

## STRUCTURAL ASSESSMENT – Delco Activity Center (BLDG-284A)

|                       |                             |
|-----------------------|-----------------------------|
| Building Purpose      | Event Center                |
| Inspection Date       | September 8, 2016 (Morning) |
| Inspection Conditions | N/A - Indoors only          |

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

**Brief Description of Existing Structure:** Delco Activity Center is a one-story event facility. A long-span pre-engineered steel building spans across a basketball court and stadium bleachers. The overhead pre-engineered metal building roof frames are typically exposed to view from below. The pre-engineered metal structure is supported at the first floor on suspended concrete floor framing and belled piers. Floor system consists of 2" concrete topping on 8" deep x 4ft wide precast hollow-core planks spanning between cast-in-place suspended concrete beams. Topping slab at corner entryways, outer walkways and restrooms around the perimeter of the building were generally exposed to view, but the topping slabs in the inner interior of the building are covered with gym flooring, carpet, etc. and typically could not be observed.

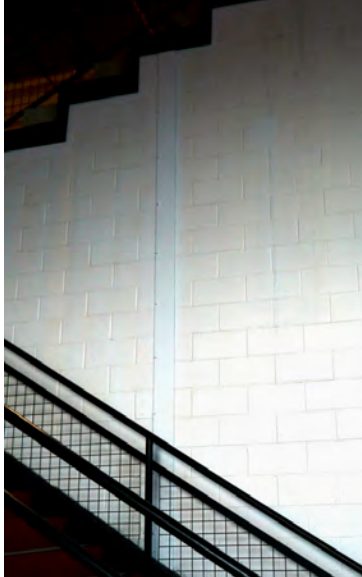
**Reported Structural Concern:** Exposed control joints in the CMU walls at building entryways have widened near the top of the walls. One CMU control joint has opened so much that maintenance personnel installed a vertical cover plate to conceal the joint. Delco Activity Center has also developed mild to advanced cracks in exposed concrete floor slabs throughout the facility.

It is worth noting that site drainage has continually been a problem at this facility. The Delco Activity Center was constructed and opened in 2002; grading/drainage issues developed soon after and localized flatwork and grading improvements were performed on the southeast side of the building in 2005. AISD has also just recently completed additional flatwork replacement, drainage improvements, and minor cosmetic improvements at the site due to ponding and water intrusion into the building. Another round of drainage improvements is underway (currently in design phase). A full account of the building's drainage and grading history is summarized in a Drainage Investigation Memo dated 11/24/2015 prepared by Tom F. Curran with Chan & Partners Engineering, LLC.

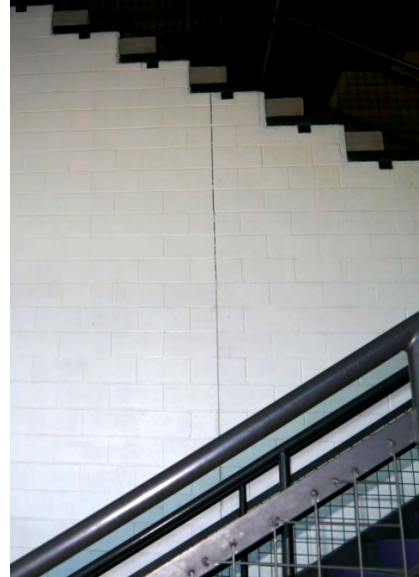
### **Structural Assessment Site Observations**

While at the facility we made the following observations:

- **CMU at Corner Entries:** Long, tall CMU walls are exposed at the ends of the bleacher seating adjacent to the entry stairs at each corner of the building. Vertical control joints in the exposed CMU walls at the NW and SW entryways had visibly opened (widened) near the top of wall. The joints appeared normal (typical width) lower on the walls (closer to slabs). The vertical control joints in the same CMU walls at the NE and SE entryways appeared normal width for the full height of the walls.



Vertical Cover Plate Concealing Opened CMU Control Joint at NW Entry



Partially Opened CMU Wall Control Joint at SW Entry

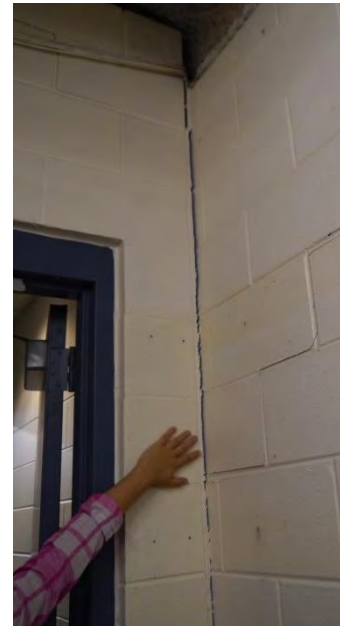
- **CMU at Outer Walkways:** Long CMU perimeter walls at the inside faces of the pre-engineered building superstructure were exposed along the long walkways on each side of the building. No cracks were observed in these walls because the CMU walls had recently been repainted and any small cracks would likely have been concealed behind the new paint coat. Large cracks, however, would have likely reflected through the new paint but none were detected.
- **Interior Walls:** Large cracks were observed at several of the building's interior walls.



