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ENGINEERING REPORT

November 12, 2025

Mr. Steele “Al” Windle III, Esquire
Windle Terry Bimbo Construction Law
11525 North Community House Road, Suite 425
Charlotte, North Carolina 28277

RE: Construction Defect Assessment
City of Fayetteville
Fayetteville Fire Department New Sub-Station No. 4
4210 Bragg Boulevard
Fayetteville, North Carolina 28303
ABS File Number: 900.25030

APPLIED BUILDING SCIENCES | ENGINEERS ARCHITECTS CONSULTANTS

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Dear Mr. Windle:

Pursuant to the request of the City of Fayetteville and in accordance with the Professional Service Agreement fully executed on August 27, 2025, Applied Building Sciences, Inc. (ABS) performed a construction defect assessment of the incomplete construction of the Fayetteville Fire Department New Sub-Station No. 4 ("the project") located at 4210 Bragg Boulevard, Fayetteville, Cumberland County, North Carolina ("the site"). Specifically, it was requested that ABS review defects and/or omissions associated with construction of the interior concrete slabs, interior and exterior concrete masonry unit (CMU) walls, exterior cast stone, light-gauge metal framing, roof assembly and structure, welds and bolts, domestic drainage pipe system, mechanical, electrical, and plumbing (MEP) systems, industrial hygiene, and completion of required special inspections. This report summarizes ABS' findings.

A list of resources and/or information within those sources that were reviewed or relied upon in this investigation are as follows:

REFERENCED STANDARDS AND RESOURCES

- *2018 North Carolina Building Code* (2018 NCBC).
- American Society of Civil Engineers (ASCE)/Structural Engineering Institute (SEI) *Minimum Design Loads for Buildings and Other Structures with Supplement 1* (ASCE 7-10).
- American Concrete Institute (ACI) *Building Code Requirements for Structural Concrete* (ACI 318-14).

- ACI *Specification for Tolerances for Concrete Construction and Materials* (ACI 117-10).
- ACI *Guide to Design of Slabs-on-Ground* (ACI 360R-10).
- The Masonry Society (TMS) *Building Code for Masonry Structures* (TMS 402-13.)
- TMS *Specification for Masonry Structures* (TMS 602-13).
- American Institute of Steel Construction (AISC) *Specification for Structural Steel Buildings* (AISC 360-10).
- AWS *Structural Welding Code – Steel* (AWS D1.1-10).
- Research Council on Structural Connection (RSCS) *Specification for Structural Joints Using High-Strength Bolts* (RCSC09).
- Historical imagery from NearMap®, Google Map®, and Google Earth® mapping programs.
- Cumberland County GIS property information and tax bill records.

PROPERTY DESCRIPTION

Photo 1 is an aerial drone view of the site, and **Photo 2** is an aerial drone view of Sub-Station No. 4 ("the building"). **Photo 3** is a drone view of the west (front) elevation of the building. Currently, the construction of the project is incomplete, and ongoing construction efforts have been suspended.

The building features two (2) primary sections: the apparatus bay and the living area. For the purposes of this report, the building shall be considered to face west towards Bragg Boulevard. The apparatus bay is a high-bay, one-story section at the north portion of the building intended for use as apparatus and equipment storage, maintenance, and training. It features a single open space with three (3) pull-through apparatus bays. The structure is primarily constructed with pre-engineered metal building (PEMB) frames, which span between the north and south walls. The exterior walls at the perimeter of the PEMB are constructed with reinforced CMU and are clad with brick veneer featuring exterior cast stone accents.

The living area is generally a one-story section at the south portion of the building primarily intended for use as training, storage, office, exercise, kitchen, bunk, and utility areas. Portions of the living area floor plan feature a second-level mezzanine and catwalk. The structure is primarily supported by a PEMB, which spans in multiple directions. The interior and exterior walls throughout the living area are primarily constructed with light-gauge metal framing, and the exterior walls are clad with brick veneer featuring exterior cast stone accents. At the mezzanine area adjacent to the apparatus bay, the walls are constructed with reinforced CMU. The roof assembly at both the

apparatus bay and living area is covered with standing seam metal panels. The foundation consists of a slab-on-ground, thickened slab areas and spread footings supporting the PEMB columns.

In addition to construction of the building, the project also includes plans for horizontal construction, including but not limited to apparatus bay aprons, drive, curb, gutter, sidewalk, hardscaping, landscaping, and a memorial constructed primarily of precast concrete components.

According to Sheet 1.00 of the construction drawings, the building consists of 18,032 square feet of gross area. It is ABS' understanding that construction began on the building circa 2022 and was suspended early 2024; therefore, it is approximately one and one-half (1 1/2) years old.

According to the plans (Sheet 1.00), the applicable building code for construction of the project was the *2018 North Carolina Building Code* (*2018 NCBC*).

REVIEWED DOCUMENTS

For an understanding of the project background information and for our assessment, ABS performed a cursory review of the following documents:

1. Fayetteville Fire Department New Sub-Station contract ("the contract") dated June 22, 2022, between W.B. Brawley Company (Brawley) and the City of Fayetteville. (**Attachment 1**)

2. Fayetteville Fire Department New Sub-Station plans ("the plans"), which include the following sections: (**Attachment 2**)
    a. Architectural drawings from Steward-Cooper-Newell Architects, P.A. (SCNA) dated January 26, 2022.
    b. Civil drawings from Moorman, Kizer & Reitzel, Inc. (MKR) dated January 20, 2022.
    c. Structural drawings from Taylor & Viola Structural Engineers, P.C. (T&V) dated January 26, 2022.
    d. MEP drawings from Optima Engineering, P.A. (Optima) dated January 26, 2022.
    e. Fire Protection drawings from Optima dated January 26, 2022.

3. Complete schedule from Brawley dated October 3, 2022. (**Attachment 3**)

4. Shop drawings as follows:
    a. Metal building shop drawing submittal from Kirby Building Systems (KBS) dated November 8, 2022; reviewed by T&V dated November 30, 2022. (**Attachment 4**)
    b. Exterior cast stone shop drawing submittal with attachment specifications from RockCast dated May 4, 2023. (**Attachment 5**)

5. Submittals from Brawley as follows:
    a. Submittal No. N/A titled "Shop Drawings" dated December 13, 2022; reviewed by T&V January 13, 2023; reviewed by SCNA January 17, 2023. (**Attachment 6**)
    b. Submittal No. N/A titled "Roof Insulation Product Data" dated December 16, 2022; reviewed by SCNA December 27, 2022. (**Attachment 7**)
    c. Submittal No. N/A titled "Cold Joint Rebar Shop Drawing" dated December 22, 2022; reviewed by T&V dated January 13, 2013 [sic]. (**Attachment 8**)
    d. Submittal No. N/A titled "Rebar Shop Drawings" dated April 20, 2023; reviewed by T&V May 9, 2023. (**Attachment 9**)
    e. Submittal No. N/A titled "Shop Drawings" dated May 16, 2023, reviewed by SCNA May 24, 2023. (**Attachment 10**)
    f. Submittal No. NA titled "Construction Joint Layout" dated June 26, 2023; reviewed by T&V dated June 27, 2023. (**Attachment 11**)
    g. Submittal No. N/A, Revision No. 2 titled "Roof Panel PD Calcs" dated July 6, 2023; reviewed by SCNA dated July 18, 2023. (**Attachment 12**)
    h. Submittal No. NA titled "Medallions Product Data & Sh [sic]" dated September 14, 2023; reviewed by SCNA dated September 25, 2023. (**Attachment 13**)
    i. Submittal No. 047206-010 titled "Engineering Letter and Analysi [sic]" dated April 5, 2024. (**Attachment 14**)

6. Product submittals as follows:
    a. Wire-Bond SureTie WS Stone Anchor. (**Attachment 15**)
    b. Wire-Bond SureTie WS Stone Anchor Z Shape. (**Attachment 16**)

7. Request for Information (RFI) as follows:
    a. RFI #30 from Leon Masonry dated April 19, 2023. (**Attachment 17**)
    b. RFI #57 from Leon Masonry dated September 13, 2023. (**Attachment 18**)

8. Construction inspection reports from SCNA as follows:
    a. Report 1677-11 dated October 4, 2023. (**Attachment 19**)
    b. Report 1677-12 dated November 1, 2023. (**Attachment 20**)

9. A schedule extension letter from Brawley dated October 18, 2023, reviewed by SCNA on January 17, 2024. (**Attachment 21**)

10. A "GPRS Scanning for Masonry Wall" letter from Froehling & Robertson, Inc. (F&R) dated March 11, 2024. (**Attachment 22**)

11. A discrepancy log from F&R dated March 15, 2024. (**Attachment 23**)

12. A "Construction Progress Observation" letter from T&V dated May 2, 2024. (**Attachment 24**)

BACKGROUND INFORMATION

On June 22, 2022, Brawley executed "the contract" with the City of Fayetteville for the construction of the project with a cost of $9,442,777. It is ABS' understanding that following the execution of the contract, construction efforts were officially scheduled to begin on or about August 29, 2022, with a scheduled substantial completion and certificate of occupant on October 30, 2023.

A letter dated December 1, 2023, from the City of Fayetteville to Brawley, provides a notice of Brawley's defaults under the contract and demands a cure for those defaults in accordance with the contract. The letter provides notice that with a failure to cure their defaults, the City of Fayetteville "*will be forced to terminate the [contract], supplement Brawley, or take other action permitted by the [contract] to ensure the proper and timely completion of the project.*" In the letter, the City of Fayetteville cites the following defaults:

1. *"Brawley has Caused Significant Delays to the Project"*
2. *"Brawley has Repeatedly Failed to Comply with the Project's Plans and Specifications"*
3. *"Repeated Safety Violations"*

It is ABS' understanding that Froehling & Robertson, Inc. (F&R) provided third-party construction administration services, which included inspection for quality assurance (QA). F&R provided a discrepancy log dated March 15, 2024, which tracked discrepancies discovered during construction. It is ABS' understanding that throughout the project, Brawley's poor scheduling of construction operations made inspection of certain project components unrealistic. As a result, F&R reportedly did not have the opportunity to inspect portions of certain building components, such as concrete and masonry reinforcement, field welding at structural steel connections, and some light-gauge metal framing components before they were inaccessible.

A letter dated April 16, 2024, from the City of Fayetteville to Brawley's counsel, Ellis & Winters LLP (Ellis), provides notice of termination for cause as a result of Brawley's continued default of its contractual obligations in relation to the project.

It is ABS' understanding that following the termination of Brawley's contract and suspension of construction of the project, no additional construction efforts have been undertaken. Various parties involved with the project have been on the site to assess the existing construction and/or determine necessary remediation for completing defective and/or incomplete work.

On August 27, 2025, ABS was retained by the City of Fayetteville for visual observations and destructive testing, procurement of investigative services from other parties, review of provided documents, and assessment of construction defects identified.

PROCEDURES

On July 24, 2025, Mr. L. Steven Moore, PE, RRC, REWC; Mr. Gabriel Marchi Molina, PE; and Mr. Charles Weiss, AIA, RRC, RWC, REWC, RBEC, all of ABS, conducted an initial site visit and cursory visual survey of the project. During the site visit, a preliminary visual review of the incomplete construction was conducted to collect background information necessary to determine a scope and protocol for future destructive testing and visual investigation. Portions of the roof, exterior elevations, interior, and site were reviewed by ABS personnel during the site visit.

On August 28, 2025, Mr. Dylan Smith, EI, of ABS, conducted a site visit to attend nondestructive testing of the underground drainage pipe systems. During the site visit, Next Level Pipe Lining (Next Level) was contracted by ABS to perform camera scoping services of select underground drainage pipes.

On September 23 and 24, 2025, Mr. Moore, Mr. Molina, Mr. Weiss, and Mr. Ryan E. Heleski, PE, also of ABS, conducted a site visit to execute a destructive testing and visual investigation protocol (**Attachment 25**) prepared by ABS to assess the alleged defects and/or omissions associated with construction of the project. During the site visit, portions of the roof, exterior elevations, interior, and site were visually reviewed, and/or destructive testing was performed. Carolina Precision Core Drilling (CPCD) was contracted by ABS to provide coring services for the concrete slab-on-ground. ABS Environmental Incorporated (ABSEI) was contracted by ABS to provide industrial hygiene services for biological growth testing. Ordcha Engineering PLLC (Ordcha) was contracted by ABS to provide engineering assessment services for portions of the project's MEP systems. Personnel from F&R were also on-site during portions of ABS' site visit and provided background information regarding the construction of the project.

In addition to Mr. Steven Bimbo, Esquire, of your firm, representatives from the City of Fayetteville and representatives from other involved parties were on site for portions of ABS' September 23 and September 24, 2025, site visit.

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Photo 1: Aerial drone view of the site.

Photo 2: Aerial drone view of the building.

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Photo 3: Aerial drone view of the west (front) elevation of the building.

OBSERVATIONS AND ANALYSIS

The following observations are related to ABS' assessment of construction defects and associated damage documented during the site visits.

In addition to the components discussed below, ABS understands and is aware of additional issues associated with, but not limited to, the construction of the training columns, mezzanine bridge light-gauge metal framing, sheathing around window openings, brick veneer color, the trash enclosure, the precast monument memorial, site soil and pavement, and the storage of materials. It is ABS' understanding that these components have been reviewed by SCNA and therefore were not included in ABS' scope or protocol for investigation.

INTERIOR CONCRETE SLABS

At the time of ABS' site visit, portions of the building's interior concrete slabs were in place. Within the apparatus bay, no slab-on-ground was in place; the plans (Sheet 3.10) indicate that the apparatus bay slab-on-ground should have been cast with 6 inches of concrete reinforced with #5 rebar spaced at 12 inches on center in each direction over a vapor barrier and 4 inches of stone base. Within the living area, the slab-on-ground was in place; the plans (Sheet 3.10) indicate that the living area slab-on-ground should have been constructed with 4 inches of concrete reinforced with 6x6 W1.4xW1.4 welded wire fabric (WWF shrinkage reinforcement) over a vapor barrier and 4 inches of stone base. According to the 2018 NCBC Section 1805.2.1, "*Where installed beneath the slab, dampproofing shall consist of not less than 6-mil… polyethylene.*" At the mezzanine, the

elevated slab was in place; the plans (Sheet 3.20) indicate that the mezzanine elevated slab should have been constructed with 3.25 inches of lightweight concrete reinforced with 6x6 W1.4xW1.4 WWF over a 2-inch 20-gauge composite metal deck. Note that multiple details within the plans indicate that the apparatus bay and living area slab-on-ground should have been constructed with 6 inches of stone base, contrary to Sheet 3.10.

During ABS' site visit, portions of the living area slab-on-ground and mezzanine elevated slab were reviewed for compliance with the plans, construction documents, and applicable codes. Specifically, ABS reviewed six (6) concrete cores drilled by CPCD and measured slab levelness and flatness across three (3) areas. The six (6) core locations were generally dispersed in an even, grid-like orientation across the living area slab (**Figure 1**). Within the living area training room and dayroom, two (2) areas measuring approximately 25 feet by 25 feet were reviewed for levelness and flatness (**Figure 2**); at the mezzanine, one (1) area measuring approximately 15 feet by 15 feet was also reviewed for levelness and flatness (**Figure 3**). Lastly, general observations of the living area slab control joints were visually reviewed. Note that the slab reinforcement at the living area slab-on-ground and mezzanine elevated slab could not be verified by ABS using an eddy current sensor since the equipment, a James Instruments Rebarscope, cannot accurately detect welded wire fabric. Instead, reinforcement was visually observed within the concrete cores; reinforcement at the mezzanine elevated slab was not reviewed.

1. For the six (6) concrete cores taken from the living area slab-on-ground, the concrete thickness measured approximately 4 inches, 4 inches, 3.25 inches, 3.75 inches, 4 inches, and 3.75 inches (**Photo 4**). The stone base measured approximately 4.75 inches, 5.5 inches, 5 inches, 6.2 inches, 4.75 inches, and 4.5 inches. The stone base was measured with a steel rod.

2. At each of the core drilling locations, a 10-mil vapor retarder was observed at the underside of the concrete slab above the stone base.

3. WWF was observed within each of the six (6) cores. Measured from the bottom of the slab core, the cover of the wire at three (3) of the cores measured approximately 1 inch; at the three (3) remaining cores, the cover of the wire measured approximately 1.25 inches, 0.75 inches, and 0.5 inches. The 4-inch diameter concrete cores each intersected one (1) parallel wire, indicating that the spacing of the welded wire fabric exceeded 4 inches. The specified WWF spacing was 6 inches.

