Arrington Mannor

Evaluation of the Structural Framing and Facade

2225 College Street
Columbia, South Carolina 29205

FINAL REPORT

October 11, 2024

WJE No. 2024.5543

PREPARED FOR:

SCAHI Fernwood, LLC
c/o Brinshore Development, L.L.C.
1603 Arlington Avenue, Suite 450
Evanston, IL 60201

PREPARED BY:

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CONTENTS

INTRODUCTION

On October 8, 2024, Wiss, Janney, Elstner Associates, Inc. (WJE) performed an evaluation of the facade and structural framing of the Arrington Manor, affordable housing high rise residential building, part of the Columbia Housing Authority. The purpose of the investigation was to assess the condition of the exterior walls and structural framing visible from the interior spaces. This report is an update to the original report issued by WJE on December 18, 2023, following the condition assessment of the exterior walls and structural framing on October 24, 2023. This report summarizes observations during the investigation and findings and provides recommendations for repairs. WJE report dated December 12, 2023, is included as Appendix B to this report

BACKGROUND

Document Review

Three sets of drawings were available for our review:

1. Original design drawings titled "Arrington Manors, FHA Project Number 054-44021-LDI, Columbia, South Carolina, 29205" by Maynard Pearlstine/William Anderson, AIA Architects/Planners, Columbia, South Carolina, dated August 5, 1970.
2. Drawings for remodeling titled "Arrington Manor Renovations, Columbia, South Carolina, Project No. SC-002-019" by Carlisle Associates, Architects, Engineers, Columbia, South Carolina, dated December 7, 1979.
3. Drawings for remodeling of the elevators titled "Arrington Manor Elevator Renovation" by Carlisle Associates, Architects, Engineers, Columbia, South Carolina, dated Novembre 5, 1998.
4. WJE field survey documents from October 2023 including notes from made exploratory openings and WJE report dated December 18, 2023.

Description of Structure

The Arrington Manor, 6-story residential building was constructed circa 1971. The building is about 52 years old. In plan, the building has a rectangular shape with overall dimensions of 144 feet and 4 inches by 55 feet. The building is bound by parking lots to its north and west elevations, with Oak Street to its east and the College Street to its south. The main entrance to the building is located to its south elevation. Plan view of the building is shown in Figure 1.

Community rooms, property manager's office, mechanical room, laundry room and three apartment units are located on the first floor. There are 58 apartment units in the building total, typically 11 apartment units per floor from second through sixth floor. The size of apartment units varies from studio to two bedrooms. Plan view of the first floor is shown in Figure 2 and plan view of the typical residential floor in Figure 3.

The building has two elevator shafts. The central one was part of the original construction. The second one was added in 1979 at the west elevation of the building. The building has two stairways. One is located at the west end of the building and one to the east end. Both are accessible from the corridor that is present at each level of the building.

Building elevations are show in Figure 4 and Figure 5.

Exterior Walls

Exterior walls of the building are constructed with 8-inch wide (one-wythe) and 12-inch long hollow masonry units. The north and south exterior walls oriented in the east-west direction are load bearing while the walls oriented in the north/south direction are not (Figure 6).

The exterior walls of the west elevator shaft comprise of 8-inch-wide concrete masonry block units (CMU) and 4-inch-wide brick cladding.

Four types of aluminum single hung punched through windows with insulating glass are present on the north, east and south elevations. Asbestos cement boards are present at windows on the north and south elevation at the first floor. Steel window lintels above windows comprise of two steel angles positioned back-to-back. Steel window lintels are bricked off with 4-inch-wide soldier bricks on their exterior side.

A/C units are present at each bedroom at second through sixth floor, and in office, community rooms and apartments on the first floor. They penetrate the north and south exterior walls and are covered on the exterior side with metal louvers. Embedded steel lintels are present above A/C units. They comprise of two steel angles.

Exhaust ducts, in pairs of two, with louver covers, three brick long and four brick courses high, penetrate exterior walls, at each floor, at five locations on the south wall and at four locations on the north wall.

Sheet metal canopies over the wood framing are present above door entrances on the north and south elevations.

Structural Framing

The structural framing of the building, in an addition to 8-inch-wide masonry bearing walls, also consists of 8-inch wide CMU bearing interion walls, parallel to the bearing exterior walls in the east-west direction. These two interior walls create a five-foot-wide corridor in the middle portion of the building that extends from the east to the west end of the building. Concrete masonry block walls were designed to have reinforced bond beam above each opening, bond beam below bearings of the composite floor decks and joists, and cells to be filled with 3,000 psi concrete and reinforced as per the schedule shown on structural drawings depending on the floor level.

Floor slabs in corridors are a 5-inch-thick composite slabs, consisting of concrete slab reinforced with wire mesh cast over steel corrugated deck.

Steel open web bar joists, 12-inch-deep span between the interior and exterior bearing walls in the north-south direction at 24 inches on center, and support 2 ½ inch thick composite deck reinforced with wire mesh. At locations where steel joist bear on the walls, the masonry units at exterior walls are solid and at CMU walls there are reinforced bond beams and solid brick.

Two, 8-inch-wide, CMU shear walls positioned in the north-south direction are present at thirds of the building length.

Framing in both stairways is comprised of steel channels, steel risers and steel treads filled with concrete, and composite deck landings. Steel channel framing is bearing on the adjacent bearing brick masonry and CMU walls.

Roof

Roof of the building comprises of insulated steel metal deck that spans over the steel joists bearing on the north and south exterior walls and interior corridor walls. The roof deck is waterproofed with a white PVC membrane.

FIELD INVESTIGATION

WJE field investigation in 2024 consisted of a visual survey of the exterior walls from the roof and grounds using binoculars and a visual survey of interior surfaces and structural framing at all floors at select apartment units and common areas.

Visual Survey Inside the Building

Out of 58 apartment units, 15 of them (26 percent) were visually surveyed. Apartment units 101, 201, 206, 208, 303, 305, 308, 403, 404, 410, 501, 507, 510, 511 and 605 were inspected. Common area rooms on the first floor were also surveyed. All our observations were documented with notes and photographs. The significant observations are as follow:

1. Unit 201 –Mildew staining is present on the west partition wall (Figure 7).
2. Unit 208 - Water stains were observed around the window (Figure 8) and at the interior corner of the portion CMU wall (Figure 9).
3. Unit 303 – Water staining is present adjacent to repaired area at the bathroom’s ceiling (Figure 10).
4. Unit 404 – New water stains are present adjacent to repaired ceiling area in the bathroom (Figure 11).
5. Hallway at 4th floor – Water damage was observed on the south wall of the hallway (Figure 12).
6. Unit 410 - Drywall above the window has a water damage (Figure 13).
7. Unit 501 – New water damage is present adjacent to the repaired ceiling in the bathroom (Figure 14).
8. Unit 502 – Water staining was observed at the ceiling along the exterior wall (Figure 15). Water damage is present above the bedroom window (Figure 16).
9. Hallway at 5th floor - Step crack is present in the CMU wall (Figure 17).

Visual Survey of Exterior Walls

The significant observations are as follows:

1. Cracking of brick masonry and significant corrosion build up was observed at embedded steel lintels above A/C sleeves on the east end of the north elevation (Figure 18). Masonry wall between windows and A/C units has visible corrosion stains. This is the only portion of the building where A/C sleeves are positioned directly below the windows.
2. Significant staining at brick masonry was present towards the east end of the north elevation below A/C sleeves. This staining trickle from the third floor down to the ground level and water is infiltrated electrical room through the exterior wall (Figure 19).

3. Asbestos cements boards are present on the ground floor windows on the north and south elevations.
4. Sealant around all windows is deteriorated.
5. Sealant around all A/C louver covers is deteriorated.
6. Grouted infill between door frame and adjacent brick masonry is cracked on one side of the door at the mechanical room on the ground level.
7. Deteriorated sealant was observed at perimeter joints between canopies and brick masonry wall on both north and south elevations.
8. Hairline cracks are present in mortar joints.
9. Window frames at several locations on the east end of the north elevation appeared distorted out of plane, pushed inward above bottom sash.

Roof

The roofing membrane is overall in good condition except for several areas where the open seams are present. The following conditions were observed:

1. Open seams are present at the northeast and northwest corners.
2. Debonded edge of the PVC roof membrane was observed in the southeast corner.
3. Water is ponding along the midline of the roof away from the roof drains.
4. Sealant at the top of the termination bar around the west elevator enclosure is debonded.

DISCUSSION OF FINDINGS

Distress conditions observed during this 2024 condition assessment are very similar to conditions observed in 2023. The conditions on the exterior walls did not worsen since last year's inspection.

As during the last year inspection, this year's inspection shows that the water damage observed inside the building appears to come from two sources. The first source are leaks coming from kitchens and bathrooms drainpipes. The second source of water infiltration is from the exterior, through one wythe exterior masonry walls, and through failed sealant in joints around windows and around A/C sleeves.

Damaged ceilings below drains in bathrooms and kitchens were repaired numerous times and it appears that leak issues were never fully addressed and are reoccurring. The leaking drains have caused deterioration of the composite floor slabs.

The exterior one-wythe ungrouted walls are very prone to water infiltration, as was evident in several units and electrical room. Water infiltrates the wall cavities through partially filled mortar joints and cracks on the facade, through cracked sealant present around all windows and cracked sealant around A/C unit sleeves. The exterior walls are also getting moisture from draining water out of A/C unit weeps.

The sealant present around windows and A/C unit sleeves is cracked, and poorly installed. The window frames were placed snug in wall openings without leaving a space for compressible joint filler to be installed that would minimize the air and water leakage. Several windows appeared to be distorted out of plane, as they were deflected inward along the top line of bottom sash.

Sealant installed over the bottom leg of the A/C steel lintels cannot accommodate drainage of water.

A/C unit drainage system is causing staining of the facade and keeping exterior walls wet.

Roof

Although no roof leaks were reported or observed, the noted open seams and failed sealant at the roofing membrane might provide a path for a water intrusion underneath the membrane and cause the leaks.

RECOMMENDATIONS

No repairs recommended in the 2023 report were addressed in a meantime. The 2024 repair recommendations are the same as proposed in 2023. To structurally repair deteriorated composite floor slabs and steel joist ends and prevent water infiltration that can accelerate further deterioration of the building, the following repairs are recommended.

Interior of Building

1. Remove drywall from ceilings from first to fifth floor to expose plumbing and composite floor slabs. Remove drywall from interior side of the exterior walls where leaks are present to verify condition of steel joist ends.
2. Repair plumbing, deteriorated sections of the composite floor slabs and repair end of corroded joists. This work may also require removal of the bathtubs, toilets, and kitchen cabinets to access those areas, installation of new ones and installation of new drywall.
3. After exterior wall repairs are completed, repair drywall around leaking windows in areas of walls where deteriorated or where mold has formed.
4. Repair bearing of stair stringer in the east stairway.
5. Repair corroded underside of composite landings in the west stairway.

Exterior Walls

1. Two options for the restoration of the exterior walls should be considered:
   a. Option 1 - All four facade walls should be considered for recladding to provide a water barrier facade system. Depending on the new type of facade recladding system, replacement of windows will most likely be required as well as A/C sleeves and louvers and exhaust duct covers. Replacement of exterior doors will also be needed. Our recommendation is to replace the windows so that adequate air and water seals could be installed in those joints.
   b. Option 2 - If recladding of exterior walls due to budgetary restraints is not doable, applying a water barrier coating and replacement of all exterior sealant should be considered to a minimum to minimize water infiltration into the exterior walls and around all windows and window lintels. Repointing of select mortar joints and cracks will be required prior to installation of water barrier coating.
2. Replace deteriorated steel lintels at windows and A/C units at the east end of the north elevation where corrosion build up is present at approximately 10 windows and 15 A/C units.
3. Tops of the canopies should be painted and resealed.
4. All asbestos cement boards at windows should be replaced with a different material.

Roof

Open membrane seams and failed sealant in termination bar joints at the roofing membrane should be addressed as soon as possible to prevent potential leaks. The roof membrane inspection should be set up annual bases as part of the regular maintenance. At that time, any new formed distress could be addressed.

TIMMING OF REPAIRS

Composite deck is deteriorating and may become unsafe if remained unrepaired and water infiltration continues to be an issue.

The repairs should be done simultaneously on both the interior and the exterior of the building as soon as possible as the budget allows to prevent water infiltration. All soffits inside all interior spaces should be removed to fully access the condition of the plumbing and composite decks, so that structurally deteriorating areas could be repaired. Drywall should also be removed from the interior side of the exterior walls to access and inspect condition of steel joist bearing ends and to perform repairs if needed. If repairs of the joist bearings ends are needed in the exterior wall the best approach would be to have those areas accessible from both inside and outside.

The facade and interior repairs should be targeted to be completed by the end of 2025.

Distress in roofing membrane should be addressed as soon as possible. Annual inspection of the roof should be scheduled as part of the regular maintenance.

