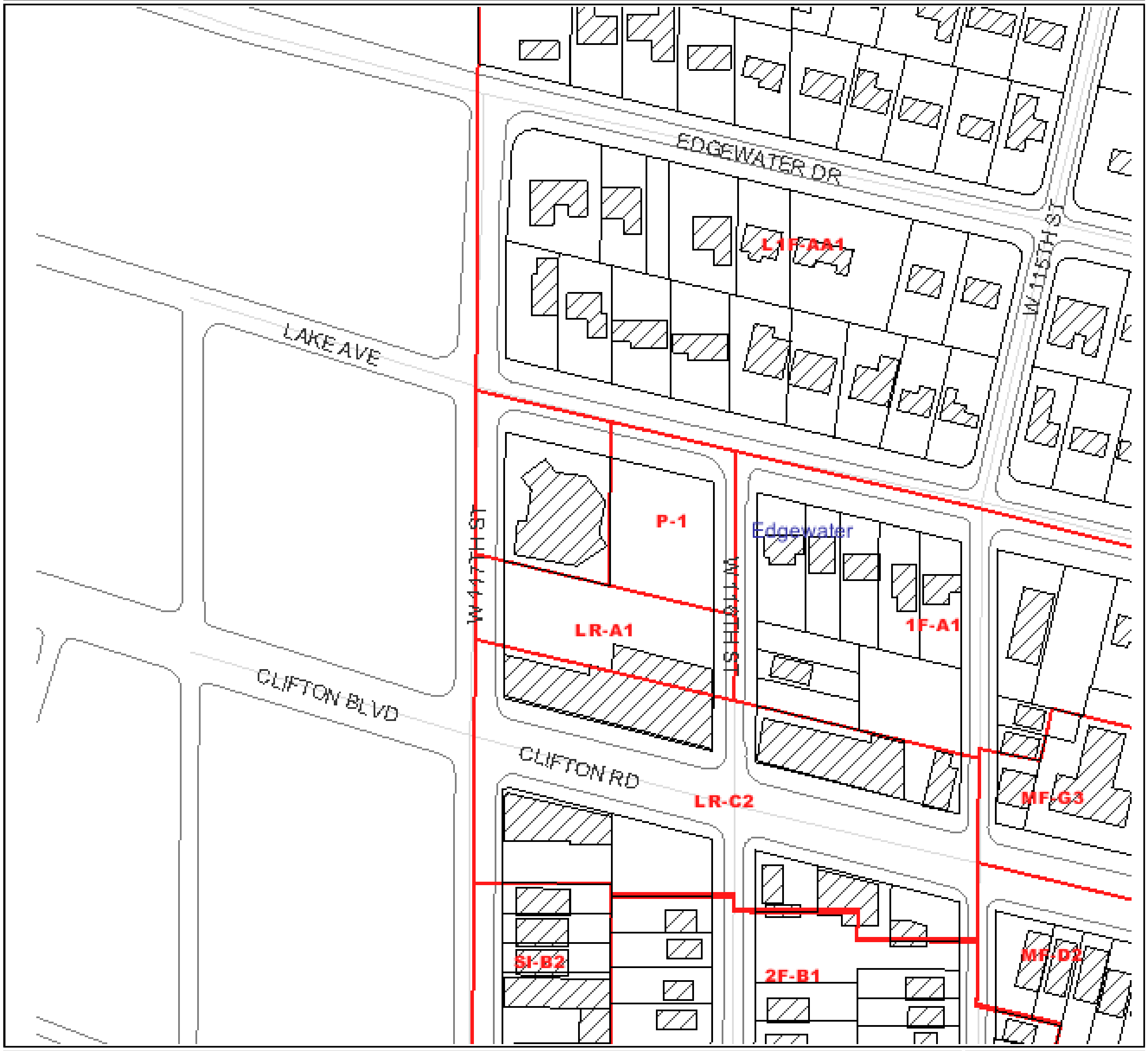
Appendices

- Appendix A: Aerial View / Location map
- Appendix B: Zoning Maps
- Appendix C: Original Drawings
- Appendix D: Building Area Summary
- Appendix E: Structural Assessment / Steel Inspection Reports
- Appendix F: Ohio Historic Inventory Form
- Appendix G: Annotated Project Images
- Appendix H: Preservation Brief 31

Appendix A: Aerial View / Location Map

Appendix B: Zoning Maps

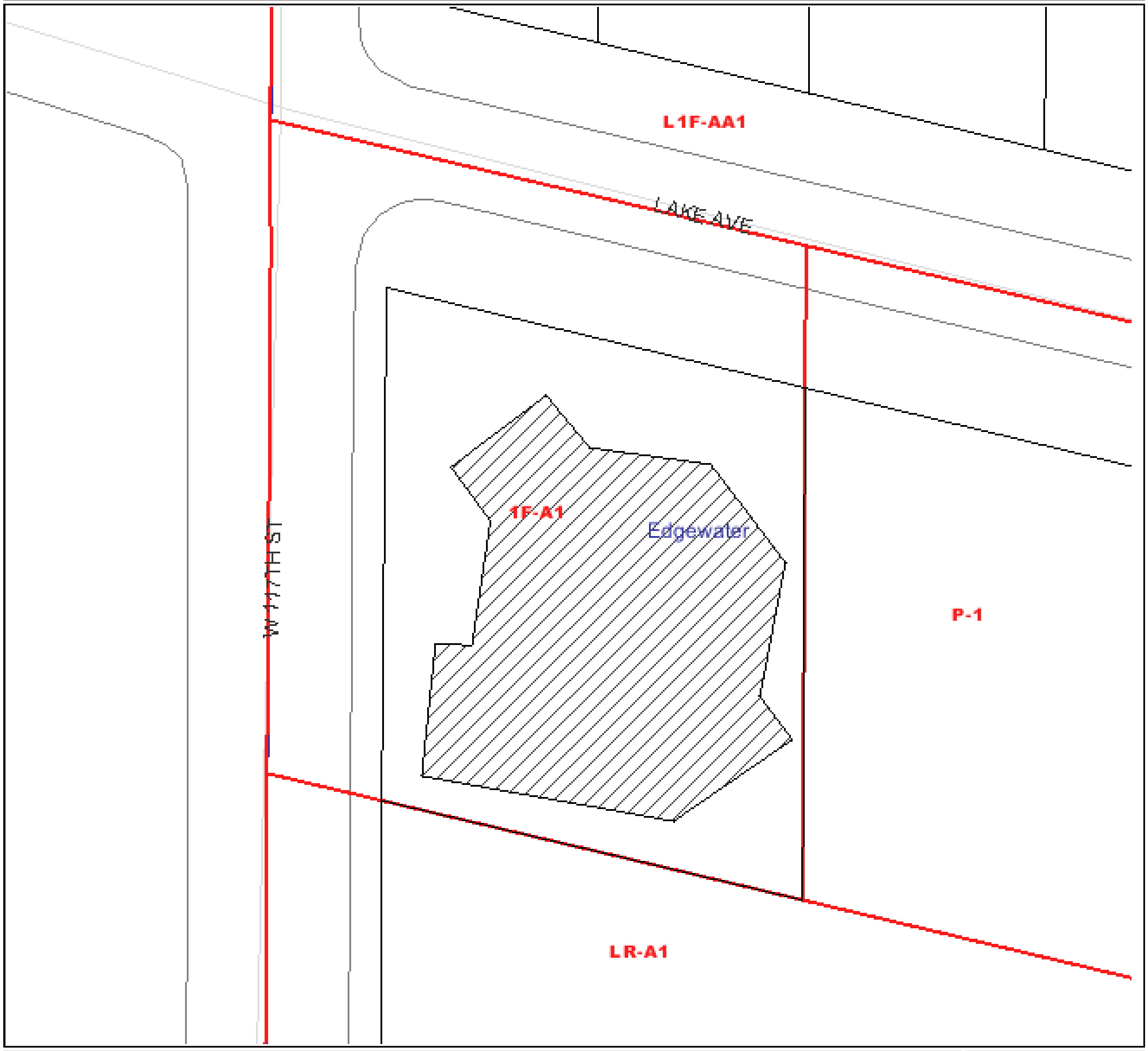
Cleveland GIS Map



LEGEND

Parcel	Street
Zoning	Building
Statistical Planning Area	Lake/Rivers
Pavement	

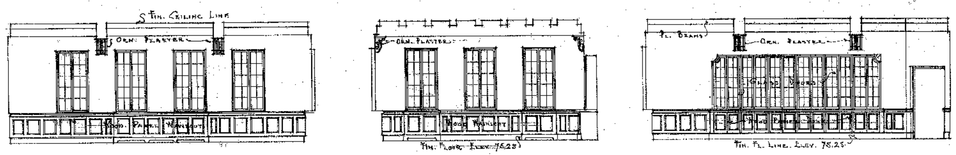
Cleveland GIS Map



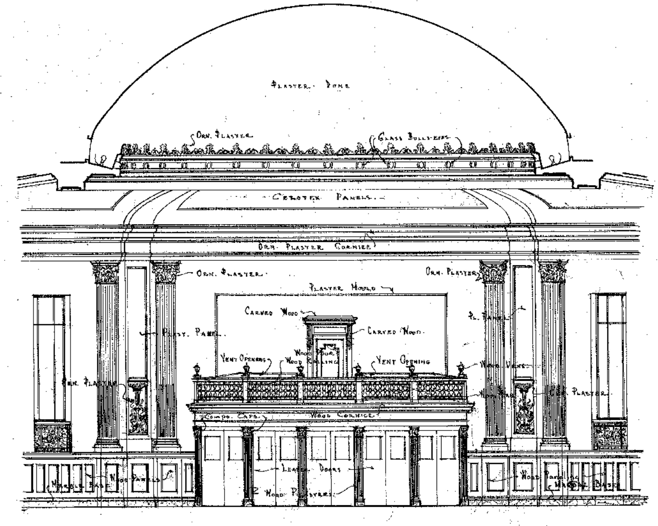
LEGEND

- Parcel
- Zoning
- Statistical Planning Area
- Pavement
- Street
- Building
- Lake/Rivers