According to ACI 117-10 Section 4.5.4, the tolerance for deviations in the thickness of slabs-on-ground is minus 0.375 inches for the average of all samples taken and minus 0.75 for an individual sample. The average thickness of the six (6) cores taken by ABS measures approximately 3.79 inches, or minus 0.21 inches from the thickness specified in the plans (Sheet 3.10). The largest core deviation measured approximately 3.25 inches, or minus 0.75 inches. Based on the measurements of the six (6) cores taken by ABS, it is ABS' opinion that the deviations in thickness of the living area

slab-on-ground are within the tolerances specified by ACI 117-10. Note that ACI 117-10 provides guidelines for samples taken, which could not be met and therefore were not followed during ABS' site visit. For example, ACI 117-10 specifies that the "*samples shall be taken within seven (7) days of placement.*" Each of the guidelines are included in Sections 4.5.4.2 through 4.5.4.6 of ACI 117-10.

The plans (Sheet 3.00) note that WWF should be placed in the center of the concrete slabs. However, the plans (Sheet 3.00) are unclear, specifying the minimum reinforcement clear cover for the concrete cast against and permanently exposed to earth as 3 inches and for slabs on grade not exposed to weather or in contact with the ground as 1.5 inches; by definition, slabs on grade are permanently exposed to earth. According to ACI 318-14 Section 20.6.1.3.1, the minimum specified reinforcement cover for concrete cases against and permanently in contact with the ground is 3 inches. Since the slab-on-ground located within the living area is cast against and in permanent contact with the ground, the welded wire should be located 1 inch below the surface of the 4-inch slab, leaving 3 inches of cover to the bottom of the slab. According to ACI 117-10 Section 2.2.3, the tolerance for deviations in reinforcement location is plus or minus 0.75 inches for vertical deviation for slab-on-ground reinforcement when the member depth is 4 inches or less. According to ACI 360R-10 Section 8.3, shrinkage reinforcement should be located "as close to the slab top surface as possible while maintaining minimum concrete cover over the reinforcement." It is ABS' opinion that the placement of the welded wire fabric at each of the six (6) cores exceeds the deviation tolerance for reinforcement location.

To assess the slab's levelness, relative elevation measurements of the slab were taken at the three (3) areas within the training room, dayroom, and mezzanine in a grid pattern spaced at approximately 5 feet. The measurements were taken using an engineer's level, a David White AL8-32. Additionally, the tested areas of the slabs were visually reviewed for surface irregularities to assess the slabs' flatness.

4. At the training room, the maximum elevation difference between any of the 36 measured locations was 0.84 inches.

5. At the dayroom, the maximum elevation difference between any of the 36 measured locations was 0.96 inches.

6. At the mezzanine, the maximum elevation difference between any of the 20 measured locations was 1.08 inches.

7. Significant irregularities in the concrete slab surfaces at any of the three (3) reviewed areas were not visually observed.

According to ACI 117-10 Section 4.4.1, the tolerance for deviations in the elevation of the top surface of slabs-on-ground is plus or minus 0.75 inches, and slabs on structural steel have no

requirement. It is ABS' opinion that the measured elevations at the living area training room and dayroom slab-on-ground indicate that the slab is not adequately level. It is ABS' opinion that the measured elevations at the mezzanine elevated slab are adequately level.

ABS visually observed the living area slab-on-ground for location and spacing of control joints.

8. The sawcut control joints observed throughout the living area slab-on-ground were generally spaced at approximately 10 to 15 feet in both directions; however, the spacing of the joints varied in some areas.

9. In at least one (1) location, the length of the control joint panel was approximately double the width of the panel, resulting in an aspect ratio of approximately 2 to 1 (**Photo 5**).

The plans (Sheet 3.01) provide a detail for the construction of control joints in the slabs, but do not specify the location or spacing of the control joints. According to the "Construction Joint Layout" submittal, comments from T&V indicate that the maximum control joint spacing for the living area 4-inch slab-on-ground is 16 feet. According to ACI 360R-10 Section 6.1.3, the recommended control joint (referred to as a contraction joint in ACI 360R-10) spacing for a 4-inch typical concrete slab is approximately 11 feet; it also specifies that the maximum aspect ratio of any panel should be 1.5 to 1 and that L- and T-shaped panels should be avoided. It is ABS' opinion that the living area slab-on-ground control joints are generally spaced in accordance with the "Control Joint Layout" submittal and ACI 360R-10, but that some control joint panels exceed the limiting 1.5 to 1 aspect ratio specified in ACI 360R-10.

ABS Recommendation: It is ABS' opinion that areas of the interior concrete slab-on-ground that do not meet these requirements should be removed and replaced or modified to meet the requirements.

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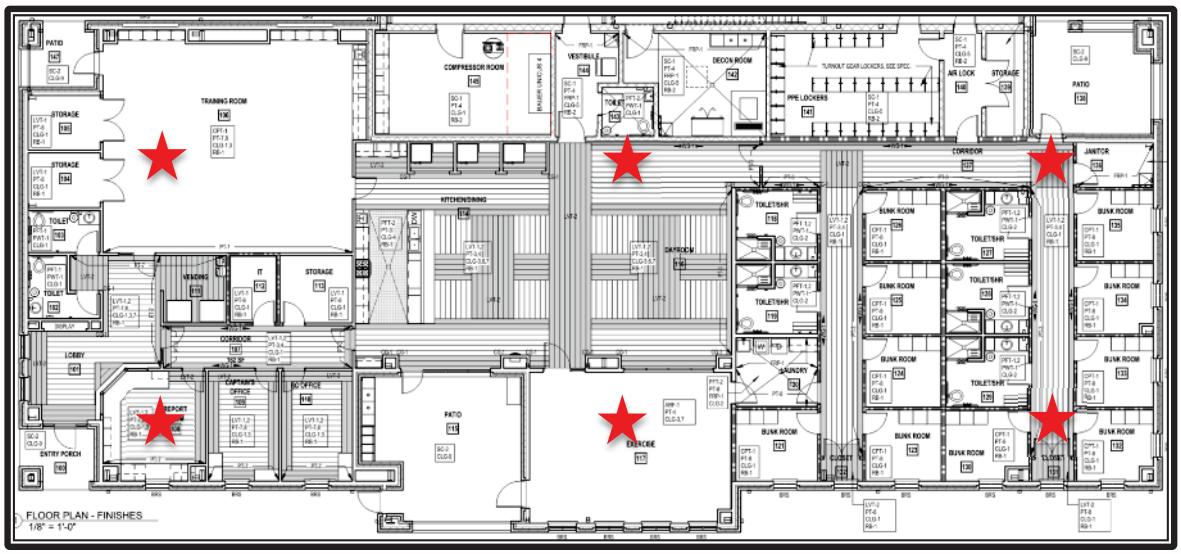

Figure 1: Partial plan of the building showing the six (6) approximate core drilling locations (stars) (cropped plan courtesy of SCNA).

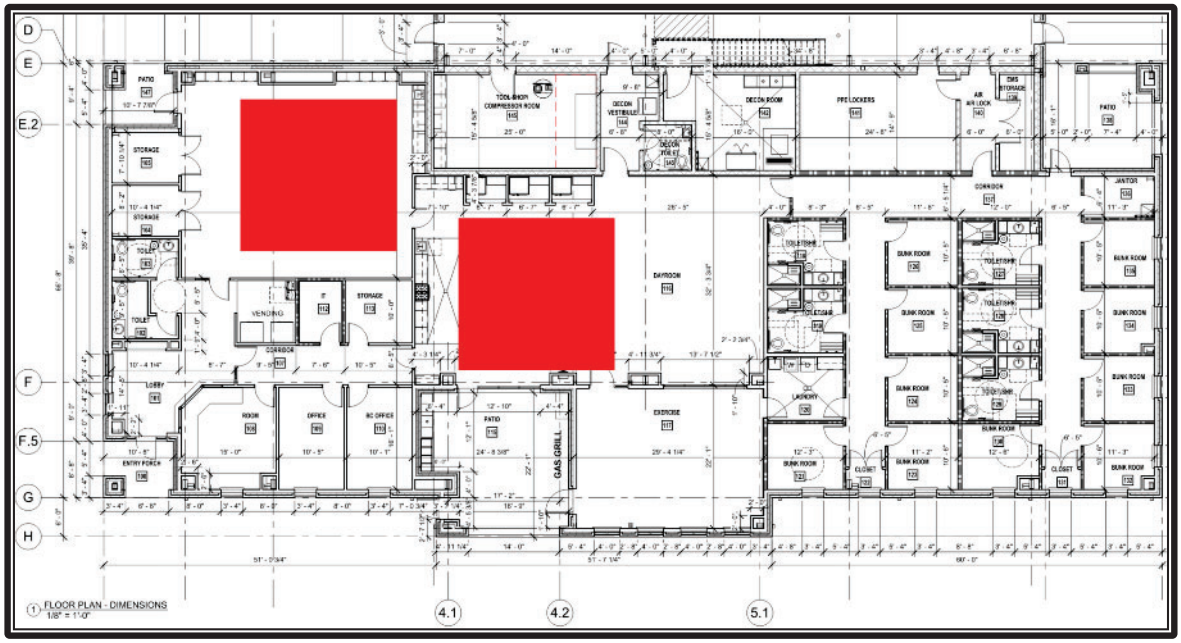

Figure 2: Partial plan of the building showing the approximate location of the two (2) levelness and flatness testing areas at the living area slab-on-ground (shaded) (cropped plan courtesy of SCNA).

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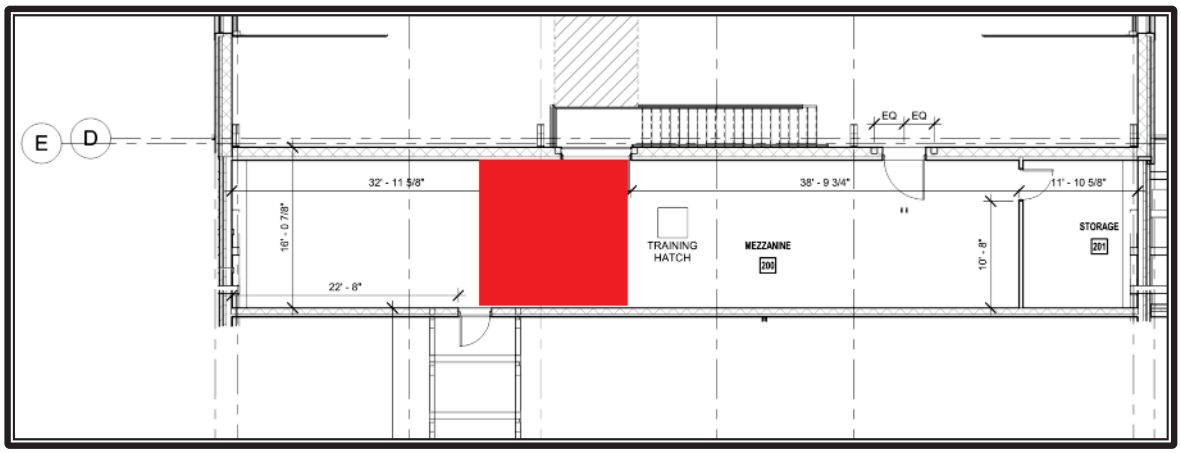

Figure 3: Partial plan of the building showing the approximate location of the one (1) levelness and flatness testing area at the mezzanine elevated slab (shaded) (cropped plan courtesy of SCNA).

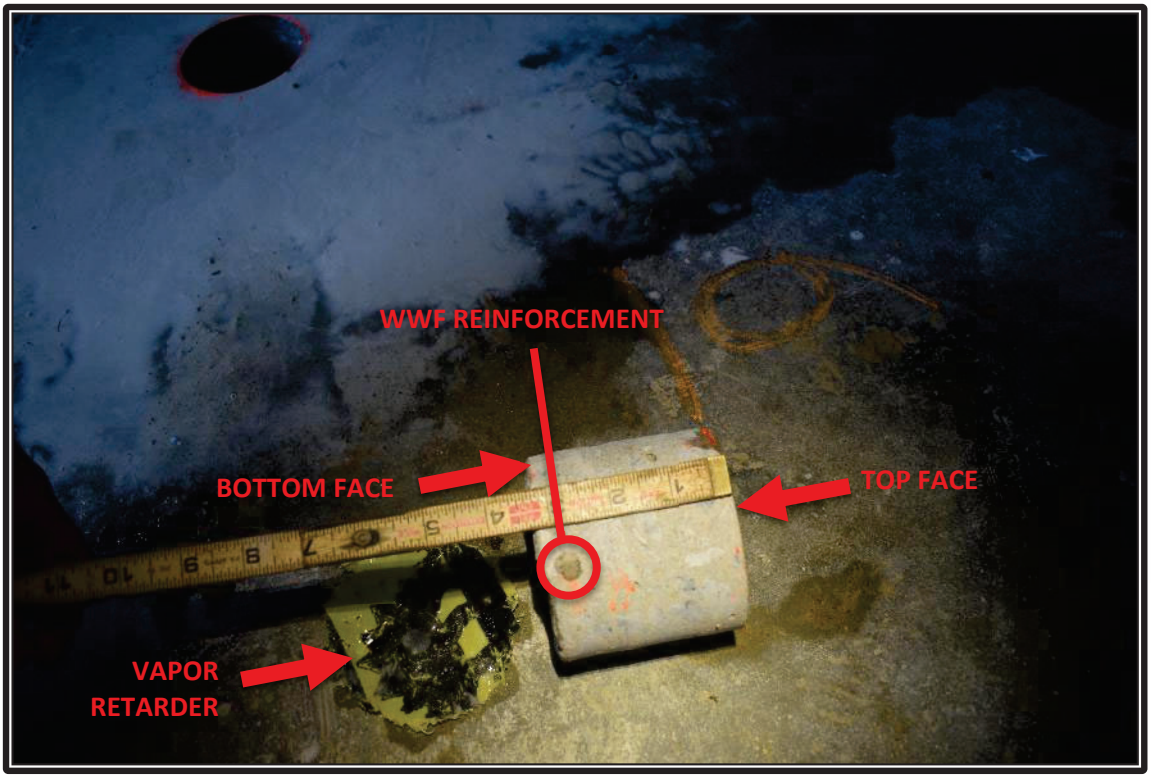

Photo 4: View of concrete core measuring approximately 3.25 inches in depth, the location of a WWF wire, and vapor retarder.

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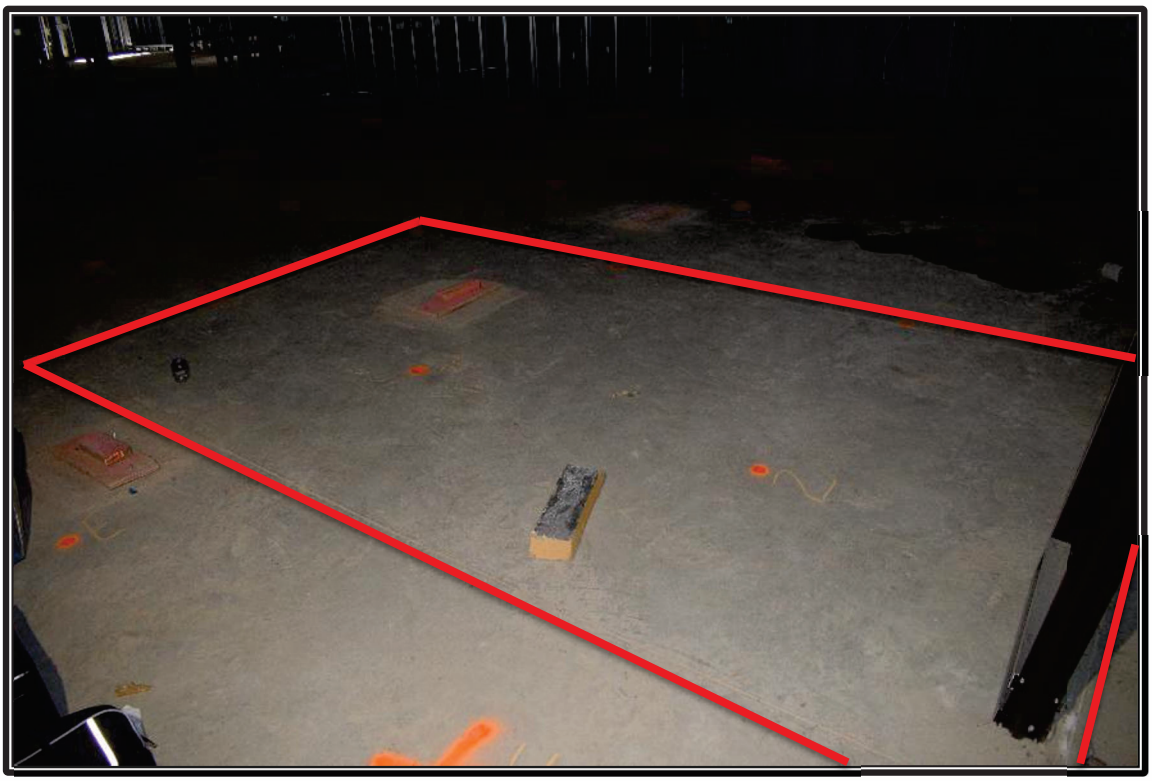

Photo 5: Representative view of a control joint panel with an aspect ratio of approximately 2 to 1 (outlined).

