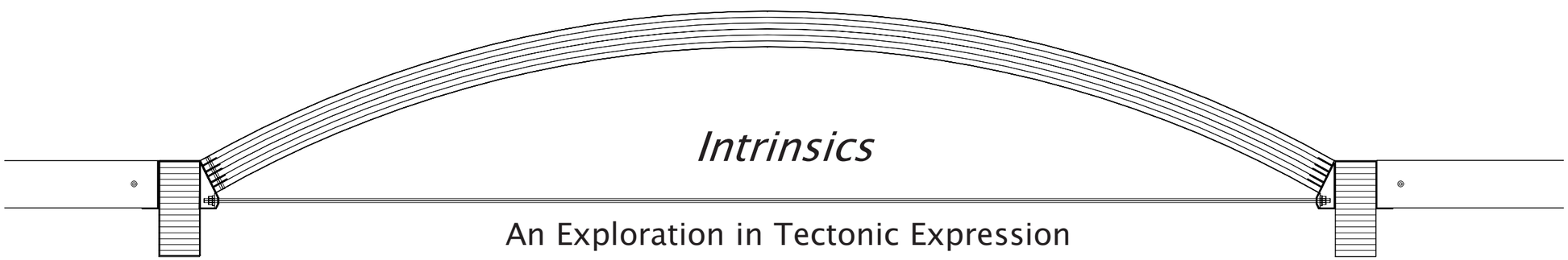

Intrinsics

An Exploration in Tectonic Expression

by

Donald B. Flick, Jr.

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An Exploration in Tectonic Expression

by

Donald Burton Flick, Jr.

Thesis submitted to the Faculty of the Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARCHITECTURE

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With gratitude...

to my commitee members for their patient and insightful guidance.

to Linda Clark for her persistent encouragement, understanding, assistance and love.

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Table of Contents

ii. Acknowledgements
2. Introduction
6. Precedents
The Project
15. Program
17. Context
19. Exploration
29. Design
56. Perspective
58. Appendix A: Montessori Background
62. Appendix B: Case Study: Omni Montessori School, Charlotte, NC
63. Appendix C: Case Study: Charlotte Preparatory School, Charlotte, NC
64. Bibliography
65. Vita

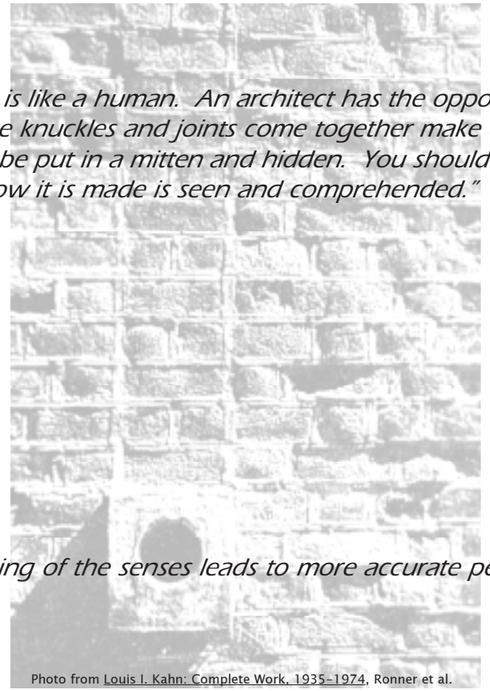


Photo from Louis I. Kahn: Complete Work, 1935–1974, Ronner et al.

"A building is like a human. An architect has the opportunity of creating life. It's like a human body - like your hand. The way the knuckles and joints come together make each hand interesting and beautiful. In a building these details should not be put in a mitten and hidden. You should make the most of them. Space is architectural when the evidence of how it is made is seen and comprehended."

Louis I. Kahn, quoted in Architecural Forum, Oct.1957

"Early training of the senses leads to more accurate perception of reality and roots imagination and intelligence in reality."

Maria Montessori, quoted in Montessori Today, R.C. Orem

Introduction

" *I was born to a family of builders, and grew up in a fervour about making. As a young man, I grew up in a time that was given rhythm by buildings going up, and new buildings being planned. Making is biologically imprinted into me. Designing buildings that express that making ... is absolutely natural to me.*"
Renzo Piano, Renzo Piano Building Workshop Complete Works Vol.2

I have a similar background. Although my father was a biology teacher, he has a passion for building, always seeking another opportunity to make one more house, garage, addition, deck, etc., even now that he's retired from both teaching and our construction business. My mother enjoyed sketching layouts for the next project, and helping with the construction.

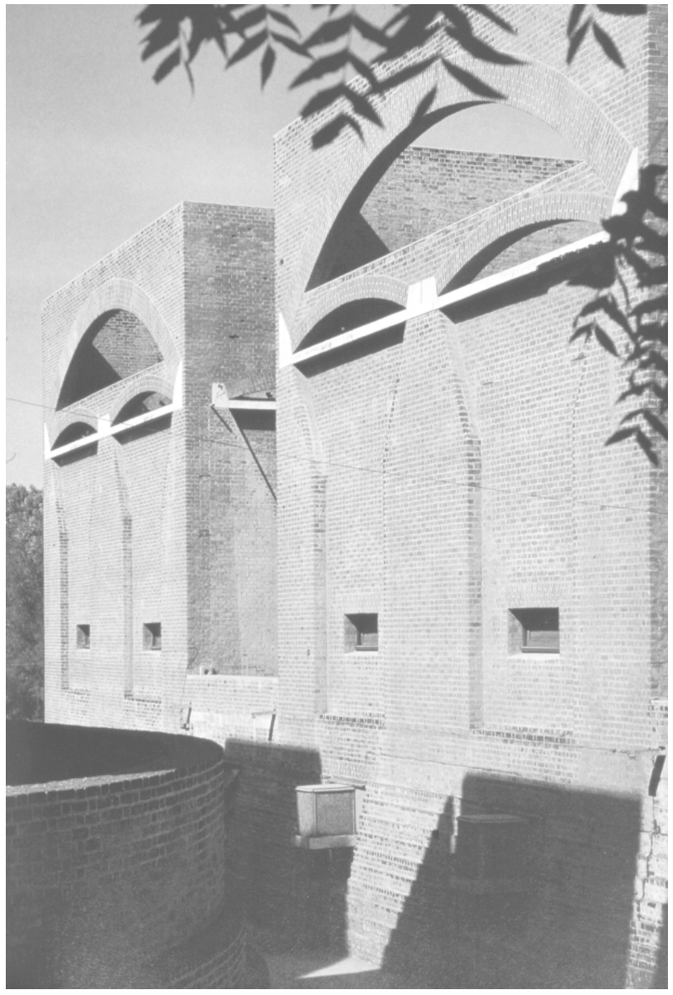
I was eleven years old when we moved into a half-completed house, and finished it ourselves. Before I graduated from high school, we had designed and built another from the ground up, as well as a cottage and horse stable. There is a unique satisfaction that comes from engaging your body, mind and spirit in making something as large, complex, beautiful and inhabitable as a building.

Yet much of the construction industry is production and money oriented. Increased cost of materials has put more pressure on builders to work fast and cheaply to make a project affordable. "Hometime" and "This Old House" have oversimplified the construction process in the mind of the average homeowner, and contributed to an expectation of speed. Our transient society has put more stress on resale value and curb appeal than on durability and craftsmanship. Our general lack of respect for construction workers in America is reciprocated by a general lack of pride on their part. If "you can't see it from my house," it's good enough for the average tradesman.

Craftsmanship changed significantly after the first world war, a change that was compounded after the second world war. There was a huge immediate need for reconstruction and new construction, but resources were tight. There was a desire within architecture to find a new architecture for the new age, drastically different from the excessive ornateness and overemphasis on style of the preceding era. The industrial revolution was making new materials and new processes available. Steel, reinforced concrete, and laminated wood are all more compatible with mass production than with more traditional, more decorative craftsmanship. Mass production of building elements satisfied the urge for economy and speed of construction. Design simplification and standardization made production faster and more economical, and was consistent with the move away from ornate decoration.

In the process, craftsmanship shifted its base from labor intensive, skilled hand work to labor-saving automation. Craftsmen have always used tools, but never before did his tools distance him so much from the material he's working with. Using extensive machinery to craft a building element makes it common for the craftsman to never even touch the product with his hands. Combined with a cultural impetus toward quantity over quality, this creates a tendency for the craftsman to be disconnected from his work. It is no longer a work of art to take personal pride in, but instead a quota to meet within acceptable quality standards. I embrace our new tools, but we need a new perspective for working with them.

photo: IBM Travelling Pavillion demonstration arch - Renzo Piano Building Workshop Complete Works, Vol.1, Buchanan



New perspectives are often strongest when we first look at the roots and then combine them in new ways with the latest developments in any given field. The tectonic tradition holds more potential than I can address in this thesis. A brief overview based on Kenneth Frampton's Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture will suffice.

There are many meanings for the word *tectonic*. It's origins are in the Greek words for carpenter or builder (*tekton*), and for producing based on knowledge (*techne*). *Techne* implies a combining of art and craft, knowing and making, and revealing what is intrinsic – manifesting inherent opportunities. *Tekton* evolved to mean a synthesis of making and poetics, then to refer to the master builder, or *architekton*, then to mean an assemblage of parts into a whole, and the art of joining.

Gottfried Semper subdivided architectural elements into earthwork, hearth, framework, and lightweight enclosing material. He distinguishes between the tectonics of framework made of lightweight components, and the stereotomics of the earthwork made with more mass and volume, often of cut pieces piled up. The lightweight connects us with the sky, and the massive grounds us in the earth. I believe the correspondence to natural features like trees and rocks helps us to feel more at home in the world.

Tectonic encompasses all these things. A concise and comprehensive definition is Kenneth Frampton's term, "Poetics of Construction."

What distinguishes tectonics from the rest of architecture? Primarily its emphasis on material and joints and assemblage rather than on the space created within.

"*The rock comes to bear and rest and so first becomes rock; metals come to glitter and shimmer, colors to glow, tones to sing, the word to speak. All this comes forth as the work sets itself back into the massiveness and heaviness of stone, into the firmness and pliancy of wood, into the hardness and luster of metal, into the lighting and darkening of color, into the clang of tone and into the naming power of the word.*"

Martin Heidigger , "On the Origin of the Work of Art," in Poetry, Language, Thought

"*Where technology reaches its real fulfiillment it transcends into architecture."*
Mies Van der Rohe, 1950 IIT Address

"Laminated wood is rapidly replacing lumber and is equally friendly to the eye.... Standardization, prefabrication, controlled experiments ... are not monsters to be avoided by the delicate sensitiveness of the artist. They are merely the modern means of controlling vast potentialities of materials for living, by chemistry, physics, engineering, production and assembly, which lead to the necessary knowledge the artist must have to expel fear in their use, broaden his creative instinct, give him new courage and thereby lead him to the adventures of unexplored places."
Louis I. Kahn, 1944 essay, "Monumentality"

all photos from Renzo Piano Building Workshop: Complete Works, Buchanan

I see signs of hope for a revival of quality craftsmanship and detailing without a relapse into decorative style. The tectonic approach respects and celebrates the way pieces are joined with detailed precision to become a whole. It reveals the inherent beauty and potential in various materials. It addresses all issues truthfully and openly. It challenges the craftspersons to do their best work, and perhaps to stretch their limits here and there, and take pride in what they've done. It adapts to each new condition and project without the need to superimpose a style. We can see how it works. We can appreciate the care that was put into its creation. We can wonder; we can see; we can understand ... we feel connected to this truth in a world of so much illusion. Craftsmanship encompasses the many people and processes involved in creating a building from design through the manufacture of elements (both prefab and onsite) to the assembly of the whole building. The architect should be the chief craftsman, coordinating the minds and hands and machines that are crafting the building, a modern version of the master builder role that architects played in Gothic times.

These days, there are too many processes and systems, etc., in a building for anyone to master them all. So the architect must rely on, respect, and coordinate the expertise of many specialized masters. The architect must know enough about each area of expertise to "engage in a dialogue" with these masters, and to make informed decisions about the craftsmanship of the building.

It is the role of the architect to question the defaults in each knowledge base: to find the best way within the budget, rather than always "the way you do it," the easiest way or the fastest way. We are not obligated to find a new and different way to do everything, obsessively asserting our creativity. But we should actively seek appropriate opportunities for improvement based on the very real principles of how things work.

"An architect must be a craftsman. Of course any tools will do. These days,, the tools might include a computer, an experimental model, and mathematics. However, it is still craftsmanship - the work of someone who does not separate the work of the mind from the work of the hand. It involves a circular process that draws you from an idea to a drawing, from a drawing to an experiment, from an experiment to a construction, and from construction back to an idea again. For me, this cycle is fundamental to creative work. Unfortunately, many have come to accept each of these steps as independent .... Teamwork is essential if creative projects are to come about. Teamwork requires an ability to listen and engage in a dialogue."

Renzo Piano, "In Search of A Balance," *Process Architecture*, 1972

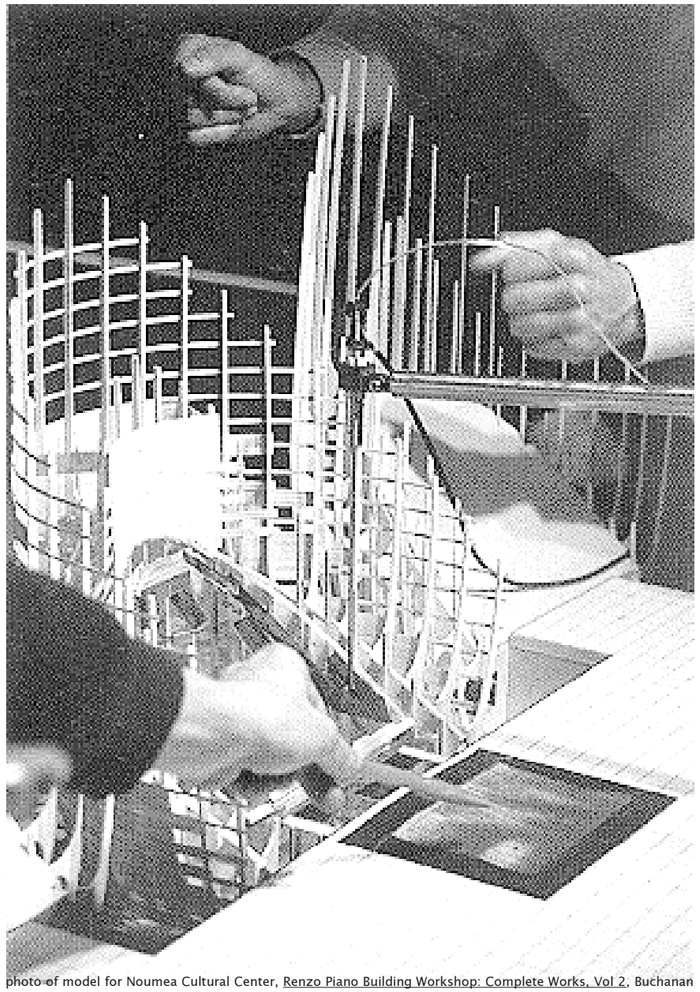
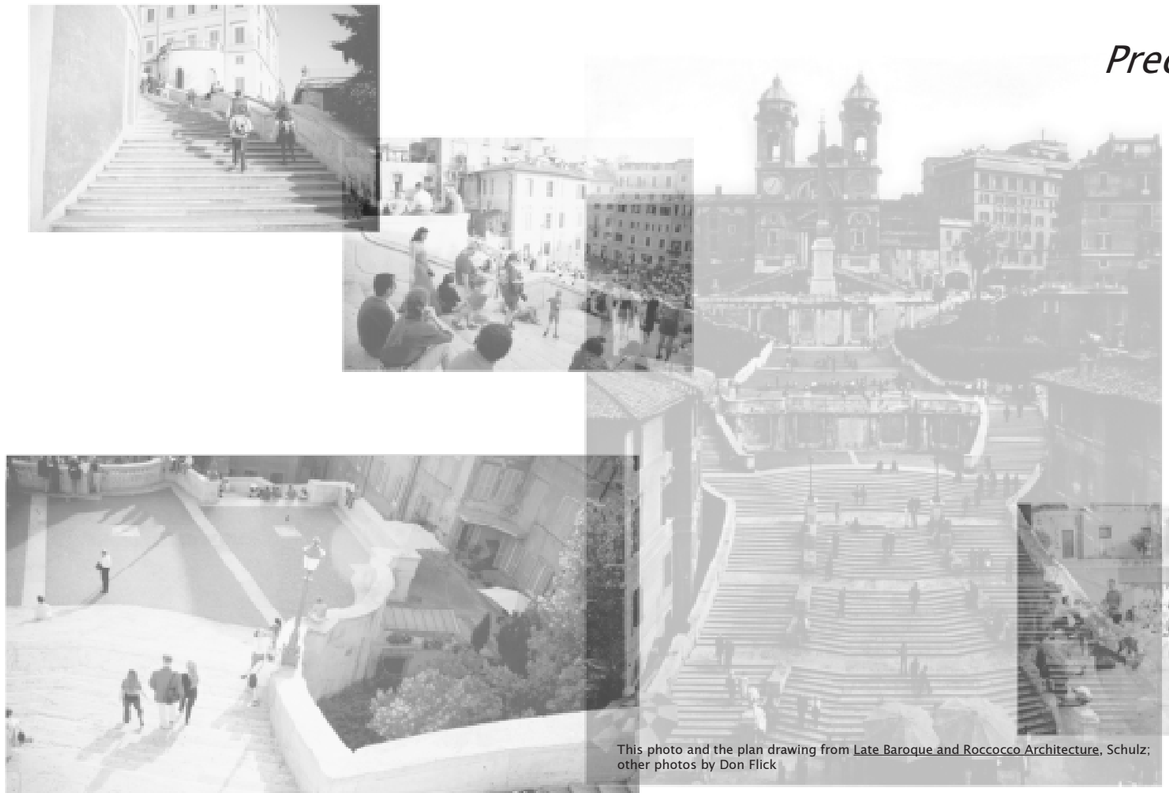
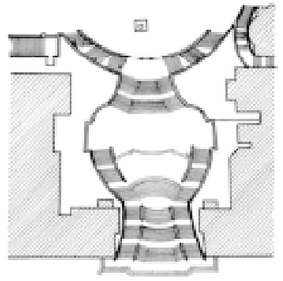


photo of model for Noumea Cultural Center, Renzo Piano Building Workshop: Complete Works, Vol 2, Buchanan

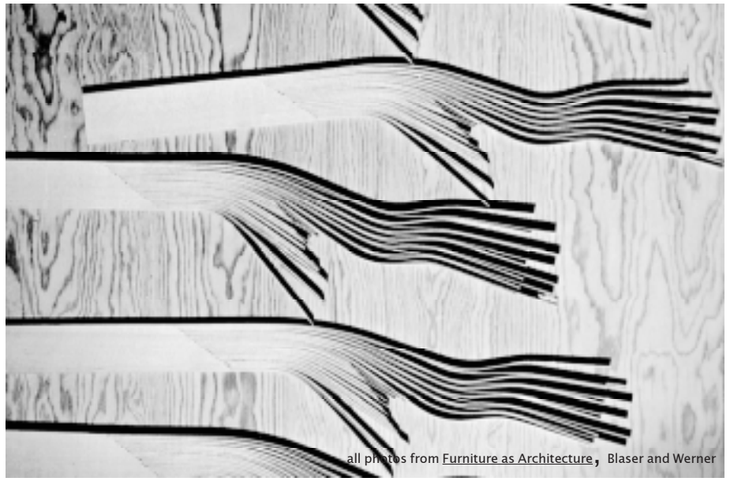
Precedents





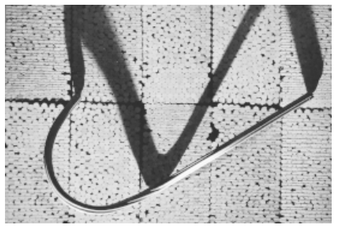
This photo and the plan drawing from Late Baroque and Roccocco Architecture, Schulz; other photos by Don Flick

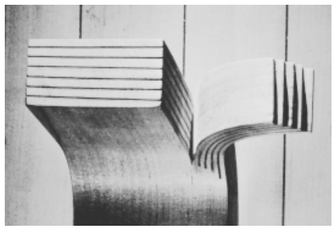
The Spanish Steps in Rome are not only a path up and down the hill, they are a sequence of spaces that unfold as you pass through, a series of places to stay a while alone, or with friends, seeing and being seen. Paths that wind and let us discover what's next are like a good story rather than long straight ones where we can see what's ahead from the start.

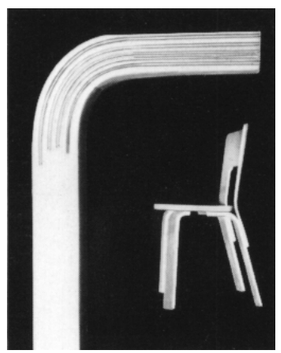


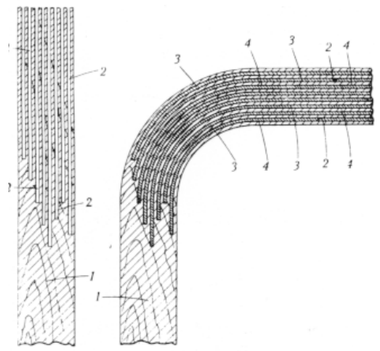
all photos from Furniture as Architecture, Blaser and Werner

Alvar Aalto began experimenting with bending wood in the late 1920's. Furniture makers, ship builders, and millworkers had been bending wood for centuries by steaming relatively large pieces of wood, using a variety of clamping devices to shape it as desired and restrain it as it dried. What is new in Aalto's approach is his conception of wood as a group of individual fibers which can be subdivided into smaller, more pliable units than the whole boards that were being bent previously. Once separated, each ply can be manipulated in individual ways, and then rejoined into a new whole. This can be done either by subtraction (multiple saw cuts), or addition (joining separate plies, usually with glue).



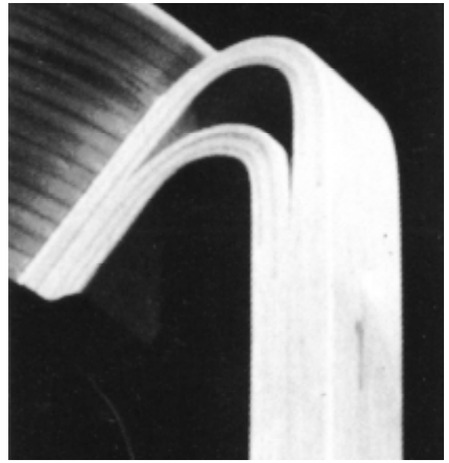






Aalto continued his experiments at least into the 1950's. He applied his findings to both his architecture and a line of furniture that is still being produced today. The range of our mass-produced, glue laminated products today was broadened by his discoveries.

