

Movement in the Fourth Dimension

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by  
thesis submitted to the faculty of the  
Virginia Polytechnic Institute and State University  
in partial fulfillment of the  
requirements for the degree of

Beverly A. Pearce

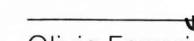
Master of Architecture

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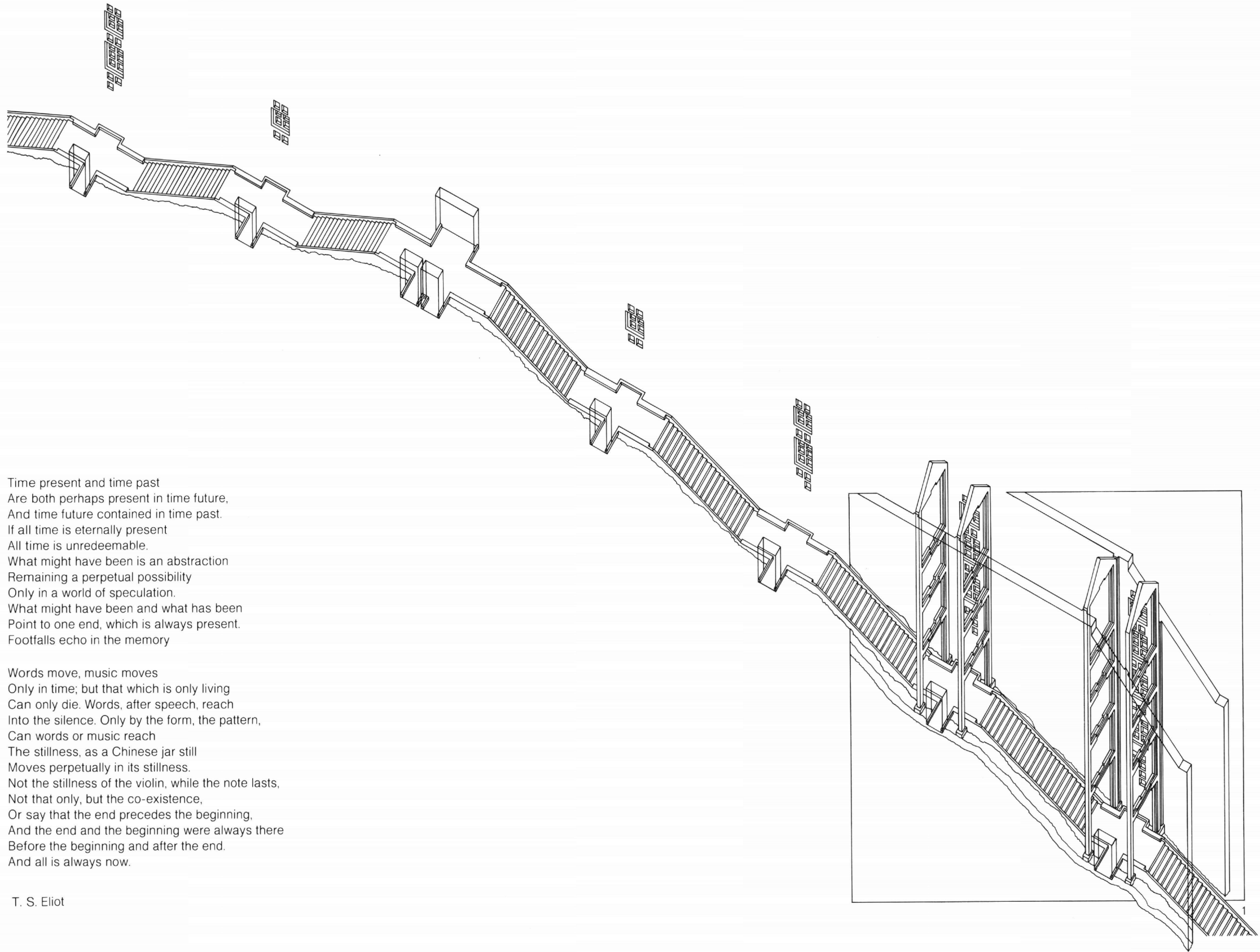
Blacksburg, Virginia

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abstract

a pause at the end of an architectural beginning  
a place to synthesize ideas and preoccupations  
a study of time and movement  
a design for a marginal world — the meeting of land and water





Time present and time past  
Are both perhaps present in time future,  
And time future contained in time past.  
If all time is eternally present  
All time is unredeemable.  
What might have been is an abstraction  
Remaining a perpetual possibility  
Only in a world of speculation.  
What might have been and what has been  
Point to one end, which is always present.  
Footfalls echo in the memory

Words move, music moves  
Only in time; but that which is only living  
Can only die. Words, after speech, reach  
Into the silence. Only by the form, the pattern,  
Can words or music reach  
The stillness, as a Chinese jar still  
Moves perpetually in its stillness.  
Not the stillness of the violin, while the note lasts,  
Not that only, but the co-existence,  
Or say that the end precedes the beginning,  
And the end and the beginning were always there  
Before the beginning and after the end.  
And all is always now.

T. S. Eliot

## introduction

In the late nineteenth and early twentieth centuries mathematicians, physicists, artists and philosophers accomplished the dissociation begun during the Renaissance with their Aristotelian tradition of constants and absolutes of a static reality. Enlarging upon the history of thought from the seventeenth and eighteenth centuries which had developed concepts of time with reference to space<sup>1</sup>, they rejected the Euclidean notion of three-dimensional geometry and identified a new reality in the conception of time as a fourth dimension, integral with the three dimensions of matter. Motion and change were the elements of this space-time reality and the struggle to understand and represent them produced a profusion of works. These developments

in the artistic and intellectual world were closely related to the mechanization of our physical world; technology enabled production to become automated, with the coordination of complex interrelated parts working toward an efficiency that facilitated and abridged labor. Everything was in motion.

The new medium of photography and various recording devices were used to freeze motion or to translate organic movement into graphic form.<sup>2</sup> In art the Cubists broke with their Fauvist and Impressionist beginnings by returning to representation of reality; not as the appearance of things or fragments of a given instance, but the representation of the 'conceptual totality of the intellect'. By this they referred to an object's totality in time. The fourth dimension was considered a product of the three physical dimensions and illustrated space eternalizing itself, representing the object's dynamism of becoming rather than its stasis of being. The aesthetic doctrines based on concepts of change and dynamics produced a new artistic form representing movement in its phases.<sup>3</sup> The Cubists wanted to create through painting an artistic form that would approach the purity of music; a form which contained no element of a particular object, but whose meaning unfolds through time.

The intellectual understanding of time also combined temporal and physical characteristics of matter into a space-time matrix. Hermann Minkowski, a German mathematician and physicist, saw coordinates within these four dimensions as having the capability of specifying a precise location for anything in time and space. His student, Albert Einstein, elaborated on the notion of four-dimensional matter and invalidated the assumption of space and time as absolutes through his theory of relativity. Only within a given inertial system could simultaneity be established; a different reality existed for systems in motion relative to the given system. Thus space was motion relative to a specific reference system.

Martin Heidegger later rejected this one-dimensional nature of time advanced by Leibniz and Einstein by identifying four dimensions in which time itself exists. The first three dimensions start with an understanding of time as a "reaching out that opens up (future), in which futural approaching brings about what had been (past), what has been brings about futural approaching, and the reciprocal relation of both brings about the opening up of openness (present)".<sup>4</sup> He described a fourth dimension as that which consists of the interplay of the first three dimensions of time toward each other. Heidegger dismissed the one-dimensional concept of time as a string of "nows", which assumes past to be the "no longer now" and future the "not yet now" or; time as now which "already disappears into the 'ago' and is already being pursued by the 'soon' ".<sup>5</sup> Time was for Heidegger inextricably bound to other existence; time was not a thing, but by passing away constantly, remained as time — without being something temporal like beings in time. Thus, being and time, determined each other reciprocally.<sup>6</sup> The notion of 'movement in space' was then obsolete as matter, or existence, became an indivisible unity which consisted of pure energies in constant mutual transformation.<sup>7</sup>

<sup>1</sup>most notably Gottfried Leibniz, who concluded that time is conceptually, but not physically coordinate with space; space being the order of co-existence and time the order of succession.

<sup>2</sup>Eadweard Muybridge, E.J. Marey and H.E. Edgerton used photography to study and record motion. Frank W. Gilbreth invented the cyclograph to measure movement through space.

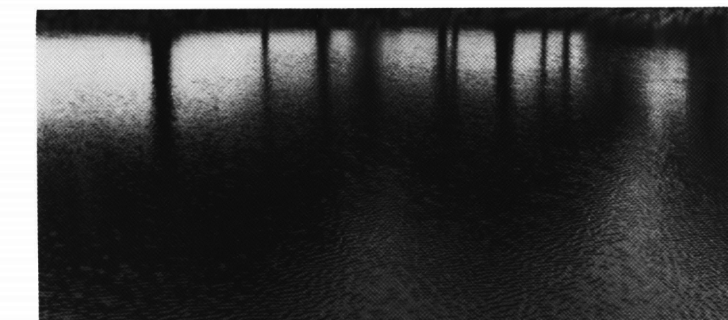
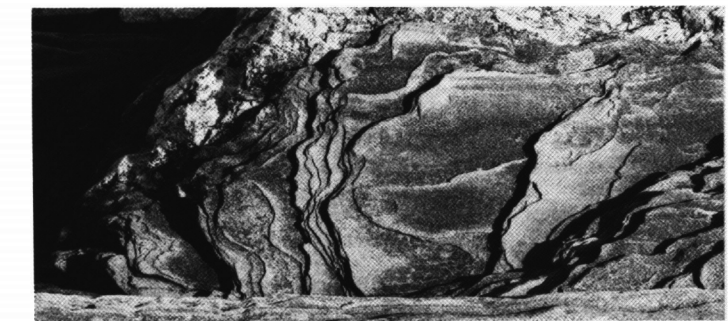
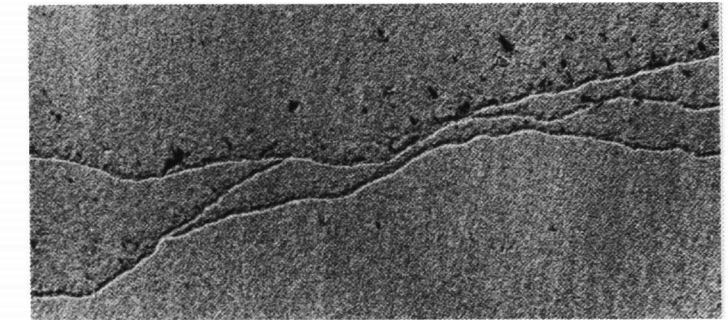
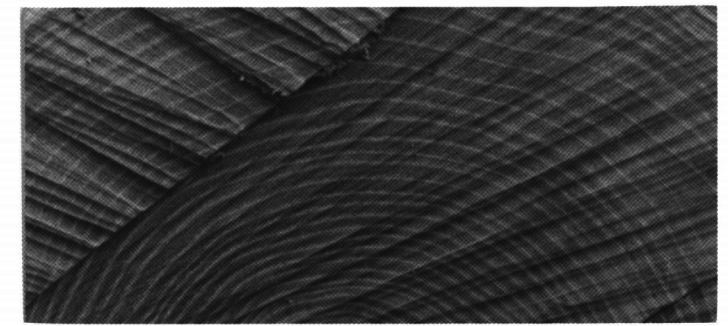
<sup>3</sup>in Marcel Duchamp's words; "A picture is not a painting but an organization of kinetic elements — an expression of time and space through the abstract presentation of movement."

<sup>4</sup>Martin Heidegger, *On Time and Being*, (Chicago, The University of Chicago Press, 1972), p. 15. Parenthesis added.

<sup>5</sup>Ibid., p. 11.

<sup>6</sup>Ibid., p. 3.

<sup>7</sup>Alexander Dorner, *The Way Beyond Art*, (New York, Wittenborn, Schultz, Inc., 1947), p. 105.