INTERIOR AND EXTERIOR CMU WALLS

At the time of ABS' site visit, the building's interior and exterior CMU walls were constructed; however, modifications to other building components resulted in portions of the CMU walls being demolished and thus incomplete. The CMU walls are largely load-bearing components that provide support to either vertical loading of the above structure, for example, at the mezzanine, or are designed for out-of-plane loading from wind loading. The building's CMU walls are constructed at the perimeter of the apparatus bay and around and below the mezzanine area. At the apparatus bay, the four (4) perimeter walls are constructed with 12-inch CMU. Three (3) of the apparatus bay walls are exterior walls, and the south elevation wall is an interior wall that connects to and is shared with the living area. At the mezzanine area (located within the living area directly adjacent to the apparatus bay), the walls are primarily constructed with 8-inch CMU; this includes one (1) full-height wall within the living area and partition walls below the mezzanine level.

F&R's March 11, 2024, letter summarizes their findings of the CMU wall construction from testing completed on February 26 and 27, 2024. The letter identifies areas where scanning using concrete ground penetrating radar (GPR) indicated concerns with the wall construction, including missing or inadequate reinforcement, missing grout, and improperly constructed bond beams. Areas selected for spot testing during ABS' site visit were selected in part based on F&R's findings.

During ABS' site visit, portions of the CMU walls were reviewed for compliance with the plans, construction documents, and applicable codes. Specifically, ABS reviewed six (6) areas located across five (5) different walls to assess, as was feasible, the construction of the walls. The investigation included sounding the areas of wall, scanning the wall areas using a James Instruments Rebarscope eddy current sensor, and selectively drilling 0.625-inch diameter holes through the face of the CMU. ABS' visual and destructive testing spot verified the as-built construction of reinforcement, grout, and bond beams at various conditions across the walls. Note that the eddy current sensor is limited to identification of whether reinforcement exists, not the quantity or sizing of the reinforcement.

Test Area 1 was located at the full-height mezzanine wall within the living area and was tested from the south face of the wall (**Figure 4**). The plans (Sheet 3.59) indicate that Test Area 1 should have included a bond beam at the top of the adjacent series of openings, jamb reinforcement at each opening, and typical wall reinforcement. Note that RFI #53 indicates that within the area below the HVAC openings at Test Area 1, cells should be fully grouted.

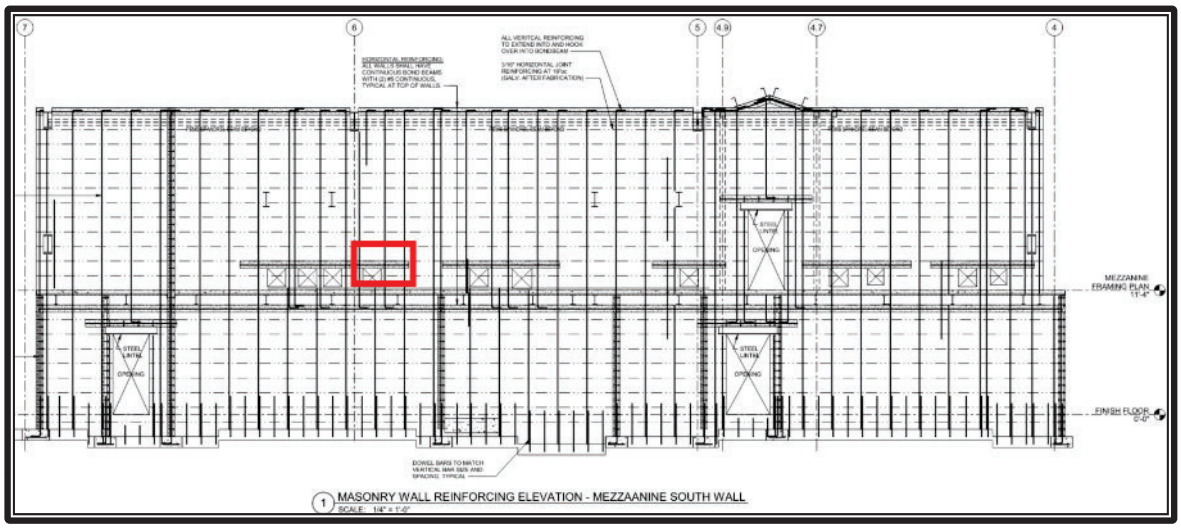

Figure 4: CMU wall elevation showing the approximate location of Test Area 1 (outlined) (cropped plan courtesy of T&V).

10. The openings at Test Area 1 were positioned such that the top of the openings were located midway through a CMU course. As a result, it appeared that the bond beam at Test Area 1 was constructed above the partial CMU course. Other openings within the same wall were located with the top of the opening level with the top of a full CMU course.

11. At the bond beam above the openings, cells appeared to contain reinforcement and be grouted.

12. Below the openings, cells appeared to be grouted but did not appear to be continuously reinforced.

13. The cells along the opening's jamb locations appeared to contain reinforcement and be grouted.

14. The presence of grout and reinforcement identified immediately below the opening was consistent with expected typical wall reinforcement.

According to F&R's March 11, 2024, letter, scanning at the cells above the openings at Test Area 1 "*did not indicate that the horizontal reinforcing steel was present.*" ABS' observations at Test Area 1 were generally consistent with the findings from F&R's letter. It appeared that the openings near Test Area 1 were located at a higher elevation than that shown on the plans (Sheet 3.59) and the shop drawings. As a result, the course directly above the opening did not appear to be constructed as a bond beam, as was detected by F&R. However, it appears that a bond beam was constructed within the full course above the openings.

Below the openings, fully grouted cells with no continuous reinforcement were observed, which was consistent with RFI #53. RFI #53 indicates that the areas below the openings do not require reinforcement but must be solid-grouted.

Test Area 2 was located at the south apparatus bay wall and was tested from the north face of the wall (**Figure 5**). The plans (Sheet 3.58) indicate that Test Area 2 should have included a bond beam at the top and bottom of the opening, a continuous bond beam at the mezzanine level, jamb and bearing reinforcement at the opening, and typical wall reinforcement.

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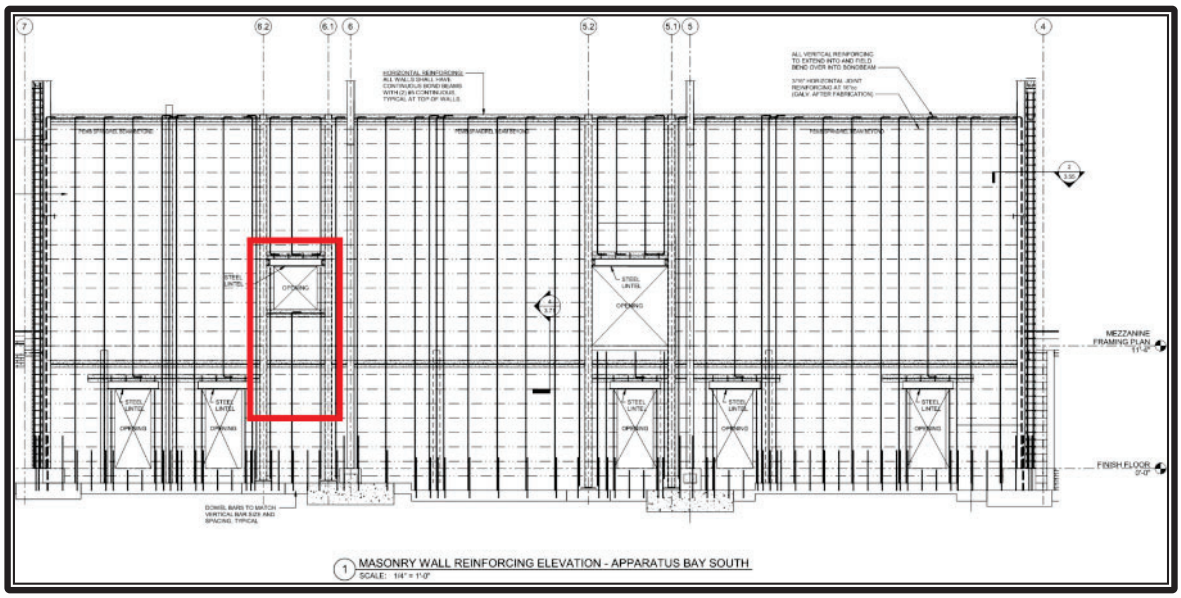

Figure 5: CMU wall elevation showing the approximate location of Test Area 2 (outlined) (cropped plan courtesy of T&V).

15. The bond beams located at the top and bottom of the opening did not appear to contain reinforcement and/or be fully grouted.

16. At the bottom bond beam, a cell without grout or reinforcement was visually observed from the sill of the opening.

17. At the top bond beam, the cells at the head of the opening above the steel lintel were exposed. Visual observation indicated that the cells were at least partially filled with debris. Holes drilled into the cells indicated that the cells were partially grout-filled above the debris.

18. Grout and reinforcement observed immediately below the opening were consistent with expected typical wall reinforcement.

According to F&R's March 11, 2024, letter, scanning at the bond beam cells below the opening at Test Area 2 "*did not indicate that the horizontal reinforcing steel was present.*" The plans (Sheet 3.58) and the shop drawings indicate that bond beams should be constructed above and below the opening at Test Area 2. Based on ABS' review, the CMU courses at these locations were not fully grouted and/or reinforced as specified.

Test Area 3 was located at the west apparatus bay wall and was tested from the east face of the wall (**Figure 6**). The plans (Sheet 3.56) indicate that Test Area 3 should have included a bond beam at the top of the adjacent opening, jamb and bearing reinforcement at each opening, reinforcement along the control joint (not shown on the plans), and typical wall reinforcement.

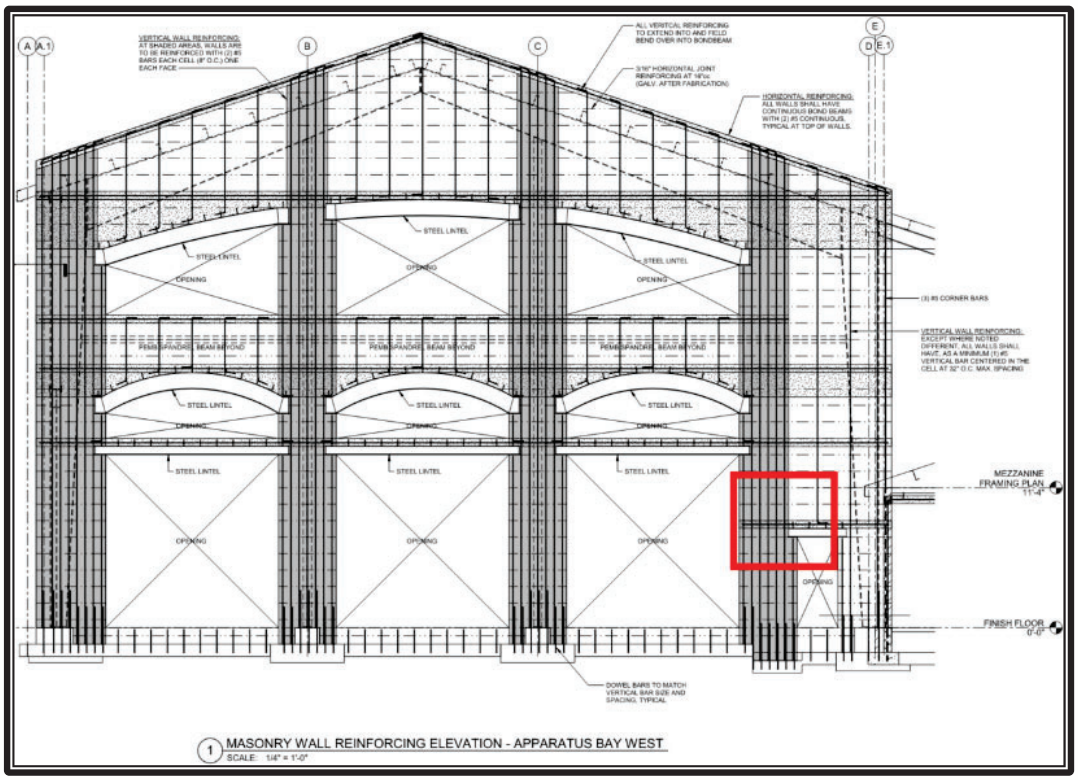

Figure 6: CMU wall elevation showing the approximate location of Test Area 3 (outlined) (cropped plan courtesy of T&V).

19. The bond beam located at the top of the adjacent opening appeared to contain reinforcement and be grouted. It appears that the bond beam reinforcement ends at the control joint located adjacent to the opening.

20. The cells along the opening's jamb and bearing locations appeared to contain reinforcement and be grouted.

21. The cells along either side of the control joint appeared to contain reinforcement and be grouted.

22. Grout and reinforcement observed in the field of the wall was consistent with expected typical wall reinforcement.

According to F&R's March 11, 2024, letter, scanning at the cells at the end of the bond beam above the opening at Test Area 3 "*did not indicate that the horizontal reinforcing steel was present.*" The plans (Sheet 3.56) and the shop drawings indicate that the bond beam above the opening should extend to the adjacent opening jamb at Test Area 3. Based on ABS' review, the cells at the end of the bond beam (beyond the control joint) were not reinforced as specified. No information for the construction of bond beams across control joints was provided in the plans or shop drawings; however, RFI #30 provides information regarding reinforcement at control joints and states "*When*

serving as primary structural reinforcement, such as bond beams located at floor and roof levels, the reinforcement should typically be continuous through the control joint." RFI #30 also provides information regarding the location of the CMU control joints, which were not shown on the plans.

Test Area 4 was located at the east apparatus bay wall and was tested from the west face of the wall (**Figure 7**). The plans (Sheet 3.55) indicate that Test Area 4 should have included a bond beam at the bottom of the opening, jamb and bearing reinforcement at the opening, corner reinforcement, and typical wall reinforcement.

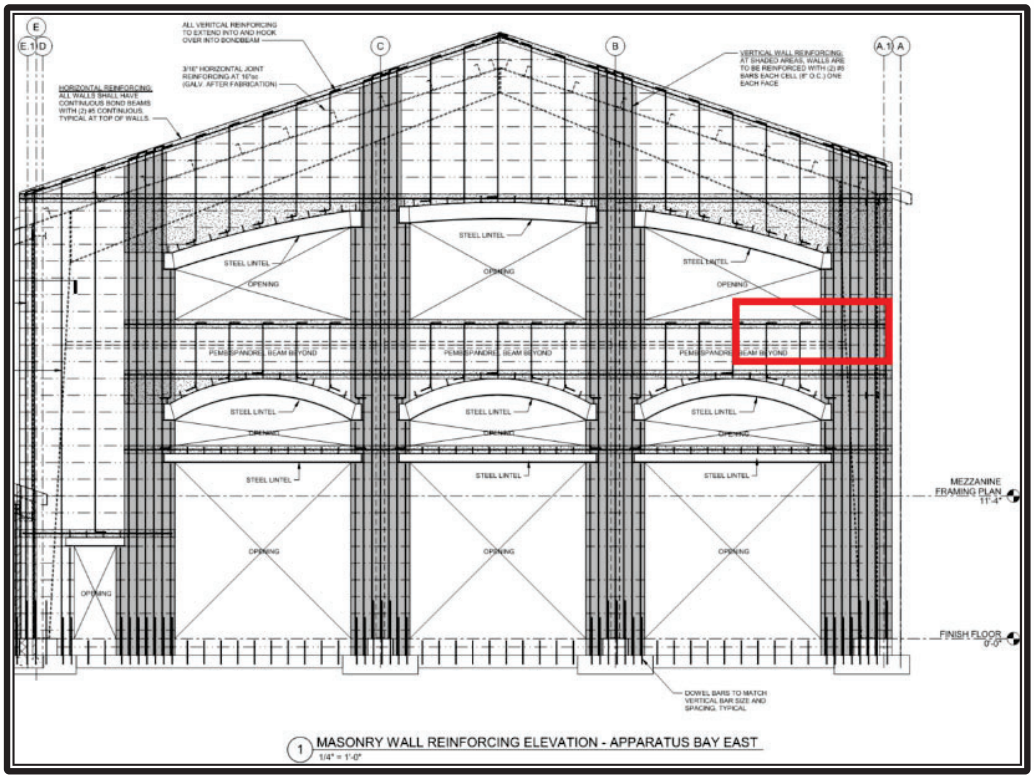

Figure 7: CMU wall elevation showing the approximate location of Test Area 4 (outlined) (cropped plan courtesy of T&V).

