

## STRUCTURAL ASSESSMENT – Ridgeview ALC – Main School Building (BLDG-012A)

Building Purpose	Administrative, Classrooms, Gym, and Cafeteria
Inspection Date	October 25, 2016 Afternoon
Inspection Conditions	79° - Cloudy & Dry

### **Building Description /History/ Reported Structural Concern**

**Brief Description of Existing Structure:** The 1951 original construction of the main school building includes the 100 Wing (classrooms), the 200 Wing (cafeteria/kitchen), the 300 Wing (shop), the 500 Wing (auditorium), the 600 Wing (gymnasium/locker rooms) and the Boiler Building. The original building's foundation was detailed as cast-in-place shallow spread footings but a previous structural investigation discovered that belled piers were used in lieu of footings; it is not clear if all or just a portion of the footings were replaced with drilled piers. Footings were detailed to be placed 6-ft below grade and the drilled piers excavated at the site were also roughly 6-ft below grade. Cast-in-place concrete columns sit on the foundations and support cast-in-place suspended interior and perimeter floor beams. The floor beams support a cast-in-place one-way flat slab. Concrete soil retainers line the perimeter of the building. The structure above consists of conventional steel columns and roof framing (metal deck, open-web steel joists, wide-flange beams and columns). In 1991 the superstructures for the 300 Wing, the eastern end of the 200 Wing and the Boiler Building were demolished. The ground floor framing and foundations for the 200 and 300 Wings were not demolished and are now being used for parking space.

The building had five main additions added over the years:

- In 1958, the west end of the 100 Wing was expanded using similar structural systems as the original construction.
- The 400 Wing was added in 1962 and consists of cast-in-place concrete columns bearing on 16-ft long belled piers. Existing plans detail the piers to extend up to the bottom of the floor beam; however, site observations revealed the piers were constructed to top of grade and cast-in-place square columns were constructed from the top of pier to the bottom of floor beam. The interior concrete columns support interior cast-in-place floor beams that generally run in the east-west direction. Cast-in-place suspended perimeter beams span between drill piers and have concrete pilasters below the steel columns above. The slab is a cast-in-place one-way flat slab.
- In 1967 the Shop Building was added to the east of the 400 Wing. The Shop Building is constructed with slab-on-grade and belled piers are provided below concentrated loads.
- In 1978 the wood portable building immediately to the west of the 400 Wing was added. The building is wood-framed and is detailed to sit on shallow concrete footings, but visual observations indicated the portable may be sitting on a slab-on-grade foundation.
- In 1984 six new wood-framed portable buildings were placed to the far west of the 400 Wing. The wood portables are supported on shallow concrete footings.

See the attached Overall Site Identification Plan for identification of the different building wings and as well as the different periods of construction.

**Previous Investigations & History of Building Damage:** Several in-depth structural investigations have been performed at this campus over the years. In 1987, Bryant-McClelland Consultants (now Fugro) conducted a soil study to analyze the slope stability of a scarp that runs along the east side of the campus. A scarp is a weakened horizontal plane of soil on a hillside that can potentially slide down the hill relative to the soil below it. Scarp sliding can occur suddenly or the top soil can creep downhill slowly over time. Their analysis determined that the slope was reasonably stable but that stability reduced when the slope was exposed to heavy amounts of water; they recommended a drainage system be implemented to reduce the amount of water soaking into the scarp soils. (To our knowledge a drainage system was never implemented.) Bryant-McClelland Consultants and Stoeltje Associates, Inc. conducted a comprehensive structural investigation in 1989 and determined that noted damage was the result of A) expansive soils on one side of the fault line crossing the building combined with too-shallow foundations and B) eastward soil movement along the scarp on the east side of the site. Note that the fault line and headscarp line (at top of scarp) are depicted on the Overall Site Identification Plan attached at the end of this report. The 1989 report also recommends demolishing the 300 Wing (referred to as the shop building in the report) and the eastern end of the 200 Wing. In 1990 Bryant-McClelland Consultants performed two additional investigations to: 1) measure slab differential elevations in the 500 Wing; and 2) to further investigate the fault line location and the soils characteristics on either side. A 1990 report prepared by Barrow & Stahl Architects includes copies of each of these reports and provides an overall summary of the reports' recommendations. A copy of the Barrow & Stahl report is provided in Appendix A at the end of this report.

In 1991 the east end of the 200 Wing, the 300 Wing and the Boiler Building were removed (although floor framing and foundations are still in place below a parking area). The remaining portion of the 200 Wing was retrofitted to level the slab and strengthen the floor framing, and the site was re-graded to promote drainage away from the building.

In 2013 Datum Engineers, Inc. performed a new comprehensive structural investigation and determined that the building was still undergoing damage due to the expansive soils at the site, lack of adequate foundation systems and lack of proper drainage. They noted that the metal deck and roof framing was severely deteriorated due to corrosion from roof leaks occurring over a long period of time, and the interior CMU and exterior brick were badly cracked in many locations (all likely due to soil movement). Even though the site was re-graded in 1991, they identified many locations around the building that had negative drainage (i.e. drains towards the building) and several areas holding standing water. They observed several crawl space areas and noted wet soil, leaking pipes, missing or caved soil retainers, compromised void spaces, exposed/corroded reinforcement and honeycombed and/or spalled concrete. Note that Datum did not observe the crawl space in the 400 Wing. Datum recommended demolishing the 500 Wing and the northern portion of the 600 Wing because the cost to rehabilitate would be too great, and they recommended implementing drainage improvements to minimize future soil movement and other structural and cosmetic repairs at the remaining wings to address existing damage. To our knowledge Datum's recommendations have not been implemented, but the 500 Wing and north side of 600 Wing are no longer occupied. A copy of Datum's report is provided in Appendix B at the end of this report.

