JOHN COOPER
MAYOR

METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY

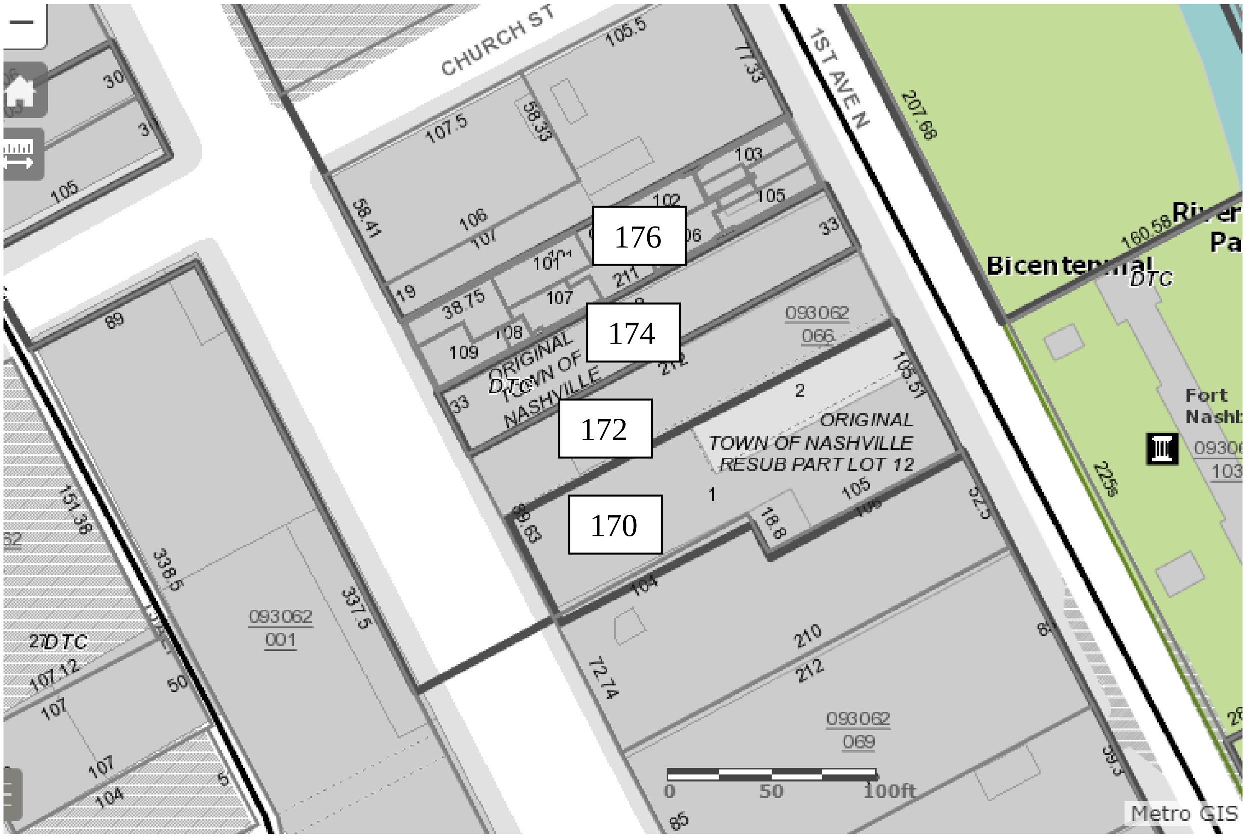
Metropolitan Historic Zoning Commission
Sunnyside in Sevier Park
3000 Granny White Pike
Nashville, Tennessee 37204
Telephone: (615) 862-7970

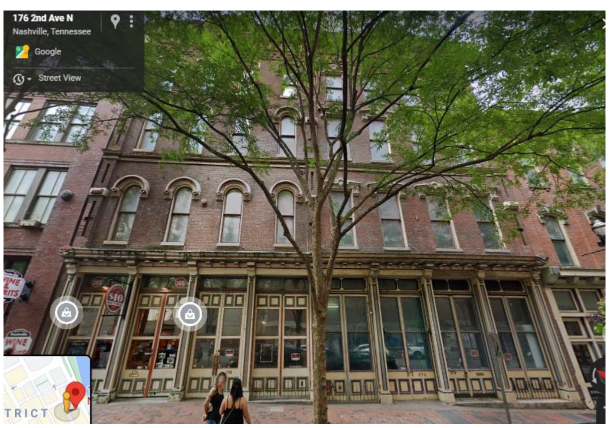
STAFF RECOMMENDATION
170-176 Second Avenue North
July 21, 2021

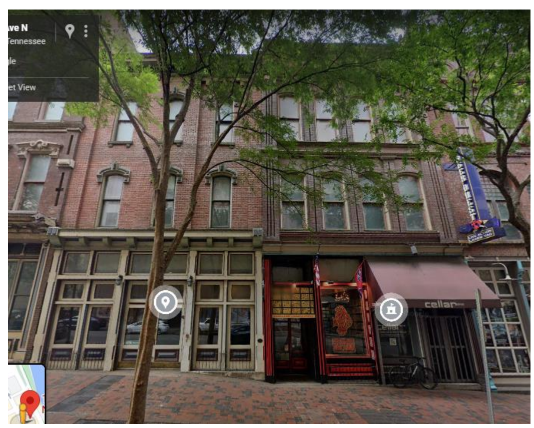
Application: Demolition
District: Second Avenue Historic Preservation Zoning Overlay
Council District: 19
Base Zoning: DTC
Map and Parcel Number: 09306206600 and 09302401900
Applicant: Callen Trust, property owner
Project Lead: Robin Zeigler, robin.zeigler@nashville.gov

Description of Project: The property owner requests to demolish four historic buildings in the Second Avenue Historic Preservation Zoning Overlay, damaged in the 2020 Christmas morning explosion. **Recommendation Summary:** If the applicants are in agreement, Staff recommends that a decision be held until the final report is received from Mr. Kelley. If not, staff recommends disapproval of demolition for 170, 174 and 176 Second Avenue North finding that demolition meets section V.1 for inappropriate demolition and does not meet section V.2 for appropriate demolition. Staff recommends demolition of 172 Second Avenue North with the condition that the permit shall not be issued until after the applicant has provided an engineer's letter confirming that 170 and 174 Second Avenue North are fully stabilized without the support of 172. Staff finds that demolition of 172 does not meet section V.1 for inappropriate demolition and does meet section V.2 for appropriate demolition.	**Attachments** **A:** STG Report **B:** ANA Report **C**: EMC Report **D**: SJK Report **E**: Kelley CV

Vicinity Map:







176 and 174 Second Avenue North North

172 and 170 Second Avenue

Applicable Design Guidelines:

V. Demolition

General Principles

Since the purpose of historic zoning is to protect historic properties, the demolition of a building that contributes historically and architecturally to the character and significance of the district is not appropriate and should be avoided.

Demolition is considered the removal of any structure or portion of a structure which affects the visual appearance of the building from the exterior. *It includes the removal of floors or sections of the building that are enclosed by the original façade.*

1. Demolition is inappropriate:

a. if a building, or major portion of a building, contributes to the architectural or historical significance or character of the district; or

b. if a building, or a major portion of a building, is of such old or unusual or uncommon design and materials that it could not be reproduced or be reproduced without great difficulty and expense.

2. Demolition is appropriate:

a. if a building, or a major portion of a building, does not contribute to the historical or architectural character and importance of the district; or

b. if a building, or a major portion of a building, has irretrievably lost its architectural and historical integrity and importance and its removal will not result in a more historically appropriate visual effect on the district; or

c. if the denial of the demolition will result in an economic hardship on the applicant as determined by the MHZC in accordance with section 17.40.420, as amended of the historic zoning ordinance.

Background:

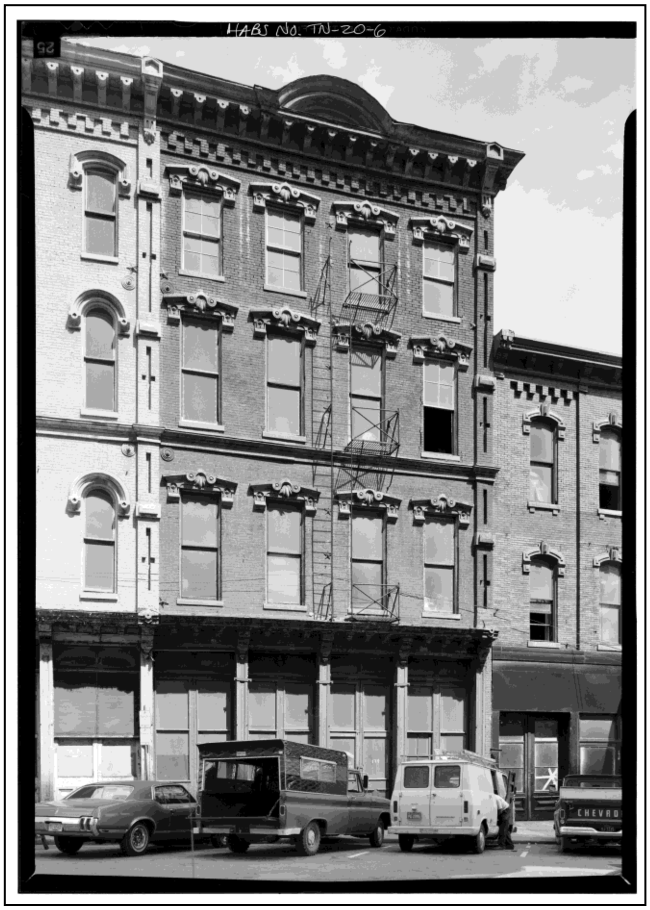
Second Avenue, generally the section between Broadway and Union was listed in the National Register of Historic Places in 1995. The nomination states that it is one of the most outstanding collections of cast iron and masonry storefronts remaining in America. The district is significant due to its "outstanding examples of Victorian commercial architecture, together with the development of the area as one of the most important industrial sections in Nashville's history from the beginning of the city to the present time."

The following is information from the National Register of Historic Places with additional, and more recent research, conducted by Robbie Jones, architectural historian. The photographs are from The National Park Service's Historic American Buildings Survey, conducted in 1970.

170 Second Avenue North is the Hillman, Buford & Corbett Hardware building, constructed c. 1880. (Brown & Farrell Hardware/M.E. Derryberry, c. 1885 in National Register nomination.) It is a contributing building in the National Register district and Historic Nashville, Inc holds a façade easement. The National Register describes the building as brick building of four-bays with an overhanging cornice that caps off five capitaled and grooved pilasters. The windows are one-over-one with a rounded sash as segmented arch. The building was home to various saddlery and wholesale hardware stores. The Nashville Plumbers & Mill Co. moved here in 1911 and renovated the building. There was another renovation in 1970. The rear wall was repaired and possibly reconstructed, and the rear roof raised in 1981 as part of Federal Tax Credit Project.

172 Second Avenue North is also the Hillman, Buford & Corbett Hardware building, constructed c. 1880. (C.B. Pearce & Co, c. 1885 in the National Register nomination.) This building is half the depth of all other buildings on Second Avenue that stretch between Second and First Avenues. It is a contributing building in the National Register district and Historic Nashville, Inc holds a façade easement. The National Register describes this building as having corbelled brick at the roofline and an overhanding cornice with brackets. The windows have rounded sashes with metal arches containing keystones. A molded, bracketed cornice separates the storefront from the upper floors. This portion of the building replaced an antebellum building that housed Charles Nelson Distillery (1869-1871). Hillman, Buford & Corbett sold iron, steel and heavy hardware (one of the

Hillman brothers built a farm in 1850s at Hurricane Mills that later became Loretta Lynn's Ranch).



174-176 Second Avenue North is the Ewing & Co building, constructed c. 1872. (Berry & Demoville, c.1875 and 1885 in the National Register nomination.) It is a contributing building in the National Register district and Historic Nashville, Inc holds a façade easement. The National Register describes these two buildings as similar Italianate style buildings. Ewing & Co. wholesale grocers built this building with galvanized iron window hoods and cornice, after a fire destroyed the previous antebellum building. Ewing & Co. sold liquor, cigars, tobacco and fancy groceries including Robertson and Lincoln County distilled whiskeys. It was also occupied by C.H. Stockell & Co. agricultural implements 1874-1882; various wholesale liquors, drugs, and groceries. As part of a Federal Tax Credit project, the rear wall of 174 was reconstructed in 1986.

A bomb was detonated on Second Avenue on Christmas morning 2020, which caused extensive damage to many buildings in the area, these four being the most heavily affected.

Many have voiced concerns regarding demolition, beyond the loss of historic fabric. To alleviate those concerns, the owner has made a commitment to rezone the property so that surface parking is not allowed, intends to salvage materials for sale or re-use and has provided a concept drawing that, with the information provided so far, meets the design guidelines. Currently, there is no timeline available for demo, design review and new construction, if demolition is approved. What materials would be salvaged is also not known but would likely include features such as cast-iron pilasters, an industrial scale, mantle, safe door, heavy timbers, and bricks and large stones from the basement level.

Analysis and Findings:

The request is for demolition based on life-safety issues and loss of integrity rather than economic hardship. Tom Schaeffer, Structural Design Group, working for the owners of the property gave an opinion on the need to demolish the four buildings. Ron Gobbell, the project manager hired by Metro to oversee restoration of Second Avenue North, retained Mark Buchanan with EMC Structural Engineers to provide an independent opinion about the condition of the structures in question. Mr. Buchanan has extensive knowledge and experience with historic buildings.

The EMC report notes that the Second Avenue facades were completely removed due to the blast and that additional portions of walls and roofing have been removed to stabilize the buildings enough for entry. He also notes that additional selective demolition will be necessary and would include complete removal of the rear walls (First Avenue elevations) of buildings 172, 174, and 176 Second Avenue North.

Historic Nashville, Inc, the non-profit that holds façade easements on the four buildings, hired a team of experts that included Sandhu Consultants International, Masonry Solutions International, Inc and Atkinson-Noland & Associates, all of which conclude that repair is possible and reasonable. Devinder Sandu is an engineer at Sandhu Consultants International who was hired by Metro just after the bomb. He holds a BE in Civil Engineering and an MSc in Environmental Engineering, both from Vanderbilt University. Masonry Solutions International, Inc specializes in appropriate stabilization, preservation and enhancement of masonry and internal and invisible structural repairs. Historic projects include Colonial Williamsburg, Washington National Cathedral and the Brooklyn Bridge. Atkinson-Noland and Associates is a specialty structural engineering firm with a focus on investigation and repair design of masonry structures.

Wayne Ruth with Masonry Solutions International, Inc was able to review the building in detail in January/February, just after the explosion and again on July 12 and 13 after the clean up and selective demolition. Based on his experience, he concludes that the condition of the demising walls and the First Avenue facades are good candidates for stabilization and in line with work his company has undertaken in the past. He recommends immediate action be taken to protect the current state of the structures and that non-destructive evaluation, such as microwave radar and petrographic mortar analysis, be undertaken to determine the best methods of repair.

Donald Harvey, Principal with Atkinson-Noland & Associates, Inc, provides general information about historic masonry walls that could be misconstrued as problematic but are very repairable. He also provides some guidance on how masonry walls can be repaired and strengthened.

Devinder Sandhu, Principal Engineer with Sandhu Consultants International, points out that demolition is estimated at 2.25 million and that those funds could go towards not just investigation of repair methods but also the actual repair of the existing walls. Mr. Sandhu also recommends immediate protection of the structures and a non-destructive evaluation to develop the appropriate repair methods, which he estimates as taking approximately two weeks to accomplish.

The District and the Metro Historical Commission Foundation hired Stephen J. Kelley, FAIA, SE, FAPT, FUSICOMOS. Mr. Kelley is a registered architect and structural engineer in private practice who has devoted these two skills to the preservation of our built cultural heritage. With 40 years of experience, his projects range from small to immense, simple to sophisticated and cover a wide range of building materials and systems. His award-winning projects are located throughout the United States, but he has also worked on significant projects in Asia, Europe, Africa, Middle East, South America and the Caribbean basin. He has published widely on various aspects of preservation and is an educator who has taught at the university level thus sharing his experience with the next generation of preservation professionals.

Mr. Kelley is a Fellow of the American Institute of Architects. He has served on the Board of Directors of both the US Committee of the International Council on Monuments and Sites (US/ICOMOS) and the Association for Preservation Technology (APT) and was elevated to Fellowship in both organizations. Mr. Kelley was chair of ASTM E6.24 and was the principal author of *ASTM Standard Guide for Selection of Cleaning Techniques for Masonry, Concrete, and Stucco Surfaces*. He is a UNESCO Tangible Heritage Expert and is Secretary-General of the International Scientific Committee on the Analysis and Restoration of Structures of Architectural Heritage (ISCARSAH).

Mr. Kelley provided a summary report after a two-day investigation of the buildings on July 12 and 13, 2021. His report provides his methodology, a physical description of the buildings and a summary of his observations. He concludes that many of the issues with 170, 174 and 176 Second Avenue are due to deferred maintenance and are repairable. He outlines the following actions for rehabilitation.

1. Secure the roof of the 170 building, install a downspout to the ground on the east facade between the 174 and 176 buildings, secure all open skylights, and windows. Continued water leakage will only hasten damage.
2. Place a concrete bond beam at the partially dismantled masonry bearing walls at Second Avenue to consolidate these walls and successfully build on top of them with contemporary masonry and techniques. Second Avenue facades can then be reconstructed using a mixture of salvaged and new materials.
3. Tie back the east walls of the 174 and 176 buildings at each level with lateral steel ties and anchor plates to achieve stability. The anchor plates should be positively connected to horizontally oriented trusses composed of wood or steel that are fastened to the underside of floor joints to create a diaphragm.
4. Construct a masonry pier at the centerline of each of the east walls of the 174 and 176 buildings on the interior side to help carry the floor support girders which are buried in these walls.
5. Place lateral steel ties and anchor plates in the north courtyard facing walls of the 170 building at the second and third floor levels to further stabilize the wall. The

lateral ties should run to the opposing masonry bearing wall and can be located within or directly beneath floor joists.

6. The north facade of the 170 building should be "deep" pointed (to a depth of at least one inch) using mortar that is compatible with the existing mortar.
7. Place lateral steel ties in the south courtyard facing wall of the 174 building at the second, third and fourth floor levels to further stabilize the wall. The lateral ties should run to the opposing masonry bearing wall and can be located within or directly beneath floor joists.
8. Reinstall or replace the displaced columns in the basement of the 170 building.
9. Consolidate and repoint the exterior masonry walls on the east, south, and north using mortar that is compatible with the original mortar.

His recommendation includes repairs that are not out of the ordinary for an old masonry building such a repointing, replacing severely damaged features, and installing masonry ties.

Mr. Kelley anticipates providing the Commission with a more detailed report by July 30, 2021 to include material analysis, a written and illustrated report of findings and recommendations and a cost estimate on the recommended repairs.

Staff finds that demolition of 170, 174 and 176 Second Avenue North meets section V.1 for inappropriate demolition as the buildings are listed in the National Register of Historic Places and of special significance to Nashville. Again, the National Register nomination states they are important as outstanding examples of Victorian commercial architecture but also for their representation of the development of the area as one of the most important industrial sections in Nashville's history. Each building is individually important as well as significant as part of a collection. Staff does not find that demolition meets section V.2 for appropriate demolition. Although the Second Avenue North façades are lost, the First Avenue North facades and significant portions of the demising walls are extant and reasonably repairable.

Staff finds that demolition of 172 Second Avenue North does not meet section V.1 for inappropriate demolition. Since both the First and Second Avenue North facades of this building have been lost, the building no longer contributes to the historical significance of the district. Demolition of 172 meets section V.2 for demolition as it has irretrievably lost its architectural and historical integrity.

Recommendation: If the applicants are in agreement, Staff recommends that a decision be held until the final report is received from Mr. Kelley. If not, staff recommends disapproval of demolition for 170, 174 and 176 Second Avenue North finding that demolition meets section V.1 for inappropriate demolition and does not meet section V.2 for appropriate demolition. Staff recommends demolition of 172 Second Avenue North with the condition that the permit shall not be issued until after the applicant has provided an engineer's letter confirming that 170 and 174 Second Avenue North are fully stabilized without the support of 172. Staff finds that demolition of 172 does not meet section V.1 for inappropriate demolition and does meet section V.2 for appropriate demolition.

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June 15, 2021

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170 – 176 Second Avenue North Buildings
Nashville, Tennessee

The removal of the heavily damaged portions on the 2nd Avenue side of the buildings at 170, 172, 174, 176 is almost complete as part of the Phase 1 demolition permit. Unfortunately, as the removal and clean-up process has progressed, more damage to the structure has been revealed. On May 25th we met at Building 176 with Bill Fay and George Guckert of Tiny's Demolition and they demonstrated the instability of the wall facing 1st Avenue. The wall has a noticeable bow in the middle of the wall and there are signs of separation from the structure, and the wall could be displaced by simply pushing on it. The wood floor joists are parallel to the wall, however, there is a steel beam at midspan that supports the floor joists that is bearing at midspan of the wall and it appears that the steel beam is bearing in a pocket of the multi-wythe brick. It is possible that the steel beam may be helping to hold the wall in place, however, with the current eccentricity in the wall, and the vertical load applied to the wall, its structural integrity is a real concern. Once the instability of this wall was realized, 1st Avenue in the vicinity of the wall was closed to traffic in the interest of public safety and a fence has been erected. I observed the condition of the wall today, and likely due to the recent rain, some bricks have come loose from the wall at the lower level.

At the on-site meeting of June 7th, we were informed by Tiny's Demolition that a similar condition exists at the 1st Avenue wall of Building 174. I observed the condition of the wall today from inside the building at each level. The condition of the wall is not as severe as the wall of 176, but there is a crack between the demising wall of 176 and the east wall of 174. The brick and mortar in this corner have deteriorated and this is the location where the downspout is missing, which is likely contributing to the condition. Building 172 is the short building, and the east wall facing the courtyard was heavily damaged from the blast and also has a distinct bow in the middle of the wall. At my visit today, this wall has collapsed more at the upper level and continues to move outward to the east. The east wall of 170 appears to have been reconstructed or repaired fairly recently which is evident from the difference in the color of the mortar. This wall appears to be tied to the floor system and there is no visible lateral movement. The north wall of 170 that faces the courtyard has some slight visible separation from the building and the mortar in some areas of the wall appears to be relatively soft.

The on-site meeting on June 7th included several representatives of Metro Nashville and the question was raised of how to mitigate the danger of these unstable walls, especially with the 4th of July celebration only about four weeks away.

When we first looked at these buildings very soon after the bombing it was hoped that we could remove the obviously damaged portions, and then the remaining structure could be repaired and renovated. However, at that time there was a lot of debris covering the floors and against the walls, and the damage to these century old structures was not apparent. Now that they have been cleaned out to some degree, the actual damage to the structures is becoming more apparent. The structural integrity of the loadbearing multi-wythe brick walls is one of the major concerns. The mortar in these walls that bond the brick together has always been an issue when renovating these buildings on 2nd Avenue. As is common for walls of this age, the strength and integrity of the mortar is variable and can vary greatly even in the area of a single wall. This is most likely due to how the mortar was originally mixed, and the environmental conditions that they walls have been exposed to over many years. As Tiny's Demolition was removing some of the walls that had become unbraced, the mortar was so weak that they were actually able to remove large portions of the wall with a hand-held shovel.

Public safety is the primary concern of everyone currently involved, and at this time it appears that the most expedient method to eliminate the potential for failure of these walls on the 1st Avenue side may be to demolish these walls and the structures they support, saving the brick as much as possible for future reuse. As mentioned above, the Phase 1 demolition is almost complete, and except for the walls on 1st Avenue, for the most part what is remaining is temporarily stable. However, the brick wall between 170 and 172 is badly out of alignment and continues to partially collapse as the removal of the damaged structure it supports has progressed, the east wall of 172 continues to move and collapse, and the condition of the east wall of 176 has worsened.

A lot of the structure is now visible and although what remains is somewhat stable, it has become apparent that if the building is to be renovated, most, if not all, of the structural floor members will have to either be removed or strengthened in order to comply with the load requirements of the current Building Code. Also, either cast-in-place concrete or concrete masonry shearwalls, or structural steel frames will be needed to resist the Code required lateral loads due to wind and earthquake forces. In addition, if any of the loadbearing brick walls are to remain, it is recommended that a historic structural brick specialist be contracted to inspect and perform material tests of the brick and mortar to determine the integrity and structural capacity of the walls. This process could take several months and the outcome of the tests may still likely require the removal and reconstruction of all or portions of the walls. And, in the interest of safety, before any of this testing takes place, temporary shoring and protection structures should be constructed adjacent to these walls to protect the public and the adjacent properties in the event of a full or partial collapse of the masonry walls. It is due to the amount of time and expense involved to accomplish all of this and the urgency with opening up the streets and the 4th of July festivities, that it appears that the most urgent solution may be to demolish the structures and rebuild.

Also, at the on-site meeting of June 7th we were asked to develop a fencing or barrier plan that would contain the structure and protect the public should the walls on 1st Avenue fail and collapse. These brick walls are partially loadbearing and what would happen should they fail is uncertain and variable, and I cannot give an opinion as to exactly how it would collapse. I would suggest as a minimum that the affected area should extend horizontally at least equal to the height of the building, and the barrier would likely need to be several stories tall and be able to take the impact of the debris as it spreads.

STRUCTURAL DESIGN GROUP

Thomas C. Schaeffer, PE, SECB

LETTER – Nashville Bombing Damage

July 14, 2021

Wayne T. Ruth
President
Masonry Solutions International, Inc.
10815 Beaver Dam Road
Suite D
Cockeysville, MD 21030
wtruth@masonrysolutions.com
410.771.1922

CC: Devinder Sandhu

Re: Nashville Bombing Damage
Limited Structural Report - Historic Unreinforced Masonry Structures 170-172-174-176 2nd Ave N Buildings
ANA Job No. 18-026

Atkinson-Noland & Associates (ANA) is a specialty structural engineering firm with a focus on investigation and repair design of historic masonry structures. We have been involved with the investigation, analysis, and design of many hundreds of historic structures, most often unreinforced masonry structures around the United States and internationally. We are providing this letter for no fee in order to support preservation of historic masonry structures and to help provide information to the decision-makers and stakeholders in the community affected by the Nashville Christmas bombing.

Perceived Strength

A common concern when evaluating and considering historic masonry structures is the perception that these structures are inherently weak and that they are built using weak materials. It is certainly true that most historic masonry buildings in the United States were constructed using brick fired at a lower temperature than modern brick and mortar blended with sand and lime only (not containing Portland Cement). These historic materials generally have compressive strengths under 1000 psi (pounds per square inch), while modern masonry and concrete generally has compressive strengths of 3000 psi or more. Therefore, historic masonry materials can appear or even "feel" weak to a demolition contractor.

However, it is critical to the understanding of historic masonry structures to keep in mind what the historic materials were intended to do by the original design. Generally, historic masonry walls are continuous and massive (often 18" thick or more at the base of multistory buildings). This creates large surface areas for loads to spread out, resulting in very low loads on any one part of the masonry. Even though the materials are not as strong as modern construction materials, the loads are distributed in a manner that usually results in a very high factor of safety against failure. It is analogous to using 5 hemp ropes that can each withstand 2,000 pounds of load to carry a bucket versus a single modern nylon rope that can withstand 4,000 pounds. The modern rope is stronger, but there is less of it. The safety of using 5 weaker ropes with a total of 10,000 pounds of capacity is much greater than using a stronger modern material with a total capacity of 4,000 pounds. The superiority of the 5-rope solution is further magnified by what structural engineers call "redundancy". If a single hemp rope in the 5-rope group completely fails, the assembly is still safe, and the failed rope can be readily repaired or replaced. However, if the single nylon rope fails, the entire system collapses.

