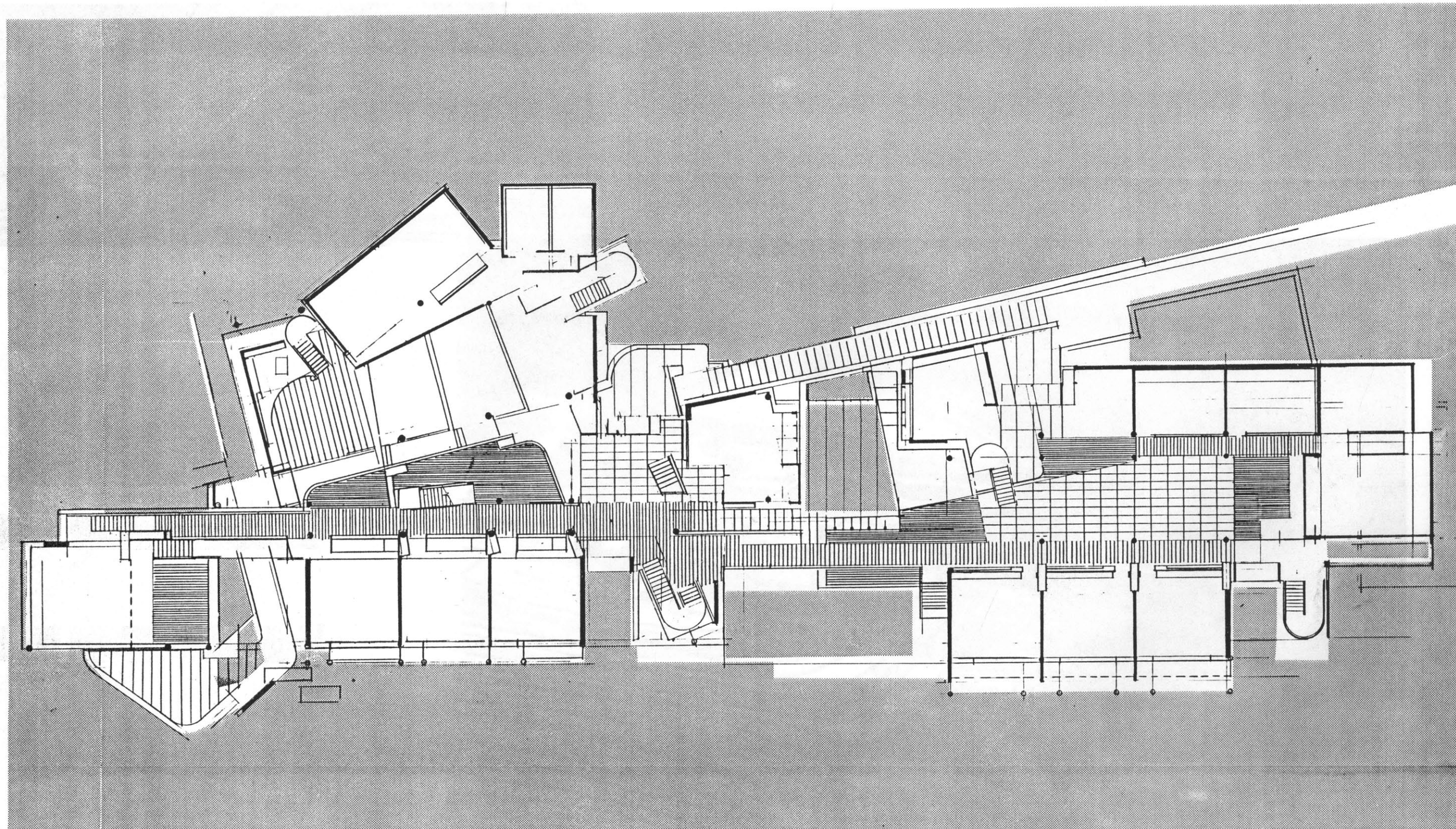
# THE FINAL DESIGN



