

perspective

design of Cascades visitors' center

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in partial fulfillment of the degree of
Master of Architecture

approved:

Albert J. Davis, Committee Chair

William Galloway

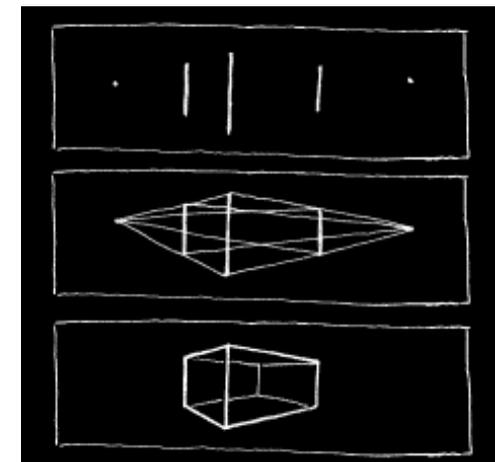
Mario Cortes

Blacksburg, Virginia
February 2000

abstract

Consider the construction of a perspective drawing. The perspective is made by drawing lines between a point of origin and several focal points. A series of lines connect the focal points to one another. The culmination of lines drawn from origin to focal point and focal point to focal point describes a place. The perspective is a view, or window into this place. The relationship of these three elements - the origin, focal points, and view - is analogous to the development of an architectural project.

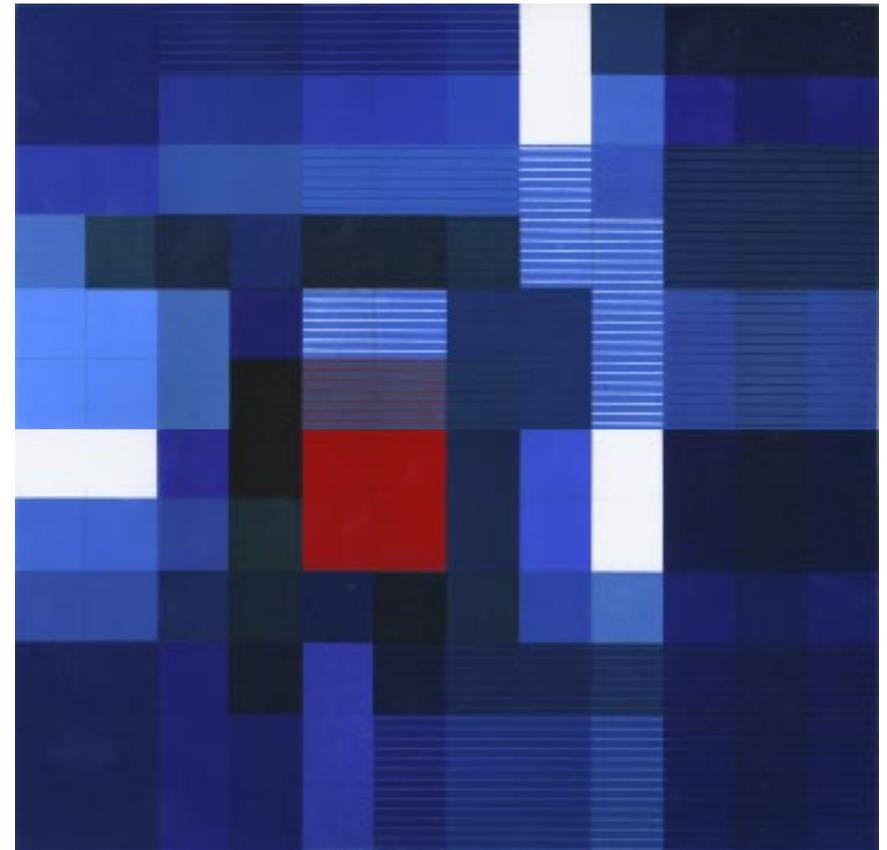
The origin is a point of beginning. Each architect brings a set of experiences and ideas to the project. The project springs from the architects' knowledge and ideals. The focal points involve the design development of a project. They relate to the areas of study and discovery for the project. Some foci are specific to a site or program. Some foci further investigate design intentions and how they relate to a given program. The links between foci create a place. Each drawing or description of this place is a view into the project. This thesis outlines the origins, focal points and views of a design for a visitors' center located in southwestern Virginia.



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origins



art & photography

What is the impact of experience on design? If art imitates life, is it not entirely appropriate for an architect to draw from his or her own experiences to create new ones? How do other forms of expression influence Architecture? The impact of experience and other design expressions is difficult to identify and describe. Influences are specific to the individual. However, these are important questions to consider. These influences can shape design ideals and act as sources of inspiration. I have learned almost as much about architecture from the study of art and photography as from the study of architecture itself.

Le Corbusier spent each morning oil painting. He considered it a source of serenity and inspiration. Painting affords the freedom of form that Corbu desired

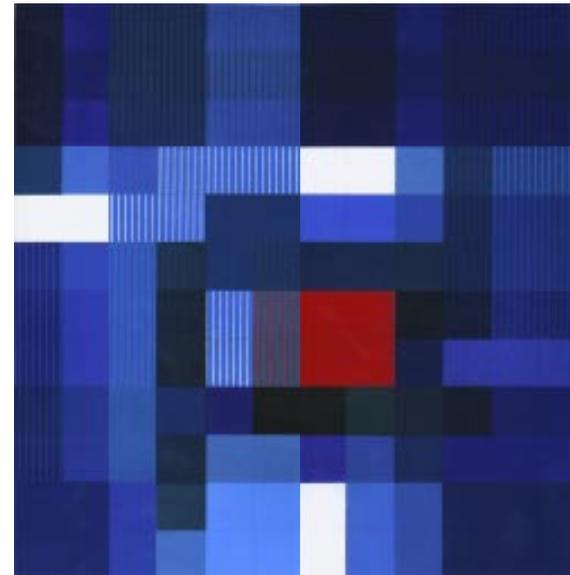
to express in his architecture. Oil painting has other design potentials. The thick body allows oil paint to develop a textural quality. Frank Auerbach experiments with layers of thick paint to form facial expressions. My interest in Auerbach's painting lead to my own layering studies in printmaking, or lithography, and black & white photography. The graphic print below was created by layering rectangles of color. Printmaking reveals how layering decisions effect composition, the joining and separation of elements and variations in color. Photography reveals the layers of elements within the image. The depth of an image is the distance between the foreground and background. How do the elements within the image draw the foreground and background together to define a depth?



Taureau I, oil painting, 1952
Le Corbusier



Head of EOW, oil painting, 1964
Frank Auerbach



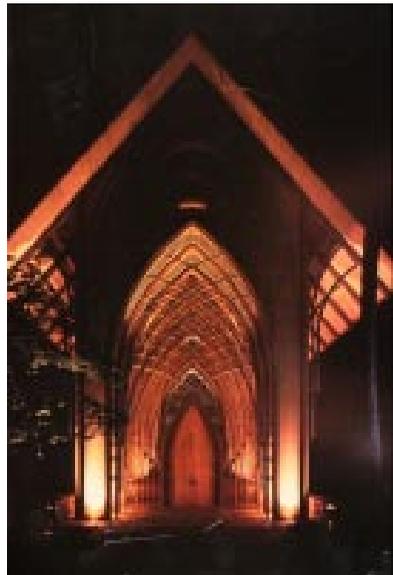
red square in blue, graphic print, 1999



ellet valley railraod tracks,
Montgomery County, Virginia

engineering in architecture

Architecture requires a balance of creativity and intuition with pragmatism and science. For that reason, I came to Architecture school with the intention of combining an appreciation of art and photography with an understanding of engineering. My background in structural engineering has been a strong design influence. Buildings that use innovative forms of structure are inspiring. Architects like Santiago Calatrava, Richard Rogers, Renzo Piano and Norman Foster push the envelope of technology, ask materials to perform in new ways and create new forms. The chapel design of E. Fay Jones proves that Architecture can be made from the simple yet artful connection of materials. The structure is inherent in the design instead of an afterthought. The marriage of engineering and architecture requires that difficult balance of creative expression and pragmatism.



Cooper Chapel, Bella Vista, Arkansas
1987, E Fay Jones



Lloyd's of London Bank Building, London, 1986
Richard Rogers



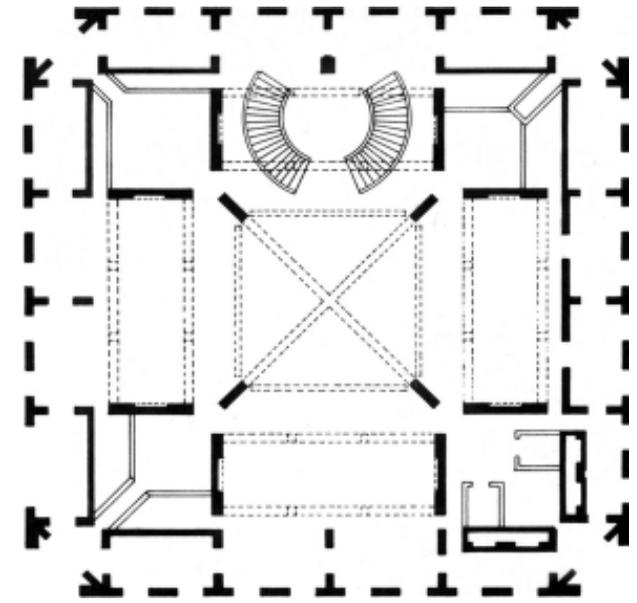
PA Technology Laboratory, Princeton, New Jersey, 1986
Piano + Rogers



'Bach de Roda - Felipe II' Bridge,
Barcelona, Spain, 1987
Santiago Calatrava

exeter library

Whether directly or indirectly, every architect is influenced by the architecture of Louis I Kahn. The poetic coherence in his work is inspirational. His designs have a clarity that results from a direct simplicity. The design of Exeter Library exemplifies this coherence. Within a straightforward plan, Kahn creates several different events. Each space reflects its function. The combination of brick, wood and light creates a cozy carrel for private study. The lounge area offers plenty of light for reading. However, the room is more open - less intimate than the carrels - suggesting a more temporary reading location. The crisp lines of the open roof terrace echo the cool fresh air of a New England school year. The stairwells are lit just enough to see where you are going, reflecting the utility of the 'servant' space. While having their own character, each space contributes to the cooperative whole. Architecture with this kind of design intelligence is appreciated.



plan, Exeter library,
Louis I Kahn



study carrels



reading lounge

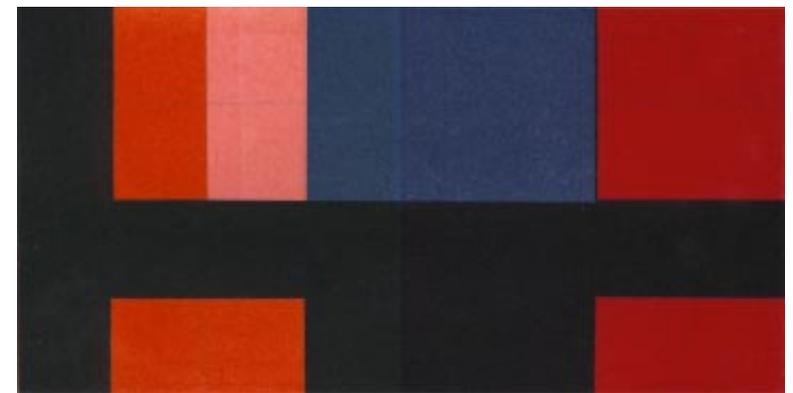
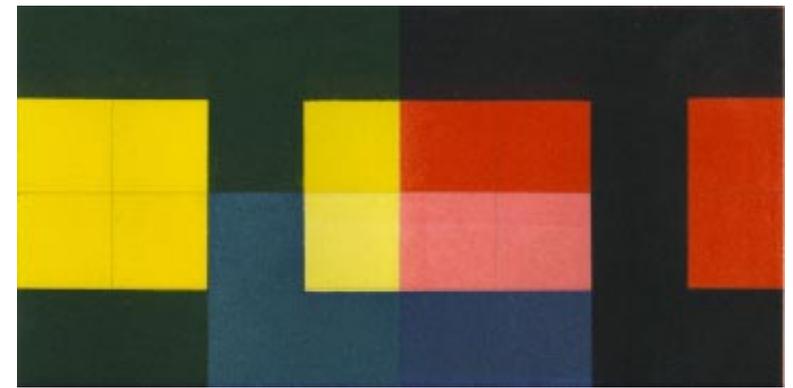


roof terrace



staircase

focal points



context

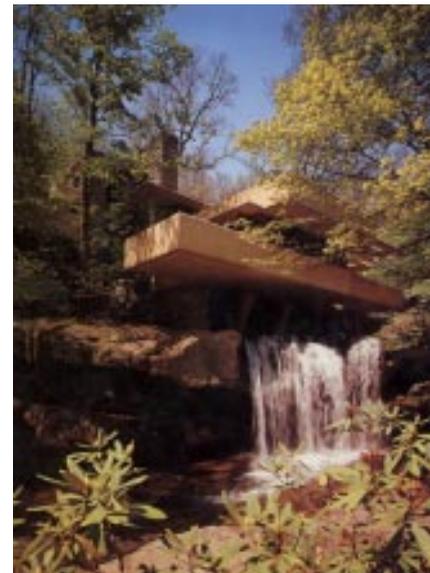
“Architecture is essentially an extension of nature into the man-made realm, providing the horizon to experience and understand the world.”

Juhani Pallasmaa, The Eyes of the Skin: Architecture and the Senses, p28

Context refers to the codependent relationship between a building and its surroundings. Architecture draws upon the elements of its environment to establish this relationship. It then gives back by defining a new way of seeing this environment. The site and the building draw upon each other to make a complete place. At Fallingwater, Frank Lloyd Wright situated the house along the banks of a stream. The building extends up the steep slope beside the stream. The presence of the stream, the slope, and the trees are highlighted by their relationship to the house. The home experience is enhanced by embracing these natural elements. The house is tied to its context. The site for a residence designed by Richard Neutra is surrounded by a panoramic view of mountains. By

enclosing this room in glass, Neutra develops a situation where the mountains are essentially the walls of the room. However, Neutra also draws attention to the beauty and significance of these mountains by framing particular views.

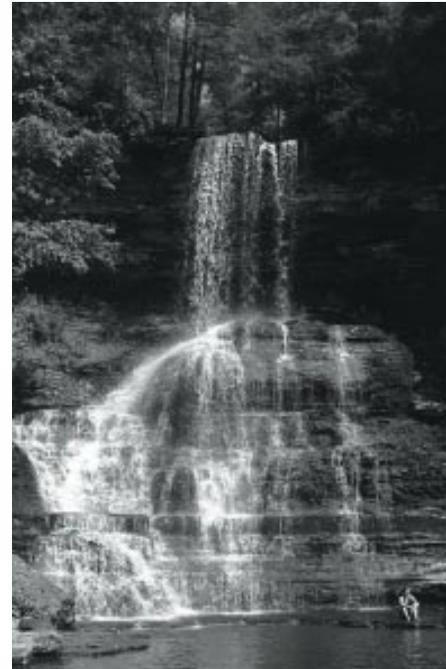
In the southwestern region of Virginia, the Jefferson National Forest preserves land for public enjoyment. The Cascades is in a portion of Jefferson National Forest just outside of the town of Pembroke. This park has a two mile hike that extends to a 70 foot waterfall. This is the context for the design of a visitors center. Two significant conditions of this site are the stream that leads to the falls and the protected public forest. The building site chosen is situated along the banks of the stream beneath the canopy of trees.



