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HISTORIC STRUCTURE REPORT
Architectural Data Section: Phase I

ARLINGTON HOUSE
THE ROBERT E. LEE MEMORIAL
VIRGINIA

by

H. Lee Arnest

U.S. DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

CONTENTS

Introduction 1

I. Administrative Data 2

II. Significance of Arlington House 3

III. Chronology of Structural Change 5
- A. The Custis and Lee Families' Residency, 1802-61 5
- B. The War Department Years, 1861-1933 9
- C. National Park Service Management, 1933-Present 17

IV. Existing Conditions in 1979 38
- A. Basement 38
- B. North Wing 40
- C. Main Block 44
- D. South Wing 48

V. Recommendations Made in 1979 51
- A. Basement 51
- B. First Floor Framing System 53
- C. North Wing and Loggia Roofs 57
- D. South Wing Roof 60
- E. Miscellaneous 61
- F. Priorities for Structural Stabilization 63

VI. Assessment of Effects 64

VII. Recommended Studies 66

Photographs 67

Drawings 78

INTRODUCTION

This report was prepared by the DSC/TNC staff in September 1979 in anticipation of emergency stabilization measures that were subsequently undertaken and completed between 1979 and 1982. It was intended to record only those aspects of the architectural/structural configuration of the Arlington House that would be altered by the work of those years and was not intended to represent a completed architectural data section. It therefore lacks certain elements, an assessment of handicapped visitor accessibility among others, that will be included in phase II.

Major contributions to this report were made by historian Charles W. Snell, who compiled most of the information contained in chapter 3, and by historical architect John Sligh, who provided the photographs for plates 9 through 21. Copies of all the historic documents cited in chapter 3 are on file at Arlington House. A comprehensive bibliography will be included in the forthcoming history data section of the historic structure report.

Concurrent related studies that have been undertaken by the National Capital Team of the Denver Service Center are as follows:

"Historical Data Section for Arlington House (The Custis-Lee Mansion), Virginia," by Charles W. Snell

"A Summary of the Physical History of Arlington House, 1802-1933," by Charles W. Snell

"Archeological Excavation at Arlington House, The Robert E. Lee Memorial, Arlington County, Virginia," by John F. Pousson

"Engineering Study of Central Block Roof Support System," by Patrick MacDonald

"Architectural Data Section, Phase II," by H. Lee Arnest and John Sligh

I. ADMINISTRATIVE DATA

Name: Arlington House, the Robert E. Lee Memorial

Number: 270

Location: Arlington National Cemetery, Arlington, Virginia

Management Category: 1A

Proposed Treatment: Preservation

Proposed Use: The mansion, its outbuildings, and immediate site have been, since 1925, an official memorial to Robert E. Lee. It is appropriately furnished and is used as a museum through which tours, both guided and unguided, are conducted. The site is open to visitors from 9:30 a.m. to 6:00 p.m. daily.

Planning documents prescribing the proposed treatment and use: (1) NPS List of Classified Structures, No. 00059-270; (2) Development/ Study Package Proposal, "Prepare Historic Structure Report and Stabilize," 10/31/77

Congressional authorization: Joint Resolution of Congress Authorizing the Restoration of the Lee Mansion in Arlington National Cemetery, Virginia (68th Cong., Pub. Res. 74, H.J. Res. 264, approved March 4, 1925), which reads as follows:

> Resolved by the Senate and House of Representatives of the United States in Congress assembled, That the Secretary of War be, and he is hereby authorized and directed, as nearly as may be practicable, to restore the Lee Mansion in the Arlington National Cemetery, Virginia, to the condition in which it existed immediately prior to the Civil War and to procure, if possible, articles of furniture and equipment which were in the Mansion and in use by occupants thereof. He is also authorized, in his discretion, to procure replicas of the furniture and other articles in use in the Mansion during the period mentioned, with a view to restoring, as far as may be practicable, the appearance of the interior of the Mansion to the condition of its occupancy by the Lee family.

II. SIGNIFICANCE OF ARLINGTON HOUSE

Arlington House, the Robert E. Lee Memorial, is located in Arlington County, Virginia, across the Potomac River from the Lincoln Memorial and Washington, D. C. The house occupies a prominent site on a wooded hill and can be seen from many points in the capital city. Since the Civil War, the house has been surrounded by the Arlington National Cemetery. On the former grounds of the house are located the tombs of many famous American military leaders, the Kennedy gravesites, and the Tomb of the Unknown Soldier. As a property administered by the National Park Service, Arlington House falls under the jurisdiction of the George Washington Memorial Parkway.

Arlington House, an outstanding landmark for more than a century and a half, is unique in its association with the families of Washington, Custis, and Lee. Its builder, George Washington Parke Custis, was the grandson of Martha Custis Washington and was raised as a foster son by George Washington; and he was the father-in-law of Robert E. Lee. Custis, an exceptional figure in early 19th century America in his own right, stands as a link beween two of this nation's great men.

The Arlington estate, named after the Custis family's homestead on Virginia's Eastern Shore, was built on 1,100 acres purchased by G.W.P. Custis's father in 1778. The house was probably designed by George Hadfield, a young English architect in charge of the construction of the Capitol. The north wing was built in 1802 and the south wing followed two years later. The large center section with the portico, completing an imposing front 140 feet long, was finished from 1817 to 1819.

The main body of the Greek Revival house is rectangular and rises two stories over a full basement. The massive portico fronting on the east facade represents one of the earliest uses of the Colossal order on a private residence. The wings to the north and south are one story high, with a basement under the entire north wing and under all rooms but the conservatory in the south wing. The entire house is of brick construction covered with a plaster scored ashlar. Photographs taken during the Civil War show that much of the exterior was streaked with paint to resemble marble. It is assumed that the adjacent outbuildings, symmetrically placed to the west of the main structure, were designed and built contemporarily with the house itself.

Arlington House is listed on the National Register of Historic Places; nomination forms have been completed by the National Capital Region and are in the process of transmittal to the National Register. Due to its prior status as a national historic landmark, Arlington House was automatically included on the National Register at its creation in 1966. Projects affecting the house are subject to the Advisory Council on Historic Preservation's "Regulations for the Protection of the Historic and Cultural Properties" (36 CFR 800). Procedures necessary to ensure compliance of all work described herein with section 106 of the National Historic Preservation Act of 1966 and with Executive Order 11593 will be executed by the National Capital Team and the National Capital Region. Technical data required for the compliance process will be provided by the professionals in charge of the various aspects of the work. Clearance was obtained prior to undertaking the architectural and archeological

investigations documented in this report because such work affects the cultural resources. Additional clearance will be obtained before any future construction or restoration can begin.

Arlington House, both by its historical associations with famous Americans and its architectural significance as one of the nation's finest examples of the 19th century "revival" period, possesses in abundance the integrity and authenticity which justify the highest level of investigation and preservation treatment.

III. CHRONOLOGY OF STRUCTURAL CHANGE

A. The Custis and Lee Families' Residency, 1802-61

Remarkably little evidence has survived, or been found, to document the actual dates of construction or to provide any details on the course of the building of Arlington House.

1. Plan for the Mansion

The architect George Hadfield appears to have prepared the plan for the mansion, probably in 1802 or 1803. This opinion is based on the fact that when Hadfield died in 1833, several of the obituaries that appeared in the different Washington, D.C., newspapers credited Hadfield with preparing the plan for Custis's mansion. The fact that G. W. P. Custis, who was an avid newspaper reader and inveterate letter-to-the-editor writer, took no steps to contradict these claims indicates that Hadfield did prepare the plans. The actual drawings, however, have never been found.

2. Initial Stage of Construction: South and North Wings, 1803-1804

The only hard documentary evidence that has been found relating to the first stage of construction of Arlington House is a letter from Cornelia Lee (probably) to Mrs. Richard Bland Lee (probably), dated April 13, 1804, which reads in part: "The House will be a very handsome building when completed. The room we were in was 24 feet Square & 18 high." This indicates that one wing of the house, probably the south wing, was substantially completed by mid-April 1804, when Custis was apparently entertaining guests in this room. The artist William Birch visited Custis at Arlington, probably in 1804, saw the proposed plan for the entire mansion and recorded in his undated journal that "he had built the two wings of his capital house [which] with the hill they stood upon was an ornament of every elegant situation within the City of Washington." (Newspaper advertisements prove that Birch was in Alexandria on September 11, 1805.)

The north and south wings were both one-story brick structures with hipped roofs measuring 40 feet long by 25 feet wide. Because of their relatively modest size, the two wings could easily have been constructed in the period 1803-1804, as they apparently were.

No account books or bills relating to the 1803-1804 construction have been found. Family tradition is that the brick used in the construction was manufactured by slaves on the estate and that the timber utilized also came from Custis land.

As Custis's home from 1804 to 1816 consisted of two one-story brick houses separated by an interval of 60 feet, it is not surprising that the many visitors to his estate during this period made no comment on the architecture of his house--the mansion did not yet exist. A shortage of money was apparently Custis's reason for stopping construction with only the two wings completed in 1804.

3. Second Stage of Construction: The Central House, 1817-18

Custis constructed the center, or main, section of his mansion in 1817-18. Again the documentary evidence is very limited and

his account books have not been found. The key evidence documenting the construction of 1817-18 is as follows.

G.W.P. Custis wrote Edward Stabler (probably), druggist, on April 8, 1818, that "not being able to command cash at this time from the heavy expense of my building, I enclose my note."

A receipt from Cornilius McLean to G.W.P. Custis, dated April 18, 1818, noted the following payment: "200. Received of Mr. Custis Two hundred dollars on account of his building being Fifteen Hundred & Fifty Dollars in cash up to this date."

The Alexandria Gazette reported on June 10, 1818: "Arlington House, the seat of Mr. Custis . . . was struck by lightning during the storm on Saturday morning. The lightning entered the roof and passed down by a temporary wooden pier, erected to support the unfinished part of the portico, but fortunately without any injury to the building or family."

In a notice regarding his invention and use of hydraulic cement, printed in the Daily National Intelligence, August 19, 1818, David Mead Randolph mentioned the application of a cement stucco to the exterior northwest corner of the house in late 1817: "One other experiment was made on the [exterior] N/W. corner of Arlington House, the seat of G.W.P. Custis, Esq., in the District of Columbia, just before sunset on Saturday, 19th day of December 1817 [the test was successful]."

A receipt dated August 22, 1818, with an illegible signature, noted the following payment: "Received of George W.P. Custis, Esq. eighteen dollars which with the other sums before received is in full of wages for plastering at Arlington House & of all demands."

Because of a lack of funds, the first floor drawing room on the south side of the center hall in the main house was left in an unfinished state in 1818.

With the exterior of the 140-foot-long mansion completed in 1818, travelers began to notice and mention the architecture of Custis's mansion. One in May 1818 called it Custis' Folly. A. Levasseur, visiting Arlington with Lafayette in December 1824, wrote that the mansion was "built according to reduced plans of the temple of Thesus [sic]." Actually, the proportions of the Arlington portico are closer to those of the Temple of Hera Argiva at Paestum, Italy (plate 2) than to those of the Athens Theseum (plate 1). A lithograph published in William Elliot's The Washington Guide in 1826 (plate 3) is the first known published view of the mansion. A balustrade adorns the roofs of the north and south wings in this picture. Francis M. Trollope, who visited the mansion in 1830, described Arlington in 1832 as "a noble looking place, having a portico of stately white columns."

4. Repairs and Improvements, 1818-54

The only documentary evidence relating to any repairs or improvements made during the period 1819-54 is as follows.

a. Pumbing, 1837

Robert E. Lee wrote his wife from Baltimore, July 12, 1837: "Tell Mother [Mrs. G.W.P. Custis] I was going to day to see about her pip[es?] but on further consideration, I thought she would not be able to compass the matter unless I was there, as they would have to be laid with care, and the joints in lead." This might relate to the installation of a water closet and/or running water in the mansion in 1837. In a letter dated October 16, 1837, Lee wrote his wife: "Arlington must now look beautiful, and you and Mother will be much engaged with your improvements."

b. New Portico Steps and Floor, Etc., 1851

Mrs. R.E. Lee wrote her son, G.W. Custis Lee, ca. October-November 1851: "Your Grandfather (G.W.P. Custis) is seized with a spirit of improvement lately--he is making new steps to the Portico (the old [wooden] ones having so decayed as to be unsafe) and intends paving it with octagonal brick tiles which are now being burned in one of the vast brick kilns in Washington--then he is going to put a new roof on the stable which is more needful than the other,--though all are most desirable." Mrs. G.W.P. Custis wrote her grandson, G.W.C. Lee, December 5, 1851: "The portico steps are finished at last, and Charles and Austen are engaged in preparing the floor for the Pavers who are to lay the tiles as soon as your Grandfather can haul them from Washington."

R.E. Lee wrote Mrs. Custis from Baltimore on March 17, 1852: "You will find the Life of Jay 2 vols. either in the little book case, that formerly stood in the dressing closet in our room or on the book shelves in the Parlor."

G.W.P. Custis wrote Benson J. Lossing from Arlington House on December 30, 1852: "I have had an excellent studio fitted up in the South wing of the house, with a first rate light, (so pronounced by Mr. Stearns of your city [New York] when painting his copies of Col. & Mrs Washington from the originals here), also a stove and everything comfortable."

c. The Custis Paintings

In the hallway of the mansion hunting scenes painted by Mr. Custis decorated the area above the doorway. There were also paintings of a Hessian soldier beside each stair, and according to one source, paintings also in the dining rooms. The dates of the paintings are unknown. Sometime after the Lees left, these paintings were all whitewashed.

An article in Harper's Weekly, May 29, 1886, described the paintings above the doors: "A remarkable hunting scene in distemper forms a sort of frieze above the doors at the end of the main hallway. The dogs are the leanest and longest, the flying rabbit is the most apoplectic, the dying agonies of the many-striped tiger the most harrowingly realistic, in the whole range of post-Raphaelite art. This is the proud handiwork of General Lee's father-in-law."

A newspaper clipping, ca. 1893, reported less enthusiastically:

> The great mansion as it stands today is copied from the Temple of Theseus of Greece. . . . The house shows much of the George Washington Parke Custis' love of art. The father-in-law of General Lee was not a great artist. . . . In the old building today, and especially in the dining rooms, are friezes, a little indistinct, but still traceable, which the cemetery people insist are the work of old General Custis. There are flying hares and dogs in full pursuit. The hares and dogs are so strikingly alive that nobody can tell which is the pursuer or which is getting away quick. In like manner old Mr. Custis got up deer and salmon and insisted upon sticking them on his walls.

5. Third Stage of Construction: Completion of the Interior of the Drawing Room and Installation of a Furnace, 1855

By May 1855 Col. and Mrs. Robert E. Lee were using their money to make certain improvements to her parents' home, Arlington House. These included the finishing of the interior of the drawing room to the south of the center hall and the installation of a coal hot-air furnace. As part of this work, Colonel Lee ordered three marble mantels from the New York City company of S. Young, 641 Hudson Street, and paid $105 for them about July 1. By this date the furnace had been largely installed, and Lee thought that the plasterers were about to get underway in the drawing room. According to an entry in Agnes Lee's diary, the new mantels were received and installed prior to September 1, 1855. Two of the new mantels, of identical size and design, were installed in the new drawing room. The third mantel, of the same size but without any carving, was placed in the adjoining room, replacing an earlier mantel. The Lee mantels in the drawing room remained in place until 1931, when they were removed and stored in the basement by the War Department on the basis of advice provided by the Commission on Fine Arts. Replicas of early style mantels at Woodlawn were then placed on the fireplaces in the drawing room.

Documents relating to the 1855 renovations include letters from Colonel Lee to Mrs. Lee dated July 1, July 9, and August 20, 1855, and October 31, 1856, and entries in Colonel Lee's memorandum book from July 23 and August 20, 1855. Colonel Lee wrote Mrs. Lee, July 9, 1855:

> I do not understand how the walls in the Hall could have been so broken, as to require being plastered all over! They could only have opened the strip for the air pipe in the Hall, & that they should have restored. They could not give the <u>new</u> the exact Colour of the <u>old</u> plastering, & the whole may have to be Coloured, but not plastered, unless you wish it <u>hard finished</u>, as it is called, which it is not now.
>
> As regard the painting of the large [drawing] room, white is the simplest & cheapest colour, & I think with stained doors will look very well. If <u>well grained</u> in imitation of oak or walnut (the latter I prefer) it will look richer, though darker,

& the room you know wants light. You had better con__t your father, though I think on the whole, white will be the best.

Colonel Lee's memorandum book no. 5 notes that he sent checks to his wife on July 23 and August 20, 1855. The first check, for $240, was "to pay for finishing large room at Arlington." The second was entered, "Bk of Commerce N.Y. to order of Collin & co. in payment of furnace for Arlington for $200.00."

In his letter of August 20, 1855, Colonel Lee noted that he was glad to hear that Mrs. Lee was having "the book cases repaired." In his letter of October 31, 1856, Colonel Lee revealed that G.W.P. Custis had insisted on paying his daughter, Mrs. Lee, for the 1855 improvements made to Arlington House.

6. Alterations to the Two Front Dressing Rooms, October 1857

Mrs. Lee wrote Colonel Lee, October 2, 1857: "The stable being pronounced unsafe we have a carpenter here putting on a new roof & I took the opportunity with Fathers sanction to have the partition taken down between the two front dressing rooms & leaving the door that opens into Markie's room as we are much in want of another room, but indeed the poor old place looks very ruinous."

G.W.P. Custis died on October 10, 1857, and under his will the Arlington estate passed to his daughter, Mrs. Robert E. Lee. His obituary in Harper's Weekly (N.Y.) October 24, 1857, describes the mansion as follows: "The Mansion occupies a commanding site upon the brow of a hill more than three hundred feet above the Potomac, and distant from its shores about half a mile. It is of stuccoed brick, and presents a front, with a centre and two wings, of, altogether, 140 feet. The grand portico, which is modeled after that of the Temple of Theseus at Athens, is supported by eight massive Doric columns, and has a front of sixty-one feet, by twenty-five feet in depth."

7. Completion of the Stables and Reroofing of the Mansion, 1858

Agnes Lee wrote Rooney Lee, October 2, 1858: "Papa [Colonel Lee] is very busy with the workmen, mending and building all of the time. The stable is beginning to approach completion and will be very handsome I think. He is repairing the sheds to both wings and rebuilding the 'planks' of brick."

In an application to the Hartford Fire Insurance Company, dated October 17, 1859, Colonel Lee noted that the roof of the mansion had been slated in 1858 and a lightning rod installed and that a new gravel roof had been placed on the stables.

Colonel Lee left Arlington House on April 22, 1861, and Mrs. Lee departed forever on May 15, 1861.

B. The War Department Years, 1861-1933

The Union Army occupied the Arlington estate on May 24, 1861. The heights were fortified and a field of fire was cleared through the forest in June and July 1861. The mansion was occupied as an army

headquarters from 1861 to 1864. The Union Army went to unusual lengths to protect Arlington House and its furnishings. Some damage was done, but much less than would normally be expected from soldiers.

The estate was sold for taxes and purchased by the U.S. government for $26,800 on January 11, 1864. Two hundred acres were set aside as a national cemetery, and the first burials were made May 13, 1864. The cemetery was opened on June 17, 1864. By April 22, 1865, nearly 5,000 soldiers had been buried there, and by 1868, 15,000 Union soldiers had been buried there. From 1864 to the 1920s Arlington House served as the office and residence of the superintendent of the national cemetery.

In the 1920s use of the mansion as a living quarters was discontinued and work was undertaken to restore Arlington House to its appearance before the Civil War.

1. Alterations and Repairs, 1867-1921

The exterior appearance of Arlington House during 1860-65 is documented in the Brady Collection photographs taken in June 1864 (see plates 6, 7, and 8). Also illustrations 1 through 15 compiled in Charles H. McCormick's "Custis-Lee Mansion, Historical Data for Grounds" (Division of History, Office of Archeology and Historic Preservation, National Park Service, Department of the Interior, Washington, D.C., June 1, 1968) show the 1864 front and rear elevations of the mansion and also the slaves' quarters and stables. The photographs of the mansion reveal that the balustrades had been removed from the roofs of the wings and that the east, north, and south exterior walls had been covered with stucco scored to resemble masonry work and then marbleized. All of these changes, of course, had been made by the Custis and Lee families prior to 1861.

For the years 1867-1921, the following references to alterations and repairs of the mansion and grounds were found.

The August 1867 monthly report of the condition of Arlington National Cemetery, prepared by the Office of the Quartermaster General, noted both exterior and interior maintenance work, including the application of yellow whitewash to the exterior of the mansion: "Buildings: The main building is in very good condition. The roof of the north wing has been shingled and the woodwork on the inside of the north wing and the woodwork on the inside of the greenhouse, has been painted during the present month: the masonry on the outside of the main building has been whitewashed, yellow, during the present month."

The National Republican (Washington, D.C.) reported on May 30, 1873: "The front of the mansion, which faces the river, received its share of beautifying, and the massive columns have all been repaired."

The 1874 annual report of the inspector of national cemeteries indicated that repair work had occurred and mentioned the expansion of the greenhouse: "Arlington: The old mansion and the outbuildings have been repaired and are now in good order. The flag

staff stands in front of the house. There is a flower garden and greenhouse just south of the mansion. . . . The greenhouse has lately been enlarged and improved."

The June 1878 monthly report on Arlington National Cemetery noted: "The main building is in good condition. The roof has been repaired by relaying the slate and putting on new sheathing. . . . The two brick outhouses and stable near the main building are in good condition."

Q.M. Gen. M.C. Meigs wrote in a memorandum dated May 17, 1881: "The capitals of the front Portico of the mansion at Arlington are of wood & more or less decayed. When renewed they should be made of Portland cement with sharp sand. 1 [part] cement. 3 [parts] sand & their profiles should be cemented to resemble those of the Parthenon, which is the accepted canon of Grecian Ionic order [sic]."

On March 10, 1883, the U.S. government acquired full title to the Arlington estate from the Lee heirs for $150,000. This was subsequent to a lawsuit brought by the heirs to recover the property.

The November 1884 monthly report on Arlington National Cemetery recorded the following work: "Buildings: The old mansion has been thoroughly renovated--plastered walls mended and kalsomined. All inside woodwork painted and the columns scraped and painted."

The quartermaster general wrote the depot quartermaster, August 14, 1885: "Referring to the accompanying plans and specifications for certain improvements at Arlington National Cemetery, you are authorized to have the roofing of the outbuilding and wings of Mansion renewed with slate, and to provide additional water and sewerage connections as recommended in report of Engineer; also to repair second story rooms of mansion, and ceiling and windows of south room on first floor, as recommended, at a total cost not exceeding $690, and the allotment for this cemetery for the current fiscal year is hereby increased accordingly." The sealed bids for furnishing the work and materials required for these repairs and improvements, dated September 4, 1885, are contained in the mansion file, "Background, Arlington Estate 1865-1925, and Cemetery Ground Reports." The same file contains a memorandum on the estimate for repairs and improvements dated September 14, 1885.

An article in Harper's Weekly, May 29, 1886, noted: "They have painted the old house yellow lately--not a screaming yellow, but a soft, unobtrusive tint that is very consistent with its age."

Various newspaper articles and travel guides published between 1900 and 1921 all described Arlington House as being used as the cemetery office and living quarters of the superintendent.

The restoration of Arlington House to its pre-Civil War condition was authorized by Congress on March 4, 1925. In a memorandum dated July 9, 1925, the quartermaster general advised that the estimated costs of carrying this joint resolution into effect would be about $252,000, to be expended as follows:

1. Restoration of Lee Mansion:

a)	Structural changes and repairs, painting, etc., to Lee mansion and the two adjacent dependent buildings, generally described as the summer kitchen and the slaves' quarters	$ 60,000
b)	Refurnishing these buildings	100,000
	Total	$160,000

2. New Buildings:

For superintendent's lodge, office building, gardener's lodge, and foreman's lodge	$ 92,000

An article in the August 13, 1925, edition of The Evening Star, a Washington newspaper, reported that Q.M. Gen. William H. Hart had submitted a request to Congress for $225,000 to accomplish this task and added: "The existing Lee Mansion is being completely overhauled and the surrounding buildings are being restored as they were at the time of the Civil War. The slave quarters will be put back in the condition that they were."

Having inspected the mansion, Chairman Moore wrote to General Bash on July 17, 1930: "Every time the members of the Commission of Fine Arts go to the Arlington Mansion they ask when the [marble] mantels in the south room [which had been installed by Colonel Lee in 1855] are to be changed to make them harmonious with the remainder of the house. Just at present they are rather a ghastly piece of Mid-Victorian."

In a meeting of the Quartermaster Committee to determine what work should be done on the mansion, held April 17, 1929, it was agreed that an outside heating plant for both the mansion and the outbuildings would be constructed adjacent to the public comfort station in the rear of the summer kitchen. The committee also determined that the exterior of the main building was to be reconditioned and repaired without change to its present general appearance except for the addition of a proper type of railing around the roofs of the north and south wings and the substitution of stone steps for the wooden steps around the main portico. With regards to the interior, it was agreed

> that the interior [should] be restored and repaired generally; that only temporary partitions be removed; that the arrangement of rooms in the North Wing be allowed, to remain, as well as the arches in the double parlors north of the main hall; that the large room in the South Wing be furnished as the state dining room; that this room and the main drawing room south of the central doorway have new marble mantels [thereby removing the Lee mantels] installed similar to those in the double parlors; that all the modern flooring be removed and the

original old floor restored; that an effort be made to discover reported mural decorations under the present paint in main drawing room; that mantels on second floor be replaced with mantels of Colonial period.

In about 1931 architect L.M. Leisenring submitted to the quartermaster general the following undated report regarding the restoration of Arlington House:

> The honor and privilege of restoring the Mansion to its original grandeur as called for by the above joint resolution fell to the lot of the Quartermaster Corps and the work was undertaken with determination to do justice to the Mansion and credit to the Corps. The Quartermaster General designated a "Committee on the restoration and refurnishing of Arlington Mansion" who would have charge of this work. The personnel of this committee were:
>
> Brigadier General William E. Horton, Chairman
> Brigadier General L.H. Bash, Assistant Quartermaster General
> Lieutenance Colonel Charles G. Mortimer, Q.M. Corps, Commanding Officer, Washington Q.M. Depot
>
> The architects were Mr. Edward W. Donn and Mr. L.M. Leisenring. The personnel of this committee has not changed, but since the retirement of General Horton, General Bash has become Chairman.
>
> Nearly sixty-five years had passed since the Lees left. How did the Mansion look at that time? What was in the house and how was it arranged? For what was the ground surrounding the house used? These major questions and minor questions in detail must be answered.
>
> All available old pictures, artists' sketches, magazine articles and old maps were carefully studied; folklore and first-hand recollections of former slaves and their descendents were gathered, and the information thus obtained was collected into a visionary replica of what had once been the beautiful and imposing Mansion.
>
> This building had been used since 1864 as quarters for the superintendent and the gardener of Arlington who occupied the entire building with the exception of the central hall and three rooms of the first floor. These latter were, without furnishings, open to the public. Modern improvements had been made; the badly worn floors had been covered with modern oak and maple flooring, the entire building was heated with steam, all rooms were provided with electric lights, and modern plumbing and bathrooms had been intalled on each floor.
>
> The first act of restoration was to discontinue the use of the Mansion as living quarters and the removal of modern

improvements. This general discard of improvements was followed by a careful examination in all parts of the structure from foundation to roof and the replacement of every crumbled brick and decayed timber which could be found. The bricks used in walls were made by hand upon the site and the wear of time had reduced many to a state of disintegration. Many used in basement walls and chimneys, where they were exposed, were entirely gone or what remained was only red earth, easily removed with the fingers. This condition of the brick work required considerable rebuilding of basement walls and the reconstruction of all chimneys from the second story ceiling to tops. The condition of timbers necessitated the reconstruction of cornices, replacement of many beams and joists, flashings on the west gable, and the roof of the conservatory. The reconstruction of these portions of the building was done with extreme care to duplicate the members used in the original work. On the second floor over the large reception room the weight of a portion had caused settlement of nearly five inches, with the resulting cracks in walls above and ceilings below. To add support to this floor without visible alterations, a truss was constructed within the partition, the sag in the floor was corrected and the walls were replastered in their original positions.

The floors consisted originally of tongued and grooved pine boards, random width and thickness, hewn out on the underside to fit over joists and provide even exposed surfaces. This old flooring in the second story was carefully cleaned, repaired in spots where necessary with old flooring taken from the first story, so that in truth the second floor of this building is now "original." The flooring of the first story over which the hardwood had been lain was in such condition that its repair was impossible, and a new pine floor, duplicating the original as closely as possible, was laid over the entire first floor.

The hardware was another item requiring considerable study. With the exception of the two large entrance doors where the original massive locks remained intact, all other locks, knobs, escutcheons and key plates had been replaced by modern hardware or the few which remained were long past usefulness. Such old locks as still remained in part were removed, and from the collection thus obtained it was possible to reproduce by hand locks very closely resembling those originally used on all doors.

Next came the question of heating this building for the comfort of the visiting public in winter. With this end in view the boiler was located in an adjacent building, not only to remove a modern utility from the Mansion, but also to reduce the fire hazard by elimination of all fires within. Hot water heat was provided, with all installation within the Mansion confined to the basement and concealed as far as possible. The heat to rooms on the first floor was brought in through gratings in the

fireplaces, thus eliminating the necessity of placing radiators in the rooms to contrast with their colonial furnishings.

The removal of heating and cooking appliances from the building reduces the fire hazard to a minimum, but for the further protection of this historic and magnificent structure, an automatic fire alarm system has been installed which will sound the alarm within a few seconds, should a fire start in any room, hall or closet throughout the entire building. With the exception of the fire gong, this silent watchman is invisible to all those not familiar with its location.

The restoration of the Mansion called for not only the return of the Mansion itself to the original condition, but also the two adjacent buildings immediately west. The slave quarters consisted of three rooms and had been used since the establishment of Arlington as a tool house and place for storing paints, oils, and the like. The woodwork of the building was badly decayed, concrete floors had been placed in two rooms and in the other a stone pavement had been placed. These floors were all removed, the woodwork replaced with duplicates of the original, the walls of rooms were cleaned where necessary, and where they had been replastered the plaster was taken from the walls. The location of joists supporting the attic floor, long since removed, was determined. Information relative to the original arrangement of those rooms and the purposes for which they were used was obtained from one of the old slaves who lived in this building, and today the building is in the same condition, as far as possible, which existed prior to the Civil War.

The summer kitchen building had been remodeled and used as quarters by the assistant gardener and was, of course, far different from the original summer kitchen which it was desired to restore. Practically everything except the walls inside this building was removed; the kitchen and basement room were restored, new floors were constructed at the original elevation, and we now have five rooms following the original arrangement. Information on the original condition of this building was also obtained from the former slave.

