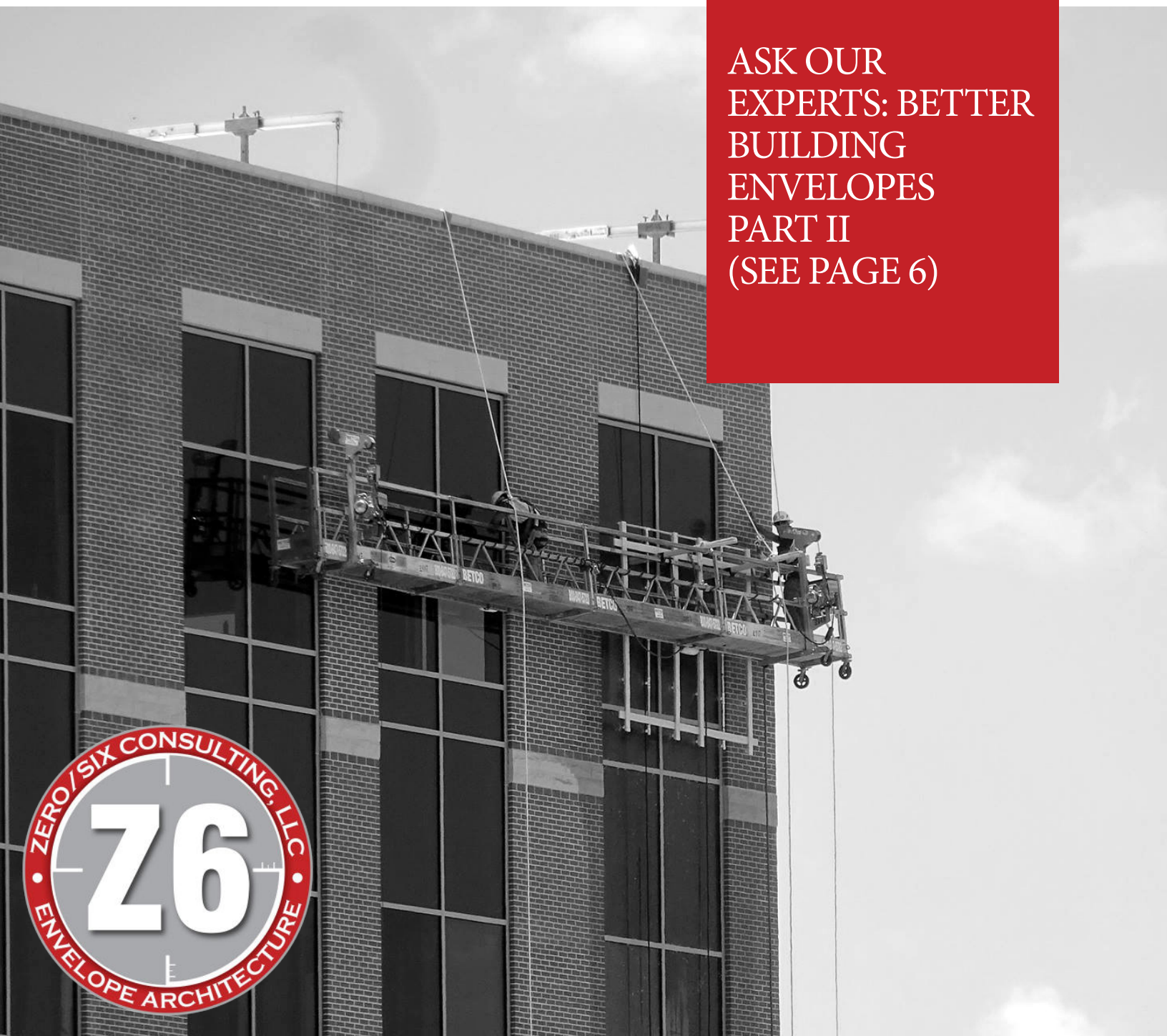
# Zero/Six

BEYOND THE EXTERIOR

September 2017

## ASK OUR EXPERTS: BETTER BUILDING ENVELOPES PART II

(SEE PAGE 6)




ZERO/SIX CONSULTING, LLC

Z6

ENVELOPE ARCHITECTURE

# CONTENT



# A MESSAGE FROM OUR PRESIDENT:

# AFTER THE STORM


WORDS: MR. BILL COLTZER JR., AIA

ALTHOUGH THE RESPONSE FROM THE "FIRST RESPONDERS" WAS IMPRESSIVE, THE RESPONSE BY THE VOLUNTEERS WAS UNLIKE ANYTHING THE WORLD HAD SEEN. WHAT DID THE WORLD SEE? THEY SAW ONE TEAM WORKING SIDE BY SIDE FOR THE SAME GOAL.

