CHRONOLOGY

October 29, 1987  Taliesin Associated Architects report on Hanna House sent to Norman Wessels, Chairman of the Hanna House Board of Governors. (This is a pre-earthquake report.)

October 17, 1989  Loma Prieta Earthquake.
All buildings were posted closed until inspection could take place.

October 18, 1989*  Building was inspected by a non-structural engineer. Posted "Limited Entry" (See ATC-20 Form).

October 23, 1989*  Building was re-inspected by a structural engineer who confirmed that the building was unsafe and should remain closed (See ATC-20 Form).

October 23, 1989  Santa Clara County independently inspected all damaged buildings and officially signed the buildings as "Closed -- Unsafe for Human Occupancy". (No documentation available).

October 28, 1989*  EM from Williams re FEMA funding and procedures. EM stated (in part) that "if it seems highly likely that we can get some sizable funding from FEMA, we may choose to do more work in buildings like Language and Geology corners, Bldg. 30, 370, row houses, etc. than we would have if these dollars were not available."

November 3, 1989*  DSR #088615 with this inspection date in the amount of $602,065. The scope of work included the repair of the main fireplace, the library fireplace, retaining walls, and other work. The work and the estimate was based on Stanford consultants' report. The DSR was submitted to FEMA prior to Stanford's review. Stanford completed the review on 12/19/89, with no evidence of non-concurrence.
**November 9, 1989**
Stanford attended a briefing (at FEMA's district field office in Mountain View) conducted by Charles Stuart from the FEMA office in Washington. Attendees: For FEMA -- Stuart, Gorup; for OES -- Jacks, del Carpio; for Stanford -- Williams, Middleton, Johnson, and Kershner. Stanford was instructed to use applicable codes in repairs. It was indicated that the 1988 Uniform Building Code (1988 UBC) would be applicable to Stanford when adopted by the County.

**November 27, 1989**
Letter from Taliesin to David Neuman expressing interest in working on repair scheme.

**December 12, 1989**
Santa Clara County passed ordinance #1100.78 relating to earthquake hazard reduction in existing buildings (URM Ordinance). On the same date, the County adopted the 1988 UBC.

**January 26, 1990**
Tour of several of Stanford's damaged buildings by representatives of the State Historical Preservation Office (SHPO) and others. Attendees included Craigo, Kariotis, and Menzek. They expressed considerable concern about the extent of repair Stanford was contemplating and appeared to feel a much reduced scope would be in order. They made no specific recommendations, however.

**February 6, 1990**
Taliesin fax to David Neuman re a list of drawings in Taliesin files on Hanna House.

**March 2, 1990**
Kershner status report noted recent visit by Chuck Stuart from FEMA's Washington office. Kershner stated that "[t]he two primary questions seem to be: 1) can unreinforced masonry walls be repaired with epoxy injection or do we have to go to gunite, as Stanford is maintaining, and 2) what code or standard applies and at what point does the cost of repair justify replacement?"

**March 8, 1990**
Kershner letter to FEMA's Stuart supplying requested information on Stanford's long term program to seismically upgrade buildings. The letter included a list of buildings planned for strengthening.
March 15, 1990*


March 20, 1990*

Letter from Kariotis to SHPO entitled "Field Survey of Stanford University," questioning the extent of damage in several buildings.

March 22, 1990*

Applications submitted by Stanford to the National Trust for Historic Preservation seeking federal grants for structural consultants for Hanna House, Green Library and the Museum.

March 30, 1990*

Stanford received a survey report by Jack Benjamin Associates, structural engineers, of approximately 200 Stanford buildings for earthquake damage. The report also provided seismic performance evaluations for future quakes.

For seismic performance, the Hanna House was rated _____ worst out of 200.

April 2, 1990*

FEMA and Stanford officials met with Congressman Tom Campbell in Washington to discuss the concern that no decisions had yet been made by FEMA in regard to major buildings at Stanford. Attendees: Congressman Campbell; for FEMA -- Tidball, Stuart, Zensinger; for Stanford -- Horton, Bendimerad, and Korn.

FEMA indicated that it had contracted with Barrett Consulting Group to do a new review of Stanford's earthquake damage. Stanford requested verification of the qualifications of these new engineers. Stanford further requested the opportunity for Stanford's engineers to meet with FEMA's engineers. FEMA indicated that the key matter might be determining the applicable code. FEMA indicated that it would move ahead expeditiously.

April 13, 1990*

Kershner status report noted the chalk-marking of cracks to assist the reinspection process.

April 20, 1990*

Kershner status report noted that quakes earlier that week caused cracks to get larger in some areas of the Quad Arcades and at the Museum.
April 26, 1990*  
Bendimerad and Kershner memo to Horton re scope of work given to Stanford's structural engineers.

May 11, 1990*  
Kershner status report noted the following: that FEMA had confirmed its acceptance of Stanford's procurement process for earthquake projects; that the re-inspection process was continuing; and that due to damage suffered in the 4/18/90 aftershock, the Museum rotundas may have to be shored.

May 11, 1990*  

May 17, 1990*  
Report by Barrett Consulting Group (Layton) on applicable building codes. The report was requested by Greg Chapell of FEMA on March 22, 1990. The report concluded that the State Historical Building Code "applies and supersedes any other code in allowing repair of these [qualified historical] structures." (Received by Stanford on July 26, 1990.)

May 17, 1990*  

The report also included the following statement on grouting: "While it can strengthen and consolidate large fractures and voids, it is generally considered preliminary treatment and not regarded as a structural repair. Testing has shown that penetration to fill fine cracks is incomplete and cannot be trusted."

May 29, 1990*  
DSR #018635 with this inspection date in the amount of $287,040. This DSR calls for rebuilding the main fireplace, but eliminated almost all of the work for the library fireplace that Stanford's consultants felt was required. The DSR also reduced the amount of FEMA funding for the front terrace and retaining wall. There is no evidence in the file that Stanford had the opportunity to concur or non-concur with this DSR.

This DSR superseded DSR #088615.
June 8, 1990
Letter from Horton to Campbell re status.

June 18, 1990
Letter from Bonnie Bamburg, historic preservation consultant, clarifying the requirement that Stanford obtain approval of SHPO for all projects receiving FEMA funding, and stating that compliance with 36 CFR 800 and the Secretary of the Interior's Standards for Rehabilitating Historic Buildings appeared to be required.

July 24, 1990
Stanford received the "Heritage Resource Inventory"[*] dated June 1979 from the County indicating those Stanford buildings identified by the Historic Resource Commission as historically significant. The Hanna House is listed on the Inventory.

Meeting at Stanford with local and national FEMA and OES officials. Attendees: for FEMA -- Lundberg, Stuart, Gorup, Wait, Hamner; for OES -- Wynne, del Carpio, Jacks, Maccoun, Shotwell; FEMA consultants -- Whitehurst, Layton, Dunn, Rabanad, Gupta; for Stanford -- Williams, Kershner, Bendinerad, Johnson, Horton, Thompson; Stanford consultants -- Holmes, Elsesser, Kellam, Freeman.

Buildings discussed included the Museum, GLW, Language and Geology Corners, Small Quad Buildings, Art Gallery, Hanna House, and Quad Arcades.

In regard to Hanna House, both FEMA and Stanford agreed the Living Room chimney needed to be rebuilt, but FEMA felt the Library chimney did not. Stanford agreed to re-inspect the damage and report back.

August 1, 1990
Letter from Hamner (FEMA) to Wynne (OES), with copy to Stanford, confirming discussion at the July 24, 1990 meeting. Hamner stated that the Stanford Museum solution set forth by Elsesser at the meeting was "generally acceptable." For Green Library, additional documentation was requested, but Hamner suggested Stanford proceed with the engineering design "required to obtain approval of local building officials. . ." For the large and small quad buildings, Stanford was directed to remove plaster to determine the extent of cracking, so that a determination could be made as to loss of strength.
August 9, 1990
Stanford completed removal of interior plaster to expose through-the-wall cracking as requested by FEMA. [For which buildings? Documentation?]

August 17, 1990*
Kershner status report noted further testing on Buildings 300, 310 and 370, and further noted receipt of "official letter from the County stating their position regarding our closed buildings."

September 5, 1990*
TEI Consulting Engineers Brick Mortar Shear Strength Survey on Building 310. The survey found a significant decrease in mortar shear value for the cracked walls.

September 14, 1990*
Kershner status report noted "a major step forward" at a 9/6/90 meeting between FEMA consultants and Stanford consultants, at which meeting "the FEMA consultant agreed that the sandstone walls [of the sandstone buildings] were indeed damaged sufficiently that a strengthening repair was necessary."

October 2, 1990*
Bendimerad EM expressing frustration with dealing with Barrett.

October 15, 1990*
Report by FEMA consultants Preece/Goudie & Associates (PGA), stating their agreement that the Geology Corner structure was damaged sufficiently to require strengthening as well as repairs.

PGA developed a repair and strengthening methodology based on satisfying the Santa Clara County URM Ordinance. It was their opinion that such a repair scheme could result in a building that would sustain damage in a future earthquake, but would not collapse.

PGA estimated the loss of strength due to the earthquake to be 12% - 17% of Building 320's calculated capacity.

October 16, 1990*
Daily Pacific Builder article on Stanford repairs (general).

October 19, 1990*
Second Daily Pacific Builder article on Stanford repairs (building by building).
October 23, 1990*

Haresh Shah letter to FEMA's Krimm re problems experienced by Stanford in FEMA process. Shah stated that "Stanford's aim is to achieve the most cost-effective solutions for repairing its damaged buildings in accordance with currently applicable codes and regulations."

Shah further stated: "FEMA should resolve the issue of applicable codes and standards in regards to current codes and practices of earthquake engineering in California. Most technical issues could be readily settled if a uniform code of practice could be agreed upon."

October 25, 1990*

First general meeting with SHPO held at Stanford. Attendees for SHPO: Kreutzberg, Kariotis; for FEMA: Rabamad, Dunn; for OES: Maccoun, Mehta, Shotwell; for Stanford: Bendimerad, Neuman, Calderon, Kershner, Quacchia, Bamburg.

SHPO stated the requirement to be sensitive to historic fabric, and indicated its desire for the most effective structural fix that least disturbs that historic fabric.

Troubling comments from Kariotis re subjectivity of life safety concerns.

It was agreed that: (1) SHPO should get all appropriate documentation already sent to FEMA/OES; and (2) Stanford would develop its guidelines for historic issues to send to SHPO. (Minutes prepared by Stanford but not distributed).

October 26, 1990*

Kershner status report re 10/19/90 meeting at FEMA (at which "Stanford standard" was raised) and building-by-building update.

October 30, 1990*

Kershner EM to Ryan and Higgins stating that there are no specific guidelines as to what costs FEMA will pay, and suggesting a series of meetings with FEMA on this issue.

November 9, 1990*

Kershner status report noted continuing OES concern about life safety. [See also Wynne's statement in 7/24/90 meeting minutes].
Response by FEMA's Krimm to Shah's 10/23/90 letter. Krimm stated that "[t]he determination of what code is applicable to this type of repair has proved to be difficult," but that with the help of Preece/Goudie & Associates (PGA), "[w]e believe that the issue of which codes apply to these buildings has been resolved."

Note that by this date, PGA had stated that the URM ordinance was the appropriate repair standard for Geology Corner. (See PGA's 10/15/90 report).

PGA report on Geology Corner and URM Ordinance. Preece concluded that "it is my engineering judgment that the alternate scheme presented by PGA and based on the Santa Clara County Ordinance adopted December 12, 1989 will provide a safe and economical solution to the strengthening requirements for Geology Corner at Stanford."

Stanford submitted its URM Ordinance mitigation plan to the County.

Shih letter to Stanford accepting Stanford's URM plan.

Letter from Shih to FEMA attaching a list of earthquake damaged buildings at Stanford. [Q: why incomplete compared to 4/4/91 letter?] Kershner bi-weekly status report included a projection (with numerous qualifiers but based on an assessment of how negotiations with FEMA were then progressing) that total FEMA recovery (without Anatomy) would be in the neighborhood of $55 million.

Memo to file from Kershner re SHPO reviews.

Report by ARG/Weil addressing all deficiencies in the building, including deferred maintenance which may not be eligible for FEMA funds. (Sent to FEMA/OES and SHPO on March 21, 1991.)
February 26, 1991* Stanford sent to FEMA/OES a report by Forell/Elsesser dated February 5, 1991 with an estimate prepared by Plant for $2,832,370. Stanford requested FEMA to make copies available to SHPO.

March 7, 1991* This report called for a complete rebuilding of all three chimneys in the Living Room, Dining Room and Bedroom, new roof diaphragms, and other work to comply with 1988 UBC.

March 12, 1991* Kershner status report indicating that the phase of SHPO review of Stanford projects was beginning.


March 22, 1991* This report indicated that the arcades are an integral part of the structural system of the Small Quad Buildings, and reiterated the necessity of considering the arcades in the repair solution.

March 21, 1991* Stanford transmitted to SHPO all documentation previously sent to FEMA/OES. See letter dated 3/21/91 for list of documents.


April 4, 1991* Shih letter to Dunn enclosing list of Stanford's earthquake damaged buildings.

April 5, 1991* Neuman memo to project managers re cover letters for FEMA submittals and the need to address historic preservation issues.

April 11, 1991* Telephone conference call between Stanford, FEMA Region IX, and FEMA's historical representative in Washington established that FEMA must adhere to the Historic Preservation Act as recorded in 36 CFR 800 for any building that is on the Historic Register or eligible for it.
**June 13, 1991**
Kershner letter to OES's Wynne re allocation of eligible/non-eligible costs.

**June 19, 1991**
Final Kershner monthly status report.

**June 20, 1991**
Wynne letter to Kershner enclosing FEMA agreement to Stanford proposal. That proposal related to contractor selection for FEMA funded projects. Packet included Kershner's 5/21/91 and 5/29/91 letters to FEMA.

**July 15, 1991**
Stanford letter disagreeing with PGA's 6/6/91 letter on the necessity of arcade repair. Stanford also submitted statements from four structural engineers (GFDS, Kellam, R&C, Messinger) agreeing with Stanford's position regarding the arcades.

**July 23, 1991**
Bendimerad's first monthly status report.

**August 20, 1991**
SHPO letter approving the proposed repair and strengthening scheme. (The letter does not make clear whether SHPO's approval is of the scheme incorporated in documentation sent to SHPO by Stanford, or the scheme described in DSR #018635. The two schemes are very different in the scope of work).

**August 23, 1991**
Region IX letter re alternate projects and historic review.

**August 23, 1991**
DSR on Building 310 for $467,016.

**September 11, 1991**
Dunn's case study/status report on FEMA assistance for Stanford. Dunn suggests a methodology for determining the scope of FEMA funding based on 10%, 20%, and 30% loss of strength categories.

**September 12, 1991**
Letter from the National Trust for Historic Preservation to the FEMA National Director expressing concern over a conclusion by FEMA's Region IX office that "alternate projects" are not subject to the Section 106 review process.

**September 16, 1991**
BOT (Committee on Land and Buildings) meeting on seismic repair projects.

**September 20, 1991**
Bendimerad memo to Culp re procurement procedure for FEMA projects.
September 26, 1991* Bendimerad letter to Wynne asking that all FEMA requests for documentation go through Bendimerad.

October 17, 1991* Monthly status report noted that Stanford had now provided the required documentation on all major projects except for the free-standing arcades, which documentation was to be transmitted to FEMA at month's end.

November 12, 1991* FEMA informed all FEMA DSR teams that, from this date on, all documentation for buildings 50 years or older should be sent to FEMA's Historic Preservation Representative (Jane Lehman) and not directly to SHPO.

Applicants were informed that it is FEMA's responsibility to coordinate the historic review process.

December 27, 1991* Bendimerad monthly status report noted the creation of the ERCC.

January 8, 1992* Stanford/FEMA/OES agreed to hold a working session during the week of 1/13/92 on all of Stanford's unresolved claims. Stanford suggested a 30-day review period to discuss, understand, and (hopefully) resolve outstanding issues.

January 8, 1992* Stanford transmitted to Dunn preliminary drawings dated May 1991 for the "Frame Scheme," and a budget estimate dated 12/16/91 for $2,026,443.

January 14, 1992* Stanford/FEMA/OES held a full day meeting and discussed the status of several buildings including the Museum, Geology Corner, and other Quad Buildings.

January 27, 1992* Wynne letter enclosing FEMA's 1/16/92 letter to the effect that Stanford's 6/13/91 proposal on eligible vs. ineligible costs "appears reasonable and is generally acceptable." FEMA added certain comments on procedure.
January 30, 1992

Stanford/FEMA/OES continue discussions on several claims. FEMA and Stanford engineers reinspect several of the damaged buildings. FEMA representatives indicated that they will report to Region IX on the issues and suggested a joint meeting with FEMA/OES/Stanford at the Presidio in February.

As to Hanna House, FEMA's consultant stated that soil stabilization is the primary consideration, and that Stanford's consultants did not incorporate this work in their proposal. Stanford agreed to contact Elsesser in this regard.

February 3, 1992

Letter from Shih to Dunn (re Buildings 1, 30, 260, Art Gallery, HRP/Anatomy and Museum) stating that "[s]imply patching the cracks of those buildings will not be an acceptable repair method...The minimum standards for repairing those buildings is the adopted URM standards and for rebuilding is the current adopted UBC." (It is our understanding that Shih wrote the letter as a result of requests made by FEMA during a meeting with County officials.)

February 4, 1992

FEMA memo to OES (Dunn to Echols) suggested the Building Official be requested to approve installation of wall and floor anchors plus epoxy grouting of walls as an acceptable repair for Stanford URMs.

February 5, 1992

Dunn memo stating that "the only structures for which FEMA has committed to fund a complete structural upgrade are Green Library West and the Main Quad Portals." In Dunn's view, FEMA and Stanford had agreed to reopen discussions on all the other buildings.

February 6, 1992

Stanford transmitted to Dunn the Hanna House/Seismic Repair Schematic Design drawings dated May 1991. This scheme substitutes a steel frame system in lieu of rebuilding the fireplaces. [Compare to 1/8/92 entry].

February 7, 1992

Memo from Dunn to Echols requesting reports re pre-earthquake condition of buildings and other information from Stanford, with an attached list of buildings under consideration.

February 10, 1992

Shih letter to Dunn rejected the February 4, 1992 wall anchor scheme for any buildings with earthquake damage.
February 12, 1992*
Stanford transmitted to Dunn drawings by Forell/Elsesser entitled "Steel Frame Location Plan."

February 13, 1992*
Stanford transmitted to Dunn the "Hanna House/Seismic Repair Structural Calculations."

February 26, 1992*
FEMA informed Stanford at a bi-weekly meeting that DSRs would be written to return Building 310 and Geology Corner to a "pre-quake condition" rather than to meet the URM Ordinance, and that FEMA was instructing PGA to develop a repair methodology to "bring the building back to pre-earthquake condition."

FEMA representatives (Gordon Miller and Pat Dunn) explained that this reversal of position was the result of instruction given to FEMA's inspectors following a meeting at Region IX attended by Grant Peterson and Craig Chapell from Washington. The meeting apparently took place on February 20, 1992 in San Francisco.

FEMA representatives suggested a meeting with Region IX to "discuss eligibility."

February 28, 1992*
Draft Stanford document entitled "General Guidelines for Eligible and Ineligible Costs."

March 5, 1992*
Letter from Kennedy to FEMA's Kranz.

March 5, 1992*
Letter from Horton to Campbell.

March 11, 1992*
Further discussion at project status meeting of FEMA's epoxy grout repair proposal for URM buildings.

March 17, 1992*
Letter from Horton to FEMA's Lundberg.

March 18, 1992*
Meeting with FEMA in San Francisco on URM Buildings.

March 24, 1992*
Stanford transmitted to FEMA's Dunn the Stanford Peer Review Standard (Guideline No. 1 -- 8/8/89).

April 9, 1992* FEMA informed OES that, prior to the start of construction, FEMA's Historic Preservation Representative, SHPO, and ACHP must be given a reasonable opportunity to comment on the proposed repairs of GLW and other Stanford buildings.

April 10, 1992* Letter from Lorri Jean to Horton.

April 23, 1992* PGA report to Barrett re feasibility of "restoring" the URM buildings "to their pre-earthquake condition." Epoxy report attached. (Received by Stanford 10/26/92).

April 29, 1992 Meeting of Campbell, Stickney, Kranz, Kennedy and Horton in Washington, D.C.

April 29, 1992* At the Project Review Meeting this date, Dunn stated that the PGA report, including a pressure grout proposal for soil stabilization, was delayed. Dunn further stated that the DSR would not be submitted for Stanford review until the "eligibility decision comes from FEMA Washington."

May 12, 1992 Meeting in Washington of counsel for FEMA and Stanford.

June 2, 1992* PGA report on the Hanna House (received by Stanford June 24, 1992). The report documented further site inspections by PGA of damage and their recommendations for repair. PGA recommended that corrective measures must include stabilizing the soil by pressure grouting, repairing the main brick fireplace, re-leveling concrete slabs, and repair to adjacent planters, stairs, retaining walls. The report feels that bringing the entire structure up to 1988 UBC standard should not be funded by FEMA in that the structure, other than the elements mentioned above, was not damaged by the earthquake.

June 18, 1992* Fact Sheet by the Advisory Council on Historical Preservation entitled "A Five-Minute Look at Section 106 Review."
Letter to OES from FEMA listing 33 buildings at Stanford which "are being reviewed as part of the Section 106 process" and cautioning OES that federal funding is contingent upon the applicant's compliance with Section 106.

Meeting of Bacchetti, Friedenrich, Horton and Schwartz with Congressman Mineta.

Tour by Cranston aides of GLW and Geology Corner.

Stanford received tentative Supplement 14 list with Hanna House listed at $______.

Letter from FEMA's Kite to OES's Wynne re Request for Information for Section 106 Review. The letter requesting information stated that FEMA "is considering funding repairs to historic properties at Stanford University" which suffered earthquake damage. Included is a list of buildings under consideration, which included Hanna House.

Veronin letter to FEMA's Darnall with proposed scope of GLW design review work to be performed for FEMA and Stanford by an independent structural engineer, plus a list of 3 proposed reviewers.

Letter to FEMA's Lorri Jean from Stanford's Peter Van Etten.

Meeting between Stanford (Van Etten, Horton, Bendimerad) and Region IX (Jean, Gorup, Dunn, Langenbach, Whitehurst) at the Presidio.

Stanford received DSR #6195 (with an inspection date of 5/27/92) in the amount of $205,949.

Stanford submitted to FEMA a Statement of Non-Concurrence for DSR# 06195. DSR's on the remaining buildings PAP'ed. 60 day appeal period begins to run. (See FEMA's ____________ letter).
October 29, 1987

Norman K. Wessells, Chairman
Hanna House Board of Governors
Office of the Vice President and Provost
Stanford University
Stanford, CA 94305

Re: Hanna House Preservation

Dear Mr. Wessells:

In accordance with your letter of August 10, 1987, we have conducted an inspection of the Hanna House and have been in contact with Valerie Veronin, Beverly Pharr and Jean Barnes of your office, who assisted us in scheduling our work, clarifying the categories of your Board's interest and by providing information helpful to our efforts.

With this letter, we are pleased to provide you and your colleagues on the Board of Governors with our findings, based on our inspections on September 17th and 22nd, 1987. We found that it was not necessary for the purposes of this effort to utilize any prints of original drawings in Taliesin's archives, and none were made. We appreciate your offer to cover the printing and shipping costs involved, and our suggestion is that such printing awaits further decisions to proceed with repairs or reconstruction work, at which time we can evaluate the desirability and extent of such printing which would be useful. We have handed to Beverly Pharr a list of all drawings in the Taliesin archives, and we will be happy to assist you in the process of comparing your inventory with Taliesin's (at no charge for our time).

We have arranged the contents of this letter generally by location, so that a reader of this report may follow it, walking on the premises and through the house. The sequence is arranged under capitalized headings, as follows, and each item noted has been numbered for reference and categorizing purposes in the summary:

I LANDSCAPING & SITE IMPROVEMENTS
II EXTERIOR OF HOUSE, INCL. ROOF AREAS
III NORTH TERRACE, OFF OF LIVING ROOM
IV INTERIORS - GENERAL OBSERVATIONS
V ENTRY
VI LIVING ROOM & ORIGINAL DINING ROOM
VII DINING ROOM (ORIGINALLY PLAYROOM)
VIII MASTER BEDROOM SUITE
IX LIBRARY
X KITCHEN, BATHROOMS & HALL
XI GUEST ROOM
XII HOBBY SHOP
XIII SUMMARY

Our comments spring primarily from two considerations. First, we seek to assist the University in identifying conditions or problems of any nature which appear to require attention for the physical preservation, maintenance and convenient adaptive use of the Hanna House. Second, from the perspective of those well acquainted with Frank Lloyd Wright's general attitudes and viewpoints on things, and his conception of the Hanna House in particular, we intend to advise your Board what we believe you are doing well and where improvement or changes seem to be warranted in your efforts in managing the preservation of this magnificent legacy.
We are delighted, in general, to find that Stanford has so obviously undertaken a serious commitment to excellent maintenance of the Hanna House. It shows. Your Board certainly knows this, and we applaud your efforts.

1. LANDSCAPING AND SITE IMPROVEMENTS

1. The landscaping is clearly the subject of dedicated attention and excellent maintenance. Recent preservation efforts on the oak trees is evident and we confirm the value of giving these specimens the full benefit of expert horticultural care. The importance of their continued companionship with the Hanna House cannot be overemphasized. The cypress tree in the carport area is apparently in a state of decline. We understand that this tree is being monitored regularly by a professional tree specialist, and we would suggest that consideration be given to the long term advantages, disadvantages and uncertainties of preserving the existing tree indefinitely versus removing it at a planned opportune time and replacing it with another specimen. The goal of such a replacement plan would be to ensure as continuous a presence of a large-size tree at this location as may be achieved. Frank Lloyd Wright paid special attention to the tree in his design, and its continued presence is important from the historical standpoint, as well as to the entire aesthetic composition of trees, house and topography of the hill.

2. Frank Lloyd Wright held an aversion towards the clipping of shrubbery into hedges or other unnatural growth patterns. The clipped juniper plants along the tops of the stepped brick retaining walls of the entrance driveway and west parking area thus provide a very un-Wrightian setting for the house from these important viewing points and from Frenchman's Road. We recommend that these plantings be controlled by limb pruning, thinning, partial removal and/or replacement as may be necessary to re-establish a landscape of natural plant growth forms in these areas and any others where clipping techniques have been utilized. The hedges to the east of the forecourt fence and above the cascade fountain likewise would best be controlled by other means.

3. It would be desirable to prune back the camellia bushes in the planter boxes along the east wall of the Living Room, north of the front entrance doors, so that they vary in height, and, generally are much lower than they are at present.

4. This is a dilemma. The "No Trespassing" sign at the bottom of the driveway may be effective, but it is somewhat disturbing. The white background color is not consistent with Frank Lloyd Wright's manner of designing landscape graphics, and the sign competes visually with the Japanese lantern atop the wall upon which the sign is mounted, to the disadvantage of this entrance composition. Thinking of the many visitors who have been attracted from far and wide to see this outstanding circumstance, and, even apart from consideration of such persons, the message is certainly jarring in juxtaposition with the inviting gesture made by the house with its extended brick walls, cascading all the way down to the road. The sign diminishes that gesture, and we believe that loss is significant and worth considering. We suggest that alternatives be considered, such as, on the opposite wall, a "Notice to Visitors", in large letters, followed by an appropriate admonition not to trespass, perhaps a brief explanation as to why, and also specific information about how to make proper arrangements to tour the house.
5. We hope a better alternative could be found for the "737" sign on the fence at the entrance forecourt. Here Mr. Wright would pay abundant attention to such detail so as to integrate artfully the necessary graphic information. This sign is visual detrimental to the approach, destroys the composition of the lantern-on-wall termination and should be removed.

6. The white pipes and chain barricade at the turn of the entrance driveway appear shabby and detract from the first impression of an approaching visitor to the house. An alternative and more compatible means of marking and/or protecting the edge of the pavement should be explored.

7. We have not inspected in operation the outdoor lighting around the house, but some of the mushroom-style light fixtures appear to be ineffective due to grown-up plantings, and at least several are of some aesthetic detriment. In particular, the elevated light fixture at the top of the approach drive, at the end of the low brick wall, is disturbing. We suggest that a complete review of all exterior lighting be conducted to determine effectiveness and with an eye toward improving daytime aesthetics.

8. The extensive piping mounted on the face of the brick retaining wall of the nor-terrace, including a gas meter, etc., is fairly well concealed by the present plantings. Some of this piping may be abandoned. Our suggestion is that the piping which is no longer active be removed, that the unpainted piping be painted to match the brickwork, and that younger plants be established beneath the present ones, to ensure that replacements will be coming up behind the older plants, some of which appear to be getting quite "leggy." The apparently unused garden hose rack on the retaining wall should be removed.

9. The large oya lava stone urn, which was designed by Frank Lloyd Wright, and which Paul Hanna salvaged from the Imperial Hotel in Tokyo, is a significant treasure in itself, and magnificently situated here by the Hannas. It is in a state of advanced deterioration at present, and every effort should be undertaken to ensure its future preservation and maintenance. We suggest that a consultant who is expert in evaluating stone and knowledgeable on the subject of stone restoration be retained to advise your Board what steps should be undertaken toward this end. There is a possibility that a colleague of ours, Raku Endo, a former apprentice to Mr. Wright and whose father assisted Mr. Wright during the construction of the Imperial Hotel, a friend of the Hannas, and, at present, a practicing architect in Japan, may be in a position to help us in connection with the preservation of this urn. There is also a possibility that a copper lid insert, which was a part of the original design, could be fabricated and installed. It was once my understanding that Endo had access to the drawings detailing this copper lid insert. We recommend this be explored.

10. The forecourt fence, which was reconstructed in 1980 in a very shoddy manner, does not have an objectionable appearance at present. However, it is likely that this fence will not withstand many years of exposure to the weather and should be rebuilt with utmost attention to authentic detail when the time comes. The hexagonal termination, accommodating a garbage can, and with the stone lantern on top, was rebuilt in concrete in the early 1950's, on account of repeated damage caused by automobiles hitting it. Unfortunately, this highly prominent building element does not look appropriate in its
present reincarnation in painted concrete, and we suggest a simple solution which will restore the correct appearance to the forecourt area and still allow for only minor or no repairs in the event of collision by automobiles. We recommend that this concrete portion be faced with redwood boards and battens. A board, lying against the concrete back-up, might not suffer any damage at all from automobile impact, and if it did, a small supply of extra boards could be kept on hand for replacement purposes. At the worst, only a single board might have to be replaced, whereas, prior to 1950, the whole wall would likely have been damaged by any impact. We would be pleased to assist the University in developing the appropriate construction detailing to accomplish this facing condition.

11. The pre-cast hexagonal concrete plant containers on the west terrace and on the north terrace, off the Living Room, do not compliment the house in a satisfying manner. This is partly due to their color, partly due to their "salt and pepper" finish and partly due to their slightly-splayed, off-vertical faces. The plants would preferably be of a cascading growth pattern, rather than upright forms. Short of replacing these containers entirely, which we do recommend be considered, we would urge you to have them stained with an appropriate semi-transparent coating, in a brown-orange color, as close as possible to the redwood wall color on the house.

12. The irrigation controller and other electrical boxes on the south end of the Hobby Shop are unsightly, particularly one at the west corner, whose door won't close. Consideration might well be given to consolidating these and relocating at least any which are visible from high traffic tour routes.

13. The new swimming pool area is fortunately somewhat remote from the Wright-designed building. We did not make any inspection of this area. In our opinion, this addition is a witless denigration of the Hanna House property. We have no recommendation other than that dense foliage be encouraged to grow up and be maintained to screen this pool area from view from tour routes. We would prefer to see the fencing painted a brown color (matching the redwood walls of the house) or a red (the brick) rather than the present black color.

14. The top of the brick wall on the north side of the steps down to the west parking area requires removal and replacement of the top, rowlock, course of bricks, including as much removal of the concrete curb behind the wall as is necessary to allow resetting the rowlock course on a uniform bed of mortar. The landing slab could be jacked up or removed and replaced, or just the crack at the bottom of the first riser up from this landing could be patched to improve the cosmetic appearance in this area. The movement has taken place ever since these walls were built and is likely to continue to a lesser degree.

15. We find the tall mushroom lighting fixtures on top of this brick wall to be objectionable and would recommend an alternative be used instead or a relocation off from the top of this wall. See Item 1-7.

16. The espalier wires on the west brick plant box, below the original Dining Room no longer serve any purpose, and we suggest they be removed.
EXTERIOR OF HOUSE, INCLUDING ROOF AREAS

1. The condition of the board and batten walls and other wood surfaces reflect attentive maintenance. In 1981, we assisted Stanford's Building Operations and Sys in selecting a (then) new product by the name of "Aquatrol", manufactured by The Flood Company of Ohio. We would be interested in having confirmed what product is in fact being used now, and we suggest that it be recorded with the responsible per in the University that we believe that the presently used material and the applicat procedure appear to constitute a highly successful maintenance program which should be continued.

2. The trellis support screen on the west terrace was the subject of Mr. Wright's attention over a long stretch of time, according to documents we have. At present, the support screen is incomplete in several regards. Mr. Wright had designed a bank of decorative blocking pieces in the upper portion of the screen. In addition, the intermediate members are incomplete in their extension, north and south, and the south-most post is of an incorrect shape. We suggest this support screen be restored to the complete version Mr. Wright set forth on his detailed plans.

3. In the late 1960's, an aluminum and glass screen wall was first installed, just outbound from the western wall of the Living Room. This storefront type of unit, perched on top of the brick retaining wall at floor level, and extending vertically to meet the overhanging roof eave, is entirely incompatible with and offensive to the Hanna House. Frank Lloyd Wright would have abhorred it. It is such an extreme violation of the many Wrightian principles embodied here in the Hanna House that, by its prominence upon this outstandingly prominent, well-visited, well-photographed, well-publicized masterpiece of Mr. Wright's creation, it does disservice, not only to this house, but to the whole cause of organic architecture, to which Frank Lloyd Wright devoted his entire life and energy for more than sixty years. It is troubling to reflect on the hundreds or thousands of photographs now being taken each year and to see, even in newly-published, large-format architecture books about Frank Lloyd Wright, this reflective screen, obliterating and interrupting the continuous horizontal banding pattern of alternating positive-negative boards and window tracery behind it which is as much the essence of the Hanna House as is the honeycomb cell itself. We consider the removal of this most unfortunate screen wall to be the singular and most important issue before the Board of Governors at this time. Whatever sun shading or other weather protection advantage may have been afforded by this element certainly can and should be addressed and achieved by alternative non-sacrificial means, and we stand ready to assist your Board in developing such appropriate alternative measures as may be necessary.

4. Frank Lloyd Wright's houses are typically characterized by strong, visually anchoring masonry masses, usually with broad chimneys extending above the roof line. He disliked sheet metal caps on his chimneys, and there is no example of one anywhere in his entire work output. There ought not be visible sheet metal flue caps on the chimneys at the Hanna House. It is our understanding that a complaint several years ago of rainwater coming down a chimney caused the University to install sheet metal caps on all of the Fireplace flues. We wonder if the installation of a total of five of these rain caps may have been an exaggerated response, or possibly a result of some degree of misunderstanding. The Hobby Shop chimney appears to be protected from rain; the Barbeque House is an open-air structure anyway, and the Master Bedroom
Norman K. Wessells  
October 29, 1987  
Page 6

fireplace has drain pipes inside it to prevent rainwater from entering the firebox. This leaves only the Living Room and the Library fireplaces as possibly requiring rain entry protection. We suggest that all of the chimney flue caps be removed, and, if future experience bears out the need for some protection, a less conspicuous style could be designed. It may be worth while attempting to verify the original complaint, or perhaps Paul Hanna might be asked for his recollections regarding any problems with rain down the chimneys.

5. The television antenna is an unfortunate, competing element on the roof line of the house, and we recommend relocating it to a remote location, possibly in a tree at the upper portion of the property. We have successfully done this in the past.

6. There are some indications that the existing built-up roof may be nearing the end of its effective life. We understand that some leaks have occurred over the fireplace in the Living Room and repairs are evident in this area. Frank Lloyd Wright had planned for the house to be roofed with copper material, and originally a copper roof was installed. Unfortunately, the product was an inferior type of copper foil; Mr. Wright claimed that it was improperly installed, and it failed early on. We suggest that the University consider a permanent copper roof be installed at the next re-roofing time. There is a working drawing in Taliesin's and Stanford's files pertaining to a new copper roof. Some minor amount of updating may be required, but essentially the design work is completed for the new copper roof.

7. There is a considerable amount of landscape lighting wiring laid loose on the roof, serving tree lights, which preferably might be rerouted in a concealed fashion, for the sake of safety and aesthetic considerations. The electrical wire which droops from the roof and across the north terrace off the Living Room is of particular aesthetic detriment.

8. We find that, around the perimeter of the house, where the exterior walls meet the adjacent walk surfaces or planter walls, caulking has been installed at the point of intersection. We presume that this caulking was intended to keep out water. However, we believe that this caulking condition may have detrimental effects on the bottom wood members, by trapping moisture which would otherwise weep out. The wood members subjected to continuous standing water at the base of the walls would be in jeopardy of accelerated decay as a result. We believe that, in a few locations, water probably does leak in under such walls, but at most it should not. We suggest that the reason behind this application of sealant be reviewed if possible. Consideration should be given to removing as much of this sealant as possible, anywhere it is not truly keeping out water. Where leaks do occur, we would propose a method of sealing which allows the wood members to breathe.

9. There is a significant amount of surface-mounted wiring for telephone, security systems, T.V. and other communications systems here and there, stapled to eaves and other surfaces. We suggest that this practice be discontinued and the existing wiring eliminated as much as possible.

10. We note the beginning signs of decay at some of the exterior door thresholds and mullions, and, to forestall the progress of such decay, we recommend that all doors and windows be opened on a regular basis, say at least twice a month, and the
Norman K. Wessells  
October 29, 1987  
Page 7

jams and thresholds wiped clean of cobwebs and debris. Any binding of doors or out-of-adjustment hardware should be repaired, to facilitate this regular opening and cleaning. The jams, door edges and thresholds might be lightly waxed with a liquid carnauba wax every month or so.

11. Mr. Wright would not like the white flash glass light diffusers around the perimeter soffits of the house, always preferring a less conspicuous, "built-in" appearing light source.

III NORTH TERRACE, OFF OF LIVING ROOM

1. We are advised that the little musical fountain which was constructed by Paul Hanna has become a continuing maintenance problem, on account of recurring rust and leaks. It appears that the present submersible pump is a replacement of the original, and its exposed power cord is makeshift and unsightly. A concealed source of power for the pump should definitely be developed as part of a reconditioning project for the fountain. Briefly, our recommendations are that the plowshares and support stalk be removed from the point of the existing union; sandblasted of all paint and rust, down to bare metal, the pipe cleaned and the orifices cleaned; then the entire assembly should be galvanized in a hot-dipped bath process, properly primed and painted a color close to the brown-orange of the redwood walls or the brick color and reset in place with a new union. If inoperative, as it appears to be, the pipe below the union should be sealed. As for the fountain pool, any rust spots should be ground off and, if the underlying material is steel rebar, it should be painted with a galvanizing paint. Then the entire pool should be repainted with appropriate materials and application techniques. Other elements, supply and overflow were not operated by us, and we suggest that they be checked and reworked if necessary as part of the reconditioning process. We would be happy to assist further with this, upon request.

2. The entire north terrace obviously has been subject to vertical and horizontal movement, and this has been occurring ever since the house was built. There is evidence of vertical settlement both on the interior and the exterior of the Living Room doors, and it is remarkable that they operate as well as they do. The steps appear to have been replaced at some time and movement has continued following such replacement. The unsightly effects of this movement are somewhat disturbing. The question at hand is whether to reconstruct the terrace, possibly including the retaining walls or a portion of them, and possibly including some new foundation support for the house itself, or not to do any major reconstruction, but maintain the existing terrace in as acceptable a cosmetic condition as possible, while taking steps to minimize further settlement. A comprehensive recommendation for repair of this terrace should be partially the product of consultation with a soils engineer and a civil engineer, and our current effort is intended to be limited to identifying problems only. Several preliminary thoughts occur with regard to this terrace:

- The movement does not appear to suggest that the house itself is in any way jeopardized by the present conditions.
- It would be useful to know whether the movement fluctuates seasonally (up and down), is progressing downward only or if it has ceased to continue.
- Every effort should be taken to prevent water from entering the sub-surface
of this area. For example, the planter box could be lined with a pan, if it is not already. The fountain and water supply pipe should be checked for leaks. The cracks in the concrete should be sealed watertight, and the surface drainage should be made to drain away positively.

- Paul Hanna would be able to shed some light on the history of the movement here. Pressure injected concrete grout was used at least once, to level the terrace slab. It would be of interest to know if the bowing out of the retaining walls was possibly a consequence of this pressure grouting operation, or if they have deflected for other reasons.

- The eastern oak tree needs some additional clearance provided for its continued growth.

Again, the condition of this terrace, the steps, retaining walls and planter boxes all show evidence of movement over time, and a detailed study appears warranted to establish any approach for future maintenance and possible reconstruction in whole or in part.

3. There are several split wood soffit light frames, with portions missing. Some alternative method of making these wood trims needs to be worked out, to prevent the repeated breaking up of these, as has heretofore occurred.

IV INTERIORS - GENERAL OBSERVATIONS

1. In general, the interiors show excellent care and attention, and we are gratified to see how well the house is being adapted to subsequent residents’ use. The concrete floors were discussed with Valerie Veronin and the present housekeeper. We understand that the floors have had no major refinishing for at least three years and that there have been no moisture problems during that period. We think the floors look extremely good, in general, and believe the somewhat mottled coloration to be a desirable attribute and not a condition to seek to eliminate.

2. Obviously, it is difficult to utilize large rectangular rugs of any design style in this house, and it was Frank Lloyd Wright’s original intention to lay carpeting throughout the Entry, Living Room and Original Dining Room areas, but not wall-to-wall. A drawing exists in both our archives showing Mr. Wright’s design for carpet layout. We suggest that this fact be kept in mind if and when a change in floor coverings for the Hanna House is given consideration.

3. This submission of our observations is not intended to inventory each and every item and feature which constitute the Hanna House, nor to record every minor blemish or sign of wear, unless there is some noteworthy condition requiring attention in our opinion. If any portion of the house or its integral furnishings is damaged or otherwise is felt by the University to require reconstruction, refinishing or replacement, adequate drawings exist in each of our files to provide authentic documentation to serve as a basis for faithful adherence to Mr. Wright’s intentions.

V ENTRY

1. Frank Lloyd Wright had included in his working drawings for the Hanna House details of a perforated board frieze, as a companion element to the ventilator element over the service hall, and a higher ceiling in the Entry, which was not executed. It may be of interest to consider building this feature at some time. Paul Hanna might be consulted as to the background on why these features were deferred and what the Hannas’ thoughts were about them.
VI LIVING ROOM AND ORIGINAL DINING ROOM

1. Surface mounted wiring for audio equipment and security systems and security monitors are somewhat objectionable and might be better concealed by rerouting and relocation.

2. Built-in shelves and couch (later the Hannas' hi-fi cabinet) which were original in the northeast alcove have been entirely removed. We recommend replacing these integral furnishings. Detailed drawings are in both Taliesin's and Stanford's file.

3. The cracked concrete hexagon in the center of the Living Room, near the fireplace, was an expressed concern. Our recommendation is that this crack be cosmetically maintained by minimal periodic patching and application of colored wax, as frequently as necessary to maintain an acceptable appearance. We advise again removal and replacement of the entire hexagon until such time that the entire floor might be scheduled for a major refinishing effort. At present, we foresee no necessity arising for such refinishing.

4. We understand that a problem has arisen when there are many dozens of people on tour at one time, passing through the Living Room. Sometimes a visitor, unfamiliar with the house, stumbles into the fireplace recess on account of not having full view of where he or she is walking. We have given consideration to alternative solutions to this problem. The special openness and flow of the honeycomb floor plan of the Hanna House is a precious aspect of a visitor's experience in the house, and it is richly brought to focus and celebrated in this masterfully-designed open fireplace and recessed hearth. A visitor's experience of this important quality ought not be compromised by a barrier around this focal point. In advance of any consideration of barricades to solve this problem, we suggest that a combination of the following procedures be implemented by the docents on tour occasions and tested for effectiveness:
   - Partial closure of the fireplace screen (the south side)
   - Judicious placement of one or two appropriate items of furniture, to divert traffic flow away from the recess. This may require a slight shift of the piano position.
   - Docents could call this specific condition to the attention of all visitors, as part of their standard presentation, explaining the hazard and their decision not to barricade the hearth, as explained above, and actually use this as an informative opportunity to bring these aspects of the house to visitors' attention.
   - Following tours, re-set furniture and fire screen to residents' preferred arrangement.

We would volunteer to meet with the docents to assist them in adopting this strategy. If experience bears this out to be ineffective, and a barrier solution appears to be absolutely necessary, we have three alternatives to suggest for your consideration.

5. We note that there are none of the hexagonal floor ottomans originally included as part of the furnishings, and suggest that these be retrieved or new ones made and placed around the house.

6. The single door at the east end of the doors to the north terrace is binding at the top, due to floor settlement, and needs adjustment for proper operation. The
caster bracket on the east pair of doors is loose, and there should be added to this bracket a back plate, on the inside of the door, so that through-bolting can be accomplished. As it stands now, these bolts could damage the wooden bottom rail of the door. The west pair of doors has loose weatherstripping, in need of repair.

7. The concrete settlement in the vicinity of the doors to the north terrace is discussed under Item III-2.

8. The four down lights in the overhead deck above the glazed doors to the north terrace are In need of adjustment or are missing some trim components.

9. We regret to note that there is only a single example of the original dining chair at the house now, and recommend that perhaps five more be retrieved or reproduce Also, in the light of the removal of the Hannas' organ console from the original Dining Room area, we would strongly recommend that at least the fixed portion of the original dining table be restored to its original location, with a grouping of dining chairs placed around it. The extension portion of the original dining room table is at present in the Library.

10. The west jamb mullion of the doors from the original Dining Room to the terrace shows the beginnings of decay at its base, and the fixed sash section at that location shows extreme weathering, although it appears to be sound at this time. The mullion will need to be replaced soon. Perhaps we could monitor it for another year to see how it progresses. We suggest an immediate application of a wood preservative, such as "copper green". When this mullion is replaced with a new member according to the original detail, the material should be dense, vertical grain all heart redwood. At the same time that this piece is milled, we should stockpile additional material for future use. The necessary quantity should be determined in advance. (Note: This operation will require extremely conscientious workmanship and attention to details, including proper shoring, materials selection, etc. The value of $75.00 which the termite company placed on this item would represent only a minuscule fraction of the likely cost of the necessary work to replace this mullion.)

11. There are several splits in boards on the exterior of the wall of the alcove where the Tang horse is placed. These boards should be monitored, and probably be replaced at the same time that the mullion described in item 10 is replaced.

VII DINING ROOM (FORMERLY PLAYROOM)

1. The steps down to the main floor level appear to have a finish on them which is different from that on the floors. This finish is flaking off in chips, resulting in an unsightly condition. This same finish and condition exists on the Kitchen steps and on the steps from the Entry to the Library. If desired, these areas would appear to require complete removal of the existing coating, by sandblasting down to the original concrete, prior to refinishing.