Large Vertical Crack in CMU Pilaster



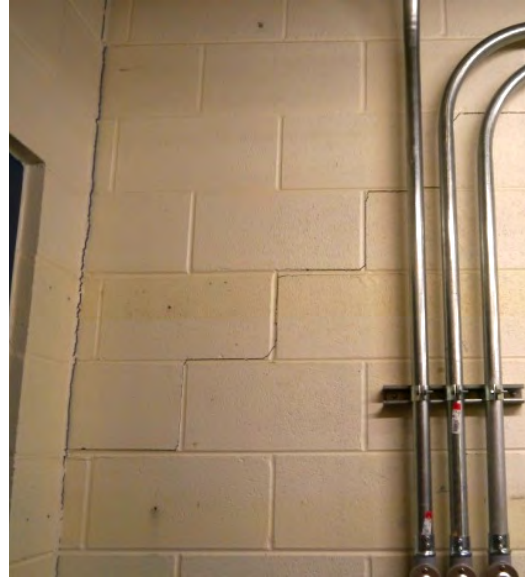
Widened Control Joint in Interior CMU Wall



Separation at Abutting CMU Walls



Separation at Top of Abutting Interior Walls



Abutting Interior Walls Have Separated, Diagonal Cracks in Interior CMU Wall

- **Slabs at Corner Entryways:** Large cracks were observed in the exposed concrete slabs at the corner entryways. The cracks typically ran from the perimeter of the building to the stairs leading up to bleacher seating.