As designers, we can learn more from Aalto's innovations in wood than just applying these specific discoveries. We can learn to search for the inherent opportunities in the nature of each material we work with and in the processes that are available to us.



all images from Alvar Aalto Furniture, Pallasmaa (ed.)

photo of IBM Travelling Pavillion from Renzo Piano Building Workshop: Complete Works, Vol.1, Buchanan

Renzo Piano Building Workshop recognizes the nature of glue-laminated lumber as multiple layers of shorter pieces of wood that are then glued together. He has developed an array of metal joints with fingers that reach in between the plies of wood, engaging each ply. This is an adaptation of the fingerjoint method of joining shorter pieces into single ply elements such as door jambs. This method transfers forces from the plies, where the forces are spread out, to the metal connectors where they are more concentrated.

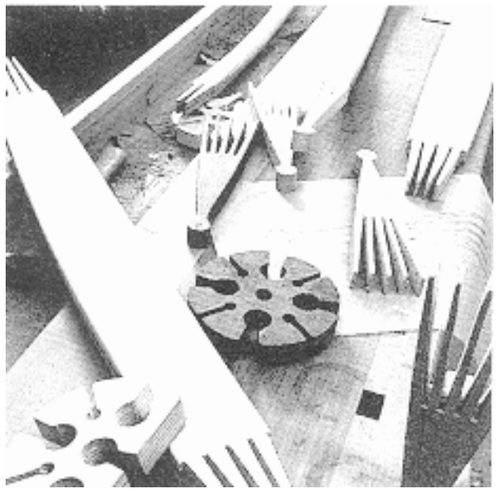
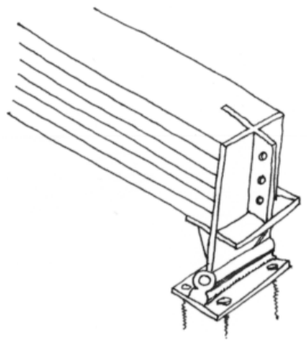
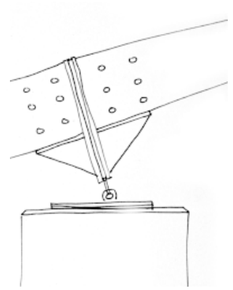
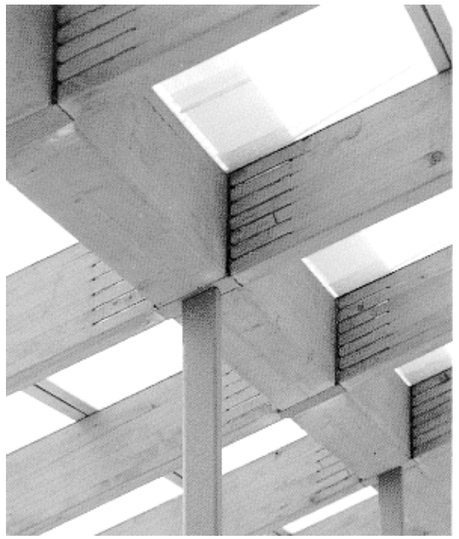
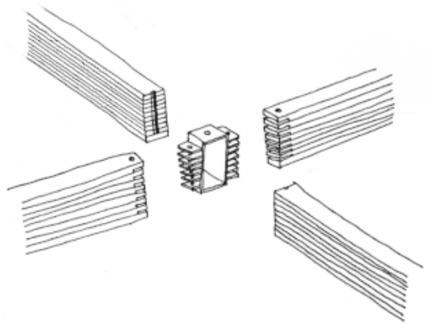


photo of IBM Travelling Pavillion family of parts, from Renzo Piano Building Workshop: Complete Works, Vol.1, Buchanan





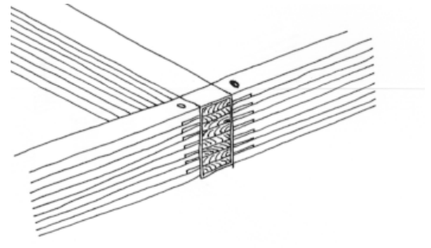


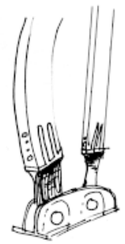


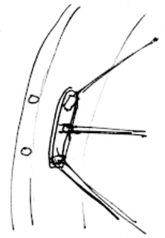
photos from Renzo Piano Building Workshop: Complete Works, Buchanan

At the Berey 2 Shopping Center in Paris (to the left), Piano uses a simpler joint that treats the glue laminated curved girders monolithically, slicing into the wood perpendicular to the gluelam joints.

For his own laboratory/workshop (above) in Genoa, Italy, Piano created another fingerjoint connection for gluelam that allows the wider girder to pass through the saddle-type connector. Metal leaves reach in between the plies in the beams, with a pin holding the beam in place laterally. I suspect that the pin is actually a lag bolt reaching down into the bottom plies of the beams to keep them from delaminating.

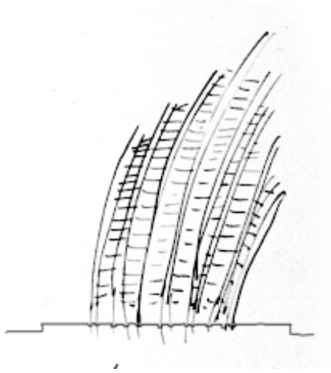






At the Cultural Center in Noumea, New Caledonia, Piano uses a progression of vertical gluelam trusses and single ply screening infill to respond to the landscape, local basketweaving and thatched houses. The structure is woven of parabolic arced vertical elements (partnered with straight ones), a coherent family of metal connectors and tie rods, and lightweight wood infill. The base connectors join the two vertical elements and their tie rod lateral braces. The concentration of loads toward the bottom is expressed both in the varied depth of the vertical elements, and their corresponding bulge outward toward the base. The structures have a natural feel of heaviness at the ground and lightness at the sky.

The depth of the vertical elements is varied by stopping some of the outside plies at various stages short of the full height, making the whole element thinner at the top.



photos from The Architecture of Bohlin Cywinski Jackson, Bohlin, Cywinski, Jackson

Peter Bohlin, with his partners, Bernard Cywinski and Jon Jackson, and collaborator James Cutler worked with recycled timbers at Bill Gates' guest house in Washington (above), and at the Weekend House in Maryland (left). They treat each piece of wood as a monolithic piece, making single slices into it for T connectors or holes for bolts. They stack beams on top of girders rather than joining them on the same level, thus making the structural hierachy more clear, and lightening the massiveness of the elements.

In the days of smaller second growth lumber, it is appropriate to celebrate the size and wholeness of these precious old growth timbers.

At the House for Unwed Mothers, Aldo Van Eyck used curved elements at entryways and windows to articulate the rectangular opening in the wall. The soaring lines of the arches start at about one's eye height and arc up over one's head. Single ply progressions in the doorless portals are made of flat steel banding welded to the vertical jambs.

Door panels also scale down the opening. They are composed of separate elements: base kickplate, vertical supports, and an arched top with its corresponding shape in the doorframe.

photos from Aldo Van Eyck: Hubertus House, Hertzberger

"*The brick was always talking to me, saying you're missing an opportunity. The weight of the brick makes it dance like a fairy above and groan below. Arcades crouch. But brick is stingy, concrete is tremendously generous. The brick is held by the concrete restraining members. Brick likes this so much because it becomes modern."*

Louis I. Kahn, Louis I. Kahn: Complete Work 1935-1974, Ronner. et al

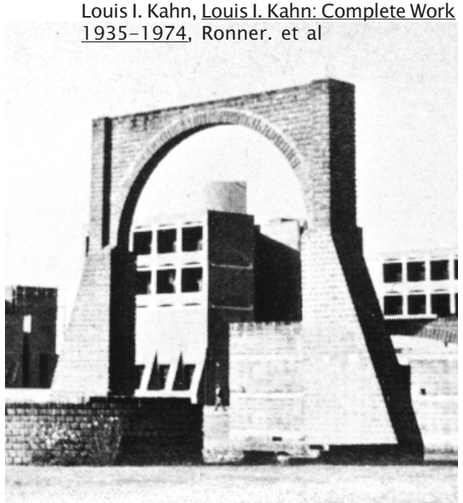
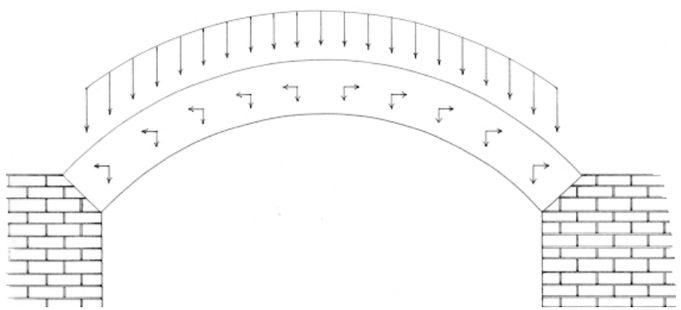


Photo of Kahn's demonstration arch for IIM, from Ronner, et al.

Louis Kahn's development of a new arch technique for the Indian Institute of Management (right) is an excellent example of an architect finding what is inherent in a material and corresponding construction method, and then developing a new way to use it. "I had to learn to lay brickwork from scratch...." (Ronner) Brick arches were not common in Indian construction, so Kahn also had to teach the workers by building a demonstration arch (left).

Arches translate vertical gravity loads into a vertical and horizontal component, carrying the loads to the supports (see illustration below). One of the challenges of using arches is the necessity to restrain the lateral thrust with either a significant amount of mass, requiring quite a bit of solid wall between openings, or some sort of collar tie which ties opposite ends of the arch together, so they counteract each other, and can't spread. The latter allows alot more flexibility in placement of the arch, and distance between the openings.

Brick is good in compression. Reinforced concrete is good in both compression and tension, so Kahn uses that for the collar tie to restrain the horizontal thrust, and also to transfer the gravity loads to the supports.



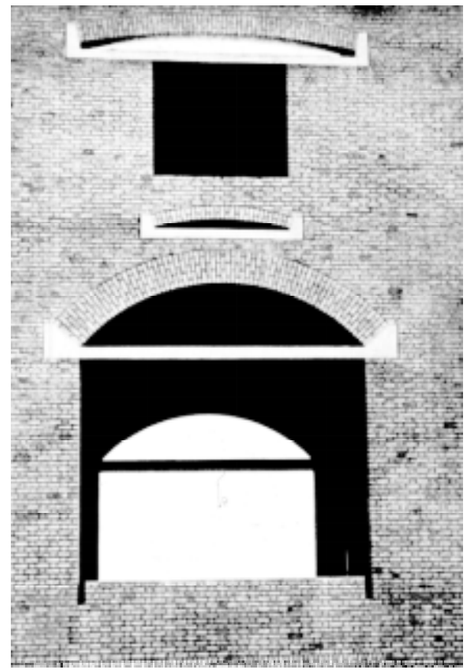


photo of IIM arches from Louis I. Kahn: In the Realm of Architecture, Brownlee and DeLong

Program: Montessori School

With an interest in exploring the full range of how the building envelope can mediate between people and their environment, separating and connecting on many levels and in many gradations, I chose to design a Montessori school because of its emphasis on learning through the senses. Montessori stresses independent learning with personalized guidance from the teacher, rather than a teacher dispensing knowledge to a group in a more traditional lecture format. This independence is limited only by the needs of the other individuals in the group. Collaboration and socialization is encouraged. Students choose what they want to explore throughout the day, where they want to work, and in what position they want to be to do it. Lightweight, appropriately scaled movable furniture and small area rugs are provided for children to create their own workspaces. Freedom of movement within limits is considered vital for uniting the mind and body. Free access to outdoor space is given (within safety limits). Kitchen and bath facilities are incorporated into the classroom; children learn to care for themselves, helping to fix food, clean up after themselves, and practicing personal hygiene. There are places for each student to keep personal items (cubbies). The classroom is an ordered place where everything has its place, and is returned there when not in use. Plants and small animals in cages are included as a vehicle for learning responsible care of other beings, and of the natural environment, as well as nature studies.

"I think of school as an environment of spaces where it is good to learn. Schools began with a man under a tree who did not know he was a teacher, discussing his realization with a few who did not know they were students. The students reflected on what was exchanged and how good it was to be in the presence of this man. They aspired that their sons also listen to such a man. Soon spaces were erected and the first schools became. The establishment of school was inevitable because it was part of the desires of man. Our vast systems of education, now vested in Institutions, stem from these little schools but the spirit of their beginning is now forgotten.... The schools are good to look at but are shallow in architecture because they do not reflect the spirit of the man under the tree. The entire system of schools that followed from the beginning would not have been possible if the beginning were not in harmony with the nature of man....
Reflect then on the meaning of school.... In school as a realm of spaces where it is good to learn, ... the corridors would be transferred into classrooms belonging to the students themselves by making them much wider and provided with alcoves overlooking the gardens.... It would become a meeting connection and not merely a corridor, which means a place of possibilities in self-learning.... The classrooms should evoke their use by their space variety and not follow the usual soldier-like dimensional similarity, because one of the most wonderful spirits of this man under the tree is his recognition of the singularity of every man."

Louis I. Kahn, Form and Design, Latour (ed.)

Since the beginning of the institution is in harmony with human nature, the spirit of the institution we are designing for springs from human nature. So, rather than basing the form for our design on the immediate needs of a particular client (or our own ego), we should base it on human nature. We should respect the clients' wishes, and interpret them with broader intentions. This architecture will embody a timelessness and an appropriateness for the variety of people and time periods that the building will hopefully serve.

While Kahn's model for the origin of school seems to be based in the traditional school system, he refers to the teacher discussing rather than lecturing, and his description of the ideal classroom and corridor hints at a belief in a Montessori approach with teachers addressing individuals rather than collective classes, and spaces that are interpretable by their inhabitants.

"I know of of no greater service an architect can make as a professional man than to sense that every building must serve an institution of man, whether the institution of government, of home, of learning, or of health, or recreation. One of the great lacks of architecture today is that these institutions are not being defined, that they are being taken as given ... and made into a building."
Louis I. Kahn, Talks with Students, Latour (ed.)

"A child exposed to carefully programmed interesting stimuli will achieve greater sophistication in observation, discrimination and, eventually decision-making."
Maria Montessori, quoted in
Montessori Today by R.C. Orem

photo from Montessori, A Modern Approach, Lillard

With human nature in a school setting set as the priority, interpretability as a guide, and a good grasp on Montessori tradition (see Appendices for more information), it is still necessary to define what places this building needs to have:

- 4 classrooms in pairs of two with some shared spaces for cooking and cleaning, bathrooms, science projects, skits and presentations, music and art, and a secure outdoor space adjacent to the classrooms.

- Each classroom should have:
  A variety of smaller spaces that are defined by the structure rather than divided into separate enclosed rooms. This will allow more interpretability by the inhabitants: students can choose between more public and more private spaces.
  A fair amount of open space should be provided which can be shaped by the user with movable furniture, blackboards, and area rugs.
  Storage space for educational materials should be within reach of the smallest students (aged 6-12 in this school).
  There should be some lockable storage space to keep certain things out of reach of the children.
  One small bathroom, with easy access to larger public bathrooms.

- Administrative offices with a similar variety of spaces interpretable for different uses, and similar character so administrators are not living in a different world and mindset than teachers and students. These offices should be near the entrance for convenience and orientation of visitors, and the security of the students.

-Public restrooms as central as possible.

- A larger meeting space to accomodate the whole school, ideally incorporated into the corridor so it can be used informally as part of the life of the school.

-A gymnasium large enough to accomodate at least one classroom at a time, with adjacent changing rooms and equipment storage.

-A playground that is relatively level, and is protected from the public.

-A library where students can explore special interests beyond the material available in the classroom.

-Gardens where students can experience and learn about nature.

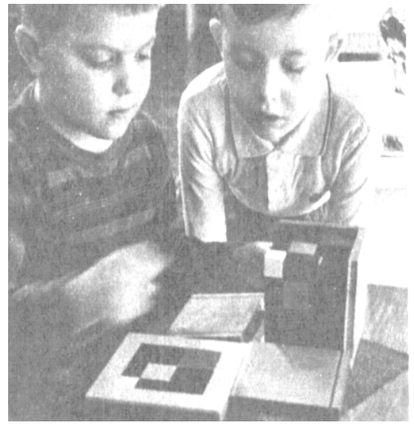


photo credits, left - right: Maria Montessori, Her Life and Work, E.M. Standing; Montessori, A Modern Approach, Lillard; (2) The Montessori Way, Gitter

Context

"The best way to respect what is
existing is to create a dialogue with it."

Aurellio Galfetti,
Lecture at Virginia Tech, 1999

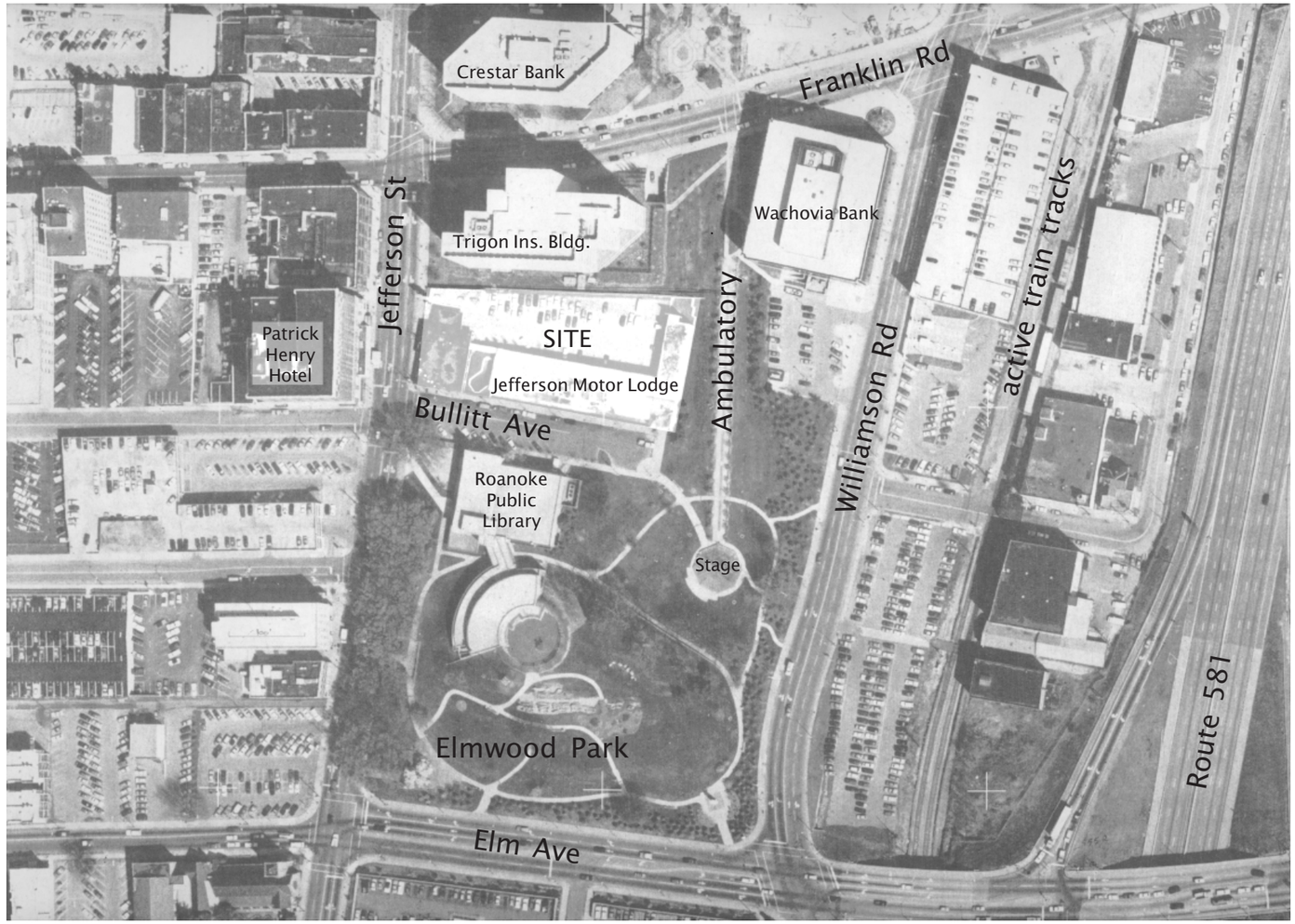
I chose a site adjacent to the Roanoke Public Library which is in Elmwood Park on the corner of Jefferson St. and Bullitt Ave. in Roanoke, Virginia (see aerial photo next page). This site offers both the practical advantages of an existing library and decently sized park, and the opportunity to improve the gateways to the park from Jefferson Street, and a nicely landscaped walkway that extends south from the Downtown's Marketplace ambulatory.

The library offers a number of advantages. It is an opportunity for students to explore their interests beyond the material available in the school. It offers an afterschool program for kids. Families who are patrons of the library are a good source for prospective students: the library is a built-in marketing program for the school and vice versa.

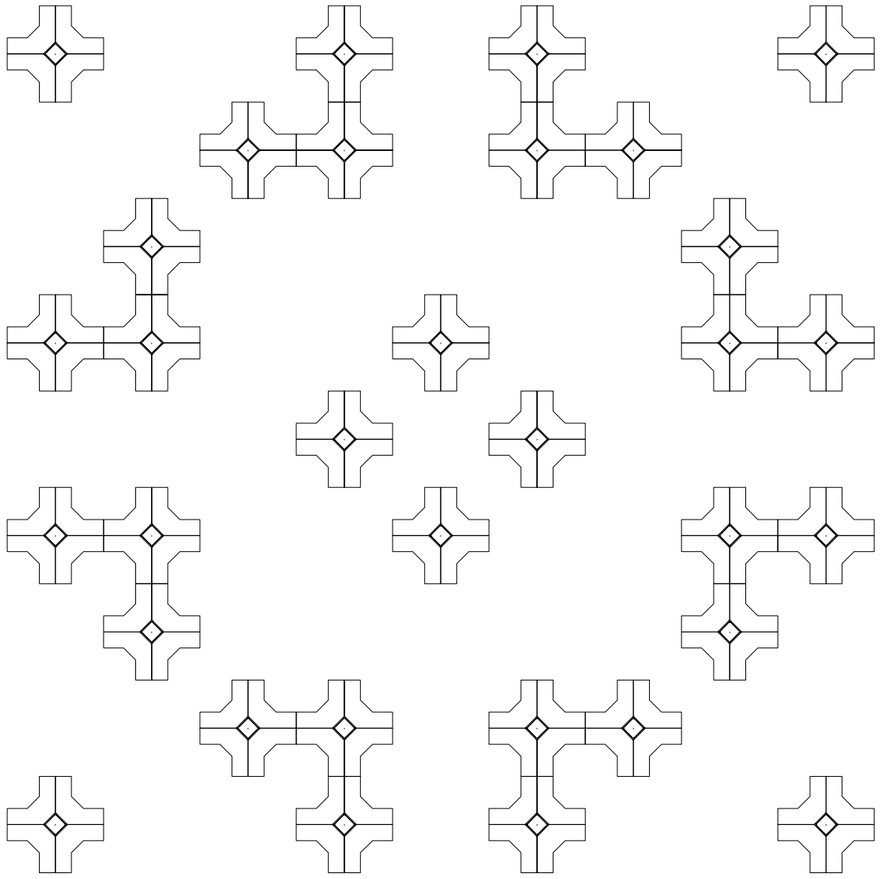
The park provides a place to go for walks through a variety of species of plants and trees, a rock garden, birds, small animals, and people. The paths in the park wind around up and over the varied terrain, offering an unfolding sequence of views, and new discoveries. The park is seldom crowded and quite safe during the school hours. There are festivals in the park on major holidays, drawing hundreds of people for arts and crafts, live music, storytelling and food. There is a natural amphitheater with a stage. Although a major road, highway and train track are not far to the east, there is an effective buffer of terrain and trees to make them almost unnoticeable.

