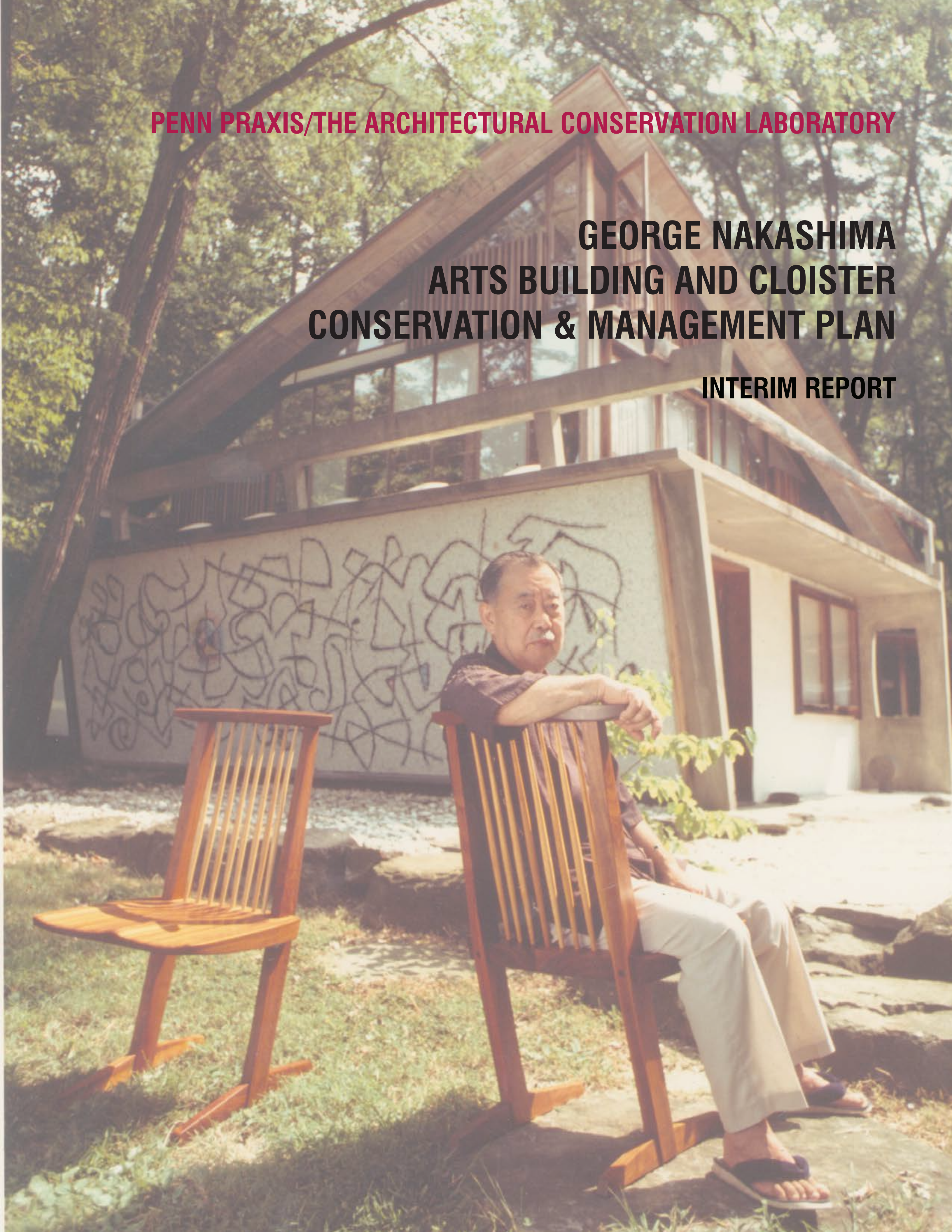
PENN PRAXIS/THE ARCHITECTURAL CONSERVATION LABORATORY

GEORGE NAKASHIMA
ARTS BUILDING AND CLOISTER
CONSERVATION & MANAGEMENT PLAN

INTERIM REPORT



Funded by:
The Getty Foundation
2015 Keeping it Modern

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January 30, 2016

Cover:
George Nakashima sitting in a Conoid Chair in front of the Arts Building.
Photographer unknown. Ca.1981
George Nakashima Woodworker Archives

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Note: Financial account attached to this report.

Right: George Nakashima Woodworker's Complex location.
40°20'25.0"N, 74°57'20.2"W

Introduction

Designed and built by renowned Japanese-American architect and furniture maker George Nakashima, the Arts Building and Cloister occupy a privileged position as the most iconic and architecturally significant of his built works. Completed in 1967, the building is of national significance in its association with George Nakashima, "one of America's most eminent furniture designer-craftsmen and a significant force within the American Craft movement of the mid- twentieth century, a seminal period for woodworking in the United States."[1] The compound represents a fusion of modernist ideas with traditional Japanese and Pennsylvania vernacular building techniques, employs a hyperbolic paraboloid plywood roof, and houses a mosaic mural executed by the Gabriel Loire stained glass studio in Paris after Ben Shahn's designs.

Stemming from Nakashima's apprenticeship and earlier experiences, particularly with Antonin Raymond, his widely recognized interpretation and combination of modernist and traditional ideas generated a personal style of design unique to him and is intimately bound up with the social values, sense of community, and family identity that Nakashima nurtured in New Hope. George Nakashima's significant sense of transcendence and spirituality resulted in the Altar of Peace Project, initiated in 1984. This composite vision clearly persists on site at every level of design, art, and craft through the family's continued engagement with furniture making.

These intangible qualities are substantially represented in the Arts Building and Cloister. The compound was conceived as an exhibition space and as a place of international exchange in relation to both craftsmanship and the arts. Shortly after construction, the building was called the Minguren Museum, which culminated Nakashima's constant interest in transcending his woodworking activity in New Hope and deepening its association with the universality of the arts and crafts.

It is also worth mentioning that the use of the hyperbolic paraboloid roof closely relates to the rise of warped roofs in post war America and exemplifies a rare example in its use of structural plywood marrying craft and engineering efforts, while at the same time representing an evolution of experimental architecture practiced at Nakashima's property.

The complex relationship between living tradition and historic site, as the property transitions and continues to serve the making of furniture, prompted the need to develop a plan for the sustainable management, interpretation, and preservation of the site.

On behalf of the Trustees of the University of Pennsylvania, Penn Praxis/ Architectural Conservation Research Center is pleased to present the re-

1. David Kimmerly and Catherine C. Lavoie. George Nakashima Woodworker Complex. National Historic Landmark Nomination (Designation April 2014), 14

search progress towards the goals of the 2015 Getty Foundation's planning grant. This report provides a summary of findings from historical and material investigation, and an account of the current consulting activity, a detailed schedule of work to complete, and a financial report containing a summary of funds spent to date.

Penn Praxis/Architectural Conservation Research Center acknowledges the engagement of George Nakashima's family and George Nakashima Woodworker's staff members who have been collaborating in the development of the historical and material investigation.

Section 1 contains a site development chronology based on the information provided by the 2014 NHL nomination, the Depreciation Accounting Books, and Nakashima Property List of Buildings (September 12, 1990).

Section 2 provides a summary of the historical research based on published and unpublished sources of a different nature: articles in journals, scholarly publications, accounting books, hand drawings, letters, and photographs. This section provides an analysis of the training and earlier influences on George Nakashima through 1941, the design and construction of the building, the rise of the hyperbolic paraboloids in the US, and Nakashima's architecture conceptualization, which drew from his dissatisfaction with the contemporary practice and his commitment to craft. The section closes examining the relationships between arts, craftsmanship, and spirituality.

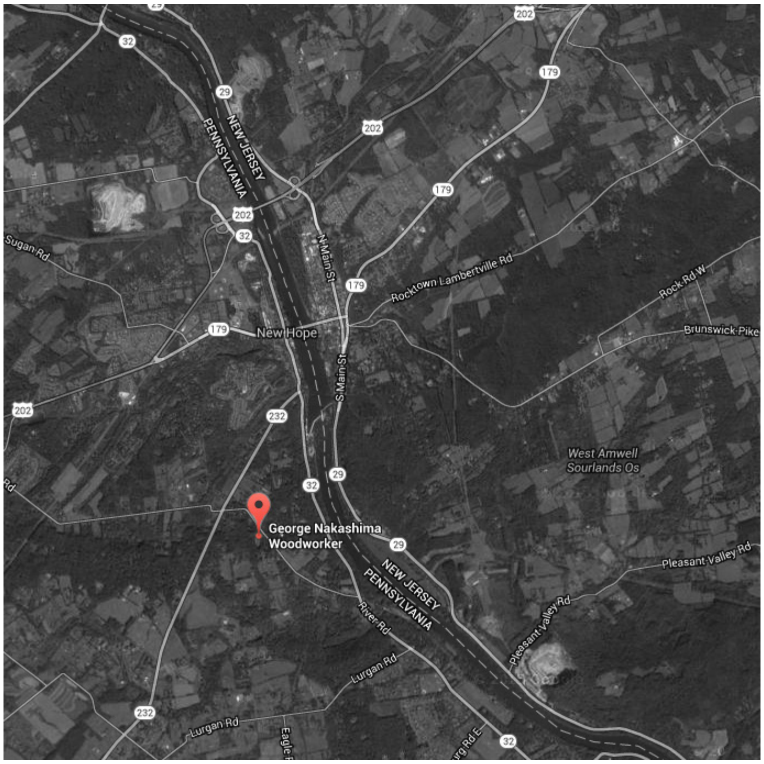
Section 3 describes the architectural and technological characteristics, assemblies, and materials of the Arts Building and Cloister.

Section 4 pays particular attention to Ben Shahn's mural mosaic fabricated by Gabriel Loire in Chartres, France.

Section 5 examines the alterations as determined through comparative analysis of archival images and photographs taken by members of the Architectural Conservation Research Center.

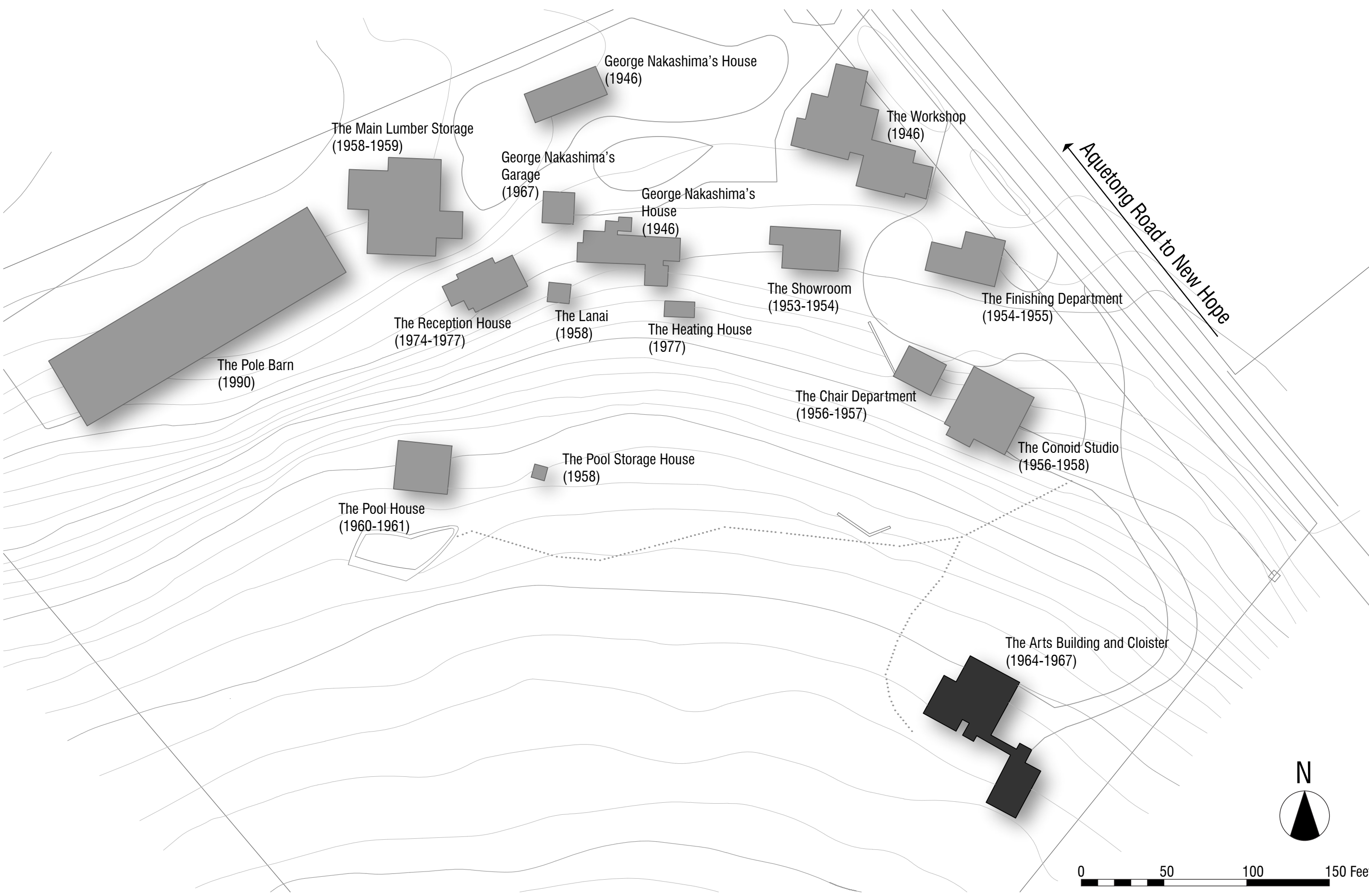
Section 6 presents the findings of the condition survey. It explores causes of deterioration in relation to the inherent qualities of the material, environmental context and use. Appendix B contains an illustrated condition glossary. Appendix D includes a set of drawing sheets with graphic representation of the conditions and annotations.

Section 7 includes a summary of the work realized by the Architectural Conservation Research Center together with the consultants, and a schedule of tasks to be completed.



Right: George Nakashima Woodworker's Complex. 1847 Aquetong Road, New Hope, PA

Below: George Nakashima Woodworker's Complex with dates of construction. The dark grey color identifies the Arts Building and Cloister.



1. Site Development: Chronology*

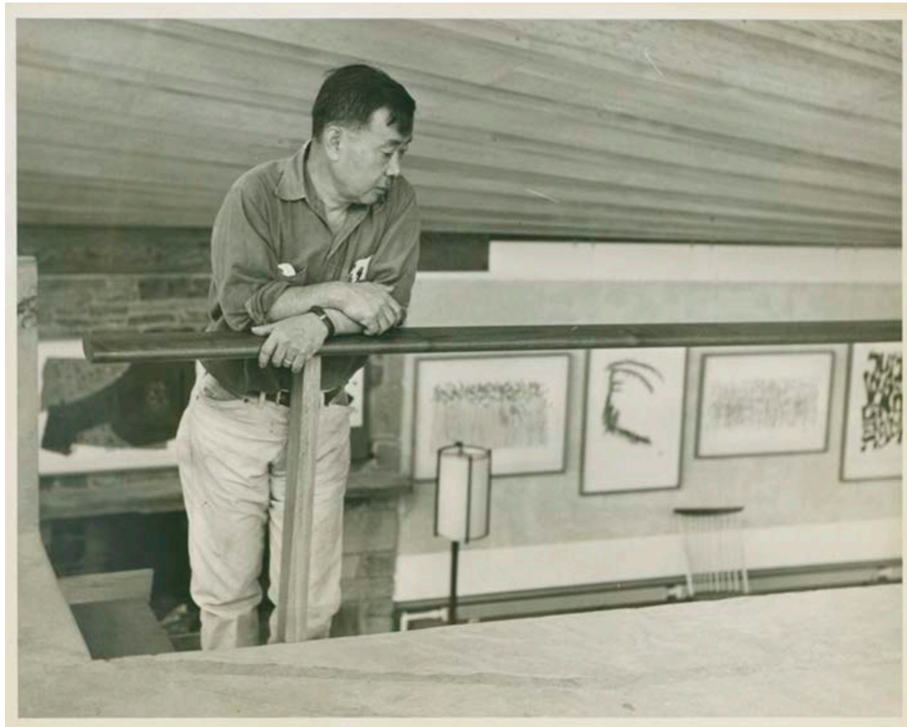
Year	Event	
1943	George Nakashima arrives to New Hope	Sponsored by architect and former employer Antonin Raymond, George Nakashima and his family were released from their interment during WWII at Camp Minidoka in Idaho and lived on Raymond's farm in New Hope, Pennsylvania. Since may of Raymond's comission were government related, Nakashima could not work as an architect and helped on the farm tasks and set up a small furniture workshop.
1945	George Nakashima leaves the farm	After the war, George Nakashima moved into a small house near Meetinghouse Road, in New Hope, and continued his activity as woodworker.
1946	George Nakashima establishes in New Hope	George Nakshima purchases three acres of land from a Quaker farmer in exchange for carpentry work. The family lives in a tent on the property, while George Nakashima buillds the first structure on the site: the Workshop.
1946	The Workshop	This building is enlarged over the years. Originally, it included a funriture making area and an exhibition space but over time, the building becomes specialized for furniture making.
1946	George Nakashima's House	The residence for the Nakashima familiy is built shorlty after the Workshop. In 1954, it is expanded south to provide an additional bedroom for the new born Kevin Nakashima.
1953-1954	The Showroom	Using a rich variety of wood species along with materials of the 20th century, Nakashima builds the Showroom to display pieces of furniture and to house a small-office space. The building sits on concrete posts and is covered with a gable roof. On its west end, it opens towards an outdoor terrace, and a pool.
1954	George Nakashima's House Expansion	The family residence is enlarged by adding a new bedroom on the south elevation.

1954-1955	The Finishing Department	Originally built as a lumber storage, the building is soon repurposed to house the furniture finishing processes.
1958-1959	The Main Lumber Storage Building	Together with Consulting Engineer Paul Weidlinger, George Nakashima experiments with the use of plywood to build his first hyperbolic paraboloid to roof a new storage shed.
1956-1957	The Chair Department	Formerly the clubhouse for the workmen, this building was soon was converted to a space for assembling chairs. The Chair Department was built in 1956 as aprototype for the larger Conoid Studio.
1956-1958	The Conoid Studio	The Studio displays a distinctive corrugated reinforced concrete roof that represents a particular application of a conoidal shell roof. This roof shape confers aesthetical qualities and produces the required strength through form while maintaining the same thickness across the section, approximately 2 1/2 inches. The building provides spaces for furniture design, meeting, and display of pieces of furniture and decorative arts.
1958	The Lanai	Sponsored by the Sipmpson Redwood Company, George Nakashima designs this small structure using California redwood. A cantilevered roof mounted upon two concrete piers houses an outdoor living room which includes a wide flat sitting area and a stone Dutch oven.
1958	The Pool Storage House	Built as a prototype for the Pool House, this small structure of concrete block is covered with a canted barrel vault roof. Nowadays, it is used for storing chemicals and the necesary equipment for the neighboring Swimming Pool.
1960-1961	The Pool House	With its distinctive canted barrel vault roof supported on its sides by stone and concrete block walls, this structure is open on both ends establishing a direct relationship with the landscape. The roof is constructed of plywood and is covered with a thin layer of asphalt and copper flashing. It houses dressing rooms and an open space for leisure activities.
1960	The Swimming Pool	The amoeba shaped pool was built of reinforced concrete and has a cantilevered overhand on its southern side.

1961	The Main Lumber Storage Building Expansion	This lumber storage was expanded adding a new storage space towards the south.
1964-1967	The Arts Building and Cloister	With a soaring hyperbolic paraboloid roof, the Arts Building contrasts a restrained and smaller Cloister. The Arts Building structure consists of the interplay of wood, a reinforced concrete grid slab and walls, and uncoursed random rubble masonry walls and abutments, which ultimately support the tilted hyperbolic paraboloid roof. The Cloister structure is comprised of exposed concrete block masonry walls. Both the Arts Building and Cloister are connected by a covered walkway or engawa, creating an asymmetrical composition. It was intended as an exhibition space and place for interchange in relation to craftsmanship and the arts.
1967	George Nakashima's Garage	The garage is a small rectangular concrete block building with a gable roof covered with corrugated Transite. The walls are covered with stucco and has a foundation of stone. It is a one-car garage with an overhead door and a round window. It also includes a laundry room and storage.
1968	The Main Lumber Storage Building Expansion	For the second time, the lumber storage was expanded.
1970	Mira Nakashima's House	Designed and constructed by George Nakashima for his daughter Mira, this rectangular two-story building is covered with a distinctive scissor truss roof covered with cedar shake shingles. Wall materials include concrete block, wood, and textured stucco.
1970	Mira Nakashima's Guest House	Adjoining Mira Nakashima´s House, this building mirrored the construction features of the main building. It is connected to the house by a covered walkway.
1971	The Main Lumber Storage Building Expansion	The building is enlarged again by adding a tractor shed.