We have all seen the videos and heard the stories of how folks of varying points of view set their differences aside to help one another during, and after, "Harvey." At a time when it really mattered (with cameras rolling), the world saw the best of Texas; no one needed to tell the Texans (or the Cajuns!) that all lives are precious and deserve preservation. Although the response by the traditional "first responders" was impressive, the response by the volunteers was unlike anything the world had seen. What did the world see? They saw one team working side by side (not mini teams of conservatives, liberals, Christians, or Muslims) for the same goal.

Our Z6 crew was blessed to have had ring side (like bull's eye in the ring, unedited, real world) seats to the event that was "Harvey" and I would not trade it for anything. The last month has reminded me of the fragility of life and how one's quality of life can change in the blink of an eye - regardless of social stature…or insurance. I saw folks cry that I am pretty sure were out of practice; some overwhelmed by loss and some overwhelmed by support, sometimes both. It was truly a disaster, but the response by our coastal communities was amazing; in a time where negativity is so widespread, it was also uplifting.

Since "Harvey," we have had "Irma," "Jose," and "Maria." Each storm has had us praying for some region to survive the storm and encouraging that region to be #strong. Personally, I hope I can move forward, without another disaster, appreciating my quality of life and the contributions of others, even those I may not want to have a beer with. Maybe now we have all been properly reminded that the world needs our prayers, not just Texas, and that disasters are horrible ways to find out that we really can work together.

#holdmybeerwhileweworktogethertostraigthenthisdamnworldout

All clear from here.

Billy.


MERCURY
15
FourStroke

# ASK OUR EXPERTS:

## BETTER BUILDING ENVELOPES PART II

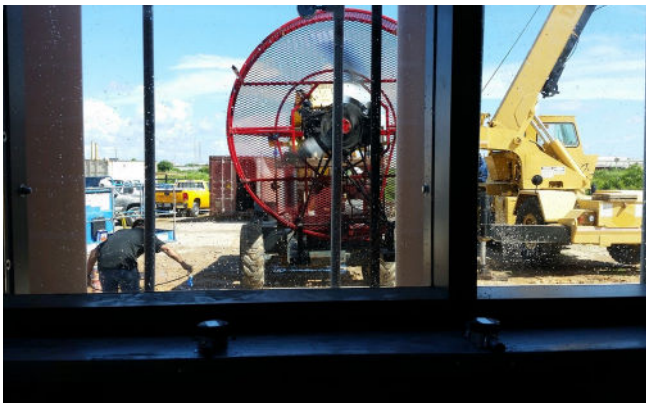
WORDS: MR. JEFF BISHOP, P.E., LEED GREEN ASSOCIATE

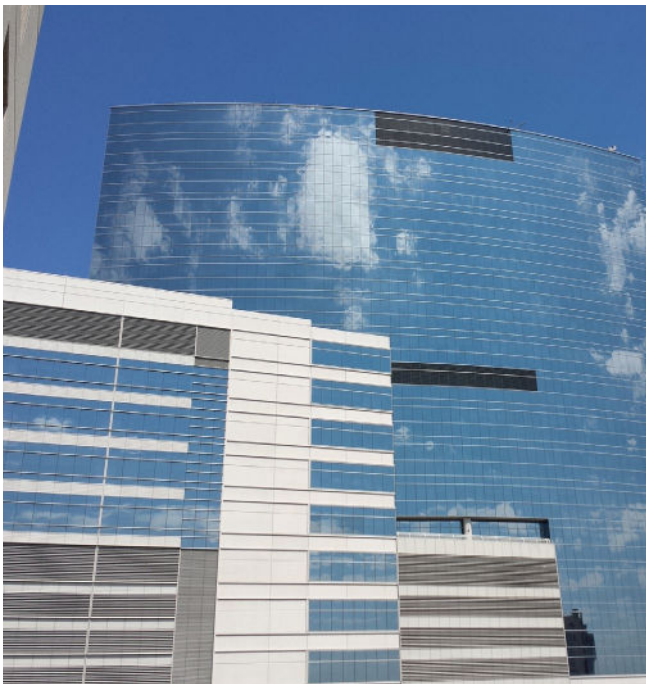
EXTERIOR ENVELOPE MATERIALS THAT INCREASE THE EFFICIENCY OF THE HVAC SYSTEM DURING THE COOLING SEASON ARE VERY IMPORTANT FOR BUILDINGS IN HOUSTON.