This principle is valid for historic masonry structures, as well. Since each portion of a masonry wall is asked to do very little, portions or sections of walls can fail, and the remaining portions will tend to arch over the failure or redistribute the loads while maintaining a high factor of safety. This ability of masonry to redistribute loads while maintaining structural integrity is one of the reasons why many of the oldest structures in the world are unreinforced masonry structures. Structures such as cathedrals and monuments have survived damage due to earthquakes, bombings, and fires in part because the compromised or collapsed portions can be reconstructed or repaired fairly readily to restore the original structural behavior. This is not a revolutionary concept in places like Europe where historic unreinforced masonry is often the most common building material. However, the building stock and structural engineering experience in the United States emphasizes modern reinforced concrete and steel construction, which often contributes to discomfort with historic masonry among many American engineers. However, when viewed globally, the concept of maintaining the use and function of masonry structures built using lime mortar, mud mortar, or even no mortar at all is not structurally novel, since these structures comprise the majority of the building stock.

Bowing, Bulging, and Out-of-Plane Movement

There is a very understandable emphasis in various reports by others on the historic structures affected by the blast on bowing, bulging, and out-of-plane movement of various masonry walls. Separation between wythes (layers) of masonry walls can reduce or eliminate composite behavior of the wall section that is required for proper structural behavior. Fortunately, modern repair materials and methods provide solutions to address these types of distress that do not require reconstruction or demolition and are often invisible.

For example, layers of masonry can be stitched back together using various types of helical ties or anchors. The most thorough and effective manner for restoring composite behavior is to use low-pressure injection grouting of a compatible fill material to restore the wall to a solid, bonded condition.

These methods can be used in combination with either internal or external reinforcing (strongbacks) to address bowing and leaning wall concerns, as well. Even walls with very significant out-of-plane movement can generally be strengthened in place in a manner that provides more than adequate structural safety.

Investigation Methods

There were questions posed in some of the structural reports related to the strength of the existing materials that implied that it is not possible to measure the mechanical properties of the historic masonry materials. It was also implied that these properties would be expected to be inadequate. However, there are well-established test methods for measuring the properties of historic masonry materials. These include ASTM Standard C1197 *Standard Test Method for In Situ Measurement of Masonry Deformability Properties Using the Flatjack Method,* which provides compressive modulus of elasticity and capacity for masonry assemblies. Standard ASTM C1531 *Standard Test Methods for In Situ Measurement of Masonry Mortar Joint Shear Strength Index* provides a measure of shear capacity of existing masonry walls for evaluation of lateral load systems. In essence, we can determine the material properties of historic materials and use these properties to perform a rational structural analysis. In our experience, it is extraordinarily rare for historic mass masonry walls to be overstressed in either compression or shear under original design loads. In fact, I cannot think of a single instance in our experience where this has been the case.

Repair and Preservation Method

Modern repair and preservation materials and methods have advanced significantly over the last 20 years to include options like low-pressure injection grouting, socked anchors, and internal reinforcing. For example, we now have equipment that has been used to core vertically about 80 feet and horizontally over 200 feet to install stainless steel reinforcing bars into historic unreinforced masonry. This allows structural engineers to address another common concern related to historic masonry: ductility. We have the technology available today to convert a completely unreinforced historic masonry wall into a reinforced, ductile structure, often with no visible change to the walls.

Value to the Community

Ultimately, modern materials and techniques allow for us to structurally preserve virtually any masonry structure in virtually any condition. The ultimate question is not "can we save it" but rather "should we save it". In the opinion of ANA, buildings that define the character of a community, structures that demonstrate permanence and an enduring spirit, and structures that tell an important story for the generations to come are quite worthy of preservation. We have observed even skyscrapers being demolished because they were deemed to be disposable. However, structures that reveal the history and soul of a city or region tend to draw people in part because they are quite simply interesting. People visit a cathedral or monument not because of its efficiency or even its structural grandeur but because it embodies much more than the sum of its brick and mortar.

Thank you for the opportunity to express our company's thoughts on this matter. Please feel free to call if you have any questions.

Sincerely,

Donald Harvey
Principal
Atkinson-Noland & Associates, Inc.

STRUCTURAL ENGINEERS, P.C.

July 8, 2021

Mr. Ron Gobbell, FAIA
President Emeritus
GHP
Via Email

RE: 170-176 Second Avenue North / Engineering Evaluation
EMC Project No. 21750

Dear Mr. Gobbell:

At your request, I have made two specific site visits to view the referenced buildings. The first visit occurred on June 7, 2021. This review was conducted with multiple parties entering the main floor of Building 176 to observe the rear wall of the building. At that time, the demolition contractor, Tiny's Demolition, was concerned with the large group of people touring the remaining buildings. Some portions of the buildings had not been cleared of debris and/or had not been temporarily shored. Therefore, I requested a separate visit so that a thorough understanding of the remaining buildings could be obtained. As such, I returned to the site on June 14, 2021, to review all buildings at all floor levels. The attached photographs were taken to document my observations: *Photographs June 7, 2021* and *Photographs June 14, 2021*.

The attached *Location Map* identifies the areas of the building which we are involved. Also, attached is a *Wall Legend* that I created providing an overview of the walls in question.

<u>Overview</u>

As previously stated, on June 7, 2021, as part of a larger group, we viewed the exterior of the buildings common to Second Avenue North. At that time, photographs were taken to document the demolition process on the front face of the buildings, which were completed at that time.

As seen in Photographs June 7, 2021, photographs 2 through 14, the complete front walls of Buildings 170 through 176 had been removed. The perpendicular walls running from Second Avenue North to First Avenue North have been removed in a tapered fashion extending to the roof line. As seen in these photographs, some of the buildings consisted of party walls, and other buildings consisted of each building having its own load-bearing wall. The construction technique used for all these buildings was to have wood floor joists running parallel to Second Avenue North. Some were supported by an interior column line and some clear spanned the building similar to Building 172.

As you will recall, Building 172 was the short building that received extensive damages to the front and rear walls as a result of the Christmas morning blast. As seen in these referenced photographs, although the interior walls have partially been demolished, their overall structural integrity is still in question. As was common practice when these buildings were erected, the wood floor joists were tapered on the end and were typically placed in a brick pocket. The tapering on the end of the floor joists allowed for the floor joists to bear on the brick pocket. However, since the end of the joists were tapered, the top of the joists were not seated into the wall, which allowed the joists to rotate out of the pocket in the event of a fire. This construction technique was typically referred to as a "fire cut." It is my understanding that this construction technique was created due to the likelihood of buildings catching fire. The intent was for the wood-structured floors and roof system to collapse to the interior of the masonry walls; thus, preventing the spread of the fire to the neighboring buildings. Since all the joists ran parallel to the front and rear walls. The front and rear walls were rarely connected to the wood-framed floor and roof system. Therefore, the masonry walls were basically unsupported from the top of the foundation system. Over time, these unsupported walls had the tendency to move laterally due to the deterioration of the mortar. To simplify this report, each building will be discussed separately.

Building 170

The front face of Building 170 from Second Avenue North can be observed in Photographs June 7, 2021, photographs 2 and 11. As can be seen in these photographs, the intensity of the blast caused the floor and roof framing to be stepped-back dramatically to remove all the broken and splintered wood members.

Upon entering the basement level of Building 170, it was discovered that approximately five-to-six wood columns supporting the main floor of Building 170 were compromised from the blast (Photographs June 14, 2021, photographs 18 through 24). Currently, approximately one-fourth of the front floor area of this building is unsupported.

From reviewing the left sidewall of Building 170, which is partially exposed due to the courtyard created from the short building length of 172, the wall appears to be both swept and bowed. It has been my experience from utilizing 3D scans for other historical structures in the Nashville downtown area that walls were typically swept during the initial construction (not built in a straight line). At this specific wall, the wall is also bowing and moving away from the floor joists themselves. This condition can be verified by seeing the patina on the bottom face of the wood joists and the open joints of the brick wall common to the wood-framed floor system.

As can be seen in Photographs June 14, 2021, photographs 32, 33, 37, and 38, a large amount of debris still remains at the front face of this building on the main floor due to the fact that the first floor is structurally unstable as previously described.

From reviewing the left sidewall, it was observed that the patina on the bottom of the floor joists can be seen in varying states (Photographs June 14, 2021, photograph 43). This varying patina would indicate that the multi-wythe brick wall on the left side of this building has recently moved approximately 1-½ inches. This same type of movement can be observed at the floor line (Photographs June 14, 2021, photograph 48).

The rear wall of Building 170 appears to be in better condition. It was rigidly connected to the wood-framed floor and roof systems. An example of the bolting of the rear wall can be observed in Photographs June 14, 2021, photographs 49 and 50. An interesting observation was made with this wall; the coursing of the bricks of the rear wall do not align with the coursing in the bricks of the left sidewall and/or right sidewall (Photographs June 14, 2021, photographs 51 through 53). It is assumed that this rear wall may have been reconstructed in the past.

Due to the amount of movement of this left sidewall, and the deteriorated state of the mortar (Photographs June 14, 2021, photographs 92 through 99), it is my recommendation to remove and reconstruct this wall in its entirety. The soft mortar conditions of this wall can be observed in photographs 94 and 96 where light finger pressure is used to sweep the mortar from the joints. The out-of-plumb condition of this wall can be observed in Photographs June 14, 2021, photographs 93, 95, 97, and 99. The interior walls common to Building 170 will also have to be addressed as they also will require reworking and/or reconstruction to return them to a safe load-bearing condition.

Another interesting fact is that steel angles were added at the left and right sidewalls common to the third floor (Photographs June 14, 2021, photographs 64 through 66). These angles may have been added to provide additional support for the floor joists due to the fact that the walls were bowing.

Obviously, the first floor will have to be reconstructed for approximately one-fourth the length of the building.

Building 172

Building 172 is the short building that had the courtyard located at the rear of the building. An overview of the front of the building can be seen in Photographs June 7, 2021, photographs 3 and 8.

This building received extensive damages during the Christmas morning blast to the front and rear walls. A review of this building on June 14 revealed that even though some of the floor joists and roof rafters remain in place, they are extensively damaged. It was observed that a fire in the past had also created structural issues (Photographs June 14, 2021, photograph 15). The intensity of this blast can be observed in the racking of the joists and at the multi-wythe brick walls common to joist pockets (Photographs June 14, 2021, photograph 8). As can be seen in Photographs June 14, 2021, photograph 10, large areas of the wood joists have been removed from the second floor.

The rear wall of this building is basically non-existent and/or is leaning away from the structure (Photographs June 14, 2021, photographs 11 through 14), which can be measured by feet. Other indications of the severity of the blast common to the joist pockets can be observed in Photographs June 14, 2021, photograph 52. An overview of the lack of roof structure common to this building can be observed in Photographs June 14, 2021, photographs 79 through 81. The joist pocket movement can be observed in Photographs June 14, 2021, photographs 82 and 83. The severity of the blast common to the more recently constructed masonry elevator shaft can be observed in Photographs June 14, 2021, photographs 84 and 85. The rear wall of Building 172 should be removed and rebuilt in its entirety. Once again, due to the severity of the blast racking the floor joists and roof rafters, extensive rework will also be required common to the interior wall of Building 172.

Building 174

The front elevation of Building 174 can be observed in Photographs June 7, 2021, photographs 4 and 7.

Building 174 was reviewed on June 7, 2021. It was found that approximately five of the columns located common to the rear of the building had experienced a significant settlement issue resulting in cracked floor beams and column capitals. An example of these cracked floor beams and column capitals can be observed in Photographs June 7, 2021, photographs 26, 34, 50, and 51.

The right sidewall of Building 174 is also exposed to the courtyard. Once again, movement of the floor joists common to the right and left sides of this building were observed (Photographs June 7, 2021, photographs 27, 30, and 31).

The rear wall of Building 174 is also experiencing an excessive amount of movement and is unsupported in its full height, with the exception of the interior beam line bearing upon this wall. The open joints between the floor and wall framing at the rear wall can be seen Photographs June 7, 2021, photographs 33 and 42.

The roof structure has been replaced in the past with metal bar joists, steel decking, and steel beams (Photographs June 7, 2021, photographs 35, 36, and 37). The construction of these steel members would, most likely, not conform with construction standards today in that mechanical anchors and brick veneer are frowned upon in the design industry. An example of one connection can be seen in Photographs June 7, 2021, photograph 40.

The right sidewall of Building 174 was reviewed from the exterior and mortar issues similar to Building 170 was observed (Photographs June 14, 2021, photographs 100 and 104). This wall appears to be relatively plumb; however, additional investigation will be required due to vine growth on the wall to determine if it can be salvaged or if it will require to be removed and rebuilt.

The rear wall of Building 174 has extensive deterioration and lateral movement and will require it to be removed and rebuilt (Photographs June 14, 2021, photographs 109 through 120).

The issues with the interior walls of this building will have to be addressed if the building is to be reconstructed. Additional repairs will be warranted in order to have the walls capable of supporting the live loads and dead loads for the roof and floor systems, which is a minimum requirement for all buildings.

Building 176

The front face of Building 176 can be seen in Photographs June 21, 2021, photographs 5 and 6. The rear wall of this building is extremely precarious. As I stated during the June 7 review, shoring should have immediately taken place to prevent collapse. This wall system has moved approximately 6" to 8" laterally. Open joints common to interior walls separating Building 176 from Building 174 can be seen in Photograph June 7, 2021 photograph 20, which shows its precarious condition. The floor joists patina located on the left and right sidewalls indicated that the building walls have moved (Photographs June 7, 2021, photographs 23, 24, and 25).

The rear of the building should be removed and reconstructed. The interior masonry walls will also require to be reconstructed and/or repaired to provide a safe load-bearing wall system.

The rear walls of both Buildings 176 and 174 were reviewed from a vertical lift (photographs 109 through 120). The mortar is in extremely poor condition, and water has been running down the rear face of the wall due to the lack of a rainwater leader, which has severely compromised the wall common to this location. The lateral movement of these walls would suggest that the walls can no longer perform as intended.

Conclusion

As seen from the above descriptions and the attached photographs, the four buildings suffered an extensive amount of damage as a result of the Christmas morning explosion. The front face of the buildings have been removed, but the amount of existing demolition to the front sections of the buildings cannot be considered final. The remaining multi-wythe brick walls and/or wood framing systems will require additional attention. The rear walls of Buildings 172, 174, and 176 are in desperate need of removal and replacement. The left sidewall of Building 170 is also in need of removal and replacement. The rear wall of Building 170 appears to have been reconstructed and is currently performing as intended. As such, this rear wall did not indicate significant issues on the day of my review. As previously stated, the demolition to the front sections of the buildings that have been completed, as of this date, do not address all of the deficiencies that will require to be addressed moving forward if the buildings are to be utilized as-is without the benefit of removal and replacement. If it is the intent to remove the buildings, my recommendation is to selectively remove the exterior bricks of the walls so that the bricks can be salvaged and reused to reconstruct a similar façade.

EMC Structural Engineers, P.C. appreciates the opportunity to be of service to you and to all who are involved in this project. After reviewing this report, please call if you have any questions or if I may be of additional assistance.

Sincerely,

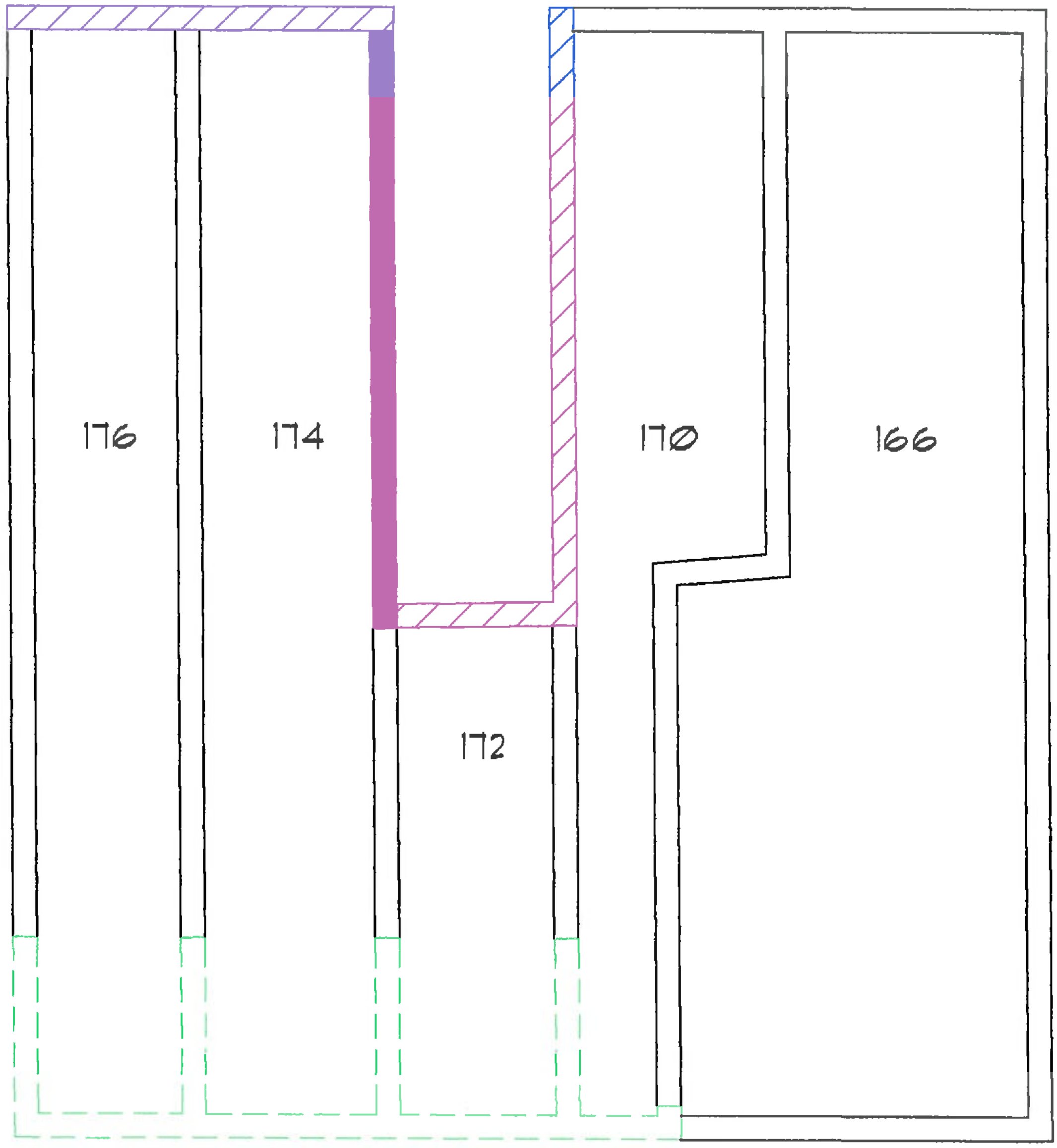
EMC Structural Engineers, P.C.

Mark E. Buchanan, P.E.
Principal

MEB/tsj

Enclosures

WALL LEGEND



LEGEND

WALLS ALREADY REMOVED.

WALLS KNOWN TO BE REQUIRED TO BE REMOVED & REPLACED.

WALLS REQUIRE FUTURE INVESTIGATION.

EMC
STRUCTURAL ENGINEERS, P.C.
4525 Trousdale Drive
Nashville, Tennessee 37204
(615) 781-8199
(615) 781-4088 (fax)

PROJECT:

170-176 2nd Ave. N.
CHRISTMAS DAY BOMBING
BUILDING WALL EVALUATION

Emc#
21750

S1

LOCATION MAP

A Project Update Map for

2nd Avenue Rebuild

Nashville, TN

Impacted Buildings

- Intense Damage
- Intense Damage Undergoing Construction
- Under Construction
- Reopened

North

0 75 150 300

This exhibit is an illustrative representation for presentation purposes only and should not be used for computation or construction purposes. The information provided within should be considered a graphic representation to aid in determining plan components and relationships and is subject to change without notice. All property boundaries, easements, road alignments, drainage, flood plains, environmental issues and other information shown is approximate and should not be relied upon for any purpose. No warranties, express or implied, concerning the actual design, accuracy, location, and character of the facilities shown on this exhibit are intended.

Reference Date: 06.16.2021

PHOTOGRAPHS
JUNE 7, 2021

Photograph 1: Front elevation.

Photograph 2: View of Building 170.

Photograph 3: View of Building 172.

Photograph 4: View of Building 174.

Photograph 5: View of Building 176.

Photograph 6: Close-up of Building 176.

Photograph 7: Close-up of Building 174.

Photograph 8: Close-up of Building 172.

Photograph 9: Close-up of Building 172.

Photograph 10: Close-up of Building 170.

Photograph 11: Close-up of Building 170.

Photograph 12: Close-up of failed masonry arch at Buildings 170/172.

Photograph 13: Close-up of wall at Buildings 168/170.

Photograph 14: Close-up of wall at Buildings 168/170.

Photograph 15: Rear wall at main floor of Building 176.

Photograph 16: Rear wall at main floor of Building 176.

Photograph 17: Intersection of rear wall and left-side wall of Building 176.

Photograph 18: Intersection of rear wall and right-side wall of Building 176.

Photograph 19: Intersection of rear wall and right-side wall of Building 176.

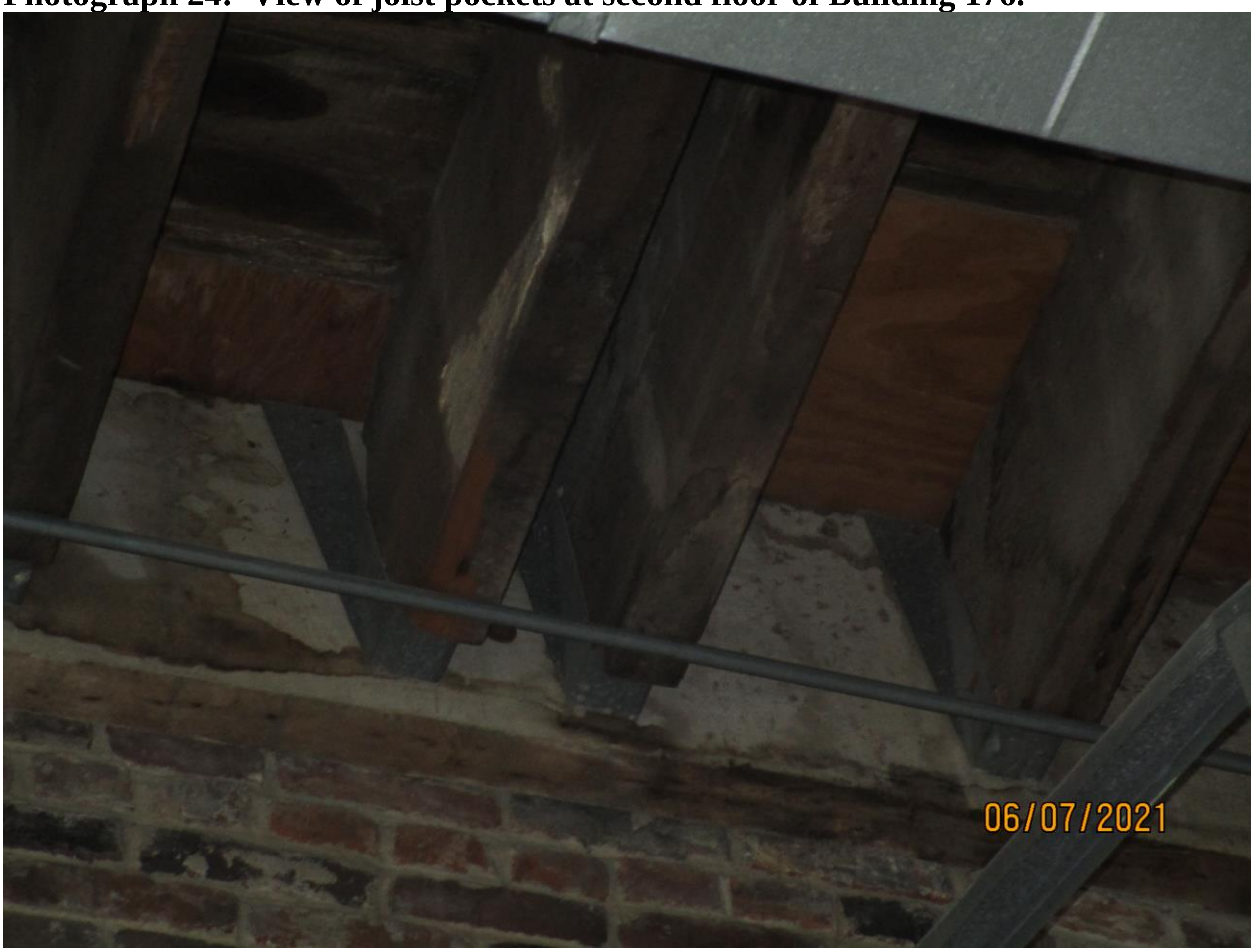
Photograph 20: Intersection of rear wall and right-side wall of Building 176.

Photograph 21: View of second floor/rear wall of Building 176.

Photograph 22: View of second floor/rear wall of Building 176.


Photograph 23: View of second floor/rear wall of Building 176.

Photograph 24: View of joist pockets at second floor of Building 176.



Photograph 25: Left-side wall of main floor of Building 174.

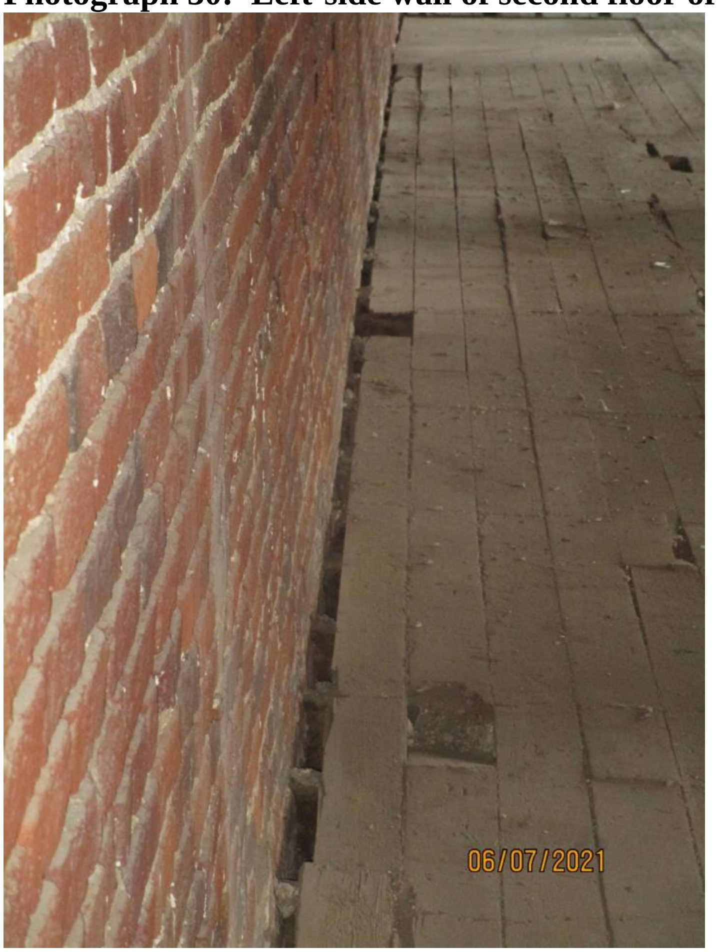
Photograph 26: Interior rear column settlement of Building 174.

Photograph 27: Right-side wall of main floor of Building 174.

Photograph 28: Rear wall of main floor of Building 174.

Photograph 29: Rear wall of second floor of Building 174.

Photograph 30: Left-side wall of second floor of Building 174.



Photograph 31: Right-side wall of second floor of Building 174.

Photograph 32: Rear wall of second floor of Building 174.

Photograph 33: Third floor rear wall of Building 174.

Photograph 34: Settlement of columns at third floor, Building 174.

Photograph 35: Close-up of roof framing of Building 174.