CONCLUSIONS

The water damage observed inside the building may affect structural capacity of the building elements due to constant exposure to moisture. Implementation of the recommended repairs will address water infiltration, structurally restore deteriorated floor decks and steel joists, and extend the service life of the structure.

The next step in the repair process is to engage the architect to develop an architectural design for the retrofit of the interior spaces and retrofit of the exterior walls. Following the architectural redesign of the facade, if the recladding option is considered, the proposed redesign should be reviewed by the structural engineer to verify that the existing exterior walls can sustain potential additional loads from newly added facade cladding. If additional strengthening of the structure is required, those repairs should be incorporated with the recommended ones above.

Thank you for the opportunity to provide engineering service for the condition assessment of this building. We look forward to continuing to work with Brinshore Development LLC. If you have any questions, please contact us.

APPENDIX A. FIGURES

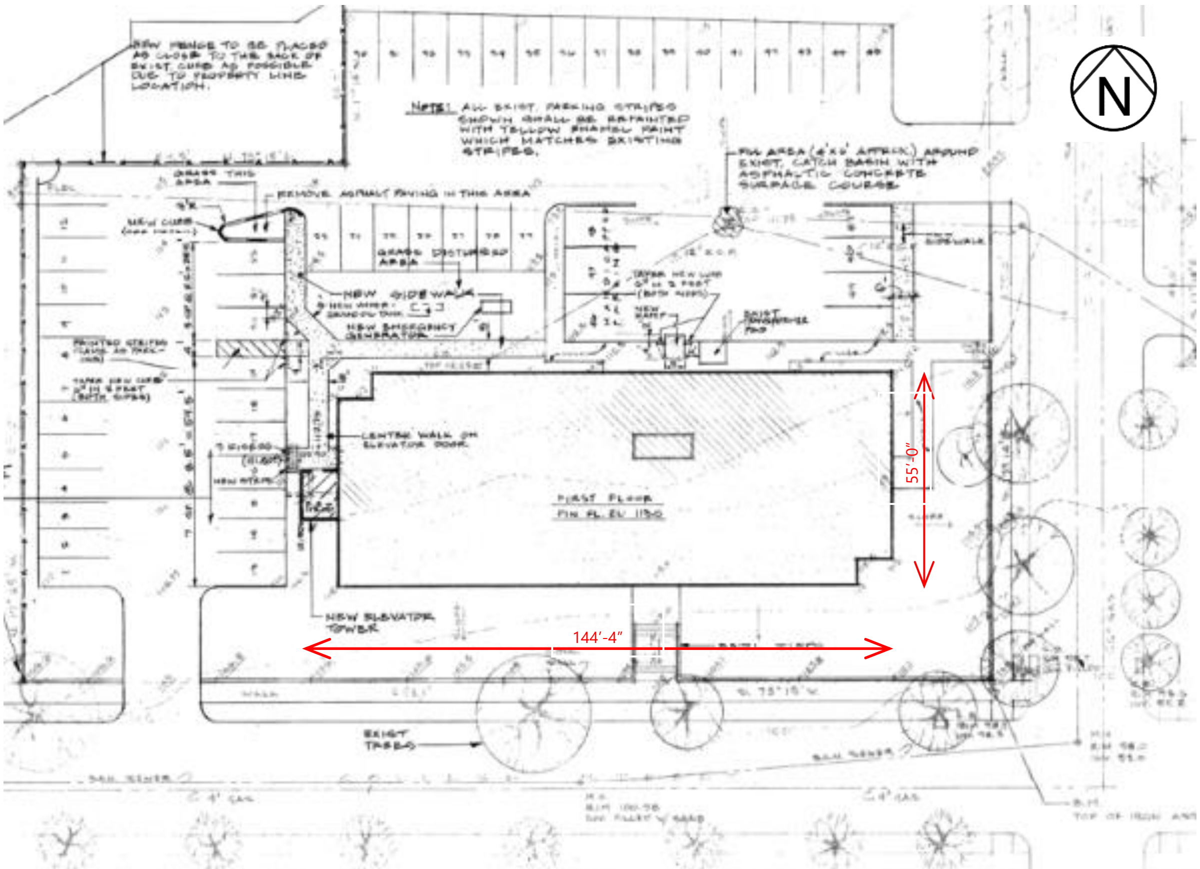

Figure 1. Plan view of Arrington Manor building located at 2225 College Street in Columbia, South Carolina