Fallingwater, Bear Run, PA 1937
Frank Lloyd Wright



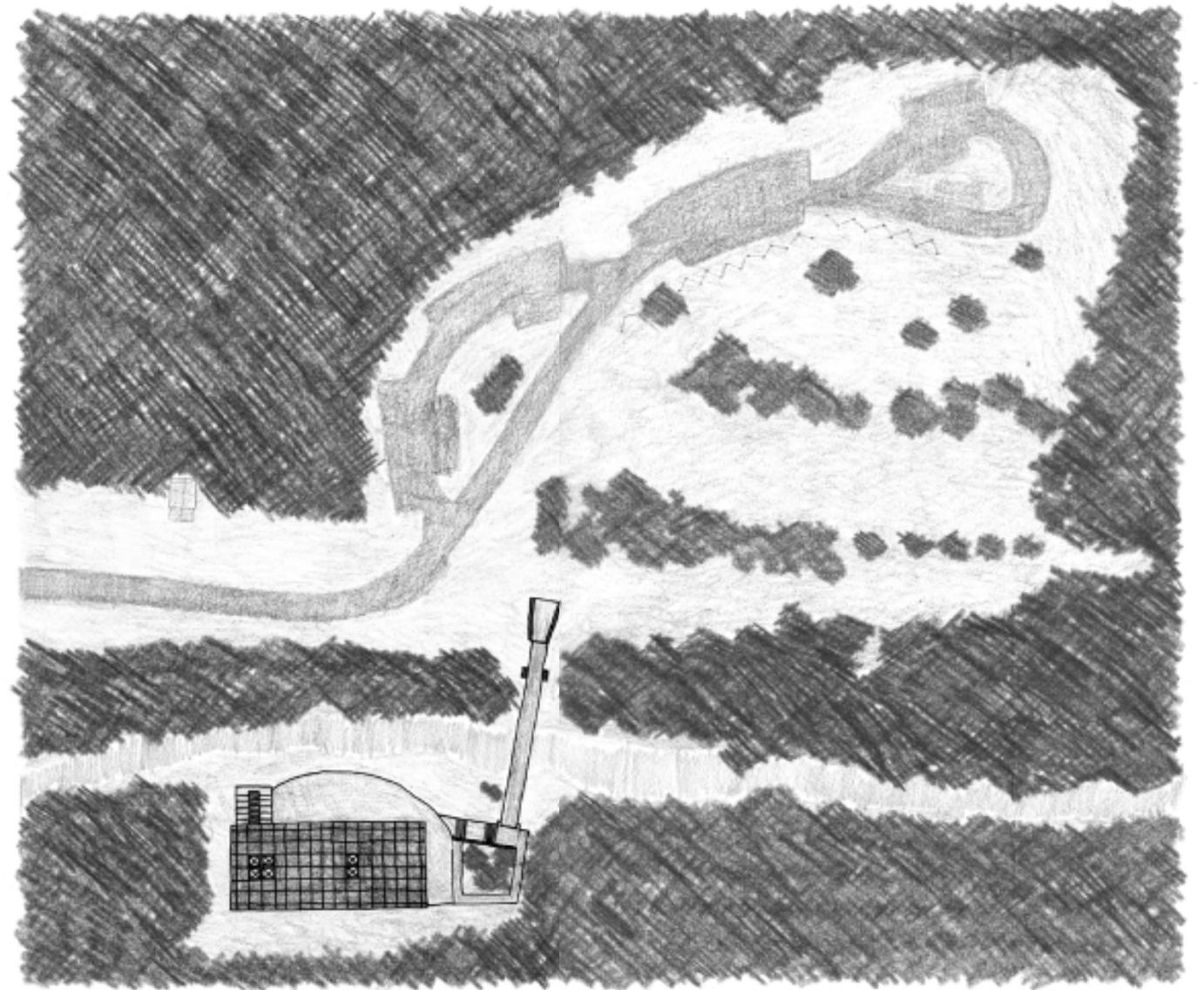
residence, South Sea Island, Guam
Neutra and Alexander, architects



building site: Casacades - Jefferson National Forest

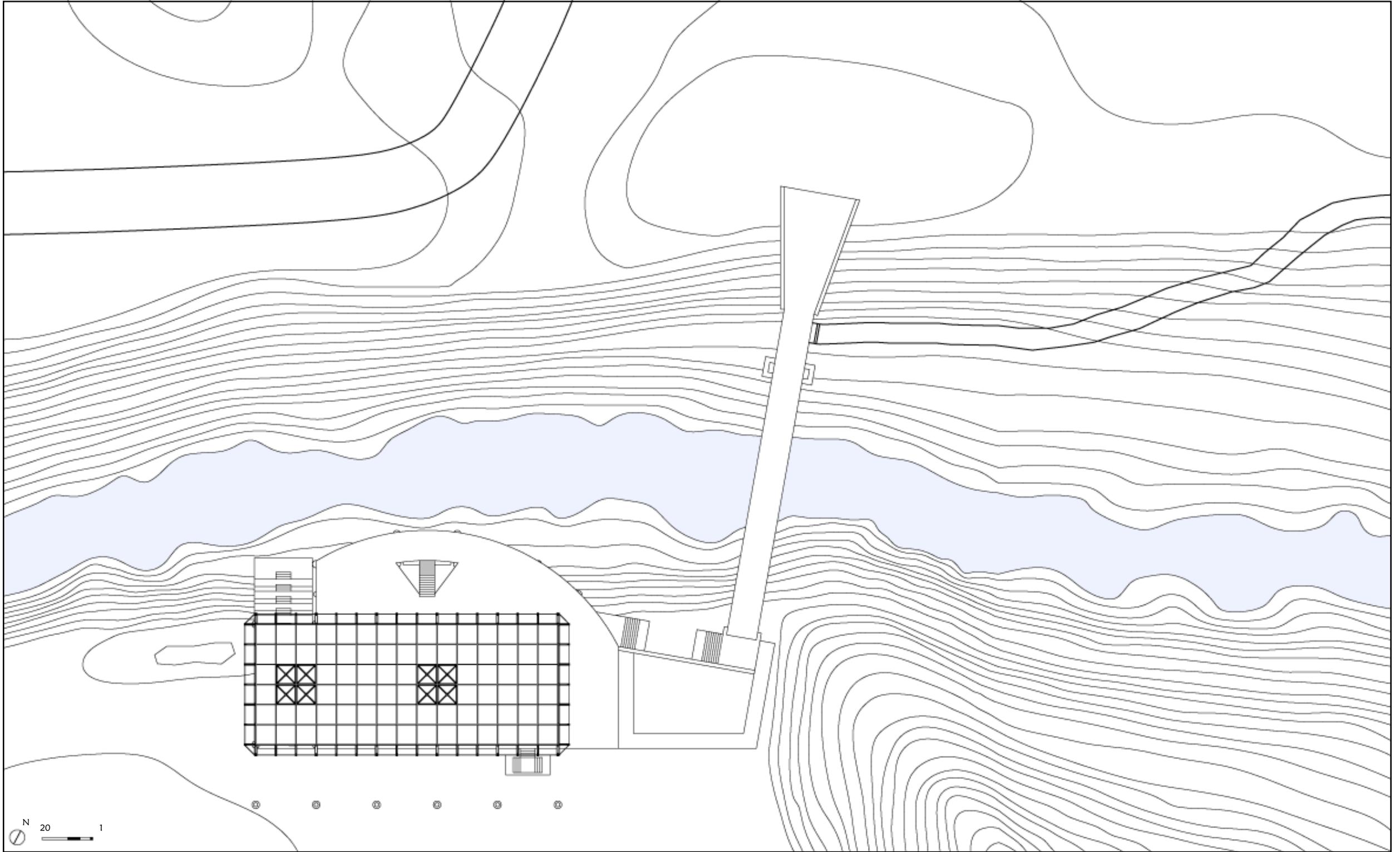
l to r: light snow on Stony Creek, waterfall in summer

The road leading the Cascades starts to follow alongside Stony Creek approximately a mile before the entrance to the park. Although the winding road varies its distance from the stream, the creek always has a presence. Upon entering the park, there is designated parking along a figure-eight driveway. There are several lines of picnic tables accompanied by grills dispersed between the parking area and the stream. The entrance to the hiking trail is marked by a single display case and a few signs of instruction. About 200 yards from the start of the hike, the trail splits. One trail leads across a bridge and follows along Stony Creek. The other takes a higher route along the wooded ridge. The trails meet again about 500 yards from the waterfall at which point the rushing sound of the falls can be heard. The trail terminates at the base of the falls. There is a small pool created by the falling water which attracts swimmers in the summer. Hikers rest on benches and boulders before making the return trip to the base. Increased visitation to the park prompts the need for a full-time park ranger as well as facilities for guests. A visitors' center, located at the base of the trail, would act as a starting and ending point for hikers. The center would provide restrooms, an opportunity to purchase food, an office for park administration and a first aid station. A visitors' center would educate guests about the environment, the area wildlife and outdoor safety. Therefore, the program allows for an information desk, exhibits and an outdoor assembly for approximately 75 visitors.



sketch, plan of site at base



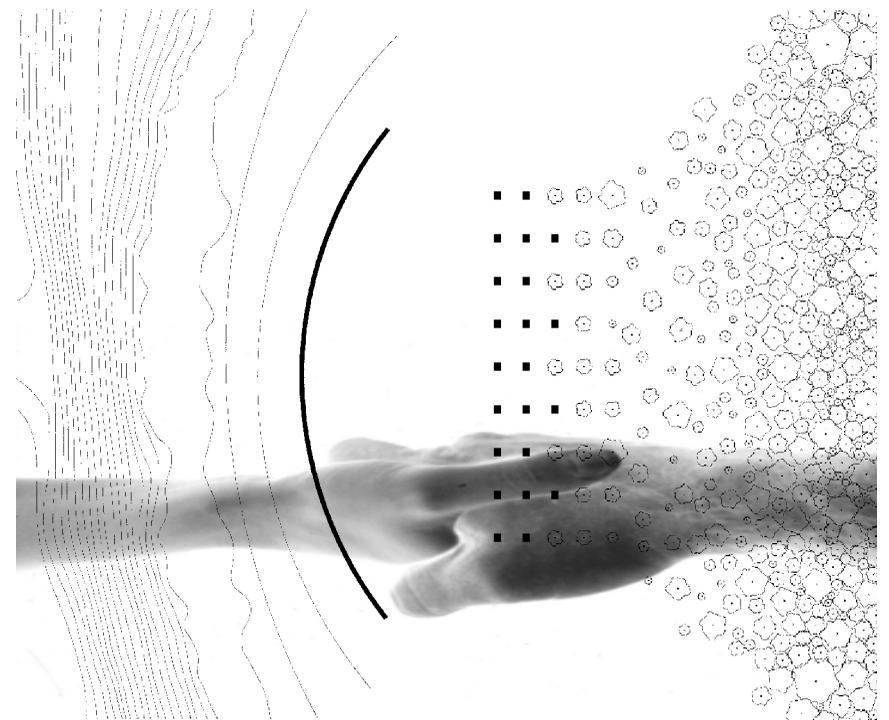
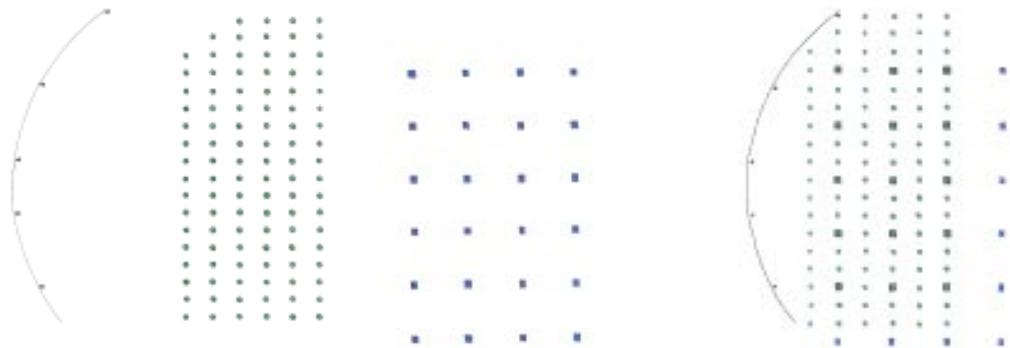
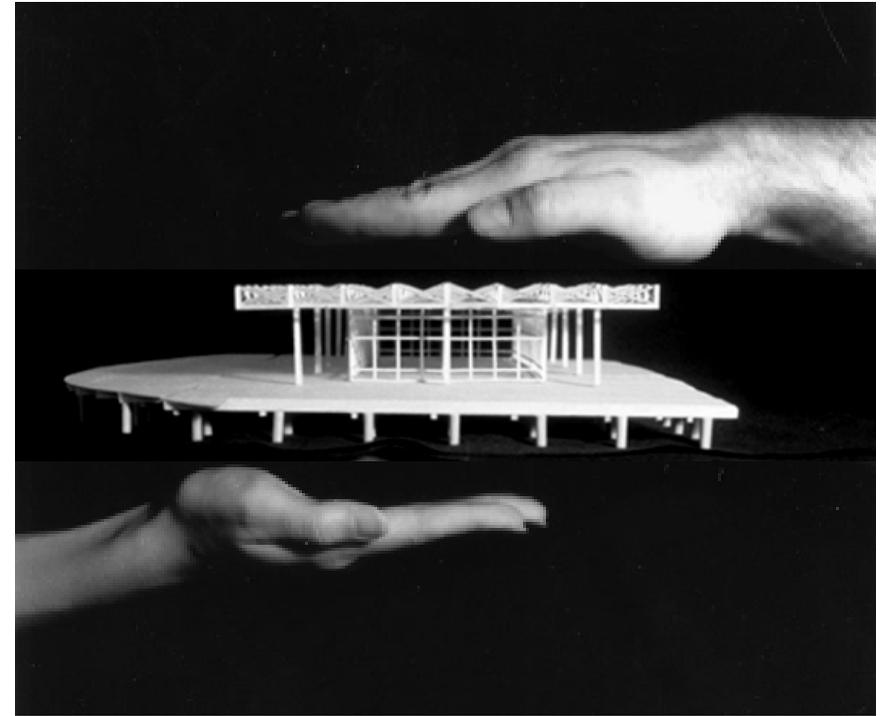


site plan: building, trail and stream

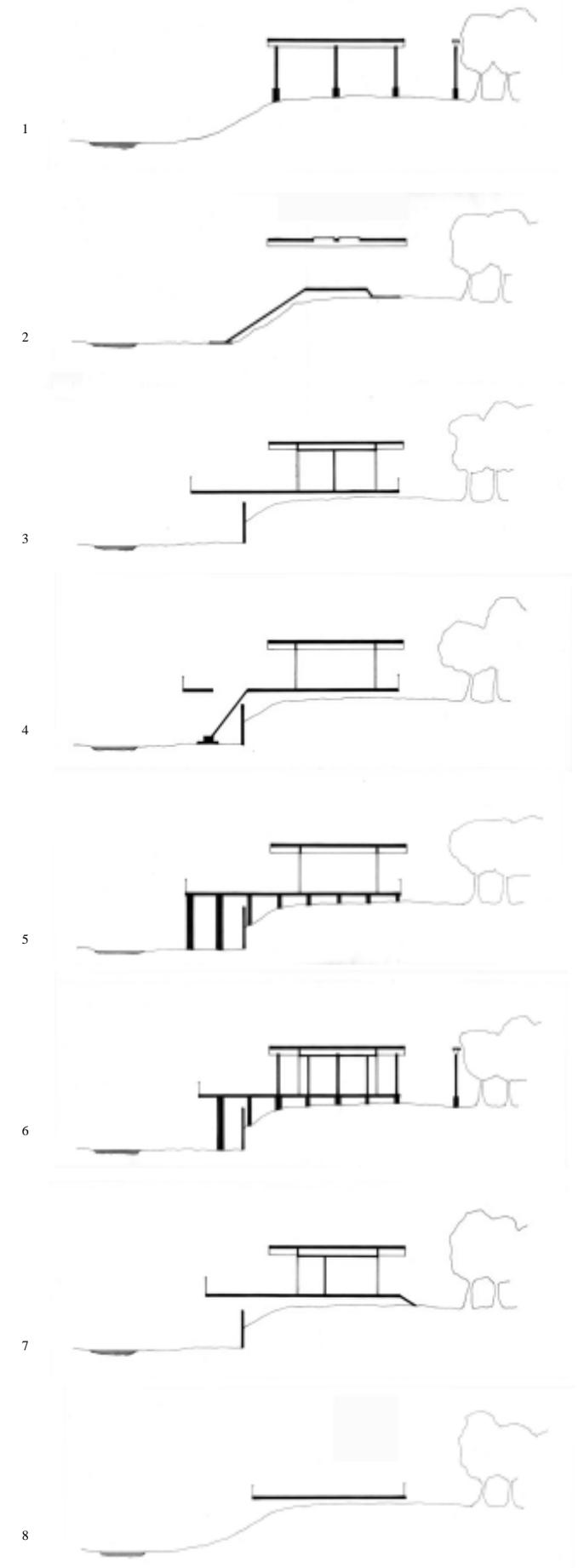
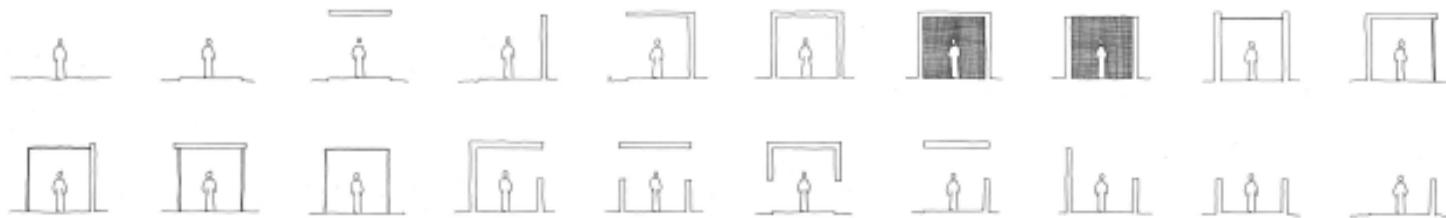
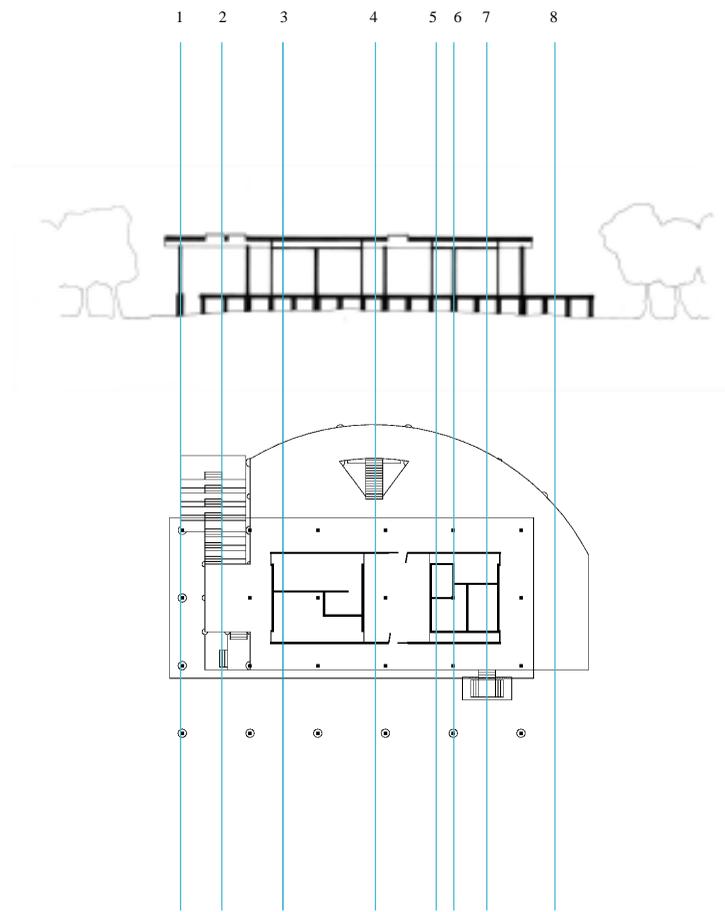


