D-5
Vol. 2 of 2

LINCOLN HOME
INTERIOR AND EXTERIOR RESTORATION

LINCOLN HOME NATIONAL HISTORIC SITE
HISTORIC STRUCTURE REPORT
ARCHITECTURAL DATA SECTION — VOLUME II

B&W Scans 2.4.2004

Ferry & Henderson Architects, Inc. 1320 SOUTH STATE • SPRINGFIELD, ILLINOIS 62704

H I S T O R I C S T R U C T U R E R E P O R T

Architectural Data Section - Volume II of II

Title I Services - Advanced Planning

LINCOLN HOME

Analysis
Restoration

Lot 8 - Block 10
Lincoln Home National Historic Site
Springfield, Illinois

Work Directive No. 5-0005-78-06
Basic Agreement No. CX-2000-5-0005

Ferry and Henderson Architects, Inc.
1320 South State Street
Springfield, Illinois 62704

20 February 1984

The Historic Structure Report, Architectural Data Section, is divided into two volumes. Volume One contains Historical & Investigative Information and Volume Two contains Previous & Proposed Restoration.

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B. Interior Paint Analysis

C. X-Ray Analysis

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B I B L I O G R A P H Y

C R E D I T S

II. PREVIOUS RESTORATIONS

Very little documentation of past restoration work is available. The following records are the only ones known to have survived over the years.

A. 1976-1977 Exterior Restoration

The restoration of the exterior in the Fall of 1976 and in the Spring of 1977 is the most recent work to Lincoln Home. The report on the following pages is an account of that project.

COMPLETION REPORT

WORK ORDER NO. DAY LABOR

Painting Exterior of Lincoln Home

Lincoln Home National Historic Site

(work order title)

Ray Kunkel, Restoration Specialist

Project Supervisor

CONTRACT NO. Day Labor

NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

Form 10-174
(June 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

FACE SHEET FOR COMPLETION REPORT

Work Order No.: Day Labor
Fund Symbol:

Park: Lincoln Home National Historic Site	Region: Midwest
Location in Park: Park General	State(s): Illinois
	County or Counties: Sangamon
☐ Contract and/or ☒ Day Labor	

Year Programmed: 5-76
PCP No.:
Master Plan No.:
Master Plan Corrected By:
As Built Drawings By: Midwest Region
Date Started: 7-76
Date Completed: 7-77

Work Order Title:
Painting Exterior of Lincoln Home
Lincoln Home National Historic Site

DESCRIPTION OF FIXED ASSETS (For completion by employee in charge of project)	TOTAL COSTS (For completion by FPO)
Historic Building HS-1 (B) Painting exterior of Lincoln Home.	
TOTAL	$

DISTRIBUTION No.	To

THE FIXED ASSET DESCRIBED ABOVE HAS BEEN COMPLETED IN ACCORDANCE WITH APPROVED DRAWINGS, SPECIFICATIONS, AND AUTHORIZED CHANGES

Submitted By: _____ Title: _____ Date: _____
Approved By: _____ Title: _____ Date: _____
COSTS VERIFIED BY _____ Title: _____ Date: _____

33760

Form 10-174A
(June 1962)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

COMPOSITION OF COST FOR COMPLETION REPORT

Work Order Number: Day Labor
Fund Symbol:

Park: Lincoln Home National Historic Site	Region: Midwest	Year Programmed: 5-76

Location in Park: Park General
Work Order Title: Painting Exterior of Lincoln Home
Lincoln Home National Historic Site

COMPOSITION OF COST

COSTS CHARGED TO FUNDS ALLOTTED TO FIELD FINANCE OFFICE		
(1) Personal Services	$40,096.07	
(2) Travel	1,372.30	
(3) Contract Work		
(4) Supplies and Materials	3,786.94	
(5) Other Direct Expenses		
(6) Operation of Equipment		
(7) Depreciation of Equipment		
(8) Purchase of Construction Equipment		
(9) Purchase of Other Accountable Equipment		
(10) Other Costs: _____		
(11) TOTAL COST CHARGED TO FPO FUNDS	XXXXXXXXXX	$45,255.31
OTHER COSTS:		
(12) PS&S, AP, and/or Facilitating Services @ _____ %	$	
(13) Inventory and Other Non-Fund Costs		
(14) GROSS WORK ORDER COSTS	XXXXXXXXXX	$
LESS:		
(15) Residual Value of Construction Equipment on Line 8	$	
(16) Other Credits		
(17) NET COST OF FIXED ASSETS	XXXXXXXXXX	$

Identify other costs and other credits by line item entry, on an attached schedule, or explain in narrative.

33761

ATTACH COPY OF FINAL ESTIMATE

NARRATIVE STATEMENT

Painting exterior of Lincoln Home
(name of project)

WORK ORDER NO. Day Labor

DESCRIPTION OF WORK Generally consisting of completely removing all of the existing exterior paint by paint remover, scraping, and hydrelectric heater. Replacing deteriorated wood siding, trim and repair or patch deteriorated wood materials and applying wood primer coat and two top wood finish coats. Also removed deteriorated mortar and replace and paint.

PLANS AND SPECIFICATIONS for this project were prepared(by the Design Office of the San Francisco Service Center) or by Midwest Region

PROJECT ACTIVITIES

Preliminary Surveys were made by Midwest Region

Construction Layout was made by Ray Kunkel

____ (no.) bids were received and opened ____ (date)

Award of Contract No. Day Labor was made to ____

Lincoln Home National Historic Site

for ____

Notice to Proceed was issued on 7-76 (date) and the date of 7-76 was established as the first day of the contract.

Construction work consisting of completely removing old deteriorated paint and applying new paint.

started on 7-76 (date)

(NOTE: In the following space describe the actual construction work. Include unusual weather, geological and latent conditions encountered; list of subcontractors and what they did; new methods of construction or techniques used; new types equipment used, etc. If the work was ordinary standard construction with nothing unusual, say so and don't elaborate.

For construction projects involving water systems, include:

1. Water right applications, permits and license numbers to the extent they have been obtained.
2. If a well replaces or supplements a surface supply, or if a surface source replaces or supplements a well, or if the point of surface diversion is changed, the effect on existing water rights based on application, permit, license and/or decree will be a part of the report.
3. Name of the water source, available flow, and capacity of diversion works including pumps if not shown on construction plans.)

The justification for completely removing all the old historic paint was determined that most of the old historic paint was dead or a lose paint. If the home was just repainted the old historic paints would peel or spoil off. Therefore, applying new paint over the old paint would cause the vehicle in the paint to penetrate through the large amount of cracks and scaling paint, and instead of holding the paint on, it would cause a reaction and cause the old paint to turn loose. The second major problem was the deteriorated wood material, badly deteriorated windowsills, and siding, also partly deteriorated sashes, trim, and shutters.

The old paint was removed with hand scrapers, paint remover, and electric heater. Approximately 60% was removed with hydelectric heater (manufactured by Hyde Tools). This heater softens the paint. After the paint was soft, a scraper was used to remove the paint. Paint scrapers used were Red Devil Hook, No. 85, Hite and Hyde Bend scrapers. Also some of the tools were redesigned and some homemade tools were designed for certain types of work, such as where the siding laps over making the lip hard to scrape. Approximately 25% was removed with scrapers, with same type as above, and approximately 15% was removed with No. 826 Wash-Away Paint Remover, manufactured by Porter Paint Company. After the paint had been removed, the deteriorated wood materials were repaired or replaced with old nonhistoric period materials (wood), Epoxy (structural), caulking and exterior spackling. The weatherboarding (siding) that was deteriorated was replaced with nonhistoric siding from some of the nonhistoric structures in the area (park). The justification for using these types of materials is to try and equal that which is on the home in species, walnut and pine. Also to assure the siding is dry and properly cured, so when it is installed there would be no problem with the paint adhering the same as to the siding already on the Home (structure). Only the badly deteriorated wood board siding was replaced, approximately 150 square board feet was replaced. Epoxy (structural paste adhesive) (2 component 3357 part A-3357, part B-Specification No. 88PC-SP6-63. This Epoxy structural was used on partly deteriorated window sashes, trim, sill, and weatherboarding (siding).

The deteriorated material was removed from area, then the Epoxy was applied for the repairs or patching. The new method with Epoxy for wood stabilization is working very well or good, at this time. It may be the upcoming new product in preservation.

NOTE: All new materials that were used for patching and replacement of deteriorated wood materials were identified and dated in pencil on the back side. The date, type of material, and location was documented. After the paint and deteriorated material had been removed, the first coat of exterior wood primer was applied. (Primer) Porter Paint Company No. 565-8P 29341, Exterior House Primer. The primer was tinted toward finish coat color, Munsell Color #7.5 YR 8/1. This tint was made by blending Munsell Chips #8/2 and 8/4. NOTE: The primer also had one (1) pint boiled linseed oil and one-half (1/2) pint paint thinner per gallon. This was added by the manufacturer. Also before applying, an additional two (2) pints of Penetrol Wood Treatment was added per gallon to the primer (only). Penetrol is manufactured by Flood Company.

Preparation of surface after the primer had been applied: Materials used were Momo by Trimco for caulking, and Synko Company Spackling. The exterior caulking used is very flexible and will give, or move, whenever the boards move from vibration or the building movement. This was used in a large amount of cracks, especially where the boards are fitted into corners against doors, window trim, and jams. The exterior spackling was used for nail holes, small cracks, and small deteriorated areas. The exterior glazing compound was No. 5186, manufactured by Porter Paint Company. This was used for the window glazing of the sashes only.

Preparation of surfaces: After caulking, glazing, and spackling had been applied, in some areas, we changed the technique a little as we originally started sanding with a medium sandpaper, which worked fine on pine board siding, but on the harder walnut board siding, we changed to a coarser sandpaper to rough the surface a little more. By doing this, it will give a better tooth for the first top coat of paint to adhere to. NOTE: All of the surfaces preparations were not started until the primer coat had a drying time of seven (7) days.

The first of two top coats exterior wood paint finish was Exterior House Paint #533 SP 29484 Oil Alkyd Semi-Gloss, slow chalking. Color: Munsell Chip No. 7.5 YR 6/3, light brown and Exterior House Primer No. 565 SP 29341 Alkyd Low-Gloss. Colors: Munsell Chip No. 7.5 YR 8/3. This was two (2) shades lighter than the finish coat. The first top coat was mixed 50% primer No. 565 and 50% top coat No. 533. Also two (2) additional pints of Penetrol Wood Treatment was added per gallon. This was done for more penetration into the wood. Also to get the preservatives into the wood (linseed oil and Penetrol).

The second of two (2) top coats exterior wood paint finish was Exterior House Paint #533 SP 29484 Oil Alkyd Semi-Gloss slow chalking. Color: Munsell Chip #7.5 YR 6/3 light brown. Thinner used was Penetrol Wood Treatment as recommended by manufacturer. Only one (1) pint or less was used for thinning per gallon of paint.

NOTE: All surfaces were cleaned free of any foreign matter of material, dirt, and dust, then sanded between each coat to remove defects.

Shutters: The shutters were completely stripped in a Caustic Soda (lye) Flake, 76% $NA2_0$, manufactured by Diamond Shamrock Chemical Company. The procedure for dipping the shutters is as follows:

1. Put water into the vat, allowing for complete coverage of the shutters. In this case, only two inches were needed for the shutters.

2. Measure proper amount of lye into the vat, depending on the coats of paint involved. These shutters have a heavy amount of paint, so a heavier solution is required. I mixed one pound of lye to one gallon of water.

3. Put the shutter in the vat and time the process. The first shutter was left in for three minutes and then we removed it. I found it had not been in the vat long enough, so we put it into the vat for two more minutes. This was an adequate amount of time to remove the paint from the shutters.

4. Remove the shutters and wash, so as to remove the lye, scum, and paint that is loose.

5. Spray with a vinegar and water solution to be sure the shutter is neutralized. This solution is 50% vinegar and 50% water.

6. Set shutters aside to dry out.

7. After the shutters have thoroughly dried, sand the few remaining spots of paint, if necessary.

One important thing to remember is never abandon a piece of material that is in the vat because lye is very strong and will deteriorate the fabric. Only dip the materials that are going to be painted into the remover. If a material is to stay unfinished or clear finished, it will cause it to discolor. It

is not recommended to dip walnut or mahogany. Pine and oak can be successfully dipped for a clear finish.

Lye is very hazardous to the skin and eyes. Protection should be taken to keep from getting it on the skin by wearing rubber gloves, goggles, and a rubber suit. If lye gets on the skin, the first thing to do is wash it off with a soap solution, then rinse with fresh water.

If the dipping is done carefully, there is no damage to the material whatsoever. It is a means of speeding up the procedure of stripping shutters, etc. Dipping, compared to a workman removing the paint, is much faster. A 16" x 5' shutter would take a workman approximately eight hours to complete, while dipping would take about 30 minutes. One disadvantage of stripping by hand is that the louvers in the shutters are hard to clean. There is also the possibility of damage to the shutter from the scraper.

Primer used on sutters was the same as the exterior primer for the siding, Porter Paint No. 565, SP 29341, plus two (2) additional pints of paint thinner.

The extra thinner was used as the paint was applied with spray gun. Color was tinted two (2) shades lighter than the finish coat. The Munsell color is 10GY 5/4, green (tinted).

The top coats were also sprayed on and thinned for spraying.

Color: Munsell Color 10GY 3/4, green, Porter Paint Company No. 985 SP 29348 Oil Alkyd Hi-Gloss, slow chalking.

Iron Railing, Porch Floors, and Steps.

Surface preparation: The paint surface of these areas was not stripped, as the porch floors and steps have been stripped of

paint or the wood materials have been replaced in the past few years. Also the iron railing had been stripped in the 1950's; therefore, the paint was in good condition, and the surface only had to be cleaned before painting. Application was the same as used on all exterior wood board siding (weather boarding siding).

Gutter Downspouts.

Surface preparation: All paint was completely stripped, using No. 826 Wash-Away Paint Remover, manufactured by Porter Paint Company. Application was the same as used on all exterior wood board siding (weather board siding).

Brick Foundation.

All exposed (exterior) brick foundation to ground level, also brick foundation on east side was excavated two (2) feet below ground level. All loose, peeling or spoiling paint was removed, utilizing scrapers and wire brushes. Also all loose or deteriorated mortar was removed, utilizing tuckpointing picks and chisels.

Application: Materials used were lime, type S, hydrated lime for masonry purposes, cement, type 1 (white), sand, conform ASTMC144, and water.

Mortar Mix: Type M mortar consisting of one part white cement, one part hydrated lime, six parts sand, and water. This mix is recommended for tuckpointing.

Paint Foundation Exposed Brick: Primer (sealer) coat, manufactured by Porter Paint Company No. 898, Brick Sealer. (Exterior) Two (2) coats exterior paint, manufactured by Porter Paint Company, No. 535XP. Base color: Hi-Gloss Gray, Munsell Color Chip 5GY 5/1.

Doors.

The paint was not stripped from doors. Color of the doors was black. Surface was cleaned and painted. Color used was Hi-Gloss Exterior Black, manufactured by Porter Paint Company, SP 29340.

NOTE: The historic door color was not determined in the paint study undertaken by the Denver Service Center, Historic Preservation Division.

Enclosures: Paint Study and Samples.

Samples of the Deteriorated Fabric

Weather boarding (siding) and windowsills

Paint from weather boarding (siding)

Mortar from Brick Foundation

Photo showing badly deteriorated paint on bracket and soffit, south side. Also most of this deteriorated paint is original.

Photo showing deteriorated paint on siding, facer boards, and brackets. Top part of building, east side.

Photo showing badly deteriorated paint on board siding of wall, east side. Also part is original paint.

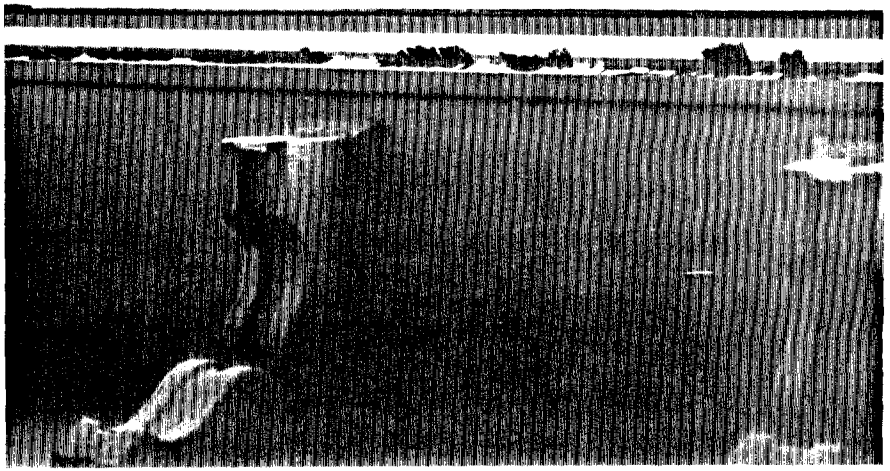


Photo showing deteriorated paint on facer board and soffit brackets on back side, east. About 31 layers of paint on this area.

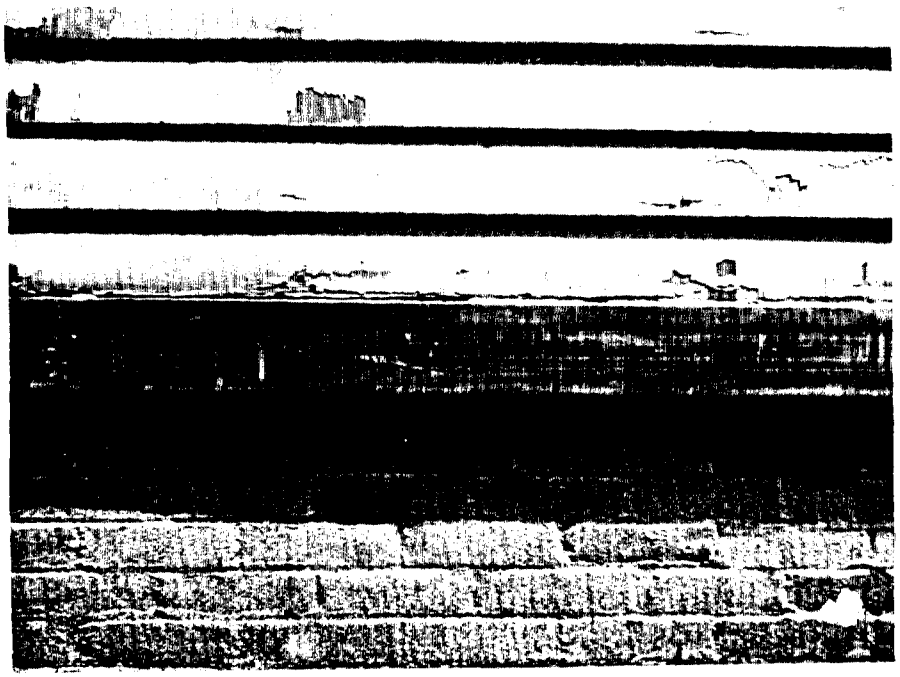


Photo showing paint on bottom boards in front side, west. Also part is original paint.

Photo showing deteriorated paint on siding boards on back side, east. Also some of these siding boards had 31 layers of paint; part of this paint is the original paint.

Photo showing badly deteriorated paint on porch column and trim, east side.

Photo showing closed-in window (boarded) by Mr. Lincoln when he added top part to house, north side of bottom floor.

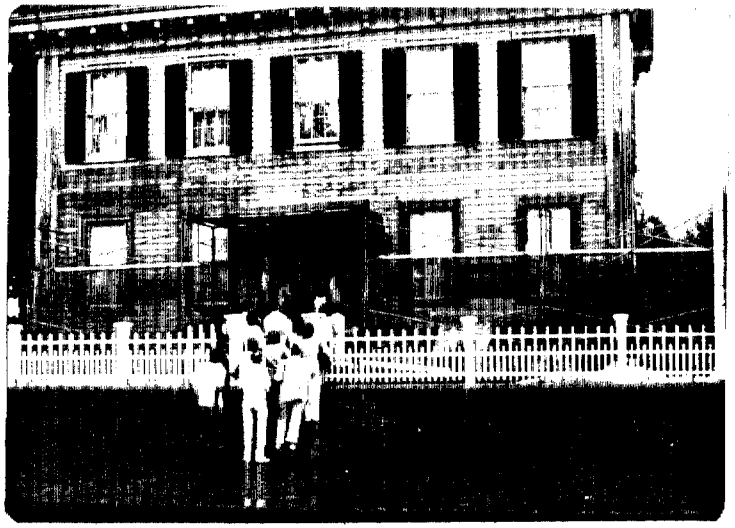


Photo showing view of paint removed, lower part of house, in front, west.

Photo showing deteriorated paint removed from windowsills down. This paint was removed with a paint scraper in front, west.

Photo showing part of the deteriorated paint removed, lower part in front, west.

Photo showing removal of old deteriorated paint. Also showing deteriorated siding in front, west.

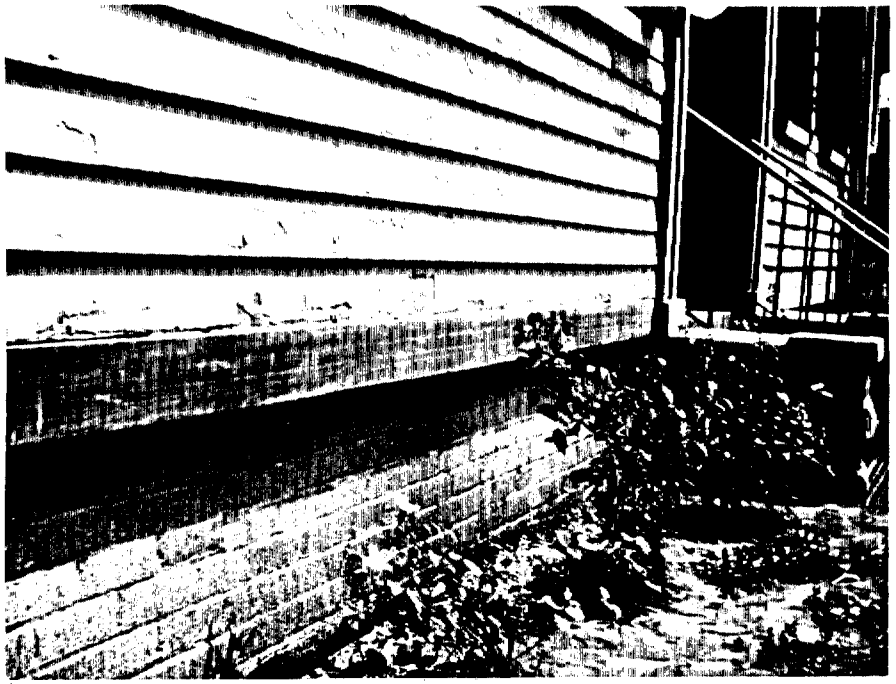


Photo showing bottom board with paint removed. Also showing deteriorated paint above, west.

Photo showing part of paint removed from bottom boards in front, west.

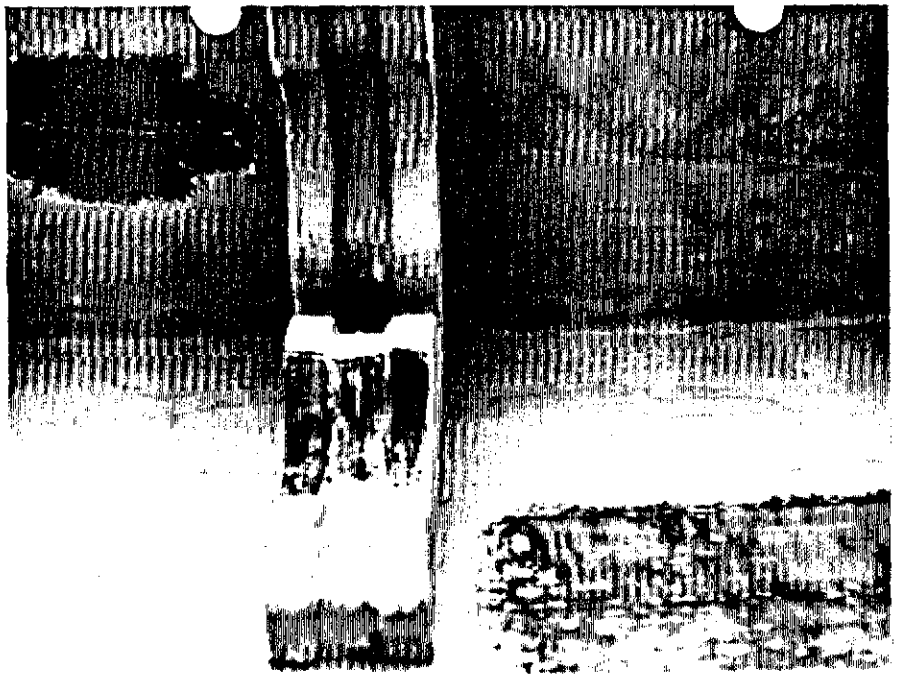


Photo showing part of the deteriorated historic (original) paint removed from eave and brackets in front, west.

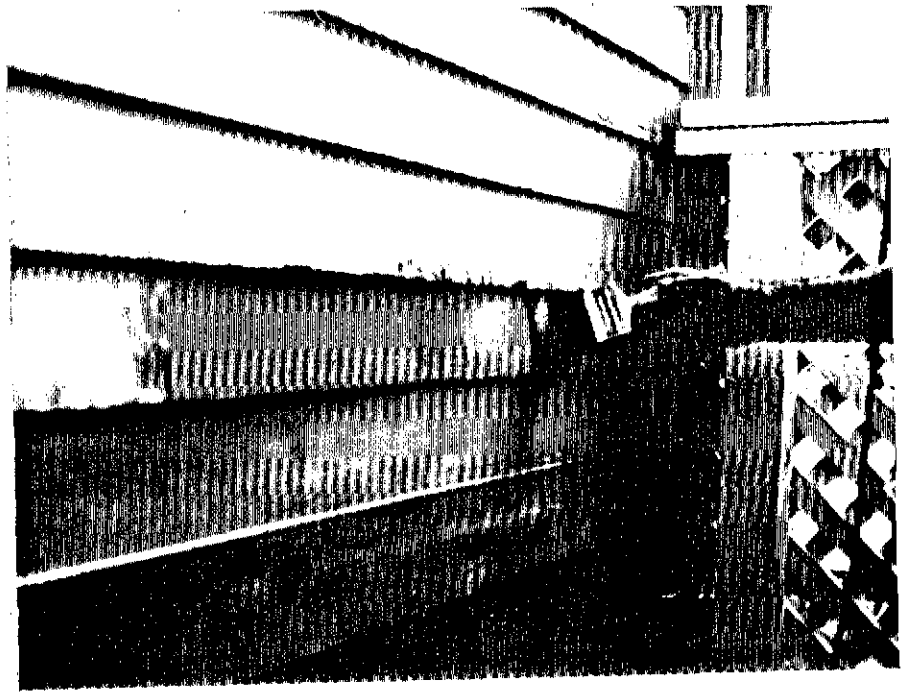


Photo showing paint remover being applied with brush. No. 826 Wash-Away paint remover by Porter Paint Company. On north side.

Photo showing removing old paint down to bare wood with electric heater. First floor, north side.

Photo showing workmen removing paint on back side, east.

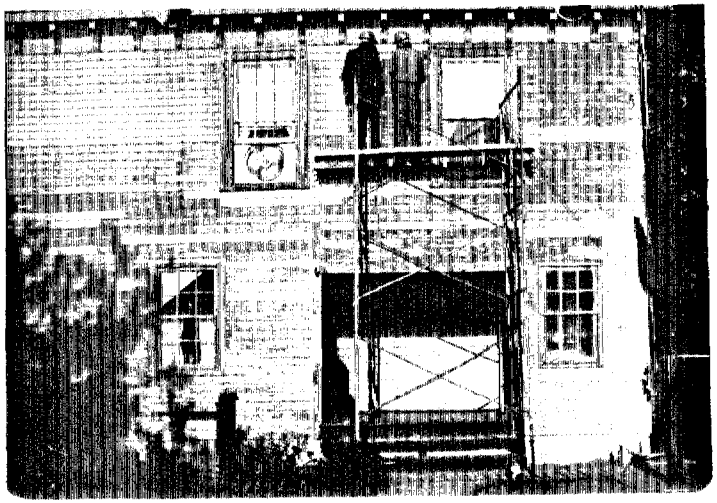


Photo showing removing paint. Most of the paint has been removed from this wall. All these areas are where the paint has been removed, east.

Photo showing workmen from roof of south porch. This was done with hydelectric paint remover.

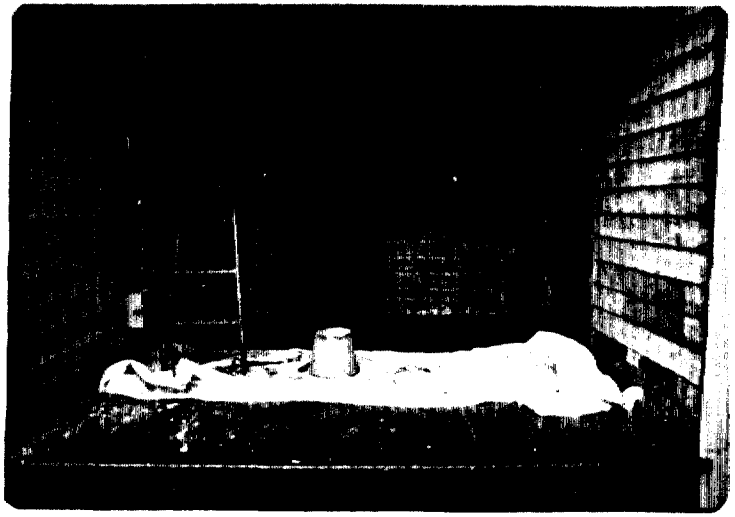


Photo showing paint being removed from wall back porch, east.

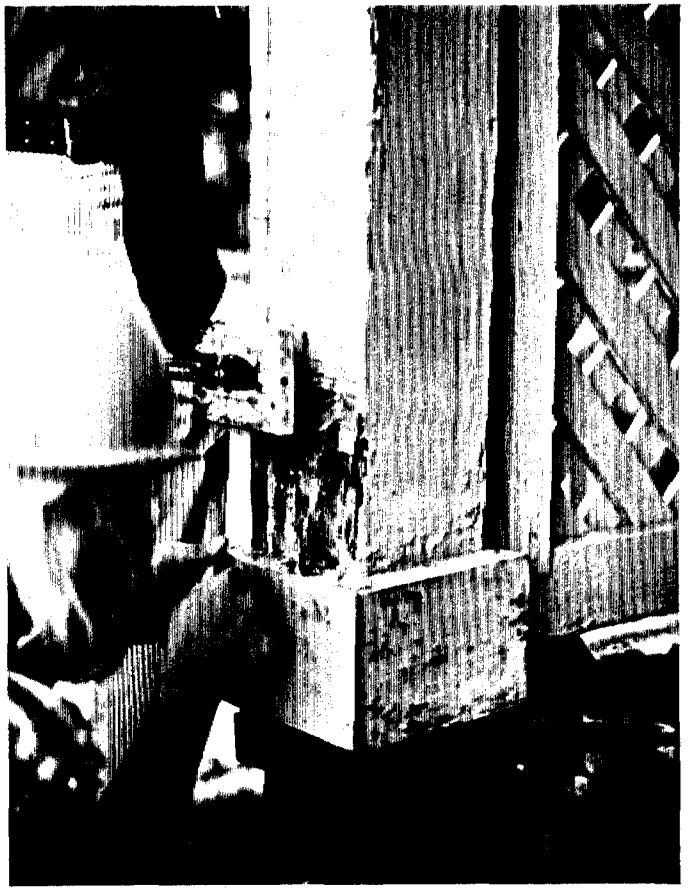


Photo showing removing paint from porch column with electric heater on south.

Photo showing workmen removing paint, south.

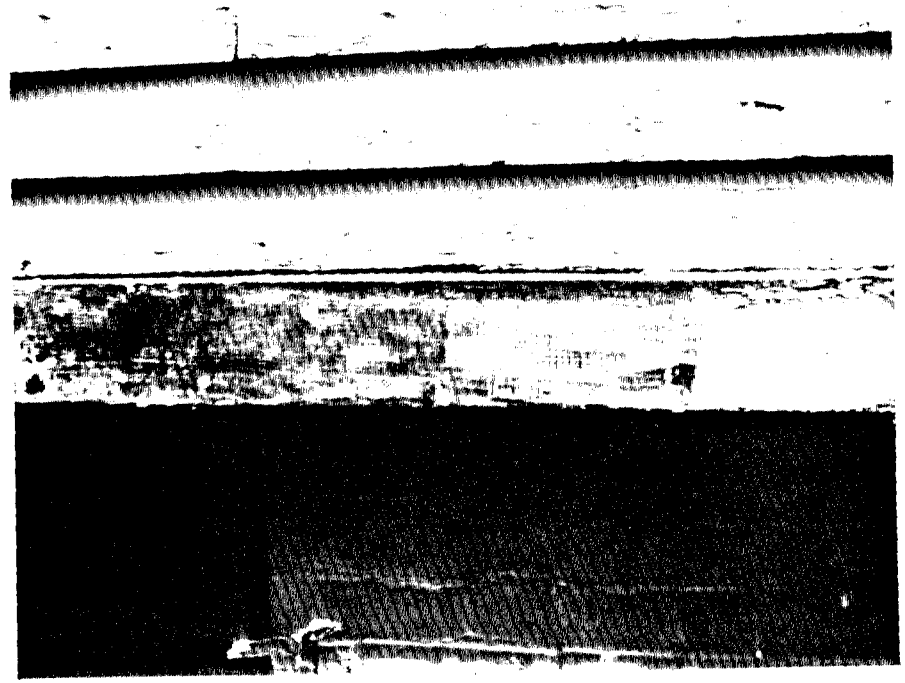


Photo showing paint removed from bottom board. The darker places on bottom board are burned. This was done by the State in 1956 with a gas torch.

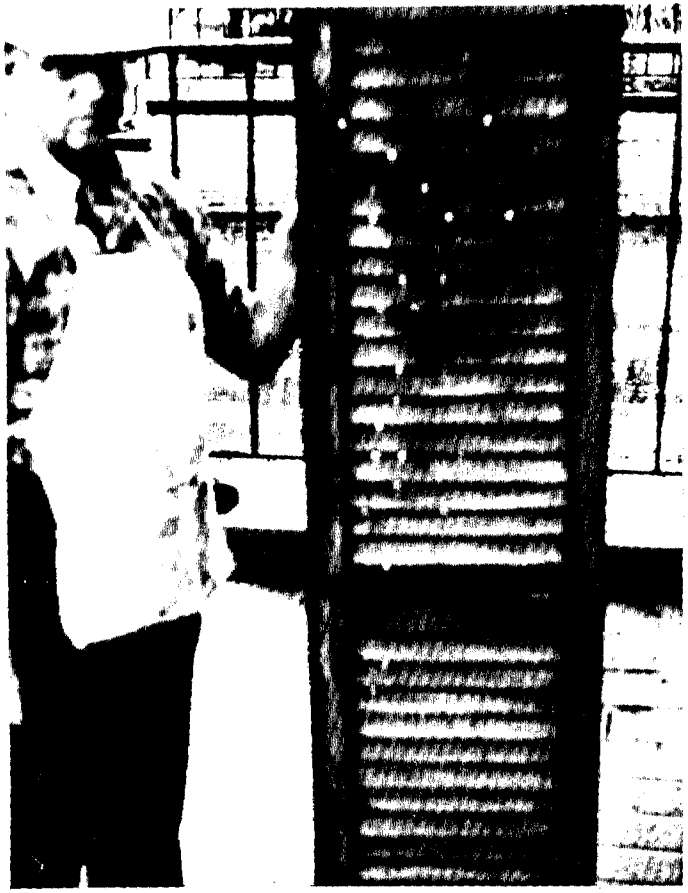


Photo showing paint removed from shutter. All of the shutters had the paint removed the same way with caustic Soda-Flake - 76% $NA2_O$.

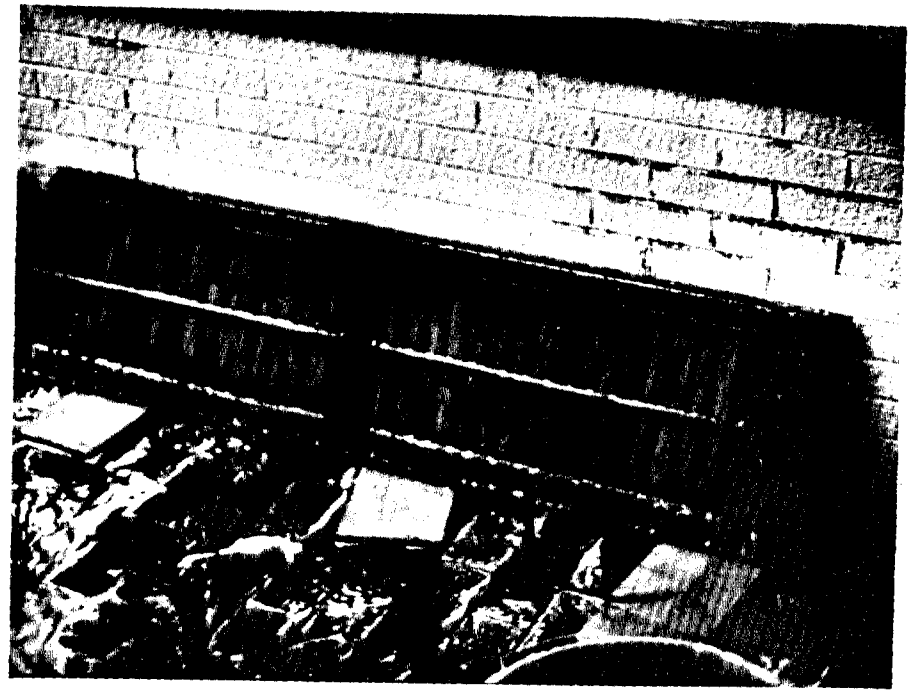


Photo showing paint removed from shutter. This was removed with caustic Soda-Flake - 76% $NA2_O$.

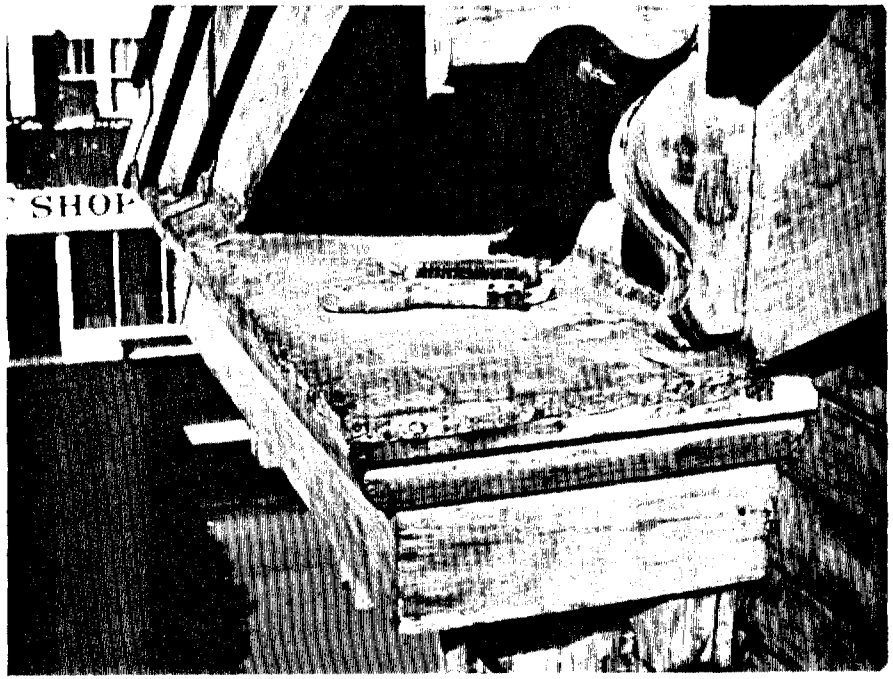


Photo showing soffit with paint removed, southwest corner.

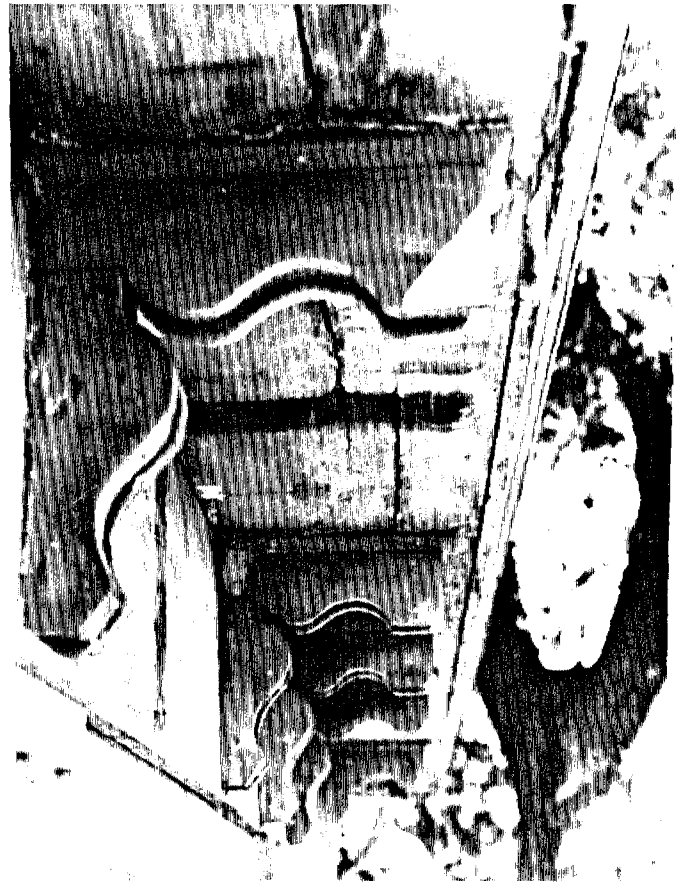


Photo showing paint completely removed from eave and brackets. Also showing some deterioration in wood on back side, east.

Photo showing paint completely removed from eave and brackets, back side, east.

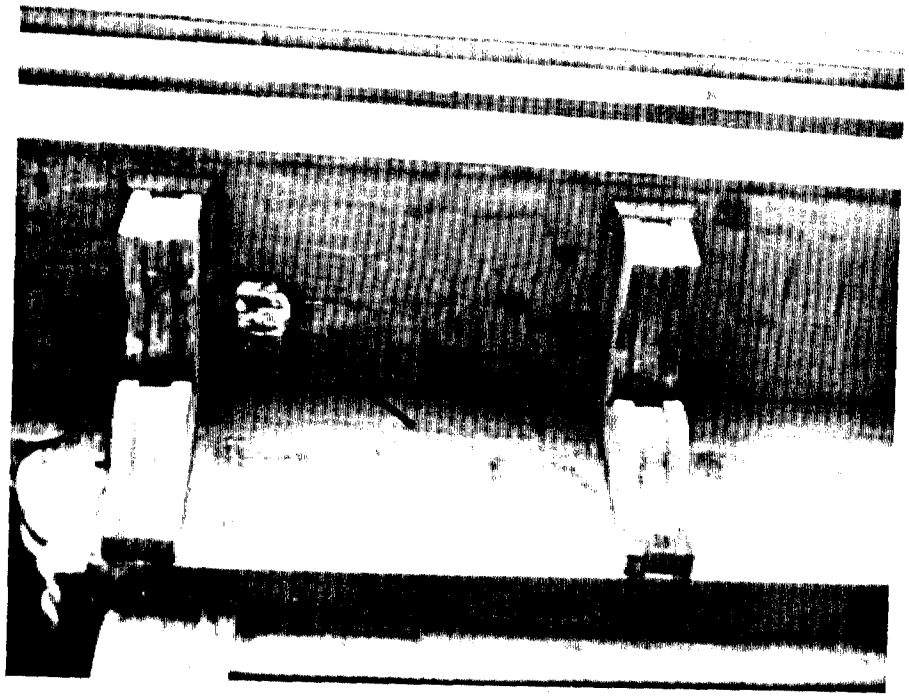


Photo showing paint removed from eave and brackets. Also arrow showing round hole covered. Tin is original downspout for water drainage. This hole is on the southeast corner.

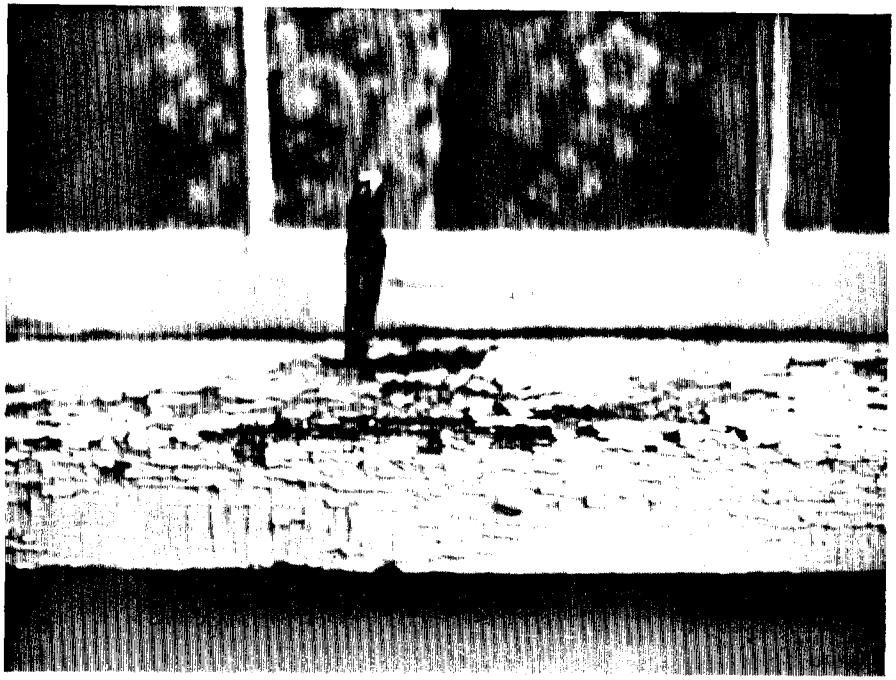


Photo showing deterioration of windowsill on south side.

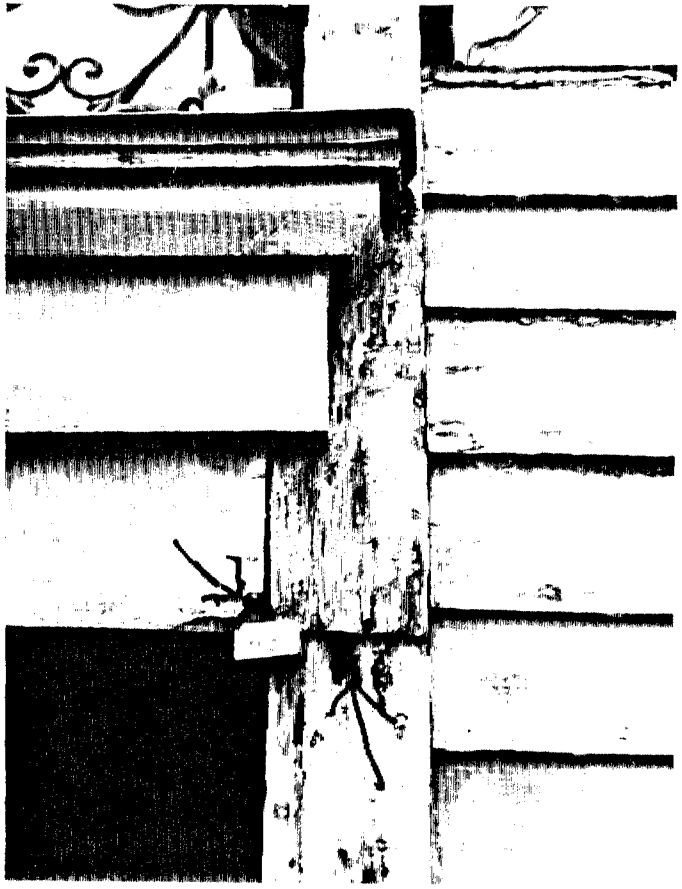


Photo showing some of the deteriorated areas in the materials trim and siding. Arrow shows these areas.

Photo showing some of the deterioration in board siding. This is as on first floor wall, east. (Back).

Photo showing some of the deterioration on siding and trim, east (back) first floor.

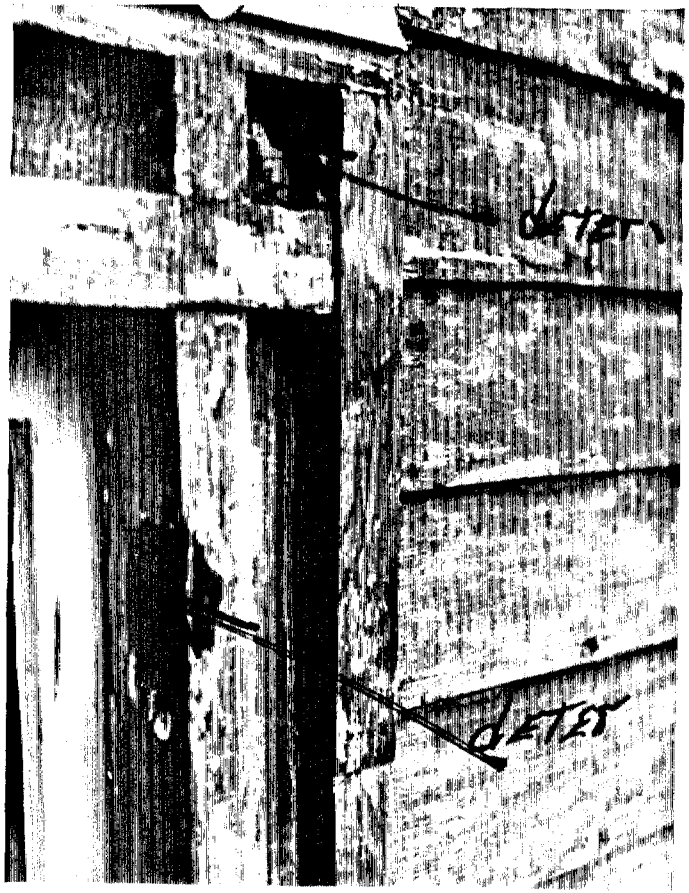


Photo showing deterioration in trim and siding. Arrow showing this.

Photo showing large space in between board siding and trim at corner, front (west). Arrow showing this.

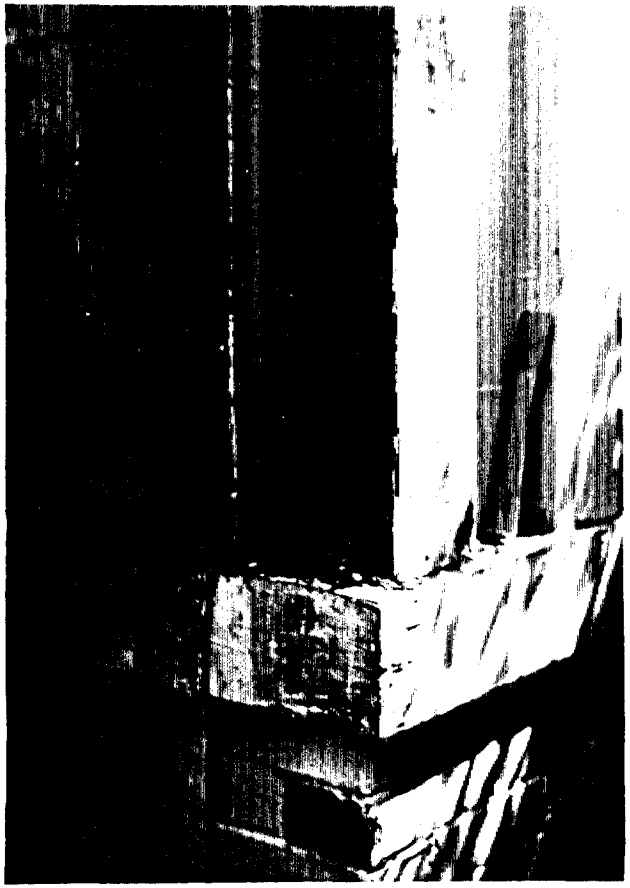


Photo showing corner trim board removed. Also showing deteriorated wood piled up inside. Arrow shows this.

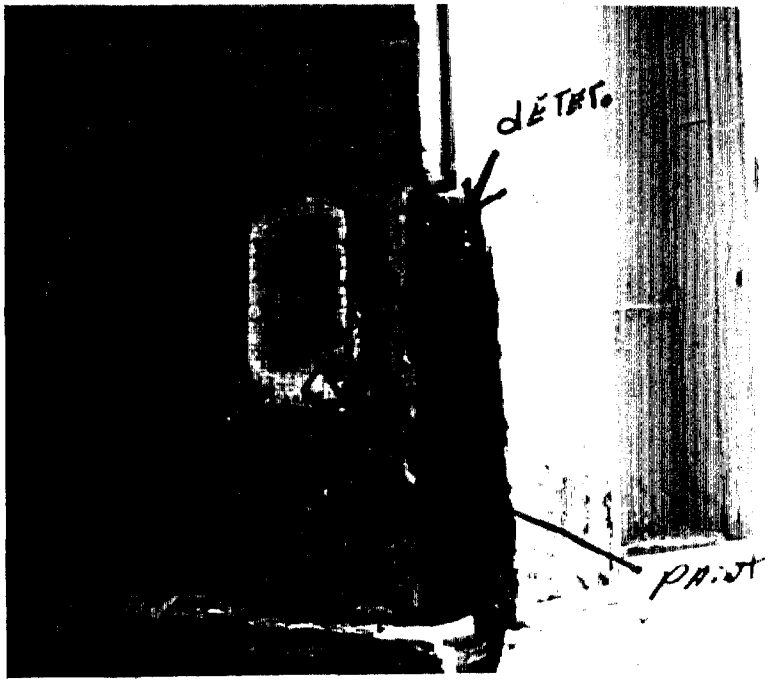


Photo showing deterioration on corner trim. Also where the deteriorated paint was removed. Arrow shows this.

Photo showing deteriorated trim removed around window jamb, front (west).

Photo showing trim removed from window jamb. Part of this trim was deteriorated. Also showing deteriorated siding, south side.

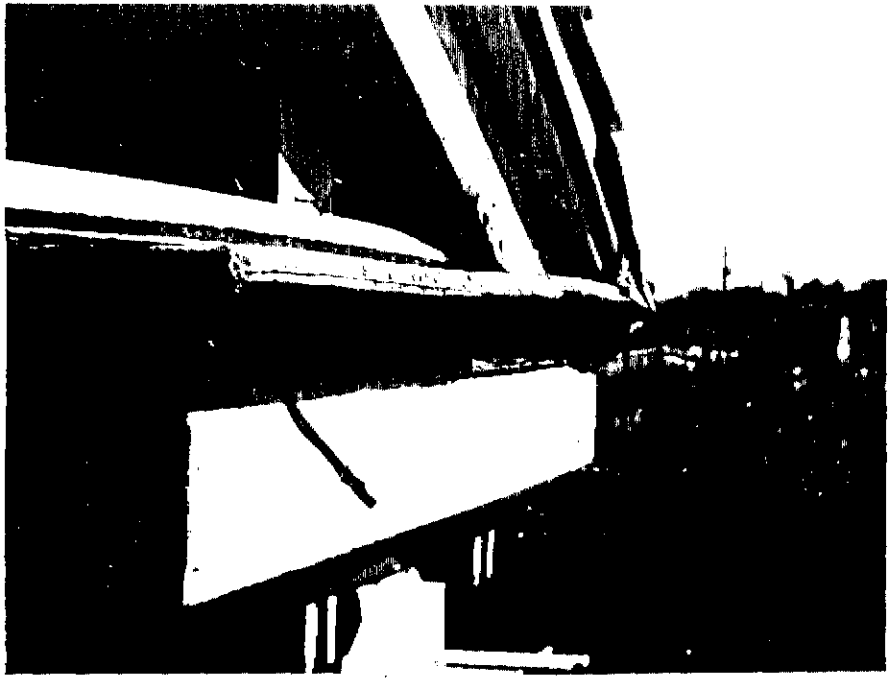


Photo showing deteriorated trim from soffit removed. Arrow shows this, south side.

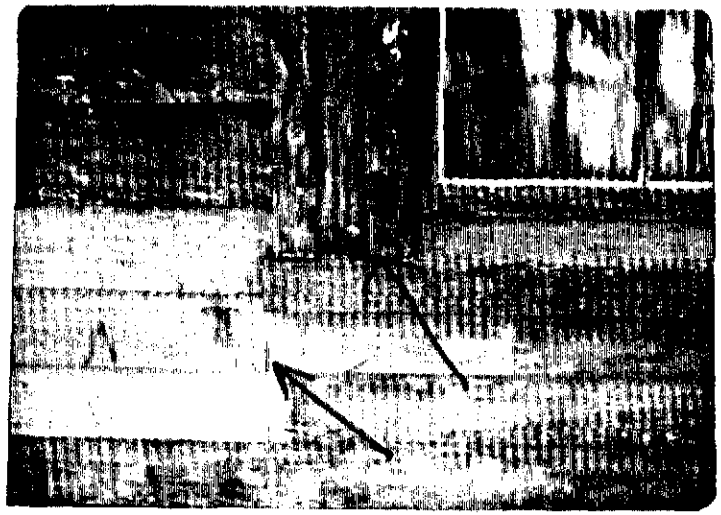


Photo showing some of the deterioration on window-sill and trim. Also board siding replaced. Arrow showing this.

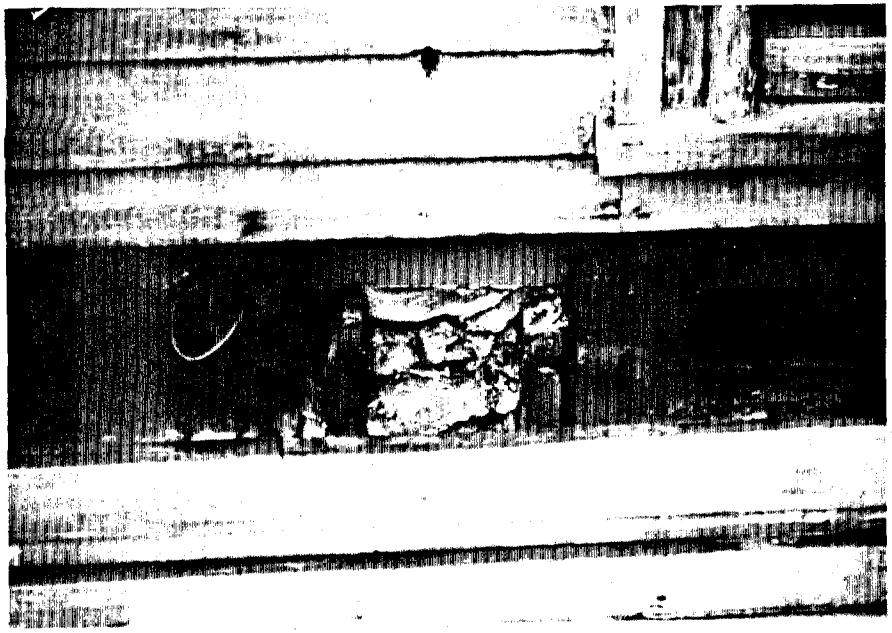


Photo showing deteriorated board (siding) removed. Also original floor joist. This is on second floor, south side.

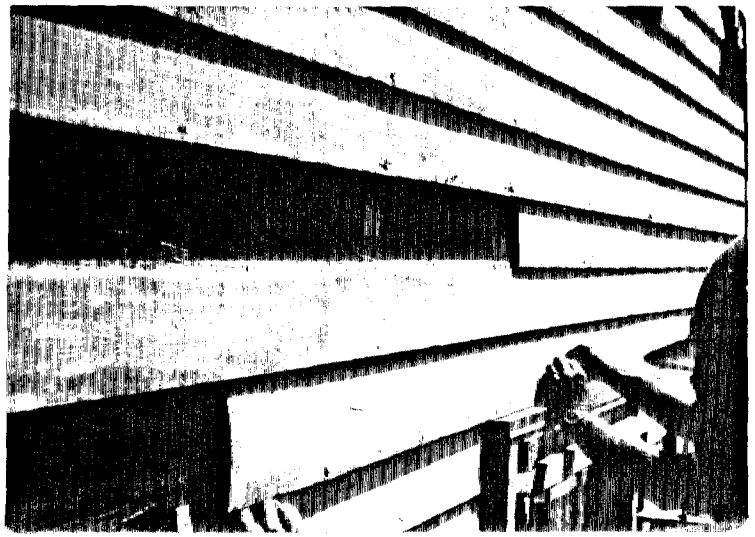


Photo showing workman renailing siding and also showing deteriorated board siding removed. West side (front).

Photo showing deteriorated siding removed. Also showing plate sill (bottom). Note hand-hewn log. Arrow showing log, east side, back by porch.

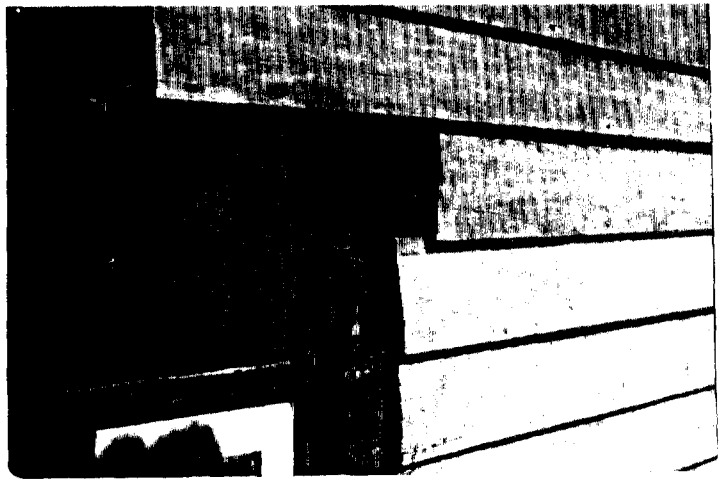


Photo showing deteriorated siding removed. Also showing boxing siding and some of the deteriorated area, west side, front.

Photo showing deteriorated board siding from some of the areas on west side (front). Also arrow showing structural epoxy used on deteriorated areas.

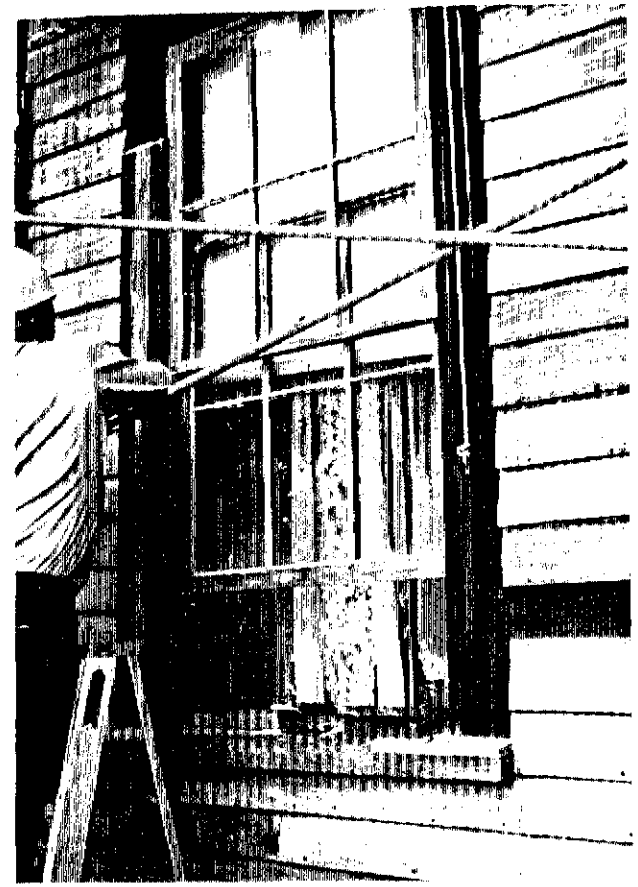


Photo showing part of deteriorated window trim cut off lower window in front, (arrow) southwest end. Also showing patched sill.

Photo showing workman replacing deteriorated siding board with nonhistoric old materials. Arrow showing board.

Photo showing replacement of deteriorated wood materials on window trim. New looking wood is the replacement in front, west.

Photo showing window trim that was replaced. Arrow shows this work. This is on the second floor front, west side.

Photo showing light colored boards as replacement for deteriorated boards in front (west). Arrow shows this.

Photo showing deteriorated areas removed from sill.

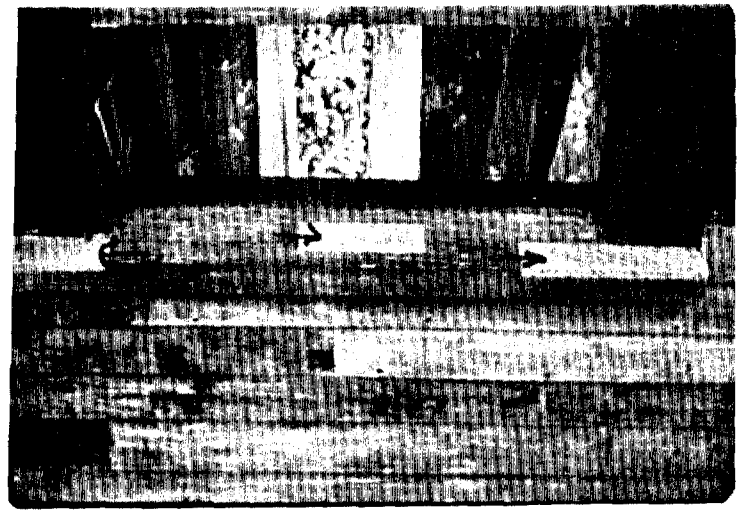


Photo showing wood plants on window sill where deteriorated wood was removed. Arrow shows work in front, west, first floor.

Photo showing wood plant being nailed on windowsill on front, west.

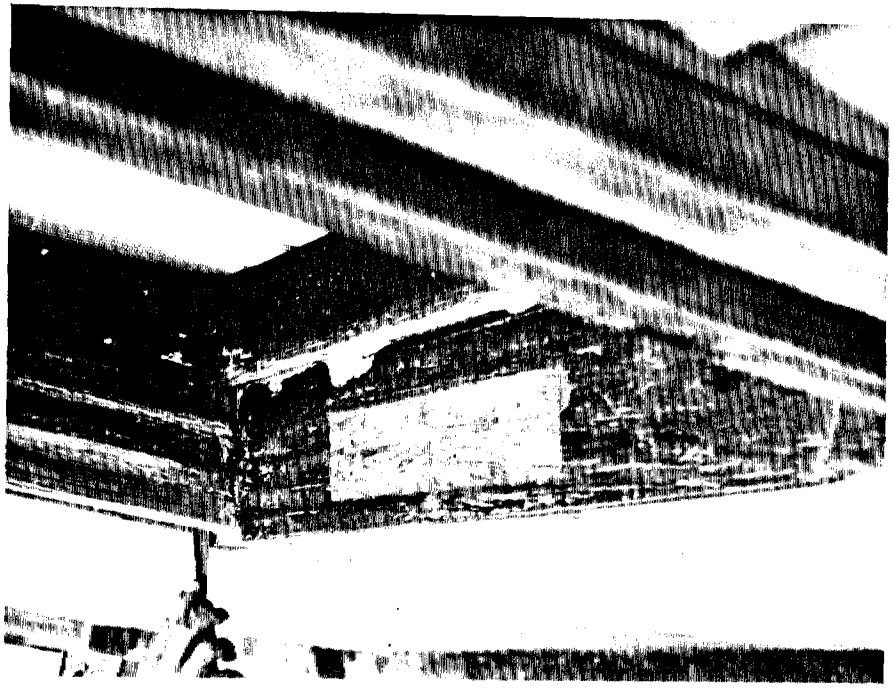


Photo showing windowsill wood plant. Also structural epoxy used on partly deteriorated sill.

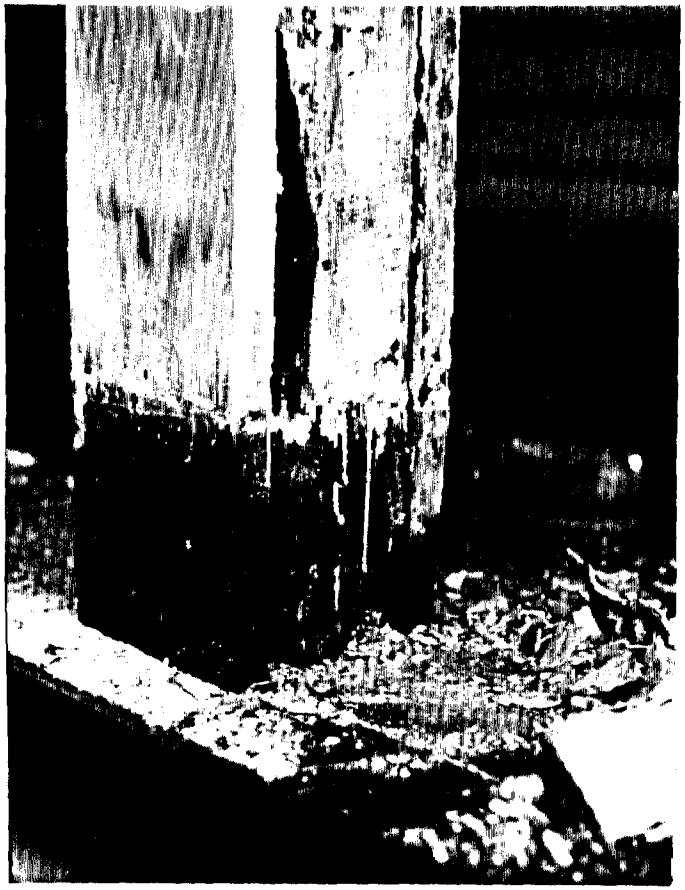


Photo showing deteriorated porch column before treatment, on south side.

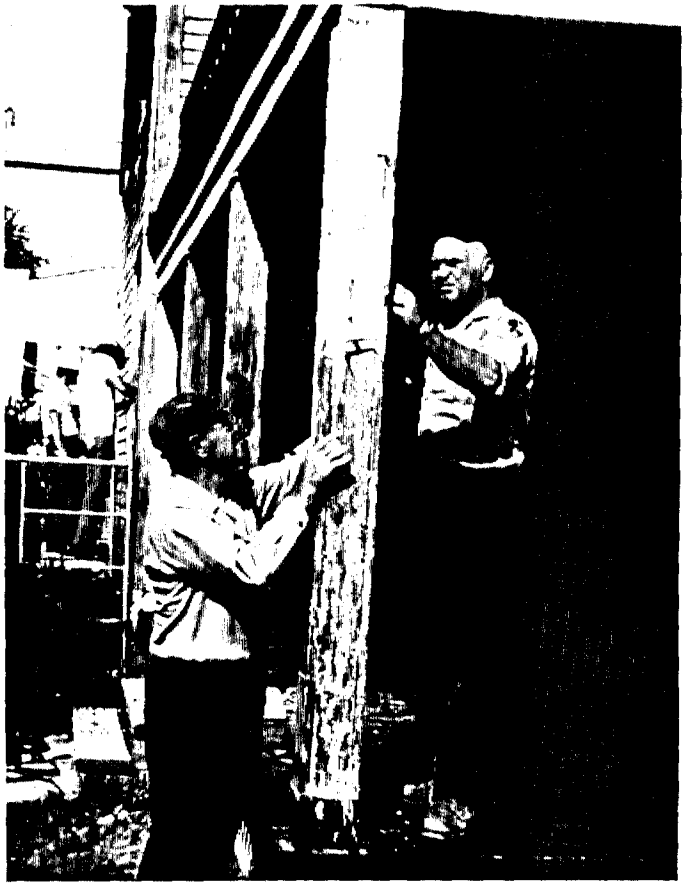


Photo showing workmen removing paint from column, south side.

Photo showing partly deteriorated sill and trim on second floor (south). Also dark spots on siding are burned spots from State Project in 1958.

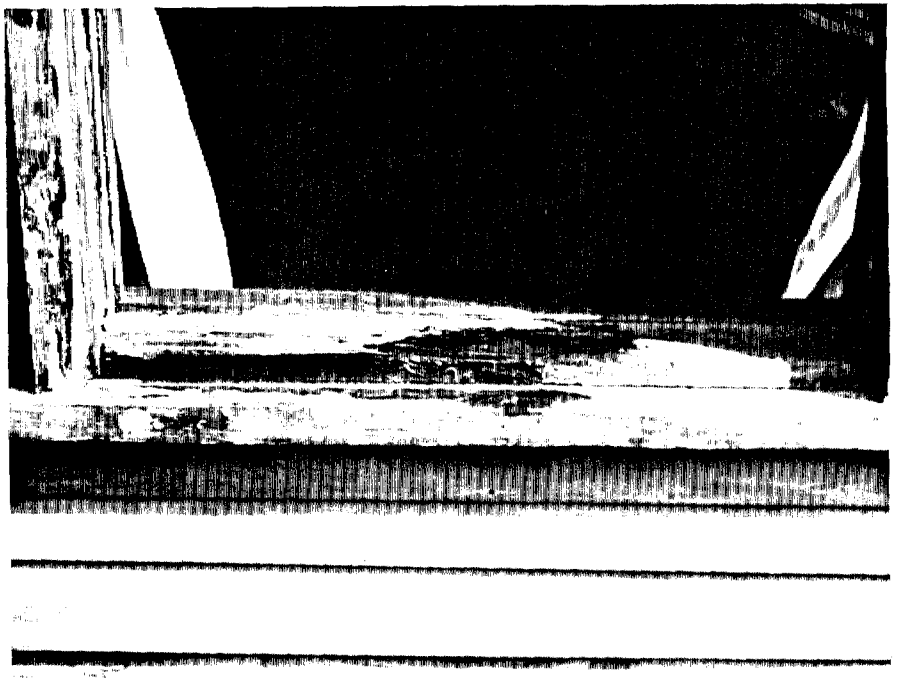


Photo showing deteriorated area patched on sash with structural epoxy, on second floor, south side.

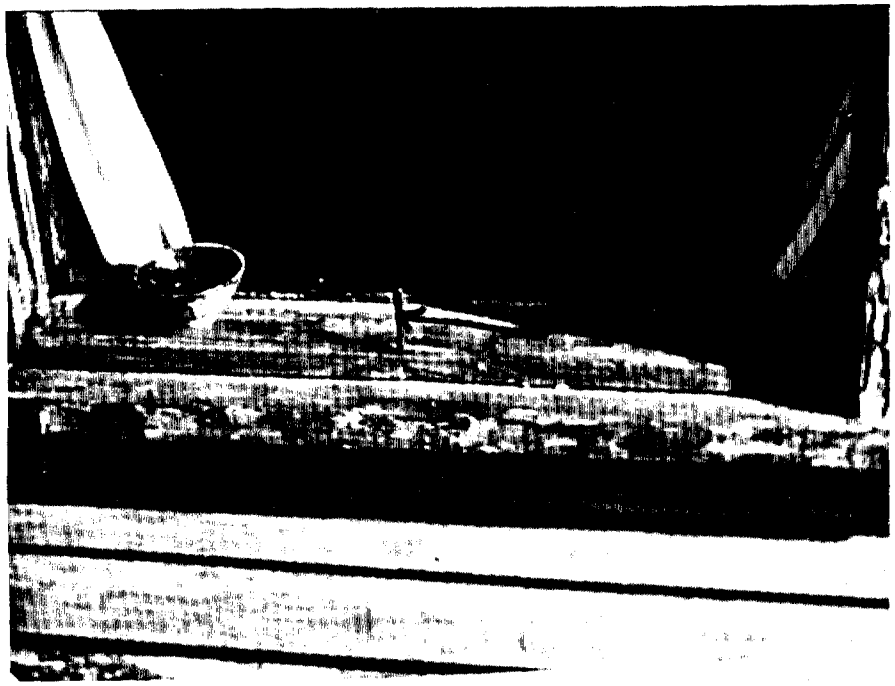


Photo showing chisel in one of the deteriorated areas on sill, first floor on south side. Arrow shows this.

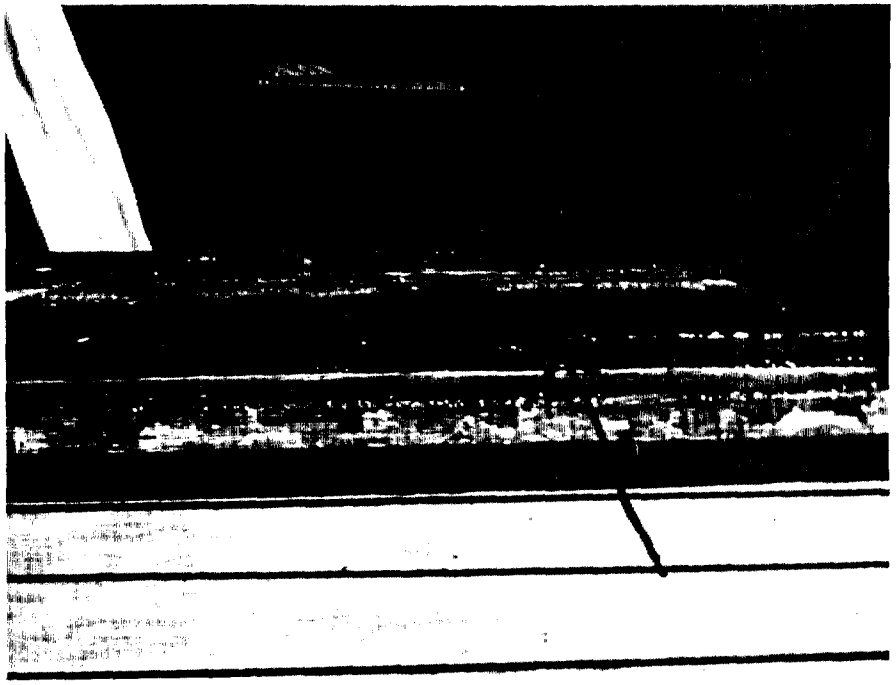


Photo shows deteriorated sill patched with epoxy (structural) on south side. Manufactured by Porter. Two component Epoxy No. 3357 and 3357D. SSPC-SP 6-63. Arrow shows this.

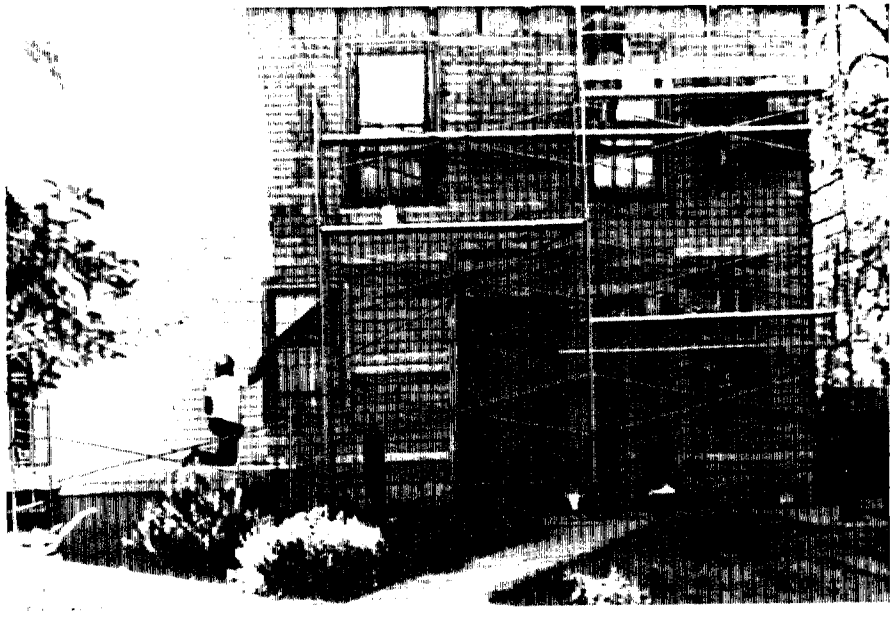


Photo showing applying primer paint and preparation of surface before applying paint. Back side (east).

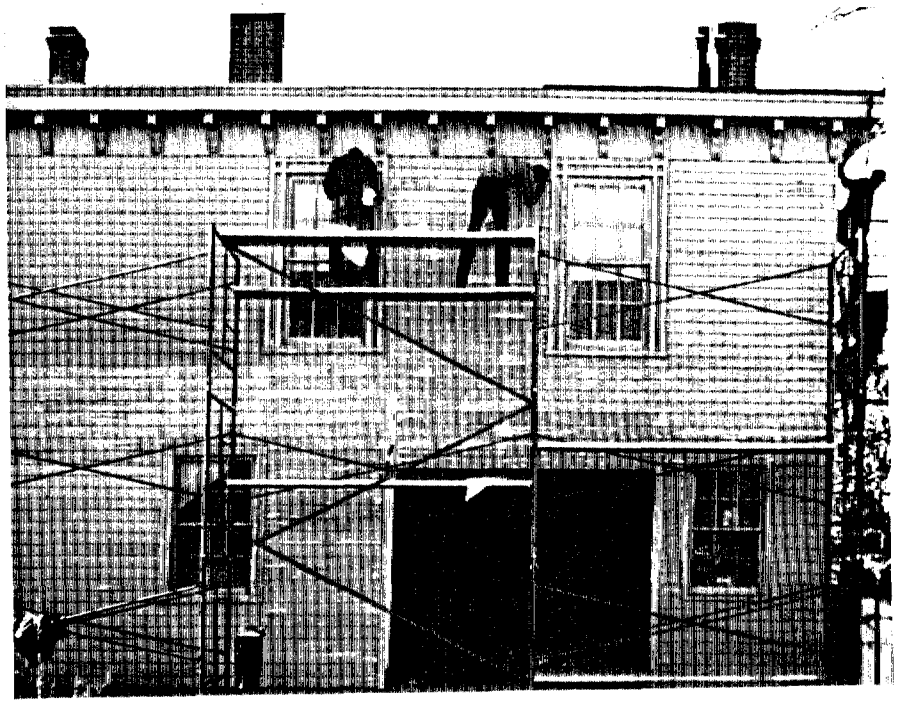


Photo showing primer paint being applied on back side, east.

Photo showing primer coat being applied on southwest corner at the top of wall. Porter Paint No. 565-SP 29341 primer tinted toward finish coat color. Munsell Color No. 7.5 YR 8/3, made from blending 8/2 and 8/4.
NOTE: 1 pint boiled linseed oil and 1/2 pint paint thinner per gallon was added by the manufacturer. Also before applying additional two pints of Penetrol wood treatment was added per gallon to the primer only.

Photo showing applying caulking Tremco (Mono Caulking) Spec. USTT S 00230. This was used on all small open joints (cracks) at end of boards (butt) as a filler on south side.

SPECIAL COLOR PRODUCTION ORDER

DATE 7/10 BRANCH 5142 SPEC. NO.* 29341

(1) FILL IN PART II, III OR IV OF FORM COMPLETELY. PART I IS SHOWN AS AN EXAMPLE OF THE PROPER WAY TO ORDER A CUSTOM COLOR IN A STANDARD BASE.

(2) APPROVED BY DIVISION SALES MANAGER. (FB) — APPROVED, DIVISION SALES MANAGER

Wink Evans — SALESMAN'S NAME AND NUMBER

(3) FORWARD TO GENERAL OFFICE, LOUISVILLE, WITH

National Paint Service — NAME OF CUSTOMER

(4) ORDER WRITTEN ON FORM 149, 2 COPY TRANSFER. — ADDRESS OF CUSTOMER

(5) AFFIX NUMBER (*) TO ANY SAMPLES SUBMITTED.

CUSTOMER AGREES TO CHARGES FOR QUANTITIES LESS THAN 30 GALLONS AND AGREES TO ACCEPT 10% OVER OR UNDERRUN.

I. CUSTOM COLOR IN STANDARD BASE (ORDER MUST BE MINIMUM OF 30 GALLONS)

(1) BASE NO.	(2)	(3) CUSTOM COLOR NO.	(4) CUSTOM COLOR NAME	(5) PRODUCT NAME
939	CC	2257R	Spray Green	Vinyl Suede

II. CUSTOM COLOR IN UNDERCOAT, SEALER OR PRIMER TINTED ACCORDING TO DIRECTIONS.

(1) PRODUCT NO.	(2)	(3) CUSTOM COLOR NO.	(4) CUSTOM COLOR NAME	(5) PRODUCT NAME
	CC			

III. CUSTOM COLOR IN A STANDARD PRODUCT WHERE A BASE IS NOT AVAILABLE.

(1) PRODUCT NO.	(2A)	(2B)	(3) CUSTOM COLOR NO.	(4) CUSTOM COLOR NAME	(5) PRODUCT NAME

1. WRITE WHITE PRODUCT NUMBER OF TYPE OF PAINT DESIRED, I.E. 425, OR 1310 OR 1610 ETC.

2A. THIS SPACE INDICATES BASE CALLED FOR IN COLOR FORMULA. WRITE IN "L" FOR LIGHT BASE, "D" FOR DEEP BASE OR "X" FOR XD BASE.

2B. WRITE P, R, T OR V AS IN CUSTOM COLOR NUMBER.

V. SPECIAL COLOR IN STANDARD PRODUCT

(1) PRODUCT NO.	(2A)	(2B)	(3) SPECIAL COLOR NO.	(4) COLOR NAME	(5) PRODUCT NAME
565	S	P	29341	Lincoln Home Le Beige	H.P. Primer

1. WRITE PRODUCT NUMBER OF TYPE PAINT DESIRED I.e. 490, 779, 900, 1310, 1610 ETC.
2B. WRITE "P" FOR LIGHT COLOR, "R" FOR MEDIUM COLOR, "T" FOR DEEP COLORS, "V" FOR EXTRA DEEP COLORS.
3. FIVE DIGIT NUMBER ASSIGNED BY BRANCH.

SPECIAL COLOR INFORMATION: (Match Munsell Color # 7.5 YR 3/3 made from blending 1/2 & 1/4)

A. MATCH SAMPLE COLOR SENT for Wink Brent Dening — TO LOUISVILLE LABORATORY

Add 1 pint tinted linseed oil per gal and 1/2 pint thinner per gal

(a) DESCRIPTION OF SAMPLE

(b) MATCH REQUIRED: FAIR ____ (1 DAY) GOOD ____ (2 DAYS) EXCELLENT ____ (3 DAYS)

B. MATCH COLOR OF PORTER STANDARD PRODUCT NO. ____

C. MATCH PORTER CUSTOM COLOR NO. ____

D. ANSWER THESE QUESTIONS: (a) FOR EXTERIOR USE [✓], INTERIOR USE [ ]

(b) ALKALI RESISTANT COLOR REQUIRED: YES [ ] NO [ ]

(c) CHEMICAL RESISTANCE REQUIRED: YES [ ] NO [ ]

IF YES, LIST CHEMICALS AND HOW EXPOSED ____

(d) MATCH IN NATURAL DAYLIGHT: YES [ ] NO [ ] IF NO, SPECIFY TYPE OF LIGHT ____

TO BE FILLED IN BY LAB.

TO BE FILLED IN BY LAB

GENERIC TYPE ____

PRODUCT TYPE ____

HUE ____

VALUE ____

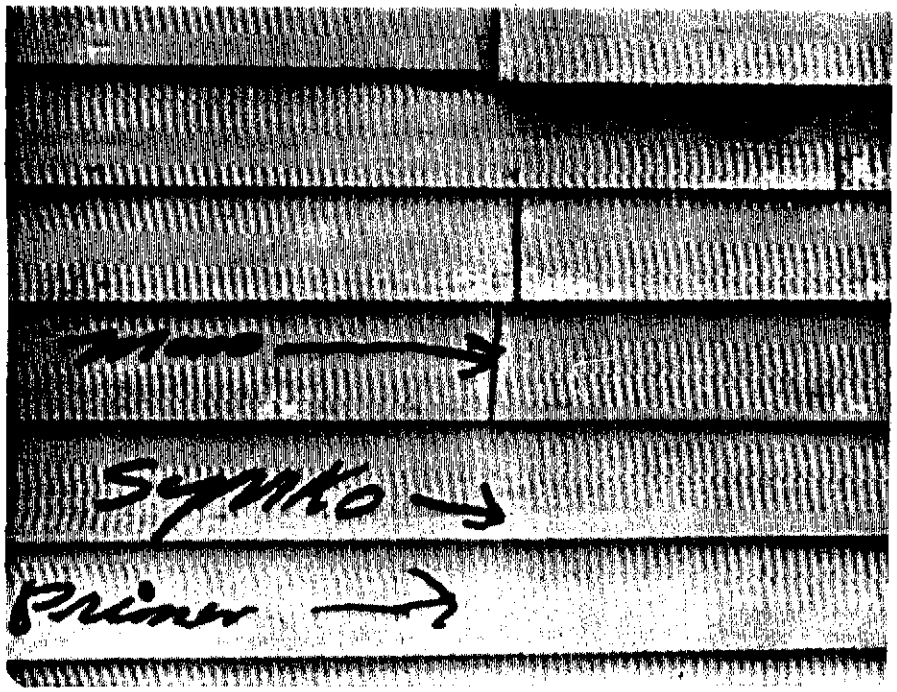


Photo showing siding with primer paint applied. Also nail holes and small cracks filled with spackling plastic exterior, manufactured by Symko Company, and larger cracks, small deteriorated area filled with exterior flexible caulking, manufactured by Tsimco (Mono). Arrows showing this on photo.

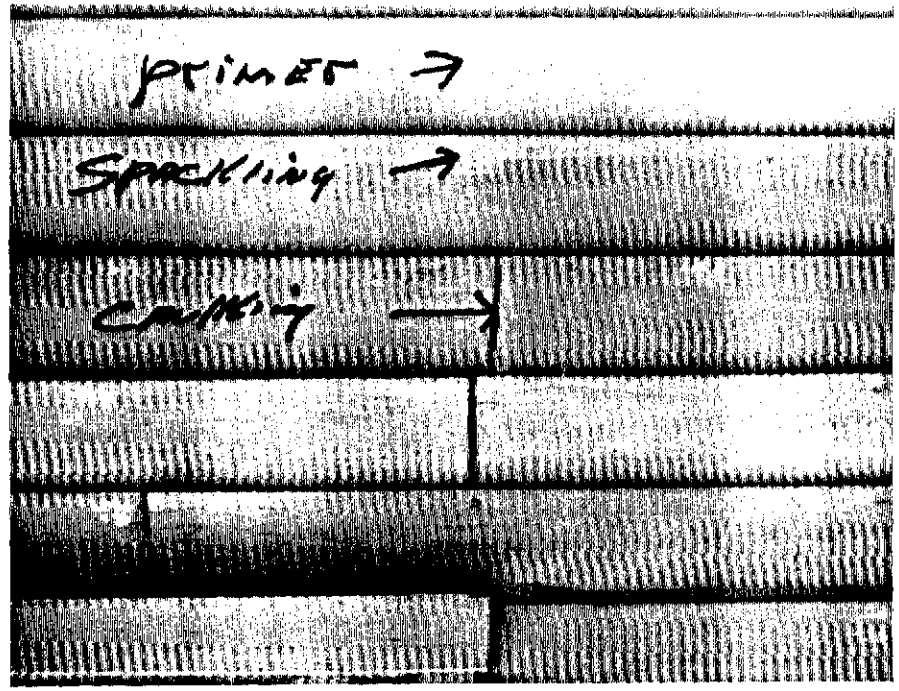


Photo showing board siding primed, spackling and caulking. Arrow showing each material. East side (back).

Photo showing deteriorated material removed and new replaced. Arrow showing this.

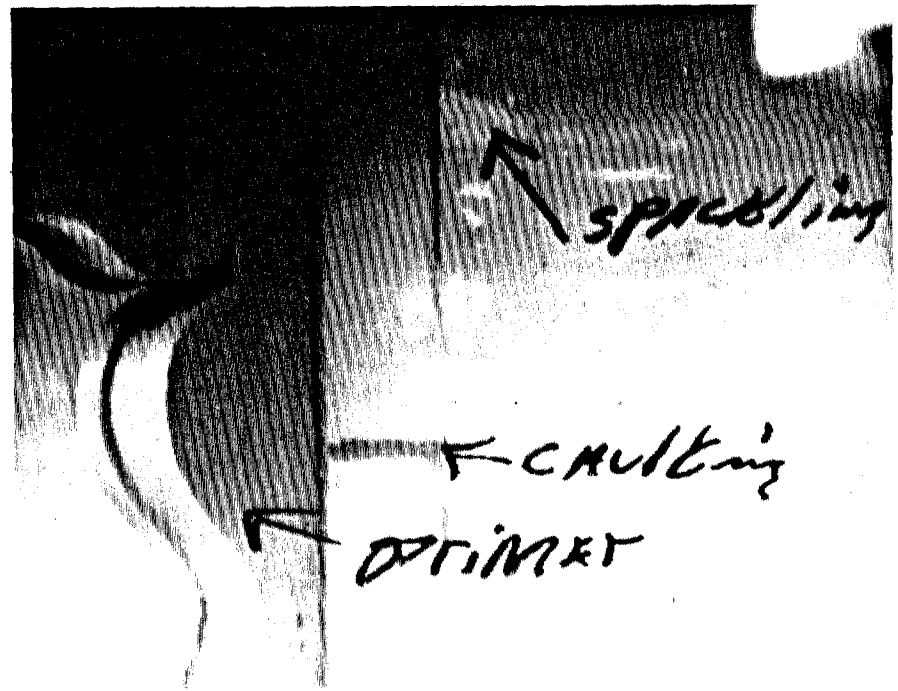


Photo showing eave and brackets with primer, spackling, and caulking. Arrow showing each material used. Back, east side.

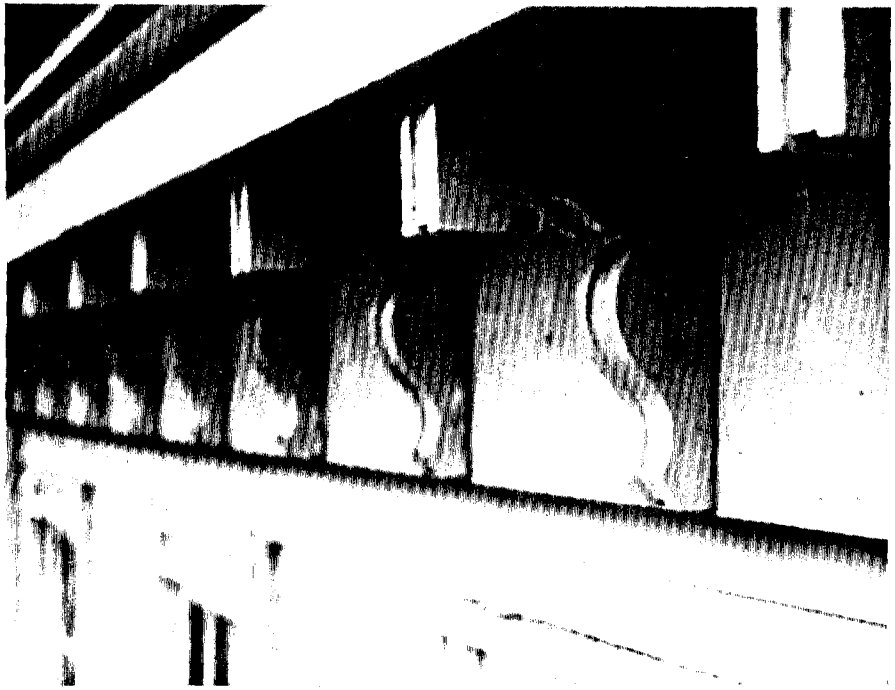


Photo showing primer coat of paint on brackets, eave and trim on front (west).

Photo showing applying primer coat paint on top, and workmen replacing deteriorated material. Arrow showing boards that have been replaced on front (west).

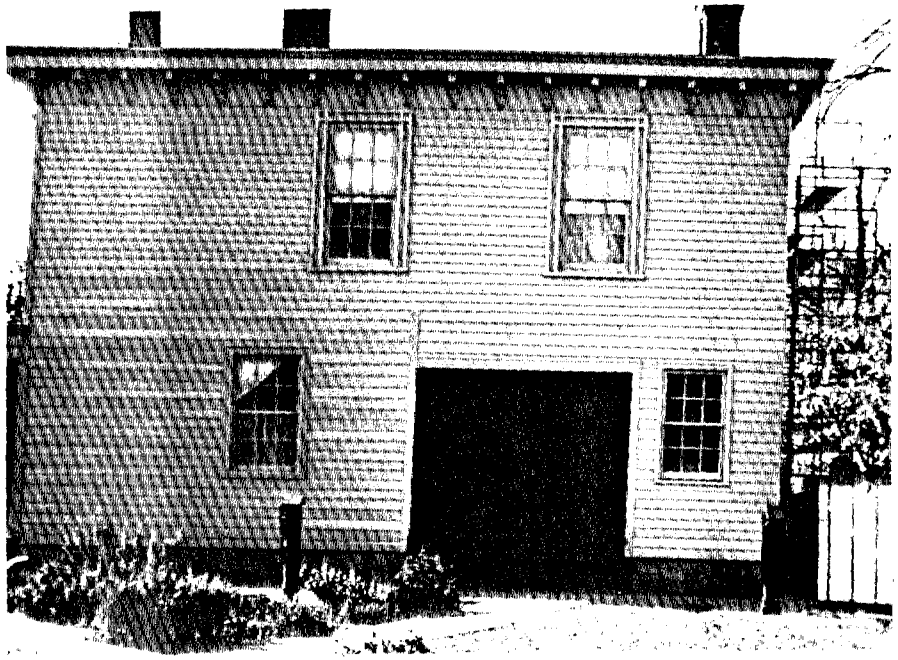


Photo showing back side (east) with primer and one top coat of paint applied.

Photo showing primer paint on front (west).

Photo showing first coat exterior wood paint, south side.

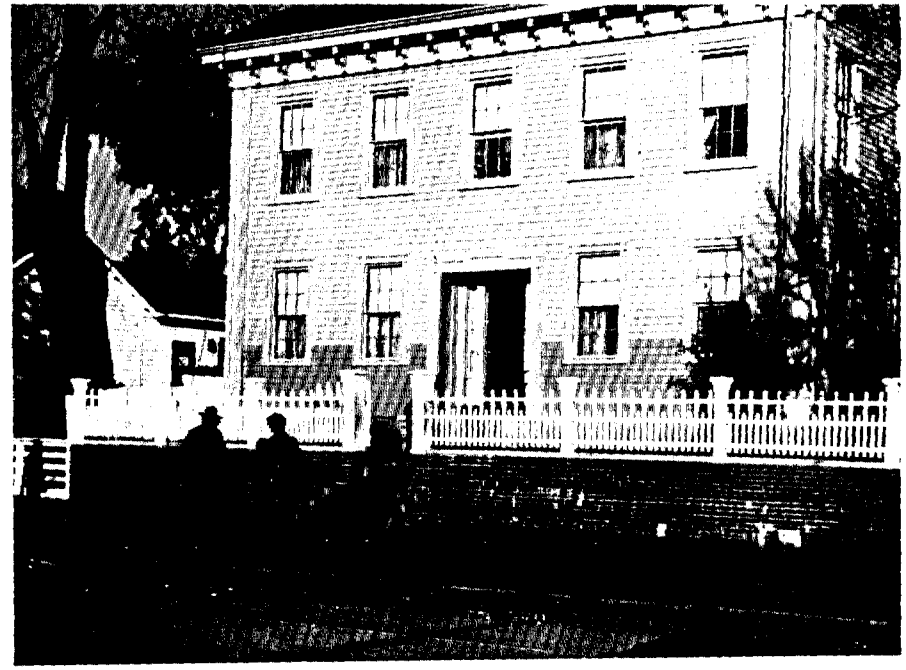
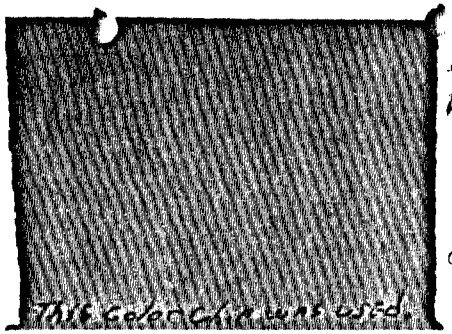


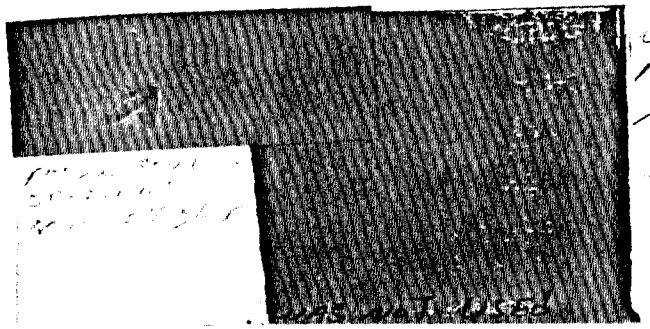
Photo showing first coat on all of front and second coat on bottom part. This is the darker part, west.

