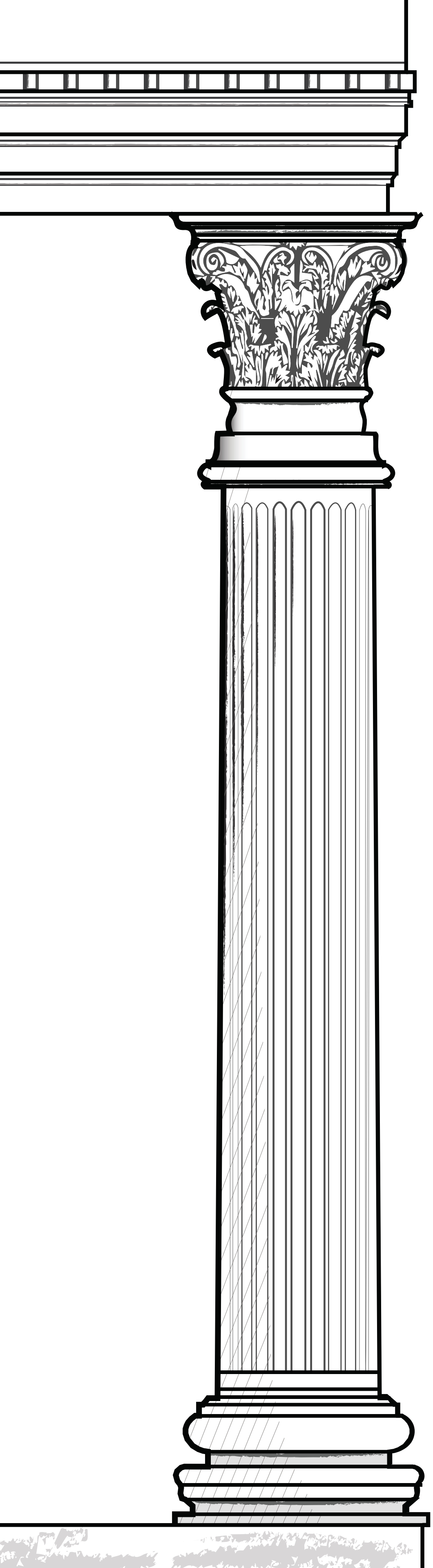

Form and Force

AN EXPLORATION OF TECTONICS

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All of the photographs and other images in this document were created by the authors – the students in ARCH 750 Investigating Architectural Tectonics, Fall 2017 – unless otherwise noted. Every effort has been made to ensure that credits accurately comply with information supplied.

Table of Contents

Preface | Alycia Pappan

In *Studies and Tectonic Culture*, architectural theorist and author, Kenneth Frampton wrote:

> Based in part on an actual Caribbean hut that he saw in the Great Exhibition of 1851, Semper's primordial dwelling was divided into four basic elements: (1) the earthwork, (2) the hearth, (3) the framework/Roof, and (4) the lightweight enclosing membrane. On the basis of this taxonomy Semper would classify the building crafts into two fundamental procedures: the tectonics of the frame, in which lightweight, linear components are assembled so as to encompass a spatial matrix, and the stereotomic of the earthwork, wherein mass and volume are conjointly formed through the repetitious piling up of heavyweight elements.[1]

In the quote above, Frampton emphasizes Semper's four elements of architecture and the impact they had on the etymology of tectonics. Semper, along with architect Karl Botticher, is widely recognized as a founding father of this line of thought, however these two scholars built their ideas on the theories of those who came before them. One hundred and fifty years later, a new line of theorists expanded on those early tectonic notions, contributing to a new contemporary perspective. Demetri Porphyrios channels Karl Botticher in his essay *From Techne to Tectonics*. In the paper, he writes about the tectonic form that "envelop[ed] the bare form of construction with a symbolism of order."[2] Architectural historian Eduard Sekler also built on these historical precedents. In *Structure, Construction, and Tectonics* he cites the work of Heinrich Wolfflin, building on the theorist's recognition of "...tectonics as the particular manifestation of empathy in the field of architecture."[3] Each historian over the past century and a half has contributed to a rich lineage of thought by defining the meaning of tectonics in their own work. Although these scholars might not necessarily agree on a single definition of tectonics, each proposal shares similar roots with the others.

This semester, our goal was to define our own understanding of tectonics by engaging with the study of architectural precedents. This interactive class was intended to broaden our systematic way of thinking about the built environment and, through investigation and research, we were able to analyze and think critically about how our precedents related to a series of tectonic themes - anatomy, construction, detail, place, ornamentation, space, and the atectonic. As well as critically understanding these tectonic themes, the class focused on specific objectives to develop a tectonic understanding of our projects. The underlying objectives were to understand architecture by considering the past development of tectonic thought, to investigate a project thoroughly and understand the architectural thought behind it, and to be able to succinctly write about architectural tectonics and explicitly demonstrate the evidence found through drawing and construction. Although each of the precedents studied engaged the tectonic in a unique way, the collective set all eleven case studies in this final submission helps to present a comprehensive understanding of the theory of architectural tectonics.

1 Kenneth Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge: The MIT Press, 2001), 5.
2 Demetri Porphyrios, In *What is Architecture?* (New York: Routledge, 2002), 129.
3 Eduard Sekler, In *Structure in Art and Science*, Edited by Kepes (New York: Braziller, 1965), 91.

Acknowledgments

We would first like to thank the Department of Architecture at Kansas State University for giving us the opportunity to participate in the Investigating Architectural Tectonics seminar. As a class being offered for the first time, the course has enlightened us to a broader interpretation of the word tectonics and how it fits in with the analysis of a building. Going into the semester, we all assumed the definition of tectonics was limited to an understanding of the filigree nature of a building. By studying an array of philosophical texts, however, we came to realize this idea was a small component of a larger body of knowledge. Some of the authors of these theoretical texts, including Gottfried Semper, Karl Botticher, Kenneth Frampton, Andrea Deplazes, and many more, presented different ideas and conceptualizations of tectonic theory. Many of these authors were revolutionary for their time and we cannot thank them enough for the research they have done.

As part of this class, each student had the opportunity develop his or her own chapter for the final book. We must thank our professor, Chad Schwartz, for guiding us through the process of analyzing an architectural precedent and helping us create the text before you. Using his recently published work and many others as precedents, our class was able to create our own book analyzing unique and important constructions located in many different parts of the world. In the same way that our sources have helped us through this process, it is our hope that this book helps you to understand the diversity of ideas housed within the theory of architectural tectonics.

Project Map

1 **Agosta Residence**
Patkau Architects
San Juan Island, Washington, USA

2 **Bavinger Residence**
Bruce Goff
Norman, Oklahoma, USA

3 **Christo Obrero Church**
Eladio Dieste
Atlantida, Uruguay

4 **Delta Shelter**
Olson Kundig
Mazama, Washington, USA

5 **Dominus Winery**
Herzog & de Meuron
Yountville, California, USA

6 **Komyo-Ji Temple**
Tadao Ando and Associate
Ehime, Japan

7 **Nest We Grow**
Kengo Kuma & Associates + College of Environmental Design,
University of California-Berkeley
Hokkaido, Japan

8 **Sea Ranch Condominium I**
MLTW
Sonoma Coast, California, USA

9 **Shelter for Roman Ruins**
Peter Zumthor
Chur, Switzerland

10 **Soe Ker Tie Houses**
TYIN Tegnestue
Noh Bo, Thailand

11 **Tubac House**
Rick Joy
Tucson, Arizona, USA


9
7
6
10

Figure 1.1
Aerial Site

01
Agosta House | Patkau Architects

Firm Brief

John Patkau graduated from the University of Manitoba in 1972 with a Masters of Architecture. His wife, Patricia Patkau, finished school two years later with a Bachelor of Interior Design. She then continued her education at Yale in architecture, graduating in 1978. After completing their degree programs, the pair founded Patkau Architects, a design-research firm originally located in Edmonton, Alberta, Canada. Patkau Architects is now situated in Vancouver in the Pacific Northwest, which has had a dramatic influence on their architecture.[1] The firm's varied work includes art instillations, houses, educational and hospitality facilities, and city planning.

Patkau Architects tends to focus on smaller projects, allowing the architectural result to take precedent over project management.[2] Due to their attention to detail, the firm has won numerous awards and design competitions while also having their work published in a variety of journals and books. Patkau Architects has also published a book, *Material Operations*, which outlines the firm's architectural research on the response of materials to applications of force. They describe their design process as an investigation of new ways of construction using common building materials to produce expressive forms. According to an interview with John Patkau conducted by *The Canadian Architect*, "Patkau Architects strives for excellence by exploring the richness and diversity of architectural practice, understanding it as a critical cultural act that engages our most fundamental desires and aspirations."[3]

Project Brief

William and Karen Agosta commissioned Patkau Architects to design them a house on San Juan Island, Washington, which was completed in 2000. The couple's dream was to build a house resembling the Metler Shelter Development in Karen Patkau's hometown in Massachusetts. This development was conceived as a home away from the density of the city and focused on environmental preservation. The Agostas chose Patkau Architects because they wanted to work with a firm that would strive for excellence while designing a house to accommodate their simple lifestyle. The home was to be unassuming, low-maintenance, and made from simple materials.[4]

Topography and climate are as crucial to this project, as they are in all of Patkau's architecture. The Agosta House was placed on the top of a hill in the middle of a Douglas-fir forest on 43 acres of land (Figure 1.1). San Juan Island is sheltered by the Olympic Mountains from winter storms brought in from the ocean, producing a "rain shadow" and creating the driest area in western Washington. Besides the lack of rain, other critical climactic details include an average summer temperature of 50 degrees

Fahrenheit (10 degrees Celsius) and winter temperatures between 30 and 40 degrees Fahrenheit (-1 to 4 degrees Celsius).

Responding to these site conditions, the overall form of the residence and the placement of the building on the site reinforce the sustainable goals of the project. To combat the cool weather, skylights from the southeast let in direct light to warm the house passively. The placement of the building takes advantage of a clearing in the forest to the northwest that allows spring and summer breezes to provide air movement in the house while also utilizing the dense trees to the southwest to block the moist winds of the fall and winter seasons. The tilted walls of the residence are also angled to redirect cold southwestern winds over the house (Figure 1.2).

The house is divided into three zones: the office/guest room, the master bedroom, and the public spaces (Figure 1.3). Patkau introduces void space into the house through "erosions," which create courtyards between the zones (Figure 1.4).[5] The firm values this more ambiguous division of space, utilizing differentiation and the juxtaposition of different scales as a formal strategy (see Space for further information).[6] These courtyard spaces emphasize the integration of nature and the building, a condition reinforced by the material palate, which highlights local materials and the surrounding context. These design decisions also reinforce the desired qualities of the Agostas' dream house – unassuming, low-maintenance and made from simple materials – allowing the building to fit within the context, perform efficiently, and accommodate the family's lifestyle.

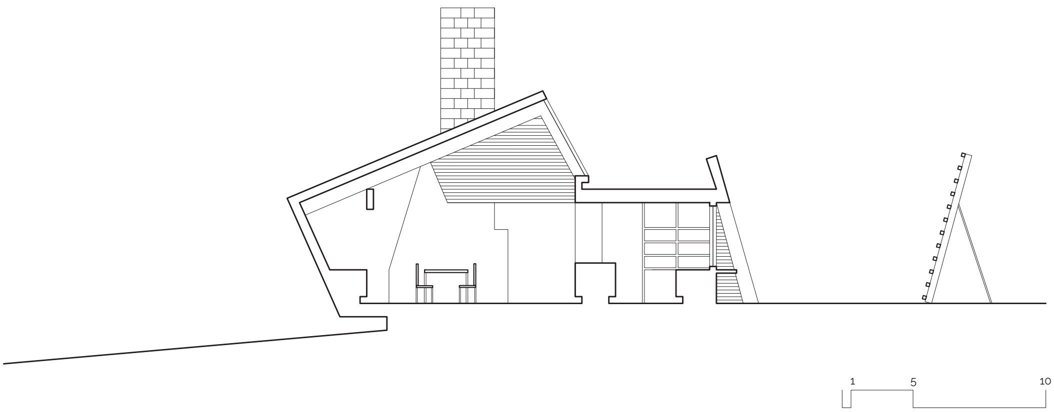
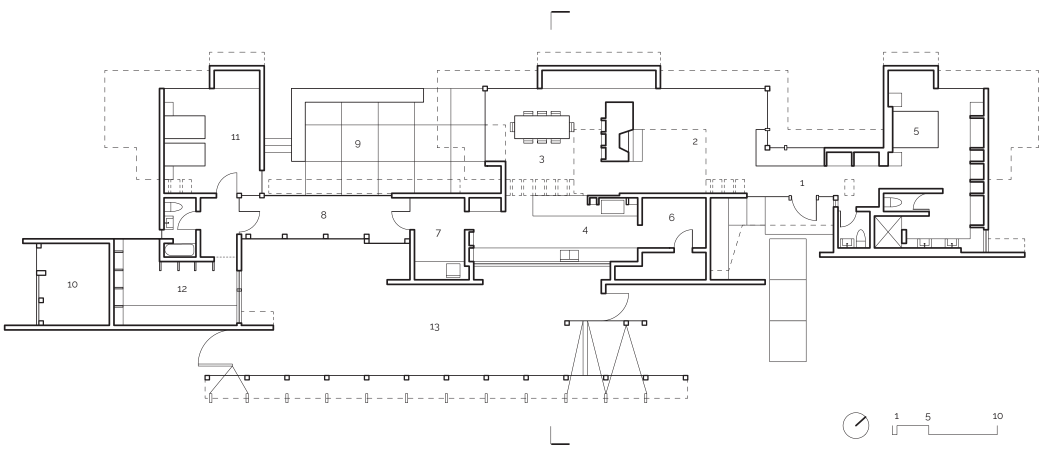


Figure 1.2

Section



Legend

Entry 1
Living Room 2
Dining Room 3
Kitchen 4
Master Bedroom 5
Storage/Mechanical 6
Mud Room 7
Covered Walkway 8
Terrace 9
Garden Shed 10
Guest Room 11
Studio 12
Fenced Garden 13

Figure 1.3

Floor Plan

Figure 1.4

Courtyard Space

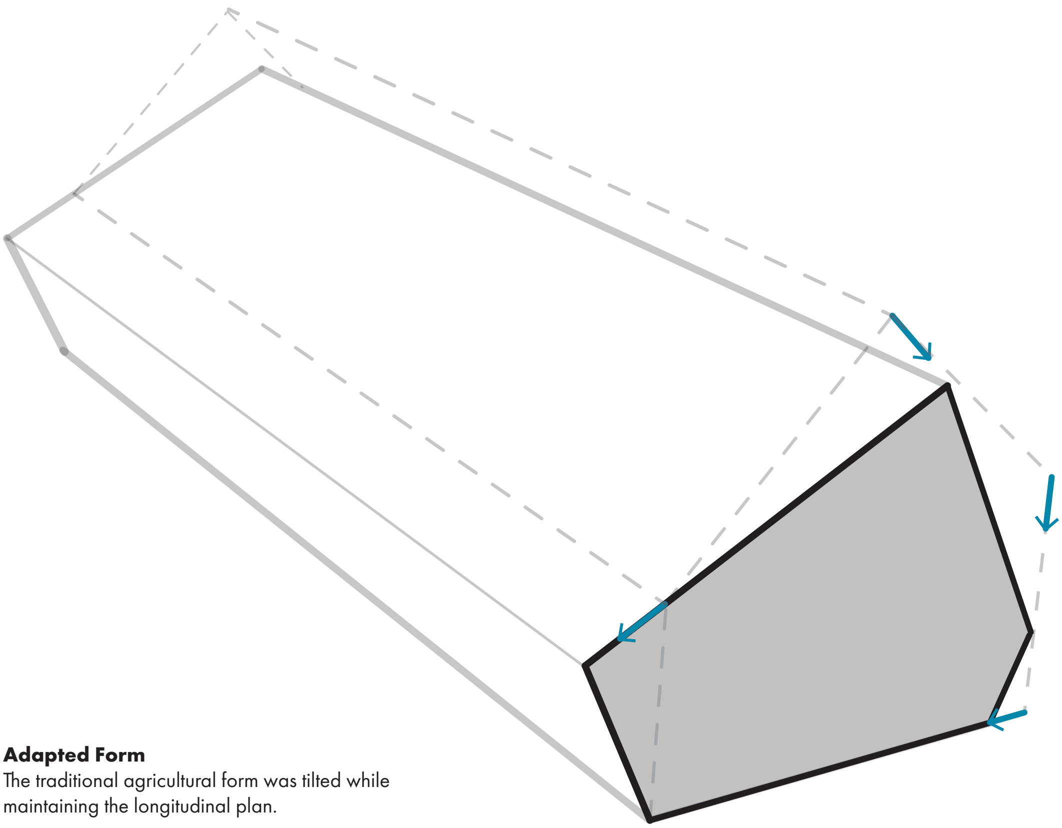
Tectonic Principles

Place

The history of San Juan Island influences the tectonic composition of the Agosta Residence. Since the islands were highly populated by farmers due to their rich soils and bountiful resources, the predominant building type became distinctly agricultural. Agricultural architecture on San Juan Island was primarily constructed of a metal, pitched roof on a wood-framed structure and was configured as a simple longitudinal volume. This construction type continues to prevail today.

Harry Mallgrave's writing, *Gustav Klemm and Gottfried Semper: The Meeting of Ethnological and Architectural Theory*, refers to Gottfried Semper's philosophy of primitive dwelling as the "original forms." Semper divides these original forms into two components: "vertical inclosure" and the "roof."[7] These primitive dwellings eventually evolved into agricultural building types similar to those found on San Juan Island. To respect the history of these agricultural forms, the architects derived the formal language of the Agosta House from this architectural lineage. Karl Botticher, a 19th century German archaeologist who specialized in architectural tectonics, notes how architectural styles change from these preliminary forms over time. In *The Principle of the Hellenic and Germanic Ways of Building*, Botticher describes the process of creating modern architecture to embody the essence of a previous architectural style. He emphasizes the need to respect an architectural tradition, but recognize that styles morph over time.[8]

The Agosta House responds to the arguments of both Semper and Botticher. The 'vertical inclosure' of the Agosta House is tilted, but it retains the overall pitched roof and longitudinal plan from the traditional agricultural forms (Figure 1.5). With respect to construction, the house exhibits the time-tested, wood-framed system of the traditional structure, modified to match the new profile of the enclosure. Materiality and the overall form of the Agosta House support Botticher's positions. The materials emulate the corrugated metal roofs and the wide wooden panels used on historic barns (Figure 1.6). The interior spaces are differentiated by utilizing horizontal wood paneling. The Agosta House respects the tradition of the agricultural building type by retaining the overall form, the material palate, and the wood-framed structural system.



Adapted Form
The traditional agricultural form was tilted while maintaining the longitudinal plan.

Figure 1.5

Architectural Style Origin

Figure 1.6

Vertical Metal Exterior Cladding

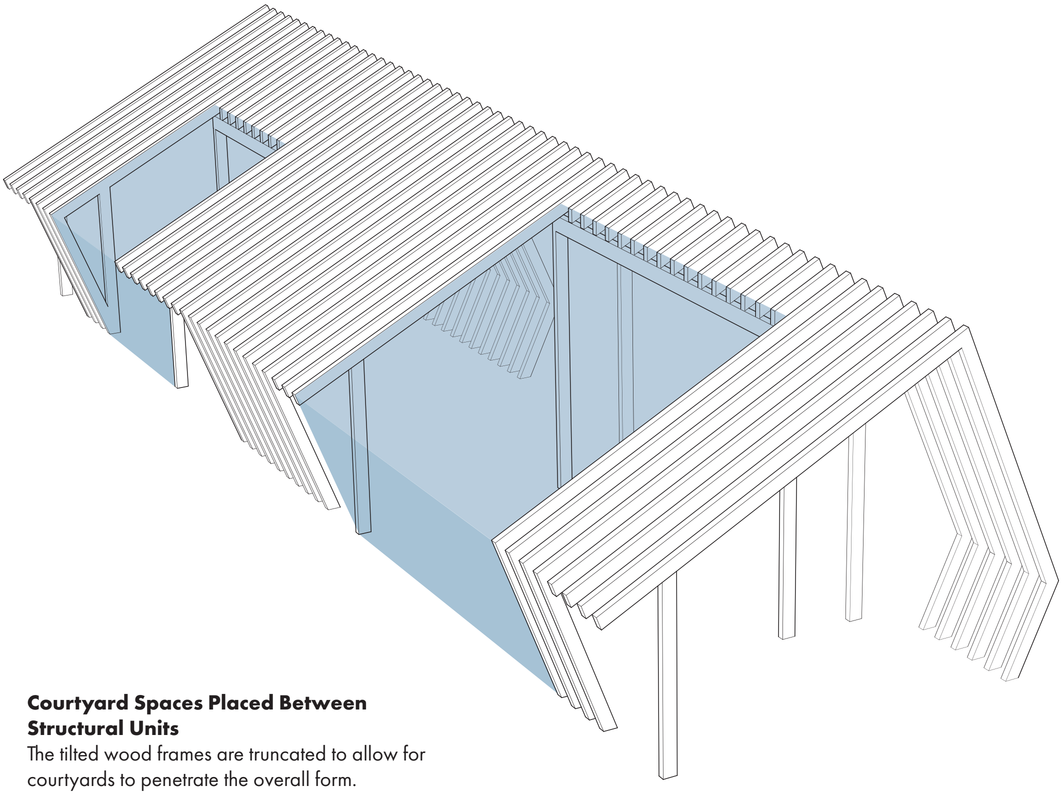


Figure 1.7

Voids Within the Framework

Courtyard Spaces Placed Between Structural Units
The tilted wood frames are truncated to allow for courtyards to penetrate the overall form.

Space

In *...Ways of Building*, Botticher explains how the covering defines the spatial identity of a structure:

> The essence of any particular style is indicated by the system according to which the covering of a space is articulated into parts or structural units. For possible form of an enclosed space is contingent on the possible form of the covering, and both of the overall plan and its particular layout depend on the organization of the covering. With all styles of covering is the factor that determines the placing and configuration of the structural supports, as well as the arrangement and articulation of the walls by which space is enclosed, and finally the art-forms of all these parts related to it. Therefore, the covering reveals the structural principle of every style and constitutes the criterion by which to judge it.[9]

The Agosta House transformed the traditional pitched roof form through the integration of tilted frames at 3 foot (.9 m) intervals. As Botticher mentions, space is created by the overhead roof plane. The roof plane determines the structural supports that are necessary, which also effect the definition of the space. From that structural grid, spaces are then subtracted to create courtyards between programmatic groupings (Figure 1.7). To categorize the programmatic units into these spatial cells, the Agosta House was divided into three zones: the master bedroom, the public areas, and the office/guest room. These zones were separated to create privacy within the three realms (Figure 1.8). In the book *Patkau Architects*, Kenneth Frampton says:

Figure 1.8
Entry Courtyard Space

> The organization of the house is the result of extruding and then manipulating the section, either by erosion, which produces exterior in-between spaces that divide the house programmatically, or by insertion, which uses ceiling bulkheads to separate the programmatic areas created by the exterior in-between spaces into more finely scaled interior areas.[10]

To reduce the scale within rooms, as mentioned by Frampton, new elements were introduced. Tilted frames provide a grander experience due to the high ceilings, exposed timber framing, and views to nature. To combat the spatial implications of the construction type, bulkheads were added to create more intimate spaces. As previously mentioned, Botticher connects the role of the covering to the organization of vertical structure, which further defines the space. In the case of the Agosta House, the roof and the vertical structure are blurred. The frame is one continuous element that goes from roof to ground, except where they have been truncated at the points of erosion. In those instances, the structure is then picked up by a horizontal beam supported by a vertical column.

Anatomy

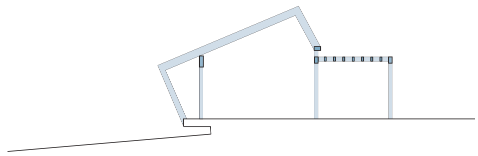
The Agosta House rests on a concrete plinth embedded in the sloping site (Figure 1.9). According to Semper in *The Four Elements of Architecture*, the mound, or plinth in this case, protects the hearth, which consequently provides a transition between the ground and the structure.[11] By raising the home off the ground, it is protected from the cold, damp earth.

Semper believed that the framework, the enclosure, and the mound were the original elements of architecture.[12] The framework of the Agosta House consists of a simple wood framed structure that is tilted, creating an uneven, pitched roof. The pitched roof structure is supported by large wooden beams that are then upheld by vertical columns throughout.

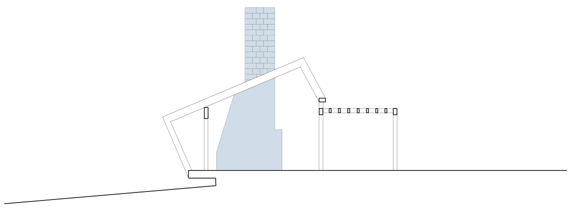
The hearth of the Agosta House is the fireplace, which sits between the living room and the dining room; it is the social hub of the residence (Figure 1.10). Semper stated that the hearth is "in a single element the public and spiritual nexus of the built domain."[13] In relation to the hearth, Semper recognized that the first tribes gathered around the fire as a place to gather and socialize.[14] The fire brings people together is this project as well, while also acting as a formal joint by physically connecting the plinth, the framework, the bulkheads, and the enclosure.

The enclosure for the Agosta House is fairly simple. The exterior of the building, including the roof and walls, is clad in standing seam metal panels that are attached to ½ inch (1.3 cm) plywood sheathing. In the spaces that have been carved away, however, the surfaces are clad with wood panels to reinforce the overall form. The additive elements, such as the bulkheads, reduce certain spaces to a more intimate scale and house the mechanical units for the residence. Lastly, the site acts as a second layer of enclosure, surrounding the home on three of the four sides and further protecting the residents from the elements.

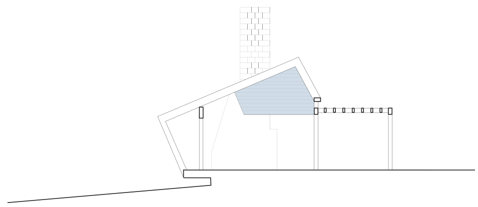
1: Plinth
Concrete slab acts as intermediate space between ground and structure.



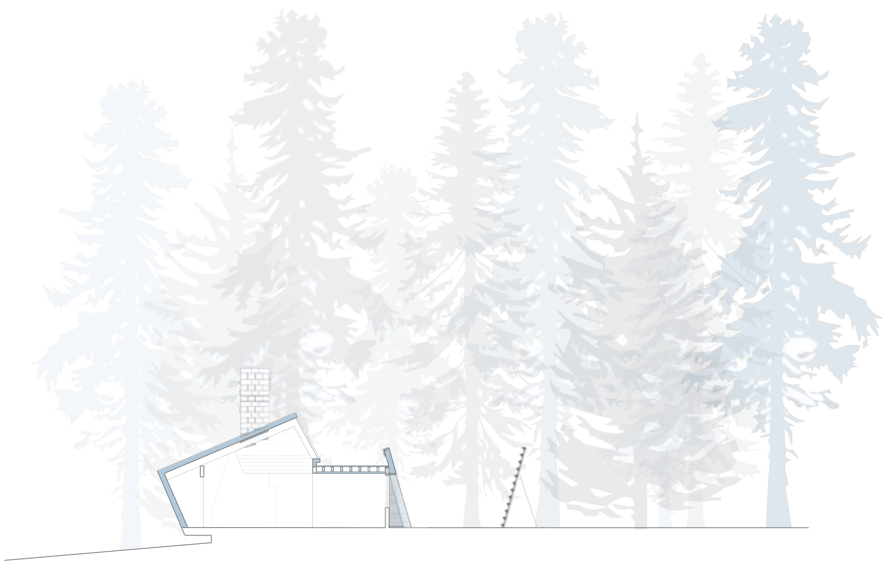
2: Framework
Tilted frame defines the form of structure.



3: Hearth
The fireplace connects elements of the home spiritually and physically.



4: Bulkheads
Soffits bring the ceiling down to a human scale and divide space.



5: Enclosure
Standing seam metal panels and the surrounding forest protect the home.

Figure 1.9

Anatomy

Figure 1.10
Fireplace

Additional Resources

Projects

Tula House, Quadra Island, British Columbia, Canada, 2012
Audain Art Museum, Whistler, British Columbia, Canada, 2016
Seabird Island School, Agassiz, British Columbia, Canada, 1991

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Patkau Architects. *Material Operations*. Princeton Architectural Press, 2017.
Patkau Architects. *Patkau Architects: Selected Projects 1983-1993*. Documents in Canadian Architecture, 1994.

Notes

[1] Kenneth Frampton, *Patkau Architects* (The Monacelli Press, 2006), 108.
[2] John Patkau, "A Conversation with John Patkau," interview by T*he Canadian Architect*, 1993.
[3] Patkau, interview.
[4] Adele Freedman, *A Not So Primitive Hut: For a virgin site in the Pacific Northwest,* Architecture (Nielsen Business Media Inc., 2001), 78.
[5] Frampton, *Patkau Architects*, 108.
[6] Patkau, interview.
[7] Harry Francis Mallgrave, "Gustav Klemm and Gottfried Semper: The Meeting of Ethnological and Architectural Theory," in *Anthropology and Aesthetics*, No. 9 (Spring, 1985), 75.
[8] Karl Botticher, "The Principle of the Hellenic and Germanic Ways of Building with Regard to Their Application to Our Present Way of Building," in *What Style Should We Build?* (Santa Monica: The Getty Center for the History of Art and the Humanities, 1992), 152.
[9] Ibid, 154.
[10] Frampton, *Patkau Architects,* 108.
[11] Harry Francis Mallgrave, "The Four Elements of Architecture," in *Architectural Theory*, (Blackwell Publishing, 2006), 537.
[12] Ibid.
[13] Kenneth Frampton, "Botticher, Semper and the Tectonic: Core Form and Art Form," in *What is Architecture*? Ed. Andrew Ballantyne (New York: Routledge, 2002), 144.
[14] Harry Francis Mallgrave, "Gottfried Semper and the Idea of Style," in *Modern Architectural Theory: A Historical Survey, 1673-1968* (Cambridge University Press, 2005), 134.

Figure 2.1

Exterior of the Bavinger House on Approach

02
Bavinger House | Bruce Goff

Architect Brief

Bruce Goff began practicing architecture when he was twelve years old. After his dad forced him to start an apprenticeship at the firm Rush, Endacott, and Rush in Tulsa, Oklahoma, Goff started to develop his unique architectural style that was deeply rooted in nature. Although an avid reader of anything related to art, architecture, and fashion, Goff was particularly drawn to the work of Frank Lloyd Wright who he kept in contact with throughout the early portion of his career. Many of his first designs at Rush, Endacott, and Rush were similar to Wright's Prairie style, and in the office, Goff was even referred to as 'Frank Lloyd Wright, Junior'.[1] Once Goff had graduated high school, he was offered the opportunity to enroll at the Massachusetts's Institute of Technology and a sponsorship to continue his education at the Beaux Arts in Paris. He strongly considered accepting, but after writing to Wright and Louis Sullivan asking what he should do, Goff decided to continue working. As a result, Goff's knowledge of architecture was gained solely through practice and a personal pursuit of knowledge, leading him to believe that, "he may have more curiosity than anyone else, but not necessarily more talent."[2]

After the depression hit in the 1930's, Goff moved around looking for work until he was offered a faculty position at the University of Oklahoma in 1947. He quickly became the chair of the architectural department and pushed the school to the forefront of architectural education by encouraging students to design with curiosity and passion.[3]

Project Brief

In 1950, while in his tenure at the University of Oklahoma, an art professor by the name of Gene Bavinger approached Goff to inquire about the architect designing a house for him and his family. Bavinger's list of requirements would prove challenging—a large, continuous open space, fabrication from local materials, integration with the surrounding landscape, and use of a minimal budget. The project site was located just outside of Norman, Oklahoma in a heavily wooded ravine. Once Goff saw the site, he developed an idea for "a helix-spiral space with no beginning or ending and of the continuous-present."[5] (Figures 2.1 and 2.2)

To help keep costs down, Goff and Bavinger used a variety of strategies and resources. Goff produced very few drawings, instead relying on the precision and dedication of Bavinger for managing the construction process and for supervising the students hired to construct the house. As for the materials, the majority were locally sourced for free or purchased at a very low cost to the client.[4] These combined efforts by the architect and owner allowed the project to stay under the set budget of $5,000.

Figure 2.2

Floor Plan of Agosta House.

The house is made up of three major components: the spiral rock wall, the roof, and the central column that supports everything but the walls (Figure 2.3). The approach to the house takes you down a small hill where you arrive at rear of the structure. A large pivoting door, sitting between two offset sheets of glass, leads you into the widest part of the spiral where the low ceiling compresses the visitor (Figure 2.4). The interior space then begins to expand upwards, climbing up the central column and around the helix spiral towards the sky.

On the outside of the central spiral is the main staircase flanked by floating, carpeted pods that contain a number of primary program spaces. Starting at the bottom of the staircase, the floating spaces transition from public to private, as one moves upwards. Each pod contains a closet and is hung from the central structural column. The kitchen, bathroom, and utility closet reside inside the center of the spiral permitting the rest of the spaces to be left completely open. Between the outside walls and the hanging roof above, a continuous skylight offers ample daylight to the interior.

