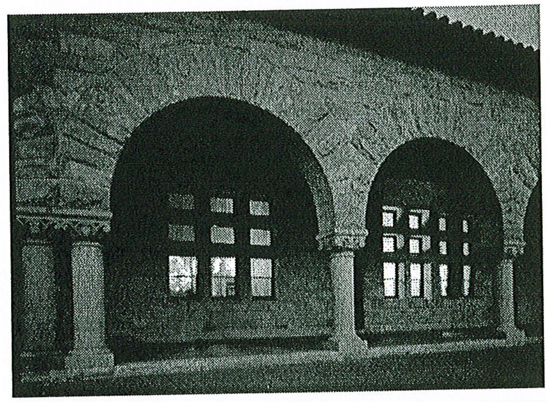
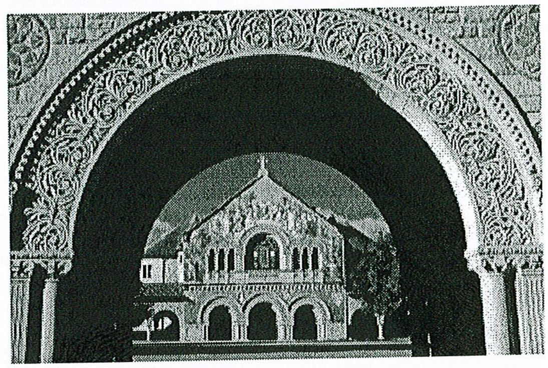
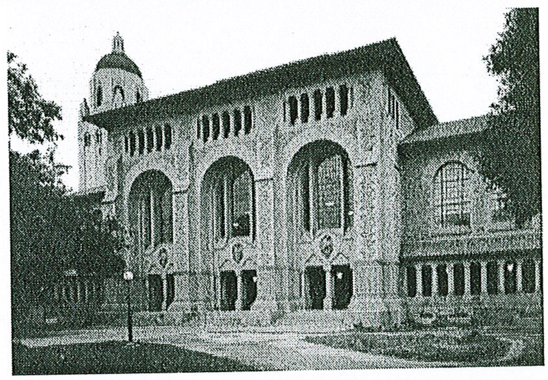
Stanford University
Preservation Award-Winning Projects
Special Tour
16 October, 2003



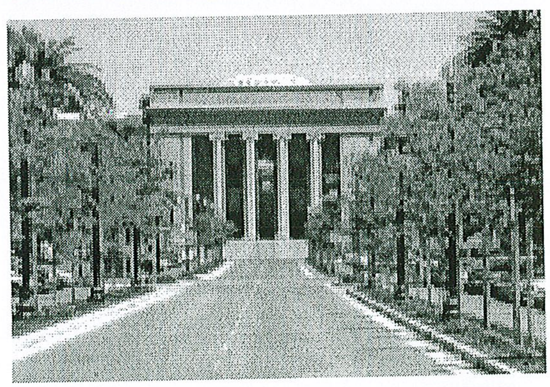
2:30 PM



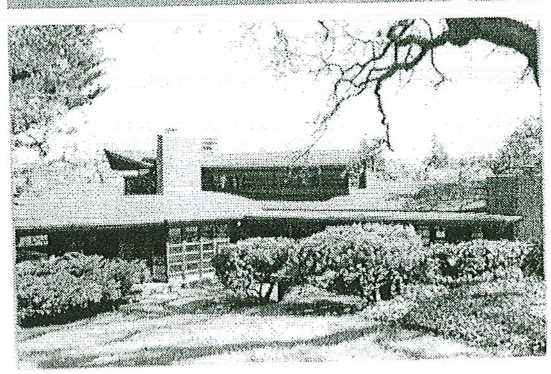
2:45 PM



3:00 PM



3:15 PM



3:30 PM

Tour Host:

H Ruth Todd, AIA
Associate University Architect
University Architect/Planning Office
ruthtodd@stanford.edu

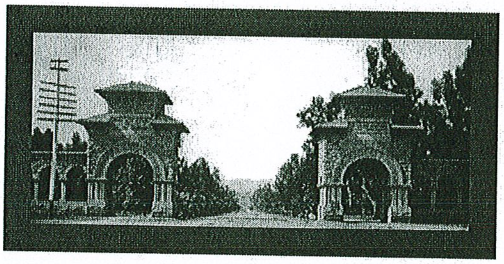
RESTORATION

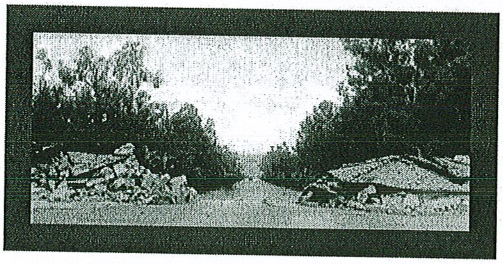
The Main Quad buildings were originally constructed with masonry exterior walls about 24" thick. These walls were composed of a sandstone outer layer and a brick or sandstone inner layer, with rubble and mortar between the layers. As the only means of lateral support for the building, the walls lacked the capacity to withstand and absorb the effects of a major earthquake.

The seismic strengthening of a sandstone building in the Main Quad typically includes two main steps. The first step is to strengthening the walls by adding a layer of reinforced concrete, applied by spraying, hence called "shotcrete". The second step is modification of the ceiling structure to act as a diaphragm, anchoring the walls at the top and distributing seismic forces to the walls.

The construction of new shearwalls begins with the removal of portions of the inner layer of the perimeter walls. Dowels are anchored into the back of the stone layer, reinforcing steel is placed, and shotcrete is blown into the wall cavity, creating a monolithic stone and concrete wall [figure 1]. The shotcreted wall sections are connected by a continuous perimeter concrete beam along the top of the wall.

New wall finishes cover the structural improvements and blend with the untouched portions of the interior. The wall on which this display is mounted was left unfinished to provide building visitors with an understanding of the original construction and subsequent reconstruction of the Main Quad.





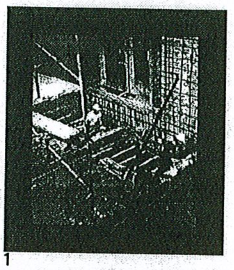
In step two, the ceiling diaphragm is strengthened, usually by the addition of new ceiling joists and plywood sheathing. The walls are anchored to the new diaphragm with steel hardware.

The seismic upgrade also includes the arcades surrounding the building [figure 2]. The original arcade wall consists of sandstone arches supported by carved sandstone columns. The arches support walls of similar construction to the main building walls. This system, held together by gravity alone lacks rigidity and continuity to withstand major earthquake movement.

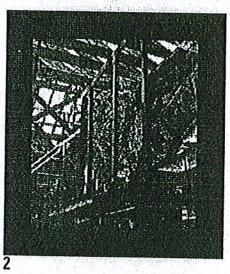
The arcades must be strengthened with reinforced concrete without altering their original appearance. First, the sandstone columns are replaced with steel reinforced, precast concrete columns, which match the original columns in appearance. This requires the entire arcade to be carefully shored so that the sandstone columns can be removed without cracking the arches [figure 3].

The columns are joined by concrete column sections, which extend to the roof through cored holes in the stone column capitals and arch walls. The wall segments above the arches are strengthened with shotcrete, similar to the building walls. The inside stone layer is cut to a thickness of approximately 3" and replaced over the shotcrete as a veneer [figure 4]. The top of the arcade is then anchored to the roof diaphragm, as with the main building.

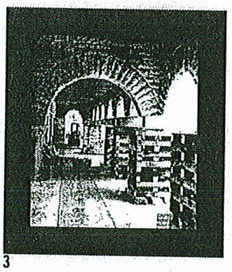
The retrofitted structure retains and preserves the original architectural appearance of the building.



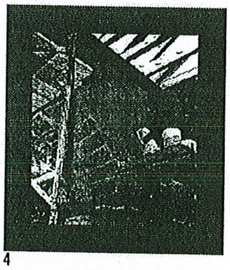
1



2



3



4

BUILDING THIRTY

Leland Stanford, Jane Lathrop Stanford, and Leland Stanford, Jr., Paris, 1880.

General Francis A. Walker, 1880's.

In Memoriam

Stanford University is a memorial to the only son of Leland Stanford and Jane Lathrop Stanford. In 1884 their 15 year old son, Leland Stanford, Jr., died of typhoid fever. From his parents' grief was born the idea of a great university that would perpetuate their son's memory.

Leland Stanford hired the foremost landscape architect of the day, Frederick Law Olmsted, to plan the campus. Olmsted favored a site in the foothills, suited to the informal, naturalistic style so evident in his famous design for New York's Central Park. But the client had his own vision. "The site is settled at last – not as I had hoped..." Frederick Law Olmsted said to his son, September 18, 1886.