Large Slab Cracks at Corner Entryways

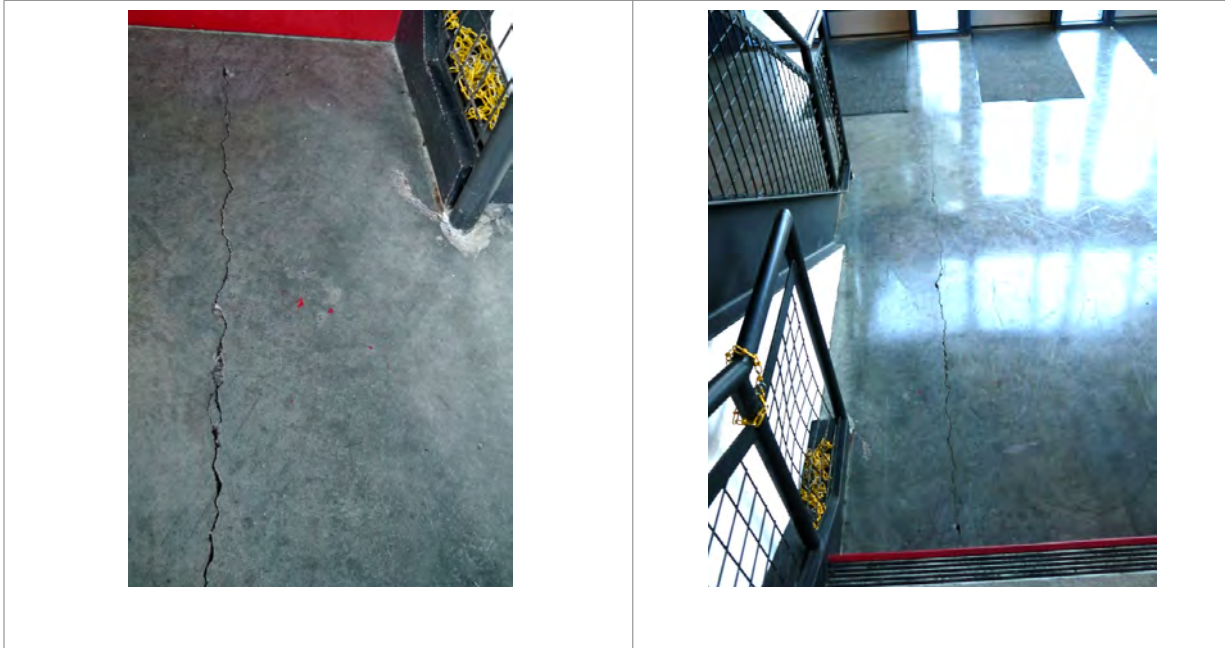


Large Slab Cracks at Corner Entryways

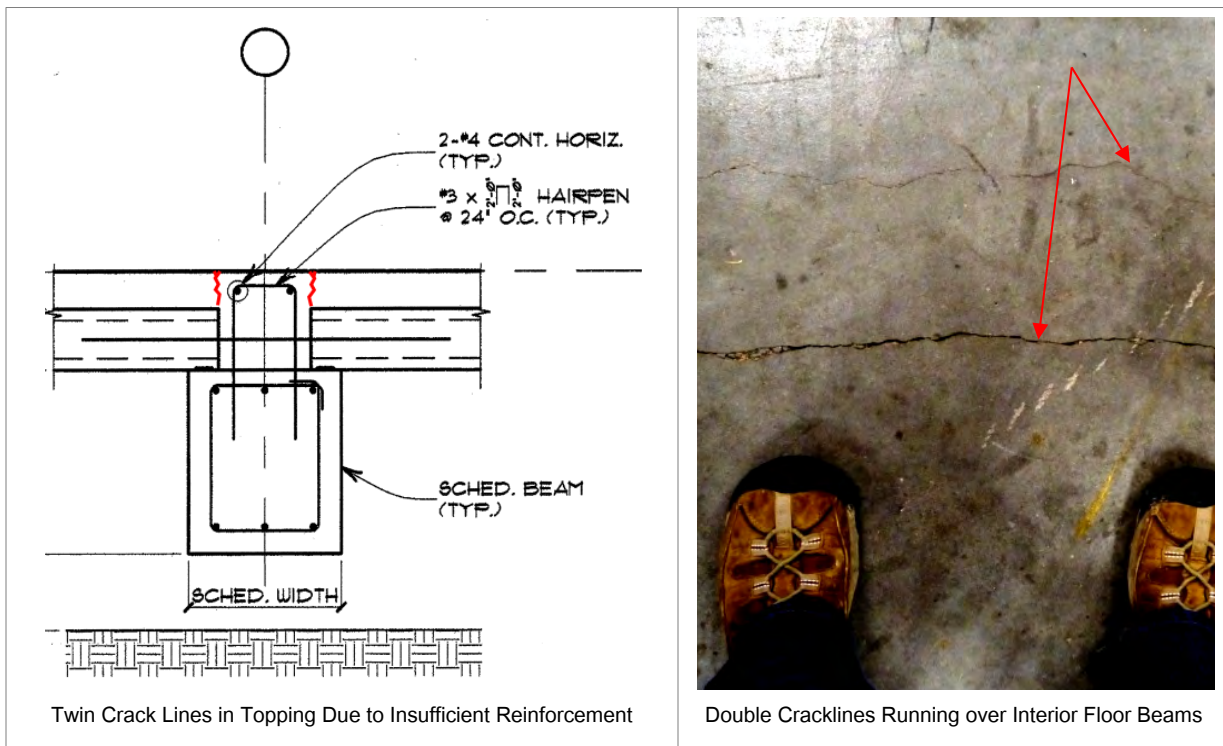


Slab Cracks at Top of Entryway Stairs





- Slab Twin Crack Lines:** Small- to large-sized twin crack lines were observed in the topping slab throughout the facility; the double crack lines run parallel to each other roughly 12" apart. The observed crack lines generally ran in the north-south direction and seemed to coincide with beam lines. Similar cracks ran north-south adjacent to existing double control joint lines (also over beams). These cracks are likely reflective cracks occurring over the hollow-core plank ends bearing on the floor beams, and this type of cracking is relatively common in topping slabs with insufficient reinforcing to support the tension forces in the top of slab either because enough steel area wasn't provided or the slab reinforcement was not chaired properly during construction. See detail below – the red line represent the twin crack lines.





Large Slab Cracks Adjacent to Double Control Joints

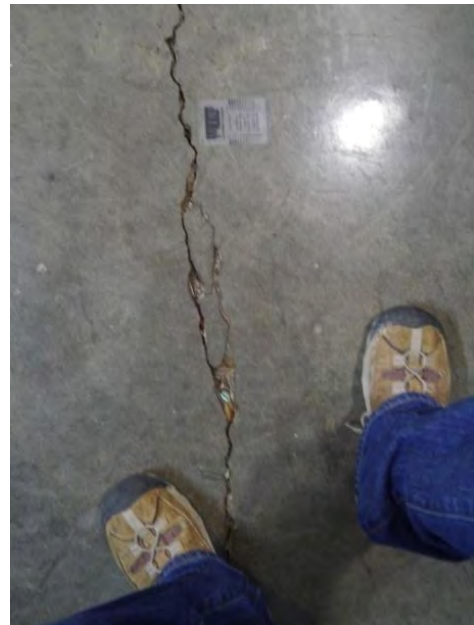


Large Slab Cracks Adjacent to Double Control Joints

- **Other Slab Cracks:** Beyond the corner entryways, cracks were observed in the slabs regularly along outer hallways and restrooms



Slab Topping Crack in Walkway in Front of Bleacher Seating



Large Slab Crack Near Central Chiller Room

- **Structure in Crawl Space:** Floor framing in crawl space was concealed behind spray-on fireproofing and could not be closely observed. This is unfortunate because we were not able to evaluate the condition of the concrete framing supporting the corner entryways and perhaps better understand the behavior causing the wall and slab cracks above.