**Reported Structural Concern:** The first noted structural concern occurred in 1981, after the 300 Wing and east end of the 200 Wing suffered significant damage due to vertical and lateral movement of the in-situ soils along the scarp line running along the east side of the campus. Over the years other damage has been reported and investigated and was determined to mostly be the result of the expansive in-situ soils, inadequate foundations and poor site drainage. Our investigation was prompted by several large concrete cracks we observed on interior columns and floor framing near the east end of the 400 Wing during a routine crawl space assessment. Currently the occupied areas of the building include the 100 Wing, the 400 Wing, the portable wood structures to the west of the 400 Wing, the cafeteria and kitchen in the 200 Wing, and the gymnasium in the 600 Wing. It is our understanding that the locker rooms to the west of the gym, the gym rec room (GYMRECRM), and the entirety of the 500 Wing are no longer occupied and are either abandoned or used for storage space. Unoccupied areas of the building are designated on the Overall Site Identification Plan.

The purpose of this structural investigation is to briefly examine the overall structural condition of the occupied areas, determine the likely cause(s) of any observed structural deficiencies, and recommend appropriate measures for repair and/or further investigation. Please note that the scope of our investigation is not as in-depth as the previous reports.

## Site Observations

### Observations at the 100 Wing (Classrooms)

The 100 Wing appeared in the best overall condition of all the wings observed.

- 100 Wing Crawl Space, Concrete Floor Framing & Exterior Stairs:** The 100 Wing crawl spaces below both the 1951 original portion of the wing and the 1958 classroom addition were observed. The soils in the crawl spaces were damp and the air was not well ventilated. Soil retainers in many locations were cracked or had slipped or caved. The void spaces below some perimeter beams were filled with caved exterior soil. The observed concrete framing appeared in good condition overall with no signs of significant structural distress or deterioration. Some mild to moderate concrete honeycombing was observed on the concrete framing in isolated locations, and at some locations reinforcement was exposed and corroding. The exterior concrete stair on the west end of the wing has displaced vertically due to soil movement.



Damp soil around perimeter of building



Void space below perimeter beam is filled with soil



Damp soil, Failing soil retainers, Honeycombing and exposed/corroded column reinforcement



Concrete honeycombing on face of interior floor beam



Condensation on pipes, potential pipe leak



Grade-supported stairs have displaced vertically

- **100 Wing Building Interior:** The central hallway and several classrooms were observed. Patched cracks in the interior brick were observed in some classrooms.



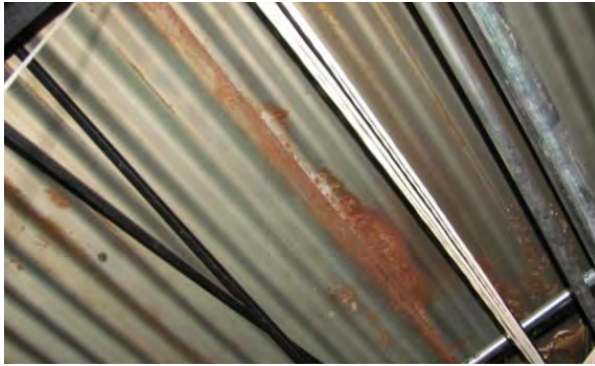
Cracks in classroom brick wall



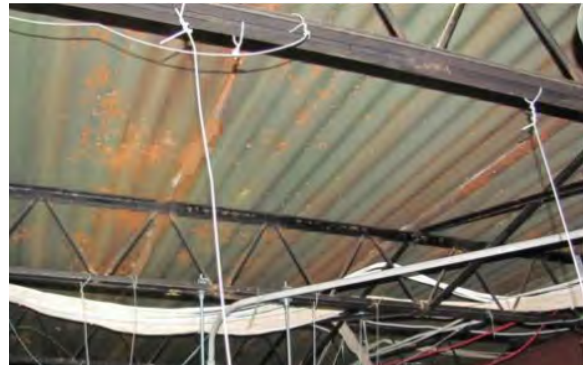
Cracks on hallway column at expansion joint between original building & 1958 west addition

- **100 Wing Roof Framing:** Our scope did not include observation of the roof framing, but according to the 2013 report there are roof leaks, and the metal deck and open-web bar joists are suffering from advanced corrosion. It is not clear if the roof leaks have been addressed. See photographs from the 2013 report copied below.





Significant deck corrosion at lap joints



Significant deck corrosion

## Observations at the 200 Wing (Cafeteria/Kitchen)

- 200 Wing Crawl Space and Concrete Floor Framing:** In 1991 the east end of the original 200 Wing was partially demolished and the floor framing for the remaining west portion of the wing was retrofitted. The slab and beams were raised/leveled using steel shim plates over the existing crawl space columns. Steel channels were placed on each side of the interior floor beams to strengthen the beams and anchor them to the new perimeter beam added to the east end of the wing. The remaining portion of the 200 Wing appears in relatively good overall condition and the structural retrofits that were implemented to level the slab and to strengthen the floor framing appear to have effectively arrested further damage. A few isolated locations with honeycombing, spalling and/or exposed/corroded reinforcement were observed. The soil was completely saturated and standing water was observed in some areas. The air was not well ventilated.

The floor framing and foundations for the old east end of the 200 Wing were not actually demolished with the above-ground walls and roof. Instead, the floor framing was left in place and is currently below a parking area. **We are concerned this may pose a safety concern to parking area users.** See the 300 Wing section below for further discussion concerning the abandoned areas and for photographs of the parking area.