My site is currently occupied by the Jefferson Motor Lodge, a two story brick motel which is entirely enclosed from the streets and the park on all sides except for a two lane driveway on Jefferson St. The wall along Bullitt Ave. is poorly maintained, with sections of solid brick faces that wrap around to the elevation on Jefferson. The east wall along the walkway is two stories of uninterrupted brick. Together they effectively cut the site off from the park, except for views from the second floor of the motel. Demolishing the motel, and building something new provides the opportunity to establish a better relationship between the park, the library, and the site.

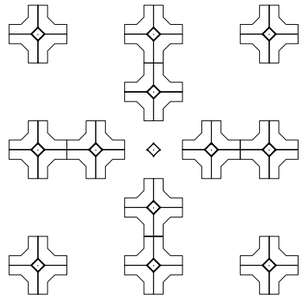
Another issue to address is the project's relationship to the Trigon Building. It is an extruded tower of off-white precast concrete elements on a built up flat base. This base is built up partly with a brick retaining wall that runs horizontally along the north edge of the site, and then steps down to meet the grade near the walkway to the east. It reaches 17 feet high at the highest point. Meeting this wall, and helping the Trigon Building seem more grounded are issues to consider in building on this site.

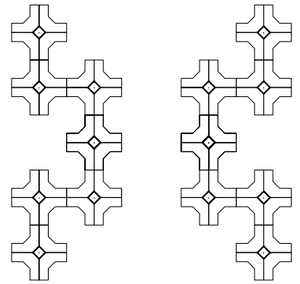

Crestar Bank
Franklin Rd
Wachovia Bank
Trigon Ins. Bldg.
Jefferson St
Patrick Henry Hotel
SITE
Jefferson Motor Lodge
Ambulatory
Williamson Rd
active train tracks
Bullitt Ave
Roanoke Public Library
Stage
Elmwood Park
Route 581
Elm Ave

100’

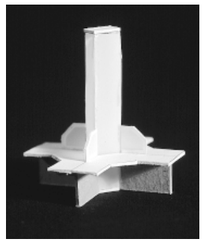


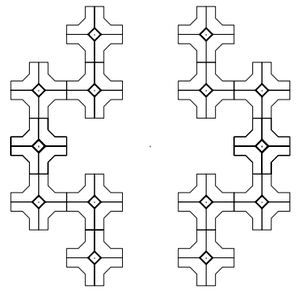
Exploration

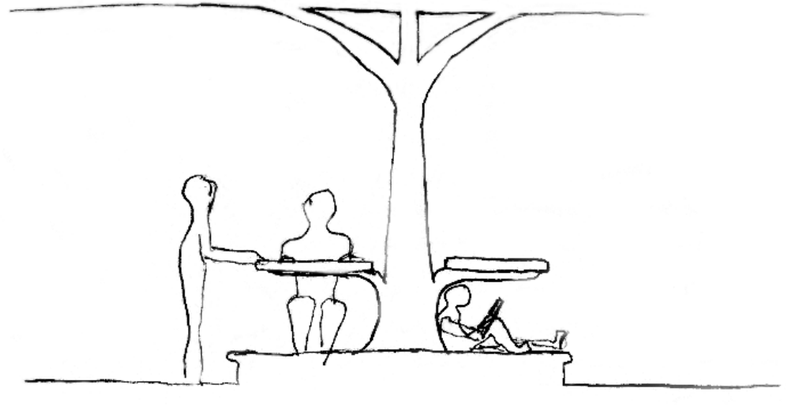


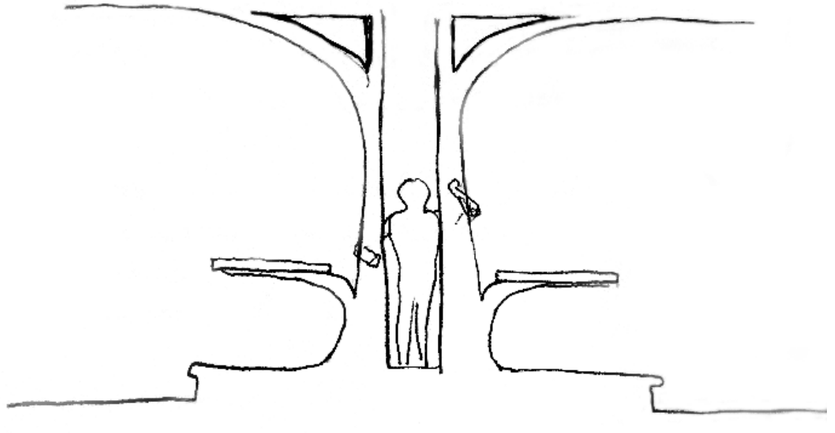


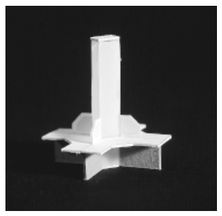
Early column/desk configurations, and correponding model, studying the creation of space between. The heart of a Montessori school is a person learning through exploration, working mostly independently. So I decided to start with designing for that activity.



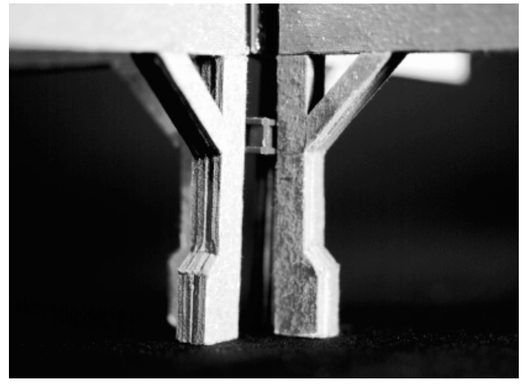


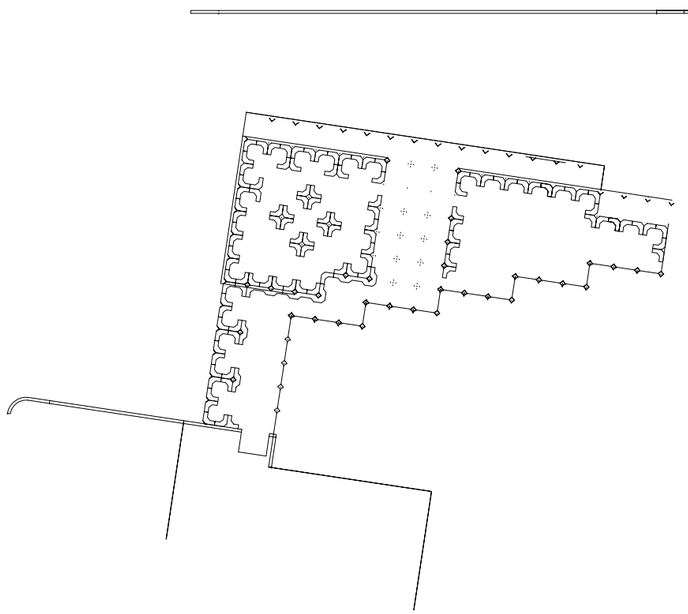


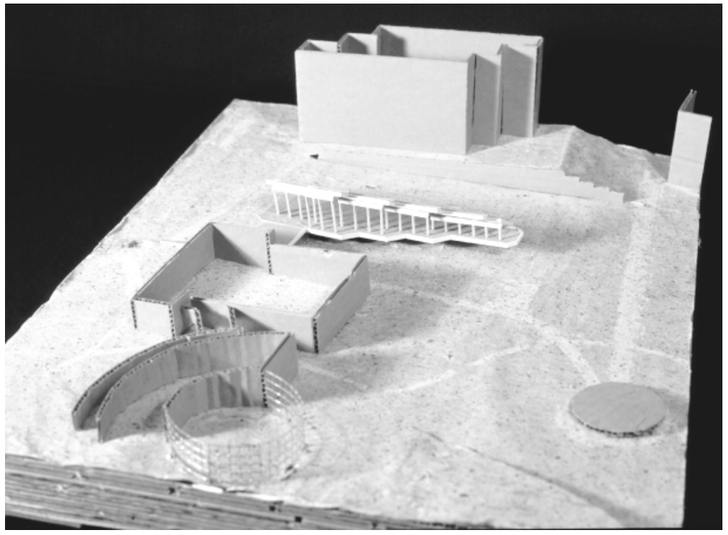




Early studies attempted to integrate the independent study work stations into column structures. The composite precast concrete column provides enough space to walk through where there are no desks around it. The column in the left photo would have light inside a diffused glass enclosure. In the sketched columns with raised bases, teachers could talk to students at their desk without bending over. Sketches of the column structure are proportioned better than the resulting models which intended to provide air duct space in their oversized depth.

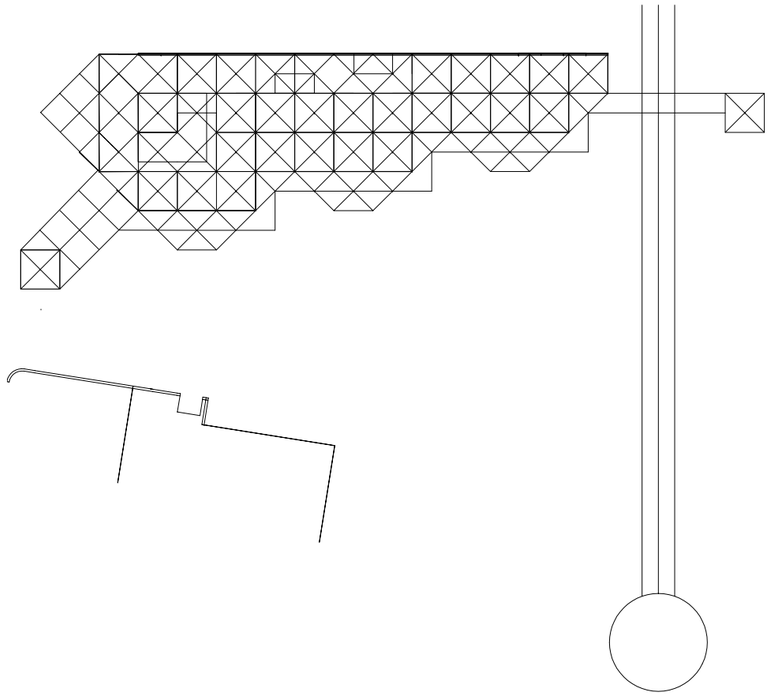


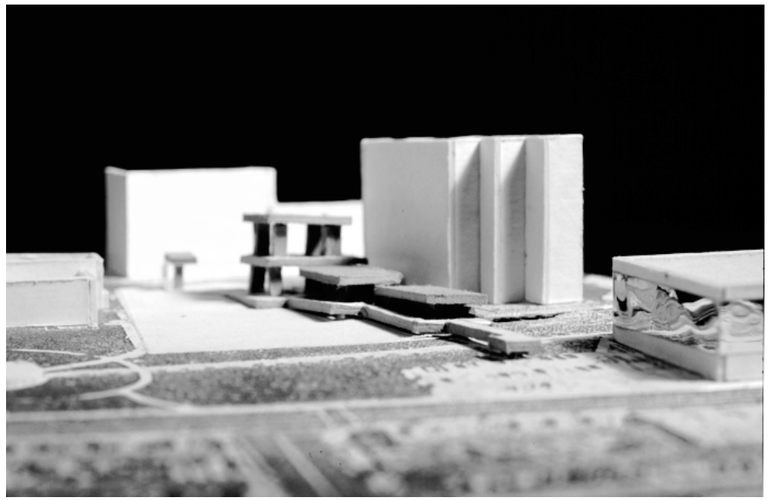


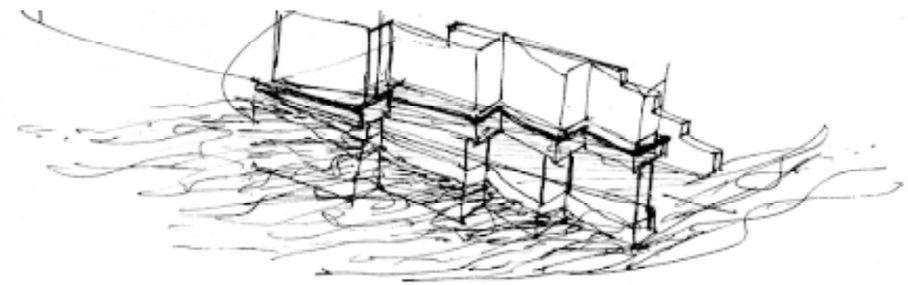


Layout and study model based on the column/desk configuration studies. The school would have an underground connector to the library with a small plaza above. There is an old entrance to the library at the point of attachment, leading to a small auditorium. Access to the park would be along the Trigon retaining wall. The oblique orientation of this wall to the library axis, and my project, would allow this gateway to widen as you enter the park. This would have required closing Bullitt Ave. completely, and making a new access to an existing utility entrance to the lower end of the library.

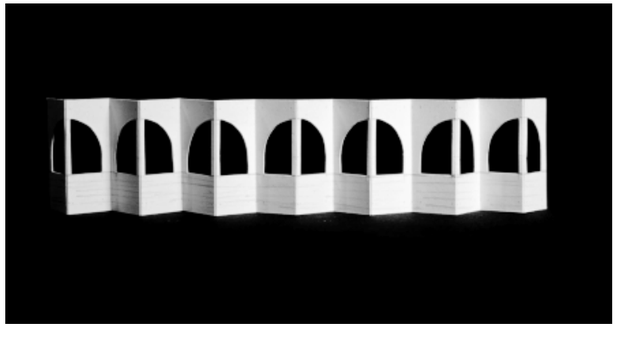
I retained my idea of having a serated edge along the south face, and using varied heights to address the difference between the 100 ft scale of the Trigon Building, Crestar Building, and Patrick Henry Hotel, and the smaller scale of the library and park.

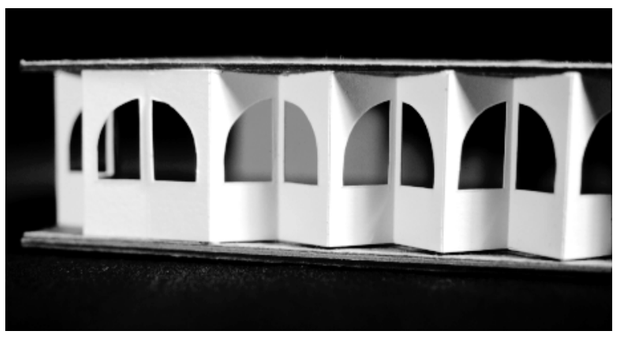


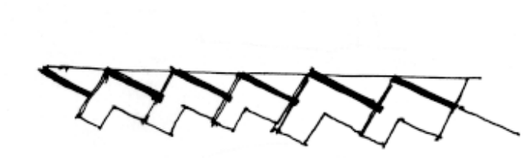


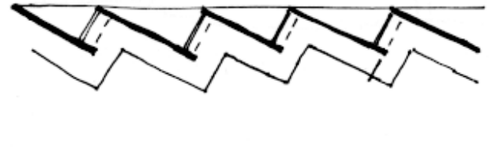


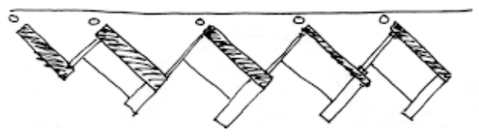
This preliminary study was based on the composite precast concrete column with its primary structure rotated 45 degrees. Extending the lines of the roof structure in the layout drawing led to a rotated square plan. The school is built against the retaining wall to maximize space left for the park entrance, but presents the need for a second skin over the brick wall, which would obscure its character. This scheme also provides no secure outdoor space for play. A raised public walk extends along the building, over the existing walk, to a stair tower displaying the column structure outside.

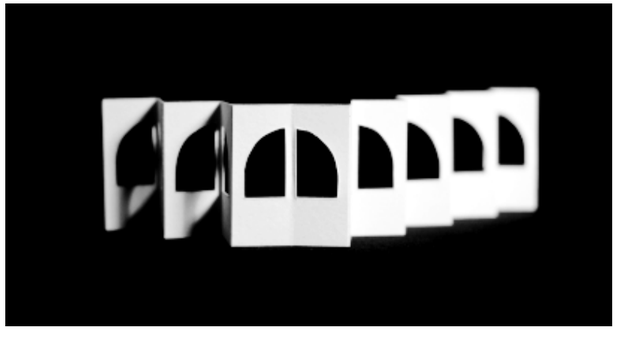








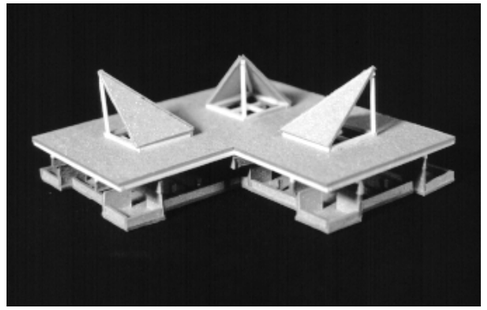




An exploration of desk configurations for the outside wall, and associated study models. Sitting at an angled desk, you would have a window in front of you, perhaps screened with book shelves or a pattern sandblasted on the glass to minimize distraction. To your left would be a clear window to look out when you want. By angling the desks, you would be less distracted by the persons next to you.

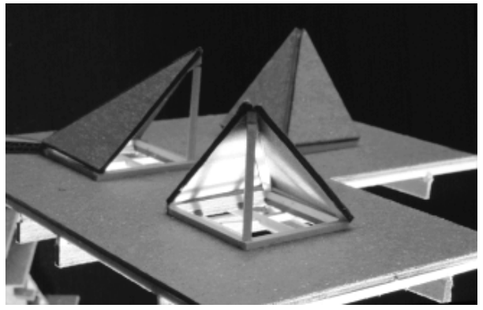
The arches provide more sunshading to the outside where they spring from, and allow more view of the sky where the roof overhang is doing the sunshading.

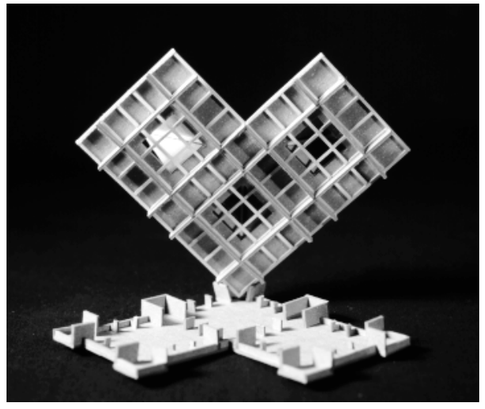
The idea of limiting distractions in front of you as you sit at a desk, while providing a clear view to the side, continued through the final design. The desk configuration did not survive the design process, but I think it has potential to be developed for another project in the future.

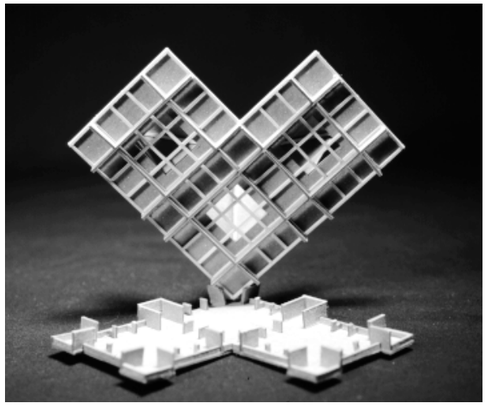


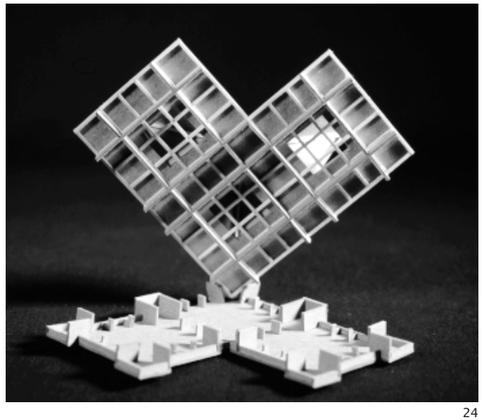
This version of the project included rotated square classrooms to right and left, joined by the third quarter of a larger square to be used as the shared space for these classrooms. Each of these three spaces has a trapezoidal skylight facing east, south or west, letting in sunlight at a different time of day.

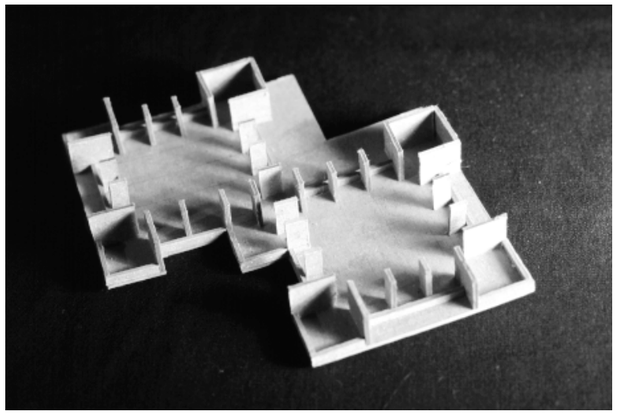
The ceiling had become an important element for defining space. Sitecast concrete girders would define the transition between more intimate study space with lower ceiling around the perimeter, and more public space with higher ceiling and skylights in the center. The secondary roof structure would be gluelam.