**WHAT EXTERIOR ENCLOSURE MATERIALS DO YOU RECOMMEND FOR HOUSTON'S CLIMATE (I.E. INCLUDING INSULATION, WEATHER PROTECTION, FIRE SAFETY, ETC.)?**

Houston's climate is classified as humid subtropical. What this means is, in addition to large amounts of rainfall (up to 50" per year) and extreme weather, the average weather climate is hot and humid. In the summer, average relative humidity is 90% in the morning and 60% in the afternoon. It is also typical to have 102 days of the year where the daily high is over 90°F. In addition, the "heat island effect" caused by people and urban infrastructure is one of the highest in the Southern US.

Obviously, air conditioning is an important factor for day-to-day life in Houston, but without an energy efficient building, much of your heating and cooling efforts will "go out the door". Exterior envelope materials that increase the efficiency of the HVAC system are very important for buildings in Houston. Insulation is of course required, but new insulation materials in the envelope, such as vacuum insulation panels (VIPs), phase change materials (PCMs) and aerogels, are already supporting the goal of making zero net energy consumption a reality. In addition, new materials such as mineral wool (made from natural and recycled materials) have also advanced performance and can provide great benefits in terms of fire resistance. Exterior sheathings also have a role to play, likely in the residential sector with SIP (structural insulated panels).





Finally, choosing the right cladding helps the exterior walls thermally as well as providing a good rain screen for the weather barrier system during the inevitable wind driven rain events in Houston. Masonry or stone cladding is traditionally the best option, due to both aesthetic and performance issues with metal panels. As an added benefit, masonry can reach a 100+ year life cycle if maintained properly. Masonry does require a bit of resealing at expansion joints and repointing every 20 years, but does not suffer from pitting, oil canning or corrosion and provides better acoustical performance. Load bearing thermal breaks are also beginning to be used between structural elements at the envelope to prevent heat transfer directly through the wall assembly.

**WINDOWS ARE THE WEAKEST POINT IN THE BUILDING ENVELOPE IN TERMS OF ENERGY LOSS - HOW DO WE DEVELOP MORE EFFICIENT WINDOW SYSTEMS? WHAT TECHNIQUES DO WE EMPLOY?**

Fenestration systems have continued to evolve as better technology is available for use in high-rise commercial construction. The float glass process invented in the 1950s allows for the mass production of architectural glass, and now many high-rise buildings use it as the primary exterior component. While fenestration systems are the weakest building envelope component, in terms of energy loss, they are the most aesthetically pleasing component as daylight allows people to connect with the outside world.

Glazing performance with new coatings has also improved by applying silver layers that reflect visible light and infrared low-E radiation (low-emissivity). Hard coatings with passive low-E work best in cold climates by allowing some of the infrared light to pass though and working in reverse to reflect heat back inside. Soft coatings created by magnetron-sputtering vacuum deposition (MSVD) can block nearly all the infrared light, making them suitable for warm climates. Innovations in thin-film photovoltaics technologies will eventually be integrated into the glazing to actually harvest energy from this part of the fenestration system.

Another obvious way to improve the energy performance of the window system is to provide shade. Modern manufacturers are constantly making innovations in sun-shading devices to provide more functional and ornamental shades and fins. Since aluminum is the most lightweight and durable material for window frames (especially curtain walls) there has always been a need to reduce heat transfer from this highly conductive material. In warm climates, the

> LOAD BEARING THERMAL BREAKS ARE ALSO BEGINNING TO BE USED BETWEEN STRUCTURAL ELEMENTS AT THE ENVELOPE.

thermal break integration in the frame will save energy, but it is absolutely necessary in humid climates such as Houston to prevent condensation.

Some builders (mostly in Europe) have taken the next step beyond insulated glass (double-glazed lites with sealed airspace) and moved towards double-skin façades. This involves erecting another curtain wall outboard of the building envelope, providing a natural ventilation space and a thermal buffer between the interior and exterior of the building.

