

CUSTIS-LEE MANSION STRUCTURE STUDY

Prepared by
A. W. Franzen, Architect
April 1971

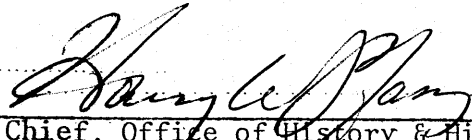
OFFICE OF HISTORY & HISTORIC ARCHITECTURE, ESC

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
WASHINGTON, D. C.

CUSTIS-LEE MANSION STRUCTURAL STUDY

A P P R O V A L S H E E T

Recommended



Chief, Office of History & Historic
Architecture, ESC

4/3/71

Date

Chief, Office of Archeology and
Historic Preservation, WASO

Date

Superintendent, George Washington
Memorial Parkway

Date

A P P R O V E D

General Superintendent, National Capital Parks

Date

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A meeting was held on March 10, 1971 at the Custis-Lee Mansion in which problems affecting the structure's stability were presented.¹ One having to do with water stains occurring at several locations within the Mansion at the exterior walls. The other being a concern over the loading capacity of the second floor structural system.

Observations by maintenance and interpretive personnel, over a period of time, indicated that the gutters and downspouts were inadequate for the roof areas they serve. This has permitted excessive amounts of water to soak into the exterior walls, particularly on the eastern facade of the structure.

Mr. Shelton had previously looked into this situation and his report and recommendations were utilized in working up material for this area of consideration. Although some of the data presented may differ from that submitted by Mr. Shelton, it is based on historical considerations and the premise that the Mansion be considered as a monumental structure in which more restrictive design factors are employed than in ordinary construction practice.

1. Those attending were Superintendent Taylor, Mr. Curran - Chief of Maintenance and Mr. Rubin and Mr. Shelton of his Division, Dr. Pfanz - Chief of the Division of History and Historic Architecture - ESC, Exhibit Specialists Harry Martin and James Askins, Architect Franzen, Curators Angas Mullins and Ann Fuqua, Mr. Pridemore - Chief of U & EA, and Mr. Bell, Site Supervisor.

Nine photographs of the structure, taken during the Civil War and shortly thereafter, were employed in determining the location, direction and sizes of the period gutters and downspouts.² While gutters and downspouts recommended may be slightly larger than indicated in the period photographs, it is highly doubtful that the difference will be perceived due to the scale of the structure. In the interest of providing positive and controlled drainage from the roof areas it was felt that [this was felt that] this was a necessary liberty to take.

Dr. Nelligan's comprehensive report on the structure was freely consulted and reference therein was noted in which the shingle roof over the central portion of the mansion had been replaced with slate some years after the war.³ However a reference has been found regarding the roof coverings used in 1859 in which the earlier north and south wings were covered with gravel and the central section with slate.^{3-A}

Inasmuch as any replacement of the existing gutters should be secured in a substantial manner and properly pitched, due consideration

2. Loaned for study through the courtesy of Mrs. Fuqua.

3. Nelligan, Murray H., "Old Arlington - The Story of the Lee Mansion National Memorial", dated April 12, 1953, p. 678.

3-A. See copy of insurance application dated October 17, 1859 appended

should be given to replacing the existing slate roofing with either shingles of the restoration period or with a material closely simulating the same. The gutter hanger's fastening leg would necessarily run up under the roofing.

The slope of the roof over the main or central portion poses no problem in waterproofing (the slope is $5\frac{1}{2}$ " in 12"). However, the roofs of the north and south wings are flatter (their slopes are 4" in 12" over the higher portions and $3\frac{1}{2}$ " in 12" over the lower and westerly slopes). This will make it difficult to weatherproof.⁴ As previously noted the wings covered with gravel. The nature of the historic sub-strate under the gravel is not known but some type of tar must have been available to make the gravel stay in place.

Wooden snow boards were used near the eaves of the central or main roof as seen on several of the period photographs and should be restored. Apparently snow boards were not employed on the roofs of the wings due to their flatter slopes. As closely as can be determined, the supporting brackets or angles for the snow boards were spaced approximately five feet apart.

Lead coated copper of appropriate weight and thickness should be used for all flashing, crickets at chimneys, gutters and downspouts. It is difficult to arrive at an exact length for the sections making up the gutters since the joints are too easily confused with stains showing on the gutters but it appears from careful study that they were possibly no longer than three or four feet. Screening over the

4. Photograph from Park file #19.4-38 entitled Arlington House. Original taken June 28, 1864 and designated BA-1502 at National Archives. Presumably taken by Mathew Brady or one of his assistants.

gutters of copper similar to the galvanized mesh now employed would help prevent clogging of the gutters and downspouts. Although the original downspouts were attached directly to the gutters it would be desirable to use gutter outlets as delineated in the supporting sketches to insure efficient emptying of the gutters. A factor in sizing the downspouts was to keep the transition of the gutter outlets small and non-intrusive to all but the most critical viewer.

