STRUCTURAL ASSESSMENT – Allison ES – Main Building (BLDG-101A)

Building Purpose	Administrative Offices, Cafe, Gym, and Classrooms
Inspection Date	January 11, 2017
Inspection Conditions	Clear and Sunny, 78 °F

Building Description / Reported Structural Concern

Brief Description of Existing Structure: Allison Elementary is a single-story school constructed at seven different stages. The original building was constructed in 1954 and consisted of portions of the cafeteria and two wings. Seven additions were constructed in the years since which expanded the two original wings and cafeteria, added two new wings, a gymnasium, kitchen, administration area and library. The original building and all additions with available structural plans were constructed with slab-on-grade foundations supported on continuous footings or stiffened with grade beams. Roof framing primarily consists of conventional steel framing with open-web metal joists and corrugated metal roof deck. The building's exterior wall finishes include brick masonry and stucco veneer, and the building's interior walls are CMU or metal stud finished with gypsum or brick veneer. A summary plan of the additions and original building construction is provided in Appendix A.

Reported Structural Concern: The reported issues included cracks in the concrete slab, brick veneer, and gypsum wall finishes, as well as vertical displacement between exterior flatwork and the building foundation. These displacements are reportedly creating trip hazards, water ponding, and water infiltration into the building.

Structural Assessment Site Observations

Typical site observations are discussed below and accompanied by corresponding example photos in Figures 1-4 below. Appendix B contains additional site visit photos along with corresponding observation notes and a photo log.

- **Exterior and Interior Wall Cracks:** Cracks in brick veneer, CMU walls, and stucco/gypsum wall finishes are visible throughout the school. Observed cracks include diagonal, vertical, and horizontal cracks in the exterior brick and interior CMU blocks and mortar joints. Also seen were horizontal and/or vertical cracks in exterior stucco and interior gypsum wall finishes.

  Cracking was found to be most prevalent near windows, doors, and at building corners. In addition to the more recent cracks, a large number of older cracks were observed that had been repaired at some point in the past. Most of these grouted repairs were found to be in good condition and without further damage; some of the repaired cracks, however, have re-opened up to ~ 1/8" since the repairs were originally made.

Diagonal cracks in interior brick wall

Diagonal cracks in exterior brick mortar joints and brick blocks

Vertical crack through brick mortar joints and brick blocks

Re-opened cracks in brick mortar after previous repair

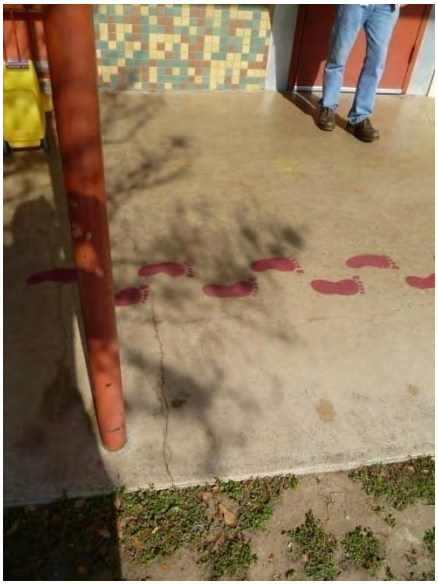
Figure 1: Examples of observed wall cracks

- **Slab Cracks:** Vertical cracks were observed at the exterior face of building slab in several areas. The crack widths generally ranged from 0.02 to 0.1 inches. These cracks were seen in the Administration area and along the 100, 200, and 300 Wings. The covered walkways alongside the 100 and 200 Wings have repeated transverse cracks, and the covered walkway alongside the 300 Wing has one long, continuous longitudinal crack running the length of the walkway.

Crack at face of building slab

Crack at face of building slab

Longitudinal crack in covered 300 Wing walkway slab



Transverse crack in covered walkway slab

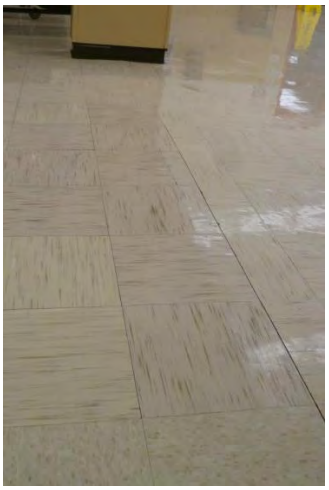
Figure 2: Examples of observed slab cracks

- **Slab and Flatwork Differential Vertical Displacements:** Evidence of soil movement was seen in the relative shifting that has occurred between the building slab and adjacent exterior flatwork. While the differential vertical movement was typically measured around 1/2" to 3/4", outside the NW entrance to the hallway connecting the Art Classroom and Gym the top of exterior flatwork was measured as almost 2" above the top of adjacent building slab. One potential cause for this vertical displacement may be the incorrect installation of an adjacent splash block. Instead of discharging the water away from the foundation as intended, the splash block directs water towards the flatwork and exacerbates any soil expansion/contraction due to changes in the soil moisture content.