No obvious signs of structural distress such as spalling or large cracks were detected through the spray-on fireproofing. Most soil retainers appeared in good condition, although a few retainers were cracked or had caved allowing exterior soil in fill in the void below the perimeter beam. Columns and piers also appeared to be performing well; all seemed plumb and cleanly cast (no mushroom tops, honeycombing or apparent stress cracks).



Concrete Floor Framing Obscured by Spray Fireproofing



Cracked and Caving Soil Retainers

- Soil in Crawl Space:** Soils in the crawl space were damp to very saturated at the time of our site visit, which indicates a substantial amount of water is infiltrating into the crawl space below the building either through the areaway openings or from heavily saturated soils around the exterior of the building. Likely water is getting into the crawl space through both means: clear signs of water flow from several areaways was apparent from the track marks visible in the soils. There were two floor drains inside the crawl space and soil was very wet around both of them, which indicates water is not flowing into the floor drains quickly and is instead soaking into the surrounding clay soils. Soils in the crawl space appeared mostly flat and are likely not maintaining positive drainage into the floor drains.



Flat, Saturated Soils Surrounding Floor Drain



Clear Flow Lines in the Soil Leading From Areaway Openings

- Areaways:** Several areaways around the perimeter of the building seemed to have very low curb heights that likely do not effectively prevent surface water around the perimeter of the building from flowing down into the crawl space.



Low Areaway Curb Heights Allow Water into Crawl Space



Low Areaway Curb Heights Allow Water into Crawl Space

- **Exterior Slabs and Flatwork:** Cracks in the topping slab at corner entryways extended to the topping slab outside the doors. In addition, concrete flatwork adjacent to the building was cracked; cracks were even observed in flatwork that appeared to have been recently replaced.



Exterior Topping Slab Cracks at Corner Entryways



Cracks in Newly Replaced Flatwork





Exterior Flatwork Around Corner Column has Settled

- **Site Grading & Drainage:** Grading around the perimeter of the building appeared flat in several areas and is likely not effectively draining water away from the building.



Flat Grading Around Perimeter of Building



Flat Grading Around Perimeter of Building

- **Cosmetic Damage to Interior Finishes:** Small cracks in wall finishes were observed around the facility.

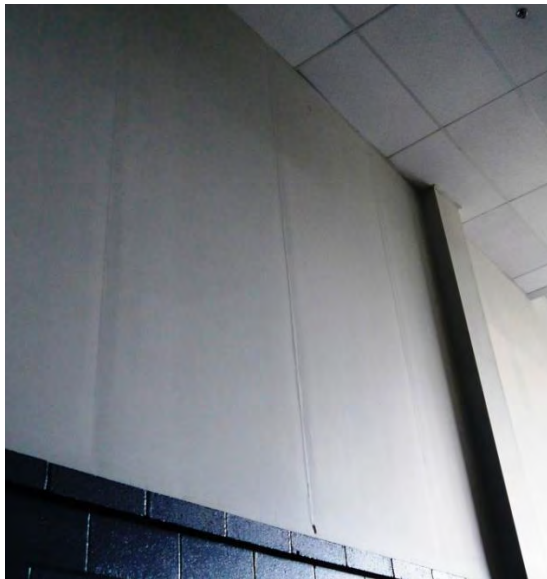




Finish Damage at Top of Red Column Near NW Entryway



Crack in Wall Finish at Entryway Window Corner



Perimeter Wall Finish Damage Above CMU in Outer Corridor



Wall Finish Damage Above CMU Pilaster in Outer Corridor

- **Superstructure:** The building superstructure is pre-engineered metal building and no damage was detected in the exposed portions of the steel framing (although roof framing could not be closely observed from ground level). Pre-engineered metal buildings tend to be flexible and can accommodate differential movement.

## **Conclusions**

The wall and slab cracks are likely from differential movement due to soil contraction and expansion. The soils below the building are highly expansive clays and will be sensitive to moisture content changes that natural occur over time and during different seasons. The corners of the building are likely shifting vertically as the soils expand and contract. The concrete floor structure in the crawl space is concealed behind spray-on insulation and the slab crack lines tend to run north-south and east-west to follow the lines of the hollow-core planks, making it difficult to discern a precise settlement pattern. However, the observed cracking does not appear to be adversely affecting the structure's structural capacity, and if soil moisture can be limited the building's movements should be minimal.