The Bavinger House took five years to construct from start to finish. The resulting home fulfilled the Bavingers' primary goal—one continuous living space that was as organic as it was functional. At the end of the project, Goff concluded by saying, "after several years of hard work and almost inexhaustible patience, the Bavingers have their house which is neither old or new so far as architectural fashion is concerned, but which is timeless."[6]

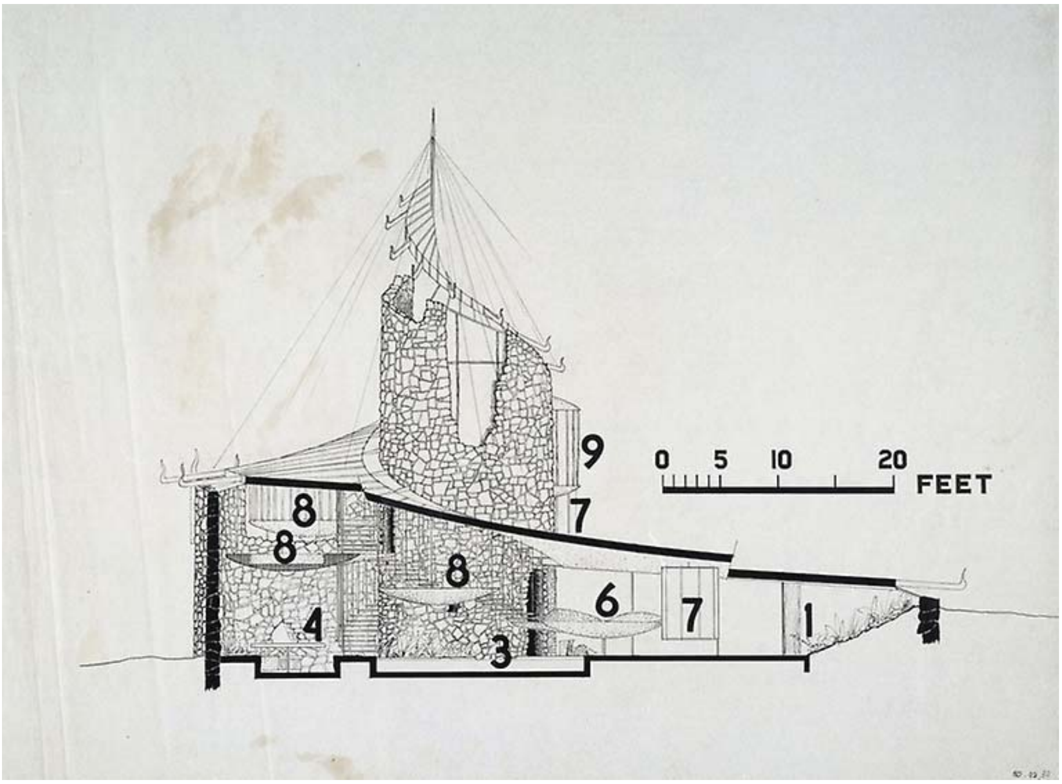


Figure 2.3

Section through pool on ground floor

Figure 2.4

Entrance

Tectonic Principles

Place

> Beneath a leafy, Dionysian shade and beside a rippling fountain, a tranquil resting place beckons the astonished wanderer that in whom it raises the desire that...he may forget the longing to return to his dear homeland and pass the days in an eternal dolce far niente.[7]

Akin to how Karl Botticher, a German architectural theorist and archaeologist, describes the astonishment of seeing Hellenic architecture for the first time in *The Principles of the Hellenic and Germanic Ways of Building*, the Bavinger House is a tranquil resting place, hidden under the canopy of the trees. The house sits at the end of an existing clearing in the woods with its massive stone wall spiraling towards the sky and the central point punctuated by its lone column. This spiral serves conceptually as either the termination point of or catalyst for the adjacent open space, thus the form of the building responds directly to the site and its surrounding environment (Figure 2.5).

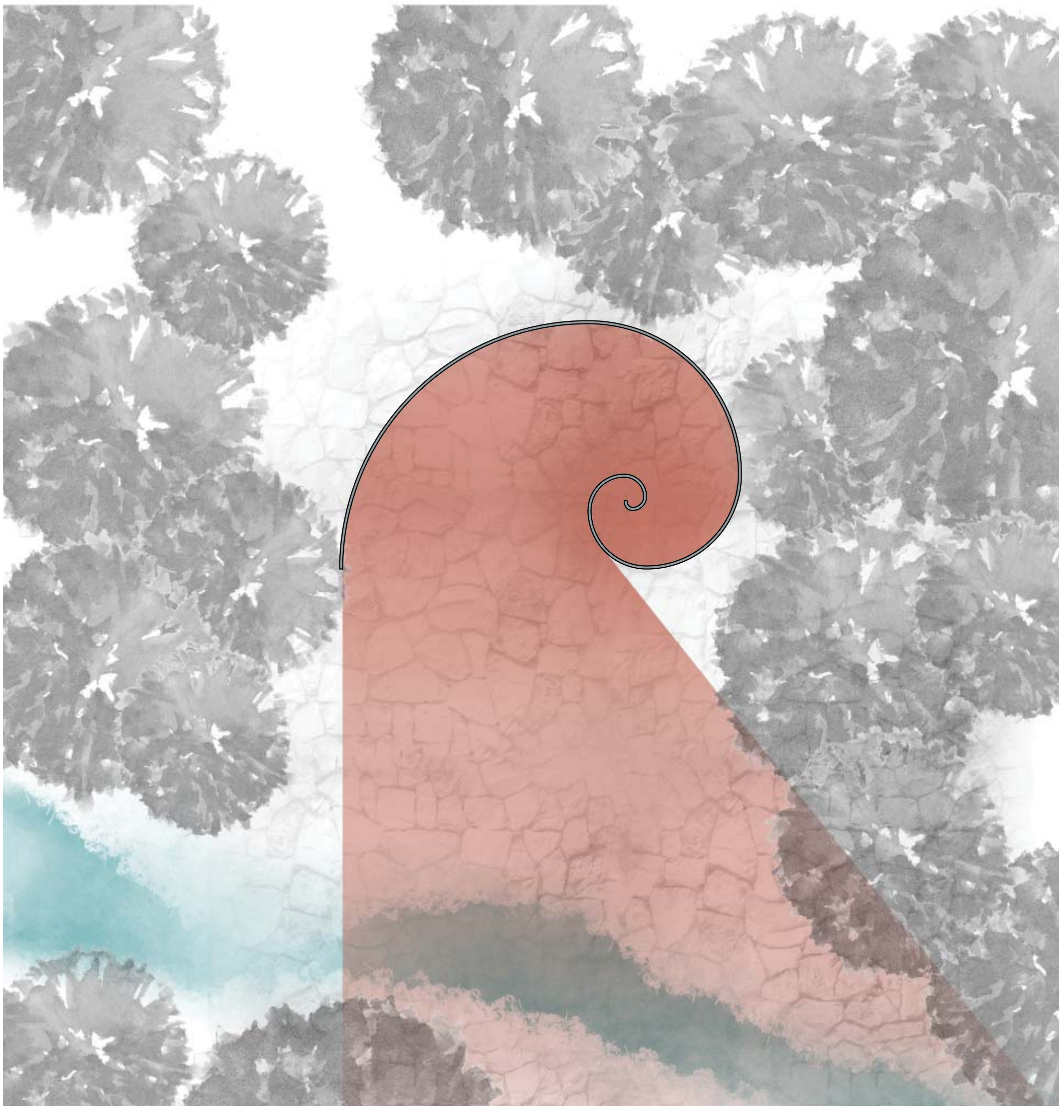


Figure 2.5

Continuation of Space
between Interior and Exterior

To further emphasize the house as a continuation of its site, Goff used daylighting techniques and local materials to promote a synthesis between its interior and exterior spaces. At the entrance, a wall of glass creates an invisible and ambiguous threshold between inside and out.[8] This glass wall along with the continuous skylight between the rock walls and floating roof then floods the interior with daylight that is constantly moving and reflecting off the stone (Figure 2.6).

To make the house look as if it had grown directly from the landscape, Goff used only local materials, while also not disturbing the existing environment of the site. The rock used for the spiral walls came from nearby fields, and the wood for the interior was taken from fallen trees that Bavinger had helped his friends clear from their property.[9] The central column—the most expensive component of the project—was a deep well drilling pipe that Bavinger repurposed as the center point of the house. Lastly, to strengthen the notion of one continuous space from exterior to interior, Goff left the ground floor to be representative of the landscape that was there before the house was constructed. This design decision led to the floor being composed of a collection of plants and pools, along with outcroppings of the original bedrock on which the house was built.

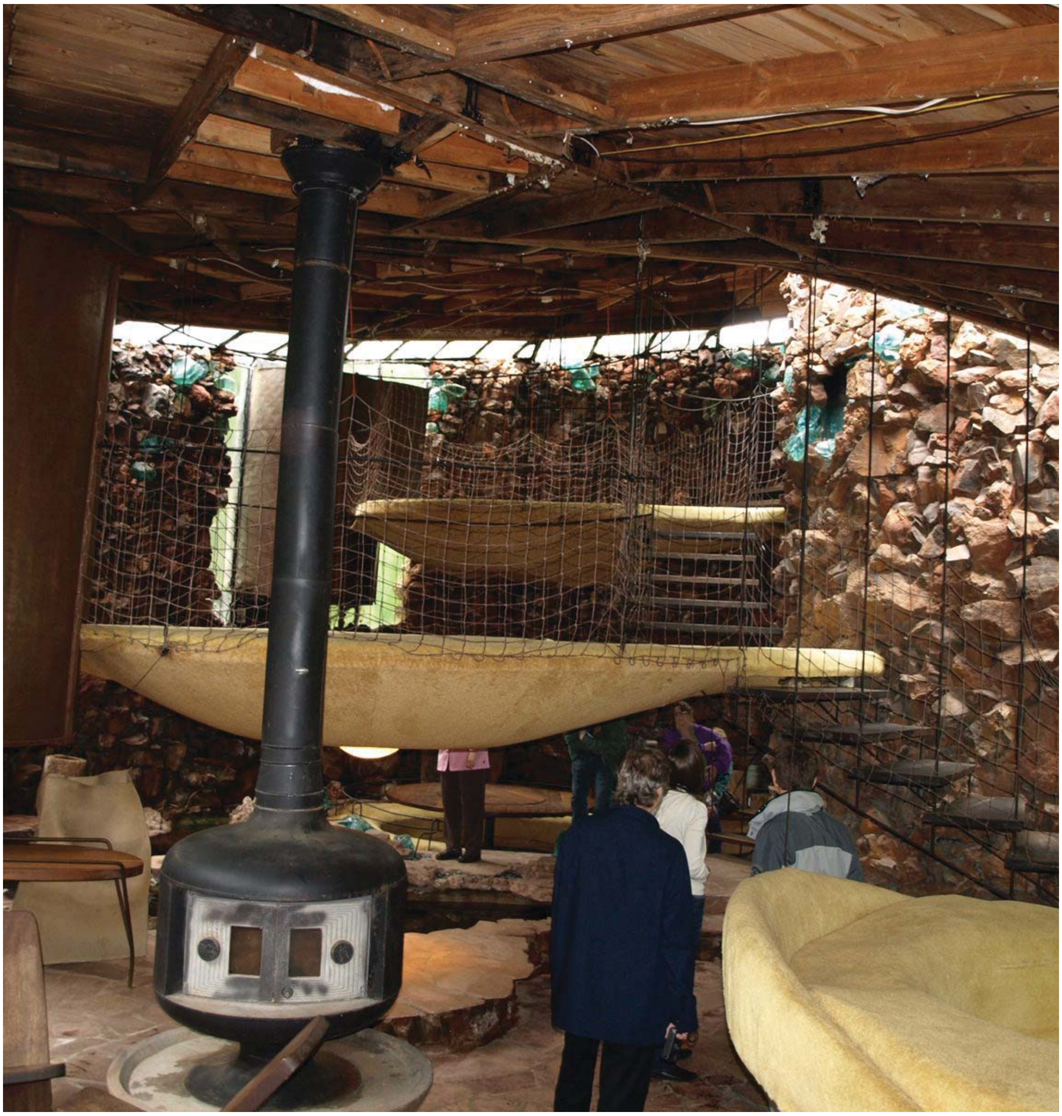
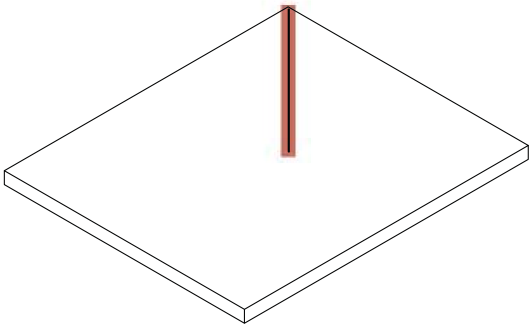
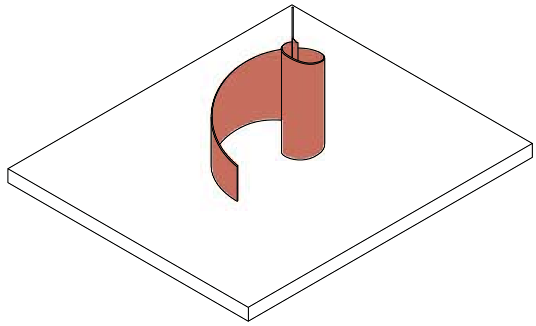


Figure 2.6

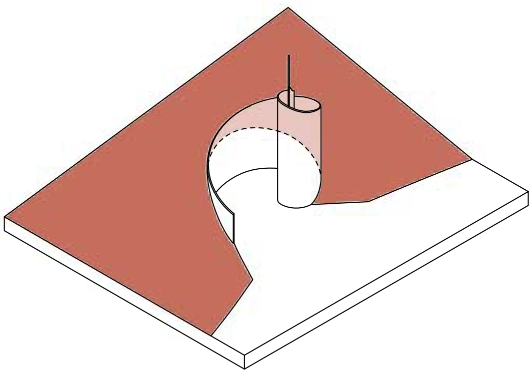
Interior of Ground Floor



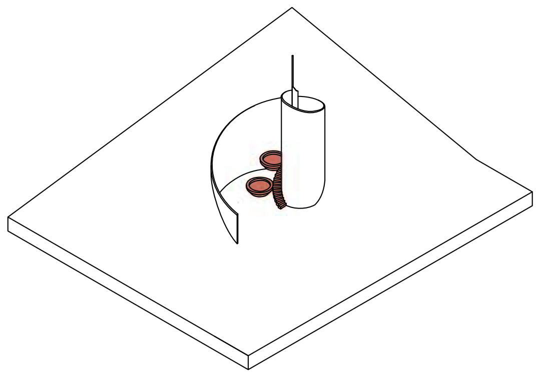
1: Hearth
The central column marks the formation and organization of space.



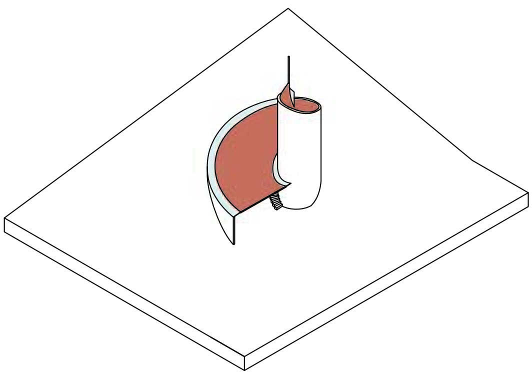
2: Enclosure | Earthwork
The stone walls form the spiral.



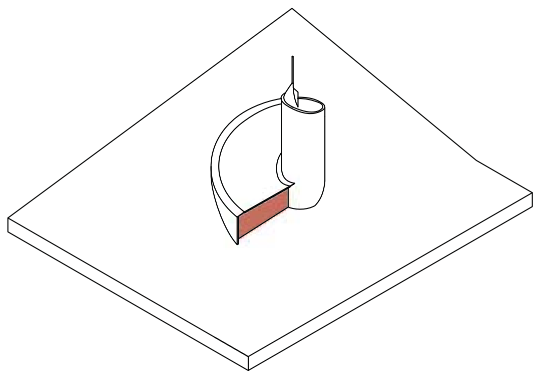
3: Earthwork
The ground is mounded to form the terminus of the space.



4: Framework
The stairs and pods wrap up around the inside of the spiral to form the programmatic spaces of the house.



5: Roof
The roof pushes space around and up towards the sky.



6: Framework
A wall of glass is placed at the entrance to blend the interior and exterior.

Figure 2.7
Anatomy

Anatomy

The hearth of the Bavinger House is located at the central point of the stone spiral and marks either the ending or beginning of space (Figure 2.7). This point is demarcated by a fifty-five-foot (16.8 m) steel pipe column. This representation of the hearth does not closely align with German architect Gottfried Semper's more commonly understood idea of the hearth, "...the social and spiritual center point for the dwelling."[10] Instead, the Bavinger House's hearth organizes the spiral form of the building and serves as a catalyst for the development of structure and space. This hearth is much closer to Semper's earlier ideas of the hearth outlined in *The Four Elements of Architecture*. Here, Semper states, "Throughout all phases of society the hearth formed that sacred focus around which the whole took order and shape."[11]

Very little earthwork was needed to start construction on the Bavinger House. The site gently slopes down to a creek and a clearing in the woods. At the end of this clearing, Goff placed the entrance to the home, allowing it to look out into the natural surroundings. To then further emphasize the house as the terminus of the continuous space in the clearing, the earth was sloped up around the rear of the house, so on approach, a visitor is at the same level as the roof before swiftly descending down and around the stone wall to the home's entrance.

Figure 2.8

Roof on Approach as it Wraps Up and Aroud the Spiral

The enclosure is perhaps the most memorable portion of the Bavinger House. The heavy, stone walls rise out of the ground and climb towards the sky, acting as an intermediary between the enclosure and earthwork. Only once someone is inside the house is he or she able to determine how the walls are delineating the interior space from the exterior and providing the expansion of space from the spiral out into the landscape.

Lastly, the stairs, floating pods, and the roof are hung from the central column to create the framework of the house. From the approach, the roof appears to become part of the ground that is extending up and around the spiral (Figure 2.8). Inside, the stairs and pods appear to cantilever off the stone wall, but because Goff designed them Wall to be hung, the atmosphere on the interior feels incredibly light, as the hearth is what structurally supports all of the program elements.

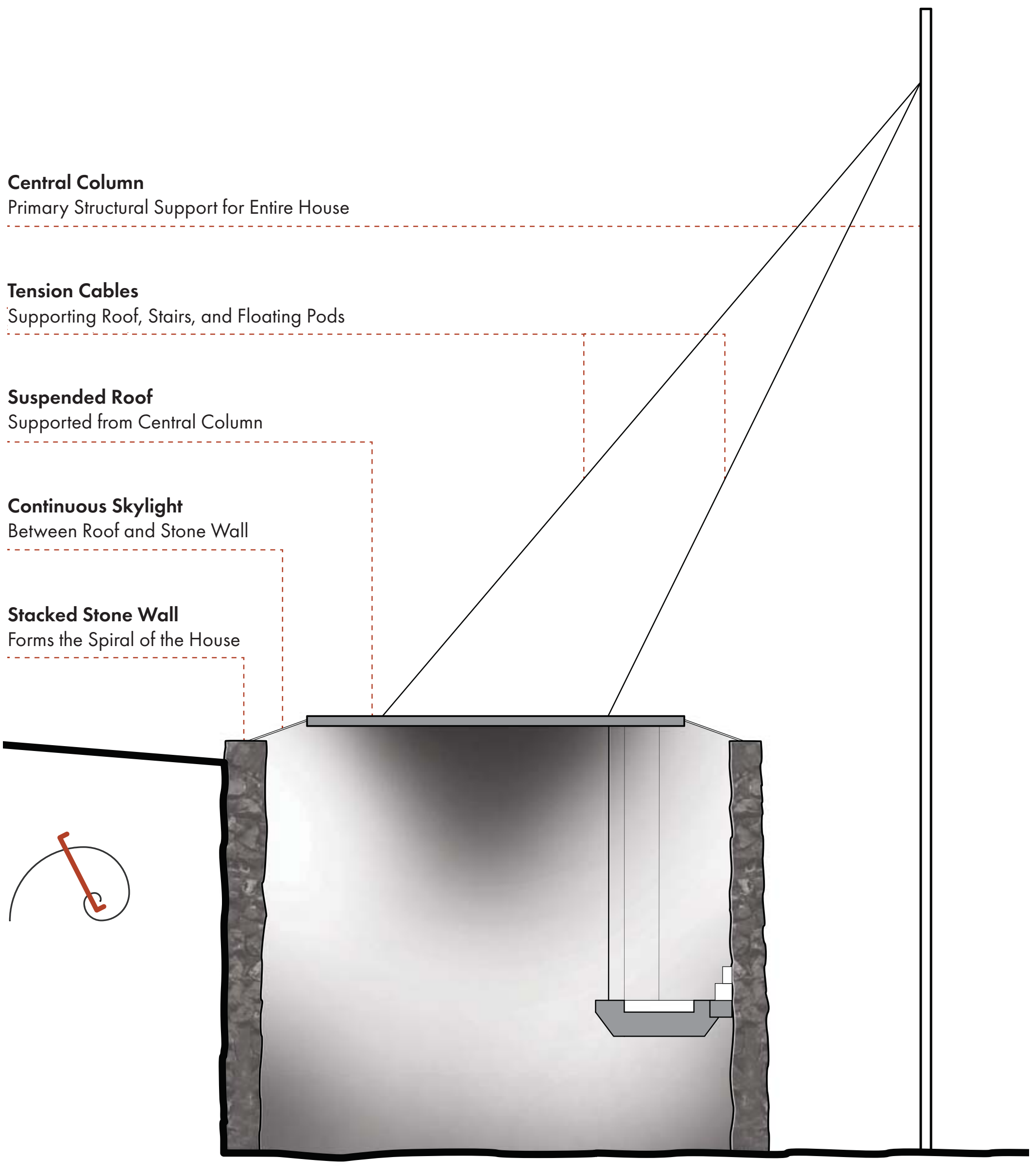


Figure 2.9

Section of Structural System

Stereotomic | Atectonic

In his essay *Structure, Construction, Tectonics*, Eduard Sekler, an architectural historian, states that tectonics is a term that should be used when, "...a structural concept has found its implementation through construction..."[12] As one stands inside the Bavinger House, the roof, stairs, and hanging pods seem to be supported by the stone wall and the entire structure appears to be load bearing. The construction of this stone wall, after all, required an incredible amount of work and energy, with Goff concluding, "...Gene lifted and shifted every-one of the stones...in the 200 ton stone wall, at least four times until they satisfied his excellent aesthetic sense."[13] But although the spiraling stone wall resembles load-bearing structure from its stereotomic nature, it in fact does not structurally support any part of the house.

Goff designed the stone wall primarily to shape space, as well as to retain the earth as it slopes up around the rear of the home (Figure 2.9). He highlighted this design decision by placing a skylight between the top of the wall and the edge of the roof. This placement underscores the structural separation between the stone wall and the roof, stairs, and floating pods (Figure 2.10). By hanging all the elements from the column, Goff allows visitors to have a moment of clarity when they finally stand under the skylight and, through this detail, he expresses how the stone wall is atectonic, in that it appears to support all the elements of the house, but instead is just shaping space.

Figure 2.10

Skylight between Stone Wall and Hanging Roof

Additional Resources

Projects

Nicol House, Kansas City, Missouri, United States, 1964

John Frank House, Sapulpa, Oklahoma, United States, 1955

Boston Avenue Methodist Church, Tulsa, Oklahoma, United States, 1929

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[1] Jeffrey Cook, *The Architecture of Bruce Goff,* (New York: Harper & Row Publishers, 1978), 3.

[2] Ibid., 9.

[3] Ibid., 30.

[4] Bruce Goff, "Bavinger House and Price House," *Global Architecture* 33, (1975): 2.

[5] David DeLong, *Bruce Goff, Toward Absolute Architecture*, (Cambridge: The MIT Press, 1988), 106.

[6] Goff, *Global Architecture* 33, 3.

[7] Karl Botticher, *The Principles of the Hellenic and Germanic Ways of Building*, (1992), 148-149.

[8] DeLong, *Bruce Goff, Toward Absolute Architecture*, 107.

[9] Cook, *The Architecture of Bruce Goff*, 50.

[10] Harry Mallgrave, "Gustav Klemm and Gottfried Semper: The Meeting of Ethnological and Architetural Theory," *RES: Anthropology and Aesthetics*, No. 9, (Spring, 1985): 75.

[11] Gottfried Semper, *The Four Elements of Architecture and Other Writings*, (Cambridge: Cambridge University Press, 1851), 102.

[12] Eduard F. Sekler, "Structure, Construction, Tectonics," In *Structure in Art and in Science*, ed. G. Kepes, (New York: 1965), 89.

[13] Goff, *Global Architecture* 33, 3.

Figure 3.1

Street View of Main Entrance

03
Cristo Obrero Church | Eladio Dieste

Architect Brief

> Only the essential finds a place in Dieste's work. He knows that his is a path taken from the tectonics and industrial side, but he is convinced that it leads to new avenues.[1] (Figure 3.1)

Eladio Dieste was born in Artigas, Uruguay. In 1943, he received a degree in civil engineering from the University of the Republic of Uruguay, located in Montevideo. He later taught at his alma mater and was an honored professor in 1992 and 1993. He worked in numerous offices early in his career before founding his construction firm "Dieste and Montañez S.A" with his colleague Eugenio R. Montañez in 1956. He spent most of his professional career in Uruguay, Argentina and Brazil, but he taught and lectured in many different universities in United States, Europe and South America as well.

The work of Eladio Dieste is widely admired by individuals from many disciplines. The technician admires Dieste's wisdom with the structures he created. The sociologist admires how Dieste always thought about the community when he was designing a project and the economist admires how Dieste could construct magnificent buildings at a low cost, using the resources at hand. Marina Waisman, an Argentine architect, believes Dieste's secrets lie in his concept of unity between forms, materials, workers and construction processes.[2] This unification of systems is evident in Dieste's work with reinforced ceramics, which are well-suited for the shell structures that the architect experimented with throughout his career. Ceramics is a traditional material in Uruguay and Dieste wanted to explore its potential while utilizing the abundance of skilled workers working his home country.

Project Brief

Cristo Obrero Church is located in Atlántida, 40 kilometers (25 miles) away from Montevideo, the capital of Uruguay. In 1952, Eladio Dieste was contracted to design a vault and after a long process his contract was extended to include a new church, which was completed in 1960. This church was Dieste's first commission, but even at this time his design sensibilities were clearly present. In this design, Dieste wanted his work to reflect the economic and social conditions of Uruguay. Atlántida is a village of manual and agricultural workers so instead of hiring people from prestigious firms, he hired local workers who had expertise in working with ceramics.

The major programmatic spaces include; the main nave, the altar, the Chapel of the Virgin, a baptistery, a confessionary, a sacristy and the choir that located above the entrance (Figure 3.2). This

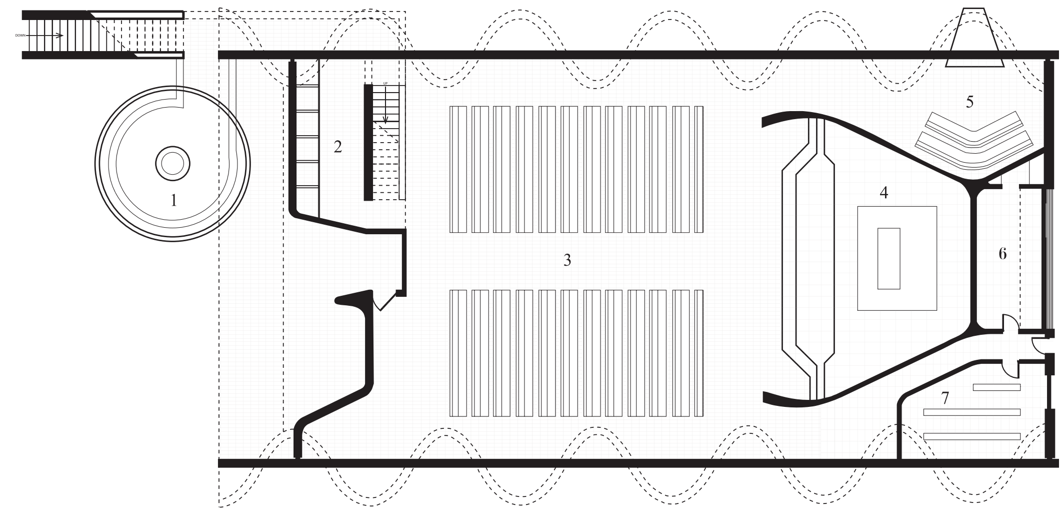

Figure 3.2

Floor Plan

Legend

Baptistery 1
Confessionals 2
Nave 3
Presbytery 4
Chapel of the Virgen 5
Secretary 6
Antesacristy 7

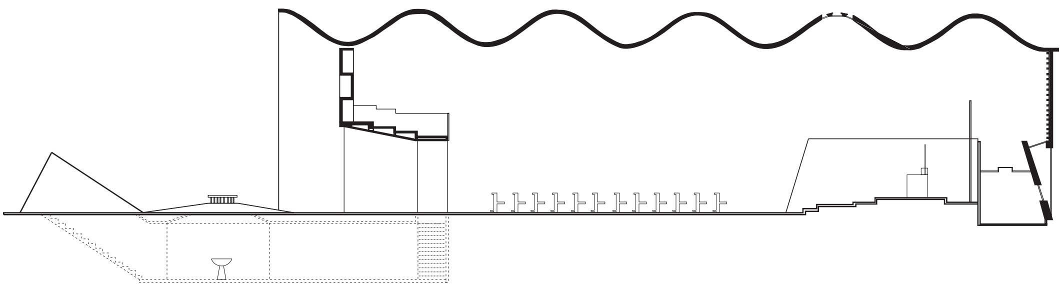

Figure 3.3

Longitudinal Section

choir is a balcony made entirely of brick. The lower part of the balcony's floor is made of mirror brick and the upper part is regular brick, which acts as floor finishing and structure. The baptistery is in the basement with its own entrance and has a circular floor plan.

The overall dimensions of the church are 16 meters (52.5 feet) wide by 30 meters (98.5 feet) long. The church has two 7-meter-high (23 foot-high) undulating structural walls, which are made out brick. These walls are supported by in situ piles and are anchored to the ground with sand mortar. From the street, a double-curvature vaulted roof begins above the main entrance, supported on each side by the undulating walls (Figure 3.3). The walls and the roof meet at and are connected to each other with a brick ***crown***. The walls and roof were reinforced with wires, strengthening the brick and reducing the cost of construction. The two end walls are non-structural, and are not attached to the undulating walls, a move visible from the interior of the church.

crown: head of any part of a building, especially of an arch or vault

Light was brought into the building in two different ways. First, there are brick louvers on the second floor, at the choir. These louvers were placed in non-structural walls, to avoid any structural complications. And second, there are small windows located in the undulating walls. These windows were complex to locate and Dieste had difficulties finding the optimal position to maximize the potential of the colored glass with the amount of light available at a given time (Figure 3.4). Dieste explains that these windows were specifically located to accentuate the formal fluidity of the brick walls.[3]

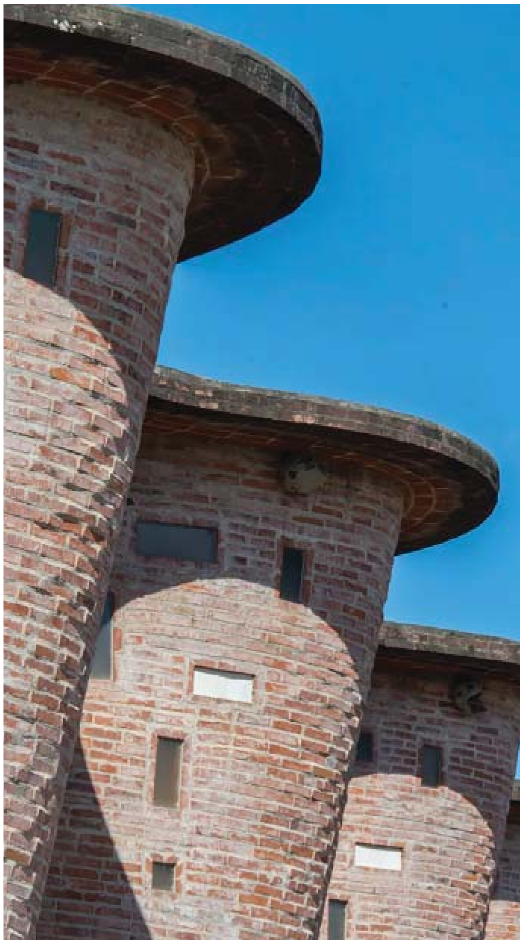

Figure 3.4 (left)

Colored Glass Windows Placed in Undulating Walls

Figure 3.5 (right)

Exterior View of Brick Walls and Roof

Tectonic Principles

Place

> Whether engaging environmental factors, the surrounding infrastructure, or the cultural needs of the inhabitants, architectural tectonics is being redefined by the world around it.[4]
>
> - Chad Schwartz, *Introducing Architectural Tectonics*

Eladio Dieste is known for choosing brick as the main material for construction. In the book Eladio Dieste 1943-1996, Dieste talks about the environmental, structural and cultural reasons why he used this material for his projects (Figure 3.5). First, there are manufacturers in Uruguay, Argentina and Brazil that produce high-quality bricks at low cost. Second, brick has a smaller elasticity component than concrete, but it still has an equal resistance. This attribute is an advantage because the structure has a greater adaptability to strains. Third, brick ages well and resists sudden temperature changes, which are common in coastal cities or towns in Uruguay. Fourth, brick provides a good thermal insulation and this can even be increased by introducing perforations. Brick, in comparison to concrete, radiates less heat during summer and it also takes less of our heat during winter. It can also naturally regulate humidity. And his last point is that the cost of the structure is very low, comparing to other materials (Figure 3.6).