1974-1977	The Reception House	Using also a scissor truss roof system and open floor plan, George Nakashima built this house with a Japanese style tea room and sunken bath to serve as a guesthouse and space for meetings. Wall materials include stone, concrete block, and stucco. A series of sliding shoji doors hides the kitchen.
1977	The Heating House	This small structure consists of concrete block walls covered with a gable roof to house a heating plant. The gas tank is housed in the open area.
1977	The New Lumber Storage Building	This storage was built of concrete block and covered with a plywood and asphalt shed roof.
1982	George Nakashima's House Repair	The earlier roof of cast concrete tiles is replaced.
1985	Mira Nakashima's Garage	With a rectangular shape and vertical wood siding, this structure is coverd with a cedar shake roof. It is a non-contributing building according to the National Historic Landmark nomination.
1990	The Pole Barn	The Pole Barn was designed in 1990, with additions in 1995 and 2008, to serve as lumber storage. It was designed by George Nakashima's grandaughter. It is a non contributing structure according to the National Historic Landmark nomination.
1990	George Nakasima passes away	George Nakashima passes away at 85 in New Hope, Pennsylvania.

* Based on the NHL nomination, the Depreciation Accounting Books, and Nakashima Property List of Buildings (September 12, 1990)



Right: George Nakashima in the Arts Building. Ben Shahn's artworks hang on the walls. This photograph was probably taken shortly after the exhibition was inaugurated in 1967. Source: George Nakashima Woodworker Archives

2. Contextual History

2.1 George Nakashima: Training and Apprenticenship

The many publications about George Nakashima during his lifetime contributed to the legend and mysticism of the artist as a furniture maker; his work as an architect, however, is less represented. In fact, before turning to woodworking, Nakashima was formally trained as an architect, and after a short stay in Paris, followed a career in this profession that led him to embrace modernist ideas in his early years, mainly with Antonin Raymond in Japan and India. These previous experiences, especially Japan, proved instrumental to the particular architectural synthesis Nakashima exemplified in the Northeastern United States.

The 1920s were a period of training. Nakashima attended the schools of architecture at the University of Washington, where he graduated in 1929, and the Massachusetts Institute of Technology, where he obtained his master's degree in 1930. Both institutions imparted an education primarily adapted from the methods and theories of the École des Beaux Arts in Paris, although in the case of MIT, it was amalgamated with a polytechnic system. In Europe, Nakashima might have been exposed to rising modernist ideas during his sponsored stay at the École Américane des Beaux Arts in France, where he received the Prix Fontainebleau in 1929.

This first exposure was supplemented with a second stay in Paris in 1933, where he witnessed the construction of Le Corbusier's Pavillon Suisse. This student dormitory offered Nakashima a first-hand introduction of the modernist interests spreading through Europe; an experience that would be enriched greatly by his work in Japan and India.

Looking to the East, Nakashima moved to Japan and joined Antonin Raymond (1888-1976) in April 1934. Antonin Raymond, who has been recognized as a "father of Modern architecture in Japan,"[2] had established his own practice in Tokyo in 1921 along with his wife Noémi Pernessin Raymond (1889-1980) . Until that moment, the Raymonds had been working in different positions serving Frank Lloyd Wright (1867-1959), first in 1916 in Taliesin, Wisconsin for nine months, and then in 1919 and 1920 at Taliesin and in Tokyo, as paid staff members supervising the construction of the Imperial Hotel and the design of other projects.

This apprenticeship was influential in the Raymonds's practice, although they would ultimately break away from Frank Lloyd Wright by embracing Japanese traditional craftsmanship as "a process to be mastered on its

2. As described in Antonin Raymond's obituaries published in the Japanese newspaper Mainichi Shinbun, 28 October 1973, and in the British newspaper Times, 22 November 1976. Kurt G.F. Helfrich and William Whitaker, Ed, Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond (Princeton Architectural Press: New York, 2006), 29

own terms to meet contemporary needs."[3] In fact, the Raymonds were disillusioned with Wright's superficial use of Japanese inspired ornament in the Imperial Hotel. They considered this a vacuous mannerism completely separated from the local climate, traditions, people, and culture. In part, these opinions recalled Antonin Raymond's earlier training in Prague, where he was in touch with the ideas connected to the rediscovery of traditional folk architecture to question the contemporary ways of designing architecture: eclecticism. Other influences drew on Auguste Perret's (1874-1954) experiences with concrete and Le Corbusier's (1887-1965) approach to collective housing, known through magazines, Raymond's personal exposure and various European architects hired by him.

The Raymonds successfully practiced a synthesis of Western modernist ideas with Japanese lifestyle and construction, which would be ultimately internalized by Nakashima. Working at Raymond's office, Nakashima was exposed to a climate of interchange, where modernist ideas were discussed and filtered with a vernacular vision, where the spirit of the Daiku, traditional carpenters, and the Minka, vernacular farmhouses, were admired. In fact, Antonin Raymond had been hiring European and Japanese architects to catalyze the modernist ideas, nurturing this climate. Nakashima worked with architects such as Maekawa Kunio (1905-1986), Junzo Sakakura (1901-1969), and Czech František Sammer (1907-1973), who had worked for Le Corbusier before joining Raymond's office. More importantly, perhaps, was Junzo Yoshimura (1908-1997), colleague at Raymond's office, who guided Nakashima in his study of the Japanese spirit, traditions, and architecture, including a travel to visit the shrines and temples of Kyoto. Raymond's publications also played an influential role, like Antonin Raymond: His Work in Japan 1920-1935 (1935) and Architectural Details (1938), which included detailing evolved from Japanese traditions that Nakashima reproduced "almost literally in both his buildings and his furniture."[4]

During his stay at the Tokyo's office, Nakashima absorbed Raymond's synthetic approach and practice. Particularly through two projects that would be early precedents of Nakashima's architecture in New Hope: the Raymond's Summer Studio (1933) and the St. Paul's Catholic Church (1934-35), both in Karuizawa, a few hours to the northwest of Tokyo.

At the Raymond's Summer Studio, Antonin Raymond dealt with the site, local materials, and construction craft, which stemmed from Daiku, vernacular Japanese carpenter traditions, to build a complex that included a residence, a studio, and a caretaker's house. The residence and studio, laid out in an asymmetrical floor plan of interconnected spaces, were a hand-hewn chestnut and cedar framed structure upon a poured concrete plinth.

3. Kurt G.F. Helfrich and William Whitaker, Ed, Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond (Princeton Architectural Press: New York, 2006), 24
4. Mira Nakashima, Nature, Form & Spirit: The Life and Legacy of George Nakashima (New York: Abrams, 2003), 21

The house's metal roof was covered with branches of Japanese larch, to protect the roof from the heat and to dampen the noise of the recurrent rains during summer. The main space was the living room, a double-height space organized around the fireplace and the ramp, which connected the studio in the upper floor. Overall, interior spaces flowed into the views of the surrounding landscape through a wide opening in each elevation.

Karuizawa Summer House. South and East Facades. Source: Kurt G.F. Helfrich and William Whitaker, Ed., Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond.

Revealing an interest in the raw qualities of the materials, the house and the furniture were of the simplest. By retaining the prints of the wooden formwork, made of the same species as the walls, the imperfections of the crafted wood were harmonized with the plasticity of the concrete. In so doing, the concrete, as a new material, dialogued with the deep-rooted tradition of wood construction in Japan. The Raymond's Summer Studio was thus a defining model for Nakashima, who witnessed first-hand the possibilities of the vernacular traditions in crafting modern architecture. In fact, Nakashima was among a select group of staff members residing in the caretaker's cottage during their visits and his work in St. Paul's Church. The caretaker's cottage and the swimming pool, which was added between the public and the private wings of the residence, might constitute the earliest references for articulation of the exterior spaces and the idea of the Cloister itself in New Hope.

The intrinsic qualities of local materials were also favored in St. Paul's Church, where Nakashima collaborated on the design and construction. In 1935, father Leo Paul Ward (1896-1942) commissioned the Raymonds to build a Catholic church, after their Summer House and Studio, to serve the spiritual needs of the foreign community sojourning in Karuizawa. Sections and floor plants showed an asymmetrical basilica arrangement, a pitched roof and bell tower with the steeple being reminiscent of Slovakian churches. However, the building and the furnishings were expressed through the Japanese carpenter traditions, this hybrid offering a new conception for the design of sacred spaces.

Deepening in the possibilities of the Raymond's synthesis, the experience in St. Paul's Church exposed Nakashima to the use of concrete and the craft of wood. In this occasion, both wood and concrete were polished with straw and sand to emphasize again the natural qualities of the materials. Nakashima also contributed to the furniture making, which was made of leftover lumber.

After Karuizawa, another influential experience would challenge Nakashima in the use of crafts, but in this occasion in a different context and without the assistance of trained carpenters. In the same year that St. Paul's Church was erected, in 1935, Sri Arubindo Gosh (1872-1950), the leader of a spiritual community or ashram, commissioned Antonin Raymond to

Below: St. Paul's Catholic Church in Karuizawa. Entry Facade. Source: Kurt G.F. Helfrich and William Whitaker, Ed., Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond

project and build a new residential dormitory for his disciples in Pondicherry, India. Previously, Raymond had been introduced by Philippe B. St. Hilaire (Pavitra), a French engineer and ashram disciple himself, who was a close friend of the Raymonds in Tokyo. In this project, Nakashima was assigned to an initial visit, and later to supervise the execution of the construction along with František Sammer. Sammer contributed with his previous experiences in the Centrosoyuz, the Palace of the Soviets competition (1931), and the Pavilion Suisse (1931-32), and undertook the Golconde project until its completion.

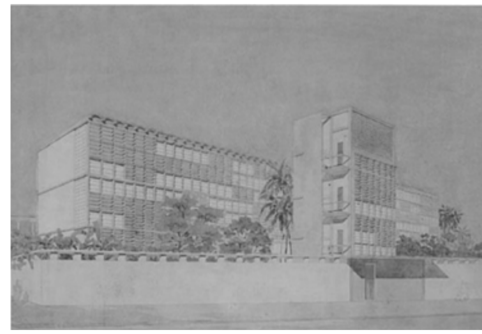
The Golconde Dormitory (1935-42) was projected as a concrete structure facing north and south. Essentially, it was comprised of two rectangular volumes, offset to each other, joined and served by a central functional tower containing the stairs and the hygienic facilities. Modest rooms dedicated to sleep and the study were placed on the upper levels, whereas the dinning and common rooms were located at the ground level. The building was engineered to adapt to tropical and humid climatic characteristics. A roof of precast concrete barrel shells, louvers and overhangs plays a role of sun shield and heat control.

Supervising and living in the ashram, Nakashima gained essential experiences both in the spiritual dimension and in his practice as an architect and craftsman. However, unlike the experiences in Karuizawa with the Japanese carpenters, Nakashima dealt with casual labor integrated by members of the ashram, who were primarily inexperienced in the field of building construction.

As a project architect, Nakashima explored and refined the construction materials and details through the construction of scaled models, which would ultimately constitute a model for his own practice in New Hope. Once again, he was in touch with the reinforced concrete technology and with the craft. Nevertheless, in this occasion, the lack of materials, due to political unrest in Asia and Europe, and the inexperience of the ashram members compelled Nakashima and Sammer to improvise and to develop alternative solutions through craft, which ultimately would help Nakashima to deepen even more in the possibilities of the materials.

Employing craft as a means of facing the lack of manufactured materials for building construction or acceptable furniture had already proved a successful path by the Raymonds, who designed their own modernist furniture in a Japanese context not sufficiently exposed to western taste. As described earlier, Nakashima participated in this process in Karuiwaza, now in Pondicherry, and would supplement and improve this training during his internment in Idaho as explained later in this section.

As an ashram disciple, Nakashima, who was called Sunderananda, which means 'one who delights in beauty', evolved a deeper understanding of life and a transcendent sense that ultimately influenced his position on craft and organizational approach in New Hope. The Sadhana, a "spiritual training to attain deep concentration resulting in union with the ultimate reality,"[5] would be implemented in New Hope. In fact, Nakashima aspired to create "a center for the evolution of life moved by higher consciousness, a life of the spirit."[6] These ideas would be summed up in his book The Soul of a Tree, published in 1981, where Nakashima revealed a spiritual interpretation of woodworking interweaved with a utilitarian dimension.



Rendering of the Golconde dormitory for Sri Arubindo's Ashram. Source: Kurt G.F. Helfrich and William Whitaker, Ed., Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond

Having completed most of the concrete work in Golconde's structure, George Nakashima left India in 1939, to work for few months in Tokyo with Kunio Maekawa (1905-1986), a former colleague of Raymond's office, before returning to the United States. During this time, Nakashima met his future wife, the American Japanese Marion Sumire Okajima (1912-2004). After marrying in 1941, they moved to Seattle, Washington, where Nakashima worked as an architect for Ray Morin and began to make furniture as a part-time activity. However, shortly after the Pearl Harbor Japanese attack and US entry into the war, Nakashima was interned with his family in Minidoka, Idaho, as other Japanese Americans. At the camp, Nakashima met Gentaro Hikogawa, an Issei carpenter who improved Nakashima's skill by training him in the use of traditional Japanese hand tools and wood joinery.

After receiving communication from the Dean of the MIT, Nakashima's former employers, Antoni and Noémi, sponsored the Nakashima family release, who settled on the Raymonds' farm in New Hope in 1943. Since most of the Raymonds' commissions were government-related, Nakashima could not work as an architect. He was dedicated to farming and eventually to woodworking, until he established himself in 1946 having bought a three-acres property along Aquetong Road in exchange for carpentry work. There, Nakashima began a woodworker complex where he brought all the above experiences in Europe, Japan, and India together, which Nakashima interpreted and synthesized on his architecture, the constant evolution of which led to the construction of the Arts Building and the Cloister in the mid-1960s.

2.2 The Arts Building

When Nakashima began the preliminary sketches for the Arts Building, he had already designed and built eight structures on the property, answering the demand of a business in expansion. The location was the low-lying eastern limit of the property, where the slope leveled off, an isolated location distant from the rest of the compound. By using a tilted hyperbolic

5. George Nakashima, The Soul of a Tree, (Tokyo, New York: Kodansha International, 1981), p.138
6. Mira Nakashima, 18

paraboloid roof, the Arts Building culminated a decade of experimental research on expressive roofing at the property and signified a continuation in the use of traditional and manufactured materials. In addition to this striking feature, the Arts Building and Cloister introduced the idea of bridging art, craft, and education together, which also became a marketing tool for both artist and woodworker.

In New Hope, in accordance with his previous experience in Pondicherry, Nakashima began constructing scaled models to understand and control the practical details for subsequent larger constructions, such as the Chair Department (1956-1957) and the Pool Storage House (1958), which established the model for the Conoid Studio (1956-1958) and the Pool House (1960-1961) respectively. In the case of the Arts Building, Nakashima used the technology previously experimented at the Main Lumber Storage Building in 1958, in which the American, Hungarian born, Paul Weidlinger (1914-1999), acted as the consulting engineer. Having collaborated in the Reader's Digest Building (1948-1951), which was built in Tokyo by Raymond and Rado's office, Paul Weidlinger was probably introduced to Nakashima by Antonin Raymond.

This was not the only collaboration between architect and engineer; together with Mario Salvadori (1907-1997), Weidlinger proposed to cover Nakashima's Conoid Studio with an undulating conoid concrete shell only 2 1/2 inch thick. The engineering firm was also the consultant for the Chair Department and the Pool House, using plywood as a roofing material for both.

Right: George Nakashima Woodworker's Complex before the Arts Building and Cloister was built. Ca. 1962. Author: Ezra Stoller, Esto Photographics. Source: George Nakashima Woodworker Archives

Nakashima eventually built six roofs of various warped shapes at New Hope, three hyperbolic paraboloids, and three conoidal shapes of different materials and shapes. In the case of the Arts Building, while the use of a hyperbolic paraboloid appears to be decided from the beginning by Nakashima, the exteriors, the general layout, and the elevations' arrangement evolved during the design phase. In addition, the drawings, which include detailing, give a particular air of precision required for crafting wood.

Although few landscape elements appear to have been considered in the beginning, the relation of the building and site was expressed in a site plan with the existence of a pond, a terrace, a footpath of scattered stones encouraging the promenade, and the inclusion of a road and parking area separating in a modernist manner the pedestrian flow from the road. It appears that the definition of the landscaped area surrounding the Arts Building probably came up after the building was being completed, when he addressed the design of the Cloister and the pathway connecting to the Arts Building.

In the front yard area, articulating the Arts Building and the Cloister areas, Nakashima introduced a pond that is probably reminiscent of the swimming pool in the Raymond's Summer Studio in Karuizawa, which separated the living area from the sleeping area and integrated a water feature as a functional and visual element in the architecture. An existing large glacial boulder partly delimited the pond. This stone generally has been defined as the element of inspiration of the building shape, but in fact, it is revealing an intended poetic relationship between architecture and landscape, as Nakashima desired in following traditional Japanese principles.

The main change to the layout during the conception phase was related to the location of the fireplace. First, it was projected on the northeast elevation, which was pierced with two windows that appear to provide views of the exterior breaking the massive perception of the wall. Lighting was guaranteed by the existence of four skylights. The duo formed by window and fireplace finally found their place in the northern wall, generating a sitting area within the exhibition space.

This sitting area was eventually conceived as visible through a squared opening in the wall closing the north side of the vestibule, which provided a larger view counterbalancing the short view of the walls. This feature exemplifies Nakashima's special sensitivity to the visual qualities and phenomenological aspects of the architecture by showing a genuine understanding of how to use the elements to manipulate the experience of the architectural space.

The change to the fireplace location was also accompanied by alterations on the west and south elevations' design. Starting with large areas covered by wood grill, Nakashima gradually broke down this shading solution and created a composition with a broader direct interrelationship with the exterior, which in turn enriched and modulated the elevations. Essentially, the wood grill was a Japanese inspired frame of vertical cypress strips supported by horizontal cypress strips, which ultimately were designed as operable sunshades.

As in earlier buildings, Nakashima used local materials at hand, such as stone and wood, and took advantage of industrial hardware and materials, some of them recalling Japanese traditions such as the ochre colored rough Structolite™ plaster emulating earthen wall finishes. This practice was a constant for Nakashima, as it happened on his own house or the showroom, where he had used flat and corrugated asbestos cement panels for covering walls and roofs.

The Arts Building was initially intended to exhibit graphic works by Benjamin Shahn (1898-1969) along with Nakashima's furniture. The building, promoted as a private museum, covered a period of around 33 years of Ben Shahn's work, beginning with 'Seward Park, 1934' through approximately 55 graphics in Nakashima's frames that were reminiscent of Shinto shrines. In placing pieces of furniture and artworks together inside the building, Nakashima also generated a suitable context for the business promotion, which portrayed high-minded ideals and a sense of moral coherence with his craft-rooted practice.

Spiritual and educational dimensions soon supplemented the use as a museum. Though no precise evidence supports it, there is a strong possibility that George Nakashima decided to build an adjoining structure in relation to his participation with Minguren, which means "People's Tool Guild" and was a newly group of designer-craftsmen based in Japan that fostered the traditional Japanese craft through its modernization in engaging American and European designers. Membership requirements for Minguren were a sincere engagement with creation and working within an equalitarian fellowship. By incorporating a humble structure, the Cloister, and its connection to the Arts Building with a pathway inspired by the Japanese engawa, Nakashima reinforced this artistic fellowship through a monastic model. This connection was so strong that by 1967, the Arts Buildings was already promoted as the Minguren museum, even before Ben Shahn's death.

2.2.1 Hyperbolic Paraboloids

Inspired by the growing interest in the functional and visually striking qualities of the warped roofs during post war America, Nakashima experimented with the use of plywood as the essential building material to construct three early roof examples. They were the Main Lumber Storage, using a hyperbolic paraboloid, a conoidal roof clubhouse for workers, which quickly became the chair assembly shop or the Chair Department, and the Pool Storage House. While the latter became the model for the Pool House, and the clubhouse roof inspired the corrugated concrete shell for the Studio, the Lumber Storage became the prototype for the Arts Building.