The sunlight in the period photographs washes out most of the evidence necessary to determine how many sections made up the various lengths of downspouts but it is presumed that their lengths would approximate those of the gutters. Simple straps apparently affixed them to the vertical wall surfaces.

Catch basins, although not a part of the original system (downspouts spilled out above grade level through an elbow) should be used and made deeper than the elevation at which the downspouts discharge therein, in order to trap debris at the bottom and large enough in diameter to provide access for cleaning out and for flushing the system if necessary. Flow from the catch basins should be directed through underground cast iron pipe by the shortest route to the most appropriate point of discharge with due consideration given to the plant material around the Mansion.

The chimneys, during the period of restoration, were not par-getted like the structure's walls (excepting the central portion of

the west facade) and should be cleaned down to the brick surface and treated with silicone or similar preservative before a new roof covering is installed.

Appended are elevations and a roof plan showing the proposed gutter and downspout arrangement, a schedule of gutter and downspout sizes, and a sketch of the proposed gutter outlets to the downspouts.

A comprehensive structural analysis of the structure was not possible at this time as only a limited probing of the fabric could be undertaken without making it necessary to follow up with extensive time consuming and costly patching of the areas that would have to be opened or exposed for inspection. Other factors deterring a more detailed search for data were the heavy visitation throughout most of the year and the logistics of moving, storing and protecting the valuable furnishings on display.

However a limited number of floor boards at the second floor level were lifted to determine the sizes, spacing and species of the underlying floor joists. A floor plan is appended to indicate the areas inspected. Mr. Harry Martin supervised the probe and recorded the findings.

At the points inspected it was found that the joists were yellow heart pine with eleven to sixteen annular rings per inch. The joists measured 3" to 3 $\frac{1}{4}$ " in width and 9-5/8" to 10-1/8" in depth. Their average spacing measured sixteen inches on center.

Of 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 subjected to.

A beam running north and south under the partition separating Rooms (207) (206) #19 and #20 measures a strong 10" by 10". The floor joists frame into this member from both sides, each joist having two tenons two inches high spaced approximately one inch down from the top and one inch up from the bottom.

Two sets of plates $\frac{1}{2}$ " thick by 3" wide and roughly fourteen inches long occur at the center of the beam span and are placed transversely so as to overhang the beam two inches on either side. These are bolted together along each side of the beam by $\frac{3}{8}$ " round vertically placed bolts. The threading on the bolt end is machine fabricated. One nut was noted as missing. Since it is not feasible at this time to remove plaster it can only be assumed that this arrangement was added to support the chandelier that hangs from the ceiling of the room below.

$\frac{3}{8}$ " by $3\frac{1}{4}$ " steel straps encompassing the beam occur two feet to each side of the center of the beam span. Another strap of the same size was found two feet beyond to the north of the straps at mid-span. There may be additional straps that could not be detected through the small area that was opened.

Referring to Mr. Leisenring's report to the Quartermaster General, it is known that "a truss was constructed within the partition"⁵ to correct a sag in the floor. It is more than likely that these straps were used to tie the beam to the truss. In any event visitors are not permitted past the barriers placed at the doors to the rooms so no unusual loading is anticipated beyond the carrying capacity of the joists.

While inspecting the basement area of the Mansion it was noted that brick on the inside of the exterior walls showed powdering in a number of spots. Upon inquiry it was found that these walls have not been waterproofed below grade on the exterior. This should be done by excavating to their bases, cleaning the joints and painting them. They should then be surfaced with a cement coating. The cement coating should then be primed and coats of asphalt applied with an asphalt impregnated membrane buried between coats for reinforcement.

5. Leisenring, L. M., "Arlington Mansion and its Restoration, Arlington National Cemetery, Fort Myer, Virginia", undated but presumed c. 1931, p. 3.

Sources of Information Consulted

Nelligan, Murray H., Old Arlington: The Story of the Lee Mansion National Memorial. National Capital Parks., April 12, 1953.

McCormick, Charles H., Custis-Lee Mansion Furnishings Study. Division of History, Office of Archeology and Historic Preservation., July 20, 1968.

McCormick, Charles H., Custis-Lee Mansion, Historical Data for Grounds. Division of History, Office of Archeology and Historic Preservation., June 1, 1968.

Staff of National Capital Region and National Capital Office of Design and Construction., Exterior Repainting of the Custis-Lee Mansion., Approved July 30, 1965.