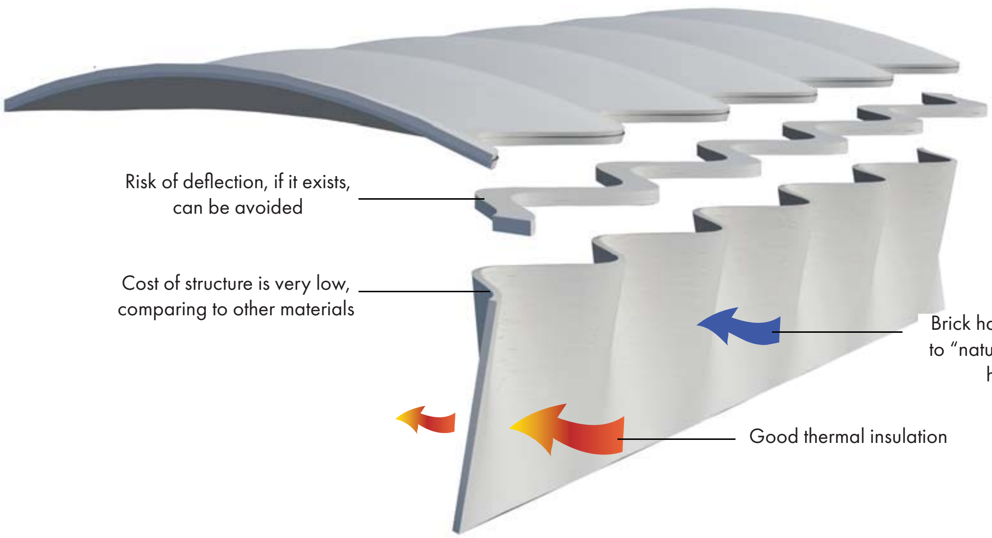

Figure 3.6

Economic and Environmental Advantages of Brick

Stereotomic

Eduard F. Sekler, an architectural historian, explains the relationship between structure and construction in his essay "Structure, Construction, Tectonics". Structure is the more general and abstract concept referring to a system or principle while construction refers to the concrete realization of that system or principle.[5] Semper, an architect and archeologist, classifies two construction typologies: tectonic and stereotomic. Cristo Obrero Church is an example of stereotomic construction (Figure 3.7).

Figure 3.7

Interior View Showing How Walls Meet the Roof

Stereotomic construction is characterized by piled or stacked elements like stone, brick and earth.[6] The stereotomic character of the project, conveyed through the brick construction, clearly affected the structure of the building and the means by which it was constructed. Eladio Dieste explains that the mathematical explanations for the walls and roof are very complex. Each wall is 30 cm (11.8 inches) thick and consists of two conoids, which according to *Diccionario de Arquitectura y Construccion* are surfaces generated by a series of lines that are supported at one end as a flat curve – in this case the crown – and on the other end as straight line – at the ground in this case. These conoids walls have a straight ***directrix*** at floor level. During the construction of the walls, wire reinforcement, measuring 30 mm (.11 inches) in diameter, was necessary to lay out the directrix. The wall was anchored to the ground using sand mortar and a horizontal crown was placed at the top to act as an eave and to absorb the thrust of the roof (Figure 3.8).

directrix: a line describing a curve or surface

Figure 3.8

Stereotomic Construction

In the book *Eladio Dieste 1943-1996*, Dieste briefly explains how the roof works. To understand this element, it is necessary to differentiate two areas within the vault. The first area is the one that acts as a ***Gaussian vault*** and that is anchored to the wall's crown and the other area, which has less curvature, is hanging from the first one. The characteristics of a Gaussian vault can be summarized in the following points; First, the combination of brick, mortar and iron performs a structurally viable unit. Second, the catenary is chosen as a directrix, then the weight of the vault produces compression and this makes the structure able to resist deflection. Third, the stress caused by the weight is independent of the section. Fourth, the reinforcement assures that the length of the vault reacts in an elastic way in relation to the loads. And lastly, we should know that the only material that needs to harden is the mortar and it rapidly acquires a resistance that stabilizes the vault. Unlike the double-curvature vault that requires support at all ends, this type of vault does not need support at each of the four ends because it acts as beam.[7]

Gaussian vault: vault with a double curved geometry that is based on the catenary resulting in mainly axial compressive forces

Space

Karl Bötticher, a German archeologist and architectural theorist, said in his text *The Principles of the Hellenic and Germanic Ways of Building with Regard to Their Application to Our Present Day of Building* that there are three steps to generating architecture from spatial development. The first step explains that the floor plan is arranged based the human need and society's social customs.[8] For this project, Dieste had to consider how people ceremonially move through space when attending mass. As such he had to acknowledge the universal rules that control the formal arrangement of a church, some of which Dieste elected to follow while others were modified to fit his version for the space.

For the second step in Bötticher's theory of spatial tectonics, the organization and structure of a building are introduced as the primary shaper of the space.[9] In this project, the roof, besides being important for structural stability, plays a big role shaping the space with its curves. It is one of the most important features of the project, along with the side walls. The roof and walls shape the primary spaces of the building, which are the altar and nave. Dieste wanted to connect these two spaces but did not want each to lose its spiritual distinction. To create a hierarchy between the nave and the altar, Dieste raised the altar three steps to create a differentiation and to give more importance to this component of the program. Lastly, Bötticher's third step is framing architectural space with solids and voids created by the structural scheme.[10] Dieste created a void in the interior of a space by not raising the secondary walls all the way until the roof. He wanted people to see how the undulating walls and vaulted roof was a feature of the entire church, and not only something present in the most important places (Figure 3.9) (Figure 3.10).

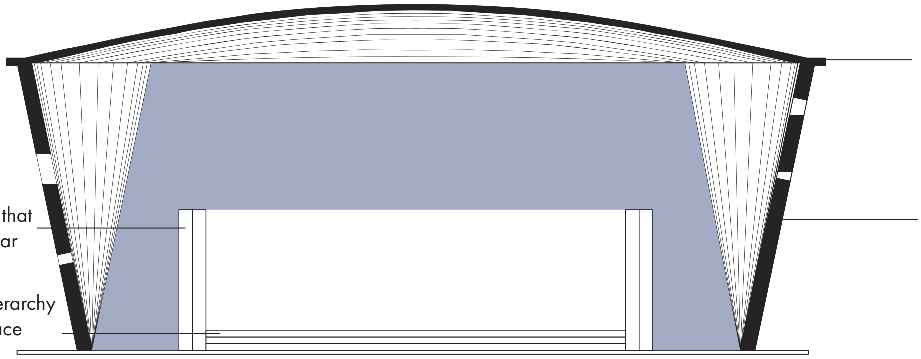

Figure 3.9

Generation of Spatial Development

Figure 3.10

Interior View Showing the Nave and Altar

Additional Resources

Projects

Market-Commercial Center, Montevideo, Uruguay, 1985
Casa Dieste, Montevideo, Uruguay, 1968
TEM Montevideo, Montevideo, Uruguay, 1962

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[1] Antonio Jimenez Torrecillas, Eladio Dieste 1943-1996 (Sevilla-Montevideo: Consejería de Obras Públicas y Transportes, 2001), 15.

[2] Waisman, Eladio Dieste 1943-1996, 22.

[3] Dieste, Eladio Dieste 1943-1996, 157.

[4] Chad Schwartz, Introducing Architectural Tectonics (New York: Routledge,2017), xliii.

[5] Eduard Sekler, Structure, Construction, Tectonics (New York: Braziller, 1965), 89-95.

[6] Schwartz, Introducing Architectural Tectonics, xlv.

[7] Dieste, Eladio Dieste 1943-1996, 41

[8] Bötticher, The principles of the Hellenic and Germanic Ways of Building (Santa Monica: The Getty Center for the History of Art and the Humanities, 1992), 154

[9] Ibid, 154

[10] Ibid, 154

Figure 4.1

Front View

04
Delta Shelter | Olson Kundig

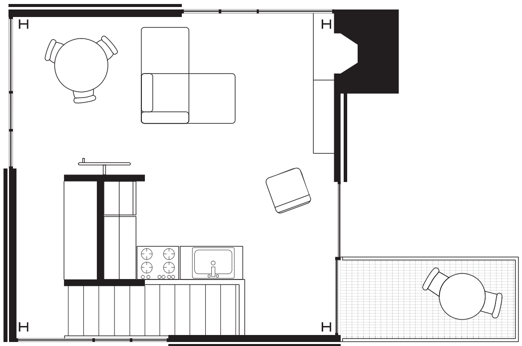
Firm Brief

In 1966, Jim Olson began his architectural practice, which would later transition to Olson Kundig after bringing on partner Tom Kundig in 1986. Olson started the firm with the belief that, "buildings can serve as a bridge be¬tween nature, culture, histories and people, and that inspiring surroundings have a positive effect on people's lives" and because of this, most of Olson's early work "explored the connection between dwellings and their environment."[1] Although a significant percentage of Olson Kundig's projects are residential, as it was before Kundig became a partner, the firm also designs museums and exhibitions, hospitality projects, academic buildings, commercial works, and religious centers. The firm currently has five partners that lead a staff of approximately 160 people out of the original office in Seattle, Washington. Jim Olson and Tom Kundig were joined in the leadership of the firm by Kirsten R. Murray and Alan Maskin in 2008, and Kevin Kudo-King in 2015. Recent additions to Olson Kundig include the opening of a location in New York in 2014 to serve the East Coast and International clients and the creation of interiors and landscape studios in the Seattle office, added in 2000. Olson Kundig has earned many accolades including the 2009 National AIA Architecture Firm of the Year, induction to the Interior Design Hall of Fame in 2012, and dozens of national and regional design awards. Olson Kundig has published nine books and a vast number of articles for publications including the New York Times, Architectural Digest, Architectural Record and the like.

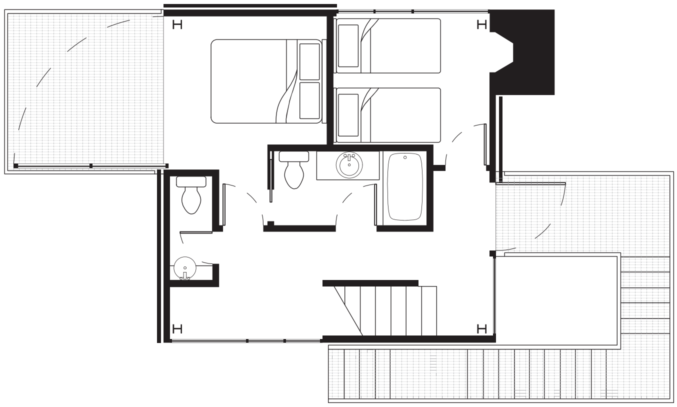
Project Brief

The Methow River bank in Mazama, Washington is home to the Delta Shelter, a vacation home designed by Tom Kundig for a client who enjoys spending time exploring the surrounding mountains (Figure 4.1). The retreat is a 1,000-square foot (93-square meter) prefabricated home built to respond to the site. An emphasis is placed on verticality in the project to mimic the mountain range on the horizon and the trees surrounding the site, as well as building to acknowledge the 100-year flood plain that the Delta Shelter sits within. The natural palate and raw materiality of the building help to blend the structure into the natural backdrop.[2]

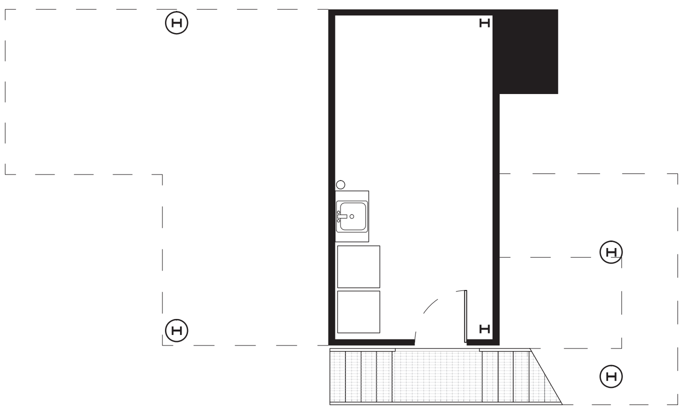
The Delta Shelter is a three-story home that goes against normal residential standards (Figure 4.2). The ground level contains a carport and utility space that has no interior connection to the rest of the home. To enter the living areas, one would climb an exterior stairway to the front door on the second level of the Shelter. Instead of placing the social areas of the home at the entry of the building, the front door leads to a landing space outside of the sleeping area of the home. Two bedrooms and a bathroom



Third Floor



Second Floor



Ground Floor

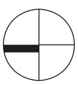


Figure 4.2

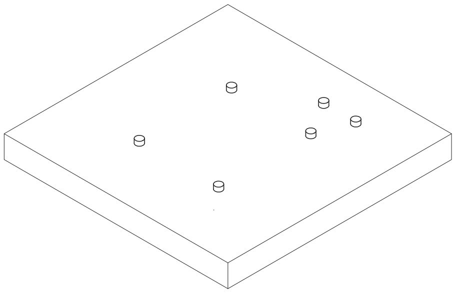
Floor Plans

occupy this second level along with an interior stair to the third floor living space and kitchen. The social spaces, housed on the top floor of the dwelling, have the best views of the surrounding site. Two cantilevered steel decks, one each on the second and third floors, provide outdoor spaces for sleeping and entertaining guests. The structure of the Delta Shelter is simple, but impressive. Four wide flange steel columns provide support for the building. The facades of the home consist of planes of wood, glass, and steel.

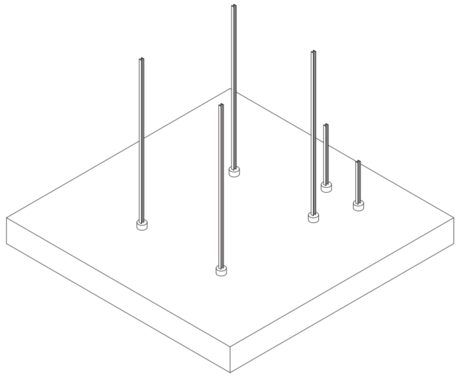
As is the case with many of Olson Kundig's projects, when the Delta Shelter was designed, sustainability was a key factor. All primary components of the project were prefabricated to reduce on-site waste and to minimize overall site disruption. Refurbished plywood was used for interior surface treatment as well as refurbished tongue and groove wood car decking as flooring. All four facades of the house open and shut using an ingenious human powered device. This operability allows air circulation throughout the entire home, eliminating the need for an air conditioner. During the winters, the panels can be closed to keep the heat in from the wood burning fire place. A clearstory that rises above the steel façade allows light to enter the main living space, even when the exterior panels are closed (Figure 4.3). The sliding panels also act as protection for the residence while the owner is away. When closed, they surround and protect the house in a curtain of steel, creating a virtually indestructible shelter.

Figure 4.3

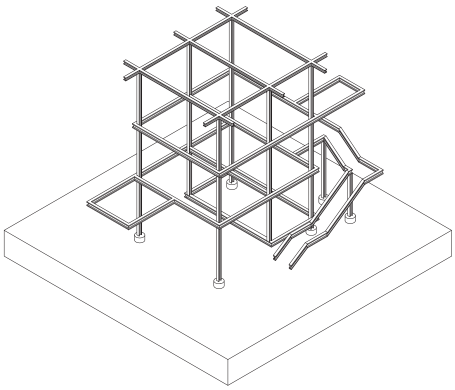
Section



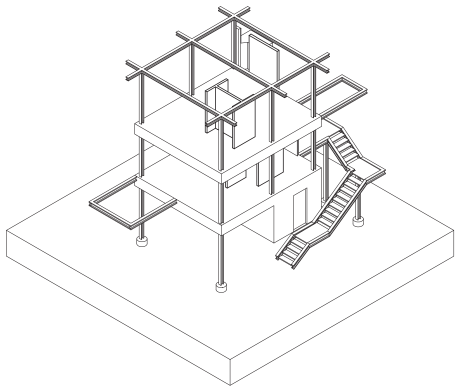
1: Earthwork
With minimal earth contact, true earthwork development is avoided.



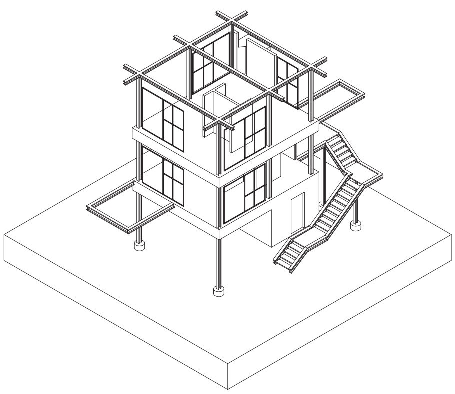
2: Columns | Framework
Steel columns with concrete footings act as the only four grounded points of stability.



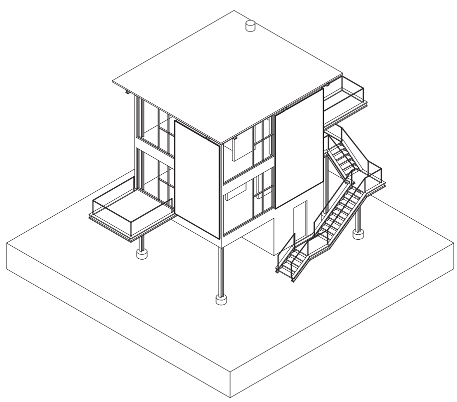
3: Framework
The steel frame begins to shape the spaces within.



4: Social Center | Hearth
The living space and fireplace act as the hearth of the Delta Shelter.



5: die Wand | Cladding
Large glass infills behind the steel give the enclosure a lightweight feel.



6: die Mauer | Cladding
The steel facade and exterior walls provide a solid, protected enclosure.

Figure 4.4

Anatomy

Tectonic Principles

Anatomy

Architect and theorist Gottfried Semper devised a method for categorizing built environments in his work *The Four Elements of Architecture*. Semper defined these elements as the earthwork, the roof, the enclosure, and the hearth. The earthwork is the foundation that receives the building, while the roof shelters the framework and the enclosure defines the building's boundaries. These three elements protect the last piece - the hearth - which is the social center of the structure.[3]

The Delta Shelter was designed with minimal connection to the earth, avoiding the development of a true earthwork condition (Figure 4.4). Four wide flange steel columns, the base of the fire place, and the foot of the exterior stairway are the only points of contact between the residence and the site. From those columns, a steel frame shapes the building and the spaces within. Plywood interior walls serve as partitions within the frame that define the spaces on the second floor. The open living area on the third floor is considered the hearth of the Delta Shelter. The hearth, according to Semper, was traditionally connected with the earthwork and was the literal fire that supported life. In the Shelter's case, the living space and fireplace serve as the hearth of the home (Figure 4.5).

Considered by Semper to be the primary element of architecture, he believed that cladding could be classified into two types of walls. The first was *die Mauer,* a solid, protective form of enclosure and the second was *die Wand*, a lightweight screen.[4] The cladding of the Delta Shelter is a moveable system that provides enclosure for the residence and, depending on the facades' configuration, could be viewed as either wall classification. Roughly half of the exterior cladding of the home is solid while the other half is filled with operable windows that create walls that appear as complete glass. These glass walls can be completely covered by steel sheets that create a full protective enclosure for the home.

Figure 4.5

The Social Space and Hearth

Space

Bruno Zevi, architect and historian, believed in two kinds of space: internal and external. In *Architecture as Space: How to Look at Architecture*, Zevi states, "...no work lacking interior space can be considered architecture."[5] For a space to be architectural, he argued that the enclosure needs to be subservient to what it contains. Zevi analogized how internal space is much like the concept of a void. A void is a completely open space that, in this comparison, is contained by walls, floor, and a roof. Zevi said,

> [E]ven if the other arts contribute to architecture, it is interior space, the space which surrounds and includes us, which is the basis for our judgement of a building, which determines the "yea" or "nay" of esthetic pronouncement on architecture. All the rest is important or perhaps we should say can be important, but always subordinate to the spatial idea.[6]

The movement provided by the façade allows the Delta Shelter to appear as either an open or enclosed building, dependent on the positioning of the steel panels (Figure 4.6). When the façade is closed, the external view of the home would appear as a solid mass. The interior spaces of the Shelter would be private and absent of views to the surrounding site. Upon opening, the façade allows the internal void to spill into the external space (Figure 4.7). The panels themselves do not have to remain fully open or closed, but rather can be positioned where the occupant pleases, allowing for a variety of spatial experiences. The drastic change in spatial properties of the internal and external spaces of the residence can be fully accredited to the façade detail.

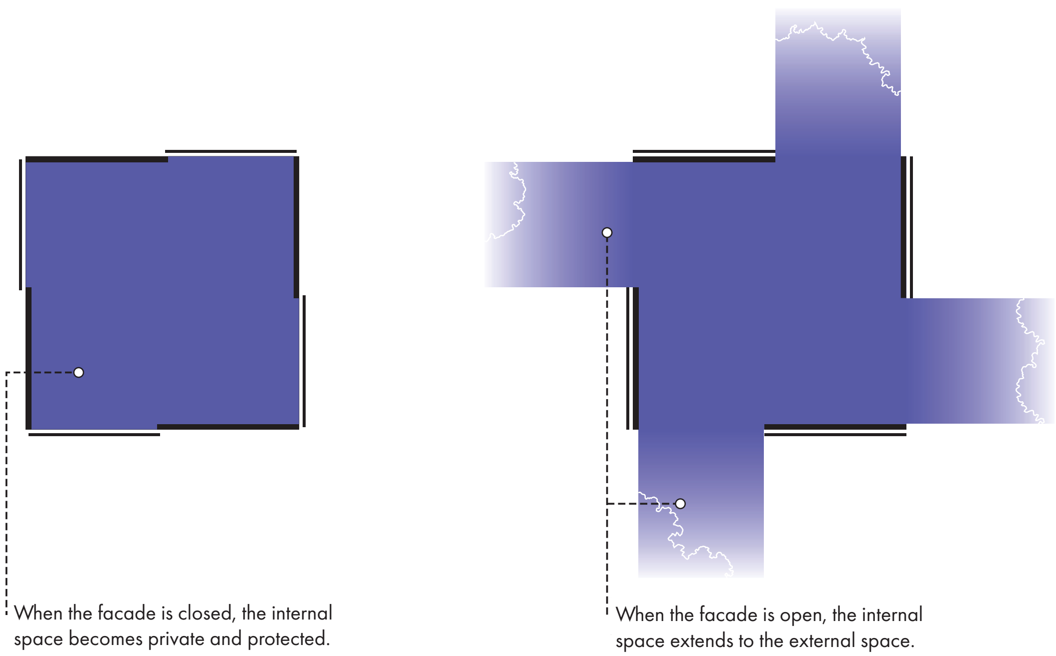


Figure 4.6

Spatial Experiences

Figure 4.7

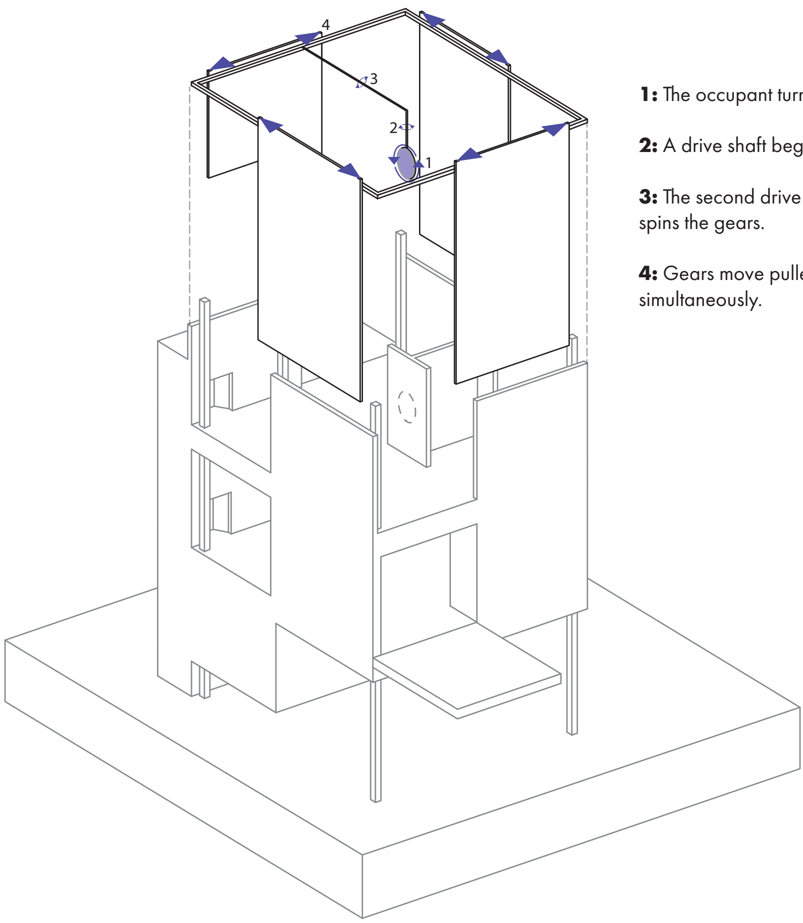
The Home in the Surrounding Landsape

Detail

In "The Tell-The-Tale Detail," educator and architect Marco Frascari wrote, "A column is a detail as well as it is a larger whole, and a whole classical round temple is sometimes a detail, when it is a lantern on the top of a dome."[7] Details exist at all scales in a building system. The façade of the Delta Shelter is an example of how one of the largest conceptual ideas and physical elements of a building can be a detail itself, constructed of a series of smaller details.

Tom Kundig is known for adding mechanical elements to his designs that create dynamic movement and lead to the transformation of space. The Delta Shelter has four 10′-0″ by 18′-0″ (3 meters by 5.5 meters) steel panels, one on each face of the building, that can be simultaneously moved along a track controlled by a single human-powered wheel located on the third floor. By using a series of drive shafts, gears and cables, the single wheel can open and close the façades with ease (Figure 4.8). When a person turns the wheel, it activates a drive shaft that transitions up to the ceiling. Additional components of the mechanical drive system, including a second drive shaft, runs to a track that lines the top of the third floor walls (Figure 4.9). There, the drive system's motion triggers a set of two gears on the track. These gears rotate pulleys, which control the cables responsible for the movement of all the steel façade panels (Figure 4.10).

This human powered mechanical system reinforces Frascari's idea about the detail. The grouping of smaller details can produce a greater element and eliminate the sense of scale in a project. The Delta Shelter's four small scale components make a system and a series of movement, creating a large scale façade detail and forming a fundamental concept of the project.



1: The occupant turns the hand cranked wheel.

2: A drive shaft begins to turn.

3: The second drive shaft consequently rotates and spins the gears.

4: Gears move pulleys that move all facades simultaneously.

Figure 4.8

Facade Movement

Figure 4.9

The Gears and Track Mechanism

Figure 4.10

Movement of the Facades

Additional Resources

Projects
Chicken Point Cabin, Valley County, Idaho, United States, 2002
Art Stable, Seattle, Washington, United States, 2009
Studhorse, Winthrop, Washington, United States, 2015

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Kundig, Tom, *Tom Kundig: Works*. New York: Princeton Architectural Press, 2015.
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Notes

[1] Quote from Firm History, www.olsonkundig.com/firmhistory
[2] Design concept from project portfolio on website, www.olsonkundig.com/deltashelter
[3] Gottfried Semper, The Four Elements of Architecture and Other Writings, trans. Harry Francis Mallgrave, Wolfgang Herman (Cambridge: Cambridge University Press, 1851)
[4] Ibid.
[5] Bruno Zevi, Architecture as Space: How to Look at Architecture, trans. Milton Gendel (New York: Horizon Press, 1974), 28.
[6] Ibid, 32.
[7] Marco Frascari, "The Tell-the-Tale Detail", from Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory 1965-1995, Kate Nesbitt.

Figure 5.1

Between Façade and Wine Storage Area

05

Dominus Winery | Herzog & de Meuron

Firm Brief

> A building is a building. It cannot be read like a book; it doesn't have any credits, subtitles or labels like pictures in a gallery. In that sense, we are absolutely anti-representational. The strength of our buildings is the immediate, visceral impact they have on a visitor.1
>
> - Jacques Herzog, speaking for himself and his partner, Pierre de Meuron.

The lifelong partnership of Jacques Herzog and Pierre de Meuron started at the early age of seven, when they met in Basel, Switzerland. The pair eventually decided to go to school at the Federal Institute of Technology Zurich. While at school they were taught by Pritzker Laureate, Aldo Rossi, who started their journey of thinking of architecture in its most visceral form. Their mutual interests eventually led them to found Herzog & de Meuron in 1978, with their head office in Basel. Today their firm has grown from a six-person team to an international powerhouse of 40 associates and 380 collaborators spanning from Berlin, to Hong Kong, London, and New York City.

The partners believe the firm's success, according to de Meuron, stems from the fact that "Jacques's strengths are my weaknesses and his weaknesses are my strengths."[2] Their close association has paid off as they won the Pritzker Architecture Prize in 2001, the RIBA Gold Medal in 2007, and the Mies Crown Hall Americas Prize in 2014. Acclaim for the firm's work has come from the collaborative nature of their practice and their ability to "challenge [their] cognitive/sensual inklings in the most peculiar way."[3] As compared to architect and theorist Gottfried Semper's architectural idea of the wall, the firm pushes the boundaries on conventional material usage, which is one of Herzog and de Meuron's most vital and characteristic concerns. Exploration of facades has led them to establish a complex relationship between surface and the enclosed space; and between inside and outside.

Project Brief

Dominus Winery was established Yountville California in 1995 by new proprietor Christian Mouix. This portion of the fertile Napa Valley region had originally been cultivated in 1866, but in 1983 Mouix created a new wine, named Dominus, which quickly gained world-wide recognition. In response to this popularity, the proprietor hired Herzog & de Meuron to design a winery on the property.

The building is a two-story box, 140 meters long by 25 meters wide by 9 meters high (460 feet long by 82 feet wide by 30 feet high) (Figure 5.2). The long axis faces north - south and is punctuated by two covered passage ways that separate the main functions of the building. The north gateway lines

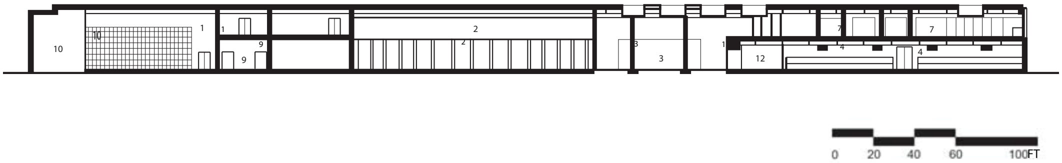
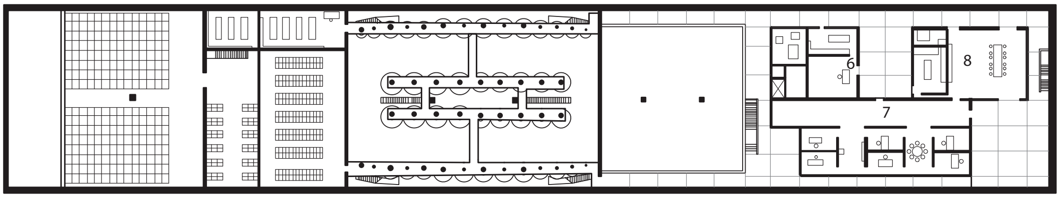
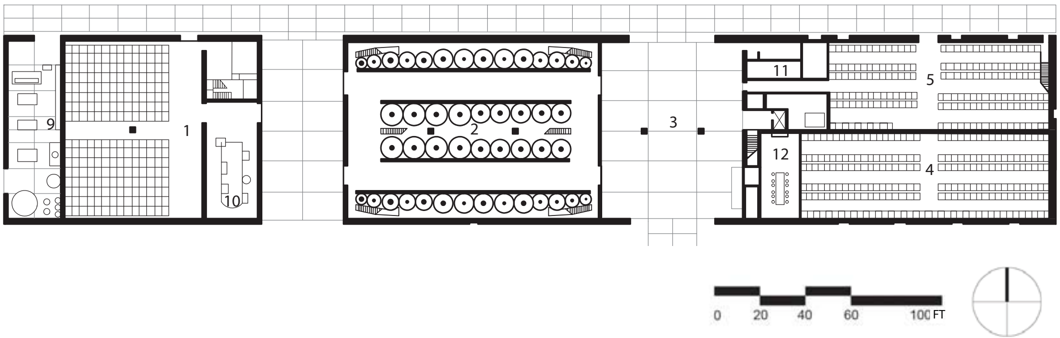


Figure 5.2

Longitudinal Section



Second Floor



Legend

Storage 1
Tank Room 2
Arch 3
Cask Cellar (First Year) 4
Cask Cellar (Second 5
Year) 6
Laboratory 7
Offices 8
Classroom 9
Plant Room 10
Bottling Room 11
Cellar Master's Room 12
Tasting Room 13

Figure 5.3

Entry Showing the Main Axis through the Winery

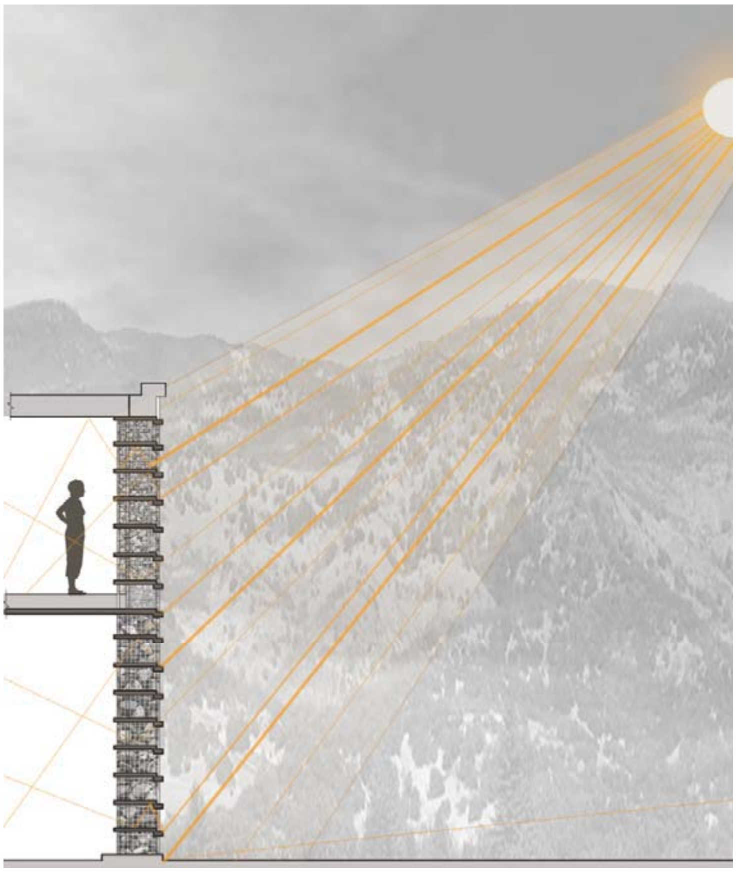
Figure 5.4

Floor Plans

up with the major east-west roadway traversing the main thoroughfare of the vineyard (Figure 5.3). This portico also houses the entrances to most of the main spaces including the tasting room, wine and cast cellar, offices and the tank room. After walking through the portico and entering the main spaces, glass walls allows direct views into the cellar (Figure 5.4). The southern half of the building houses storerooms for cases of wine and a parking area.