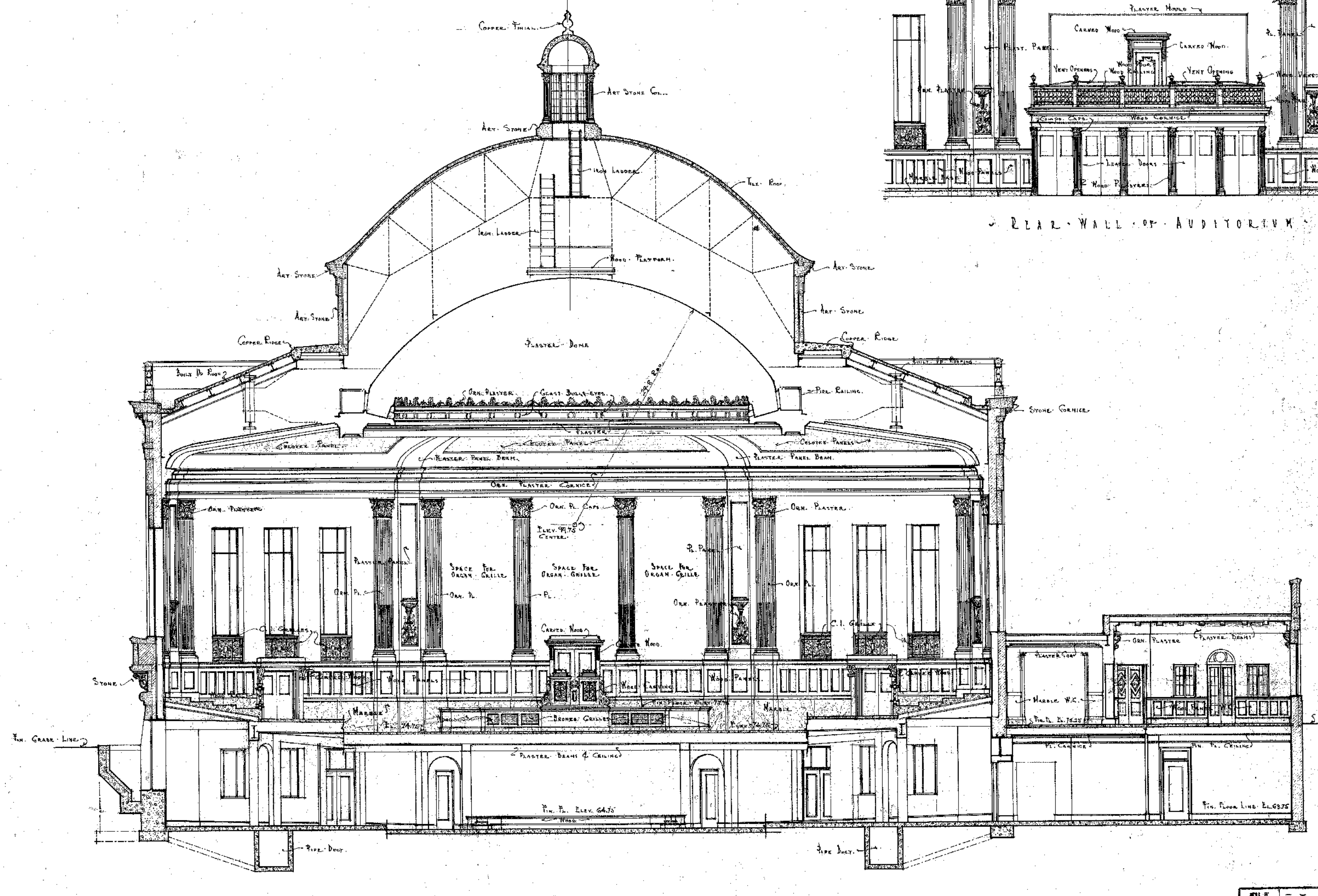
Appendix C: Original Drawings



· Reading · Room · Walls ·

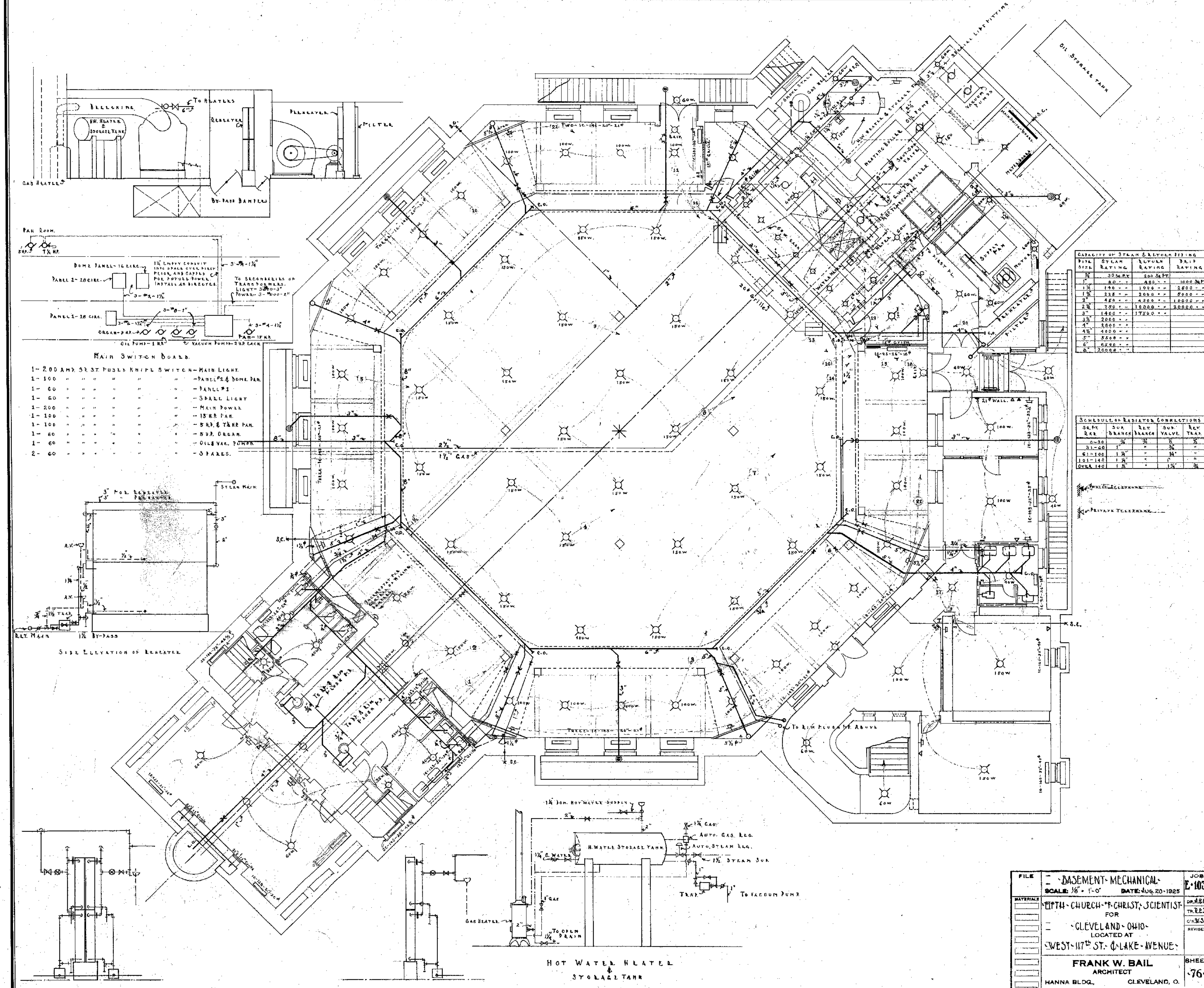


· Rear · Wall · of · Auditorium ·



· Transverse · Section ·

FILE	- Transverse · Section -	JOB
	SCALE: 1/8" = 1'-0" DATE: Aug. 20 - 1923	E-103
MATERIALS	Fifth · Church · of · Christ · Scientist FOR	DR. HOR.
	Cleveland · Ohio LOCATED AT	TR. HOR.
	West · 117th St. & Lake · Avenue	CK. W.F.K. REVISED
	FRANK W. BAIL ARCHITECT	SHEET
	HANNA BLDG. CLEVELAND, O.	12



Capacity of Steam & Return Piping			
Pipe Size	Steam Rating	Return Rating	Drip Rating
3/4"	30 Sq. Ft.	200 Sq. Ft.	
1"	80 " "	400 " "	1000 Sq. Ft.
1 1/4"	140 " "	1000 " "	2500 " "
1 1/2"	225 " "	2000 " "	5000 " "
2"	450 " "	4300 " "	10000 " "
2 1/2"	750 " "	10000 " "	20000 " "
3"	1400 " "	17500 " "	
3 1/2"	2000 " "		
4"	2800 " "		
4 1/2"	4000 " "		
5"	5500 " "		
6"	6500 " "		
8"	20000 " "		

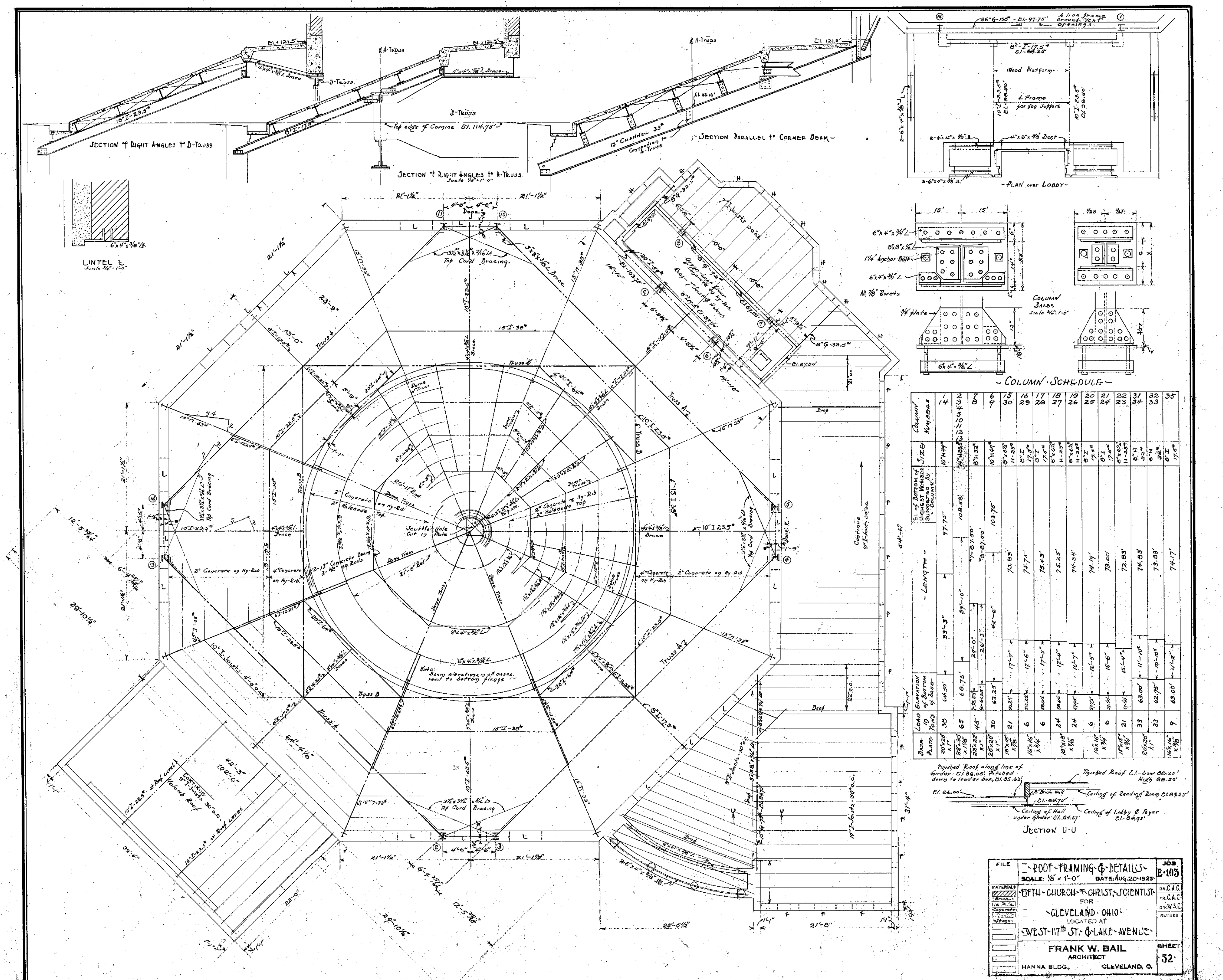
Schedule of Radiator Connections				
Sq. Ft. Rad.	Sup. Branch	Ret. Branch	Sup. Valve	Ret. Trap
0-30	3/4"	3/4	1/2	1/2
31-60	1"	"	3/4"	"
61-100	1 1/4"	"	3/4"	"
101-140	1 1/4"	"	1"	"
Over 140	1 1/2"	"	1 1/4"	3/4

Dome Panel - 16 Circ.
Panel 2 - 28 Circ.
Panel 1 - 28 Circ.
1 1/4" Empty conduit into space over first floor and capped for future power. Install as directed.
To secondaries of transformers. Light - 3-#00-3" Power - 3-#000-2"
Organ - 5 H.P.
Oil Pump - 1 H.P.
Vacuum Pumps - 2 H.P. each
Fan - 15 H.P.

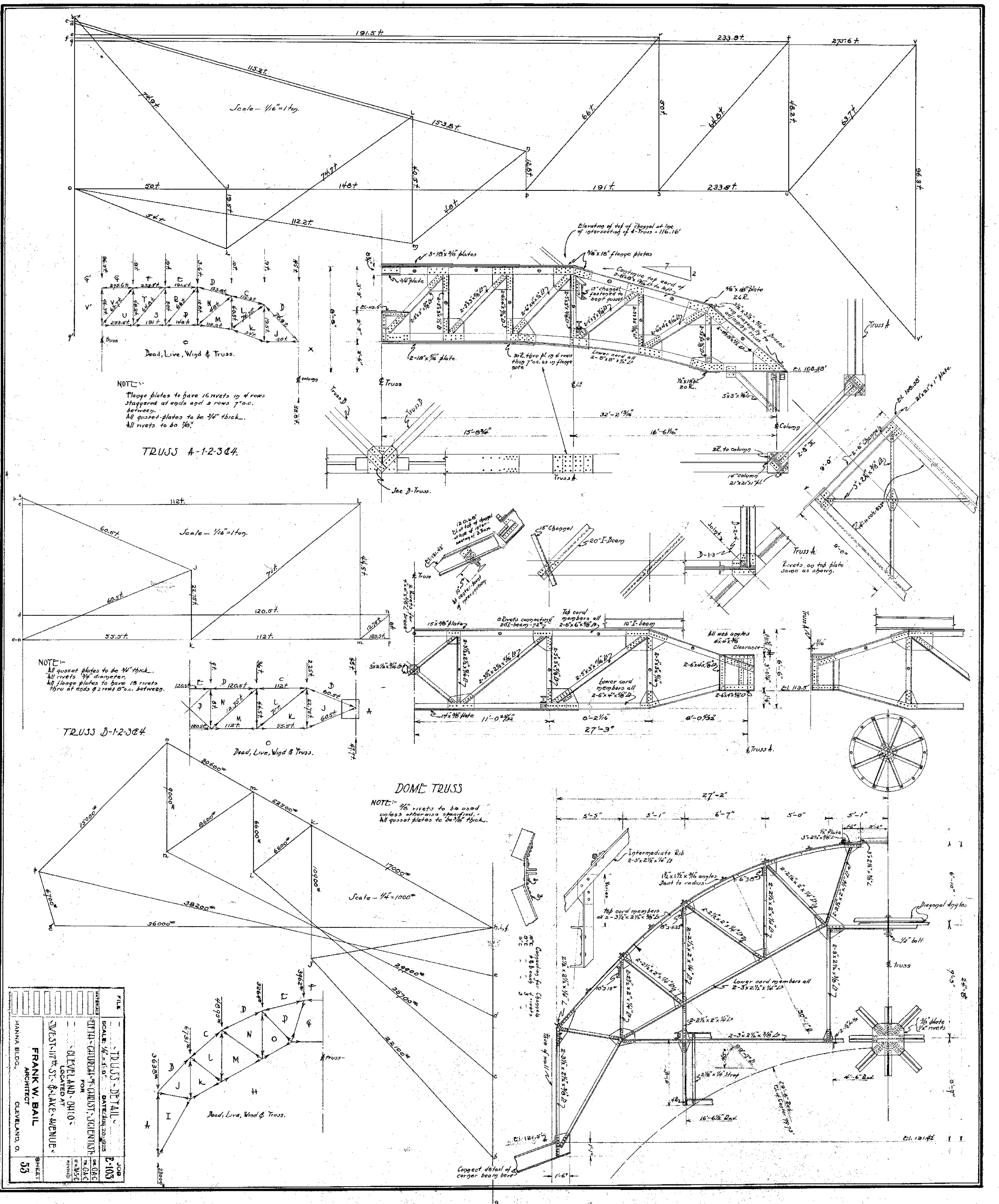
Main Switch Board.