Above provided for study through the courtesy of Henry A. Judd.

Photographs

Photocopies of five photographs taken by F. H. Bell in 1867. Originals in Library of Congress, Lot No. 4149.

Photocopies of two photographs taken by Mathew Brady or an assistant in June of 1964. Originals in the National Archives, No. 19.4-38.

An additional Photocopy similar to above item.

Photocopy of photograph of the rear of the Mansion taken June 28, 1864. No additional information.

Photocopy of photograph of the East Portico taken presumably between 1864 and 1867. Custis-Lee Mansion Collections, No. 393 2377.

Drawings

Prints of approximately 100 drawings covering details, working drawings, mechanical plans etc., for Mansion plus several site plans.

Above provided for study through the courtesy of Mrs. Ann Fuqua.

Eighteen sheet of HABS drawings

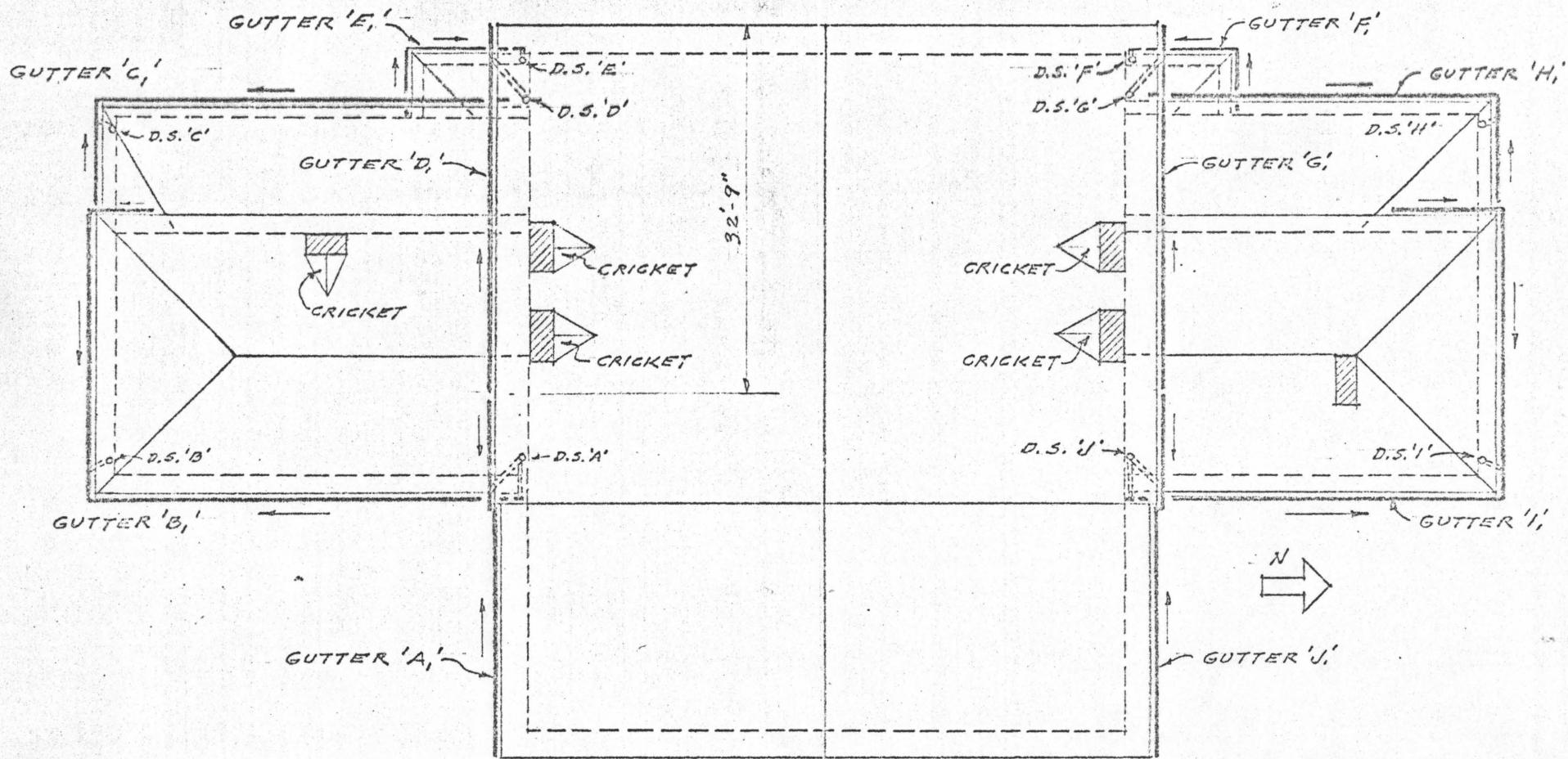
Above provided through the courtesy of Mr. Denys P. Myers.