The slab cracks should be treated otherwise they are likely to worsen over time. We suggest routing the larger cracks in walkways and public-use areas and sealing with a flexible sealant that will accommodate future movement. The double crack lines over ends of hollow-core planks can be left alone if small, or if cracks are large or if foot traffic causes the cracks the worsen over time then they can be treated in a similar fashion to the entryway cracks (rout and seal).

We suggest treating CMU wall cracks and where abutting walls are separating in a similar manner – fill with a flexible sealant.

The most important repair effort to limit building movement is to address exterior site grading and drainage. Chan & Partners Engineering, LLC outlines a comprehensive plan to overhaul grading and drainage across the site in their Preliminary Drainage Investigation Memo (dated 11/24/2015): they recommend acquiring a current topographical survey around the building to understand existing grades, testing the existing storm drainage system to confirm it is fully operational, re-grading landscaped areas and flatwork surrounding the building to promote positive drainage to the storm drains, sealing cracks in the perimeter roadways to limit moisture intrusion. They estimate the repairs will cost roughly \$175,000. We recommend executing all of their suggested repairs, but we suggest allotting an increased budget of \$250,000 to perform the work.

An additional measure to help control soil moisture is to minimize exposed ground surface around the building by constructing a continuous concrete apron around the building perimeter. Areaway curbs should also be retrofitted so they are at least 3 inches above the surrounding ground/concrete surface.

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## Delco Activity Center – Summary of Structural Repair Recommendations

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

### **Delco Activity Center Structural Repair Recommendations**

**1. Control of Soil Moisture:**

- a. Perform grading and drainage repairs recommended by Chan & Partners Engineering, LLC in their Preliminary Drainage Investigation Memo (dated 11/24/2015):
  - i. Obtain current topographical survey of exterior ground around building
  - ii. Test storm drainage system and clean or repair as needed
  - iii. Seal cracks in perimeter roadway to limit water intrusion
  - iv. Re-grade landscaping areas and flatwork around building to promote drainage to storm drain inlets
  - v. Test irrigation system and repair as needed
- b. Increase height of areaway curbs so curb height is at least 3" above top of surrounding ground/flatwork surface
- c. Consider constructing an impervious concrete apron 10ft to 15 ft wide around perimeter of building to prevent water infiltration into soils near the building

**2. Crawl Space:**

- a. Re-grade soils in crawl space to effectively carry surface water to existing storm drains. Lower drain inlets if required to maintain a minimum 2% slope downward to the storm drain inlets.
- b. Replace all broken and collapsed soil retainers, remove any caved soils in contact with bottoms of beams