The climate, for most of the year in this part of California is very hot in the daytime and cold at night. In response to this significant diurnal temperature shift and to create a building that is attuned to the local climate, Herzog & de Meuron created an exterior skin of native basalt stone. These stones are closely packed in wire boxes known as gabions. The gabion walls allow natural light and air to filter through the building during the daytime and as artificial lights are turned on in the evening the building appears to glow like the embers of a fire. The continuity of the building's finishes increases the ambiguity between interior and exterior spaces. This concept is applied to the building's interior structure as it is a blend of steel and concrete. Because the steel and concrete are utilized as part of the filigree construction of the building, light is able to filter through to the interior spaces in the building.

Like the wine-making that occurs on site, Dominus Winery is a "refined blend of science and art."[4] The building is purposefully placed so that it appears to rise directly out of the earth, accentuated by the stone facade. Herzog & de Meuron have created a building that is highly rational and at the same time seems to fuse with the earth as if it was meant to be there.



The gabion wall acts as a mediator for environmental factors. The various sizing of the basalt rocks filters the indirect light in differing quantities, varying based on the sizes of the stones.

Figure 5.5

Environmental Relationships

Tectonic Principles

Ornamentation

Dominus Winery combines Semper's ideas of ornamentation with the idea that the environment's role is to work simultaneously with the building. Gottfried Semper believed there is a connection between culture and ornamentation. His theories explore the relationship between textiles and the environment, culminating with the belief that walls "originally formed the motive for textiles and metaphorically served as a vertical spatial divider."[5] Semper extensively studied this relationship between making spaces through the dressing of the building and the resulting social separation of people within.

Ornament, with respect to Dominus Winery, can be defined as the integration of the built environment and the building skin, where the façade is relying on the stones and its metal cages to connect the building and its structure to the landscape. The local basalt stone material utilized in the building is placed in a way that causes the façade's structural system to become less definable. It is difficult to discern which pieces of the wall are solid and which are void, thus blurring Semper's idea of the wall as a "spatial divider." The gaps in this system then become just as important as the solid nature of the stones. They create a dialogue with the environment in which they act as a rain screen, while also allowing for the circulation of air and the filtering of light (Figure 5.5).

Standing back from the façade, the patterning of solid and void in the stone walls help to "define, but not dictate, environment."[6] The winery is situated against the landscape in such a way that it can be understood differently from different distances. Up close, one notices how light filters through the wall system and how the building becomes a buffer/gateway between one side of the winery and the mountains in the distance. Taking a step back allows one to appreciate the way Dominus Winery simply meets the ground and sky. The next realization is how the seemingly simple basalt walls are barely distinguishable from the mountains in the background (Figure 5.6). This unassuming relationship not only helps the building better assimilate with the environment, but it also helps elevate the skin as not only a beautiful motif but as a functional and rational association between nature and the man-made.

Figure 5.6
Approaching the Winery

Construction

Tectonic construction is characterized by lightweight framework, while its opposing strategy for building, stereotomic construction, is characterized by the piling or stacking of materials. Dominus Winery utilizes both tectonic and stereotomic constructions, becoming the place where our eyes go to search for both the identity of the materials and the structure.[7] (Figure 5.7). The tectonic components in the building are steel columns that run along the core of the building and are integrated into the gabion steel structure of the façade. Not only do these columns help to hold up the building but they help to define two of the most public spaces in the winery, the tasting room and cask cellar. These two rooms are given prominence in the winery by being "raised on a slender plinth, with abstract glazed doors reflecting the vineyard below."[8] Elevating program in a building helps to establish a hierarchy, and because the structure is helping to define the importance of the spaces, the structure is then given more importance within the building. The tectonic structure continues to the exterior portion of the building in the use of the steel gabions (Figure 5.8). The filigree nature of these steel cages makes them appear delicate in comparison to the stones they cradle within.

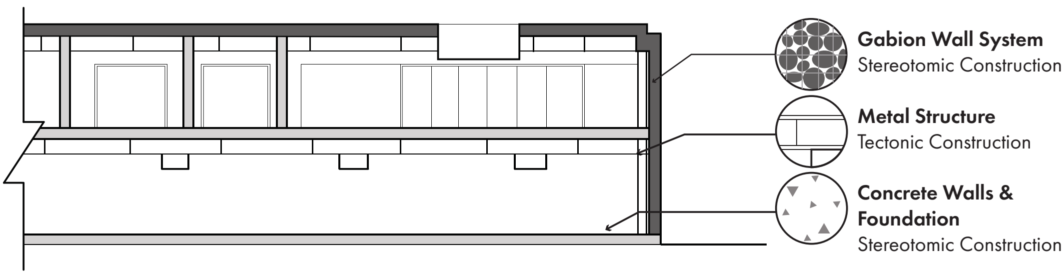


Figure 5.7

Tectonic vs. Stereotomic Construction

The structure of the building is composed of both a tectonic system consisting of a primarily metal structure of beams and columns, and stereotomic construction of heavy concrete floors and a stone gabion system. These construction systems define different spaces within the building.

On first appearance, the stereotomic system of the building is obvious. "Three grades of stones are used"[9] to create the complex façade. The largest stones are utilized in the covered outdoor areas such as the main porticos to the building. Most of the second grade of stone, the mid-sized option, is applied throughout the rest of the façade. The third, and finest grade of stone is employed on the outside of the cask cellar to provide a more substantial barrier against light infiltration and more insulation for the space to minimize diurnal temperature changes. Another stereotomic system within the winery is provided in the inner concrete walls of the building. These walls help to define the spaces within the winery and are located around spaces which need additional protection from environmental factors. As a whole, the blend of these construction types helps to create a building that embodies the connectivity of materials and the integration of tectonic and stereotomic constructions.

Figure 5.8

Tectonic Structure
Utilized in the Winery

Detail

Derived from the Italian word *gabbione*, meaning "big cage,"[10] gabions are thin metal enclosures filled with rocks typically used to stabilize soil and prevent erosion. These cages are generally airtight to prevent water and soil from shifting and can be utilized as a retaining wall, bridge, or in the case of Dominus Winery as a mediator for environmental factors. In this project, Herzog & de Meuron establish a unique relationship between the delicate metal cages and the stones within. This relationship is established through the joining of materials, elements, and building parts in a functional and aesthetic manner.[11] Like most gabion systems, the rocks inside the cage appear massive; making the wire cages appear insubstantial and unable to hold the stones contained inside. (Figure 5.9) This notion of the thin steel tectonic system holding together the heavy stereotomic one is juxtaposed by the cages fundamental purpose to create stability and structure within the façade system.

The fragmentation within the system allows environmental factors to filter through the spaces between the stones. This idea is demonstrated in the appearance of each stone as "a fragment of an implied metal frame."[12] While the basalt rock and metal cages help to define a gabion, they are an element of a greater architectural system. (Figure 5.10). The joining of these two materials creates the façade and helps to define a consistent idea about how each piece of the building is clad. The dual nature of the gabion system creates a building skin that is not wholly solid nor transparent and helps to further develop the complexity of a seeming simple winery.

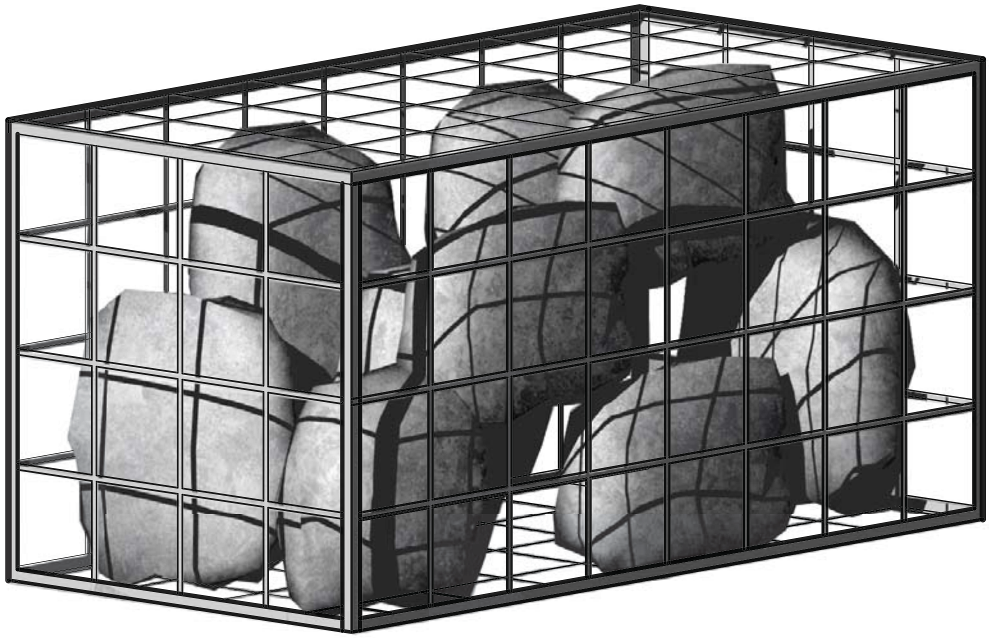


Figure 5.9

Gabion System

The gabion system is comprised of two parts, the basalt stones and the metal cage. The metal cage appears insubstantial in relation to the stones within, however the metal cage is what creates the stability and structure of the gabion system.

Figure 5.10

Gabion Construction

Additional Resources

Projects

VitraHaus, Weil am Rhein, Germany, 2009 (47.59344, 7.61981)
Elbphilharmonie Hamburg, Hamburg, Germany, 2016 (53.54133, 9.98413)
de Young Museum, San Francisco, California, United States, 2005 (37.77147, 122.46867)

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Benjamin, Muschg. "Dominus Winery, Yountville, California, 1997." In Oberflachen, Zurich, Switzerland: Werk,Bauen,and Wohnen, (1998): 12-21.

Henry, Plummer. "Light in Japanese Architecture", June 1995. Tokyo, Japan: U Publishing Co, (1995): 4-24.

Notes

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[2] Lifson, 4.

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[7] Carles Vallhonrat. "Tectonics Considered." *Perspecta*, vol. 24, 1988, 134.

[8] Lecuyer, 46.

[9] Ibid, 47.

[10] "Gabion." Merriam-Webster. Accessed October 23, 2017. https://www.merriam-webster.com/dictionary/gabion.

[11] Marco Frascari. "The Tell-the-Tale Detail." In *Theorizing a new agenda for architecture: an anthology of architectural theory: 1965-1995,* New York City, (New York: Princeton Architectural Press, 1996),3.

[12] Raymond, Ryan, "Memories of Light, Curtain, and Stone." In *Architecture and Urbanism*. Vol. 4. Series 331. Tokyo, Japan: U Publishing Co, 1998,26.

Figure 6.1

View Upon First Entering the Site from the Main Gate

06
Komyo-Ji Temple | Tadao Ando & Associates

Architect Brief

Tadao Ando is a Japanese, self-taught architect who spent the beginning of his career as a truck driver and boxer before transitioning to the practice of architecture. During an interview, Ando reminds us of his childhood and how he translated his early career into architecture.

> When I was 15 years old I was a professional boxer. I fought about a dozen professional fights. At the same time designing architecture is also a battle, you must go forward, always one step ahead, you have to go forward, otherwise you lose.[1]

The battle that Ando refers to is evident in his design work. Most of Ando's projects reflect "the Zen state of mind inherent in traditional Japanese culture, which is characterized as being quiet, distant, clear, and poetic."[2] Further on in his career, his relationships and collaborations with renowned architects such as Le Corbusier, Mies van der Rohe, Frank Lloyd Wright, and Louis Kahn inspired him to finally establish his own design firm, Tadao Ando Architect & Associates, in 1968.

When studying Ando's work, a few elements stand out, specifically "his unparalleled work with concrete, his sensitive treatment of natural light, and his strong engagement with nature."[3] His architecture reduces even the most complex buildings to simple and clean concepts.

Project Brief

The historic Komyo-ji temple, a 250-year-old Pure Land Buddhist temple, is nestled in the foothills of a mountainous region of south-western Japan in the city of Saijo. The city is relatively small, but the site of the temple serves as the entrance to the highest mountain range in western Japan. Because it is positioned at the base of the mountains, the city of Saijo is abundant with fresh mountain water and a vast network of streams and rivers feed and sustain the population and wildlife of the city.

The temple itself originated in the Edo Period (c. 1603 to 1868) but by the 21st century it was no longer structurally sound nor did it fit the needs of its patrons and monks. The temple committee convened and, in 2001, Tadao Ando completed the redesign and construction of a new structure. When Ando took on the project, there were not many requirements given by the client. The temple committee explained that they wanted the new temple to be a place where "people will come to gather together, a temple that is open to the community,"[4] and a facility which would relate to the age-old traditions of Edo Architecture. The temple was also required to have a connection to the existing guest halls and priests living quarters (Figure 6.2).

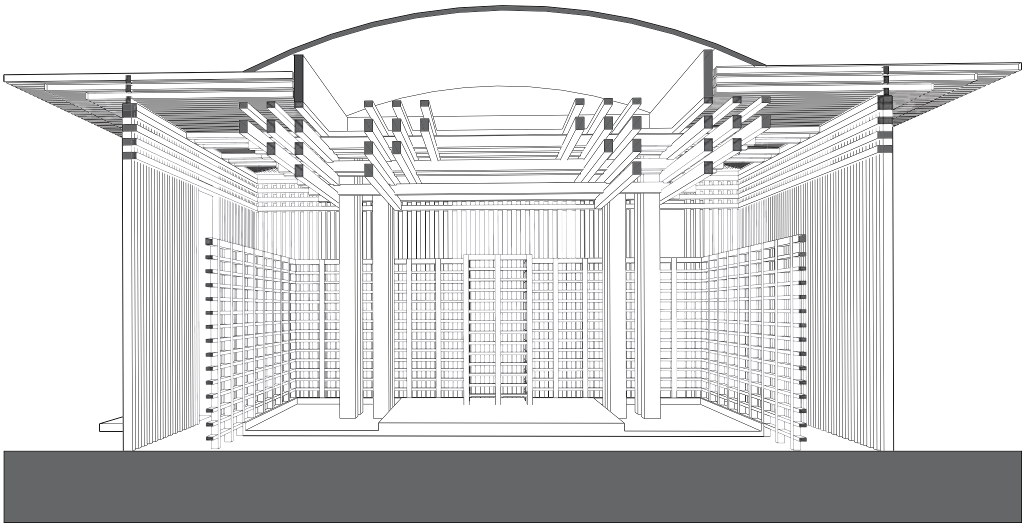
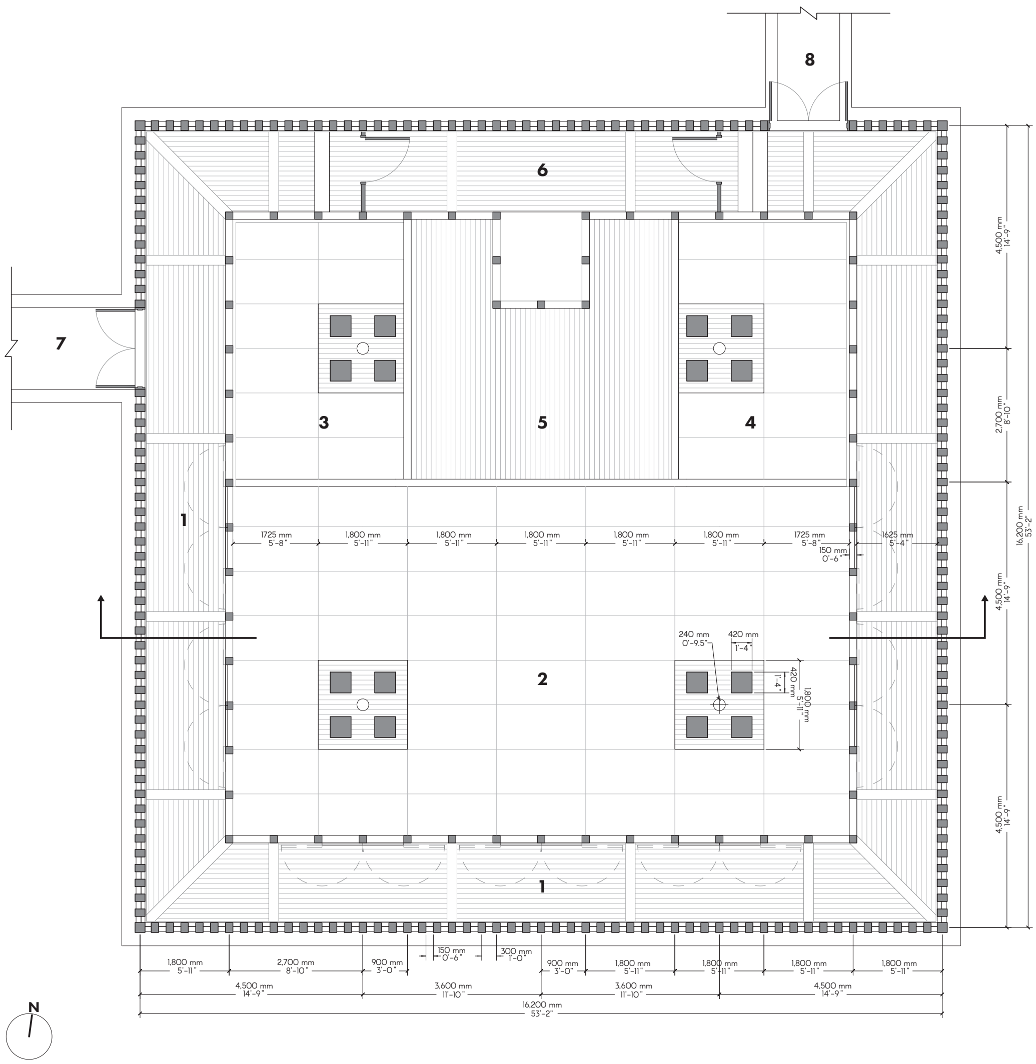


Figure 6.2

Building Section



Legend

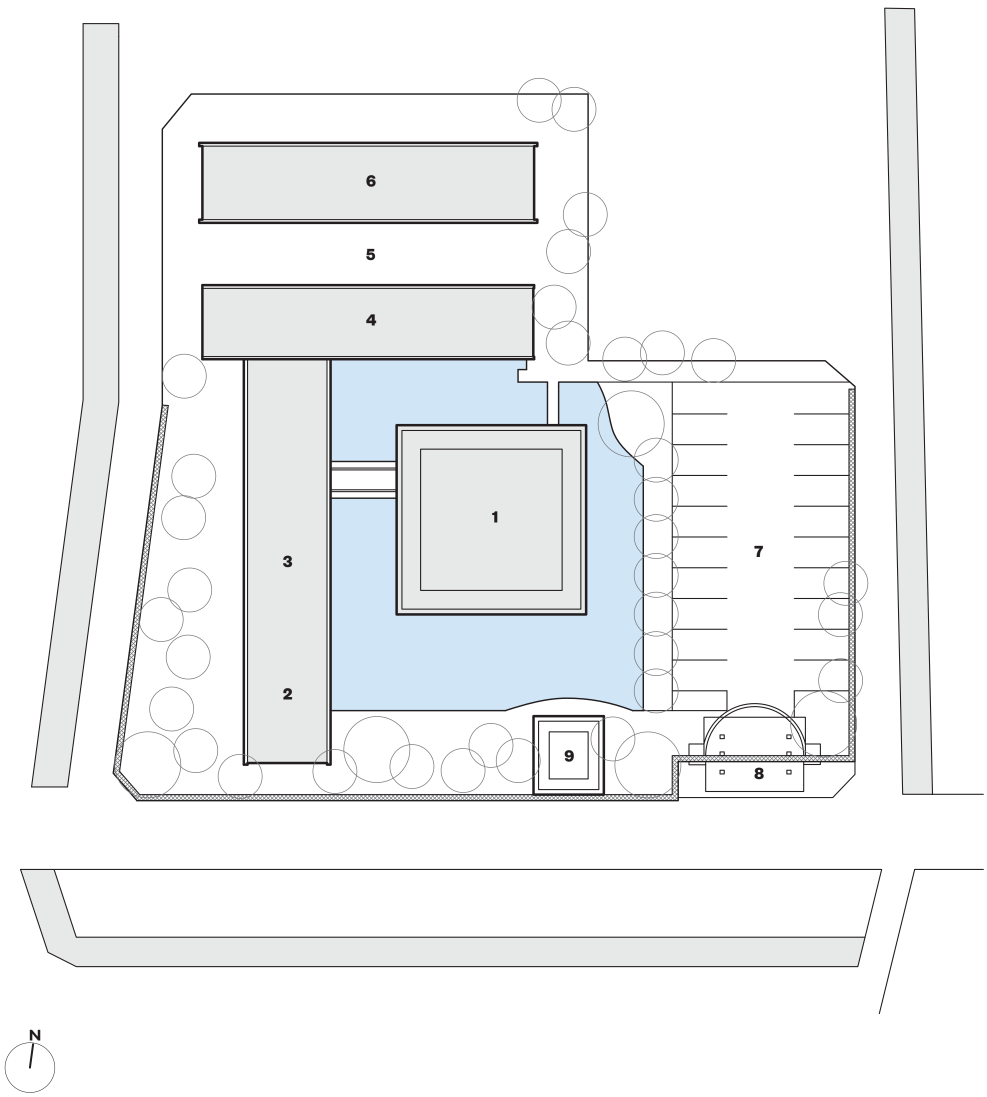
- Corridor 1
- Outer Chamber 2
- Left Chamber 3
- Right Chamber 4
- Inner Sanctum 5
- Ante Room 6
- Bridge to Main Hall 7
- Egress Path 8

Figure 6.3

Floor Plan

In the development of the project, Ando utilized the natural resources of Saijo and later stated that this project "allowed [him] to rediscover and gain a new awareness of the origins of [his] architectural methods."[5] He captured spring water from a nearby stream and utilized this element to not only bind the new temple structure within the existing site, but also to connect the entire complex to the fabric of the city. The new building is enveloped by a serene pool of water, connecting to the existing structures on the site using two small bridges (Figure 6.3). The position of the structure at the center of the pool leads to a mirror-like reflection of the temple's activities within and evokes wonder and mysticism for the patrons (Figure 6.1).[6]

This project had a clear desire to respect the environment and history of the preceding structure, which is evident in Ando's material choices. He highlights the local landscape by using wood as a primary construction medium instead of concrete, his signature building material. Ando sought to recognize and appreciate wood as a traditional Japanese material in Komyo-ji, but he also wanted to integrate the history of the site with a more contemporary take on material technology.[7] He decided to build the entire temple using laminated timber, weaving and intertwining them to allow each structural member to support the tension or force created by another, similar to how a community supports one



Legend

1 Main Building
2 Entrance
3 Guest Hall
4 Worship Hall
5 Courtyard
6 Private Living
7 Parking
8 Gate
9 Bell Tower

Figure 6.4

Site Plan

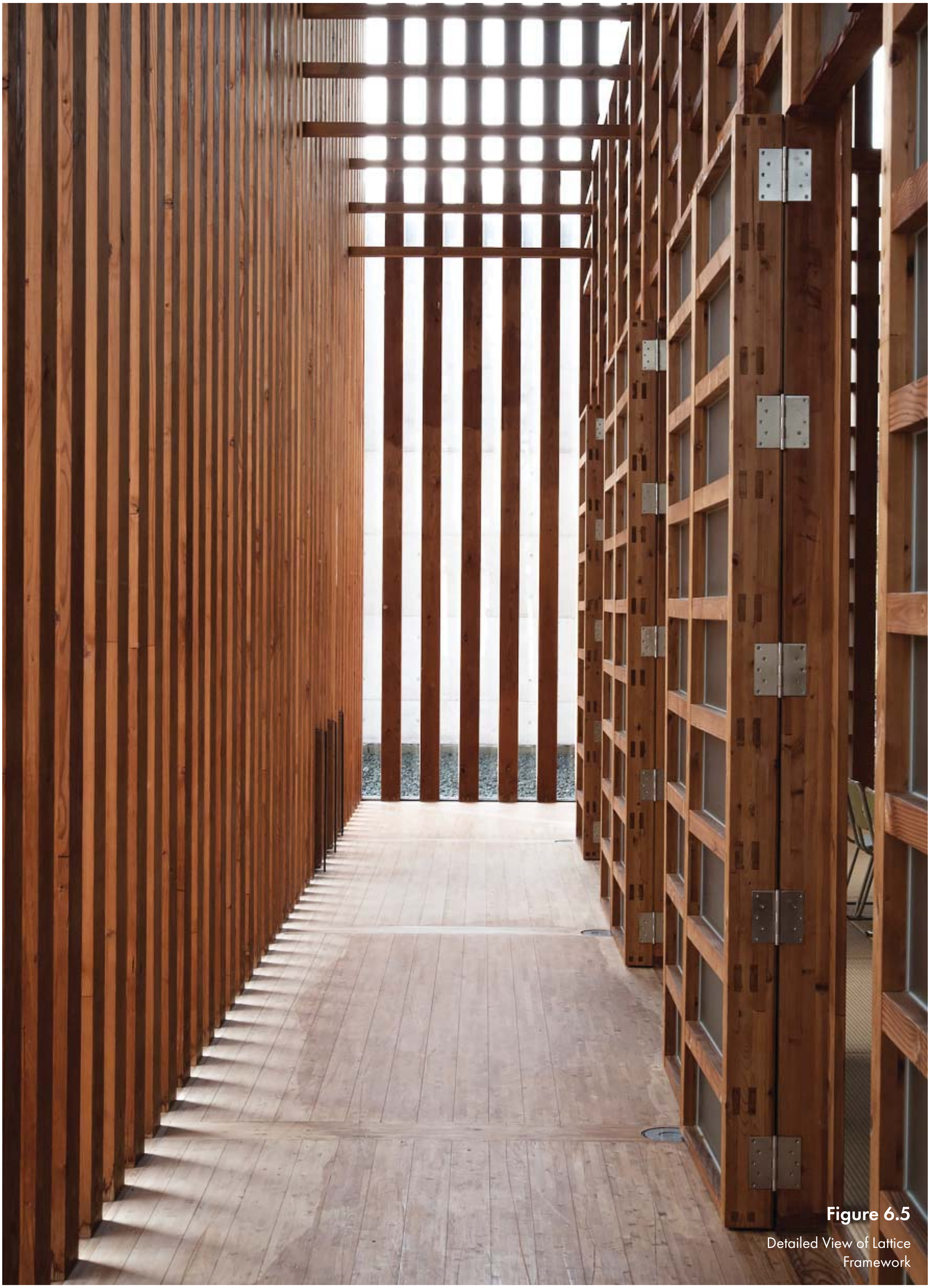


Figure 6.5

Detailed View of Lattice Framework

another (Figure 6.4). Due to the strength of laminated timber, Ando could use many thin, but long beams to create delicacy in the structural system. He also created a latticed façade with varying openings, which transforms the interior space by allowing glimpses of sunlight to shine in along with reflections from the water, exposing the interior to the outside, blending the two (Figure 6.5). The qualities of the temple create an atmosphere built on light, material, and water, which speaks to the visitor.[8] After dark, a reversal takes place where the life inside the building is reflected onto the clear waters outside, signaling to the community that they too are welcome to join.

Figure 6.6
The Ceremonial Hearth

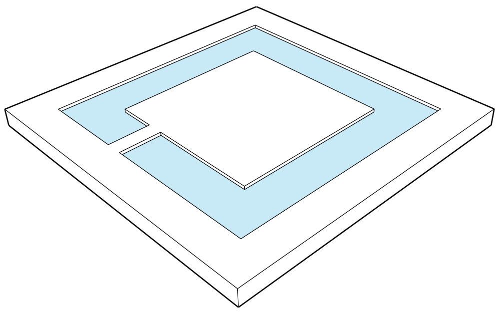
Tectonic Principles

Anatomy

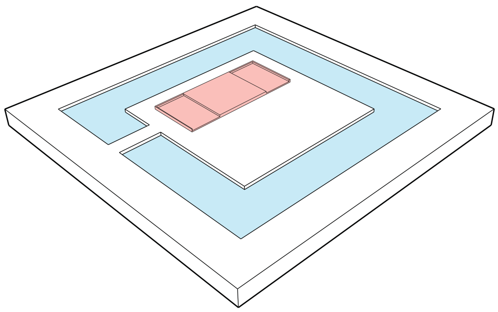
The development of Komyo-Ji temple first necessitated the earth to be excavated to create the large reflection pond filled with spring water from surrounding Saijo, Japan.

> The water surrounding the temple is serene yet at the same time dynamic. It quietly reflects the wooden structure, extending the height of the temple and, at the same time, reflecting the ever-changing light which dances on the monolithic concrete walls of the administrative buildings of the temple compound.[9]

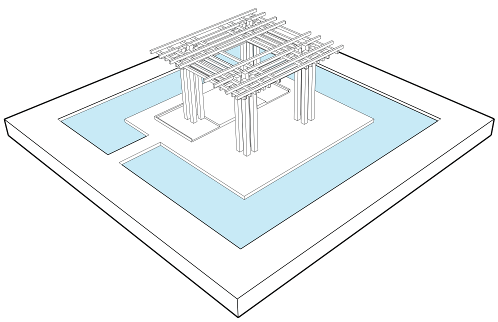
The shrine was built at the center of the reflection pond, appearing as though it floats on the water. The shrine serves as a gathering spot for communal events and prayer (Figure 6.6). Around the shrine, Ando designed a large hall. The framework of the structure begins with the placement of four columns at every corner, each of which is also composed of four smaller wood component columns that have been fastened together (Figure 6.7). The system of columns supports a framework of beams. The beams gradually move out from the columns, stacked and intricately woven upon each other. The



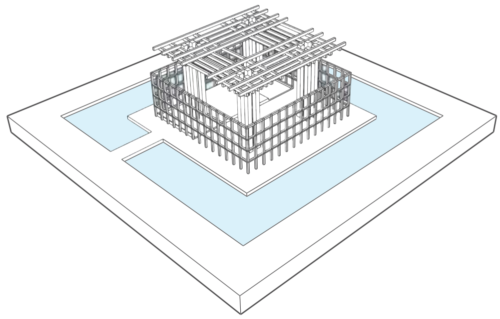
1: Earthwork
The temple sits on a concrete pad surrounded by a reflecting pool.



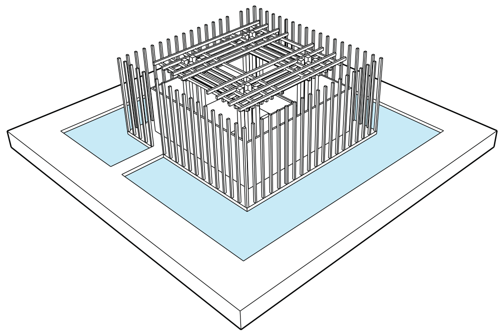
2: Hearth
The temple's central shrine serves as the main focus for visitors.



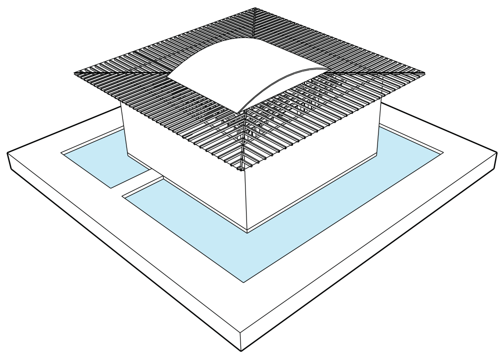
3: Framework
A network of glulam columns and beams support the roof and facade of the structure.



4: Inner Volume
The central shrine is highlighted by a wooden interior partition wall.



5: Cladding | Exterior Shell
The exterior skin is made of wooden members that are spaced tightly together as they work to filter in the natural light.



6: Roof
A relatively flat wooden roof surrounding a central skylight further highlights the complexities of glulam construction and protects the patrons inside.

Figure 6.7

Anatomy

three interlocking layers of beams within the ceiling of the project support the façade and roof. The central shrine is further emphasized by an inner area of tatami mats, surrounded by a pair of enclosing envelopes. The inner wrapping is frosted glass to provide an unobtrusive barrier for the sacred space within.