Memo from Sheetmetal Foreman George Shelton to Chief, Division of Maintenance, G.W.M.P.

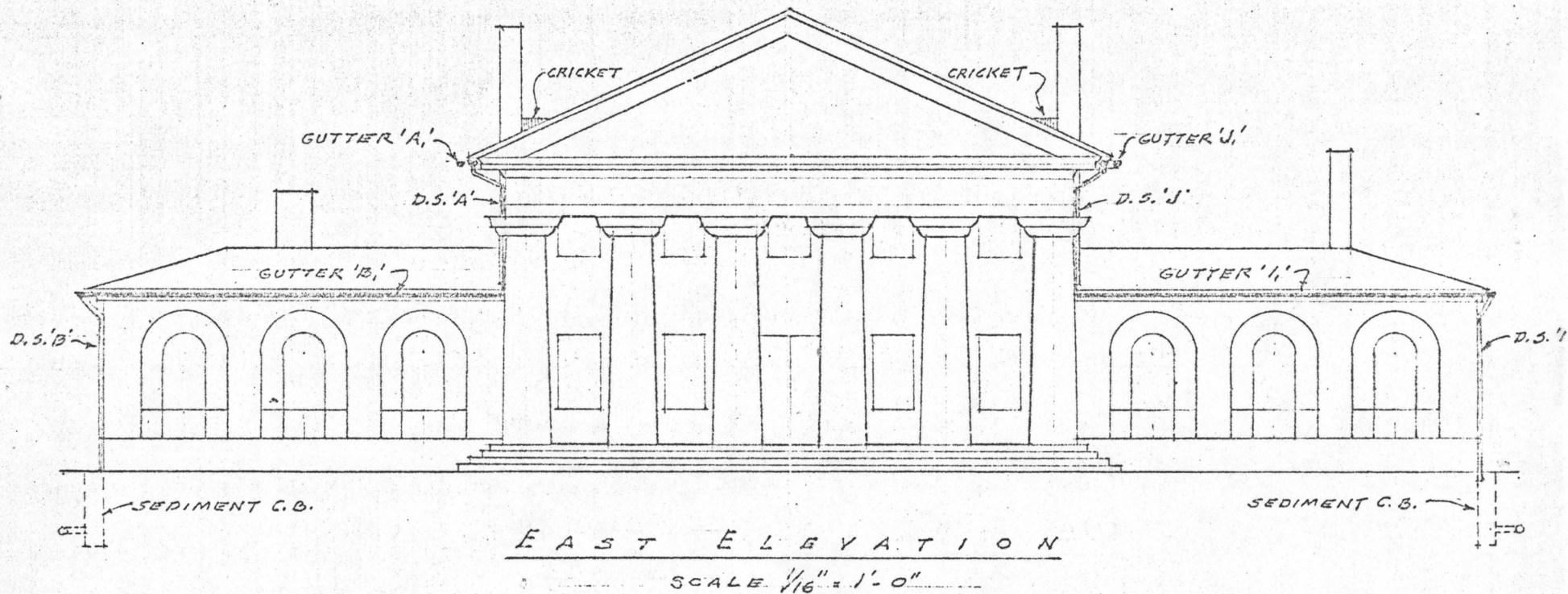
Zeroxed copy of L.M. Leisenring's report to Quartermaster General Titled Arlington Mansion and Its Restoration. c. 1931.

Application by Robert E. Lee to Hartford Fire Insurance Company dated October 17, 1859, for insurance to cover his "mansion house" at Arlington Virginia.