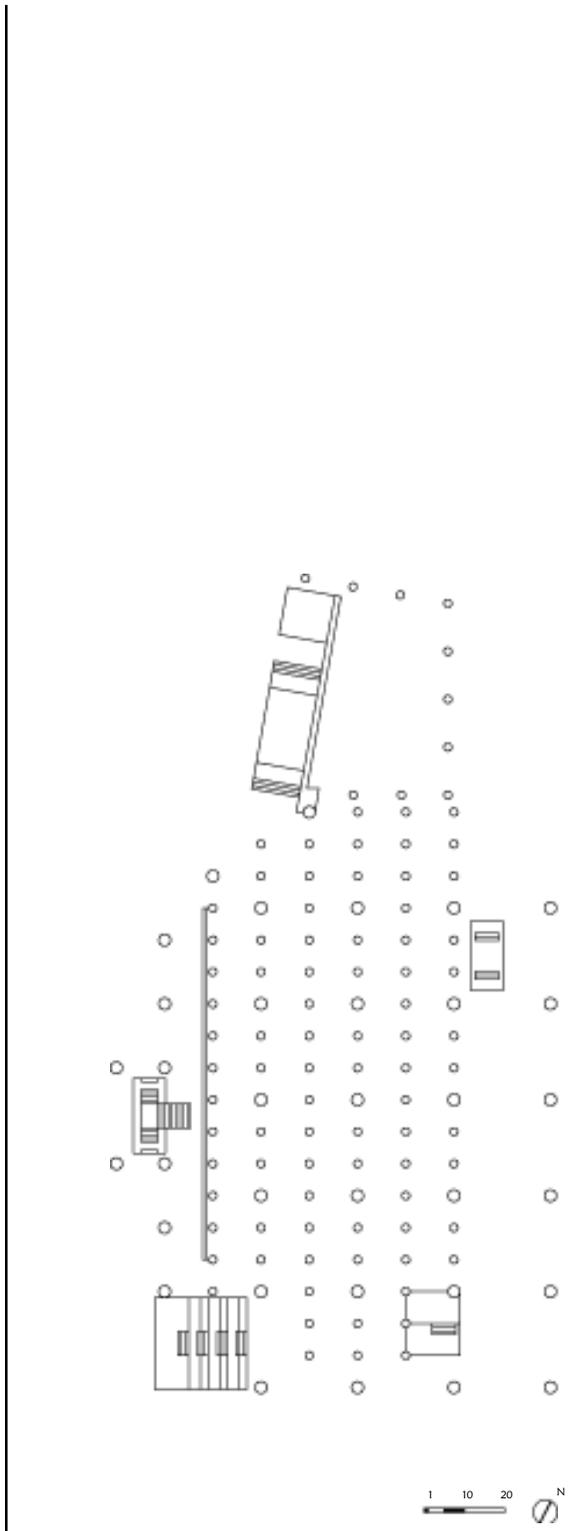
photographic study of context l to r: hay stacks, Blacksburg, Virginia; ellet valley farm, Montgomery County, Virginia; big al's, Blacksburg, Virginia; trucks at industrial park, Blacksburg, Virginia

The contextual relationship between the building and its site is much like the meeting of two hands. The two can be intertwined, embedded, butt together, lie next to one another, or barely touch. In the design for the visitors' center, the building needs to find its place between the stream and the trees and draw these two elements together. The base of the building relates to the earth responding to the stream and the changing grade. There is a slight bend in the course of the stream along the building site. The building meets the stream along this curvilinear path. The column and roof structure mimics the tree canopy. Much like shattered tree trunks, columns hold the canopy above the earth. By ordering these columns, a grid is defined.

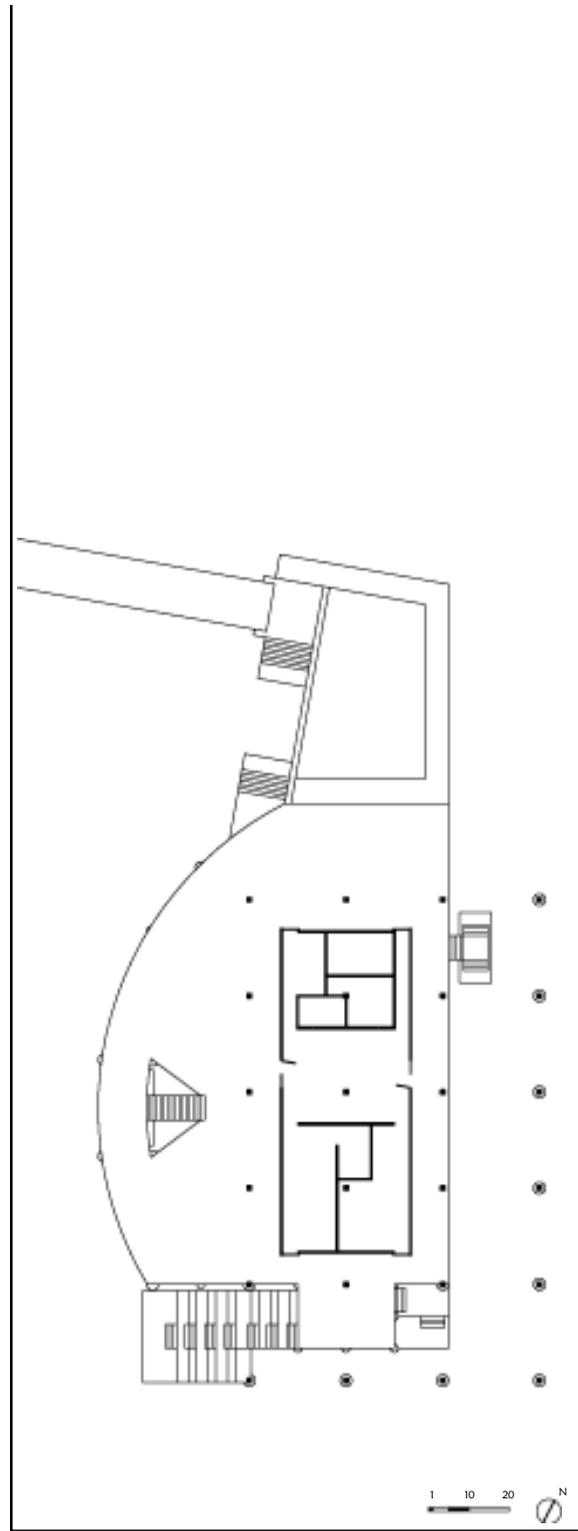


As a person travels through a building, his or her relationship to the built surroundings changes. This set of experiences follows a progression. One stands on the earth without built elements, travelling next along a defined path. The path leads to a stair that rises to a constructed floor. The floor leads to an area protected by a roof. Beneath the ceiling is a wall that leads to a door. On the other side of the door is an enclosed room. The relationships between roof canopy, floor and earth create varying sets of experiences. One can be standing on the base unsheltered, or sit on the grass under the protection of the roof, or proceed under the base to play by the stream. In plan, layers are established. The set of piers gently link the changing grade of earth to the floor construction. The floor provides a base to the enclosure and a vantage point from which to view the stream. Columns link the grid of the footings to the grid of the roof truss. The truss carries loads from the roof to the columns. The roof protects the area beneath.

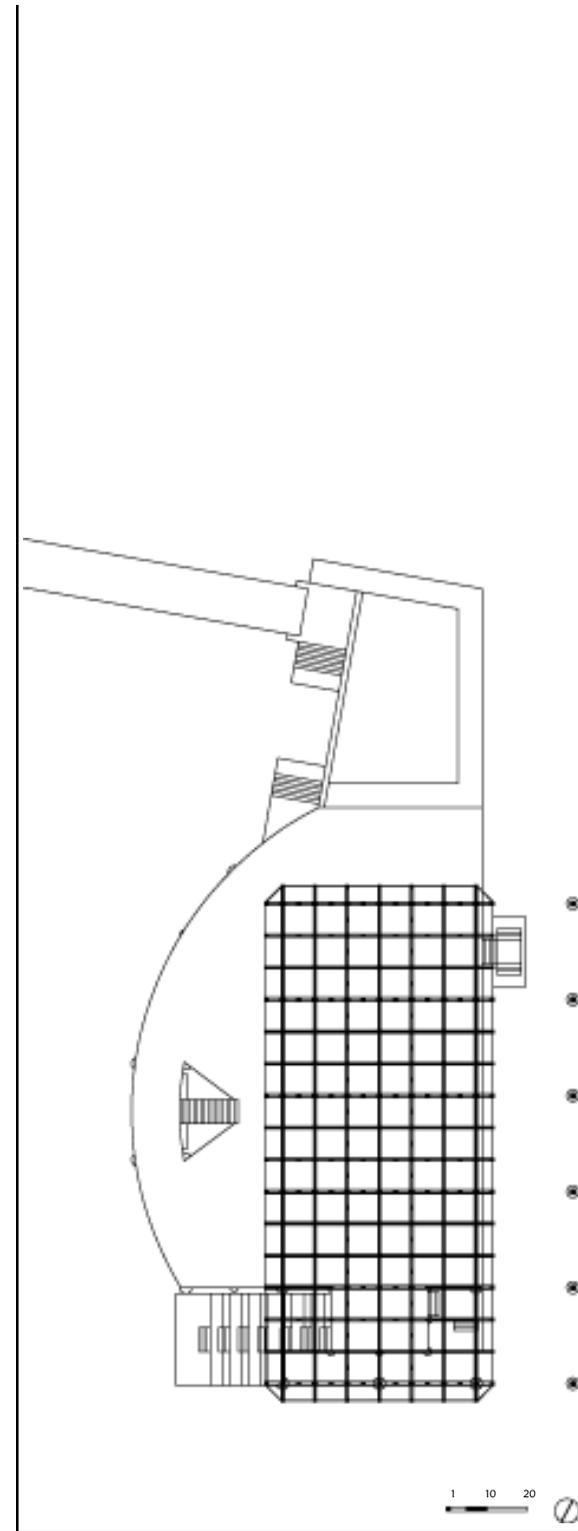




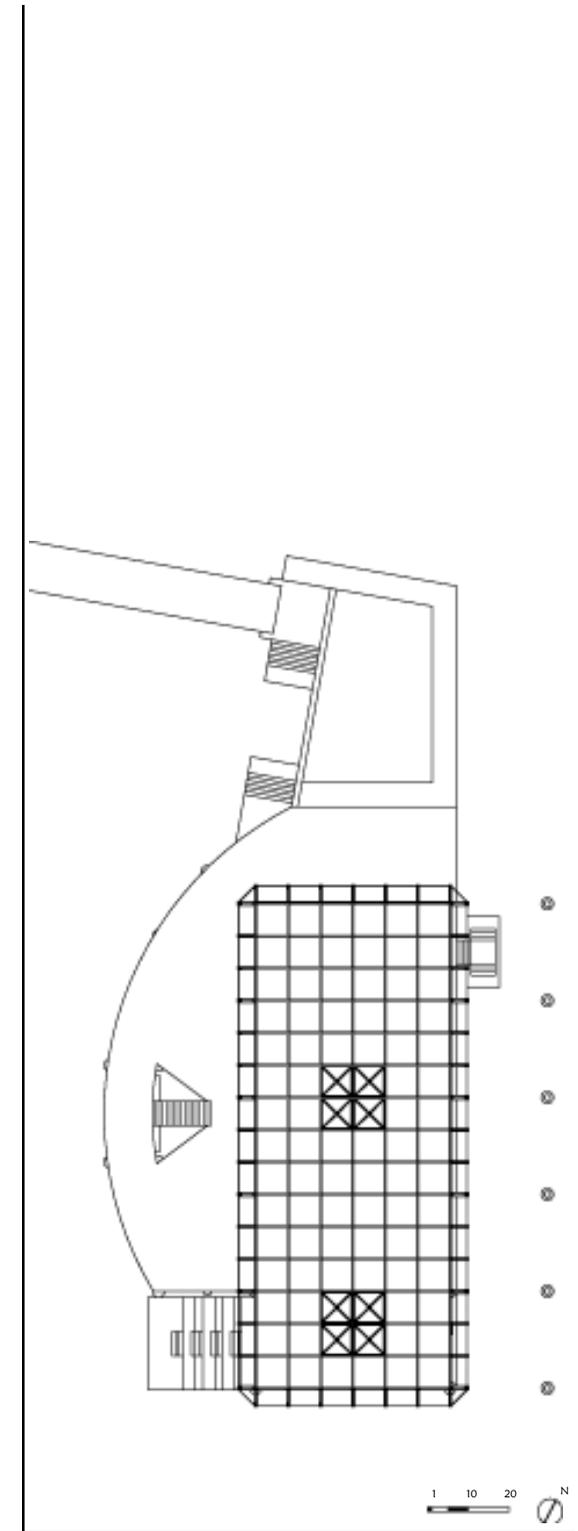
foundation plan



floor plan



truss plan



roof plan

structure

The analogy of tree trunk and canopy to a column and roof structure is not new. Santiago Calatrava sketched and modeled an idea representing a tree structure. The light structure is formed by thin vertical members webbed together by even thinner horizontal members. At the Back Bay Station of Boston, a row of large glulam arches support the roof. The repetitive structure under the long uniform roof provides for multiple functions below. The supporting arches are held with steel tension tie-rods. For the pool room, James Cutler

designed columns that branch out to support the beam. These heavy timber members are connected with steel. In previous two examples, wood members carry the compressive loads. However, steel is used in the connection of members and to resist tension and buckling forces. The wood creates a warm and natural feel. The steel connections allow the wood members to carry loads in new ways. The visitors' center design investigates how the marriage of wood and steel translates to lighter framing structures similar to the one sketched by Calatrava.