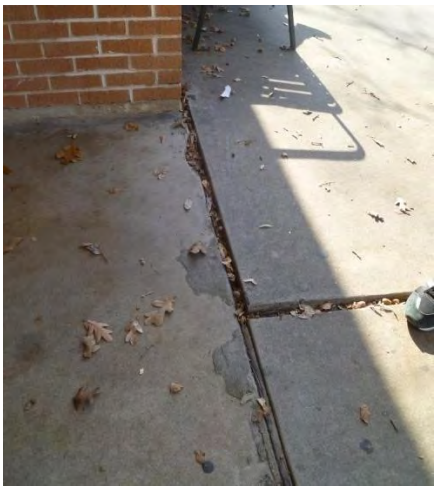
  In the building interior, differential slab settlement was observed within the Cafeteria between the original building and the 1955 Addition.

Vertical displacement between building slab & flatwork

Nearby splash block installed backwards



Interior slab differential elevations at joint between Orig Building and 1955 Addition



Differential movement between building slab & adjacent flatwork

Figure 3: Examples of slab/flatwork vertical differential displacement

- **Lateral Displacements at Vertical Wall Joints:** Lateral separations at vertical wall joints are visible at isolated locations throughout the building, particularly at the interfaces between building areas constructed at different times. Typically the separation between adjacent wall finishes increases towards the top of the wall.

Separation at Addition wall interface

Separation at wall joint increases towards the top

Separation at 1997 Addition

Separation at 1955 Addition

Figure 4: Examples of lateral wall separation

Conclusions

Soil expansion and contraction is the likely culprit causing the observed slab/flatwork differential displacements and the cracking in the walls and building slab. Soil expansion/contraction generally occurs when expansive clays are present below a building and the building's foundation system does not extend below the expansive soil's active zone. Expansive clay soils in the active zone tend to shrink and swell seasonally in response to the changing moisture content in the soil. This movement commonly results in the cyclic opening and closing of foundation and wall cracks and differential displacements between adjacent slabs and/or flatwork.

It is possible that subgrade settlement may have contributed to some of the damage at the interfaces between building areas constructed at different time periods. Settlement generally occurs due to improper soil compaction at the time of construction and is a "one-time" occurrence (rather than a continuing cyclical issue like soil expansion/contraction), so once the settlement has taken place no further movement is expected. Given that some of the previous crack repairs have re-cracked, we know that subgrade settlement is not the only source of building movement.

At the time of this report, the cracks observed are likely not a serious structural concern that immediately impacts user safety or the overall integrity of the building structure. However, there are safety concerns to consider such as loose bricks or mortar falling into public spaces and/or trip hazards at uneven slab-flatwork joints. Also, until soil moisture is effectively controlled below and around the building, the existing cracks and differential slab movement will continue to worsen over time and new cracks, trip hazards and/or roof leaks are likely to occur. Water seeping into the building envelope via roof leaks and/or cracked exterior veneer is another concern that should be addressed.

The observed wall/slab cracks, separations and differential displacements have been documented in Appendix B attached at the end of this report. If substantial crack/separation enlargement or continued propagation occurs in the future, we recommend an additional structural investigation be performed at that time.

Allison ES – Summary of Structural Repair Recommendations

This document is based on current conditions observed during fieldwork and provides recommendations for corrective actions.

Allison ES Structural Repair Recommendations

1. Improve site grading and drainage around building to promote positive drainage away from the building; ensure that the surrounding grade is sloped downward away from the building and eliminate and standing water near the building.
2. Replace missing splash blocks and ensure all splash blocks are oriented to direct water away from the building.
3. To prevent water infiltration into the building envelope, repair badly cracked bricks and mortar with a flexible sealant that will accommodate crack movement during cyclical soil changes.
4. To prevent additional slab cracking and corrosion of slab reinforcement, patch exterior slab cracks with a flexible sealant.
5. Where trip hazards exist, remove and replace exterior flatwork as necessary. Construct new flatwork with a doweled connection to the building foundation that will allow differential lateral movement but restrain differential vertical movement.
6. Regularly monitor the building for new or worsened cracks and/or roof leaks. Repair new damage as warranted.

Note: This report is based on and limited to the observations and information noted above. This is not a guarantee. Additional deficiencies may exist which were not observed and which may require additional remedial work which is not listed here.