The inner quadrangle would be the core of a monumental and readily expandable plan to be sited on the plain. Stanford hired Charles Allerton Coolidge, a successor to renowned Boston architect H.H. Richardson, to design the buildings. Olmsted, Coolidge, and Leland Stanford concurred that the architecture should suit the regional landscape and climate.

"When I suggested to Mr. Olmsted an adaptation of the adobe building of California, with some higher form of architecture, he was greatly pleased with the idea, and my Boston architects have skillfully carried out the idea, really creating for the first time an architecture distinctly Californian in character."

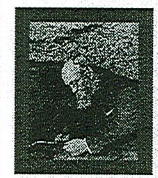
– Leland Stanford, San Francisco Examiner, April 28, 1887.

Built to Last

Completed in 1891, Building Thirty retains the high ceilings of the original quadrangle interiors. Francis A. Walker, president of Massachusetts Institute of Technology, had advised Stanford: "I would strongly recommend one-story buildings of stone..." Over the years, all the buildings in the Inner Quadrangle except this one have been converted to two stories.

Careful research has enabled Stanford University to restore Building Thirty to closely resemble its original appearance. Paint colors, light fixtures, and furnishings have been used to replicate the original choices made by Charles Allerton Coolidge.

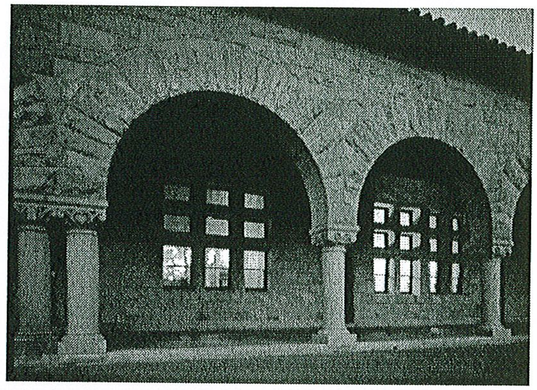
Building Thirty now houses the Stanford Language Center, established in 1995. The Center's charge is to guarantee that Stanford language programs are of the highest quality and reflect the most recent knowledge about language teaching and technical innovation. The teaching wing of the center is equipped as a modern facility with flexible audio, video, and computer capabilities. The administrative wing has been furnished with original early California antiques. The Director's office [room 110] and the Director's conference room [room 108] provide a glance into Stanford's past. Many of the pieces in these rooms were located on the campus itself; others were acquired throughout the San Francisco peninsula area.



Frederick Law Olmsted, c. 1892.

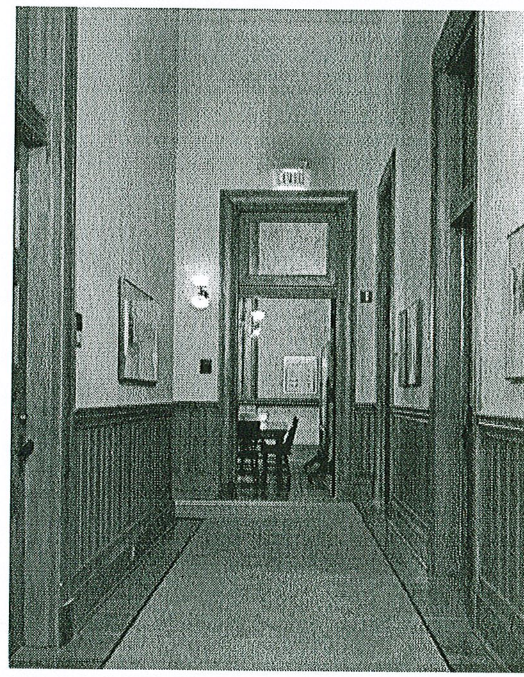
Cornerstone-laying ceremony Jane and Leland Stanford in center, May 14, 1887.

Building 30, The Language Center
Stanford University



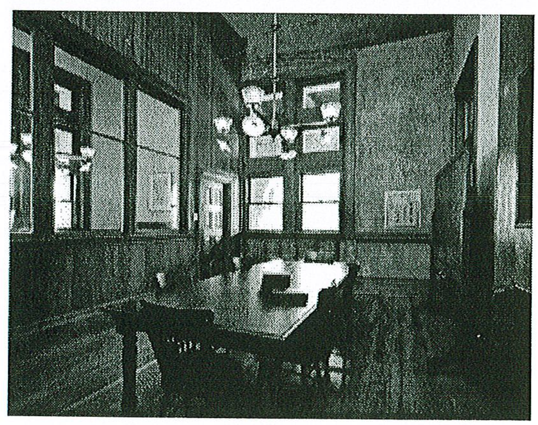
The Building 30 rehabilitation represents a commitment to historic preservation: returning a significant historic resource to its original use. The success of the project is attributed to the collaborative team efforts of the architects, engineers, university building users and university archivist in undertaking research and developing creative solutions to modernizing the facility without compromising its integrity. Now completed, the facility operates both as a state-of-the-art teaching center and a true interpretive "working museum."

Why the Building is Important
Building 30 was constructed as part of the Inner Quad during the first phase of construction of Stanford University designed by Charles Coolidge of Shepley, Rutan & Coolidge and completed in 1891. The Inner Quad buildings were designed based on recommendations by the University's consultant, Frederick Law Olmsted, designer of New York's Central Park, who urged the University not to reproduce East Coast college architecture: "If we are to look for types of buildings suitable to the climate of California, it will rather be in those founded by the wiser men of Syria, Greece, Italy and Spain."



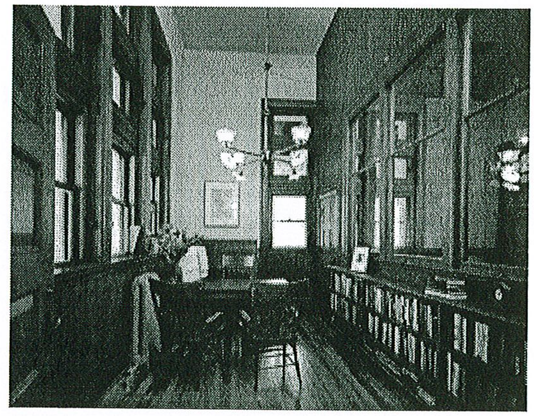
Today, Building 30 exists as the only building of the Main Quad which retains a one-story interior structure and the original space configuration, 16' high interior spaces and details such as wood wainscot, doors and transoms, and door and window trim. The walls in the building were constructed of structural sandstone, rather than brick as is typical throughout the other later quad buildings. Although partition walls were added, woodwork had been painted, and plaster work was removed for safety reasons shortly after the Loma Prieta earthquake, no original walls or details were significantly altered or removed.

Design: Excellence in Historic Preservation
The new user of the building is the Language Center, which provides classroom teaching and audio/video instructional training for foreign languages. The goal of the project was to repair the earthquake damage, strengthen the building, and return the building to its original configuration and its original use as classrooms and teaching offices. The architectural team worked closely with the Director of the Language Center to sensitively tailor the design improvements to meet the Center's programmatic needs. However, the architectural team's historic preservation philosophy was to restore the building to its original configuration for continued use for any department or future use. Thus, all programmatic changes were designed to be completely reversible, in keeping with the *Secretary of Interior's Standards for the Treatment of Historic Properties*.



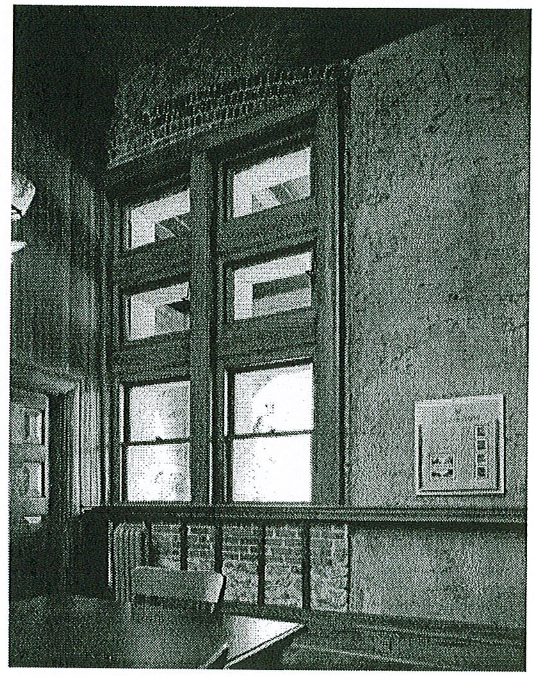
In one instance, where the Center's program required a "sound-proof" room for the recording of instructional video/audio tapes, the architectural team designed a "room within a room" rather than greatly impacting the historically significant classroom space. The result is a space-efficient room that enables the rest of classroom to be used for study and work spaces.