2. The entire west wall of this room shows the effects of a combination of factors such as weather, concrete settlement, lateral displacement of sash and modifications made over the years to the original doors. We recommend that this entire wall be the
subject of a detailed inspection, including some amount of physical dismantling to inspect concealed conditions, so that a comprehensive recommendation for repair be developed. Such an inspection is beyond the scope of our present effort, which is intended only to identify problem areas, and we would be pleased to conduct further inspection and analysis of this wall at your Board's request.

3. The north screen door leaf is binding at present and needs to have the tracks cleaned and all hardware lubricated. Possibly some minor planing of wood is necessary to achieve full travel of this door.

4. This section of wall is one area where we believe the typical metal water barrel was not installed under the sash units. Therefore, we would not be surprised to find rain driven leaks here. The perimeter has been caulked, for the most part, and although it may be considered unsightly by some, it appears relatively sound at this time. We would recommend that this caulking remain in place until the suggested comprehensive study can be conducted, which is contrary to our recommendation under Item 11-8 for the remainder of the house.

5. The insect screening presently in place on the screen doors has a surprising quality of picking up a strong reflection in the afternoon light, such that an unfortunate opaqueness results when viewing the building from points west. We recommend that the screen material be replaced with bronze wire cloth (not bronze anodized aluminum or bronze colored fiberglass), oxidized to remove its luster, to eliminate this condition.

6. We observed the recently-installed redwood and brass barricade which can be erected on the sliding glass doors, to prevent persons from stumbling over the step threshold upon departing from the dining table. Although these appear effective enough for preventing these accidents, we are sorry to observe how seriously they brutalize the otherwise delicate horizontal tracery of the window sash units, so characteristic of the Hanna House and particularly as expressed by Mr. Wright throughout this remarkably exquisite wall. We have several ideas for a more respectful solution, one being a system of telescoping horizontal metal members, closely matched in size to the dimensions of the horizontal sash muntins, which would be extendable to the center of the opening, as the sliding glass doors are opened. We would be pleased to develop details of this alternative for your review.

VIII MASTER BEDROOM SUITE

1. Unfortunately, the white window coverings would not be our recommendation for use at the Hanna House, both from the standpoint of their appearance on the interior, and for their appearance from the exterior. Mr. Wright selected for this house, and the Hannas used exclusively, a type of roller shade made of wooden slats, in a color which matched the redwood walls. We recommend that any future changes in window coverings be made with an eye toward selecting a similar color to Mr. Wright's preference. We have found in the relatively new pleated blinds, such as the Versaline line, several appropriate neutral colors. This product has the added advantage of stacking into almost no space at all, which would have pleased Mr. Wright in his constant effort to minimize the evidence of window coverings.

2. We noticed that the large walk-in closet latch is incorrectly installed.
3. Some of the doors to the bedroom terrace bind, need adjustments to hardware and collide with the non-Wright-selected white soffit light fixture diffusers. See Item II-10.

IX LIBRARY

1. We note in this room that removal of the Hannas' desks and books in favor of the audio-visual center has somewhat changed its character, and would only suggest that, when and if the time comes that further adaptation or possibly reversion to a reading library is considered, the 1957 version by Mr. Wright might be evaluated for reinstatement in whole or in part. We ought to be careful that, once a Wrightian scheme is partially dismantled in favor of adaptive use needs, the next time the room undergoes modifications, we come back to the complete Frank Lloyd Wright designed scheme, as a benchmark reference, and not just its remnants from the previous change.

X KITCHEN, BATHROOM AND SERVICE HALL

1. The "Ventilator" in the Service Hall had shutters designed by Mr. Wright, which were never constructed. The reason behind his interest in these shutters can best be appreciated from the exterior, where the high clerestory windows of this hall are visible from ground level. Frank Lloyd Wright held a life-long aversion toward double-hung windows, which he railed about continuously. He called them "guillotine" windows. The windows of the Hall ventilator, so prominently visible atop the Hanna House inadvertently turned out looking exactly like the hated double-hung windows, and hence Mr. Wright's coming forth with a design to alter their appearance with perforated shutters and a directive to change the glazing from the two-paned units as originally built to a single pane of glass in each window. Paul Hanna may be able to shed additional light on this explanation.

XI GUEST ROOM

1. Mr. Wright would disapprove of the wall coverings, furniture, window draperies and heaters in this room. Also the tile in the bathroom.

XII HOBBY SHOP

1. The fireplace hood, firescreen and skimpy hearth size appear aesthetically constrained and are inconsistent with Mr. Wright's penchant for open, generous fireplaces and surrounding hearth areas. These elements should be remodeled to more appropriately express Mr. Wright's attitude toward "the hearth".

2. The fluorescent lighting should be shielded from normal sightlines by the addition of wood baffles or by recessing the fixtures further out of view.

3. Operate, clean and lubricate windows and sliding door regularly, as per item 8

4. The white window coverings: See Item VIII-1.
XIII SUMMARY

We found ourselves somewhat uncertain about categorizing the noteworthy items we found in our inspections in terms of the three categories as set forth in your letter of August 10, 1987. We found that, when an item in Category 1 was deemed worthy of action, it got bumped into Category 2 or 3. We sought clarification on this matter from Valerie Veronin, and the following lists reflect our best effort at placing the items among the three levels of changes which we believe should be taken under consideration by your Board in connection with the Hanna House.

CATEGORY 1: INVENTORY OF EXISTING CONDITIONS OF THE PROPERTY, INCLUDING ITS INTEGRAL FURNISHINGS

Note: In this category we have placed our observations which we felt moved to bring to your attention for you to take under advisement, but which may require little in the way of discussion, decision or expense to implement. This is not intended to be an inventory of all features or items which constitute the property, but only those items which we considered to be noteworthy and deserving of your consideration.


CATEGORY 2: IDENTIFY SIGNIFICANT CHANGES OR PROBLEMS WHICH SHOULD BE ADDRESSED

Note: At Valerie Veronin's request, we have included in this category items of relatively modest scope which would appear to require remedial action and also items which have arisen on account of changes in the use of the house and premises.

Items I-10, I-14, II-2, II-4, II-5, II-7, III-1, VI-3, VI-4 (if necessary, and we hope not), VI-6, VI-8, VI-10, VI-11, VII-5, VII-6 and XI-2.

CATEGORY 3: OUTLINE RECOMMENDATIONS FOR FUTURE REPAIRS AND RESTORATION WHICH WE FEEL WOULD BE APPROPRIATE

Note: Valerie Veronin has suggested that we also include in this category any suggestions we have for "big ticket" items, some of which might be considered by prospective donors interested in making bequests to fund the preservation of a Frank Lloyd Wright object or building portion.

Items I-9, II-3, II-6, III-2, V-1, VI-2, VI-5, VI-9, VII-2, VIII-1, IX-1, XII-1 and XII-4.

It has been the nature of this report and of our inspections to draw attention to problems or conditions of use which require attention, remedial work, repairs, etc. As anyone who visits the Hanna House and, again, as you and your colleagues on the Board of Governors know well, the Hanna House is excellently maintained and we are pleased to witness the beneficial results of the University's efforts in this regard. We remain grateful for the opportunity to present our findings and thus participate with you in this stewardship. We sincerely look forward to a continued regular association with you in the pursuit of authentic maintenance, preservation and adaptive use of the Hanna Honeycomb House.
Sincerely yours,

TALIESIN ASSOCIATED ARCHITECTS

By: William J. Schwarz, A.I.A.

WJS:th
ATC-20 Rapid Evaluation Safety Assessment Form

BUILDING DESCRIPTION:
Name: HANNA C. L. WRIGHT
Address: 737 FRANKLIN

No. of stories: /  
Basement: Yes ☐ No ☑ Unknown ☐

Primary Occupancy: Dwelling ☑
Other Residential ☐ Commercial ☐ Office ☐
Industrial ☐ Public Assembly ☐ School ☐
Government ☐ Emer. Serv. ☐ Historic ☐
Other

OVERALL RATING: (Check One)
INSPECTED (Green) ☐
Exterior only ☐
Exterior and Interior ☐
LIMITED ENTRY (Yellow) ☑
UNSAFE (Red) ☐

INSPECTOR:
Inspector ID TERRY VERNON
Affiliation EPM

INSPECTION DATE:
Mo/day/year 18 OCT 89
Time 1:30 - 2:30 am pm

Instructions: Review structure for the conditions listed below. A "yes" answer to 1, 2, 3, or 5 is grounds for posting entire structure UNSAFE. If more review is needed, post LIMITED ENTRY. A "yes" answer to 4 requires posting AREA UNSAFE and/or barricading around the hazard. Hazards such as a toxic spill or an asbestos release are covered by 6 and are to be posted and/or barricaded to indicate AREA UNSAFE.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
<th>More Review Needed</th>
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<tbody>
<tr>
<td>1. Collapse, partial collapse, or building off foundation</td>
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<td>2. Building or story noticeably leaning</td>
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<td>3. Severe racking of walls, obvious severe damage and distress</td>
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<td>4. Chimney, parapet or other falling hazard</td>
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<td>5. Severe ground or slope movement present</td>
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<td>6. Other hazard present</td>
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Recommendations:
☐ No further action required
☒ Detailed Evaluation required (circle one) Structural Geotechnical Other
☐ Barricades needed in the following areas:

☐ Other: LIMITED ENTRY

Posted at this Assessment: ☑ Yes ☐ No

Comments:
BRICK COLUMN NEEDS TO BE REPAIRED ASAP. PARTICIPEMENT OF AREA OF HOUSE FOR LIMITED ACCESS. HOUSE IS SAFE TO OCCUPY.
ATC-20 Rapid Evaluation Safety Assessment Form

BUILDING DESCRIPTION:
Name: HAUNA HOUSE
Address: 

No. of stories: 
Basement: Yes ☐ No ☐ Unknown ☐

Primary Occupancy: Dwelling ☐
Other Residential ☐ Commercial ☐ Office ☐
Industrial ☐ Public Assembly ☐ School ☐
Government ☐ Emer. Serv. ☐ Historic ☐
Other ______________________________

OVERALL RATING: (Check One)
INSPECTED (Green) ☐
Exterior only ☐
Exterior and Interior ☐
LIMITED ENTRY (Yellow) ☐
UNSAFE (Red) ☐

INSPECTOR: Found B.
Inspector ID __________________________
Affiliation __________________________

INSPECTION DATE: 10/23
Mo/day/year __________________________
Time _____ am / pm ____________________

Instructions: Review structure for the conditions listed below. A "yes" answer to 1, 2, 3, or 5 is grounds for posting entire structure UNSAFE. If more review is needed, post LIMITED ENTRY. A "yes" answer to 4 requires posting AREA UNSAFE and/or barricading around the hazard. Hazards such as a toxic spill or an asbestos release are covered by 6 and are to be posted and/or barricaded to indicate AREA UNSAFE.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
<th>More Review Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collapse, partial collapse, or building off foundation</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Building or story noticeably leaning</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Severe racking of walls, obvious severe damage and distress</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Chimney, parapet or other falling hazard</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Severe ground or slope movement present</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Other hazard present</td>
<td>☐</td>
<td>☐</td>
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</tbody>
</table>

Recommendations:
☐ No further action required
☒ Detailed Evaluation required (circle one) Structural ☐ Geotechnical ☐ Other __________________________
☐ Barricades needed in the following areas: __________________________
☐ Other: __________________________

Posted at this Assessment: ☐ Yes ☐ No

Comments: SEVERE STRUCTURAL DAMAGE TO BRICK CHIMNEY
RAFTERS PULL-OUT AND BEARING IS ONLY ABOUT AN-INCH RISK OF COLLAPSE OF THESE RAKTERS
IN CASE OF STRONG AFTERSHOCKS - EVALUATION IS NEEDED - OVERALL RATING  B.

CENTRAL

Appendix C

ATC-20
March 15, 1990

To: Hanna House Board of Governors
Re: Hanna House Repair and Seismic Bracing

The following report is in response to two requests: by the Hanna House Board of Governors for a project proposal to repair damage caused by the October 17, 1989 earthquake and by the Director of Facilities Project Management for the development and pricing of a concept for seismic bracing.

This report was prepared with the assistance of a number of consultants most notably: Eric Elsesser of Forell and Elesser, Structural Engineers; Roger Klem of Synthesis Design Group, Architects and Gee Heckshure of Plant Builders Inc.

Jonathan Ryan

JXR: mh
1.0 Background
2.0 Observations/Analysis
  2.1 Geotechnical
  2.2 Structural
  2.3 Architectural
  2.4 Weather Proofing
  2.5 Electrical, Mechanical, Plumbing

3.0 Recommendations
  3.1 Concept One
  3.2 Concept Two
  3.3 Deferred Maintenance
  3.4 Aesthetic improvements

4.0 Cost

5.0 Schedule

6.0 Conclusion

7.0 Appendix
1.0 BACKGROUND

The October 17, 1989 Loma Prieta Earthquake damaged the Hanna House severely. Structural failure occurred within the building's cut and fill foundation as well as at the building superstructure. In addition, there was considerable damage sustained to nonstructural items throughout the house.

Subsequent to the earthquake, Facilities Project Management conducted a series of three emergency inspections and determined that the central fireplace posed an overturning hazard, therefore heavy timber shoring was installed. A more pronounced inspection followed and an inventory of the damage was presented to the House Board on November 16, 1989.

The Board requested an estimate to repair the earthquake damage and this information was reviewed with the University Architect, the Assistant Provost for Management and Planning, and the Director of Facilities Project Management on December 8, 1989. At this point, it was requested that a complete analysis be conducted of the House's condition and recommendations be made concerning seismic bracing as well as upgrades to other building systems and components. A progress report was given on January 14, 1990 to representatives of the Office of Planning and Management.

Facilities Project Management has also conducted a series of four house tours for representatives of the Federal Emergency Management Administration. A Damage Survey Report and a detailed project estimate has been filed with the Federal authorities. In addition, tours reviewing the damage were conducted by FPM for representatives of the National Trust for Historic Preservation and the J. Paul Getty Foundation.
2.0 ANALYSIS

2.1 Geotechnical:
Site observations as well as examination of archival documents indicate that significant cut and fill was performed in order to provide a level building pad for the main house. This fill beneath the house has shifted significantly, causing cracking and differential settlement throughout the main living room as well as the adjacent north terrace. The top portion of the retaining wall at the north end of the house has collapsed and the adjacent retaining walls have bowed out significantly. Reportedly, settlement of the fill has been occurring over time but was accelerated due to the recent earthquake. In addition, the retaining wall comprising the wall adjacent to the cypress tree planter next to the garage has also bowed. Bowing was also observed at the small wood retaining wall on the other side of said planter. Other isolated indications of soils failure were observed at the south and west terraces and adjacent steps.

Standards of construction in practice in 1937 did not dictate engineering criteria for earthwork. Poor fill placement and compaction beneath portions of the main house contributed to large differential settlement, partly caused by earthquake shaking. Current standards of practice dictate proper benching, drainage and compacting of fill placed on slopes. Properly constructed fills should not exhibit the kinds of deformation which have likely occurred in the fills.

The effect of the earthquake on the workshop/office appears to be not as great as the main house due to the workshop being founded on a cut in the hillside. In addition, the pool performed well, due most likely to better fill placement and compaction at that location.
2.2 Structural:
It has been observed by a number of architectural historians that the basic Wright plan is one in which the spaces radiate out from a central fireplace core. It is, perhaps, axiomatic that the structural organization should also follow this notion. The structural failure of this masonry core is observable in a number of locations about the hearth as well as at the foyer and kitchen. This failure can be attributed to the unreinforced nature of the masonry construction as well as the inadequate sizing of the footing.

Structural failure was also observed at the roof where the rafters tie in radially to the chimney. That this construction is located over the previously discussed cut and fill earthwork may also have contributed to its poor performance during the earthquake. Less, but still significant damage was observed at the library fireplace, this perhaps being attributed to construction on virgin soil.

The wood frame superstructure also performed poorly. This is believed to be the result of the undersized nature of the wall studs and the inadequacy of connections amongst various wood members.

2.3 Architectural:
A list of 61 deficiencies are noted in the Appendix Section. These deficiencies divide into categories of quake-related damage and deferred maintenance.

In terms of general observations, it is noted that many exterior window and door sills are worn and rotting. Rot was also observed at a number of exterior wood trim locations. The earthquake has caused numerous wall panels within and without the building to have moved exposing unvarnished ends. The earthquake also affected the alignment of door hardware in a number of locations. This was particularly noted at exterior locations.
In 1987 a detailed report on the house was submitted by the Taliesin Associated Architects. A number of the conditions identified in the Taliesin Report have been addressed. Those that remain are listed in the Appendix section.

2.4 Weatherproofing:
The existing roof membrane is serviceable and nothing was noted during the inspection that would indicate the need for immediate roof replacement. Signs of past leaks are evidenced by a few water stains on the ceiling finish and visible plastic cement repairs on the roof.

The building design includes a number of wooden ceiling hatches opening to a well ventilated attic. Eave overhang structural spaces, however, do not appear to be ventilated, contrary to current design practice.

The building's window glazing method is leak prone and apparently, from silicone sealant oversealing visible on some windows, an actual source of water infiltration.

2.5 Electrical, Mechanical and Plumbing:
Heating: The furnaces are relatively new and are in good operating condition. The HVAC Shop reports no systemic problems.

Plumbing: The all copper system appears in good condition, plenty of pressure at the taps, drains are clear. The Plumbing Shop reports no systemic problems.

Electrical: The service and meter area requires some re-working to be within code compliance. Exposed wiring at the roof and inside is hazardous. The Electric Shop reports no systemic problems.
3.0 RECOMMENDATIONS

3.1 Concept One: Damage Repair
This work includes removal and replacement of living room and north
terrace floor slabs; north terrace retaining walls; and living room
and library fireplaces. The scope of this option would also include
miscellaneous patching and repair to cracked masonry and concrete,
racked doors, panels and cabinetry and other damage conditions
incidental to the earthquake.

The foundation and structural work would be designed and installed to
current uniform building code requirements. However, in the opinion
of the structural consultant, the overall seismic performance of the
building would not be significantly improved. A major earthquake
could still cause serious damage or partial collapse.

Construction estimate: $560,000

3.2 Concept Two: Seismic Bracing
In order to meet current uniform building code Life Safety Standards,
additional structural elements would be added throughout the house in
addition to the scope of work proposed in concept one. These
elements would include a new plywood roof diaphragm, truss chords and
collectors; a concrete pier in the master bath storeroom; 2 or 3
plywood shearwalls; and a single steel frame to provide lateral
resistance at the transverse roof gable. A new roof would be
required because of the installation of the roof diaphragm.

Construction estimate: $928,000

3.3 Deferred Maintenance:
Small isolated conditions would be addressed within the context of
one of the structural alternatives. Additional areas of proposed
repair are as follows:
Wood rot: The house has localized conditions of wood rot, particularly at door and window locations. Past applications of weather caulking at locations not originally designed to receive caulk have promoted or accelerated this condition.

Construction estimate: $6,000

Weather Sealant: Numerous conditions of cracked and fatigued caulking were noted. Removal of this material and replacement with modern silicone sealant is recommended.

Construction estimate: $5,000

Exterior Wood Finishes: Some exterior wood preservative finishes are failing. Removal and retreatment is recommended. In addition, various individual wood trim pieces are split, badly checked or warped. In some places trim is missing. This occurs mostly on the south and west sides of the house - the areas most exposed to weather.

Construction estimate, refinishing: $9,000
Construction estimate, wood trim: $8,000

3.4 Aesthetic Improvements:
The 1987 Talesin Report outlined in thorough detail those items in need of correction in order to make the building right. While some of the items have been addressed, a number remain. Most, however are small and incidental and may be addressed by the Board within the course of its normal stewardship. The following are recommended for consideration at this time.

Roof: Depending on the structural upgrade selected, a new roof may be required. The options recommended are, 1) reinstall a new roof to match current materials - built up bitumen with gravel aggregate, 2) install a new copper roof per Wright's original drawings.

Construction estimate, copper roof: $165,000
Construction estimate, bitumen roof: $59,000
Exposed Wiring: Exterior wiring for landscape lighting is now draped across the roof. Telephone, security and audio-visual wiring is exposed in a number of locations indoors.

Construction estimate: $2,100

Aluminum storefront window: The aluminum framed tinted glass wall may be replaced by photosensitive glass which will darken when exposed to direct rays.

Construction estimate: $13,000

Exterior lighting: A number of exterior soffit lights protrude down from the bottom of the soffit. In one case, the light prevents a door from opening properly. These lights should be replaced with concealed fixtures to match the original design. It is also recommended that portions of the exterior landscaping and perimeter lighting system be replaced. Given the large evening gatherings, safety may be a factor.

Construction estimate, 60 soffit lights: $19,000

Construction allowance, exterior lighting: $20,000
4.0 COSTS

Costs are categorically quoted in terms of estimated construction dollars. Other costs, such as design, permit and University management fees are in addition to those costs stated. Total project costs may be estimated by multiplying the estimated construction costs by an experience factor. The most recent project managed by Facilities Project Management similar to the Hanna House reconstruction was the University President's residence, The Hoover House. Our experience factor on that project was 1.38.

<table>
<thead>
<tr>
<th>SCOPE OF WORK</th>
<th>CONSTRUCTION ESTIMATE</th>
<th>PROJECT COST X 1.38</th>
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</thead>
<tbody>
<tr>
<td>Concept One: Damage Repair</td>
<td>$ 560,000</td>
<td>$ 773,000</td>
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<tr>
<td>Concept Two: Seismic Bracing</td>
<td>928,000</td>
<td>1,280,000</td>
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<tr>
<td>Wood Rot Repair</td>
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<td>Weather Sealant Renewal</td>
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<tr>
<td>Exterior Wood Finish Repair</td>
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<tr>
<td>Replace Wood Trim</td>
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<tr>
<td>Bitumen Roof Replacement</td>
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<tr>
<td>Copper Roof Installation</td>
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<td>Exposed Wiring</td>
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<td>Remove/Replace Aluminum</td>
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<td>18,000</td>
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<td>Storefront</td>
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<td>Replace Soffit Lighting</td>
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<tr>
<td>Improve Exterior Lighting</td>
<td>20,000</td>
<td>28,000</td>
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</table>
5.0 SCHEDULE

The Project schedule will be a function of the concept alternative selected. Concept One will take about 9 months; Concept Two will require 11 months to complete.

All of the deferred maintenance and aesthetic improvements can be accomplished within these schedules with the exception of the copper roof which will add 30 days. This would be a competitive bid contract.

As an alternative, if time is of essence, a negotiated fast track contract with the current consulting team would yield schedules of 7 months for Concept One and 9 months for Concept Two. This option could however, preclude the house from qualifying for Federal Emergency Management Administration Funds.

Detailed schedules are contained in the Appendix Section.
6.0 CONCLUSION

The outlined repair and bracing solutions pose significant, and highly debated theoretical questions with regard to architectural historic preservation. Indeed the term historic preservation could not be applied with regard to the explicit nature of the two structural solutions proposed. The living room fireplace, the axial planning and structural element of this historic house will be gone in terms of technology and time if either scheme is undertaken. The reconstruction of this and the other fireplace will at best only replicate the original. However, if the notion of historic preservation were to be considered in the broader context of the entire building and its survivability in the next earthquake, perhaps this intrusive surgery can be justified.

Questions of consistency with respect to Frank Wright's theory of architecture as well loom over the proposed alternatives. An attempt has been made through: review of the Hanna House archives; review of significant Wright texts, both authored by the architect, as well as about him, and review and discussion of other Wright homes, to understand this house and the problems therein in terms of the Architect's theoretical perspective and to generate a set of solutions consistent with same.
The following list represents observations made at the house following the earthquake and is intended to catalog seismic damage and deferred maintenance. Numbers correspond to those on illustration 1.

1. Cracking at the top of fireplace bricks.
2. Wall displaced laterally 3/8".
3. Header sagged @ folding door to TV room - doors won't close.
4. Wall panel opened up - 2 walls.
5. Earthquake may have racked chest of drawers in closet - drawers hard to open.
6. Doors from bedroom to dining room racked.
7. Storage drawer below seat @ tub does not stay closed - bottom piano hinge loose.
8. Door @ towel storage adjacent to tub won't close - cabinet frame racked.
9. Door to toilet won't close - frame racked.
10. Folding door from bedroom to bath is busted.
11. Caulking failure at wall sill.
12. Brick patio trim band separated from concrete patio slab.
15. Patio slab concrete cracks.
16. Slab or steps displaced 1" vertically big gap under bottom step to slab below.
17. Crack @ top step to patio - slab differential 1".
18. Sliding closet door does not slide.
20. Wall panels moved.
22. Bottom of glass display cabinet door in library rubs on counter.
23. Dining room slab @ window pockets has moved out.
24. Dining room inner doors bind - do not slide well.
25. Steps cracked in several places.
26. Dining room slab significantly moved down and away - 1".
27. Steps from dining room to living room cracked 1/4" @ top riser.
7.2 TALESIN REPORT SUMMARY, AESTHETIC IMPROVEMENTS

The following is a summary of the report made by Talesin Associated Architects in October 1987. The report addresses mostly aesthetic recommendations but there is some overlap with the previous damage/maintenance listing. Numbers correspond to the indications on Illustration 2.

100. Study replacement vs. preservation of existing Cypress tree at carport.

101. Prune, thin, remove & replace junipers @ driveway & west parking areas.

102. Prune the camilias @ east wall of living room.

103. Remove existing "No Trespassing" sign @ bot. of driveway. Replace with new sign.

104. Remove "737" sign @ entrance forecourt. Replace with custom designed lettering.

105. Remove pipes & chain barricade @ driveway. Replace with custom designed edge protection.

106. Review all outdoor lighting fixtures. Replace as determined.

107. Remove piping @ north terrace retaining wall where abandoned use. Paint remaining. Plant new plants. Remove hose rack.

108. Repair Imperial Hotel Urn & treat in restorative manner. Hire architect in Japan to advise method of restoration. Fabricate & install custom copper lid for urn.


110. Remove precast concrete planters @ west terrace. Replace with custom planters, or stain existing concrete.

111. Remove & relocate irrigation controller & electrical boxes @ south end of Hobby House.

112. Repaint swimming pool fencing. Install plantings adjacent to fence.

113. Remove & replace top brick coursing @ wall adjacent to steps down to west parking. Jack up, or remove & replace landing slab @ steps.
114. Remove mushroom lights @ wall adjacent to steps down to west parking. Replace with custom designed lighting.
115. Remove espalier wires @ west brick plant box.
116. Investigate nature of wood preservative currently being used. Document in detail existing maintenance program.
117. Remove & replace trellis support screen @ west terrace, per original Wright design.
118. Remove storefront-style aluminum & glass shade screen @ living room. Install custom designed shading device.
119. Remove all 5 sheet metal chimney caps. Test for water leaks.
120. Remove & relocate TV antenna to remote tree. Reroute wiring underground.
121. Remove existing built-up roof. Replace with new copper roof.
122. Reroute in concealed manner the loose landscape lighting located on roof.
123. Investigate reasons for installation of building sill sealant. Remove all sealant. Install custom designed "breathable" sealant at leak locations.
124. Remove abandoned surface-mounted wiring @ eaves. Reroute in-service wiring in concealed manner.
126. Remove all protruding glass lights @ ext. soffits. Install custom designed built-in lighting.
127. Completely disassemble, clean, and galvanize the metal parts of the musical fountain. Replace concealed piping & pump. Grind out, reseal & repaint concrete basin.
129. Remove & replace split & checked wood soffit light frames. Replace missing sections.
130. Inspect & refinish interior floors.
131. Remove existing rugs. Replace with custom designed carpeting @ entry, living room & original dining room.
132. Remove non-Wright furnishings & replace with new custom-fabricated Wright furniture.

133. Fabricate & install custom-designed perforated board frieze @ ventilator over service hall.

134. Remove & reroute audio equipment wiring to concealed locations.

135. Fabricate & install custom designed built-in shelving & couch @ northeast living room alcove, per Wright design.

136. Patch & wax crack @ cracked living room floor hexagon.

137. Fabricate & install custom barrier @ living room fireplace.

138. Fabricate & install custom designed hexagonal floor ottomans @ living room.

139. Adjust living room doors @ north terrace. Add additional casters & bracket. Repair weatherstripping @ west doors.

140. Same as item #128 (III-2).

141. Replace missing trim of lights @ north terrace soffit & adjust lighting.

142. Fabricate & install min. 5 dining chars, to match original Wright design. Relocate original dining table from library to original dining room.

143. Monitor decay of west jamb mullion @ dining room for one year. Apply wood preservative. Replace mullion & stockpile additional milled stock to replace other decayed conditions.

144. Monitor split boards @ Tang horse alcove for one year. Replace boards.

145. Remove existing coating from steps throughout interior of house. Sandblast concrete & refinish.

146. Provide detailed inspection of west wall @ dining room. Dismantle for inspection portions of wall.

147. Clean & lubricate hardware & track @ dining room screen door. Plane door edges.

148. Investigate if flashing in place under caulking @ west dining room wall.

149. Remove existing insect screen from dining room wall screens. Reinstall bronze wire cloth.

150. Remove existing redwood & brass barricade from dining room sliding doors. Fabricate & install custom designed, telescoping iron barricade.
151. Remove existing window coverings @ master bedroom. Reinstall Verasol type.
152. Remove & reinstall bedroom walk-in closet latch.
153. Adjust & service hardware & doors from bedroom to terrace.
154. Rebuild the library back to the 1957 Wright design.
155. Rework ventilator windows in service hall.
156. Remove & replace wall coverings, furniture, window draperies and heaters @ guest room. Remove & replace tile @ bathroom.
157. Remove & reconstruct fireplace hood, firescreen & hearth @ hobby house.
158. Install wood baffles @ hobby house fluorescent lights.
159. Clean & adjust windows & doors @ hobby house.
160. Remove existing window coverings @ hobby house. Reinstall Verasol type.
CONCEPT ONE: DAMAGE REPAIR -
BID CONTRACT

CONCEPT ONE: DAMAGE REPAIR -
NEGOTIATED CONTRACT [FF]

HANNA HOUSE (# 6050)

STANFORD UNIVERSITY
STANFORD UNIVERSITY

HANNA HOUSE

REPORT ON THE
OCTOBER 17, 1989
EARTHQUAKE DAMAGE AND THE
PROPOSED EARTHQUAKE
REPAIR SCHEME

PREPARED FOR
STANFORD UNIVERSITY
FACILITIES PROJECT MANAGEMENT

BY
FORELL/ELSESSER ENGINEERS, INC.
539 BRYANT STREET
SAN FRANCISCO, CA 94107

FEBRUARY 5, 1991

FORELL/ELSESSER ENGINEERS, INC.
1.0 INTRODUCTION

This study describes the post Loma Prieta earthquake condition of the Hanna House at Stanford University designed by Frank Lloyd Wright. This structure is a National Landmark and is on the National Registry of Historic Places. The Loma Prieta earthquake caused damage to several parts of the building and especially to the two large brick fireplace chimneys considerably diminishing the seismic resistance of the structure. Portions of the roof are now endangered resulting in the evacuation of the house and the installation of shoring. Several remedial measures which comply with current applicable standards of safety have been developed and reviewed by Stanford's architectural consultant team consisting of Architectural Resources Group and Martin Eli Weil, Restoration Architect. The requirement of providing a complete lateral load carrying system which can be installed without compromising the historic nature of the building leads to a recommended scheme presented below.

2.0 BUILDING DESCRIPTION

The Hanna House was constructed in 1937 with an additions built in 1950 and 1960. This single story house is a unique wood framed building with three masonry fireplace chimneys. The exterior walls contain a large percentage of glass door and window area. The interior and exterior walls are of special thin construction and are designed as movable partitions to facilitate remodeling. These partitions consist of 12" wide redwood boards and battens screwed to flat 1x8 studs at 2' - 2" on center. The 60° and 120° partition corners resulted in a great variety of specially hand-crafted joints. The floor is a two layer 3-1/2" thick reinforced concrete slab on grade with a topping slab. The building has a small partial basement. A brick faced concrete retaining wall provides down-slope support. See Figure A for a building plan and details.
The existing soil conditions under the house are described by the Geotechnical Investigation by J.V. Lowrey & Associated dated September 7, 1990. A layer of poorly compacted fill described in that report was used to level the site. The fill varies in thickness and reaches a maximum of 9 feet at the north patio (the fill thickness profile is shown on Figure A).

3.0 EARTHQUAKE DAMAGE

Structural damage to the Hanna House was concentrated around the main fireplace and chimney, the library fireplace and chimney, and several areas of wood wall framing, the dining room and living room retaining walls, the carport retaining wall, and the slab-on-grade.

The main chimney was cracked near the floor line and the entire chimney has rotated slightly. Several bricks at the chimney corners were crushed or displaced. This chimney supports a significant portion of the roof so shoring has been installed to prevent collapse.

The library chimney also shows cracking around its perimeter just above the hearth level. This indicates over stresses during the 1989 Earthquake and a loss of lateral load carrying capacity. This chimney also vertically supports a large portion of the roof structure.

A portion of the front brick retaining wall near the north end of the house rotated and lost its brick facing. This allowed the fill soil to settle under the patio and under the house at the livingroom. This ground movement has caused both vertical and horizontal movements of the slab on grade resulting in cracks at steps and within the hexagon slab pattern.

Non-structural elements were also damaged. Soil settlements caused cracking of the planter walls near the entrance and cracking of the concrete steps leading to the patios. Partitions, doors, windows and cabinets were also affected by racking of the flexible wood framing and by soil settlement in the
living room area. A partition wall near the car port has buckled and now has a bowed shape. A large urn, also of Frank Lloyd Wright design, located near the driveway fell from its pedestal, and is severely damaged.

4.0 APPLICABLE CODES AND DESIGN CRITERIA

The repair of this building should attempt to meet two general goals. First, the seismic resistance of the structure must be restored to a level which can adequately protect the life safety of the occupants. Second, the structural repairs and modifications should be done in a cost effective manner with as little impact on the historic architectural features of this building as possible. Several building codes and published design guidelines have been consulted while developing the design criteria to be used for this project.

FEMA guidelines define permanent work as "that restorative work that must be done through repairs or replacement to restore an eligible facility on the basis of its pre-disaster design and current applicable standards." These statements require adherence to the building code requirements and design guidelines provided by the local jurisdiction. In this case, Stanford University has developed an approach which is based on the current Uniform Building Code.

The State Historical Building Code also provides guidelines which could be applied to this structure. Chapter eight of this code states: "A complete, continuous and adequate stress path, including connections, from every part or portion of the structure to the ground shall be provided for the required horizontal forces." The horizontal force required by this code for the upgrade of existing buildings is not explicitly defined but is left up to the local jurisdiction, which in this situation would be the 1988 UBC.

The Stanford performance goal is to prevent collapse, while allowing minor structural damage and moderate non-structural damage under a Richter Magnitude 7.0 to 7.5 Earthquake on the Peninsula Section of the San Andreas Fault. The
method prescribed for meeting this goal is to apply the 1988 UBC lateral loads to the structure which must be provided with a complete lateral load resisting system. Compliance with detail requirements of the code which apply to new buildings is not always possible in an economically feasible restoration program. However, new elements added to the structure would be detailed to meet the code requirements and the overall strength and stiffness of the restored structure would be sufficient to resist the code prescribed seismic force and drift limitations.

For all construction work, Stanford University must legally comply with the by-laws and regulations of Santa Clara County. The building code applicable for work in Santa Clara County is the 1988 edition of the Uniform Building Code (UBC) [1]. The 1988 UBC prohibits the use of brittle (non-ductile) lateral load resisting elements such as unreinforced masonry and promotes the use of well-detailed structures.

In order to reinstate the strength and stiffness of the building to: (i) its pre-1989 earthquake condition; (ii) to meet the minimum seismic requirements of Santa Clara County (the current applicable code); and (iii) to satisfy the requirements in the FEMA guidelines and the State Historical Building Code, the minimum strength of the repaired Hanna House is the design base shear specified by the 1988 UBC. Furthermore, a complete lateral load resisting system must also be provided, in so far as practical.

5.0 LOSS OF LATERAL LOAD CAPACITY

The Hanna House does not have a formal lateral load resisting system. The walls in this house are flexible and incapable of resisting lateral forces because they are made with non-standard 1 x 8 studs and battens which are not well attached to the slab. The flexible wood framing is inadequately tied to the chimneys which are the primary elements capable of resisting lateral loads. Damage to these elements during the Loma Prieta earthquake indicate that the building’s capacity is now lower than the pre-earthquake condition.
The main chimney was the most substantial and rigid lateral load resisting element before it was damaged by the earthquake. The cracking and rotation of the base of the chimney indicates that the current lateral load resistant capacity is significantly diminished.

The library chimney was also a rigid lateral load resisting element damaged by the earthquake. Although the signs of damage are less severe than in the main chimney, cracking all the way around the perimeter and displacement of bricks at the corners indicate that the mortar bond is severed and the lateral load capacity is also significantly diminished.

The third chimney in the bedroom is also a significant element in the lateral load resisting system. No cracking or other damage was noted after the Loma Prieta Earthquake. Although this chimney has maintained its pre-earthquake capacity, a larger earthquake, or one of the same magnitude with a longer duration, could exceed the capacity of this unreinforced masonry element.

The pre-Loma Prieta earthquake capacity of this structure has been estimated at 7.3\(^g\) which is only 40\% of the force level suggested by the 1988 UBC for masonry structures. The post-Loma Prieta earthquake capacity has been reduced 40\% to 3\(^g\) because the cracked masonry no longer has any flexural strength to help resist lateral loads. The current capacity is therefore approximately 16\% of the code required level. See calculations in the Appendix.

6.0 REMEDIAL MEASURES

Several techniques could be used to repair the Hanna House and provide an adequate level of seismic resistance (see the applicable codes and design criteria section above). These techniques were evaluated for their structural performance, construction cost and architectural impact. The options available and our recommendations are listed below. These recommendations are based on information gathered visually and by review of original design drawings.
1. Repair the main, library and bedroom chimneys. All three chimneys are rigid elements of the lateral force resisting system. The main and library chimneys are cracked and require repair to current building standards. Although the bedroom chimney is not cracked, it should be rebuilt in order to become a reliable part of the lateral load resisting system. These three chimney elements form the basic load path which is required by all applicable codes and guidelines referenced in Section 4.0 above.

The recommended repair technique for the chimneys is to shore the roof and dismantle the chimneys which would be rebuilt with a new reinforced concrete foundation and vertical reinforced concrete or grouted CMU core. The original bricks or specially made replacement bricks would be built up as facing, restoring the original appearance. Anchorage for the roof framing to provide the necessary load path could easily be provided within this work. See Sheet S5 for chimney sections.

Core drilling the chimneys to provide new grouted reinforcing bars was considered but is not recommended because a variety of construction problems make this option less desirable. The main problem with core drilling is that the required foundation work would be done with the chimney in place resulting in a very large excavation with extensive shoring and underpinning. Also, mounting a drill rig over these chimneys would require elaborate scaffolding and roof reinforcement, and water from the drilling operation would be difficult to contain. Finally, providing anchorage for roof support members would cause significant sections of the chimneys to be dismantled even with the core drilled reinforcing technique.

A testing program has been developed to verify our assumption that insufficient reinforcing steel exists in the library chimney which is a more recent addition to the house. The recommended repair for that chimney may be modified if significant amounts of reinforcing are found.
2. Anchor the roof to the chimneys and add a plywood roof diaphragm. The recommended approach is to anchor all roof beams which are supported on the chimneys, add blocking and ties to create collector lines and add a new 1/2" plywood layer to the roof to provide an adequate diaphragm. This work is required for any solution which could be considered "a complete lateral load resisting system". See roof plan on Sheets S2 and S3.

3. Provide lateral resistance for unrestrained portions of the roof diaphragms. The addition of new lateral load resisting elements is required to provide a complete system and to adequately transfer the roof diaphragms loads away from the chimneys. Each section of the multi-level roof must be anchored sufficiently to prevent lateral movements and rotation under seismic loading. The recommended lateral force resisting system is a combination of new plywood shear walls and vertical cantilevered steel posts anchored to concrete foundations. The roof diaphragm would be attached to these new lateral load resisting elements with blocking and ties similar to the chimney attachments noted above. See Sheet S4 for wall and post details.

It is structurally feasible to use shear wall elements exclusively. However, various architectural features such as folding doors, windows, clear-story windows and very thin wall elements would be compromised by extensive use of plywood shear walls. The combined shear wall and cantilever post layout shown on Figure S1 utilizes shear walls where possible and posts in the architecturally sensitive brace locations.

4. Repair the front retaining wall. The only feasible option for repair of the north end of the retaining wall supporting the living room terrace which was damaged by the Loma Prieta earthquake is replacement with a new brick faced concrete wall. Soil under the house would be temporarily stabilized with shoring until new fill can be compacted behind the new wall and a new patio slab cast-in-place. The balance of the front
retaining wall along the living room and the dining room terrace must be stabilized to prevent down slope movement of the soil under the house. The most economic solution which is also sensitive to this historic preservation goals of the project is to install soil anchors through the existing walls. See Sheet S4 for retaining wall sections.

Tests pits will be excavated near the dining room terrace to verify that the foundation is configured as shown on the original plans. If a more substantial footing than is expected or a second wall footing at the building line is found, soil anchors at this terrace wall would not be necessary.

Other techniques for stabilizing the fill under the house were considered and found to be either more expensive or not feasible. These options include removal and recompaction of the fill which would require that much of the house be shored or dismantled. This option was dismissed as too expensive and architecturally disruptive. Soil grouting was also considered, but is not technically feasible with the clay soil used as fill.

5. Repair the garage retaining wall. This wall failed during the Loma Prieta earthquake and now has a noticeable bowed shape. It must be removed and replaced with a new wall and foundation which will conform to current design requirements. See detail no. 1 on Sheet S4.

6. Repair and strengthen the living room flitch plate. Soil movement in this area has caused distortion of the living room windows. We recommend reworking and reinforcing these supporting members.
7.0 SUMMARY AND CONCLUSIONS

The Hanna House can be repaired and a complete lateral load resisting system installed by completing the recommended work noted above. Repair of damaged elements includes the three main chimneys, the front retaining wall and the garage retaining wall. The balance of the structural work involves installing a complete lateral load resisting system. Roof ties, blocking and the new plywood roof diaphragm could be hidden within the ceiling spaces. The new steel posts could be hidden within existing closets and storage spaces. New plywood shear walls would create slightly thicker wall sandwiches and require some modifications. However, locating these walls in unobtrusive locations would mitigate the architectural impact.

The work noted above is recommended to meet the FEMA design guidelines local building standards which call for repair of damaged elements and installation of a complete lateral load resisting system. The elements of this solution attempt to meet these safety goals while respecting the historic value of this national landmark designed by Frank Lloyd Wright.
REFERENCES


Hanna House

Description

Single family house w/ wood framed walls and roofs, several substantial masonry chimneys supported on shallow foundations with a slab on grade. Historically sensitive structure because it was designed by Frank Lloyd Wright in 1930.

Vertical Load System

Roof loads are supported on thin wood partitions and the masonry chimneys which rest on shallow foundations. The majority of the slab on grade is supported on fill material.

Lateral Load System (Existing)

The masonry chimneys provide the only rigid lateral load resisting elements. The main chimney and library chimney have been cracked at their bases during the Loma Prieta EQ and will not provide significant resistance to the next event. Even if the chimneys could resist the required loads, inadequate anchorage to the roof framing (unanchored seated connections) would allow the roof to pull away from the chimney and loose vertical support.

The wood partitions could resist nominal lateral forces—however, their construction is not rigid and their contribution to lateral load resistance is considered insignificant. (See constr. details)
Lateral Load Resistance

Current Condition

Resistance is provided by the undamaged bedroom chimney and the partition walls. The eccentric location of the bedroom chimney and the high flexibility of the partitions would allow torsional rotations. Overall resistance is very low and partial collapse adjacent to chimneys is likely.

Desired Condition

Stanford University criteria requires a life-safety level of life safety protection provided by the current UBC. Although detail requirements of the new code will not be satisfied, the lateral force levels prescribed by that code will be used to design new lateral load resisting elements and load collectors.