Brigadier General William E. Horton, Retired, is still very active on the Committee on the restoration and refurnishing of Arlington Mansion. For many years the General has been a close student of fine old furniture and a collector of the cream of antiques. He had in storage for some time a very select assortment of furnishings. In looking over Arlington Mansion, the General saw where part of his furniture could become useful and delight the hearts of others who saw it, as well as his own. So he has loaned the War Department nearly one hundred pieces of equipage. All the furnishings in General and Mrs. Lee's bedroom and in the "Lafayette Room" are his. In addition to the two rooms mentioned above, the General has loaned many other pieces and there is no room of the entire fifteen

throughout the Mansion that does not contain something loaned by him. Not long ago, General Horton saw another piece of furniture that was needed in the "Lafayette Room" and also one for the "Lees' bedroom." The pieces desired had to be of a particular kind, and the General went to Boston to purchase them at a price that plainly showed that he loved Arlington more than money.

In addition to the furniture supplied by General Horton, many other items were donated by various benefactors. As an illustration of the generosity displayed by these various benefactors, the following incidents are cited: one of the very first benefactors was Mrs. James Peyton Powell of Huntsville, Alabama, who opened her richly furnished home with the request that anything she had be taken that could be used in refurnishing the Mansion. From her home was brought the very finest of these furnishings. Articles of furniture, dishes, silverware, bedding, spinning-wheel, and deer horns were among the donations of Mrs. Powell.

The furnishing of the Mansion is by no means complete, and in this respect the committee is working diligently to secure originals where possible and failing in this to secure replicas that are authentic in all respects. Work of this kind must of necessity be rather slow.

It should be remembered that much of the original furnishings of Arlington came hence from Mount Vernon on the death of Martha Washington who willed many of the fine paintings and portraits of the Washington collection, furniture and furnishings, as well as most of the Wahington war relics to her grandson--George Washington Parke Custis--the builder and original proprietor of Arlington Mansion.

In the nature of things, these cannot be returned to Arlington. Some are in the National Museum, some are back at Mount Vernon, and others are in possession of the Washington and Lee heirs. Reproductions are being made and they will take the places of the originals. The old hall lantern presented by Admiral Vernon to Lawrence Washington at the time he built Mount Vernon and which hung in the main hall there until it moved to Arlington in 1802 will shortly be replaced by a faithful copy. It will hang in the main hall of Arlington at the same point from which swung the Vernon lamp for over fifty years, and until Mrs. Robert E. Lee removed it preparatory to packing "the Washington relics" early in 1861.

Much remains to be done toward completing the furnishings, and study must be given each item to the end that the will of Congress to restore "as far as practicable," the appearance of the interior of the Mansion to the condition of its occupancy by the Lee family may be fulfilled. Such a job is not one of weeks or months, but of years.

On June 9, 1933, the Quartermaster Department still had an unobligated balance of $12,470 appropriated for "Restoration, Lee Mansion." Under Executive Order 6166, dated June 10, 1933, as interpreted by Executive Order 6228, dated July 28, 1933, the Custis-Lee mansion was transferred from the War Department to the Department of the Interior on August 9, 1933.

C. National Park Service Management, 1933-Present

1. Restoration and Repair Work, 1933-41

In a memorandum to H.R. Owen, Buildings Branch, National Park Service, dated October 20, 1933, Col. Charles G. Mortimer elaborated on the work to be done on Arlington House:

> 1. Painting and repairing Mansion and Slave Quarters (inside and out): Since the restoration of the building was completed in March 1930, no painting has been undertaken, although it was contemplated to repaint it in less than three years, due to the fact that a large amount of the paint was put on rebuilt walls and similar surfaces.
>
> In the nearly four years which have elapsed since the painting was done, there has been certain deterioration in joints, woodwork, etc., which require new putty stoppings, and repairs to plastering and woodwork, also repairs to down spouts, gutters, etc. Other needed repairs will be done, including repairs to heating plant.
>
> Due to the fact that the walls of some of the rooms were whitewashed in the past, it has developed that all of the lime was not entirely eradicated prior to the painting in 1920-30. The result has been that both ceilings and walls have partially peeled in places. These walls will have to be scraped and all of the present paint removed. It can be seen that the painting is a large job and that all furniture must be taken out of the rooms and stored elsewhere. It will be necessary to close parts, if not all of the building, during the progress of such work. It is going to be my effort to keep the building open, at least in part, if it be found practicable. Work to be done by contract. Specifications therefore and request for advertising have been submitted.
>
> 2. Removing all wood steps on east, north and south sides of the portico of the Mansion and replacing same with stone steps is a part of the restoration originally planned and which, due to shortage of funds, was never undertaken. The architect's study in preparation for the restoration included this item. That architect is coming out shortly to go over the matter with me again to determine the type of steps to be used, as well as refresh his mind in order that the necessary drawings and specifications may be brought up to date.
>
> It is hoped that this work will start before long, provided the architect's estimate is not too much in excess of the one which I have made and which was based on a cheaper type of stone

steps than the architect's study contemplated. Probably contract job.

3. Restoration in part the kitchen garden: In the preliminary study for the restoration, it was found that on the south side of the Mansion there was a flower garden of quite considerable dimensions, enclosed by a picket fence. On the north side, there was likewise a picket fence surrounding the kitchen garden. The latter was divided into various beds by the usual paths, borders of flowers and other appurtenances of the well-attended kitchen garden in the days of slavery.

It is proposed to start this work and to prepare and plant and maintain that part of the kitchen garden which it is now possible to undertake the restoration of. Conditions are such that it is not now possible to undertake the restoration of this entire garden. Under the supervision of regular cemetery personnel, all of this work will be done by the "Purchase and Hire Method."

4. Improvements and maintenance of grounds about the Mansion. This item includes the necessary maintenance work on trees, shrubbery, as well as a small amount of tree surgery at this point, also walks, gravel roadways and landscaping. It involves the necessary restoration of the slope in front of the Mansion at a point where a considerable slide occurred a few weeks ago. Purchase and Hire Method.

5. Laying brick floors in Basement: In the basement of the Mansion there are several rooms, some of which are not open to the public. This is necessarily so, as hallways leading to these rooms are so largely involved with ducts of the heating plant system that passage thereto can only be made with considerable difficulty. According to the study made in preparation for the restoration, these rooms were either completely or partly paved with bricks. It is now contemplated to lay old bricks on these floors not only as a part of the restoration but principally to stop the recurring dampness which comes up through some of them and to keep down the dust which arises throughout the house from the unpaved clay and dirt floors. Some repairs to basement walls will likewise be involved in this work. Purchase and Hire Method.

6. Minor Repairs to Walls and Roof: This item is in itself explanatory. Purchase and Hire Method.

7. Rebuilding the Conservatory roof: The roof of the glass Conservatory is carried on wooden beams and strips. The latter are constantly rotting out or sagging, causing the roof to leak and the glass to break. It is contemplated to replace these, if not all, then part, with stronger wood frames or to replace the entire work with metal so constructed and painted that the fact of them being metal will not be noticeable. Maintenance on this work is a considerable item and my plan

contemplates reduction of that maintenance. Purchase and Hire Method.

Historian Elbert Cox reported to Chatelain, November 15, 1933: "Had interview with Architect Leisenring. War Department restoration of Arlington Mansion, 1929-1930, based on what data Leisenring had been able to gather. 'No thorough or complete study or search for full historical data on Arlington had been made.'" Cox continued:

> It seems that the records for Arlington are scattered and sketchy. No original plans or specifications for the estate exist, so far as he [Leisenring] knows. Furthermore, it seems certain that the building was not completed according to the first plans nor was it built all at one time. Instead, the wings were built first--and perhaps changed to answer immediate utilitarian demands--before the main or central part of the house was begun. Then financial inability prevented the completion of the building in as fine a manner as it had been intended to do it.
>
> With reference to the particular items listed in Colonel Mortimer's program of improvements and repairs, I can see no objection to going ahead with items 1, 4, 6, and 7. No great point of historical import is involved in these, they being more particular matters for the Branch of Plans and Design to pass on.
>
> In regard to item 2, removing old wood steps and replacing with stone, this is in line with the plan drawn by Mr. Leisenring. There have never been stone steps for the building. However, Mr. Leisenring feels that if the original owner had been financially able to complete the building as he started out to do or if the architect who designed the building could have carried out his original plans, the stone steps would most likely have been built. Reasoning on this basis, he feels that a faithful restoration of the mansion demands stone steps.
>
> Fragmentary evidence only is the basis for the restoration of the kitchen garden. It is a part of the plan proposed and now being carried out.
>
> The plan to pave the floors in all the basement rooms not now paved was not suggested by Mr. Leisenring. At present the winter kitchen and one other small room in the basement are paved with the original brick. The wine cellar has a few brick along one side. The remainder of the rooms are not paved, some of them not even graded. The only justification for paving these rooms is to keep down the dust. The present arrangement of heating system makes impossible the utilization of the greater part of the basement space. There seems to be no reason from an historical standpoint which demands that they be paved. From the standpoint of operation, the paving may be considered a desirable improvement.

The projects above outlined and explained raise a point of policy with reference to the restoration of Arlington. To place stone steps where there have never been stone steps and to pave the basement floors that have never been paved is restoration in spirit, but not in detail. However, there is little question that the original plan of the house would have included these items. Furthermore, they will fit into the present condition of the building; and as to the question of steps, I feel that stone steps that will in weathering take on the appearance of old steps are preferable to new wood steps that will have to be replaced at very frequent intervals. Therefore, my recommendation is that the improvements as suggested by Colonel Mortimer be approved. I mention, however, the desirability of close control being exercised over the design, material, and construction. In the meantime I shall continue my research in an effort to get additional data on the building and the original layout of grounds.

Historical architect Charles E. Peterson also commented on Colonel Mortimer's list, writing to the director of the National Park Service on December 15, 1933 (Peterson was at that time employed as a landscape architect):

I understand from reading the newspapers that the painting work has gone ahead in the Mansion. The thing in particular that an architect could advise in this matter is the color of the paint, but we do not have any records here of the original colors, and I do not know that anyone else has.

Items 2, 3 and 5 in Col. Mortimer's memorandum seem to involve the installation of features which never existed in the earlier days. This office is opposed to "improving" antique structures to make them look as modern people think they should have, instead of trying to make them look as they really did.

Items 4, 6 and 7 pertain to purely maintenance matters though we would like to investigate them in detail before any construction is carried out.

Mr. Cox's memorandum on Arlington Mansion was interesting though it contained only the most superficial information about the physical condition of the structure and grounds.

In summarizing his work from January to June 30, 1934, Colonel Mortimer reported on July 9, 1934:

1. Reference is made to my estimate of September 30, 1933, for funds required for the necessary work on Arlington Mansion, Arlington National Cemetery, Fort Myer, Virginia, submitted to your office. This estimate was made in accordance with allotment for $12,470.00, made your office by the Public Works Administration for furthering the restoration of the

Mansion and grounds. Seven items were included in that estimate; report thereon is submitted.

Item 1 - Painting Arlington Mansion and Slave Quarters. Contract for this painting was made by your office and did not include the exterior of the Slave Quarters. All work called for was completed last spring in a satisfactory manner. Since that time I have painted those portions of the exterior of the Slave Quarters which were not included in the contract.

Item 2 - Removing old wood steps of the portico and replacing same with stone steps. Drawings were submitted to the Engineering Branch of your office with a view to having them write up specifications on those drawings some time last winter. I have never received either the drawings or specifications back. It is my understanding that objections to replacing the steps were made by your department.

Item 3 - Restoration in part of the kitchen garden. Items a, b, c, d, e and f have all been completed as indicated. Item g - one laborer was employed on this work as a gardener up to June 30, 1934, on which date he was dropped from your rolls.

Item 4 - Improvements and maintenance to grounds--expenditures made under this item up to June 30th amounted to $519.00 (gross amount).

Item 5 - Restoring brick floors in all basement rooms. Continuing efforts have been made to secure old bricks necessary for this work and through the help of your office I succeeded in getting about 2000 bricks and paved one hallway, wine cellar and part of another room. The remainder of the work is not completed, due to the lack of suitable material.

Item 6 - Minor repairs to walls, roof, etc. This has been done from time to time, using material supplied by this office and charging labor to the Mansion payrolls.

Item 7 - Rebuilding Conservatory roof. This item has been taken care of but the roof has not been rebuilt, inasmuch as the estimate is not believed sufficient to cover.

2. I consider the rebuilding of the steps with stone a very necessary part of the restoration.

John L. Nagle's report of January 23, 1935, to Gill described the work that had been accomplished by that date:

With reference to Colonel Charles G. Mortimer's memorandum of July 9, 1934, attached hereto, you are advised that the following work has been completed:

1. The painting work has been completed.

2. The old wood steps at the portico are in bad shape and should be replaced. Plans were drawn up by the Construction Division of the Quartermaster General for the replacing of these steps with stone. This plan was submitted to Mr. Peterson but was not approved. Mr. Peterson's office should be notified that this work should be completed as early as possible to prevent a serious condition.

3. The restoration of the kitchen garden has been completed.

4. The improvements to the grounds [have] been completed.

5. The restoration of the brick floors in the basement has not been completed. As far as we could determine, approximately five rooms and one hallway are yet to be completed.

6. The minor repairs to walls, roof, etc., have been completed.

7. The roof over the Conservatory is in very poor condition and should be replaced. The present construction is wood which has rotted away in several places so that leaks have developed. It was the intention to replace this with a structural steel structure with wire glass panels.

Thomas T. Waterman wrote in a memorandum to Peterson, May 7, 1935:

The proposal to restore the steps to the portico of Arlington Mansion makes me wonder if further restoration work should not be undertaken to fulfill the requirements of Public Resolution - No. 74 68th Congress (H. J. Res. 264) that the Lee Mansion be restored to the Condition in which it existed immediately prior to the Civil War. Funds for this work are available, I believe.

In one important characteristic the house has been radically changed from this state, that is in the exterior painting. In the photographs taken during the war the stucco of the exterior is definitely shown as veined to represent Aquia Creek stone. This is now painted white and buff. A drawing shows the pediment to have been plastered and laid off in blocks to represent stone, while at present it is boarded. In my opinion, the intent of the architect will be more nearly fulfilled if the exterior stucco is restored to simulate stonework. Thus a true restoration, as required by the Congress, will be accomplished, and the Mansion as seen across the new bridge will better harmonize with the stone work of the approach. It is possible

that the simulated stone veining was done in fresco and running under the existing paint, and can be recovered.

Although no photograph seems to exist of the court side of the house, there is an indisputable indication that a porch was proposed if not built here. This is in the hinged panels under the second floor hall window, to permit egress. No signs show on the exterior as the stucco has been replaced here. I believe that excavations should be made under the rear steps to determine if the porch was ever built. The rebuilding of such a porch would be a great artistic addition to the facade.

Colonel Mortimer requested on September 11, 1935, that the National Park Service make a careful inspection of the beams or struts supporting both stairways in the mansion. Charles A. Peterson informed the colonel on September 17:

The struts and beams supporting the stairways were found to be in excellent condition and the stairs were amply strong, except for the second flight of the "up" stairs. This flight deflects and vibrates under traffic.

It is suggested that the plaster be removed during a slack period so that the beams may be examined further.

On October 18, 1935, Assistant Chief John L. Nagle advised the Redmond Concrete Co., contractor for rebuilding the conservatory roof:

It has been found that the brick wall does not extend high enough to anchor the new aluminum rafters in the manner indicated on the contract drawings.

Therefore, this office is considering the advisability of including the followng described work under your contract, and accordingly you are requested to submit an estimate of the cost which would be involved, and on a separate sheet indicate a detail breakdown of your estimate.

The work would consist of undercutting the existing wooden rafters and installing a 6 inch by 4 inch yellow pine plate above and toe-nailed to the existing wood wall plate. The new plate would extend the entire length of the wall involved in supporting the new aluminum rafters.

Your attention is invited to the fact that if the work be performed in the manner indicated above, it will not be necessary for you to drill for or furnish expansion bolts for the anchors, but you will be required to install anchor bolts through the wood plates for each aluminum rafter.

The superintendent's report for June 1937 addressed artwork and the heating system:

At the Lee Mansion the painting of the woodwork in the Mansion and north slave quarters was continued. In addition the three paintings over the doors of the south slave quarters and the fresco in the hall of the Mansion were retouched by Mr. Herman Van Cott, an artist from the Museum Division. The work was carefully done so that the antique appearance of the paintings might be preserved.

The Lee Mansion Heating Project contemplates revamping the present heating system to give adequate heating--$3500.00. The present heating system in the Lee Mansion is of the indirect type using hot water as the heating medium. There are six sets of cast iron hot water coils on the basement ceiling each connected to ductwork supplying heated air to concealed outlets on the first floor. The inlet to those coils is from window openings in the basement.

With these outside air connections, there is not sufficient heating surface in the coils to heat the building. The heating is also at the mercy of the winds as a cold wind blowing against an outside air intake will produce cold drafts in the room.

It is proposed to apply motor-driven fans to these heating units and change the outside air intake connections to recirculate the air from the house. Such an alteration would reduce the heating costs by approximately thirty per cent and insure adequate heating without cold drafts.

The budget request for the 1940 fiscal year, submitted April 18, 1938, included the following request under "Buildings":

The sum of $2,000 is recommended to install 1-1/2" standpipe hose stations and hose. The present fire fighting equipment consists of portable extinguishers. After their use, additional protection depends on arrival of the fire engine and crews from Fort Myer and a fire could gain headway and cause much damage before any equipment and large hose lines could be brought into service. Favorable consideration of this item is urged to protect the buildings and their irreplaceable historical contents.

The installation of a new heating system was addressed in a report dated July 15, 1938, from assistant architect "S.M.B." to Tom Vint:

Architectural Comments Regarding Installation of
Heating System At The Lee Mansion.

On Thursday, July 14, in the company of Inspector Hunt of the Branch of Engineering, I visited the Lee Mansion. The purpose of this visit was to determine how the installation of the new heating plant would affect the architectural features of the structure.

The most inconspicuous positions have already been selected for the heat grilles. The only contribution I could make to further their obscurity was to suggest they be kept as close to the base board as possible and be grained in painting to match the present flooring.

In the basement it will become necessary in the installation of new work to cut into the original arched chimney foundations and in one instance to cut into part of an original basement fireplace. There seems to be no way to eliminate the necessity of this cutting other than exposing a large unsightly grille in the floor of one of the main rooms of the first floor. It is therefore recommended that the fireplace to be altered be measured and recorded before construction begins and that pure white Medusa cement mortar be used in making these and all other changes in the masonry. By so doing the white joints in the new work will furnish a permanent and obvious record of changes which have been made to the original structure.

Data relating to the history of work on the roof of the mansion were included in a memorandum from J.W. Hetrick to Superintendent Truett, dated September 17, 1940:

\ Kendall

As there appears to be some thought in the minds of some of the N.C.P. officials that the present condition of the slate on the wings of the Lee Mansion is due to employees walking on the roof--particularly to gather magnolia buds--I should like to tell you a little of the history of this roof and explain why its present condition cannot be attributed to our employees walking on the roof.

To begin with, the roof, according to the Superintendent of the Cemetery, is close to forty years old, and perhaps older. The greatest amount of damage was done to roofs on the wings of the house when the mansion was restored. At that time it was necessary to determine if there had been balustrades on the roofs. Several experts were called and holes were cut in the roof. When it was learned that there had been balustrades, they were built on the roof, and in doing this, permanent damage was done to the roof. The workmen cracked much of the slate, and when the posts were set in, leaks developed that have never been permanently mended. Every few months it starts leaking around the posts and we have to go out and cement it.

Another reason for the cracking of the slate is that every three or four years when the house has been painted, scaffolds have been built on the roof. Very little care was apparently taken. Sand bags were never used.

A few years ago while Cemetery workmen were blasting stumps some rather heavy pieces were blown upon the roof of the North wing.

Up until this summer we did go out on the roofs to cut Magnolias. Only one person ever did this--Dave Spencer--and he has been doing it since the Mansion was restored. He cut Magnolias for Col. Mortimer and the Cemetery officials before the Mansion was turned over to the Park Service. Before this the Cemetery gardener cut them. . . . Dave always was very careful of the roof.

A point to note is that the roof leaks as badly other places as it does where Dave Spencer went out on it. In fact, the worst leak has always been on the West side of the South wing where there are no Magnolias, or trees of any kind. The patch of plaster which fell recently in the State Dining Room was a result of this leak, although the roof at the time was not leaking.

In the spring of 1941 the National Park Service undertook to improve the fire protection system at Arlington House by installing four standpipes.

2. Repair Work, 1942-52

a. Exterior Paint, 1942

The superintendent wrote to George E. Clark on August 20, 1942: "During the past year, we have been considering painting the Lee Mansion. This last spring, the interior was completed and now the exterior trim and front columns need attention. Will you assign a crew from the Paint Shop to accomplish this work as soon as possible. . . . We feel that the stucco which is now painted a dark cream does not need attention at this time."

In a letter to Thompson dated August 23, 1948, T. Sutton Jett wrote that this work had occurred: "The exterior of the Lee Mansion was last painted in September and October, 1942."

b. Heating Problem, 1945

Gartside wrote Thompson on February 19, 1945:

The hot-water plant at the Lee Mansion, which is located in the basement of a small building 75 feet from the mansion, fails to provide adequate heat during the winter months. During the last part of January, a record of the temperature was made in several parts of the building. The highest temperature recorded was 62° in the conservatory (south entrance) which is the warmest place in the building. In the south hall the temperature averaged about 58°; in the center hall about 50°, and in the north hall about 45°.

It is recommended that a thorough study of the heating problem at the Lee Mansion be made by persons experienced in this subject for remedial action in the post-war period.

c. Woodwork, 1947

On November 18, 1947, T. Sutton Jett, then chief of the National Memorials and Historic Sties Division, wrote to Harry T. Thompson:

It is noted that the many coats of paint which have been applied to the woodwork over the years have destroyed much of the interesting detail. It is recommended that this old paint be removed prior to adding another coat. It is understood that this will require considerable labor and that time may not be available to complete this job throughout the building this winter. It seems advisable, however, to make every effort to accomplish this work in the rooms listed for painting this year, and if necessary, to delay the painting of the doorframes and other trim in the hallways until such time as the old paint can be removed.

d. Termite Control, 1948

T. Sutton Jett wrote Thompson on March 22, 1948:

It is recommended that the services of a specialist in termite control be engaged to examine the timbers of the Lee Mansion.

There is evidence of deterioration visable in the basement of this area. It is possible that the damage is being done by termites, and I am informed that other buildings in the National Cemetery have required termite extermination service.

e. Main Stairway, 1948

Jett wrote Thompson on April 20, 1948: "It is requested that the Engineering Division examine the principal stairway at the Lee Mansion National Memorial. During periods of high visitation there is some indication of instability in these steps."

f. Borer Damage to Basement Joists

Horace V. Wester, plant pathologist, wrote to George E. Clark on May 10, 1951:

At your request I have investigated insect damage to joists in the basement of the Lee Mansion.

The insect damage referred to was determined as caused by the old house borer, Hylotropus bajalus, by Dr. T.E. Snyder, R.A. St. George, of the U.S. Department of Agriculture, and the writer. This is an introduced European insect pest which may cause serious damage to coniferous wood in buildings. It only attacks sapwood and not heartwood.

A survey of the woodwork in the basement showed that the borer damage was confined only to certain joists under the center hallway and drawing room. The results of examining each joist for the borer damage are summarized below.

Joists under center hallway

The joists under the center hallway were numbered 1-28 from east to west wall. Joists numbered 5, 10 and 13 were found weakened respectively about 20%, 25% and 10% by the borer

damage. The remaining joists under center hallway appeared free of borer damage.

Joists under drawing room

The joists under the drawing room were numbered 1-16 from north to south wall, east and west side. Joists 3, 4 and 6, east side, were found weakened respectively about 20%, 5% and 20%, while those remaining on this side appeared free of borer damage. Only joist #1 on west side showed any evidence of borer damage, which was estimated as weakened about 5% from this cause.

The borer damage to joists generally appeared to be old and possibly was caused some years back. Only one borer tunnel was found which appeared relatively fresh, indicating this pest was active in the building. This was found in the sixth joist from north wall under east side of drawing room. The tunnel is next to flooring, about 11½ feet from east wall. Although no borers causing the above damage were found in the joists, this does not necessarily mean they are not in the building, as the insect is difficult to find in the wood.

Recommendations

Continue observations for presence of borers up to November 1, 1951. Suggest that personnel attached to building be instructed to look for fresh borer droppings on floor below joists and occasionally listen for clicking sound, made by the borer as its mandibles come together in rasping the wood. The clicking sound is most likely to be heard when the building is quiet, as at nighttime. Any observations of the above nature should be brought to my attention.

In November 1951, when I understand the tourists visiting the building will be at about the minimum for the year, I recommend that the building be fumigated or local treatment be applied for control of old house borer as conditions indicate.

Messrs. Truett and Haussman concur in the recommendation that the woodwork in all the rooms of the Mansion, except the doors in the Drawing Room should be restored to a stained walnut finish--a treatment which has been established historically by Mr. Murray H. Nelligan. This was done in the Custis Sitting Room last year, and has been considered highly satisfactory.

g. Ceiling in Girls' Room, 1952

William Haussman, architect, wrote to Superintendent Truett on January 7, 1952:

At your request I am putting into memorandum form the results of our investigation of Friday morning and some recommendations concerning the proposed work.

The ceiling appears at a glance to be in extremely poor shape, with many cracks and irregularities and two places which seem to be sagging. You will recall that I tested a large part of the area by sounding it. There were no hollow spots. The sags seem to be "built in" and not the result of loosening of the plaster. The cracks are sound except in a few small spots where the juncture of two diagonal cracks has broken into a small island. Imperfections in the moulded plaster cornice may be the result of past attempts at patching. Continuing our investigations into the attic, I examined the key between the plaster and the lath and between the lath and the joists. So far as I could determine there was no appreciable loosening of either. There were no important indications of broken keys or loose lath. It should be noted, of course, that both materials are old and brittle and cannot be relied upon to remain stable but are in as good condition as can be expected.

As a result of this inspection it seems to me that your idea of canvassing the ceiling is an excellent one. All paint should be removed from the surface and cracks cleaned, cut and filled with Swedish putty or plaster. Loose plaster should of course be cut out and replaced. Where one side of a crack may have dropped below the other side, the juncture should be smoothed down with a sand block but no attempt need or should be made to remove other irregularities. This work can well be peformed by our own forces and include both the flat portion of the ceiling and the moulded cornice.

The flat area should then be covered with canvas, such as the Columbus Coated Fabrics Corp. "Wall-Tex Stiffened Canvas #3097". The ceiling should first be glue sized and the canvas then pasted on with regular wheat flour wall paper paste. This portion of the work should be done by a good commercial paperhanging firm experienced in this type of work.

The canvas and the cornice may then be painted with flat lead and oil by our own men.

This treatment should strengthen the ceiling and greatly improve its appearance although it will not, of course, convert it into a perfectly smooth unblemished expanse.

2. First Extensive Investigation and Corresponding Restoration Work, 1950-53

In 1950-53 historian Murray H. Nelligan conducted the first extensive research on the history of the mansion and its inhabitants from 1800 to 1861 and also did some research into later periods. This work provided the first definite evidence about the history of the construction of Arlington House and the changes that Robert E. Lee made to it in 1855 and 1858.

a. Interior Paint and Plans for Interpretation, 1952

Historian Nelligan wrote to Louis C. Cramton on August 18, 1952:

I am sure you will be pleased to know that we are continuing the development of this memorial along the lines you so wisely established twenty-seven years ago. For example, just this past winter we made what may be termed an archaeological exploration of the paint and wood finishes originally used in the interior of the Lee Mansion. Two of the upstairs bedrooms, the upstairs hall, both stairways, the main hall and the short halls running north and south of it were due to be repainted. Before this was done, however, we got down under the many many layers of mostly cream-colored and buff coats of paint that had been applied to the walls and woodwork since 1864. The results were most interesting. We found that the walls of the south hall had been originally a light gray with a sand finish; the main hall a slightly darker gray without the sand finish. Upstairs, the Lee bedroom was found to be a light green, the girls' room across the hall a darker, almost olive green. The hall itself was something of a peach color which the Lees had carried on down the north, or service stairs, and the small north hall just off the family dining room. All the woodwork and doors had been stained or painted walnut originally; but most of the woodwork had been painted white sometime before the Civil War, and some of the doors stained oak and artificially grained. We repainted accordingly with the result that the Mansion presents a more attractive, homelike atmosphere than heretofore, besides which it is of course more authentic. As other parts of the house are done over, we hope to do the same thing and thus get away from the institutional appearance of the hitherto mostly cream-colored walls.

You will also be interested to know that the old potting house north of the house has recently been put in good repair and that we are now making plans for a museum to be installed on the lower floor. This will tell the story of Arlington and the Mansion. I have also just finished writing a full-length definitive history of the mansion based on research I have done since 1948; this we hope to have published in the near future. Two years ago the plot north of the house was transferred from the Department of Defense to the Department of the Interior and we now have a lovely flower garden established there. We hope to acquire the corresponding area to the south at some not too distant date so we can restore the old Lee flower garden in all its ante-bellum beauty, which will add considerably to the attractiveness of the setting of the house. We understand that the War Department planned to have a garden here originally, but was prevented from carrying out their plan presumably for lack of funds at the moment. Perhaps you could give us some information on this point.

b. The Lee Mantels and Interior Walls and Surfaces, 1953

Historian Nelligan's report for January 1953 reported under the heading of "Interpretation":

Early in the month the work of installing the Lee mantels in the drawing room of the Lee Mansion was completed. The work was well done, and because of their association with the Lees, the mantels should prove of great interest to visitors.

The archaeological reconnaissance of the paint on the walls and woodwork of the school room, inner hall and pantry of the Lee Mansion was continued, and brought to light some interesting information about not only the original colors in which these rooms were painted, but also the construction of the wing itself. More important was the discovery of evidence corroborating the hypothesis that the north wing was built as a unit, and partitioned off into three small rooms perhaps two or three years later. All this information has been recorded in the Restoration and Repair Records.

Nelligan's monthly report for March 1953 added:

In the north wing, the work of scraping the walls and ceiling of the inner hall and school room, prior to repainting, was finished. Because this wing is the oldest part of the house and its unusual interior partition wall arrangement requires explanation to most visitors, it is the best place to tell the story of the construction of the house; hence, it was decided to restore the school to one of its earlier colors, a light, greyish green. The inner hall was restored to a light gray, with white trim, its color just before the Civil War. Because of the time and expense involved in scraping the walls and woodwork of the school room, it was decided to put off painting the north hall and playroom (upstairs) until next fall or winter.