The exterior envelope, which creates the temple's facades, is clad with a wooden lattice structure. Frosted glass has been inserted into openings of the lattice, which protects patrons from distractions, but still transmits the qualities of light sought by Ando. Ando said that this configuration of enclosure "results in an indeterminate demarcation between interior and exterior. Light filters through the latticed exterior wall to fill the interior with soft, natural illumination. It is a bright, open, and ceremonious space."[10] The temple is topped with a wooden roof that lightly touches the rest of the building, protecting those within from the natural elements. The central shrine contains a skylight that mimics the surrounding buildings and allows additional light into the main space.

Detail

Ando takes full advantage of the surrounding mountains at Komyo-Ji by capturing mountain water from the streams and rivers that run through the city. By creating the reflection pool, Ando creates an image of a building that gently floats on the water. Although it would appear that the water is binding the site together, its true purpose is to highlight the temple as a separate element from the rest of the site. Ando furthers this disconnect by making other structures out of a heavy monolithic concrete which also helps visitors focus on the wooden temple design (Figure 6.8).

Figure 6.8

Adjacent Monolithic Concrete Buildings

Upon entering the complex, visitors quickly realize that there is no direct entry to the temple. To access the temple, visitors must first enter the prayer hall of the community building. From the prayer hall visitors are led to the only public entrance to the temple: a small wooden footbridge that quietly connects the main hall to the surrounding context (Figure 6.9). This bridge serves as a formal joint as it connects the main building with the surrounding buildings on the site. In "The Tell-the-Tale Detail," late architect and educator Marco Frascari states, "the art of detailing is really the joining of materials, elements, components, and building parts in a functional and aesthetic manner."[11] This joining of buildings can be seen in how Ando uses the spring fed pond to create a separation with the existing site and then further accentuates the joinery of the site by using the wooden bridge where visitors cross this body of water to enter.

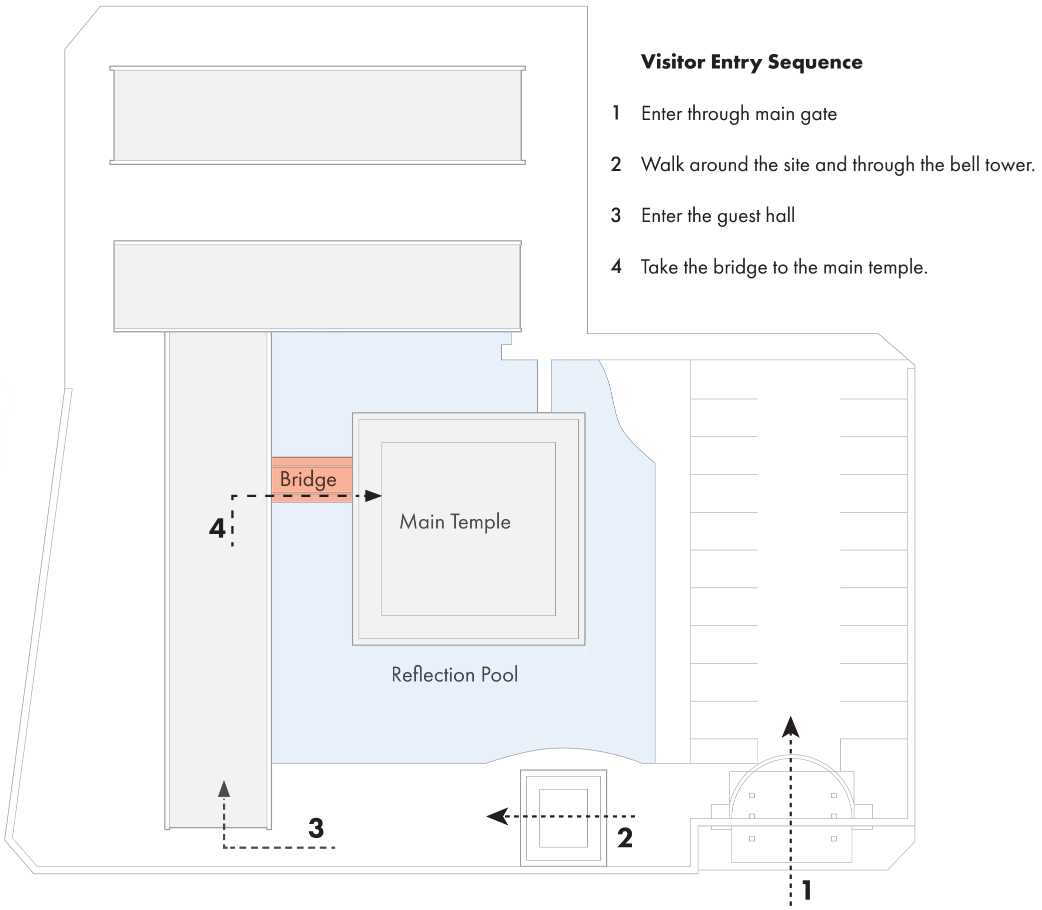


Figure 6.9

The Bridge as an Entry Detail

Intersection

Traditional Buddhist architecture has always relied on wood in its many forms as a primary building material for its temples. During the material selection process, Ando decided to respect tradition and use a more modern interpretation of the age-old building technique.

> In my view, the essence of traditional Japanese wooden architecture is "assembly.". A tremendous number of wooden parts are cut for a single building, and the building takes shape as these parts are assembled and fitted together...I wanted to create a space that would return to the origins of wooden architecture.[12]

Ando accomplishes this by using a contemporary building material called laminated timber (Figure 6.10). Laminated timber, or glulam, is an effective building material; its strength derives from the fact that "the material itself is made up by layering smaller parts [...] it seemed especially appropriate to the intent of this design."[13] Ando starts by placing sixteen large columns in sets of four inside the main temple. By creating a crisscrossing network of beams on top of the columns, the structural members rely on one another to distribute force, through complex geometry, holding up the temple's façade and roof (Figure 6.11). Professor and architectural historian Eduard Sekler published a paper examining the relationship between construction and structure in which he writes:

> To achieve a desired end in building we may rely on the accumulated strength and mass of assembled materials. This will be a constructional effort. But with a structural change, the same end may be achieved in a more elegant fashion. A form may emerge that is a more direct result of, or reply to, the forces at work.[14]

The resulting form, according to Sekler, is a direct result of Ando's constructional effort in making an open floor plan with stronger members, but using an elegant system. In this design, Ando constantly blurs the line between respecting an age-old building technique with something that is more modern and reliable, intersecting different methods to create a place that was appropriate for the client.

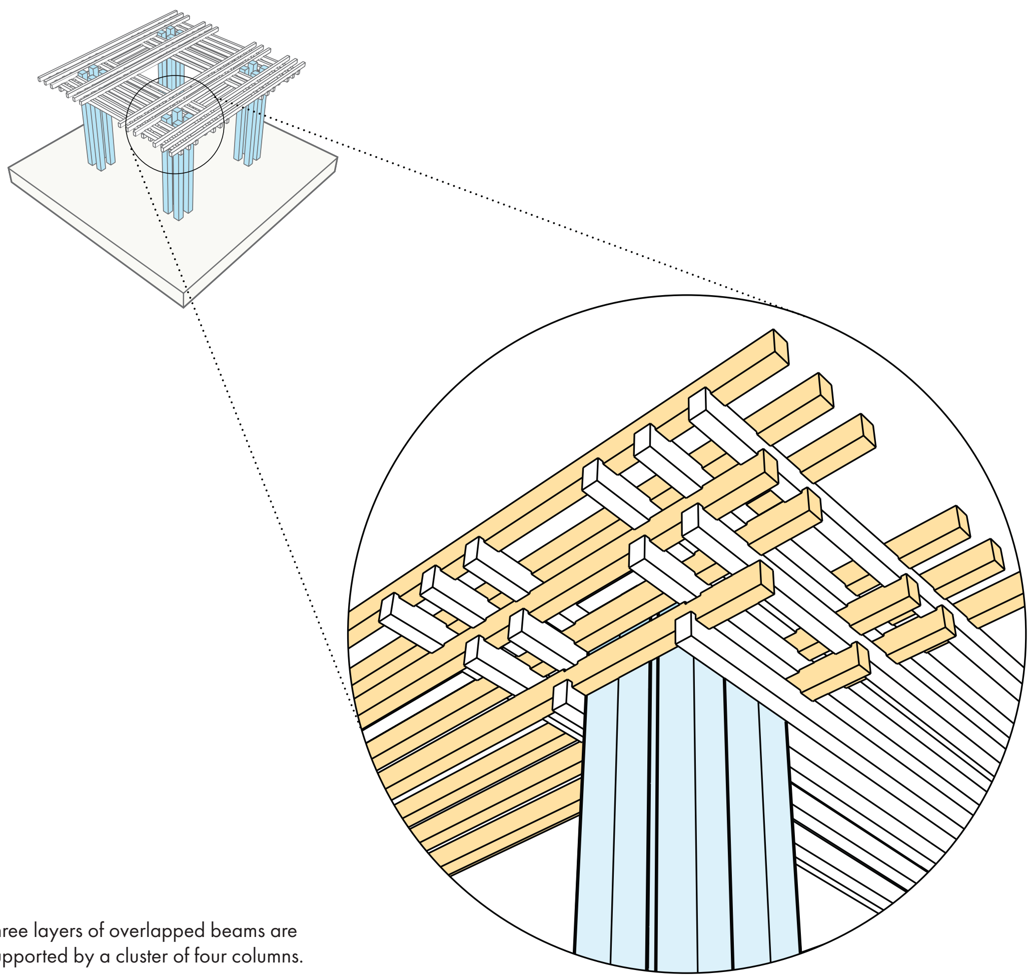


Figure 6.10

Glulam Beam to Column Connection

Three layers of overlapped beams are supported by a cluster of four columns.

Additional Resources

Projects

Modern Art Museum, Fort Worth, Texas, United States, 2002
Church on the Water, Tomanmu, Hokkaido, Japan, 1988
Church of the Light, Ibaraki, Osaka, Japan, 1989
Punta della Dogana, Venice, Italy, 2009

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14 Sekler, Eduard. "Structure, Construction, Tectonics," In *Structure in Art and Science*, edited by Gyorgy Kepes, 89. New York: Braziller, 1965.

Figure 6.11

Assembly of the Framework

Figure 7.1

Nest We Grow Project and Team

07
Nest We Grow | Kengo Kuma and Associates + College of Environmental Design at UC Berkeley

Architect Brief

Kengo Kuma, born in Kanagawa, Japan in 1954, is one of the most prominent Japanese architects of our time. Kuma graduated from the University of Tokyo in 1979 and continued his studies at Columbia University in NYC, where he published his first book entitled *10 houses* as an initial attempt to express his "non-style" architecture.[1] Then in 1990, he established his own office, Kengo Kuma and Associates, which emphasizes the revitalization of traditional Japanese values, such as the essential consciousness and science of the body, blended poetically with modern technological advancements. His efforts have led to many innovative uses of conventional Japanese materials in the modern technological era. Kuma has a strong desire to showcase how architecture can dissolve into an integral part of its surrounding to achieve a "one whole entity" mentality.[2] As such, instead of the typical approach to design, which treats architecture as an object, Kuma aims to design projects that create a harmonious connection between architecture and nature. He draws his inspiration from the surrounding context of the project while also placing a strong focus on material selection and the manipulation of light. This philosophical approach, which ties together the body and architecture is seen throughout his many projects and it is this attention to detail, when combined with various technological, philosophical and psychological methods that elevates Kuma's design to architectural poetry. Kuma has stated that:

> Space as the basic matter for architecture is changing. Architecture no longer deals with enclosed space or that of a city and its buildings but it also deals with psychological, virtual, or electronic space. I would highlight this as something we could call and approach as 'pure' architecture.[3]

Project Brief

The latest technological advancements can often take precedence over traditional techniques, which have been fine-tuned by centuries of craftsmen. It is important to note, however, that neither excludes the other. Instead it is the combination of innovative technology and local tradition which helps promote the evolution of architecture.[4] Such ideas are prominent in 'Nest We Grow', a collaborative endeavor between Kengo Kuma & Associates and a group of students from the University of California Berkeley. In 2014, Kuma mentored the students who were participating in a design/build studio that sought to create a structure that both celebrates the local community through renewable building methods and serves as a food orientated hub.[5] Located in the Memu Meadows Center of Hokkaido, Japan, Nest We Grow pays tribute to both the Japanese agricultural landscape and the traditional wood frame construction style of this area (Figure 7.2).[6] With an emphasis on environmental consciousness, the project acknowledges all the necessary steps needed to harvest food. The frame of the Nest serves a multimodal purpose allowing the local community to harvest, store, prepare, compose and even consume food throughout the year (Figure 7.3).[7] Overall, the building serves as a platform to reshape the community's knowledge about food harvest and, in return, strengthen the community. This project, which was honored with the top award in the 4th Annual LIXIL International Design-Build Competition, was a collaborative effort in which Kuma was able to influence the use of "natural materials to create airy, open rooms filled with sunlight" in order to achieve a festive relationship between food and the community and as a way to honor the community and the surrounding landscape.[8]

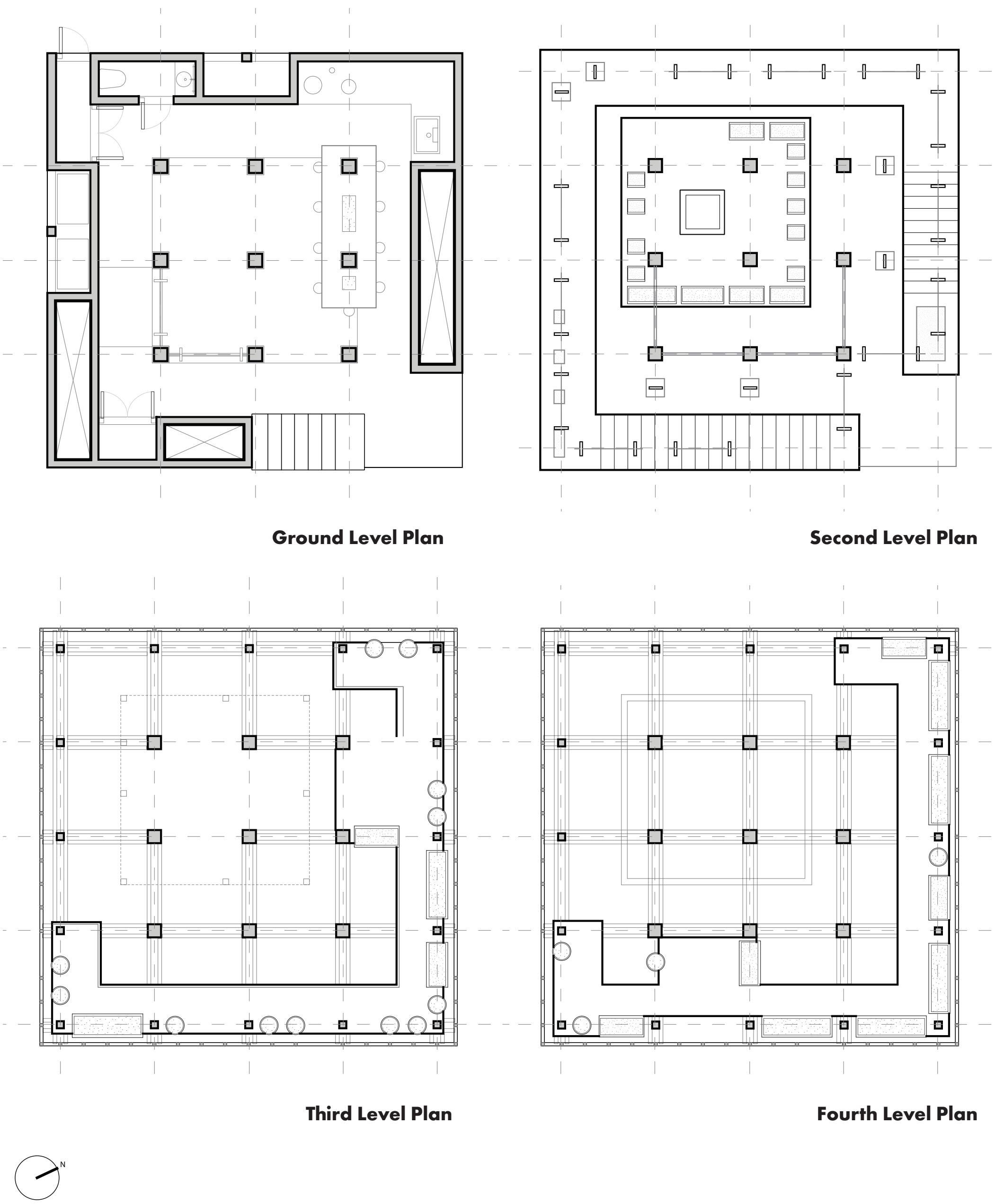


Figure 7.2

Floor Plans

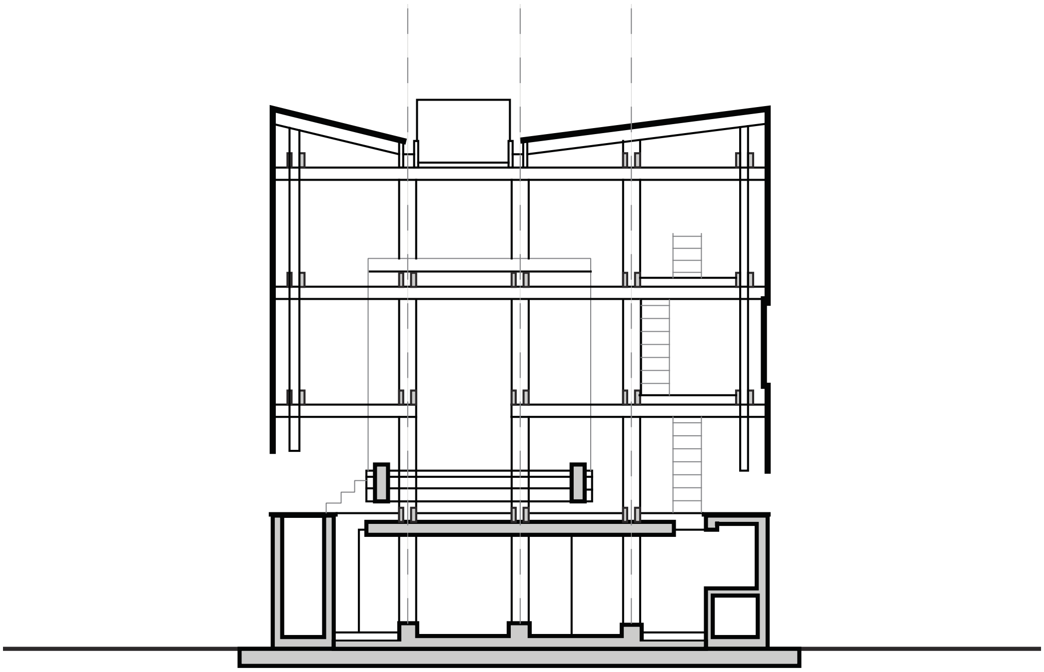


Figure 7.3

Section

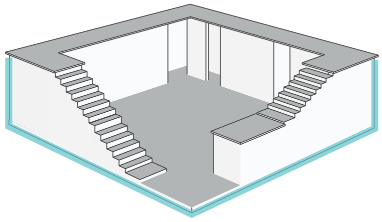
Building Section

Tectonic Principles

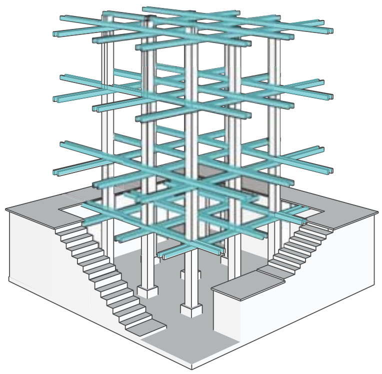
Anatomy

Nest We Grow is a rigid -timber frame, designed to both resemble a forest and to pay homage to traditional Japanese structures. Additionally, the construction palette was comprised of local materials, such as wood and straw bale to reflect the natural surroundings of the project's site (Figure 7.4). The ground level of the building utilizes rammed earth walls and straw bale construction to compose a solid base that wraps around a framework of nine columns. These nine columns, made of composite timber, are anchored with concrete footings to the earth. Each of these nine columns are composed of four smaller members, which are attached together using steel plates.

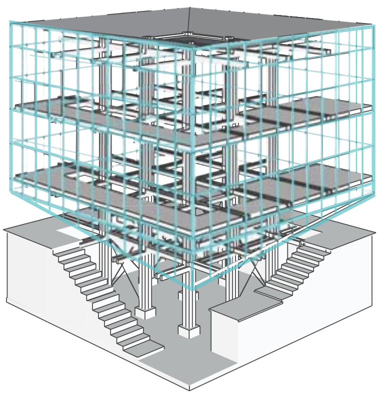
The real strength of this structure is developed in the moment connections established between the columns and the sets of paired beams that form the structure of the building's floors (see detail analysis below) (Figure 7.5). This floor system as a whole helps define the levels of the project while also offering resistance to lateral loads on the building. In addition to these beams, the first floor utilizes steel cross bracing connection points within the timber frame and the upper levels contain catwalks, which help to stabilize the frame. At the perimeter the framework, the façade's membrane is hung off the periphery of the grid of beams. The bottom of this façade system then hovers above the rammed earth construction, giving the illusion that the upper levels of the Nest float above the base. The enclosing membrane is made up of translucent plastic corrugated sheets that protect the interior spaces from elements such as harsh northwestern winds.[9] In addition, the plastic allows for penetration of light, which is essential for the growing of crops inside the building, and functions to stabilize the interior temperature through the harsh winters, thus extending the seasonal usability of the Nest.



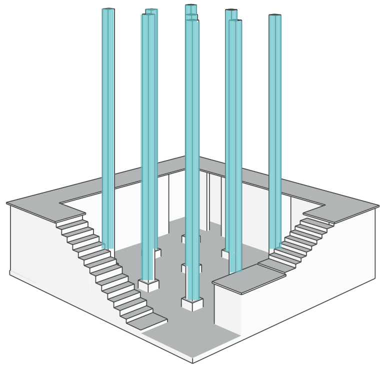
1: Earthwork | Foundation
Rammed earth wall and straw bale construction act as the foundation of the structure.



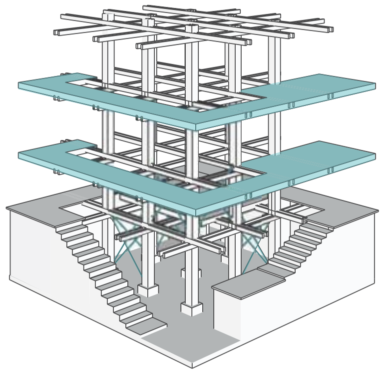
2: Framework | Columns
Located at the heart of the project are 9 timber composite columns anchored in concrete footings.



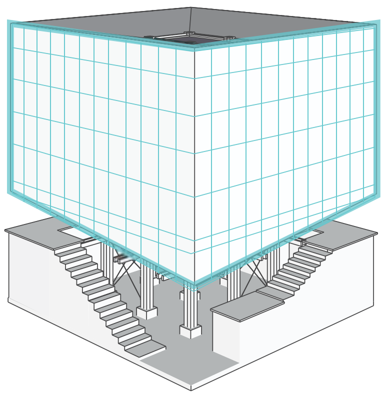
3: Framework | Beams
Beams then run parallel to the columns in moment connections to create the structure of the project.



4: Framework | Lateral Bracing
Cross-bracing is added to the lower level and catwalks are added to the upper layers to achieve stronger lateral bracing.



5: Framework | Beams
Beams then run parallel to the columns in moment connections to create the structure of the project.



6: Enclosure
The floating framework is then enclosed with corrugated plastics which protects the interior from the elements.

Figure 7.4

Anatomy

Figure 7.5

The gathering of the nest

Space

Starting early in the development process, the goal for the project team was to sculpt a design that highlighted the process of cultivating food. This effort is made apparent in the relationships between space, construction and function found in the building. Karl Botticher, a German professor in architectural tectonics, promotes a similar theory in which he states that the needs of the inhabitant significantly influence the construction of space. He states that "the first matter that has to be dealt with in our examination is the concept that lies behind the spatial organization of the building."[10] Nest we grow shows a great understanding of this spatial concept while also adding to the spiritual connection to the surrounding landscape.

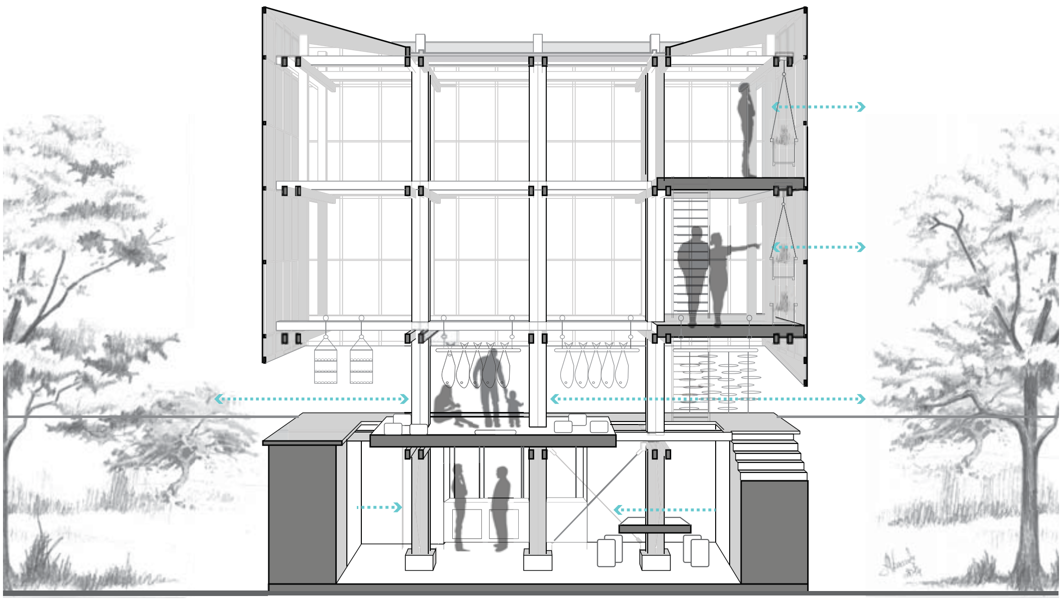


Figure 7.6

Interior/Exterior relationship

The project itself promotes the ability to grow, harvest, store, cook, eat, compose, interconnect and learn from community participation (Figure 7.6). At the ground level the Nest serves a more intimate function in which the interior space is enclosed by a solid foundation of rammed earth walls, which serve to not only protect the inhabitants from exterior conditions but also provided an ideal space to store, prepare, and grow food (Figure 7.7). The foundation walls are essential for this space because embedded inside of the foundation walls are ample storage options and also the kitchen utilities that allow for food to be cooked. As we proceed up to the next level of the building, utilizing stairs protruding from the foundation walls, we arrive at the "hearth" of the project: a central fireplace. This element and the space in which it resides, creates the perfect stage for people to gather to share stories and knowledge. It sits in a void that is expressed in the wooden framework. The purpose of this element is to strengthen the relationship with the surrounding landscape while enjoying the sense of community within the heart of the nest.

Figure 7.7

Food preparation area

The upper levels of the Nest then contain a combination of exposure and enclosure that is greatly dependent on the membrane of the building. The membrane of this project is composed of translucent plastic panels which protect the user from environmental conditions. Some of these panels located on the membrane and roof are designed to slide to allow sunlight and air to flow into the building. These areas of the building are for harvesting and growing food. In addition, the sloped roof of the structure is able to harvest rain water and snow. As the roof collects water, it distributes it to reservoirs located in the foundation walls. From there the water is used to water the plants throughout the nest. This project is designed primarily as a cycle, causing its form to be derived from the choreography of spaces that responds to the needs of the community and giving life to the "Nest."

Detail

As mentioned in the previous section, the structural system of Nest We Grow is bound together by a repeated moment connection between the primary structural compound columns and paired system of beams, creating a rigid wooden frame. This unique connection becomes a catalyst for the rest of the project; the critical detail is repeated and creates an aesthetically pleasing moment that can be described as art (Figure 7.8). In his essay "The Tell-the-Tale Detail," architect and educator Marco Frascari wrote:

> Architecture is an art because it is interested not only in the original need of shelter but also in putting together spaces and materials in a meaningful manner. This occurs through formal and actual joints. The joint, that is the fertile detail, is the place where both the construction and the construing of architecture take place.[11]

The connection begins by bundling together four individual 155 x 155 millimeter (6 x 6 inches) glulam component columns that make up each of the nine compound columns (Figure 7.9). Each component column contains two s-shaped notches, dimensioned at 305 x 75 x 255 millimeters (12 x 3 x 10 inches) that are alternated 90 degrees from the center, so that when bundled together, the notches are adjacent, creating a place in which the beams can reside. The notches occur at each floor of the structure, with four notches total per component column. Once the smaller columns are orientated correctly, two s-shaped steel plates are used within the notches to assemble the bundled columns. The paired beams are then introduced to the system, sitting in the notches in the columns and creating a flush finish for the structural system. The repetition of this moment connection creates a strong grid from which the rest of the structure is hung. Kengo Kuma is a master for his innovation in the "union of construction" with poetic design and attention to the smallest detail, which expresses not only the characteristics of materials but the strength of Japanese tradition.[12]

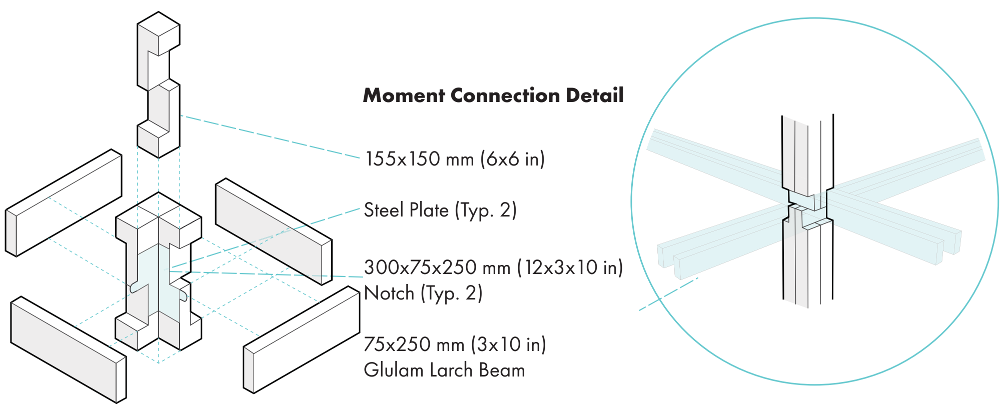


Figure 7.8

Moment Connection Diagram

Figure 7.9
Moment Connection Frame

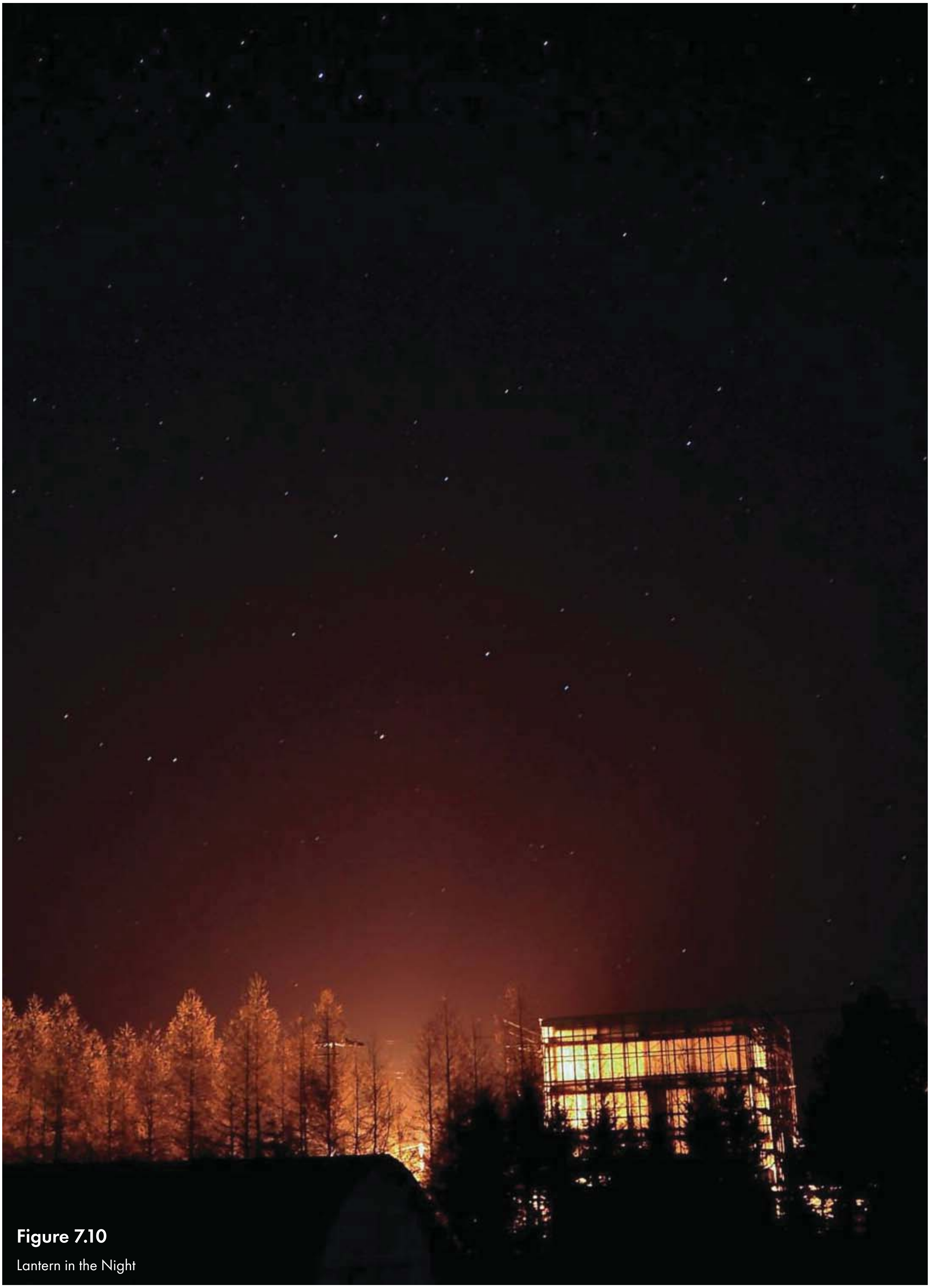


Figure 7.10

Lantern in the Night

Additional Resources

Projects

Yusuhara Wooden Bridge Museum Technical Information
Horai Onsen Bath House
Japan House São Paulo

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Kengo Kuma: Complete Works, Kenneth Frampton

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Figure 8.1
View from the Ocean

08
Sea Ranch Condominium One | MLTW

Firm Brief

The Berkeley, California based firm of MLTW (Charles Moore, Donlyn Lyndon, William Turnbull, Richard Whitaker) was founded by the partners in 1962, existing for only eight years before disbanding in 1970. Moore, Lyndon, and Turnbull all met while studying architecture at Princeton University. Whitaker, a faculty member at the University of California in Berkley, was introduced to the group when they were hired to teach at the university. As faculty members, the group wanted to design buildings that they could utilize for lessons in their classes. Creating eloquent relationships between buildings and their surroundings was one of the firm's aspirations and an attribute that the group wanted to pass onto their students. It is here that the link between the firm's principles and the partner's teaching philosophies, start to overlap. After the separation of the partnership, Moore and Turnbull started their own firms and continued to focus their careers in the professional world while Lyndon and Whitaker chose to return to academia to focus on teaching.