Upgrade Techniques

General - provide lateral load resisting elements and collectors to transfer roof loads to these elements

Elements - Repair & Reinforce chimneys
Add Shear Walls
Add Cantilever steel posts
Collectors & New diaphragm for load transfer by tributary area method
Design Criteria

'88 UBC Vertical & Lateral Loads

Zone 4

Rw = 6

V = 193 W

Soils Info - See "Geotechnical Investigation For Hanwa House Seismic Upgrade" by J.V. Howrey & Associates - Sept 7, 1990

Passive pressure 350 psf/ft 5000 psf max

Active Pressure @ Retaining Wall
(to prevent down slope movement)

Pressure Profile

Soil Anchor design values are not available at this time but concept confirmed as a feasible option. (Field testing is needed)
Seismic Loading

Wt  Roof = 15 psf
     Partitions = 5 psf
     Use 20 psf total

System: Bearing walls - Light Framed Walls w/ Non-Plywood Shear Panels & Masonry Shear Walls

Use $R_w = 6$

$$V = \frac{21Ew}{R_w} = \frac{1.4 \times 1 \times 2.75 \times w}{6} = 18.3\% W$$

Base shear is applied to roof framing to be resisted by vertical element based on trib. area

Trib Area - Largest post = 450" (see plan of upgrade scheme)

$$V = \frac{450 \times 20 \times 0.18}{1.61} = 1.61 K/\text{post} @ \text{Roof level}$$
POST/PIER DETAIL
3'-6" Ø PIER INTO FILL
Post Option

(entirely perpendicular to slab restraint)

\[ M = 1.6 \times (9 + 14') = 20.8 \text{ kft} \]

\[ P = 1.6 \times 12' \]

\[ h = 13' \]

Try 2'-\(\phi\times 10'\) long pier

\[ A = \frac{2.34 \times 12'}{2} = \frac{2.34 \times 1.6}{1.17 \times 2} = 1.6 \]

\[ S_1 = 350 \times 9' \times 10' \times 13' = 1.17 \text{ kft} \]

\[ d = \frac{1.7}{2} \left( 1 + \frac{1}{1 + \frac{4.36(13)}{1.2}} \right) = 4.2 \]

Try 2'-\(\phi\times 8'\) long

\[ A = \frac{2.34(1.6)}{1.17} = 2 \]

\[ S_1 = 350 \times 8' \times 13' = .93 \]

\[ d = 2 \left( 1 + \frac{1}{1 + \frac{4.36(13)}{2}} \right) = 6.4' \]

Use 2'-\(\phi\times 8'\)

By slab restraint

\[ P = 16 \]

\[ h = 13' \]

\[ S_1 = 350 \times 4 = 1400 \]

\[ b = 2.0 \]

\[ d^2 = 4.75 \times \frac{P \times h}{S_1 \times b} \]

Use 2'-\(\phi\times 5'\) long

\[ d^2 = 4.75 \times \frac{1.6 \times 15}{1.4 \times 2} \]

\[ d = 5.6' \]
**Condition of Fill Areas**

\[ \text{post} \]
\[ h = 9' \]
\[ m = 1.6 \times 9 = 14.4 \text{ k-ft} \]
\[ S_{c0} = \frac{14.4 \times 12}{24} = 7.2 \text{ cu ft} \]
\[ \text{Try T} = 6 \times 6 \times \frac{1}{4} \quad S_{p} = 10.1 \quad I_{p} = 30.3 \]
\[ \Delta = \frac{1.6 \times 108^3}{3 \times E \times 30.3} = 7.6 \text{ k} = \frac{h}{141} \quad \text{NG} \]

\[ \text{Try T} = 7 \times 7 \times \frac{1}{4} \]
\[ \Delta = 1.77 \quad = \frac{h}{232} \quad \text{OK} \]
\[ a = 12.2 \text{ ksi} \quad \text{OK} \]

**Pier**

\[ \text{try } d = 2' \]
\[ d' = 4 + 2 = 6' \]
\[ p = 1.6 \times 9 / 6 = 2.4 \text{ k} \]
\[ p = 350 \times 8^2 \times d'^2 \]
\[ = 1.58 \text{ k/ft width} \]
\[ \text{ie use 18" wide pier} \]
\[ p' = 1.6 \times 2.4 = 4.0 \text{ k} \]
The post:

Try 40° p pier

w7 slab restraint

\[ m = 1.6 x q_1 \]

= 14.4 kips

0 fill

w7 d = 3'

\[ P = 14.4 / 2 \]

= 7.2 kips

\[ P' = 350 \times 3 \times 3.5 \times 3.5 \]

= 5,512 kips

Try d = 4'

\[ P = 14.4 / 4 \times 3.75 \]

= 5.4 kips

\[ Wt = 4 \times 3.5^2 \times 1.5 \]

= 5.77 kips

\[ f_d = 4 \times 1.5 = 6 \text{ ksf} \]

\[ S = 7 \times d^2 / 3 - 4.2 	ext{ ksf} \]

\[ f_s = 14.4 / 4.2 = 3.4 \text{ ksf} \]

Slab on Grade:

\[ = P + 1.6k \]

1.6 kips
Post Option

4' 4'

\[ m = 14.4 \text{ k-ft} \]

\[ P = \frac{14.4}{(4 + \frac{3}{2})} \]

\[ = 2.6 \text{ k} \]

\[ C = 2 \times 3.5 \times 3.5 \times 2 \text{ k} = 2.45 \times 2.6 \text{ OK} \]
Post on spread foot

\[ M = 1.6 \times 9.4 \]
\[ = 20.8 \text{ kcf} \]

try 4'x4'

\[ M_{req} = (27.15 + 27.11) \times 16' \times 2 \]
\[ = 16.6 \text{ kcf NC} \]

try 5'x5'

\[ M_{req} = (27.15 + 27.11) \times 25 \times 2.5 \]
\[ = 37.5 \]

\[ P = (27.15 + 27.11) + 20.8/5 \times 5\% \]
\[ = 52 + .998 \]

OK but too large to accommodate Arch. constraints
Retaining Wall

\[ h_{\text{max}} = 9.0 \]
\[ \rho = 70 \text{ kips/ft}^3 \]
\[ w_t = 110 \text{ kips/ft}^3 \]
\[ M = 70 \times 9/6 = 8.5 \text{ kips/ft} \]
\[ w = 3 \]
\[ M_{\text{res}} = 110 \times 9 \times 3 = 273 \text{ kips/ft} \]
\[ M_{\text{res}} = 110 \times 9 \times 5 \times 7.5 = 12,300 \text{ kips/ft} \]

\[ \rho_{\text{max}} = 9 \times 110 + 8.5 \times 5/6 = 990 + 2.04 = 3 \text{ kips/ft} \]

Slide: \[ 70 \times 9/2 = 2.8 \text{ kips/ft} \]

Soil: \[ 5.7 \times 9.99 \times 5 = 25.14 \text{ kips/ft} \]

Pre-tensioning:
\[ m = 8.5 \text{ kips/ft} \]

Try: \[ 2^\circ \phi \text{ at 6 ft deep} \text{ per UBC sect 2.9.7} \]
Retaining Wall con t
try 6' leg

Net = 8.5 k/lft

\[ m_{res} = 0.11 \times 9 \times 6^2 / 2 \]
\[ = 17.8 \text{k/lft} \]

\[ c = 3 - \frac{17.8 - 8.5}{5.94} \]
\[ = 1.43 \text{ ft} \] not in middle 1/3

\[ L' = 3(6/2 - 1.43) = 4.7 \text{ ft} \]

\[ \rho_{max} = \frac{2(5.74)}{4.7} = 2.5 \text{ k/sf} \]

(Not used)
**Retaining Wall**

Try Cant Piers @ 10'-0" oc.

\[ M_{ot} = 85 \text{ kft} \]
\[ P = 28.3 \text{ kFt} \]
\[ h = 3' \]

Try \( d = 12' \)

\[ \phi = 2\frac{1}{2}' \ (15^\circ) \]

\[ S_1 = 4 \times 350 \]
\[ = 1,400 \text{ kFt} \]

\[ A = \frac{2.34 \times (28.3)}{1.14 \times 2.5} = 18.9 \]

\[ d = \frac{18.9}{2} \left(1 + \sqrt{1 + \frac{4.36 \times 3}{18.9}}\right) \]

\[ = 23' \]

Try 40° \( \phi \)

\[ d = 8' \]

\[ S_1 = 8.3 \times 350 \]
\[ = 2,856 \text{ kFt} \]

\[ A = \frac{2.34 \times (28.3)}{0.93 \times 3.5} = 70.3 \]

\[ d = \frac{20.3}{2} \left(1 + \sqrt{1 + \frac{4.36 \times 3}{20.3}}\right) \]

\[ = \frac{27.2}{4} \]

\[ d = 17.1' \]

Use 30° \( \phi \) Piers @

10'-0" oc

embedded 12'-0"
Spacing to be determined after confirming wall strength & anchor capacity.

SECTION @ RETAINING WALL
Chimney Foundation

Chimney Seismic Loads

\[ W_e = 25 \times 150 = 3750 \text{ lb} \]

\[ W_s = 375 \times 3 = 1125 \text{ lb/ft}^2 \] (use 30% \( g \) for braced chimney, design projection \( \frac{1}{4} \) of its height)

\[ \text{Roof} = 200 \text{ lb/ft} \] (30' x 20 psf x 3 = 180)

\[ M = 110 \times 2 \times \frac{3}{2} + 200 \times 19' \]
\[ = 32 + 4 \]
\[ = 36 \text{ klf/ft} - M_o = 50 \text{ klf/ft} \]

\[ d = 24' \]
\[ b = 12 \]

\[ \frac{50}{4(24)} = 0.52 \]

\[ \text{Try } A_s = 1.6 \text{ ft}^2 \]

\[ \phi M_w = 63.6 \]

\[ \text{Try } A_s = 44 \]

\[ \phi M_w = 47 \]
Chimney w/o slab support
use piers as cantilevered posts
@ base

\[ M = 155 \times 30^{3/2} + 1.61 \times 24 \]
\[ = 280 \text{ kips} \]

Try 4' Ø Pier

\[ L = 12' \]
\[ A = \frac{7.34 \times 18.1}{1.4 \times 4} = 7.56 \]
\[ S = 1400 \]
\[ P = 155 \times 30 = 1818 \]
\[ b = 4 \]
\[ h = \frac{7.56}{15} = 0.5 \]

Try 5' Ø x 12' long

\[ A = \frac{7.34 \times 18.1}{1.4 \times 5} = 15.4 \]
\[ b = 4 \]
\[ h = \frac{15.4}{15} = 1.0 \]

5' Ø x 13' long
Chimney

\( h = 24' \)
Width \( = 3'-0" \) ave

\( W_t' = 3' \times 110 \frac{\text{lb}}{\text{ft}^2} = 330 \frac{\text{lb}}{\text{ft}^2} \)

Use 3 piers

\( T = 9' \)

\( W_c = 9' \times 330 \times 0.183 = 550 \frac{\text{lb}}{\text{ft}^2} \)

@ slab

\( M = 1.6 \times 24 + 3.5 \times 24 \times \frac{1}{2} \)
\( = 38.4 + 158.4 = 196 \text{ k-ft} \)

\( \theta = 18^\circ \)

\( A_s = 2.7 \text{ in} \)

\( V = 14.8 \text{ k} \)

\( V = 14.8 \times 24 = 26 \text{ psi} \)

Try \( d = 6' \)

\( P = \frac{196}{6 + 4} = 19.6 \text{ k} \)

\( P = 350 \times 6^2 \frac{\text{lb}}{\text{ft}^2} = 6.3 \text{ k/ft} \)

Need 3'-0" wide pier

Try \( d = 8' \)

\( P = \frac{196}{6 + 7.6} = 17.3 \text{ k} \)

\( P = 350 \times 8^2 \frac{\text{lb}}{\text{ft}^2} = 11.2 \text{ k} \)

\( \phi = 18.6^\circ \)

\( \phi = 18.6^\circ \)

Problem slab reaction too large for 3'-0" pier.
**Problem** - Area excavated for piers is too expensive and architecturally disruptive.
Bedroom

Chimney, \( h_t = 9 \) ft

Use \( w_t = 300 \text{ lb/ft}^2 \)

- \( C_p = 0.3 \)
- \( v = 90 \text{ mph} \)
- \( P = 1.6 \text{ kC} / 51 \) = 3 kC

\[ M_{ot} = 0.09 \times 8 \times \frac{1}{2} + 0.3 \times 7 \]
\[ = 2.88 + 2.1 \]
\[ = 5\text{ kC/ft} \]

\[ W_t = 8 \times 3 = 2.4 \text{ kC} \]

Try \( w = 6 \) ft

\[ M_{eso} = 2.4 \times 3 \]
\[ = 7.2 \]
\[ f_s = 1.44 \]

Use \( w = 7 \) ft
Seismic Resistance
Pre & Post Loma Prieta EQ

The capacity of the house will be based upon the capacity of the main load resisting element which is the main chimney (i.e. when the main chimney's capacity is exceeded, the structure's entire lateral system is no longer stable). The chimney's capacity will be based on working stress design of unreinforced masonry walls lateral loads associated with its own mass and a tributary section of roof framing.

Loads
DL Walls: 120 * $/ft²
Roof: 15 * $/ft²

Seismic working stress loads on Unrinf. Masonry
Rw = 6
(Masonry bearing wall)
C = 2.75

V = \frac{144 \times 2.75}{6} = 103 \text{ G}

Stresses
f_{all} = 10 \text{ psi} \quad \text{tension in flexure}\quad \text{per UBC}
\text{Type M or S mortar with special inspection}\quad \text{per Table No 24-14}
Analyze 1 wide section of main chimney & floor line.

**Roof:**
- \( A = 10' + 30' = 40' \)
- \( w = 40 \times 15 \text{ psf} = 600 \text{ kN} \)
- \( P = 600 \times 183 = 110 \text{ kN/ft} \)

**Chimney:**
- \( A = 2.5 \times 20 \)
- \( = 50 \text{ ft}^2 \)
- \( w_c = 50 \times 120 \)
- \( = 6000 \text{ kN/ft} \)
- \( P_c = 600 \times 183 = 1,100 \text{ kN} \)

\[
M_{ec} = 110 \text{ kN} \times 13' + 1,100 \text{ kN} \times 10' = 1,430 + 11,000 = 12,430 \text{ kN-m}
\]

\[
M_{res} = 6000 \text{ kN} \times 2.5/2 = 7,500 \text{ kN-m}
\]

\[
M_{net} = 12,430 - 7,500 = 4,930 \text{ kN-m}
\]
\[ f_o = \frac{4530 \times 12}{1800} = 33 \text{ psi} > 10 \text{ psi} \times 1.33 = 13.3 \text{ psi} \]

Cap = 40\% of Demand

Cracked Cond:

\[ m_o = 12,430 \text{ #ft} \]
\[ P = 6,000 \text{ in} \]
\[ e = 12,430 \times \frac{12}{6,000} = 24.9 \text{ in} \]

If chimney would rock up on its edge leading to cyclic damage and collapse in many cycles.

\[ e = \frac{24}{6} = 4'' \text{ (reaction at center #s)} \]
\[ P = 6K \]
\[ M_{max} = 24 \text{ ink} \]
\[ = 2K \text{ ft} \]

\[ e = \frac{2K \text{ ft}}{12,430 \text{ #ft}} = 16\% \text{ of demand} \]
February 26, 1991

Jose M. del Carpio
Public Assistance Officer
Office of Emergency Services
2800 Meadowview Road
Sacramento, CA  95832

RE:  FEMA - 845-DR P.A. 085-90000
     APPLICANT:  STANFORD UNIVERSITY
     SUBJECT:  HANNA HOUSE

Dear Jose:

The Hanna House has an existing DSR Number 88615. This DSR has been in your suspended file for some months waiting documentation of damage and development of a repair methodology.

This letter is to alert FEMA and OES officially that the documentation requested by FEMA from Stanford has been completed by Stanford's consultants. Be advised that copies have been delivered to Pat Dunn for FEMA's consultants and to Sam Mehta for OES review.

For file purposes, the documentation is entitled "Stanford University Hanna House, Report on the October 17, 1989 Earthquake Damage and the Proposed Earthquake Repair Scheme", prepared by Forell/Elsesser Engineers, and dated February 5, 1991. Also included is a cost estimate for the work prepared by Plant Construction Company.

As soon as FEMA and its consultants have had an opportunity to review this data, we would like to request a meeting to resolve a final DSR for this project.

I assume that FEMA will make copies of this data available to SHPO for its review.

Sincerely,

Earl Gene Kershner
Associate Director
Facilities Project Management

cc:  Pat Dunn, with 2 encl.
     Sam Mehta, with 1 encl.

bcc:  Larry Wolfson
      Rodney Johnson
      Bob Owens
      Jonathon Ryan
PI: Name: Hanna House Seismic Reconstruction
Proj. No.: 6050
Phase: Pre-Design

Prepared Date: 06 Feb 91
Printed Date: 21-Feb-91

ENR (SF BLDG) Index: 3245.04 ENR Date: 01-JAN-91
Sq. Ft. Assignable: 3548
Sq. Ft. Gross: 4487
% Net Gross: 79.07%

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<th>%</th>
<th>$/Sq.Ft.</th>
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<td>A. Basic Construction (Prime Consultant's Scope)</td>
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<td>7. General Plant Improvements Pro Rate</td>
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<td>9. Other Project Costs</td>
<td>$0</td>
<td></td>
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<tr>
<td>TOTAL WITHOUT FINANCING</td>
<td>2,832,370</td>
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<tr>
<td>10. Construction Financing</td>
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<tr>
<td>TOTAL PLUS FINANCING</td>
<td>2,832,370</td>
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</tbody>
</table>

Reviewed By: __________________________ Date: __________
Approved By: __________________________ Date: __________

* GPI Campus Pro Rate is 5.16% for Auxiliaries & Service Centers (See PO-22)

For FEMA

For Ship

Gene
Project Name: Hanna House Seismic Reconstruc  Proj #: 6050  Date: 06 Feb 91

SCHEDULE SUMMARY

<table>
<thead>
<tr>
<th>Activity</th>
<th>No of Months</th>
<th>Start Date</th>
<th>End Date</th>
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</thead>
<tbody>
<tr>
<td>1. Pre-Design</td>
<td>6</td>
<td>01 SEP 90</td>
<td>01-MAR-91</td>
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<tr>
<td>2. Schematic Design (Inc. reviews)</td>
<td>2</td>
<td>01-MAR-91</td>
<td>01-MAY-91</td>
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<tr>
<td>3. Design Develop. (Inc. Reviews)</td>
<td>2</td>
<td>01-MAY-91</td>
<td>01 JUL 91</td>
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<td>4. Construction Doc. (Inc. reviews)</td>
<td>3</td>
<td>01 JUL 91</td>
<td>01 OCT 91</td>
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<td>5. Bidding/Award</td>
<td>1</td>
<td>01 OCT 91</td>
<td>01 NOV 91</td>
</tr>
<tr>
<td>6. Construction</td>
<td>11</td>
<td>01 NOV 91</td>
<td>01 OCT 92</td>
</tr>
<tr>
<td>7. Activation</td>
<td>1</td>
<td>01 OCT 92</td>
<td>01 NOV 92</td>
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<td>8. Warranty</td>
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<td>12 01 OCT 92</td>
<td>01 OCT 93</td>
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<tr>
<td>10.</td>
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COST RISE CALCULATIONS (Compounding annually)

<table>
<thead>
<tr>
<th>DATES</th>
<th>No. Of Months</th>
<th>% per Const</th>
<th>Cost</th>
<th>Rise</th>
<th>Subtotal**</th>
<th>New Constr.</th>
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</thead>
<tbody>
<tr>
<td>From To</td>
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<td></td>
<td></td>
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<tr>
<td>01-FEB-91</td>
<td>01-NOV-91</td>
<td>9</td>
<td>0.42%</td>
<td>1750000</td>
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TOTAL COST RISE..Line 1A4, Page 1... $65,520

* Compounding annually, number of months in Col. A always 12 or less.
** Each successive Col. E total carries forward to Col. C on subsequent line.

First line in Col. C is subtotal after line 1A3 from Page 1.
3. PROFESSIONAL SERVICES

<table>
<thead>
<tr>
<th>A. Prime Consultant</th>
<th>Arch</th>
<th>Mech</th>
<th>Civil</th>
<th>Struct</th>
<th>Elect</th>
<th>Oth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Basic Fee</td>
<td>12.5%</td>
<td>x</td>
<td>175000</td>
<td></td>
<td></td>
<td>218,750</td>
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<tr>
<td>2. Reimburseable</td>
<td></td>
<td></td>
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<td>15,000</td>
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<tr>
<td>3. Additional Services</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>23,000</td>
</tr>
<tr>
<td>4. Presentation Graphics/Models</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5,000</td>
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</tbody>
</table>

Prime Consultant Total: 261,750

B. Landscape Architect (0.00% x $0) $0
C. Acoustics, Audio-Visual $0
D. Interior Designer $10,000
E. Construction/Cost Consultant $35,000
F. Safety Consultant $0
G. Asbestos Consultant $3,000
H. Survey $0
I. Soils Engineering: Design $20,000 Construct. $40,000 $60,000
J. Materials Testing $20,000
K. Balancing (Mechanical Systems) $0
L. EIR Consultant $0
M. Other Professional Services: Photogrammetry $35,000
N. Extra Prints, Reproduction Costs $19,000
O. Campus Model $0

TOTAL FOR PROFESSIONAL SERVICES: 444,750

4. ADMINISTRATIVE COSTS

<table>
<thead>
<tr>
<th>A. University Management Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PM 900.0 Hrs $86  $77,400</td>
</tr>
<tr>
<td>2. ENGR 700.0 Hrs $86  $50,200</td>
</tr>
<tr>
<td>3. CA 1200.0 Hrs $86  $103,200</td>
</tr>
<tr>
<td>4. JrPM 108.0 Hrs $54.5  $5,450</td>
</tr>
<tr>
<td>5. Stu 100.0 Hrs $20.5  $2,050</td>
</tr>
<tr>
<td>6. FP 260.0 Hrs $98  $21,450</td>
</tr>
<tr>
<td>7. UA 150.0 Hrs $100. $15,000</td>
</tr>
</tbody>
</table>

B. Med Center Plans Review: 0
C. Insurance (See PD-13): 0
D. Plan Check Fees (See PD-13, ASA, Use Permit, OSHPD, etc.): 10,000
E. Suspended Charges: 0
F. Other Admin. Costs (Archaeol. Inspections, etc.): 0

TOTAL FOR ADMINISTRATIVE COSTS: 294,750

5. ACTIVATION

| A. Moving Expense (New Occupants): 0 |
| B. IR Charges: 4 TSO’s $3 $1,500 |
| C. Keys & Locks: 1,500 |
| D. Initial Cleaning and Window Washing: 2,000 |
| E. Operations & Maintenance Startup (See PD-12): 5,000 |
| F. Dedication Ceremonies (if project funded): 5,000 |
| G. Other Activation: 0 |

TOTAL FOR ACTIVATION: 17,500
STANFORD UNIVERSITY
FACILITIES PROJECT MANAGEMENT OFFICE
PROJECT COST AND TIME SUMMARY (Back-up Sheet)

Project Name: Hanna House Seismic Reconstruc Proj #: 6050 Date: 06 Feb 91

CONSTRUCTION
1A. BASIC CONSTRUCTION (PRIME CONSULTANT’S SCOPE) $ % %/sq.ft

<table>
<thead>
<tr>
<th>Item</th>
<th>$</th>
<th>%</th>
<th>%/sq.ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Structure/Site Prep/Demolition</td>
<td>1,750,000</td>
<td>100.00%</td>
<td>$390.02</td>
</tr>
<tr>
<td>2. Exterior Walls</td>
<td>0</td>
<td>0.00%</td>
<td>$0.00</td>
</tr>
<tr>
<td>3. Roofing System</td>
<td>0</td>
<td>0.00%</td>
<td>$0.00</td>
</tr>
<tr>
<td>4. Interior Construction</td>
<td>0</td>
<td>0.00%</td>
<td>$0.00</td>
</tr>
<tr>
<td>5. Equipment in Contract</td>
<td>0</td>
<td>0.00%</td>
<td>$0.00</td>
</tr>
<tr>
<td>6. Plumbing</td>
<td>0</td>
<td>0.00%</td>
<td>$0.00</td>
</tr>
<tr>
<td>7. Fire Sprinkler &amp; Hydrant</td>
<td>0</td>
<td>0.00%</td>
<td>$0.00</td>
</tr>
<tr>
<td>8. HVAC</td>
<td>0</td>
<td>0.00%</td>
<td>$0.00</td>
</tr>
<tr>
<td>9. Electrical</td>
<td>0</td>
<td>0.00%</td>
<td>$0.00</td>
</tr>
<tr>
<td>10. Site Dev/Paving/Landscape</td>
<td>0</td>
<td>0.00%</td>
<td>$0.00</td>
</tr>
<tr>
<td>11. Site Lighting/Util/Drainage</td>
<td>0</td>
<td>0.00%</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

12. (1A1 TO 1A11) SUBTOTAL 1,750,000 100.00% $390.02

13. General & Special Conditions           0.00% 0.00% $0.00

14. Contractor’s Markup                    0.00% 0.00% $0.00

15. (1A1 TO 1A14) SUBTOTAL 1,750,000 100.00% $390.02

16. Estimating Contingency                 0 0.00% $0.00

17. TOTAL BASIC CONSTRUCTION               1,750,000 100.00% $390.02

* Use checklists for Equipment in Contract (pg. 6) and Site Work (pg. 7).

CALCULATIONS:

GRAND TOTAL (line 17 above).......................... 1,750,000

Less: Equipment in Contract (Item 5 plus proportion share of Items 13, 14 and 16)........... 0 Line 1A2, Page 1

Site work (Item 10 & 11 above plus proportion share of Items 13, 14 and 16)................. 0 Line 1A3, Page 1

TOTAL for Building 1,750,000 Line 1A1, Page 1

page 4
<table>
<thead>
<tr>
<th>CONSTRUCTION</th>
<th>$</th>
<th>$/SQ.FT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Asbestos Abatement</td>
<td>20,000</td>
<td>$4</td>
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<tr>
<td>2. Force Account</td>
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<td></td>
</tr>
<tr>
<td>a. Utility Cut-Offs &amp; Connections</td>
<td>3,000</td>
<td></td>
</tr>
<tr>
<td>b. Traffic Barricades</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>c. Fire Alarm Connections</td>
<td>2,500</td>
<td></td>
</tr>
<tr>
<td>d. Signs</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>e. Other (Including Work Orders)</td>
<td>5,000</td>
<td>11,500</td>
</tr>
<tr>
<td>3. Site Clearance (if outside architect's scope):</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>4. On-Site Utilities (if outside architect's scope):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Steam/Condensate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Chilled Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Communication Ducts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Alternate Power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Domestic Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Fire Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Sanitary Sewer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Storm Sewer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Other On-Site Utilities</td>
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</tr>
<tr>
<td>Total On-Site Utilities</td>
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<td>$0</td>
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<tr>
<td>5. Communication Systems (Wiring/Equip.)</td>
<td>5,000</td>
<td>$1</td>
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<tr>
<td>6. Not in Contract Lab Equip. Hookups</td>
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<td>$0</td>
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<tr>
<td>7. Moving (Relocation &amp; Reoccupancy)</td>
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<tr>
<td>8. Fire Extinguishers</td>
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<td>$0</td>
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<tr>
<td>9. Plaques and Signs</td>
<td>1,000</td>
<td>$0</td>
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<tr>
<td>10. Allow. 1st Year Constr. Adjust (See PD-12)</td>
<td>15,000</td>
<td>$3</td>
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<td>11. Other:</td>
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<td>$0</td>
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TOTAL FOR OTHER CONSTRUCTION | 52,500 | $12
## BUILT-IN SPECIALTIES AND EQUIPMENT CHECKLIST

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>In Contract (Architect's Scope)</th>
<th>Included in Equipment &amp; Furnishings line item</th>
<th>Included in Other Construction</th>
<th>Not required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Classroom Seating</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>Audio-Visual Equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Chalkboard and Tackboard</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Faculty/Student Mailboxes</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>Room Identifying Devices</td>
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<tr>
<td>6</td>
<td>Building Identifying Devices</td>
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</tr>
<tr>
<td>7</td>
<td>Directory and Bulletin Boards</td>
<td></td>
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<tr>
<td>8</td>
<td>Plaques</td>
<td></td>
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<tr>
<td>9</td>
<td>Lockers</td>
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<tr>
<td>10</td>
<td>Postal Specialties</td>
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<tr>
<td>11</td>
<td>Storage Shelving</td>
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<tr>
<td>12</td>
<td>Telephone Booths</td>
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<tr>
<td>13</td>
<td>Toilet and Bath Accessories</td>
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<td>14</td>
<td>Wardrobe Specialties-Coathooks</td>
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<td>15</td>
<td>Clocks</td>
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<td>16</td>
<td>Darkroom Equipment</td>
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<td>17</td>
<td>Food Service Equipment</td>
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<td>18</td>
<td>Dishwashing Equipment</td>
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<td>Refrigerated Cases</td>
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<td>20</td>
<td>Athletic Equipment</td>
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<td>21</td>
<td>Recreational Equipment</td>
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<td>Laboratory Equipment</td>
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<td>Patient Care Equipment</td>
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<td>Residential Equipment</td>
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<td>30</td>
<td>Stage Equipment</td>
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<tr>
<td>31</td>
<td>Fume Hoods</td>
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<tr>
<td>32</td>
<td>Electron Microscope</td>
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<tr>
<td>33</td>
<td>EN Chiller Units</td>
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<td>36</td>
<td>Incubators</td>
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<td>37</td>
<td>Centrifuges</td>
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<td>Freezers</td>
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<td>Ice Machines</td>
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<tr>
<td>41</td>
<td>Other:</td>
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</tr>
</tbody>
</table>

### LEGEND

- **IC**: In Contract (Architect's Scope)
- **EF**: Included in Equipment & Furnishings line item
- **OC**: Included in Other Construction
- **NR**: Not required
**SITE WORK CHECKLIST**

---

### Site Preparation

<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demolition</td>
<td>ic</td>
</tr>
<tr>
<td>Clearing</td>
<td>nr</td>
</tr>
<tr>
<td>Tree Removal</td>
<td>ic</td>
</tr>
<tr>
<td>Strip Topsoil</td>
<td>nr</td>
</tr>
<tr>
<td>Rough Grading-Cuts &amp; Fill</td>
<td>nr</td>
</tr>
<tr>
<td>Engineered Fill</td>
<td>ic</td>
</tr>
<tr>
<td>Yard Drains &amp; Inlets</td>
<td>nr</td>
</tr>
<tr>
<td>Sub-Surface Drains</td>
<td>ic</td>
</tr>
<tr>
<td>Relocation of Buildings</td>
<td>nr</td>
</tr>
<tr>
<td>Reroute./Reloc. of Exist. Utilities</td>
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</tr>
</tbody>
</table>

### On-Site Utilities

<table>
<thead>
<tr>
<th>Utility</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>Service Tunnel</td>
<td>nr</td>
</tr>
<tr>
<td>Heat Distribution</td>
<td>nr</td>
</tr>
<tr>
<td>Power Distribution</td>
<td>nr</td>
</tr>
<tr>
<td>Water (Domestic)</td>
<td>nr</td>
</tr>
<tr>
<td>Water (Fire Protection)</td>
<td>ic</td>
</tr>
<tr>
<td>Gas</td>
<td>ic</td>
</tr>
<tr>
<td>Telephone</td>
<td>nr</td>
</tr>
<tr>
<td>Signal Lines</td>
<td>nr</td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>nr</td>
</tr>
<tr>
<td>Storm Sewer</td>
<td>nr</td>
</tr>
<tr>
<td>Chilled Water</td>
<td>nr</td>
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<tr>
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**LEGEND**

- ic: In Contract (Architect's Scope)
- nr: In Other Construction
- NC: Not Required

---

*Page 7*
## Project Cost and Time Summary

**Project Name:** Hanna House Seismic Reconstruction

**Project #:** 6050  
**Date:** 06 Feb 91

### 2. Equipment & Furnishings (Not in Contract)

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**Total for Equipment and Furnishings (Not in Contract):** $\

**Note:** Estimates should include the costs as applicable of taxes, shipping, and cost rise to purchase date, plus installation costs and any contingency deemed necessary.
CONTINGENT COSTS

The following is a summary of potential costs which, although not part of the facility project budget, are real costs to the university which may be associated with undertaking a specific project. Info. on all such contingent costs should be prepared, at least in outline format. The info. should be complete by the end of schematic design, when the project budget is taken to the Trustees for approval. Separate backup detail should be prepared for each applicable item below.

A. CAPITAL COSTS

1. General Plant Improvements required by the facility. (New or upgraded systems, e.g. roads, parking, landscaping/mall development, utility distribution mains, steam/chilled water central plant):

2. Other campus support facilities, non-GPI (e.g. Food Services/Commissary, Police, Fire, parking structures):

3. Any major equipment which cannot be included in the project budget: Attach list.

4. Interim housing of building occupants, if not included in project budget:

5. Facility costs in other buildings necessitated by the program (e.g., Health Physics relocation for Encina East Wing):

6. Cost of remodeling space vacated when occupants move to new facility (if required to make old space usable for other functions):

7. Other:

CAPITAL COSTS TOTAL

B. NON-CAPITAL COSTS-ANNUAL COSTS:

1. Incremental annual operations and maintenance cost of new facility (first year): Estimate by O & M Department

2. Debt service: approx. annual cost, for ________ years.
   (Cost of financing during construction included in project budget, but long-term financing cost is borne by other University budgets subsequent to occupancy.)

3. Incremental annual support from operating budget (or other budgets) for programs expanding in the new space (salaries, supplies, etc.)

4. Other:

ANNUAL TOTAL

NON-CAPITAL COSTS-ONE TIME COSTS:

1. Dedication Ceremonies

NON-CAPITAL COSTS TOTAL

page 9
SECOND REVISION PRELIMINARY BUDGET ESTIMATE #1

DATE
February 8, 1991

PROJECT
1900148
Hanna House
Stanford University

SCOPE OF WORK


PRELIMINARY BUDGET ESTIMATE
APPROXIMATELY: $1,794,000

ALTERNATE #1

Allowances for deferred maintenance and conservation of original materials (see attached breakdown).

APPROXIMATELY: $450,000

ESTIMATE INCLUDES:

1. General requirements, including supervision, clean up, layout of the work, protection of finishes, temporary job site office, tools and equipment, temporary telephone, and permit fees.

- continued -

PLANT CONSTRUCTION COMPANY

ACCEPTED

[Signature]

[Signature]
2. Photogrammetry of three chimneys, HABS photos and an engineered photographic survey.


4. Removal of existing systems to facilitate the installation of the new structural work, including:
   - ceiling panels
   - chimneys
   - roofing
   - miscellaneous trim
   - cabinets
   - walls
   - doors and windows

5. All above materials to be stored for reuse including brick from selected locations.

6. Structural demolition as necessary for new footings and retaining walls.

7. Shoring, including:
   - existing roof structure at three chimneys and dining room door header
   - earth at new footings (temporary) and retaining walls (permanent)

8. Site clearing as necessary to install soil anchors.

9. Concrete reinforcement of west retaining wall behind soil anchors.

10. Excavation and backfill.

11. Concrete patching of existing floors adjacent to the new work and repair of slab cracks.
12. Concrete work, including:
   - formwork
   - reinforcing steel
   - finishing

13. Five new concrete piers, all 13 feet deep. We assume existing soil conditions are 1-2 feet of fill and 3-13 feet of clay or native soil.

14. Sixteen 8" x 20' DCP soil anchors. We include no provisions to penetrate existing foundation walls.

15. Asphalt patching at carport and terrace retaining wall.

16. Foundation drainage at new terrace retaining wall.

17. Landscaping allowance.


20. Rough carpentry, including blocking and backing for millwork.

21. Repair and replacement of ceilings, walls, cabinets, shelving, doors and trim at areas affected by the structural upgrade.

22. Rebuilding the main, library and bedroom fireplaces and chimneys. Fireplaces will consist of reinforced concrete faced with a brick veneer to match existing. We assume all bricks will be new and include no provisions to salvage or reuse existing bricks. All existing fireplace hardware will be reused.

23. Patching brick at soil anchors and planters and pointing cracked joints.

- continued -
24. Addition of 1/2" plywood sheathing to the existing roof diaphragm. We assume new plywood will be installed directly over existing 1" sheathing and will not require edge blocking. At locations to receive new straps and blocking, we include removal of existing 1" sheathing and patching with new plywood.

25. New built-up roofing and related galvanized sheetmetal flashings.

26. New wire glass and frames at trellises.

27. Allowances to strengthen the header above the dining room sliding doors.

28. New shearwalls at two locations.

29. An allowance for wood treatment and painting flashings.

30. Mechanical, plumbing and electrical modifications as required by the structural repair.

31. Contractor's fee, taxes and contingency.

ESTIMATE EXCLUDES:

1. Irrigation.

2. Paving for drainage of existing asphalt surfaces.

3. Architectural, engineering or other consultants' fees.

4. Relocation of any utilities either above or below grade.

5. Waterproofing of subsurface areas or dewatering.

6. Underpinning.

7. Termite or dry rot repair.

8. Any floor preparation or leveling.

9. Any work performed on an overtime and/or premium time basis.

10. Telephone, audio or computer equipment and wiring.

- continued -
11. Any work required as a result of existing historic tunnels under site.

This is a preliminary budget estimate made in advance of final plans, specifications, competitive subcontractor bids, or review by the various City agencies. It is based on present day costs and commencing the work at this time. It is intended for budgeting purposes only.

GAH:ks

cc: Naomi Miroglio
    Paul Rodler
    David G. Plant
### General

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## Description by Section

### 2050 Salvage

- **Tote for Salvage**
  - ALLOW. RENT/MAIL SALV. MATT.

### 2110 Exterior Finish Demo

- **Exterior Fin. Demo. Labor**
  - SHEATHING & ROOF JOISTS
  - NEW SHEAR WALLS
  - EXTER. TUBE STL. COLS

### 2170 Wall Demolition

- **Wall Demol. Labor**
  - REMOVE BLOCK WALL PANELS

### 2180 Ceiling Demolition

- **Ceiling Demo Labor**
  - PANELS & MAIN CHIMNEY

### 2220 Carpet Demo

- **Carpet Demo Budget**

### 2240 Tile Demolition

- **Tile Demo Labor**
  - TOILET ROOM COUNTER

### 2250 Door Demo

- **Door Demo Labor**

### 2255 Trim Demo

- **Trim Demo Labor**
  - MAIN CHIMNEY
  - LIBRARY CHIMNEY

### 2260 Cabinetry Demo

- **Cabinetry Demo Labor**

### 2290 Hard Demolition

- **Hard Demolition**
  - TERR. SLAB & RET. WALL
  - FIREPLACE SLABS
  - TUBE STL. FGTS
  - TERR. SLAB & RET. WALL
  - TERRACE SLAB & STAIRS
  - SLABS BELOW CHIMNEYS
  - FRAG. ADJACENT CHIMNEYS
### General Description

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**Total**

- **CARTAGE CHIPPED CONCRETE 12.00 CY**
- **CARTAGE CHIPPED CONCRETE 3.00 CY**
- **Haul Hand Chip Concrete 20.00 CY**
- **Haul Hand Chip Concrete 20.00 CY**
- **Haul Hand Chip Concrete 3.00 CY**
- **CARTAGE CHIPPED CONCRETE**
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- **CARTAGE CHIPPED CONCRETE**
- **BRICK/BLOCK DEMO BUDGET 5.00 LOC**
- **BRICK/BLOCK DEMO BUDGET 25.00 CY**
- **BRICK/BLOCK DEMO BUDGET 102.00 CY**
- **BRICK/BLOCK DEMO BUDGET 7.00 CY**
- **BRICK/BLOCK DEMO BUDGET 3.00 CY**
- **CARTAGE 112.00 CY**
- **CARTAGE 112.00 CY**
- **SOIL STABILIZATION 6.00 LOC**
- **SOIL STABILIZATION 16.00 LOC**
- **EARTH SHORING BUDGET 523.00 SF**
- **EARTH SHORING BUDGET 523.00 SF**
- **EARTH SHORING BUDGET 523.00 SF**
- **EARTH SHORING BUDGET 523.00 SF**
- **HAND DUG PIER BUDGET 5.00 EA**
- **SITE CLEARING BUDGET**
- **EXCAVATION 240.00 CYT**
- **EXCAVATION 240.00 CYT**
- **EXCAVATION 240.00 CYT**
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- **EXCAVATION 240.00 CYT**
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### 2540 ROCK, SAND & GRAVEL

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- **Blocking/Backing**: 227.00 LOC EDGE BLK PLY @ ROOF INFIL 11.50 LOC 11,500.
- **Nails/Staples**: 6270.00 SF RENAILING @ ROOF .18 SF 1,157.
- **Carpenter's Iron**: 6270.00 SF RENAILING @ ROOF .18 SF 1,157.
- **Interior Finish Carpentry**: 160.00 SF NEW SHEAR WALL PANELS 34.50 SF 5,520.
- **Paneling**: 90.00 REINSTALL CLG PALM.CHIM. 45.99 4,140.
- **Roofing**: 6270.00 SF 7.19 SF 45,209.
- **Wood Doors & Frames**: Adjustable Misc. Doors 1,725.
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- Glass Breakage Allow
- Reinst. T.RM Mirrors
- Repl. Allow & Trellis

### Tile

- Patch Tile & Toilet RM

### Carpet

- Reinstall Carpet
- Misc. Patching

### Paint & Wall Covering

- 1000.00 SF (N) Int. Conc. Slabs
- Wood Treatment Allow.
- 1888.00 LF Pt. Flashings

### Plumbing

- Relocations + Shutoffs
- PGE METER & TERR. RET. WL
- EXTER. MODE BIBS
- REM/REPL/BRACE WTR HTR

### HVAC Systems

- Relocations + Shutoffs
- Remove/Replace B/Vent HTR
- Modify (E) Ducts & Tunnels
- Clean Ducts
- REPL.PLUE

### Electrical Service & Dist.

- Reloc Misc. Audio Wiring
- Relocations + Shutoffs
- Conceal Epspd. Roof Wires
- Reinstl. (E) Lites @ CLGS
- 8.00 LOC Reinstall Outlets
- Misc. New Conduit & Ter. WL

### Security Systems

- Misc. Relocations

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**Grand Totals**: 1,794,013
February 11, 1991

Jonathan Ryan
Facilities Project Management
855 Serra Street, 2nd Floor
Stanford University
Stanford, CA 94305-6114

Dear Jonathan:

We are pleased to submit the final report for the Hanna House which was prepared under contract number FC - 6362 signed in September, 1990. This report provides the recommendations for seismic repair of the Hanna House and additional recommendations for long term conservation of the building. It is the result of the efforts of all the team members assembled to work on the project.

We have enjoyed working together with you on this report and look forward to beginning the next phase of the project.

Sincerely,

Stephen J. Farneth, AIA

Martin Weil

SJF/tf
HANNA HOUSE

RECOMMENDATIONS FOR SEISMIC REPAIR
and
CONSERVATION OF HISTORIC FEATURES

Prepared for:
Facilities Project Management
Stanford University
Stanford, California 94305

Prepared by:

Martin Eli Weil
Restoration Architect
2175 Cambridge Street
Los Angeles, California 90006

Architectural Resources Group
Pier 9, The Embarcadero
San Francisco, California 94111

February, 1991
# TABLE OF CONTENTS

**HANNA HOUSE**

Recommendations for Seismic Repair and Conservation of Historic Features.

**TABLE OF CONTENTS**

**LETTER OF TRANSMITTAL**

**INTRODUCTION**

- Methodology ................................................................. 2
- Executive Summary ........................................................ 3
- Administrative Data ...................................................... 5
- Landmark Status .......................................................... 5

**HISTORICAL BACKGROUND**

- Introduction ................................................................... 9
- Design and Construction 1935-1937 ................................ 9
- Periods of Modification 1937-1975 ................................. 10
- Period of Stanford Occupancy 1975-1990 ....................... 14

**EXISTING CONDITIONS SUMMARY**

- Seismic Damage .......................................................... 17
- Deferred Maintenance .................................................. 19
- Ongoing Occupant Use ................................................ 20

**CONSERVATION OBJECTIVES**

- Introduction ................................................................... 23
- Proposed Goals for Ownership ...................................... 23
- Proposed Conservation Standards ................................. 24
# Table of Contents

## General Considerations for Implementation of Work
- Protection of the House and Site .......................................................... 59
- Storage and Protection of Original Materials during Construction .......... 59
- Identification of Architectural Elements and Materials ................................ 59

## Repair and Conservation of Historic Features
- Introduction ........................................................................................................ 61
- Exterior Building Elements
  - Terrace Walls ................................................................................................. 63
  - Terrace Paving ............................................................................................... 67
  - Walls .................................................................................................................. 70
  - Doors/Windows ............................................................................................... 79
  - Eave/Fascia ...................................................................................................... 85
  - Roof .................................................................................................................. 87
  - Planters Contiguous to the Building ............................................................... 89
- Interior Building Elements
  - Floors ............................................................................................................... 93
  - Walls .................................................................................................................. 96
  - Chimneys ......................................................................................................... 98
  - Ceiling .............................................................................................................. 103
  - Casework ......................................................................................................... 105
  - Fixtures and Equipment .................................................................................. 108

## Conservation Cost Estimate ........................................................................... 113

## Appendix
- Cost Estimate Worksheet
- National Register Nomination
INTRODUCTION

On October 17, 1989, the Loma Prieta Earthquake damaged the Ilanna House which at that time served as the residence of the Stanford University Provost. As a result of the 1989 earthquake the occupants of the house moved out of the house, the cracked chimney in the living room was shored with heavy timbers and the University embarked on a program to repair the house. Stanford assembled a team to determine the factors that contributed to the seismic damage, evaluate the condition of the structure as the result of the earthquake, and prepare recommendations for the seismic repair. The purpose of this report is to provide Stanford University with the results of the work that has been performed by the team of consultants.

TEAM MEMBERS

The team assembled by Stanford University to work on the Ilanna-Honeycomb House include the following:

Project Manager:
Jonathan Ryan
Facilities Management
Stanford University

Architects:
Architectural Resources Group
Pier 9, The Embarcadero
San Francisco, CA 94611

Partner-in-Charge, Stephen Farneth
Project Manager, Naomi Miroglio

Martin Eli Weil
Restoration Architect
2175 Cambridge Street
Los Angeles, CA 90006-4236

Structural Engineer:
Forell/Elsesser Engineers, Inc.
539 Bryant Street
San Francisco, CA 94107-1270
Partner-in-Charge, Eric Elsesser
Project Manager, Paul Rodler

Geotechnical Engineer:
J.V. Lowney and Associates
145 Addison Avenue
Palo Alto, CA 94301

Mechanical Engineer:
William Mah, P.E.
410 Townsend Street, Suite 40
San Francisco, CA 941107
METHODOLOGY

With the completion of the geotechnical report and the structural investigation, it was evident to the team that the primary thrust of the proposed project was to repair the seismic damage to the house and return the residence to its condition at the time of the earthquake. While the focus of the proposed project was primarily the seismic rehabilitation work that would prolong the life of the house and render it habitable the project also involves substantive conservation issues. When it became apparent that the seismic structural repairs would in fact impact almost every type of material and architectural detail found in the house, garage and terrace, it was decided that the architectural study would have to include conservation guidelines that would ultimately be applicable to the rest of these structures. As a result this report includes not only the specific recommendations for each area affected by the structural repairs, but also includes more general recommendations that are pertinent to the conservation of the rest of the house.

The approach that the team has developed for the seismic repair of the house includes the following priority of work:

1. The house should be repaired so that it is habitable and safe for occupancy.

2. The seismic repair work should correct any injury that has occurred to the house, correct conditions that permitted the present damage and prevent substantive harm in the future.
3. The repair must meet the Stanford University performance goal which is to prevent collapse while allowing minor structural damage for an earthquake of a magnitude of 7.0 to 7.5.

4. The repair work should be carried out in a manner that will minimize demolition of original details of the house and not compromise the integrity of the original architectural members that remain.

5. The repair work should be designed so that the live oak trees and the Monterey cypress tree adjacent to the seismic damage will not be adversely affected by the seismic repairs.

6. The seismic repair work should be cost effective and appropriate to the level of work required to preserve the architectural integrity of the house.

EXECUTIVE SUMMARY

By the time the Loma Prieta Earthquake subsided on October 17, 1989, the Hanna-Honeycomb House, designed by Frank Lloyd Wright for Paul and Jean Hanna in 1937, had been seriously damaged. The fireplaces in the living room and the library were cracked at the base, terrace walls had rotated and cracked, the soil had settled causing the concrete terrace paving and interior floors to crack and doors, windows, and walls to move and become distorted.

The examination of the house and the historical documents concerning the construction and evolution of the house revealed that most of the damage could be traced to three major factors:

1. The architectural detailing that Wright had used was as innovative as the design of the house. In many cases, such as the 2-3/4" thick exterior and interior wall panels, the design was unconventional. Not only did Wright's walls look unlike the walls used in standard construction, they also performed in a different manner. In this case the walls provided no shear strength to brace the roof as would have occurred in a conventionally built structure.

2. Many of the features in the house such as the brick chimneys, terrace walls and the roof were under-designed to meet the stresses caused by a major earthquake. The brick chimneys had no footings and were minimally reinforced. The terrace walls were built without footings and inadequate steel reinforcing in the concrete wall. The brick veneer was not tied to the concrete wall. The roof framing system was constructed with no lateral support.
except for the three brick chimneys. At the exterior faces of the
house, the walls provide virtually no lateral support to the edge of
the roof.

3. When the house was constructed, it was located on the side
of a hill using inadequately reinforced retaining walls to hold
back the fill on which the house was built. When the fill was
brought in, it was not properly compacted. During the
earthquake the uncompacted soil settled and caused cracking and
movement in the house and on the terraces.

The Structural Engineers have designed a seismic repair scheme
made up of six distinct components that will provide for the
repair of the house and ensure that the house will sustain
substantially less damage in any subsequent earthquake. These
measures include:

1. Rebuilding the chimneys using appropriately designed
footings and reinforced brick masonry.

2. Repair of the terrace walls including new footings and the use
of soil anchors to stabilize existing walls where new footings will
not be built.

3. Installation of a roof diaphragm, blocking and collectors to
provide a complete lateral load resisting system.

4. Installation of five cantilevered lateral bracing members to
reinforce the roof.

5. Installation of two shear wall panels to provide lateral bracing
where cantilevered lateral bracing members cannot be used.