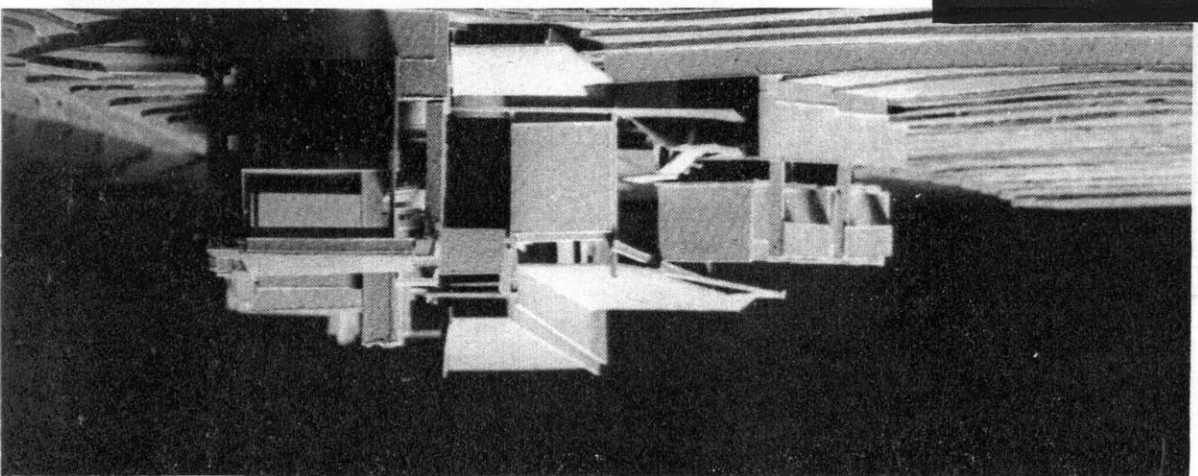
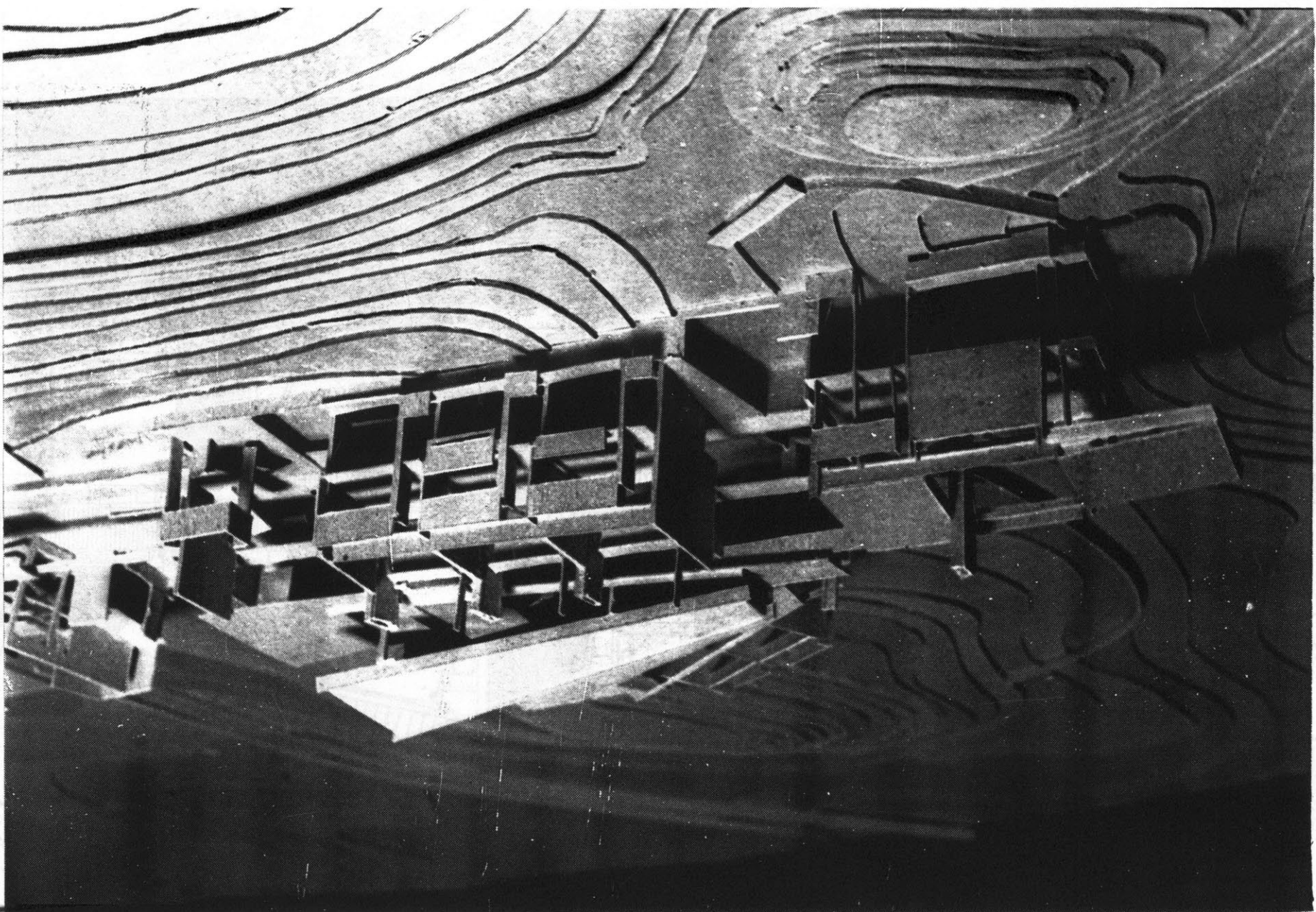