model, BCE Place Gallery & Heritage Sq.
Toronto, Canada, 1988
Santiago Calatrava



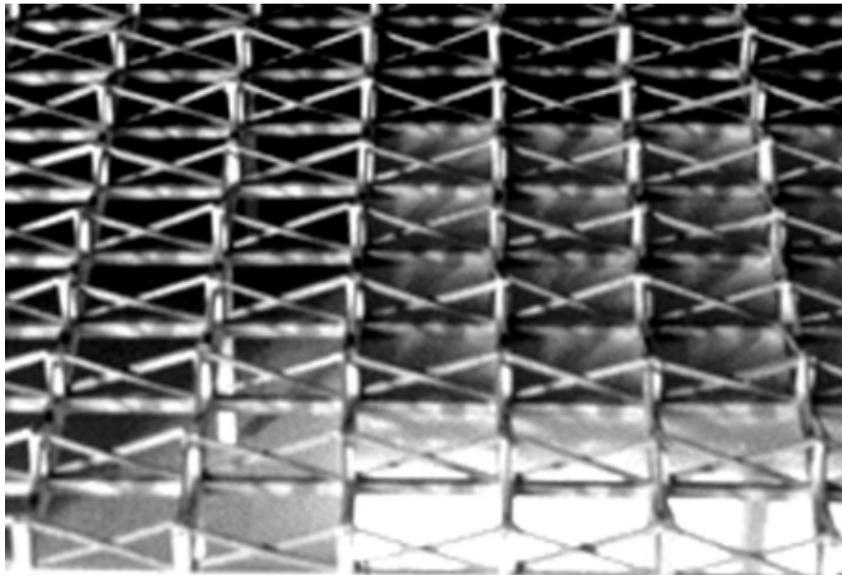
sketch, BCE Place Gallery & Heritage Sq.
Toronto, Canada, 1988
Santiago Calatrava



Back Bay Railroad and Rapid Transit Station
Boston, Massachusetts, 1987
Kallman, McKinnell and Wood



swimming pool, Medina, Washington
1995, James Cutler
(with Bohlin Cywinski Jackson)

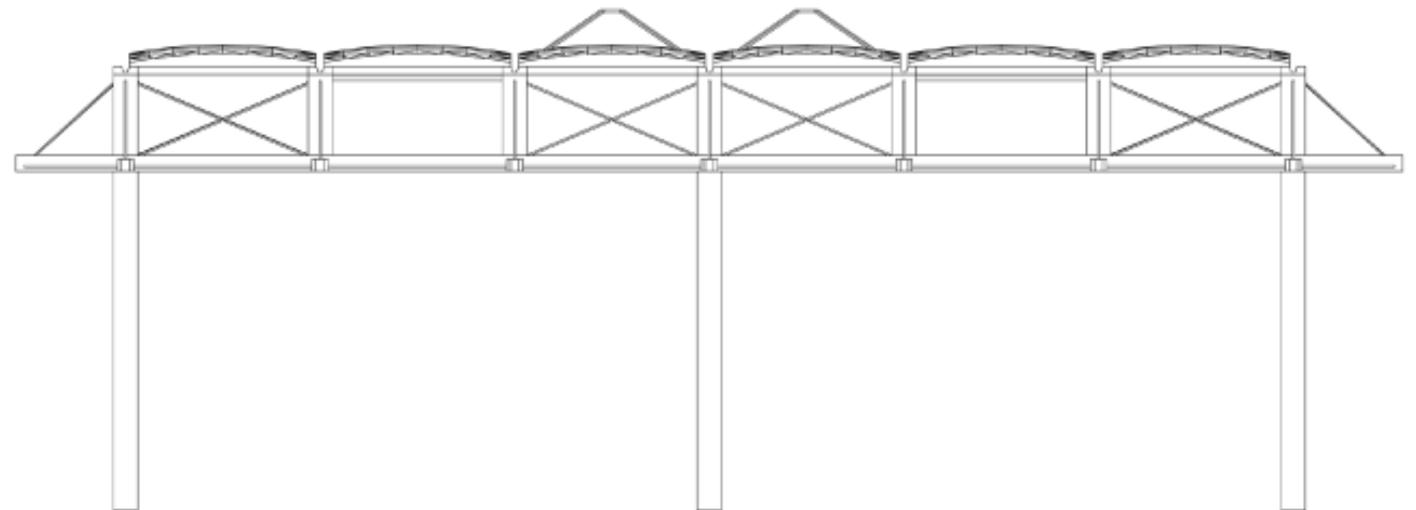
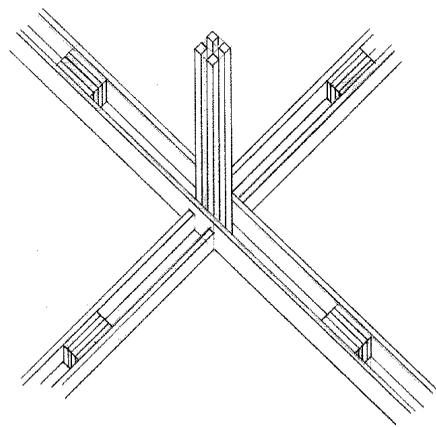
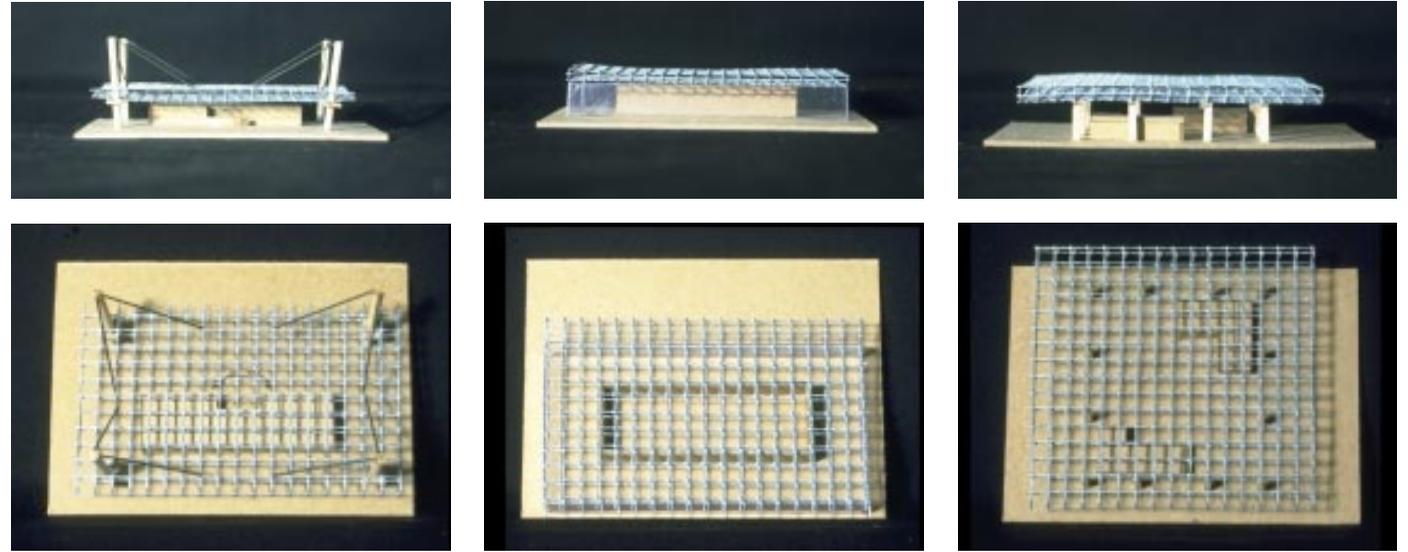


model of structural truss

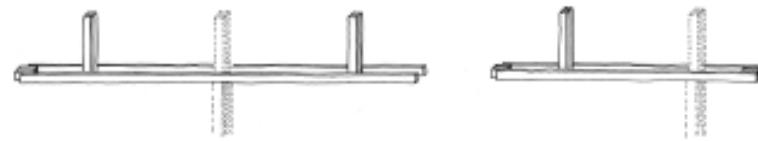


model of roof panels

The design of a truss structure combines wood and steel to support loads. Wood members are built up from standard size light wood framing. These members provide compressive strength in the bottom and vertical chords of the truss. Steel compression rods resist compression loads in the top chord of the truss. Steel cables provide cross-bracing to transfer tension loads to the wood members. With a uniform depth, a truss roof provides the uniformity to accommodate the multifunctional needs of the space below. However, the repetition of truss elements establishes a grid to order the separation of functions. The best support system for this truss roof works with both the needs of the enclosure and the character of the truss. An open column structure easily conforms to the grid of truss elements. The columns also allow the enclosure to be unencumbered by loading requirements.



An integral part of the design of a trussed roof is its assembly. The built up wood members are constructed off-site and are brought to the location. The main supporting truss spans across three columns. It is brought to the site in three pieces. Each segment slides over the top of the column and rests on a haunch. These segments are then joined at the midspan of the columns. The secondary trusses span perpendicular, carrying loads to the main trusses. Shorter blocking members provide lateral stability to the system. All of these elements are tied together by the addition of cross-bracing and top chord compression rods. The edge elements that provide sun shading around the outside of the building are then added. The truss is then covered by the roof panels, skylights and gutter system.



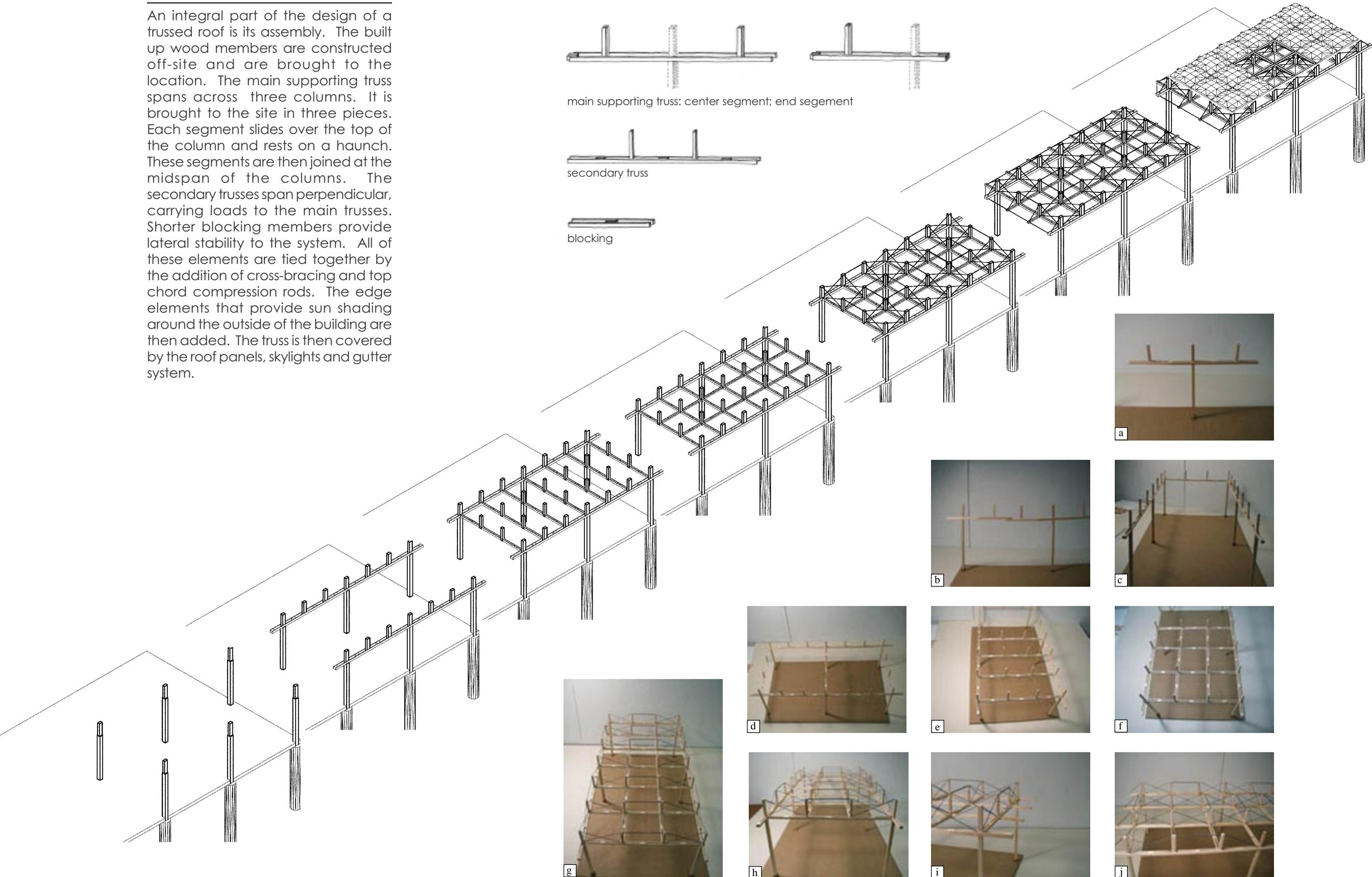
main supporting truss: center segment; end segment



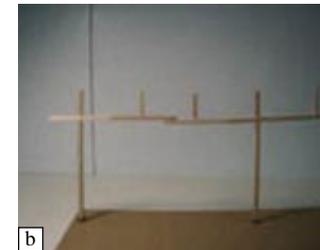
secondary truss



blocking



a



b



c



d



e



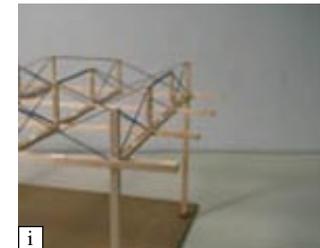
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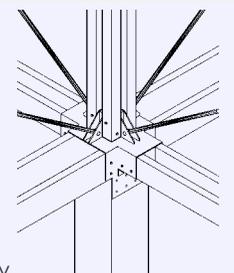
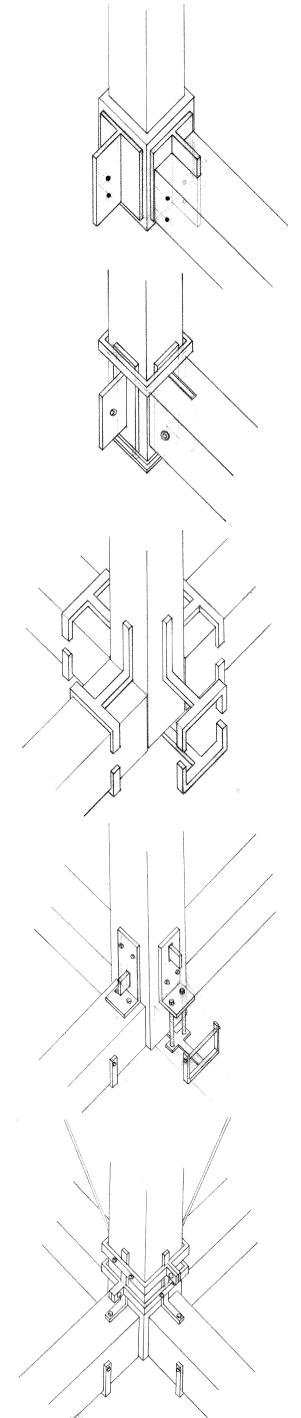
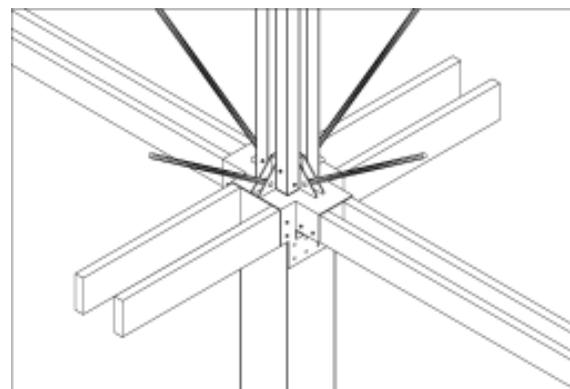
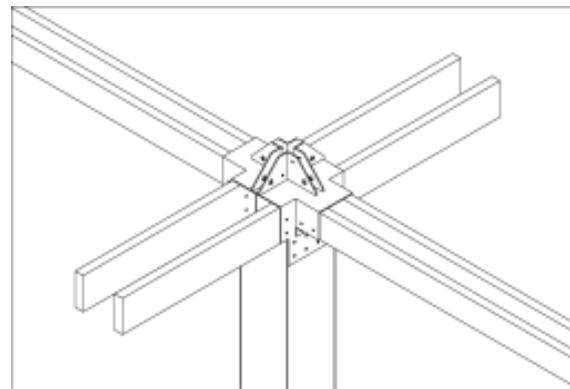
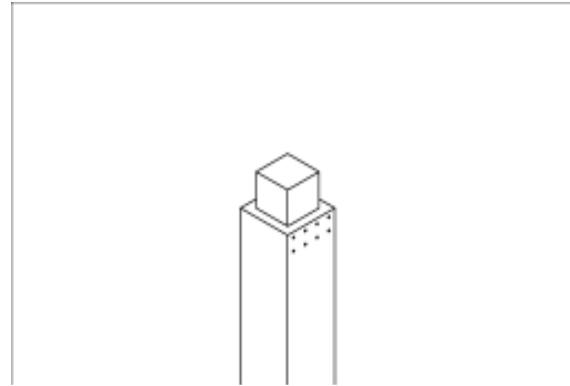
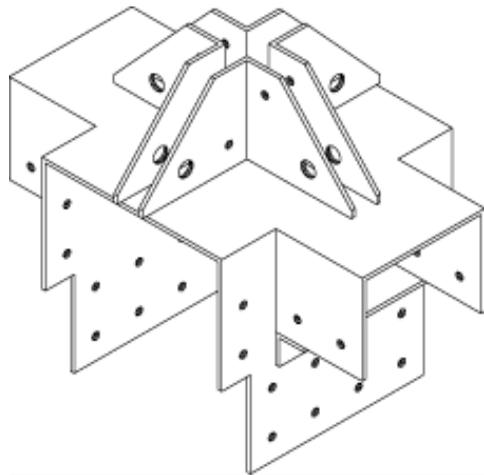