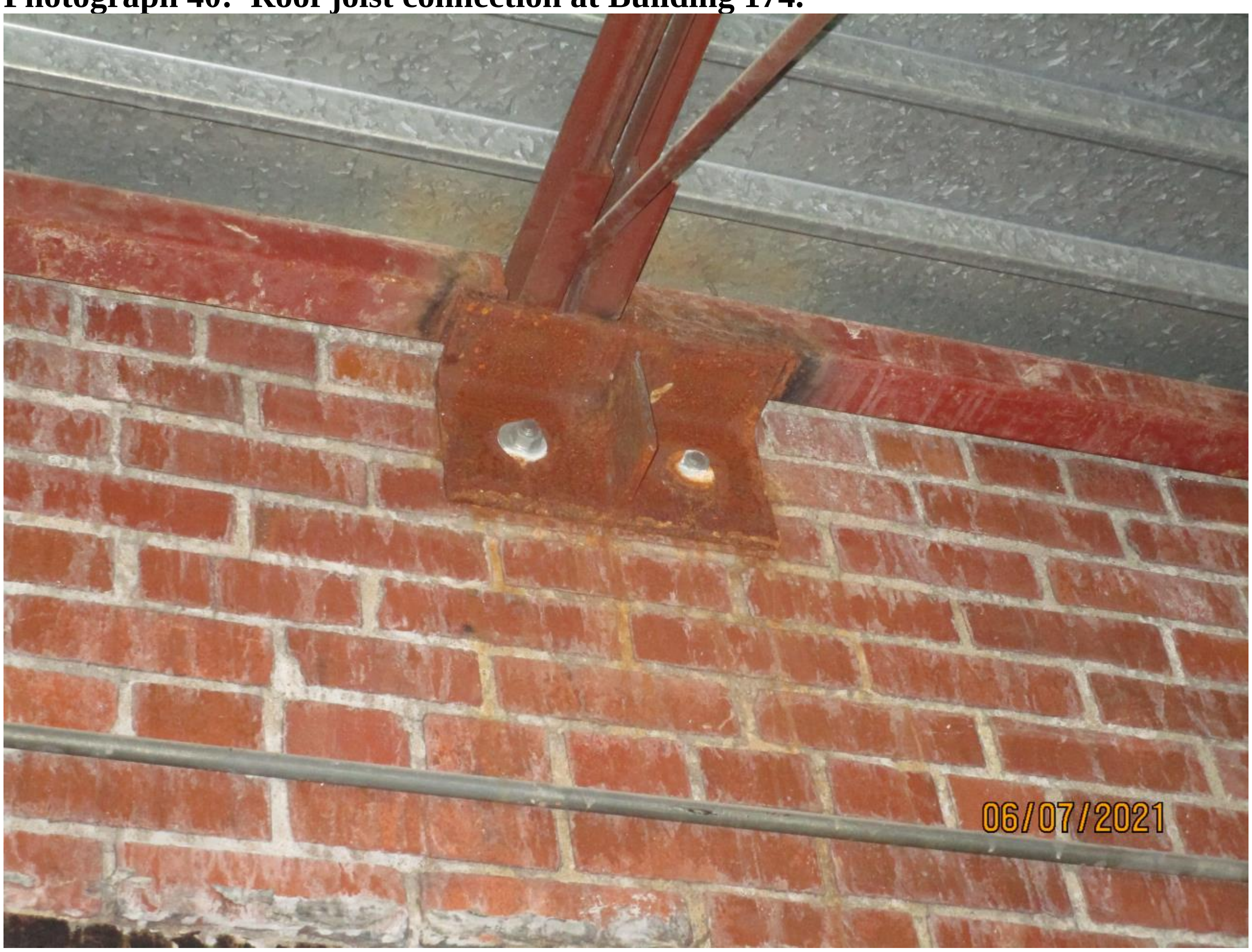
Photograph 36: Close-up of roof framing of Building 174.

Photograph 37: Overview of fourth floor of Building 174.

Photograph 38: Concrete overlay at fourth floor of Building 174.

Photograph 39: Left-side wall of fourth floor of Building 174.

Photograph 40: Roof joist connection at Building 174.



Photograph 41: Rear wall at fourth floor of Building 174.

Photograph 42: Rear wall at fourth floor of Building 174.

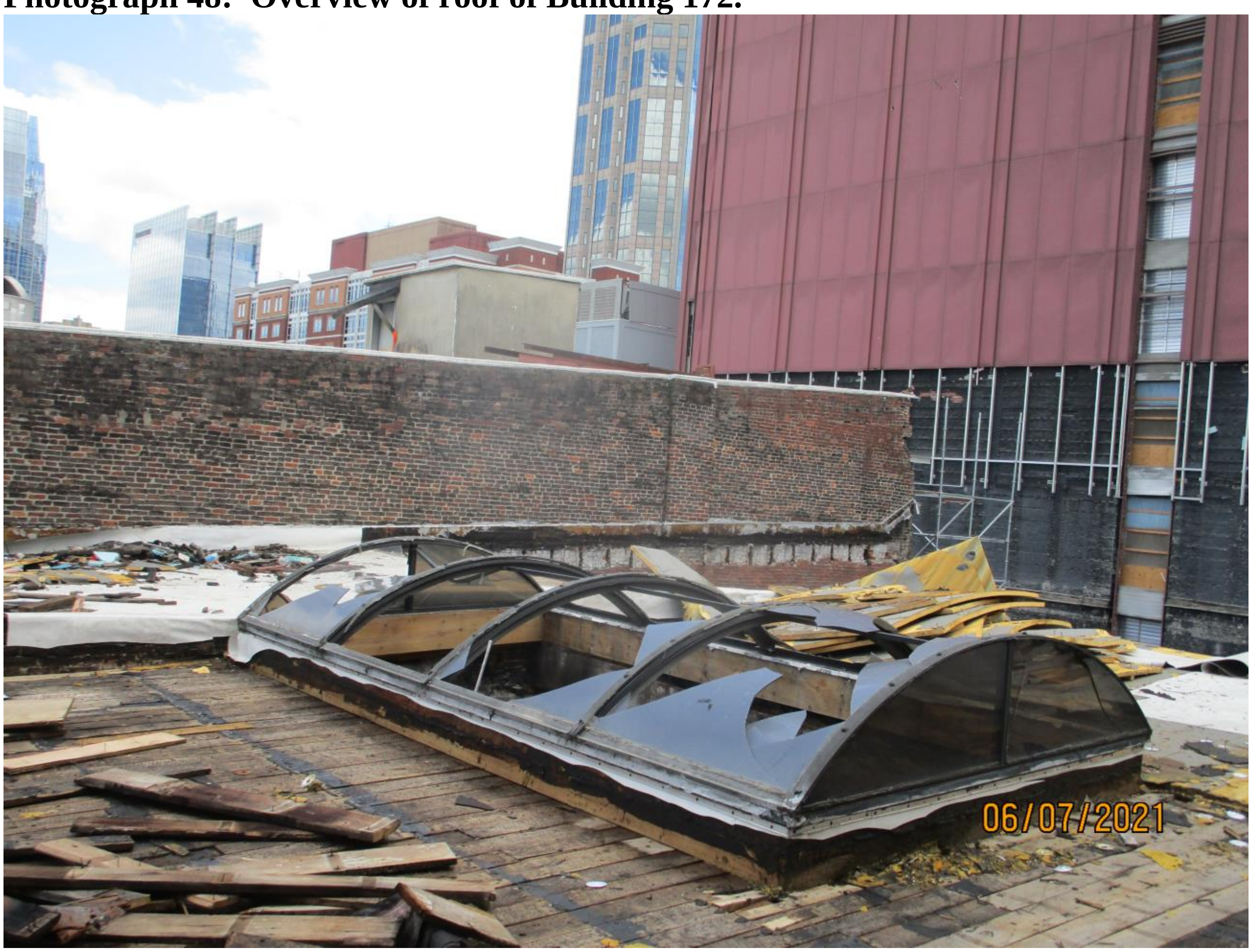
Photograph 43: Side wall at fourth floor of Building 174.

Photograph 44: Roof joists at left-side wall of Building 174.

Photograph 45: Fourth floor elevator shaft of Building 174.

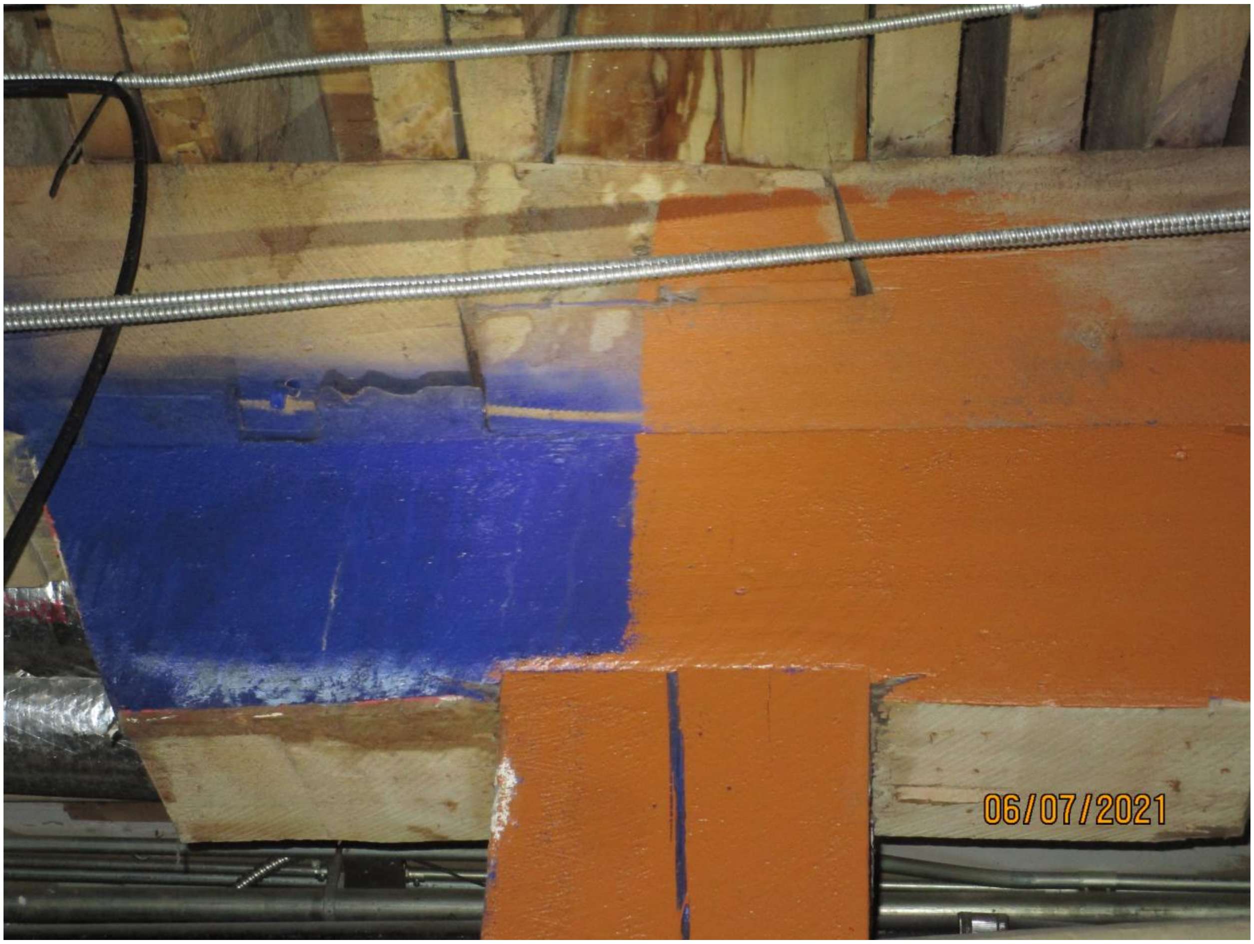
Photograph 46: Overview of roof of Building 170.

Photograph 47: Overview of roofs of Buildings 170 and 172.

Photograph 48: Overview of roof of Building 172.


Photograph 49: Basement of Building 174.

Photograph 50: Broken wood beam in basement/settlement Building 174.



Photograph 51: Broken wood beam in basement/settlement Building 174.

Photograph 52: Rear wall at Building 176.

Photograph 53: Rear wall at Building 176 (wood lintel at right side).

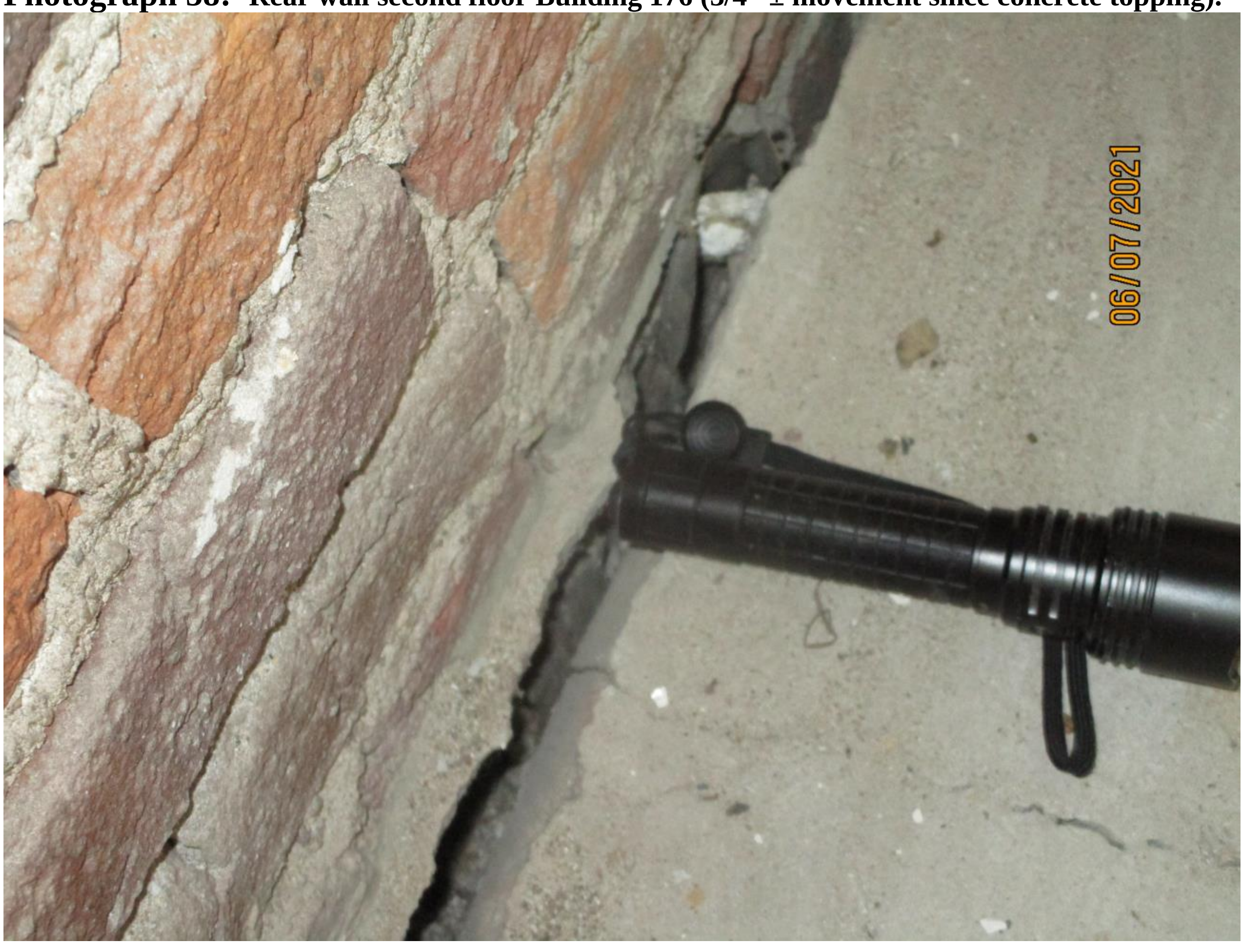
Photograph 54: Typical joist pocket at Building 176.

Photograph 55: Overview of mezzanine of Building 176.

Photograph 56: Steel beam at rear wall of second floor at Building 176.

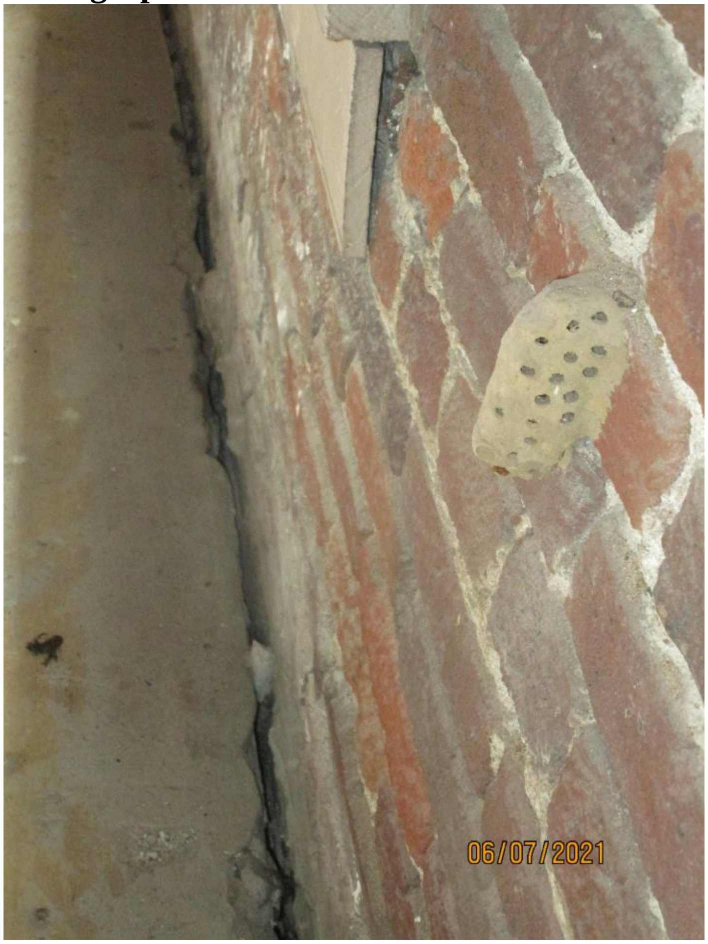
Photograph 57: Rear wall at second floor of Building 176.

Photograph 58: Rear wall second floor Building 176 (3/4” ± movement since concrete topping).



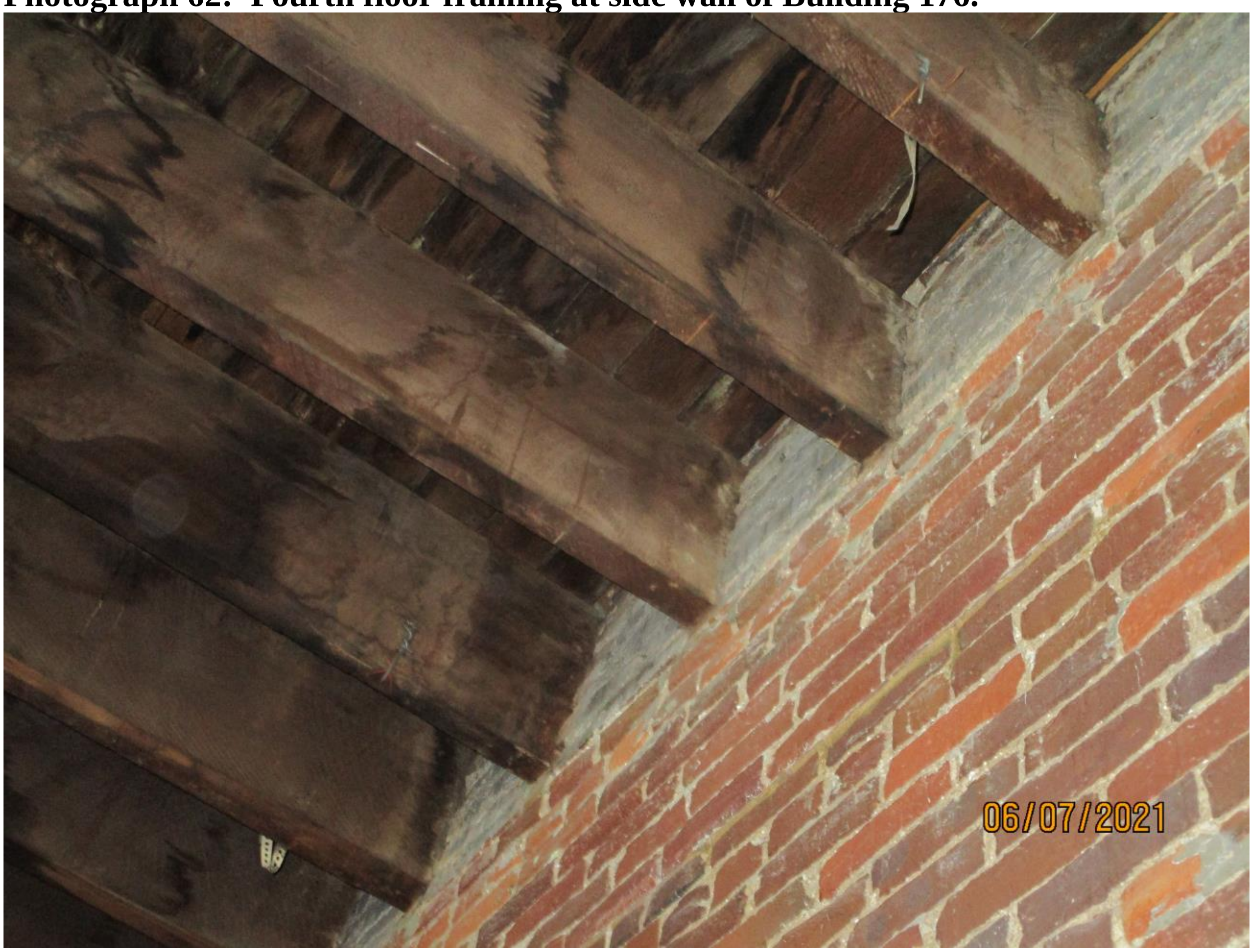
Photograph 59: Third floor at rear wall of Building 176.

Photograph 60: Third floor at side wall of Building 176.



Photograph 61: Fourth floor framing at rear wall of Building 176.

Photograph 62: Fourth floor framing at side wall of Building 176.



Photograph 63: Third floor framing at right-side wall of Building 176.

Photograph 64: Third floor framing at left-side wall of Building 176.

Photograph 65: Bolted ledger board at right-side wall of third floor, Building 176.

Photograph 66: View of corbeled brick wall at right side of Building 176.

Photograph 67: View of corbeled brick wall at right side of Building 176.

Photograph 68: Thickness of concrete overlay.

Photograph 69: Joist seats at fourth floor of Building 176.

Photograph 70: Left-side wall of fourth floor of Building 176.

Photograph 71: Roof structure of Building 176 (rear of building).

Photograph 72: Rear wall at fourth floor of Building 176.

Photograph 73: Rear wall at roof of Building 176.

Photograph 74: Overview of fourth floor of Building 176.


Photograph 75: Rear view of rear wall at fourth floor of Building 176.

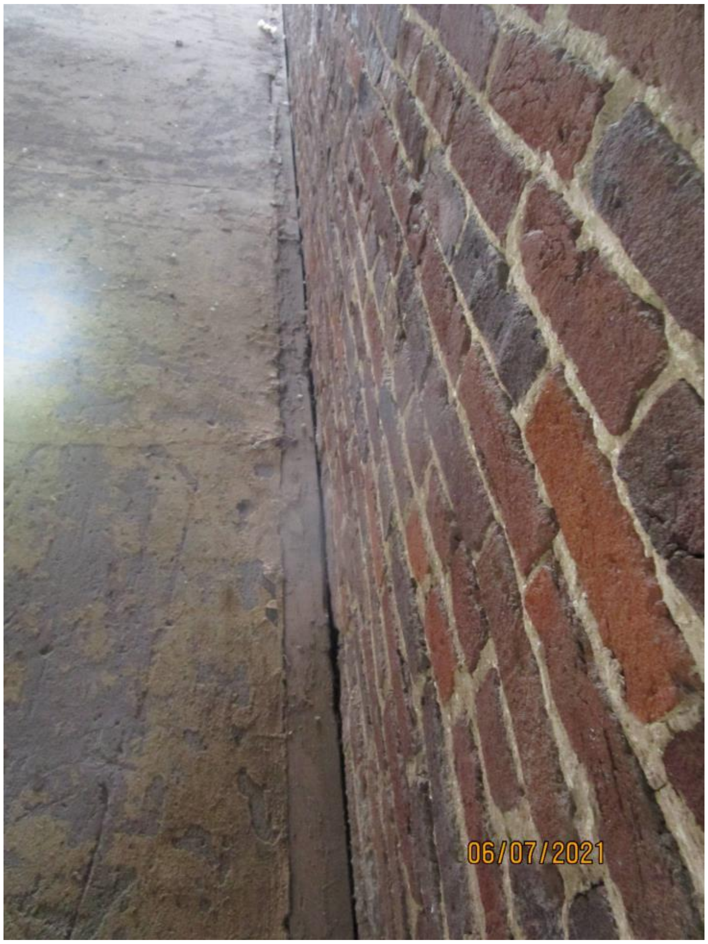
Photograph 76: Left-side wall of fourth floor of Building 176.

Photograph 77: Right-side wall of fourth floor of Building 176.

Photograph 78: Right-side wall of fourth floor of Building 176

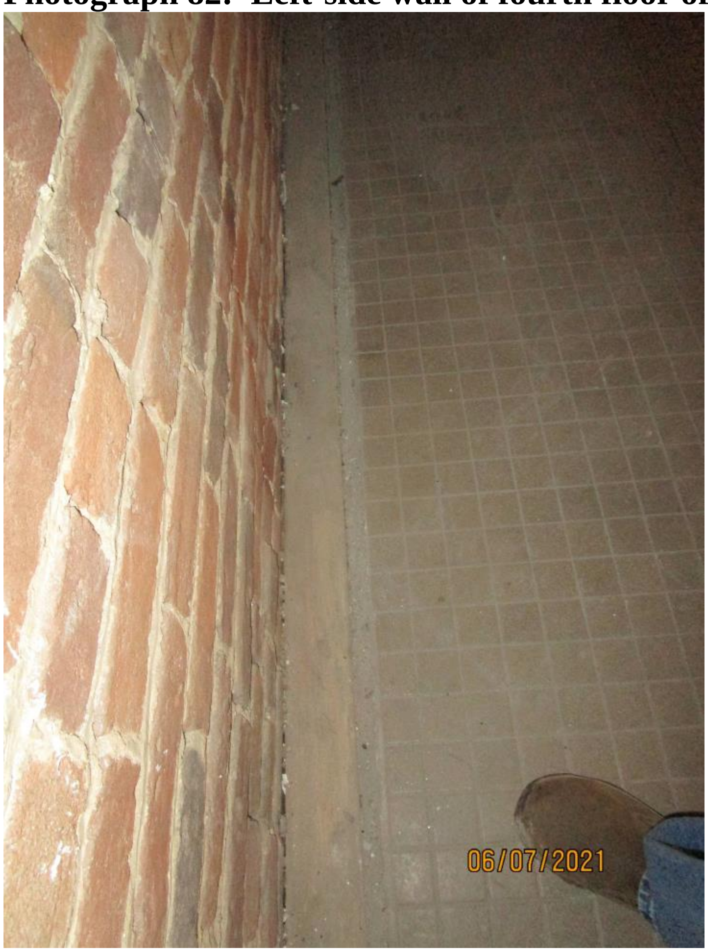
Photograph 79: Overview of fourth floor of Building 176.

Photograph 80: Overview of fourth floor of Building 176.



Photograph 81: Right-side wall of fourth floor of Building 176.