Of European origin, hyperbolic paraboloids widely spread across America during the 1950s within a general climate of innovation. Two main groups favored this context: engineers, architects, and builders, who emigrated from Europe fleeing from war ravages, searching for new opportunities; and manufacturers associations, like the Douglas Fir Plywood Association (1933-1964), which promoted the use of materials used during the war through experimentation in domestic construction and design. Simultaneously, a myriad of publications in journals, university researchers, and conferences accompanied the rising interest in hyperbolic paraboloids. In publishing an article devoted to this type of roof in 1955, Architectural Forum illustrated the trend and offered a concise definition:

> A hyperbolic paraboloid is a warped double-curved surface, saddle shaped, generated by straight line that slides along two straight line directrices not in same plane and remains parallel to plane director. Any intersection of surfaces with vertical plane parallel to its diagonals produces parabolic curves. Although it is double-curved surface, its intersection with vertical plane parallel to edges of surface produces straight lines. Only central lines are horizontal.[7]

The article showed various structural combinations, including the two eventually used by Nakashima: the hyperbolic paraboloid and the tilted hyperbolic paraboloid. Architectural Forum was familiar to Nakashima, as his Showroom (1954) had been published a few months earlier accompanied with some photos in color. Although there is no documented evidence of it, in the case of the Main Lumber Storage, the most direct typological reference might be the sweeping roof built in Raleigh, North Carolina, in 1954, which was designed by Argentinian architect Eduardo Catalano (1917-2010) for his own house. Catalano used bent timber planking for constructing a shell. This was the result of a research program that he implemented at North Carolina State College, continuing the efforts of his predecessor Polish architect Matthew Nowicki (1910-1950). In Raleigh, Nowicki, local architect William H. Deitrick (1895-1974), and engineer Fred Severud (1899-1990) had designed the J.S. Dorton Arena (1952), a structure covered with a parabolic cable roof, which earned ample recognition in the United States. In 1955, Architectural Forum published Catalano's hyperbolic paraboloid roof, and other influential works such as those of Pier Luigi Nervi (1891-1979). Progressive Architecture did the same with Félix Candela (1910-1997), who had attracted attention with his hyperbolic

7. "A New Way to Span Space" in Architectural Forum vol. 103 (November, 1955), 174

Below: Eduardo Catalano's hyperbolic paraboloid. Source: Architectural Forum, November 1955.

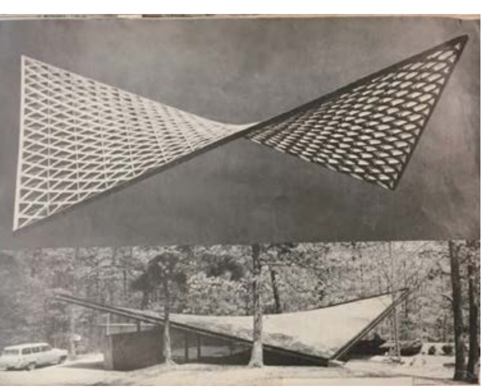
paraboloids in the early 1950s. Nervi and Candela became leading figures who also contributed to the general interest in creating greater and more exciting structures.

In the Mid-West, contemporaneous with Nakashima's Lumber Storage, Professor William Strode and Donald L. Dean, from the Department of Architecture and Architectural Engineering of the University of Kansas, began their own research using plywood sponsored by Douglas Fir Plywood Association (DFPA). As a consequence of this research, in April of 1956, students of the department built an experimental combination of two hyperbolic paraboloid shells each 20 by 20 feet connected along one edge. Essentially, the shell was a lattice structure that consisted of two layers of 1/4-inch plywood strips nail-glued to a plywood box which created the necessary beam on the perimeter. Three reinforced concrete abutments supported the roof structure.

DFPA continued sponsoring research projects, widely lectured in conferences and symposia, and advocated the use of plywood with technical and promotional publications such as Exciting new leisure-time homes of fir plywood (1958) and Second Homes for Leisure Living (1960). This effort accompanied and probably nurtured an increasing interest in plywood as a building material, the use of which became a natural path for Nakashima.

Although there is no documental evidence for affirming that Nakashima knew about of all these experiments before building the lumber storage, it is likely the engineer Paul Weidlinger and associates did. In fact, Mario Salvadori, who began his collaboration with the engineering firm in 1945, had already discussed the overall virtues of thin shells, their various shapes, and suitable materials in a series of three articles in Architectural Record in 1954. Nakashima already knew this modern material through Antonin Raymond, who had used plywood for his house in New Hope (1938-39) and earlier works in Japan.

2.2.2. The Hands-on Approach on the Arts Building: Organization and Hierarchy



George Nakashima's dissatisfaction with the modern practice of architecture in America catalyzed his primary adherence to woodworking, a process that he could control from beginning to end and which demanded an integrated relationship between the processes of design and production. When considering this approach in the context of both the particular conditions in Bucks County and his apprenticeship with Antonin Raymond, why Nakashima did few drawings in comparison to other contemporary architects becomes clear. As the hand drawings portray, Nakashima's sketches are not necessarily empty of details but mirror the hierarchy in the construction process.

As Antonin and Noémi Raymond, Nakashima found the New Hope vicinity an appropriate location for establishing his workshop. In fact, since the late nineteenth century, New Hope had been attracting artists searching for both a sense of community and a relatively cheap location in the proximity to New York and Philadelphia. By the time the Raymonds established their farm in 1939, various visual artists, writers, playwrights, and wealthy New Yorkers had been buying and restoring countryside stone farmhouses to settle in the area, which generated a vibrant artistic community.

George Nakashima working in the workshop. Date Unknown. Author: Ezra Stoller. Esto Photographics. Source: George Nakashima Woodworker Archives.

Within this context, Nakashima adhered to the “model of the solitary craftsman” . He began to work in a single studio applying a philosophy that echoed the tenets of Antonin Raymond, who believed that “life philosophy and design philosophy are one thing, and if the fundamental precepts of life’s philosophy become confused, so will design in any field of art become confused.” Intriguingly, this approach resonated with other craftsmen and designers in the Northeast United States, such as Wharton Esherick (1887-1970) and previously with Henry Chapman Mercer (1856-1930).

Despite Nakashima’s aloofness, a successful business demanding new facilities, offered him a chance to apply his hands-on approach in architecture that stemmed from his earlier experiences in India and Japan, which were discussed in greater detail in the previous section.

In Pondicherry, while supervising the Golconde construction, two main factors were instrumental for Nakashima’s architectural approach: the lack of training of the disciples of the ashram, who were the only builders for the construction according to the explicit wish of Sri Aurobindo, and the lack of materials due to political disturbances in Europe and Asia. While Sammer was in charge of completing the construction drawings, Nakashima delineated detailed and measured drawings for the construction of concrete formwork to explain and guide the construction process to his spiritual colleagues. Craft became a necessary and unexpected action to solve the details stipulated on these project drawings. The lack of materials stimulated the search of alternative solutions on-site like the construction of a foundry for producing the hardware and evolved in Nakashima a sense that “an architect is at the mercy of materials- that he can design only in set patterns because methods of handling materials are so hard to change.”[8]

The difficulties found supervising the Golconde construction probably helped Nakashima to understand even deeper Raymond’s respect for Japanese master-carpenters: the craftsmen who control the process and

8. Bern Ikeler, “George Nakashima: Tenet and Tools” in Bucks County Traveler (December 1951): 45-46

explore the possibilities of the materials, understanding their intrinsic qualities. This approach was connected to the idea of simplicity and honesty in every act of construction.

These attitudes soundly resonated with Nakashima, and rather than acting as a mere designer who envisages the initial idea and plans, Nakashima conceived architecture as an ongoing process in close collaboration with builders. In fact, during a guest lecture at a school of architecture, George Nakashima offered a clear vision of how the education of an architect ought to be. Opposite to the established academic training, involving mainly theoretical action, George Nakashima upheld a hands-on approach through the appreciation of the materials and workmanship. For Nakashima, "only with that knowledge can a designer rise above the status of theoretician and create buildings that in his view successfully synthesize structure and aesthetics, as well as form and function."[9]

In fact, Nakashima more often than not spoke out against a modernist practice focused on questing meaningless innovation and on drafting at the drawing board. For Nakashima "building is essentially a practical problem, and we must face the hard fact that the fundamentals are tools and not paper."[10] Nakashima felt that the division between designer and craftsman "compromised the aesthetics and the literal foundation of a building".[11] Undoubtedly, Nakashima merged this practice with the Raymonds' principles, earlier discussed, and the appreciation of Daiku; accordingly, he said, "designers should be in the same business as contractors. That is the way the master carpenters of pre-modern Japan operated, and it is a good sound system."[12]

In the case of the Arts Building and the Cloister, various and detailed sketches were delivered to the builders. This action does not contradict the widespread idea that Nakashima was intuitive and produced only few project drawings. This practice agrees with the constant supervision by George Nakashima, and even with his own direct participation in the construction process. Known drawings for the Arts Building include exterior elevations, plan, section and elevation of different specific sections, such as the Cloister, the stone masonry abutments, and the fireplace, and highly defined detailing of architectural elements such as post connection and windows. This collection of drawings reveals the breakdown of the project in a manageable scale depending on the operation.

With the construction started, Nakashima embarked on a trip that began with a visit to his daughter Mira in Tokyo, then continued to meet the Minguren group, and finished in Ahmedabad, India. On this same trip, Nakashima also started to work on another hyperbolic paraboloid roof: the Catholic Church of Christ in Katsura (1964-65), near Kyoto. This project came

9. This was said in occasion of an article related to a shop and exhibition at the Full Circle Gallery (April 27th-May 10th, 1986). Rob Howe, "A Lifelong Dedication to Craftsmanship: George Nakashima's One-Man War with the Ordinary" in The Washington Post, Washington Home (April 24, 1986): 19
10. Ibid.
11. Ibid.
12. Charles S. Terry, "George Nakashima, Woodworker" in Japan Architect (February 1963), 59-68

through an old friend from Seattle, the Father Tibesar of the Maryknoll Missions. Mira Nakashima assisted on this project, which was expressed in reinforced concrete. This fact implies that George Nakashima had to remotely supervise the construction of the Arts Building. This probably was done through detailed drawings, which implicitly reveals a construction hierarchy.

Depreciation books offer a glimpse of the construction chronology. The building permit was paid in March of 1964. In May, procurement of materials inaugurated the construction, which was extended until April of 1967. One of the actors in this process was Robert 'Bob' Lovett, who had begun his collaboration with Nakashima working at the workshop in the winter of 1946. Bob's brother, Frances, had introduced him to Nakashima after Bob had been temporarily laid off from his regular job. First, Bob Lovett was involved in the furniture making, and eventually, after sporadic collaborations, became the builder of different buildings at Nakashima's property, among them the Arts Building.

The carefully detailed and measured drawings, which also incorporated basic annotations, were reminiscent of Nakashima's task in Pondicherry: a reflection to show what was to be built. In fact, although builders may be used to Nakashima's architecture and techniques, since the final solution portrayed a high level of craft, the construction process required detailed drawings to communicate the ideas and not mere sketches of the idea, as it happened when the work was initiated and presented to the builders for the first time.

2.2.3 The Relationship with the Arts and the Craftsmanship

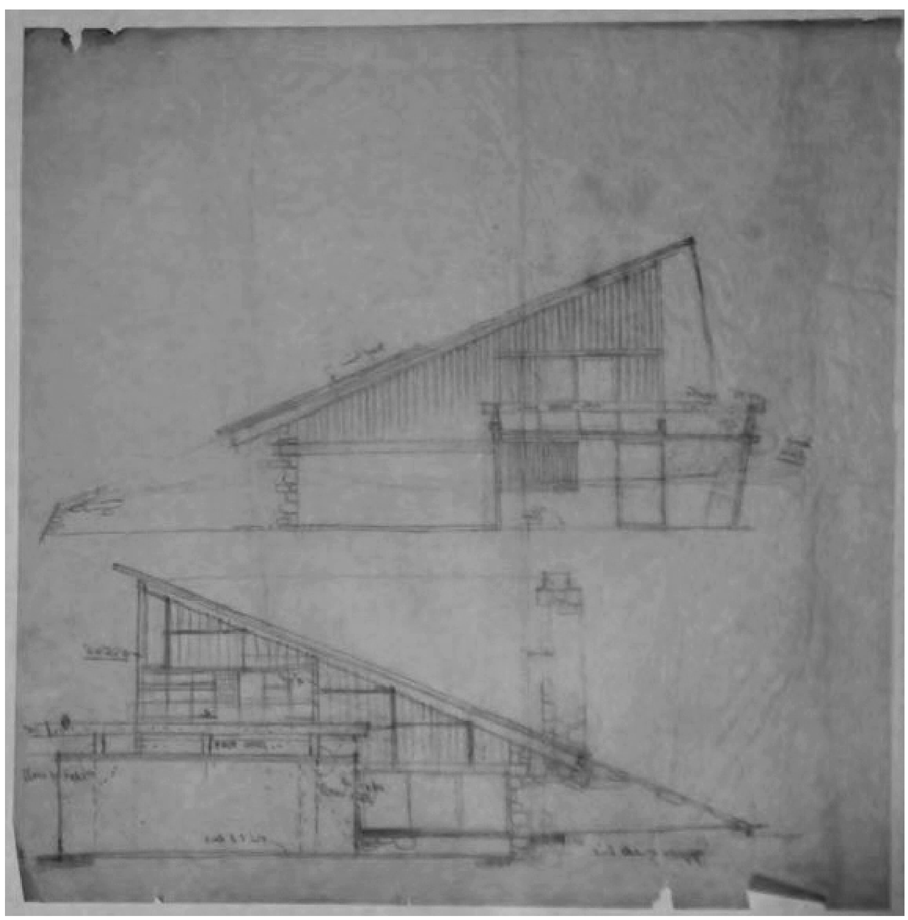
The Arts Building and the Cloister were intended as an exhibition space and as a place of exchange in relation to craftsmanship and the arts. This original idea probably influenced the location of the new building that stood apart from the rest of the complex, which essentially includes a combination of business-related buildings and residences. Undoubtedly, Nakashima's friendship with Ben Shahn and his later involvement with Minguren in the 1960s nurtured Nakashima's personal interest in establishing an association with the arts and craftsmanship that transcended his woodworking activity in New Hope.

In the 1950s, George Nakashima became a friend of the Russian American artist Ben Shahn (1898-1969). Both men implicitly shared beliefs about the redemptive power of the arts and their ephemerality as well, although they reached their ideals from distinct spiritual paths. This acquaintance eventually resulted in a fruitful collaboration in the arts and architecture. Ben and his wife Bernarda Shahn acquired various pieces of furniture by

Nakashima, and Nakashima designed and built the addition of Ben and Bernarda Shahn's house in Roosevelt between 1960 and 1967. In addition, Ben designed the mosaic mural that stands on the southwest wall of the Arts Building.

Benjamin Shahn, son of Russian Jewish émigrés , naturalized American, was a famous and resourceful plastic artist who expressed his ideas using different media such as easel paintings, illustration, photography, mosaics, and murals, within a long career amply recognized by museums, critics, and audience. While Shahn attained wide success during the depression period in America, the triumph of abstract expressionism during the post-World War II relatively set him aside in the artistic scene. Nevertheless, MOMA organized Shahn's first retrospective in 1947 and he was selected to the Venice Biennale's American Pavilion together with Willem de Kooning in 1954.

In the early 1960s, Ben Shahn commissioned George Nakashima to design the extension of his house in Jersey Homesteads, a New Deal community now called Roosevelt, New Jersey. The original building was a single-story cinder block structure designed by Alfred Kastner; Louis I. Kahn being the



George Nakashima's hand drawing for the Arts Building. Ca. 1964. Source: George Nakashima Woodworker Archives.

assistant architect in the office. Mira Nakashima described this addition as a patient process in which George selected the required wood for each purpose. As in earlier buildings, Nakashima crafted built-in furnishings, ensured quality, and adjusted the project to the human scale through its sensitivity and know-how. Some architectural elements at Nakashima's extension greatly resemble those used at the Arts Building: an exposed beam, a grill, and exterior poles. The beam of poured concrete reposes on and extends beyond a random masonry of roughly dressed stone on the western aisle. This detail is repeated in the mezzanine at the Arts Building; an interior grill bears high resemblance to the work in the Cloister, and exterior poles preserve a peculiar shape less concerned with a perfect appearance, which echoes the utilitarian and aesthetic Japanese folk traditions. Other elements are usual in earlier buildings such as the Showroom: exposed post and beam structure, a raffia plaster that echoes Japanese wattle and daub technique, and a stone fireplace with a metallic hood.

Unfortunately, Shahn died in 1969, shortly after the Arts Building was concluded along with the first exhibition of his artwork took place. On one of the visits to the property, "Ben noticed that George had designed a wall with a perfect cant for a mosaic."[13] To this end, Ben Shan painted a gouache titled 'The Poet's Beard,' which had to be enlarged 5.5 times and eventually used as the base design for the mosaic. In 1970, George Nakashima hired the services of Gabriel Loire through the Société d'Exportations d'Art Religeux and the agent of Loire in the United States, which had headquarters in New York. Gabriel Loire (1904-1996) was a well-known French stained glass mural artist. Among his commissions in Pennsylvania were the Main Line Reform Temple in Wynnewood (1960), Saint Thomas Moore Church in Allentown (1969), and the mural at the Arts Building, which was fabricated at the Gabriel Loire Atelier (1946) in Chartres, France. The mural was divided into eight panels that were mounted together during the process of manufacture to control and minimize as much as possible the visual impact of the joints. Finally, the mural was shipped to New Hope in October 1970 and installed on the exterior of the building.

In 1964, Nakashima became involved with the Japanese sculptor Masayuki Nagare (1923), founder of Minguren, who was in New York for an exhibition of his work at the Staempfi Gallery in Manhattan and supervising the execution of a stonewall of volcanic rock called 'Stone Crazy' at the 1964-1965 World's Fair in New York. Nagare and Nakashima's first acquaintance became a fruitful friendship that led Nakashima to visit the Minguren group in Japan and to rename the Arts Building as the Minguren Museum as previously described.

In the fall of 1963, to participate in the Japanese pavilion construction,

13. Mira Nakashima, 187

Nagare brought a group of seven craftsmen from Shikoku to recreate the traditional stone masonry of Japanese castles. This pavilion, which intended to embody the best of Japan, combined three buildings that merged traditional and contemporary Nipponese designs, emphasizing the contrast between old and new, both in architecture and content. It offered an overview of technology, products, and food along with a glimpse to pre-industrial Japan.

Nakashima possibly abhorred the technological purview of the fair. However, the improvised character that Nagare showed during the construction probably aroused his sympathy. In response, Nagare invited Nakashima, being a craftsman himself, to join Minguren. Nakashima did not hesitate to collaborate with this group, establishing a strong tie that was memorialized when the Arts Building was renamed Minguren museum. Two other material evidences corroborate this connection: Nakashima obtained some black volcanic stones of Nagare's stone wall, which were used eventually in the construction of the interior masonry wall that supports the cantilevered steps leading to the second story at the Arts Building. Additionally, Nakashima placed a sculpture called 'keyhole' by Masayuki Nagare, originally made for the Japanese Pavilion, near to the entrance.

Together with the spiritual lessons of life, the intention of erecting an adjoining building to host Japanese craftsmen visiting New Hope was probably related to the experiences Nakashima had in Japan, while visiting Minguren's members in the fall of 1964, and possibly reinforced by the fact that he was also designing and consulting for the National Design Institute in Ahmedabad, India. As described previously, the earliest precedent might have been the outbuilding at Raymond's Summer Studio in Karuizawa, where a selected group of staff members stayed, among them Nakashima.

2.3. The Foundation for Peace

Having an aspiration for something beyond his identity and using two massive slabs of American walnut, Nakashima envisioned the craft of a first altar of peace, which was a culminating expression of his spiritual interest in bringing peace to the world across the years. The altar of peace eventually became six, one for each continent, to be placed in a space in agreement with the symbolism of the altars. Ultimately, the Arts Building would house the headquarters of the Foundation for Peace, who aimed to promote and expand the 1984 Altar of Peace Project.

In 1983, Nakashima purchased a large walnut log from his logger, Frank Kozlosky, and cut by Scot Wineland, a California-based logger. The log was obtained from a 300-year-old tree in Long Island, 12 feet long, and tapering in diameter from 5 to 7 feet. The process of cutting the log and obtaining the boards was thoughtful and sensitive, and deserved the attention of the media, which interpreted it beyond a utilitarian approach to link it with a transcendental dimension. The boards obtained from the log possessed a suitable size and magnificent grain to become the expression of Nakashima's spiritual endeavor. In fact, Nakashima envisioned each Altar of Peace: "as a genuine expression of nature and an act of beauty... Peace in a tangible form, instead of an abstract idea and an absence of war... the pure spirit of peace for which all people yearn and the world politicians spurn... A shrine for all peoples and owned by no one."