PORTER PAINT NO 533



This color chip is the final color, Munsell No. 7.5 YR 6/3.
Porter exterior, siding, and trim, paint No. 533 SP 2948.

NOT USED



NOT USED

PORTER PAINT CO.

INTER-OFFICE COMMUNICATION

TO:	Joe Winkelmann	cc:	Arvil Short
			Bennie Benton
FROM:	Buck Hourigan		Ott Schilling
DATE:	September 14, 1976		Jack Brady
SUBJECT:	Lincoln Home Colors		

Enclosed please find four Munsell chips as you requested. They are 10 GY 5/4 (shutter primer color), 7.5 YR 6/4 (original finish coat color), 7.5 YR 6/2 - 7.5 YR 6/4 (blend of which is final finish coat color for Lincoln Home.

Also enclosed, Joe, are three small drawdown chips. As you can see, two of these are matched to Munsell chips - 7.5 YR 6/4 and 7.5 YR 6/2 respectively. The third color labeled 29484 is a blend of these two matches. Would you please have the National Park Service approve this color as the color we should match for the finish coat.

Buck Hourigan

BH/gs:0-24/76

Enclosures

Photo showing completed paint job on south side of home.

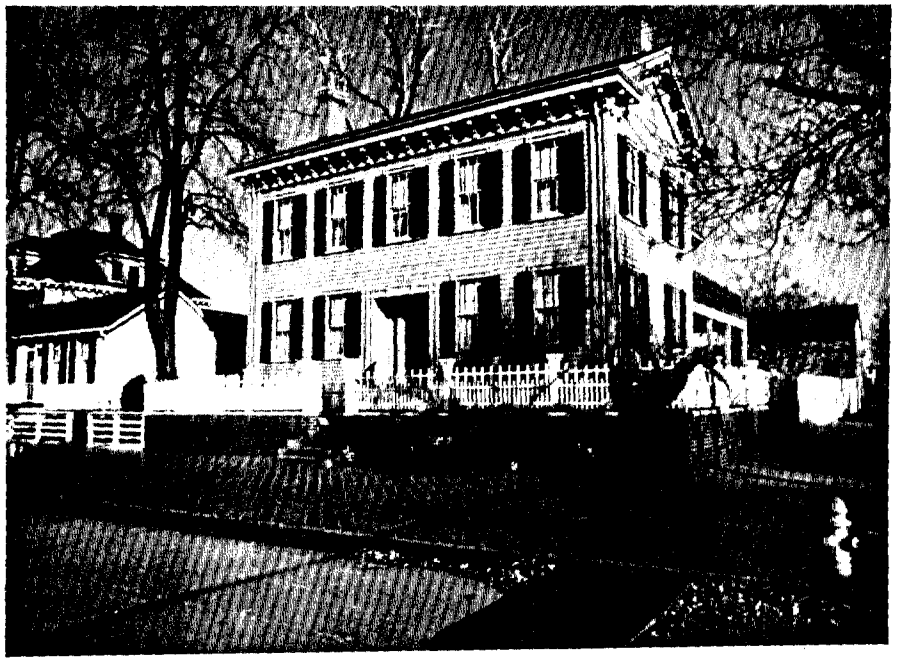


Photo showing completed paint job, front (west).

Photo showing board that was used to replace deteriorated original material. Date on board 8-10-1976, shows when it was replaced. Front, west side.

Photo showing picket in front of Lincoln Home.

Photo showing soil excavated so old deteriorated mortar could be removed and new mortar replaced. Back side, east.

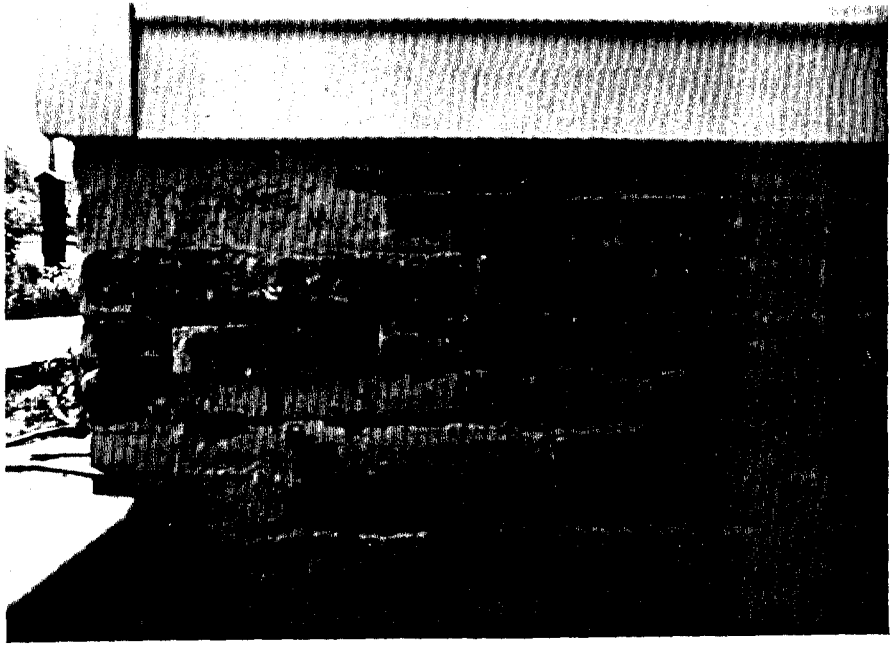


Photo showing badly deteriorated mortar in joints. This on east side.

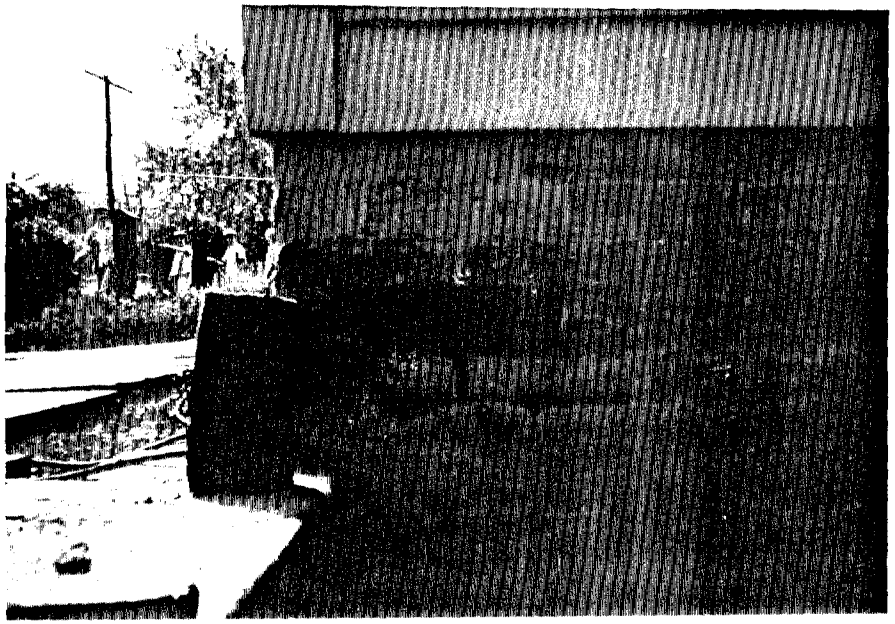


Photo showing one of the historic bricks removed. Note the appearance of this brick.

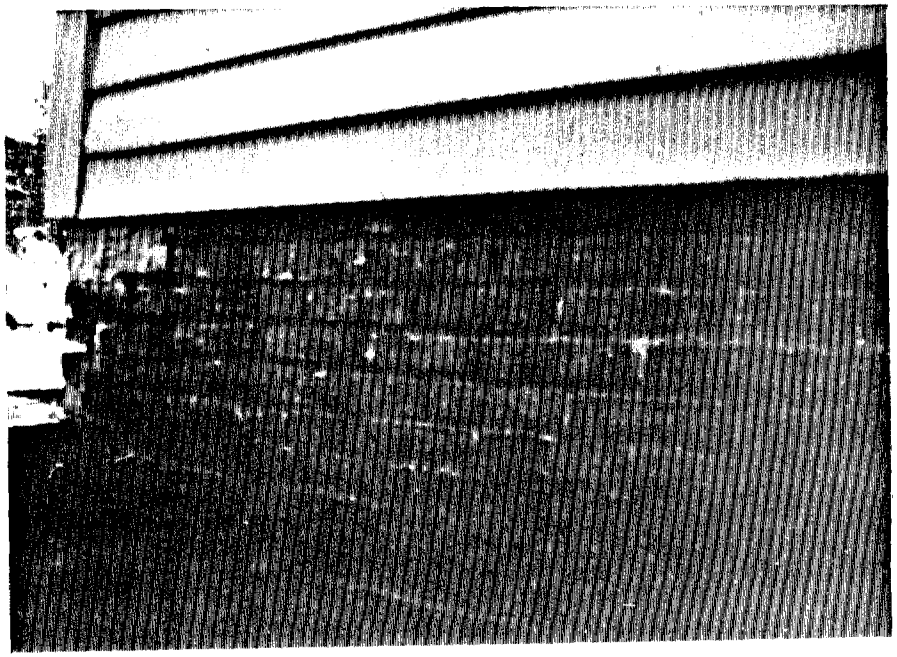


Photo showing deteriorated mortar from joints. Almost all the old mortar had a cut-back.

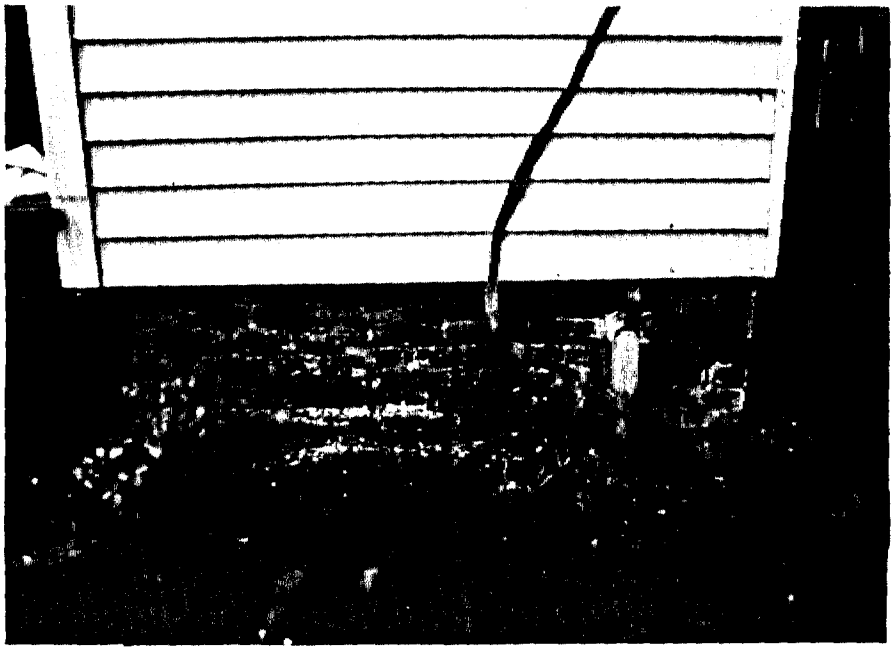


Photo showing brick foundation before old and new mortar work was accomplished, back side (east).

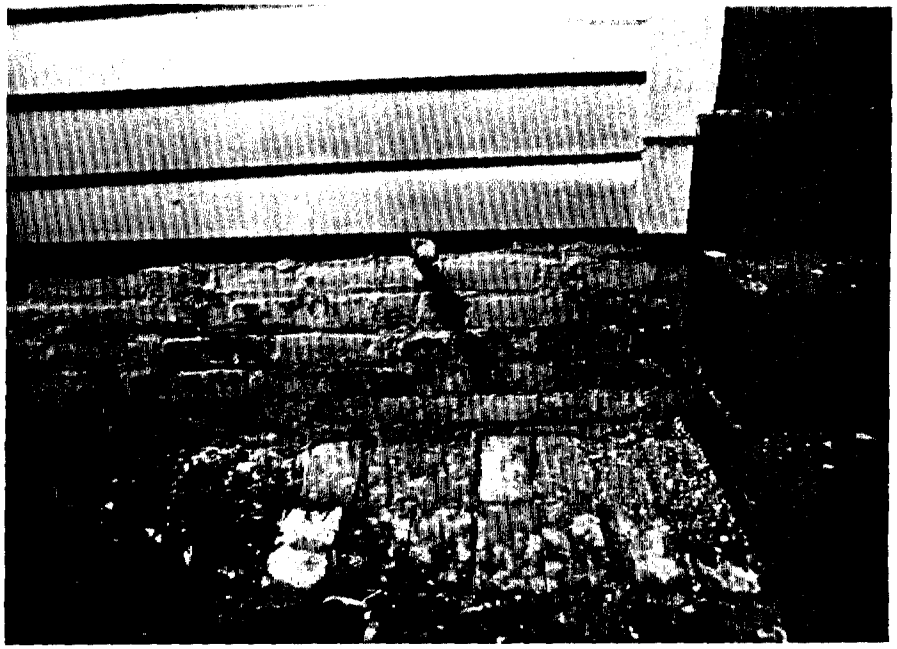


Photo showing badly deteriorated paint on brick foundation. (East).

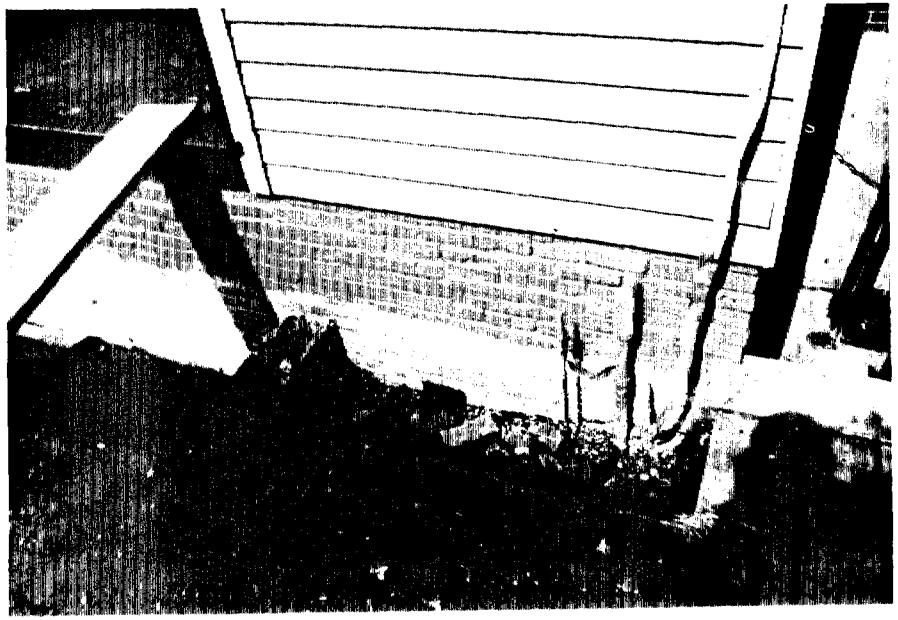
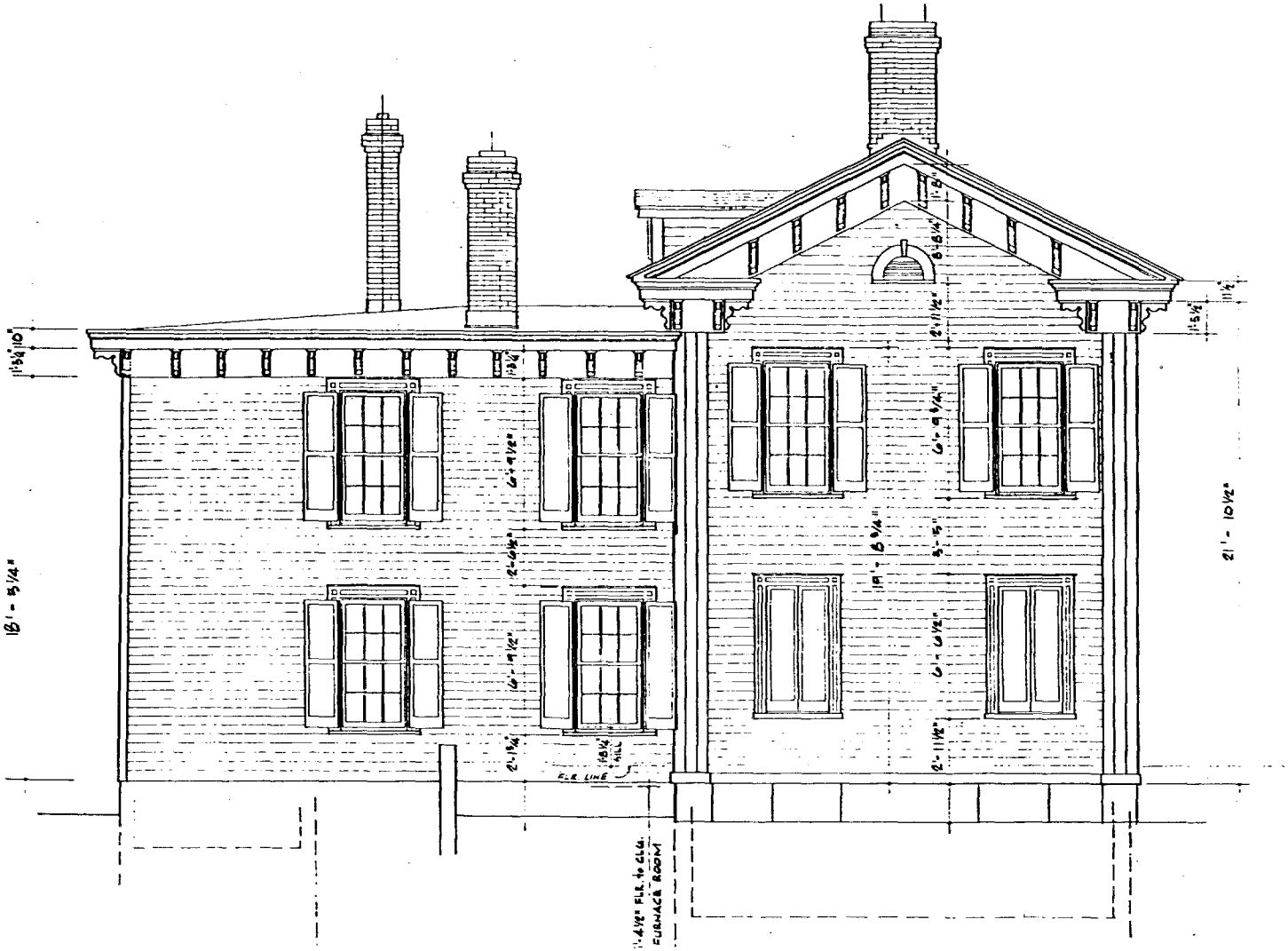


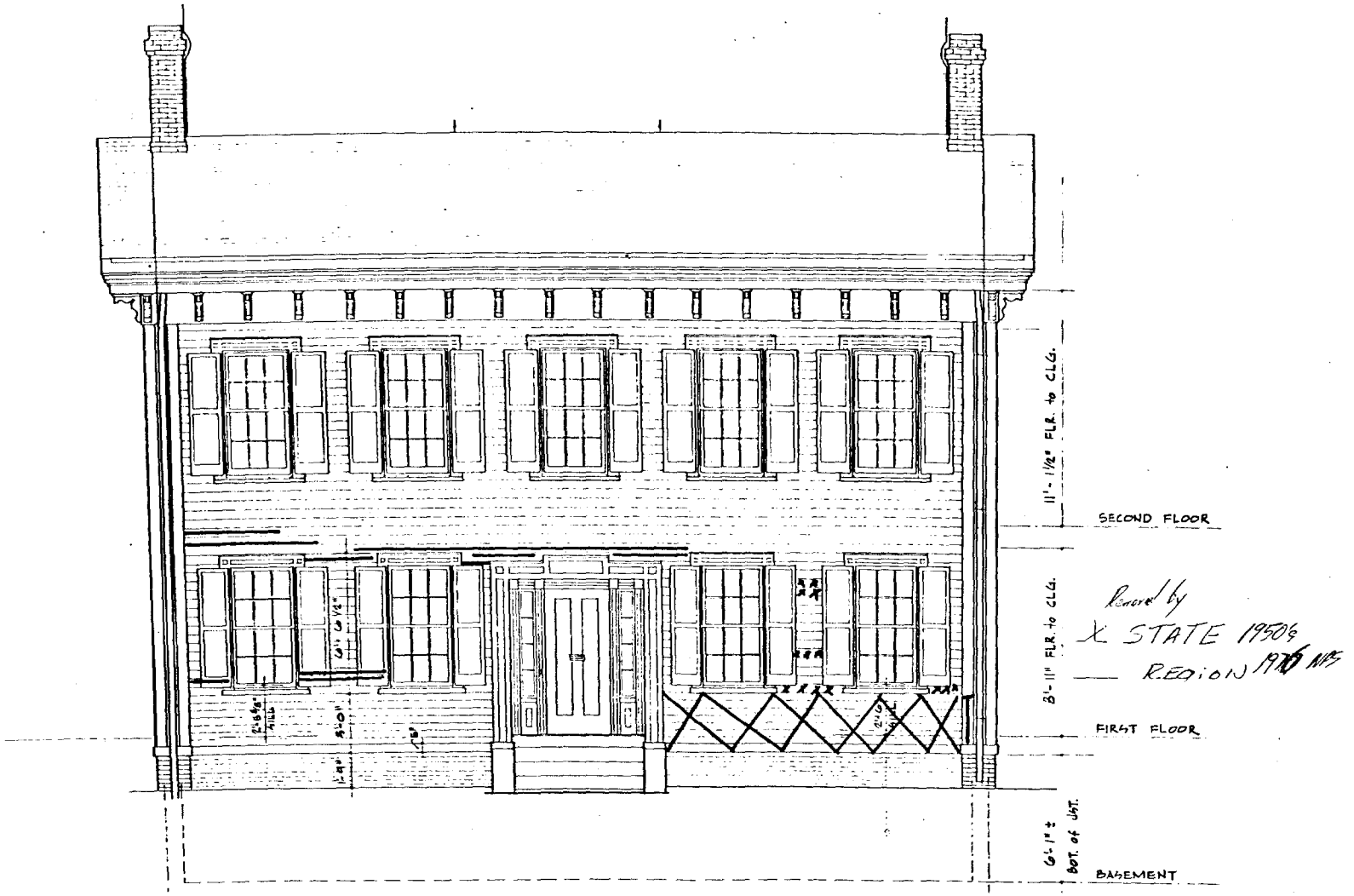
Photo showing new mortar in joints. Also brick painted Exterior Masonry, Munsell Color Gray 5 BY 5/1. East side.

Photo showing masonry and painting finished on brick foundation, front, west side.



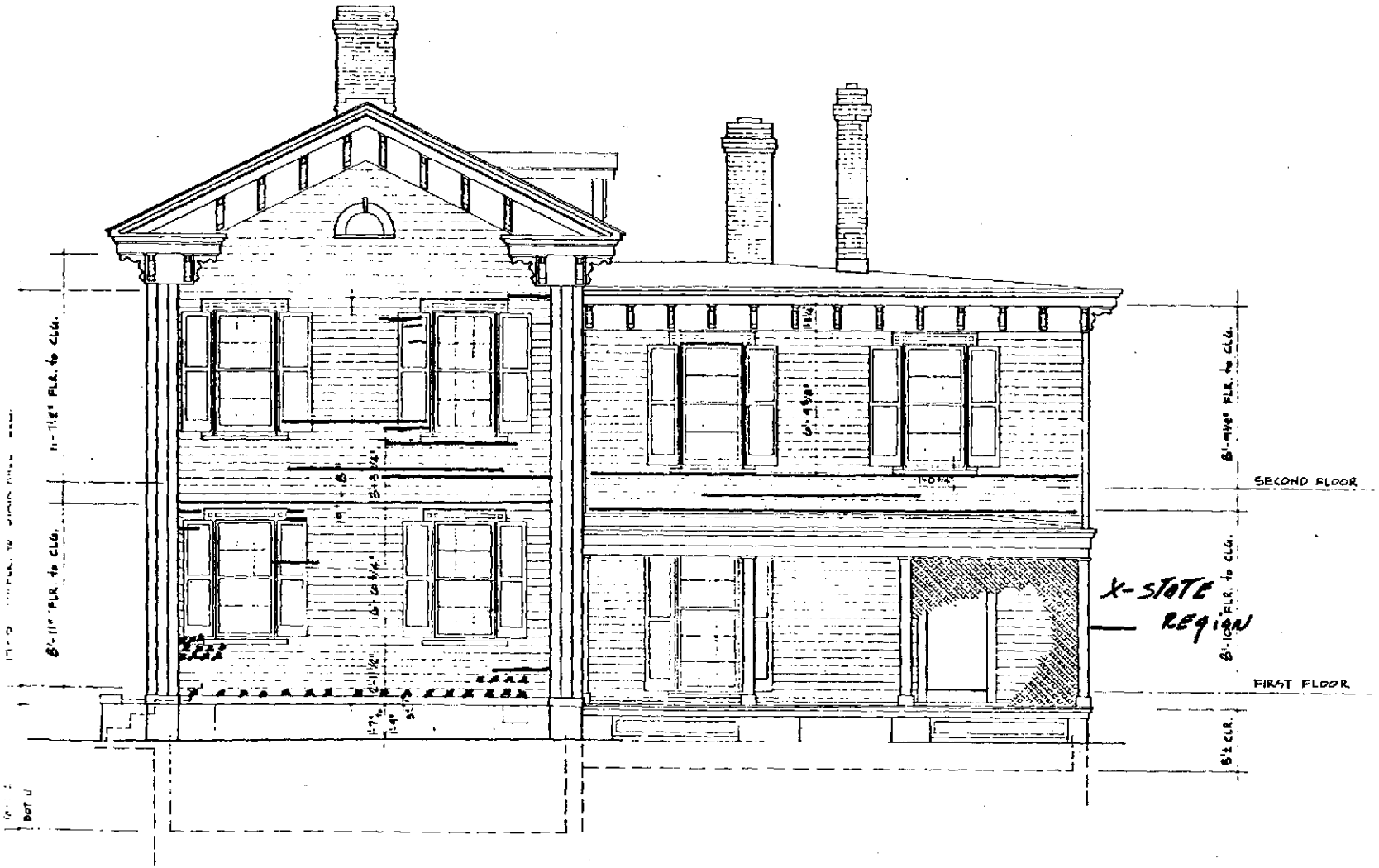
NORTH ELEVATION

No Scale



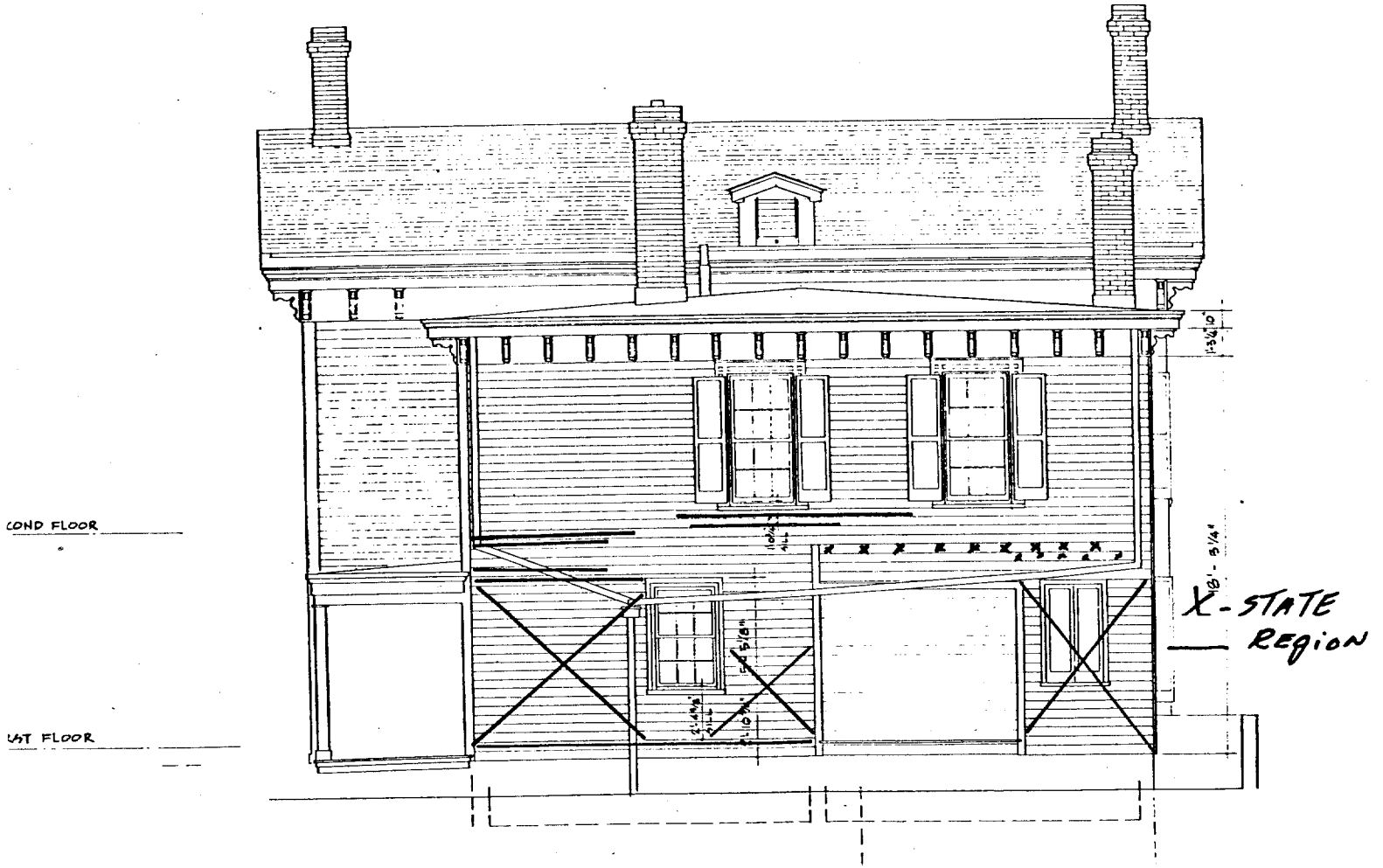
WEST ELEVATION

No Scale



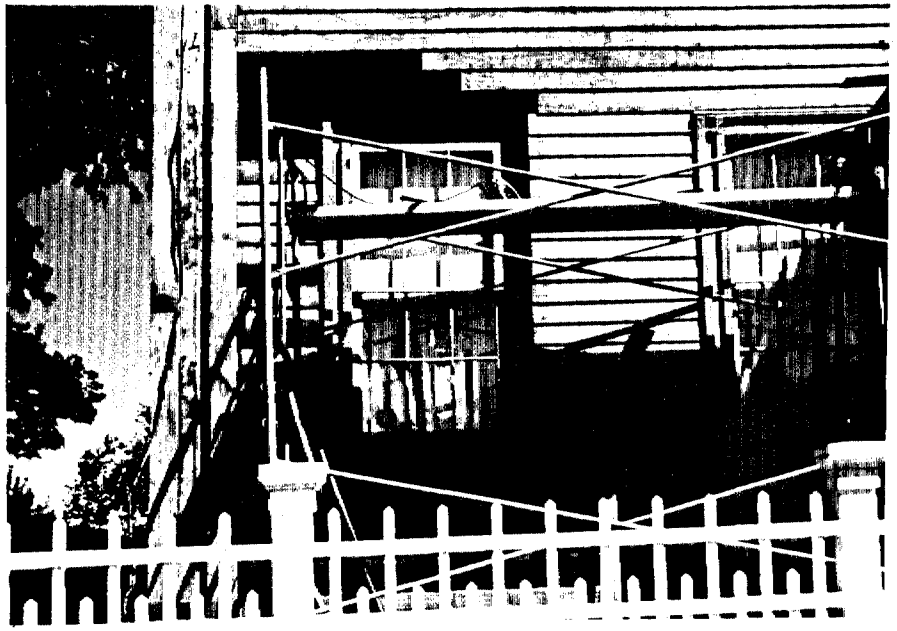
SOUTH ELEVATION

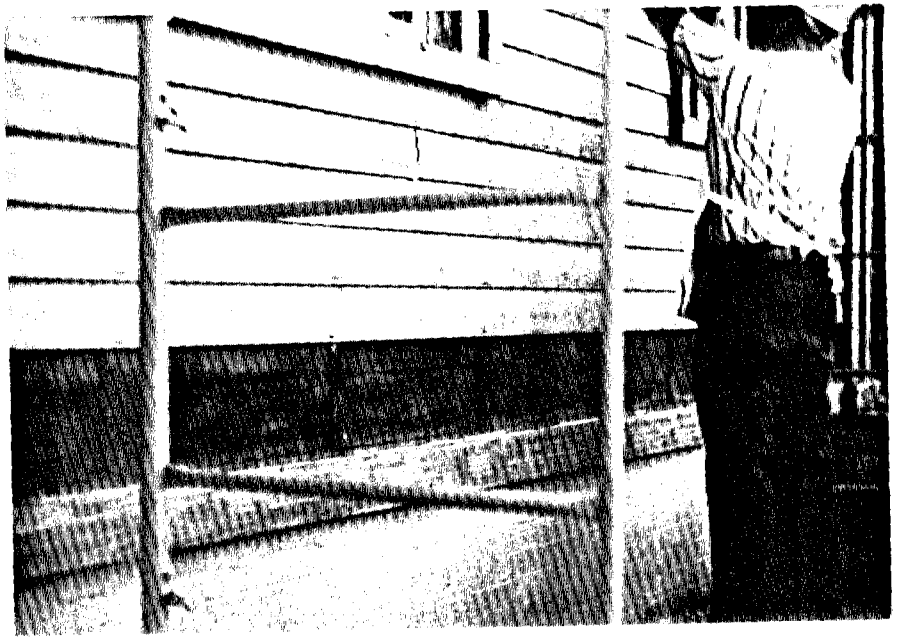
No Scale

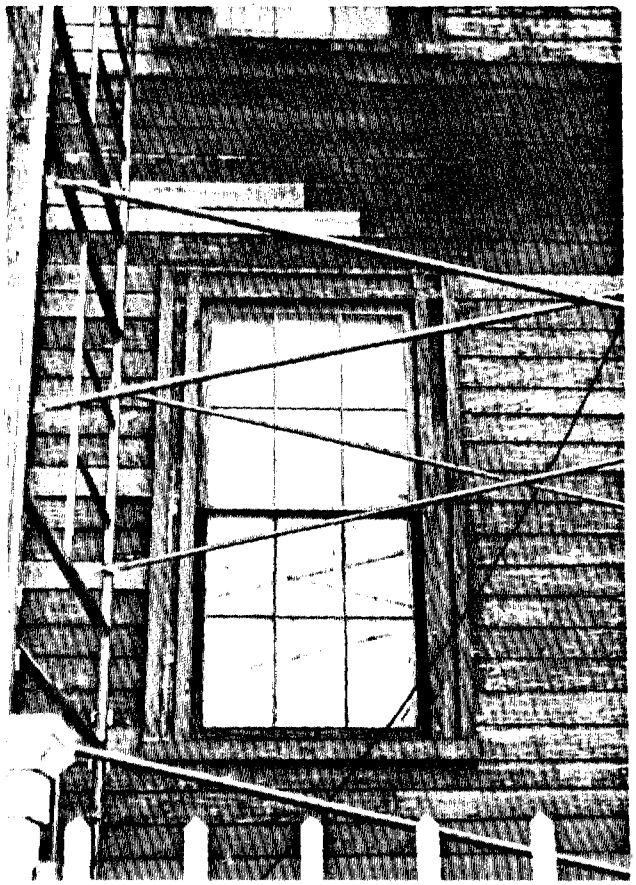


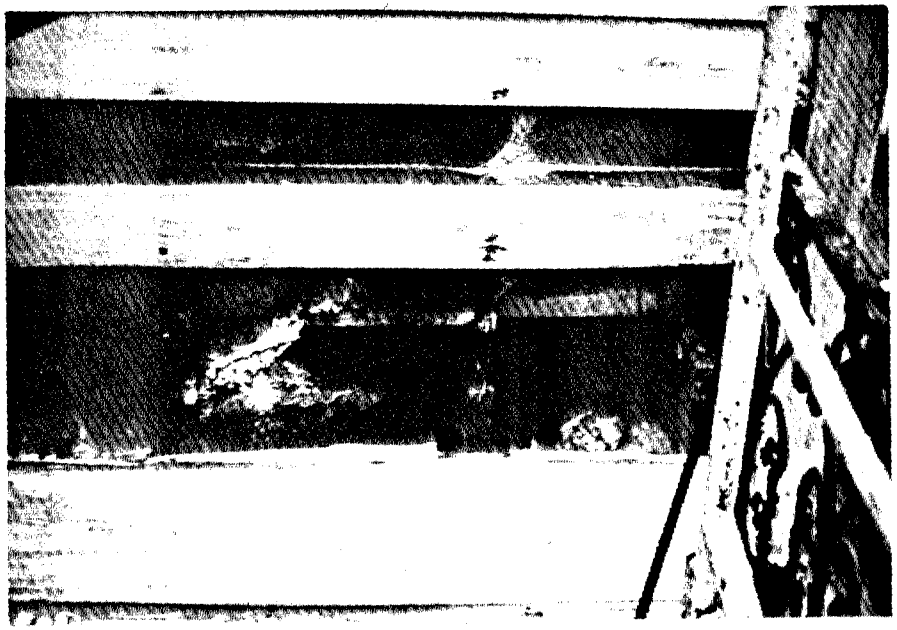
EAST ELEVATION

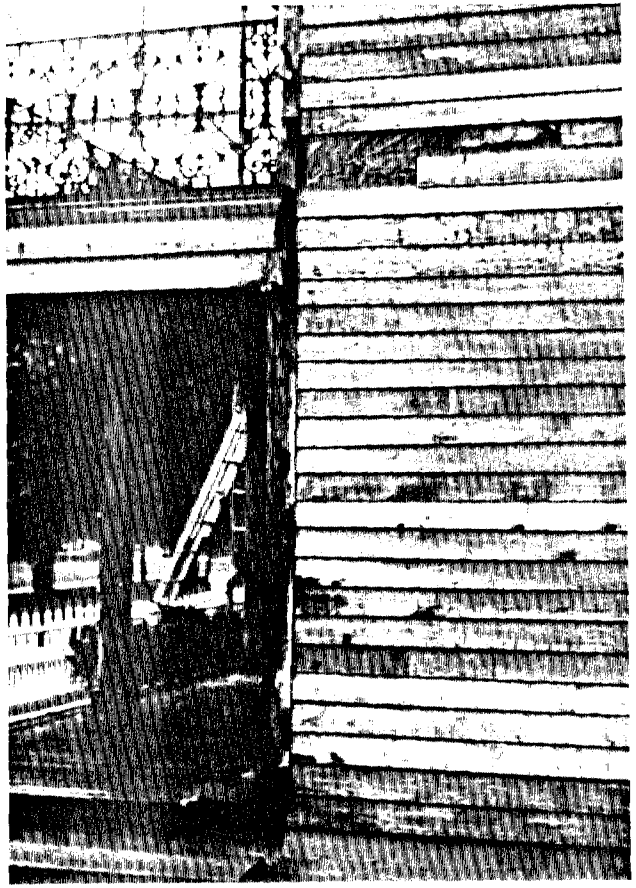
No Scale







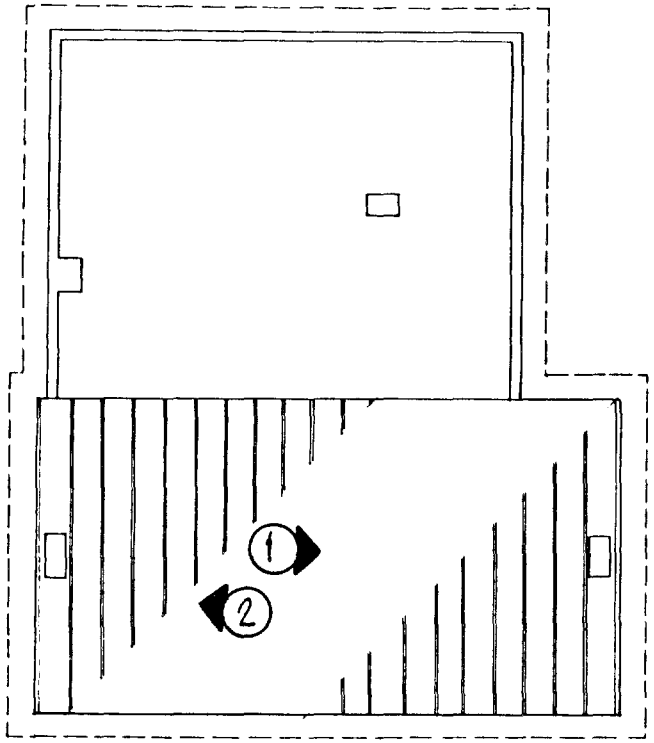




B. 1954 Restoration Photographs

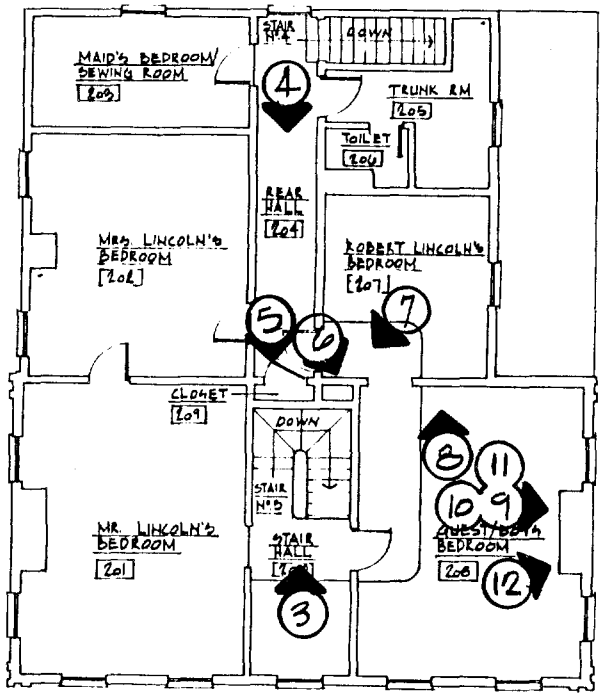
Dr. James Hickey, an architectural historian and Lincoln scholar, was present at the 1954 Second Floor Restoration. The notes and photographs on the following pages by Dr. Hickey provide valuable information about the 1954 restoration work on Lincoln Home. This material is the only available account of the Restoration.

The plans on the following pages provide a key as to the direction and location of each photograph.



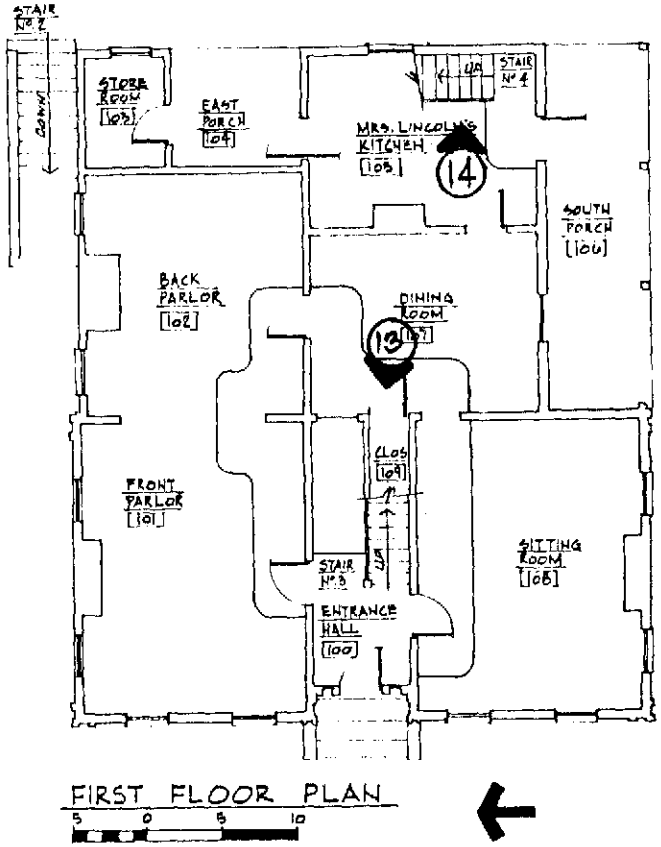
ATTIC PLAN

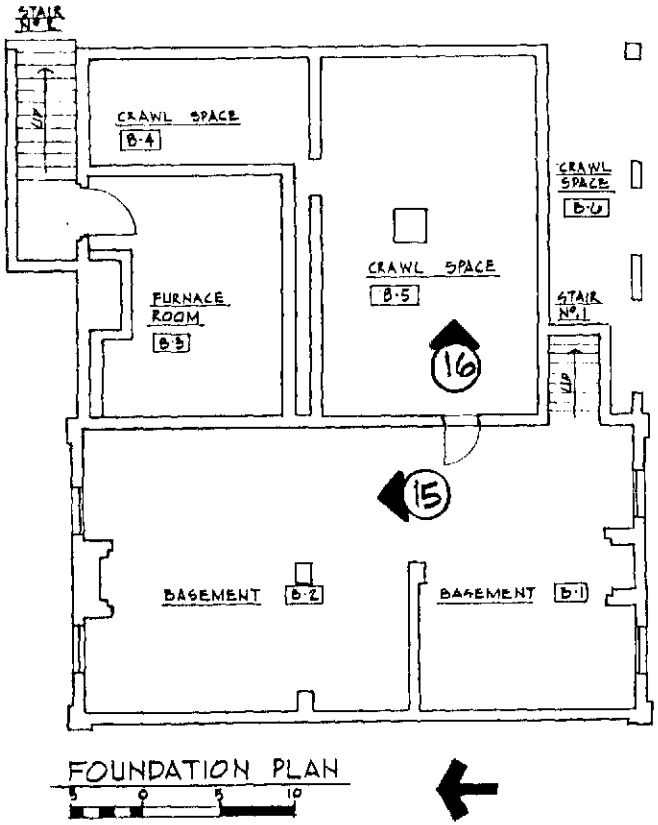
5 0 5 10

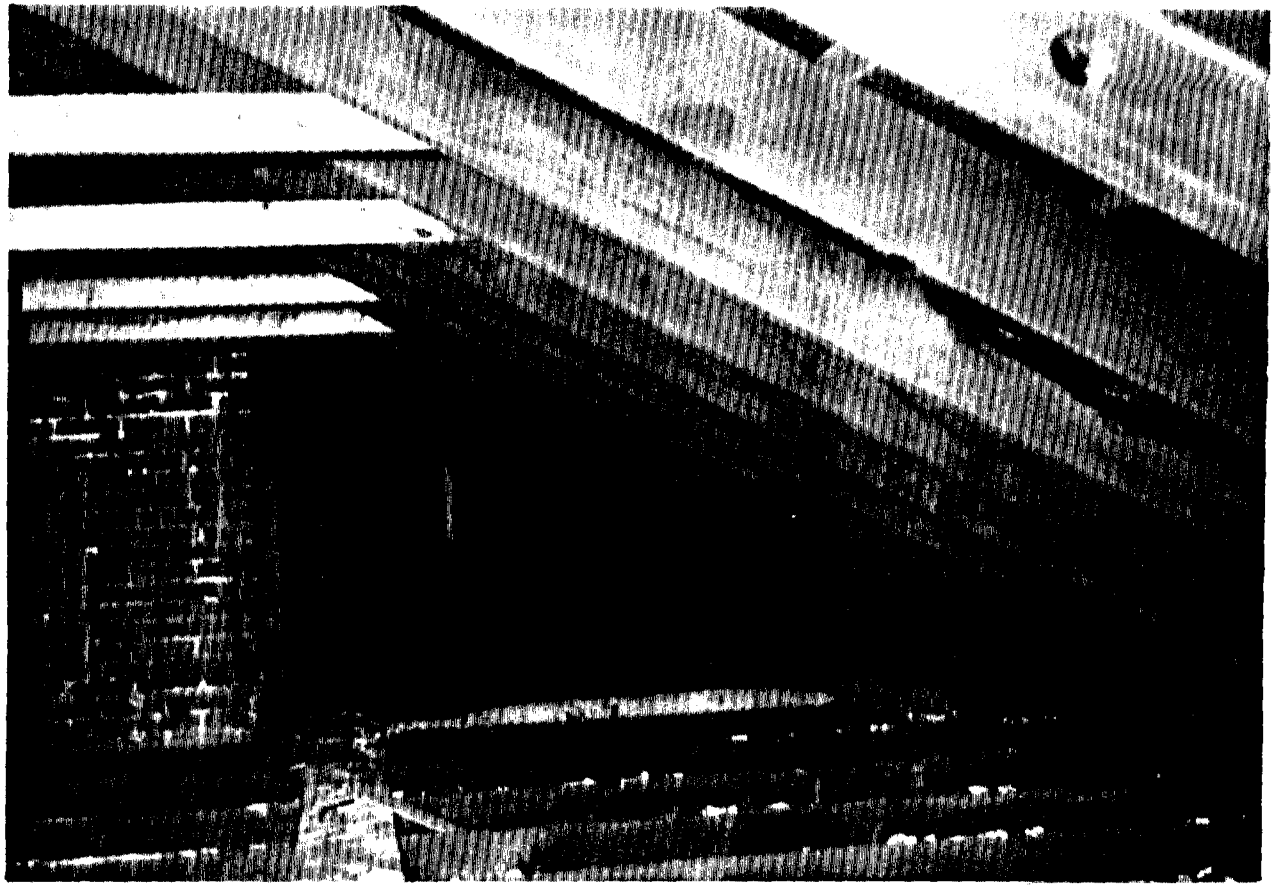


SECOND FLOOR PLAN

5 0 5 10

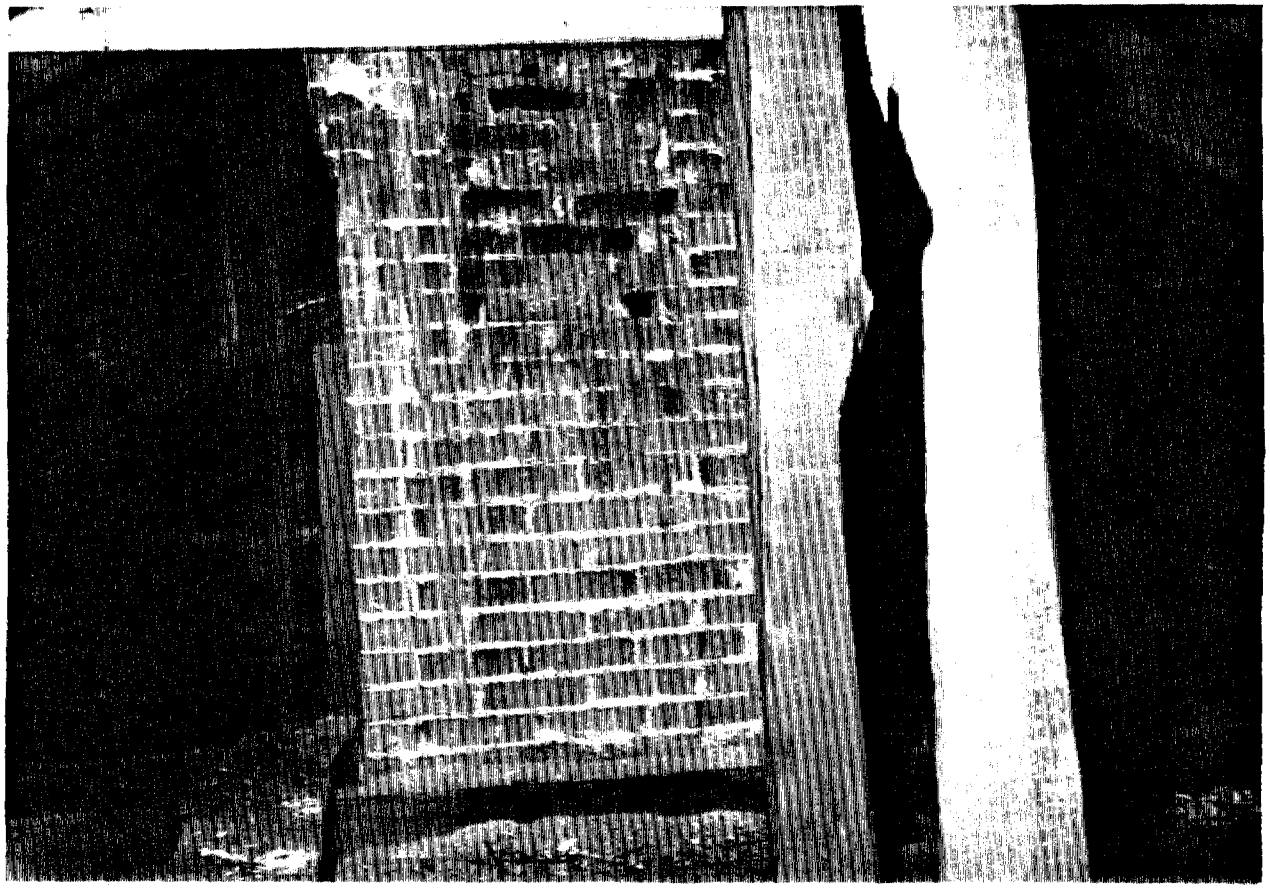

STAIR No. 2
STORE ROOM [102]
EAST PORCH [104]
MRS. LINCOLN'S KITCHEN [105]
STAIR No. 4
SOUTH PORCH [106]
BACK PARLOR [102]
DINING ROOM [107]
CLOS [109]
FRONT PARLOR [101]
STAIR No. 3
SITTING ROOM [108]
ENTRANCE HALL [100]
14
13
FIRST FLOOR PLAN
5 0 5 10


STAIR No. 1
CRAWL SPACE B-4
CRAWL SPACE B-6
CRAWL SPACE B-5
FURNACE ROOM B-3
STAIR No. 1
16
15
BASEMENT B-2
BASEMENT B-1
FOUNDATION PLAN
5 0 5 10



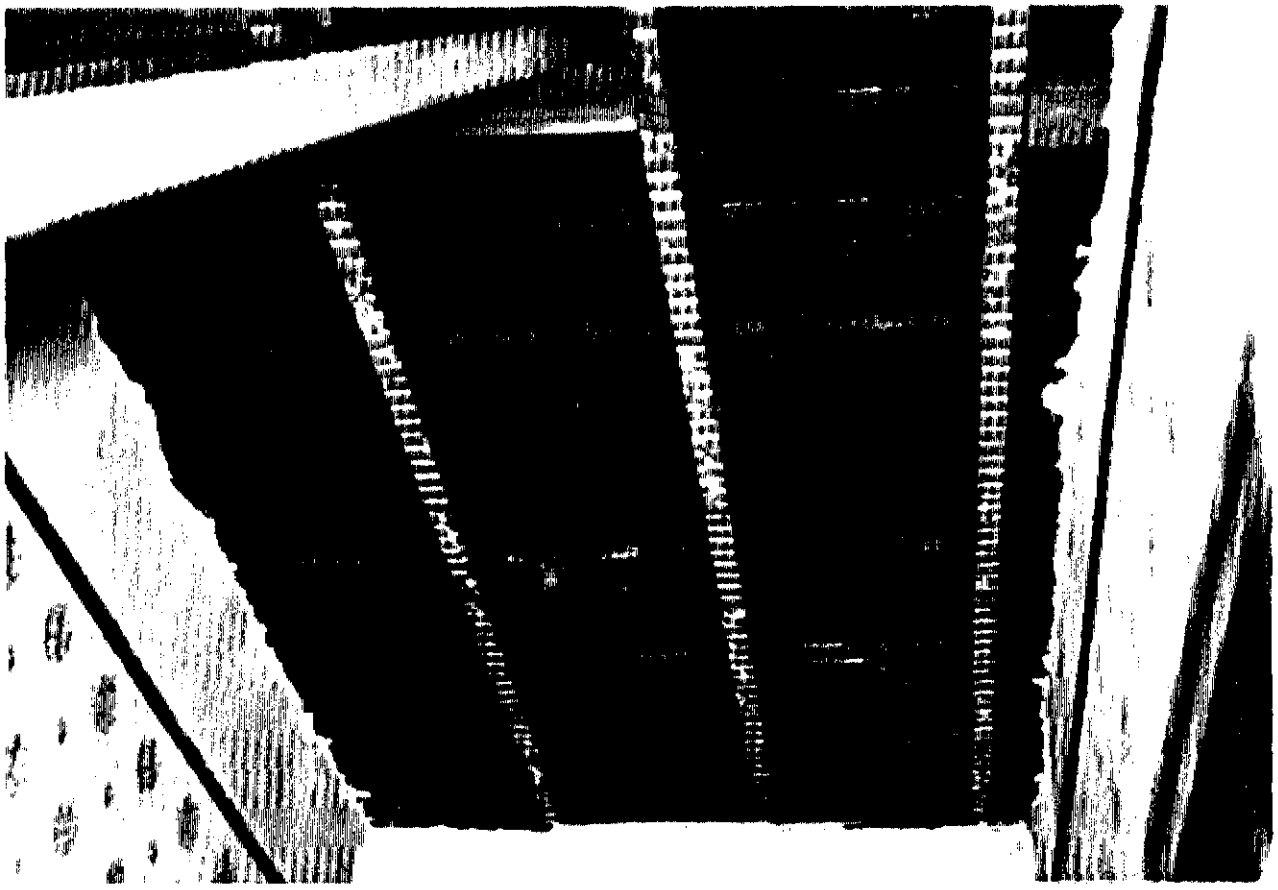
H - 1

Southwest corner of attic over front (west) portion of house



H - 2

North end of attic over front (west) portion of house

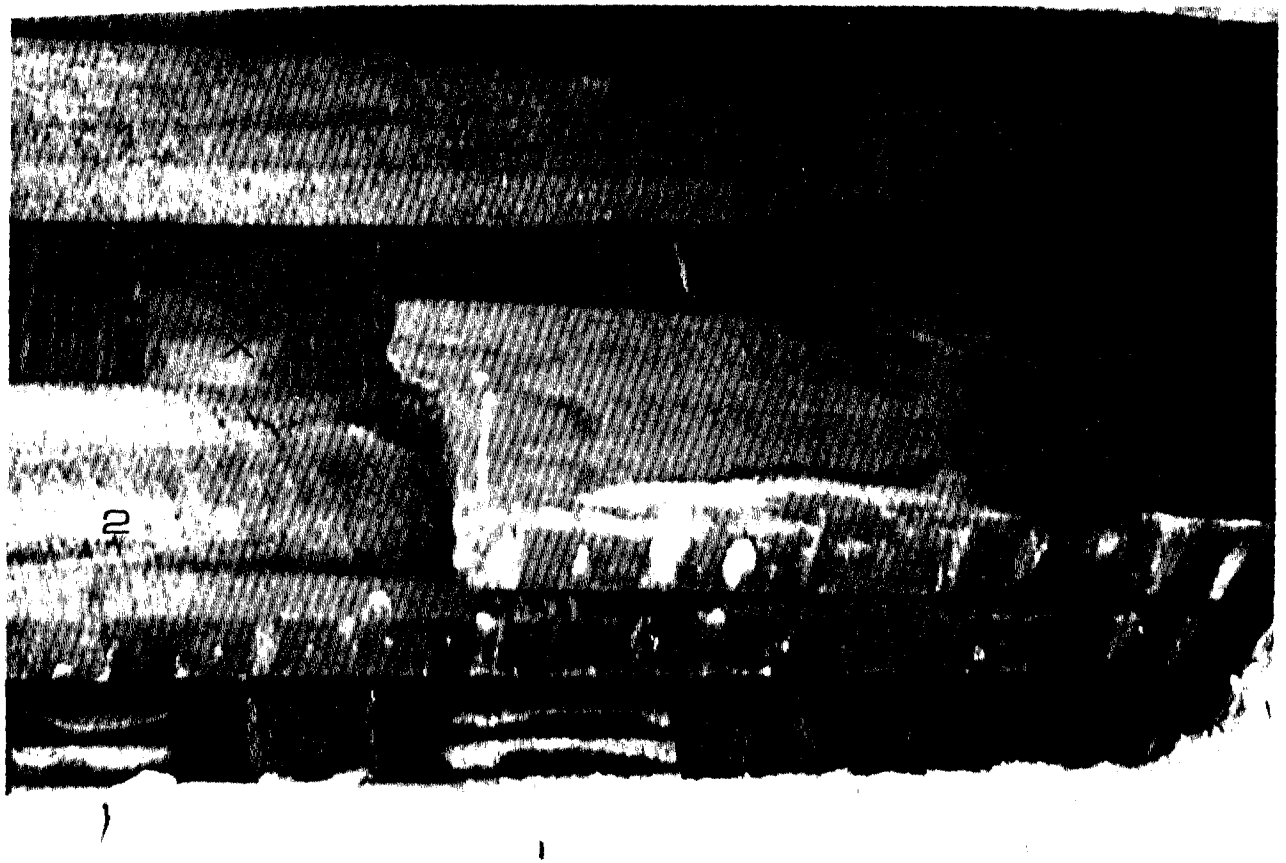


H - 3

Second floor, front hall ceiling removed, exposing ceiling joists, roof rafters and roof sheathing

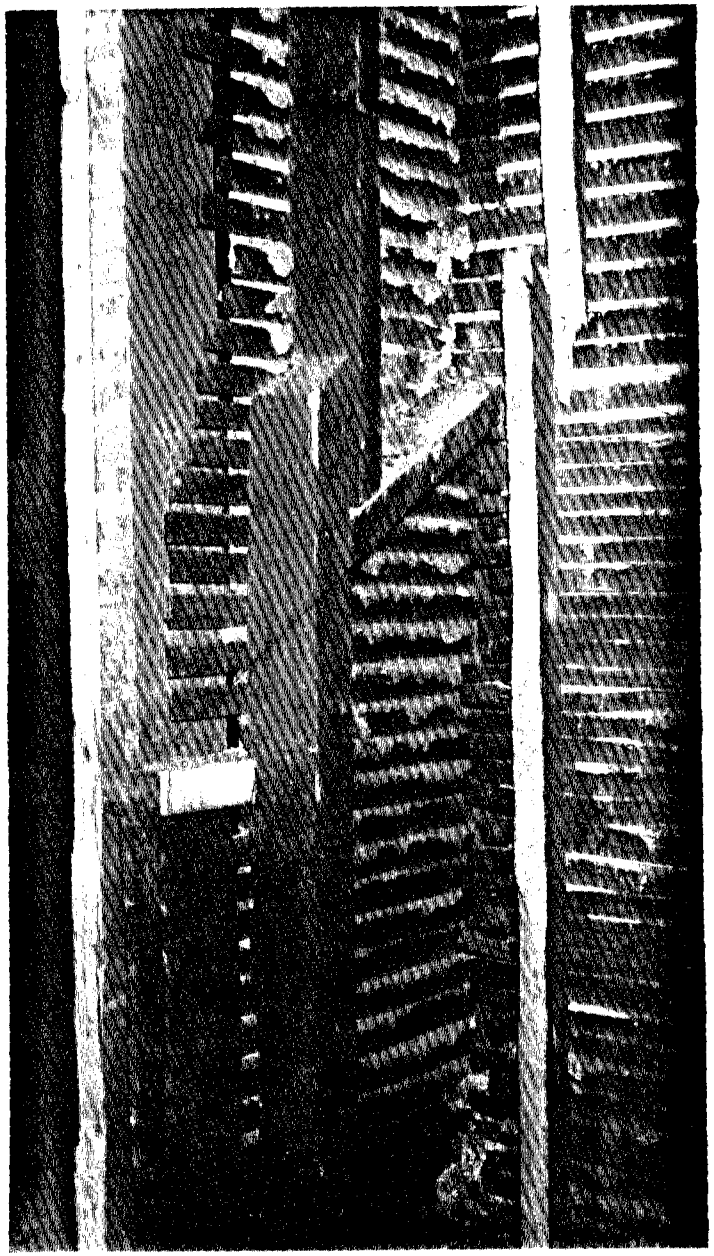
Second floor, back hall ceiling removed, exposing ceiling joists.

H - 4

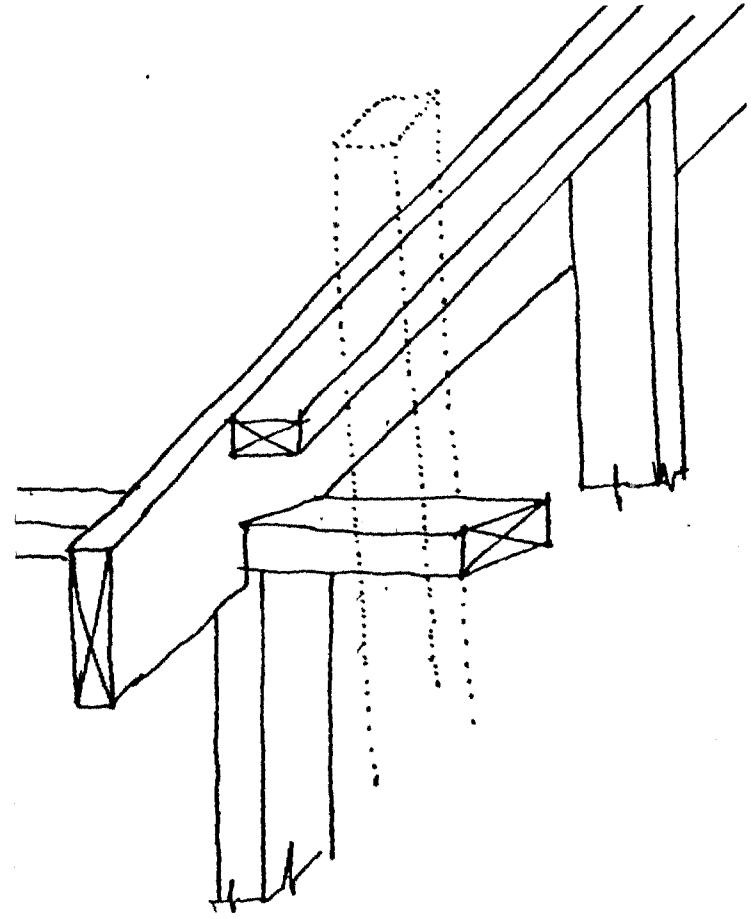


H - 5

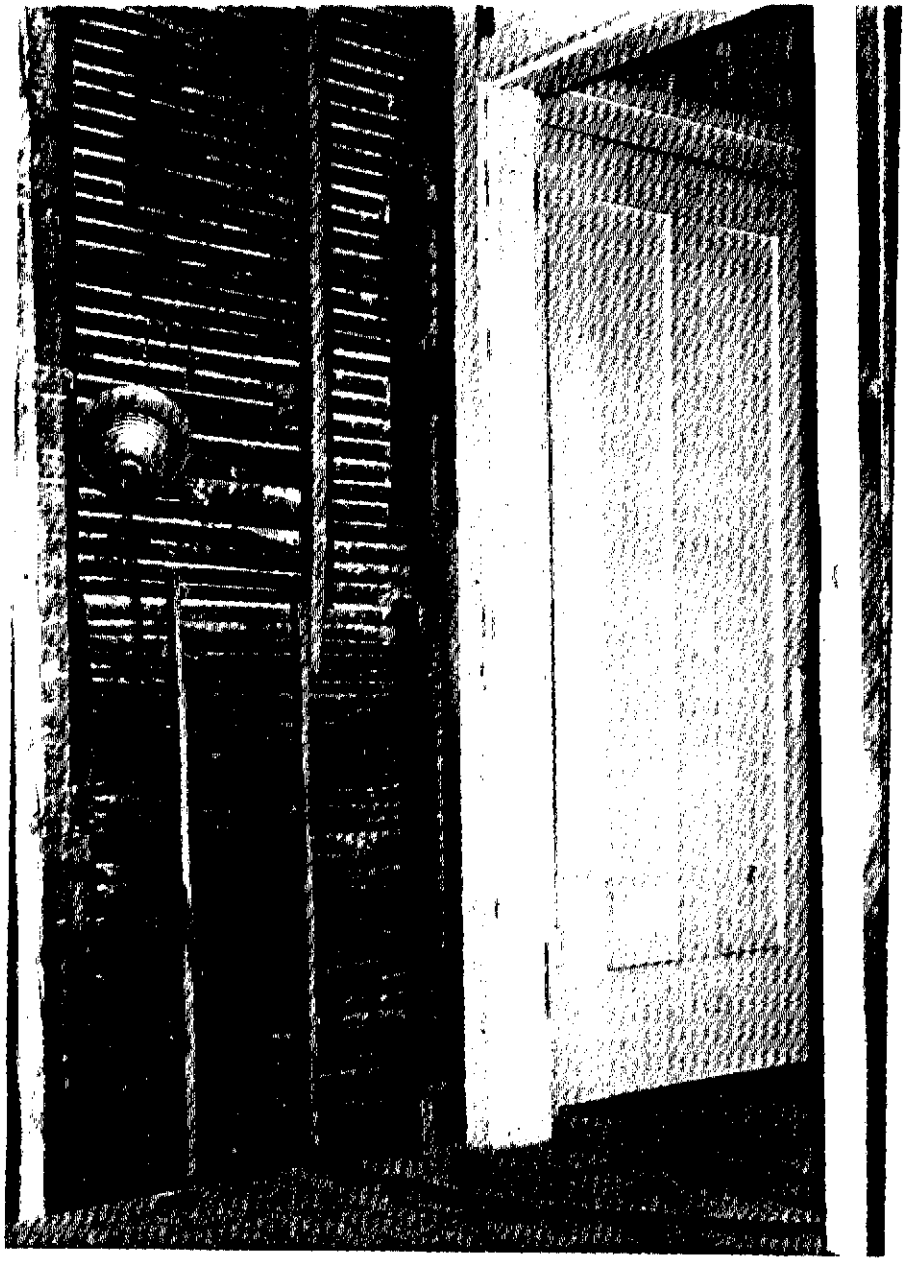
Second floor, back hall (west end), looking up through ceiling joist at cornice board which runs across back of house same as in the front. "X" marks the spot where brackets were removed to fasten back part of house to the front. This board is painted "Quaker Brown." Board #1 is a roof rafter and Board #2 is a ceiling rafter.



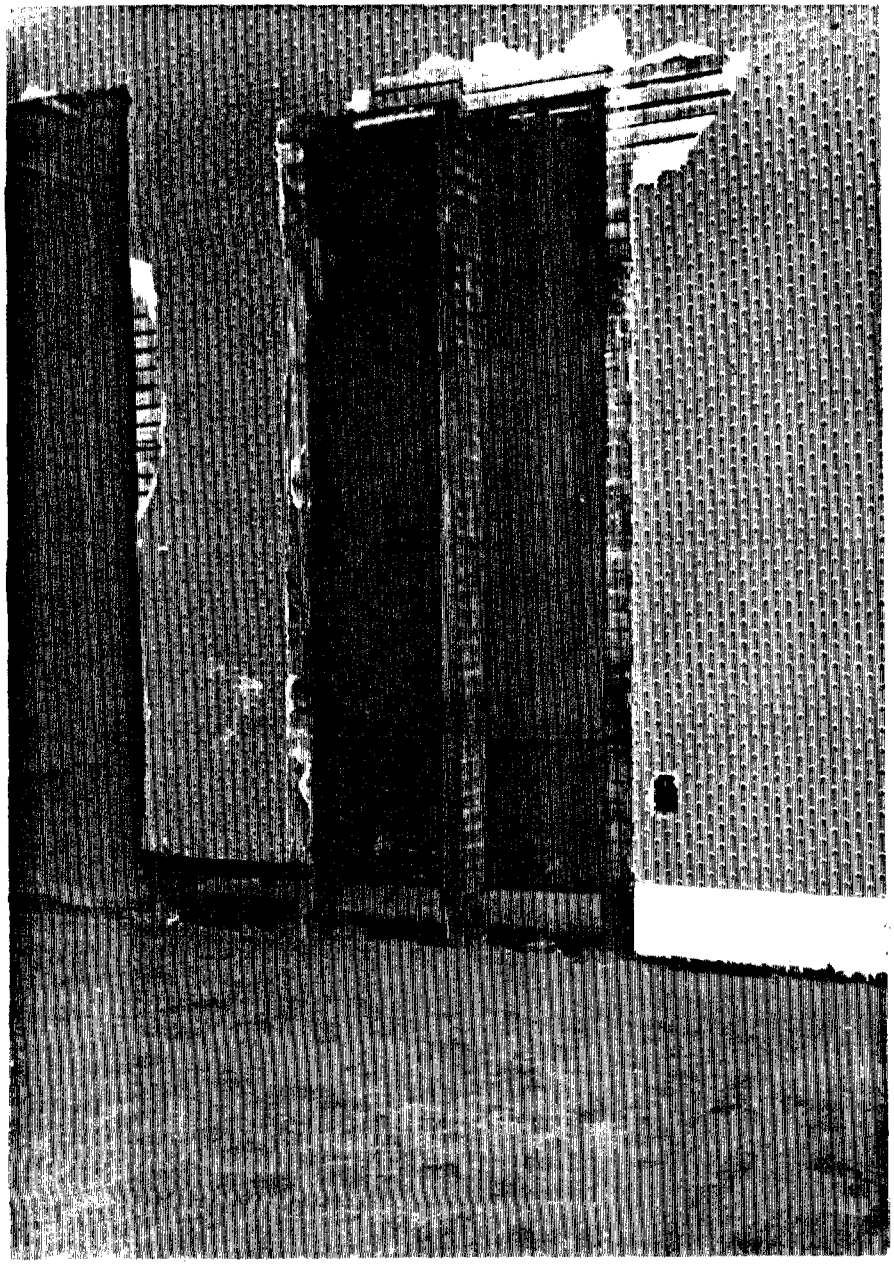
Second floor, structural details of the Home, the removal of fabric has exposed an area at east end of front stairway. Visible is the angle of the house before the story and one-half structure was remodeled by Hannar & Ragsdale in 1856.



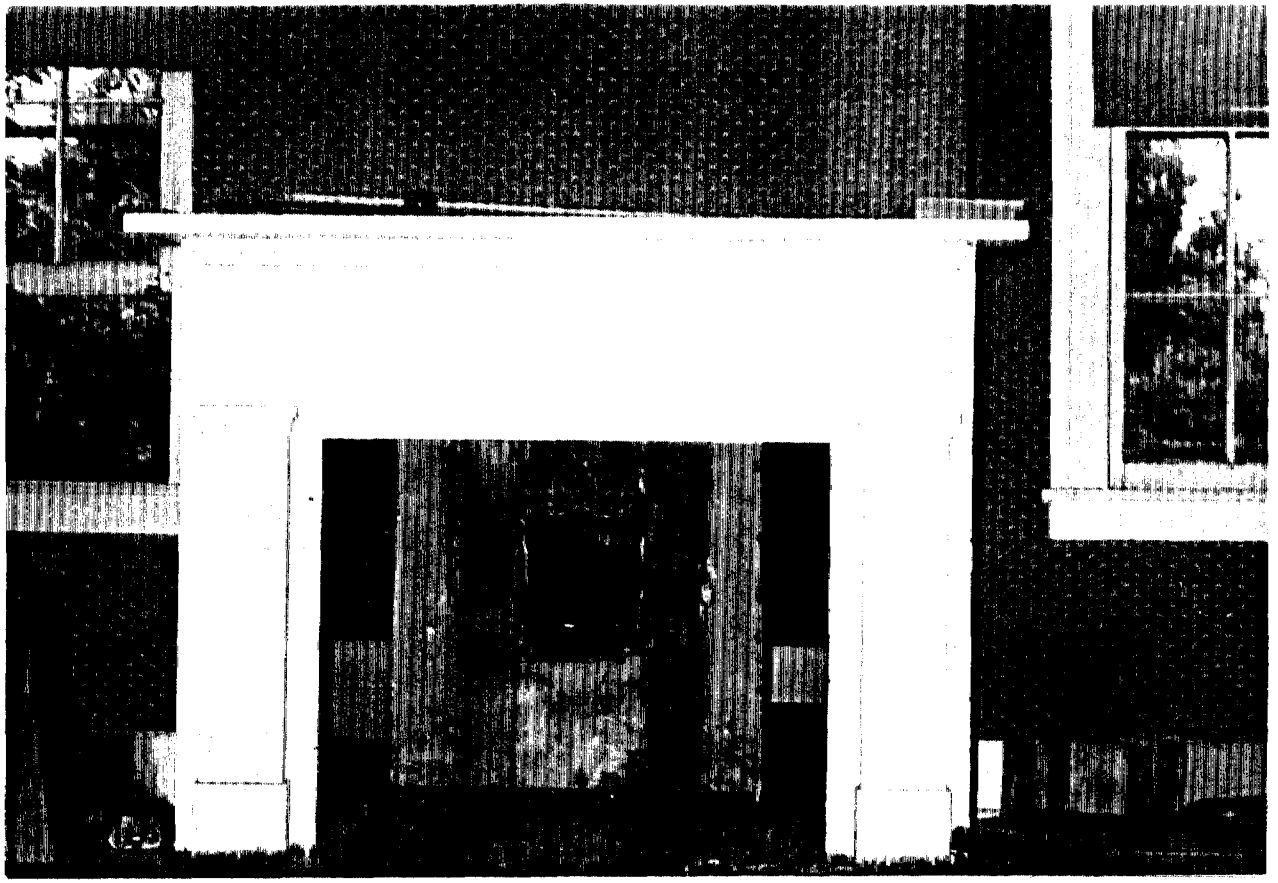
H - 6



Second floor, Robert Lincoln's Bedroom, northeast corner, showing split hickory lath up to point where addition was made.

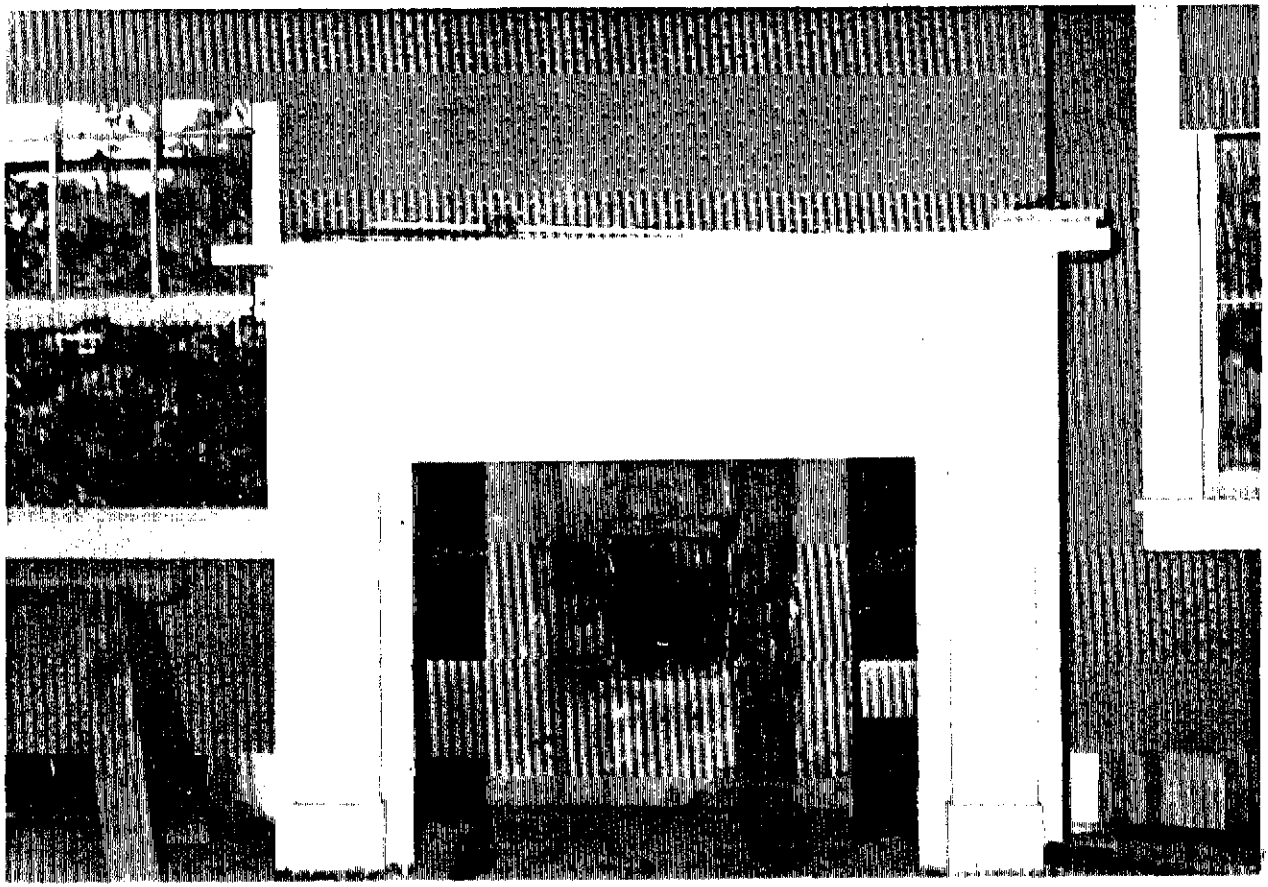


Second floor, Boys/Guest Bedroom, looking at east wall at removal of fabric. Structural detail of original house header exposed. The subject header can be seen in the wall between the two openings.



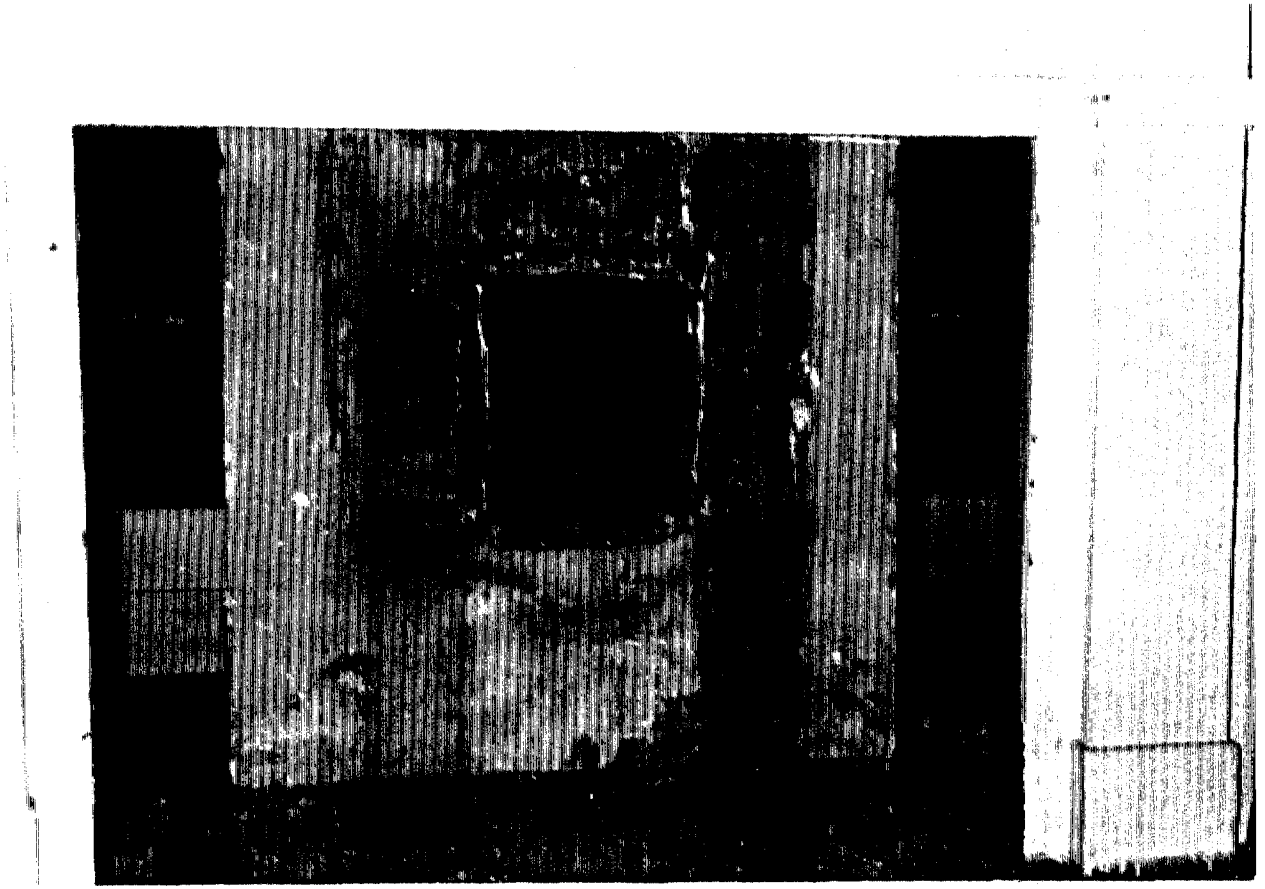
H - 9

Second floor, Boys/Guest Bedroom, fireplace on south wall, depicted is a false fireplace.



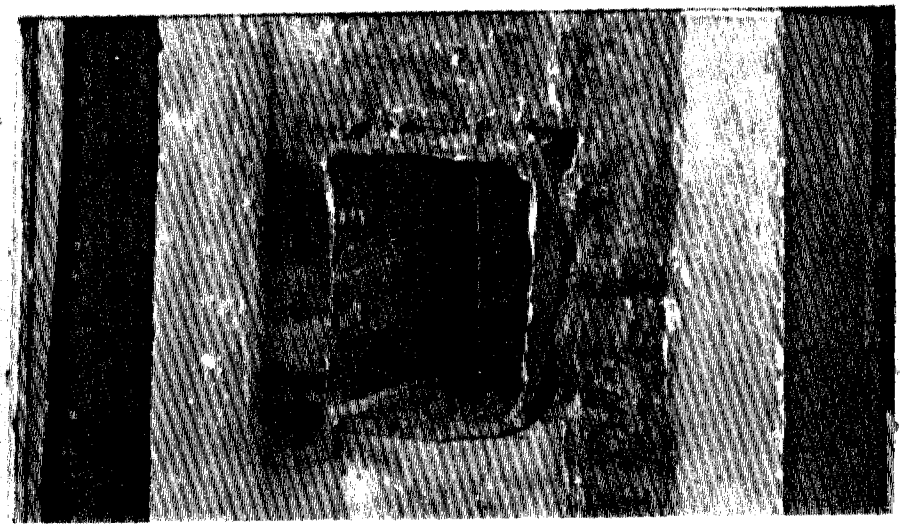
H - 10

Second floor, Boys/Guest Bedroom, fireplace on south wall;
note where baseboard was removed from chimney.



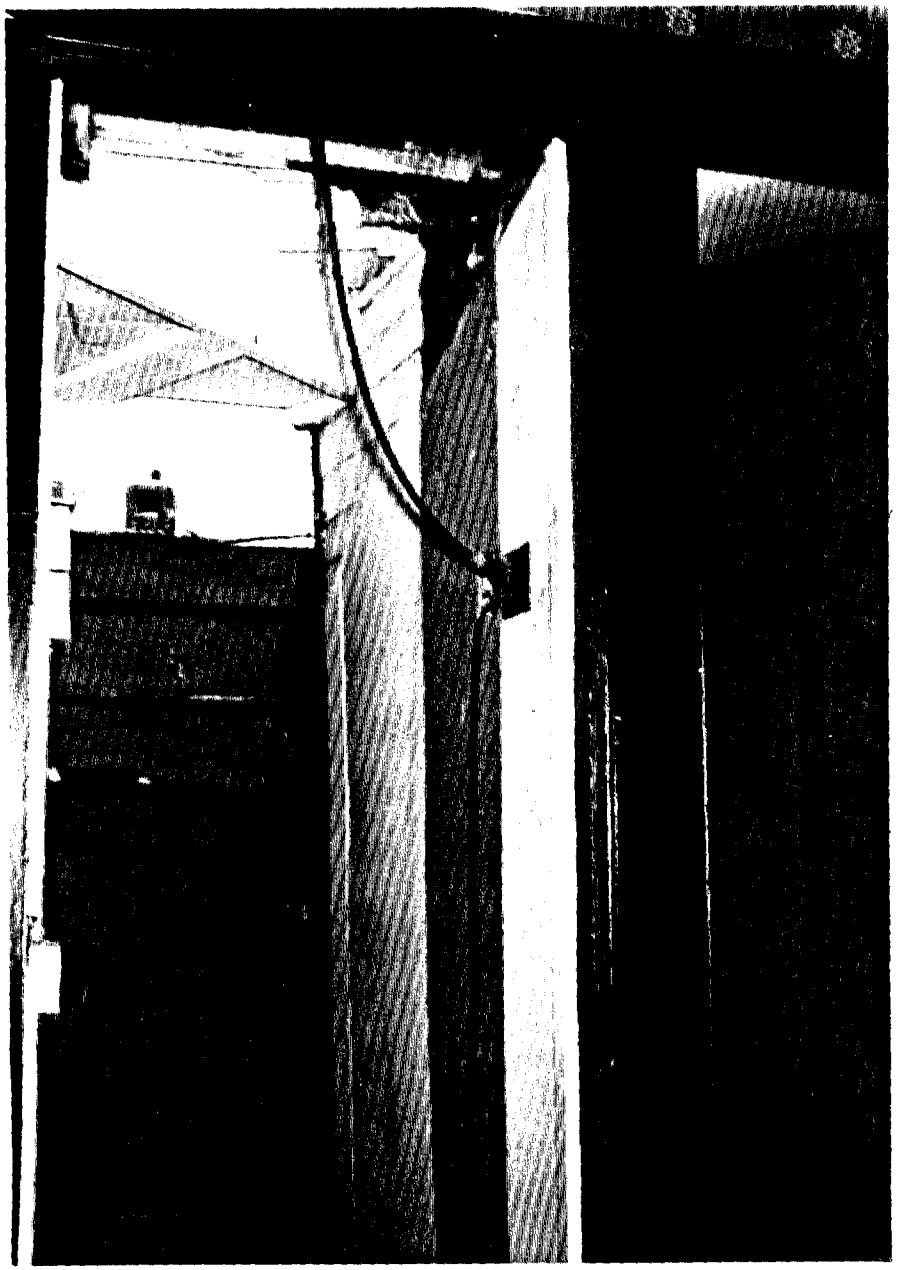
H - 11

Second floor, Boys/Guest Bedroom, closeup of "fireplace."

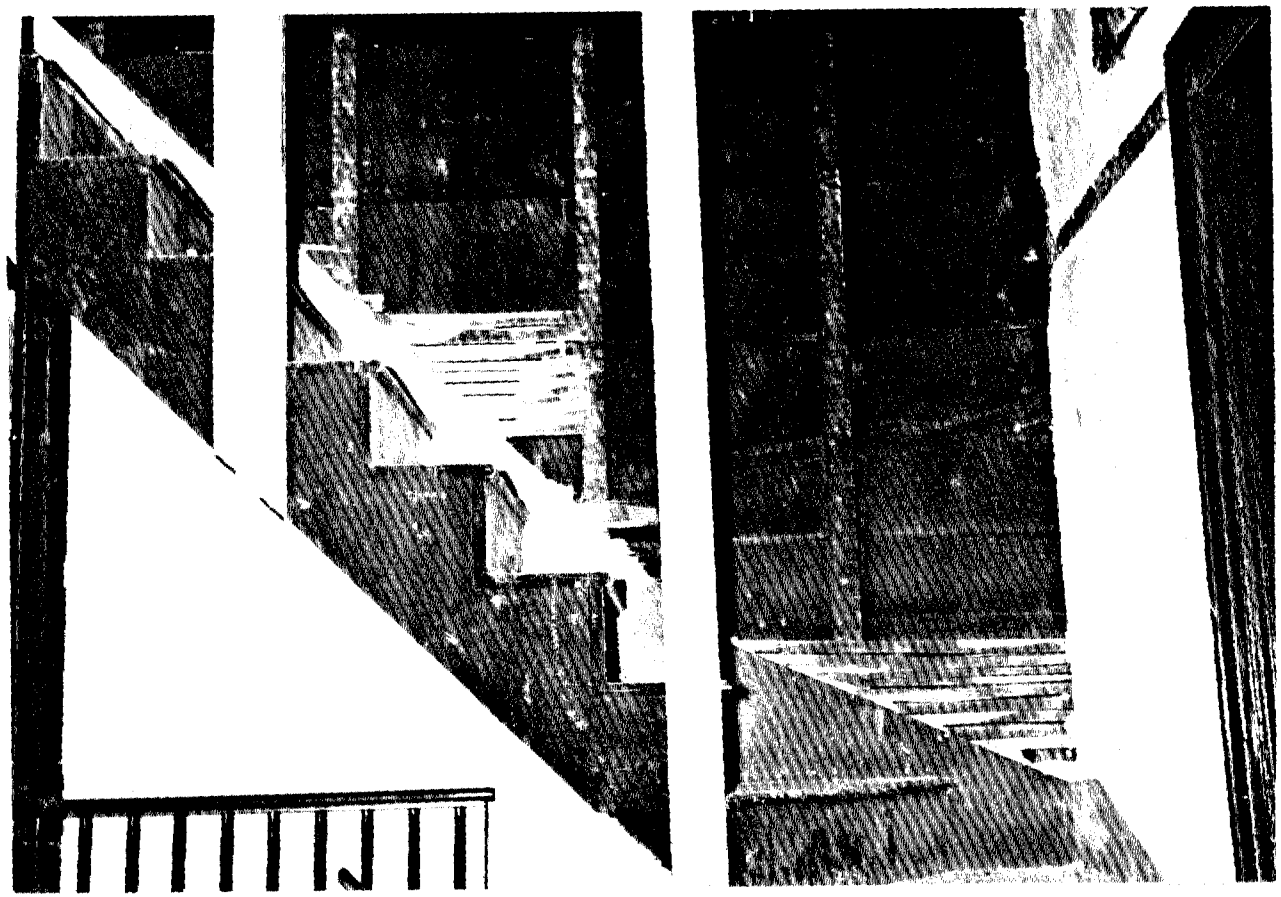


H - 12

Second floor, Boys/Guest Bedroom, closeup of "fireplace."

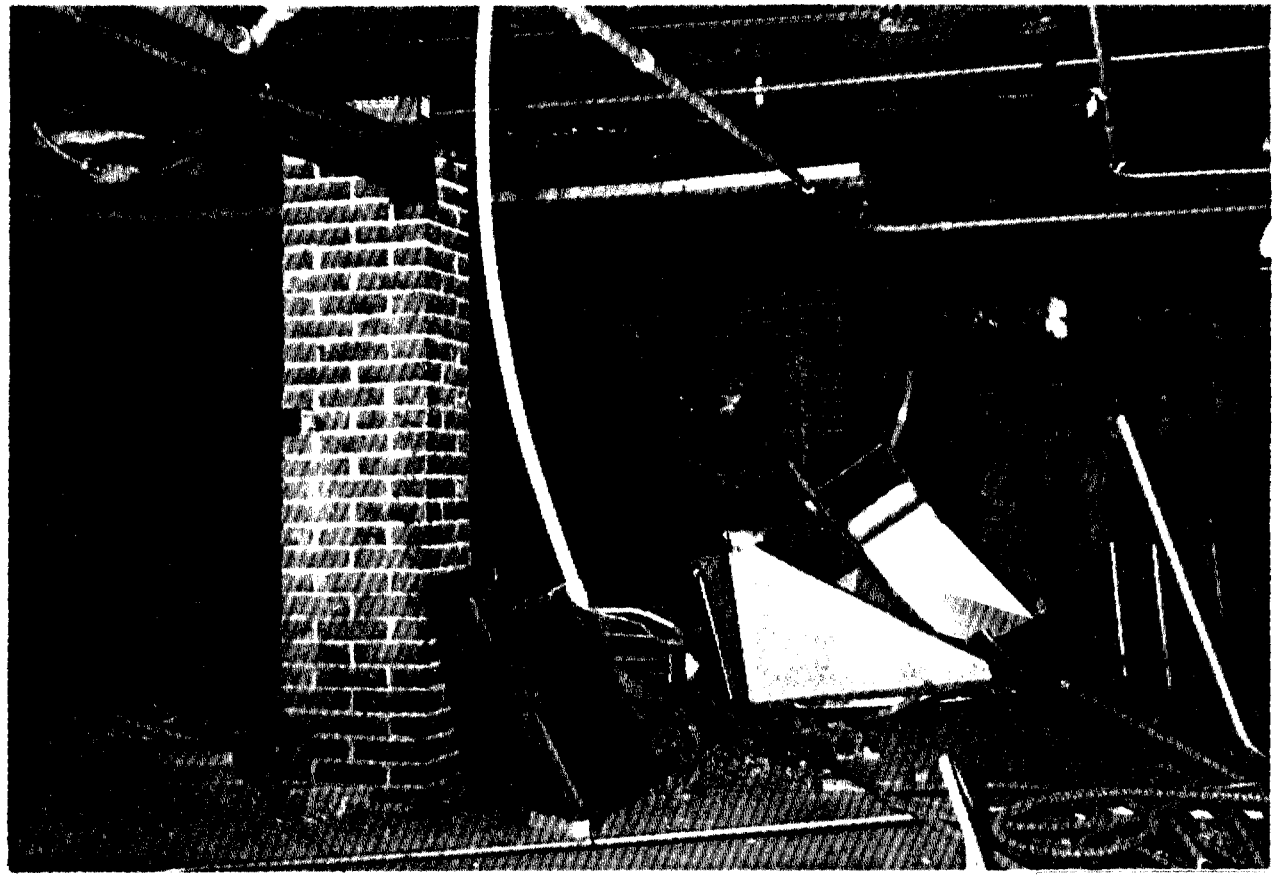


First floor, closet under front stairs, view from Dining Room.