APPENDIX A: PLAN OF BUILDING ADDITIONS

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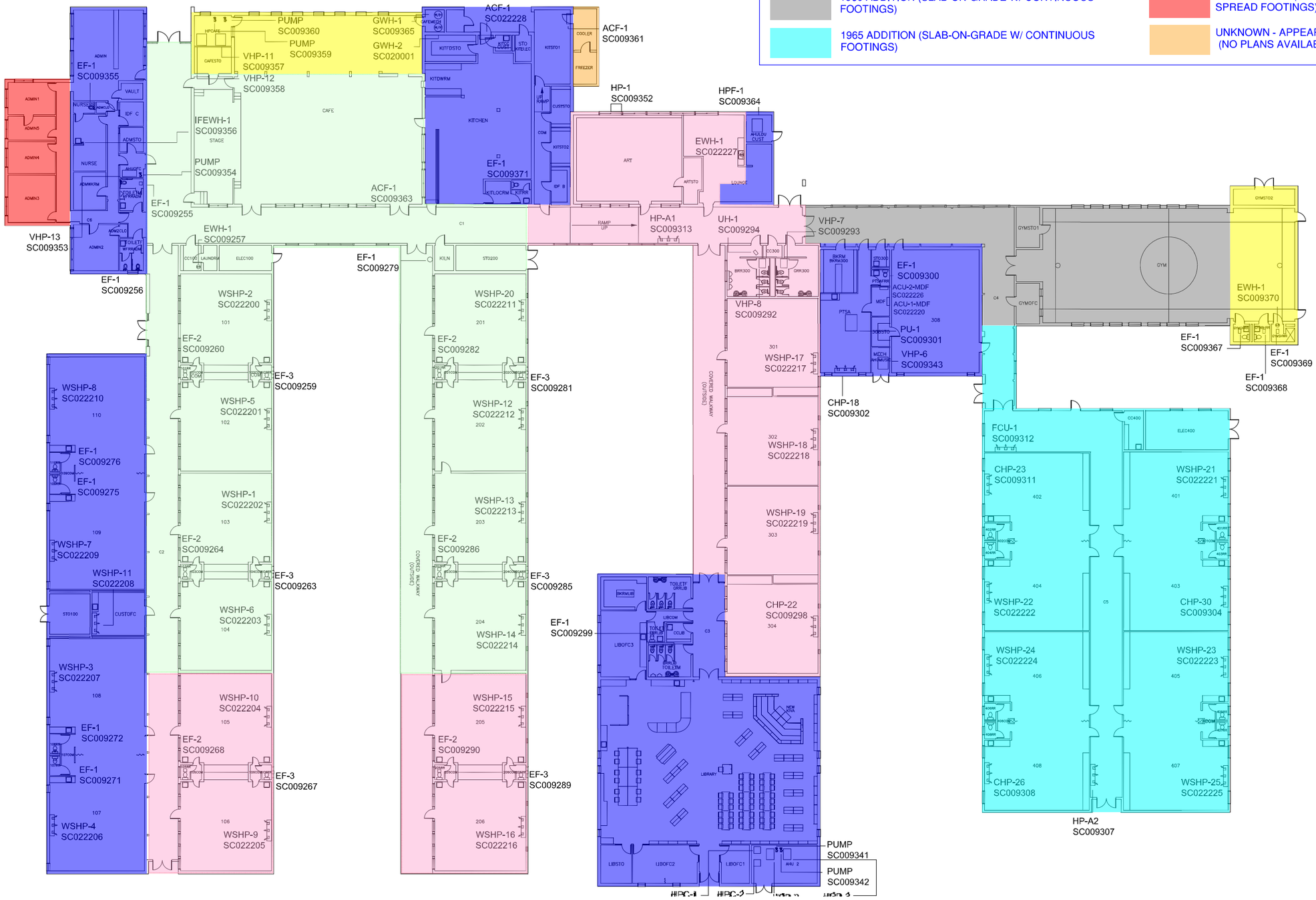
PLAN OF BUILDING ADDITIONS

- ORIGINAL BUILDING - CONSTRUCTED IN1954; SLAB-ON-GRADE W/ CONTINUOUS FOOTING
- 1955 ADDITION (SLAB-ON-GRADE W/ CONTINUOUS FOOTINGS)
- 1960 ADDITION (SLAB-ON-GRADE W/ CONTINUOUS FOOTINGS)
- 1965 ADDITION (SLAB-ON-GRADE W/ CONTINUOUS FOOTINGS)
- 1974 ADDITION (STRUCTURAL PLANS UNAVAILABLE, APPEARS TO BE SLAB-ON-GRADE W/ CONTINUOUS FOOTINGS)
- 1990 ADDITION (SLAB-ON-GRADE STIFFENED W/ GRADE BEAMS)
- 1997 ADDITION (STIFFENED SLAB-ON-GRADE W/ SPREAD FOOTINGS)
- UNKNOWN - APPEARS TO BE BUILT BETWEEN 2005 AND 2008 (NO PLANS AVAILABLE, FOUNDATION TYPE UNKNOWN)