George Nakashima and the first Altar of Peace completed. 1986. Neal Boenzi. Source: George Nakashima Woodworker Archives.

A first Altar, to be installed at the Cathedral of Saint John the Divine in New York City and sponsored by Steven C. Rockefeller and Dean James Parks Morton, was finished in 1986, the dimensions being 10.5 by 10.5 feet. The altar was formed from two walnut boards built on a base, connected by butterfly keys, and engineered to allow expansion and contraction because of thermic loads.

When George Nakashima passed away in 1990, the first Altar Peace was already placed and there were negotiations to install a second one in Russia. Eventually, this was housed in the Academy of Sciences in Moscow in 2001. In 1996, a third Peace Altar was dedicated in Auroville, an international spiritual community near Pondicherry found by Sri Aurobindo and Mother Mira in 1968.

The Altar of Peace Project was renamed as the Nakashima's Foundation for Peace in 1995, which would set the Altar of Peace Project and the advocacy of the cultural programs related to the various Peace Altars as its main goals. George Nakashima's wife, Marion Nakashima, donated the Arts Buildings and Cloister to the foundation in 2003. This action added a new layer of significance to the building, which became the foundation's headquarters. In addition, now the building houses wood boards for crafting new future altars, personal objects gathered through the years by George Nakashima and his family, prototype furniture and archival material, and it is used for concerts and other events related to the Foundation for Peace's goals.









3. Architectural and Material Description

Visitors walking down the path from the Conoid Studio soon recognize the expressive Arts Building with its tilted hyperbolic paraboloid roof that contrasts a restrained and smaller attached Cloister. Both buildings stand apart in an isolated wooded area on the eastern limit of the property, where the slope flatten out. As described earlier, the compound displays Japanese and Bucks County influences, which are recognizable through the use of typical architectural elements that are merged in a new way of expression. In this building, it is possible to find a combination of traditional materials, such as stone and different woods, with innovative twentieth century materials, such as plywood and concrete block.

The Arts Building is about 23 feet high and measures nearly 36 by 40 feet; the Cloister is about 11 feet tall and measures approximately 19 by 39 feet, which includes a porch. The Arts Building structure consists of the interplay of wood, a reinforced concrete grid slab and walls, and random rubble masonry walls and abutments, which ultimately support the hyperbolic paraboloid roof. The Cloister structure is comprised of common exposed concrete block masonry walls. Both the Arts Building and Cloister are connected by a covered walkway, which is reminiscent of a Japanese *engawa*, creating an asymmetrical composition.

The Arts Building opens entirely towards the south and west through the interplay of structural elements made of cypress and single and double-glazing infill , which is further screened by Japanese-inspired hinged grills, also of cypress. The varying combination of glazed spans and grills generates different degrees of privacy while offering shade and controlled views of the surrounding landscape.

These elevations noticeably contrast with the massive and solid east and north elevations. On the southwestern corner, a reinforced concrete structure partly intersects the main volume while giving form to three functions: to announce the main entrance, to serve as an exterior terrace, and to act as Ben Shahn's mosaic support. Upon this volume, an interconnected combination of wood and poured concrete rails define the terrace.

Covering the Arts building, the tilted hyperbolic paraboloid roof, with noticeable slightly curved eaves, rests on two triangular stone masonry abutments and a reinforced concrete section. The roof is held by two tapered white oak beams, on the west and south elevations, and on plates con-

Below: The Arts Building's exhibition space. Notice the cantileverd steps leading to the mezannine. November 2015.

nected to concrete block masonry walls on the north and east elevations. Each tapered beam is supported on their lower ends by the two triangular abutments of 18 inch-thick random rubble masonry, whereas the thinner upper ends, are joined and probably bolted together with a through wedged tenon joint, which is supported by a white oak post connected to a concrete dado built upon a concrete grid slab. Originally, tapering and adjusting the main beams to their final position took about three weeks. The roof is pierced on its north side by a rubble stone chimney and a skylight, which allow additional daylight to the interior.

Sliding windows and doors establish a clear relationship between exterior and interior on both elevations, progressing from a controlled environment to the wood, passing through a landscaped ground area that combines organic forms, such as the pond surrounded by rock arrangements, and with rectilinear elements such as a stone masonry fence to create an exterior foyer.

In the main entrance, the transition between the exterior and the interior is formally materialized through a single ample door housed on a white rendered 12 inch concrete block unit masonry wall, which stands recessed under the south side of the terrace. The door leads to a compressed space known as the "cave", which is the vestibule of the Arts Building.

This vestibule is delimited by the mentioned exterior wall on its south side, an oblique concrete slab reinforced with concrete ribs on the west side, and a stone masonry wall in the north side. The east side remains open to the main exhibition area. Stone slabs of various sizes and shapes form the flooring, which is heated by a radiant heating sy. A lower ceiling, which consists of a six by five reinforced concrete grid, emphasizes the compressing effect. A bar in a closet serves this space, which is illuminated by five skylights with fixed shoji screens and a window with sliding shoji screens.

The exhibition space reads as a flowing, variable-height large room, divided into two areas: a large exhibition area and a sitting area around a fireplace. The north and east wall are plastered with Structolite™. The flooring is of vinyl asbestos tiles simulating travertine. Referencing the exterior materials, the fireplace is constructed of uncoursed random rubble stone masonry. The firebox back is partially constructed with firebrick, and the front hearth is polygonal flat sandstone. On the left side of the fireplace, a casement window with a fixed pane of glass, which terminates directly into the stone wall, provides light, ventilation, and views to the north side of the building.

A second sitting room is placed on the second floor, accessed via cantilevered steps, the shape of which echoes Nakashima's earlier milk table design. This mezzanine overlooks the main space of the gallery and has direct access to the exterior terrace through an opening with sliding doors. A walnut floor, built-in spindle-back settees, and built-in shelves enriched with a variety of different connections characterize the space. For ventilation, there are two single paned casement windows with a crank handle.

The tapered beams hold seventeen ribs of tapered section, which are the support for the plywood deck. These ribs are based on those utilized in the New Lumber Storage, which was the model for the Arts Building as described in the previous section. The half-lap scarf joints with exposed bolts used at the Lumber Storage to transmit stresses were stylized. Now Japanese-inspired scarf joints, which are secured with a single screw on each side, display conspicuous craftsmanship. Over the ribs, Nakashima harnessed three layers of 5/8-inch plywood boards and a non-ventilated roofing system, which, according to Robert Lovett's interview, consists of two layers of Cellotex™, asphalt impregnated lining, and marble chips.

Providing exterior shelter for visitors moving from the Arts Building to the Cloister and vice versa, the pathway structure incorporates a light interplay of ipe posts, beams, 1 inch thick plywood, and a bituminous waterproof skin. The pavement is comprised of reddish fieldstone flat slabs directly placed upon the ground and with gray gravel, which covers the rest of the pathway.

The austere geometry of the Cloister is reinforced by the modesty of its materials. While the front of the Cloister opens up to the landscaped yard with the pond on a different level, in the rear, the Cloister walls directly meet the ground level.

Divided by concrete block wall partitions, the Cloister layout is comprised of four spaces: a storage room, now used to house archival material, a service area with kitchenette and bathroom, a room for the heating system, and a small-sized multifunctional living/sleeping area. The front elevation reveals the access to the main spaces, while the rear houses the access to the room that contains the heating system.

Upon the walls, douglas fir wood plates rest upon the concrete block walls, and provide the necessary connection between rafters and walls. The roof is a built-up system upon a one 5/8 inch plywood board substrate. Ceiling and eave soffits are made of tongue and groove fir boards, probably 1/2 by 4-inch.

In the rear elevation, openings house sliding windows. The concrete lintels mimic those used in other buildings such as the Workshop and the New Lumber Storage. Indoors, a shoji screen diffuses the light; outdoors, a utilitarian metallic screen protects from insects.

On the front elevation, doors, which are an interplay of wood and glass covered with paper, give access to the interior spaces. As in the Arts Building, the flooring is a vinyl asbestos tiles simulating travertine. In the living/sleeping area, three walls are covered with Structolite™, recalling the Arts Building.

3.1. The Hyperbolic Paraboloid Roof: Plywood, Copper, and Impervious Materials.

For the Arts Building, Nakashima reproduced the plywood shell roof first developed for the Main Lumber Storage (1958). However, the intentional display of visible craft at the Arts Building required carefully designed ribs and joints, and the application of a delicate white translucent finish on the exposed faces of the plywood.

The New York engineering firm of Paul Wiedlinger suggested the use of three layers of 1/2-inch plywood, shifted ninety degrees to overlap joints, and nailed with twelve 6d nails by foot. Hand measuring revealed that each panel is 5/8-inch thick, and 4' wide and 8' long, which was a common standard in the plywood industry since the early 1930s. Therefore, the as-built thickness shows an excess of 3/8-inch in relation to the initial design.

Regarding the construction, Robert "Bob" Lovett, one of the builders, revealed that the three layers of plywood comprised 160 sheets, which needed to be trimmed, screwed, nailed, and glued together. Opposite sides are laid on the ribs and opposite ends, which appear not to be glued, abut to the contiguous panels.

This plywood shell was connected to tapered beams on two sides, and to warped plates installed on the walls. A preliminary sketch by Matthys P. Levy, one of the associates at Paul Weidlinger Consulting Engineer, recommended to fasten the shell to a 12 inches concrete block wall with 3/4-inch bolts spaced 7 inches on center. These bolts joined the three layers of plywood to a tapered plate placen on the wall top. A handwritten annotation offered the possibility of countersinking the bolts into the plate and nailing the plywood down.

According to Bob Lovett, the shell was secured installing a plate 2x8-inch above it and all around the perimeter. This plate would be fastened to the plates installed on the walls and to the edge beams. Therefore, the three plywood layers remained inserted in between those elements. A sketch by George Nakashima is very telling about this final solution. Roughly drawn, a cross section shows a 2x8-inch plate fastened to a tapered beam with two rows of 5 and 6-inch long screws spaced 8 inches on center.

Beyond the perimetric structure, the plywood shell projects to form wide eaves, which taper towards the roof's upper corner. The exterior edges on the eaves are protected with a strip made of cypress, abutting the edge of the second layer of plywood; the first layer simply sets back and is currently finished with white paint. Since the wooden strip was not available in the required length, scarf joints were used in the south and west elevations, whereas in the north and east elevations the strip appears to be abutted and screwed to the plywood shell. Half blind corner half lap or perhaps a half blind corner joint was used on the intersections at 90º degrees in the lower ends, whereas on the top southwestern corner and in the northeastern corner beveled joints were used.

A similar solution was used on the Cloister's porch, according to the construction sketches, where an inset detail shows a 1 1/8-inch thick wooden strip trimmed to receive and house a plywood panel edge, whereas on the walkway an inset detail depicts a 1 3/4-inch by 5 1/2-inch cypress soffit also trimmed to receive and house the plywood panel edge. Therefore, these components perform a double function: they protect the edge and stiffen the border, which has more proclivities to deterioration. In case of deterioration, they can be replaced without affecting the plywood edge.

According to Bob Lovett, the roof was finished with two layers of 3/4-inch Celotex™[14], asphalt saturated felts, and eight tons of marble chips on top of the asphalt lining. In the case of the Arts Building, the asphalt coating acted as the waterproofing coat as well as the adhesive material to maintain the white marble chips in place. Taking into account the dates of construction, it is necessary to know that bituminous coatings may involve either liquid bitumen with nothing added, or may have asbestos fibers admixed.

The current state shows that the hyperbolic paraboloid roof eaves are covered with copper sheets, which are overlapped and present sealed joints. By bending the outward ends over an edge nailer, the outer sheets form the edges of the eaves and allow water to shed from the roof eaves. The outer edges of the inward copper sheets turn up to form an edge strip that contains the roofing materials, such as the insulation, impervious materials, and marble chips. Therefore, between the turned up edge and the nailer, this roofing solution forms a flat wide channel to carry water towards the gutters. Expansion joints are not recognizable. The green patina covering most of the copper surface suggests that the copper sheets have age and are probably original.

In addition to the wide eaves, box-style copper gutters (approximately 3 1/2" x 3 1/2") were installed and directly fastened along the drip edge of the eaves in the northeast and northwest sides to carry off rainwater. In-

14. Usually, Celotex™ was an insulating fiberboard which could be used as ordinary sheathing in walls and cealings. The board had a waterproofing treatment. Roof sampling will offer the opportunity to investigate and identify the type and the properties of the material.

stead of outlets, the gutter ends are open and extended beyond the eaves' limits to drain the rainwater directly to two ponds, which were strategically situated since the beginning. Gutters appear to be custom made, manufactured from 0.250" patinated copper sheet and the sections assembled by overlapping and nailing their ends. Numerous copper gutter hidden hangers help to preserve the squared section shape and to connect the gutters to the eaves edges, also crafted with copper sheets.

A copper canopy installed over the sliding window in the west elevation was also designed. This canopy, which is an alteration from the original state, was built using a standing seam cooper roof. Upper and lower pans are connected by means of standing seams, which are laid where the canopy meets the copper flashing attached to the wood frame. Seams and edges appear to be properly sealed. Copper is also used on the flashing of the stone masonry chimney and in the patinated copper edge strips installed in the covered walkway, which connects the Arts Building and Cloister, as well as in the Cloister's roof and porch.

3.2. The Envelope: Masonry, Wood, and Glass

Stone

In the *Soul of a Tree*, Nakashima praised the Bucks County barns and admired the stone masonry traditions of the English Quakers, thus suggesting his recognition of and reference to local materials and traditions. Nakashima admired the durability of stone masonry stating, "There is a wonderful feeling to be had in erecting a stone wall. There is a sense of order and permanence. A good wall will last for generations and even millennia."[15]

Nakashima's craft of stone masonry is evident in most of the buildings throughout the property, first in his residence, and then in the Showroom, the Conoid Studio, the Arts Building and Cloister, and the Reception House. In the case of Nakashima's House, the family collected most of the stone on site and the vicinity. In the case of the Arts Building, Nakashima used a massive uncoursed random rubble masonry technology to construct load-bearing 18-inch thick abutments. The provider was Delaware Quarries founded by Joseph Busik in 1946 after buying a company that historically operated on the banks of the Delaware River. Busik expanded the business and diversified the stone offer under an agreement reached with other quarries, becoming thus a stone yard. Consequently, the origin of the stones at the Arts Building is probably diverse.

The stone masonry is comprised of a variety of stones of distinctive type, size, and color: volcanic stones (gift of Masayuki Nagare), granite, yellow sandstone, brownstone, argillite, granite, Pennsylvania black limestone, di-

15. George Nakashima, *The Soul of a Tree*, 71

verse colored sandstones, and possibly diorite, basalt, siltstone, and shale.

In the abutments, the stones are arranged in a random pattern with some regular courses interrupted by large stones, a technique which is reminiscent of the Bucks County stone masonry barns. Overall, shapes are irregular, from more rounded to more squared stones. Stone finishes comprise slightly dressed rubble, which include some work on face, beds, and joints. Quoin stones are squared, and are placed either as headers or stretchers; some act as bond stones. Special stones are carved and interlocked with the lower end of the tapered beams, creating a joint that involves both wood and stone.

Unlike the abutments and the stack, the chimney is a mixed rubble masonry with predominately roughly squared units, particularly in the corners. The cap consists of a flat stone slab resting upon concrete bricks.

The stones are laid with a lime or lime-cement mortar, the color of which ranges from light brown to grey, a quality that is likely related to the type of aggregate employed. Joints range from half an inch to one inch and a half and are irregularly recessed from the stone faces approximately one inch.

Concrete Block

A genuine material of the twentieth century, the history of the concrete block dates back to the last decades of the nineteenth century. Nakashima used this material for foundations and for both the stuccoed and exposed walls.

The Cloister stands tight to the technical recommended restrictions for construction with CMU. Its greatest height is around 11 feet and its maximum width approximately 12 feet. The interior wall partitions, which are keyed to the load-bearing walls, are disposed perpendicularly to the Cloister's length, contributing thus to stiffening and stabilizing the building structure against lateral loads.

Although there is no evidence of the use of reinforcements, such as steel wires placed in mortar bed joints over the face shells in hollow masonry, the Cloister load-bearing walls were probably reinforced by grouting the CMU cores at least on the elements that need to resist higher stresses: corners and jambs. In the east elevation, lintels, which are reminiscent of those used at the Workshop and the Main Lumber Storage, are made of reinforced concrete connected to the CMU masonry. Footings are unknown.

The as-built conditions reveal the use of stretcher units and single corner units, the faces of which are in the plane. Unit nominal dimensions used at the Cloister are 8 by 8 by 16-inch for the load-bearing walls, 4 by 8 by 16-

inch for the partitions, and 8 by 4 by 16-inch for the top row in the plinth. At the Cloister, two types of concrete blocks that vary in color have also been identified. A dark grey color was used in the wall foundation at the southeastern corner, while a lighter concrete block was used for the rest of the masonry.

The bond follows the typical running bond pattern, which at some point is replaced by a stack bond construction in the plinth. The running bond is a concrete masonry bond having successive courses of overlapping stretcher units with head joints falling in the middle of the unit in the previous row. In the stack bond, the overlap is less than 1/4 of the unit length. It is noticeable that the mortar joint profile is concave, very likely produced with a rounded jointer, probably 5/8 inch. This type of joint was recommended for exterior walls because it easily sheds water.

In the case of the Arts Building, Nakashima used a load-bearing wall comprised of a single width of lightweight concrete block rendered with fine layer of white stucco on the exterior. As revealed by moisture stains, a running bond was also used. Insulation was provided by Styrofoam™, placed between the concrete block masonry and the plaster lath.[16] In the interior, walls were finished with Structolite™. Nakashima crafted and applied this ready-mix base coat plaster to resemble vernacular wattle and daub plaster.

Wood

Nakashima as woodworker crafted wood to generate a variety of utilitarian and structural elements. The joinery that can be seen in Nakashima's furniture is also employed in his architecture. Nakashima noticed this practice in the Bucks County barns, where joinery was shared both by the structural elements and furniture.

Two species were originally primarily employed: White Oak (*Quercus alba*) and Cypress (*Taxodium distichum*). Alterations introduced a new species: Ipe (*Tabebuia spp.*) Load-bearing elements, like the beams and lintels are White Oak. Extant earlier posts in the pathway are also White Oak, while the replaced posts are Ipe. The frame and the architectural elements in the south and west elevations, such as the grills and sliding windows, are cypress. Tongue and groove fir board was employed as sheathing in the Cloister. The stairway is made of three-inch thick White Oak planks cantilevered twelve inches from a stone masonry wall.

Specific species of other architectural elements made of wood are unknown, such as the ribs, the doors, the baseboard heater protection, and plates. Further investigation is required to identify and characterize the

16. This description is based on the interview withz Aram Dadian, master craftsman, who was involded in a number of repairs done in the early 1990.

species of these elements, in order to determine material properties and analyze causes of deterioration, since wood behavior is highly variable depending on the characteristics of the wood species and the conditions of use.

Glass

On the window walls, plate glass is used as double glass and single glasses. Fixed windows are combined with sliding doors and casement windows, which are built using single glass. Simple glass was used in all the sliding windows and in the casement window at the side of the fireplace. Usually, double glass is used for the infill in the window walls except for the lower panes in the corners. Both types of glass are original to the Arts Building.

Curiously, despite the high level of openness of these elevations and the clear intention of linking exterior and interior, grades of transparency and translucency are incorporated into the project through the use of exterior grills and interior shojis. With regard to the window walls, a window schedule will be submitted, which will include window deatiling and the examination of glazing systems.

3.3 The Use of Reinforced Concrete

George Nakashima chose a grided concrete slab to cover the column-free wide space of the vestibule in the Arts Building. The original framing plan, projected by Paul Weidlinger Consulting Engineering, suggested a six by six grid of identical squared spaces. Conversely, as-built conditions reveal a handling of the engineered elements that provides a less rigid solution while economizing on material. The extant framing is a six by five grid of identical squared spaces. In the row next to the wall at an angle, the spans were substituted by openings to house five skylights. This structural arrangement exhibits Nakashima's mastery to craft the creative and aesthetic aspects of the structure, while controlling technical aspects.

Essentially, this structural system is a reinforced concrete monolithic two-inch thin slab integral with six by six-inch tapered joists. Beams and walls in the grid slab's perimeter support it, which include a stone masonry wall at the north, CMU masonry wall at the south, and a reinforced concrete wall at an angle reinforced with ribs.