23. The bond beam along the bottom of the opening appeared to contain reinforcement and be grouted. Note that the eddy current sensor could not identify differences between continuous bond beam reinforcement and typical vertical wall reinforcement bent and embedded into the bond beam.

24. Where the bond beam is continuous to the corner of the CMU wall, investigation of reinforcement and grout was obstructed by the PEMB structural steel. Reinforcement at the corner could not be verified.

25. The cells along the opening's jamb and bearing locations appeared to contain reinforcement and be grouted.

26. Grout and reinforcement observed in the field of the wall were consistent with expected typical wall reinforcement.

Based on ABS' investigation, it is unclear if the bond beam at the bottom of the opening at Test Area 4 was reinforced as specified in the plans (Sheet 3.55) and shop drawings. ABS did verify that the cells were fully grouted. Reinforcement detected by ABS within the cells may be that of the bent ends of typical vertical wall reinforcement embedded into the bond beam; however, according to F&R's March 11, 2024, letter, scanning at the bond beam cells below the openings at Test Area 4 "*did not indicate that the horizontal reinforcing steel was present.*"

Test Area 5 was located at the west apparatus bay wall and was tested from the east face of the wall (**Figure 8**). The plans (Sheet 3.56) indicate that Test Area 5 should have included a bond beam at the top of the opening, jamb and bearing reinforcement at the opening, and typical wall reinforcement.

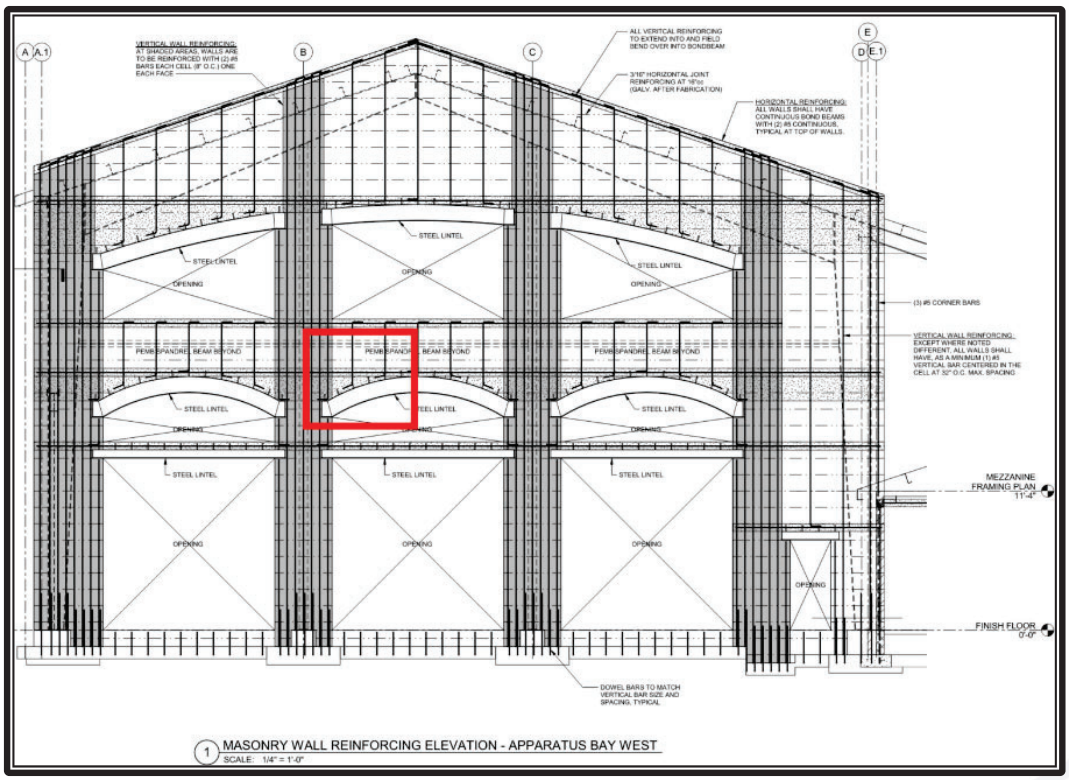

Figure 8: CMU wall elevation showing the approximate location of Test Area 5 (outlined) (cropped plan courtesy of T&V).

27. The bond beam along the top of the opening appeared to contain reinforcement and be grouted. Note that ABS' investigation could not identify differences between continuous bond beam reinforcement and typical vertical wall reinforcement bent and embedded into the bond beam. Additionally, studs from the steel lintel may have interfered with the observed reinforcement within the bond beam.

28. The cells along the opening's jamb and bearing locations appeared to contain reinforcement and be grouted.

29. Grout and reinforcement observed in the field of the wall were consistent with expected typical wall reinforcement.

Based on ABS' investigation, it is unclear if the bond beam at the top of the opening at Test Area 5 was reinforced as specified in the plans (Sheet 3.56). ABS did verify that the cells above the steel lintel were fully grouted. Reinforcement detected by ABS within the cells may be that of the bent ends of typical vertical wall reinforcement embedded into the bond beam and/or studs from the lintel extending into the bond beam; however, according to F&R's March 11, 2024, letter, scanning at the bond beam cells below the opening at Test Area 5 indicated that horizontal reinforcement was present.

Test Area 6 was located at the north apparatus bay wall and was tested from the south face of the wall (**Figure 9**). The plans (Sheet 3.57) indicate that Test Area 6 should have included joint reinforcement (not shown on the plans) and typical wall reinforcement.

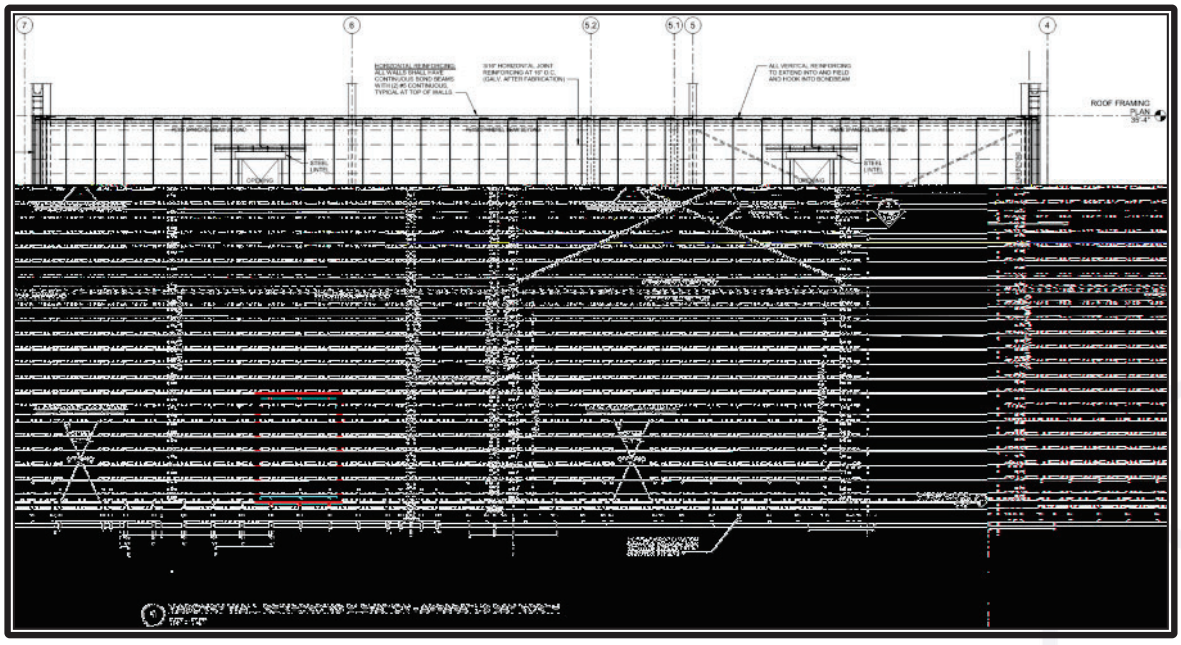

Figure 9: CMU wall elevation showing the approximate location of Test Area 6 (outlined) (cropped plan courtesy of T&V).

30. The cells along either side of the control joint appeared to contain reinforcement and be grouted.

31. Grout and reinforcement observed in the field of the wall were consistent with expected typical wall reinforcement.

32. At the control joint, ladder reinforcement within the mortar joints was observed between every other course (16 inch spacing).

Based on ABS' investigation, it appears that the CMU wall within Test Area 6 was as reinforced as specified. GPR scanning in this area from F&R's March 11, 2024, letter did not identify reinforcement issues with the wall in this area.

Based on a visual review and select destructive testing of the six (6) representative areas and a review of F&R's March 11, 2024, letter, it is ABS' opinion that multiple CMU structural components were not constructed in accordance with the plans and/or other relevant construction documents.

ABS Recommendation: Because of the extent of improperly constructed CMU walls identified in F&R's March 11, 2024, letter and/or during ABS' site visit, including at multiple critical structural components, it is ABS' opinion that the interior and exterior CMU walls should be removed and reconstructed.

EXTERIOR CAST STONE

At the time of ABS' site visit, most of the building's exterior cast stone was installed; in limited areas, primarily at the jambs and sills of some openings, some cast stone was not yet installed. All of the cast stone medallions were installed at the time of ABS' site visit. Cast stone was installed as an accent to the brick veneer cladding throughout the exterior of the building. The exterior cast stone throughout the building consisted of 11 cast stone medallions and cast stone accents around openings and other geometric building features.

During ABS' site visit, three (3) areas of the cast stone were investigated, which included limited removal of brick veneer adjacent to the cast stone and use of a Teslong Model No. TD500 articulating borescope. Using the articulating borescope, portions of the cavities behind the reviewed cast stone were observed. The primary objective of the exterior cast stone investigation was to determine if the anchorage of the cast stone was in compliance with the plans, construction documents, and applicable codes.

Test Area 1 was located at the large medallion on the west elevation of the apparatus bay above the bay door openings (**Figure 10**). In total, two (2) large medallions were installed at the exterior of the building. Investigation at Test Area 1 served as a representative sample of the construction

of the large medallions. ABS removed seven (7) partial brick veneer units located around the bottom perimeter of the large cast stone medallion.

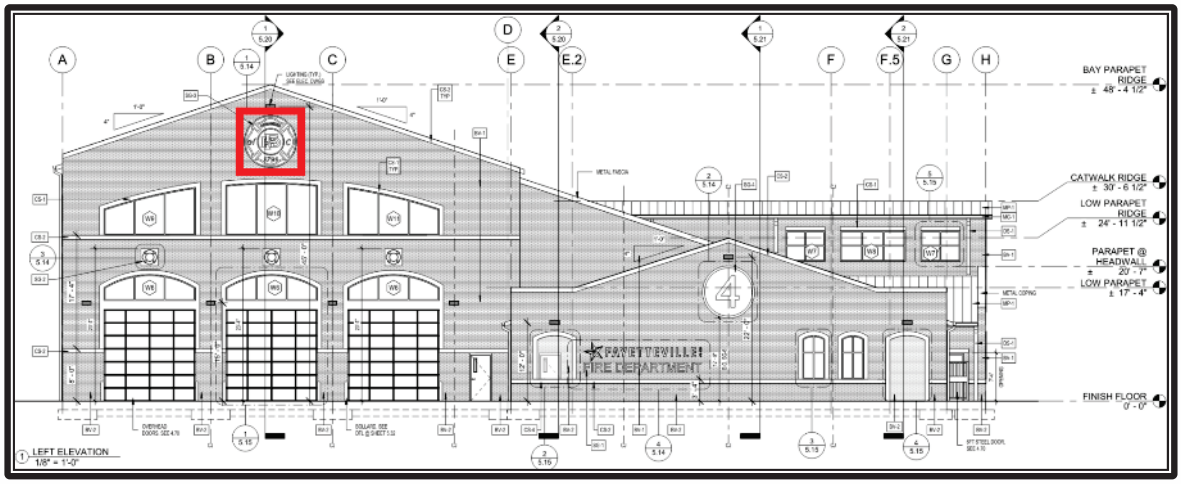

Figure 10: West exterior wall elevation showing the approximate location of Test Area 1 (outlined) (cropped plan courtesy of SCNA).

33. The cast stone medallion at Test Area 1 was comprised of five (5) individual sections of cast stone: one (1) circular section at the center surrounded by four (4) sections of a ring (**Photo 6**).

34. The bottom and outer edge of the lower ring section were observed in their entirety by means of brick veneer removal and use of the articulating borescope. Along this edge, no anchors holding the section of cast stone were observed.

35. At the joint between the lower ring section and the right ring sections, at least two (2) anchors were observed (**Photo 7**). The depth of the anchor flange into the cast stone could not be determined.

36. At the right and outer edge of the right ring section, one (1) anchor was observed. The anchor was located near the joint with the lower ring section. Other portions of the right ring section were not observed. The location of the anchor flange into the cast stone measured approximately 1.75 inches from the front face.

37. Anchoring of the left ring section, upper ring section, and center circle section could not be verified without additional brick removal.

The RockCast exterior cast stone shop drawings with attachment specifications depict the large cast stone medallion as a circle segmented into four (4) individual sector sections. The shop drawings specify that three (3) anchors should be installed within the mortar joint along the outer arc of each sector section using the Wire-Bond SureTie WS Stone Anchor Z Shape. Additionally, the shop

drawings specify that three (3) anchors should be installed within the mortar joint along the joint between each sector section using the Wire-Bond SureTie WS Stone Anchor.

The cast stone medallion at Test Area 1 does not match the depiction of the large medallion in the shop drawings. As a result, the attachment of the medallion must inherently differ from the specifications–at the very least, no attachment for the inner circular section of the medallion is provided. Given the error/discrepancy in the shop drawings, additional information in the form of an RFI should have been requested prior to installation. It is ABS' understanding that no RFI for the medallion attachment was submitted.

If the anchoring of the sector sections depicted on the shop drawings was used for installation of the ring sections at Test Area 1, missing anchors were identified. Due to the limited access and visibility, all anchors could not be identified; however, ABS was able to confirm that no anchors were installed along the bottom and outer edge of the lower ring section. The equivalent sector section from the shop drawings requires three anchors along this edge. It is ABS' opinion that the anchoring of at least one (1) section of the large cast stone medallions is not in compliance with the exterior cast stone shop drawings.

Test Area 2 was located at the southernmost small medallion on the east elevation of the apparatus bay (**Figure 11**). In total, nine (9) small medallions were installed at the exterior of the building. Investigation at Test Area 2 served as a representative sample of the construction of the small medallions. ABS removed five (5) full or partial brick veneer units located around the top, bottom, or right edge of the small cast stone medallion.