1 - 200 Amp. 3 P. S.T. Fused Knife Switch - Main Light.
1 - 100 " " " " " " - Panel #2 & Dome Pan.
1 - 60 " " " " " " - Panel #1
1 - 60 " " " " " " - Spare Light
1 - 200 " " " " " " - Main Power
1 - 100 " " " " " " - 15 H.P. Fan.
1 - 100 " " " " " " - 5 H.P. & 7 1/2 H.P. Fan.
1 - 60 " " " " " " - 5 H.P. Organ.
1 - 60 " " " " " " - Oil & Vac. Pumps.
2 - 60 " " " " " " - Spares.

FILE	· BASEMENT · MECHANICAL · SCALE: 1/8" = 1'-0" DATE: Aug. 20 - 1925	JOB E·103
MATERIALS	·FIFTH · CHURCH · OF · CHRIST, · SCIENTIST· FOR · CLEVELAND · OHIO · LOCATED AT ·WEST · 117th ST. · & · LAKE · AVENUE ·	DR. A.S.K. TR. R.E.B. C'K. W.S.C. REVISED
	FRANK W. BAIL ARCHITECT HANNA BLDG., CLEVELAND, O.	SHEET ·76·



Section at Right Angles to D-Truss
Section at Right Angles to A-Truss
Scale 3/8" = 1'-0"
Section Parallel to Corner Beam
Plan over Lobby
Wood Platform
Lintel L
Column Bases
Scale 3/4" = 1'-0"
Column Schedule
Section U-U
Truss A
Truss B
Dome Truss
Top Cord Bracing
Note: Beam elevations, in all cases, read to bottom flange.
Scuttle Hole Cut in Plate
Roof Framing & Details
Scale: 1/8" = 1'-0"
Date: Aug. 20-1925
Fifth Church of Christ, Scientist
for
Cleveland, Ohio
located at
West 117th St. & Lake Avenue
Frank W. Bail
Architect
Hanna Bldg., Cleveland, O.
Job E-103
Sheet 52



TRUSS A-1-2-3 & 4.
Dead, Live, Wind & Truss.
Scale – 1/16" = 1 ton.
NOTE:–
Flange plates to have 16 rivets in 4 rows staggered at ends and 2 rows 7" o.c. between.
All gusset-plates to be 3/4" thick.
All rivets to be 7/8".
TRUSS B-1-2-3 & 4.
NOTE:–
All gusset plates to be 3/4" thick.
All rivets 3/4" diameter.
All flange plates to have 18 rivets thru at ends & 2 rows 8" o.c. between.
DOME TRUSS
NOTE:– 5/8" rivets to be used unless otherwise specified. All gusset plates to be 3/8" thick.
Scale – 1/4" = 1000#
Lower cord members all 2-3"x2 1/2"x 1/4" Ls
Top cord members all 2-3 1/2"x2 1/2"x 3/8" Ls
Intermediate Rib 2-3"x2 1/2"x 1/4" Ls
Diagonal Angles
Face of wall
Connect detail of corner beam here
TRUSS DETAIL
SCALE: 1/4" = 1'-0"
DATE: AUG. 20, 1923
FIFTH CHURCH OF CHRIST, SCIENTIST
FOR
CLEVELAND, OHIO
LOCATED AT
WEST 117th ST. & LAKE AVENUE
FRANK W. BAIL
ARCHITECT
HANNA BLDG., CLEVELAND, O.
JOB E-103
SHEET 53

Appendix D: Building Areas Summary

Fifth Church of Christ - Facility Assessment
11623 Lake Avenue
Cleveland, Ohio 44102

City Architecture Job No. 09033 October 1, 2009

PROJECT STATISTICS

Site Area	26,946	S.F.	0.62	ACRES
Basement Floor Area	11,394	S.F.		
Ground Floor Area	10,888	S.F.		
TOTAL FLOOR AREA	22,282	S.F.		
APPROXIMATE ENCLOSED BUILDING VOLUME	598,000	C.F.		
APPROXIMATE CONDITIONED VOLUME	460,000	C.F.		
Roof Area				
Tile roof (dome)	5,084	S.F.		
Tile roof (cupola)	66	S.F.		
TOTAL TILE ROOF	5,150	S.F.		
Sloped portion at octagon	5,076	S.F.		
Octagon to drum transition	1,243	S.F.		
Low slope roof - one story addition	2,035	S.F.		
TOTAL BUILT-UP ROOF	8,354	S.F.		
TOTAL ROOF	13,504	S.F.		
Exterior Walls				
Octagon	11,773	S.F.		
Entry	3,296	S.F.		
Balustrade	1,690	S.F.		
Dome drum	836	S.F.		
Cupola	153	S.F.		
one-story - primary	1,593	S.F.		
one-story - secondary (brick) areas	783	S.F.		
TOTAL EXTERIOR WALL AREA	20,123	S.F.		

Windows

Sanctuary	90 sq. ft.	x 18 openings	1,620	S.F.
Window Wells	44 sq. ft.	x 12 openings	533	S.F.
Entry	90 sq. ft.	x 2 openings	180	S.F.
One-story addition	21 sq. ft.	x 11 openings	232	S.F.
One-story bay window	76 sq. ft.	x 1 opening	76	S.F.
Cupola	12 sq. ft.	x 8 openings	96	S.F.
TOTAL WINDOW AREA		= 50 openings	2,737	S.F.

Doors

North entry doors	45 sq. ft.	x 4 openings	180	S.F.
West entry doors	48 sq. ft.	x 3 openings	144	S.F.
Service door pairs	42 sq. ft.	x 3 openings	126	S.F.
TOTAL DOORS		= 10 openings	450	S.F.

Interior wall/ceiling surfaces

Basement (flat plaster)		
Walls	8,940	S.F.
Ceiling	11,400	S.F.
Sanctuary		
Walls	9,100	S.F.
Flat ceiling	5,600	S.F.
Dome	2,232	S.F.
Entry		
Walls (stone)	1,625	S.F.
Ceiling	1,348	S.F.
One-story wing		
Walls	4,200	S.F.
Ceiling	1,945	S.F.
TOTAL INTERIOR WALL AND CEILING SURFACE AREA (APPROX).	46,390	S.F.

Appendix E: Structural Assessment / Steel Inspection Reports

5TH CHURCH STRUCTURAL INSPECTION

9/4/09

PURPOSE

The primary purpose of this investigation is to determine the existing condition of structural systems for the 5th Church and also to determine an estimate of probable cost for their repair. The estimate also includes costs for completely new mechanical, plumbing, and electrical systems.

OBSERVATIONS

The building is an octagonal steel framed structure with a stone masonry exterior. It includes a basement and a large dome roof at the center of the building. The dome ceiling rests nearly thirty feet above the 1st floor of the building. The roof's supporting steel consists of radial and tangential arch-shaped trusses approximately 15 feet deep with supporting purlins at the top chords of the trusses and ceiling and at the bottom chords and bears on steel columns encased in masonry. The roof decking consists of a thin shell of concrete. The 1st floor structure consists of steel channels and bar joists on a steel frame supporting a concrete floor slab. The total building area is approximately 22,000 square feet.

The building has been vacant and unheated for nearly 20 years and without any real maintenance. Because of roof leaks, there is a concern for the extent to which corrosion may have degraded structural steel and their connections as well as for walls, floors and ceilings.

During site visitations the following conditions were found:

1. Significant roof leaks were observed along the perimeter walls. As a result, partial ceiling collapses were noticeable at various locations.

2. Low roof areas are supported in various areas by bar joists or built-up channels and the steel appears to be in many areas severely corroded.

3. Water was observed in basement areas with excessive moisture damage visible in the southwest corner.

4. The basement floor has heaved considerably (approximately 8" above the surrounding floor) in portions of its northwest quadrant.

5. Above grade 1st floors are supported either by 9" bar joists or back-to-back channel and are also in areas severely corroded.

6. Masonry is cracking outside adjacent to steel lintels, primarily along the southern wall of the one story portion of the building. The existing lintels are corroding and expanding, jacking up the masonry parapet above.

7. There is no power or lighting available inside the building.

DISCUSSION

Polytech visited the building on two occasions. On 5/21/2009, we visited the building and observed portions of the structure that were visible and readily exposed from ground or floor levels. It was decided access was needed to areas too far above the floor for reasonable inspection. Scaffolding was arranged to be erected for access to representative areas and to the catwalk below the dome.

During these visits and from our vantage points roof leaks are causing structural steel and connection issues that may eventually lead to structural system failures. Also, due to the leaks, plaster and other ceiling material is falling to the floor.

During our visit on 8/19/2009, a typical truss bearing location at the exterior wall of the dome was made accessible via scaffolding and one of the two trusses viewed showed the effects due to long time exposure to moisture.

Outside in the area of the demolished mechanical/electrical spaces a scaffold stair was erected allowing access to the existing catwalk under the dome. From here much of the dome's interior was visible. Most of the steel here is in good condition with the possible exception of the connections at the top of the dome.

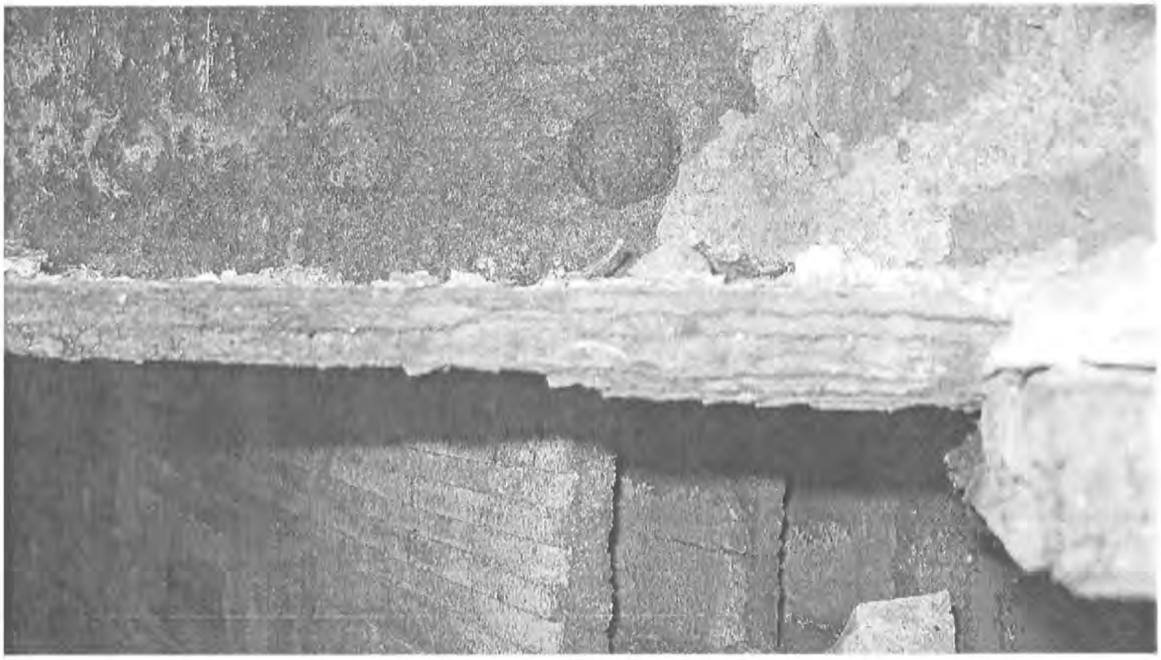
The roof steel/trusses support columns are encased in block. It is doubtful the columns themselves are affected.

Storm water tends to collect at connections and bearing points. The integrity of roof purlins, trusses, and their connections can be affected.

The roof(s) leak in many areas and are supported by light weight steel. In some instances, corrosion is severe. The bearing points of floor trusses are not always visible and some demolition may be required to properly inspect them.