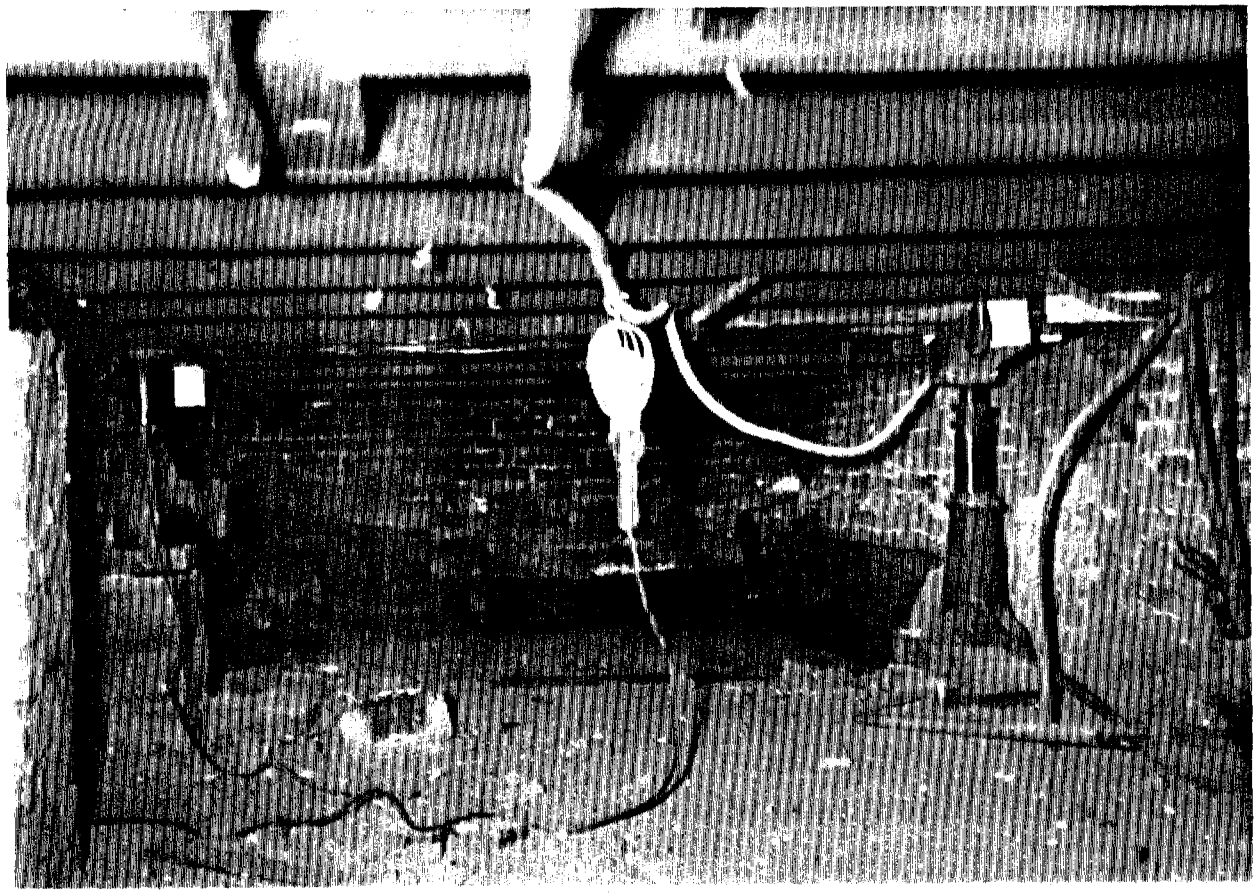
H - 14

First floor, back stairs, view from kitchen; wall partly removed, exposing the wide sheathing constituting the east wall.



H - 15

Basement, view of north end of basement under west portion of Home.



H - 16

Crawl space, view of southeast end of east portion of Home, under kitchen.

C. Guest/Boys Bedroom Floor Repair

During the summer of 1981, investigation and structural repair of the floor area in the Guest/Boys Bedroom on the second floor of Lincoln Home was performed by Harold O'Shea Builders, the Lincoln Home National Historic Site staff and the Architect/Engineer.

The following is a record of the investigation and repair.

11 May 1981

Mr. David Scherer
United States Department of the Interior
National Park Service
Denver Service Center
655 Parfet Street RMW
Post Office Box 25287
Denver, Colorado

Re: Project No. 7816
LINCOLN HOME DESIGN SERVICES
Title I Services - Pkg. 196
Work Directive 5-0005-78-06
Fabric Removal & Investigation

Dear Mr. Scherer:

Enclosed is our Proposal for Fabric Removal and Investigation of the structural connections of the floor joist in the doorway between Robert Lincoln's Bedroom and the Guest/Boys Bedroom on the Second Floor of the Lincoln Home.

In preparing our Proposal, we asked Harold O'Shea Builders to perform the work. We feel that this Contractor is qualified due to his previous fabric removal experience in the Lincoln Home and his work on other houses in the Lincoln Home National Historic Site.

As noted on our Proposal, the total cost for the fabric removal and investigation is $1,733.43. In order for this work to be completed the week of 18 May 1981, we will need immediate approval.

Upon receipt of your approval to proceed, we will schedule the work with the Contractor. If you have any questions regarding the enclosed Proposal, please do not hesitate to call.

Yours very truly,

Wesley Corgan
Architect AIA

WC:bjw

cc: Mr. Francis Krupka

S C O P E O F W O R K

106 Structural Investigation

Lincoln Home
Lincoln Home National Historic Site
Springfield, Illinois

1. The investigative work is to be performed during the week of 18 May 1981 through 22 May 1981. This work will be under the direction of FERRY AND HENDERSON ARCHITECTS, INC. and under the supervision of the staff of THE LINCOLN HOME NATIONAL HISTORIC SITE.

2. All work must be performed on an overtime basis (before 8:00 A.M. and after 6:00 P.M.). Coordination with the Lincoln Home National Historic Site staff will be required to avoid conflict with the public.

3. The extent of the work is shown on a separate sheet (Drawing LH-1).

4. All work shall be completed at one time - fabric removal, investigation and documentation by the Architect/Engineer (measurements and photographs), temporary repair if required, and fabric replacement to match the existing. The Contractor is to provide the most competent, skilled craftsmen available, subject to the approval of the Architect. The preparation of the rooms for the Contractor will be the responsibility of the staff of the Lincoln Home National Site.

5. Historic materials shall be reinstalled and refinished as necessary to match the original. Non-historic materials shall match the original and/or adjacent materials in all respects, subject to the approval of the Lincoln Home National Historic Site staff.

6. INSURANCE: The Contractor shall provide and maintain until final completion and acceptance of the work, such insurance as will protect the Owner, himself, his Subcontractors and the Architect or any of them from claims arising under Workmens Compensation Acts, Workmens Occupational Diseases Act and from any other claims for damages for personal injury, including death or for property damage which may arise from operations under this Contract, whether such operations be by himself or any Subcontractor or anyone directly or indirectly employed by either of them.

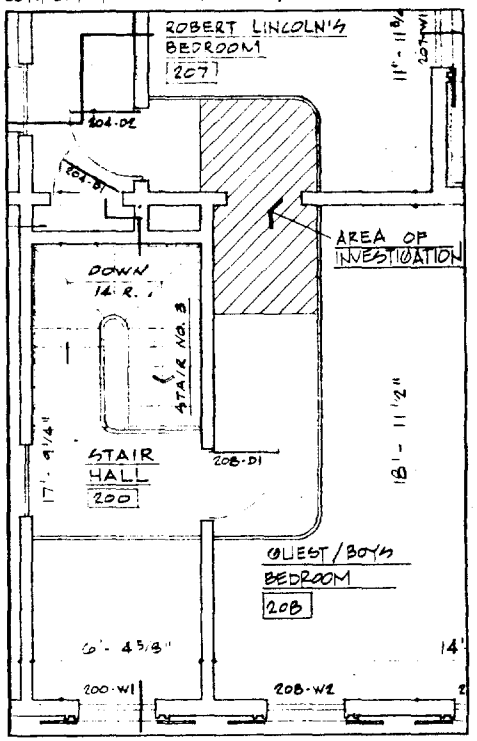
(1) Bodily Injury Liability and Property Damage Liability Insurance:

The Contractor shall take out and maintain, during the life of this Contract, such Bodily Injury Liability and Property Damage Liability Insurance and Automobile Bodily Injury Liability and Property Damage Liability Insurance as shall protect him and any Subcontractor performing work covered by this Contract from claims for damages for personal injury, including accidental death, as well as from claims for property damage, which may arise from operations under this Contract, whether such operations be by himself or by any Subcontractor or by anyone directly or indirectly employed by either of them and the amounts of such insurance shall not be less than:

(a) Bodily Injury Liability Insurance, in an amount not less than Three Hundred Thousand Dollars ($300,000.00) for injuries, including wrongful death to any one person and subject to the same limit for each person in an amount not less than Five Hundred Thousand Dollars ($500,000.00) on account of one accident.

(b) Property Damage Insurance in an amount not less than Three Hundred Thousand Dollars ($300,000.00) for damages on account of any one accident and in an amount not less than Five Hundred Thousand Dollars ($500,000.00) for damages on account of all accidents.

100 CLEARANCE
FABRIC & STRUCTURAL INVESTIGATION
CONNECTION CAPACITY OF FLOOR JOISTS.



PARTIAL FLOOR PLAN

LINCOLN HOME - SECOND FLOOR

5 0 5 10

EXTENT OF WORK

1. PULL BACK CARPET, MAT, ETC. TO EXPOSE WOOD FLOOR. CUTS IN CARPET TO BE MADE AT EXISTING SEAMS ONLY.
2. REMOVE DOOR TRIM AND BASEBOARD AS REQUIRED TO REMOVE FLOOR BOARDS
3. LIFT OR REMOVE VISITOR GUARDRAIL AS REQUIRED TO REMOVE FLOOR BOARDS.
4. REMOVE FLOORING AS REQUIRED FOR INVESTIGATION BY ARCHITECT / ENGINEER. PERMANENT CHANGES IN THE FABRIC SHALL BE KEPT TO A MINIMAL.
5. CONTRACTOR SHALL BE PREPARED TO MAKE TEMPORARY REPAIR TO STRUCTURE IF EMERGENCY REPAIR DEEMED NECESSARY BY ARCHITECT / ENGINEER OR N.P.S. REPRESENTATIVE. CONTRACTOR SHOULD HAVE AVAILABLE MISC. CONNECTION ITEMS SUCH AS JOIST HANGERS, LAG BOLTS, NAILS, 2X WOOD MATERIAL & ETC.
6. AFTER INVESTIGATION, CONTRACTOR SHALL REPLACE FABRIC REMOVED DURING INVESTIGATION AND RESTORE TO MATCH EXISTING.
7. CARPET INSTALLER MAY RETURN PRIOR TO 8:00 AM THE FOLLOWING DAY AFTER REMOVAL TO FINISH REPLACEMENT.

PAGE 3 OF 3	Ferry & Henderson Architects, Inc. FABRIC REMOVAL AND INVESTIGATION LINCOLN HOME LINCOLN HOME NATIONAL HISTORIC SITE	PROJECT NO. 7816	LHI ..... 4 MAY '84

3 June 1981

Mr. David Scherer
National Park Service
United States Department of the Interior
655 Parfet Street
Post Office Box 25287
Denver, Colorado 80225

Re: Project No. 7816
LINCOLN HOME DESIGN SERVICES
Title I Services - Package 196
Work Directive No. 5-0005-78-06
Fabric Removal and Investigation

Dear Mr. Scherer:

Investigation of the structural connection of the floor joists in the doorway between Robert Lincoln's Bedroom and the Guest/Boys Bedroom on the second floor of Lincoln Home began at 6:00 P.M. on Thursday, 21 May 1981.

By 10:15 that night, we had completed the investigative work with the exception of reinstallation of the carpeting which was performed the next morning (Friday at 7:00 A.M.) prior to the 8:00 A.M. deadline.

The investigation was successful in that we were able to observe, document and determine the course of action required to provide adequate support.

Enclosed, please find a copy of a two-page letter (and three pages of calculations) sent to my attention from George Bloome of RALPH HAHN & ASSOCIATES, INC. Also enclosed are four pages of photographs and an 8½ x 11 drawing of the existing conditions investigated.

It is recommended that prompt action be taken (by early July 1981) to adequately support the existing joists. We believe this repair work could be performed in one night as was the investigative work.

In order to hasten the progress of this work, we have provided a proposal for the structural repair work. In preparing this proposal, we have aked HAROLD O'SHEA BUILDERS to perform the work. Also, the proposal includes the work of RALPH HAHN & ASSOCIATES, INC. and of FERRY AND HENDERSON ARCHITECTS, INC. The total cost for the structural repair work is $1,200.00.

Enclosed, please find a copy of the Scope of Work which outlines the structural repair required.

Upon receipt of your approval to proceed, we will schedule the work with Mr. O'Shea. If you have any questions, please do not hesitate to call.

Yours very truly,

Wesley Corgan
Architect

WC:bjw

Enclosures

cc: Mr. Francis Krupka
Mr. Albert W. Banton
Mr. Ralph C. Hahn

Ralph Hahn and Associates
Consulting and Design Engineers Inc

May 27, 1981

Wes Corgan
Ferry & Henderson Architects, Inc.
1320 S. State
Springfield, IL 62704

RE: Lincoln Home
Springfield, IL
RHA # SME78-810

Dear Mr. Corgan:

On Thursday evening, May 21, I observed the floor framing in the northeast corner of the boy's bedroom. You and Don Walton also observed this same area. Mr. Banton and two other persons from the U.S. Park Service and two workmen from Harold O'Shea Builders also observed this area.

Your sketch accurately delineates what we observed. Based upon these observations and the attached calculations, I've concluded:

1. The live load capacity for this area in our November 10, 1980, report is correct, based upon bending stresses and shear stresses.

2. The bearing capacity in the report is incalculable because of the framing of the members of the floor joists.

Generally, the floor joists in this area are supported by part of an existing original wood stud wall that is supported by a door header of undetermined size. The stud supporting the original and the new joists is of questionable support value. In addition, a 2x4 laying flat supports one new floor joist. To make this condition even worse, the 2x4 is simply toenailed into the side of the existing joists. These two conditions represent a significant structural deficiency, and this isolated area must be restructured to safely support assembly type loadings.

For a temporary short term time, this area can continue to be used with a restricted floor loading. This restricted loading is as outlined in your April 22, 1981, letter to Mr. Banton.

I recommend that the Park Service retain a contractor to install a wood lintel supported by the studs on each side of the opening below. This lintel installation will remove the load from the head of the door opening below and provide positive support of all joists in this immediate area. You and I have discussed how this lintel might be installed, and I stand ready to assist you in preparation of a drawing that can be sent to the National Park Service. This drawing should illustrate the work we want done.

Once this work is completed (no longer than a month from now), the Park Service can again use this area to its full liveload capacity. Based upon what I have observed and my calculations, it appears to me that this area can safely carry approximately 2500 lbs., approximately 15 people of average stature.

If you have any questions or comments, please contact me.

Sincerely yours,

George W. Bloome, P.E.
Executive Vice President

GWB/cc

Enclosure

Ralph Hahn and Associates
Consulting and Design Engineers Inc
1320 South State
Springfield, IL 62704
217-544-0721

7816

Designed: [illegible] | Project: Lincoln Home
Date: May [illegible] 1981 | Subject: Field observ.
Checked: | Project No.: SHE 73-810.
Date: | Sheet 1 of 3

SEE ATTACHED SKETCHES OF FRAMING OBSERVED THE NIGHT OF FIELD OBSERVATIONS FROM 7:15 to 9:45 pm.
OBSERVED BY [illegible], MESS [illegible] AND [illegible] WALTON OF #54.

ORIGINAL TIMBER JOISTS.
$1\frac{7}{8}'' \times 9''$ (HICKORY)

$A = 1.875 \times 9 = 16.88\ in^2$
$S = 1.875 \times 9^2/6 = 25.31\ in^3$
$I = 1.875 \times 9^3/12 = 113.91\ in^4$

NEW JOISTS.
$1\frac{5}{8}'' \times 9\frac{1}{4}''$ (FIR)

$1.625 \times 9.25 = 15.03\ in^2$
$1.625 \times 9.25^2/6 = 23.17\ in^3$
$1.625 \times 9.25^3/12 = 107.18\ in^4$

FROM p 2-48 OF AITC TIMBER CONSTRUCTION MANUAL
HICKORY f_b = 2000 psi. ALL INDICATIONS ARE GREATER STRENGTH THAN SO. PINE.
FIR f_b = 1500 psi. CONSTRUCTION GRADE.

COMPUTE MAXIMUM VALUES.
BENDING. $f_b = 2.0$ ksi (+ FIR) [illegible]

$f_b S = \frac{wL^2}{8}$

$M_R = 2.0(25.31)/12 = 4.22^{K\cdot FT}$ | $M_R = 1.5(23.17)/12 = 2.90$

$M = \frac{wL^2}{8}$

$w = 4.22(8)/19^2 = \boxed{.0935^{KLF}}$ | $w = 2.90(8)/19^2 = \boxed{.064}$

$F_v = .12$ ksi

$f_v = \frac{3V}{2A}$

$\therefore V = \frac{F_v(2)(16.88)}{3} = \boxed{1.35^K}$ | $V = \frac{.12(2)(15.03)}{3} = \boxed{1.20^K}$

$R = .0935(9.5) = .89^K$ - BEND CONT. | $R = .064(9.5) = .61^K$ [illegible]

$\Delta = \frac{5wL^4}{384EI} = \frac{5(.0935)(19)^4(1728)}{384(1700)(113.91)} = 1.27''$ | $\Delta = \frac{5(.064)(19)^4(1728)}{384(1700)(107.18)} = .9$

NORMAL $\Delta = \frac{.02}{.0935}(1.27) = .27''$ | NORMAL $\Delta = \frac{.02}{.064}(.9) = .28''$

$\Delta_{LONG\ TERM} = .27(2.5) + .63 = 1.31'' = \frac{L}{[illegible]}$ | $.28(2.5) + .63 = 1.33'' = \frac{L}{171}$

Ralph Hahn and Associates
Consulting and Design Engineers Inc
1320 South State
Springfield, IL 62704
217-544-0721

7816

Designed: [illegible] | Project: [illegible]
Date: [illegible] | Subject: [illegible]
Checked: | Project No.: SHE 73-810
Date: | Sheet 2 of 3

THERE ARE 5 JOISTS SUPPORTING AREA IN QUESTION (HALF CORRIDOR ALONG NORTH END OF [illegible] BEDROOM)

$w_R = .0935^{KLF}$ ORIG. = .1035.
$w_R = 2(.064)$ = .128 } = .2315 KLF

WIDTH OF AREA = 5'-6" = 5.5'
TRIBUTARY AREA OF FLOOR = 23'

$\therefore w_{S.F.} = .2315/2.35 = .0951$ KSF.

FROM OBSERVATION SUPPORT CONDITIONS ARE POOR AND REALLY CONTROL CAPACITY.

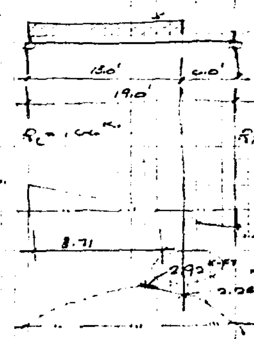
CHECK SHEAR (HORIZONTAL) CAPACITY WITH 2" NOTCH.

$R = \frac{.12(2)(1.875)(7)}{3} = 1.05 = .35^K$ BEND. | $R = \frac{.12(2)(1.625)(7.5)}{3} = .98^K = .61^K$ BEND.

ASSUME NEW JOIST TAKES ENTIRE LOAD.

$.0951(14/2) = .0583$

$.05$ / $.0175$ = $.05(14/2) = .0175$



1 DOT DURATION

$2.90^{K\cdot FT} \times 1.33 = 3.88^{K\cdot FT}$

THIS VALUE CHECKS CLOSELY WITH RJP CALC 8-20-80.

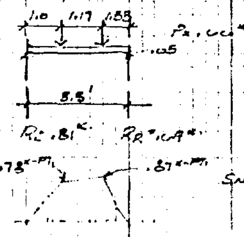
7816

Ralph Hahn and Associates
Consulting and Design Engineers Inc
1320 South State
Springfield, IL 62704
217-544-0721

Designed: [illegible] | Project: Lincoln Home
Date: May 27, 1981 | Subject: Field Design
Checked: | Project No.: [illegible] 78-810
Date: | Sheet 3 of 5

CONNECTION CAPACITY IS INCALCULABLE, BECAUSE OF FRAMING CONFIGURATION.
ITS OBVIOUS SOME SORT OF LINTEL NEEDS TO BE INSTALLED ACROSS OPENING TO SUPPORT JOISTS DIRECTLY.

SIZE OF THIS LINTEL TO BE:



R_L = .81k R_R = [illegible]

Sreqd = .87(12) / 1.5(1.22) = [illegible]   [illegible] = 17.1 [illegible]
[illegible] = 7.1 [illegible]

PROVIDE NEW 2-2x6 LINTEL OVER OPNG.
1. SAW CUT EXISTING JOIST OUT.
2. INSTALL L SUPPORTS INTO EXISTING STUDS.

.81k

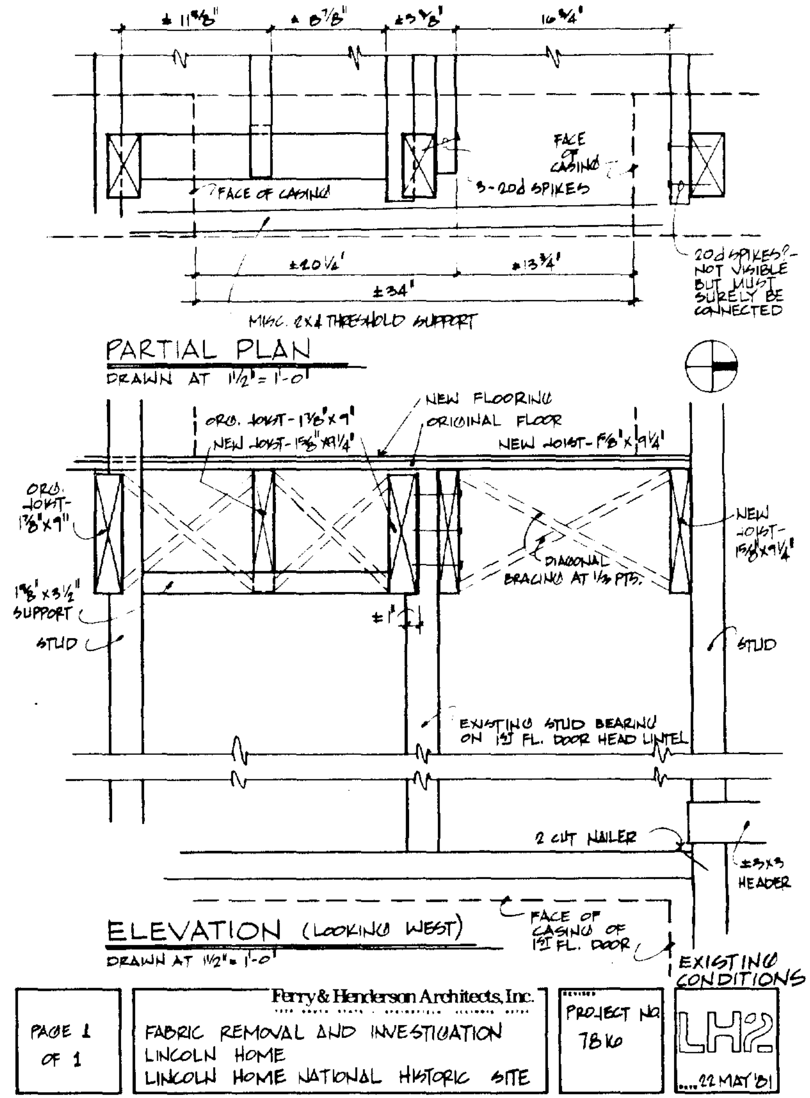
WIRE NAILS, K=2040 — 16d = 138# — .81/.138 = [illegible]
20d = 172# — .810/.172 = 5 NAILS.

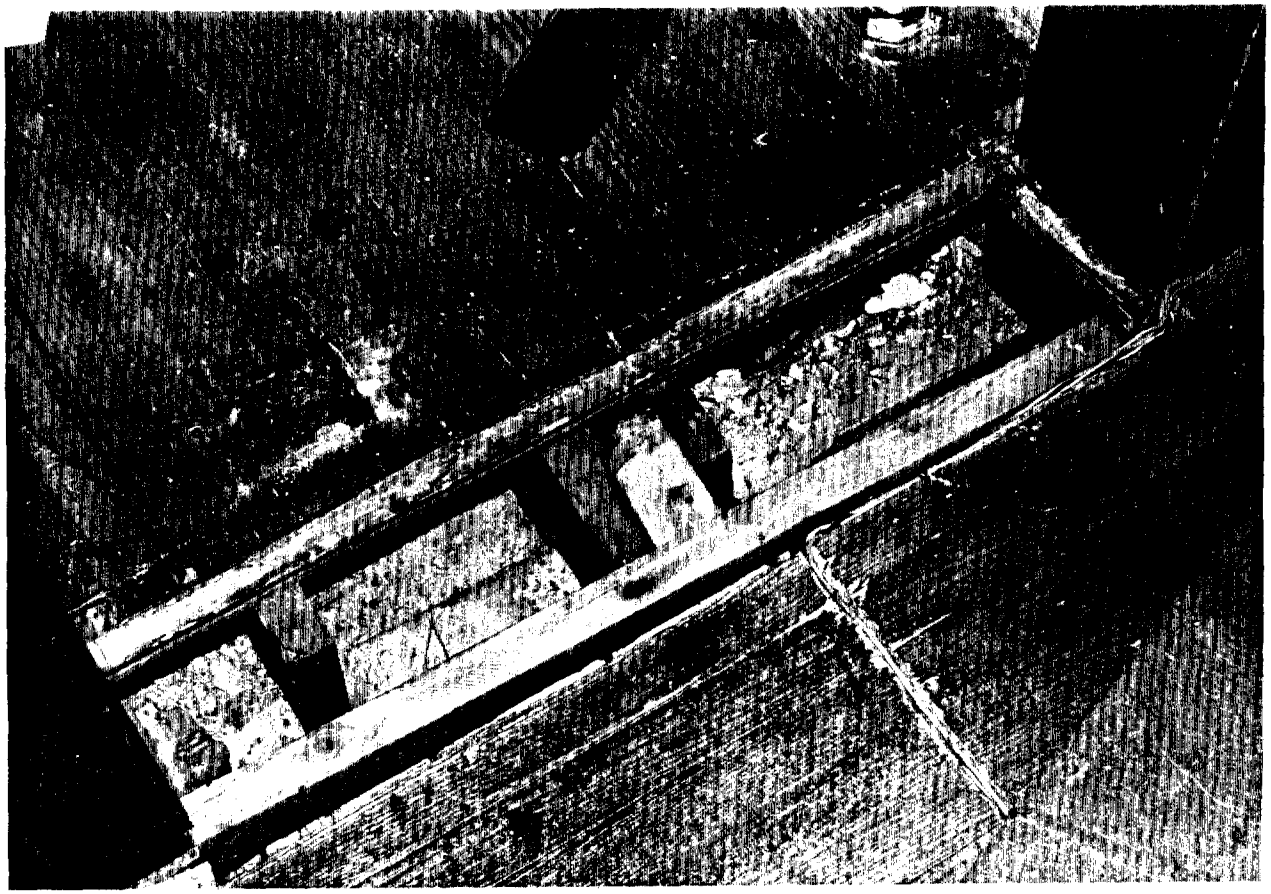
SCREWS, K=4[illegible] — #10 — 178# — 5 SCREWS.

LAG BOLTS. GROUP 4.
3/8"φ P = KD² = 2640(.375)² = .37k — 3 LAG SCREWS.
7/16"φ P = 2640(.44)² = .51k
LENGTH IN GROUP 4 WOOD = 7×7/16 = 3" LONG.

2. 7/16"φ × 3"
3-3/8"φ × 2½"

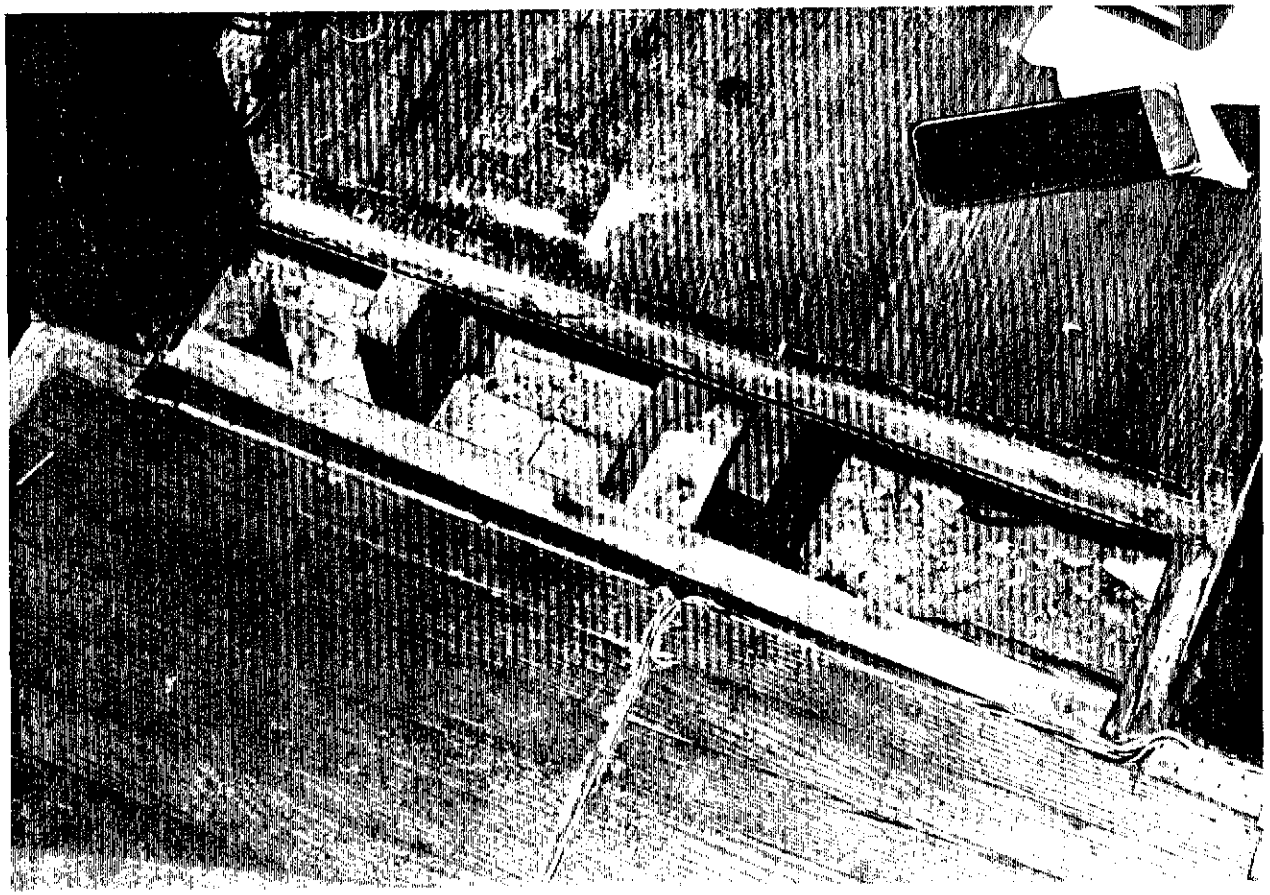
[USE 3-3/8"φ × 2½ LAG SCREWS]





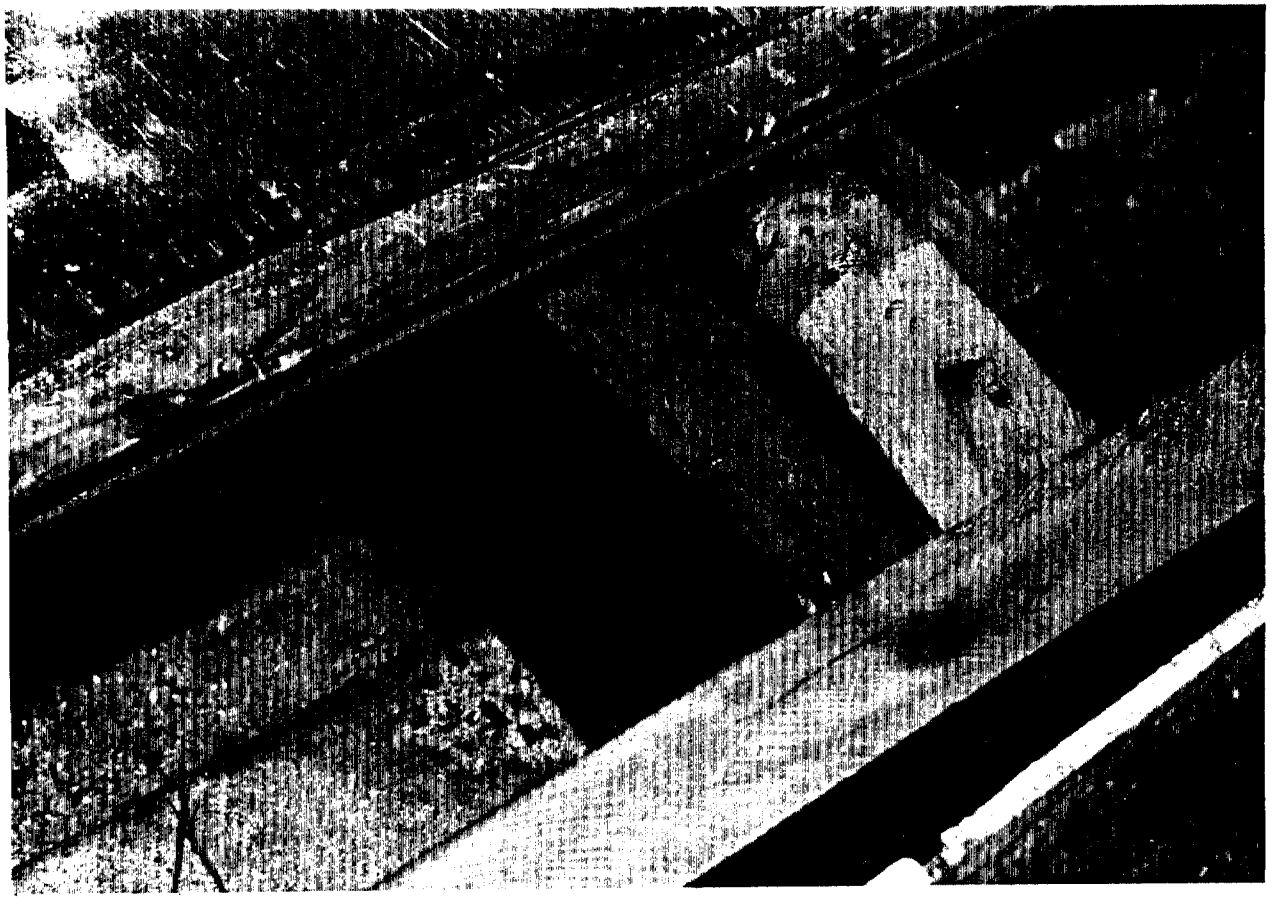
Fabric Removal and Investigation 21 May 1981

Looking down at opening, standing southeast of the doorway in Robert Lincoln's Bedroom



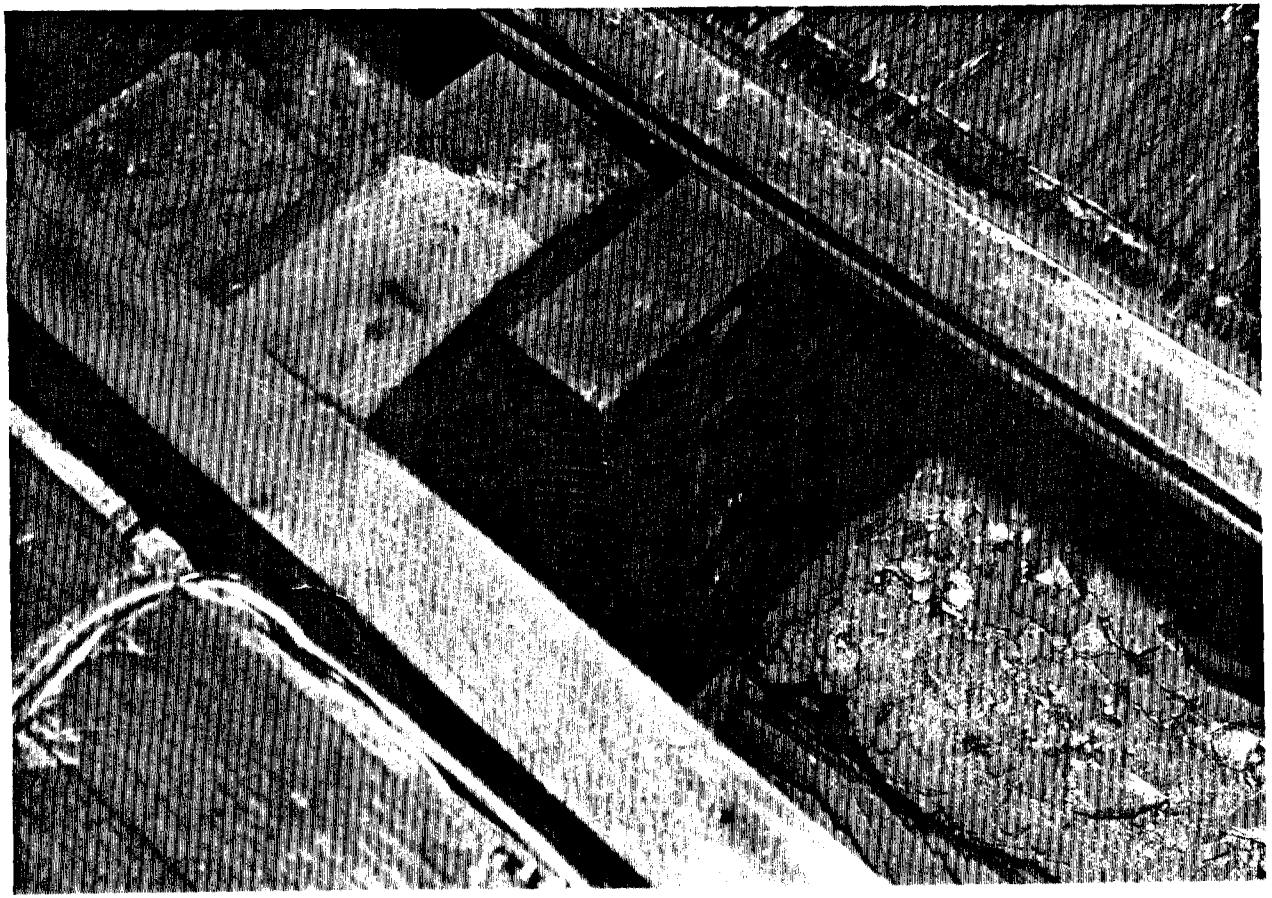
Fabric Removal and Investigation 21 May 1981

Looking down at opening, standing northeast of the doorway in Robert Lincoln's Bedroom



Fabric Removal and Investigation 21 May 1981

Close-up of joists to stud connection in center of doorway, from the southeast

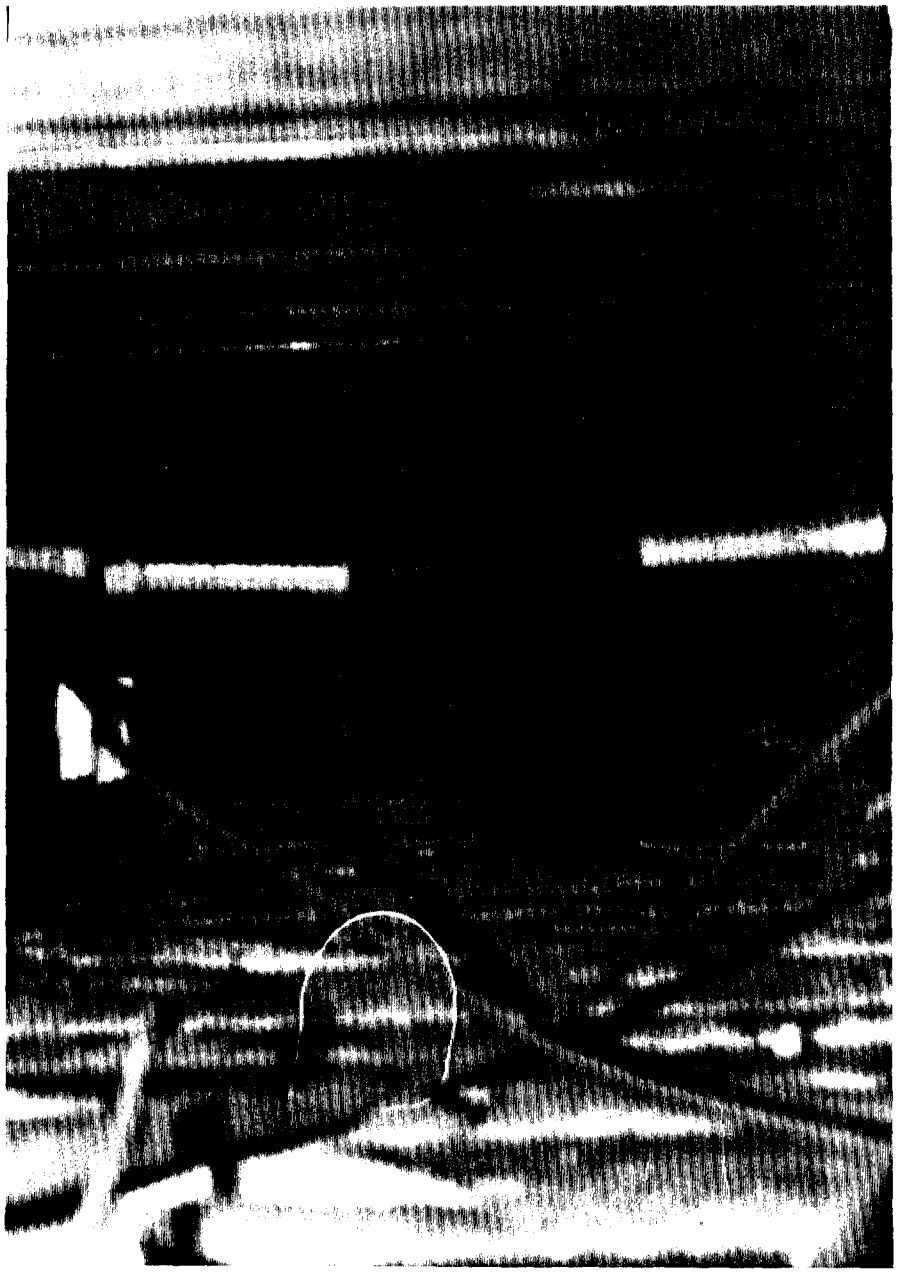


Fabric Removal and Investigation 21 May 1981

Close-up of joists to stud connection in center of doorway, from the northeast

Fabric Removal and Investigation
21 May 1981

View west, between the joists and the second floor/first floor ceiling, looking at the bridging



Fabric Removal and Investigation
21 May 1981

View down, into the cavity between the walls above the doorway on the first floor, looking at the lintel which supports the center stud

SCOPE OF WORK

106 Structural Repair

Lincoln Home

Lincoln Home National Historic Site

Springfield, Illinois

1. The structural repair work is to be performed late in June 1981 or in early July 1981 under the direction of FERRY AND HENDERSON ARCHITECTS, INC. and under the supervision of the staff of the LINCOLN HOME NATIONAL HISTORIC SITE.

2. All work must be performed on an overtime basis (before 8:00 A.M. and after 6:00 P.M.). Coordination with the Lincoln Home National Historic Site staff will be required to avoid conflict with the public.

3. The location of structural repair shall be in the flooring between the Guest/Boys Bedroom, 208 and Robert Lincoln's Bedroom, 207; the same location as the Fabric and Structural Investigation on 21 May 1981 and as shown on Sheet LH-1 of the Scope of Work for the 106 Structural Investigation.

4. The extent of the work shall be:

   a. Pull back carpet, mat, etc. to expose wood floor. Cut the carpet in a location that will result in the least damage.

   b. Remove door trim and baseboard as required to remove floor boards.

   c. Remove flooring as required for repair work incurring minimal damages to fabric.

   d. Repair structure as outlined in Solution #1 on Sheet LH-3 or Solution #2 on Sheet LH-4. Also, Contractor should have available miscellaneous construction material for unexpected situations if they should arise.

   e. Support of floor joists during repair shall be from above. One possible method would be to use 2 x 8's as a beam supported on 2 x 4 wood blocking on each side of the door jamb. Eye bolts could be screwed into the top of the joists to be repaired. Threaded bolts could hook into the eye and support the joists by extension through the beam with nut and washer above.

      Support from below shall not be allowed. Any other recommended methods shall be approved by Architect/ Engineer and/or the LHNHS staff.

   f. After repair, replace flooring and other material to match the existing.

   g. Carpet Installer may return the following day and finish carpet replacement prior to 8:00 A.M.

5. All work shall be completed at one time - fabric removal, repair, documentation by the Architect/Engineer (sketches and photographs), and fabric replacement to match the existing. The Contractor is to provide the most competent, skilled craftsmen available, subject to the approval of the Architect. The preparation of the rooms for the Contractor will be the responsibility of the staff of the Lincoln Home National Site.

6. Historic materials shall be reinstalled and refinished as necessary to match the original. Non-historic materials shall match the original and/or adjacent materials in all respects, subject to the approval of the Lincoln Home National Historic Site staff.

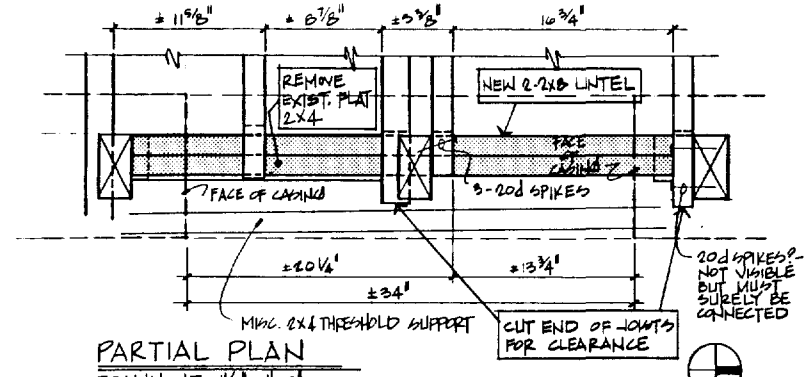
7. INSURANCE: The Contractor shall provide and maintain until final completion and acceptance of the work, such insurance as will protect the Owner, himself, his Subcontractors and the Architect or any of them from claims arising under Workmens Compensation Acts, Workmens Occupational Diseases Act and from any other claims for damages for personal injury, including death or for property damage which may arise from operations under this Contract, whether such operations be by himself or any Subcontractor or anyone directly or indirectly employed by either of them.

(1) Bodily Injury Liability and Property Damage Liability Insurance:

The Contractor shall take out and maintain, during the life of this Contract, such Bodily Injury Liability and Property Damage Liability Insurance and Automobile Bodily Injury Liability and Property Damage Liability Insurance as shall protect him and any Subcontractor performing work covered by this Contract from claims for damages for personal injury, including accidental death, as well as from claims for property damage, which may arise from operations under this Contract, whether such operations be by himself or by any Subcontractor or by anyone directly or indirectly employed by either of them and the amounts of such insurance shall not be less than:

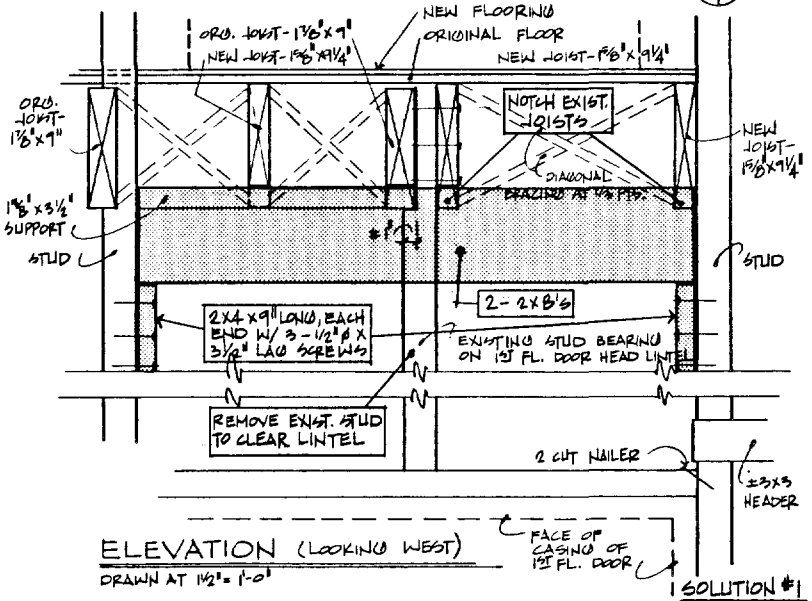
(a) Bodily Injury Liability Insurance, in an amount not less than Three Hundred Thousand Dollars ($300,000.00) for injuries, including wrongful death to any one person and subject to the same limit for each person in an amount not less than Five Hundred Thousand Dollars ($500,000.00) on account of one accident.

(b) Property Damage Insurance in an amount not less than Three Hundred Thousand Dollars ($300,000.00) for damages on account of any one accident and in an amount not less than Five Hundred Thousand Dollars ($500,000.00) for damages on account of all accidents.



PARTIAL PLAN

DRAWN AT 1½" = 1'-0"

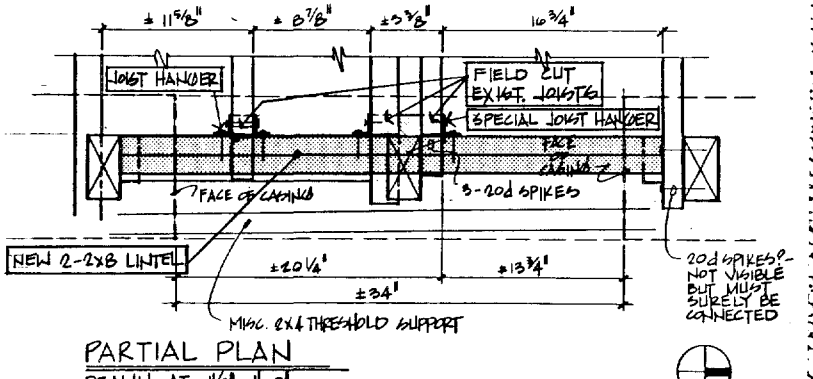


ELEVATION (LOOKING WEST)

DRAWN AT 1½" = 1'-0"

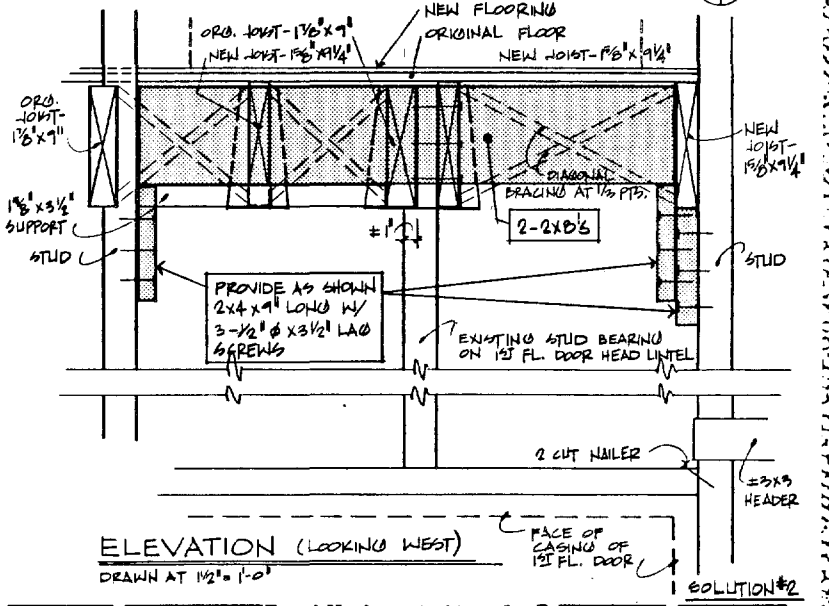
SOLUTION #1

PAGE 4 OF 5	Ferry & Henderson Architects, Inc. FABRIC REMOVAL AND INVESTIGATION LINCOLN HOME LINCOLN HOME NATIONAL HISTORIC SITE	PROJECT NO 78K0	LH3 ....22 MAY '81



PARTIAL PLAN

DRAWN AT 1½" = 1'-0"



ELEVATION (LOOKING WEST)

DRAWN AT 1½" = 1'-0"

SOLUTION #2

PAGE 5 OF 5	Ferry & Henderson Architects, Inc. FABRIC REMOVAL AND INVESTIGATION LINCOLN HOME LINCOLN HOME NATIONAL HISTORIC SITE	PROJECT NO 78K0	LH4 ....22 MAY '81

6 October 1981

Mr. David Scherer
National Park Service
United States Department of the Interior
655 Parfet Street TMW
Post Office Box 25287
Denver, Colorado 80225

Re: Project No. 7816
LINCOLN HOME DESIGN SERVICES
Title I Services - Package 196
Work Directive No. 5-0005-78-06
Fabric Removal and Investigation

Dear Mr. Scherer:

Repair of the structural connection of the floor joists in the doorway between Robert Lincoln's Bedroom and the Guest/Boys Bedroom on the second floor of the Lincoln Home began at 6:00 P.M. on Monday, 21 September 1981.

By 1:30 A.M. on Tuesday, 22 September 1981, the structural repair was completed with the exception of reinstallation of the carpeting which was performed at 7:00 A.M. of the same day (prior to the 8:00 A.M. deadline).

The repair was successful in that we were able to install new material to carry the existing joists, thereby adequately supporting the floor at the east end. However, the joist connection at the west end (the west wall of the Boys/Guest Bedroom) remains as is, thereby increasing the visitation in this area to approximately fifteen people of average stature (as stated in Mr. George Bloome's letter to me, dated 27 May 1981).

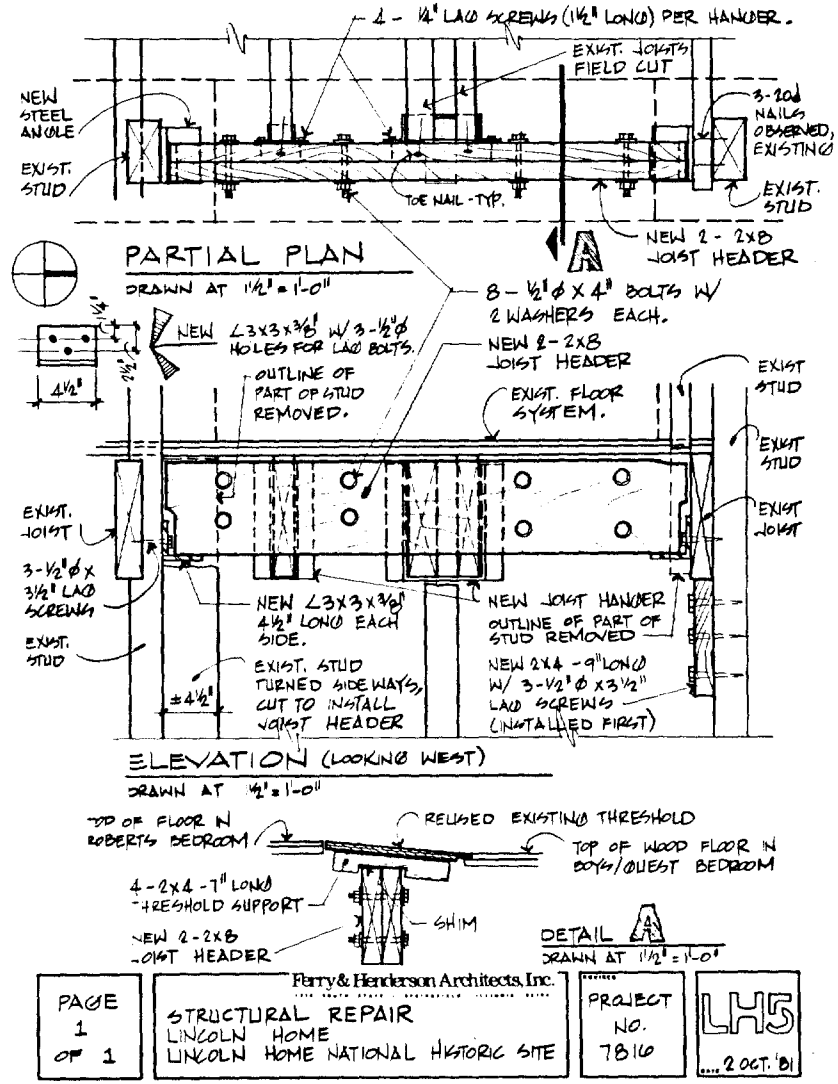
Enclosed, please find a drawing of the new connection on Sheet LH-5. Also enclosed are four pages of photographs to clarify the work performed.

If you should have any questions, please do not hesitate to contact me.

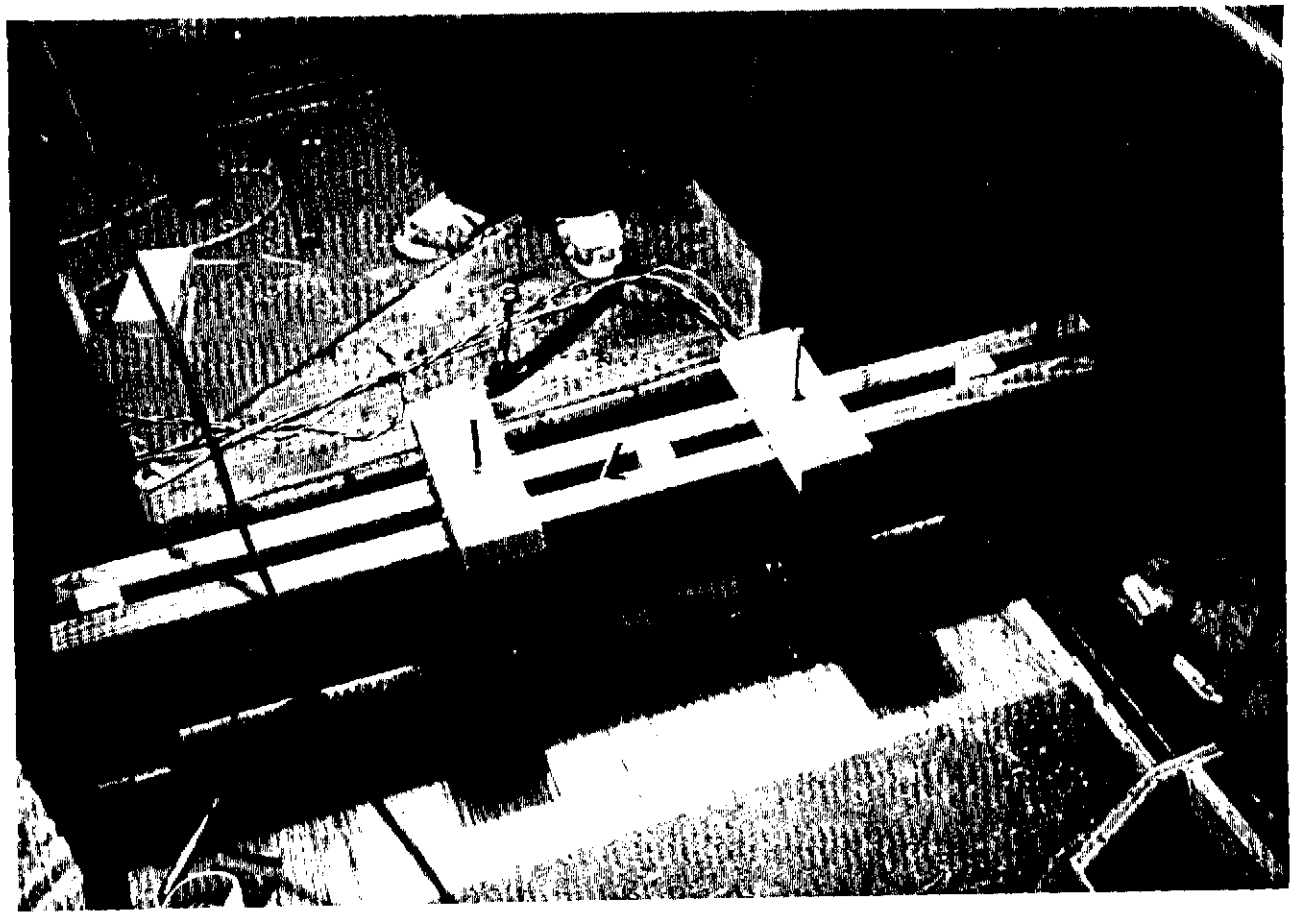
Very truly yours

Wesley Corgan
Architect

WC:bjw
cc: Mr. Albert W. Banton
Mr. Ralph C. Hahn



PAGE 1 OF 1	Ferry & Henderson Architects, Inc. STRUCTURAL REPAIR LINCOLN HOME LINCOLN HOME NATIONAL HISTORIC SITE	PROJECT NO. 7816	LH5 2 OCT. '81

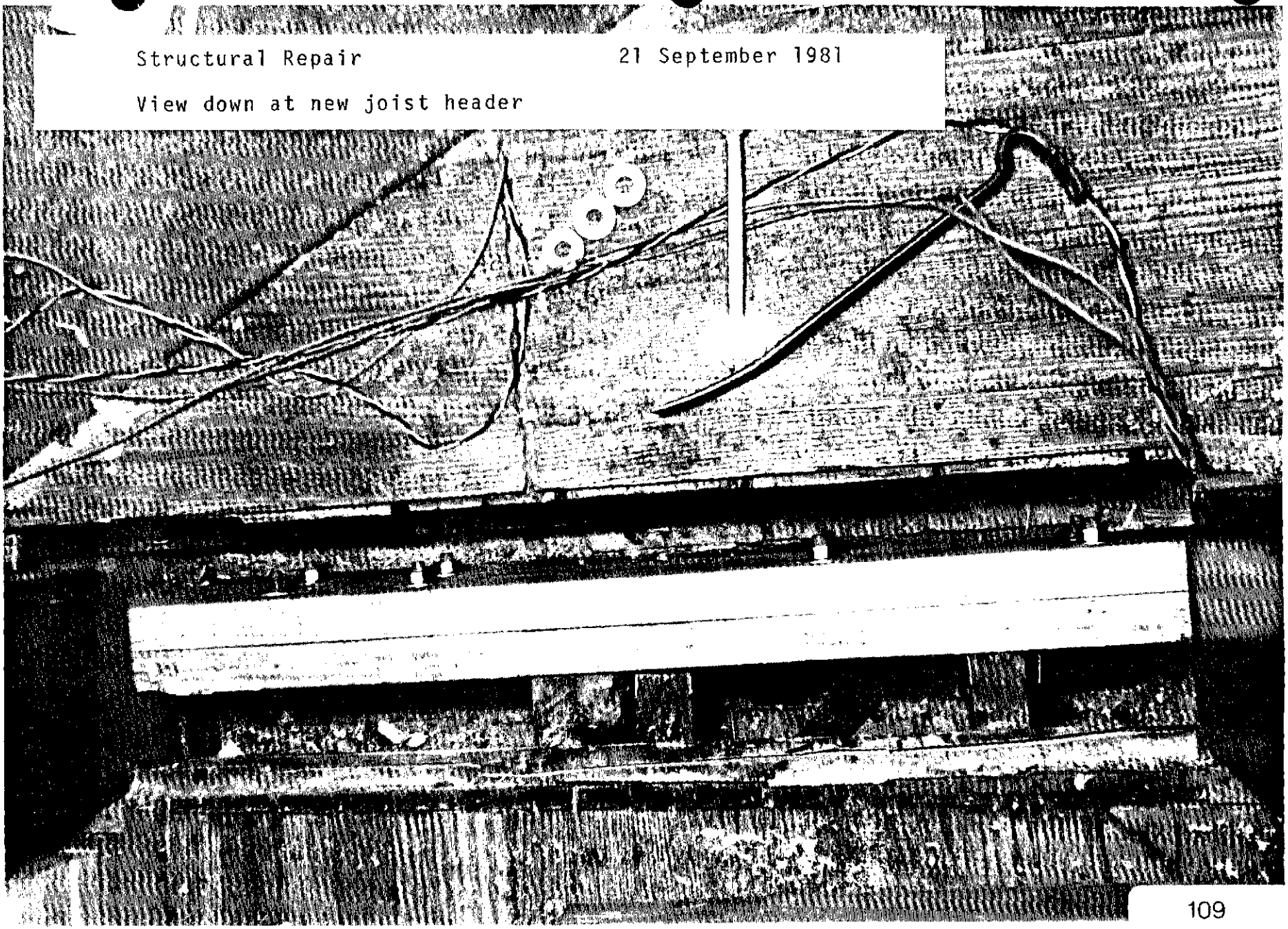


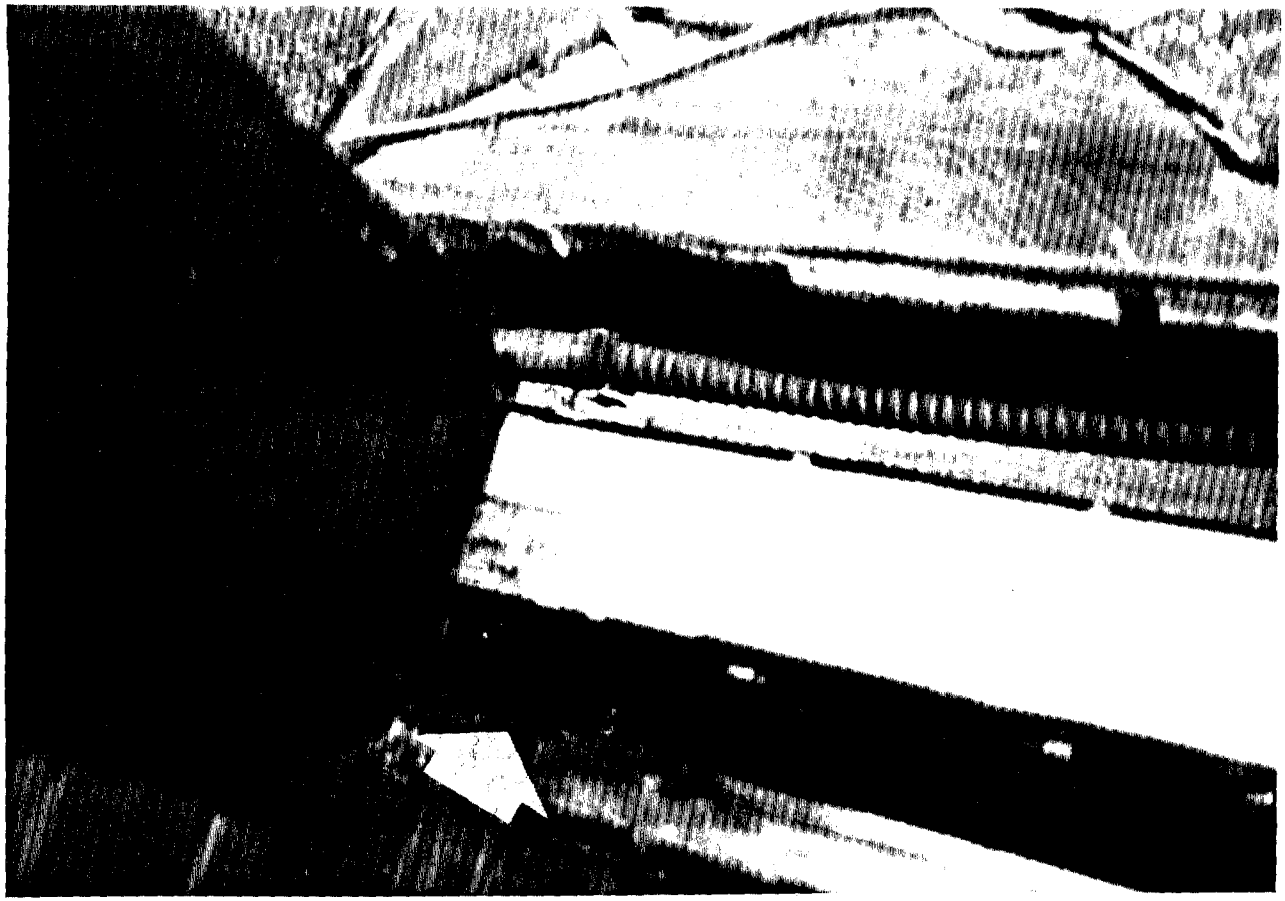
Structural Repair 21 September 1981

View of temporary joist support beam from the west in Boys/Guest Bedroom

Structural Repair 21 September 1981

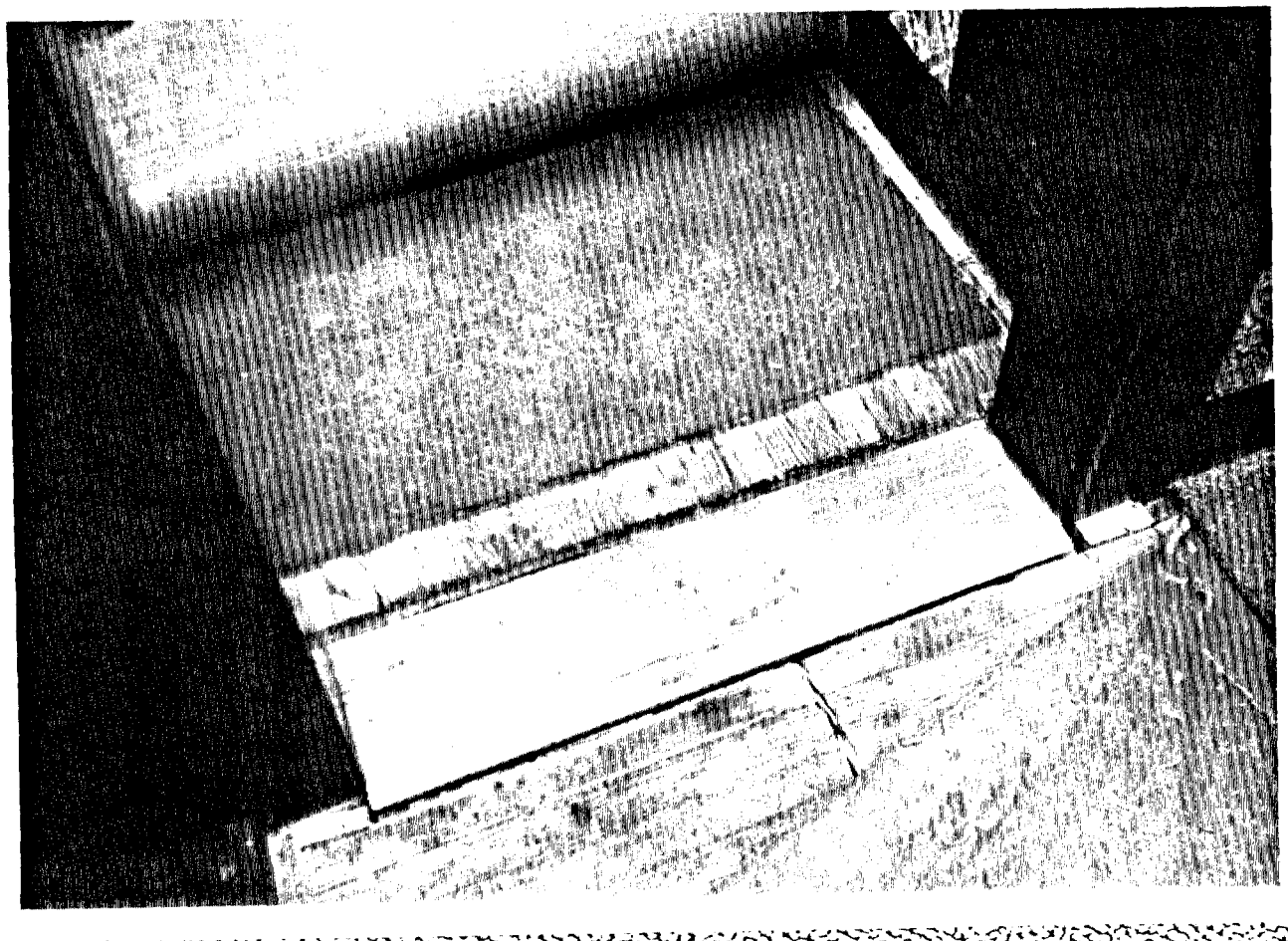
View down at new joist header





Structural Repair 21 September 1981

Close-up view of steel angle/beam under north jamb from the southwest



Structural Repair 21 September 1981

View of threshold in place before carpeting is replaced from the southeast

for wheat. SANFORD, FRANCIS & DAY.
July 16 1841. 14tf

FOR SALE.

ON accommodating terms the house at present occupied by the subscriber. If not sold before the first of Sept, it will then be for rent.

C. DRESSER.

Springfield July 7th 1841.

Advertisement from the "Sangamon Journal" for the sale of the property at the northeast corner of Eighth and Jackson Streets.

III. HISTORIC CONFIGURATION

The physical configuration of Lincoln Home is a result of the requirements for space, aesthetics, and activity by its occupants or owner. The sequence of events relating to Lincoln Home help to understand the changes made in its configuration.

A list of events in chronological order is provided on the following pages. The list is not complete, nor meant to be, as its primary intent is for use as a guide (source of information from Historic Structure Report, Lincoln Home National Historic Site, Illinois, by Edwin C. Bearss, National Park Service, July 1973).

DATE	EVENT
April 1839	Reverend Charles Dresser purchases Lot 8, Block 10, Elijah Iles Addition, at the northeast corner of Eighth and Jackson Streets from Dr. Gersham Jayne.
August 1839	Reverend Dresser purchases the south ten feet of the adjoining Lot 7, north from Francis Webster.
Autumn 1839	Reverend Dresser has a story and one-half house constructed on the lot. The house is characteristic of the Greek Revival style.
7 July 1841	Reverend Dresser advertises the house and lot for sale in the "Sangamo Journal" for the months of July and August. Reverend Dresser fails to sell or rent the property and continues to live there.
7 January 1844	Abraham Lincoln enters into a Contract for Deed with Reverend Dresser for the purchase of the house and lot.
2 May 1844	Reverend Dresser gives Abraham Lincoln a warranty deed for the property. Lincoln Family moves into the house.

27 October 1847	After being elected to the 30th Congress Mr. Lincoln leased the house to Cornelius Ludlum of Jacksonville, Illinois for one year beginning 1 November 1847.
after 1 November 1848	Mr. Lincoln had considerable remodeling done - four ceilings were whitewashed, along with the Kitchen a hearth was laid, and fireplaces filled up and plastered by a local Contractor, Mr. Roll. Mr. Lincoln gave Mr. Roll six walnut doors as part of the payment.
30 March 1850	Mr. Roll whitewashed two more rooms.
11 June 1850	Mr. Lincoln instructs Nathaniel Hay, a Brick Contractor, to build a brick retaining wall and fence in front of the fifty-foot lot.
June 1855	The Lincoln Family has the brick retaining wall and fence continued on the Jackson Street side for one-fourth of the lot length and has a high board fence constructed on the same side on the rear of the lot.
April 1856	The Lincoln Family has the back (east) half of their house raised from one-story to a full two stories by local Contractors, Hannan & Ragsdale.

November 1860	Mr. Lincoln becomes President-Elect of the United States of America.
February 1861	The Lincoln Family moved to the Chenery House for a few days before leaving for Washington, D.C.
8 February 1861	Mr. Lincoln insures against loss or damage by fire the house, carriage house, woodshed and privy.
15 April 1865	President Lincoln is assassinated.
	Judge David Davis named administrator of the estate.
	Heirs to the estate are Mary Lincoln, Robert Todd Lincoln, and Thomas Lincoln.
	Mary Lincoln quick-claimed her interest in all family real estate to her sons.
1868	Tilton spent $200 on repairs to property.
1869	Tilton Family moved to Chicago.
1870	Robert Todd Lincoln rents the house to George H. Harlow and Family.
	While the Harlow Family was renting the house, they constructed a one-story frame addition to the east elevation.

November 1870	Robert Lincoln disburses $55.00 for unspecific repairs.
July 1871	Thomas (Tad) Lincoln dies.
1880	The Harlow Family vacates the property and Dr. Gustav Wendlandt rents the Home.
1883	Wendlandt vacates property and Osborn Oldroyd rents the house. Mr. Oldroyd spends his own time and money repairing the house and grounds.
14 April 1884	Oldroyd opens the Lincoln Museum with his collection of Lincolniana.
15 June 1887	Legislation to establish the Home as a State Memorial was passed and signed into law by Governor Oglesby. Lincoln Home administered by the Board of Trustees of the Lincoln Home.
8 July 1887	Robert Todd and Mary Harlan Lincoln deed property to the state. Mr. Oldroyd becomes the state's first custodian of the Lincoln Home.

Spring 1888	Carriage House demolished by George Smith.
1893	Herman Hofferkamp becomes custodian. Mr. Oldroyd removes his collection.
1 July 1897	Albert S. Edwards becomes custodian.
20 December 1915	Custodian Edwards dies. His wife, Josephine Edwards, succeeds him as custodian.
1917	The Board of Trustees for the Lincoln Homestead is abolished and all their rights, powers and duties are vested in the State Department of Public Works and Buildings. Mrs. Edwards is retained as custodian.
Autumn 1918	Mrs. Edwards dies. Her daughter, Mrs. Mary Edwards Brown, succeeds her as custodian.
1924	Mrs. Mary Edwards Brown resigns as custodian.
1 July 1924	Miss Virginia Stuart Brown succeeds her mother as custodian.
Spring 1930	Restoration of Mr. Lincoln's Bedroom.

Autumn 1947	Tourists through the Home were numerous, sparking the need for restoration.
1 August 1951	Archeological investigation began in the back yard.
20 August 1952	The first phase of work begins on the restoration of the Lincoln Home.
1 June 1953	Mrs. Kathleen Bradish named custodian.
13 April 1954	Bids for the second phase of work on the restoration of the Lincoln Home were opened.
12 February 1955	Second floor opened to visitation.
Winter 1953-54	Charles H. Crawford donates a privy to be used at the Lincoln Home.
1964-65	Carriage House reconstructed.
1 October 1972	Transfer of title of the Lincoln Homestead from the State of Illinois to the National Park Service.

NOTE: A more complete record and description of repairs and alternatives can be found in the Historic Structure Report, Lincoln Home National Historic Site, Illinois by Edwin C. Bearss.

A. Physical Configuration

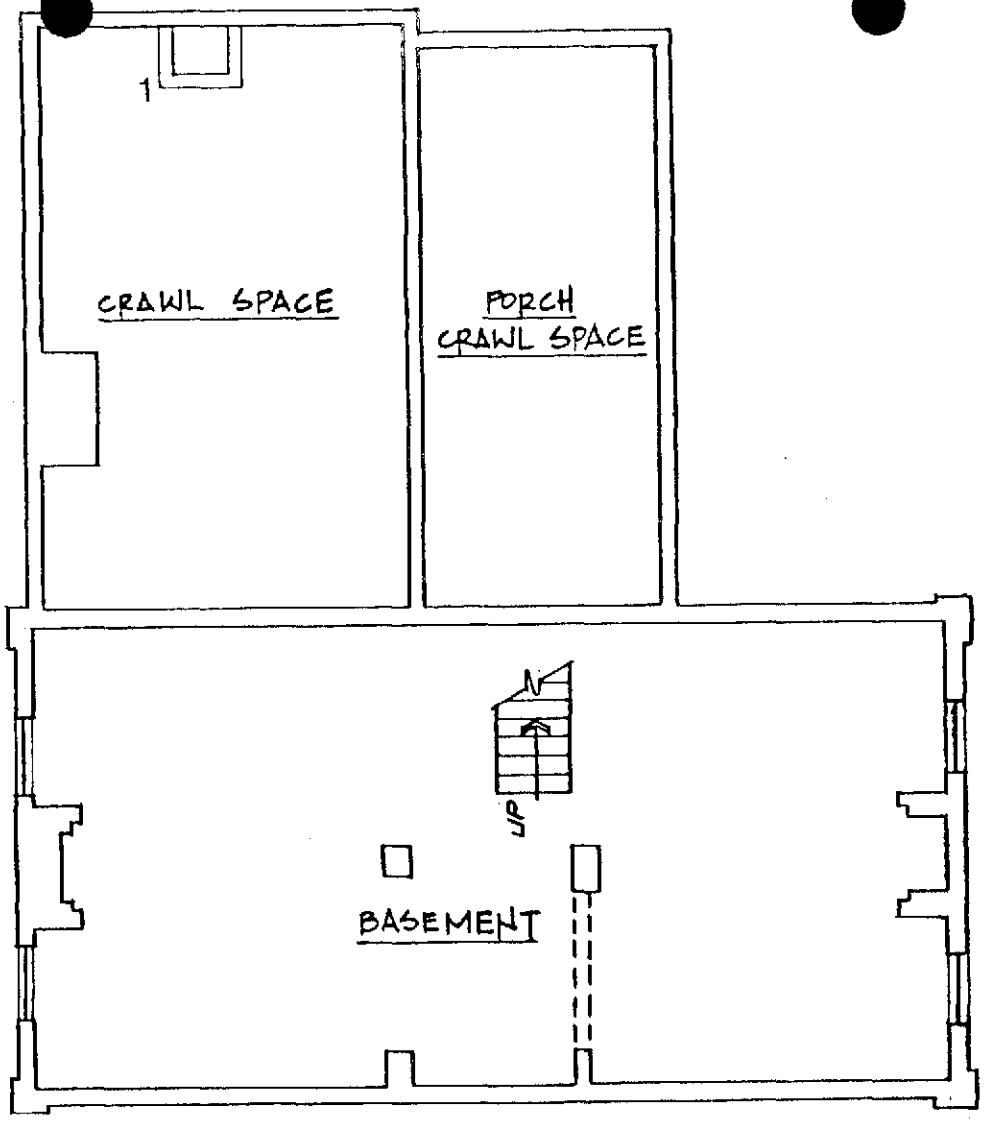
The physical configuration of the Lincoln Home has been altered since the original construction. To accommodate the various occupants since 1839, the house has undergone major remodeling.

The following sequence of changes to the Lincoln Home presents the configurations at four time periods - 1839, the original structure; by 1844, the house when the Lincoln Family moved in; 1855, the second floor addition to the western portion of the house; and 1856, the second floor addition to the eastern portion of the house - based on the available information and analyses.

1839

The original house was built as a wood "balloon" frame structure with clapboard siding on a brick foundation. The main portion of the house was 1½ stories, oriented north-south, facing west, with a basement underneath. A 1-story ell was at the northeast rear, with a crawl space underneath. The main entry to the house is in the center of the west facade.

The original house had classical revival features on the exterior at the corners, the eaves and around doors and windows. The windows were shuttered. There are three chimneys, one at the north end and at the south end of the main portion of the house, and one in the ell. A south porch existed off the ell.

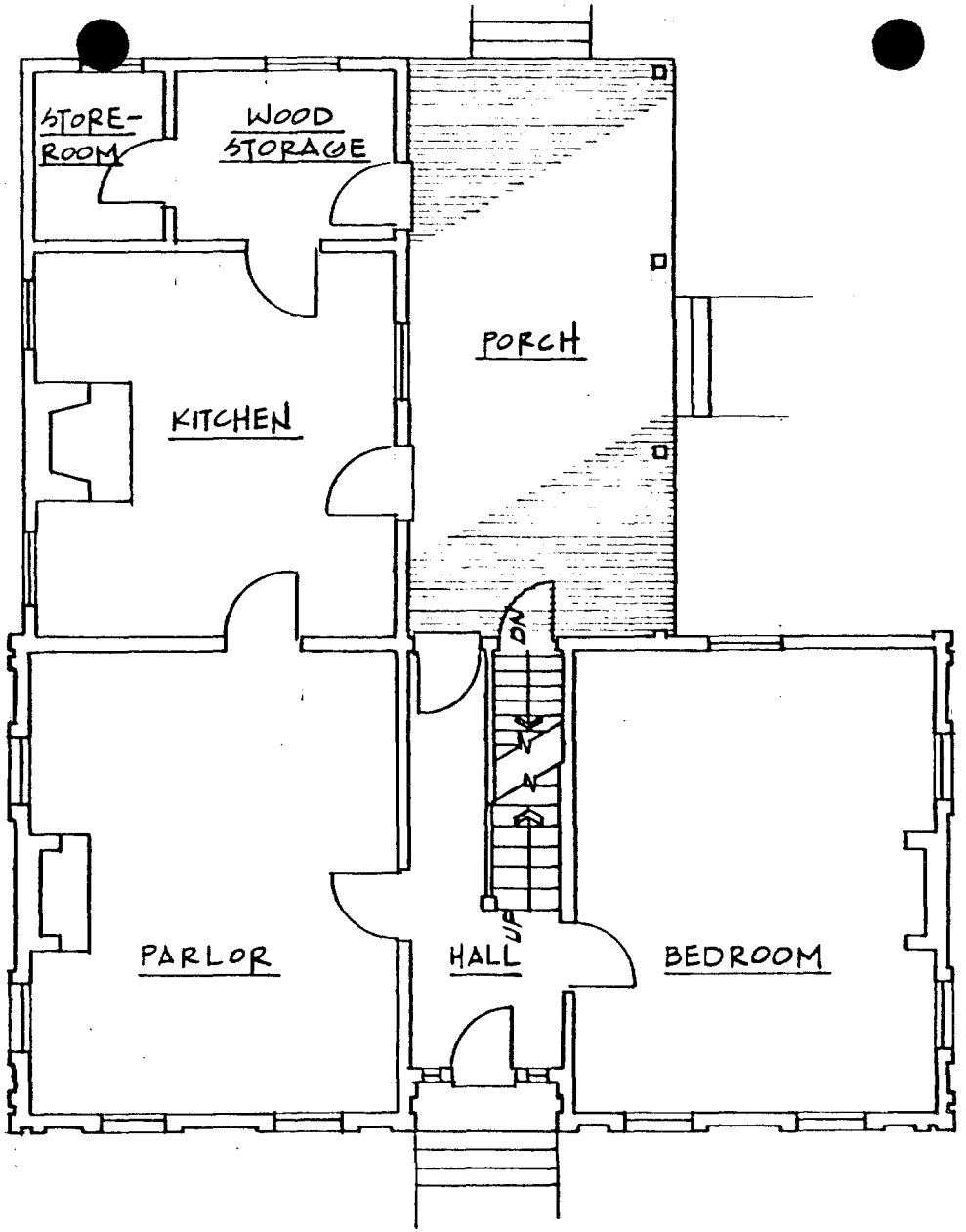


1. This represents brick footing below grade which may have been for a fireplace.

BASEMENT FLOOR PLAN

10 5 0 10 20

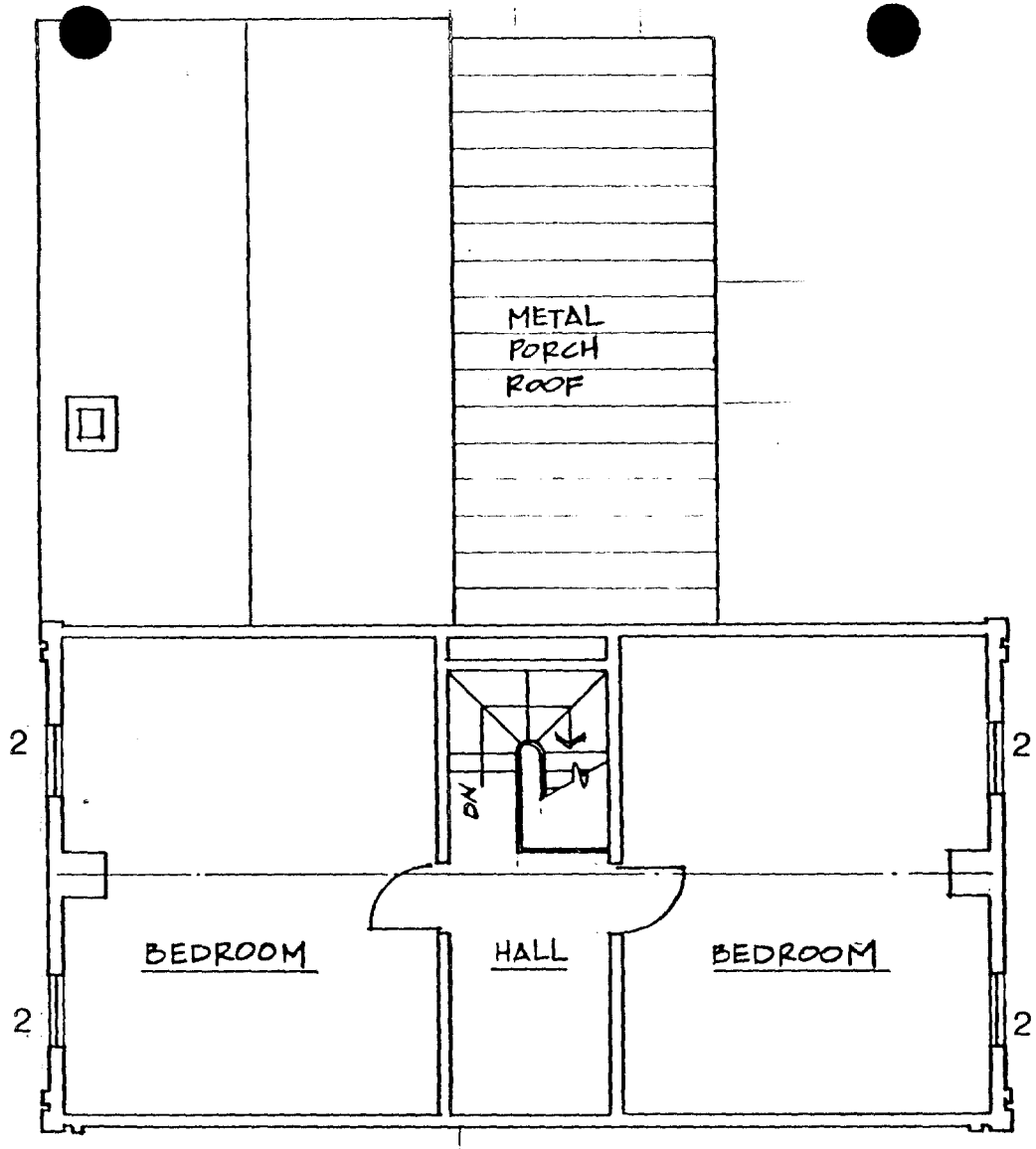
1839



FIRST FLOOR PLAN

10 5 0 10 20

1839



SECOND FLOOR PLAN

10 5 0 10 20

1839

2. Windows in the gable end would have existed to provide natural light to the upstairs.

3. Classical details that may have existed on the original structure.

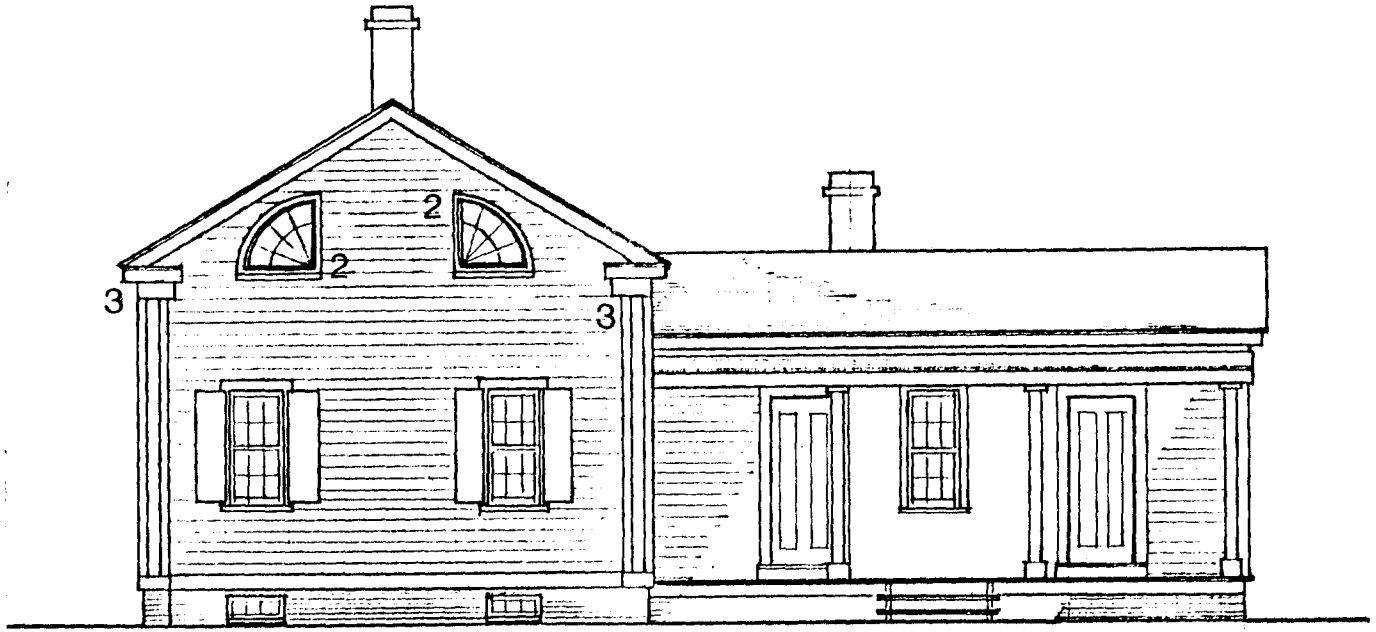
WEST ELEVATION

10 5 0 10 20

1839

2. Windows in the gable end would have existed to provide natural light to the upstairs.

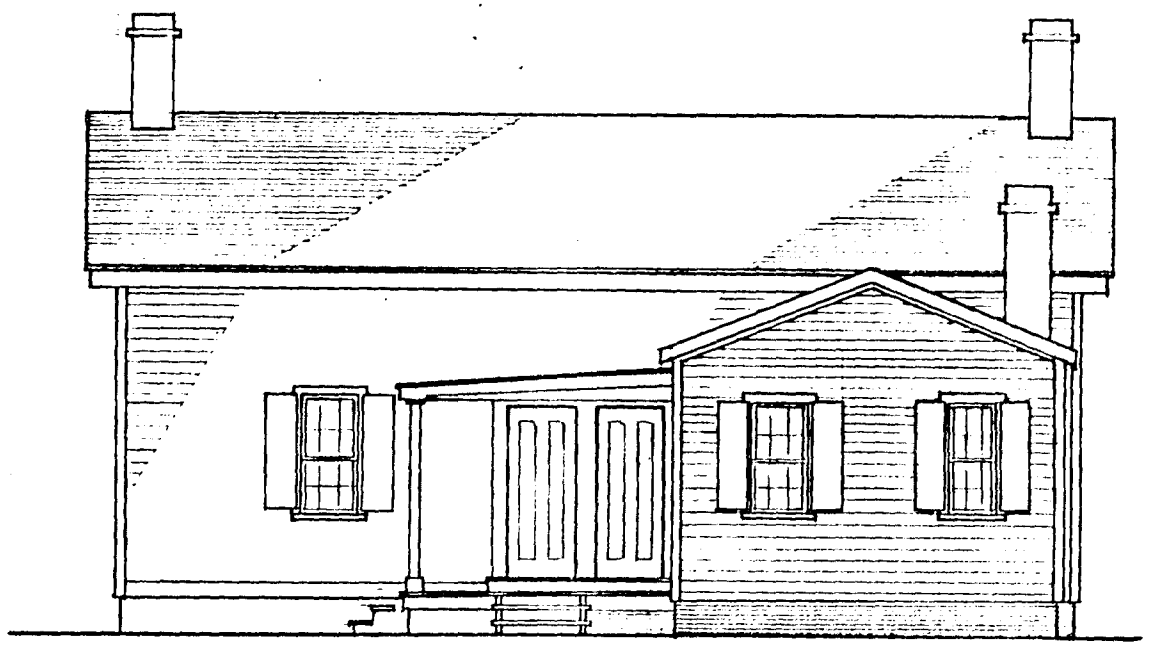
3. Classical details that may have existed on the original structure.



SOUTH ELEVATION

10 5 0 10 20

1839



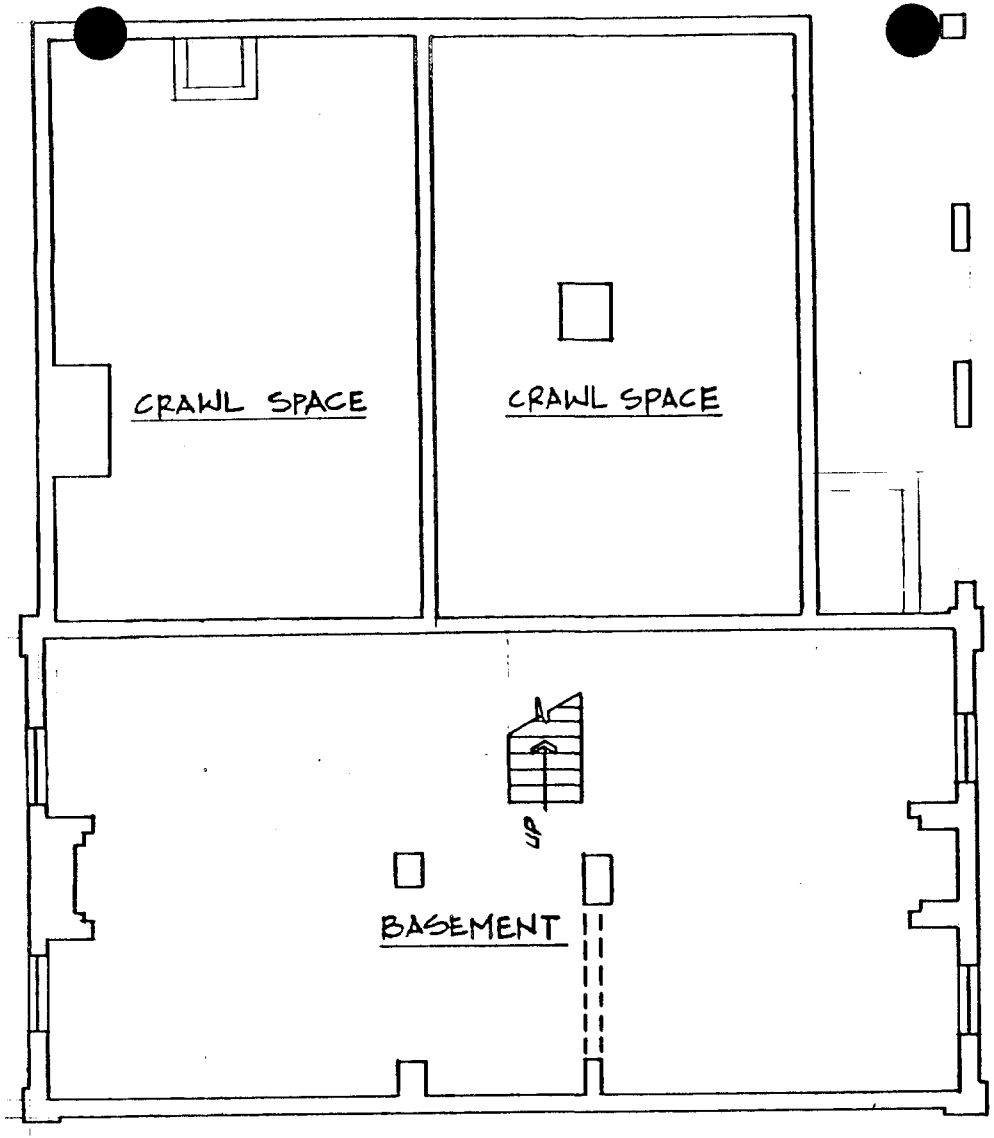
EAST ELEVATION

10 5 0 10 20

1839

By 1844

By the time Mr. Lincoln bought the house in 1844, several changes had been made. The ell had been expanded southward to provide more space in the rear portion of the house. The south porch was moved south also, but was made narrower. The main portion (west end) remained unchanged.