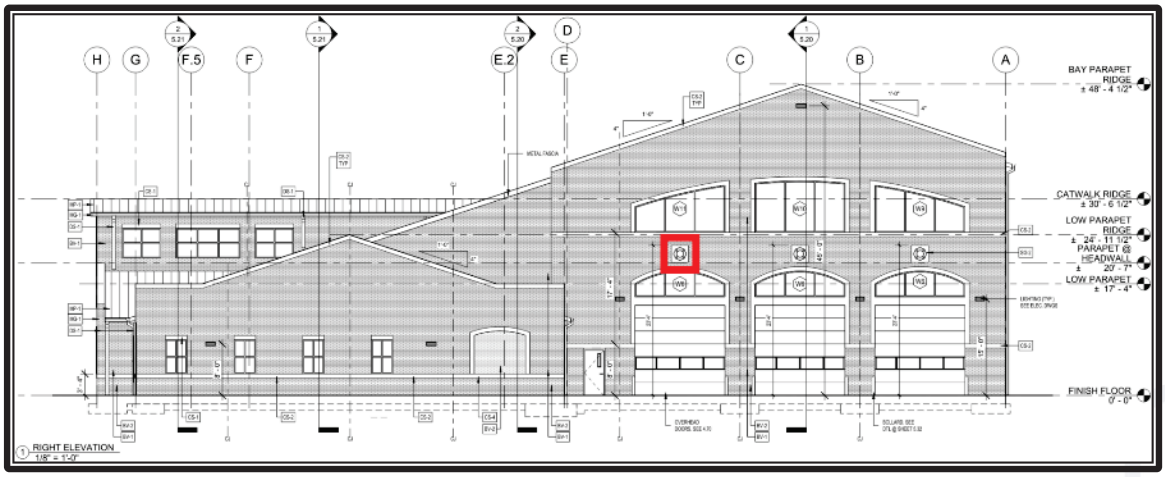

Figure 11: East exterior wall elevation showing the approximate location of Test Area 2 (outlined) (cropped plan courtesy of SCNA).

38. The cast stone medallion at Test Area 2 was comprised of a single rectangular section of cast stone.

39. The bottom edge of the cast stone was observed in its entirety by means of removal of one (1) brick veneer unit and use of the articulating borescope. Along this edge, no anchors holding the cast stone were observed.

40. The top edge of the cast stone was observed with the removal of two (2) partial or full brick veneer units. Access to the entire top edge of the cast stone was limited due to the metal lintel located at this location. At the observed portion of this edge, no anchors holding the cast stone were observed. Note that the metal lintel along the top edge of the cast stone would prevent anchoring along this edge given the observed construction.

41. The right edge of the cast stone was observed in its entirety by means of removal of two (2) partial brick veneer units and use of the articulating borescope. Along this edge, two (2) anchors holding the cast stone were observed (**Photo 8**). The depth of the anchor flange into the cast stone measured approximately 1.5 inches from the front face. Anchoring along the left edge of the medallion could not be verified without additional brick removal.

The RockCast exterior cast stone shop drawings with attachment specifications depict the small cast stone medallions with anchors at the top and bottom of the medallion. The shop drawings specify that two (2) anchors should be installed within the mortar joint along each of the top and bottom edges of the medallion using the Wire-Bond SureTie WS Stone Anchor Z Shape.

The cast stone medallion at Test Area 2 was installed with two (2) anchors along the right edge of the medallion. No anchors were installed at the top or bottom of the medallion. <u>It is ABS' opinion that the anchoring of the small cast stone medallion is not in compliance with the exterior cast stone shop drawings.</u>

Test Area 3 was located around the window opening at the south elevation of the living area (**Figure 12**). The test area included cast stone accents at the head and jambs of the window opening as well as the water table along the elevation of the brick veneer wall. ABS removed three (3) full brick veneer units located around the cast stone accents.

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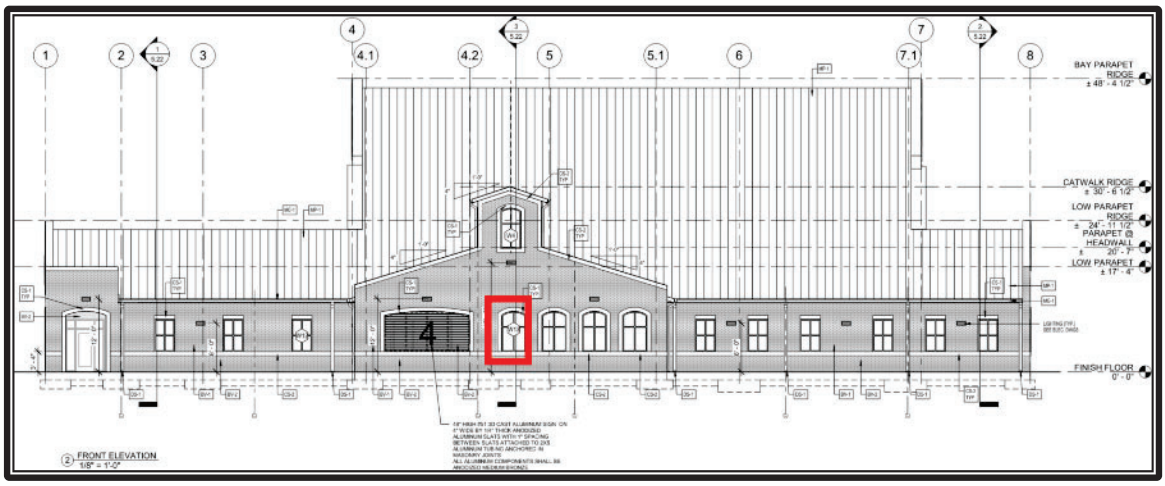

Figure 12: South exterior wall elevation showing the approximate location of Test Area 3 (outlined) (cropped plan courtesy of SCNA).

42. The cast stone accents at the jamb of the window were comprised of multiple sections of cast stone.

43. At the joint between sections of cast stone along the jamb of the window opening, an anchor was observed. The depth of the anchor flange into the cast stone could not be determined.

44. At the joint between the cast stone at the top of the jamb and the head of the window opening, no anchor was observed.

45. At the top edge of the cast stone along the head of the window, masonry wall ties were observed at each of the intersecting metal studs (**Photo 9**).

46. At the cast stone water table, masonry wall ties were observed along the top and bottom of the stone at each of the intersecting metal studs.

The RockCast exterior cast stone shop drawings with attachment specifications depict the cast stone accents with anchors within the mortar joint between adjacent sections of stone at the jamb observed at Test Area 3; it also depicts masonry wall ties within the mortar joint along the top of the head cast stone, but no spacing is provided. At the water table, masonry wall ties within the mortar joints along the top and bottom of the cast stone are depicted, but no spacing is provided.

The cast stone accents at the jamb were installed with anchors between adjacent sections; however, no anchor was observed at the section of cast stone at the top of the jamb. <u>It is ABS' opinion that the anchoring of the cast stone at this location is not in compliance with the exterior cast stone shop drawings.</u>

The cast stone accents at the head were installed with masonry wall anchors along their top edge at the intersecting metal studs; likewise, the cast stone accents at the water table were installed with masonry wall anchors along their top and bottom edges at the intersecting metal studs. While this construction may be correct, it is ABS' understanding that no construction document specifies the spacing of the masonry wall ties at these locations. Given the spacing specification omitted from the shop drawings, additional information in the form of an RFI should have been requested prior to installation. It is ABS' understanding that no RFI for the cast stone accent attachment was submitted. Therefore, it is ABS' opinion that it could not be determined if the anchoring installed at the cast stone along the head of the window opening or along the water table was adequate.

ABS Recommendation: ABS recommends that the exterior cast stone as-built conditions identified during ABS' site visit be reviewed by the cast stone manufacturer and EOR. It is ABS' opinion that if the as-built condition of the cast stone is approved by the cast stone manufacturer and EOR, no further action is required; however, if modifications to the attachment method specified by the cast stone manufacturer and EOR are required, removal of the cast stone and/or brick veneer may be necessary.

Photo 6: View of the cast stone medallion at Test Area 1.

Photo 7: Representative view of the anchors at Test Area 1 (arrows).

Photo 8: Representative view of the anchor at Test Area 2 (arrow).

Photo 9: Representative view of a masonry wall tie at the head of the window opening at Test Area 3 (arrow).

LIGHT-GAUGE METAL FRAMING

At the time of ABS' site visit, most, if not all, of the building's light-gauge metal framing was constructed. Throughout the living area, the building was structurally supported by the PEMB but was enclosed with light-gauge metal-framed walls and partitions. The plans (Sheet 3.04) indicate that the light-gauge metal wall framing was comprised of 6- and 8-inch, 18-gauge studs at 16- or 12-inch on-center spacing.

During ABS' site visit, portions of the light-gauge metal framing were reviewed for compliance with the plans, construction documents, and applicable codes. Review of the metal framing was completed with visual assessment and no destructive testing.

47. Flat metal straps were installed over pre-manufactured slip tracks (**Photo 10**). This condition appears to be an attempt to create a deeper slip track.

48. At many locations, the light-gauge metal studs had little to no clearance to the slip track, creating a condition that will allow little to no movement (**Photo 11**).

49. Bridging was missing within 12 inches of the slip track on multiple light-gauge metal walls (**Photo 12**).

50. The first row of light-gauge metal wall bridging was measured at 59 inches above the concrete slab and 72 inches on center above that (**Photo 13**). Detail 3 on Sheet 3.04 indicates a 48-inch maximum distance to the first row of bridging above the concrete slab.

51. At the arch above window openings, the upper metal track was shimmed with gypsum wallboard (GWB) at multiple locations (**Photo 14**). No box header was observed over these openings as required on Sheet 3.04 (**Photo 15**).

ABS Recommendation:
It is ABS' opinion that all non-complying components that may also be compromised due to long-term exposure to the elements should be repaired or replaced to be in compliance with the approved architectural and structural plans.

Photo 10: Representative view of the metal strapping at the slip track.

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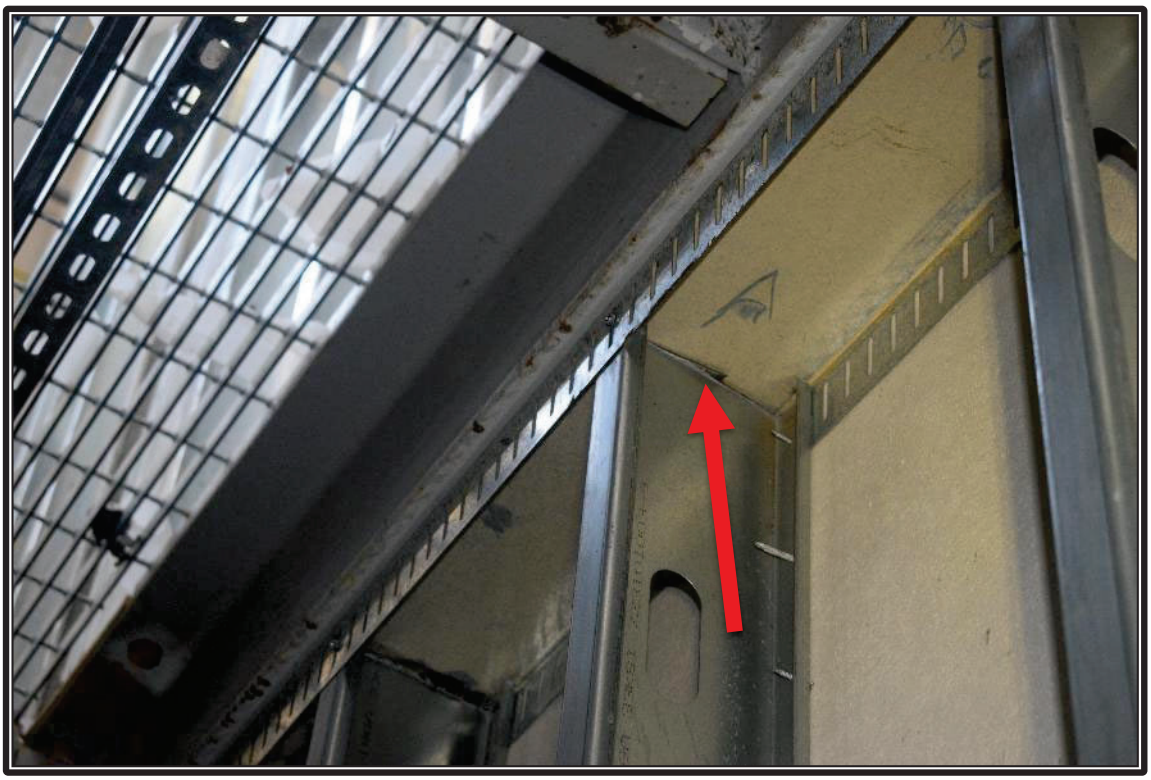

Photo 11: Representative view of a light-gauge metal stud with inadequate clearance at the slip track (arrow).

Photo 12: Representative view of the missing light-gauge metal wall bridging (oval).

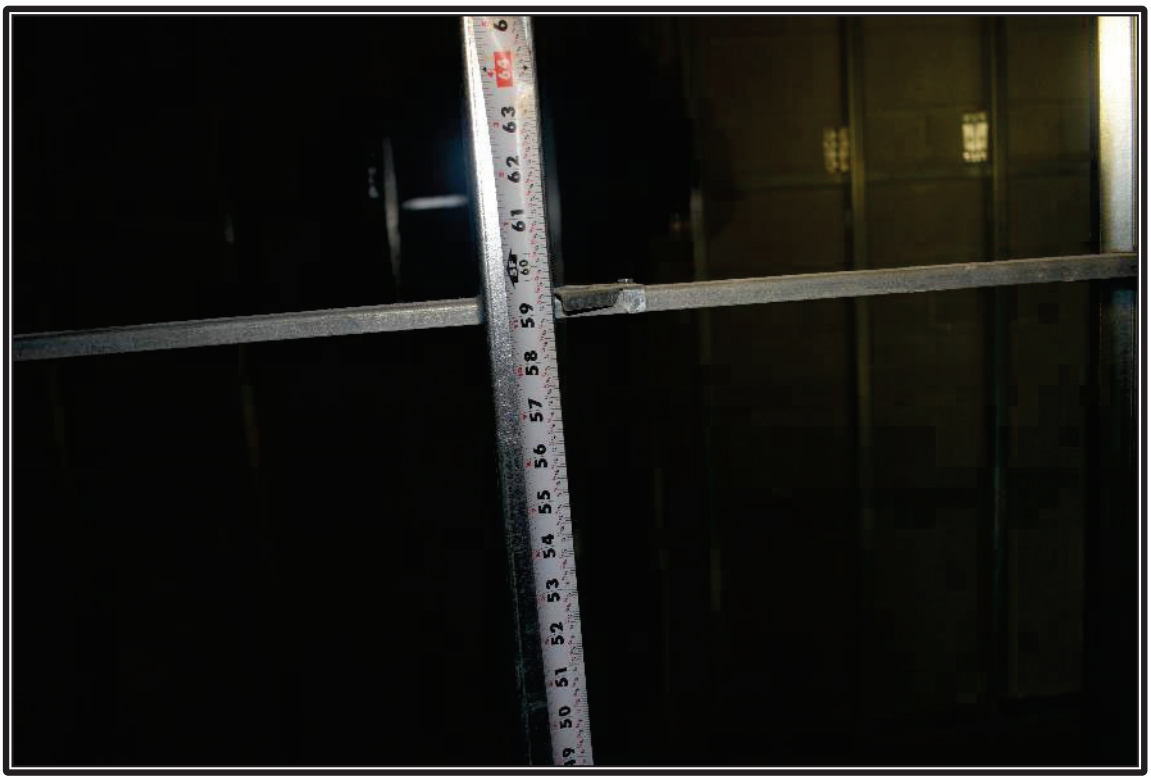

Photo 13: Representative view of the measured distance to the first row of bridging above the concrete slab.