In addition to restoring the building accurately and sensitively, the architectural team developed design solutions to incorporate updated technology, including projection systems, telecommunication wiring and internet connections. The facility was upgraded to provide disabled access to meet the requirements of the California State Building Code, Title 24 and the provisions of the ADA. On the exterior of the building, work also included seismic strengthening of the arcade. The approach involved replacing the existing sandstone columns with steel reinforced precast concrete columns. The construction phase of this work was particularly challenging, involving the shoring of the arcade to provide support to the sandstone arches while replacing the columns. In order to provide structural stability, the top of the arcade is anchored to the roof diaphragm.



Collaborative Team Coordination
Project team members worked collaboratively to develop the following solutions which respected the building's historic fabric: design of a concealed seismic strengthening scheme using reinforced concrete; upgrade of mechanical and heating system; replacement of electrical system and design of compatible lighting fixtures; and repair to woodwork, trim, and windows. The architectural team conducted a paint analysis to determine and specify the original colors of the interior walls.

The team and the University conducted extensive research to identify, replicate and reinstall original gas and electric light fixtures, which were upgraded to use current electrical requirements. Working with the University Archivist, the team located the original milk glass light shades in the Stanford Museum archives and had the matching upper shades replicated. Historic photographs (included in the slide images) provided insight into the original fixtures and furnishings.

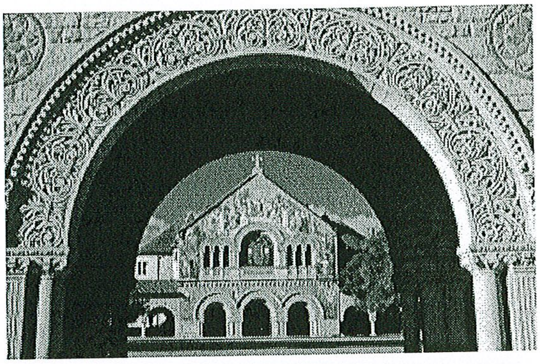


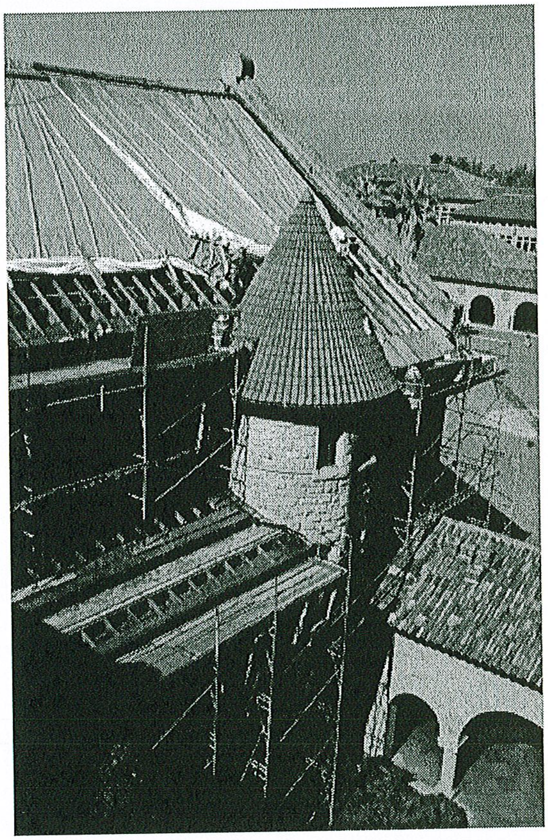
Quality of Campus Environment: Building as Educational Tool and as Cultural Resource
During the project, the architectural team proposed the concept of keeping one of the existing interior walls exposed to illustrate the original construction process and the recent concrete strengthening solution. The result is in the conference room, where the brick and sandstone wall serves as an interpretive exhibit, demonstrating the use of shotcrete and steel to provide support to the building. The architectural team worked with the university to develop specialized signage which describes and illustrates with photographs the process of rehabilitation (included in attached binder).

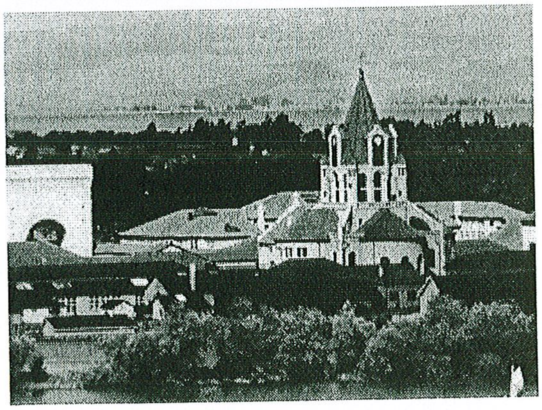
Through the use of historical photographs, many of the fixtures as well as chairs, tables, desks and display cases in the restored building were either original pieces or authentic period furnishings. Two particularly significant pieces of furniture are the desk and bookcase in the Director's office, which Stanford's first president, Dr. David Starr Jordan, brought with him from Indiana in the 1880s. By utilizing these historic furnishings and fixtures for their intended uses in an historically appropriate setting, the building has become a "working museum" for both students and the public to learn from and appreciate.

Architect: Architectural Resources Group
Structural Engineer: GFDS Engineers
Contractor: Hathaway Dinwiddie Construction

Memorial Church
Stanford University







Stanford University was founded in 1891 by Leland and Jane Stanford as a memorial to their young son, Leland Stanford, Jr. The campus was planned by Fredrick Law Olmstead and Charles Coolidge (a protege of the late H.H Richardson) as a series of academic quadrangles with arcades oflocally quarried sandstone creating a unified whole. Leland Stanford,Sr. died in 1893, before the completion of the first part of the campus, and his wife Jane led the final effort to create the campus we know today.

At the center of the Main Quad, Mrs. Stanford chose to erect a Memorial Church to her husband -the one building on campus to be specifically dedicated to its founder. Charles Coolidge designed an impressive towered edifice, similar in form to one of the early sketches for Trinity Church in Boston, and Jane Stanford personally worked with artisans around the world to develop the building's lavish artwork. The building was completed in 1903. Soon after, the devastating 1906 earthquake caused major damage to the structure, toppling its tower and collapsing many of its decorative walls. Jane Stanford led the remarkable reconstruction effort over the next ten years, with the rebuilding of nearly the entire structure except its tower.

A significant element of the building left standing in 1906 and not rebuilt in 1913 were the central crossing arches and dome under the earlier tower. In the next big earthquake, the 1989 Loma Prieta quake, the movement of these interior stone arches caused some of the stone to fall and shift out of plane, as well as begin to delaminate the four large mosaic tile angels from their structural backing at each comer. It was clear that this central component of the church would need to be significantly strengthened, as well as implementing improvements in other areas of the structure to ensure the building's survival in another seismic event. A team of Architects, Structural Engineers, Conservation Specialists, and Contractors was assembled to develop a seismic stabilization plan that would reinforce the damaged areas without altering the myriad of decorative surfaces throughout the building.

Seismic Strengthening Program

Key to the program would be the major work at the crossing itself, where a significant amount of concrete and steel would need to be introduced to stabilize the structure. A delicate plan was developed to insert new steel bracing above the old brick arches and infill the void between the walls with reinforced concrete, creating a monolithic and continous structure above the arches. A massive steel "strongback" was created to connect the four walls above the arches and the entire bracing system was then knitted together with a continuous 18"x54" concrete cap beam around the perimeter of the crossing. All this work was accomplished within a space whose dimensions ranged from 2 to 4 feet, and the materials were brought in through a minimal 2' x 3' opening in the building's exterior.

Using steel collector beams, the reinforced crossing was tied to the previously rebuilt nave, chancel, and transepts. Each of these areas was further strengthened by removing its tile roof and installing a new plywood diaphragm; the existing tile was salvaged and nearly all of it successfully reinstalled. In addition to the overall building program, each of the church's significant decorative and interior elements was evaluated and strengthened as required to ensure both safety and longevity. These aspects of the work are described in detail below.

Strengthening and Conservation of Important Historic Elements

The interior work was developed, evaluated, and implemented by a team of conservation scientists, engineers, architects, and craftspeople in the following specific areas:

Stone

Displaced and fractured voussoir stones at the crossing arches were removed and composite repairs made, anchored by stainless steel dowels concealed within the stone's intricate carving. The stone railings at the interior balconies were removed and new anchors were core drilled into the stone pilasters. On the exterior, the central stone cross was repaired and reinstalled.