6. Rebuilding the Garage retaining wall.

The proposed work will cause substantial modification to the
architectural and structural integrity of the Hanna House as well
as the adjacent architectural, mechanical, electrical and landscape
features that will be impacted by the work. Due to the
cultural/historical importance of the Hanna-Honeycomb House,
its listing on the National Register of Historic Places and its
designation as a National Landmark, the proposed work must be
carried out in a manner that meets the accepted procedures for the
conservation of an historic structure. In spite of these
precautions, there will be a substantial loss of original materials.
This includes the three brick chimneys, the concrete floors
adjacent to the chimneys, concrete terrace paving on the living
room terrace and a portion of the living room terrace wall.
ADMINISTRATIVE DATA

The Board of Trustees of the Leland Stanford Junior University
The Board of Trustees of the Leland Stanford Junior University

is the owner of the Hanna House. The Board has the

responsibility for planning and implementing all work on the

house and the site and assuring that this work is carried out

within the framework of the goals and objectives of the

University.

The Hanna House Board of Governors
The Hanna House Board of Governors are appointed by the

Board of Trustees. It is the responsibility of the Board of

Governors to review significant changes to the use and care of

the buildings and grounds that constitute the Hanna House

complex.

Federal Emergency Management Administration
The Federal Emergency Management Administration provides

funds to repair the damage to the Hanna House that was caused

by the Loma Prieta Earthquake. The FEMA guidelines provide

that restorative work must be done through repairs or replacement

to restore an eligible facility on the basis of its pre-design and

current applicable standards.

Stanford has chosen to use the Uniform Building Code as its

current applicable standard and can also use the State Historical

Building Code since the Hanna House is designated as a National

Landmark and is listed on the national Register of Historic

Places.

All work funded by the Federal Emergency Management
Administration must be reviewed and approved by the State

Historic Preservation Office to ensure that no federal funds will

be used to adversely affect a building listed on the National

Register of Historic Places or a National Landmark.

State Office of Historic Preservation
The State Historic Preservation Officer is the senior staff member

of the State Office of Historic Preservation, Department of Park

and Recreation. The State Historic Preservation Officer is

responsible for reviewing all projects involving buildings listed

on the National Register of Historic Places where federal funds

are used.

LANDMARK STATUS

National Register of Historic Places
The National Register of Historic Places is the official list of the

National cultural resources worthy of preservation. All

nominations to the National Register are made through the State

Historic Preservation Officer.

In 1977 Paul Hanna prepared the forms to nominate the Hanna

Honeycomb House to the National Register of Historic Places.

Although the State Historic Preservation Officer signed off on the

nomination form on November 11, 1977, the property was not

placed on the National Register of Historic Places until June 19,

1989. The provision of Section 106 of the National Historic

Preservation Act of 1966, requires that all federal agencies

consider the effects of their activities on historic properties that

are listed on the National Register of Historic Places. The
proposed use of federal funds administered by the Federal Emergency Management Agency for the repair of seismic damage to the Hanna House, is a situation where Section 106 of the Act applies. In this case the State Office of Historic Preservation has been assigned the role of reviewing the proposed work to ensure that federal funds will not be used to diminish the architectural/historical/culture integrity of the house.

National Historic Landmarks
The Hanna-Honeycomb House was designated as a National Landmark in 1989. National Landmarks include all historic areas in the National Park System along with those private properties listed on the National Register of Historic Places which are considered to be of national significance.

American Institute of Architects Citation
In 1960 the Frank Lloyd Wright Memorial Committee of the American Institute of Architects elected the Hanna House and sixteen other buildings designed by Wright for special notice at a special event honoring Wright at their annual convention. The Hannas received a plaque with the following inscription: "This structure designated by the American Institute of Architects as one of the 17 American Building designed by Frank Lloyd Wright to be retained is an example of his architectural contribution to American culture." In addition a set of photostatic copies of the original plans were made from the original drawings at Taliesin and deposited in the AIA archives. This citation by the American Institute of Architects does not convey any rights to the organization concerning the care of the house.
HISTORICAL BACKGROUND

INTRODUCTION

The historical information on the house is based primarily on historical material found in Frank Lloyd Wright's Hanna House: The Clients Report, Second Edition, by Paul R. and Jean S. Hanna, examination of original construction and subsequent remodelling plans for the house and a review of photographs in the Hanna Archives. While there is a fairly good sense of the evolution of the house through the 1960's, the Hanna's book does not provide much information about the appearance of their house in the decade before they moved out in 1975. Except for the roof replacement in 1977 that is recorded in the book, there is little account of changes made by the University and the occupants during the period of 1975 to the present.

DESIGN AND CONSTRUCTION 1935 - 1937

From the time that Paul and Jean Hanna married in 1926, they began to plan for the day when they would build a home for themselves. They had initially been influenced by the tenets of modern architecture developed by the Bauhaus movement, however, after attending a lecture given by Frank Lloyd Wright in 1930, reading his book Modern Architecture and meeting with him in New York and at Taliesin, they decided that someday when they built a house it would be designed by Mr. Wright based on his philosophy of organic architecture. Upon being offered a position by Stanford University in 1935, they commissioned Frank
Lloyd Wright to design a house that would be built on land owned by the university. The house was to be designed according to a set of eleven principles they had established with the architect.

During his visit to Palo Alto, Wright talked about his notion of utilizing the hexagon in architecture, however, the Hannas were not prepared when the first sketches for their new home arrived. Upon reviewing the plans they found that Wright had designed a house for them that was a major departure from his earlier work. The project he proposed for the Hannas was a house using a hexagonal module. All rooms in the house would be formed by 120 degree and 60 degree angles.

After intensive work with the architect, considerable delay and without a complete set of plans and specifications, work began on construction of the house in January 1937 under the direction of Harold Turner the contractor. Working with Mr. Turner were a group of craftsmen who had never worked on a building that was so unorthodox in design or detailing. At various critical points within the construction process, the working drawings were insufficient or arrived after the work had been initiated. Through the fortitudes of the Hannas, the contractor and the workmen, the house was habitable by late 1937.

PERIODS OF MODIFICATION 1937-1975

During the thirty-eight years that the Hannas lived in their home, they carried out modifications to their home as the
circumstances of the family changed. The major changes were always made only after consultation with Frank Lloyd Wright. While the general appearance of the house and site continued to follow the precedents set by the initial work, the new features often are representative of the period in which they were added to the residence.

The first major change to the site involved the construction of a wing adjacent to the carport that contained guest quarters and a hobby shop. The design plans for the wing were prepared by Frank Lloyd Wright at Taliesin. The construction drawings and supervision of the construction were undertaken by Jack Seward who worked for the local architectural firm of Spencer and Ambrose. The cost of the new wing was $22,250.00. As the result of being built on the peak of the hill the addition did not suffer significant seismic damage during the 1989 earthquake.

In 1952 the Hannas built the driveway and parking area on the west side of the house. Frank Lloyd Wright designed the brick retaining wall and concrete steps that join the parking area to the west terrace. On the interior of their home, the Hannas covered the new wood ceilings in the living room and original dining room with saguran, a fabric that they had found in Manilla.

In 1953 the original linen Klearflax rugs were replaced with Wooturf carpeting. In the living room and entry the carpet was laid in the same configuration as the original rugs allowing a border of the scored concrete floor around the perimeter of the room.
With the departure of their three children, the Hannas began to consider remodeling the house to serve their needs as a couple. In 1956 they wrote to Frank Lloyd Wright to ask his help in planning the remodeling. The work that was carried out during 1957 replaced the four bedrooms, library and three bathrooms with an interconnected library, guest room and master bedroom, powder room, utility bath and enlarged master bathroom. The playroom was modified to serve as the new dining room.

In conjunction with the changes in room configuration and use, the following alterations were made to the house:

**Entry:**
1. Entry closet was replaced by double doors to the kitchen.

**Dining Room:**
1. Carpeting was laid on the concrete.
2. Aeroshades on sliding screens were added to the windows.
3. Glass doors were added to shelves to form enclosed cabinets.

**Library:**
1. Fireplace was built.
2. Built-in couch was remodeled.
3. Bookshelves were built.
4. Two desks were constructed with a marra wood top supported by filing cabinets.
**Master Bedroom:**
1. Fireplace was built
2. Wall to wall carpet was laid.

**Ceilings:**
1. Saguran cloth was applied to all the ceilings in the house other than the living room and original dining room which were covered in 1952.

**Living Room Terrace:**
1. New footings were installed under the retaining wall.
2. The Terrace paving was jacked up.

In 1957, the planters adjacent to the dining room terrace were rebuilt. Prior to 1960, Mr. Hanna modified a planter box on the living room terrace into a fish pool, transforming three plowshare dishes into drip dishes.

In 1960 the Hanna's decided to build the summer house, pools and cascade that Frank Lloyd Wright had designed in 1936 but which had not been built. William Wesley Peters, the senior architect of Taliesin Associates, refined the design prior to construction.

As the Hanna's grew older they became concerned about the future of the residence that they had built, nurtured and enjoyed. They finally decided that they would like to give the site to Stanford University for use as a "residence of a distinguished visiting university professor".
In December 1966, they donated 20 per cent interest in the house to Stanford. In 1969 a 25 percent donation was made. In 1971 another 25 was given to the university. The final 30 percent was given to Stanford on February 21, 1974 despite the fact that a $500,000 endowment for the care of the house and a separate one million dollar endowment for a visiting professor program had not been funded. At that time the Board of Governors of the Hanna House was established.

In October 1975, Mr. and Mrs. Hanna moved out of their cherished home and settled nearby in a condominium on the Stanford Campus.

PERIOD OF STANFORD OCCUPANCY 1975-1990

Since there were no funds for visiting professors program, the University decided to use the Hanna House as the home of the University Provost on an interim basis until the endowment programs had been funded. In 1990 Nissan Motor Corporation donated $500,000 to Stanford for remodeling the Hobby Shop into a caretakers apartment, the caretaker's salary for improvements and maintenance of the house. Plans were prepared by Taliesin Associates for the work but it was not carried out.

Major changes known to have been made to the house and gardens since 1975 include the installation of a new roof covering in 1977, replacement of the saguran fabric on the ceiling of the living room with grasscloth and refinishing the...
wood walls with a polyurethane or an alkyd varnish in 1981. The date of the installation of the aluminum window frames with tinted glass and altering the shelves in the library have not been determined. The swimming pool was added in 1987. Minor changes to the building include the installation of surface mounted wiring for a sound system, new appliances and new furnaces. For the last twelve years Erik Upmanis has been retained on an annual basis to treat the wood on the exterior of the house with a clear water repellent wood preservative. (See Architectural Section in Appendix for further information on the treatment of the wood.) In addition, the nursery firm of Mayne Tree Service has been retained to care for the oak trees and the Monterey cypress on the grounds. (See Landscape Section)

On October 1989, the Loma Prieta earthquake caused considerable damage to the Hanna House. As the result of the initial inspection the occupants moved out of the house, the fireplace in the living room was braced with heavy timbers and Stanford University embarked on a program to evaluate the condition of the house, prepare plans to repair the seismic damage, and to carry out the necessary construction. By the end of 1990 the evaluation of the condition of the structures and the site has been completed and the recommendations for repair of the seismic damage has been prepared.
EXISTING CONDITIONS SUMMARY

SEISMIC DAMAGE

The damage that was sustained by the house and carport during the Loma Prieta earthquake include the following major items:

1. The fireplace in the living room was cracked in various areas. The damage to the fireplace was exacerbated by the lack of an appropriate footing, the absence of adequate steel reinforcing in the brick walls of the chimney and the fact that the house was built on uncompacted soil.

2. The fireplace in the library was cracked. The damage can be attributed to the absence of adequate steel reinforcing in the brick masonry above the foundation.

3. The fireplace in the Owner's bedroom has no visible cracks, however, the structural engineer believes it is a hazard because it has no footing and inadequate steel reinforcing. He recommends that it be rebuilt in order to become a reliable part of the proposed lateral load resisting system.

4. Floors in the living room and dining room cracked when the uncompacted soil moved.

5. Partition walls were displaced.

6. Certain windows, doors and cabinets in the house and carport are no longer aligned due to the movement of walls.
7. Terrace walls, in the living room and dining room terraces rotated, cracked and in one area, the brick veneer broke loose and crumbled.

8. The poured concrete terrace paving and steps cracked due to soil settlement.

9. Brick planter walls adjacent to the living room terrace cracked.

The seismic damage was exacerbated by the following pre-existing conditions of the house.

1. The brick chimneys were constructed of inadequately reinforced brick masonry.

2. The brick chimneys were not constructed with spread footings.

3. The walls of the house were not constructed with spread footings.

4. The terrace walls were not constructed with spread footings.

5. The major portion of the house was constructed on uncompacted fill that was held in place by terrace walls which did not have spread footings.
6. The house has no lateral load resisting system except for the unreinforced brick chimneys due to the fact that the thin wood batten walls have no shear capacity.

DEFERRED MAINTENANCE

The Hanna House like many of the Frank Lloyd Wright structures requires a significant maintenance program in order to deal with the unusual problems arising out of the special design choices, materials and detailing that were used to create the residence. From examination of the structures and the grounds it is apparent that Stanford has attempted to provide the type of maintenance commensurate with the cultural value, scale and use of the site. Yet, it is apparent that in many cases there has been deferred maintenance or inappropriate repairs to the house due to the unconventional nature of many of the problems that have developed. Some of the following issues appear to go back to the period when the Hannas occupied the house.

1. Many of the wood details on the exterior of the house have dried out and shrunk over the years. Rather than replace original members, gaps have been filled with various types of sealants.

2. Exterior wood details subject to excessive sunlight or water have become bleached and weathered. Some have been painted.

3. The surface of the interior woodwork is dull and there are nicks and scratches.
4. The finish of the hardware particularly on the exterior have become deteriorated.

5. The drainage system on the living room and dining room terraces have never completely resolved the problem by the fact that the terrace floors were not sloped when they were built.

6. The base of the oak trees adjacent to the living room terrace have been covered with earth.

7. Lighting fixtures and wiring have been added to the exterior of the house.

8. The terrace walls have been repaired with poor quality workmanship.

9. Floors have cracked due to settlement of the uncompacted fill.

ONGOING OCCUPANT USE

In order to provide facilities for a sound system throughout portions of the house, wiring was surface mounted on walls and ceilings and the cupboards in the entry were modified for large speakers. The book shelves have been altered in the library.
CONSERVATION OBJECTIVES

INTRODUCTION

The life of the Hanna House has not been static. After the house was constructed in 1937, the Hannas embarked on a lifelong relationship with their home. The care and attention that they gave to furnishing, landscaping and renovating their residence appears to have been an important aspect of their lives. The Hannas held Frank Lloyd Wright in high regard and continued to keep him involved in the evolution of their home. As they reached the end of their tenure as owners of the house they worked conscientiously to ensure that the special place that they and Frank Lloyd Wright had created would be preserved. Their gift of the Honeycomb House to Stanford University was a witness to their faith that the stewardship they had maintained for thirty-eight years would be honored by the institution that had been a major component in their life and the special place that they had built.

The gift of the house to Stanford in 1974 and the Hanna's move to a new residence in 1975, marked the end of the unique relationship between the Hanna's, Frank Lloyd Wright and the Honeycomb House. The changes and modifications that had been carried out during their occupancy embody the evolution of the Hanna's lifestyle and aesthetic judgement, the maturation of Frank Lloyd Wright's design sensibility and the changes in popular taste and design between 1937 and 1975.

During the fifteen years since the Hannas moved out of the Honeycomb House, Stanford University has maintained the buildings and the grounds in the manner in which they were received. There have been some changes to the site, but in general they have not altered the integrity of the house or the landscape. As the result of the earthquake, significant changes will be wrought on the house. It is therefore timely that the University consider not only the impact that the seismic repair will have on the house that the Hanna's built, but on the long range goals for maintaining the unique character of the site and the manner in which these goals will be implemented.

In order to assist the Board of Trustees of Leland Stanford Junior University and the Hanna House Board of Governors in setting goals for the use and care of the Hanna House, the following proposed goals and standards are listed below for their review and consideration.

PROPOSED GOALS FOR OWNERSHIP AND UTILIZATION OF THE HANNA HOUSE

1. The Hanna House including the house and grounds will be held in perpetuity by the Trustees of the Leland Stanford Junior University.

2. The main house and garage will continue to be used as a residence.

3. The Hobby house will be used for purposes compatible to the residential characteristics on the site.
PROPOSED CONSERVATION STANDARDS

PRESERVATION

1. The Hanna House, including the site and the structures, is a unique architectural monument created by the architectural genius of Frank Lloyd Wright and the lifelong stewardship of Jean and Paul Hanna.

2. The site and structures will be preserved in its present evolutionary state recognizing the culture and historical value of the original structure built in 1937, the modifications made in 1950 and 1957 and the other changes made by the Hannas up to 1975 when they moved out of the house.

3. No part of the site and/or the structures will be restored to a period earlier than its evolutionary state in 1975.

4. Consideration will be given to removing modifications that have been made to the house between 1975 and 1990 and restoring details that were known to have existed in 1975.

5. Changes or additions that are required by the occupants of the site and buildings should be provided in a manner that does not significantly alter the appearance or condition of the site and structures.

6. Acknowledgement is made of the unique design details and construction practices which have caused ongoing deterioration to the site and the structures.

7. Recognition is given to the fact that due to the unique design of the Hanna House, certain repair and maintenance procedures may have to be more invasive than normal to preserve the visual integrity of the whole building.

8. Priority will be given to retention of existing historic materials in a deteriorated state until they can no longer function properly.

9. In order to correct seismic damage, priority will be given to solutions that preserve the material integrity of the evolutionary character of the site and structures up to 1975.

10. When original features must be removed to correct seismic damage or original unique design details and original construction practices, priority will be given to procedures that permit the feature to be moved intact or dismantled and reassembled after the repair work has been completed.

11. When an architectural feature cannot be moved intact or dismantled and reassembled, the new feature should be reconstructed matching the 1975 configuration, size, material, color and texture of the detail that was replaced.

12. All work proposed for the site and structures will be subject to review by the Hanna House Board of Governors.

13. The work on the site and structure will be in compliance with the Secretary of the Interior's Standards for Preservation Projects.
14. Maintenance records will be kept on all work carried out on the site and structures.

15. All work on the site and structures will be documented through the use of photo documentation, measured drawings and written narrative.

16. Copies of all written and iconographic material associated with the work on the site and structures shall be placed in the Hanna House archives.
STRUCTURAL SECTION

INTRODUCTION

This section describes the post Loma Prieta earthquake condition of the Hanna House. The Loma Prieta earthquake caused damage to several parts of the building and especially to the two large brick chimneys diminishing the seismic resistance of the structure. Portions of the roof are now endangered resulting in the evacuation of the house and the installation of shoring. Several remedial measures which comply with current applicable standards of safety have been considered. The requirement of providing a complete lateral load carrying system which can be installed without compromising the historic nature of the building leads to a recommended scheme presented below.

SOILS CONDITION

The existing soil conditions under the house are described by the Geotechnical Investigation by J.V. Lowney and Associates dated September 7, 1990. A layer of poorly compacted fill described in that report was used to level the site. The fill varies in thickness and reaches a maximum of 9" at the north terrace (the fill thickness profile is shown on Figure A)

EARTHQUAKE DAMAGE

Structural damage to the Hanna House was concentrated around the main fireplace and chimney, the library fireplace and chimney and several areas of wood wall framing, the dining room and living room retaining walls, and the carport retaining wall, and the slab-on-grade.

The main chimney was cracked near the floor line and the entire chimney has rotated slightly. Several bricks at the chimney corners were crushed or displaced. This chimney supports a significant portion of the roof so shoring has been installed to prevent collapse.

The library chimney also shows cracking around its perimeter just above the hearth level. This indicated over stresses during the 1989 earthquake and a loss of lateral load carrying capacity. This chimney also vertically supports a large portion of the roof structure.

A portion of the front brick retaining wall near the north end of the house rotated and lost its brick facing. This allowed the fill soil to settle under the patio and under the house at the living room. This ground movement has caused both vertical and horizontal movements of the slab on grade resulting in cracks at steps and within the hexagon slab pattern.

Non-structural elements were also damaged. Soil settlements caused cracking of the planter walls near the entrance and cracking of the concrete steps leading to the terraces. Partitions, doors, windows and cabinets were affected by racking of the flexible wood framing and by soil settlement in the living room area. A partition wall in the garage had buckled and now has a bowed shape. A large urn located near the driveway fell from its pedestal.
APPLICATION CODES AND DESIGN CRITERIA

The repair of this building should attempt to meet two general goals. First, the seismic resistance of the structure must be restored to a level which can adequately protect the life safety of the occupants. Second, the structural repairs and modifications should be done in a cost effective manner with as little impact on the historic architectural features of this building as possible. Several building codes and published design guidelines have been consulted while developing the design criteria to be used for this project.

FEMA guidelines define permanent work as "that restorative work that must be done through repairs or replacement to restore an eligible facility on the basis of its pre-disaster design and current applicable standards." It also states that "if an applicant is willing to adopt a standard, either of its own development or based upon a national standard, FEMA will apply that standard to the restoration of the damaged facility." These statements require adherence to the building code requirements and design guidelines provided by the local jurisdiction. In this case, Stanford University has developed an approach which is based on the current Uniform Building Code (UBC).

The State Historical Building Code also provided guidelines which could be applied to this structure. Chapter eight of this code states: "A complete, continuous and adequate stress path, including connections, from every part or portion of the structure to the ground shall be provided for the required horizontal forces." The horizontal force required by this code for the upgrade of existing buildings is not explicitly defined but is left up to the local jurisdiction, which in this situation would be the 1988 UBC.

The Stanford performance goal is to prevent collapse, while allowing minor structural damage and moderate non-structural damage under a Richter Magnitude 7.0 to 7.5 earthquake on the Peninsula section of the San Andreas Fault. The method prescribed for meeting this goal is to apply the UBC 1988 lateral loads to the structure which must be provided with a complete lateral load resisting system. Compliance with detail requirements of the code which apply to new buildings is not always possible in an economically feasible restoration program. However, new elements added to the structure would be detailed to meet the code requirements and the overall strength and stiffness of the restored structure would be sufficient to resist the code prescribed seismic forces and drift limitations.

For all construction work, Stanford University must legally comply with the by-laws and regulations of Santa Clara County. The building code applicable for work in Santa Clara County is the 1988 edition of the Uniform Building Code (UBC) [1]. The 1988 UBC prohibits the use of brittle (non-ductile) lateral load resisting elements such as unreinforced masonry and promotes the use of well-detailed structures.

In order to reinstate the strength and stiffness of the building to: (i) its pre-1989 earthquake condition; (ii) to meet the minimum seismic requirements of Santa Clara County (the current applicable code); and (iii) to satisfy the requirements in the FEMA guidelines and the State Historical Building Code, the minimum strength of the repaired Hanna House is the design base shear
specified by the 1988 UBC. Furthermore, a complete lateral load resisting system must also be provided, in so far as practical.

EXISTING LATERAL FORCE RESISTING SYSTEM

The Hanna House does not have a formal lateral load resisting system. The walls in this house are flexible and incapable of resisting lateral loads because they are made with non-standard 1 x 8 studs and battens which are not well attached to the slab. The flexible wood framing is inadequately tied to the chimneys which are the primary elements capable of resisting lateral loads. Damage to these elements during the Loma Prieta earthquake indicate that the building’s capacity is now even lower than the inadequate pre-earthquake condition.

The main chimney was the most substantial and rigid lateral load resisting element before it was damaged by the earthquake. The cracking and rotation of the base of the chimney indicated that the current lateral load resistant capacity is significantly diminished.

The library chimney was also a rigid lateral load resisting element damaged by the earthquake. Although the signs of damage are less severe than in the main chimney, cracking all the way around the perimeter and displacement of bricks at the corners indicate that the mortar bond is severed and the lateral load capacity is also significantly diminished.

The third chimney in the bedroom is also a significant element in the lateral load resisting system. No cracking or other damage was noted after the Loma Prieta earthquake. Although this chimney has maintained its pre-earthquake capacity, a larger earthquake, or one of the same magnitude with a longer duration, could exceed the capacity of this unreinforced masonry element.

The pre-Loma Prieta earthquake capacity of this structure has been estimated at 7.3% which is only 40% of the force level suggested by the 1988 UBC for masonry structures. The earthquake damaged chimneys no longer have any flexural strength which reduces their ability to resist lateral forces by 40% to 3%g. The current capacity is therefore approximately 16% of the code required level.

REMEDIAL MEASURES

Several techniques could be used to repair the Hanna House and provide an adequate level of seismic resistance (see the applicable codes and design criteria section above). The options available and our recommendations are listed below. These recommendations are based on information gathered visually and by review of original design drawings. A testing program has been developed to verify foundation configurations and reinforcement locations. The results of this testing program may lead to a modification of the recommended repair techniques listed below for the bedroom chimney and the living room retaining wall.

1. Rebuild the main, library and bedroom chimneys. All three chimneys are rigid parts of the lateral force resisting system. The main and library chimneys are cracked and require rebuilding to current building standards. Although the bedroom chimney is not cracked, it should be rebuilt in order to become a reliable part of the lateral load resisting system. These three chimney
elements form the basic load path which is required by all applicable codes and guidelines referenced above.

The recommended rebuilding technique for the chimneys is to shore the roof and dismantle the chimneys which would be rebuilt with a new reinforced concrete foundation and vertical reinforced core. The original bricks, or specially made replacement bricks, would be built up as facing, restoring the original appearance. Anchorage for the roof framing to provide the necessary load path could easily be provided within this work.

Core drilling the chimneys to provide new grouted reinforcing bars was considered but is not recommended because a variety of construction problems make this option less desirable. The main problem with core drilling is that the required foundation work would be done with the chimney in place resulting in a very large excavation with extensive shoring and underpinning. Also, mounting a drill rig over these chimneys would require elaborate scaffolding and roof reinforcement, and water from the drilling operation would be difficult to contain. Finally, providing anchorage for roof support members would cause significant sections of the chimneys to be dismantled even with the core drilled reinforcing technique.

A testing program has been developed to verify our assumption that insufficient reinforcing steel exists in the library chimney which is a more recent addition to the house. The recommended rebuilding of that chimney may be modified if significant amounts of reinforcing are found.

2. Anchor the roof to the chimneys and add a plywood roof diaphragm. The recommended approach is to anchor all roof beams which are supported on the chimneys, add blocking and ties to create collector lines and add a new 1/2" plywood layer to the roof to provide an adequate diaphragm. This work is required for any solution which could be considered "a complete lateral load resisting system".

3. Provide lateral resistance for unrestrained portions of the roof diaphragms. The addition of new lateral load resisting elements is required to provide a complete system to provide resistance for the roof diaphragms away from the chimneys. Each section of the multi-level roof must be anchored sufficiently to prevent lateral movements and rotation under seismic loading. The recommended lateral force resisting system is a combination of new plywood shear walls and vertical cantilevered steel posts anchored to concrete foundations.

It is structurally feasible to use shear wall elements exclusively. However, various architectural features such as folding doors, windows, clear-story windows and very thin wall elements would be compromised by extensive use of plywood shear walls. The combined shear wall and cantilever post layout shown on Figure S1 utilizes shear walls where possible and posts in the architecturally sensitive brace locations.

4. Repair the front retaining wall. The only feasible option for repair of the north end of the retaining wall supporting the living room terrace which was damaged by the Loma Prieta earthquake is replacement with a new brick faced concrete wall. Soil under the house would be temporarily stabilized with shoring until new
fill can be compacted behind the new wall and a new patio slab cast-in-place. The balance of the front retaining wall along the living room and the dining room terrace must be stabilized to prevent down slope movement of the soil under the house. The most economic solution which is also sensitive to the historic preservation goals of the project is to install soil anchors through the existing walls.

Test pits will be excavated near the dining room terrace to verify that the foundation is configured as shown on the original plans. If a more substantial footing than is expected or a second wall footing at the building line is found, soil anchors at this terrace wall would not be necessary.

Other techniques for stabilizing the fill under the house were considered and found to be either more expensive or not feasible. These options include removal and recompacktion of the fill which would require that much of the house be shored or dismantled. This option was dismissed as too expensive and architecturally disruptive. Soil grouting was also considered but is not technically feasible with the clay soil used as fill.

5. Repair the garage retaining wall. This wall failed during the Loma Prieta earthquake and now has a noticeable bowed shape. It must be removed and replaced with a new wall and foundation which will conform to current design requirements.

6. Repair and strengthen the dining room flitch plate. Soil movement in this area has caused the dining room doors not to operate properly. We recommend reworking and reinforcing these supporting members.

**SUMMARY AND CONCLUSIONS**

The Hanna House can be repaired and a complete lateral load resisting system installed by completing the recommended work noted above. Repair of damaged elements includes the three main chimneys, the front retaining wall and the garage retaining wall. The balance of the structural work involves installing a complete lateral load resisting system. Roof ties, blocking and the new plywood roof diaphragm could be hidden within the ceiling spaces. The new steel posts could be hidden within existing closets and storage spaces. New plywood shear walls would create slightly thicker wall sandwiches and require some modifications. However, locating these walls in unobtrusive locations would mitigate the architectural impact.

The work noted above is recommended to meet the FEMA and Stanford design guidelines which call for repair of damaged elements and installation of a complete lateral load resisting system. The elements of this solution attempt to meet these safety goals while respecting the historic value of Frank Lloyd Wright's architectural design.
REFERENCES


HANNA HOUSE STANFORD
EXISTING CONDITION PLAN
FIGURE A

FORELL/ELSESSER
ENGINEERS, INC.
Structural Engineers
515 Bryant St. • San Francisco, CA 94107-2209
(415) 956-8100
ARCHITECTURAL SECTION

INTRODUCTION

The seismic repair scheme for the Hanna House will involve the implementation of six distinct components: three rebuilt chimneys and footings, terrace wall repair, roof diaphragm and blocking, cantilevered columns and footings, shear walls, and carport retaining wall repair. While each of the six components of the structural repair scheme has significant affect on the primary architectural or structural element involved there will also be extensive impact on all of the architectural elements that are adjacent to each of the primary architectural features. For example, when the main chimney is rebuilt there will be an impact on the adjacent concrete floor, walls, ceiling, roof framing, roof covering and mechanical and electrical systems which must be protected in place or removed and rebuilt in conjunction with the new fireplace.

In addition to the damage caused by the earthquake, Hanna House also suffers from a broad range of deterioration that is the result of constructing the house on uncompacted soil, unique design features that do not conform to standard construction practices, deferred maintenance, and ill considered maintenance and alterations. The rectification of these issues impact features in the house that were also damaged by the earthquake as well as those areas which were left unscathed.

The purpose of the Architectural Section is to provide an overview of the architectural implications of the proposed seismic repair scheme and the particular conservation issues that are evident in the house. The comprehensive report on each of the architectural exterior and interior building elements has been placed in the Repair and Conservation of Historic Features Section.

OUTLINE SCOPE OF WORK

The following is an outline of the scope of work for the installation of the new structural repair scheme, the repair of earthquake damage and related conservation work for each building element.

Documentation
Prior to carrying out the work, all impacted elements should be documented according to HABS/HAER Standards which include photo documentation and measured drawings.

Terrace Walls
New Structural Work
1. Remove existing brick at each soil anchor location and reinstall over recessed anchor with new mortar to match the existing. Remove and rebuild concrete paving and contiguous brick planters along length of terrace wall for installation of concrete pilasters and grade beam for soil anchor system.

Repair of Earthquake Damage
1. Reconstruct earthquake damaged northern portion of the terrace wall to match the original.
2. Repoint earthquake cracked mortar joints.
3. Replace earthquake cracked bricks with new brick to match the existing.

Conservation of Building Materials
1. Repoint deteriorated mortar joints.

Terrace Paving
New Structural Work
1. Remove dining room terrace paving for installation of concrete pilasters and grade beam for soil anchor system.

Repair of Earthquake Damage
1. Remove earthquake damaged living room terrace paving and steps and rebuild to match the original.

Conservation of Building Materials
1. Repair concrete cracks.

Exterior Walls
New Structural Work
1. Label, dismantle, modify as required and reassemble exterior wood walls in their original location for installation of the following components of the structural system:
  • Chimneys
  • Shear Walls
  • Cantilevered Columns and Footings
  • Roof Diaphragm and Blocking

Repair of Earthquake Damage
1. Repair displaced walls.

Conservation of Building Materials
1. Replace metal screws with brass screws to match the original.
2. Replace deteriorated caulk.
3. Treat wood.

Windows and Doors
New Structural Work
1. Label, dismantle and reassemble windows in their original location for installation of the following components of the structural system:
  • Chimneys
  • Shear Wall
  • Roof Diaphragm and Blocking

Repair of Earthquake Damage
1. Repair windows and doors which are out of alignment.
2. Retain and stabilize living room terrace doors.
3. Repair of the deflected flitch plate over the dining room windows and doors may require that they be modified.

Conservation of Building Materials
1. Replace deteriorated wood members which are no longer performing effectively with new wood to match the original.
2. Remove sealant and install new weatherseal at window glazing.
3. Refinish hardware.
4. Treat wood.
Eave/Fascia
New Structural Work
1. Label, dismantle, modify as required and reassemble eave and fascia boards in their original location for installation of the following components of the structural system:
   - Chimneys
   - Shear Walls

Repair of Earthquake Damage
1. Repair of the deflected flitch plate over the dining room windows and doors may require modification of the existing eave and fascia.

Conservation of Building Materials
1. Repair open joints.
2. Treat wood.

Roof
New Structural Work
1. Remove existing roofing and flashing for installation of the following components of the structural system:
   - Chimneys
   - Shear Walls
   - Cantilevered Columns and Footings
   - Roof Diaphragm and Blocking

Repair of Earthquake Damage
1. Repair deflected flitch plate over dining room windows and doors.

Planters Contiguous to the Building
New Structural Work
1. Remove existing brick and reinstall in new mortar to match the existing for installation of the following components of the structural system:
   - Shear Walls
   - Cantilevered Columns and Footings
   - Garage Retaining Wall

Repair of Earthquake Damage
1. Reconstruct the earthquake damaged planter walls to match the original wall.
2. Repoint earthquake cracked mortar joints.
3. Replace earthquake cracked bricks with new bricks to match the existing.

Conservation of Building Materials
1. Repoint deteriorated mortar joints.

Floors
New Structural Work
1. Sawcut, remove and rebuild the concrete flooring to match the existing for installation of the following components of the structural system:
   - Chimneys
   - Cantilevered Columns and Footings

Repair of Earthquake Damage
1. Retain earthquake damaged floor and repair cracks.
Conservation of Building Materials
1. Refinish floors.

Interior Walls
New Structural Work
1. Label, dismantle and reassemble interior wood walls in their original location for installation of the following component of the structural system:
   • Chimneys
2. Protect interior walls in place for installation of the following component of the structural system:
   • Cantilevered Columns and Footings

Repair of Earthquake Damage
1. Repair displaced walls.

Conservation of Building Materials
1. Refinish wood.

Chimneys
New Structural Work
1. Remove the three existing chimneys.
2. Remove adjacent architectural elements which tie into chimneys:
   • Floors, Interior and Exterior Walls, Windows, Ceiling, Casework, Fixtures and Equipment, Eaves/Fascias, Roofing and Flashings
3. Rebuild the chimneys with new brick and mortar to match the existing.

Ceilings
New Structural Work
1. Label, dismantle and reassemble ceilings in their original location for installation of the following components of the structural system:
   • Chimneys
   • Cantilevered Columns and Footings

Conservation of Building Materials
1. Replace grasscloth wallpaper with saguran cloth.

Casework
New Structural Work
1. Dismantle intact and reinstall casework in their original location for installation of the following component of the structural system:
   • Chimneys

Repair of Earthquake Damage
1. Repair doors and drawers which are out of alignment.

Conservation of Building Materials
1. Refinish wood.

Fixtures and Equipment
New Structural Work
1. Label, dismantle and reassemble ceiling light fixtures in their original location for installation of the three chimneys.
2. Remove and reinstall kitchen stove and hood for installation of the main chimney.
Conservation of Building Materials
1. Replace existing plastic lenses in ceiling light fixtures with glass lenses to match the original.
2. Refinish wood.
MECHANICAL SECTION

INTRODUCTION

This section summarizes the impact of the structural damage to the mechanical systems as observed by the mechanical engineer during a site visit on October 14, 1990. The mechanical systems included the heating system and plumbing.

EXISTING CONDITIONS

The heating system was originally installed in 1937 by the Electrogas Furnace and Manufacturing Co. of San Francisco. The original system used a single gas-fired, forced warm air furnace. The heating air is distributed by three separate ducts in order to provide three individual zones.

Zone 1 includes the living room, entry, library, and kitchen. Zone 2 is the play room. Zone 3 serves the bedrooms and bathrooms. The ducts are located below the floor inside a narrow service tunnel. The supply air registers are located in the walls near the floor.

The single furnace has been replaced with three smaller individual furnaces. Each serves a single zone. The furnaces were manufactured by Ruud (Model UGGD-10NC-JR, 100,000 input BTUH). The units were not dated, however, installation appears to have been within the past 5 or 6 years. The furnaces should last another 12 to 15 years if properly maintained.

The connections to the existing ductwork were accomplished with new ductwork and a new return air plenum. Aside from these new duct connections, the remainder of the system is the original ductwork.

The water heater was manufactured by Hoyt (Model 75,54.6 GPH recovery rate, 75 gallon storage, 65,000 input BTUH). Those portions of the copper water piping that were examined appear to be in good condition.

It was noted that some of the threaded joints in the steel gas piping in the mechanical room were coated with a sealant. This may have been repair work. A slight whiff of natural gas odorant was detected, indicating a very small leak still exists.

To improve the seismic requirements for the mechanical equipment it is recommended that the gas flex tubing connections to the furnaces and water heater be extended to allow greater movement. The water heater should be braced.

After the reconstruction work is completed, the interior of the ductwork should be cleaned with blowers and vacuum cleaners.

IMPACT OF REPAIRS OF SEISMIC DAMAGE

This is a summary of the impact on the mechanical systems due to the proposed seismic repairs.

Main Fireplace - The rebuilding of the main fireplace and chimney in the living room will impact the heating system since the supply air outlets were built into the fireplace walls. These
outlets need to be rebuilt during the reconstruction. In addition, the combustion flues for the water heater and furnaces as well as the flue for the kitchen stove are located inside the chimney and need to be incorporated into the reconstruction.

**Tunnel -** Excavations for the footings for the main and library foundations will impact the existing mechanical ducts located in the utility tunnel. These ducts should be removed and replaced following completion of the chimneys.

**Cantilevered Columns/New Footings -** The excavation for the footing of the steel column in the guest room may impact the existing return air duct located beneath the dining room couch. This existing duct would need to be removed for excavation of the footing and a new duct installed following completion of the structural work. This duct should be relocated as required to connect with the existing return air grille built into the couch.
ELECTRICAL SECTION

EXISTING BUILDING SYSTEMS

Electrical Service and Power System:
The existing service and meter is located in an electrical closet located on the exterior east wall of the hobby shop behind the kitchen. From this location, the entire complex is served with a 200 AMP service at 120/240V, 1 Phase, 2 Wire. Refer to Single Line Diagram on attached SK-1. The main Hanna House is served by a 60 AMP/2-Pole disconnect switch terminating to a 60 AMP main fuse box and a 24 circuit panel located in the kitchen.

The hobby shop is served by three panels located in the same service closet. The other loads such as the swimming pool, fountain and irrigation system are served by a 100 AMP-pole disconnect switch and an exterior panel located west of the hobby shop.

There are exposed power cables in closets that are not stapled tight to walls and might be unsafe and hazardous if tripped or pulled.

With the exception of the panel in the main house, all existing electrical equipment is fairly new and made from present manufacturing standards. The existing panel in the main house is old and antiquated but can still be used and kept in place for the existing load. The only drawback is that replacement parts might be difficult to find later for ease of maintenance.

Lighting System:
The existing interior lighting systems primarily utilized incandescent lamps with the fixtures recessed and architecturally designed with the ceiling. In most rooms, fluorescent cove lighting is predominant as additional supplemental lighting.

The exterior lighting under soffits is provided by recessed incandescent fixtures with drop opal lenses, square in shape with soft curves at the corners. In certain areas, the drop lens is in the way of the terrace door swing due to the low soffit ceiling. Also, exterior bullet type fixtures are used in some areas and are also mounted on trees. These fixtures are connected with exposed cables that are draped over the roof and trees. This installation is unsafe and possibly hazardous.

Receptacles:
Most receptacles are two-prong ungrounded type with brass plates except in the kitchen and bathrooms where receptacles are three-prong ground type. All devices are brown finish except for a receptacle in the library that is on a surface raceway and is ivory finish.

Telephone, Security Alarm, Audio/Speaker and Cable TV Systems:
The telephone system service is located in an exterior service closet with the electric service equipment. The entire facility is served from this point. Security Alarm System main control panel is located in a closet near the main entry door with a keypad mounted on the exterior wall of the closet. Motion detectors are strategically located in the entire house to detect entry at any location.
The Audio/Speaker System is set up with the amplifier located in the library and speakers are located in the loft over the kitchen and in the cove in the master bedroom. Controls are wired in the same locations.

The cable TV system is fed at outlets in the TV room and kitchen.

The exposed signal cables are all over the house with pigtailed and terminations specifically located in the kitchen, library shelves and head wall at master bedroom.

Miscellaneous Equipment such as fountain pump, swimming pool and irrigation systems.

The electrical equipment serving the fountain pump, swimming pool equipment and irrigation systems has been installed fairly recently and is adequate for the capacity. As previously noted and shown on drawing sheet SKE-1 the panel is a weatherproof type located on the southeast corner of hobby shop.

IMPACT OF REPAIRS OF SEISMIC DAMAGE

Terrace walls:
Replace broken conduits and wiring for landscaping lighting damaged by the earthquake along the north front terrace wall.

Fireplace and Chimney Reconstruction
Main Fireplace - Remove existing receptacles (total of 5) in built-in couch and walls around main fireplace including kitchen.
Replace the 2-prong ungrounded receptacles with 3-prong grounded type and reinstall with existing brass cover plate. Also, remove and reinstall one (1) wall mounted lighting fixture over the kitchen door from the entry. Remove and reinstall all signal and communication wires and cables running at kitchen work desk, south end of kitchen.

Library Fireplace - No electrical system affected.

Bedroom Fireplace - Remove and reinstall two (2) receptacles, one exterior and one inside bedroom next to wardrobe that are affected by this repair work.

Foundation work affecting utility tunnel due to new footings:
Based on our visual observation, the electrical system running inside the tunnel is in conduit except for telephone wiring. The system in conduit can remain in place and be maintained during excavation and construction of the new footings. The exposed telephone wiring should be removed and replaced after work is done.

Roof Diaphragm:
Exposed wiring on roof for exterior lighting shall be removed. The wiring should be replaced with a concealed wiring in the roof framing prior to the installation of the roof diaphragm. The exposed wiring on the trees should be replaced with appropriate cables that are suited for use in exposed exterior areas and stapled on the trees. This work occurs in the north and south terraces where there are exterior lighting on trees.
LONG TERM ELECTRICAL RECOMMENDATIONS

The following recommendations are related to the long term use of the building and are not a part of the seismic repair work.

**Electrical Service and Distribution System:**
It is assumed that the existing system will remain as it is unless any load such as exterior lighting is added to the house. The new circuits should be connected to the panel serving the fountain pump, irrigation system and swimming pool.

For future added load in the main house, it is recommended that the existing 24-circuit panel be replaced with a 30-circuit panel, reusing existing panel enclosure to maintain the original installation. Likewise, the existing 60 Amp fuse main shall be increased to 100 Amp fuse main and feeder wires from the main service equipment replaced with existing conduit being reused.

**Lighting System:**
Existing interior fixtures shall remain. Relamp all burned-out incandescent or fluorescent lamps.

Exterior soffit fixture with opal drop lens will be replaced with a recessed lens to clear door swing.

Exposed wiring on the trees throughout the site for exterior lighting should be rewired in conduit or liquid-tight cables.

Landscaping fixtures that are broken at their stem will be replaced and reinstalled to original condition.

**Receptacles:**
Replace all 2-prong ungrounded receptacles with 3-prong grounded type, brown finish with the existing brass cover plate reused. Receptacles within 6 feet of sinks in kitchen and in toilets will be replaced with ground fault interrupter (GFI) types. These recommendations are safety and code requirements.

**Signal Systems:**
Existing signal systems to remain except all exposed wiring and cables to be concealed for aesthetic and safety reasons.

**Fountain Pump, Swimming Pool Equipment and Irrigation Systems:**
All existing equipment and wiring to remain since all are in good condition and installed in conformance to code.
NOTE: RECOMMENDATION FOR FUTURE LOAD IN MAIN HOUSE IS TO REPLACE 60 AMP/2 POLE MAIN DISCONNECT SWITCH AND PANEL TO A NEW 100 AMP/2 POLE MAIN WITH ADDITIONAL CIRCUITS IN NEW 100 AMP PANEL.
LANDSCAPE SECTION

INTRODUCTION

The garden and grounds surrounding the Hanna House date back to the late 1930's when the house was built. Subsequent additions to the house and the garden have necessitated alterations to the landscape in the 1950's and 60's. The present requirements for seismic repair and/or reconstruction will also require changes to the grounds, especially in relation to the major oak trees (Quercus lobata) near the house and the large Monterey cypress (Cupressus macrocarpa) in the breezeway.

The intent of this report and its recommendations is to ensure that the garden and landscape are maintained as nearly as possible in the appearance during the period of the 1960's and 70's when the garden matured and its design complimented the house and the lifestyle of the Hanna family. There should be no attempt to redesign the garden so that its character and appearance are noticeably altered. However, there may be minor changes due to structural modifications to the damaged retaining walls, to ensure the longevity of the major trees and to correctly prune overgrown shrubs.

This report, then, focuses first on evaluating the present condition of the garden, especially the five trees (one Monterey Cypress and four Valley Oaks) surrounding the house. Second, the report evaluates the impacts of the options proposed to reconstruct or renovate the house, garage and retaining walls which were damaged in the October 1989 earthquake. Finally, the report makes recommendations for techniques to be used during the process of reconstruction to preserve and protect these trees. The latter will include some maintenance procedures. However, detailed maintenance guidelines will be included in a separate report to be prepared at a later time. It must be emphasized that the health and continued life of these trees is not only contingent on care during the reconstruction process but also on sound long-term maintenance including some minor redesign to the areas beneath the trees. It is imperative that the Landscape Management Report be accomplished as soon as possible so that certain critical procedures can be implemented as soon as possible.

SITE HISTORY

Prior to constructing the house in 1937, the site consisted of a grassy knoll dotted with native Valley Oaks and one lone Monterey Cypress. This tree had been planted by persons unknown or possibly as a volunteer seedling planted by birds. This natural oak savanna was typical of the landscape of the Stanford lands. The trees were spaced well apart due to limited available moisture, cattle grazing, and occasional grass fires. The force of the prevailing westerly wind is evident in the lean of the trees to the east.

This landscape typifies the Mediterranean type climate of the region. Vegetation depends upon the limited precipitation of winter rains stored in the clayey soil and in underground aquifers.

After the flush of growth in the spring and early summer, soil moisture is depleted, grasses die and the trees go into a summer
dormant period. During this period oaks are particularly susceptible to increased soil moisture especially near their trunks. Fortunately the soil on this site is well drained and relatively fertile as evident in the relatively good health of the trees.