Finally, dynamic glass systems may be the future for energy efficient glass. Electrochromic (ion deposited variable tint) glass has ultra-thin ceramic layers that can slowly dim when low voltage electricity is applied. Thermochromic glass can tint automatically when heated by direct sunlight to reduce the heat gain on buildings while still providing a view. Newer types of quicker dynamic glass, such as liquid crystal glass and suspended particle device (SPD) film, are currently being developed to provide instant and variable privacy and energy savings when desired.

**SHOULD YOU EMPLOY AIR BARRIERS IN HOUSTON? WHAT BENEFIT DO THEY BRING?**

Houston has excessive humidity and rainfall each year, which requires a high-performance weather barrier and exterior façade system to provide good indoor air quality. Vehicle pollution adds to the hurdles, as maintaining clean, fresh, cool air in downtown Houston is vital to the comfort of Houstonians. When you add heat to the mix, moisture in envelope assemblies and within the building can form to deteriorate components and create the perfect breeding environment for microorganisms such as mold and bacteria.

Modern stone and brick veneers provide a rain screen and uses a cavity and weather barrier to keep water out of the façade via flashings and weeps. Air exfiltration and infiltration in buildings through this weather barrier can have negative consequences. The most problematic type of flow is typically orifice flow in an air barrier system, known as a breach or a crack. This type of airflow typically occurs at detailing or transitions between components or ineffective materials. Air leakage (exfiltration) will typically trigger higher energy costs, as the HVAC system must constantly provide a

slight positive pressure within the building. Wind and other factors can cause air infiltration, which isn't desirable either, and will bring in moisture along with outside air.

**WHAT FUNCTIONAL TESTS WILL BE REQUIRED DURING CONSTRUCTION TO ENSURE SUCCESSFUL WATER & MOISTURE MANAGEMENT?**

We would recommend a thorough design review and envelope commissioning plan developement in advance. Another important tool is a performance mock-up, which can be tested in advance, prior to actual building erection. The mock-up can serve as a visual and physical model for designers and owners and provides a good troubleshooting tool for verifying performance. Mock-ups tie in exterior components to guard against constructibility and performance issues common to high-rise commercial buildings. Test standards include ASTM E1105 for water resistance, E283 for air leakage, ASTM E907 for roof uplift, and AAMA 501.2 nozzle testing for field checks of the mock up and installed building components. These tests, along with quality assurance inspections and commissioning efforts are important to protect against the elements and guarantee high performance as expected from all parties.

**IN CONCEPT, THE "PERFECT" WALL HAS…?**

Vitruvius was a Roman author, architect, civil and military engineer during the 1st century BC. In his writings, he identified three elements to good architecture, firmitas, utilitas, and venustas. This means firmness, commodity, and delight, or more plainly strength, utility, and beauty. For walls, the utility is obvious as this component is the necessary divide between outside and inside space. The firmness or physical strength can be expanded in meaning, as performance. The perfect wall must perform perfectly as part of the overall building design. Z6's motto "keeping the outside out" is typically the overall design goal for how the perfect wall should perform.

Lastly, the beauty of the perfect wall has changed over time as building technologies have changed. In the past, the ideal wall would typically be based on function, as mass wall systems were basically all that existed. This type of wall would be accented with ornaments to add an aesthetic quality. Although the ornamental elements have changed with different classical styles, traditionally it included only small enhancements or additions to the wall. Modern architectural styles (ie International Style) like brutalism and minimalism use a "less is more" form of ornament to walls. In turn, this creates a situation where the exterior wall components themselves are the ornament. As parametric modeling and manufacturing technologies improve, more exotic forms of these modern styles will become more and more popular as the exterior walls transform into a sculpture of their own.

**BUILDING ENVELOPE DESIGN IS REQUIRED TO SATISFY A LARGE NUMBER OF PERFORMANCE PARAMETERS – WHAT ARE SOME OF THEM?**

The parameters for performance of a building envelope are nearly endless. They can be broken into two main categories: water resistance and energy efficiency. While water resistance is pretty clear cut, it involves controlling and planning ahead since compatibility becomes an issue when materials are exposed to water. For example, limestone dust in water runoff will deteriorate zinc cladding products. Moisture transfer becomes another mechanism for water infiltration. Energy efficiency is being modernized greatly with the new modeling techniques made possible with computing. As mentioned above, the actual performance will rely on workmanship and testing, but predictable building energy efficiency can now be estimated with near certainty. This will lead to gradual energy efficiency improvements over time which material improvements alone could not achieve.