Craftsmanship

Along with the seismic strengthening program, the Church's interior decorative components were evaluated, repaired, and cleaned as needed. One of the most complicated and intricate portions of the work involved the stabilization of the large mosaic tile angels at each comer of the crossing. During the earthquake, as the stone crossing arches were moving, the pendente angels became loosened from their structural support and began to delaminate from their backing support. The angel at the northeast comer, "Uriel", suffered particular damage and loss of large pieces of bonded tile. Perhaps appropriately, this was one angel looking downward while all the others are gazing towards the heavens!

All around the angels would be the massive effort to strengthen the crossing, with the addition of significant quantities of steel and concrete. The work at the angels would require a far more delicate approach and be fully coordinated with the overall building work as there was very little physical space to accomplish both.

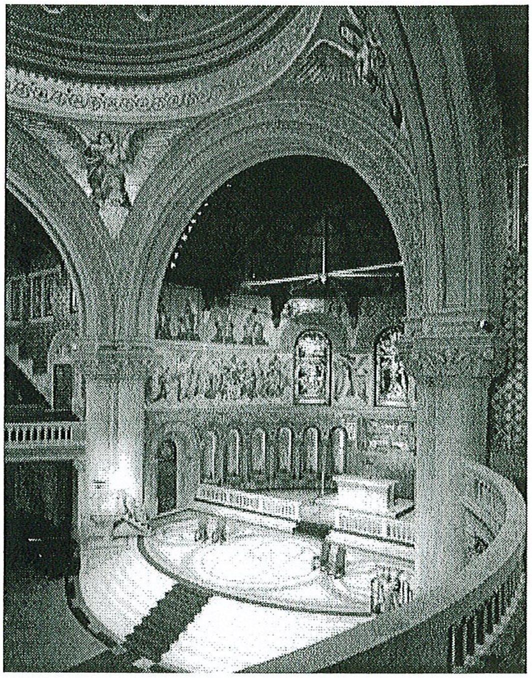
The first step in developing a solution to the difficult problem of reattaching the angels was to understand why they tended to delaminate at all. An investigation of the original structural system supporting the angels revealed that the individual glass tesserae tiles of the mosaic were embedded in a mortar cement mix with underlying layers of weak lime plaster. This assemblage was anchored to steel straps that were fixed to steel angles tied back to the crossing arches. Overall, it appeared that it was the concave shape of the angels themselves which provided a natural stabilizing compression force to keep them in place.

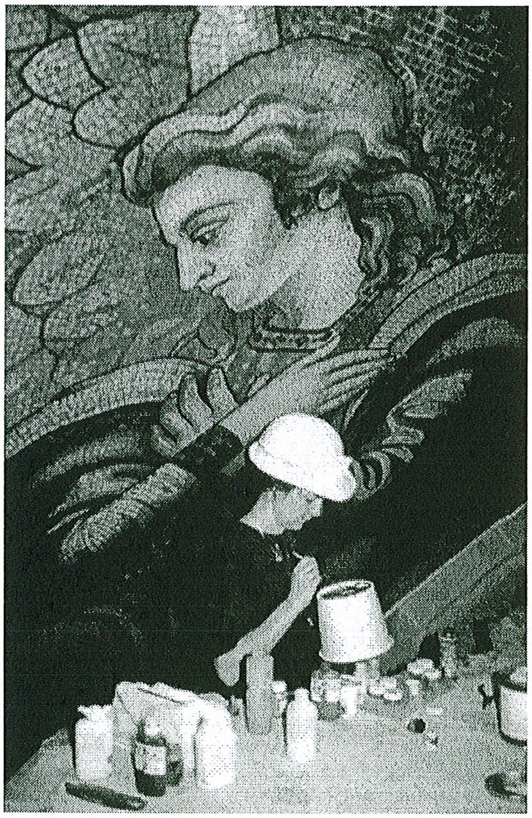
From this understanding and a chemical analysis of the plaster and lime layers, it became clear that the solution of repairing and stabilizing the mosaics would require the removal of all the weak lime plaster down to the last mortar layer just behind the glass tesserae itself. New adhesive materials and steel members would then need to create an entirely new support system. This process is outlined below.

Angel Rehabilitation and Repair Process

The steps involved in implcmcnting the new support system and refurbishing the damaged angels were carried out by highly experienced and qualified conservators and craftspeople.

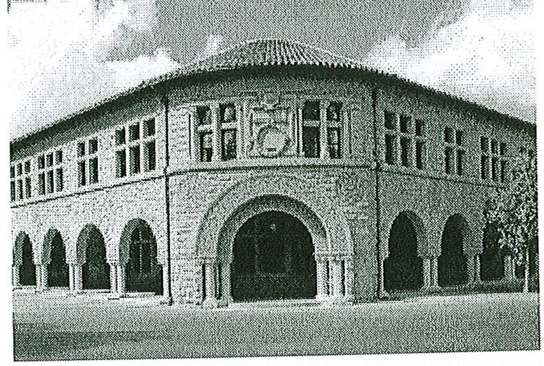
1. A custom fiberglass mold was created for each angel in order to support them from the front while work was carried out from behind
2. The mold was anchored by steel dowels which penetrated the mosaics and were fixed on the back side to the existing steel straps.
3. With the angels supported, the intricate excavation and removal of the layers of lime bonding plaster was carried out over several weeks.
4. Concurrently, a team of artisans pieced together the fragments of the fractured angel's wing which had fallen. The glass tesserae was painstakingly reassembled and restored.
5. With the removal of the plaster backing, the surface was ready to accept its new bonding material. This method included two layers of resin keyed to the existing cement mortar .
6. On the first layer of resin was placed a series of lx2 inch wood stringers at 8" on center running top to bottom, parallel and between the existing steel T -bars of the original construction. Two more layers of resin material were placed over the stringers.
7. On top of the existing T -bars and perpendicular to their direction, 1/4" x 11/2" steel bars were placed at 16" on center. 111ese were tied to the stringers below by placing foam under the new steel bars and draping resin layers overall to connect the entire assembly together.
8. Small holes were made in the resin down to the original cement mortar layer to allow the tile assembly to breathe and avoid potential condensation problems.
9. With the backing complete, the molds on the front were removed, tesserae were replaced over the dowel penetrations, and the angels were repaired and cleaned.



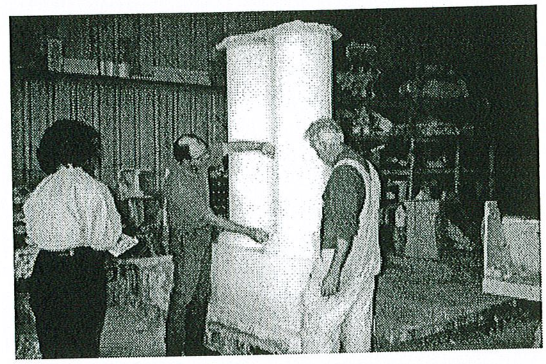


Architect: Hardy Holzman Pfieffer Associates
Structural Engineer: Degenkolb Associates
Conservators: Leslie Bone, Richard Pieper
Contractor: Dinwiddie Construction

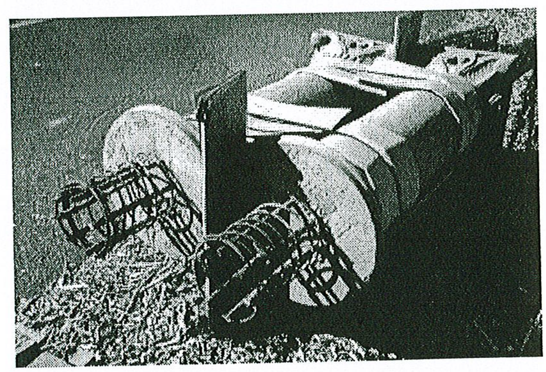
Language Corner
Stanford University



The Language Corner is located on the university's Main Quadrangle. Built in 1906 as the Engineering Building, it is a three-story unreinforced masonry building. Damaged in the 1906 earthquake, it has been repaired and substantially modified over the last 80 years as classrooms and offices for the Language Department. On October 17, 1989, the 7.1 Loma Prieta Earthquake caused sufficient damage to close the building.