MLTW referred elements of their design to the human body and emphasized the importance of people within their projects. Interaction with the structure and generating human connections within the spaces was significant to them. The firm molded spaces that allowed for diverse use and produced confidence in ownership.[1] Charles Moore stated, in the 1977 work *Body, Memory, and Architecture*, "...that the architect should be devoted to the "'task of understanding the potential of a place and the possibility of dwelling in it, of experiencing it with all the senses, of feeling it and remembering it and making it the center of a whole world.'"[2]

Project Brief

Sea Ranch Condominium One was constructed in 1965 in Sea Ranch, California and serves primarily as vacation and weekend houses for the owners of its ten units (Figure 8.1). Each unit is about 1,000 square feet (93 square meters) and consists of one bedroom, one and a half bathrooms, a kitchen, and sitting areas. All the units share a similar layout, but no two are analogous.

The project's site and environmental conditions proved to be a concern for the architects. Lawrence Halprin, the landscape architect on the project, had to overcome a number of varying slopes in the topography. While challenging, this landform also provided ample design opportunities. The steeper slopes of the site were used to generate views for the units and the flatter portions were utilized to introduce vehicles onto the site, as well as to host a car courtyard.

Figure 8.2

Entrance to the Community Courtyard

Figure 8.3

Plan of the Ten Units

Outdoor spaces were created through careful arrangement of the units, first studied by the architects using simple sugar cubes. In the final configuration, there are two courtyard spaces. One is a community space for the residents and the other is the car courtyard (Figure 8.2). The community aspect was important to the architects, so they created an exterior space that linked all the units implying a communal use. "In their 1974 book *The Place of Houses*, the architects confessed that 'the condominium building was the initial attempt to make a community.'"[3] Although community was the focus, privacy also needed to be addressed for the residents. Privacy played an important role in this project because the units were placed so close together. The units were arranged, so each does not have a direct view into another. In order to allow the units to have both a view and privacy, ***Saddlebags*** are introduced to the units, which create sunlit spaces in-between the units with seating for the owners to have a view of the sea.

saddlebag: piece that is extended at the sides with ***outshots***, lean-tos

outshot: the extension of a building under a lean-to roof

The design of Sea Ranch creates a composition in which ten separate living units act and feel like a cohesive composition, unified by a single sloping roof plane (Figure 8.3). The angle of the shed roof of the structure also serves to obstruct the harsh winds coming off the ocean. Additionally, a hedgerow was fashioned on the Northeast side of the condominiums to help control the robust wind gusts that inundate the site.

On the interior, the kitchen and bathrooms are stacked in a wooden enclosure that visually links the first and second level of each unit (Figure 8.4). Unlike these service spaces, the rest of the interior is organized to accentuate the living areas. Seven out of the ten units also contain a two-story ***aedicule*** that lofts the sleeping area to the second level on a four-post structure. Beneath the lofted bedroom, there are sitting pits, which provide a central hearth and fireplace for the home.

aedicule: an opening such as a door or a window, framed by columns on either side, and a pediment above

Unit 1

Figure 8.4

Section Perspective of a Unit

Tectonic Principles

Place

In *Twenty-Five Buildings Every Architect Should Understand*, author Simon Unwin, explains that, "[t]he avowed aim of the architects [of Sea Ranch Condominium One] was to identify a place in a direct and simple way, without extravagance or show, in harmony with surrounding conditions."[4] Here, Unwin outlines the architects' plan to contextualize Sea Ranch. They achieved this feat by applying the concept of a fishing village to the layout.[5] Fishing villages are typically laid out to have each unit closely knit to the others and oriented in relation to the surrounding water or landscape, just as the units are in Sea Ranch Condominium One. MLTW joined the units to form a simple shared space and create a community impression that is commonly represented in the precedent of the villages.

Kenneth Frampton, architectural theorist and author of *Studies in Tectonic Culture*, stated, "Situated at the interface of culture and nature, building is as much about the ground as it is about the built form."[6] He thought that it was important that architecture took into consideration the earth and the impact the characteristics of the site can have on the structures it receives. At Sea Ranch, Halprin focused on preserving the existing landscape. "One of Halprin's precepts for the whole development was that it should damage the land and its appearance as little as possible.", stated Unwin.[7] In order to try and adhere to that, the building's form follows the topography by stepping the units down the slope (Figure 8.5). The columns rest on concrete foundations and the system varies to conform to the slope of the site (Figure 8.6).

Figure 8.5

Slope of the Site in Contrast with the Building

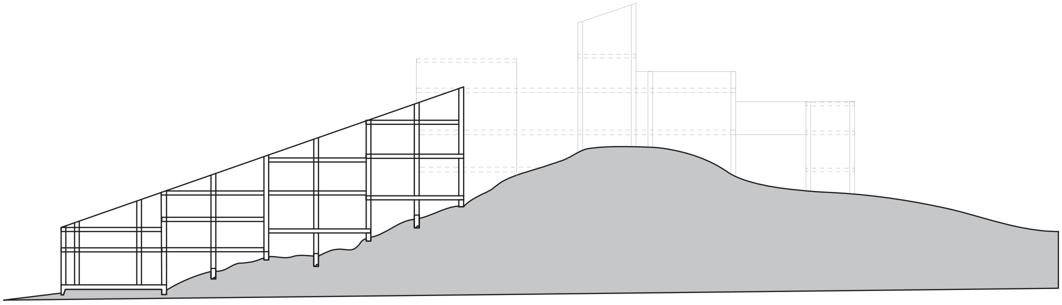


Figure 8.6

Relationship of Building Structure and Site

Tectonic

In *Studies in Tectonic Culture*, Frampton writes:

> Semper would classify the building crafts into two fundamental procedures: the *tectonics* of the frame, in which lightweight, linear components are assembled so as to encompass a spatial matrix, and the *stereotomics* of the earthwork, wherein mass and volume are conjointly formed through the repetitious piling up of heavyweight elements.[8]

Per Frampton's definition, the skeletal frame structure of Sea Ranch Condominium One is accurately a tectonic construction. The building is supported by a heavy timber structure that employs post-and-beam construction principles and which is clad with redwood panels harvested from the surrounding forest. According to Lyndon, "The timber framing of local barns informed the way the condominium was built..." (Figure 8.7).[9] Six columns were placed along the edge of the structure, but the four columns that would typically be positioned in the corners were shifted inward, allowing the corners to be open (Figure 8.8). ***Girts*** that support each other through cantilever, were then bolted to the exterior face of the columns. Bracing is connected between the girts and columns to solidify the structure against lateral forces, such as earthquakes and wind. The redwood panels are attached to the exterior of the wood frame in a vertical orientation and serve as a finish material for the external facades. Eduard Sekler, architectural historian and author of *Structure, Construction, Tectonics*, stated, "Thus structure, the intangible concept, is realized through construction and given visual expression through tectonics."[10]

girt: a horizontal structural member in a framed wall

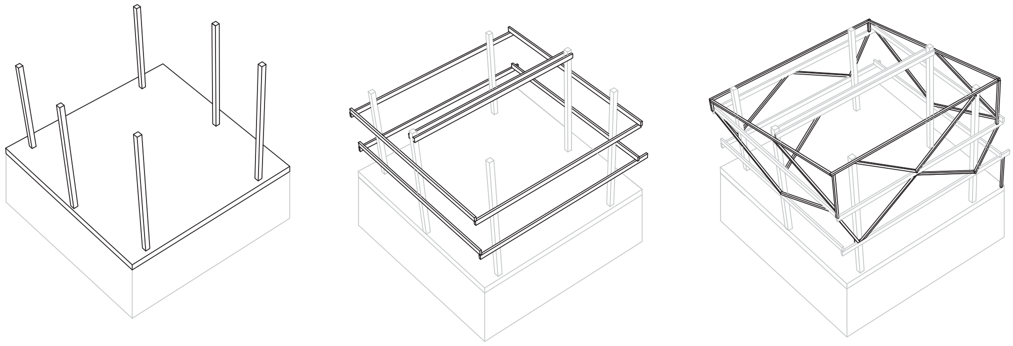


Figure 8.7

Timber Frame Construction

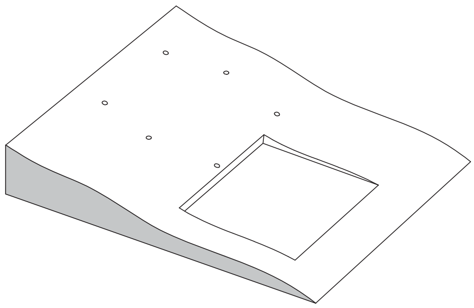
Figure 8.8
Column Receded from the Corner

Metal plates bond the columns to the concrete foundation that supports them. The angles of the connecting members in the rest of the structural system, however, varied, so a connector was developed for the bracing that could account for the variation. The connector was a 36 inch (91 cm) metal disk that could be manipulated on site, accommodating any angles required during construction. After being manipulated, it was then nailed to the structure to create stable connections between the members. The exterior cladding utilized a tongue and groove profile to increase stability while also being nailed to the structure.

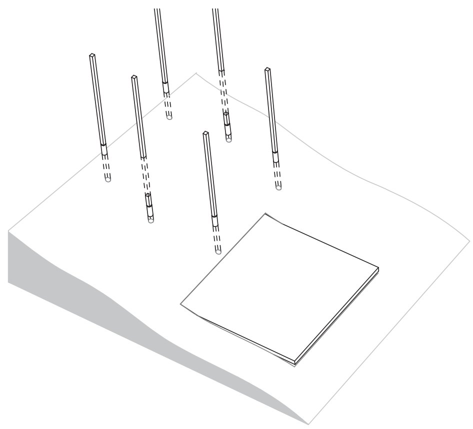
Anatomy

> Throughout all phases of society the hearth formed that sacred focus around which the whole took order and shape. It is the first and most important, the *moral* element of architecture. Around it were grouped the three other elements: the *roof*, the *enclosure*, and the *mound*, the protecting negations or defenders of the hearth's flame against the three hostile elements of nature.[11]
>
> - Gottfried Semper, *The Four Elements and Other Writings*, 2010

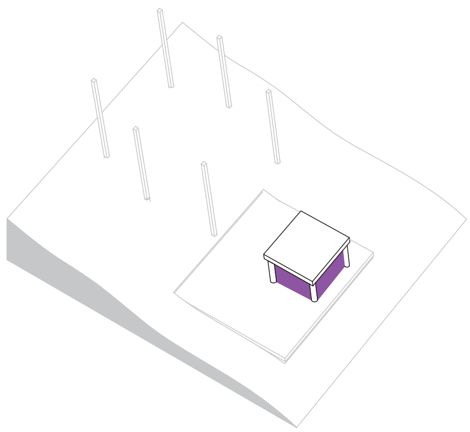
The earthwork of the Sea Ranch Condominium One consists of drilled holes for the foundation and groundwork for a concrete slab (Figure 8.9). The construction of this project began with the foundation system, anchored into the earth with 12 inch (30.5 cm) piers, establishing the connection between the site and foundation. The piers towards the middle of the building receive wooden posts that then attach to the floor framing underneath the units. The four outer columns of each unit pierce through the wood frame and attach to the piers at grade. The hearth of each unit, positioned underneath either an aedicule or mezzanine, contains a sitting pit and a fireplace, which ¬symbolize the "heart" of the unit and unify the distinct spaces of the residence. "The space under the sleeping platforms is cozy and tight compared to the rest of the unit, and this feeling is heightened by the inclusion of [the] fire place,"[12] wrote architect, William Turnbull, Jr. in *Global Architecture Detail* (Figure 8.10).



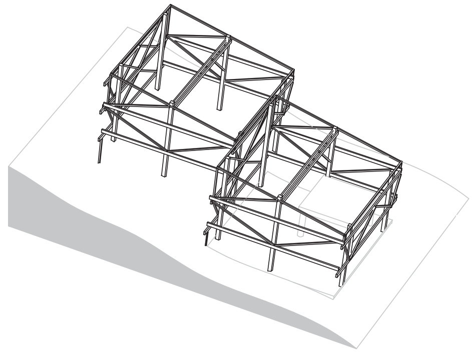
1: Earthwork
The site is lightly touched, to avoid damage and to overcome the slope variation.



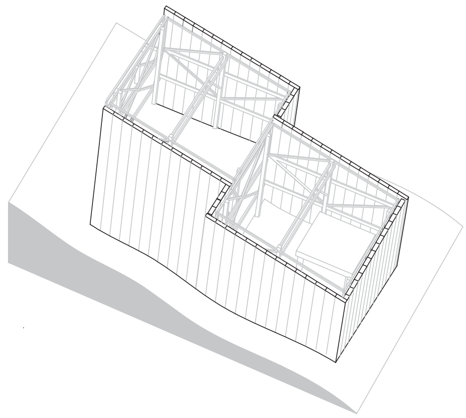
2: Foundation System
The piers puncture the earth to connect the units to the site and the three lower units contain concrete slabs.



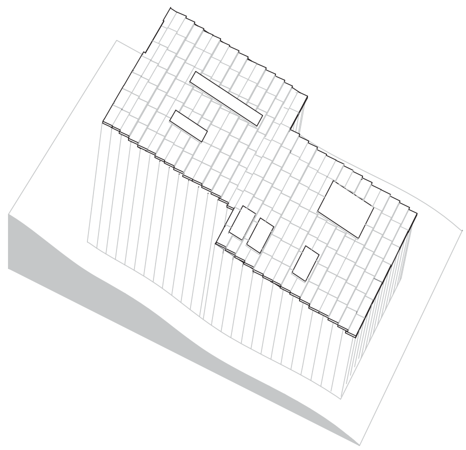
3: Hearth
Underneath the aedicule is where the heart of the units is located.



4: Framework
The units are a heavy timber structure, that are constructed of columns, girts, and bracing.



5: Enclosure | Cladding
Redwood panels are bolted on the exterior of the structure to construct the facade.



6: Roof
Skylights are utilized to highlight the structure and portray the location of the hearths.

Figure 8.9

Anatomy

A framework of heavy timber surrounds the hearth and defines the space of the living unit. The columns of this framework differ in height, creating the slope in the roof system. Vertical redwood panels, as mentioned in a previous section, make up the primary enclosure system of Sea Ranch and are located on the exterior surface of the framework. Overhead, skylights puncture the roof at significant points, including directly above the aedicule signifying the hearth's location. At the highest point of the roof's slope, skylights are also centered on the columns below to celebrate the structure of Sea Ranch.

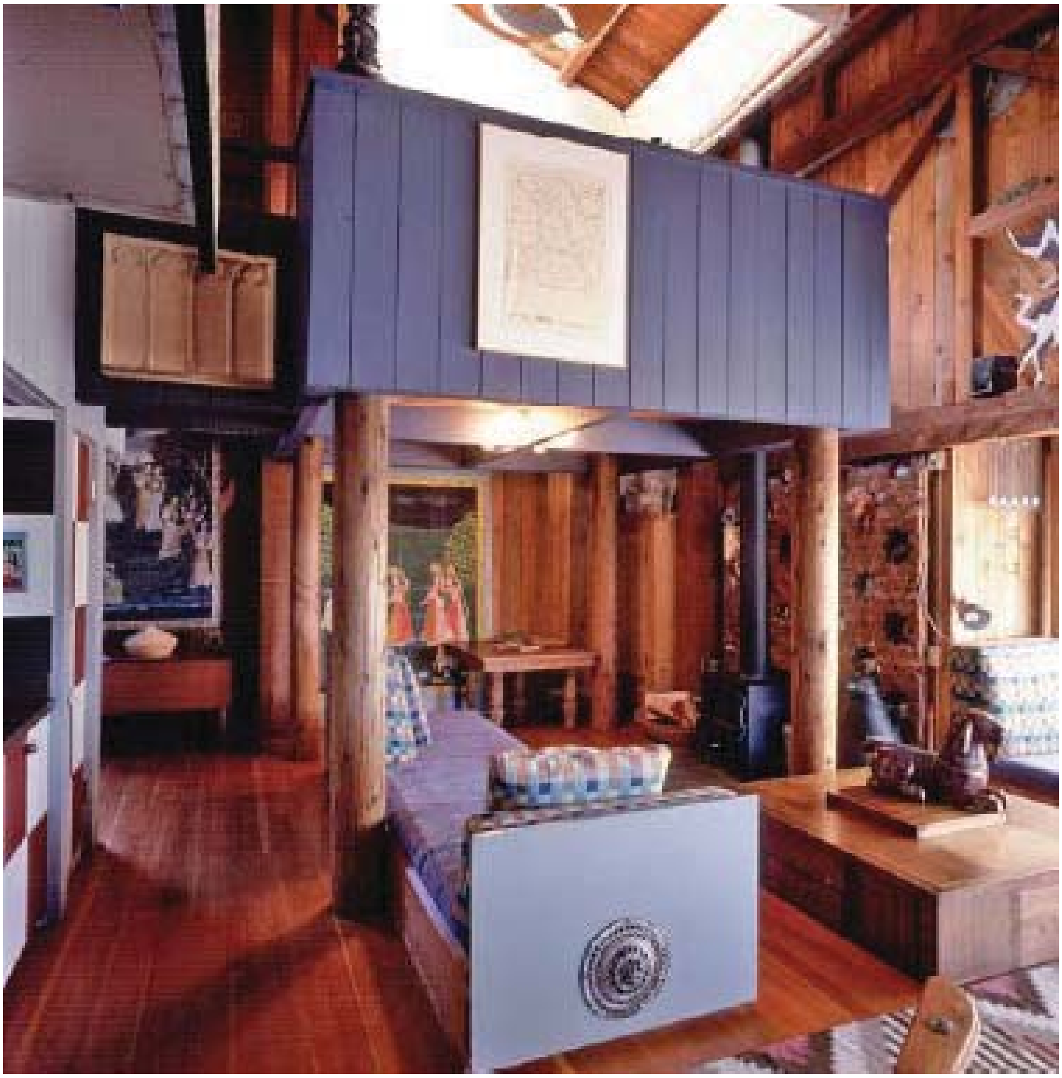


Figure 8.10

Unit Nine Aedicule and Sitting Pit

Additional Resources

Projects

Lawrence House, Sea Ranch, California, 1966

Budge House, Healdsburg, California, 1966

Moore House, New Haven, Connecticut, 1967

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[2] Charles Moore and Kent Bloomer, In *Body, Memory, and Architecture* (New Haven: Yale University Press, 1977), 138

[3] Simon Unwin, *Twenty-Five Buildings Every Architect Should Understand* (New York: Routledge, 2015), 155

[4] Ibid.

[5] Ibid.

[6] Kenneth Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge: The MIT Press, 2001), 27

[7] Unwin, *Twenty-Five Buildings Every Architect Should Understand*, 156

[8] Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture*, 5

[9] Donlyn Lyndon, *Journal of Architectural Education* (2009), 84

[10] Eduard Sekler, In *Structure in Art and Science*, Edited by Kepes (New York: Braziller, 1965), 4

[11] Gottfried Semper, In T*he Four Elements and Other Writings*, edited by Harry Francis Mallgrave and Wolfgang Herrmann (New York: Cambridge University Press, 2010), 102

[12] William Turnbull, Jr., *Global Architecture Detail* (Tokyo: A.D.A EDITA, 1963-69), 5

Figure 9.1

Interior View of Wall and Roof Construction

09
Shelter for Roman Ruins | Peter Zumthor

Firm Brief

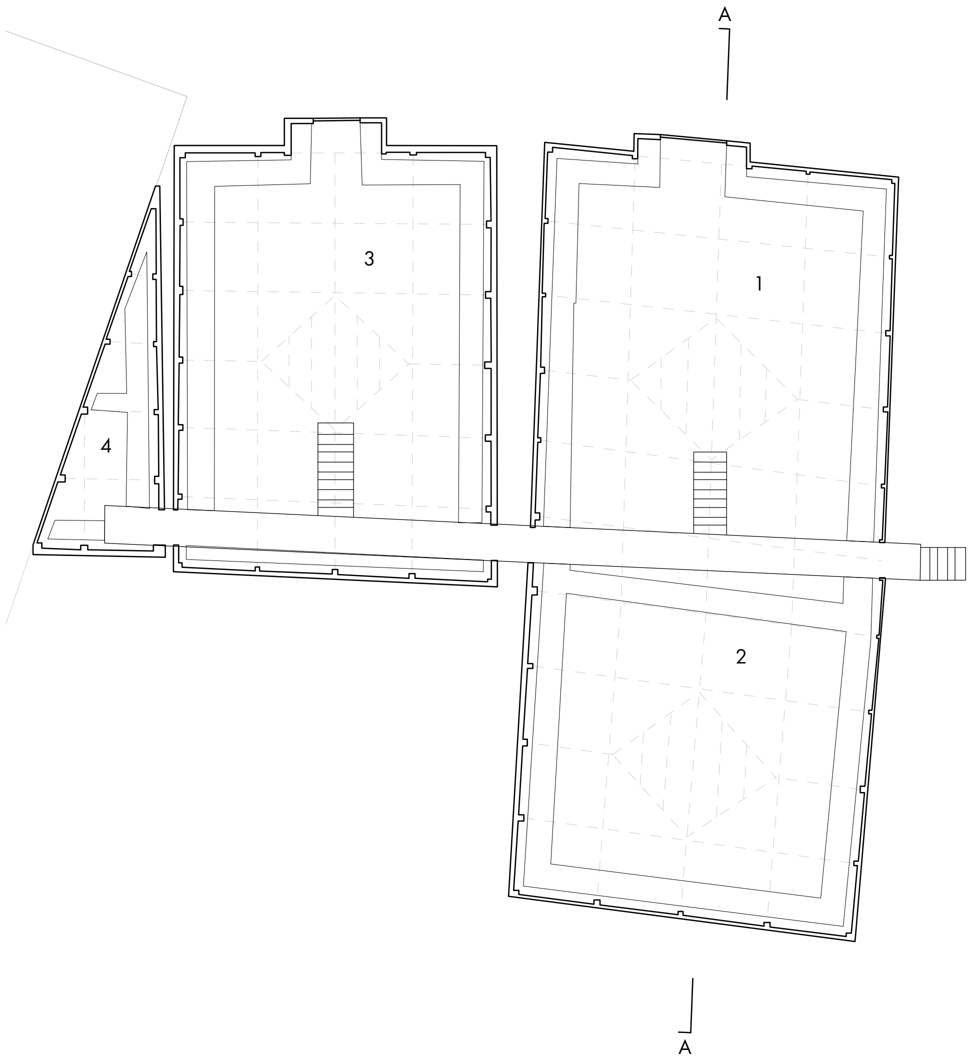
As a cabinetmaker's son, Peter Zumthor had an early understanding of craft and materials. He took his experience and turned it into an education first in his hometown and later as an exchange student studying industrial design and architecture at Pratt Institute in New York. Zumthor first started practicing architecture by doing historic restoration projects before founding his own firm in 1978. Atelier Zumthor is located in Haldenstein, Switzerland and operates with a staff of thirty. Although his practice is modest in scale, Zumthor has been the recipient of many prestigious awards, including the 2009 Pritzker Prize and the 2013 RIBA Royal Gold Medal. These awards are testaments to his lifelong architectural achievements.

Zumthor's career has been based around his ability to work with materials and to understand the role of craft in the process of making architecture. In his essay, "A Way of Looking at Things," Zumthor says this about Joseph Beuys' use of materials: "It seems anchored in an ancient, elemental knowledge about man's use of materials, and at the same time to expose the very essence of these materials which is beyond all culturally conveyed meaning."[1] With that in mind, Zumthor strives to use materials that offer a poetic quality to any architectural work. However, because materials are not inherently poetic, it is the architect who creates any meaningful situation for them. He breaks from the palpable rules of composition by not defining materials in terms of smell and acoustic quality. Rather he designs with the intent that a material in one location is perceived differently than when situated in another location.

Project Brief

While Peter Zumthor may have gained international acclaim for Therme Vals, a decade earlier he completed one of his less recognized masterpieces: The Shelter for Roman Ruins. The shelter serves as a protective enclosure for colonial Roman ruins dating back to 4AD. The site, located in Chur, Switzerland not far from Zumthor's studio, consists of the foundations of ancient roman houses. Zumthor's concept for the shelter was to align the structure with the existing foundations to provide visitors a sense of scale of the preexisting buildings. The design scheme utilized the existing geometry of the nearly square foundations to form the groundwork of the shelter (Figure 9.2).

Along the modern street edge, where the physical entrances once were, is a visual portal into the past. This portal gives passersby a glimpse into the shelter, but restricts access. Located on the East façade is the new entrance. Zumthor placed the entrance on the side so that he could form a clear axis running through each volume of space. "The treatment of the entrances represents a play on the relationship between history and the present."[2] The stairs leading up to the steel door do not touch the

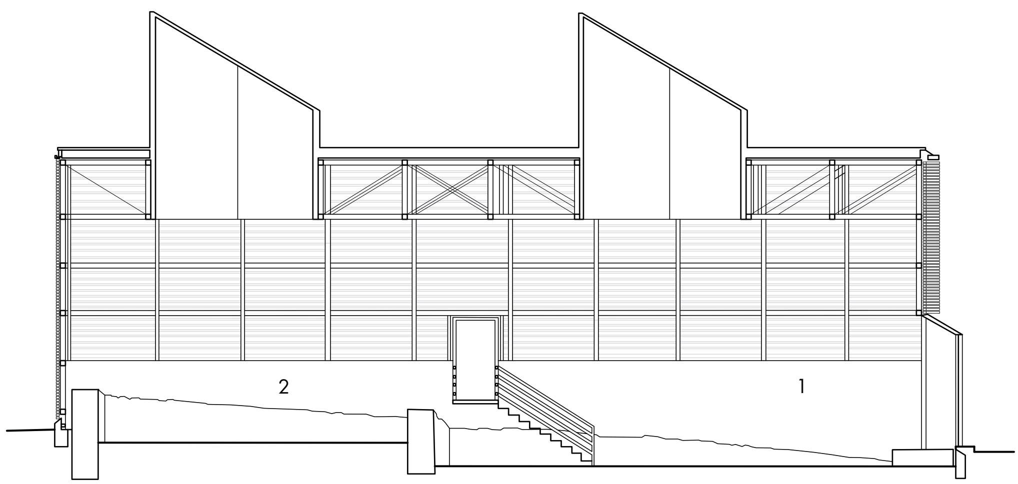


Legend

(Public) East Ruins 1
(Private) East Ruins 2
Central Ruins 3
West Ruins 4

Figure 9.2

Floor Plan



Legend

(Public) East Ruins 1
(Private) East Ruins 2

Figure 9.3

Building Section

ground and aid in Zumthor's idea of separating the past from the present. After stepping through the metal door, the individual is greeted by the open volume of the interior. This gesture is perceived by the free exchange of light, sound, and air flowing through the timber lamella walls.

Zumthor aligned the primary circulation axis with the building entrance. Visitors walk on an elevated path above the ruins. Two breaks along the walkway allow visitors to step down into the ruins. Zumthor again plays with the separation of old and new by lightly touching the ground with the steps coming off the circulation path (Figure 9.3). The stone of the ruins contrasts with black fabric, which has been draped on the enclosure behind, and the entire space is bathed in zenithal light flooding from above.

Tectonic Principles

Stereotomic | Tectonic

The majority of this project is comprised of tectonic construction. Timber posts and beams are the primary structural system, and timber slats are the primary cladding. Even though timber is usually associated with tectonic construction, this building can give the impression of being both stereotomic and tectonic. From the exterior, the tightly spaced wood slats give the shelters a dense aesthetic. Adding to this density is the weathering of the wood, as over time the cladding has patinaed to an earthy grey. This neutral color begins to blur together with the shadows in between the slats limiting any depth in the façade.

The perception of a stereotomic box from the exterior is contrasted by the atmosphere the cladding provides on the interior. The tectonic nature of the shelters is expressed as light and air pass through the façade. Unlike on the exterior, the lamella wall does not weather as significantly on the inside, where the wood has retained its natural orange color (Figure 9.4). When light hits the interior wood, the space is filled with a warming glow. The effect is enhanced at night. The interior lights shine through the cladding and reveal the tectonic nature of the enclosures (Figure 9.5). In effect the Shelter transitions from a heavy box to a delicate shell.

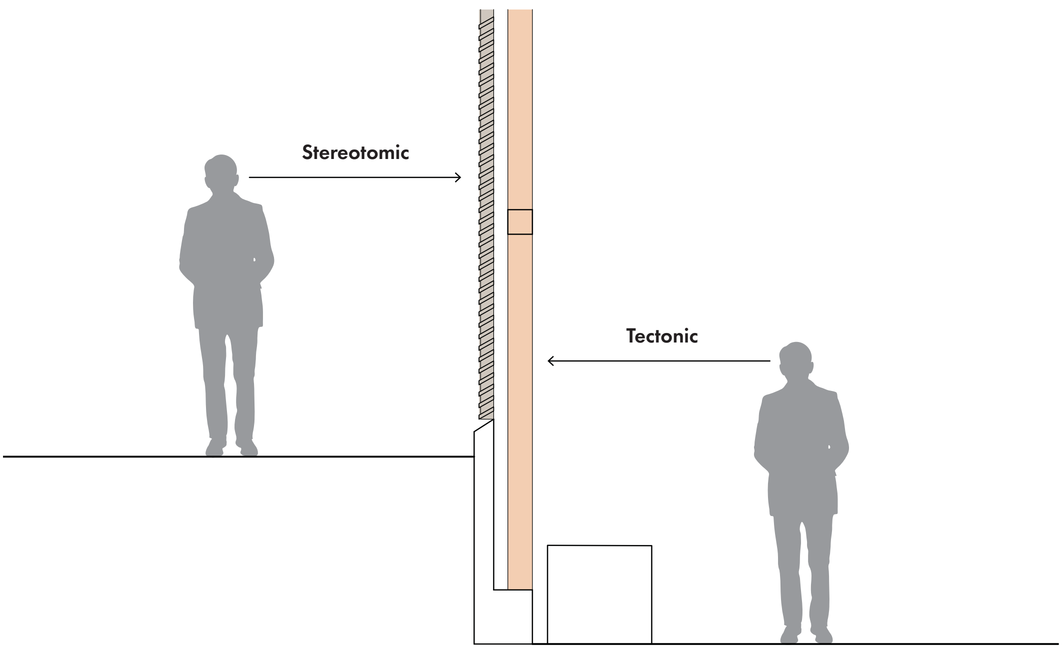


Figure 9.4

Perception of Stereotomic vs. Tectonic

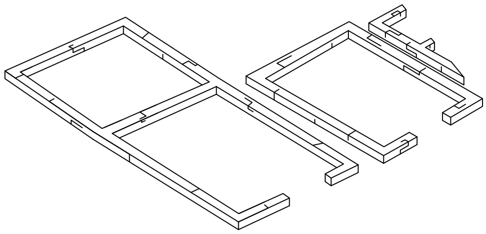
Figure 9.5
Exterior View of
Facade at Night

This duality of construction is Zumthor's tectonic statement. Eduard Sekler, a 20th century architectural historian and professor, defines a tectonic statement as, "...the noble gesture which makes visible a play of forces, of load and support in column and entablature, calling forth our own empathetic participation in the experience."[3] From the stereotomic exterior perspective, the shelters have an appearance of resting on the ground. Then on the tectonic interior perspective, the timber frame expresses the true nature of visible forces. This shift in perception from outside to inside makes one empathize with the nature of the shelters; the protective enclosure wrapped around an experiential space.