Saturated soils in crawl space



Standing water in crawl space



200 Wing floor framing retrofit appears in good condition



200 Wing slab spalling with exposed/corroded rebar

- 200 Wing Interior:** The kitchen concrete slab had many patched cracks, some of which have reopened. The dining area slab is covered with a vinyl tile floor finish so any signs of slab distress could not be observed. There was a noticeable floor deflection near the center of the wing on the east side of the cafeteria dining room. It is not clear if this slab deflection is a new development or if it was preexisting and not corrected during the 1991 retrofit work; the floor deflection is not mentioned in Datum's 2013 report and their differential slab elevation study does not have measurements in that area.



200 Wing Kitchen reopened slab cracks

- 200 Wing Roof Framing:** Our scope did not include observation of the roof framing, but according to the 2013 report there are roof leaks, and the metal deck and open-web bar joists are suffering from advanced corrosion. It is not clear if the roof leaks have been addressed. See photographs from the 2013 report copied below.



Advanced deck corrosion, joist corrosion



### Observations at the 300 Wing (Old Shop Building)

The 1989 structural report recommended that the 300 Wing be demolished, and the 1991 repair documents specified for it to be removed. Instead of demolishing the complete structure, however, the superstructure (walls and roof) was removed but the concrete floor framing and foundations were left in place. Now the area above the old 300 Wing floor framing is being used for parking and construction offices. **We are concerned that this may pose a safety concern.** The crawl space below the 300 Wing could not be accessed because the side hatch door was welded shut. While we could not assess the condition of the framing ourselves, the 1989 structural report clearly indicates the structure is in poor condition and should not be used.



Crawl space hatch door is welded shut



Outside face of perimeter beams show signs of structural distress



300 Wing floor framing is currently being used to support parking



300 Wing floor framing is currently being used to support a dumpster and construction offices

### Observations at the 400 Wing (Classroom Addition)

Please note that our site observations indicate the 400 Wing floor framing is in the worst condition of all the wings. Also please note that the 400 Wing crawl space does not appear to have been evaluated in any of the past structural investigations, so it is unclear when the damage first occurred and whether the damage has stabilized or is continuing to advance over time.

- **400 Wing Crawl Space, Concrete Floor Framing and East Concrete Stairs:** Large cracks were observed at all exterior beam openings near the east end of the wing. These diagonal cracks originated at the top and bottom reentrant corners of the openings and typically extended diagonally through the beam. There are also large cracks at the ends of

interior beams where they frame into the perpendicular perimeter beam at the east end of the wing. It appears that the perimeter beam has shifted laterally eastward and is pulling away from the perpendicular interior beams. In a few other areas of the crawl space, some honeycombing and exposed/corroded reinforcing was observed. The crawl space soils were damp around the perimeter of the wing and the air was not well ventilated.

The east exterior stair also has a large crack that runs up the stairs and appears to align with the inside face of the stair side beam.



Soil damp around perimeter of wing



Diagonal crack at southeast corner



Diagonal cracks around vent opening



Horizontal crack under interior beam



Crack from bottom of interior beam to vent



Cracks on 400 Wing east perimeter beam at abutting interior beam (near stairs)





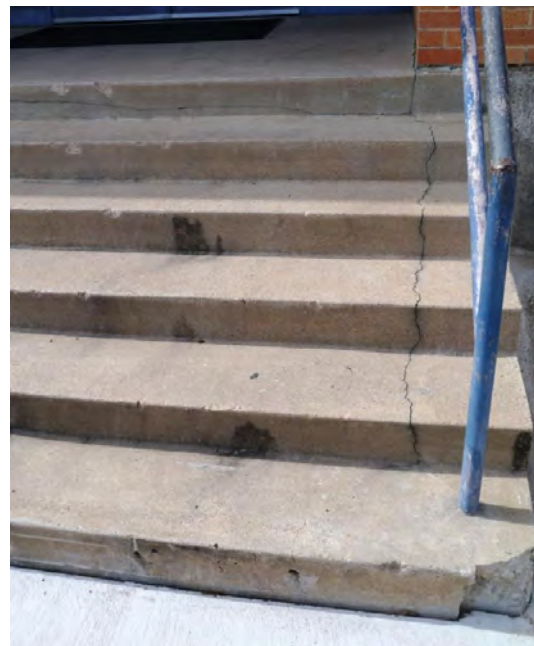
Diagonal crack on 400 Wing east perimeter beam near bottom of abutting interior beam and (near stairs)



East perimeter beam is shifting eastward and pulling away from perpendicular interior beams