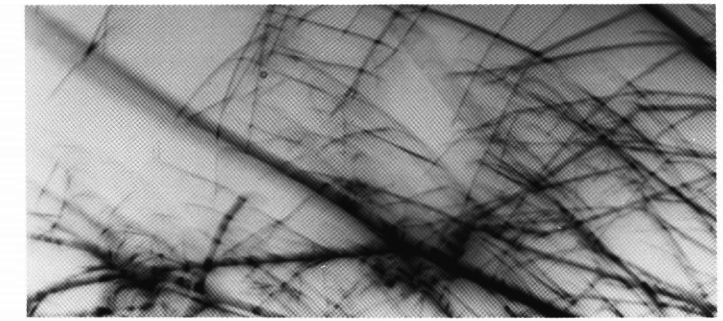
"Movement and rest distribute themselves in our surroundings not according to the hypotheses which our intelligence is pleased to construct but according to the way we settle ourselves in the world and the position our bodies assume in it."<sup>1</sup> Merleau-Ponty's phenomenological approach assigns priority to the human awareness of our place in time and contributes to the understanding of the means by which our physical surroundings affect our sense of aesthetics. The essential characteristic of life in terms of our physical existence is movement and transformation, and the fundamental law of dynamics in our environment is rhythm. Our corporal condition functions with the rhythms of respiration and blood circulation and our physical surroundings are ordered through cycles of days, seasons, and lunar phases. The method of ordering our lives in repetitious patterns is a natural consequence of this rhythmic consciousness.

Our standard of aesthetics is based on a human desire for order and predictability, but one which at the same time provides interest through the imposition of variations on a theme. The performing arts, most notably music and dance, are examples of how these standards fulfill our intuitive needs; the audience derives meaning from patterns as they unfold through time and space. The total consists of parts which have separate functions, but are interdependent, just as our muscles collaborate within a single motor movement. Therefore the first standard, rhythm, produces an efficient function of parts, and the second, variation, a beauty derived from the need to avoid purely mechanical regularity. The deviation from the predictable pattern should not, however, be a random motion made for the sake of variation, a condition which often results in chaos. Instead, it should be a new articulation of a more complex set of rules. This standard of aesthetics is, for me, the same which governs the visual organization of architecture.

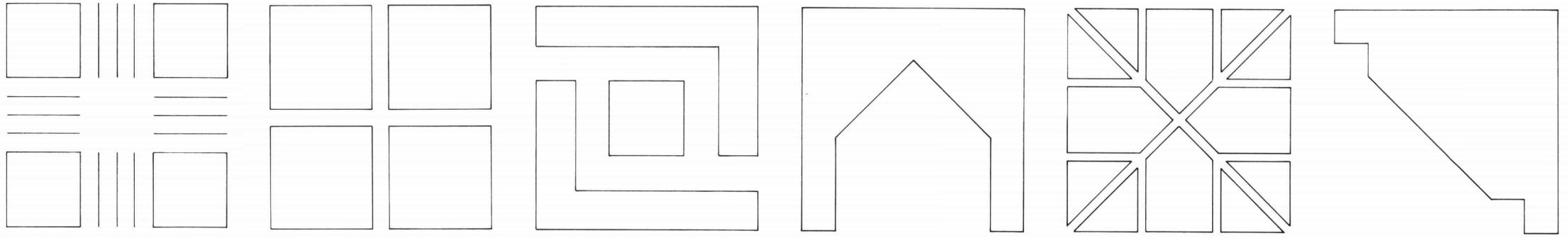
<sup>1</sup>Maurice Merleau-Ponty, *Sense and Non-Sense*, (Evanston, Northwestern University Press, 1964), p. 52.

"Architecture is the manifestation in form of the order of our experience. It is a model of our consciousness, the fitting of ourselves between the earth and the sky, the patterns in which we relate one to another and the physical presence of our institutions."

Louis I. Kahn



language



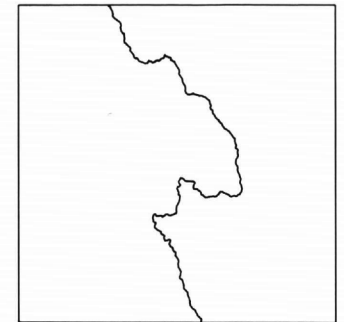
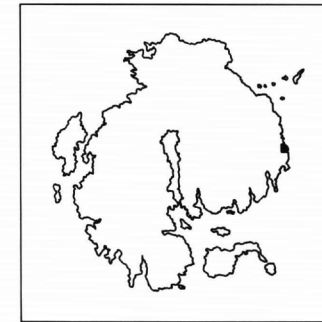
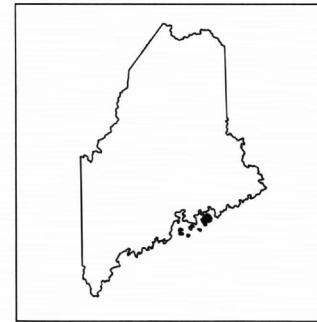
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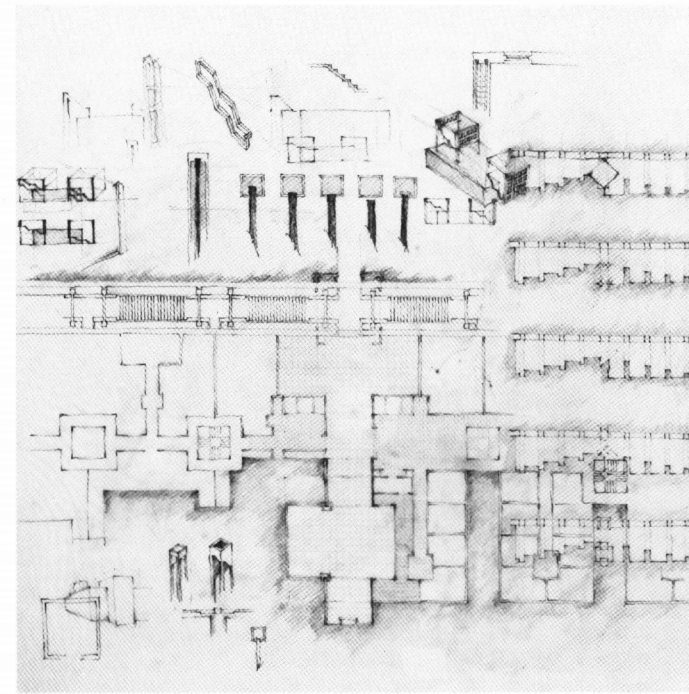
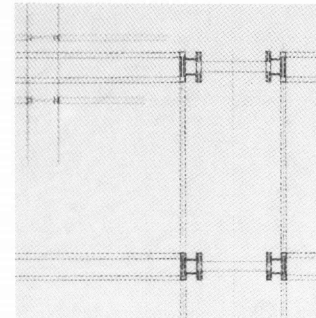
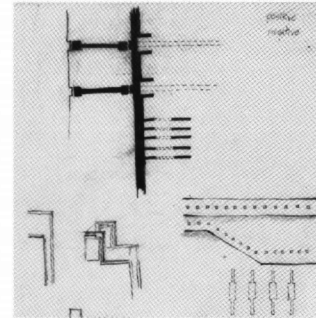
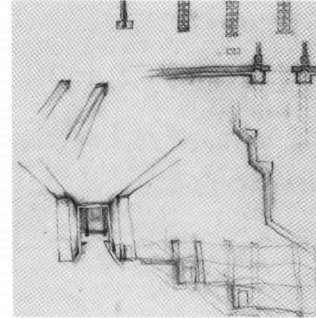
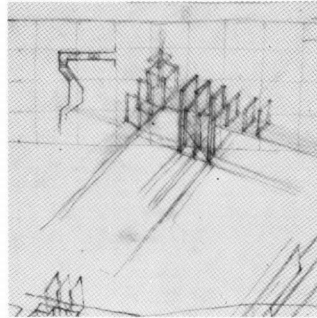
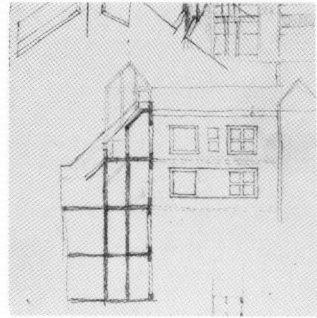
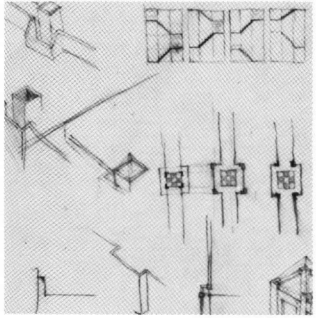
marine biology laboratory and housing complex

Due to evolution in an environment of nearly constant temperatures, pressures and salinities, marine life provides simple, reproducible biological systems, ideally suited for basic investigations into human biology and medicine. The sea is also an invaluable resource for diverse biological forms and biological development elsewhere unavailable. Marine laboratories are repositories of significant scientific and technical knowledge and provide essential opportunities for the study of these resources; they also are indispensable in developing a general understanding of the role of the sea in human affairs and the impact of society on the marine environment. To facilitate this study of marine life, an architectural connection is made at the elusive boundary of the water's edge.

site

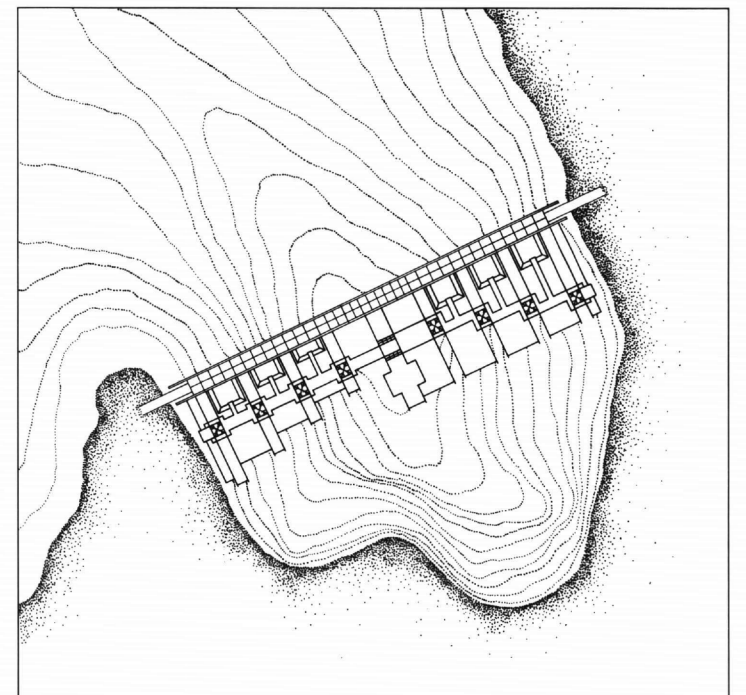
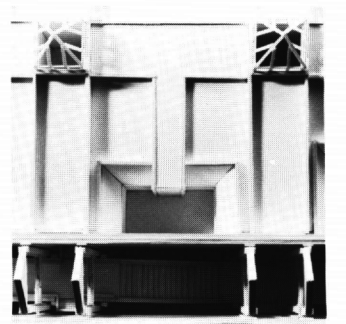
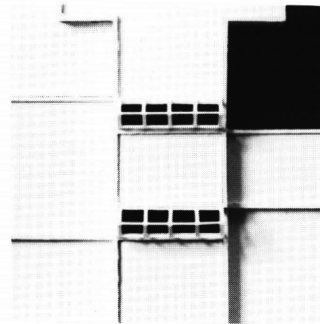
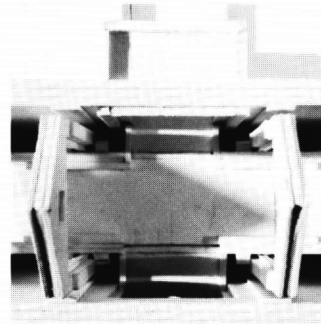
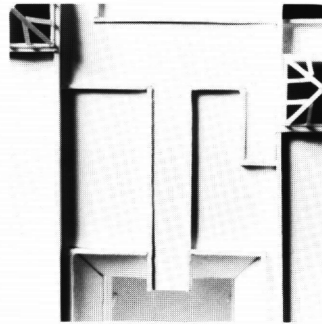
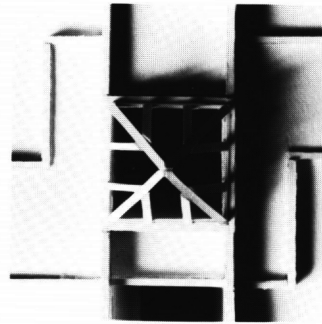
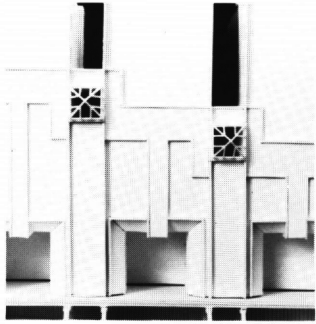
A peninsula of rock projects into the Atlantic, separating the ocean surf from a small insulated sand beach harboring stiller water and bordered on its far side by a grove of birch trees. A physical connection is proposed using a stair to link the two types of water, providing access to the aquatic worlds longitudinally and to the housing and research facilities transversely.