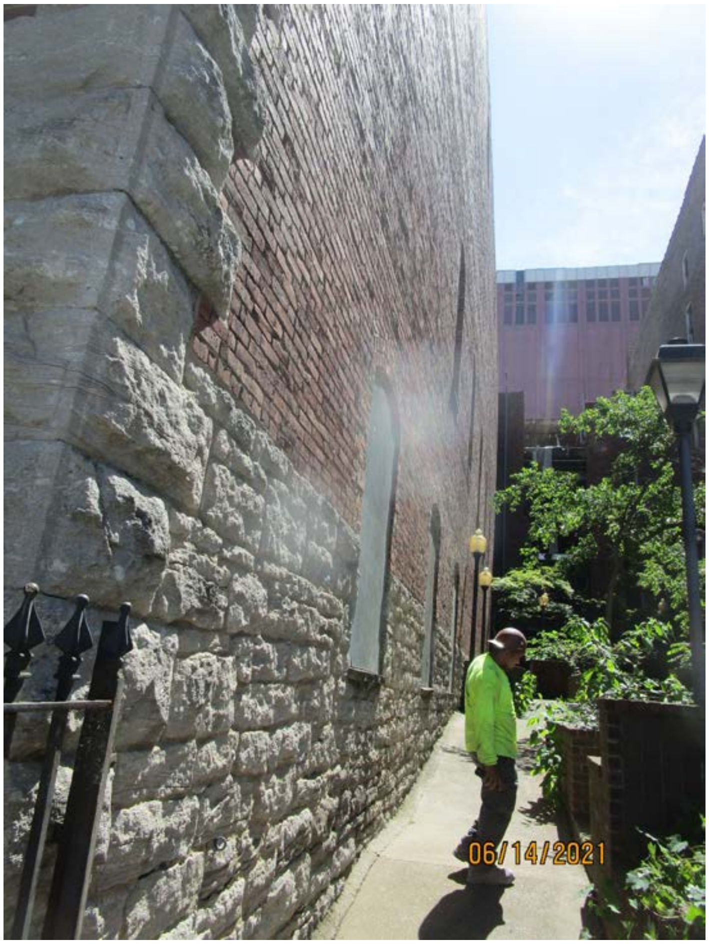
Photograph 82: Left-side wall of fourth floor of Building 176.



Photograph 83: Rear joists of Building 176.

Photograph 84: Rear wall of fourth floor of Building 176.

PHOTOGRAPHS
JUNE 14, 2021

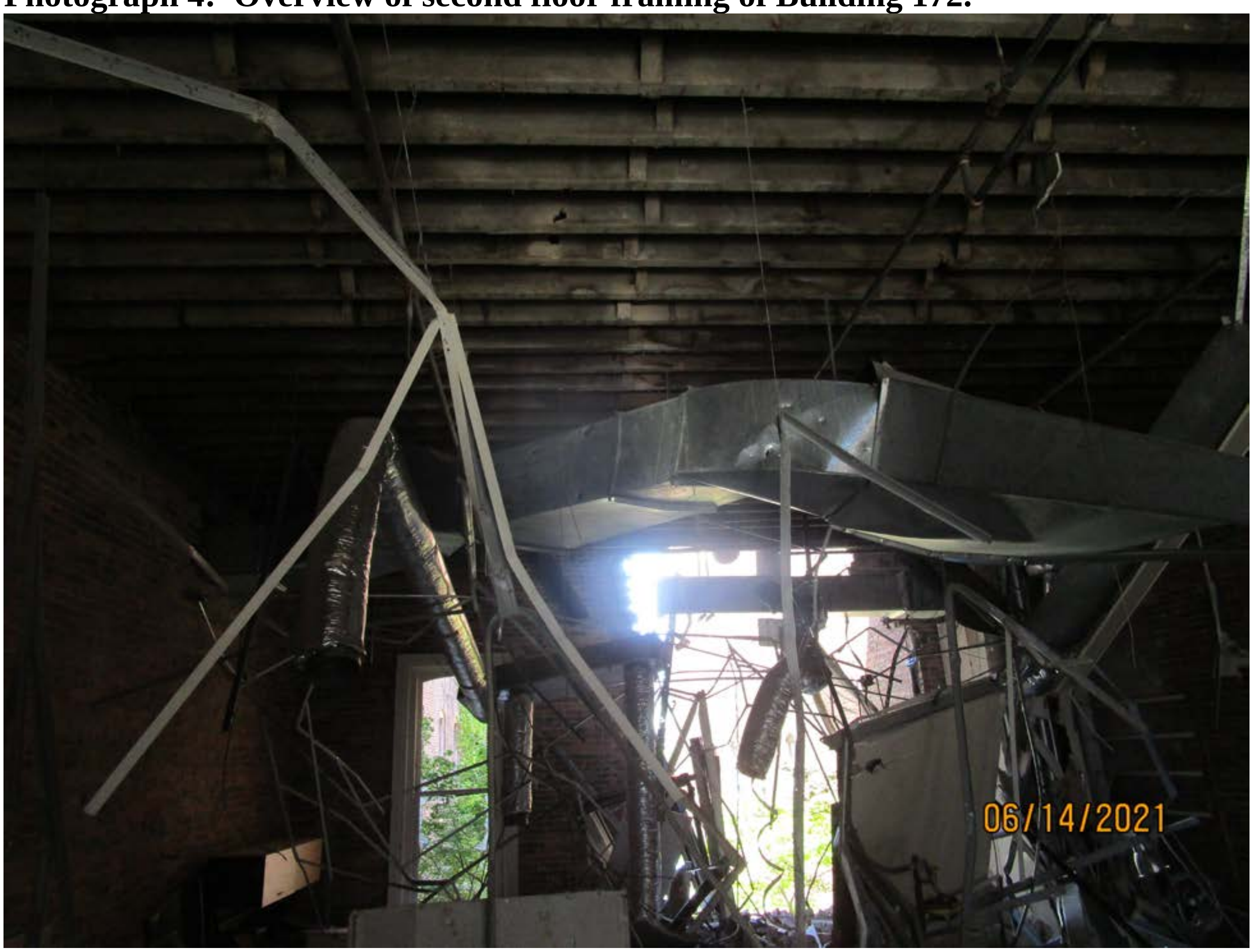


Photograph 1: Left-side wall of Building 170.

Photograph 2: Second floor framing of Building 172.

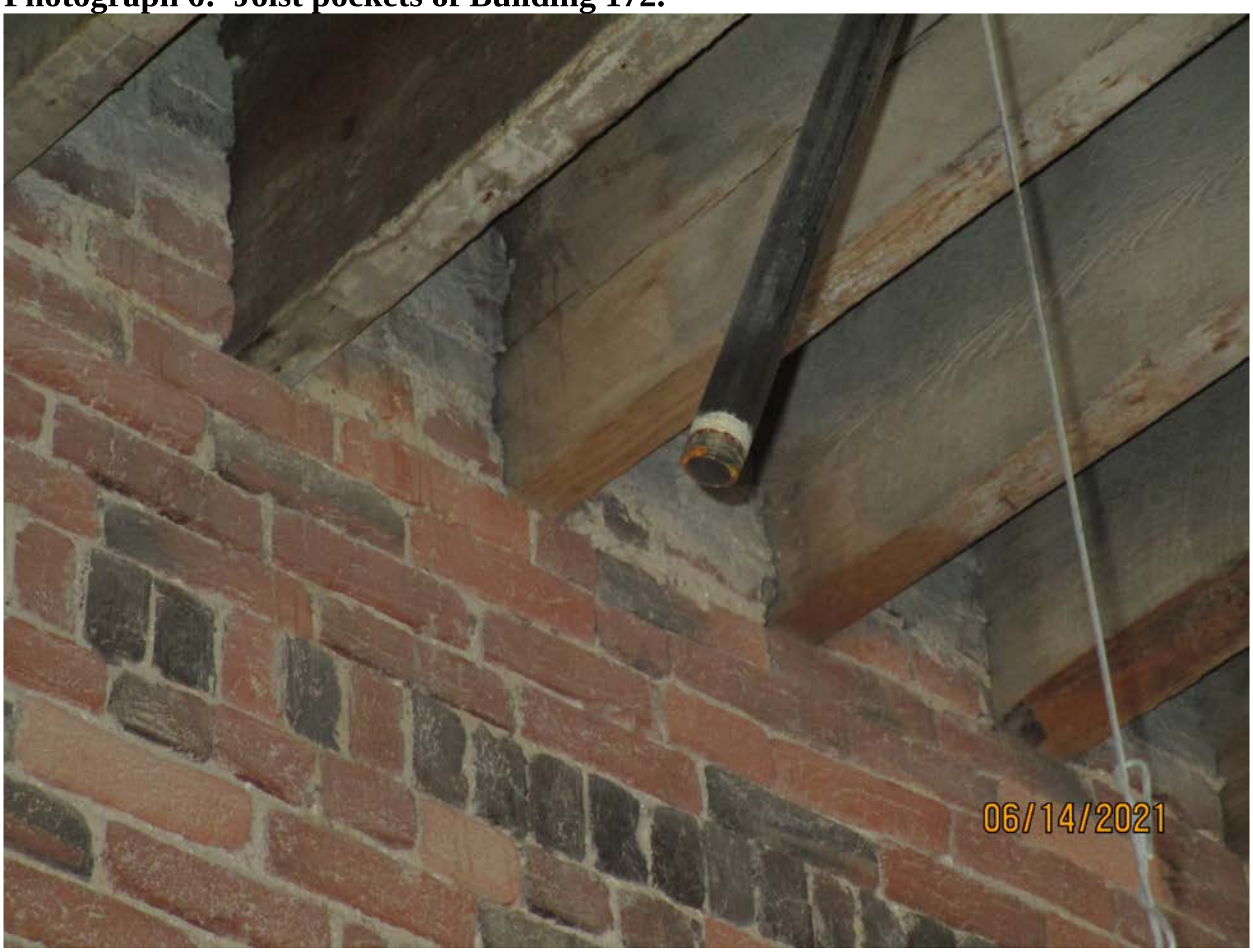

Photograph 3: Right-side wall of Building 172.

Photograph 4: Overview of second floor framing of Building 172.



Photograph 5: Left-side wall of Building 172.

Photograph 6: Joist pockets of Building 172.

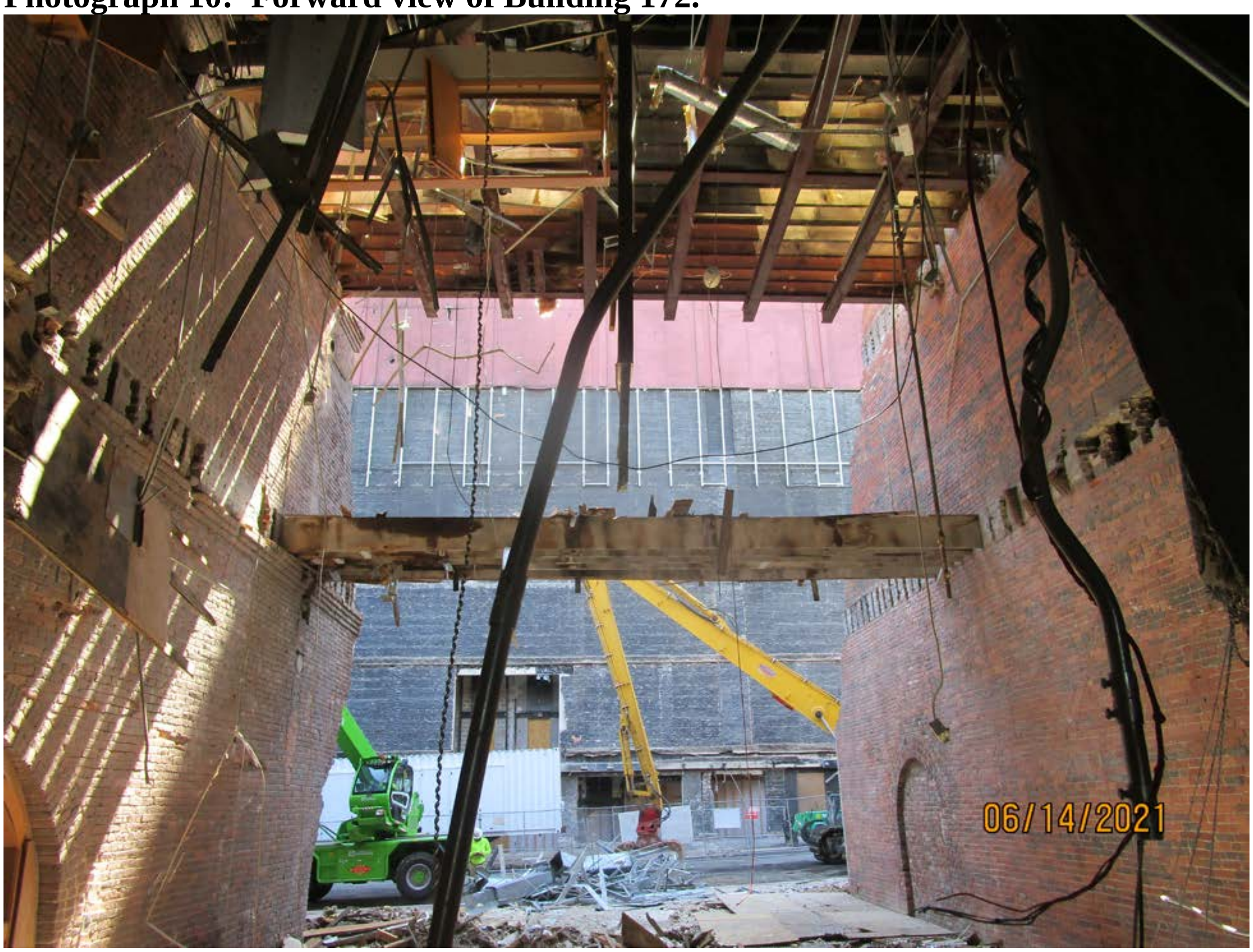


Photograph 7: Joist pockets of Building 172.

Photograph 8: Joist pockets of Building 172.

Photograph 9: View of steel beams at Building 172.

Photograph 10: Forward view of Building 172.



Photograph 11: Rear wall of Building 172.

Photograph 12: Rear wall of Building 172.


Photograph 13: Rear wall of Building 172.

Photograph 14: Rear wall of Building 172 .

Photograph 15: Fire-damaged wood floor joists at Building 172.

Photograph 16: Common right-side wall of Building 172.

Photograph 17: Rear wall of Building 172.

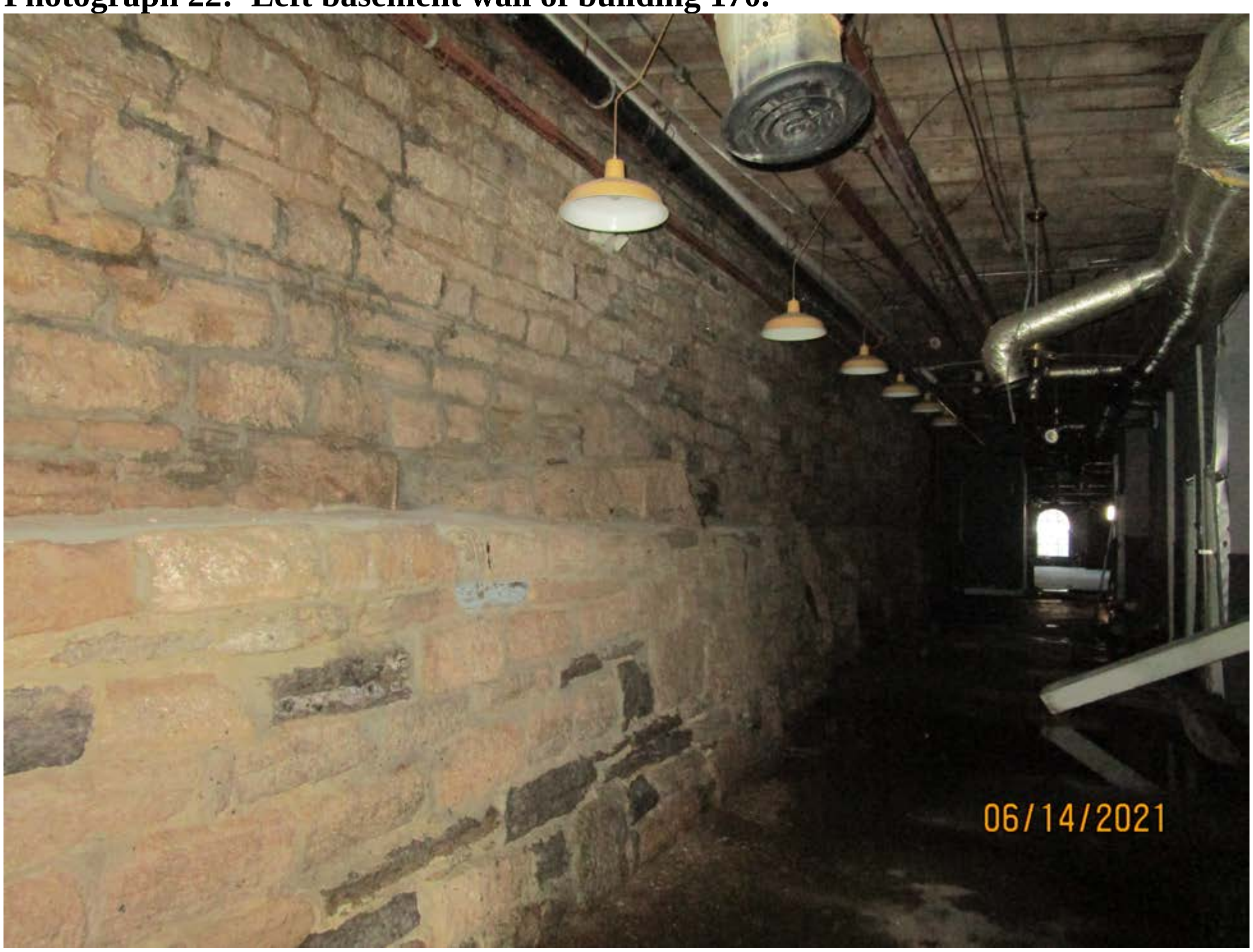
Photograph 18: Basement level (front) of Building 170.

Photograph 19: Basement level (front) of Building 170.

Photograph 20: Basement level (front) of Building 170.

Photograph 21: Basement level (front) of Building 170.

Photograph 22: Left basement wall of building 170.

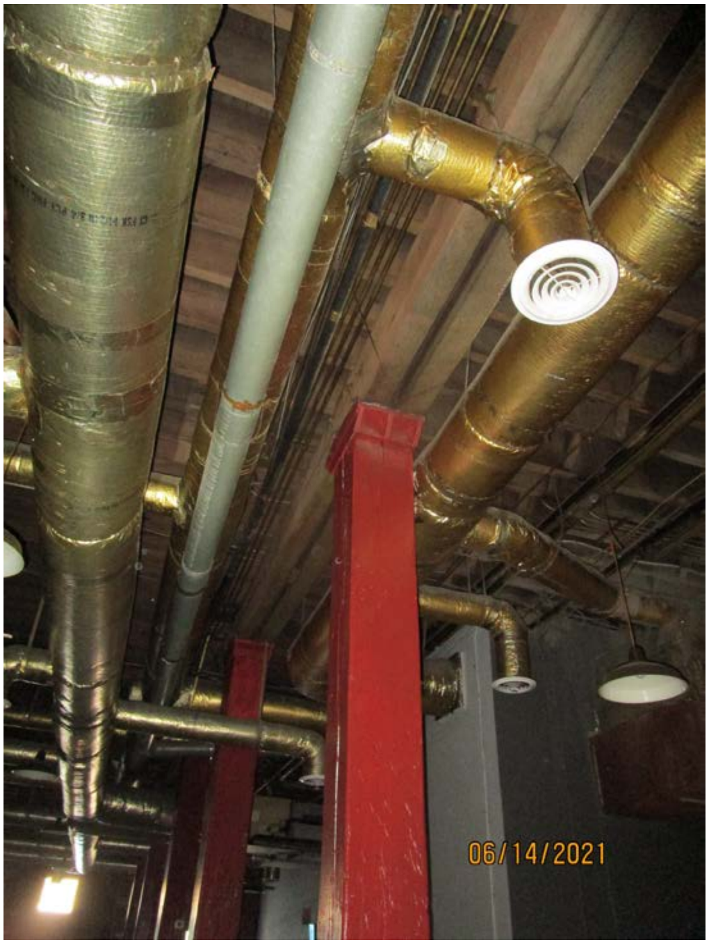


Photograph 23: Basement level (front) of Building 170.

Photograph 24: Basement level (front) of Building 170.

Photograph 25: Left-side wall of Building 170 (rear of building).

Photograph 26: Overview of rear of Building 170 at basement.

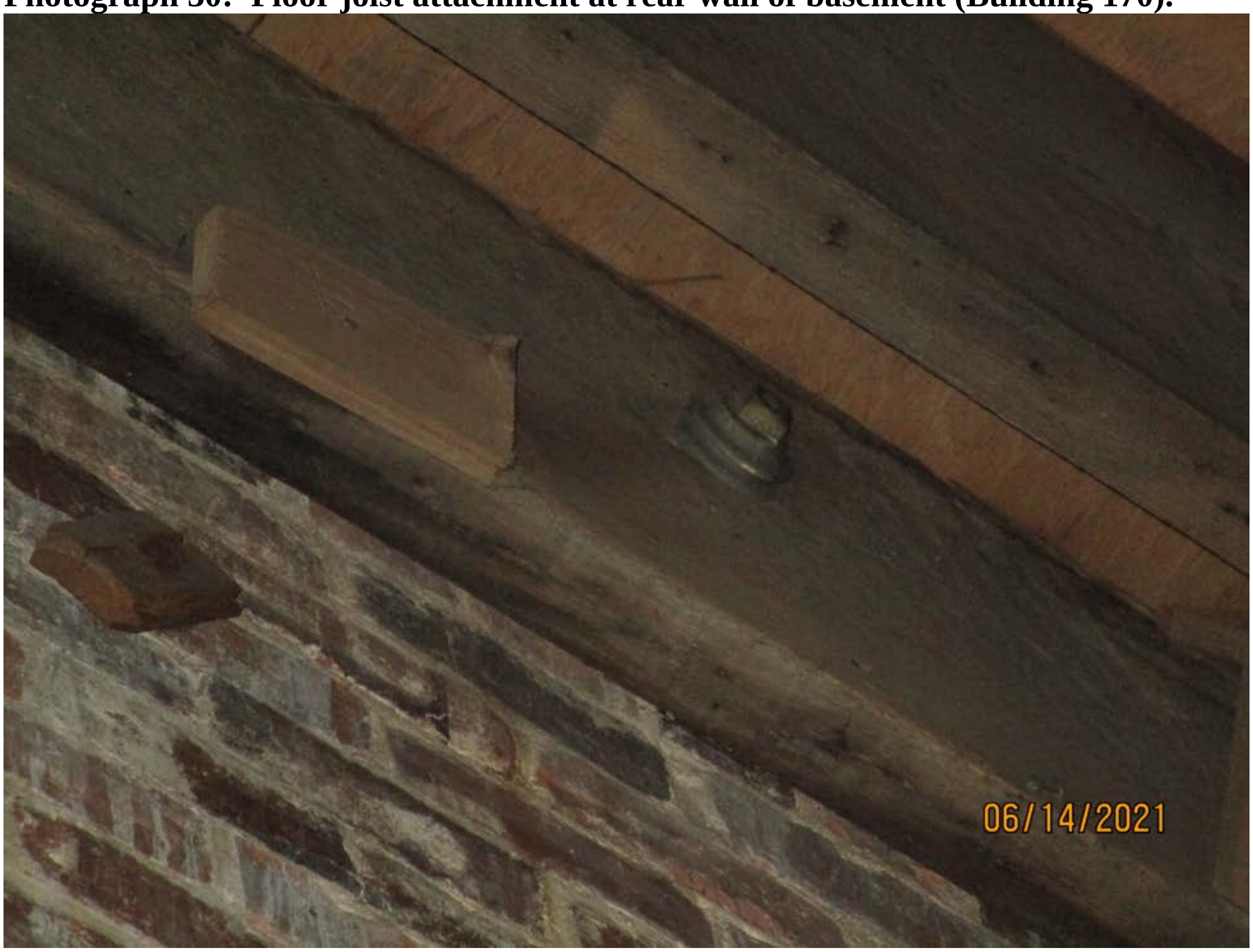


Photograph 27: Overview of rear of Building 170 at basement.

Photograph 28: Overview of rear of Building 170 at basement.

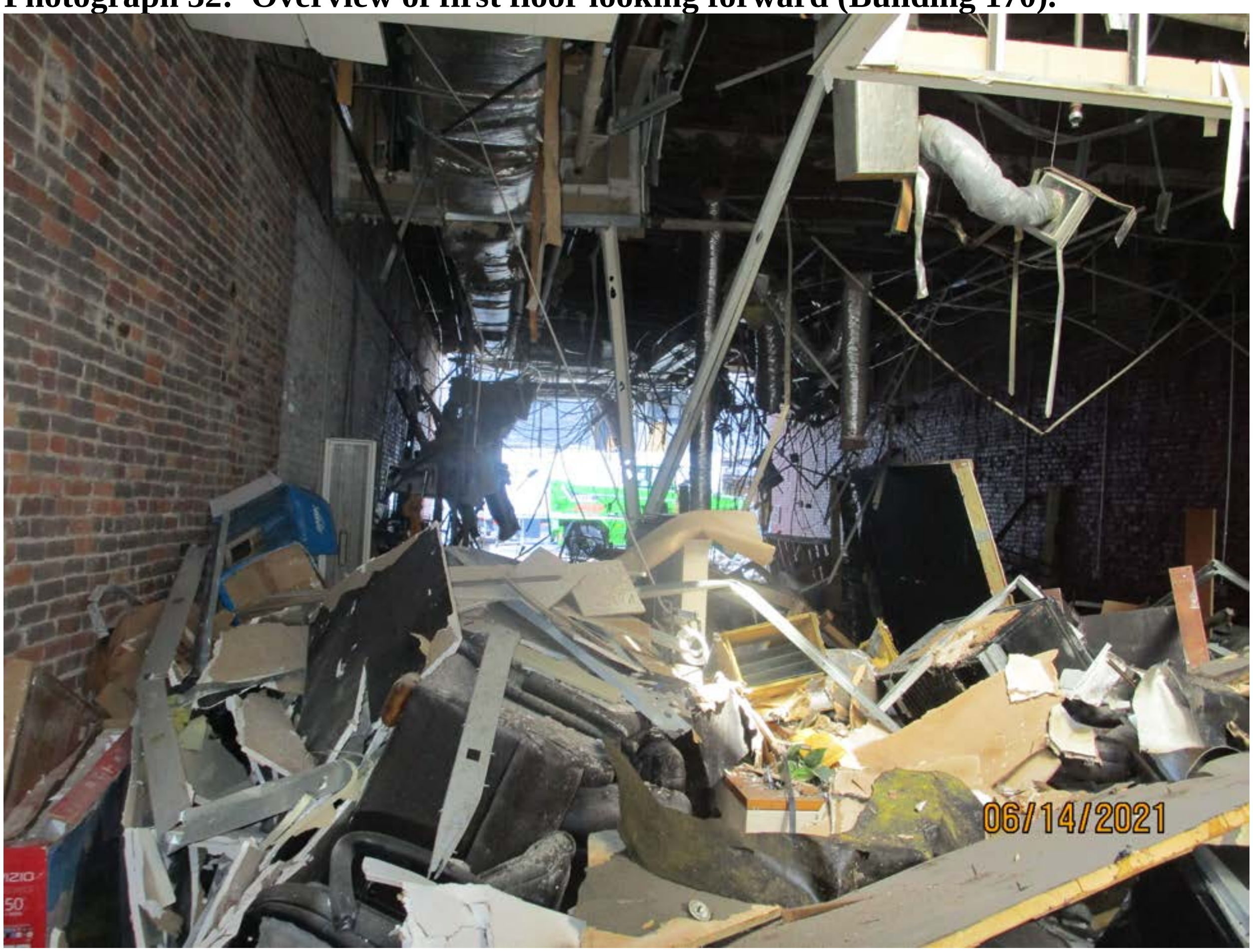
Photograph 29: Floor joist attachment at rear wall of basement (Building 170).