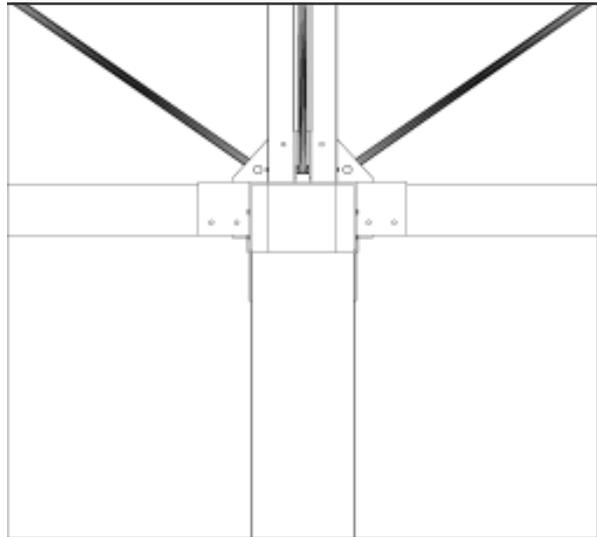
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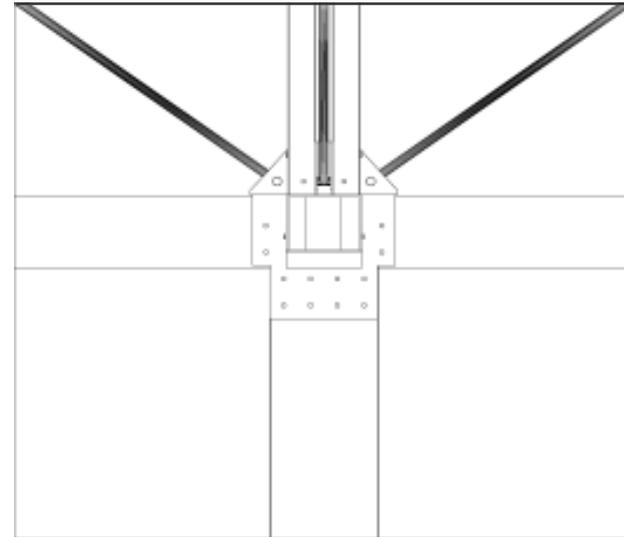
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The main truss, secondary truss, column, vertical members and crossbracing all meet at the same spot. A solid connection of these elements is critical. The column makes a place for the main truss to rest. The metal connector piece slides over the main truss and is bolted to the column and truss. The secondary truss is brought from underneath and attached to the side. The connector piece defines a place for the addition of vertical members and cross bracing.





front view of connection detail



side view of connection detail

stair

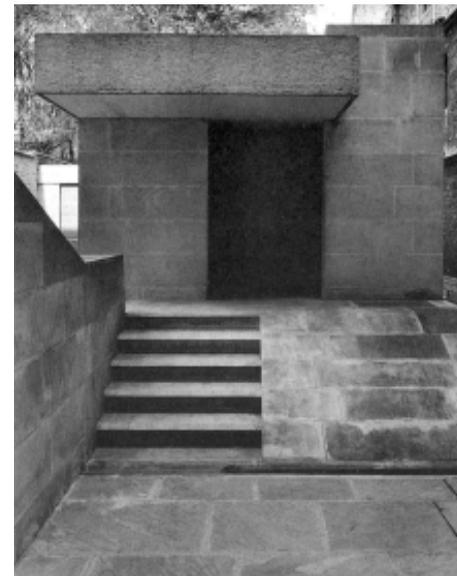
Like the structure, stairs satisfy a utilitarian purpose as well as express an artistic potential. Stairs are a means of vertical movement through space. The design of a stair affects feel and use. A stair can be welcoming or discouraging, draw people together or separate them. The speed and ease of travel are factors that an architect can influence by the design of the stair. The progression of a stair can be smooth or interrupted. The path of travel can be straight or change direction. A stair can be a place to gather. The width of the stair affects the number of people that move on the stair at one time. The manner in which the stair connects the spaces at either end must be considered. Another mechanism of vertical movement is the ramp. Ramps could be necessary for handicap accessibility. However, they can also provide an alternative, the route less traveled.



'scala regia', Vatican City, 1664
Gian Lorenzo Bernini



stairway, Castelvecchio Museum
Verona, Italy, 1962, Carlo Scarpa



stair and ramp, residence, England
Powell & Moya Partnership

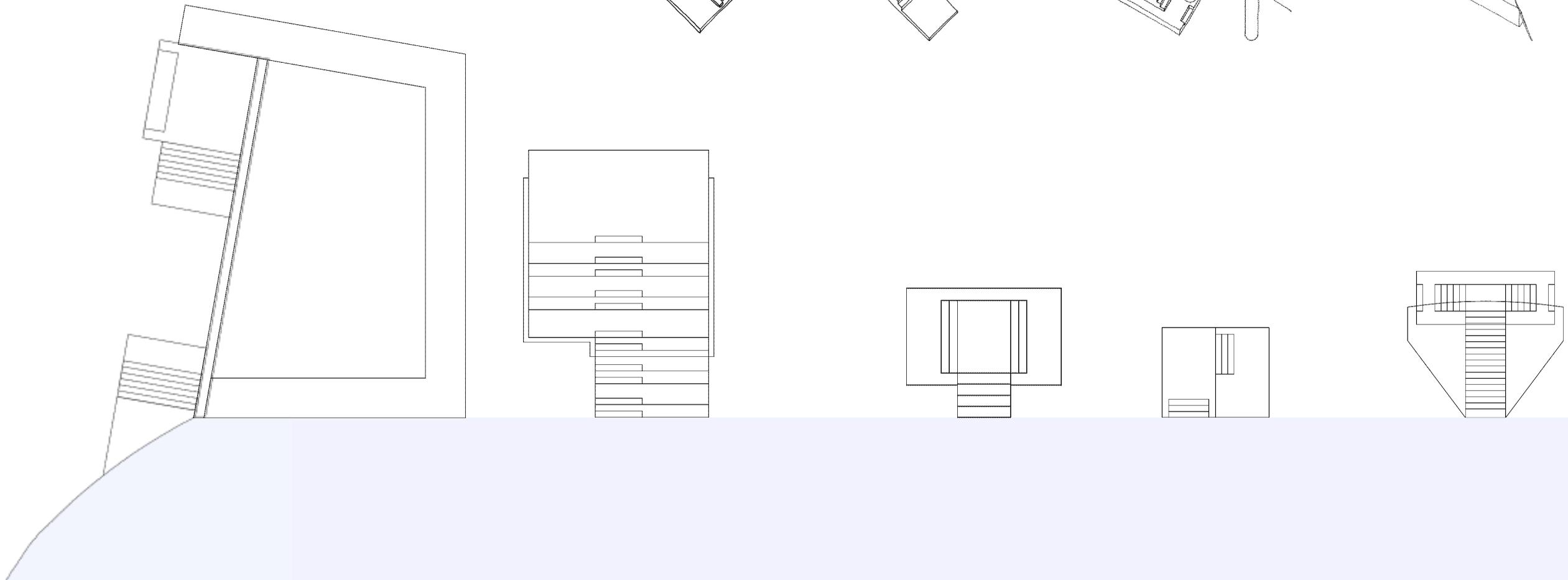
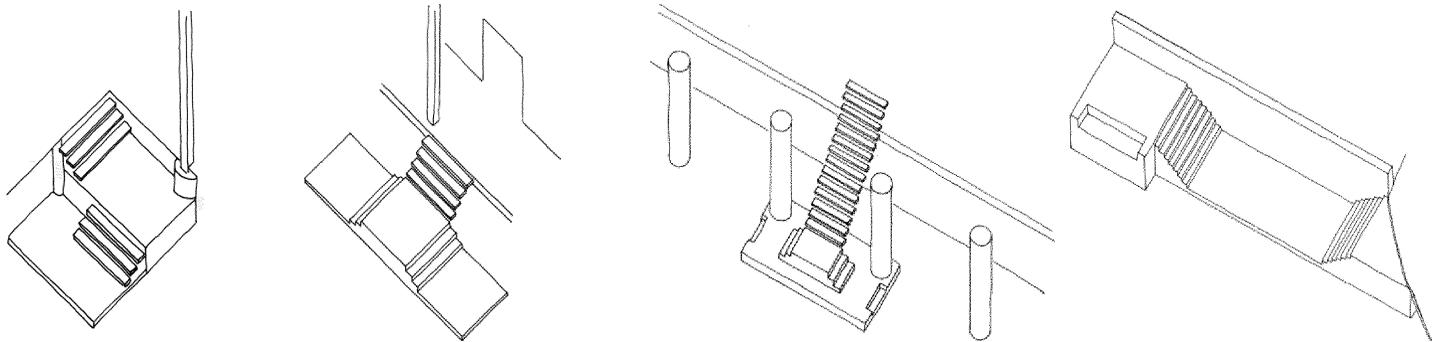
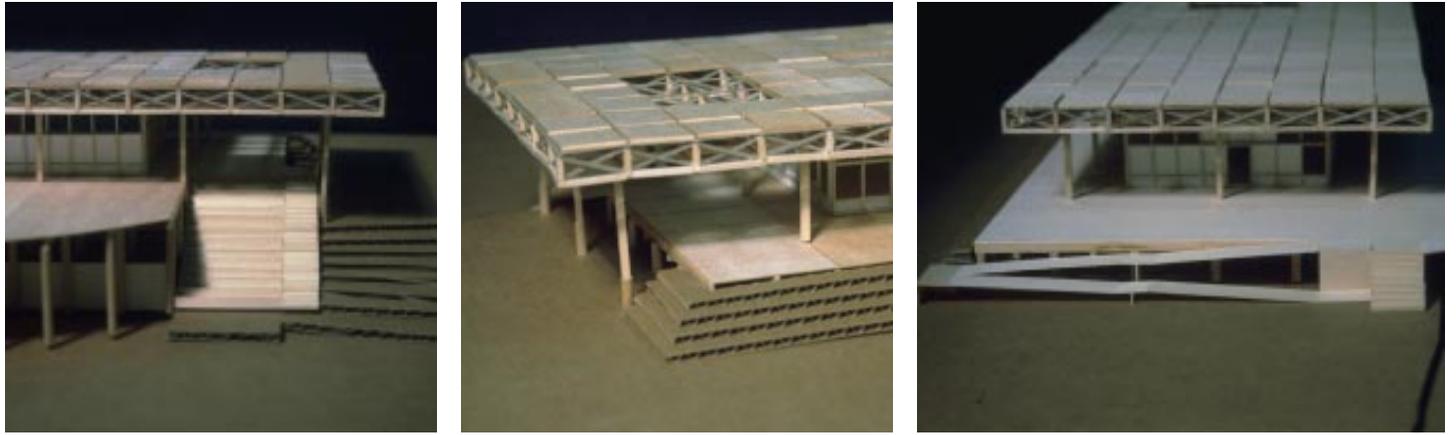


main hall, Elementary School 'De Evenaar'
1986, Herman Hertzberger



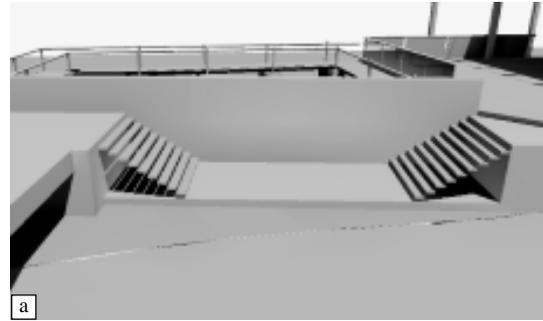
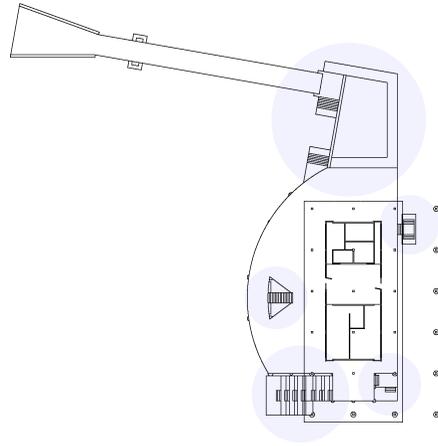
photographic study of stairs l to r: Carpenter Center, Boston, Massachusetts; residence, Nantucket, Massachusetts; Fallingwater gift shop, Bear Run, Pennsylvania; Mountain Lake resort, Giles County, Virginia; Henderson Hall at Virginia Tech, Blacksburg, Virginia

Five sets of stairs link site and building. The entrance stair brings visitors down from the bridge to ground level. The visitor can then choose to proceed down the bank to the stream or go back up the stair to the base of the building. The ramp provides an alternate path from the bridge to the base of the building. A second set of stairs makes places for visitors to assemble for a lecture. The smaller upper portion of the stair is sheltered for small groups that still meet in inclement weather. In a large group, visitors can sit in the sun or the shade. A third stair divides to allow visitors to join either direction of the path that runs along the wooded edge of the building. The fourth stair completes the corner of the building. It leads to picnic tables situated next to the building. The fifth set of stairs connects the base of the building to the streamside.

