Event Report
For the Biotechnology Sciences and Engineering Building (BSE)

University of Texas at San Antonio
San Antonio, Texas

Performed for UTSA

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Envelope Architecture

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# Table of Contents

<table>
<thead>
<tr>
<th>TAB</th>
<th>Description</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Table of Contents</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Project Data</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Executive Summary</td>
<td>4-6</td>
</tr>
<tr>
<td>4</td>
<td>Key Plans</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Photos</td>
<td>8-14</td>
</tr>
</tbody>
</table>

---

## Legend

<table>
<thead>
<tr>
<th>X</th>
<th>Subject</th>
<th>Photograph number and camera angle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leak Area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Area of Roof Drain Test—Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Area of Roof Drain Test—Fail</td>
<td></td>
</tr>
</tbody>
</table>

## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACM</td>
<td>Aluminum Composite Material</td>
</tr>
<tr>
<td>AVB</td>
<td>Air Vapor Barrier</td>
</tr>
<tr>
<td>BUR</td>
<td>Built Up Roof</td>
</tr>
<tr>
<td>BW</td>
<td>Barrier Wall</td>
</tr>
<tr>
<td>CIP</td>
<td>Cast in Place Concrete</td>
</tr>
<tr>
<td>CW</td>
<td>Glazed Aluminum Curtain-wall</td>
</tr>
<tr>
<td>IBC</td>
<td>International Building Code</td>
</tr>
<tr>
<td>MB</td>
<td>Modified Bitumen</td>
</tr>
<tr>
<td>MP</td>
<td>Metal Panels</td>
</tr>
<tr>
<td>MV</td>
<td>Masonry Veneer</td>
</tr>
<tr>
<td>PC</td>
<td>Pre-cast Concrete Panels</td>
</tr>
<tr>
<td>PW</td>
<td>Punched Windows</td>
</tr>
<tr>
<td>SI</td>
<td>Structural Integrity</td>
</tr>
<tr>
<td>SF</td>
<td>Storefront Glazing System</td>
</tr>
<tr>
<td>UBC</td>
<td>Uniform Building Code</td>
</tr>
<tr>
<td>WB</td>
<td>Weather Barrier</td>
</tr>
<tr>
<td>WI</td>
<td>Water Infiltration</td>
</tr>
<tr>
<td>WL</td>
<td>Wind Loading</td>
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## Report Definitions

**Service Life**

The period during which a building is structural sound and not vulnerable to water infiltration.

**Poor Condition**

Vulnerable to next wind and/or rain event. Needs attention now.

**Fair Condition**

Service life should survive 5 years with yearly inspections and normal maintenance.

**Good Condition**

Service life should survive 5 years with no action.
Event Area—Rise Wall at East Side of Barrel Vault Roof

- During rain events infiltration has been observed at 19 reported locations around the fourth level of the building, above the window head at all locations. These leaks are reported to be old areas of water infiltration that leaks during most rain events, amount of leakage relevant to amount of rain.
Executive Summary

The project is the Biotechnology, Science and Engineering Building (BSE) located on the campus of the University of Texas at San Antonio. BSE is a five story structure with four levels above grade and one partially below grade. The building façade is comprised of primarily limestone veneer, plaster, GFRC cornice, glazed aluminum curtain-walls and punch windows, clay tile roofing with underlayment and a Sarnafil single ply roof gutter.

Zero/Six Consulting L.L.C (ZSC) has been commissioned by UT OFPC to determine the cause of the water infiltration around the perimeter of the fourth level of the BSE and provide direction as to “next steps” for remediating causes of water infiltration. ZSC has not been provided with the original contract documents and all assumptions in this report are based from what has been observed throughout the forensic evaluation in the field.

Upon arrival on site, two areas where water infiltration had been previously observed were pointed out to Zero/Six personnel by Vaughn and UTSA personnel. These areas were identifiable due to removed or fallen sheetrock above the window head and a temporary plastic water catch taped to the perimeter of the remaining interior gyp and ceiling grid. It was stated by UTSA personnel that the other areas of water infiltration were at the same locations throughout the fourth level, but the two areas observed were the worst in regards to amounts of water observed at the interior during rain events. The worst of the two was located along the West elevation of the building along room 4.212 (Leak Area 1) and the other point of water infiltration was located at the North elevation along room 4.320 (Leak area 2)

Leak Area 1: Leak area 1 was marked by removed or fallen interior gyp ceiling. ZSC began observations from the interior side utilizing a ladder to access the interior gyp above the drop ceiling. There were obvious signs of water infiltration along light gauge metal ceiling joists, curtain wall head, stud track and vertical studs above the curtain wall head and sheetrock above the window system, indicating that the water infiltration was occurring above the termination of waterproofing to the ribbon window system at the exterior.