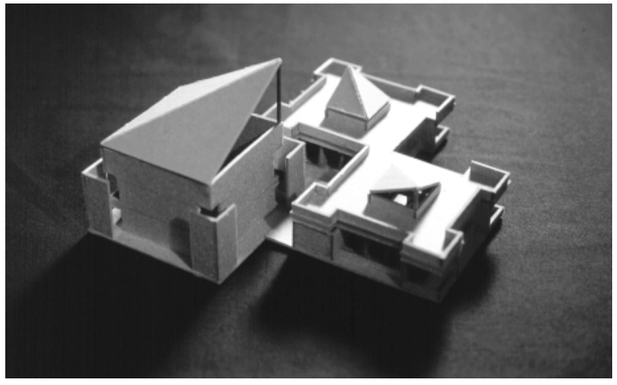




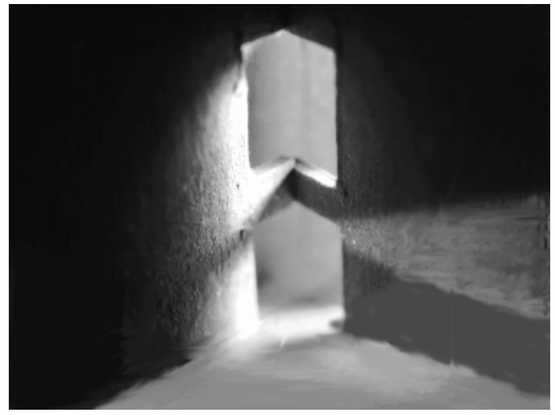


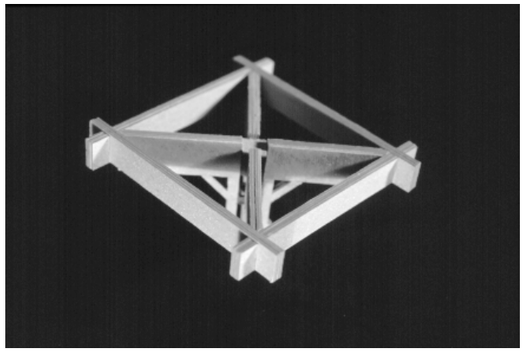


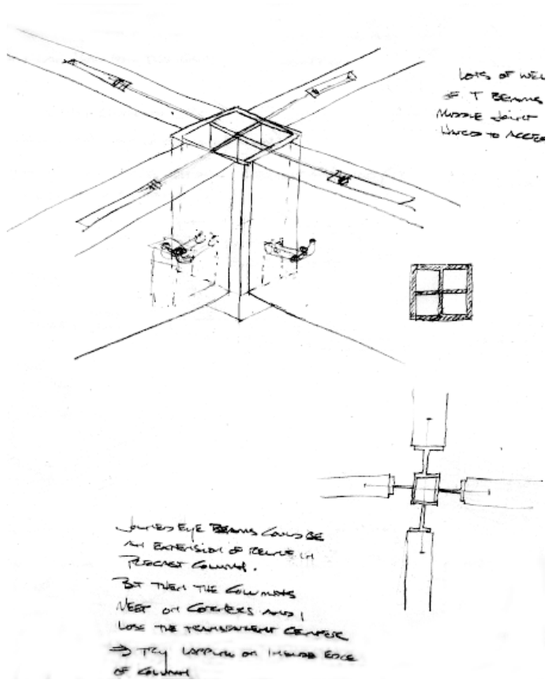


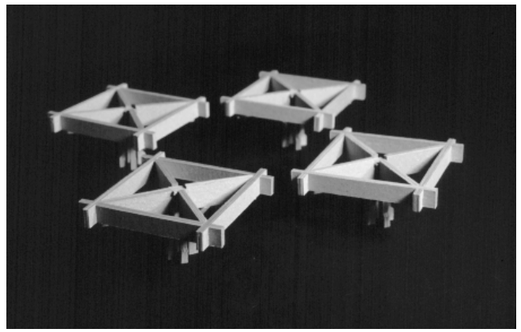


Corner seminar rooms for small groups have narrow corner entries to minimize distractions from the classroom, and wide openings to view the outside environment. Independent study areas in the middle of each perimeter wall are divided by fin walls. The larger element to the rear in the photo below is the gym. It would get indirect light bounced in through the corners (as in photo to the right).

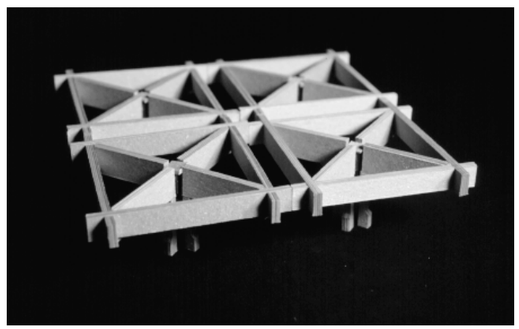


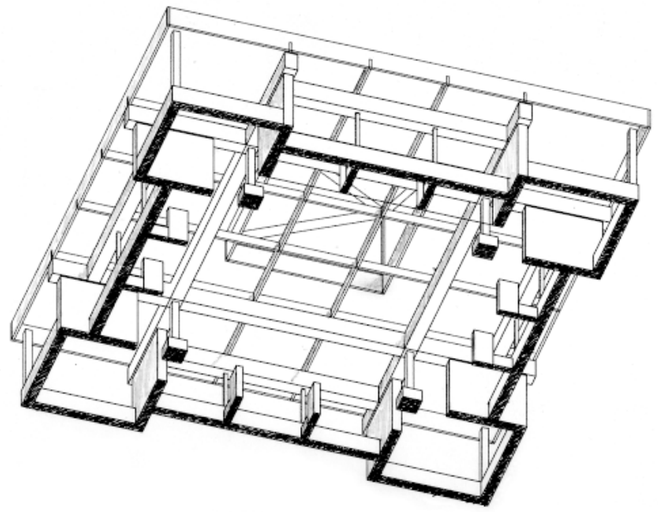


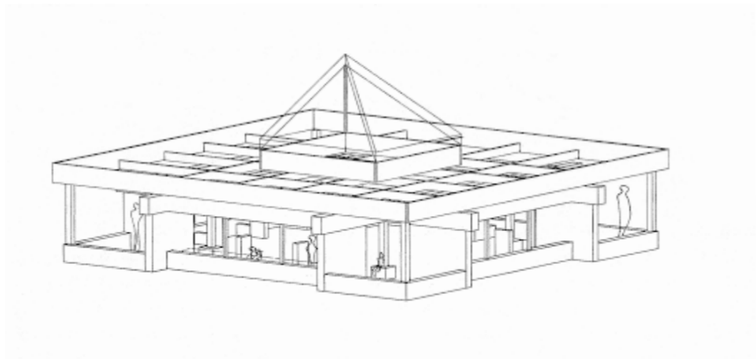


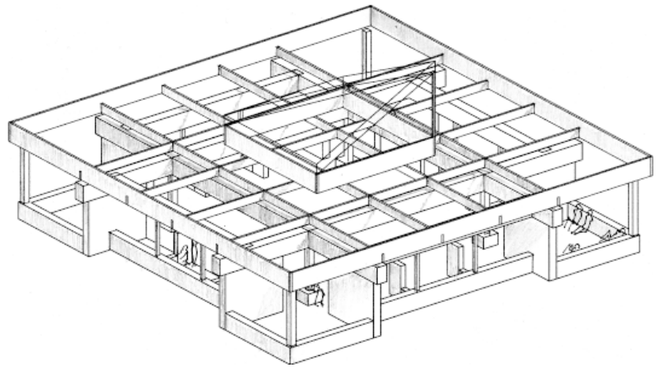


Models and alternative groupings of the column and beam structure. The idea was to cantilever out in both directions with precast concrete members joined in the center as sketched. The joint could also house downlighting. The perimeter beams and cross girders are notched together at the corners.

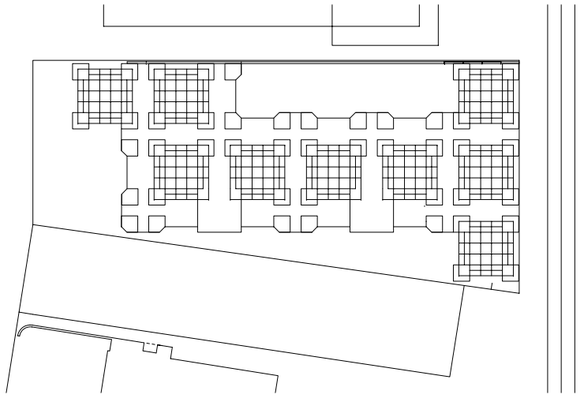




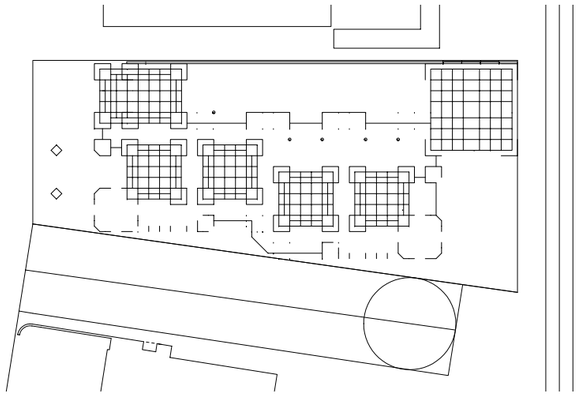


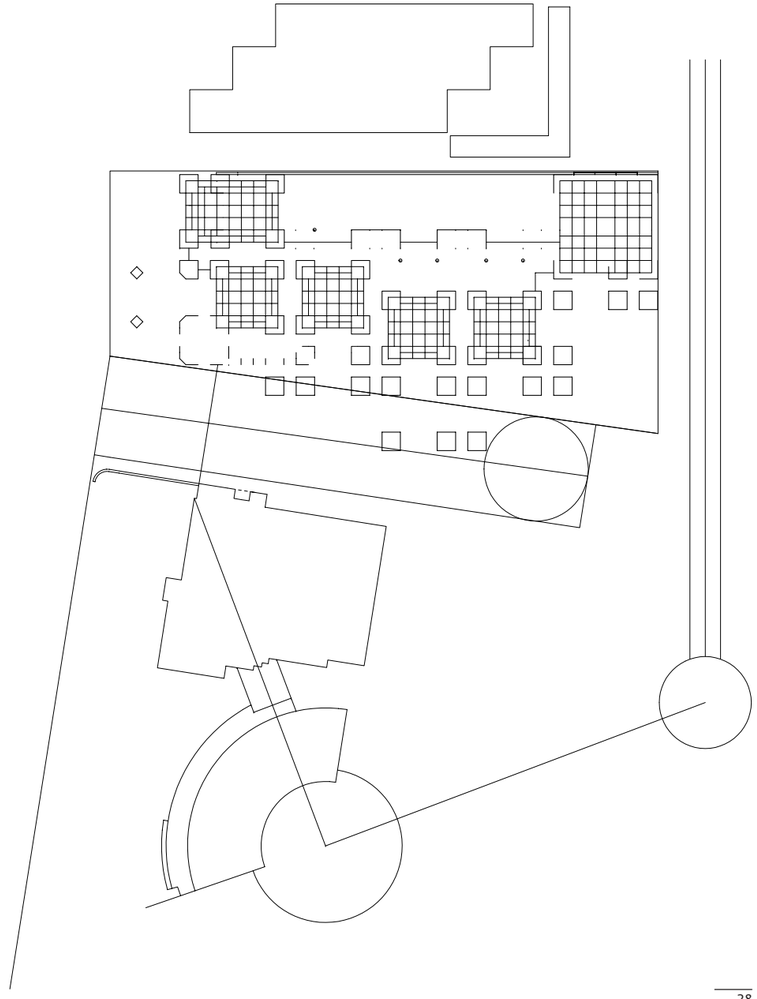


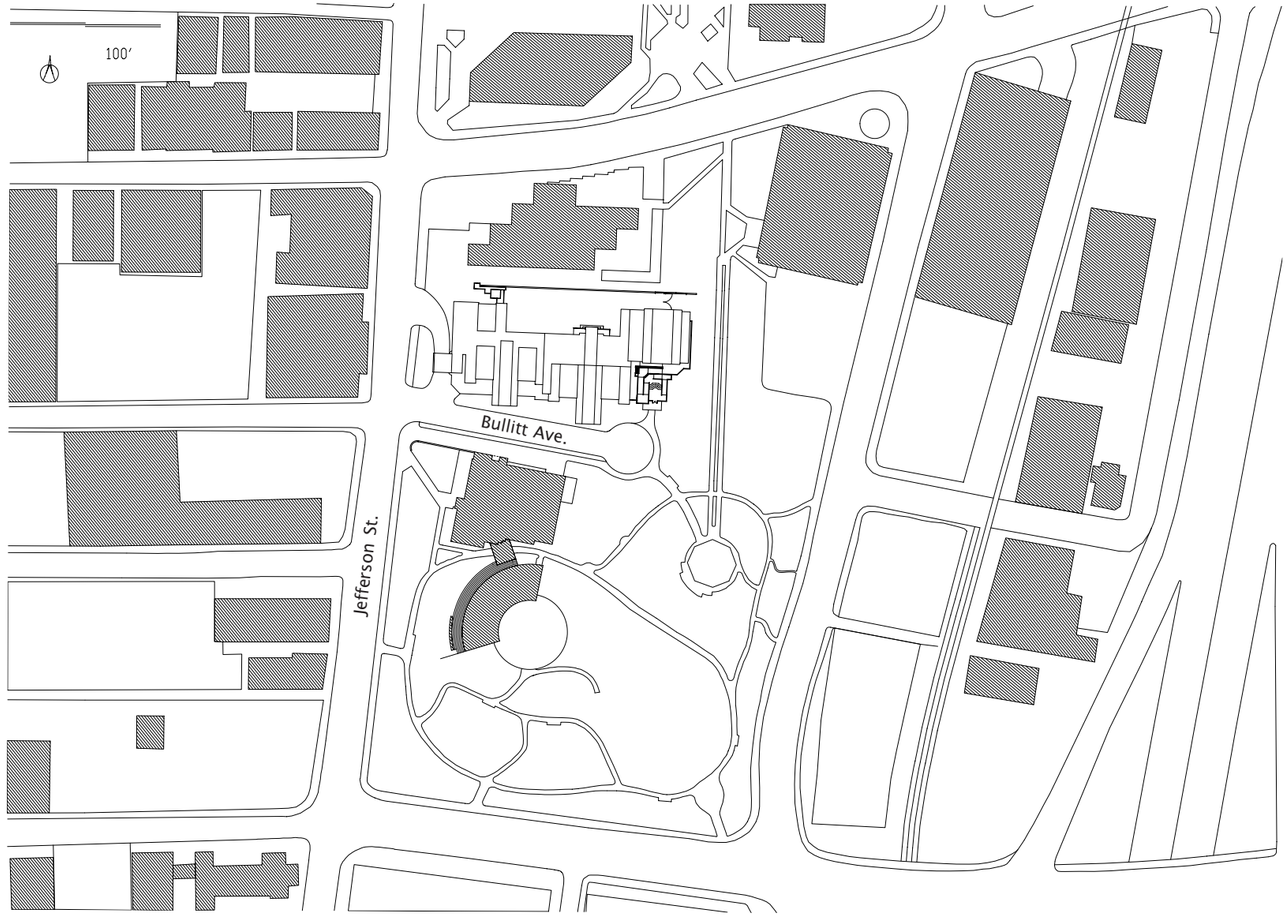
Axonometric views of the computer model for the rotated square scheme. The worm's-eye view gives a sense of how the ceiling structure would define spaces.



Exploration of the building layout using the classroom as a unit placed on an eight foot grid with some four foot shifts. Repeating the end bays of the classroom creates the administration space (to the upper left in each configuration). Expanding the middle section proportionally between the corner elements generates the gym (to the upper right).
The configuration to the right was the basis for the final design.







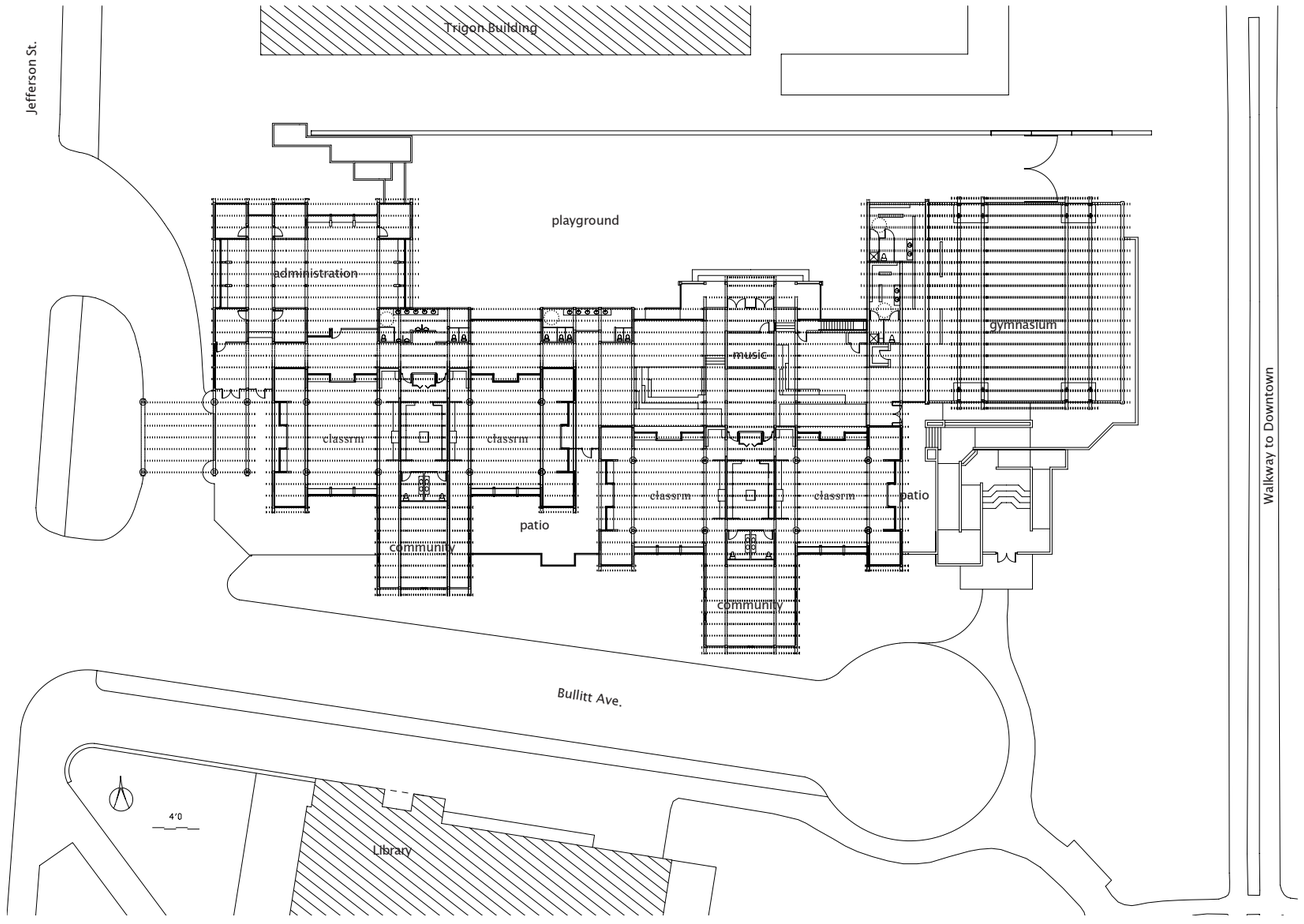
Site Plan

Design

I decided to narrow Bullit Ave. by one half, and resurface it with pavers to make it more of a pedestrian entrance to the park, and to make more space for the school. Existing diagonal parking on one side of the street, and parallel parking on the other side takes up about half of the width of the existing street. Eliminating the parking still leaves space for two vehicles to pass, and gains the desired space for the school. This maintains the utility entrance to the library as well as emergency access to all sides of the library and school, and allows a secondary dropoff point for the school. A covered drive-through entrance is provided along Jefferson.

The space created between the school and the retaining wall for the Trigon Building will be used as a secure playground.

The school is oriented with its main axis parallel to the Trigon Building, within two degrees of east-west. Two rooms of the building reach out to respond to the Library/ Bullit Ave axis. The spaces between these would make good places for vendors during festivals. This serrated edge of the building weaves the school into the park, in contrast to the knife edge division created by the existing motel's wall along Bullitt.



Plan

Entering from Jefferson St., you find a receptionist ahead of you for orientation and security. There is a conference room to the left of the receptionist, and a waiting area to her right, with offices beyond. Following the corridor to the right you will find entrances to a pair of classrooms, and restrooms to the left.

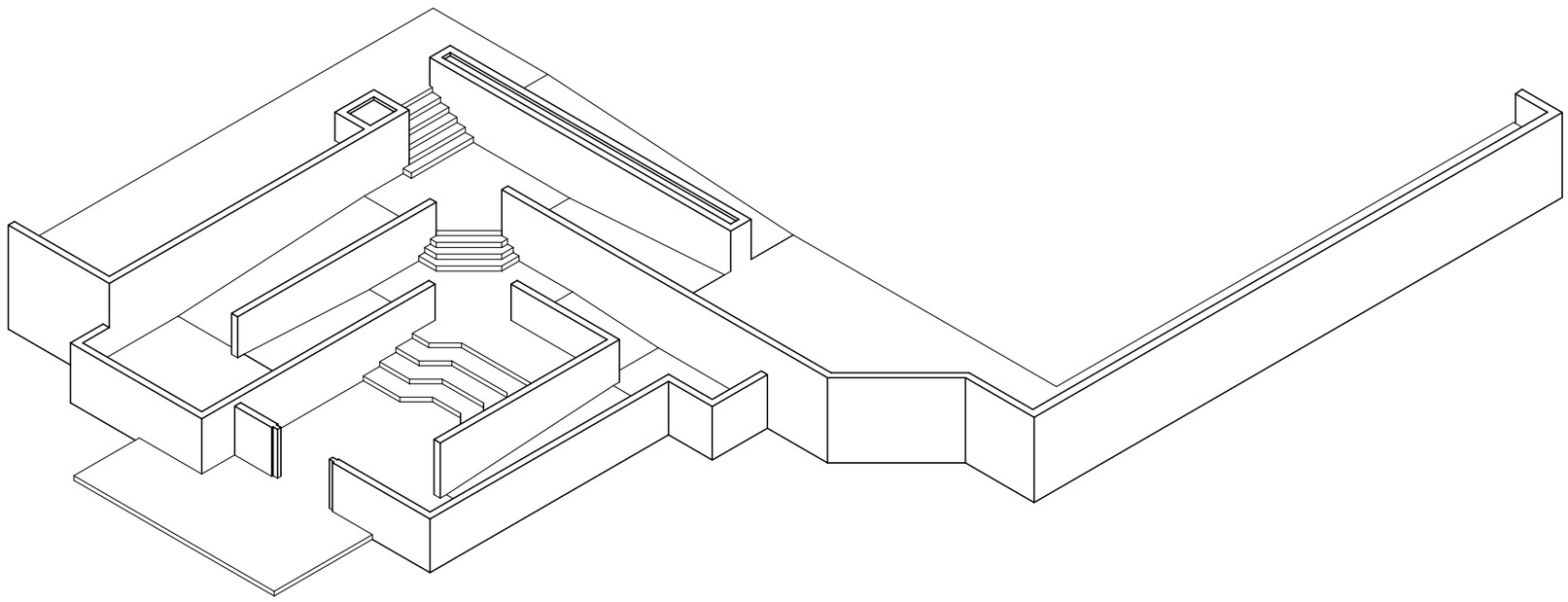
Beyond that the corridor opens into a wider, taller space suitable for larger gatherings with sunken floor, wide steps for informal seating, and space around the side that can be used as mini-stages.