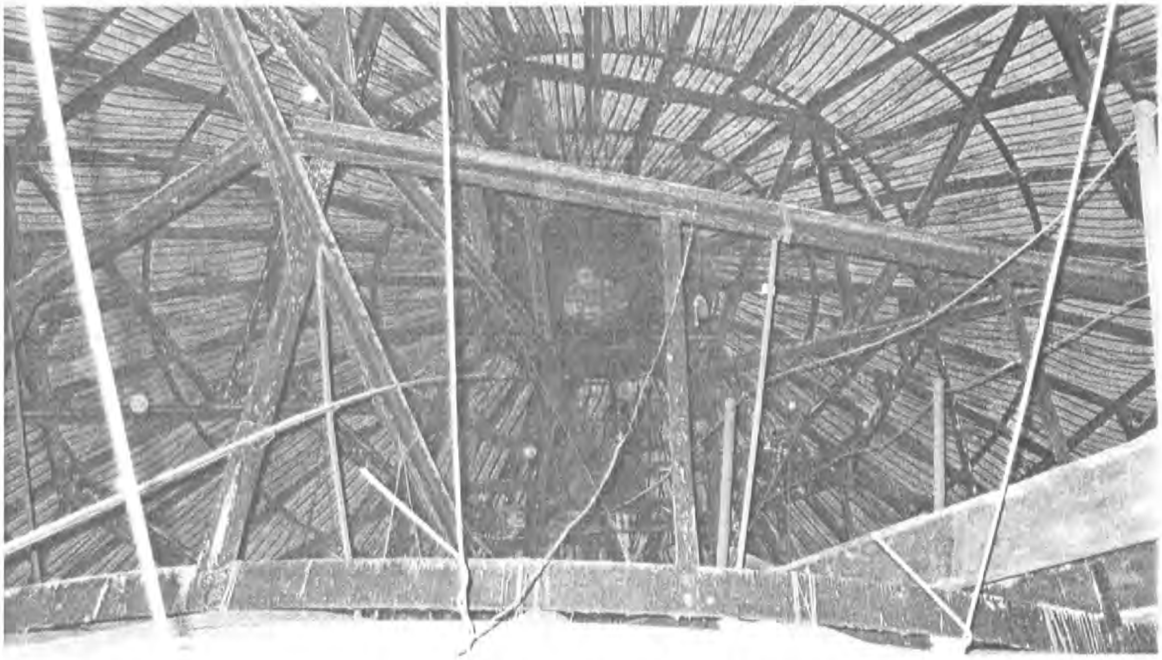
There is also a steel framework hung from structure supporting the plaster domeed ceiling. The hangers and their connections are not always visible for inspection. Depending on the renovation to be considered further investigation of their condition will be necessary.

The heaving of the basement floor slab is likely due to freezing of subgrade moisture, possibly caused by leaking subslab piping or the existing underground ductwork which is currently flooded. Excavation of the area would be required to verify the exact cause of the problem.



TRUSS "A" AT EXTERIOR COLUMN

Inside the auditorium area we were able to investigate the connection and bearing points for two of eight major trusses type "A" (as indicated in the original plans see Truss Details below). One was in good condition the other not so. Water has caused corrosion at the truss bearing on an exterior column. Easily observed, approximately 1/16" of the ½" L flange material has been lost. (As a precaution we generally assume an equal additional amount lost due to field conditions.) This results in a total reduction of approximately 25%. We could not inspect the other connection points at exterior columns and masonry supports and assume 50% them to be in similar condition.



DOME TRUSS CONNECTIONS PLATE RING

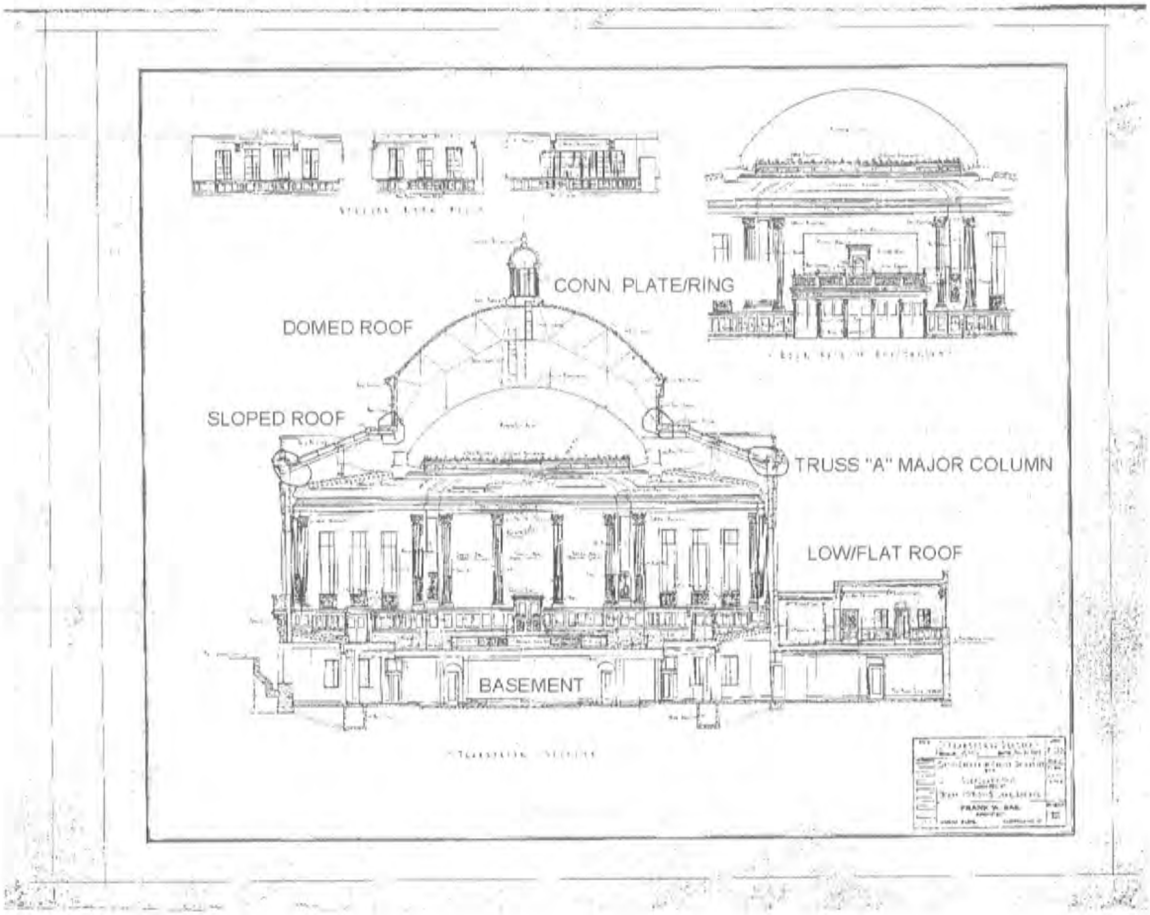
We also, via the exterior scaffolding were able to investigate much of the steel and connections in the slanted roof area surrounding the dome as well as below the dome itself. There is a catwalk in this area and also ladder access to the cupola.

Below the cupola are band and plate connections for the intersecting domed trusses. We observed a good deal of moisture damage as a result of long term water leakage here.

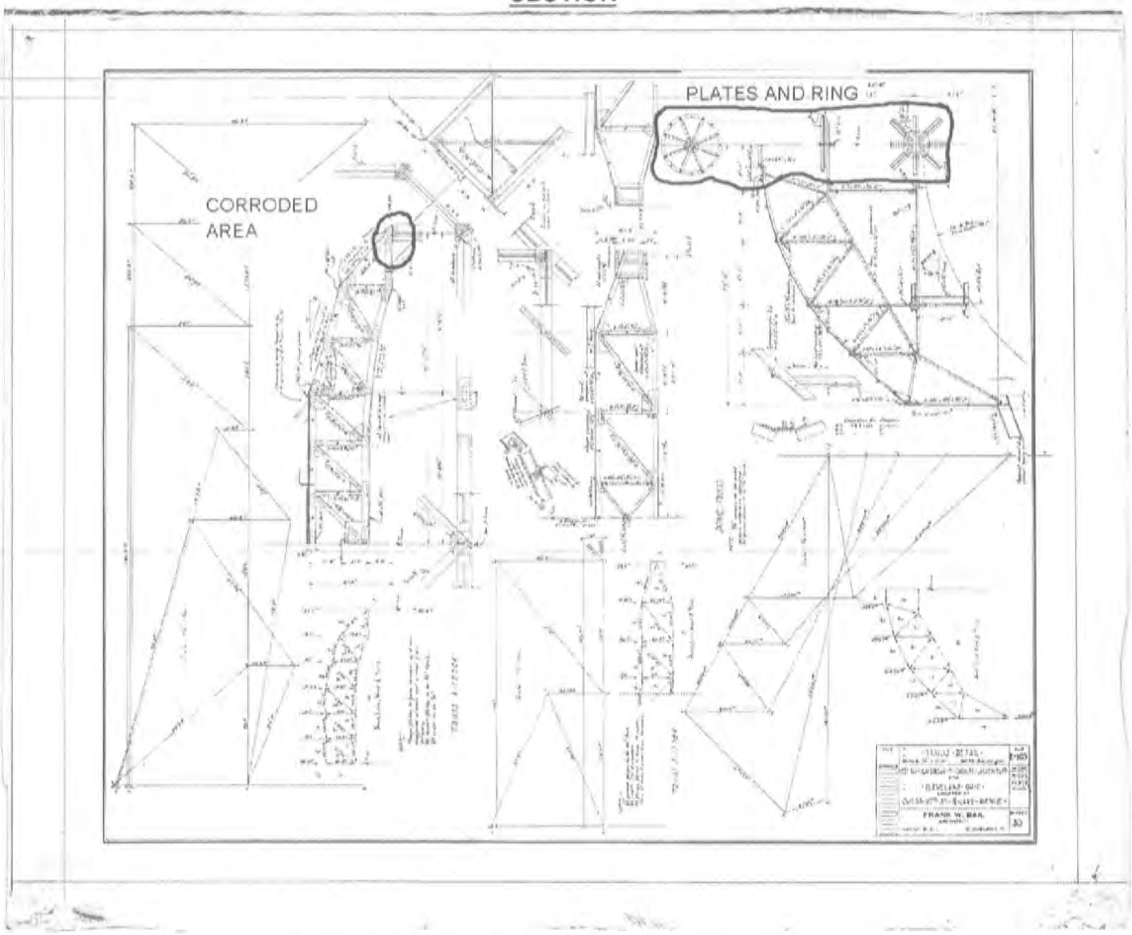
RECOMMENDATIONS

Due to all of the above we believe the following areas may need repair to complete a comprehensive renovation.

1. Domed truss connection plates and ring at center of dome below cupola.
2. Four of the eight trusses type at exterior columns
3. Eight of the sixteen intermediate truss connections at exterior masonry.
4. Not more than 30% of domed roof purlins and deck.
5. Not more than 25% of sloped roof purlins and deck.
6. Not more than 50% of low roof joists and deck.
7. Not more than 30% of first floor steel and deck.


CONN. PLATE/RING
DOMED ROOF
SLOPED ROOF
TRUSS "A" MAJOR COLUMN
LOW/FLAT ROOF
BASEMENT

5TH CHURCH BUILDING SECTION



5TH CHURCH BUILDING TRUSS DETAILS

COST ESTIMATE

We have included a preliminary cost estimate for repairs and new work.

Structural

1.	Domed truss connection plates and ring at center of dome.	$100,000
2.	(4) Truss "A" at major columns	$40,000
3.	(8) of the sixteen intermediate truss connections at exterior masonry.	$40,000
4.	Domed roof purlins and deck.	$17,000
5.	Sloped roof purlins and deck	$40,000
6.	Low roof joists and deck	$38,000
7.	First floor steel and deck.	$77,000
	TOTAL	$352,000

At this time the building's structural system does not appear to pose a threat to the public when considered from outside the building. However, debris (plaster, miscellaneous metal and lath) can be seen most everywhere and any one accessing the building should use extreme caution. Clearly there are areas of flooring which have been damaged by water/moisture to the extent walking on it may not be safe.

Repairs most likely will consist of the welding or connecting of additional steel at weakened points. Replacement of members should not be required.

To protect the building from further structural damage the building envelope needs immediate attention. Roofing and flashing in combination with associated decking and supporting steel requires immediate repair or replacement. During the course of this we strongly recommend existing ceiling surfaces be removed to permit all connection points and structural members be closely inspected to insure the safety of all parties and so that further investigations can be undertaken to determine the timing as well as exact extent of needed repairs to items 1, 2 , 3 and 7.

Items 4, 5, and 6 above as well as roofing, flashing and tuck-pointing should be considered as soon as possible.

The first floor and basement floor repairs can be done at any time prior to occupancy.

For occupancy all of the above work should be considered.

New Mechanical/Electrical/Plumbing Work

The actual cost of this work can vary considerably depending on use.
The original mechanical/electrical spaces (once a portion of the low roof area) have been demolished. New spaces will need to be created or space allocated from what remains.

A new electrical service will be required; distribution panels, lighting, power wiring, fire alarm, security, communications, etc.

Mechanical heating/ventilation/air-conditioning equipment will be needed along with all new duct work. All new above ground plumbing will be needed. Below ground will need modification or replacement.

A fire protection system could also be required depending on occupancy.

<u>MEP & FP Cost</u>

The cost of a complete renovation could be approximately:

22,000 total square feet X $40/Sq-ft $880,000

For leasing and subsequent tenant build-out new electrical and telephone services at a minimum will be needed. The condition of the existing water and gas services as well as sanitary and storm piping requires further investigation but we include this in the estimate below assuming new connections and street openings:

Electrical	25,000
Water	20,000
Storm	30,000
Sanitary	35,000
Gas	10,000

Conclusions

Based on our experience with the condition of the 5th Church we believe it to be serviceable providing proper repairs are undertaken soon.

We strongly recommend **all** connection points and structural members be closely inspected to insure the safety of all parties during any future work or repair.

If you have any question regarding this report, please do not hesitate to contact us.

Respectfully,

POLYTECH, INC.