Although the as-built reinforcement is unknown, during a visit to the Michener Museum in March 2015, a frame plan by Paul Weidlinger was discovered. The plan shows typical reinforcement for the joists and the slab. Essentially, it was recommended to install two #4 rebars in the upper section and one #9 rebar in the lower section of each joist, and #4 rebar at 12 inches between joists. All concrete walls below the grid slab had to be 8 inches thick with #4 rebar 10 inches at each way in each wall. Rebars in the joists in the north are bent and anchored into the wall.

As the surficial woodprints reveal, plywood was used as a formwork. However, not much care was taken on pouring the concrete as the imperfections, such as the plywood seams are and the honeycomb. The presence of some offsets reveals that the form did not fit perfectly at the time of pouring the concrete.

At some point, the framing experienced a significant deformation that caused cracks providing an easy path for rainwater and demanded the addition of a new support, a polished wooden log.

3.4. Flooring materials

A combination of traditional and modern flooring materials establishes an interrelationship between the interior and the landscape. The vestibule floor is laid with local stone slabs of different sizes and shapes. The main exhibition space in the Arts Building floor is laid with vinyl flooring, which was also used to cover the Cloister floor. In the mezzanine, a raised walnut floor partially covers the exposed concrete.

On the exterior different sizes of stones add visual interest while at the same time accomplishing a functional purpose. Overall, walkways are made with irregular flagstone, but in the covered pathway, where the flagstone shows a more regular and square shape; white pea gravel completes the path. A dark river rock band is used to cover the ground that receives the water runoff from the Cloister roof.

Nakashima employed artificial Amtico™Travertine tiles of 36 by 36-inch size with 1/8-inch thickness installed upon a smooth concrete base, the adhesive being unknown. This dimension exceeds the standard 12 by 12 inches; 3/32-inch gauge Amtico Rubber Flooring, a subdivision of American Biltrite Rubber Company, commercialized under the vinyl-asbestos travertine tiles type.

American Biltrite Rubber Company, which still exists, was founded as Ewell Rubber Company in 1908. The company first produced shoe heels and soles entering into the flooring material industry in the first decades of expansion. In 1961, American Biltrite acquired Bonafide Milles, Inc., a manufacturer of vinyl-asbestos and asphalt coverings, which doubled the production abilities of its Amtico Rubber Flooring division, which produced solid vinyl and rubber floor coverings.

The fact that Amtico produced such a diversity of flooring materials implies two possibilities: that Amtico™ Travertine vinyl-asbestos tiles were manufactured as a special size, costs being higher, or, as described earlier, 36 by 36 inch was a standard within the solid vinyl tiles produced by the company. Consequently, it might be a possibility that the tile used by Nakashima is free of asbestos.

3.5. Building Mechanical Systems and Installations

Building mechanical systems and installations in the Arts Building and Cloister include heating, electricity, telecommunications, water distribution, and sewage collection systems.

Heating is based on a central heating system that feeds pipe radiations. Each radiator is a welded steel pipe that bristles with steel radiating fins and is connected to the following radiator by the pipes. The radiators are mounted on the wall and are integrated in the architecture by housing them under a wood board that reads as a baseboard all around the main exhibition space and in the west side of the mezzanine. Pipes installed below the stone paving heat the vestibule area. The boiler is housed in the Cloister, in a utility's room with access from the east side. The fuel tank stands outdoors in the north side of the Cloister, partly hidden by the concrete masonry and a wood grill. Thermostats strategically placed in the interior assist in regulating the comfort level. During the site visits in the fall and the winter, heating was operative.

Artificial lighting is occasional and strategically located, enhancing the architectural experience. Noguchi lamps are used in the interiors, providing an indirect and filtered warm light. Outdoors, lighting fixtures is solely present in the Cloister porch.

There is no air-conditioning system. However, the casing windows strategically placed in the mezzanine area and sliding windows and doors allow enough interior natural ventilation.

A water pipe system distributes water to a faucet installed in the bar at the Arts Building, and to a kitchenette, shower, and toilet housed in the Cloister. The design and sizing of the sanitary sewage system, installed below grade, is unknown.

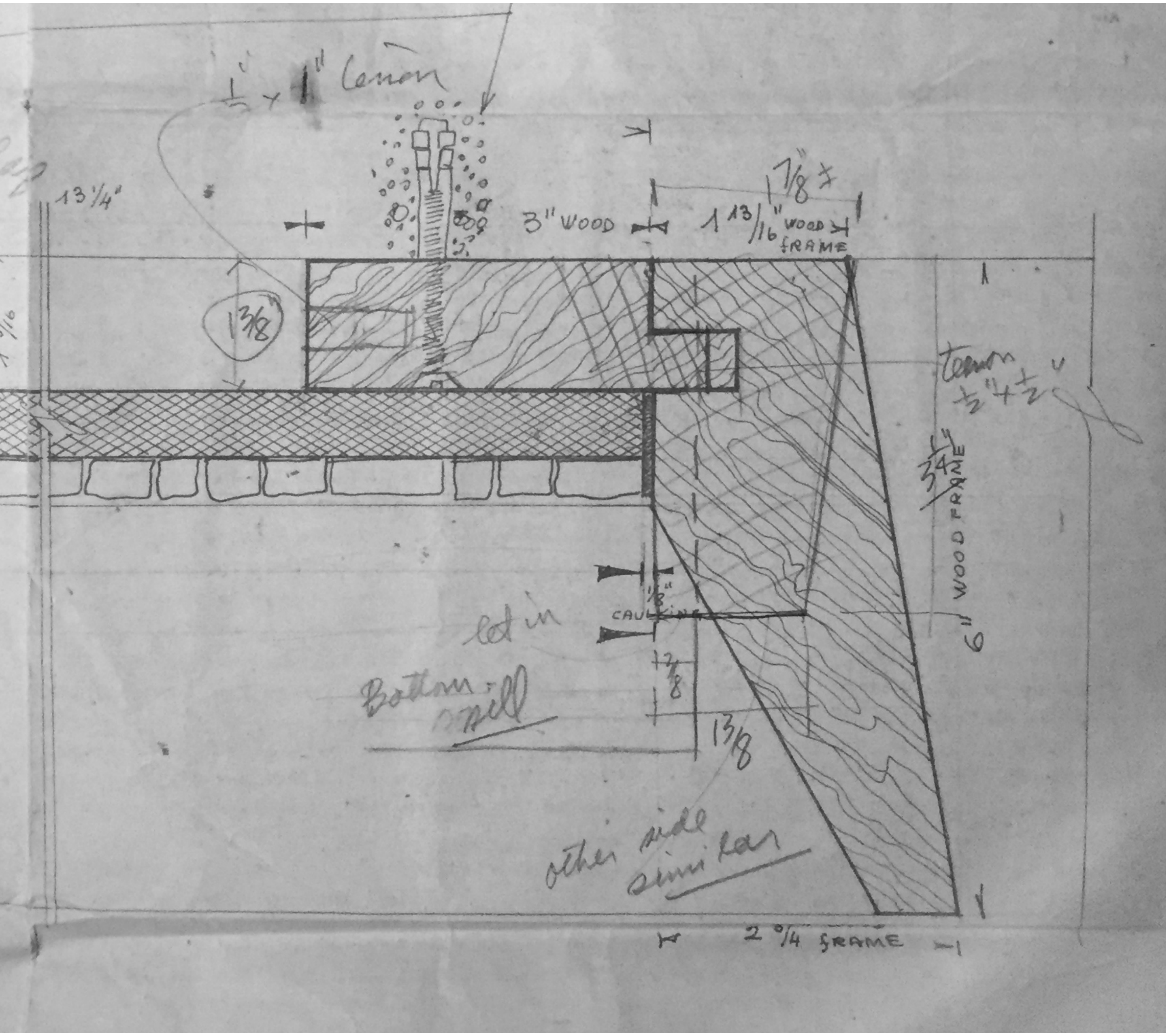


Fig. 4.1. Detailing for installation of the mural mosaic.
Provided by Gabriel Loire, June 1970, with corrections by George Nakashima.
Source: George Nakashima Collection, James A. Michener Art Museum Archives.
Gift of Mira and Kevin Nakashima.

4. Ben Shahn's Mosaic

As described earlier, Ben Shahn painted a gouache cartoon that served as the design for a mosaic mural to be ultimately installed in the Arts Building. The location, the angled concrete wall on the northwest elevation, was described by Nakashima as follows:

> It is somewhat forward at the top and slopes back, so that it is well protected from the weather. There is almost no rain that falls on this wall and it does not freeze, so we feel that it would be very favorable for a mosaic of this kind (…) It will be principally black and white, with a few areas of brilliant color. We think it is very beautiful and it is at one end of a large field, with a few small trees in front of it. The vista to the mural is quite long; it can probably be seen from something like 300 feet away.[17]

The seven feet high by approximately twenty-three feet wide mural was manufactured in eight panels by Gabriel Loire in Chartres, France and shipped to New Hope during the fall of the 1970. Together with the panels, Gabriel Loire delivered detailed plans and instructions for the installation. Although the archival documentation does not contain information about the materials employed for the manufacture, the tesserae are possibly marble or a highly metamorphosed limestone/dolomite and stained glass, the backing being unknown.

External visual investigation reveals that the panels are screwed to a hidden frame. The correspondence between Pierre Massin de Miraval, the art agent, and George Nakashima are a very illuminating source and explain the process of how the panels had to be installed. Additionally, the detailed drawings of construction with hand corrections also provide useful information to understand the elements that were probably installed in order to maintain the mural in place. The joints between panels were designed to show the minimum possible. For this purpose, the mural was completely mounted and demounted at Gabriel Loire's workshop.

A letter signed October 13th, 1970, indicates that eight bags were provided together with the panels. Each one containing nineteen numbered tesserae corresponding to the locations of the screws to be covered. The explanation was clear, "when the screw is screwed, you have to cover the screw head with the numbered piece of mosaic for that screw with epoxy. You can easily understand that this way, the screw heads become invisible."[18] It appears that the final solution was to employ a type of elastomer adhesive, although it could be a repair treatment where the epoxy failed.

Nakashima modified the detailing proposed by Gabriel Loire. A wooden frame was intended to house completely the mosaic. However, Nakashima

17. Letter from George Nakashima to Gabriel Loire, January 26, 1970. George Nakashima Collection, James A. Michener Art Museum Archives. Gift of Mira and Kevin Nakashima.
18. Letter from Pierre M. de Miraval to George Nakashima, October 13th, 1970. George Nakashima Collection, James A. Michener Art Museum Archives. Gift of Mira and Kevin Nakashima.

excluded the upper rail from the final installation. In addition, the tapered sill section was changed to a squared one, in which Nakashima would ultimately use a Japanese- inspired joint. A grid of dimensional lumber screwed to the concrete wall was proposed to serve as the backing for supporting the panels. A total of 24 strips were used. Seven 4 by 1 3/16 inch strips, wider to receive a screw, placed each 35 1/4 inch center lines, and 10 3 by 1 3/16 inch strips regularly arranged in between.

Fig. 4.2. Photomontage of Ben Shahn's Mosaic.
Source: Architectural Conservation Research Center

5. Architectural Archaeology

Building alterations were investigated and evidence supported by comparing archival images with the building current state, and by a number of interviews, which include Mira Nakashima, president of George Nakashima Foundation for Peace, John Lutz, Manager of George Nakashima Woodworker, and Aram Darian, master craftsman.

Water Disposal System

The collection and disposal of rainwater and snow melt are a critical aspect for any building. In the Arts Building, eaves, gutters and downspouts are the principal means of carrying water off the roof, which ultimately protects the building. In the case of the Cloister, a shed roof carries off water towards a band of grey-black middle-sized river stones laid out at the ground level.

Two photographs, taken shortly after construction, reveal that the original copper gutters envisioned by George Nakashima were an L-section of unequal angles. These gutters appear to connect to the lower ends of the eaves and to the north and east roof edges by their larger angle. In their placement, Nakashima exhibits sensitivity to their effect on the overall roof's appearance. In effect, forming a continuous surface of the roof, the gutters are perfectly integrated into the eaves' slope with their larger angle parallel to the slope plane.

In each corner, wooden plates connected to the wall accompanied the gutters by extending beyond the wall planes in order to convey the rainwater off into the ponds: one in the front courtyard and the other attached to the Arts Building on the northwest side.

Today, a new drainage design has been implemented and areas of the first copper flashing have been replaced along the eaves, particularly at the lower ends. Differences in the green patina between original and replacement flashing will eventually disappear over time. New box-like gutters were designed and attached to the eaves' edges. Although this design does not retain the aesthetic spirit of the original, they appear to function better.

In 1994, another major alteration to the exterior was the repair of the seat window on the northwest elevation. This repair included the installation of a copper canopy designed by Mira Nakashima Yarnall, which would conceal the head of the window as envisioned by George Nakashima. The original building solution was a cypress head interlocked in the oak beam (Fig. 5.1)

Fig. 5.1. Northwest elevation view. Notice the original gutters, the original head in the sliding window, and the skylight domes. The concrete floor of the terrace is exposed. Source: George Nakashima Woodworker Archives

Fig. 5.2. Northwest elevation view. Date: December 2104. Notice the new gutter system, the copper canopy , and the new flat skylights. The copper patina is indicative of new and old flashing campaigns. The concrete floor of the terrace exhibits a waterproofing coating painted in white, which disrupts the original aesthetics. Landscape features have been changed overt time. Source: Architectural Conservation Research Center

and reinforced in the middle by an additional piece of wood that was placed perpendicular to the larger length.

To control leaks, the original exposed concrete terrace was waterproofed with an impervious membrane in a first campaign and painted white with an epoxy based coating in a second campaign. This intervention disrupted the original finish and aesthetic qualities of the exposed concrete, although providing a watertight seal that protects the interior from moisture penetration.

The Covered Walkway

In the south elevation, the white oak load-bearing post of the engawa and the Cloister porch were replaced. The intervention also altered the original finish of the plywood soffit in a large area of the porch.

A photograph taken in 1965 confirms these changes. The original crafted oak posts stood directly upon the concrete block masonry in the porch area and upon concrete bases in the rest of the walkway. These posts were reminiscent of the details of traditional Japanese farmhouses. The model for the post was the menkawa, a post with four planed sides, and four unplaned surfaces that are left with the natural contours. A Japanese-inspired cross-shaped open mortise is cut in the top of each post to connect three joist members on three faces of the post: two porch girders and a roof rafter, which pass through. The joint similarly works like a triple plug-connecting joint. The first two elements to be connected are the two girders, which have a tenon of the same length that projects half the distance of the post section. The second part of the assembly is the roof rafter, which is perpendicular to the other two girders, placed over them securing the connection in its upper part. In the inside face, the joist has a vertical slot to house the rafter.

In the 2000s, the original load-bearing posts were replaced by ipe posts, which are machine made. Unlike the original posts, the new ones rest upon ipe Japanese-inspired bases, which are a truncated square pyramid. This detail was modified presumably to discourage rot at the post base. Upper connecting joints were replicated to join new and original members.

Girders and roof rafters appear to be the original in the porch area; however, although the plywood sheets appear to be the original, they have been relocated and painted with an opaque coat different from the earlier translucent white ‘stain’ used by Nakashima. Furthermore, on the north side, where the parking area is located, two joists have been replaced by machine made members, one of which is a glue-laminated joist. Replacement has involved roof waterproofing and new copper flashing.

19. This intervention took place after George Nakashima passed away. The contractor found some difficulties in replacing the original element because of the craftsmanship-inspired details, and he stated that the building was "like a cabinet" because its members were interlocked.

The Exterior Envelope

Overall, the Arts Building and Cloister's exterior envelope possesses a high level of integrity. Subtle repair occurred as elements deteriorated, usually in kind.

On the upper level, the wooden rail support appears to have been replaced in kind. In addition, the sliding window sill was replaced because it was rotten.[19] Above it, the thin wall was cleaned and repaired with a similar finish. (Fig. 5.3)

Below the terrace and facing southwest, the wall span that houses the main entrance and a window was replastered with a cementitious stucco. As reported by Aram Dadian, the proportions were two parts white Portland cement, one part lime, and three parts white sand.

On the northeast and southeast, areas of repair can be seen where the white stucco came loose or cracked. Particularly in the northeast wall, a white cementitious mortar was randomly used for filling cracks, resurfacing spalled areas, and repairing chipped edges.

The terrace and the skylights have had the greatest alterations as described in the previous section. The five acrylic sky domes observed in Fig. 5.1 were first replaced in kind, and ultimately, by customized skylights. The earlier sky domes consisted of a fiberglass dome installed in an aluminum frame. In the 2000s, these were substituted by new sky domes, which were thought to cause again water seepage and eventually were substituted by functional skylights, which were manufactured by Aram Dadian with wood and Polymethyl methacrylate sheets. A similar solution was installed in the skylight located in the hyperbolic paraboloid roof.

Interior

Major alterations were detected in the interior as well. These changes affected the lobby area, the corner of the north wall, and the fireplace.

An early photograph of the lobby reveals that a patterned fabric covered three of the four bays between the concrete stub walls. It is possible to observe at least two distinct motifs in the fabrics. Three shelves inserted between the spans, were located at different heights and projected slightly. Shoji screens, which diffused natural light from the skylights, were flush in the lower face of the concrete grid. No folding door is visible in the bar area as today, instead there is a standing divider.

In response to structural deformation of the gridded concrete slab, a wooden column was installed to underpin the slab. In the area, surrounding the post base, removal and reinstallation of the floor stone can be observed.

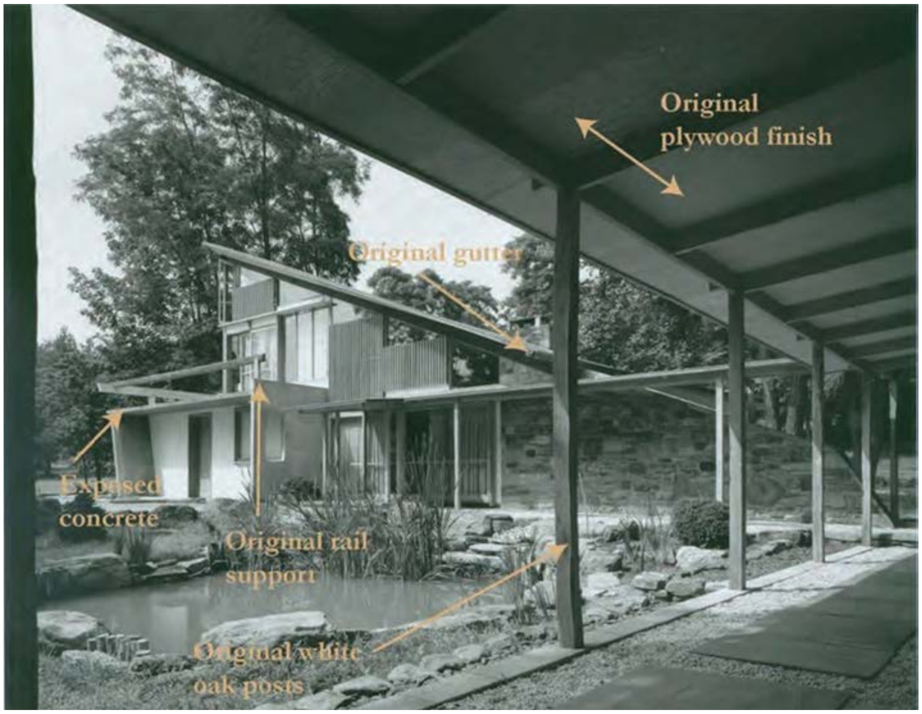


Fig. 5.3. South elevation view. Date: 1965. Notice the original white oak posts, plywood soffit finish, rail support, and gutter. Source: George Nakashima Woodworker Archives.

Fig. 5.4. South elevation view. Date: December 2014. Notice the new gutter system, the new ipe posts upon ipe bases, and the opaque white paint covering the plywood soffit. As shown in Fig. 5.1, the concrete floor of the terrace has been waterproofed.

Original stone slabs were removed, probably to place the footing for the wood column and cut later as they were adjusted to the column perimeter. A change in the color of the cementitious mortar used for the joints is noticeable.

There are other recognizable changes. Because of the deterioration caused by moisture penetration, the shelves and the fabric covering three spans of the four between stub walls were removed, and the reinforced concrete wall was roughly plastered with white plaster. Ghosts on the sides of the stub walls indicate the original position of the former shelves, which stood in place without connections. Mira Nakashima remembers that when the wood shelves shrank, because of the hygroscopic nature of the wood, they became loose and usually fell out.