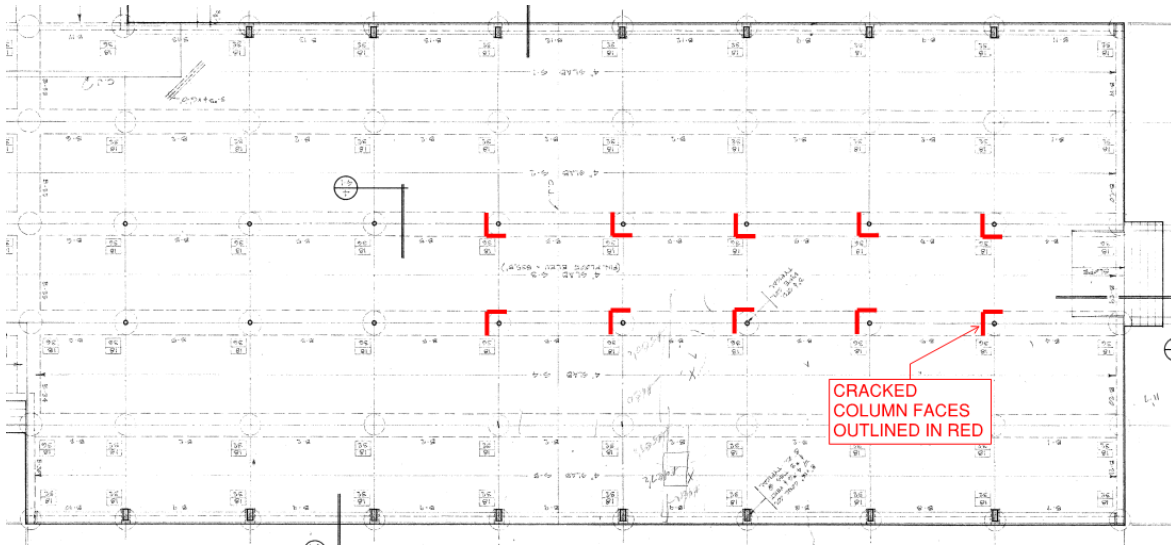


Concrete honeycombing, exposed/corroded reinforcement



Exterior vertical crack on 400 Wing east exterior stairs

Several interior concrete columns in the crawl space had horizontal cracks near the connection to the interior beam above. The cracks sometimes travelled to the underside of the interior beam. The largest cracks were observed on the inner faces of the columns. The crack widths get smaller on each column as they progress westward along the length of the wing. Smaller horizontal cracks were observed on west column faces. The figure below identifies the faces of the columns with horizontal cracks. The two outer rows of interior columns were also observed but no obvious signs of distress were apparent.



400 Wing Column Horizontal Crack



400 Wing Column Horizontal Crack



400 Wing Column Horizontal Crack



400 Wing Column Horizontal Crack





400 Wing Column Horizontal Crack



400 Wing Column Horizontal Crack

The south perimeter beam near the east end of the wing showed signs of distress at the crawl space side hatch. Diagonal cracks originated from the corners of the rectangular opening and could be observed from both the interior and exterior sides of the beam.



Diagonal crack at top of access hatch



Access hatch diagonal crack from interior

- **400 Wing Building Interior & Roof Framing:** The building interior walls showed no obvious signs of distress; however, the interior walls are covered with wood paneling which may not show signs of distress. Limited areas were uncovered but no signs of distress were observed. The roof framing was not observed.

### Observations at the 500 Wing (Auditorium)

The 500 Wing is currently not occupied and, as such, our observations in this area were very limited.



- 500 Wing Crawl Space and Concrete Floor Framing:** A small portion of the 500 Wing crawl space was observed. Some honeycombing, spalling and exposed/corroded reinforcement were observed in limited locations, but no significant distress or deterioration was noted in the structural components observed. The crawl space soils were damp and the air was not well ventilated. Pipes were heavily corroded.



Exposed/corroded beam rebar, beam not centered over pier



Exposed/corroded beam rebar, extensive honeycombing at pier-beam connection

- 500 Wing Roof Framing:** Our scope did not include observation of the roof framing, but according to the 2013 report there are significant roof leaks and the metal roof deck and open-web bar joists are suffering from advanced corrosion. See photographs from the 2013 report of the 500 Wing roof framing copied below. It is not clear if the roof leaks have been addressed.



Advanced roof deck corrosion



Roof deck corrosion

## Observations at the 600 Wing (Gymnasium)

Please note that the crawl space below the Gymnasium could not be accessed and the condition of the floor framing there could not be evaluated. Only the Men's Locker Room and other rooms to the north of the Gymnasium could be accessed. Previous investigations were also unable to access and evaluate the crawl space below the Gymnasium.

- 600 Wing Crawl Space and Concrete Floor Framing:** The 600 Wing floor framing below the Men's Locker Room and Gym Recreation Room was observed from the crawl space. Due to piles of debris, excrement and pipe congestion, we were unable to access the crawl space below the Gym. Some honeycombing, spalling, exposed/corroded reinforcement and rust stains were observed in limited locations, but no significant structural distress or deterioration was noted in the structural components observed. The crawl space soils were damp and the air was not well ventilated. Soil from around the perimeter of the building had caved inward and was violating the void space below the perimeter beams.

The 2013 report measured differential slab elevations and found that there was significant variation in the slab elevations. The slab movements were attributed to the expansive nature of the soils and existing shallow foundations that are not deep enough to penetrate past the expansive materials.



Damp soil



Void space below perimeter beam is filled with soil



Spalling concrete interior beam and exposed/corroded rebar



Spalling concrete deck and exposed/corroded rebar

- 600 Wing Building Exterior:** The perimeter walls of the gymnasium were faced with brick veneer. Diagonal and horizontal cracks were observed on the west and north walls of the Gym. The planter adjacent the north entrance to the Gym has cracks that appear to have reopened after a previous repair. The wall east of the Gym Recreation Room has many patched and reopened diagonal cracks. Patched cracks were also observed at corners of window openings on the north wall of the Gym. Lastly, two cracks were observed near the southeast corner of the Women's Locker Room on the outside of a foundation perimeter beam.





Horizontal crack on planter masonry



Vertical/diagonal crack below window



Gym recreational room diagonal cracks (some previously repaired)



Crack at window opening on west wall of gym



Perimeter beam crack below exterior brick



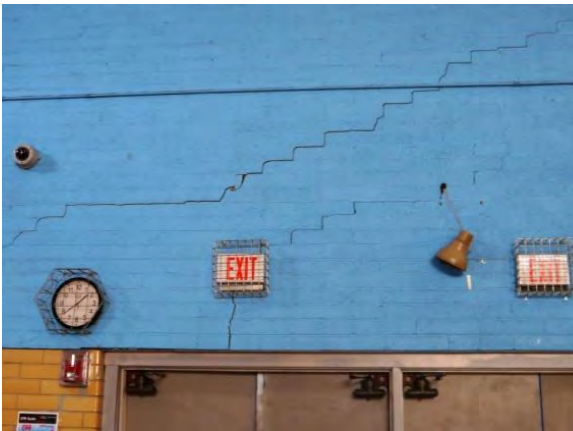
- **600 Wing Interior Wall Faces:** The Gymnasium and Locker Rooms had many vertical and diagonal cracks on the interior faces of the masonry walls. See photos below and see Photo Log attached for additional information.