The siting of the house by Frank Lloyd Wright and the development of the garden dominated by irrigated lawn was typical of the work of both architects and landscape architects in California earlier in this century. Little was known about the impact of construction and lawn irrigation on oaks and other trees at that time. For its time, the house is sited sensitively taking advantage of the shade and bold sculptural qualities of the trees. Only one small oak was removed which was located “in the center of the living room-to-be, a sickly tree without potential” (Hanna, 1981).

The cypress stood where the breezeway was to be built. Despite gloomy predictions that this “large, bark-beetle infested tree would soon die”, Wright designed the breezeway and steps around the tree in an attempt to preserve it. This required cutting away four vertical feet of soil on three sides of the tree and the removal of a substantial portion of the root system, perhaps as much as 60-70%. Evidence of what was a very large buttress root on the south side of the tree can be seen today. After over 50 years it is even more remarkable that this tree has survived.

Construction of the house, its surrounding pavement and terrace walls have had similar impacts on the Valley Oaks in three locations. The living room terrace and its retaining wall (which was severely damaged in the 1989 earthquake) were built within a few feet of two large oaks. Approximately half of their root systems was covered by the terrace and house. Irrigated lawn was installed below the trees and the grade of the lawn appears to have been raised about 12” or more above the original grade.

The long bedroom wing was built very close to another large Valley Oak at the south end. A concrete terrace was built very close to the tree leaving very little soil space around the trunk. There is evidence that the grade was raised around the trunk and filled with rock. Three large trapezoidal openings are filled with pebbles surrounding a triangular sculpture pad, in the terrace, therefore most of the root system of this tree is covered by building and pavement.

Above the rear patio on top of the knoll is another Valley Oak. A portion of the root system was removed when the building pad was excavated, retaining walls built and the waterfall and pool installed. A small lawn surrounds the eastern side of the tree although it has been held several feet back from the trunk.

The garden is planted very simply with introduced (exotic) plants, without any attempt to create a native or natural garden. The garden is typical of the 1950’s and 60’s in that the simple plant palette of juniper and ivy surrounding the lawn with few flowers creates a lush effect that is both functional and decorative, providing a rich green setting for the red brick house and simple backdrop for outdoor activities.
EXISTING CONDITIONS

CYPRUS TREE

Despite spending 50 years contained in a high brick walled planting space, the tree is in surprisingly good health and in stable condition. This is largely due, no doubt, to the expert care given it by Mayne Tree Service. It appears to suffer from Cypress Bark Canker disease which commonly affects cypress planted inland, away from its preferred coastal habitat. Spraying for the bark beetle and regular fertilization has kept the tree from declining.

The lack of root space prevents the tree from growing actively and, thus, is in a stable, but stagnant state. It can be maintained in this way for some time, perhaps 10-15 years. Eventually it will decline and die. There is no way to ascertain when that might happen. Nevertheless, due to its size and important relationship to the house, every effort should be made to keep the tree as long as possible.

The brick retaining wall on the south side is bowed outward, no doubt due to pressure from the root system. This is further evidence that the tree needs more root space.

VALLEY OAKS

North Terrace

The two trees below the high brick retaining wall are in only fair condition. This is no doubt due to a combination of detrimental factors including 50 years of buried roots beneath the terrace and house, raised grade below the walk, summer irrigation for the lawn and the presence of water mold fungi and oak root fungus at the base, (due to summer irrigation and the raised grade).

Fortunately, the trees have been well-maintained by Mayne Tree Service through a program of pruning, spraying for oak moth caterpillars and for pit scale, and for attempting to keep the basal area dry by installing wooden boxes.

The proximity of the tree to the damaged brick wall is of great concern. One tree is actually resting on the wall and both hang over the terrace considerably. Both trees are within three feet of the base of the wall which will make repair and/or reconstruction difficult.

South Terrace

This Valley Oak at the end of the bedroom wing is by far the most magnificent and significant tree on the property. Its long tortuous limbs are typical of the species and form a great spreading canopy to shade the house and terrace. One large limb has been propped with a steel post which is essential to support that portion of the tree. An appropriate number of guy wires have been installed in the tree to support other limbs.

In general the tree is in excellent condition despite the coverage of most of the root system with the house and pavement. There is evidence that the grade has been raised as much as two feet around the trunk. Such a raise in grade almost always results in destruction of the bark and cambium layer (growth tissue) which slowly kills a tree.
Patio Tree
The Valley Oak which sits above the ornamental pool and waterfall is in fairly good condition despite the loss of a substantial portion of its root system during past grading and construction activities. However, the irrigated lawn is detrimental to the long-term health of the tree, even though the area around the trunk is barren of grass.

The tree has evidence of Oak Mildew disease scattered all through its new foliage. This may be due to poor timing of an ammonium based fertilizer in the spring or to a relationship between a fluke of weather and other fertilizer timing.

Tree at Driveway
This tree is in relatively weak condition due to asphalt pavement covering much of its root system and to the grade having been raised around the trunk on the uphill side. Although this tree is outside the influence of reconstruction work, it nevertheless is a significant tree and should not be ignored. Specific recommendations to help improve its health will be included in the Landscape Management Report.

OLIVE TREES (across parking lot below house)
These trees form a valuable screen between Hanna House and the immediate neighbors. The trees are in fair condition due to an apparent infection of Verticillium Wilt causing dieback of upper branches. This disease does not generally kill trees. But, because of the importance of these trees as a buffer screen, their care should not be ignored. Specific recommendations for both treatment of the disease and replanting will be included in the Landscape Management Report.

MISCELLANEOUS PLANTS
The entire garden is in fairly good condition but the juniper along the west side are overgrown. Careful thinning is needed to renew their growth and to reduce their size and massiveness. Recommendations for this work and for other aspects of the garden such as the lawn will be made in the Landscape Management Report.

IMPACTS OF REPAIRS OF SEISMIC DAMAGE
There are two places where proposed structural changes will have a direct impact on the trees and landscape. The Cypress tree in the raised brick planting bed and the two Valley Oaks below the north terrace wall. The following discussion evaluates the likely impact of the various proposed structural solutions and makes recommendation to minimize the effects of seismic repair or reconstruction on the trees. Recommendation for other landscape changes and maintenance not related to the seismic upgrade will be included in the Landscape Management Report.

CYPRESS TREE PLANTER
New Structural Work
The proposed reconstruction of the retaining wall along the garage side of the tree should have only a moderate impact on the tree depending on the manner in which excavation and reconstruction is accomplished. The roots of the tree certainly fill
the planting bed and are no doubt matted against the retaining walls. The root space for this tree is so small that removal of a significant portion of roots would seriously affect the health and longevity of the tree. This means that little or no excavation in the rootball is possible. Further, enlargement of the root space by reconstructing the outer, bowed wall a foot or so further from the trunk would greatly enhance the longevity of the tree.

Once the existing wall at the carport is removed, the extent and condition of the rootball can be determined. It is expected that most of the roots occur in the top two to three feet of soil because that is where air and moisture are present. (The greatest percentage of roots normally occur in the top 18-24" of soil for most trees). Therefore, the greatest impact to the root system most likely will be from the new wall rather than the footing.

The new wall will entail construction of wood forming that will require space now occupied by tree roots and soil. This will necessitate excavation of 6-8" into the root zone to accommodate the forming wood. Such excavation could be seriously detrimental to the tree. I cannot be certain that shaving off of even 3-6" of roots won't hurt the tree. Some minor root pruning should stimulate new root growth, however, and could help invigorate the tree once new backfill soil is added.

Since the rootball and soil volume is probably very dense, it may be possible to form only the outer side of the wall and footing, thereby reducing or eliminating the need for excavation. If this is feasible, the root and soil mass should be covered with a sheet of plywood to provide a smooth surface to pour against and to protect the roots from fresh concrete which is very calcareous.

**Recommendations**

1. All demolition and grading work should be done by hand. If significant large roots over 1" in diameter are encountered while excavating for the footing, it may be necessary to bridge the root or roots with a pier and grade beam type of footing. The landscape architect or consulting arborist should be consulted for a recommendation before proceeding with work if large roots are encountered.

2. Maximum excavation for the inner wall forms should be 6". Such excavation should be done by hand very carefully so as to disturb the roots and soil as little as possible. Fine matted roots should be cut or shaved off using a sharp spade or mattock. The soil should be relatively moist, not dry.

3. If elimination of the inner form is possible, a maximum of 2" of excavation should be done, just enough to accommodate the thickness of the wall and plywood shoring.

4. If a drainline is uncovered during excavation, it should be replaced with the same type of drainage system.

5. The exposed roots should be covered with burlap and kept wet every day until the new wall is built. If that becomes an extended period, plywood sheets should be installed and a backfill mix placed between the roots and the plywood.
OAKS AT NORTH TERRACE

New Structural Work
Of the two options being considered for the high retaining wall, Option #2 will have the most detrimental impact on the trees. Therefore, it is strongly urged that Option #1 be employed and coordinated with the structural seismic repair work.

1. Option #1 - Soil Anchors:
This option appears to require little work on the outside of the wall and no excavation. If so, there should be no adverse impact on the trees other than that possible damage from workmen and their equipment as they work around the trees. The trees should be protected from damage to the bark, surface roots and any branches. Otherwise this solution, if feasible, is the most desirable technique for repairing the wall.

2. Option #2 - Rebuilt Wall:
The excavation and footing required for this option will have a major impact on the two oaks. The spread footing extending four feet out from the wall will necessitate removal of both trees if installed as shown in detail 8/S4 on the structural drawings.

An alternative is to use a pier and grade beam footing to bridge over the base of the one tree and any large buttress roots or roots over 4" diameter of both trees. All demolition and grading must be done by hand to prevent damage to the root systems and the trunks.

For either option overhead limbs must be protected from damage by construction equipment so that limbs are not broken or the bark damaged. The rebuilt wall should be designed to accommodate the leaning trunk of the closest tree and the large limb of the other. A pipe support should be incorporated into the wall to ensure continued stability of this tree and limb. A temporary support is necessary for the leaning tree closest to the wall.

Also for either option, the grade at the base of both trees (outside the wood boxes) should be lowered to original grade thereby eliminating the need for the boxes. This new grade should slope downward to provide positive drainage away from the wall and the trunks. The lawn and its irrigation system should be removed out to the dripline of these trees.

Recommendations
1. It is recommended that Option #1 be employed to stabilize the retaining wall with the least impact on the trees.

2. If Option #2 is used, a pier and grade beam footing must be used to bridge buttress roots and any other large roots over 4" diameter.

3. Drilling for piers should be done only in locations where no roots exist as determined by probing down to the required depth using a small diameter steel rod.

4. All excavation should be done by hand including drilling holes for the piers. When large diameter roots (over 2" diameter) are encountered, they should be left undisturbed until either the landscape architect or consulting arborist can inspect the excavation and recommend how to proceed.
5. Any roots which must be cut are to be cut using a pruning saw (over 1" diameter) or loppers (under 1" diameter).

6. For either of the seismic repair options, the following measures must be employed to protect the trunks and root systems.
   a. Trunks should be wrapped with wire and lathe snow fencing to 8' above grade. Three wraps of such fencing tied to itself and the trees will serve as efficient protection for the trunks to prevent damage during wall demolition and reconstruction.
   b. An 8" thick layer of wood chips should be laid over all areas beneath the trees where equipment and workers will be located. This material should be added as often as necessary to maintain an 8" thick layer to cushion the impact of men and equipment and to prevent soil compaction.
   c. Any low overhead limbs which might be damaged by equipment should be wrapped with 3" thick foam rubber secured with duct tape.

7. The leaning tree closest to the wall should be supported by a prop or props during demolition and reconstruction of the wall. The exact method should be determined in consultation with the landscape architect or consulting arborist prior to beginning demolition work.

8. Four inch galvanized steel posts with caps (similar to that supporting the limb of the tree at the south end of the house) should be incorporated into the new wall and/or terrace to support the leaning tree and the large overhanging limb of the larger tree.

9. After all structural work is completed, the wooden boxes around the base of these trees are to be removed, and the soil is to be excavated at least 12" deep in all directions around the trunks to reach the original grade or large flaring buttress roots. After such excavation the consulting arborist should inspect the roots and remove the patches of oak root fungus from infected places on the trunk or roots.

10. The soil should be graded so that the surface slopes smoothly away from the base of the trees toward the existing lawn to achieve positive drainage.

11. The lawn and irrigation system should be removed from within the dripline of these trees. A revised planting plan will be included in the Landscape Management Report.

The details for such supports will be provided by the landscape architect prior to reconstruction of the wall.
The preliminary cost summary below includes the structural, architectural, mechanical, electrical and landscape costs related to the seismic repair of the Hanna House. (Refer to the Appendix for the detailed cost estimate worksheet.)

**BREAKDOWN**

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GENERAL CONSIDERATIONS FOR IMPLEMENTATION OF WORK
GENERAL CONSIDERATIONS FOR IMPLEMENTATION OF WORK

PROTECTION OF THE HOUSE AND SITE

During the work that is projected to correct seismic damage to the house almost every section of the garage and house interior and exterior will be impacted. Particular consideration needs to be given to the protection and care to those portions of the house where work will be carried out. Due to its unique design, use of materials and methods of construction the house is extremely fragile. Whereas buildings using conventional construction can withstand the normal wear and tear of the construction process, the materials and finishes used on the Hanna House cannot. They can be easily damaged with no opportunity to conceal the corrective work if it is carried out.

On the grounds of the house the hardscape features such as the concrete terraces, paving, and the brick walls cannot be easily repaired. The four oak trees and the Monterey cypress are extremely vulnerable to damage due to the proximity of the roof systems through the branches of the construction. No loss of roofs, trunks and branches is acceptable.

Included in the construction package, will be specific instructions for providing the care and protection not only for the house, but also for the grounds in general and specific architectural details and landscape features.

STORAGE AND PROTECTION OF MATERIALS DURING CONSTRUCTION

In order to execute much of the work to repair the seismic damage to the house and garage it will be necessary to dismantle a variety of brick, wood, glass, and fiberboard, architectural features, hardware and casework. Some details can be disassembled into a number of small units. Other items such as doors, windows and casework will be removed intact. Some of the items, such as the built-in living room couch are extremely large. In general, these items are fragile or have fragile finishes that require that they be stored in weather tight, clean, and secure storage buildings. The issue of security will be important since a number of these architectural elements have considerable monetary value apart from their cultural value. There is a ready market for certain individual items. All features removed from the house need to stored in a manner that will allow for easy identification and retrieval for reinstallation. The order in which features will be removed is not necessarily the order in which they are reinstalled.

IDENTIFICATION OF ARCHITECTURAL ELEMENTS AND MATERIALS

All architectural features in the house and garage which are to be dismantled will be identified and keyed to plans and elevations to insure reinstallation in their original location. The manner and materials which are used to identify the dismantled features must fulfill certain requirements. The markings must survive the storage and retrieval procedure. The markings will be reversible and not cause damage to the element. The identification must be easily read in order to facilitate storage and retrieval.
REPAIR AND CONSERVATION OF HISTORIC FEATURES

INTRODUCTION

The work of this section addresses the impact of the proposed structural repair system on the original features of the building. Recommendations are given for carrying out the work required for construction of the new structural system and the repair of other earthquake damage which occurred throughout the house. In addition, evaluation of the current condition of the building has been carried out and general recommendations have been given to guide the conservation and rehabilitation of the building.

The building exteriors and interiors are divided by individual building elements. For each of the building elements this section considers the following items:

1. Description of Original Materials
2. Existing Conditions
3. Earthquake Related Repairs
4. Conservation Recommendations

Description of Original Materials
This section describes the original appearance of each element.

Existing Conditions
This section describes the general deterioration of materials and features and specific earthquake damage.

Earthquake Related Repairs
This section includes a description of the repair work required for each of the building elements impacted by installation of the structural repair system.

Recommendations for the repair of earthquake damage are included to ensure that this work is carried out with materials and techniques that will not jeopardize the architectural integrity of the building. This work should be carried out immediately.

Conservation Recommendations
This section deals with the issues that are related to the long term preservation of the building and includes general recommendations for the conservation of original materials as well as for the repair and rehabilitation of individual elements and features. This is work that should be carried out as soon as there are available resources, but does not have to be part of the proposed seismic repair work.

LEVELS OF INTERVENTION

Given the unusual nature of the original design and construction of the Hanna House, the unusual circumstances of the original house and site and the extraordinary impact of the seismic damage to this structure, work is being proposed that are variations of the standard procedures that would normally be taken in the conservation of a building of this stature. The following levels of intervention will be used throughout this report as well as in the preparation of contract documents.
Dismantle Intact: In general, the removed feature will maintain its complete existing configuration as it appears in the house.

Dismantle: Disassemble the feature into its component elements.

Remove: Demolish the feature in such a manner that it cannot be reconstituted using the original materials, such as roofing, brick, masonry and concrete paving.

Reinstall: Replace the feature which has been removed intact in its original position in the house.

Reassemble: The component elements of the feature are to be put back together and replaced in their original position in the house.

Rebuild: Construction of a feature that existed in the house using new materials. The external appearance of the new feature will replicate the external appearance of the original element.
EXTERIOR BUILDING ELEMENTS

TERRACE WALLS

DESCRIPTION OF ORIGINAL WORK

The terrace walls are constructed of brick veneer on concrete retaining walls. The brick courses are laid in a running bond with a header course forming the cap. All inside and outside corners are constructed with an interlocking brick detail. The brick is a wire-cut common San Jose red brick. Yellow color variations occur in brick units which were caused during the firing process and are the result of the proximity of individual bricks to the heat source. The brick is laid in a cement mortar colored to match the brick. The vertical joints are narrow and flush with the face of the brick and the horizontal joints are raked to a depth of 3/4". These construction details are typical for all masonry elements throughout the building.

EXISTING CONDITION

General

The hard fired brick and the dense Portland cement mortar construction of the terrace walls has generally held up well against the effects of weathering. There is extensive efflorescence staining the wall. Efflorescence is a white film on the surface of the bricks due to crystallization of soluble salts. This occurs throughout the wall where the brick is subjected to water drainage from the terrace paving and planters. It also occurs at the base of the wall directly above grade. There is also evidence of exfoliation, where the surface of the brick has peeled off in thin layers. Exfoliation occurs when the crystallization, instead of occurring on the surface of the brick, takes place below the surface, which breaks down the material and causes it to peel. This condition occurs primarily at the north terrace walls.

The cement mortar joints exhibit surface erosion in locations at the north terrace wall and at the base of the wall above the natural grade. This erosion occurs primarily in the vertical joints. The mortar joints also have extensive areas of surface efflorescence, as well as limited areas of staining due to biological growth.

Repair work to the terrace walls has been carried out, including repointing and brick replacement, which does not match the original level of craftsmanship that appears throughout the house. This is most noticeable at the dining room terrace walls. The horizontal mortar joints are not straight and there is repointing which does not match the color of the original mortar or tooling and which has been applied so that it extends across the face of the brick.

Earthquake Damage

The earthquake caused the brick facing on the northernmost portion of the terrace wall to collapse as well as various cracks throughout the wall. The cracks occur primarily in the mortar joints but occasionally they extend through individual bricks. At the present time it is not possible to determine if the concrete wall under the brick veneer is cracked.
EARTHQUAKE RELATED REPAIRS

New Structural Work

The proposed structural work for the terrace walls, based on the structural information for the original building available to the engineers at this time, is to rebuild the north end of the retaining wall at the living room terrace and to stabilize the remainder of the wall through the installation of soil anchors.

1. Rebuild Terrace Wall

The existing northern portion of the terrace wall will be removed and replaced with a new reinforced concrete retaining wall and footing with a brick veneer that will match the detail and configuration of the existing wall.

Ideally, the new wall would be rebuilt using the original bricks. Due to the hard Portland cement mortar used in the original construction, however, it does not appear to be feasible to remove the existing bricks without damaging them. Prior to making a final decision on this matter tests on the brick removal should be carried out. If it is not possible to rebuild the wall with the existing brick, new bricks which match the original should be used. (Refer to the Chimney section for the recommended procedure for finding replacement bricks.)

The brick should be installed in new mortar that matches the existing which is tooled to match the original joints. In order to develop the new mortar mix, the original mortar used in the construction of the walls will be analyzed to determine the composition of the mix, and the size and type of sand and pigments used. A new mix will be developed based on the results of this analysis for use in the rebuilding, as well as on all future work carried out on the terrace walls.

The construction of the new retaining wall will impact the oak trees adjacent to the wall. (Refer to the Landscape Section for recommendations for protection of these trees.)

2. Soil Anchors

Soil anchors with a reinforced concrete pilaster and grade beam system behind the wall will be installed to stabilize the existing terrace wall.

Existing bricks and mortar will need to be removed for reinstallation at each soil anchor. This removal work should be carried out in such a manner that it does not damage the individual bricks or the adjacent material. Due to the hard Portland cement mortar, it may be necessary to utilize a technique which involves sawcutting the mortar joints in those areas where bricks are to be removed. A jig must be set up and a blade must be used which is narrower than the existing mortar joint to ensure that no damage is caused to the original bricks. The mortar that remains on the bricks following this operation should then be carefully chipped away. Tests should be carried out on site to determine the feasibility of this method.

The soil anchors will be recessed behind the face of the existing brick wall. The bricks which have been removed will be saw cut and installed as thin face brick.
If it is not possible to remove the existing bricks without damaging them, new bricks should be installed at the soil anchors which match the original.

The concrete paving along the entire length of the terrace wall and brick planters which tie into the wall will need to be removed for installation of the concrete pilasters and continuous grade beam. The concrete paving should be replaced with new paving to match the original. (Refer to the Terrace Paving section.) The brick planters should be rebuilt according to the procedures described above.

**Repair of Earthquake Damage**

The earthquake damaged northern portion of the terrace wall should be reconstructed to match the original wall. The bricks from the collapsed wall have been stored on site. To the extent possible, the excess mortar should be removed and the brick reused in the reconstruction. Where additional bricks are needed to complete the wall they must match the original in size, color and texture as well as general strength and porosity. (Refer to the Chimney section for the recommended procedure for finding replacement bricks.)

There is electrical conduit, a gas meter and water lines adjacent to the portion of the wall to be reconstructed. (Refer to the Electrical and Mechanical sections for recommendations for these elements.)

The earthquake cracks which occur in the mortar joints in the terrace walls should be repointed with the new mortar mix developed to match the existing and tooled to match the original joints. The earthquake cracks which occur through bricks should be evaluated on an individual basis. Bricks with hairline to moderate size cracks should remain and should be carefully monitored for future expansion. Bricks with large cracks should be removed and replaced with new brick that match the original size, color and texture as well as general strength and porosity. Removal of brick units should be carried out according to the procedure developed for installation of the soil anchors.

**CONSERVATION RECOMMENDATIONS**

**Masonry**

The efflorescence, exfoliation, mortar joint deterioration and biological staining is a result of moisture penetration in the terrace walls.

Prior to carrying out any work on the walls the source of moisture and the nature of the deterioration process must be determined. This will require additional study and laboratory analysis.

1. A detailed survey should be carried out to record the condition of the walls, including the location and severity of efflorescence, exfoliation and mortar joint deterioration.
2. Laboratory analysis should be carried out on the brick. X-ray diffraction tests should be conducted to identify the specific salts present in the wall, and water absorption tests should be conducted to determine the porosity of the brick.
3. Laboratory testing should be carried out to determine the nature of the biological staining.

Drainage
The extent of the deterioration in the walls off of the terraces indicates that drainage of the terrace slabs may be the principal source of water into the wall. Measures should be taken to address this problem. (Refer to Terrace Paving Section)

Following further analysis of the deterioration process and mitigation of the moisture penetration problems the following work should be carried out on the terrace walls.

Cleaning
1. Efflorescence should be removed by brushing with a stiff natural fiber brush. This should be carried out as often as the efflorescence reoccurs.
2. General cleaning should be carried out with either a low-pressure water wash or a chemical restoration cleaner. The specific method should be developed based on the identification of salts in the laboratory analysis and tests conducted on site.

Repointing
1. All deteriorated or cracked mortar joints should be repointed using mortar which matches the color and texture of the existing mortar and should be tooled to match the existing joints.
2. Following stabilization of the terrace walls and repointing of all cracked and open mortar joints as part of the earthquake related repairs, the walls should be carefully monitored for future movement. Cracks which develop in the mortar joints should be repointed.

Brick Replacement
1. The individual exfoliated brick should be monitored closely to determine whether the condition of the exposed surface of the brick stabilizes as a result of reducing the amount of moisture the wall is exposed to.
2. If the brick surface continues to erode this presents a source of water penetration into the wall. The existing brick should be removed and replaced with a new brick which matches the original in size, color and texture, as well as general strength and porosity.

Correction of Past Repairs
Research should be carried out to document all repair work which has been carried out on the terrace walls as well as the nature of the problem that necessitated the repairs.
1. All mortar joints which have been improperly repointed should be removed and repointed with the new mortar which has been developed to match the existing, and tooled to match the original joints.
2. Areas of brick replacement or reconstruction which has been carried out on the terrace walls after 1975 should be removed. These areas should be rebuilt with brick that matches the original and mortar that matches the color, texture and tooling of the original joints. This work should be done according to the procedures developed for brick replacement and repointing in Earthquake Related Repairs.
TERRACE PAVING

DESCRIPTION OF ORIGINAL WORK

The terrace paving is constructed of two 3 1/2" layers of reinforced concrete, separated by a slip sheet of building paper. This forms a continuous flooring throughout the exterior terraces and the interior spaces with the hexagonal scored units, measuring 2'-2" on each side, establishing the basis for which the interior and exterior building walls were constructed.

The original specifications called for the concrete to have an integral colored finish of iron oxide and lamp black. Although this was not carried out, notes which appear on early photographs in the Hanna archives indicate that the color of the terraces matched the color of the brick. This suggests that a painted or stained finish that was originally applied to the concrete surface has subsequently worn off.

EXISTING CONDITION

General

Where the concrete paving has been constructed over fill, such as at the living room and dining room terraces, the floor exhibits differential settlement and cracking in the slab and the concrete steps. This condition is most severe at the living room terrace. In the areas where the concrete paving was constructed over natural or cut grade, such as at the east terraces, the settlement and cracking is less severe.

The living room and dining room terraces both show evidence of past repair work to the slabs and modifications to improve their drainage. The north western area of the living room terrace and steps has been replaced and an opening has been made in the brick terrace wall for drainage of water. The dining room terrace has been modified for installation of floor drains which carries water out through pipes in the brick wall. Individual hexagonal units have been replaced with new concrete. This new concrete does not match the color and texture of the original, and saw cuts made during removal of the original concrete extend into the adjacent original units.

Deterioration in the materials at the base of the building and at the terrace walls indicates that there continues to be drainage problems in the terrace slabs in spite of modifications made to improve the situation.

The existing color of the concrete terraces is a natural grey cement. It appears that the original painted or stained finish was not maintained, and notes which appear on photographs in the Hanna archives indicate that the finish had faded over the years. The finish was completely worn off by 1975.

Earthquake Damage

The earthquake caused soil settlement at the living room terrace area. This ground movement resulted in severe settlement and cracking in the concrete slab and steps.
EARTHQUAKE RELATED REPAIRS

New Structural Work

The concrete paving at the dining room terrace will be removed for installation of the concrete pilasters and grade beam for the soil anchor system.

The terrace paving should be rebuilt to match the color, texture and scored hexagonal pattern of the original. The original concrete slab will be analyzed to determine the composition of the mix. A new mix will be developed based on the results of this analysis for use in the rebuilding of the terrace paving in order to match the color and texture of the original paving.

The new terrace should be constructed with positive slope to provide adequate drainage, floor drains to carry water away from the terrace and beyond the terrace wall and expansion joints to allow for future movement of the slab.

Repair of Earthquake Damage

1. Living Room Terrace
   The earthquake damaged living room terrace and steps should be removed and rebuilt to match the existing according to the procedures described above.

CONSERVATION RECOMMENDATIONS

Concrete

Crack Repair
Cracks in the concrete have been caused by earthquake movement, soil settlement and the absence of expansion joints in the original 1937 construction of the house. In addition, cracks have developed in the score lines of the concrete paving which appear to have become natural control joints.

Prior to development of a crack repair program, a detailed survey should be conducted to record the existing cracks. Consideration should then be given to determine if the crack will be left as a natural control joint, repaired as a rigid joint or repaired to allow continuing movement of the building.

1. No additional work will be performed on cracks that will be left to act as natural control joints.
2. All rigid joints will be repaired with a cementitious patching compound utilizing traditional methods and materials in order to match the color, texture and ability to age of the adjacent concrete.
3. Crack repairs to allow for continuing movement of the building should include an elastomeric joint in conjunction with the cementitious repair to allow for both future movement and visual integrity with the adjacent existing materials.

Drainage
Drainage of the exterior terraces is extremely important in terms of the conservation of the building materials at the base of the
building and at the terrace walls. The roof was designed and constructed to have no gutters or downspouts to carry water away from the building and roof runoff falls directly onto the terraces. These terraces, however, were designed and specified to be finished flat with no pitch. The wood doors, windows and walls were constructed directly on the terrace paving and steps. Since the terraces do not drain water away properly, the doors and windows exhibit significant weathering at the base. In addition, the brick terrace walls, where drainage of the terrace paving is directed, also exhibit deterioration.

1. An observation program during rainy weather should be initiated to determine the actual drainage behavior and patterns to guide decisions for future action on this issue.
2. Where terrace paving has to be rebuilt, the steps and terrace should be designed and built to provide a positive slope away from the house and provisions should be made to take this drainage through and away from the terrace walls.
3. Where the existing concrete paving is to be left in place, additional work will be required to maintain the finish on the base of the wood doors, windows and walls.

Correction of Previous Repairs
1. The concrete mix established through analysis of the original concrete should be utilized in the new repair.
2. Repairs to the terrace paving which do not match the original concrete should be replaced with new concrete to match the color, texture and scored hexagonal pattern of the existing.
3. Previously cracked concrete which has been repaired but which has failed again should be removed and replaced using the repair methods described in Concrete Crack Repair.

New Concrete Work
In order to reduce future cracking expansion joints should be installed in all new concrete work.

WALLS

DESCRIPTION OF ORIGINAL WORK

The 2 3/4" exterior walls are constructed of 7/8" x 11" redwood boards with 1/2" x 2" recessed battens. The boards and battens are joined together by a tongue and groove connection and are attached to the 1 x 8 framing with exposed brass screws through the recessed battens only. The slotted screws are installed with the slots in a horizontal position. At the 120 degree and 60 degree corners of the walls the boards and battens are joined to vertical wood ties by a tongue and groove connection. The walls are attached to the concrete slab through a zinc strip embedded in the scored hexagonal units which fits into a slit at the bottom of the wall panel.

The original specifications called for no paint or stain of any kind to be applied to the exterior woodwork. Construction photographs show the application of a Rezite sealer to the wood prior to installation. No research has been carried out to document subsequent treatments that the Hannas carried out to maintain the wood. Mr. Erik Upmanis, who has been retained by the University to treat and maintain the exterior wood, reported that when he began work on the house in 1977 it was
Exterior walls under construction

View of wood board and batten siding

Earthquake damage at exterior storage closet
evident that the wood had been maintained with natural oils and had never been stained.

EXISTING CONDITIONS

General

The exterior redwood walls show evidence of weathering, which includes raised grain, warping, and split and cracked wood. In addition, the wood is darkened in some locations. These conditions vary in severity according to orientation and location on the building and subsequent exposure to water and sun. Weathered wood occurs primarily at the base of the building throughout the house and garage directly above the concrete mat, brick planters and paving where the wood is exposed directly to water. Weathering due to sun exposure occurs where the wood is not protected from the sun by the deep roof overhangs or the oak trees. These conditions are most severe on the south and west walls of the building. Severely weathered wood also occurs at the base of the upper roof walls, where the wood is warped and split, and in some cases is working lose from its nailing. The wood walls at the garage which extend beyond the protection of the garage roof are severely weathered and many boards are lose and in some cases missing.

The original brass screws have been replaced with steel screws in some locations and this has caused dark stains on the recessed battens.

Black caulk has been applied to the wood at the base of the building in an apparent attempt to provide a weather seal. The caulk that has been applied in large quantities is dried out and cracking. Caulk that has also been applied in conjunction with painted metal flashing at the base of the walls above the planters is also dried out.

The exterior wood currently is being treated with a clear water repellent wood preservative. The walls at the upper roof have a painted finish which was apparently applied to protect severely weathered wood.

Earthquake Damage

The earthquake caused the wood wall at the garage to buckle and it now has a bowed shape. Wood walls at the garage and forecourt storage closets and the north end of the living room were displaced and are now in a racked position.

EARTHQUAKE RELATED REPAIRS

New Structural Work

The proposed structural work which will impact the exterior wood walls includes the removal and rebuilding of the three chimneys, and the installation of shear walls, cantilevered columns and footings, and the roof diaphragm.

1. Chimneys

The exterior wood walls which tie into the three chimneys which are being removed and rebuilt should be carefully labeled, dismantled and stored for reassembly in their original location.
Prior to dismantling, the elements that make up each of the wall panels should be identified to ensure reassembly in their existing location. The walls should then be dismantled by removing the screws in the recessed battens. The wood should be carefully handled to ensure there is no damage to the tongue and groove connections between the boards and battens as well as the tongue and groove connections to the vertical ties. The wood and the screws should be stored according to conservation standards and procedures. The 1x8 framing members of the walls should be dismantled only where required to provide working space for the masons.

Following rebuilding of the chimneys, the walls should be reassembled with all elements in their original location. The wood should be inspected once it has been reassembled and refinished where necessary to match the condition of the wood prior to the work.

2. Shear Walls
Where shear walls are proposed the exterior boards and battens need to be dismantled for installation of the 1/2" plywood over the existing framing. In addition, the vertical ties at each end of the wall and therefore the flanking board and batten walls will also need to be dismantled. This dismantling should be carried out according to the procedures described for work at the chimneys.

The installation of the plywood shear wall will increase the thickness of the wall by 1/2". Due to this increased thickness the existing tongue and groove joinery of the board and battens will not be able to be reassembled into the existing corner vertical ties. New vertical ties will need to be milled in a new shape to accommodate the boards and battens joining at the face of the new wall. The new corner ties should be milled out of new redwood which matches the existing and should be finished to match the adjacent existing wood.

Following installation of the shear walls, the new vertical ties should be installed and the board and battens should be reassembled in their original locations. The wood should be inspected once it has been reassembled and refinished where necessary to match the condition of the wood prior to the work.

The walls have existing electrical wiring and outlets located in the walls. (Refer to the Electrical Section for recommendations for this work.)

3. Cantilevered Columns and New Footings
Cantilevered columns and footings are proposed for installation at the garage and forecourt storage closets. This will require dismantling all of the closet walls and framing to provide working access to excavate the footings and install the steel columns.

The wood boards and battens should be carefully dismantled, labeled and stored for reassembly in their original location according to the procedures described for work at the chimneys.

The storage closets have existing electrical wiring and fixtures located on the walls. Refer to the Electrical Section for recommendations for this work.
4. Roof Diaphragm
Installation of the new roof diaphragm will necessitate removal of the existing roofing and flashing at all roofs. The wood details at the base of the walls of the upper roof will need to be removed or dismantled. Where the wood at the base of the walls is severely weathered, warped, cracked and rotten, it should be replaced with new wood to match the existing. The new wood should be finished to match the existing finish on the adjacent wood. Where the wood is not severely deteriorated it should be labeled, dismantled and stored for reassembly according to the procedures described for work at the chimneys.

5. Garage Retaining Wall
The proposed retaining wall at the garage will require dismantling of the wood boards and battens which are attached to the existing concrete wall as well as the two upper windows.

The wood boards and battens should be carefully labeled, dismantled and stored for reassembly in their original location over the new concrete retaining wall according to the procedures described for work at the chimneys.

Construction of the proposed retaining wall and footing at the garage will also have an impact on the existing Monterey Cypress tree in the adjacent planter. (Refer to the Landscape Section for recommendations to protect the tree.)

Repair of Earthquake Damage

The earthquake damaged walls will be repaired through construction of the proposed structural work.

CONSERVATION RECOMMENDATIONS

Wood

The weathered condition of the wood throughout the building is primarily a result of the exposure of the wood to moisture and sunlight.

1. The increase in the moisture content in the wood causes swelling and shrinkage and this, in conjunction with temperature changes due to exposure to sun, causes cracks, checks and warping.

2. Raised grain is a result of differential swelling and shrinkage between the soft wood and the hard wood due to moisture. In addition, exposure of the wood to ultraviolet light causes a breakdown of the natural oils in the wood, and once the surface loses strength the softer wood is easily eroded.

The severity of the weathered wood throughout the building can be attributed to a number of characteristics of the original construction which affect the exposure of the wood to water and sunlight.

1. The exterior wood was specified to have no finish of any kind and the redwood, which is a softwood, when left unfinished is naturally susceptible to surface erosion.

2. The roofs were designed with no gutter or downspout system to carry roof runoff away from the building.

3. The wood walls, doors and windows were designed to sit directly on the concrete terraces and steps, where they are exposed to roof backsplash and the roof and site water runoff.
Deterioration of wood at base of wall above planter

Earthquake damage - bowed garage well
Since it is recommended that the characteristics of the original design of the building are to be preserved, the exterior wood will continue to be subjected to extreme exposure to water and sunlight. Therefore, the wood must be maintained with a treatment which will increase its resistance to moisture and sunlight, while retaining its natural unfinished appearance. In addition, all measures which can be taken to reduce excess moisture should be carried out wherever possible.

Wood Treatment
The wood is currently being treated with a clear water repellent wood preservative which provides a protective coating while maintaining the natural redwood appearance. The preservative contains fungicide to prevent the growth of mildew, silicone to provide a water repellent to reduce the absorption of water, and a linseed oil which replenishes the wood's natural oils to prevent drying out. A summary of this treatment program is included at the end of this section.

Drainage
(Refer to the Terrace Paving Section.)

Recommendations
Although the weathered wood walls have lost surface material, and in some cases are warped or stained, in general the wood appears to be quite sound, and no replacement is recommended. The condition and treatment of the wood should be carefully monitored through the following measures.
1. A survey should be carried out of the exterior walls to record the condition of each wood member. The severely weathered boards and trim should be carefully monitored. If it is determined that the deteriorated wood, such as the wood trim at the base of the walls, has become a weathersealant problem it should be replaced with new wood to match the original.
2. The annual maintenance program currently being carried out by Mr. Erik Upmanis should be increased to a semi-annual program. Inspections should be conducted in the spring and fall of each year. The spring inspection would provide the opportunity to evaluate how the wood has been affected by the winter rains and which areas require treatment for protection from the summer sun. The fall inspection would provide the opportunity to evaluate how the wood has been affected by the summer sun and which areas require treatment for the winter season.
3. Maintenance records should be established for the current treatment program. This should include the following information.
   - Photographic documentation should be compiled of the condition of the wood in 1977 prior to treatment.
   - Records should be established to document each of the specific preservatives which have been applied to the wood and an evaluation of their advantages and disadvantages.
   - The annual treatment should be recorded including the type of treatment and the location it is applied.

Screws
The steel screws should be removed and replaced with brass screws to match the original.

Caulking
The deteriorated caulking at the base of the building is visually obtrusive and should be removed. Inspections should be carried
out to determine the condition of the wood at the base where the caulking has been applied.
1. Where the wood is severely deteriorated and the cause of weathersealant problems it should be replaced.
2. Where the wood trim is not severely deteriorated the caulking should be removed and new repairs should be made with a less visually obtrusive weathersealant system.

**Painted Wood**

In order to make recommendations for the treatment of the painted wood at the upper roof walls, further research is required in order to determine when this paint was applied.

1. If the paint was applied prior to 1975 then the wood should remain painted. If this is the case, paint analysis should be carried out to determine the chronology of the paint colors.
2. The following procedure should be followed if the wood was not painted prior to 1975:
   - Determine if the finish on the wood can be restored and maintained in a manner that will protect the wood from additional deterioration.
   - Consider whether the appearance of the stripped wood with a new translucent coating will detract from the visual integrity of the exterior.

**Current Wood Treatment**

The wood is being treated with a clear water repellent wood preservative annually.

The condition of the wood in 1977, according to photographs taken by Mr. Upmanis prior to beginning any work, was extremely poor. The previous wood treatment had worn off, the surface was visibly dried out and there was evidence of extensive water staining.

The initial treatment Mr. Upmanis carried out involved removal of the dead wood surface with a natural fiber brush until sound wood was exposed. The entire exterior was then treated with a clear water repellent wood preservative. The wood which was painted at the time of this work, the upper roof walls and windows, was repainted. In addition, Mr. Upmanis also made recommendations for removal of sprinklers adjacent to the building which were watering the surface of the walls.

Subsequent to this initial treatment of the wood, Mr. Upmanis has been retained to maintain the wood on an annual basis. This involves a visual inspection of all the exterior wood and an evaluation of its condition. The current linseed oil based preservative treatment tends to yellow through exposure to ultra violet light and forms a brittle surface. Where this appears on the wood surface, it is removed by brushing with a natural fiber brush and preservative is reapplied. The wood is also evaluated for its ability to repel water. Where water does not bead on the surface, preservative is reapplied. Typically, reapplication of preservative is required every year to the base of the walls, doors and windows, and fascia boards. Other areas, such as the eave soffits have not required retreatment since 1977.

The wood is responding well to the treatment of the wood preservative, and the deterioration process appears to have stabilized. According to Mr. Upmanis, there is no evidence of wood fibers when the surface of the wood is brushed prior to reapplication of the preservative each year.
Transom windows at upper lantern

Transom windows at upper lantern over entry

Fixed windows at dining room terrace

Living room terrace doors
WINNODS AND DOORS

DESCRIPTION OF ORIGINAL WORK

The windows and doors throughout the house are constructed of redwood frames with plate glass window glazing.

The windows and doors which make up window walls are full wall height and their configuration corresponds to the shape of the hexagonal scored units in the concrete floor. The window sections are installed directly on the concrete slab or brick planter walls. They are attached to the concrete slab through a zinc strip embedded in the joint of the scored hexagonal unit. The doors are installed to appear identical to the windows. The bottom door rail rests directly above the concrete on a thin threshold.

The transom windows at the upper roof are fixed. The construction detailing is similar to the doors and windows with the exception of windows along the western wall above the kitchen which are constructed with wide vertical and horizontal muntins.

The casement windows are also constructed with similar detailing to the doors and windows.

Glazing
The plate glass window glazing was set into the wood door and window frames with wood trim. This glass was originally set in putty, which was then covered with the wood strips.

Hardware
The hardware was originally specified to be invisible type black iron made of black iron.

Wood Finish
The wood doors and windows were originally finished to match the wood walls with no paint or stain finish.

EXISTING CONDITION

General
Door and Window Frames
In general, the redwood window and door frames exhibit similar conditions of weathering as the wood walls. This includes raised grain, and split and cracked wood. The weathered wood is most severe at the base of the doors and windows directly above the concrete where the wood is exposed to water and on the south and west sides of the house and where the wood is not protected from the sun by the deep overhangs. The most severely weathered wood occurs at windows along the west wall of the living room, the dining room terrace doors and windows, and on the west and south wall of the master bedroom. Cracked and split wood also occurs in doors at hinge locations such as at the master bedroom doors. In some cases this wood has been face nailed, and caulking has been installed in vertical cracks.

Wood trim has come loose at the transom windows at the upper roof and in some cases is missing.
Glazing and Sealant
The glazing is in intact throughout the building. Black sealant has been applied to all door and window glazing in an attempt to weatherseal the joints where the wood members have shrunk. Although the sealant appears to be in good condition, it is visually obtrusive. The sealant extends beyond the edge of the wood frame at all sides and corners, and the black color is not compatible with the natural finish of the wood.

Hardware
Aside from the entry doors, all doors are operable from the interior only. The doors are operated primarily by bronze lever activated vertical rods which extend into the sill and head of the door frame. A bronze knob and face plate and closure is mounted on the exterior of the entry doors. On the interior face the panic hardware is surface mounted. All of the bronze hardware throughout the house is worn.

The existing door and casement window hinges are painted metal. The painted surface is deteriorated.

The original size and placement of the hardware for the living room terrace doors appears not to have been sufficient to support the weight of the doors. The weight of the doors has caused deformation of the wood frames. Wheels were added to the bottom of the doors to facilitate opening and closing them. These wheels appear in a 1962 photograph. Weatherstripping has been added to the base and head of the doors to seal the openings caused by the deformation and racking.

Wood Finish
The doors and windows throughout the building have been treated with a clear water repellent wood preservative. The transom window frames and trim at the upper roof as well as the living room windows along the west wall have a painted finish.

Aluminum Storefront Window
A black aluminum framed tinted glass wall has been installed on the exterior of the living room windows along the west wall. The base is anchored into the terrace wall and the head is attached to the eave soffit. This was installed to provide shade for these windows. No research has been carried out to determine when the aluminum storefront was installed.

Earthquake Damage
Where the earthquake caused displacement of the concrete slab the doors and windows are out of alignment.

The roof framing above the 28 foot wide opening over the dining room terrace doors and windows has deflected and prevents the doors from opening and closing properly.

Settlement of the concrete floor at the living room terrace doors and windows has caused them to be severely out of alignment. There are large openings at the base and head of the doors and windows.
EARTHQUAKE RELATED REPAIRS

New Structural Work

The proposed structural work which will impact the doors and windows includes the removal and rebuilding of the three chimneys, and the installation of the shear walls and the roof diaphragm.

1. Chimneys
The windows which tie into the three chimneys which are being removed and rebuilt will need to be carefully labeled, dismantled and stored for reassembly in their original location.

The interior and exterior wood trim should be dismantled by carefully loosening the nailed connections without causing damage to the wood. The windows should be carefully dismantled and protected to ensure that there is no breakage of glass during dismantling, transportation or storage.

Following rebuilding of the chimneys, the windows and trim should be reassembled in their original location. The wood trim should be reattached with non corrosive nails through the original nail holes. The wood should be inspected and refinished or painted where necessary to match the condition of the wood prior to the work.

2. Shear Wall
The casement window in the west wall of the living room where the new shear wall is proposed will need to be carefully labeled, dismantled and stored for reassembly in its original location.

This work should be carried out according to the procedures described above.

The installation of the plywood over the existing framing will increase the thickness of this wall by 1/2". Due to this increased thickness, the existing frame will not be able to be reassembled in the new wall. A new redwood frame will need to be made to match the profile and detailing of the existing frame to fit the width of the new wall.

The existing casement window should be reinstalled in the new wood frame. The existing wood trim and window should be refinished and the new wood frame finished to match.

3. Roof Diaphragm
The installation of the proposed roof diaphragm will necessitate removal of the existing roofing and flashing. In order to remove the existing flashing, the wood trim below the fixed transom windows at the upper roof will need to be labeled, dismantled and stored for reassembly in their original location. This work should be carried out according to the procedures described above for wood trim.

Repair of Earthquake Damage

The doors which are out of alignment should be restored to operation without extensive removal of existing material or repositioning of existing hardware.

The deflected flitch plate over the dining room terrace doors and windows should be repaired. The frames, doors and windows
Painted deteriorated wood at upper lantern window  Caulk repair of wood and glazing at dining room terrace windows  Detached wood trim at upper lantern windows
may have to be modified as a result of realigning the structural members.