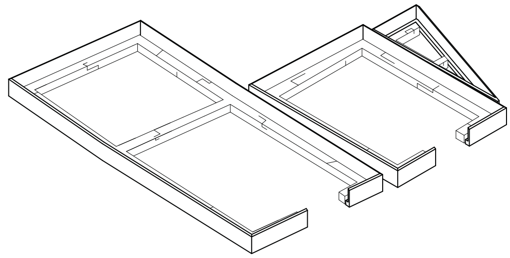
Anatomy

Many architects have addressed the classification of architectural elements as part of their theoretical approaches to design. One of those architects, Gottfried Semper, was a German who is known for his theory of the four elements of architecture. He based his work on the study of a Caribbean hut and identified the hearth, earthwork, roof, and enclosure as its basic elements. In his system, Semper believed that the earthwork, framework, and cladding serve to protect the hearth or social and cultural center of place.[4]

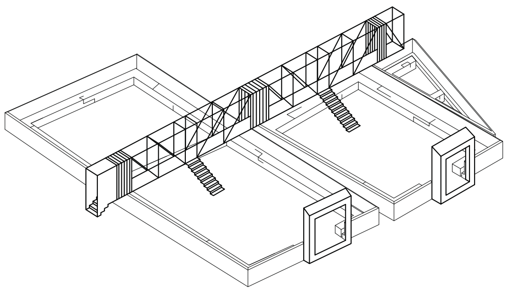
This notion of protection is brought to life in the shelter's metaphysical nature. The ruins are the hearth and find safety and protection through the other architectural elements (Figure 9.6). The first line of defense is the earthwork. This element takes the form of a concreate foundation offset from the ruins. The foundation functions as a retaining wall holding back the unexcavated soil from the archaeological site. To bridge the gap over the earthwork and the hearth, Zumthor introduced a steel footbridge. The footbridge is a metal framework that shapes the circulation path. The next major element is the timber framework. This framework defines the interior volume of the shelter. In addition to shaping space, the timber framework supports a black fabric, which visually separates the timber framework and earthwork from the ruins, creating a transition between new and old constructions. Cladding the framework are horizontal timber slats. The downward angle of the slats and narrow spacing prevents the penetration of harsh environmental elements to the interior environment and to the ruins.



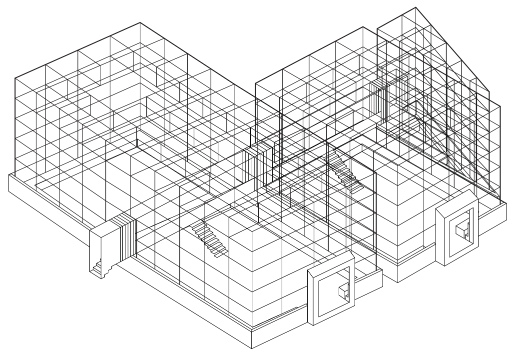
1: Hearth
Roman ruins are the driving cultural factor shaping the design.



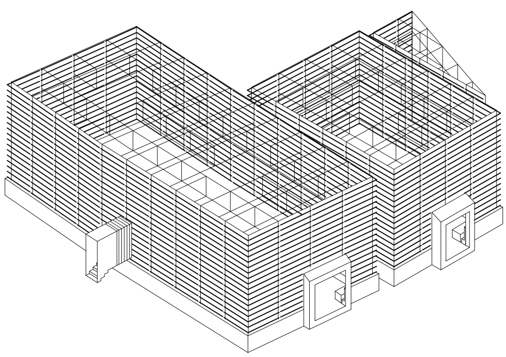
2: Earthwork
Concrete foundation walls hold back soil and provide base for framework.



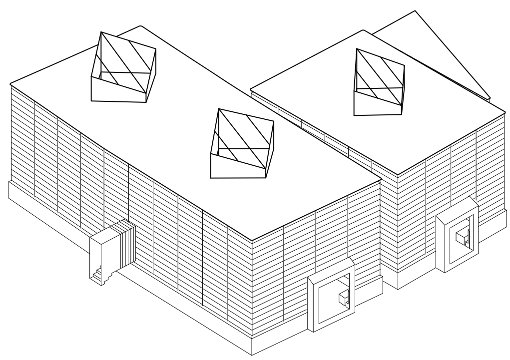
3: Framework | Steel
A steel foot bridge shapes the main circulation path and steel boxes frame visual portals along the street.



4: Framework | Timber
Timber columns stand on the concrete foundation and begin to form the interior volume.



5: Cladding
The exterior facade provides shelter for the ruins with timber lamella walls.



6: Roof | Skylights
Skylights are inserted into the roof above the center in each block of ruins. The two close to the street facade highlight the junction between the footbridge and ruins.

Figure 9.6

Anatomy

Another individual who contributed to the theory of architectural tectonics was Karl Bötticher. He viewed the roof as the driving factor for the form to a building.[5] The Shelters for Roman Ruins contradict Bötticher's view. The irregular geometry of the ruins forces the earthwork and framework to mold around it. The roof then follows the shape of the framework. Nestled into the roof are three rhomboid skylights. The two skylights on the North highlight the intersection of the steel framework and the ruins. Located above this metaphoric meeting of past and present is a zenithal light emphasizing a harmonious union between each element of the building (Figure 9.7).

Figure 9.7

Skylight over Ruins

Detail

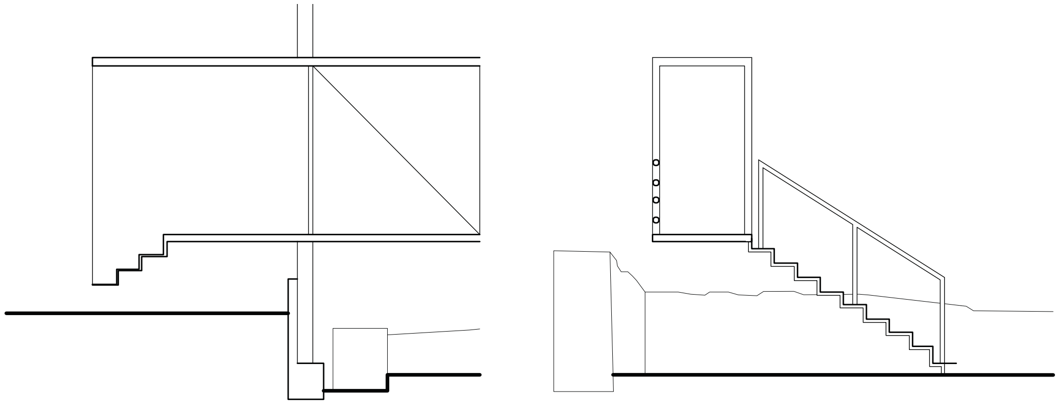
> Buildings are artificial constructions. They consist of single parts which must be joined together. To a large degree, the quality of the finished object is determined by the quality of the joints.[6]
> - Peter Zumthor, *Architecture and Urbanism*, 1998

When a building is constructed, it is built using joints. Marco Frascari, an Italian architect and theorist, describes two types of joints in his essay "The Tell-the-Tale Detail." The first type is a material joint like the connection between column and beam. The second joint is more formal in nature like the threshold between the interior and exterior of a building.[7] In Zumthor's project, the circulation path is a formal joint. From the exterior the shelters are easily identified as being grounded to the site. On the east side of the building, however, the entrance is visible. The visitor is greeted with a projecting steel box, which breaks the continuity of the timber slats wrapping the volumes. The entrance is identifiable as significant for two reasons: a change in materiality and a disconnect from the ground plane. It is the second factor that is most striking. The steel box enclosing the entrance projects out of the wall and forms the steps (Figure 9.8). This floating architectural element, which meets the ground in virtually all architectural works, provides the connection between outside to inside.

A similar strategy is used on the interior. Branching off the main circulation path are two sets of steel stairs, which descend into the ruins. These interior stairs appear to hover above the ground and their metallic color contrasts with the wood structure and the ruins themselves. Unlike the exterior stair, the interior stairs have no ability to create the cantilevered condition required to support themselves in the air. Therefore, they do have steel supports which are tucked behind their face and hidden in the stair's shadow (Figure 9.9). These details express meaning. Frascari said, "The geometrical structures embodied in the architectural details do not state facts but rather provide a structure for stating facts within a 'scale.' They give us a way of making comparisons that meaningfully relate visually perceived architectural details."[8] The visual perception of floating stairs both on the interior and exterior is a sign of respect to the ruins. The stairs avoid a collision between past and present by creating a formal joint visually linking and separating the two.

Figure 9.8

Exterior Stairs



Exterior Stairs

Interior Stairs

Figure 9.9

Stair Details

Additional Resources

Projects

Kunsthaus Bregenz: Bregenz, Austria 1990-1997

Swiss Sound box: Hannover, Germany 2000

Bruder Klaus Field Chapel: Mechernich, Germany 2007

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[2] Ibid., 28.

[3] Eduard Sekler, “Structure, Construction, Tectonics,” in *Structure in Art and Science*, ed. Gyorgy Kepes (New York: Braziller, 1965), 93.

[4] Harry Francis Mallgrave, Gustav Klemm and Gottfried Semper: The Meeting of Ethnological and Architectural Theory, (The President and Fellows of Harvard College), 75.

[5] Karl Botticher, “The Principles of the Hellenic and Germanic Ways of Building with Regard to Their Application to Our Present Way of Building,” in *What Style Should we Build? The German Debate on Architectural Style*, ed. Wolfgang Herrmann (Santa Monica: The Getty Center for the History of Art and the Humanities, 1992), 154.

[6] Zumthor, *Architecture and Urbanism*, 12.

[7] Marco Frascari, “The Tell-the-Tale Detail.” *Theorizing a New Agenda for Architecture, an Anthology of Architectural Theory 1965-1995*, ed. Kate Nesbitt (New York: Princeton Architectural Press, 1996), 501. (originally published in VIA 7: The Building of Architecture (1984): 23-37.)

[8] Ibid., 505.

Figure 9.10

Exterior View of South Facade

Figure 10.1

Exterior View of the Soe Ker Tie Houses

10
Soe Ker Tie Houses | TYIN Tegnestue

Firm Brief

> It is natural for designers to strive for beautiful surfaces and expressions. It just happens as a consequence of using the available resources in the right way.[1]
>
> \- Andreas Grontvedt Gjertsen

TYIN Tegnestue is a Norwegian architectural firm, established in 2008 by a small group of architecture students from the Norwegian University of Science and Technology. In order to complete their studies, the group established a new curriculum for their university centered on non-profit, humanitarian projects in Thailand. Their firm and its projects have been funded by more than sixty Norwegian companies, allowing them to continue to work in third-world regions.

TYIN wants to use architecture to help people who are living in less than ideal circumstances and to work to improve the conditions in their communities. They focus on bringing the culture and resources of the region into their projects, then they take these elements and merge them together to design and create structures. The firm's use of locally sourced resources also empowers the partnering communities with new knowledge and techniques for creating structures and improving their lifestyle.

The core beliefs of TYIN are creating architecture in which everything serves a purpose and developing buildings that follow necessity.[2] Working within this system of beliefs, the firm creates highly sustainable architecture, a strategy which has garnered the group a number of significant awards for their efforts.[3]

Project Brief

The Soe Ker Tie Houses, also known as The Butterfly Houses, are located in Noh Bo, Thailand near the border of Myanmar and Burma (Figure 10.1). This region has been in conflict for almost sixty years, forcing several hundred thousand people to flee and leaving Karen refugee children orphaned and displaced. In 2006, an orphanage was created by Ole Jorgen Edna, a Norwegian Social Worker, to help these children.[4] He solicited the assistance of TYIN to design special dorm housing for the orphans. In total, twenty-four children are able to be sheltered in these homes (Figure 10.2), but future plans have been drafted to allow that number to be doubled.[5] Each dwelling contains three platforms that are utilized for different purposes (Figure 10.3). The first platform, or ground floor, is the main public space. Here, the children interact with each other freely (Figure 10.4). The second and third platforms, since they are elevated, are considered to be the private spaces of the dwellings, and contain room for personal belongings and sleeping spaces for three to four children.

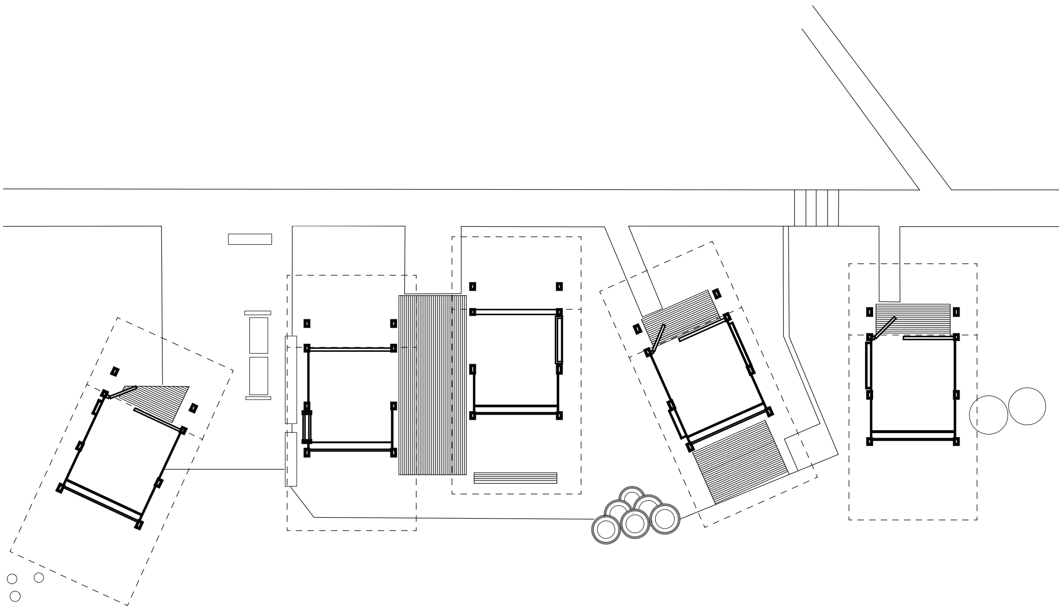


Figure 10.2

Floor Plan

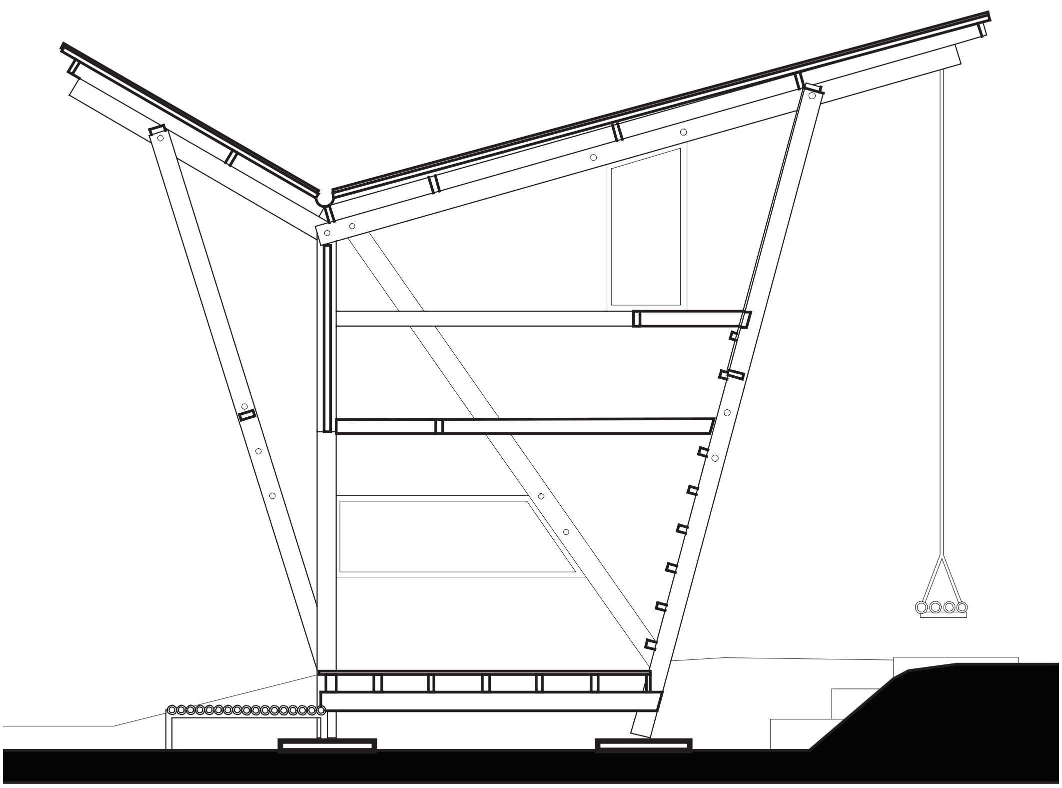


Figure 10.3

Section

Figure 10.4
Interior View of Living Platforms

The materials for the project are primarily of local origin. The most prominent resources used were bamboo for the siding and floors and ironwood, which is a dense, native wood, for the structure. To keep the building materials protected from moisture, the houses were raised off the ground with footings made from tires and concrete.[6] Passive ventilation was also an important factor for these buildings because of the environmental conditions of the region. The architects responded to this need through the roof configuration and through the inclusion of woven siding to help the circulation of air.

The buildings are topped with metal roofs, which have generous overhangs to protect the unsealed wood below. The overhangs also protect the bamboo siding, allowing for it to stay dry and resist rot. Since bamboo is a sustainable and readily available resource in the region, it is cost-effective and, as such, is the most prominent material used in these houses, serving as both siding and flooring. For the floor surface, the bamboo is left whole, with the diaphragms intact, and is bound together to create a solid walking surface.[7] When the bamboo is used as a screen in the wall, it is either left as a full round with the inner diaphragms removed or it is cut in half and woven together. The weaving of bamboo takes advantage of the material's tensile strength, which makes it a viable option for siding on these houses.

Tectonic Principles

Construction | Place

TYIN is driven to carefully consider each detail of each project and to be conscious of the realities of their work. This philosophy falls in line with the discussion Eduard Sekler, architectural historian and author of *Structure, Construction, Tectonics*, has in relation to construction: "As far as construction is concerned there are all the questions of selecting and handling materials, of process and technique."[8] The architects and designers working on the Soe Ker Tie houses have a similar belief system, which aligned with Sekler's philosophy. They researched local materials and traditions to make an effort to design a facility that was in tune with its place and built for longevity in the region (Figure 10.5). One tradition borrowed from the surrounding community was the technique of creating a woven bamboo wall Figure 10.6) Locals were hired onto the project to assist in the construction of the bamboo walls, while assisting in weaving they were taught modern construction techniques.[9]

Figure 10.5

Local Man Weaving Bamboo Siding

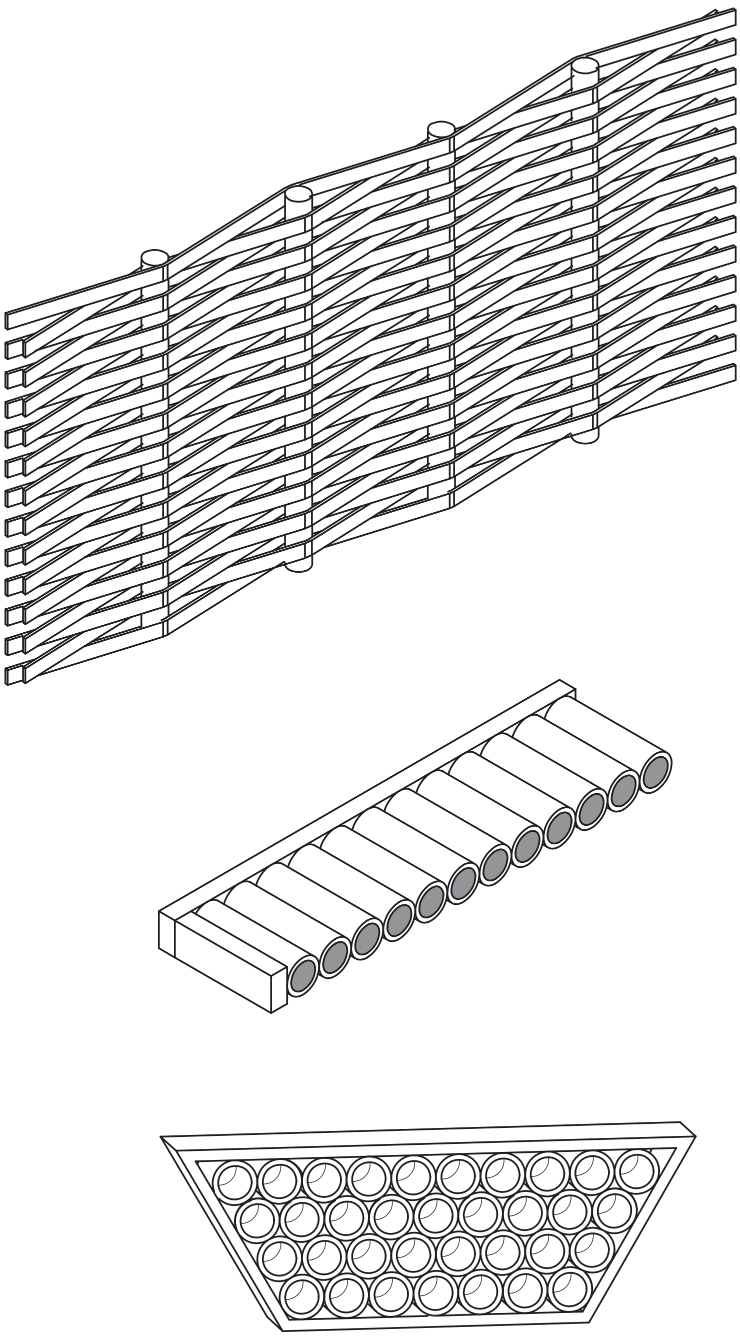
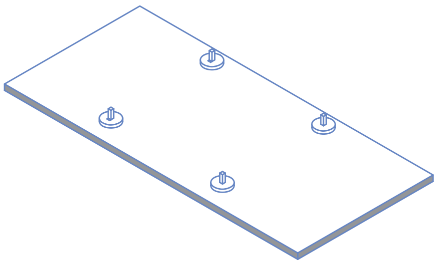


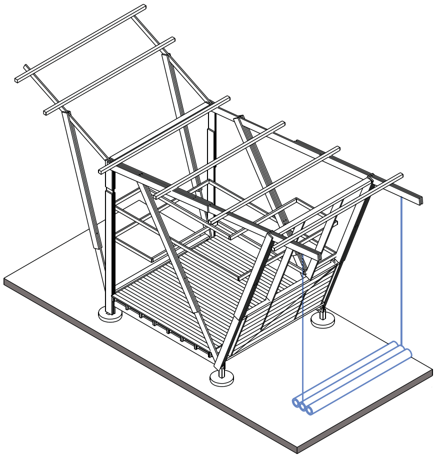
Figure 10.6

Uses of Bamboo

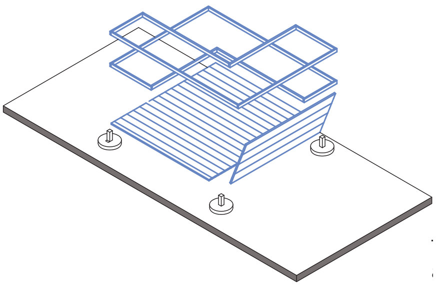
In the *Four Elements of Architecture*, architect and tectonic founding father Gottfried Semper discusses his belief that many tribes first started by making 'hedge-fences' which are the beginnings of wickerwork, and weaving of tree branches to form continuous sheets of material which would protect the interior from the exterior environment.[10] The Soe Ker Tie houses' primary facades relate to this statement as they are at their core a hut, and the enclosure of the space is made from woven bamboo. This technique of weaving bamboo can be inferred that it has been used in the region for generations, due to the readily available nature of the resource and generational passing of fabrication techniques.



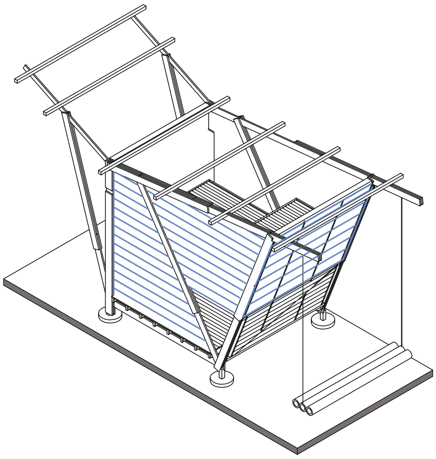
1: Earthwork
The building was built on footings made from tires and concrete



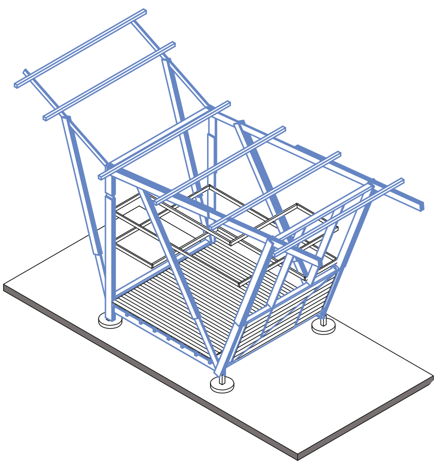
4: Hearth
The small pieces around the complex that the orphans are able to manipulate are the hearths.



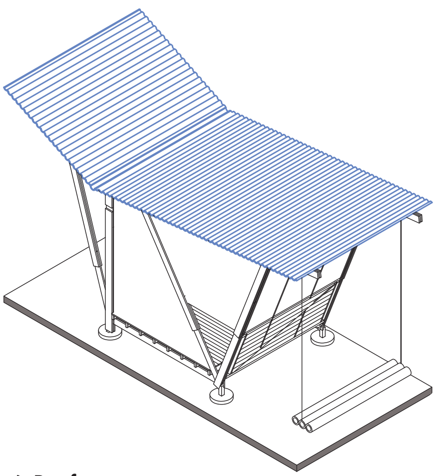
2: Framework | Interior
The ironwood boards frame the floors and are used as cladding on the south wall.



5: Cladding
Each house is clad in bamboo using a variety of techniques.



3: Framework | Exterior
The structure is lap joined and connected with bolts and the structure also dictates the form and space.



6: Roof
The roof is placed over the top of the structure and its form is controlled by structural ironwood arms.

Figure 10.7

Anatomy

Anatomy

The foundation of the Soe Ker Tie houses are simple footings fabricated from recycled tires filled with concrete. The footings allow for minimal ground disturbance and also keep the houses floating above the earth to keep the structure away from the moisture in the ground. The structural framework of the units extends upward at a variety of angles, creating the unique form of these dwellings. The angles of the ironwood armature were determined by the positioning and extent of the butterfly roofs. The structure of the three interior platforms was also constructed of the same ironwood, while whole bamboo stalks were used for the flooring. After the structure and platforms were in place, the houses were clad in a variety of ways: a weaving of bamboo, a screen of hollowed out bamboo cores, and ironwood panels. Finally, the Soe Ker Tie houses were topped with butterfly roofs made from corrugated metal panels. (Figure 10.7).

Figure 10.8

Kids on the Bamboo Swing

In the *Four Elements of Architecture*, Semper discusses that each culture has adapted to and made more prominent one or more of the elements of architecture.[11] The Soe Ker Tie houses, in accordance with Semper's definition, is similar to a traditional hut structure. The hearth does not occur in each individual dwelling but rather in the complex as a whole. In the complex, there are special pieces that create a sense of home and hearth for the orphans who live there: a swing, an outdoor grill, and a chess set, amongst others. These individual aspects, each being their own hearth, give the children a place to grow and play as a community (Figure 10.8). The earth around the houses is hardly disturbed during the construction process as each home is built up to avoid contact with the moisture in the ground. As stated before, the tradition of woven bamboo siding encloses each dwelling and works with the climate. Gaps in the woven cladding help ventilate the spaces within, which is essential in the humid climate. The climate and region of Thailand in which these dwellings are located requires a passive system to be used to ventilate the spaces. Accordingly, the roof also reflects Semper's definition of a hut, as it is specifically characterized for the region in which it is located, but thought through in a modern way.

Detail

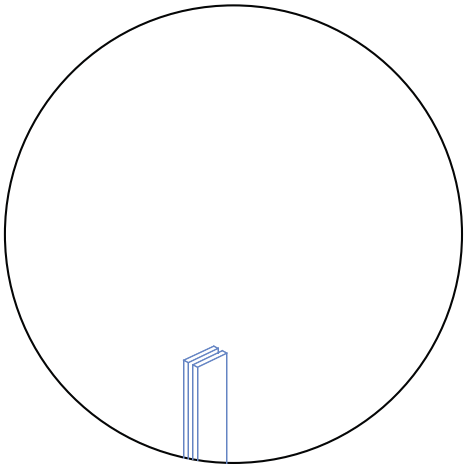
In *The Tell-the-Tale Detail*, Marco Frascari discusses how the definition of a detail has changed in relation to everyday thought and its use in architecture. He compares how the dictionary definition of detail - a small part in a larger whole - differs from an architectural definition of detail – "a joint."[12] Frascari then examines how the word detail has changed over time with respect to architectural practice, initially inferenced in the field during construction from sketches, but now fully considered in the office long before the onset of construction.[13] In the Soe Ker Tie houses, the means of construction were only talked through in person, the only drawings for this project were a plan and a section, and construction methods were developed from traditional practices of the community. (Figure 10.9). This means of working minimized the modern day expression of detailing and, instead, created a hybrid of old and new techniques.

Figure 10.9

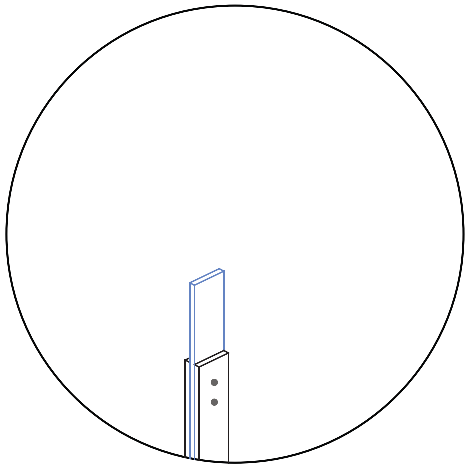
Local Men and Children Lifting a Side of a House

Figure 10.10

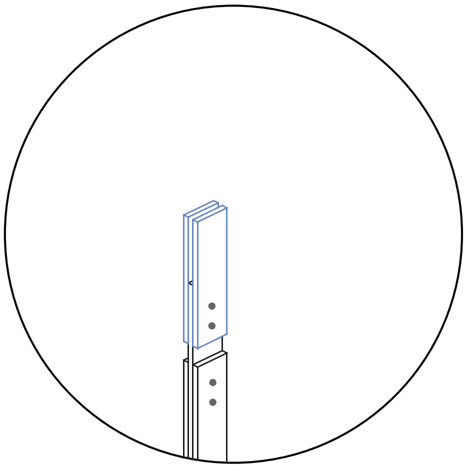
Structural Joint Detail



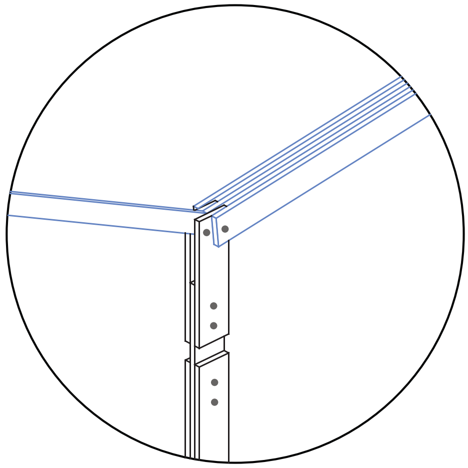
Step One
Two long Ironwood boards parallel to each other and perpendicular to the ground.



Step Two
One board is placed in the middle of the long two parallel boards and bolted.



Step Three
Two boards are placed parallel to the single board in the middle and are bolted into.



Step Four
The boards for the roof are then angled up to create the butterfly profile.

The detailing in these dwellings follows both definitions and history of detail outlined in Frascari's writing. In the structure of the Soe Ker Tie houses, the ironwood boards are prefabricated on site and then bolted together. The fabrication of the structural system is a complex joining of boards in a lap joined configuration where boards are parallel to each other and bolted to keep structural members stiff and load bearing.[14] At the critical intersection of the two roof planes, there are vertical columns composed of a pair of ironwood boards attached to the tire footings below (Figure 10.10). The boards are placed parallel to each other and are spaced apart to leave a gap between to receive a smaller board. When the board in the middle is inserted, all three pieces are bolted together. At the top end of the middle board, two more boards are placed similar to those of the post, but stretching off horizontally to support one plane of the roof. Another arm is placed on the opposite side of the column and all of the members are secured with bolts. This series of boards creates the most complex connection in the projects and plays a significant role in defining the form of the dwelling.

Additional Resources

Projects

Safe Haven Library by TYIN Tegnestue
Safe Haven Bathhouse by TYIN Tegnestue
Klong Toey Community Lantern by TYIN Tegnestue

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[10] Gottfried Semper, "Chapter 5 The Four Elements, Chapter 6 Practical Applications," The Four Elements of Architecture and Other Writings¬: 103

[11] Semper, The Four Elements of Architecture and Other Writings¬: 110

[12] Marco Fracari,"The Tell-the-Tale Detail," In Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory 1965-1995: 501

[13] Ibid. 503

[14] Bell and Rand, Materials for Architectural Design 2, 104

Figure 11.1

View from the Desert
© Jeff Goldberg/Esto

11
Tyler Residence | Rick Joy

Architect Brief

Rick Joy worked as a carpenter and musician before deciding to study architecture at the University of Arizona in Tucson. Once there, he fell in love with the desert and started his firm, Rick Joy Architects, in 1993. The firm has become known for its high-concept contemporary design, specifically in high end residential projects throughout the Southwest. Joy's deep understanding of the sensory dimension of architecture is derived from his experience as a carpenter and musician, and is prevalent in his work.

Joy's experience as a carpenter is reflected in his relationship with the process of making. He chooses to be involved in all aspects of the building process, reestablishing the architect's role as the true master of construction work.[1] He utilizes materials and construction techniques in a very contextual manner and as a mean to convey certain sensual messages. Throughout his earlier career he utilized rammed earth, which is an ancient wall-building technique common in the Southwest. Applying such a technique, he established a dialogue with both the environment and the historical context.