Another passage to the right leads to an outdoor patio for the first pair of classrooms.

Opposite this is the entrance to the playground, and a music room. The playground can be seen clearly from the administrative offices and from windows in the corridor for safety. It is surrounded by the existing Trigon retaining wall, terraced retaining walls adjacent to the offices, and a gate adjacent to the gym for maintenance and emergency access.

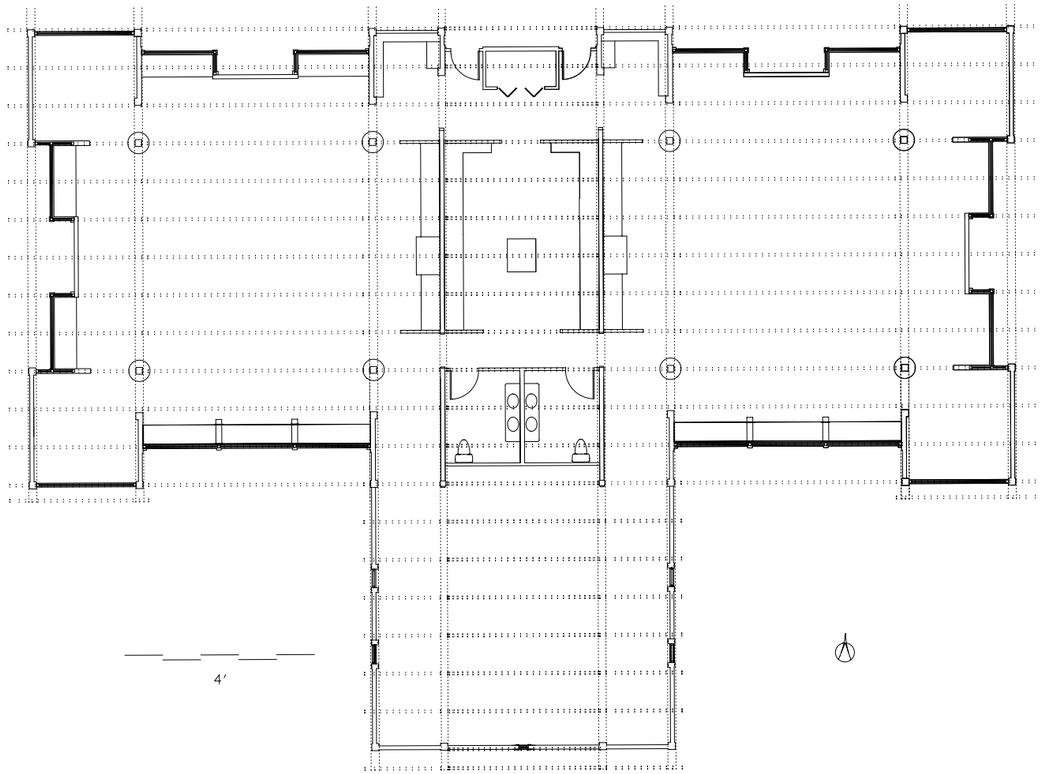
An ADA ramp from the head of this corridor slopes down 2 feet along the classroom to a landing at the entrance for the second pair of classrooms. From here you can go straight down the next ramp another 2' to the rear entrance and the gymnasium, or bear left down stairs to another informal meeting area, also leading to the gym. A stairway to the back of this meeting area leads down to the basement where the utilities are housed.

The gymnasium is entered on a diagonal. Changing rooms and equipment closet are adjacent. Limited showering facilities are provided for this preadolescent age group.



Outside the rear entrance is a patio for the adjacent classrooms, and a generous ramp and stair system with wide ramps and landings for people to gather, or to enjoy the view of the park. At the bottom are wide stairs for informal seating so a class can meet outside when the weather is nice. This area could be opened up to the public during festivals for storytelling, smaller music performances, and simply a place to see and be seen. A gallery wraps around the corner of the gym for viewing the walkway to downtown.

Isolated Axonometric of Ramp and Stair System on Southeast End of School



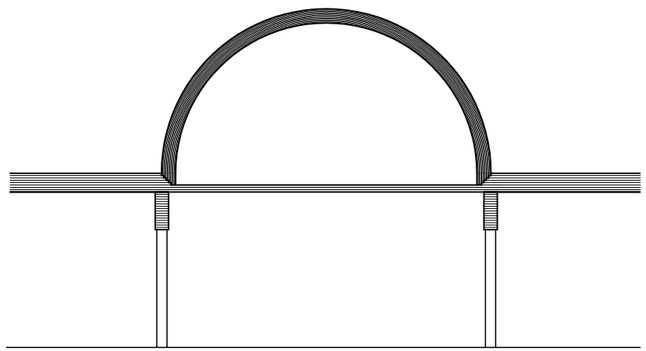
Double Classroom Plan

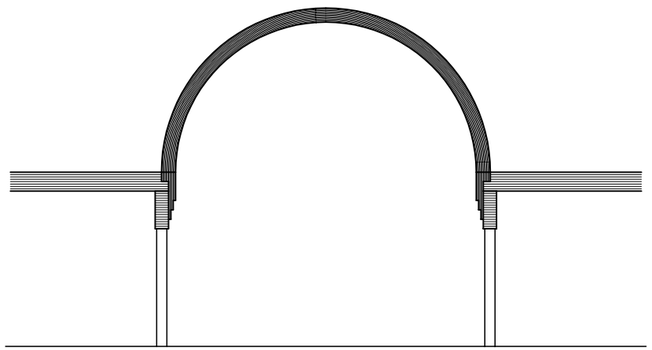
Just inside the entrance to a classroom are cubbies in an ell shape for students to store personal belongings, and a bench to sit on for changing shoes. Entering the main space on a diagonal through a portal, you pass one of the four columns that define the central group space.

Along the outside walls are eight foot wide independent workspaces. On the south wall these are separated by bookshelves, and by an inset on the other exterior walls. These inset walls provide pinnable presentation space facing the group area. Solid walls define corner spaces for small groups to meet and work together.

The interior wall adjoining the shared kitchen/art space has counters with storage cabinets below for learning materials, and a taller lockable cabinet in the middle for teachers to store certain things out of reach. One section of counter would be the teachers' desk.

The kitchen/art space provides enough counter for up to twenty students from either classroom to eat or work on art projects. An adjacent closet near the entrance is large enough for a washer and dryer (for towels, spills and accidents), or could simply be used as a pantry. Two accessible bathrooms are located at the entrance to the larger meeting/project space. The wall between this room and the bathrooms serves as presentation space for the community room, which is large enough for both classes to gather together for certain activities.

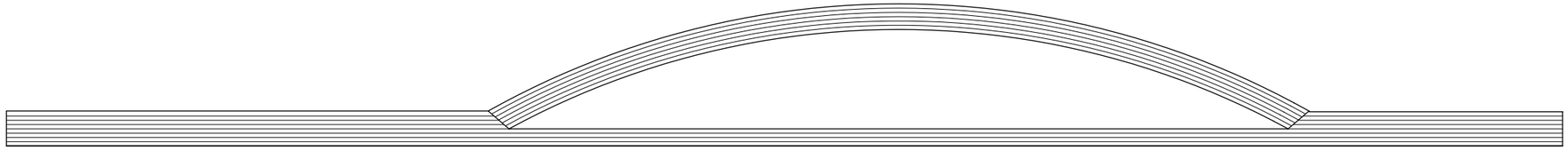


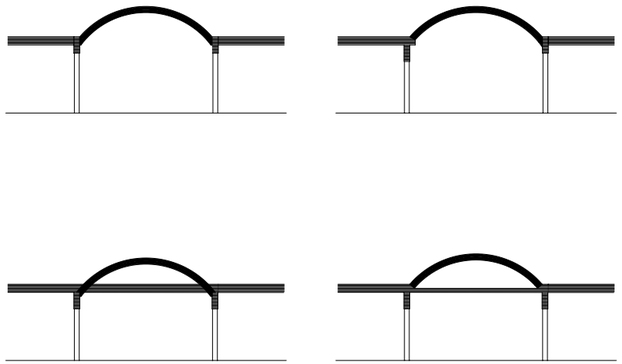


Continuing my idea to define space with the ceiling structure, I decided to use arches over the meeting areas in my new scheme, with flat beams over the independent study areas. I experimented in these drawings with individually articulating each ply of a glue-laminated arch as it meets the girder. This would yield some nice detailing that comes out of the nature of the material.

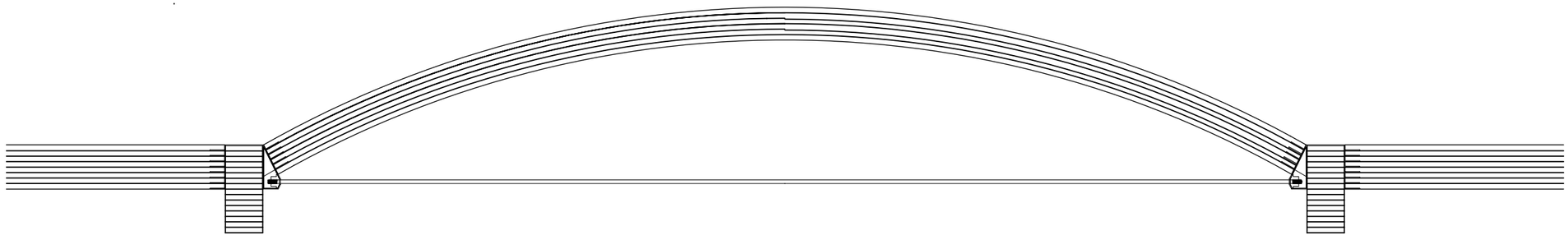
It also would act as a scaling element at the base of the arch, closer to your point of view. Unfortunately, with load bearing members, any differential between treatment of the plies can cause delamination. So I had to find other methods to express the individual plies.

Section Studies





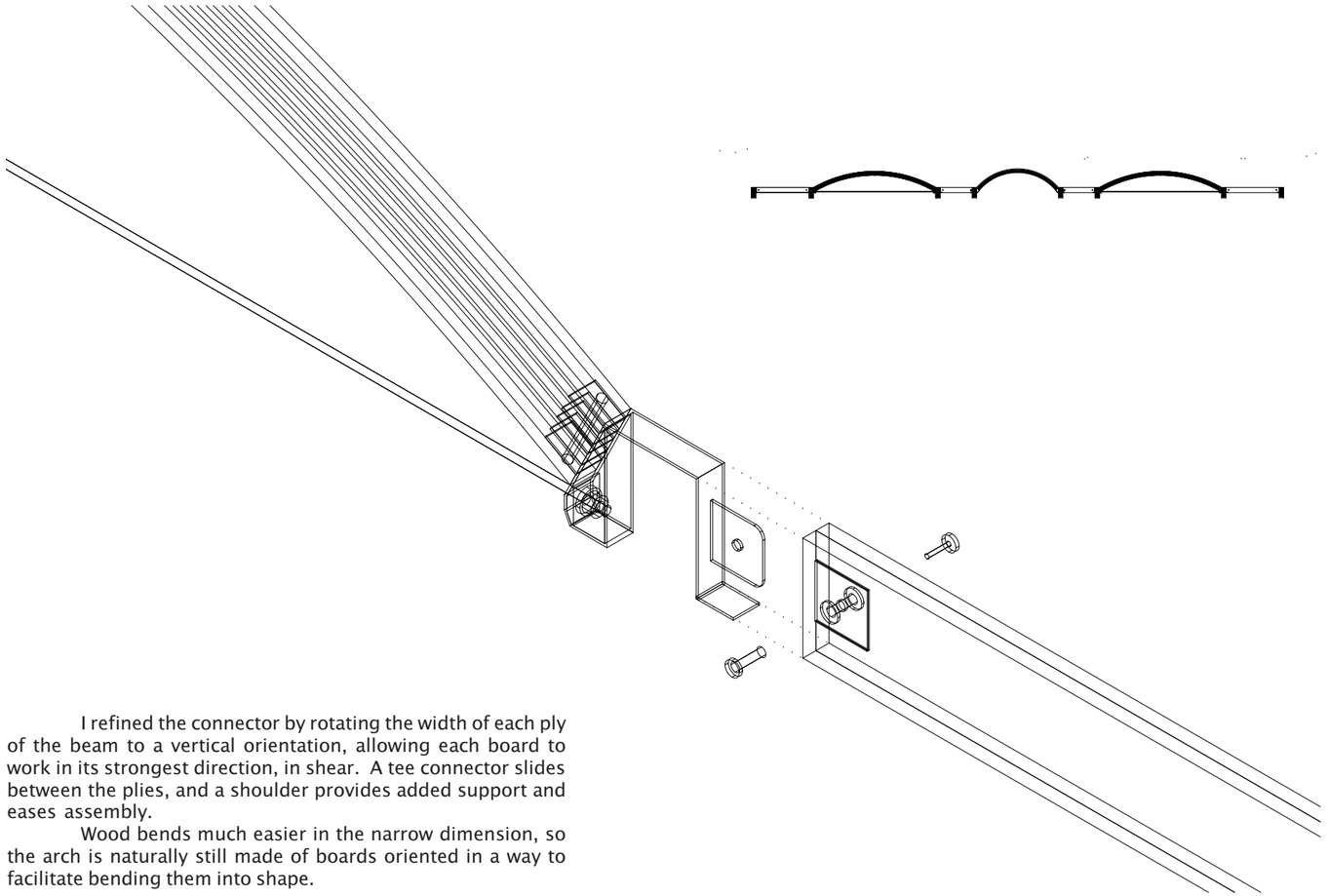
Similar studies for a shallower arch for the classroom, and thoughts about Kahn's Indian Institute of Management arches, led to this arch for the classrooms. I realized that what Kahn had done was to translate the collartie into something that not only restrains outward thrust, but transfers the gravity loads too. So I translated my collartie, allowing it to extend beyond the arch and become the beam between arches as well. The wood collar tie seemed bulky, though. At the time, I thought a double T connector was the best way to connect it. But this would be treating the wood member more monolithically. To lighten the ceiling, and find a connector that worked with the plies, I developed a metal tie rod and a connector based on Piano's design for his Genoa studio instead.



Renzo Piano's series of gluelam connectors seems most appropriate to me because of the way they acknowledge the layered nature of gluelam by fingering into the joints between individual plies. By doing so, they express the idea of connection and the transfer of forces. Attachments to other members modify the connector in each case and make it clear what is going on structurally.

I made a saddle to be routed into the top of the girder with fingerjoint connectors to join the beam on one side and the arch on the other, and an attachment for the collar tie rod, allowing enough space to tighten the rod as necessary. A gusset plate stiffens the connector against bending.

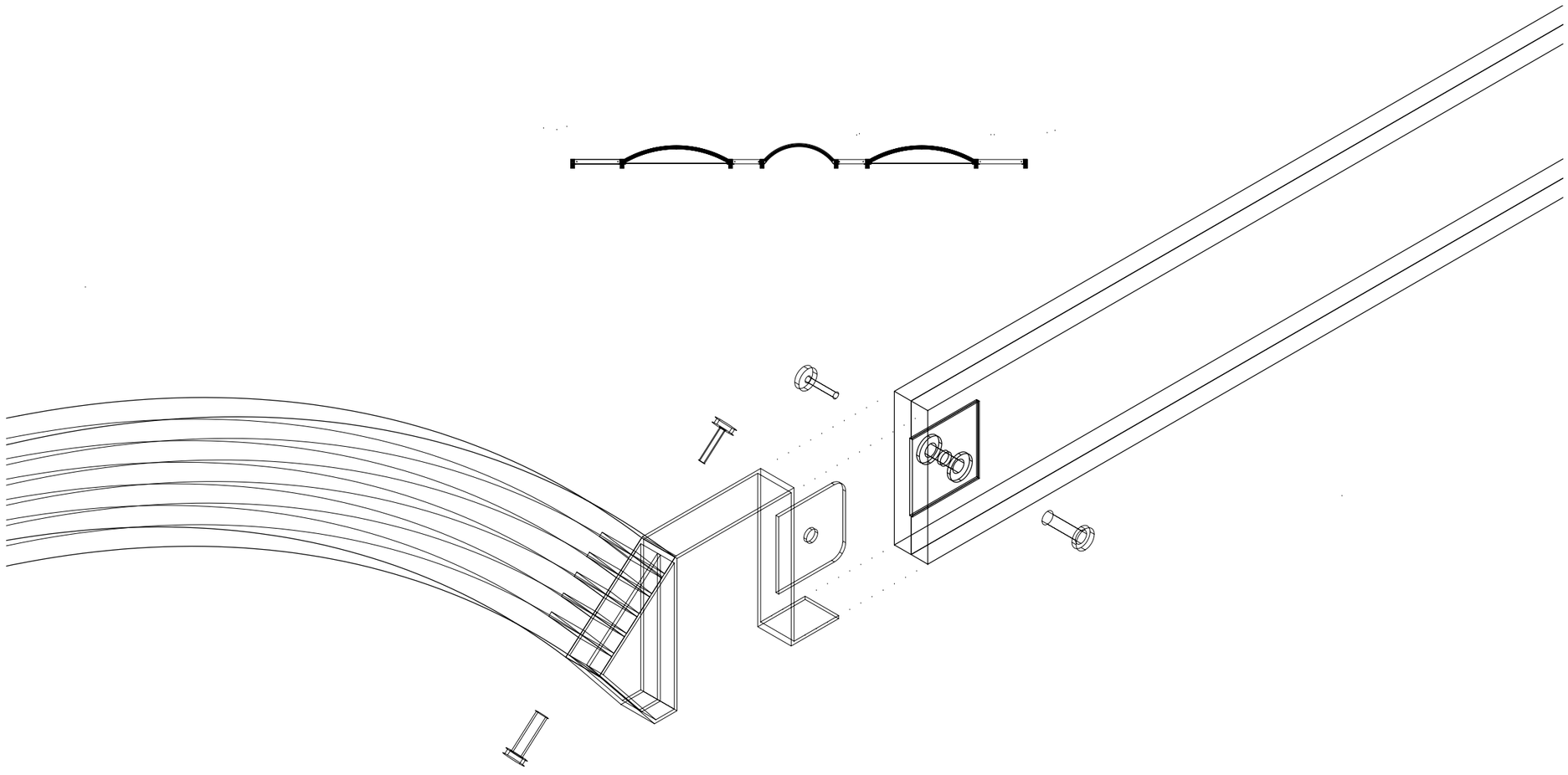
Arch Development



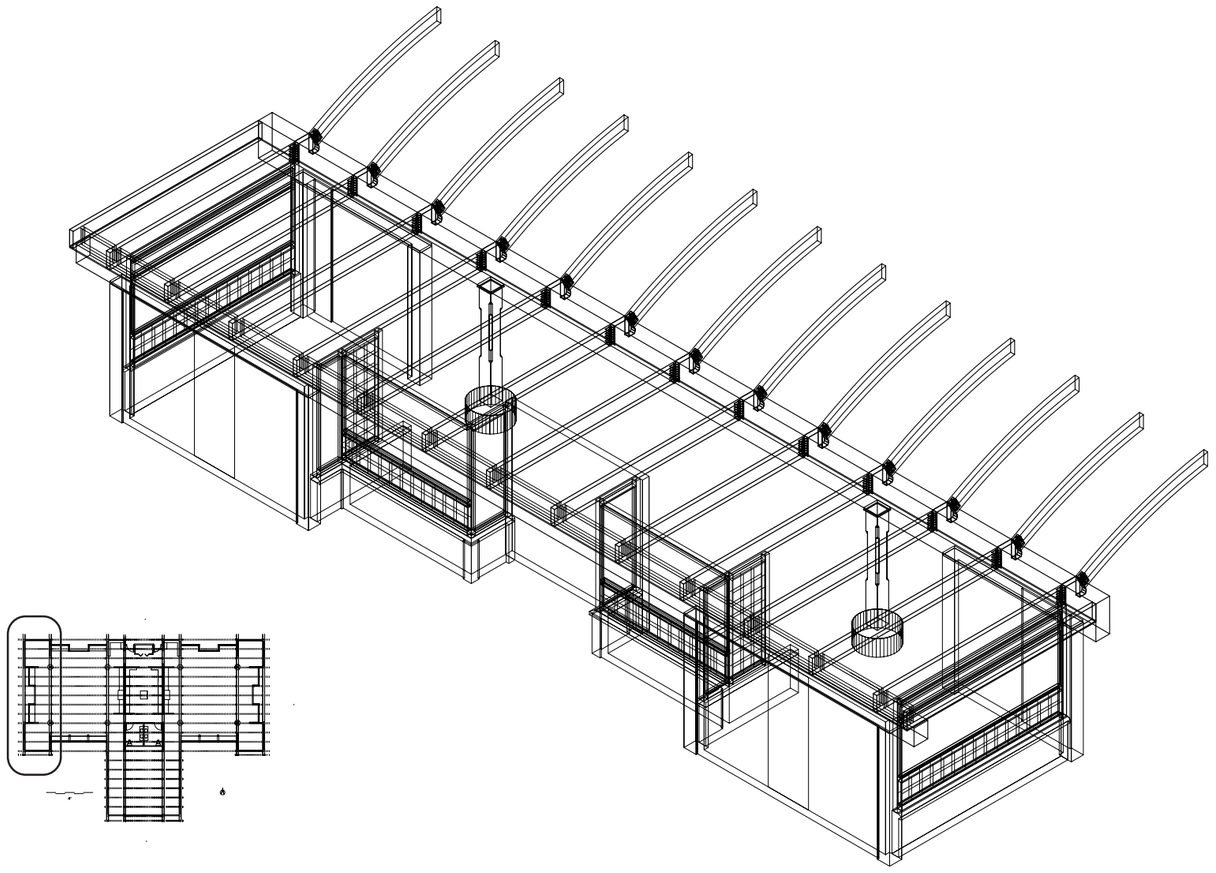
I refined the connector by rotating the width of each ply of the beam to a vertical orientation, allowing each board to work in its strongest direction, in shear. A tee connector slides between the plies, and a shoulder provides added support and eases assembly.

Wood bends much easier in the narrow dimension, so the arch is naturally still made of boards oriented in a way to facilitate bending them into shape.