MOCK-UPS TIE IN EXTERIOR COMPONENTS TO GUARD AGAINST CONSTRUCTIBILITY & PERFORMANCE ISSUES COMMON TO HIGH-RISE COMMERCIAL BUILDINGS.

AT-A-GLANCE

### ANGO GLOBAL INTERNATIONAL, INC.

The Ango Global Headquarters Building is an 18,530-square-foot office that was built for an Angolan oil company. This building features extremely high-end finishes and includes structural studs, masonry exterior walls, and extensive glass curtain walls. Ango Global commissioned Zero/Six to perform an exterior envelope assessment in an effort to ascertain the overall condition of the building's ability to resist water infiltration.

| | |
|---|---|
| **Owner:** | Ango Global International, Inc. |
| **Architect:** | Jacobs |
| **Contractor:** | Arch-Con Corporation |
| **Location:** | Sugar Land, TX |
| **Type:** | Forensic |
| **Scale:** | 18,500 SF |
| **Scope of Work:** | Exterior Envelope Forensic Assessment |

### THE POST OAK SCHOOL

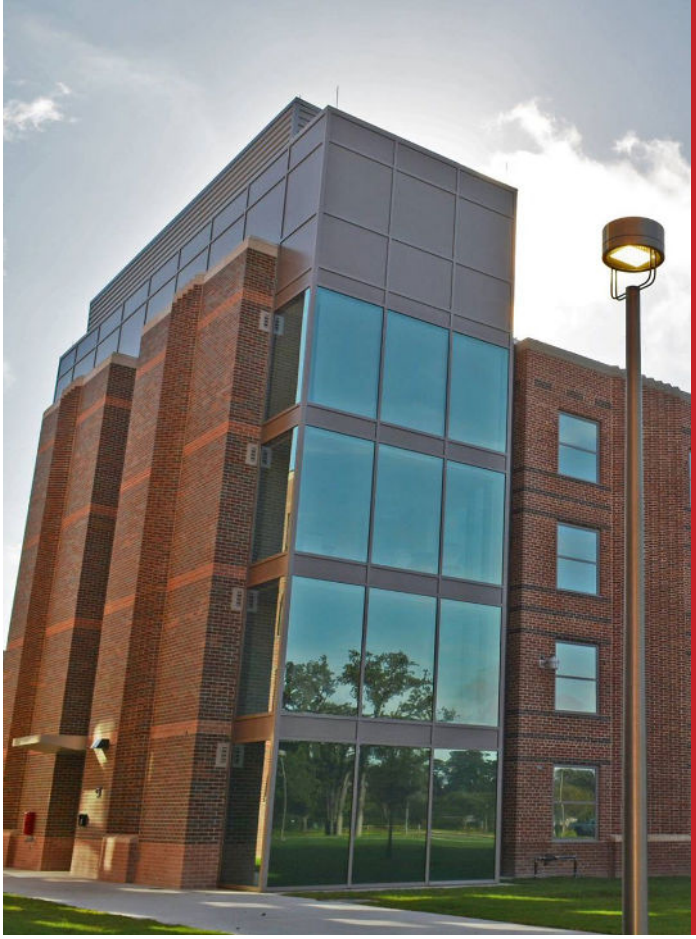
The Post Oak School is a Montessori school with two campuses in Greater Houston. Zero/Six provided professional services related to the concrete roof tile replacement for the Bissonnet campus, which will be dedicated solely to early childhood development and elementary education programs. Our team produced construction drawings, coordinated the bidding process and performed on-site QA/QC and reporting services during the construction phase of the first large-scale renovation and expansion in 15 years for the school.

| | |
|---|---|
| **Owner:** | The Post Oak School |
| **Architect:** | Gensler |
| **Location:** | Bellaire, TX |
| **Type:** | Renovation & Expansion |
| **Scope of Work:** | Site Survey Investigation, Preparation of Specifications and Construction Documents, Bidding Process, QA/QC Roof Replacement Monitoring, and Construction Administration |