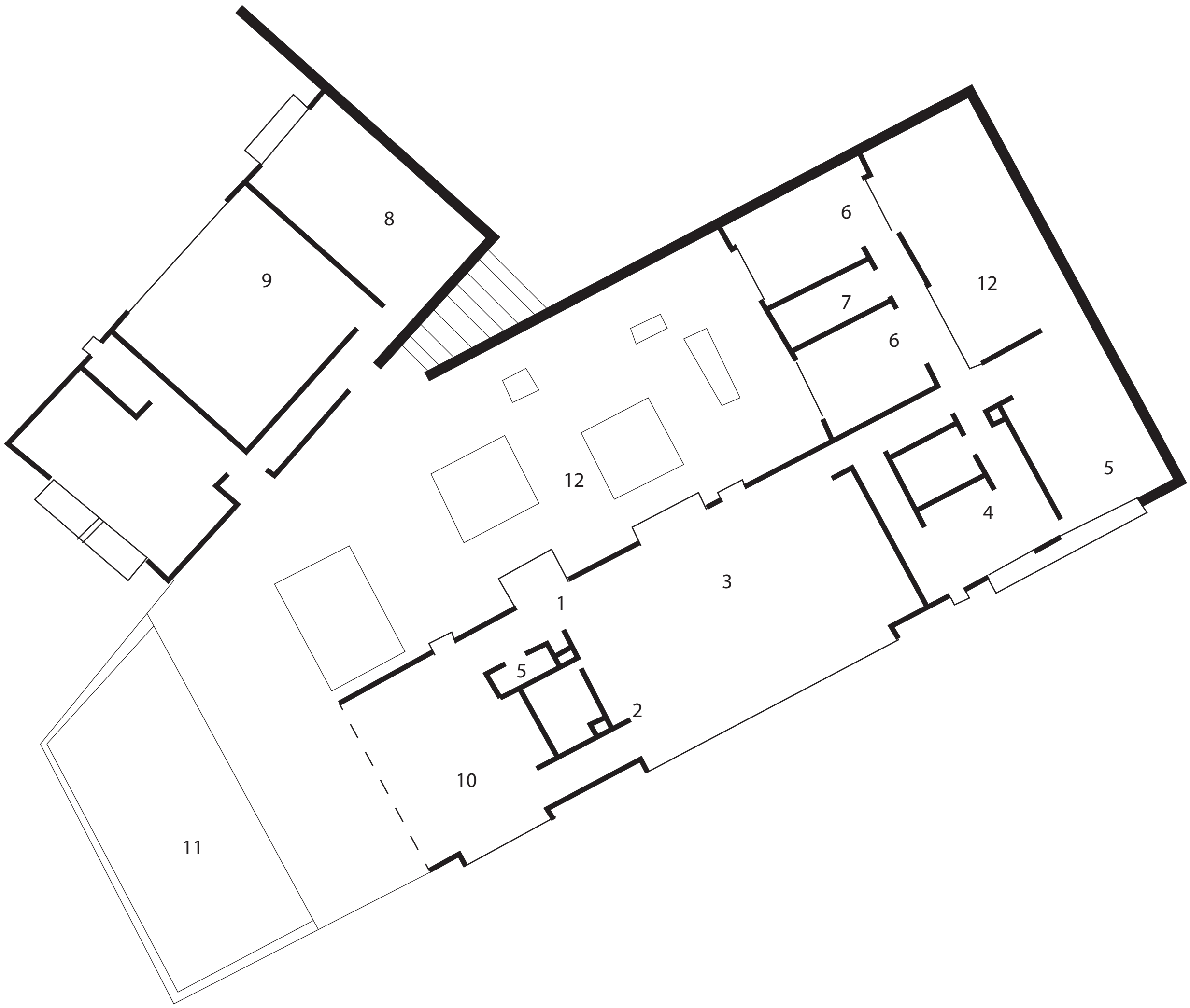
Rick Joy's understanding and appreciation of music has had a profound impact on how he views architecture. He states that, "silence is often more profound than sound."[2] He believes that the role of architecture is to "create the silence, calmness, and concentration that enable us to experience the beauty of the world and life around us."[3] In taking this stance on architecture, maneuvering his buildings becomes a theatrical experience that is both relaxing and enticing.[4]

Project Brief

The Tyler Residence, located in Tubac, Arizona, was designed for a retired astronomer and his wife (Figure 11.1). The residence is a 4,000-square foot second home that is nestled in the desert landscape, fifty miles south of Tucson and fifteen miles from the Mexican border (Figure 11.2).[5] The site was chosen for its desert panorama and 360-degree views to three mountain ranges.

A shelf was first carved into the landscape to receive the house. Two U-shaped concrete retaining walls separate the natural and built environments. The house is in the form of two-shed like structures half embedded in the ground and sitting on the retaining walls. The larger of the two forms is a 2,500-square-foot main dwelling area while the other contains the studio and guest bedroom (Figure 11.3).[6] The courtyard serves to both tie the forms together and separate served from servant.

The inspiration for the house derived from the configuration of a geode with a rough exterior shell protecting a jewel-like interior. The material palate of the Tyler residence mimics the geode. The exterior walls of the residence are clad in weathered steel and are punctuated by steel box windows that frame



Legend

Entry	**01**
Kitchen	**02**
Living Room	**03**
Bathroom	**04**
Bedroom	**05**
Office	**06**
Laundry	**07**
Workshop	**08**
Garage	**09**
Porch	**10**
Pool	**11**
Courtyard	**12**

Figure 11.2

Floor Plan

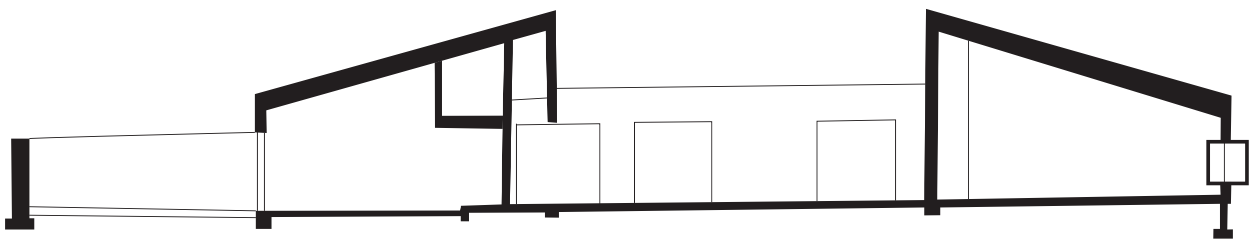


Figure 11.3

Building Section

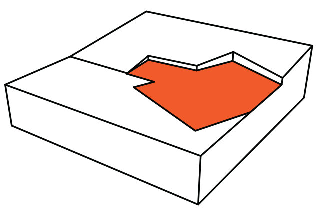
views of the mountain ranges in the distance.[7] The surrounding desert vistas can have an overwhelming quality and from the interior the windows are able to contain and control this expansiveness.[8] The interior sits in contrast to the exterior with its use of white plaster, stainless steel, maple, and translucent glazing.

On approach, the house blends into the landscape, mimicking the rusted artifacts found in the Arizona desert. A descending concrete staircase nestled in between the retaining walls signifies the entrance to the house. The entry courtyard is cool and enclosed to contrast the hot expansiveness of the surrounding desert.[9] The entrance to the house is a large double height exterior space from which the interior expands to meet the exterior. In this home, Joy creates delineations to emphasize where the contrasting interior and exteriors conditions meet, allowing one to peer through the cracks of the rough exterior to view the jewel within.

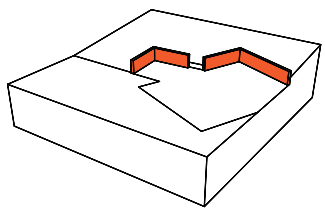
Tectonic Principles

Anatomy

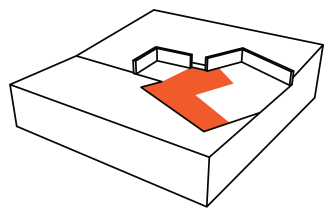
In his writings, architect and tectonic theorist Gottfried Semper divides architecture into four essential elements: hearth, earthwork, framework, and enclosure.[10] Semper tied each element to unique underlying elements: earthwork to masonry, framework to carpentry, cladding to textiles, and the hearth to ceramics.[11] The earthwork of the Tyler residence consists of the U-shaped retaining walls, which describe the boundaries of the built environment (Figure 11.4). These retaining walls become the connecting elements between built environment and the ground. The shelf that was carved from the landscape becomes the resting place for the hearth. While Semper maintains that the fire traditionally was a symbol of the hearth, here in the desert, the elements of water found in the courtyard serve a similar purpose. The exterior courtyard becomes the hearth for the house which sits in the center of the carved-out shelf. The courtyard is flanked by the two primary volumes of the house and the entry stair. This configuration of elements sets up the courtyard as the center of activity, an oasis in the desert landscape (Figure 11.5).



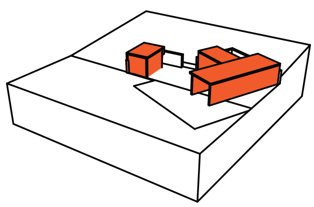
1: Shelf
A shelf was cut into the landscape to receive the house.



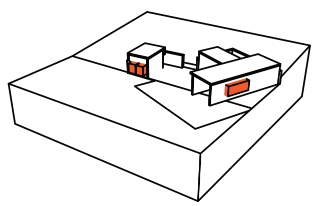
2: Earthwork
The U-shaped retaining walls create the space for the house.



3: Hearth
The courtyard acts as the hearth sitting in the center of the shelf.



4: Framework | Enclosure
The wood studs are embedded in the weathered exterior walls. The steel shed-like structures shelter the hearth.



5: Enclosure | Punctures
The windows act to frame the landscape. The steel boxes amplify this idea.

Figure 11.4

Anatomy

Figure 11.5

View of Pool Terrace
© Jeff Goldberg/Esto

In the Tyler residence, the framework and the cladding are integral aspects of the wrapped steel forms of the house. The framework of the house consists of wood studs that serve as the structural core for the exterior walls. Weathered steel panels serve as the cladding and hide the framework elements from viewers, concealing the inner workings of the house's structural reality. Windows puncture the veil between interior and exterior realms of the residence. Where these punctures occur, Joy expresses them through the use of projecting steel boxes, which contain the glazing at the outer edges. Through these portals, he frames views of the exterior world.

Figure 11.6

Night View from Gravel Path
© Jeff Goldberg/Esto

Precedent | Place

The precedent Rick Joy utilized in the design of the Tyler Residence was a rusted artifact peeking through the desert sand, reminiscent of many such structures found throughout the Arizona desert. Additionally, the house was designed as a geode-like structure. The precedent of a geode allowed the exterior of the building to speak directly to the rustic environment, while still maintaining a clean, modern palate on the interior. The weathered steel on the exterior relates it to the environment. The interior, being clad in white plaster and stainless-steel detailing, contrasts this harsh exterior. This contrast amplifies the differentiation of the interior and exterior realms. Windows serve as cracks in the shell of the geode (Figure 11.7).

Semper established two typologies regarding architectural tectonics and the relationship to place: the wall-dominated courtyard building and the roof-dominated hut.[12] In *The Four Elements of Architecture*, Semper discusses how courtyard style buildings were created in warmer southern areas to deal with climate conditions. The Tyler Residence is a courtyard style building that addresses both the climatic context and the desert landscape to which it belongs (Figure 11.6). The courtyard of the Tyler Residence is sub-divided into two sectors: the private and the public. The public sector is the first space that is introduced as part of the built environment. The courtyard, serving as an entry plaza, is shaded to cool the space and provide visitors with relief from the hot desert climate. The stairs leading down into the courtyard are nestled between the house forms. In his writings, architect and architectural theorist Marco Frascari describes perception as the idea of an object resulting from our interpretation of sensations that occur in the unconscious.[13] The experience of walking down between the two forms evokes the feeling of descending into a canyon, thereby establishing the unconscious connection with the surrounding context acting as a transitional phase between the natural and built environments.

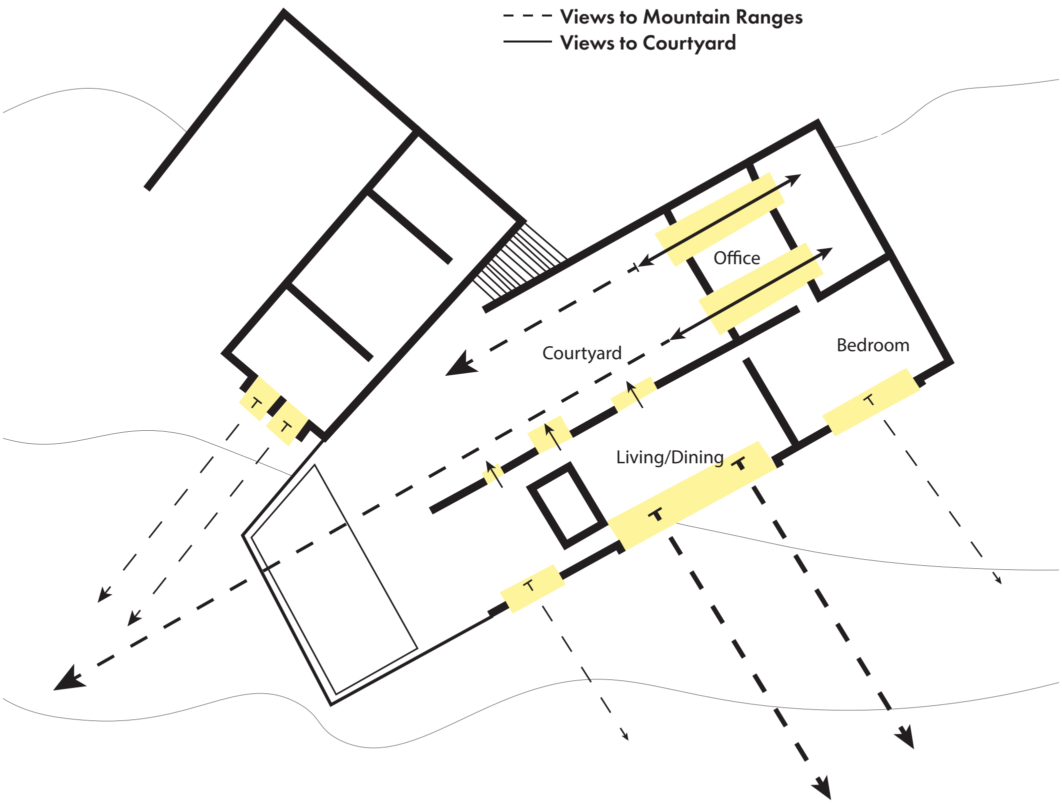


Figure 11.7

View Analysis

> The two primary archetypes: the hearth and the cloth, the Urherd and the Urtuch. They were the first mark of settlement and the first fabrication.[14]

Semper separates architecture into these two archetypes and the Tyler Residence embodies the idea of marking space using the hearth and the cloth. In Joy's work it is evident that the demarcation of space becomes a crucial aspect of the design. The demarcation of space becomes even more important in the Tyler residence where the vast desert landscape envelops the built environment. The design of the house uses both the hearth and the cloth to signify different types of spaces and the change from natural environment to built environment. The courtyard acts as the hearth and serves as the exterior demarcation of space as it becomes the entry point from the desert landscape. The exterior planes of the house act as the cloth and serve as the demarcation between the interior and exterior realms.

The courtyard as the hearth serves as the transitional element from interior to exterior and thus is the first introduction to the built environment. The courtyard is intricately designed to serve as a delicate transition from the desert landscape to the house. Joy achieves such intricacy by taking elements which are sporadic in the landscape and placing them very deliberately. Such elements are the mesquite trees which are seen scattered in the landscape. In the courtyard, the mesquite trees are placed in rectilinear planters showcasing how the landscape becomes a part of the hearth in the same way that the house becomes part of the landscape.

Figure 11.8

View of Wall Protrusion
© Jeff Goldberg/Esto

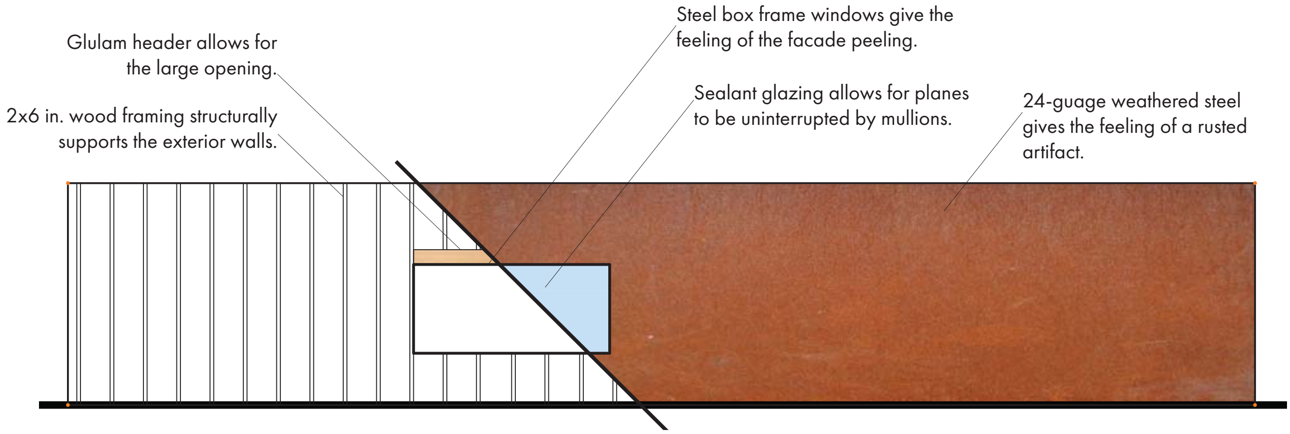


Figure 11.9

Weathered Steel Facade Analysis

The exterior walls serve as the cloth and consist of a wood stud framing structure clad in twenty-four-gauge custom weathered steel panels. The wood framing is invisible to onlookers and thus the weathered steel exterior feels very much like a wrapper containing the interior spaces. The places where the exterior walls are interrupted are places where Joy further expresses the idea of the constant wrapper encompassing the house. Steel boxes encompass the windows to signify the places where a view to the interior realm is possible from outside the house (Figure 11.8). From the interior the steel boxes act as framing elements further portraying the differentiation between interior and exterior. The steel boxes around the windows give the impression that the material itself is being peeled away from the wall to create the openings. At these locations, Joy makes sure to not show any structural elements from the wall or the glazing, further developing the idea of a constant wrapper around the house (Figure 11.9). Glulam headers are used to span the large openings of the windows allowing for the elimination of primary structural elements that would normally occur.[15] Sealant glazing is a technique that uses a sealant instead of mullions to support the glass and was used to eliminate any structural elements that would normally be supporting the glass. The use of sealant glazing and glulam headers allowed for the language of materials as constant planes to continue in both the steel and glass planes. [16]Using atectonic construction methods, Rick Joy embraced the idea of the hearth and the cloth. In the Tyler residence everything is, or is enveloped by, these two elements (Figure 11.10).

Additional Resources

Projects

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Desert Nomad House, Tucson, Arizona, United States, 2005

Ventana Canyon House, Tucson, Arizona, United States, 2008

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[4] Susanna Sirefman, "Rick Joy's Tubac House: "Desert Treasure." Graphis 61, no. 355 (January 2005): 35. https://search.proquest.com/docview/1459605933.

[5] Ibid., 35.

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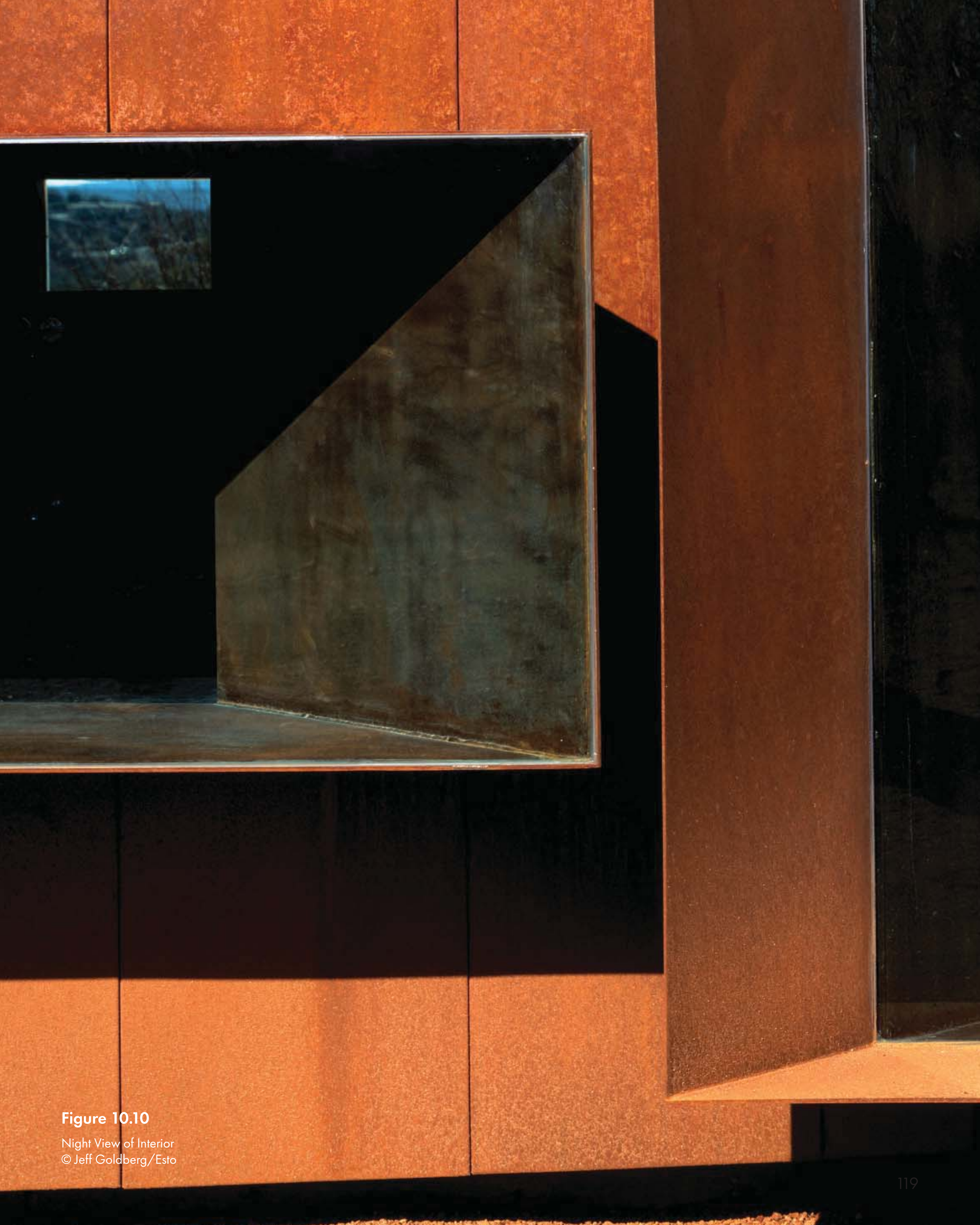

Figure 10.10

Night View of Interior
© Jeff Goldberg/Esto

Supporting Material

Afterword | Alex Wilson

> In the details are the possibilities of innovation and invention, and it is through these that architects can give harmony to the most uncommon and difficult...environment generated by a culture.[1]
>
> - Marco Frascari, *The Tell-the-Tale Detail*, 1981

Architectural history traces the constantly evolving conditions of our built environment; these conditions change because of technological innovation and shifting cultural beliefs, amongst a host of other catalysts. Those individuals engaged with the development of the theory of architectural tectonics, including Gottfried Semper, Karl Botticher, Karl Friedrich Schinkel, and others, proposed the need for evolutionary shifts within the practice of architecture. Many of these historians, most notably Semper and Botticher, investigated the remains of ancient civilizations, attempting to analyze the reasoning behind the architectural choices made in an effort to find precedent to impact direction contemporary architectural theory. The foundation of architectural tectonics was derived from the study of the built works of these past cultures. While some of the interpretations proposed by these philosophers remain to be concluded as valid, "they remain correct in their general, if not specific conclusions, regardless of the inaccuracy of much of the historical analysis used to support them."[2]

In this seminar, we used the lessons learned from each theorist as points of reference for our investigation. Each chapter of this book focuses on how those concepts relate to an architectural project from the past half-century. The study of tectonics allows for a more critical reading of the architectural components of our built environment, tying together design intent and constructed reality. This connection, in turn, promotes an understanding that architecture is not just about how one inhabits a space, but also how we construct the experience, which is essential to our understanding of architecture as a whole.

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Project Credits

Agosta Residence | Patkau Architects

Architect: Patkau Architects, Inc.
Client: William and Karin Agosta
Architect's Website: www.patkau.ca
Structural Engineer: Fast & Epp Structural Engineers
Contractors: Ravenhill Construction Inc.

Bavinger House | Bruce Goff

Architect: Bruce Goff
Client: Eugene, Nancy, and Bill Bavinger

Cristo Obrero Church | Eladio Dieste

Architect: Eladio Dieste
Client: Catholic Church
Civil Engineer: Dieste y Montañez S.A

Delta Shelter | Olson Kundig

Architect: Design Principal- Tom Kundig
Project Manager: Ellen Cecil
Interior Designer: Debbie Kennedy
Architect's Website: www.olsonkundig.com
Structural Engineer: MCE Structural Consultants
Shutter Engineer and Fabricator: Turner Exhibits
Contractors: Tim Tanner
Manufacturers: Fleetwood, Knoll, Milgard, Poltrona Frau, Cassina, AEP Span, CECO
Craftspeople: Farwest Iron Works, Inc.

Dominus Winery | Herzog & de Meuron

Architect: Herzog and de Meuron
Client: Christian Moueix
Architect's Website: https://www.herzogdemeuron.com/
Project Team: Uli Ackva, Béla Berec, Ines Huber, Nathalie Kury, Mario Meier
Structural Engineer: Zucco Fagent Associates
Electrical Engineer: Hansen & Slaughter, Inc.
Consultants: Plumbing/HVAC - Larkin & Associates
Contractors: Wright Contracting, Inc
Subcontractors: Construction - Valley Architects

Komyo-Ji Temple | Tadao Ando and Associates

Architect: Tadao Ando and Associates
Client: Komyo-ji temple committee and head priest
Architect's Website: http://www.tadao-ando.com

Nest We Grow | Kengo Kuma and Associates

Architect: Kengo Kuma & Associates, College of Environmental Design UC Berkeley
Client: Annual LIXIL International Design-build Competition
Architect's Website: http://www.kkaa.co.jp/
Structural Engineer: Massato Araya
Mechanical Engineer: Tomonari Yashiro Laboratory at the Institute of Industrial Science, University of Tokyo/Bumpei Magori, Yu Morishita
Contractors: Takahashi Construction Company

Sea Ranch Condominium 1 | MLTW

Architect: MLTW (Charles Moore, Donlyn Lyndon, William Turnbull, Richard Whitaker)

Shelter for Roman Ruins | Peter Zumthor

Architect: Peter Zumthor
Client: City of Chur
Structural Engineer: Jürg Buchli
Collaboration and Construction Supervision: Reto Schaufelbühl

Soe Ker Tie Houses | TYIN Tegnestue

Architect: Pasi Aalto
Andreas Grontvedt Gjertsen
Yashar Hanstad
Magnus Henriksen
Line Ramstad
Erlend Bauck Sole
Client : Ole Jorgen Edna
Architect's Website: http://www.tyinarchitects.com/
Built by: TYIN Tegnestue/Local Workers from Noh Bo

Tyler Residence | Rick Joy

Architect: Rick Joy Architects
Project Team: Rick Joy, Andy Tinucci, Chelsea Grassinger, Franz Buhler
Client: Warren and Rose Tyler
Structural Engineer: Southwest Structural Engineers
Mechanical Engineer: Otterbein Mechanical Engineering

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2 | Bavinger House
Figure 2.1: Photograph taken by Victor Hamberlin, found at
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http://www.artic.edu/aic/collections/artwork/178815?search_no=1&index=1
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3 | Cristo Obrero Church
Figure 3.1: Photograph taken by Lauro Rocha, found in article by Jade Budd*
Figure 3.2: Drawing by Giuliana Fustagno.
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Figure 3.10: Photograph taken by Lauro Rocha, found in article by Jade Budd*
Budd, Jade. "Inside-Iglesia del Cristo Obrero." Befront Magazine, October 17, 2017. http://befrontmag.com/2016/10/17/inside-iglesia-del-cristo-obrero/

4 | Delta Shelter
Figure 4.1: Photograph by Tim Bies, found on ArchDaily*
Figure 4.2: Drawing recreated by Jessica Wyatt.
Figure 4.3: Drawing recreated by Jessica Wyatt.
Figure 4.4: Drawing by Jessica Wyatt.
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Figure 4.10: Photograph series taken by Benjamin Benschneider, found on ArchDaily*
* "Delta Shelter | Olson Kundig." Arch Daily, October 3, 2017. http://www.archdaily.com/215448/delta-shelter-olson-kundig-architects.

5 | Dominus Winery
Figure 5.1: Photograph taken by Kevin Matthews, courtesy of Architectureweek.com.
Figure 5.2: Drawing by Alexandra Wilson.
Figure 5.3: Photograph taken by Steven Rothfield, courtesy of Dominus Winery Estates.
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6 | Komyo-Ji Temple
Figure 6.1: Photograph taken by Kari Silloway, 2004, found at Galinsky.com. http://www.galinsky.com/buildings/komyoji/
Figure 6.2: Drawing by Dipen Patel
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Figure 6.5: Photograph taken by Kaiki Nakamori, found at http://nakamouri.tumblr.com/
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7 | Nest We Grow

Figure 7.1: Photograph taken by Shinkenchiku-sha, found at https://www.archdaily.com/592660/nest-we-grow-college-of-environmental-design-uc-berkeley-kengo-kuma-and-associates
Figure 7.2: Drawing recreated by Eddie Garcia.
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Figure 7.7: Photograph taken by Hsin-Yu Chen.
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8 | Sea Ranch Condominium One

Figure 8.1: Photograph courtesy of Jim Alinder, found at House of the Day: Sea Ranch Condominium by MLTW | Journal." The Modern House. Accessed September 16, 2017. http://www.themodernhouse.com/journal/house-of-the-dayranchcondominium-by-mltw/.
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Figure 8.3: Drawing recreated by Alycia Pappan.
Figure 8.4: Drawing recreated by Alycia Pappan.
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Figure 8.10: Photograph courtesy of Jim Alinder, found at Lyndon, Donlyn. "The Sea Ranch: Qualified Vernacular." Journal of Architectural Education 63, no. 1 (October 2009): 81-89.

9 | Shelter for Roman Ruins

Figure 9.1: Photograph found at, Venezia, Nicholas Lee. October 16, 2011. Communicating Architecture, The Richard A. Campbell Travelling Scholarship. http://communicatingarchitecture.blogspot.co.nz/2011/10/shelters-for-roman-archaeological-site.html
Figure 9.2: Drawing by Matt Dickman.
Figure 9.3: Drawing by Matt Dickman.
Figure 9.4: Drawing by Matt Dickman.
Figure 9.5: Photograph taken by Helene Binet, found at "Exterior View at Night." Arch Society, 13 Apr. 2009, www.archsociety.com/news.php?extend.93.1.
Figure 9.6: Drawing by Matt Dickman.
Figure 9.7: Photograph taken by Helene Binet, found at Jeff Kaplon. "Skylight over Ruins." Tumblr.com, 10 Apr. 2013, www.subtilitas.site/post/47666578955/peter-zumthor-shelter-for-roman-ruins-chur.
Figure 9.8: Photograph taken by Helene Binet, found at Jackie Craven. "South View of Shelter." Thoughtco.com, 22 July 2016, www.thoughtco.com/peter-zumthor-architecture-portfolio-4065270.
Figure 9.9: Drawing by Matt Dickman.
Figure 9.10: Photograph found at, Quindos, Juan Carlos. "Close up of Exterior Stair." Pinterest.com, www.pinterest.co.uk/pin/198228821072260682/.

10 | Soe Ker Tie Houses

Figure 10.1: Photograph taken by Pasi Aalto.
Figure 10.2: Drawing recreated by Ashton McWhorter.
Figure 10.3: Drawing recreated by Ashton McWhorter.
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Figure 10.8: Photograph taken by Pasi Aalto.
Figure 10.9: Photograph taken by Pasi Aalto.
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11 | Tyler Residence

Figure 11.1: Photograph taken by Jeff Goldberg, courtesy of Esto.
Figure 11.2: Drawing by George Aguilar.
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When a structural concept has found its implementation through construction, the visual result will affect us through certain expressive qualities which clearly have something to do with the play of forces and corresponding arrangement of parts in the building, yet cannot be described in terms of construction and structure alone. For these qualities, which are expressive of a relation of form to force, the term tectonic should be reserved.

- Eduard Sekler, Structure, Construction, Tectonics, p. 89

Structure has long been considered the expertise of the engineer, and construction, the expertise of the builder. The architect, however, is responsible for the domain arising from the intersection of the two, as poetically described in the quote above delivered by noted architectural historian Eduard Sekler. *Form and Force* is an investigation into the multifaceted nature of the theory of architectural tectonics, exploring the realm of architectural study that examines the resolution of structural expression in the means of construction as well as the resulting impact on the qualities of architectural space.

The book examines eleven built works of architecture located throughout the world, illuminating the expressive qualities of their structures, the consideration for their details, their constructional makeup and anatomy, and their distinct relationship to place, amongst other objectives. Many of these projects are designed by renowned architects, such as Herzog and de Meuron, Olson Kundig, Kengo Kuma and Patkau Architects, and have achieved significant praise, while others are lesser known. All of these projects, however, are rigorous in their design and clear in their relationship to tectonic thought. Each chapter highlights a different work, discussing the specifics of the project through a comparison of tectonic principles. The hope is that by learning from the collection, there is a greater understanding of the poetic potential of architecture.