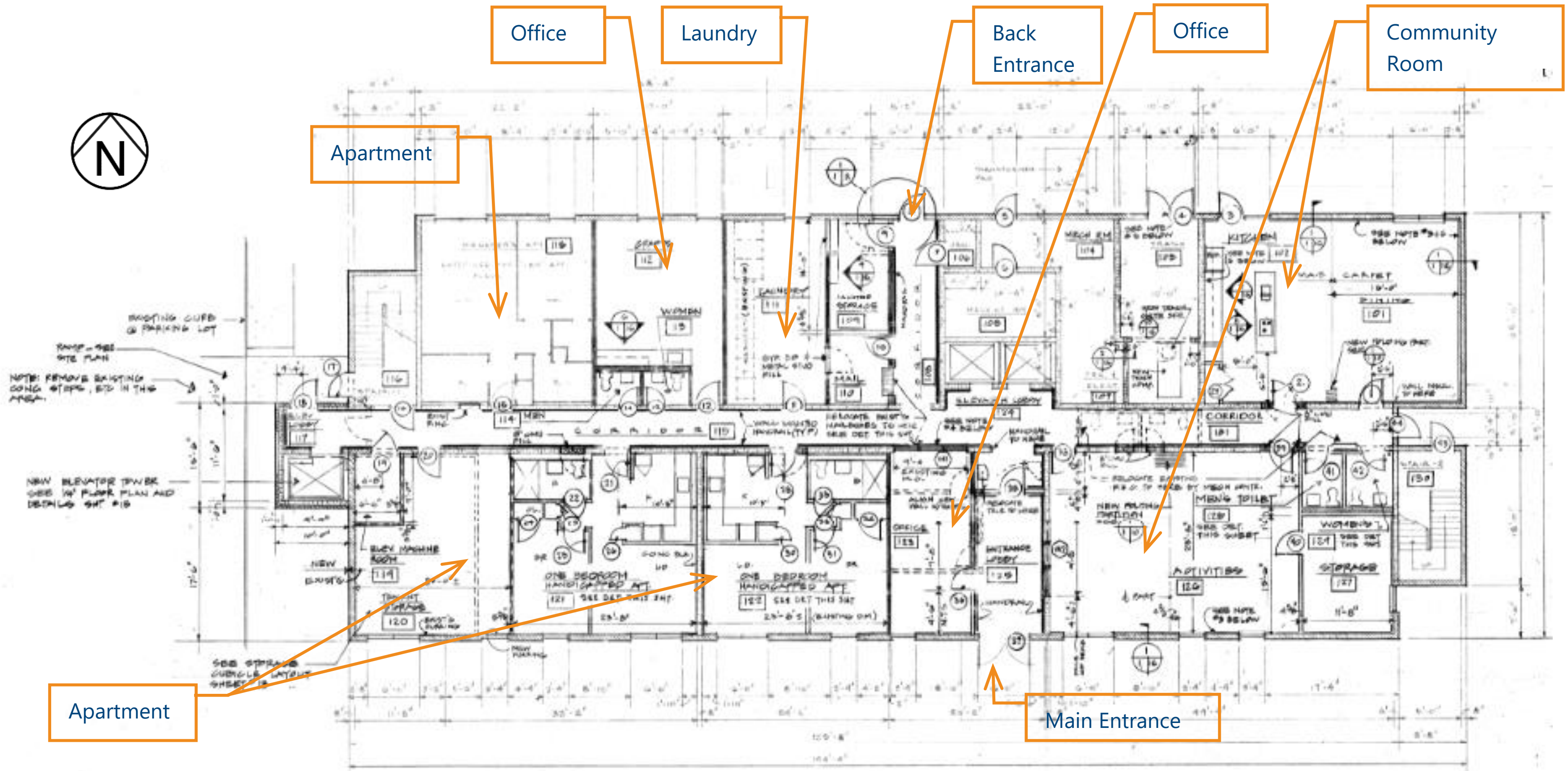

Figure 2. Plan view of the first floor

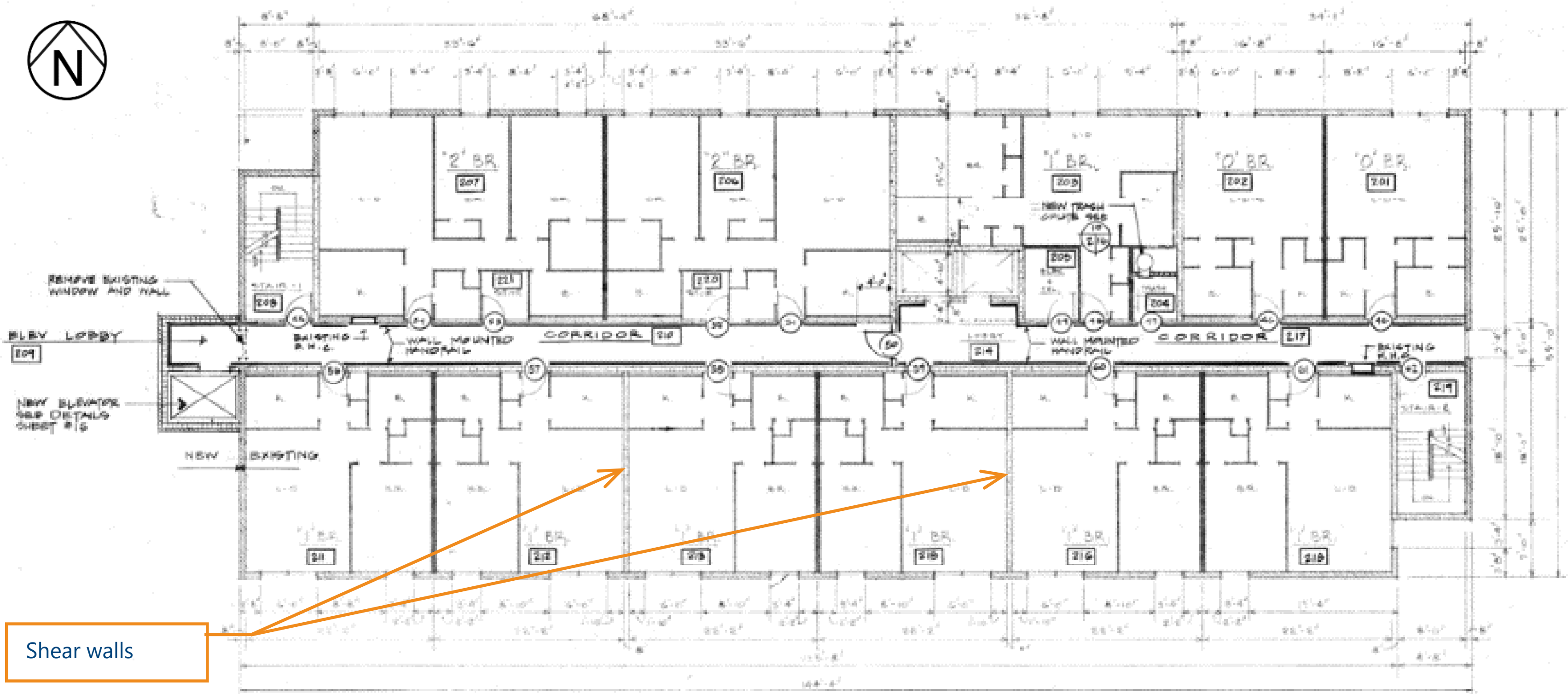

Figure 3. Typical residential floor plan, second through sixth floor

Figure 4. North elevation

Figure 5. Partial south elevation

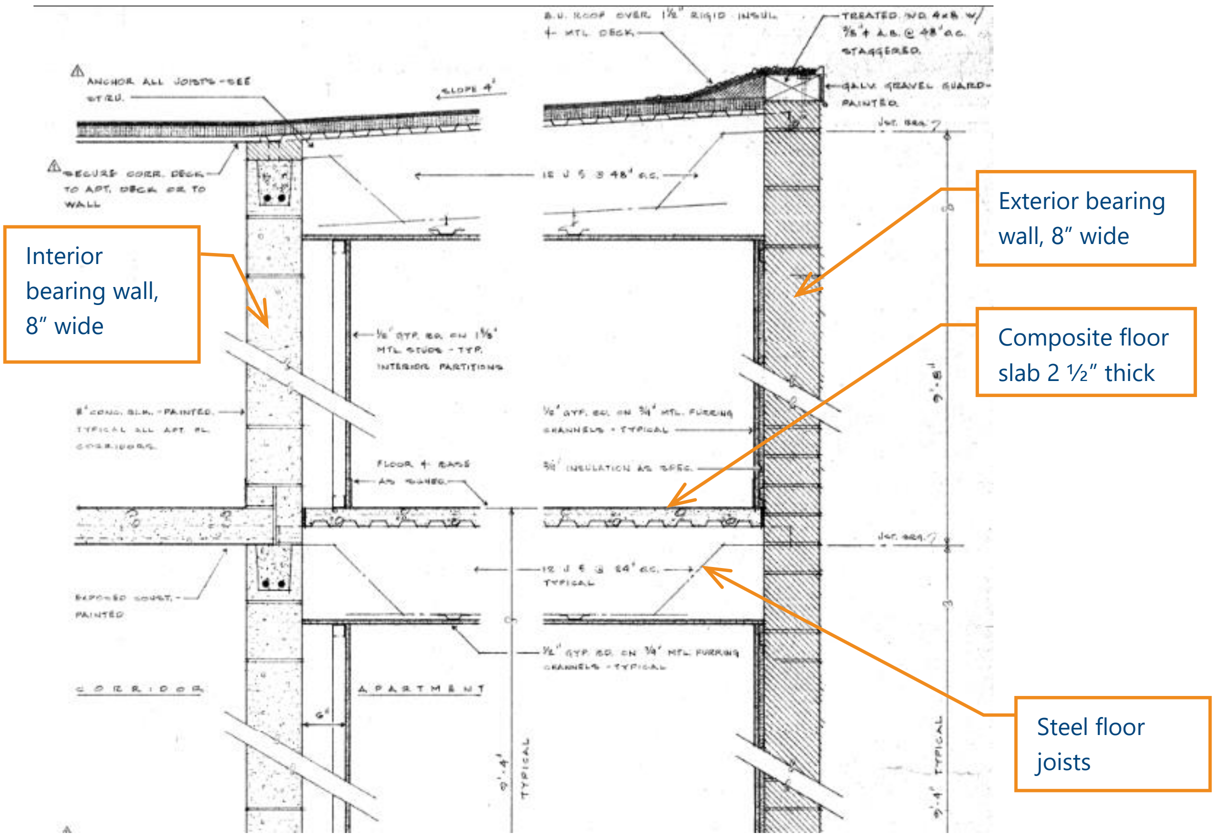

Figure 6. Section (north-south direction) through the exterior and interior bearing walls

Figure 7. Area of mildew developing on the wall, Unit 201

Figure 8. Water damage at the base of the window, Unit 208

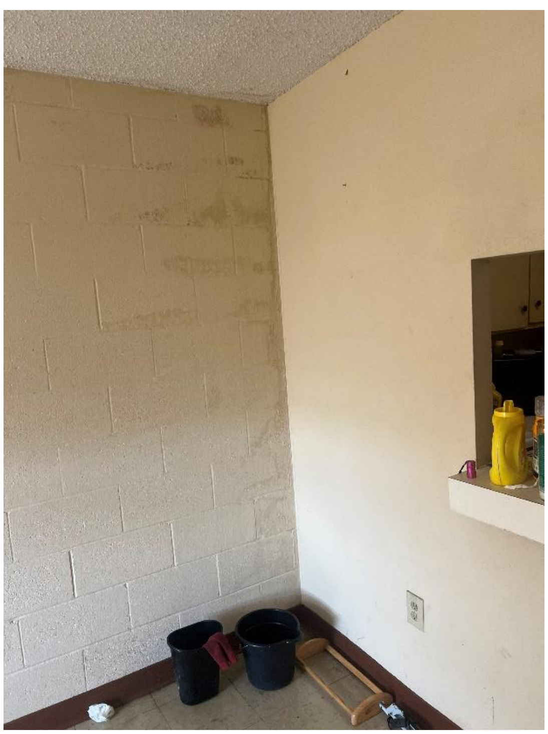

Figure 9. Water damage at the interior corner of the CMU partition wall

Figure 10. Water staining is present adjacent to repaired area at the bathroom's ceiling, Unit 303

Figure 11. Water staining is present adjacent to repaired area at the bathroom's ceiling, Unit 404

Figure 12. Water damage in the wall at fourth floor hallway

Figure 13. Water damage above the window in Unit 410

Figure 14. New water leak adjacent to the repaired area of the bathroom ceiling, Unit 501

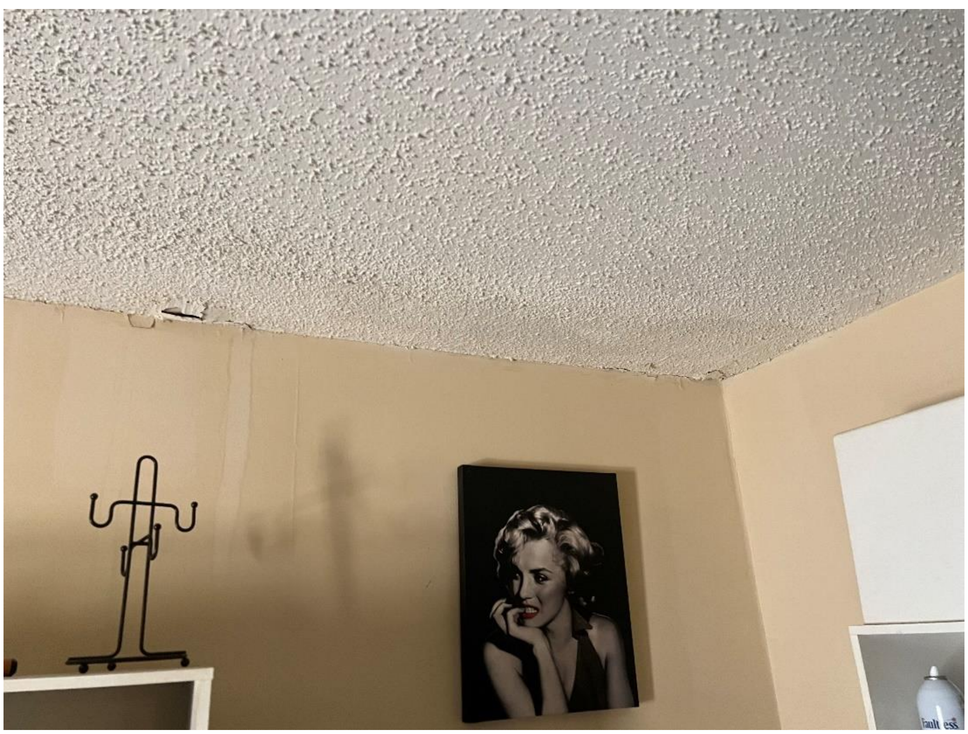

Figure 15. Stains from water leak along the edge of the ceiling against the exterior wall, Unit 502

Figure 16. Water damage present above the bedroom window, Unit 502

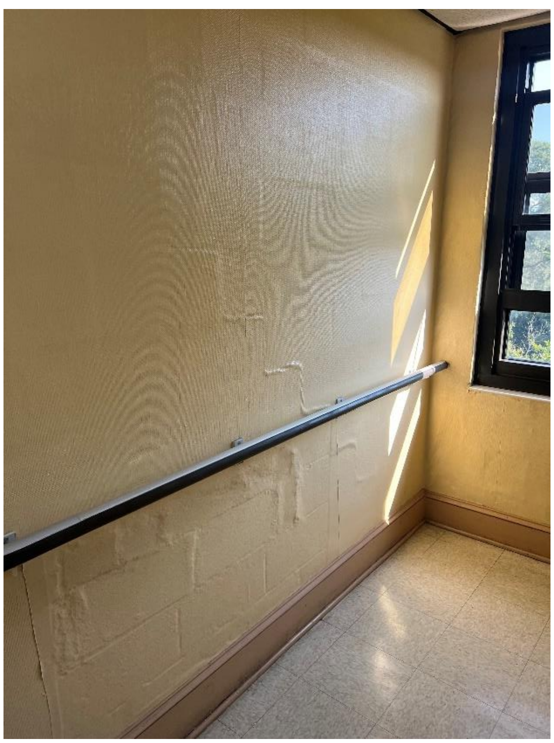

Figure 17. Step crack in the CMU wall at fifth floor hallway

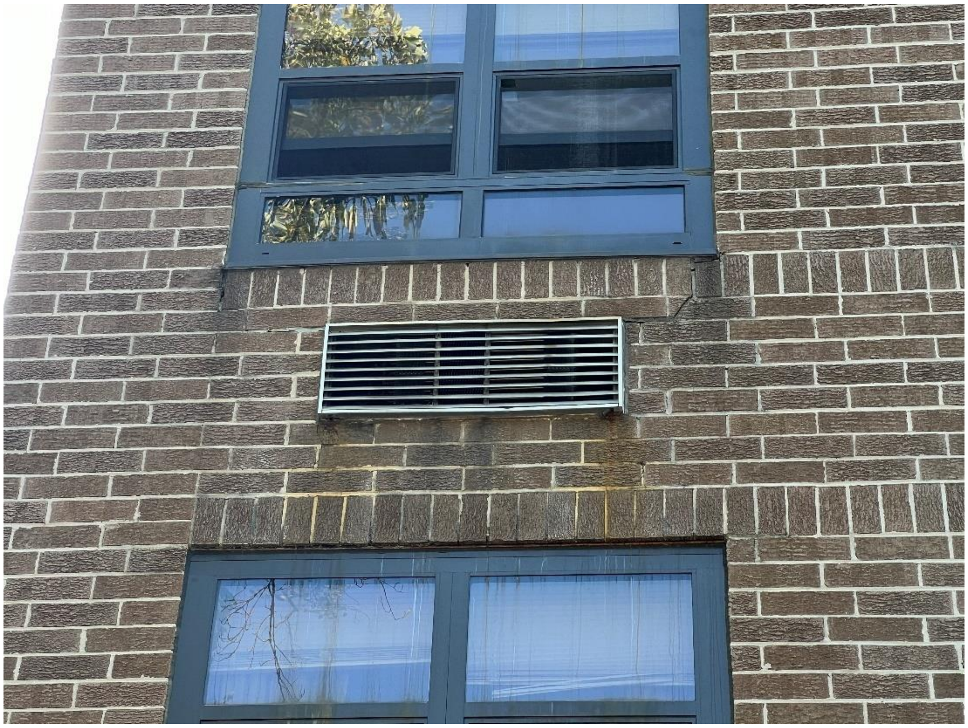

Figure 18. Cracks in brick masonry and corrosion build up at embedded steel lintels above A/C sleeves on the east end of the north elevation

Figure 19. Staining at brick masonry at the east end of the north elevation below A/C

APPENDIX B. WJE REPORT DATED DECEMBER 18, 2023

WJE

Arrington Mannor

Evaluation of the Structural Framing and Facade

2225 College Street
Columbia, South Carolina 29205

FINAL REPORT

December 18, 2023

WJE No. 2021.2141

PREPARED FOR:

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INTRODUCTION

On October 24, 2023, Wiss, Janney, Elstner Associates, Inc. (WJE) performed an evaluation of the façade and structural framing of the Arrington Manor, affordable housing high rise residential building, part of the Columbia Housing Authority. The purpose of the investigation was to assess the condition of the exterior walls and structural framing visible from the interior spaces. This report summarizes observations during the investigation and findings and provides recommendations for repairs.

BACKGROUND

Description of Structure

The Arrington Manor, 6-story residential building was constructed circa 1971. The building is about 52 years old. In plan, the building has a rectangular shape with overall dimensions of 144 feet and 4 inches by 55 feet. The building is bound by parking lots to its north and west elevations, with Oak Street to its east and the College Street to its south. The main entrance to the building is located to its south elevation. Plan view of the building is shown in Figure 1.

Community rooms, property manager's office, mechanical room, laundry room and three apartment units are located on the first floor (Figure 2). There are 58 apartment units in the building total, typically 11 apartment units per floor from second through sixth floor (Figure 3). The size of apartment units varies from studio to two bedrooms.

The building has two elevator shafts. The central one was part of the original construction. The second one was added in 1979 at the west elevation of the building. The building has two stairways. One is located at the west end of the building and one to the east end. Both are accessible from the corridor that is present at each level of the building.

Building elevations are show in Figure 4, Figure 5 and Figure 6.

Exterior Walls

Exterior walls of the building are constructed with 8-inch wide (one-wythe) and 12-inch long hollow masonry units. The north and south exterior walls oriented in the east-west direction are load bearing while the walls oriented in the north/south direction are not (Figure 7).

The exterior walls of the west elevator shaft comprise of 8-inch-wide concrete masonry block units (CMU) and 4-inch-wide brick cladding (Figure 8).

Four types of aluminum single hung punched through windows with insulating glass are present on the north, east and south elevations (Figure 9). Asbestos cement boards are present at windows on the north and south elevation at the first floor (Figure 10). Steel window lintels above windows comprise of two steel angles 2L 3 ½ x 3 ½ x1/4 for 3 feet-4-inch-wide openings and 2L 6 x 3 ½ x1/4 for 6 feet wide openings. Steel angles are positioned back-to-back. Steel window lintels are bricked off with 4-inch-wide soldier bricks on their exterior side.