Classroom Arch and Beam Connector



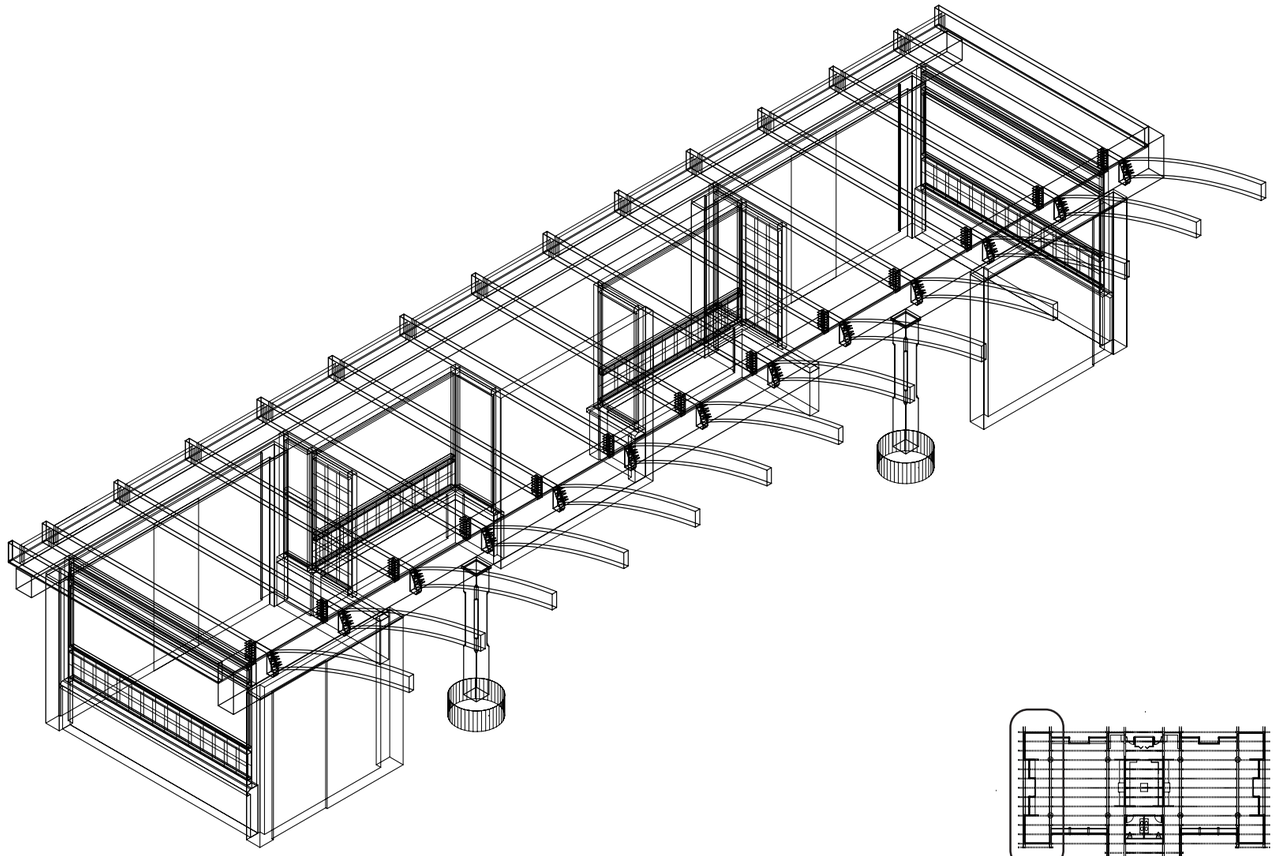
Community Room Arch and Beam Connector



The east and west end of each classroom has insets in the wall that create a place for benches where someone could wait to be picked up (at the west entrance), or socialize (in the corridor between classrooms, and the east patio).

Loadbearing reinforced concrete walls have no glass below the girder, whereas nonloadbearing walls have a 28" knee wall tall enough to cover seated work surface heights up to adult level. This knee wall helps to scale the room down to child size by creating a datum line around the classroom. Two rows of glass block above that obscure the view up to 44" (above 12 year old average seated eye levels) in front of workstations to improve concentration, but allow a view when standing. Clear views are provided to the sides for connection to the environment, and chosen moments of distraction.

Isolated Axonometric of Hihglighted Area - West View



Isolated Axonometric of Highlighted Area - East View

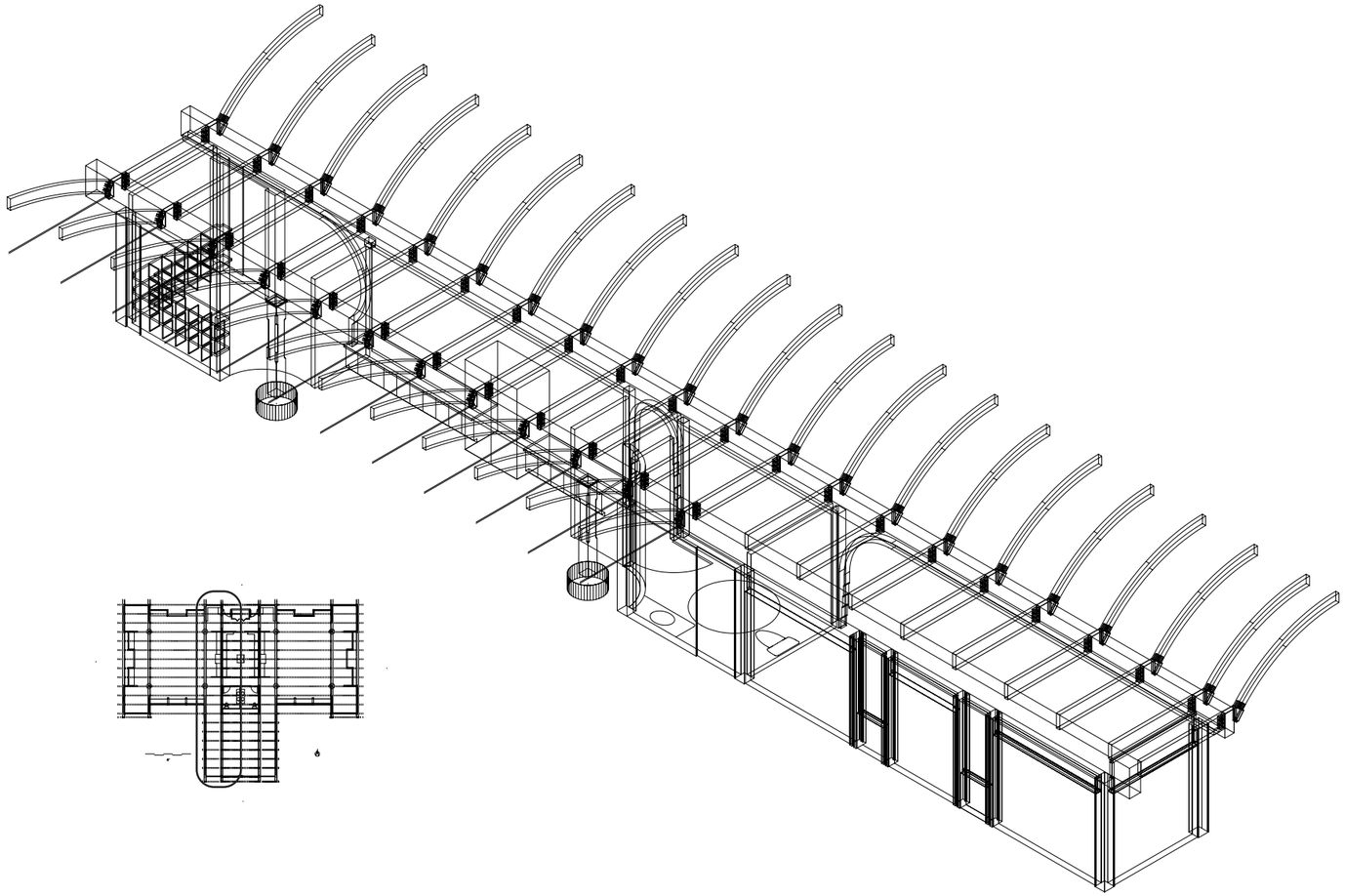
Glass between beams could let in a slot of light and view of the sky in the seminar rooms especially. At the insets, this would have to be pulled back on top of the walls several feet from the edge of the roof, letting in little light or view. For these reasons, and simpler construction, I'd choose to drop the tongue and groove wood ceiling to the bottom of the beams over the inset (in addition to decking on top), and keep glass between the beams only in the corner seminar rooms. This also makes a finer distinction between public and private spaces: the inset is defined as most private with the lowest ceilings, the seminar rooms as semi-private with a higher ceiling surface, and the group area on the other side of the girder as most public with its still higher arched ceilings.

In this view of the same area seen from the classroom side, you can see two of the gluelam columns. Their edges are chamfered from the height of the secondary datum line created by the glass block (just above the standing eye height of an average 6 year old) to nine inches below the girder. Their bases would be board formed with smooth tops and upper edges for more comfortable seating.

In this view of the opposite side of the classroom, you can see the cubbies near the entrance portal, and the storage cabinets and counter space along this edge of the classroom.

The bathroom shown here crowds the column too much, muddying the clarity of the room as defined by the four columns. It was ultimately moved to the far side of the girder, under the community room arches. This also creates a more discreet entrance along the sides of the community room.

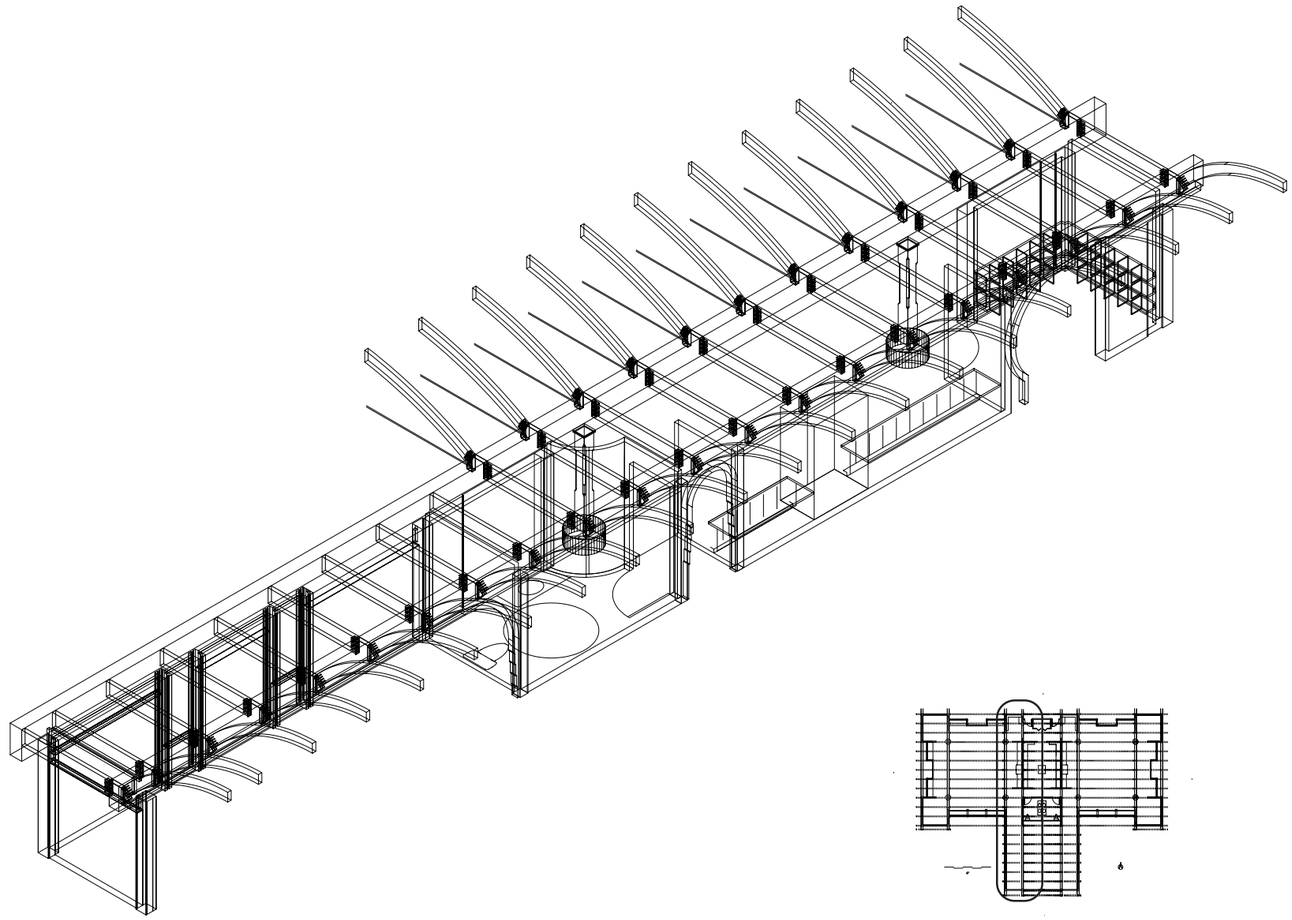
The community room has narrower windows since a student's attention is expected to be focused more on group activities here than on independent thought. Narrow horizontal bands of window under the girder allow slots of light and view of the sky.



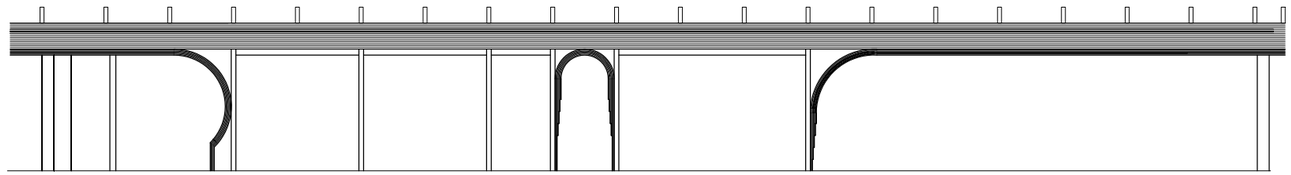
Isolated Axonometric of Highlighted Area - West View

The girder is supported intermittently across the top of the wall, allowing these horizontal windows. Supporting it continuously would be redundant. In fact, the wall could support the beams without a girder, but the girder is important for structural clarity and continuity.

I was able to do without a collar tie for the community room arches because the flat section of roof along the edges acts as a shear diaphragm, transferring the arches' thrust to the corners where perpendicular walls restrain it. This allows another gradation of ceiling height for the most public space where two classes come together.



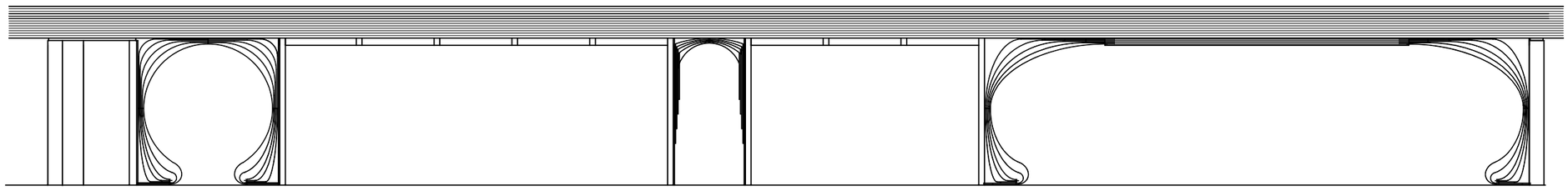
Isolated Axonometric of Highlighted Area - East View



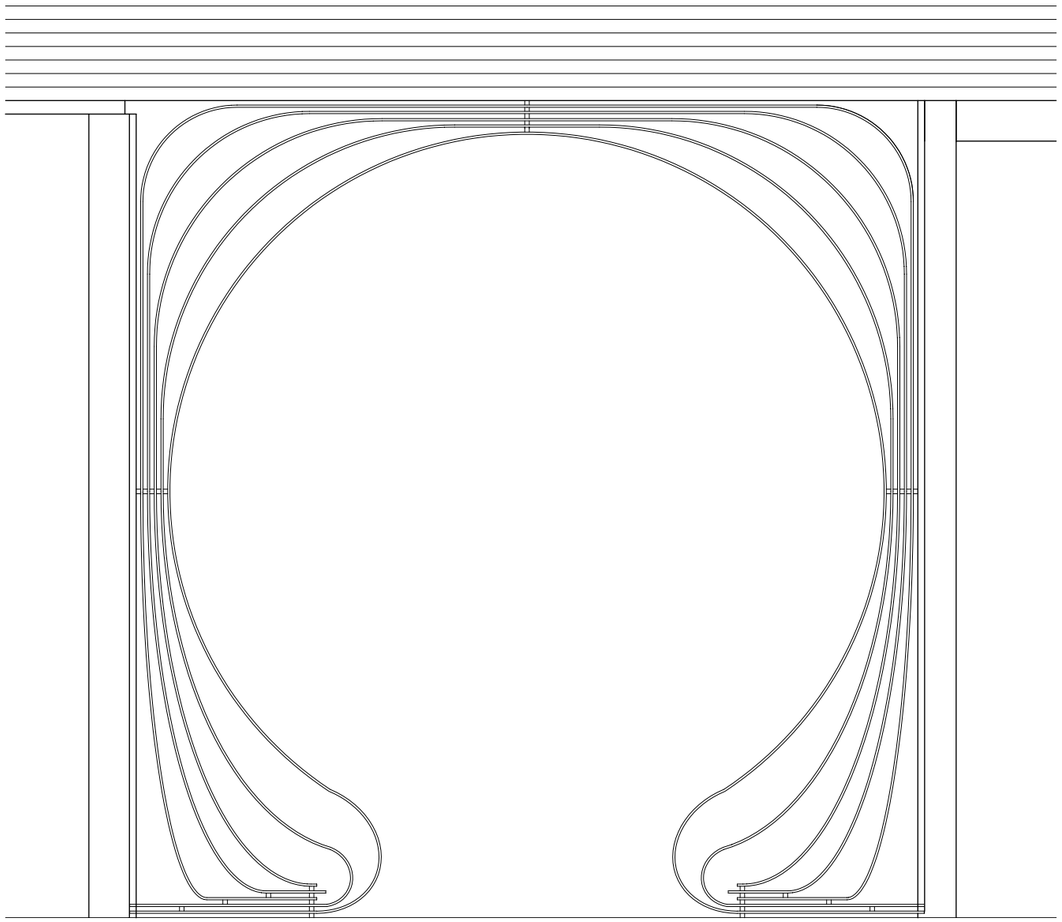
The girder running atop the wall between the kitchen and classroom, then spanning the community room gave me an opportunity to explore the question of redundant structure further with solutions for portal openings. To make it clear where the girder was carrying the most load, I thought about different ways to make the girder thicker where it's spanning an opening. Continuing with the idea of treating the plies of a gluelam member individually, I pulled several plies from the bottom of the girder, and curved them down into the end of the wall at every opening, abstractly expressing the transfer of loads. By ending the plies at different points, they also helped with scaling.

It would be impractical to manufacture, ship, and install this as one piece. Making it a separate piece would still be expensive, and would negate any real structural benefit these plies would contribute.

Since it's not really structural, I changed the material of the plies that are peeled away, from wood to metal strapping. This makes it clear that they are there more for illustration and for fun than for support.



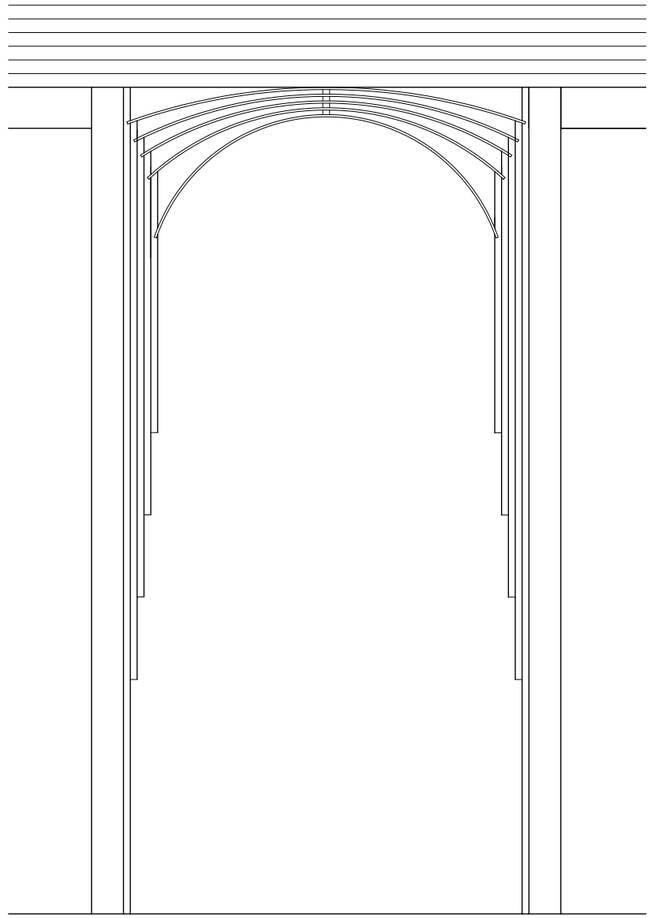
Elevation Studies for Portal Wall



Entry Portal

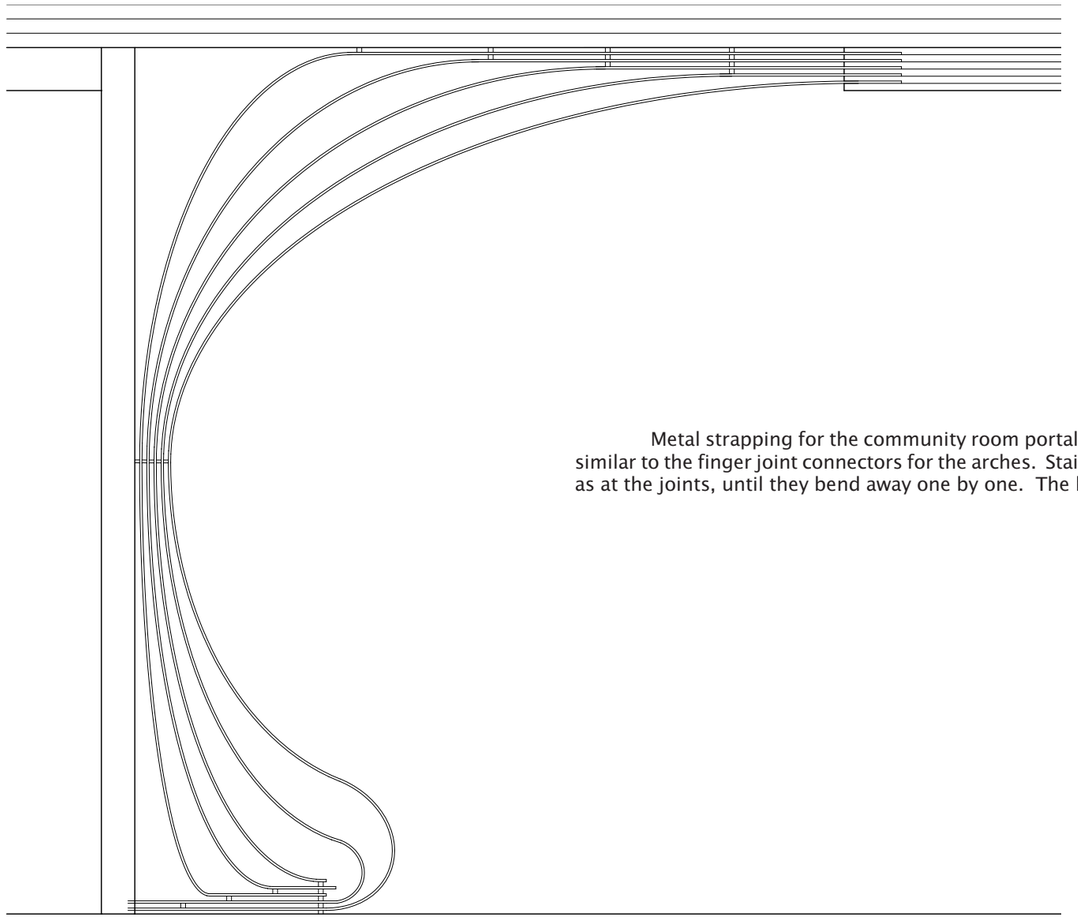
Since it's easier to bend them, the change to metal strapping also freed the plies to act more independently. I used the opportunity to make a progression from the orthogonal opening to a semicircle in the top half of the opening, turning into something more free-form at the bottom, still spaced narrow enough to prevent a child from getting his head stuck between the straps. The two outer straps wrap under the rest, and continue into a slot routed in the wood jamb.