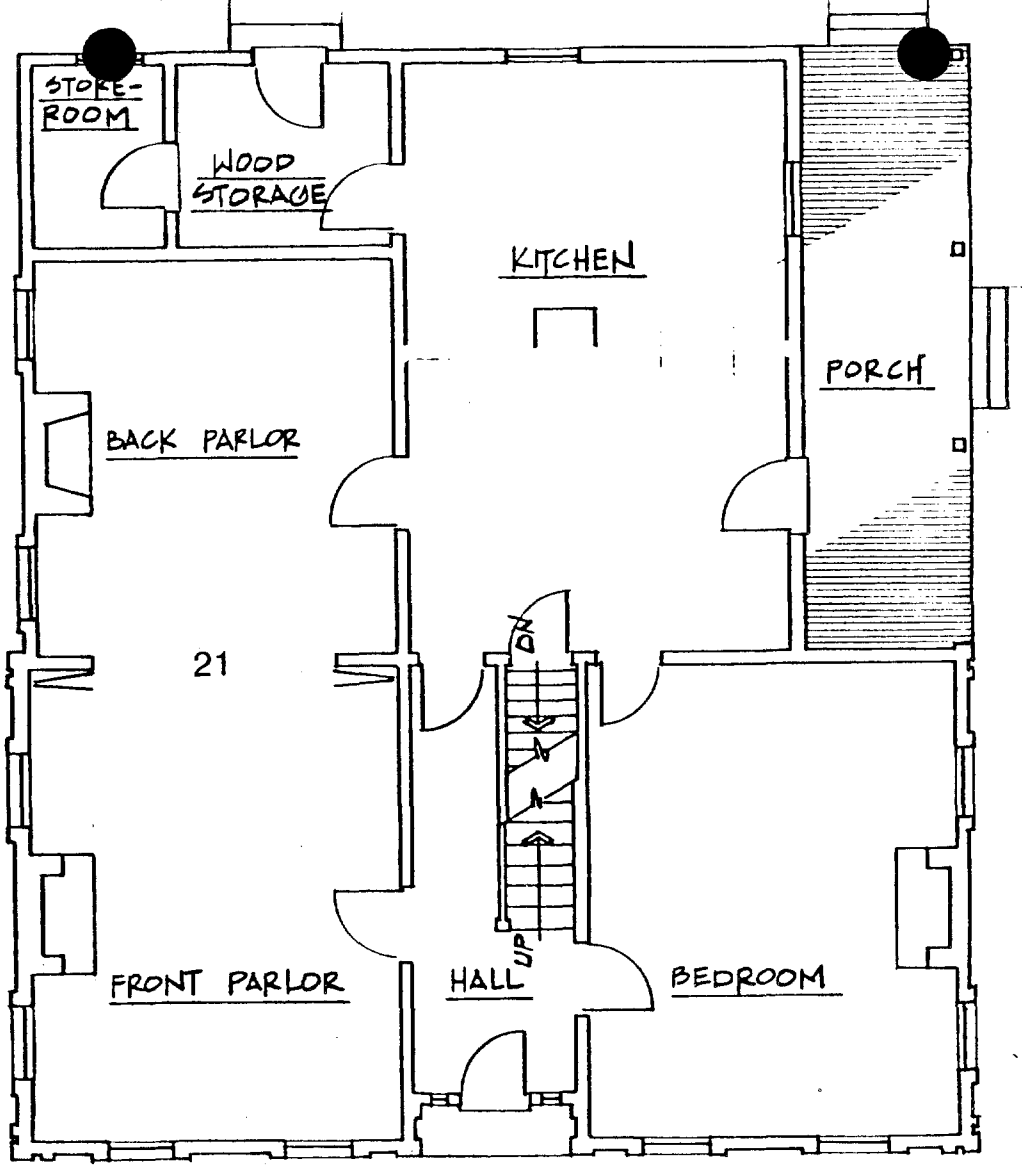


BASEMENT FLOOR PLAN

10 5 0 10 20

1844

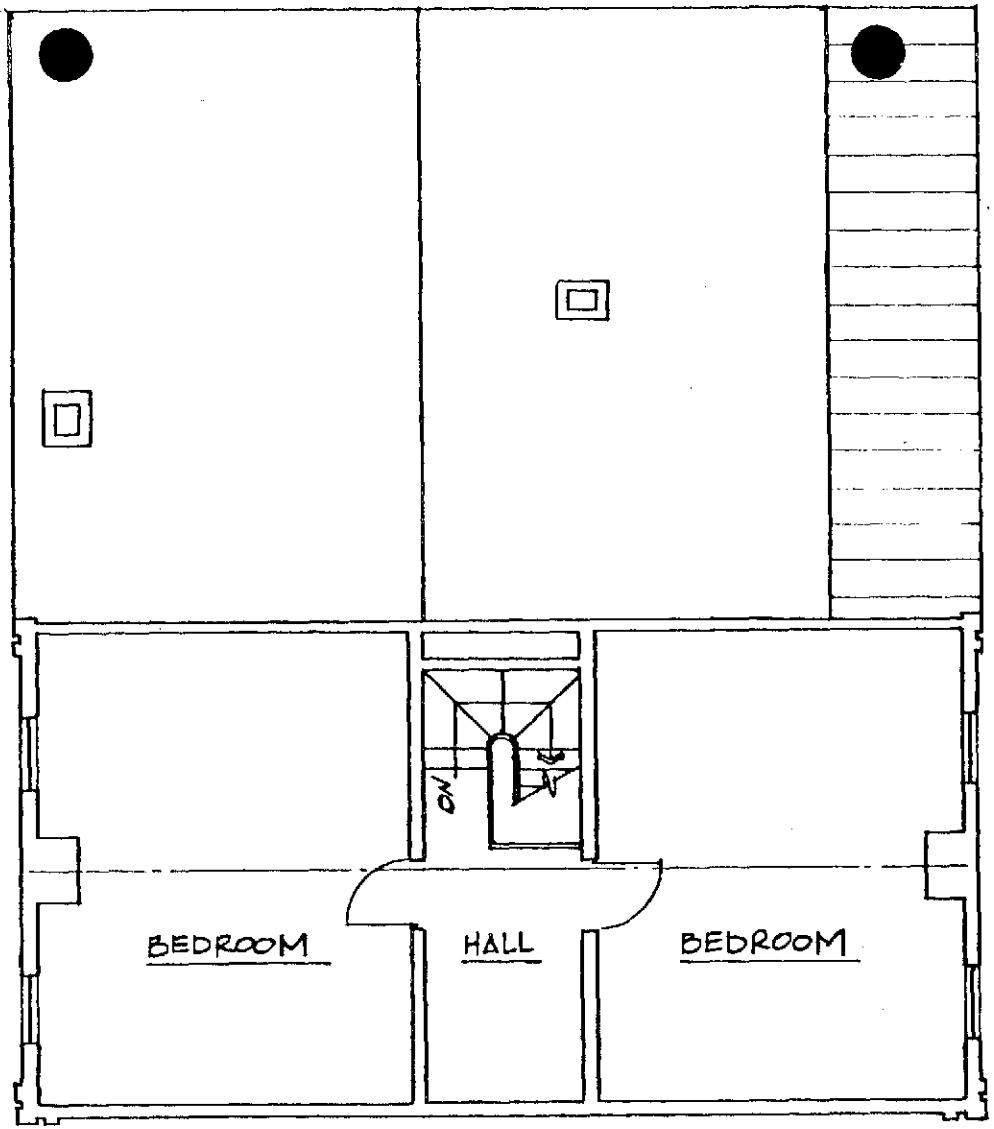
21. Larger opening between Front Parlor and Back Parlor existed by this time or it may have been built originally.



FIRST FLOOR PLAN

10 5 0 10 20

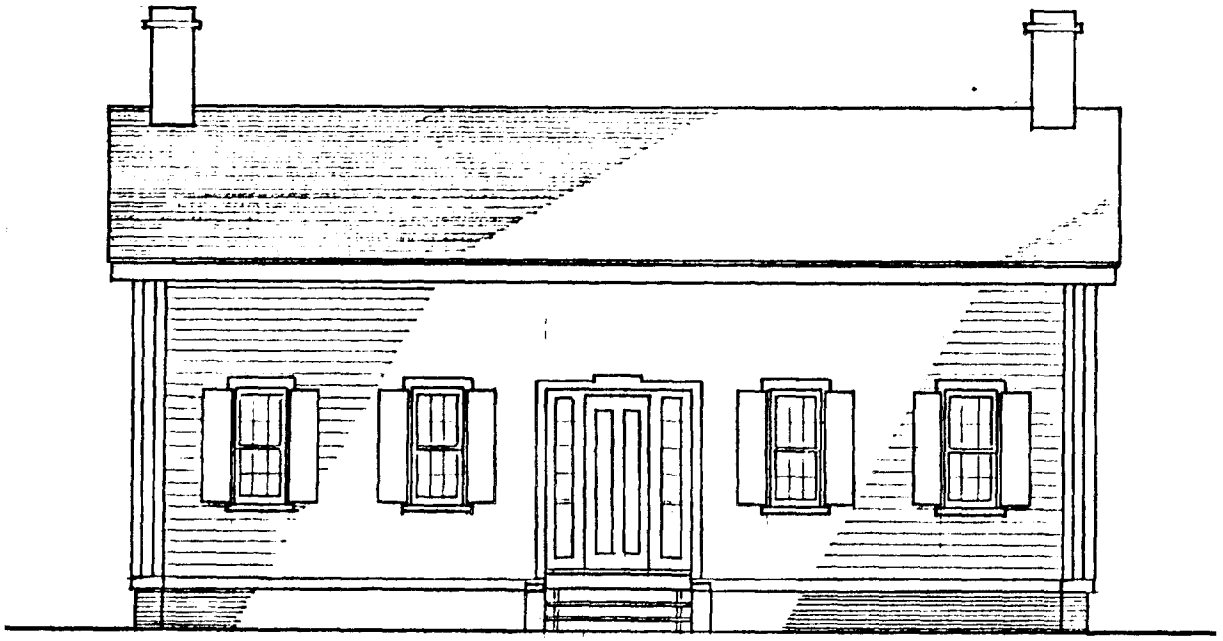
1844



SECOND FLOOR PLAN

10 5 0 10 20

1B44



WEST ELEVATION

10 5 0 10 20

1844

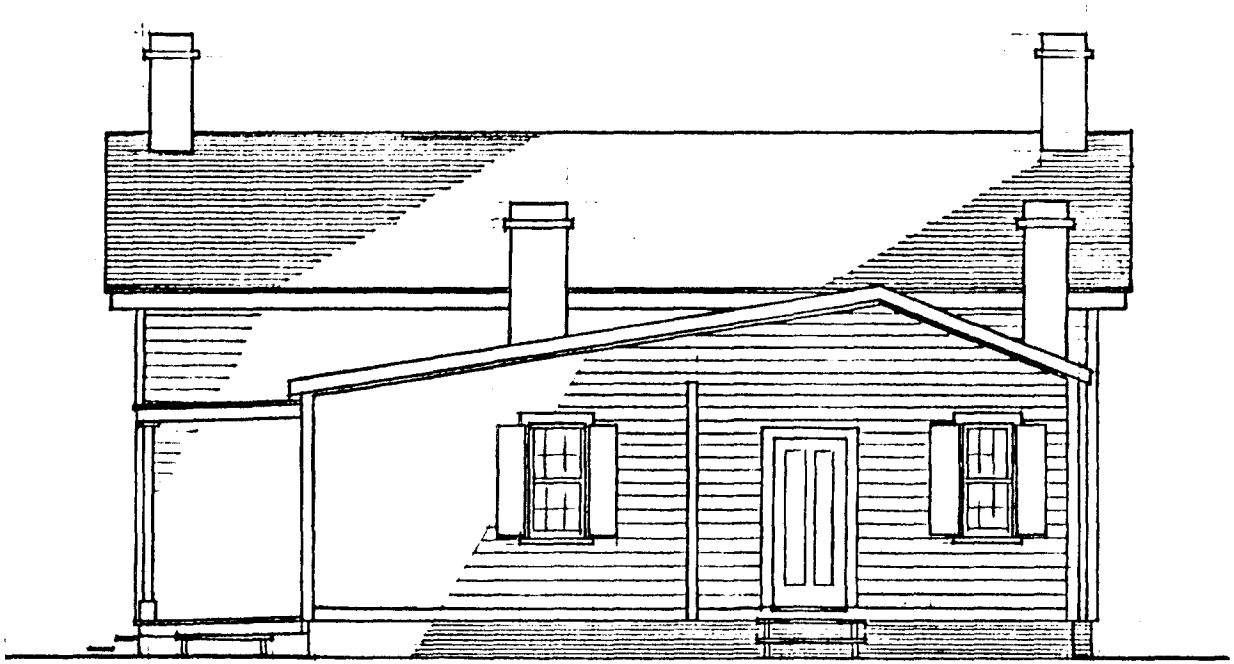
22. Slope of original 1½ story roof was approximately 7.2" in 12".

23. Actual size and shape of upper windows unknown. Examples of the quarter circle windows can be found in the area today.

SOUTH ELEVATION

10 5 0 10 20

1844



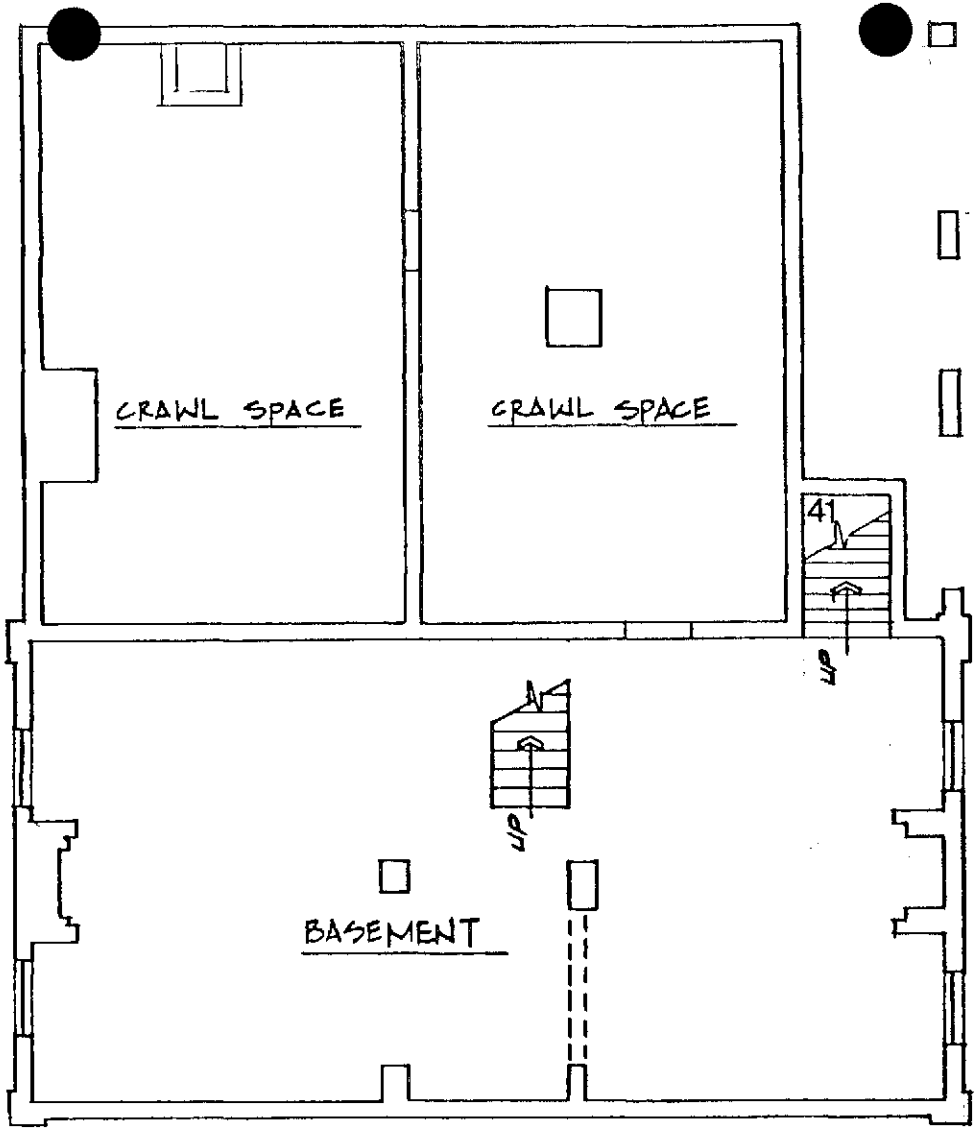
EAST ELEVATION

10 5 0 10 20

1844

1855

In 1855, the Lincoln Family had the main (western) 1½ story portion of their home raised to 2 stories. The existing gable roof was completely removed, the walls extended upward off the existing rafter plate, and a new roof system built on the top of the new walls.

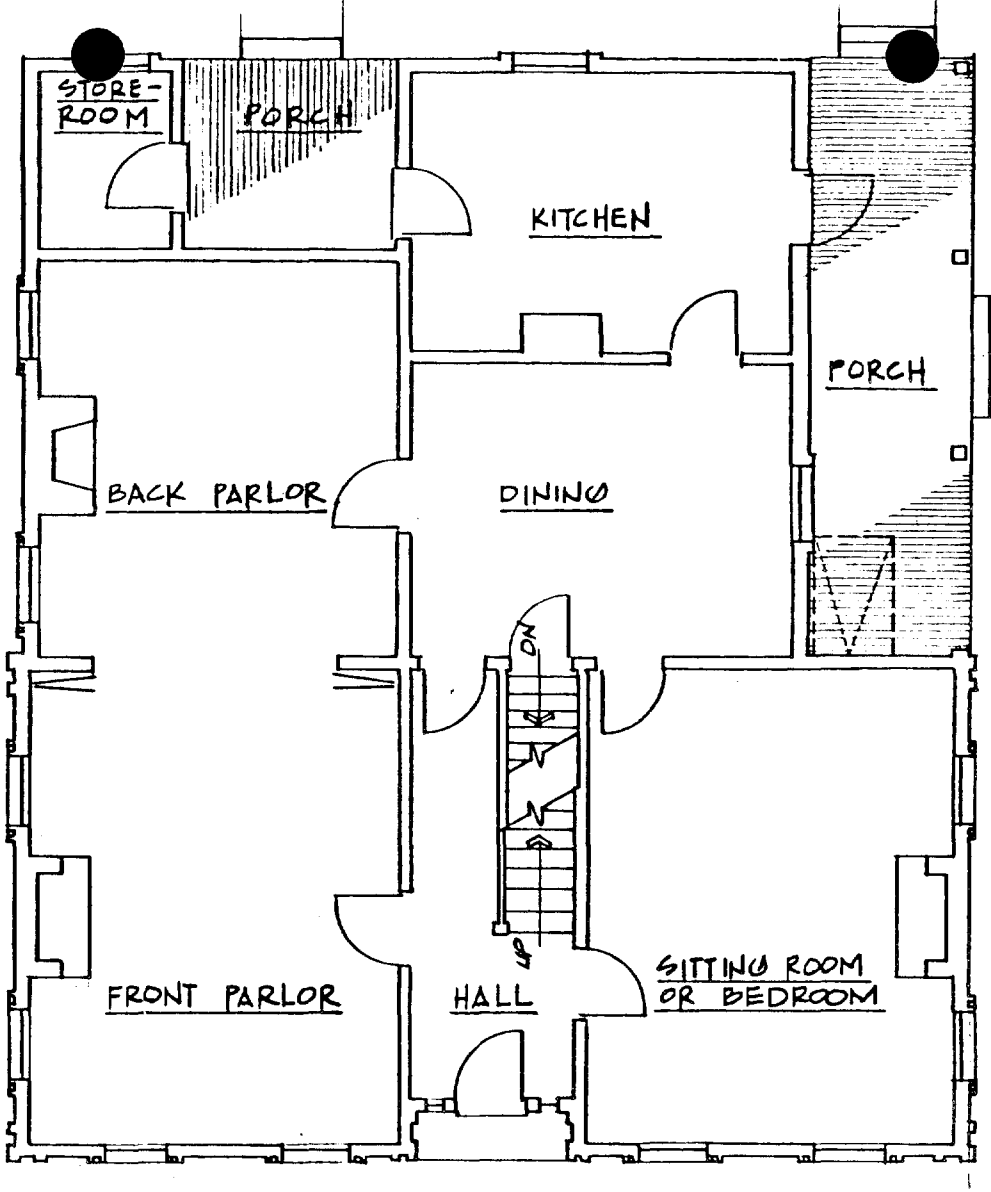


BASEMENT FLOOR PLAN

10 5 0 10 20

1855

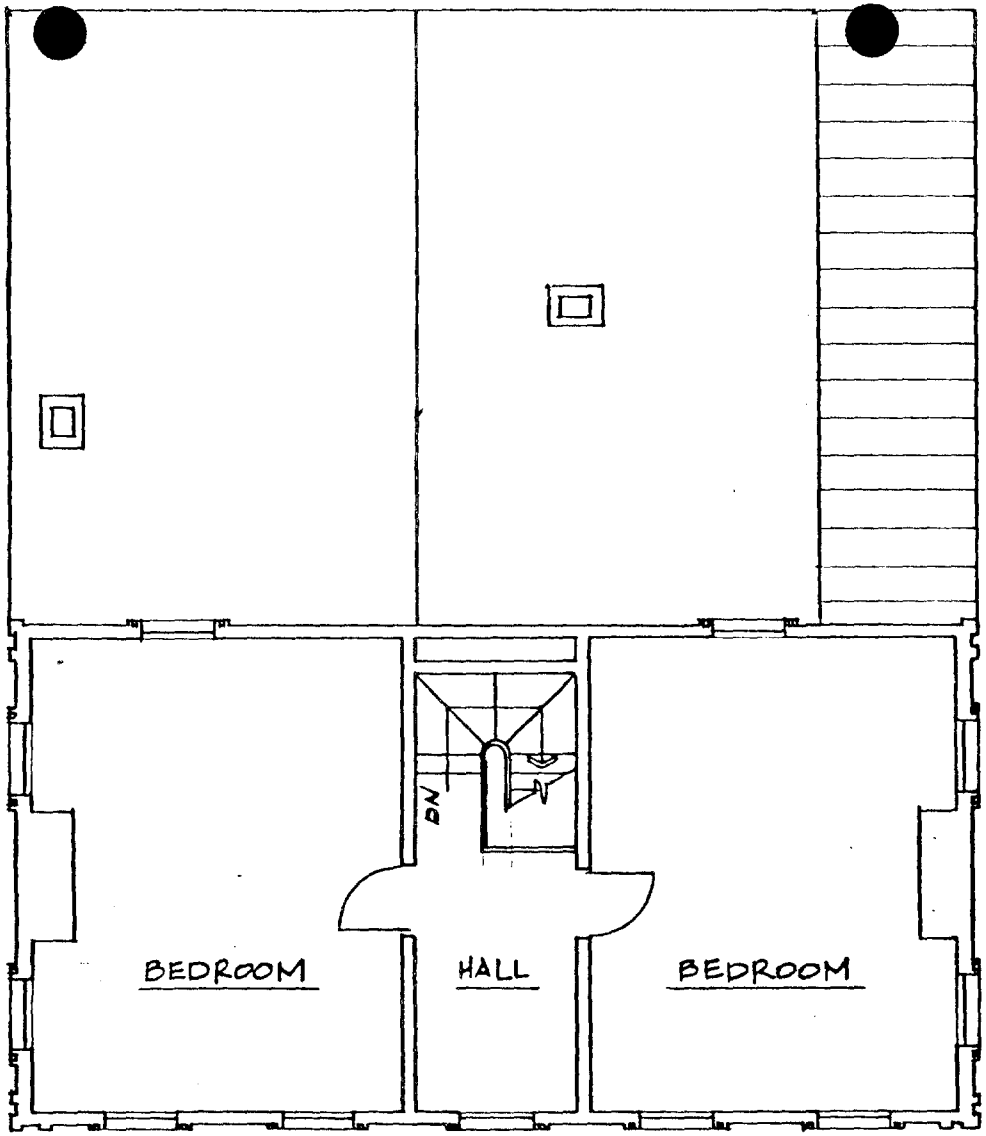
41. Access to the basement from the exterior of the house may have been provided at this time.



FIRST FLOOR PLAN

10 5 0 10 20

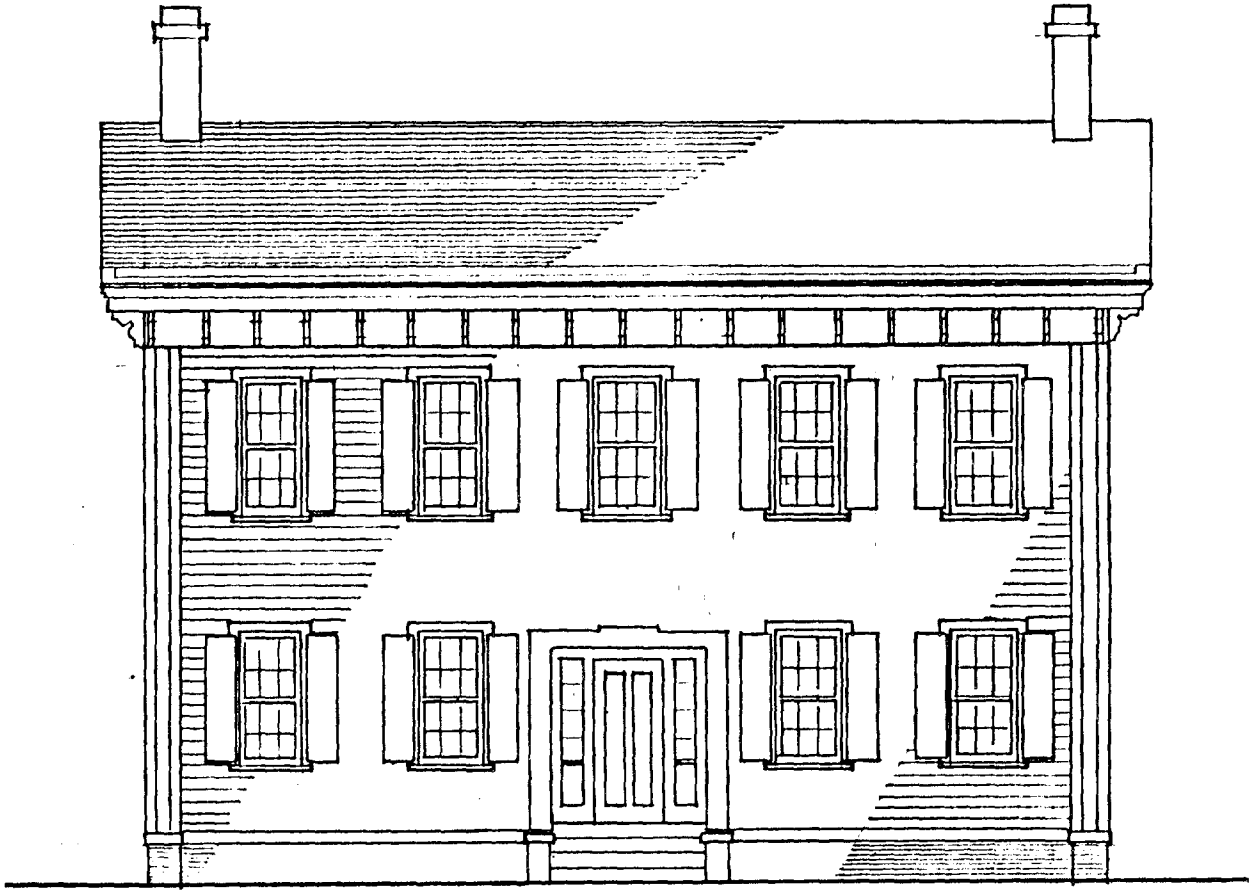
1855



SECOND FLOOR PLAN

10 5 0 10 20

1855

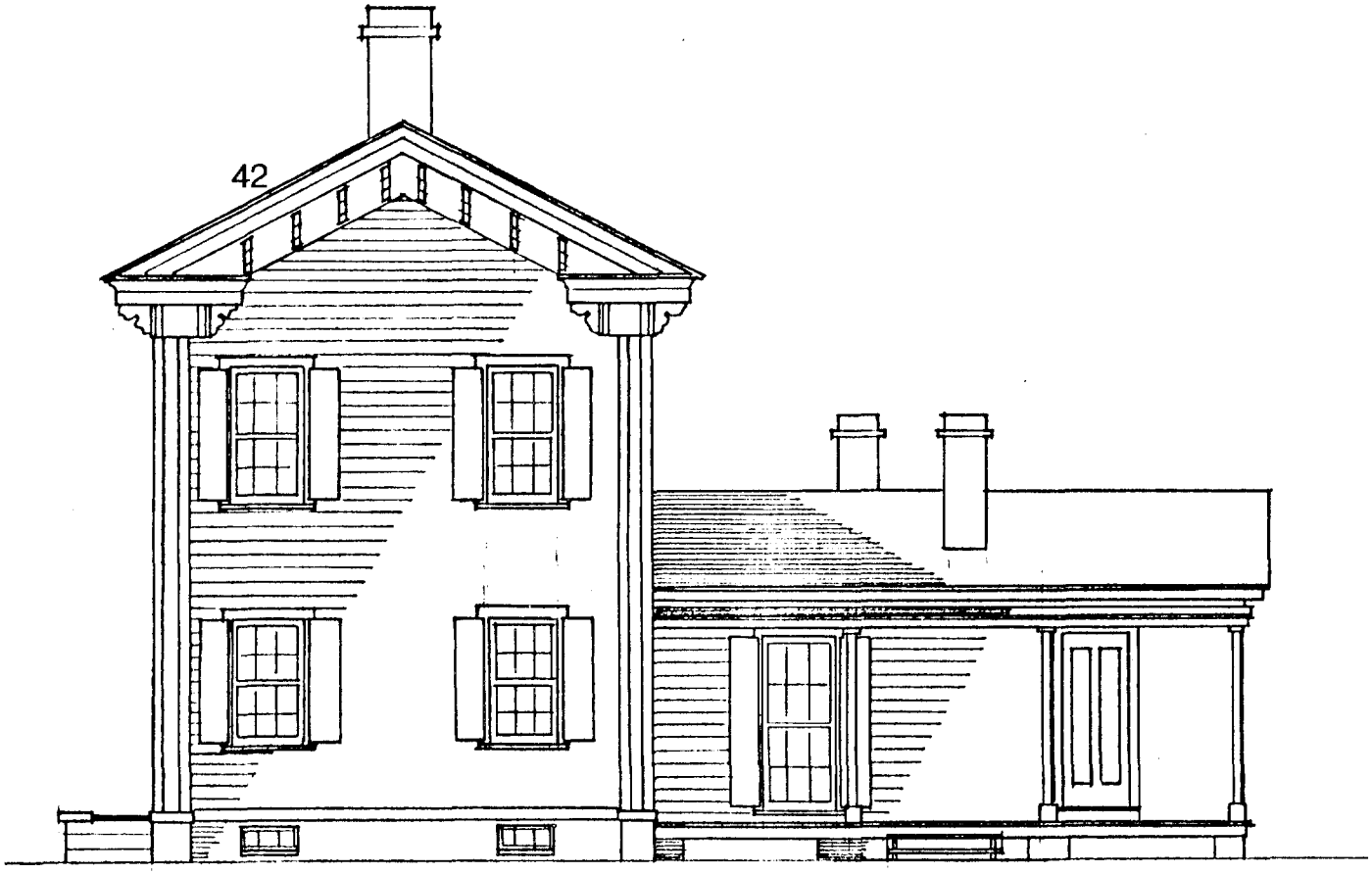


WEST ELEVATION

10 5 0 10 20

1855

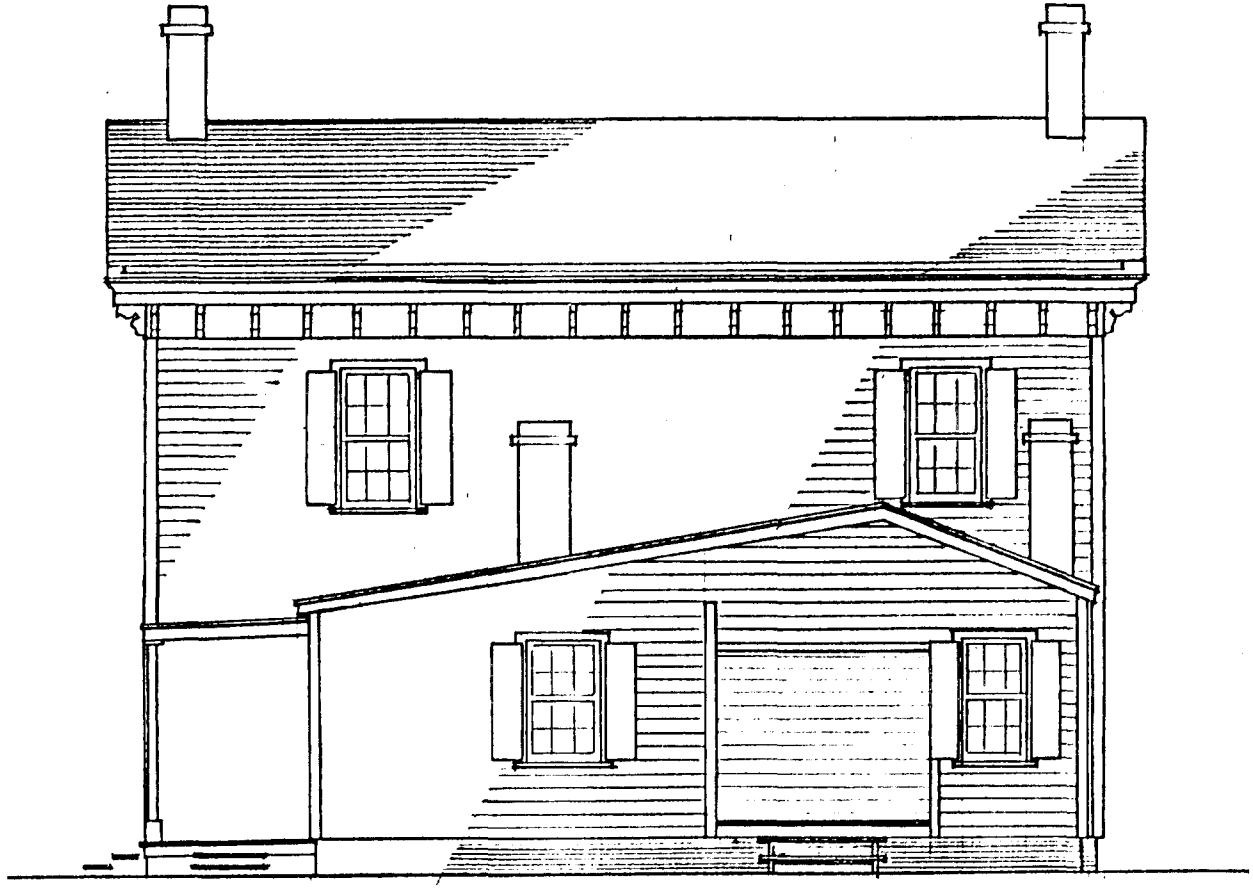
42. Slope of roof after the remodeling from a 1½ story house to a 2 story house is approximately 6" in 12".



SOUTH ELEVATION

10 5 0 10 20

1855



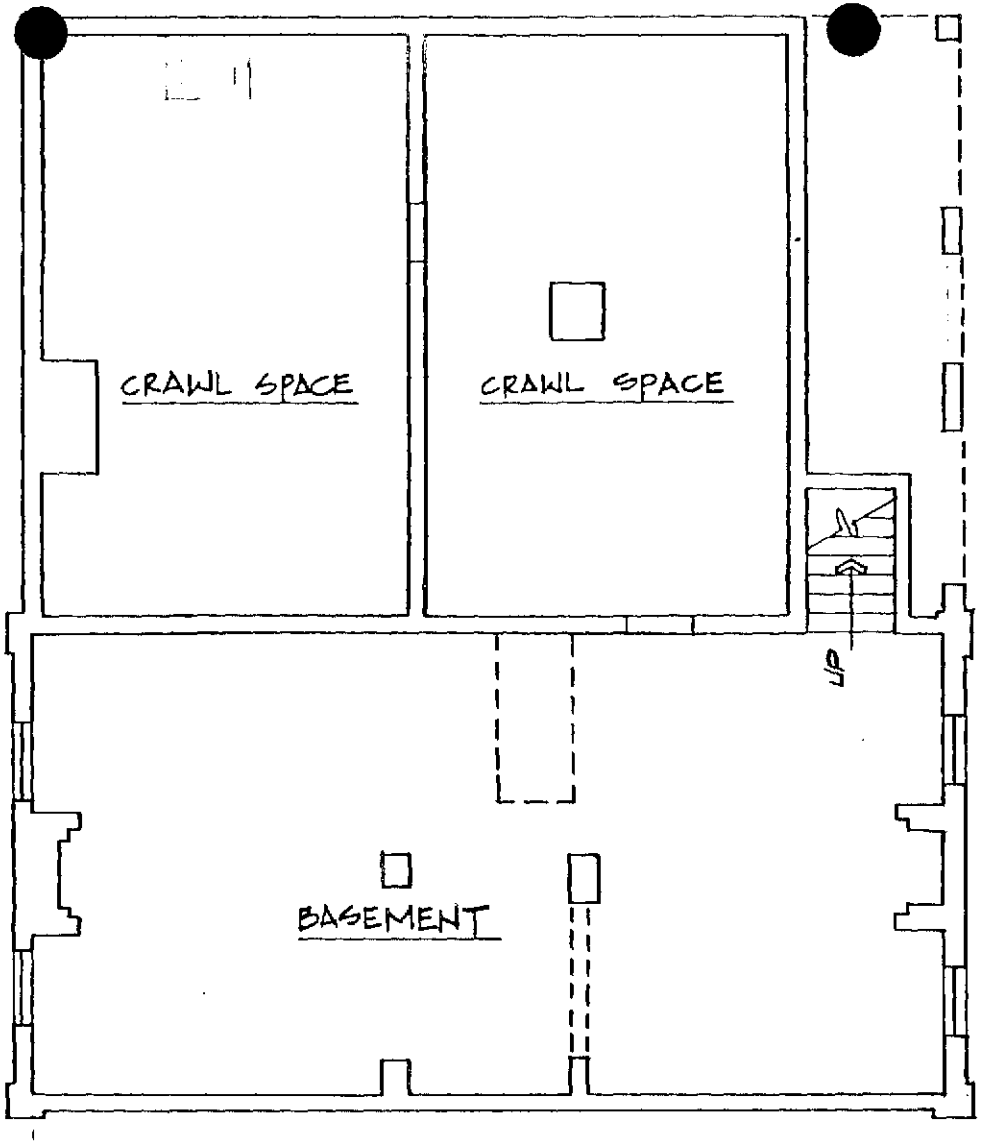
EAST ELEVATION

10 5 0 10 20

1855

1856

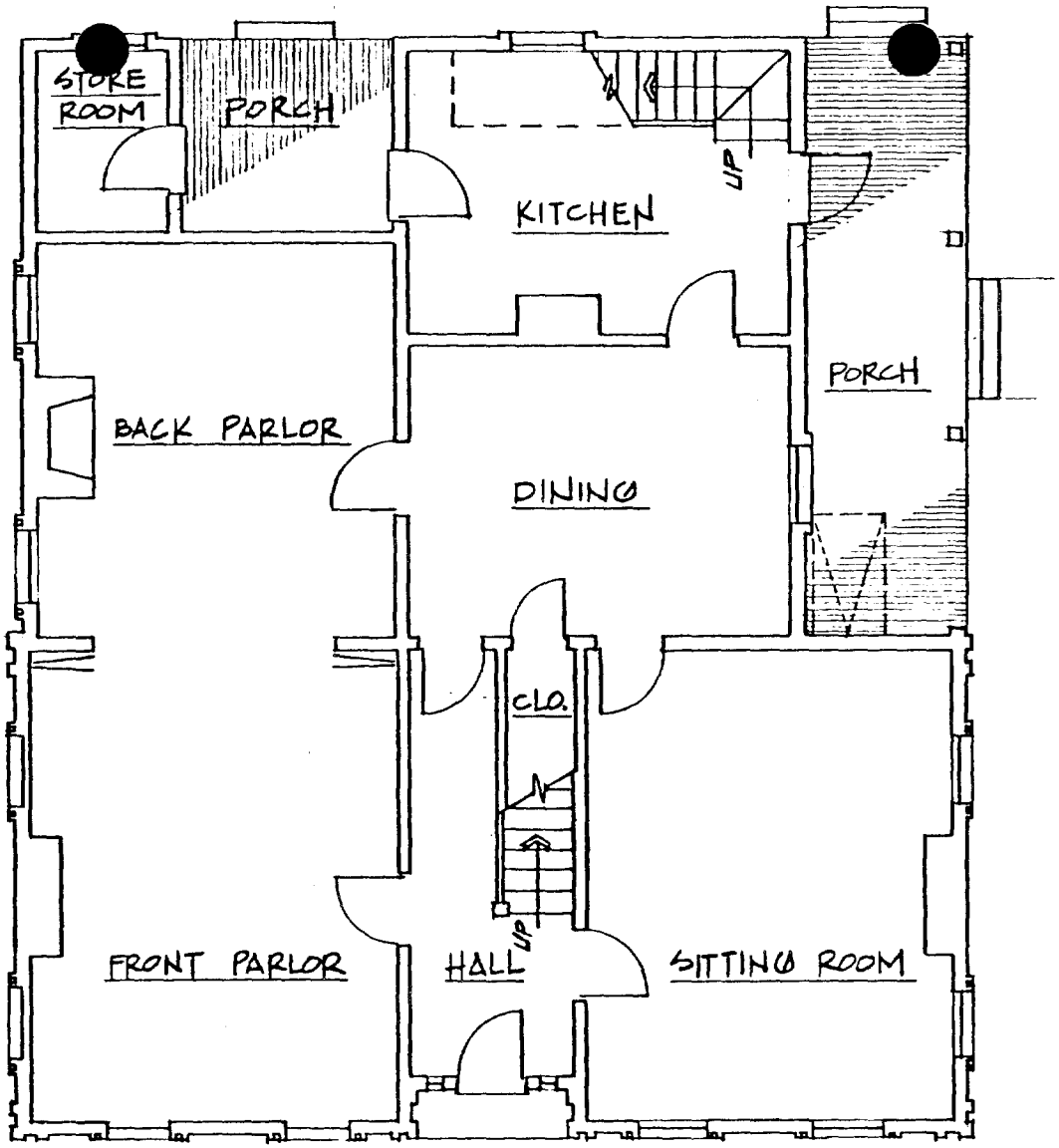
A year later, in 1856, the Lincoln Family had the rear (eastern) portion of their home raised from 1 story to 2 stories. The new roof was metal with a low slope hip.



BASEMENT FLOOR PLAN

10 5 0 10 20

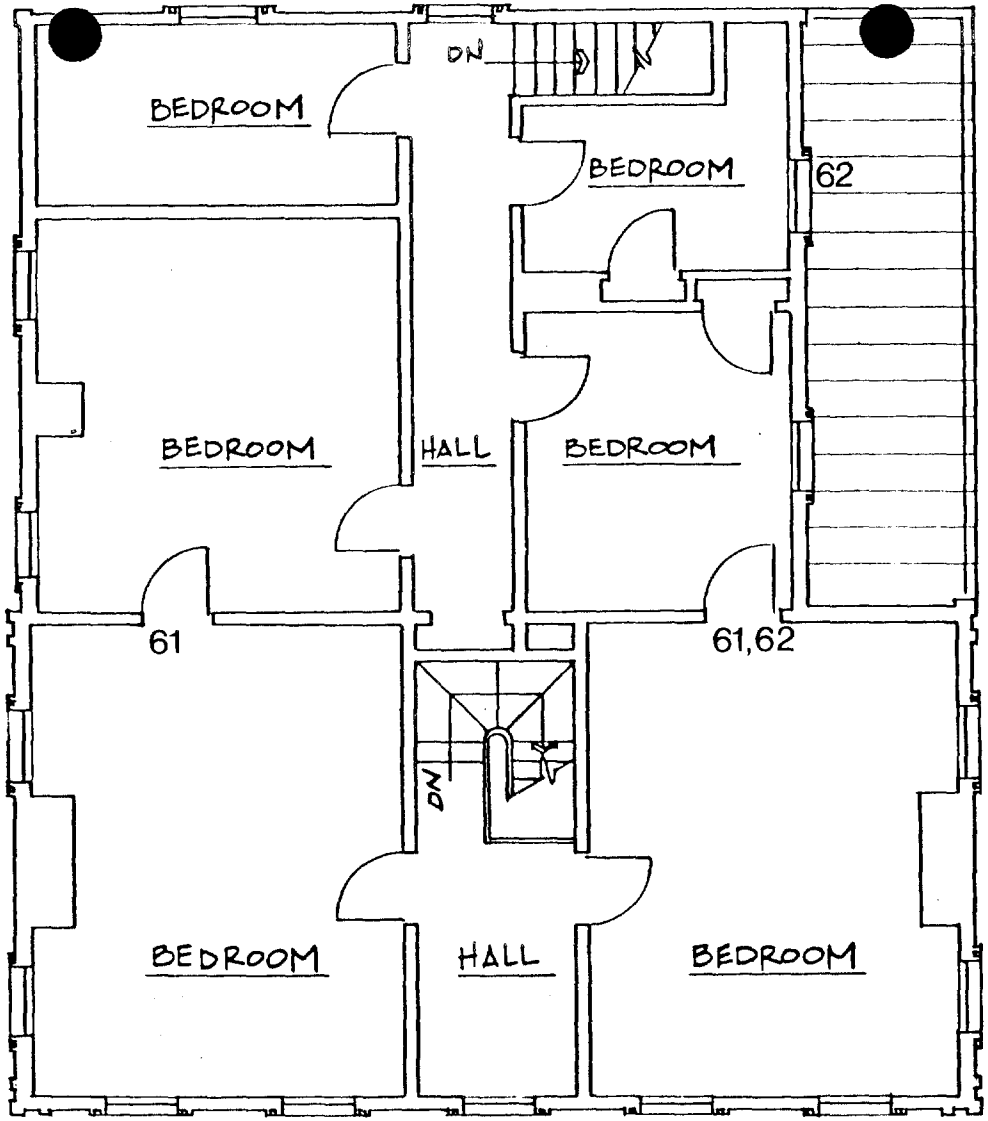
1/8"=1'-0"



FIRST FLOOR PLAN

10 5 0 10 20

1856



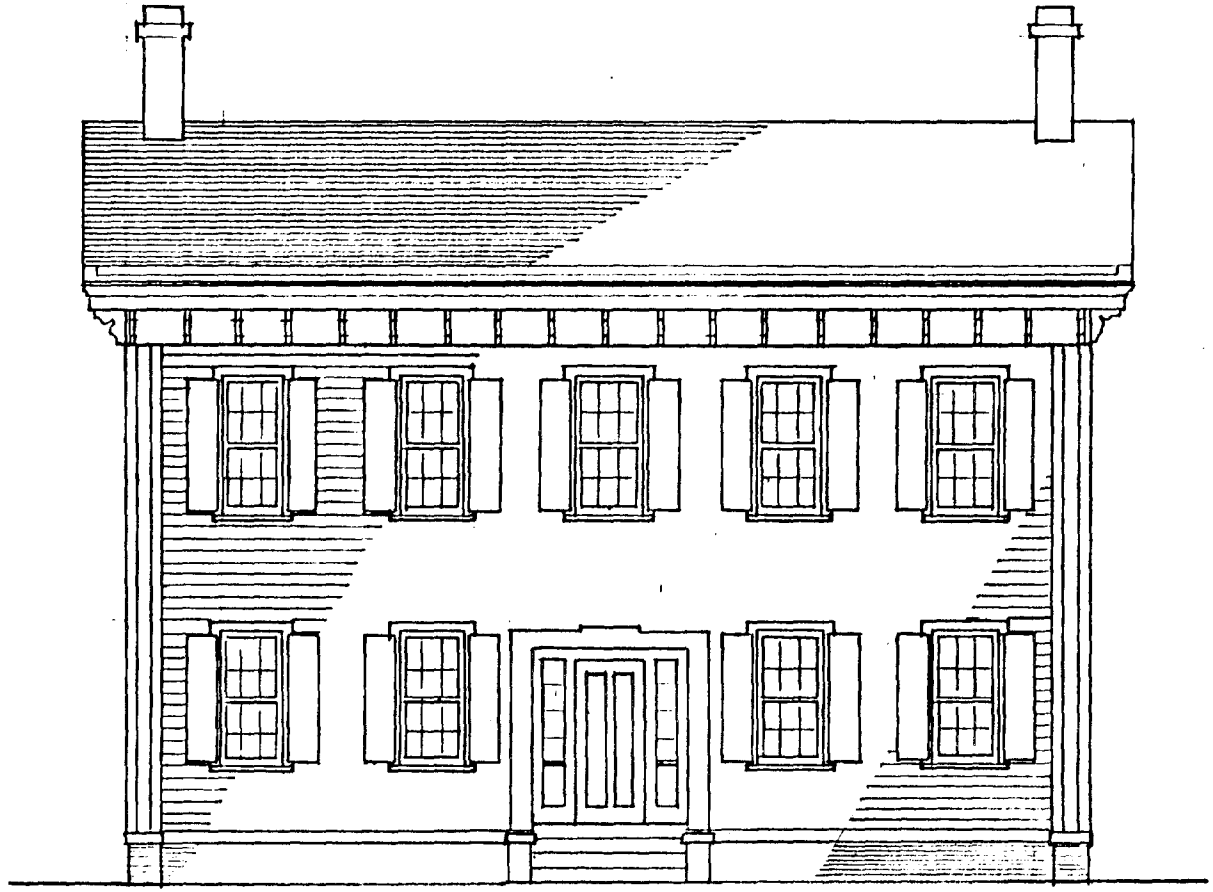
SECOND FLOOR PLAN

10 5 0 10 20

1856

61. The door is located where the window may have previously been placed.

62. The window may have been relocated to the south wall of the southweast bedroom when the door was installed.



WEST ELEVATION

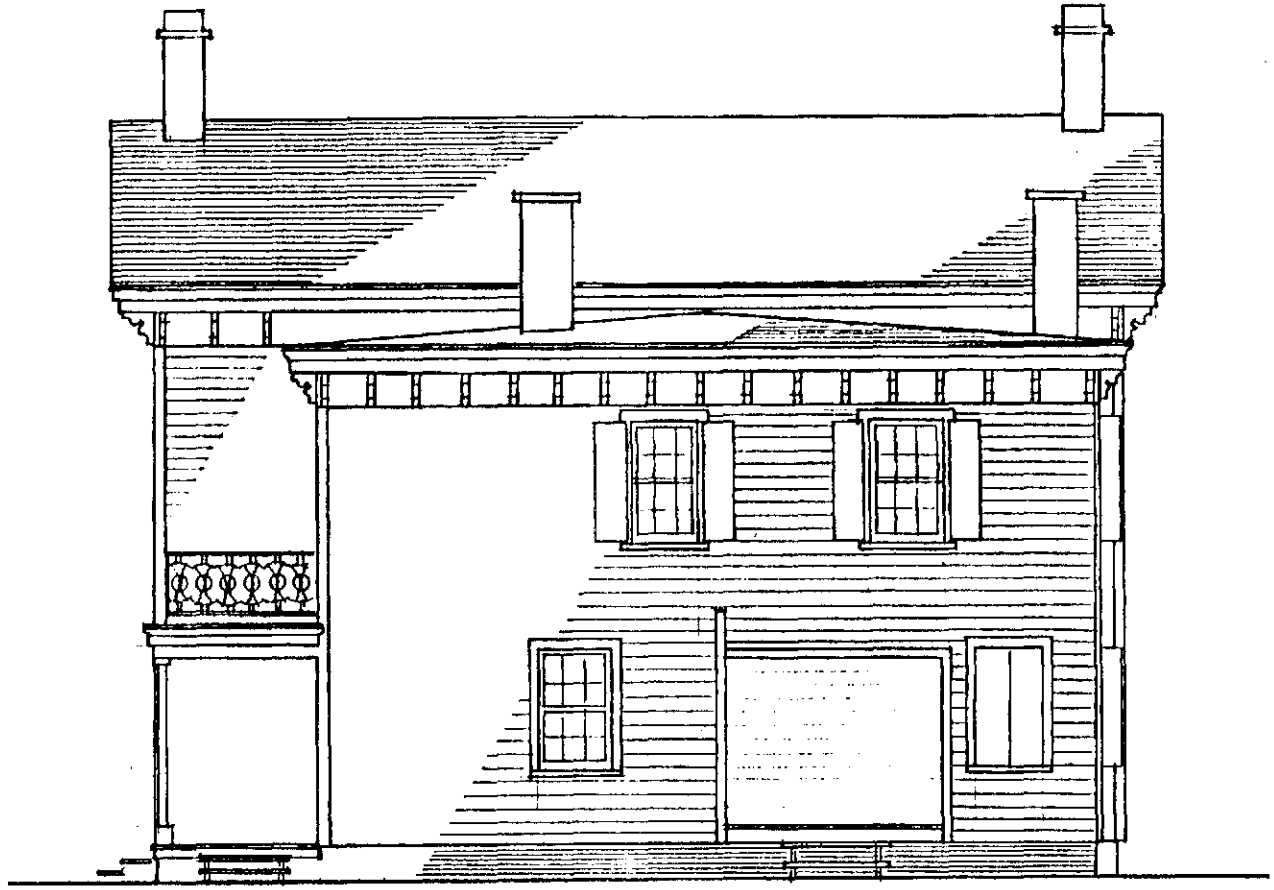
10 5 0 10 20

1855

SOUTH ELEVATION

10 5 0 10 20

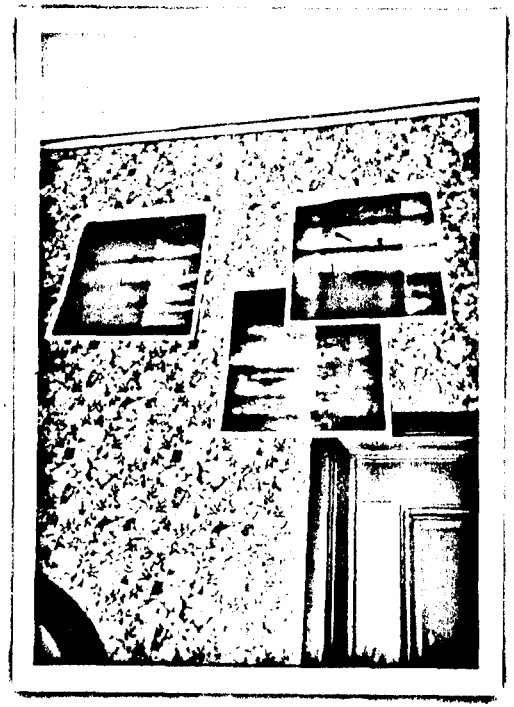
1B56



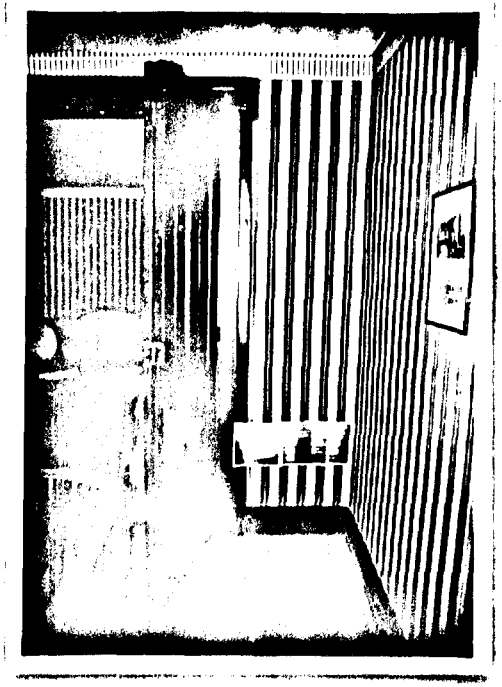
EAST ELEVATION

10 5 0 10 20

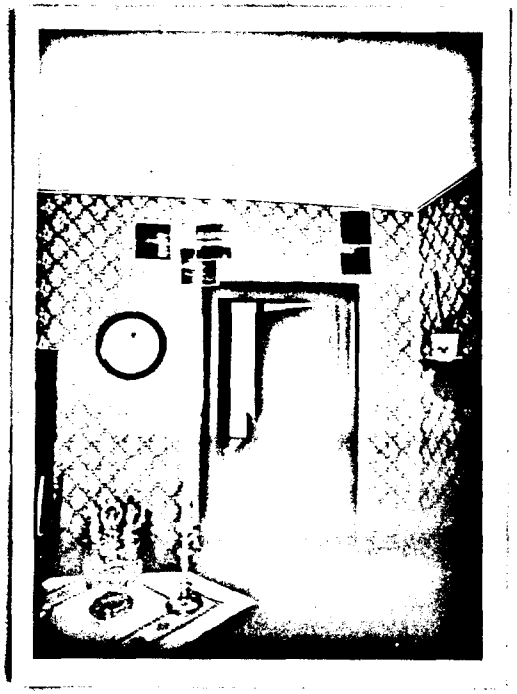
1856



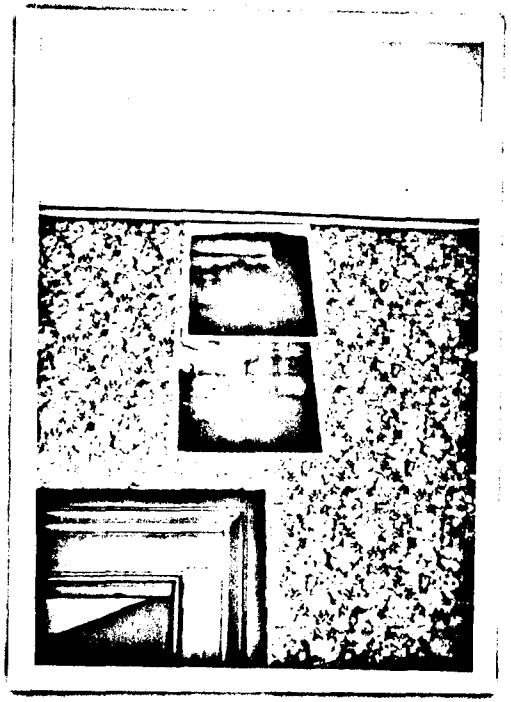
28. Dining room, close-up



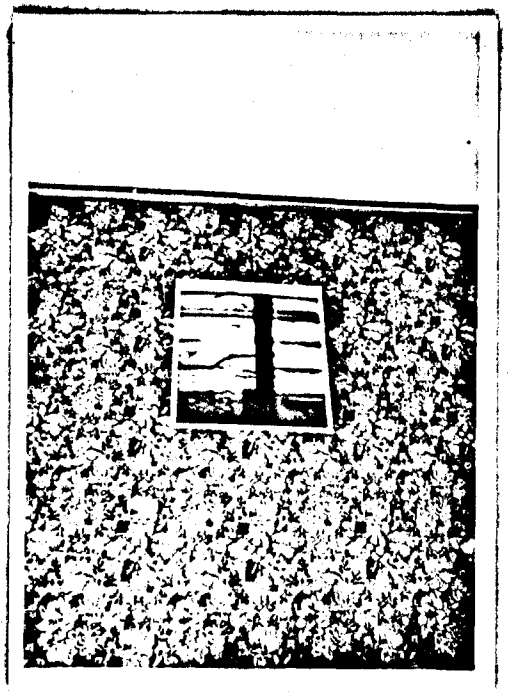
29. Front Parlor, East Wall (101)



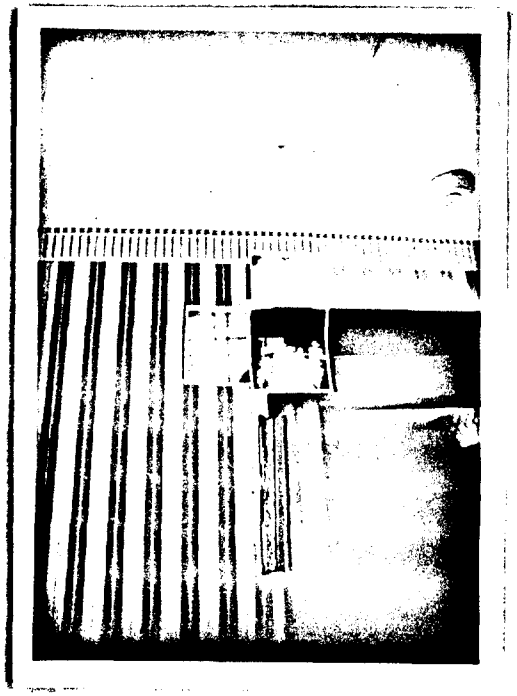
26. Dining room, East wall (107)



27. Dining room, close-up

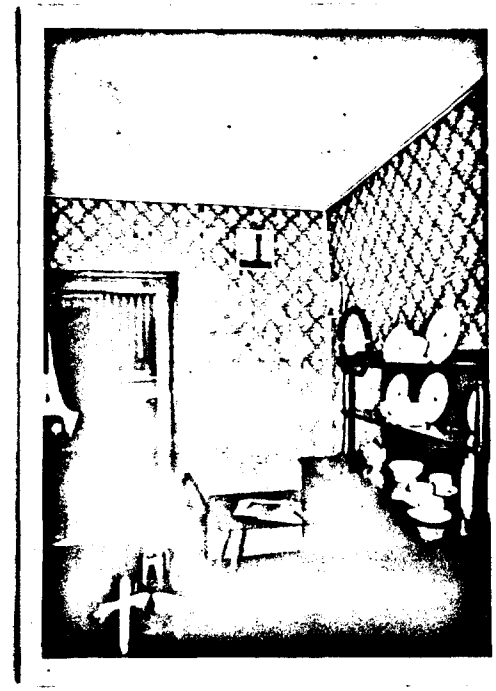


24. Dining Room, North Wall (107)

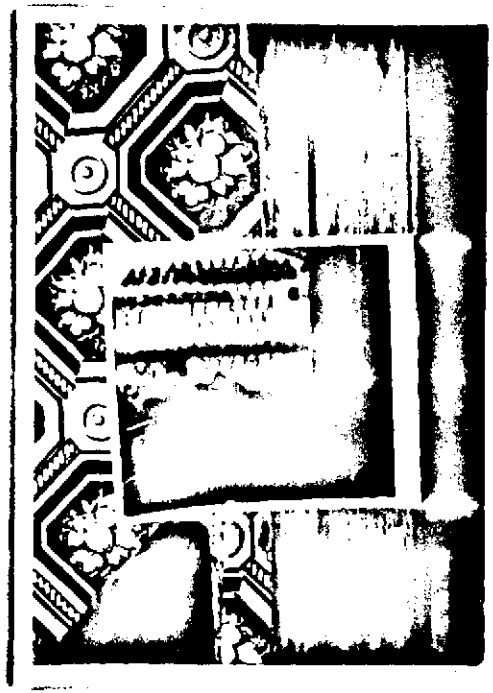


25. Back parlor South wall (102)

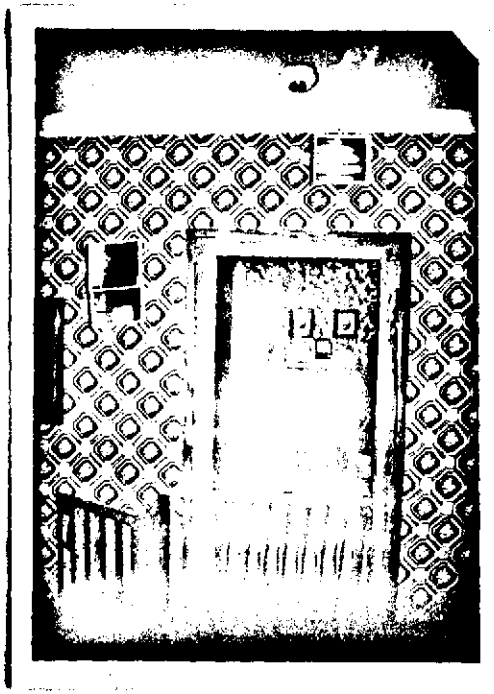
22. Close-up of Stud-blocking



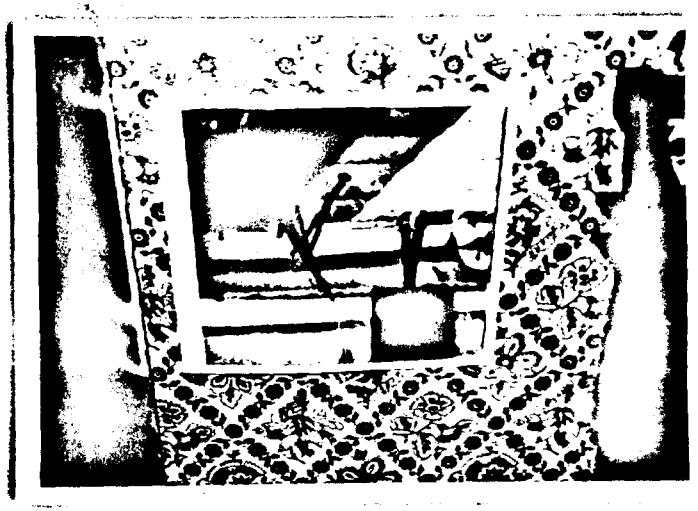
23. Dining Room, North-east corner (107)



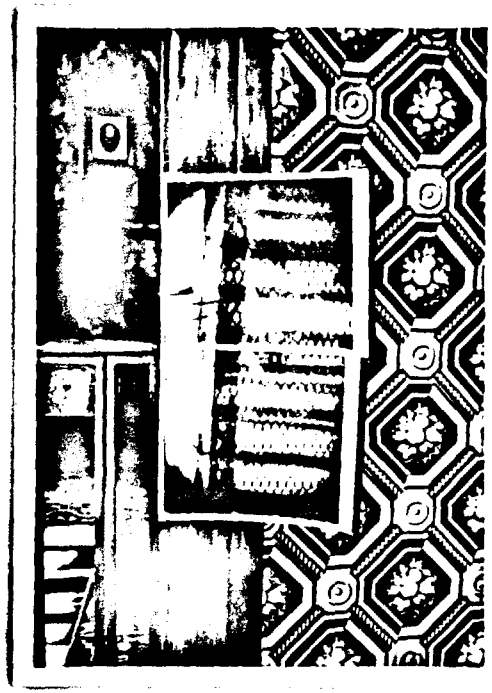
20. North Partition at door W jamb, Stair Hall (200)



21. North Partition, Stair Hall (200)

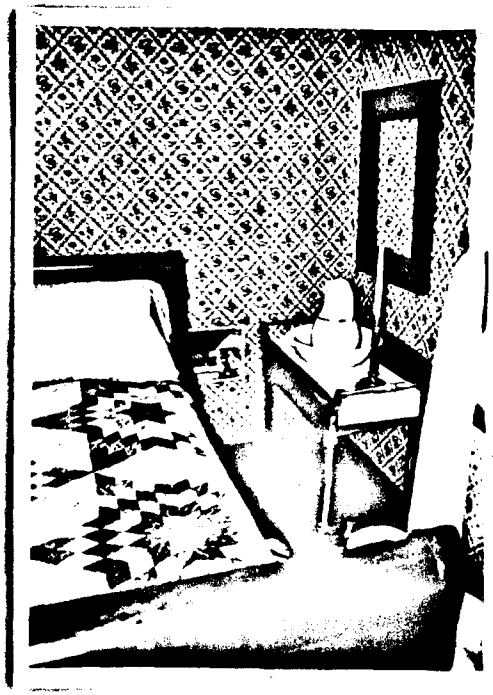


18. Plate framing, East Wall, Boys Bedroom (208)

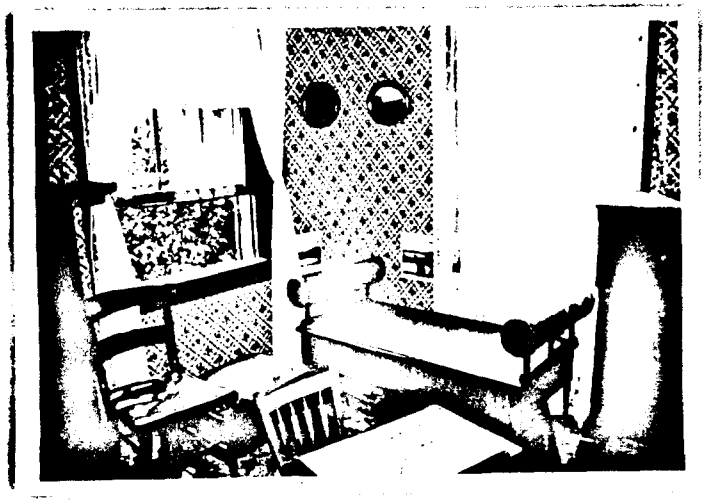


19. North Partition at door E jamb, Stair Hall (200)

16. Plate framing, South-west corner, Boys Bedroom (208)

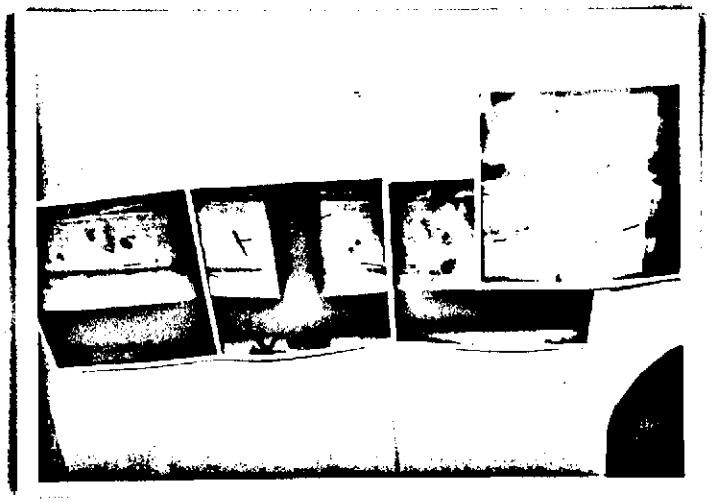


17. Plate framing, East Wall, Boys Bedroom (208)

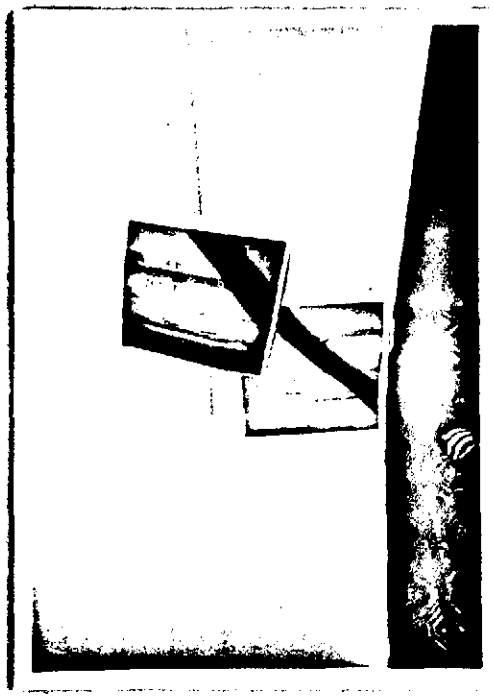


14. Plate framing, South-west corner, Boys Bedroom (208)

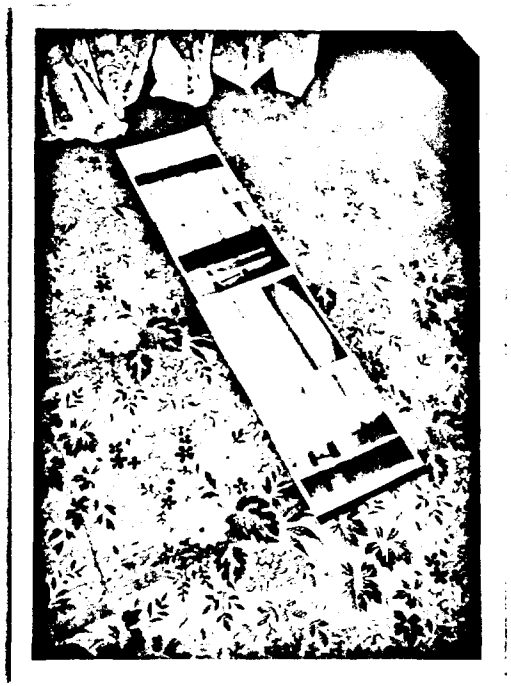
15. Plate framing, South-west corner, Boys Bedroom (208)



12. Entrance Hall Framing (100)

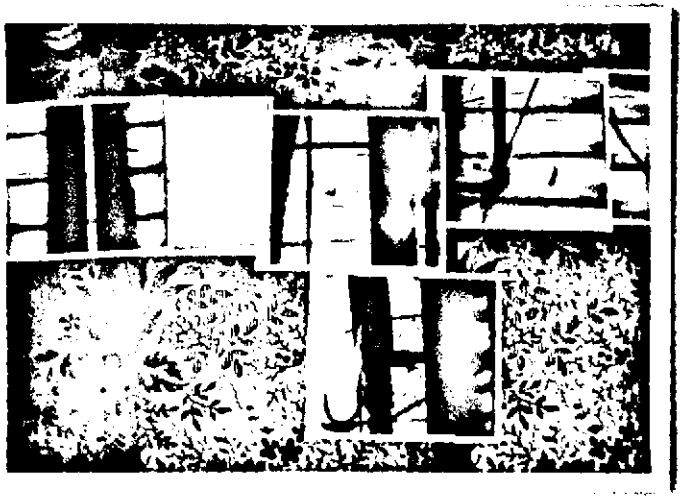


13. Entrance Hall framing (100)



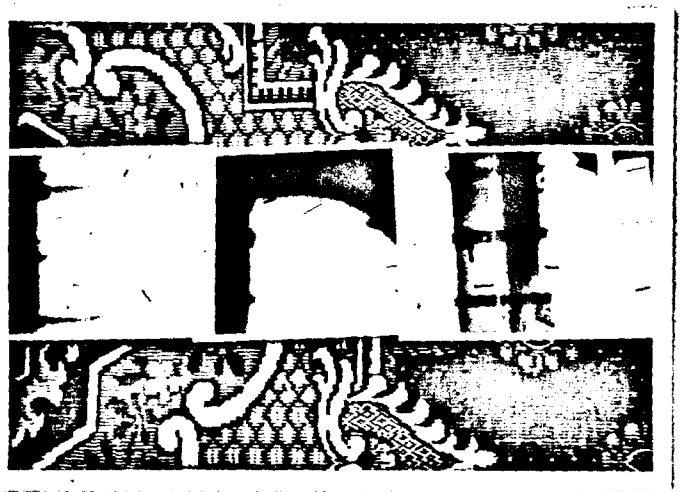
10. Floor framing, Boys Bedroom (208)

11. Entrance Hall framing (101)



8. Floor framing, Boys Bedroom (208)

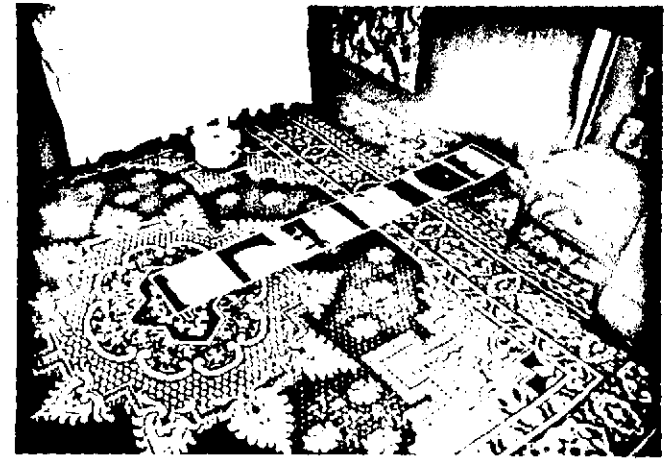
9. Floor framing, Boys Bedroom (208)



6. Floor framing, Mr. Lincoln's Room (201)

7. Floor framing, Mr. Lincoln's Room (201)

4. Mr. Lincoln's Room (201) from Stair Hall (200)



5. Floor framing, Mr. Lincoln's Room (201)

2. View to North-west

3. South Elevation

Nogging. Used in New England in the 17th and early 18th century in exterior walls; probably as insulation. It usually consisted of soft-burned or sun-baked brick laid in mud mortar. The practice was revived in the mid-nineteenth century and sometimes can be found as late as the 1870's.

1. West Elevation (unless otherwise noted, all photographs are of the Lincoln Home, and were made in July 1979 or April 1980).

APPENDIX

Glossary of terms used in this report:

Cut Nail. The cut nail was first used in the U. S. about 1790. Early types of cut nails were usually machine cut from a steel strip and hand-headed. Machine-heading equipment was gradually developed after 1800 and by 1830 almost all cut nails were completed manufactured by machinery. Typically, cut and hand-wrought nails were both used in house construction through the 1810's; by 1820 it is unusual to find hand-wrought nails used in original construction.

Wire Nail. Machinery for manufacturing wire nails was developed about 1883, and by 1885 these types of nails almost completely replaced the earlier cut nail.

A caveat is that the cut nail continued to be used in some areas of construction such as roofing and flooring, and in part can be found today in contemporary construction. In addition, some "restorations" have had cut nails and cut nails with simulated hand-wrought heads used in these projects.

Sash-sawn (up & down mill sawn) Wood. Early types of sawn used steel strip sawblades mounted in a "sash", which operated from water or steam power in an up-and-down fashion as the wood was fed against the blade. This type of technology became highly sophisticated during the mid-late nineteenth century, when gang-mounted saws could cut a dozen or more boards simultaneously from one log. The sash saw persisted in use until the early 20th century.

Circular Saw. The invention and use of circular saws are recorded as early as the 1820's in the U. S. Their use seems to be limited to the production of shingles, clapboards, laths, sash and window blind stock ("small stuff") prior to about 1850.[4] Improvements in steel technology and saw design about 1850 led to the use of the circular saw in producing larger-dimensioned stock.

Split lath. Lath up until about 1840 was usually manufactured from thin boards sawn in one dimension, and then split by hand to the desired width.

Sawn 4S lath. Lath sawn on four sides became somewhat universally used in construction about 1840 (with the advent of the circular saw). The caveat is that split lath was sometimes used, particularly in remote regions, until the early 20th century.

Hand Hewn wooden members. Typically larger dimension wooden members (6" x 6" and larger) were hewn from logs much later than smaller dimension, sawn structural members. It is not unusual to see houses constructed of predominantly hewn members as late as 1840. The use of large hewn members for sills is seen in the late nineteenth century.

[4] "Circular Saws and the History of Technology", John O. Curtis, APT Bulletin Vol VII, No. 3, 1975, p.29.

FINISHES

MAIN HOUSE

The records of 1954 have been confirmed in most areas examined. The interior partitions and ceilings at first floor level were originally constructed of split lath attached to framing members with cut nails (x-ray LH 9, 10, 11, 12, LH 45 - 57). (Figures 23, 25)

The second floor exhibits signs of the extension upwards which took place in 1855, as sawn 4S lath is used in all areas above the 2'-0" elevation above the floor in the exterior walls. These are attached to the studs with cut nails. (x-rays LH 1, 2, 5, 6 7). (Figures 14, 15) A visual inspection of the attic reveals the second floor ceiling lath to be sawn 4S.

ELL

The early portion of the ell, below the 8'-0" ± elevation at the first floor level is constructed with split lath attached with cut nails (x-rays LH 13, 14, 59, 60). (Figure 27)

The areas above this line, indicating new (1854) work, is constructed with sawn 4S lath, attached with cut nails. (x-ray 60). (Figure 21)

SUMMARY

The entire first floor of the main house and ell (with the exception of Mrs. Lincoln's Kitchen, 105) is constructed of similar materials: split lath attached with cut nails. The vertical extension of the ell, above the 8'-0" elevation, and the vertical extension of the main house above the plate level (2'-0" ± above the second floor), have all been constructed of similar materials: sawn 4S lath attached with cut nails. The framing in all cases is similar: early work in 2" or 2½" members, later (1855) work is pieced-in stock.

There have been few additional alterations, and major 20th century work (which would have been evident by the use of wire nails and expanded metal lath) has been limited to the second floor front hall, Mrs. Lincoln's Kitchen and the Dining Room. A large steel member was placed in the opening between the front and back parlors.

DOOR, WINDOW OPENINGS

Door opening, Dining Room (107) (X-rays LH 14). The X-ray produced no evidence of a previous door opening to the Kitchen (105), to the north of the chimney. The Dining Room side of the wall appears to be split lath, while the Kitchen side appears to be expanded metal lath (Figures 37, 38).

Present Door opening, Dining Room (107) (X-ray LH 13). The X-ray produced evidence that this doorway is probably in its original location. The Kitchen side of the partition has been disturbed by the insertion of expanded metal lath. The Dining Room side contains split lath attached to the door frame members with cut nails. No sign of cutting through appears (Figures 37, 39).

Present door opening, Sitting Room (X-ray LH 59). The east wall of this room is unusually thick (7" ±) and contains evidence of possible door jamb widening. An X-ray reveals one of the door frame members to not be attached to the header. The plaster on one side of the wall appears to have been cut away, or at least does not extend under the trim to the said framing member. Materials used include split lath attached with cut nails (Figures 40, 41).

Original windows, Sitting Room (108). (X-rays LH 122-LH 127). The southeast window frame is attached directly to the studs with nails rather than notched-in. The southern area of the east wall was examined where a window could have existed (Figure 42). The X-rays taken

at 2'-2" off the floor of the two southerly studs revealed no evidence of change (Figure 43, 44). Note that there are no remains of extra nails, and that the clapboards (presumed to be original) are intact. (The clapboards are cut around the window frame on the south). The X-ray taken at ceiling level reveals the flashing for the porch roof and extra nails, including some that are broken. Considering the evidence at 2'-2" off the floor, these broken and extra nails would more likely be associated with the porch roof framing. It is possible, nevertheless, that all the window frames were replaced in the 1855 remodeling.

Original window, Mr. Lincoln's Room (201) (X-ray 142). An examination of the east wall of Mr. Lincoln's Room was made to determine the possibility of an original window (original to the 1855 remodeling). An X-ray of the stud at head level revealed no evidence of a frame either let into or nailed to the stud (Figure 45).

NOGGING

Brick and mortar infill (nogging) was found along the west wall of the first floor sitting room (108). X-rays taken along the south wall of this same room indicate that this wall does not contain the nogging.

in this location brings up the question of alterationsin this area; it is probably that some of the material examined is original, and some added (Figures 21, 22).

North Interior Partition, Dining Room (107) (X-rays LH 60 and LH 128 - LH 130). An X-ray at 8'-0" above the first floor level reveals the top of a 2½" wide stud at the 8'-0" vertical height. The stud has been extended by a 1" member nailed to the original (Figures 23, 24). Lath associated with the south wall is sawn 4S. Additional X-rays taken at the east door jamb indicate that the stud in this location also terminates at 8' above the floor level (Figure 25).

East Interior Partition, Dining Room (107) (X-rays LH 131-LH 135). Framing in this wall appears to be balloon, and there are indications that the original ceiling was at 8' above the floor. The top of the stud at the southern door jamb was found, although the original rafter has been removed (Figures 26, 27). The X-rays taken at the northern door jamb revealed a plaster line running horizontally at 8' above the floor level. Above 8' the lath is sawn 4S; below split. A row of cut finishing nails can be seen running at 8' above the floor. These are either holding a plaster stop or screed in place, or a piece of molding now covered over (Figure 28). The wire lath is known to exist on the kitchen side.

Interior Partition, Front Parlor (101). (X-rays LH 10, 11, 12). This series, taken at the east wall to the right of the large opening, reveals no evidence of a

previous window-sill at this location (Figures 29, 30). The lath appear to be attached to the 2½" wide studs with cut nails. Lath is split and perhaps is of 1839 construction.

Fire damage, exterior west wall, Front Parlor (101) (X-rays LH 25, 26, 27). This series revealed no unusual configuration of the exterior wall framing (Figures 31, 32).

Framing around opening, Front Parlor (101) (X-rays LH 104-LH 110 and LH 136 - LH 141). The 12' wide opening between room 101 and 102 was examined to determine the framing method (Figure 29). X-rays revealed that the opening is spanned by a least one, and probably two steel members. One member is 4 or 6" deep and actually may be one or two channels or plates (Figure 33, 34, 35). Another member rises slightly from the southern jamb but is not continuous; it disappears at about mid-span (X-ray 105). The method of attachment to vertical studs is unknown, and it is suggested that trim be partially removed in a judicious fashion to examine the exact details.

Original rafter, Maid's Bedroom/Serving Room (203) (X-ray LH 120). The east exterior wall was examined to determine the possible existence of an original rafter near the present floor level. If one did exist, it has been removed (Figure 36).

X-RAY ANALYSIS

The X-ray analysis was initially carried out during July of 1979. After a preliminary report was issued and reviewed by the architect, a second series was taken during April, 1980.

FRAMING

Floor Framing, Mr. Lincoln's Room (201) (X-rays LH 32 through LH 38). This series indicates the presence of 2" wide original joists spaced at 22" ± o.c. The joists span the long (20') dimension of the room, E-W. The original joists appear to have been supplemented by new members placed along-side the originals, and also at mid-spacing. The new spacing now appears to be 11" ± o.c. (Figures 4, 5, 6, 7). Split lath appear to cover the first floor ceiling below.

Floor Framing, Boys Room (208) (X-rays LH 45 through LH 57 and LH 111-LH 113). This series indicates the presence of 2" wide original joists spaced at 22" ± o.c. The joists span the long (20') dimension of the room, E-W. It appears that some joists have been strengthened by new members having been installed alongside the originals, and some new joists have been installed at mid-spacing. This situation is not universal, however. (Figures 8, 9). The existence of gas piping and a gas fixture shut-off valve was found in the center of the ceiling of the Sitting Room (108) (Figure 8).

Floor Framing, Front Hall, Second Floor (200) (X-rays LH 39 through LH 44 and LH 101-LH 103). A 2" member

extends across the hall, N-S along the line of the stairhall head opening below. 2" joists at 22" ± o.c. extend E-W from this trimmer, to the west wall. A diagonal 2" member extends from the front edge of the top step, at the stair hall opening, and extends towards the north-west (Figures 11, 12). Another diagonal member crosses this piece in a symmetrical fashion. This second diagonal is solid, whereas the one first referred to is partially cut and lapped over at the "X" joint in mid-span. Thus the stair is supported in a cantilevered fashion from the solid joist running SW-NE (Figure 13).

Boys Bedroom (208) (X-rays LH 22, 23, 24). The existence of the original 3" wall plate was found at 2'-0" ± above the second floor level (Figures 14, 15, 16, 17, 18). The existence of a wind-brace at a 45° angle was found in the east wall of this room, extending from the plate to the corner (Figures 17, 18).

Interior Partition, Stair hall, Second Floor (200). (X-rays LH 1, 2, 3). The interior partition between the stairhall (200) and Mr. Lincoln's room (201) appears to be of split lath construction to the east of the doorway (Figure 4, 19). There is a possibility that a plate exists 2'-0" ± above the floor level to the west of the doorway (Figures 4, 20).

A series of X-rays was taken at a location where an original rafter probably would have existed. A continuous stud was found, with bracing attached in a diagonal fashion (X-ray LH 143-LH 146). A large quantity of nails found

EXISTING CONDITIONS

MAIN HOUSE

The wooden frame consists of approximately 8" x 8" hewn members used as first floor framing sills and girts, while 2" x 8" sash-sawn (up and down mill) floor joists are attached to sills and girts by butt-cog joints. The joists have been cut away at each lower end to a depth of approximately 4".

Fireplace hearth framing at the basement level is constructed of sash-sawn members attached by pegged, mortice and tenon joints.

The remnants of an original hatch opening to the basement appears in the first floor framing. A hewn member spans between the two interior E-W hewn girts; this member appears to be the header for an opening (too small for a stair), which was probably used as a hatch access from the first floor to the basement. This area is now used as a mechanical shaft for heating and ventilating the second floor.

Wall framing at the first floor level appears to be 2½" wide studs @ 24" o.c. The original frame carried to about 2'-0" above second floor level where it originally was capped by a plate approximately 3" in thickness. Original rafters and gable studs undoubtedly rested on this plate. Framing above the plate is 2" vertical members toe-nailed into the plate.

Attic framing consists of all circular-sawn material for rafters, ridge and some studs. It is unusual to find large dimension circular-sawn stock used in buildings in 1839, and from a technological standpoint it is doubtful that the circular saw technology was advanced in 1839 to a point of sawing large (2" x 8") members.[3]

From a stylistic standpoint, the original pitch of the roof would have been steeper (approximately 35°) when the house was in a one-story configuration. If the roof was raised using the original members, evidence of re-cutting joints for the ridge and plate would be evident, which they are not.

All other wood framing in the first floor area is thought to be up and down mill sawn, but the attic framing is completely different. It is therefore probable that the entire roof was reframed in 1855 with new stock.

Brick and mortar infill was found along the west wall of the first floor sitting room. This was used extensively in New England in the 17th and early 18th centuries and is referred to as "nogging". It probably was inserted for insulation. The practice revived again in the mid 19th century.

[3] While "Mr. Smart's Saw" (circular) was noted in 1820, it is commonly accepted that the circular saw was not in use until about 1840, and even at this date was used for small jobs, such as sawing lath and trim. 1856 is even an early date for circular sawn framing members.

C. Second Floor:

1. Determine existence of earlier top plate @ 2'-0" ± off floor.
2. Determine existence of stud plate in interior wall in Mr. Lincoln's Room (201).
3. Determine existence of top stud plate in Mrs. Lincoln's room (202).
4. Determine existence of window in east wall of Mr. Lincoln's room (201).
5. Determine spacing and quality of floor joists in Mr. Lincoln's room (201), Boys Bedroom (208) and Robert Lincolns's Bedroom (207).
6. Determine quality and spacing of floor joists in 2nd floor hall.

D. Exterior

Determine fire damage to studs in west wall of Front Parlor (101)

EQUIPMENT

A Bendix® Model 105 Porta-shot unit was used as the x-ray source. Polaroid® 3000 Radiographic Film was used in conjunction with a Polaroid® Radiographic Cassette. A Polaroid® Portable Processor was used for field development of the images. Typical exposures were approximately 1.5 microroentgens with a distance of 18" from source to plate.

INTRODUCTION

The Lincoln Home is a two-story wooden frame structure with a two-story ell projecting to the rear. The main house is approximately 20' x 39' and the ell is approximately 24' x 31'. Twin chimneys are centered at the ends of the main structure, and a kitchen chimney and a back parlor chimney serve the ell. (Figures 1, 2, 3).

The Lincoln Home was built in 1839 as a one-and-a-half story structure.[1] The existence of a one-story ell to the east, contemporary with the front portion of the house is conjectural; it may have been added shortly after the main house was built. According to Park records, the house was raised at the front in 1855 to two stories with attic, and the ell was raised to two stories at the same time. Record photographs and descriptions of 1954 repairs have documented some of the structural conditions and repairs made at the time.[2]

In section the first floor of the main house is 8'-11" high and the second floor is 11'-1½" high. The ell section is 8'-10" high at the first floor and 8'-4½" high at the second floor. The second floor ell roof pitch is extremely shallow. The main house roof pitch is 27° and 6'-0" high in section at the ridge.

[1]As reported by National Park Personnel at LHNHS
[2]Hickey's reports, Parks & Memorials files

X RAY INSPECTION SCOPE

The purpose of the x-ray examination was to non-destructively determine the following conditions:

A. Basement:

Condition of hewn beams exhibiting insect and water damage

B. First Floor:

1. Determine differences in floor framing and wall framing between Back Parlor (102), Front Parlor (101), Sitting Room (108) and Dining Room (107)
2. Evaluate framing around large (10 ±) wall opening between Front Parlor (101) and Back Parlor (102).
3. Determine possible existence of exterior door header at east wall of Back Parlor (102)
4. Determine existence of plate at 8'-0" ± level in Dining Room (107) which would indicate ceiling was raised.
5. Determine if South window in Dining Room (107) had been altered from door opening.
6. Determine if window existed in east wall of Sitting Room (108) overlooking porch (106).
7. Determine spacing and quality of studs in north wall of entrance hall (100).
8. Determine possibility of a previous door opening between Dining Room (107) and Kitchen (108) to north of chimney.

X-RAY INSPECTION AND ANALYSIS

LINCOLN HOME
LINCOLN HOME NATIONAL HISTORIC SITE
SPRINGFIELD, ILLINOIS

JULY-1979 AND
APRIL 1980

Ferry & Henderson Architects, Inc.
430 South 8th Street
Springfield, Illinois
Contractor, Historic Structure Report

David McLaren Hart & Associates
77 Washington Street North
Boston, Massachusetts 02114
Subcontractor, X-ray Inspection & Analysis

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GENERAL NOTES

1. All of the plaster in the rooms where there is no paper covering is new.

2. All of the trim in the stairway from the kitchen to the second floor back hallway is new.

3. If the doors on the second floor are to be regrained, a careful survey should be made of period area buildings to find examples of oak graining so that it can be copied. The one door at the Robinson House is a good beginning.

XIV. ROOM 208

A. Original Wood Trim: Trim of Doorway to Room 201 (Sample #2).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Light Gray			19th c
4.Finish	Yellowish White			19th c
5.Finish	Dark Brown			19th c
6.Finish	Green			20th c
7.Finish	Yellowish White			20th c
8.Finish	Yellowish White			20th c
9.Finish	Yellowish White			20th c
10.Finish	Yellowish White			20th c
11.Finish	Yellowish White			20th c
12.Finish	Yellowish White			20th c
13.Finish	Dark Brown			20th c
14.Finish	Varnish			20th c

NOTE: The trim of doorway to Room 207 is new.

B. Original Wood Trim: Window Trim (Sample #4).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Light Gray			19th c
4.Finish	Dark Brown			19th c
5.Finish	Green			20th c
6.Finish	Yellowish White			20th c
7.Finish	Yellowish White			20th c
8.Finish	Yellowish White			20th c
9.Finish	Yellowish White			20th c
10.Finish	Yellowish White			20th c
11.Finish	Yellowish White			20th c
12.Finish	Yellowish White			20th c
13.Finish	Dark Varnish			20th c
14.Finish	Dark Brown			20th c

C. Wood Trim: Window Sash (Sample #5).

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

D. Original Wood Trim: Baseboards (Sample #1).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Light Gray			19th c
4.Finish	Yellowish White			19th c
5.Finish	Dark Brown			19th c
6.Finish	Green			20th c
7.Finish	Yellowish White			20th c
8.Finish	Yellowish White			20th c
9.Finish	Yellowish White			20th c
10.Finish	Yellowish White			20th c
11.Finish	Yellowish White			20th c
12.Finish	White			20th c
13.Finish	Dark Varnish			20th c
14.Finish	Dark Brown			20th c
15.Finish	Varnish			20th c

E. Original Wood Trim: Mantlepiece (Sample #6).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Ground	Yellowish White	2.5 Y 8.5/2	Oil;Low	1856
3.Glaze for graining				1856
4.Finish	Clear, Oil-Resin, Gloss Varnish			1856
5.Ground	Yellowish White			19th c
6.Glaze for graining				19th c
7.Finish	Varnish			19th c
8.Finish	Dark Brown			19th c
9.Finish	Green			20th c
10.Finish	Yellowish White			20th c
11.Finish	Yellowish White			20th c
12.Finish	Yellowish White			20th c
13.Finish	Yellowish White			20th c
14.Finish	Yellowish White			20th c
15.Finish	Yellowish White			20th c
16.Finish	Dark Varnish			20th c
17.Finish	Dark Varnish			20th c

F. Original Wood Trim: Door to Room 201 (Sample #3).

This door has been thoroughly stripped. The only paint evidence remaining is the following:

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Ground	Yellowish White	2.5 Y 8.5/2	Oil;Low	1856
3.Glaze for graining				1856
4.Finish	Clear, Oil-Resin, Gloss Varnish			1856
5.Finish	Green			20th c
6.Finish	Dark Varnish			20th c
7.Finish	Dark Brown			20th c

XIII. ROOM 207

A. Original Wood Trim: Trim of Doorway to Room 205; Transom Sash of Same Doorway (Sample #2).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Light Gray			19th c
4.Finish	Green			19th c
5.Finish	Brownish Pink			19th c
6.Finish	Yellowish White			20th c
7.Finish	Yellowish White			20th c
8.Finish	Yellowish White			20th c
9.Finish	Yellowish White			20th c
10.Finish	Yellowish White			20th c
11.Finish	White			20th c
12.Finish	Dark Varnish			20th c
13.Finish	Brown			20th c

NOTE: This trim has been relocated from its original location. (See 1880's drawings).

NOTE: The trim of doorway to Room 208 is new.

B. Original Wood Trim: Window Trim (Sample #4).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Yellowish White			19th c
4.Finish	Green			19th c
5.Finish	White			19th c
6.Finish	White			19th c
7.Finish	Dark Brown			20th c
8.Finish	White			20th c
9.Finish	White			20th c
10.Finish	Dark Brown			20th c
11.Finish	Varnish			20th c

C. Original Wood Trim: Baseboards (Sample #1).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish Gray	10 YR 8/2	Oil;Semi	1856
3.Finish	Light Gray			19th c
4.Finish	Yellowish White			19th c
5.Finish	Yellowish White			19th c
6.Finish	Dark Brown			20th c
7.Finish	White			20th c
8.Finish	White			20th c
9.Finish	Dark Varnish			20th c
10.Finish	Brown			20th c

D. Wood Trim: Window Sash (Sample #5).

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

E. Wood Trim: Door to Room 205 (Sample #3).

This door has been thoroughly stripped. The only paint evidence remaining is the following:

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Ground	Yellowish White	2.5 Y 8.5/2	Oil;Low	1856
3.Glaze for graining				1856
4.Finish	Clear, Oil-Resin, Gloss Varnish			1856
5.Finish	Green			20th c
6.Finish	Dark Brown			20th c
7.Finish	Varnish			20th c

NOTE: See NOTE in IX-D.

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Ground	Yellowish Gray	2.5 Y 8.5/2	Oil;Low	1856
3.Glaze for graining				1856
4.Finish	Clear, Oil-Resin, Gloss Varnish			1856
5.Ground	Pale Yellow			19th c
6.Glaze for graining				19th c
7.Finish	Varnish			19th c
8.Finish	White			20th c
9.Finish	Dark Varnish			20th c
10.Finish	Dark Varnish			20th c
11.Finish	Dark Varnish			20th c

NOTE: See NOTE in IX-D.

XII. ROOM 206

A. Original Wood Trim: Trim of Doorway to Room 205; Transom Sash of the Same Doorway (Sample #1).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Light Gray			19th c
4.Finish	Yellowish White			19th c
5.Ground	Yellow			19th c
6.Glaze for graining				19th c
7.Finish	Varnish			19th c
8.Ground	Yellow			20th c
9.Glaze for graining				20th c
10.Finish	Varnish			20th c
11.Finish	White			20th c
12.Finish	Dark Varnish			20th c
13.Finish	Dark Varnish			20th c

B. Original Wood Trim: Window Trim (Sample #4).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Light Gray			19th c
4.Ground	Yellow			19th c
5.Glaze for graining				19th c
6.Finish	Varnish			19th c
7.Ground	Yellow			20th c
8.Glaze for graining				20th c
9.Finish	Varnish			20th c
10-15.Finishes	Yellowish Whites			20th c
16.Finish	White			20th c
17.Finish	Dark Varnish			20th c
18.Finish	Dark Varnish			20th c

C. Wood Trim: Window Sash (Sample #5).

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

D. Wood Trim: Baseboards (Sample #3).

1.Finish	Dark Varnish	20th c

NOTE: This is a new baseboard.

E. Original Wood Trim: Door to Room 205 (Sample #2).

This door has been thoroughly stripped. Some evidence of original paints remain. They include a yellowish white ground coat for a glaze coat (for graining) and a varnish coat; a dark green; a brownish pink; a white and several layers of recent dark varnish.

E. Original: Plaster Between Window & Baseboard (Sample #6).

0.	Dirt	1856
1-7.Finishes	same as 6-12 in X-A.	
8.Finish	Brown	20th c
9.Intmed	Brown	20th c
10.Finish	Varnish	20th c

NOTE: This is the only original plaster in the room.

XI. ROOM 205

A. Original Wood Trim: Window Trim (Sample #4).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Light Gray			19th c
4.Finish	Brownish Pink			19th c
5.Finish	Green			20th c
6.Finish	Brown			20th c
7.Finish	Brown			20th c
8.Finish	Varnish			20th c

NOTE: All the trim has been stripped. This is the only layering that remains. It is not the full layering.