A/C units are present at each bedroom at second through sixth floor, and in office, community rooms and apartments on the first floor. They penetrate the north and south exterior walls and are covered on the exterior side with metal louvers. Embedded steel lintels are present above A/C units. They comprise of two steel angles.

Exhaust ducts, in pairs of two, with louver covers, three brick long and four brick courses high, penetrate exterior walls, at each floor, at five locations on the south wall and at four locations on the north wall.

Sheet metal canopies over the wood framing are present above door entrances on the north and south elevations.

Structural Framing

The structural framing of the building, in an addition to 8-inch-wide masonry bearing walls, also consists of 8-inch wide CMU bearing interion walls, parallel to the bearing exterior walls in the east-west direction. These two interior walls create a five-foot-wide corridor in the middle portion of the building that extends from the east to the west end of the building. North-south section through the building is shown in Figure 7. Concrete masonry block walls were designed to have reinforced bond beam above each opening, bond beam below bearings of the composite floors decks and joists, and cells to be filled with 3,000 psi concrete per the following schedule:

- Around all openings in the walls 16" horizontally up to the bond beam
- Solid below the first floor
- First to second floor: 16 inches at 24 inches on center
- Second to third floor: 16 inches at 32 inches on center
- Third to fourth floor: 16 inches at 40 inches on center
- Fourth to fifth floor: 16 inches at 48 inches on center
- Fifth to sixth floor: 16 inches at 8 feet on center
- Sixth floor to roof: 16 inches at 16 feet on center.

Floor slabs in corridors are a 5-inch-thick composite slabs (Figure 7 and Figure 11). The composite deck consists of concrete slab reinforced with 6x6x4/4 wire mesh cast over steel corrugated deck.

Steel open web bar joists, 12-inch-deep span between the interior and exterior bearing walls in the north-south direction at 24 inches on center, and support 2 ½ inch thick composite deck reinforced with 6x6x10/10 wire mesh. At locations where steel joist bear on the walls, the masonry units at exterior walls are solid and at CMU walls there are reinforced bond beams and solid brick.

Two, 8-inch-wide, CMU shear walls positioned in the north-south direction (Figure 12) are present at thirds of the building length at its south half as shown in Figure 2 and Figure 3.

Framing in both stairways is comprised of 12C10.6 steel channels, steel risers and steel treads filled with concrete, and composite deck landings. Steel channel framing is bearing on the adjacent bearing brick masonry and CMU walls.

Roof

Roof of the building comprises of insulated steel metal deck that spans over the steel joists bearing on the north and south exterior walls and interior corridor walls. The roof deck is waterproofed with a white PVC membrane.

Document Review

Three sets of drawings were available for our review:

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3. Drawings for remodeling of the elevators titled "Arrington Manor Elevator Renovation" by Carlisle Associates, Architects, Engineers, Columbia, South Carolina, dated Novembre 5, 1998.

Repair History

Based on the available documents the restoration of kitchens, electrical and replacement of windows took place in circa 1980. At that time, the west elevator tower was added.

During our investigation we observed that exterior door at mechanical room was widened. It is possible that this took place in circa 1999 along with renovation of the central elevator.

The PVC roof appears to be of a newer date. But no records about this replacement were available.

Numerous repairs were done in the kitchen and bathroom ceiling drywalls, and around A/C units where leaks were reported over the years. We were informed that flooding took place on the fifth floor several years ago. The water from the fifth floor at that time caused water damage on all floors below. Some of the ceiling repairs were done due to that unfortunate event.

Some sealant repairs were done on the exterior side of windows at select locations, typically on the ground level.

FIELD INVESTIGATION

WJE field investigation consisted of a visual and close-up survey of the exterior walls from the roof, grounds, and boom lift, a visual survey of interior surfaces and structural framing at all floors at accessible areas, four exploratory openings at the exterior walls, and scanning of the masonry walls with a metal detector to verify the presence of wall ties.

Visual Survey Inside the Building

Out of 58 apartment units 15 of them (26 percent) were visually surveyed. Typical structural framing was visible by removing suspended ceiling tiles on the first floor and at several other areas where drywall at ceiling was damaged. All our observations were documented with notes and photographs. The significant observations are as follow:

1. Corrosion of the metal deck and section loss were observed in the composite deck at four locations at both north and south community rooms at the east end of the building at the first floor. Three locations were around floor drainpipes close to the corridor (Figure 13). Those locations were overlapping with bathrooms and kitchens at the floor above. The fourth location was observed at the south east corner (Figure 14). At all four locations surface corrosion was observed on the steel joist directly below deteriorated decks. No active leaks were present at those drains. At two locations old water stains were visible on ceiling tiles.
2. Water damage on the drywall was observed at the east window at the office on the east end of the building (Figure 15) at the first floor.
3. Water is infiltrating the top of the mechanical room through the exterior west wall at the ground level (Figure 16). At this location electric conduit is penetrating the wall.
4. Water damage was observed at the base of both bathroom walls in the west portion of the corridor at the first floor.
5. Water damage was observed in the ceiling of each bathroom from the second through fifth floor. Typical observed condition is shown in Figure 17. Damaged areas were typically at locations directly above bathtub drains and toilets.
6. Water damage was observed in the ceiling of each kitchen from the second through fifth floor. Typical observed condition is shown in Figure 18.
7. In many kitchens cabinets areas below sinks have stains from water leaks (Figure 19).
8. Deteriorated concrete floor slab was observed inside the kitchen where the water heater tank is stored, Unit 305 at the third floor.
9. Water damage around windows was observed in Units 101, 206, 303, 305, 307 (Figure 20).
10. Water damage was observed in the drywall at walls and ceilings adjacent to the exterior wall in Units 101, 102, 205, 206, 218, 307, 404 and 410 (Figure 21). Water damage was observed in the ceiling of Unit 508 approximately two feet inside the unit from the exterior wall. The metal deck visible from the hole in the celling was corroded (Figure 22).
11. Water damage was observed in the drywall around A/C units in Units 100, 205, 218, 303, 307, 404 and (Figure 23).
12. Mold on the walls and ceiling was observed in the bathroom of Unit 101, on the bedroom walls in Unit 201 (Figure 24) and in the bedroom walls in Unit 303. In Unit 201 mold was also present on the drywall covering the exhaust duct installed along the ceiling (Figure 25).
13. Step cracks were observed in the shear CMU walls in Units 307 and 510. At both locations cracks had a width of hairline.
14. Horizontal cracks in drywall above windows were observed in many units. In Unit 201 the crack wide and drywall above window appeared distorted out of plane.
15. Vent duct in the mechanical room adjacent to the laundry room is bearing on improvised support (Figure 26).
16. Surface corrosion staining was observed on the underside of the steel stringers supporting west stairway landings at their southeast corners on the second, fourth and fifth floors (Figure 27). Surface

corrosion was also observed on the steel channel at the midfloor landing on the second floor that abuts the exterior wall. At those locations end of the composite metal deck is starting to corrode.

17. Spalled brick masonry is present below the steel stinger bearing in the east stairway at mid landing between the first and the second floor (Figure 28). The paint was peeling off the steel members in that corner and very minor rust staining has started to form.
18. Daylight could be seen at the exit door threshold on the ground level at the west stairway.
19. Paint on the top of the canopies has been peeled of, exposing remains of the previous paint coats.

Visual Survey of Exterior Walls

The significant observations are as follows:

1. Cracks is brick masonry were observed at one location above and around the A/C sleeve at the west part of the north elevation at the first floor (Figure 29). Embedded steel lintel angle above A/C unit is corroded and joint around it has widened. The sealant in joints around A/C is deteriorated.
2. Significant corrosion build up was observed at steel window lintels (Figure 30) and at embedded steel lintels above A/C sleeves (Figure 31) at the east end of the north elevation. Masonry wall between windows and A/C units has visible corrosion stains. This is the only portion of the building where A/C sleeves are positioned directly below the windows.
3. Significant staining at brick masonry was present towards the east end of the north elevation where A/C sleeves are positioned below the portion on the windows (Figure 16). Weeps present at the bottom of the A/C sleeves are draining the condensed water which drains onto the wall and windows below them (Figure 32). The metal plate, gutter like, was installed to redirect the water from above the second-floor window. The staining in that areas is the worst at the first, second and third floors.
4. Mild corrosion staining was present at masonry exterior wall typically below all A/C units.
5. Asbestos cements boards are present on the ground floor windows on the north and south elevations.
6. Sealant around all windows is deteriorated (Figure 33).
7. Sealant around all A/C louver covers is deteriorated (Figure 34).
8. Grouted infill between door frame and adjacent brick masonry is cracked on one side of the door at the mechanical room on the ground level.
9. Mortar in joints was debonded from the brick and appeared eroded at select locations (Figure 34).
10. Deteriorated sealant was observed at perimeter joints between canopies and brick masonry wall on both north and south elevations (Figure 35).
11. Window frames at several locations appeared distorted out of plane, pushed inward above bottom sash (Figure 36).

Roof

The roofing membrane is overall in good condition except for several areas where the open seam's are present. The following conditions were observed:

1. Debonded edge of the PVC roof membrane was observed in the southeast corner (Figure 37).
2. Water is ponding along the midline of the roof away from the roof drains.

3. Open seams are present at the northeast and northwest corners (Figure 38).
4. Sealant at the top of the termination bar around the west elevator enclosure is debonded (Figure 39).

Exploratory Openings

Four exploratory openings at exterior walls were made during our inspection. All four openings were made at the north elevation at the ground level. All three openings were closed the same day. The following was observed:

- Opening #1 – The location of this opening was selected based on present vertical cracks in brick masonry towards the west end of the north elevation (Figure 29 and Figure 40). The single wythe brick masonry unit was removed partially as it broke off. The masonry unit was hollow. The unit was not fully set in mortar bed. One inch of the face of joists were filled with mortar in both head and bed joints. The rest of the joints had voids. Mortar appeared soft to the touch (Figure 41).
- Opening #2 – Soldier brick masonry was removed directly above the steel window lintel to expose the flashing. The flashing was not shown on design drawings. The painted steel window lintel bearing 8 inches on the brick masonry was exposed. The PVC type of flashing was wrapped over the lintel (Figure 42). No end dam was present at the end of the flashing. The steel lintel was in good condition.
- Opening #3 – Portion of the sealant was removed from the cove joint between the window frame and masonry wall at the westmost window on the north elevation at the first floor (Figure 43). Sealant was deteriorated. After the sealant was removed it was revealed that windows frame was installed snug against the brick masonry, leaving no room for compressible joint filler to be installed inside the joint. The sealant present in cove joint could be easily pulled off. It was failing both cohesively and adhesively when tried to be remove. It appeared that no surface preparation of the substrate was done or bond breaker tape installed prior to its installation.
- Opening #4 - Portion of the sealant was removed from the joint between the A/C sleeve and brick masonry at the level of the embedded steel lintel (Figure 44). Sealant at the joint was deteriorated. Exposed steel lintel behind it was corroded and had a significant corrosion built up causing jacking of the brick around it.

Metal Detector Survey

Metal detector was used to scan exterior walls of the west elevator tower to identify wall ties between the CMU back us wall and exterior brick cladding as shown on the drawings. No wall ties could be identified.

DISCUSSION OF FINDINGS

During the inspection of the exterior walls, WJE noted several conditions that caused water infiltration inside the Arrington Manor building through exteriors. Some of those were rerated due to single-wythe wall construction, some due to corrosion of the steel windows lintels causing further distress in the masonry at select locations and some due to failed joint sealers.

The structural floor composite decks are compromised at locations where water infiltration from exterior and interior water leaks is an issue. The following sections provide further details concerning the identified areas requiring repairs.

Interior of the Building

The water damage observed inside the building appears to come from two sources. The first source are leaks coming from kitchens and bathrooms drainpipes. At these places, the source of leaks appears to be leaking drainpipes from bathtubs, toilets and kitchen sinks. Damaged ceilings below these drains were repaired numerous times and it appears that leak issues were never fully addressed and are reoccurring. Water damaged ceilings in those areas were observed in every inspected apartment from the first through the fifth floor. As could be observed from the first floor, the leaking drains have caused deterioration of the composite floor slabs. At these locations, the corrugated metal deck was corroded, concrete deteriorated, and at some locations entire section of the slab was missing. Corrosion was also observed at bearing end of steel joists at those locations.

The second source of water infiltration is from the exterior, through one wythe exterior masonry walls, and through failed sealant l joints around windows and around A/C sleeves. The one-wythe un-grouted walls are very prone to water infiltration, as was evident in several units and mechanical room. Water infiltrates the wall cavities through partially filled mortar joints and cracks on the façade, through cracked sealant present around all windows and cracked sealant around A/C unit sleeves. The exterior walls are also getting moisture from draining water out of A/C unit weeps.