The quarter inch straps would be held apart with stainless steel spacers where they are fastened, accentuating the joints.



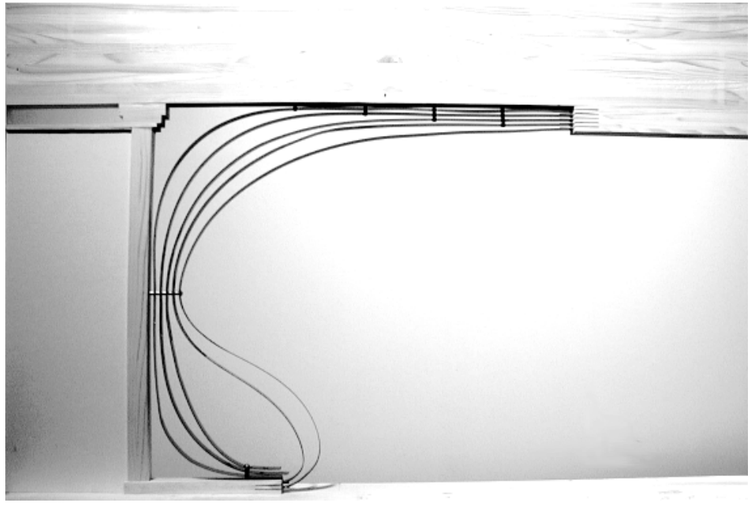
The narrower opening by the bathrooms allows less room to vary the shape of each ply. I kept the wood plies on the vertical jambs with stepped heights for scaling, and routed each metal strap into a corresponding wood ply, consistent with the idea of the metal as a continuation of the wood plies.

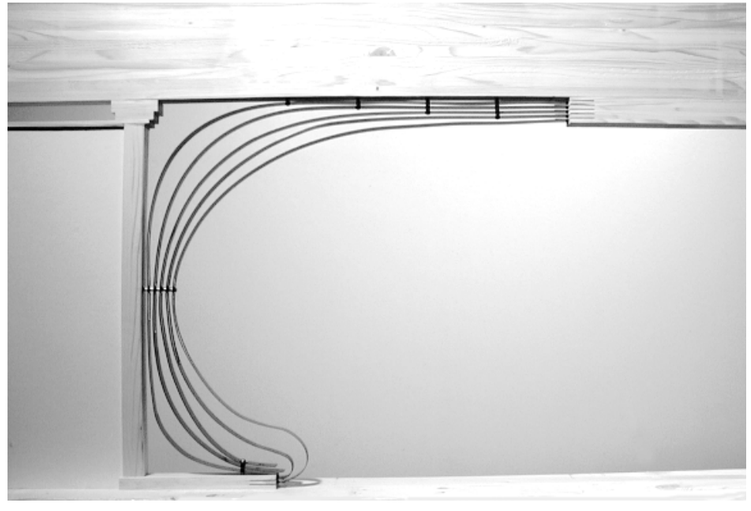
Middle Portal

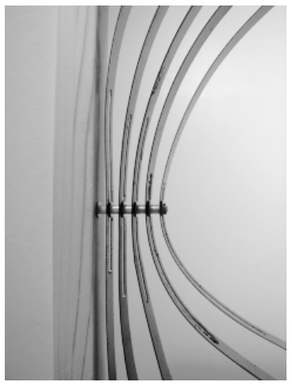


Metal strapping for the community room portal fingers between the plies of the deeper part of the girder similar to the finger joint connectors for the arches. Stainless steel spacers hold the strapping at the same spacing as at the joints, until they bend away one by one. The base is a repetition of the entry portal design.

Community Room Portal

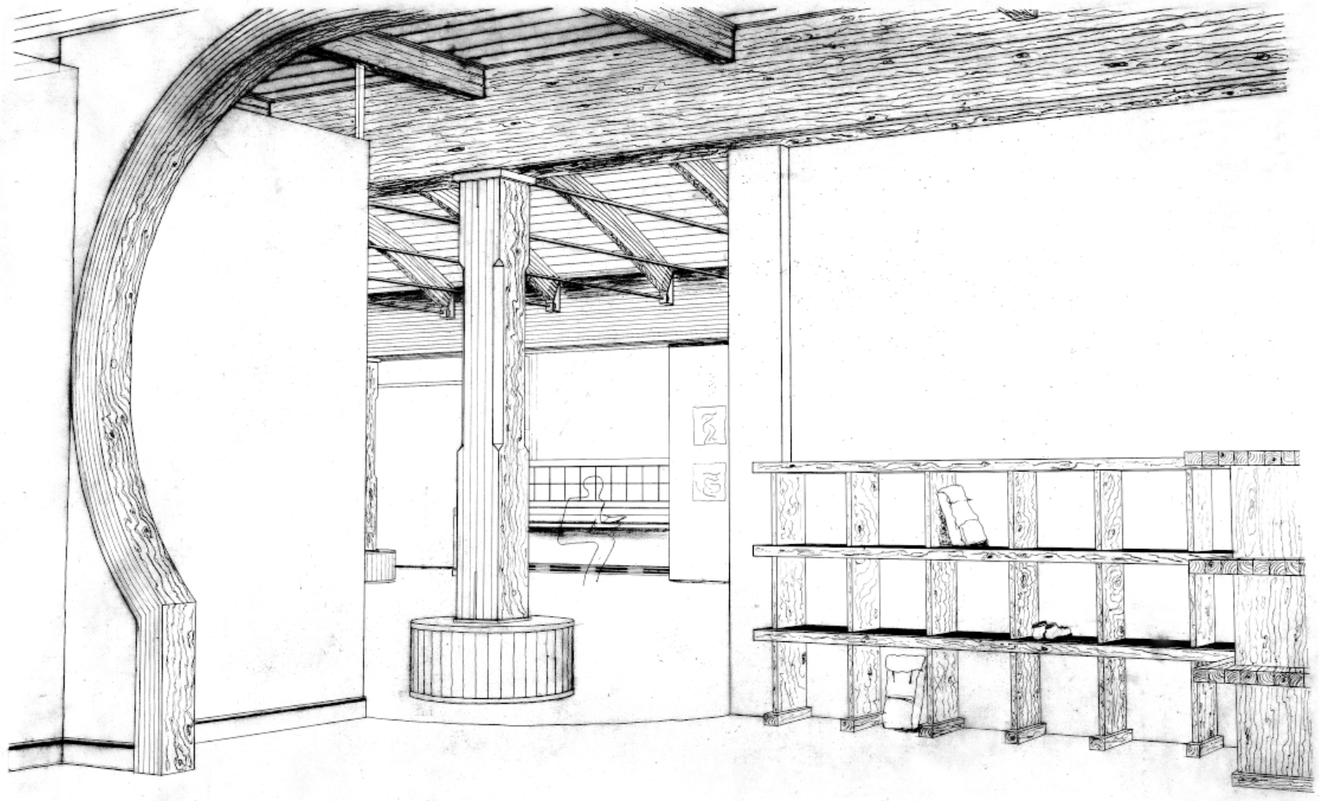




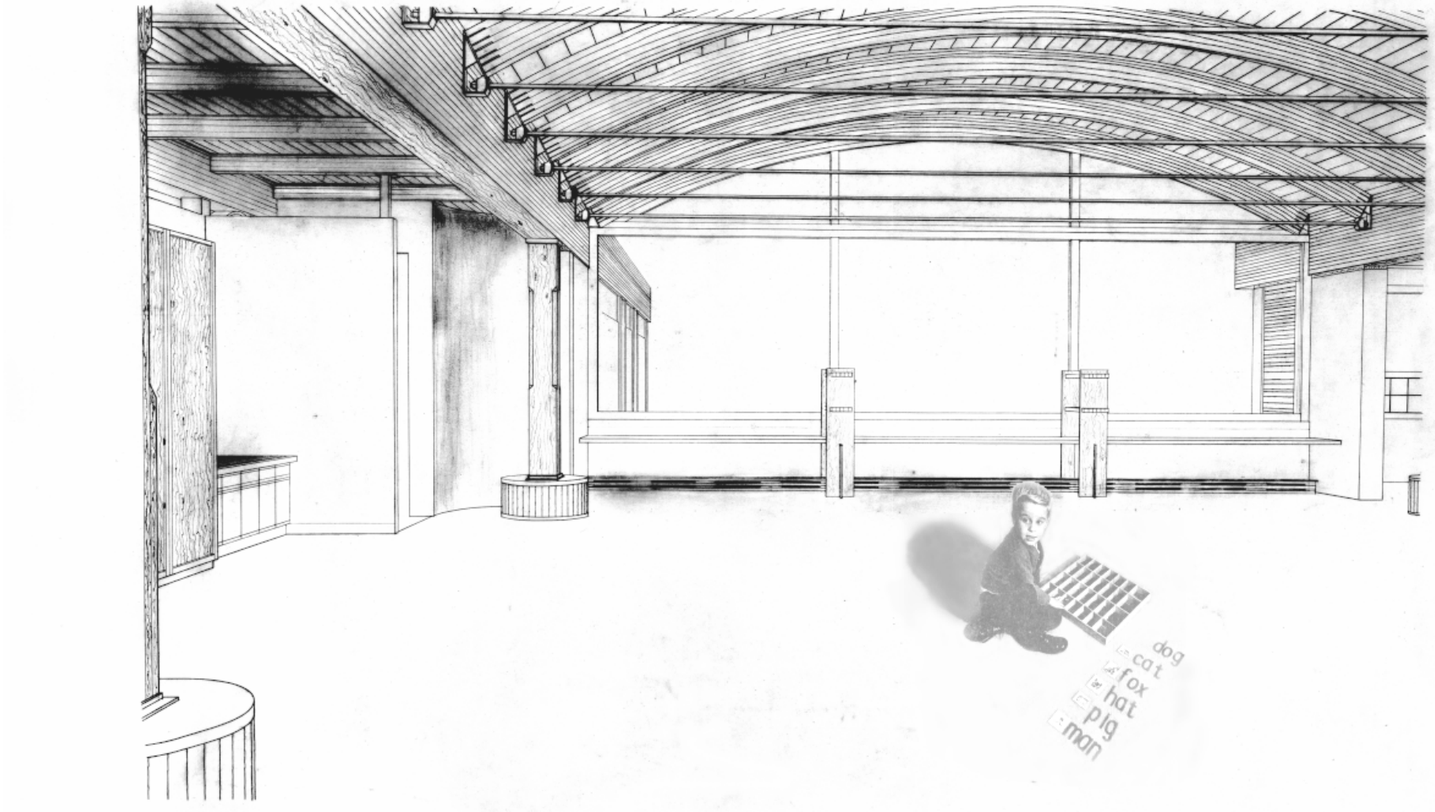


The model photo above, left, shows how the outer two metal straps wanted to bend at the bottom based on their natural properties, without forcing them into shape. The wider opening would be hazardous for children. The other photo shows the straps bent to approximate the shapes in the drawing. Except for straightening the band along the vertical jamb, the curves of the other bands were determined by their length, and placement of the fasteners – no bending was required. Some minor adjustments were made with slots milled in the strapping to slide on the center fastener. Ideally the children could slide the strapping, changing its shape slightly, and allowing them to interact with it and learn from the experience.

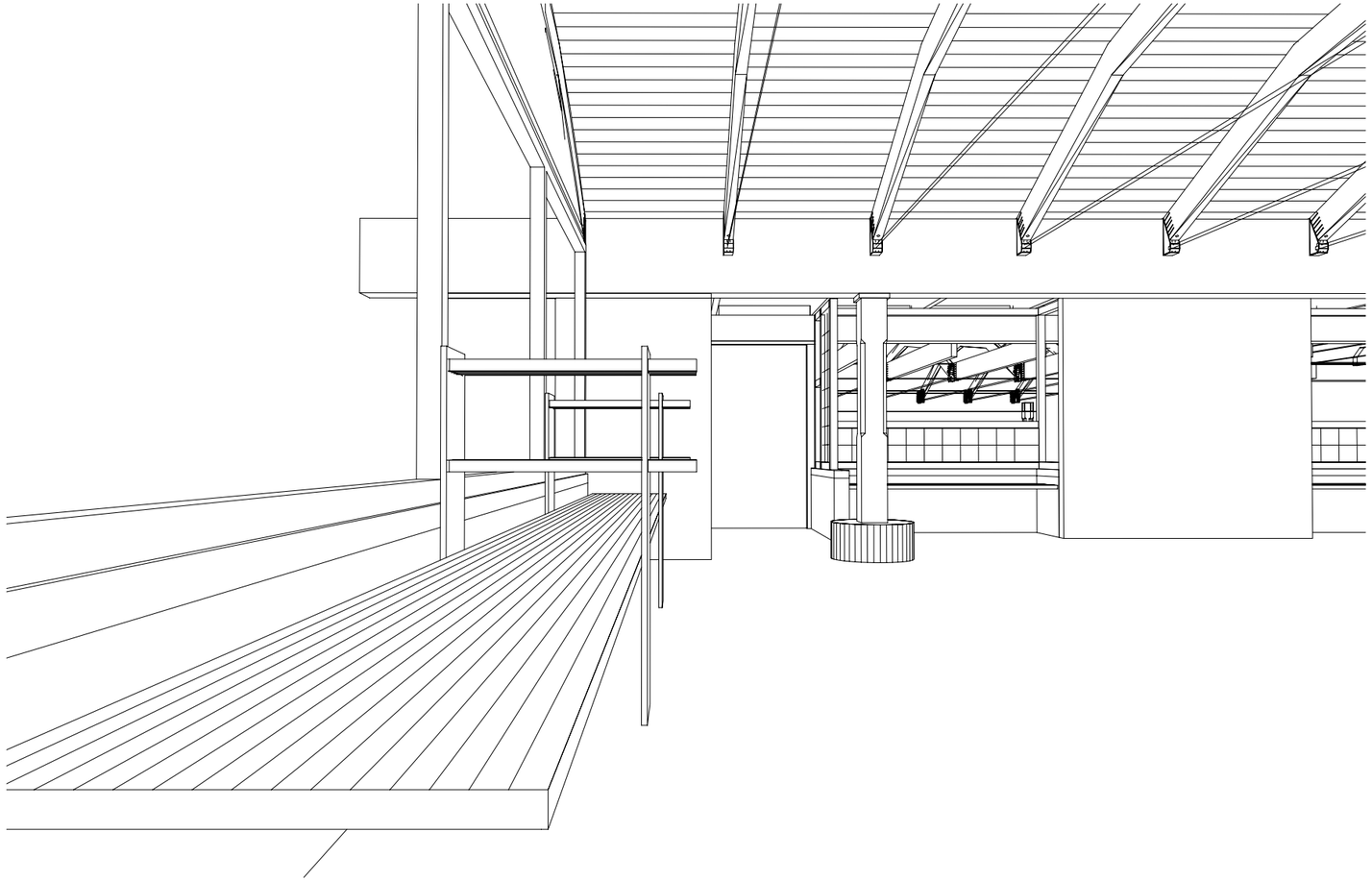
Model of Community Room Portal



Perspective Looking from Classroom Entry into Classroom

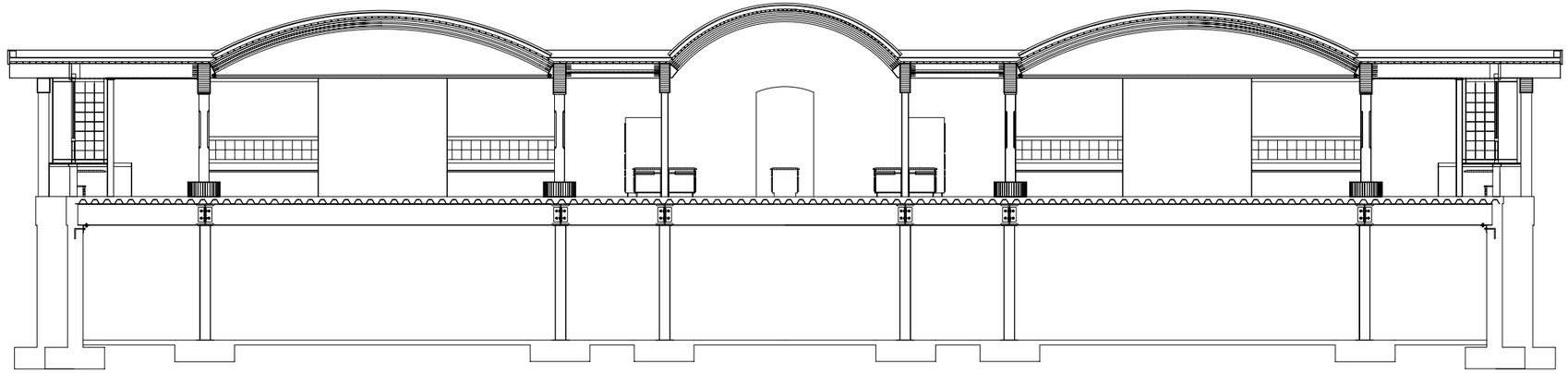


Classroom Perspective Facing South



Classroom Perspective Facing Main Entrance to Building

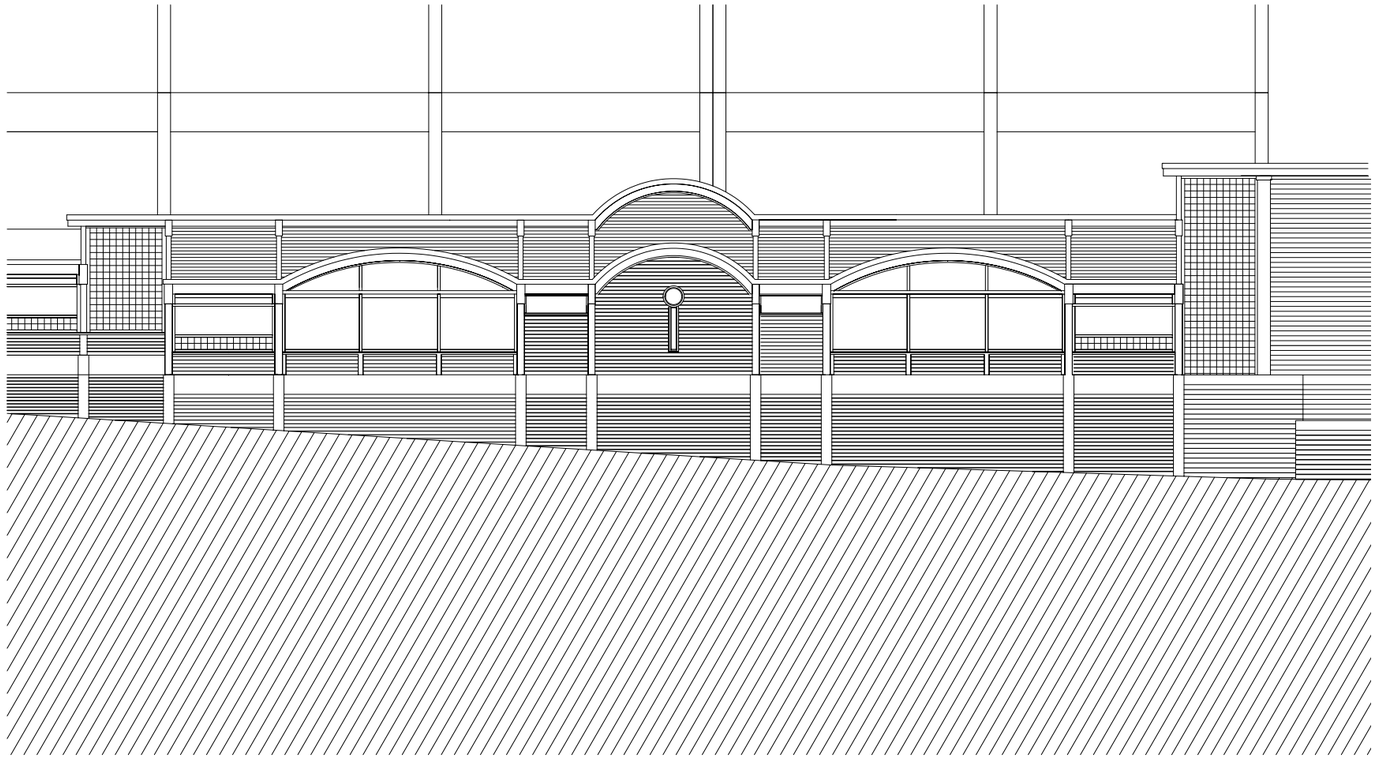
Community Room Perspective Facing South

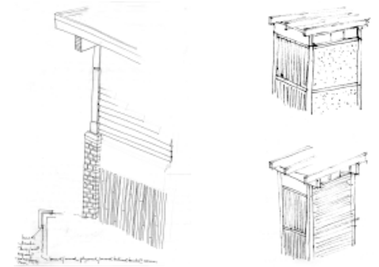


The section for this final design is much more directional than the earlier rotated square scheme. I had resisted directionality to avoid imposing on the inhabitants' interpretation of the building. I decided that the main axis created by the barrel vault ceiling only suggests how to use the space, still leaving plenty of options for the user. The vaulted ceiling suggests using the blank wall under the arch for group presentations.

The roof is covered with tongue and groove decking with a V-groove facing the living space, rigid foam insulation, and plywood, topped with EPDM membrane on the flats, and raised seam metal on the curved sections. The floor is reinforced concrete on steel beams with carpet in the classroom and community room to accomodate kids who want to work on the floor, and more easily washable tile or terrazzo in the kitchen/art room.