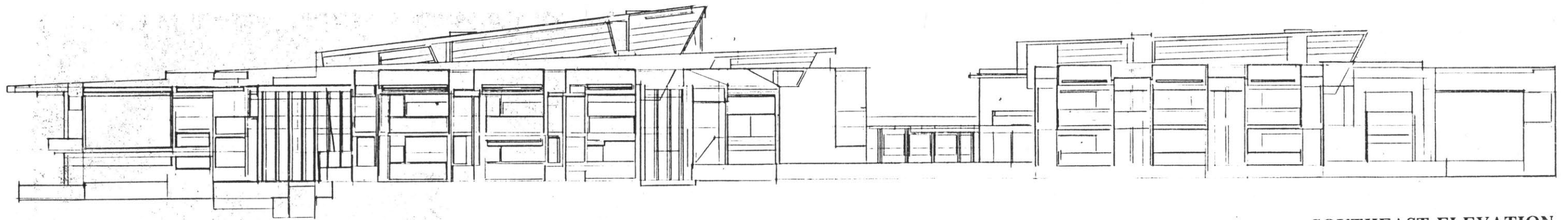


FIRST FLOOR PLAN

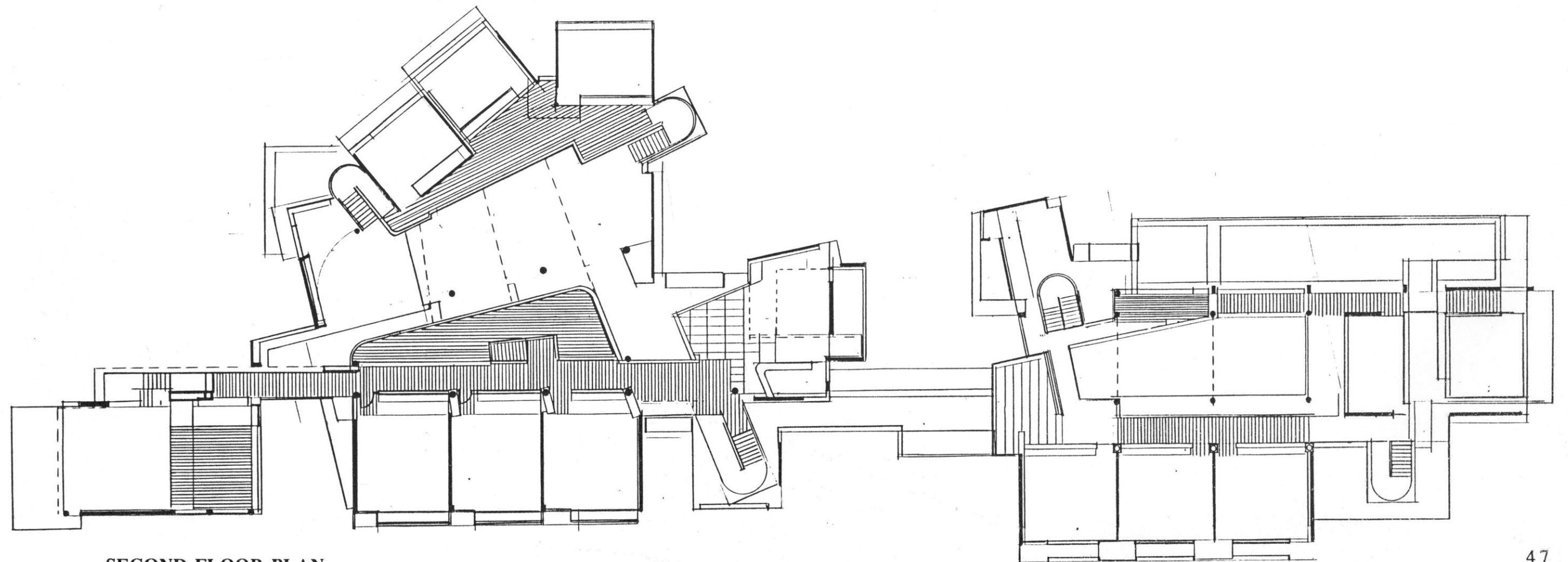








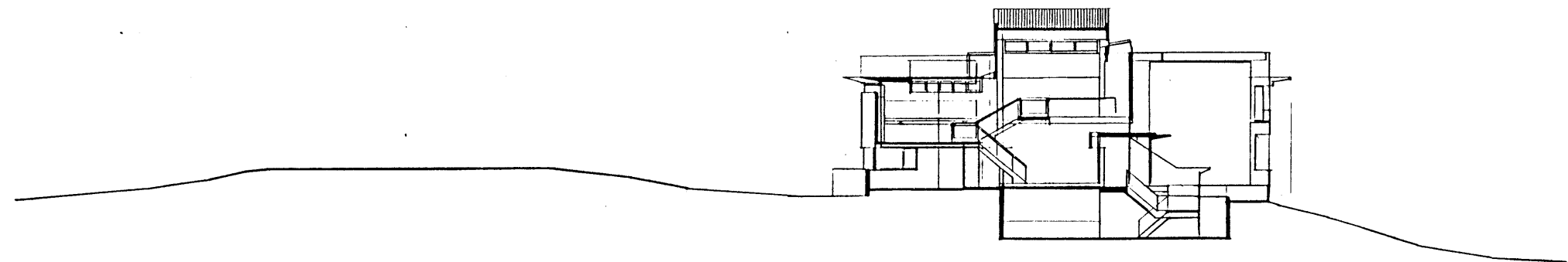
SOUTHEAST ELEVATION



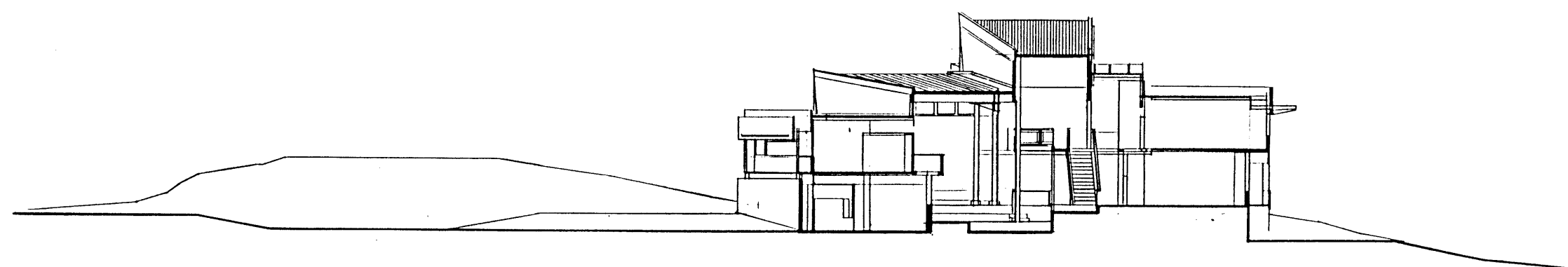
SECOND FLOOR PLAN



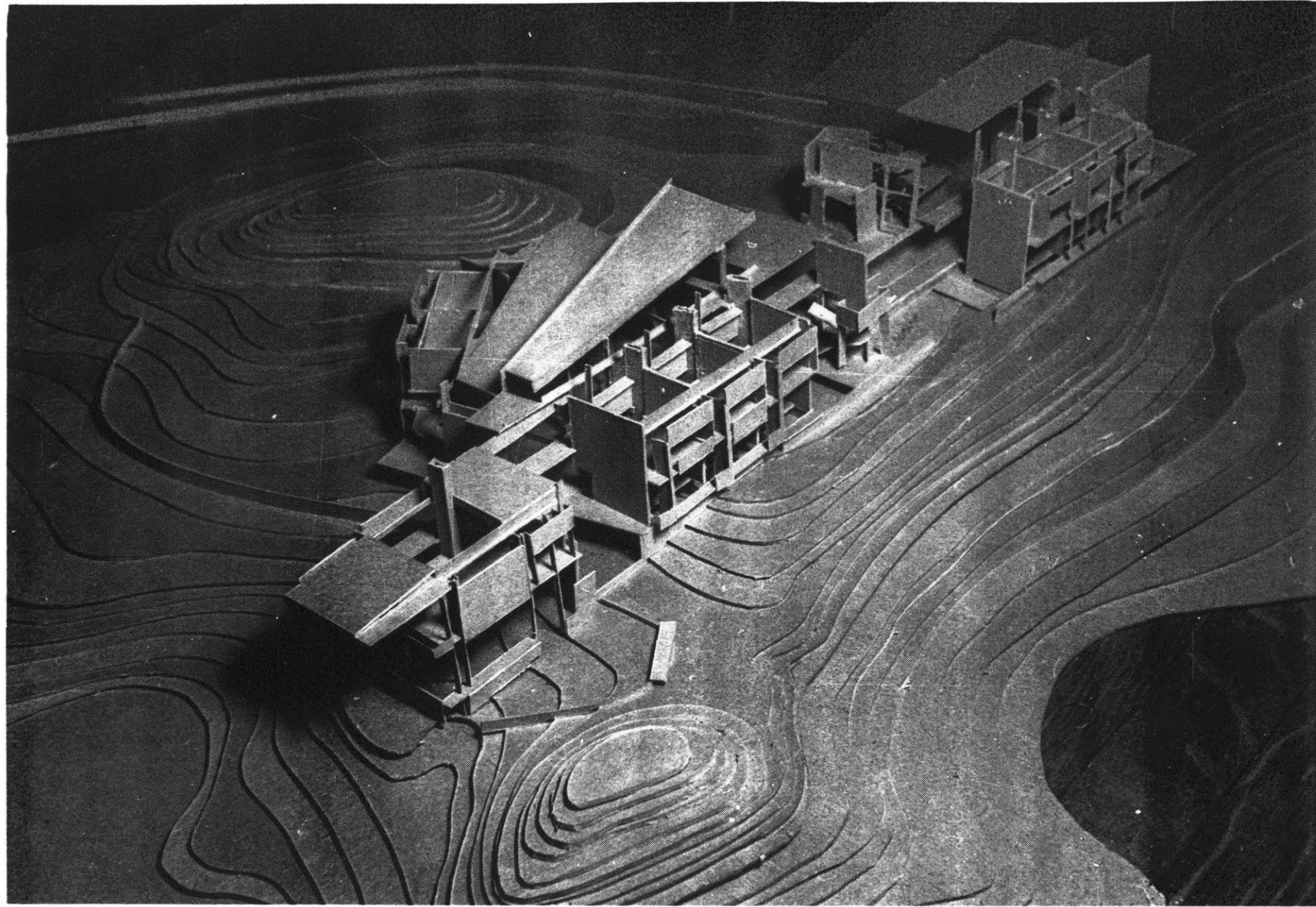


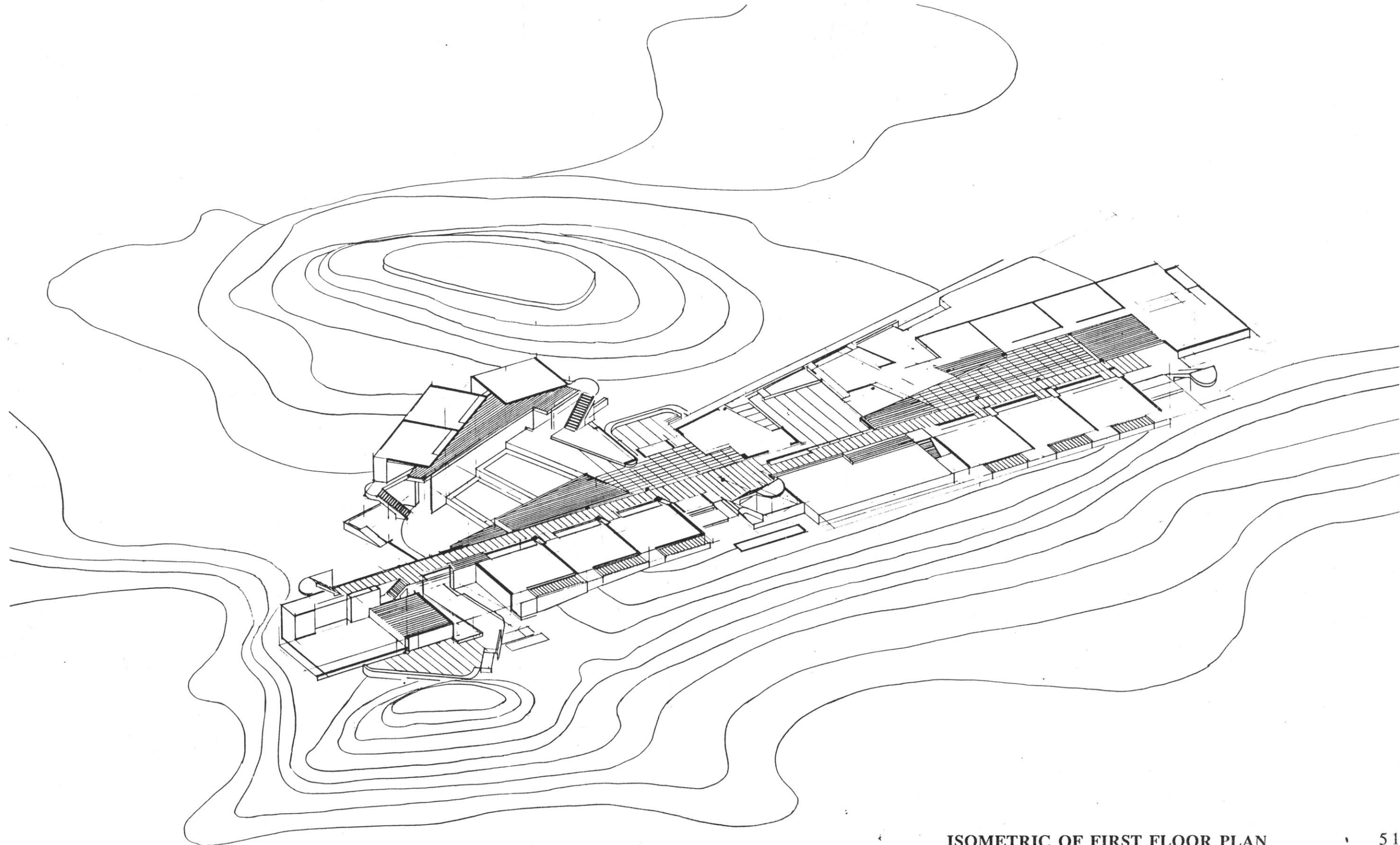


**SECTION A-A**



**SECTION B-B**





ISOMETRIC OF FIRST FLOOR PLAN



## SUMMARY OF DESIGN PROCESS:

### THE COMPUTER AS A DESIGN TOOL

In the development of the concept the computer only played a part in the representation of the concept and process references. In all of the references the concept and form of the buildings had largely been decided. In these references the computer was used as a tool to intensify whatever experience and information the existing drawings had to offer. In this capacity the computer offered a number of rapidly produced views, sections and wireframe diagrams.