**ST. MARY CATHEDRAL BASILICA**

St. Mary Cathedral Basilica is a Gothic Revival church designed by Paris trained Architect Theodore E. Giraud. The floor plan is a traditional Latin cross with the entrance facing west. The masonry mass wall and timber framed structure includes 500,000 Belgium bricks that had been used for shipping ballast. In 1876, a bell tower, designed by Architect Nicholas Clayton, was added to the east side of the cathedral, and in 1878, a cast-iron statue of "Mary Star of the Sea" was added to the top of the bell tower. In 1884, Clayton raised the twin spires on the west side of the cathedral to eighty feet, an elevation just below that of the bell tower. On August 2, 1979, Pope John Paul II made St. Mary's Cathedral a minor basilica in recognition of its historical importance. Zero/Six performed an assessment of the exterior building envelope, providing a report outlining findings, suggested next steps, and repair recommendations.

| | |
|---|---|
| **Owner:** | Archdiocese of Galveston-Houston |
| **Location:** | Galveston, TX |
| **Year Built:** | 1848 |
| **Type:** | Forensic |
| **Scope of Work:** | Exterior Envelope Forensic Assessment |



# FEATURED PROJECT:
# TEXAS A&M'S
## CORPS OF CADETS RESIDENCE HALLS

THE DORMITORIES HAVE NOW BEEN COMPLETELY RENOVATED, BRINGING ONE OF THE MOST CENTRAL PIECES OF AGGIE HISTORY BACK TO PROMINENCE.

With construction dating back to 1939, the Texas A&M University Corps of Cadets Residence Halls has seen quite a few changes in the past 77 years. Comprised of 12 halls, the original dormitories have now been completely renovated, while preserving the outward appearance of the dorms, and bringing one of the most central pieces of Aggie history back into visual prominence.

Zero/Six's participation in this $200 million effort included a peer review of construction documents, quality control inspections, and building envelope performance testing. The building envelope assessment and testing process was fully incorporated from design through acceptance of the project. The process helped Texas A&M University circumvent many of the issues during the renovation and their potential for problems during the life cycle of the buildings that were not addressed in the design and construction phases. As Phase II of the project nears completion, Zero/Six continues to perform field observations and conduct site visits during all building envelope activities.

### PROJECT DETAILS

| | |
|---|---|
| **Client:** | Texas A&M University System |
| **Location:** | College Station, TX |
| **Type:** | Renovation & Restoration |
| **Year Built:** | 1939 |
| **Architect:** | Kirksey Architecture |
| **Contractor** | SpawGlass |
| **Project Scale:** | 12 Buildings |
| **Construction Cost:** | $200 Million |
| **Scope of Services:** | Masonry Survey<br>Drawing Review<br>Recovery Details<br>On-site QA/QC and Reporting<br>Cx Plan and Specifications<br>Commissioning of the Building Envelope, including Air Infiltration Testing per ASTM E783, Static Pressure Water Infiltration Testing per ASTM E1105, and Diagnostic Nozzle |

## ▲ Meet Our Interns: Kyle Colombo

A Galveston native, Kyle majors in Mechanical and Energy Engineering with a minor in Mathematics at the University of North Texas. As an intern for Zero/Six, he has gained a better understanding of performance testing of the building envelope and enhanced his technical skills with programs such as AutoCAD and Bluebeam Revu. There is no "typical" day in the office for Kyle; he may be in Houston one day and Austin the next, working alongside our Architecture department on different job sites across Texas to ensure building specification requirements are fulfilled. When he's not training for a triathlon, he spends his spare time surfing, gardening, and cooking.

## ◀ Meet Our Interns: Jackson Glenn

Heading into his junior year at Ball High School this August, high school student Jackson joined our team as a way to gain valuable hands-on work experience. As an intern, he assisted our sister company, Z6 Commissioning, LLC, at their laboratory facility to conduct performance testing on building materials. He is a Galveston native who loves to go swimming and play video games. After graduation, he plans on attending Galveston College; upon completing his general studies, Jackson aspires to major in Mechanical Engineering at Texas A&M University.