NORTH

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

ALLISON ELEMENTARY SCHOOL

515 Vargas Rd.
Austin, Texas

FLOOR PLAN

FIRST FLOOR

APPROVALS		
DRAWN	CHECKED	APPROVED
J.R.		
04/22/13		
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DRAWING SCALE		1 OF 1
1/16"=1'-0"		

APPENDIX B: SITE VISIT PHOTO PLAN & ADDITIONAL PHOTO'S

PLAN OF SITE VISIT PHOTOS

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6) MULTIPLE CRACKS REPAIRED ON BRICK VENEER

25) 3/4" SLAB DIFFERENTIAL VERT. MOVEMENT BETWEEN SLAB & FLATWORK

3) REPORTED SLAB CRACK REPAIR (NOT VISIBLE)

1) REPAIRED VERTICAL/ DIAGONAL CRACKS IN WALL PANEL

2) HORIZ. & VERT. CMU CRACKS

4) ~1/2" DIFF. SLAB MOVEMENT AT INTERFACE BETW/ ORIG. CONSTR. & 1990 ADDITION

24) VERTICAL CMU CRACK

6A) DIAGONAL CRACKS IN BRICK VENEER ABOVE WINDOW CORNER

6B) CORNER OF SLAB CRACKED

5) DIAG. & VERT. CRACKS IN BRICK VENEER (PREV. REPAIRED)

AREA WITH REPORTED DAMAGE

15) DIAGONAL CRACK IN BRICK ABOVE DOOR (PREV. REPAIRED)

23) DIFFERENTIAL VERTICAL MOVEMENT BETWEEN SLAB & FLATWORK

23A) SPLASH BLOCK INSTALLED BACKWARDS

AREA WITH REPORTED DAMAGE

7) PREVIOUSLY REPAIRED CRACK IN BRICK HAS OPENED ~ 1/8" SINCE REPAIR

19) CRACK IN SLAB & REPAIRED CRACK IN BRICK ABOVE DOOR

18) VERT. CRACK IN BRICK FROM FLOOR TO BOTTOM OF WINDOW

27) DIAG. CRACKS IN BATHROOM BRICK

22A) SLIGHT GROUND SLOPE TOWARDS BUILDING

25A) DIAGONAL BRICK CRACK

MULTIPLE BRICK CRACK REPAIRS & HORIZ. CRACKS IN STUCCO PANELS ON THIS WALL

16) MULTIPLE TRANSVERSE CRACKS IN SLAB ALONG COVERED WALKWAY

8) VERTICAL CRACK IN BRICK VENEER (PREV. REPAIRED)

18A) LONGITUDINAL CRACK IN SLAB ALONG LENGTH OF COVERED WALKWAY

MULTIPLE HORIZ. CRACKS IN BRICK AT WALL OPENINGS (PREV. REPAIRED)

22) DIAGONAL CRACK IN BRICK VENEER (PREV. REPAIRED)

14) VERTICAL CRACK AT SIDE OF FACE OF SLAB

VERT. CRACK AT SIDE FACE OF SLAB

9) HORIZONTAL CRACKS IN BRICK VENEER AT DOOR OPENING (PREV. REPAIRED)

26) NO SEPARATION BETWEEN BRICK COLUMN & TILED WALL AT FLOOR; 1/8" SEPARATION AT TOP

13) VERTICAL CRACK AT SIDE FACE OF SLAB

20A) MISSING SPLASH BLOCK BELOW DOWN SPOUT

28) VERTICAL CRACK IN WALL FINISH ABOVE DOOR

10) DIAGONAL CRACK IN BRICK VENEER AT WINDOW OPENING (PREV. REPAIRED)

19A) MULTIPLE SMALL VERT. CRACKS IN SLAB ALONG THIS WALL (EVERY 20-30')

12" DIAG. CRACK IN STUCCO VENEER

21A) DIAGONAL CRACK IN BRICK AT WINDOW CORNER (PREV. REPAIRED)

17) VERT. CRACK IN BRICK ABOVE WINDOW

20) VIEW NW

12) DIAGONAL CRACK AT TOP OF BRICK

AREA WITH REPORTED DAMAGE

10A) 1/2" DIFFERENTIAL MOVEMENT BETWEEN SLAB & ADJACENT FLATWORK

11) DIAG. CRACK IN BRICK VENEER (PREV. REPAIRED)

19B) VERTICAL SEPARATION IN BRICK EXPAN. JOINT

21) VIEW NW

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Photo 1: Repaired vertical/ diagonal cracks in wall panel