APPENDICES

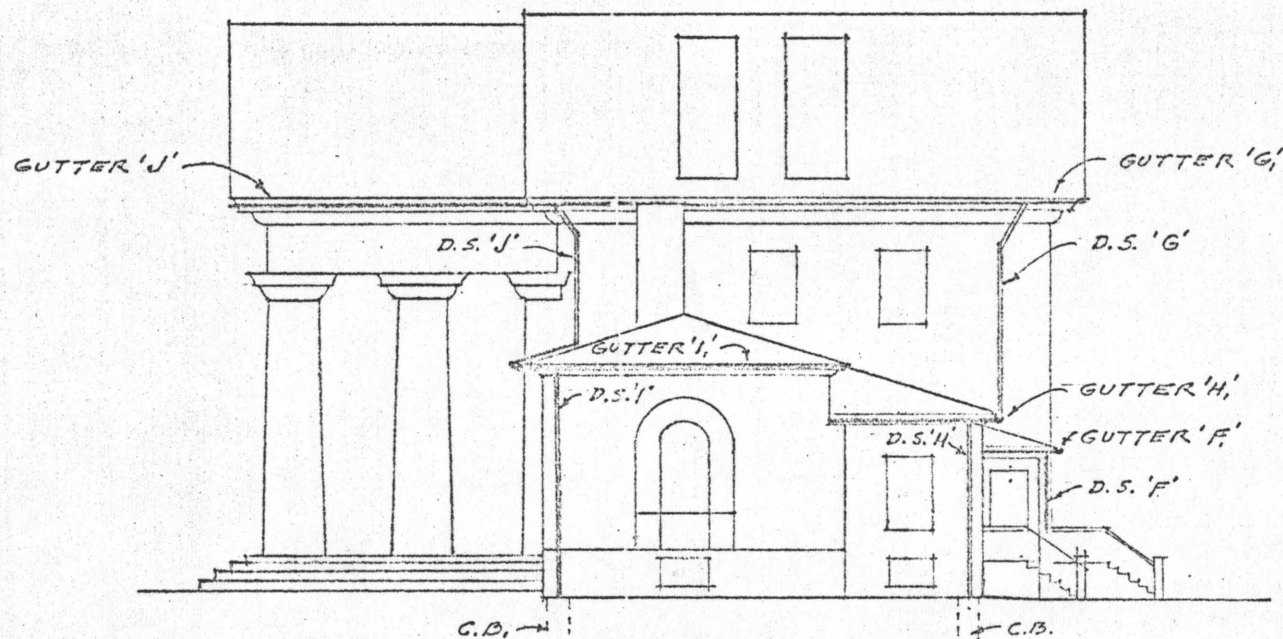


ROOF PLAN
SCALE $\frac{1}{16}" = 1'-0"$



CUSTIS-LEE MANSION

4/30/71

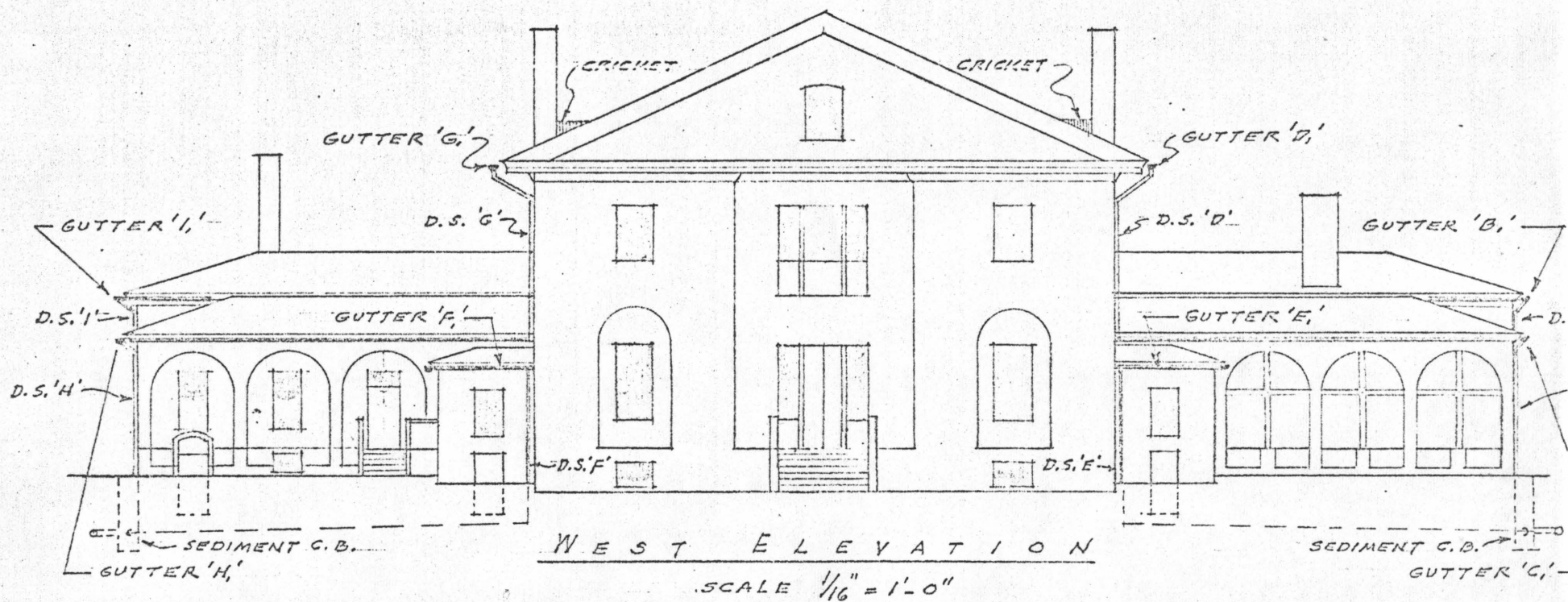


N O R T H E L E V A T I O N

SCALE $\frac{1}{16}'' = 1'-0''$

- CUSTIS - LEE MANSION

4/30/71



CUSTIS-LEE MANSION

4/30/76



S O U T H E L E V A T I O N

SCALE $\frac{1}{16}" = 1'-0"$

CUSTIS - LEE MANSION

4/30/71

SCHEDULE OF GUTTER AND DOWNSPOUT SIZES

Gutters

A₁ = 10"