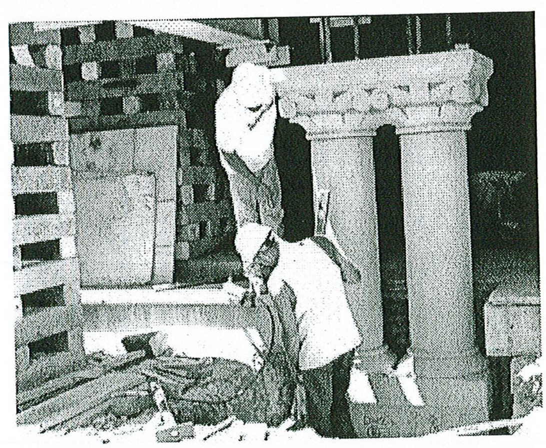


Options for the seismic upgrade and programmatic reorganization of the entire building were developed by the architects. Structural design standards dictated the need to create a new structural system to be inserted into a reinforced shell. The building interiors were reorganized, creating a new building within the existing historic sandstone walls.

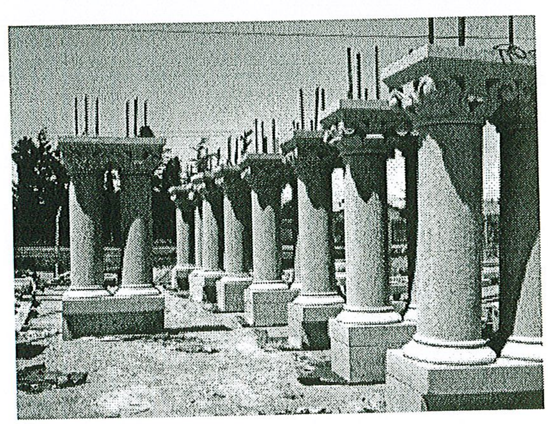


Special attention was paid to maximizing the volume of space within the historic building while creating a new environment for the French/Italian, Slavic, Portuguese, and German Departments. The zoning of the floors allows all departments to be connected vertically from the arcade to the third floors. Important historic features such as handrails, lighting and wood wainscots have been seamlessly recreated. The new building contains 44,000 square feet of space.

The facility includes state-of-the-art language laboratories, faculty offices, seminar spaces and a 150-seat, fully-automated, multimedia auditorium. Each classroom in the building is outfitted with a large screen video system capable of multi-network connections including broadcast, cable, campus closed-circuit TV, and future computer networks.

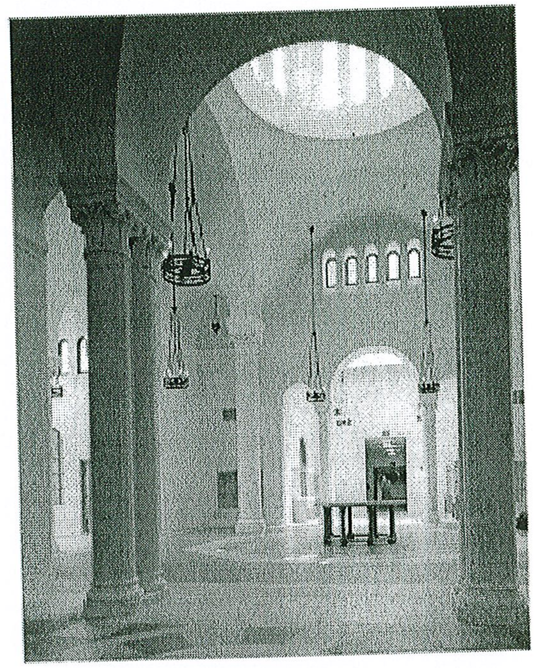


HHPA installed new precast columns to replicate the original sandstone columns that had to be removed as part of the seismic upgrade of the building. HHPA worked closely with stone masons and pre-cast sub-contractors to develop a column design that has since been adopted as the campus standard for all Stanford Historic Quad projects. The restoration and column replacement endeavor led to the development of a plaster model used to make adjustments to the tooled appearance of the columns prior to making the final mold for precasting. This step dramatically decreased the number of "aesthetically unsuitable"/rejected columns and facilitated product consistency. Unreinforced masonry exterior walls were reinforced as part of the renovation.



Architect: Hardy Holzman Pfieffer Associates
Structural Engineer: Rutherford and Chekene
Contractor: Nibbi Brothers

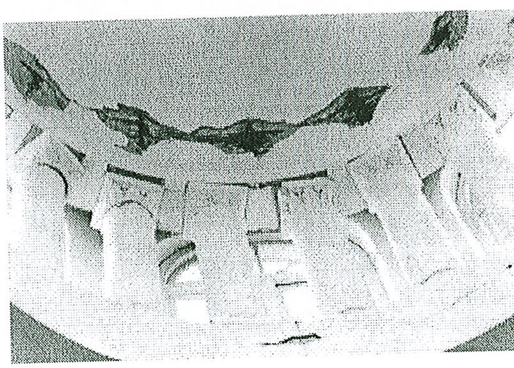
The Bing Wing of Green Library
Stanford University



The Bing Wing of the Green Library at Stanford University was designed by John Bakewell, Jr. and Arthur Brown, Jr., Architects, in the Richardson Romanesque style. P. J. Walker Company was the builder. Plans were approved by the University Trustees in 1916, construction lasted from July 16, 1917 to July 7, 1919, and the building opened on July 14, 1919. The building is included in the Historic American Building Survey (HABS No. CA-2613) and is eligible for the National Register of Historic Places. The building reopened for use on August 2, 1999, and was rededicated on October 12, 1999.

The original architects' description of the building provides interesting information regarding the design, architectural and historical significance, and contextual importance of the building and its site. Excerpts from this description follow, with the current names of rooms and spaces as identified in the drawings and photographs noted in italics:

> "In addition to the main axis [of the main campus quadrangle], there is the other principal axis drawn at a right angle to it through the central court. This axis is left open at both ends....[I]t was felt that this axis should be preserved and emphasized, and so the library was placed in such a position as to terminate this cross vista....[I]t was felt that the large mass of the library was necessary both in order to preserve this axis and also to relieve the monotony of the long rows of lower buildings.
>
> "The library was kept in the same style as the older buildings, though an attempt has been made to vary the elements somewhat in order to give interest and variety to the whole group. The large mass of the front facade is broken up somewhat by advancing the central portion out over the arcade and constructing low arcades on either side of this central motive. The buttresses and large arches above the entrance, with their bold reveals, give a play of light and shade and also emphasize the massiveness of this central figure.
>
> "The building is 180 feet wide by 235 feet deep. It is of steel frame construction with reinforced concrete floors and roof slabs, the latter covered with red tile in harmony with the other buildings of the University. The main facade is of San Jose sandstone, and the side and rear facades are of buff brick trimmed with sandstone. The three figures over the entrances, representing Art, Philosophy, and Science, give interest and a certain amount of necessary contrast to the heavy walls.
>
> "Entering and crossing the arcade ...we enter the building *[Entry]*. Directly in the center is the grand stairway leading up to the main [second] floor and delivery room *[Munger Rotunda]*. This stairway is surrounded with a colonnade on the main floor. As one goes up the stair, his eye is drawn up into the dome and arches at the top of the delivery room....[T]his space under the cupola is the central feature of the library. It is the place where the staff and public meet, and sentimentally, as well as actually, it is the heart of the library. For this reason it is given great height, and, in combination with the stairway, it forms the architectural feature of the building. The shape of this room and its proportions lend themselves admirably to a Romanesque treatment. There is a very strong suggestion of the Byzantine, as is quite often found in Romanesque work, which is further carried out by the hanging lights.
>
> "The reading room *[Lane Reading Room]*, which opens directly off of this delivery space to the left, is a well-proportioned room 42 feet by 177 feet and 31 feet high, light, airy, and simple. At the right of the delivery hall is the main stack, equipped with shelves for 310,000 volumes, but with an ultimate capacity of 678,000 volumes.
>
> "Directly facing the main stairway is the space for the card catalogue *[East Apse]*, behind which are the library administration rooms....At the opposite end of the building, across the western front, are arranged the periodical room *[Field Room]*, 41 feet by 88 feet, 31 feet high; and two smaller rooms, the Timothy Hopkins room *[Barchas Room]* and the faculty reading room *[Special Collections]*.



University records list the following significant events in the history of the library:

- 1956: Upper two tiered stack levels were added.
- 1963: Most of the basement was excavated and roofs were built in light wells over the first level for occupancy in the basement.
- 1970: Two stairs were added at the main stacks, a fire sprinkler system was

added, and the lobby area was partitioned off at both sides of the entry.

1980: Construction of the east wing (Green Library - East) was com pleted.