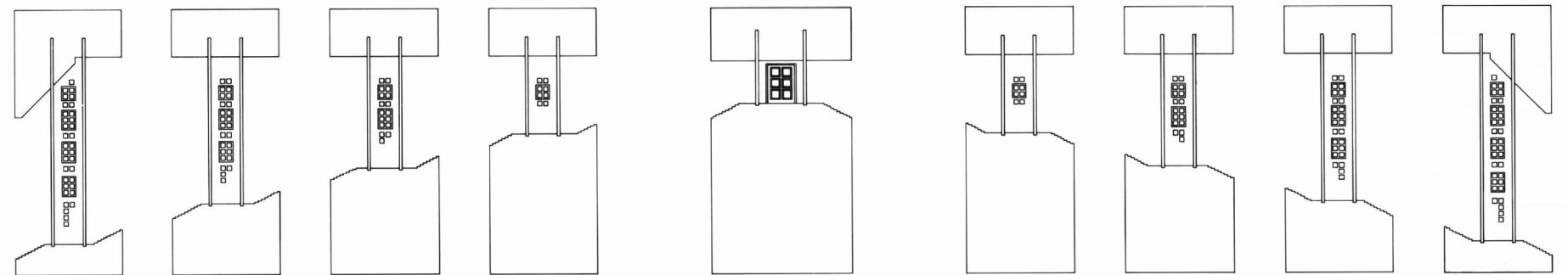
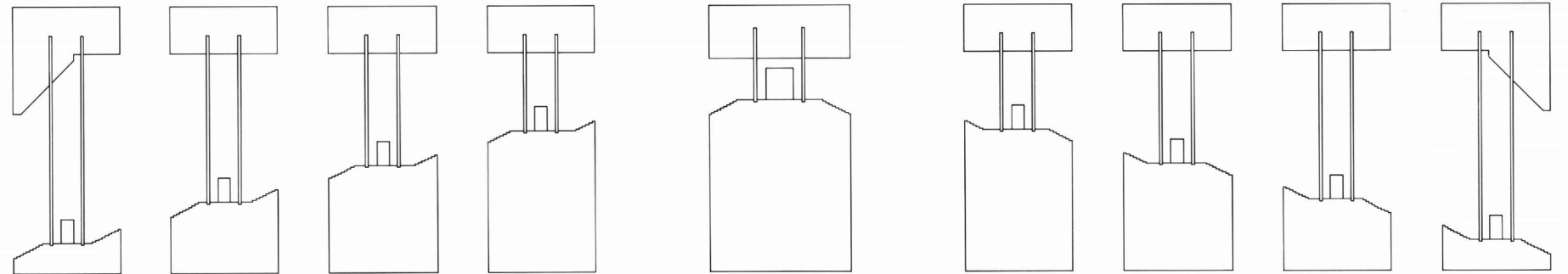
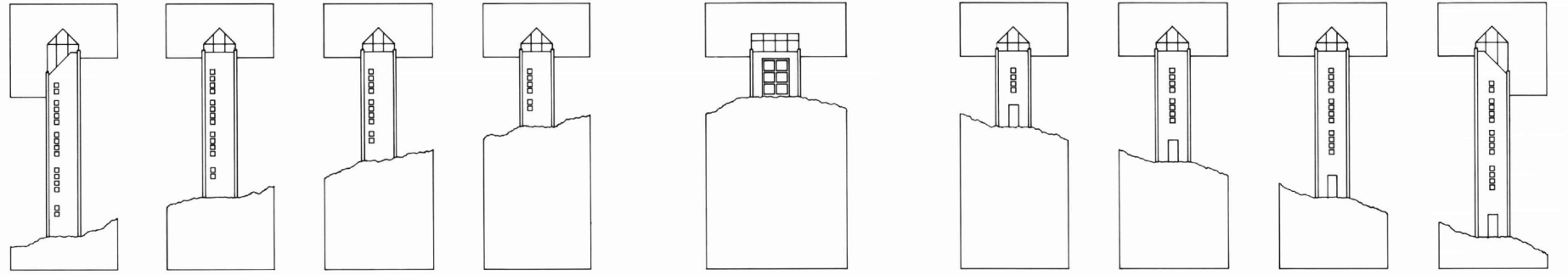


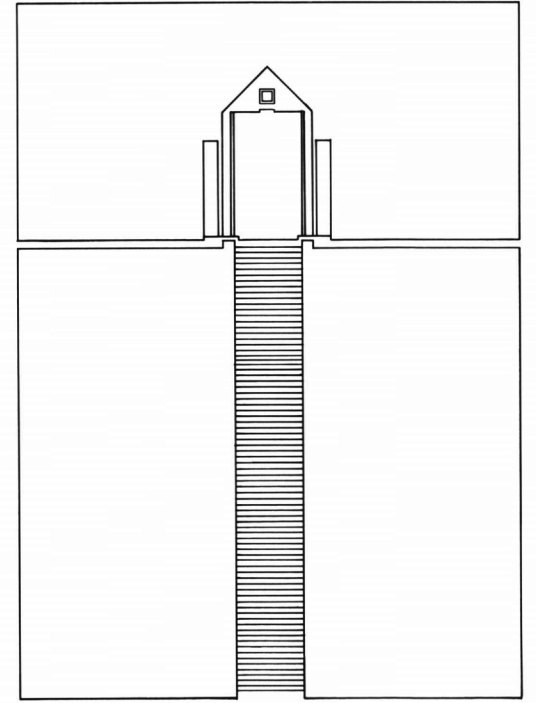
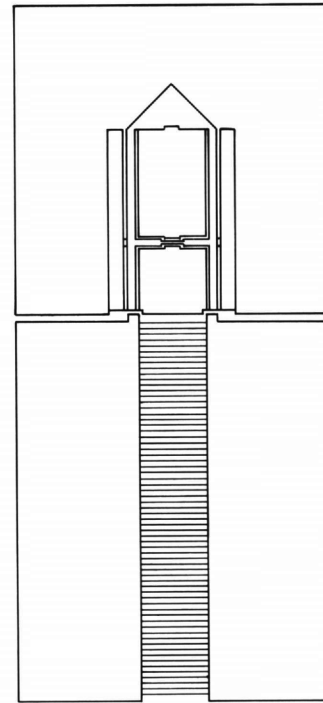
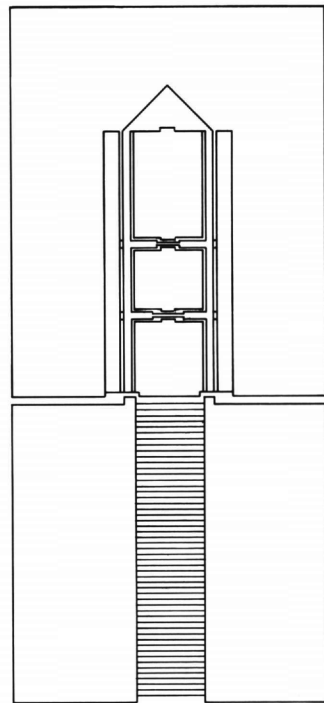
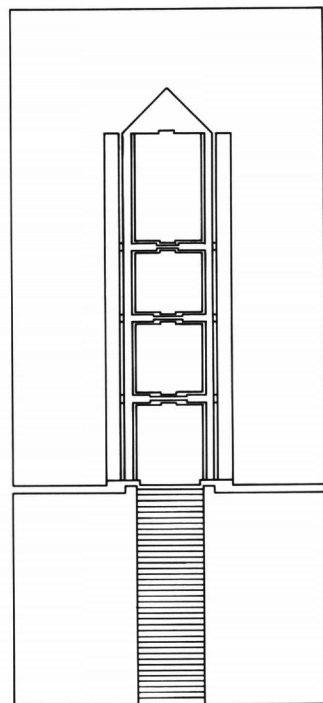
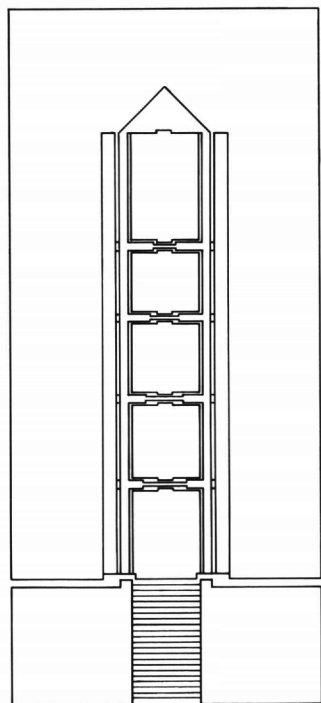




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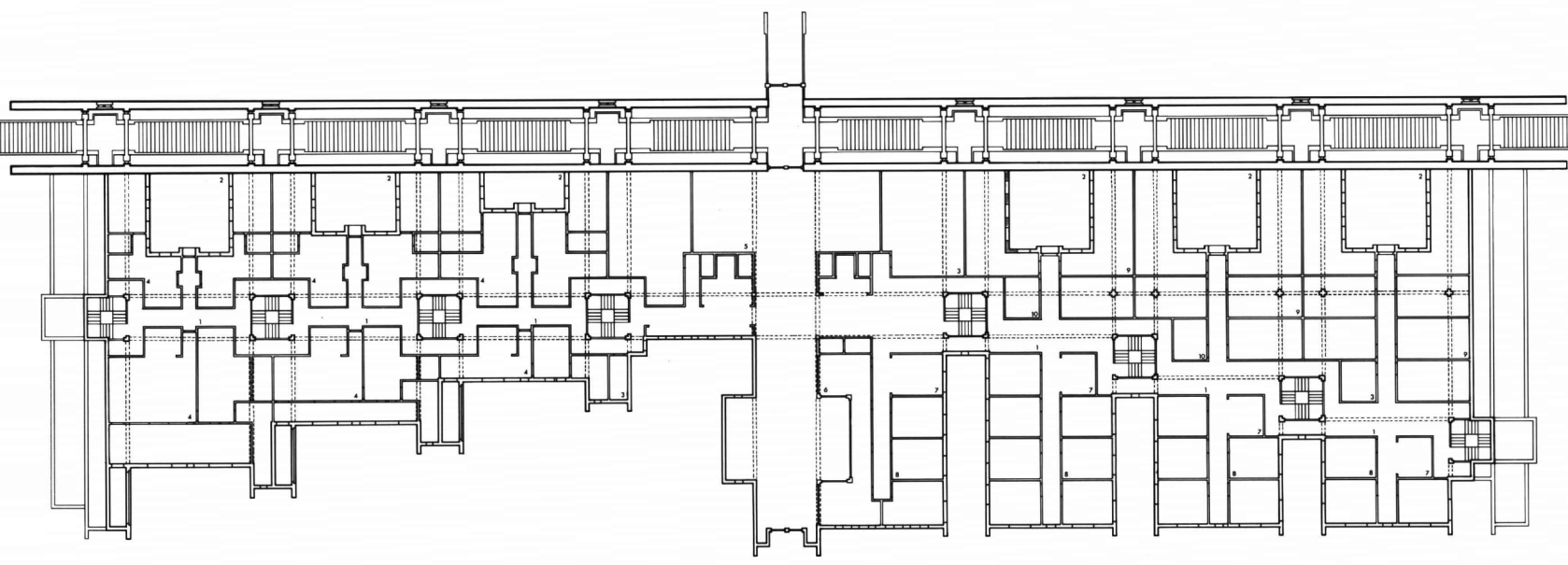