Photograph 30: Floor joist attachment at rear wall of basement (Building 170).



Photograph 31: Right rear corner at basement level of Building 170.

Photograph 32: Overview of first floor looking forward (Building 170).



Photograph 33: Overview of first floor looking rearward (Building 170).

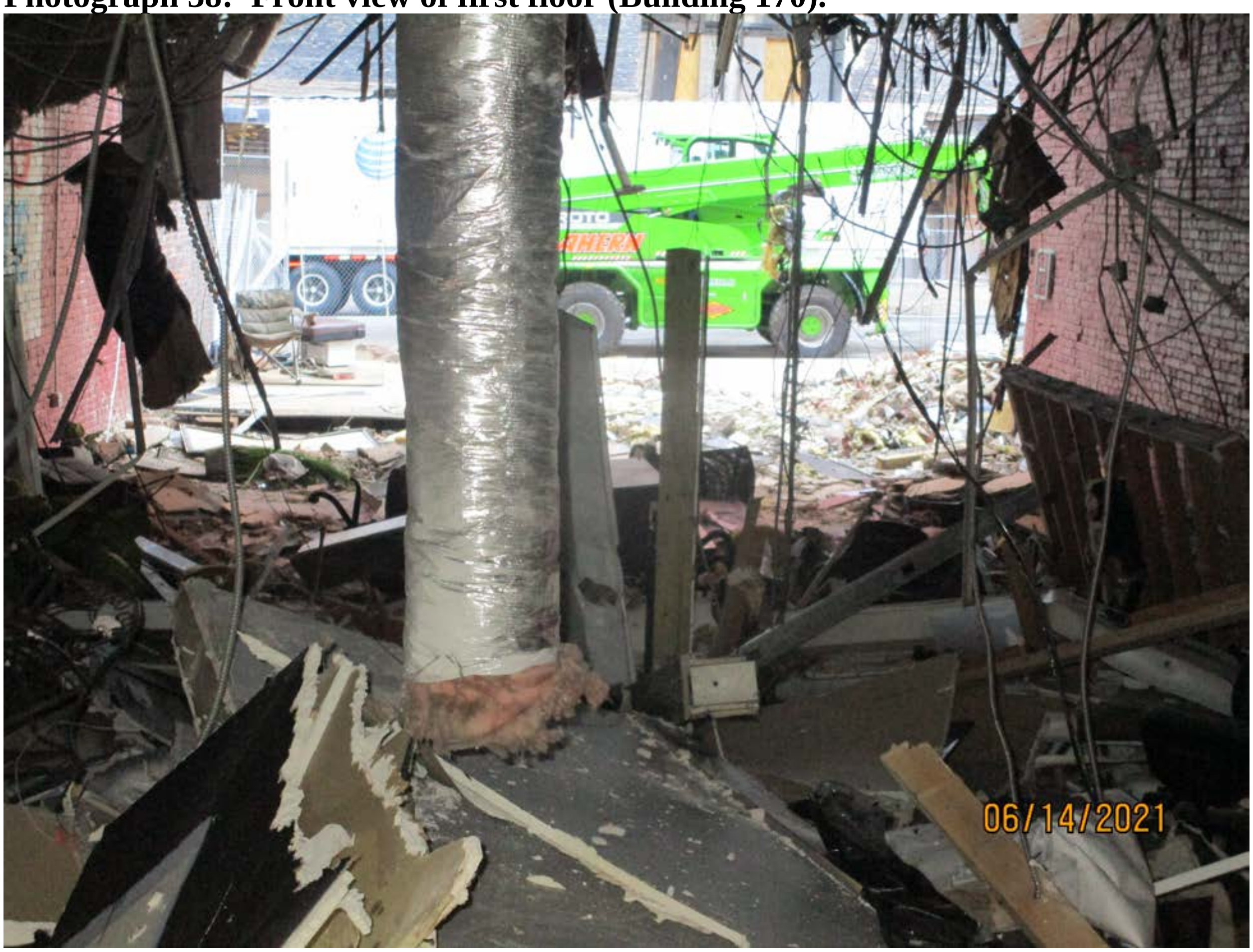
Photograph 34: Floor/wall intersection at first floor (Building 170).

Photograph 35: Second floor joist movement (left wall) of Building 170).

Photograph 36: First floor (left wall) of Building 170.

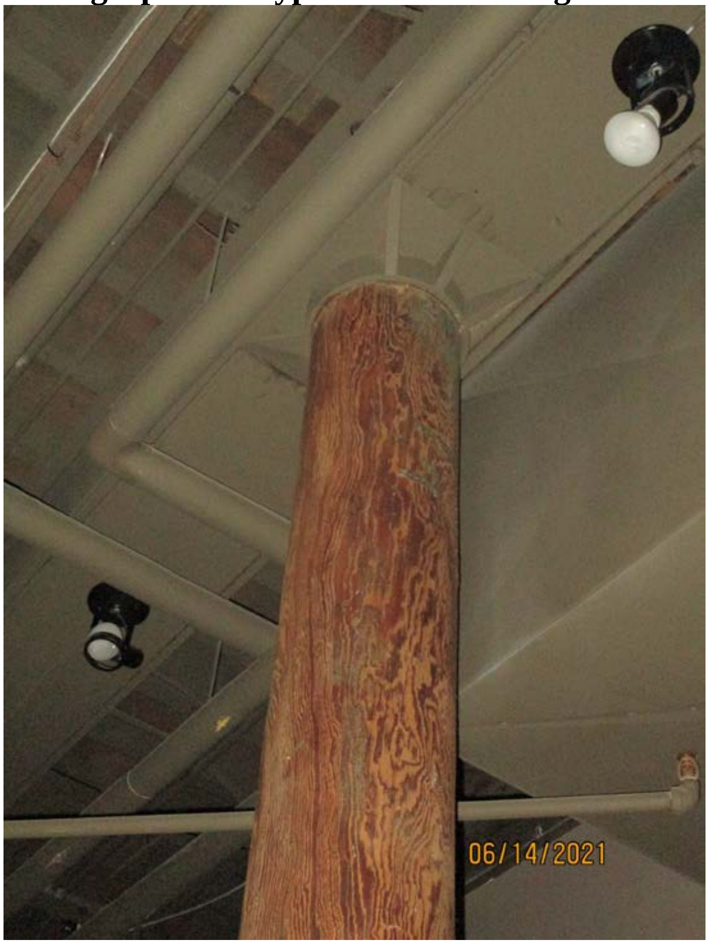
Photograph 37: First floor (right wall) of Building 170.

Photograph 38: Front view of first floor (Building 170).



Photograph 39: Left side wall at first floor (Building 170).

Photograph 40: Typical floor framing at second floor (Building 170).



Photograph 41: Right-side wall of second floor (Building 170).

Photograph 42: First floor movement at left-side wall (Building 170).

Photograph 43: Second floor left-side wall movement (Building 170).

Photograph 44: Rear wall of first floor (Building 170).

Photograph 45: Right-side wall at second floor (Building 170).

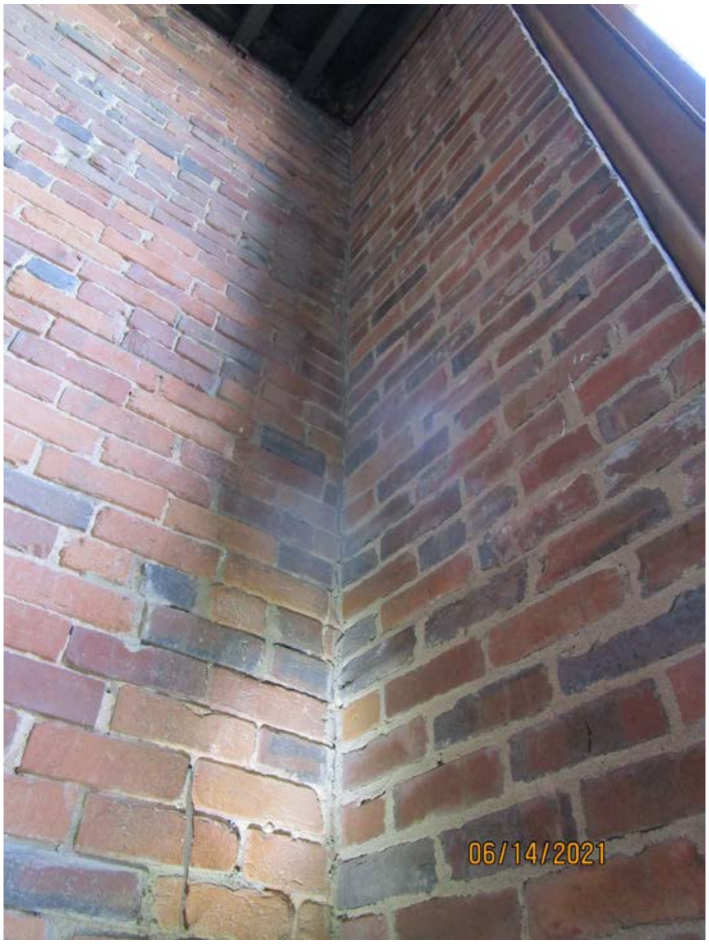
Photograph 46: Left-side wall at first floor (Building 170).

Photograph 47: Left-side wall at first floor (Building 170).

Photograph 48: Left-side wall at first floor (Building 170).

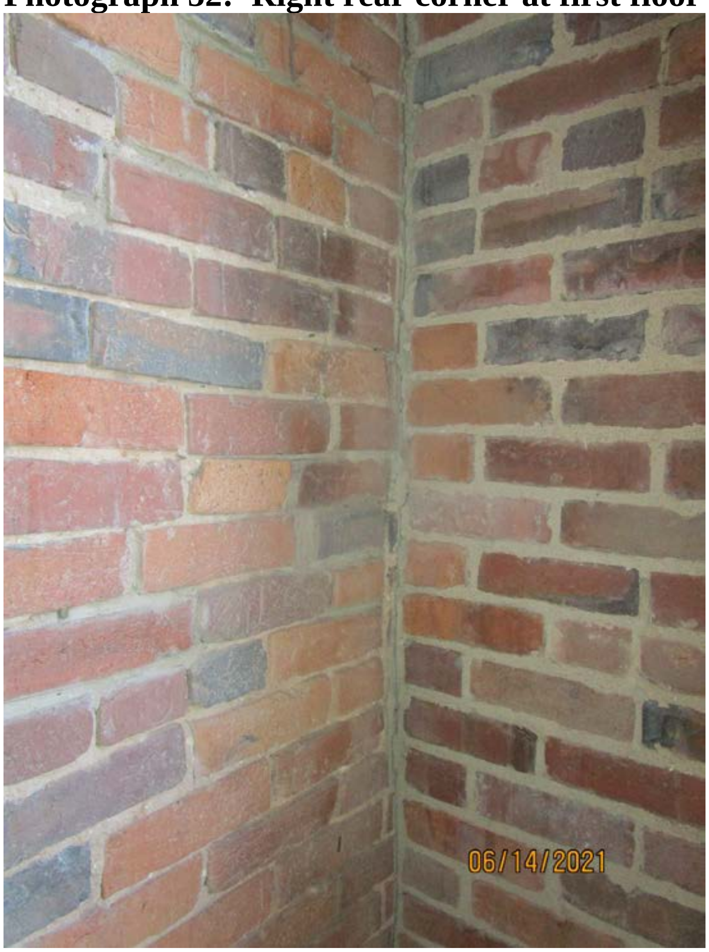
Photograph 49: Rear wall at second floor (Building 170).

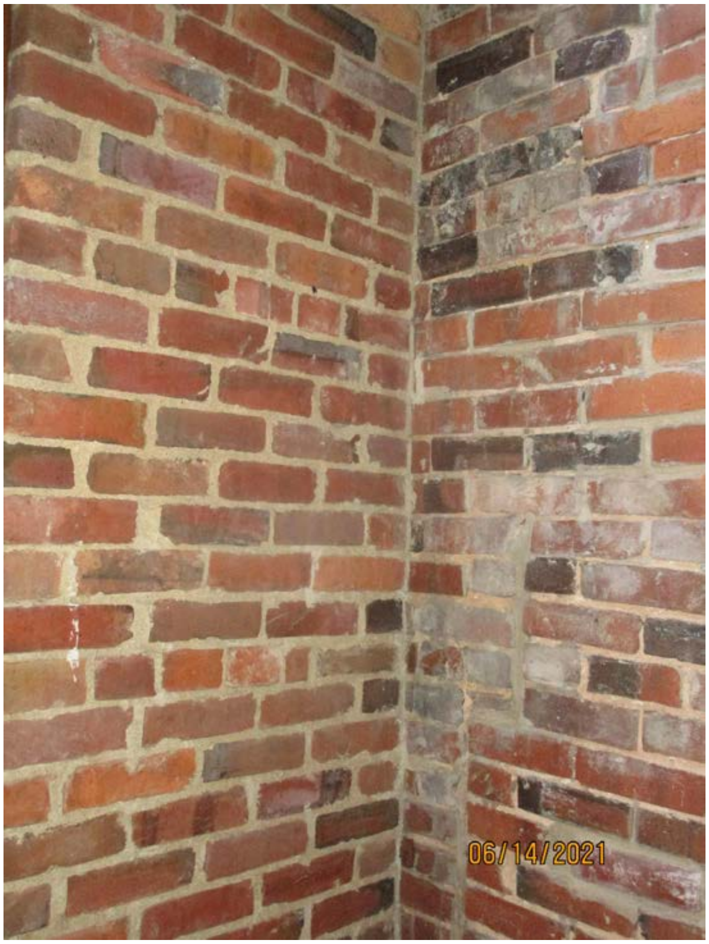
Photograph 50: Rear wall at second floor (Building 170).



Photograph 51: Left rear corner at first floor (Building 170).

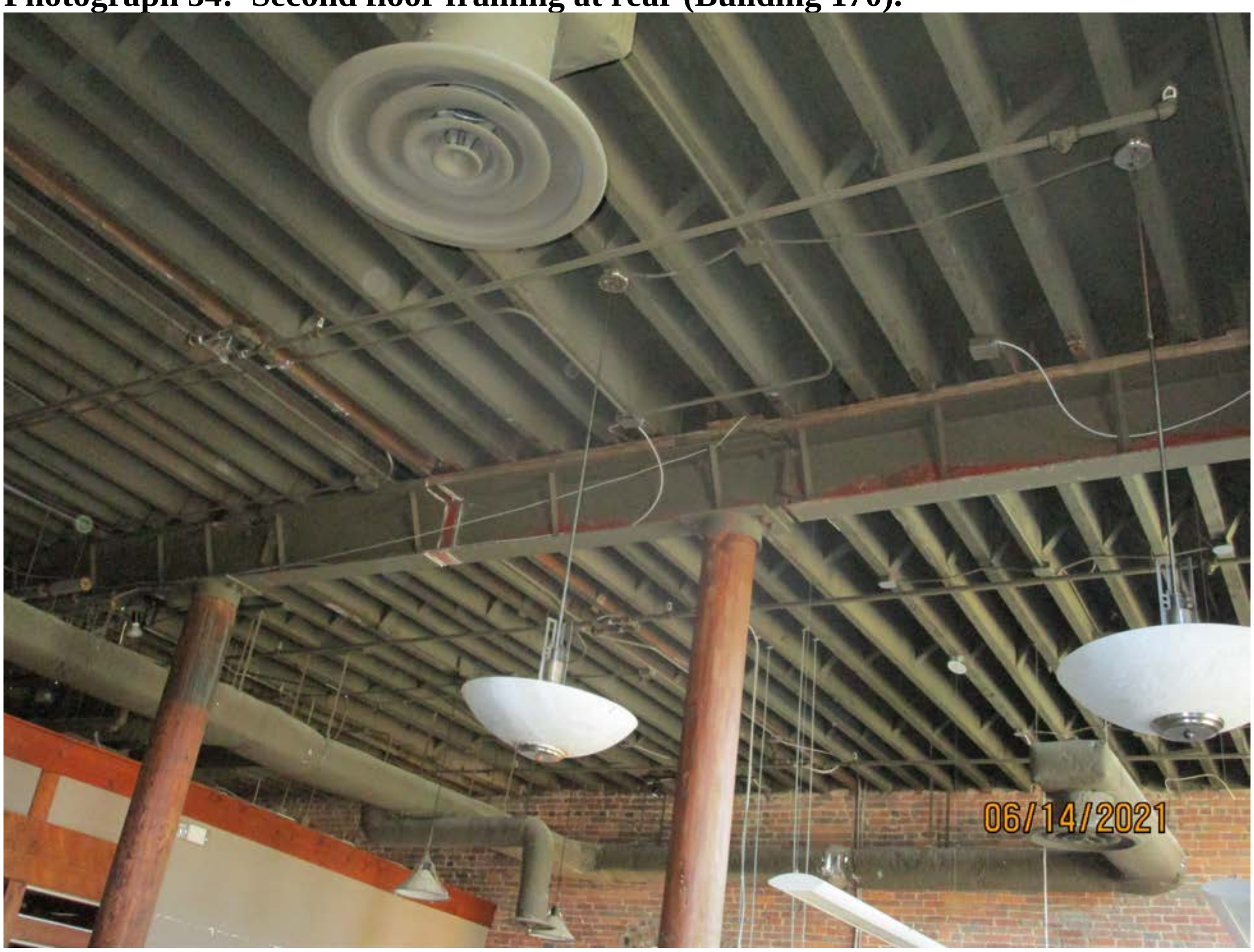
Photograph 52: Right rear corner at first floor (Building 170).





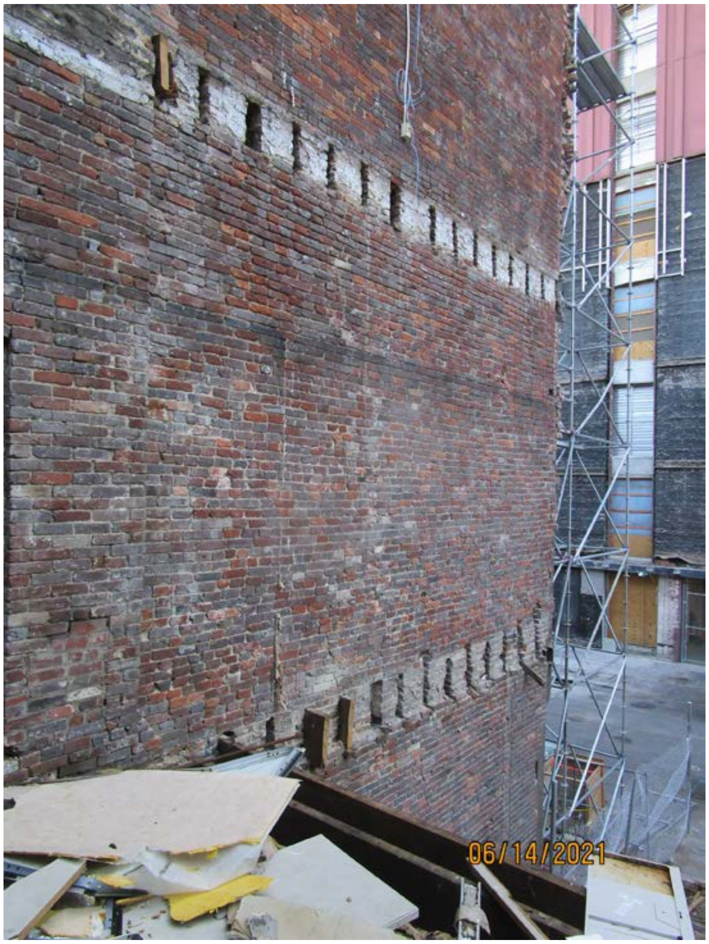
Photograph 53: Right rear corner at first floor (Building 170).

Photograph 54: Second floor framing at rear (Building 170).



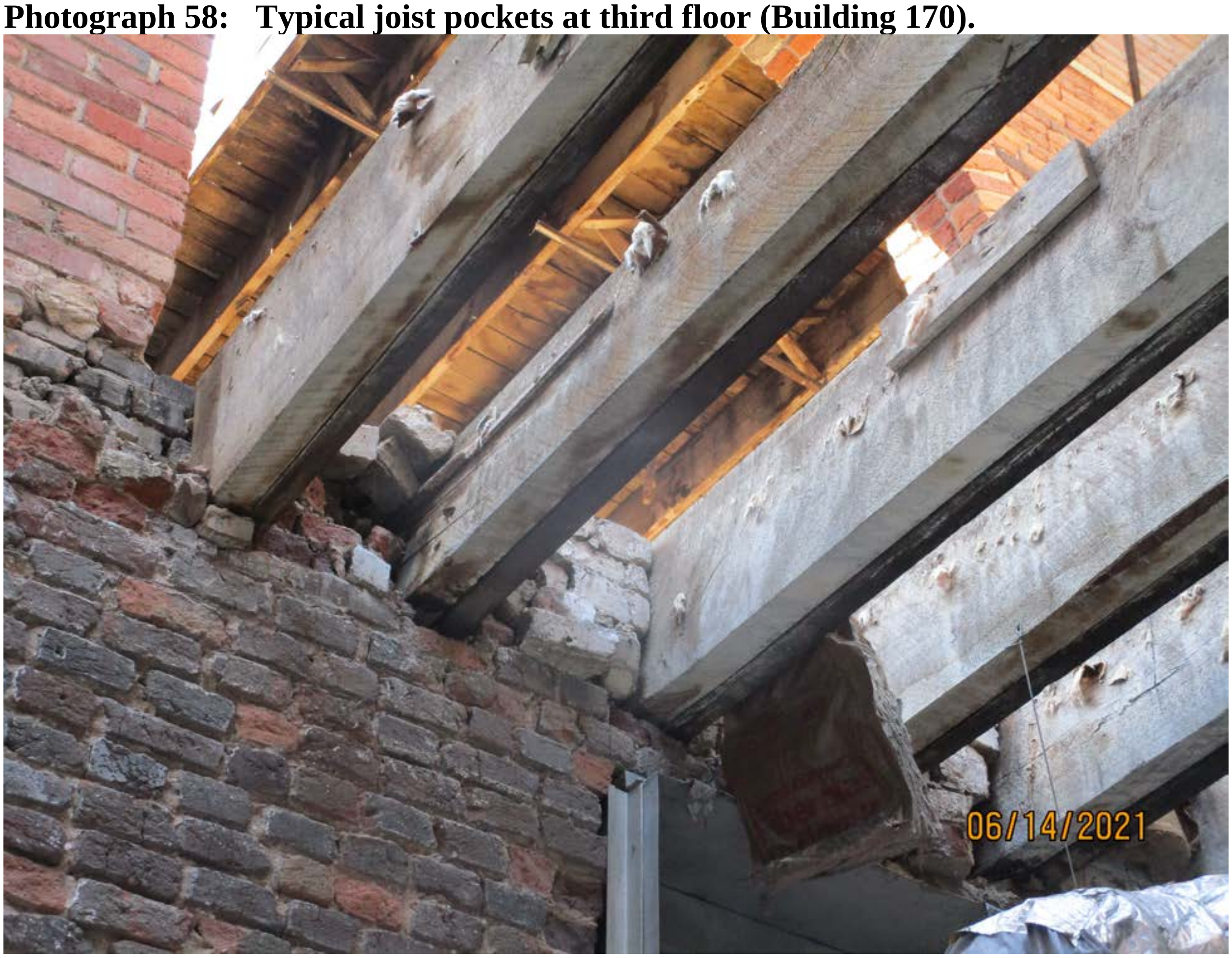
Photograph 55: Front view of second floor (Building 170).

Photograph 56: Left-side wall of second floor (Building 170).



Photograph 57: Right-side wall of second floor (Building 170).

Photograph 58: Typical joist pockets at third floor (Building 170).



Photograph 59: Steel beam connection at third floor (Building 170).

Photograph 60: Rear view of second floor (Building 170).

Photograph 61: Left-side wall of second floor (Building 170).

Photograph 62: Third floor framing (Building 170).

Photograph 63: Wood truss at third floor (Building 170).

Photograph 64: Third floor joist support (left-side wall) at Building 170).

Photograph 65: Overview of left-side wall of third floor (Building 170).

Photograph 66: Third floor right-side wall joist support (Building 170).

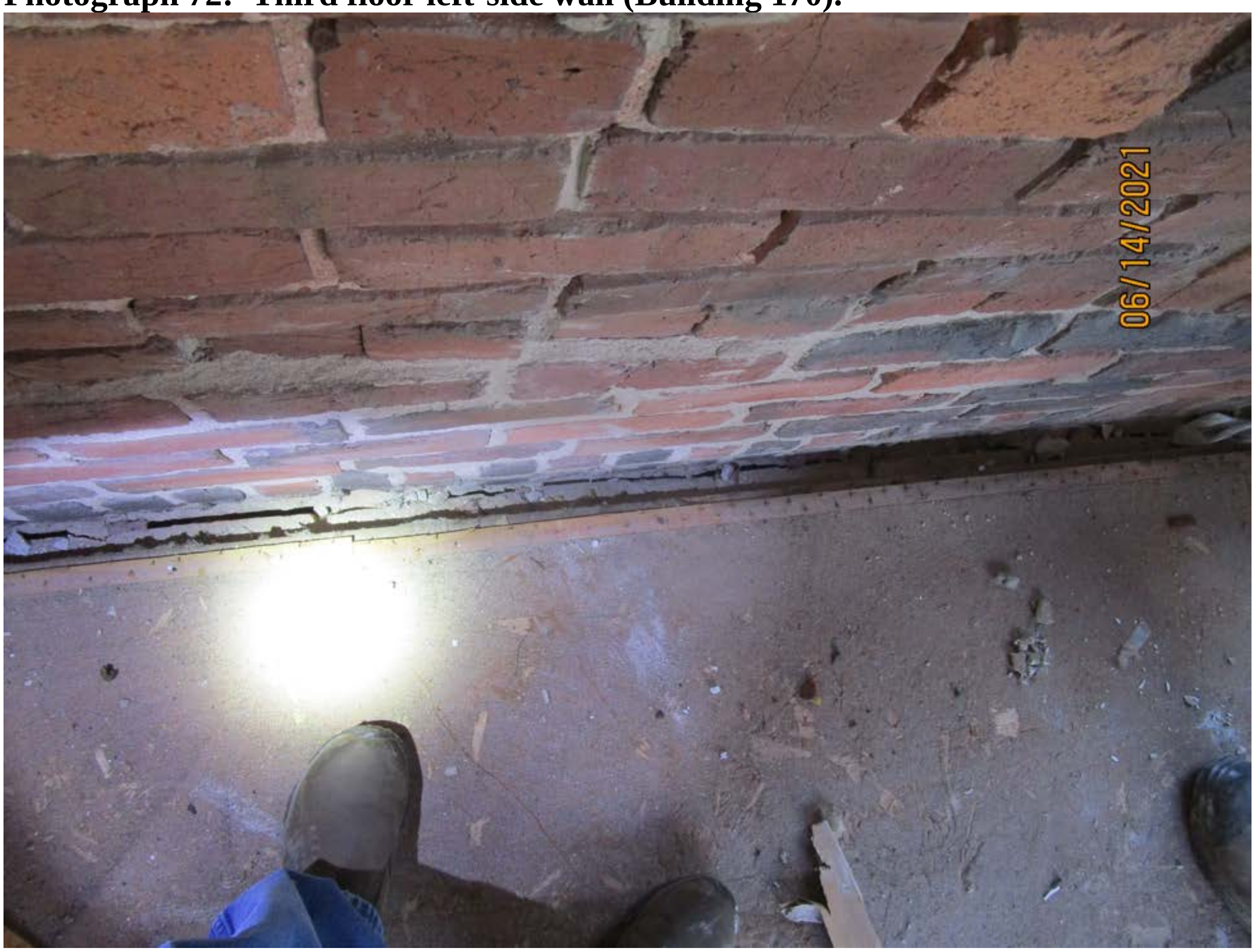
Photograph 67: Floor joist movement at second floor (Building 170).