The most concerning water infiltration was observed inside the Units 201, 205 303 where besides the damage in the drywall mold has started to develop on the walls. Those units are in the areas on the north elevation where on the outside of the wall, A/C units have caused the most staining on the exterior from water drainage out of weeps. Moisture infiltrating interior side of the wall through exterior can also cause corrosion of the steel joist bearing ends and composite floor slab along those edges. This condition was observed at the ground level on the southeast corner of the building where the ceiling could be removed.

To fully access the extent of corrosion of composite floor slabs, the drywall from ceilings and walls should be fully removed, and the slab should be surveyed. Based on the observed conditions, it is to be expected that composite deck may deteriorate around very bathroom and kitchen drainpipe from the second through fifth floor. Deteriorated composite floor slabs present a compromised structural condition and should be schedule to be repaired within next one to two years.

Leaks from the bathrooms were observed at several landings in the west stairway that are directly adjacent to them. At those locations, corrosion was observed on the underside of the composite metal decks. Corroded underside of the landings should be repaired. If left as is, the corrosion will progress and cause further damage of the slab and steel framing below them.

Compromised bearing of the girder observed at one location is a structural issue and should be repaired.

Exterior Walls

The one-wythe un-grouted walls are prone to water infiltration especially if the masonry units were not set in fully grouted bed and head mortar joints. Voids in these mortar joints observed, as observed - at exploratory opening, can allow for even faster water migration through the wall.

Exploratory openings made at window lintel revealed no presence of end dams. The configuration of the existing flashing accommodates for water to travel down their ends into the open wall cavities.

The sealant present around windows and A/C unit sleeves is cracked, and poorly installed. The window frames were placed snug in wall openings without leaving a space for compressible joint filler to be installed that would minimize the air and water leakage. Several windows appeared to be distorted out of plane, as they were deflected inward along the top line of bottom sash.

Steel window and A/C lintels at the east portion of the north elevation have substantial corrosion build up. As the steel corrodes it creates expansive forces that cause pushing of the adjacent mortar and brick masonry and ultimately create distress in form of cracking in the masonry wall around them. Interior walls at those locations were observed to have more extensive water damage.

These exterior walls, if not reclad or, at a minimum, coated with a moisture barrier coating to prevent water infiltration, will continue to leak, causing extensive water damage inside the building and further corrosion of the embedded steel window lintels. There is a significant difference in cost impact between recladding of the exterior walls versus coating them with a moisture barrier. Recladding of the building will be more expensive, more durable, and esthetically more pleasing option. This option will most likely require replacement of all windows and exterior doors. Depending on a type of a reclad system, structural analysis to determine the capacity of ungrouted exterior walls will most likely be needed to determine their capacity to sustain new loads. The option of coating the building with a moisture barrier, will be less costly, less durable and esthetically less pleasing. Its life expectancy is about 10 to 15 years. Prior to installation of the moisture barrier coating, the exterior wall will need to be repointed where joints are eroded or cracked. Sealant in all joints around windows, doors and A/C sleeves would need to be replaced with new.

Sealant installed over the bottom leg of the A/C steel lintels cannot accommodate drainage of water although the flashing is present. This has caused water to continuously accumulate on the shelf angle and cause it to corrode.

A/C unit drainage system is causing significant staining of the facade and keeping exterior walls wet. The A/C sleeves should be reconfigured with new weeps to drain water away from the walls. This will most likely result in replacement of louver covers as well.

Exhaust duct vent covers appear to allow for water to infiltrate the building interior around their covers. Sealant present around those covers has deteriorated and should be replaced with new.

Cancer causing asbestos boards are present on the ground level windows. This presents a health hazard and those boards should be removed and replaced with a different material.

Cracked mortar fill around mechanical room doors allows for water infiltration into the building. Cracked mortar should be replaced with new.

Attempt to remove the corrosion stains from the masonry walls caused by A/C/ water drainage to improve its esthetics might cause damage to the masonry if harsh chemicals are used. The mockups should be performed prior to making such decision. They will help understand what can be realistically achieved and if it is even worth doing it. Corrosion stains are typically very difficult to be removed.

Roof

Although no roof leaks were reported or observed, the noted open seams and failed sealant at the roofing membrane might provide a path for a water intrusion underneath the membrane and cause the leaks. Observed distress should be repaired as soon as possible to avoid their worsening and potential leaks.

RECOMMENDATIONS

To structurally repair deteriorated composite floor slabs and steel joist ends and prevent water infiltration that can accelerate further deterioration of the building, the following repairs are recommended.

Interior of Building

1. Remove drywall from ceilings from first to fifth floor to expose plumbing and composite floor slabs. Remove drywall from interior side of the exterior walls where leaks are present to verify condition of steel joist ends.
2. Repair plumbing, deteriorated sections of the composite floor slabs and repair end of corroded joists. This work will also require removal of the bathtubs, toilets, and kitchen cabinets to access those areas, installation of new ones and installation of new drywall.
3. Repair drywall around leaking windows in areas of walls where deteriorated or where mold has formed after exterior wall repairs are completed.
4. Repair bearing of stair stringer in the east stairway.
5. Repair corroded underside of composite landings in the west stairway.

Exterior Walls

1. Two options for the restoration of the exterior walls should be considered:
   a. Option 1 - All four façade walls should be considered for recladding to provide a water barrier facade system. Depending on the new type of façade recladding system, replacement of windows will most likely be required as well as A/C sleeves and louvers and exhaust duct covers. Replacement of exterior doors will also be needed. Our recommendation is to replace the windows so that adequate air and water seals could be installed in those joints.
   b. Option 2 - If recladding of exterior walls due to budgetary restraints is not doable, applying a water barrier coating and replacement of all exterior sealant should be considered to a minimum to minimize water infiltration into the exterior walls and around all windows and window lintels. Repointing of select mortar joints and cracks will be required prior to installation of water barrier coating.
2. Replace deteriorated steel lintels at windows and A/C units at the east end of the north elevation where corrosion build up is present at approximately 10 windows and 15 A/C units.
3. Tops of the canopies should be painted and resealed.
4. All asbestos cement boards at windows should be replaced with a different material.

Roof

Open membrane seams and failed sealant in termination bar joints at the roofing membrane should be addressed as soon as possible to prevent potential leaks. The roof membrane inspection should be set up annual bases as part of the regular maintenance. At that time, any new formed distress could be addressed.

TIMMING OF REPAIRS

Considering that most of distressed conditions listed above are caused by water infiltration from the exterior walls and windows or due to water leaks from the bathrooms and kitchens inside the building, they will continue if not addressed. The living conditions due to water leaks in the building are unsanitary and in addition to that, deteriorated composite deck is structurally compromised at areas of constant leaks and will become unsafe if remained unrepaired and continues to leak.

The repairs should be done simultaneously on both the interior and the exterior of the building as soon as possible as the budget allows to prevent water infiltration from various sources. If this approach gets elected, the work should start at the upper floors first and work downward. If the building cannot be fully vacant during the construction, two consecutive floors should be worked on at the same time. All soffits inside all spaces should be removed to fully access the condition of the plumbing and composite decks, so that structurally compromised areas could be repaired. Drywall should also be removed from the interior side of the exterior walls to access and inspect condition of steel joist bearing ends and to perform repairs if needed. If repairs of the joist bearings ends are needed in the exterior wall the best approach would be to have those areas accessible from both inside and outside.

The facade and interior repairs should be targeted for 2024 and 2025.

Distress in roofing membrane should be addressed as soon as possible. Annual inspection of the roof should be scheduled as part of the regular maintenance.

CONCLUSIONS

The water damage observed inside the building caused unsanitary living conditions and has compromised the structural capacity of the building elements due to constant exposure to moisture. Implementation of the recommended repairs will address water infiltration, structurally restore deteriorated floor decks and steel joists, improve the sanitary conditions in the building and extend the service life of the structure.

To prevent water infiltration through single wythe exterior walls, two options should be considered, full façade reclad option or installation of moisture barrier coating. If recladding of the façade option is elected, depending on the type of the new facade cladding, a supplemental structural analysis will be needed to determine if the existing exterior walls can provide structural support for the new cladding or if supplemental strengthening of the walls will be needed. This option will most likely require the replacement of all windows, A/C sleeves and exterior doors. Both options for the façade restoration should be analyzed from the cost point, durability, and aesthetic appearance. This analysis should be developed by the architect and the Owner’s input.

The next step in the repair process is to engage the architect to develop an architectural design for the retrofit of the interior spaces and retrofit of the exterior walls. Following the architectural redesign of the facade, if the recladding option is considered, the proposed redesign should be reviewed by the structural engineer to verify that the existing exterior walls can sustain potential additional loads from newly added façade cladding. If additional strengthening of the structure is required, those repairs should be incorporated with the recommended ones above.

We are available to assist you in the next phase of this project and to work along with the architect on any aspect of structural design and detailing.

Thank you for the opportunity to provide engineering service for the condition assessment of this building. We look forward to continuing to work with Brinshore Development LLC. If you have any questions, please contact us.

APPENDIX A. FIGURES

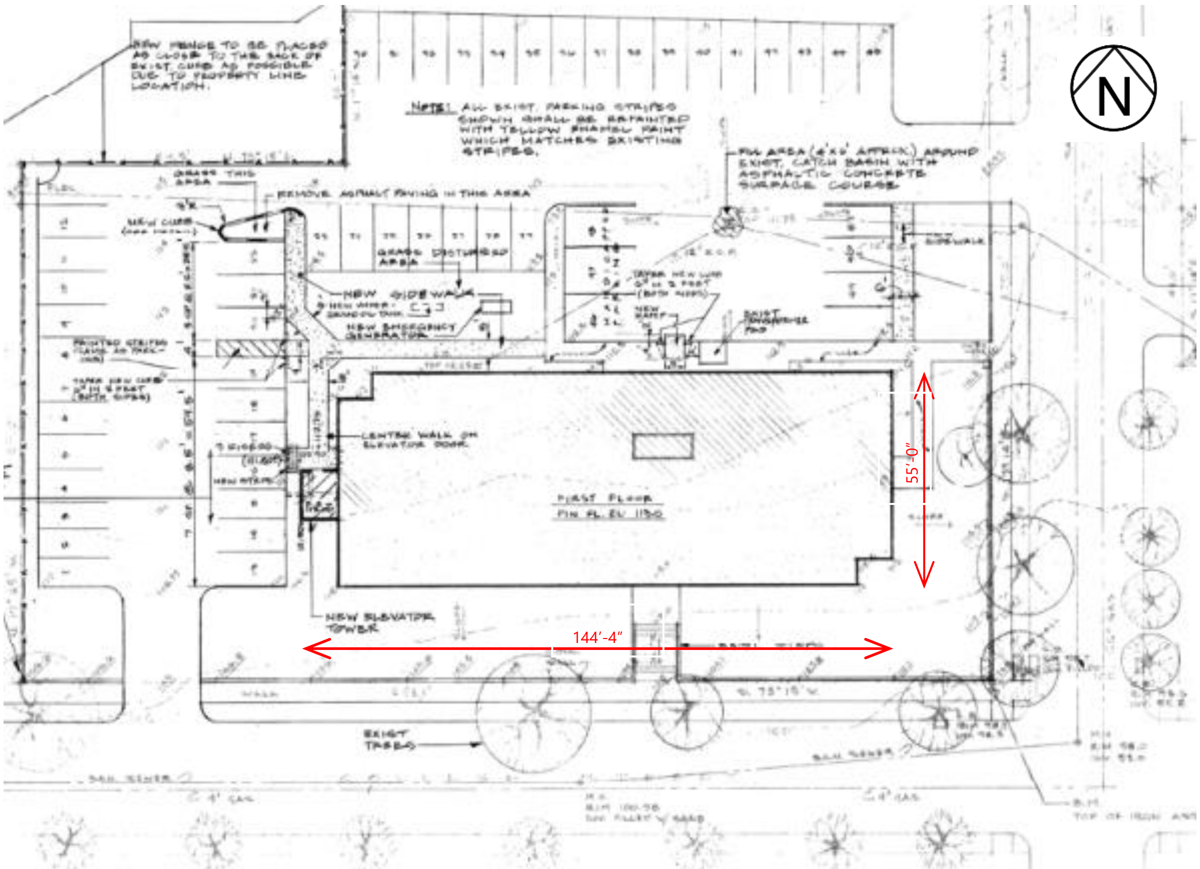

Figure 1. Plan view of Arrington Manor building located at 2225 College Street in Columbia, South Carolina