4. Repairs, 1956-60

Superintendent Harry T. Thompson wrote to Bartel on January 27, 1956:

As a result of an inspection of certain conditions in and about this structure made on January 25 by Mr. McCarthy, Mr. Hinkel, Mr. Reeves and Mr. Haussmann as well as Miss Downey and Mr. Pierce, it was concluded that it would be advisable to:

1. Correct hazardous conditions in the brick walls by re-laying and leveling up spots and areas considered definitely unsafe.
2. Re-lay the exit steps from the basement to the exterior by making 4 risers in place of the existing 3, each to be 7½" high. This will require one additional step slab. If one cannot be found in our various stock piles it will have to be purchased. This treatment will result in a slight departure from the present arrangement but to an extent scarcely noticeable and it will need to be carried out so as to closely resemble the present work. This should greatly reduce the very real safety hazard at that point.

3. Re-lay the brick flooring in the rear hall in the basement. It is in many places unsightly, being full of irregular areas, holes and broken bricks which could make walking unsafe. The new work must be in the spirit of the old work and old bricks are to be used for it.
4. Re-lay the hearth in the family dining room, doing whatever is required to stabilize it.
5. Re-paint the large dining room and, at the same time, make an effort to replace the existing mantelpiece with one of the proper design and material as established by the records, if funds permit.

Historian Paul C. Swartz wrote to the chief of the Branch of Interpretation, December 1, 1959:

> Repair damage of conservatory door facing, caused by infestation of termites, and lay stone slab or course of bricks under wood supporting door sill in order to prevent re-occurrence of infestation.
>
> Replace the following door sills:
> a. two in south hall
> b. four in center hall
> c. two in north hall
>
> Stabilize lower steps of north stairs.

In a second memorandum, dated April 1, 1960, Swartz pointed out the need for floor repair work: "The second story hall floor of the Mansion is in critical condition. Wood putty cannot be supported between wide gaps of the boards. Under use the boards splinter and the cracks are widened. The entire original floor, under continued heavy use will soon be ruined. Accidents to visitors will increase."

5. Roofing, 1960-61 and 1974

Superintendent T. Sutton Jett wrote to the director of the National Park Service on September 30, 1960:

> In a memorandum dated July 1, 1959 we informed your office of our intent to replace the roofs on the north and south wings of the Custis-Lee Mansion as nearly as possible to their appearance as designed by the architect of the house, George Hadfield. We pointed out that this decision was reached after careful consideration by our own staff and in consultation with Mssrs. Nahler and Peterson of your staff. We proposed at that time to replace the existing parapet with one more nearly in keeping with the probable Hadfield design.
>
> The expressed intent of the Congress was that the building be restored as nearly as practical to its appearance just prior to the Civil War. We are now about to begin the repairs on the roofs of the north and south wings and upon reviewing our previous research and conclusions it has seemed to us that we

should not have recommended the replacement of the parapet. It is now our feeling that the parapet should be omitted altogether and that the roofs should be made to appear "as nearly as may be practical" to their appearance just prior to the Civil War. That parapets existed on those roofs at an earlier date is brought out by documentary evidence in the form of a water color made in 1853 by Benson Lossing and a pencil sketch made by Markie Williams in 1843. We also know that the parapets were removed and the roofs, which were wood shingles, coated with a layer of tar and gravel. We know further that the present slate roofs and balustrades were put on in 1929.

In reviewing this evidence it is demonstrated that the roofs just prior to the Civil War were wood shingled and that there were no parapets. We propose, therefore, to carry out the intent of the Congress by replacing the existing roofs with simulated wood shingles similar to those recently installed on the roof of the south servants quarters. We propose also to remove the existing balustrade and not to replace it. That this was their appearance is borne out by a series of photographs dated 1864 in which it is also shown that the roof of the "conservatory" was also of wood shingles. We propose to restore this appearance also. Copies of the earlier correspondence are attached for your reference.

Superintendent Jett wrote to a visitor, August 16, 1961: "We are, indeed, sorry that you did not find the Custis-Lee Mansion in as good condition as you had expected. We have just now completed major repairs, including completely new roofs over the north and south wings, repainting of the exterior, replacement of steps, and other external improvements. Now that this has been done, it will be possible to move inside during the next few months and complete the interior decorating."

The following roofing work was accomplished in May and June 1961.

a. North Wing Roof, May 1961

New 20-inch-long rafter tails were added at the end of each rafter. Four feet of new sheathing was placed around the extremities of the main roof, and two feet of new sheathing was placed around the extremities of the adjoining roof. Balustrade and tile (simulating wooden shingles), not original, were removed from the entire north wing roof and replaced. Thirty pounds of building felt were placed in double thickness under all the tile. Wood preservative was applied to the new lumber used in the rafter tails.

b. South Wing Roof, May 1961

All sheathing was removed from the south wing main roof hip and replaced with new sheathing. Four feet of old sheathing were replaced on both the east and west sides of the main roof. New collar beams were placed on every A set on the main roof. The entire main roof was covered with new building felt and new tile. All new wood was treated with wood preservative.

c. Conservatory Roof, June 1961

Glass roof (not original) and aluminum rafters (not original) were removed, and a new roof was placed over the conservatory. This involved 5 new rafters at the south end of the roof and 18 new rafters (3" x 18") 24 inches apart on the main section. All rafters were tied into the main plate with 2½-inch metal straps. New sheathing was placed over the entire roof, and all new wood used was treated with wood preservative. Thirty pounds of double thickness building felt were placed over the entire conservatory roof, and new tile was laid.

d. North and South Wing Roofs, 1974

Both the north and south wings received a new composition roof during 1974, to better simulate the supposed conditions existing in 1861.

6. Exterior Refurbishing, 1964

The assistant regional director for operations and maintenance, Rudolph R. Bartel, wrote to the regional chief for facilities maintenance, September 18, 1964, regarding the exterior refurbishing of the mansion:

> This project has been discussed with Mr. Charles W. Lessig who has concurred in and approved the sandblasting of the exterior surfaces excluding the small portion of what is thought to be the original stucco finish. Mr. Lessig has also approved the use of a waterproof decorative-white resurfacer known as Re-Nu-It. You may proceed with procuring sufficient quantities of this material in order to proceed with the project as soon as the sandblasting is completed.

Documentary Evidence: There is extensive documentary evidence establishing the 1861 exterior appearance of Arlington House. For example, in a letter home (copy in files), a Civil War soldier described the house as being white in color. It is believed that the ground coat which was streaked to resemble marble was an off-white color. At the distance of the troop encampments, the house's marblized exterior would have appeared to be white.

Pictographic Evidence: In 1861 the Union Army of the Potomac trained on Arlington Estate. Arlington House was used as headquarters and frequently formed a background for photographs of soldiers. Civil War photographs show definite designs resembling marble on the columns, pilasters, and cornices of the portico, and on the east side of the building. The first five of the photographs listed below show details of the marblization. The last two show that the chimneys and the west wall were not plastered (stuccoed) and a different design of the steps leading to the center door including a canopy. A list of the photgraphs follows, in chronological order:

1861 General McDowell and Staff	B	6246	N.A.
1862 General Heintzelman and Staff	B	1762	N.A.
1864 East Front and South Side	CN	5654	
1864 East Front	BA	1562	N.A.
1864 South Side	CN	972	N.A.
1864 South Side and West Front	CN	969	N.A.
1864 West Front	CN	6799	N.A.

Physical Evidence: Some of the original plaster remains in place on the exterior walls. Samples from these are being analyzed by the FBI Laboratory. The first color put on these walls, ca. 1817, was French ochre. This color was followed by a series of yellows and off-whites. The exact date for the application of each cannot be established. No trace of the color of the marble streaking has been found. The small number of coats of paint suggest that the house has been scraped since 1861.

Restoration of outside paint based on evidence at hand: Following sandblasting and repair to the plaster (stucco), paint the house an off-white color (exterior); the columns, pilasters and the entire east front should be streaked dark grey to produce a marblized effect. The photographs listed above to guide the restoration of the marble design. Please consult with Donald Myer, Architectural Historian, NCDC, for exact color.

Since Congress stipulated that the Mansion be restored to its 1861 appearance, decisions regarding the color of the marblized cornices of the portico, removal of the plaster (stucco) on the chimneys and on the west wall of the central portion of the mansion, and reconstruction of the west steps and canopy to the center hall will be deferred and will be the subjects of subsequent memoranda.

7. Framing 1976-79

a. Second Floor Joist System, South Side Main Block

During 1976 the truss between the Lee bedroom and Lee boys' room was renovated. Originally, the second floor joist system of the south side of the mansion's main block had been framed into a beam beneath the wall separating these two rooms. The beam lacked the depth for such a span, and the combined weight of the plaster wall above and one-half the total floor loads of each room had caused the beam to sag. Subsequently a truss had been let into this wall during the War Department restoration work of the late 1920s. The badly deflecting beam had been hung from this truss, and the stability of this floor system had been greatly increased.

By the mid 1970s, however, the truss was suffering from several defects, including improper seating, slippage and openings along the joints, and a further deflection caused by the weight of a large chandelier placed in the White Parlor by the War Department around 1930.

Under the supervision of John Longworth of the Office of Professional Services, National Capital Parks, the chandelier was removed and plans were formulated for the overhauling of the truss. This renovation of the truss included the addition of webs, vertical and horizontal tension rods, blocks, and gusset plates. Hangers were added where certain room floor joists intersected the center beam. The truss was reenclosed into the partition wall after the renovation work was completed. All current indications point to the conclusion that the truss as repaired is in good working order and operating at its designed capacity.

b. Second Floor System, Center Hall

Strengthening of the floor system above the north arch in the upstairs center hall and of the main stairway was accomplished in early 1978 under the direction of John Longworth. The floor system above the north arch of the center hall depended on the seating of the joists in the brickwork of the top of the arch. The brick, unusually soft and deteriorated due to initial underfiring when made, had crushed and no longer solidly supported the joists above. After removal of flooring in the area between the pilasters separating the upstairs servants' stair hall from the center hall section, joists above the arch were cut back to allow the insertion of a header seated on metal plates on the bases of the opposing pilasters on their south face. The joists were attached to this header and secured by Teco clips. With all joist load taken off the deteriorating arch, the floor became more stable and the structural deficiency was corrected.

A similar condition to the one just described existed across the hallway over the south arch. The situation over the south arch was complicated, however, by the presence of the main stairway and the stairway to the attic, both of which landed on the second floor just over the arch. Again flooring was removed, the floor joists were cut back, and a header was seated on metal plates on the bases of the opposing pilasters on their north sides. The joists were attached to this header and secured with Teco clips, thereby relieving the arch below and giving the floor greater solidity.

Several further problems plagued the framing at the head of the main stairs in the upstairs center hall. Once the flooring was removed it was found that when the house was constructed there had been no positive connection between the main stair stringers and the header, which had been put in place between bases of the pilasters on their south sides to catch the stair stringers. This header was double, and the stringers from both the main stair arriving from below and the adjacent stairs departing for the attic were positively attached to the double header by metal straps fashioned for this purpose. Also, the base of the newel post was solidly fixed to the header.

Work was also undertaken to strengthen the landing of the main stair. The header spanning the width of the stairway framed into the doorway between the south stair hall and the White Parlor and into the area just beside the south stair hall window. The framing system of the landing had been weakened by the deep mortises cut into the headers to catch the floor joists, thereby decreasing the effective

sections of the headers. A double laminated header was added just above the doorway, and an additional timber was placed along the side of the landing in front of the window. The existing header catching the stringers of both stairways was then attached to the new timbers with Teco clips. The connection between the header and the stair stringers was strengthened by the addition of metal connectors.

c. First Floor Framing System

During the same year work was carried out in the basement at Arlington House in order to temporarily strengthen several weak points in the first floor framing system. Three beams with two posts each were placed under the north stair hall where the system had been damaged by beetles, the cutting of joists for a former stairway, and placement of a diffuser for the heating system. Similar beams and posts were added beneath the heat diffuser duct opening under the south stair hall and to strengthen the lintel under the north arch between the center hall and the north stair hall. Posts alone were added to stabilize a weak point near the former stair opening in the winter kitchen (one post), the opening in joists around the stairway beneath the pantry (two posts), and the beam under the southern half of the White Parlor (one post).

Following the computation of load ratings of the first floor framing system by Dean Robinson of Arthur Beard Engineers, Inc., in March 1979, it was recommended that additional temporary supports be added to those already in the basement to ensure the preservation of the historic resource as well as the safety of visitors. A beam and five posts were placed in the winter kitchen beneath the wall between the Custis bedroom and the hallway of the north wing. A beam and two posts were wedged beneath the header facing the segmental arch beneath the morning room. Four steel angles had been added during this century to strengthen the connection of the floor joists to the header in question, but the connection was not thought to be completely positive. A beam and posts were added to strengthen the lintel symmetrically opposite the one under the northern arch of the center hall, and one post was put under each remaining lintel of the bearing wall openings to the south side of the chamber under the center hall.

IV. EXISTING CONDITIONS IN 1979

The Arlington House harbors a number of structural defects of immediate concern. There follows here a description of existing conditions in its structure; when applicable there will be an indication of the historical condition should it differ from the present condition.

Little was known concerning the scientific design of structural systems when Arlington House was constructed in the early 19th century. While much of the house was well designed by the methods of common sense engineering traditional to the trade, the effects of time and heavy visitation have altered the stability of the structure.

In any consideration of the house as a structure, it is important to remember that the mansion was built to house a family and the social functions of that family. Undoubtedly it would be a surprise to both the patron and the architect were they to discover, a century and a half later, that the house was visited annually by half a million people.

The Arlington House, an image of classical perfection to the eye, was built somewhat like a stage set. That which was seen by the viewer was of the greatest importance and concern; that which was supporting the classical facade, both on the interior and the exterior, was of decidedly secondary importance. The fact that the entire structure was composed of underfired brick, which should have been unacceptable as a building material, does not seem to have concerned the patron. This inferior brick, once in place, served to hold the stucco (much of the material confirms that function a century and a half later), but one of our main problems today concerns brick in deterioration. A cursory inspection of the basement reveals that the process of deterioration is advanced in certain areas (plate 9), areas which must be protected from moisture in a regular program of building maintenance in the future. Other problems stem from understructured framing members; these members were either inferior materials when used, undersized or damaged by insects, or were overspanned or overspaced to the point of structural instability. Many other individual problems result from the fact that the builder of Arlington House was more concerned with appearance than structure.

Regarding contemporary tourist visitation, it is clear that the house was not built to accommodate such a multitude; the effects of wear are increasingly apparent. It is therefore important that many of these problems be addressed in the near future in order to avoid any accidents to the public or damage to the historic property. It is further recommended that consideration be given some plan of limited daily visitation for the future protection of the resource.

A. Basement

The basement of Arlington House extends under every room of the first floor except the conservatory. Its walls are the foundation walls, of brick, and measure just under 2 feet thick. The ceiling height, from the bottom of the first floor joists to the dirt floor, varies, averaging around 6½ feet. It is believed that the greater part of the basement floor was traditionally dirt, but this fact has not been confirmed

by any archeological investigation. During the War Department restoration of the late 1920s, used brick was placed in sand in the wine cellar, north wing basement hallway, and the areas beneath the north stair hall and under the center hall. It was projected to brick the entire basement on the premise that G.W.P. Custis would have done it himself if he had had the money. This philosophy of restoration was altered after the mansion passed into National Park Service hands, and the rest of the basement floor was left dirt.

The most serious problem with the Arlington House basement today is its high moisture content. It is apparent that this moisture results from two principal sources: inadequate drainage on the exterior around the house and lack of a vapor barrier over the basement floor.

The drainage problems around the exterior walls of the house have two facets. There exists a gutter and downspout system on all roofs with underground pipes to carry the rain off. This system ideally will take the roof water away from the building foundations; however, the underground pipes appear to be partially blocked, backing the water up against the foundation wall itself.

The other facet of drainage around the foundation concerns the topography. As Arlington House sits on the crest of a hill, it is assumed that all water drains automatically away from it. Close inspection reveals, however, that there are areas against the house which are actually lower in elevation than the areas adjacent. This situation is particularly acute off the south wall of the south wing, where the worst basement wall brick deterioration has occurred. It can also be seen that the earth against the house at this point was once at a higher level, as the break between the stuccoed wall and the unstuccoed foundation is now clearly visible.

At the moment there is nothing to prevent moisture from rising through the basement floor. While this condition is easily recognized in the areas having a dirt floor, it is equally true where there is brick laid in sand, as the cracks between the individual bricks negate any protection. The area under the morning room has one of the highest moisture contents; the presence of mold spore growth on some joists has caused alarm and is noted in the engineering report on first floor framing conditions recently prepared by Arthur Beard Engineers, Inc., and quoted later in this study.

Adjacent to this area under the morning room are the two small areas under the office. As has already been noted, the most advanced deterioration of interior brickwork is occurring along the southern wall (the end wall of the south wing, see plate 9). The deterioration is thought to be so advanced at this point due to the frequent application of rock salt to the gravel walkway running between the conservatory entrance and the portico of the mansion, much of which is being carried into and through the brickwork by the action of moisture seepage.

Further notable deterioration is occurring around the area of the southeast corner under the morning room in the south wing. The very poor quality of the underfired brick, the movement of moisture through the wall, and the chemical action of the salt all combine to

further this rapid deterioration. The problems with moisture and fungus growth in the basement area are compounded by the lack of adequate ventilation throughout and the absence of any light in some areas.

The problem of fire prevention also exists in the basement. Much of the basement area is taken up with an elaborate combination hot water/hot air heating system which runs into all rooms of the main block and south wing and which contains no fire dampers. Dust is taken up into this forced air system and effectively distributed throughout the public area upstairs. While the basement area is divided into a number of spaces corresponding to the public rooms above, there is virtually no fire separation of any kind between the spaces with the exception of one fire door between the wine cellar and the area under the family parlor and dining room. Effective fire prevention in the basement area is further hampered by the absence of brick fire stops between certain ceiling joists.

B. North Wing

1. First Floor Framing System

The floor framing system of the north wing contains one of the most serious structural problems at Arlington House. The floor joists, visible in the winter kitchen below, are not distributed on much of a regular pattern. Beginning at the north end wall under the sewing room, the first five joists are replacements and span the entire width of the kitchen. The last two of these five are headed off over the window and have an inadequate connection to the header.

The brick pile of the fireplace and fireplace supporting arch in the mid-section of the winter kitchen interrupts the joist span in this area. The joists are well seated on the brick rectangular structure and give better support here because of their shorter span. The joists between the fireplace pile and the west wall give the most support to the wall above, which separates the Custis bedroom and guest room from the north wing hallway. This wall, of plaster on both sides and approximately 14 feet in height, has no support other than the floor joists beneath and the 9-inch brick wall separating the winter kitchen from the wine cellar.

The remaining section of framing above the winter kitchen is the floor system's weakest link. In the original plan of the north wing there was evidently a stairway connecting the winter kitchen with the north wing hallway above. Five of the principal floor joists are headed off at this former opening by only a single member with questionable end supports. All the framing in the area of this closed-in stairway opening is weakened by the ineffective arrangement of timbers and connections, the bottom of the western header being split off entirely. The remaining two joists span the entire width of the room and are replacements.

The floor system of the guest room above the wine cellar is very regular, spanning the width of the north wing with some of the largest timbers in the entire first floor system. The joists are regularly sized and spaced in comparison to the rest of the first floor framing system, averaging approximately 3 by 12 inches in section. It is difficult

to assess the condition of the individual joists, as 90 percent of the ceiling is now covered by old tongue and groove flooring, pieces of beaded baseboard, and other used material randomly placed to give the effect of original fabric. While it will not be possible to thoroughly examine and assess the conditions of the floor joists until this ceiling is removed, cursory examination in the exposed area near the window reveals the joists to be a mixture of original members and replacements, all seemingly in good condition. Two joists are headed off at the window and are inadequately connected to the header, which is also inadequately attached to the flanking joists.

The floor system of the pantry also represents a weak link in the first floor framing system. The joists in question are logs of different diameters flattened on their upper sides to receive the flooring. Except for a few instances, the logs are spaced too far apart to be structurally sound (plate 10). The bathroom, believed to have been installed around the mid-1800s, preserves its original flooring, which is set right on the log joists. The remainder of the pantry floor, however, was covered in this century by a plywood subfloor highly visible to the public from the basement hallway below. Replacement pine tongue and groove flooring is above the plywood subfloor. All log joists appear in good condition.

It is not known when this portion of the house enclosing the pantry was built. It is evident, however, that this loggia area was finished after the completion of both the north wing (1803) and the main block (1819), as an exterior window opening into the loggia is present in each. Also, the pantry floor is at the same level as that of the main block of the house, while the floor of the north wing is several inches higher. This fact indicates that the loggia must have been built after the construction of the main block defined the true floor level of the house.

Whenever built, it is clear from even the most superficial inspection that neither the floor nor the roofing systems of the loggia were as well constructed, or constructed with as good material, as the remainder of the house. A detailed chronology of the building disclosing the relationship of the loggia and the remainder of the north wing will not be fully known until further fabric investigation, perhaps destructive, is conducted at a future date.

Currently, the understructured pantry floor gives noticeably under the weight of small groups of visitors. As this enclosed loggia area forms a main public thoroughfare between the main block of the mansion and the rooms of the north wing and basement, its structural renovation is one of the highest priorities of the projected work.

2. Roof Framing System

The framing system of the north wing roof is the most serious structural problem at Arlington House. Changes in the roof design over the years have weakened it by degrees, and very little has been done to correct the accruing problems.

From drawings of the Arlington House left by 19th century artists, it can be seen that the wing roofs had parapet walls which

concealed their hip roofs in the neoclassical manner. These parapet walls, most likely constructed of wood, rose flush with the exterior walls of the wings and were broken regularly by balustered openings (plates 4 and 5).

It appears that originally the rafters of the hip roof landed on the continuous plate above the ceiling joists. Extensions were attached beside each rafter at a lower angle of pitch, continuing the roof out to the fascia board (plate 11). A few remains of this system, giving a splayed eave effect, can be found under the old hip roof, which was partially left standing in the south wall of the north wing (see section BB' of north wing roof, drawing sheet 9).

From material remains and nailing patterns found in the north wing attic, it can be seen that the roofs were originally wood shingle. The original parapet roof system was retained at least until 1853, when the Lossing sketch was made. Sometime after 1853, probably after the death of G.W.P. Custis and during the tenure of Robert E. Lee, the roofs were reworked. In the 1864 photographs from the Brady Collection, Library of Congress (plates 7 and 8), a different roof system appears--the parapets are gone and the roof runs in a straight line from the ridge to the fascia without the change in the angle of the slope of the former splayed eaves.

It can be speculated that this simpler roof design was implemented because of problems with leaks in the joint where the hip roof intersected the rear lower edge of the parapet. It can be further speculated that Lee, an engineer and soldier, would have been more concerned with practicality than with strict adherence to neoclassical roof forms and would pragmatically have preferred the simpler and more direct solution.

When the roof system was changed from splayed eaves to a continuous pitch, the ends of the rafters were disconnected from the plate above the ceiling joists and raised on an additional plate or blocks (plates 12 and 13). In this way additional space was created between the plate and the sheathing above the rafter. This increased space allowed a continuation of the roof on rafter tails in a straight line, thereby creating the same pitch from ridge to fascia board. Parapet walls without splayed eaves were reinstated during the army restoration work of the 1920s and remained in place until 1960, when they were removed because of leakage problems in the roof. The wood shingle roof, now known to have been covered with tar and gravel in the 1864 photographs, was retained as a covering material until 1929, when it was replaced with slate to match the roof of the main block. The slate roof on each wing was replaced in 1960, after the Brady photographs were discovered, with a tile roof of material simulating wood shingles. A polymer and gravel composition roof on tongue and groove plywood was put in place on both wings in 1974, when the Brady photographs were further interpreted as showing a composition-type roof on the mansion in 1864.

The present poor condition of the north wing roof is primarily attributable to this reworking of the system from one characterized by splayed eaves to one involving a single pitch. When the

rafters were raised off the plate, any positive connection was lost. At the moment the most significant connection between the roofs of the north and south wings and the roof joists is that supplied by gravity and friction. At present the usual connection between the rafter end and ceiling joist, separated by blocks or an additional plate, is by a single vertical piece nailed to one side of the joist and rafter. At the most, in several instances, there are two vertical pieces, one on each side of the joist and rafter connections; and in some cases, there is no connecting piece at all. In other instances, the rafters are suspended in mid-air with a vertical connector and an absence of blocking (plate 12). The two main hip rafters on the south end of the north wing have no connection at all to the plate below (plate 14).

One of the main problems of the north wing roof today is attributable to the small size of the rafters which have been required to span a significant distance at a very low pitch. Other than the rafters making the north hip face, which are replacements, most of the rafters are original and in good condition. In some cases, particularly in the gable end built over the remains of the south hip face when the north wing was connected to the main block, the rafters are not centered close enough together to be wholly effective. Beyond the plate in all directions the rafter extensions and some sheathing were replaced in 1961.

The north wing roof was also strengthened somewhat in 1961 by the addition of collar beams where possible. Apparently at the same time a double line of vertical pieces was put in place near the center of the rafter spans. These boards are nailed to the south side of the rafters, but only rest on the top of the corresponding floor joist below, with no connection at all. These verticals have prevented some of the roof rafter deflection, as intended, but they have also passed loading forces onto the ceiling joists, causing two joists to fail completely and endangering the plaster ceilings. Regarding the plaster in the ceilings of the north wing, replacement plaster on metal lath exists in the guest room and the sewing room. Plaster ceilings over the north wing hall and the Custis bedroom are on split lath and are apparently historic.

All ceiling joists are apparently historic, as are the outriggers. In recent years, during the replastering of the guest room's ceiling, auxiliary joists in the form of two-by-fours were added between existing ceiling joists to give added strength to the metal lath. Most of the ceiling joists are in good condition with the exception of the following: Counting from the north end, joist 3 contains powder-post beetle damage; 9 is broken completely in half; 10, 11, and 12 are discontinuous and extend less than half way across the span; and 14 has a longitudinal crack which renders it ineffective. On the eastern side of the north wing, ends of joists 3, 5, 6, 7, 8, 17, and 19 have been damaged by rot and are connected to the fascia board by joist extensions.

3. Loggia Roof

The north wing loggia roof is composed almost entirely of 5-inch diameter logs flattened on the side receiving the sheathing or plaster. Interspersed in the system are six three-by-five joists (numbers 1, 5, 9, 13, 15, and 21, counting from the north end), six three-by-four outriggers (north end), and four three-by-five jack rafters (north end).

There is a great deal of powder-post beetle damage throughout, and it is difficult to give any accurate assessment of strengths. The plaster is on split lath and apparently dates from the 19th century.

Of primary concern in the loggia roof structure is the absence of any connection between the ceiling joists and the west bearing wall of the north wing. These joists are not properly seated, but rather rest 4 inches into the wall in holes much too big for them (plate 15). The rafters above are well seated on a continuous plate resting on the top ledge of the west bearing wall, notched into place. One exception to this acceptable arrangement is the hip rafter itself, which is notched so deeply that it retains only 2 inches of effective section. Currently, much of the roof load is being received by temporary, nonhistoric posts standing between the center of the ceiling joists and the rafters which are transferring forces to the ceiling. This condition will eventually cause the joists to fail and/or the plaster ceiling to be ruined.

Counting from the north end of the loggia, joist number 13 is a three-by-five member having rectangular mortises near its top edge in a pattern nearly identical to the one on the north end carrying the loggia outriggers. It appears that this joist was originally in the position of joist number 20, prior to the building of the main block, when the loggia roof had a hip face on each end. This evidence confirms the existence of a loggia on the north wing prior to the building of the main block. The loggia could originally have been the traditional open porch with a floor slightly lower than that of the interior of the north wing, which was later enclosed, thereby explaining the existence of two exterior windows opening onto the loggia area, one from the north wing (set between the pantry and the north wing hallway) and one from the main block (in the south end of the basement hallway).

Another fact of historic interest is the absence of any plaster remains on the ceiling joists passing over the lead-lined water tank in the north end of the loggia (joists 1, 2, 3, and 4). This condition indicates that the water tank and the roof were installed at the same time, pointing to a date around 1850 for that roof system. It is interesting to note that that roof system, perhaps built later than the rest of the house, is of inferior materials and workmanship to the original portions.

C. Main Block

1. First Floor Framing System

Prior to the recent installation of the three beams and supporting posts, the floor system of the north stair hall was in very poor condition. At the same time as the installation of the beams, joists 6, 7, 8, and 9 (counting from the north end) were doubled with new two-by-twelves.

Much of the problem under the north stair hall is attributable to two holes in the framing system. The larger, as well as older, break in the framing once allowed a small stairway to run from the basement up under the present servants' stairway into the north stair hall. After the removal of this stairway and the closing off of the hole, a closet was installed under the servants' stairway.

The small framing break just in front of the window on the west wall was cut to allow a heating diffuser to be placed in the north stair hall floor under the window. It is around this rectangular hole that the original joists have been doubled by new members. The lintel above the basement window, approximately a two-by-twelve, appears overloaded due to understructuring.

While the joists appear to be of a sufficient section to be effective, particularly in consideration of their short span, many of them are in poor material condition, primarily due to powder-post beetle damage in the past.

The floor system under the family parlor and dining room is framed adequately with well-sized members, consistent spacing, and reasonable spans. The weak point in the framing occurs at the center beam, which supports the inner ends of all the joists. This beam, fashioned of two three-by-tens nailed together, is in two sections which butt at the center of the basement space and are supported by a brick pier. Recently an extra three-by-eleven was added to the south section of the beam.

The problem with the beam under the mid-section of the family parlor and dining room is its being understructured in relation to the floor system it carries. There is deflection present in each of the two sections, and the beam ends are not well seated on the pier. All of the joists appear original and while seemingly weakened by powder-post beetle damage retain most of their original strength.

The lintel of the opening between the spaces under the north stair hall and under the family parlor and dining room is overloaded due to the action of the joists upon it.

The framing system of the ground floor center hall is potentially one of the best structured areas in the house today. Most of the timbers are in good condition, oversized by contemporary standards, consistently centered, and spanning short distances. Counting from the east, joists 5, 10, 13, and 19 exhibit appreciable powder-post beetle damage. Joists 10, 11, 12, and 13 pass through two return-air ducts, one on the north wall and one on the south. Joists 14 and 15 each have had a part of their sections chiseled out vertically to allow the heat duct from the furnace installed by Robert E. Lee to pass up through the center hall to the second floor.

The weak link in the center hall flooring system is the bearing of joists above the undersized wood lintels over the openings between the space under the center hall and the rest of the basement (plate 16). In addition to this loading, there is the weight of brick infill between these joists, a dead weight serving no structural purpose.

The framing of the south stair hall is in a similar condition to the corresponding north stair hall already described. The system appears in better condition than that of the north hall, however, with less insect damage and no breaks in its continuity other than that for the heat duct in the floor under the window. At the time the beam and posts

were installed to strengthen the header forming the duct passage hole, joists 4, 6, and 8 were doubled with new three-by-twelves. As in the north hall, the lintel over the window appears overloaded.