Above the fireplace, the lintel was replaced as a consequence of carpenter ant activity. Repair occurred to the adjacent window as well. Below, a 1967 photograph (fig. 5.5) partly shows the original white oak beam over the fireplace. As the wood was cut parallel to the grain direction and tangent to the growth rings, a wavy plain grain characterized this beam. Other photographs supplement the information and show the six plugs that concealed the bold heads. Unfortunately, there is no image of the previous window, although clearly the fixed pane of glass directly terminated into the stone masonry wall. A direct examination reveals that the stones were cut to house the glass.

The grain figure of Nakashima's original fireplace lintel was undoubtedly selected in relation to the heavily patterned exposed plywood ceiling, which is still visible. Although the replacement lintel reveals a sensitive repair, this visual relationship is now lost (fig. 5.6). Likewise, the northern corner was replaced and repaired in kind to mend the deterioration caused by leaks. During this intervention, the skylight was also covered in the same manner as those in the exterior terrace.

Historically, in the mezzanine, the shelves contained shoji screens made of translucent white paper mounted a wooden lattice. They were placed devising a composition which created an interplay of unfiltered and filtered light. Evidence suggests that the shoji screens were probably damaged by water condensation in the internal face of the glass, and consequently, removed but not replaced.

In summary, failures related to deterioration from moisture have compelled specific alterations to the Arts Building and Cloister over time. Changes have ranged from sensitive in kind replacement such as the fireplace lintel and window to repairs that have modified the visual appearance and presumably improved the functionality of certain details such as the

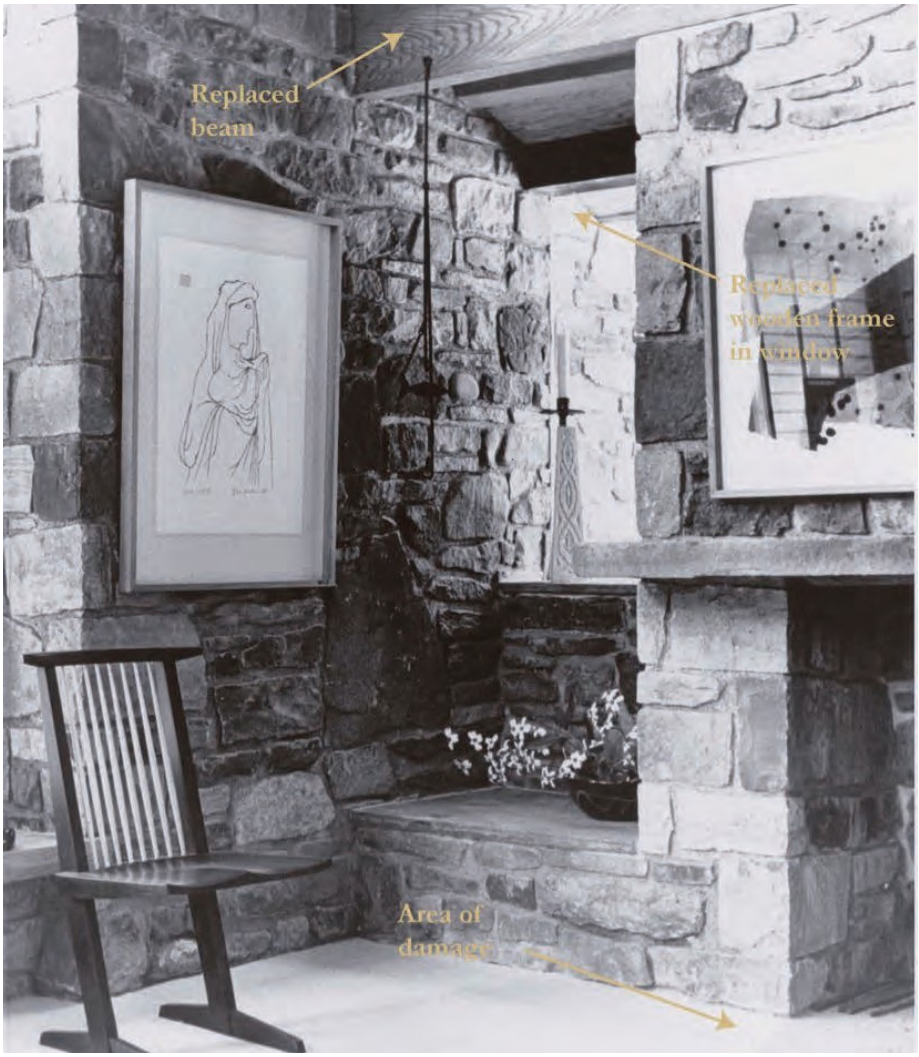


Fig. 5.5. Fireplace corner. Date: 1967. Author unknown. Source: George Nakashima Woodworker Archives.

Fig. 5.6. Current state of the fireplace corner. Date: November 2014.

replacement of the posts in the covered walkway. Within the latter group, is it possible to include also the white waterproofing coating applied on the concrete terrace and the general substitution of the skylights.

6. Preliminary Conditions Assessment

This section identifies the primary processes of deterioration observed at the Arts Building and Cloister. Conditions were recorded by building element and location. They are discussed in terms of the original material and subsequent alterations and maintenance, as well as their environment. Ultimately, all conditions describe the past and current state of the structure and overall integrity. The consultants contributing to the Conservation and Management Plan will expand these findings and, together with the Architectural Conservation Research Center, will establish a series of recommendations based on existing conditions and the preservation objectives.

After a preliminary visit, conditions were recorded during two site visits in February, and March 2015 and included a visual ground survey. Architectural drawings and photographic montage were used together to identify the type and location of conditions recorded.

Conditions were noted and categorized according to standards such as the ICOMOS ISCS: Illustrated Glossary on Stone Deterioration Patterns, ACI Concrete Terminology, and the National Park Services' Preservation Briefs. Additional categories were created to cover all identified conditions not included in these documents. As a result, specific terms are defined in an illustrated glossary that is organized by categories depending on the building parts: roof, stone masonry, CMU masonry, reinforced concrete structure, wood frame, mosaic, interior finishes, and flooring.

Structural analysis was not attempted other than visual inspection. In some cases, the causes of decay will need further research through laboratory characterization and analysis.

Environmental Context and Use

In the Arts Building and Cloister, identifying the deterioration mechanisms involves the consideration of enabling factors present in the environment and the use of the spaces, both influenced by time. Buildings and cultural resources interact with the physical context that is determined by the topography of the site, landscape features, climate and weather, and other natural factors such as soils, sub grade and surface hydrology. Past and current use, as well as how the building is maintained, illuminated, heated, and ventilated, also affect the building fabric.

The detrimental effect of moisture in buildings and the importance of temperature fluctuations to judge and explain decay due to condensation or freeze-thaw are crucial. Bucks County experiences a humid continental climate modified by the Atlantic Ocean. As reported by the International Energy Conservation Code (IECC) the climatic zone is 4 A.

According to the weather data provided by the Northeastern Region Climatic Center, summers are warm and humid while winters are drier. The maximum average is 75.7ºF, with a maximum of 101ºF, and the minimum average is 19.1ºF, with a minimum of 3ºF. The average annual precipitation is 46.83 inches. On average, there are 101 precipitation days and 205 sunny days. The snowfall reaches an annual average of 26.4 inches. The highest registered average snow depth is 8 inches, the registered maximum being 14 inches in February 2014. The UV index is 5. Cloudiness is more prevalent in winter because cold fronts and coastal low pressures systems are frequent. Prevailing winds are from the west- northwest and average 10 to 12 miles per hour.

As described earlier, the Arts Building and Cloister were built in a wooded area on a down slope in New Hope, Bucks County, Pennsylvania.The relatively protectd location of the building in a wooded landscape protect it from the wind loads.

Taking into account building shape and orientations, the northeast and southeast walls are largely protected from sunlight, either by their position or the surrounding trees, the evaporative drying rate being slower than in the other orientations. This is exacerbated during humid periods. Most of the surface rainwater is managed by the water disposal system installed below grade and pertaining to the building.

Changes in use have not been significant. The Arts Building continues its role as an exhibition space. It occasionally houses music concerts and events related to its actual function as George Nakashima’s Foundation for Peace headquarters. Additionally, the building is included in the regular guided tours that take place every month from spring to early fall. The Cloister hosts temporary visitors and scholars and contains the business archives.

6.1 Findings

6.1.1 Roofs, Terrace, and Skylights

Water penetration, associated with failures or damages in the waterproofing, the roof design, and the water disposal system, is a persistent problem. Addressing these issues in the past has required different intervention campaigns that have affected the integrity of the building. For example, the gutter design was changed as one alteration to address the problem, large areas of the eaves in the southeast and northeast walls were repaired.

Surrounding trees must be considered as a contributing cause in the case of roof puncture, particularly when the ballast has been washed out and the asphalt lining is exposed. In addition, soil and debris accumulation provides a suitable substrate for biological colonization, which might exacerbate the problems noticed in the roof; while, at the same time, it suggests the presence of excess water.

The consequences of melting snow must be also considered where icicles and ice dams form at roof eaves and clog the gutters. Water that is retained behind the ice dams could ultimately penetrate through failures in the waterproof coating or may rise above the flashing, therefore, causing leaks in the future. Excess moisture in the roofing system can weaken and eventually rot wood elements underneath.

Concerning the waterproof coatings, service performance of roofing asphalts depends upon their chemical and mechanical characteristics. Chemical changes resulting from exposure to light, heat, and oxygen facilitate oxidation and produce progressive embrittlement. Therefore, service stresses, which include the gravity loads depending on the inclination, and thermal expansion and contraction can cause cracking and eventually failures where the moisture can migrate.

Brown and Sparks offer an explanation to this phenomenon. Essentially,

> as a roofing asphalt ages in service, oxidation reactions result in composition changes reflected in an increase in asphaltenes and a decrease in resins as defined by the analysis types reported here. Oil content decreases slightly but probably more as a result of evaporation than by conversion to resins or asphaltenes. As the asphaltenes content or its ratio to resin content increases, there is intensified tendency for the highly polar asphaltenes to agglomerate into a gel or skeleton structure of appreciable rigidity. This is reflected in less plasticity and more brittleness in the product. In the earlier life of the asphalt, viscous flow properties consistent with higher dispersion of a lesser asphaltenes content permit dissipation of normal service-encountered stresses before a critical level is attained.[20]

Embedded aggregate or loose stone ballast disposed upon the asphalt lining slows down their rate of aging. However, there are noticeable areas where the marble chips on the roof have been partly washed out or completely removed because of rainwater and snow melt disposal. In localized areas, asphalt appears to be cracked. In this case, if the asphalt membrane is original it can be inferred that it has reached or is close to attain the end of its service life in those areas. However, the recent removal of the ballast covering the lower area of the roof revealed that the asphalt lining appears to be in good condition.

20. A. B. Brown, J. W. Sparks. “Composition and Rheology of Roofing Asphalts” in Symposium on Bituminous Waterproofing and Roofing Materials (Philadelphia, PA: ASTM, 1960), 6

As described in Section 3, roof flashing accomplishes a variety of functions: gravel stops, eave flashing, connections at roof penetrations, such as the chimney masonry intersect with the roof, and edge protection, as in the eaves on the covered pathway. Flashing should receive particular attention in building design, construction, and maintenance, since a failure in its performance causes undesired moisture infiltrations that compromise overall performance of elements and building systems.

Although copper is a durable material, and it is rigid enough to form the different flashing shapes employed in the Arts Building and Cloister, the inability of the copper to withstand mechanical impacts, the lack of adhesion, and corrosion in connections are causing failures and may deepen the magnitude of the moisture-related conditions in the future.

The copper elements show different rates of weathering, accordingly with the amount of time passed since they were installed. When exposed to atmospheric conditions, a conversion film turns the initial light reddish-brown copper from light brown to darker colors and then to greenish turquoise over the years. This patina makes copper resist further corrosion. The patina can be copper oxide or sulfides when the products are red or black, and copper carbonate hydroxides (basic copper carbonates) orcopper chloride hydroxides polymorphs when the products color range from blue to green. Other corrosion chemical compounds include copper hydroxide nitrate (basic copper nitrates), copper acetate monohydrate (neutral verdigris), and copper acetate hydroxide (basic verdigris). A greenish patina covers the eaves, while the more recently installed flashing and gutters remain dull brown with green staining because water carries the corrosion products of both eaves and earlier elements.

In addition, the copper gutters show crevice corrosion and galvanic corrosion in all the junctures because of direct contact between dissimilar metals: the steel nails and the copper sheet. If this type of corrosion continues, current leakage in the junctures will be expedited. Furthermore, there is noticeable damage because of impact to the gutter edges; a section has been deformed probably by fallen branches. The base exhibits deformation by marble chips carried off by the snow melt and rainwater.

The fact that marble chips remain on the base facilitates the accumulation of debris, including fallen leaves, that clog the gutters, allowing the rainwater to overflow directly to the ground by one side and on the eaves' edges on the other side. This worsens the moisture- related problems on the north and east walls and contributes to faster decay of the wood strip protecting the roof eaves, as verified in the condition survey. An awl was used to probe suspected rot.

A section in the chimney flashing is also out of plane, which might cause water penetration above the head lap of the waterproofing coating, which the copper protects, and saturates the substrate.

In addition, expansion and contraction from thermal movements may affect the overall performance of the copper flashing installed on the eaves. Sealing covering the flashing seams appears to be deteriorated. In the south elevation, the lower end of the flashing covering the edge is loose.

Regarding the roof plywood shell, this material is exposed to interior and exterior conditions. Therefore, the rate of decay is different and the solutions applied in the maintenance campaigns diverse. Expected service life for plywood is one hundred years, but depends on the moisture conditions.

Overall, the plywood sheets show checks, which appear on the surface in the form of multiple hairline cracks or slightly open superficial parallel splits of different lengths. Under severe moist and dry conditions, According to the technical guides, these checks may in time become cracks penetrating virtually the full thickness of the face. The main cause of this deterioration is moisture penetration and evaporation.

Causes of these checks are found in the chemical properties of the wood and the plywood characteristics as a composite material. On one hand, the wood cell wall is largely made up of cellulose and hemicellulose, and the hydroxyl groups on these chemicals make the cell wall hygroscopic. Conversely, the differential moisture conditions to which ply faces are exposed create differential stresses that compromise plywood performance. In fact, under high humidity conditions, the outer face of the exposed veneer expands, while the inner face is relatively fixed because it is glued to the next ply, which is placed crosswise. Fibers in the exposed face then create compression stresses against one another. When the fibers dry out and shrink, they pull away from each other, creating checks of different intensity. This phenomenon can be more severe under rapid drying than under slow drying because wood has a plastic behavior.[21]

Regarding the concrete terrace, a fiberglass membrane was installed to solve leakage problems in the past. It appears that this solution was not enough, since water penetrated at the lap splices. A white epoxy coating was applied covering the entire surface and the vertical joint creating an impervious continuous film. Conditions before fiberglass installation are unknown. However, in the interior, moisture stains and rust stains are the effect of the earlier rainwater penetration.

Prefabricated plastic skydomes installed with an aluminum frame were thought to be a source of leaks; consequently, new skylights with wood

21. Nelson S. Perkins, Ed. Plywood: Properties, Design, and Construction. (Tacoma, WA: Douglas Fir Plywood Association, 1962), 91

frames and methacrylate panes were manufactured to replace them. Now, some condensation occurs, as revealed by moisture stains in the wood frame.

With regard to the Cloister's roof, it is in overall good condition. However, big areas are affected by bio growth and sealants appear to be deteriorated. Flashing exhibit deterioration because of impact.

6.1.2. Envelope: Materials and Structural Elements

Concrete

Concrete conditions were recorded to describe possible causes as well as to estimate their possible effect upon the performance, service life, and safety of the structure as recommended by ASTM.

Overall, damage from inappropriate design and imperfections as a result of improper placing of concrete is visible. Flaws include honeycombing, bugholes, and uneven edges because of joints between the formwork panels. Surfaces also show impact damage, scratches, efflorescence, scour, soiling, and biological colonization. After visual examination and sounding with a hand-held hammer, no incipient spalling and blind delamination was observed.

Long-term loading and insufficient support caused deflection and visible cracking in the gridded slab. It is necessary to point out that this slab is not uniformly loaded. On the southwest elevation, loads from the interplay of wood and glazing directly set on a joist that has the same section as the rest. On the northwest, the pole supporting the tapered beams rests upon an end of a standing reinforced concrete beam. This beam, which is monolithic with the gridded slap, had no support.

This deflection was corrected with the addition of a wooden column, which was installed at the intersection of two joists providing additional support. Rust staining indicates that moisture infiltration through the cracks has affected the rebars.

Good-quality concrete usually guarantees that the steel rebar remains in passive condition delaying corrosion. However, past cracking on the upper face facilitated the infiltration of carbon dioxide and rainwater that could have contributed to the carbonation in the concrete. In this context, the calcium present in concrete reacts with the carbon dioxide and is converted to calcium carbonate, modifying the concrete's alkalinity toward basic. A more neutral environment replaces the normal alkalinity and provides the factors for a rapid corrosion of the rebars. Concrete carbonation is potentially hazardous, since it can compromise the overall performance of the building. Consequently, evaluation of concrete becomes necessary and may include study of rebar arrangement, sampling cores, pH test, strength, and determination of composition by petrographic analysis. This information is basic to identify active mechanisms of deterioration related to concrete carbonation.

There is no visual evidence to conclude the existence of active corrosion in the embedded rebars, which could ultimately cause further cracking. Corrosion measurements can be taken using copper-copper sulfate half-cell tests or linear polarization techniques to determine the probability or rate of active corrosion of the reinforcing steel.

In the interior of the building, various hairline cracks are visible on the gridded slab spans. Cracks are primarily random, with a variable length and a width around 1/16" or less. Generally, whitish leaching deposits fill in the cracks, and a brown stain can be observed surrounding some cracks. These deposits are a consequence of water-soluble compounds leached out of the concrete by infiltrated water and precipitated by reactions such as carbonation or crystallization by evaporation. Carbonation occurs because the calcium hydroxide present in the concrete has combined with carbon dioxide once it reaches the exterior surface of the concrete. In the areas where moisture interacts with the rebar, corrosion products accompany the deposits.

Regarding surface defects, bugholes are small irregular cavities, usually not exceeding 5/8 inch in diameter, which result from entrapment of air bubbles of formed concrete during pouring and hardening. This defect is observable in some surfaces on the exterior, and in the interior in the soffits, and lower faces of the joists together with entrapped fallen leaves, which were not removed before pouring the concrete.

Honeycombing[22] was noticed in different locations in the interior and the exterior: in one of the concrete ribs, in soffits and joists, in the concrete rail of the stair landing, and in the lower section of the wall at an angle close to the access. Generally, honeycombing is a condition that ranges from moderate to a severe problem in concrete structures because the affected areas are weaker and more permeable that sound areas. Technical literature recommends patching these areas as early as the form is retired, the greener the concrete the better. However, now, the difficulty in achieving a good match may suggest accepting these flaws, particularly in the interior. Additionally, it confers a particular and more organic character to the hardened material, which might be desirable if performance is not compromised.

On the exterior surfaces, different rates of erosion or scour on the unpro-

22. Honeycombing, also known as rock pockets, are areas of voids because of failure of the paste to fill effectively the spaces between the gravel. This can be produced by poor mixing, segregation during pouring, or leaching out of the mortar at a leak in the form.Vibration during concrete placing might have prevented both honeycombing and trapped air bubbles. However, the relatively small section of the described elements probably made vibration of the concrete mix difficult once poured.

tected surfaces was observed due to loss of the outer layer of cement paste causing the exposure of the aggregate. In some areas, inadequate drip grooves and drainage caused this deterioration that is generally accompanied by moisture stains, which are a minor problem. In addition, the elevations that remain most of the time in shade show biological colonization, mainly comprised of algae and lichens.

In the entrance area, noticeable hairline cracks with leaching deposits were observed on the soffit under the balcony. The rest of the concrete surfaces shows good condition, except for some areas that are abraded by mechanical action and show chipped edges and impact damage.

Concrete Block Masonry

Overall, both northeast and southeast rendered walls display large localized areas of moisture. Moisture is even more intense on the northeast wall, which is largely protected from the sunlight; therefore, the drying rate is slower. It appears that moisture chiefly migrates through the mortar joints, which may have higher permeability compared to the concrete blocks, making partly visible the joint pattern on the stucco. Hairline cracking on the stucco accompanies these moisture stains, particularly on the masonry head joints. Cracking may also contribute to increased water seepage into the concrete block backing allowing moisture infiltration through the cracks when the pressure gradient occurs from outside to inside.