Photograph 68: Rear view of second floor (Building 170).

Photograph 69: Second floor/rear wall of Building 170.

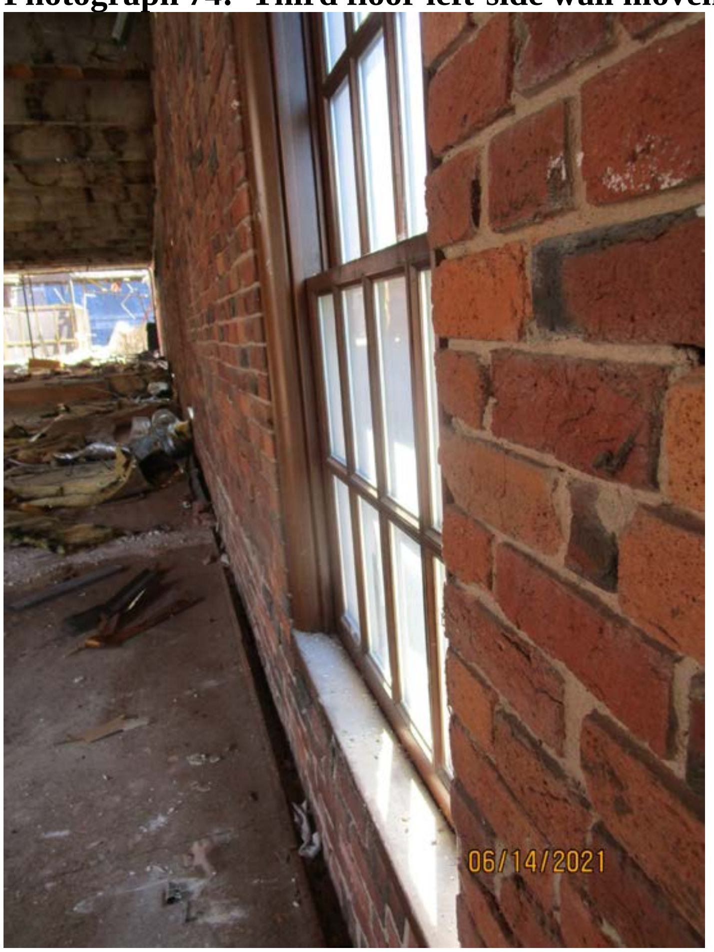
Photograph 70: Third floor/rear wall of Building 170.

Photograph 71: Overview of third floor rear wall (Building 170).

Photograph 72: Third floor left-side wall (Building 170).


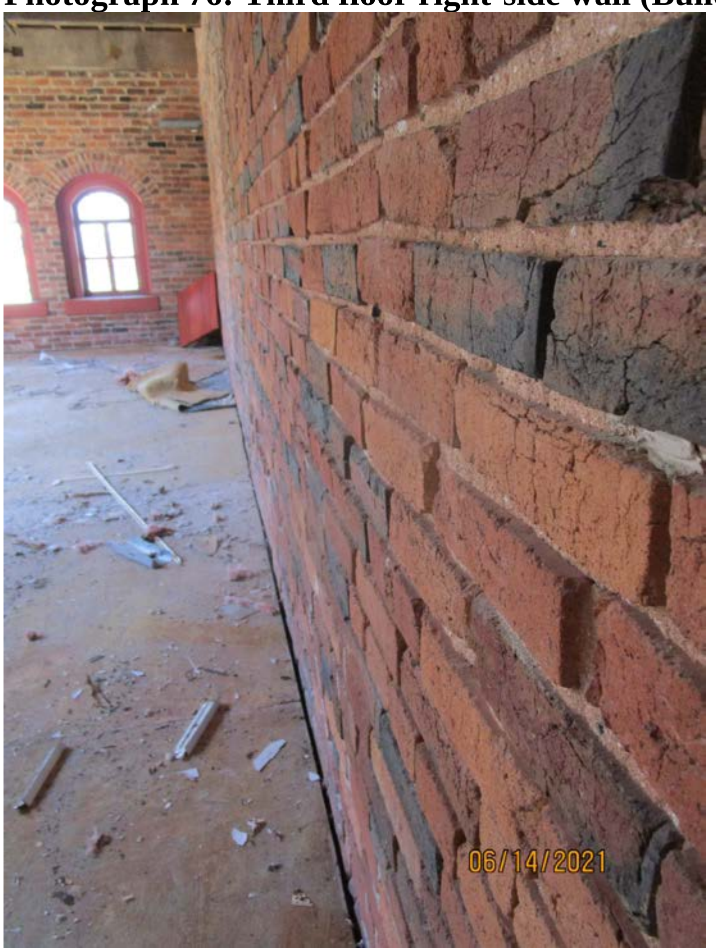
Photograph 73: Roof rafter movement at left-side wall (Building 170).

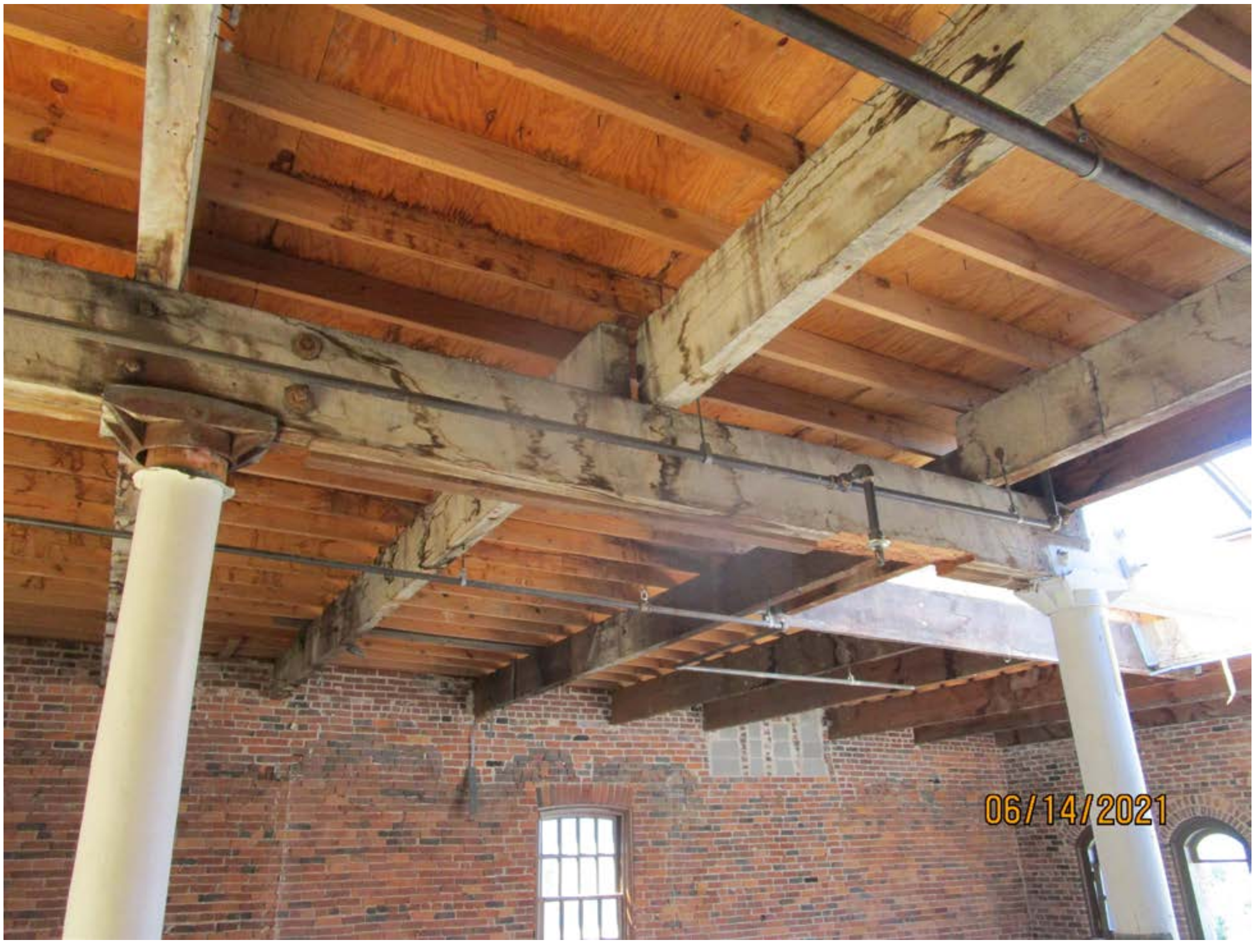
Photograph 74: Third floor left-side wall movement (Building 170).



Photograph 75: Third floor left-side wall movement (Building 170).

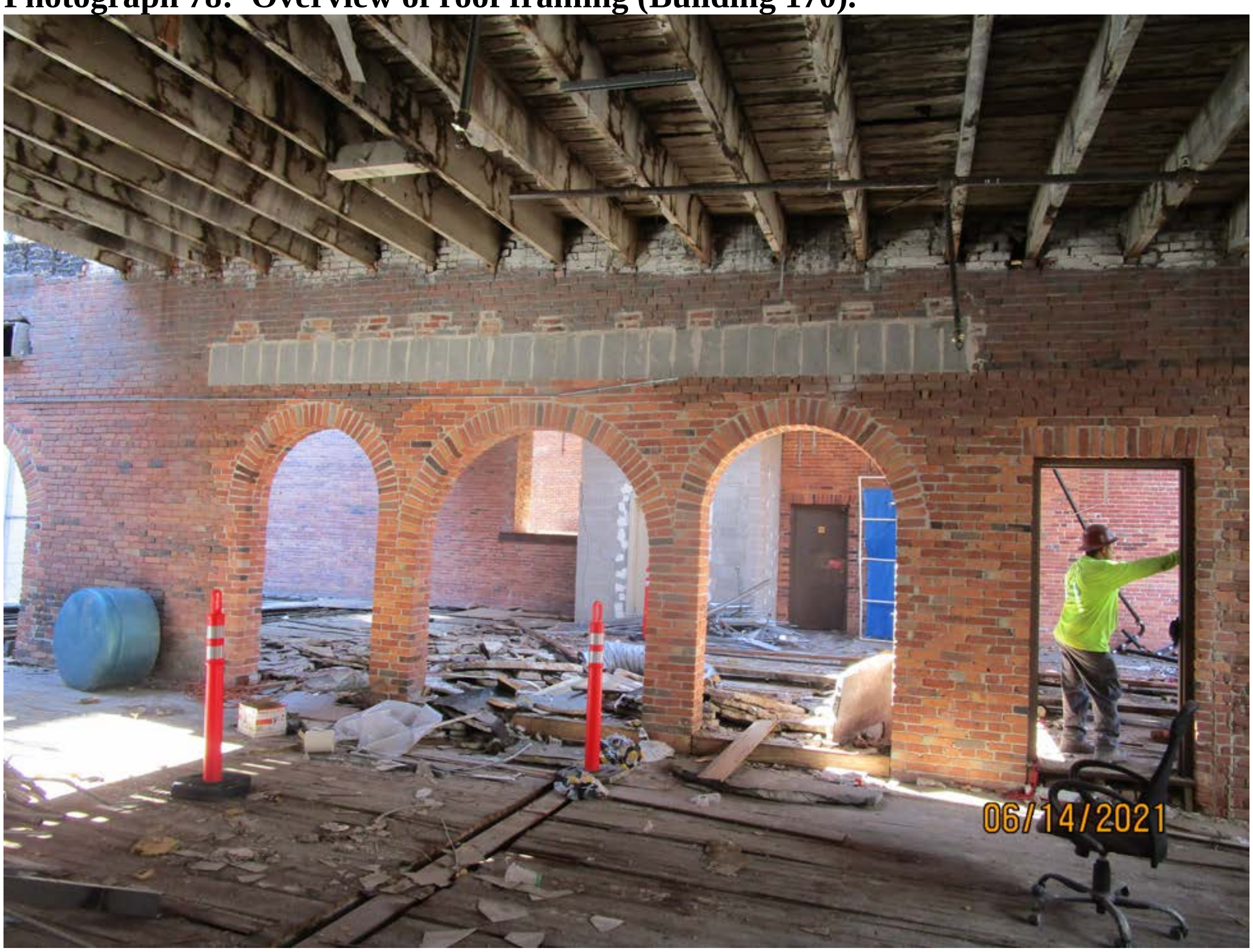
Photograph 76: Third floor right-side wall (Building 170).





Photograph 77: Overview of roof framing (Building 170).

Photograph 78: Overview of roof framing (Building 170).



Photograph 79: Rear wall of Building 172.

Photograph 80: Rear wall of Building 172.


Photograph 81: Left-side wall of Building 172.

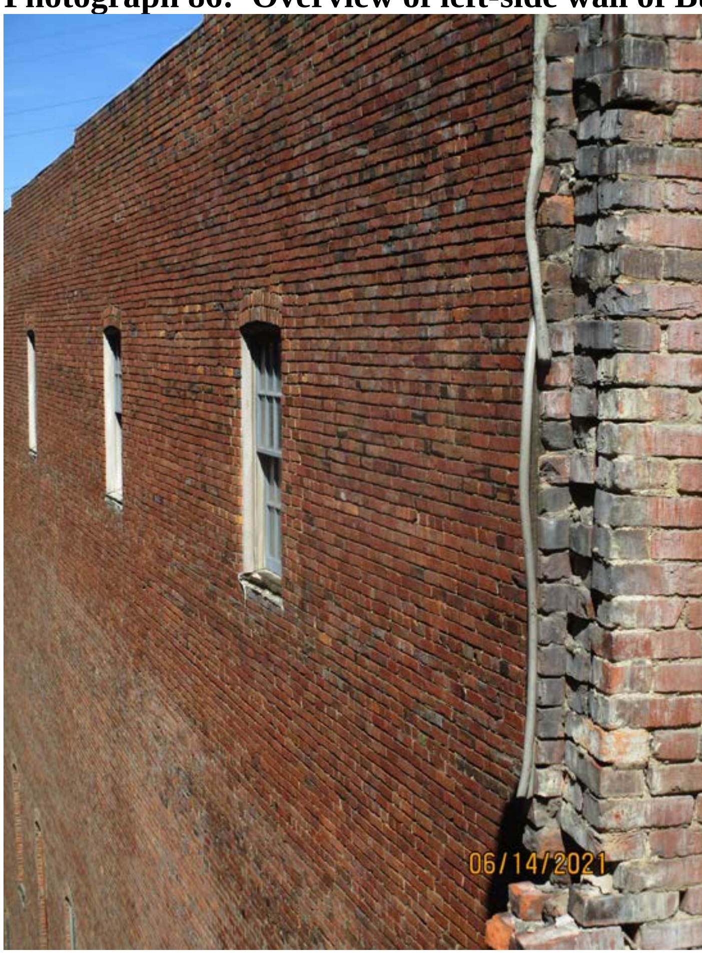
Photograph 82: Roof joist movement of Building 172.

Photograph 83: Roof joist movement at Building 172.

Photograph 84: Masonry elevator shaft at Building 172.

Photograph 85: Masonry elevator shaft at Building 172.

Photograph 86: Overview of left-side wall of Building 170.

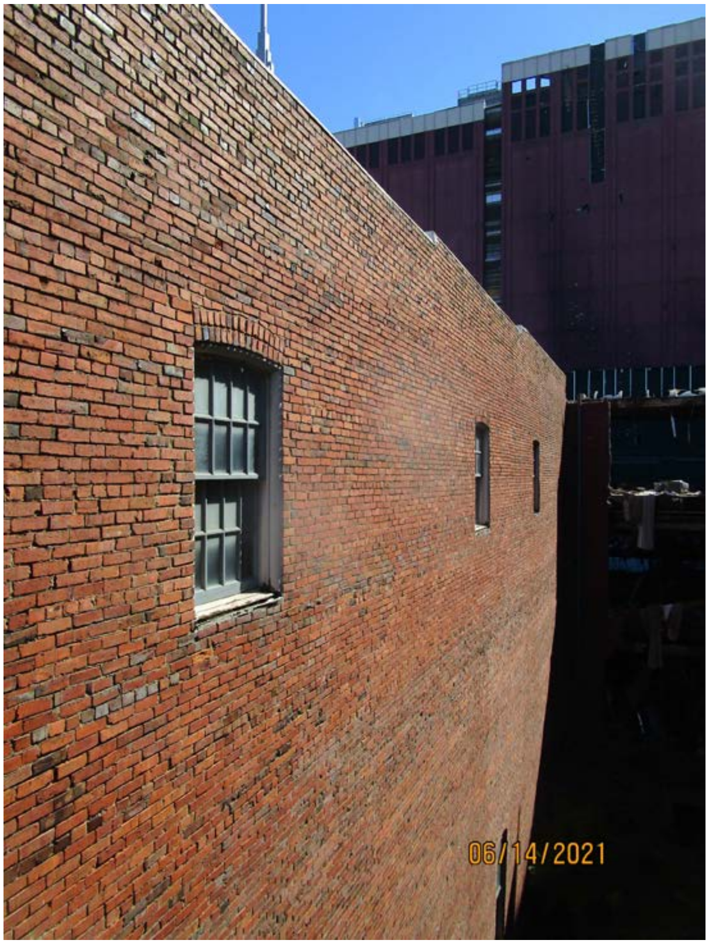


Photograph 87: Recently fallen bricks at Building 176 (EMC photo #53 6/7/2021).

Photograph 88: Recently fallen bricks at Building 176 (EMC photo #53 6/7/2021).

Photograph 89: Recently fallen bricks at Building 176 (EMC photo #53 6/7/2021).

Photograph 90: Recently fallen bricks at Building 176 (EMC photo #53 6/7/2021).



Photograph 91: Right-side wall of Building 174.

Photograph 92: Close-up of left-side wall of Building 170.

Photograph 93: Out-of-plumb left-side wall of Building 170.

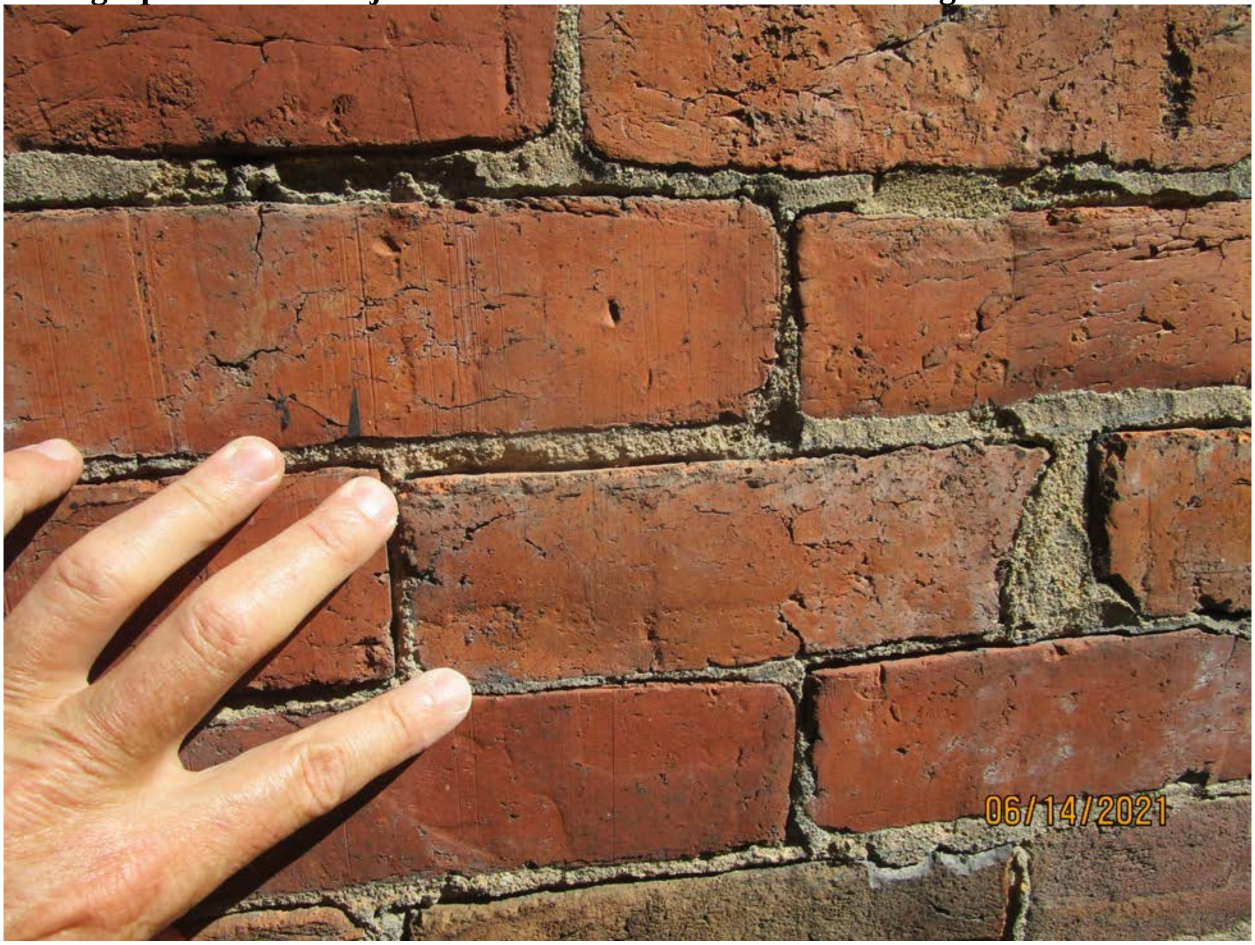
Photograph 94: Soft mortar at left-side wall of Building 170.

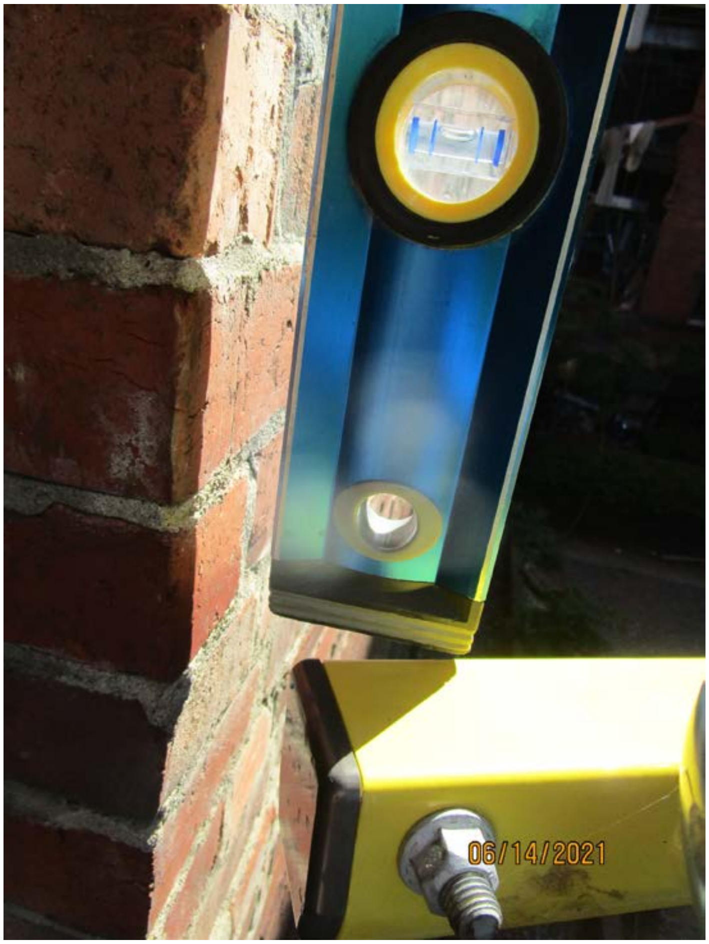

Photograph 95: Out-of-plumb left-side wall of Building 170.

Photograph 96: Soft mortar at left-side wall of Building 170.

Photograph 97: Out-of-plumb left-side wall of Building 170.

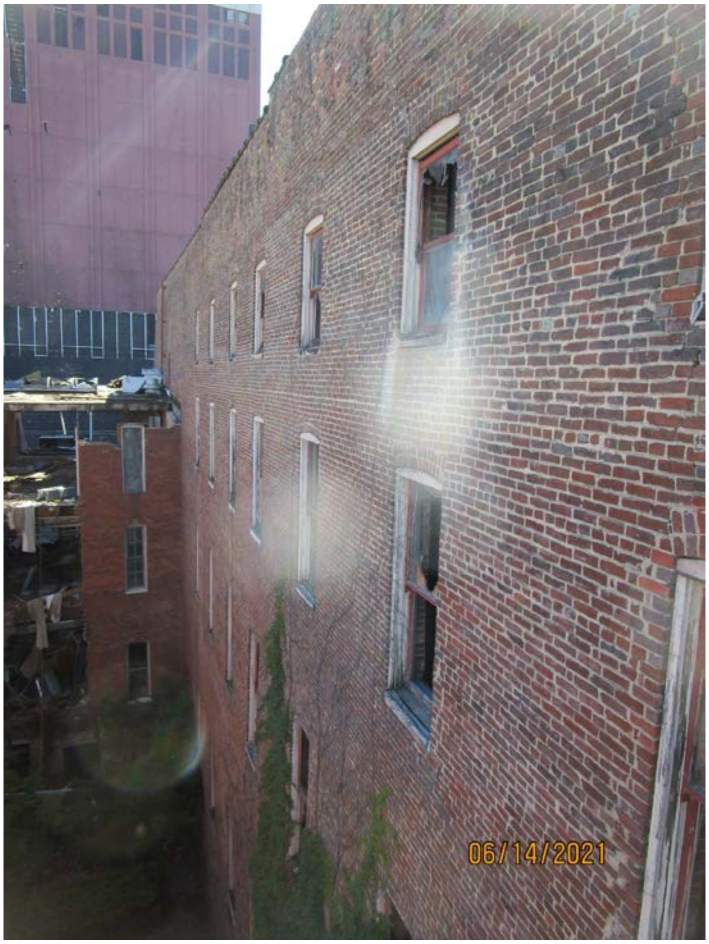
Photograph 98: Mortar joint condition at left-side wall Building 170.





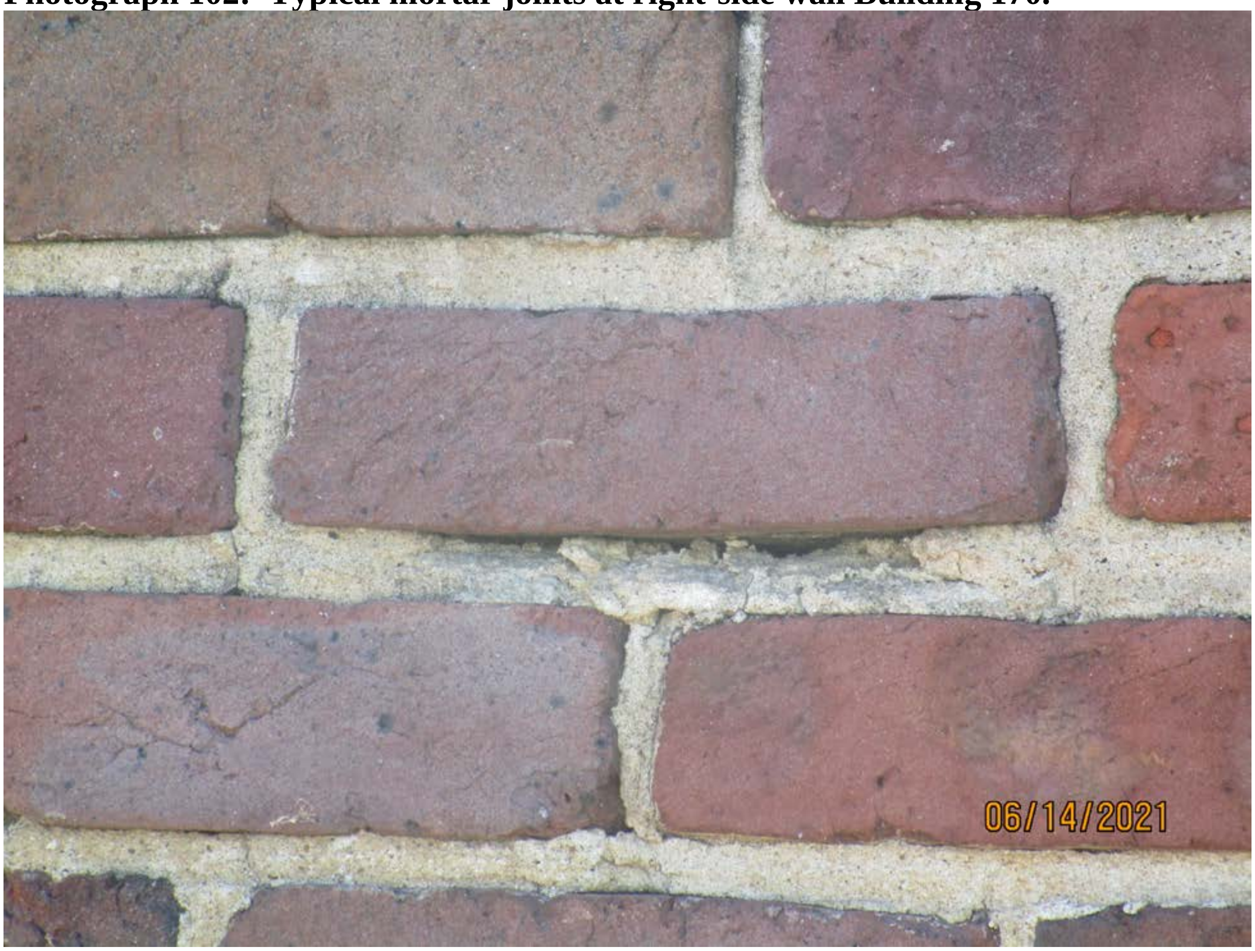
Photograph 99: Out-of-plumb left-side wall of Building 170.