The earthquake damaged concrete floor below the living room terrace doors and windows will be retained in its present position. These doors will not be modified in order to compensate for the uneven surface of the floor due to the extent of original construction that would be required to be removed. It is recommended that the doors and windows not be reconditioned to make them operable since this would require removal of extensive amounts of original material and repositioning of original hardware. It is recommended that the doors be fixed in place. Concealed weatherstripping should be installed at the base and head of the doors and windows to provide a weathertight installation.

CONSERVATION RECOMMENDATIONS

Wood
The cause of the weathered surface of the wood doors and windows and the recommendation for conservation has been discussed in the Exterior Wall Section.

Glazing and Sealants
The existing window sealant is visually obtrusive and should be removed. The existing water infiltration problem will then need to be addressed.

In order to provide proper weathersealing where the wood trim has shrunk it will be necessary to either replace wood members, or utilize an alternative sealant application which does not unduly compromise the appearance of the windows.

Horizontal muntins and trim which are severely deteriorated should be removed and replaced with new members that match the original profile. They should be properly installed to provide a complete weatherseal. Where replacement of wood muntins and trim is not recommended, new weathersealant using a backer rod to compensate for the wood shrinkage should be installed. The sealant should match the color of the adjacent wood. The new installation should not significantly alter the appearance of the original doors and windows.

Hardware
The deteriorated hardware should be removed and refinished. The interior bronze hardware should be polished and finished to match the original finish. Paint analysis should be carried out to determine the color of the original hinges and the painted metal door and window hinges repainted. The removal of the hinges should be carried out with great care in order not to damage the weathered wood door stiles during dismantling or reinstallation.

Wood Trim
Where door and window trim has become detached it should be reattached with non corrosive nails. Where door and window trim is missing it should be replaced with new trim to match the wood and profile of the original, but which is finished to match the adjacent wood finish.
Painted Wood
In order to make recommendations for the treatment of the painted wood window frames, further research is required in order to determine when this paint was first applied. (Refer to Exterior Wall Section.)

Aluminum Storefront Window
The aluminum storefront window should be removed. A new shading device should be installed on the exterior of the building to provide protection for the wood.

Deteriorated wood at trellis fascia

Open joint, deteriorated wood at fascia
EAVE/FASCIA

DESCRIPTION OF ORIGINAL WORK

The eave, which includes an inner fascia board, soffit and outer fascia board, is constructed of redwood. Trellises within the flat roof are also constructed with redwood fascias to match the eaves. There is no gutter and downspout system at the eaves.

EXISTING CONDITION

General

The wood at the inner fascia board and eave soffit is well protected by the deep overhangs and is in excellent condition. The outer fascia boards and the trellises exhibit weathering which includes split and cracked wood and raised grain. Weathered wood is most severe on the south and west sides of the building where the wood is not protected from the sun by the oak trees. The joints at the corner of the eaves and between soffit boards are open in some locations. The surface of the outer fascia boards and trellises is stained black by nails at some locations.

The trellis openings above the entry and east and west terraces have been filled in with wire glass in an attempt to keep water from draining off the roof at these locations. The glass in the east terrace trellis was installed by the Hannas and appears in a photograph taken in 1962. No research has been carried out to determine when the glazing in the other locations was installed.

Earthquake Damage

The deflected flitchplate over the dining room terrace doors and windows has caused deflection in the eave.

EARTHQUAKE RELATED REPAIRS

New Structural Work

The proposed structural work which will impact the eaves and fascias includes removal and rebuilding of the three chimneys and installation of the 1/2" plywood shear walls.

1. Chimneys

The inner fascia boards, eave soffits and outer fascia boards that tie into the three chimneys should be carefully labeled, dismantled and stored for reassembly in their original location after the chimneys are rebuilt.

Prior to dismantling, the inner fascia boards, eave soffits and outer fascia boards need to be identified to ensure reassembly in their existing location. The wood should then be dismantled by carefully loosening the nailed connections without causing damage to the wood.

Following rebuilding of the chimneys, the fascias and eave soffits should be reassembled in their original location. All of the wood members should be reassembled with non corrosive nails through the original nail holes. If nail holes need to be filled, they should be filled with a wood putty and stained to match the finish of the adjacent wood. The wood should then be inspected.
and refinished where necessary to match the condition of the wood prior to the work.

2. Shear Walls
It will be necessary to dismantle the inner fascia board and trellis fascia boards at each roof framing member along the length of the shear wall. At the north wall of the living room the inner fascia board of the sloped roof will also be dismantled. (See procedures described for work at the chimneys.)

The installation of the plywood shear wall will increase the thickness of the wall by 1/2". Due to this increased thickness, the existing fascia boards will not fit in their original locations. The trellis fascia boards will need to be cut back 1/2". The fascia boards at the walls on either side of the new shear wall will have to be dismantled and lengthened or shortened as necessary to provide a tight joint with the fascia boards on the shear wall.

Following installation of the shear wall and modification of the existing fascia boards, the wood fascia units should be reassembled in their original locations using the procedures described above.

Repair of Earthquake Damage

Repair of the deflected fitch plate above the dining room terrace windows may necessitate dismantling the eave soffit and fascia. This work should be done according to the procedures described above.

CONSERVATION RECOMMENDATIONS

Wood
The wood at the eaves and fascia are currently being treated with a clear water repellent wood preservative. (Refer to Exterior Walls, Conservation Recommendations for a summary of this treatment program.)

Open Joints
The open joints in the corners of the eaves and between boards should be repaired by installing a piece of neoprene in the joint so that it is recessed behind the face of the boards. The neoprene should be colored to match the adjacent wood.

Trellis Glazing
Further research should be carried out to determine when the entry and west trellises were enclosed with wire glass. If they were installed prior to 1975 they should remain. If they were installed after 1975 a determination will need to be made whether it should be retained due to their ability to keep water away from the affected areas.
ROOF

DESCRIPTION OF ORIGINAL WORK

A copper foil roof was originally installed on the house. The continuous narrow lengths of copper foil were lapped like shingles over wood strips which followed the line of the rafters. This roof was not built according to Frank Lloyd Wright's design which called for horizontal ridges in the copper running parallel with the line of the eave. Photographs indicate that the roof failed by 1942 and was replaced soon after with built-up roofing.

The existing built-up red gravel roof was installed in 1977 over the main gable roof, the upper gable roof, the flat roof and trellis framing. Painted metal flashing occurs at the roof edge, chimneys and walls of the upper roof.

EXISTING CONDITIONS

General

The roof appears to be in fair condition. There is evidence of past repairs and intermittent water stains on the interior ceilings adjacent to the chimneys. Exposed electrical wiring has been draped on top of the roof.

EARTQUAKE RELATED REPAIRS

New Structural Work

The proposed structural work which will impact the existing roofing and flashing includes the installation of a new roof diaphragm and blocking, shear walls, cantilevered columns and rebuilding the three chimneys.

1. Roof Diaphragm and Blocking

The new roof diaphragm, blocking and ties will require removal of the existing roofing and metal flashing. It will also require removal of limited areas of existing roof planking for installation of the new blocking and ties from above.

The installation of the new blocking and ties will need to be done very carefully in order not to damage the ceiling fiberboard attached directly to the underside of the roof framing.

Following completion of the proposed structural system installation, a new built-up roof and new painted metal flashing should be installed to match the built-up roof which was on the house in 1975. Further research is required to determine the specific nature of that roof.

The removal of the existing roofing for installation of the proposed structural work will impact the exposed electrical wires which are draped across the roof. (Refer to the Electrical Section for recommendations for this work.)

Blocking and ties will be installed at the edges of the roof opening where the Monterey Cypress tree extends through the roof. This opening is currently too small for the size of the tree, and should be enlarged. (Refer to the Landscape Section for requirements for protection of the trees during the work.)
2. Shear Walls
New blocking will be installed in the roof framing to tie the new shear walls into the new roof diaphragm. Access for this work will be provided through removal of the fascia boards. The method of attachment between the shear wall and the blocking is critical and should be developed to minimize the impact on the adjacent trellis framing.

3. Cantilevered Columns
The installation of the cantilevered columns and footings will require removal of the existing wood plank sheathing to install the columns from above. Blocking and ties will be installed which will anchor the new roof diaphragm to the new columns.

4. Chimneys
The removal and rebuilding of the three chimneys will necessitate removal of roof framing which ties into the existing masonry. This removal is necessary to provide working space for the masons. The removal of the roof framing should be kept to a minimum.

PLANTERS CONTIGUOUS TO THE BUILDING

DESCRIPTION OF ORIGINAL WORK

The brick planters are constructed of concrete walls with a brick veneer in a similar manner to the terrace walls. The brick courses are laid in a running bond with a header course forming the cap. Where the concrete planter walls form the base for the wood building walls the brick cap continues along the length of the wall below the wood.

EXISTING CONDITION

General

The conditions which occur in all of the brick planters is similar to those observed in the terrace walls. There is extensive efflorescence staining on the brick and mortar joints. The cement mortar is cracked and missing in some locations. There is surface erosion of the mortar at the base of the walls and staining due to biological growth. There is also evidence of previous repairs. This includes repointing that does not match the original color, texture or tooling. Notes on drawings from the remodelling work carried out in 1957 call for rebuilding the broken planter at the south end of the dining room terrace.

Earthquake Damage

The earthquake caused extensive cracking in the brick planters throughout the site. These cracks occur in the mortar joints and in some cases through the brick units. It also caused severe displacement in the planters at the entry and living room terrace.
Construction of Cypress tree planter

Efflorescence and cracked mortar joints at entry planter
EARTHQUAKE RELATED REPAIRS

New Structural Work

The proposed structural work which will impact the brick planter walls includes the installation of the shear walls, cantilevered columns and footings at the exterior storage closets and the new garage retaining wall.

1. Shear Walls

The proposed shear walls will anchor into the back wall of the brick planters at the north and west living room walls. The detail of this connection has not yet been developed, but it appears that the brick cap will need to be dismantled to provide anchorage of the new shear wall to the existing concrete retaining wall. If this is required, the dismantling and reassembly of the existing brick should be carried out according to the procedure outlined for dismantling and reassembling bricks for the soil anchor installation in the Terrace Wall Section.

2. Cantilevered Columns and New Footings

Cantilevered columns and new footings are proposed for the exterior storage closets at the garage and forecourt. The existing storage closet at the garage ties into the adjacent brick planter, and dismantling of the closet and excavation for the footing should be carried out very carefully in order not to damage the brick planter.

The existing storage closet at the forecourt is constructed with a brick base. This brick should be removed for installation of the new footing. (Refer to the Terrace Wall section for the recommended procedures for this work.)

3. Garage Retaining Wall

Rebuilding the damaged retaining wall at the garage will impact the adjacent brick planter. The brick cap at the top of the existing concrete wall need to be dismantled and reassembled. Where the brick planter walls tie into the garage wall which is to be removed and rebuilt, this work will need to be carefully executed in order not to damage the brick wall which is to remain.

Repair of Earthquake Damage

The earthquake cracks which occur in the mortar joints in the brick planter walls should be repointed with new mortar to match the existing joints. (Refer to Terrace Wall Section.)

The brick planters which have suffered severe displacement at the entry and living room terrace should be rebuilt to match the original. The original brick should be reused if possible. If that is not possible, new brick should be used which match the original in size, color and texture as well as general strength and porosity. (Refer to the Chimney section for the recommended procedure for finding replacement bricks.) The mortar to be used in rebuilding the wall is to match the existing, and should be pointed to match the existing joints.

CONSERVATION RECOMMENDATIONS

Masonry

The efflorescence and mortar joint deterioration and staining is a result of moisture penetration in the brick walls of the planters. As was recommended for the terrace walls, further research
should be carried out on the brick planter walls to determine the specific nature of the deterioration.

Measures should be taken to reduce the amount of moisture to which the planter walls are subjected. Plants should be limited to those that do not require large amounts of water. An evaluation should be made of the maintenance of the current plants to determine if the fertilizers being used are contributing to the efflorescence staining.

Following further analysis of the deterioration process and mitigation of the moisture penetration problems the planter walls should be cleaned and repointed. (Refer to the Terrace Walls, Long Term Recommendations for specific recommendations on this work.)

Correction of Past Repairs
Research should be carried out to document all repair work which has been carried out on the planter walls as well as the nature of the problem that necessitated the repairs. These previous repairs which have been improperly carried out or which were installed after 1975 should be removed and replaced. (Refer to Terrace Walls, Conservation Recommendations for specific recommendations for this work.)

Monterey Cypress Tree Planter
According to the Landscape Architect, the size of the existing planter at the Monterey Cypress tree restricts the root system and thus presents a danger to the long term health of the tree. The recommendation is that the east planter wall be moved to provide for additional root space. Although this represents an alteration of the original brick planter wall, the Cypress tree was a significant feature in the original siting and design of the house. The modification is necessary to provide for the growth of the tree. The planter wall could be moved to the east approximately 22 1/2", one half of the hexagonal unit and would then line up with the north portion of the wall. (Refer to the Landscape Section for additional recommendations on this issue.)
INTERIOR BUILDING ELEMENTS

FLOORS

DESCRIPTION OF ORIGINAL WORK

Concrete
The interior concrete slab, constructed in a similar manner as the exterior slab, forms a continuous flooring throughout the interior spaces of the house. The hexagonal scored units, measuring 2'-2" on each side, form the basis for which the interior walls and features are constructed.

The original finish on the concrete was a painted or stained coating which was colored to match the brick. This finish was applied instead of the integral colored concrete finish which was originally specified.

Carpet
The original floor covering in the entry, living, dining and playroom was a goldenrod and blue linen Klearflax carpet laid so that the scored concrete flooring was exposed at the edges of these rooms. This was replaced in 1953 with a off-white and beige Woolturf carpeting which was laid in the same manner. The Woolturf carpet was also installed in the library, guest bedroom and master bedroom and bathroom where it was laid over the entire floor.

Resilient Tile
The original specifications called for a resilient tile named Linotile for the kitchen floor. The color of the Linotile was to match the golden color of the carpet. A 1962 photograph from the Hanna archives shows a linoleum tile floor in the kitchen with notes saying the flooring had subsequently been removed and the concrete floor exposed.

Tile
It is believed that the tile flooring in the powder room and utility bathroom was installed over the concrete when these spaces were remodelled in 1957. The tile is a 10" hexagonal quarry tile with a mat glaze to match the color of the painted concrete.

EXISTING CONDITIONS

General

Concrete
Where the concrete floor has been constructed over fill the floor and steps exhibit differential settlement and cracking. This condition is most severe in the living room. Where the concrete flooring was constructed over natural or cut grade the cracking and settlement is less severe.

The existing paint finish on the concrete floor is worn and flaking in traffic areas.

Carpet
An off white looped carpeting has replaced the wall to wall Woolturf carpet in the guest bedroom, master bedroom and
Installation of metal bars in scored concrete slab

Settlement of concrete floor in living room
bathroom. This carpeting appears to have been recently installed and is in good condition.

Tile
The tile flooring in the powder room and utility bathroom is in good condition. The mat glaze finish is intact and the grout joints are sound.

Earthquake Damage
The earthquake caused soil settlement at the living room area. This ground movement resulted in severe settlement and cracking in the concrete slab and cracks in the steps leading to the dining room.

EARTHQUAKE RELATED REPAIRS

New Structural Work
The proposed structural work which will impact the concrete floor includes the removal and rebuilding of the three chimneys and the new footings for the cantilevered steel columns.

1. Chimneys
The concrete floor adjacent to the three fireplaces will be removed for the removal of the existing footings and the excavation of new foundations.

In order to keep the loss of the original floor to a minimum, only the hexagonal units above the new foundation will be removed.

No floor will be removed to provide additional work area since hand excavations can be carried out within the footing area. The concrete should be cut along the existing score lines of the hexagonal units and removed. Care must be taken during this operation in order not to overcut into the existing flooring that is to remain.

Following completion of the rebuilt chimneys new concrete flooring will be installed to match the color, texture and configuration of the adjacent original floor. The mix for the new concrete will be developed based on laboratory analysis of the existing concrete. The new concrete should be finished to match the finish which was on the floor in 1975. If possible, this work should be done in conjunction with refinishing of the floors in the entire room.

2. Cantilevered Columns and New Footings
The concrete flooring and carpeting will need to be removed in the guest bedroom and master bathroom closets for excavation of the footings for the proposed cantilevered columns.

The removal of this flooring will be restricted to the inside face of the interior closet walls which are to remain. The footing excavations will be dug out by hand.

Following installation of the footing and column, new concrete will be installed to match the color, texture and configuration of the original floor. The carpeting should be reinstalled over the new concrete.
Repair of Earthquake Damage

Measures will be taken to repair the cracks in the living room floor. The uneven surfaces will be left in place.

CONSERVATION RECOMMENDATIONS

The floor finishes throughout the house should be restored to the state they were in when the Hannas moved out of the house in 1975. Research should be carried out to document the history of finishes which have been installed on the floors throughout the house and to determine the nature of the finishes which existed in 1975.

Concrete
Paint analysis should be carried out on the existing concrete floor finish in order to determine the material, color and method of application of the finish which existed in 1975. Based on the results of this analysis the existing floors throughout the house should then be refinished.

Carpet
The existing carpet in the guest bedroom and master bedroom and bathroom should remain since it is in good condition and it follows the installation method of the carpet which existed when the Hannas lived in the house.

A new carpet should be installed in the entry, library, living room and dining room. The type of carpet could be one that meets the needs of the current occupants, but it should be laid in the manner the carpet was originally installed. This includes keeping the concrete floor at the edges of the room exposed in the entry, living room and dining room, where the relationship between the hexagonal floor pattern and the walls and windows was intended to be clearly visible. The carpet should be laid wall to wall in the library.

Tile
Further research should be carried out to determine when the existing tile flooring in the powder room and utility bathroom was installed. If it was installed prior to 1975 it should be retained. If it was installed after 1975, the it should be removed and replaced with flooring to match the floor the Hannas installed.

WALLS

DESCRIPTION OF ORIGINAL WORK

The interior walls are constructed in the same manner and of the same material as the exterior walls and consist of exposed redwood boards with recessed battens.

The original interior wood finish, according to documents in the Hanna archives was a wax based finish. Correspondence between the Hannas and Frank Lloyd Wright documents that the interior wood walls were refinished with a wax base varnish in 1956. In 1981, according to a conversation with Mr. Erik Upmanis, it appears that a polyurethane varnish was applied to the interior wood throughout the house.
During major remodelling by the Hannas in 1957, alterations were carried out to the interior walls in the library, bedrooms and bathrooms.

EXISTING CONDITIONS

General

The interior walls are generally in good condition, however, mechanical damage was observed at the base of the walls in traffic areas. This damage includes scratched and gouged wood. Some of these marks appear to be old and have been refinished others appear to be fresh. There is overstaining of the floor finish at the base of the walls in some locations. There are large dark stains at the base of the kitchen fin wall facing the living room.

Earthquake Damage

The earthquake caused movement in the walls throughout the interior exposing unvarnished edges and causing closet doors not to open and close properly.

EARTHQUAKE RELATED REPAIRS

New Structural Work

The proposed structural work which will impact the interior walls includes the removal and rebuilding of the three chimneys and the installation of the cantilevered columns and footings in the closets.

1. Chimneys
   The interior wood walls that tie into the three chimneys will need to be carefully labeled, dismantled and stored for reassembly in their original locations. (Refer to the Exterior Wall section for the recommended procedure for this work.)

2. Cantilevered Columns and New Footings
   The installation of the cantilevered columns and excavation for the new footings in the interior closets will be carried out with the closet walls in place.

   The walls should be protected from abrasion and soiling during excavation and installation of the structural work. The existing shelves and the closet doors should be dismantled and stored for reinstallation.

   Following completion of the cantilevered columns and footing installation, the interior of these closets should be repainted to match the existing and the shelves and closet doors should be reinstalled.

   There is existing electrical wiring and outlets located in the closet walls. (Refer to the Electrical Section for recommendations for their protection.)

Repair of Earthquake Damage

The walls which have been displaced by the earthquake where unvarnished edges have been exposed should be refinished. The refinishing of this wood should be carried out in a similar manner as for the wood walls impacted by the chimneys.
The doors which are out of alignment and which do not open and close properly should be readjusted. This repair should be carried out without extensive removal of existing material or repositioning of existing hardware.

CONSERVATION RECOMMENDATIONS

The wood finishes throughout the house should be restored to the state they were in when the Hannas moved out of the house in 1975. Research should be carried out to document the history of finishes which have been installed on the walls throughout the house and to determine the nature of the finishes which existed in 1975. In addition, research should be carried out to document the physical alterations to the interior walls.

If research confirms that the existing finish is a polyurethane varnish it should be removed. This would require stripping the wood with a chemical stripper in order not to damage the soft wood through mechanical stripping, and tests should be carried out to develop a successful stripping method. A new wax based finish should be applied to the wood which matches the finish which existed in 1975.

CHIMNEYS

DESCRIPTION OF ORIGINAL WORK

Main Chimney

The massive irregular shaped main fireplace and chimney in the living room is constructed of brick which is detailed in a manner similar to the masonry construction on the exterior of the house. The fireplace is approximately twenty four feet long and forms the east wall of the living room and the west wall of the kitchen. The brick hearth at the center of the wall steps down from the level of the floor. A vertical iron fireplace fixture stands in the hearth, and above the hearth is a cantilevered brick hood. The chimney has been constructed around internal vents as well as supply and return air ducts for the heating system located in the basement. Openings in the brick chimney walls serve as the supply and return registers for the living room, kitchen and entry.

A coating appears to have been applied to the masonry, and a sheet metal spark arrester has recently been installed.

Library Chimney

The library fireplace and chimney was constructed in 1957 when the library was remodelled. The fireplace carries through the detailing of the original brick construction, and also contains internal heating ducts and openings in the brick for air supply and return. The hearth is raised with a small cantilevered brick hood and recessed fire screen. In the concrete floor below the existing raised hearth is the brick outline of the hearth constructed in
Main fireplace and chimney under construction

View of main fireplace and chimney from living room

Iron fireplace fixture
View of main chimney from entry

View of main chimney from kitchen
1937. The remainder of the fireplace was designed but was not built at that time due to budget constraints.

A coating appears to have been applied to the masonry, and a sheet metal spark arrester has recently been installed.

**Bedroom Chimney**

The Bedroom fireplace and chimney was also constructed in 1957 during remodelling of the the bedrooms. While the design is different from the main fireplace it shares similar construction detailing.

A coating appears to have been applied to the masonry, and a sheet metal spark arrester has recently been installed.

**EXISTING CONDITION**

**General**

Prior to the earthquake the brick chimneys were in good condition. A coating which has been applied to the exterior face of the chimneys is currently flaking.

**Earthquake Damage**

Refer to the Structural Section for a description of earthquake damage.

**EARTHQUAKE RELATED REPAIRS**

**New Structural Work**

The new structural repair system proposes removing the three existing brick chimneys and rebuilding them using entirely new materials.

1. **Chimneys**

The three existing chimneys and footings will be removed and replaced with reinforced chimneys on new foundations built of reinforced concrete faced with a brick veneer that will match the detail and configuration of the existing chimneys. The new concrete core will be constructed around new mechanical vents and ducts to replace the existing.

In order to ensure that the chimneys will exactly match the appearance of the existing, prior to removal they will be recorded utilizing measured drawings and metric photographs that will show the details and location of elements, templates to provide the horizontal configuration at all levels and an engineered survey that documents all key horizontal points and vertical heights. Prior to removal of the chimneys, the iron fireplace fixture and associated connections in the main chimney and the fireplace screens in the library and Bedroom chimneys should be dismantled intact and stored for reinstallation in the rebuilt chimneys.

Ideally, the new chimneys would be rebuilt using the original bricks. Due to the hard Portland cement mortar used in the original construction, however, it does not appear to be feasible
View of library chimney from entry

View of bedroom fireplace

View of library fireplace and chimney
to remove the existing bricks without damaging them. Prior to making a final decision on this matter tests on the brick removal should be carried out. If it is not possible to rebuild the chimneys with the existing brick, new brick which matches the existing should be used. In order to find replacement bricks research should be carried out to locate the original supplier of both the 1937 and the 1957 bricks to determine if matching bricks are still available. If brick from the original suppliers is not available, and if no standard brick can be found to match, custom bricks should be made and used in the rebuilding.

The brick should be installed in new mortar that matches the existing which is tooled to match the original joints. In order to develop the new mortar mix, the original mortar used in the construction of the walls will be analyzed to determine the composition of the mix, and the size and type of sand and pigments used. The new mortar mix will be developed based on the results of this analysis for use in the rebuilding.

The rebuilt chimneys should include new flashing installed in the mortar joints to replace the flashing which is to be removed. Dampers and spark arresters which were not included in the original chimneys should be installed in the new chimneys.

Research should be carried out on the existing coatings on the interior and exterior of the masonry chimneys in order to determine the nature and the year of application of the finish. If the coatings were applied prior to 1975 they should be reapplied on the new masonry.

CEILINGS

DESCRIPTION OF ORIGINAL WORK

Originally, all of the ceilings in the house were covered with Nu­wood, a wood fiberboard material, which was attached directly to the underside of the roof framing. Narrow redwood trim marking strips were installed over the seams between the fiberboard panels which carried out the diagonal line of the hexagonal floor pattern on the ceiling.

In 1952 the Hannas installed fabric over the fiberboard ceiling panels in the living room and dining room. The fabric, which was pasted directly to the fiberboard, was a natural woven fabric from Manila called saguran. In 1957, during remodelling of the house, additional cloth was ordered and installed on the ceilings in the library, utility bathroom, guest room and master bedroom and bathroom.

According to discussions with Mr. Erik Upmanis, he repaired water damaged ceilings throughout the house in 1981. This involved removal of saguran cloth in the living room, dining room and library, and repair of the fiberboard ceiling in the water damaged areas. The ceiling repairs were carried out with drywall tape and patching compounds, and the panels were renailed to the roof framing. Asian grasscloth wall paper was installed in the areas where the original saguran fabric was removed.

The original finish on the redwood marking strips and ceiling soffit trim was a wax based finish to match the wood walls. It is believed that the wood trim at the ceiling soffits was refinished in
1981 with a polyurethane varnish in conjunction with the refinishing of the wood throughout the house.

EXISTING CONDITIONS

General

The original fiberboard ceilings in the entry, kitchen and powder room are generally in good condition, however, there are water stains on the ceiling in the entry adjacent to the chimney.

The saguran fabric covered ceilings in the guest room, master bedroom and bathroom are in good condition. The fabric is well adhered to the fiberboard in most areas, however, there are locations where it is coming loose at seams and under marking strips. The fabric is also frayed at exposed seams and ceiling edges in some locations.

The grasscloth wallpaper covered ceiling, although in good condition, does not match the color or weave of the original saguran cloth.

Earthquake Damage

The movement of the chimneys, interior walls and casework caused by the earthquake impacted the ceilings. The roof framing and ceiling along the west wall of the main chimney appears to have settled.

EARTHQUAKE RELATED REPAIRS

New Structural Work

The proposed structural work which will impact the ceilings includes removal and rebuilding of the three chimneys as well as the shoring required for this operation, and installation of the cantilevered columns and footings and blocking and ties in the roof framing.

1. Chimneys

The removal and rebuilding of the three chimneys, as well as installation of the roof shoring required for these operations, will require removal of the ceiling panels adjacent to the chimneys to provide work space for the masons.

The wood marking strips and ceiling trim in these areas adjacent to the chimneys will need to be labeled, carefully dismantled and stored for reassembly.

Ideally, the ceiling in the area adjacent to the chimneys should be dismantled in large panels with the cloth intact, labeled and stored for reassembly in their original location. This should be done by cutting the ceiling panel along the line of the nearest marking strip and loosening it from the roof framing. In order to study the feasibility of this procedure investigations will need to be made into the method of attachment between the ceiling panel and the roof framing.

If it is not possible to dismantle the ceiling panels with the fabric intact, they should be removed and replaced with new fiberboard
panels to match the existing. In those areas where the original saguran fabric covering is intact the fabric should be taken off the fiberboard prior to removal of the panels and reinstalled on the new fiberboard panels. The fabric should be removed by dissolving the paste through steaming or the use of a solvent. If it is not possible to remove the fabric from the ceiling panels without damage to the fabric, the new fiberboard panels should be covered with new cloth that matches the original saguran fabric.

In those areas where new grasscloth wallpaper exists it would be preferable to replace the wallpaper with cloth throughout the room in conjunction with this work.

2. Cantilevered Columns and New Footings
   The ceiling in the guest bedroom and master bathroom closets should be removed for installation of the new steel columns. The ceilings in these closets are constructed of sheets of wood which are painted white. These panels should be dismantled and stored for reassembly in their original locations. They should be repainted following completion of the work.

Light fixtures are installed in the closet ceilings. (Refer to the Electrical Section for recommendations for this work.)

3. Blocking and Ties
   The installation of the blocking and ties in the roof framing will be carried out from above and will not require removal of the ceiling. Great care will need to be taken during installation of this work to ensure no damage occurs to the fiberboard ceiling. In addition, when the roof has been removed for installation of the diaphragm and blocking, measures will need to be taken to protect the exposed ceiling from weather.

CONSERVATION RECOMMENDATIONS

The ceiling finishes should be restored to the state they were in when the Hannas moved out of the house in 1975. This would involve removing the grasscloth wallpaper which was installed in 1981 and replacing it with new saguran cloth.

According to conversations with Paul Hanna prior to his death, additional bolts of the saguran cloth had been ordered during the remodelling of the house in 1957 and had been kept in storage. These bolts have not been found, but further attempts should be made to locate them. If this extra cloth is not located, research should be carried out to find the original source for the cloth in order to determine whether matching cloth is still available. If the original source for the cloth is no longer available new cloth to match the original should be installed to replace the wallpaper.

CASEWORK

DESCRIPTION OF ORIGINAL WORK

The original casework installed in the house included built-in cabinets and shelves, closets and cupboards throughout the house, and built-in couches in the living room, library and playroom.
The original casework is constructed of redwood that appears to have been finished with a wax based finish to match the wood walls. The cabinets, cupboards and closets are detailed with the doors and drawers that fit flush with the frames. The drawer and door pulls are narrow angled redwood strips and the doors are installed with piano hinges.

In 1957, during remodeling of the house, modifications were made to the original casework in the library and new casework was installed throughout the new guest room and master bedroom and bathroom. In general, these additions were detailed in a similar manner and constructed of the same materials as the original casework.

EXISTING CONDITIONS

General

The wood at the base of the built-in couches and the exposed edges and corners of counters and shelves is extremely nicked, scratched and gouged. The wood at the base of cabinets, closets and cupboards also shows sign of wear. The shelves in the library have been cut and the desks have been removed.

The casework was apparently refinshed with a polyurethane varnish in conjunction with refinishing of all the interior wood in 1981. Brush strokes are evident in the finish and there is poor coverage at corners and edges.

Earthquake Damage

The earthquake caused movement in the casework causing the closet and cupboard doors and drawers not to open and close properly.

EARTHQUAKE RELATED REPAIRS

New Structural Work

The proposed structural work that will impact the casework includes the removal and rebuilding of the three chimneys.

1. Chimneys

The built-in fireside couch and shelves in the living room, the cabinets and pantry cupboard in the kitchen and the closet in the entry that ties into the main chimney, the built-in fireside couch and shelves in the library, and the wardrobe closet in the master bedroom which ties into the chimney should be dismantled intact and stored for reinstallation.

Prior to dismantling the individual pieces of casework, all movable interior shelves and rods should be labeled, dismantled and stored for reinstallation. In addition, the doors and drawers should be bound in their closed position so no movement or damage is caused to these elements during transport to and from storage.

The casework should be refinished to match the finish which was on the wood in 1975. If at all possible, this work should be done in conjunction with refinishing of the wood in the entire room.
Further research is required to confirm the nature and the year of application of the existing wood finish. Following completion of the new chimneys the casework pieces should be reinstalled in their original location.

Electrical wiring and outlets are located within the individual pieces of casework. (Refer to the Electrical Section for recommendations for this work.)

Repair of Earthquake Damage

The doors which are out of alignment should be restored without extensive removal of existing material or repositioning of existing hardware.

CONSERVATION RECOMMENDATIONS

The wood finishes throughout the house should be restored to the state they were in when the Hannas moved out of the house in 1975. Research should be carried out to document the history of finishes which have been applied to the casework throughout the house and to determine the nature of the finishes which existed in 1975. In addition, research should be carried out to document the history of casework installation and modification that the Hannas carried out throughout their tenure in the house.

FIXTURES & EQUIPMENT

DESCRIPTION OF ORIGINAL WORK

Light Fixtures
The original light fixtures consisted primarily of recessed fixtures in the ceiling soffits and concealed lamps installed on top of the ceiling decks. Task lighting was provided by wall, floor and table lamps. The recessed fixtures were detailed with a redwood trim with Czechoslovakian glass lens.

The original glass lens in the recessed ceiling fixtures have been replaced with prism plastic lenses in the library and master bedroom. New downlights have been installed in the living room ceiling soffit.

Kitchen Equipment
No research has been carried out on the original kitchen equipment. The existing kitchen equipment includes a Maytag four-burner stove and oven with a hood above which vents through the chimney and a Kitchen Aid under counter dishwasher. The installation date of this equipment has not been documented.

Plumbing Fixtures
The original plumbing fixtures were specified to be porcelain enameled iron. Construction photographs indicate that the original bathtubs in all bathrooms were sunken into the floor slab.
In 1957, during remodelling of the house, the bathrooms underwent alterations and a new master bathroom was installed. All of the existing bathroom fixtures and features appear to have been installed at that time.

EXISTING CONDITION

General

The existing light fixtures appear to be in good condition, and the kitchen and plumbing fixtures appear to be in good working order.

Earthquake Damage

The earthquake caused no significant damage to the light fixtures, kitchen equipment or plumbing fixtures.

EARTHQUAKE RELATED REPAIRS

New Structural Work

The proposed removal and rebuilding of the three chimneys and the necessary removal of the ceiling panels adjacent to the masonry will impact the existing recessed light fixtures. The removal and rebuilding of the main chimney will impact the kitchen equipment adjacent to the main chimney.

Chimney

Ceiling panels will need to be dismantled to provide working space for construction of the new chimneys. The recessed light fixtures located in these panels, which includes the wood trim, glass lenses, recessed metal boxes and associated wiring should be labeled, dismantled and stored for reinstalation in their original locations. The glass lenses will need to be carefully protected during transport to ensure that no breakage occurs.

Following completion of the new chimneys and reassembly of the ceiling panels the light fixtures should be reassembled. Where the lenses have been replaced with plastic prism lenses, they should be replaced with new glass to match the original. Further research is required to determine the nature of the original glass. The wood trim should be inspected and refinished with a wax based finish.

The existing kitchen stove which is adjacent to the main chimney will need to be removed and stored for reinstallation. The hood which is attached to the masonry will also need to be removed and stored for reinstallation and reconnection to a new vent in the new chimney.

CONSERVATION RECOMMENDATIONS

Research should be carried out to document the physical alterations as well as the history of the fixtures and finishes in the kitchen and bathrooms.

The existing kitchen and bathroom fixtures, which appear to have been installed prior to 1975 should be retained until they no longer function in good working order. At that time, they should be replaced with a new fixture which is compatible with the house.
Permanent features and finishes in the kitchen and bathroom which were installed by the Hannas prior to moving out of the house in 1975 should be retained and properly maintained.
The preliminary cost summary below includes those costs related to the long term conservation of the Hanna House. (Refer to the Appendix for the detailed cost estimate worksheet.)

**BREAKDOWN**

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Total                                            $ 450,000
SECOND REVISION PRELIMINARY BUDGET ESTIMATE #1

DATE: February 3, 1991

PROJECT: 190C148

Stanford University
633 Serra
Stanford, CA 94305

Attention: Jonathan Ryan

VIA FAX/MAIL

SCOPE OF WORK


PRELIMINARY BUDGET ESTIMATE

APPROXIMATELY: $1,794,000

ALTERNATE #1

Allowances for deferred maintenance and conservation of original materials (see attached breakdown).

APPROXIMATELY: $450,000

ESTIMATE INCLUDES:

1. General requirements, including supervision, clean up, layout of the work, protection of finishes, temporary job site office, tools and equipment, temporary telephone, and permit fees.

- continued -

ACCEPTED: PLANT CONSTRUCTION COMPANY
2. Photogrametry of three chimneys, HABS photos and an engineered photographic survey.


4. Removal of existing systems to facilitate the installation of the new structural work, including:
   - ceiling panels
   - chimneys
   - roofing
   - miscellaneous trim
   - cabinets
   - walls
   - doors and windows

5. All above materials to be stored for reuse including brick from selected locations.

6. Structural demolition as necessary for new footings and retaining walls.

7. Shoring, including:
   - existing roof structure at three chimneys and dining room door header
   - earth at new footings (temporary) and retaining walls (permanent)

8. Site clearing as necessary to install soil anchors.

9. Concrete reinforcement of west retaining wall behind soil anchors.

10. Excavation and backfill.

11. Concrete patching of existing floors adjacent to the new work and repair of slab cracks.

   - continued -
11. Concrete work, including:
   - formwork
   - reinforcing steel
   - finishing

13. Five new concrete piers, all 13 feet deep. We assume existing soil conditions are 1-2 feet of fill and 3-13 feet of clay or native soil.

14. Sixteen 8" x 20' DCP soil anchors. We include no provisions to penetrate existing foundation walls.

15. Asphalt patching at carport and terrace retaining wall.

16. Foundation drainage at new terrace retaining wall.

17. Landscaping allowance.


20. Rough carpentry, including blocking and backing for millwork.

21. Repair and replacement of ceilings, walls, cabinets, shelving, doors and trim at areas affected by the structural upgrade.

22. Rebuilding the main, library and bedroom fireplaces and chimneys. Fireplaces will consist of reinforced concrete faced with a brick veneer to match existing. We assume all bricks will be new and include no provisions to salvage or reuse existing bricks. All existing fireplace hardware will be reused.

23. Patching brick at soil anchors and planters and pointing cracked joints.

- continued -
24. Addition of 1/2" plywood sheathing to the existing roof diaphragm. We assume new plywood will be installed directly over existing 1" sheathing and will not require edge blocking. At locations to receive new straps and blocking, we include removal of existing 1" sheathing and patching with new plywood.

25. New built-up roofing and related galvanized sheetmetal flashings.

26. New wire glass and frames at trellises.

27. Allowances to strengthen the header above the dining room sliding doors.

28. New shearwalls at two locations.

29. An allowance for wood treatment and painting flashings.

30. Mechanical, plumbing and electrical modifications as required by the structural repair.

31. Contractor's fee, taxes and contingency.

ESTIMATE EXCLUDES:

1. Irrigation.

2. Paving for drainage of existing asphalt surfaces.

3. Architectural, engineering or other consultants' fees.

4. Relocation of any utilities either above or below grade.

5. Waterproofing of subsurface areas or dewatering.

6. Underpinning.

7. Termite or dry rot repair.

8. Any floor preparation or leveling.

9. Any work performed on an overtime and/or premium time basis.

10. Telephone, audio or computer equipment and wiring.

- continued -
11. Any work required as a result of existing historic tunnels under site.

This is a preliminary budget estimate made in advance of final plans, specifications, competitive subcontractor bids, or review by the various City agencies. It is based on present day costs and commencing the work at this time. It is intended for budgeting purposes only.

GAH:ks

cc: Naomi Miroglio
    Paul Rodler
    David G. Plant
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**2290 - STRUCTURAL SHORING**

| STRUCTURAL SHORING MAT'L | 40.00 | @ MAIN CHIMNEY | 920 |
| LIBRARY CHIMNEY           | 30.00 | @ BEDROOM CHIMNEY | 575 |
| BASEMENT CLOS/WALLS       | 30.00 | @ NEW DINING RM & HLR | 575 |
| E MAIN CHIMNEY            | 50.00 | @ SHORING ACTIVITIES | 920 |
| @ HAND CHIMNEYS           | 20.00 | @ SOIL ANCHORS | 3.25 |
| @ MISC. & B/M WALLS/STES | 10.00 | @ TUBE STL COL. FTOS | 45.99 |
| @ TERR. RET. WALL         | 30.00 | @ BRICK & MORTAR CHIMNEYS | 45.99 |
| @ TERR. RET. WALL         | 12.00 | @ BASEMENT CLOS/WALLS | 45.99 |
| AND CHIMNEY               | 50.00 | @ NEW DINING RM & HLR | 1,840 |
| @ TERR. RET. WALL         | 12.00 | @ BRICK & MORTAR CHIMNEYS | 3.25 |
| @ TERR. RET. WALL         | 6.00 | @ MISC. SOIL ANCHORS | 23.00 |
| @ TERR. RET. WALL         | 12.00 | @ MISC. & B/M WALLS/STES | 13.455 |
| @ TERR. RET. WALL         | 36.00 | @ TERR. RET. WALL | 1,760 |
| AND CHIMNEY               | 240.00 | @ TUBE STL COL. FTOS | 11.50 |
| @ TERR. RET. WALL         | 36.00 | @ MISC. & B/M WALLS/STES | 12.26 |
| @ TERR. RET. WALL         | 12.00 | @ TERR. RET. WALL | 2,898 |

**2490 - SPECIAL FOUNDATIONS**

| SPECIAL FOUNDATIONS | 6.00 | @ ADD'L SOIL ANCHORS | 6,660 |
| SPECIAL FOUNDATIONS | 18.00 | @ SOIL ANCHORS | 9,760 |

**2599 - EARTH BANDING**

| EARTH BANDING | 500.00 SF | @ MAIN CHIMNEY FTG/PIERS | 23.00 SF | 11,975 |
| EARTH BANDING | 500.00 SF | @ MISC. & B/MANT WALLS/TUNNELS | 11.50 SF | 5,750 |
| EARTH BANDING | 500.00 SF | @ TERR. WALL | 23.00 SF | 11,500 |
| EARTH BANDING | 500.00 SF | @ MISC. & PLANTERS | 23.00 SF | 11,500 |

**2698 - SITE CLEARING**

| SITE CLEARING | 6.00 | @ ADD'L SOIL ANCHORS | 5,900 |
| SITE CLEARING | 18.00 | @ SOIL ANCHORS | 8,950 |

**2799 - SITE CLEARING**

| SITE CLEARING | 5.00 | @ ADD'L SOIL ANCHORS | 83,950 |

**2799 - SITE CLEARING**

| SITE CLEARING | 4.00 | @ ADD'L SOIL ANCHORS | 83,950 |

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NATIONAL REGISTER OF HISTORIC PLACES
INVENTORY -- NOMINATION FORM

SEE INSTRUCTIONS IN HOW TO COMPLETE NATIONAL REGISTER FORMS
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME
HISTORIC
AND/OR COMMON

2 LOCATION
STREET & NUMBER 737 Farmhouse Road
CITY TOWN Stanford University
STATE California

3 CLASSIFICATION
CATEGORY DISTRICT BUILDING STRUCTURE SITE OBJECT
OWNERSHIP PUBLIC PRIVATE OWNER
STATUS OCCUPIED UNOCCUPIED WORK IN PROGRESS ACCESSIBLE
PRESENT USE AGRICULTURE COMMERCIAL MILITARY
PRESENT USE MUSEUM PARK
PRESENT USE EDUCATIONAL PRIVATE RESIDENCE
PRESENT USE ENTERTAINMENT RELIGIOUS
PRESENT USE GOVERNMENT SCIENTIFIC
PRESENT USE INDUSTRIAL TRANSPORTATION
PRESENT USE MILITARY OTHER

4 OWNER OF PROPERTY
NAME STANFORD UNIVERSITY
STREET & NUMBER c/o Edward E. Shaw
CITY TOWN Stanford STATE California

5 LOCATION OF LEGAL DESCRIPTION
COURTHOUSE, REGISTRY OF DEEDS, ETC. Santa Clara County Records
STREET & NUMBER 191 North First Street
CITY TOWN San Jose STATE California

6 REPRESENTATION IN EXISTING SURVEYS
TITLE (See continuation sheet)
DATE
DEPOSITORY FOR SURVEY RECORDS
CITY TOWN
AIA plaques Hanna-Honecomb as "one of seventeen buildings designed by Frank Lloyd Wright to be retained as an example of his architectural contribution to American Culture".

DATE
1968  X Federal

DEPARTMENT FOR SURVEY RECORDS
National Headquarters of AIA
CITY
Washington  D.C.

TITLES
1. Title
Santa Clara County (California) Inventory
DATE
1962 and 1975  X County

DEPARTMENT
Santa Clara County Records
CITY
San Jose  STATE
California

2. Title
Santa Clara County (California) Planning
DATE
X County

DEPARTMENT
Santa Clara Records
CITY
San Jose  STATE
California
**DESCRIPTION**

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**DESCRIBE THE PRESENT AND ORIGINAL IF KNOWN: PHYSICAL APPEARANCE**

This house is set into the side of a hill in a wooded area.

The original University town. The concrete set and terrace work into the house.

The side of the house is overhanging, presenting 75 degree. The concrete set and terrace work into the house.

The house is constructed of native redwood board and gabbro to 6/2 inch studs (interior and exterior walls identical), 3.5 inch brick, cement, and plate glass. The original size roof has been replaced by vaulted.

The building complex in 1937 consisted of the main house, the house, garage, shop, studio building, double garage, storage, cellar, and garden house with tools and meter casette.

The house was built with Mr. Wright's house plans during 1937 and 1938. The construction was started in January 1937, on the original plans of buildings built in 4 phases, over a period of 25 years. However, Wright gave the entire project and presented plans for all buildings 1937. During the 25 years following, Mr. Wright and the house viewed the original plans and made minor revisions to conform to changing needs and circumstances.

The original main house was constructed in 1937 to accommodate a growing family living in a University community. It consisted of bedrooms, three baths, a large playroom (later to become the living room), a large living-dining room for university entertainments and seminars, a small music room, a kitchen, small study, and enclosed porch.

The original of the interior space was planned to accommodate a variety of very flexible use. Only the bedrooms and baths are built for privacy. The three floor levels reflect the gentle slope of the site and give the space interesting relief. A house is built below ground houses 3 forced-air gas furnaces with the controls, a water heater and water softener equipment. A vol. 4 feet by 4 feet (cross section), running the entire length of the house, contains heating ducts, pluming, electric lines -- all easily accessible for repair.

The kitchen, in the center of the house, and the bathrooms are lighted and ventilated from clerestory windows and vents.

In 1938, Phase 2 of the construction was undertaken. A 1200 square foot hobby shop, a guest house, and a storage room were added.

*(See continuation sheet)*
In 1957, Phase 3 was begun. The original 4 small bedrooms and study were converted into a spacious library, a master bedroom suite, and a small bedroom for a visiting grandchild.

Mr. Wright, in 1937, accepted the Hanna's request that the house plans provide for alteration of the interior space to conform to the needs of the parents after the young had departed. It was a relatively simple matter to unscrew the non-bearing walls between the bedrooms and the study. A fireplace was added in the new library, and another in the new master bedroom suite.

In 1961 Phase 4 was completed with the construction of a garden house at the south end of the extended concrete terrace, and two garden pools connected with a water cascade. Thus, after 25 years, the complex of buildings and the gardens and landscaping were completed. The attached floor plan reflects the Hanna-Honeycomb House as it grew to be in 1961.

The "living and growing" residence has one more phase contemplated. Hannas gave their residence to Stanford University in 1974. The donors suggested a use for the residence which the university hopes to be able to achieve, namely, to obtain gifts to endow a professorial chair to be known as the Distinguished Visiting Professorship. A couple with worldwide visibility would occupy Hanna-Honeycomb for a year at a time. This plan requires that the hobby shop and guest house be converted to an apartment for a caretaker couple who would serve the distinguished visiting professor, maintain the property in mint condition, and interpret the architecture to visitors who desire to know more about Mr. Wright's organic architecture.