B₁ = 10"

C₁ = 8"

D₁ = 10"

E₁ = 4"

F₁ = 4"

G₁ = 10"

H₁ = 8"

I₁ = 10"

J₁ = 10"

Downspouts

A = 6"

B = 6"

C = 6"

D = 6"

E = 3"

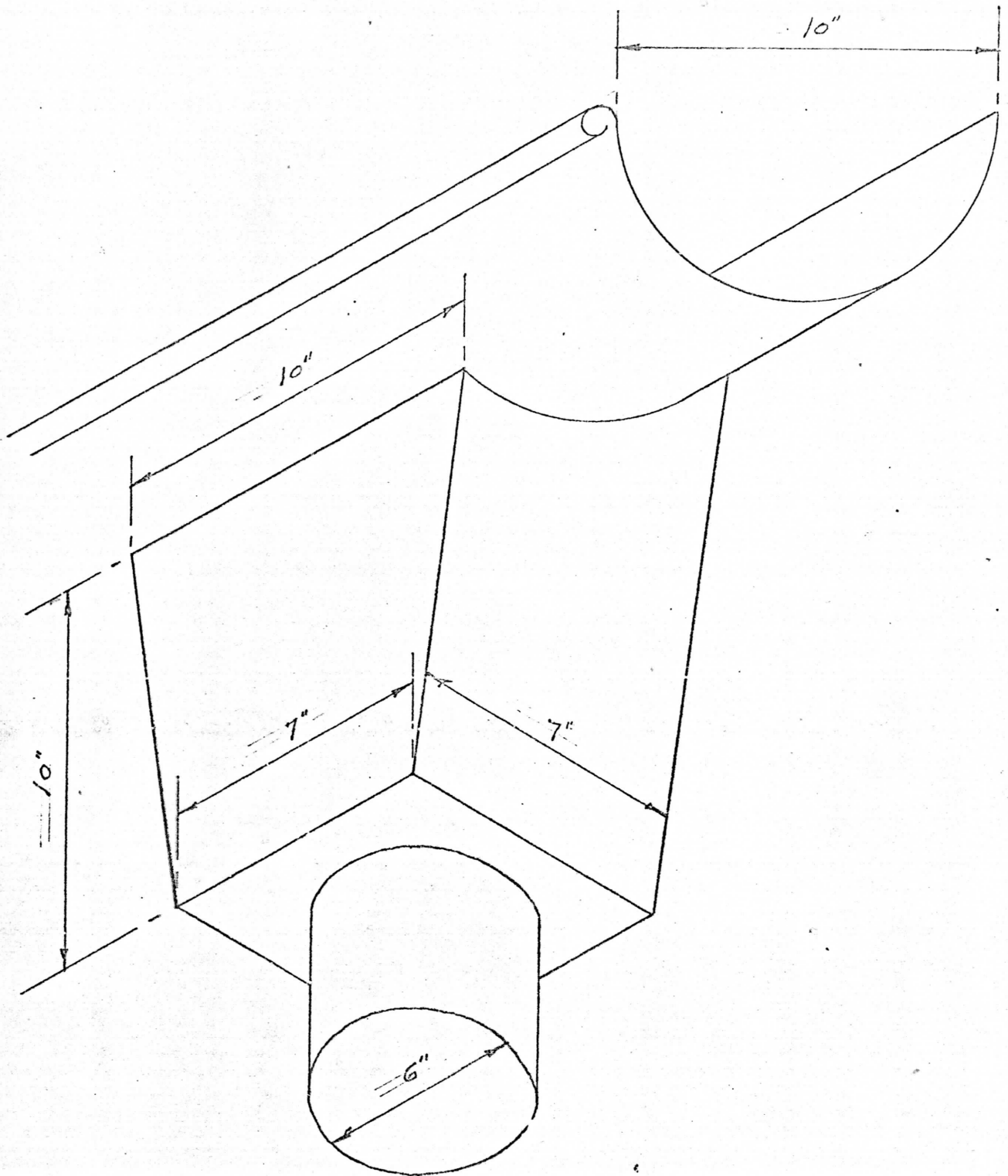
F = 3"