Photograph 100: Brick cracks at right-side wall of Building 174.



Photograph 101: Overview of right-side wall of Building 170.

Photograph 102: Typical mortar joints at right-side wall Building 170.



Photograph 103: Near-plumb at right-side wall of Building 174.

Photograph 104: Brick cracks at right-side wall of Building 174.

Photograph 105: Near-plumb right-side wall of Building 174.

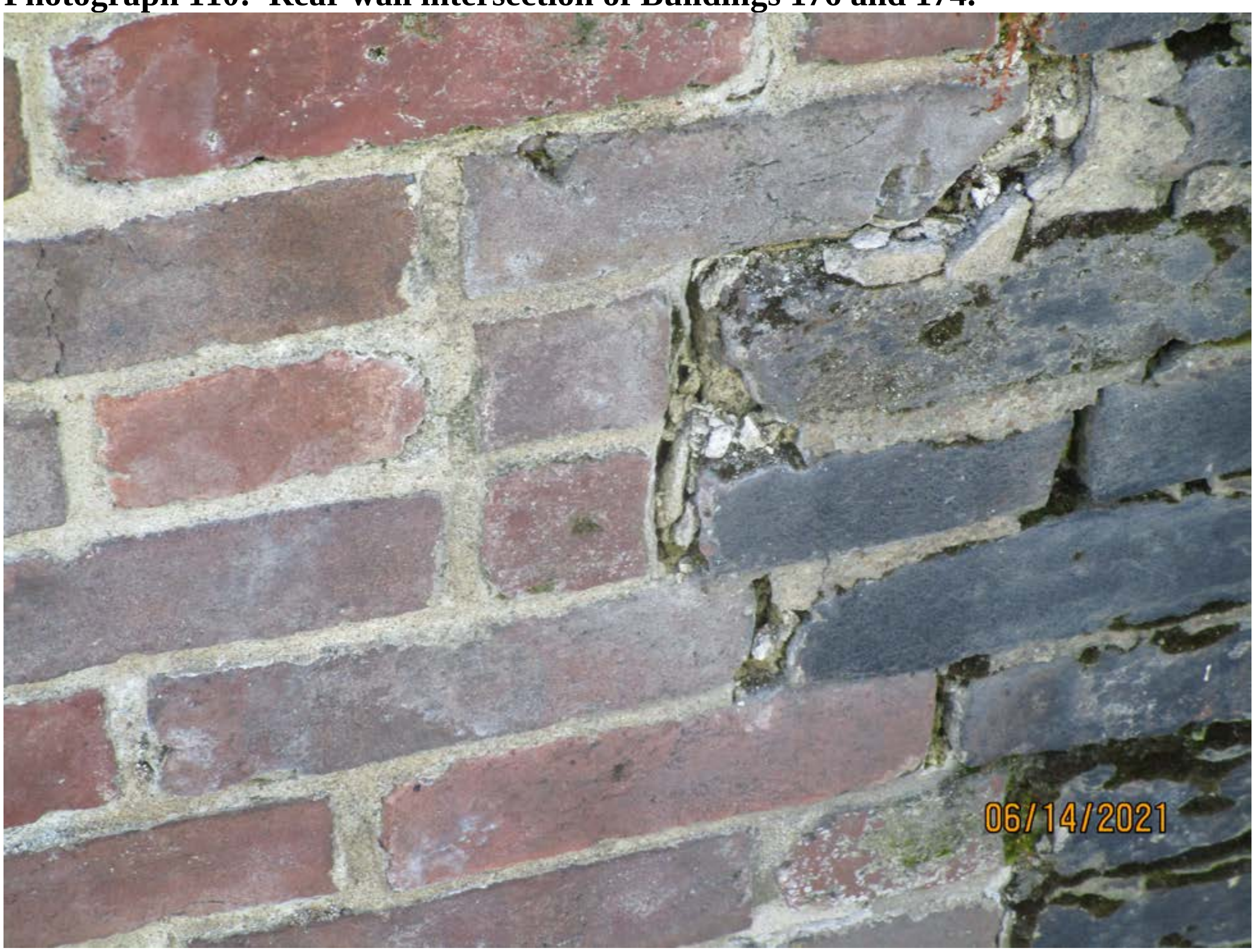
Photograph 106: Near-plumb right-side wall of Building 174.

Photograph 107: Near-plumb right rear corner of Building 174.

Photograph 108: Near-plumb right rear corner of Building 174

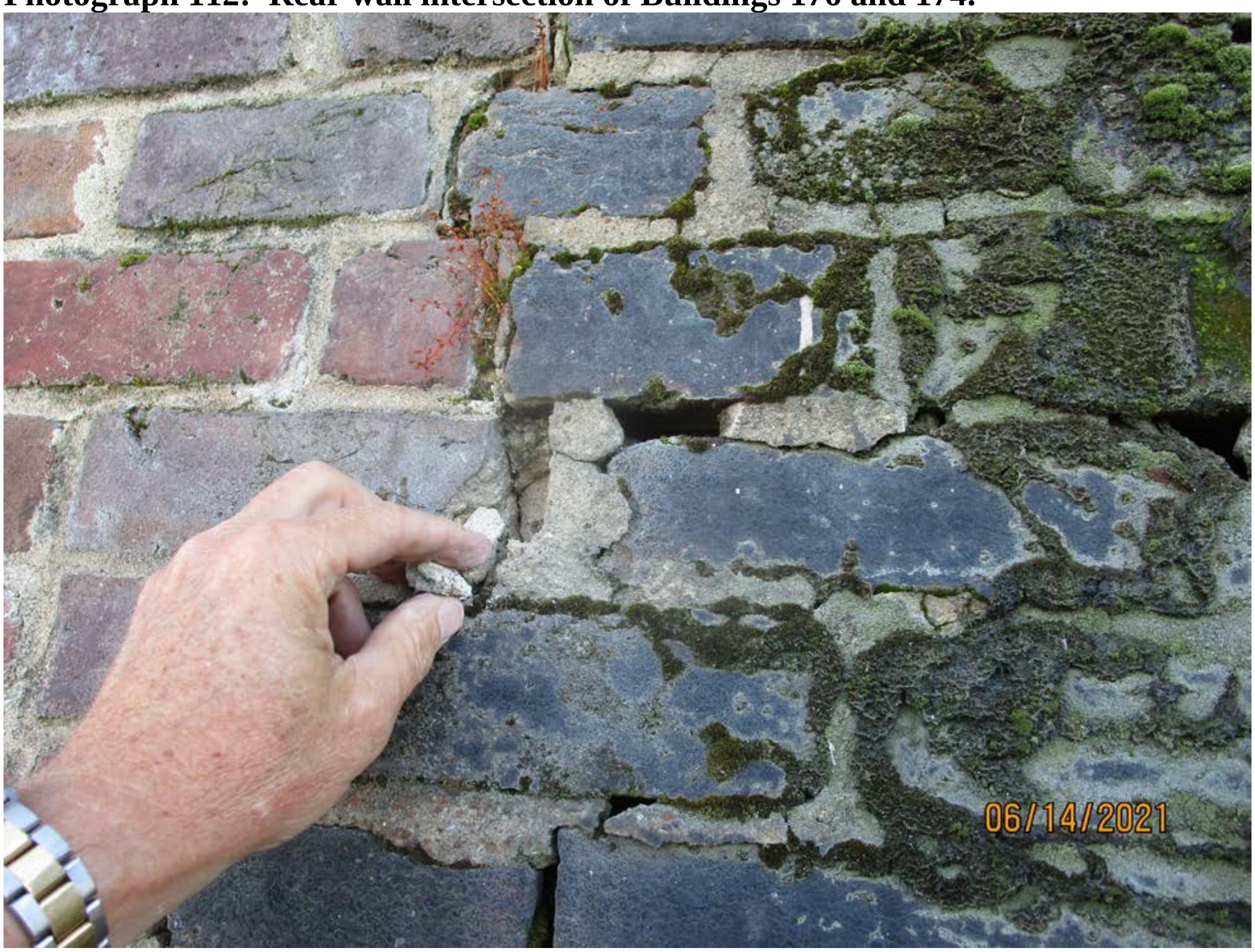
Photograph 109: Rear wall intersection of Buildings 176 and 174.

Photograph 110: Rear wall intersection of Buildings 176 and 174.



Photograph 111: Rear wall intersection of Buildings 176 and 174.

Photograph 112: Rear wall intersection of Buildings 176 and 174.



Photograph 113: Rear wall intersection of Buildings 176 and 174.

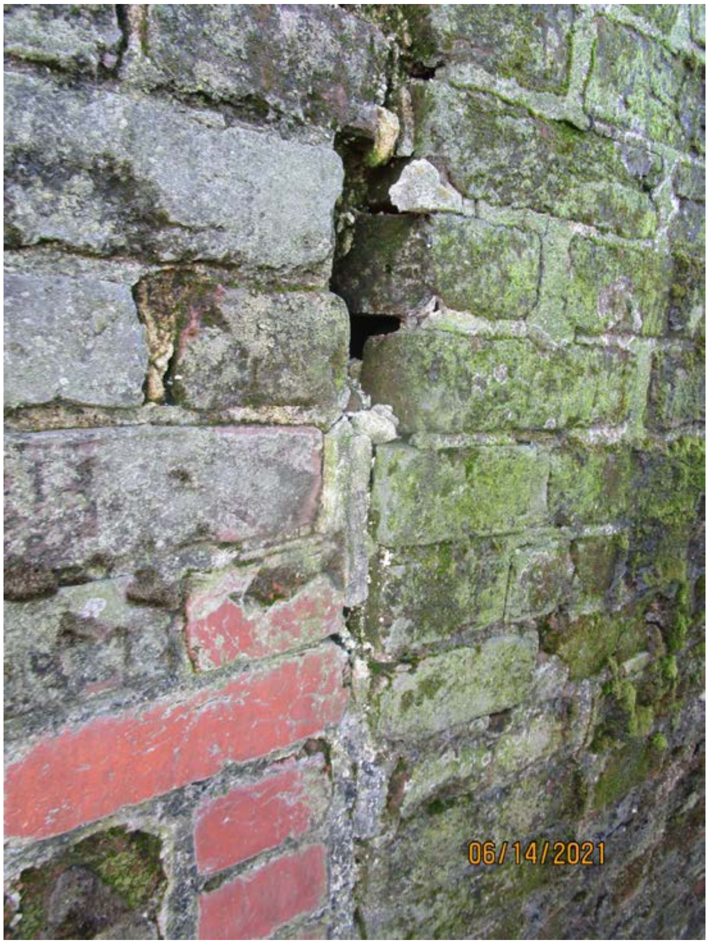
Photograph 114: Rear wall intersection of Buildings 176 and 174.

Photograph 115: Rear wall intersection of Buildings 176 and 174.

Photograph 116: Rear wall intersection of Buildings 176 and 174.

Photograph 117: Rear wall intersection of Buildings 176 and 174.

Photograph 118: Rear wall intersection of Buildings 176 and 174.



Photograph 119: Rear wall intersection of Buildings 176 and 174.

Photograph 120: Rear wall intersection of Buildings 176 and 174.

Stephen J. Kelley, FAIA, SE, FAPT
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130 South Kenilworth Avenue
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PRESERVATION SJK ARCHITECT/ENGINEER

16 July 2021

Ms. Robin Zeigler
Historic Zoning Administrator
Metro Historic Zoning Commission
Nashville, TN 37204

Re: Condition survey of Buildings 170, 172, 174 and 176 on Second Avenue North in Nashville, TN
SJK no. 2021.15

Dear Ms. Zeigler:

At the request of The District and the Metro Historical Commission Foundation I performed a condition survey of buildings 170, 172, 174 and 176 on Second Avenue North in Nashville, Tennessee. This condition survey was performed in reaction to the findings of previous engineering and architectural reports performed by others, namely: EMC Structural Engineers, PC report dated 13 January 2021; STG Design dated 10 June 2021; Structural Design Group dated 15 June 2021; and the EMC Structural Engineers, PC report dated 8 July 2021.

I was on site performing investigative work on 12 and 13 July 2021. I was provided access to the facades of buildings 170, 174, and 176 using an 85-foot boom lift. I was also provided access to the interiors of buildings 170, 174 and 176 from the basement to the top floor. The basement at the front of building 170 was considered unsafe and was not entered. I was discouraged from entering building 172 and was told that entry to the basement was not possible. I was aided in my investigative work by Jaxson Fay of Tiny Demolition & Recycling. Mr. Fay's help made it possible for me to accomplish more investigative work than if I had been working on my own.

As the buildings have been stripped of all but the most essential accretions, they now stand with much of their original structural components exposed. As such a condition survey was expedited, and observations can be made which could be considered archaeological in nature. I limited my survey to original and early structural components. Since the west facades of each building have been removed, I will not comment on these facades. I did not evaluate contemporary additions to the structures including steel columns and beams, open web joists, concrete slabs, added mezzanine levels, and concrete block stair and elevator shafts. I did not perform a survey of the roofing structure, membranes but skylights but will make general comments on the water shedding elements.

Finally, and as agreed, this is a ***preliminary and summary report****. A comprehensive report including data gathered and its interpretation, supporting figures, conclusions, and recommendations will be provided soon.*

Methodology

The following methodology was followed during the investigative site visit:

- Review of archival materials: the National Register of Historic Places Inventory – Nomination Form for the Second Avenue Commercial District dated 20 May 1971; and a recently prepared laser survey of the floor plans of the four buildings.
- Visual nonintrusive inspection of the buildings which included:
  - close up inspection of the east facades of buildings 170, 174, and 176; reachable portions of the north facade of building 170: and reachable portions of the south facade of building 174 from an 85-foot boom lift.
  - Sounding of selected portions of the facades acted from the boom lift.
  - Visual survey from the basement through the top floor levels of buildings 170, 174 and 176.

  Geometric survey of structural components and column spacings in buildings 170, 174, and 176
- Levelness survey of the third floor at the back of building 174
- Plumbness survey of columns on the first and second floors of building 174
- Laser survey of key exterior walls of buildings 170, 174 and 176 to determine out-of-plumbness.
- Microscopic examination of *in situ* mortars of buildings 170, 172, 174 and 176.
- Removal of mortar and structural wood samples from selected areas for microscopic examination. I have also provided direction for the testing of brick samples to be performed by others. *These examinations and testing procedures have not taken place as of the date of this writing.*
- Simple structural analysis of floor loading capabilities of original floors and load capabilities of masonry bearing walls. *This analysis has not taken place as of the date of this writing.*

Physical Description of the Buildings

Following is a physical description of the structural components of each of the four buildings based upon archival and archaeological evidence. The brick wall thicknesses and wood member sizes and spacing are actual rather than nominal measurements, but these dimensions vary from wall to wall and from member to member.

170 Second Avenue North Building (170 building)

The 170 building was reportedly originally the Brown & Farrell Hardware/M. E. Derryberry building and was constructed circa 1885. The portion of the building facing Second Avenue is a simple structure with joists spanning between north and south brick masonry bearing walls that are oriented perpendicular to the Avenue.[1] The rear portion of the building is an early addition with the same structural layout with the inclusion of a row of columns and girders running parallel to the masonry bearing walls and centered between these bearing walls. The building is three levels high plus a basement. Following is a description of the structural systems from bottom to top:

---

[1] 8 x 8" wood columns were observed in the basement of the front of the structure. It is not known whether these columns are original or added to increase the loadbearing capacity of the floor above.

Basement
- Foundation walls of the original structure are composed of cut stone.
- Foundation walls of the early addition are composed of cut stone.

First floor
- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall thickness: 4 wythes or 17" thick
- South bearing wall thickness: 2 wythes or 8.5" thick
- East facade wall: 6 wythes or 25.5" thick with a built-in pier
- North back wall: 4 wythes or 17" thick
- Columns at front: 8" x 8"
- Girders at front: not determined
- Columns at rear: 13" x 13"
- Girders at rear: steel (contemporary)
- Joists at front: not determined
- Joists at rear: 2.25" x 16" @ 16" o.c.

Second floor
- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 4 wythes or 17" thick
- South bearing wall: 2 wythes or 8.5" thick
- East wall: 5 wythes or 21.25" thick at all levels with built-in pier
- North back wall: 3 wythes or 12.75" thick
- Columns at rear: 9.5" diameter
- Girders at rear: steel (contemporary)
- Joists at front: not determined
- Joists at rear: 2.25" x 15" @ 12" o.c.

Third floor
- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 4 wythes or 17" thick
- South bearing wall: 2 wythes or 8.5" thick
- East wall: 5 wythes or 21.25" thick with a built-in pier
- North back wall: 3 wythes or 12.75" thick
- Columns at rear: 9.5" diameter
- Girders at rear: 2 – 4" x 12"
- Joists at front: 2 - 2.25" x 1"2 @ 16" o.c.
- Joists at rear: 2.25" x 16" @ 16" o.c.

172 Second Avenue North Building (172 building)

The 172 building was reportedly originally the C. B. Pearce & Company building and constructed circa 1885. Archaeological evidence suggests that the 170 and 172 buildings were built at the same time because they share a common bearing wall. The building is a simple structure with joists spanning between North and South brick masonry bearing walls that are oriented perpendicular to the Avenue. The building is three levels high plus a basement. Following is a description of the structural systems from bottom to top:

Basement

- Could not be entered

First floor

- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 2 wythes or 8.5" thick
- South bearing wall: 5 wythes or 21" thick
- Joists: could not be determined

Second floor

- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 2 wythes or 8.5" thick
- South bearing wall: 5 wythes or 21" thick
- Joists: could not be determined

Third floor

- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 2 wythes or 8.5" thick
- South bearing wall: 5 wythes or 21" thick
- Joists: 2.25" x 16" @16" o.c.

174 Second Avenue Building (174 building)

The 174 building was reportedly originally the Berry & Demoville building and was constructed circa 1875. Archaeological evidence suggests that the 174 building was constructed prior to the 172 building which bolsters the original construction date provided in archival documents. The building is a simple structure with joists spanning between north and south brick masonry bearing walls that are oriented perpendicular to the Avenue. There is a row of columns and girders running parallel to the masonry bearing walls and centered between these bearing walls. The building is four levels high plus a basement. Following is a description of the structural systems from bottom to top:

Basement

- Foundation walls are composed of cut stone.

First floor

- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.

- North bearing wall: 5 wythes or 21.25” thick
- South bearing wall: 5 wythes or 21.25” thick
- South back wall: 4 wythes or 17” thick
- East wall: 4 wythes or 17” thick
- Columns: 9.5” x 11.5”
- Girders: 15” x 9.5” wood girders
- Joists: 3” x 17” @ 16” o.c.

Second floor

- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 4 wythes or 17” thick
- South bearing wall: 4 wythes or 17” thick
- South back wall: 4 wythes or 17” thick
- East wall: 4 wythes or 17” thick
- Columns: 9.5” x 9.5” or 9.5” x 11.5”
- Girders: 15” x 9.5”
- Joists: 3” x 17” @ 16” o.c.

Third floor

- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 4 wythes or 17” thick
- South bearing wall: 4 wythes or 17” thick
- South back wall: 4 wythes or 17” thick
- East wall: 4 wythes or 17” thick
- Columns: 9.5” x 9.5”
- Girders: 12” x 9.5”
- Joists: 2.25” x 16” @ 16” o.c.

Fourth floor

- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 4 wythes or 17” thick
- South bearing wall: 4 wythes or 17” thick
- South back wall: 4 wythes or 17” thick
- East wall: 4 wythes or 17” thick
- Joists: 2.25” x 16” @ 16” o.c.
- Columns: 9.5” x 9.5”
- Girders: 12” x 9.5”

176 Second Avenue North Building (176 building)

The 176 building was reportedly constructed circa 1885. Archaeological evidence suggests that this building was built at the same time as the 174 building because they share a bearing wall. Therefore, this building may have been constructed earlier than stated in archival documents. The building is a simple structure with joists spanning between north and south brick masonry bearing walls that are oriented perpendicular to the Avenue. There is a row of columns and girders running parallel to the masonry bearing walls and centered between these bearing walls. The building is four levels high plus a basement. Following is a description of the structural systems from bottom to top:

Basement
- Foundation walls are composed of cut stone.

First floor
- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 3 wythes or 12.75" thick
- South bearing wall: 5 wythes or 21" thick
- South back wall: 4 wythes or 17" thick
- East wall: 4 wythes or 17" thick
- Columns: Steel (contemporary)
- Girders: Steel (contemporary)
- Joists: not determined

Second floor
- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 3 wythes or 12.75" thick
- South bearing wall: 4 wythes or 17" thick
- South back wall: 4 wythes or 17" thick
- East wall: 4 wythes or 17" thick
- Columns: Steel (contemporary)
- Girders: Steel (contemporary)
- Joists: 3" x 17" @ 16" o.c.

Third floor
- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 3 wythes or 12.75" thick
- South bearing wall: 4 wythes or 17" thick
- South back wall: 4 wythes or 17" thick
- east wall: 4 wythes or 17" thick
- Columns: Steel (contemporary)
- Girders: Steel (contemporary)
- Joists: 2.25" x 16" @ 16" o.c.

Fourth floor
- Masonry bearing walls are composed of molded brick and lime-based mortar. The brick is laid in running bond with a stretcher course at every 6th to 8th course.
- North bearing wall: 3 wythes or 12.75" thick
- south bearing wall: 4 wythes or 17" thick
- South back wall: 4 wythes or 17" thick
- east wall: 4 wythes or 17" thick

- Columns: 9.5” x 9.5”
- Girders: 12” x 9.5”
- Joists: 2.25” x 16” @ 16” o.c.

Conditions Observed

The 170 Building

1. The roof is leaking in numerous areas and the skylights are open to the elements. The building envelope should be secured if the building is to be saved.
2. The east facade was reportedly reconstructed. If so, it was reconstructed using lime mortar. It is the most robust east masonry wall of the four buildings with a large pier supporting the girders at each level. The mortar is in fair condition though some pointing is required. It is apparent that there is water in the wall towards the top of the structure. This is probably related to the poor condition of the roof membrane.
3. The windows of the east facade are in fair to poor condition with wood rot at casings and sills.
4. The north facade facing the courtyard was measured using a laser level to determine if there was out-of-plane deformation. There was a bow of 2.5” at the third level near the center of the wall and 3.25” at the second level near the center of the wall. There is no related cracking indicating that this deformation is old and not caused by the explosion.
5. However, a wall-to-wall measurement comparison with the laser survey indicates that at least some of this bowing is shared with the south bearing wall making the overall bowing lass severe.
6. The north facade facing into the courtyard is the thin being only three wythes or 12.7” thick at the upper two levels. The mortar is in poor shape on the exterior.
7. The brick of the north facade facing the courtyard varies in quality and some of the bricks are decaying, probably due to long-term freeze thaw deterioration.
8. The windows on the north facade facing of the courtyard are in fair to poor condition with wood rot at casings and sills.
9. The brick masonry walls exposed on the interior are in fair condition, and the mortar is in fair condition.
10. The wood framing appears to be in fair to good condition with no observed rotting or infestations.
11. About a 1-inch outward slippage of the joists from their pockets along the north wall facing and the courtyard was observed.
12. Some steel was installed in the front of the building that spans between the bearing walls at the third level. It is not known why the steel was installed.
13. Three columns in the basement near the front of the building have been dislocated or fallen away due to the force of the blast or the consequent collapse.

The 172 Building

It was not possible to conduct a meaningful condition survey of the 172 building because of lack of access, safety concerns, and the aggregate of debris that is still to be removed from the first and second levels. It may not be feasible to reconstruct the building. However, the joists that span between the bearing walls should be left in place for the time being to stabilize the walls on either side until the 170 and 174 buildings are rehabilitated.

The 174 Building

1. The east facade has been substantially reconstructed as the mortar is Portland cement-based and the window sills are composed of cast stone rather than limestone. However, it was noted that the interior side of this wall is laid in lime-based mortar indicating that the wall was refaced rather than reconstructed in total.
2. Tie rods with cast iron anchor plates shaped like five pointed stars have been introduced into the east facade at the third and fourth levels in a haphazard manner. Several of these anchors are not presently sitting tight against the wall.
3. The east facade was measured using a laser level at the fourth level and found to contain no significant deformations.
4. The windows on the east facade were found to be in fair to poor condition with wood rot at casings and sills.
5. It is apparent that the eastern portion of the south façade facing and the courtyard was reconstructed in the past and Portland cement-based mortar was used in the reconstruction. However, lime-based mortar is still present on the interior of the wall indicating that the wall was refaced rather than being reconstructed in total.
6. The south facade facing the courtyard was measured using a laser level to determine if there was out-of-plane deformation. The most extreme bow was measured to be 4.5" at the fourth level followed by 2.75" at the second level. There is no related cracking indicating that this deformation is old and not caused by the explosion.
7. The windows on the south façade are in poor condition with wood rot at casings and sills.
8. The brick masonry walls exposed on the interior are in fair condition and the mortar is in fair condition.
9. There is a crack in the north bearing wall near the east facade. At the first level the crack is vertical but evolves into 2 to 3 cracks on the second third and fourth levels which are diagonal and move outwards toward the northeast corner of the building. The cracking is old and appears to be related to building settlements. It is not related to the recent blast.
10. The floor level this was measured at the third level at the back of the building. This area was chosen because it is a place where the original structural framing is still in place and has not been altered. There is a difference in elevation of more than a 12" between the exterior walls and the interior portion supported by interior columns. These extreme floor dips are caused by differential settlement between the interior columns and between the columns and bearing walls. This condition is not a result of the recent blast.
11. The wood framing appears to be in fair to good condition with no observed rotting or infestations.

The 176 Building

1. There is a disconnected downspout on the east elevation between the 174 16 building. This is a chronic condition and excessive amounts of moss are growing below the downspout. Close up examination revealed that the brick beneath the moss is replacement brick. It is believed that this replacement brick has different porosity characteristics than the bricks on either the 174 or 176 building east facades and this brick promotes moss growth. This replacement brick is an indication that the leaking downspout is a long-term and chronic condition. There is Portland-based repair mortars within and around this replacement brick. There is extreme damage in the basement brickwork directly below where this leakage is been taking place.