## ▲ Iceland Adventures

Jeff Bishop and his wife Ashley brought her younger brother John Ryan along for their trip to explore Iceland. Reykjavík was the first destination in Iceland, and they picked up their camper van to trek through the country beginning by visiting the Hallgrimskirkja, a modern cathedral with a 240' tower. They decided to take Þjóðvegur (ring road) clockwise and went to the West fjords after seeing Glanni and a few other waterfalls along the way. In Ísafjörður, they visited the Westfjords Heritage Museum built in a house from 1784. Hvitserkur was the next stop on the way to Akureyri, where they visited Akureyrarkirkja, a Lutheran church with a beautiful suspended ship (nortic tradition) and a 3200-pipe organ. Next was the troll filled lava fields and the nature baths near Mývatn. Beautiful waterfalls – Goðafoss, Dettifoss, Fardagafoss as well as many others were seen along the way around the East side to the South and glaciers at Vatnajökull National Park. Vik and the Reynisfjara black sand beach were seen on the South coast on the way to Skjòl and Gullfoss. Finally returning to Reykjavík and seeing Montreal briefly on the way back to Texas.


## ▲ Texas A&M Career Fair

Senior Project Manager & Aggie alum Brandon McDermott attended the Texas A&M University Construction Science Career Fair to tell Aggies more about Zero/Six!

# ZERO/SIX OUT&ABOUT

## ▲ Hotel Zaza Memorial City

The Zero/Six team was at Hotel ZaZa Memorial City observing Z6 Commissioning, LLC perform water infiltration testing per ASTM E1105. Hotel ZaZa Memorial City will serve as the anchor of an existing upscale mixed-use area that includes a rich blend of Class A office towers, retail, restaurants, and luxury residential within Memorial City.

## ◀ UTRGV Science Building

Zero/Six observing waterproofing, windows, roof, brick and metal panel installations at UTRGV's Science Building in Edinburg, TX. The four-story, 115,000 SF addition will complete a 272,000 SF building dedicated to research and education in Science, Technology, Engineering and Mathematics.

## ◀ Houston Methodist West Hospital

The team was at the Houston Methodist West Hospital Phase II Expansion in Katy observing Z6 Commissioning, LLC perform water infiltration testing per ASTM E1105. Zero/Six's scope of work includes peer review, submittal/show drawing review, and site inspections for building enclosure components on the hospital.

# SPEAKING ENGAGEMENT:
# WHOLE BUILDING COMMISSIONING

## ZERO/SIX CONSULTING & Z6 COMMISSIONING PRESENT IN PARTNERSHIP WITH THE USGBC GULF COAST REGION: WHOLE BUILDING COMMISSIONING

For years, we have commissioned dynamic systems to ensure performance throughout the whole enclosure while assuming that the static envelope would also perform. Over time, commissioning (Cx) and specialty Cx disciplines, such as building envelope commissioning (BECx), have gained momentum as necessary processes in achieving optimal building performance through mandatory requirements as set forth by LEED v4 and the 2015 IECC codes. This presentation establishes the foundation for integrating commissioning with other professional disciplines through the use of 3rd party consultants, performance testing and mock-ups beginning in the design phase and continuing through to project close-out. This presentation will also describe the methods, phases, activities and testing opportunities for effective whole building commissioning. During Part 2 of this session, participants will tour an ISO-accredited laboratory that displays a pre-construction mock-up created to provide insight into potential design conflicts, sequencing of exterior systems, and establishing installation requirements to ensure these installed systems interface as intended.

### LEARNING OBJECTIVES

1. Understand the life span of the commissioning process.
2. Understand the players in the process and how each player fits into that process.
3. Understand the difference between the commissioning process of the past versus the movement towards “whole building commissioning”; and how LEED v4 and the 2015 IECC will influence the commissioning process moving forward.
4. Understand how commissioning language in project manuals needs to coordinate with the testing requirements typically found in the project manual.

### EVENT INFORMATION

**DATE**
Thursday, October 5

**AGENDA**
12:30 PM Registration / Check-in
1:00 PM Introductions
1:15 PM to 2:00 PM Overview of Cx Requirements
2:15 PM to 3:00 PM Cx Language in Project Manuals
3:15 PM to 4:00 PM Tour of UTMB Mock-up
4:00 PM to 5:30 PM BBQ

**LOCATION**
6101 Harborside Dr.
Galveston, TX 77550

**ADMISSION FEES**
USGBC Members: $30
AIA, ASHRAE, UTMB: $30
Students: $15
Nonmembers: $40

**TRANSPORTATION**
$35 from Houston and return. Depart 11:00 AM from City of Houston Permitting Center. Return after BBQ. Max 12 Seats Available.