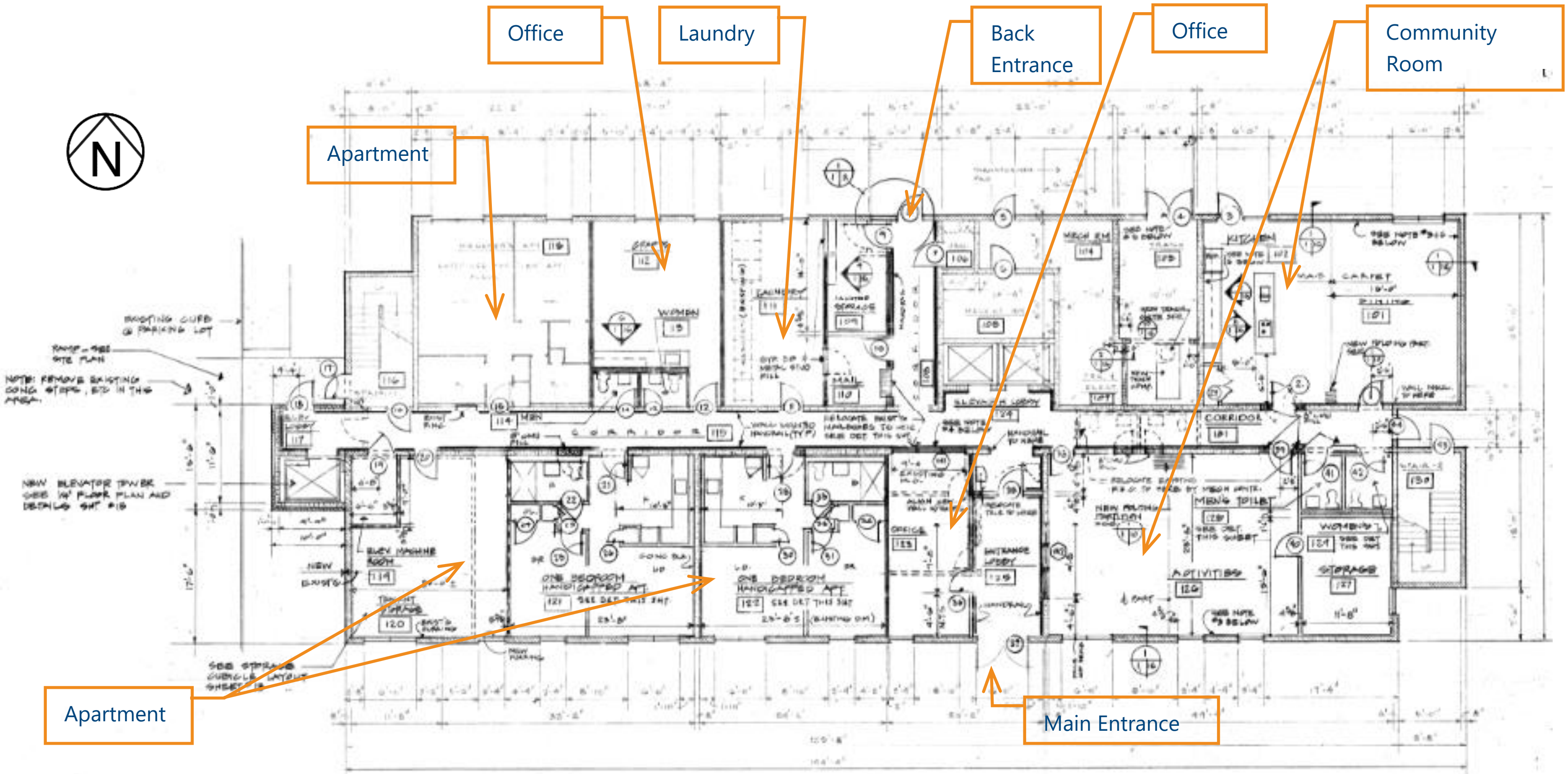

Figure 2. Plan view of the first floor

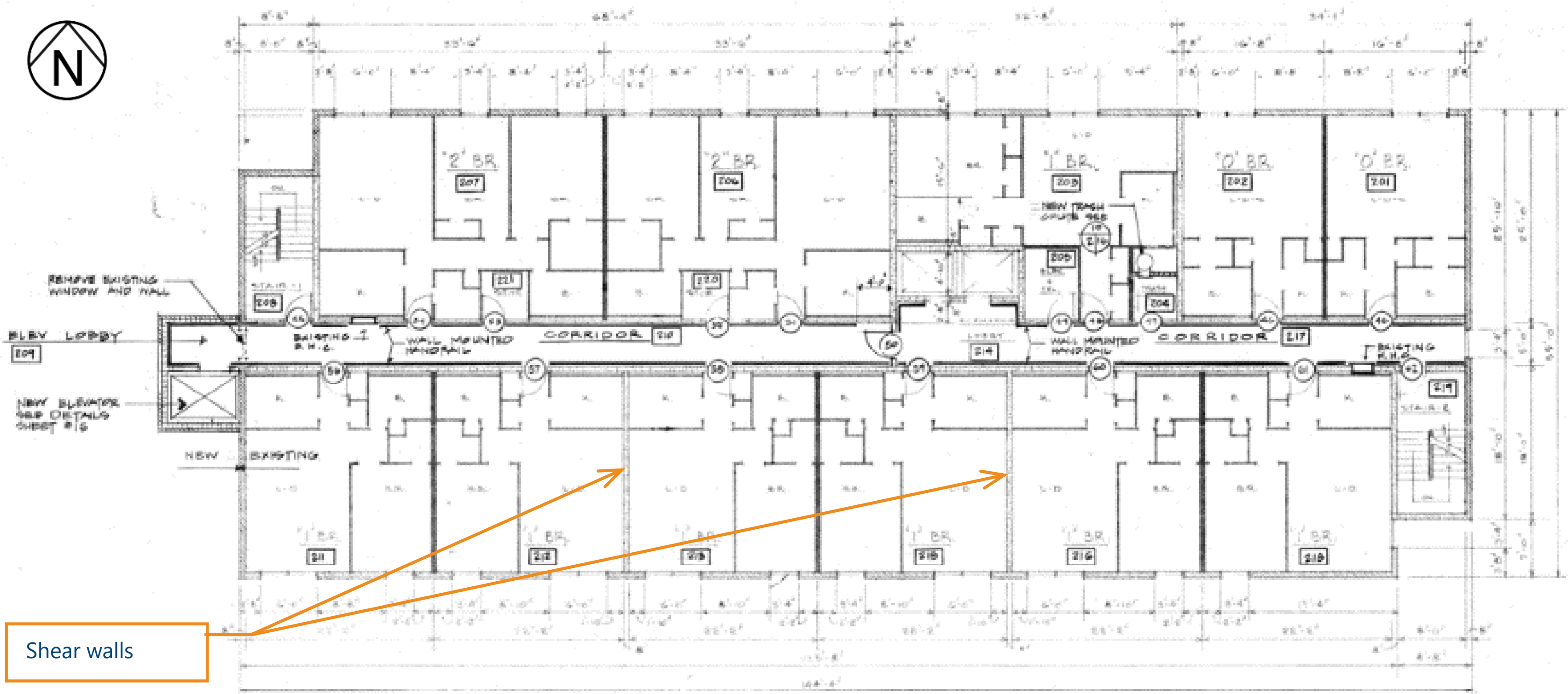

Figure 3. Typical residential floor plan, second through sixth floor


Figure 4. South and partial east elevations


Figure 5. Partial west elevation, south end

Figure 6. North elevation

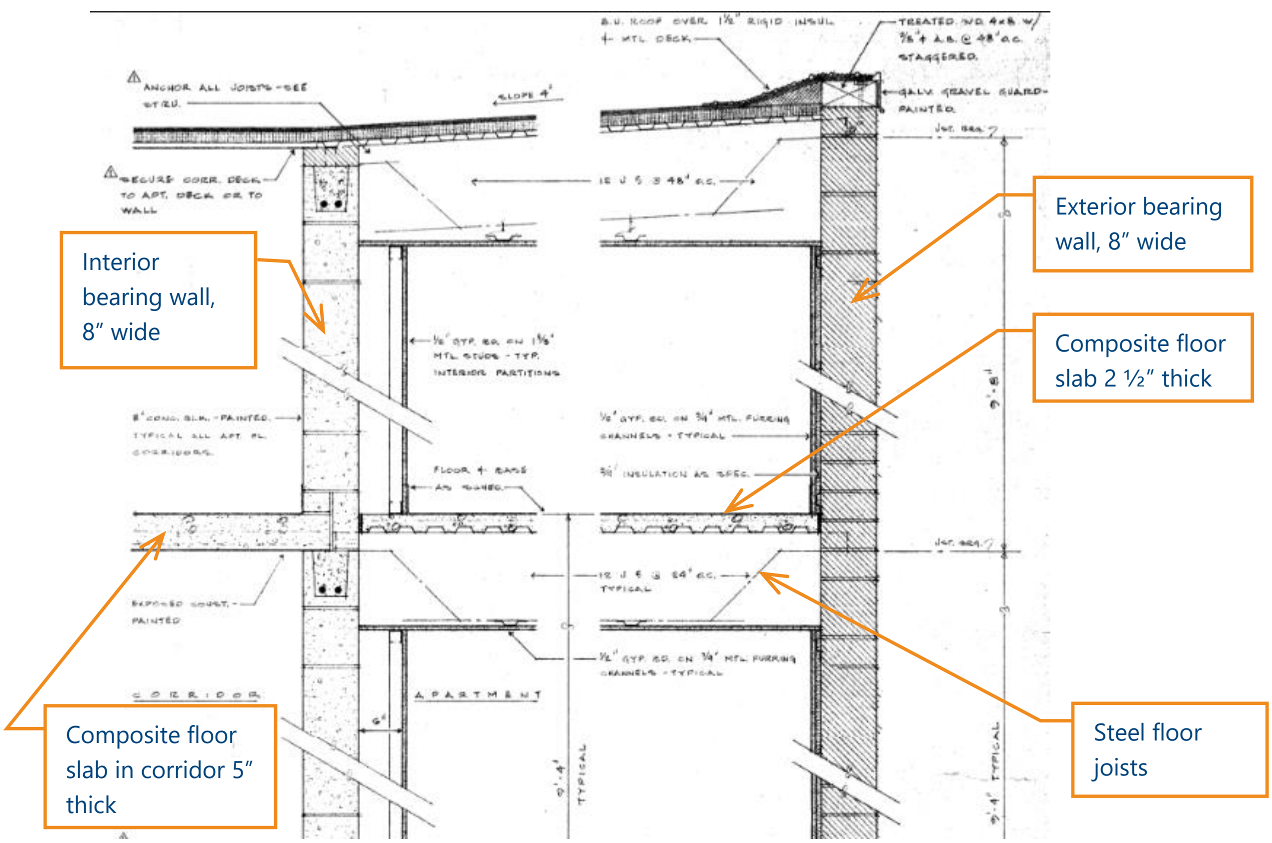

Figure 7. Section (north-south direction) through the exterior and interior bearing walls