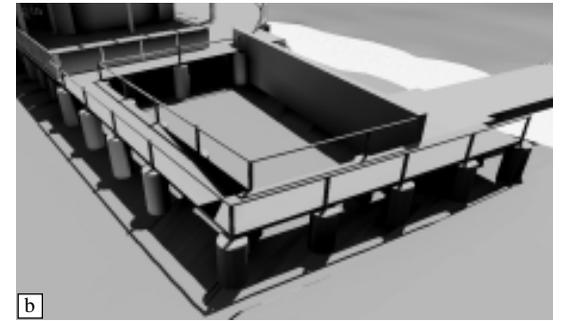


digital models of stairs

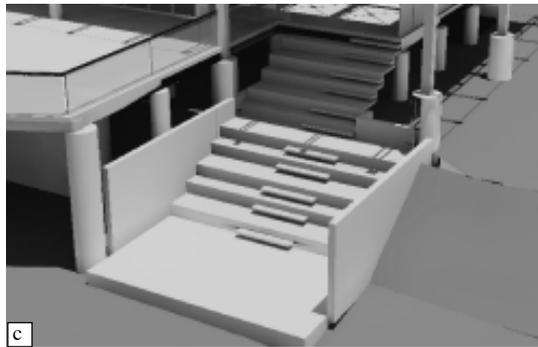
- a. connection from bridge to building
- b. ramp from bridge to building
- c. stair allowing for assembly of visitors
- d. stair joining path along wooded edge
- e. stair completing corner to picnic area
- f. stair leading to streamside



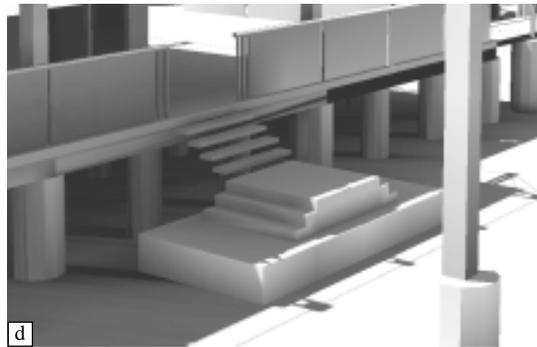
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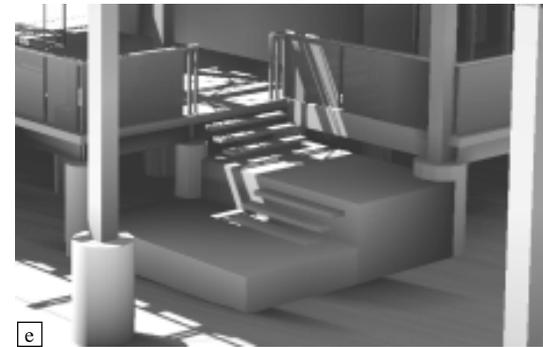
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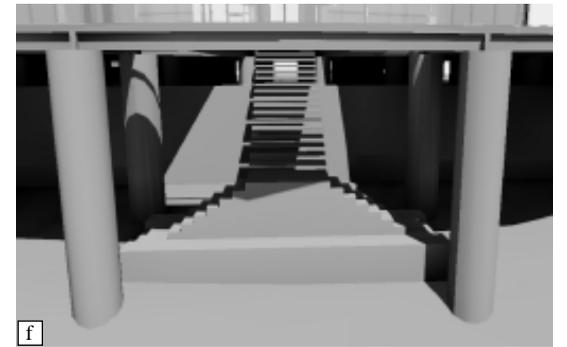
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d

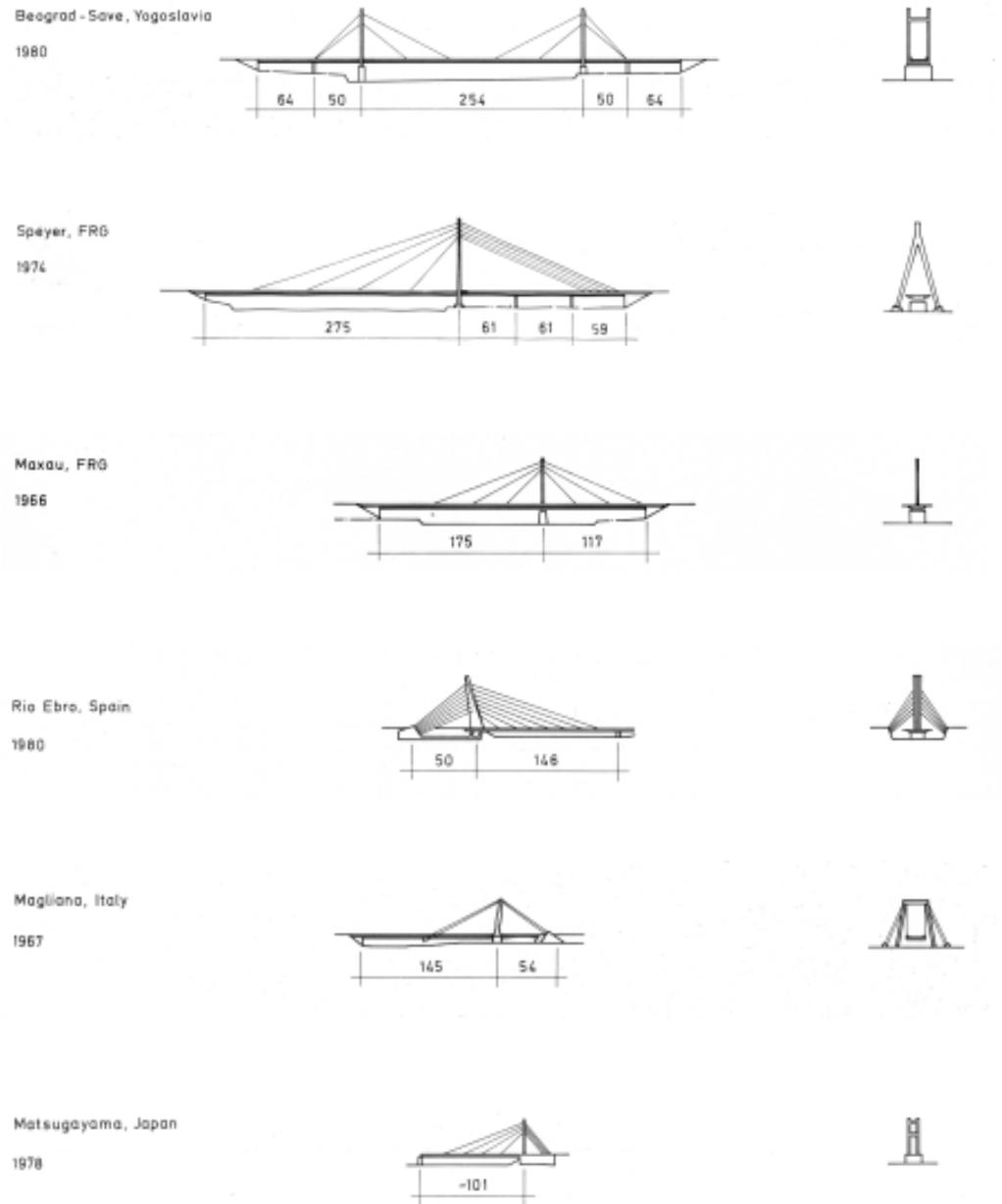


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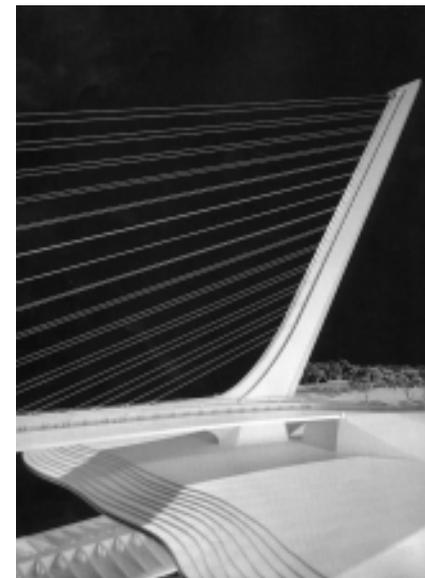


f

bridge



A bridge connects two places that are separated by some obstacle. The small bridge by Carlo Scarpa is an extension of the building across the canal. Its distinct directional quality frames a view of the building. The bridge design by Santiago Calatrava is supported by suspension cables. Its presence is highlighted by a prominent vertical element at one end. This strong vertical element is prevalent in many different suspended bridge designs.



Sevilla Bridge, Spain 1987
Santiago Calatrava

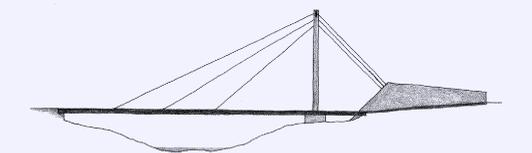
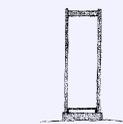
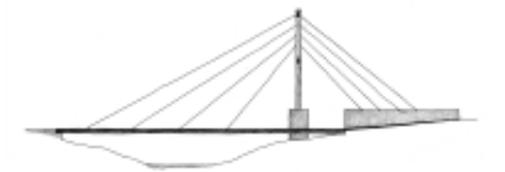
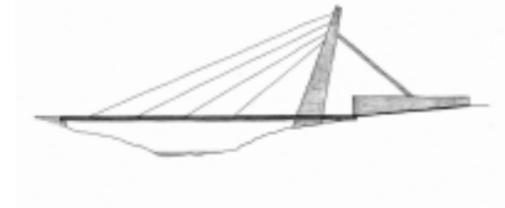
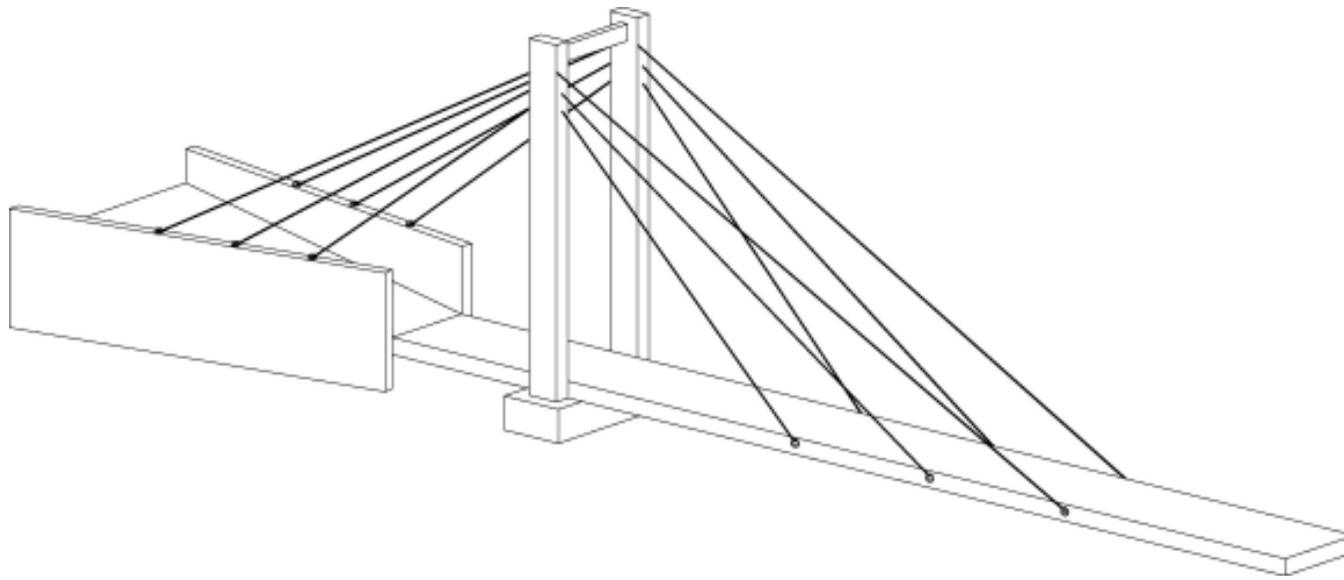
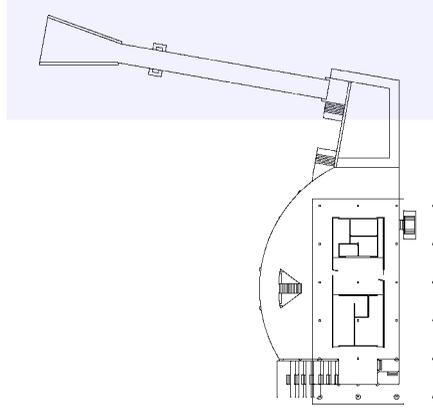


Querini-Stampalia Foundation, Venice, Italy
1963, Carlo Scarpa



photographic study of bridges | to r: duck pond footbridge at Virginia Tech, Blacksburg, Virginia; 181 rest area footbridge, Ironton, Virginia; huckleberry trail, Christiansburg, Virginia; ellet valley covered bridge, Montgomery County, Virginia

At the visitors' center, a bridge is required to cross over the stream and connect the parking area to the center. At the parking area end of the bridge, a strong vertical element captures the attention of arriving visitors. It announces the path to the visitors' center and marks the beginning of the hiking trail. A ramp draws visitors from grade level down to the bridge. As the ramp descends along a wall the view of the visitors' center is limited. The bridge extends to direct visitors to this site across the stream. As one starts out onto the bridge, a view of the visitors' center is revealed.



bridge design study



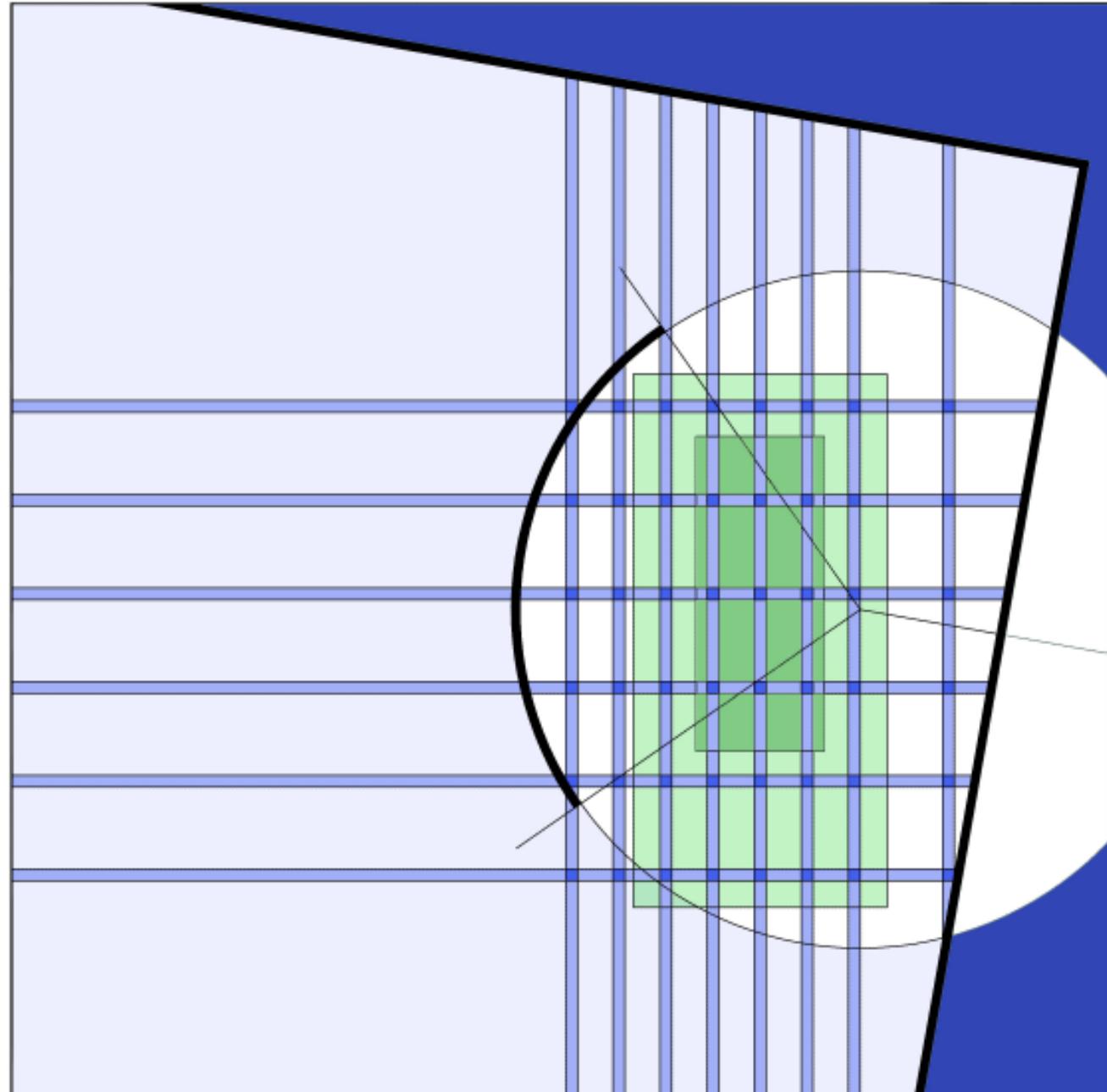
view of bridge leading from parking area to visitors' center