B. Original Wood Trim: Baseboards (Sample #1).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish Gray	10 YR 8/2	Oil;Semi	1856
3.Finish	Yellowish White			19th c
4.Finish	Brownish Pink			19th c
5.Finish	Green			20th c
6.Finish	Brownish Pink			20th c
7.Finish	Yellowish White			20th c
8.Finish	Yellowish White			20th c
9.Finish	Yellowish White			20th c
10.Finish	Yellowish White			20th c
11.Finish	Dark Varnish			20th c
12.Finish	Dark Varnish			20th c
13.Finish	Dark Varnish			20th c

C. Original Wood Trim: Trim of All Doorways and Transom Sash (Sample #2).

1. All the trim has been thoroughly stripped and varnished. No paint evidence remains. It is most likely that they were painted the same as the window trim.

D. Wood Trim: Window Sash (Sample #5)

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

E. Original Wood Trim: Doors (Sample #3).

The doors have been thoroughly stripped; however, most of them have scant evidence of original finishes. They are:

IX. ROOM 203

A. Original Wood Trim: Window Trim; Trim of Doorways to Rooms 202 & 205; Transom Sash of Same Doorways (Sample #'s 3 & 2 respectively).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Yellowish White			19th c
4.Finish	Light Gray			19th c
5.Finish	Dark Brown			19th c
6.Finish	Green			20th c
7.Finish	Yellowish Gray			20th c
8.Finish	Yellowish White			20th c
9.Finish	Yellowish White			20th c
10.Finish	Yellowish White			20th c
11.Finish	White			20th c
12.Finish	Brown			20th c
13.Finish	Varnish			20th c

B. Original Wood Trim: Baseboards (Sample #1).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish Gray	10 YR 8/2	Oil;Semi	1856
3-13.Finishes	same as 3-13 in IX-A.			

C. Wood Trim: Window Sash (Sample #4).

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

D. Original Wood Trim: Doors to Rooms 205 and 202 (Sample#5).

Both doors have been stripped. The small and very poor paint evidence which remains shows the following layering:

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Ground	Yellowish White	2.5 Y 8.5/2	Oil;Low	1856
3.Glaze for graining				1856
4.Finish	Clear, Oil-Resin, Gloss Varnish			1856
5.Finish	Dark Brown			19th c
6.Finish	Green			20th c
7-8.Finishes	Yellowish Whites			20th c
9.Finish	Brown			20th c
10.Finish	Varnish			20th c

NOTE: Because the evidence for layers 1, 2, 3, & 4 is so small and so poor, the characteristics of the graining are impossible to establish. The ground coat color and the light tone (color) of the glaze suggest oak graining. This would agree with the notes on the late 1880's floor plans.

X. ROOM 204

A. Original Wood Trim: Window Trim; Trim of Doorway to Room 205; Transom Sash of Same Doorway (Sample #'s 4 & 2 respectively).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Yellowish White			19th c
4.Finish	Light Gray			19th c
5.Finish	Brownish Pink			19th c
6.Finish	Lt Yellowish Green			19th c
7.Finish	Green			20th c
8.Finish	Greenish Gray			20th c
9.Finish	White			20th c
10.Finish	White			20th c
11.Finish	White			20th c
12.Finish	Dark Varnish			20th c
13.Finish	Dark Varnish			20th c
14.Finish	Varnish			20th c

B. Original Wood Trim: Baseboards (Sample #1).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish Gray	10 YR 8/2	Oil;Semi	1856
3-14.Finishes	same as 3-14 in X-A.			

C. Wood Trim: Window Sash (Sample #5).

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

D. Original Wood Trim: Door to Room 205 (Sample #3).

Although this door has been stripped, there is a small amount of paint evidence remaining which, even though it is in poor condition, shows the following layering. It is not the complete layering however.

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Ground	Yellowish White	2.5 Y 8.5/2	Oil;Low	1856
3.Glaze for graining				1856
4.Finish	Clear, Oil-Resin, Gloss Varnish			1856
5.Finish	Brownish Pink			19th c
6.Finish	Lt Yellowish Green			19th c
7.Finish	Green			20th c
8.Finish	Dark Varnish			20th c
9.Finish	Dark Varnish			20th c

NOTE: See NOTE in IX-D.

VII. ROOM 201

A. Original Wood Trim: Window Trim; Baseboards (Sample #'s 5 & 4 respectively).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Yellowish White			19th c
4.Finish	White			?
5.Finish	Light Gray			20th c
6.Finish	Yellowish White			20th c
7.Ground	Pink			20th c
8.Glaze for graining				20th c
9.Finish	Varnish			20th c
10.Finish	Dark Brown			20th c
11.Finish	Dark Brown			20th c

B. Original Wood Trim: Trim of Doorways to Rooms 202 & 208 (Sample #2).

1. The trim has been stripped; the only paint evidence remaining on the return edges is: several layers of white, a dark brown and a layer of varnish.

C. Wood Trim: Window Sash (Sample #6).

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

D. Original Wood Trim: Baseboard Which is Continuation of Stair Skirting (up to doorway to Room 202) (Sample #1).

1-12.Finishes same as 1-12 in I-C

E. Original Wood Trim: Door to Room 208 (Sample #3).

1. This door has been stripped recently and varnished. There is no evidence of the original finish. It is most probable that it was grained.

VIII. ROOM 202

A. Original Wood Trim: Window Trim; Trim of Doorway to Rooms 201 & 203 (Sample #'s 5 & 2 respectively).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Yellowish White			19th c
4.Finish	Dark Brown			19th c
5.Finish	Yellowish White			19th c
6.Finish	Yellowish White			20th c
7.Finish	Yellowish White			20th c
8.Finish	Yellowish White			20th c
9.Finish	Yellowish White			20th c
10.Finish	White			20th c
11.Finish	Brown			20th c
12.Finish	Varnish			20th c

B. Original Wood Trim: Baseboards (Sample #1).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Yellowish White			19th c
4.Finish	Yellowish White			19th c
5.Finish	Reddish Brown			19th c
6.Finish	Dark Brown			20th c
7.Finish	Yellowish White			20th c
8.Finish	Yellowish White			20th c
9.Finish	Yellowish White			20th c
10.Finish	White			20th c
11.Finish	Brown			20th c
12.Finish	Varnish			20th c

C. Wood Trim: Window Sash (Sample #6).

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

D. Original Wood Trim: Mantlepiece (Sample #4).

1. This mantlepiece has been thoroughly stripped and varnished. The original paint evidence which remains is in too poor condition to determine what the original finish was. It is most likely that it was grained as was the mantlepiece in Room 208. (See: XIV-C).

E. Original Wood Trim: Door to Room 203 (Sample #3).

1. This door has been stripped recently and stained and varnished. The only older paint evidence remaining is a yellowed white. It is most probable that it was grained originally.

3.Finish	Varnish	20th c
4.Finish	Varnish	20th c

G. Original Wood Trim: Door to Closet Under Stairs (Sample #7).

1. This door has been stripped recently and varnished. There is no evidence remaining of the original finish which most probably was a Clear, Oil-Resin, Gloss Varnish.

IV. ROOM 106

A. Original Wood Trim: Window Trim (Sample #3).

1.Prime	Light Gray	N 8.0/	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Yellowish White			19th c
4.Finish	Yellowish White			19th c
5.Finish	Yellowish White			?
6.Finish	White			?
7.Finish	White			20th c
8.Finish	White			20th c
9.Finish	Light Gray			20th c
10-15.Finishes	same as 7-12 in IV-D			

B. Original Wood Trim: Trim of Doorways to Rooms 101 & 105 (Sample #5).

1. All of the original paint evidence has been thoroughly stripped from this trim. It is most likely that it would have been painted the same as IV-A.

C. Wood Trim: Window Sash (Sample #4).

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

D. Original Wood Trim: Door to Room 101; Mantlepiece; Baseboards (Sample #6, 2, & 1 respectively).

1.Finish	Clear, Oil-Resin, Gloss Varnish	1856
2.Finish	Clear, Oil-Resin, Gloss Varnish	19th c
3.Finish	White	?
4.Finish	White	20th c
5.Finish	White	20th c
6.Finish	Light Gray	20th c
7.Finish	Reddish Brown	20th c
8.Ground	Pink	20th c
9.Glaze for graining		20th c
10.Finish	Varnish	20th c
11.Finish	Varnish	20th c
12.Finish	Varnish	20th c

NOTE: The baseboard on the wall within the visitors walkway has been stripped recently and varnished.

3.Finish	Brownish Pink	5 YR 7/2	Oil;Semi	1860's
4-21.Finishes	same as 5-22 in IV-A.			

NOTE: The door to Large South Porch is a recent replacement.

V. ROOM 105

A. Original Wood Trim: Trim of Doorway to Room 104 (Sample #2).

1.Prime	Light Gray	N 8.0/	Oil	1856
2.Finish	Yellowish White	3.9Y8.7/1.4	Oil;Semi	1856
3.Prime	Light Gray			19th c
4.Finish	Light Gray			19th c
5.Finish	Light Pink			19th c
6.Finish	Yellowish White			19th c
7.Finish	Yellowish White			20th c
8.Finish	Yellowish White			20th c
9.Ground	Pink			20th c
10.Glaze for graining				20th c
11.Finish	Varnish			20th c
12.Finish	Varnish			20th c
13.Finish	Varnish			20th c

B. Original Wood Trim: Baseboards (Sample #1).

1-11.Finishes	same as 1-11 in V-A	
12.Finish	Brown	20th c
13.Finish	Varnish	20th c

NOTE: The baseboard on the wall within the visitors walkway has been stripped recently and varnished.

C. Original Wood Trim: Trim of Triple Doorway and Doorway To Room 103 (Sample #6).

1. All of this trim has been stripped recently and varnished. The paint evidence on the return edges of the architraves is not clear enough to make any accurate determination of the original paint layering.

D. Wood Trim: Window Trim (Sample #4).

1.Prime	White	19th c
2.Finish	Light Pink	19th c
3-10.Finishes	same as 6-13 in V-B.	

E. Wood Trim: Window Sash (Sample #5).

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

F. Original Wood Trim: Door to Room 103; Door to Room 104 (Sample #'s 8 & 3 respectively).

1.Finish	Clear, Oil-Resin, Gloss Varnish	1856
2.Finish	Clear, Oil-Resin, Gloss Varnish	19th c

III. ROOM 103

A. Original Wood Trim: Trim of Doorway to Room 102; Trim of Doorway to Room 104; Window Sash; Window Trim (Sample #'s 1, 3, 7, & 6 respectively).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Yellowish White			19th c
4.Finish	Yellowish White			?
5.Finish	Yellowish White			?
6.Finish	Yellowish Gray			20th c
7.Ground	Pink			20th c
8.Glaze for graining				20th c
9.Finish	Varnish			20th c
10.Finish	Varnish			20th c
11.Finish	Varnish			20th c

B. Original Wood Trim: Baseboards (Sample #5).

1.Finish	Clear, Oil-Resin, Gloss Varnish	1856
2.Finish	Varnish	19th c
3.Finish	Dark Brown	20th c
4.Finish	Varnish	20th c

C. Original Wood Trim: Mantle (Sample #8).

1.Finish	Clear, Oil-Resin, Gloss Varnish	1856
2.Finish	Clear, Oil-Resin, Gloss Varnish	19th c
3.Finish	Varnish	20th c
4.Finish	Varnish	20th c

D. Original Wood Trim: Door to Room 104; Doors to Room 102 (Sample #'s 4 & 2 respectively).

1.Finish	Clear, Oil-Resin, Gloss Varnish	1856
2.Finish	Clear, Oil-Resin, Gloss Varnish	19th c
3.Finish	Varnish	?

IV. ROOM 104

A. Original Wood Trim: Baseboards; Full Door To Small Rear Center Porch; Trim of Doorway to Large South Porch; Trim of Doorway to Room 105 (Sample #'s 1, 8, 4, & 2 respectively).

1.Prime	Lt Bluish Gray	10 B 7/1	Oil	1856
2.Finish	Lt Bluish Gray	10 B 7/1	Oil;Semi	1856
3.Prime	Light Brown	5 YR 6.3/3	Oil;Semi	1860's
4.Finish	Brownish Pink	5 YR 7/2	Oil;Semi	1860's
5.Intmed	Light Gray			19th c
6.Finish	Light Gray			19th c
7.Finish	Brownish Pink			19th c
8.Finish	Yellowish White			19th c
9.Finish	White			19th c
10.Finish	Light Gray			20th c
11.Finish	Reddish Brown			20th c
12.Finish	Green			20th c
13.Finish	Green			20th c
14.Finish	Grayish Pink			20th c
15.Finish	Light Gray			20th c
16.Finish	Lt Yellowish Pink			20th c
17.Finish	Yellowish White			20th c
18.Finish	Yellowish White			20th c
19.Finish	White			20th c
20.Finish	White			20th c
21.Finish	Brown			20th c
22.Finish	Brown			20th c

NOTE: The half door is new.

B. Original Wood Trim: Trim of Doorway to Small Rear Center Porch; Window Trim (Sample #'s 7 & 5 respectively).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Finish	Lt Bluish Gray	10 B 7/1	Oil;Semi	1856
3.Prime	Light Brown	5 YR 6.3/3	Oil	1860's
4.Finish	Brownish Pink	5 YR 7/2	Oil;Semi	1860's
5-22.Finishes	same as 5-22 in IV-A.			

C. Wood Trim: Window Sash (Sample #6).

1. The sash have been stained and varnished. I cannot determine whether or not they are original.

D. Original Wood Trim: Door to Room 105 (Sample #3).

1.Finish	Clear, Oil-Resin, Gloss Varnish			1856
2.Prime	Light Brown	5 YR 6.3/3	Oil	1860's

8.Intmed	Dark Brown		20th c
9.Finish	Varnish		20th c
10.Intmed	White		20th c
11.Finish	Dark Brown		20th c
12.Finish	Dark Brown		20th c

D. Original Wood Trim: Trim of Doorways to Exterior (including side lights) and to Rooms 102 and 106 (Sample #1).

1. This trim has been thoroughly stripped of all finishes; however, there is still some evidence of white paint in the grain of the small wood samples that were taken.

E. Original Wood Trim: Door to Room 106 (Sample #10).

1.Finish	Clear, Oil-Resin, Gloss Varnish	1856
2.Finish	Clear, Oil-Resin, Gloss Varnish	19th c
3.Finish	Pigmented Varnish	20th c
4.Finish	Pigmented Varnish	20th c

F. Original Wood Trim: Door to Exterior; Door to Room 102 (Sample #3).

1. Both of these doors have been thoroughly stripped and varnished. There is no evidence remaining of the original finish which was probably a Clear, Oil-Resin, Gloss Varnish.

G. Original Wood Trim: Newel Post (Sample #7).

1.Finish	Clear, Oil-Resin, Gloss Varnish	1856
2.Finish	Clear, Oil-Resin, Gloss Varnish	19th c
3.Finish	Varnish	20th c
4.Finish	Varnish	20th c
5.Finish	Dark Brown	20th c

NOTE: The handrail is walnut and is varnished. The balusters are metal.

H. Original Wood Trim: Stair Treads; Stair Risers (Sample #'s 8 & 9 respectively.

1.Prime	White	N 8.5/	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
0.	Evidence of chemical paint removal			?
3.Ground	Pink			20th c
4.Glaze for graining				20th c
5.Finish	Varnish			20th c
6.Finish	Dark Brown			20th c
7.Finish	Dark Brown			20th c

II. ROOM 102

A. Original Wood Trim: Window Trim; Trim of Doorway to Room 103; Trim of Doorway to Room 101 (Sample #'s 4, 3, & 1 respectively).

1.Prime	Yellowish White	5 Y 9/1	Oil	1856
2.Intmed	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Thin, Clear, Oil Glaze Over the	5 Y 9/1		1856
4.Finish	Yellowish White			19th c
5.Finish	White			?
6.Finish	White			?
7.Finish	White			20th c
8.Finish	White			20th c
9.Finish	Light Gray			20th c
10.Ground	Pink			20th c
11.Glaze for graining				20th c
12.Finish	Varnish			20th c
13.Finish	Dark Brown			20th c
14.Finish	Varnish			20th c

B. Wood Trim: Window Sash (Sample #8).

1. The sash have been stained and varnish. I cannot determine whether or not they are original.

C. Original Wood Trim: Baseboards; Mantle (Sample #'s 6 & 7 respectively).

1.Finish	Clear, Oil-Resin, Gloss Varnish	1856
2.Finish	Clear, Oil-Resin, Gloss Varnish	19th c
3.Finish	Varnish	20th c
4.Finish	Varnish	20th c

D. Original Wood Trim: Doors to Room 103; Door to Room 101 (Sample #'s 5 & 2 respectively).

1.Finish	Clear, Oil-Resin, Gloss Varnish	1856
2.Finish	Clear, Oil-Resin, Gloss Varnish	19th c
3.Finish	Varnish	?

PREFATORY NOTES

1. Almost all wood trim in the house has been stripped previously and recoated. There are several exceptions in the first floor rooms. Therefore, I was severely limited in my search for good paint evidence. Because of this, almost all samples were taken from the return edges of door and window trim and baseboards and in the corners of the door panels and on the under sides of moldings on the mantles. This fact increases the margin for error in attempting to establish the correct finishes and colors of the 1856 period. Please keep this in mind when reading the following report.

2. I compared my findings with the notes on the late 1880's measured drawings (floor plans) and found that, in general, all agree. Where there is disagreement, I feel that the trim had been repainted a different color. The one major disagreement is with the second floor mantles. The architect at that time also assumed that all painted trim was pine. This is not true. Much of the originally painted trim on the first floor is walnut.

3. The plaster walls and ceilings were not investigated because 1- I did not want to destroy the present paper coverings, and 2- all documentary evidence mentions and suggests the original use of wallpaper. I do recommend that when the papers are removed (because of deterioration etc.) the plaster then be carefully examined for evidence.

4. Abbreviations:

   Lt = Light
   Intmed = Intermediate

FINISHES

DISTRIBUTION - COLORS

INTERIOR

I. ROOM 101

*Layer/ Coat	Color Name	Color Notation	Type & Gloss**	Circa Period
A. Original Wood Trim: Baseboards; Trim of Doorway to Room 105 (Sample #'s 4 & 2 respectively).				
1.Prime	White	N 8.5/	Oil	1856
2.Finish	Yellowish White	5 Y 9/1	Oil;Semi	1856
3.Finish	Yellowish White			19th c
4.Finish	White			?
5.Finish	White			?
6.Finish	White			20th c
7.Finish	White			20th c
8.Finish	Light Gray			20th c
9.Ground	Pink			20th c
10.Glaze for graining				20th c
11.Finish	Varnish			20th c
12.Finish	Dark Brown			20th c

*NOTE: These headings are implied for the remaining descriptions.

**NOTE: The gradations of spectral reflectance referred to are: Flat; Low-Gloss; Semi-Gloss; Gloss; High-Gloss.

B. Original Wood Trim: Stringer Architraves and Moldings Under Outer Tread Nosings (Sample #6).				
1-7.Finishes	same as 1-7 in I-A.			
8.Intmed	Dark Brown			20th c
9.Finish	Varnish			20th c
10.Ground	Grayish Pink			20th c
11.Glaze for graining				20th c
12.Finish	Varnish			20th c
13.Finish	Dark Brown			20th c
14.Finish	Dark Brown			20th c
C. Original Wood Trim: Stair Skirting (Sample #5).				
1-7.Finishes	same as 1-7 in I-A.			

INTRODUCTION

Research for the paint and color analysis of The Lincoln Home was conducted by examining (scraping with a surgical scalpel) as many "test" locations on the painted architectural fabric as possible; then removing small representative samples for microscopic inspection for the purpose of attempting to determine the color, type, gloss and/or kind of the particular period architectural surface coating or coatings of primary interest.

My research began on August 24, 1978. The decision reached and agreed upon by myself and The Denver Service Center and Ferry and Henderson Architects, Inc., as to the scope of the research conducted was the following:

Exterior: None.

Interior: Concentrate research and limit color matching (with Munsell Color System) to the first original prime and finish coats only on the original, Ca. 1856 architectural fabric. List the approximate number of later paint layers on top of the first finish and identify them by color name only. The description of paint layering on several non-original features is also included.

NOTE: The chemical composition and pigment identifications of the paint films is not in the scope of this research.

NOTE: The contract agreement called for budgeting three days of on-site research and two days for lab analysis and report collation and completion. This time enabled full research of the entire building.

The tools and equipment used for this investigation included a binocular microscope (20 - 40 power), an illuminating lamp, a surgical scalpel, the Munsell Color Books, and a magnifying visor, etc. The small representative samples which I took for analysis and color matching are included (and identified) in the original copy of this report. The color matching was done under natural (sky) lighting conditions and not under artificial lighting which tends to adversely affect the perception of the colors. I am aware of the nature of architectural paints to fade in color with age; therefore, during my investigation I attempted to find the cleanest and brightest samples possible for use in color matching. Where I could not find the best color samples I estimated a color approximately one value step lighter on the value scale of the Munsell System to compensate for yellowing of oil mediums and darkening of pigments due to age.

My evaluation of findings is presented here in an area by area and layer by layer (prime and finish coats) description. I must reiterate that my conclusions are based on the evidence which I was able to obtain by investigating as many "test areas" as feasible. This type of investigation is somewhat analogous to "archeology above ground." There are implicit limitations here because the research does not constitute nor signify a complete "excavation." I also caution against holding present conclusions as absolute because the possibility of human error always exists within a fluctuating area of uncertainty.[1]

The colors of the original paint films are named according to The National Bureau of Standards Color Name Charts and The Munsell Color System. I use them both for the purpose of describing color in a more standard and universal way. The Munsell Color System "identifies color in terms of three attributes: hue, value and chroma." Their color standards are "opague pigmented films on cast coated paper." The Munsell Color Company (which is not a paint company) is presently located at 2441 North Calvert Street in Baltimore, Maryland, 21218.

This report may be used to assist in the preparation of a paint-color schedule for the restoration/preservation of these 19th century finishes. It might also serve as a source for gaining more of an understanding of regional and period styles of architectural decoration.

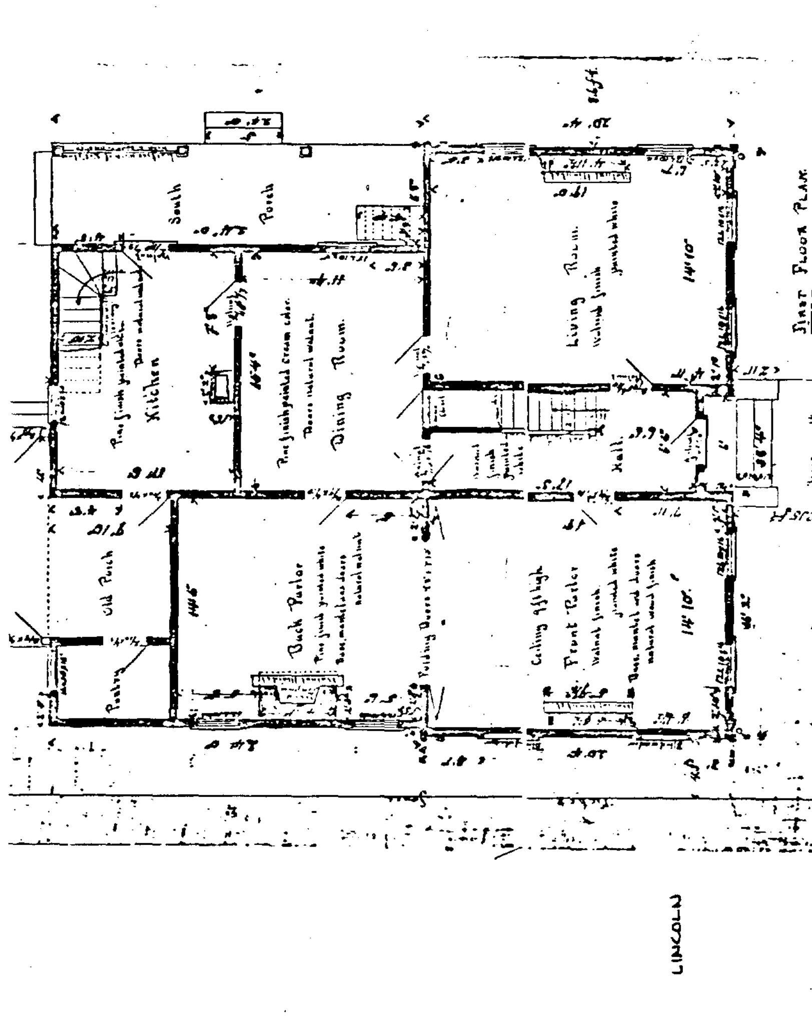
If at any time new evidence of any kind is discovered which would applify and/or change my findings and conclusions, I request immediate notification for the purposes of further evaluation and discussion.

[1] Karl Friedrich Gauss: "The Gaussian Curve"
Werner Heisenberg: "The Principle of Uncertainty"

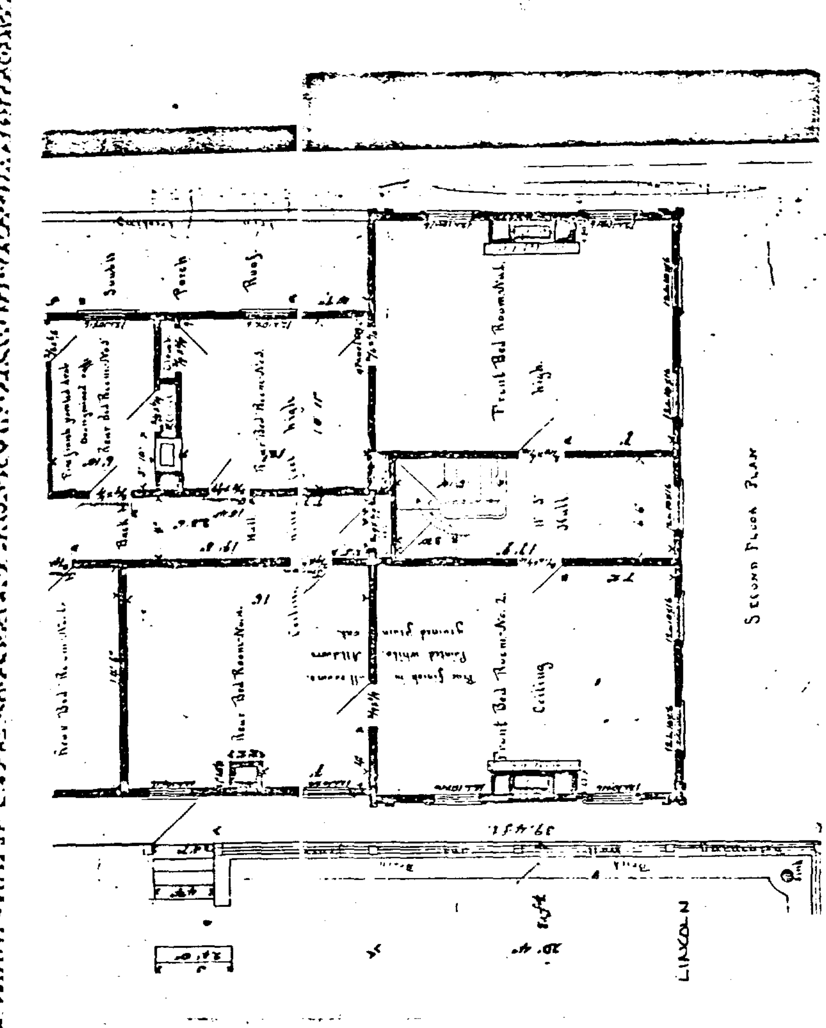
Lincoln Home; National Park Service; Springfield Illinois
Built: Ca. 1856.

Frank A. Welsh

October, 1978 — Historic Paint & Color Consultant

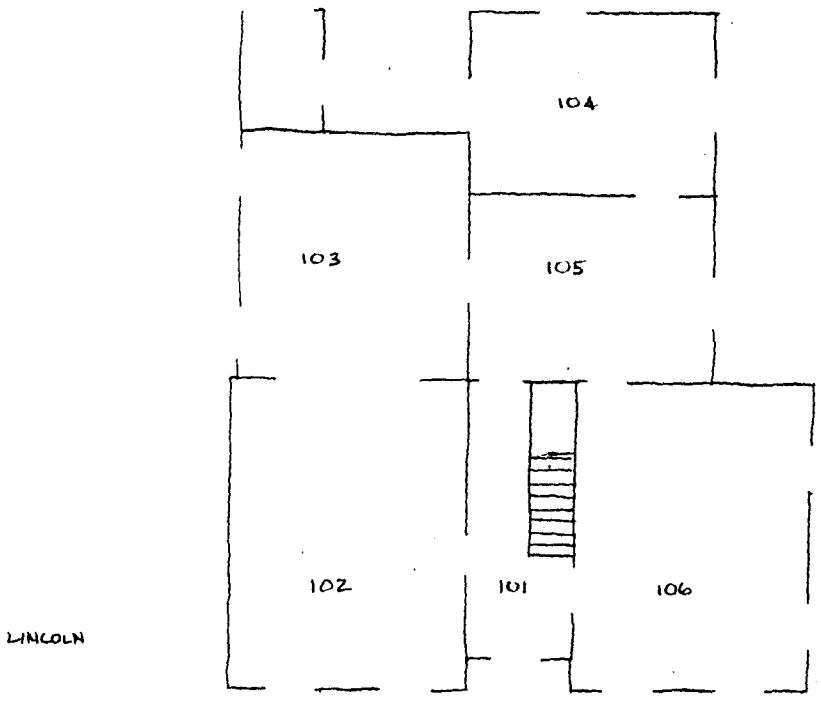


First Floor Plan
South Porch
Kitchen
Dining Room
Living Room
Hall
Old Porch
Pantry
Back Parlor
Front Parlor
Folding Doors
LINCOLN

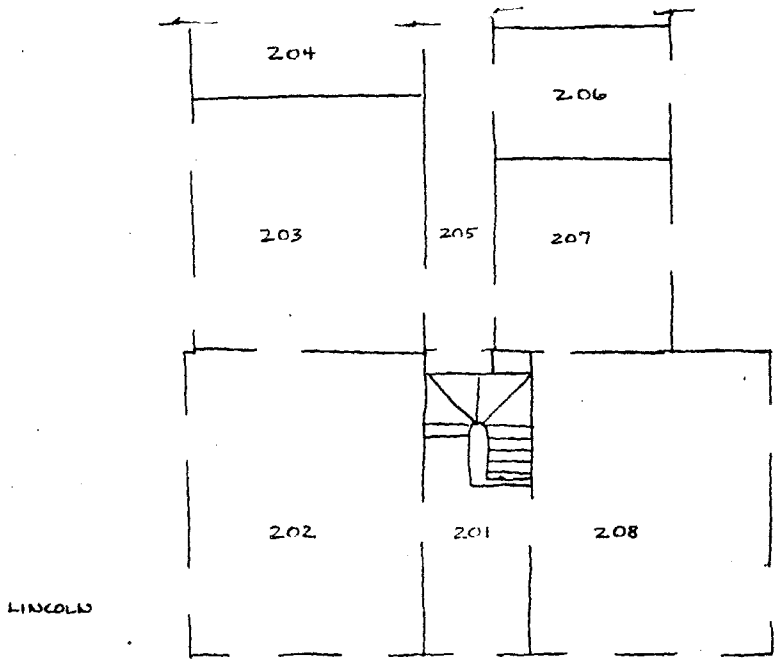


Second Floor Plan
South Porch Roof
Front Bed Room
Hall
Back Hall
Rear Bed Room
Front Bed Room No. 2
LINCOLN

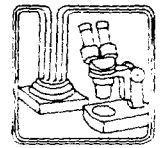
B-2



FIRST FLOOR



SECOND FLOOR



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ABRAHAM LINCOLN HOME

Ca. 1856

Springfield, Illinois

MICROSCOPIC COMPARATIVE ANALYSIS

of the interior

to determine the

Original Architectural Finishes

Prepared for:

Ferry & Henderson Architects, Inc.
1320 South State Street
Springfield, ILL. 62704
and
The National Park Service
Denver Service Center

October, 1978

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I would like to especially thank Sally Sweetser of Philadelphia Field Office of Historic Preservation, DSC, for her on-site instruction and guidance.

PAINT LAYERING, NON-ORIGINAL SHUTTERS: (1, 2, and 3)

Number of Layers	Color	Munsell No.
1	Dark Green	5 G 2/4
3-4 (exp.)	Black/Green	10 GY 2/1 (Existing)

PAINT LAYERING, ORIGINAL SHUTTERS:

(4) North Elevation First Floor Original to 1839

Number of Layers	Probable Year of Application	Color	Munsell No.
1 Heavy Soil	1839	Yellow/Green	7.5 GY 3/4
2 Heavy Soil	1849	Dark Green	5 G 3/4
1	1856	Yellow/Green	10 GY 3/4 (Existing)

(5) North Elevation Second Floor Original to 1856?

Number of Layers	Probable Year of Application	Color	Munsell No.
3		Dark Green	5 G 3/4
1		Gray/Green	10 GY 3/2
1		Yellow/Green	10 GY 3/4
1		Dark Green	5 G 3/4
1		Gray	10 GY 4/1
1-2		Dark Green	5 G 2/4
4		Black/Green	10 GY 2/1 (Existing)

(6) Shutter Stored in Basement—Original to 1856

Number of Layers	Probable Year of Application	Color	Munsell No.
1	1856	Green (primer)	5Y 8.5/1
1	1856	Yellow/Green	10 GY 3/4
2		Dark Green	5 G 3/4
1		Black/Green	10 GY 2/1
2		Dark Gray/Green	5 G 2/2
3		Black/Green	10 GY 2/1 (Existing

Though the evidence is not conclusive, it is reasonable to assume that 10 GY 3/4 is color of the shutters during Lincoln's occupancy.

RECOMMENDED COLOR SCHEME

Weatherboard Siding	Light Brown	7.5 YR 6/3
Shutters	Green	10 GY 3/4
Iron Railing, South Porch	Green	10 GY 3/4
Porch Floors, Steps	Green	10 GY 3/4
Exposed Brick Foundation	Gray	5 GY 5/1 (Existing)

NOTE: The samples examined show the "Quaker Brown" of Lincoln's occupancy to be a color that lies between a 7.5 YR 6/2 and a 7.5 YR 6.4. I have estimated the proper color to lie about midway between these colors, or a 7.5 YR 6/3

SOUTH PORCH RAILING PAINT LAYERING

Number of Layers	Probable Year of Application	Color	Munsell No.
2		Green/Black	10 GY 2/1
4		Black	
1 (exp.)		Green/Black	10 GY 2/1 (Existing)

None of these layers is original. The Green/Black color matches the existing color of the shutters. I recommend 10 GY 3/4 to match the shutters.

SHUTTER PAINT LAYERING

Photographic evidence as far back as 1860 clearly shows a difference between first-story and second-story shutters. It indicates that the original 1839 shutters, with no central rail, were retained by Lincoln on the first floor after the 1856 remodeling, and newer shutters, with a central rail, were used on the new second-story addition. Most of the original shutters (both 1839 and 1856) have been replaced by modern replicas patterned after the 1856 shutter style and have no mortise and tenon as do the 1839 and 1856 originals. Also, on the 1839 shutters, only the lower half of the louvers are moveable while both upper and lower halfs are moveable on the 1856 shutters.

Paint samples were taken from the following shutters:

1. West elevation first floor, south side, north window, south shutter--not original, modern construction.
2. West elevation second floor, south window, south shutter--not original, modern construction.
3. South elevation, rear wing, second floor, west window, west shutter--not original, modern construction.
4. North elevation, front building, first floor, east window, inside of closed east shutter--original to 1839, mortise and tenon.
5. North elevation, front building, second floor, east window, east shutter--original to 1856 very likely, mortise and tenon.
6. Shutter stored in basement, construction (mortise and tenon), style (central rail), and dimension (6 feet-0 inches in length) indicate this shutter original to 1856.

TRIM (Typical)

Number of Layers	Probable Year of Application	Color	Munsell No.
1	1856	Cream (primer)	2.5Y 8/2
1	1856	"Quaker Brown"	7.5 YR 6/2 - 7.5 YR 6/4
1	1884	Brown	10 YR 5/2
1	1887	Brown	10 YR 4/2
1	1890	Dark Brown	10 YR 3/2
1	1895	Primer Brown	10 YR 6/1
1	1895	Dark Brown	10 YR 3/2
1	1899	Dark Brown	10 YR 2/2
1	1903	Dark Brown	5 YR 2/2
1	1907	Dark Brown	10 YR 3/2
1	1914	Cream (primer)	2.5Y 8/2
1	1914	Dark Brown	10 YR 3/2
1	1918	Cream (primer)	2.5Y 8/2
1	1918	Gray	5Y 5/1
10	1920	Whites	See Weatherboard Siding
7	1952	Browns	See Weatherboard Siding
	1973		

BRICK FOUNDATION PAINT LAYERING

Number of Layers	Probable Year of Application	Color	Munsell No.
1		Dark Gray	5Y 4/1
1		Gray	5 GY 5/1
1		Dark Brown	5 YR 4/2
2		Slate Gray	N 4.5/
3	c.1920 - c.1940?	Brick Red	5 R 4/6
7	1952 - 1973	Brown	See Weatherboard Siding

Assuming that the Dark Brown (5 YR 4/2) was applied in the 1890's to match the trim (which by then was beginning to be painted in Dark Browns) then the color during the Lincoln occupancy was either the Gray or Dark Gray first coat. By far the heaviest soil layer occurs on the Gray (5 GY 5/1), indicating that it was exposed for a long period of time, possibly from the 1850's to the 1890's. It is therefore reasonable to assume that 5 GY 5/1 is correct for Lincoln's occupancy.

WEATHERBOARD SIDING

Number of Layers	Probable Year of Application	Color	Munsell No.
1	1856	Cream (primer)	2.5Y 8/2
1	1856	"Quaker Brown"	7.5 YR 6/2 - 7.5 YR 6/4
2	1884	Brown	10 YR 6/2
1	1887	Brown	10 YR 4/2
1	1890	Brown	10 YR 6/1
1	1895	Brown	10 YR 5/2
1	1899	Cream (primer)	2.5 YR 8.5/2
4	1899, 1903, 1914, 1917	Brown	10 YR 6/1
4	c. 1920	White	5Y 8/1
6		White	5Y 9/1
2	1952	Brown	7.5 YR 6/2
1	1957	Brown	7.5 YR 6/2
1	1965	Brown	10 YR 6/4
1	1968	Brown	10 YR 6/2
1	1971	Brown	10 YR 6/2
1	1973	Brown	10 YR 6/2 (Existing)

TRIM PAINT LAYERING

(To include all cornices, soffits, pilasters, window and door trim)

Sometime around the turn of the century the trim of the Lincoln Home was painted in dark Browns. During the 1880's and 1890's the home had been painted in somewhat darker Browns than Lincoln's "Quaker Brown," so the dark trimwork of the 1890's and 1900's was probably not that abrupt a change. Photographs clearly show the pilasters at the corners of the home, the cornicework and window trim to be darker against a lighter siding in the years 1900, 1905, 1908, 1910, 1911, and 1917.

The earliest "All White" photograph is dated 1930.

The sash and trimwork around the small windows to either side of the front door were once painted a deep Green/Black just prior to the "White Years" of the '20's, '30's, and '40's, probably to match the shutters.

ORIGINAL COLOR OF 1839 1-1/2-STORY STRUCTURE

It was reported in Edwin Bearss' Historic Structure Report LINCOLN HOME (p. 46) that the original building had been "painted in gray or drab-colored paint." Small traces of this original color on first floor window trim on the north, west, and east elevations bear this out. The best samples were found behind the closed shutters of the front parlor, north elevation, on the window jamb, and sashpocket coverboard. It was these two windows that the Lincolns, probably during the 1856 remodeling, had completely closed off from within and papered over. The shutters were then kept closed. There is a layer of "Quaker Brown" over the original gray on the window jamb behind the closed shutters, indicating that it was indeed the Lincoln's who closed off the parlor windows.

Number of Layers	Probable Year of Application	Color	Munsell No.
1	1839	Cream (primer)	2.5Y 8/2
1	1839	Gray	5BG 7/1

WEATHERBOARD SIDING PAINT LAYERING

(SIDING ORIGINAL TO 1856)

The most reliable sample of Lincoln's "Quaker Brown" was taken from a section of the soffit board which was covered in 1856 when the roof of the east wing was raised, interrupting and burying a middle portion of the main (front) building's east cornice. Portions of this section of cornice were removed in 1954 to facilitate mechanical alterations (see Bearss, p. 101). This "Quaker Brown" piece is believed to be from the cornice of the 1839 structure (the existing brackets were new to the 1856 remodeling), which Lincoln painted in 1849. This color was confirmed by numerous paint samples taken from trim, cornice, and siding on both upper and lower stories, and indicates that Lincoln used the same color in 1856 as he did in 1849.

	1880	Robert Lincoln rents home to Wendlandt.
	1883	Robert Lincoln rents to Oldroyd.
**	1884	Early spring, home probably painted p. 43.
	1884	April, Oldroyd opens museum.
	1887	Board of Trustees assumes ownership, home reported "essentially the same since 1856" (externally) p. 46.
*	1887	Home is painted, $98.50.
*	1888-1890	Home is painted, $58.00.
	1892	"Stands as Mr. Lincoln left it" p. 51.
	1893	Hofferkamp replaces Oldroyd as custodian.
*	1893-1895	Home is painted, $112.00.
	1897	Edwards replaces Hofferkamp as custodian.
	1897-1898	"Painting, papering, and repairs," $107.70.
*	1899 July	Home is painted. "Workmen burned off old paint" p. 54.
*	1903 Autumn	Home is painted $90.00.
**	1907	Major improvements, $1,593.10.
*	1914 Autumn	Home is painted, "major part of $1,019.11."
	1915	Edwards dies, Mrs. Edwards becomes custodian.
	1917	State assumes ownership.
*	1918	State programs painting and clapboard replacement p. 63.
	1918	Reporter: Lincoln Home is "A restful tan with green shutters."
	1918	Mrs. Edwards replaced by Mrs. Brown as custodian.
	1924	Mrs. Brown replaced by Miss Brown as custodian.
c.	1920 1951	Ten coats of white paint applied during this 30-year span.
	1952	Paint restoration—"members of the advisory committee were accustomed to a white house" (p. 87). This committee included Miss Brown, custodian since 1924.
*	1952	Home is painted light brown.
	1953	Miss Brown resigns.
	1956	Some paint removal.
*	1957	Home is painted light brown.
*	1965	Home is painted light brown.
*	1968	Home is painted light brown.
*	1971	Home is painted light brown.
*	1973	Home is painted light brown.

NOTE: The extent or precise methods of the paint removal efforts of 1899 and 1956 are not known. No evidence of paint removal was detected in the samples taken. However, some samples were missing some layering that other samples taken from similar locations on different elevations exhibited. This would indicate either material replacement, records of which have not been located, or paint removal.

LINCOLN HOME OWNERSHIP CHRONOLOGY

1839-1844	Reverend Charles Dresser
1844-1865	Abraham Lincoln
1865-1887	Abraham Lincoln Family
1887-1917	City of Springfield—Administered by the "Board of Trustees of the Lincoln Homestead"
1917-1972	State of Illinois
1917-1925	State Department of Public Works and Buildings
1925-1972	State Department of Conservation
1972-	National Park Service

LINCOLN HOME PAINTING CHRONOLOGY (EXTERIOR)

* Known Painting
** Probable Painting

Page numbers refer to Historic Structure Report LINCOLN HOME, prepared by Edwin Bearss, July 1973.

**	1839	House built, painted "gray or drab-colored paint" p. 46.
	1844	Lincoln buys house.
	1847	House leased one year, Lincolns go to Washington.
*	1849	Lincoln paints house before going to Washington.
*	1856	Major remodeling and painting, $1,300.00 p. 17.
	1857	More improvements, $200.00 p. 18.
	1861	Lincoln moves to Washington, rents to Tilton.

NEWS ACCOUNTS OF LINCOLN HOME COLOR p. 25-29

1860	June	"Plain Brown"
	June	"Brown"
	August	"Quaker Tint of Light Brown"
	October	"Stone Color" "Green Blinds"
	November	"Pale Chocolate Color" "Window Blinds a Deep Green"
1862	September	"Brown Colored"
1865	March	"Dirty Clay Color"
1866	Autumn	"Brown House"

1868	Tilton spends $200.00 in repairs.
1870	Robert Lincoln rents home to Harlow.
	Back kitchen addition constructed in 1870's.

PAINT STUDY FOR LINCOLN HOME

LINCOLN HOME NATIONAL HISTORIC SITE

SPRINGFIELD, ILLINOIS

Prepared by
Richard Wolfe, Architect

DENVER SERVICE CENTER
HISTORIC PRESERVATION DIVISION
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR
DENVER, COLORADO

June 1976

PAINT STUDY FOR LINCOLN HOME

In anticipation of the scheduled paint removal and repainting of Lincoln Home late this summer, this paint study of the home was undertaken to determine those paint colors used during Lincoln's occupancy of the structure, particularly during the years 1856-1861, as well as an overall paint history of the structure.

This analysis was conducted by taking paint samples from the exterior of the house (approximately sixty samples were taken) and examining paint chips under a microscope using a scalpel to scrape and separate paint layering. The paint colors were all keyed to the Munsell Color System. Separate glossy color samples may be purchased from the:

Munsell Color Company
2441 North Calvert Street
Baltimore, Maryland 21218

The Munsell numbers noted in this study have been coded as nearly as possible to the original paint color and not to discoloration due to sunlight, the surface migration of oils in the paint, and soil build-up between paint layers.

A P P E N D I X

Exterior Paint Analysis	A-1 thru A- 9
Interior Paint Analysis	B-1 thru B-16
X-Ray Analysis	C-1 thru C-35
Mechanical Report	D-1 thru D-13
Structural Report	E-1 thru E-17
Archaeological Survey	F-1 thru F-21
Electrical Report	G-1 thru G-15

DSC-HFC
Form 802

Page 1 of 1 for this package

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

20 February 1984

PACKAGE ESTIMATING DETAIL

REGION	PARK
Midwest Region	Lincoln Home National Historic Site
PACKAGE NUMBER	**PACKAGE TITLE**
PCIP No. 196	Phase A, Title I Lincoln Home Historic Structure Report - Schematic Design

(If more space is needed, use plain paper and attach)

ITEM		QUANTITY	COST
RESTORATION - Based on Parameters by N.P.S.			
Architectural			
Site Work	$ 30,872		
House	57,569		
Outbuildings	44,759		
	$133,200		$ 133,200
Structural			37,100
Mechanical			46,400
Electrical			40,300
Documentation			44,000
			$ 301,000
10% Contingency			30,100
TOTAL ESTIMATED COST (Based on January 1984 Construction)			$ 331,100

SUMMARY OF CONSTRUCTION ESTIMATES		CLASS OF ESTIMATE: A Working Drawings; B Preliminary Plans; C Similar Facilities	
Proj. Type		Totals from Above B & U	R & T
52	Museum Exhibits		XXXXX
55	Wayside Exhibits		XXXXX
62	Audio-Visual		XXXXX
89	Ruins Stabilization		XXXXX
91	Construction		
92	Utility Contracts		XXXXX

ESTIMATES APPROVED (Signature) | (title) | (date)

POST PROFESSIONAL SERVICES ESTIMATES AND SCHEDULING ON BACK OF FORM

DSC-HFC
Form 802

Page 1 of 1 for this package

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

20 February 1984

PACKAGE ESTIMATING DETAIL

REGION	PARK
Midwest Region	Lincoln Home National Historic Site
PACKAGE NUMBER	**PACKAGE TITLE**
PCIP No. 196	Phase A, Title I Lincoln Home Historic Structure Report - Schematic Design

(If more space is needed, use plain paper and attach)

ITEM		QUANTITY	COST
RESTORATION - Based on Recommendations as per HSR-ADS (2/20/84)			
Architectural			
Site Work	$ 30,872		
House	81,569		
Outbuildings	44,759		
Corrigan Barn	11,700		
	$168,900		$ 168,900
Structural			37,100
Mechanical			119,400
Electrical			41,200
Documentation			44,000
			$ 410,600
10% Contingency			41,060
TOTAL ESTIMATED COST (Based on January 1984 Construction)			$ 451,660

SUMMARY OF CONSTRUCTION ESTIMATES		CLASS OF ESTIMATE: A Working Drawings; B Preliminary Plans; C Similar Facilities	
Proj. Type		Totals from Above B & U	R & T
52	Museum Exhibits		XXXXX
55	Wayside Exhibits		XXXXX
62	Audio-Visual		XXXXX
89	Ruins Stabilization		XXXXX
91	Construction		
92	Utility Contracts		XXXXX

ESTIMATES APPROVED (Signature) | (title) | (date)

POST PROFESSIONAL SERVICES ESTIMATES AND SCHEDULING ON BACK OF FORM

SECTION 16111 - CONDUIT

Wiring shall run in conduit where applicable. New conduit for all feeders and branch circuit wiring will be provided unless noted otherwise on the drawings. Conduit shall be rigid steel, EMT (thinwall), or flexible as specified for application.

SECTION 16120 - WIRE AND CABLE

All wire shall be copper. Feeder and branch circuit wire shall be 600 volt, Type THW. Minimum wire size shall be #12 AWG except for signal systems and as otherwise indicated.

SECTION 16130 - BOXES

Section specifications cover outlet, pull and junction boxes including materials, sizes, locations and installation.

SECTION 16134 - CIRCUIT BREAKER PANELBOARDS

Panelboards shall be dead - front safety type, with distribution phase bus bar connections. Circuit breakers shall be quick-make quick-break, thermal-magnetic and trip indicating.

SECTION 16137 - CIRCUIT BREAKER DISTRIBUTION PANELBOARDS

SECTION 16140 - WIRING DEVICES

Section includes specifications for new toggle switches and receptacles.

SECTION 16150 - GROUNDING

System shall be grounded in conformance with applicable provisions of the National Electrical Code, including Article 250 - Grounding.

SECTION 16160 - MOTOR STARTERS

SECTION 16161 - POWER AND CONTROL WIRING

Description of mechanical and electrical responsibilities with regard to power and control wiring.

SECTION 16510 - LIGHTING FIXTURES

An allowance shall be included for the purchase of lighting fixtures as selected by the Architect. Relocation of some fixtures will be necessitated by architectural revisions and/or circulation pattern modifications.

SECTION 16551 - LAMPS

New lamps will be provided for all fixtures.

SECTION 16720 - ALARM AND DETECTION (SECURITY)

Local (room) intrusion detection system shall include new wiring and panels and new photo-electric detectors. Home security system shall be new including control panels, annunciator panels and passive infrared intrusion detectors. System will include a dialer tie-in to a central monitoring alarm company.

SECTION 16721 - FIRE ALARM SYSTEM

Complete new solid state, zoned, modular fire alarm system will be provided including control panel, annunciator panel, alarm horns, heat detectors and photo-electric smoke detectors. System will include a dialer tie-in to a central monitoring alarm company.

SECTION 16740 - TELEPHONE

Section covers required revisions to the telephone system.

SECTION 09950 - WALL COVERING

Provide wall covering as shown on the drawings, to match the historic period wall covering.

DIVISION 10 - SPECIALTIES

Not Applicable

DIVISION 11 - EQUIPMENT

Not Applicable

DIVISION 12 - FURNISHINGS

Not Applicable

DIVISION 13 - SPECIAL CONSTRUCTION

Not Applicable

DIVISION 14 - CONVEYING SYSTEMS

Not Applicable

DIVISION 15 - MECHANICAL

SECTION 15010 - GENERAL PROVISIONS

General requirements for job administration, execution and coordination.

All material shall be new, conform with accepted industry standards, and bear appropriate labels and/or approvals. All work shall be installed in conformance with applicable codes.

SECTION 15050 - BASIC MATERIALS AND METHODS

Products applicable to multiple classes of mechanical work including motors, pipe, fittings and valves shall be specified along with their installation.

SECTION 15250 - INSULATION

Section shall include materials and methods of installation for pipe and duct insulation.

SECTION 15400 - PLUMBING

Materials and installation requirements for plumbing systems. Demolition and relocation of plumbing lines necessitated by structural, mechanical (HVAC) and architectural modifications. Revisions to gas piping to serve new duct furnace. New piping to serve humidifier and new service sink.

SECTION 15600 - HEAT GENERATION

Section includes specifications for gas-fired duct furnace to be used for space heating.

SECTION 15650 - REFRIGERATION

Equipment, material and installation specifications covering split DX (direct expansion) system with air-cooled condensing unit and refrigerant piping.

SECTION 15700 - LIQUID HEAT TRANSFER

Humidifier unit and its installation is specified.

SECTION 15800 - AIR DISTRIBUTION

Section specifications will cover material and installation requirements for ductwork, duct accessories, air handling unit, and air balancing.

SECTION 15900 - CONTROLS AND INSTRUMENTATION

HVAC system control components and sequences.

DIVISION 16 - ELECTRICAL

SECTION 16010 - GENERAL PROVISIONS

General requirements for job administration, execution and coordination.

All material shall be new and bear UL Label where applicable.

All work shall be in accordance with the 1984 Edition of the National Electrical Code and all other applicable codes and ordinances.

SECTION 06200 - FINISH CARPENTRY

All new millwork will be treated with penetrating preservatives. The Carriage House will be constructed of vertical board and battens and shutters and floors will be constructed to match the existing, as detailed.

SECTION 06600 - RESTORATION

Provide for treatment and repair of deteriorated features and materials.

DIVISION 7 - MOISTURE CONTROL

SECTION 07110 - WATERPROOFING

Foundation walls will be waterproofed with material similar to the Volclay Bentonite panels.

SECTION 07190 - VAPOR BARRIER

Provide vapor barrier as shown on the drawings.

SECTION 07210 - BUILDING INSULATION

Provide insulation as shown on the drawings.

SECTION 07310 - SHINGLES

Provide shingles as shown on the drawings.

SECTION 07600 - FLASHING AND SHEET METAL

Provide material and labor as required on the drawings.

SECTION 07631 - GUTTERS AND DOWNSPOUTS

The Contractor shall repair or provide new gutters and downspouts as shown on the drawings.

SECTION 07900 - SEALANTS

Caulking material will be used on the interior and sealants will be used on the exterior. Silicone rubber sealant shall be a one-component type similar to Dow Corning 7080 or Mono as manufactured by the Tremco Manufacturing Company.

DIVISION 8 - DOORS, WINDOWS AND GLASS

SECTION 08210 - WOOD DOORS AND FRAMES

Exterior wood doors and frames to match existing historic doors and frames.

Interior wood doors and frames to match existing historic doors and frames.

SECTION 08610 - WOOD WINDOWS

All wood windows shall match historic windows.

SECTION 08710 - FINISH HARDWARE

All doors, windows, shutters, etc. shall have hardware of the appropriate period or to match the existing.

SECTION 08810 - GLASS AND GLAZING

All glass in historic windows shall match existing historic glass.

DIVISION 9 - FINISHES

SECTION 09100 - LATH AND PLASTER

All new and existing walls to be constructed or repaired shall have lath and plaster surfaces.

SECTION 09560 - WOOD FLOORING

All new and existing flooring to be constructed or repaired shall be wood to match the existing historic floor.

SECTION 09680 - CARPETING

Provide carpeting as shown on the drawings.

SECTION 09900 - PAINTING

Finish Color Schedule will be provided in the Specification. Munsell Color Company schedules with reference for the colors will be provided. Exterior and interior will be painted as shown on the drawings.

DIVISION 3 - CONCRETE

SECTION 03100 - CONCRETE FORMWORK

Forms for all concrete shall be equivalent to B-B Plyform, Class 1, as designated by the American Plywood Association.

The inside of forms shall be coated with a non-staining form oil.

SECTION 03200 - CONCRETE REINFORCEMENT

All reinforcing bars shall be rolled from new billet steel conforming to ASTM Specification A-615, Grade 60 and deformed in accordance with ASTM A-305.

SECTION 03300 - CAST-IN-PLACE CONCRETE

All concrete for this project shall have a minimum compressive strength at 28 days of 3,000 psi.

All concrete surfaces shall be treated with a curing agent to seal in moisture.

The work covered by this Section shall be governed by the appropriate parts of the ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318-77).

DIVISION 4 - MASONRY

SECTION 04100 - MORTAR

Mortar for all unit masonry shall match the existing historic mortar mix design proportions by volume. Tuckpointing will be required and so noted on the drawings.

SECTION 04150 - MASONRY ACCESSORIES

Provide masonry accessories as required. Historic appearance of the masonry work shall be maintained.

SECTION 04200 - UNIT MASONRY

Masonry units shall match the existing historic units. The Contractor will be required to save and reuse as much of the existing brick as possible.

SECTION 04201 - MASONRY WORK

The Contractor shall perform all masonry work as shown on the drawings and specified herein.

SECTION 04520 - MASONRY RESTORATION

Deteriorated masonry units will be replaced with existing bricks being salvaged from removal of the existing foundation. Tuckpointing will be required in some areas and so noted. A procedure for tuckpointing and repair/replacement of masonry units will be provided.

DIVISION 5 - METALS

SECTION 05120 - STRUCTURAL STEEL

All structural steel shall conform to ASTM A-36 unless otherwise noted on the drawings.

All steel shall receive one coat of shop paint equivalent to red lead mixed pigment-alkyd varnish-linseed oil complying with TT-P-86E, Type II.

The work covered by this Section shall be governed by the appropriate parts of the 1969 Edition, including Supplements 1, 2 and 3 of the AISC Code of Standard Practice and Specification for the Design, Fabrication and Erection of Structural Steel for Building.

SECTION 05701 - WROUGHT IRON

All wrought iron work shall be covered by this Section. The Contractor is responsible for providing all wrought iron work.

DIVISION 6 - CARPENTRY

SECTION 06100 - ROUGH CARPENTRY

All dimension lumber for framing shall be equivalent in terms of strength to No. 1 Southern Pine (surfaced at 15% moisture content, K.D. Used at 15% max. MC) F_c= 1650 P.S.I., F = 95 P.S.I., F_c perp. = 405 P.S.I., F_b= 1450 P.S.I., and E = 19,000,000 P.S.I.

Lumber must be sound, thoroughly seasoned, well manufactured and free from warp. Provide plywood of the type and thickness indicated on the drawings.

O U T L I N E S P E C I F I C A T I O N

PROJECT: LINCOLN HOME
Lincoln Home National Historic Site
Springfield, Illinois

D I V I S I O N 1 - G E N E R A L R E Q U I R E M E N T S

SECTION 01010 - SUMMARY OF THE WORK

A description and location of the project will be provided. In addition, access to the site and the responsibility for layout work will be established.

SECTION 01200 - PROJECT MEETINGS

Guidelines to meetings will be established.

SECTION 01300 - SUBMITTALS

The procedures and numbers required for the submission of Shop Drawings and Samples will be established and all Sections will be noted as to what samples are required.

SECTION 01510 - TEMPORARY SERVICES

Temporary heat, electrical and water will be the responsibility of the Prime General Contractor.

SECTION 01590 - FIELD OFFICES AND SHEDS

Parameters of offices and sheds will be defined.

SECTION 01600 - CONTRACT CLOSE-OUT

The Contractor will be required to provide a set of project record drawings which have been marked with all changes made during the construction.

D I V I S I O N 2 - S I T E W O R K

SECTION 02060 - DEMOLITION

The areas to be removed will be noted on the drawings.

SECTION 02072 - DEMOLITION FOR HISTORIC FABRIC

Historic fabric will be saved when removed. The Contractor will be instructed to retain all reusable items such as millwork, window trim, masonry and similar items.

SECTION 02102 - CLEARING AND GRUBBING

The procedure for clearing the site will be established. Protection of trees and utilities will be outlined and will be the responsibility of the Prime Contractor.

SECTION 02210 - SITE EXCAVATION AND GRADING

The Contractor will be required to establish the final grades, as noted on the drawings.

SECTION 02225 - STRUCTURE EXCAVATION AND BACKFILL

The Contractor will be required to establish the final grades, as noted on the drawings.

SECTION 02281 - TERMITE CONTROL

The Contractor shall treat soil for insect control.

SECTION 02450 - FENCES, GATES AND GUARDRAILS

The Contractor shall provide, as shown on the drawings.

SECTION 02480 - EARTH WORK

Compaction of backfill will be established as 92% maximum density beneath lawns and unpaved areas and 98% maximum density beneath all slabs on grade.

SECTION 02495 - LANDSCAPING

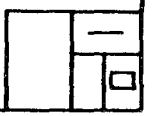
Soil preparation and the type of seed to be used on the lawn will be specified. In addition, the trees and shrubs will be noted.

SECTION 02601 - MANHOLES

The Contractor shall provide drainage, as shown on the drawings.

SECURITY PLANS
SEE SHEET NO. 15

1st and 2nd FLOOR PLANS
SEE SHEET NO. 14



BASEMENT PLAN
SEE SHEET NO. 13

1st and 2nd FLOOR PLANS
SEE SHEET NO. 12

BASEMENT PLAN
SEE SHEET NO. 11

2nd FLOOR FRAMING
SEE SHEET NO. 10

1st FLOOR FRAMING
SEE SHEET NO. 9

FURNITURE LAYOUT
SEE SHEET NO. 8

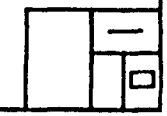
SOUTH & EAST ELEVATIONS
SEE SHEET NO. 7

NORTH & WEST ELEVATIONS
SEE SHEET NO. 6

ATTIC & ROOF PLANS
SEE SHEET NO. 5

1st & 2nd FLOOR PLANS
SEE SHEET NO. 4

BASEMENT PLAN
SEE SHEET NO. 3



SITE PLAN
SEE SHEET NO. 2.

COVER SHEET
SEE SHEET NO. 1

G. Preliminary Documents

1. Preliminary Drawings

The Preliminary Drawings represent the restoration work outlined in Parts A, B, C and D of this section.

F. Restoration Documentation

Documentation of this restoration work is absolutely necessary for future understanding and interpretation. Past renovation and restoration projects at Lincoln Home provide little or no information or data. This "less than adequate" record of the work performed has deterred accurate understanding of the physical configuration in 1860.

One benefit of restoration documentation is that during the progress of work, crucial investigation and analysis in areas previously inaccessible can be performed.

It is recommended that an adequate professional staff record the restoration work and investigate the structure on a daily basis during the progress of work to culminate in a detailed final report.

An integral part of the investigation and documentation should be an archaeological survey in areas where restoration work is below grade.

E. Handicapped Accessibility

Accessibility to Lincoln Home for the handicapped (persons confined to wheelchairs) is restricted due to the physical parameters of the structure. Presently, persons must use stairs to approach the front door of Lincoln Home, move between the first floor level and the second floor level, and exit the structure and site.

Several possibilities have been examined for barrier-free circulation through Lincoln Home. The use of ramps and elevators (including lifts) will require extensive reconstruction. The site around the home will need modification to accommodate ramps to the west and/or to the south/east. Elevator(s) would be required on the interior. This will result in alteration or destruction of historic fabric and a diminished historical/period interpretation by the visitor.

Access for the handicapped can be provided for, but serious consideration should be given to the consequences, cost of renovation and maintenance, loss of historical integrity, permanent destruction of fabric, and an abbreviated understanding of Lincoln Home in 1860.

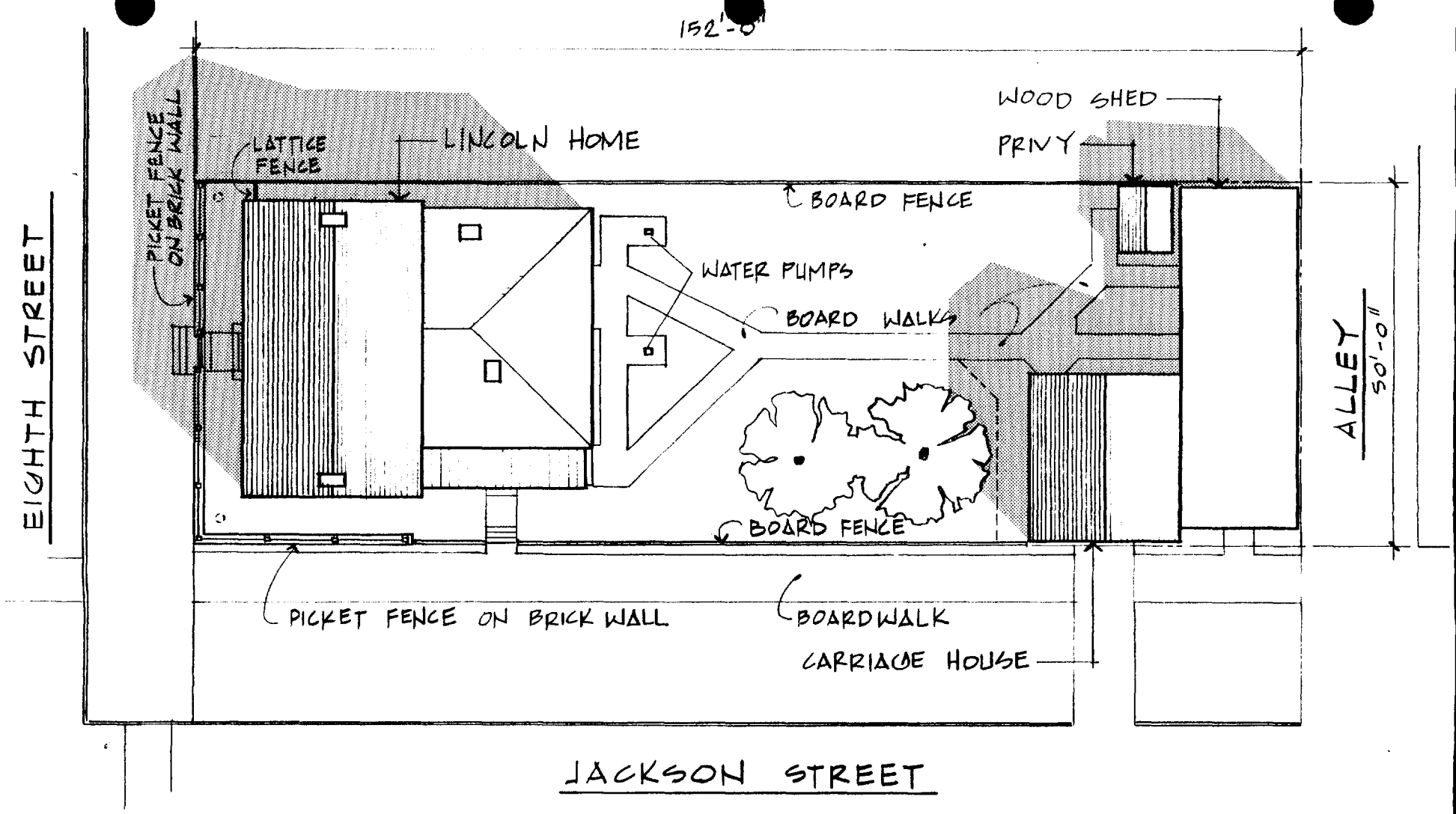
We recommend that the N.P.S. continue with its present programs for the handicapped.

D. Corrigan Barn

The Corrigan Barn should be constructed at the southeast corner of the lot north of Lincoln Home where the original barn existed. The exterior will be built to reflect the appearance and material of the 1860 period.

The interior of the Corrigan Barn will house the mechanical and electrical systems for Lincoln Home. An underground tunnel will connect the Barn and House.

Apart from the use of the Corrigan Barn as an appurtenant of Lincoln Home, its image will enhance the historical conceptualization of the back yard.



LINCOLN HOME

5. SITE PLAN · 1860

10 0 10 20 30 40 50

4. Landscaping

Landscaping around the Lincoln Home during occupancy by the Lincoln Family was minimal. At one time, a large garden existed in the back yard. Two apple trees grew on the south side of the back yard.[1] Not much documentation is available as to the landscaping in 1860.

Option #1: Continue with landscaping as it presently exists.

Option #2: Continue with landscaping as it presently exists but also provide another apple tree at the west side of the existing one, between the Home and the Carriage House.

Option #3: Seek a Landscape Architect for professional consultation as to the historical landscaping of the period.

[1]Bearrs, Edwin, Historical Base Map, Lincoln Home, Springfield, Illinois, National Park Service, U.S. Department of the Interior, p. 17-20.

3. Miscellaneous Improvements

- Remove concrete gutter from inside brick retaining wall on west and south sides of the Lincoln Home.

- Remove concrete flag base from southwest corner of the Lincoln Home.

- Remove concrete manhole from southwest corner of the Lincoln Home.

- Remove concrete retaining wall at grade level from the southeast corner of the Lincoln Home.

- Remove square concrete slab from southwest corner of the Lincoln Home.

- Provide grading for proper drainage into a "concealed" area drain.

- Remove concrete steps through west gate in south fence and replace with wood steps inside the south fence.

- Remove cleanouts from above grade and place in an accessible below-grade cavity with a sod cover.

- Provide poles and line for clothes drying.

- Provide a more concealed lighting system for the exterior of the Lincoln Home.

- Remove concrete steps at west entry to the Lincoln Home and replace with stone and wood steps.

2. Outbuildings

a. Privy

- Paint the privy to match other outbuildings.

b. Wood Shed

- Raise the height of the wood shed.

- Replace door on west elevation with two new doors.

- It appears that a chimney may have been in the wood shed for washing clothes.

- Remove vent opening in west elevation.

- Replace concrete block foundation wall with a brick one

c. Carriage Barn

- Remove conduit, hose bibb, vent openings, gable vent and other miscellaneous items from exterior of the building.

- Provide venting in gable through space between clapboards.

- Replace concrete block foundation wall with a brick one.

- Visitor circulation may pass through the restored Carriage House instead of through the east gate in the south fence.

C. Lincoln Home Site

The following work is required to restore the site to the period 1860.

1. Fences

- The height of the north board fence shall be raised a few inches.

- The west end of the north fence shall be at a greater angle; this will be adjusted when the north fence is raised.

- A lattice screen shall be installed between the northwest corner of the house and the north fence.

- Remove and rebuild the brick retaining wall and modified picket fence on west and south (west end) property line. The south retaining wall and modified picket fences shall be shortened westward to the proper length.

- The south board fence and gate shall be extended further west and raised a few inches. Exit at the rear of the lot may not have been through another gate, located next to the Carriage House, but through the Carriage House or wood shed.

- Stabilize the south board fence.

- Remove stone cap from brick retaining wall and provife new wood cap to reflect historic condition.

4. South Porch

The South Porch is showing signs of deterioration in the roof/porch ceiling area and the foundation area.

- Roof/Ceiling

  We recommend that the existing roof/ceiling be repaired so as to restore it to its historic appearance.

- Foundation

  We recommend the removal of the existing footings/foundation support/walls and the providing of new footings/foundation to match the existing historic condition.

  Temporary repair was considered but, since extensive investigation is required to determine the source of the problem, complete replacement is feasible.

3. Siding Analysis

The existing wood siding was restored in the Fall of 1976 and in the Spring of 1977. It is presently in a deteriorating condition and requires immediate attention. The extent of replacement of the clapboards is over 50%. Considering the extent of clapboard replacement, it is more economical to replace the entire exterior.

For past exterior restoration projects, adequate records are not available for determining if fabric is original/historic.

One of the problems associated with the deterioration of the clapboards is the absence of a vapor barrier in the exterior wall. This also results in paint peeling atn an accelerated rate.

We recommend the removal of all exterior siding and the providing of new vapor barrier, insulation, sheathing, and siding to match the existing historic.

By upgrading the shell of the structure and providing a vapor barrier and insulation, the fabric will not be greatly damaged by the required moisture (humidity) levels. Also, a reduced cost in energy for heating and cooling can be expected. (Refer to Section A.4. Climate Control System).

2. Roofing Analysis

The existing roofs are in mediocre condition. The west roof needs some shingles replaced and the east roof requires repair of the joints.

We recommend repair of the existing roofs, as required, with the option of completely replacing any roof should the repair prove more costly than full replacement.

- Shutters

Most of the exterior window shutters are deteriorated and in need of repair. The likelihood of most of the shutters being original is doubtful; therefore, we recommend that all existing shutters be removed and replaced with new to match existing historic shutters.

All shutters, new or existing, shall be installed on hardware to match the historic period and shall be fully operable.

- Provide access to the Furnace Room by cutting an opening in the east wall of the existing basement.

- On east elevation, place downspouts as shown in historic photographs - Ridgeway Glover Stereopticon.

- Remove the dormer (for the exhaust fan) on the east slope of the west roof and provide exhaust through the eave.

- Restore chimneys on the east "flat" roof as shown in historic photograph - Ridgeway Glover Stereopticon.

- The hose bibbs, electrical conduit and other items not characteristic of the period, should be removed from the foundation wall on the exterior face of the building.

- Remove wire mesh from gable eave returns and replace with a stainless steel needle bird control systems.

- Remove plumbing vent.

- Relocate lightning rods on chimneys.

- Provide electrical heat tape in gutters and downspouts at east "flat" roof area - prevent visibility from ground level.

B. Exterior of Lincoln Home

The exterior of the Lincoln Home has recently undergone restoration work (see 1976-1977 Exterior Restoration). Like all houses, periodic work is required for proper maintenance

1. Historical Alterations

The house needs several modifications to restore its historic integrity. These items are listed below.

- Removal of vents in the north and south gables of the west end of the house.

- The pulley system of lifting the outside door to the basement in the South Porch Floor should be revised.

- Remove the brick wall around the stair to the Furnace Room, B-3. Remove the concrete steps and fill with earth to match existing conditions.

7. Lighting

The existing lighting system is adequate and provides sufficient foot candles to safely use and interpret the Home. The cost estimate is based on similar fixtures provided or relocated as structure and circulation require.

However, we recommend the removal of all non-historic lighting and the providing of modern lighting that would reflect historic lighting in appearance.

6. Electrical System

Refer to Appendix G, Electrical Report.

Remove all accessible electrical material (wiring, conduit, hangers, panels, etc.).

Provide new electric service throughout the house. The existing conduit may be used if it is inaccessible or its removal will result in damage to the historic fabric.

5. Security/Fire Detection

Refer to Appendix D, Mechanical Report and Appendix G, Electrical Report.

Completely remove the existing security system and install a new system, utilizing passive infrared detectors.

Completely remove the existing fire alarm system, utilizing photo-electric smoke detectors.

System and Contractor shall be by selection of the Architect/Engineer and the Lincoln Home National Historic Site staff.

An automatic Halon System has been discussed as a possible fire suppression system. The Halon System is safe and relatively non-damaging. Its cost is approximately $37,000 for a thorough system.

We recommend that a new Halon System be installed since it provides the greatest degree of non-damaging protection (especially during unattended hours). In addition, the most opportune time for its incorporation would be as the restoration is being performed.

Also considered was the restricted use of the mumidifier in the "winter season"; however, the museum pieces will be exposed to climate conditions which could cause them damage.

Therefore, two clear choices are available. One is to provide a thermal and moisture efficient shell and a year-round controlled climate; thus, an end to the problem of damaged museum pieces and structural fabric deterioriation.

Choice two is to provide local repair to the existing siding and a year-round controlled climate, resulting in a continually increased problem of moisture (condensation) and fabric damage.

We prefer and strongly recommend the first choice.

Note: The recommendation by the Architect/Engineer have complied with the Secretary of the Interior Standard for Historic Preservation Projects by the Department of the Interior (Stock No. 024-016-00105-2).

A humidifier has been added to the climate control system which has the capacity to maintain a "constant" interior climate the year-round. The principal intent of the humidifier is to introduce moisture into the structure during the dry season (winter months) to avoid subjecting the museum pieces (original furniture) to extreme fluctuations in humidity.

According to the parameters/guidelines, a high relative humidity level is required by Mr. Hunter's letter (see Appendix D, Mechanical Report). The introduction of this amount of moisture into the structure with no vapor barrier, no insulation, and a high air change per hour (infiltration) will result in irreversible damage to the structure (new and historic fabric). For example, this is to a lesser degree the cause of the problem of paint peeling on the exterior clapboards. (Refer to Section B.3. Siding Analysis).

We recommend maintaining the required interior climate the year-round and providing adequate insulation and vapor barrier in the shell of the structure.

By locating the air-handling unit and furnace away from the structure, gas is not introduced into a historic building, a safety measure.

Access to Furnace Room B-3 from Basement B-2 is greatly restricted due to existing and new duct work. Therefore, access must be from another direction.

We recommend that access to the Furnace Room be by tunnel and limited access through a door to Basement B-2.

Should the air-handling unit and furnace be located in the Furnace Room, access would be required from the north side of the house through a non-historic exterior wood cellar door.

4. Climate Control System

Refer to Appendix D, Mechanical Report

Three alternate HVAC systems were studied as replacement for the existing gas-fired furnace heating system. The recommended replacement system is a split direct expansion (DX) cooling system with an air-cooled condensing unit located outdoors, an air-handling unit with DX coil located in the basement furnace room, and an indirect gas-fired duct furnace.

Existing duct work is presently in good condition. However, some revisions will be required.

We recommend that the air-handling unit and furnace be located outside Lincoln Home and off the site in the Corrigan Barn to be constructed at the southeast corner of the lot, north of Lincoln Home. Refer to Section D, Corrigan Barn. Duct work will run underground in a tunnel between the barn and Lincoln Home.

We considered locating the air-handling unit and furnace in the existing Furnace Room B-3 but believe this would pose possible danger to the structure, is an accessibility problem, and would not be a long-term solution.

As areas of Lincoln Home become more accessible, further structural investigation, analysis, design, and restoration may be required.

2) Remove second floor framing and provide new floor framing as shown on preliminary drawings.

We recommend that the new flooring span north-south throughout the house.

Another option considered was that the new framing span in the same direction as the existing framing (east-west in Mr. Lincoln's Bedroom and the Guest/Boys Bedroom). This selection will necessitate additional joists or greater joist depth.

Also the east-west span option will require structural repair to the lintel (header) above the opening on the first floor between Front Parlor, 101 and Back Parlor, 102.

3. Structural Sufficiency

Refer to Appendix E, Structural Report.

a. Foundation Walls

The existing masonry basement walls of the structure appear to be stable and in reasonably good condition. However, in some areas, local repairs will be necessary as the masonry has deteriorated or has been loosened or removed during past construction efforts.

b. Framing

It is recommended that the first and second floor framing be modified to bring its capacity up to the recommended design loads of the Uniform Building Code. This will require the following work:

1) Permanent shoring of first floor beams and joists in the basement area and removal of temporary supports.

b. Portable Post and Rope

Also considered was the use of posts and rope to define and restrict circulation of visitors. This option has less control over visitor movement and may require an increase in staff.

c. Partitions

We concur with the N.P.S. that partitions are not an acceptable means to control circulation.

- Circulation Flooring

We recommend using historic flooring and covering in circulation areas to aid in the visual interpretation of the period 1860.

We considered providing carpeting over the flooring in all circulation areas but feel that its appearance would be a distraction.

- Circulation Control

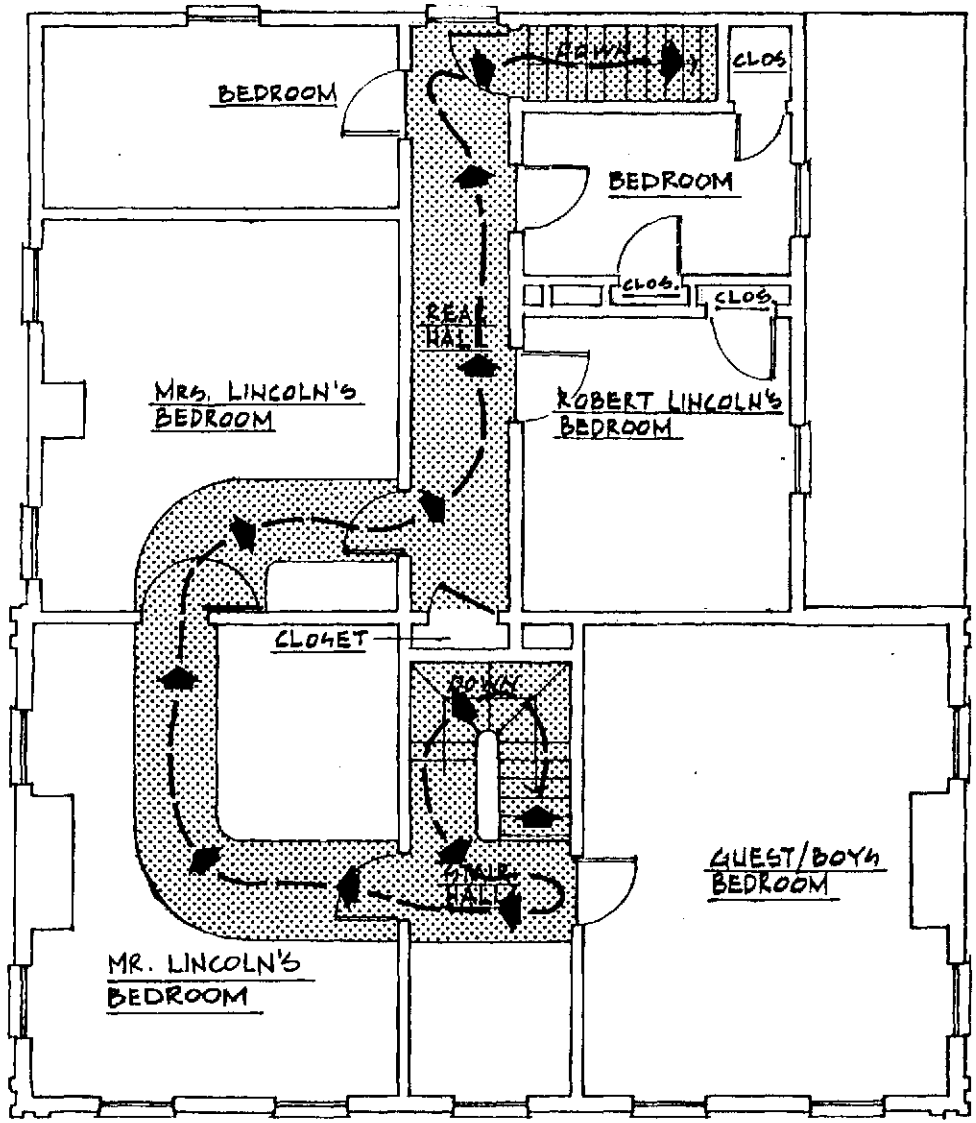
a. Railing

We recommend the use of a 2'- 6" or up to 3'- 0" high railing in Mr. Lincoln's Bedroom, 201 and Mrs. Lincoln's Bedroom, 202 to match the existing system.

The railing can be either "portable" or "fixed" but if fixed, the railing could match that which exists throughout the entire home.

Another option considered was the use of a 2'- 6" or up to 2'0 " high transparent panels with top railing in Mr. Lincoln's Bedroom, 201 and Mrs. Lincoln's Bedroom, 202 throughout the entire home. The transparent panels would require frequent cleaning.

The use of any railing in Mr. Lincoln's Bedroom, 201 and Mrs. Lincoln's Bedroom, 202 may necessitate the removal of historic furnishings and replacing them with exact duplicates in areas where visitors can reach them.



SECOND FLOOR PLAN

5 0 5 10

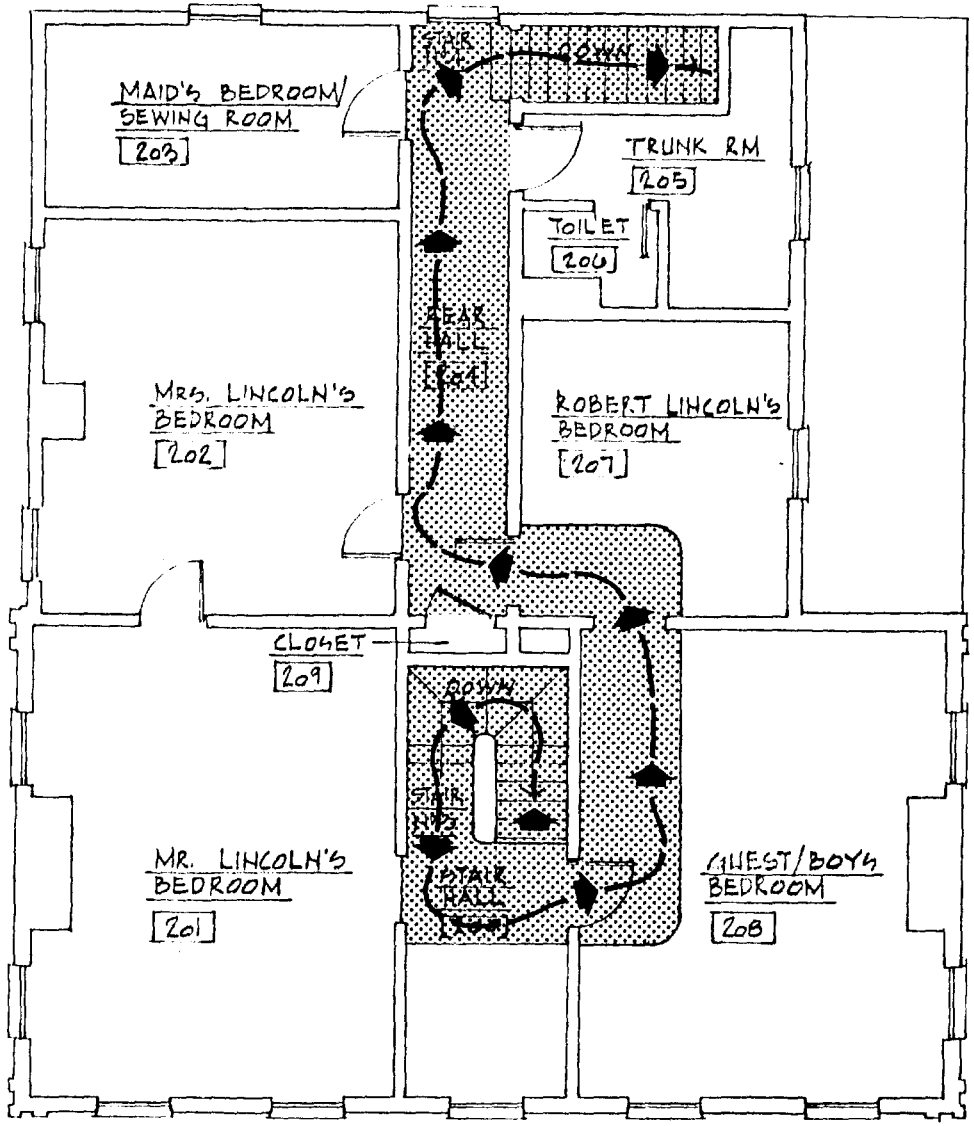
Proposed Circulation Path

Second Floor

Historic

This circulation route is a major alteration from the existing one. Visitor travel would not be through the Guest/Boys Bedroom and Robert Lincoln's Bedroom, but would be through Mr. Lincoln's Bedroom and Mrs. Lincoln's Bedroom.

Note the restoration of the bedroom in the southeast corner of the Home. A single wall may have existed between the southeast bedroom and Robert Lincoln's Bedroom instead of two closets.



SECOND FLOOR PLAN

5 0 5 10

Existing Circulation Path

Second Floor

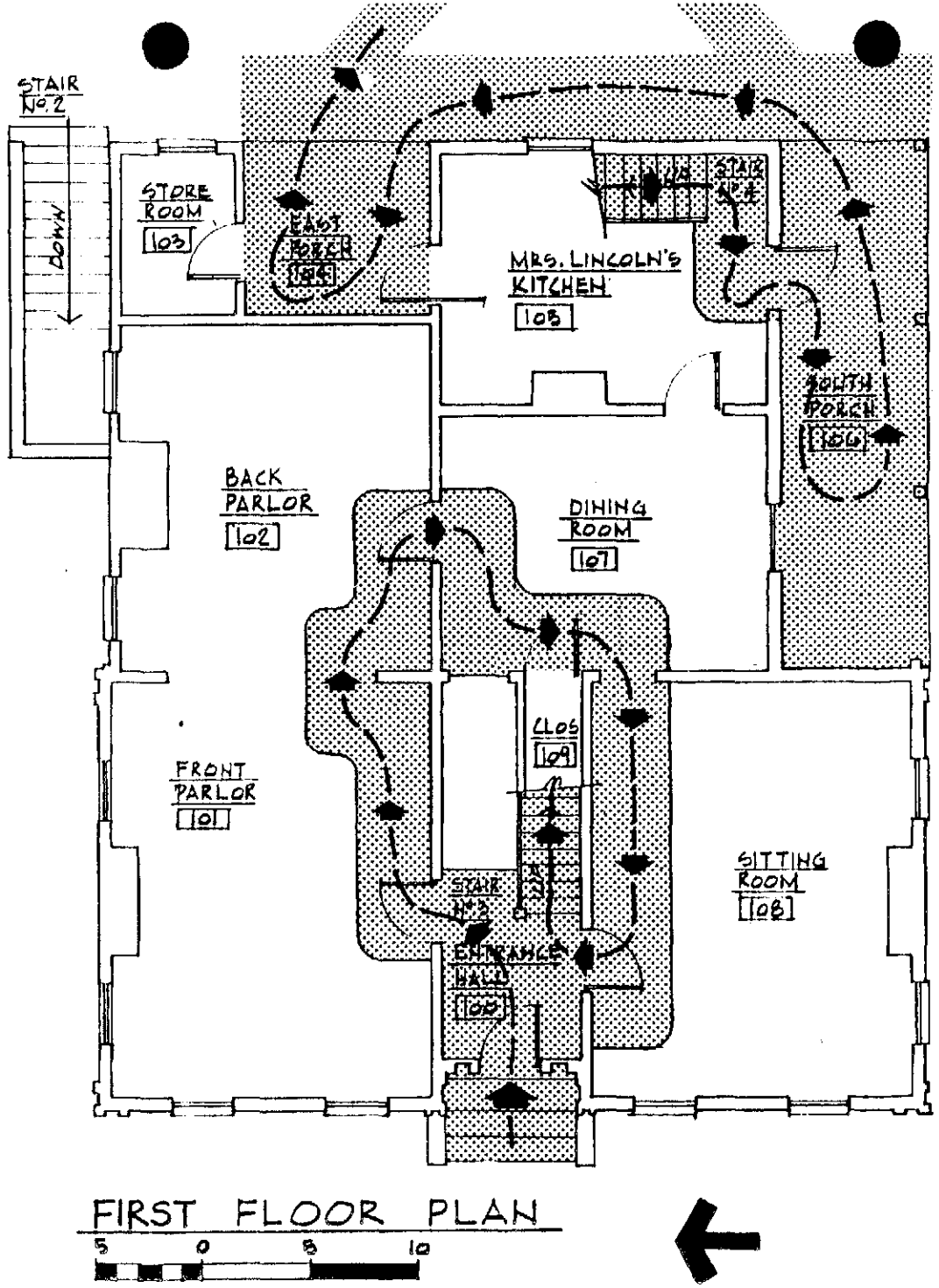
The existing second floor circulation path is presently not through historically correct openings.

The east doorway in the Guest/Boys Bedroom, 208 and the south doorway in Robert Lincoln's Bedroom, 207 were relocated slightly to the north in the 1950's to ease circulation.

The existing first floor circulation path needs no alterations. This route works well and modifications to historic conditions have been kept to a minimum.

Existing Circulation Path

First Floor



2. Visitor Circulation

Several options on visitor circulation were reviewed by the N.P.S. Their decision will keep visitor flow on the first floor as is but on the second floor, visitors will walk through Mr. Lincoln's Bedroom, 201 and Mrs. Lincoln's Bedroom, 202 from the Stair Hall, 200 to Rear Hall, 204 instead of through the Guest/Boys Bedroom, 208 and Robert Lincoln's Bedroom, 208.

- Restoration of ceilings

  We recommend the removal of deterirated and loose plaster and patching with new to match the existing historic plaster.

  Another option would be to provide new ceiling to match the existing historic in areas where the ceiling is non-historic but we feel this is excessive in light of the fact that the ceiling will be wall-papered.

- Sun Shading (ultra-violet rays)

  We recommend the use of window coverings and/or exterior shutters to "shut out" the sunshine. This historical method will require daily attention by the N.P.S. staff.

- Restoration of walls and ceilings

  We recommend the removal of deteriorated and loose plaster and patching with new to match the existing historic plaster.

- Restoration of glass and glazing in the exterior windows

  We recommend the replacement of all existing glass with insulated glass (double thickness) of which one pane matches the historic glass.

  We have considered single-pane historic glass in all windows and the use of a single piece glass over the sash on the interior. These options are thermally and aesthetically inferior, compared to the recommendation.

- Move the door and frame in the north wall of Robert Lincoln's Bedroom, 207 the proper location.

- Restoration of the first floor floors

  We recommend the removal of all carpeting, mats, hardwood flooring and other non-historic material. Refinish the original wood floor as required, and remove the original wood floor and install subfloor and new wood floor to match existing historic, as required.

  An attempt to keep the original wood floor will be made; however, if the original floor is deteriorated, damaged or structurally insufficient, it will be replaced.

- Restoration of wood windows

  We recommend the removal of existing wood windows and the installation of new wood windows to match existing historic.

  Repair of the existing wood windows was considered but, due to their extensive deterioration, repair is not feasible.

A. Interior of Lincoln Home

Even though the plan of Lincoln Home exists today almost as it did in the 1860's, past reconstruction work has caused the removal of historic fabric, resulting in parts of the house being non-historic.

1. Architectural Restoration

- Remove Toilet Room, 206 and restore the Trunk Room, 205 on the Second Floor into a bedroom. Move the door and frame to the proper location and restore the closet.

- Restore the closet in Robert Lincoln's Bedroom, 207.

- Rear Hall, 204 ceiling

  We recommend that the ceiling height be left as it presently exists to continue accommodation of the mechanical duct work above.

  The option to restore the ceiling to its proper historic height has been considered.

- Remove door between Robert Lincoln's Bedroom, 207 and Guest/Boys Bedroom, 208 and fill to match existing historic wall.

vided that temperature changes do not cause the selected RH to fluctuate beyond established limits or to change faster than the established rate.

c) Air Quality: Freed of as much dust and chemical air pollutants as technically feasible.

3) The mechanical equipment may be located outside the structure in a remote spot or in its present location.

4) No historic fabric will be removed for the purposes of installing vapor barrier and insulation in the walls..

5) There will be no separation of visitor spaces and exhibit spaces for climatic zoning.

Listed below are some notable parameters/ guidelines for reference.

1) Reference Codes are Uniform Building Code and National Electric Code

2) Climate control inside Lincoln Home should be:

   a) Relative Humidity: Maintained constantly, without regard to season or time of day, as close as possible to an ideal RH (possibly 55%) within the range of 45% to 65%. Annual variations not to exceed 5% on either side of the ideal, such variations to occur at a rate not to exceed 1%-2% per month. Daily fluctuations not to exceed 3% on either side of the ideal during a 24-hour period.

   b) Temperature: Maintained constantly, without regard to season or time of day, as close as possible to an optimum temperature (normally 68 degrees F) within the permissible range of 60 to 75 degrees F. Annual variations shall remain within the stated range and shall occur at a rate not to exceed 2 degrees per month. Daily fluctuations may be permitted to occur, provided the daily maximum and minimum do not exceed 5 degrees on either side of the selected optimum and pro-

II. PROPOSED RESTORATION

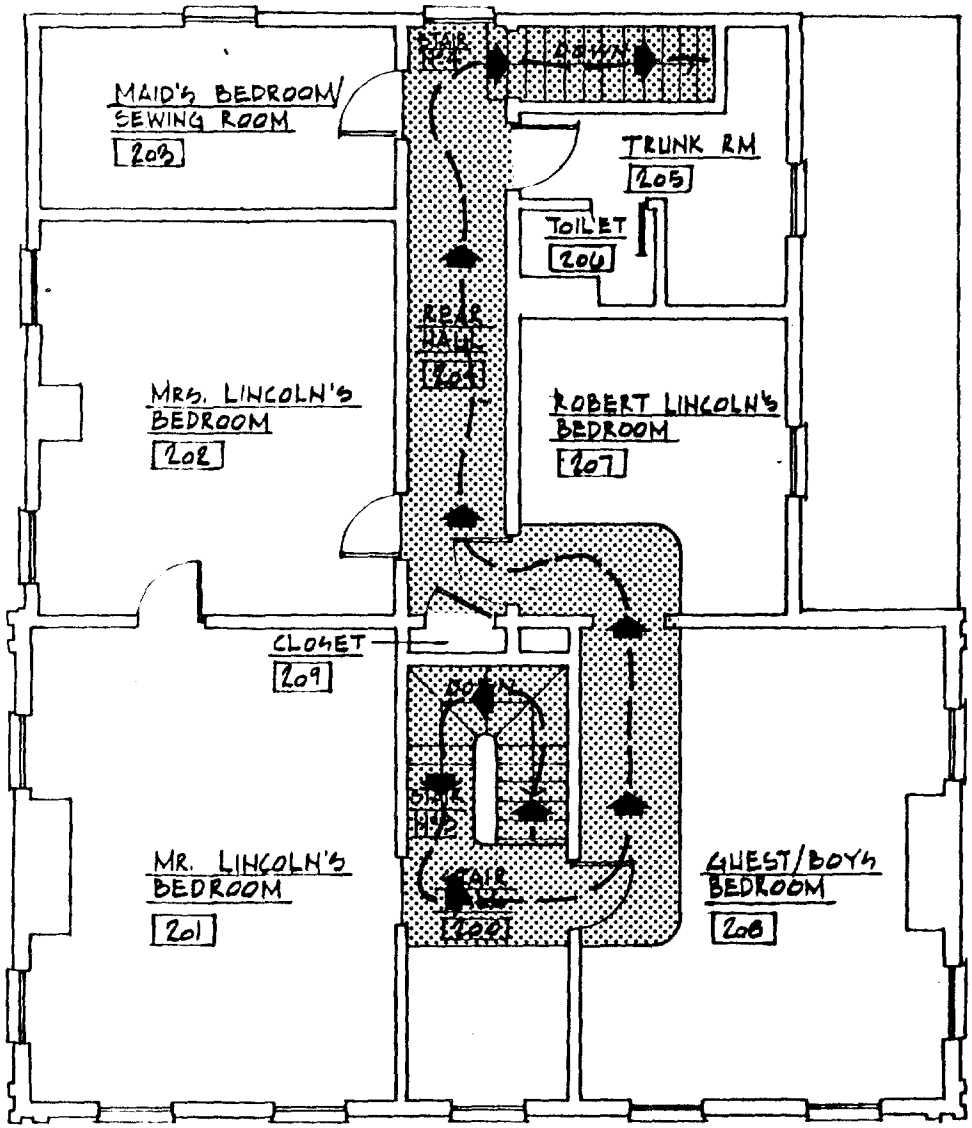
The evaluation of the Historical Data and Physical Investigation Data in the first part of this Report and interviews with individuals associated with the Lincoln Home have provided essential information and clues for the proposed restoration work.

Restoration to the period of 1860 can take many directions, depending upon feasibility, economics, time, etc., all finally making Lincoln Home a safe, usable structure of historical accuracy.

The following sections outline the proposed restoration work recommended by the Architect/Engineer. This proposal is intended to provide the National Park Service with a long-term solution to the physical deficiencies and historical errors now present.

Several guidelines/parameters have been established for the restoration design work. Evaluation of their importance and pertinence to this specific structure has resulted in conflicting solutions to the problems.