Moisture migration through the wall masonry is likely due to an uncontrolled source of water and the lack of a waterproof membrane or through-wall flashing. This absence facilitates moisture migration driven by a moisture gradient, adsorption, and capillary action. Moisture sources could be the water table below grade, and the surface from rainfall and snow melt. Mira Nakashima recalled that a French drain, which essentially is a system comprised of a perforated drain pipe installed in a trench filled with compact gravel, was installed. However, the current system is incapable of diverting the surface water and the ground water away from the structure.

Water has been carrying soluble salts to the wall surface, where it evaporates and crystallizes. Salt sources could be the soil, the foundations, the concrete blocks, or the cement mortar. A large accretion of mineral matter, as a consequence of the evaporation, suggests the potential hazard that moisture infiltration represents for building performance.

X-ray diffraction showed that this mineral accretion is composed of calcium and small traces of copper; suggesting that part of the water source is from the roof. Wetting and efflorescence also contributed to the disintegration of the stucco surface, which shows a coarse-grained surface instead of the original smooth finish.

Larger cracking results from outside stress transferred to the stucco, which might be related to structural movements, such as stresses transferred through the bolts by the roof reacting to wind loads. The roof might also generate lateral stresses and horizontal movements affecting the concrete block masonry. In fact, the rigid wall connection does not allow translational movements. As a consequence, the northern wall has developed a series of longitudinal cracks parallel to the bed joints, particularly in the mid-upper section. Cracks range from 2 1/2 feet to nearly 18 feet long with an approximate width of 1/32 to 1/16 inch. Some cracks also show mineral accretions. The northeast corner is out of plumb at the level of the roof plate, which might involve the whole masonry section, and display hairline cracks. In the east side, the lower part of the wall shows a hairline crack. This area has been and repainted in the past, but now is open again, which might be indicative of slight settlement.

Overall, the concrete block masonry in the Cloister is in good condition, with few minor to moderate problems such as dark moisture stains with efflorescence, biological colonization, located hairline cracks in joints and in concrete blocks, and dirt covering the lower section of the walls, particularly on the south and east elevations. In fact, on the porch elevation rainwater runs into a gravel path, while the south and east masonry is completely exposed to the rainwater splash transporting soil particles.

Stone Masonry

The various types of stones that comprise the stone masonry are causing an uneven rate of deterioration, especially in the abutments. Superficial erosion, soiling, mechanical damage, blistering, flacking, hair cracks, and efflorescence are all visible. Overall, biological colonization is also present.

As explained in the previous section, efflorescence is due to the evaporation and crystallization of salts in solution transported by moisture infiltrated in porous materials. Since the presence of efflorescence is primarily limited to some units or areas, the sources of salts can be the stone units themselves too. In this case, laboratory testing would help to identify the type and sources of the salts.

Overall exposure to freeze/thaw cycling is causing superficial erosion and micro cracking expressed by hairline cracks of different orientation. In limited stone units, the surface has erupted into blisters and flacking. These conditions are primarily related to processes of granular disintegration because of moisture infiltration and salt crystallization.

Hair cracks and failing mortar joints, particularly in the chimney, and hairline separations from the stone due to shrinkage have been noticed. The extent of cracking affecting mortar joints is limited, thus a pattern has not been observed to support a hypothesis to explain possible causes.

Regarding biological colonization, algae, lichen, and mosses pervasively cover the stone in the areas exposed to rainwater or ground water splash. Biological activity varies across the seasons. During the fall, moss-covered large areas, which were reduced during the colder winter were noticed. Additionally, crusted areas varying in tone were observed on areas where previously algae had grown because of temporary wetting episodes. Biological colonization contributes to moisture retention in the fabric slowing down evaporation and furthering greening thus. Although the decay mechanism is slow, some lichen species will disintegrate the substrate by chemical action.

Wood

Prolonged exposure to moisture and other environmental factors has caused discolorations, moisture stains, loss, and rot of wooden elements. Overall, exposed wood experiences natural weathering, which is the slow degradation of the material caused by various factors in combination, including sunlight (UV radiation).

Of these, it is the UV portion of the solar spectrum that initiates weathering, which together with moisture advances the degradation process. UV radiation is limited to the range of 295 to 400nm and represents the 6.8% of the total radiation. It causes the photo oxidation and photochemical degradation of the wood surfaces. First, the exposure produces a color alteration, because of a chemical change in the wood extractives. Then, UV radiation degrades the lignin, which is the polymer that bonds cellulose and hemicellulose, therefore, weakening the wood cellular structure and ultimately causing the slow erosion of the wood fibers from the surface. Eventually, colonization of microorganisms, commonly mildew, occurs. The rough and grey appearance of surface is a symptom of this degradation process.

Moisture stains are the result of a single wetting or of periodic wetting and drying cycles; consequently, the cause can be active or inactive. Sources of moisture are water vapor that condensates, rainwater and snow through the open surface, and water below grade that infiltrates upwards through the fabric by capillary action. Some leaks appear to be no longer active. However, moisture stains are still present. Such stains are minor visual alterations that do not affect the wood structurally. Otherwise, condensation and active leaks, which ultimately may lead to a major deterioration, need to be addressed. Therefore, it is important to determine whether a stain is the result of an isolated historical event or the result of an active problem.

It is necessary to indicate that few windowpanes in the envelope exhibit simple glazing.

Water, along with heat and oxygen, causes fungus damage to wood. This condition is clearly recognizable in the exterior white oak posts. Fungus attacks either heartwood or sapwood in most wood species, when the moisture content of wood is above the fiber saturation point (average 30%). Although the lower end of the posts rests upon stone, they are exposed to moisture in form of rainwater splash, wetting the wood enough to allow the development of fungi.

Similar conditions were noticed in some sections of the wood strips used to protect the eaves' edges and in the frame of the casement window in the mezzanine area. Failures in the flashing and gutters have been provided enough water to wet wood at a rate below the drying cycle. In located areas, the wood has changed color and is easily penetrable with an awl, suggesting its structural capabilities have been compromised.

Other types of biological activity include squirrels, birds, and insects. Squirrels have damaged wood surfaces by gnawing on elements, such as the grills installed on the elevations or on the plywood ceiling in the porch area. Woodpeckers have made holes looking for insects and carpenter bees have drilled their characteristic holes in the wood elements. The holes have been repaired with a brown epoxy resin. The site is protected against subterranean termites by bait stations.

6.1.3. Ben Shahn's Mosaic

Although the mosaic shows a high level of physical integrity and good state, the following conditions were recorded: color alteration, missing tesserae, granular disintegration, failing substrate, biological colonization, and superficial erosion. While most alterations are limited in extension, the biological colonization by micro flora along the lower section of the mosaic is affecting various panels.

Discoloration is due to the use of epoxy resin to adhere the tesserae and hide the screw heads, which fasten the mosaic to a wood substructure. This application has stained the tesserae covering the screw as well as the surrounding tesserae altering their appearance. Discoloration was noticed on the joints between panels.

The presence of dark grey deposits covering the lower areas of the panels reveals the existence of micro flora probably associated with higher moisture content. Sources of moisture for this biological colonization are rainwater splash and accumulated snow in winter that is retained in the irregular interstices between tesserae, which are partly embedded in the bedding layer mortar. Curiosly, this condition is stressed in front of a row of large stones placed perpendicularly to the mosaic. While on the rest, the existent gravel diminishes the effect of the water splash.

Missing tesserae may be due to a weak assembly, since some of them have lost adhesion to the bedding layer or, occasionally, the epoxy. The granular disintegration, which appears to be active deterioration, occurs in various specific locations. This loss of stone is not uniform. Firstly, the original stone surface forms a hardened layer, while the subsurface experiences a process of granular disintegration. Ultimately, there is a process of detachment that generates an abraded coarse surface.

Lastly, the wood frame surrounding the mosaic exhibits sign of damage from animal activity in association with epoxy repairs. Various sections of the mortar that fills the upper joint between the mosaic panels, and the inclined soffit of the concrete eave are deteriorated. There are signs of mud daubers nests that have been removed. The condition of the wood substructure is unknown.

6.1.4. Doors and Windows

Generally, windows and doors are in good condition, although their shrinking and swelling seasonally reduce their operability. In addition, wood frames show moisture stains because of condensation and natural weathering, which was described above. In general, weather stripping, which consists of cypress stops exteriorly mounted and nailed to the wood frame, show signs of wear.

Moisture stains are probably produced by condensation. When the indoor air is humid, and the outdoor air temperature is below the dew point temperature of the indoor air, condensation of the water vapor occurs in the glass panes, which are the colder surface in relation to the wooden frame. Water leaks and soaks the wood frame causing the moisture stains as it dries. This phenomenon possibly damaged the screens originally housed on the shelves in the mezzanine. Environmental monitoring should be implemented to execute a comprehensive study of the interior conditions to understand further when and where condensation occurs, and to engineer a solution.

In the Arts Building, isolated conditions include mechanical impact to one of the panes of the sliding window facing southwest and a lifted sliding door leaf. In this location, the gap between the door leaf and the window frame accumulates dirt. In the Cloister, the red door closing the heating room is damaged in its lower end because the core has swelled due to moisture infiltration.

6.1.5. Interior Finishes

Discontinuities between the stone masonry and the concrete block masonry, and between those systems and the openings' frame have been causing moisture infiltration, which ultimately has led to interior wall deterioration evidenced by staining and efflorescence.

In the vestibule, efflorescence and color alterations are visible in the window jamb and the area below. Particularly in the right corner, it is recognizable an area that ranges from light ochre to light pink. Some of the plastered soffits in the gridded slab, which stand directly below the terrace area, are perforated and stained because of hidden leaks that appear to be no longer active.

The walls plastered with Structolite™ show moisture stains and rust spots. In the northeastern corner, the staining runs vertically and is related to an earlier leak in the area. In the fireplace area, wet moisture stains and whitish deposits are recognizable. Moisture infiltration causes for the latter can be discontinuities between the concrete block wall and the fireplace stone masonry, insufficient chimney cap, failures in the roof waterproofing system, and rising damp. In the Structolite™, the visible circular rust stains may be related to the oxidation of the metallic constituents contained in the aggregate or to an unknown chemical reaction between constituents.

6.1.6. Flooring Materials

Overall, the vinyl tile flooring system is in moderate to good condition; however, the Arts Building tile floor shows sign of wear from visitation and direct sunlight after approximately fifty years in place. Conversely, shoji screens protect the tiles in the Cloister, and their use is minimum.

In the exhibition area, the Amtico™ travertine flooring has lost adhesion to the subfloor and displays loose areas. As the technical literature indicates, if moisture migration can permeate the underlying concrete slab at a higher rate that it can permeate the vinyl tile flooring system, failures will occur. In fact, the moisture infiltration is causing lifting of the vinyl tile system. This failure can occur between the adhesive and the subfloor or between the tiles and the adhesive. Moisture source is likely to be water below grade. This fact leads to question whether a convenient vapor barrier was installed regarding the boundary conditions or not.

The tiles suggests a contraction in comparison to their original dimensions. This shrinkage isprobably related to the sunlight (infrared radiation) exposure, which has led to uneven joints, discoloration, and ultimately can also cause embrittlement. There is also observable fire damage on the fireplace hearth limits.

On the stone slabs used in the vestibule, moisture stains and scaling in some units are noticeable. The latter being a problem in the slabs used for the fireplace hearth, which is probably related to the temperatures that the stone has to resist when the firebox is used. Mortar joint failure is also noticeable.

7. The Arts Building and Cloister Conservation &Management Plan Project

Below: Nicholas Pevzner and his assistant Stephanie Carlisle are preparing the balloon for launching. January 2016.

7.1 Summary of Work

At the time of the completion of this report, three consultants have initiated their work on-site and have offered preliminary findings. This work, as described in the following section, will be completed between March and April.

Landscape Architecture

As consulting landscape architect, Nicholas Pevzner is responsible for preparing a survey and assessment of the immediate landscape of the Arts Building and Cloister. Pevzner will prepare a cultural landscape report with recommendations to be incorporated in the Conservation & Management Plan. Treatments and long-term management policy will inform decision-making in relation to landscape's physical attributes and use to preserve historical significance.

During a first visit, the consultant was assisted by members of the Architectural Conservation Research Center and George Nakashima Woodworker, and conducted a preliminary oral history and analyzed the landscape context.

During a second visit, the team focused on the immediacy of the Arts Building and Cloister. With the purpose of creating a high resolution orthorectified aerial photograph and site plan; the team used a weather balloon with a GoPro camera to take different aerial shots. These shots were post-proceded and merged creating orthoimages. These orthoimages form the final digital source to delineate the landscape features in the Arts Building ground floor, and in a site map provided by George Nakashima Woodworker, which has been already digitized. The drawing will provide a valuable base to expand the analysis of the setting, identify the contributing features on the site map, and overlay conditions as well.

The following is a group of preliminary findings:

- The Arts Building and Cloister is surrounded on three sides — north, east, and south — by mixed deciduous forest, and on the southwest by lawn with hay meadow beyond. The landscape immediately surround-

Fig. 8.1. The landscape survey team launches and operates the weather balloon to take aerial photographs of the building and the immediate landscape. January 2016.

ing the Arts Building includes a straight stone wall, pea stone patio, and stone-lined pond, with associated vegetation (pond planting). The larger borrowed landscape of the Arts Building includes the individual trees to the west and southwest, and the forested character of the view to the north, east, and south.

- Pea gravel, larger round stone mulch, gravel, stepping stones, rocks, and large boulder are all original; these various stone materials are important contributing features of the Arts Building landscape.

- Stone wall is an important contributing feature of the Arts Building landscape. Along the south side, at the eastern end of the stone wall, an electrical outlet protrudes from the grass in front of the wall. It is a non-contributing feature, and the visual presence of the electrical outlet should be minimized.

- The pond is constructed around a large glacial boulder. Pond uses recirculated water, pumped from nearby well. Large rocks form the edge of the pond, along with lines of wooden posts. The wooden posts are in an advanced stage of deterioration. The rocks, wooden posts, and pond itself are all important contributing features of the Arts Building landscape. The posts should be restored or replaced as necessary to maintain their appearance as part of the pond perimeter.

- The pond planting includes small shrubs and one large Eastern red cedar (*Juniperus virginiana*) tree. The tree was planted by Nakashima as a sapling and is the visually dominant vegetation in this planting area. It is a contributing feature of the Arts Building landscape and should be pruned/tended to maintain its health.

- The west-side lawn features an approach path that was recently improved with stone paving. The new paving visually dominates the more subtle paving stones on the South Patio, minimizing the feeling of arrival. This paving is non-contributing, and should be rethought as part of a restored approach sequence (path geometry and material).

- The view from the Arts Building to the southeast includes a view of wooded verges on the east and south sides. A neighboring house and lawn, built in the 1980s, is visible through the wooded verge. The design intent of the view to the southeast was intended to include the pond in the foreground and was intended to terminate in the wooded backdrop. The construction of the neighboring house (with associated clearing of a majority of the woods on that side) is a visual imposition on the intended view from the Arts Building and is certainly non-contributing. The Nakashima Foundation has been planting pine trees and bamboo for a number of years in an

Below: Aerial view of the Arts Building and Cloister. January 2016.

attempt to screen out the house. A more holistic visual screening strategy should be considered, which extends the character of the native Pennsylvania woodland and enhances the ecological health of the forest verge while minimizing the use of potentially invasive vegetation.

- Seasonal Pond. This small pond is not pumped, and thus the water level varies seasonally. It is manmade, but sits adjacent to an original glacial boulder. It appears as an isolated element within the larger lawn at the south of the property. The pond is very close to the South Patio and is a visual point of interest. It may feel visually more integrated into the larger landscape if taller grass vegetation is allowed to extend further around the seasonal pond. The line of mowed lawn vs. hay meadow should be reconsidered as part of a re-evaluation of the view from the South Patio to the southwest.

- East-side Wooded Verge, Approach Drive, North Gravel Drive. More study needed. Appearance of the forest to the north and east seems like it would be a contributing feature, albeit more limited than that of the southeastern view.

Structural Assessment

With the purpose of completing and supplementing the building investigation provided in this report, David T. Biggs, as consulting structural engineer, will prepare an initial structural assessment, focusing mainly on the roof. Drawing on his expertise and as a part of the Conservation & Management Plan, Bigg's goals involve identifying the structural issues, future needs, and to make recommendations for further investigation.

The revision of existing oral and written documentation and a preliminary visual survey on site provided insights into the overall state of the roof and its performance:

- There are no indications of structural distress. Very few gaps were noticed in both the sheet joints and the purlins (ribs) joints.

- Previous signs of water leaks are visible on the purlins. Probably related to condensation, signs of moisture stains along the perimeter are visible.

- An interview with Robert Lovett, noted dead load deflection after falsework removal of 1 ¼ inch. Deflections of the roof are visible and need to be quantified.

- Paul Weidlinger Engineers required three ½ inch sheets of plywood. Eventually, three 5/8 inch were used. Therefore, there is 3/8 inch of excess capacity. There are no calculations available to confirm.

Below: Members of the Arts Building and Cloister Conservation & Management Plan project, William Whitaker and Michael Henry, together with Mira Nakashima, review archival documentation. November 2015.

- Lovett indicated that the sheets were glued. However, in a recent interview with Aram Dadian, who did repairs on the roof, there were no recollections of glue. Plywood sheets were fastened with screws at the perimeter at 8" o.c. and 12" o.c. in field.

- Critical elements are the perimeter sloping tapered beams that are in compression. The ribs are not particularly structural and appear to hide the joints.

- The roof acts as a membrane. There is tension on the catenary curve between the sloping sides, and compression arches between low to high.

In relation to this preliminary structural assessment, further investigation will include:

- To determine the joint layout of plywood sheets and connectors if possible.

- To determine water damage by removing portions of the roofing lining to expose the plywood shell.

- To take deflection readings.

- To grade existing wooden components.

- To study winter snow patterns, how snow builds up, melts and drifts from the roof. In fact, a primary concern is over unbalanced loads due to the snow buildup. Wind loads could be an issue, but the site is generally well protected.

Environmental Engineering

Michael Henry, as a consultant environmental engineer, is preparing an initial assessment of the exterior envelope and a proposal monitoring for the Arts Building and Cloister. In coordination with the Architectural Conservation Research Center, Michael Henry engaged students from the Graduate Program in Historic Preservation at the University of Pennsylvania and The Winterthur/University of Delaware Program in Art Conservation.

In relation to this research, the final report includes an inventory of materials present in the collection of artifacts together with recommendations for its preservation.

Wood

Wood is a fundamental material in the Arts Building, both in traditional and modern applications. As consulting wood scientist, Ron Anthony will prepare an initial assessment and material characterization of both

Below: Penndesign HSPV 551 course fieldwork lead by Michael Henry. Students were investigating the building to propose a Monitoring Program. October 2015.

the wooden structural elements and the plywood deck of the hyperbolic paraboloid roof. Together with this research, he will include an assessment and treatment recommendations for conservation to be incorporated to the Conservation Management Plan.

Regarding the roof, in coordination with the consultancy of David Biggs, areas of the asphalt lining will be uncovered. Prior to the sampling, visual investigation, with the help of an IRT camera, will identify locations that might be damaged, preferably areas on the perimeter and wet spots. This will allow grading of the plywood deck in locations were it might de damaged.

7.2 Schedule Management Plan

The following table shows a schedule of work that summarizes all the tasks to be completed until project completion. Periodical review meetings have been established to control the development of the tasks and outcomes for the Arts Building and Cloister Conservation & Management Plan.

The project is divided into three phases. Phase 1 involves the development of the Statement of Significance. It includes the expansion of the current documentation, delving into the cultural significance of the site and setting, the research of the consultants as explained in the previous section, and the study of the enabling environment along with the policy framework.

Phase 2 concerns the development of the conservation policies and the plan of action for each of the listed items: physical setting and landscape, physical building condition, collections, energy conservation and sustainability, interpretation, current and future use, and cyclical maintenance and repair program.

Overlapping Phase 1 and 2, Phase 3 focuses on the dissemination efforts and involves the creation of a dedicated website, tours, and an exhibition. Once the website is in place, contents will be updated periodically and outcomes published for the benefit of preservation professionals and stakeholders. The exhibition during the Spring 2017 will coincide with the presentation and final submission of the Conservation & Management Plan.

These dissemination efforts include education and professional training involving students on the research, such as PennDesign HSPV 551 and ARCH 632, publishing articles, and presenting the outcomes in professional and forums.