Multiple areas of gyp board above ceiling were observed to be damaged from apparent water infiltration, however ZSC was unable to remove the areas that were not damaged due to horizontal bracing members that were attached to the wall assembly.

The investigation then moved to the 5th level attic space as ZSC attempted to locate signs of water infiltration that would imply the clay tile roof as a potential contributor to the water infiltration observed below. The room directly above 4.212 is integrated into the building exhaust system and is under constant negative pressure, which was apparent when trying to access the room by opening the door and has begun to pull fire sealant out of multiple joints around penetrations through the room. ZSC observed multiple signs of water infiltration inside of the room which appeared to be originating in the clay tile roofing above. There was also a notably large area of sheetrock directly above “Leak Area 1” which appeared to be damaged by water infiltration.

ZSC’s review of the exterior at “Leak Area 1” showed multiple deficiencies in construction and material degradation which include the following:
1. Multiple damaged and loose clay tile directly above the roof area. Tiles along the edge of the roof appeared to be held down by one galvanized ring shank nail per tile and were not driven flush with the surface of the tile in most locations observed. Also, the head of the nails appeared to be of equal or lesser diameter than the predrilled holes in the tile. ZSC observed no wind straps along the edge of the tiles and multiple edge tiles were missing.

2. Multiple sections of roof flashing that were not sealed during construction, including valley and edge flashings.

3. Deteriorated wood decking below the clay tile and underlayment could be felt by pressing on the underlayment where a few tiles where lifted for review. This would suggest that water had been infiltrating the roofing system for an extensive period of time.

4. Sarnafil roof membrane appeared to be in fair condition in regards to the service life.

5. Sealant joints in Glass Fiber Reinforced Concrete (GFRC) appeared to be a silicone product that connected to a horizontal polyurethane sealant joint at the top of the surface mounted receiver flashing. At the point of intersection between the two joint types, ZSC observed adhesive failure at every joint intersection between dissimilar materials. ZSC also observed adhesion failure in the vertical sealant joints in the GFRC at multiple locations. ZSC believes that delaminating due to the adhesive failure is allowing water to infiltrate the plane of GFRC and subsequently infiltrate the damp-proofed backup wall due to various deficiencies at penetrating members and joints in sheathing.

6. ZSC performed a pull test of the GFRC sealant joints in accordance with ASTM C1521 protocol which produced negative results in regards to adhesion. A borescope was utilized to observe the damp-proofed back up wall through the hole in which sealant was removed for testing. Open sheathing joints on the face of the wall and in the corner where the wall makes a 90° turn were observed with the borescope.

7. The horizontal sealant joint connecting the ribbon window head to the GFRC panels appeared to be discolored in multiple locations, likely due to the silicone joint contacting the leading edge of self adhered membrane that is terminated to the head of the curtain wall system. ZSC does not believe this poses any threat to the performance of the sealant joint. The weeps installed in the sealant joint however appear to be too small in diameter and too few to drain the amount of water entering the GFRC panels.

**Leak Area 2:** Leak Area 2 was marked by removed or fallen interior gyp ceiling. ZSC began observations from the interior side utilizing a ladder to access the interior gyp above the drop ceiling. There were obvious signs of water infiltration along light gauge metal ceiling joist above the window system, implying that the water infiltration was occurring above the termination of water proofing to the ribbon window system at the exterior.

Interior gyp above the ceiling was presented as a “non-fire rated wall” by project team members in attendance. ZSC was granted permission to remove sections of this gyp by Vaughn (Brett Fairman) and UTSA (Rick Zamora) due to limited vision access with the bore scope.

After removing two sections of gyp, ZSC observed a large patch in the exterior gyp sheathing (exterior backup wall behind GFRC panels) approximately 10” above the head of the window system. The perimeter of the patch appeared to be filled in with emulsified asphalt damp-proofing, a product known to become brittle and has little to no ability to span cracks without some type of joint reinforcement. ZSC observed two dark trails, along the bottom of the patch, that appeared to be water staining, implying that this patch has been a source of water infiltration at some point.
Executive Summary (continued)

The investigation then moved to the 5th level attic space as ZSC attempted to locate signs of water infiltration that would implicate the clay tile roof as a potential contributor to the water infiltration observed below. No evidence of water infiltration was observed at this location, however the possibility that the roofing system is contributing to the water intrusion below cannot be ruled out at this time.

ZSC was unable to access the roof from the exterior for further review due to the congested site at the North elevation of the building.