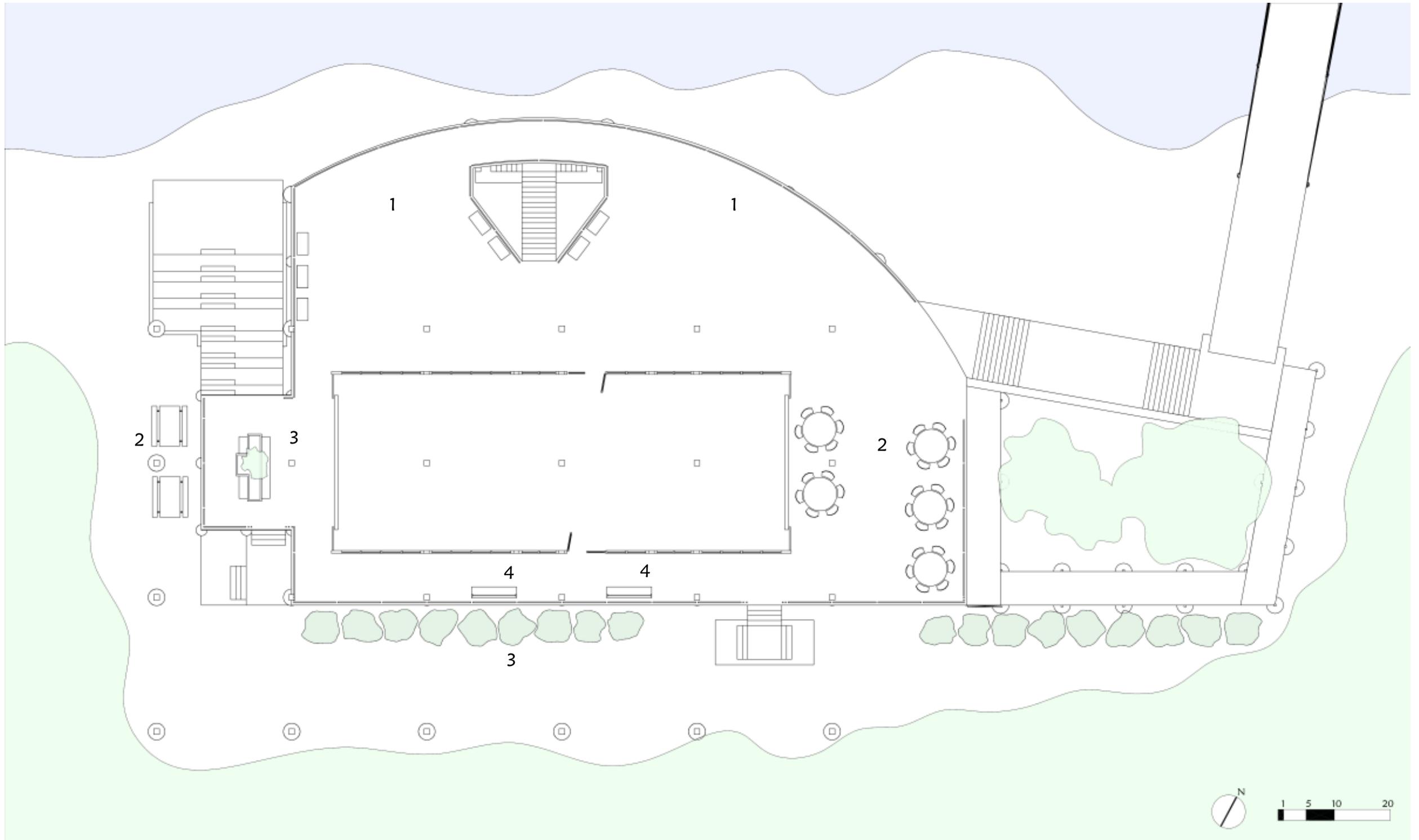


views

Drawing Together Focal Points:

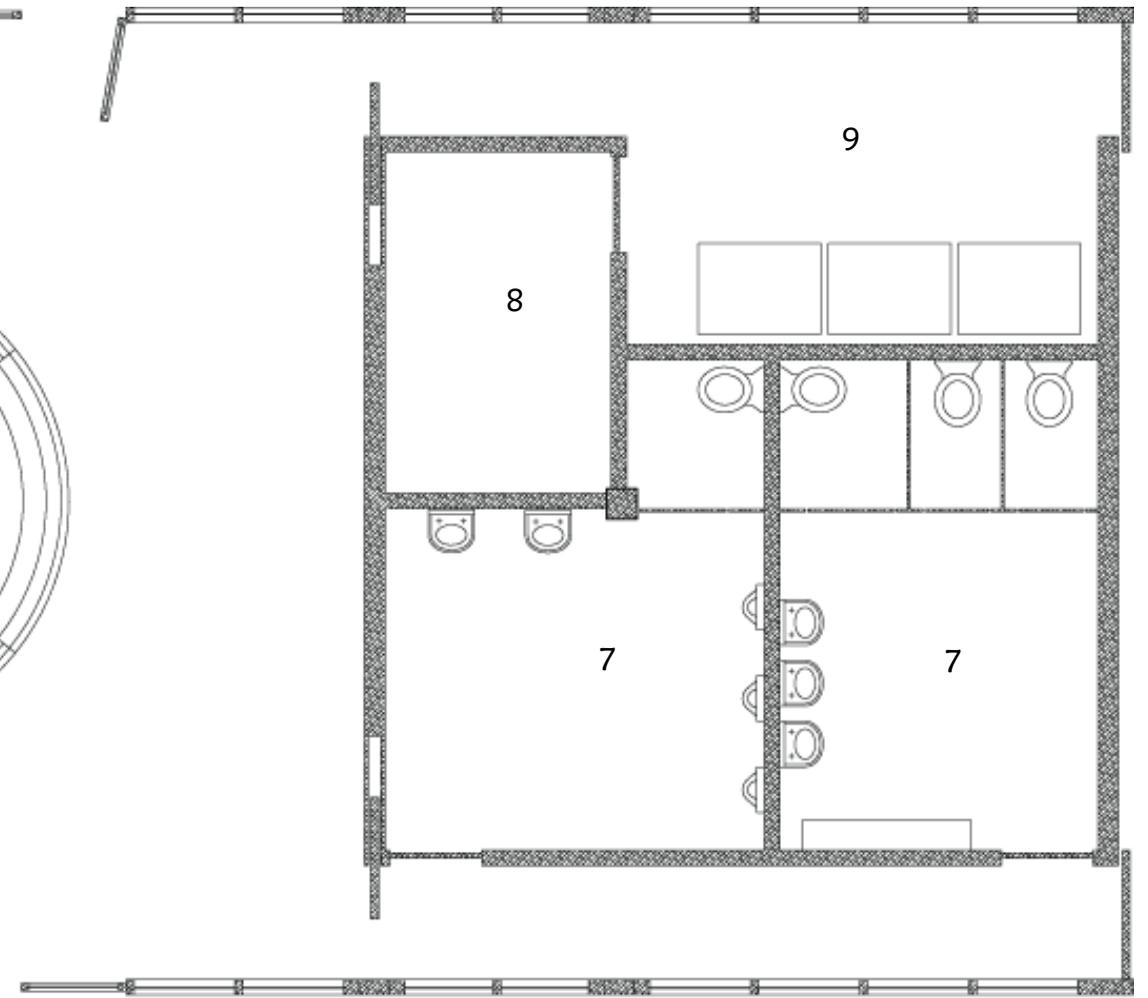
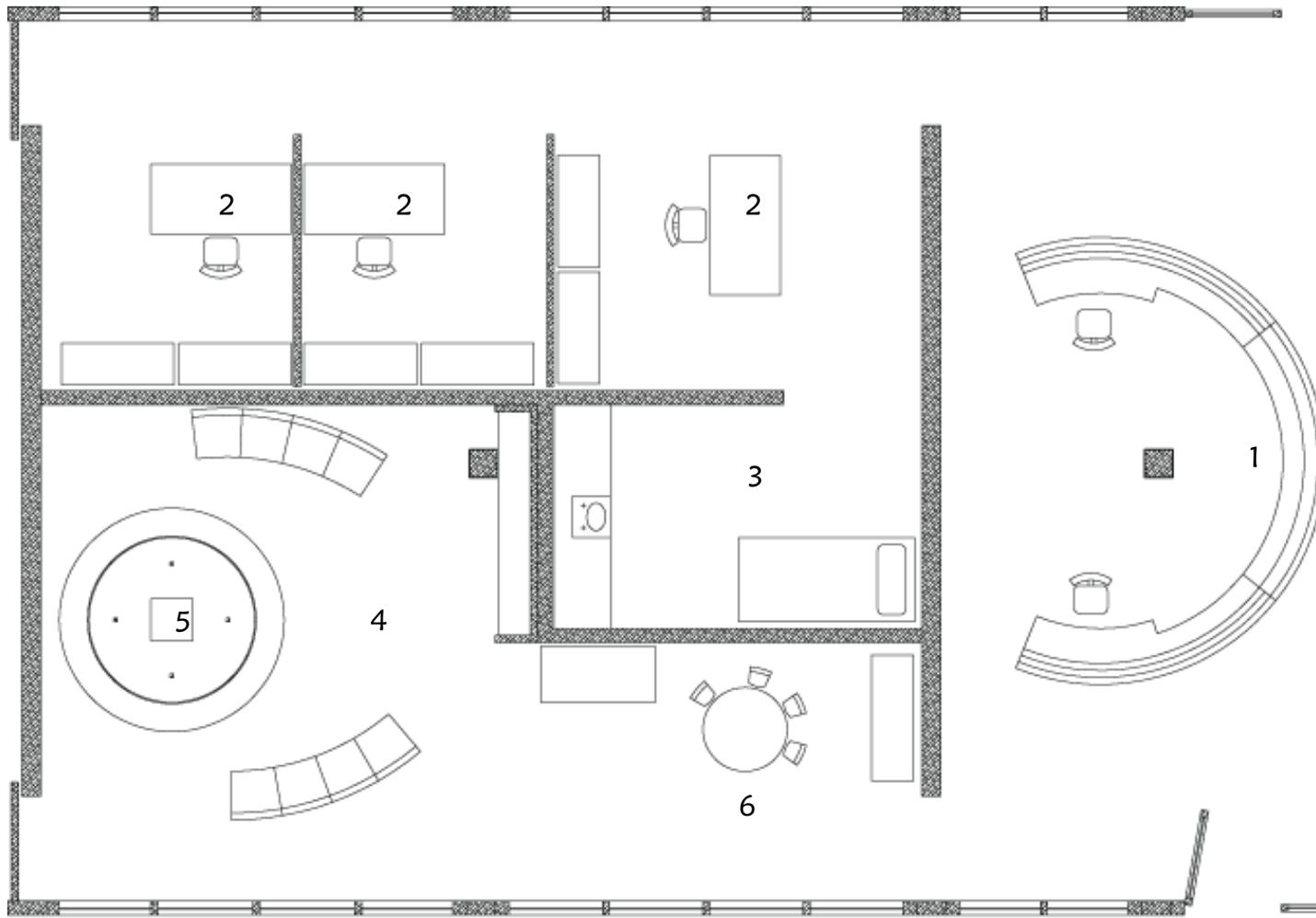
- defining a place between a stream and a forest
- grid of columns links grid of foundation to grid of truss
- relationship of ground to floor; relationship of open, covered and enclosed spaces
- constructing an overhead canopy analogous to the canopy of trees
- providing a several links between site and building through the use of stairs
- influence of bridge across stream as strong design element of the design





building plan

- 1. observation deck
- 2. picnic area
- 3. garden
- 4. display

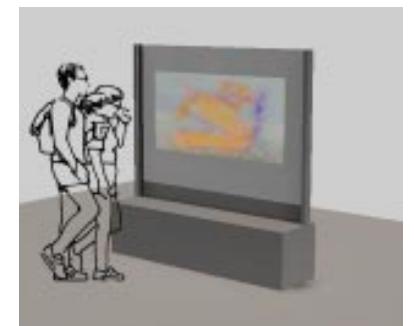
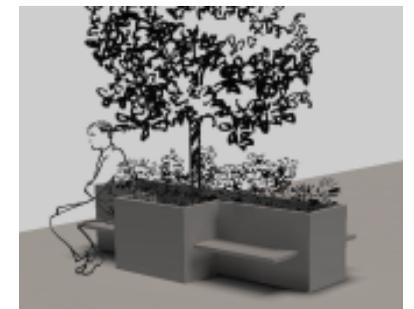
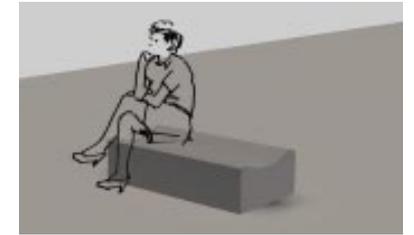


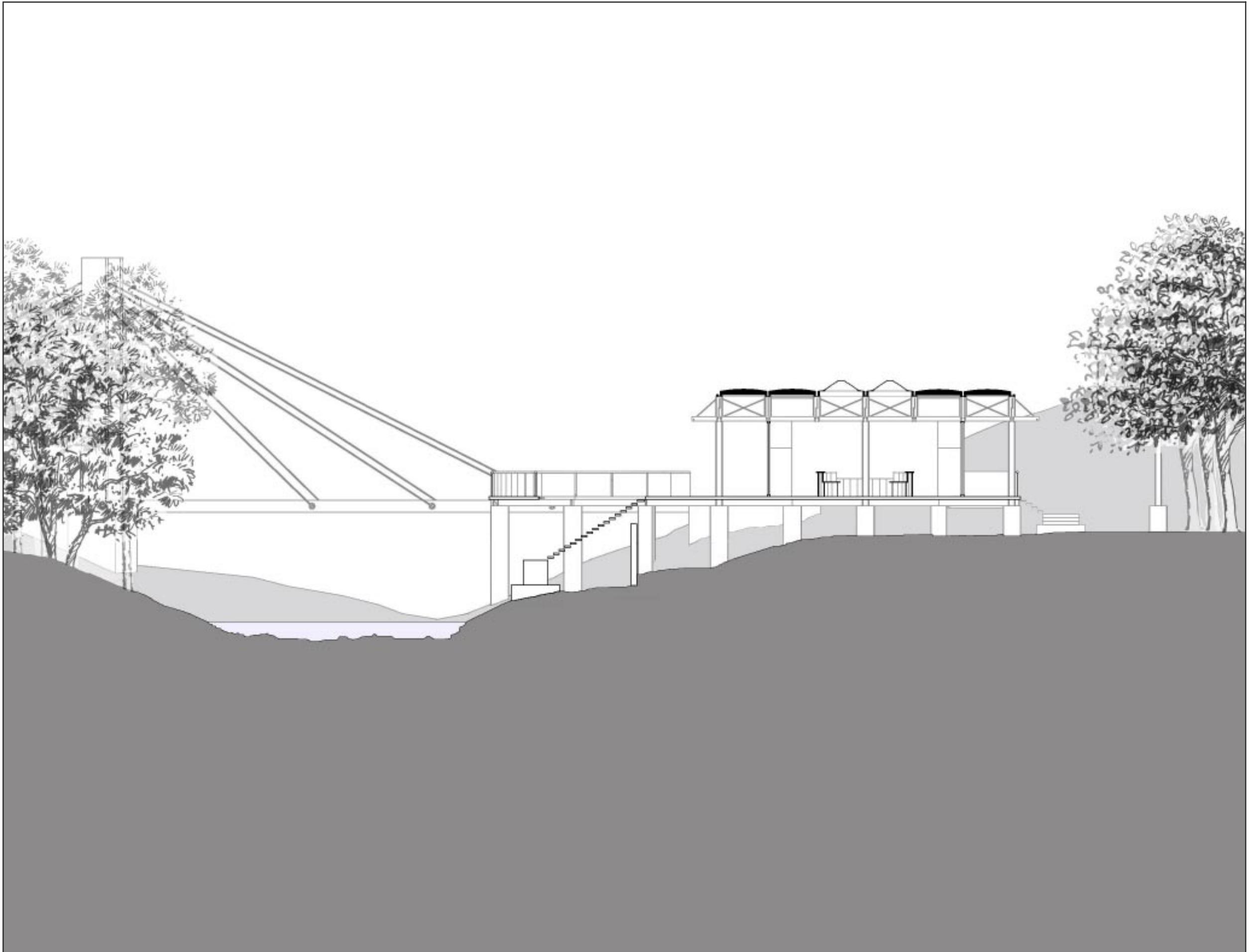
interior plan



- 1. information
- 2. office
- 3. first aid
- 4. lounge
- 5. fireplace
- 6. children's play area
- 7. restroom
- 8. storage
- 9. vending