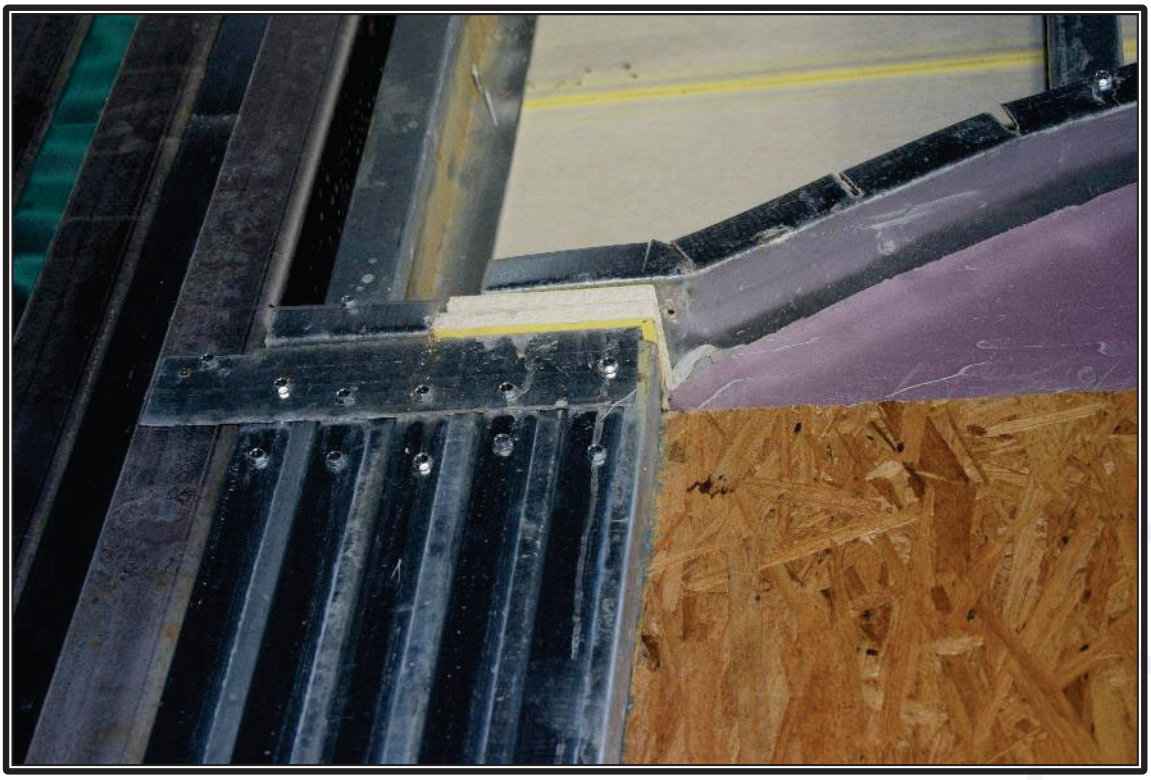

Photo 14: Representative view of GWB used as shims between the arched track and jack studs (arrow).

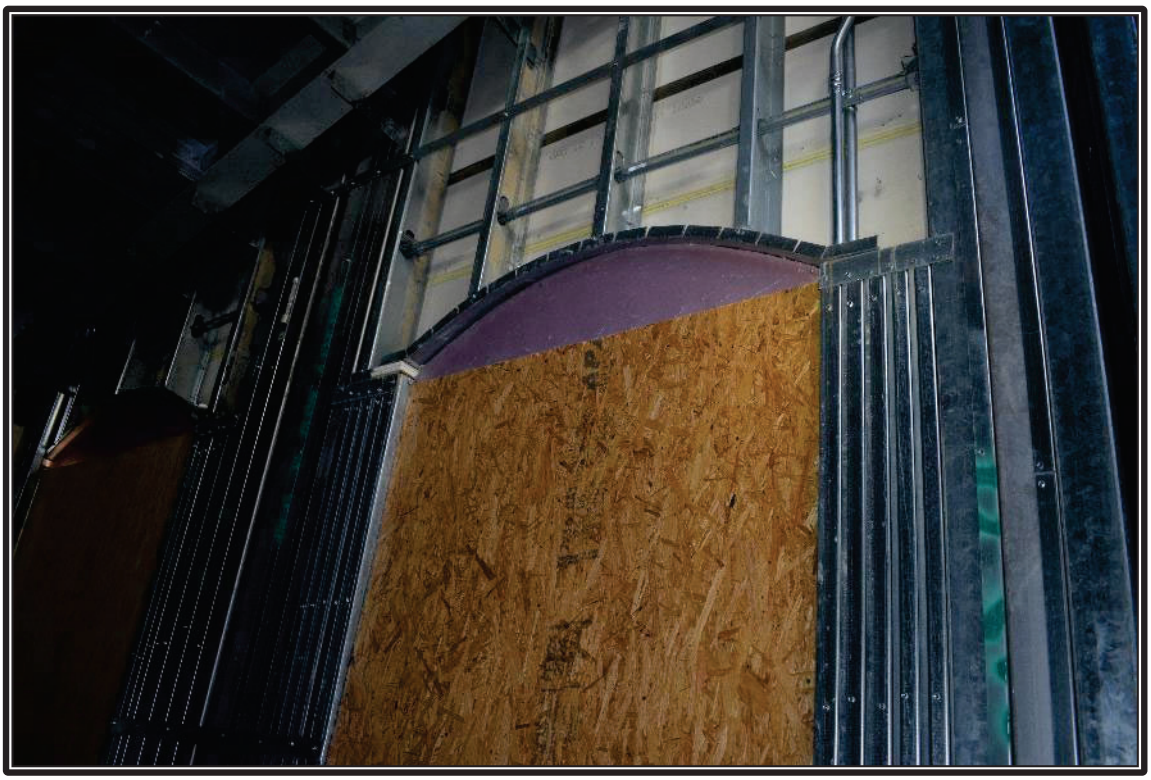

Photo 15: Representative view of an arched opening with no header.

ROOF ASSEMBLY AND ROOF STRUCTURE

At the time of ABS' site visit, the building's roof assembly was constructed over the majority of the roof structure; in limited areas, the roof assembly was incomplete. The roof structure was structurally supported by the PEMB. Above the PEMB purlins, the roof assembly was constructed with rigid insulation boards below the standing seam metal panel roof covering.

During ABS' site visit, portions of the roof assembly and structure were reviewed for compliance with the plans, construction documents, and applicable codes. In select areas, portions of the roof assembly were removed for destructive testing.

52. The primary roof slope measured approximately 4:12.

53. The width of the standing seam metal roof panels measured 16 inches wide with 2-inch standing vertical seams.

54. The two (2) layers of rigid insulation board each measured 2.5 inches thick and were 4 feet wide by 10 feet long.

55. The standing seam metal roof panels were generally seamed with a 90-degree single roll (1 phase) (**Photo 16**). At some locations, the panels were unseamed (**Photo 17**).

56. Based on the limited partial removal of select standing seam metal roof panels, it appeared that the edges of each panel were fastened to the roof structure with roof clips located at each purlin; however, no clip was installed at some purlins. Therefore, the spacing of the roof clips varied based on the spacing of the purlins below.

    At the observed areas of the roof eave, the first roof clip measured approximately 32 inches from the fascia purlin. At the fascia purlin, five (5) exposed-head screws were fastened through each panel. The screws appeared to fasten into the light-gauge metal at the end of the rigid insulation boards, which were also connected with an adhesive. It is unclear how the light-gauge metal at the end of the rigid insulation boards was fastened to the roof structure.

57. The rigid insulation boards were fastened to the roof structure with 6-inch self-tapping screws spaced in accordance with the purlin spacing (**Photo 18**). Each insulation board generally exhibited 2 or 3 fasteners. The 6-inch screws fastened both layers of insulation to the roof. Each screw was partially held in place by 5-inch by 5-inch light-gauge metal plates located at the top of the upper layer of insulation. At most observed locations, the metal plate was covered by a second metal plate of the same size, which was fastened to the bottom disc with a small screw. Where the upper insulation boards were temporarily removed by ABS, no fasteners at the bottom layer of insulation were observed.

58. The seams between rigid insulation boards were offset between each layer. Seam tape was observed along some, but not all, of the seams. At some locations, closure strips were observed at the board seams. From the interior of the building, it appeared that most of the seams along the bottom surface of the lower insulation boards were installed with a foil tape; however, some untaped seams were observed (**Photo 19**).

59. From the interior of the building, the exposed lower insulation boards appeared to be two (2) different products in various areas.

60. Approximately 36 inches of self-adhered asphalt underlayment was observed at the eave of the roof.

61. As an apparent result of sections of the roof being incomplete and exposed to the elements for an extended period of time, deteriorated sections of the roof assembly materials were observed (**Photo 20**).

62. At multiple locations, the through-wall flashing through the brick veneer extended into the roof insulation assembly (**Photo 21**). This condition permits moisture that bypasses the brick veneer to enter into the roof assembly.

63. Openings and gaps at the exterior wall-to-roof junction were observed at multiple locations (**Photo 22** and **Photo 23**). Details 1, 2, and 3 on Sheet 5.31 indicate to provide "*Dow Froth-pak in open joints as required to seal building envelope at all exterior roof wall intersections.*" Additionally, Note 14 under "*Roofing General Notes*" indicates "*G.C. to fill all void ends of [light-gauge metal] top chords (at overhang) with spray foam insulation/Froth-Pak prior to installation.*"

The "Roof Panel PD Calcs" submittal indicates that the standing seam metal panel installed at the building is the 22-gauge Loc Seam 360 panel from Nucor Building Systems. The Loc Seam 360 panels are mechanically rolled seams with a 360-degree double roll (2-phase). The panel seams throughout the roof were generally constructed with 90-degree single-roll (1-phase) seams installed. It is ABS' opinion that the standing seam metal roof panel seams were not installed in accordance with the submittal.

It is ABS' understanding that no standing seam metal roof panel roof clip spacing was directly provided in the plans or construction documents. However, in the "Roof Panel PD Calcs" submittal, comments from SCNA state to "*coordinate installation of material to reflect minimum pressure requirements listed [in the plans].*" The plans (Sheet 3.00) indicate that the components and cladding wind pressures for the various roof zones range from 43 to 150 pounds per square foot. According to the submittal, for 22-gauge panels, the span required for an uplift/wind suction pressure greater than 150 pounds per square foot is 1.0 feet. Comparing the pressures identified for the various roof zones on the plans (Sheet 3.00) to the submittal, the maximum roof clip span is as follows:

- Roof Zone 1 (43 pounds per square foot): 5.27 feet (71.6 pounds per square foot)
- Roof Zone 2 (75 pounds per square foot): 5.0 feet (76.5 pounds per square foot)
- Roof Zone 3 (110 pounds per square foot): 3.0 feet (113.0 pounds per square foot)
- Roof OH Zone 2 (95 pounds per square foot): 3.5 feet (103.8 pounds per square foot)
- Roof OH Zone 3 (150 pounds per square foot): 1.0 feet (163.1 pounds per square foot)

For a view of the zones referenced in the plans (Sheet 3.00), see the diagram from ASCE 7-10 (**Figure 13**).

According to information from the plans (Sheet 3.00) and the submittal, the roof clip spans at the corners of the roof should not exceed 3.0 feet, or 1.0 foot for overhangs. Given that the first purlin past the fascia purlin at the eave of the roof was spaced at approximately 32 inches, the roof clips at the corner overhangs cannot be spaced at less than 32 inches. It is ABS' opinion that the roof clips in some locations were not installed in accordance with information from the plans and submittal.

The "Roof Insulation Product Data" submittal indicates that the rigid insulation installed at the building is the IsoRed Max and IsoRed Max HD rigid polyiso insulation boards from Ox Engineered Products. It is ABS' understanding that fastener spacing for the rigid insulation boards was not specified in the plans. Fastener installation information within the "Roof Insulation Product Data" submittal is unclear in regard to the use of the product in roof applications. With no other information provided, ABS used product information within the submittal to best interpret applications to roofs. However, the submittal provides a table that specifies the fastener spacing over metal framing as 12 inches at the perimeter and 12 inches throughout the field. The submittal also states that boards "*used to resist transverse wind pressure or used as WRB shall be installed on studs spaced a maximum of 410 mm (16") o.c. and all [board] edges shall be located on framing or blocking.*" Given that there is no structural deck below the insulation boards, the edges of boards would require significant blocking and intermediate support spacing between purlins to meet the requirements of the submittal. Blocking along the board edges and intermediate purlin support (to meet the 16-inch spacing requirements) was not observed. It is ABS' opinion that the edge and field supports for the rigid insulation boards did not meet the requirements of the submittal. It is also ABS' opinion that the fastener spacing at the perimeter and field of the boards did not meet the requirements of the submittal.

The plans (Sheet 4.30) indicate that the seam treatment differs at the two (2) roof assemblies. Roof assembly 1 is primarily located over the living area; roof assembly 2 is primarily located over the apparatus bay. For both assemblies, seams at the top layer of rigid insulation should have been installed with a flashing tape product along the top surface. For roof assembly 1, seams at the bottom layer of rigid insulation should have been installed with a foil tape product along the bottom surface. For roof assembly 2, seams at the bottom layer of the rigid insulation should have been installed with closure strips. At the observed sections of rigid insulation boards, it appeared that the seams along the top surfaces of the upper boards were taped in accordance with the plans (Sheet 4.30). However, it appeared that seams along the bottom surfaces of the lower boards were not installed with foil tape or closure strips. Therefore, it is ABS' opinion that in some areas, the lower layer of rigid insulation boards were not installed in accordance with the plans (Sheet 4.30).

The plans (Sheet 4.30) also indicate that acoustic fiberboard over 0.5-inch hat channel should have been installed at the underside of the roof purlins in some locations. Detail 4/4.30 indicates that the fiberboard should have been installed in specified locations at roof assembly 2. The roof assembly notes on Sheet 4.30 indicate that the fiberboard should have been installed in specified locations at roof assembly 1. It is unclear where the fiberboard should have been installed. Given the error/discrepancy in the plans (Sheet 4.30), additional information in the form of an RFI should have been requested prior to installation. It is ABS' understanding that no RFI for the fiber board installation was submitted. No fiberboard at the underside of the roof purlins was observed at any location throughout the building. It is ABS' opinion that fiber board was not installed in accordance with the plans.

ABS Recommendation: Because of the extent of improper installation of the roof assembly identified during ABS' site visit and incomplete roof construction resulting in multiple points of entry for water intrusion, in addition to components now compromised due to long-term exposure to the elements, it is ABS' opinion that the entire roof assembly should be removed and replaced.

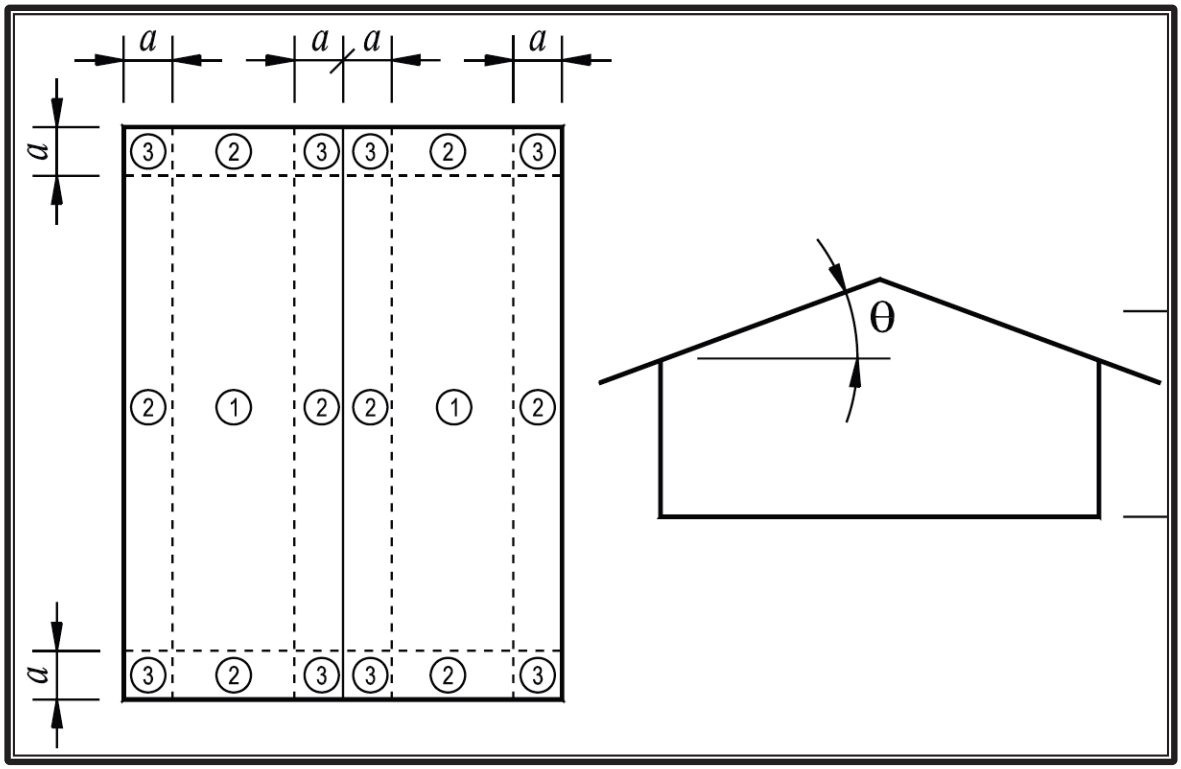

Figure 13: Wind pressure zones for gable roofs with a slope between 7° and 27° (courtesy of ASCE 7-10).