Photo 2: Horizontal and vertical CMU cracks

Photo 3: Reported slab crack repair (not visible)

Photo 4: ~1/2” differential slab movement at interface between Original Construction & 1990 Addition

Photo 5: Diagonal and vertical cracks in brick veneer (previously repaired)

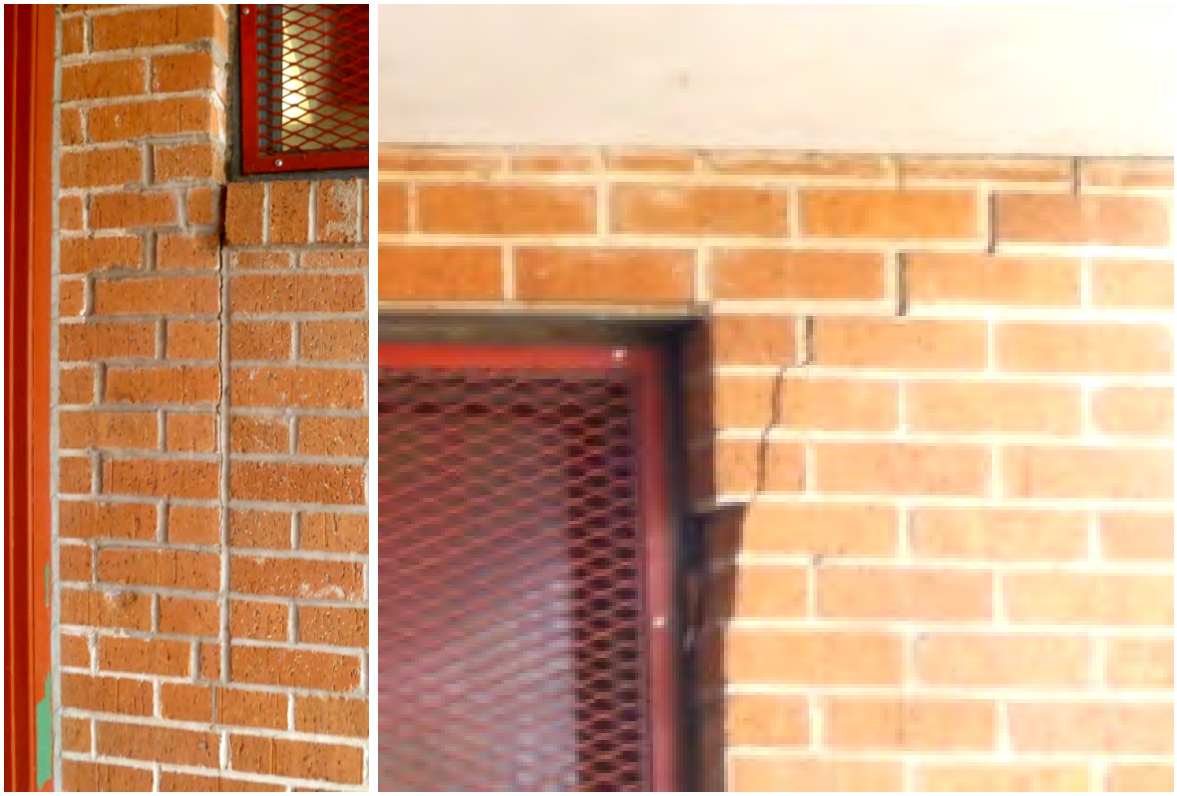

Photo 6: Multiple repaired cracks on brick veneer

Photo 6A: Diagonal cracks in brick veneer above window corner

Photo 6B: Corner of slab cracked

Photo 7: Previously repaired crack in brick has opened ~1/8” since repair

Photo 8: Vertical crack in brick veneer (previously repaired)

Photo 9: Horizontal cracks in brick veneer at door opening (previously repaired)

Photo 10: Diagonal crack in brick veneer at window opening (previously repaired)

Photo 10A: 1/2" differential movement between slab and adjacent flatwork

Photo 11: Diagonal crack in brick veneer (previously repaired)

Photo 12: Diagonal crack at top of brick

Photo 13: Vertical crack at side face of slab

Photo 14: Vertical crack at side face of slab

Photo 15: Diagonal crack in brick above door (previously repaired)