The area under the White Parlor is identical in size and configuration to that under the family parlor and dining room. Similar conditions exist in both, although the joists in this instance appear in better condition. In the east joist section, joist number 6 has some powder-post beetle damage; in the west section, joists 7, 8, and 9 are replacements. The majority of joists are original, exhibiting the usual characteristics of being broad-ax hewn on one side and hand-sawn on the other.

As in the system under the family parlor and dining room, the center beam is understructured here and not well seated on the brick pier (plate 17). There is evident beetle damage in the members of the beam section to the north, and a temporary support has been placed under the south section.

The lintel of the opening between the spaces under the south stair hall and under the White Parlor was strengthened sometime in the recent past by the introduction of a K-brace, which appears effective in upgrading its loading capacity to an acceptable level.

2. Miscellaneous Problems in the Main Block

a. Center Hall Arches

In recent years cracks have appeared in the tops of the arches on either side of the center hall at the entrances to the north and south stair halls. This condition has become so severe in the north arch as to require the placement of a temporary support under the arch to ensure that its bottom section does not disengage.

As far as can be ascertained without destructive investigation, it appears that the body of each arch is of solid brick. The jamb and trim on the lower section are of wood, but those forming the barrel of the arch itself are seemingly of plaster, as they have cracks as well.

The main problem with these arches appears to be stemming from interior deterioration of the materials which compose them. It is known from brick samples taken from the tops of the arches by Longworth in 1978 that the arches are fashioned of particularly poor specimens of the underfired brick that was used throughout the construction of the mansion. These brick, more akin to sun-dried brick than kiln-fired, can be crumbled by hand. Also, much of the mortar is by now completely dehydrated, leaving little more than loose sand and lime in place.

While these salmon brick can perform satisfactorily in situations involving pure compression, they are incapable of resisting any tension. As there are only about 3½ feet of brick above the top of the arches, and no loads above that on either arch, a condition exists where there is simply not enough compressive load operating on the arches to hold their parts in place. The fact that the arches are fashioned from

inferior materials makes any resistance to this self-destructive tendency an impossibility.

Frescoes depicting hunting scenes, reportedly painted by G.W.P. Custis and restored in this century, are located above the west center hall door, the east arch, and the north arch. The cracking above the north arch has damaged the fresco along several lines.

b. Upstairs Center Hall

Portions of the upstairs center hall framing system were reworked in 1976, as described in chapter 3. No drawings were made of the conditions existing prior to the emergency repair work above each arch. The joists of the upstairs center hall were uncovered toward their mid-span in 1971 and inspected. Quoting from a report by A.W. Franzen ("Custis-Lee Mansion Structure Study," Office of History and Historic Architecture, DSC, April 1971): "It was found that the joists were yellow heart pine with eleven to sixteen annular rings per inch. The joists measured 3" to 3-1/4" in width and 9-5/8" to 10-1/8" in depth. Their average spacing measured sixteen inches on center. Judging by the portions that could be seen it appeared that they were in excellent condition. Calculations based on this data showed that the joists are more than capable of sustaining a live load of 100 lbs per square foot (an accepted loading for the use the Mansion is subject to)." As the joists are of the same approximate section as those supporting the center hall below and are in good condition, and if they are well seated, the upstairs center hall should be more than capable of supporting the loads from visitation. This conclusion is corroborated to some extent by the fact that the upstairs center hall appears and also feels in good structural condition.

c. Main Block Roof

The extensive system of large wood trusses, purlins, and rafters carrying the slate roof of the main block has been superficially examined but has not been measured, drawn, calculated, or assessed for this report.

According to insurance records preserved at the site, the main block of the house had a slate roof in 1858. It is presumed that this slate roof was not original, but was a replacement of a wood shingle roof which covered the entire house originally. It is apparent from quick examination that the roof loads from the slate roof are too great for the existing system, which was most likely built to support a lighter roof of wood shingles. There is splitting present around some of the pegs in the trusses and a good deal of longitudinal splitting and visible deflection in the purlins bearing the enormous weight of the slate. It appears that many of the rafters are understructured for the weight they support. It also appears that many of the ceiling joists holding the second story plaster ceilings are undersized in section considering their long spans.

Because of the extensive nature of more immediate structural concerns, which must be corrected first, and a lack of personnel and funds at this time, further consideration of the structural problems of the main block roof will be necessarily postponed to the beginning of the next phase of the historic structure report. The fact

that serious problems do exist in this major roof system will go on record at this time, and also the statement that the full investigation and recommendations for corrective work should be concluded as soon as possible.

D. South Wing

1. First Floor Framing System

The framing system under the morning room contains several major problems which render it one of the weakest links in the whole first floor configuration. One problem is found in the joist material itself; joists 10, 11, 12, 13, 14, 16, 17, and 18 are all original members with serious damage from powder-post beetles.

Joists 2, 3, 4, 5, 6, 7, 8, and 15 are replacements in good condition. Three of these new joists are headed off above the segmental arch on the west wall and attached with steel angles. Four other joists are connected into a header which carries the morning room fireplace sandbox. As a result of these extensive breaks in the framing system, a great deal of the floor load above falls on joists 6 and 7, which intersect the west wall between the fireplace support arch and the segmental arch.

The header carrying two joists located in the wall above the window on the east appears overloaded.

The opening between the space under the morning room and the larger of the two areas under the office was cut during this century to accommodate the heating system. Much of this wall has been rebuilt with new brick and the opening is spanned by a steel lintel. There exists a very small opening framed in wood between the space under the morning room and the smaller space under the office.

These spaces under the office, the larger to the west, were left unexcavated when the wing was built in 1804. The larger space was partially excavated when the heating unit and duct were installed under the office. There exists a square pile of brick in the northwest corner of the larger space which is believed to serve as a base for the chimney flue located in the corner of the office. The smaller space to the east remains unexcavated, but offers a crawl space between the ground and the undersides of the joists.

The office floor is spanned by six joists which meet on the top of a brick wall between the two spaces. The joists are all replacements and appear to be of used material once in place in other parts of the house. Plaster remaining on some joists indicates that they may once have carried a plaster ceiling in another location or at least served as scaffolding. All joists in this area appear in good condition, but they are poorly seated.

The area under the storeroom is framed like that under the pantry of the north wing. The log joists are highly irregular in size and disposition and difficult to assess as to potential loading capacity. Joists 2 and 3 are poorly seated on the south end (plate 18). As to material makeup, the log joists are seemingly in good condition.

2. Roof Framing System

The framing system of the south wing roof is very similar to that of the north wing, but it is currently in much better condition. As in the north wing, the original roof contained the parapet walls and splayed eaves which characterized the wings of neoclassical buildings. As the south wing was to contain only two rooms, both of which were to extend the width of the wing, two king post trusses were installed under the hip apices to carry the roof (plate 19). The rafters, usually larger in section than those in the north wing, were given further support by purlins near their mid-span which ran between the trusses, to and between the hip rafters, on both sides of the system. Many of the rafters are notched into these purlins, which are themselves let into the trusses and wedged tight. The purlins are further strengthened by a number of small wood struts rising in a nearly vertical position from the top of the joists (plate 19). Forces currently taken by these struts to the ceiling below from heavy roof loads are detrimental to the plasterwork in the morning room and office.

There is currently little connection between the rafter ends and the continuous plate above the ceiling joists, since the rafters were raised on blocks and connected to the joist with short vertical pieces of questionable value, as in the north wing (plate 12). Many rafters on the west side have been doubled by the addition of new rafters of similar size; the same collar beams which appear on the north wing rafters have been added in the south where possible. Unlike the plate in the north wing, the south wing plate is uniform and continuous; its corners are reinforced by diagonal braces let into the plate in half dovetail joints (plate 20).

While the south wing roof framing system is better structured than that in the north wing, the condition of the material is worse. From all appearances, it seems that all original material is weaker than when installed. A rough estimate puts 75 percent of the roof rafters as suspect as far as reliability of support; the three factors determining this estimation are rot, powder-post beetle damage, and the lack of positive connections of the rafter to the plate. The rafters in the former hip end, which now connects to the main block as a gable, are overspaced and therefore considerably understructured. The second and third rafters on the east side are notched and have only a 2-inch depth of section; the same condition exists in the third rafter on the west side, which also has powder-post beetle damage in the end of the purlin on the north end, west side. On the north end, the end of the western hip rafter is not well seated, and the end of the eastern hip rafter contains an 18-inch split (plate 21). Splits also exist in the 11th and 14th rafters on the east face on the plate ends. The connections between the rafters and the header crossing the eastern face of the chimney, and the seating of this header, are in question.

On the southern end of the wing there is rot present in the plate below rafter number 23 and in jack rafter number 8. There are no blocks under jack rafters 8 and 10, and the hip rafters do not seem to contact the plate. Jack rafters 5, 6, and 7 appear weaker than the others.

In the ceiling joists, numbers 1, 6, 12, 14, 16, 20, and 24 strongly show the presence of rot and powder-post beetle damage. Many of the ends of these joists on the eastern side of the wing are rotten; it is difficult to assess their exact condition due to the constricted space. There is some rot present in the southern truss, which is partially sitting on the brick wall that separates the morning room from the office. A chandelier support made of three large beams that distribute the load is putting extra force on the ceiling joists above the middle of the morning room.

All the plaster visible in the attic floor is on split lath and believed to be original. Some of the keying has broken, and the connection between plaster and lath is in question.

The present roof system of the conservatory (south loggia) was constructed in June 1961 and covered with tiles in a simulated wood shingle design. The roof was originally wood shingle, but a glass and wood roof was added by the War Department at the beginning of this century. Due to problems of leaking and maintenance, the roof covering was replaced in 1974 after it was determined by the Brady photographs that a composition roof, or what appeared to be one, existed on the loggia and wings in 1864. The present roof system and covering are in good condition.

V. RECOMMENDATIONS MADE IN 1979

A. Basement

1. Archeology

Prior to any interior effort to permanently control moisture in the basement, it will be necessary to conduct an archeological investigation. This effort will be in two phases: (1) conduct a general survey with random test pits to determine which areas may be best for exploration, and (2) concentrate on selected areas, determined in phase 1, to ascertain the historic use of the basement spaces.

2. Drainage and Moisture Control

All drain pipes around the mansion will be checked to ensure that they are open and free running, and gutters and downspouts will be inspected to make certain they are operating to capacity. Any historic drains found during this investigation will be documented. To ensure that all grades slope away from the house, all areas adjacent to the house that are higher than the elevation of the ground at the foundation wall will be lowered. This work will be accompanied by appropriate archeological monitoring; archeological investigations will determine historic grades if possible. All exposed wall areas below the stucco line will be covered. The first layer of material used to raise the grade should be of some impervious substance like clay, which will conduct water away from the house rather than let it sink into the soil along the foundation wall. All use of chemicals will be stopped around the mansion, particularly within 5 feet of the foundations.

The basement has an acute moisture problem. While much of the moisture is seeping through the walls from the outside, a great amount is also rising through the dirt floor. Because there is no money for archeology at present, and because it will be some years before extensive archeological work can be done and a permanent floor installed, it is recommended that temporary measures be taken to retard moisture in the basement.

Before any measures are taken, however, an investigation will be conducted to determine the areas of greatest moisture concentration on the basement walls. This survey will be carried out by the use of a moisture meter, readings on which will be taken at regular predetermined locations along the walls in question. Readings will be recorded on a regular basis over the period of three to six months.

The temporary measure to retard the concentration of moisture rising from the floor will consist primarily of evacuating the moisture from the basement. To accomplish this, as many areas as possible will be opened to each other, and a continuous current of air will be set up by the use of a fan strategically placed at one opening to the exterior, probably the window in the basement area under the morning room. To further retard fungus attack, permanent incandescent lighting will be installed to burn on a 24-hour basis in areas not receiving adequate natural light.

On the subject of moisture control, the engineering report on the first floor framing system makes the following statements: "The

majority of the basement is not floored, and is extremely damp. Some of the first floor joists have mold spore growth. These spores propagate and spread under damp conditions and could, if not checked, completely destroy the wood. It is suggested that a concrete floor be installed over a vapor barrier throughout, and that some dehumidification and air circulation be maintained. Minimum light should also be maintained, and incandescent lighting should be maintained to retard fungus attack. Fungicide treatment may be advisable." As has been stated, no floor system for the basement is recommended until further investigation, including extensive archeology, is conducted and a determination is made as to the advisability of such a permanent measure.

3. Insect Control

The engineer has also recommended that a check be made by a qualified exterminator with regard to the possibility of termites and wood beetles. Should evidence of these insects be found, the ground will be extensively treated.

4. Fire Control

Fire dampers will be installed in the heating ducts, and all missing fire stops between the joists will be bricked up. The opening between the areas under the center hall and under the south stair hall will be enclosed with brick, as will the west opening between the center hall and the area under the White Parlor. Grade A fire doors will be installed under the segmental arch between the areas under the storeroom and morning room, under the full arch between the areas under the morning room and White Parlor, between the areas under the White Parlor and center hall at the east opening, and between the areas under the center hall and north stair hall underneath the existing heating duct. Preferably these fire doors will be equipped with mechanical parts controlled by the fire alarm system, which will close all doors automatically in the event of a fire; they can then normally be left open to allow ventilation between the spaces. Should this system of automatic doors not be feasible, ventilation will be accomplished by placing vents with fire dampers in the existing openings between the basement spaces. The back and edges of the wooden door between the areas under the north stair hall and pantry, which separates the public and private areas of the basement, will be covered with galvanized steel so that it can function as a fire stop. The installation of these doors will effectively divide the basement into six fire zones, which should greatly increase the chances of containing and controlling a basement fire. These zones will be the north wing and loggia, north main block, center main block (containing the cold air return units), south main block, south wing, and the area under the storeroom (containing the present fire stand pipe). These plans fulfill the engineer's requirements that "consideration should be given to installation of fire separation in various segments of the total area, and fire dampers should be installed within the duct system, in particular where air handling units are located."

5. Heating Pipes

The area under the north wing and loggia is open to the public for visiting the winter kitchen and wine cellar. When the house was outfitted with central heat during the War Department restoration, the north wing was provided with radiators under the windows and

concealed in two pseudo-Colonial corner cupboards in the pantry. The pipes for these units were run through the basement of the north wing with no attempt at concealment or minimization of effect on the historic scene (plate 10).

While the problem presented by these intrusive pipes has little to do with the structural problems with which this report is concerned, they should nonetheless be removed as soon as possible for several good reasons. As has already been stated, these highly visible pipes in a public thoroughfare are intrusive on and disruptive to the historic scene. In the entire Arlington House, the only location open to the public where modern intrusions are visible (except for the smoke detectors) is in this north wing basement. Also, the hot water heating system in the pantry and guardroom will have to be removed anyway, because the furnishing report prepared by Agnes Mullins in 1978 recommends the removal of the pantry cupboards that conceal the radiators. The hot water system will be replaced with a concealed radiant electric system, presumably in the plaster ceiling.

As the present pantry floor must be temporarily removed to add the locust log joists for the recommended structural upgrading (described later) and to take out the present plywood subfloor, it is logical that these pipes, and the cupboards and radiators in the pantry above, should be removed at the same time and the new heating system installed.

B. First Floor Framing System

Investigations into the present carrying capacity of the first floor framing system were carried out by Dean Robinson of Arthur Beard Engineers, Inc. His findings, and the projected capacity after the upcoming recommendations are effected, are included here:

> Ideally all hallways where visitors are allowed would be designed so that they would be capable of sustaining an allowable load of 100 psf. Realistically however, these loads in all probability will not be reached, and the modifications that would be required to reach this level of ideal loading are not considered justifiable in light of cost, visitor inconvenience and loss of historical integrity. Established desired live load capacity has been set at a minimum of 70 psf for corridors, and 35 psf for adjacent rooms to provide for furnishings and occasional loading for maintenance and minor storage of material as now exists in some of the rooms. No attempt or suggestions have been made to make the entire structure capable of carrying heavy visitor loads throughout. It has been assumed that visitors will be confined to the corridors and hallways, and that loads in the rooms will be kept primarily as exist now.
>
> Load ratings were established based on the timber and flooring sections from NPS field measurements. Timber framing is pine, and conventional stress allowances for pine are 1100 psi in bending and 100 psi in horizontal shear. This allowable was reduced to allow 1/8 inch loss in section all around for deterioration due to some dry rot and insect attack, and further reduced by 15% to allow for its condition. Pine flooring

was rated at 1600 psi in bending and 115 psi in horizontal shear, allowing some overstress for temporary loading.

Based on an assumed concentrated loading of 250 pounds, it was found that spacing of the joists could not safely exceed a spacing of 24 inches.

Based on allowable stresses and load rating objectives, it was found that there were some rather serious deficiencies in the system with regard to safety of the public as well as to the integrity of the structure as a whole. Summarized below are the various rooms with the load rating capacity existing now, that projected after the recommended work is accomplished, and the controlling factor in the ratings.

ROOM	PRESENT	FUTURE	CONTROLLING FACTOR
Office	60 psf	60 psf	Floor Joists
Morning Room	20 psf	35 psf	Header Joists
White Parlor	25 psf	50 psf*	Center Beam
Center Hall	38 psf	100 psf	Lintels under Floor
Store Room	25 psf	70 psf	Floor Joists
South Stair Hall	100 psf	100 psf	Floor Joists
North Stair Hall	100 psf	100 psf	Floor Joists
Family Dining & Parlor	20 psf	35 psf	Center Beam
Guest Room	35 psf	35 psf	Various Members
Custis Bedroom	18 psf	35 psf	Floor Joists
Sewing	30 psf	35 psf	Floor Joists
Pantry	34 psf	70 psf	Floor Joists
North Wing Hallway	18 psf	70 psf	Floor Joists

*While the overall rating is 50 psf, the area where the public passes through the room near the center beam will be considerably over 70 psf.

1. North Wing and Loggia

The most serious problem addressed in the north wing floors will be the strengthening of the joists in the ceiling of the winter kitchen below the Custis bedroom affected by the opening for the former stairway. It is recommended that a steel channel be installed on the north side of joist number 14 and let into the brick wall on either end 7½ inches and well seated. All steel in the basement will be painted with two coats of bituminous paint. The steel member will be placed as unobtrusively as possible.

An additional three-by-twelve will be added between joist numbers 14 and 15. A new three-by-twelve will also be added alongside of the existing east header framing the former stair opening. Joist hangers will be added on the connections to these headers. The header on the west, which is split in half, will be replaced or spliced. Joist hangers are to be placed on the joists intersecting the header above the

northeast window; the ends of the header will be spiked to the supporting joists on either side. After this recommended work is completed, the post put in place by Longworth and the temporary joist support installed after the engineering report of 1979 will be removed. All joist hangers visible to the public in the basement area will be mortised and concealed by wood strips.

The ceiling of the wine cellar, composed of unrelated flooring, etc., arranged to appear old, will be removed. At that time the joists can be examined and their present condition evaluated, and work to strengthen them can occur if necessary. From what can be seen from the present partial exposure of the system, it is not anticipated that any work will be required beyond the addition of hangers where the joists intersect the header over the window and the spiking of that header to its carrying joists. An attempt will be made to determine the historic ceiling in the wine cellar and to simulate it in replacing the one now in place.

The pantry floor in the loggia will be numbered and carefully removed; the plywood subfloor will be removed and discarded. New locust logs, roughly matching those now in place and flattened on the top side, will be put in place on the north side of joist 2, and between joists 4 and 5, 5 and 6, 6 and 7, 7 and 8, 8 and 9, 9 and 10, 10 and 11, 11 and 12, 12 and 13, 14 and 15, 15 and 16, and 16 and 17. These new log joists will be let into the brick bearing walls 4 inches on either end and will be well seated. The pantry floor will then be replaced without a subfloor, as is the case in the guardroom beyond the pantry in the north loggia. Steel angles will be let into the lintels of the two windows on the west side and above the west doorways to reinforce the wood members, which will be carrying additional joists after the reworking of the pantry floor. Existing joists 9 and 12 will be attached to posts within the pantry stairway structure, which apparently date at least from the 19th century, to give added strength to the framing in that area. After such restructuring, the two temporary posts installed by Longworth, which are intrusive on the historic scene, can be removed.

2. Main Block

Work on the framing system of the area under the north stair hall will be a low priority. While it would be preferable to strengthen the system within itself so that the temporary supports installed under Longworth's direction could be removed, the fact that these supports are now giving a psf rating of 100 makes those two small stair halls the best structured portions of the entire house. Ideally, all single joists, most of which have powder-post beetle damage, and headers would be doubled with new material and hangers would be added where all joists intersect headers. This procedure would effectively give the hallway a new framing system without disturbing the historic fabric. Also, the lintel above the window would be strengthened with the addition of a steel angle. Structural renovation under the north stair hall should take place, however, only after all other structural work in this report has been effected. All the recommendations and statements concerning the north stair hall are also applicable to the south stair hall, which will not receive further treatment here.

The main problem under the family parlor and dining room concerns the center beam carrying the joists. This beam is composed of double timbers on the north section and triple timbers on the south, in two sections, butting in the center of the space on the brick pier. The pier itself will receive a new brick top layer to serve as an adequate seat. The understructured beams will each receive a steel channel, which will be bolted on their west sides to avoid the heating unit, which backs up to the beam on the east side, north section. These steel joists will be seated on steel plates at right angles to them, one atop the pier and one embedded in the brick wall beside the present beam. The third joist, which carries the sandboxes, will be doubled with a new timber and adequately nailed. Steel angles will be installed to reinforce the lintel above the opening between the area under the north stair hall and the area under the family parlor and dining room. The joist ends seated into the east wall will be randomly exposed and examined for rot. Joist hangers will be added to the headers flanking each fireplace support where they are attached to the doubled sandbox joists.

The area under the White Parlor will be treated the same as the area under the family parlor and dining room. Any joists in either space which are so damaged by previous powder-post beetle activity as to be judged seriously impaired in their function will be doubled by a similar timber, adequately nailed, and seated in the bearing wall.

All joists showing extensive powder-post beetle activity in the area under the center hall, particularly joists 5, 10, 13, 19, and any one in the 20s judged to be in need of strengthening, will be doubled by a similar timber, adequately nailed, and seated at least 3 inches into each bearing wall. Joists 14 and 15, which lost some of their section to the heating chase from the Lee furnace, will be doubled on the side opposite the chiseled sections so that these cut portions will remain visible in the future. Lintels over the opening between the areas under the center hall and north stair hall and over the east opening between the areas under the center hall and White Parlor will be strengthened by the placement of steel angles on either side, with fire doors to close each opening. The west opening between the areas under the center hall and White Parlor and the opening between the areas under the center hall and south stair hall will both be closed by the placement of a new brick wall, one brick thick, running tight up under the lintels.

3. South Wing

Joists 10, 11, 12, 13, 14, 16, 17, and 18 have been damaged by beetle activity in the past and will be doubled with similar material, nailed adequately to existing members, and seated well into each bearing wall. Joist number 7 will also be doubled, as it is carrying the sandbox header. Joist hangers will be put in place where the floor joists intersect the sandbox header and where the header intersects the joists which carry it. The header above the window will be reinforced with a steel angle. A brick column will be added on either side of the opening below the segmental arch between the areas under the morning room and storeroom. The columns will rise from adequate concrete bases and will carry a substantial wood beam which, in turn, will support the header carrying the three joists above the arch. Ends of joists currently concealed in the east bearing wall will be randomly checked for rot.

Access between the area under the morning room and the smaller space under the office, currently limited to a very small hole, will be enlarged to easily accommodate a man; the new opening will be headed by steel angles. The joists spanning this area will be inspected and doubled where necessary.

The larger area under the office was excavated when the heating unit and diffuser were installed. It will be necessary to square the sides of the excavation and to build a two-brick-thick retaining wall to stabilize the earth against the foundation. Archeological investigations will not be required here as the ground level is nonhistoric. Any damaged joists found will be doubled, and all joists will be reseated on both ends.

The closet in the storeroom, added during the War Department occupancy, will be fully documented and removed (as recommended in the Mullins furnishing plan). The walls of the storeroom will be examined for any indications of shelves or pegboards believed to have once been in that room, and these remains will be fully documented. The floor boards of the storeroom will be numbered and removed, and log joists will be added between existing logs 2 and 3, 3 and 4, 4 and 5, 5 and 6, 7 and 8, and 8 and 9. The ends of existing log joists will be examined for rot at this time and reinforced with epoxy or replaced if necessary, and all will be firmly seated. The floor will be renailed on the renovated joist system and the storeroom will be arranged as recommended by the furnishing plan.

C. North Wing and Loggia Roofs

The following excerpt from C.D. Robinson's engineering recommendations for work on the north wing roof is quoted here as a part of this report's renovation plan:

> Ideally the roof should be sized or made up of such members that the system would be at least capable of supporting a superimposed live loading of 20 psf minimum, with member stresses allowable being per today's allowable code stresses.
>
> The investigations reveal that stresses under a 20 psf live loading in several cases approach 400 psi in bending, which is almost three times conventional allowable stresses of even the better woods in use today. It would be an exaggeration to state that stresses that now exist are of such danger that failure of the entire roof system is imminent. However, the magnitude of the stresses does indicate that some remedial action is required to reduce the stresses to bring the structure better in line with conventional safety.
>
> The primary member that is overstressed is the 3 x 3 roof rafters, which have a computed stress of 3823 psi based on live load of 20 psf (minimum per code) and treating the roof system as a 3 hinged arch which by present conditions most nearly describes its action. In addition, the hip rafters on the hip end are overstressed by a lesser amount, and the ceiling joists by an even lesser amount.

In order to provide greater strength, the investigations were first to form a truss of the ceiling and rafter system by adding some verticals and diagonals to the existing roof. Stresses were computed with this assumption, first with a four panel Howe Truss which reduced theoretical stresses in the rafters and joists, but not to the present day code allowables. Next, a 6 panel Triangular Fan Truss was investigated and it was found that the stresses fell within those allowable. The truss system in order to work would require that all joints at exterior walls where roof joists meet ceiling joists be exposed and that gusset plate connections of sufficient strength to transfer thrust and bending be installed. This will require removal of a strip of roof approximately 3 feet wide along both sides of the structure. Next, additional diagonal and vertical 2 x 4's will have to be installed from within the attic space above the ceiling. This space is so confined that installation, though possible, would require extreme amounts of time and patience to complete. It is felt that from an economic point of view the work required to install the trussed roof system is of such magnitude that it is not recommended.

The investigations then turned to installation of a beam and post system to reduce present loadings to acceptable magnitudes but not necessarily down to present day code stresses. It is felt that this additional strengthening will reduce stresses to 1.15 of present code maximums and that the additional 15% overstress during snow loadings is acceptable. Several codes allow an additional load capacity for short term duration loads such as snow.

The proposed system consists of installing 3 glued laminated wood beams at approximately 12 feet on centers transversely to the structure, then installing two lines of 2 x 12's longitudinally. From these beams posting up to receive loads from the rafters can be accomplished without adding to the existing loads on the ceiling joists. It is most important that the new beams be installed a minimum of 2 inches above the existing ceiling so as not to induce cracking in the plaster when beams are loaded and are deflecting. Without a doubt the installation of such a system will offer its own difficulties, and does require a great deal of work to be accomplished from within the attic space. However, this work will not be nearly so great as installation of the trusses, nor will it require removal of portions of the roof for the installation of gusset plates. It will, however, require that the openings be placed through the roof to install beams and to introduce other material into the structure.

Robinson's system of wood laminated beams and posts rising vertically to intersect the undersized rafters and reduce their present span is the recommendation also of this report. It succeeds in adding a system of modern materials to the existing system of original fabric to bring the entire concurrent system up to an acceptable load-bearing capacity. The use of this system will also fulfill the National Park Service's goal of preserving original fabric rather than restoring.

The north wing roof renovation work will also include the strengthening of the connection, now minimal in many cases, between the rafter ends and the ceiling joists. Where the vertical connecting members are missing or unstable, they will be replaced by gusset plates cut from one-by-twelve pine and adequately nailed. The present vertical pieces in question are not historic fabric and were scrap pieces of wainscoting or flooring when installed after the rafters were raised on plates or blocking.

Any weak, failed, or discontinuous joists present in the north wing roof system will be doubled or connected to the doubled two-by-twelve beams running between the glue-laminated beams. All one-by-six webbing, currently in place and not historic, will be removed. It will be important to ensure that the three glue-laminated beams are seated well, and as fully as possible, on large wooden plates atop the existing bearing walls. Further doubled two-by-twelve beams will span the longitudinal beams and carry the hip end on the north and the gable on the south between the hip rafters and the wall of the main block.

During the work on the north wing roof, one hole will be opened near the eave for each glue-laminated beam to enter the attic. If other materials cannot be brought through an interior ceiling, a sizable hole will also be opened in the roof. After the work is completed, the holes will be patched to match the remainder of the roof.

Robinson's report on the north wing roofing system also covers the loggia roof:

> The lean-to portion of the roof was also investigated, and stresses were found to be approximately 1200 psi maximum which is within the present code allowables. One problem with the present system is that ceiling joists are not anchored to the inner wall. This does not cause any difficulty to the joists, but thrust from the roof rafters is taken by the exterior wall only. Computed stresses indicate that a net tension of approximately 30 psi is caused by the thrust from the rafters. This tension can be reduced by 60% by tying the rafters to the wall. This remedial work is recommended to be done. However, it should take a lower priority than other recommended work.

It is further recommended that any roof rafters or ceiling joists which are judged significantly weakened by beetle damage or other rot be doubled by an adjacent two-by-eight. The end of the hip rafter, which rests on the bearing wall and is of an insufficient section, will have a notched two-by-six attached to each side with through bolts to strengthen the historic timber where it rests on the walls. Temporary struts which currently help support weakened sections of this roof will be removed once the areas of damaged rafters are reinforced.

As recommended by Robinson, the ceiling joists will all be anchored into the bearing wall. As the log joists are all of a slightly different diameter, it will be necessary to nail two-by-sixes on both sides

of each, extending them three inches into the bearing wall. These timbers will be two feet long, except where the logs are weak, in which case they will span the entire pantry ceiling. A continuous doubled two-by-six will be attached to the bearing wall above with expansion anchors, with nails being driven at an angle through this doubled timber into the two-by-six pieces below.