G = 6"

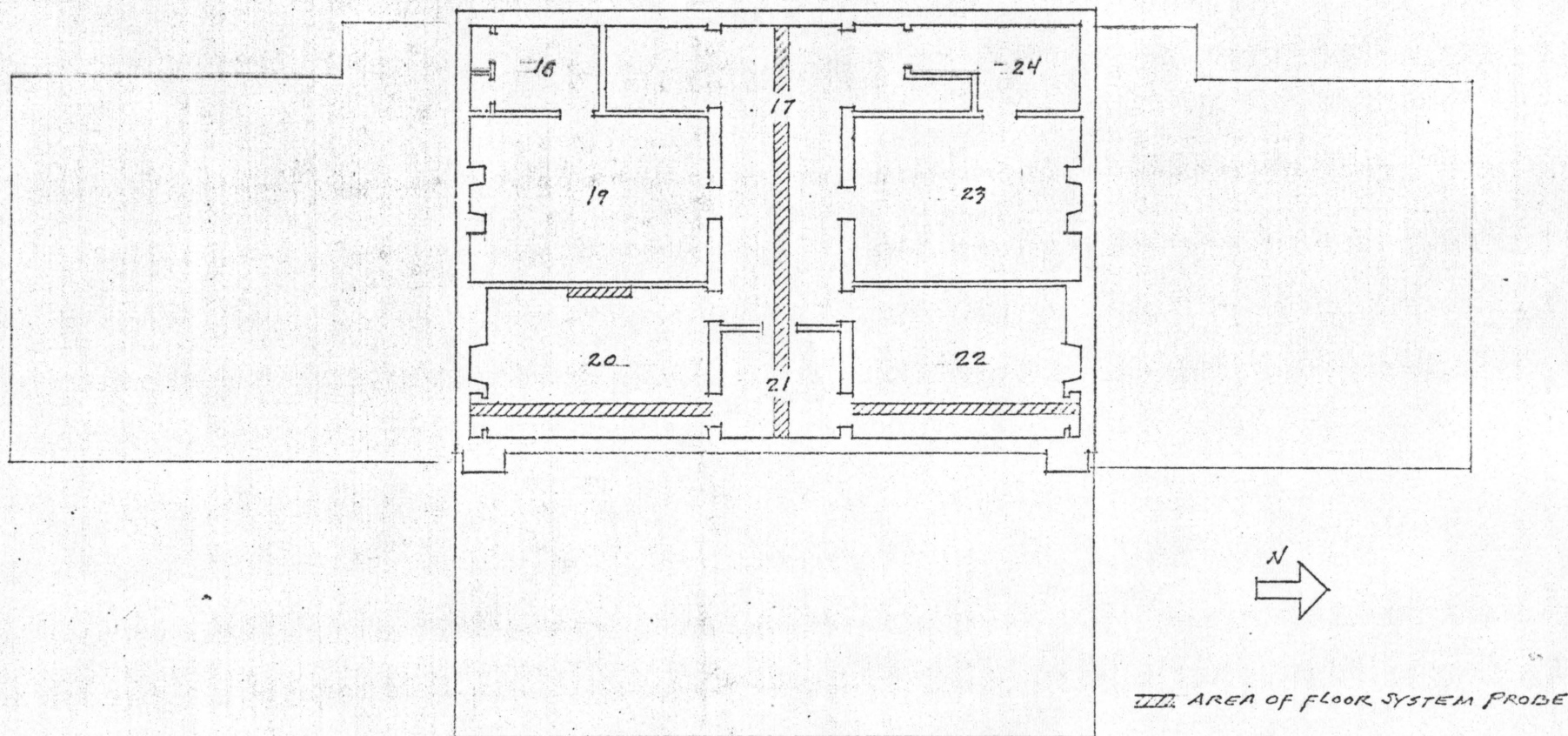
H = 6"

I = 6"

J = 6"



GUTTER OUTLET DETAIL
 FOR GUTTERS A, - B, - D, - G, - I, - J.



SECOND FLOOR PLAN
 SCALE $\frac{1}{16}" = 1'-0"$

Please return to
Arthur Lee Harrison, Jr.

Facsimile of application made by General Robert E. Lee, in 1889, for insurance in the Hartford Fire Insurance Company to cover his dwelling known as the "Mansion House," situate at Arlington, Virginia.

Hartford Fire Insurance Company, of Hartford, Conn.