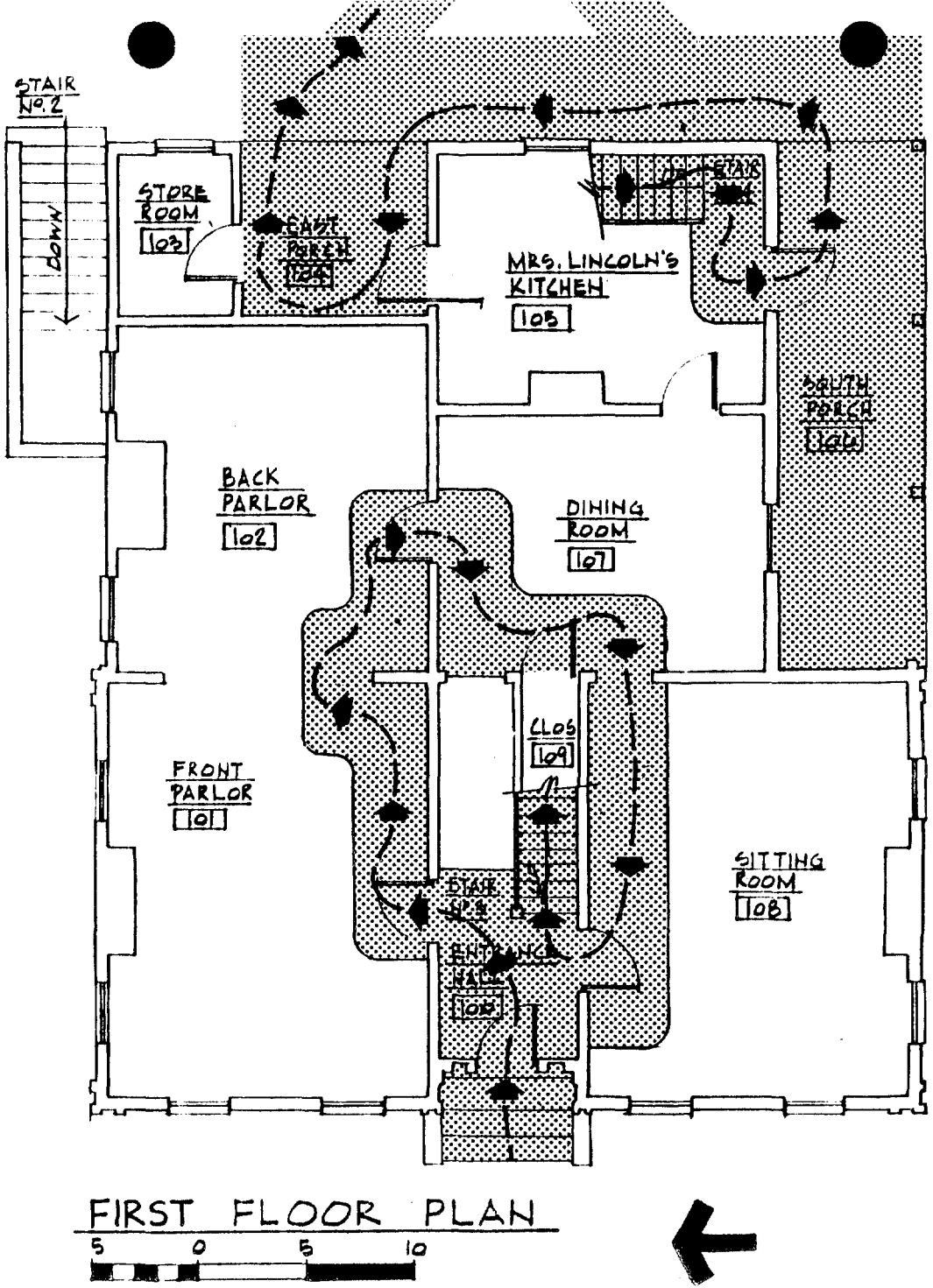
However, we have objectively addressed these contradictions and firmly stand behind our recommendations.

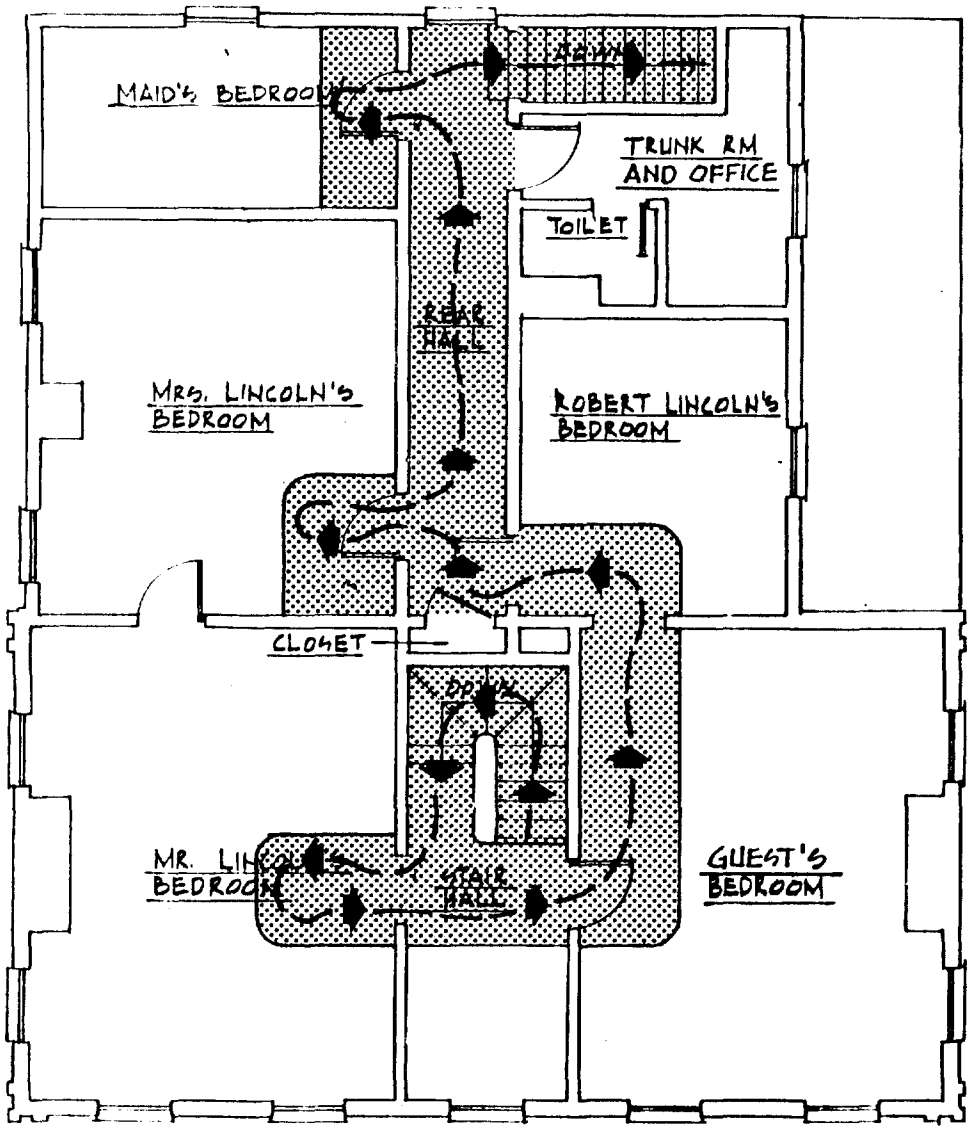


SECOND FLOOR PLAN

5 0 5 10

Existing Circulation Pattern





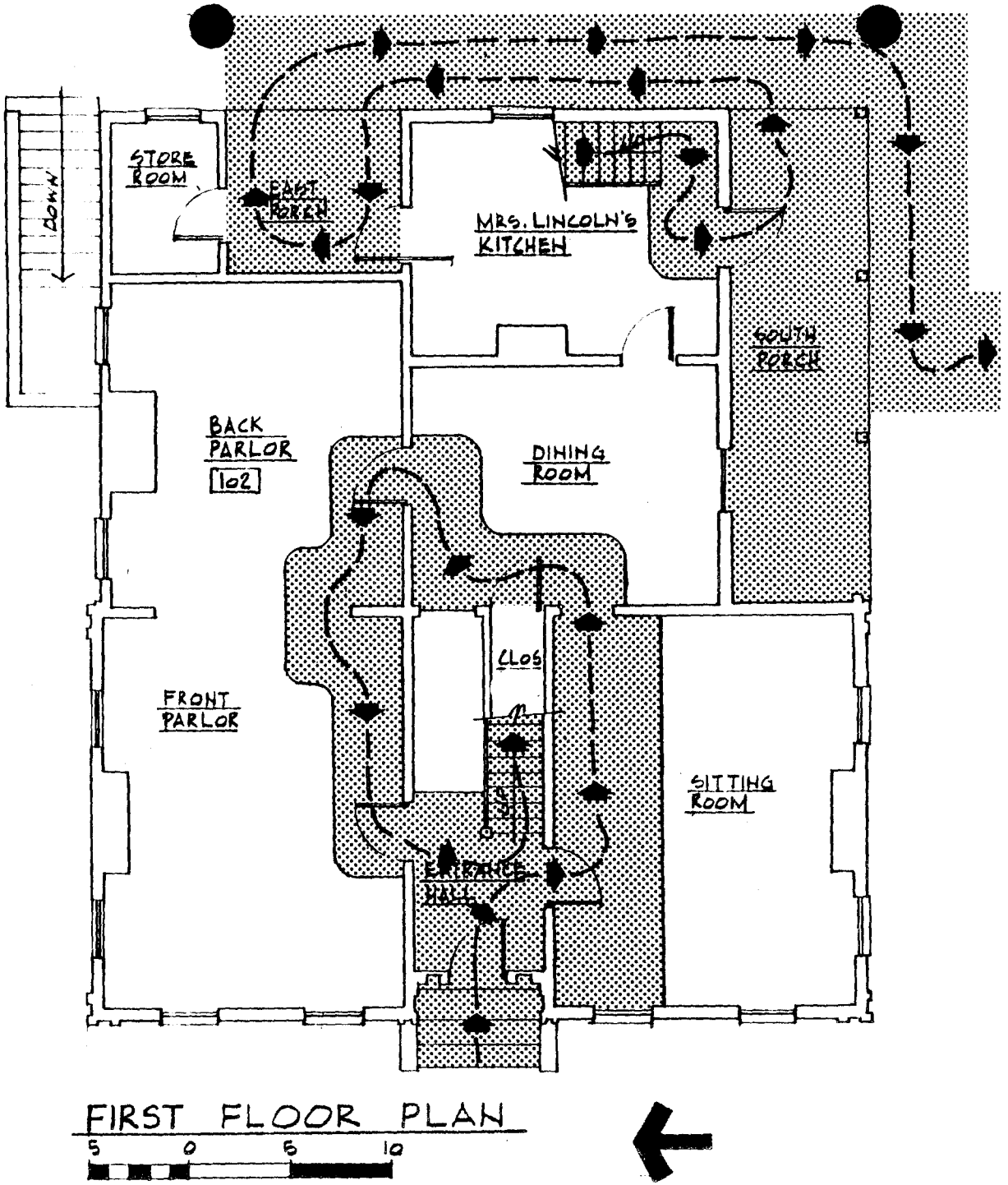
SECOND FLOOR PLAN

5 0 5 10

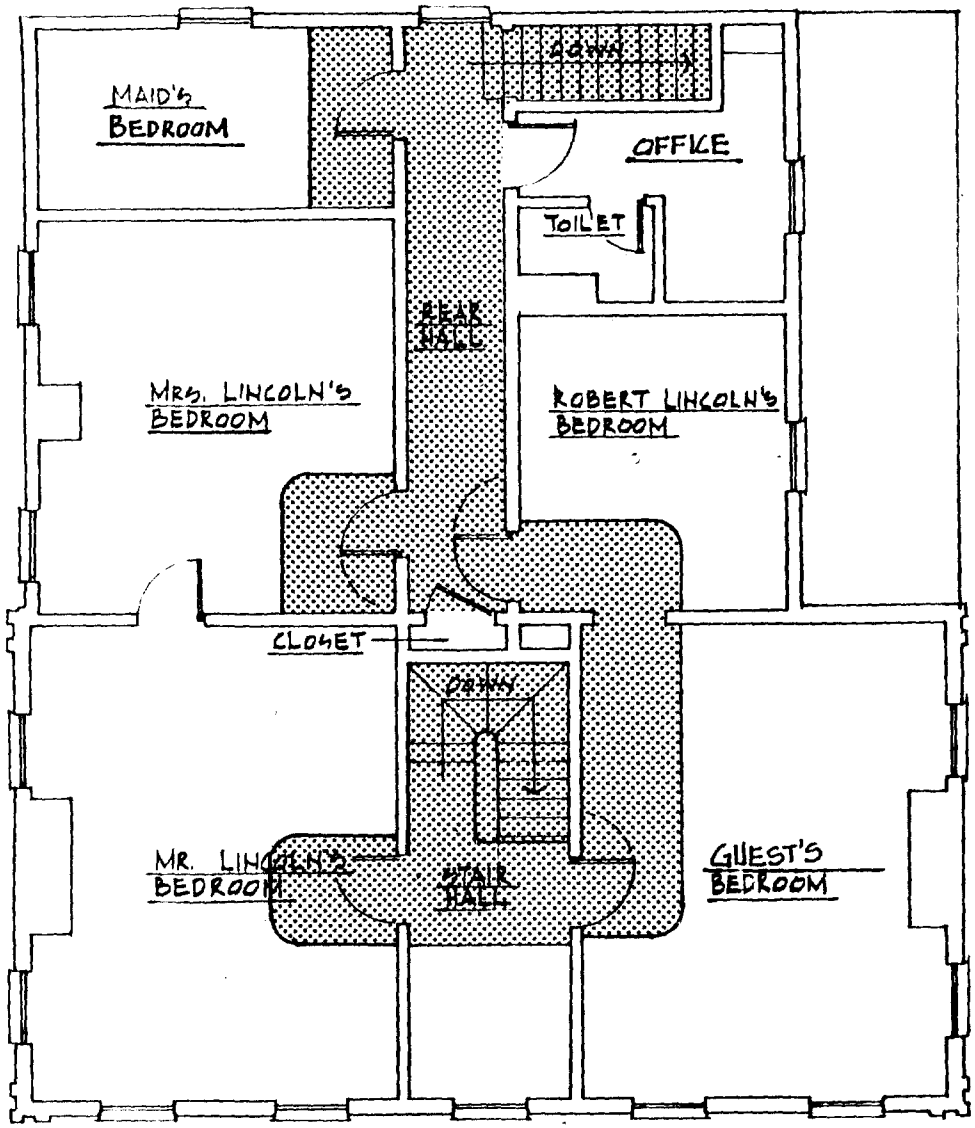
August 1964

Circulation Plans

Index No. 64/66-1



FIRST FLOOR PLAN



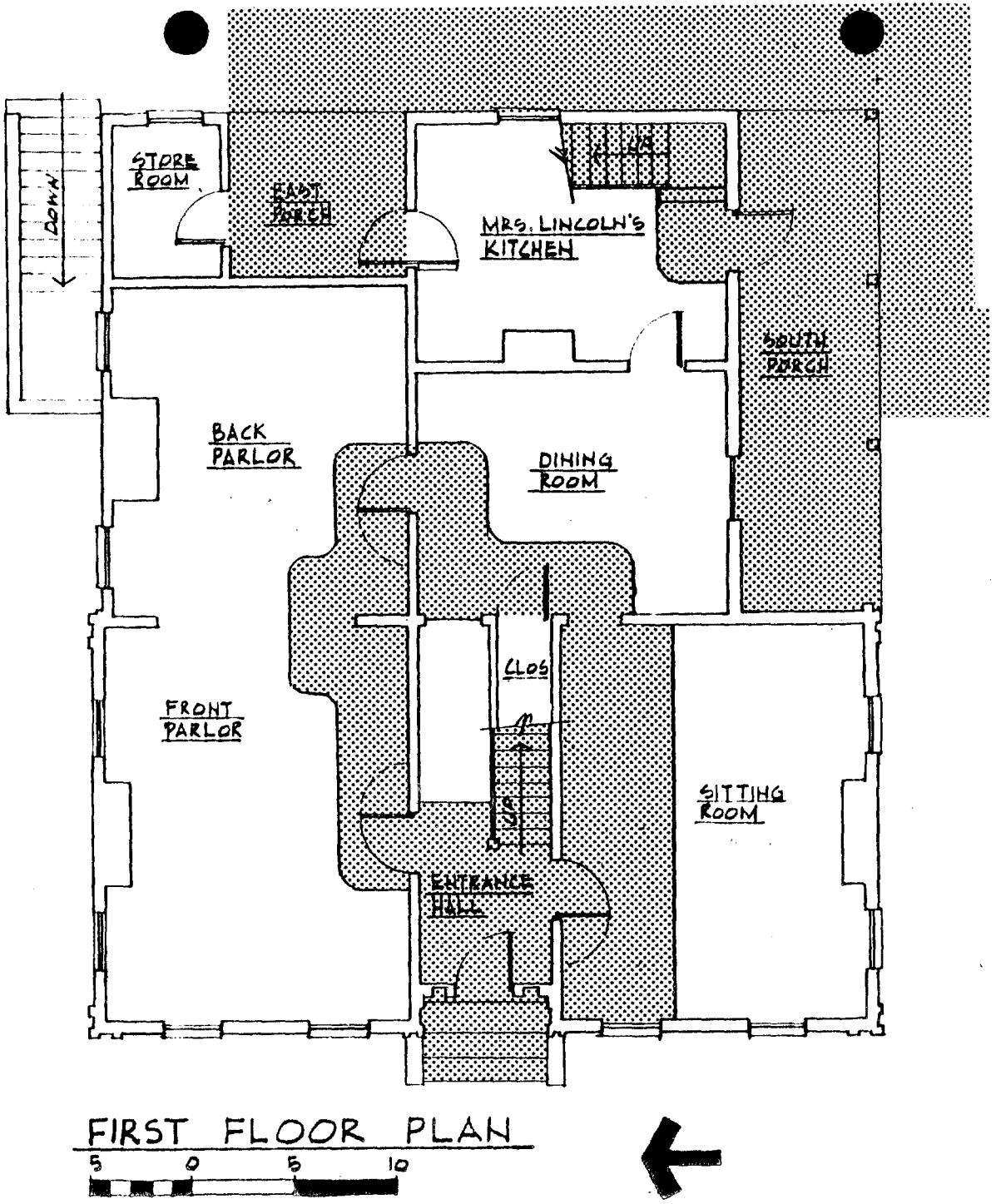
SECOND FLOOR PLAN

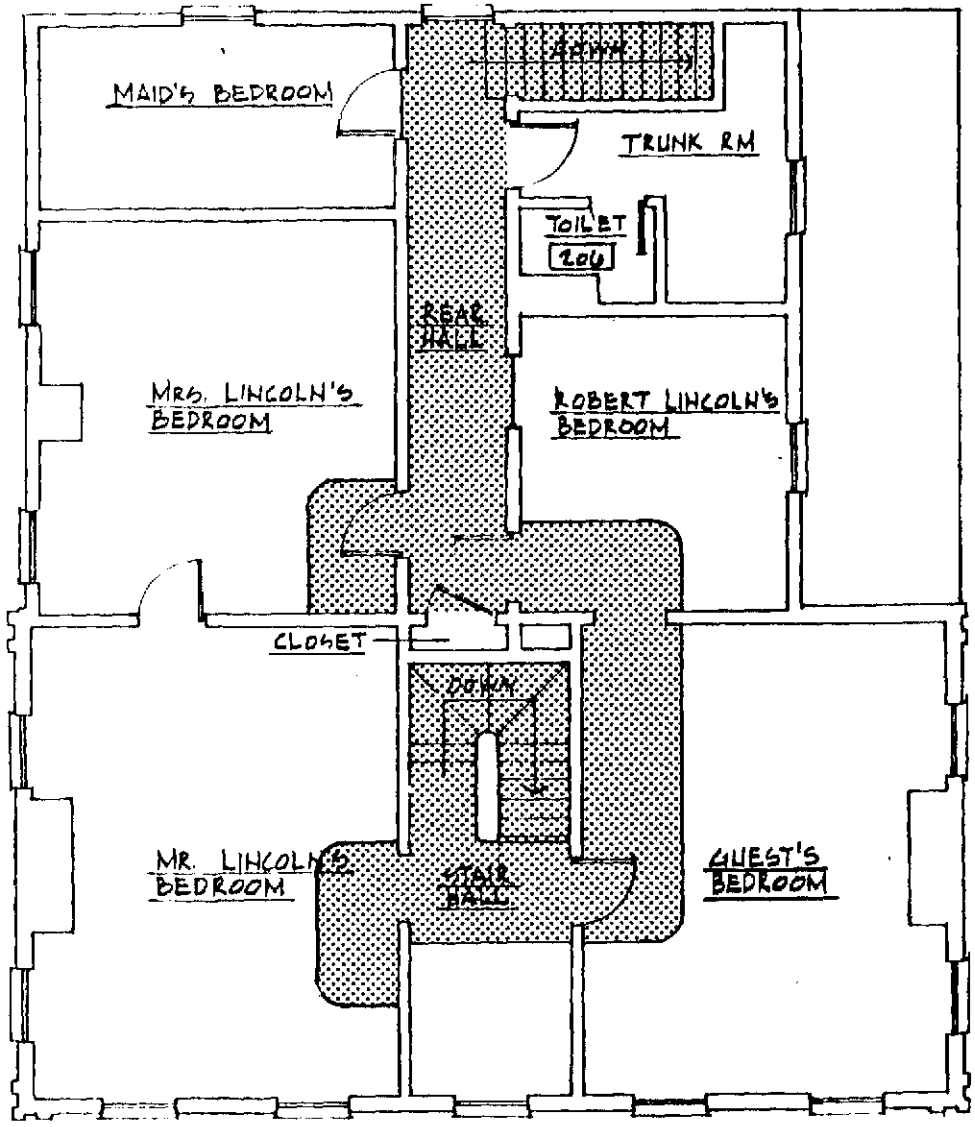
5 0 5 10

1 February 1954

Department of Public Works and
Buildings Construction Drawings

Index Nos. 54-2 and 54-3





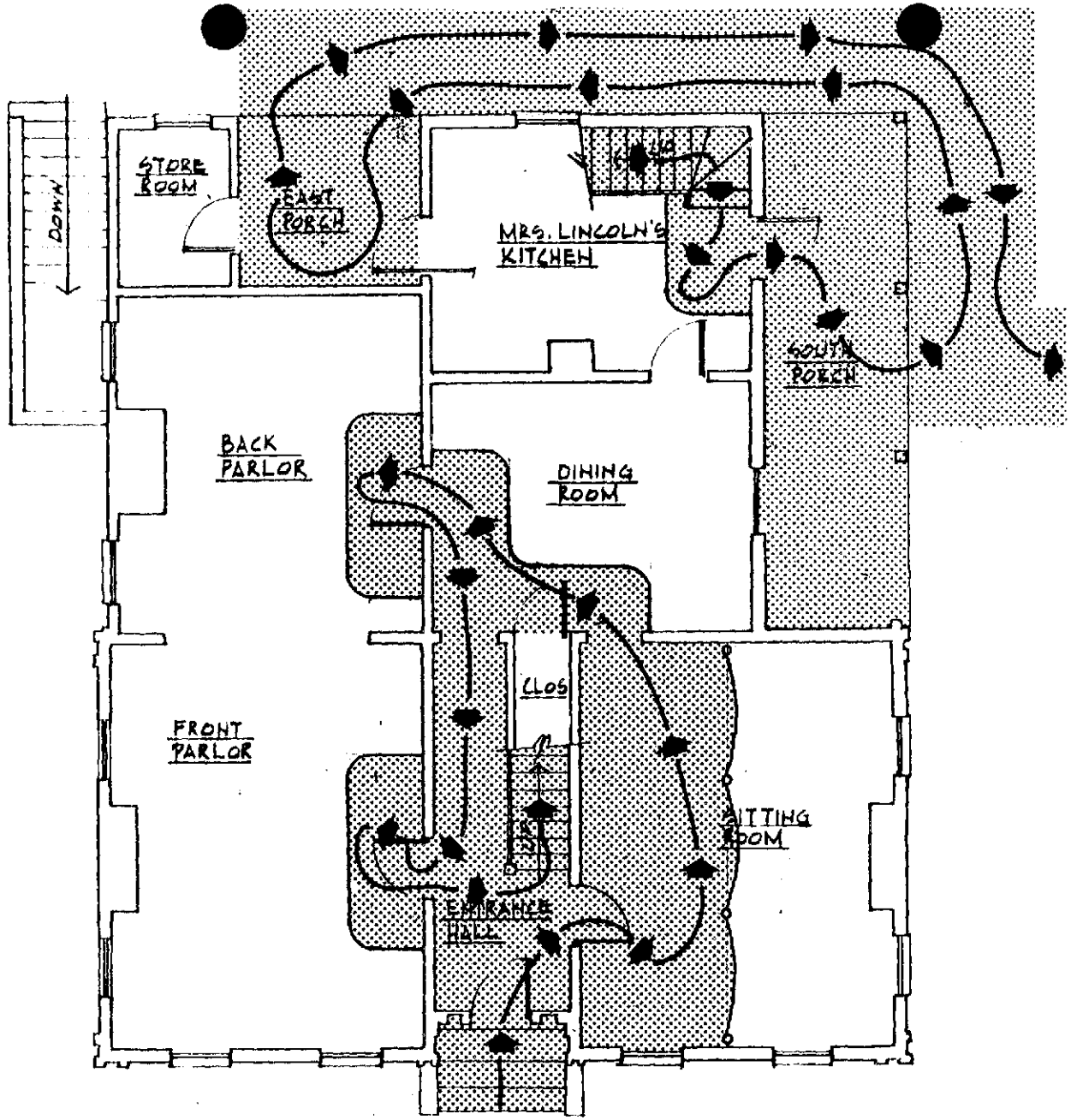
SECOND FLOOR PLAN

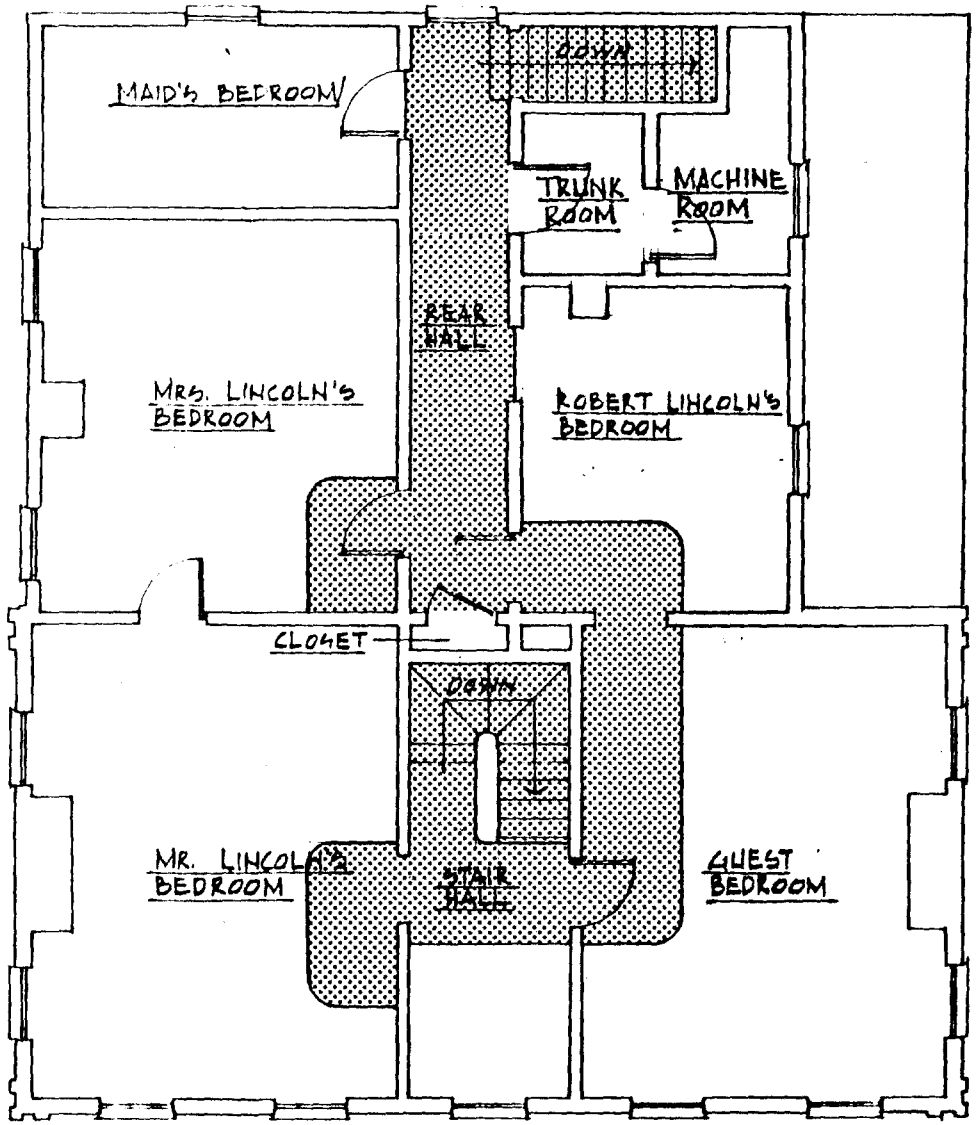
5 0 5 10

29 June 1952

Department of Public Works and Buildings Circulation Study

Index No. 52-10





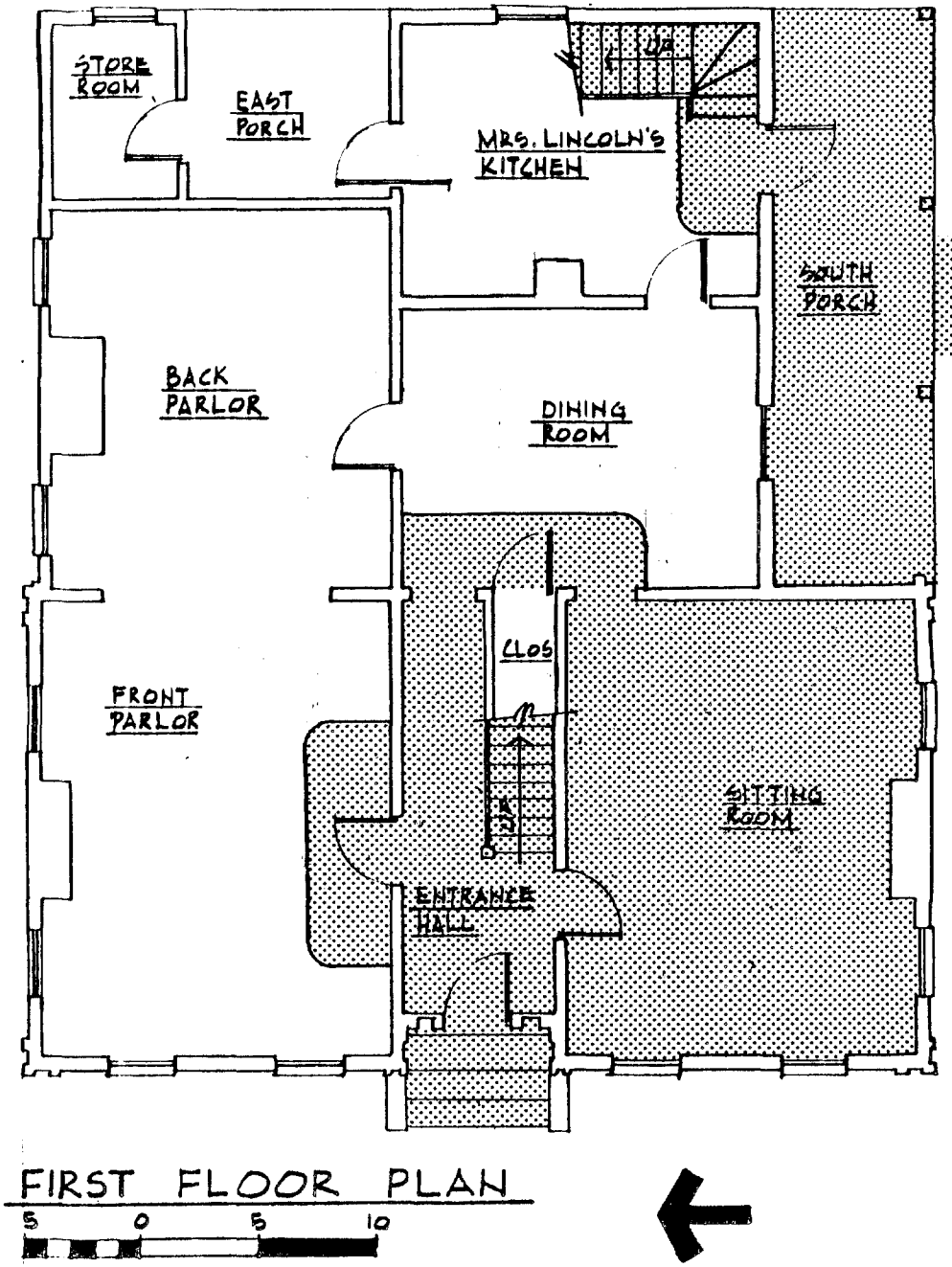
SECOND FLOOR PLAN

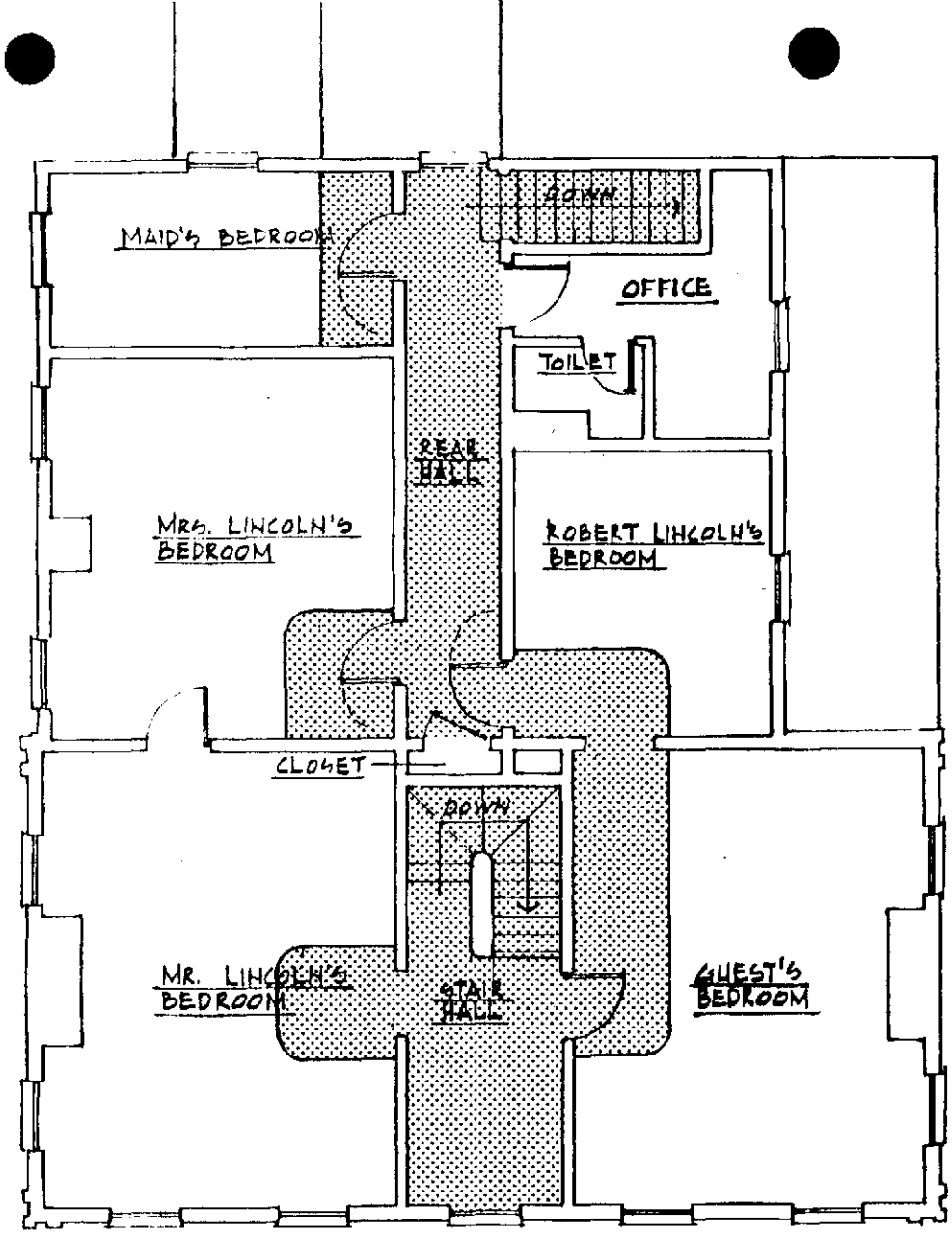
5 0 5 10

1952

Department of Public Works and Buildings Proposed Plans

Index No. 52-1





SECOND FLOOR PLAN

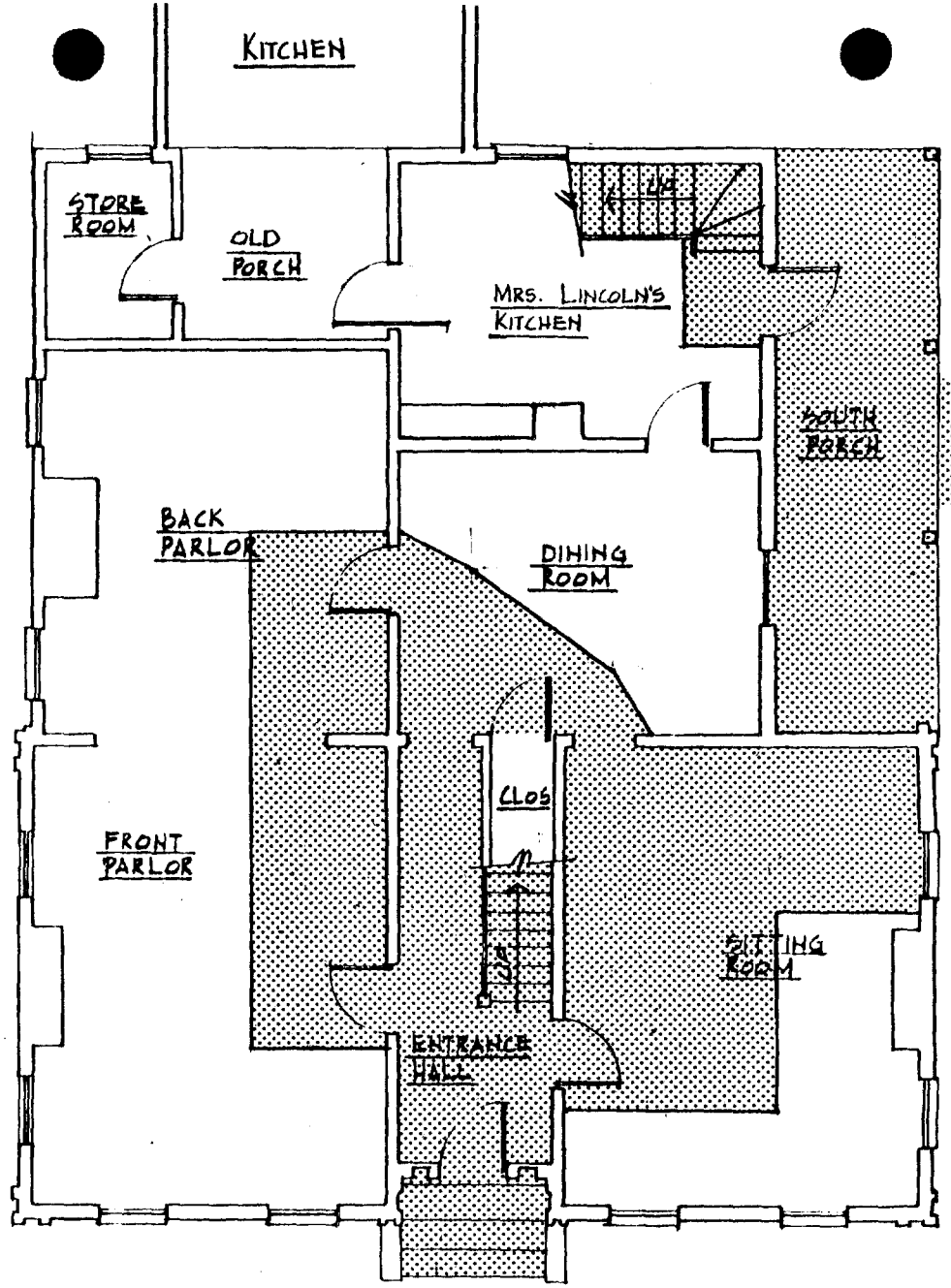
5 0 5 10

1 Nov. 1948

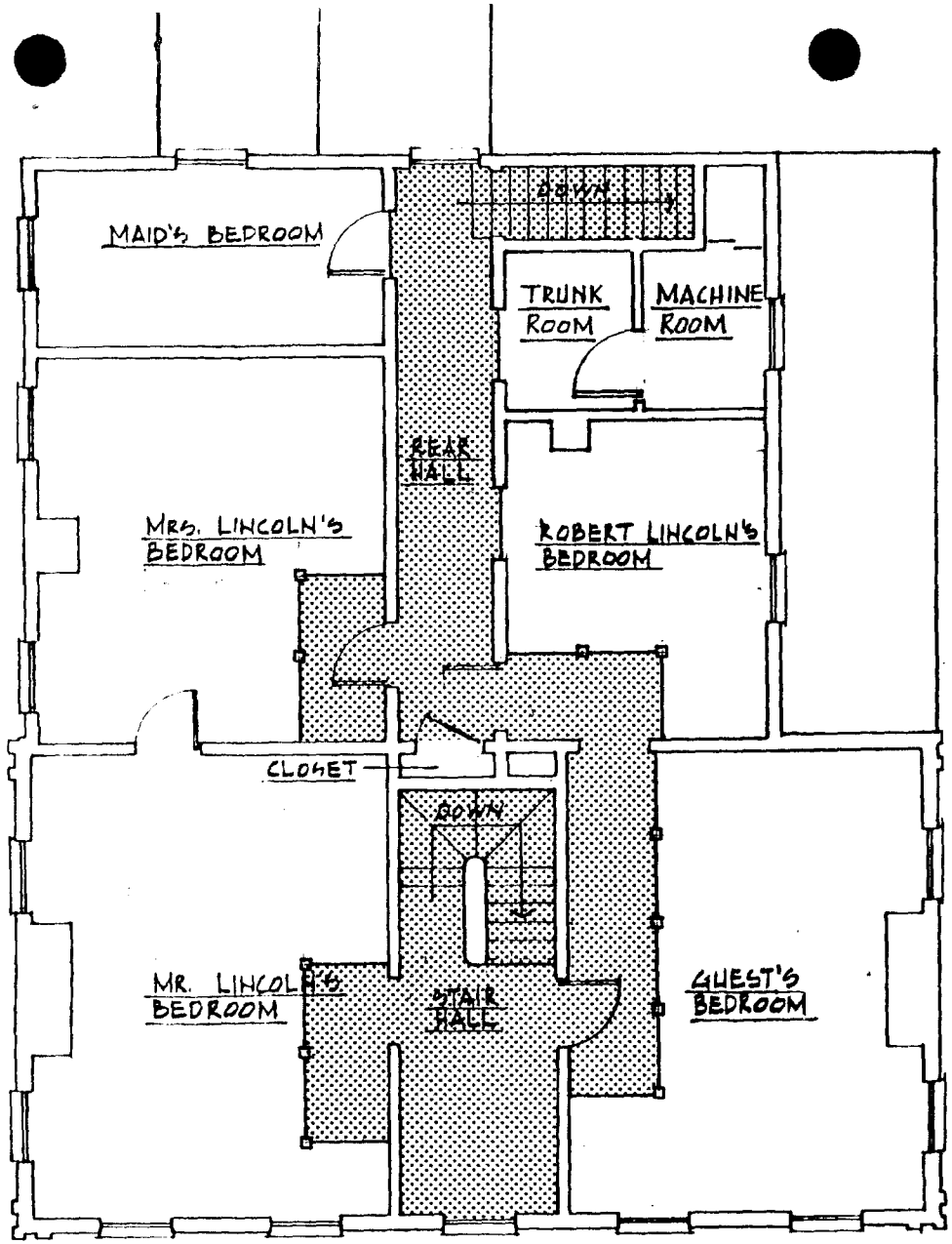
Department of Public Works and Buildings Drawings

Index No. 48-6

Assume First Floor railing has remained unchanged



FIRST FLOOR PLAN



SECOND FLOOR PLAN

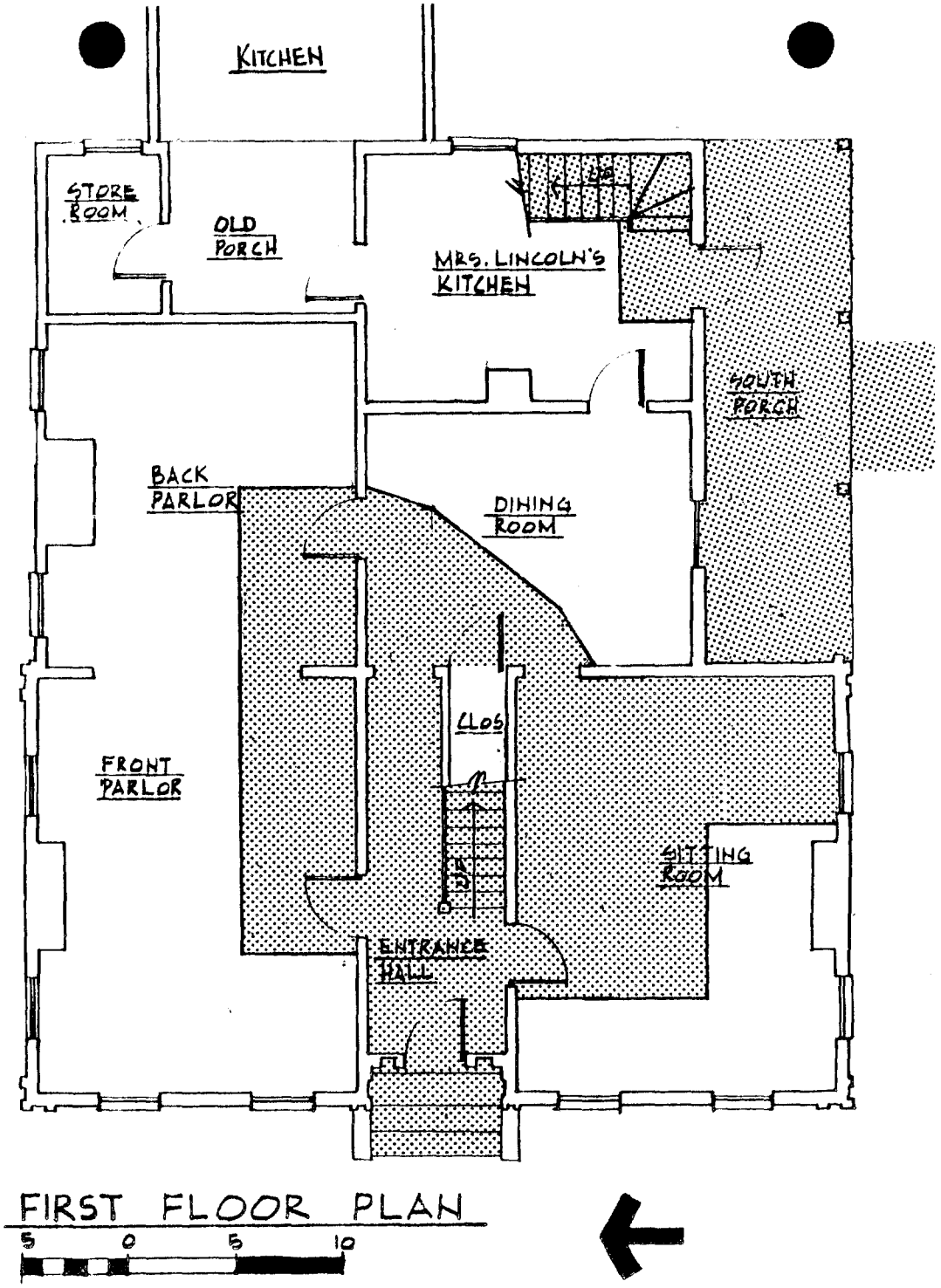
5 0 5 10

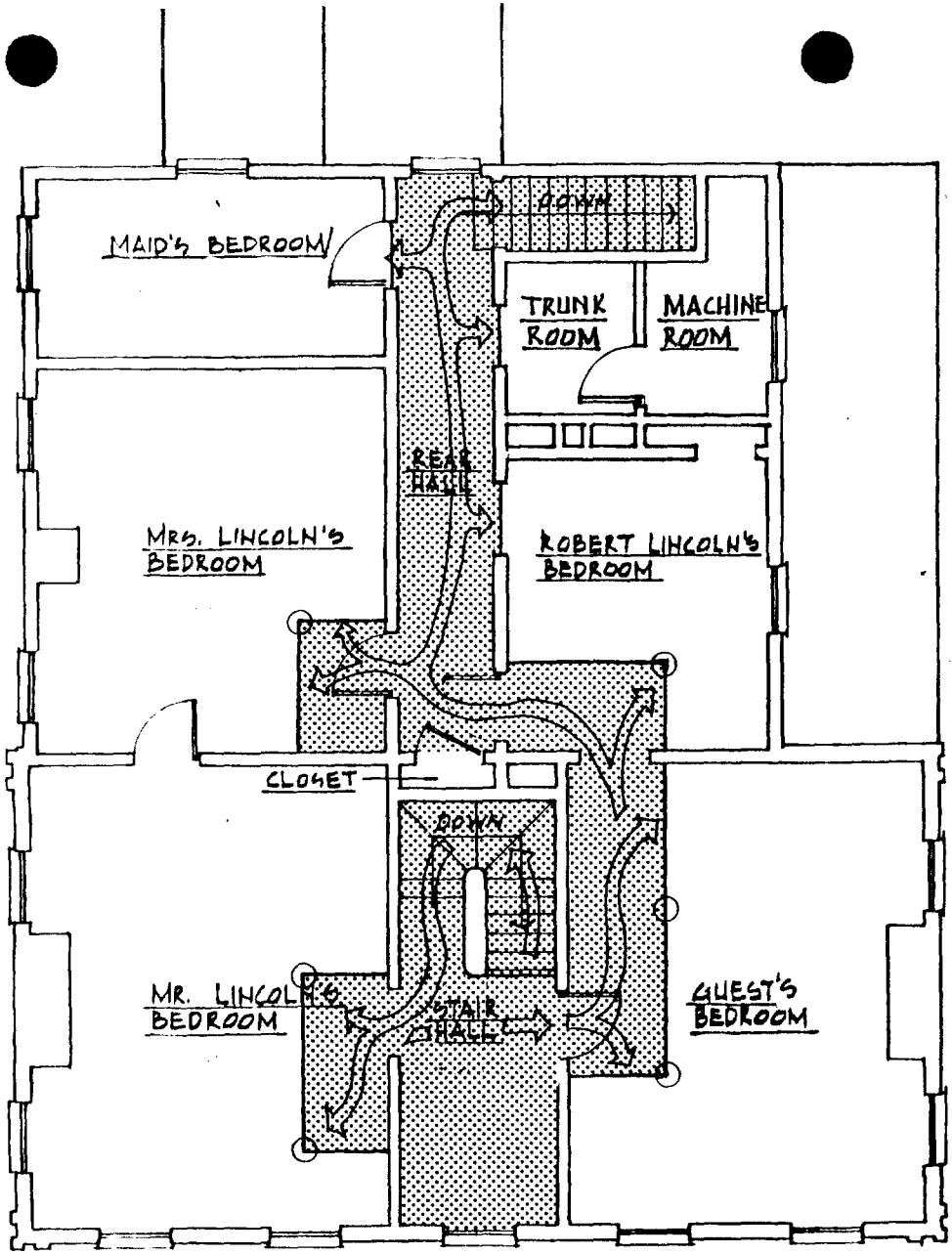
1 Nov. 1948

Department of Public Works and
Building Contract Drawings

Index No. 48-3

Assume First Floor railing has
remained unchanged





SECOND FLOOR PLAN

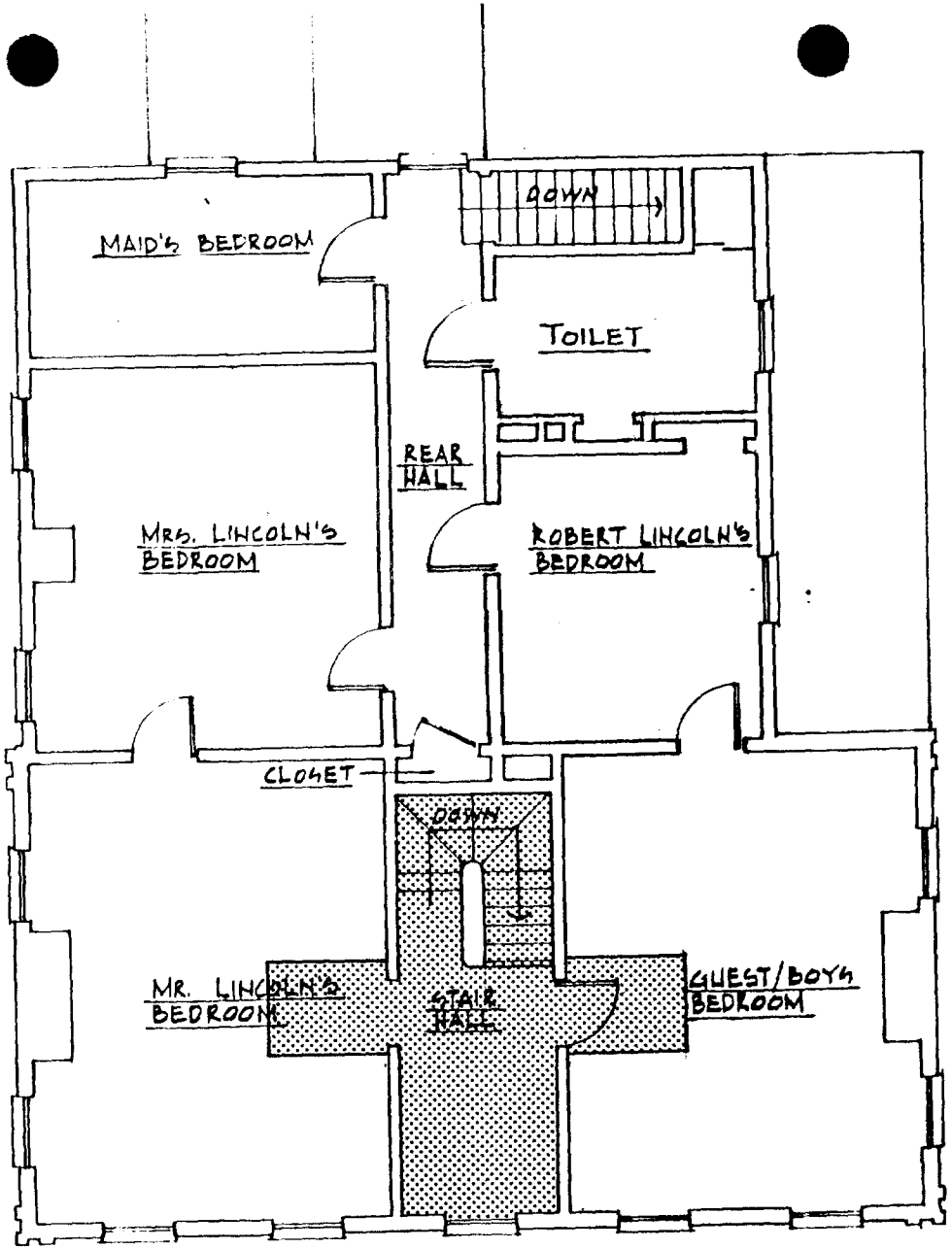
5 0 5 10

16 July 1948

Department of Public Works and
Buildings Proposed Alterations

Index No. 48-1

No proposal made for the First
Floor



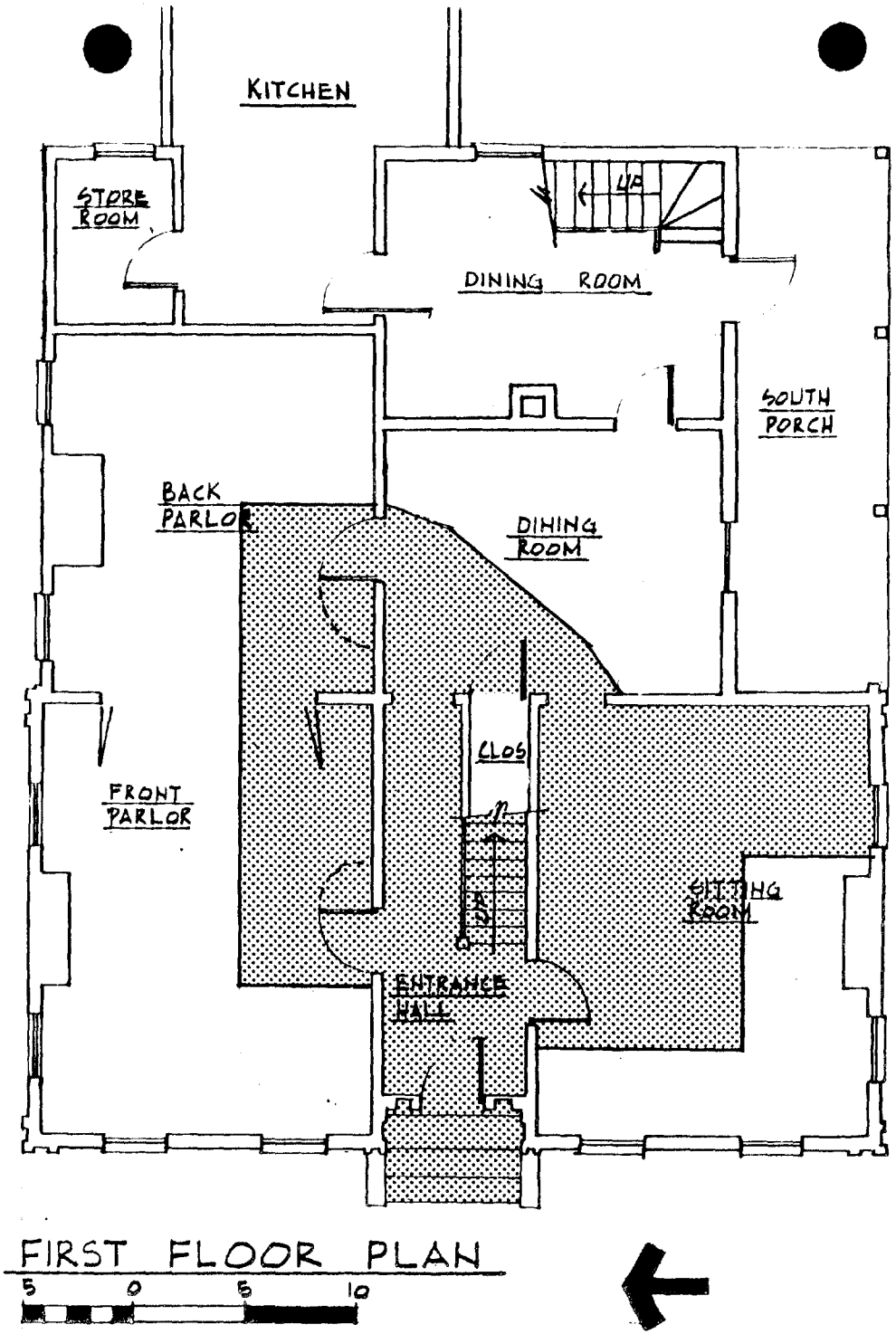
SECOND FLOOR PLAN

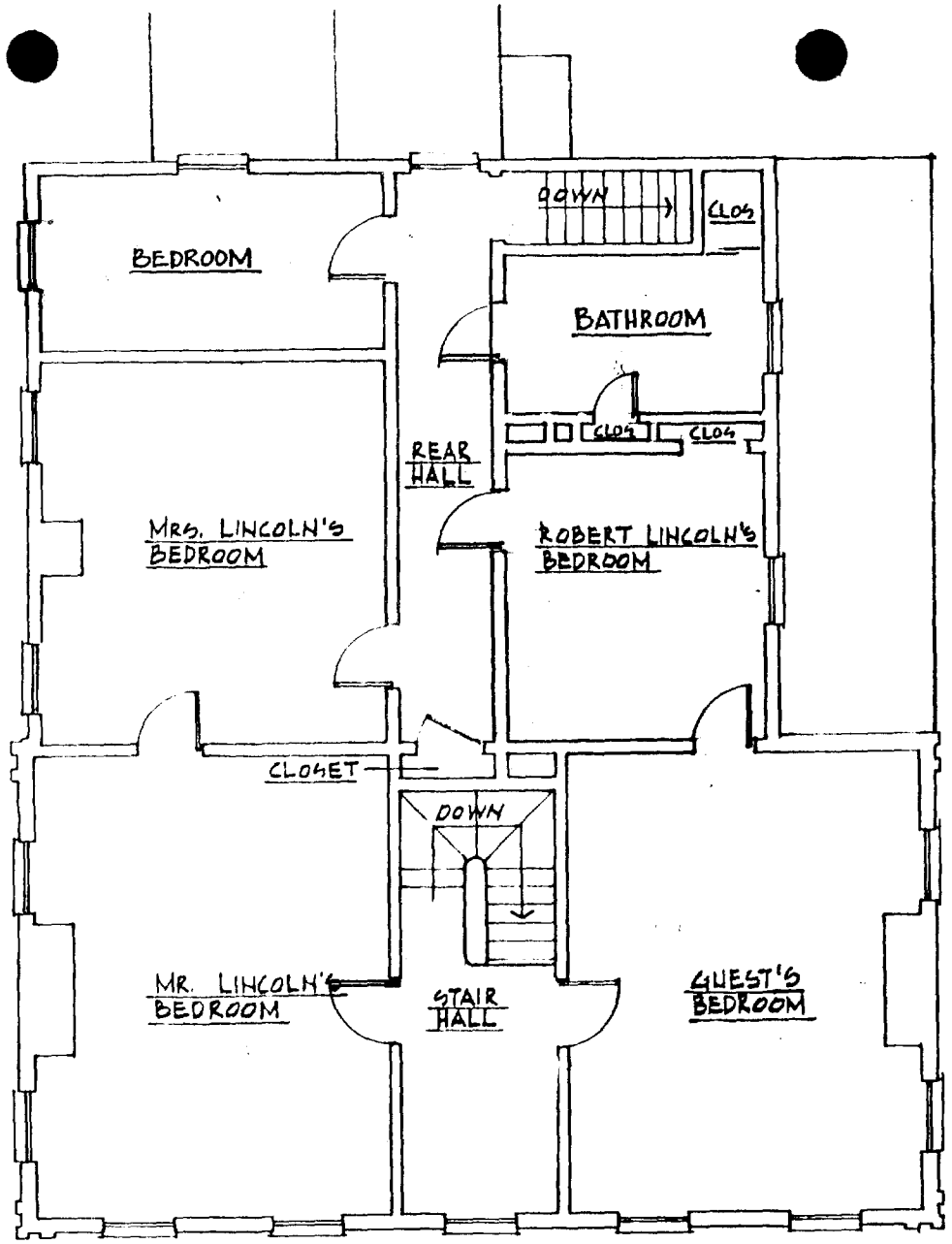
5 0 5 10

1933

Department of Purchases and Construction Drawings

Index Nos. 33-3 and 33-4





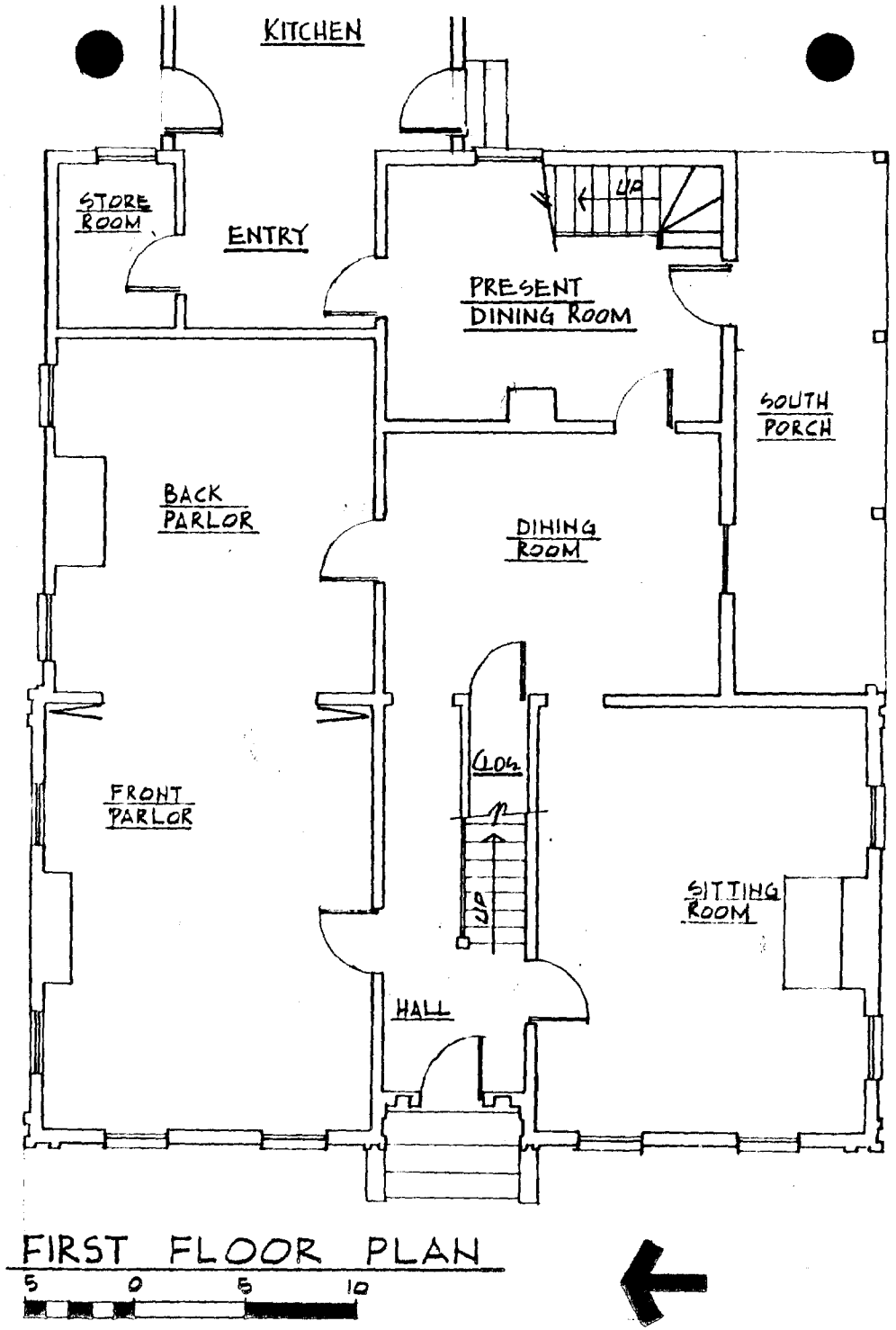
SECOND FLOOR PLAN

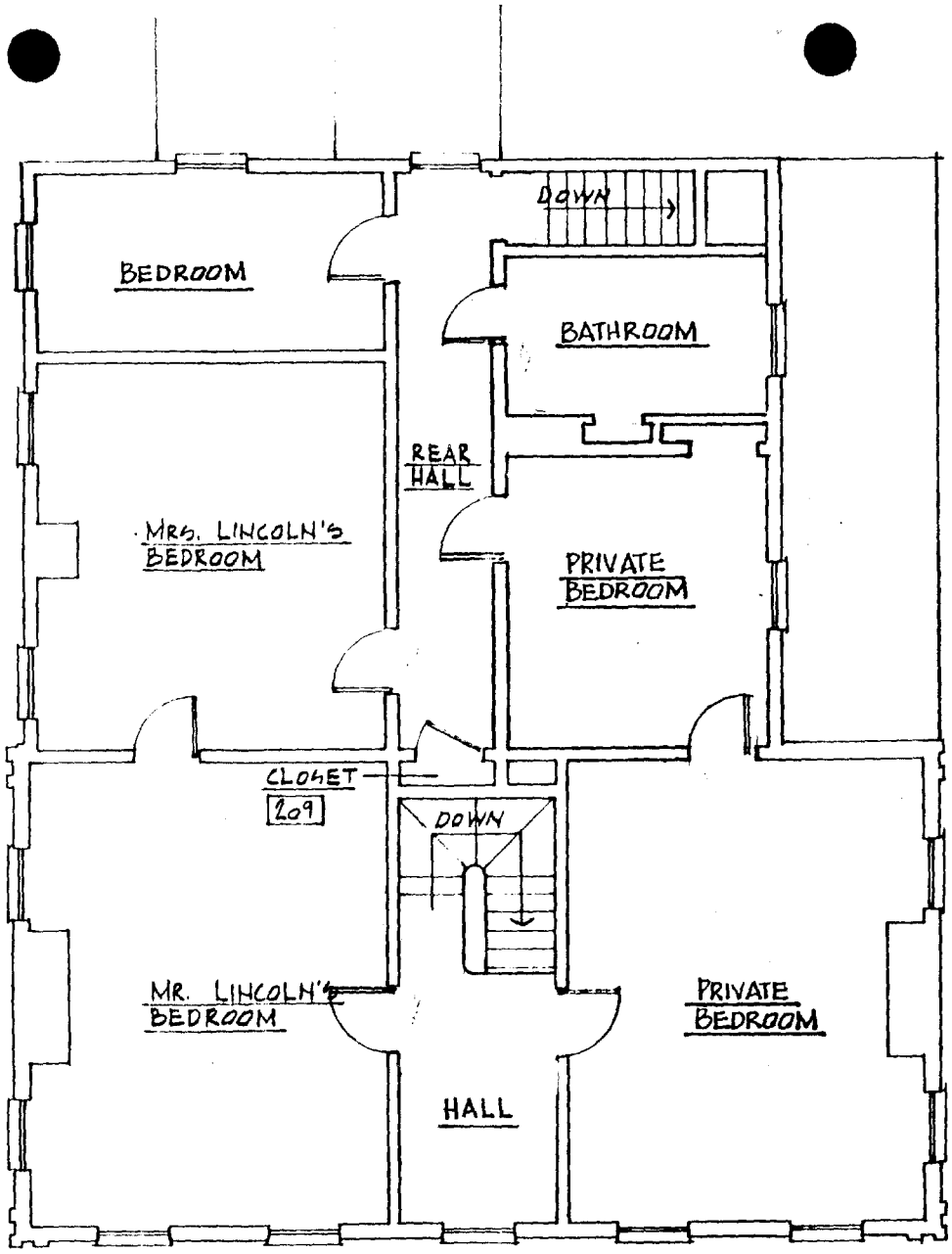
5 0 5 10

1927

Department of Public Works
Measured Drawings

Index Nos. 27-2 and 27-3





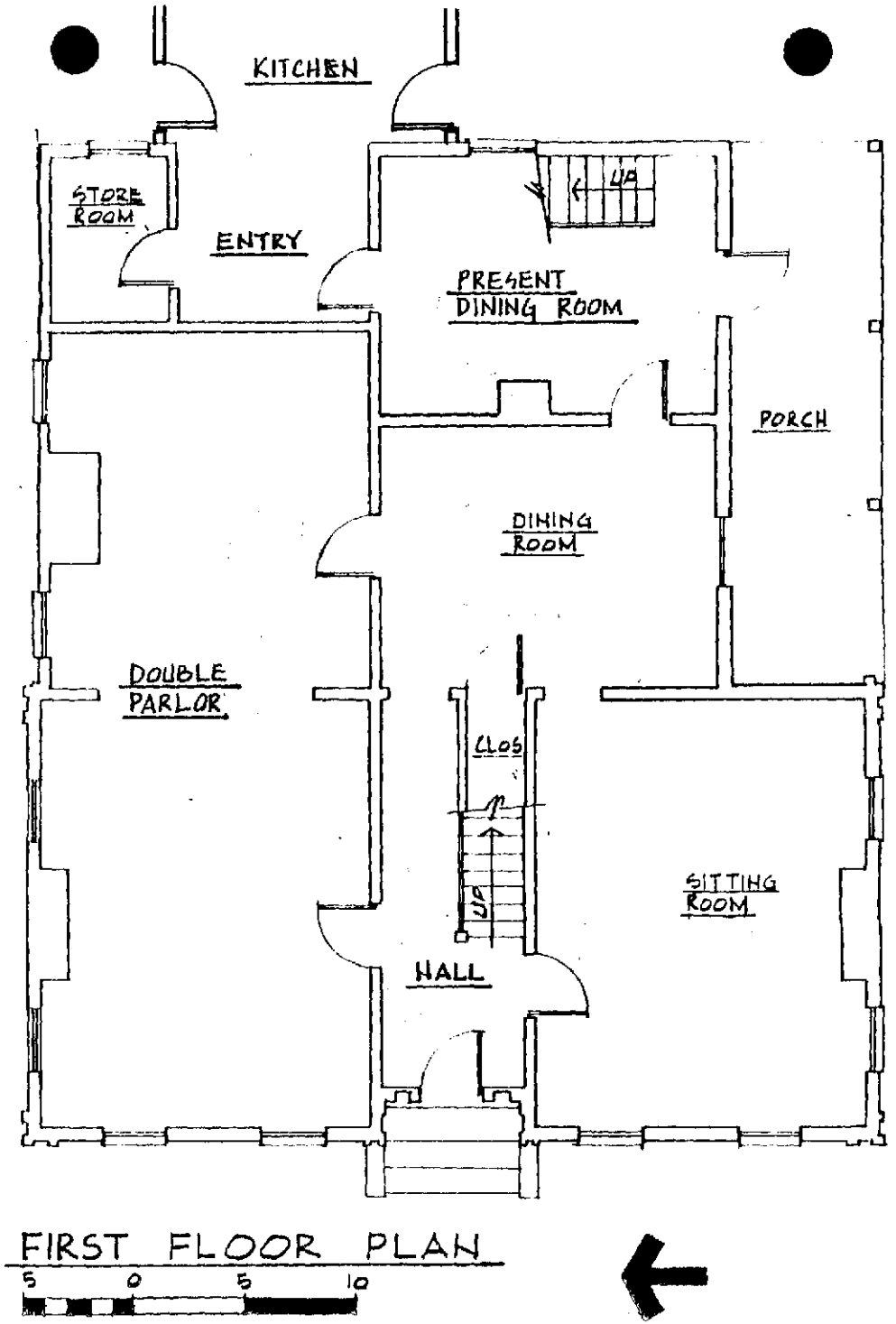
SECOND FLOOR PLAN

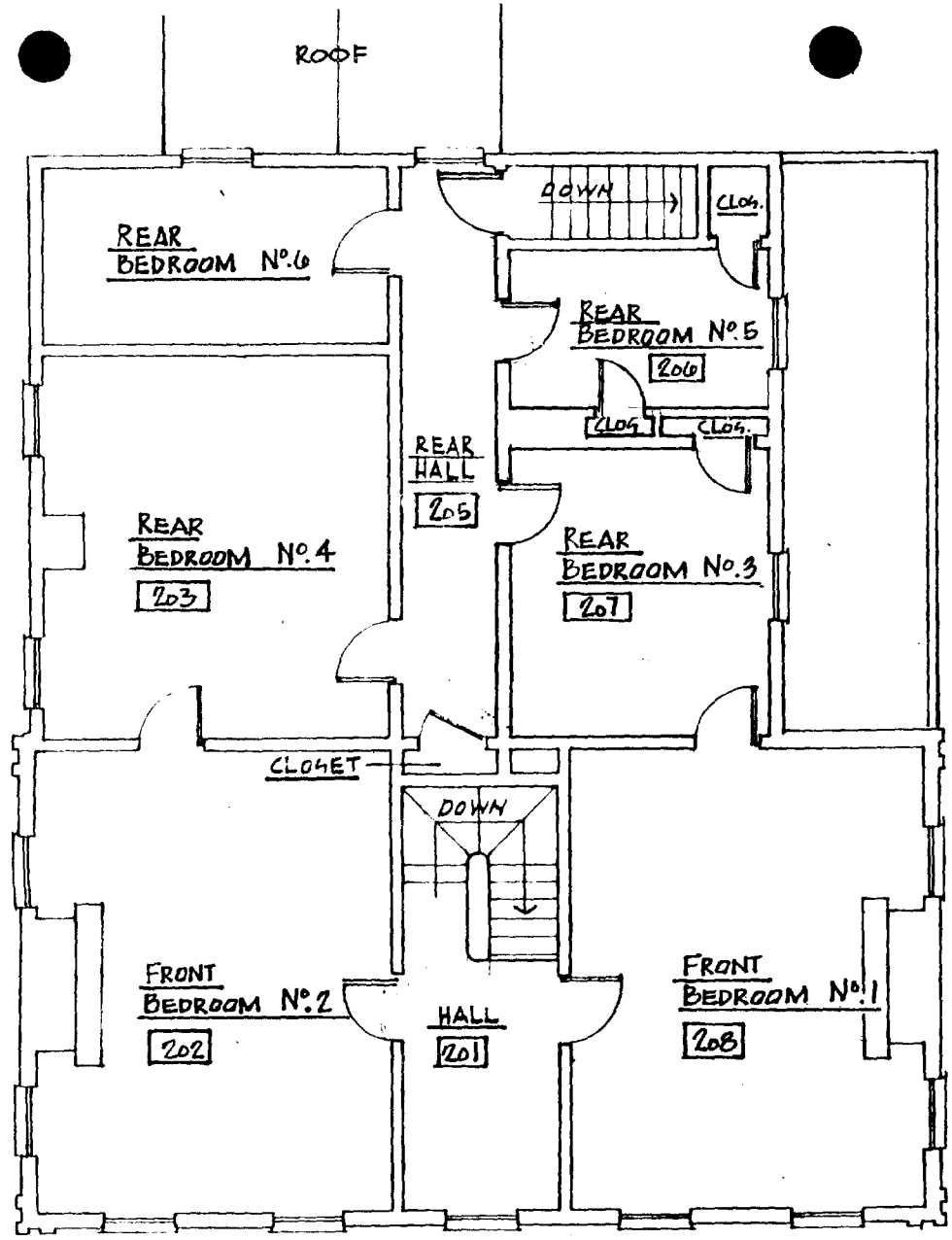
5 0 5 10

1920

Department of Public Works Drawings

Index No. 20-1





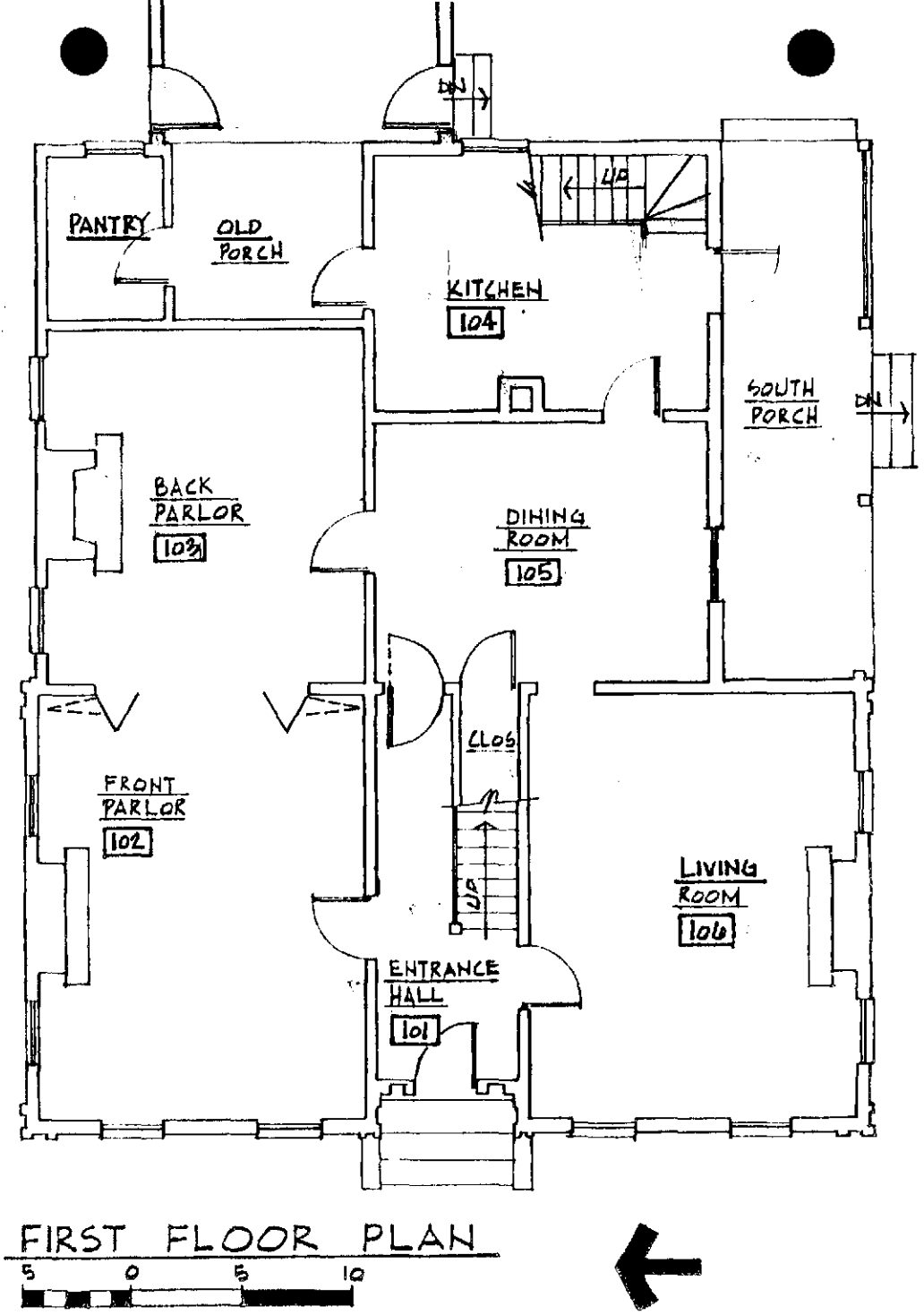
SECOND FLOOR PLAN

5 0 5 10

1888

Bullard Drawings

Index No. 88-1

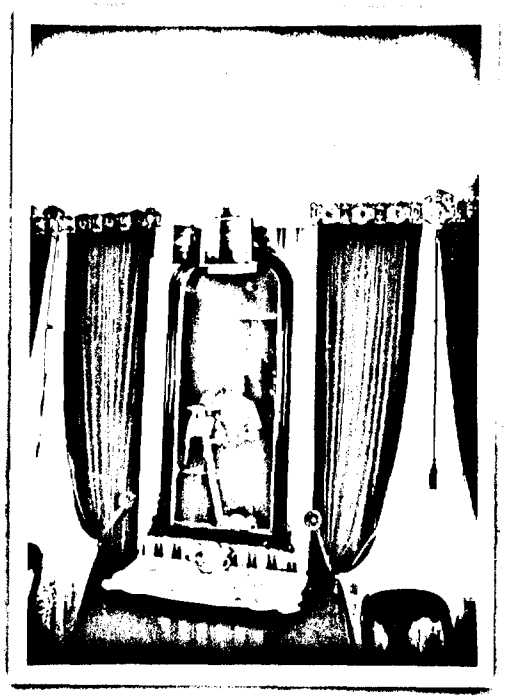


B. Visitor Circulation

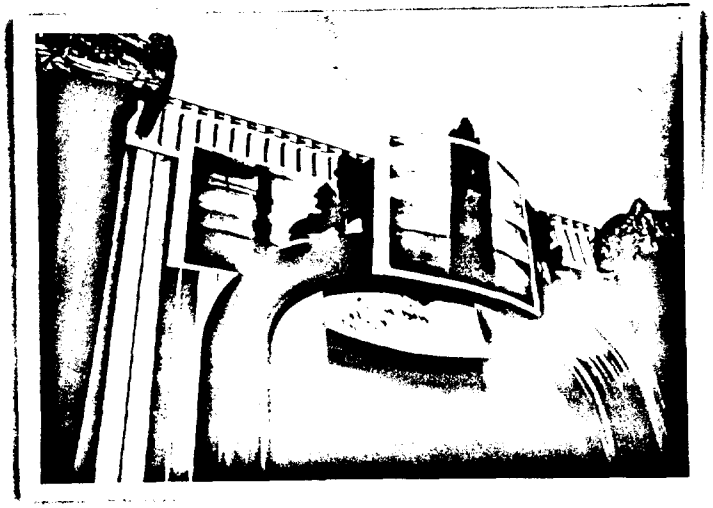
Recorded historic visitor circulation patterns are incomplete and sketchy. The best clues in determining the routing of visitors through Lincoln Home are found in the Historic Drawings.

The following sets of plans represent certain time periods, from the date of that drawing up to the date of the next drawing. Each set of plans can be identified by the date of the drawing, the Architect or Administration responsible for the drawing and the Index No. which corresponds to the Historic Drawings.

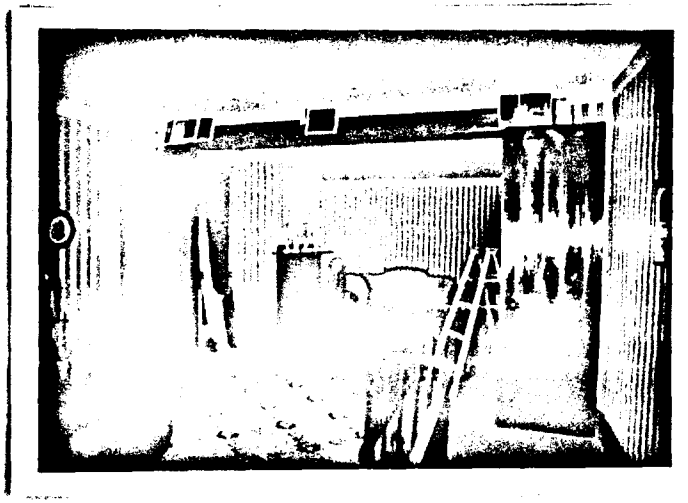
30. Front Parlor, East Wall (101)



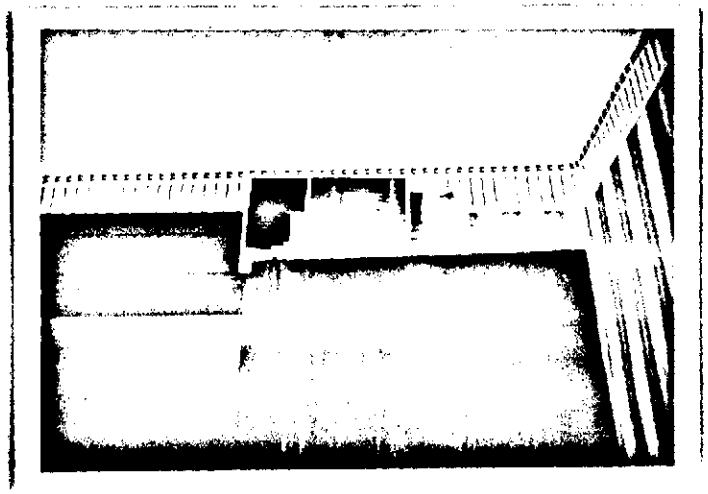
31. Front Parlor, West Wall (101)



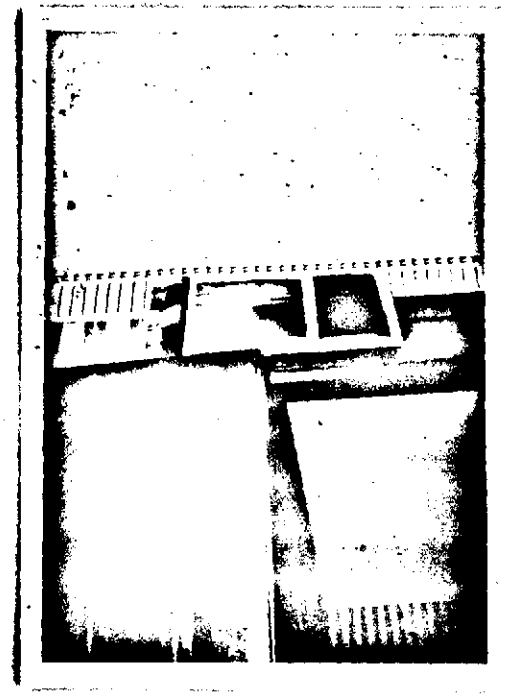
32. Front Parlor, West Wall (101)



33. Front parlor, opening (101)

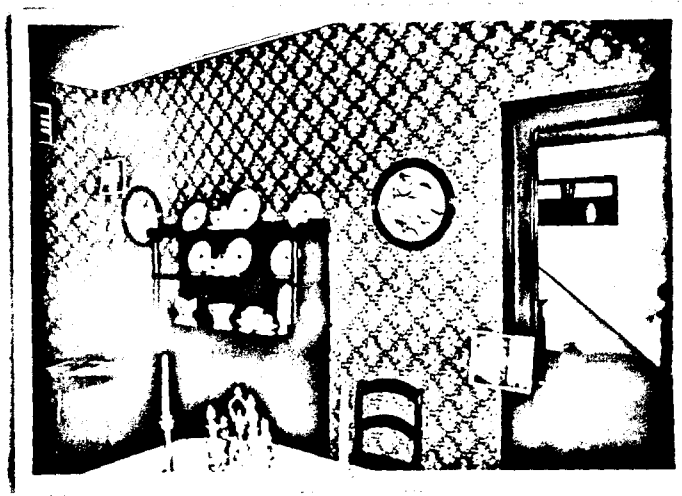


34. Front parlor, opening, South by jamb



35. Front parlor, opening, Northerly jamb

36. Maid's Bedroom/Serving Room, East wall (203)

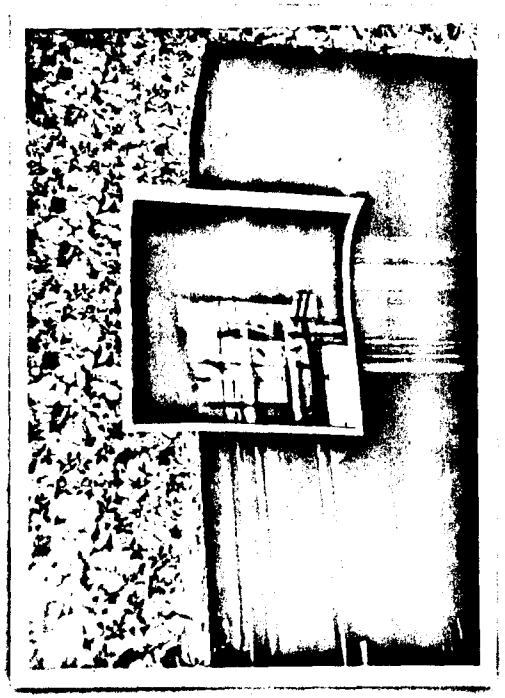


37. Dining Room, East Wall (107)

38. Dining Room, East Wall (107)

39. Dining Room, East wall at door jamb (107)

40. Dining Room, West wall at door jamb (107)

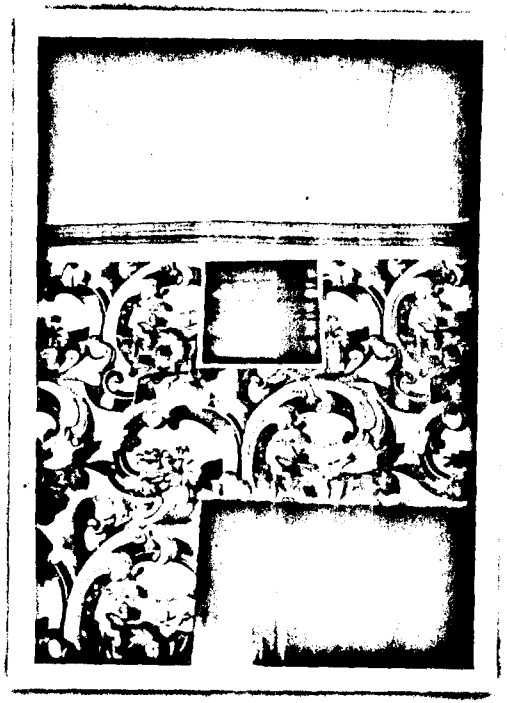


41. Dining Room, West Wall at door jamb (107)

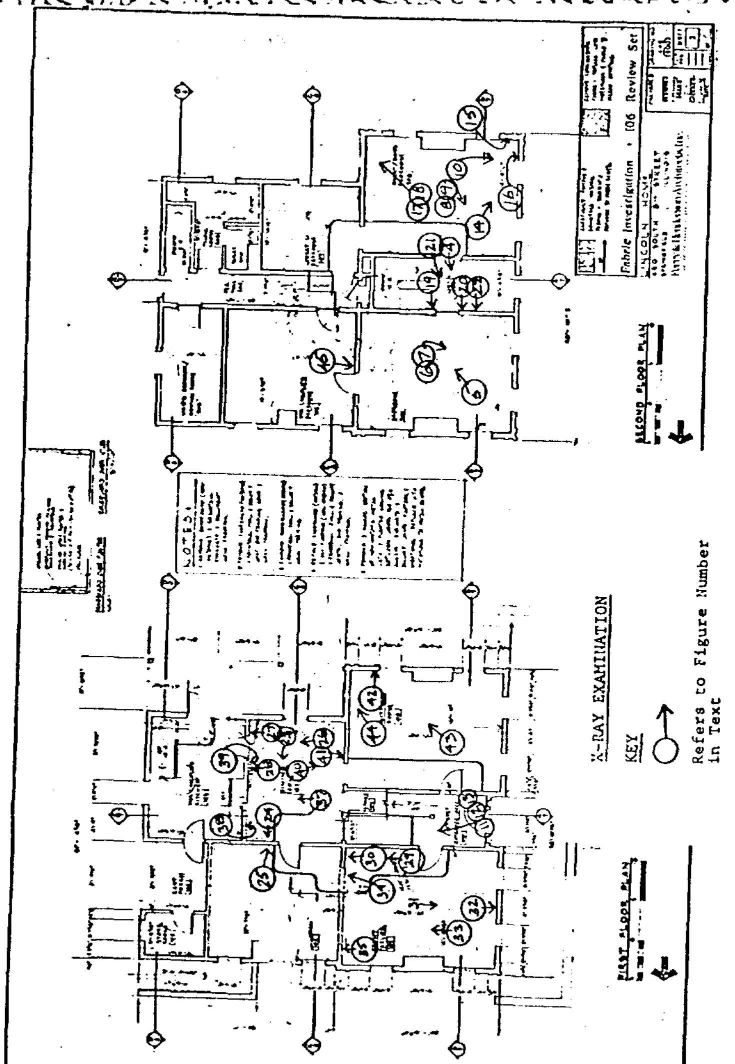
42. Sitting room, South wall, Easterly window (108)

43. Sitting room, East wall (106)

44. Sitting room, close-up of X-rays



45. Mrs. Lincoln's room, West partition, at ceiling (202)



David McLaren Hart & Associates
Architects
77 Washington Street North
BOSTON, MASSACHUSETTS 02114
(617) 723-4654

JOB: LINCOLN HOME
SHEET NO: SPRINGFIELD, ILLINOIS
CALCULATED BY: ______ DATE: 7/31-8/2/79
CHECKED BY: ______ DATE: ______
SCALE: DM Hart

X-RAY INSPECTION

SHOT #	ROOM #	DIRECTION Wl.	Fl.	Cl.	COORDINATES Off Flr.	Off Wall, Jamb	X-From Wall	Y-From Wall	NOTES
1	200	X			34"	@ right jamb, N. wall			
2	↓	X			20"	"		"	
3		X			22"	@ left jamb,		"	
4		X			22"	9" F. W. wall, S. wall			
5	208	X			22"	12" F. door opening, E. wall			
6	↓	X			"	20"	"	"	
7		X			"	26"	"	"	
8	201	X			"	10"	"	, E. wall	
9	100	X			51"	@ right jamb, N. wall			
10	102	X			25"	@ right jamb, E. wall			
11	↓	X			21"	top of opening			
12		X			26"	top of opening		"	
13	107	X			37"	@ right jamb		"	
14	"	X			7'-1	@ N. end of E. wall			
15	204			X			16" F.W.W		
16	↓			X			25" F.W.W		
17				X			39" F.W.W		
18				X			45" F.W.W		
19	207			X			16'-23 FWW		
20	↓			X			20-24 FWW		
21				X			20-33 FWW		
22	208	X			27"	27" F.S. wall, E. wall			
23	↓	X			27"	@ window, S. wall			
24		X			27"	@ corner, W. wall			
25	101	X			@ clg	above S. window, W. wall			
26	↓	X			"		"	"	
27		X			"		"	"	
28	201		X			11'-11" FWW, along S. wall			
29	"		X			13'-11" F.W.W		"	

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JOB: LINCOLN HOME
SHEET NO ____ OF ____
CALCULATED BY ____ DATE 7/31-8/2/79
CHECKED BY ____ DATE ____
SCALE: DM Hart

X-RAY INSPECTION

SHOT #	ROOM #	DIRECTION W1.	DIRECTION F1.	DIRECTION C1.	COORDINATES Off Flr.	Off Wall, Jamb	X- From Wall	Y- From Wall	NOTES
30	201		X			13-3	FWW, along s. wall		
31			X			12'-5			"
32			X				FWW 9'-6	FSW 7"	
33			X					16"	
34			X					26"	
35			X					32"	
36			X					42"	
37			X					52"	
38			X					62"	
39	100			X			FNW 9"	FWW 10'-8	
40				X			16"		
41				X			27"		
42				X			30"		
43				X			55"		
44				X			52"		
45				X			19"	FSW 59"	
46	208		X				9"	FWW 0'6	
47							1'-4		
48							2'-2		
49							3'-0		
50							4'-5		
51							5'-3		
52							5'-11 3/4		
53							6'-6		
54							7'-3	8'-4	
55							8'-1		
56							8'-9		
57							ctr @ light fixture		
58	204		X				N.W. crnr. of doorway		

FORM 7.4 Available from NEBS Inc. Townsend Mass. 01470

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(617) 723-4654

JOB: LINCOLN HOME
SHEET NO ____ OF ____
CALCULATED BY ____ DATE 7/31-8/2/79
CHECKED BY ____ DATE ____
SCALE: DM Hart

X-RAY INSPECTION

SHOT #	ROOM #	DIRECTION W1.	DIRECTION F1.	DIRECTION C1.	COORDINATES Off Flr.	Off Wall, Jamb	X- From Wall	Y- From Wall	NOTES
59	108	X			7'-9	@ S. jamb, east wall			
60	107	X			8'-0				
61	"	X			8'-2	@ N. wall, N. of jamb			

FORM 7.4 Available from NEBS Inc. Townsend Mass. 01470

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JOB LINCOLN HOME
SHEET NO SPRINGFIELD, ILLINOIS
CALCULATED BY ____ DATE 4/9-4/10/80
CHECKED BY ____ DATE ____
SCALE D McHart

X-RAY INSPECTION

SHOT #	ROOM #	DIRECTION Wl.	DIRECTION Fl.	DIRECTION Cl.	COORDINATES Off Flr.	COORDINATES Off Wall, Jamb	COORDINATES X-From Wall	COORDINATES Y-From Wall	NOTES
101	100	X	north		@ ceiling	8'-6 F.W. wall			
102	100	X	north			44" F.E. jamb of Door			12" down from ceiling
103	100			X		15" F.N. wall	10'-8 F.W.W.		(at opening header)
104	101	X	west		12" F. ceil	18" F.S. wall			
105	↓	X	↓		6" F. ceil	@ S. jamb			
106		X			6" "	22" F.S. wall			
107		X			8" "	8' F.S. wall			
108		X			8" "	21" F.N. wall			
109		X			8" "	30" F.N. wall			
110	↓	X	↓		8" "	26" F.N. wall			
111	203		X				F.W. wall 48"	F.S.W. 14"	
112	↓		X				"	25"	
113	↓		X				"	35"	
114			X				"	45"	
115	201	X	south		6'-0	1'-10 F.W. jamb of door			
116	↓	X	↓		6'-10	"			
117		X			8'-6	7" F.E. jamb of door			
118	↓	X	↓		9'-4	"			
119	203	X	South		43"	17" F.W. wall			
120	203	X	east		1'-7"	11" F.S. jamb of window			
121	108	X	south		48"	11" F.W. wall			
122	108	X	east		ceiling	2'-2 F.S.W.			
123	108	X	east		2'-2	2'-2 F.S.W.			
124	108	X	east		2'-2	58" F. edge of door jamb			
125	108	X	east		2'-2	48" F.S.W.			
126	109	X	east		2'-2	51" F.S.W.			
127	108	X	south		@ sill	@ east jamb			
128	102	X	south		7'-2	@ east jamb			
129	102	X	south		7'-6	12" e. of e. door jamb			

FORM 224 Available from NEBS Inc. Townsend, Mass. 01470

David McLaren Hart & Associates
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77 Washington Street North
BOSTON, MASSACHUSETTS 02114
(617) 723-4654

JOB LINCOLN HOME
SHEET NO SPRINGFIELD ILLINOIS
CALCULATED BY ____ DATE 4/9-4/10/80
CHECKED BY ____ DATE ____
SCALE D Mc Hart

X-RAY INSPECTION

SHOT #	ROOM #	DIRECTION Wl.	DIRECTION Fl.	DIRECTION Cl.	COORDINATES Off Flr.	COORDINATES Off Wall, Jamb	COORDINATES X-From Wall	COORDINATES Y-From Wall	NOTES
130	108	X	south		8'4	7" e. of e. jamb of door			
131	107	X	east		7'4	7" f. N. door jamb			
132	107	X	"		7'10	5"	"		
133	107	X	"		"	19"	"		
134	107	X	"		"	@ S. jamb			
135	107	X	"		8'5	@	"		
136	101								
137	101		X			6' F. N. wall Room 202			@ door opening in 202
138	101		X			"			6" to east
139	101		X			64"	"		"
140	101		X			6' F. N. wall 202.			6" to west
141	101	X	opening		@ ceiling	6'	"		
142	202	X	west		8'3	5'6 F.S.W.			
143	200	X	north		53"	33" F.W.W.			
144	200	X	"		62"	"			
145	200	X	"						
146	200	X	"		62"	31" F.W.W.			