D. South Wing Roof

Pertinent sections of Robinson's engineering study of the south wing roof are included here:

> Unlike the North Wing, the present roof was constructed to a pattern, members fit better, and overall sizing and spacing of members are of such nature as to make up a much better roof system.
>
> The original roof was constructed with hips at both ends, later modified, extending the gable to the main house when this portion of the structure was completed. The roof consists basically of 3 x 4 rafters and 3 x 8 ceiling joists at approximately 1'-5" on centers. At either end where hip rafters frame to the roof ridge line, there is a King Post Truss with strutted top chord support & bracing. The original hip flanking the main house has been removed, but the hip rafters remain. Roof rafters have an intermediate 4 x 4 support member spanning between the King Post Trusses.
>
> Investigations reveal that the rafters can carry their loading by compression and bending without the intermediate support, and further the 4 x 4 intermediate support is not capable of furnishing full support if full load were transferred there. It is suspected that the rafters deliver some load to the 4 x 4 causing it to deflect to a point where the rafters then act as a normal rafter system. Computations reveal if the 4 x 4 were to carry all dead and live loading that would be normally assigned to a support beam then stresses would be of such magnitude that failure would be imminent.
>
> The final conclusion is that the rafters act basically as normal rafters, and that the 4 x 4 member acts as bracing and carries only minimal load, and that the full system is sound.
>
> Investigations on the Hip Rafter at the Hip end of the structure indicate that if the rafter acts only as a beam, stresses would be of such magnitude that it would be considerably overstressed under full live loading. At this end, however, Jack Rafters form arches carrying most of the hip rafter's load down to the walls, and it is concluded that this system needs no repair.
>
> The Hip Rafter at the end where modifications occurred, however, is not as well taken care of. Stresses here are computed at 2800 psi, and are enough in excess of common allowables to warrant additional support. In addition, roof rafters added at the time when the roof was converted from a

hip to a gable are spaced too far apart, and although structural failure is not assumed, stresses in the members and their consequential deflections, as well as deflections in the roof sheathing, are considerably higher than should be allowed. These deflections will under live loading cause sagging and resultant damage to the membrane roofing, causing shorter life and more leakage. It is therefore recommended that at this end the Rafters, Ridge Beam, and "Hip" Rafters be strengthened to increase structure life and roof life.

Recommendation for Hip Rafters is to increase capacity by adding an additional 2 x 8 each side of existing rafter, with the same for the Ridge Beam. If it would be easier to install, then a single 4 x 8 could be installed directly under these members. In addition, I recommend the installation of 4 additional rafters each side of the ridge.

As in the north wing roof, all insufficient vertical connections in the south wing between the ceiling joists and the rafters will be reinforced with an adequately nailed gusset plate made from one-by-twelve pine. In the same manner there will be an attempt made to firmly connect the four hip rafter ends to the 45-degree outriggers of the ceiling joist system directly below each.

Hip jack rafters on the south end (numbers 5, 6, 7, and 8) should be doubled with two-by-sixes. Any other rafters found to be suspect as to true strength will be similarly doubled. Collar beams between rafters in the mid-section will be more securely nailed. Any rafters not having wedges where they contact the purlins will receive new wedges.

Robinson's recommendations regarding the renovation of the rafter system in the north end of the south wing roof will be carried out. In order to introduce needed materials into the attic space it may be necessary to open up one or more holes into the roof, all of which will be repaired once the work is completed. After all roof work is completed, all wing and loggia roofs will receive a sprayed clear coat, a process recommended on such roof systems every five years.

Ceiling joists 1, 6, 12, 14, 16, 19, and 20 show damage from beetles and rot, and should be doubled. The plaster ceiling above both the morning room and office should be closely inspected to determine its present condition, and an approximation should be made of its age. If it is felt to be original, it will be necessary to reinforce these ceilings from above in such a way as to ensure their withstanding the work which will go on in the attic space. This reinforcement can be accomplished after the doubling of ceiling joists judged too weak to stand alone, and before any rafter renovation is initiated. All temporary struts installed in this century between the purlins and ceiling joists will be removed.

E. Miscellaneous

1. First Floor Center Hall Arches

The object in the repair of the two center hall arches showing deterioration will be to correct the problem while preserving as

much historic fabric as possible. As this area is highly visible to the public, and as one arch contains an artwork by G.W.P. Custis which will have to be preserved and restored, special care will have to be taken in this work.

The arches were examined by Dean Robinson, and he has recommended that a semicircular steel plate be installed behind the plaster under the barrel of each arch. These steel arches will be affixed to the arch jambs with expansion bolts on each end. Once the plaster is replaced, there will be no visible evidence of the repair materials. Robinson summarized the situation in his report as follows:

> The arches are semicircular, some 8'-0" in span, and are assumed to be or to have been fixed or tied into other masonry at the springing. Semicircular arches are not completely stable in that the compression thrust lines do not always lie within the middle third of the cross section, hence some tension in masonry and masonry mortar. It is my theory that the masonry cracked because of high tensile stresses, and as such, rotated somewhat and formed a three-hinged arch of considerable more stability. If this is the case, then the triangular piece of masonry within the cracks at the crown is loose and subject to falling when shoring and plaster is removed.
>
> I attempted a design wherein the arch would be loaded by a means of pre-stressed rods, forcing load on the arch barrel; however, it was later felt that this could not be fully reliable. From this point, I have designed a steel plate arch to fully carry the arch masonry and 3'-6" of brickwork above the crown. No additional live loads are assumed to be carried by the steel plate. The alternative, as I see it, is to completely remove the masonry, and re-build it with masonry and mortar capable of carrying tension, in this case ordinary brick and portland cement mortar would suffice.
>
> Prior to ordering any materials or commencing any repair, some destructive investigations will have to be done to ascertain the validity of the assumptions. The upper areas around the cracks should have plaster removed to verify the masonry is cracking, and enough plaster must be removed below the arch crown to verify that the steel plate will fit.

It is recommended that Robinson's design be followed with appropriate safeguards, as regards both the artwork in question and the safety of the workmen involved. A specialist in the preservation of fresco work will be consulted regarding the treatment of the paintings during the repair work and the restoration of their cracks after the renovation is completed.

2. South Hall Servants' Stairway

Stringers of the servants' stairway run continuously from the first to the second floor without adequate center support. It was the intention of Longworth to give this stairway a support in mid-run, as a part of his 1978 work on the upstairs center hall, by posting up in the

closet underneath. After further investigation it has been found that the main problem is concentrated in the center stringer of the stairway, which receives little support along its run and is sagging at this time. As the two side stringers receive adequate mid-run support from the closet walls underneath, it is only the center stringer which needs reinforcement.

It is recommended that a steel angle be installed under the center stringer behind the head of the closet door, to be supported on either side by the closet walls. A section of the newly installed sheet rock will be removed to facilitate this work, and the material will be replaced after the installation is complete.

3. Upstairs Center Hall

As has been noted previously in this report, renovation work was done on the west end of the upstairs center hall above the arches in 1976. Furthermore, the joists were inspected at mid-span in 1971, at which time they were found to be in very good condition.

While it is valuable to know the condition of the joists, particularly at the center of their span where crucial forces are concentrated, it is also necessary to know their end conditions, in particular the condition of their individual seating in the soft brick wall. It is recommended, therefore, that enough flooring beside each side wall be removed to examine the seating condition and that any repairs necessary be made before the boards are replaced.

F. Priorities for Structural Stabilization

1. North wing roof
2. Floor of Custis bedroom (ceiling of winter kitchen)
3. Floor of pantry (ceiling of north wing basement hall); change heating system
4. Center hall arches
5. Exterior drainage and grading
6. Basement fire doors, retaining wall, etc.*
7. Floor of morning room
8. Floor of storeroom
9. North wing loggia roof
10. South wing roof
11. Floor of office
12. Floor of White Parlor
13. Floor of center hall
14. Floor of family parlor and dining room
15. Center stringer of servants' stair
16. Seating of upstairs center hall joists
17. Floor of guest room (ceiling of wine cellar)
18. Floor of north stair hall
19. Floor of south stair hall

*Monitoring of moisture conditions in the basement walls began in September 1979.

VI. ASSESSMENT OF EFFECTS

There are several alternatives to all the recommendations presented in chapter 5. One obvious alternative to any proposal is to not act at all, which in the case of these particular recommendations on structural reinforcement, would automatically result in an eventual adverse effect. Because many of these recommendations address specific structural deficiencies which have been identified and confirmed by scientific analysis, and as they can only worsen with time, to ignore their needed correction can only result in further and more rapid deterioration of the mansion's structural system. Such unchecked deterioration will not only have an adverse effect on the historic resources, but could endanger the public as well.

Work recommended for the basement area will have an effect on the house, but it will not be adverse to its historic qualities. Archeology always has the effect of disturbing the historic document that is buried beneath the ground, but the result should have the effect of opening the basement areas to better interpretation.

While the addition of ventilating devices, fire doors, and new brick walls will have an effect on the historic qualities of the house, all are eminently practical, and none would be irreversible and, therefore, could not be thought of as wholly adverse. The removal of the heating pipes will affect the structure only by taking one 20th century intrusion from the historic scene.

The renovation work on the first floor framing system is crucial to the structural stability of the resource. The only portion which will be visible to the public is located in the north wing under the winter kitchen and the pantry. The steel channel which will span the space and reinforce the existing joist will be concealed as much as possible from public view, as will the joist hangers above the window near the northeast corner. The log additions to the area under the pantry will be visible to the public, but they will blend with the historic fabric. The addition of these logs will allow the removal of the offensive plywood subflooring from the pantry floor and the two temporary posts from beside the stairway. Some historic fabric will be necessarily removed from the brick bearing walls to form pockets for the locust logs. Certainly these additions will have some effect on the qualities of the structure which make it historic, but it is not felt that these effects will be adverse.

In the same view, structural reinforcement of the first floor framing system throughout the rest of the basement is highly necessary to the preservation of the historic resource. As these areas are not open to the public, and are not projected to be opened, these repairs will represent a functional addition to what is now a purely functional area. None of these repairs can be seen as adverse in light of the surrounding 20th century intrusions already enumerated. In no event, in the basement or elsewhere in the mansion, is historic fabric being removed. Following the National Park Service dictum to "preserve rather than restore," new material is being used beside the original to upgrade carrying capacity with no necessity for the removal or replacement of historic fabric.

None of the work recommended for either the north or south wing roofs will ever be visible to the public. In neither case will historic material be removed; rather, it will be reinforced in place so that it, with the assistance of new material to increase its strength, can continue its traditional function. The effect on the house will be one of addition to existing fabric; it will not be adverse, as all historic fabric will remain in place with any new material clearly distinguishable as such. There will be no attempt to disguise the new material in relation to the historic in the roof repairs.

The center hall arches are completely in the public eye, as is their deteriorating condition. The work projected will necessitate the temporary removal of historic trim to install thin steel arch reinforcements adjacent to the brickwork of the undersides of the arches. This reinforcement of historic fabric so it can continue its traditional function is in line with the philosophy governing the other work proposed for Arlington House. Once the arches are reinforced, the wood trim will be carefully replaced and the plaster reconstructed. If the arches were not reinforced in some manner, there would be an adverse effect on the mansion from the continued dependence on unsightly props in the center hall, or the alternative of risk to visitors from an arch in collapse. As historic fabric will be preserved by the action of reinforcing the arches, and all arch degeneration will be stopped, the effect of this work cannot be seen as adverse.

The addition of a steel angle just behind the door header of the servants' stair hall closet will affect the mansion, but not adversely. It will be totally concealed, even when the closet door is open, and therefore will not visually detract from the historic qualities of the resource while it will strengthen the stairway substantially.

Potential work on the upstairs center hall floor joists and their seating will not adversely affect any material on the historic scene. As in the work on the servants' stair, this work will ensure the safety of visitors to the second floor and will not be visible to the public when completed.

An overall assessment of effect on the historical qualities of Arlington House by the work recommended in this report is that it will have an effect on the mansion, but that it will not be adverse. The effect in question will be one of reinforcement of historic fabric, either by obviously new material where it will not be publicly viewed, or by blended material where it will be publicly viewed and might otherwise detract from the historic ambience. This effort will be characterized by the preservation of historic fabric in all cases, whether structurally viable or not, which will result in the overall preservation of the historic resource for the future.

VII. RECOMMENDED STUDIES

A. HSR Phase I

Recording of moisture conditions in basement walls
Investigation and documentation of existing exterior drains
Documentation of main block roof and recommendations for structural stabilization
Estimate of cost for recommended work

B. HSR Phase II

Basement and exterior archeology
Measured drawings of the Arlington House (updating of HABS and additional drawings)
Photographic documentation, interior and exterior
Documentation of George Hadfield, architect
Paint study, interior and exterior
Documentation of existing electrical and mechanical systems (feasibility study of climate control system)
Investigations to determine the chronology of building and the historic appearance of the wings prior to 1817
Investigation (if necessary) into any Custis-Lee-Washington papers at the Virginia Historical Society, Washington and Lee University, etc., to locate original drawings, building records, account books, etc., concerning the Arlington House (possible resource study project)
Written description of the interior and exterior of the mansion
Recommendations for work required to return portions of the mansion to 1861 appearance
Estimate of cost for recommended work

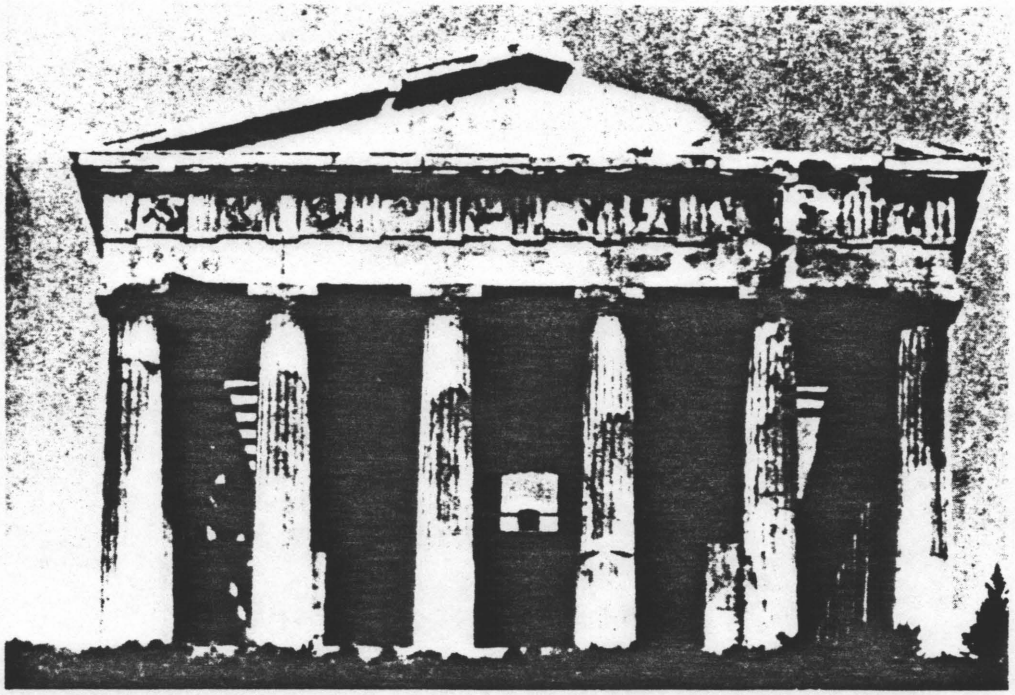


PLATE 1 THESEUM (Temple of Hephaestus) Athens, Greece
circa 450 BC

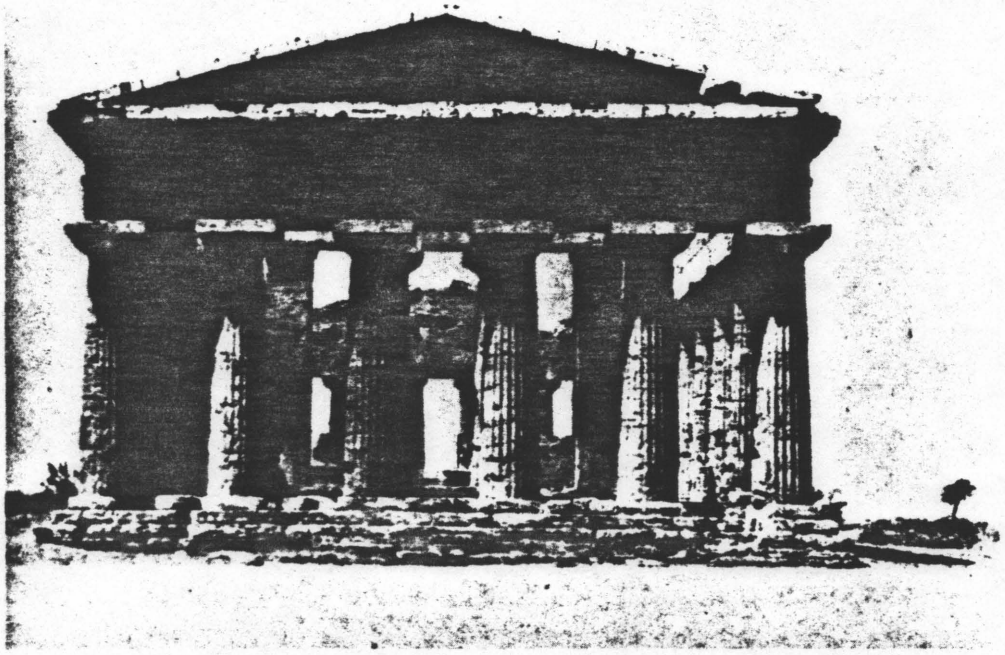


PLATE 2 TEMPLE OF HERA ARGIVA (Hera II) Paestum, Italy
circa 450 BC

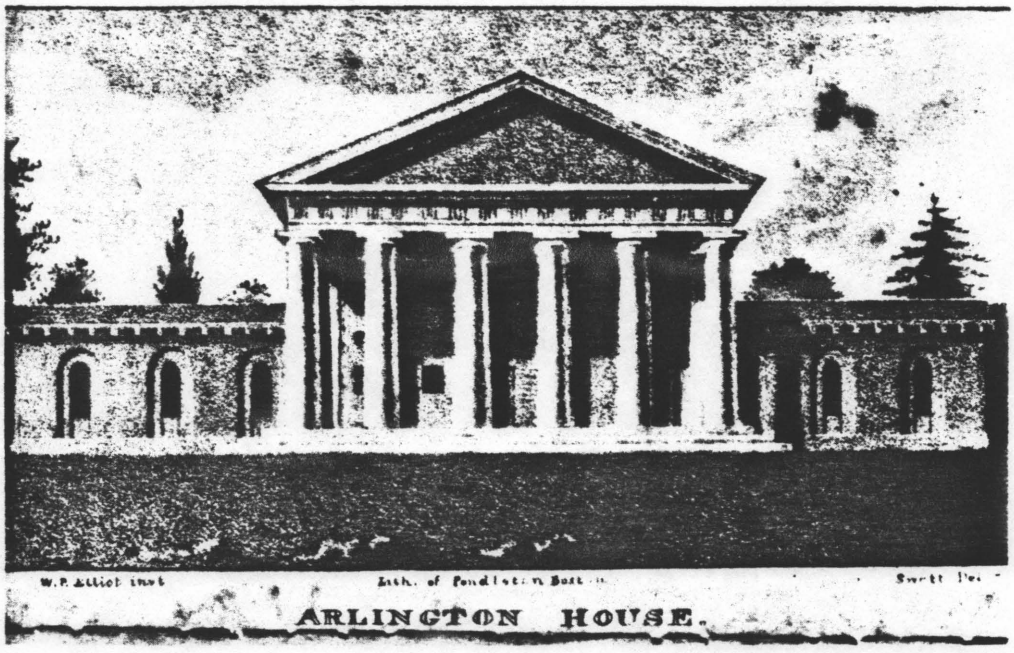


PLATE **3** Lithograph published in William Elliot's The Washington Guide (1830 Edition)

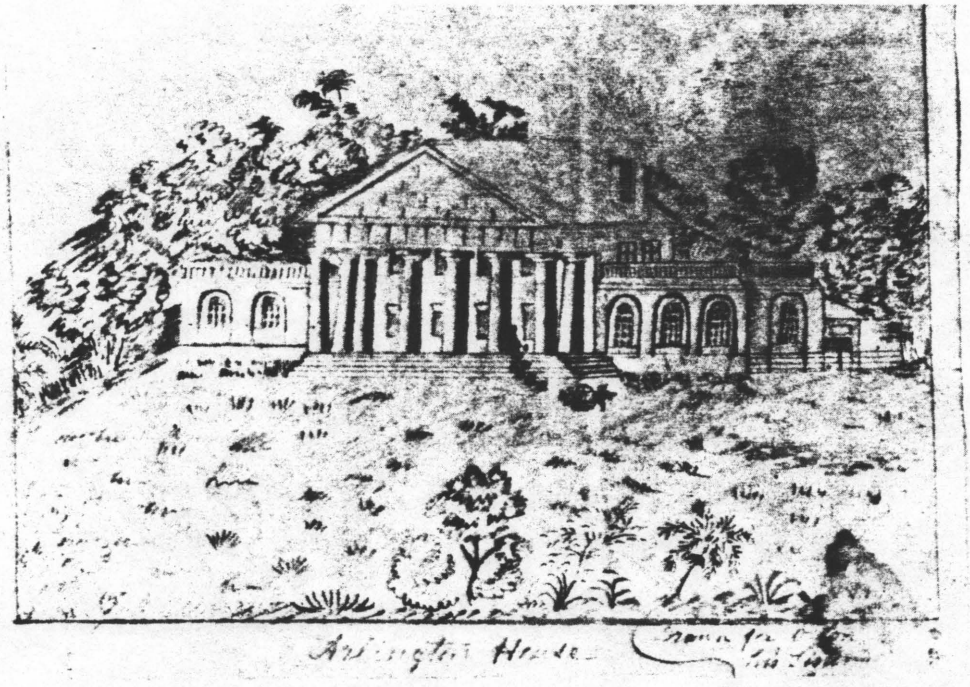


PLATE **4** Pencil sketch by Markie Williams, a resident of Arlington House, 1843



PLATE **5** Watercolor by Benjamin Lossing for Harper's Weekly, 1853

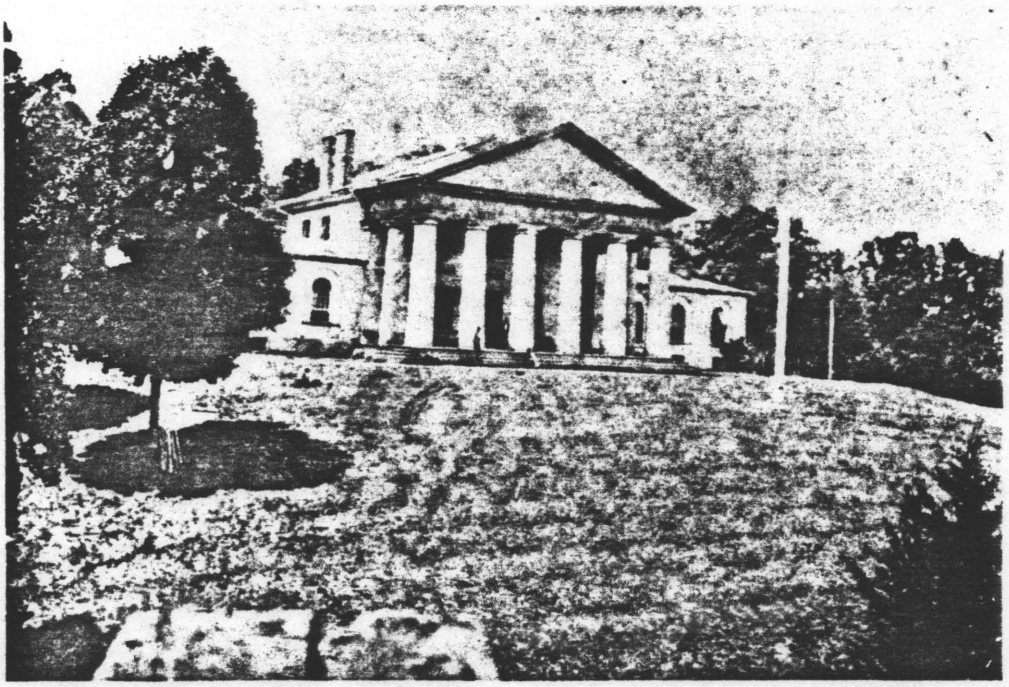


PLATE **6** East Façade, 1864 (Van Horn Donation, original preserved at The Arlington House)

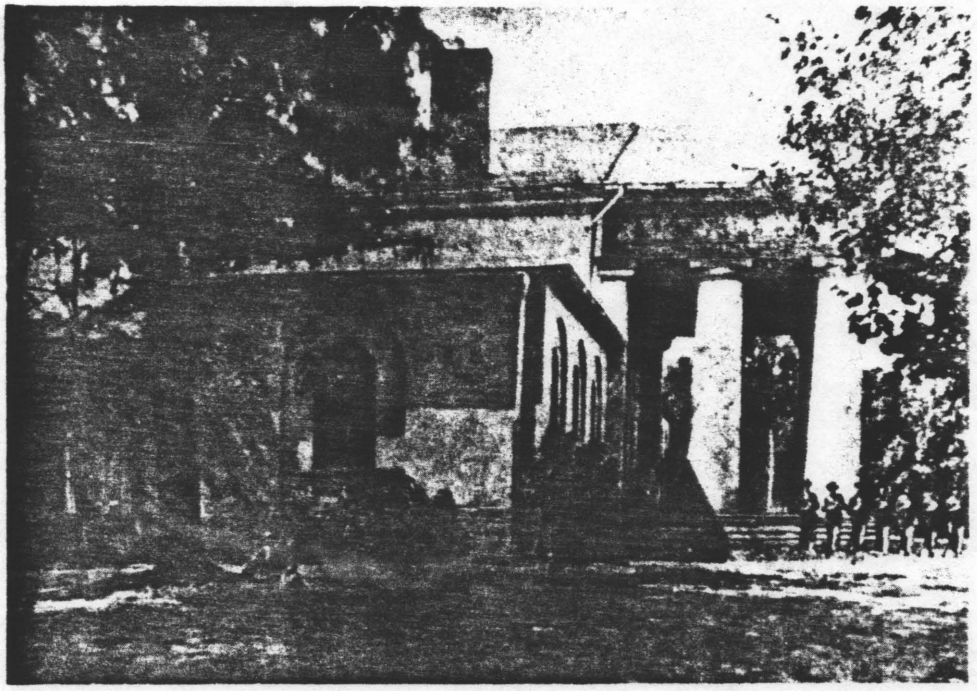


PLATE 7 South Façade, 1864 (Library of Congress, Brady Collection)

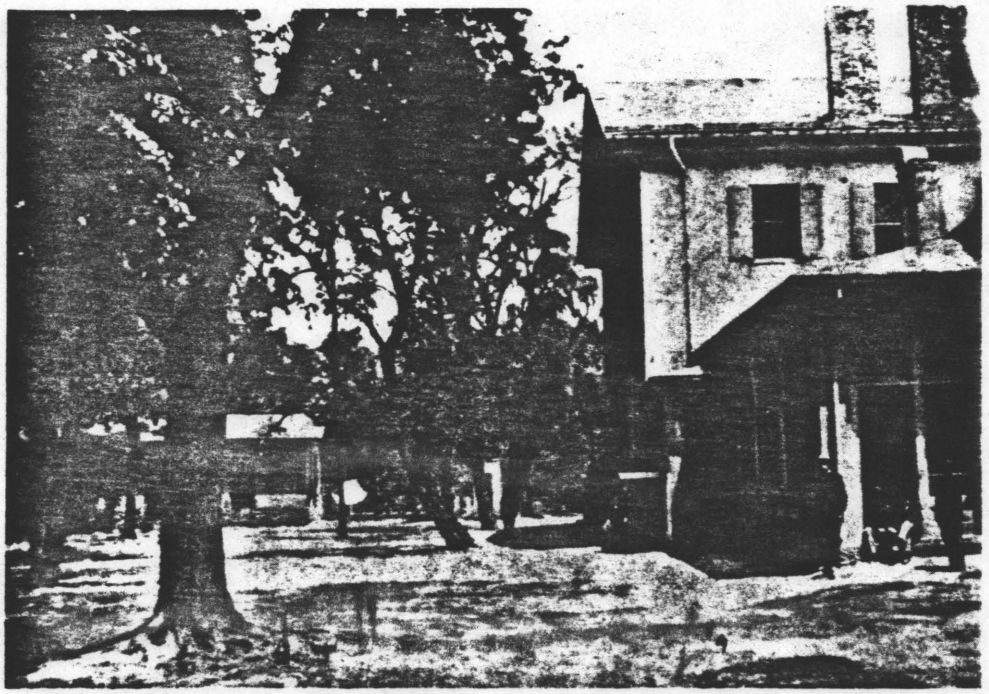


PLATE 8 Southwest Façade, 1864 (Library of Congress, Brady Collection)

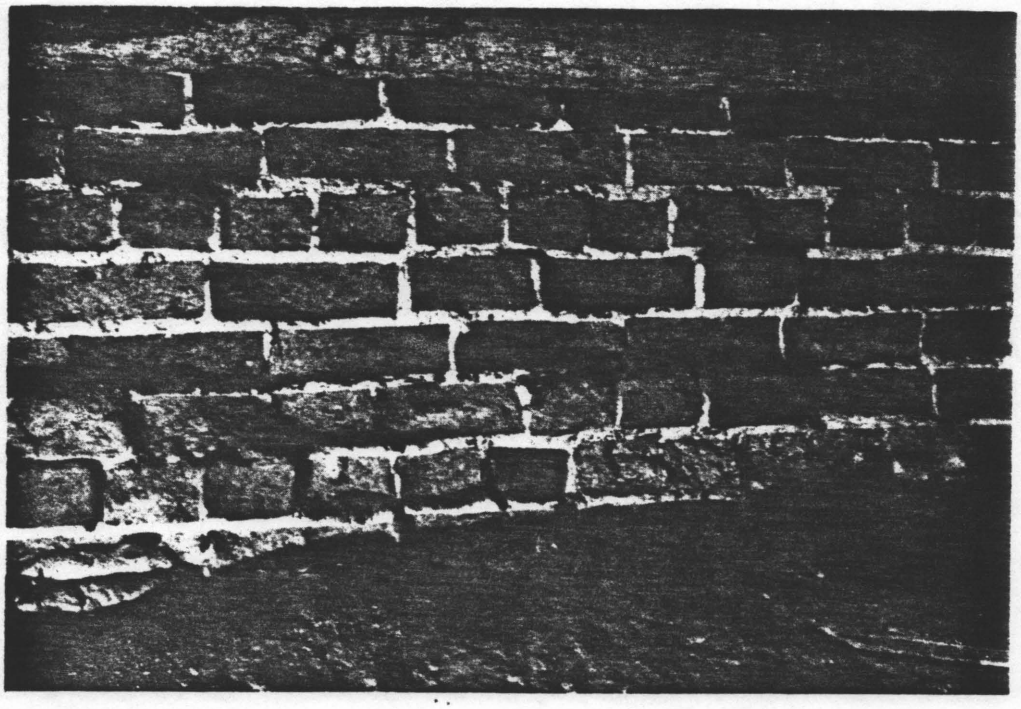


PLATE 9 Brick deterioration, Basement of South Wing, South wall under Office, 1979



PLATE 10 Framing under Pantry, Basement of North Wing Loggia, showing plywood subfloor and exposed heating pipes, 1979