CONSERVATION & MANAGEMENT PLAN - SCHEDULE OF WORK TO COMPLETE

The Arts Building and Cloister, George Nakashima House and Studio, New Hope, Pennsylvania USA

Activity	Resources	Period
Phase 1: Development of the Statement of Significance		**Sept 15, 2015 - May 15, 2016**
1.1. Expand Current Recording		
1.1.1 Map the entire property in GIS	JH/CB	Feb 2, 2016 - Feb 12, 2016
1.1.2 Expand recording of the roof	CB	Feb 2, 2016 - Feb 12, 2016
1.1.3 Window schedule	CB	Nov 16, 2016 - Jan 15, 2016
1.2. Understanding Cultural Significance		
1.2.1 Chronology of the construction	WW/CB	Feb 2, 2016 - Feb 12, 2016
1.2.2 Illustrated general chronology	WW/CB	Feb 12, 2016 - March 1, 2016
1.2.3 Oral histories and interviews	WW/JH/CB	Feb 2, 2016 - April 1, 2016
1.2.4 Final Assessment of Significance and Identification of Values	All	March 11, 2016 - March 29, 2016
1.3. Building Fabric and Setting Investigation		
1.3.1 Landscape survey and assesment	NP	Nov 23, 2015 - March 4, 2016
1.3.2 Structural assessment	DB	Nov 23, 2015 - May 15, 2016
1.3.3 Envelope and interior environment assessment	MH	Nov 12, 2015 - May 15, 2016
1.3.4 Wood characterization and assessment	RA	Nov 12, 2015 - May 15, 2016
1.3.5 Inventory and collections assessment	MH	Jan 15, 2016 - May 15, 2016
1.4. Enabling Environment and Policiy Framework	CB	Apr 1, 2016 - May 15, 2016
Phase 2: Development of Conservation Policies and Plan of Action		**June 1, 2016 - Jul 15, 2016**
2.1. Physical setting and landscape	NP	June 1, 2016 - Jul 15, 2016
2.2. Physical building condition	All	June 1, 2016 - Jul 15, 2016
2.3. Collections	All	June 1, 2016 - Jul 15, 2016
2.4. Energy conservation and sustainability	All	June 1, 2016 - Jul 15, 2016
2.5. Interpretation	All	June 1, 2016 - Jul 15, 2016
2.6. Current and future uses (including development)	All	June 1, 2016 - Jul 15, 2016
2.7. Cyclical Maintenance and Repair Program	All	June 1, 2016 - Jul 15, 2016
Phase 3: Dissemination		**Feb 1, 2016 - Dec 16, 2016**
3.1. Website	CB	Feb 1, 2016 - March, 1 2016
3.2. Alumni/Staff/Students Tour	FM/WW/CB	Feb 1, 2016 - March, 19 2016
3.3. Exhibition (during Spring 2017 together with final submission)	FM/WW	Nov 1, 2016 - Dec 16, 2016

Resources

Team:	FM	Frank Matero	Project Director
	WW	William Whitaker	Associate Director/Architectural Historian
	CB	Cesar Bargues	Conservation Architet/Project Coordinator
	JH	John Hinchman	Heritage Surveyor
	MH	Michael Henry	Environmental Engineer
	DB	David Biggs	Structural Engineer
	RA	Ron Anthony	Wood Scientist
	NP	Nicholas Pevsner	Landscape Architect

A. Terminology

Modernism: the cultural practices that both mediate and produced a transformation in social, political, and environmental spheres as consequence of the industrialization and the machine. (Banham, 1960)

Modernity: is the subjective experience of each individual in the sociocultural context of modernization, which aims to make the present different from the past and paves the way for the future, being a break or a conflict with tradition. (Banham, 1960)

Modernist: this term is associated with modernism and conveys the functional, visual and perceptual characteristics of creative works. (Prudon, 2008)

Modern Movement: an artistic and architectural movement that consciously embodied modernism, which began with new and rupturing social, technical and design theories in Europe in the early twentieth century. DoCoMoMo promotes a time-based definition that involves architecture that dates from the 1920s to the 1970s and states that such works look forward to the future without overt references to historical precedent. For DoCoMoMo, modern design emphasized expression of functional, technical or spatial properties rather than reliance on decoration.

Modern architecture: opposite to Modern Movement, this term involves a wide range of architectures, which is linked to a more temporal than stylistic meaning. It refers to all the architecture of the recent past. (Prudon, 2008)

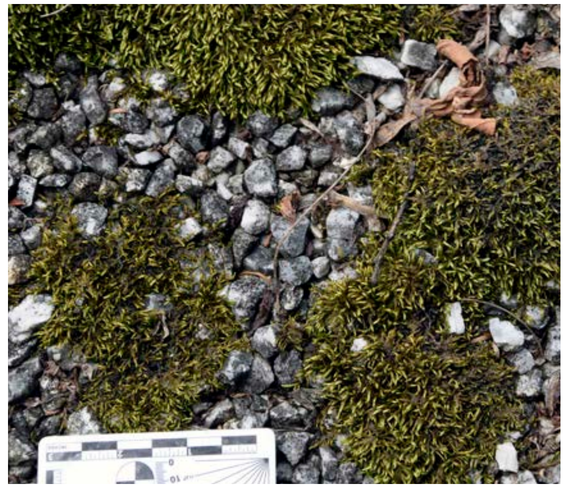
B. Conditions Glossary

Roofing system

Conditions

Biological Colonization

Presence of mosses, lichens, and related plants on the roof slope contributing to moisture retention.



Asphalt Cracking

Asphalt exposed layer is cracked due to brittle because weathering which results in loss of elasticity.

Clogged gutters

Presence of marble chips and leaves accumulated in the base of gutters contributing to poor drainage and water overflow.

Roofing system
Conditions

Corrosion

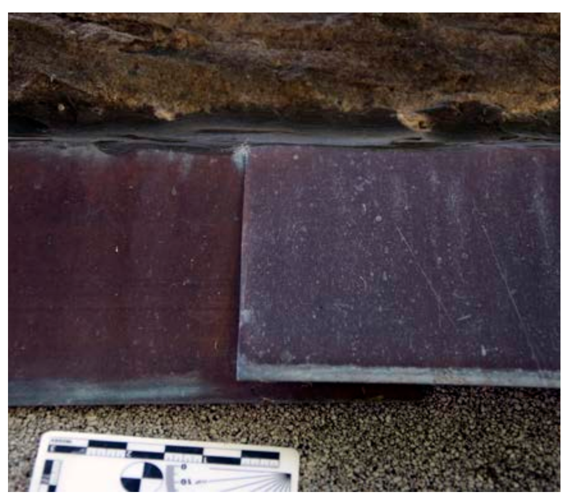
Greenish-blue corrosion occurs in the flashing joints due to water retentionand redox reactions.

Impact Damage

Bent sections of copper due to mechanical impact of fallen branches.

Open Flashing

Sections of copper sheets are out of plane because of lack of adhesion or insufficient adhesion.



Roofing system

Conditions

Active Leak

Moisture stains and wet surface from water seepage through the roofing system.

Plywood Deformation

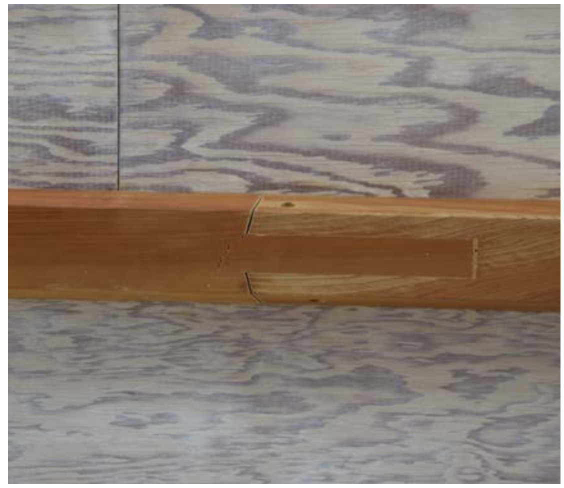
Plywood board is bent and not flush with the contiguous boards.

Plywood Checking

Multiple hairline cracks or slightly open parallel splits of different length.

Rib Crack

Single crack visible in rib joint.



Rib checks

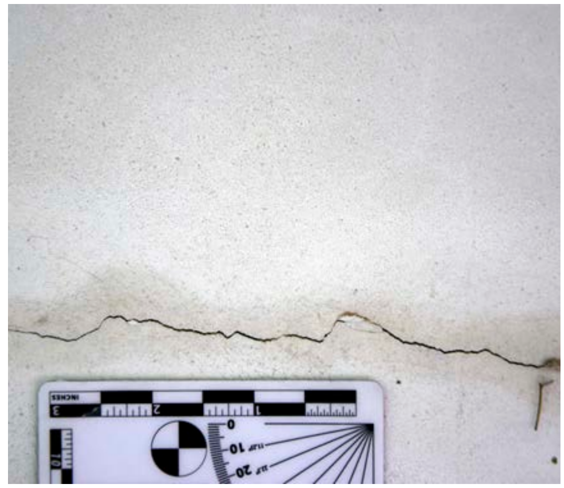
Checks limited to the lower middle section of the rib.

Moisture Stain

Color alteration in the ribs because of historic exposure to moisture.

Crack

Cracks of variable lenght with a width between 1/32 and 1/16 inch, primarily longitudinal along the bedding joint.



Hairline Crack

Cracks in the stucco surface having widths so small as to be barely perceptible. Orientation may vary and they can intersect other cracks forming a pattern.

Mineral Accretion

Salts transported by water has evaporate and crystallized on the stucco surfaces forming mineral deposits in association with a reddish bronw stain.

Soiling

Water splash deposited soil particles upon the rendered surfaces creating a thin brown film disrupting the aesthetics qualities of the white stucco.

Superficial Erosion

Increased surface roughness due to moisture infiltration and salt crystallization. Surfaces constrast with the smoother sour-rounding surfaces.

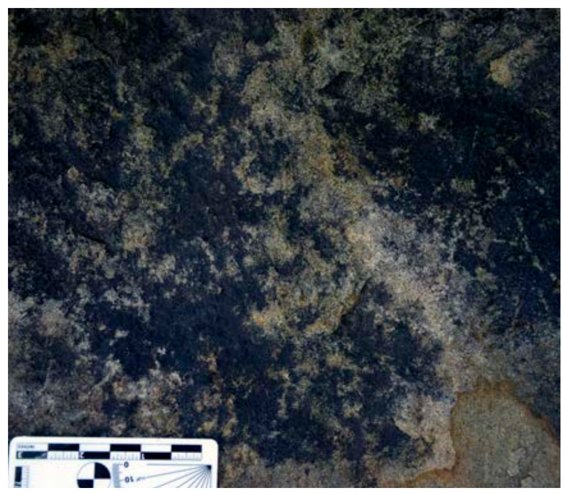
Previous Repair

Repair of eroded and cracked surfaces with a white cementitious material that shows a coarse-grain texture.

Efflorescence

Generally whitish, powdery salts crystallized on the surface. Efflorescences are generally poorly cohesive and commonly soluble salt. This condition has been observed in the exterior and interior walls.

Soiling



Deposit of a very thin layer of particles giving a dirty appearance to the stone surface. It may be a direct effect of earlier biological colonization with algae.

Insect Nest

Mud dauber wasps have constructed their nest on the stone surface. Nests are also localized on other substrates in the other areas of the building.

Flaking

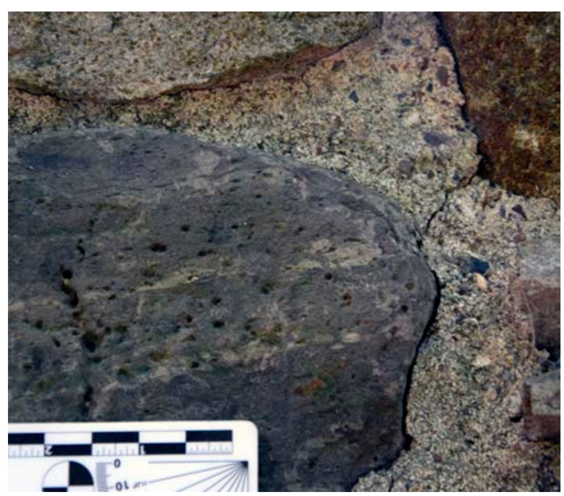
Scaling in thin flat or curved scales. The detachment is located near to the stone surface.

Blistering

Surface erupts into blisters and crumbles away leading to a loss of stone surface.

Hairline cracks

Thin cracks between mortar joints and stone units.



Biological Colonization

Presence of mosses, lichens, and related plants on stone masonry.

Hairline Crack

Cracks in the concrete elements having widths so small as to be barely perceptible. Hairline cracks show a variety of direction and can be accompanied by efflorescence or rust staining.

Rust Staining

Rust brownish red stains in a limited area of the concrete surface as a consequence of moisture intrusion and rebar corrosion.

Honeycombing

Voids left in concrete due to poor mixing of the aggreagate and vibration during the placing process.

Bugholes

Small regular or irregular cavities as a result of entrapped bubbles during the placing process. Overall, they do not exceed 5/8 inch in diameter.

Scour

Overall rough surfaces due to exposure to rainwater, which has dissolved the outer layer of the cement paste leaving the aggregate particles exposed.

Moisture Stains

Discoloration of the concrete surface as a consquence of temporary wetting episodes.

Efflorescence

A whitish deposit of salts crystallized on the concrete surface precipitated by carbonation or evaporation.

Biological Colonization

Presence of algae covering surfaces exposed to permanent moisture or regular wetting episodes.

Impact Damage

Mechanical damage on the outer surface of the concrete.

Ferrous materials

Installation of metallic elements by insertion in a concrete element.

Scratches

Mechanical damage to the outer surfaces of the concrete thus damaging the fragile woodprint pattern.

Entrapped Elements

Leaves and formwork wood chips entrapped in the concrete during the placing process.

Wood elements

Conditions

Rot

Areas of wood, showing color alteration, that have been attacked by fungus. These areas are soft and easily penetrable with an awl.

Checking

Longitudinal openings extending along the length of the wood member facitilitating moisture infiltration. Structural stability appears not to be comprosised though.

Moisture Stains

Uneven color alteration because of wetting episodes. Wood may be wet or dry.

Wood elements

Conditions

Natural Weathering

Wood surfaces showing the symptoms of slow degradation from a combination of natural factors: sunlight, moisture, temperature, chemicals, suspended particles carried by wind, and biological agents.

Animal Abrasion

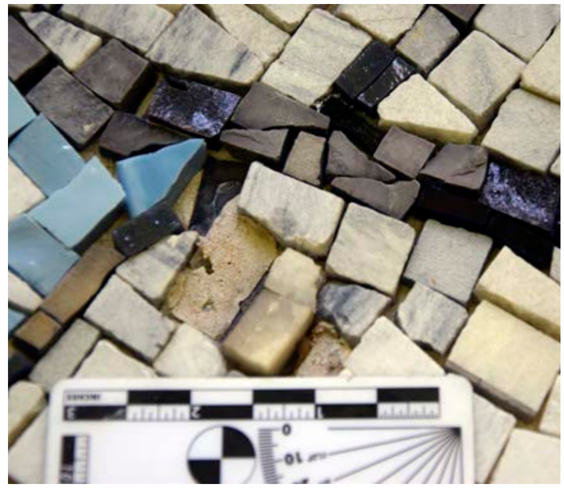
Damages from animal activity, probably squirrels.

Previous repair

Holes perforated by woodpeckers repaired with the use of a brown epoxy resin.

Missing Tessera

Single or multiple tesserae have detached because of lack of adhesion between the tesserae and the substrate.



Granular Disintegration

Eroded and detached surface of tesserae.

Color Alteration

Discoloration due to the use of epoxy resin to adhere the tesserae and hide the screw heads fastening the mosaic to a wood substructure.

Detachment

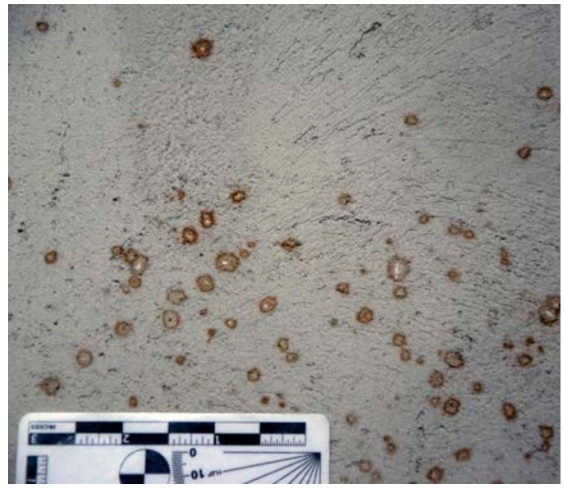
Adhesion failure causing individual tessera loss.

Biological Colonization

Microflora and soiling covering the lower section of the mosaic panels.

Spotting

Circular staining that might be related to the oxidation of metallic components in the Structolite™ or to an unknown chemical reaction between constituents.



Efflorescence

Chiefly whitish powdery deposit of salts crystallized on the plaster surface.

Moisture Stains

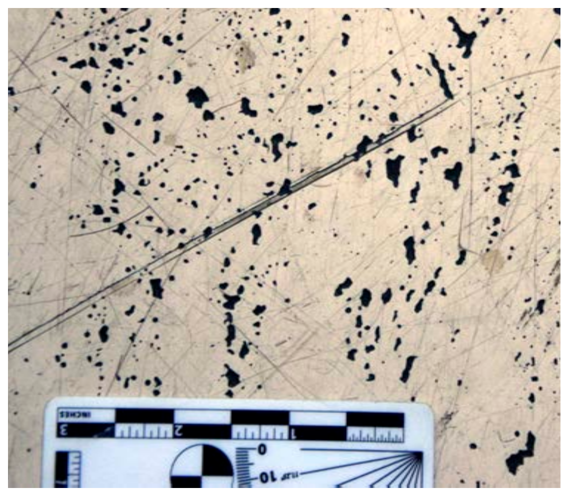
Color alterations of the surfaces caused by active leakage or past moisture infiltration.

Fire Damage

Flooring has been damage by fire in the proximity to the fireplace hearth.

Wear

Scratches and superficial damage from visitation and use.



Tile shrinkage

The flooring present a contraction in comparison to their original dimension due to sunlight exposure.

C. Expenses During Construction**

DATE	ITEMS	FOLIO	DEBITS
1964			
March 31, 1964		CD	$45,00
April 30, 1964		CD	$54,00
May 31, 1964		CD	$692,53
June 30, 1964		CD	$4.096,18
July 31, 1964		CD	$2.886,88
August 31, 1964		CD	$599,67
September 30, 1964		CD	$2.611,97
October 31, 1964		CD	$254,93
December 31, 1964	Balance		$11.241,16
1965			
January 1, 1965	Balance		$11.241,16
April 30, 1965		CD	$1.704,95
May 31, 1965		CD	$946,24
June 30, 1965		CD	$688,11
July 31, 1965		CD	$751,61
August 31, 1965		CD	$576,28
September 30, 1965		CD	$862,68
October 31, 1965		CD	$3.064,59
November 30, 1965		CD	$1.932,48
December 31, 1965		CD	$597,45
December 31, 1965	Balance		$22.365,55
1966			
January 1, 1966	Balance		$22.365,55
January 31, 1966		CD	$2.237,20
February 28, 1966		CD	$584,09
March 31, 1966		CD	$1.185,54
April 30, 1966		CD	$643,24

May 31, 1966		CD	$1.141,28
June 30, 1966		CD	$3.061,42
July 31, 1966		CD	$2.482,46
August 31, 1966		CD	$871,88
September 30, 1966		CD	$362,13
October 31, 1966		CD	$3.143,92
November 30, 1966		CD	$622,91
December 31, 1966		CD	$266,73
December 31, 1966	Balance		$38.968,35

1967

January 1, 1967	Balance		$38.968,35
January 31, 1967		CD	$431,82
March 31, 1967		CD	$146,35
April 30, 1967		CD	$390,00
December 31, 1967	Balance	CD	$39.936,52

1968

January 1, 1968	Balance		$39.936,52

1970

March 31, 1970	Ben Shahn Mural on wall	CD	$2.500,00
December 31, 1970	Ben Shahn Mural on wall	CD	$2.500,00
December 31, 1970	Balance		$44.936,52

1971

January 1, 1971	Balance		$44.936,52
February 28, 1971		CD	$2.316,40
December 31, 1971			$47.252,92

** Based on Depreciation Accounting Book. Together with the information provided by the recorded check and payments, it will be possible to provide a sense of the construction chronology.

D. Drawing Sheets