Crack on corner of main gym east and north walls



Diagonal cracks on main gym north wall



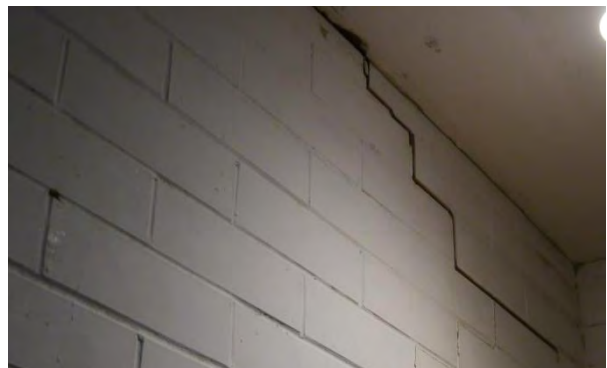
Diagonal cracks on main gym north wall



Vertical cracks on west wall



Patched crack in Men's Locker Room



Diagonal crack in Men's Locker Room



Reopened crack in Men's Locker Room



Reopened crack in Men's Locker Room

- **600 Wing Roof Framing:** Our scope did not include observation of the roof framing, but according to the 2013 report there are significant roof leaks and the metal roof deck and open-web bar joists are suffering from advanced corrosion. See photographs from the 2013 report of the 600 Wing roof framing copied below. It is not clear if the roof leaks have been addressed.



Advanced deck corrosion



Advanced deck corrosion

## Observations at the Wood Portables West of 400 Wing

The wood portables did not allow for visual inspection of the structural systems. The exterior and interior panels and floor finishes were observed and no significant defects were noted. The 2013 report indicates the Science Addition portable is experiencing severe floor movements due to the expansive soils and shallow foundations and recommends that the building be removed and replaced.

## Conclusions

**General:** The original building and various additions all have shallow foundation systems that do not penetrate deep enough into the soil to pass through the expansive materials. As such, the entire building is subjected to soil movement as the surrounding soils expand and contract with seasonal moisture changes. The crawl space areas observed were

consistently wet and poorly ventilated, and the site surrounding the building is poorly graded and does not effectively drain surface water away from the building. Roof gutters discharge onto soils adjacent to the building perimeter and standing water accumulates instead of draining away from the building. All of these items contribute to the expansive behavior of the soils and as such, have contributed to the extensive damage incurred by the building. Future slab movements, flatwork movements, wall cracks, and roof leaks can be significantly reduced if the moisture content of the soil can be controlled by implementing significant drainage measures.

**100 & 200 Wings:** The 100 & 200 Wings do not require any additional repair beyond the drainage improvements, roof and deck repair, and some minimal concrete repair in the crawl space.

**Demolished 300 Wing and eastern portion of 200 Wing:** The concrete floor framing for the eastern portion of 200 Wing and the 300 Wing that remains in place and is being used as a parking surface needs to be removed or filled with a flowable fill. **Occupying the compromised floor framing is potentially dangerous and should be avoided.**

**400 Wing:** The interior column cracks observed in the 400 Wing crawl space are likely due to soil movement and would not continue to worsen if the moisture content of the surrounding soil is controlled. The damage at the east perimeter beam, however, appears to be due to the scarp creep. The perimeter beam appears to be separating from the rest of the floor framing and is sliding eastward down the scarp. Implementing drainage measures to keep the scarp soils relatively dry can help reduce the downward creep of the soil. The east perimeter beam will also need to be retrofitted with deeper foundations to isolate it from the creeping soil.

**500 Wing & 600 Wing:** The 2013 report recommended that the 500 Wing and the north portion of the 600 Wing be demolished and replaced because the cost to rehabilitate the structure would be too great. We agree that attempting to retrofit the building with deeper foundations would be very costly, but we feel that these areas could be recovered as occupiable space if drainage measures are implemented that limit moisture changes to the soils around the building and the roof is repaired. Even after drainage measures are employed, slab deflections and wall cracks are still likely to occur over time (but to a lesser magnitude) and will require continual maintenance. The roof leaks must be fixed and the advanced corrosion on the steel roof deck and roof framing must be addressed. **The severely corroded roof deck should be repaired/replaced or shored before the roof is accessed.** Likely the building requires a new roof to prevent further leaks. Even without extensive foundation repair, the cost to remediate these wings will be considerable and AISD may opt to replace these wings with new construction rather than invest funds to rehabilitate a sixty-five year old damaged building.