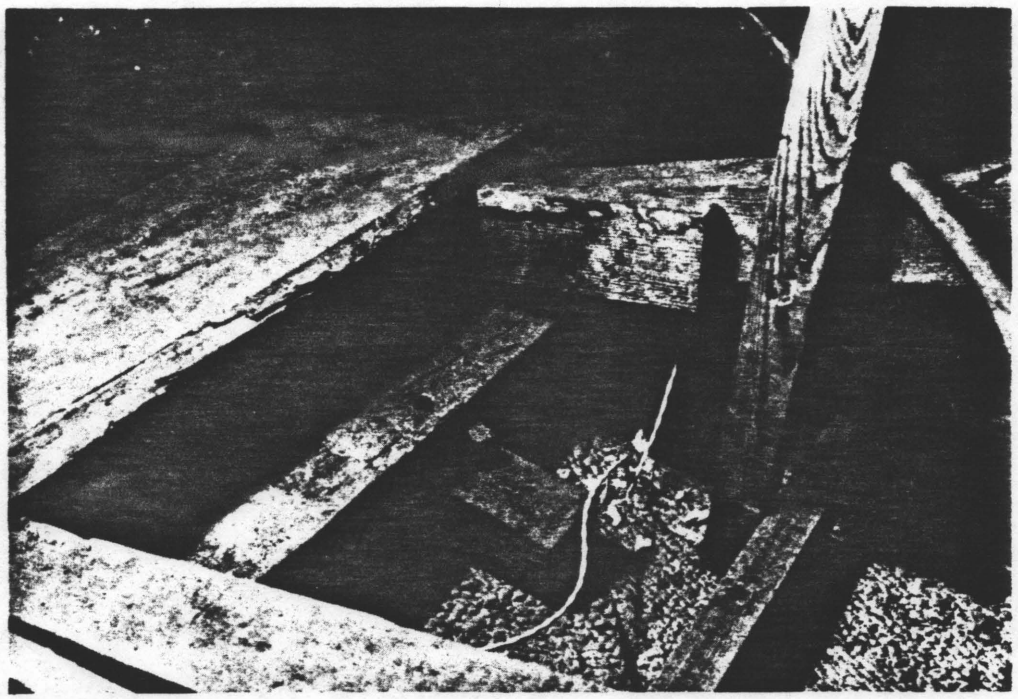


PLATE 11 Splayed eave rafter tail and original sheathing, North Wing Attic, South end, 1979

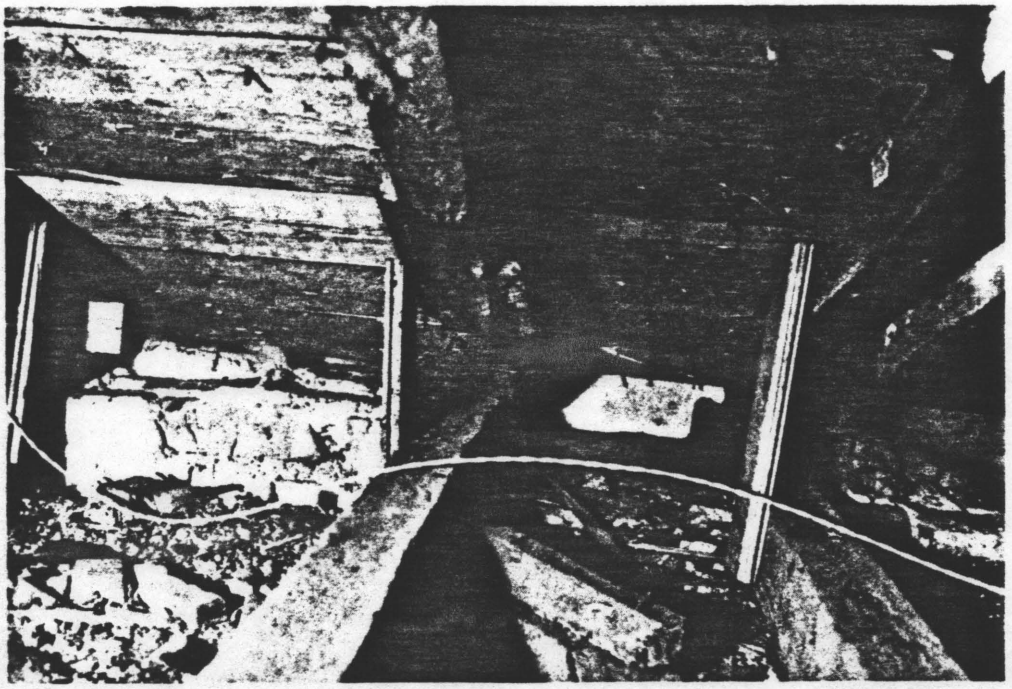


PLATE 12 Rotted rafters and temporary supports, North Wing Attic, West side, 1979

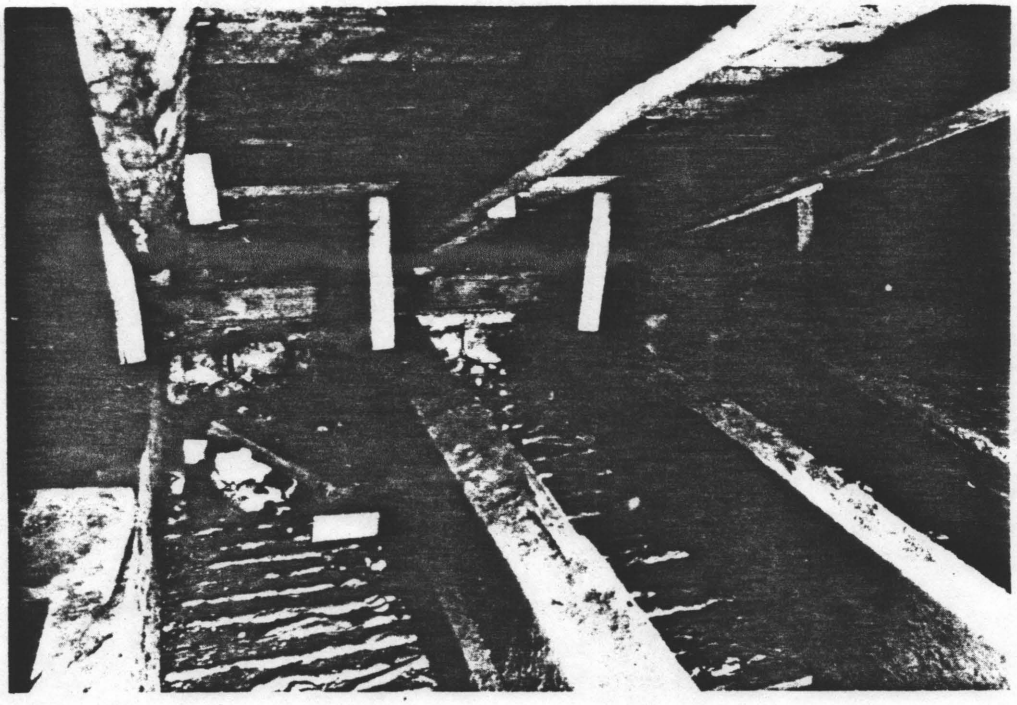


PLATE 13 Rafters raised on a plate and temporary supports, South Wing Attic, East side, 1979

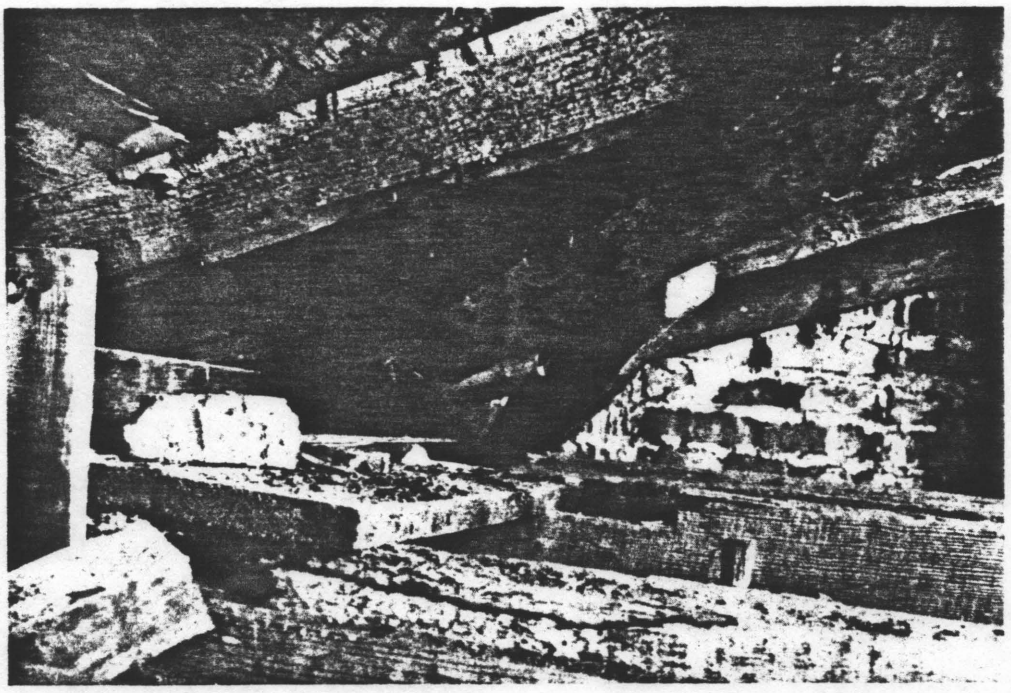


PLATE 14 Unsupported hip rafter end, North Wing Attic, Southeast corner, 1979

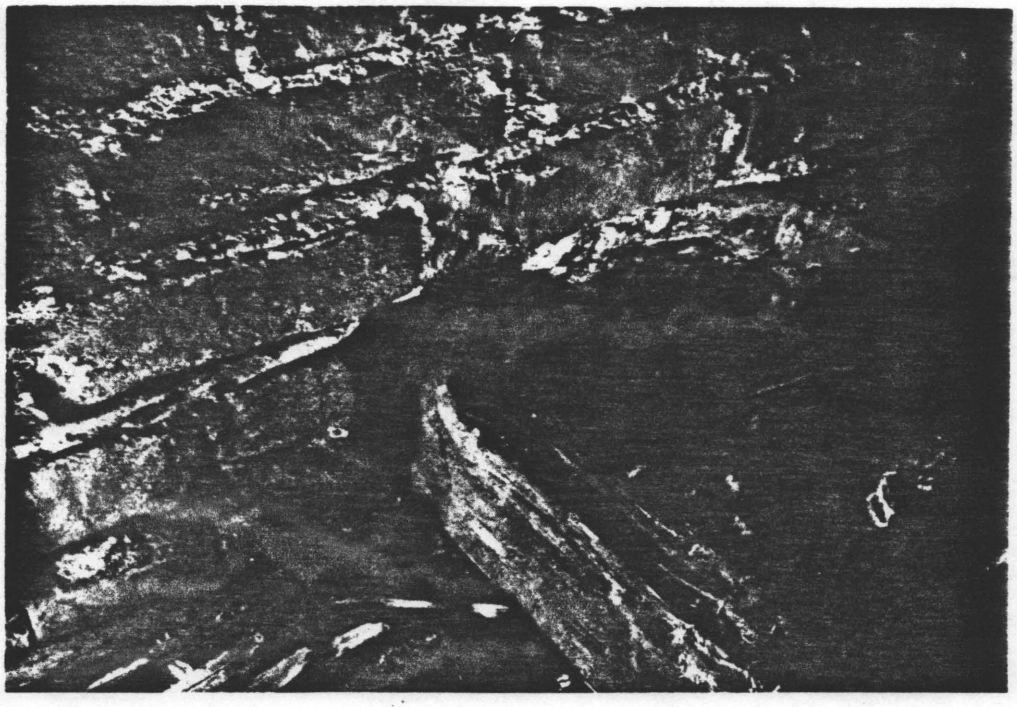


PLATE 15 Ceiling joist seating in bearing wall, North Wing Loggia Attic, East side, 1979

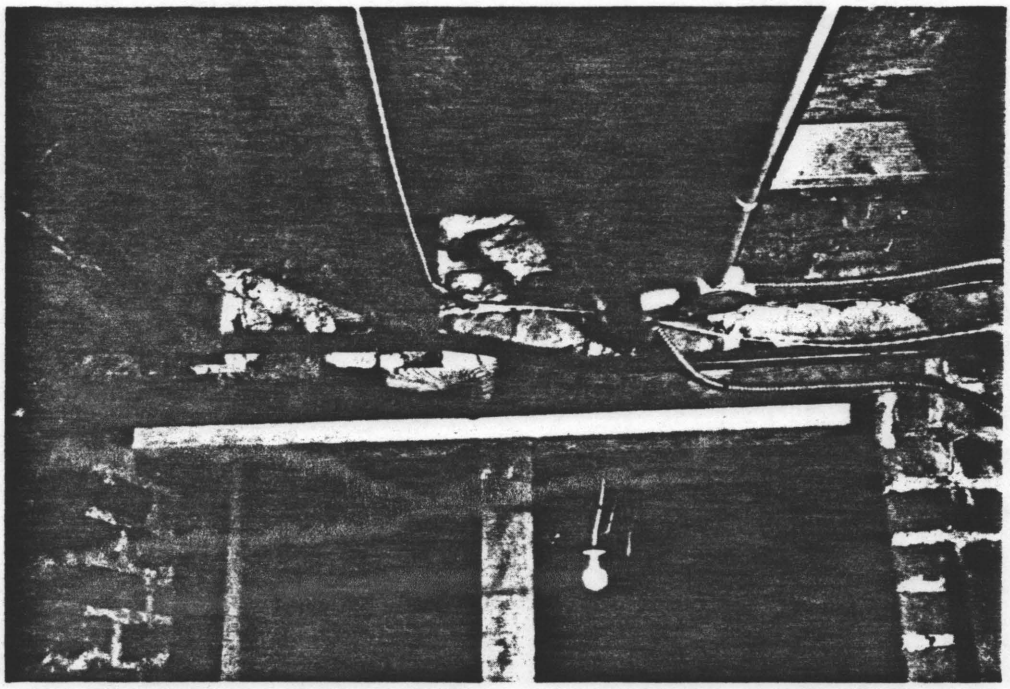


PLATE 16 Lintel in South bearing wall of Centerhall, Main Block Basement, and temporary support, 1979

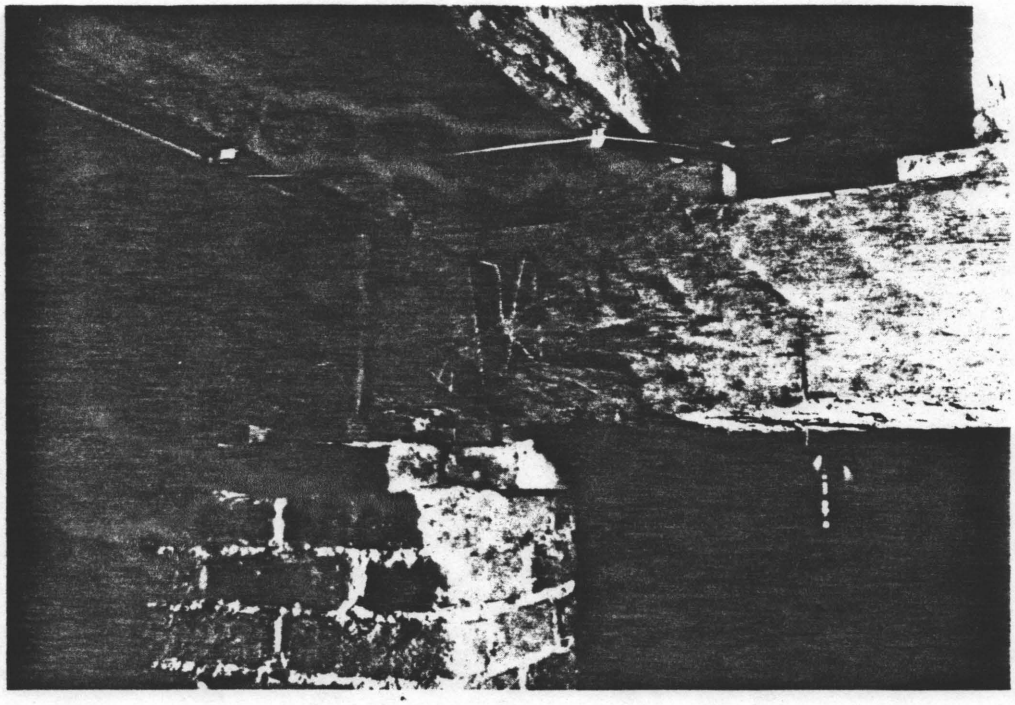


PLATE 17 Beam support pier under White Parlor, Main Block Basement, 1979

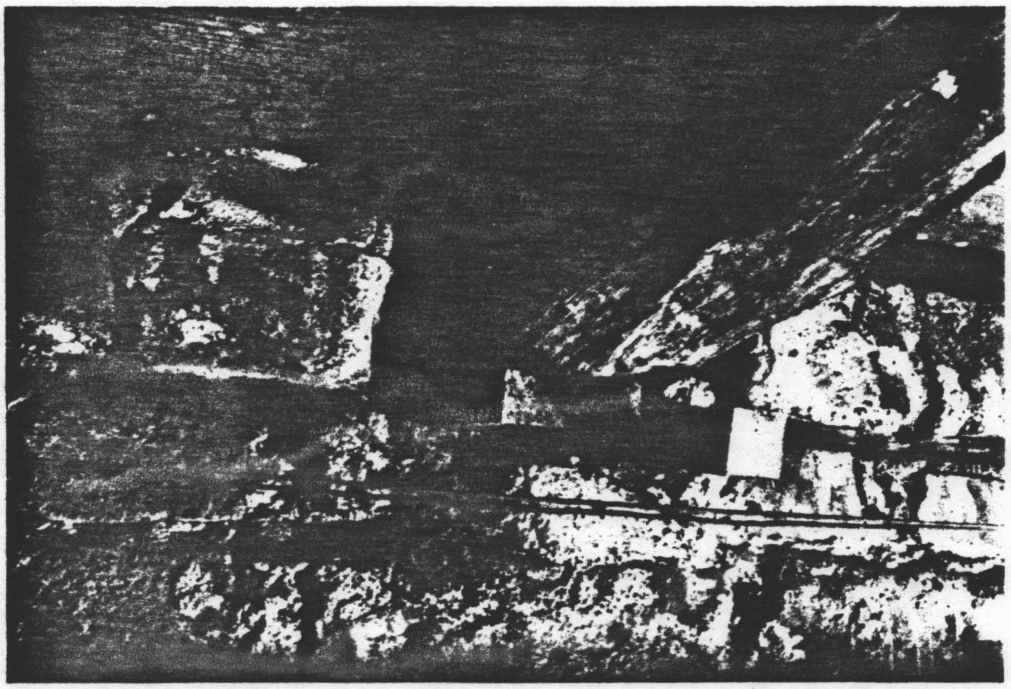


PLATE 18 Floor joist of Store Room seating condition, South Wing Basement, South side, 1979

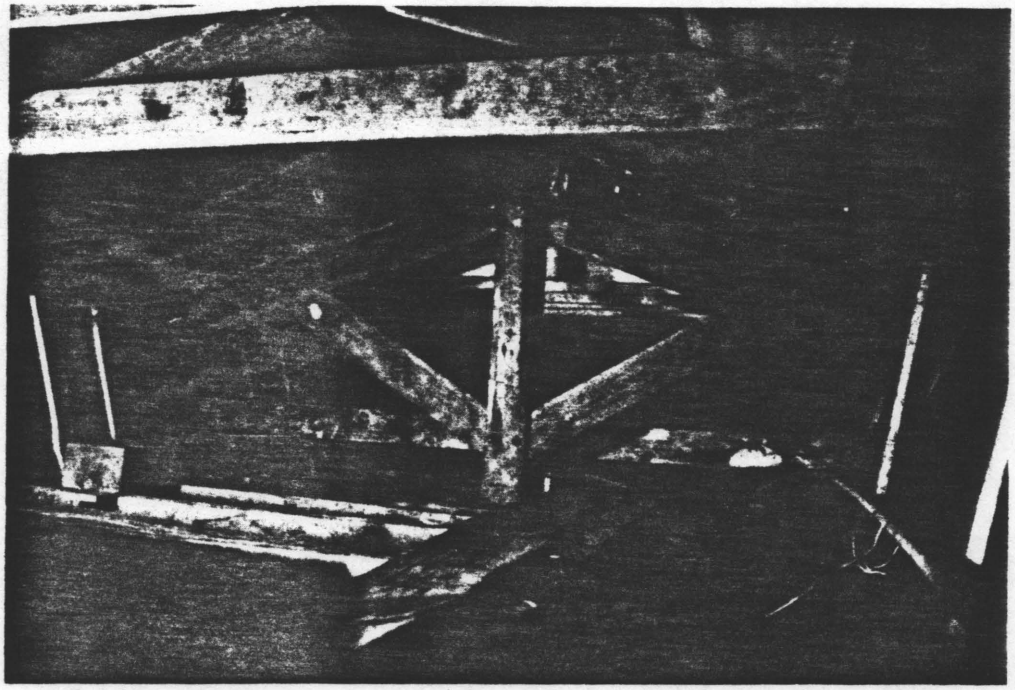


PLATE 19 King Post Truss, South Wing Attic, looking South, 1979

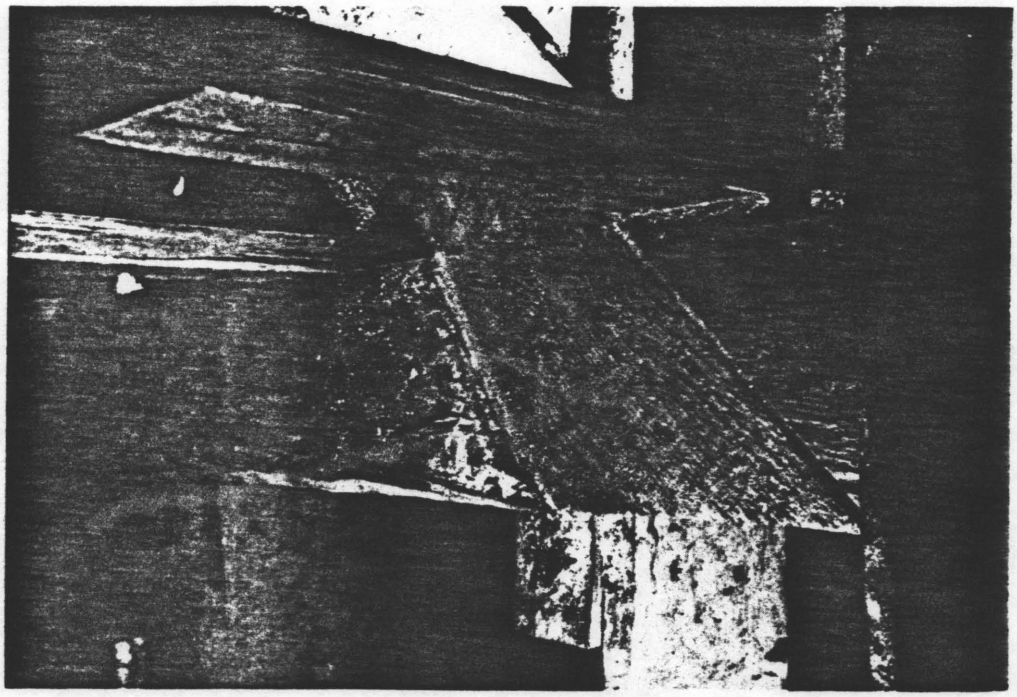


PLATE 20 Half-Dove Tail in diagonal plate brace, South Wing Attic, Northeast corner, 1979

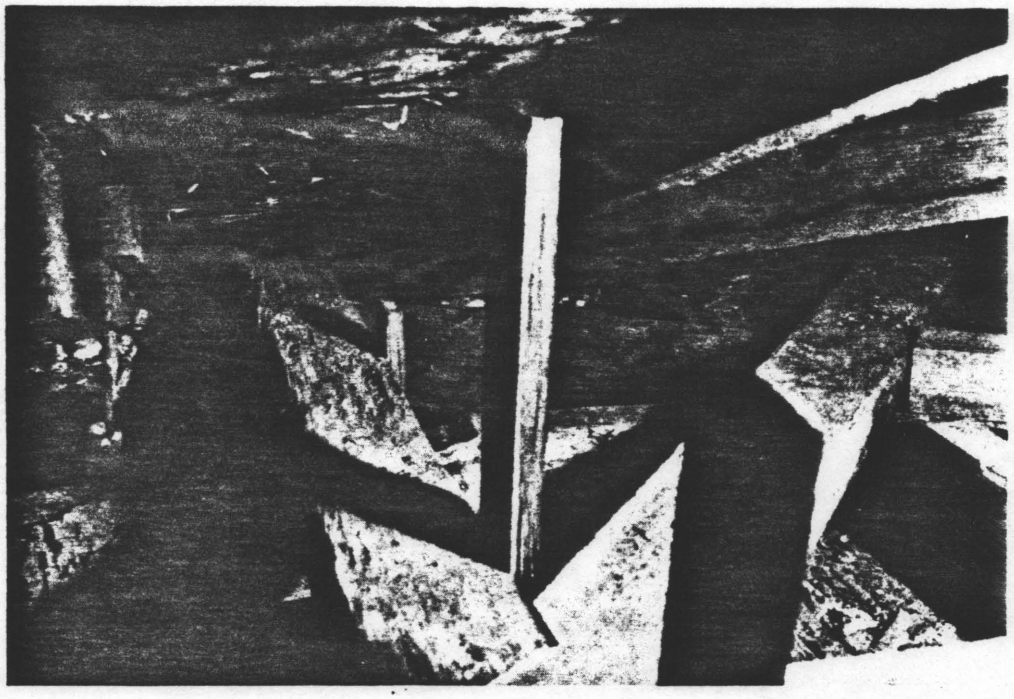
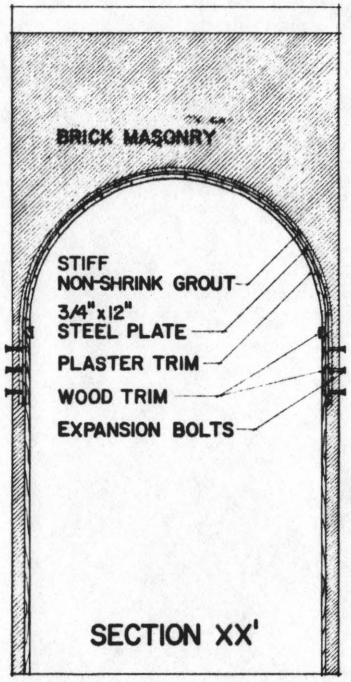
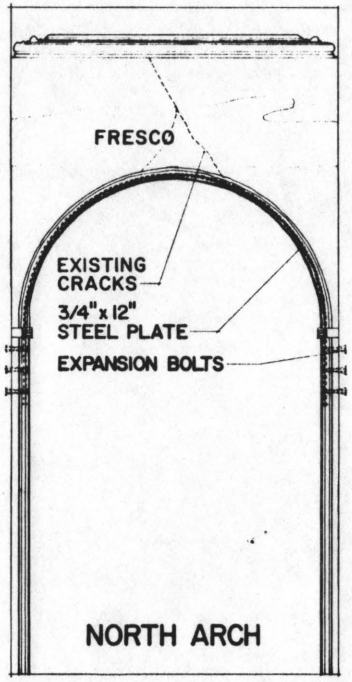


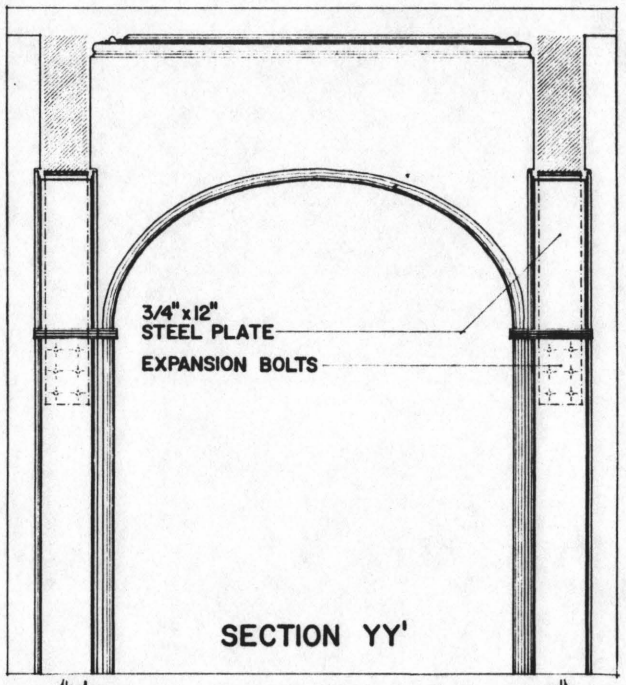
PLATE 21 Hip rafter seating showing split, South Wing Attic, Northeast Corner, 1979



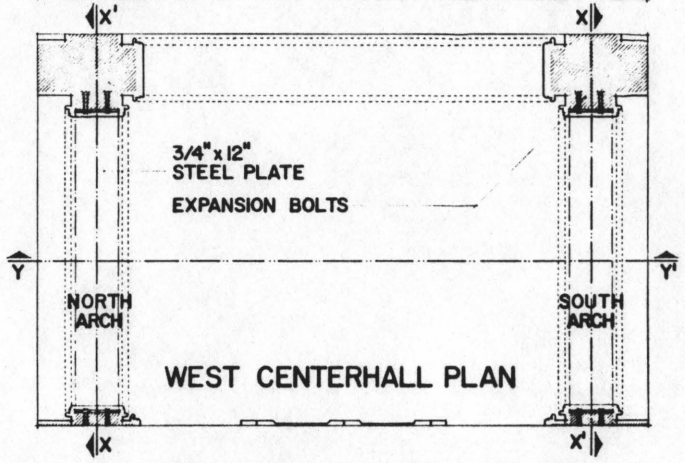
SECTION XX'



NORTH ARCH



SECTION YY'