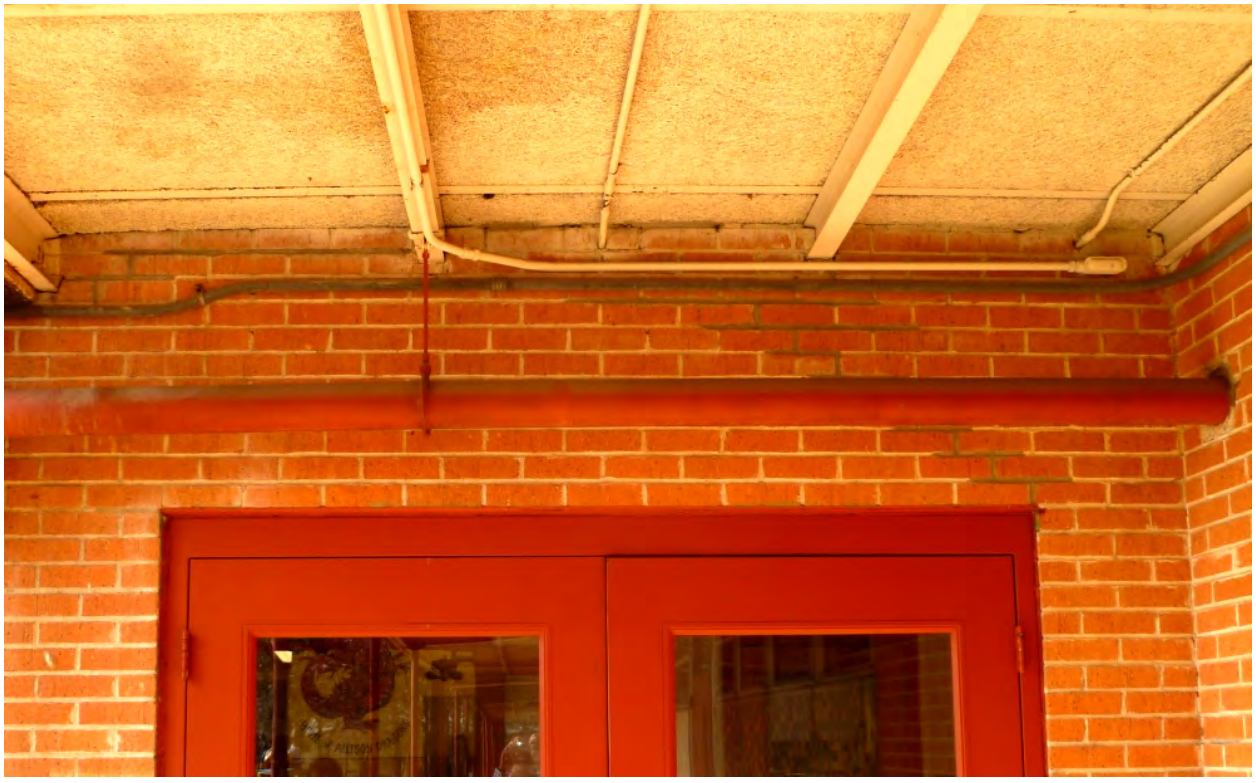

Photo 16: Multiple transverse cracks in slab along covered walkway

Photo 17: Vertical crack in brick above window

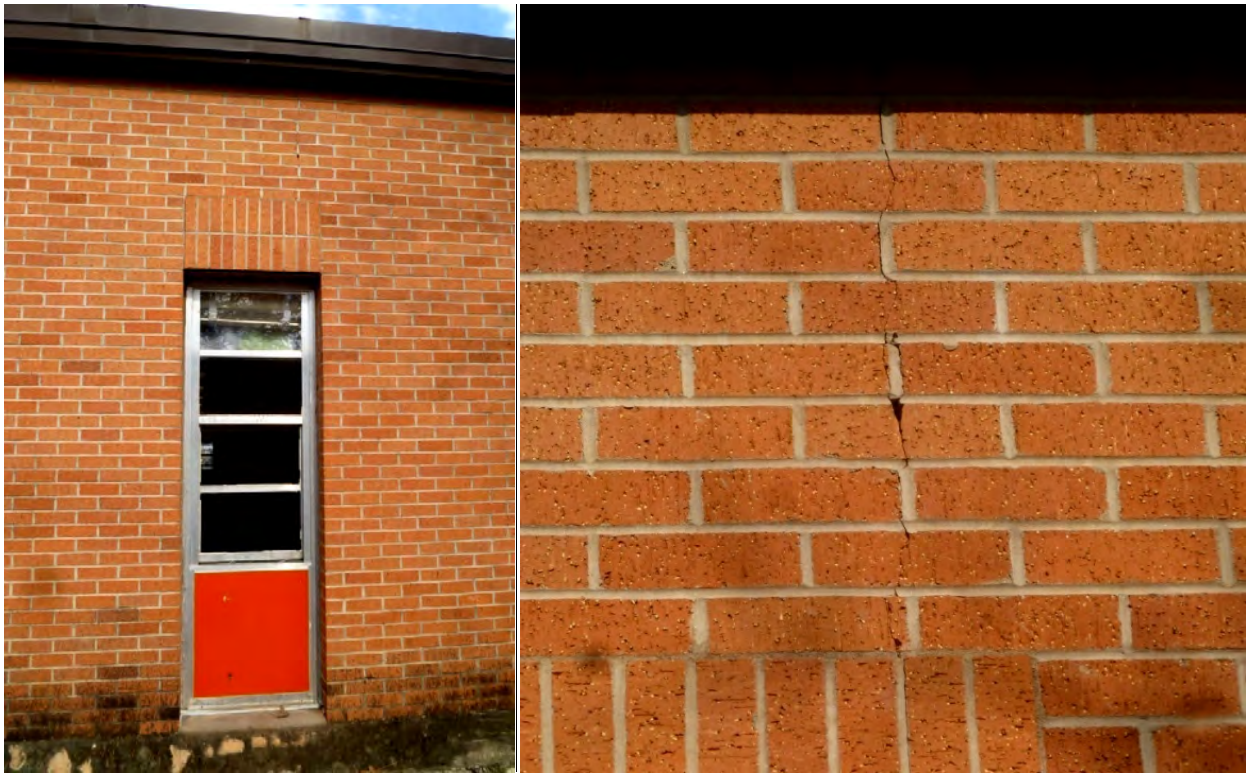

Photo 18: Vertical crack in brick from floor to bottom of window

Photo 18A: Longitudinal crack in slab along length of covered walkway

Photo 19: Crack in slab and repaired crack in brick above door

Photo 19A: Multiple small vertical cracks in slab along this wall (every 20-30')

Photo 19b: Vertical separation in brick expansion joint

Photo 20: View NW

Photo 20A: Missing splash block below down spout