*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.*



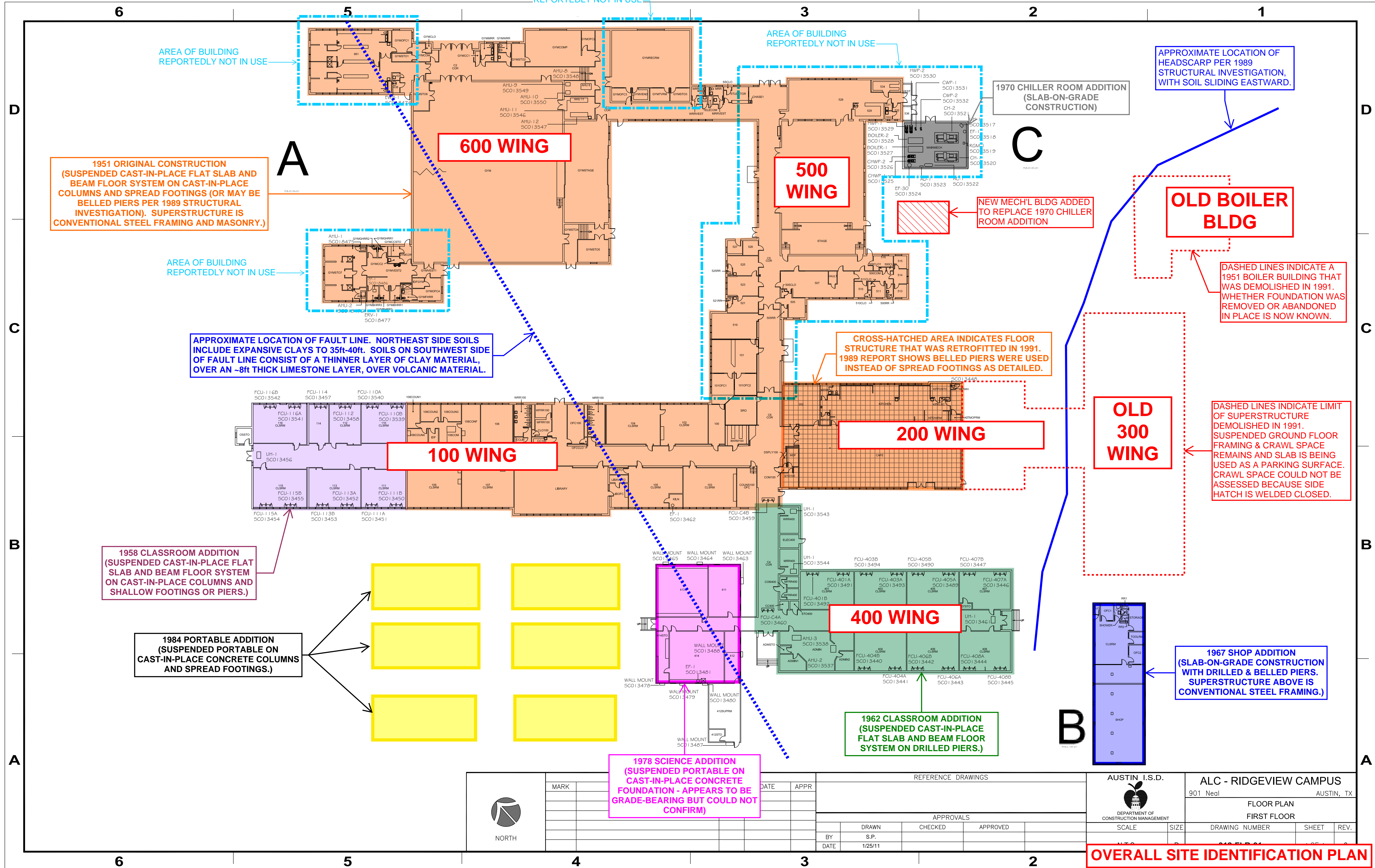
## Ridgeview ALC– Summary of Structural Repair Recommendations

### Main School Building Structural Repair Recommendations

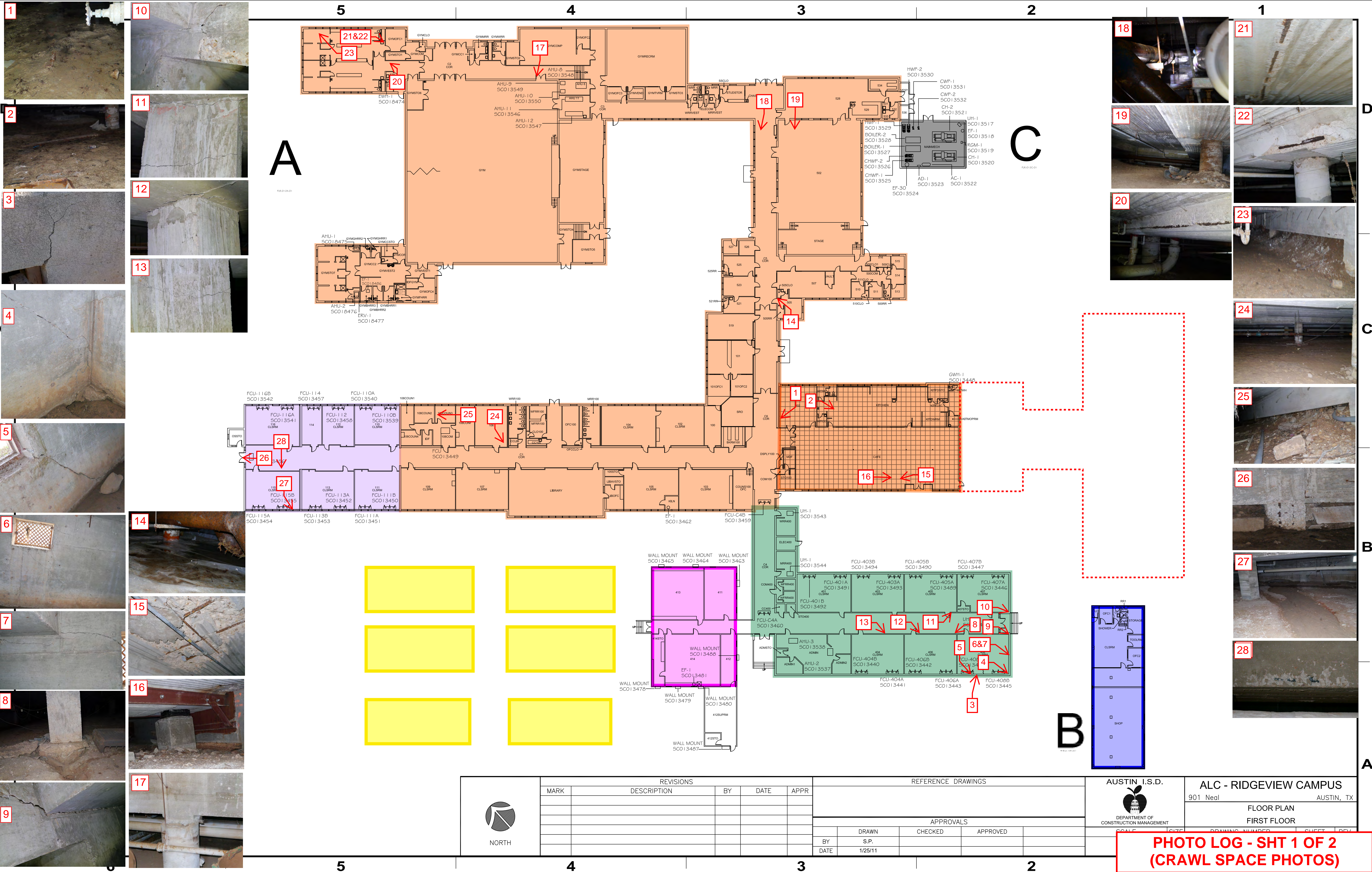
Below are the recommendations for additional investigative work needed to understand the issue and/or the corrective measures needed to repair the observed damage:

1. Fill holes, low spots and re-grade soils around the campus to promote positive drainage away from the buildings.
2. Consider adding area drains and storm sewer system in the crawl space and around the perimeter of the buildings so surface water is quickly collected before soaking into the surrounding soils. Extend roof drains to discharge directly into storm sewer system.
3. Consider adding a concrete apron around the building to prevent surface water from soaking into the soils immediately around the building perimeter and seeping into the crawl spaces.
4. Under the supervision of a geotechnical engineer, implement a subhorizontal drainage system around the scarp to minimize moisture in the scarp soils.
5. Either remove the existing concrete floor framing for the demolished 200 and 300 Wings or fill with a flowable fill material. If filled with flowable fill, regular vent holes should be used to verify no air gaps remain.
6. Properly vent the crawl spaces by adding new areaways and a mechanical ventilation system.
7. Inspect crawl space pipes and repair all pipe leaks found.
8. Replace all damaged or caved soil retainers and restore void spaces below perimeter beams.
9. Inspect roof drains, gutters, etc. and repair as needed. Collect all water from roof and discharge at least 20ft away from the building (preferably collect in a storm sewer).
10. Replace the roof membrane and repair any damage due to past leakage.
11. Once existing roof membrane is removed but before new roof system is applied, thoroughly clean the more heavily rusted areas of the metal deck. Add strips of new decking at end laps and side lap joints, etc. that are in particularly poor condition. Weld or fasten new decking to existing support members and existing deck.
12. Perform a thorough inspection of the roof framing currently concealed by ceilings and identify all areas with significant corrosion. Once all areas are identified, clean rust from the open-web joists and/or steel framing and paint with a rust-inhibitive primer to prevent further corrosion. Repair deck as noted above.
13. Repair connections of crawl space interior beams to the perpendicular east perimeter beam of the 400 Wing. Use epoxy-injection and concrete repair mortar to fill cracks and spalls.
14. Widen the 400 Wing east perimeter beam and add up to five new deep piers (for pricing assume 30ft depth) to isolate the beam from scarp movement.
15. Seal exterior brick cracks with a flexible sealant.
16. Seal interior wall cracks with a flexible caulk.