WEST CENTERHALL PLAN

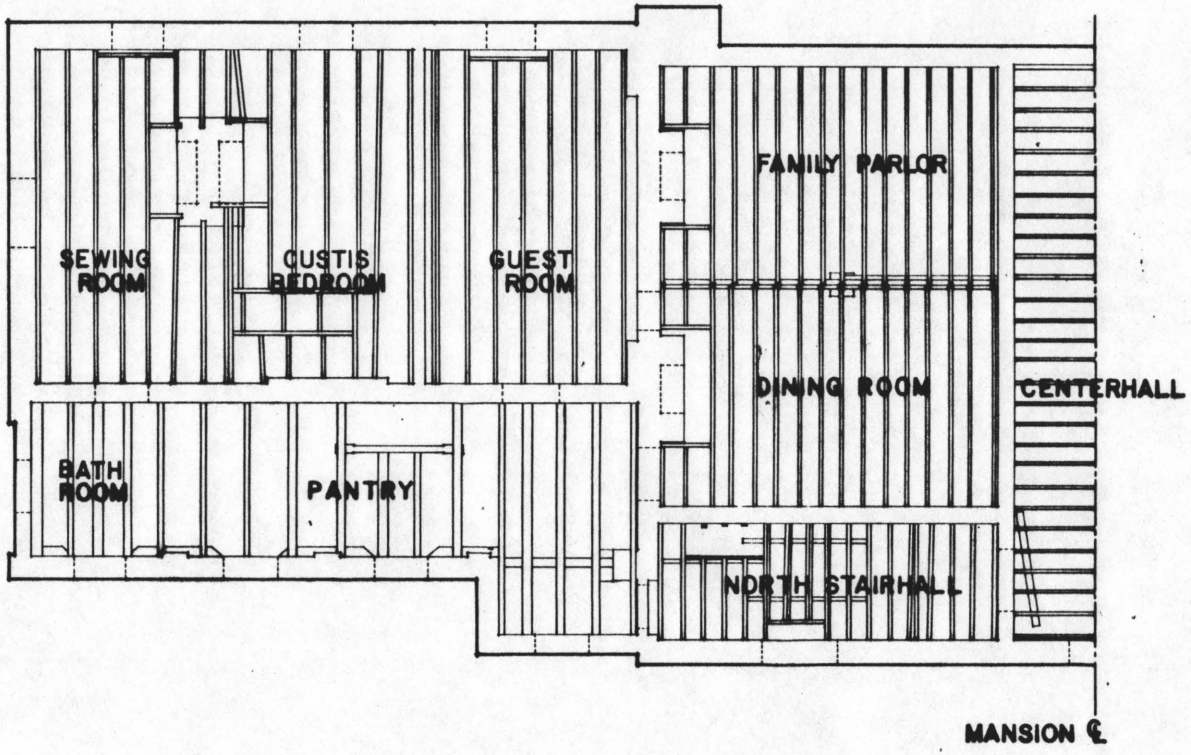
PROPOSED STABILIZATION / THE ARLINGTON HOUSE

CENTERHALL ARCHES

SCALE: 3/4" = 1'-0"

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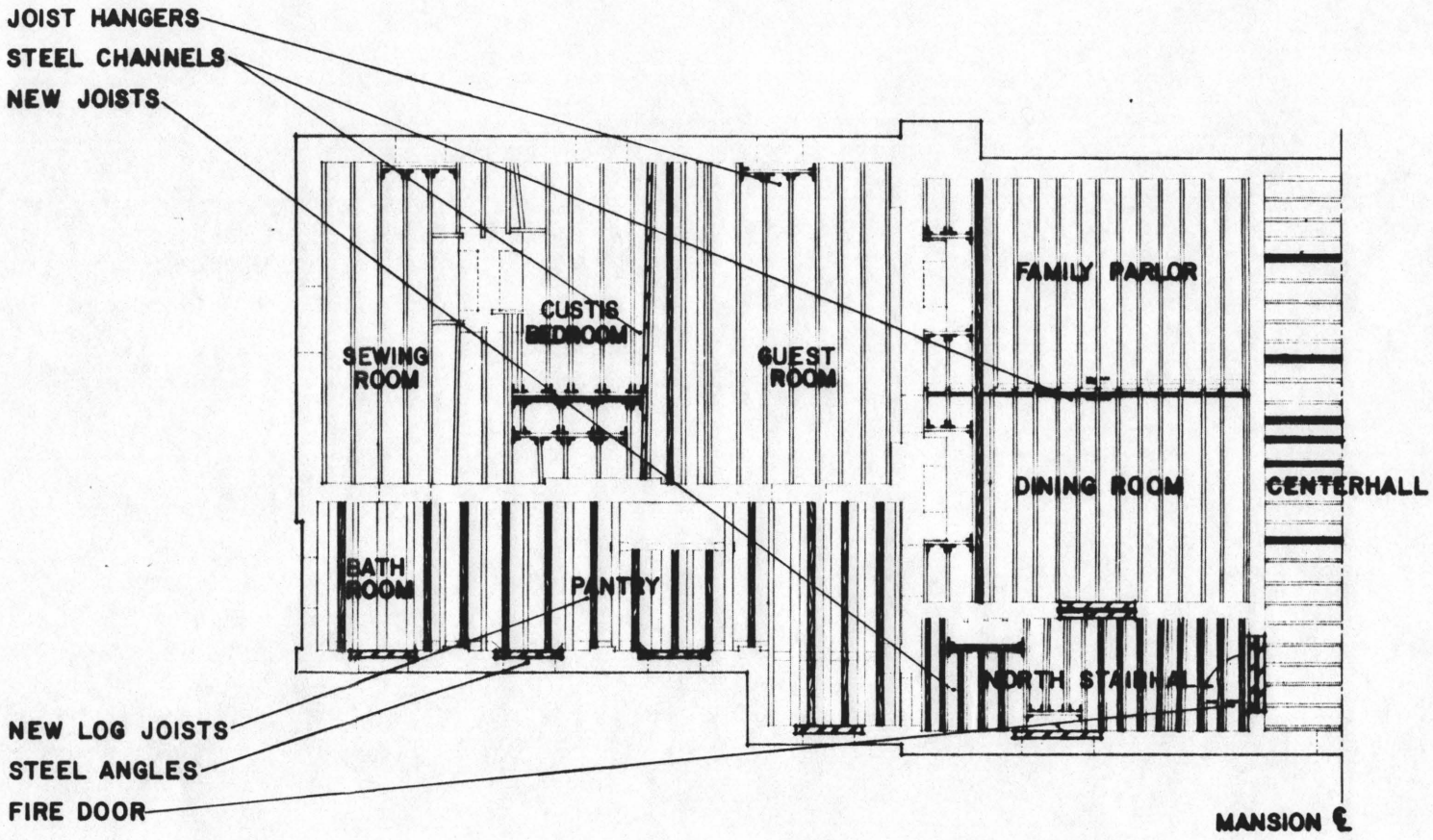
EXISTING CONDITIONS / THE ARLINGTON HOUSE

PLAN: FIRST FLOOR FRAMING (NORTH)

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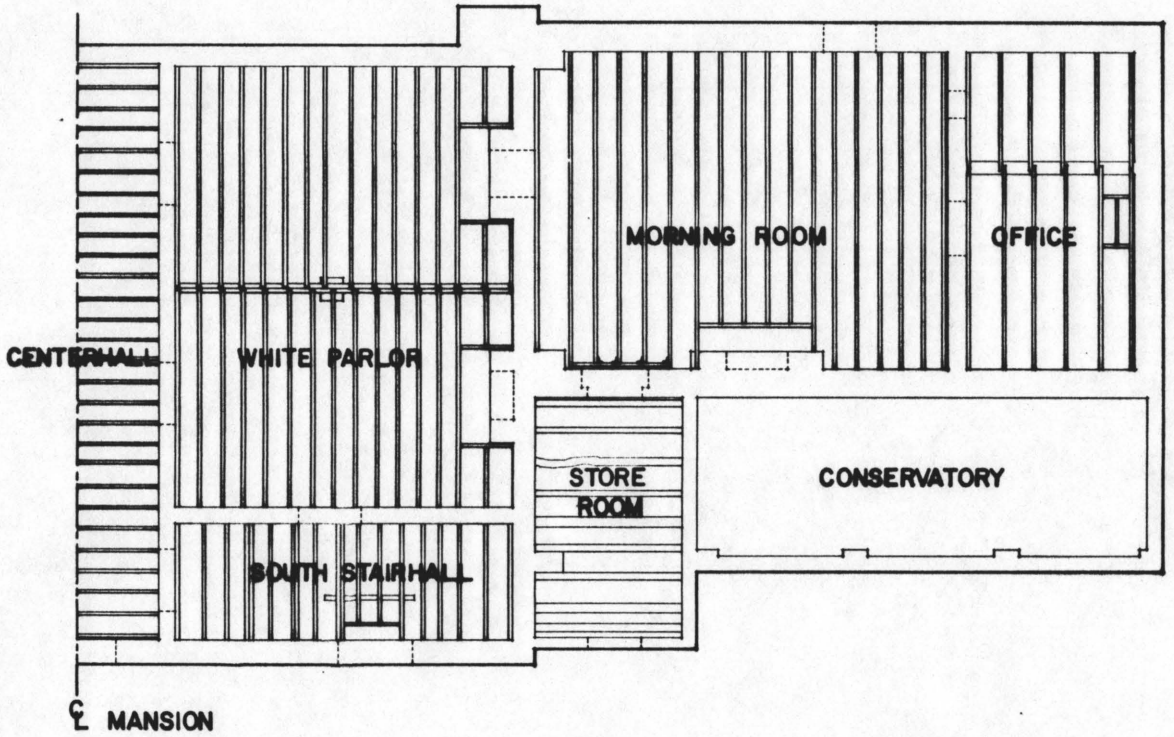
PROPOSED STABILIZATION / THE ARLINGTON HOUSE

PLAN: FIRST FLOOR FRAMING (NORTH)

SCALE: 1/8" = 1'-0"

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EXISTING CONDITIONS / THE ARLINGTON HOUSE

PLAN: FIRST FLOOR FRAMING (SOUTH)

SCALE: 1/8" = 1'-0"

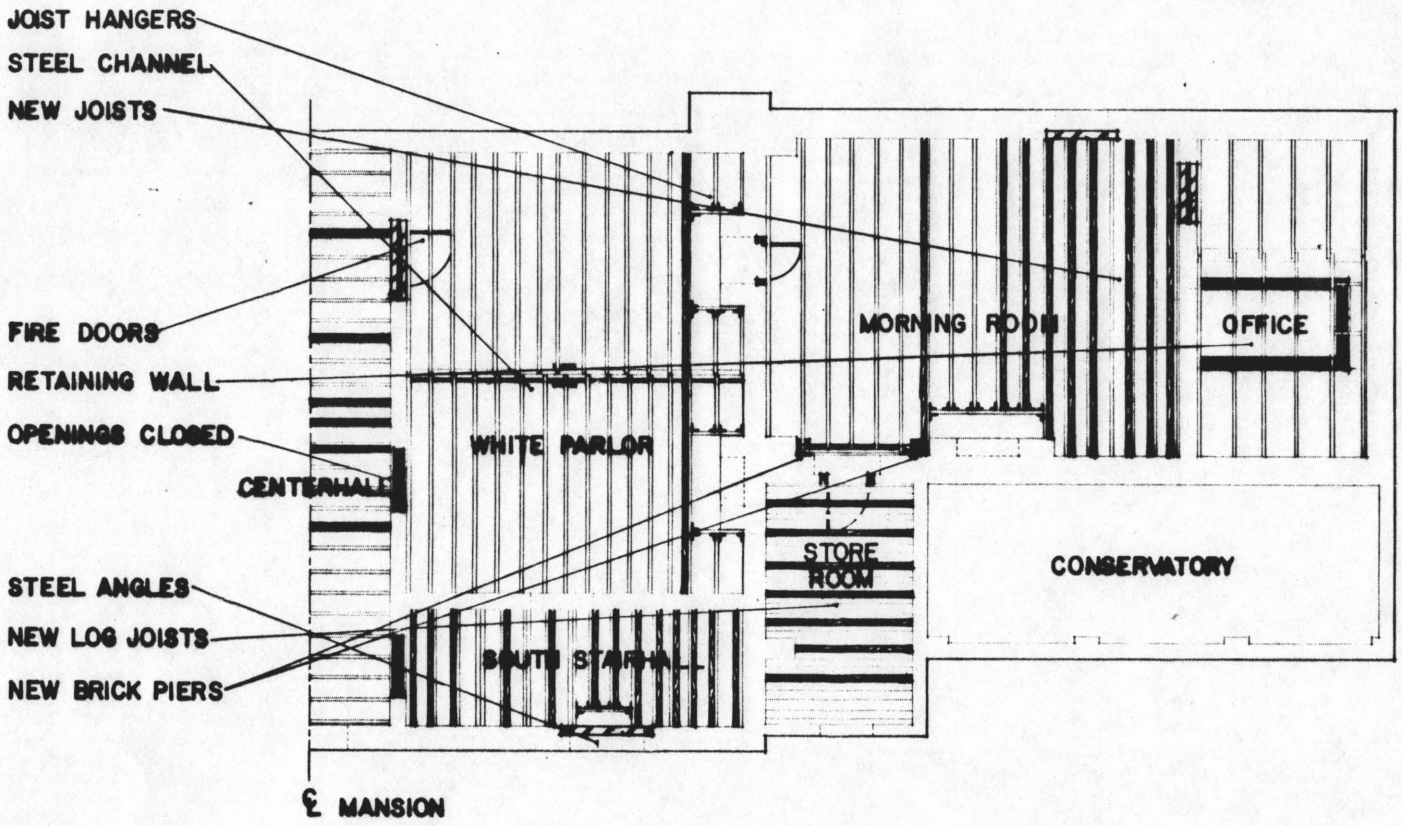
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PROPOSED STABILIZATION / THE ARLINGTON HOUSE

PLAN: FIRST FLOOR FRAMING (SOUTH)

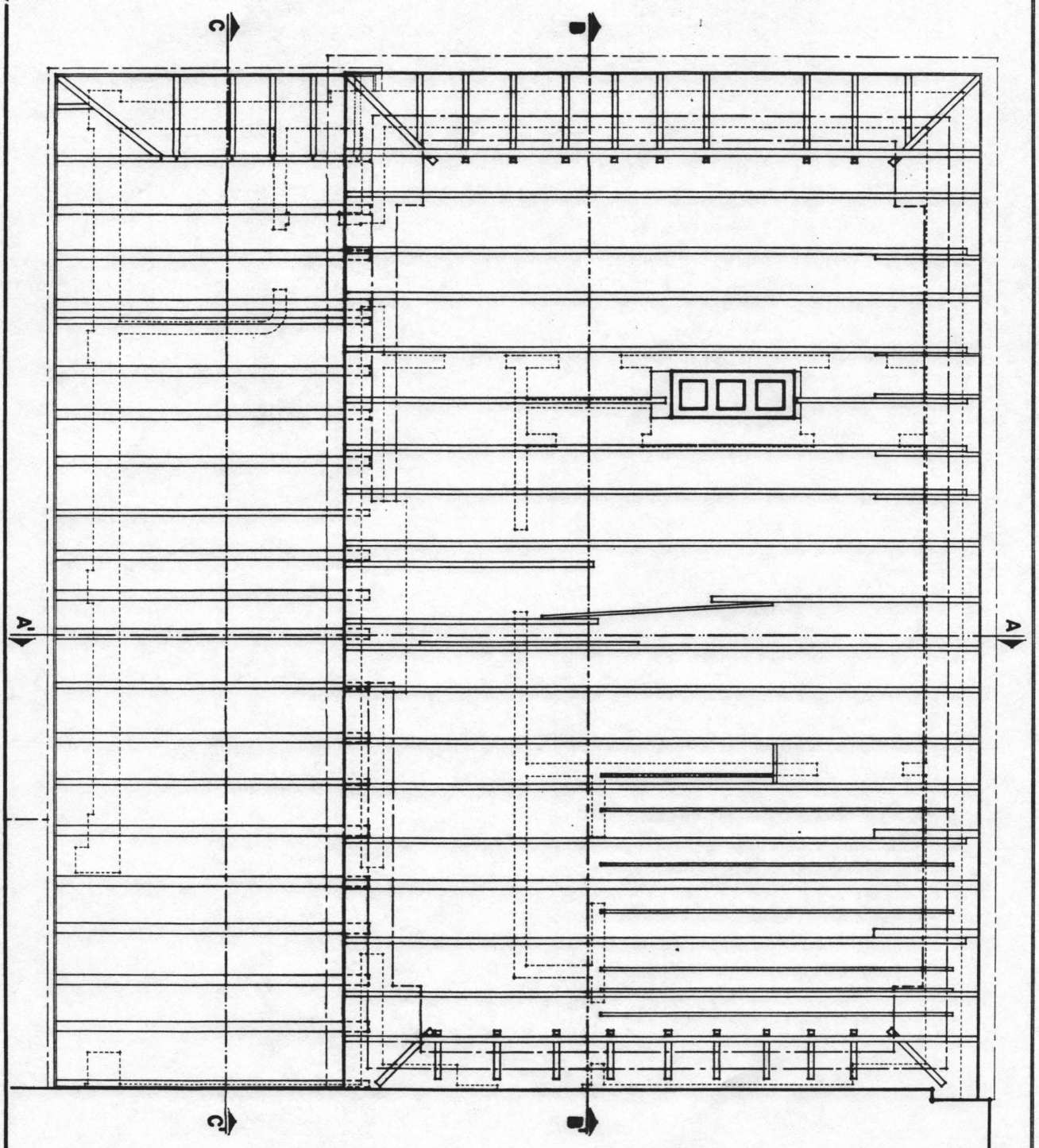
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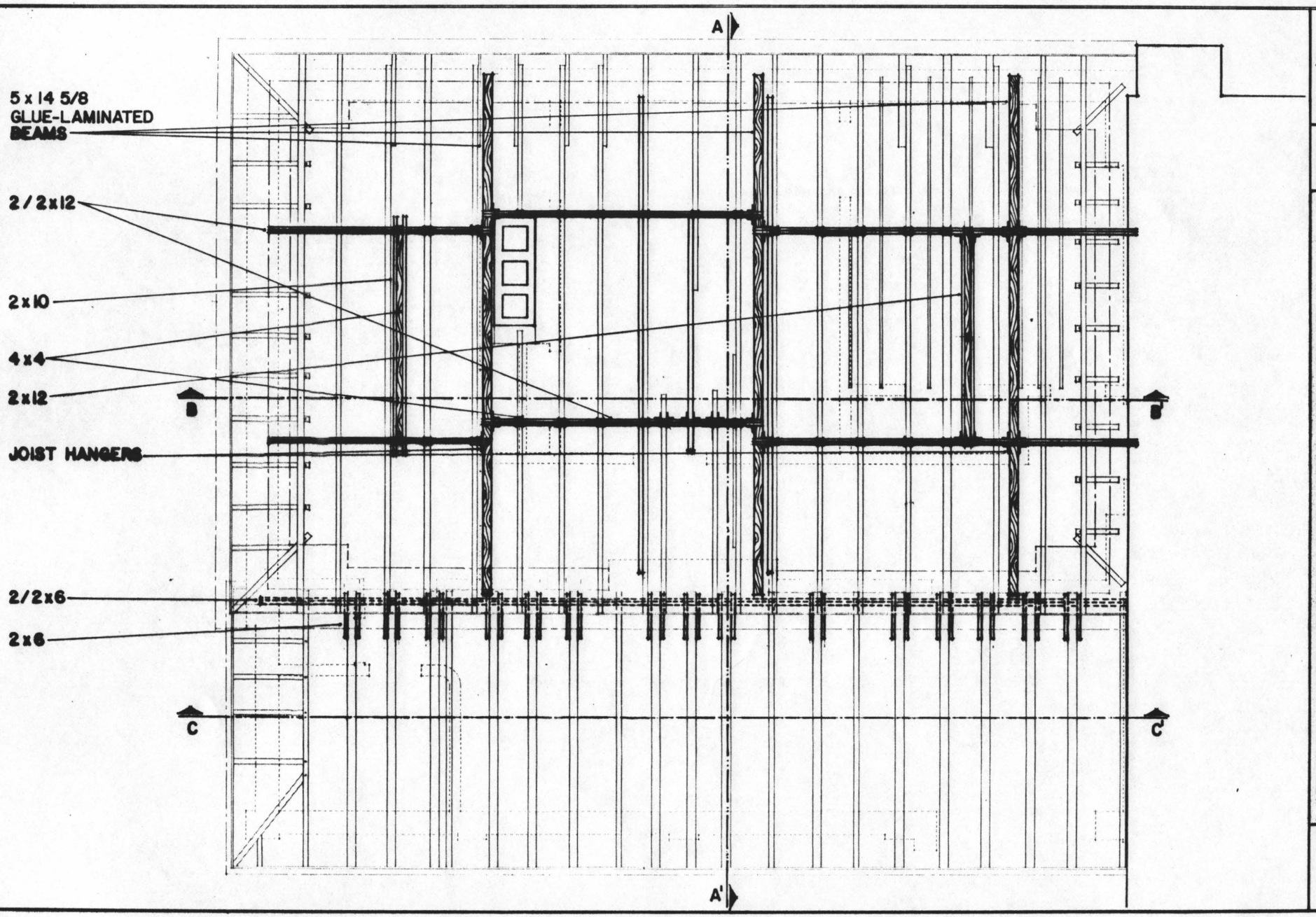
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EXISTING CONDITIONS / THE ARLINGTON HOUSE

PLAN: NORTH WING AND LOGGIA CEILING JOISTS

SCALE: 1/4" = 1'-0"

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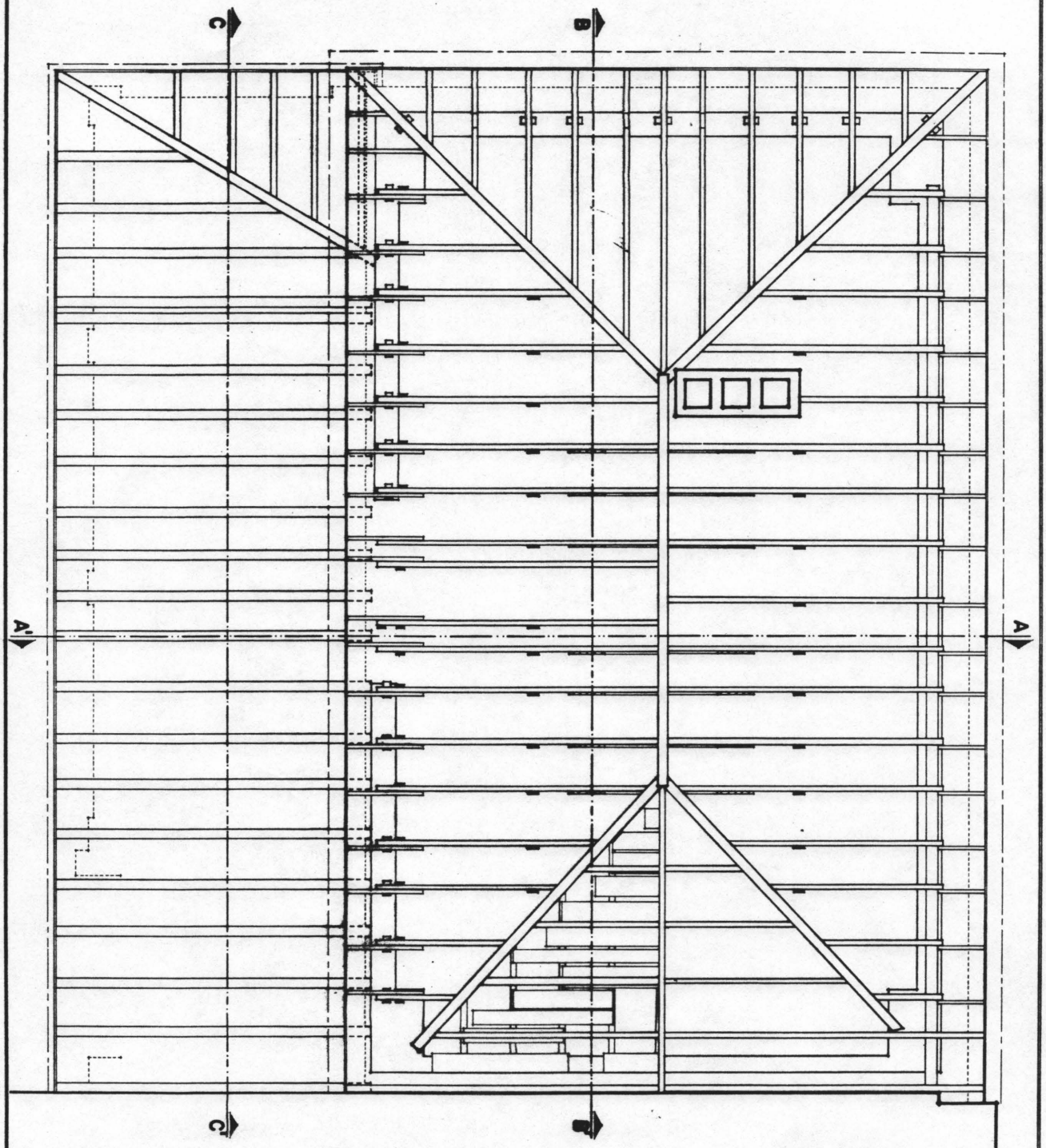
PROPOSED STABILIZATION / THE ARLINGTON HOUSE

PLAN: NORTH WING AND LOGGIA CEILING JOISTS

SCALE: 1/4" = 1'-0"

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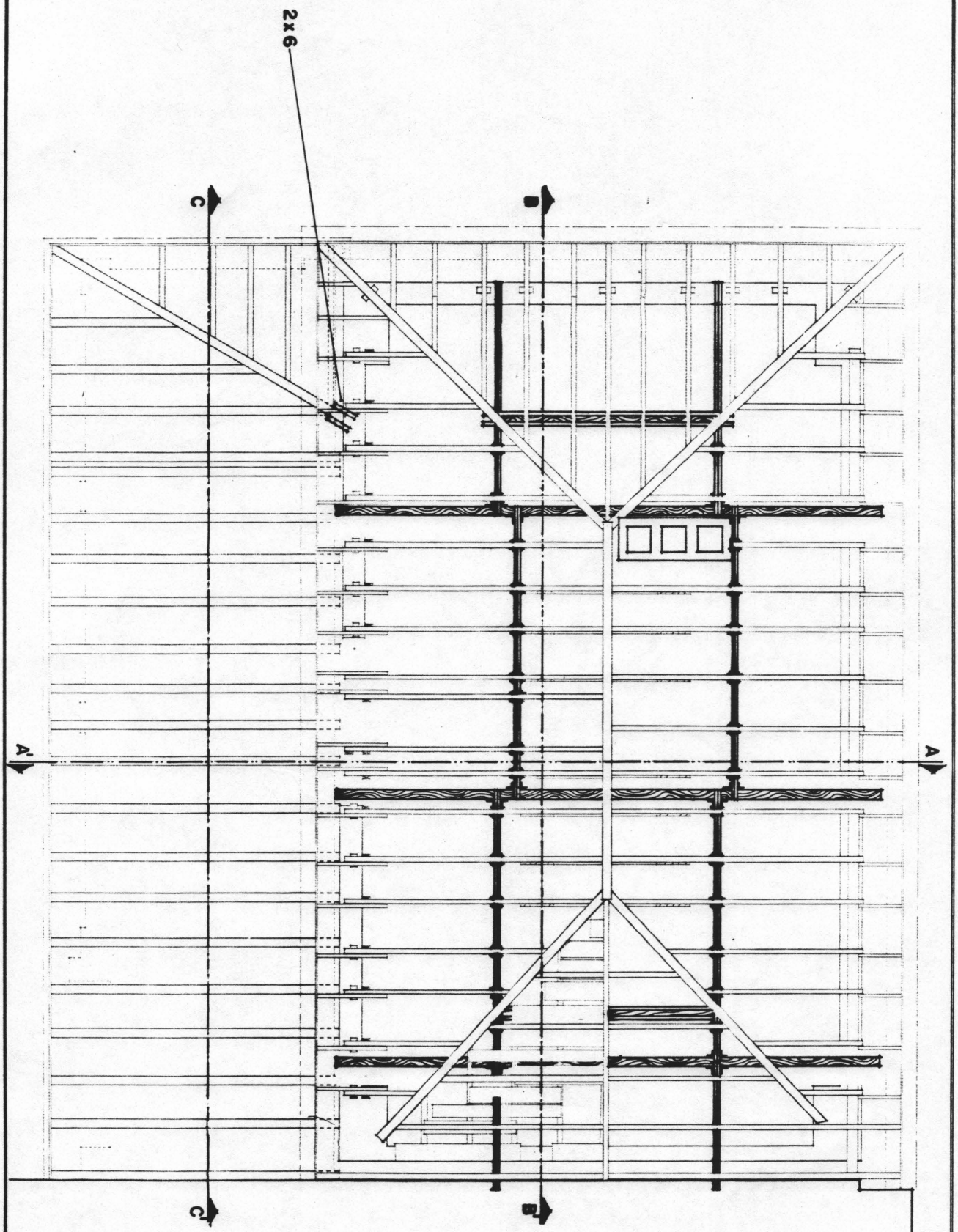
SHEET 7 OF 12

EXISTING CONDITIONS / THE ARLINGTON HOUSE

PLAN: NORTH WING AND LOGGIA RAFTERS

SCALE: 1/4" = 1'-0"

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METERS



PROPOSED STABILIZATION / THE ARLINGTON HOUSE

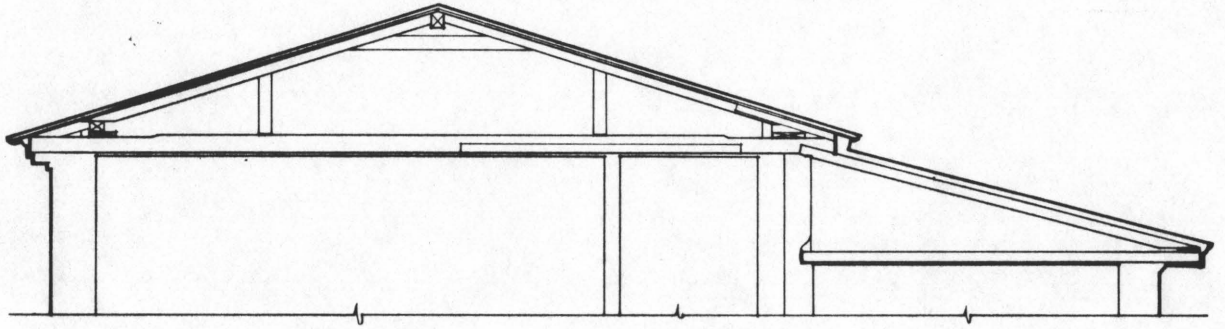
PLAN: NORTH WING AND LOGGIA RAFTERS

SCALE: 1/4" = 1'-0"