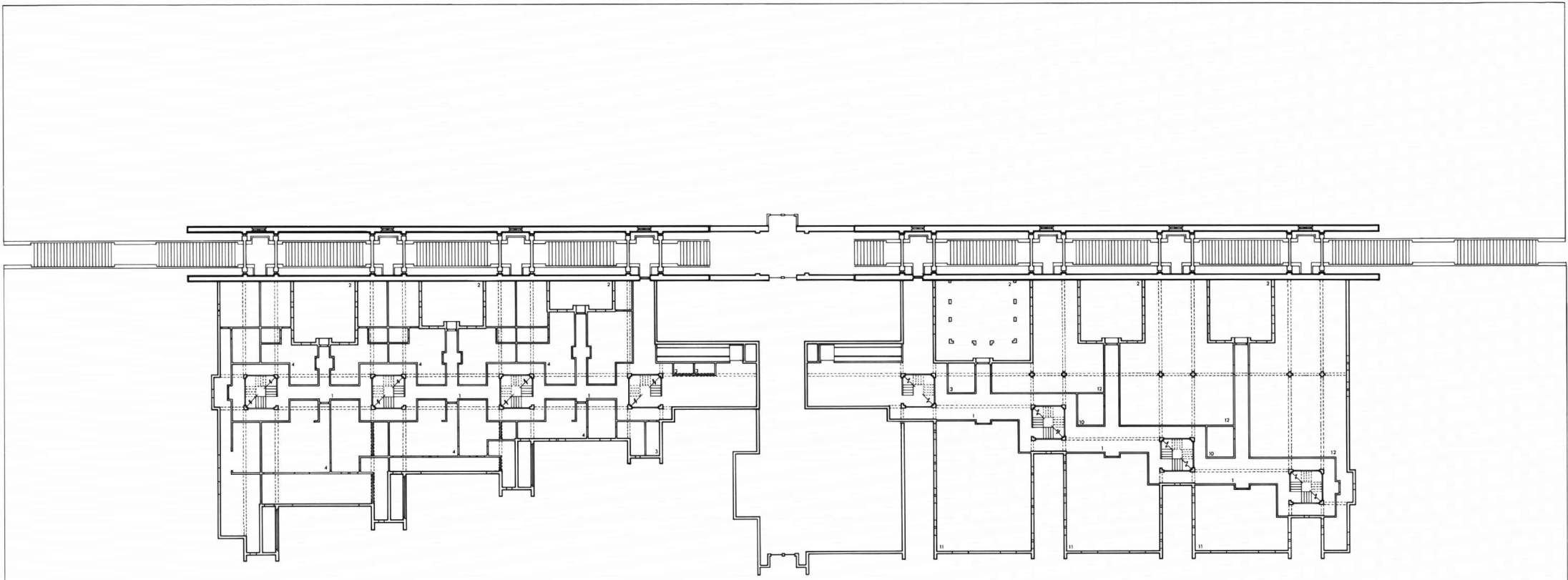
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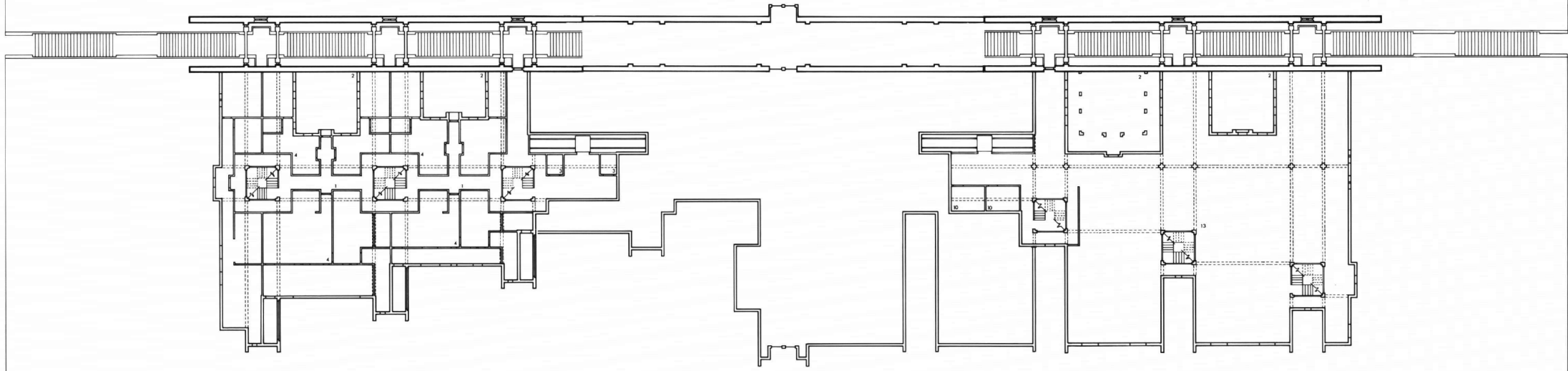
- 1 circulation
- 2 courtyard
- 3 storage
- 4 housing
- 5 lobby
- 6 aquarium
- 7 clerical
- 8 office
- 9 private laboratory
- 10 restroom
- 11 classroom
- 12 student laboratory
- 13 library
- 14 metal shop
- 15 wood shop
- 16 darkroom
- 17 marine resources
- 18 boat maintenance
- 19 scuba storage