Stanford has received a $500,000 endowment fund for the preservation, management, and improvement of Hanna-Honeycomb House. The Frank Lloyd Wright Foundation has prepared the plans for the construction of the caretakers' apartment. Work is anticipated during 1977-78.
PERIOD | AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW
---|---
PREHISTORIC | ARCHAEOLOGY PREHISTORIC
400-1999 | ARCHAEOLOGY HISTORIC
500-1999 | AGRICULTURE
600-1999 | ARCHITECTURE
700-1999 | ART
800-1899 | COMMERCE
1900- | COMMUNICATIONS
1860- | EXPLORATION/SETTLEMENT
1860- | INVENTION

**STATEMENT OF SIGNIFICANCE**

1. This architectural complex is significant because Frank Lloyd Wright used the 120 degree angle of the humpback form throughout Lincoln-Honeycomb House -- the first building ever to be designed on this geometric pattern. Since, this geometric pattern has been used in hundreds of buildings.
2. Frank Lloyd Wright left the buildings to grow and change over time as the family size and the activities of the house were modified.
3. This residence has been evaluated as significant for individuals and organizations, e.g.,
   a) "one of seventeen buildings designed by Frank Lloyd Wright to be retained as an example of his architectural contribution to American Culture" (ML plaque permanently displayed in Lincoln-Honeycomb House).
   b) "The Hump house is, for me, more important than the weekend pavilion, Tillingham, because it is attuned to a growing family and is less extroverted." (John Sargent in Frank Lloyd Wright's 'Tillingham', p. 32)
   c) "The living room of the Paul Frank House (1937) .......show how important the pattern of light and dark shadow is in Wright's total conception......The way we have a nervously rich and complex organization of the textures and colors of materials, jeweled, patterned light working on them. It should be remembered that these interior effects are not the result of an unthinking, cluttered architectural style but a new sensibility that has grown out of the desire to create a consistency of a fully developed philosophy of design combined with the design ability to execute the concept which that philosophy implies." (Sargent, "Wright", University of Chicago Press, p. 103.)

4. Lincoln-Honeycomb House has retained its original 1937 glassed-in banks of windows and is frequently used by hundreds of architects, writers, humanities, and scientists from every nation, thus serving an important educational function for them.
5. This "new" house represents an ideal union of modern architecture.

**SPECIFIC DATES**

- Designed: 1935-1936
- Built: 1937

**ARCHITECT/ARCHITECTURE**

Frank Lloyd Wright
10 GEOGRAPHICAL DATA

ACREAGE OF NOMINATED PROPERTY

UTM REFERENCES

ZONE EASTING NORTHING ZONE EASTING NORTHING

VERBAL BOUNDARY DESCRIPTION

737 Freudenthal's Road on Stanford University Campus.
Approximately a square lot bounded by Freudenthal's Road on
the west, by the residence of Professor John Davis on the
north, by Pine Mill Subdivision on the east, and by the
residence of Professor L. James Gill on the south.
See attached copy of Gift Deed, dated 21 Feb. 1974

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

STATE CODE COUNTY CODE

11 FORM PREPARED BY

NAME / TITLE
Paul L. Hanno Senior Research Fellow

ORGANIZATION
Harvard Institution

STREET & NUMBER
430 Mitchell Place

CITY OR TOWN
Stanford University

12 STATE HISTORIC PRESERVATION OFFICER CERTIFICATION

THE EVALUATED SIGNIFICANCE OF THIS PROPERTY WITHIN THE STATE IS

NATIONAL X STATE LOCAL

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

STATE HISTORIC PRESERVATION OFFICER SIGNATURE

DATE

TITLE State Historic Preservation Officer

FOR NPS USE ONLY

I HEREBY CERTIFY THAT THIS PROPERTY IS INCLUDED IN THE NATIONAL REGISTER

DATE

DIRECTOR, OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

ATTEST:

KEEPER OF THE NATIONAL REGISTER
1) "The Frank Lloyd Wright Houses," Frank Lloyd Wright House Designed, "How, Still in Our Time.

2) The Incorporator, Frank Lloyd Wright House Designed, "How, Still in Our Time."

3) John Crampton, Frank Lloyd Wright's Architecture, "How, Still in Our Time."


6) Honeycomb House is presented in a color image and in more than 20 periodicals.
Out of this plan came beautiful simplicity

Like the growth pattern of a tree, a ground work of hexagons, 30" on a side, establishes the basic pattern of this floor plan and the areas of the spaces it encloses, maintaining an orderly consistency within the complex form of the structure. Chimneys, retaining walls, and thin 3½" thick redwood partitions, laid out on the lines of this grillage, result in an easy flow from space to space and, like contour lines, they bring about an easy marriage between the building and its gently sloping site. The plan, overlying this basic web in a free, asymmetrical design, avoids the rigidity and monotony of a series of fire-walled enclosures. The result is a fluid continuity that makes each room seem an extension of another.
August 28, 1991

Mr. Fouad Bendimerad
Manager, Seismic Engineering
Stanford University
855 Serra Street
Stanford, California 94305

Dear Mr. Bendimerad:

Subject: SHPO Review of Hanna House (Bldg. 11-300)
FEMA-845-DR, P.A. 085-90000
Subgrantee: Stanford University

Attached is a copy of the letter, dated August 20, 1991, from the Office of Historic Preservation to the Federal Emergency Management Agency (FEMA), providing the recommendations concerning the proposed repair scheme for the Hanna House. We are providing a copy of this letter for your information.

If you have any further questions, please contact our office at the above telephone number.

Sincerely,

CHARLES P. WYNN
Chief, Disaster Assistance Division

attachment

cc: Tommie Hamner, FEMA
August 20, 1991

Mr. Roy F. Gorup, Chief
Public Assistance Program
Region IX - Federal Emergency
Management Agency
Presidio of San Francisco
Building 105
SAN FRANCISCO, CA 94129

RE: REPAIR AND STRENGTHENING OF HANNA HOUSE (BLDG. 11-300)
STANFORD UNIVERSITY

Dear Mr. Gorup:

We have reviewed the proposed scheme for repair and strengthening of the Hanna House, a highly significant historic property on the campus of Stanford University.

Because of this property's importance and because of the complexity of the problems associated with its repair, we have spent considerable time on our examination of the proposed repair plan.

We have concluded in the first instance, that it would be accurate to characterize the proposal as replication rather than repair of the principal lateral load resisting systems. These systems essentially consist of three chimneys - elements not customarily used for structural purposes. Due to their stiffness, however, they served as the primary lateral load resisting system and will behave in similar fashion during future groundshaking.

Replicating the fireplaces appears to be the most rational method of repair. Although not the method of choice under various applicable federal preservation standards and guidelines, we have not identified any alternatives to replication as the repair option most likely to minimize future property damage. By installing a plywood shear wall within an existing wall, and by situating cantilever structural steel columns in concealed spaces, historic ambience is retained and the level of potential damage from future groundshaking to such things as exterior glazing and interior partitioning may be minimized.
Replication of other important elements is proposed and supported by the analysis of the building's lateral load resistance. The strength provided by the plywood shear wall and cantilever columns does not intrude on historic ambience. Replication of retaining walls and pavement damaged by soil settlement is advisable since otherwise, the cause of the problem will probably not be eliminated and the problem itself would likely worsen.

In conclusion, the proposed repair scheme conforms to applicable historic codes, standards and guidelines in that the alternatives studied are not sufficient to minimize future earthquake damage to the Hanna House. The present scheme has the greatest potential for preserving the property.

If the repair scheme we have reviewed is carried out with FEMA assistance, it is our opinion that the effects of the undertaking on this historic property will have been duly considered and that FEMA will have met the intent of Section 106 of the National Historic Preservation Act and implementing regulations codified at 36 CFR 800.

Please be advised that modifications to the proposed repair scheme must be submitted to us for review prior to implementation so long as the undertaking may be supported by federal funds.

If you have any questions or require further assistance, please contact Hans Kreutzberg by writing to the letterhead address or by calling (916) 322-9621.

Sincerely,

Kathryn Gualtieri
State Historic Preservation Officer

cc: Mr. Charles Wynne, CAR
LETTER OF TRANSMITTAL

STANFORD UNIVERSITY
FACILITIES PROJECT MANAGEMENT
855 SERRA STREET, SECOND FLOOR
STANFORD, CALIFORNIA 94305-6114

DATE: 1/08/92                 PROJECT NUMBER: 6050

TO: Pat Dunn (FEMA)

FROM: Fouad Bendimerad

SUBJECT: HANNA HOUSE

WE ARE SENDING YOU:

Drawings X Copy of letter/memo
Prints Change Order
Other Estimate #2

Attached under separate cover:

Plans Samples Specifications

Copies Date Description
1 May 1991 Drawings (ARG)
1 12/2/91 Preliminary Budget Estimate #2
1 12/16/91 CATS form

These are transmitted as checked below:

For your approval: X         Approved as noted:
For your use: X             Returned for corrections:
As requested: X             For review and comment: X
Approved as submitted:

Remarks: This is the preliminary design for
the frame scheme for the Hanna House

cc: Carlo Rodriguez (GES)      Signed
### Project Name: Hanna House Seismic Reconstruction

**Phase:** Concept

**Proj No:** 6050

**Prepared Date:** 16-Dec-91

**Printed Date:** 19-Dec-91

**ENR (SF BLDG) Index:** 6232.94

**ENR Date:** 01-Nov-91

**Sq Ft Assignable:** 4253

**Sq Ft Gross:** 6347

**% Net Gross:** 67.01%

### 1. Construction

#### A. Basic Construction (Prime Consultant’s Scope)

1. **Building**
   - Cost: $1,370,000
   - %: 67.61%
   - $/Sq. Ft.: 216

2. **Equipment In Contract**
   - Cost: $0
   - %: 0.00%
   - $/Sq. Ft.: 0

   **(1A1 to 1A2) SUBTOTAL:** $1,370,000

3. **Site Work**

   **(1A1 to 1A3) SUBTOTAL:** $39,958

4. **Cost Rise**
   - To: 01-Jun-92
   - **(1A1 to 1A3) SUBTOTAL:** $39,958

### B. Other Construction

#### Equipment & Furnishings (Not In Contract)

- Cost: $9,000

#### Professional Services

- Cost: $192,000

#### 4. Administrative Costs

- Cost: $41,900

#### 5. Activation

- Cost: $2,500

### 6. Project Contingency

- (1 To 5) SUBTOTAL: $1,555,358

### 7. General Plant Improvements Pro Rata

- Campus: 1% x (Con Bud + Cont)
- Parking: x (Con Bud + Cont)

### 8. Replacement Parking

- Spaces: @ $14,189

### 9. Feasibility Analysis

- Cost: $215,000

### TOTAL WITHOUT FINANCING

- $2,026,443

### TOTAL PLUS FINANCING

- $2,026,443

---

* GPI Campus Pro Rata is 5.16% for Auxiliaries & Service Centers (See PD-22)
STANFORD UNIVERSITY
FACILITIES PROJECT MANAGEMENT OFFICE
PROJECT COST AND TIME SUMMARY (Back-up Sheet)

Project Name: Hanna House Seismic Reconstruction
Proj #: 6050
Date: 18-Dec-91

SCHEDULE SUMMARY

<table>
<thead>
<tr>
<th>Activity</th>
<th>No of Months</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre-Design</td>
<td>1</td>
<td>01-Sep-91</td>
<td>01-Oct-91</td>
</tr>
<tr>
<td>2. Schematic Design (Inc reviews)</td>
<td>1</td>
<td>01-Sep-91</td>
<td>01-Oct-91</td>
</tr>
<tr>
<td>3. Design Develop (Inc Reviews)</td>
<td>1</td>
<td>01-Sep-91</td>
<td>01-Oct-91</td>
</tr>
<tr>
<td>4. Construction Doc (Inc reviews)</td>
<td>1</td>
<td>01-Sep-91</td>
<td>01-Oct-91</td>
</tr>
<tr>
<td>5. Bidding/Award</td>
<td>1</td>
<td>01-Sep-91</td>
<td>01-Oct-91</td>
</tr>
<tr>
<td>6. Construction</td>
<td>-</td>
<td>01-Sep-91</td>
<td>01-Oct-91</td>
</tr>
<tr>
<td>7. Activation</td>
<td>1</td>
<td>01-Sep-91</td>
<td>01-Oct-91</td>
</tr>
<tr>
<td>8. Warranty</td>
<td>1</td>
<td>01-Sep-91</td>
<td>01-Oct-91</td>
</tr>
<tr>
<td>9.</td>
<td>1</td>
<td>01-Sep-91</td>
<td>01-Oct-91</td>
</tr>
<tr>
<td>10.</td>
<td>1</td>
<td>01-Sep-91</td>
<td>01-Oct-91</td>
</tr>
</tbody>
</table>

COST RISE CALCULATIONS (Compounding annually)

<table>
<thead>
<tr>
<th>Dates From</th>
<th>To</th>
<th>No. Of Months</th>
<th>% per Month</th>
<th>Constr. Cost</th>
<th>New Constr. Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-Dec-91</td>
<td>01-Jun-92</td>
<td>7</td>
<td>0.42%</td>
<td>$39,958</td>
<td>$140,9958</td>
</tr>
</tbody>
</table>

TOTAL COST RISE..Line 1A4, Page 1... $39,958

* Compounding annually, number of months in Col. A always 12 or less.
** Each successive Col. E total carries forward to Col. C on subsequent line.
First line in Col. C is subtotal after line 1A3 from Page 1.
page 2
## STANFORD UNIVERSITY
FACILITIES PROJECT MANAGEMENT OFFICE
PROJECT COST AND TIME SUMMARY (Back-up Sheet)

**Project Name:** Hanna House Seismic Reconstruct  **Proj #:** 6050  **Date:** 16-Dec-91

### PROFESSIONAL SERVICES

<table>
<thead>
<tr>
<th>Prime Consultant:</th>
<th>Arch</th>
<th>Mech</th>
<th>Civil</th>
<th>Struct</th>
<th>Elect</th>
<th>Oth</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Basic Fee</td>
<td>10.00%</td>
<td>x</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>137,000</td>
<td></td>
</tr>
<tr>
<td>2. Reimbursables</td>
<td>$10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Additional Services</td>
<td>25,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Presentation Graphics/Models</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Prime Consultant Total</strong></td>
<td>172,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### B. Landscape Architect
- 0.00% x 0 = 0

### C. Acoustic
- Audio-Visual
- Communicate

### D. Interior Designer

### E. Construction/Cost Consultant

### F. Safety Consultant
- Lab Consultant
- Surveillance

### G. Asbestos Consult

### H. Survey

### I. Soils Engineering:
- Design
- Construct
- 15,000

### J. Materials Testing

### K. Balancing (Mechanical Systems)

### L. EIR Consultant

### M. Other Professional Services:

### N. Extra Prints, Reproduction Costs

### O. Campus Model

**TOTAL FOR PROFESSIONAL SERVICES** 192,000

### ADMINISTRATIVE COSTS

<table>
<thead>
<tr>
<th>University Management Fee</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PM</td>
<td>300 Hrs @$86</td>
</tr>
<tr>
<td>2. ENGR</td>
<td>50 Hrs @$86</td>
</tr>
<tr>
<td>3. CM</td>
<td>0 Hrs @$86</td>
</tr>
<tr>
<td>4. Stu</td>
<td>0 Hrs @$25</td>
</tr>
<tr>
<td>5. GPI</td>
<td>0 Hrs @$59</td>
</tr>
<tr>
<td>6. FP</td>
<td>50 Hrs @$67</td>
</tr>
<tr>
<td>7. UA</td>
<td>50 Hrs @$100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>

### B. Med Center Plans Review

### C. Insurance (See PD-13)

### D. Plan Check Fees (See PD-15, ASA, Use Permit, OSHPD, etc)

### E. Suspended Charges:

### F. Other Adm. Costs (Archaeol. Inspections, etc)

**TOTAL FOR ADMINISTRATIVE COSTS** 41,900

### 5. ACTIVATION

<table>
<thead>
<tr>
<th>$</th>
</tr>
</thead>
</table>
| A. Moving Expense (New Occupants)
| B. IR Charges: TSO's @ $ /TSO |
| C. Keys & Locks
| D. Initial Cleaning and Window Washing |
| E. Operations & Maintenance Startup (See PD-12)
| F. Dedication Ceremonies (if project-funded)
| C. Other Activation |

**TOTAL FOR ACTIVATION** 2,500
### INSTRUCTION

#### BASIC CONSTRUCTION (PRIME CONSULTANT'S SCOPE)

<table>
<thead>
<tr>
<th>Description</th>
<th>$</th>
<th>%</th>
<th>$/Sq.Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Structure/Site Prep/Demolition</td>
<td>1,370,000</td>
<td>100.00%</td>
<td>216</td>
</tr>
<tr>
<td>2. Exterior Walls</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>3. Roofing System</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>4. Interior Construction</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>5. Equipment in Contract</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>6. Plumbing</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>7. Fire Sprinkler &amp; Halon</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>8. HVAC</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>9. Electrical</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>10. Site Dev/Paving/Landscape</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>11. Site Lighting/Util/Drainage</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
</tbody>
</table>

12. **(1A1 To 1A11) SUBTOTAL** 1,370,000 100.00% 216

13. General & Special Conditions (0.00%)
    
14. Contractor's Markup (0.00%)
    
15. **(1A1 To 1A14) SUBTOTAL** 1,370,000 100.00% 216

16. Estimating Contingency 0 0.00% 0

17. **TOTAL BASIC CONSTRUCTION** 1,370,000 100.00% 216

Use checklists for Equipment in Contract (pg. 6) and Site Work (pg. 7).

### CALCULATIONS:

#### GRAND TOTAL (Line 17 above)

1,370,000

Less: Equipment in Contract (Item 5 plus pro rata share of Items 13, 14 and 16) 0 Line 1A2, Page 1

Site work (Item 10 & 11 above plus pro rata share of Items 13, 14 and 16) 0 Line 1A3, Page 1

**TOTAL for Building** 1,370,000 Line 1A1, Page 1
SFANFORD UNIVERSITY
FACILITIES PROJECT MANAGEMENT OFFICE
PROJECT COST AND TIME SUMMARY (Back-up Sheet)

Project Name: Hanna House Seismic Reconstruction  PIP #: 6050  Date: 16-Dec-91

**1B. OTHER CONSTRUCTION**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>$/SQUARE FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos Abatement</td>
<td>5,000</td>
</tr>
<tr>
<td>Force Account</td>
<td></td>
</tr>
<tr>
<td>a. Utility Cut-Offs &amp; Connections</td>
<td>1,500</td>
</tr>
<tr>
<td>b. Traffic Barricades</td>
<td>0</td>
</tr>
<tr>
<td>c. Fire Alarm Connections</td>
<td>0</td>
</tr>
<tr>
<td>d. Signs</td>
<td>0</td>
</tr>
<tr>
<td>e. Other (Including Work Orders)</td>
<td>2,500</td>
</tr>
<tr>
<td>Site Clearance (if outside architect's scope):</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>On-Site Utilities (if outside architect's scope):</td>
<td></td>
</tr>
<tr>
<td>a. Steam/Condensate</td>
<td>0</td>
</tr>
<tr>
<td>b. Chilled Water</td>
<td>0</td>
</tr>
<tr>
<td>c. Power</td>
<td>0</td>
</tr>
<tr>
<td>d. Communication Ducts</td>
<td>0</td>
</tr>
<tr>
<td>e. Alternate Power</td>
<td>0</td>
</tr>
<tr>
<td>f. Domestic Water</td>
<td>0</td>
</tr>
<tr>
<td>g. Fire Water</td>
<td>0</td>
</tr>
<tr>
<td>h. Sanitary Sewer</td>
<td>0</td>
</tr>
<tr>
<td>i. Storm Sewer</td>
<td>0</td>
</tr>
<tr>
<td>j. Gas</td>
<td>0</td>
</tr>
<tr>
<td>k. Other On-Site Utilities</td>
<td>0</td>
</tr>
<tr>
<td>Total On-Site Utilities</td>
<td>0</td>
</tr>
<tr>
<td>Communication Systems (Wiring/Equip)</td>
<td></td>
</tr>
<tr>
<td>Not in Contract Lab Equip Hookups</td>
<td></td>
</tr>
<tr>
<td>Moving (Relocation &amp; Reoccupancy)</td>
<td></td>
</tr>
<tr>
<td>Fire Extinguishers</td>
<td></td>
</tr>
<tr>
<td>Plaques and Signs</td>
<td></td>
</tr>
<tr>
<td>Allow 1st Year Constr Adjmt (See PD-12)</td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td>TOTAL FOR OTHER CONSTRUCTION</td>
<td>9,000</td>
</tr>
</tbody>
</table>

page 5
DATE: 2/13/92
TO: PAT DUNN
FROM: JEANE BARNES
SUBJECT: HANNA HOUSE / Seismic Repair (May 16, 1991)

WE ARE SENDING YOU:

<table>
<thead>
<tr>
<th>Drawings</th>
<th>Copy of letter/memo</th>
<th>Under separate cover via</th>
<th>Plan</th>
<th>Sample</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>□</td>
<td>□</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Print</td>
<td>Change Order</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attached</td>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Copies | Date         | Description                          |
-------|--------------|---------------------------------------|
1      | 2/13/92      | Hanna House/Seismic Repair             |
       |              | Structural Calculations                |

These are transmitted as checked below:

For your approval: 
For your use: X
As requested: 
Approved as submitted: 
Approved as noted: 
Returned for corrections:
For review and comment:

Remarks:

CC: Jean/File
    Chron File

Signed
Hanna House

Seismic

\[ V = 18.370 \text{ W} \quad (R_u = 6) \]

\[ W_t = \text{Roof} \quad 15' \]

\[ \text{Part.} \quad \frac{5}{20} \text{ psf} \quad \text{wide} \]

\[ V^* = 3.7 \text{ psf} \quad \times 36' = 133 \text{ ksf \ transverse} \]

Wind

\[ P = C_e C_g g_1 \]

\[ = 1.2 \quad 1.3 \quad 1.3 \]

\[ = 20.3 \text{ psf} \quad \times 14' = 284 \text{ ksf \ transverse} \]
Typical Frame

Max Area = 321
\[ p = 321 \times 2.84 \]
\[ = 911.16 \text{ ft}^2 \]

Max Moment:
\[ M_{max} = 51^2 \times 12 = 60K\text{ft} \quad \text{(pinned base)} \]

Step:
\[ S_{2g} = 60 \times 12/24 \]
\[ = 30^2 \]
\[ TS \ 10 \times 6 \quad \text{(Conservative est)} \]

\[ 5 \times 9 = 45 \]

\[ S_{2g} = 22.5 \quad TS \ 8 \times 6 \times 2^{1/8} \]

Some Base Fixity will make TS 8x6 (or smaller) feasible.
Chimney Core Drilling

\[ W = 330 \times 1.83 \]
\[ = 60 \text{ lb/ft}^2 \]
\[ P = 79 \text{ lb/ft} \]

\[ M = 60 \times 15.78 \]
\[ + 79 \times 15.74 \]
\[ = 1.69 + .728 \]
\[ = 2.42 \text{ k-ft} \]

Core drill at 10'

\[ M = 20 \text{ k-ft} \]
\[ = 240 \text{ k-in} \]

\[ P/12 = 240/12 \]
\[ = 20 \text{ k} \]

\[ P_{\text{max}} = \frac{20}{18 \times 36} \]
\[ = 0.2 \text{ psi} \]

\[ T_u = 20 \times 1.4 = 28 \text{ k} \]

\[ T_u = 0.9 \times 60 \text{ ksi} \times 0.6^{0.7} = 32 \text{ k} > 28 \text{ k} \]

OK (\( J = 7 \))
RISA - 2-D
MODEL of
Tall Frame

Width = 4
Col = 6" x 4" x 5/16
Bm 1 = 8" x 4" x 1/4
Bm 2 = 4" x 4" x 3/16

At width = 3"
8" x 3" x 4" = .94"
8" x 3" x 4" = .32"
3" x 3" x 3/16 = .12"

Semi fixed base
Semi fixed base

Stress & Deflection are OK
WE ARE SENDING YOU X Attached □ Under separate cover via __________ the following items:

☐ Shop drawings  ☐ Prints  ☐ Plans  ☐ Samples  ☐ Specifications

☐ Copy of letter  ☐ Change order  ☐

<table>
<thead>
<tr>
<th>COPIES</th>
<th>DATE</th>
<th>NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6/7/92</td>
<td></td>
<td>Hanna House Report by Petite/Geertje &amp; Associates</td>
</tr>
</tbody>
</table>

PLEASE REVIEW AND DISTRIBUTE TO CC's -- THE ORIGINAL DID NOT HAVE PAGE 5.

JENN

6/7/92

THESE ARE TRANSMITTED as checked below:

☒ For approval  ☒ Approved as submitted  ☒ Resubmit ___ copies for approval

☒ For your use  ☒ Approved as noted  ☒ Submit ___ copies for distribution

☒ As requested  ☒ Returned for corrections  ☒ Return ___ corrected prints

☒ FOR BIDS DUE ___/19___ ☒ PRINTS RETURNED AFTER LOAN TO US

REMARKS Per your request

COPY TO ______________________  SIGNED: ______________

If enclosures are not as noted, kindly notify us at once.
June 2, 1992

Mr. Dennis Whitehurst
FEMA
c/o Barrett Consulting Group
Presidio, Region 9, Bldg. 105
San Francisco, CA 94129

SUBJECT: The Hanna House (Bldg. 11-300)
Stanford University

Dear Mr. Whitehurst:

As requested, we have reviewed the documents furnished by FEMA, as provided by Stanford and other sources. These are listed on the enclosed "List of Documents Reviewed." Following are our comments and the conclusions reached as a result of our review and visits to the site.

SCOPE

We understand the purpose and scope of our study to be:

1. Examine and evaluate the existing structure to determine which structural elements were damaged by the Loma Prieta Earthquake of October 17, 1989 (LPEQ) and recommend the repairs necessary to restore them to at least their pre-disaster condition.

2. Review the Forell/Elsesser report and preliminary (conceptual) design of repairs and comment on its relevancy to FEMA regulations and applicable building codes as they apply to the structure.

DESCRIPTION

A general description of the residence is included in the Final Report by the Architectural Resource Group (Ref. 1) and it need not be repeated here.

The fact that the house was designed by the world-famed architect, Frank Lloyd Wright, did not guarantee a damage-free building during a moderate or major earthquake. It can be argued that Mr. Wright did not have an understanding of the effects of expansive soil movement and earthquakes in this particular site. Soil creep and consolidation of the fill portion by earthquake shaking and subsequent settlement may have been prevented had proper consolidation techniques been used at the time of construction.
To illustrate Mr. Wright’s attitude towards things technical, we have excerpted the following portion from "The Hanna House," a book written by Mrs. Hanna describing in detail the planning and construction of the house. (Ref. 16)

"On a Sunday afternoon we were on our hillside lot with plot plan, floor plan, stakes, string, and measuring tape, busily laying out our house among trees. We were so engrossed in our project that we did not hear approaching footsteps. A voice startled us with, 'Young people, what are you doing?' We looked up to see Bailey Willis, world-famous geologist, looking disapprovingly at us and our equipment.

We proudly showed him our plans. His reaction was dismaying. With an impatient wave of his hand he said, 'You can't build here; a minor earthquake fault runs right through this hill.'

'But Professor Willis,' we countered, 'the university has granted us this site on this hilltop and our architect is drawing up the working plans.'

'In that case,' said the professor, 'I suggest you inform your architect that there is a branch of the San Andreas fault running through this hill.' With that, Professor Willis continued his Sunday walk. Naturally we were distraught, and telegraphed to Mr. Wright. We received this reply:

I BUILT THE IMPERIAL HOTEL.

A letter from Professor Willis on September 7, 1936, helped to reassure us:

'In the role of good neighbor I should, I think, inform you regarding certain geologic conditions that you might wish to consider in building on your house site. You may, perhaps, not be aware of them.

The rock which underlies most, and possibly all of your lot is a firm sandstone and an excellent foundation for all conditions. But just west of it is a bed of greasy, gypsiferous clay which becomes very slippery when wet. If any part of your foundation rests upon that clay, it should be set in a deep trench and thoroughly drained.
Furthermore your architect should give special consideration to earthquake resistant construction, since a minor earthquake fault runs through the hill, along the western slope. The fault is not itself an earthquake generator, but it may vigorously transmit a shock from the major fault. Being aware of this condition I would, myself, make my residence as light and rigid as possible, would set it on a continuous concrete foundation, and take special care in building chimneys.

There is no occasion for alarm, but good reason for care in design and construction. If you care to talk the problem over, I shall be glad to do so at your convenience.

We were sure that Mr. Wright had already incorporated the major ideas suggested by Professor Willis, but we were grateful for his helpful concern."

It can be concluded, therefore, that the Hanna House was designed with little knowledgeable regard for quantification of lateral forces nor for evaluation of such geotechnical considerations as compaction of earthfill, creep, settlement and heaving of the clay-based soils on the site used for fill.

The major lateral force resisting elements in the building are the wood sheathed roof, the roof framing members which connect the roof to the brick chimneys and the chimneys themselves which are the most rigid vertical elements in the building. The moveable walls and partitions contribute very little to lateral force resistance and must be ignored in any analysis of the building’s performance.

OBSERVATION OF DAMAGE CAUSED BY THE LPEQ

Differential settlement (from creep and heaving of expansive soils) may have caused some damage prior to the LPEQ to the exterior steps, retaining walls and soil supported concrete paving. There are obvious signs of pre-LPEQ soil creep at the steps of the north terrace, with a large crack on the side closest to the driveway.

However, the amount of pre-LPEQ damage can not be readily quantified, and for the purpose of defining repair methods we are ignoring the pre-LPEQ damage. In the preparation of the DSR for this building the team, perhaps can account for the different sources of damage by cost sharing some of the repair work.
The primary damages observed are as follows:

1. The main fireplace and brick chimney that separates the living room from the kitchen and entrance foyer has rocked about its base and crushed some of the bricks in the entrance foyer and caused separation, loose bricks and cracking at the perimeter of the base, particularly in the kitchen areas. The chimney has been temporarily shored, apparently to prevent collapse during after-shocks. The chimney remains plumb and is undamaged throughout its height. No cracking is evident at the roof line where, traditionally, unreinforced brick chimneys have been observed to fail during major earthquakes. The library fireplace also has some displaced bricks and minor cracking at its base, but is otherwise undamaged.

2. The brick-faced retaining wall at the north end of terrace and which extends approximately 50 feet in an east-west direction has tilted to the north and as a result the top 3 to 4 feet of brick facing has broken and fallen away for a distance of 20 to 30 feet. The failure has exposed some corroded rebar in the top of the wall which may have originally anchored the brick to the concrete. A terracotta drain line runs along the top of the concrete wall just inside. This raises questions about the adequacy of drainage behind the wall at the footing level.

3. The north terrace (off the living room) and the steps leading down to it are badly cracked and are evidence of differential settlement of the loose fill below. Part of this can be attributed to long term creep and settlement prior to the LPEQ.

4. The brick walls forming the large planter between the front entrance and the north terrace are also badly cracked. It also shows signs of differential settlement caused by soil creep and earthquake shaking.

5. The living room slab was placed over loosely compacted fill varying in thickness from 5 to 9 feet. The hexagonal patterned concrete slab on ground is now uneven and not habitable because of differential settlement.

Other items of damage noted by the Architectural Resources Group are not addressed by us because they are not of any structural significance, in our judgment.
REPAIR OF DAMAGES

The primary concern is the differential settlement from consolidation and creep of loosely compacted fills which are affected by earthquake shaking during the LPEQ. Consequently, there is a need to restore the supporting soil to a stable, reliable condition. The concern was also expressed by J. V. Lowney and Associates in their September 1990 report. (Ref. 4)

The first preference by Lowney would be to remove the soil from below the building slabs and to bench into the cut slope prior to replacing and recompacting the fill with suitable material. Because of the obvious impracticality and cost of house removal in order to accomplish this, Lowney also suggested the possibility of stabilizing the fill with chemical grouting but raised a question of its effectiveness in the plastic silty-clay fill material.

We have pursued this alternative possibility with Mr. Al-Alusi of the Pressure Grout Company. We propose combining it with a tie-back retaining wall along the existing north terrace wall where the fill is deepest.

Mr. Al-Alusi has assured us of the feasibility of such a procedure and has submitted a proposal for doing the grouting portion of the repairs. (Ref. 14)

We have prepared the following recommended scope of repairs to the damaged areas outlined above:

1. The main fireplace can be restored to its pre-earthquake condition by: removing the broken and loose brick and excavating back to sound mortar and brick. This probably will require some temporary underpinning, working on small areas in stepped sequence so that the existing masonry is not overstressed. Each area so cleaned out can then be carefully restored by setting matching bricks and mortar. This must be carefully done by experts in masonry restoration so that the character and texture of repairs is practically indistinguishable from existing. Where there are no loose mortar or bricks, but where the base joint is cracked, it can be repaired by removing the outer mortar at the joint, epoxy injection of the crack and repointing of the mortar. The feasibility and acceptance of this type of repair has been described by Mr. Robert Gaul in other repair recommendations by PG&A for the sandstone URM buildings on campus. The base of the library fireplace can be repaired in a similar manner.
2. The 50-foot long concrete retaining wall along the north edge of the north terrace should be stripped of the brick veneer, saving the brick for re-use, if possible. The existing concrete wall, even though slightly tilted, can be used to support tie-back anchors which will extend down and into the cut material below the existing fill beneath the terrace and house. After pre-stressing the anchor rods and chemically grouting the fill material (as described in item 3 below), a new brick wall with footing can be built 4 inches (minimum) from the face of the existing concrete wall. The new brick wall should have anchors into the space which is to be reinforced and fully grouted so as to tie the two walls together to act compositely. The new brick wall will be higher than the existing concrete wall but will be reinforced to withstand lateral soil pressure above the existing wall.

3. The north terrace patterned concrete slab off the living room, including the concrete stairway leading to the house, must be removed. The fill beneath this slab can then be consolidated by pressure grouting as proposed by the Pressure Grout Company. A new patio slab and the stairs then can be replaced. This replacement work must be done carefully to match the existing color and texture of other terrace slab areas. Here again, there is a need for expertise in historic restoration to accomplish acceptable results.

4. The planter area adjoining the north terrace is trapezoidal in shape and is enclosed by a brick wall about 40 feet in length. We recommend this entire wall be removed and rebuilt to match the existing construction.

5. Inside the house, the living room slab, which is uneven and shows differential settlement between hexagonal patterns, is otherwise uncracked. We recommend the repair procedure deemed feasible by the Pressure Grout Company. That is, re-leveling the slabs using a pressure grout after the fill below the living room, as well as that below the adjoining terrace, is stabilized by lens grouting.

COMMENT ON REPAIRS TO SUPERSTRUCTURE

Forell/Elsesser Engineers, Inc., (F/E) in their final report, dated February 1991, recommended that the structure of the house itself be upgraded to meet the current uniform building code (UBC). This would involve new roof diaphragms, collectors, drag
struts and either moment-resisting steel frames or plywood shear walls added to the structure.

While we may agree such strengthening would be desirable (in light of Mr. Wright's design), we did not observe any other significant structural damage to the building caused by the LPEQ. Consequently, we can not recommend that such upgrade strengthening of the superstructure be funded by FEMA under the current stated policy of funding only those repairs which are a direct result of the disaster and which are required by current applicable codes. As stated many times before, there is no code requirement to strengthening structures as a consequence of an earthquake.

We have not attempted to estimate the cost of our recommended repairs. Neither have we checked the Plant Construction Company estimates against the repairs recommended by F/E.

CONCLUSION

It is our engineering judgment, based upon the review of the documents listed and our many visits to the site that:

1. The Hanna House was damaged as a direct result of the LPEQ.

2. The damage observed was limited to effects of the soil settlement (caused by shaking), particularly in the filled areas under the house and the north terrace.

3. The repairs should correct the defect in the supporting soils by stabilizing to prevent damage while at the same time re-leveling the concrete slabs and repair the adjacent planters, stairs, retaining walls and the main brick fireplace.

If you have any questions regarding this report, please contact Mr. Preece.

Very truly yours,

F. Robert Preece                        H. Robert Hammill

FRP/mml
Enclosure
LIST OF DOCUMENTS REVIEWED


**PART I - PROJECT DESCRIPTION**

<table>
<thead>
<tr>
<th>Applicant/Name/County</th>
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**PART II - ESTIMATED COST OF PROPOSED WORK**

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**PART III - FLOODPLAIN MANAGEMENT/HAZARD MITIGATION REVIEW**

22. In or Affects Floodplain or Wetlands: Y
23. Floodplain Location: Y
24. % Damage: 85
25. Disaster Area: Y
26. Land Use: R
27. FEMA Req: Y

**PART IV - FOR FEMA USE ONLY**

32. Worksite No. 39027

33. Insurance Com- mitment Required: F
   - Building: $205,949
   - Property: $G
   - Content: $H

35. Comments/Changes: This DSR replaces void DSRs 88615 and 18695

**First Review (Signature):** [Signature]

**Second Review (Signature):** [Signature]

FEMA Form 90-91, AUG 87

REPLACES EDITION OF APR 85, WHICH IS OBSOLETE.
DAMAGE SURVEY REPORT

REVIEWER'S COMMENTS

Disaster No. 845  P.A. No. 085-90000
Category E  DSZ No. 06195
DAR Inspection Date 5/2/792
Applicant: STANFORD UNIVERSITY, HANNA HOUSE, 11-330
County: SANTA CLARA

I have reviewed DAR #06195 and determined the repairs to be appropriate for the damage incurred. The work as described will cause no adverse effect to historic properties.

Applicant must submit final repair plans for section 106 review. Review must be completed prior to start of construction.

HTR Code 15

T. Ridgway
For Jane LeMay
7-7-92
Historic Preservation Rep. - FEMA
On November 3, 1989 a DSR # 88615 for $602,065 was prepared for repair of the earthquake damages to the Hanna House as itemized by the "Synthesis Design Group" (SDG) and estimated by Plant Builders for the applicant, Stanford University.

The repairs proposed were for 1) The main fireplace
2) The library fireplace
3) The North terrace/retaining wall
4) Other specific itemized damages per SDG list.
   (See Sheets 27 & 28.)

This DSR was suspended to investigate if all of the work was earthquake related and what might be non-eligible. Subsequently, the team of Pat Dunn and Carlos Rodriguez (TAC/OES) inspected the site and checked each of the items on the SDG list. DSR # 18635 dated 5/29/90 was then written by the team for $287,040, which contained similar scope to the previous DSR and was written to supersede it.

The primary differences in funding were;
1) elimination of the contractors contingencies
2) allowance of only 1/2 of the roofing and flashing costs
3) a more simple repair of the library fireplace rather than rebuilding
4) elimination of the duplication of terrace/retaining wall repair cost
and 5) adjustment to the costs of miscellaneous repairs as determined to be eligible for FEMA compensation.

This DSR was also placed in suspension, pending further information from the applicant, as Stanford University felt that seismic upgrade of the structure may be warranted. Stanford proceeded to have a geotechnical report prepared by J.V. Lowney & Associates on 9-7-90. This was followed by a report of proposed repair scheme by Forrell/Elsasser Engineers (F/E) on 2-5-91 and "Recommendations for Seismic Repair and Conservation of Historic Features" by Architectural Resources Group on 2-11-91. All of which information was received by FEMA on 3-25-91.

The geotechnical report found that the house is underlain by improperly compacted fill material which is creeping down slope and settling, resulting in differential settlement of the slabs and
distress to down slope retaining walls. There may also be the existence of excavated tunnels under the house though they have not yet been detected, that could add to the possibility of settlement.

Utilizing the recommendations of the soils report and requirements of the 1988 UBC, the structural engineer, F/E developed a repair and seismic upgrade scheme consisting of the following:

1. Repair the main, library and bedroom chimneys, by dismantling the chimneys and rebuilding as brick faced reinforced concrete structures with new foundations.

2. Anchor the roof to the chimneys and add a plywood diaphragm.

3. Provide additional lateral load elements in the form of shear walls and cantilever steel posts.

4. Repair the front retaining wall, by removing the north terrace wall and replacing it with a new brick faced concrete wall. The soil would be replaced with compacted fill behind the wall and a new concrete slab would be poured. Along the living room and dining room terrace the wall would be stabilized with soil anchors.

5. Repair the garage retaining wall by removal and replacement.

6. Repair and strength the living room flitch plate. (Header Beam).

A more complete description of these repairs can be found in the report by F/E.

Architectural Resources Group's report compiled information of repair methods for the structural, electrical, mechanical, landscape and architectural features. It discussed the historical background, the existing conditions and the conservation considerations necessary for the historical features. Cost estimates were included for the seismic repair and the conservation work, that were prepared by Plant Builders, Inc. They were $1,794,000 and $450,000, respectively.

The Facilities Project Management Office (FPM) added professional and administrative services along with contingencies and miscellaneous costs which increased the total for the seismic repair to $2.8 million.

FEMA consulted with another structural engineering firm, Preasse/Goudie and Associates, (PG&A), to determine if the extent of upgrade proposed by the Applicant was required due to the earthquake damages. While this was being studied the applicant conducted an alternative design study, as well, to see if costs
could be reduced by use of some other strengthening scheme. Before finalizing their report, PG&E awaited the conclusion of Stanford's design alternatives development. The first upgrade scheme had such a high cost that it seemed it would be cheaper to demo and rebuild the structure.

The revised scheme was submitted as an estimate prepared by Plant Builders, Inc. dated December 2, 1991. The basic construction cost was $1,370,000 and with FPM additions as above the total came to $2.0 million.

The new scheme proposed to core drill and reinforce the fireplaces without removal, and to add steel moment frames on the interior of the home as the additional lateral elements. All else remains about the same. This results in a $400,000 savings in the basic construction cost and an additional $400,000 savings in the project management costs, per the revised estimate.

PG&E reviewed the proposed schemes and evaluated them in light of the extent of damages to the structure, viewed during several site inspections. Their findings and recommendations of repair were issued subsequently in a letter dated 6-2-92. (see sh'ts. 46-54)

PG&E interprets the applicable codes to not require upgrade due to the earthquake caused damages. Upgrade may be desired due to pre-existing substandard conditions or lack of sufficient lateral stability, but this is not reason to upgrade due to the earthquake damage.

Therefore this DSR is written to repair the damages of the earthquake per applicable codes and standards. Specifically repairs to only the following are considered eligible:

1) The main fireplace - removal and replacement of the crushed or broken masonry and epoxy injection of mortar cracks that remain. Foundation and utility relocation work should not be necessary, nor any alteration to the basement tunnel, to restore the fireplace structure to it's pre-earthquake condition.

2) The library fireplace - replacement of cracked masonry and epoxy injection of mortar cracks to restore element to its pre-earthquake capacity.

3) The North Terrace/retaining wall - remove the crumbled & remaining brick facing from the north 50 feet of failed & bowed retaining wall. Old concrete retaining wall to be restrained with soil anchors due to restrictions of existing landmark oak trees on new construction. A new plumb face of brick should then be applied to match existing by reusing the original brick or using new that is an appropriate match. The terrace slab shall be removed and have top the 12"-18" of existing subgrade replaced and recompacted. To eliminate the fill
consolidation and creep problem the remainder of the soil area should be stabilized by lens grouting. A new decorative concrete slab and stairs shall be poured in place.

4) Repair or rebuilding of 45' of brick planter wall adjacent to the North Terrace along driveway.

5) The interior floor slabs shall be leveled as the soil below is stabilized through lens grouting and soil densification by pressure grout injection.

6) Other specific minor damages as itemized by SDG and confirmed as eligible by prior DSR team will be included.

The west terrace and retaining wall did not show signs of failure as at the north retaining wall and terrace. The soil condition of poorly compacted fill probably exists at this location as well. So, while lens grouting is probably advisable at this location, it is not substantiated by earthquake damage and is therefore not eligible.

Also the seismic upgrade work is not eligible as there is no trigger in the applicable codes that requires upgrade due to earthquake repairs being made.

The following is a discussion of the observed damages and description of repairs with estimates of cost developed from information provided by Plant Builders for the various schemes.
DAMAGES & REPAIRS

General Discussion

The Hanna House, which was designed by Frank Lloyd Wright, sustained significant damage during the October 17th earthquake. The two areas which suffered the most damage are the living room fireplace and the north terrace slab/retaining wall. The living room fireplace is a massive unreinforced brick structure which also houses the flues for the furnace, hot water heater and the stove. The total structure is approximately 25 feet long and 2 1/2 feet wide and 21 ft. in height. The brick work suffered significant cracking and brick displacement, primarily at the base of the structure. The applicant has shored up portions of the structure in case of another earthquake (EQ). Some of the ceiling joists and roof rafters frame into the chimney and would partially collapse if the chimney itself collapsed. We can only fund repairing the chimney to its pre-earthquake capacity though additional strengthening and stabilization would be prudent.

In regards to the front terrace and retaining wall, we recommend paying 2/3 of the eligible construction costs. While some of the damage was earthquake caused there are definite signs of pre-EQ damage. According to the applicant’s consultants the damage was caused by movement of improperly placed fill which was used in the original building construction. There is obvious evidence of pre-EQ movement and repair work to the concrete steps and slab. This is also true of the interior slabs in the living room area. Therefore, the slab jacking by dense grouting will only be 2/3 eligible as well.

In regards to the library fireplace repair, we do not feel that the total rebuilding of the fireplace is justified due to EQ damage. We have included a repair estimate which should fix the minor EQ caused damage. The bedroom fireplace did not sustain any damage, so repair of any type would be ineligible.

Finally, the applicant’s architect has made a detailed list of minor EQ damages and estimated the repair costs. We have used this list in our site visit and checked each individual item. For those eligible items we have either used the applicant’s original estimate or calculated our own. We have included a written explanation for those items which have different cost estimates.

This DSR was written to supersede DSRs #088615, and #18635 written in November, 1989 and May, 1990 respectively. We have included the following as backup material: 1) cost estimates from the applicant’s representatives, 2) written summary from Stanford’s Facilities Project Management department (FPM), 3) Preece/Goudie and Associates Report, 4) Pressure Grout Company proposal for soil grouting.
Main Fireplace Repair

The main fireplace which is in the living room is approximately 25 feet long and 2 1/2 feet in width. The layout of the main fireplace and the adjoining rooms can be seen in sheets 27, 28, 31 and 32. The attached brickwork also contains flues for the furnace hot water heater, and the stove. In our site visit, we saw cracking and brick displacement particularly at the wall corners and at the floor level.

The applicant has shored up portions of the brickwork to prevent further damage or collapse. The fireplace and attached brickwork is an integral structural component of the building. Ceiling joists and roof rafters frame into the brick. Collapse of the chimney would in turn cause collapse of portions of the building. The chimney and attached brickwork is unreinforced and could not be built as such under present code. Due to the significant amount of damage incurred and the historical importance of the structure, we recommend a restoration masonry expert perform repair of the fireplace and chimney.