Norman R. Bliss, P.E.
Project Principal

REPORT OF STEEL INSPECTION

Report Number: N4091107.0001
Date of Service: 08/19/09
Finalized Report Date: 08/24/09

H. C. NUTTING
A Terracon COMPANY
790 Morrison Road
Columbus, OH 43230
614-863-3113

Client

Resource International
Attn: Jim Norden
6350 Presidential Gateway
Columbus, OH 43231

Project

Fifth Church of Christ Facility Assessment
Fifth Church of Christ
West 117th Street and Lake Avenue
Cleveland, OH 44107
Project Number: N4091107

Refer to attached Report of Steel Inspection and photosheets

Terracon Rep.: John M. Szumski
Reported To:
Contractor:
Report Distribution:

Reviewed By: Russell W Flax
Russell W. Flax P.E.
Professional IV (Matlsenger)

REPORT OF STEEL INSPECTION

Report Number: N4091107.0001
Date of Service: 08/19/09
Finalized Report Date: 08/24/09

H. C. NUTTING
A Terracon COMPANY
790 Morrison Road
Columbus, OH 43230
614-863-3113

Client

Resource International
Attn: Jim Norden
6350 Presidential Gateway
Columbus, OH 43231

Project

Fifth Church of Christ Facility Assessment
Fifth Church of Christ
West 117th Street and Lake Avenue
Cleveland, OH 44107
Project Number: N4091107

As requested, the inspector reported to the above-referenced project to perform an assessment of the structural steel.

- All members reviewed on this date are built-up structural riveted members. No welds or bolts were noted.
- The truss bearing plates appear to be 1" in thickness. The structural attachments to the bearing plates were inaccessible and could not be verified.
- The corrosion on the truss at the west wall was chipped away using a slag hammer. Noted flange thickness for the lower flange was 7/16"± in thickness. The upper flange thickness appeared to be ½"±.
- The floor joist at the first floor framing level was heavily corroded, with the horizontal bridging deteriorated.
- The second floor W8 beams and decking have heavy corrosion and were completely rusted-through at different locations.
- The interior structure of the dome shows mild corrosion of the built-up structural members.
- See attached photos for clarification.

Terracon Rep.: John M. Szumski
Reported To:
Contractor:
Report Distribution:

Inspected By: John M. Szumski (signature)
John M. Szumski
CWI #85010851

Fifth Church of Christ Facility Assessment
Project No. N4091107
Date Pictures Taken On: 8/18/2009

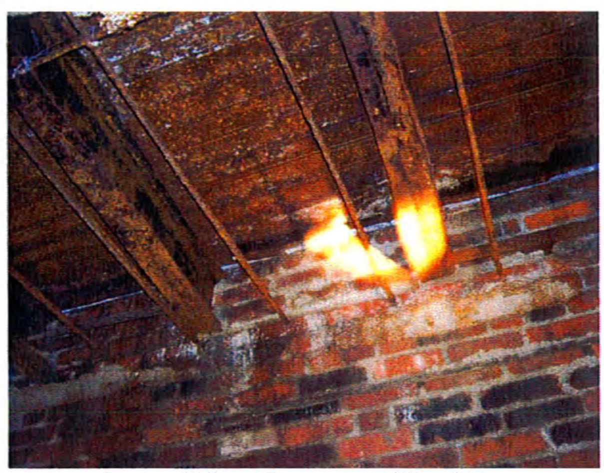
i. Riveted Truss Connections

First Floor Joist

First Floor Joist

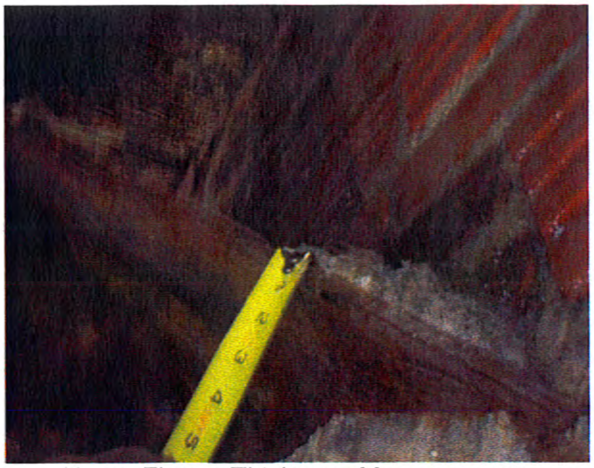
First Floor Joist

Second Floor Beams and Decking



Second Floor Beams and Decking

Fifth Church of Christ Facility Assessment
Project No. N4091107
Date Pictures Taken On: 8/18/2009


Upper Flange Thickness Measurements


Lower Flange Thickness Measurements

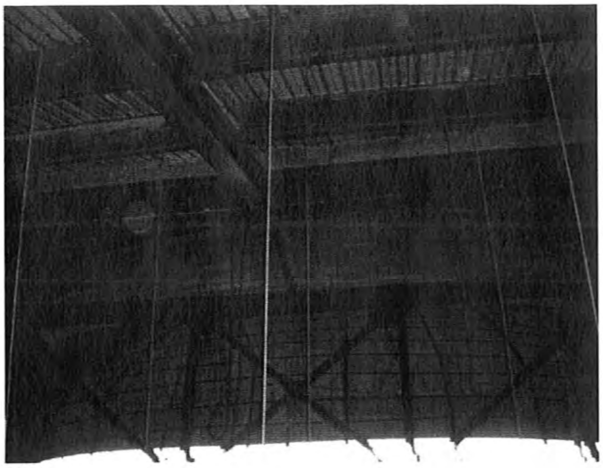

Truss Bearing Plate Thickness Measurements


Truss and Dome Area


Truss and Dome Area


Truss and Dome Area

Fifth Church of Christ Facility Assessment
Project No. N4091107
Date Pictures Taken On: 8/18/2009



Appendix F: Ohio Historic Inventory Form

OHIO HISTORIC INVENTORY

Ohio Historical Center
Columbus, Ohio 43211

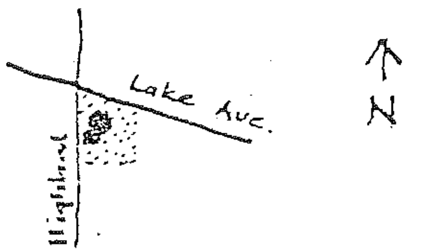
1. No. CUY-872-3
2. County Cuyahoga
3. [Loc]ation of Negatives WRHS
4. Present Name(s) Fifth Church of Christ Scientist
5. Other Name(s)

872-3
CUYahoga
Fifth Church of Christ Scientist

6. Specific Location
11623 Lake Avenue

7. City or Town / If Rural, Township & Vicinity
Cleveland

8. Site Plan with North Arrow



9. Coordinates Lakewood
Lat. Long.
U.T.M. Reference

Zone	Easting	Northing
17	435840	4593040

10. Site ☐ Structure ☐ Building ☒ Object ☐
11. [On N]ational Register? Yes ☐ No ☒
12. Is It Eligible? Yes ☒ No ☐
13. Part of Estab. Hist. Dist.? Yes ☐ No ☒
14. District Potent'l? Yes ☐ No ☒
15. Name of Established District

16. Thematic Category D, N
17. Date(s) or Period 1926
18. Style or Design Neo-classic revival
19. Architect or Engineer Frank Bail
20. Contractor or Builder Van Blarcom Company
21. Original Use, If apparent Church
22. Present Use Church
23. Ownership Public ☐ Private ☒
24. Owner's Name & Address, if known
25. Open to Public? Yes ☒ No ☐
26. Local Contact Person or Organization
27. Other Surveys in Which Included

28. No. of Stories 2
29. Basement? Yes ☒ No ☐
30. Foundation Material Concrete
31. Wall Construction Brick
32. Roof Type & Material Flat/Gravel
33. No. of Bays Front 3 Side 3
34. Wall Treatment Dressed Stone
35. Plan Shape Irregular
36. Changes (Explain in #42) Addition ☐ Altered ☐ Moved ☐
37. Condition Interior Exterior Very Good
38. Preservation Underway? Yes ☐ No ☒
39. Endangered? By What? Yes ☐ No ☒
40. Visible from Public Road? Yes ☒ No ☐
41. Distance from and Frontage on Road 40'

42. Further Description of Important Features
Stone faced octagonal church with rear reading room wing. Central dome with crowning lantern and finial. Balustraded parapet. Projecting vestibule with a Palladian portal supported on Ionic columns. Central, semi-circular window flanked by roundels over front entrance. Rectangular nave windows within round-arched recesses.

43. History and Significance
In a period of rapid growth after the turn of the century, the Christian Science Church established this fifth congregation at 5730 Franklin Blvd in 1915. This building was constructed in 1926 to accommodate members on the far West Side and in nearby Lakewood. Its cost, $250,000, reflects the wealth of the congregation.

44. Description of Environment and Outbuildings
Located at an active corner in a prestigious residential area near Lake Erie.

Edgewater SPA

45. [Sour]ces of Information
Rose, Cleveland, (1950), pg. 623.
Cleveland City Directories
Cleveland Building Permits

46. Prepared by Fisher/Johannesen
47. Organization WRHS
48. Date 9/76
49. Revision Date(s)

Appendix G: Annotated Project Images

Aerial view from west

Aerial view from north

Aerial view from east

Former Fifth Church of Christ
11623 Lake Avenue
Existing Conditions

View from W. 117th/Lake Ave intersection

View looking east on Lake Ave

View looking south on W. 117th

View from W. 116th / Lake Ave

View from W. 116th, looking west

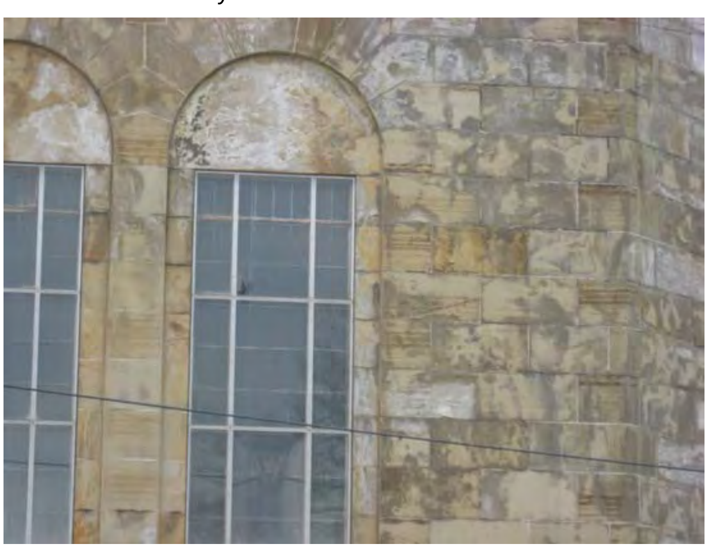
View from W. 116th, looking west


East elevation


Dome east side


Chimney from east


East elevation detail showing efflorecense


East elevation detail showing efflorecense


East exit door


Southeast elevation, former mech. room location


Former mech. room location


South elevation, one-story wing in foreground


One-story wing, salvaged sandstone from demolished mech. room.


One-story south wing. Note horizontal cracking from corroded lintels swelling to push up masonry above

Stone spalling at south wall

View from southwest

West elevation

West entrance, reading room window

Stone deterioration at west entry

Stone spalling and staining at west elevation


Decorative cartouche, west side of north entry. Note open joint.


Steps at north entry


Steps at north entry, deteriorated stone.


Steps at north entry


Steps at north entry


Northwest facade above north entrance.

Northwest facade above north entrance

North entrance

Northwest facade

Dome and cupola from northwest

West side of north entrance

Stone spalling, open joint at north elevation bracket

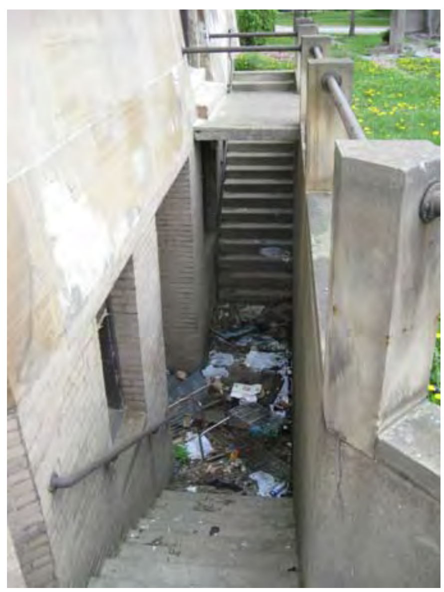
North elevation

Stone spalling and staining at north elevation

Areawell, northeast elevation

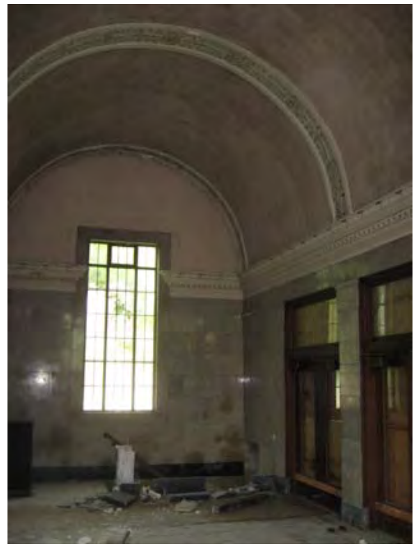
Stone spalling and staining at north elevation bracket

Areawell, east elevation



Areawell, east elevation

North entrance lobby doors

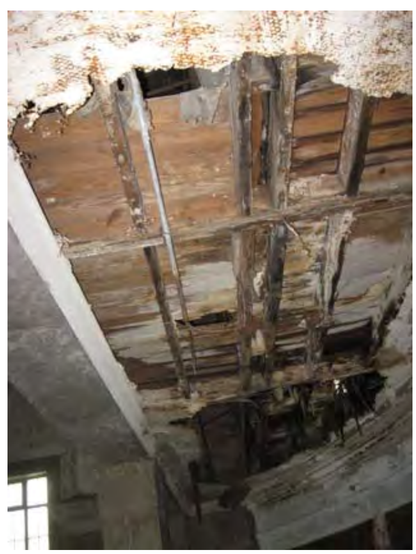


North entrance lobby, vaulted ceiling

North entrance lobby, looking east

North entrance lobby, doors to sanctuary

North entrance lobby, doors to sanctuary. Existing stone facing.