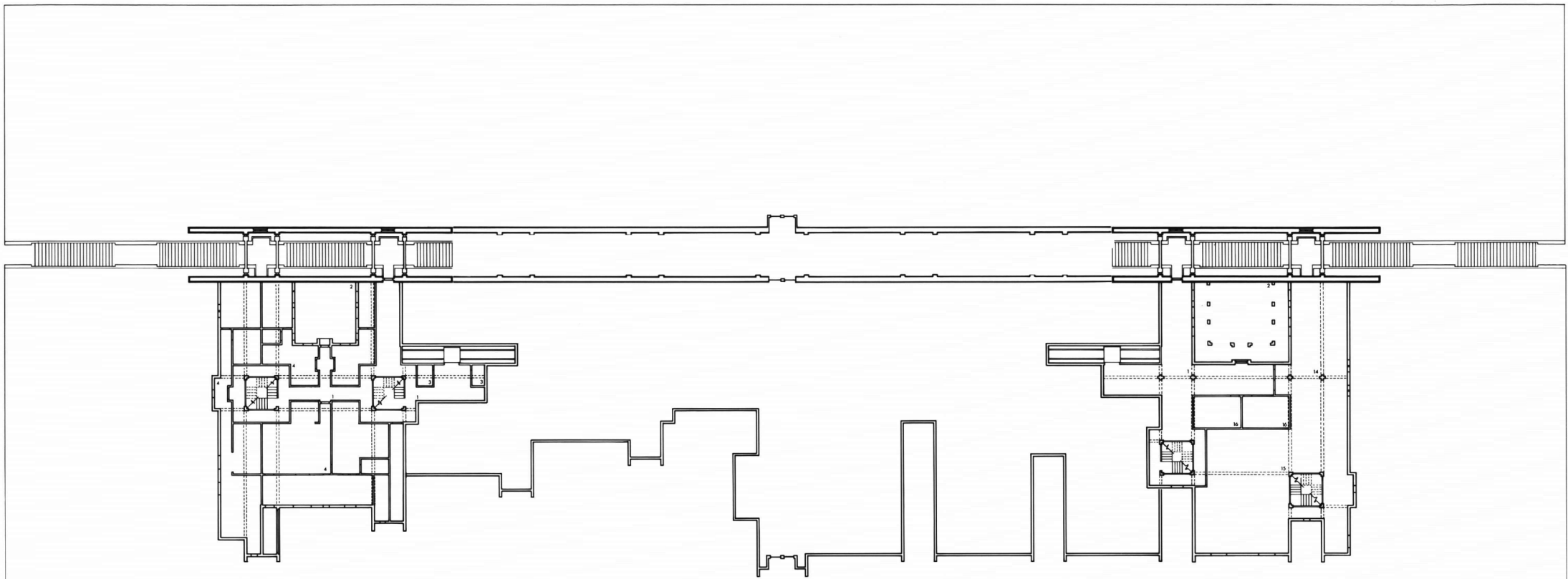
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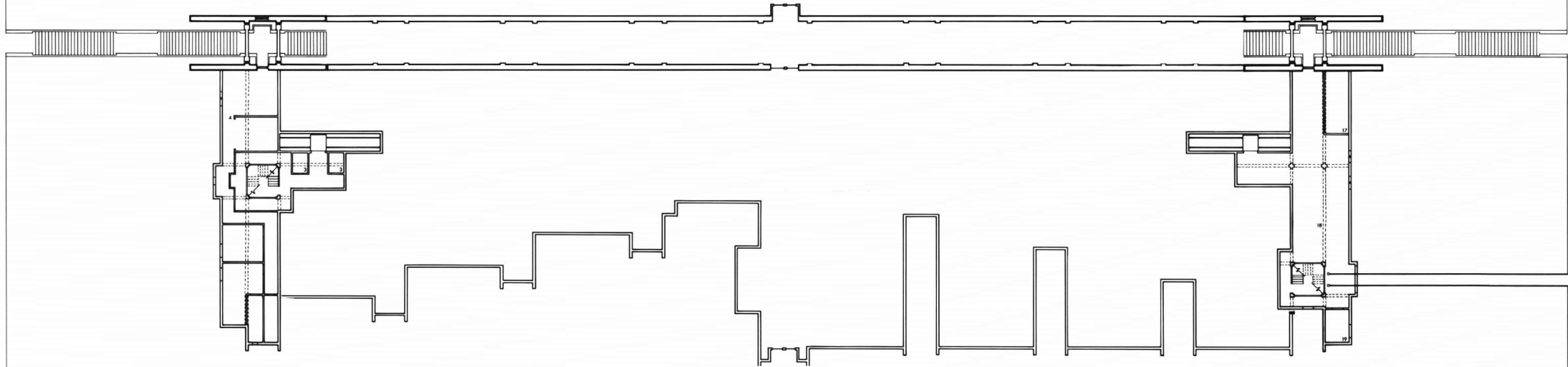
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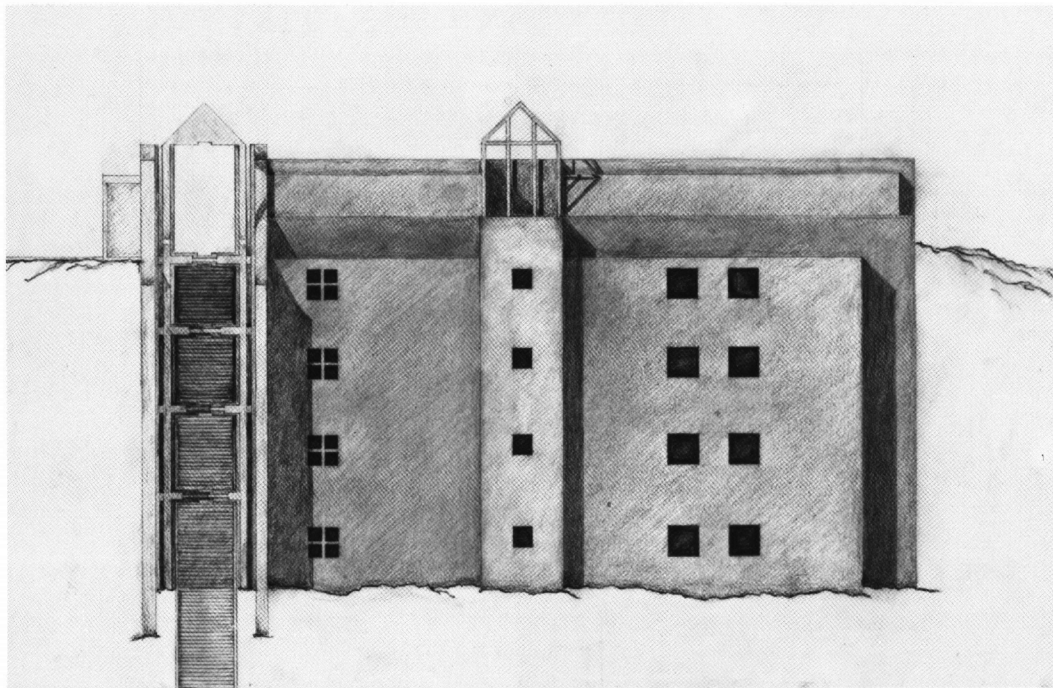
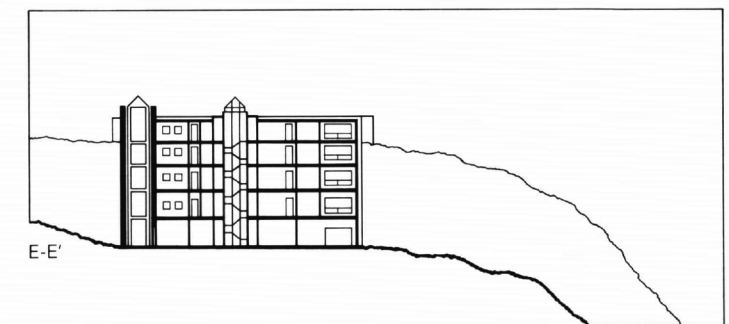
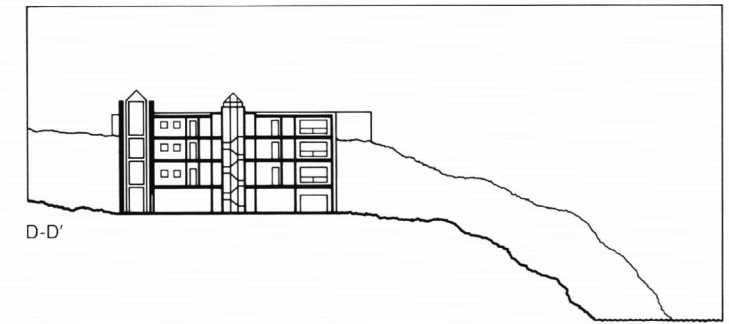
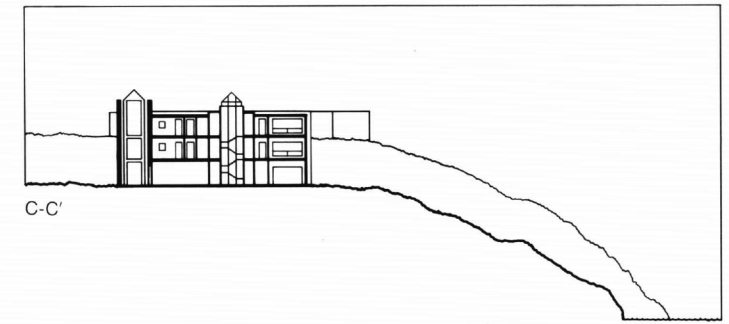
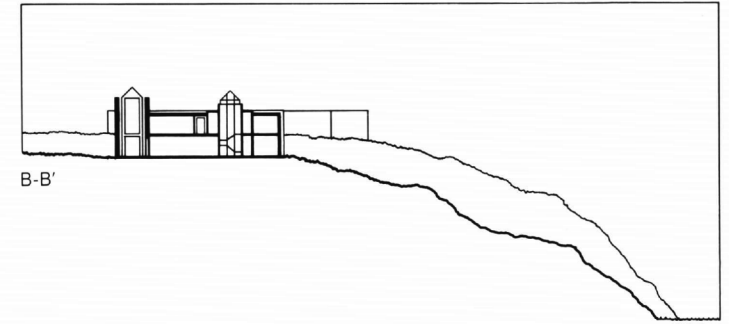
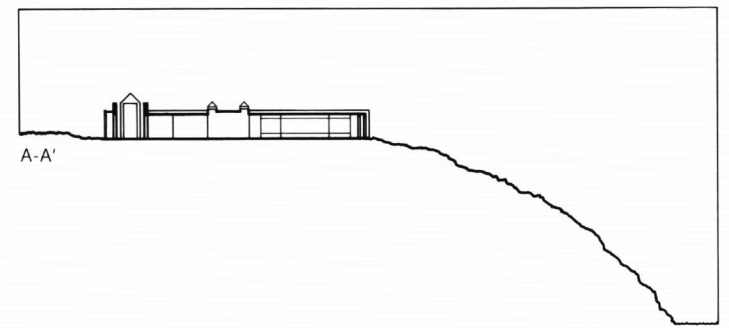
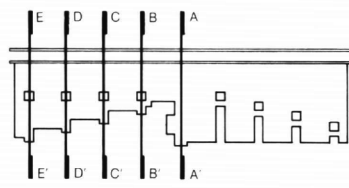
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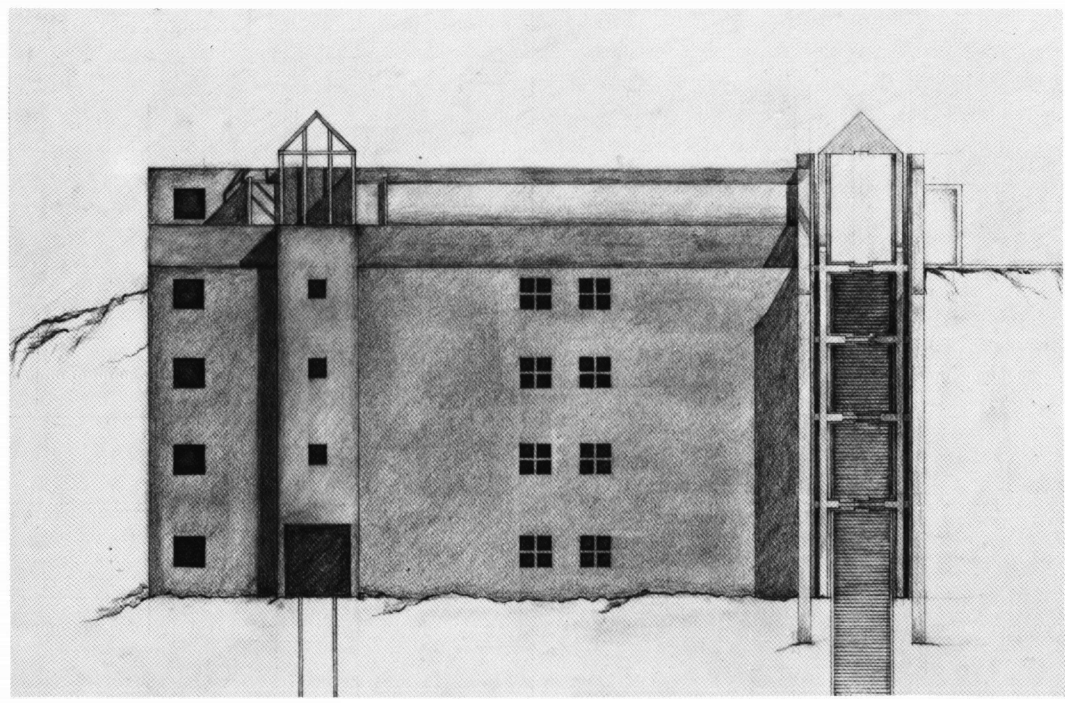
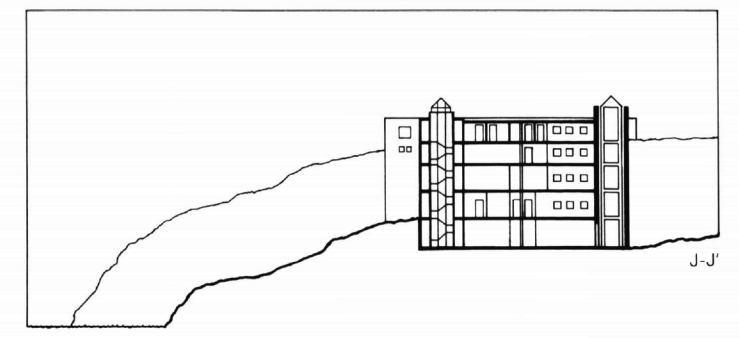
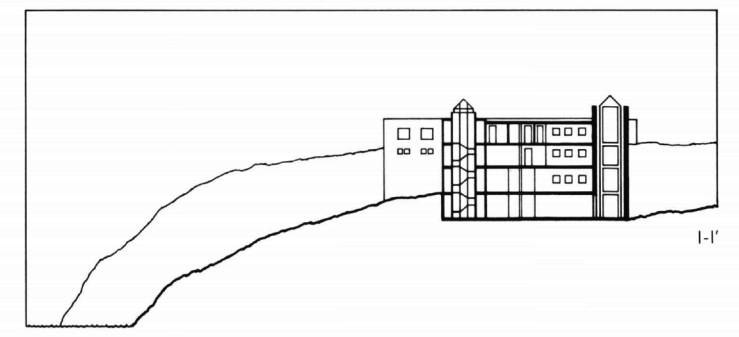
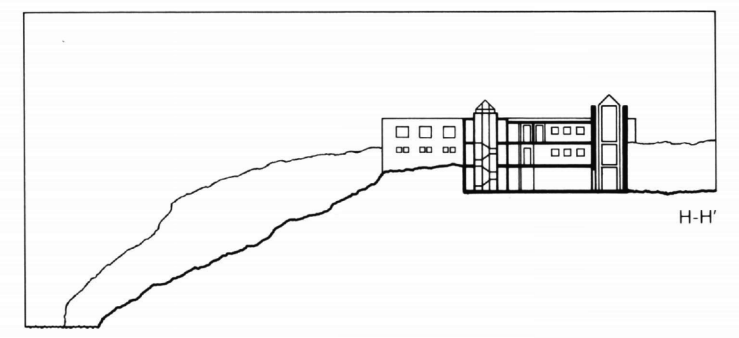
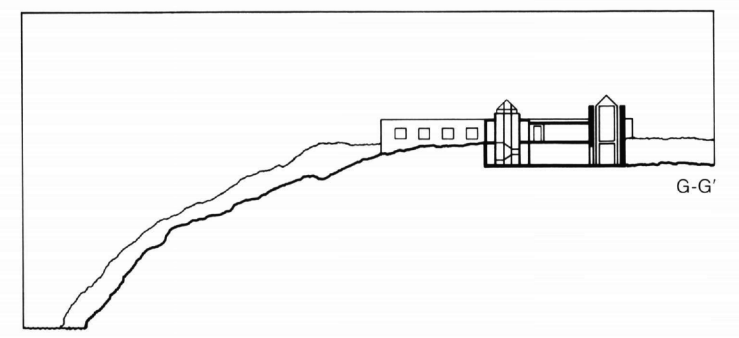
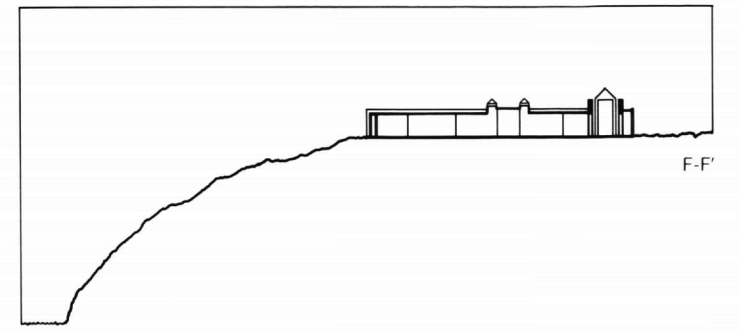
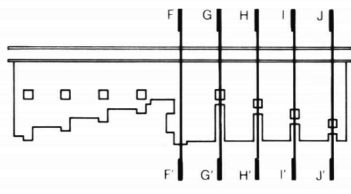


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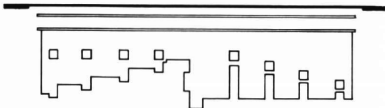
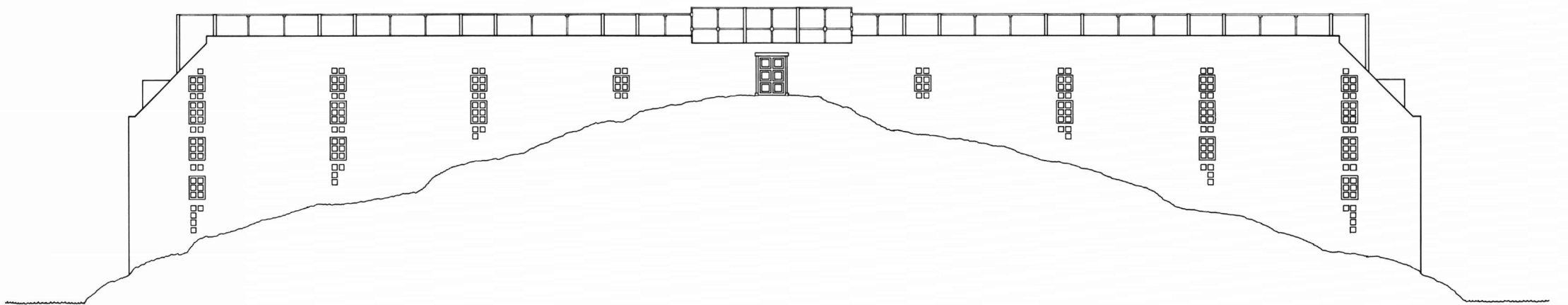
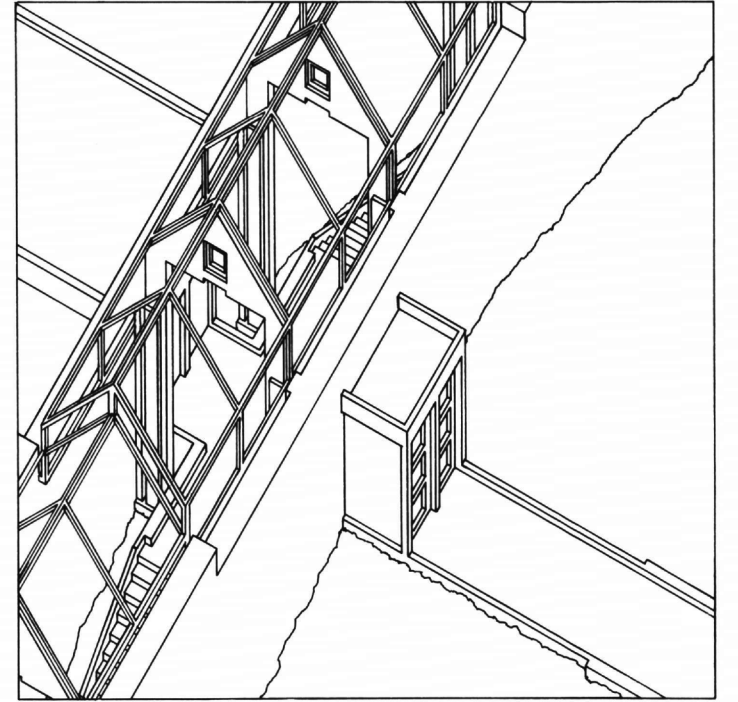