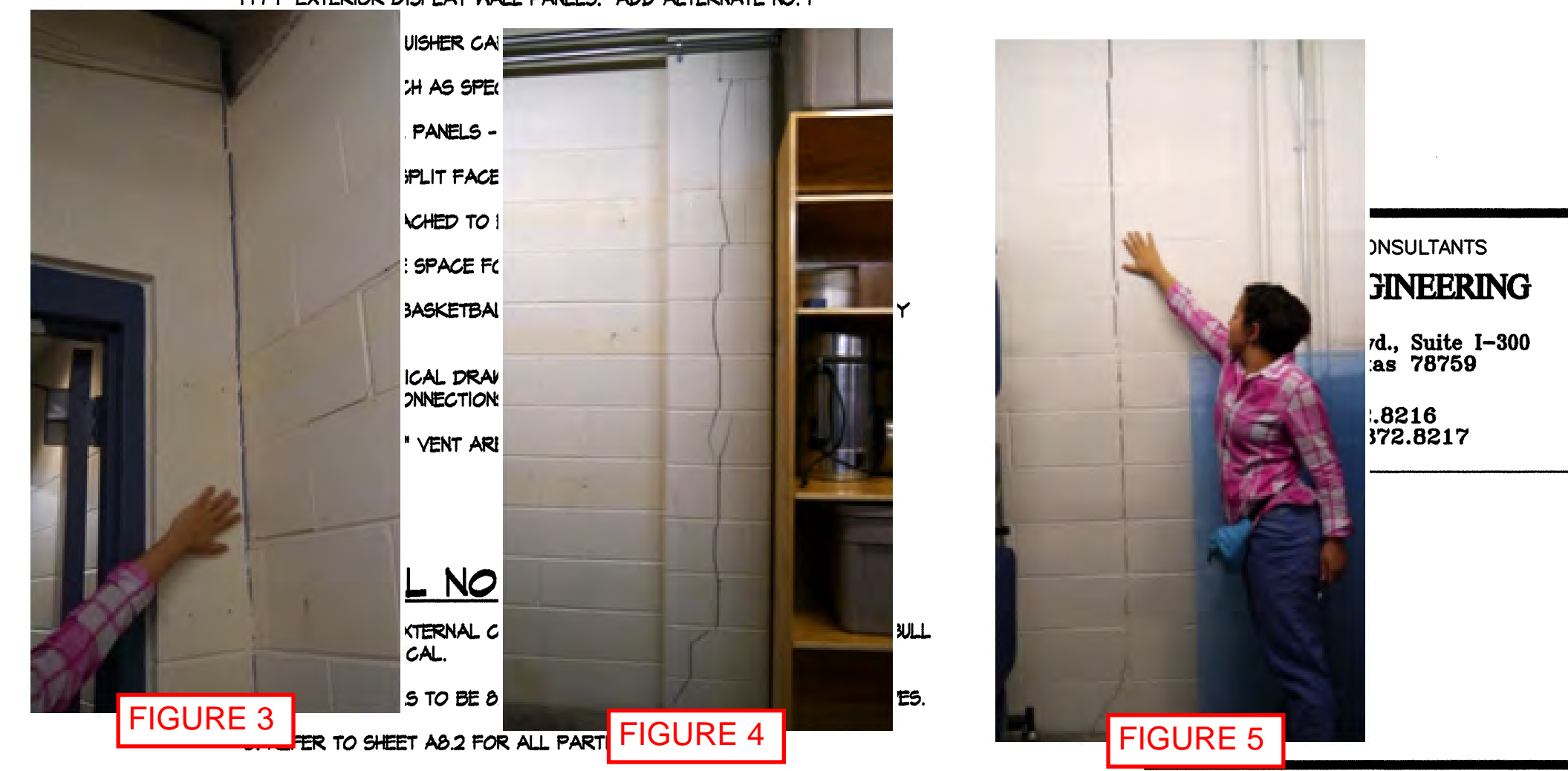
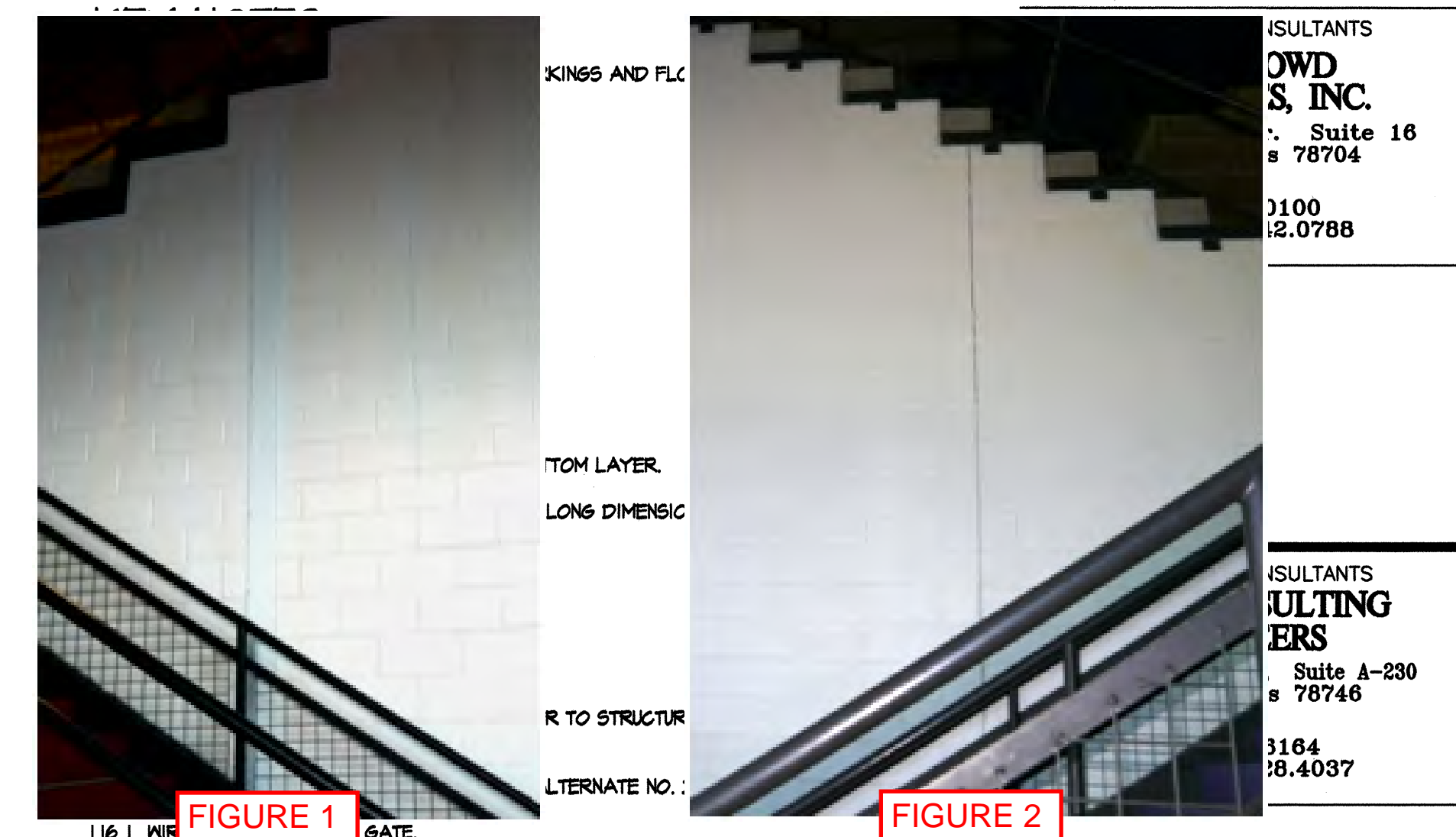
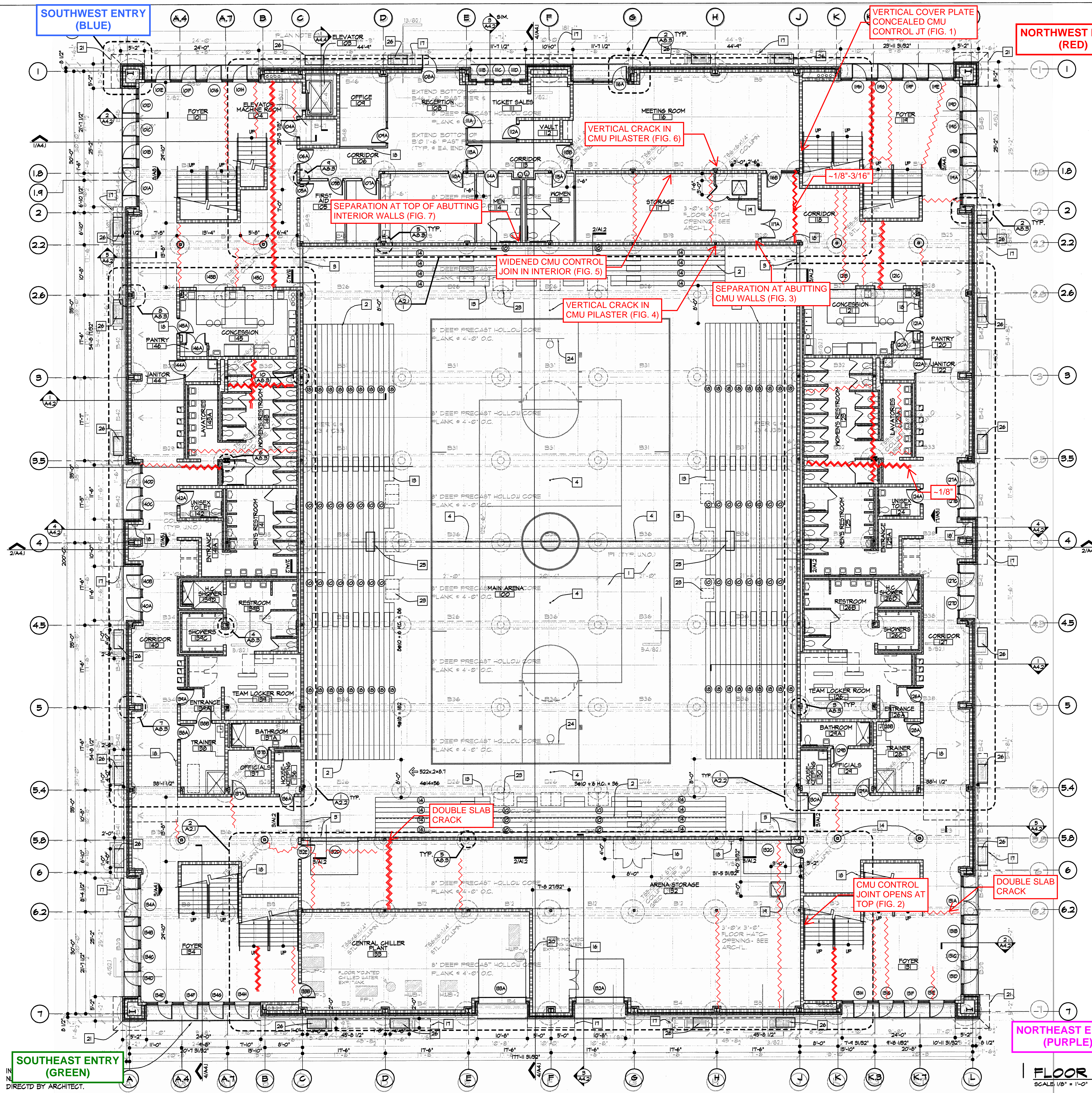
**3. Cracked Topping Slab:** Rout and seal larger cracks and cracks exposed to foot traffic with a flexible sealant.