To determine the costs for repair, use of the line item estimates by Plant Builders are adjusted to account for repair of this sort to only the main fireplace rather than all 3 fireplaces. Thus the preliminary estimate of this eligible repair work is $65,362. (see sheets 12 & 13)

Library Fireplace Repair

The library fireplace, shown in the architectural layout on sheet 11 suffered minor damage in the EQ. The primary damage was cracking of the mortar and brickwork in the foyer and some minor cracking in the fireplace area. The damage was significantly less than that incurred by the main fireplace. Minor epoxy injection and brick replacement will bring the chimney and fireplace back to it's pre-EQ condition; for an estimated cost of $2,450. (see sheet 14)

Front Terrace/Retaining Wall Repair

The applicant's contractor consultant has put together a preliminary estimate for demolition and reconstruction of the front concrete terrace and supporting retaining wall. Pictures 1-2, 13, 17-22 & 34 show the front terrace and/or portions of the retaining wall. Also included on sheet 15 is a portion of the architectural plan showing this area.

In a site visit on 5/4/90, Pat Dunn & Carlos Rodriguez accompanied by Jonathan Ryan, a project manager with Stanford's Facilities Project Management department, who will be in charge of the repair work. He stated that the retaining wall and terrace damage was due to movement in improperly placed fill material in the front portion of the house. There is evidence of pre-EQ movement in the terrace slab and concrete steps. See picture #15.
which shows a crack at the top of the uppermost step which had been
patched prior to the earthquake. The top two steps are a different
pour than the rest of the concrete perhaps indicating that this
settlement has been an ongoing problem. Also the terrace slab has
cracking which occurred prior to the Oct. 17th earthquake.

Even though there was some pre-EQ ground movement causing slab
and wall damage, it appears that the EQ has increased the damage.
Portions of the retaining wall nearest the carport have collapsed.
See Pictures 21 & 22.

Picture 18 shows separation of the retaining wall and the
concrete terrace slab. Portions of the front retaining wall have
a significant bow when viewed from the top of the wall. This
portion of wall will need to be soil anchored to regain its
original strength.

The contractor's estimate includes the demolition and
rebuilding of 85 LF of concrete retaining wall with brick veneer,
600 SF of concrete terrace slab and 2 sets of concrete steps
leading to the carport area and the living room. We feel that the
applicant is entitled to 2/3 of the costs related to the terrace
and retaining wall repair, as a good portion of damage was caused
by the earthquake but there was obviously pre-EQ damage as well.
The contractor's estimate has been adjusted to account for
demolition of only the brick facing, installation of tiebacks and
replacement of brick facade to 60 LF of wall. The only costs we
have disallowed in the contractor's estimate is for landscaping and
the general contractor's contingency (10% of contract work). We do
not feel that $2000 is a reasonable number for replacement of
landscaping damaged during construction. Most plants in the area
are junipers. We feel that the contractor's bid item #2510 site
clearing includes enough money for both site clearing and new
landscaping. We recommend compensation in the amount of $ 95,150
for the front terrace and retaining wall repair. (see shts. 16-18)

Brick Planter Wall Repair

The low brick walls which form a planter between the front entrance
and the North terrace are badly cracked and show signs of
differential settlement. As with the terrace, only 2/3 of the cost
will be eligible due to pre-EQ damage. Due to the current
unlevelness of the top of the wall it seems necessary to remove the
entire brick planter wall, recompact the subgrade and construct a
new planter using the same brick or matching brick if original is
not salvageable. This would be approximately 45' of double wythe
wall, amounting to $ 9,222 of repair. (see sht. 19). The rear
brick wall of this planter which is against the house was not noted
to be in need of repair. There are other brick walls that incurred
some cracking from the earthquake and should be repaired by
repointing. These are covered under the specific minor damages
section as an estimated lump sum cost.
INTERIOR SLAB JACKING AND STABILIZATION

The living room slab of approx. 4' hexagon patterned concrete tiles shows signs of differential settlement of the concrete slab below. This has occurred at some locations over time but was probably accelerated by the earthquake. Because of the pre-existing unlevel condition, evidenced by the ground edge of some raised hexagons, only 2/3 of the floor leveling and soil stabilization is deemed eligible. The soil under the living room, entry & kitchen (the lower floor level) shall be stabilized by lance grouting. Then the living room slab can be releveled with pressure grouting. The feasibility of this repair procedure has been confirmed by the Pressure Grout Company of Hayward. They have also provided a price quote for the work which this DSR estimate is based on. (see Sh. 20) Therefore, $12,700 is allotted for this work.

OTHER SPECIFIC MINOR DAMAGES

These were assessed and estimated by the previous DSR team and upon review are deemed adequate still. (see shs. 21-28) The total for miscellaneous repairs is $21,065.
MAIN FIREPLACE REPAIR COST

Using the appropriate values by Plant-Builders Inc. repair only of the main fireplace from the three prepared bids, a final repair estimate can be compiled. The three schemes that Plant estimated:

1. Remove and rebuilding of main fireplace.
2. Remove and replacement of old 3 fireplaces with reinforced concrete with brick veneer.
3. Core drilling of 3 3 fireplaces with repair of damaged brick.

- Line items must be picked & chosen from the three estimates because no one of the estimates matches the determined eligible repair.

Example: Estimates 0.1 + 1.1 called for demo of old brick,
and Estimates 2+ 1 called for repair of all 3 fireplaces
rather than just the main one.

For main fireplace repair only use estimate #0 for perimeter.

Work includes the cement removal & replacement.

Use 1/2 of estimate # 2 values that relate to repair of the
existing brickwork as the main fireplace is approximately equal
to the other two - a balance adjustment. Take into account the
correction of the cracks (not a major correction).
# Damage Survey Continuation Sheet

**Date:** 5-27-90  
**Sheet:** 3 of 57

### Main Fabric Repair Cost (cont.)

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<tr>
<td>6730</td>
<td>Replace Trim</td>
<td>4840</td>
<td>+ 0</td>
</tr>
<tr>
<td>6740</td>
<td>Reinstall Gla Panels</td>
<td></td>
<td>Not Required</td>
</tr>
<tr>
<td>7500</td>
<td>Patch (E) Roofing</td>
<td>1500</td>
<td>Allowance</td>
</tr>
<tr>
<td>7600</td>
<td>Sh. Htl. Flashing</td>
<td>1000</td>
<td>Allowance</td>
</tr>
<tr>
<td>3900</td>
<td>Paint &amp; Wall Covering</td>
<td>2000</td>
<td>= 0 Allowance</td>
</tr>
<tr>
<td>10360</td>
<td>Fire Place Hardware R/R</td>
<td>1000</td>
<td>= 0 Allowance</td>
</tr>
<tr>
<td>15400</td>
<td>Plumbing Relocation</td>
<td></td>
<td>Not Required</td>
</tr>
<tr>
<td>14500</td>
<td>Electrical Relocation</td>
<td></td>
<td>Not Required</td>
</tr>
<tr>
<td>5930</td>
<td>Epoxy Grout Injection</td>
<td>1125</td>
<td>75' x $15/ft Allowance</td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td>47536</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General Repairs</td>
<td>11884</td>
<td>= 47536 x .25</td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td>59420</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contractor's Fee 15%</td>
<td>5942</td>
<td>59420 x 15%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>$63,362</td>
<td></td>
</tr>
</tbody>
</table>

MAIN = REPLACE  
REPA TO  
PRE = EQ CONDITION
LIBRARY FIRE PLACE REPAIR COST

Only minor brick work is required due to the earthquake damage to mortar joints in the fire place. A few cracked bricks in the corner.

- Estimate of brick & mortar work.
  - Crew 1 mason $45/4.
  - 1 laborer $35/4.

$80/4.

24 hrs @ $80/4 = $1,920 labor
+ $80 material

$2,000

- Epoxy work

30' allowance @ $15/foot = $450 labor + material.

TOTAL $2,450
FRONT TERRACE / RETAINING WALL REPAIR COST

Using the approximate values by Plant Business Inc. (22-)
the apply to removal of the brick veneer, excavation of
soil under the, demolition of terrace slab, and replacement
of slab and stairs from the three prepared bids. The item
estimates were compiled. The three (3) schemes were not
prepared estimates or costs as follows.

1. Remove & Rebuild North terrace slab, $28000, retain wall
   contract was concrete retaining wall with soil under the
   brick face. Excavate soil and backfill under terrace
   slab, and demo and repair terrace slab & stairs, $4000.
   Also had costs for similar work on west terrace and retaining
   wall, No Pressure Grout work.

2. Remove & Rebuild North terrace slab, retain wall
   Summary (1) above, but with drilled piles for retaining
   wall footing and only ½ as much excavation & backfill
   Clean the original concrete slab as needed.
The line from entrance to a back terrace needs to be
quantified as work and not as a repair. This is paying for some
placement of 34 to 35% which is in addition to work and extra work. No
work to be performed and nothing done except repairs. No
estimates have been provided by PB for this or any work to be done.

The differences between the eligible repair and PB's
estimates are:

a. Concrete retaining wall will not be demolished.
b. New footing for retaining wall is not needed.
c. Soil stabilization will be done underneath north terrace slab.
d. No west terrace of retaining wall will be done.
<table>
<thead>
<tr>
<th>Item</th>
<th>General Description</th>
<th>Amount</th>
<th>Reference Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>General conditions</td>
<td>See below</td>
<td>25% due to impact</td>
</tr>
<tr>
<td>2300</td>
<td>Wall demo &amp; clean up</td>
<td>—</td>
<td>Not needed</td>
</tr>
<tr>
<td>2310</td>
<td>Strip/concrete cut out</td>
<td>500</td>
<td>Allowance 50%</td>
</tr>
<tr>
<td>2310</td>
<td>Terraces slab demo</td>
<td>2160</td>
<td>$44/lf 8 mj/cy</td>
</tr>
<tr>
<td>2310</td>
<td>Terraces slab demo</td>
<td>980</td>
<td>$44/lf 8 mj/cy</td>
</tr>
<tr>
<td>2410</td>
<td>Fill demo ret wall</td>
<td>980</td>
<td>$44/lf 8 mj/cy</td>
</tr>
<tr>
<td>2410</td>
<td>Soil auger</td>
<td>26850</td>
<td>Per FBT $4 (1000m³)</td>
</tr>
<tr>
<td>2410</td>
<td>Shoring</td>
<td>—</td>
<td>N/A</td>
</tr>
<tr>
<td>2650</td>
<td>Chemical injection</td>
<td>4650</td>
<td>$100.00 misc cost</td>
</tr>
<tr>
<td>2510</td>
<td>Excavation subtopsoil</td>
<td>1650</td>
<td>$1.50/lf 8 mj/cy</td>
</tr>
<tr>
<td>2510</td>
<td>Site landscape clearing</td>
<td>1800</td>
<td>Per FBT $4</td>
</tr>
<tr>
<td>3510</td>
<td>Backfill slab top of wall</td>
<td>990</td>
<td>22 mj x 3 1/2 mj/cy</td>
</tr>
<tr>
<td>2540</td>
<td>Rock sand &amp; gravel underlay</td>
<td>864</td>
<td>$225 per 1,400 sf</td>
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<tr>
<td>2560</td>
<td>Asphalt patch</td>
<td>1000</td>
<td>Allowance</td>
</tr>
<tr>
<td>2850</td>
<td>Foundation drain pipe</td>
<td>1150</td>
<td>Per FBT $4</td>
</tr>
<tr>
<td>3010</td>
<td>Seal concrete slab (finishing)</td>
<td>920</td>
<td>Per FBT $4</td>
</tr>
<tr>
<td>3010</td>
<td>Concrete foundation</td>
<td>—</td>
<td>Not needed</td>
</tr>
<tr>
<td>3130</td>
<td>Concrete slab on grade</td>
<td>3040</td>
<td>400 sf x $7.60/sf</td>
</tr>
<tr>
<td>3200</td>
<td>Concrete walls (N) ret. wall extends</td>
<td>3750</td>
<td>3' x 50' x 28/lf per FBT $4</td>
</tr>
<tr>
<td>3550</td>
<td>Concrete stairs</td>
<td>4704</td>
<td>Per FBT $4</td>
</tr>
<tr>
<td>3920</td>
<td>Dowels at (N) ret wall extens</td>
<td>430</td>
<td>25 x 17.5 cu ft</td>
</tr>
<tr>
<td>3930</td>
<td>Epoxy work for dowels</td>
<td>500</td>
<td>Allowance</td>
</tr>
<tr>
<td>4130</td>
<td>Masonry veneer</td>
<td>11232</td>
<td>Per FBT $4</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td>69200</td>
<td></td>
</tr>
<tr>
<td>1001</td>
<td>General conditions</td>
<td>17300</td>
<td>69 200 x .25</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td>86500</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Contractor's fee 10%</strong></td>
<td>8650</td>
<td>86500 x .10</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>95150</td>
<td>North terrace/retaining wall repair</td>
</tr>
</tbody>
</table>
**BRICK PLANTER WALL REPAIR (THIRD NORTH TERRACE & ENTRANCE) COST**

Costs for this item were included in Plant Building Inc. Estimate 1-5-82 as line items for Planter wall summarised as follows.

<table>
<thead>
<tr>
<th>Item</th>
<th>General Description</th>
<th>Amount</th>
<th>Reference Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2300</td>
<td>Labor, Plaster True</td>
<td>720</td>
<td>PBI 1.5</td>
</tr>
<tr>
<td>2400</td>
<td>Sheet Metal</td>
<td>1080</td>
<td>40 x 2.56 x 2.5 sf</td>
</tr>
<tr>
<td>2500</td>
<td>Earthwork</td>
<td>2400</td>
<td>PBI 1.5 - PBI 2.0</td>
</tr>
<tr>
<td>2560</td>
<td>Aspact Patch</td>
<td>500</td>
<td>Allowance</td>
</tr>
<tr>
<td>2650</td>
<td>Landscaping</td>
<td>250</td>
<td>Allowance</td>
</tr>
<tr>
<td>3050</td>
<td>Foundation</td>
<td>720</td>
<td>2 CY 2.360/cy</td>
</tr>
<tr>
<td>4200</td>
<td>Brick PLANTER Walls</td>
<td>1120</td>
<td>PBI 1.0 x 2 x 1/3</td>
</tr>
</tbody>
</table>

**Subtotal** 7290

General Conditions 15% 1094 7290 x .15

**Subtotal** 8384

Contractions Fee 10% 838.4 8384 x .10

**Total** $9222  

*Only labor values - material costs will be required only.*
INTERIOR SLAB JACKING & STABILIZATION

The firm of Pressure Grout Co. was consulted to determine the feasibility of stabilizing the soil and relaying the slab around the room. They assured the plan was possible and forwarded the proposal dated 4-17-92. (See sketch). The costs for this work are estimated:

Mobilization $1850

Interior classification $3450 1st shift
+ slab jacking

Subsequent shifts

$3200 x 2 = $6400

Grout materials

$8.50/CF x 120 CF = 1020

Total $12,700 includes OH&P

Estimated work by AL ALBIE of PRESSURE GROUT CO.
Miscellaneous Repairs

The following table explains the differences in costs between that estimated by Synthesis Design Group and that amount deemed eligible for FEMA compensation. We refer to sheets on which are repair estimates for individual repairs as found by the applicant and/or its consultants. We only offer explanations where our repair estimates differ from their repair estimates.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Requested Amount</th>
<th>Eligible Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Header sagged @ folding door to TV room. Doors close ok, pre-EQ sagging noted on door.</td>
<td>$780</td>
<td>$0</td>
</tr>
<tr>
<td>4</td>
<td>Wall panel opened up - 2 walls</td>
<td>$720</td>
<td>$720</td>
</tr>
<tr>
<td></td>
<td>- very small gap noted in wall panel. Apply new varnish to match</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>EQ rocked chest of drawers in closet - drawers hard to open</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- no damage found</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Coupling failure at wall sill</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- no damage found, not located on architectural plan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Miscellaneous Repairs (Cont'd)

Item #15 - Active slab concrete cracks - rebuild panels
- refer to Pic #16 f #33
- Some pre-EQ cracking in slab noted. No eligible damage found.
  Requested amount = $19,800  Eligible amount = $0

Items #16 f #17 - Slab or steps displaced 1" vertically
- refer to Pic #10
- Minor crack at junction of slab and top step. Patch w/ mortar as applicant has done in other areas
  Requested amount = $3000  Eligible amount = $250

Item #18 - Sliding closet door does not slide
- Door off of runners, we fixed ourselves
  Requested amount = $240  Eligible amount = $0

Item #19 - Cracked tile at shower - patch

  Requested amount = $250  Eligible amount = $75

Item #20 - Wall panels moved
- No EQ damage found
  Requested amount = $320  Eligible amount = $0
Miscellaneous Repairs (Cont'd)

Item #25 - Steps cracked in several places
  - refer to Pic #13.
  - Some minor EQ & pre-EQ cracks. Fix with epoxy grout.
  - Requested amount = $4000  Eligible amount = $500

Item #29 - Storage cabinet door binds on top soffit
  - No EQ damage found
  - Requested amount = $120  Eligible amount = $0

Item #30 - Doors to outside blind - sill fits poorly
  - Contractor's estimate too high for minor work
  - Requested amount = $320  Eligible amount = $240

Item #31 - Entry closet doors do not close - all across entry
  - Contractor's estimate high
  - Requested amount = $640  Eligible amount = $480

Item #36 - Entry cabinet doors bind
  - No EQ damage found
  - Requested amount = $240  Eligible amount = $0

Item #39 - Brick retaining wall cracked
  - Refer to Pic #15
  - Item #47 included in amount
  - Not necessary to rebuild brick planter. Rebuild & re-point portions.
  - Requested amount = $2000 + $1500 = $3500  Eligible amount = $1500
Miscellaneous Repairs (cont'd)

Item #55 - Pool bricks cracked - REPLACE
-no EQ damage found @ location shown
Requested amount = $300  Eligible amount = $0

Item #51 - Steps settled 1/2" - REBUILD
-Steps have pre-EQ damage. Not necessary to rebuild steps.
Requested amount = $250  Eligible amount = $250

Item #55 - Check flashing @ chimney
-no movement or damage found.
Requested amount = $160  Eligible amount = $0

Item #60 - Check pool equipment fittings
-no EQ damage found
Requested amount = $500  Eligible amount = $0

Item #146 - Dining room west wall
See Pics #3, #4 of #30.

The applicant's contractor has estimated the repair costs for this area at $15,000. Some pre-EQ damage was noted during our site visit. See Pic #4. We are assuming that this repair cost includes removing the dining room doors and windows and, repaving the concrete steps to match the dining room slab above and the terrace slab below. The contractor has not supplied any descriptions for this work.
### Miscellaneous Repairs (Cont'd)

**Item #446 (Cont'd)**

In our site visit, we verified the snugness of the dining room doors. We also noted slab cracking in the step areas below the main dining floor. See Pic #14. Note the pre-EO damage and concrete patch.

Our recommended method of repair involves adjusting the doors by planing, rechaging or replacement of the sills to give the doors a proper fit. Concrete patching work similar to what the applicant has used in the past will take care of cracks in the concrete.

#### Carpentry Work

<table>
<thead>
<tr>
<th>Labor</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3200</td>
<td>$300.</td>
</tr>
</tbody>
</table>

Total = **$3500.**

#### Concrete Work

<table>
<thead>
<tr>
<th>Labor</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>$450</td>
<td>$50.</td>
</tr>
</tbody>
</table>

Total = **$500.**

---

Grand Total = **$4030.**

Item #446.
<table>
<thead>
<tr>
<th>Type</th>
<th>Specific Observations</th>
<th>Count</th>
<th>Rate (HR)</th>
<th>Unit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>1 Wall displaced laterally 3/8&quot;</td>
<td>16</td>
<td>$40.00</td>
<td>HR</td>
<td>640</td>
</tr>
<tr>
<td>H</td>
<td>2 Wall panel opened up - 2 walls</td>
<td>6</td>
<td>$40.00</td>
<td>HR</td>
<td>240</td>
</tr>
<tr>
<td>H</td>
<td>3 Earthquake racked chest of drawers in closet-drawers hard to open</td>
<td>8</td>
<td>$40.00</td>
<td>HR</td>
<td>320</td>
</tr>
<tr>
<td>H</td>
<td>4 Door to toilet won't close-frame raked</td>
<td>6</td>
<td>$40.00</td>
<td>HR</td>
<td>240</td>
</tr>
<tr>
<td>H</td>
<td>5 Caulking failure at wall sill</td>
<td>1</td>
<td>$40.00</td>
<td>HR</td>
<td>40</td>
</tr>
<tr>
<td>B</td>
<td>6 Brick patio trim band separated from concrete patio slab</td>
<td>2</td>
<td>$40.00</td>
<td>HR</td>
<td>80</td>
</tr>
<tr>
<td>B</td>
<td>7 Brick retaining wall cracked ---Caulk &amp; Point</td>
<td>10</td>
<td>$600.00</td>
<td>Panel</td>
<td>6000</td>
</tr>
<tr>
<td>C</td>
<td>8 Slab or steps displaced 1&quot; vertically - big gap under bottom step to slab below</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>9 Crack top step to patio, slab differential 1&quot; ---REPLACE 16 &amp; 17</td>
<td>6</td>
<td>$500.00</td>
<td>RSR</td>
<td>3000</td>
</tr>
<tr>
<td>N</td>
<td>10 Sliding closet door does not slide</td>
<td>6</td>
<td>$40.00</td>
<td>HR</td>
<td>240</td>
</tr>
<tr>
<td>O</td>
<td>11 Cracked tile at shower --- PASTE</td>
<td>8</td>
<td>$40.00</td>
<td>HR</td>
<td>320</td>
</tr>
<tr>
<td>N</td>
<td>12 Wall panels moved</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>13 Broken window above shower in clerestory</td>
<td>3</td>
<td>$40.00</td>
<td>HR</td>
<td>120</td>
</tr>
<tr>
<td>C</td>
<td>14 Bottom of glass display cabinet door in library fails on counter</td>
<td>2</td>
<td>$40.00</td>
<td>HR</td>
<td>80</td>
</tr>
<tr>
<td>C</td>
<td>15 Dining room slab @ window pocket has moved out ---Caulk &amp; Seal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>16 Dining room inner doors bind - do not slide wall</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>17 Steps cracked in several places</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>18 Dining room slab significantly moved down and away - 1&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>19 Steps from dining room to living room cracked 1/4&quot; @ top riser</td>
<td>8</td>
<td>$40.00</td>
<td>HR</td>
<td>320</td>
</tr>
<tr>
<td>H</td>
<td>20 China cabinet doors bind</td>
<td>2</td>
<td>$40.00</td>
<td>HR</td>
<td>80</td>
</tr>
<tr>
<td>H</td>
<td>21 Storage cabinet door binds on top soffit</td>
<td>3</td>
<td>$40.00</td>
<td>HR</td>
<td>120</td>
</tr>
<tr>
<td>M</td>
<td>22 Doors to outside bind - still fits poorly ---REPLACE SLAB</td>
<td>8</td>
<td>$40.00</td>
<td>HR</td>
<td>320</td>
</tr>
<tr>
<td>H</td>
<td>23 Clerestory window wall above entry is Masonry</td>
<td>8</td>
<td>$40.00</td>
<td>HR</td>
<td>320</td>
</tr>
<tr>
<td>H</td>
<td>24 Entry closet doors do not close - all across entry</td>
<td>16</td>
<td>$40.00</td>
<td>HR</td>
<td>640</td>
</tr>
<tr>
<td>M</td>
<td>25 Kitchen doors bind @ header - just loose @ closet door to Masonry</td>
<td>2</td>
<td>$40.00</td>
<td>HR</td>
<td>80</td>
</tr>
<tr>
<td>H</td>
<td>26 Kitchen cabinet doors bind</td>
<td>6</td>
<td>$40.00</td>
<td>HR</td>
<td>240</td>
</tr>
<tr>
<td>M</td>
<td>27 Door frame cracked</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>28 Brick retaining wall cracked (facing driveway) ---REBUILD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>29 Brick retaining wall failed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>30 Brick retaining wall cracked</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>31 Steps heaved 2&quot; --- REBUILD</td>
<td>4</td>
<td>$700.00</td>
<td>RSR</td>
<td>2800</td>
</tr>
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<td>PH NO</td>
<td>Specific Observations</td>
<td>COUNT</td>
<td>RATE/UNIT</td>
<td>TOTAL</td>
<td></td>
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<td>---------------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Door sill dropped 1 1/2&quot;</td>
<td>8</td>
<td>$40.00</td>
<td>320</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Pool bricks cracked ---REPLACE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Outer wythe of brick @ retaining wall (living room) separated from slab 1/4&quot; ---RESET</td>
<td></td>
<td></td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Slab heave @ joint, slab cracking within panels ---REBUILD COMPLETE</td>
<td>6</td>
<td>$600.00</td>
<td>3600</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Garage wall severely bowed - at least 2&quot; ---REBUILD, REPL. WALL &amp; REALIGN</td>
<td></td>
<td></td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Storage cabinet doors raked</td>
<td>4</td>
<td>$40.00</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Steps settled 1/2&quot; ---REBUILD</td>
<td>5</td>
<td>$500.00</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Brick wall cracked</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Gilding door binds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Soffit &amp; clerestory above moved 3/4&quot; away from masonry wall</td>
<td>8</td>
<td>$40.00</td>
<td>320</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Check flashing @ chimney - it moved</td>
<td>4</td>
<td>$40.00</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Waterfall slab cracks @ rocks ---REPLACE, QULK</td>
<td></td>
<td></td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Cracks @ pool retaining wall (near steps to house) ---RESET</td>
<td>8</td>
<td>$400.00</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Slab cracks @ pool patio</td>
<td></td>
<td></td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Check pool equipment fittings = appear raked</td>
<td>4</td>
<td>$40.00</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Steps cracking @ lower brick steps</td>
<td></td>
<td></td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Remove piping at north terrace wall</td>
<td></td>
<td></td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Replace cap courses of brick at west parking</td>
<td></td>
<td></td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Reconstruct north terrace and wall</td>
<td></td>
<td></td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>IDing room west wall</td>
<td></td>
<td></td>
<td>500</td>
<td></td>
</tr>
</tbody>
</table>

GENERAL EXPENSES IF DONE WITH FIREPLACE
PAINT & STAINING TOUCH-UP

63,890 159,923 19,50
3,000 3000 0
3,000 5000 0

74,921 167,923 17,75
10,019 16792 17,15
79,011 189,715 21,065

miscellaneous repairs not including hunt terrace work.

Note: This item is covered as a separate cost item.
HASINA HOUSE DAMAGE SURVEY CONTINUATION SHEET

Applicant: STANFORD UNIVERSITY

Category: Permit

Photo No.: 1

Item No.: __________

Description: West side of building, living room and building retaining walls seen.

Photo No.: 2

Item No.: __________

Description: Northeast corner of building and retaining wall.
### Photo No. 3

**Item No.:**

**Description:** Brick planter box seen with mortar cracks. Planters box located at steps between carport and front terrace.

### Photo No. 4

**Item No.:**

**Description:** Detached wood trim at windows or main chimney.
Photo No.: 5
Item No.: 
Description: 

Hanna House

Quant: Picture 330

Steps to back carving
Area - minor separation of mortar joints

Photo No.: 6
Item No.: 
Description: 

Slope to back carving
Area - cracking in concrete landing slab
Photo No.: 7
Item No.: 
Description: Cracks in retaining wall at bottom of steps n.r. swimming pool.

Photo No.: 9
Item No.: 
Description: Caulking separation at brick/concrete interface.
<table>
<thead>
<tr>
<th>Photo No.</th>
<th>Item No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td></td>
<td>HANNA HOUSE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QUAD II BIDE 230</td>
</tr>
<tr>
<td></td>
<td></td>
<td>steps to Union Court</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Photo No.</th>
<th>Item No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td>steps to Union Court</td>
</tr>
<tr>
<td></td>
<td></td>
<td>on red, minor cracking of bottom of slab intersection with top step</td>
</tr>
<tr>
<td>Photo No.:</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>Item No.:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td>Mortar cracking in brick planter box at south end of steps leading from dining room</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Photo No.:</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.:</td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td>Same retaining wall as above.</td>
</tr>
</tbody>
</table>
**Hawiia House**

**DAMAGE SURVEY CONTINUATION SHEET**

**Applicant:** Stanford University

**Santa Clara County**

**Date:** 5/32/92

**Sheet of:** 35/37

**APHS**

**Photo No.:** 13

**Item No.:**

**Description:**

Crack seen in corner of slab in pre-EQ patch.

**Photo No.:** 14

**Item No.:**

**Description:**

Window area - Divining room in side wall - Crack seen in corner of slab in pre-EQ patch.
<table>
<thead>
<tr>
<th>Photo No.</th>
<th>Item No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15</td>
<td>Cracking in pre-EO patch at top of steps leading from living room to front terrace.</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>Cracking at top step leading from dining room to living room.</td>
</tr>
</tbody>
</table>
Hanna House

DAMAGE SURVEY CONTINUATION SHEET

Applicant: Stanford University / Santa Clara County

Date: 5/27/89

Declara. No: FEMA 845
PA No: 085-9000

Category: □ Perm. □ Emer. □ Item No. □ Supp. to

GRAPHS

Photo No.: 17

Item No.:

Description: Front terrace slab w/ steps leading to
carport area

Photo No.: 18

Item No.:

Description: Displacement in front terrace slab @
connection to retaining wall
<table>
<thead>
<tr>
<th>Photo No.</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Cracks seen in corner of brick retaining wall of large oak tree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Photo No.</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Portion of front retaining wall running parallel to west side of house</td>
</tr>
</tbody>
</table>
Photo No.: 21
Item No.: 
Description: Damaged Imperial Hotel unusually collapsed retaining wall in background

Photo No.: 22
Item No.: 
Description: Damaged brick retaining wall w/ concrete retaining wall behind clay drain pipe.
**Photo No.:** 23
**Item No.:** 
**Description:** Damaged door above carport

**Photo No.:** 24
**Item No.:** 
**Description:** Cracked brick and displacement of retaining wall between carport and garage areas
<table>
<thead>
<tr>
<th>Photo No.</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.</td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td>Garage walls bowed inward. Cypress tree in brick planter box located on other side of wall</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Photo No.</th>
<th>26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.</td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td>Library chimney above roof. No damage found</td>
</tr>
<tr>
<td>Photo No.</td>
<td>Item No.</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
</tr>
</tbody>
</table>
| 27       |          | Main chimney 
roof level flues for 
stone furnace and hot water 
heater also contained within 
same brick structure |
| 78       |          | End of main 
fireplace structure @ kitchen/living room junction. Some 
separation of mortar joints |
<table>
<thead>
<tr>
<th>Photo No.</th>
<th>29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.</td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td>Brick planter box and terrace outside of dining room. Also see Pictures 11 &amp; 12. EQ cracks in brick planter.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Photo No.</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.</td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td>Dining room sliding doors no longer open properly.</td>
</tr>
</tbody>
</table>
Photo No.: 31
Item No.: 
Description: **MAIN CHIMNEY**
S WALL SHORING ALONG WEST SIDE

Photo No.: 32
Item No.: 
Description: **MAIN CHIMNEY**
S WALL SHORING FROM THE NORTH SIDE.
<table>
<thead>
<tr>
<th>Photo No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>Steps leading to driveway from west end of house. Some 50 and some pre-50 cracking in slab and brick planter walls.</td>
</tr>
<tr>
<td>34</td>
<td>Steps leading to front terrace from living room.</td>
</tr>
</tbody>
</table>
June 2, 1992

Mr. Dennis Whitehurst
FEMA
c/o Barrett Consulting Group
Presidio, Region 9, Bldg. 105
San Francisco, CA 94129

SUBJECT: The Hanna House (Bldg. 11-300)
Stanford University

Dear Mr. Whitehurst:

As requested, we have reviewed the documents furnished by FEMA, as provided by Stanford and other sources. These are listed on the enclosed "List of Documents Reviewed." Following are our comments and the conclusions reached as a result of our review and visits to the site.

SCOPE

We understand the purpose and scope of our study to be:

1. Examine and evaluate the existing structure to determine which structural elements were damaged by the Loma Prieta Earthquake of October 17, 1989 (LPEQ) and recommend the repairs necessary to restore them to at least their pre-disaster condition.

2. Review the Forell/Elsesser report and preliminary (conceptual) design of repairs and comment on its relevancy to FEMA regulations and applicable building codes as they apply to the structure.

DESCRIPTION

A general description of the residence is included in the Final Report by the Architectural Resource Group (Ref. 1) and it need not be repeated here.

The fact that the house was designed by the world-famed architect, Frank Lloyd Wright, did not guarantee a damage-free building during a moderate or major earthquake. It can be argued that Mr. Wright did not have an understanding of the effects of expansive soil movement and earthquakes in this particular site. Soil creep and consolidation of the fill portion by earthquake shaking and subsequent settlement may have been prevented had proper consolidation techniques been used at the time of construction.
To illustrate Mr. Wright's attitude towards things technical, we have excerpted the following portion from "The Hanna House," a book written by Mrs. Hanna describing in detail the planning and construction of the house. (Ref. 16)

"On a Sunday afternoon we were on our hillside lot with plot plan, floor plan, stakes, string, and measuring tape, busily laying out our house among trees. We were so engrossed in our project that we did not hear approaching footsteps. A voice startled us with, 'Young people, what are you doing?' We looked up to see Bailey Willis, world-famous geologist, looking disapprovingly at us and our equipment.

We proudly showed him our plans. His reaction was dismaying. With an impatient wave of his hand he said, 'You can't build here; a minor earthquake fault runs right through this hill.'

'But Professor Willis,' we countered, 'the university has granted us this site on this hilltop and our architect is drawing up the working plans.'

'In that case,' said the professor, 'I suggest you inform your architect that there is a branch of the San Andreas fault running through this hill.' With that, Professor Willis continued his Sunday walk. Naturally we were distraught, and telegraphed to Mr. Wright. We received this reply:

I BUILT THE IMPERIAL HOTEL.

A letter from Professor Willis on September 7, 1936, helped to reassure us:

'In the role of good neighbor I should, I think, inform you regarding certain geologic conditions that you might wish to consider in building on your house site. You may, perhaps, not be aware of them.

The rock which underlies most, and possibly all of your lot is a firm sandstone and an excellent foundation for all conditions. But just west of it is a bed of greasy, gypsiferous clay which becomes very slippery when wet. If any part of your foundation rests upon that clay, it should be set in a deep trench and thoroughly drained.
Furthermore your architect should give special consideration to earthquake resistant construction, since a minor earthquake fault runs through the hill, along the western slope. The fault is not itself an earthquake generator, but it may vigorously transmit a shock from the major fault. Being aware of this condition I would, myself, make my residence as light and rigid as possible, would set it on a continuous concrete foundation, and take special care in building chimneys.

There is no occasion for alarm, but good reason for care in design and construction. If you care to talk the problem over, I shall be glad to do so at your convenience.

We were sure that Mr. Wright had already incorporated the major ideas suggested by Professor Willis, but we were grateful for his helpful concern.

It can be concluded, therefore, that the Hanna House was designed with little knowledgeable regard for quantification of lateral forces nor for evaluation of such geotechnical considerations as compaction of earthfill, creep, settlement and heaving of the clay-based soils on the site used for fill.

The major lateral force resisting elements in the building are the wood sheathed roof, the roof framing members which connect the roof to the brick chimneys and the chimneys themselves which are the most rigid vertical elements in the building. The moveable walls and partitions contribute very little to lateral force resistance and must be ignored in any analysis of the building's performance.

**Observation of Damage Caused by the LPEQ**

Differential settlement (from creep and heaving of expansive soils) may have caused some damage prior to the LPEQ to the exterior steps, retaining walls and soil supported concrete paving. There are obvious signs of pre-LPEQ soil creep at the steps of the north terrace, with a large crack on the side closest to the driveway.

However, the amount of pre-LPEQ damage can not be readily quantified, and for the purpose of defining repair methods we are ignoring the pre-LPEQ damage. In the preparation of the DSR for this building the team, perhaps can account for the different sources of damage by cost sharing some of the repair work.
The primary damages observed are as follows:

1. The main fireplace and brick chimney that separates the living room from the kitchen and entrance foyer has rocked about its base and crushed some of the bricks in the entrance foyer and caused separation, loose bricks and cracking at the perimeter of the base, particularly in the kitchen areas. The chimney has been temporarily shored, apparently to prevent collapse during after-shocks. The chimney remains plumb and is undamaged throughout its height. No cracking is evident at the roof line where, traditionally, unreinforced brick chimneys have been observed to fail during major earthquakes. The library fireplace also has some displaced bricks and minor cracking at its base, but is otherwise undamaged.

2. The brick-faced retaining wall at the north end of terrace and which extends approximately 50 feet in an east-west direction has tilted to the north and as a result the top 3 to 4 feet of brick facing has broken and fallen away for a distance of 20 to 30 feet. The failure has exposed some corroded rebar in the top of the wall which may have originally anchored the brick to the concrete. A terracotta drain line runs along the top of the concrete wall just inside. This raises questions about the adequacy of drainage behind the wall at the footing level.

3. The north terrace (off the living room) and the steps leading down to it are badly cracked and are evidence of differential settlement of the loose fill below. Part of this can be attributed to long term creep and settlement prior to the LPEQ.

4. The brick walls forming the large planter between the front entrance and the north terrace are also badly cracked. It also shows signs of differential settlement caused by soil creep and earthquake shaking.

5. The living room slab was placed over loosely compacted fill varying in thickness from 5 to 9 feet. The hexagonal patterned concrete slab on ground is now uneven and not habitable because of differential settlement.

Other items of damage noted by the Architectural Resources Group are not addressed by us because they are not of any structural significance, in our judgment.
REPAIR OF DAMAGES

The primary concern is the differential settlement from consolidation and creep of loosely compacted fills which are affected by earthquake shaking during the LPEQ. Consequently, there is a need to restore the supporting soil to a stable, reliable condition. The concern was also expressed by J. V. Lowney and Associates in their September 1990 report. (Ref. 4)

The first preference by Lowney would be to remove the soil from below the building slabs and to bench into the cut slope prior to replacing and recompacting the fill with suitable material. Because of the obvious impracticality and cost of house removal in order to accomplish this, Lowney also suggested the possibility of stabilizing the fill with chemical grouting but raised a question of its effectiveness in the plastic silty-clay fill material.

We have pursued this alternative possibility with Mr. Al-Alusi of the Pressure Grout Company. We propose combining it with a tie-back retaining wall along the existing north terrace wall where the fill is deepest.

Mr. Al-Alusi has assured us of the feasibility of such a procedure and has submitted a proposal for doing the grouting portion of the repairs. (Ref. 14)

We have prepared the following recommended scope of repairs to the damaged areas outlined above:

1. The main fireplace can be restored to its pre-earthquake condition by: removing the broken and loose brick and excavating back to sound mortar and brick. This probably will require some temporary underpinning, working on small areas in stepped sequence so that the existing masonry is not overstressed. Each area so cleaned out can then be carefully restored by setting matching bricks and mortar. This must be carefully done by experts in masonry restoration so that the character and texture of repairs is practically indistinguishable from existing. Where there are no loose mortar or bricks, but where the base joint is cracked, it can be repaired by removing the outer mortar at the joint, epoxy injection of the crack and repointing of the mortar. The feasibility and acceptance of this type of repair has been described by Mr. Robert Gaul in other repair recommendations by PG&A for the sandstone URM buildings on campus. The base of the library fireplace can be repaired in a similar manner.
2. The 50-foot long concrete retaining wall along the north edge of the north terrace should be stripped of the brick veneer, saving the brick for re-use, if possible. The existing concrete wall, even though slightly tilted, can be used to support tie-back anchors which will extend down and into the cut material below the existing fill beneath the terrace and house. After pre-stressing the anchor rods and chemically grouting the fill material (as described in item 3 below), a new brick wall with footing can be built 4 inches (minimum) from the face of the existing concrete wall. The new brick wall should have anchors into the space which is to be reinforced and fully grouted so as to tie the two walls together to act compositely. The new brick wall will be higher than the existing concrete wall but will be reinforced to withstand lateral soil pressure above the existing wall.

3. The north terrace patterned concrete slab off the living room, including the concrete stairway leading to the house, must be removed. The fill beneath this slab can then be consolidated by pressure grouting as proposed by the Pressure Grout Company. A new patio slab and the stairs then can be replaced. This replacement work must be done carefully to match the existing color and texture of other terrace slab areas. Here again, there is a need for expertise in historic restoration to accomplish acceptable results.

4. The planter area adjoining the north terrace is trapezoidal in shape and is enclosed by a brick wall about 40 feet in length. We recommend this entire wall be removed and rebuilt to match the existing construction.

5. Inside the house, the living room slab, which is uneven and shows differential settlement between hexagonal patterns, is otherwise uncracked. We recommend the repair procedure deemed feasible by the Pressure Grout Company. That is, re-leveling the slabs using a pressure grout after the fill below the living room, as well as that below the adjoining terrace, is stabilized by lens grouting.

COMMENT ON REPAIRS TO SUPERSTRUCTURE

Forell/Elsesser Engineers, Inc., (F/E) in their final report, dated February 1991, recommended that the structure of the house itself be upgraded to meet the current uniform building code (UBC). This would involve new roof diaphragms, collectors, drag
struts and either moment-resisting steel frames or plywood shear walls added to the structure.

While we may agree such strengthening would be desirable (in light of Mr. Wright's design), we did not observe any other significant structural damage to the building caused by the LPEQ. Consequently, we cannot recommend that such upgrade strengthening of the superstructure be funded by FEMA under the current stated policy of funding only those repairs which are a direct result of the disaster and which are required by current applicable codes. As stated many times before, there is no code requirement to strengthening structures as a consequence of an earthquake.

We have not attempted to estimate the cost of our recommended repairs. Neither have we checked the Plant Construction Company estimates against the repairs recommended by F/E.

CONCLUSION

It is our engineering judgment, based upon the review of the documents listed and our many visits to the site that:

1. The Hanna House was damaged as a direct result of the LPEQ.

2. The damage observed was limited to effects of the soil settlement (caused by shaking), particularly in the filled areas under the house and the north terrace.

3. The repairs should correct the defect in the supporting soils by stabilizing to prevent damage while at the same time re-leveling the concrete slabs and repair the adjacent planters, stairs, retaining walls and the main brick fireplace.

If you have any questions regarding this report, please contact Mr. Preece.

Very truly yours,

F. Robert Preece
H. Robert Hammill

FRP/mml
Enclosure
LIST OF DOCUMENTS REVIEWED


April 17, 1992

Mr. H. Robert Hambill
150 North Wigel Lane, Suite 204
P. O. Box 3121
Walnut Creek, CA 94598

Subject: Grouting for Hanne House, Stanford, California

Dear Bob:

Following our site visit and discussions, and based on the Soils Report by J. H. Lowney and Associates, we offer to furnish labor, equipment, and materials as follows:

1. Mobilization to the site, one time lump sum .............. $1,850.00
2. Lense grouting of the northern terrace with two rows of six injections each ........ 6,650.00
3. Lense grouting of the western side, one row of 20 injections .................. 8,300.00
4. Interior densification and slabjacking, if needed
    a) First shift including labor (4 men) and equipment, eight-hour straight-time shift or fraction thereof .......... 3,450.00
    b) Subsequent shifts for labor (4 men) and equipment, eight-hour straight-time shift or fraction thereof .......... 3,200.00
    c) Grouting, per cubic foot .......... 8.50

As discussed with you during the site visit, voids may exist in the areas where the lense grouting or slabjacking is to be performed. If voids are encountered we shall
fill and tighten up the soils as much as possible at the rate of $8.50 per cubic foot.

The lensing technique is to be used for reinforcing the loose soils in the proposed area without exerting pressures on the ailing retaining walls. The soil densification of the interior is for densifying the soils and/or lifting the slabs.


The grout we intend to use will intrude into openings, joints, cracks, crevices or any other space which is 1/32 inch or larger. Upon discovering the intrusion of grout into undesirable spaces, we will stop all pumping operations and make every effort to flush out the grout which has intruded into undesirable spaces. You shall accept full responsibility in the event of any damage to utilities or other features due to grout intrusion.

This proposal contemplates lifting the slabs in the grouted area to livable straight lines as allowed by the reaction of the slabs and other items connected to the slab(s). All joints and connections for other slabs or structures must be cut loose before our arrival at the jobsite to enable us to lift the slabs.

Drilling and grouting only are included in this proposal; no cosmetic, structural, mechanical, landscaping or other repairs are included. Some of the potential repairs to be anticipated are:

1. Damaged plants, bushes and lawns within 5 to 10 feet of our work area.

2. Replacement of floor slab if not properly constructed (thin spots, weak concrete, etc.).

3. Damage to lawns at our equipment set-up area and working area.

4. Portland cement and other stains in our equipment set-up area and working area.

5. We will rough clean our work area; fine cleaning (if needed) is to be accomplished by you.

Our warranty extends to workmanship and materials only. This warranty is in lieu of all other warranties, expressed or implied.
Mr. H. Robert Hammill  
April 17, 1992  
Page 3 of 3

We will use such information as you are able to supply regarding concealed installations and conditions that are not visible, but liability for damage and repairs, if any, to sewers, utilities, etc., due to our operations, are not included. We will accept this liability for the additional sum of $10,000.00, if you so indicate in writing prior to our arrival on the job. We recommend employing a utility locator firm to precisely locate all underground lines. Further, we request that you check the property grant deeds or any other legal documents that the owners have for easements in the work areas. If buried utilities are discovered on any such easements, you should locate such utilities carefully and properly inform us before our arrival at the jobsite.

Costs of engineering, permits, fees, inspections, testing, certifications, calculations and interpretations, if required, are not included.

Terms: Net 20 days after the completion of our work, regardless of paperwork.

Unpaid amounts by the due date shall accrue interest at the rate of 1 1/2% monthly until completely paid with interest.

This agreement is being entered into the State of California and all rights hereunder shall be governed by the laws of the State of California. In the event that the company incurs any attorneys' fees and or legal action is instituted in forcing the terms and conditions of this agreement, the company shall be entitled to recover its attorneys' fees incurred in connection herewith.

Sincerely,

PRESSURE GROUT COMPANY

H. E. Al-Alusi

Accepted by (full name):_________________________________________

Signature:_____________________________________________________

Title:_________________________________________________________

Date:_________________________________________________________
October 23, 1992

Mr. Pat Dunn  
Disaster Assistance Program  
Region IX -- FEMA  
The Presidio, Building 105  
San Francisco, CA 94129

Dear Pat:

Enclosed are Statements of Concurrence for the following buildings: Buildings 1, 20, 80, 110, 250, 360, Art Gallery, Free-standing Arcades, Cooksey (Phi Psi), and HRP/Anatomy.

Also enclosed, pursuant to Tom Fenner's telephone conversation with Lorri Jean on October 21, 1992, are Stanford's Statements of Non-Concurrence on Buildings 260, 310, 320, the Knoll, and Hanna House.

Please attach each statement to the appropriate DSR. Thank you.

Sincerely,

M. Fouad Bendimerad, P.E. Ph.D.  
Manager, Seismic Engineering

Attachments

cc: Charles Wynne, Governor's Authorized Representative (with attachments)
October 23, 1992

RE: FEMA - 845-DR P.A. 085-90000
APPLICANT: STANFORD UNIVERSITY
SUBJECT: Hanna House - DSR No. 06195

**Applicant's Statement of Non-Concurrence**

Stanford University does not concur in the above-numbered DSR.

M. Fouad Bendimerad, P.E., Ph.D.
Manager, Seismic Engineering

cc: Charles Wynne, Governor's Authorized Representative
HANNA HOUSE STANFORD
ORIGINAL PLAN AND DETAILS
FIGURE A
HIGH ROOF FRAMING PLAN