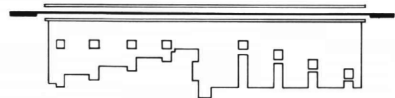
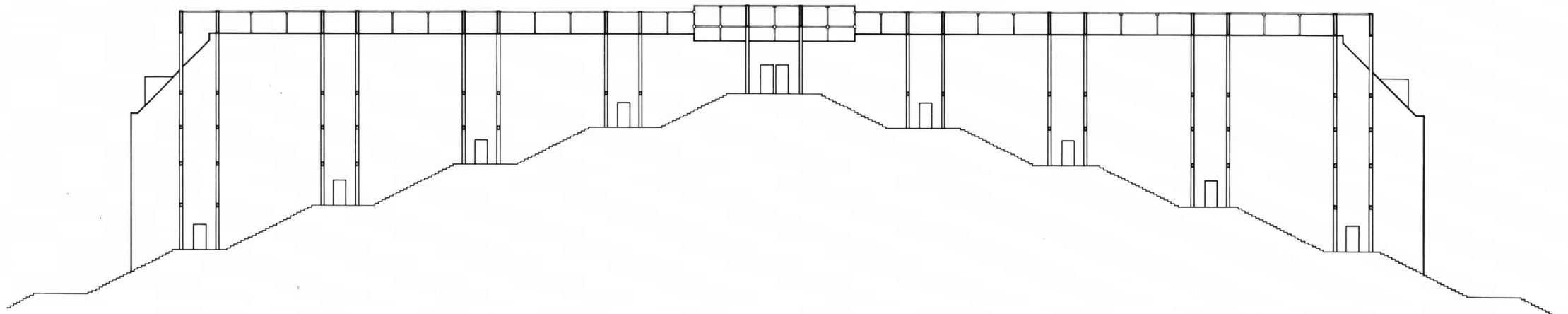
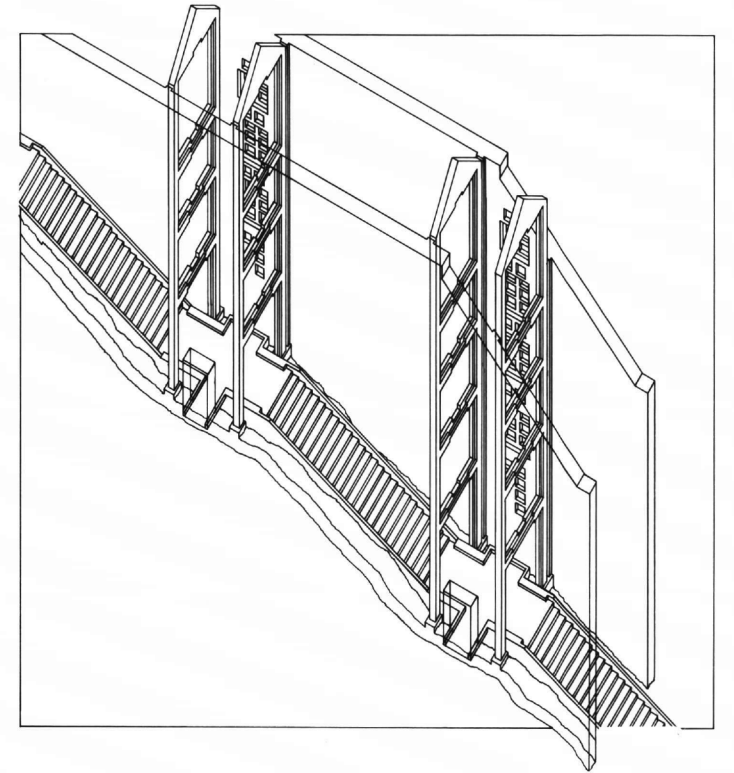
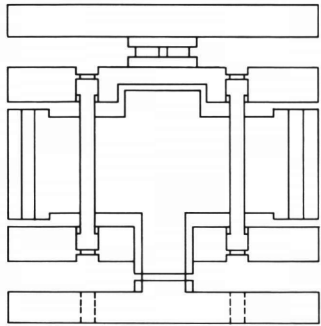
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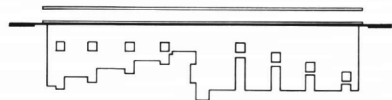
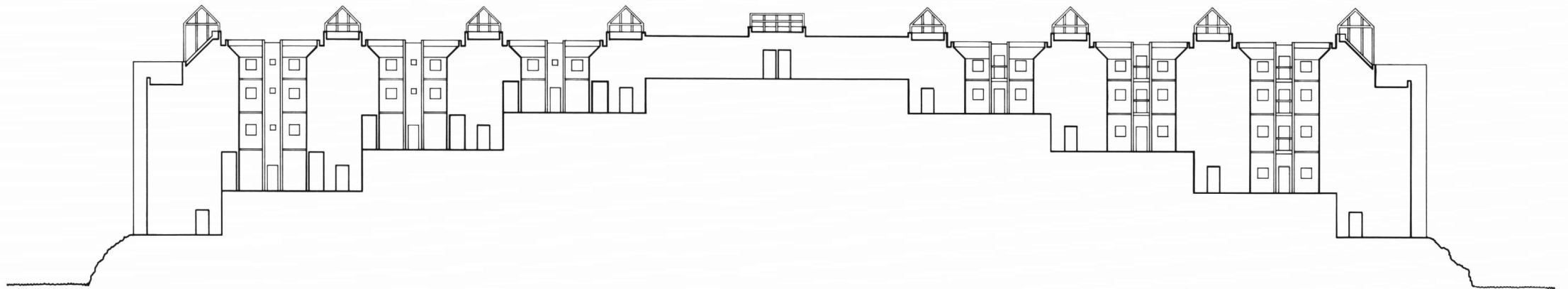
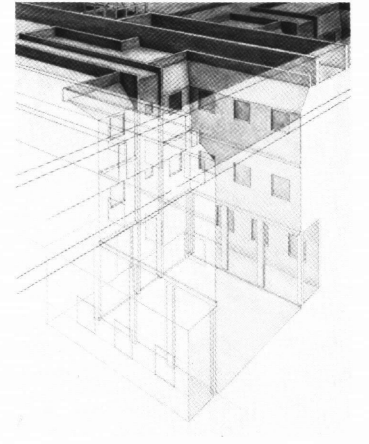
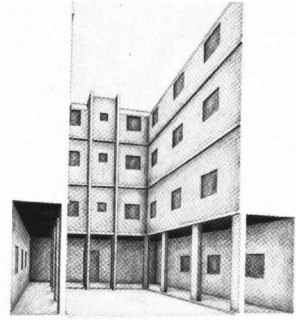
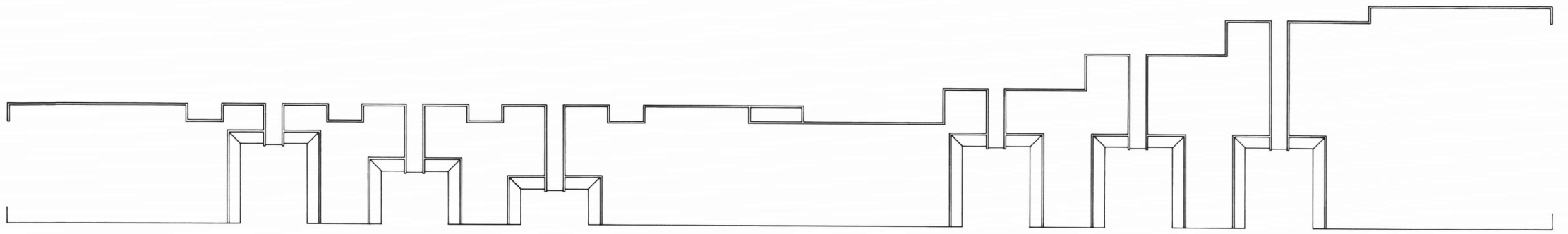


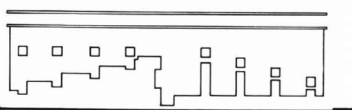
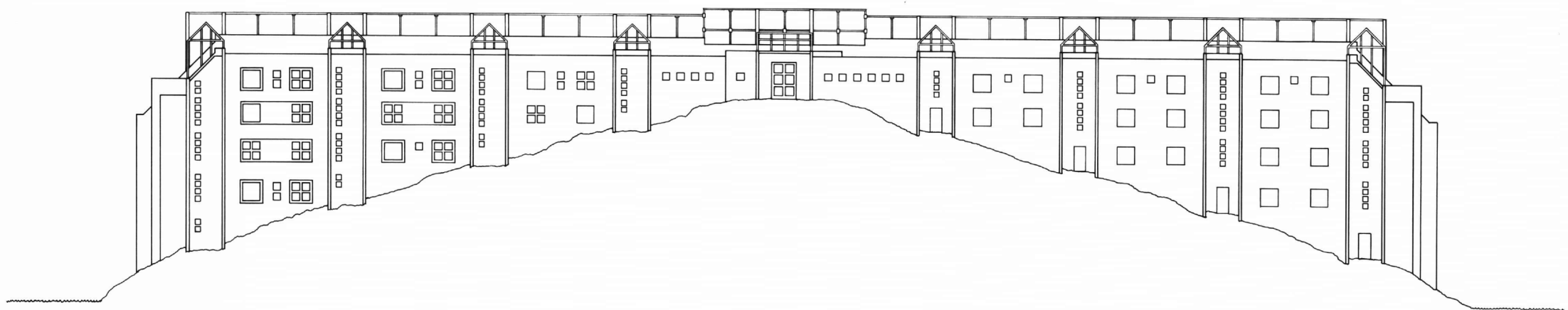
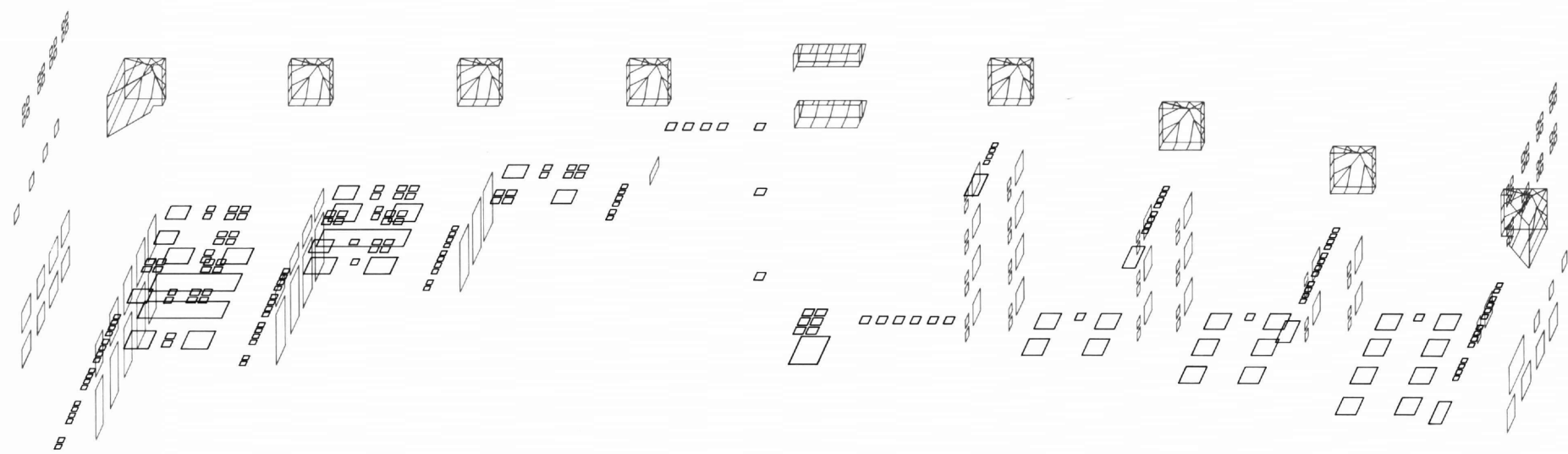