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Photo 16: Representative view of a 90-degree single roll (1 phase) standing seam metal roof panel (arrow).

Photo 17: Representative view of an unseamed standing seam metal roof panel (arrow).

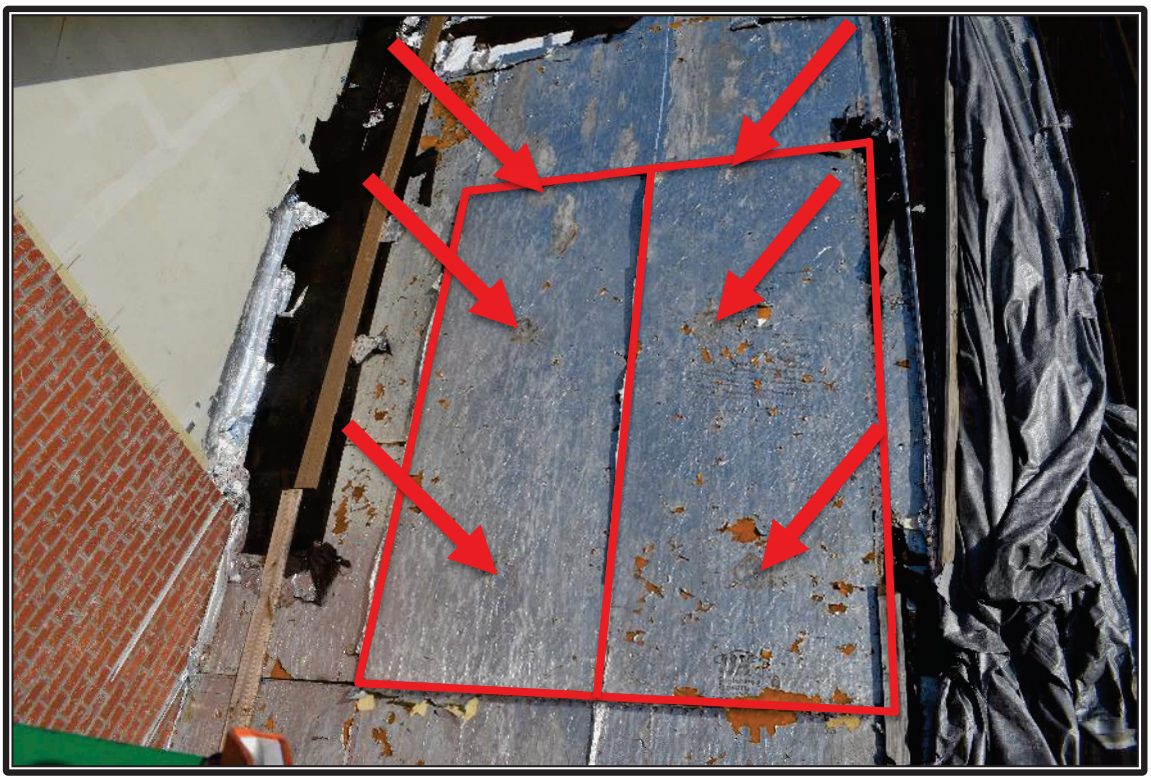

Photo 18: Representative view of fastener locations installed through the upper two (2) rigid insulation boards (temporarily removed by ABS) (arrows).

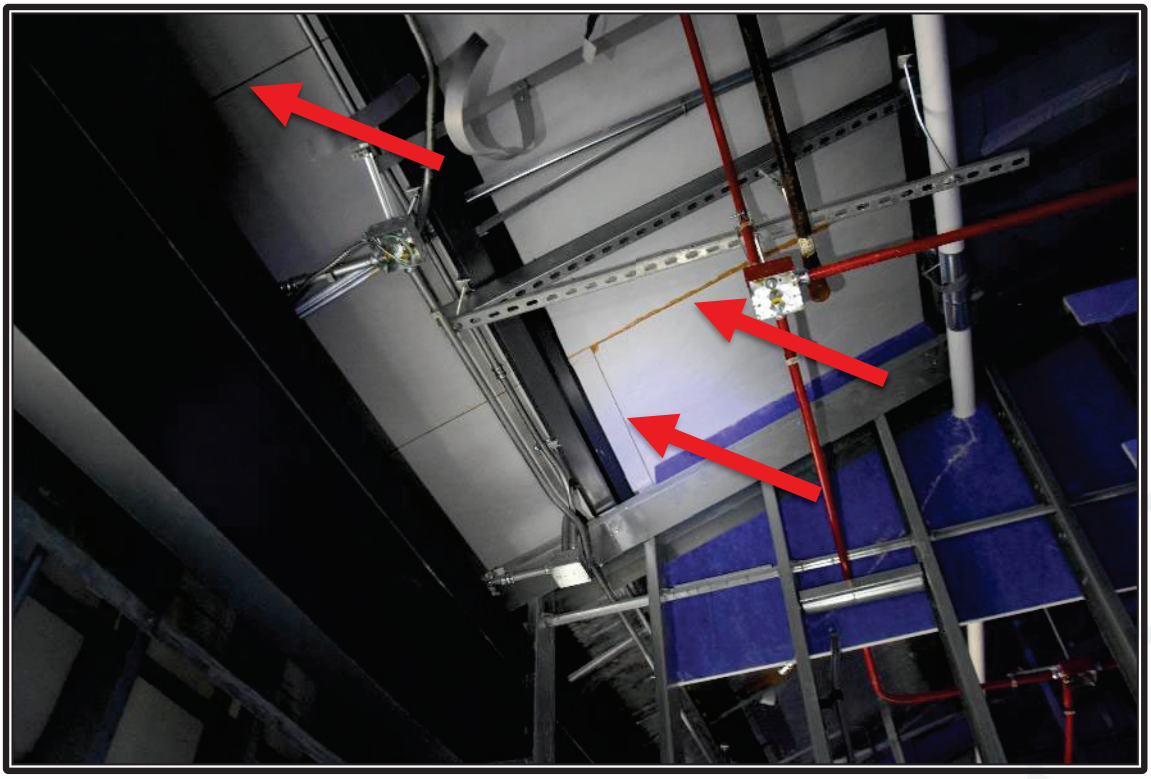

Photo 19: Representative view of seams with no tape or closure strip (arrows).

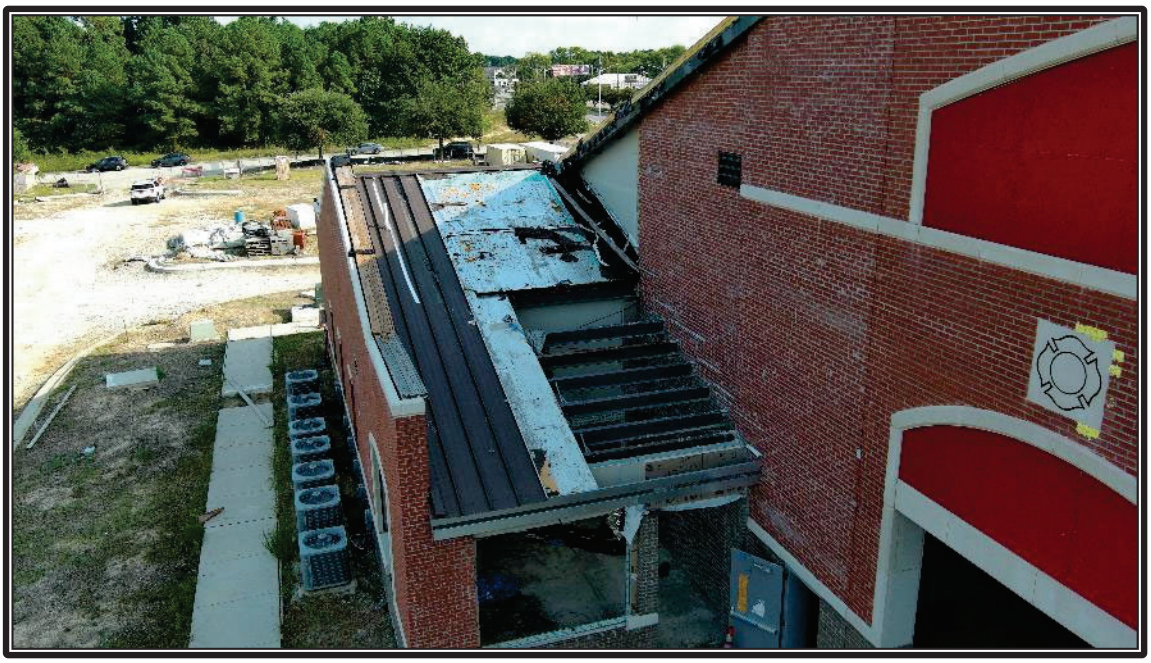

Photo 20: Representative view of deteriorated roof assembly materials at a section of incomplete roof.

Photo 21: Representative view of through-wall flashing penetrating the roof insulation.

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Photo 22: Representative view of missing spray foam insulation at the roof-to-exterior-wall interface (arrows).

Photo 23: Representative view of visible daylight through an unsealed penetration at the exterior wall sheathing.

WELDS AND BOLTS

At the time of ABS' site visit, most, if not all, of the welds and bolts throughout the building were completed throughout the PEMB structural steel at various connections. It is ABS' understanding that no welds or bolts were used for light-gauge metal framing connections.

During ABS' site visit, portions of the PEMB structural steel bolted and welded connections were visually observed for compliance with the plans, construction documents, and applicable codes. ABS' review did not include any destructive testing of the welds and bolts.

64. At many welded connections, what appear to be field welds exhibited surface corrosion and did not appear to ever be coated (with primer/paint) (**Photo 24** and **Photo 25**). The apparent field welds also exhibited significant imperfections and irregularities.

65. Four (4) PEMB beams identified by F&R were allegedly field spliced by Brawley during construction. ABS located and observed what appeared to be field-welded splices in the four (4) beams (**Photo 24**). Evidence of excessive heat in the welding process, which resulted in discoloration of the steel and improper base metal removal as evidenced by the presence of a coating, was observed.

66. At many bolted connections, the bolts and/or structural steel in the area directly adjacent to the bolts exhibited surface corrosion (**Photo 26** and **Photo 27**).

The PEMB shop drawings state that "*all welding of structural steel is based on… AWS D1.1.*" The shop drawings also state that "*all welding must be performed by AWS-qualified welders for the welding processes and positions to be used. All welding and weld prep must be completed and visually inspected to AWS acceptance criteria… in accordance with the applicable AWS standard.*" For field welds, it states that "*all field welding must be performed by AWS… certified welders who are qualified for the welding processes and positions indicated. All work must be completed and inspected in accordance with the applicable AWS… specifications,*" and that for touching up welded areas, "*restoration of the area will be performed in accordance with ASTM A 780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.*" Documentation such as welding procedure specifications (WPS), procedure qualification record (PQR), or welder certification from the welding subcontractor was not available to ABS to verify compliance with AWS requirements. Based on a visual assessment of the welded connections, welds that appeared to have been field welded did not exhibit workmanship consistent with an AWS-certified welder. According to AWS D1.1, Section 6.9, all welds must be visually inspected. Documentation of the visual inspections of the welds was not available to ABS to verify compliance with AWS requirements. Note that AWS D1.1 states that visual inspection and necessary correction of all deficiencies in materials and workmanship are the responsibility of the contractor. It is ABS' understanding that the required inspection reports for field welding performed have not been provided by Brawley.

It is also ABS' understanding that the installation of multiple structural steel components was not performed in accordance with the plans and/or shop drawings. Notably, it was reported to ABS that at the four (4) PEMB beams that were spliced with apparent field welds, Brawley neither acquired approval from the EOR for the splices nor performed the welding with code-required inspections. It is ABS' opinion that the apparent field welds installed at many locations throughout the building, including at the PEMB beam splices, were not likely completed by an AWS-certified welder, and that no inspection reports of those welds were provided in accordance with the requirements of the shop drawings or AWS D1.1.

For bolts, the metal building shop drawings state that "*all A490 bolts shall be 'fully-pretensioned'*" and that "*all A325 bolts in primary framing (rigid frames and bracing) may be 'snug-tight'*" except for special connections or uses defined on the shop drawings. Bolts for the connections throughout the PEMB were not specified in the shop drawings. Without further information, it is ABS' opinion that it could not be determined if the bolts installed throughout the building are adequate.

The "Shop Drawings" submittal, which provides various structural steel connection details, also specifies guides for welding and bolting. It states that "*all bolding shall conform to the requirements of the RCSC 'Specification for Structural Joints using High Strength Bolts'*" and that "*all welding shall conform to the requirements of AWS D1.1, latest edition.*" It also specifies that bolts used should be "*3/4" A325N or 1" A325N U.N.O.*" and that welding electrodes should be "*low hydrogen*" "*E70xx (SMAW), ER70S-X (GMAW), or E7X5-X (FCAW).*"

ABS Recommendation: It is ABS' opinion that all PEMB welded and bolted connections not previously inspected as part of the code-required special inspections be reviewed in accordance with code-required specifications and that all welded and bolted structural connections that were not approved during construction should be removed and weld repair designed and implemented. It is recommended that the PEMB manufacturer, Kirby, be consulted to confirm the adequacy of the field welds and bolting.

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Photo 24: Representative view of an apparent uncoated field weld with surface deterioration at a PEMB beam splice.

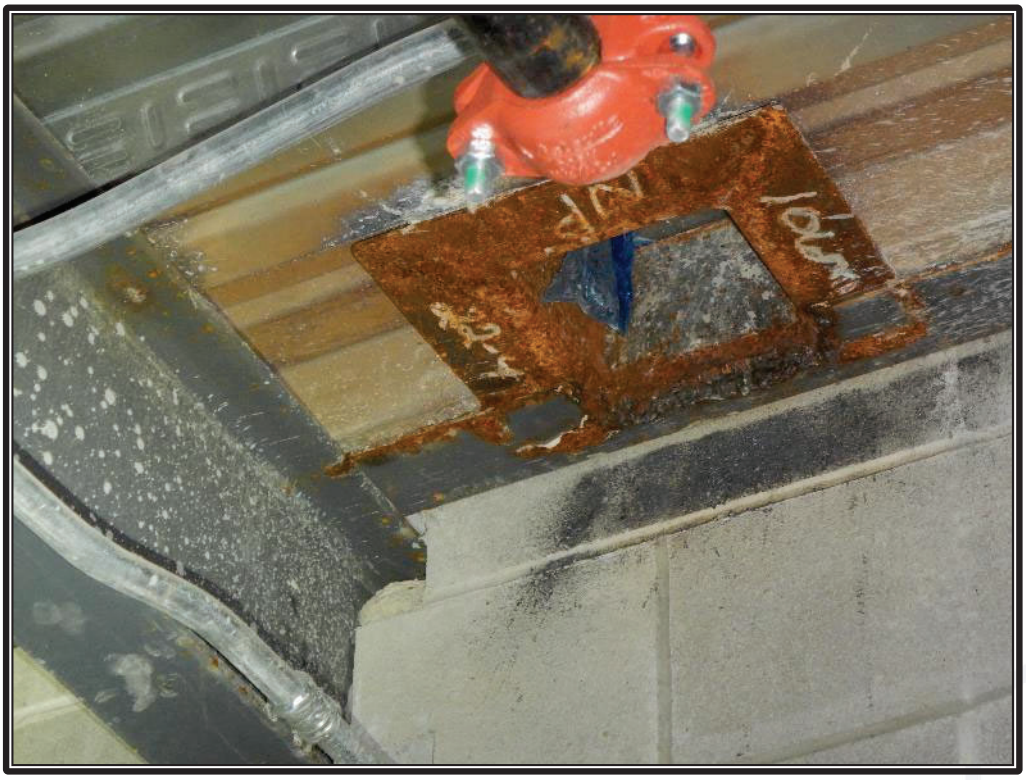

Photo 25: Representative view of an apparent uncoated field weld with surface deterioration.

Photo 26: Representative view of the bolts and structural steel with surface corrosion.

Photo 27: Representative view of the bolts and structural steel with surface corrosion.