FORM 224 Available from NEBS Inc. Townsend, Mass. 01470

Interim Historic Structures Report -
Architectural Data Section
(Preliminary Surveys/Schematic Design Services)
Lincoln's Home
Lot 8, Block 10
Lincoln Home National Historic Site
Springfield, Illinois

Ferry and Henderson Architects, Inc.

November 10, 1980
Project Number SME78-810

MECHANICAL EXHIBITS

A	-	Letter from John E. Hunter	4 pages
B	-	Psychrometric Chart	1 page
C	-	Air Conditioning Sketches	3 pages
D	-	Humidifier	2 pages
E	-	Heating and Cooling Calculations	10 pages

EXHIBIT A
(1)

United States Department of the Interior

NATIONAL PARK SERVICE
Federal Building, Room 474
100 Centennial Mall North
Lincoln, Nebraska 68508

REPLY REFER TO:
D6215 MWR(MI)

April 27, 1978

Memorandum

To: Associate Regional Director for ~~Planning~~ and Resources Preservation, Midwest Region
To the attention of: Randy Biallas

Through: Associate Regional Director for Operations, Midwest Region

From: Staff Curator, Midwest Region

Subject: Climate control for Lincoln's Home

In response to your telephonic request of April 19, I am sending you Xerox copies of several journal articles and pamphlets on the topic of controlling the environment in historic houses and museums. Except as may be noted on certain copies, all of this material is for your permanent retention and use in planning the work at LIHO. Additional copies of all titles can be obtained from this office upon request. Moreover, many of the titles referred to in the bibliographies of the enclosed articles can be made available in Xerox copy form if needed.

For the most part, the authors of the enclosed works agree on what constitutes the proper environment for museum objects. However, if the reader is not familiar with the arguments and considerations put forth by these authors, he may be confused. In the remainder of this memorandum I shall attempt to reduce these arguments into the form of a recommendation or specification which you can follow.

The three most important factors to be considered when talking about museum climate are: relative humidity (RH), temperature, and air pollution. I believe that we can establish pretty firm standards for temperature and air pollution; that leaves only RH as a point of discussion.

All of the enclosures state that, except in arid climates, the outside limits of relative humidity should be a minimum of 45% and a maximum of 65%. Within that range there will be a particular RH which

EXHIBIT A
(2)

constitutes the optimum RH for any given museum or historic house. Furthermore, all the authors agree that, no matter what RH is selected, it ought to be maintained constantly, year round, regardless of the season.

Selection of the optimum RH should be based mainly on two factors: (1) the proper RH for that class of material either in greatest abundance in the collection or which would suffer the most if the wrong RH were maintained and (2) the mean RH which has prevailed in the past. So far as the classes of materials at LIHO are concerned, wood (in furniture) probably is more abundant than any other material and, with the possible exception of paper, is the material most likely to suffer from improper RH. (For your purposes, you can safely provide the same RH for both wood and paper.) I have no idea what the mean RH at LIHO has been in the past, although it is likely to have been somewhat on the high side.

Selecting the proper RH for wood will be relatively easy at LIHO, its RH range is the same as that already expressed: 45% to 65%. Below 45% excessive drying occurs, resulting in cracking, checkering or loss of finishes, and loosening of joints. Above 65%, mold can develop and finishes can be softened. Beyond either extreme, the net result is deformity of the piece and the risk of permanent damage. Maintenance of a stable RH within the expressed limits will prolong the life of the furniture.

Selecting the proper RH to maintain in the Home based on mean prevailing RH will not be so easy. Weather records will have to be consulted. The staff should be consulted to learn their impressions of the RH conditions during each season of the year and to learn if any particular problems have been noted with the furniture which could be attributed to excessively low or high RH. The midpoint of the RH range acceptable for wood is 55%, i.e., halfway between 45% and 65%. If the mean yearly RH at LIHO tends to be above 55%, the optimum RH selected probably ought to be between 55% and 65%. If the mean yearly RH tends to be below 55%, the optimum RH selected probably ought to be between 45% and 55%. If the optimum RH is selected on the basis of the existing climate, one avoids further stress on the furniture by maintaining it at a constant RH similar to that to which it has become accustomed. In practice, of course, the optimum RH is based both on existing climate and on the needs of the material to be protected. In this instance, I believe that a RH near to the 55% mark is likely to be easiest to achieve and in the best interests of the collection.

EXHIBIT B

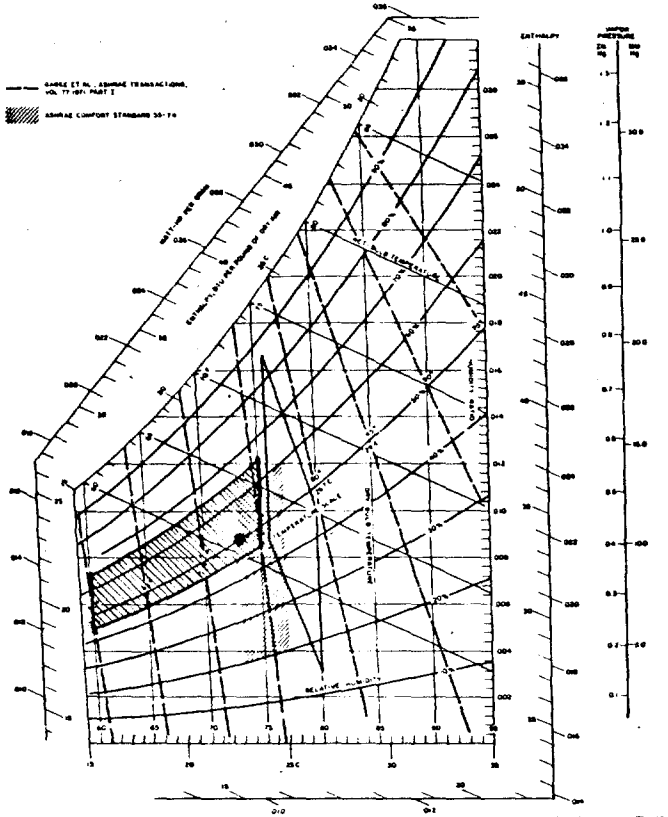
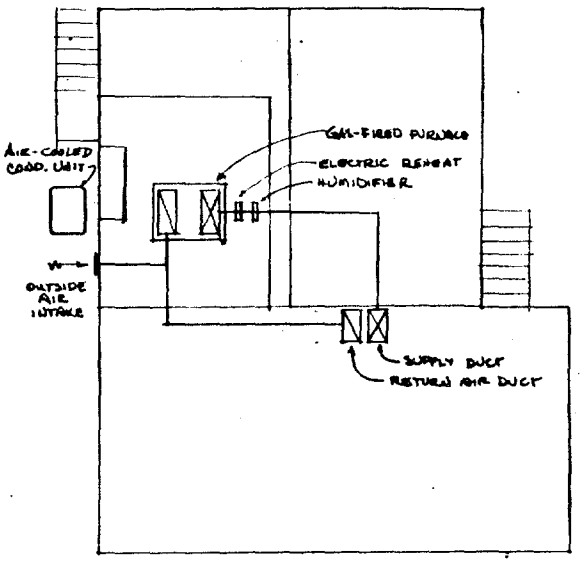


Fig. 16 New Effective Temperature Scale (ET*)

EXHIBIT C

RALPH HAHN AND ASSOCIATES
CONSULTING AND DESIGN ENGINEERS, INC.

DSGN. GFH DATE 1/28/80 PROJECT LINCOLN'S HOME PROJ NO. ____
CKD. ____ DATE ____ SHT. (1) OF 3



BASEMENT PLAN

1/8 SCALE

1320 SOUTH STATE STREET / SPRINGFIELD, ILLINOIS 62704 / TELEPHONE 217 / 544-0721
TWX 910-242-0563

It is not enough just to maintain the RH between two extremes. It is essential that the RH selected be maintained as stable as possible. By "stable" I mean the RH should not vary more than 5% in either direction from the optimum RH over the course of a year. Moreover, the RH should not vary more than 3% in either direction from the optimum RH over the course of a 24-hour period. If variation beyond this ideal level of stability is necessary (as may be the case due to changing seasons), the change from the optimum RH either upward or downward should be controlled so that it does not occur rapidly. For example, if 55% were selected as the optimum RH, and it were necessary to go up to 60% in the summer, the change should take place at a rate not to exceed 1-2% per month; the change back to 55% should be at the same rate. Changes below 55% should be similarly slow.

Please understand that I am not suggesting that one should change RH seasonally over the course of a year. I am simply saying that if such changes are unavoidable, they must at least occur slowly. This rule applies to any changes, whether over a 12-month period, over a month, a week, or a day: the shorter the time period for the change, the less rapid it must be and the less dramatic it must be.

Thus, we can say that the ideal climate inside Lincoln's Home should be:

Relative Humidity: Maintained constantly, without regard to season or time of day, as close as possible to an ideal RH (possibly 55%) within the range of 45% to 65%. Annual variations not to exceed 5% on either side of the ideal, such variations to occur at a rate not to exceed 1-2% per month. Daily fluctuations not to exceed 3% on either side of the ideal during a 24-hour period.

Temperature: Maintained constantly, without regard to season or time of day, as close as possible to an optimum temperature (normally 68° F) within the permissable range of 60° F to 75° F. Annual variations shall remain within the stated range and shall occur at a rate not to exceed 2° per month. Daily fluctuations may be permitted to occur provided the daily maximum and minimum do not exceed 5° on either side of the selected optimum and provided that temperature changes do not cause the selected RH to fluctuate beyond established limits or to change faster than the established rate.

Air Quality: Freed of as much dust and chemical air pollutants as technically feasible.

The actual climate realized will, of course, depend upon such factors as the visitor load and the type of equipment which can be introduced into the building. Just remember, even though it may be impossible to achieve what can be termed an ideal climate, anything closer to that ideal than the present climate will be an improvement.

John E. Hunter

John E. Hunter

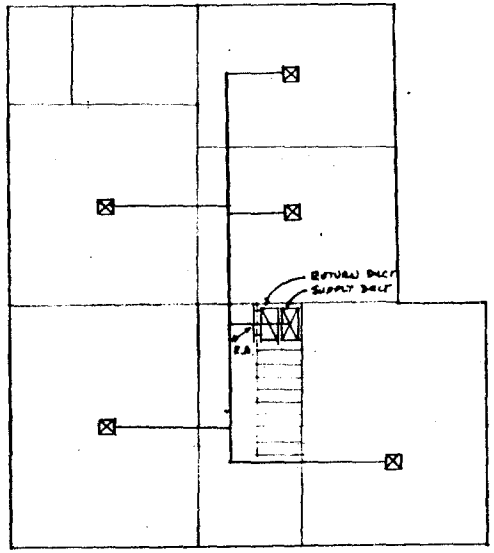
Enclosures 16:
See list.

cc:
WASO-560, Hugh Miller w/list of enclosures
Manager, Harpers Ferry Center
Attention: Art Allen w/list of enclosures
MWR-Mr. Schaack w/list of enclosures

EXHIBIT C

RALPH HAHN AND ASSOCIATES
CONSULTING AND DESIGN ENGINEERS, INC.

DSGN. GFM DATE 1/28/81 PROJECT Lincoln's Home PROJ NO.
CKD. ____ DATE ____ SHT. (2) OF 3



FIRST FLOOR PLAN

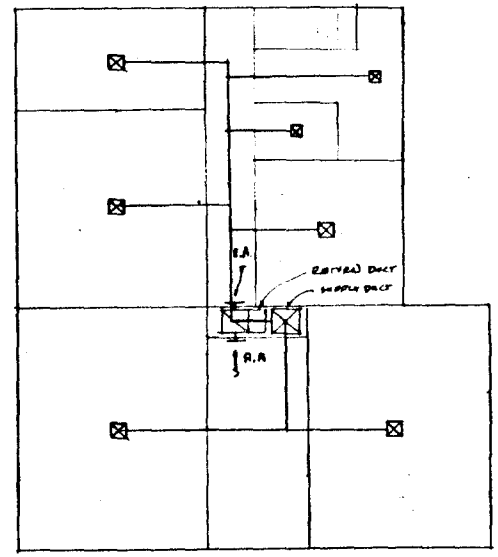
NO SCALE

1320 SOUTH STATE STREET / SPRINGFIELD, ILLINOIS 62704 / TELEPHONE 217 / 544-0721
TWX 910-242-0563

EXHIBIT C

RALPH HAHN AND ASSOCIATES
CONSULTING AND DESIGN ENGINEERS, INC.

DSGN. GFM DATE 1/28/81 PROJECT Lincoln's Home PROJ NO.
CKD. ____ DATE ____ SHT. (3) OF 3



SECOND FLOOR PLAN

NO SCALE

1320 SOUTH STATE STREET / SPRINGFIELD, ILLINOIS 62704 / TELEPHONE 217 / 544-0721
TWX 910-242-0563

Operating Cycle

EXHIBIT D
(1)
[SHEET (2) FOLLOWS]

General

The following description applies to each Lumatic steam generator circuit.

Tap Water Flow

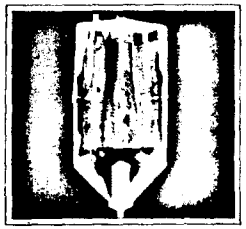
Tap water enters the top of the Lumatic cabinet and is piped down the back of the cabinet and into the water filter (1). The water filter removes any large particles (over 50 micron size) from the entering tap water. From the water filter, the tap water flows to the pressure regulator with pressure gauge (2). The pressure regulator reduces the entering tap water pressure to 10 psi regardless of fluctuations in the water supply to the unit. (Supply water pressure may be as high as 100 psi.) As sediment builds up on the water filter cartridge, it may be necessary, from time to time, to adjust the pressure regulator in order to maintain 10 psi.

From the pressure regulator, the tap water flows to the make-up water solenoid valve (3). On the call for humidity this valve will open allowing water to flow to the make-up water adjustable needle valve (4). The needle valve regulates the amount of make-up water. As the water flows from the needle valve it goes up the gooseneck tube (5), across the air gap (6) and into the fill cup (7) on top of the standpipe (8).

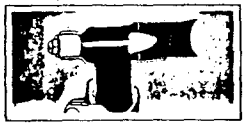
The air gap, between the gooseneck water supply tube and the fill cup, is provided as a contamination safeguard (required by some plumbing codes).

The make-up water then flows down the standpipe and into the bottom of the steam generator cylinder (9). The water is used as the resistance and as soon as the water rises in the cylinder to the level where it touches the electrodes (10; also see photo insert of cylinder cutaway), the circuit is completed and current will begin to flow as registered by the ammeter.

Steam Generator Cylinder Operation



Within the capacity limitations of the steam generator cylinder, the actual steam output of each generator circuit is determined by the opening of the adjustable steam orifice at the entrance of the steam distributor pipe and the pressure represented by the difference in the water levels in the stand pipe and cylinder. Water will fill the steam generator cylinder and cover as much of the lattice electrode as necessary to generate as much steam as can possibly be pushed across the steam orifice opening (11; also see photo insert of steam orifice cutaway).



If water covers too much of the electrode, steam will be generated at a rate greater than what can be passed thru the orifice opening and back pressure will build up within the steam generator cylinder. This in turn depresses the water level in the cylinder.

Because the standpipe provides a head of approximately 13" W.G., if the water in the generator does not cover enough of the electrode, equilibrium back pressure will not be reached and more water will be pushed into the generator cylinder until it covers enough of the electrode to generate as much steam as can be pushed across the steam orifice opening.

The water level in the steam generator will continuously and automatically seek the proper level and cover as much of the lattice electrode as necessary to generate the set amount of steam that can be passed thru the steam orifice opening.

As the make-up water boils in the steam generator, the mineral solids that are left behind are either drained away or trapped in the disposable generator cylinder. This means a nearly pure water vapor is injected into the air stream.

Condensate Return

Condensate which forms in the steam hose (12) will fall back into the steam generator for re-evaporation. A small amount of steam will condense in the steam distributor pipe (13) and this is returned back to the standpipe in the cabinet thru the condensate return line (14). The steam distributor pipe is pitched down 2° to facilitate the return of this condensate.

It is not mandatory to return the condensate back to the Lumatic cabinet, but there is the advantage of bringing nearly pure water back which helps prolong the steam generator life.

Because of the relatively short run of steam hose and the construction of the steam generator cylinder, adjustable steam orifice and steam distributor pipe, dry steam is injected into the airstream. This eliminates the necessity for a drip pan or tray under the steam distributor pipe.

Drain Cycle

The continuous cycle timer (15) automatically actuates the micro switch (16), which in turn energizes the drain solenoid valve (17). The drain solenoid valve is open long enough to drain away some of the mineral sludge and mineral enriched water. During the automatic drain cycle, the make-up water continues to flow into the standpipe. This provides a flushing action for the drain line and drain solenoid valve as well as reducing the temperature of the waste water going out the drain.

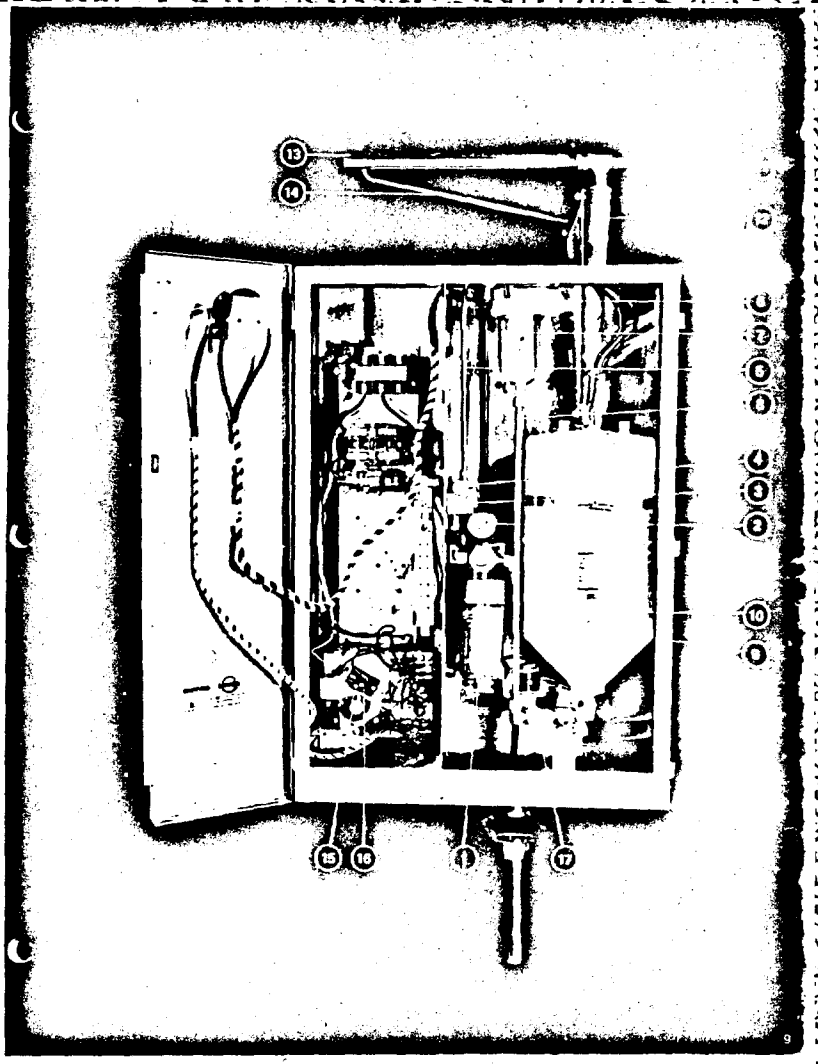


EXHIBIT E

RALPH HAHN AND ASSOCIATES
CONSULTING AND DESIGN ENGINEERS, INC.

DSGN. GEM DATE 1/28/80 PROJECT Lincoln's Home PROJ NO. SMS 78-810
CKD. _____ DATE _____ SHT. (1) OF ____

HEATING AND COOLING COEFFICIENTS

DESIGN CONDITIONS FOR SPRINGFIELD

Heating - -10°F outside to +70°F inside

Cooling - 94°D.B. & 79°W.B. outside
75°D.B. & 50%R.H. inside

REFERENCES

Carrier Manual
Trane Manual
ASHRAE Guide

HEATING AND COOLING COEFFICIENTS

~~Wall: 4" Brick, 8" L.W. Block U = .30~~

~~Wall: 4" Brick, 8" L.W. Block M.L. & Plast. U = .23~~

Other: FIRST FLOOR - SEE FOLLOWING SHEET U = .25

Other: SECOND FLOOR - " " " U = .33

~~Roof: P. & G., 1" Insul., Metal Deck, Steel Joists U = .26~~

~~Roof: P. & G., 1" Insul., Metal Deck, Joists, Clg. U = .17~~

Other: SEE FOLLOWING SHEET U = .25

~~Other:~~

Single Glass & Doors U = 1.13

~~Double Glass U = .61~~

~~Other:~~

Infiltration Windows 62 CFH x .018 x 80 = 90 BTU/Lin. ft. of crack
Doors 111 CFH x .018 x 80 = 160 BTU/Lin. ft. of crack
Other 1/2 Air Changes x .018 x 80 = .7 BTU/CU.Ft. of Room

Floor Perimeter .6 x 80 = 50 BTU/Lin. ft.
Bsm't Floors Use 1 BTU/Sq.Ft.
FLOOR: SEE FOLLOWING SHEET U = .53

SOLAR HEAT GAIN - SEE REFERENCES NAMED ABOVE

Total resistance and U value determined as follows:

$$R_T = \frac{1}{fi} + \frac{x_1}{k_1} + \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \frac{x_2}{k_2} + \frac{1}{fo} \qquad U = \frac{1}{R_T}$$

ANNUAL DEGREE DAYS = 5429

EXHIBIT E

RALPH HAHN AND ASSOCIATES
CONSULTING AND DESIGN ENGINEERS, INC.

DSGN. GEM DATE 1/28/80 PROJECT Lincoln's Home PROJ NO. SMS 78-810
CKD. _____ DATE _____ SHT. (2) OF ____

HEATING COEFFICIENTS - EXISTING BUILDING

FIRST FLOOR WALL: WOOD SIDING, ¾" WOOD SHEATHING, WOOD STUDS, WOOD LATH & PLASTER

R = .17 + .81 + .93 + 1.01 + .40 + .68 = 4.0
U = 1/4 = .25

SECOND FLOOR WALL: SAME AS ABOVE WITH NO SHEATHING.
R = 3.07 U = 1/3.07 = .33

ROOF: COVER SHINGLES, ¾" WOOD SHEATHING, AIR SPACE, 4" FIBERGLASS INSUL. BETWEEN STUDS, ½" GYP. BD.

R = .17 + .94 + .93 + .96 + .45 + .62 = 4.07
U = 1/4.07 = .25

FLOOR: 1½" WOOD (PONDEROSA PINE)
R = 1.5/.80 = 1.9 U = 1/1.9 = .53

PEOPLE: 40 VISITORS
4 STAFF
44 TOTAL

1320 SOUTH STATE STREET / SPRINGFIELD, ILLINOIS 62704 / TELEPHONE 217 / 544-0721
TWX 910-242-0563

EXHIBIT E

RALPH HAHN AND ASSOCIATES
CONSULTING AND DESIGN ENGINEERS, INC.

DSGN. GEM DATE 1/28/81 PROJECT Lincoln's Tomb PROJ NO. SMB 78-81
CKD. ______ DATE ______ ______ SHT. (3) OF ___

<u>Heating Coefficients</u> - ASHRAE 90-75

See following Page 13, 16 and 17

Walls U = .22

Roof U = .08

Floors U = .08

Double Glass U = .61

1320 SOUTH STATE STREET / SPRINGFIELD, ILLINOIS 62704 / TELEPHONE 217 / 544-0721
TWX 910-242-0563

EXHIBIT E
(4)

Fig. 1

U_o WALLS—TYPE "A" BUILDINGS

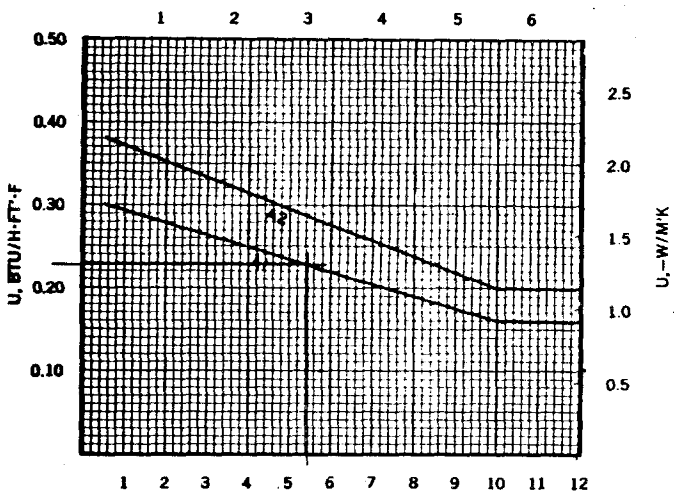
TYPE A BUILDINGS SHALL INCLUDE:

A 1 DETACHED ONE AND TWO FAMILY DWELLINGS

A 2 ALL OTHER RESIDENTIAL BUILDINGS, THREE STORIES OR LESS, INCLUDING BUT NOT LIMITED TO:

MULTI-FAMILY DWELLINGS
HOTELS AND MOTELS

ANNUAL CELSIUS HEATING DEGREE DAYS (18 C BASE)
(IN THOUSANDS)



ANNUAL FAHRENHEIT HEATING DEGREE DAYS (65 F BASE)
(IN THOUSANDS)

EXHIBIT E
(6)

Fig. 4

U_o—ROOFS AND CEILINGS

TYPE "B" BUILDINGS

FOR ALL BUILDINGS NOT COVERED BY PARA. 4.3

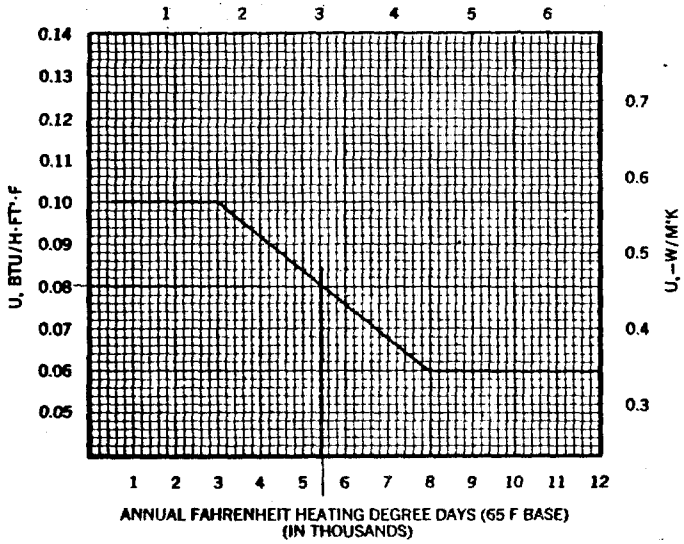
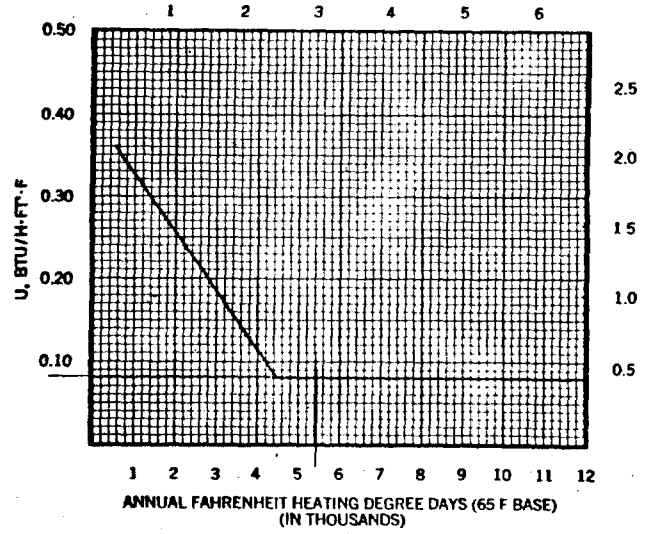


EXHIBIT E
(6)

Fig. 5

U_o VALUES—FLOORS OVER UNHEATED SPACES



COEFFICIENTS – PRESENT BLDG.

COOLING AND HEATING LOAD ESTIMATE SHEET

THE TRANE COMPANY
LA CROSSE, WISCONSIN

DATE 1-29-80 JOB NO. 79-810 EST. BY TJF
NAME Lueseb's Home
ADDRESS
CITY & STATE Springfield IL
BRANCH OFFICE FIRST FLOOR
ROOM FLOOR 1 SH. NO. 3
L'GTH 44 W'DTH 37 HT. 10 VOL. 16280 CU.

DESIGN DATA

SUMMER	OUTSIDE	INSIDE	DIFFERENCE
DRY BULB	92 F	77 F	(To-Ti) 15
WET BULB	75 F	— F	X X X X
DEW POINT	F	F	X X X X
RELATIVE HUMIDITY	%	50 %	X X X X
TOTAL ENTHALPY BTU PER LB. OF DRY AIR	31.1	19.0	(Ho-Hi) 12.1
GRAINS OF MOISTURE PER LB. OF DRY AIR			(HRo-HRi)
WINTER	-10 F	72 F	T.D. 30

LATITUDE 40° TIME AM. 1600 PM.

WALL COLOR		ROOF COLOR		WINDOWS	
LIGHT	☐	LIGHT	☐	AWNINGS	☐
MEDIUM	☑	MEDIUM	☑	SHADES	☐
DARK	☐	DARK	☐	BARE	☑

SUMMARY OF HEAT GAINS

ITEM NO.	ITEM	SENSIBLE	LATENT
11	TRANS. & SOLAR	37312	
17	TRANSMISSION	24061	
18	DUCTS		
22	BODY	13860	14300
29	EQUIPMENT	6814	
32	INFILTRATION		
33	TOTAL SENSIBLE	82087	X X X X X X
34	TOTAL LATENT	14300	←
35	TOTAL HEAT GAINS	96387	

SENSIBLE HEAT RATIO

36 ITEM 33 / ITEM 35 = 82087 / 96387 = .8516

37 DRY BULB TEMP. AIR SUPPLY 55 F

38 WET BULB TEMP. AIR SUPPLY 54 F

39 RISE IN DRY BULB TEMP. OF AIR SUPPLY: ROOM D.B. – ITEM 37 = 79 – 55 = 24 F

40 TOT. AIR SUPPLY = ITEM 33 / (1.1 X ITEM 39) = CFM
82087 / (1.1 × 24) = 3108 CFM

HEAT LOAD OF VENTILATION AIR

41 NO. PEOPLE 44 × 5 CFM/PERSON = 220 CFM

42 CFM O.A. 220 × 4.5 × 12.1 (Ho-Hi) = 9999 BTU/HR

TOT. COOLING LOAD ON COILS & REFR. APPAR.

	ITEM 35	96387
	PLUS ITEM 42	9999
43	TOT. COOLING LOAD BTU/HR	106386

TONNAGE EQUIVALENT OF COOLING LOAD

44 ITEM 43 / 12000 = 106386 / 12000 = 8.86 TONS

TRANSMISSION & SOLAR SENSIBLE HEAT GAIN

ITEM NO.	ITEM	AREA SQ. FT.	TEMP DIFF	"U" FACTOR	BTU/HR.
1	EXTERIOR WALL N	423	24	.25	2538
2	EXTERIOR WALL S	411	29	.25	2930
3	EXTERIOR WALL E	343	37	.25	3173
4	EXTERIOR WALL W	273	67	.25	4573
5	ROOF				
	GLASS SUMMARY CALCULATIONS	AREA SQ. FT	SOLAR FACTOR BTU/HR-SQ. FT		
6	EXTERIOR GLASS N	72	47.0		3384
7	EXTERIOR GLASS S	107	59.6		3576
8	EXTERIOR GLASS E	27	55.5		1499
9	EXTERIOR GLASS W	72	216.6		15595
10	SKYLIGHTS				
11	TOTAL TRANSMISSION & SOLAR				37312

HEAT LOSS

TEMP. DIFF.	"U" FACTOR	BTU/HR.
80	1.13	6509
80	1.13	5424
80	1.13	2441
80	1.13	6509
		20883

TRANSMISSION SENSIBLE HEAT

ITEM NO.	ITEM				BTU/HR.	TEMP. DIFF.	"U" FACTOR	HEAT LOSS
12	FLOORS	1336	15	.53	10621	20	.53	14162
13	CEILINGS							
14	PARTITIONS							
15	GLASS IN PARTITIONS							
16	MISCELLANEOUS (INFILT. FOR HEATING)	Doors for m = 84			13440			
17	TOTAL TRANSMISSION				24061	TOTAL	HEAT LOSS	14162

ITEM NO.		SENSIBLE	LATENT
18	DUCT GAINS		
	BODY HEAT GAINS		
19	SENSIBLE NO. PEOPLE 44 × 315	13860	
20	LATENT (QUIET) NO. PEOPLE 44 × 325		14300
21	LATENT (ACTIVE) NO. PEOPLE ×		
22	TOTAL BODY HEAT GAINS	13860	14300
	EQUIPMENT HEAT GAINS		
23	ELECTRIC LIGHTS 2004 WATTS × 3.4	6814	
24	SMALL ELECTRIC MOTORS (2 H.P. & SMALLER) H.P. × 3600		
25	LARGE ELECTRIC MOTORS (3 H.P. & LARGER) H.P. × 3000		
26	ELECTRIC EQUIPMENT WATTS × 3.4		
27	GAS EQUIPMENT NO. ×		
28	MISC NO. ×		
29	TOTAL EQUIPMENT GAINS	6814	
	INFILTRATION GAINS (CHECK VENTILATION ITEM 42)		
30	SENSIBLE ROOM VOL. C.F. X .018 X AIR CHANGES X (To-Ti)		X X X X X
31	LATENT ROOM VOL. C.F. X .011 X AIR CHANGES X (HRo-HRi)	X X X X X X	
32	TOTAL INFILTRATION HEAT GAINS		

EXHIBIT (3)

8 AIR CHANGES PER HR: 16,280 × 8/60 = 2170 CFM

COEFFICIENTS - PRESENT BLDG.

COOLING AND HEATING LOAD ESTIMATE SHEET

THE TRANE COMPANY
LA CROSSE, WISCONSIN

DATE 1-29-80 JOB NO. 78-810 EST. BY T.M.F.
NAME Lucas's Home
ADDRESS
CITY & STATE Springfield IL
BRANCH OFFICE SECOND FLOOR
ROOM FLOOR 2 SH. NO. 3
L'GTH 44 W'DTH 32 HT 10 VOL 16280 CU.

DESIGN DATA

SUMMER	OUTSIDE	INSIDE	DIFFERENCE
DRY BULB	94 °F	79 °F	(To-Ti) 15
WET BULB	75 °F	— °F	X X X X
DEW POINT	°F	°F	X X X X
RELATIVE HUMIDITY	%	50 %	X X X X
TOTAL ENTHALPY BTU PER LB. OF DRY AIR	38.1	28.0	(Ho-Hi) 10,1
GRAINS OF MOISTURE PER LB. OF DRY AIR			(HRo-HRi)
WINTER	-10 °F	70 °F	T.D. 80

LATITUDE 40° TIME AM 1600 PM.

WALL COLOR		ROOF COLOR		WINDOWS	
LIGHT	☐	LIGHT	☐	AWNINGS	☐
MEDIUM	☑	MEDIUM	☑	SHADES	☐
DARK	☐	DARK	☐	BARE	☑

SUMMARY OF HEAT GAINS

ITEM no.	ITEM	SENSIBLE	LATENT
11	TRANS. & SOLAR	77272	
17	TRANSMISSION		
18	DUCTS		
22	BODY	13860	14300
29	EQUIPMENT	8208	
32	INFILTRATION		
33	TOTAL SENSIBLE	99340	X X X X X X
34	TOTAL LATENT	14300	←
35	TOTAL HEAT GAINS	113640	

SENSIBLE HEAT RATIO

36 ITEM 33 / ITEM 35 = 99340 / 113640 = .8742

37 DRY BULB TEMP. AIR SUPPLY 55 °F

38 WET BULB TEMP. AIR SUPPLY 79 °F

39 RISE IN DRY BULB TEMP. OF AIR SUPPLY ROOM D. B. − ITEM 37 = 79 − 55 = 24 °F

40 TOT. AIR SUPPLY = ITEM 33 / (1.1 × ITEM 39) = CFM
99340 / (1.1 × 24) = 3763 CFM

HEAT LOAD OF VENTILATION AIR

41 NO. PEOPLE 44 × 5 CFM/PERSON 220 CFM

42 CFM O. A 220 × 4.5 × 10.1 (Ho-Hi) = 9999 BTU/HR

TOT. COOLING LOAD ON COILS & REFR. APPAR

	ITEM 35	113640
	PLUS ITEM 42	9999
43	TOT. COOLING LOAD BTU/HR	123639

TONNAGE EQUIVALENT OF COOLING LOAD

44 ITEM 43 / 12000 = 123639 / 12000 = 10.30 TONS

24.04 (7465)

TRANSMISSION & SOLAR SENSIBLE HEAT GAIN

ITEM NO.	ITEM	AREA SQ. FT.	TEMP DIFF.	"U" FACTOR	BTU/HR.
1	EXTERIOR WALL N	363	24	.33	2875
2	EXTERIOR WALL S	363	27	.33	3474
3	EXTERIOR WALL E	334	37	.33	4078
4	EXTERIOR WALL W	280	67	.33	6191
5	ROOF	1702	74	.25	31487
	GLASS SUMMARY CALCULATIONS	AREA SQ. FT.	SOLAR FACTOR BTU/HR.-SQ. FT.		
6	EXTERIOR GLASS N	72	47.0		3384
7	EXTERIOR GLASS S	72	59.6		4291
8	EXTERIOR GLASS E	36	55.5		1998
9	EXTERIOR GLASS W	90	216.6		19494
10	SKYLIGHTS				
11	TOTAL TRANSMISSION & SOLAR				77272

HEAT LOSS

TEMP. DIFF.	"U" FACTOR	BTU/HR.
80	1.13	6509
80	1.13	6509
80	1.13	3254
80	1.13	8136
		24408

TRANSMISSION SENSIBLE HEAT

12	FLOORS	0						
13	CEILINGS							
14	PARTITIONS							
15	GLASS IN PARTITIONS							
16	MISCELLANEOUS INFILT. FOR HEATING	Doors Perim = 0						
17	TOTAL TRANSMISSION					TOTAL	HEAT LOSS	

		SENSIBLE	LATENT
18	DUCT GAINS		
	BODY HEAT GAINS		
19	SENSIBLE NO. PEOPLE 44 × 315	13860	
20	LATENT (QUIET) NO. PEOPLE 44 × 325		14300
21	LATENT (ACTIVE) NO. PEOPLE ×		
22	TOTAL BODY HEAT GAINS	13860	14300
	EQUIPMENT HEAT GAINS		
23	ELECTRIC LIGHTS 2414 WATTS × 3.4	8208	
24	SMALL ELECTRIC MOTORS (2 H.P. & SMALLER) H.P. × 3800		
25	LARGE ELECTRIC MOTORS (3 H.P. & LARGER) H.P. × 3000		
26	ELECTRIC EQUIPMENT WATTS × 3.4		
27	GAS EQUIPMENT NO. ×		
28	MISC. NO. ×		
29	TOTAL EQUIPMENT GAINS	8208	
	INFILTRATION GAINS (CHECK VENTILATION ITEM 42)		
30	SENSIBLE ROOM VOL. ____ C.F. × .018 × ____ AIR CHANGES × ____ (To-Ti)		X X X X X
31	LATENT ROOM VOL. ____ C.F. × .011 × ____ AIR CHANGES × ____ (HRo-HRi)	X X X X X X	
32	TOTAL INFILTRATION HEAT GAINS		

Ex Wall E

COEFFICIENTS – ASHRAE 90-75

COOLING AND HEATING LOAD ESTIMATE SHEET

THE TRANE COMPANY
LA CROSSE, WISCONSIN

DATE 1-29-80 JOB NO. 78-810 EST. BY TMF
NAME Livesh's Home
ADDRESS
CITY & STATE Springfield IL
BRANCH OFFICE FIRST FLOOR
ROOM ______ FLOOR 1 SH. NO. 3
L'GTH 44 W'DTH 37 HT. 10 VOL. 16280 CU.

DESIGN DATA

SUMMER	OUTSIDE	INSIDE	DIFFERENCE
DRY BULB	94 F	79 F	(To-Ti) 15
WET BULB	75 F	– F	X X X X
DEW POINT	F	F	X X X X
RELATIVE HUMIDITY	%	50 %	X X X X
TOTAL ENTHALPY BTU PER LB. OF DRY AIR	38.1	28.0	(Ho-Hi) 10.1
GRAINS OF MOISTURE PER LB. OF DRY AIR			(HRo-HRi)
WINTER	-10 F	70 F	T.D. 73

LATITUDE 40° TIME ______ AM. 1600 PM.

WALL COLOR		ROOF COLOR		WINDOWS	
LIGHT	☐	LIGHT	☐	AWNINGS	☐
MEDIUM	☑	MEDIUM	☑	SHADES	☐
DARK	☐	DARK	☐	BARE	☑

SUMMARY OF HEAT GAINS

ITEM NO.	ITEM	SENSIBLE	LATENT
11	TRANS. & SOLAR	35720	
17	TRANSMISSION	15043	
18	DUCTS		
22	BODY	13860	14300
29	EQUIPMENT	6814	
32	INFILTRATION		
33	TOTAL SENSIBLE	71437	X X X X X X X
34	TOTAL LATENT	14300	←
35	TOTAL HEAT GAINS	85737	

SENSIBLE HEAT RATIO

36 ITEM 33 / ITEM 35 = 71437 / 85737 = .8332

37 DRY BULB TEMP. AIR SUPPLY 55 F

38 WET BULB TEMP. AIR SUPPLY 79 F

39 RISE IN DRY BULB TEMP. OF AIR SUPPLY ROOM D.B. – ITEM 37 = 79 – 55 = 24 F

40 TOT. AIR SUPPLY = ITEM 33 / (1.1 X ITEM 39) = CFM

71437 / (1.1 × 24) = 2706 CFM

HEAT LOAD OF VENTILATION AIR

41 NO. PEOPLE 44 × 5 CFM/PERSON 220 CFM

42 CFM O.A. 220 × 4.5 × 10.1 (Ho-Hi) = 9999 BTU/HR

TOT. COOLING LOAD ON COILS & REFR. APPAR.

	ITEM 35	85737
	PLUS ITEM 42	9999
43	TOT. COOLING LOAD BTU/HR	95736

TONNAGE EQUIVALENT OF COOLING LOAD

44 ITEM 43 / 12000 = 95736 / 12000 = 7.98 TONS

TRANSMISSION & SOLAR SENSIBLE HEAT GAIN / HEAT LOSS

ITEM NO.	ITEM	AREA SQ. FT.	TEMP DIFF.	"U" FACTOR	BTU/HR.	HEAT LOSS TEMP. DIFF.	HEAT LOSS "U" FACTOR	HEAT LOSS BTU/HR.
1	EXTERIOR WALL N	422	24	.22	2228			
2	EXTERIOR WALL S	411	29	.22	2622			
3	EXTERIOR WALL E	343	37	.22	2792			
4	EXTERIOR WALL W	273	67	.22	4024			
5	ROOF							
	GLASS SUMMARY CALCULATIONS	AREA SQ. FT.	SOLAR FACTOR BTU/HR.-SQ. FT.					
6	EXTERIOR GLASS N	72	47.0		3384	80	.61	3514
7	EXTERIOR GLASS S	60	59.6		3576	80	.61	2928
8	EXTERIOR GLASS E	27	55.5		1499	80	.61	1318
9	EXTERIOR GLASS W	72	216.6		15595	80	.61	3514
10	SKYLIGHTS							
11	TOTAL TRANSMISSION & SOLAR				35720			11274

TRANSMISSION SENSIBLE HEAT

ITEM NO.	ITEM	AREA SQ. FT.	TEMP DIFF.	"U" FACTOR	BTU/HR.	HEAT LOSS TEMP. DIFF.	HEAT LOSS "U" FACTOR	HEAT LOSS BTU/HR.
12	FLOORS	1336	15	.08	1603	20	.08	2138
13	CEILINGS							
14	PARTITIONS							
15	GLASS IN PARTITIONS							
16	MISCELLANEOUS (INFILT. FOR HEATING)	Doors Perim = 84			13440			
17	TOTAL TRANSMISSION				15043	TOTAL	HEAT LOSS	2138
18	DUCT GAINS							

BODY HEAT GAINS

ITEM NO.	ITEM	SENSIBLE	LATENT
19	SENSIBLE NO. PEOPLE 44 × 315	13860	
20	LATENT (QUIET) NO. PEOPLE 44 × 325		14300
21	LATENT (ACTIVE) NO. PEOPLE ×		
22	TOTAL BODY HEAT GAINS	13860	14300

EQUIPMENT HEAT GAINS

ITEM NO.	ITEM	SENSIBLE	LATENT
23	ELECTRIC LIGHTS 2004 WATTS × 3.4	6814	
24	SMALL ELECTRIC MOTORS (2 H.P. & SMALLER) H.P. × 3600		
25	LARGE ELECTRIC MOTORS (3 H.P. & LARGER) H.P. × 3000		
26	ELECTRIC EQUIPMENT WATTS × 3.4		
27	GAS EQUIPMENT NO. ×		
28	MISC. NO. ×		
29	TOTAL EQUIPMENT GAINS	6814	

INFILTRATION GAINS (CHECK VENTILATION ITEM 42)

ITEM NO.	ITEM	SENSIBLE	LATENT
30	SENSIBLE ROOM VOL. ___ C.F. × .018 × ___ AIR CHANGES × ___ (To-Ti)		X X X X X
31	LATENT ROOM VOL. ___ C.F. × .011 × ___ AIR CHANGES × ___ (HRo-HRi)	X X X X X X	
32	TOTAL INFILTRATION HEAT GAINS		

24-01 (7/65)

Coeffkient - ASHRAE 90-75

COOLING AND HEATING LOAD ESTIMATE SHEET

THE TRANE COMPANY
LA CROSSE, WISCONSIN

DATE 1-29-80 JOB NO. 78-810 EST. BY TME
NAME Lueade's Home
ADDRESS
CITY & STATE Springfield Il
BRANCH OFFICE SECOND FLOOR
ROOM FLOOR 2 SH. NO. 3
L'GTH 44 W'DTH 37 HT. 10 VOL. 16280 CU.

DESIGN DATA

SUMMER	OUTSIDE	INSIDE	DIFFERENCE
DRY BULB	94 °F	79 °F	(To-Ti) 15
WET BULB	75 °F	– °F	X X X X
DEW POINT	°F	°F	X X X X
RELATIVE HUMIDITY	%	50 %	X X X X
TOTAL ENTHALPY BTU PER LB. OF DRY AIR	38.1	28.0	(Ho-Hi) 10.1
GRAINS OF MOISTURE PER LB. OF DRY AIR			(HRo-HRi)
WINTER	-10 °F	70 °F	T.D. 80

LATITUDE 40° TIME AM 1600 PM.

WALL COLOR	ROOF COLOR	WINDOWS
LIGHT ☐	LIGHT ☐	AWNINGS ☐
MEDIUM ☑	MEDIUM ☑	SHADES ☐
DARK ☐	DARK ☐	BARE ☑

SUMMARY OF HEAT GAINS

ITEM NO.	ITEM	SENSIBLE	LATENT
11	TRANS. & SOLAR	50322	
17	TRANSMISSION		
18	DUCTS		
22	BODY	13860	14300
29	EQUIPMENT	8208	
32	INFILTRATION		
33	TOTAL SENSIBLE	72390	X X X X X X X
34	TOTAL LATENT	14300 ←	
35	TOTAL HEAT GAINS	86690	

SENSIBLE HEAT RATIO

36 ITEM 33 / ITEM 35 = 72390 / 86690 = .8350

37 DRY BULB TEMP. AIR SUPPLY 55 °F

38 WET BULB TEMP. AIR SUPPLY 79 °F

39 RISE IN DRY BULB TEMP. OF AIR SUPPLY ROOM D. B. – ITEM 37 = 79 – 55 = 24 °F

40 TOT. AIR SUPPLY = ITEM 33 / (1.1 X ITEM 39) = CFM
72390 / (1.1 × 24) = 2742 CFM

HEAT LOAD OF VENTILATION AIR

41 NO. PEOPLE 44 × 5 CFM/PERSON = 220 CFM

42 CFM O. A. 220 × 4.5 × 10.1 (Ho-Hi) = 9999 BTU/HR

TOT. COOLING LOAD ON COILS & REFR. APPAR

	ITEM 35	86690
	PLUS ITEM 42	9999
43	TOT. COOLING LOAD BTU/HR	96689

TONNAGE EQUIVALENT OF COOLING LOAD

44 ITEM 43 / 12000 = 96689 / 12000 = 8.06 TONS

TRANSMISSION & SOLAR SENSIBLE HEAT GAIN

ITEM NO.	ITEM	AREA SQ. FT.	TEMP. DIFF.	"U" FACTOR	BTU/HR.
1	EXTERIOR WALL N	363	29	.22	1917
2	EXTERIOR WALL S	363	29	.22	2316
3	EXTERIOR WALL E	334	37	.22	2719
4	EXTERIOR WALL W	288	67	.22	4129
5	ROOF	1702	74	.08	10076
	GLASS SUMMARY CALCULATIONS	AREA SQ. FT.	SOLAR FACTOR BTU/HR.-SQ. FT.		
6	EXTERIOR GLASS N	72	47.0		3384
7	EXTERIOR GLASS S	72	59.6		4291
8	EXTERIOR GLASS E	36	55.5		1998
9	EXTERIOR GLASS W	90	216.6		19494
10	SKYLIGHTS				
11	TOTAL TRANSMISSION & SOLAR				50322

HEAT LOSS

TEMP. DIFF.	"U" FACTOR	BTU/HR
80	.61	3514
80	.61	3514
80	.61	1757
80	.61	4392
		13177

TRANSMISSION SENSIBLE HEAT

12	FLOORS	0						
13	CEILINGS							
14	PARTITIONS							
15	GLASS IN PARTITIONS							
16	MISCELLANEOUS (INFILT. FOR HEATING)							
17	TOTAL TRANSMISSION					TOTAL	HEAT LOSS	
18	DUCT GAINS							

		SENSIBLE	LATENT
	BODY HEAT GAINS		
19	SENSIBLE NO. PEOPLE 44 × 315	13860	
20	LATENT (QUIET) NO. PEOPLE 44 × 325		14300
21	LATENT (ACTIVE) NO. PEOPLE ×		
22	TOTAL BODY HEAT GAINS	13860	14300
	EQUIPMENT HEAT GAINS		
23	ELECTRIC LIGHTS 2414 WATTS × 3.4	8208	
24	SMALL ELECTRIC MOTORS (2 H.P. & SMALLER) H.P. × 3600		
25	LARGE ELECTRIC MOTORS (3 H.P. & LARGER) H.P. × 3000		
26	ELECTRIC EQUIPMENT WATTS × 3.4		
27	GAS EQUIPMENT NO. ×		
28	MISC. NO. ×		
29	TOTAL EQUIPMENT GAINS	8208	
	INFILTRATION GAINS (CHECK VENTILATION ITEM 42)		
30	SENSIBLE ROOM VOL. ____ C.F. X .018 X ____ AIR CHANGES X ____ (To-Ti)		X X X X X
31	LATENT ROOM VOL. ____ C.F. X .011 X ____ AIR CHANGES X ____ (HRo-HRi)	X X X X X X	
32	TOTAL INFILTRATION HEAT GAINS		

MECHANICAL REPORT

50% REVIEW

7 November 1983

MECHANICAL

The mechanical work requires the following:

1. Finalize the environmental control system.
2. Advantages and disadvantages of the design.
3. Heat loss calculations.
4. Life cycle costing.
5. Cost estimate.

The existing conditions that influence the design of the environmental control systems are:

1. No insulation in the walls or attic.
2. No vapor barrier in the walls or attic.
3. Infiltration through loose fitting windows and doors.
4. Unable to disturb existing wall coverings and floors.

Systems considered possible solutions are as follows:

Air System:

1. One air handling unit in the basement to serve the first and second floor.
2. One air handling unit in the basement to serve the first floor, and one air handling unit in the attic to serve the second floor.

Heating System:

1. Indirect gas fired furnace, using natural gas, connected to the air handling units.

2. Hot water boiler, using natural gas or fuel oil, located in the barn. Piping run below grade to the basement, and hot water coils in the air handling units.

Alternate energy source for 1. and 2. is electricity and fuel oil. This time, natural gas is the lowest cost.

Cooling System:

1. A split system with the air cooled condensing unit in barn and direct expansion coils in the air handling units.

2. A air cooled packaged water chiller located in the barn. Piping run below grade to the basement and chilled water coils in the air handling units.

An alternative solution to air cooled heat rejection, as in 1. and 2., is to provide water source heat rejection. The possibility of rejecting heat to the ground by way of a buried pipe loop is being investigated.

Humidification:

1. An electric self-contained steam generating unit located in the supply air duct of the air handling units.

2. An evaporative pan-type humidifier located in the air handling unit.

MECHANICAL DISCUSSION

The mission of the environmental system is to provide temperature and humidity control for the facility on a year round basis. A basic assumption is that the acceptable temperature range is 75°F ±3° and that the acceptable relative humidity range is 40% to 60% RH.

The structure, as it now exists, is uninsulated in the walls and ceiling, and there is no vapor barrier. Under the stated temperature-humidity range, there will be condensation of moisture within the shell of the building during the colder months.

Two avenues are open for solving the moisture problem. The first is not to introduce moisture into the facility. The second is to provide insulation and a positive vapor barrier in the shell of the structure.

Our preliminary analysis of the alternative systems indicates that the environmental system shall consist of a single air handling unit in the basement serving both the first and second floors. The air handling unit shall contain a gas fired furnace, supply air fan, air filters, and a refrigerant cooling coil. A self-contained, electric, steam humidifier should be installed in the duct downstream of the air handling unit. Existing ductwork appears to be in good condition and should be reused as much as posible. All joints should be sealed air tight, and the ductwork should be wrapped with insulation where possible. The condensing unit for the refrigerant cooling coil will be located remotely from the structure with the refrigerant piping buried in a tile underground.

E L E C T R I C A L

1. This report is based upon the following information;

   a. Review of existing conditions "As-is Measured Drawings," Drawing No. 449/26003, Sheets 20 and 21.

   b. Telephone conversation with George Alarm Service, Springfield, IL, the original installer of the fire alarm and security system.

   c. Telephone conversation with Romco Alarm Services, Springfield, IL, the alarm company that now monitors the system.

   d. Meeting with Ms. Joan Sanders of the National Park Service and a brief tour of the site on November 3, 1983.

2. Summary of existing conditions.

   a. The existing electrical service entrance main panel is not sized to accommodate the proposed additional mechanical loads. Service entrance conductors appear to have sufficient capacity for anticipated loads. Branch circuit wiring appears to be satisfactory.

   b. The fire alarm system is comprised of an outdated Walter Ridde panel with the addition of numerous remote relays and field installed modifications and devices installed in an unorthodoxed manner. A digital dialer exists that ties the system to a remote station. System is now zoned with a remote annunciator and break glass station located in the first floor closet. Detection is by heat detectors and ionization smoke detectors. Coverage of detectors appears to be adequate.

FINAL MECHANICAL REPORT

3 January 1984

MECHANICAL

Three alternate HVAC systems were examined as replacement for the existing gas-fired furnace heating system. The first system utilized a split DX (direct expansion) cooling system with an air-cooled condensing unit located outdoors, an air handling unit with DX coil located in the basement furnace room and an indirect gas-fired duct furnace. The second system utilized the same DX cooling system and air handler, but replaced the duct furnace with a gas-fired HW boiler serving a hot water heating coil in the AHU. The third system utilized an air handling unit with chilled and hot water coils. An air-cooled chiller located outside would provide the cooling while a gas-fired hot water boiler provided the heating.

Estimates reflecting approximate equipment and installation costs were generated to compare first cost of the various systems. Estimates were also made for annual maintenance costs along with associated annual escalation factors. Equivalent full load cooling hours and modified degree day data were used in conjunction with energy consumption data for typical equipment to estimate total annual energy consumption and costs. Estimated annual escalation factors were also applied to unit fuel costs.

The first costs, maintenance costs and operating costs for all three alternate systems were input to a computerized economic program for life cycle analysis. The first alternate, split DX and duct furnace, was determined to be the best choice based upon lower first costs and operating costs. The physical size and layout of the equipment in the mechanical room appears to be the only constraint; requiring revisions to the main ductwork in the basement and crawl space. Revisions to the building structure also necessitate some duct revisions.

The existing heating and air handling equipment is located in the furnace room in the basement. For the present design and cost estimate, we have located the new air handler and heating equipment (duct furnace) in the same room. A strong argument may be made for locating the equipment in a barn or shed remote from the home and providing an underground tunnel for the utilities, (ductwork). Comments and discussion indicated interest in this proposal by the local NPS representatives. From a safety standpoint, the gas-fired equipment will be remote from the home. In addition, if the northeast exterior stairs are removed for historic restoration reasons; another exterior access to the furnace room must be provided if equipment is to be located there. We estimate the additional cost of moving the heating and air handling equipment remote from the home and providing a connection tunnel and equipment barn to be approximately $36,000.

The branch ductwork, registers and grilles serving the first and second floor appear to be in good condition and could be reused. Our cost estimate reflects those duct changes necessitated by new HVAC equipment, structural revisions and existing deteriorated material. However, comments received early during this project noted that air supplied by the existing floor and low wall registers may be damaging to furniture located close by. If inconspicuous diffusers could be incorporated in the first floor ceiling during the structural framing rework for the second floor, this could improve air distribution. An estimate of the extra costs associated with these duct changes is approximately $5,500.

A humidifier has been added to the project per NPS directives; however, no additional insulation or vapor barrier has been added to the walls. As noted in previous conversations and discussions, adding moisture to the home during the winter will result in condensation in the walls without this insulation. Again, RHA strongly urges the addition of insulation and a vapor barrier to the exterior walls since a humidifier is being provided.

Heating and cooling will be controlled by a space thermostat located on the hall wall next to the stair on the first floor. A separate humidistat will control the new humidifier.

FIRE PROTECTION

Presently, hand held fire extinguishers are located at several locations in the home. These constitute the on-site fire protection for the home. An automatic Halon system has been discussed for additional protection when the home is unattended. Halon is safe and eliminates the damaging effects a water sprinkler system would have to furniture and finishes.

The cost of an automatic Halon system has not been included in our cost summary, but we estimate a cost of approximately $37,000 for providing a system throughout the home.

********** CDS NETWORK **********

For exclusive use by: RALPH HAHN & ASSOCIATES

L O A D D E S I G N E C H O P R I N T

LINCOLN'S HOME
SPRINGFIELD, ILLINDIS
NATIONAL PARK SERVICE - DENVER CENTER
ROBERT J. KNOEDLER

LAT	LONG	TIME Z	S CN	W CN	PRESS	ALT	WTHR
39	89	6	.975	.975		588	CHANUTE

SUM DB	SUM WB	D MNTH	RANGE	WIN DB	REFLCT	R ALPH
92	74	8	24	-5		

COOL DB	REL H	HEAT DB	CFM/P	CFM/SQF
78	50	70		.10

ZONE#	DESC	FLOR A	WAL1 D	WAL1 A	ROOF A	WAL2 D	WAL2 A	INFIL	XFLOR A
1	FPRLR101	300	0	200		270	200		300
2	BPRLR102	232	0	160		0	85		232
3	STORE103	41	0	160		90	60		41
4	KITCH105	173	0	190		90	160		173
5	DINRM107	180	0	120					180
6	SITRM108	285	180	200		270	150		285
7	ENTRH100	79	270	60					79
8	STAIR200	117	270	72	117				
9	MRBED201	285	0	200	285	270	160		
10	MSBED202	232	0	176	232				
11	MAID203	128	0	80	128	90	160		
12	TRUNK205	132	90	132	132	180	127		
13	ROBED207	132	180	140	132				
14	GUEST208	285	180	200	285	270	160		
15	REARH204	104	90	40	104				

ZONE#	LIGHTS	MISC S	MISC L	PEOP S	PEOP L	PEOP D	ROOF U	ROOF T	FLOR U
M	.25			230	190	270	.33	E	.40

ZONE#	WALL#	%GLASS	GLAS U	S COEF	WALL U	WALL T	W TILT
M			1.07	1.0	.34	A	0
1	1	18					
1	2	18					
2	1	22.5					
3	2	25					
4	2	9.4					
5	1	12.5					
6	1	18					
6	2	24					
7	1	16.6					
8	1	25					
9	1	18					
9	2	22.5					
10	1	20.5					
11	2	11.3					
12	2	14.2					
13	1	12.9					
14	1	18					

********** CDS NETWORK **********

For exclusive use by: RALPH HAHN & ASSOCIATES

L O A D D E S I G N E C H O P R I N T

ZONE#	WALL#	%GLASS	GLAS U	S COEF	WALL U	WALL T	W TILT
14	2	22.5					
15	1	45					

%ROOF	%LIGHT	%WALL
0	0	0

SYSTEM	SF SP	RF SP	MTR EF	SADBC	SADBH	TONS	FAN	DMIT	ECON
SZ	2.0		75	58	95	PEAK	DRAW		

********** CDS NETWORK **********

For exclusive use by: RALPH HAHN & ASSOCIATES

LINCOLN'S HOME

BUILDING LOADS IN BTU/HOUR

			COOLING						
BLOCK SYSTEM:			SPACE LOAD	RETURN AIR LD	COND LOAD	SOLAR LOAD	SPACE LOAD	RETURN AIR LD	EXPOSED FLOOR
SYS	MO/HR	DB	WALL	WALL	GLASS	GLASS	ROOF	ROOF	LOAD
1	8/16	91	23606.	0.	6641.	38773.	30929.	0.	5664.

			COOLING						
PEAK ZONE:			SPACE LOAD	RETURN AIR LD	COND LOAD	SOLAR LOAD	SPACE LOAD	RETURN AIR LD	EXPOSED FLOOR
ZN	MO/HR	DB	WALL	WALL	GLASS	GLASS	ROOF	ROOF	LOAD
1	8/17	89	3108.	0.	910.	6245.	0.	0.	1378.
2	8/16	91	1229.	0.	467.	991.	0.	0.	1019.
3	8/10	78	372.	0.	-34.	2021.	0.	0.	-70.
4	8/15	91	2038.	0.	185.	657.	0.	0.	658.
5	8/16	91	619.	0.	191.	406.	0.	0.	790.
6	8/16	91	3011.	0.	956.	7676.	0.	0.	1251.
7	8/17	89	663.	0.	129.	1530.	0.	0.	363.
8	8/16	91	690.	0.	239.	2589.	2557.	0.	0.
9	8/16	91	2556.	0.	945.	6076.	6229.	0.	0.
10	8/15	91	798.	0.	452.	1098.	5017.	0.	0.
11	8/15	91	1394.	0.	226.	803.	2768.	0.	0.
12	8/15	91	1997.	0.	228.	1600.	2854.	0.	0.
13	8/15	91	1255.	0.	234.	1638.	2854.	0.	0.
14	8/16	91	3149.	0.	945.	7561.	6229.	0.	0.
15	8/15	91	145.	0.	231.	821.	2249.	0.	0.
TOTAL			23024.	0.	6304.	41711.	30758.	0.	5389.

	INTERNAL COOLING							
	SPACE LOAD	RETURN AIR LD	PEOPLE	PEOPLE	MISC	MISC	INFIL	INFIL
ZN	LIGHTS	LIGHTS	SENS	LATENT	SENS	LATENT	SENS	LAT
1	256.	0.	256.	211.	0.	0.	0.	0.
2	198.	0.	198.	163.	0.	0.	0.	0.
3	35.	0.	35.	29.	0.	0.	0.	0.
4	148.	0.	147.	122.	0.	0.	0.	0.
5	154.	0.	153.	127.	0.	0.	0.	0.
6	243.	0.	243.	201.	0.	0.	0.	0.
7	67.	0.	67.	56.	0.	0.	0.	0.
8	100.	0.	100.	82.	0.	0.	0.	0.
9	243.	0.	243.	201.	0.	0.	0.	0.
10	198.	0.	198.	163.	0.	0.	0.	0.
11	109.	0.	109.	90.	0.	0.	0.	0.
12	113.	0.	112.	93.	0.	0.	0.	0.
13	113.	0.	112.	93.	0.	0.	0.	0.
14	243.	0.	243.	201.	0.	0.	0.	0.
15	89.	0.	89.	73.	0.	0.	0.	0.
TOTAL	2308.	0.	2304.	1904.	0.	0.	0.	0.

			HEATING					
ZN	SPACE LOAD WALL	RETURN AIR LD WALL	COND LOAD GLASS	SPACE LOAD ROOF	RETURN AIR LD ROOF	EXPOSED FLOOR LOAD	INFIL LOAD	VENT AIR LOAD

********** CDS NETWORK **********

For exclusive use by: RALPH HAHN & ASSOCIATES

BUILDING LOADS IN BTU/HOUR

			HEATING					
ZN	SPACE LOAD WALL	RETURN AIR LD WALL	COND LOAD GLASS	SPACE LOAD ROOF	RETURN AIR LD ROOF	EXPOSED FLOOR LOAD	INFIL LOAD	VENT AIR LOAD
1	-8364.	0.	-5778.	0.	0.	-9000.	0.	-2441.
2	-5350.	0.	-2825.	0.	0.	-6960.	0.	-1888.
3	-5228.	0.	-1204.	0.	0.	-1230.	0.	-334.
4	-8558.	0.	-1156.	0.	0.	-5190.	0.	-1408.
5	-2693.	0.	-1156.	0.	0.	-5400.	0.	-1465.
6	-7089.	0.	-5778.	0.	0.	-8550.	0.	-2319.
7	-1270.	0.	-819.	0.	0.	-2370.	0.	-643.
8	-1377.	0.	-1445.	-2896.	0.	0.	0.	-952.
9	-7364.	0.	-5714.	-7054.	0.	0.	0.	-2319.
10	-3590.	0.	-2825.	-5742.	0.	0.	0.	-1888.
11	-5671.	0.	-1412.	-3168.	0.	0.	0.	-1042.
12	-6151.	0.	-1427.	-3267.	0.	0.	0.	-1074.
13	-3106.	0.	-1461.	-3267.	0.	0.	0.	-1074.
14	-7364.	0.	-5714.	-7054.	0.	0.	0.	-2319.
15	-561.	0.	-1445.	-2574.	0.	0.	0.	-846.
TOTAL	-73736.	0.	-40156.	-35021.	0.	-38700.	0.	-22012.

********** CDS NETWORK **********

For exclusive use by: RALPH HAHN & ASSOCIATES

LINCOLN'S HOME

SYSTEM AIR QUANTITIES

		MAIN COOLING				MAIN HEATING				
ZN	OA CFM	CFM	CFM/ SQ FT	MBH	BTU/ SQ FT	CFM	CFM/ SQ FT	MBH	BTU/ SQ FT	SKIN CFM OR MBH
1	30.	557.	1.86	12.4	41.21	0.	.00	25.6	85.28	.0
2	23.	188.	.81	4.3	18.38	0.	.00	17.0	73.37	.0
3	4.	108.	2.64	2.4	58.22	0.	.00	8.0	195.00	.0
4	17.	176.	1.02	4.0	22.86	0.	.00	16.3	94.28	.0
5	18.	106.	.59	2.4	13.55	0.	.00	10.7	59.52	.0
6	28.	613.	2.15	13.6	47.65	0.	.00	23.7	83.28	.0
7	8.	129.	1.64	2.9	36.39	0.	.00	5.1	64.57	.0
8	12.	288.	2.46	6.4	54.33	0.	.00	6.7	57.00	.0
9	28.	747.	2.62	16.5	57.87	0.	.00	22.5	78.78	.0
10	23.	356.	1.53	7.9	34.15	0.	.00	14.8	60.54	.0
11	13.	248.	1.94	5.5	42.96	0.	.00	11.3	88.23	.0
12	13.	317.	2.40	7.0	53.01	0.	.00	11.9	90.30	.0
13	13.	285.	2.16	6.3	47.72	0.	.00	8.9	67.48	.0
14	28.	842.	2.96	18.6	65.16	0.	.00	22.5	78.78	.0
15	10.	166.	1.60	3.7	35.55	0.	.00	5.4	52.17	.0
TOT	269.	5126.	1.89	113.7	42.03	0.	.00	209.6	77.50	

ECONOMIC SUMMARY

	ALTERNATIVE		
SUMMARY OF ECONOMIC DATA	1	2	3
INSTALLED COST	15525.	18711.	23598.
UTILITY COST (FIRST YEAR)	3101.	3298.	3350.
UTILITY COST (FINAL YEAR)	19662.	20915.	21241.
MAINTENANCE COST (FIRST YEAR)	351.	400.	445.
LIFE CYCLE COST	77389.	84879.	91342.

C O M P A R I S O N O F E C O N O M I C D A T A

	FIRST COST DIFFERENCE ($)	PAYBACK PERIOD (YRS)	NET PRESENT VALUE ($)	INTERNAL RATE OF RETURN (%)
ALTERNATIVE 2 -- ALTERNATIVE 1	3186.	0.	-7490.	.0
ALTERNATIVE 3 -- ALTERNATIVE 1	8073.	0.	-13953.	.0
ALTERNATIVE 3 -- ALTERNATIVE 2	4887.	0.	-6463.	.0

Economic Performance Alternative 1
Split DX - Gas Fired Duct Furn.

Economic Performance Alternative 2
Split DX - Gas Fired HW Boiler

Economic Performance Alternative 3
Air-Cooled Chiller - HW Boiler

FINAL MECHANICAL REPORT

REVISED

13 February 1984

MECHANICAL

Three alternate HVAC systems were examined as replacement for the existing gas-fired furnace heating system. The first system utilized a split DX (direct expansion) cooling system with an air-cooled condensing unit located outdoors, an air handling unit with DX coil located in the basement furnace room and an indirect gas-fired duct furnace. The second system utilized the same DX cooling system and air handler, but replaced the duct furnace with a gas-fired HW boiler serving a hot water heating coil in the AHU. The third system utilized an air handling unit with chilled and hot water coils. An air-cooled chiller located outside would provide the cooling while a gas-fired hot water boiler provided the heating.

Estimates reflecting approximate equipment and installation costs were generated to compare first cost of the various systems. Estimates were also made for annual maintenance costs along with associated annual escalation factors. Equivalent full load cooling hours and modified degree day data were used in conjunction with energy consumption data for typical equipment to estimate total annual energy consumption and costs. Estimated annual escalation factors were also applied to unit fuel costs.

The first costs, maintenance costs and operating costs for all three alternate systems were input to a computerized economic program for life cycle analysis. The first alternate, split DX and duct furnace, was determined to be the best choice based upon lower first costs and operating costs. The physical size and layout of the equipment in the mechanical room appears to be the only constraint; requiring revisions to the main ductwork in the basement and crawl space. Revisions to the building structure also necessitate some duct revisions.

The existing heating and air handling equipment is located in the furnace room in the basement. For the present design and cost estimate, we have located the new air handler and heating equipment (duct furnace) in the same room. A strong argument may be made for locating the equipment in a barn or shed remote from the home and providing an underground tunnel for the utilities, (ductwork). Comments and discussion indicated interest in this proposal by the local NPS representatives. From a safety standpoint, the gas-fired equipment will be remote from the home. In addition, if the northeast exterior stairs are removed for historic restoration reasons; another exterior access to the furnace room must be provided if equipment is to be located there. We estimate the additional cost of moving the heating and air handling equipment remote from the home and providing a connection tunnel and equipment barn to be approximately $36,000.

The branch ductwork, registers and grilles serving the first and second floor appear to be in good condition and could be reused. Our cost estimate reflects those duct changes necessitated by new HVAC equipment, structural revisions and existing deteriorated material. However, comments received early during this project noted that air supplied by the existing floor and low wall registers may be damaging to furniture located close by. If inconspicuous diffusers could be incorporated in the first floor ceiling during the structural framing rework for the second floor, this could improve air distribution. An estimate of the extra costs associated with these duct changes in approximately $5,500.

Another alternative considers replacing the fixed blade (grille) registers with new double deflection registers allowing the discharge air pattern to be adjusted; away from furniture located close by. An estimate of the extra cost associated with replacing the registers is approximately $500. Consideration must be given to the appearance of these registers in the areas where they are conspicuous.

The new ductwork in the basement will be sheetmetal, internally lined with insulation for both thermal and acoustic considerations. (If necessary, ductwork may be externally wrapped with insulation for improved thermal protection.) The internal liner along with turns (elbows) in both supply and return ductwork should sufficiently attenuate any airborne equipment noise in this low pressure system. Presently, the air handling unit is proposed to be located in the basement furnace room, below the Back Parlor on the first floor. This room has a ceiling below the first floor joists and radiated equipment noise should not be a problem. If the alternate solution to locate the equipment in a remote barn is accepted, there will be no problem with equipment noise.

A humidifier has been added to the project per NPS directives; however, no additional insulation or vapor barrier has been added to the walls. As noted in previous conversations and discussions, adding moisture to the home during the winter will result in condensation in the walls without this insulation. Again, RHA strongly urges the addition of insulation and a vapor barrier to the exterior walls since a humidifier is being provided.

The size of the humidifier is directly related to the tightness of the building shell. It is difficult to accurately estimate the infiltration due to loose fitting windows, the porous nature of the existing walls and their effect on the heating load and ultimately moisture requirements (humidification) for the present home. However, estimates made during design development indicate a maximum requirement for approximately 30 lb./hr of steam for humidification. If the insulation and vapor barrier were added, and window openings reworked, we believe this humidification requirement could be reduced to less than half.

We must take exception to the letter by John E. Hunter dated 4-27-78, in which a relative humidity requirement of 55% was set for the home; with allowances for monthly variances of only 1-2% and daily fluctuations of only 3% (either side). These parameters are impossible to meet with the existing home and would be equally difficult to meet with an improved shell. Controls to maintain these close tolerances are very expensive and would be useless in a home experiencing the tourist traffic (and associated infiltration) that this home sees on an annual basis. In addition, our only means of dehumidification will be by our cooling coil during the air conditioning season. The humidity level will be significantly improved over the existing unconditioned home during the summer months; but no dehumidifier has been included in the project. A regenerative absorption dehumidifier is an expensive piece of equipment, whose value would be compromised by the circulating traffic. We expect the proposed HVAC system modifications, coupled with an improved shell, will enable the home to maintain humidity within a range of 40% to 60%.

An electronic air filter has been included in our cost estimates; however, this is an expensive piece of equipment for this size system. With no major dust producing processes (smoking is prohibited, tourist traffic and infiltration are the major contributors of air pollution), our office feels a medium-to-high efficiency glass fiber media filter would be sufficient for this home. The local LHNHS staff have personnel that could maintain and replace the filters as required.

Heating and cooling will be controlled by a space thermostat located on the hall wall next to the stair on the first floor. A separate humidistat will control the new humidifier.

FIRE PROTECTION

Presently, hand held fire extinguishers are located at several locations in the home. These constitute the on-site fire protection for the home. An automatic Halon system has been discussed for additional protection when the home is unattended. Halon is safe and eliminates the damaging effects a water sprinkler system would have to furniture and finishes.

The cost of an automatic Halon system has not been included in our cost summary, but we estimate a cost of approximately $37,000 for providing a system throughout the home.

Interim Historic Structures Report -
Architectural Data Section
(Preliminary Surveys/Schematic Design Services)
Lincoln's Home
Lot 8, Block 10
Lincoln Home National Historical Site
Springfield, Illinois

Ferry & Henderson Architects, Inc.

November 10, 1980
Project Number SME78-810

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IV. EXISTING CONDITIONS/AS IS MEASURED DRAWINGS
(22 x 36 Bluelines - Sheets 11 thru 15)

I. STRUCTURE INVESTIGATION AND ANALYSIS REPORT

Ralph Hahn and Associates
Consulting and Design Engineers Inc

1320 South State
Springfield, IL 62704
217-544-0721

Mr. Don Walton
Ferry & Henderson Architects, Inc.
1320 South State Street
Springfield, IL 62704

November 10, 1980

RE: Lincoln Home
Springfield, IL
RHA # SME78-810

Dear Mr. Walton:

TITLE IA SERVICES relating to the Lincoln Home, Lot 8, Block 10 require the following structural related work be completed:

A. Interim Historic Structures Report - Architectural Data Section (Preliminary Surveys/Schematic Design Services).

1.a. Physical investigation of the structural fabric.

1.c. Complete set of measured drawings which documents the structural system's features and locations.

2.a. A detailed engineering analysis to determine the structural sufficiency of the Home.

2.e. A visitor circulation analysis to include both the historic and modern alterations, additions, etc.

Included with this report is a copy of the structural measured drawings and 8-1/2 x 14 sketches of additional data obtained during removal of some of the building fabric (i.e. baseboards and ceiling, etc.). This information should complete the requirements of Sections 1a. & 1c.

In regard to A.2a., a copy of RHAI's final analysis calculations are included in this report. Our preliminary analysis stated that the live load capacity of the first floor framing is approximately 26 pounds per square foot, based on allowable bending stresses, and five pounds per square foot, when based on allowable shear stresses. A more refined analysis indicates the live load capacity of the first floor to be approximately 33 pounds per square foot, based on allowable bending stresses, and five pounds per square foot, when based on allowable shear stresses. In calculating the above capacities, a 33% increase in the

Ralph C. Hahn, P.E.
George W. Bourne, P.E.
Frank L. [illegible], P.E.
Charles [illegible], P.E.
James R. [illegible], P.E.
Bobby G. [illegible], P.E.
Gerald F. Morrow, P.E.

David Mears
Robert [illegible], P.E.
Larry [illegible], P.E.
Brad [illegible], P.E.

allowable bending and shear stresses was used to account for the short duration of load (approximately 1 day). The calculations for the second floor framing indicate the following live load capacities:

Mr. Lincoln's Room

Based on Bending Stresses	- 56 pounds per square foot
Based on Shear Stresses	- 54 pounds per square foot
Based on Connection Capacity	- 16 pounds per square foot

Boy's Bedroom

Based on Bending Stresses	- 46 to 28 pounds per square foot
Based on Shear Stresses	- 50 to 44 pounds per square foot
Based on Connection Capacity	- 33 to 13 pounds per square foot
In circulation area only	- 50 pounds per square foot (assumes that capacity of east end connection is controlled by Horiz. shear in wood and member depth @ end equals or exceeds 7-5/8".)

Robert's Bedroom

Based on Bending Stresses	- 71 pounds per square foot
Based on Shear Stresses	- 68 pounds per square foot

The above second floor framing capacities include a 33% increase in the allowable bending and shear stresses and connection loads to account for the short duration of load (approximately 1 day) and assume that only the newer joists to which flooring is nailed carries the floor load as original joists were not in contact with flooring material or appeared to be connected to newer joists along their length.

Efforts to determine the actual construction of the main stair (West side) from first to second floor and member sizes proved fruitless and were discontinued as historic fabric would have to be removed and possibly irrepairably damaged in order to determine this information. However, X-ray information did indicate the probable construction of the second floor landing. Our calculations for this area, which are based on assumptions of member sizes and properties, indicate the landing of the stair at the second floor level is probably structurally capable of supporting a live load of 100.0 pounds per square foot. The stair seems rigid when walking and jumping on the stair treads and landing. This rigidity may be due in part to the very stiff steel railings and posts attached to the stair.

All previous reference to allowable stresses refers to the recommended working stresses published by the American Institute of Timber Construction. Allowable working stresses are basically determined as follows:

1. Wood strength values are established using the methods of ASTM (American Society of Testing and Materials)Standard D2555-76.
2. Wood strength values are then modified using the methods of ASTM D245-74, the factors used in adjusting strength values include:
   a. seasoning adjustment
   b. strength ratio - considers effects of knots, splits, slope of grain, density, etc.
   c. normal duration of load
   d. safety factors
   e. other special factors.

The safety factor applied to wood strength values for bending is approximately 2.0, while that for horizontal shear is approximately 4.0.

CONCLUSIONS & RECOMMENDATIONS

As stated in our preliminary analysis, the Uniform Building Code (and most National codes) recommends that residential structures be designed for a live load capacity of 40 pounds per square foot and that areas for public circulation should have a live load capacity of 100 pounds per square foot. Based on the 1978 Visitation figures, we estimate that during peak periods, it is conceivable that 500 people might tour through the Home in one hour's time. Assuming an average visit might take eight minutes, sixty-six visitors and staff might occupy the Home at one time. Based on our analysis, we are of the opinion that the first and second floor wood framing should be shored or restructured or reinforced or a combination of these methods used if the present Visitation rates and circulation patterns are to continue or new circulation patterns created. Considering the importance of maintaining the present and historic appearance of the Home, we ask that either your office or the National Park Service consult with our office, as soon as possible, in regard to future plans for the Home, future circulation possibilities, and parameters to be used in preparing a proposal for structure stabilization.

If you have any questions or comments or require additional information, contact our office at your convenience.

Sincerely yours,

Robert J. Power, Jr.

Robert J. Power, Jr., P.E.
Project Engineer

RJP/cc

Ralph Hahn and Associates
Consulting and Design Engineers Inc

1320 South State
Springfield IL 62704
217 544 0721

March 26, 1981

Mr. Don Walton
Perry & Henderson Architects, Inc.
1320 South State Street
Springfield, IL 62704

RE: Lincoln Home
Springfield, IL
HBR # SMS 78-610

Dear Mr. Walton:

This letter is written as a follow-up to our November 10, 1980 report which presented the results of our engineering analysis for the structural sufficiency of the Lincoln Home. In our report, we recommended that the first and second floor wood framing be shored or restructured or reinforced or a combination of these methods used if the present visitation rates and circulation patterns are to continue.

Considering the Historic significance of the Lincoln Home, we recommend that the first and second level floor framing be modified to bring its' capacity up to the recommended design loads of the Uniform Building Code. This will require the following work:

1. shoring of first floor beams and joists in the basement area,
2. addition of some new joists in the first floor level,
3. modification of first floor joist and connections,
4. in Mr. Lincoln's Room and Boy's Bedroom, removal of base trim, some flooring and possibly portions of the first level ceiling to allow for modifications to be made to the floor joist and connections to achieve a more efficient floor load transfer to the wall structure and possibly the addition of some shear connections between the newer and original joists.

We estimate the range of probable construction costs for the above work to be $6,500 to $11,000.

If you have any questions or comments or require additional information, contact our office at your convenience.

Sincerely yours,

Robert J. Power, Jr.

Robert J. Power, Jr., P.E.
Project Engineer

II. FIELD INSPECTION DATA
(8½ x 14 Sketches - Sheets 1 thru 7)

Mrs. Lincoln's Room

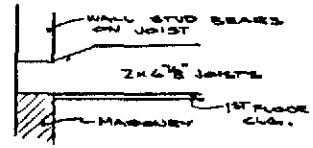
Joists look in good shape. Floor is supported by joists. Pipe runs perpendicular and thru top of joists at approx. ⅓ to ½ span.

4"x4" member @ West side of North Window has evidence of termite damage at floor level.

Counterweights in window appear to not be functional.

At North side of Mrs. Lincoln Room floor joists are not notched into studs but fall to side of studs and are toenailed into plate below, however this is at a window location.

At W. side of fireplace -



At W. side of Mrs Lincoln Room, floor is approx. level with Mr. Lincoln floor.

At S. side Mr Lincoln floor is approx. 3" lower than Mrs. Lincoln floor. Mrs. Lincoln floor is approx. level with hallway.

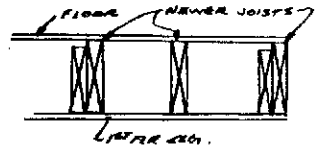
Most wall studs appear to be in good condition.

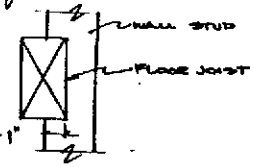
Mr. Lincoln's Room

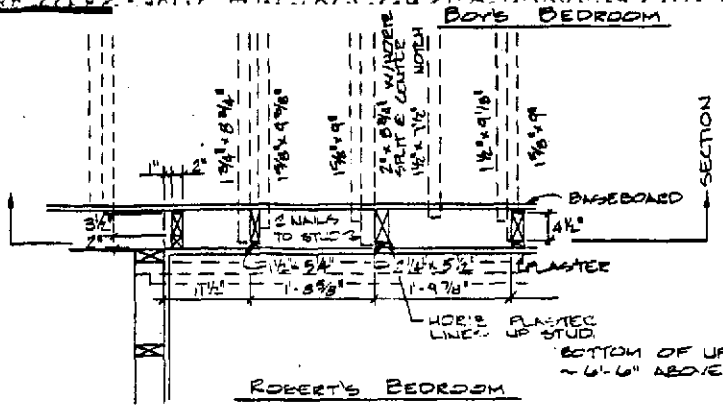
Floor joists rest in approx. 1" notch in studs which go up to sill plate approx. 24" above floor level.

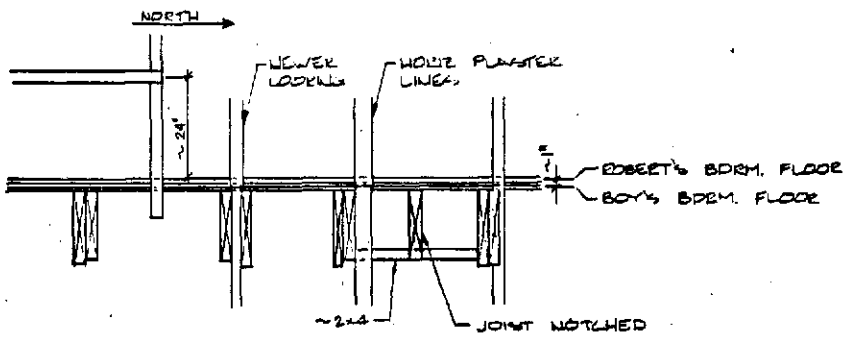
New joists are higher than original joists and support floor. Newer joists are nailed to wall studs with approx 4 nails. Between studs newer joists sit on 3" blocks or shims and bear on oak beam at East Wall.

Some old joists are split. Newer joists look to be in good condition. Oak beam feels solid.

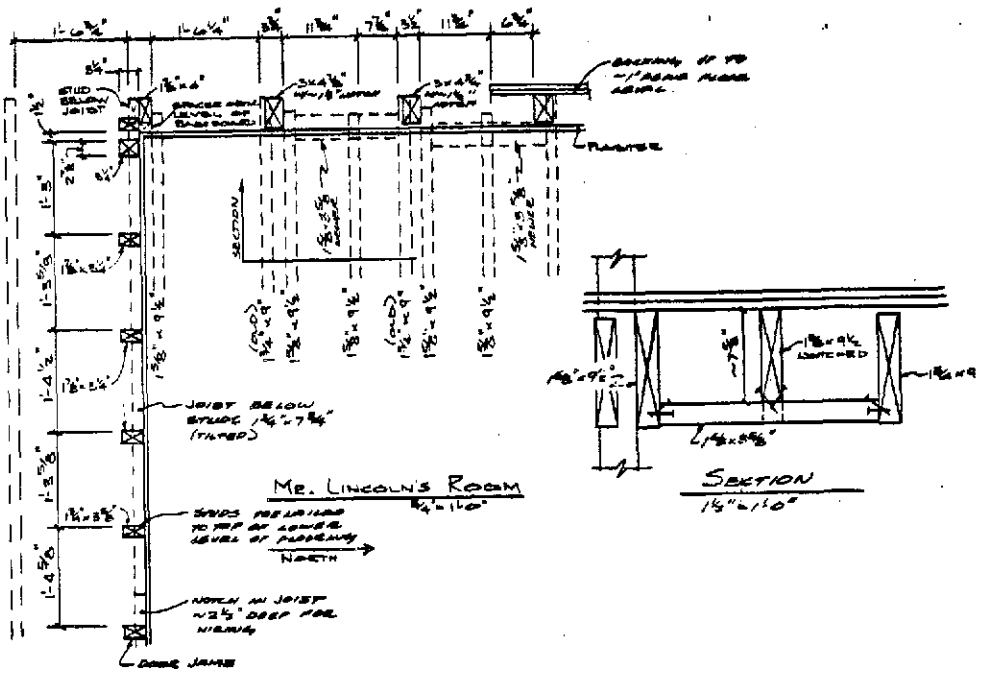




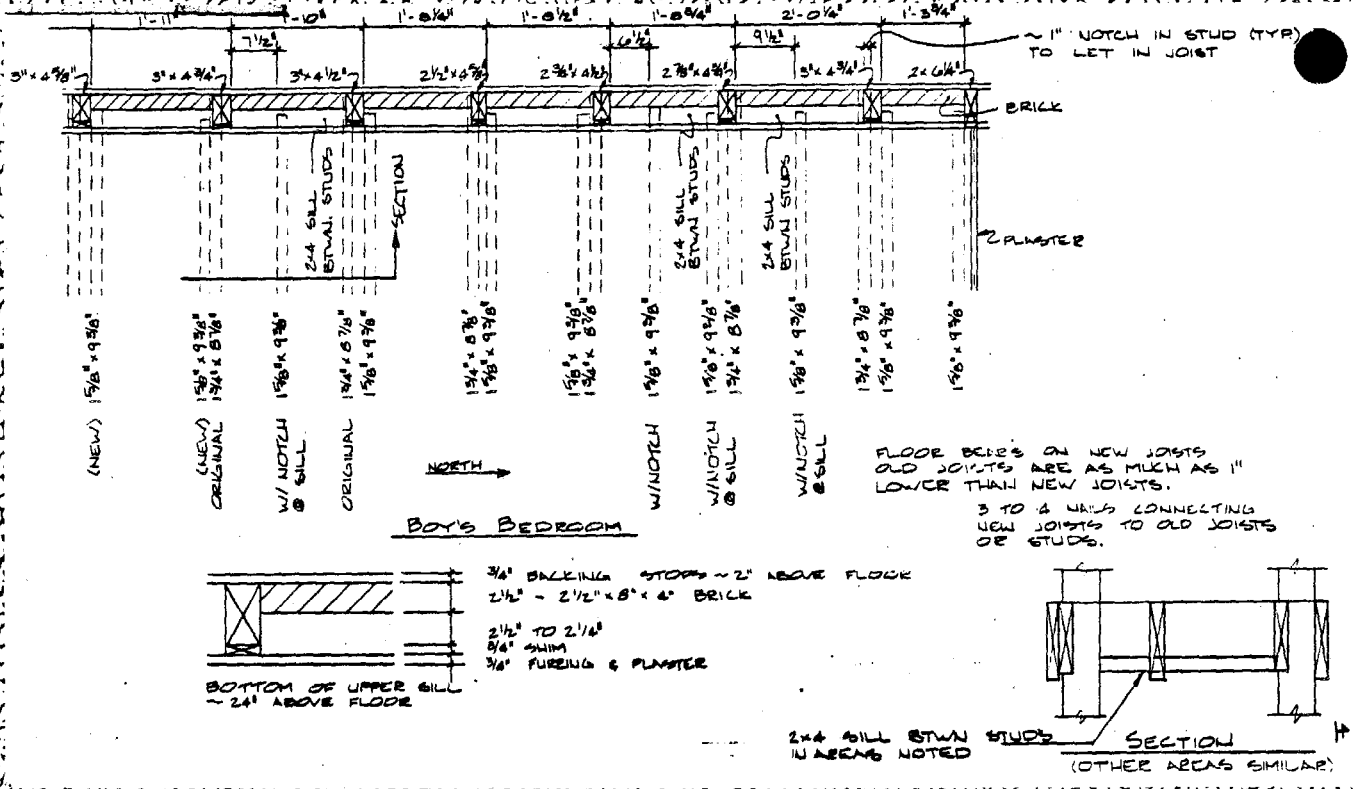


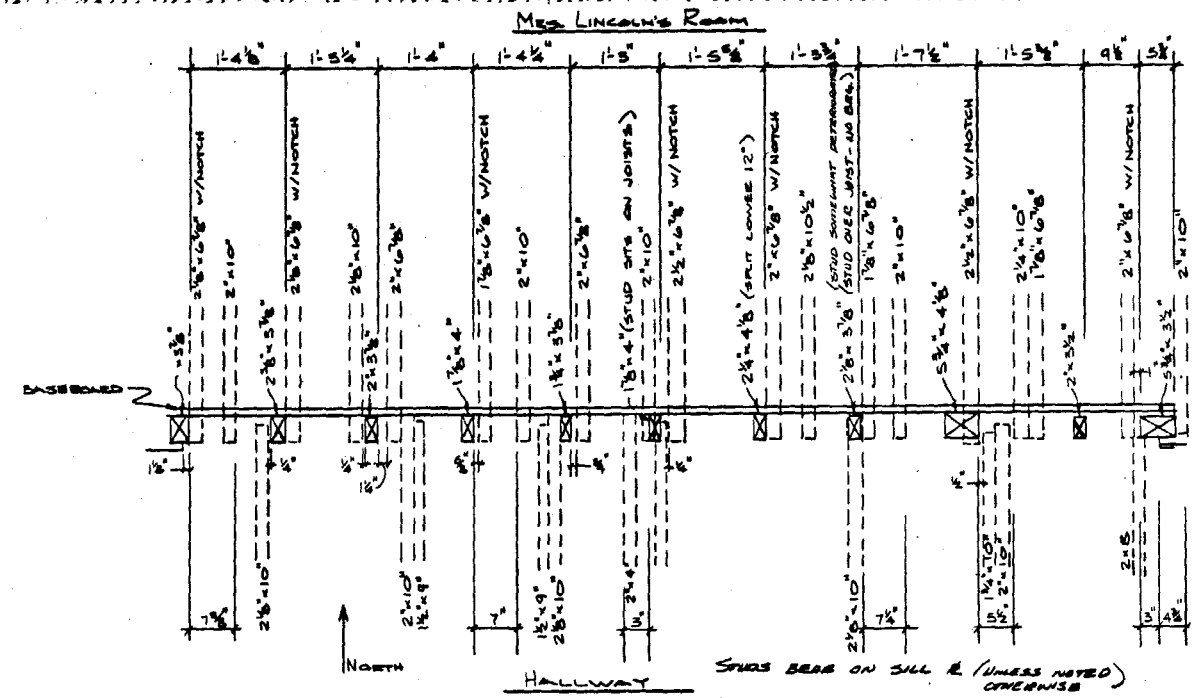


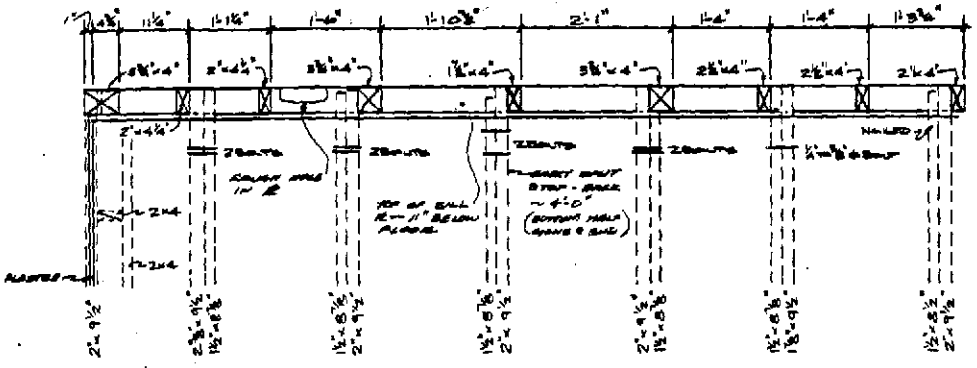
SECTION



ME. LINCOLN'S ROOM

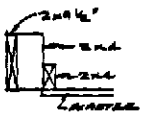

~1" NOTCH IN STUD (TYP) TO LET IN JOIST
BRICK
PLASTER
SECTION
2x4 SILL BTWN STUDS
(NEW) 1⅝" x 9⅜"
(NEW) ORIGINAL 1⅝" x 8⅞"
1¾" x 8⅞"
W/ NOTCH @ SILL 1⅝" x 9⅜"
ORIGINAL 1¾" x 8⅞"
1⅝" x 9⅜"
1¾" x 8⅞"
1⅝" x 9⅜"
W/NOTCH 1⅝" x 9⅜"
1¾" x 8⅞"
W/NOTCH @ SILL 1⅝" x 9⅜"
1¾" x 8⅞"
1⅝" x 9⅜"
NORTH
BOY'S BEDROOM
FLOOR BEAMS ON NEW JOISTS OLD JOISTS ARE AS MUCH AS 1" LOWER THAN NEW JOISTS.
3 TO 4 NAILS CONNECTING NEW JOISTS TO OLD JOISTS OR STUDS.
3/4" BALLOON STOPS ~2" ABOVE FLOOR
2½" ~ 2½" x 8" x 4" BRICK
2½" TO 2 1/16" SHIM
3/4" FURRING & PLASTER
BOTTOM OF UPPER SILL ~24" ABOVE FLOOR
2x4 SILL BTWN STUDS IN AREAS NOTED
SECTION
(OTHER AREAS SIMILAR)

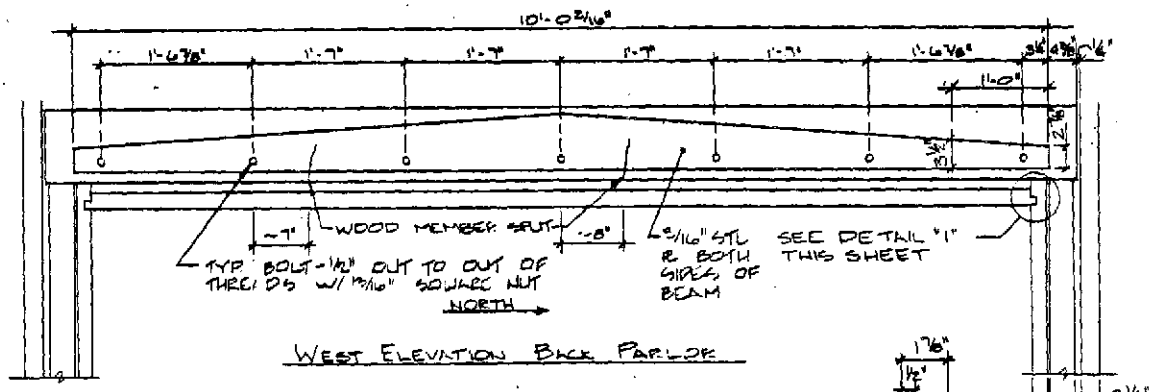

MRS. LINCOLN'S ROOM
BASEBOARD
NORTH
HALLWAY
STUDS BEAR ON SILL & (UNLESS NOTED OTHERWISE)



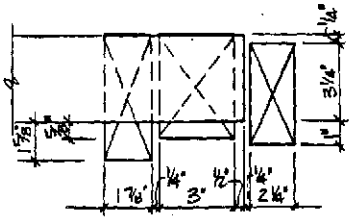
NORTH

ROBERT'S BEDROOM

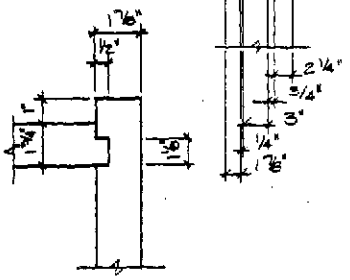




WEST ELEVATION BACK PARLOR



PLAN - NORTH END



DETAIL "1"

III. FINAL ANALYSIS CALCULATIONS
(Sheets 1 thru 6)

Ralph Hahn and Associates
Consulting and Design Engineers Inc
1320 South State
Springfield, IL 62704
217-544 0721

Designed R. Powell
Date Nov. 4, 1980
Checked
Date

Project Lincoln's Home
Subject Analysis (Final)
Project No. SME 78-810
Sheet 1 of 6

1 DAY DURATION FACTOR = 1.33
PERMANENT DURATION FACTOR = .90

MR. LINCOLN'S ROOM

CHECK CAPACITY OF 1 5/8 x 9 1/2" JOISTS (NEW) @ 12" O.C.