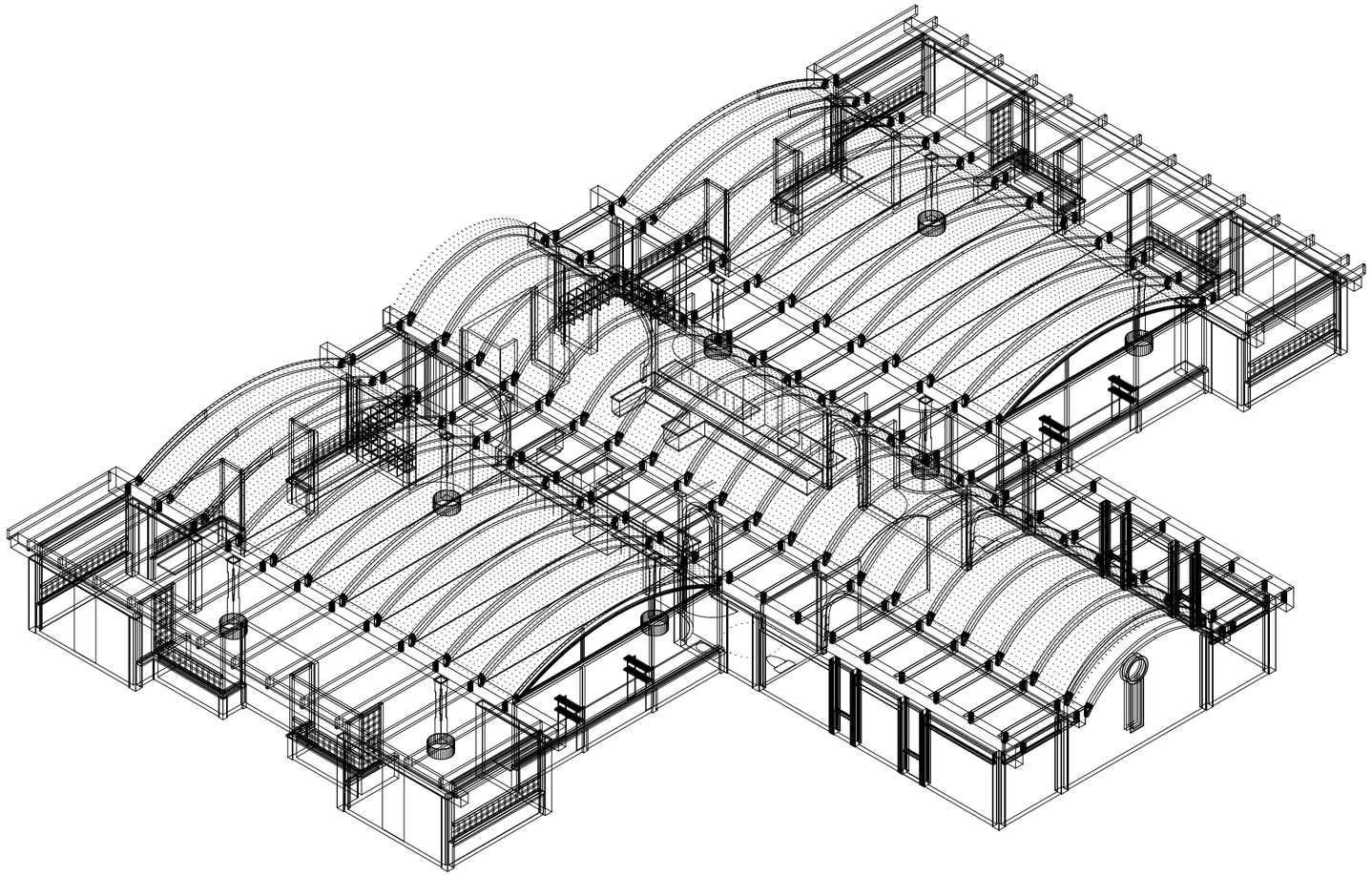
Double Classroom Section E-W, Facing North





Based on material study sketches, I chose smooth concrete corners, trim and spandrel with horizontal board formed concrete infill for durablity, and to distinguish between loadbearing corners and nonloadbearing (when separated by glass) infill wall, as seen in the elevation drawing. The board form concrete will help to scale the building down. The wood grain impression creates a dialogue with the surrounding trees, and gives an indication of how it was made.

Double Classroom Elevation



Double Classroom Axonometric

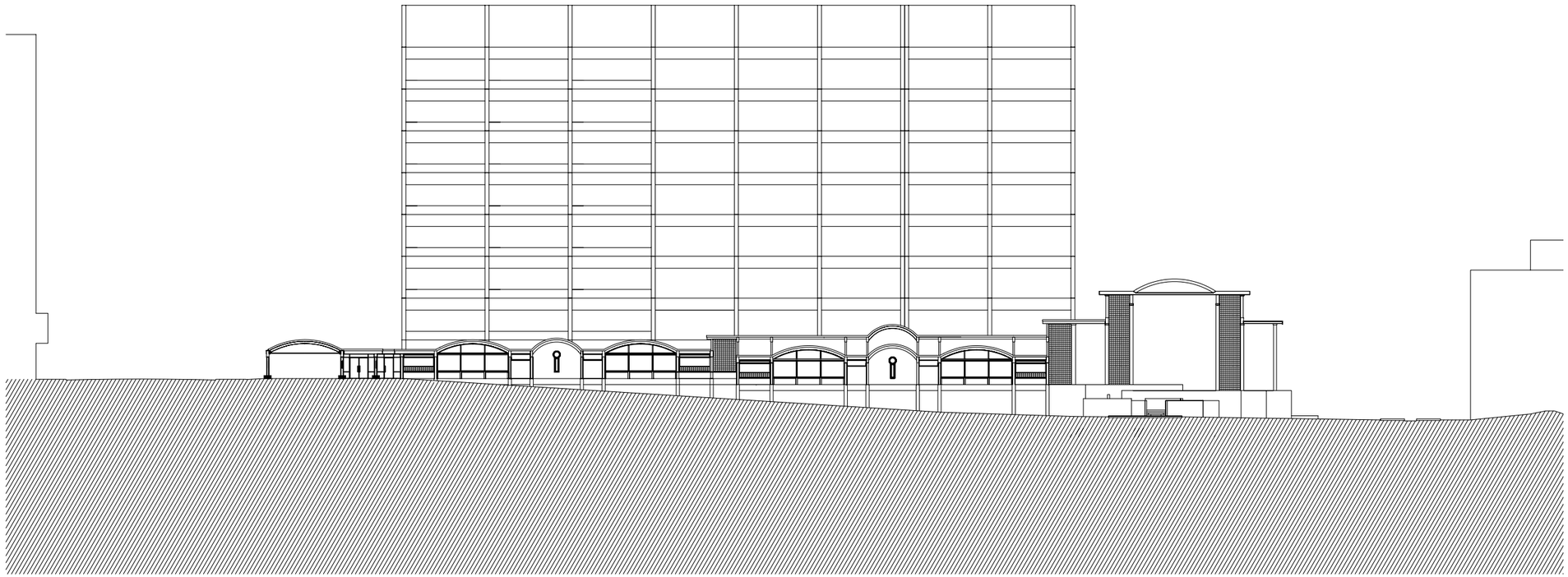
This section cuts through the first pair of classrooms, through the larger meeting space behind the second pair of classrooms, and then through the gym.

In the meeting space, a slot of light is let in along the north wall, leaving blank wall below as a backdrop for performances on the informal stage. Adjacent steps are wide enough to sit on comfortably.

Walls for the gym's equipment closet and changing rooms get progressively taller as they step back, making a transition of scale to the taller gym. A short wall along the entry side of the gym is suitable to lean against and watch the activity inside.

The gym is lit by clerestory windows and glass block extending up between the columns.

Section W-E, Facing North



The bland repetition of the Trigon Building makes a good background for this rhythm of arches stepping from the main entrance canopy up to the gym roof. This progression initiates a dialogue with the slope of the site, and with the Wachovia Building to the right. This dialogue helps to ease the transition from the pedestrian scale to the towering scale of the Trigon Building and Patrick Henry Hotel (left).

The second pair of classrooms steps down, while the meeting hall steps up behind it. The ramps in front of the gym step down further to meet the grade.

The circular parts of the keyhole windows in the community rooms, and mullions in the classrooms help to continue the horizontal line of the flat roofs where the arches curve across the same span.

South Elevation, Facing North

Perspective

Since the classroom is where learning takes place, I consider it to be the heart of a school. I developed the classroom in more detail, establishing a language and an approach for more detailed development of the rest of the school. As is, I think the project as a whole is successful in terms of responding to both context and program. The construction is viable and is integral to the building's character. One can clearly see how the structure works. The structure also defines space without enclosing it, as intended. Materials are chosen and used according to their true nature, and not used simply to evoke a certain image.

My thesis has given me the opportunity to synthesize my construction background with my architecture. The way a design is built, with or without a skin, can be the creator of space. The way elements are joined can be the decoration. The way the building meets the ground and the sky can be the way it is experienced and perceived. The way the part relates to the whole can generate the order.

There is still untapped potential for exploration in the project, and in the thesis. There are things which would need further development if the project were to be built. There is always more to learn. But this is beyond the scope of my thesis. The time has come to put what I've learned to the test on new projects, and to continue my learning process in that way.

Appendix

Montessori

photo from The Montessori Method and The American School, Ward

photo from Maria Montessori: Her Life and Work, Standing

"The educator must be as one inspired by a deep worship of life, and must through his reverence, respect, while he observes with human interest, the development of the child life. Now child life is not an abstraction; it is the life of individual children. There exists only one biological manifestation: the living individual; and toward single individuals, one by one observed, education must direct itself. By education must be understood the active help given to the normal expansion of the life of the child."

Maria Montessori, The Montessori Method

Maria Montessori started studying engineering, then became the first female student at the Medical School of the University of Rome. As a resident at the University Hospital in search of clinical research subjects, she discovered a group of "defective" children in an empty room who had created a toy using bread crumbs to occupy their minds. Fascinated by their initiative, she began studying education of the mentally retarded, and conducting her own scientific experiments based on careful observation without any preconception of the results.

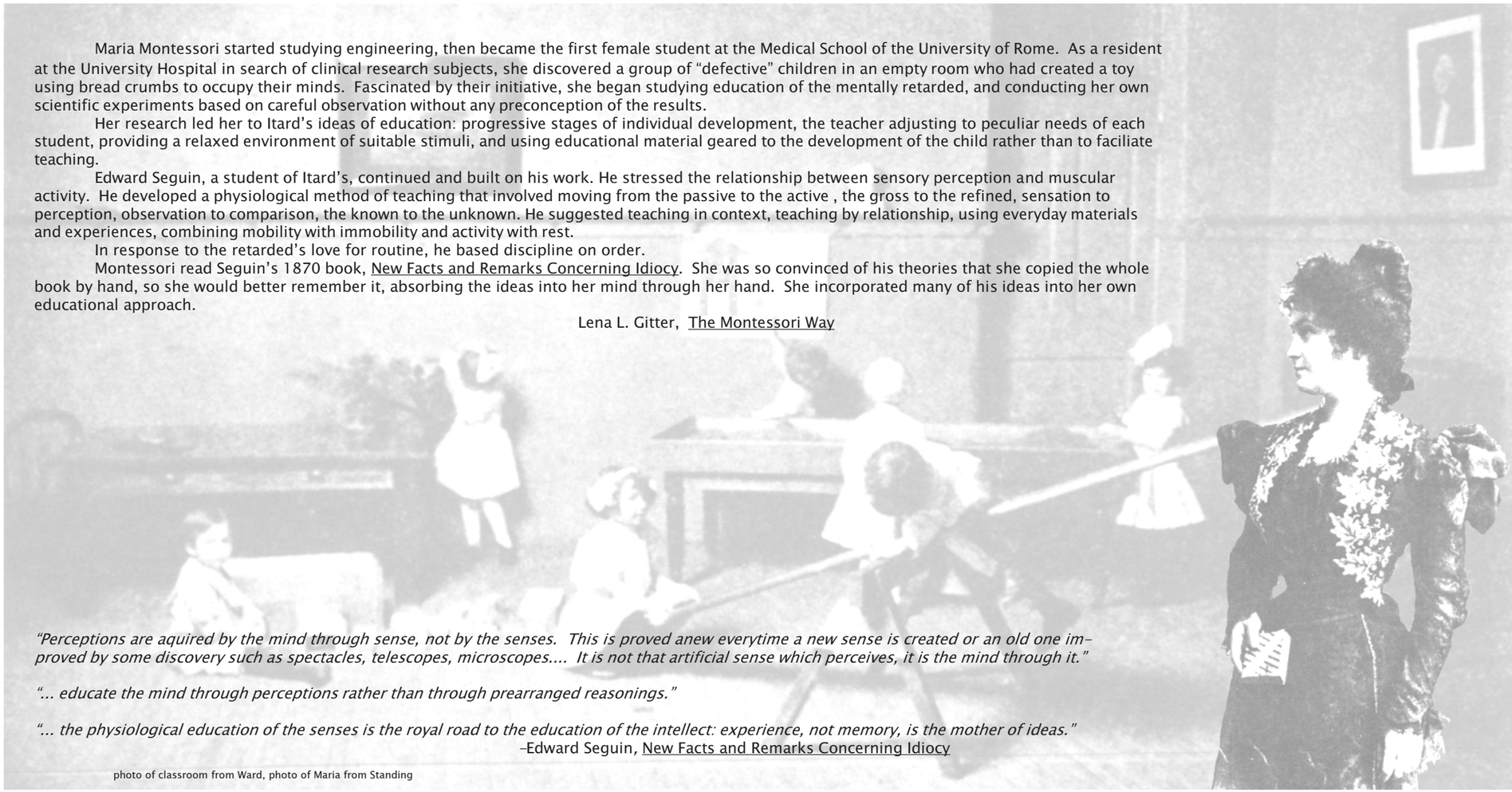
Her research led her to Itard's ideas of education: progressive stages of individual development, the teacher adjusting to peculiar needs of each student, providing a relaxed environment of suitable stimuli, and using educational material geared to the development of the child rather than to faciliate teaching.

Edward Seguin, a student of Itard's, continued and built on his work. He stressed the relationship between sensory perception and muscular activity. He developed a physiological method of teaching that involved moving from the passive to the active , the gross to the refined, sensation to perception, observation to comparison, the known to the unknown. He suggested teaching in context, teaching by relationship, using everyday materials and experiences, combining mobility with immobility and activity with rest.

In response to the retarded's love for routine, he based discipline on order.

Montessori read Seguin's 1870 book, New Facts and Remarks Concerning Idiocy. She was so convinced of his theories that she copied the whole book by hand, so she would better remember it, absorbing the ideas into her mind through her hand. She incorporated many of his ideas into her own educational approach.

Lena L. Gitter, The Montessori Way



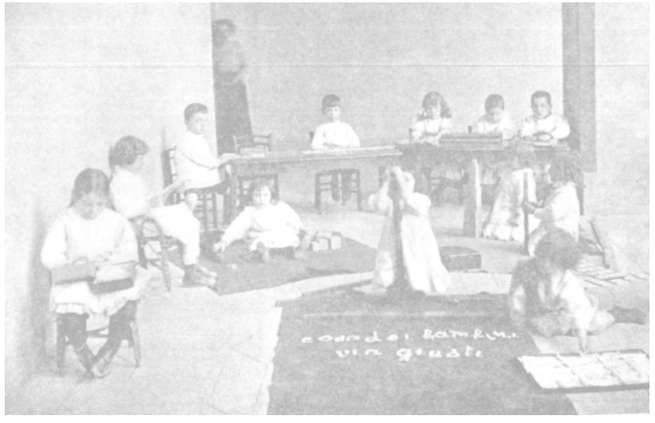
"Perceptions are aquired by the mind through sense, not by the senses. This is proved anew everytime a new sense is created or an old one improved by some discovery such as spectacles, telescopes, microscopes.... It is not that artificial sense which perceives, it is the mind through it."

"... educate the mind through perceptions rather than through prearranged reasonings."

"... the physiological education of the senses is the royal road to the education of the intellect: experience, not memory, is the mother of ideas."

–Edward Seguin, New Facts and Remarks Concerning Idiocy

photo of classroom from Ward, photo of Maria from Standing



photos from Ward

"The children work by themselves, and, in doing so, make a conquest of active discipline, and independence in all the acts of daily life, just as through daily conquests they progress in intellectual development. Directed by an intelligent teacher, who watches over their physical development as well as over their intellectual and moral progress, children are able with our methods to arrive at a splendid physical development, and in addition to this, there unfolds within them, in all its perfection, the soul, which distinguishes the human being."

Maria Montessori, The Montessori Method

"When a skill is perfected in a freely chosen field, and it creates the will to succeed and to overcome obstacles, something more than a simple accomplishment has occurred; a feeling of one's own worth has developed. From the tenderest age, man gains most satisfaction from a feeling of independence. The feeling of being sufficient to oneself comes unexpectedly as a revelation. There can be no doubt that this is a fundamental element of social life.... It is very evident that the need to help others or to seek their collaboration cannot manifest itself when one is entirely dependent on them and when one is convinced of one's own inadequacy.... Vital energies consist in the sense of one's true value and in the knowledge of participating in a social organization."

Maria Montessori, From Childhood to Adolescence

"The idea for open space [playground and garden]... is to be in direct communication with the schoolroom, so that the children may be free to go and come as they like, throughout the entire day."

"The old method was dependent on silence and immobility... which hindered the child from learning to move with grace and discernment."

"... liberty is activity.... We call an individual disciplined when he is master of himself.... Since the child now learns to move rather than to sit still, he prepares himself not for the school, but for life; for he becomes able, through habit and through practice, to perform easily and correctly the simple acts of social or community life. The discipline to which the child habituates himself here is, in its character, not limited to the school environment but extends to society. The liberty of the child should have as its limit the collective interest."

Maria Montessori, The Montessori Method

photos from Ward

portrait by Sir Frank Salisbury, from Standing

Case Study: Omni Montessori, Charlotte, NC

Classes are grouped 3yr. old-kindergarten; 1st through 3rd grade; 4th through 6th grade.

Each class has 25-30 students, with one teacher and one assistant for each class.

Each of the younger groups has 1200-1250 square feet of space in two parallel, long, economical buildings about fifty feet apart.

True to Montessori's doctrine, each classroom has about 400 sf of outdoor space for meeting in good weather, and for growing plants. The entrance to each classroom has open "cubbies" and coat hooks for students to put their shoes, coats and other personal belongings. The only built-in furniture is the kitchen counter and cabinets in each room. Tables and chairs are light and movable, and of different heights. There are tables for sitting in a chair, and shorter tables for sitting on the floor. Small area rugs allow a student or small group to create their own small workspace on the floor for a chosen activity. Small stools allow each student to be able to reach everything in the room, except for those things the teachers keep high enough that only they can reach. Movable blackboards allow participants to reconfigure the space for group lessons as desired. There are birds, hamsters, turtles, and such in appropriately sized cages. There is a small bathroom in each room.

There is one larger common room for all these classes to share. This is used for a small library with a few computers, music, skits, and larger indoor projects. There is a recycling area outside.

Teachers wish for a separate heat source for science experiments, a shared washer and dryer to wash towels, etc., lots of separate closets and shelving. They stressed the conflicting needs for lots of wall space, and natural light.

The 4-6th grade group has a separate building (shown here), at least 100 ft away from the others, designed by a parent/architect working closely with one of the teachers. The entrance is a large shaded deck, large enough for the whole class. A serpentine cubbie tower stands inside the door. Separate male and female bathrooms are off to the left. Rooms to the right provide smaller, quieter spaces for reading, library shelves, and computer use. A large open kitchen provides a long, wide, curving multi-purpose counter to the left, adjoining the main classroom. Beyond the kitchen, the ceiling slopes up to the right over the whole classroom to allow more natural light, and a view of the outdoor environment from the ground to the sky. Short shelves line the window sill. Open beams, and decorative bracing draw your eye up. Other smaller shelf units are distributed around the room. Combined in changeable ways with assorted tables and chairs, and area rugs, they create several smaller spaces of various size and shape.

Thanks to: Kevin O'Laughlin, Susie Gaudioso, Portia, Reese, and Jim Webster

Case Study: Charlotte Preparatory School

This Montessori school has similar features to Omni Montessori with a more upscale appearance. It was designed by David Furman as a new ell shaped building with covered drive-through entrance.

The main difference programatically is that kitchen and eating facilities are centralized in a large hall rather than integrated into each classroom. Administrative offices are right inside the entrance whereas Omni's are beyond the first classroom.

Classrooms for even the younger students have ceilings that slope up to clerestory windows. The rooms are scaled down somewhat with iconic gabled walls with smaller openings evoking a small house image. Corridors have knooks off to the side for cubbies, etc.

The ceiling is high in the corridor too, but is scaled down with girders crossing at a normal eight foot ceiling height, and with checkerboard floor tiles.

Bibliography

Blaser, Werner; Furniture as Architecture, Waser Verlag Zurich, Switzerland, 1985

Bohlin, Cywinski, Jackson; The Architecture of Bohlin Cywinski Jackson, Rockport Publishers, Rockport, MA, 1994

Buchanan, Peter; Renzo Piano Building Workshop Complete Works, Vols.1 &2, Phaidon Press Ltd., London, 1993

Frampton, Kenneth; Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture, MIT Press, Cambridge, MA, 1995

Gilli, Gustavo; Sustainable Architectures: Renzo Piano, SA Barcelona, 1998

Gitter, Lena L.; The Montessori Way, Special Child Publications, Inc., Seattle,WA, 1970

Hertzberger, Herman; AldoVan Eyck: Hubertus House, Stichting Wonen/Van Loghum Slaterus, 1987

Heidigger, Martin; "On the Origin of the Work of Art" in Poetry, Language, Thought, Harper & Row, New York, 1971

Latour, Alessander (ed.); "Form and Design" and "Talks with Students" by Louis Kahn printed in Louis I. Kahn: Writings, Lectures, Interviews, Rizzoli Int'l Publications, New York, 1971

Lillard, Paula Polk; Montessori: A Modern Approach, Schocken Books, New York, 1972

Montessori, Maria; The Advanced Montessori Method, Vol.1&2, Thoemmes Press, Bristol, England, 1919, 1995
From Childhood to Adolescence, Schocken Books New York 1948, 1973
The Montessori Method, Schocken Books, New York, 1912, 1964
Spontaneous Activity in Education; Schocken Books, New York, 1965

Orem, R.C.; Montessori Today, G.P. Putnam's Sons, New York 1971
A Montessori Handbook, Capricorn Books, New York, 1966

Pallasmaa, Juhani (ed.); Alvar Aalto Furniture, MIT Press, Cambridge, MA, 1985

Ronner, Heinz, Jhaveri and Vasella; Louis I.Kahn: Complete Work, 1935-1974, 2nd ed., Basel and Boston, 1987

Schulz, Christian Norberg; Late Baroque and Roccocco Architecture, Henry N. Adams Publshers, Inc., New York, 1974

Standing, E.M.; Maria Montessori: Her Life and Work, Hollis & Carter Ltd, New York, 1957

Ward, Florence Elizabeth; The Montessori Method and The American School, The MacMillan Co., New York, 1913

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