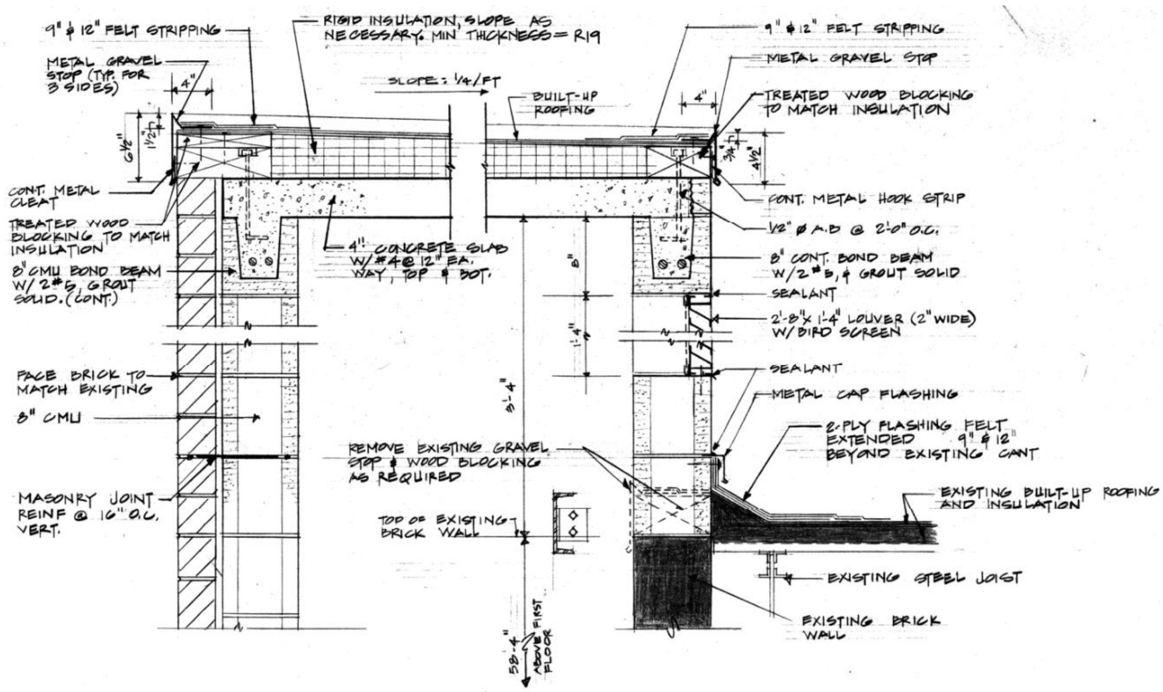

Figure 8. Section at west elevator tower roof

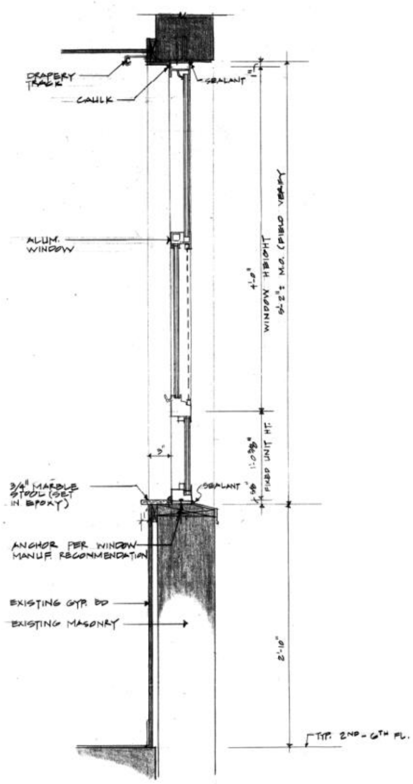

Figure 9. Section through typical window 2nd through 6th floor

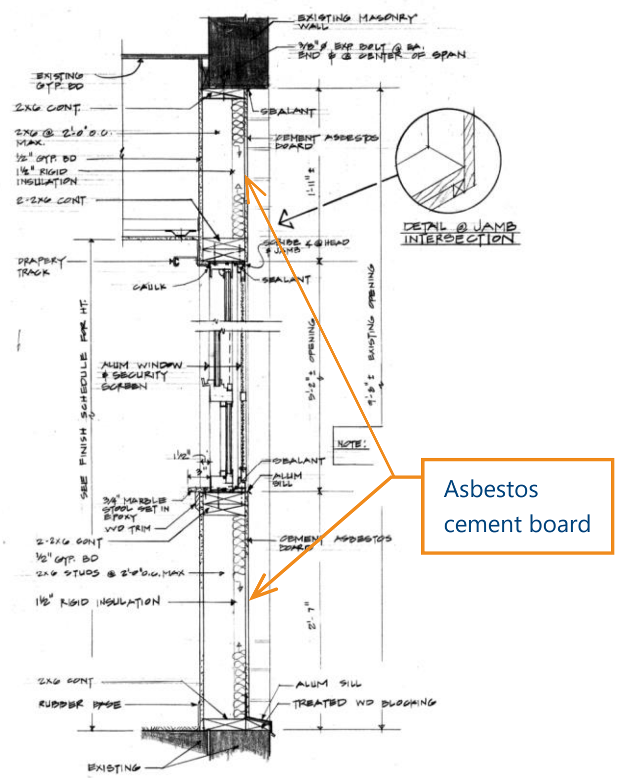

Figure 10. Section through the 1st floor window with asbestos cement board

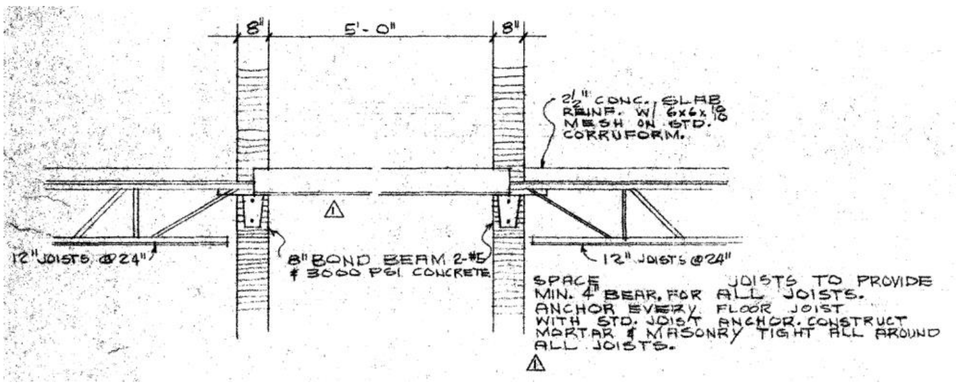

Figure 11. Section through corridor

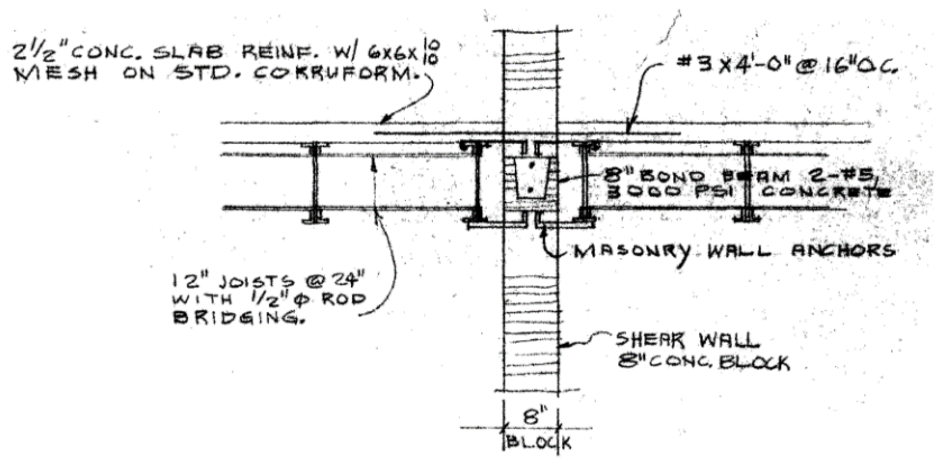

Figure 12. Section through shear wall

Figure 13. Deteriorated composite deck with section loss around the second floor bathroom drain pipe

Figure 14. Corroded underside of the second floor composite deck by the exterior wall at the southeast corner of the building

Figure 15. Water damage on the east wall in the office by the south community room, first floor

Figure 16. Leaks observed in the mechanical room (exterior and interior side of wall), north elevation

Figure 17. Typical condition of ceilings in bathrooms

Figure 18. Typical condition of ceilings in kitchens

Figure 19. Water damage inside kitchen cabinet from past leaks

Figure 20. Water damage around window in Unit 303

Figure 21. Water damage in drywall at ceiling by the exterior wall, Unit 218

Figure 22. Damaged ceiling due to water infiltration two feet from the exterior wall, Unit 508

Figure 23. Water damage around A/C unit typ.

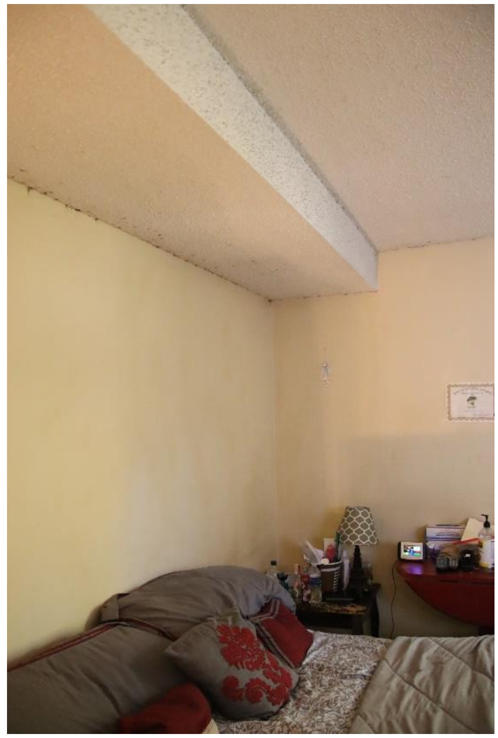

Figure 24. Mold observed on walls in Unit 201

Figure 25. Mold present along the duct and in the wall below it in Unit 201

Figure 26. Improvised duct support in the mechanic room adjacent to laundry room

Figure 27. Surface corrosion present on the underside of the sixth floor stairway landing

Figure 28. Overall and close-up views of spalled CMU below steel girder bearing in the east stairway, at mid-landing between first and second floor

Figure 29. Overall and close-up views of cracks observed in the north exterior wall.

Figure 30. Corroded steel window lintel with packed rust

Figure 31. Corroded steel A/C lintel with packed rust

Figure 32. Weeps at A/C sleeves and rust stains below them

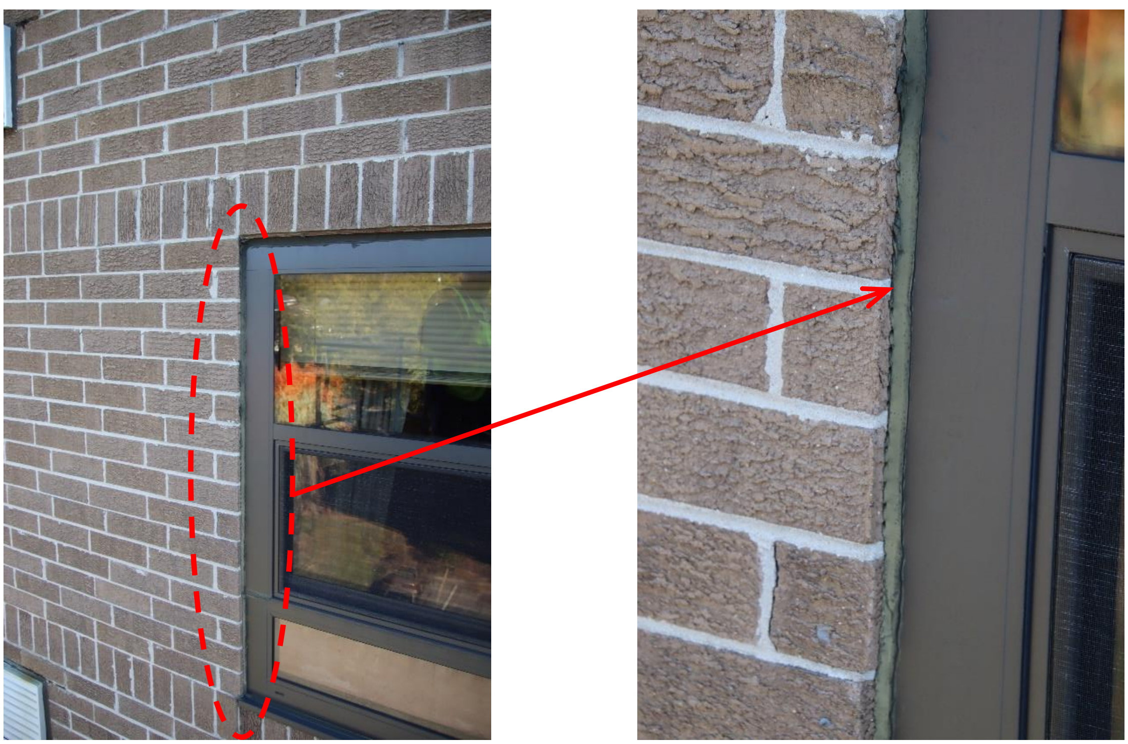

Figure 33. Overall and close u views of debonded sealant around window frames

Figure 34. Deteriorated sealant around A/C louvers

Figure 35. Deteriorated sealant between canopy and exterior wall and worn out paint at the top of the canopy