Photo 21: View NW

Photo 21A: Diagonal crack in brick at window corner (previously repaired)

Photo 22: Diagonal crack in brick veneer (previously repaired)

Photo 22A: Slight ground slope towards building

Photo 23: Differential vertical movement between slab and flatwork

Photo 23A: Splash block installed backwards

Photo 24: Vertical CMU crack

Photo 25: 3/4" slab differential vertical movement between slab and flatwork

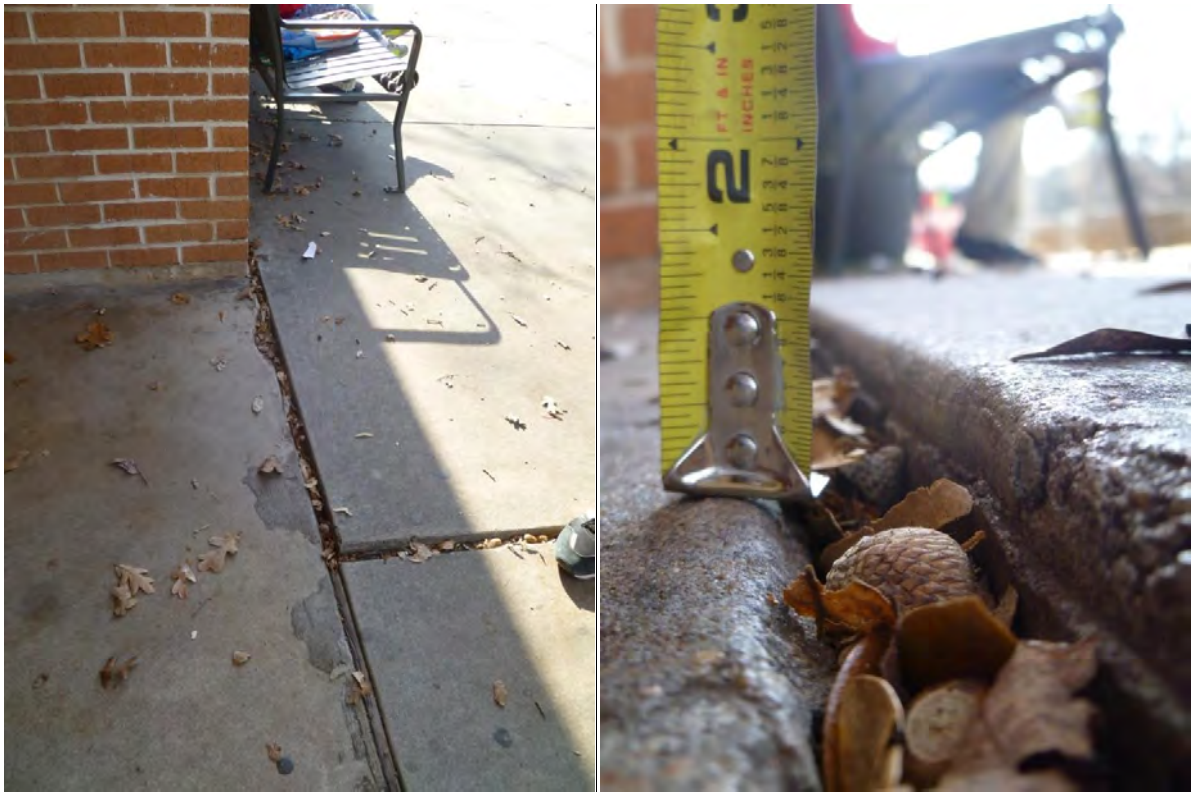

Photo 25A: Diagonal brick cracks

Photo 26: No separation between brick column and tiled wall at floor; 1/8” separation at top