The concept itself was developed independently of the computer. Because software packages available today do not have efficient sketch capabilities, concept models constructed on the computer often appear too stiff, and display few options or directions for further development. The concept for this thesis was modeled physically and diagrammed with sketches. These models were rich in texture and conveyed a multitude of ideas much more quickly and easily than virtually any other method of representation. This is not to say the task of developing a concept was simple: it was only the small scale representation that seemed to go quickly.

Making the concept into architecture is where using the computer is the most seductive. An architectural language and scale can be quickly applied in order to investigate the feasibility of some of the many ideas inherent in any concept. Often the software's strongest attribute is its worst enemy. The designer can easily be lulled into a false sense of security by the barrage of images available

to him or her. Often times images that appear a brilliant stroke of genius on the screen often can appear ridiculous or weak when modelled conventionally. In this step of the design process many of the conventional views such as sections and elevations offered the best representation of this thesis.

When a wire framed drawing on the screen is processed into solid image model only the outer boundaries of that solid are visible. There are no joints or brick coarses. There is just the continuous surface of the computer's rendering. These images can often possess a dialectical clarity and legibility of their own, particularly when they are shaded.

The form of the structure is obvious but other characteristics such as color and texture remain unresolved. The effect is very much the same if you spray-painted a physical model grey, your attention is immediately drawn to the overall form as an entity.

It is my experience that the effectiveness of the computer significantly decreases at this point due to the increasing complexity of the computer model. It is almost certain that this condition is bound to change with the advent of faster, more efficient computers. However, in the production of this thesis attention was turned to the drawings for finer details and texture. Computer generated drawings were used as under-lays for the final presentation drawings.





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