Summary: ZSC believes that deficiencies in the GFRC sealant joints, the damp-proofed backup wall and the clay tile roof above “Leak Area 1” in conjunction with the negative pressure on the interior side of the room below are all contributors to the water infiltration issues at the subject building. Recommendations for the “next Steps” of repair are as follows:
1. Remove a 10’ x 10’ section of clay tile at the valley above “Leak Area 1” to expose underlying details for visual inspection.
2. Remove a section of metal panels for visual inspection of underlying details, directly below the valley area of “Leak Area 1”.
3. Dependent upon the quantity and quality of deficiencies observed during steps “1” and “2”, another section of clay tiles may need to be removed to determine the frequency and coverage of deficiencies throughout the system.
4. There are two options to move forward with alleviating water infiltration at the GFRC cornice. The following options vary greatly in upfront costs and longevity of repairs:
   A. Repairing Original Drainage Plane: This option would provide a long service life for the repair with little maintenance involved; however would be the most cost invasive up front - Remove the Sarnafil roofing system and metal decking in the gutter to access and make necessary repairs at the damp-proofed backup wall. Remove sealant joint between head of ribbon window system and base of GFRC cornice to promote air flow in the cavity and provide adequate drainage. Replace sealant joinery in GFRC cornice and install new metal decking and roofing system in gutter.
   B. Relocation of the Drainage Plane to Face of GFRC: This option, though it would be less cost invasive up front, would require frequent inspection and maintenance due to the service life of surface applied coatings or sealers - Flood test Sarnafil roof system and ensure all termination details are water tight and installed per manufacturer’s requirements (this may include additional water testing of the termination details). Replace sealant joinery in GFRC Panels and along the top edge of the surface mounted counter flashing. Apply an elastomeric coating or Siloxane based sealer over GFRC cornice to prevent water infiltration. Remove sealant joint between head of ribbon window system and base of GFRC cornice to promote air flow in the cavity and provide adequate drainage should the primary line of defense (Sealant and coating) fail.

Other observations (Not related to study area):
1. ZSC observed multiple holes in the plaster along the fourth level, below the ribbon window system, that appear to be where scaffold ties were mounted during construction and removed. While ZSC does believe that this is a point of water infiltration, it is not related to the areas of water infiltration noted in this report.
2. Multiple areas of control joint sealant in the limestone façade have begun to fail due to adhesion loss, leaving multiple avenues for water to enter the cavity.

End of Executive Summary
Leak Area No. 1

Leak Area No. 2
Removed Gyp Ceiling

Mineral Wool Insulation From Backside of Spandrel Glass

Leak Area No. 1

Damaged Gyp Above Ceiling

Water Staining at Head Mullion

Leak Area No. 1

Damaged Gyp Above Ceiling

Leak Area No. 1
<table>
<thead>
<tr>
<th>Photos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Staining at Interior Gyp Appears to Be Coming From Roof Above</td>
</tr>
<tr>
<td>Leak Area No. 1 4</td>
</tr>
</tbody>
</table>
| Water Staining on Duct Work  
Water Ponding on 5th Level Floor |
| Leak Area No. 1 5 |
| Water Staining on Gyp Ceiling Below Valley |
| Leak Area No. 1 6 |
Negative Pressure Has Damaged Fire Sealants

Negative Pressure in Room has Blistered and Damaged Fire Sealants

Missing Clay Tile Along Roof Edge
Photos

Area of Deteriorated Wood Decking Below Underlayment
Galvanized Ring Shank Nail

Leak Area No. 1

Flashings do Not Appear to be Spliced with Sealant

Leak Area No. 1

Delaminated Sealant at Intersection Between Dissimilar Materials

Leak Area No. 1
Delaminated Joint Sealant Chosen For Pull Test

Leak Area No. 1 13

Deficient Damp-Proofing at Horizontal Joint in Gyp Sheathing

Photo taken with Bore Scope Through Opened Vertical GFRC Joint

Leak Area No. 1 14

Deficient Damp-Proofing at Vertical Corner Joint in Gyp Sheathing

Photo taken with Bore Scope Through Opened Vertical GFRC Joint

Leak Area No. 1 15
Gyp Ceiling Removed/Fallen

Leak Area No. 2

Water Staining Initiating From Patch at Exterior Sheathing (Behind GFRC Cornice)

Backside of Exterior Sheathing

Leak Area No. 2

Water Staining Initiating From Patch at Exterior Sheathing (Behind GFRC Cornice)

Backside of Exterior Sheathing

Leak Area No. 2
Sheathing Patch Above (5th Level)

Leak Area No. 2

Hole Remains in Plaster Veneer (Assumed Scaffold Tie During Construction)

Add. Observations

Exterior Control Joint Sealant Failing Due to Adhesion Loss

Add. Observations