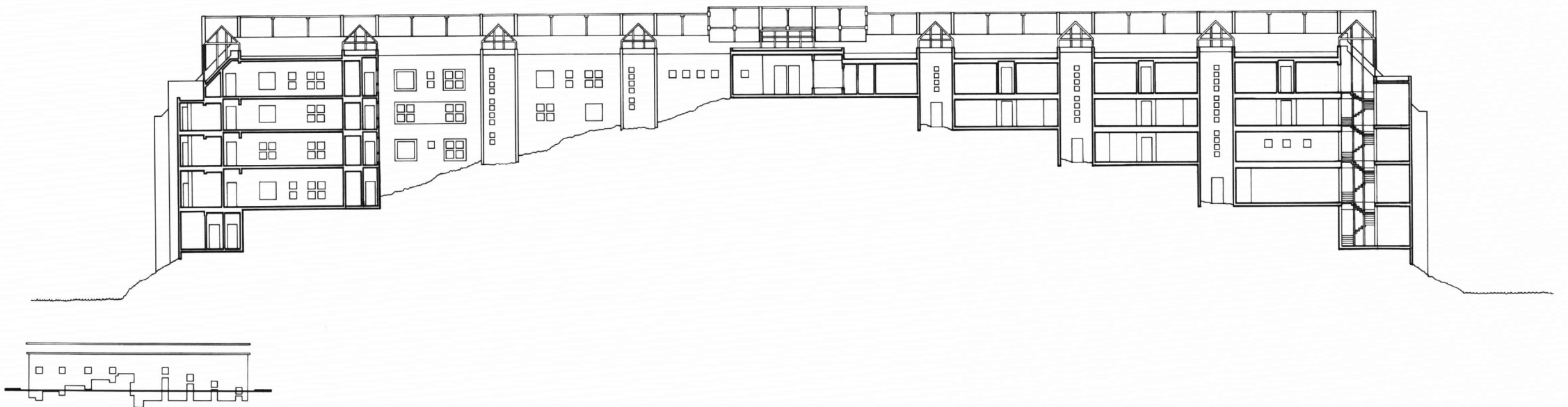
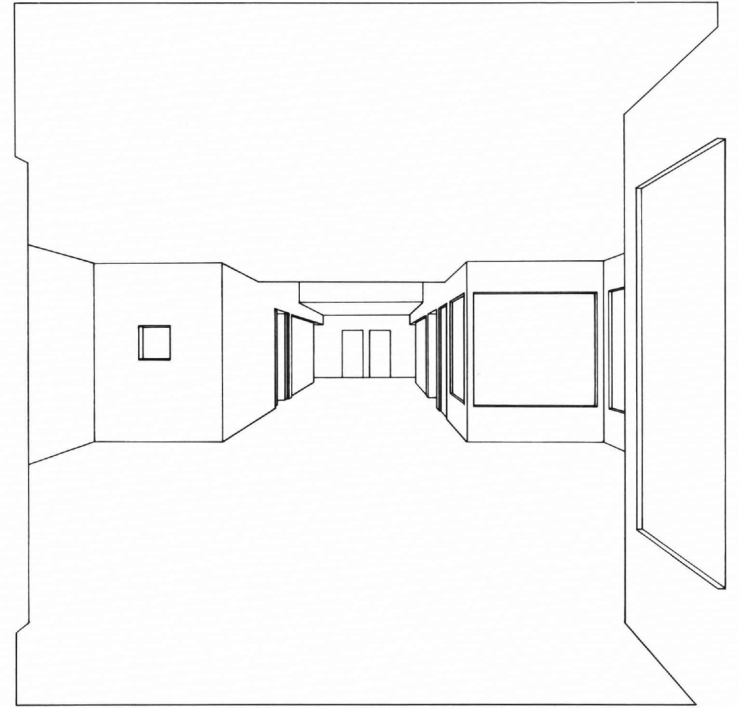


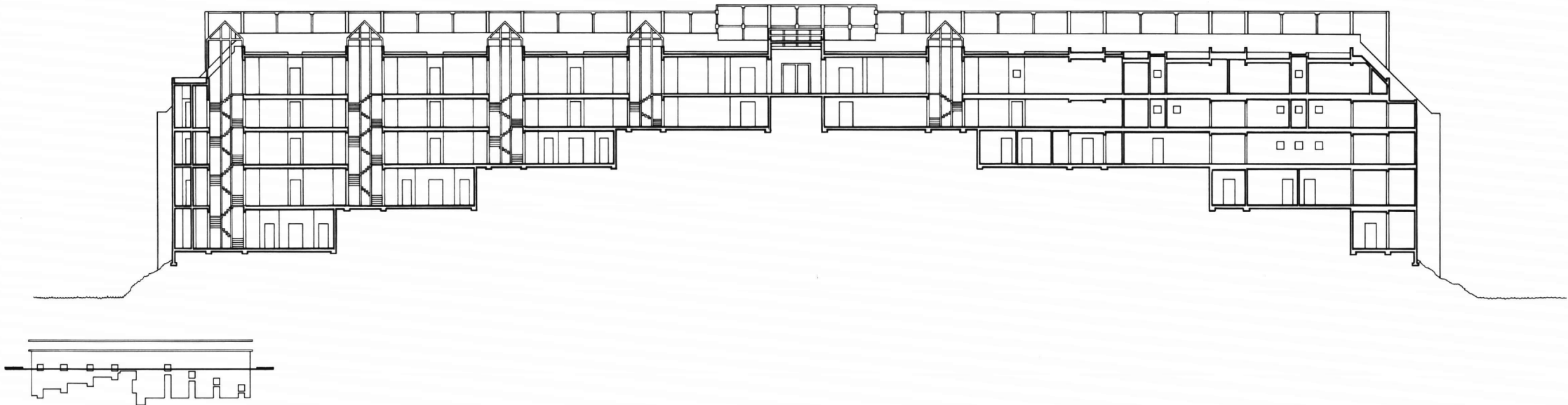
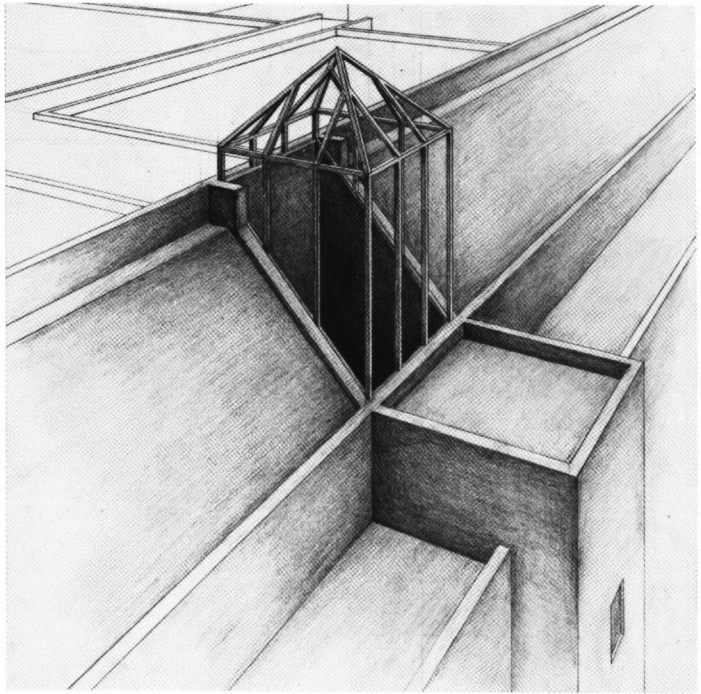


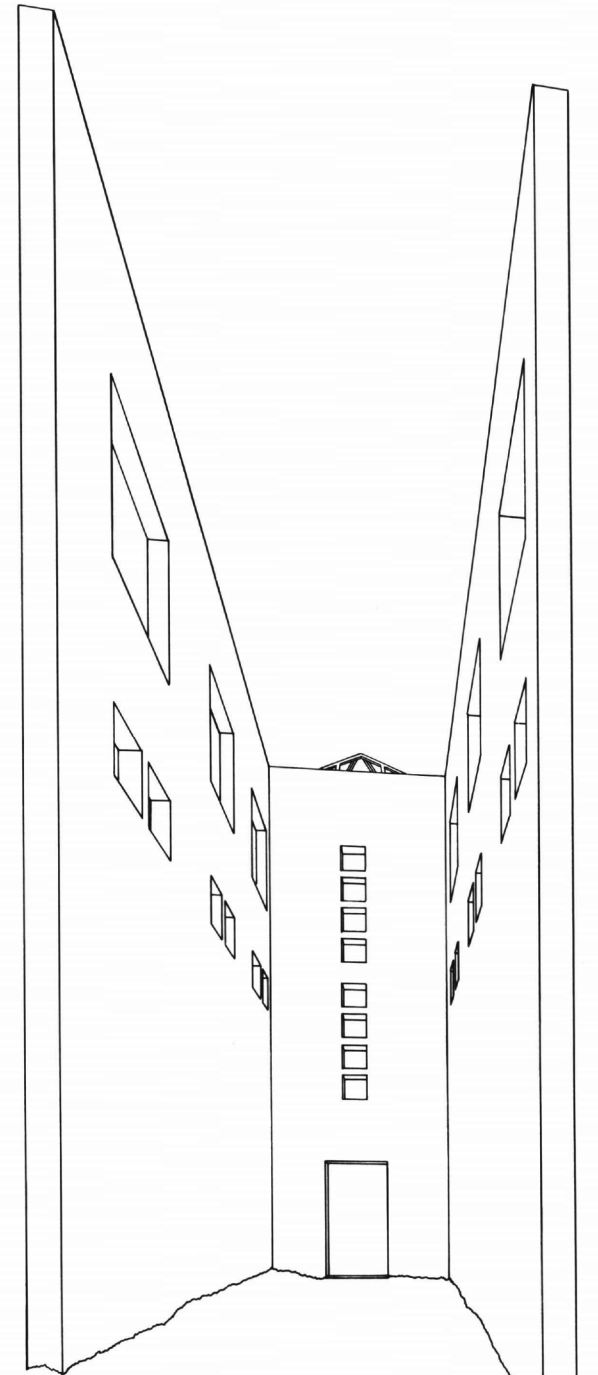
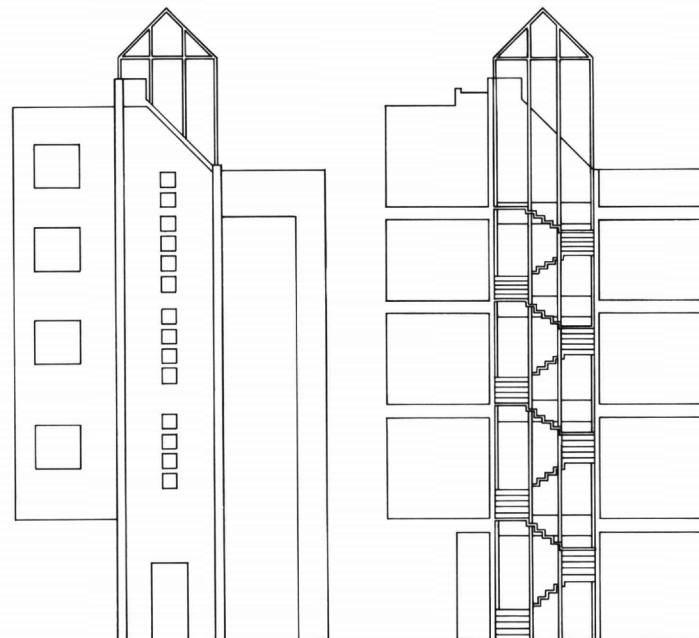
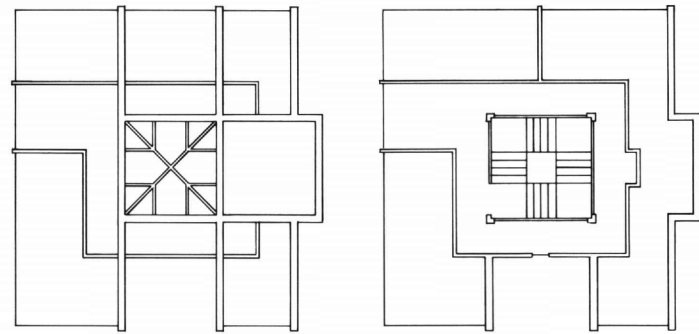