North entrance lobby, ceiling above sanctuary doors


Sanctuary, looking southeast. Wall finishes deteriorated

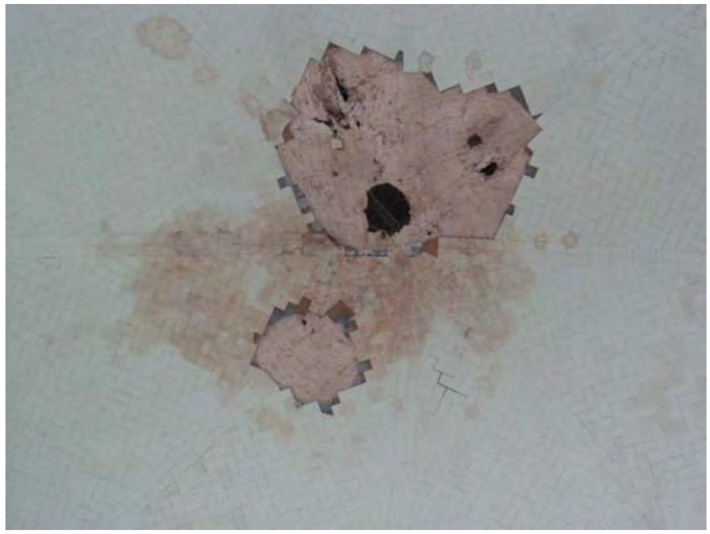

Sanctuary, looking south


Sanctuary dome


Sanctuary west walls. Wall finishes deteriorated


Sanctuary dome and ceiling


'Reader's desk' / altar area, with temporary exterior wall


Sanctuary dome. Moisture damage in plaster, acoustic tile missing


Sanctuary dome plaster detail at perimeter


Typical condition at sanctuary wall / ceiling


Sanctuary looking northwest


Sanctuary, access to mechanical room above north entry lobby

Room south of sanctuary

Ceiling and corroded structure. One-story wing south of sanctuary

Southwest stairs to basement and west entrance.

Heavily corroded ceiling structure near west entry. Note failing roof deck

Reading room, southwest portion of ground floor

Reading room entrance

View from northwest stairs to basement

Room under north exterior stairs. Heavy water damage

Men's basement restrooms

Women's basement restrooms

Northeast basement stairs. Stone covered with plaster debris.

Stairs / doors to basement social hall.

Flooded underslab ductwork in basement

Basement social hall

Basement social hall windows

Basement social hall windows

Basement social hall

Basement social hall

Basement social hall ceiling structure

Stairs from basement to west entrance lobby

Basement office areas

Basement office areas

South exit door from basement

Flooded underslab ductwork in basement


Structure above sanctuary ceiling between dome and ext. wall.


Structure above sanctuary dome


Sanctuary dome catwalk


View towards top of dome structure and cupola


Primary roof truss


Typical concrete roof deck above sanctuary, between dome and exterior wall.

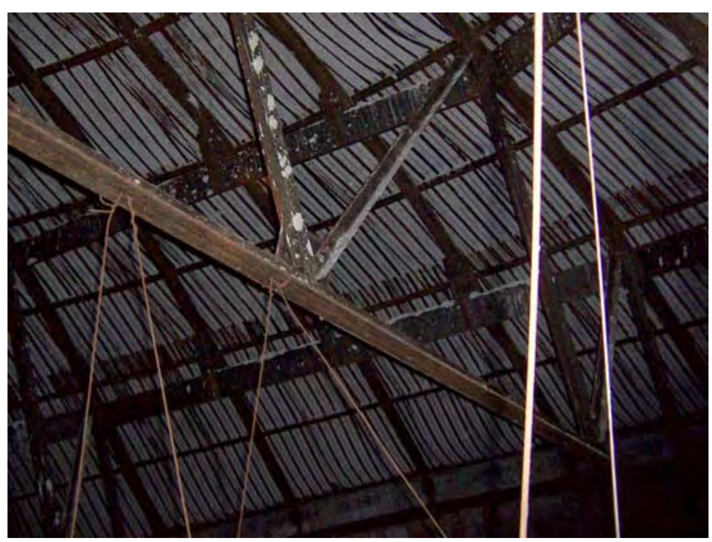
Sanctuary roof truss, very minor corrosion

Sanctuary dome catwalk, roof truss.

Sanctuary roof truss, connection between 'A' and 'B' trusses

Access ladder to cupola. Heavy corrosion.

Roof trusses under cupola. Access to these ladders is via rotted wooden platform that appears unsafe to walk on.



Roof truss under dome

Hole in plaster dome

Ramp to top of dome from lower catwalk

Roof truss under dome, showing some corrosion

Roof truss under cupola. View to dome perimeter.

Primary truss bearing at west wall, southern truss. Corrosion observed by steel inspector: 1/16" of 1/2" bottom flange.

Primary truss bearing at west wall, northern truss. Only minor corrosion observed

Primary truss viewed from exterior wall

Intersection of west and northwest walls.

View towards intersection of west and southwest walls.

View of sanctuary from top of scaffold

Primary truss bearing at west wall, northern truss.

Scaffold at west wall

Scaffold at southeast wall, accessing dome interior catwalk

Roof over one-story south wing

Detail at cornice, southeast wall

Detail at cornice, southeast wall

Chimney from west

Temporary plywood wall infill, southeast wall

Appendix H: Preservation Brief 31

National Park Service
Technical Preservation Services:
Mothballing Historic Buildings

31 Preservation Briefs

Technical Preservation Services
National Park Service
U.S. Department of the Interior

Mothballing Historic Buildings

Sharon C. Park, AIA

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

When all means of finding a productive use for a historic building have been exhausted or when funds are not currently available to put a deteriorating structure into a useable condition, it may be necessary to close up the building temporarily to protect it from the weather as well as to secure it from vandalism. This process, known as mothballing, can be a necessary and effective means of protecting the building while planning the property's future, or raising money for a preservation, rehabilitation or restoration project. If a vacant property has been declared unsafe by building officials, stabilization and mothballing may be the only way to protect it from demolition.

This building has been successfully mothballed for 10 years because the roof and walls were repaired and structurally stabilized, ventilation louvers added, and the property maintained. Photo: NPS files.

This Preservation Brief focuses on the steps needed to "de-activate" a property for an extended period of time. The project team will usually consist of an architect, historian, preservation specialist, sometimes a structural engineer, and a contractor. Mothballing should not be done without careful planning to ensure that needed physical repairs are made prior to securing the building. The steps discussed in this Brief can protect buildings for periods of up to ten years; long-term success will also depend on continued, although somewhat limited, monitoring and maintenance. For all but the simplest projects, hiring a team of preservation specialists is recommended to assess the specific needs of the structure and to develop an effective mothballing program.

A vacant historic building cannot survive indefinitely in a boarded-up condition, and so even marginal interim uses where there is regular activity and monitoring, such as a caretaker residence or non-flammable storage, are generally preferable to mothballing.

In a few limited cases when the vacant building is in good condition and in a location where it can be watched and checked regularly, closing and locking the door, setting heat levels at just above freezing, and securing the windows may provide sufficient protection for a period of a few years.

Boarding up without adequate ventilation and maintenance has accelerated deterioration of this property. Photo: NPS files.

But if long-term mothballing is the only remaining option, it must be done properly. This will require stabilization of the exterior, properly designed security protection, generally some form of interior ventilation--either through mechanical or natural air exchange systems--and continued maintenance and surveillance monitoring.

Comprehensive mothballing programs are generally expensive and may cost 10% or more of a modest rehabilitation budget. However, the money spent on well-planned protective measures will seem small when amortized over the life of the resource. Regardless of the location and condition of the property or the funding available, the following 9 steps are involved in properly mothballing a building:

Documentation

1. Document the architectural and historical significance of the building.
2. Prepare a condition assessment of the building.

Stabilization

3. Structurally stabilize the building, based on a professional condition assessment.
4. Exterminate or control pests, including termites and rodents.
5. Protect the exterior from moisture penetration.

Mothballing

6. Secure the building and its component features to reduce vandalism or break-ins. 7. Provide adequate ventilation to the interior.
8. Secure or modify utilities and mechanical systems.
9. Develop and implement a maintenance and monitoring plan for protection.

These steps will be discussed in sequence below. Documentation and stabilization are critical components of the process and should not be skipped over. Mothballing measures should not result in permanent damage, and so each treatment should be weighed in terms of its reversibility and its overall benefit.

Documentation

Documenting the historical significance and physical condition of the property will provide information necessary for setting priorities and allocating funds. The project team should be cautious when first entering the structure if it has been vacant or is deteriorated. It may be advisable to shore temporarily areas appearing to be structurally unsound until the condition of the structure can be fully assessed. If pigeon or bat droppings, friable asbestos or other health hazards are present, precautions must be taken to wear the appropriate safety equipment when first inspecting the building. Consideration should be given to hiring a firm specializing in hazardous waste removal if these highly toxic elements are found in the building.

Documenting and recording the building

Documenting a building's history is important because evidence of its true age and architectural significance may not be readily evident. The owner should check with the State Historic Preservation Office or local preservation commission for assistance in researching the building. If the building has never been researched for listing in the National Register of Historic Places or other historic registers, then, at a minimum, the following should be determined:

The overall historical significance of the property and dates of construction;

The chronology of alterations or additions and their approximate dates; and,

Types of building materials, construction techniques, and any unusual detailing or regional variations of craftsmanship.

Old photographs can be helpful in identifying early or original features that might be hidden under modern materials. On a walk-through, the architect, historian, or preservation specialist should identify the architecturally significant elements of the building, both inside and out.

Documenting a building's history and assessing its condition provide information to set priorities for stabilization and repair, prior to mothballing. Photo: NPS files.

By understanding the history of the resource, significant elements, even though deteriorated, may be spared the trash pile. For that reason alone, any materials removed from the building or site as part of the stabilization effort should be carefully scrutinized and, if appearing historic, should be photographed, tagged with a number, inventoried, and safely stored, preferably in the building, for later retrieval.

A site plan and schematic building floor plans can be used to note important information for use when the building is eventually preserved, restored, or rehabilitated. Each room should be given a number and notations added to the plans regarding the removal of important features to storage or recording physical treatments undertaken as part of the stabilization or repair.

Because a mothballing project may extend over a long period of time, with many different people involved, clear records should be kept and a building file established. Copies of all important data, plans, photographs, and lists of consultants or contractors who have worked on the property should be added to the file as the job progresses. Recording actions taken on the building and identifying where elements that have been removed are stored will be helpful in the future.

The project coordinator should keep the building file updated and give duplicate copies to the owner. A list of emergency numbers, including the number of the key holder, should be kept at the entrance to the building or on a security gate, in a transparent vinyl sleeve.

Preparing a condition assessment of the building

A condition assessment can provide the owner with an accurate overview of the current condition of the property. If the building is deteriorated or if there are significant interior architectural elements that will need special protection during the mothballing years, undertaking a condition assessment is highly recommended, but it need not be exhaustive.

A modified condition assessment, prepared by an architect or preservation specialist, and in some case a structural engineer, will help set priorities for repairs necessary to stabilize the property for both the short and long-term. It will evaluate the age and condition of the following major elements: foundations; structural systems; exterior materials; roofs and gutters; exterior porches and steps; interior finishes; staircases; plumbing, electrical, mechanical systems; special features such as chimneys; and site drainage.

To record existing conditions of the building and site, it will be necessary to clean debris from the building and to remove unwanted or overgrown vegetation to expose foundations. The interior should be emptied of its furnishing (unless provisions are made for mothballing these as well), all debris removed, and the interior swept with a broom. Building materials too deteriorated to repair, or which have come detached, such as moldings, balusters, and decorative plaster, and which can be used to guide later preservation work, should be tagged, labeled and saved.

Buildings seriously damaged by storms or deterioration may need to be braced before architectural evaluations can be made. Photo: John Milner Architects. Photo: NPS files

Photographs or a videotape of the exterior and all interior spaces of the resource will provide an invaluable record of "as is" conditions. If a videotape is made, oral commentary can be provided on the significance of each space and architectural feature. If 35mm photographic prints or slides are made, they should be numbered, dated, and appropriately identified. Photographs should be cross-referenced with the room numbers on the schematic plans. A systematic method for photographing should be developed; for example, photograph each wall in a room and then take a corner shot to get floor and ceiling portions in the picture. Photograph any unusual details as well as examples of each window and door type.