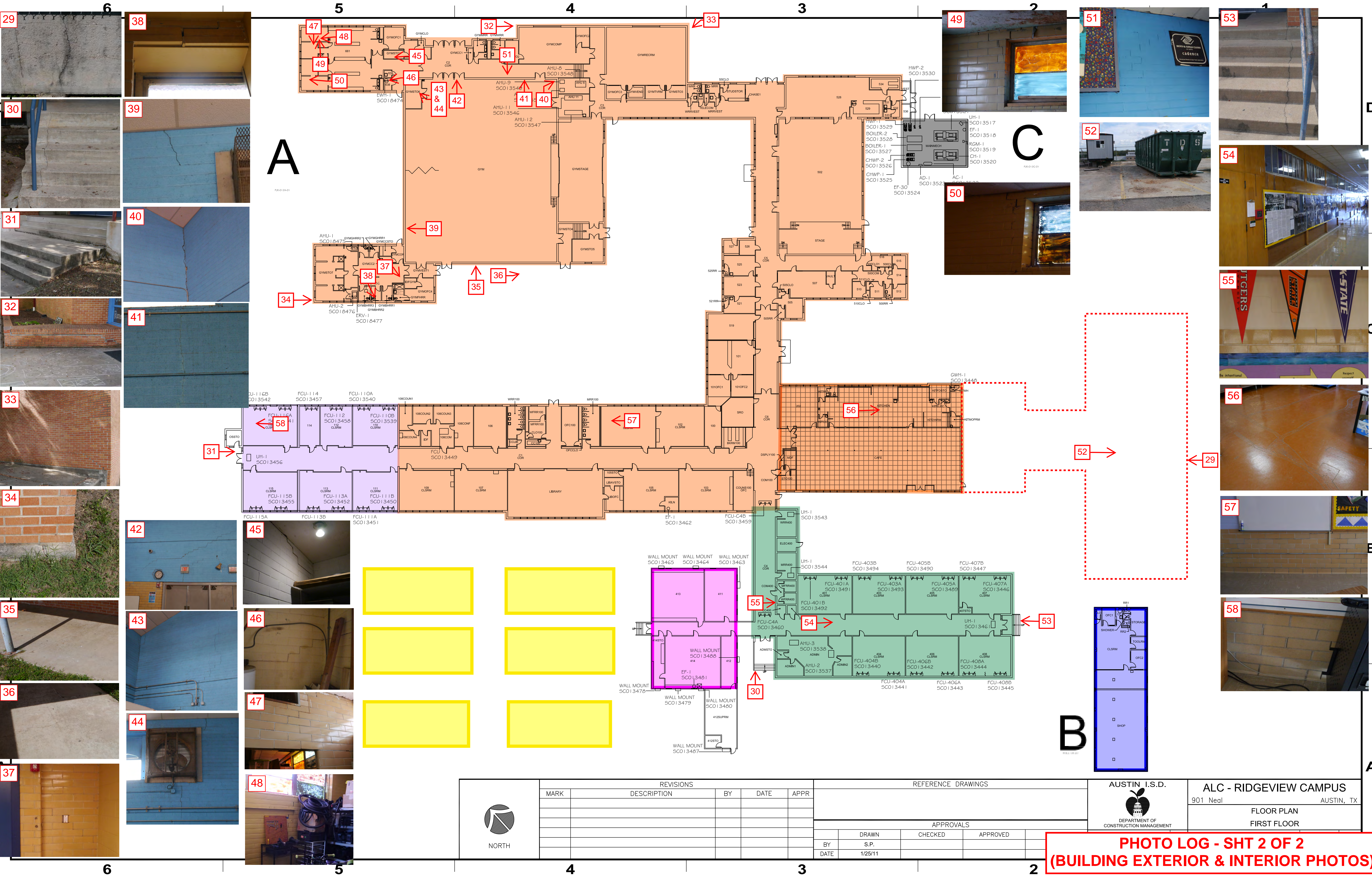
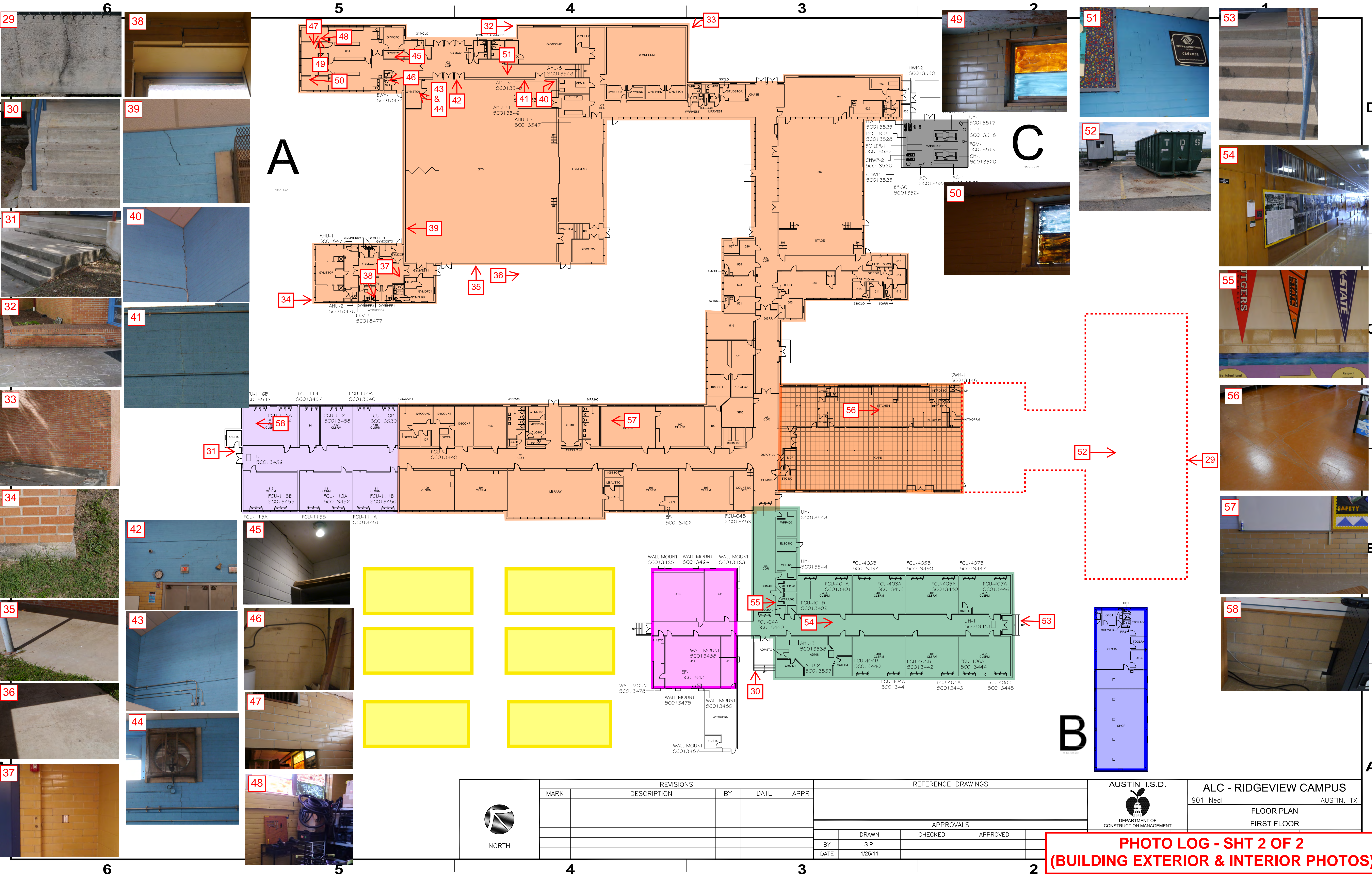













MARK	REVISIONS					REFERENCE DRAWINGS			
	DESCRIPTION	BY	DATE	APPR					
						APPROVALS			
						DRAWN	CHECKED	APPROVED	
						S.P.			
						DATE	1/25/11		



AUSTIN I.S.D.  
DEPARTMENT OF  
CONSTRUCTION MANAGEMENT

ALC - RIDGEVIEW CAMPUS  
901 Neal  
AUSTIN, TX

FLOOR PLAN  
FIRST FLOOR

PHOTO LOG - SHT 2 OF 2  
(BUILDING EXTERIOR & INTERIOR PHOTOS)