1987 The tiered stacks were seismically braced with an independent three-dimensional structural steel moment frame.

The Green Library suffered significant damage during the Loma Prieta Earthquake of October 17, 1989. The building was immediately closed, its rooms and stacks emptied, and its staff dispersed to several temporary locations. The reconstruction of the building followed the requirements of the Federal Emergency Management Agency, (FEMA), and in accordance with the Secretary of the Interior's Standards and input from the State Historic Preservation Office and the Advisory Council on Historic Preservation. The reconstruction involved four principal programmatic criteria:

1. Structural strengthening of the building to better withstand future earthquakes. This work consisted primarily of extending existing columns to new, deeper footings; construction of reinforced concrete shear walls from the basement to the top level; "shotcrete" reinforcing of the interior sides of the stone and masonry exterior walls; reinforcing of the structural steel building frame; and demolition of hollow clay tile interior walls and construction of new metal stud-framed walls.

2. Reconstruction or rehabilitation of historically significant elements and spaces. Unsympathetic materials and elements that had been imposed on the building over the years were removed. Historic design elements such as columns, plaster ceilings, skylights, glass "laylight" ceilings, doors and door frames, and windows were refurbished and reinstalled in the building. New elements such as metal stud and veneer plaster walls, doors and door frames, windows, and casework were designed to match and be compatible with the historic character of the building. Interior colors were based on the building's original colors. Existing furniture and lighting fixtures were rehabilitated, and new furniture and lighting fixtures were designed to relate to the original building architecture. Two of the many significant examples of this work are:

   a. Reintroduction of glass "laylights" in the ceilings of the second floor Lane Reading Room and the fifth floor Bender Room, referred to as the "gentlepersons reading room". The original "laylight" glass was removed and replaced with painted panels for blackout purposes early in World War II. The glass had never been reinstalled.

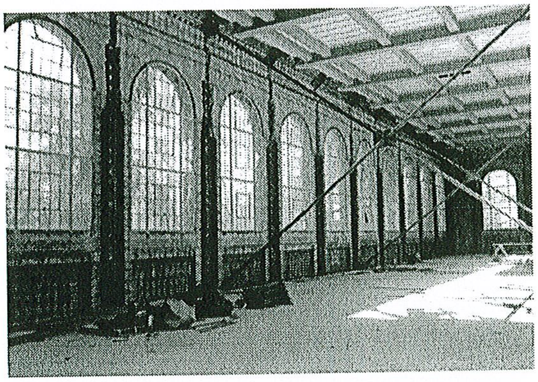
   b. Reconstruction of the cupola above the Munger Rotunda. Because of the structural need to reduce the weight, the existing brick masonry cupola was dismantled brick-by-brick. It was reconstructed with a structural steel frame and metal stud infill walls. The interior plaster dome was reconstructed, the original face brick was installed as a veneer over the metal studs on the exterior, and the original clay roof tiles were reinstalled. The appearance is identical to the original.

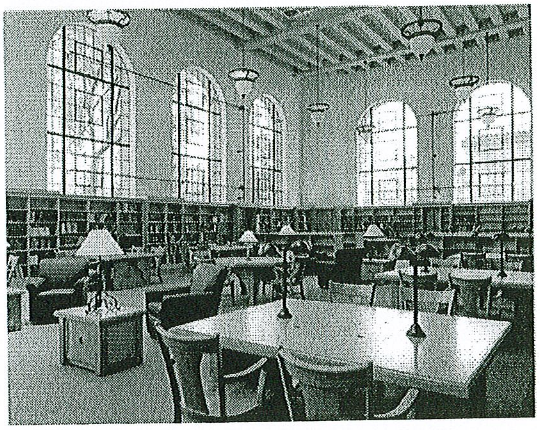
3. Functional improvements to accommodate current library practices and procedures. This included enhanced connections with Green Library - East, and provision of group study rooms, seminar rooms, and staff spaces designed to facilitate support to patrons and scholarly research. All of this was designed with a degree of flexibility to accommodate possible future changes.

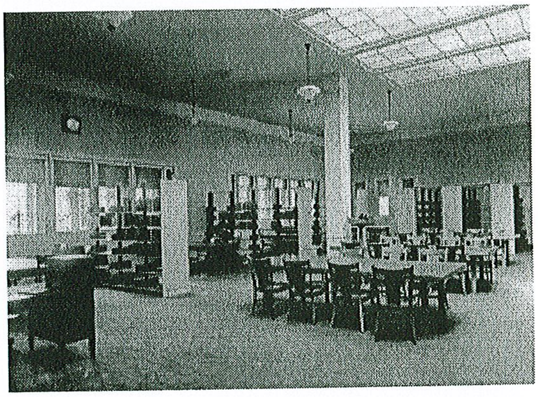
4. New environmental systems, including lighting, HVAC, communications, and state-of-the-art data systems, including over 400 outlets where patrons may "plug-in" for direct access to the Internet. The systems were carefully integrated into the historic fabric and structure of the building to help retain its original character.

After assessing the significant damage caused by the 1989 earthquake and considering many factors, not the least of which was the great amount of damage caused throughout the campus, the University administration wisely made the decision to rebuild rather than demolish the Green Library. The result of a ten-year effort is the rebirth of a magnificent structure that is structurally sound, programmatically state-of-the-art, architecturally and historically sympathetic with the original design, and capable of functioning well into the next century. Perhaps its significance is best described in the following quotation from the University Librarian:

"... in this restoration of [T]he Main Library, now to be known as the Bing Wing, we have attempted to be true to the simple grandeur of the building, while accommodating the incredible changes in the University and its libraries in the years since 1916. We have tried as well to prepare for the unforeseeable possibilities of the future."

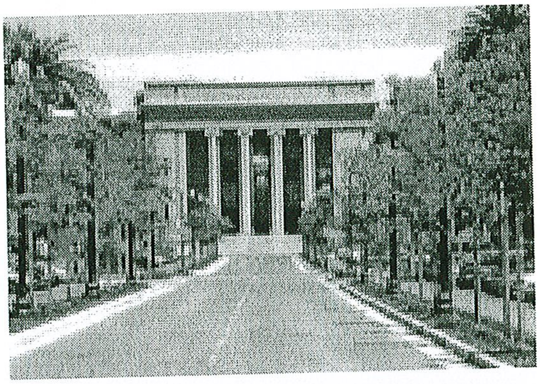


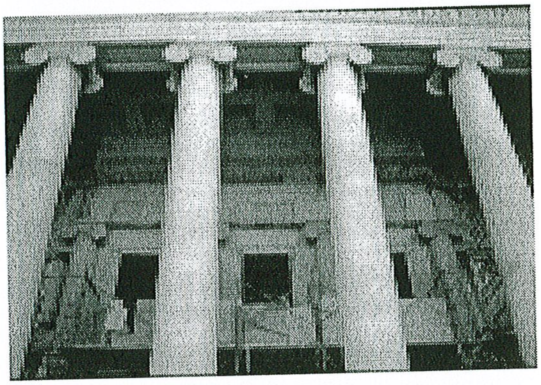


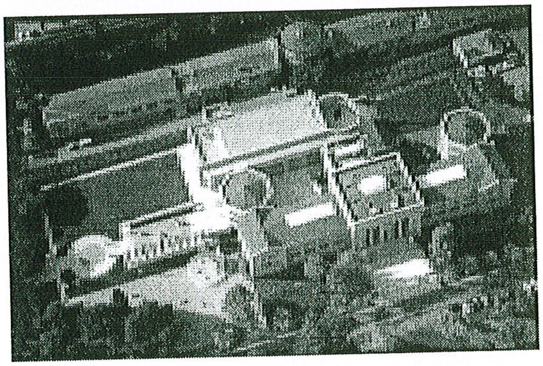


Architect: Fields Devereaux Architects
Preservation Consultant: Architectural Resources Group
Interiors Architect: Brayton Hughes Design Studio
Structural Engineer: Forell-Elsesser, Structural Engineers
Contractor: Barnes Construction

The Iris and B. Gerald Cantor Center for the Arts
Stanford University







Statement of Significance

The Museum of Art at Stanford University possesses historical significance on two levels. It represents the first use of the Neoclassical style in a museum building in the United States, serving as a model for subsequent museums built throughout the country. In addition, the building was one of the first structures to be constructed completely of reinforced concrete. Both of these factors give the building a national significance that extends well beyond its obvious importance to the development of the Stanford University campus. Conceived by Jane Stanford, who insisted on its Neoclassical appearance, designed by the San Francisco architectural firm of Percy and Hamilton, and engineered by Ernest Ransome, a pioneer in reinforced concrete design, the building was an important design and engineering accomplishment.