For historic buildings, the great advantage of a condition assessment is that architectural features, both on the exterior as well as the interior, can be rated on a scale of their importance to the integrity and significance of the building. Those features of the highest priority should receive preference when repairs or protection measures are outlined as part of the mothballing process. Potential problems with protecting these features should be identified so that appropriate interim solutions can be selected. For

Loose or detached elements should be identified, tagged and stored, preferably on site. Photo: NPS files

example, if a building has always been heated and if murals, decorative plaster walls, or examples of patterned wall paper are identified as highly significant, then special care should be taken to regulate the interior climate and to monitor it adequately during the mothballing years. This might require retaining electrical service to provide minimal heat in winter, fan exhaust in summer, and humidity controls for the interior.

Stabilization

Stabilization as part of a mothballing project involves correcting deficiencies to slow down the deterioration of the building while it is vacant. Weakened structural members that might fail altogether in the forthcoming years must be braced or reinforced; insects and other pests removed and discouraged from returning; and the building protected from moisture damage both by weatherizing the exterior envelope and by handling water run-off on the site. Even if a modified use or caretaker services can eventually be found for the building, the following steps should be addressed.

Structurally stabilizing the building

While bracing may have been required to make the building temporarily safe for inspection, the condition assessment may reveal areas of hidden structural damage. Roofs, foundations, walls, interior framing, porches and dormers all have structural components that may need added reinforcement.

Interior bracing which will last the duration of the mothballing will protect weakened structural members. Photo: John Milner Architects.

Structural stabilization by a qualified contractor should be done under the direction of a structural engineer or a preservation specialist to ensure that the added weight of the reinforcement can be sustained by the building and that the new members do not harm historic finishes. Any major vertical post added during the stabilization should be properly supported and, if necessary, taken to the ground and underpinned.

If the building is in a northern climate, then the roof framing must be able to hold substantial snow loads. Bracing the roof at the ridge and mid-points should be considered if sagging is apparent. Likewise, interior framing around stair openings or under long ceiling spans should be investigated. Underpinning or bracing structural piers weakened by poor drainage patterns may be a good precaution as well. Damage caused by insects, moisture, or from other causes should be repaired or reinforced and, if possible, the source of the damage removed. If features such as porches and dormers are so severely deteriorated that they must be removed, they should be documented, photographed, and portions salvaged for storage prior to removal.

If the building is in a southern or humid climate and termites or other insects are a particular problem, the foundation and floor framing should be inspected to ensure that there are no major structural weaknesses. This can usually be done by observation from the crawl space or basement. For those structures where this is not possible, it may be advisable to lift selective floor boards to expose the floor framing. If there is evidence of pest damage, particularly termites, active colonies should be treated and the structural members reinforced or replaced, if necessary.

Controlling pests

Pests can be numerous and include squirrels, raccoons, bats, mice, rats, snakes, termites, moths, beetles, ants, bees and wasps, pigeons, and other birds. Termites, beetles, and carpenter ants destroy wood. Mice, too, gnaw wood as well as plaster, insulation, and electrical wires. Pigeon and bat droppings not only damage wood finishes but create a serious and sometimes deadly health hazard.

If the property is infested with animals or insects, it is important to get them out and to seal off their access to the building. If necessary, exterminate and remove any nests or hatching colonies. Chimney flues may be closed off with exterior grade plywood caps, properly ventilated, or protected with framed wire screens. Existing vents, grills, and louvers in attics and crawl spaces should be screened with bug mesh or heavy duty wire, depending on the type of pest being controlled. It may be advantageous to have damp or infected wood treated with insecticides (as permitted by each state) or preservatives, such as borate, to slow the rate of deterioration during the time that the building is not in use.

Securing the exterior envelope from moisture penetration

Regrading has protected this masonry foundation wall from excessive damp during its 10-year mothballing. Note the attic and basement vents, temporary stairs, and interpretive sign. Photo: NPS files.

It is important to protect the exterior envelope from moisture penetration before securing the building. Leaks from deteriorated or damaged roofing, from around windows and doors, or through deteriorated materials, as well as ground moisture from improper site run-off or rising damp at foundations, can cause long-term damage to interior finishes and structural systems. Any serious deficiencies on the exterior, identified in the condition assessment, should be addressed.

To the greatest extent possible, these weatherization efforts should not harm historic materials. The project budget may not allow deteriorated features to be fully repaired or replaced in-kind. Non-historic or modern materials may be used to cover historic surfaces temporarily, but these treatments should not destroy valuable evidence necessary for future preservation work. Temporary modifications should be as visually compatible as possible with the historic building.

Roofs are often the most vulnerable elements on the building exterior and yet in some ways they are the easiest element to stabilize for the long term, if done correctly. "Quick fix" solutions, such as tar patches on slate roofs, should be avoided as they will generally fail within a year or so and may accelerate damage by trapping moisture. They are difficult to undo later when more permanent repairs are undertaken. Use of a tarpaulin over a leaking roof should be thought of only as a very temporary emergency repair because it is often blown off by the wind in a subsequent storm.

If the existing historic roof needs moderate repairs to make it last an additional ten years, then these repairs should be undertaken as a first priority. Replacing cracked or missing shingles and tiles, securing loose flashing, and reanchoring gutters and downspouts can often be done by a local roofing contractor. If the roof is in poor condition, but the historic materials and configuration are important, a new temporary roof, such as a lightweight aluminum channel system over the existing, might be considered. If the roofing is so deteriorated that it must be replaced and a lightweight aluminum system is not affordable, various inexpensive options might be considered. These include covering the existing deteriorated roof with galvanized corrugated metal roofing panels, or 90 lb. rolled roofing, or a rubberized membrane (refer back to cover photo). These alternatives should leave as much of the historic sheathing and roofing in place as evidence for later preservation treatments.

Urban buildings often need additional protection from unwanted entry and graffiti. This commercial building uses painted plywood panels to cover its glass storefronts. The upper windows on the street sides have been painted to resemble 19th century sash. Photo: NPS files.

For masonry repairs, appropriate preservation approaches are essential. For example, if repointing deteriorated brick chimneys or walls is necessary to prevent serious moisture penetration while the building is mothballed, the mortar should match the historic mortar in composition, color, and tooling. The use of hard portland cement mortars or vapor-impermeable waterproof coatings are not appropriate solutions as they can cause extensive damage and are not reversible treatments.

For wood siding that is deteriorated, repairs necessary to keep out moisture should be made; repainting is generally warranted. Cracks around windows and doors can be beneficial in providing ventilation to the interior and so should only be caulked if needed to keep out bugs and moisture. For very deteriorated wall surfaces on wooden frame structures, it may be necessary to sheathe in plywood panels, but care should be taken to minimize installation damage by planning the location of the nailing or screw patterns or by installing panels over a frame of battens. Generally, however, it is better to repair deteriorated features than to cover them over.

Foundation damage may occur if water does not drain away from the building. Run-off from gutters and downspouts should be directed far away from the foundation wall by using long flexible extender pipes equal in length to twice the depth of the basement or crawl space. If underground drains are susceptible to clogging, it is recommended that the downspouts be disconnected from the drain boot and attached to flexible piping. If gutters and downspouts are in bad condition, replace them with inexpensive aluminum units.

If there are no significant landscape or exposed archeological elements around the foundation, consideration should be given to regrading the site if there is a documented drainage problem. If building up the grade, use a fiber mesh membrane to separate the new soil from the old and slope the new soil 6 to 8 feet (200 cm-266 cm) away from the foundation making sure not to cover up the dampcourse layer or come into contact with skirting boards. To keep vegetation under control, put down a layer of 6 mil black polyethylene sheeting or fiber mesh matting covered with a 2"-4" (5-10 cm.) of washed gravel. If the building suffers a serious rising damp problem, it may be advisable to eliminate the plastic sheeting to avoid trapping ground moisture against foundations.

Mothballing

The actual mothballing effort involves controlling the long-term deterioration of the building while it is unoccupied as well as finding methods to protect it from sudden loss by fire or vandalism. This requires securing the building from unwanted entry, providing adequate ventilation to the interior, and shutting down or modifying existing utilities. Once the building is de-activated or secured, the long-term success will depend on periodic maintenance and surveillance monitoring.

Securing the building from vandals, break-ins, and natural disasters

Securing the building from sudden loss is a critical aspect of mothballing. Because historic buildings are irreplaceable, it is vital that vulnerable entry points are sealed. If the building is located where fire and security service is available then it is highly recommended that some form of monitoring or alarm devices be used.

To protect decorative features, such as mantels, lighting fixtures, copper downspouts, iron roof cresting, or stained glass windows from theft or vandalism, it may be advisable to temporarily remove them to a more secure location if they cannot be adequately protected within the structure.

The first floor openings of this historic building have been filled with cinder blocks and the doors, window sash, and frames removed for safe keeping. The security metal door features heavy duty locks. Photo: NPS files.

Mothballed buildings are usually boarded up, particularly on the first floor and basement, to protect fragile glass windows from breaking and to reinforce entry points. Infill materials for closing door and window openings include plywood, corrugated panels, metal grates, chain fencing, metal grills, and cinder or cement blocks. The method of installation should not result in the destruction of the opening and all associated sash, doors, and frames should be protected or stored for future reuse.

Generally exterior doors are reinforced and provided with strong locks, but if weak historic doors would be damaged or disfigured by adding reinforcement or new locks, they may be removed temporarily and replaced with secure modern doors. Alternatively, security gates in an new metal frame can be installed within existing door openings, much like a storm door, leaving the historic door in place. If plywood panels are installed over door openings, they should be screwed in place, as opposed to nailed, to avoid crowbar damage each time the panel is removed. This also reduces pounding vibrations from hammers and eliminates new nail holes each time the panel is replaced.

For windows, the most common security feature is the closure of the openings; this may be achieved with wooden or pre-formed panels or, as needed, with metal sheets or concrete blocks. Plywood panels, properly installed to protect wooden frames and properly ventilated, are the preferred treatment from a preservation standpoint.

There are a number of ways to set insert plywood panels into

This painted trompe l'eoil scene on plywood panels is a neighborhood-friendly device. Photo: NPS files.

windows openings to avoid damage to frame and sash. One common method is to bring the upper and lower sash of a double hung unit to the mid-point of the opening and then to install pre-cut plywood panels using long carriage bolts anchored into horizontal wooden bracing, or strong backs, on the inside face of the window. Another means is to build new wooden blocking frames set into deeply recessed openings, for example in an industrial mill or warehouse, and then to affix the plywood panel to the blocking frame. If sash must be removed prior to installing panels, they should be labeled and stored safely within the building.

Plywood panels are usually 1/2"-3/4" (1.25-1.875 cm.) thick and made of exterior grade stock, such as CDX, or marine grade plywood. They should be painted to protect them from delamination and to provide a neater appearance.

These panels may be painted to resemble operable windows or treated decoratively. With extra attention to detail, the plywood panels can be trimmed out with muntin strips to give a shadow line simulating multi-lite windows. This level of detail is a good indication that the building is protected and valued by the community.

If the building has shutters simply close the shutters and secure them from the interior. If the building had shutters historically, but they are missing, it may be appropriate to install new shutters, even in a modern material, and secure them in the closed position. Louvered shutters will help with interior ventilation if the sash are propped open behind the shutters.

There is some benefit from keeping windows unboarded if security is not a problem. The building will appear to be occupied, and the natural air leakage around the windows will assist in ventilating the interior. The presence of natural light will also help when periodic inspections are made. Rigid polycarbonate clear storm glazing panels may be placed on the window exterior to protect against glass breakage. Because the sun's ultraviolet rays can cause fading of floor finishes and wall surfaces, filtering pull shades or inexpensive curtains may be options for reducing this type of deterioration for significant interiors. Some acrylic sheeting comes with built-in ultraviolet filters.

A view showing the exterior of the Brearley House, New Jersey, in its mothballed condition Photo: Michael Mills, Ford Farewell Mills Gatsch, Architects.

Securing the building from catastrophic destruction from fire, lightning, or arson will require additional security devices. Lightning rods properly grounded should be a first consideration if the building is in an area susceptible to lightning storms. A high security fence should also be installed if the property cannot be monitored closely. These interventions do not require a power source for operation. Since many buildings will not maintain electrical power, there are some devices available using battery packs, such as intrusion alarms, security lighting, and smoke detectors which through audible horn alarms can alert nearby neighbors. These battery packs must be replaced every 3 months to 2 years, depending on type and use. In combination with a cellular phone, they can also provide some level of direct communication with police and fire departments.

If at all possible, new temporary electric service should be provided to the building. Generally a telephone line is needed as well. A hard wired security system for intrusion and a combination rate-of-rise and smoke detector can send an immediate signal for help directly to the fire department and security service. Depending on whether or not heat will be maintained in the building, the security system should be designed accordingly. Some systems cannot work below 32°F (0°C). Exterior lighting set on a timer, photo electric sensor, or a motion/infra-red detection device provides additional security.

Providing adequate ventilation to the interior

Once the exterior has been made weathertight and secure, it is essential to provide adequate air exchange throughout the building. Without adequate air exchange, humidity may rise to unsafe levels, and mold, rot, and insect infestation are likely to thrive. The needs of each historic resource must be individually evaluated because there are so many variables that affect the performance of each interior space once the building has been secured.