2. There is a marked inward bow of the east elevation on the exterior façade that is most noticeable at the fourth level and most pronounced at the south end of the facade.
3. The east facade at the first level has a noticeable inward lean, and there is an opening where the wall meets the floor. It appears that the east wall is moving away from the floor at this level. There are also noticeable cracks that appear to be quite old at the southeast corner. This condition was not caused by the blast.
4. The east wall was measured at the first, second, and third levels to determine if there were deformations. A bow of more than 2.5" was measured near the southeast corner at the first level, a bow of about 2" was measured at the second level, and a bow of about 1 inch was measured at the third level. There was no cracking related to this bowing indicating that the deformation occurred over time and is not related to the recent blast.
5. The windows on the east facade are in fair condition.
6. There are cracks on the south wall at the second, third, and fourth levels that mirror the cracks described on the north wall of the 174 building. It is believed that these cracks are caused by differential settlement.
7. The wood framing appears to be in fair to good condition with no observed rotting or infestations.

Conclusions and Recommendations (*Preliminary*)

The following conclusions and recommendation are preliminary and subject to change based upon laboratory examination and structural analysis.

I have found that the conditions reported by others and observed and documented by me are long standing existing conditions that are not related to the recent blast. Many of these conditions, i.e. wall bowing, wall cracking, differential settlement, were hidden or not noticeable until after the contemporary accretions had been removed. Other conditions such as the long-term damage caused by the lack of a downspout on the east facade of the 174 and 176 buildings is caused by neglect.

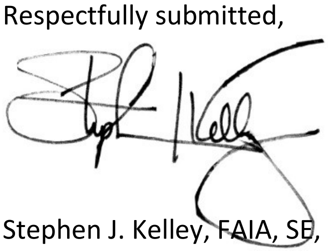
In addition, the recommendations below are based on the understanding of the nature of brick walls laid up with lime-based mortars. Lime mortars differ from contemporary Portland cement-based mortars in that they are autogenous (self-healing). When hairline cracks develop in the mortar, hydrated lime reacts with carbon dioxide in the atmosphere which helps to seal the crack and fill voids in the mortar. Consequently, masonry laid up with lime-based mortars is more flexible than Portland cement-based mortars. That is why older masonry buildings laid up with lime mortars do not crack as readily as contemporary walls. The introduction of expansion joints in contemporary construction became necessary as the construction industry moved away from lime to Portland mortars.

Also, lime mortar is a bedding mortar with good compressive properties but little or no tensile properties. Portland mortars have tensile as well as compressive properties. That is why the demolition contractor found it difficult to find a stopping point in wall demolition working from Second Avenue as they looked for "solid" areas of the wall such as what they would expect with a contemporary brick masonry construction.

With these understandings in mind, here are some preliminary recommendations for rehabilitation of the 170, 174 and 176 buildings.

1. Secure the roof of the 170 building, install a downspout to the ground on the east facade between the 174 and 176 buildings, secure all open skylights, and windows. Continued water leakage will only hasten damage.
2. Place a concrete bond beam at the partially dismantled masonry bearing walls at Second Avenue to consolidate these walls and successfully build on top of them with contemporary masonry and techniques. Second Avenue facades can then be reconstructed using a mixture of salvaged and new materials.
3. Tie back the east walls of the 174 and 176 buildings at each level with lateral steel ties and anchor plates to achieve stability. The anchor plates should be positively connected to horizontally oriented trusses composed of wood or steel that are fastened to the underside of floor joints to create a diaphragm.
4. Construct a masonry pier at the centerline of each of the east walls of the 174 and 176 buildings on the interior side to help carry the floor support girders which are buried in these walls.
5. Place lateral steel ties and anchor plates in the north courtyard facing walls of the 170 building at the second and third floor levels to further stabilize the wall. The lateral ties should run to the opposing masonry bearing wall and can be located within or directly beneath floor joists.
6. The north facade of the 170 building should be “deep” pointed (to a depth of at least one inch) using mortar that is compatible with the existing mortar.
7. Place lateral steel ties in the south courtyard facing wall of the 174 building at the second, third and fourth floor levels to further stabilize the wall. The lateral ties should run to the opposing masonry bearing wall and can be located within or directly beneath floor joists.
8. Reinstall or replace the displaced columns in the basement of the 170 building.
9. Consolidate and repoint the exterior masonry walls on the east, south, and north using mortar that is compatible with the original mortar.

Respectfully submitted,



Stephen J. Kelley, FAIA, SE, FAPT

Curriculum Vitae

Stephen J. Kelley, FAIA, SE, FAPT, FUSICOMOS
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Summary and Expertise

- Stephen J. Kelley is a registered architect and structural engineer in private practice who has devoted these two skills to the preservation of our built cultural heritage.
- With 40 years of experience, his projects range from small to immense, simple to sophisticated and cover a wide range of building materials and systems.
- His award-winning projects are located throughout the United States, but he has also worked on significant projects in Asia, Europe, Africa, Middle East, South America and the Caribbean basin.
- He has developed and worked closely with state-of-the-art multidisciplinary teams that were designed to meet the demand of each project.
- He has published widely on various aspects of preservation and is an educator who has taught at the university level thus sharing his experience with the next generation of preservation professionals.
- With this depth of experience there are few technical challenges that he is not prepared to meet as a leader or as part of a team.

Mr. Kelley is a Fellow of the American Institute of Architects. He has served on the Board of Directors of both the US Committee of the International Council on Monuments and Sites (US/ICOMOS) and the Association for Preservation Technology (APT) and was elevated to Fellowship in both organizations. Mr. Kelley was chair of ASTM E6.24 and was the principal author of *ASTM Standard Guide for Selection of Cleaning Techniques for Masonry, Concrete, and Stucco Surfaces*. He is a UNESCO Tangible Heritage Expert and is Secretary-General of the International Scientific Committee on the Analysis and Restoration of Structures of Architectural Heritage (ISCARSAH).

Education

- **Bachelor of Science in Architecture**, University of Illinois at Urbana-Champaign, June 1976
- **Master of Architecture**, University of Illinois at Urbana-Champaign, June 1978

Registrations

- **Illinois Architect** license # 001-010468 (1983)
- **Illinois Structural Engineer** license # 081-004497 (1983)

Work History

- **Stephen J. Kelley, Inc.**, Oak Park, Illinois, Consulting Architect and Engineer (2015-present)
- **Wiss, Janney, Elstner Associates, Inc.**, Chicago, Illinois, Principal (1984-2014).
- **Philip Prince Architects**, Chicago, Illinois, Design Architect (1982-1984).
- **Gillum Consulting Engineers**, Chicago, Illinois, Design Structural Engineer (1982).
- **Skidmore Owings and Merrill**, Chicago, Illinois, Design Structural Engineer (1978-1982).

Representative Projects

World Heritage Sites

- **Citadelle Laferriere near Cap Haïtien, Haiti (1805-1820).** Heritage architect for condition assessment, seismic stabilization and restoration of Palais Sans Souci**,** Citadelle Laferreiere and Ramiers for UNESCO (2016 - ongoing).
- **Maidan Imam (Imam's Square), Isfahan, Iran (early 17th C.).** Team leader for preparation of Heritage Impact Assessment Report of the UNESCO World Heritage Site impacted by the planned Isfahan Underground Subway (2015).
- **Shwe nandaw Kyaung monastery, Mandalay, Myanmar (1880).** Preservation architect for structural stabilization and restoration of wooden Buddhist monastery for World Monuments Fund, (2014-ongoing).
- **Ani Cathedral (1004) and Surp Prikitch (1037) Armenian Church ruins, Ani, Kars Region, Turkey**. Preservation

Consultant for stabilization and conservation of church ruin for World Monuments Fund (2009, ongoing).

- **Endless Column (1938) Târgu-Jiu, Romania**. Structural consultant for World Monuments Fund for restoration of sculpture designed by Constantin Brancusi for World Monuments Fund (1999).
- **Qasr al-Bint Temple Ruin (4 BCE), Petra, Jordan.** Project manager for the feasibility study to stabilize Nabatean temple ruin at the UNESCO World Heritage Site of Petra for the American Center for Oriental Research (1996).
- **Tserkva Spasa na Berestove (12th, 17th, 18th Centuries), Kyiv, Ukraine** Project coordinator for the development of Historic Structure Report and drawings and specifications for conservation of Byzantine church for the Getty Conservation Institute, *Pechersk Lavra* UNESCO World Heritage Site (1999-2002).
- **Cathedral of the Dormition, Pecharska Monastery Kiev, Ukraine (12th C.).** Preservation consultant to the UNESCO regarding the reconstruction after damage caused in World War II (1999).
- **Save Old Tbilisi Program, Georgia.** US/ICOMOS representative to Tbilisi to consult on preservation of the Betlemi Quarter of Old Tbilisi (2001).
- **Bernardine Convent, Vilnius, Lithuania (16th C).** Preservation consultant for Project Planning of property in historic center for St. John's University, Archdiocese of Vilnius, the Kress Foundation and World Monuments Fund (1995).
- **Kizhi Pogost near Petrozavodsk, Russia (17th-18th C).** Preservation Consultant on structural restoration of the Church of the Transfiguration at UNESCO World Heritage Site (1995-1996).

Religious Structures

- **Choijin Lama Temple Museum (1912), Ulaanbaatar, Mongolia**. Preservation consultant for the condition survey and preparation of a conservation management plan for Buddhist monastery complex has been converted into a museum (2019-ongoing).
- **Tseto Goenpa (15th C), Paro Dzongkhag, Bhutan**. Preservation Architect for rehabilitation and seismic retrofit of secluded monastery constructed of rammed earth and wood for World Monuments Fund (2014-ongoing).
- **St Paul United Methodist Church (1914), Cedar Rapids, Iowa, USA.** Condition assessment for suspended plaster ceiling failure in sanctuary of National Register property designed by Louis Sullivan (2016).
- **St George Anglican Cathedral (1820, 1880-1887), Kingstown, St, Vincent and the Grenadines.** Assessment and repair recommendations for National Trust property for Atlantic Heritage (2016).
- **Holy Trinity Russian Orthodox Cathedral (1903), Chicago, USA.** Restoration architect for structural stabilization and stained glass window and stucco repair of National Register property designed by Louis Sullivan (2016).
- **El Pacha Mosque (1796) Oran, Algeria**. Preservation Consultant to US State Department on seismic stabilization and restoration of historic religious structure in active use (2007).
- **Sha La Ke Buddhist Monastery (10th-12th C), Ganzi Autonomous Region, Sichuan, China**. Preservation Consultant for restoration of Tibetan-style Buddhist Monastery for World Monuments Fund (2007).
- **St. Cecilia's Cathedral (1905-1959), Omaha, USA**. Project manager for investigation and restoration design for the tile roofing, exterior walls, and interior painted surfaces of National Historic Landmark (2003-2010).
- **New Jerusalem Monastery (1666), Istra, Russia.** Preservation Architect for the development of a Master Plan for Restoration of historic Church of the Resurrection for World Monuments Fund (2003-2010).
- **Prešov Workshop, Prešov, Slovakia.** Team Leader to develop a master plan to restore 28 Slovak and 4 Polish 17th to 19th Century log churches, World Monuments Fund (2003).
- **Basilica of St. Adalbert (1911), Grand Rapids, Michigan, USA**. Project manager for investigation and restoration for the tile roofing, exterior facade, and stained glass windows of landmark church (2002-2008).
- **Holy Family Church (1860, 1866-1868), Chicago, USA.** Project manager for investigation and restoration of exterior masonry and structural systems of National Historic Landmark (1997-2001).
- **Old St. Patrick's Church (1856), Chicago, USA.** Project manager for condition assessment and design for repair of structural systems in historic landmark church (1995).
- **Condition Survey of Twenty Historic Chicago Churches, USA.** Project manager for Historic Structure Report preparation for historic churches representing a variety of materials and building types including All Saints Episcopal, Church of the Epiphany, First Presbyterian, Second Presbyterian, Lakeview Presbyterian, Kenwood United Church of Christ, Old St. Patrick's Church, Our Lady of Peace, St. Ita, and Uptown Baptist (1993).

Monuments and Archaeological Sites

- **Temple of Jupiter Colonnade (1st C ACE), Baalbek, Lebanon.** Preservation Consultant to UNESCO on proposed conservation work on Roman ruin (2018, ongoing).

- **Mren Cathedral (6th C) near Karabağ, Kars Region, Turkey**. Preservation Consultant for stabilization and conservation of Armenian Church ruin for World Monuments Fund (2015, ongoing).
- **Gateway Arch, Jefferson National Expansion Monument (1965), Saint Louis, USA.** Project manager for investigation of stainless steel exterior of 603 foot catenary arch monument designed by Eero Saarinen (2006 - 2014).
- **Zi Mo Tower (14th Century), Ganzi Autonomous Region, Sichuan, China**. Preservation Consultant for restoration of Tibetan-style 13-cornered finger tower for World Monuments Fund (2007).
- **Jefferson Davis Monument (1917-1922), Fairview, Kentucky, USA.** Project manager for the diagnosis for restoration of the 355-foot-tall unreinforced concrete monument (1999).

Disaster Response and Assessment

- **2015 Gourka Earthquake, Nepal.** Technical consultant for damage assessments of built cultural heritage in the Kathmandu Valley following the devastating earthquake for World Monuments Fund (2015-ongoing)
- **Wangdue Phodrang Dzong Wangdi, Bhutan (1638)**. Leader of technical team to assess the damage to and develop restoration strategies for the fire damaged castle for US/ICOMOS (May 2013).
- **2013 Typhoon Haiyun and 2013 Bohol Earthquake, Philippines.** Tangible immovable heritage expert for damage assessments of built heritage following two natural disasters on the islands of Bohol, Cebu, Lehte and Samar for UNESCO (2013-2014)
- **2012 Hurricane Sandy, New York and New Jersey, USA.** Project manager for damage assessment of 19 properties in Queens and Brooklyn, New York City; Long Island; and New Jersey that were damaged due to surge, flooding and wind from Hurricane Sandy (2012).
- **Maison Dufort, Port-au-Prince, Haiti (1912).** Preservation consultant for seismic retrofit of mansion in the Gingerbread House Historic District (2012-2015).
- **2010 Haiti Earthquake, Port-au-Prince, Haiti.** Technical consultant for assessment of damage to 200 Gingerbread houses in the historic district following the Earthquake for ICOMOS and World Monuments Fund (2010).
- **2009 Bhutan Earthquake.** Technical consultant for assessment of damage to the Trashigang Dzong, the Drametse Goemba and several Phajoding Lhakhangs for World Monuments Fund (2010).
- **2005 Hurricane Katrina, Gulf Coast, USA.** Project manager for damage assessment of more than 140 religious properties along the Gulf Coast that were damaged by wind, surge and flooding due to Hurricane Katrina (2005-2006).
- **Macedonia Shaketable Project in Skopje, Macedonia.** US Principal Investigator in conjunction with the Smithsonian Institute and the University of Saints Cyril and Methodius (1997 to 2000).
- **Fire, Wind and Tornado Damage, USA.** Project manager for assessments of more than 30 religious properties since 1985 in California, Illinois, Iowa, Kentucky, Minnesota, Nebraska, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, Vermont, Virginia, Tennessee, Washington, and Wisconsin (1985-ongoing).
- **West Baden Springs Hotel (1899), West Baden Springs, Indiana, USA.** Project manager for investigation and emergency stabilization of National Historic Landmark after partial collapse (1995).
- **1993 Mississippi River Basin Flooding, USA.** Team leader to assess more than 200 properties in historic river towns in Iowa, Illinois, Missouri, and Indiana that were devastated by the record-breaking flooding for the National Trust for Historic Preservation (1993-1994).

Governmental Buildings

- **Douglas County Courthouse (1912), Omaha, Nebraska USA.** Project Architect for restoration of the murals below the rotunda. (2017)
- **Allen County Courthouse (1902), Fort Wayne, Indiana, USA.** Condition assessment of cast iron rotunda framing and development of repairs. (2017)
- **Oklahoma State Capitol (1914-17), Oklahoma City, USA.** Project advisor for the comprehensive investigation for the restoration of the exterior facade and Historic Preservation Specialist for the interior restoration of National Historic Landmark. (2014-2020)
- **Tangier American Legation Museum, Tangier, Morocco (1821-1931).** Project manager for preparation of Historic Structure Report (2010) and design of structural stabilization of the Pavilion Arabe (2014) for US Department of State.
- **Eisenhower Executive Office Building (1868-1884), Washington DC, USA.** Historic Preservation Specialist for Design-Build Team to restore the interior of Second Empire Style National Historic Landmark. (2003-2012).
- **Nebraska State Capitol (1922-1932), Lincoln, USA.** Project architect for the comprehensive investigation, consultant for the restoration of the exterior facade and roofs and interior restoration of National Historic Landmark designed by

Bertram Goodhue. (1996-ongoing)

- **Kentucky State Capitol (1907), Frankfort, USA***.* Historic Preservation Consultant on the preparation of Historic Structures Report, Master Plan, and restoration of the terra cotta dome of National Historic Landmark. (1996-2001)
- **Illinois State Capitol (1868-1884), Springfield, USA***.* Project manager for preparation of Historic Structure Report and continued preservation consulting for National Historic Landmark. (1999-2011)
- **Georgia State Capitol (1888), Atlanta, USA.** Project manager for investigation of the façade and appropriate cleaning techniques for National Historic Landmark. (1998)

Skyscrapers

- **Tribune Tower Building (1925), Chicago, USA**. Project manager for the investigation, cleaning, and restoration of the facades of National Historic Landmark skyscraper. (1989-2007).
- **Reliance Building (1895), Chicago, USA.** Project manager for investigation, cleaning, and restoration of terra cotta facades and windows of National Historic Landmark skyscraper. (1994-1996)
- **Hard Rock Hotel (Carbide and Carbon Building) (1929), Chicago, USA.** Project advisor for investigation, cleaning, restoration, and window restoration of terra cotta clad National Historic Landmark skyscraper (1997-2005).
- **Midcontinent Tower (1917, 1983), Tulsa, USA.** Project manager for investigation and restoration of terra cotta facades and windows of National Historic Landmark skyscraper. (1991-2011)

Honors and Awards

- UNESCO Asia-Pacific Awards for Cultural Heritage Conservation, Award of Merit for the rehabilitation of the Tseto Goenpa in Paro, Bhutan (2019).
- Invited Resource Person to the *International Symposium on the Seismic Retrofit of Unreinforced Masonry Heritage Churches in the Philippines*, National Museum, Manila, January 2016.
- Elevated to American Institute of Architects (AIA) College of Fellows (2015).
- Invited participant to the *Experts' Conference on the Restoration of Selected Heritage Structures in Cebu and Bohol*, Philippines, November 2014.
- General Services Administration Award In Recognition of Outstanding Contribution to Excellence in Federal Design, Eisenhower Executive Office Building in Washington DC (2014).
- Named UNESCO Tangible Heritage Expert to UNESCO (2013).
- Winner-Restoration, North American Copper in Architecture Awards, Basilica of St Adalbert Domes restoration, Grand Rapids, Michigan (2013).
- Craftsmanship Award Winner, Special Construction Category, Washington Building Congress, for cast iron repair and restoration at the Eisenhower Executive Office Building (2012).
- Restoration Award for the preservation of the Scoville Park World War I Memorial Oak Park Historic Preservation Commission (2011).
- President of ICOMOS symposium, "Development or a Return to the Art of Building," at 17th ICOMOS General Assembly in Paris, France (2011).
- Preservation Award, Heritage Nebraska, for the outstanding historic preservation of the exterior of the Nebraska State Capitol (2011).
- Nebraska Preservation Award, Nebraska State Historical Society, for significant achievement in the preservation of the State Capitol (2011).
- Community Service Award, Park District of Oak Park, Illinois (2010).
- Outstanding Preservation Partner Award for consultations on the Industrial Arts Building by Heritage Nebraska (2010).
- President's Award for "Expertise & Advocacy on the Industrial Arts Building" by the Preservation Association of Lincoln (Nebraska) (2010).
- Keynote Speaker, Structural Analysis of Historical Constructions (SAHC08) Conference, Bath, United Kingdom (July 2008).
- Elevated to United States Committee of the International Council on Monuments and Sites (US/ICOMOS) College of Fellows (2008).
- Invited participant, Preserve America Summit hosted by Laura Bush, New Orleans, LA (October 2006).
- ABC/WMC Construction Awards Program, Award of Excellence in the Historical Renovations Category, Basilica of St Adalbert in Grand Rapids, MI (2006).
- City of Chicago, Chicago Landmarks Award for Preservation Excellence, Marquette Building. Facade restoration and

cleaning (2006).

- Building Owners and Managers Association (BOMA) Office Building of the Year Award in the Historical Building Category, Rehabilitation of facade and windows of 135 South LaSalle Building in Chicago following a fire (2006).
- Structural Engineers Association of Illinois (SEAOI) Award of Merit, Restoration of the cornice of the Marquette Building, Chicago, IL (2005).
- Excellence in Masonry, Illinois Indiana Masonry Council, Silver Award, Exterior Restoration of the Hard Rock Hotel (Carbide and Carbon Building) Chicago, IL (2004).
- Friends of Downtown Awards, Best Restoration Project, Hard Rock Hotel (Carbide and Carbon) Chicago, IL (2004).
- Midwest Construction Best of Awards, Project of the Year - Renovation/Rehabilitation, Hard Rock Hotel (Carbide and Carbon), Chicago, IL (2004).
- Driehaus Award, Outstanding Rehabilitation, Hard Rock Hotel (Carbide and Carbon Building), Chicago, IL (2004).
- ICRI Award of Excellence, Historic Repair of Jefferson Davis Monument, Fairview, KY (2004).
- Midwest Construction Best of Awards, Award of Merit - Renovation/Rehabilitation, Holy Family Church Steeple Restoration, Chicago, IL (2003).
- Louisiana Preservation Alliance Special Award, Restoration of the Antioch Baptist Church, Shreveport, LA (2001).
- AIA Nebraska Chapter Restoration Award, Restoration of St Cecelia's Cathedra, Omaha, NE (2001).
- Commissioned a "Kentucky Colonel" by Paul E. Patton, Governor of KY (2001).
- Kentuckiana Masonry Institute, Restoration of the Dome of the Kentucky State Capitol, Frankfort, KY (2000).
- Excellence in Masonry, Illinois Indiana Masonry Council, Honorable Mention, Exterior Restoration of the Reliance Building, Chicago, Illinois, IL (1999).
- Invited participant in the "Workshop on the Tower of Pisa" by the Italian Ministry of Culture in Pisa, Italy (July 1999).
- Elevated to Association for Preservation Technology (APT) College of Fellows (1998).
- Excellence in Masonry, Illinois Indiana Masonry Council, Honorable Mention, Exterior Restoration of the Tribune Tower, Chicago, IL (1996).
- Richard H. Driehaus Foundation Preservation Award, Exterior of the Reliance Building, Chicago, IL (1995).
- Richard H. Driehaus Foundation Preservation Award, Holy Family Church Exterior Restoration and Structural Stabilization, Chicago, IL (1994).
- CSI Chicago Chapter Award for Technical Contributions, WJE speaker contributions (1998).
- City of Evanston Restoration Award, Merrick Garden Fountain Restoration, Evanston, IL (1989).
- City of Aurora Mayor's Award, Restoration of Fourth Street United Methodist, Aurora, IL (1988).

Professional Activities

- Secretary-General, International Scientific Committee on the Analysis and Restoration of Structures of Architectural Heritage (ISCARSAH) (2017-2020)
- Vice President, ISCARSAH (2014-2017)
- President, ISCARSAH (2008-2014)
- Officer of the ICOMOS Scientific Council (2008-2011).
- Board of Directors, Association for Preservation Technology (2003 to 2007)
- Chairman, APT Outreach and Partnerships Committee (2003 to 2007)
- Board of Directors, Unity Temple Restoration Foundation (Architectural Restoration Committee), Oak Park (2003 to 2005)
- US Representative to the ICOMOS International Scientific Committee on the Analysis and Restoration of Structures of Architectural Heritage (ISCARSAH), (1997 to present)
- Board of Directors and Executive Committee, US/ICOMOS (1997 to 2003)
- Recording Secretary, ASTM E06, Building Construction (1996)
- Chair, ASTM E06.24, Building Preservation and Rehabilitation Technology (1988 to 1998)
- Board of Directors, Landmarks Preservation Council of Illinois (1994 to 2000)
- Chair, Landmarks Preservation Council of Illinois Fund Committee (1994 to 1998)
- Oak Park Historic Preservation Commission (1990-1994)

Teaching Experience

- Professor, Smithsonian Iraqi Institute Course, "Fundamentals of Heritage Conservation," the Iraqi Institute for the

Conservation of Antiquities and Heritage (2019-ongoing).

- Visiting Lecturer, Universitat Politècnica de Valencia, School of Architecture, Valencia, Spain on Building Diagnostics (October 2019).
- Adjunct Associate Professor of Architecture, Columbia University School of Architecture, Planning and Preservation, New York, NY, A6418 Condition Surveys, New York, NY (2015-2016).
- Instructor, APT Workshop, Preservation Engineering: Principles and Practice in the Assessment and Treatment of Heritage Structures, Quebec City, Quebec (October 2014).
- Instructor and Developer, APT Taliesin Workshop, Diagnosing Existing Buildings, Spring Green, WI (June 2012).
- Adjunct Professor, School of the Art Institute Historic Preservation Graduate Curriculum, Chicago, IL, HPRS5012 Building Diagnostics Spring Semester (2007 to 2011).
- "A Philosophy for Preservation Engineers," *Preservation Engineering Workshop, APT2004 Conference*, Galveston, TX (November 2004).
- University of Minnesota, Continuing Education Seminar, "Cathodic Protection Systems in Historic, Masonry-Clad, Steel-Framed Buildings (December 2003).
- RESTORE Workshop on Terra Cotta, Seattle, Washington (April 2001).
- RESTORE Workshop on Cleaning of Facades, Stanford University (October 2000).
- RESTORE Workshop on Terra Cotta, Chicago Intercontinental Hotel, Chicago (May 1999).
- Lectures on Architectural Conservation of Recent Heritage; ICCROM Conservation of Architectural Heritage/Historic Structures International Refresher Course (ARC 98); Rome (June 1998).
- "Curtain Walls and Claddings: Design, Installation, Diagnosis, Maintenance and Repair;" 2 Day Executive Training Course for the Real Estate Construction Centre, Singapore and Kuala Lumpur, Malaysia (May 1998).
- "Preserving 20th Century Curtain Walls – A One Day Workshop," co-sponsored by Simon Fraser University, DOCOMOMO BC, and the British Columbia Ministry of Small Business, Tourism and Culture; Vancouver, BC (December 1997).
- "Curtain Wall Workshop," development and primary instructor of workshop for the National Park Service and presented at the Windows II Conference, Washington DC (February 1997).
- "Conservation of Wood Structures," March 1996; "History, Diagnosis, and Repair of the Curtain Wall," May 1995; "Technical Consulting at the Kizhi Pogost World Heritage Site," April 1995; "Analysis of Cleaning Techniques at the Chicago Tribune Tower," April 1994; "Preservation Technology, January 1993, January 1992, October 1992, and April 1992; "Investigation and Analysis of Historic Structures," November, 1990; "Assessment Techniques Utilized with Historic Buildings," June, 1989; and "Restoration of the Tribune Tower," October 1989. University of Illinois Department of Architecture, Graduate Program, Champaign-Urbana.
- Adjunct Professor for Building Pathology Class, Spring semester 1994. School of the Art Institute of Chicago Historic Preservation Curriculum.
- "Mitigation Response to Flooding of Historic Structures along the Mississippi River," development of curriculum of instruction for the National Trust for Historic Preservation, 1994.
- "Maintenance of Religious Properties," development and presentation of full-day workshop for Inspired Partnerships, Chicago, Illinois, April 1991.
- "Assessment Techniques Utilized with Historic Highrises," development and presentation of curriculum for the Association for Preservation Technology International, Annual Conference, Chicago, Illinois, September 1989.

Publications

Provided upon request.