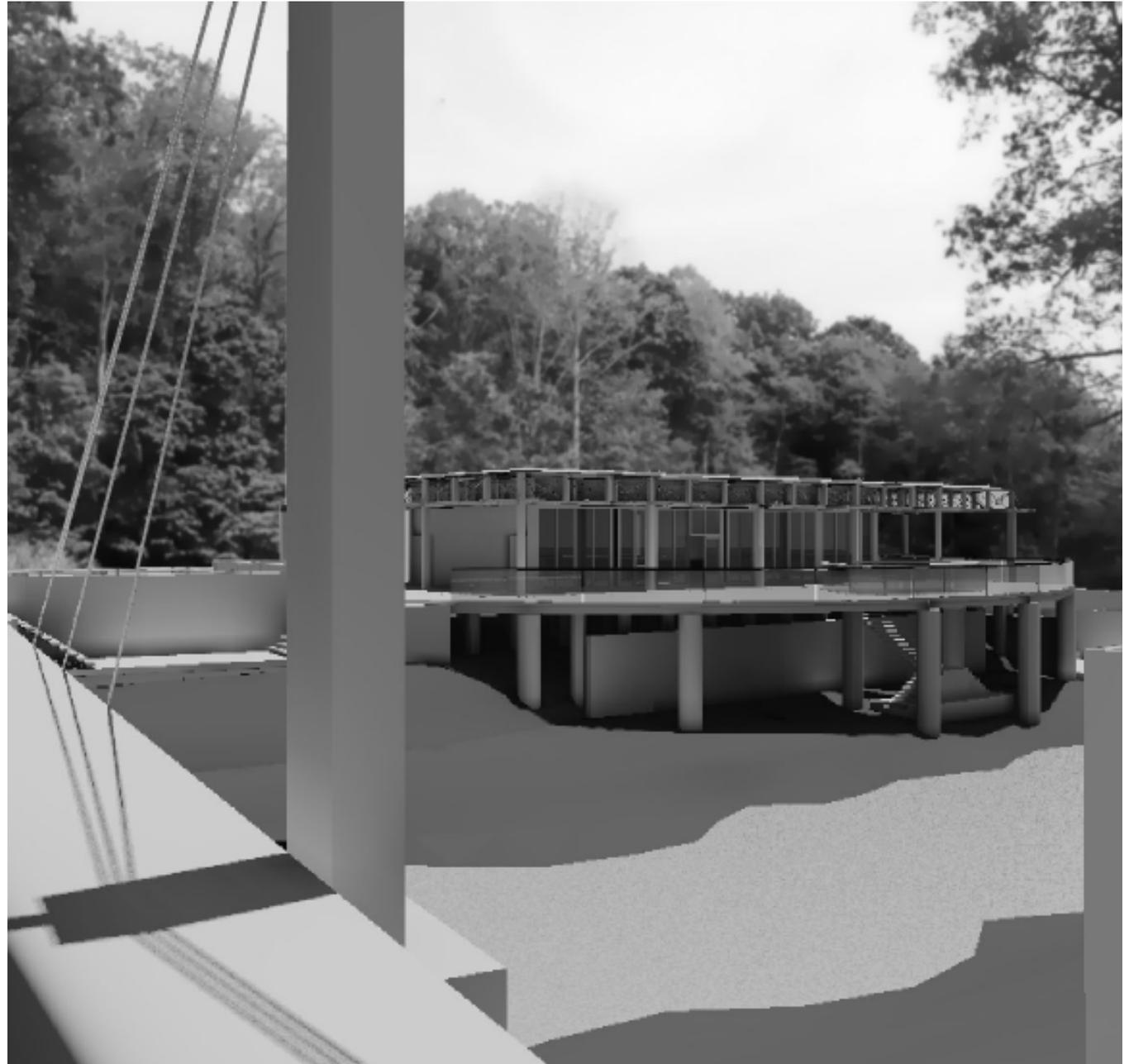
The fireplace, located in the lounge, and the information desk at the entrance of the building are strong elements within the interior of the visitors center. Benches, tables, planters and displays outside of the enclosure contribute to the activity around the building.



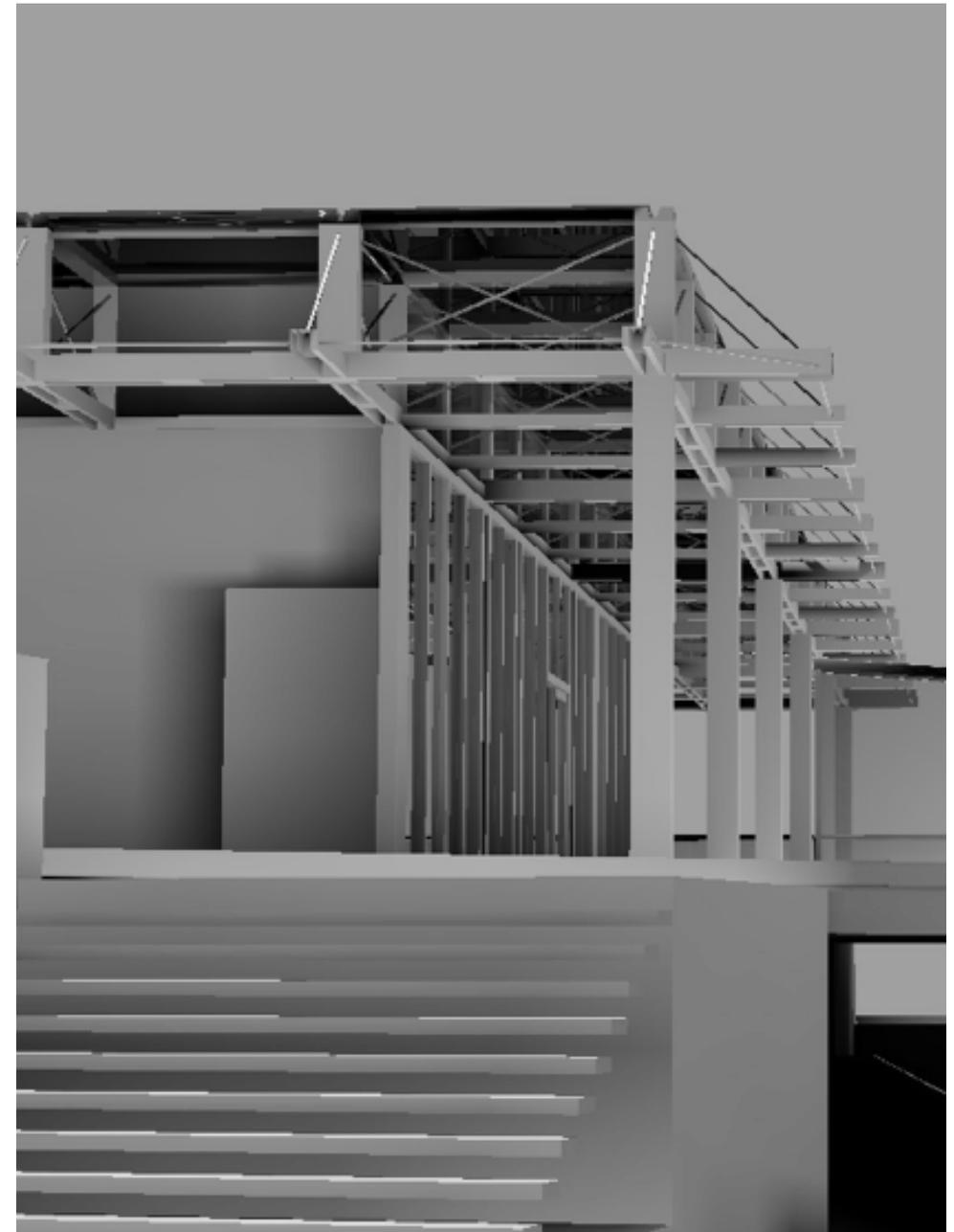




photographic study in depth of field | to r: colonial house, Montgomery County, Virginia; farmers' market, Blacksburg, Virginia; main street, Blacksburg Virginia; ellet valley railroad tracks, Montgomery County, Virginia



view of visitors' center from bridge



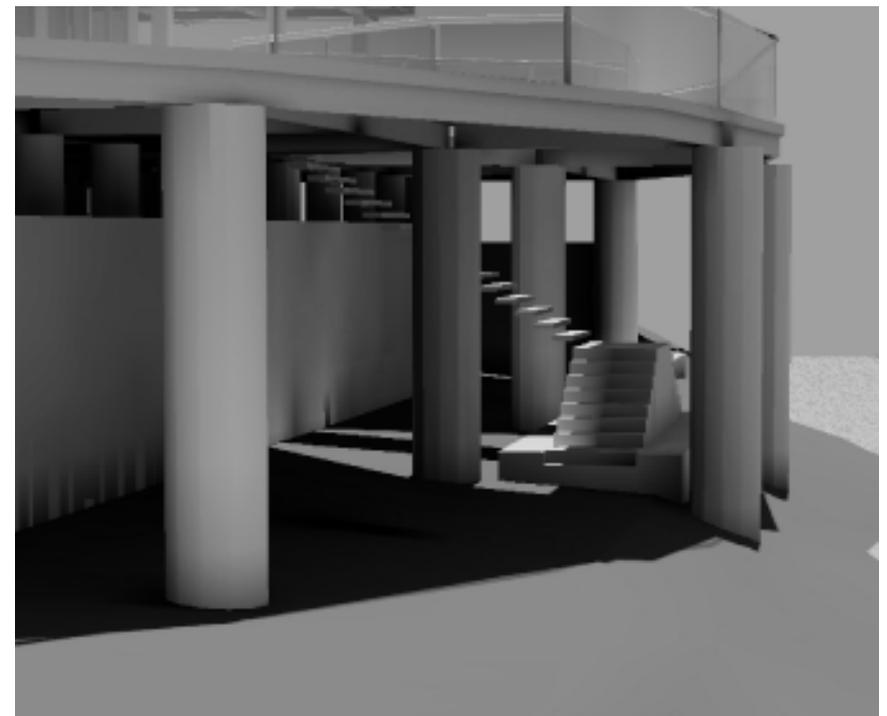
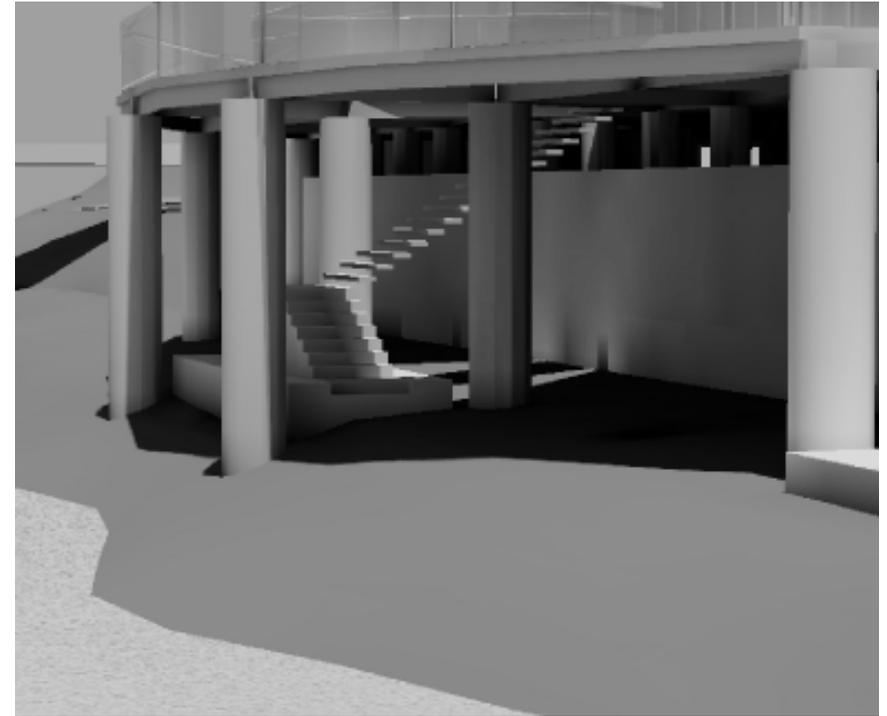
view of stairs leading toward entrance of building



view of path along wooded edge of building



newman library at Virginia Tech, Blacksburg Virginia



views of stair and edge responding to stream



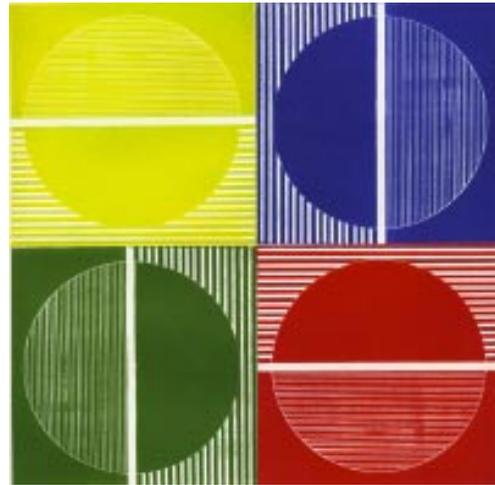
south main stairway, Blacksburg, Virginia



view of assembly stairs

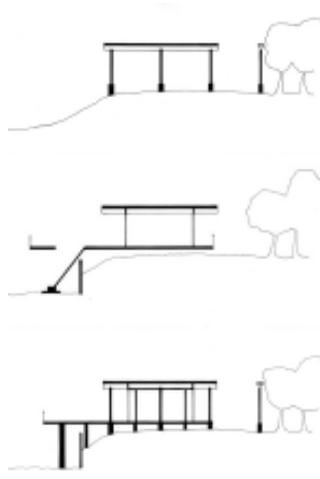
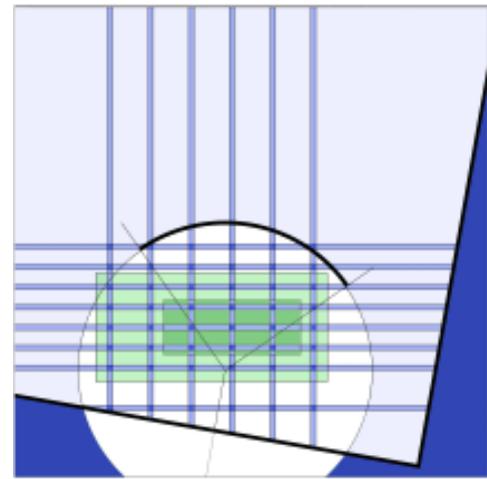


view of trussed roof assembly

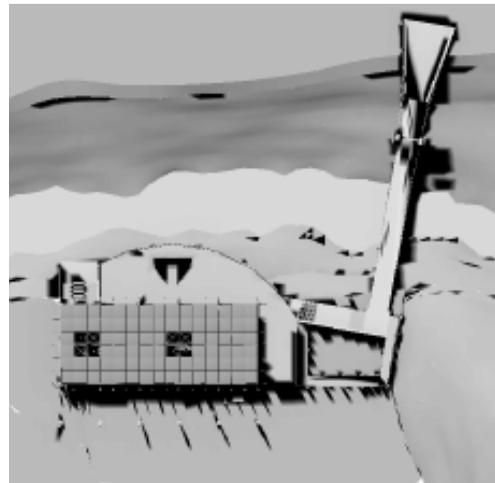


Architecture develops from the process of linking a matrix of influences.

origins



focal points



views

credits

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page 2: *Taureau I*: Le Corbusier, Le Corbusier, Architect of the Century, p308 *Head of EOW*: Frank Auerbach, Frank Auerbach, p 30

page 3: *Cooper Chapel*: Virginia Polytechnic Institute, Art & Architecture library slide collection; *Llyods of London*: Deyan Sudjic, Norman Foster, Richard Rogers, James Stirling: New Directions in British Architecture, p181; *PA Technology Laboratory*: Kenneth Powell, Richard Rogers, p80; *'Bach de Roda - Felipe II'*: Santiago Calatrava: Engineering Architecture, p150

page 4: *plan, Exeter Library*: Alexandra Tyng, Beginnings: Louis I Kahn's Philosophy of Architecture, p51

page 5: *Fallingwater*: Maria Constantino, Frank Lloyd Wright, cover; *residence in Guam*: Richard Neutra, Life and Human Habitat, p311

page 14: *BCE Place Gallery and Heritage Square*: Santiago Calatrava: Engineering Architecture, model: p72, sketch: p68; *swimming pool*: Theresa Morrow, James Cutler, p71

page 20: *'scala regia'*: Alan Blanc, Stairs, Steps and Ramps, p22; *Castelveccchio stairway*: Maria Antonietta Crippa, Carlo Scarpa: theory design projects, p189; *stair and ramp*: Alan Blanc, Stairs, Steps and Ramps, p337; *'De Evenaar' main hall*: Heman Hertzberger, Herman Hertzberger, p126

page 24: *bridge sequence study*: Hans Wittfoht, Building Bridges: history, technology, construction; *Sevilla Bridge*: Santiago Calatrava: Engineering Architecture, p168; *Querini-Stampalia bridge*: Maria Antonietta Crippa, Carlo Scarpa: theory design projects, p204

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For Rob Kovack, who lives on in our memories

vita

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