Photo 27: Diagonal cracks in bathroom masonry

Photo 28: Vertical crack in wall finish above doors

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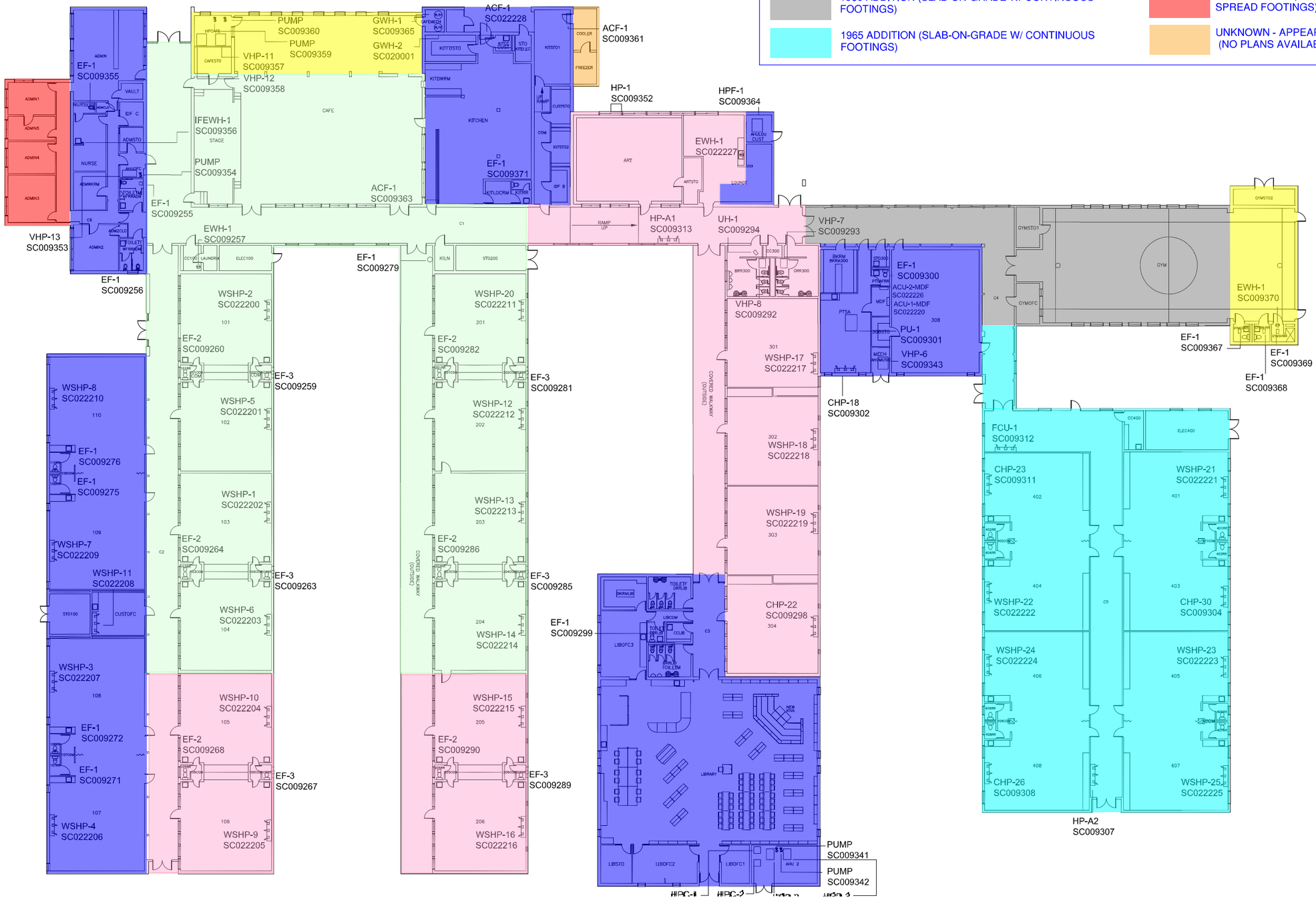

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