**4. Cracked CMU Walls:** Seal larger cracks with a flexible sealant. Existing control joints that have opened can be cleaned and resealed with a flexible sealant.

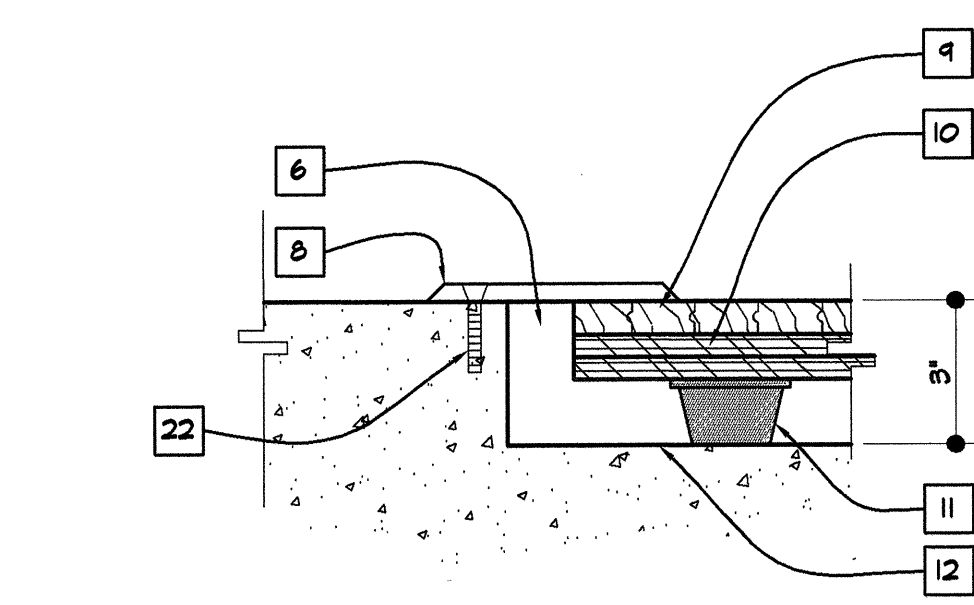
**5. Interior Finishes:** Damage to interior finishes was minimal but can be repaired if desired. Any repairs to finishes are purely cosmetic and are not required structurally. Also, please note that differential soil movements may cause finishes to crack and separate in the future, so it may be worthwhile to monitor finishes after other repairs are made to verify damage will not recur before repairing.

*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.*





2 WOOD FLOOR AT CMU WALL  
SCALE: 3" = 1'-0"



3 WOOD FLOOR AT CONCRETE FLOOR  
SCALE: 3" = 1'-0"

**INSULTANTS**  
**OWD & ASSOCIATES**  
Suite 100  
78704  
3100  
12.0788

**INSULTANTS**  
**OWD & ASSOCIATES**  
Suite A-230  
78746  
3184  
18.4037

**INSULTANTS**  
**OWD & ASSOCIATES**  
Suite 1-300  
78759  
8216  
172.8217

**OWD & ASSOCIATES**  
**ARCHITECTS, INC.**  
Cross Drive, Suite 203  
Austin, Texas 78758  
512.451.6586  
512.451.6583  
Joint venture with  
**ON GALLOWAY**  
**OLLIER, PLLC**  
6th Street, Suite C  
Austin, Texas 78703  
512.474.8085  
512.474.9820

**PROJECT**  
**AUSTIN INDEPENDENT**  
**SCHOOL DISTRICT**  
**ACTIVITY**  
**CENTER**  
**(NORTH AUSTIN)**  
**AUSTIN, TEXAS**  
**FLOOR PLAN**  
**LOWER LEVEL**  
**SCALE**  
**1/8" = 1'-0"**  
**ISSUE DATE**  
**May 16, 2001**  
**REVISIONS**  
**AS-BUILT DRAWINGS - 10-6-04**  
**DRAWN BY:**  
**JS**  
**CHECKED BY:**  
**PMIII**  
**PROJECT NO.**  
**MAA-9901**  
**284-0057**  
**TOTAL SHEETS**  
**SHEET NO.**  
**A1.2**