Jane Stanford began planning for a museum in honor of her son, Leland Stanford, Jr., shortly after his untimely death, at age 15, in 1884. Mrs. Stanford specified that the building be modeled after the National Archaeological Museum in Athens, Greece, which the family had visited while traveling in Europe before the death of Leland, Jr. He had been especially fond of this Greek building, and expressed his desire to someday endow his own museum. Jane Stanford's insistence upon the Greek model for the new museum is of importance to the development of this building type in the United States. Prior to the Stanford example which was begun in 1891 and completed by 1894, most of the major museums in America were in the Gothic or Romanesque style. However, after the turn of the century, many new museums were constructed with some form of a Classical reference.

Main Lobby

This two story domed space is built of concrete and partially covered with marble panels. the first story is composed of marble Doric pilasters, the second story features a set of small Ionic pilasters set within larger Ionic pilasters that rise toward the dome. This arrangement follows traditional classical principles and proportions. The second story pilasters form an arcade with plaster ornamentation. The low oval dome, installed after 1906, is the third dome in this space and is constructed of concrete and glass. The lobby floor is embellished with a terrazzo mosaic in a sunburst pattern. Alternating squares of light and dark terrazzo, bordered by Greek fret work, comprise the rest of the floor design. Floor cracks and unobtrusive repairs, as well as the large area near the newel post at the north stair, are references to the damage incurred during the 1906 earthquake.

This lobby is the most grandiose space in the Museum and was the most problematic to seismically strengthen following the Loma Prieta Earthquake of 1989. The challenge was to create a space which would be seismically safe, without damage to the marble walls, the terrazzo floor, and other historically significant features.

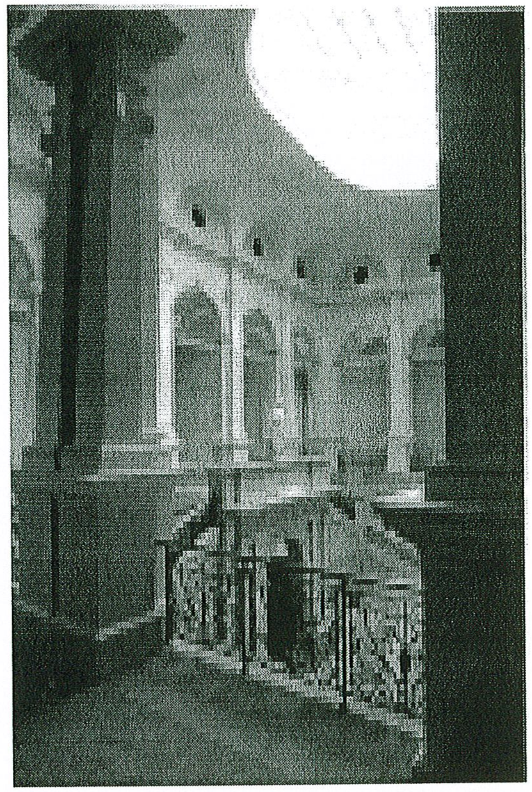
The most significant structural effort involved the replacement of the east entry wall. All of the walls in the Museum are sparsely reinforced. The east wall, the thinnest in the building at 11 inches thick versus the typical 30, suffered the most serious damage in the Loma Prieta Earthquake. The existing wall was removed above the marble line and completely reconstructed with reinforced concrete. Protection of the exterior mosaics above the doors was a major concern. All plaster detailing was accurately replicated with the use of latex molds and castings.

The work in the lobby also consisted of replacing the poorly reinforced second floor balcony and attic slabs with new, heavily reinforced concrete. This was necessary to create a stiff and strong structural "ring" around the open lobby space, thereby protecting the tall perimeter walls and arcade columns. At the second floor, the texture and color of the replacement concrete was carefully chosen to match the original condition.

Although there has been much reconstruction of elements in the lobby, many original features have been restored. The main entrance doors weigh more than 600 pounds each and are clad with bronze. They contain 24 bas relief panels which depict the history of architecture. The art panels have been cleaned and the exterior rails and stiles were stripped and repatinated to match the patina of the panels. At the stairs, the brass and metal handrails have been cleaned and polished. Original wood pocket doors to the upper galleries have been secured in the closed position in order to comply with code requirements.

Art Galleries

The majority of the seismic strengthening work in all galleries consisted of interconnecting the six concrete wings of the building. Five-foot wide slots were cut into the existing lightly-reinforced concrete floors—the first example of such anywhere in the world—and the original reinforcing carefully preserved in place. The concrete coffer beams underneath the floors were also preserved while the work was done. New steel reinforcement was placed, and concrete re-cast to match the original color and pattern. The reinforcement extended through the wings to tie them together so that they work together as a single structural unit. The roofs of the main galleries were strengthened with large steel truss braces, threaded between the original truss elements, and hidden above the ceiling line.

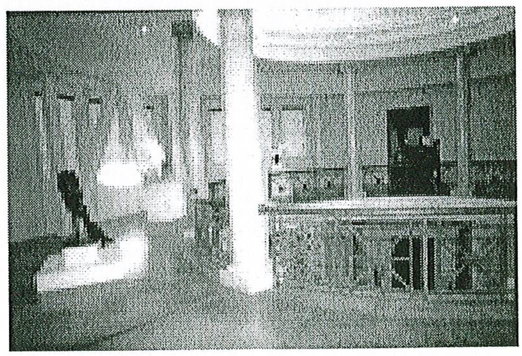


South Rotunda, Original Construction, 1898

The South Rotunda is one of two remaining elements of an 1898 addition to the Museum. Now a main entrance to the Museum, it is two stories in height with an open gallery on the second floor. The gallery and dome are supported by Tuscan columns with Doric capitals that encircle the open central space. The column shafts are of sheet metal, finished with scagliola to imitate marble. The capitals are of painted sheet metal, marbleized to match the column shafts. The flooring at entry level is a deep red integrally colored concrete, scored in a pattern which radiates from the center. The flooring of the gallery above has radiating segments which are alternately red, blue gray or ochre. The brass railing at the balustrade, originally in the North Rotunda, was relocated to this rotunda in order to provide an example of how this space appeared originally.

North and South Rotundas: Structural Stengthening, 1998

The North and South Rotundas, unlike the rest of the building, are constructed with brick masonry walls instead of concrete, and consequently performed much worse in the Loma Prieta Earthquake of 1989. As part of the seismic strengthening, the east and west walls of both rotundas were demolished and replaced with reinforced concrete. The north and south walls of each were preserved and new steel braced frames were constructed inside the building to add strength. The heavy concrete floors were anchored into the new walls and frames. The ceiling space was strengthened from above with plywood, in order to stabilize the large central domes.



North Rotunda: Architectural Elements, 1998

Mosaics The six niches of the North Rotunda contain mosaics which were probably installed in 1899 by Salviati studios of Venice, Italy, when the mosaics along the museum's front facade were added. During the reconstruction following the Loma Prieta Earthquake, these mosaics were carefully protected in place. New structural walls were constructed around two of the niches and paint was removed from all of them in order to expose the original appearance of the mosaics.

Scagliola Columns The column shafts in the rotundas are of sheet metal, with a scagliola finish. A lost art form in the United States since early this century, scagliola is plaster work which simulates stone, in which mixtures of marble dust, sizing, and various pigments are manipulated to form decorative figures. The scagliola was most probably installed by transferring the marbleized mixture from an oilcloth onto the column shaft. Over time and two major earthquakes, the scagliola de-bonded with the metal column shaft, displaying cracks which are still visible. The scagliola has been conserved and stabilized by injecting epoxy adhesives through the cracks in order to stabilize them.

Stairway and Railings To improve circulation through the Museum galleries, a new steel stair was added in the north rotunda. The stair's design avoids the increase of additional weight to the existing floor system- the upper landing cantilevers from its support columns, and "floats" next to the existing balcony. Railings have been installed in such a way as to prevent damage to the adjacent scagliola columns.

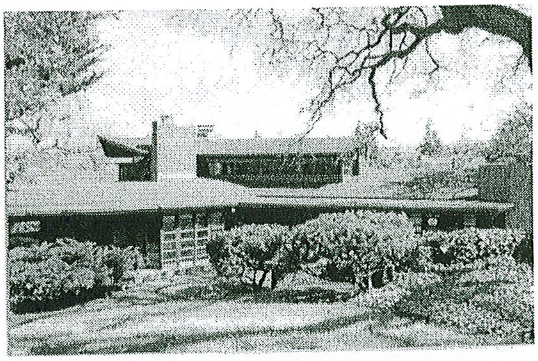
Exterior Mosaics

In 1898, Jane Stanford commissioned Antonio Paoletti to design mosaics for the exterior of the Art Museum. Paoletti presented his designs in the form of watercolor paintings; some of these paintings are displayed in the Stanford Family room of the art museum. With the paintings as a reference, the Salviati Company of Venice, Italy, produced cartoons on large paper. The individual pieces of tessera were glued face-down onto the large sheets of paper, following the desired design and color pattern. The completed mosaics were sent from Italy to the building site and set in mortar by Italian craftsmen. After the setting bed of mortar had cured, the paper was removed and the mosaics grouted.