A mechanical engineer or a specialist in interior climates should be consulted, particularly for buildings with intact and significant interiors. In some circumstances, providing heat during the winter, even at a minimal 45° F (7°C), and utilizing forced-fan ventilation in summer will be recommended and will require retaining electrical service. For masonry buildings it is often helpful to keep the interior temperature above the spring dew point to avoid damaging condensation. In most buildings it is the need for summer ventilation that outweighs the winter requirements.

This exhaust fan has tamper-proof housing. Photo: Michael Mills, Ford Farewell Mills Gatsch, Architects.

Many old buildings are inherently leaky due to loose-fitting windows and floorboards and the lack of insulation. The level of air exchange needed for each building, however, will vary according to geographic location, the building's construction, and its general size and configuration.

There are four critical climate zones when looking at the type and amount of interior ventilation needed for a closed up building: hot and dry (southwestern states); cold and damp (Pacific northwest and northeastern states); temperate and humid (Mid-Atlantic states, coastal areas); and hot and humid (southern states and the tropics).

Once closed up, a building interior will still be affected by the temperature and humidity of the exterior. Without proper ventilation, moisture from condensation may occur and cause damage by wetting plaster, peeling paint, staining woodwork, warping floors, and in some cases even causing freeze thaw damage to plaster. If moist conditions persist in a property, structural damage can result from rot or returning insects attracted to moist conditions. Poorly mothballed masonry buildings, particularly in damp and humid zones have been so damaged on the interior with just one year of unventilated closure that none of the interior finishes were salvageable when the buildings were rehabilitated.

The absolute minimum air exchange for most

Portable monitors are used to record temperature and humidity conditions in historic buildings during mothballing. Photo: NPS files.

mothballed buildings consists of one to four air exchanges every hour; one or two air exchanges per hour in winter and twice that amount in summer. Even this minimal exchange may foster mold and mildew in damp climates, and so monitoring the property during the stabilization period and after the building has been secured will provide useful information on the effectiveness of the ventilation solution.

There is no exact science for how much ventilation should be provided for each building. There are, however, some general rules of thumb. Buildings, such as adobe structures, located in hot and arid climates may need no additional ventilation if they have been well weatherized and no moisture is penetrating the interior. Also frame buildings with natural cracks and fissures for air infiltration may have a natural air exchange rate of 3 or 4 per hour, and so in arid as well as temperate climates may need no additional ventilation once secured. The most difficult buildings to adequately ventilate without resorting to extensive louvering and/or mechanical exhaust fan systems are masonry buildings in humid climates. Even with basement and attic vent grills, a masonry building many not have more than one air exchange an hour. This is generally unacceptable for summer conditions. For these buildings, almost every window opening will need to be fitted out with some type of passive, louvered ventilation.

Depending on the size, plan configuration, and ceiling heights of a building, it is often necessary to have louvered opening equivalent to 5%-10% of the square footage of each floor. For example, in a hot humid climate, a typical 20'x30' (6.1m x 9.1m) brick residence with 600 sq. ft.(55.5 sq.m) of floor space and a typical number of windows, may need 30-60 sq. ft.(2.75sq.m-5.5 sq. m) of louvered openings per floor. With each window measuring 3'x5'(.9m x 1.5 m) or 15 sq. ft. (1.3 sq.m), the equivalent of 2 to 4 windows per floor will need full window louvers.

Small pre-formed louvers set into a plywood panel or small slit-type registers at the base of inset panels generally cannot provide enough ventilation in most moist climates to offset condensation, but this approach is certainly better than no louvers at all. Louvers should be located to give cross ventilation, interior doors should be fixed ajar at least 4" (10cm) to allow air to circulate, and hatches to the attic should be left open.

Monitoring devices which can record internal temperature and humidity levels can be invaluable in determining if the internal climate is remaining stable. These units can be powered by portable battery packs or can be wired into electric service with data downloaded into laptop computers periodically. This can also give long-term information throughout the mothballing years. If it is determined that there are inadequate air exchanges to keep interior moisture levels under control, additional passive ventilation can be increased, or, if there is electric service, mechanical exhaust fans can be installed. One fan in a small to medium sized building can reduce the amount of louvering substantially.

If electric fans are used, study the environmental conditions of each property and determine if the fans should be controlled by thermostats or automatic timers. Humidistats, designed for enclosed climate control systems, generally are difficult to adapt for open mothballing conditions. How the system will draw in or exhaust air is also important. It may be determined that it is best to bring dry air in from the attic or upper levels and force it out through lower basement windows. If the basement is damp, it may be best to zone it from the rest of the building and exhaust its air separately. Additionally, less humid day air is preferred over damper night air, and this can be controlled with a timer switch mounted to the fan.

The type of ventilation should not undermine the security of the building. The most secure installations use custom-made grills well anchored to the window frame, often set in plywood security panels. Some vents are formed using heavy millwork louvers set into existing window openings. For buildings where security is not a primary issue, where the interior is modest, and where there has been no heat for a long time, it may be possible to use lightweight galvanized metal grills in the window openings. A cost effective grill can be made from the expanded metal mesh lath used by plasterers and installed so that the mesh fins shed rainwater to the exterior.

Securing mechanical systems and utilities

At the outset, it is important to determine which utilities and services, such as electrical or telephone lines, are kept and which are cut off. As long as these services will not constitute a fire hazard, it is advisable to retain those which will help protect the property. Since the electrical needs will be limited in a vacant building, it is best to install a new temporary electric line and panel (100 amp) so that all the wiring is new and exposed. This will be much safer for the building, and allows easy access for reading the meter.

Most heating systems are shut down in long term mothballing. For furnaces fueled by oil, there are two choices for dealing with the tank. Either it must be filled to the top with oil to eliminate condensation or it should be drained. If it remains empty for more than a year, it will likely rust and not be reusable. Most tanks are drained if a newer type of system is envisioned when the building is put back into service. Gas systems with open flames should be turned off unless there is regular maintenance and frequent surveillance of the property. Gas lines are shut off by the utility company.

If a hot water radiator system is retained for low levels of heat, it generally must be modified to be a self-contained system and the water supply is capped at the meter. This recirculating system protects the property from extensive damage from burst pipes. Water is replaced with a water/glycol mix and the reserve tank must also be filled with this mixture. This keeps the modified system from freezing, if there is a power failure. If water service is cut off, pipes should be drained. Sewerage systems will require special care as sewer gas is explosive. Either the traps must be filled with glycol or the sewer line should be capped off at the building line.

Developing a maintenance and monitoring plan

While every effort may have been made to stabilize the property and to slow the deterioration of materials, natural disasters, storms, undetected leaks, and unwanted intrusion can still occur. A regular schedule for surveillance, maintenance, and monitoring should be established. The fire and police departments should be notified that the property will be vacant. A walk-through visit to familiarize these officials with the building's location, construction materials, and overall plan may be invaluable if they are called on in the future.

The optimum schedule for surveillance visits to the property will depend on the location of the property and the number of people who can assist with these activities. The more frequent the visits to check the property, the sooner that water leaks or break-ins will be noticed. Also, the more frequently the building is entered, the better the air exchange.

By keeping the site clear and the building in good repair, the community will know that the building has not been abandoned. The involvement of neighbors and community groups in caring for the property can ensure its protection from a variety of catastrophic circumstances.

The owner may utilize volunteers and service companies to undertake the work outlined in the maintenance chart. Service companies on a maintenance contract can provide yard, maintenance, and inspection services, and their reports or itemized bills reflecting work undertaken should be added to update the building file.

Sidebar

Mothballing Checklist

In reviewing mothballing plans, the following checklist may help to ensure that work items are not inadvertently omitted.

Moisture

- Is the roof watertight?
- Do the gutters retain their proper pitch and are they clean?
- Are downspout joints intact?
- Are drains unobstructed?
- Are windows and doors and their frames in good condition?
- Are masonry walls in good condition to seal out moisture?
- Is wood siding in good condition?
- Is site properly graded for water run-off?
- Is vegetation cleared from around the building foundation to avoid trapping moisture?

Pests

- Have nests/pests been removed from the building's interior and eaves?
- Are adequate screens in place to guard against pests?
- Has the building been inspected and treated for termites, carpenter ants, rodents, etc.?
- If toxic droppings from bats and pigeons are present, has a special company been brought in for its disposal?

Housekeeping

- Have the following been removed from the interior: trash, hazardous materials such as inflammable liquids, poisons, and paints and canned goods that could freeze and burst?
- Is the interior broom-clean?
- Have furnishings been removed to a safe location?
- If furnishings are remaining in the building, are they properly protected from dust, pests, ultraviolet light, and other potentially harmful problems?
- Have significant architectural elements that have become detached from the building been labeled and stored in a safe place?
- Is there a building file?

Security

- Have fire and police departments been notified that the building will be mothballed?
- Are smoke and fire detectors in working order?
- Are the exterior doors and windows securely fastened?
- Are plans in place to monitor the building on a regular basis?
- Are the keys to the building in a secure but accessible location?
- Are the grounds being kept from becoming overgrown?

Utilities

- Have utility companies disconnected/shut off or fully inspected water, gas, and electric lines?
- If the building will not remain heated, have water pipes been drained and glycol added?
- If the electricity is to be left on, is the wiring in safe condition?

Ventilation

- Have steps been taken to ensure proper ventilation of the building?
- Have interior doors been left open for ventilation purposes?
- Has the secured building been checked within the last 3 months for interior dampness or excessive humidity?

Maintenance Chart

1-3 months; periodic

- regular drive by surveillance
- check attic during storms if possible
- monthly walk arounds
- check entrances
- check window panes for breakage
- mowing as required
- check for graffiti or vandalism

- enter every 3 months to air out
- check for musty air
- check for moisture damage
- check battery packs and monitoring equipment
- check light bulbs
- check for evidence of pest intrusion

every 6 months; spring and fall

- site clean-up; pruning and trimming
- gutter and downspout check

- check crawlspace for pests
- clean out storm drains

every 12 months

- maintenance contract inspections for equipment/utilities
- check roof for loose or missing shingles
- termite and pest inspection/treatment
- exterior materials spot repair and touch up painting
- remove bird droppings or other stains from exterior
- check and update building file

Conclusion

Providing temporary protection and stabilization for vacant historic buildings can arrest deterioration and buy the owner valuable time to raise money for preservation or to find a compatible use for the property. A well planned mothballing project involves documenting the history and condition of the building, stabilizing the structure to slow down its deterioration, and finally, mothballing the structure to secure it. The three highest priorities for a mothballed building are 1) to protect the building from sudden loss, 2) to weatherize and maintain the property to stop moisture penetration, and 3) to control the humidity levels inside once the building has been secured.

While issues regarding mothballing may seem simple, the variables and intricacies of possible solutions make the decision-making process very important. Each building must be individually evaluated prior to mothballing. In addition, a variety of professional services as well as volunteer assistance is needed for careful planning and repair, sensitively designed protection measures, follow-up security surveillance, and cyclical maintenance.

In planning for the future of the building, complete and systematic records must be kept and generous funds allocated for mothballing. This will ensure that the historic property will be in stable condition for its eventual preservation, rehabilitation, or restoration.

Further Reading

Cotton, J. Randall. "Mothballing Buildings." The Old-House Journal. July/August, 1993.

Fisher, Charles E. and Thomas A. Vitanza. "Temporary Window Vents in Unoccupied Historic Buildings." Preservation Tech Note (Windows, No. 10). Washington, DC: National Park Service, 1985.

Frazier Associates. "Mothballing Historic Buildings." Preserving Prince William, 2. County of Prince William, VA, 1990.

Michell, Eleanor. Emergency Repairs for Historic Buildings. London: Butterworth Architecture, 1988.

"Mothballing Vacant Buildings," An Anti-Arson Kit for Preservation and Neighborhood Action. Washington, DC: Federal Emergency Management Agency, 1982.

Solon, Thomas E. "Security Panels for the Foster-Armstrong House." Association for Preservation Technology Bulletin. Vol XVI no. 3 & 4, 1984. (note the design of the panels, but be aware that additional louvering may be needed on other projects).

Acknowledgements

The author, Sharon C. Park, Senior Historical Architect, Heritage Preservation Services Division, National Park Service, would like to acknowledge the assistance of the following individuals in the preparation and review of this publication. H. Ward Jandl served as the technical editor and assisted with producing this Preservation Brief. In addition the following persons have provided invaluable information and illustrations: Ernest A. Conrad, PE; Doug Hicks, NPS Williamsport Preservation Training Center; Thomas C. Taylor, Colonial Williamsburg; Karen Gordon, Seattle Urban Conservation Office; Kevin B. Stoops, Seattle Department of Parks and Recreation; Michael Mills, AIA; Christina Henry, architect, Mary Beth Hirsch, Ohio Historical Society. Thanks also to Heritage Preservation Services Division staff members Michael J. Auer, Anne E. Grimmer, Kay D. Weeks, Tim Buehner, and Jean Travers, and to the numerous staff members of the NPS Regional offices who submitted comments. All photographs and drawings are by the author unless otherwise noted.

Washington, D.C. September, 1993

Home page logo: Appropriately mothballed historic building. Photo: NPS files.

This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments to a broad public.

Order Brief | Technical Preservation Services | Preservation Briefs | Search | Questions/Answers

KDW