F_b = 1200 psi
F_v = 75 psi
E = 1,404,000
$S_x = bd^2/6 = 1.626(9.5)^2/6 = 24.4 in^3$ $I = 115.9 in^4$

$M_{CAP} = 1200(24.4) = 29280$ #-in
$= 2440$ ft-#

$w = 8(2440)/19^2 = 54$ psf

$54 \times 1.33 = 71.9$ psf
-15.0 psf DL
56.9 psf LL CAPACITY SAY 56 PSF

SHEAR CAPACITY BASED ON FULL SECTION

$F_v = 3/2\ R_v/bd$ $\quad 75 = 3/2\ R_v/1.626(9.5)$

$R_v = 772$#
$772 \times 3/19 = 81.8$ psf
$\times 1.33 = 108.0$ psf LL

@ d = 7 5/8" @ NOTCH $\quad R_v = 2(75)(1.625)(7.625)^2/8(9.5) = 497$#

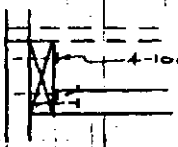
$w = 497 \times 3/19 = 52.3$ psf LL
52.3 psf $\times 1.33 = 69.6$ psf
-15.0 psf DL
54.6 psf LL

Ralph Hahn and Associates
Consulting and Design Engineers Inc
1320 South State
Springfield, IL 62704
217-544-0721

Designed R. Power | Project Lineman's Home
Date Nov. 6, 1980 | Subject Analysis (Final)
Checked | Project No. SHE 78-810
Date | Sheet 2 of 6

Assume joist bears on 2x4 w/ 4 toe nails } total
2 slant nails }
Assume 1½" penetration - Group II 6-10d nails

4(.83)(85) + 2(85) = 452# × 8.5/4.5 = 405# (accounts for joist not centered on 2x4)
× 1.33 = 538#
538 × 3/19 = 56.6 psf
-15.0 psf ⊥
41.6 psf ⊥ capacity



Capacity = 4(85) = 340#
× 1.33 = 452#
+ ½ joists = 301#
301 × 3/19 = 31.7 psf ⊥
-15.0 psf ⊥
16.7 psf ⊥ cap.

Ralph Hahn and Associates
Consulting and Design Engineers Inc
1320 South State
Springfield, IL 62704
217-544-0721

Designed R. Power | Project Lineman's Home
Date Nov. 6, 1980 | Subject Analysis (Final)
Checked | Project No. SHE 78-810
Date | Sheet 3 of 6

Boy's Bedroom

1 5/8 × 9 3/8" joists @ 14" & 20" o.c.

w = 71.9 (sht. 1) × 13/14 = 61.6 psf
-15.0 psf ⊥
46.6 psf ⊥

w = 71.9 × 13/20 = 43.1 psf
-15.0 psf ⊥
28.1 psf ⊥

Shear capacity

w = 69.6 (sht. 1) × 13/14 = 59.7 psf
-15.0 psf ⊥
44.7 psf ⊥

w = 108 (sht. 1) × 13/20 = 64.8 psf
-15.0 psf ⊥
49.8 psf ⊥

Connection Capacity
See sht. 2

56.6 psf × 13/14 = 48.5 psf
-15.0 psf ⊥
33.5 psf ⊥

or 16.7 psf ⊥ (sht. 2)

or 452 × 13/20 = 271# × 3/19 = 28.5 psf
-15.0 psf ⊥
13.5 psf ⊥

Ralph Hahn and Associates
Consulting and Design Engineers Inc
1320 South State
Springfield, IL 62704
217-544-0721

Designed R. Power | Project Lincoln's Home
Date Nov. 6, 1980 | Subject Analysis (Final)
Checked | Project No. SME78-810
Date | Sheet 4 of 6

CHECK JOISTS @ CIRCULATION AREA

50 PSF × 14/12 = 58.3 PLF

15 PSF × 14/12 = 17.5 PLF

13.0' 6.0'

166.3# 498.6# E. END 664.9#

166.8# 259.3# 425.6# W. END

6.77'

2916'#

2916'# < 2440'# (SHT. 1) × 1.33 = 3245'#

664.9# ≈ 497# (SHT. 1) × 1.33 = 661#

425.6# < 452# (SHT. 2)

ASSUMES E. END CONNECTION CAPACITY CONTROLLED BY WOOD AND MEMBER DEPTH @ END 7 5/8"

Ralph Hahn and Associates
Consulting and Design Engineers Inc
1320 South State
Springfield, IL 62704
217-544-0721

Designed R. Power | Project Lincoln's Home
Date Nov. 6, 1980 | Subject Analysis (Final)
Checked | Project No. SME78-810
Date | Sheet 5 of 6

ROB'T'S BEDROOM

ASSUME ONLY 1½ × 8 3/8" JOISTS CARRY LOAD ~24" o.c.

S_x = 19.7 in.³

M_{CAP} = 1200 × 19.7 = 23640 in-# = 1970 ft-#

w = 1970(8)/11.0² = 130 plf

× ½ (24" o.c.) = 65 plf

× 1.33 = 86.5 PSF LL

− 15.0 PSF DL

71.5 PSF LL

BASED ON SHEAR

V_S = 3/2 R_V/(1.5/8.875) R_V = 666#

× ½ = 333#

× 1.33 = 444#

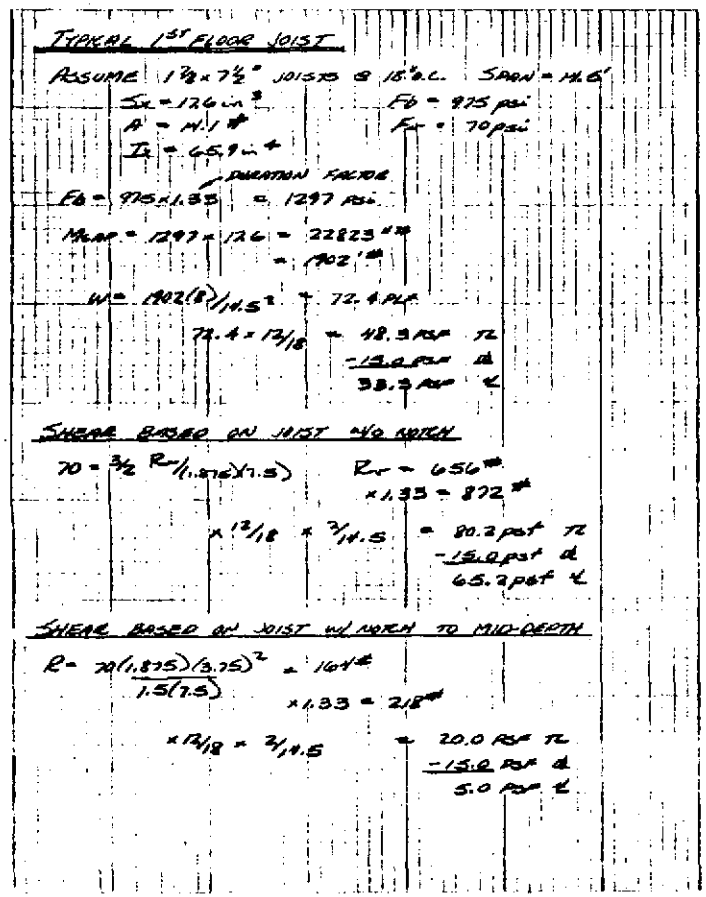
× 3/11 = 80.7 psf LL

− 15.0 psf DL

65.7 psf LL

Ralph Hahn and Associates
Consulting and Design Engineers Inc
1320 South State
Springfield, IL 62704
217-544-0721

Designed R. Powell — Project Lincoln's Home
Date Nov. 6, 1980 — Subject Analysis (Floors)
Checked — Project No. 80FE28-210
Date — Sheet 6 of 6



IV. EXISTING CONDITIONS/AS IS MEASURED DRAWINGS
(22 x 36 Bluelines - Sheets 11 thru 15)

1st FLOOR FRAMING PLAN AND DETAILS
(See Sheet No. 11 in Measured Drawings)

2nd FLOOR FRAMING PLAN
(See Sheet No. 12 in Measured Drawings)

ATTIC AND ROOF FRAMING PLAN
(See Sheet No. 13 in Measured Drawings)

1st FLOOR STUD FRAMING ELEVATIONS
(See Sheet No. 14 in Measured Drawings)

2nd FLOOR STUD FRAMING ELEVATIONS
(See Sheet No. 15 in Measured Drawings)

STRUCTURAL REPORT

50% REVIEW

7 November 1983

Ralph Hahn and Associates
Consulting and Design Engineers Inc

1320 South State
Springfield IL 62704
544-0721

November 7, 1983

Mr. Wes Corgan
Ferry & Henderson Architects, Inc.
1320 South State Street
Springfield, IL 62704

RE: Lincoln Home
Springfield, IL
RHA # SME83-806

Dear Mr. Corgan:

In regards to Basic Agreement No. CX-2000-5-005, Work Directive No. 5-0005-78-06 Design Services Relating to Lincoln Home, Lot 8, Block 10, Package No. 196, the following report describes the structural, mechanical and electrical work required to complete this portion of the contract.

If you need additional information, please do not hesitate to call.

Sincerely,

Lourdes T. Knepler, P.E.
Project Engineer

LTK/cc

Enclosure

ENGINEERING REPORT
FOR

Basic Agreement No. CX-2000-5-005, Work Directive No. 5-0005-78-06 Design Services Relating to Lincoln Home, Lot 8, Block 10, Package No. 196.

S T R U C T U R A L

1. Finalize locations, capacities, and required alterations to building members and components based upon the approved furnishings plan and the revised visitor circulation pattern.

2. Include any additional loads imposed by the various environmental control system concepts.

All references in this report to allowable stresses refer to the recommended working stresses published by the American Institute of Timber Construction. Allowable working stresses are basically determined as follows:

1. Wood strength values are established using the methods of ASTM (American Society of Testing and Materials) Standard D2555-76.

2. Wood strength values are then modified using the methods of ASTM D245-74. The factors used in adjusting strength values include:

   a. seasoning adjustment

   b. strength ratio - considers effects of knots, split, slope of grain, density, etc.

   c. normal duration of load

   d. safety factors

   e other special factors.

The safety factor applied to wood strength values for bending is approximately 2.0, while that for horizontal shear is approximately 4.0.

Based on the Interim Historic Structure Report, written by Ralph Hahn and Associates, Consulting and Design Engineers, Inc., dated November 10, 1980, structural analysis shows that the live load capacity of the first floor framing is approximately 33 pounds per square foot, based on allowable bending stresses, and 5 pounds per square foot, based on allowable shear stresses.

The calculations for the second floor framing indicate the following live load capacities:

Mr. Lincoln's Room

Based on Bending Stresses-56 pounds per square foot
Based on Shear Stresses-54 pounds per square foot
Based on Connection Capacity-16 pounds per square foot

Boy's Bedroom

Based on Bending Stresses-46 to 28 pounds per square ft
Based on Shear Stresses-50 to 44 pounds per square foot
Based on Connection Capacity-33 to 13 pounds per sq.ft.

Robert's Bedroom

Based on Bending Stresses-71 pounds per square foot
Based on Shear Stresses-68 pounds per square foot

Main Stair-Calculations for this area, based on assumptions of member sizes and properties, indicate the landing of the stair at the second floor level is probably structural capable of supporting a live load of 100 pounds per square foot.

Mrs. Lincoln's Room

There are no structural calculations for this area since this room was never used for visitor circulation, but since this area was probably added at the same time as Robert's Bedroom, the construction and load capacity are probably comparable.

All capacities shown above include a 33% increase in the allowable bending and shear stresses to account for the short duration of load (1 day).

STRUCTURAL CONCLUSIONS

A copy of RHAI's final analysis calculations are included with this report.

The Uniform Building Code recommends that residential structures be designed for a live load capacity of 40 pounds per square foot and that areas for public circulation should have a live load capacity of 100 pounds per square foot. Since the circulation pattern of this structure could change in the future, the whole structure will be upgraded to carry a live load capacity of 100 pounds per square foot.

Shear capacity of existing floor joists in the first floor can be increased to about 65 psf by installing joist hangers on all floor joists that are notched. The existing shoring and framing that is presently installed in the basement brings the load carrying capacity of the first floor to approximately 115 pounds per square foot to satisfy Code requirements.

The door opening between the front and back parlor needs to be restructured at the door head. The existing wood beam is cracked and, although steel plates have been bolted to the beam, insufficient capacity exists to carry the additional load imposed by the new circulation pattern.

Based on the new furniture layout and visitor circulation pattern, Mr. Lincoln's Room and Mrs. Lincoln's Room will have to be strengthened to resist a live load of 100 pounds per square foot. This can be accomplished by either:

1. Removing existing first floor ceiling, install new 2x10 joists between existing joists, at approximately 6" on centers, and reinforce existing connections on existing floor joists.

2. Remove existing first floor ceiling, remove existing floor fabric, remove all existing floor joists, and replace with new 2x10 joists at 8" on centers. The existing floor fabric to be reinstalled, and a new plastic ceiling to be installed.

The remaining bedrooms on the second floor will not be open to visitor circulation, nevertheless they will have to be capable of supporting a minimum of 40 pounds per square foot. Connections will have to be upgraded to carry 40 psf minimum. This can be accomplished by installing joist hangers at the ends of the wood joists.

SUMMARY OF STRUCTURAL RECOMMENDATIONS

1st Floor

1. Install joist hangers at all notched beams or joists or place permanent shores near ends of joists and beams.

2. Place permanent shores near midspan of joists and beams. This can be accomplished by removing the temporary shoring and installing new treated lumber.

2nd Floor

1. Install joist hangers at all existing joists in Robert's Room, Guest Room, Maid's Room, Trunk Room, and hallway.

2. Remove existing flooring, floor joists and plaster below in Mr. Lincoln's Room and Mrs. Lincoln's Room, and install new 2 X 10 joists at 8 inches on center. Replace plaster ceiling and reinstall existing flooring.

3. Restructure beam spanning N/S above doors between front and back parlor.

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Designed LTK Project LINCOLN'S HOME
Date NOV. 4, 1983 Subject FLOOR ANALYSIS
Checked Project No. SHEB3-806
Date Sheet 1 of

MR. LINCOLN'S ROOM

UNIFORM BUILDING CODE (UBC)
EXIT FACILITIES = 100 PSF (CORRIDORS SERVING AN OCCUPANT LOAD OF 10 OR MORE PERSONS)

RESIDENTIAL = 40 PSF

1DAY DURATION FACTOR = 1.33

LOADS = 100 PSF LL
15 PSF DL
115 PSF TL

USING 2X10 1½" x 9¼" $A = 13.875\ in^2$
$I = 98.932\ in^4$
$S = 21.391\ in^3$

F_b = 1500 psi
F_v = 75 psi
E = 1,700,00 psi

$f = M/S$ $f(S)/12 = M$
$M = 1500\ (21.391)/12 = 2674$ Kft
$M = wl^2/8$ $w = M(8)/l^2$ $l = 19'$
$w = (2674)(8)/19^2 = 59.25\ (1.33) = 78.80$

SPACING = $\frac{78.8}{115} = .685' = 8.22"$

PLACE 2X10 @ 8" O.C.

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TYPICAL 1ST FLOOR

1⅞" x 7½" JOISTS @ 18" O.C.

L = 14.5'

A = 14.1 in²
I = 65.9 in⁴
S = 17.6 in³

Fb = 975 PSI

Fv = 70 PSI

f = M/S f(S)/12 = M

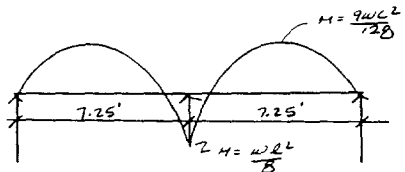
M = 975 (17.6) /12 = 1430 K0T

w = 1430 (8)/(14.5)² = 54.41 (1.33) = 72.4 PSF

72.4 (12/18) = 48.24 PSF T.L.

TOTAL CAPACITY BASED ON BENDING = 48.2 PSF

WITH EXISTING SHORING



$M = \frac{WL^2}{8} = \frac{1430(8)}{(7.25)^2} = 217.6\,(12/18) = 145$ PSF = T.L.

FINAL STRUCTURAL REPORT

3 January 1984

ENGINEERING REPORT
FOR

Basic Agreement No. CX-2000-5-005, Work Directive No. 5-0005-78-06 Design Services Relating to Lincoln Home, Lot 8, Block 10, Package No. 196.

STRUCTURAL

1. Finalize locations, capacities, and required alterations to building members and components based upon the approved furnishings plan and the revised visitor circulation pattern.

2. Include any additional loads imposed by the various environmental control system concepts.

All references in this report to allowable stresses refer to the recommended working stresses published by the American Institute of Timber Construction. Allowable working stresses are basically determined as follows:

1. Wood strength values are established using the methods of ASTM (American Society of Testing and Materials) Standard D2555-76.

2. Wood strength values are then modified using the methods of ASTM D245-74. The factors used in adjusting strength values include:

   a. seasoning adjustment

   b. strength ratio - considers effects of knots, split, slope of grain, density, etc.

   c. normal duration of load

   d. safety factors

   e other special factors.

The safety factor applied to wood strength values for bending is approximately 2.0, while that for horizontal shear is approximately 4.0.

Based on the Interim Historic Structure Report, written by Ralph Hahn and Associates, Consulting and Design Engineers, Inc., dated November 10, 1980, structural analysis shows that the live load capacity of the first floor framing is approximately 33 pounds per square foot, based on allowable bending stresses, and 5 pounds per square foot, based on allowable shear stresses.

The calculations for the second floor framing indicate the following live load capacities:

Mr. Lincoln's Room

Based on Bending Stresses-56 pounds per square foot
Based on Shear Stresses-54 pounds per square foot
Based on Connection Capacity-16 pounds per square foot

Boy's Bedroom

Based on Bending Stresses-46 to 28 pounds per square ft
Based on Shear Stresses-50 to 44 pounds per square foot
Based on Connection Capacity-33 to 13 pounds per sq.ft.

Robert's Bedroom

Based on Bending Stresses-71 pounds per square foot
Based on Shear Stresses-68 pounds per square foot

Main Stair-Calculations for this area, based on assumptions of member sizes and properties, indicate the landing of the stair at the second floor level is probably structural capable of supporting a live load of 100 pounds per square foot.

Mrs. Lincoln's Room

There are no structural calculations for this area since this room was never used for visitor circulation, but since this area was probably added at the same time as Robert's Bedroom, the construction and load capacity are probably comparable.

All capacities shown above include a 33% increase in the allowable bending and shear stresses to account for the short duration of load (1 day).

STRUCTURAL CONCLUSIONS

A copy of RHAI's final analysis calculations are included with this report.

The Uniform Building Code recommends that residential structures be designed for a live load capacity of 40 pounds per square foot and that areas for public circulation should have a live load capacity of 100 pounds per square foot.

The first floor framing is to be reshored with permanent shores. This is to be accomplished by using 2 - 2x10 wood beams, 4 inch tube columns and concrete footings. 4x8 wood beams can be used, but 2x10 beams are more readily available, easier to handle and more convenient to use 2 beams to splice to span the total length. The use of wood beams was chosen over steel beams because of the actual depth of the existing joists. By using wood beams, shimming of the joists is easier and provides a better and cheaper solution.

All existing temporary shores are to be removed. New permanent shores will be placed at the midspan of the existing floor joists and near the ends, close to the supports, of the joists or beams.

The second floor framing will be completely removed. The new framing of Mrs. Lincoln's Room, Robert Lincoln's Room, Maid's Room and Trunk Room will consist of 2x10 joists spaced at 8 inches on center spanning North/South Direction. 2x10 beam will be attached to the bearing walls and the new 2x10 joists will be supported by using joist's hangers. The framing of Mr. Lincoln's Bedroom and the Guest/Boys Bedroom presently spans East/West Direction. If new framing is to span E/W, the solution would be to use 2x10 at 4" on center or to use 2x12 at 8"on center. If the new framing spans N/S, we can use 2x10 at 8" on center. This way, the second floor framing is all the same. The use of steel members was investigated. For 19.25 foot span, steel member must be at least 8 inches plus additional depth of wood blocking for the finish floor framing. Therefore the steel solution is not practical.

Further investigation of the first floor framing shows that it spans North/South. The foundation walls can take the additional load of the second floor if the framing is changed N/S. By spanning the second floor N/S no repairs will be required over the opening between front and back parlor.

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FINAL DESIGN OF SECOND FLOOR FRAMING

USE UNIFORM BUILDING CODE (UBC)

LOADS (LIVE) - RESIDENTIAL - 40 PSF
EXIT FACILITIES - 100 PSF (CORRIDORS SERVING AN OCCUPANT LOAD OF 10 OR MORE PERSONS)

SINCE THE CIRCULATION PATTERN OF THIS STRUCTURE COULD CHANGE IN THE FUTURE DESIGN THE SECOND FLOOR TO SUPPORT 100 PSF LIVE LOAD THRUOUT.

LOADS - LL = 100 PSF
DL = 15 PSF
TL = 115 PSF

TRY 2x10 @ 8" O.C.

2x10 = 1 1/2" x 9 1/4" A = 13.875 in²
I = 98.932 in⁴
S = 21.391 in³

USING NO. 1 SOUTHERN PINE (SURFACED AT 15% MOISTURE CONTENT, K.D, USED AT 15% MAX M.C.)

Fb = 1600 PSI
Fv = 95 PSI
Fc PERP = 406 PSI
Fc = 1450 PSI
E = 1,800,000 PSI

1 DAY DURATION FACTOR = 1.33
PERMANENT " " = .90

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MR. LINCOLN & GUEST BEDROOM

2x10 @ 8" O.C. = .667' O.C.

TOTAL LOAD = 115 PSF (.667') = 76.71 PLF = w

BENDING

$M = \frac{wl^2}{8}$ $\quad w = 76.71$ PLF $\quad l = 19.25$ ft

$M = \frac{76.71(19.25)^2}{8} = 3553$ #ft = 3.6 K ft

$f_b = \frac{M}{S} = \frac{3553(12)}{21.391 in^3} = 1993$ psi

$F_b = 1600 psi (1.33) = 2128$ psi $>$ 1993 psi OK
(DURATION FACTOR)

SHEAR

$R = \frac{wl}{2} = 76.71$ PLF $(19.25)/2 = 738.33$ #

$f_v = \frac{3R_v}{2bd} \quad \frac{3(738.33)}{2(1.5)(9.25)} = 79.82$ psi

$F_v = 95 psi (1.33) = 126.35$ psi $>$ 79.82 psi

DEFLECTION

$\Delta_{TL} = \frac{5wl^4}{384EI} = \frac{5(76.71)(19.25)^4(1728)}{384(1,800,000)(98.932)} = 1.33$ in
$\Rightarrow L/174$ T

$\Delta_{LL} = 1.16$ in $\Rightarrow L/199$ N.G.

DEFLECTION SHOULD BE KEPT TO L/360 DUE TO PLASTER CEILINGS BELOW.

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IF 2x10 ARE SPACED AT 6" O.C.

$w = 115 psf (.5') = 57.50$ PLF

$\Delta_{TL} = \frac{5(57.50)(19.25)^4(1728)}{384(1800000)(98.932)} = .997" \Rightarrow L/230$

$\Delta_{LL} = .867" \Rightarrow L/266$

IF 2x12 ARE SPACED AT 8" O.C.

$I = 177.979$

$\Delta_{TL} = \frac{5(76.71)(19.25)^4(1728)}{384(1,800,000)(177.979)} = .74" \Rightarrow L/312$

$\Delta_{LL} = .64" \Rightarrow L/361$

TRY SPANNING NEW JOISTS N-S DIRECTION

$L = 14.75'$

2x10 @ 8" O.C.

$\Delta_{TL} = \frac{5(76.71)(14.75)^4(1728)}{384(1,800,000)(98.932)} = .46" \Rightarrow L/385$

$\Delta_{LL} = .40" \Rightarrow L/443$

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TRY 2x10 @ 9" O.C SPANNING 14.75'
N-S DIRECTION

115 (9/12) = 86.25 PLF

$$\Delta_{TL} = \frac{5(86.25)(14.75)^4(1728)}{384(1{,}800{,}000)(98.932)} = .52"$$

$\Delta_{LL} = .452" \Rightarrow L/392$

THE USE OF STEEL MEMBERS WAS INVESTIGATED. FOR 19.25' SPAN STEEL MEMBER MUST BE AT LEAST 8" PLUS ADDITIONAL DEPTH OF WOOD BLOCKING FOR FINISH FLOOR FRAMING. THEREFORE STEEL SOLUTION IS NOT PRACTICAL.

INVESTIGATION OF THE FIRST FLOOR FRAMING SHOWS THAT THIS FRAMING SPANS NORTH / SOUTH, THE FOUNDATION WALLS CAN TAKE THE ADDITIONAL LOAD IF THE SECOND FLOOR FRAMING SPANS THE NORTH / SOUTH DIRECTION ALSO. BY SPANNING SECOND FLOOR N/S NO REPAIRS WILL BE REQUIRED OVER THE OPENING BETWEEN FRONT AND BACK PARLOR.

SECOND FLOOR FRAMING TO BE 2x10 @ 8" O.C. THROUGHOUT!

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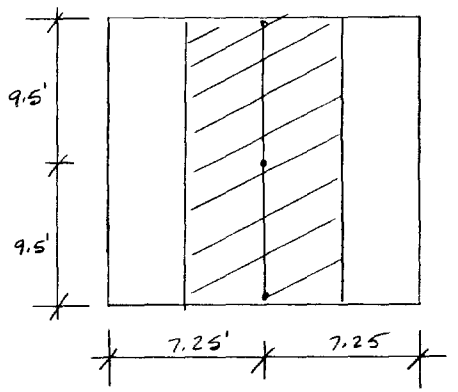
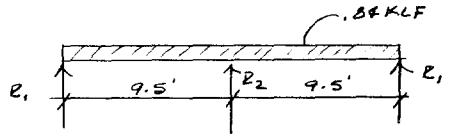
REFRAMING OF FIRST FLOOR FRAMING PLAN

① REMOVE TEMPORARY SUPPORTS

CHECK AREA UNDER SITTING ROOM



115 PSF (7.25 ft) = 833.75 PLF



$R_1 = 3/8\ wL = 3/8(.84\ KLF)(9.5ft) = 3^K$

$R_2 = 10/8\ wL = 10/8(.84\ KLF)(9.5ft) = 10^K$

$M = 9WL^2/128 = 9(.84)(9.5)^2/128 = 5.33\ K\text{-}ft$

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USE W8X9 BEAM

$f = M/S = \frac{5.33(12)}{5.56} = 11.50$ KSI OK

$\Delta = \frac{Wl^4}{185EI} = \frac{.84(9.5)^4(1728)}{185(29,000)(15)} = .15" \Rightarrow L/760$

USE W6X9 BEAMS AND 4" ϕ COLUMNS ON 2'X2'X 10" BASE FOOTING.

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Checked | Project No. SME 83-806
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SINCE FLOOR JOISTS ARE SO UNEVEN IN THICKNESS AND DEPTH, STEEL BEAM SHORING IS NOT THE CORRECT SOLUTION

EACH EXISTING JOIST WILL HAVE TO BE SHIMMED.

IF WOOD BEAMS ARE USED, WOOD SHIMS WILL BE EASIER TO INSTALL.

USING 2-2X10 BOLTED TOGETHER

115 PSF (7.25 ft) = 833.75 PLF

M = 5.33 K-ft

$fb = M/S = 5.33(12) / 21.391(2) = 1495$ psi > 1600 psi

$\Delta = \frac{Wl^4}{185EI} = \frac{.84(9.5)^4(1728)}{185(1800)(98.932)(2)} = .18" \Rightarrow L/633$ OK

ONE 4X8 WILL WORK ALSO, BUT 2X10 ARE EASIER TO GET, HANDLE AND IF BEAM IS SPLICED, SPLICES CAN BE OFFSET.

USE 2-2X10 WOOD BEAMS WITH 4" ϕ COLUMNS

Archaeology Survey

In August and September of 1951, an archaeological survey was made in the back yard of the Lincoln Home. The primary aim of this survey was to ascertain information relative to the outbuildings that existing during Lincoln's time.

The excavations were begun fifty feet east of the house and carried on eastward to the alley.

The following pages contain reduced copies of the remaining report.

An article by Richard S. Hagen titled "Back-Yard Archaeology at Lincoln's Home" in the Journal of the Illinois State Historical Society, Vol. XLIX, No. 3 provides a good accounting of the survey.

Lincoln Homd

Recorded

ILLINOIS ARCHEOLOGICAL SURVEY

Survey No. 9 [illegible]

County Sangamon
Twp. Capital
Quadrangle Springfield West
Location Jackson and 8th Sts.

Reg. Inst. No.
Culture historical
Type of site house and lot

Sec. Twp. T 15N Range 5W
U.T.M. E 273550 N 4408380

Site owner National Parks
Site address 526 S. 7th
Previous owners Dept. of Conservation
Present tenant NPS
Directed to site by
Mapped by
Extent of site (area and depth) lots 7 & 8 Block 10 of Iles addition

Previous excavation 1951 Richard Biggen
Pitting

ENVIRONMENT

Topography urban

Water supply
Drainage

Nearby sites
Modern occupation (building, plowing, etc.)
house built 1839 owned by by Abraham Lincoln outbuildings torn down 1880s (?) rastoration done 1950s on basis of excavations

Type of soil
Ground cover

MATERIAL FROM SITE

presently in possession of Dept. of Conservation, will be turned over to NPS upon completion of cataloguing

Surface coll. Date Owners
Tested Date By whom
Excavated Date By whom
Nature and extent of collections no catalgoue exists nor notes or drawings from the site. Artifacts boxed by square.
Study permission —
Study facilities

MATERIAL REPORTED AS BELONGING TO SITE

—

Owner of material
Certainty of origin
Photos
Site reported by Date
Survey report by Date Visited

F-2

Lincoln's Home Locational Information from artifact boxes

Margaret Brown

20 L 45 around northeast corner of privy in upper disturbed area

" 15" below surface beside privy bricks

" 10" below surface at ½ 21 L 42

30 L 30 3'3" at 34 L 29

" Mortar taken from between B 34 and B. 35 (B=brick?)

25 L 35 from broad disturbed area over rubbish pit to ca. 2' 7"

13 L 13 2' 9" large nail

12½ L 13½ 2' 10" small nail

30 L 15 from below 3' in deep pit feature

20 L 30, 25 L 30 from disturbed areas over brick lined pit and over rubbish pit

35 L 30 8" below surface

33 L 24 below 3' 6" in shallow ash area

25 L 25 Mortar sampel from brick wall at 25 L 25

" Surface to 2' 6" yellow clayey mottled zone

31'2" L 24' 6" beneath brick wall

35"6" L 18 deep in ashes, teacup fragment

30 L 15 surface to 3'

30 R 0 posthole 31½ R 6"

10 L 10, 10 L 15, 10 L 20, 10 L 25 surface to 3 '

15 L 15 surface to 2'6"

" below -2'7" around brick bats

25 L 20 sodd to 2'6" dark soil area

25 R 0 -3' and below

25 L 25 below -3' inside brick pit

" surface to 2'6" dark soil area

artifact box info. continued

38'8" L 15' 10" from under course of brick

15 L 20, 15 L 25 surface to 2' 6"

15 L 20 whole square key at 19 L 18' 6" below surface

20 L 15, 20 L 25 surface to 2' 6"

20 L 15 2' 6" to 3'

0 L 30, 5 L 30, 10 L 30 surface to 3'

25 L 15 below hx 2 bricks at 25' 3" L 11

" surface to 2' 6" yellow clay mottled zone

" below 2'6" in speckled area at southwest part of square

35 R 0 surface to 3'

0 R 0, 0 L 5, 5 L 5 surface to 31

Rubbish pit - bottles, comb, glasses, tiara, pin, brushes etc.

another box - china fragments

" window glass g frag. nails and spikes

33 L 28 6" below surface

10 LS, 15 L 5, 15 R 0, 15 L 10 surface to 3'

20 LS, 20 L 10, 25 L 10 surface to 3'

20 L 45 10" below surface at 21 L 42

20 L 50 north of sidewalk above privy

10 R 0, 10 R 5 surface to 3'

10 R 0, 10 R 5

15 L 5' 3" - 2' 10" stone frag.

15 L 5 & 15 L 10 3' to 3'6" china fragments

16'8" L 11'6" glass stem

15 L 10 below 3' nails

15 L 45

20 R 0 below 3' in h yellow x clay zone

" strap and harness ring at 23 R 2 3'2"

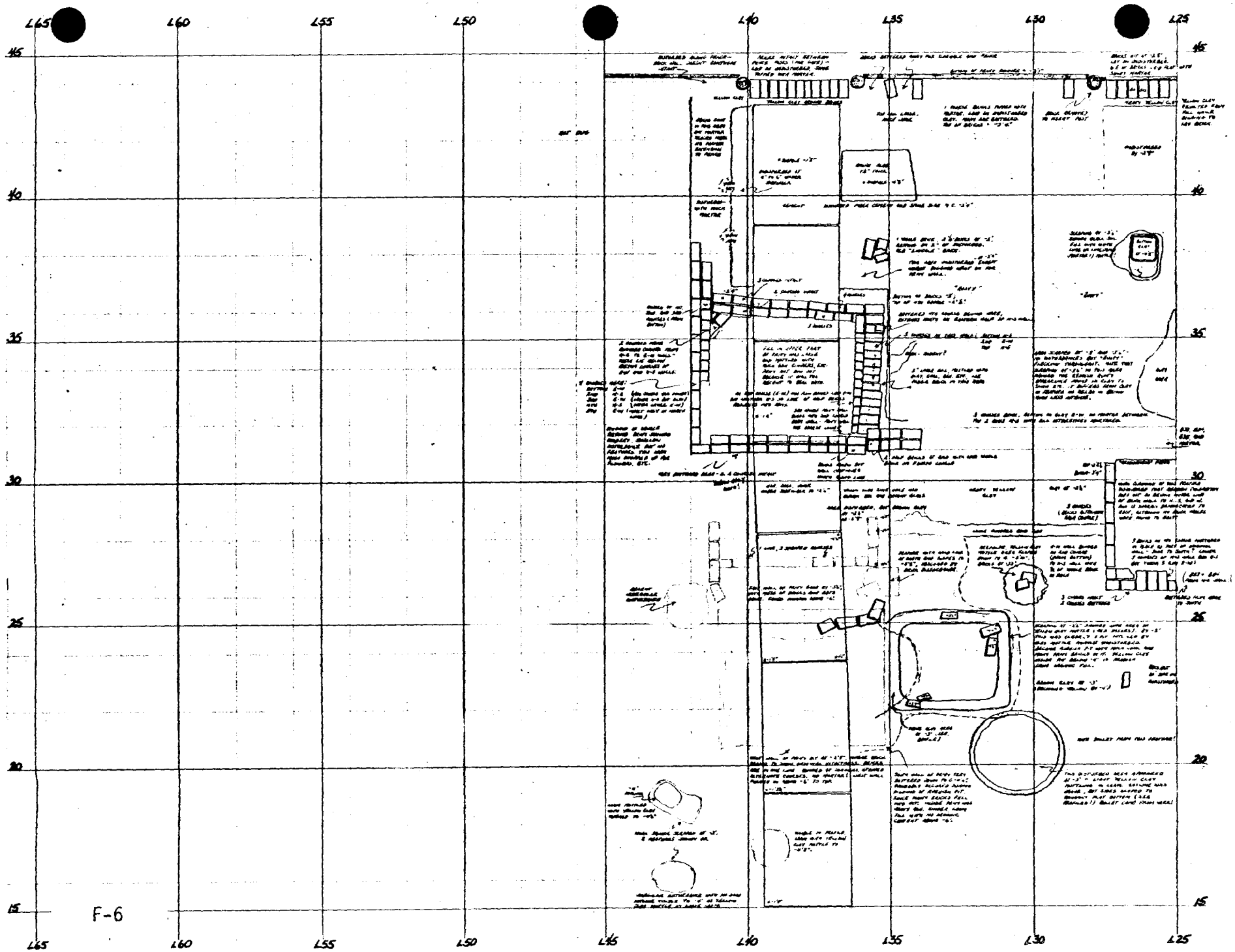
20 L 40 within privy down to 4' except for button found at 5 '

" outside east wall of privy drinking glass at 4' 6"

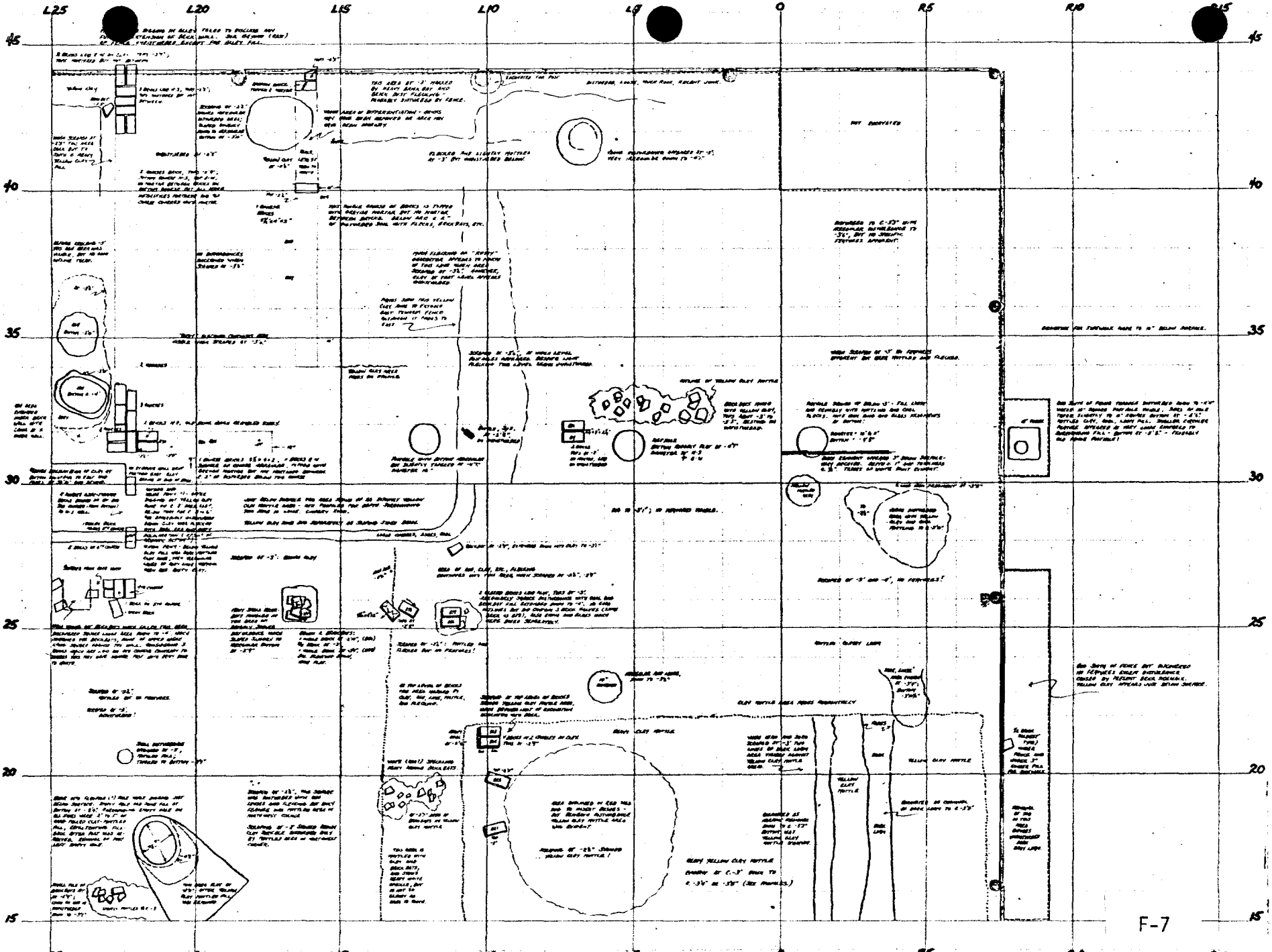
small bottle at 3' 6"

27 L 13 axehead 2' 6"

bottle 31'9" L 106" 2'8"



F-6


L25
L20
L15
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R5
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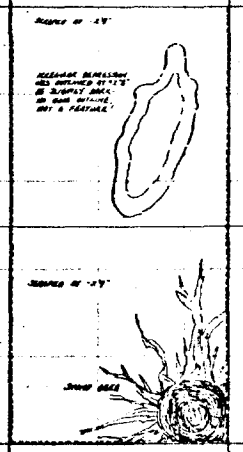

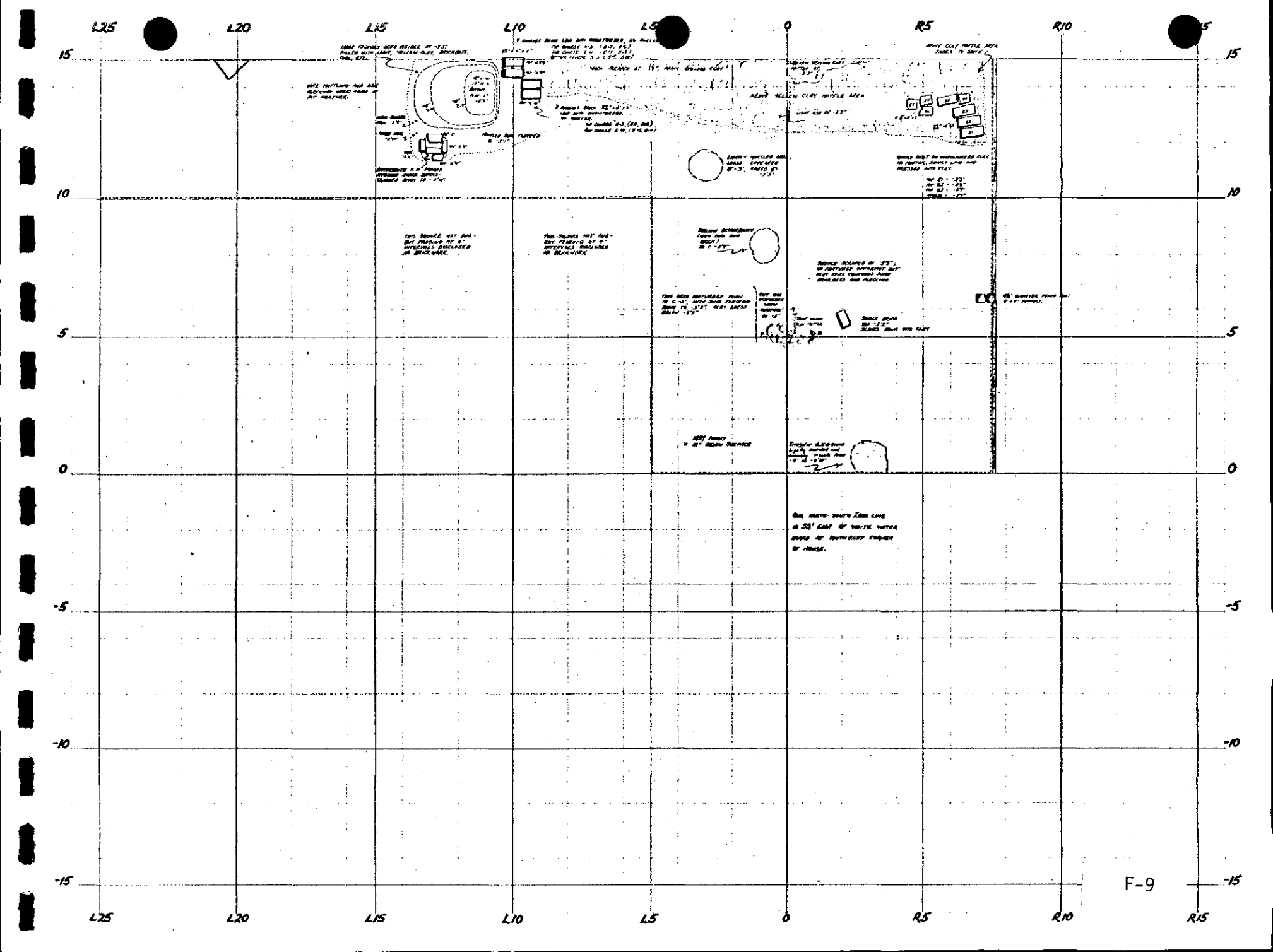
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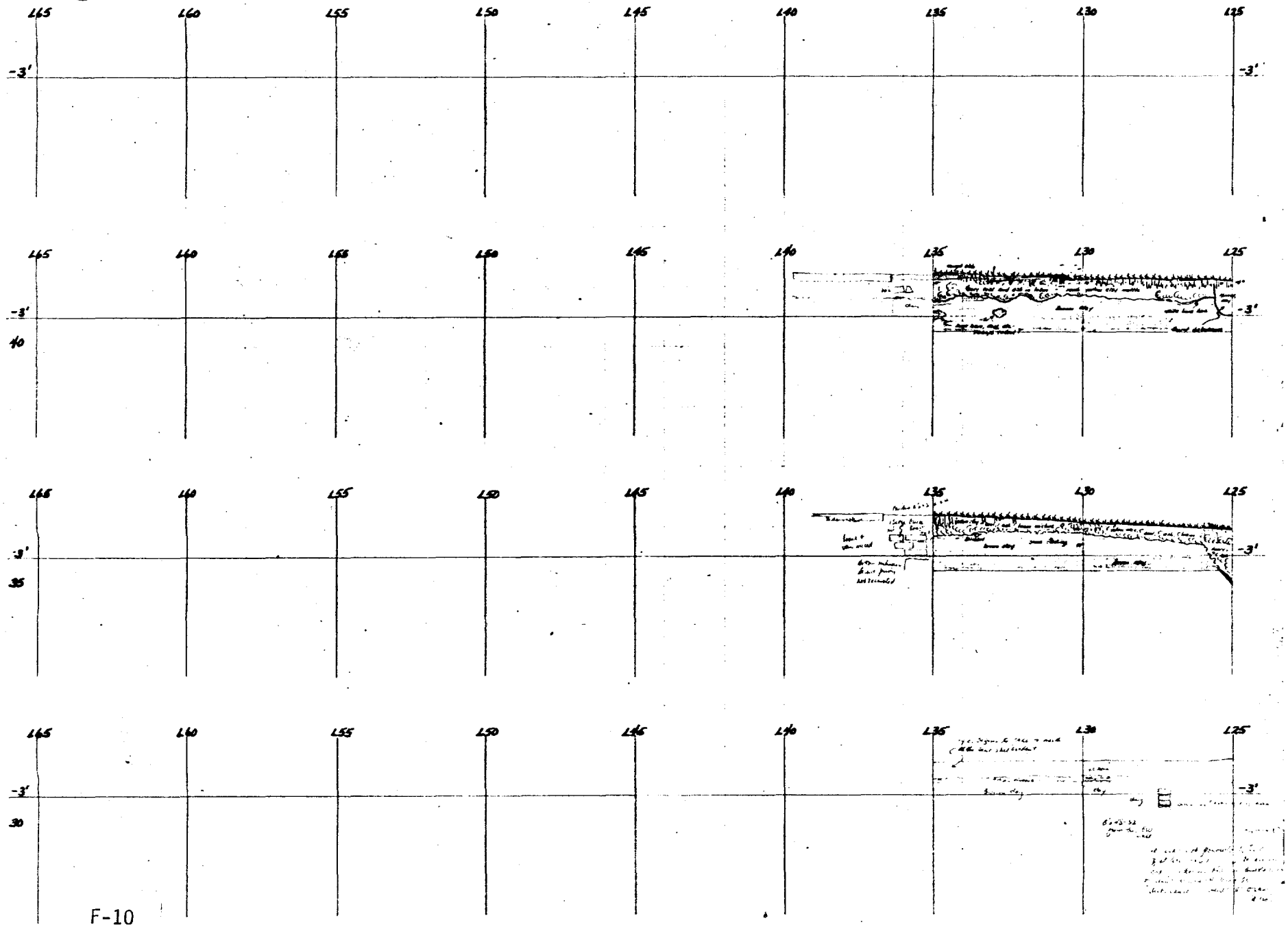
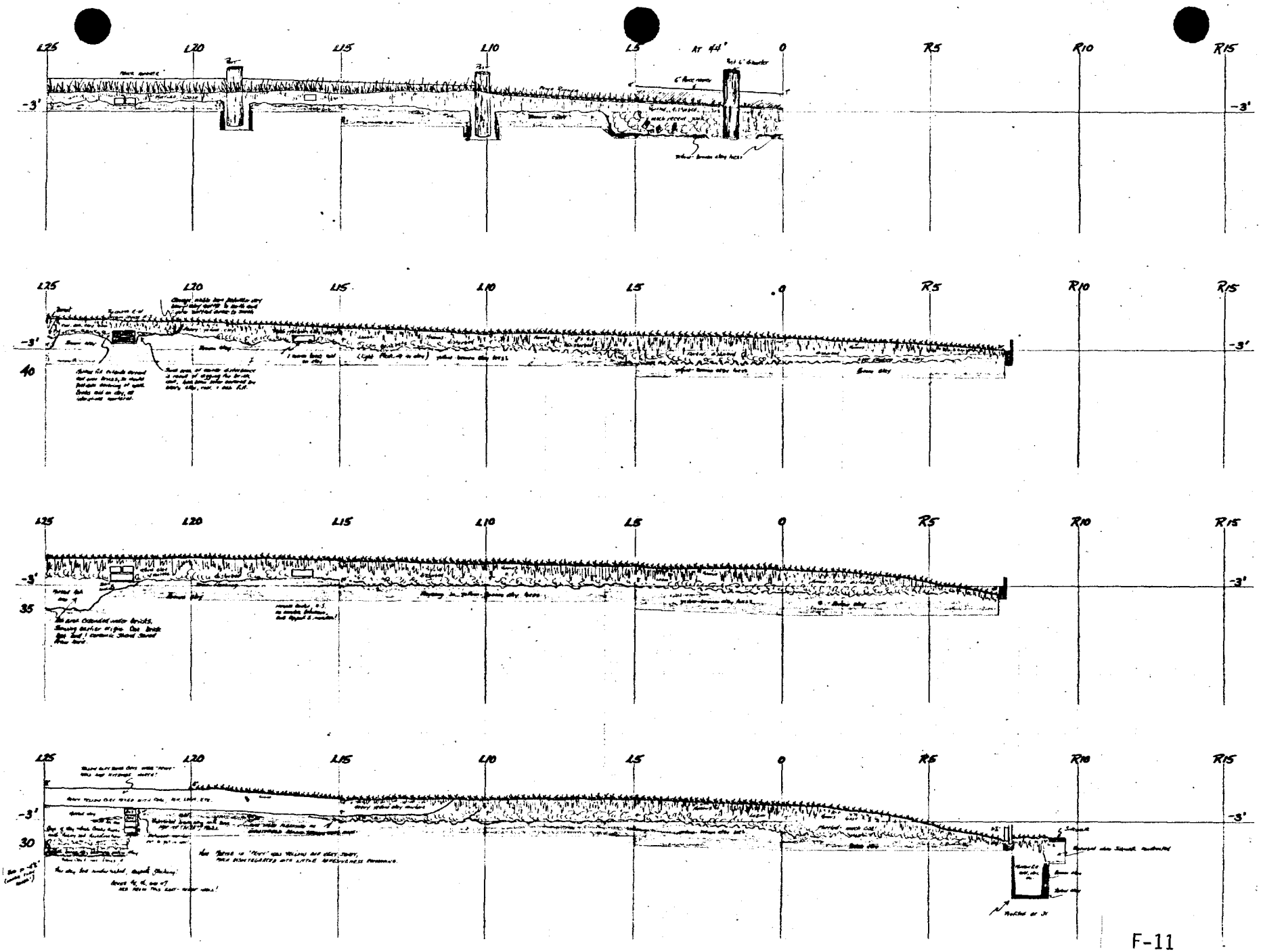
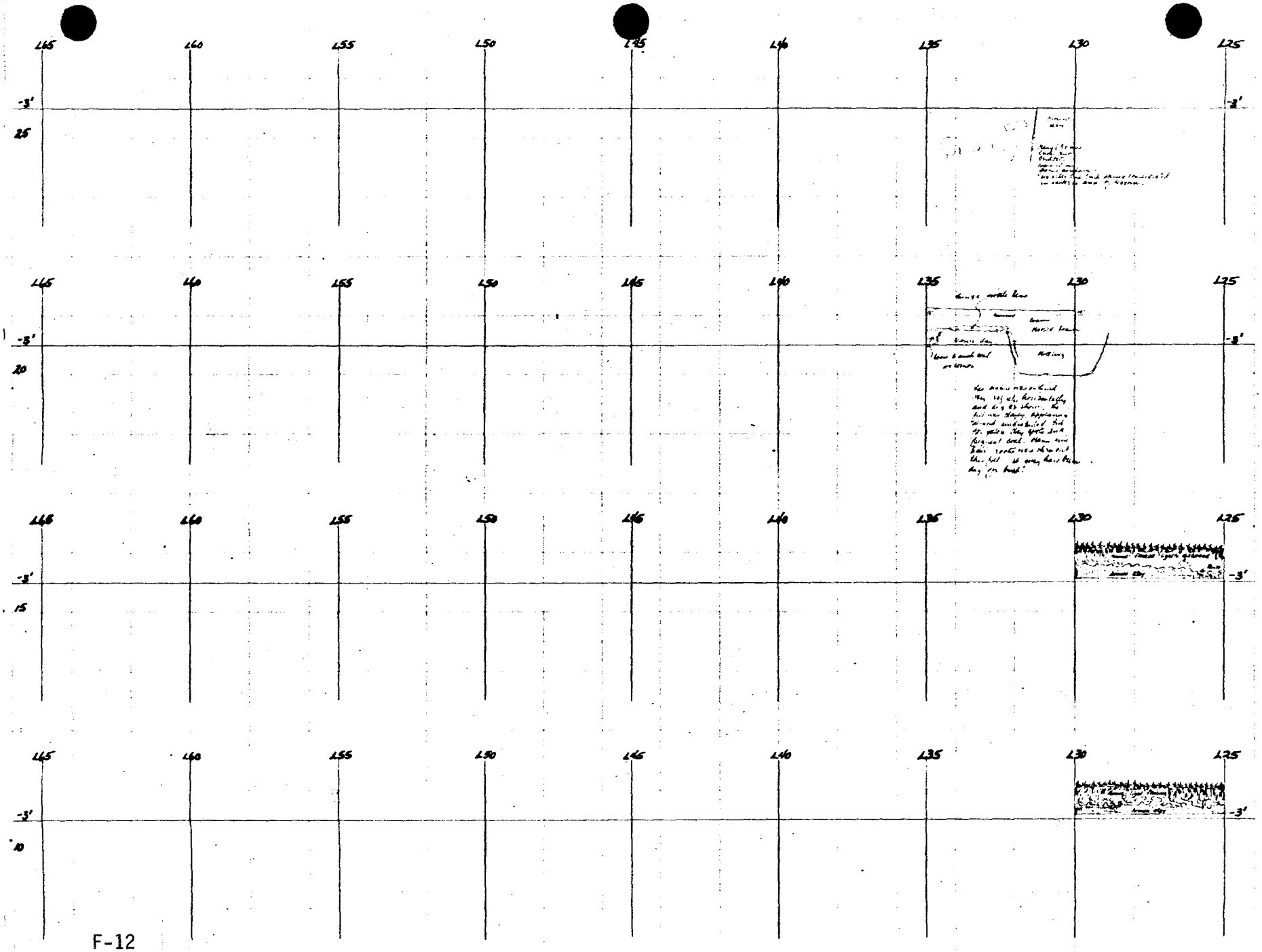

165
160
155
150
145
140
135
130
125
-3'
40
35
30


L25
L20
L15
L10
L5
At 44'
0
R5
R10
R15
-3'
40
35
30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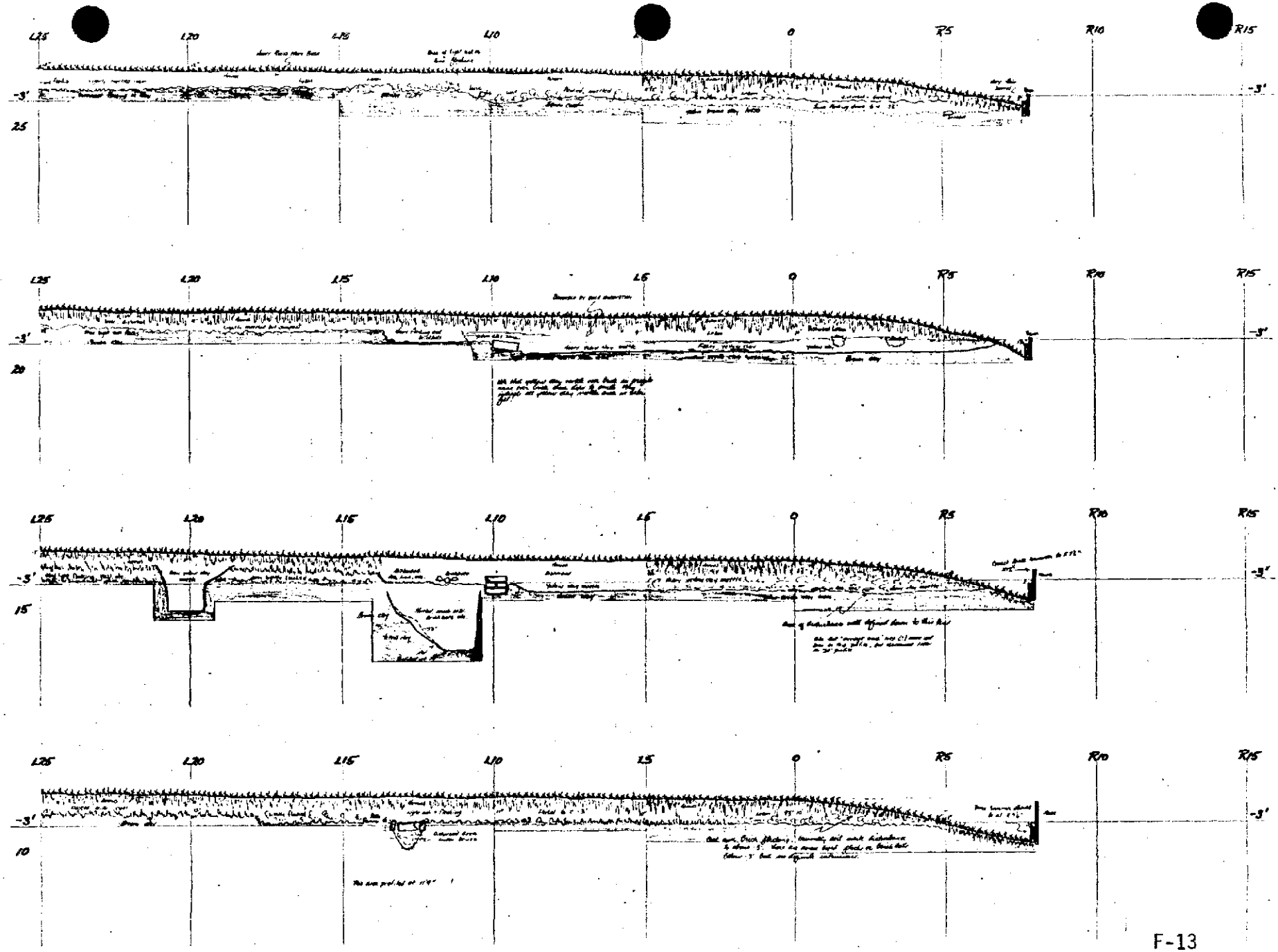
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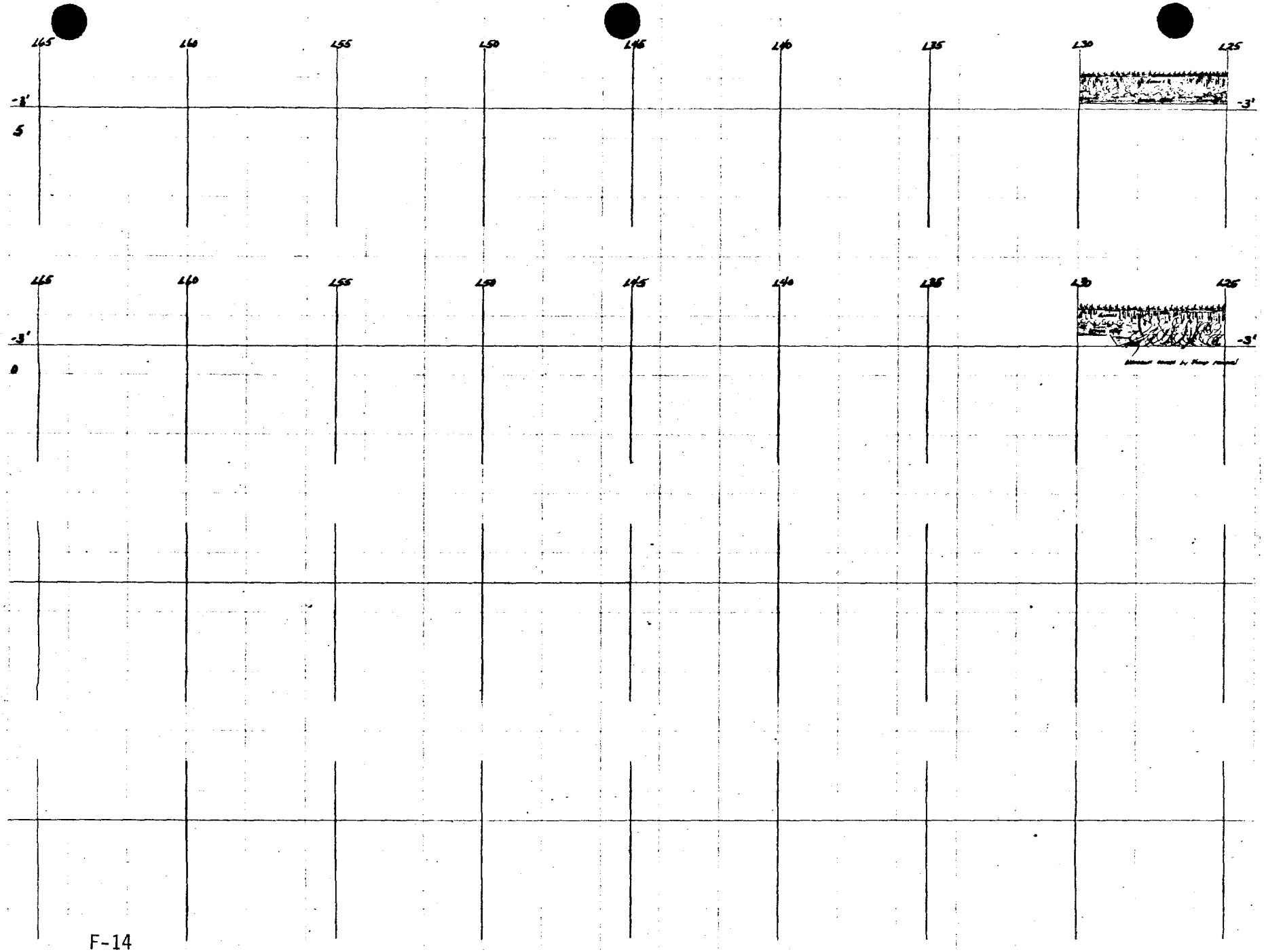
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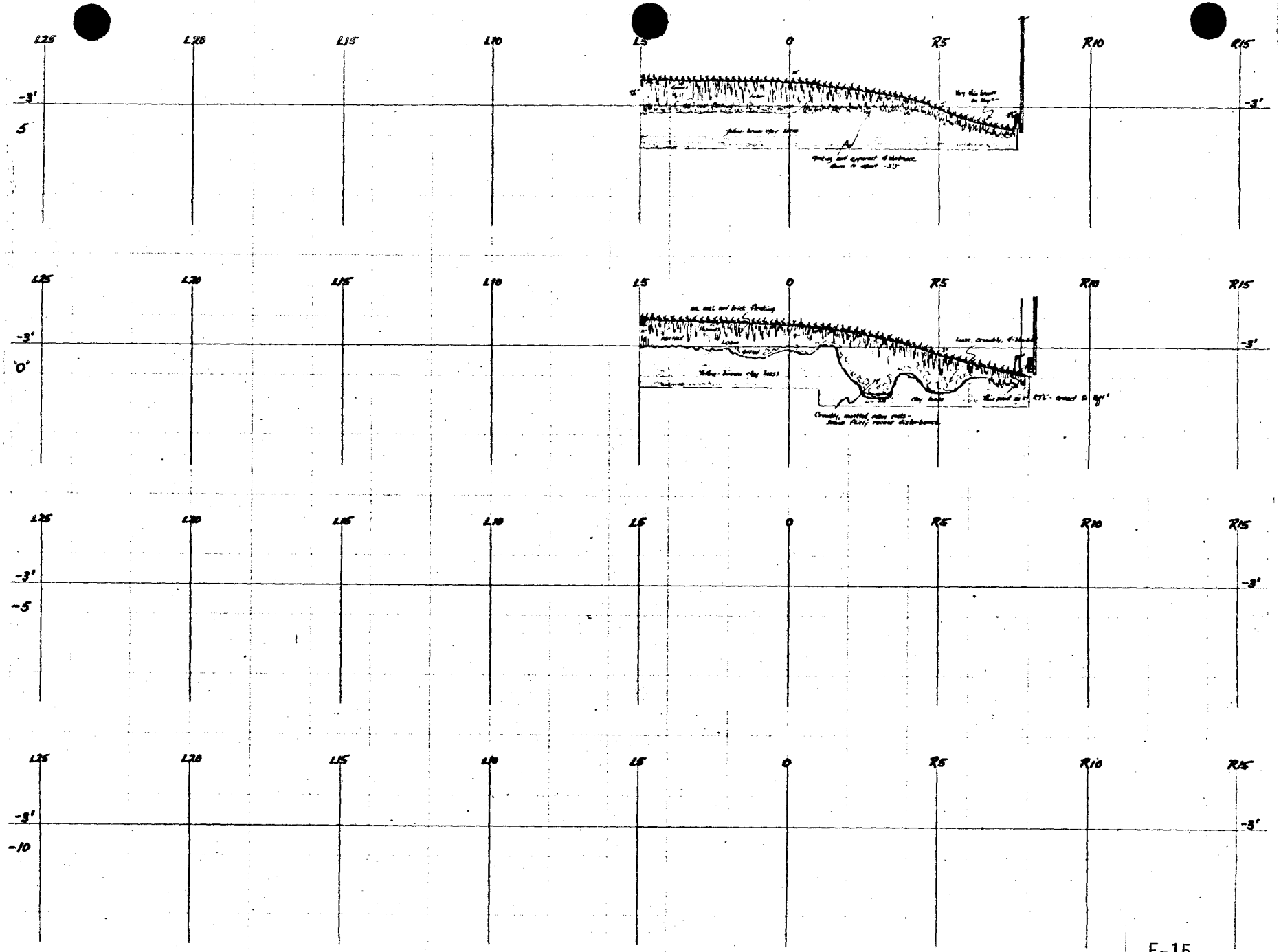
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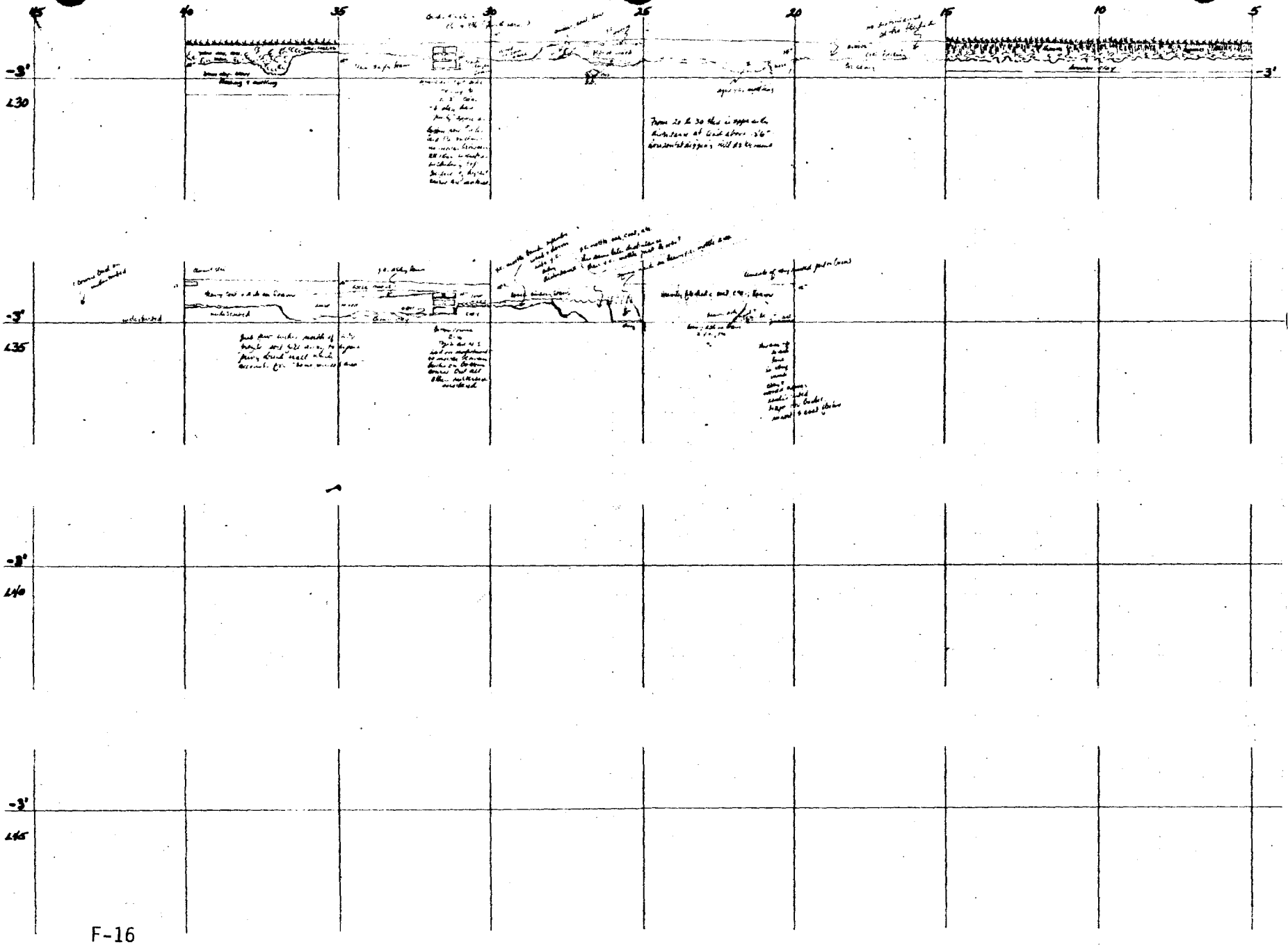
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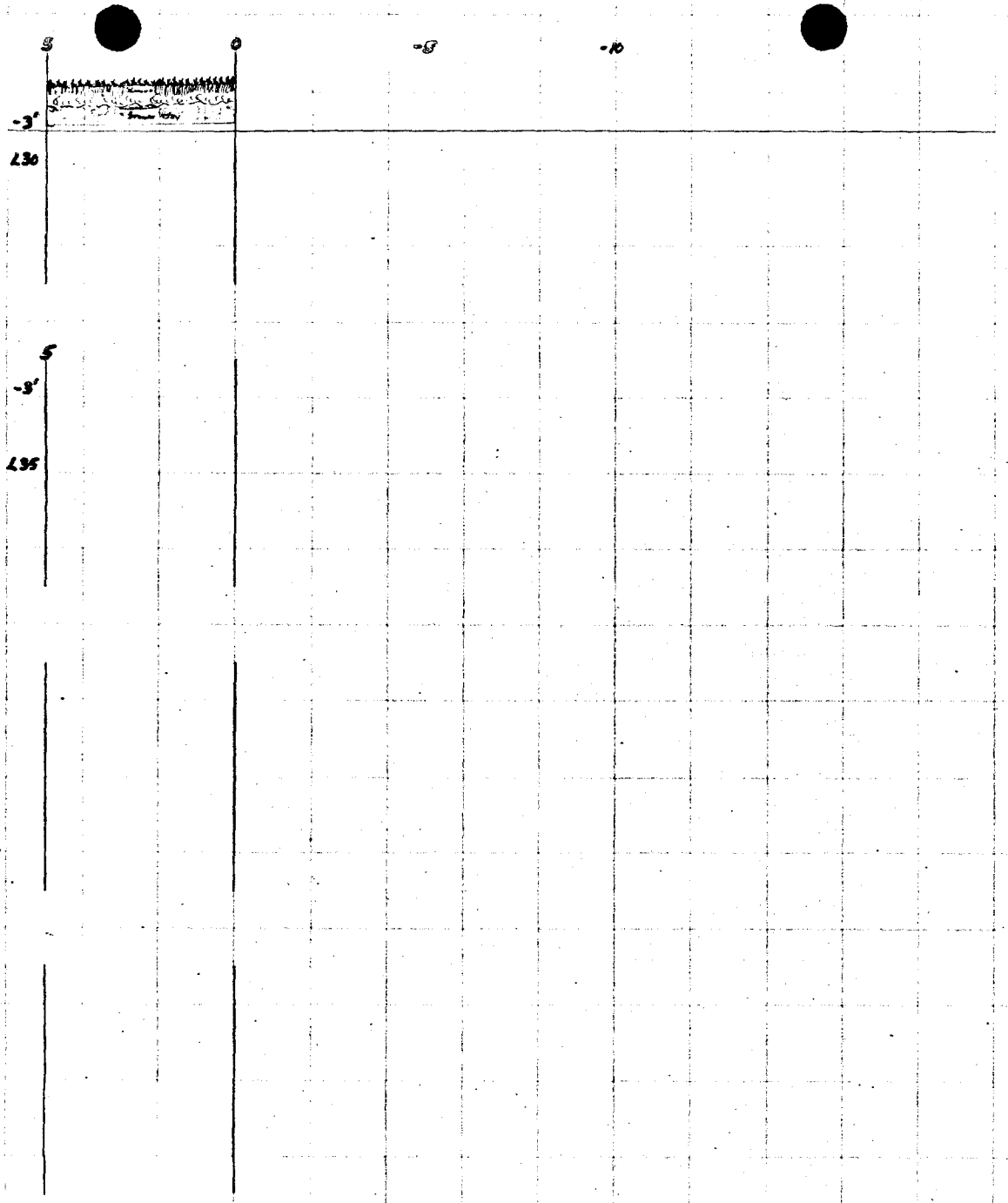
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-3'
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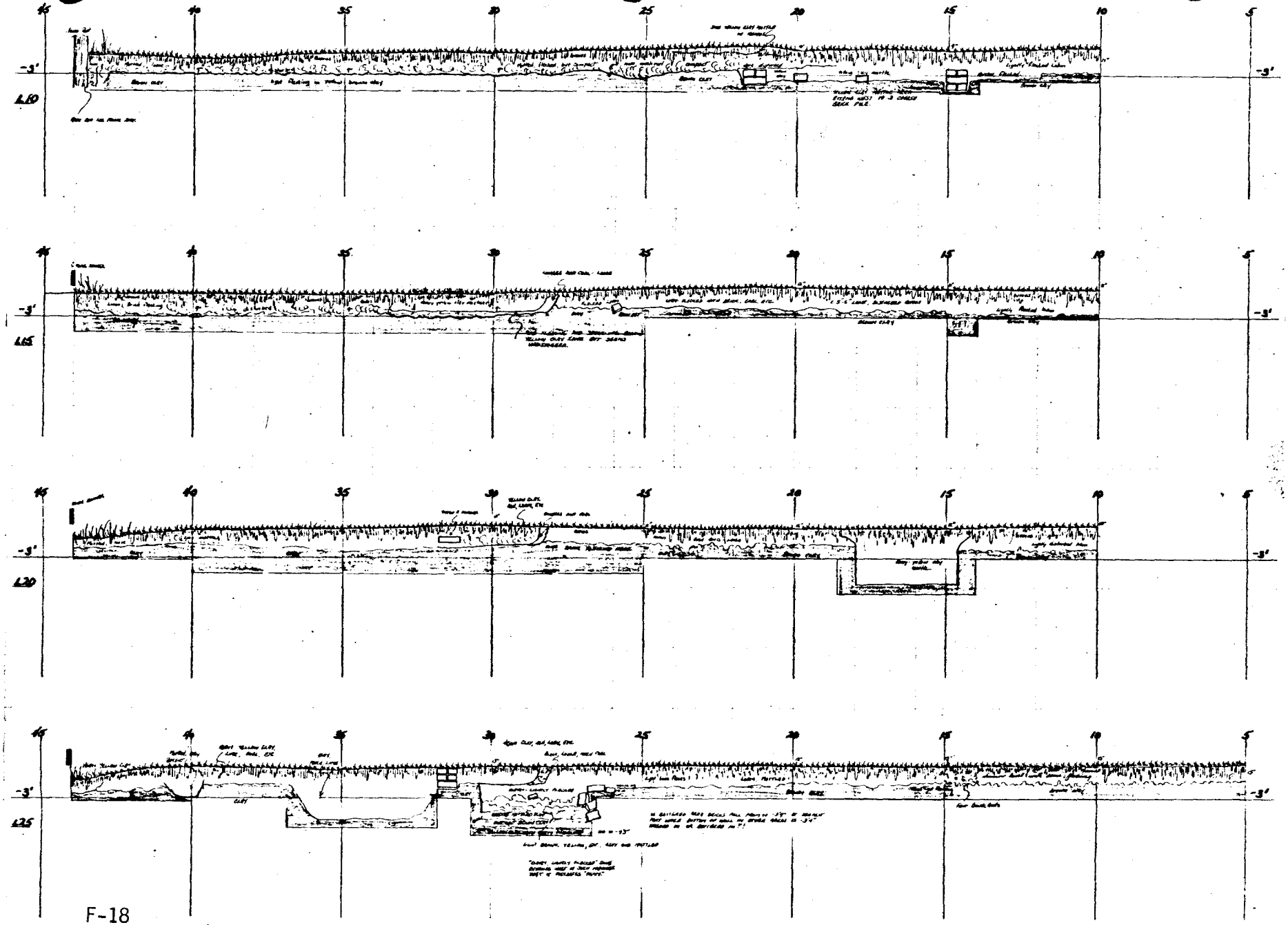
-5'
435



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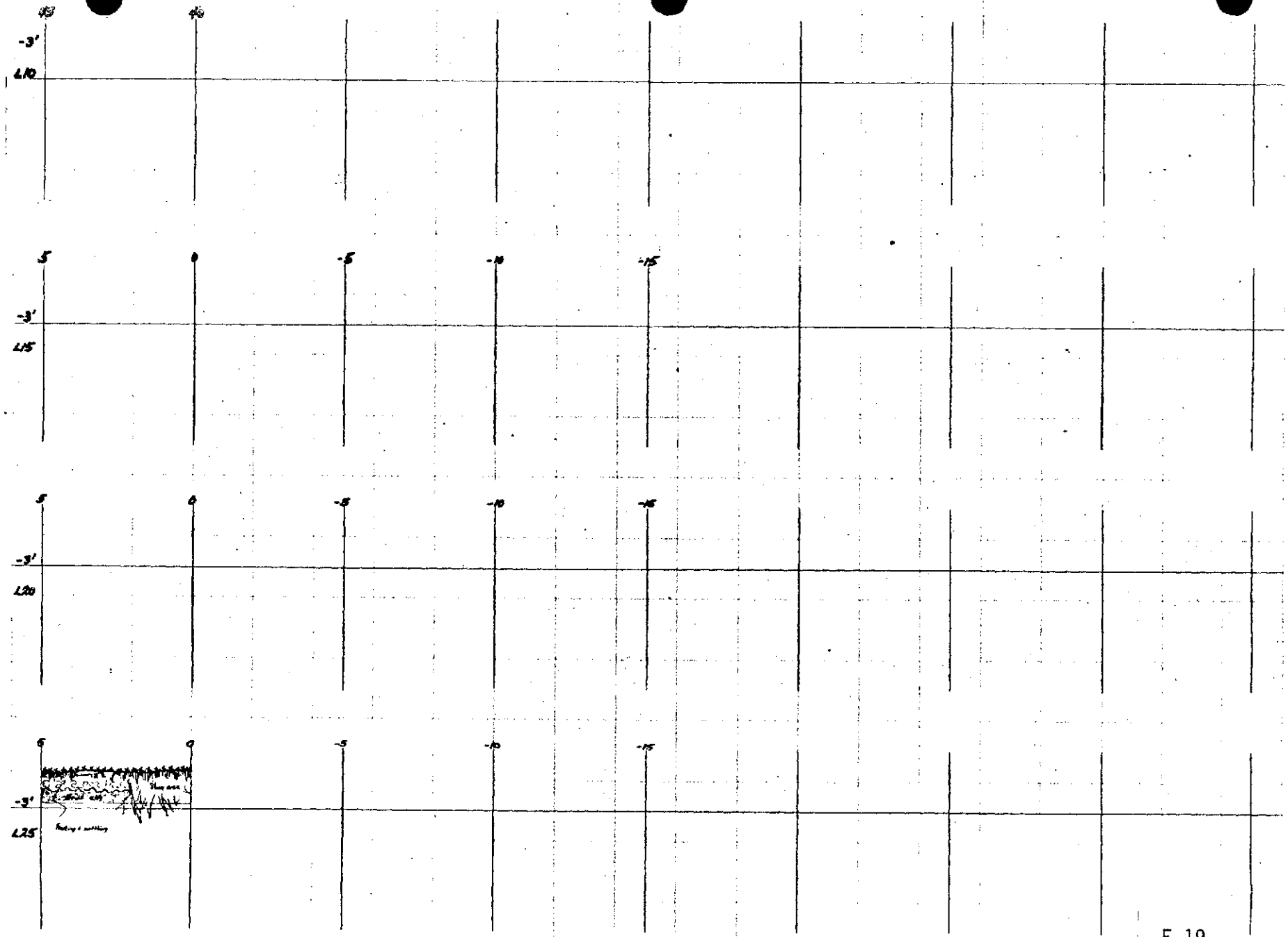
-3'
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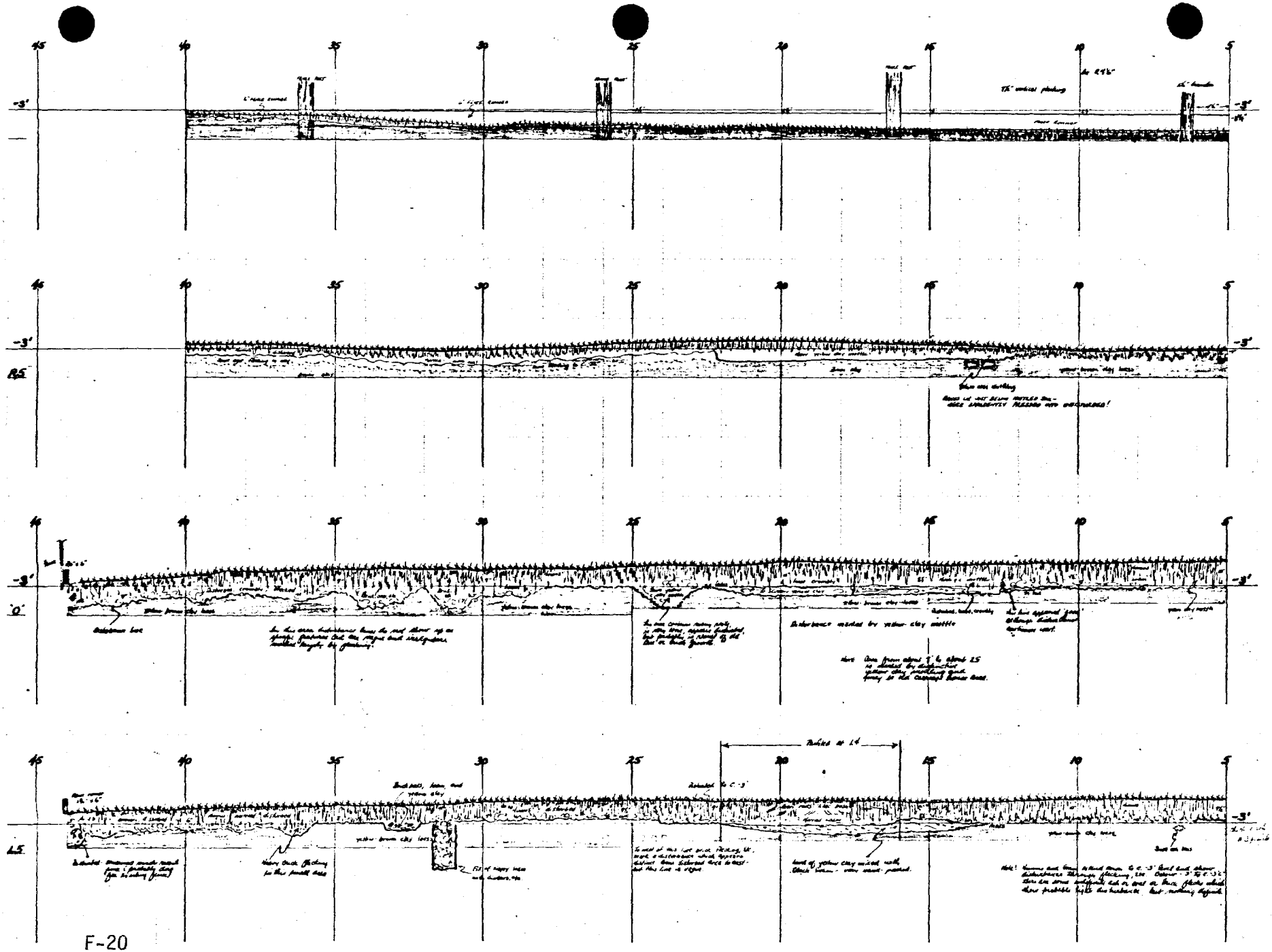

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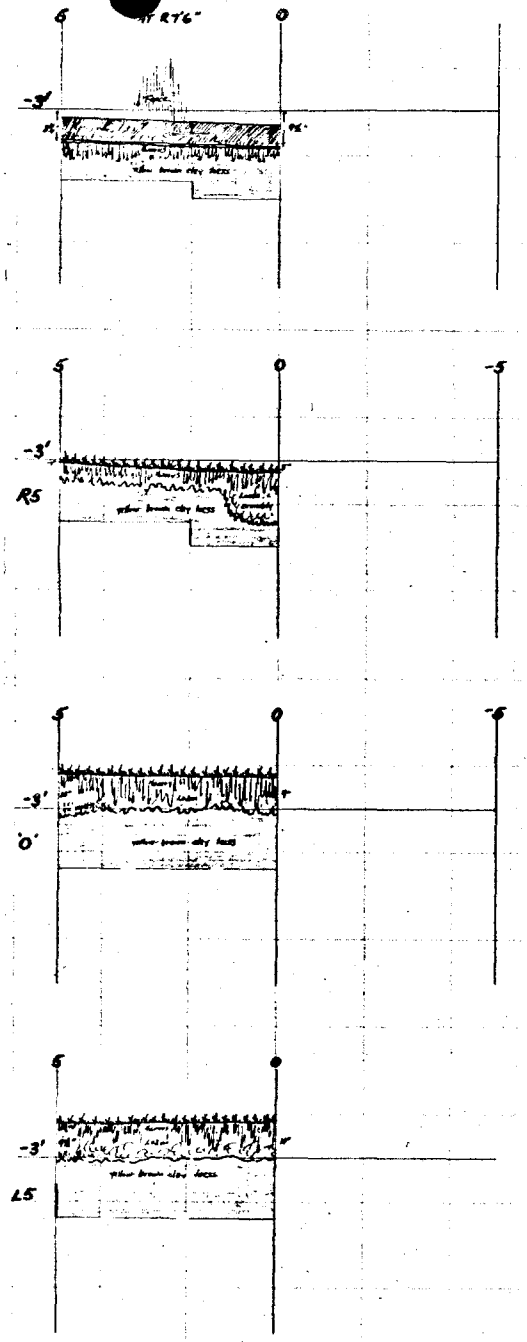
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ELECTRICAL REPORT

50% REVIEW

7 November 1983

ELECTRICAL

1. This report is based upon the following information;

   a. Review of existing conditions "As-is Measured Drawings," Drawing No. 449/26003, Sheets 20 and 21.

   b. Telephone conversation with George Alarm Service, Springfield, IL, the original installer of the fire alarm and security system.

   c. Telephone conversation with Romco Alarm Services, Springfield, IL, the alarm company that now monitors the system.

   d. Meeting with Ms. Joan Sanders of the National Park Service and a brief tour of the site on November 3, 1983.

2. Summary of existing conditions.

   a. The existing electrical service entrance main panel is not sized to accommodate the proposed additional mechanical loads. Service entrance conductors appear to have sufficient capacity for anticipated loads. Branch circuit wiring appears to be satisfactory.

   b. The fire alarm system is comprised of an outdated Walter Kidde panel with the addition of numerous remote relays and field installed modifications and devices installed in an unorthodoxed manner. A digital dialer exists that ties the system to a remote station. System is now zoned with a remote annunciator and break glass station located in the first floor closet. Detection is by heat detectors and ionization smoke detectors. Coverage of detectors appears to be adequate.

c. Local detection system is comprised of local warning device with annunciator at first floor. Detectors are photo-electric devices and floor mats installed in the second floor to control visitor access to protected areas. Photo-electric control in Mr. Lincoln's Bedroom must be kept inoperative due to furniture placement.

d. Intrusion detection equipment is operable at this time. Control equipment is located in the basement and first floor, with key entry provided at east rear entrance door. Detection devices are located at the first and second floor areas and are of the ultrasonic type.

3. Based upon the above, the following minimum electrical changes must be made due to the proposed altered construction.

a. Upgrade the electrical service entrance to handle the new air conditioning load.

b. Relocation of existing local alarm devices in the second floor to accommodate the proposed new circulation pattern, which would include the relocation and/or addition of floor mats and photo-electric detectors for the local alarm system.

c. Relocate the existing wall mounted fluorescent fixtures in Robert Lincoln's Bedroom to above new door.

d. Electrical connections to new mechanical equipment.

e. Relocation of existing conduit and wiring required by construction of new second floor framing in Mr. & Mrs. Lincoln's Bedroom areas.

4. In addition to the minimum electrical changes outlined in paragraph 3, we would recommend that the following additional electrical work be accomplished.

a. Replace the existing fire alarm system components with a new UL approved solid state, zoned, modular system using existing heat detectors and new photo-electric smoke detectors to replace the existing ionization-type units.

(1) It is our opinion that photo-electric detectors are more trouble-free than ionization-type units and provide the same degree of protection.

b. Replace the existing local alarm and intrusion detection system with a new solid state, zoned, modular control panel and passive infrared detection devices in lieu of the existing ultrasonic detectors. The existing photo-electric detectors and floor mats would be re-used for local alarm detection. These would be relocated as required to accommodate the new furniture and circulation pattern.

5. Statement of Probable Construction Costs:

a. Our estimate for the electrical work, as outlined in Paragraph 3 above, shall be in the amount of Nine Thousand Two Hundred Dollars ($9,200.00).

b. Our estimate for the electrical work, as outlined in Paragraph 4 above shall be in the amount of Twenty Thousand Eight Hundred Dollars ($20,800.00).

FINAL ELECTRICAL REPORT

3 January 1984

ELECTRICAL

A new electrical service will be provided; increased in size to accommodate the additional load of the cooling (air conditioning) equipment. Branch panels, wiring and devices will be replaced to clean up the existing system and insure a properly co-ordinated and protected system. Existing conduit located in walls or partitions with finishes not scheduled for replacement will be reused. Otherwise, all conduit and wire will be new.

An allowance has been made in the estimate for new light fixtures to be selected by the Architect. Existing fixtures will be relocated when conflicts with structural revisions or the new circulation pattern are noted.

A new fire alarm system will be provided to replace the existing system. The existing system is the result of numerous additions and revisions resulting in an abnormal amount of cables, panels and confusion. The new system will use photo-electric smoke detectors in lieu of ionization detectors. RHA has found the former to afford equal protection with greater dependability and less service problems.

The main security (intrusion detection) system for the home will be replaced with a new system utilizing passive infrared detectors in lieu of the existing ultrasonic detectors. The local detection system for the individual rooms will reuse existing floor mats and photo-electric detectors; however, new control panels and annunciators will be provided. Detectors will be relocated where required, depending upon the new circulation pattern and furniture placement.

FINAL ELECTRICAL REPORT

REVISED

13 February 1984

ELECTRICAL

A new electrical service will be provided; increased in size to accomodate the additional load of the cooling (air conditioning) equipment. Branch panels, wiring and devices will be replaced to clean up the existing system and insure a properly co-ordinated and protected system. Existing conduit located in walls or partitions with finishes not scheduled for replacement will be reused. Otherwise, all conduit and wire will be new.

An allowance has been made in the estimate for new light fixtures to be selected by the Architect. Existing fixtures will be relocated when conflicts with structural revisions or the new circulation pattern are noted.

A new fire alarm system will be provided to replace the existing system. The existing system is the result of numerous additions and revisions resulting in an abnormal amount of cables, panels and confusion. The new system will use photo-electric smoke detectors in lieu of ionization detectors. RHA has found the former to afford equal protection with greater dependability and less service problems.

The present security systems for the home are also the result of numerous additions and revisions. The present alarm company monitoring the home reports numerous false alarms over the past year. The main security system for the home (active during unoccupied periods) will be a new system utilizing passive infrared detectors in lieu of the existing ultrasonic detectors. Shock sensors for exterior openings (windows) may be included, (refer to drawings). The local (room) intrusion detection system (active during visiting hours) will also be new and utilize photo-electric detectors. New control panels, annunciator and dialer tie-in will be included. Detector locations will be co-ordinated with the new circulation pattern and furniture layout.

B I B L I O G R A P H Y

1. "MASTER PLAN" - Lincoln Home National Historic Site/ Illinois - February 10, 1970.

2. "HISTORICAL BASE MAP" - Lincoln Home, Springfield, Illinois - Edwin C. Bearss - November 30, 1969.

3. "HISTORIC STRUCTURE REPORT" - Lincoln Home National Historic Site/Illinois - Edwin C. Bearss - July 1973.

4. "HISTORIC STRUCTURE REPORT/HISTORIC RESOURCE STUDY - BLOCKS 6 and 11" - Lincoln Home National Historic Site/Illinois - Edwin C. Bearss - October 1975.

5. "HISTORIC PRESERVATION - POLICIES OF THE NATIONAL PARK SERVICE" - 1968 Reprint from "Administrative Policies for Historical Areas of the National Park System".

6. "MANAGEMENT POLICIES" from Historical Architects' Reference File - National Park Service, U. S. Department of the Interior - 1975.

7. "ACTIVITY STANDARDS" - Historic Resource Studies and Management - National Park Service, U. S. Department of the Interior - December 1971.

8. 1966 "ZONING ORDINANCE" - City of Springfield, Illinois.

9. "HISTORIC HOMES OF SPRINGFIELD" by Dr. Floyd S. Barringer, M.D. - Springfield, Illinois - 1966.

10. "CITY OF SPRINGFIELD TAX MAPS" - Sanborn Map Company 1884, 1890, 1896, 1917, 1952.

11. "AERIAL PERSPECTIVE SKETCHES OF SPRINGFIELD" - Courtesy of the Illinois State Historical Library.

"A. Ruger" Panorama - Circa 1867
"Beck & Pauli" Panorama - Circa 1870
"Augustus Koch" Panorama - Circa 1875

12. "PHOTO FILE - 19th CENTURY SPRINGFIELD AND SANGAMON COUNTY HOUSES" - Illinois State Historical Library.

13. "ATLAS OF SANGAMON COUNTY" - 1874.

14. "SPRINGFIELD ILLUSTRATED" - H. R. Page & Co. - 1889.

15. "HISTORIC AMERICAN BUILDING SURVEY - NORTHERN ILLINOIS" - HABS - 1937.

16. "THE LINCOLN HOME" - James T. Hickey and King V. Hostick - 1964.

17. "BACKYARD ARCHEOLOGY AT LINCOLN'S HOME" - Richard S. Hagen - Journal of the Illinois State Historical Society, Vol. 44, Winter 1951.

18. "WHAT A PLEASANT HOME ABE LINCOLN HAS" - Richard S. Hagen - Journal of the Illinois State Historical Society, Vol. 48, Spring 1955.

19. "BICKNELL'S VILLAGE BUILDER" - Amos J. Bicknell - 1870.

20. "VICTORIAN ARCHITECTURE - TWO PATTERN BOOKS" - Amos J. Bicknell and W. T. Comstock - 1873.

21. "HELMLE & HELMLE, ARCHITECTS" - Edward J. Russo - 1974.

22. "VICTORIAN HOUSES - A TREASURY OF LESSER-KNOWN EXAMPLES" - Edmund V. Gillon, Jr. and Clay Lancaster - 1973.

23. "BUILDING EARLY AMERICA" - Charles E. Peterson, Editor - The Carpenters Company of the City and County of Philadelphia - Chilton Book Company - Radnor, Pennsylvania - 1976.

C R E D I T S

Office of Ferry and Henderson Architects, Inc.

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Coordinator:
Wesley Corgan
Robert Swenson (August 1978 to April 1980)

Technicians:
Randall Draughan
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Cynthia Gibbs

Secretarial:
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Office of Ralph Hahn & Associates, Inc.

Principal in Charge:
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Coordinator:
Lourdes Knepler
Robert Power

Structural:
Lourdes Knepler
Robert Power

Mechanical:
Robert Knoedler
Gerald Morrow

Electrical:
Robert Knoedler
David Means

Consultants

Lincoln Home National Historic Site staff
Dr. James Hickey, Illinois State Historical Library

Contractor

Harold O'Shea Builders

Other

William Hagen - Photographer
Richard Binetsch - Photographer