The estimated value of Personal Property, and of each Building to be insured, and the sum to be insured on each, must be stated separately. When Personal Property is situated in two or more Buildings, the value and amount to be insured in each must be stated separately. When Insurance is wanted on Personal Property, the same description should be given of the Building containing the property, as if Insurance is wanted on the Building.

Application of R. E. Lee, U. S. A.
for Insurance against loss or damage by fire by the **HARTFORD FIRE INSURANCE COMPANY**, in the sum of Five Thousand Eight Hundred Dollars on the property specified: the value of the property being estimated by the Applicant.

	AMOUNT TO BE INSURED.	VALUATION.
On <u>Dwelling House</u>	<u>\$5000</u>	<u>\$20,000</u>
On <u>Barn</u>	<u>\$800</u>	<u>\$12,000</u>
On	\$	\$

The Applicant will answer the following questions, and sign the same, as a description of the premises on which the Insurance will be procured.

1. BUILDING—Is it stone, brick, or wood? How many stories high? Where situated? When built? Which part occupied by Applicant?
2. WALLS—Are the division walls of brick? Are they entire? Do they rise above the roof?
3. ROOF—What is it covered with? Are the gutters stone, metal or wood? Is there a scuttle and stairs to it?
4. Are the stores and apparatus for using fire properly secured, and will you engage to keep them so?
5. Do the pipes enter a chimney? And is it built from the ground? Do pipes pass one or more wood partitions or floors? If so, how secured?
6. What fuel is used? And how are ashes disposed of?
7. What material is used for lighting?
8. For what purpose is the building used? How many tenants?
9. Distance and materials of other buildings, within 100 feet of the one to be insured? And how occupied?
10. What other insurance is there upon the property, and at what office? Has this Company any other insurance within 100 feet of this risk?
11. Is the property mortgaged? And to what amount? Is there any insurance by the mortgagee?
12. Is there any other party interested in the property?
13. Has the building a lightning rod? If so, is it on the old or new plan?

1 Dwelling of Brick, main building two stories high, and wings one story, in Alex. Co. Va., built about the year 1820 - all occupied by applicant. 2 The Barn is of brick, one story high, with a stone basement. The main building of the Mansion House is covered with slate and the wings with gravel. 3 The Barn is covered with gravel. 4 The gutters are metal. 5 The division walls are of brick. 6 There is not a scuttle in the roof of the dwelling. 7 The Barn has a cupola from which ascends the roof eave. 8 Pipes enter chimney. 9 Chimneys built from the ground. 10 No wood partitions. 11 Stones and masonry apparatus well secured. 12 Wood & coal are used for fuel. 13 Ashes are put out a safe distance. 14 Burning fluids, or candles, or Kerosene Oil, or Gas are permitted. 15 Dwelling House - one tenant. 16 A one story brick kitchen to a one story brick stone house, both covered with wood. 17 The one standing West of the dwelling on a line with the north line thereof, & the other on a line with the south line thereof, both distant 44 feet. 18 \$5000. by the "Home" Ins. Co. 19 No other risk within 100 feet. 20 No other ins. on the Barn. 21 Property unencumbered. 22 Barn has a lightning rod. 23 Dwelling has also. 24 New plan. 25 Barn has a cattle shed about 150 feet south east, and a wagon shed about 100 feet south, otherwise detached.

"Arlington"

And the said applicant hereby covenants and agrees to and with said Company, that the foregoing is a just, full and true exposition of all the facts and circumstances in regard to the condition, situation, value and risk of the property to be insured, so far as the same are known to the applicant and are material to the risk.

Dated October 17th 1889.

For 1 year at 40 cents.

" 1 " at 80 [For Make a diagram of the premises on the other side of this sheet.]

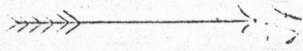
R. E. Lee Applicant.

Distance 44 feet in air line
1st brick
stone house

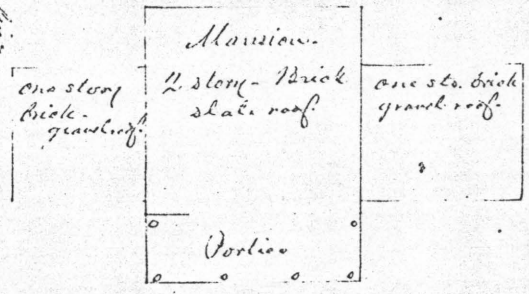
No other buildings
within 100 feet.

1st brick
kitchen
stamped

Distance from building 44 feet



Opener



at every corner
Col. R. V. Lee
USA.
Dated Oct 11th 1909.
NO. 46.

ANDREW JAMIESON AGENT
ALEXANDRIA

one story
brick with granular
roof

100 feet

Main room
1st story
granular
roof
about 30 feet
about 30 feet

one story
brick with granular
roof



West