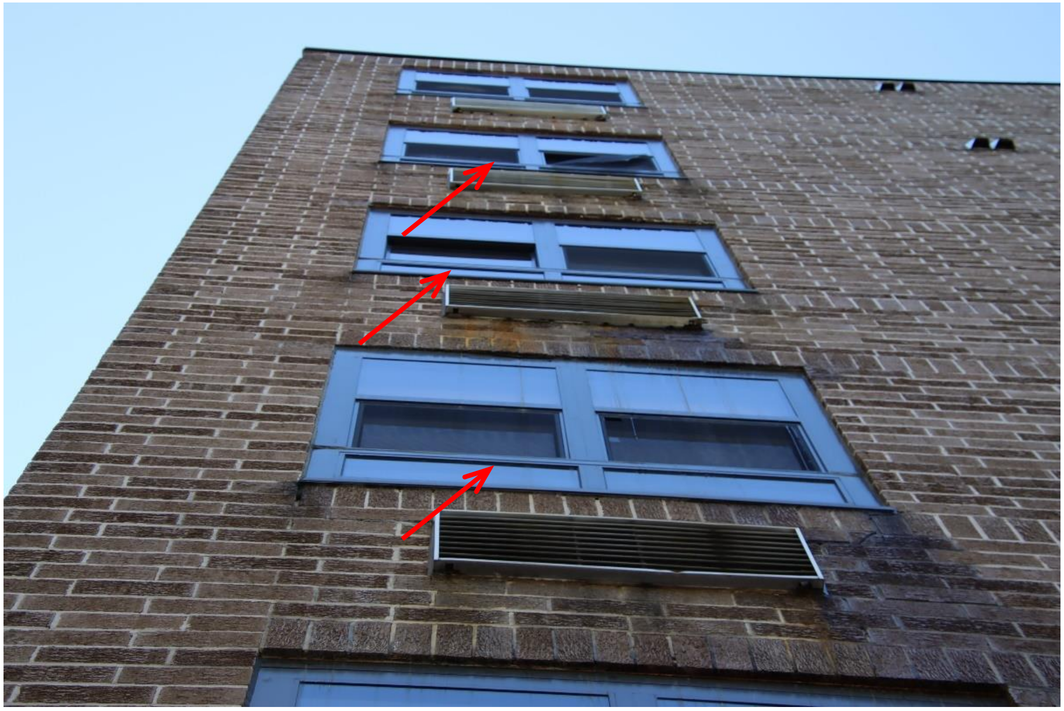

Figure 36. Windows appear distorted out of plane, pushed inward above bottom sash

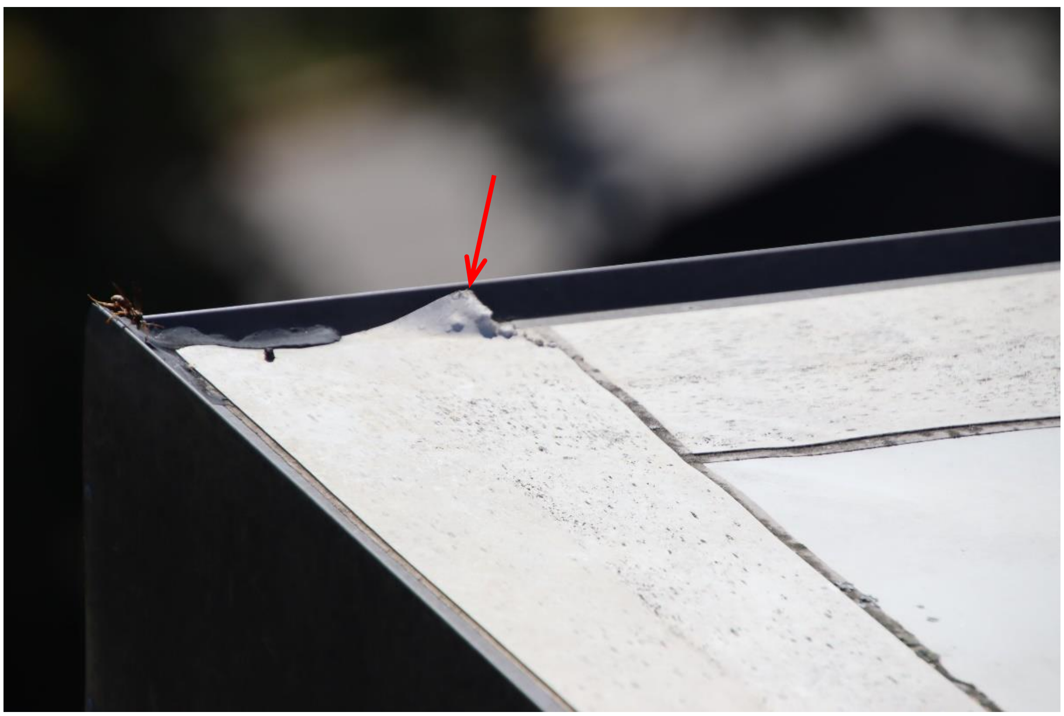

Figure 37. Debonded edge of PVC membrane

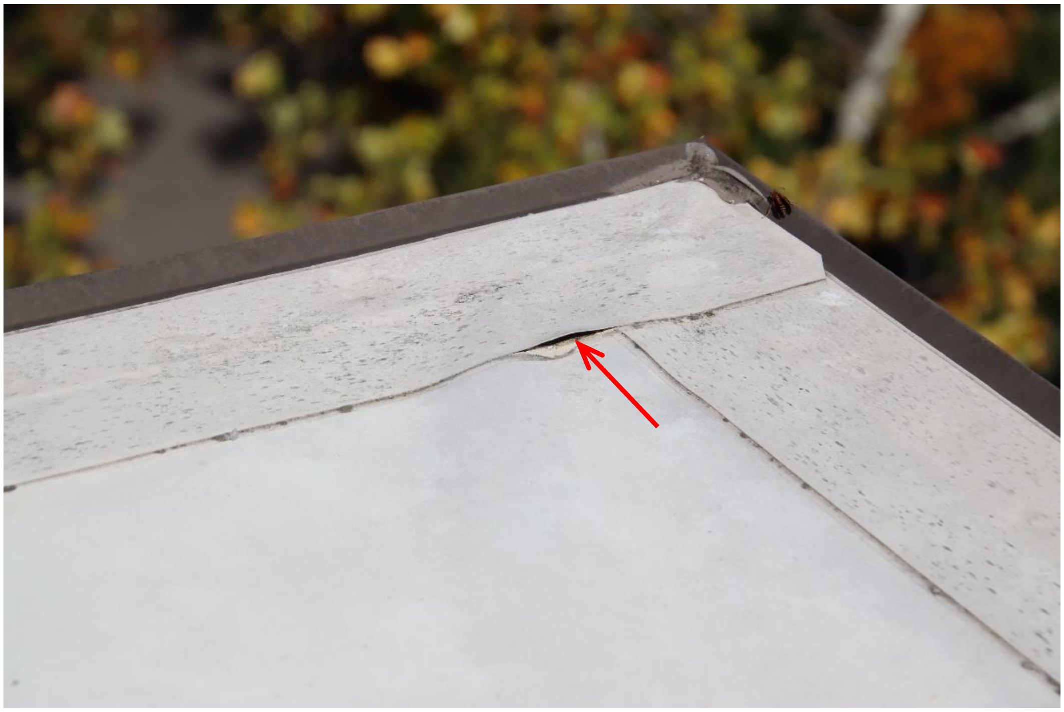
Figure 38. Open seam


Figure 39. Debonded sealant at termination bar

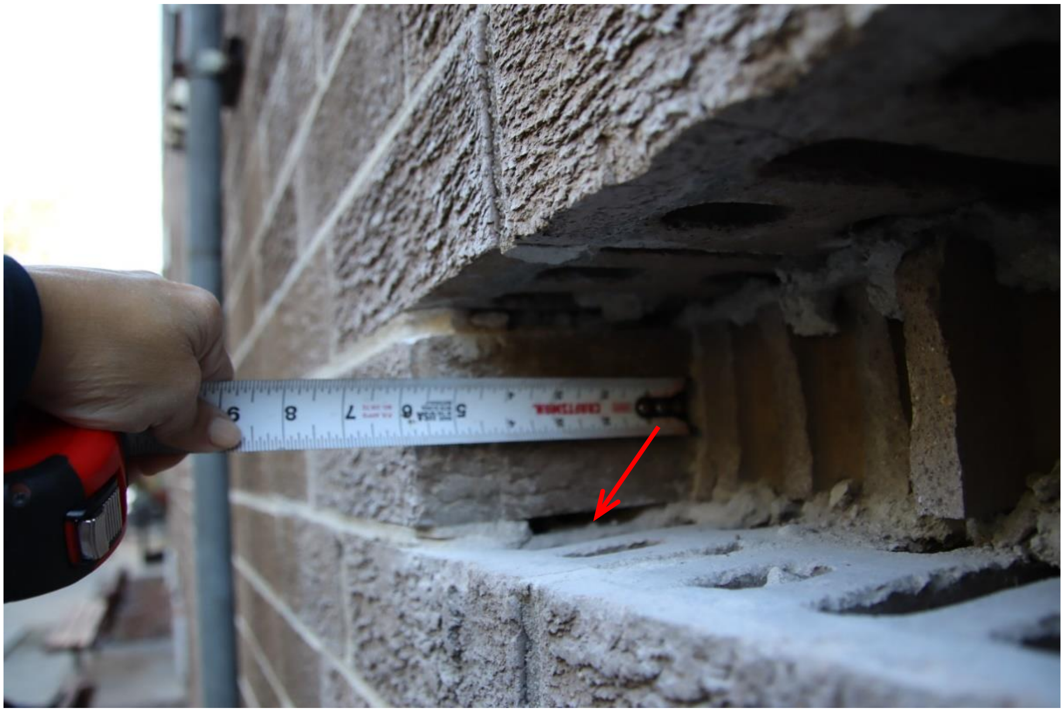

Figure 40. Exploratory opening #1. Voids in mortar at bed joint and hollow cells of masonry units

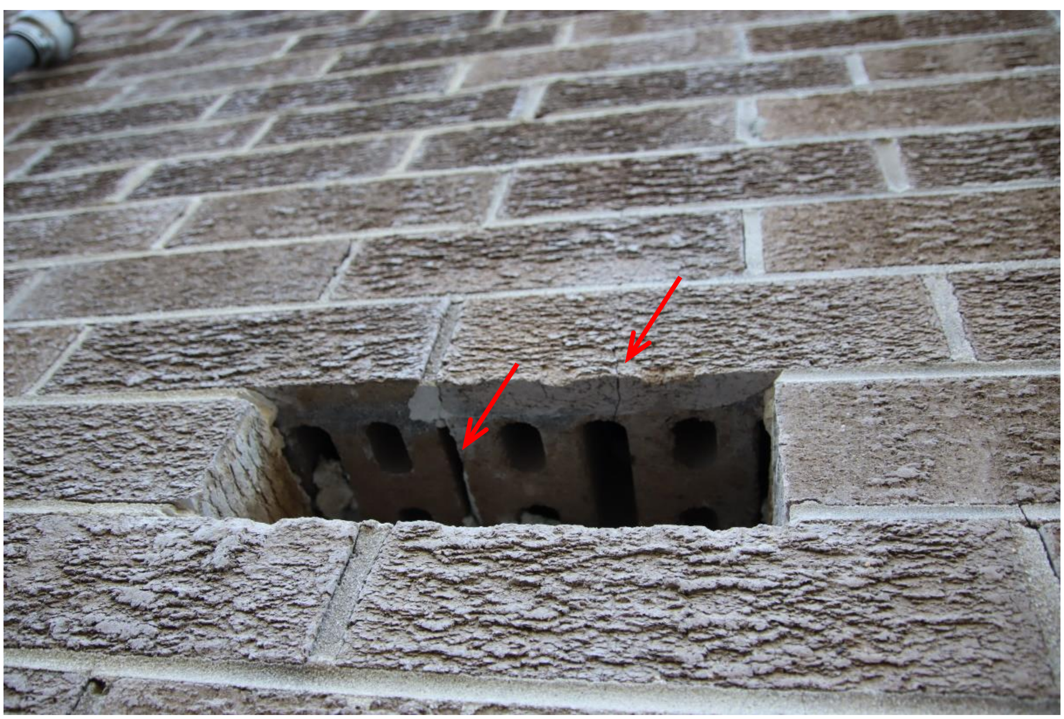

Figure 41. Exploratory opening #1. Voids in mortar at head joint, hollow cells of masonry units and crack in masonry unit

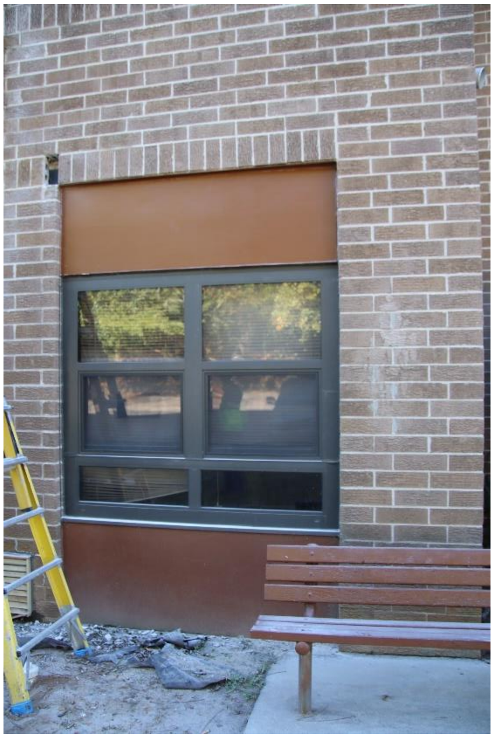


Figure 42. Exploratory opening #2. Overall and close-up views of PVC flashing over steel lintel

Figure 43. Exploratory opening #3. Removed sealant. No compressible joint filler present between window frame and brick masonry

Figure 44. Exploratory opening #4. Sealant and compressible joint filler present over corroded steel lintel above A/C sleeve