DOMESTIC DRAINAGE PIPE SYSTEM

At the time of ABS' site visit, most, if not all, of the building's domestic drainage pipe system was constructed. A system of interconnected floor drains, plumbing drains, cleanouts, and other components was located below grade within and adjacent to the building footprint. The plans (Sheet 8.10) indicate that the below-grade drainage pipe system consists of 2-, 3-, 4-, and 6-inch pipes. Specifically, the plans (Sheet 8.00) indicate that the below-grade drainage pipe system should be constructed with service weight cast iron pipe. In general, main branches of the pipe system flow south and west; all parts of the system eventually connect to a 6-inch pipe that flows to the west.

During ABS' site visit, accessible portions of the domestic drainage pipe system were reviewed via camera scoping performed by Next Level. In total, 30 pipe stubs located throughout the building were scoped. Multiple other pipe stubs were visually reviewed by ABS where obstructions prevented camera scoping.

67. The visually observed section of the drainage pipe system appeared to have been constructed out of polyvinyl chloride (PVC) pipe.

68. At multiple locations, components of the drainage pipe system were missing.

69. At multiple locations, footage from the scoping camera indicated that water backup and/or debris filled or partially filled the pipe (**Photo 28**); further scoping into the pipe was obstructed. At some locations, the backup was located at or near the end of the pipe stub/inlet. It is possible that the water observed at some locations is held within a p-trap.

70. At multiple locations, a watery sludge backup filled the pipe (**Photo 29**); further scoping into the pipe was obstructed.

71. At one (1) location, footage from the scoping camera indicated a significant collection of debris/dirt/stone; further scoping into the pipe was obstructed. Limited excavation and removal of the pipe was required (**Photo 30**).

72. At multiple locations, footage from the scoping camera indicated that the pipe/pipe fitting joints were partially separated or poorly fit during construction (**Photo 31**).

73. At one (1) location, footage from the scoping camera indicated that the pipe/pipe fitting joints were fully separated (**Photo 32**); further scoping into the pipe was obstructed.

74. Within the apparatus bay, multiple pipe stubs were partially bent over and collapsed (**Photo 33**).

Based on the condition of the pipes observed by camera scoping, the operation of the building's domestic drainage pipe system may not function as intended. With the domestic drainage pipe system not yet in use, ABS would expect to find no water held within the pipe system, except at locations where p-traps were installed. Based on the observed locations, it appears that water was being held within the entire 6-inch pipe that all branches of the system flow into. Given that the pipe was designed and constructed properly, water should not ever be held within the pipe. It is possible that the pipe was filled as a result of an obstruction or because it was at too low of an elevation, causing the pipe it drains into to backflow into it.

Additionally, clear pipes observed at points past water/debris-filled pipes within the same pipeline likely indicate an issue with the drainage. It is possible that the pipes at this location are reverse sloped, causing the pipes to flow backwards and subsequently back up. More likely, there is an obstruction within the pipe that is holding water/debris within the pipes before the backup but leaving a clear pipe past the backup. Alternatively, it is possible that some water/debris-filled pipes were located at p-traps. Based on the issues observed, it is ABS' opinion that the domestic drainage pipe system is unlikely to function as intended when the system is loaded with a fully operational building.

The entire pipe system appears to have been constructed with PVC pipes. According to the plans (Sheet 8.00), the below-grade piping should have been constructed with cast iron pipes. Additionally, multiple pipe stubs shown on the plans (Sheet 8.10) were not observed. It is possible that the missing sections of pipes were never installed or that the concrete slab was poured over the stubs, concealing those sections of pipe. It is ABS' opinion that the domestic drainage pipe system was not installed in accordance with the plans.

ABS Recommendation: Because the drainage pipes were not constructed in accordance with the plans and will not likely function as intended, ABS recommends that the domestic drainage pipe system be removed and replaced.

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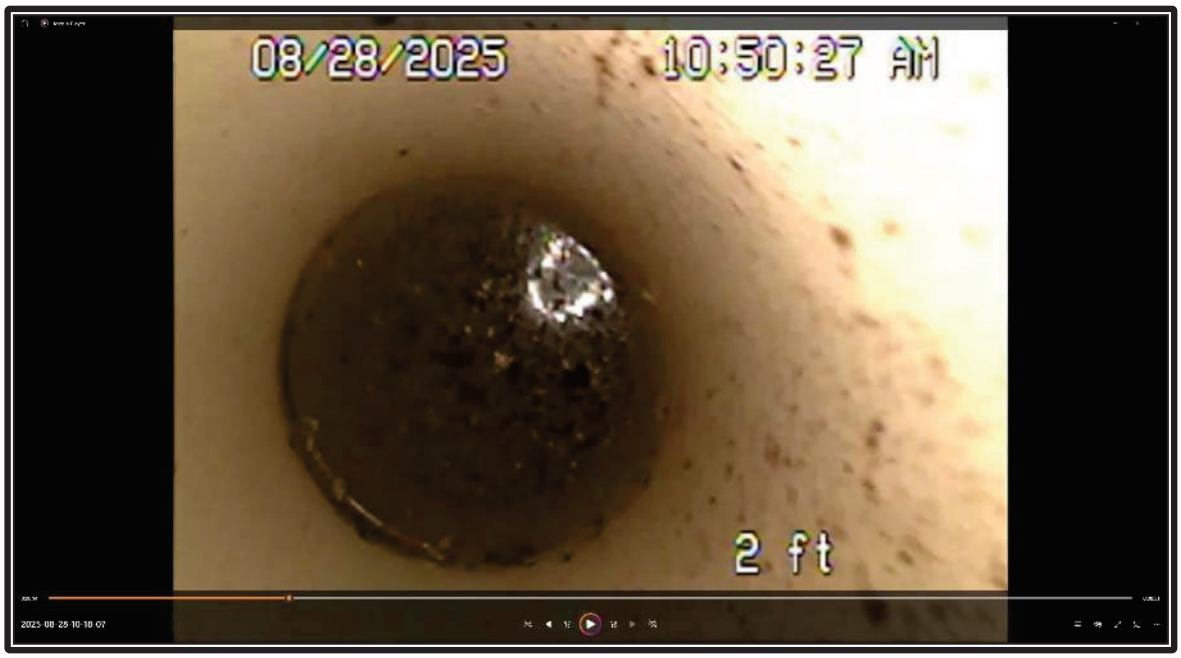

Photo 28: Representative view of a water/debris-filled pipe (courtesy of Next Level).

Photo 29: Representative view of a pipe filled with a watery sludge.

Photo 30: View of debris/dirt/stone-filled pipe.

Photo 31: Representative view of a partially separated or poorly fit pipe joint (courtesy of Next Level).

Photo 32: Representative view of a separated/cracked/collapsed section of pipe (courtesy of Next Level).

Photo 33: Representative view of partially bent over and collapsed pipe stub (arrow).

MEP SYSTEMS

During ABS' site visit, personnel from Ordcha performed an engineering assessment of portions of the building's MEP systems. On October 16, 2025, Ordcha issued a report summarizing their findings associated with the assessment (**Attachment 26**).

For a summary of Ordcha's conclusions as they related to the project's mechanical systems, see the following:

"*The following are conclusions based on the available evidence, site walk evaluation, and review of design drawings:*

- *The equipment installed, including heat pump outdoor units and indoor air handling units appears to match the specified capacities, be in good condition, and do not show signs of damage.*
- *The partially installed refrigeration line sets and ductwork serving the seven indoor units appears to match the specified sizes, be in good condition, and do not show signs of damage.*
- *The partially installed exhaust duct and dryer vent appear to be in good condition and do not show signs of damage.*
- *The infrared natural gas heaters, exhaust fans, duct heaters, kitchen hood, and ductless mini-split have not yet been installed.*
- *The thermostats controlling each respective HVAC device have not been installed.*
- *The air terminals have not yet been installed.*
- *The condensate drains for each indoor unit have not been installed.*
- *The partially installed refrigeration and duct systems upon completion are subject to pressure/leak testing as a part of startup. These tests can serve as a validation of the system's integrity.*"

For a summary of Ordcha's conclusions as they relate to the project's electrical systems, see the following:

"*The following are conclusions based on the available evidence, site walk evaluation, and review of design drawings and contractor conversations:*

- *As observed, the electrical system is in acceptable condition and may be reused as is to complete the electrical installation.*

- *Major missing components such as the generator, automatic transfer switch, and utility transformer need to be installed. Other major components, including the manual transfer switch, main panel, mezzanine sub-panels, and precast transformer pad, are installed.*

- *The lightning protection system is incomplete due to missing aerials on the lower roof section. This system was not shown on the electrical building plans and will require the review of a lightning protection engineer to verify its reusability.*

- *The cover for panel P-2 requires replacement due to damage sustained during construction.*

- *The PVC pipe from the wall to the kitchen island is not in violation of NEC 300.8 provided the PVC is used as a sleeve and NOT a raceway. This should be verified with the electrical inspector when construction begins again.*"

For a summary of Ordcha's conclusions as they relate to the project's plumbing systems, see the following:

"*The following are conclusions based on the available evidence, site walk evaluation, and review of design drawings:*

- *The equipment installed including, water heaters, circulation pumps, grease and oil separators, appears to match the specified capacities, be in good condition, and do not show signs of damage.*

- *The installed piping associated with the sanitary, oil, grease, and domestic cold and hot water appears to match specified sizes, be in good condition, and do not show signs of damage.*

- *The water heater's installation will require either a request for information (RFI) to clarify the exhaust termination –current conditions will be roughly 8' from fresh air intake.*

- *The vent, natural gas, and compressed air piping are unfinished.*

- *The fixtures and appliances are not installed.*

- *An RFI (request for information) will need to be provided clarifying the use of the shared underground pathway of domestic water piping and electrical conduit.*"

INDUSTRIAL HYGIENE

During ABS' site visit, personnel from ABSEI performed an industrial hygiene assessment of portions of the building's components. On October 14, 2025, ABSEI issued a report summarizing their findings associated with the assessment (**Attachment 27**).

For a summary of ABSEI's conclusions as they relate to industrial hygiene at the building, see the following:

"*Visible evidence of fungal growth was observed on various construction components within the building. Laboratory results for eight (8) samples collected within the building confirmed the presence of fungal growth on six (6) samples. The fungal growth should be properly remediated by a qualified mold remediation contractor.*"

COMPLETION OF SPECIAL INSPECTIONS

During ABS' site visit, personnel from F&R provided information about building components for which special inspections may be required but were not performed. The following list provides which components reportedly did not receive special inspections in accordance with building code requirements and/or have been identified by F&R as possible construction deficiencies:

- Construction of multiple masonry pours, including at the bond beam and opening reinforcement. Concrete GPR scanning summarized in F&R's March 11, 2024, letter indicates that some of those pours are inadequately constructed.
- Construction of the tie beam reinforcement, which was not installed and properly connected to the PEMB column foundations. No repair has reportedly been approved by the EOR.
- Installation of diamond dowels at the west elevation concrete slab-on-ground apparatus bay apron/drive.
- Construction of field-welded PEMB beam splices, which were reportedly not approved by the EOR and were not completed in accordance with code-required specifications.
- Welder certifications and qualifications that did not meet code-required specifications.
- Installation of deteriorated bolted PEMB structural steel connections.
- Installation defects associated with the erection of the PEMB structural steel.
- Construction of the apparatus bay training columns.
- Construction of light-gauge metal framing components, including discrepancies from the shop drawings, installed details that were not approved by the EOR, and missing and/or damaged components.

According to the 2018 NCBC Section 1705.1.3, special inspections are required for buildings that are Risk Category IV in accordance with Table 1604.5. Table 1604.5 defines buildings used as fire stations as Risk Category IV, and the structural drawings confirm the Risk Category IV; therefore, special inspections are required for the project.

According to the 2018 NCBC Section 1703.2, special inspections require written approval after satisfactory completion of the required tests and submission of test reports.

According to the 2018 NCBC Section 1705.2.1, special inspections of structural steel shall be in accordance with AISC 360-10, which discusses the inspection of welding, nondestructive testing of welded joints, inspection of high-strength bolting, and other inspection task requirements.

According to the 2018 NCBC Section 1705.3, special inspection of concrete construction shall be in accordance with Section 1705.3 and Table 1705.3.

According to the 2018 NCBC Section 1705.4, special inspection of masonry construction shall be in accordance with TMS 402-13 and TMS 602-13.

According to the 2018 NCBC Section 1705.6, special inspection of soils shall be in accordance with Section 1705.6 and Table 1705.6.

According to the 2018 NCBC Section 1705.12.5, special inspection of architectural components such as cladding and exterior veneer shall be required.

According to the 2018 NCBC Section 1705.12.6, special inspection of electrical components such as anchorage of electrical equipment for emergency power systems shall be required.

According to the 2018 NCBC Section 1705.7, special inspection of fire-resistant penetrations and joints shall be required.

ABS Recommendation: ABS recommends that all components that require special inspections in accordance with the 2018 NCBC but were not specially inspected or where adequate documentation for the inspection was not provided be removed and replaced or testing conducted if sufficient access is available to conduct the required testing.

CONCLUSION

As discussed in this report, ABS has investigated and conducted an assessment of the City of Fayetteville Fire Department New Sub-Station No. 4 for construction defects, including, but not limited to, interior concrete slabs, interior and exterior concrete masonry unit (CMU) walls, exterior cast stone, light-gauge metal framing, roof assembly and roof structure, welds and bolts, domestic

drainage pipe system, MEP systems, industrial hygiene, and completion of required special inspections.

Our evaluation determined that numerous components do not conform to the construction documents or applicable code requirements. Given the widespread nature of these defects, limited accessibility to certain systems, damage that has resulted from the incomplete building enclosure, and the proprietary design of the pre-engineered metal building (PEMB), repairs are neither economically practical nor technically feasible. Accordingly, it is ABS' recommendation that the existing building be completely demolished, including the superstructure, foundations, and remaining systems that are installed to allow for reconstruction of the building.

LIMITATIONS

This report has been prepared based on information available at the time and in accordance with generally accepted engineering practices and standards. This report represents ABS' review of the items specifically identified within the report and, by no means, should be taken as liability and/or acceptance of any item not specifically addressed herein. ABS reserves the right to make revisions should additional information become available that affects our observations and conclusions. This report is for the sole use of the client for its intended purpose and is not transferable to other entities, locations, or projects. If you have any questions regarding this report, feel free to contact us.

Cordially,

APPLIED BUILDING SCIENCES, INC.
North Carolina Engineering Firm License Number C-2773

November 12, 2025

L. Steven Moore, PE, RRC, REWC

Larry Steven Moore

Digitally signed by Larry Steven Moore
Date: 2025.11.12 08:25:15 -05'00'

Digitally signed by Gabriel M Molina
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Date: 2025.11.12 09:20:18-05'00'

November 12, 2025

Gabriel Marchi Molina, PE

Enclosures:
Attachment 1 – Fayetteville Fire Department New Sub-Station contract
Attachment 2 – Fayetteville Fire Department New Sub-Station plans
Attachment 3 – Complete schedule
Attachment 4 – Metal building shop drawing
Attachment 5 – Exterior cast stone shop drawing
Attachment 6 – "Shop Drawings" submittal
Attachment 7 – "Roof Insulation Product Data" submittal
Attachment 8 – "Cold Joint Rebar Shop Drawings" submittal
Attachment 9 – "Rebar Shop Drawings" submittal
Attachment 10 – "Shop Drawings" submittal
Attachment 11 – "Construction Joint Layout" submittal
Attachment 12 – "Roof Panel PD Calcs" submittal
Attachment 13 – "Medallions Product Data & Sh [sic]" submittal
Attachment 14 – "Engineering Letter and Analysi [sic]" submittal
Attachment 15 – Wire-Bond SureTie WS Stone Anchor product submittal
Attachment 16 – Wire-Bond SureTie WS Stone Anchor Z Shape product submittal
Attachment 17 – RFI #30
Attachment 18 – RFI #57
Attachment 19 – Report 1677-11
Attachment 20 – Report 1677-12
Attachment 21 – Schedule extension letter
Attachment 22 – "GPRS Scanning for Masonry Wall" letter
Attachment 23 – Discrepancy log
Attachment 24 – "Construction Progress Observation" letter
Attachment 25 – ABS Construction Deficiency Investigation Protocol
Attachment 26 – Ordcha Fayetteville Fire Station #4 Evaluation
Attachment 27 – ABSEI Fayetteville Fire Station #4