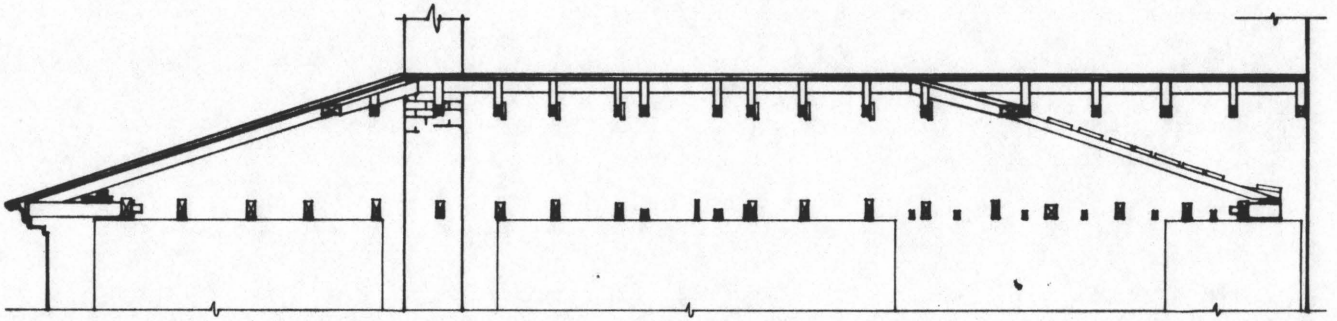
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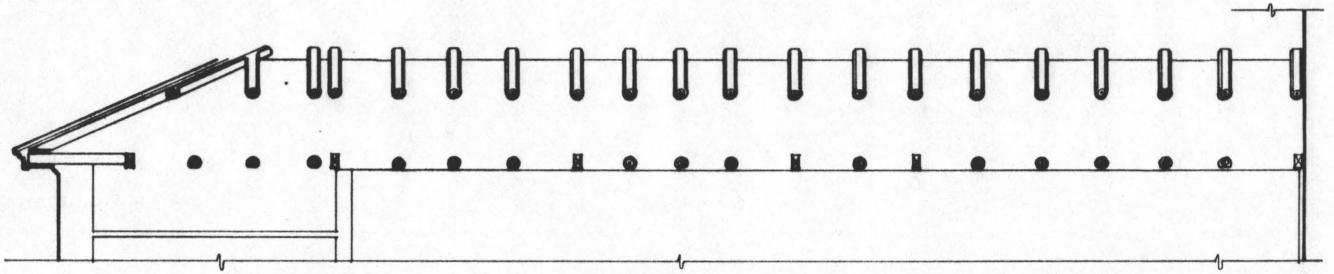
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SECTION BB'



SECTION CC'



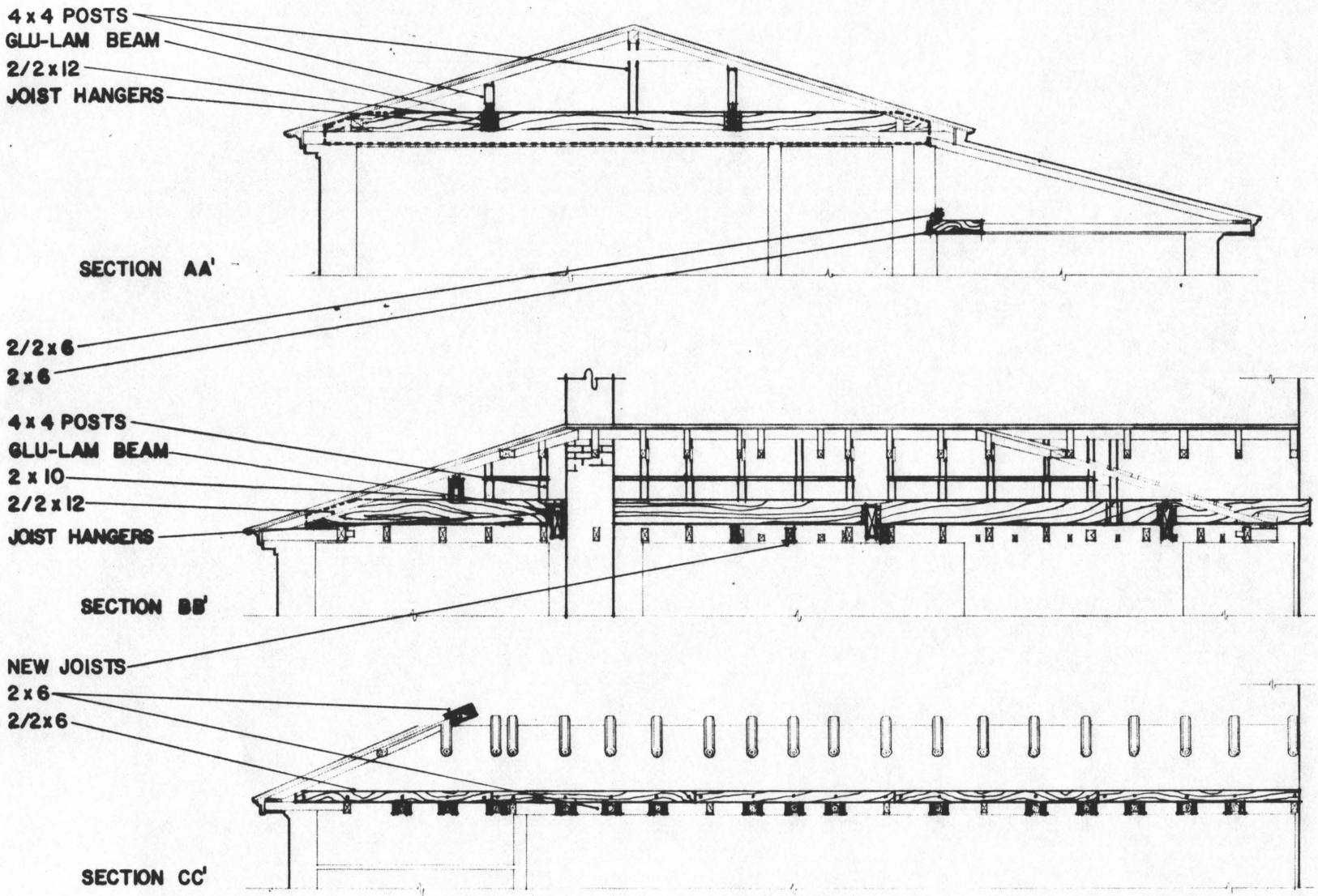
EXISTING CONDITIONS / THE ARLINGTON HOUSE

SECTIONS: NORTH WING AND LOGGIA ROOFS

SCALE: 1/4" = 1'-0"

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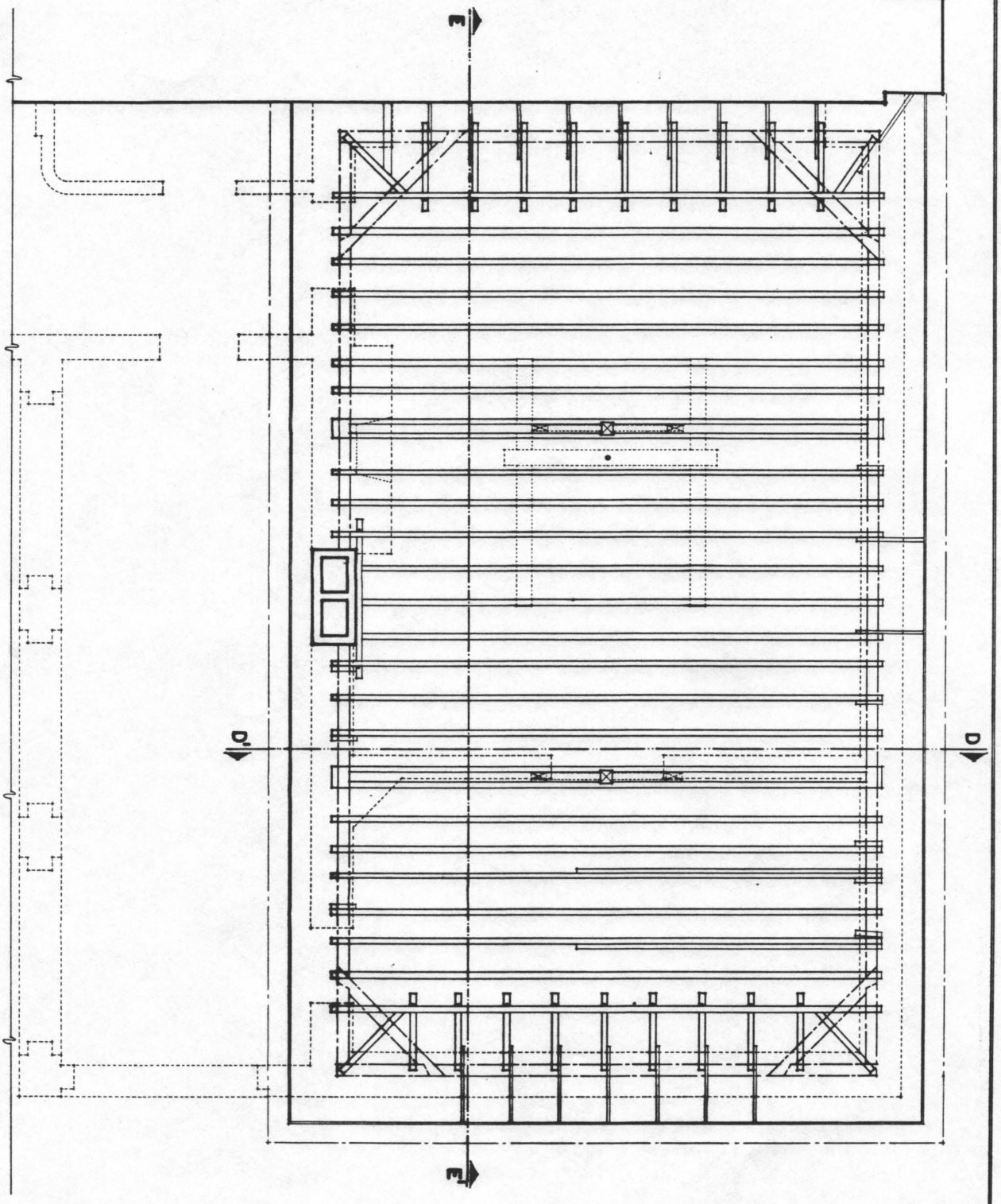
PROPOSED STABILIZATION / THE ARLINGTON HOUSE

SECTIONS: NORTH WING AND LOGGIA ROOFS

SCALE: 1/4" = 1'-0"

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EXISTING CONDITIONS / THE ARLINGTON HOUSE

PLAN: SOUTH WING CEILING JOISTS

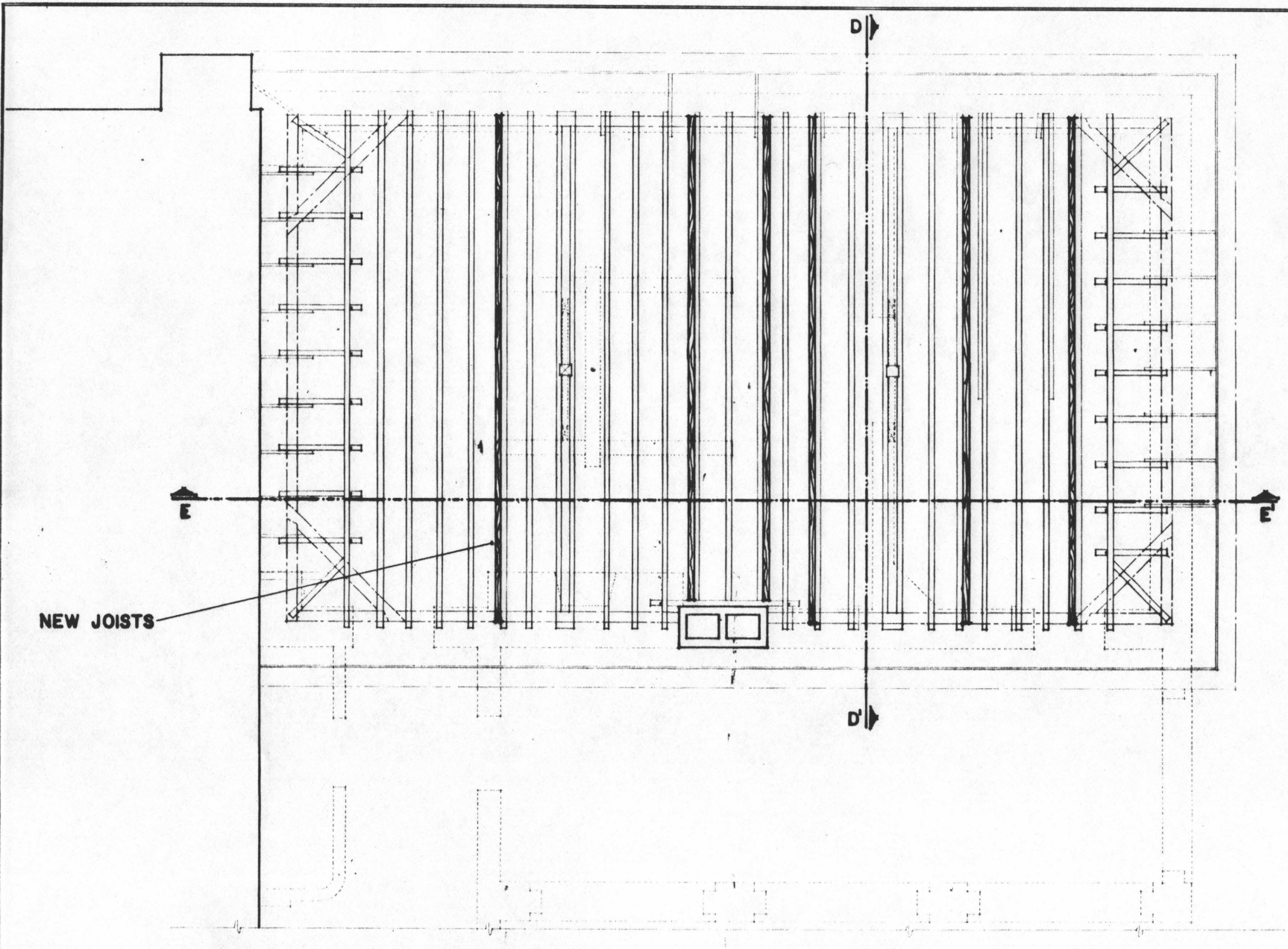
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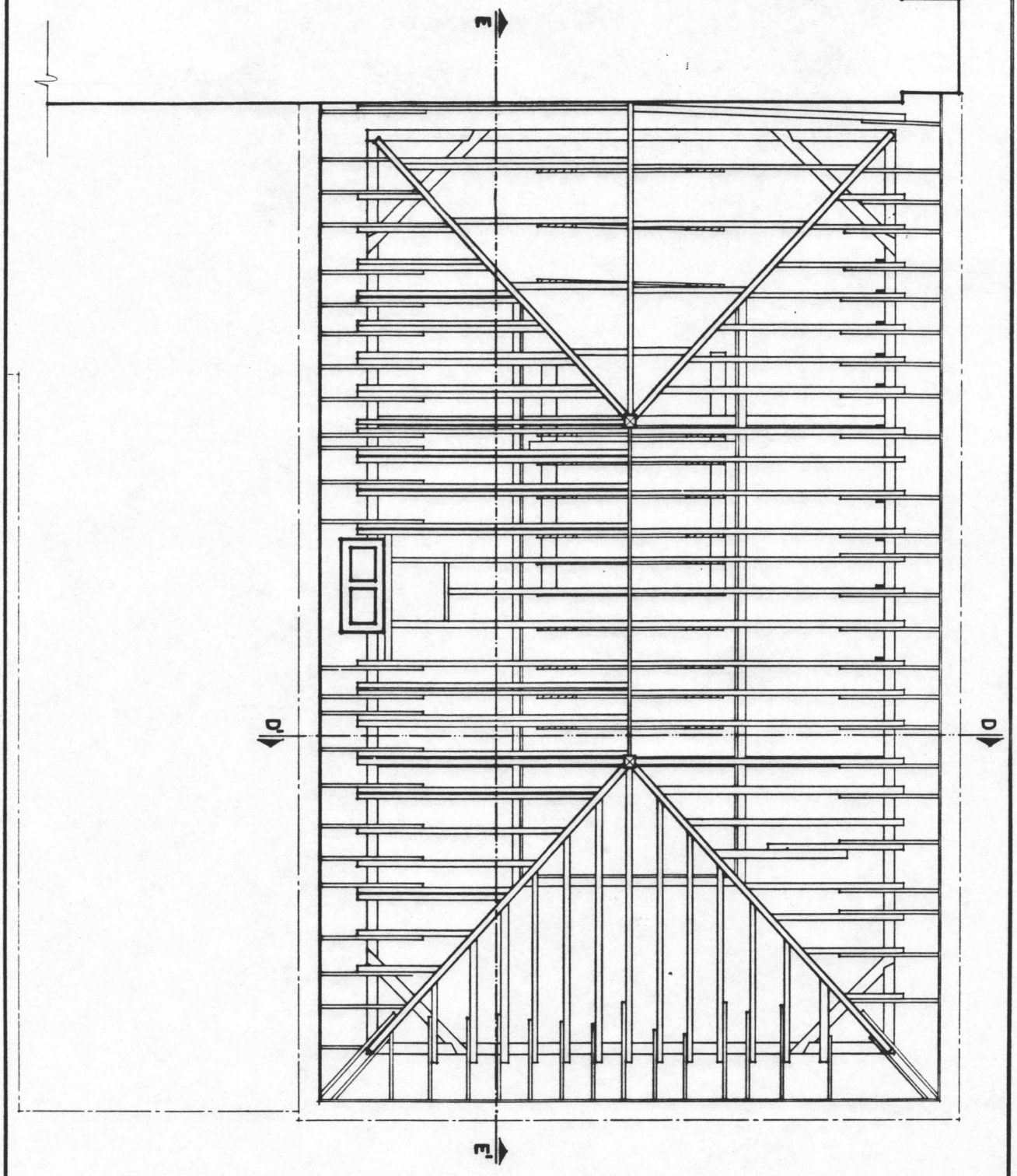
PROPOSED STABILIZATION / THE ARLINGTON HOUSE

PLAN: SOUTH WING CEILING JOISTS

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SCALE: 1/4" = 1'-0"

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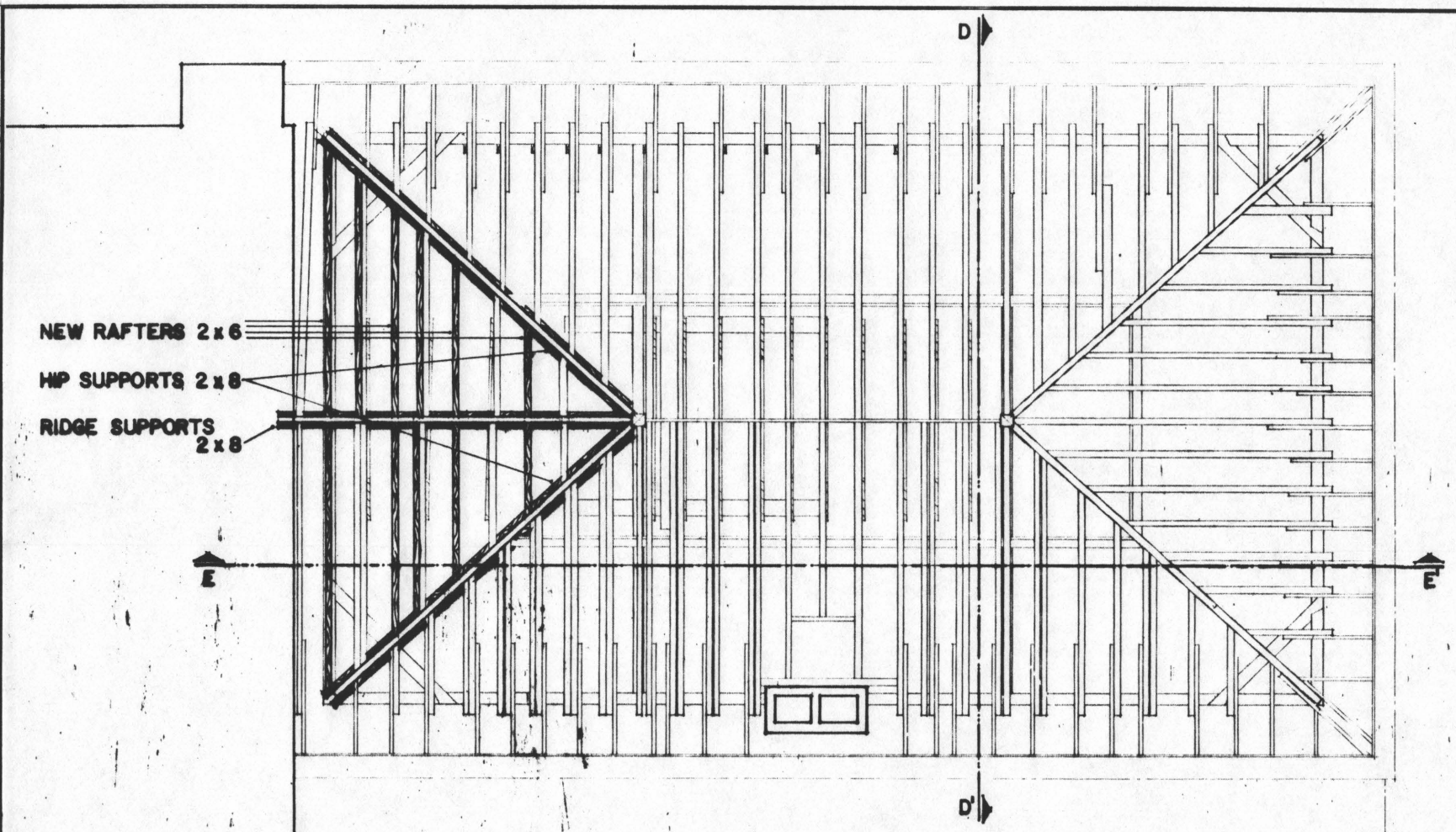
EXISTING CONDITIONS / THE ARLINGTON HOUSE

PLAN: SOUTH WING RAFTERS

SCALE: 1/4" = 1'-0"

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PROPOSED STABILIZATION / THE ARLINGTON HOUSE

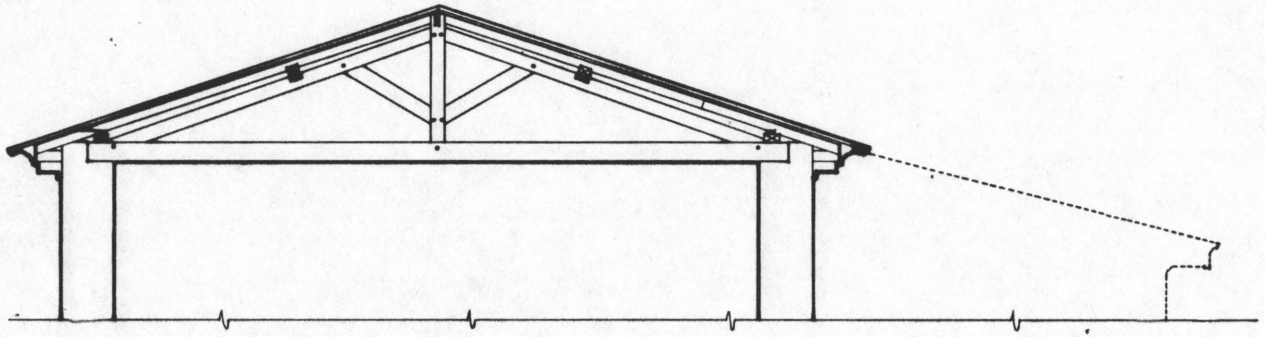
PLAN: SOUTH WING RAFTERS

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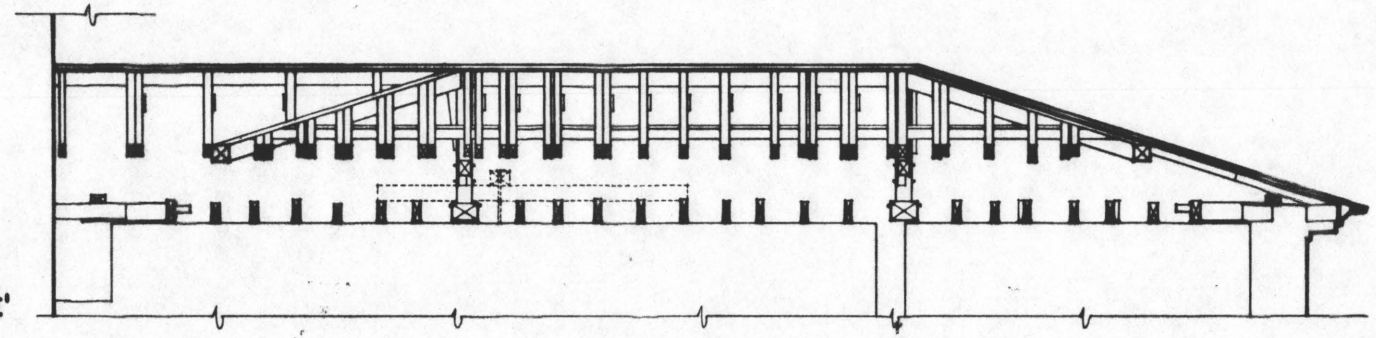
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SECTION DD'



SECTION EE'



EXISTING CONDITIONS / THE ARLINGTON HOUSE

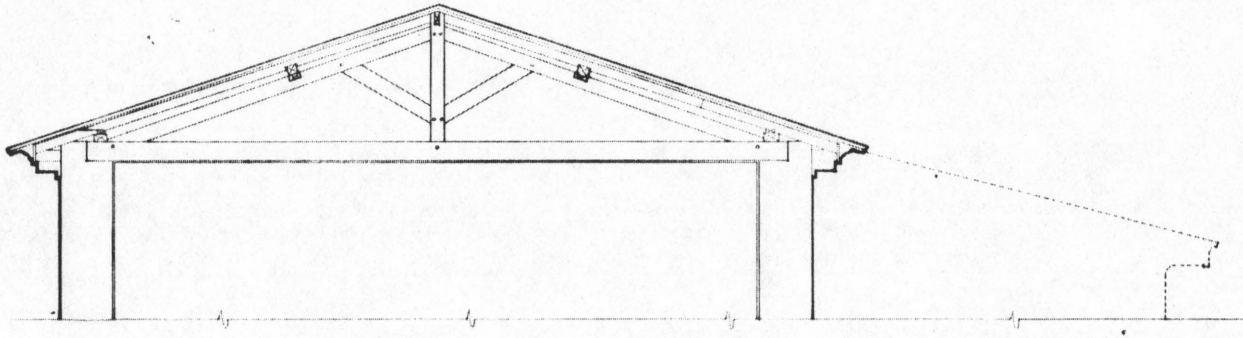
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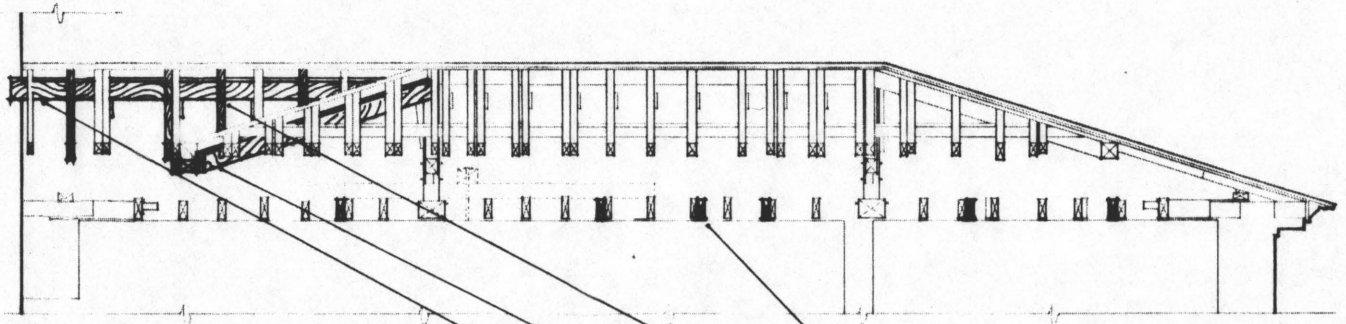
SCALE: 1/4" = 1'-0"

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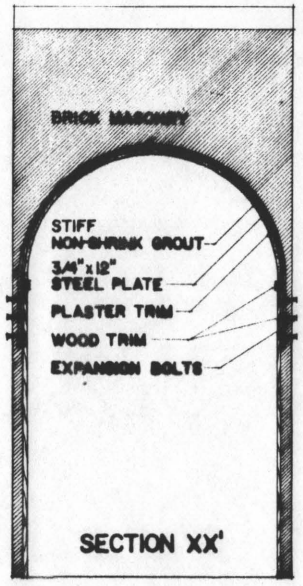
PROPOSED STABILIZATION / THE ARLINGTON HOUSE

SECTIONS: SOUTH WING ROOF

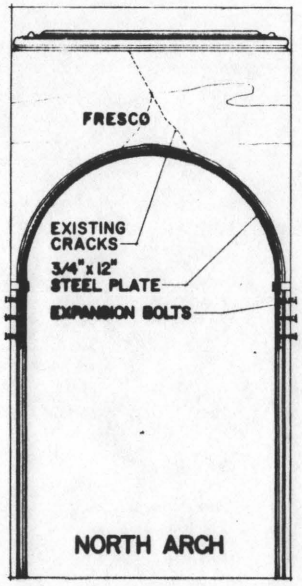
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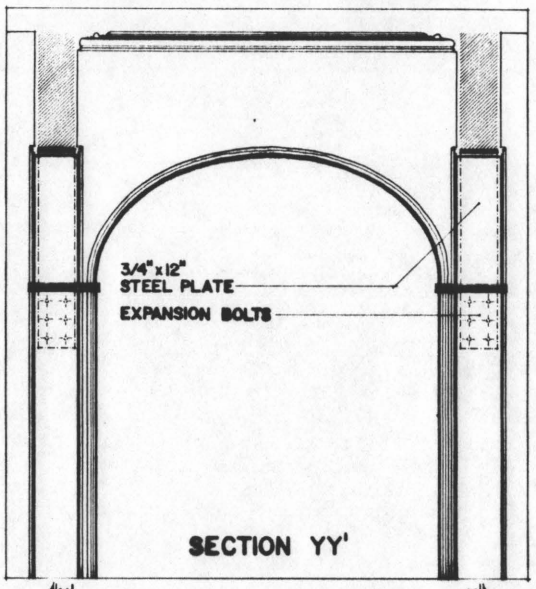
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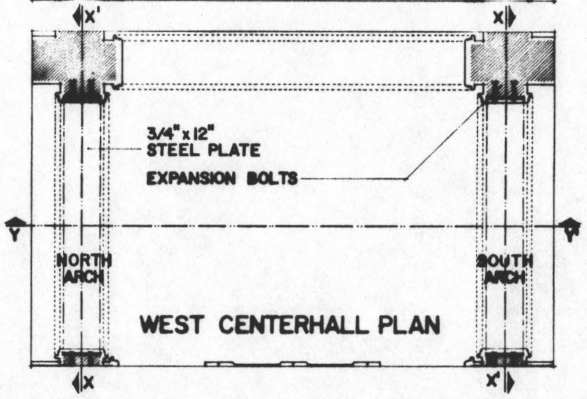
SECTION XX'



NORTH ARCH



SECTION YY'



WEST CENTERHALL PLAN



PROPOSED STABILIZATION / THE ARLINGTON HOUSE

CENTERHALL ARCHES

SCALE: 3/4" = 1'-0"

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As the nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, parks and recreation areas, and to ensure the wise use of all these resources. The department also has major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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