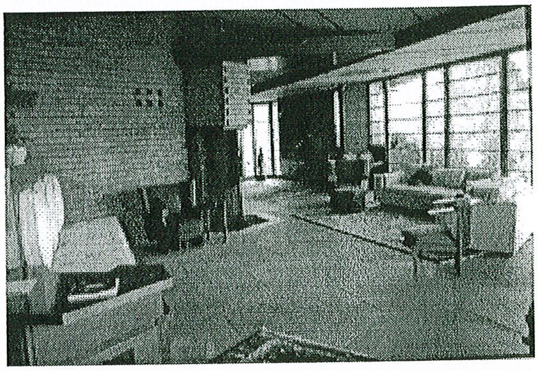
The subject matter for the thirteen mosaic panels was chosen to reflect the collections within, and to celebrate the progress of world civilizations. The major themes of learning, the arts, and ancient civilizations are all represented by important collections started by Leland, Jr.

Architect: Polshek and Partners
Preservation Consultant: Architectural Resources Group
Structural Engineer: Degenkolb Associates
Landscape Architect: The SWA Group
Contractor: Rudolph and Sletten

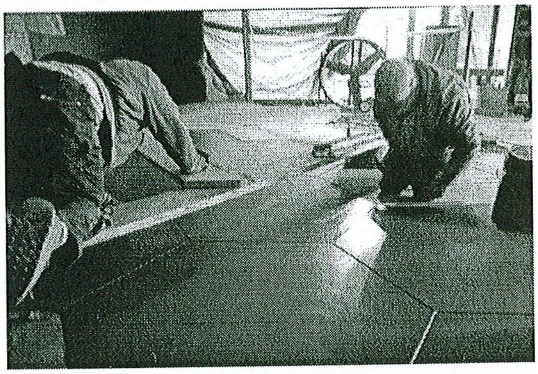
Frank Lloyd Wright's Hanna House Stanford University



The Hanna House, constructed from 1936 to 1937 for Paul and Jean Hanna, involved an intense collaboration with architect Frank Lloyd Wright. The Hannas became familiar with Wright and his writings about how new architecture could change lives when Paul Hanna was teaching at Columbia University. After moving to Stanford in 1935, the Hannas commissioned Wright to design a house for them on property leased from the University. The house was Wright's first designed in Northern California and his first experimentation with the hexagonal module as a design formula. In developing the design for the Hanna House, Wright abandoned the traditional right-angle corners. While the house's design incorporates many details Wright developed in his earlier Usonian houses, the commitment to the use of the hexagonal geometry earned the residence its name as the "Honeycomb House."

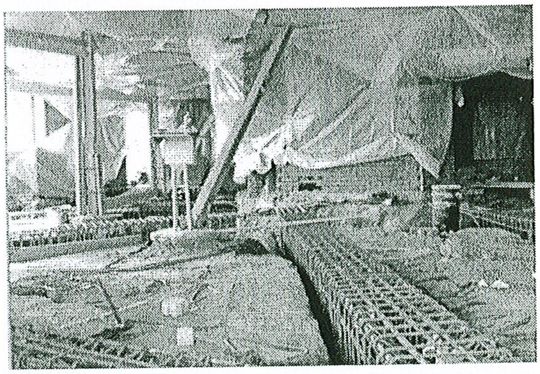


The house is a prime example of how the Hannas kept Wright involved in the evolution of their home over the years, through alterations and improvements. They alternately disagreed with him and revered him, as the house grew and developed. On all the difficult tasks throughout the construction of the house, the Hannas joined in the work themselves and labored alongside the work crew. Though the cost of the project grew from $15,000 to $37,000, in the end the Hannas were thrilled with the results as well as their lasting friendship with Wright.



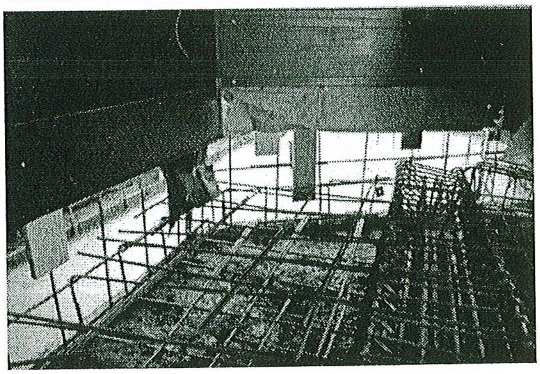
In 1975, the Hannas donated the house to Stanford University for educational and cultural purposes; it eventually became the residence of the University Provost in the '80s. The Hanna House is listed on the National Register of Historic Places and has been designated by the American Institute of Architects as one of seventeen buildings designed by Frank Lloyd Wright that ought to be "restored or preserved as a part of our American architectural culture." The 1989 Loma Prieta earthquake caused considerable damage, rendering the house uninhabitable.

As the house needed to be repaired and stabilized, the University took the opportunity to review the building's function and program use. The project's focus became two-part:



1) Programming: The rehabilitation provided an excellent opportunity to adapt the building to be more in concert with the original bequest of the Hannas: to be used as an educational center and a cultural resource. The main public spaces could be used for conference and lecture rooms; the private bedrooms could become offices. Improvements to meet code and ADA requirements would enable the house to be toured by visiting groups and students.

2) Seismic repair and strengthening:
The greatest challenge of this project was to develop a successful scheme for repairing and strengthening a building with very serious structural deficiencies without altering the exterior and interior spatial characteristics and appearance. The deficiencies were due to:



- unstable foundation: the house was built as a "cut and fill" solution on a sloped site, but the fill was never compacted; thus, the settlement of the concrete slab was already a pre-existing condition that was greatly exacerbated by the earthquake.

- beautiful but unstable design elements: tall and massive unreinforced brick chimneys; and perimeter walls made of 1" boards or glass which gave limited capacity for resisting earthquakes.

Frank Lloyd Wright's Hanna House

Solutions:

The architectural team, led by Architectural Resources Group of San Francisco and joined by architect Martin Eli Weil of Los Angeles, worked collaboratively with structural engineers from Rutherford & Chekene in San Francisco. Many alternatives were studied; the preferred scheme is a mixture of interventions:

- Concrete Slab Stabilization: below the house, concrete grade beams were installed below the damaged floor as a means to 1) brace the top of the lower retaining wall and 2) buttress the chimney. The grade beams also support the repaired floor slab, is no longer a slab-on-grade, eliminating the need to extensively remove or recompact the existing loose fill.
- Reinforced Chimneys: utilizing a core-drilling process, involving the insertion of rebar into vertically drilled holes into the masonry, the chimneys were stabilized without altering their appearance but providing them with additional bending strength and ductility.
- Strengthened Hexagons: Three redwood board and batten hexagon closets, which Wright used as "columns" to support concentrated vertical roof loads, were internally strengthened with steel and plywood to improve their lateral resistance.
- Insertion of Plywood: the redwood 1" board and batten sandwich construction was dismantled (they were originally attached with brass screws); plywood pieces were installed in interior 1" voids, screwed from the inside to the existing siding, and then the siding was screwed back into place using the original brass screws. This unusual approach provides additional strength and stiffness without any change in appearance. As part of an extensive validation program, a full size prototype of a strengthened wood wall assembly successfully passed dynamic cyclic tests designed to simulate the ground motions on the nearby San Andreas fault.

Implicit in the project is the replacement of roofing and flashing systems, as well as repair of damaged and weathered portions of the wood and brick. One interesting aspect to the original design: Wright specified a copper-foil roof, which was installed; however, the Hannas had it removed immediately because it leaked considerably. It was replaced with built-up roofing.

Schedule:
Construction began in early June 1998.
Project was completed in March 1999.
Professional photographs taken by David Wakely, August 1999

Key Project Team Members:

Architect of Record:
Architectural Resources Group, San Francisco, CA
Stephen J. Farneth, FAIA, Project Principal
Naomi Miroglio, Project Manager

Associated Architect:
Martin Eli Weil, Los Angeles, CA

Structural and Geotechnical Engineer:
Rutherford & Chekene, San Francisco, CA
John Burton, Geotechnical Engineer
Bret Lizundia, Structural Engineer