**REGISTER NOW!**

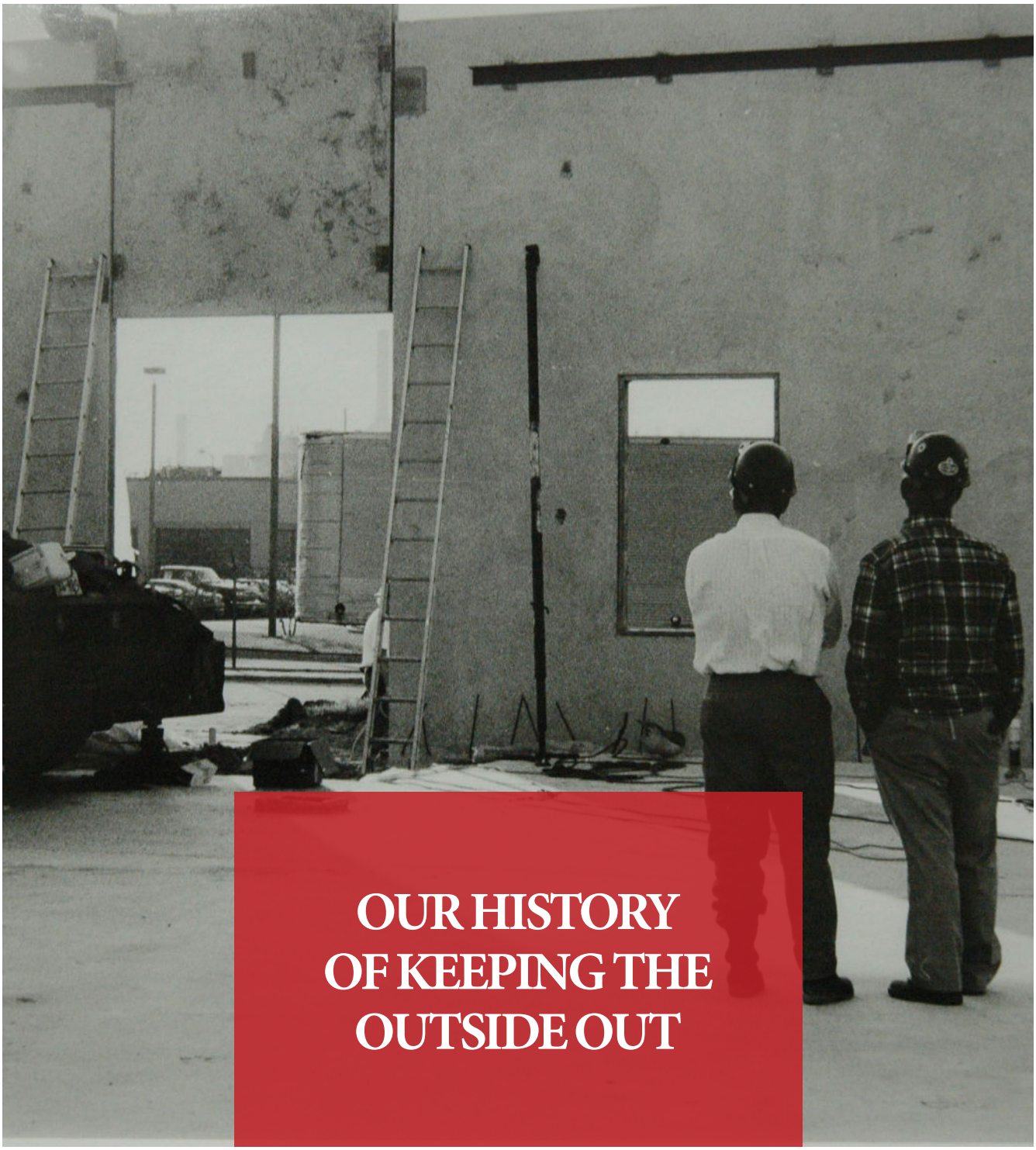

BILL COLTZER JR., AIA
PRESIDENT
ZERO/SIX CONSULTING, LLC & Z6 COMMISSIONING, LLC

DAVID MACLEAN, CPMP, LEED AP BD&C
CHAIR/VICE PRESIDENT
USGBC TGC REGION / MCMAC COMMISSIONING
SERVICES, LLC

# EARN 1 USGBC CEU & 1 AIA CEU

U.S. GREEN BUILDING COUNCIL USGBC

CONTINUING EDUCATION AIA



# OUR HISTORY OF KEEPING THE OUTSIDE OUT

Thank you for reading our newsletter!

For more information, visit www.z6consulting.com!