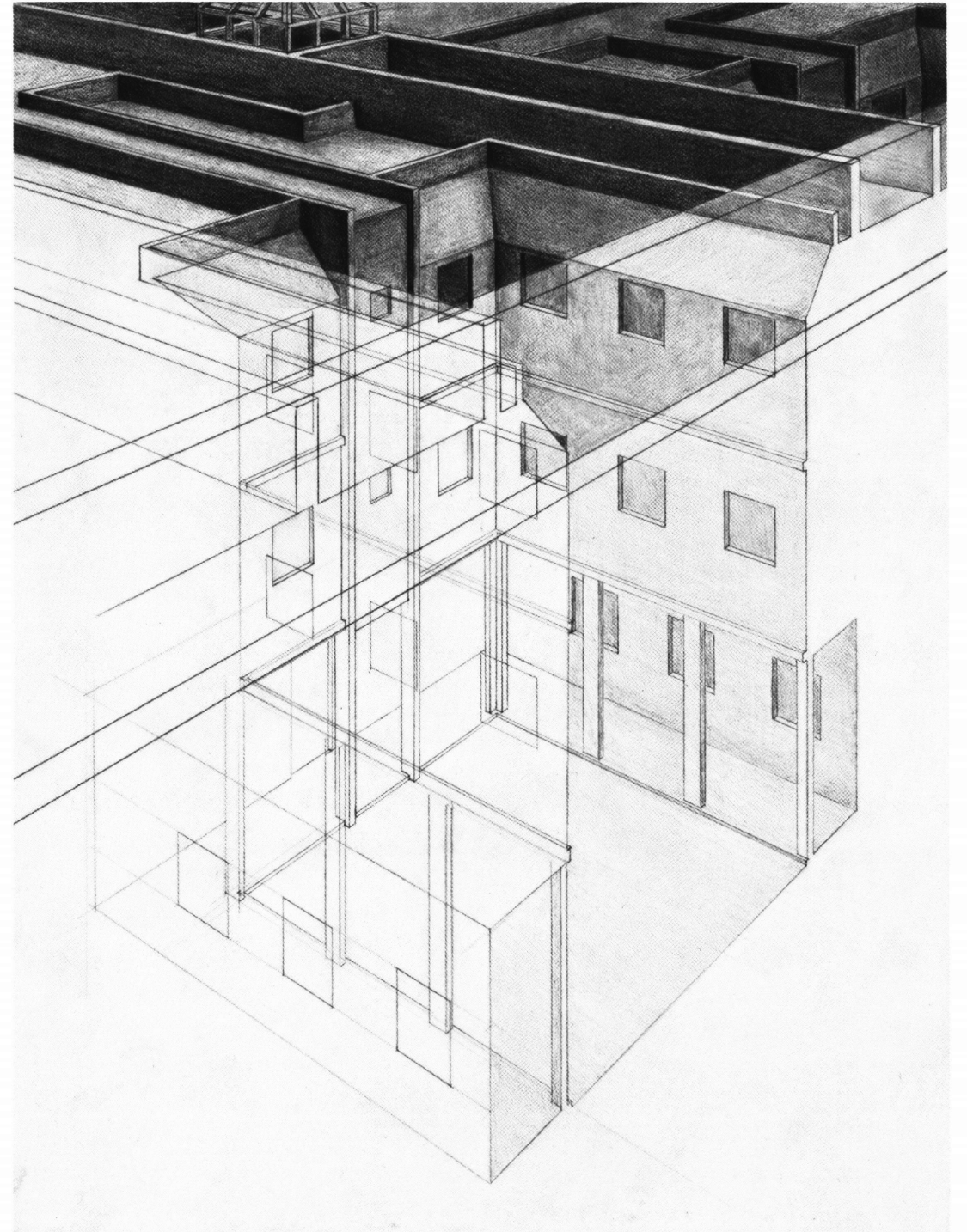






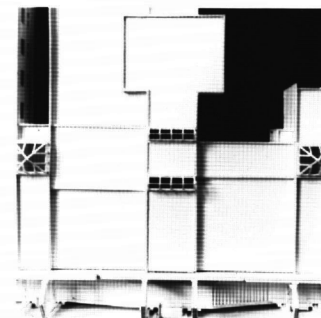
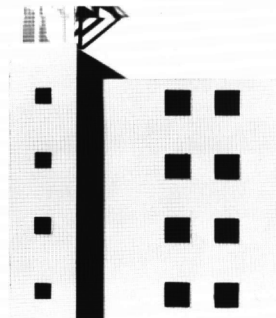
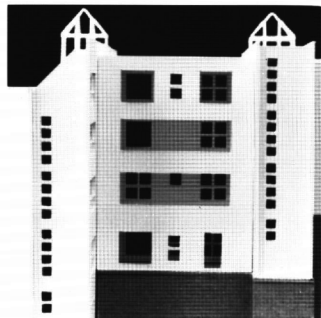
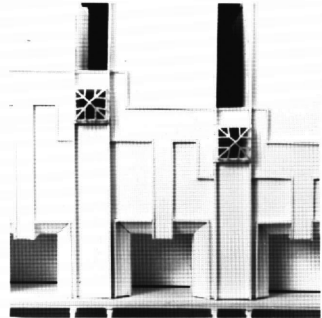
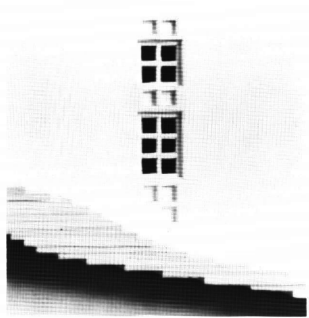


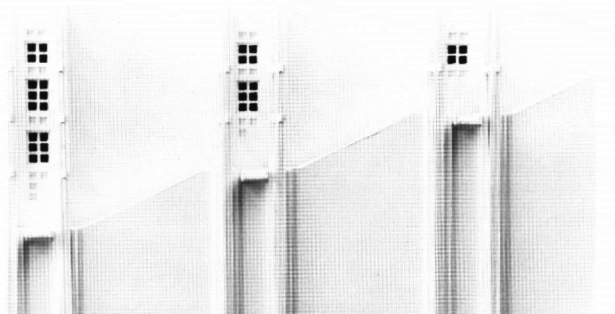
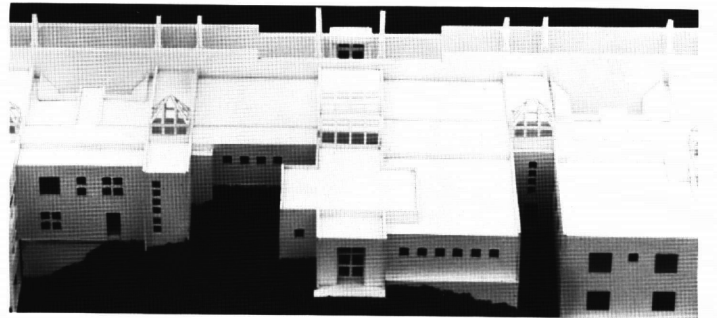
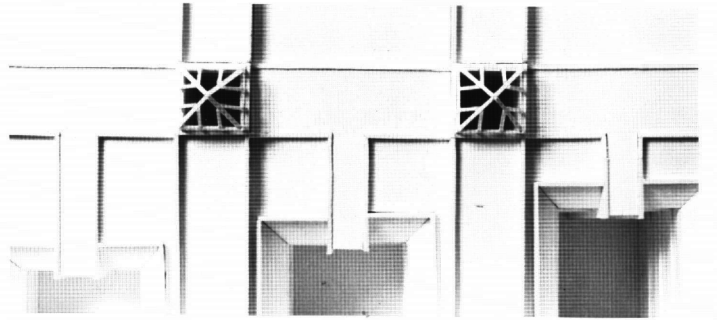
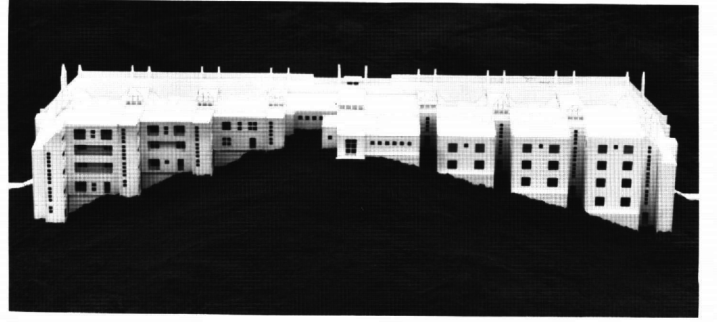
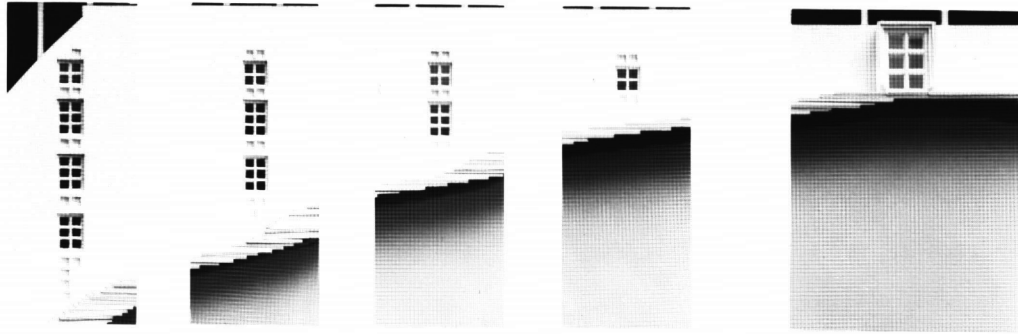
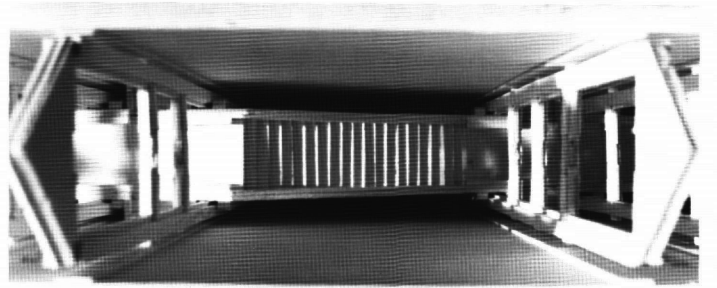


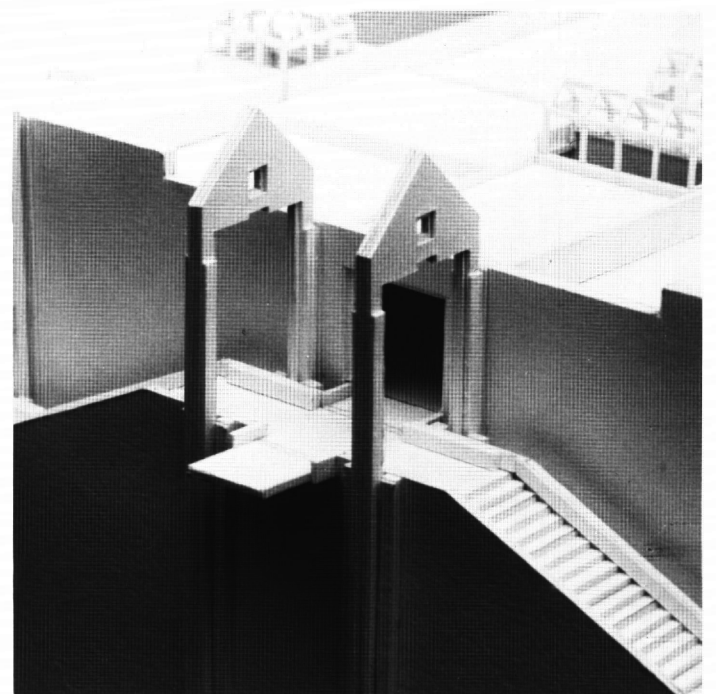
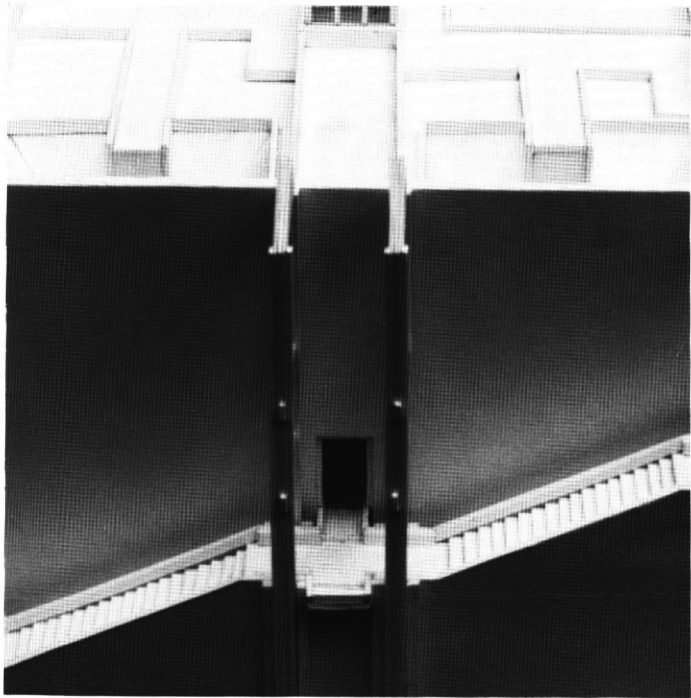














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